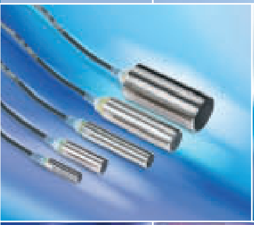
GENERAL CATALOGUE 2005/2006

Sensing & Safety





Advanced Industrial Automation

GENERAL CATALOGUE 2005/2006

Sensing & Safety

Sensing & Safety

Never fail...

This catalogue features products that lead the field in technology by providing new solutions for inspection, measurement, quality assurance and safety issues. What makes our products so special is that they are designed to deliver high performance and total reliability. With Omron's sensing and safety products in your automation system your products never fail, and your production never stops.

The attached CD-ROM contains comprehensive information of our sensing and safety product range. In addition you can find our latest innovations on www.omron-industrial.com or give us a call!

Omron – a global corporation

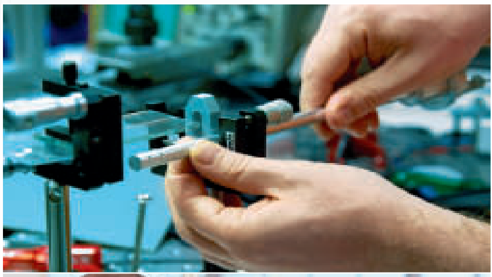
...right on your doorstep

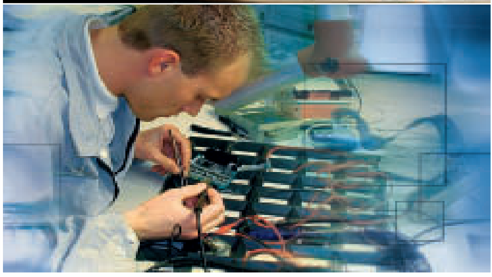
- 50 years in industrial automation
- Over 24,000 employees
- Support in every European country
- Over 1,800 employees in 18 European countries
- 8% of turnover invested in R&D
- More than 200,000 products
- More than 6,950 patents registered to date

Omron Corporation

Omron Industrial Automation is a leading manufacturer of technologically advanced industrial automation products and worldwide supplier of application expertise. It is part of the global Omron Corporation, which has been anticipating and filling social needs since 1933. With pioneering technology Omron has developed into a $5 billion global manufacturing company in sensing and control.

Omron continues to make significant contributions in a wide variety of fields such as industrial automation, electronic and automotive components, and healthcare. Omron Industrial Automation technologies can be found in factories and machines all over the world. Our solutions continue to be flexible and innovative, but our standards remain rigid: *never stop, never fail, just create!*





Omron Industrial Automation Europe

In Europe we have maintained a leading position in machine and industrial automation for over 30 years. Our infrastructure is designed to think globally while acting locally. From sales, application knowledge and support to R&D and customised production, we can support your needs wherever you are located, and through every step of your manufacturing process.
You'll find Omron's expertise in control systems, motion & drives, sensing, safety and control components.

Application support

As an Omron customer you have unprecedented support from our application engineers, who can advise you on-site anywhere in Europe. We can carry out tests on your design on-site or demonstrate a new product without disturbing or halting your production process.

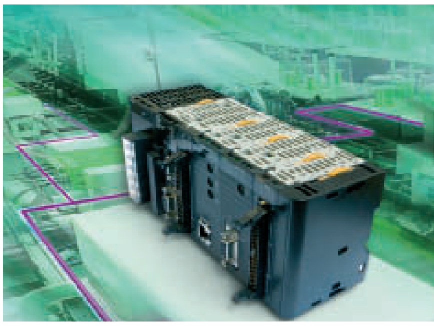
“From the moment you contact Omron you get direct access to our application expertise, wherever and whenever you need it....”

European manufacturing
Omron has manufacturing sites in s'Hertogenbosch, the Netherlands and Nufringen, Germany where, in addition to our standard product offering, we can provide fast and flexible customised solutions using on-site R&D facilities and expertise. Both factories meet very strict quality assurance standards, and are the forefront of meeting global environmental standards. Omron actively welcomes people to come and visit these facilities.

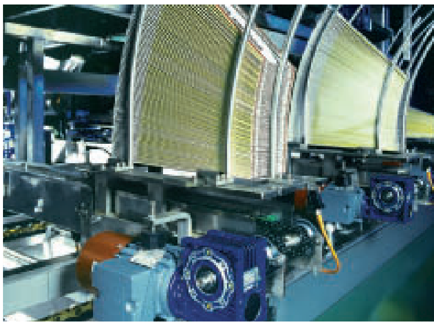
Online support
Omron's web-site is designed to provide fast, no-nonsense support, enabling you to quickly find the latest information on manuals, data sheets and brochures, read about our latest product releases, and check out the most frequently asked questions. You can also download our latest software versions or patch upgrades along with 2-D and 3-D CAD drawings. All the support you need is available on www.omron-industrial.com.

European Repair Centre
Omron has set up a special repair service with DHL that enables your product to be picked up, repaired and returned within 5 days. This repair service is totally free for products under Omron's warranty conditions, and includes a direct pick up and delivery at your site. You can get more information on this service at www.repair.europe.omron.com.

Competence areas



Control Systems



Motion & Drives

Sensing

Safety

Control & Switching Components

Smart Platform

Experts in sensing and safety

„We speak your languages... talk to us!“

A strong knowledge match

Omron is renowned in the field of Industrial Automation for making innovative products that offer the highest possible product reliability. Our application knowledge in combination with our sensing technology knowledge, enable us to advise you on the right sensing solution. In almost every case to date we have been able to select a product from our sensor program that offers the best possible solution. With Omron's sensing and safety products in your automation system your products never fail, and your production never stops.

Our products are managed by teams of product experts, who are supported by development and application experts and by manufacturing sites. Together they form competence centres dedicated to provide unrivalled automation products and customised expert solutions for all industries throughout Europe. This expertise is available "at your door-step" in every country.

Omron's expertise in industrial automation comes from years of product development and accumulated know-how. Our ability to offer customers several options for their application needs is what distinguishes us from competition. We know that you cannot afford defects in your production. That's why we can provide on-site testing of your process with minimal disturbance to your production, so that together we can strive for zero defects. Challenge us!

Sensing & safety competence

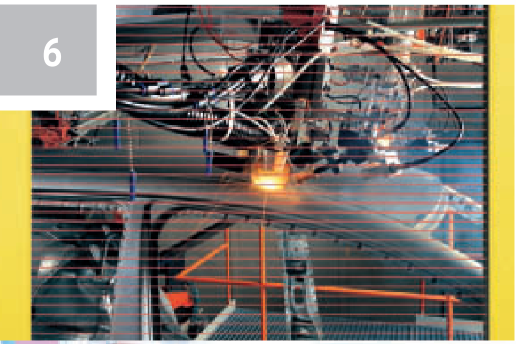
The competence centre is the hub for application-specific support and regular product training seminars for our European sales engineers, to train your engineers. It consolidates product, development & application, and production expertise on the very latest technologies. Here, an elaborate network to the national sales organisations and industry specialists is nurtured, which guarantees a thorough understanding of the latest offerings in your local market.

This network enables us to incorporate a fast-track customisation service and to respond quickly to changing trends and future requirements.
At our European sensor and safety manufacturing site in Nufringen, near Stuttgart/Germany, products are tested under severe conditions at several on-site laboratories. ISO-Certifications DIN EN ISO 9001:2000 and DIN EN ISO 14001:1996 guarantee a high standard of quality and environmental protection.

Proven application expertise

Zero defects and total reliability

Omron's in-depth knowledge of many specific industries enables us to offer high-quality products as diverse as the applications they are designed for. Our expertise in machine building means that you can use our sensing and safety solutions in nearly every sector of manufacturing, including the automotive, semiconductor, food, beverage packaging and pharmaceuticals industries.



Safety solutions
Floating blanking is used when robot's arms have to pass through the light curtain for particular operations – Safety is guaranteed.

Fitting a complete pre-assembled cockpit
To achieve a seal between the cockpit mounting plate and the engine compartment a robot first applies the bonding bead around the entire cockpit plate. A sensor head is mounted on the robot arm and focuses directly behind the glue nozzle outlet, measuring the height of the bonding bead continuouly.

Automotive industry

In the automotive industry, complex integrated production processes put enormous demands on production planning, and only a totally reliable assembly process using measurement and inspection technology is acceptable for achieving a zero-error production rate in the sense of Poka-Yoke.

Omron is a well-established provider of advanced technologies in the automotive business. Our optical sensing techniques enable components to be checked directly in the assembly process. This reduces rework rates, as only correctly fitted parts are released to the next production phase.

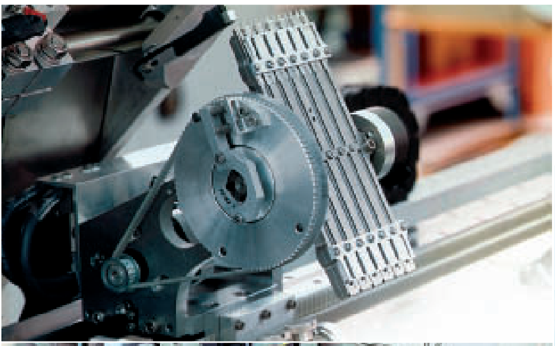
Our latest generation of intelligent sensors can check for the presence and condition of components, and carry out measurement tasks without interrupting the process.

Mega-retailers
Your packaging should always deliver absolute quality for bulk and multi-packs. That includes zero defect labelling, custom coding for automatic inventories and point-of-sale carton arrangements on pallets.

Back-end process
ICs are individually tested before shipment to ensure that they meet the required quality levels. Omron's sensing solutions meet the highest demands of testing.

Zero defect
Tamper evident seals and clear date/lot codes must be in place to maintain customer confidence and protect your company against liability.

Verify bottle position
Two independent sensors detect toppled bottles to prevent a jam.



Front-end process
The very nature of CMP demands specially designed products that can perform processes like wafer identification and security monitoring of critical handling areas. Omron's range of sensors can cover all aspects of the CMP process.

Semiconductors Industry

In the semiconductor electronics industry, the ever-advancing miniaturisation of electronic products requires smaller, purer and thinner chip technologies. Manufacturers are under continuous pressure to increase their productivity while reducing the costs per chip.
The trend is towards ever-smaller structure widths and the development and manufacturing of silicon wafers with large diameters.

Omron's sensors are designed to cover everything in semiconductor production, from the critical processes like wafer etching and cleaning, to high-precision distance measurement required for the production of 300 mm wafers. Through long-term partnerships with market leaders in machine building and with influential entities such as SEMI, we have developed the knowledge necessary to equip these complex machines with the sensors and safety components needed to successfully develop and market your product.

Food & beverage / packaging industry

In the food & beverage industry a 99.9% success rate in the packaging process simply isn't enough.
With such high throughput speeds, one simple error can lead to pallets of unlabelled or incorrectly labelled products, or damaged packaging.

Omron's highly effective inspection solutions combine vision, measurement and fibre-optic sensors to help you meet the strict quality requirements required in this industry. Our packaging inspection solutions can help boost the quality of your output and reduce waste. With our sensing and safety solutions, your production never fails.

If you would like to know more about Omron's industry knowledge, please order our market segment brochures or download them at www.europe.omron.com.

Smart Platform concept

One software – One connection – One minute

The launch of Smart Platform, Omron's new fully integrated automation architecture, demonstrates Omron to be one of the most innovative players in the market. Designed to make machine automation easy, the goal of Smart Platform is to allow increasingly complex machines to be developed, commissioned and maintained without the need of automation specialists.

It enables users to mix and match their preferred solutions without the need to worry about hierarchy or other communication issues. Driven by the need to make connectivity as simple and flexible as possible, Omron's Smart Platform creates a harmonious combination of sensing, control, motion and regulation devices.

The Smart Platform concept is built around three major advantages for the user:

- One software
- One connection
- One minute

Easy programming and configuration with Omron's CX-One software.

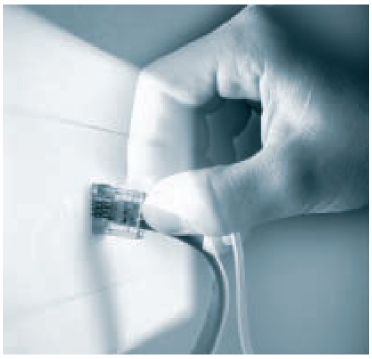
For a demonstration and to order your 30 days' trial version for free please visit **www.smartplatform.info**

One software

Omron introduces CX-One, a single programming and configuration environment that enables the user to build, configure and program networks, PLCs, HMIs, motion control systems, drives, temperature controllers and sensors.

The result of a single software is to reduce complexity of the configuration and allow automation systems to be programmed or configured with minimal training.

One connection



From a single connection point either locally, through networks, or from a modem connection the Omron 'Smart Platform' devices on your machine can be programmed or parameterised. This allows remote access or servicing of your complete machine to become a reality.

The same transparent communications architecture also allows Omron devices to easily communicate together, passing and sharing information and enabling more effective modular machine design.

One minute

'Plug & Work' functionality is achievable through Omron's function block library, device profiles and SMART Active Parts, which can be simply 'drag & drop'-configured in contrast to conventional programming.

The SMART Active Parts are pre-defined electronic objects of field devices (e.g. 'read actual speed' of an inverter, view a scene from a vision sensor, represent a temperature controller etc.) that can be dragged and dropped into the HMI screen.

... just create

Why Smart Platform?

Smart Platform can help you increase the flexibility and efficiency of your machines or production lines. It provides:

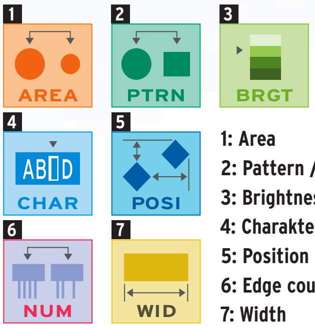
- A single software environment for your machine covering sensing, regulation, control, motion, and visualisation.
- Easy drag & drop object-based programming and configuration of the complete system.
- Communications and architecture that is network independent.
- Distributed intelligent devices that are self-reporting and self-maintaining to reduce downtime and identify the source of production problems.

New products

Smart vision sensor ZFV

Main features and benefits

- Brilliant colour display
- Real time result and image display
- Intuitive user interface
- One button teach – teach and go
- Up to seven inspection tools
- Adjustable inspection area and distance
- Integrated, adjustable LED light
- Up to 250 inspections per second



1: Area
2: Pattern / Search
3: Brightness / Defect
4: Charakter
5: Position
6: Edge count
7: Width

Easy vision – teach & go

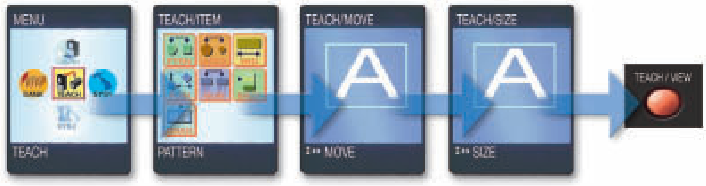
Omron's new ZFV smart vision sensor is an image-processing system in a sensor format. It consists of two separate components, a camera head with an integrated light source and a processing unit.

Parameter settings and lighting control are available at the touch of a button. A "smart" user interface allows parameter setting using a few buttons and the built-in colour LCD monitor.

During operation, the display gives direct feedback showing results and images in real time. Easy Vision – teach & go, for applications which can be solved in minutes – not hours or days.

The ZFV verifies the correct position of the cap to secure proper closure of the bottle.

Verifying the printed article information in a high-speed packaging line.



Teach and go...

ZS-L Series – 2-D CMOS measurement displacement sensor

Main features and benefits

Easy to integrate and to operate

- Fast change-over-handling for various products on the same production line
- Easy reconfiguration for latest product trends by using ZS-controller HMI
- Getting started within a minute

More flexibility through scalability

- Tailored ZS configuration to suit your process needs is possible by easy application oriented and user guided menu settings.
- Additional functionality can be easily expanded by adding additional modules to the high speed sensor bus

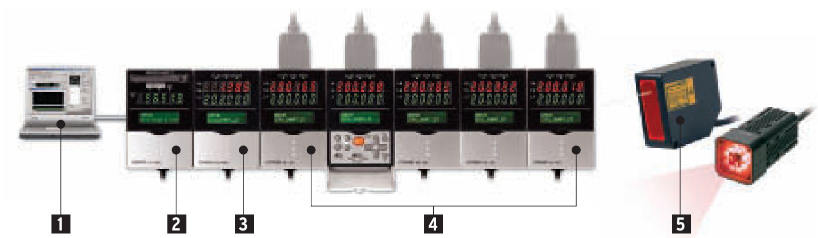
With Omron's ZS-L series, zero defect inspection is assured!

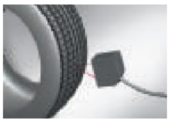
Innovative 2-D CMOS technology

The ZS-L's ability to provide high-speed image processing and high resolution is thanks to Omrons innovative 2-D CMOS image sensor. The sensor features an enhanced controller running a powerful algorithm, which ensures optimal sensitivity, no matter how varied the reflected light. The image is processed in the sensor head and transferred to the controller via a Low Voltage Differential Signal (LVDS). This arrangement results in a high-performance platform that can measure almost any surface.

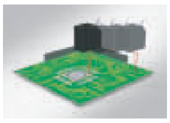
Measurement Tools:

- Hight measurement
- Step measurement
- Thickness measurement
- Gap measurement
- Flatness measurement
- Average measurement
- Excentricity
- Warpage / Evenness

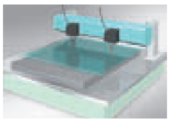




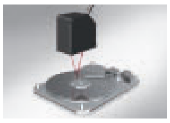
Rubber



PC-Board



Glass



HDD Mirrow

1: Monitor SmartMonitor Professional PC-based user software ZS-SW11E – for set up and monitoring

2: Record Data storage unit ZS-DSU – ideal for ZS series data logging

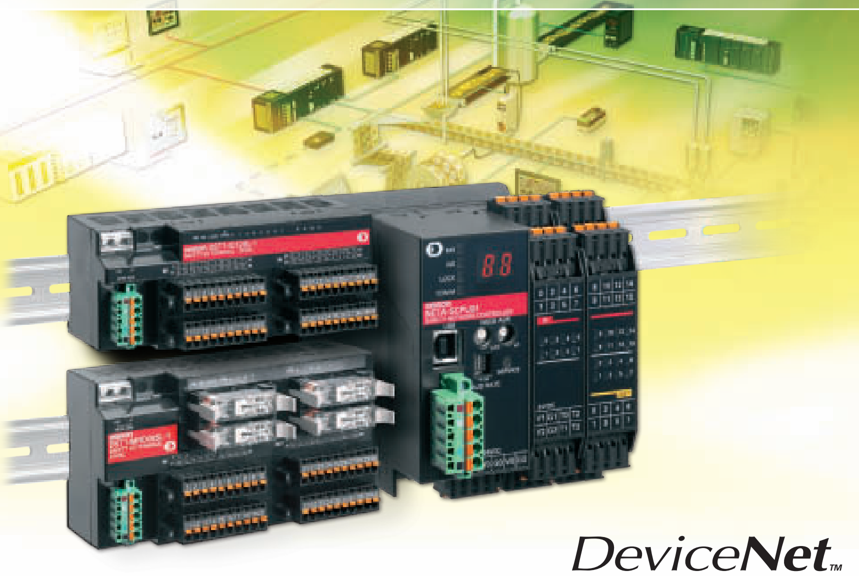
3: Control Multi-calculation-controller ZS-MDC – enables logical operation and processing for up to 9 gang mounted controllers

4: Operate Sensor controllers ZS-LDC – enable maximum sensing performance with fully digital processing

5: See Sensor heads ZS-LD – advanced laser CMOS sensing technology with high speed, high resolution, packed into smallest IP67 housing

New products

DeviceNet safety



Main features and benefits

- Open communication standard
- Fast and easy installation
- Predefined and certified function blocks.
- Detachable cage clamp terminals.
- Future-ready for easy additions as your needs change
- DeviceNet Safety is designed for easy network additions to save your investment
- Smart, seamless and flexible
- I/O-Modules support standard and safety mode on one module.
- Reliable and safe
- Predicitive maintenance and self diagnosis.
- Certified for applications up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508).

DeviceNet safety offers more than a safe network

DeviceNet is an innovative industrial network system that enables a wide range of devices to be easily networked and managed remotely.

Everything can be seamlessly integrated into DeviceNet, making it one of the best industrial field busses around.

As a founding member of DeviceNet and specialist for machine safety, Omron is one of the few companies with expertise to combine innovative bus technology and safety to a seamless solution up to safety category 4 (EN 954-1) and SIL 3 (IEC 61508).

Unique features of the DeviceNet Safety products are:

- Test pulse outputs to ensure crosstalk and short circuit detection.
- Mixed mode operation of the DeviceNet Safety Terminals. All in- and outputs can flexibly be assigned to the safety or standard part of the control system.
  If they are used for safety, the Safety Network Controller ensures system integrity. Smart slave functions like operation counters and monitoring of ON-time or operation time are fully supported.
- Bulb current monitor function by using a dedicated test output of the remote terminals.

Safety Network Controller

The Safety Network Controller hosts the safety application program, monitors the safety inputs and controls the safety outputs.
The simplest DeviceNet Safety based solution is using the Safety Network Controller stand alone.

Advanced diagnostic is provided by the Safety Network Controller. LED displays, status LEDs for all in- and outputs and the accessibility of the system status data via DeviceNet enables easy troubleshooting and predictive maintenance.

DeviceNet Safety Terminals

The DeviceNet Safety Terminals have been designed to provide highest flexibility for all your installations.

G9SX – Flexible safety unit

Main features and benefits

- Unique! Logical connection
- Advanced diagnostics and trouble-shooting functionality
- Extended operating life through solid state outputs
- Expandable with up to 25 outputs per segment
- Choice of terminals
- Meeting all safety requirements

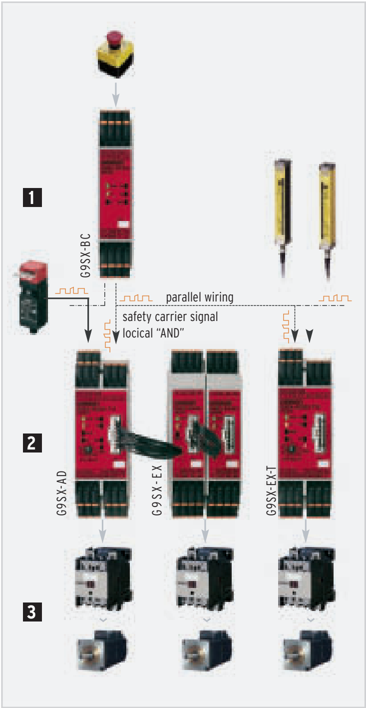
The flexible way to design-in safety

Omron's G9SX is an innovative, flexible safety unit that provides a clever solution for partial and complete safeguarding the machine control. Using microprocessor technology, the G9SX provides a transparent and logical connection throughout your system that enables you to shut down any segmentation according to your machine's safety layout.

The G9SX increases your productivity by enabling you to isolate a faulty process within your machine instead of having to switch off the entire system, which minimises production losses and downtime. It features LED indicators to reduce troubleshooting time and support diagnostic maintenance. The G9SX lets you expand your system easily without having to completely re-design safety circuits. And while the G9SX uses a hardwired logical connection based on microprocessor technology, there is no programming or special training involved.

The G9SX is the latest segment in Omron's safety product portfolio and underlines the company's reputation as a total safety solutions' provider. Use the G9SX to design a flexible, expandable and reliable safety system in all applications like packaging, semiconductor, moulding and food processing industries.

The G9SX flexible safety unit range



1: Basic unit G9SX-BC
The basic unit is used to control the primary safety function like the overall E-Stop.

2: Advanced unit G9SX-AD
This unit can be logically connected to the G9SX-BC and other G9SX-AD to provide precise shutdown of individual sections in a machine. The advanced units give you more precise control over the safety section you want to stop, without affecting the total process.

3: Expansion unit G9SX-EX
This unit is ideal for use in complex machines that require multiple safety output paths (Instantaneous or time delayed).

Product selection table





Standard Photo-electric Sensors	Advanced Photo-electric Sensors	Displacement & Width-Measuring Sensors	Vision Systems	Inductive Sensors
E3F2	E32	ZX-L	ZFV	E2A
E3Z	E32-ET16WR-1/2*	ZS-L	F150	E2F
E3T	E32-ETS/EDS	Z300	Vision Composer*	E2A3
E3NT	E32-D82F*	Z500	F400*	E2E small diameter
E3S-C	E32-L25T*	Z510	F160	TL-W
E3S-CL	E32-V*	Z550	F210	TL-T*
E3G	E3X-DA-S*	ZX-E	F250	E2S
E3M-V	E3X-DA-N*	ZX-T	F500	E2Q2
E3MC*	E3X-MDA*		V530-R150*	E2Q4
E3S-LS3	E3X-NA*		V530-R160*	E2C-EDA
E3JK	E3X-DRT2*			E2EL
F3C-AL*	E3X-SRT21*			E2EC
E3G-L1/L3*	E3X-CIF11*			TL
E3X-NL*	E3C-LD11*			E2E
E3S-CR62/67	E3C-LD21*			E2AX*
F3UV*	E3C-LD31*			E2AU
E3S-A*	E3C-LDA*			E2EZ
E3S-R*				E2FQ
F3C-AA*				E2EQ
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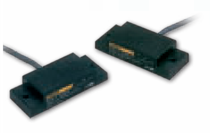   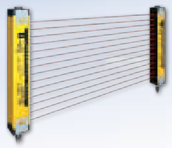 

Capacitive Sensors	Rotary Encoders	Pressure Sensors	Safety Sensors/ Components	Catalogue CD
E2KQ	E6A2-C	E8F2*	F3SN-A/F3SH-A	*These products are available on the CD–ROM, which is enclosed to this catalgoue.
E2K-C	E6B2-C	E8MS/E8M*	F3S-B	
E2K-F	E6C2-C/E6C3-C		F3S-TGR-SB	
E2K-L*	E6F-C		F3SL	
	E6H-C*		E3FS	
	E6C3-A		F3SS*	
	E6F-A		F3SP-U4P	
	E6L*		DeviceNet Safety	
			F3G-C*	
			G9SX	
			G9SA	
			G9SB	
			D4NS	
			D4BS	
			D4GS-N*	
			D4NL	
			D4GL	
			D4BL	
			D40B	
			D4NH	
			D4N-_	
			D4B-_N	
			D4F	
			D4N-_R	
			A22E*	
			A165E	
			G7SA	
			G7S*	
			A4E	
			F3W-D*	
			F3ZN*	
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omron ZFV

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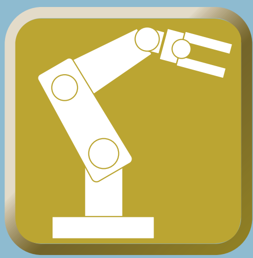
Applications



Applications

OMRON

Semiconductors and Electronic Components

Packing, Food Products, Chemicals, and Sanitation

Applications

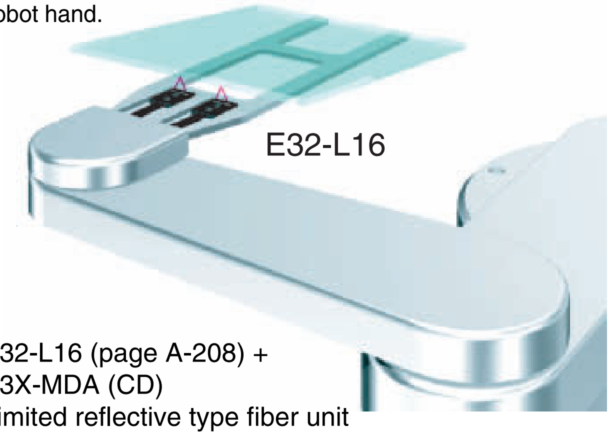
OMRON

OMRON

Semiconductors and Electronic Components

1. Detecting the Placement of a Transparent Liquid Crystal Glass with the Limited Reflective Type Fiber units

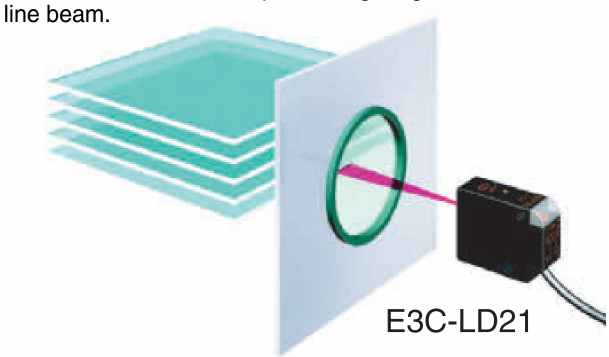
Stable detection of placement is possible only with two fiber units and one amplifier. The fiber units are embedded at the robot hand.



E32-L16 (page A-208) +
E3X-MDA (CD)
Limited reflective type fiber unit

2. Detecting the Liquid Crystal Glass with the Line Beam

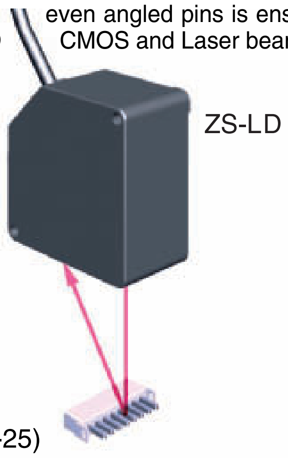
The edge of the liquid crystal glass surfaces are detected from outside of the view port, using long-distance and wide line beam.



E3C-LD21 + E3C-LDA (CD)
Photoelectric Sensors with Separate Digital Amplifiers

3. Measuring the Co-planarity of Connector Pins

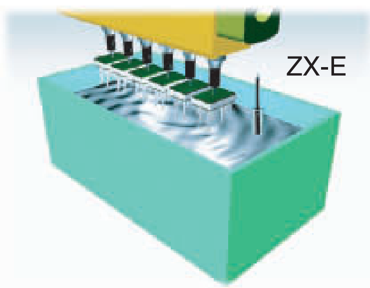
Stable measurement of even angled pins is ensured by the combination of a 2D CMOS and Laser beam.



ZS-L Series (page B-25)
Smart Sensor (2-Dimensions CMOS and Laser Beam)

4. 200 °C Solder Surface Inspection with Linear Proximity Type

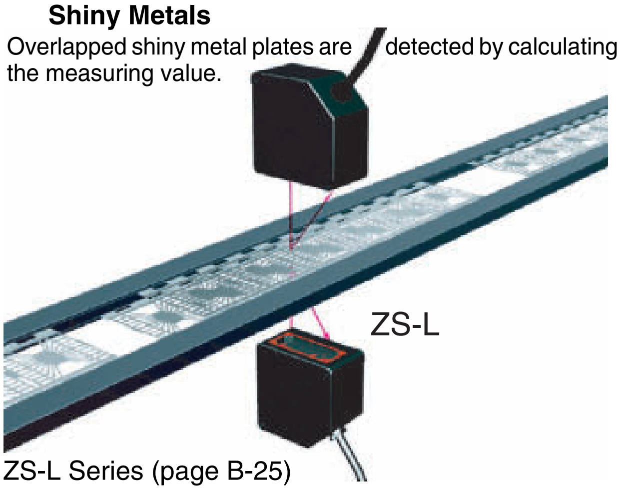
Precise measurement of the surface of solder at the linear proximity which is excellent in environment-proof, if it can inspect for a short distance from the tank upper part.



ZX-E Series (page B-61)
Smart Sensor (Linear Proximity Type)

5. Detecting Overlapped Lead Frames and Other Shiny Metals

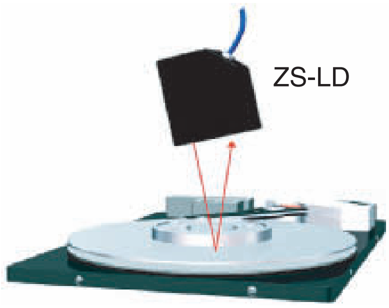
Overlapped shiny metal plates are detected by calculating the measuring value.



ZS-L Series (page B-25)
Smart Sensor (2-Dimensions CMOS and Laser Beam)

6. Deflection Inspection of a Specular Surface

High precision inspection of specular surface, such as an HDD aluminum deposition side, is possible by CMOS laser.



ZS-L Series (page B-25)
Smart Sensor (2-Dimensions CMOS and Laser Beam)

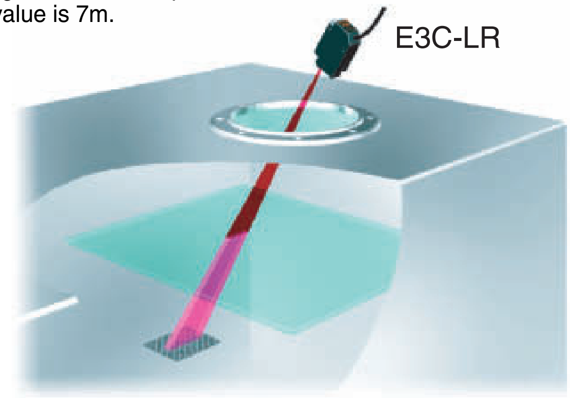
OMRON

Applications

Semiconductors and Electronic Components

7. 7m Long-Range Glass Inspection

Retroreflective long-range glass inspection with spot laser light over a view port.The detection distance of the catalog value is 7m.

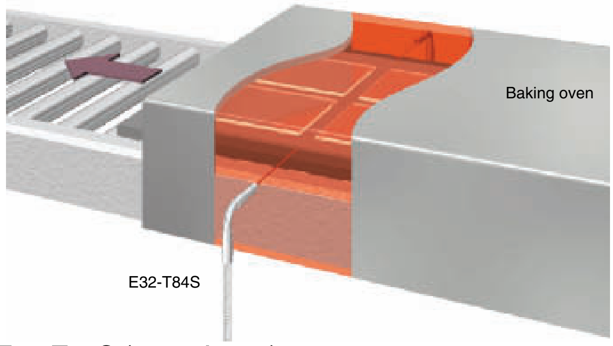


E3C-LR + E3C-LDA (CD)

Photoelectric Sensors with Separate Digital Amplifiers

8. Detecting Glass Substrates in Baking Ovens

An L-shaped side-view sensor requiring little space and providing 200°C heat resistance is used. The detection distance of 1,300 mm (for E3X-DA-N Standard Mode) is more than sufficient to detect even large glass substrates.

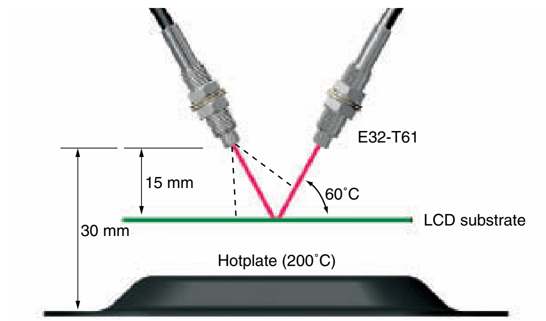


E32-T84S (page A-204)

Heat-resistant, Narrow-beam Fiber Unit

9. Detecting Liquid Crystal Substrates in Ovens

Regular reflective light from the LCD substrates is received with a fiber to detect the presence or absence of the substrates. The large spot ensures stable detection of substrates even if positioning is not completely consistent.

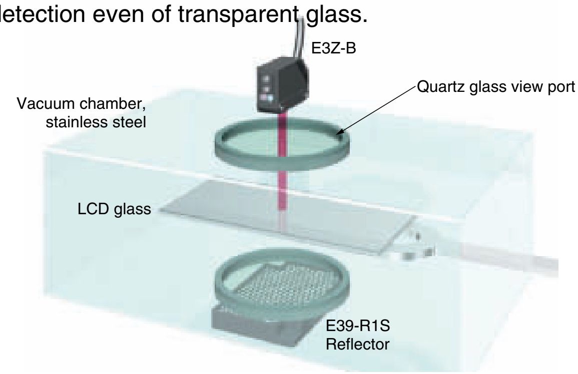


E32-T61 (page A-203)

Heat-resistant Fiber Unit

10. Detecting Glass Substrates in Vacuum Chambers

The E3Z-B is a retroreflective sensor that enables accurate detection even of transparent glass.

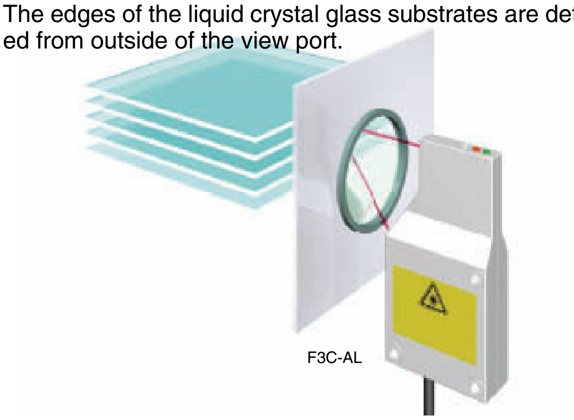


E3Z-B (page A-43)

Photoelectric Sensors for Detecting Transparent Objects

11. Detecting the Edges of Liquid Crystal Glass through a View Port

The edges of the liquid crystal glass substrates are detected from outside of the view port.

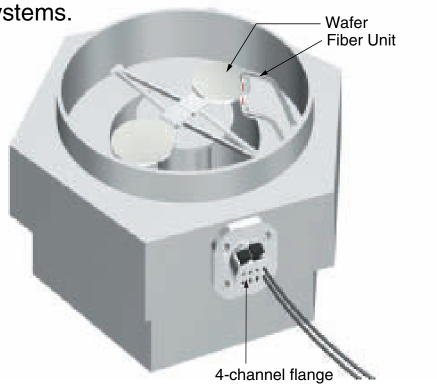


F3C-AL (CD)

Distance-controlled Laser Photoelectric Sensors

12. Detecting Wafers in a Vacuum Conveyance System

The E32-V provides an easy-connecting fiber and easy-to-use 4-channel flange system, making it ideally applicable to vacuum systems.

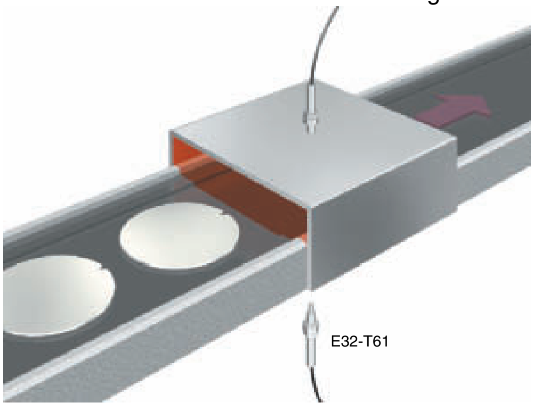


E32-V (CD)

Vacuum Sensors

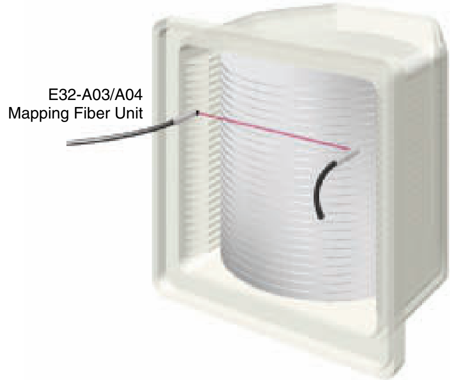
Applications

13. Detecting Wafers under High Temperatures
The E32-T61 features a temperature-resistant fiber for stable detection of wafers baked at 300°C or higher.



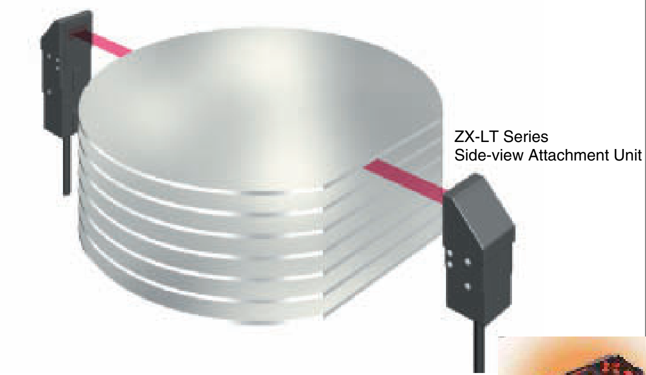
E32-T61 (page A-203)
Heat-resistant Fiber Unit

14. Mapping Wafers with a Through-beam Side-view Sensor
The narrow beam permits the detection of single wafers, even of wafers with mirror surfaces.



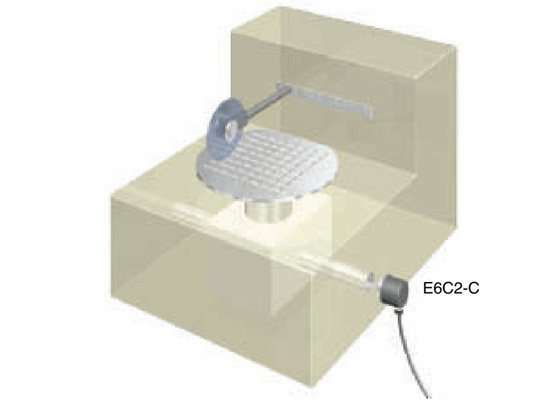
E32-A03/A04 (page A-211)
Mapping Fiber Units

15. Mapping Wafers with a Through-beam Laser Sensor
The ZX-LT Series even detects transparent objects and glossy wafers.



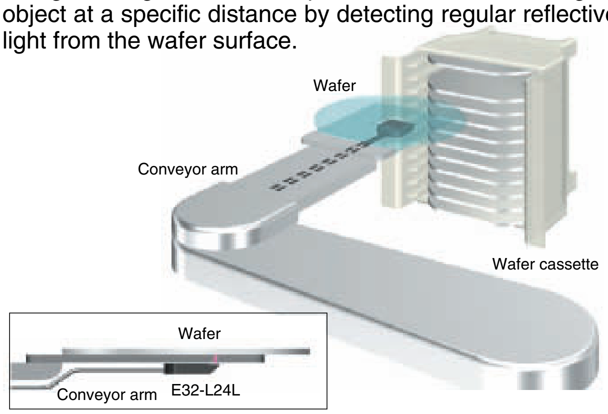
ZX-LT Series (page B-3)

16. Positioning for Wafer Cutting Machines
This sturdy rotary encoder enables positioning at a consistent cutting pitch when cutting silicon wafers.



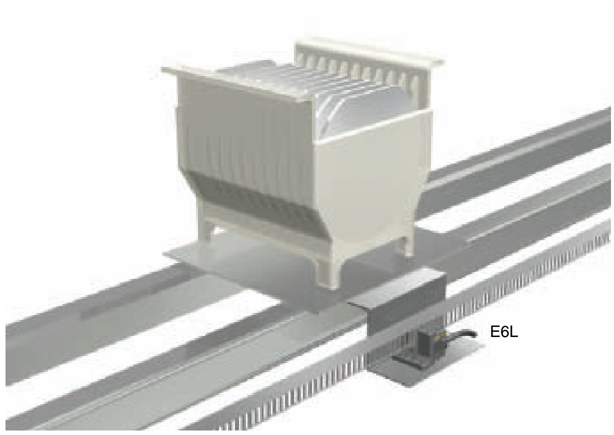
E6C3-C (page E-7)
Incremental Rotary Encoders

17. Detecting the Bottom Wafer
Using convergent reflective operation enables detecting an object at a specific distance by detecting regular reflective light from the wafer surface.



E32-L24L (page A-209)
Convergent Reflective Fiber Unit

18. Wafer Positioning and High-speed Detection



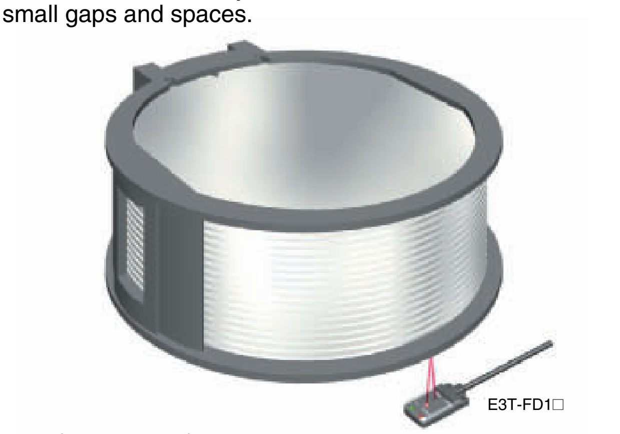
E6L (CD)
Easy-scale Linear Encoder

OMRON

Semiconductors and Electronic Components

19. Wafer Cassette Mounting Confirmation

This slim sensor is only 3.5 mm thick to allow installation in small gaps and spaces.

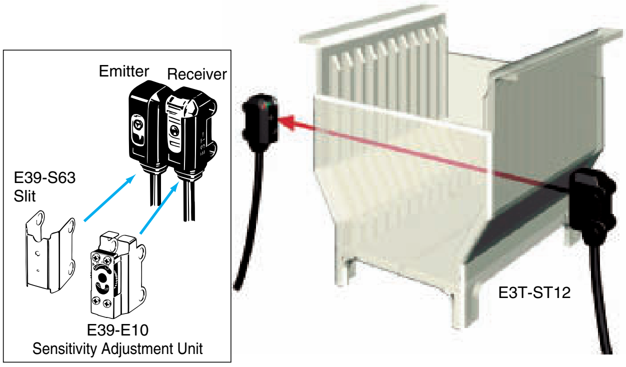


E3T (page A-67)

Subminiature Photoelectric Sensors with a Built-in Amplifier

20. Detecting Wafer Cassette Racks

The installation of a Slit and Adjustment Unit permits a restricted light for stable detection even when there is inconsistency in the cassette resin or individual units.



E3T (page A-67)

Subminiature Photoelectric Sensors with a Built-in Amplifier

21. Positioning Wafer Notches

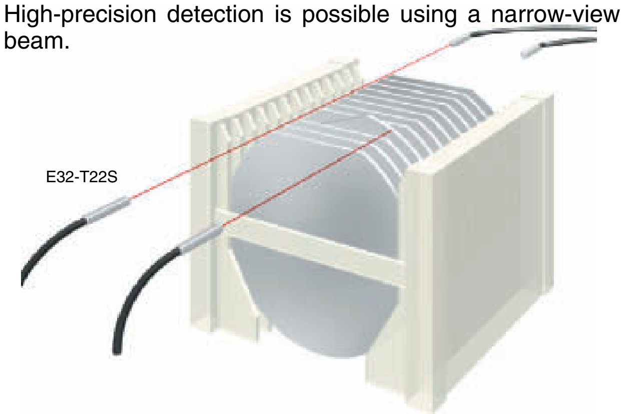
The small spot with a 0.1 mm diameter allows high-precision notch positioning.

E32-T16J (page A-184)

Area-detecting Fiber Unit

22. Checking Orientation Flat Directions with a Fiber Unit

High-precision detection is possible using a narrow-view beam.

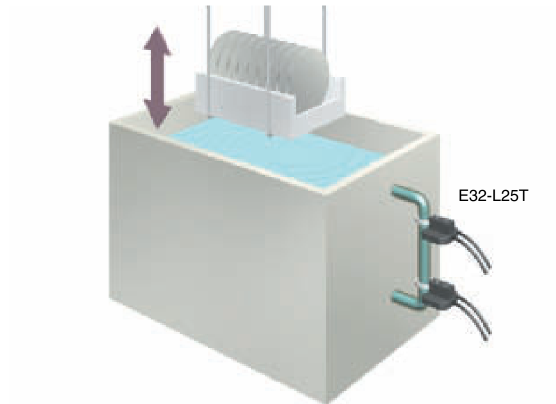


E32-T22S (page A-207)

Narrow-view Fiber Unit

23. Chemical Level Detection with Pipe Mounting

A minimum level difference of 4 mm can be detected in stages to control resist liquid levels.

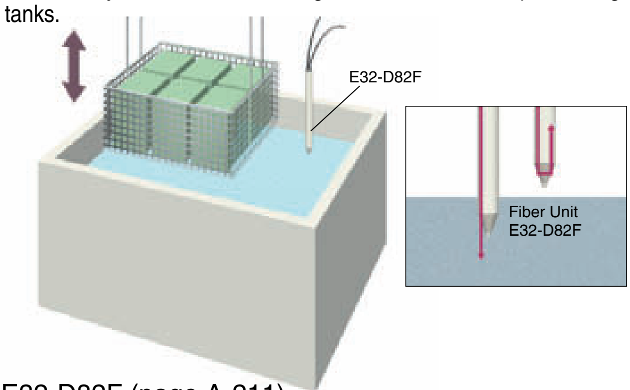


E32-L25T (page A-211)

Fiber Pipe-mounting Liquid Level Sensor

24. Level Detection in Heated Chemicals

The Fiber Unit uses Teflon* so that chemical levels can be precisely and directly detected in cleaning tanks or chemical processing tanks.



E32-D82F (page A-211)

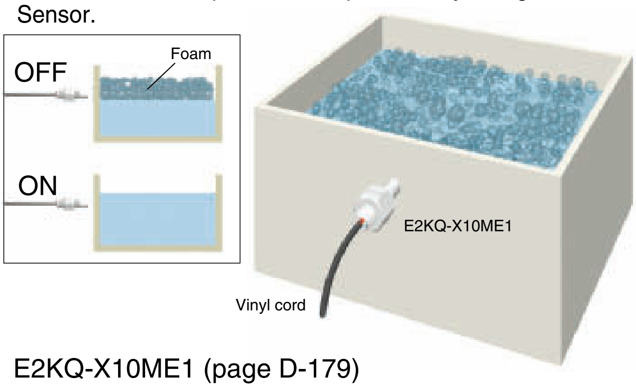
Contact Liquid Level Sensors

*Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluoride resin.

OMRON

25. Detecting Levels of Corrosive Liquids

Sensitivity adjustment can prevent detection errors previously caused by foam in cleaning tanks containing soap. Application in corrosive liquids is also possible by using a Teflon* Sensor.



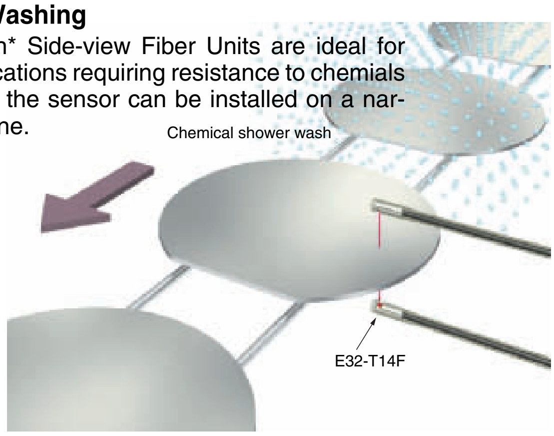
E2KQ-X10ME1 (page D-179)

Chemical-resistant Capacitive Proximity Sensor

*Teflon is a registered trademark of t DuPont Company and Mitsui DuPont Chemical Company for their fluoride resin.

26. Detection on Narrow Lines for Chemical Washing

Teflon* Side-view Fiber Units are ideal for applications requiring resistance to chemials when the sensor can be installed on a narrow line.



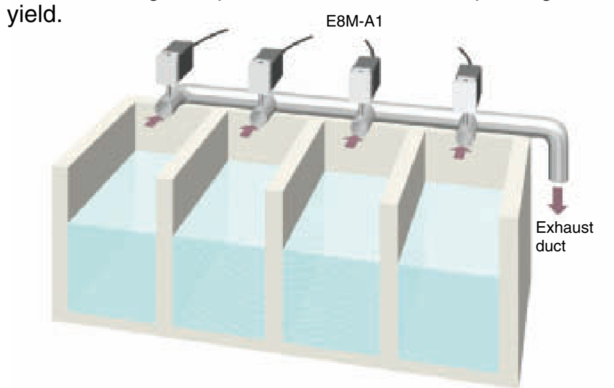
E32-T14F (page A-201)

Teflon Side-view Fiber Unit

*Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluoride resin.

27. Controlling Exhaust Pressure for Individual Cleaning Tanks

Sensors detect the exhaust pressure of each cleaning tank, enabling independent control and improving wafer yield.

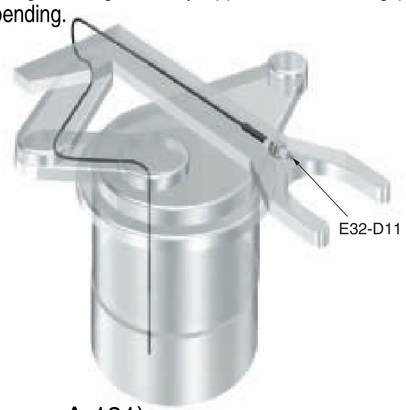


E8M-A1/K3C-MP8-T1Z (CD)

Minute Pressure Sensors

28. Detecting Workpieces by Robot Hand

An allowable bending radius of 4 mm enables the E32-D11/D21 to withstand repeated bending, making it ideally applicable to moving parts subject to frequent bending.

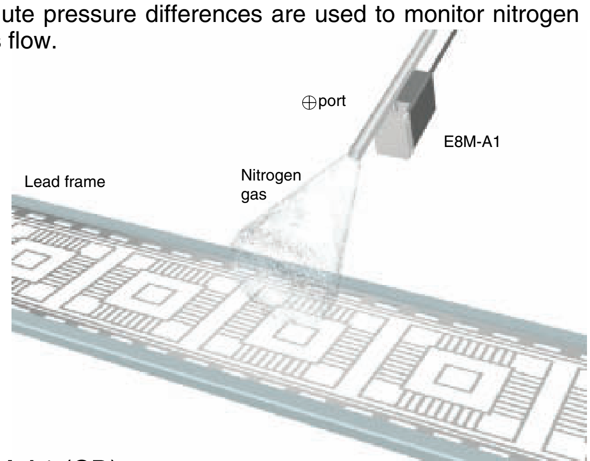


E32-D11/D21 (page A-181)

Moving-piece-mounting Fiber Unit

29. Controlling Nitrogen Gas Pressure

Minute pressure differences are used to monitor nitrogen gas flow.

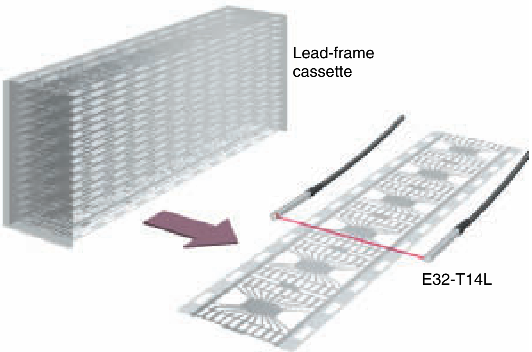


E8M-A1 (CD)

Minute Pressure Sensors

30. Detecting Lead Frames in Tight Spaces

Side-view configuration allows use in spaces that are too small to install ordinary through-beam sensors. Highly effective, space-saving installation.



E32-T14L (Through-beam) (page A-193) /
E32-D24 (Reflective) (page A-197)

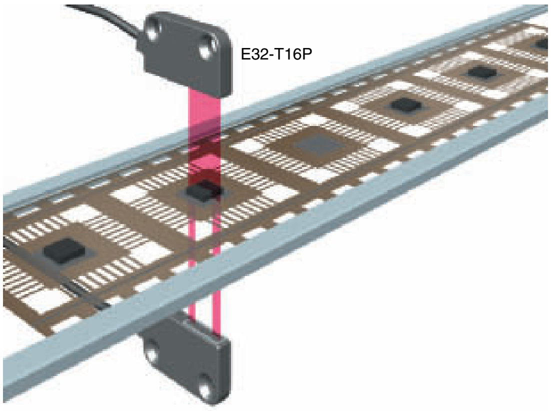
Side-view Fiber Units

OMRON

Semiconductors and Electronic Components

31. Detecting Chips on TAB Films

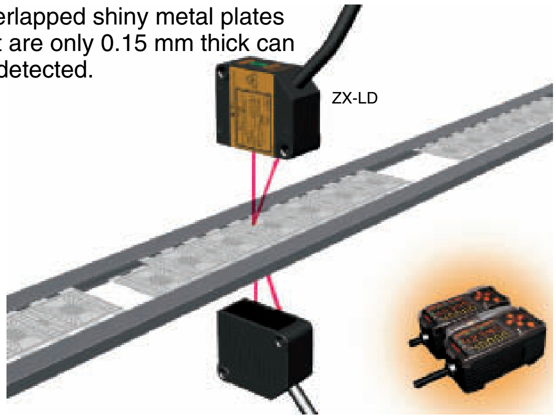
Chips are detected in an area of 11 mm.



E32-T16P (page A-185)
Area-detecting Fiber Unit

32. Detecting Overlapped Lead Frames and Other Shiny Metals

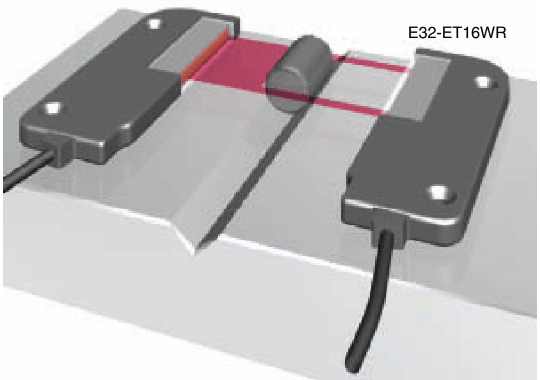
Overlapped shiny metal plates that are only 0.15 mm thick can be detected.



ZX Series (page B-3)
Smart Sensors

33. Distinguishing the Length of IC Resin Tablets

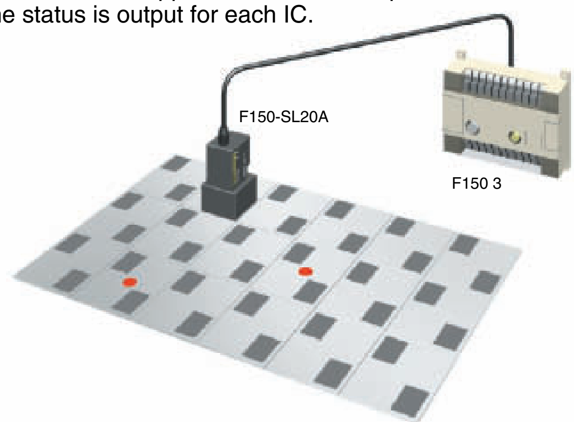
The length of resin tablets for different IC types can be distinguished by the amplifier's monitor output.



E32-ET16WR Area-detecting Fiber Unit (CD)
E3X-DA-21-N Digital Fiber Amplifier with Monitor Output

34. Determining Defective IC Chips by Identifying Bad Marks

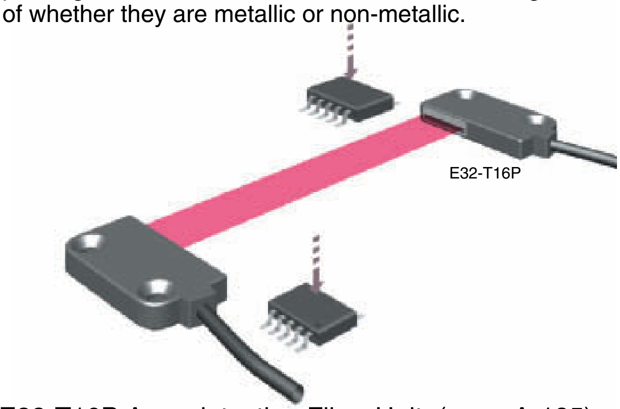
The bad marks applied to ICs on wafer plates are read, and the status is output for each IC.



F150-3 (page C-11)
Vision Sensors

35. Detecting the Passage of Chip Components

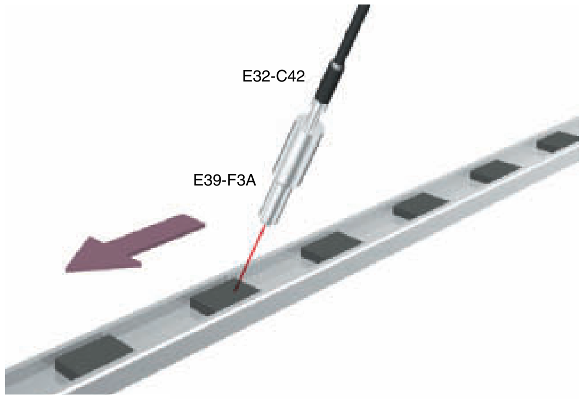
The passing of chip components is detected even if the passing location varies within a width of 11 mm, regardless of whether they are metallic or non-metallic.



E32-T16P Area-detecting Fiber Unit (page A-185)
E3X-DAD Digital Fiber Amplifier with Differential Output

36. Detecting Chip Components

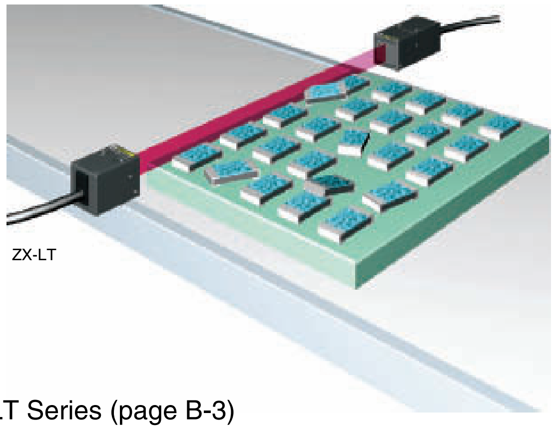
Adding a Lens Unit to a fiber sensor enables the spot to be varied from 0.1 to 0.6 mm in diameter.



E32-C42 Fiber Unit (page A-199)
E39-F3A Lens Unit (page A-245)

37. Detecting the Alignment of Chip Components

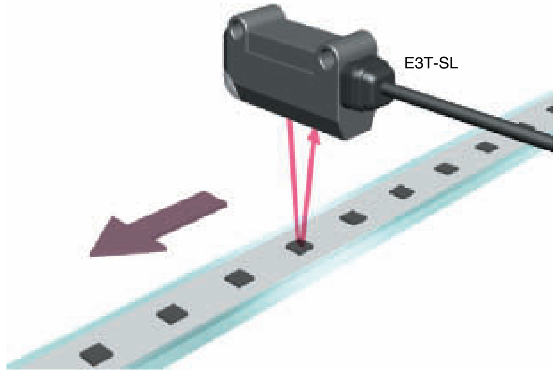
Raised or angled chips can be found on trays. Inspection time is shortened by handling an entire tray with a single inspection.



ZX-LT Series (page B-3)
Parallel Beam Linear Sensors with a Separate Amplifier

38. Detecting Chip Components on the Tapes of Taping Machines

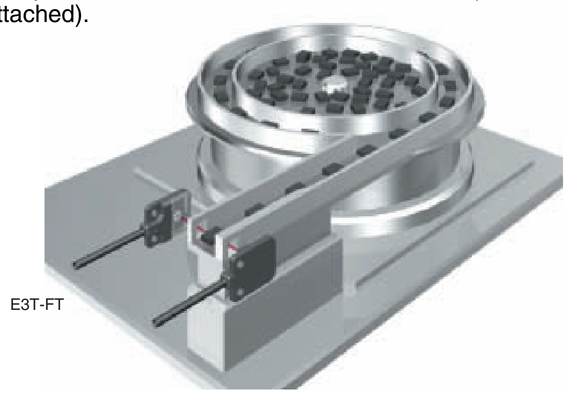
The E3T is capable of detecting objects as small as 0.15 mm. Detection remains stable, with minimal effect from backgrounds or surrounding metals.



E3T (page A-67)
Subminiature Photoelectric Sensors with a Built-in Amplifier

39. Detecting the Passage or Retention of Components by a Parts Feeder

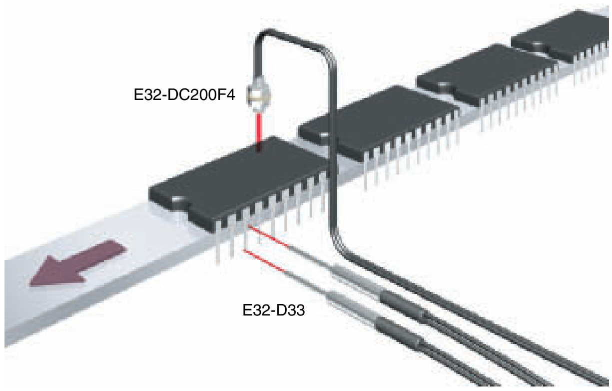
The use of a visible pinpoint beam permits the detection of workpieces smaller than 0.5 mm in diameter (when slit is attached).



E3T (page A-67)
Subminiature Photoelectric Sensors with a Built-in Amplifier

40. Detecting Bent or Missing IC Pins

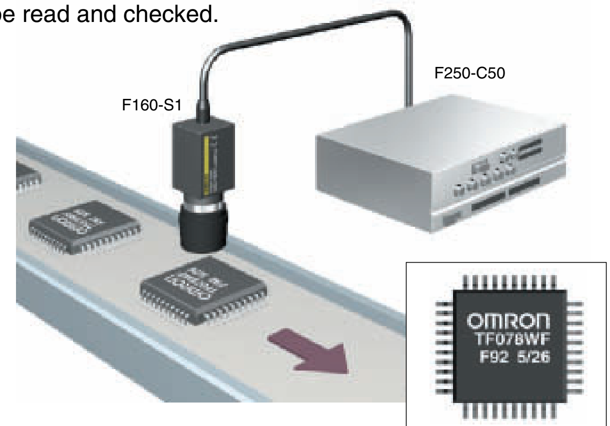
Three sensors are used to simultaneously detect bent or missing pins.



E32-D33 (page A-189)
Thin Head Fiber Unit

41. Verifying IC Models, Lot Numbers, and Printed Characters

IC model numbers, lot numbers, and other information can be read and checked.

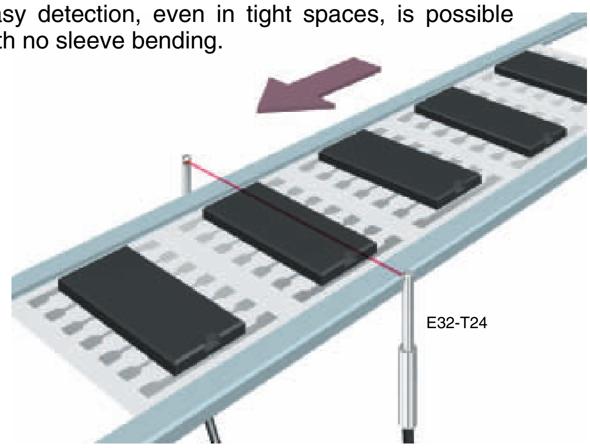


Characters as read

F250 (page C-45)
High-performance Vision Sensor

42. Detecting Rises in Lead Frames

Easy detection, even in tight spaces, is possible with no sleeve bending.



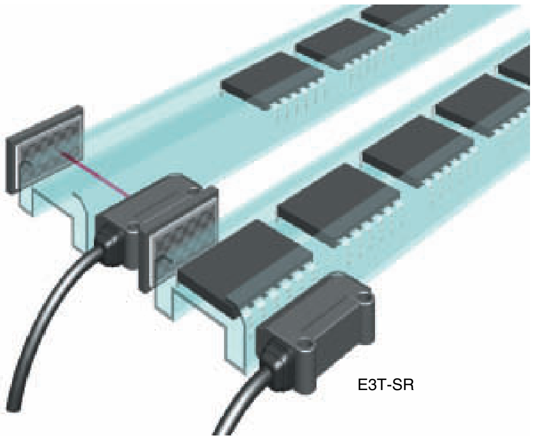
E32-T24 (page A-194)
Thin Side-view Fiber Unit

OMRON

Applications

Semiconductors and Electronic Components

43. Detecting Full IC Sticks

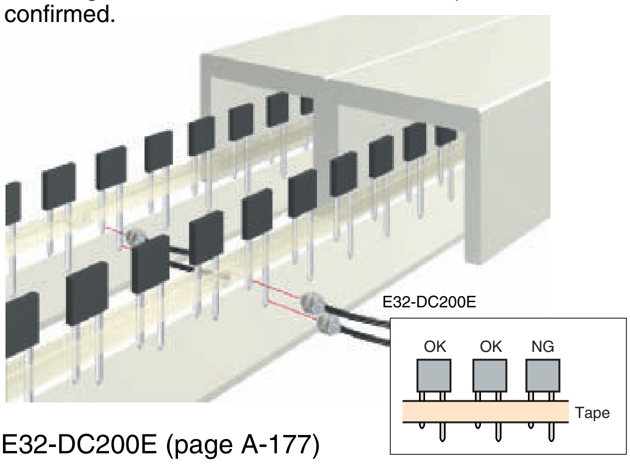


E3T (page A-67)

Subminiature Photoelectric Sensors with a Built-in Amplifier

44. Distinguishing Lead Wire Defects in Components

The length of lead wires of electronic components can be confirmed.



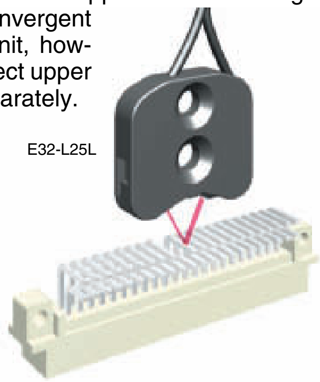
E32-DC200E (page A-177)

Fiber Unit

45. Detecting Connector Pins

When inspecting two levels of connector pins with an ordinary fiber unit, the lower set of connector pins caused an ON signal even when the upper level is missing.

The E32-L25L Convergent Reflective Fiber Unit, however, is able to detect upper and lower sets separately.

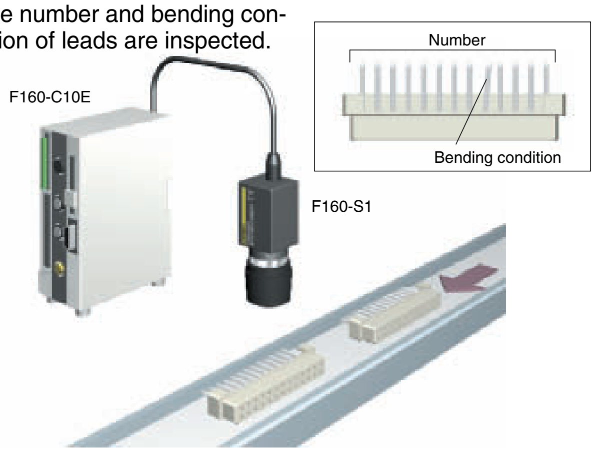


E32-L25L (page A-209)

Convergent Reflective Fiber Unit

46. Inspecting Connector Leads

The number and bending condition of leads are inspected.

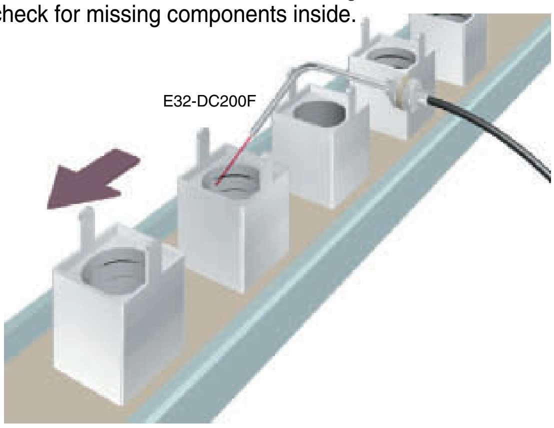


F160 (page C-25)

Vision Sensor

47. Detecting Parts Inside Metal Cases

The E32-DC200F detects reflected light from internal threads to check for missing components inside.

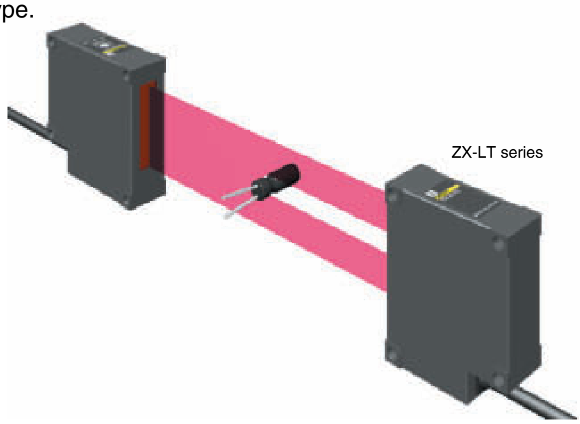


E32-DC200F (page A-188)

Thin Sleeve Fiber Unit

48. Classifying Capacitors

The diameter of each capacitor is used to determine its type.

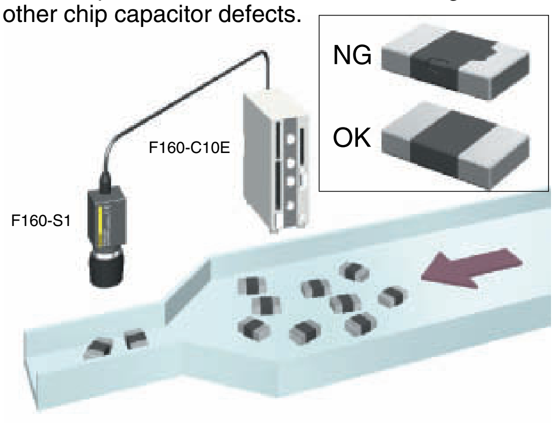


ZX-LT Series (page B-3)

Parallel Beam Linear Sensors with a Separate Amplifier

49. Inspecting for Defects on Chip Capacitors

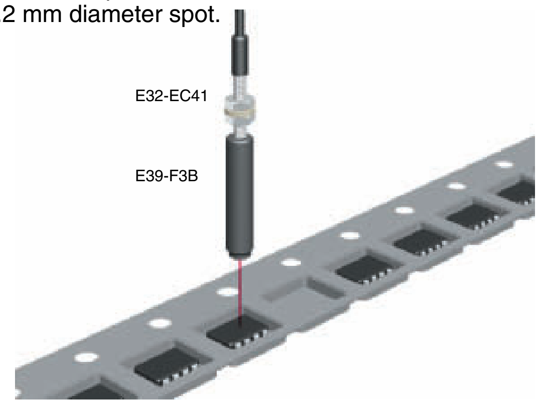
Inspection is possible for mold defects, missing terminals, and other chip capacitor defects.



F160 (page C-25)
Vision Sensor

50. Detecting Missing Chips on Embossed Tape

Adding a Lens Unit to a fiber sensor permits the detection of very small workpieces at a detection distance of 17 mm with a 0.2 mm diameter spot.

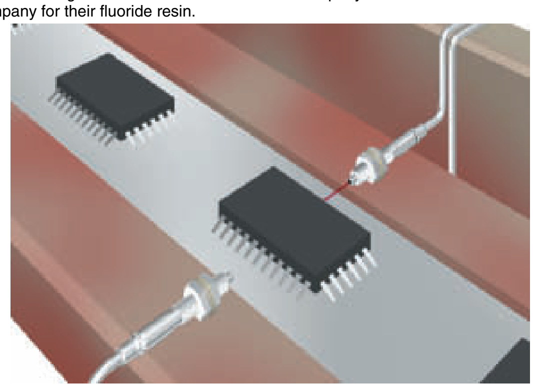


E32-EC41 Fiber Unit (page A-199)
E39-F3B Lens Unit (page A-245)

51. Detecting ICs in a High-temperature Handler

A Teflon* coating eliminates the weak spot of heat-resistance fibers (i.e., hard and difficult to bend) to achieve a bending radius of 10 mm.

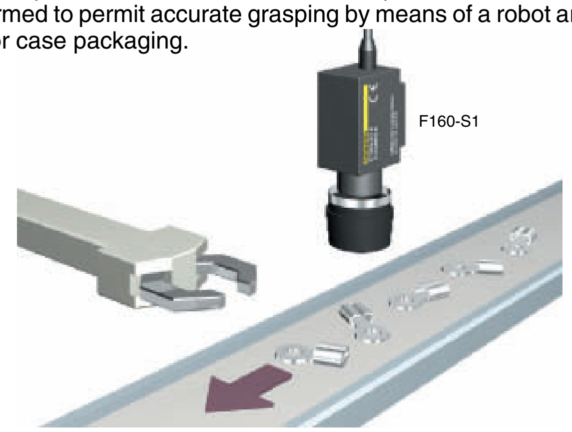
*Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluoride resin.



E32-T81R (page A-203)
Heat-resistant Fiber Unit

52. Terminal Picking

The position and orientation of workpieces can be confirmed to permit accurate grasping by means of a robot arm for case packaging.



F250 (page C-45)
High-performance Vision Sensor

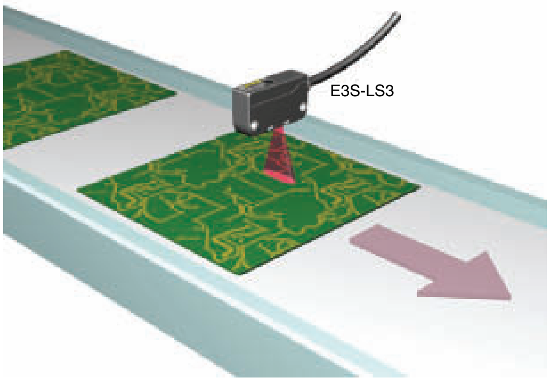
53. Liquid Crystal Position Measurement

The positions of liquid crystal reference marks can be measured using two cameras to determine the overall position. Stable measurement is achieved at low cost for moving objects.

F250 (page C-45)
High-performance Vision Sensor

54. Detecting PCBs

Stable detection is possible because the large spot is not affected by the color, holes or notches of the boards.



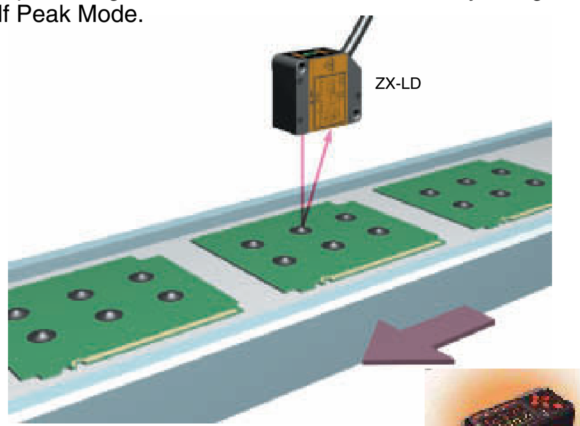
E3S-LS3 (page A-145)
PCB Sensors

OMRON

Semiconductors and Electronic Components

55. Inspecting Board Mold Height

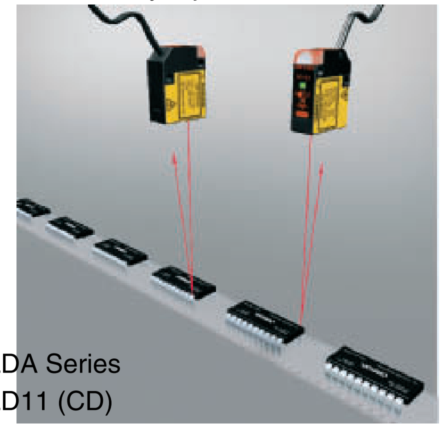
The peak height of a board can be measured by using the Self Peak Mode.



ZX Series (page B-3)
Smart Sensors

56. Detection of fine pins

E3C-LD11 detects with it’s small laser spot of 50 µm each small IC-pin. Due to very high response time of 80 µs it can be done in the real process. The optical axis and focus of the spot can be easily adjusted.



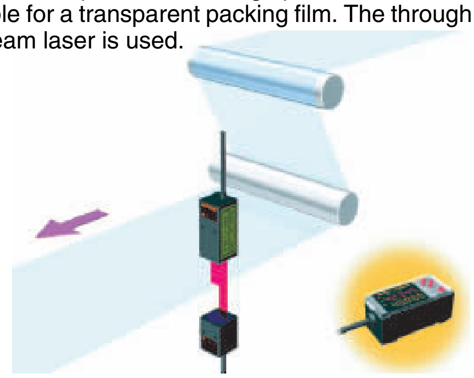
E3C-LDA Series
E3C-LD11 (CD)

OMRON

Packing, Food Products, Chemicals, and Sanitation

57. Meandering Inspection of a Transparent Packing Film

The stable inspection of an edge position or meandering is possible for a transparent packing film. The through type of line beam laser is used.

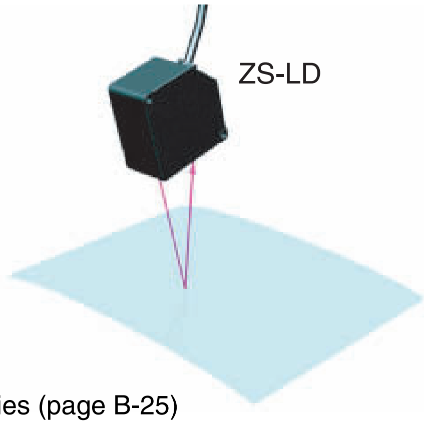


ZX-L-N (page B-3)

Smart Sensor (Laser type)

58. Measuring Plastic Board Warping with 2-Dimensions CMOS

The warping of clear plastic boards can be measured with high precision.

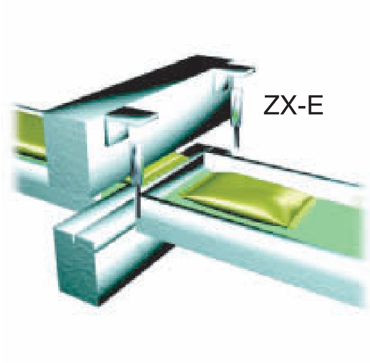


ZS-L Series (page B-25)

Smart Sensor (2-Dimensions CMOS and Laser Beam)

59. Packing Miss Inspection with Linear Proximity Type

It can inspect the height of machine of packing miss, contents get caught in the machine.

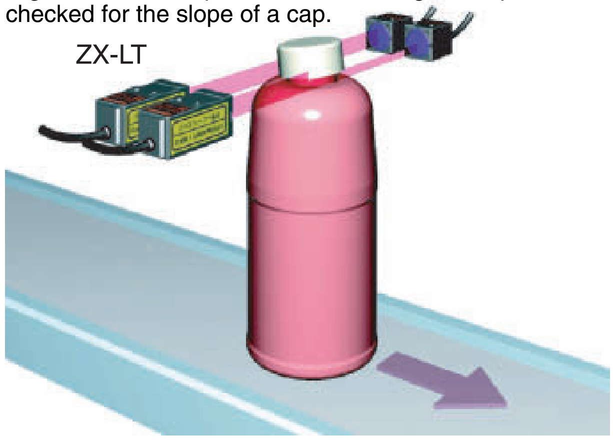


ZX-E Series (page B-61)

Smart Sensor (Linear Proximity Type)

60. Inspection of the Slope of a Cap

Right-and-left comparison and the degree of parallel are checked for the slope of a cap.

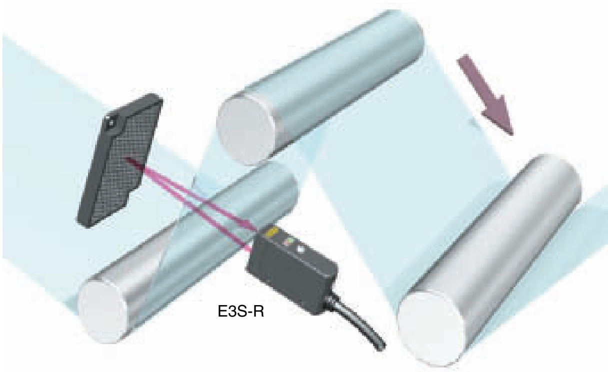


ZX-L-N (page B-3)

Smart Sensor (Laser Type)

61. Detecting Clear Film

Clear film can be detected with a reflector, reducing the amount of wiring.

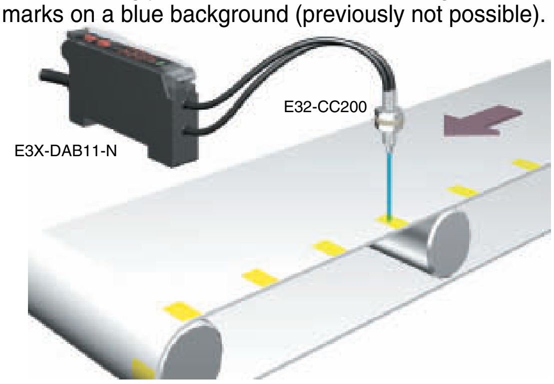


E3S-R (CD)

Transparent Object Photoelectric Sensors

62. Detecting Registration Marks

Teaching is also possible, and sensitivity can be adjusted without aligning the register marks. A blue LED light source enables detecting yellow marks on a white background or purple marks on a blue background (previously not possible).



E32-CC200 (page A-198)

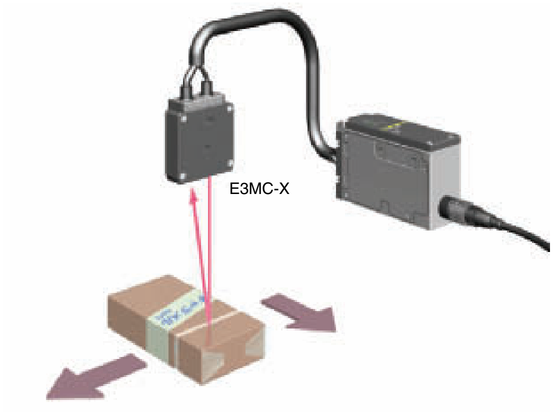
E3X-DAB11-N

Blue LED Teaching Fiber Amplifier

OMRON

Packing, Food Products, Chemicals, and Sanitation

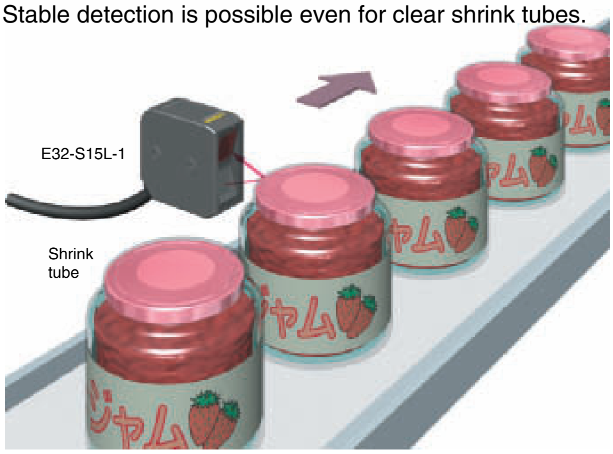
63. Detecting Out-of-place Candy Wrapper Tapes



E3MC (CD)
RGB Color Sensors

64. Detecting Shrink Tubes

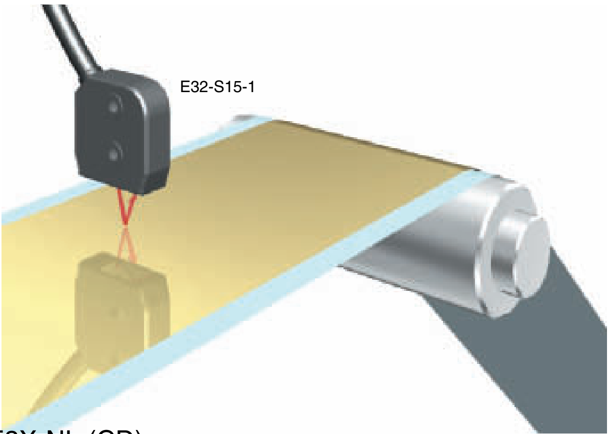
Stable detection is possible even for clear shrink tubes.



E3X-NL (CD)
Optical Fiber Glossy Object Sensor

65. Detecting Coatings on Paper or Metal

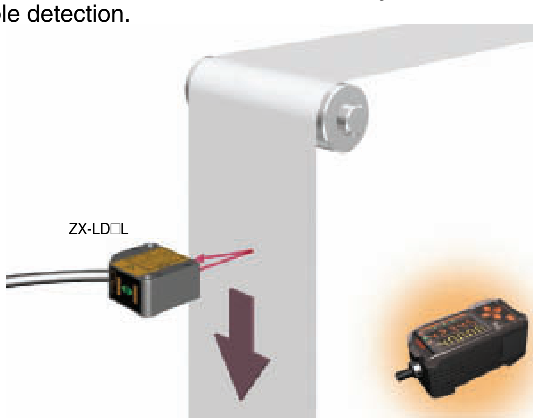
Differences in gloss can be used to detect coatings.



E3X-NL (CD)
Optical Fiber Glossy Object Sensor

66. Detecting Looseness in Sheets

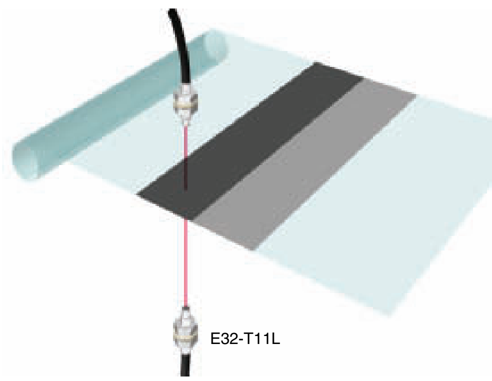
Small surface variations can be averaged out to enable stable detection.



ZX Series (page B-3)
Smart Sensors

67. Detect Shades of Black on Sheets

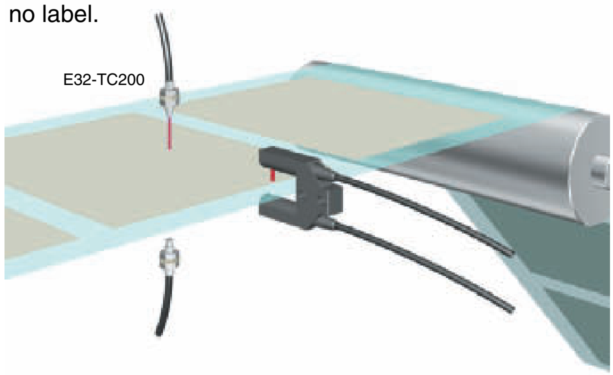
Differences in mark density can be used to permit detection using an infrared light source and through-beam sensor.



E32-T11L Long-distance Fiber Unit (page A-190)
E3X-DAH11-N Infrared Digital Fiber Amplifier

68. Detecting Labels

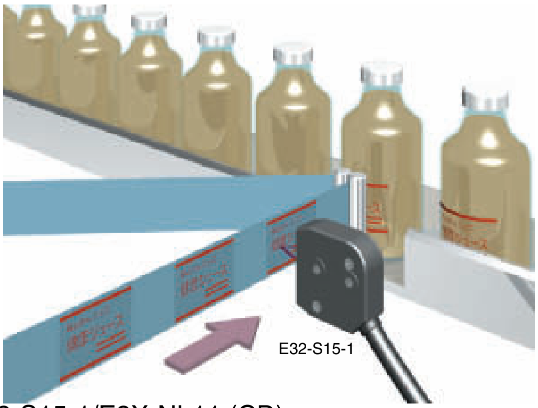
Detection is possible with a through-beam fiber sensor if the backing material is translucent. The light beam is interrupted when a label is detected and received when there is no label.



E32-TC200 Fiber Unit (page A-173)
E3X-DAB11-N Blue LED Teaching Fiber Amplifier

69. Detecting Clear Labels on Support Paper

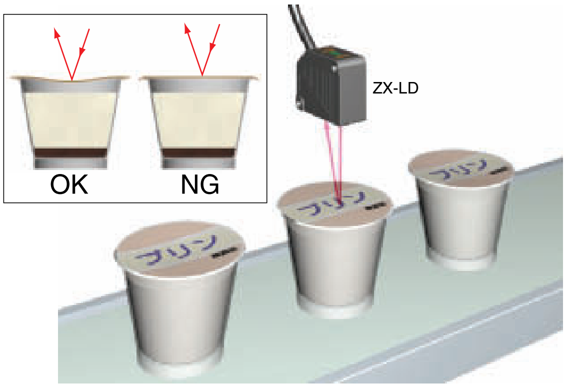
Even clear labels at close intervals on support paper can be positioned without contact.



E32-S15-1/E3X-NL11 (CD)
Optical Fiber Glossy Object Sensor

70. Detecting Pinholes in Sealed Containers

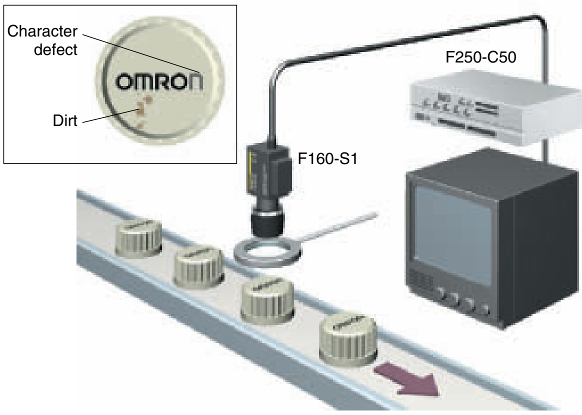
Differences in the depression of the film on the top of the container can be used to detect pinholes.



ZX Series (page B-3)
Smart Sensors

71. Detecting Dirt on Caps

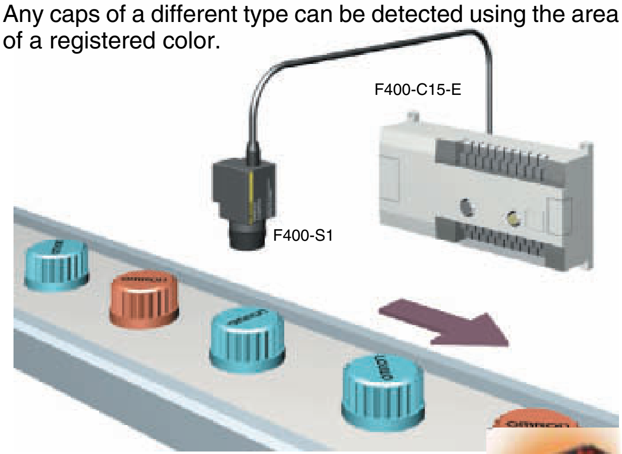
Character defects and other defects can also be detected.



F250 (page C-45)
High-performance Vision Sensor

72. Detecting Incorrect Caps

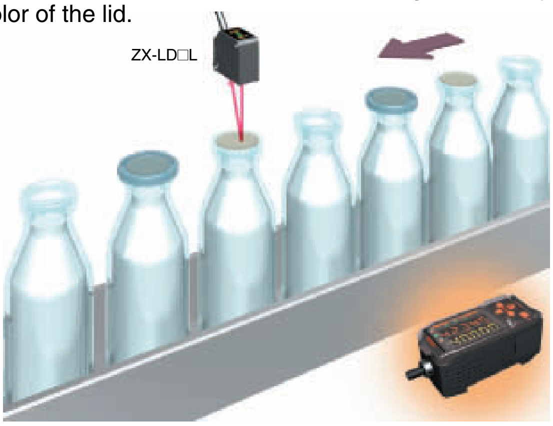
Any caps of a different type can be detected using the area of a registered color.



F400 (CD)
Color Vision Sensor

73. Detecting Lids on Milk Bottles

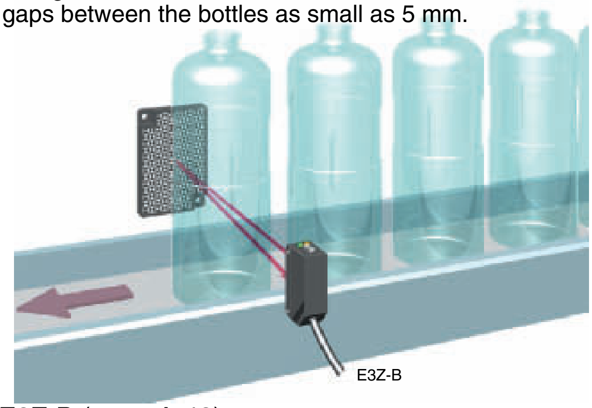
Stable detection is possible without being affected by the color of the lid.



ZX Series (page B-3)
Smart Sensors

74. Detecting PET Bottles

A retrospective reflex sensor that saves both space and wiring can achieve stable detection of PET bottles with gaps between the bottles as small as 5 mm.



E3Z-B (page A-43)
Photoelectric Sensors for Detecting Transparent Bottles

Applications

Packing, Food Products, Chemicals, and Sanitation

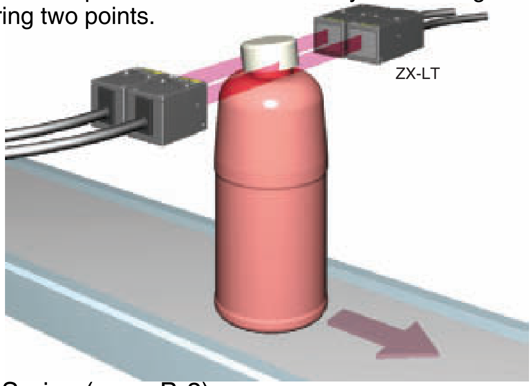
75. Position Detection of Glass Bottle Hollows

The 2- to 3-mm hollow on the bottom of bottles can be used for positioning and other operations.

ZX Series (page B-3)
Smart Sensors

76. Detecting Cap Height

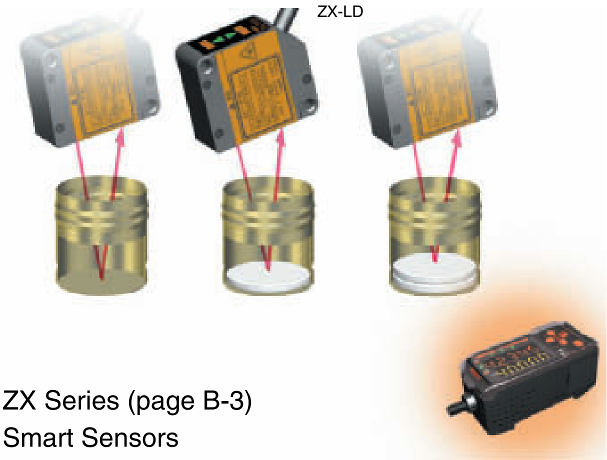
A check can be made for caps that are not straight by comparing the height of a cap left-to-right. The height and inclination of a cap can be determined by measuring and comparing two points.



ZX-LT-Series (page B-3)
Smart Sensors

77. Determining the Number of Inner Linings in Bottle Caps

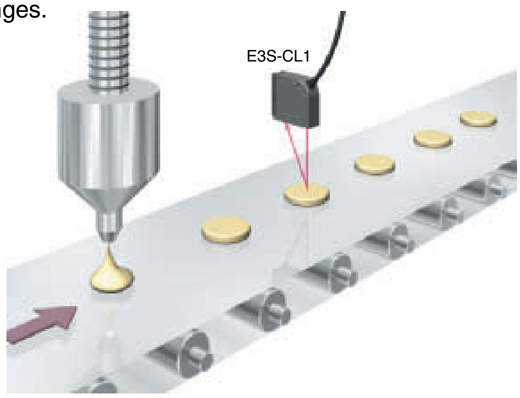
The evaluation output of the amplifier can be used to determine the number of cap linings.



ZX Series (page B-3)
Smart Sensors

78. Detecting Candy and Cookies on Conveyor Belts

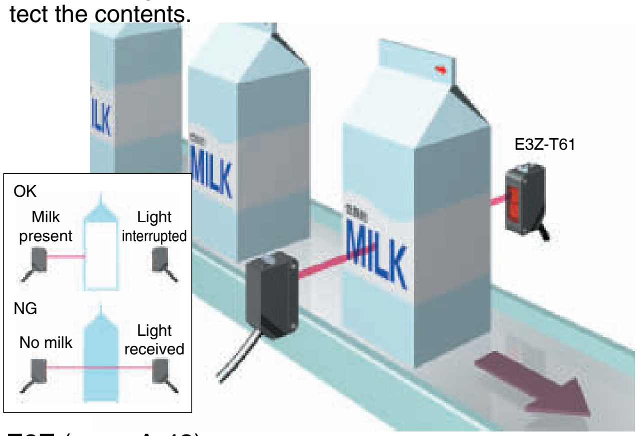
Detection is even possible from overhead. Sensitivity adjustment is not required even if the color of the product changes.



E3S-CL Distance-controlled (page A-111)
Photoelectric Sensors

79. Detecting Liquid in Paper Cartons

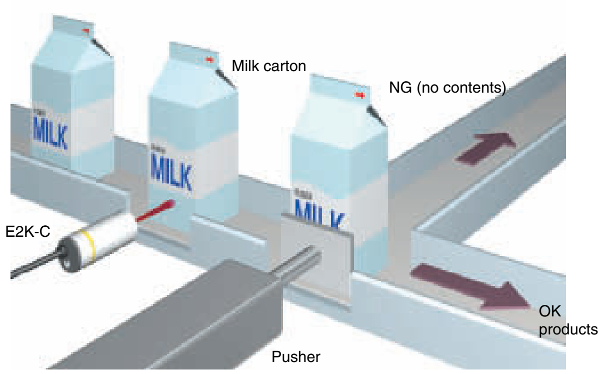
A powerful light beam can penetrate paper cartons to detect the contents.



E3Z (page A-43)
Photoelectric Sensors with a Built-in Amplifier

80. Detecting Milk in Paper Cartons

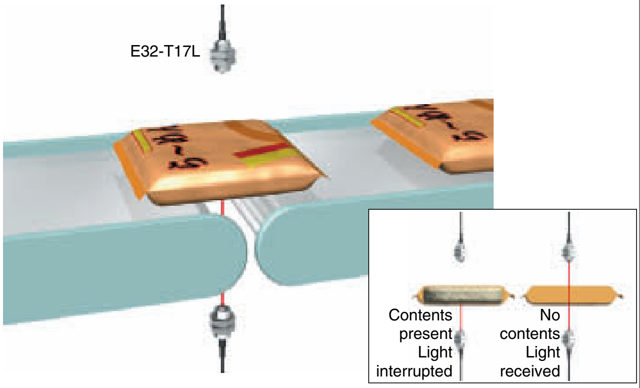
Milk in opaque paper cartons can be detected using a capacitive sensor.



E2K-C (page D-183)
Long-distance Capacitive Proximity Sensors

81. Detecting the Contents of Opaque Packages

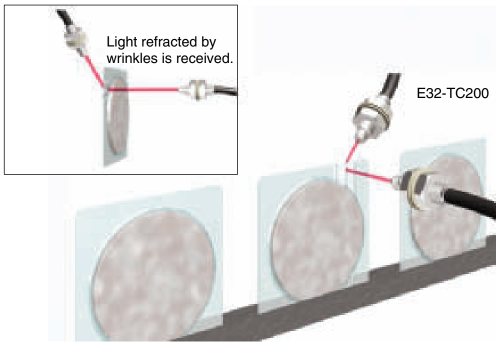
The E3X-DA-N Long-distance Sensor enables detecting the contents of opaque packages.



E32-T17L (page A-180)
Long-distance Fiber Unit

82. Inspecting Food Packages

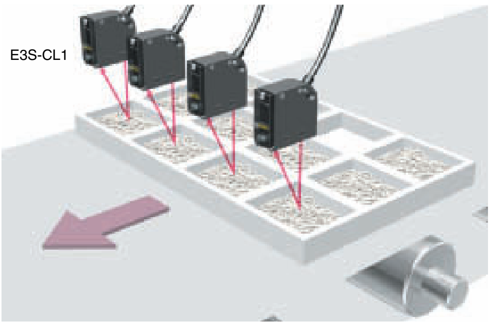
Wrinkles in package materials can be detected. As shown below, light diffused by wrinkles in the package is received if the emitter and receiver are installed at an angle to each other.



E32-TC200 (page A-173)
Fiber Unit

83. Detecting Noodles in Trays

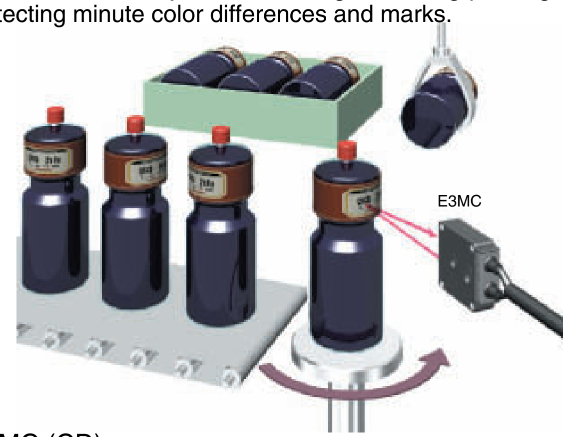
Being able to differentiate between the tray separators and the tray bottoms enables stable detection of noodles without chattering. Water resistance of IP67 is provided for application in water rinsing processes in the food industry.



E3S-CL Distance-controlled (page A-111)
Photoelectric Sensors

84. Aligning Object Direction during Packing

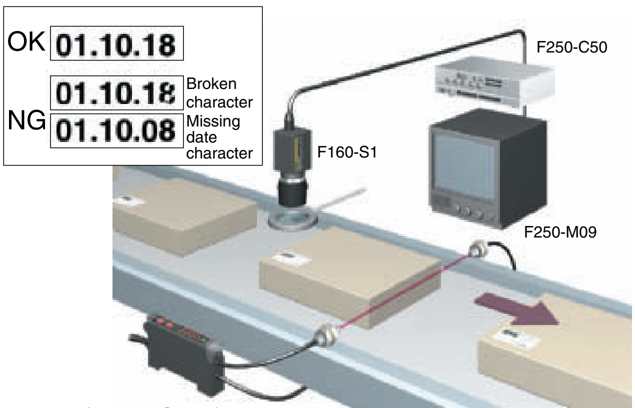
The direction of objects can be aligned during packing by detecting minute color differences and marks.



E3MC (CD)
RGB Color Sensors

85. Verifying Expiration Dates

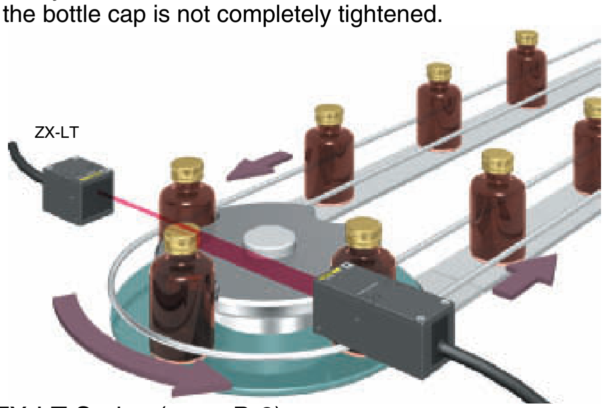
The characters in expiration dates can be read and confirmed.



F250 (page C-45)
High-performance Vision Sensor

86. Inspecting the Tightening Condition of Caps on Bottled Chemicals

The amount of blocked light is measured at the end of the rotary table. The amount that is blocked increases when the bottle cap is not completely tightened.

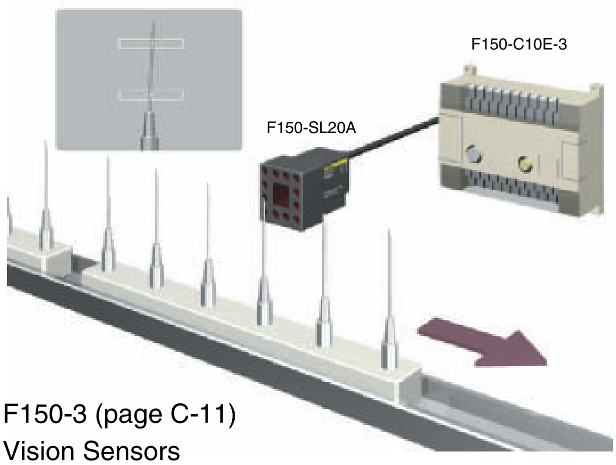


ZX-LT Series (page B-3)
Parallel Beam Linear Sensors with a Separate Amplifier

Applications

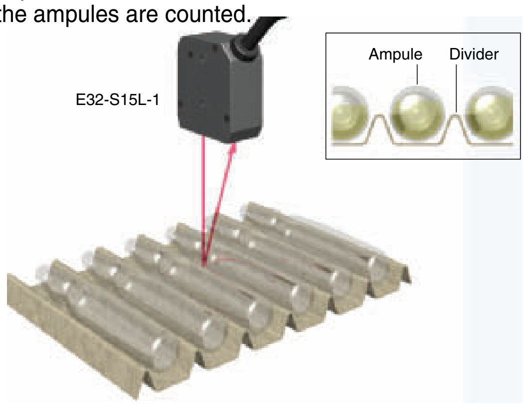
Packing, Food Products, Chemicals, and Sanitation

87. Inspecting for Bent Hypodermic Needles
Bending can be determined by measuring the difference between the base and the tip of the needle.



F150-3 (page C-11)
Vision Sensors

88. Counting Glass Ampules
The difference in glossiness is used to differentiate between the ampules and the dividers between them, to ensure that only the ampules are counted.

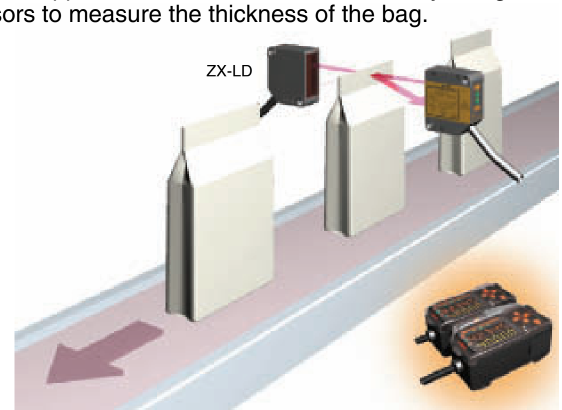


E3X-NL (CD)
Optical Fiber Glossy Object Sensor

89. Detecting the Powdered Chemicals Passing through a Transparent Tube
Powdered chemicals passing within a specific area can be detected, and adjustments can be made by teaching. Teaching can be done without a workpiece.

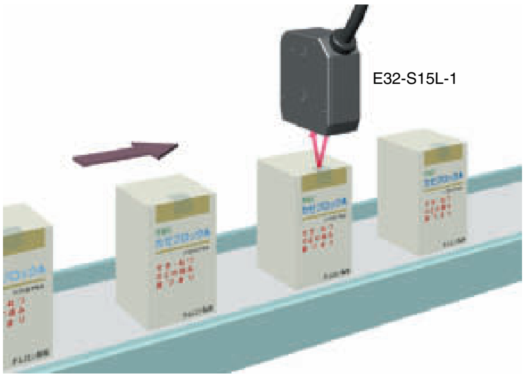
E32-D36P1 (page A-186)
Area-detecting Fiber Unit

90. Detecting Adhesive Application on Bags of Chemicals
The application of adhesive is detected by using two sensors to measure the thickness of the bag.



ZX Series (page B-3)
Smart Sensors

91. Checking Sealing Tape on Boxes of Pharmaceuticals
The difference in glossiness is used to detect sealing tape without being affected by the colors or patterns on the box.



E3X-NL (CD)
Optical Fiber Glossy Object Sensor

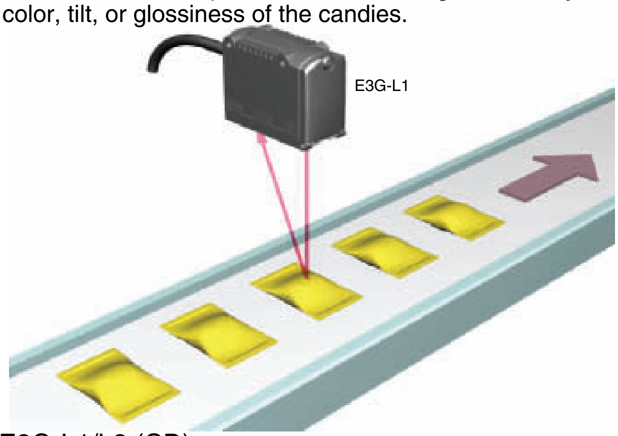
92. Liquid Color Detection
The E3MC RGB Color Sensors distinguish colors by detecting differences between them and registered reference colors. Stability can be further enhanced by placing a white panel in the background.

E3MC (CD)

OMRON

93. Detecting Wrapped Candies

Stable detection is possible without being affected by the color, tilt, or glossiness of the candies.

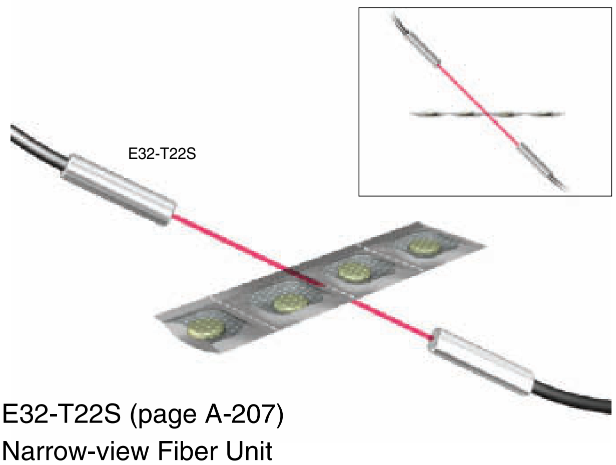


E3G-L1/L3 (CD)

Distance-controlled Photoelectric Sensors

94. Counting Desiccant Packets

The perforations between desiccant packets are detected by the E32-T22S Narrow-view Fiber Unit.

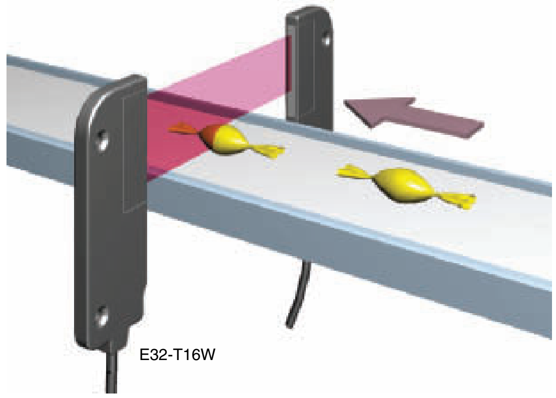


E32-T22S (page A-207)

Narrow-view Fiber Unit

95. Detecting the Front Edge Location of Candies

Area detection using a screen fiber enables positioning of even irregularly shaped objects.

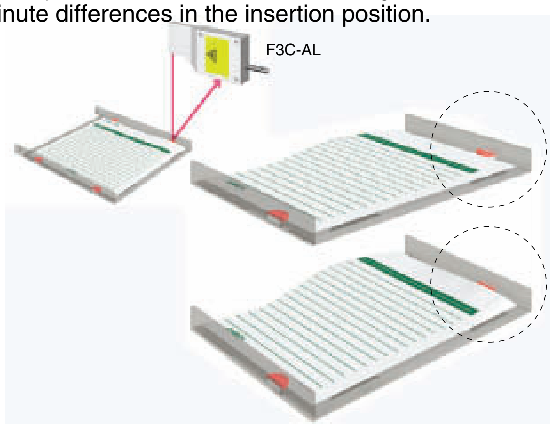


E32-T16W (page A-183)

Area-detecting Fiber Unit

96. Detecting Title Cards Inside CD Cases

Low hysteresis in the distance setting enables detecting minute differences in the insertion position.

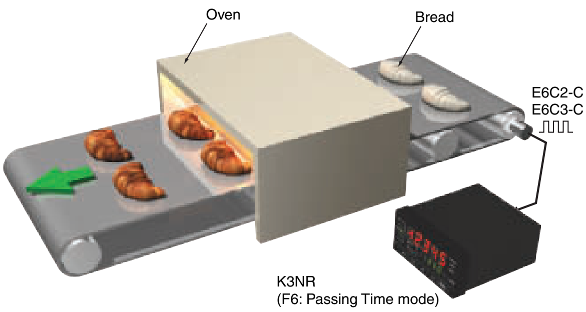


F3C-AL (CD)

Distance-controlled Laser Photoelectric Sensors

97. Display of Bread Baking Time

To control the baking condition of conveyor-transported bread by monitoring the time elapsed while passing through the oven, the speed of the conveyor belt is detected by the Rotary Encoder, and the result is converted to passage time and displayed by the frequency/ratemeter.

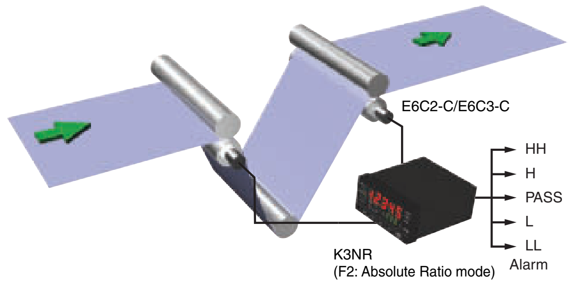


E6C2-C/E6C3-C Rotary Encoders (page E-7)

K3NR Frequency/ratemeters

98. Measuring the Rotational Ratio of a Roller

The rotational ratio between two rollers being used to take-up film, textiles, paper, wire, etc., is measured to monitor and control tension and slackness.



E6C2-C/E6C3-C Rotary Encoders (page E-7)

K3NR Frequency/Rate Meters

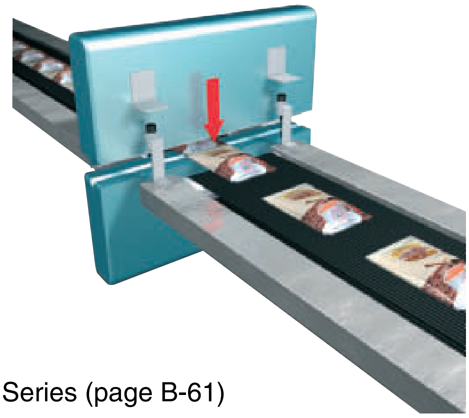
Applications

OMRON

Packing, Food Products, Chemicals, and Sanitation

99. Jamming detection in packaging process

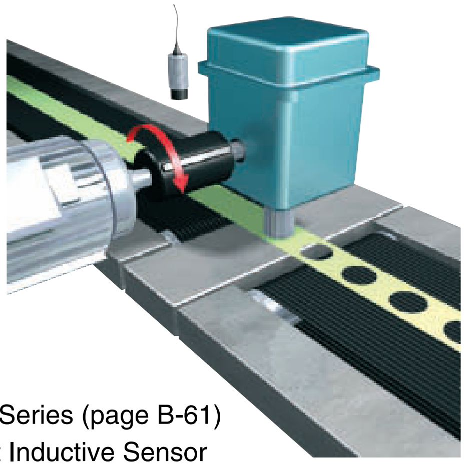
ZX-E controls the gap while sealing the products and stops the machine if jamming is detected.



ZX-E Series (page B-61)
Smart Inductive Sensor

100. Monitoring the cutting process

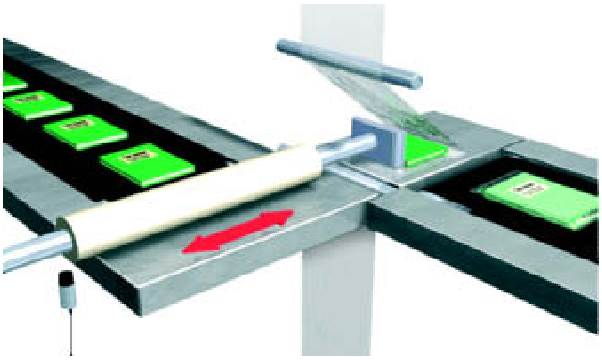
ZX-E sensor measures the bottom-dead-end point of the cutting tool in order to ensure the proper quality of products



ZX-E Series (page B-61)
Smart Inductive Sensor

101. Distance monitoring in vertical packaging machines

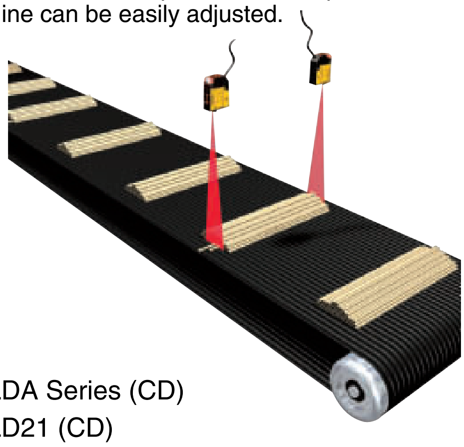
ZX-E sensor monitors the distance of a mechanical movement in a vertical packaging machine.



ZX-E Series (page B-61)
Smart Inductive Sensor

102. Noodle protrusion in food industry

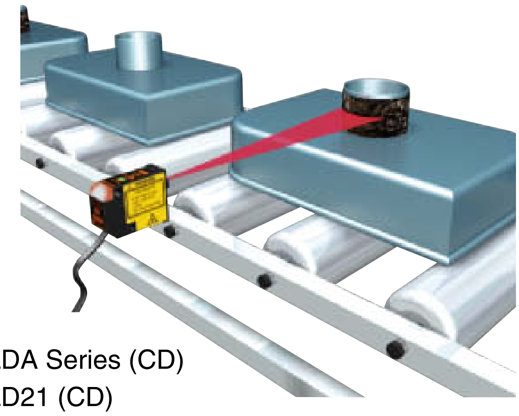
E3C-LD21 with a laser line beam can detect the protrusion of noodles before packaging. Thanks to the laser, the sensing distance can be up to 1 m. The optical axis and focus of the line can be easily adjusted.



E3C-LDA Series (CD)
E3C-LD21 (CD)

103. Label detection

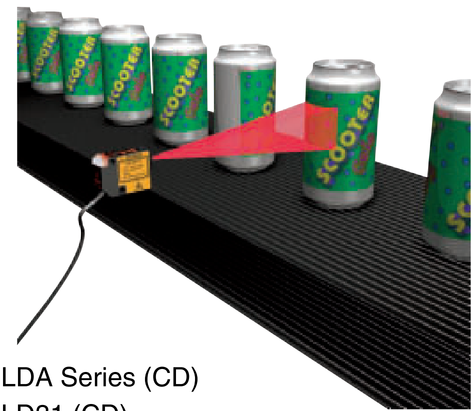
The E3C-LD21 detects the label from a long sensing distance, so therefore the sensor head can be mounted outside from moving parts. The optical axis and focus of the line beam can be easily adjusted.



E3C-LDA Series (CD)
E3C-LD21 (CD)

104. Detection of product orientation

By using the E3C-LD31 with an area laser beam it is possible to control the orientation in a certain area. The optical axis and focus of the area can be easily adjusted.

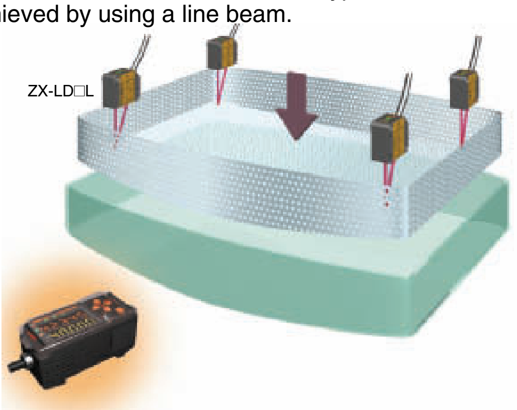


E3C-LDA Series (CD)
E3C-LD31 (CD)

Household Appliances and Office Automation

105. Confirming the Insertion of Shadow Masks into CRTs

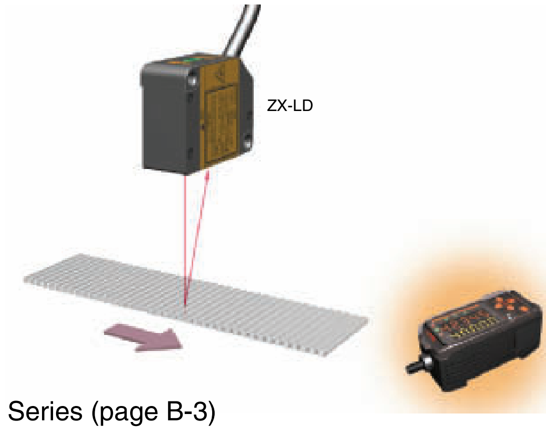
Stable detection of even mesh-type shadow masks is achieved by using a line beam.



ZX Series (page B-3)
Smart Sensors

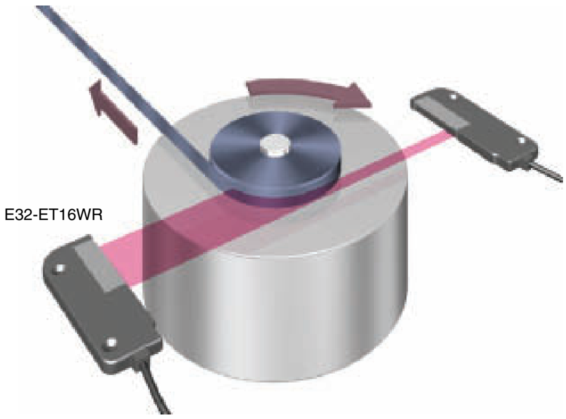
106. Counting Copy Machine Staples

The ultra-small spot of the ZX Series enables counting by precisely detecting the grooves between the staples.



ZX Series (page B-3)
Smart Sensors

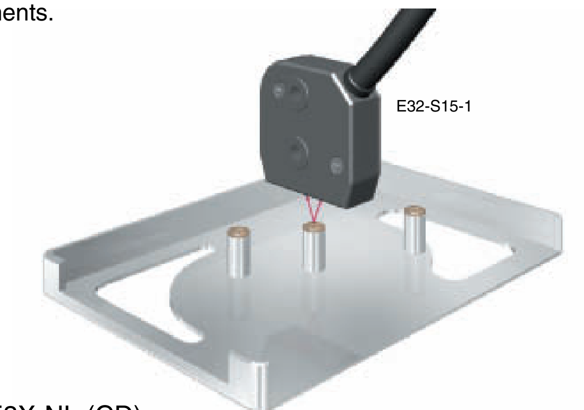
107. Inspection of Tape Remaining in Tape Take-up Applications



E32-ET16WR (CD)
Area-detecting Fiber Unit

108. Confirming the Application of Adhesive/Grease onto Components

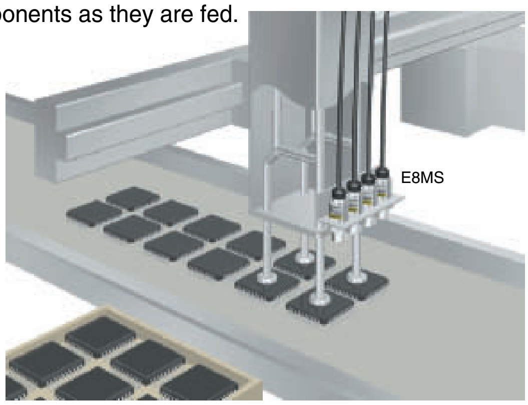
The small 2 mm diameter spot can detect even minute amounts of adhesive or grease applied to precision components.



E3X-NL (CD)
Optical Fiber Glossy Object Sensor

109. Confirming Suction of Chip Components

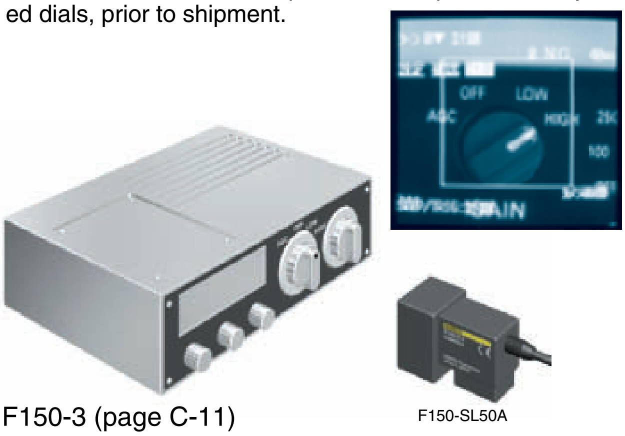
As part of the chip component inspection process, the E8MS/K3C Pressure Sensors are able to confirm the suction of components as they are fed.



E8MS/K3C (CD)
Pressure Sensors

110. Inspecting the Position of Rotary Switches

The F150-3 Vision Sensors permit the detection of switches and buttons, and the inspection of the position of adjusted dials, prior to shipment.



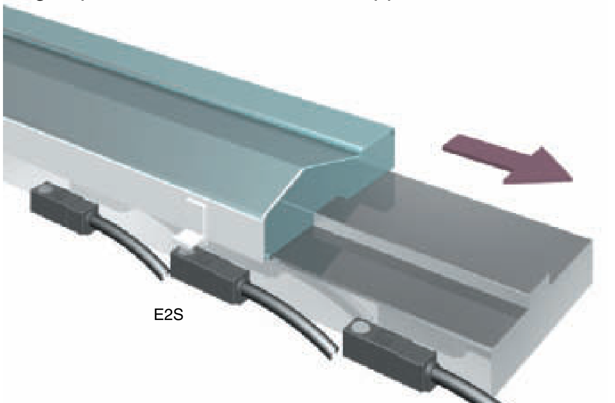
F150-3 (page C-11)
Vision Sensors

Applications

Automobiles, Machine Tools, and Robots

111. Inspection of High-speed Table Movement

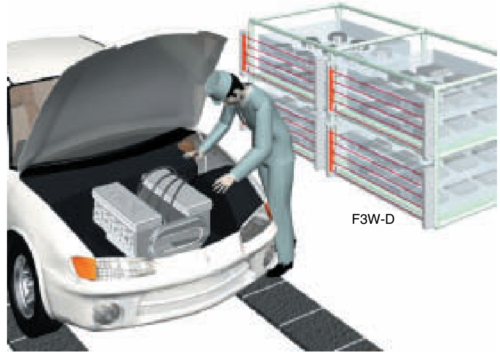
A response frequency of 1 kHz makes the E2S well suited to high-speed machine and device applications.



E2S (page D-61)
Compact Square Inductive Proximity Sensors

112. Confirming the Indication and Picking of Assembly Components

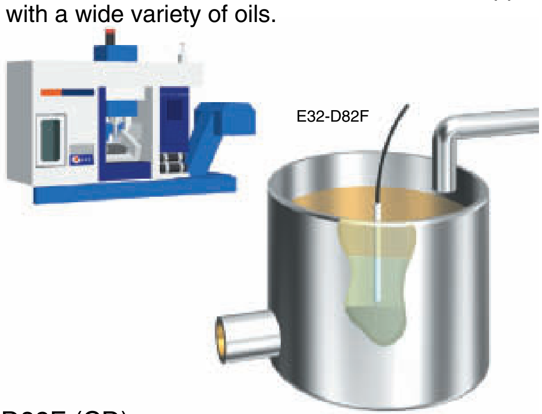
An F3W-D Sensor makes it possible to confirm that components are not forgotten in automotive assembly lines.



F3W-D (CD)
Picking Sensors

113. Managing Liquid Level for Lubricating Oils

The use of Teflon* makes these Sensors ideal for applications with a wide variety of oils.

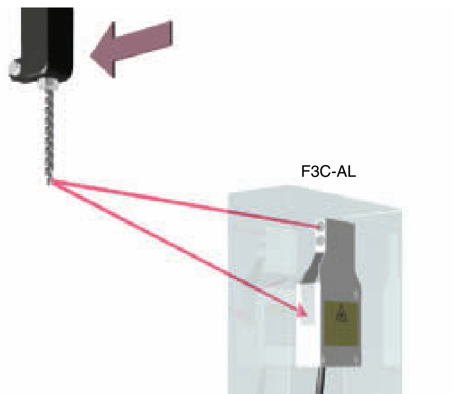


E32-D82F (CD)
Contact Liquid Level Sensors

*Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluoride resin.

114. Detecting Bent Drill Bits

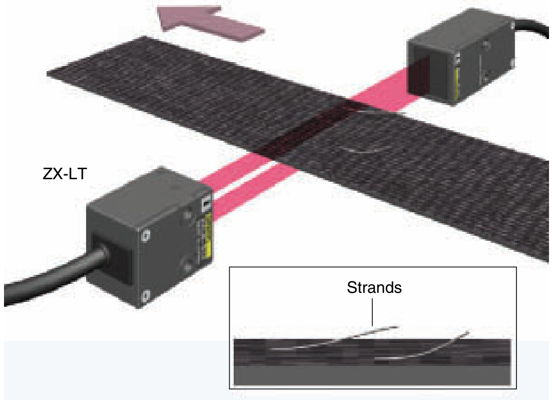
The installation of a transparent shield in front of these sensors protects them from splattering oil.



F3C-AL (CD)
Distance-controlled Laser Photoelectric

115. Detecting Frayed Edges on Safety Belts

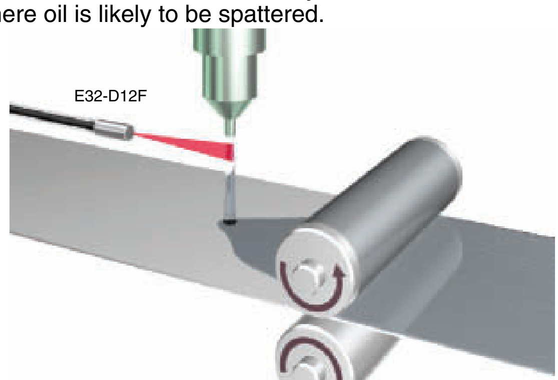
The ZX-LT can detect the strands of frayed edges during the weaving process in safety belt production.



ZX-LT Series (page B-3)
Smart Sensors

116. Detecting Oil Drops

The E32-D12F can detect light reflected from oil drops. The Teflon* fiber can also be safely used in an environment where oil is likely to be spattered.

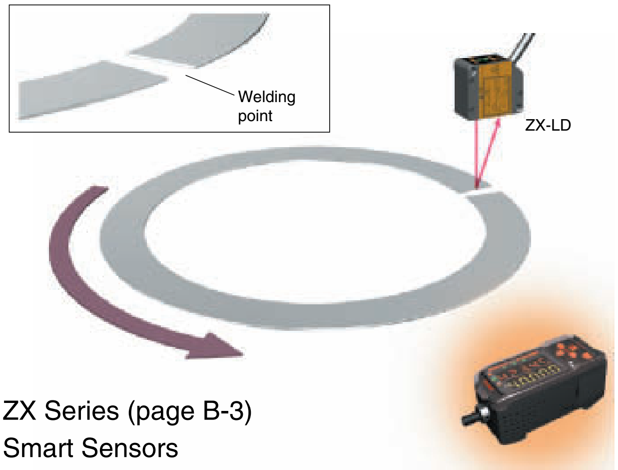


E32-D12F (page A-202)
Chemical-resistant Fiber Unit

*Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluoride resin.

117. Positioning the Welding Point on Ring Gears

The compact size makes it possible for these Sensors to be mounted on welding machines in small spaces.



ZX Series (page B-3)
Smart Sensors

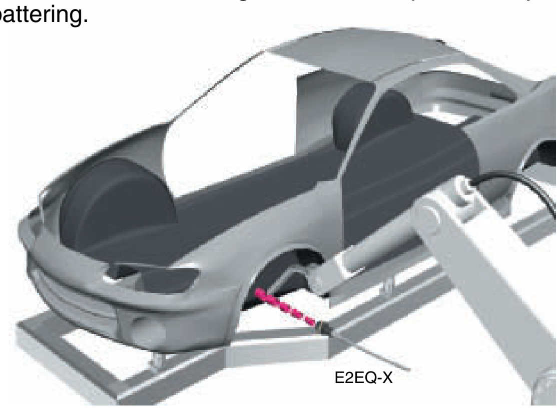
118. Detecting Weld Locations on Metal Pipes

Because teaching without a workpiece is possible for the E3X-DA-N, the sensitivity for detecting weld locations can be set without having to stop the workpiece.

E32-CC200 (page A-198)
Fiber Unit

119. Positioning at the Welding Site

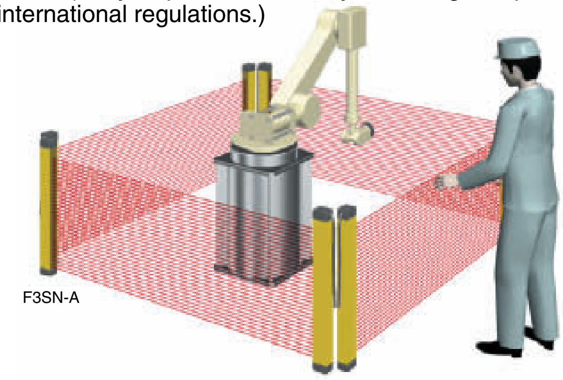
These Sensors are designed for use in places subject to spattering.



E2EQ (page D-171)
Antispatter Proximity Sensors

120. Detection of People Entering the Work Area of Robots

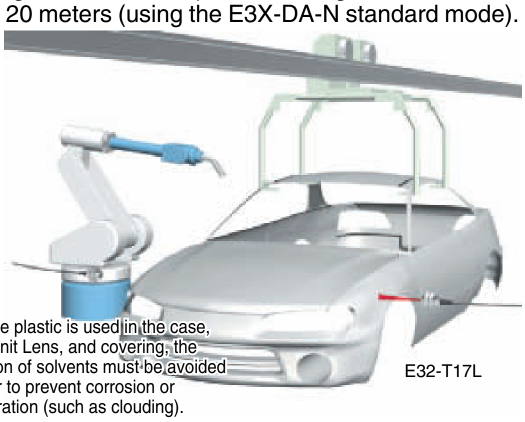
F3SN-A Safety Light Curtains help to provide a protection measure by detecting the entry of people into dangerous areas. (They help to ensure safety according european and international regulations.)



F3SN-A/F3SH-A (page G-3), F3S-TGR (page G-49)
Safety Light Curtains

121. Detecting Workpieces in the Automotive Coating Process

A fiber length of 10 meters permits a long-distance detection up to 20 meters (using the E3X-DA-N standard mode).

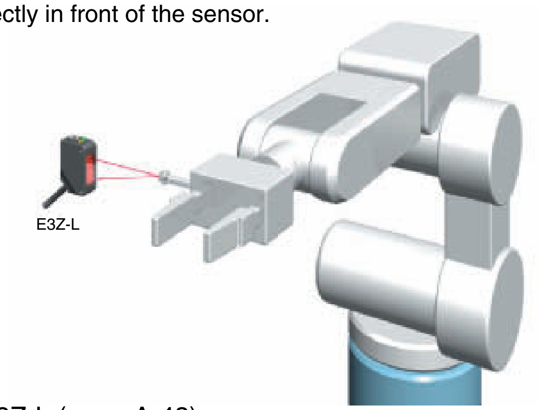


Note: Because plastic is used in the case, Fiber Unit Lens, and covering, the adhesion of solvents must be avoided in order to prevent corrosion or deterioration (such as clouding).

E32-T17L (page A-180)
Fiber Unit with Lens

122. Detecting the Position of Robot Arms

Due to a small metal ball installed on the robot arm, the position of the arm can be detected when the ball moves directly in front of the sensor.



E3Z-L (page A-43)
Narrow-beam Photoelectric Sensors with a Built-in Amplifier

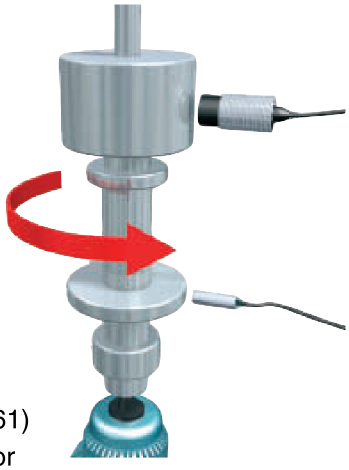
Applications

OMRON

Automobiles, Machine Tools, and Robots

123. Eccentricity control of shaft and bearings

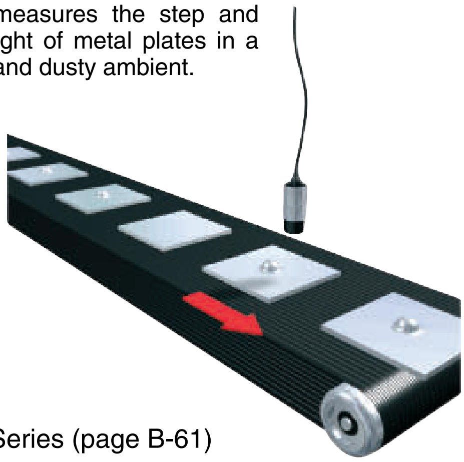
ZX-E measures the eccentricity of shaft and bearings while rotating without influence of oil and water due to inductive principle.
The control function can be used to stop the machine at a curtain point.



ZX-E Series (page B-61)
Smart Inductive Sensor

124. Height and step measurement in rough metal plates

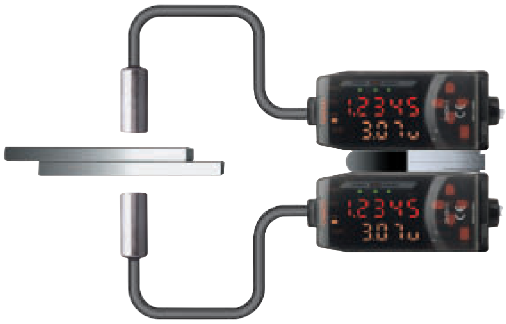
ZX-E measures the step and the height of metal plates in a rough and dusty ambient.



ZX-E Series (page B-61)
Smart Inductive Sensor

125. Thickness measurement of metal plates

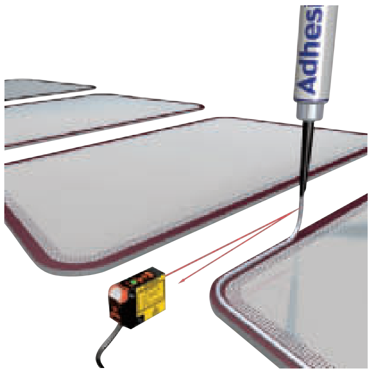
By simply connecting two sensors with a calculation unit the thickness can be measured and monitored using the digital outputs.



ZX-E Series (page B-61)
Smart Inductive Sensor

126. Adhesive and seal inspection

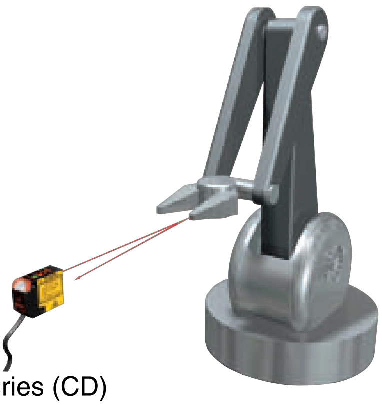
The small sensor head can be easily mounted on a robot arm and the line beam can detect the profile of sealing and adhesive. The optical axis and focus of the line can be easily adjusted



E3C-LDA Series (CD)
E3C-LD21 (CD)

127. Repeatability of robot arm teaching

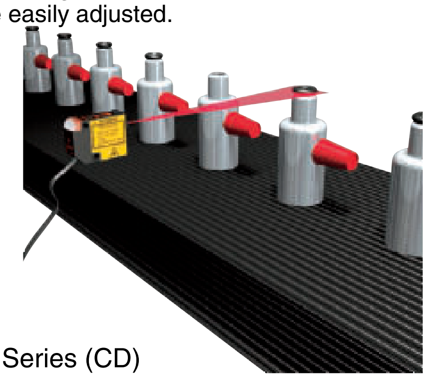
The small laser spot size of the E3C-LD11 ensures a high repeat accuracy from a long sensing distance, therefore the sensor head can be mounted with safety distance to the robot arm.



E3C-LDA Series (CD)
E3C-LD11 (CD)

128. Detecting of a sealing rubber in the assembly process

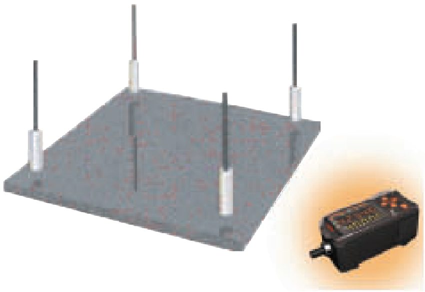
The E3C-LD21 detects even black rubber from a long distance, so therefore the sensor head can be mounted outside from moving parts. The optical axis and focus of the line can be easily adjusted.



E3C-LDA Series (CD)
E3C-LD21 (CD)

129. Warping control of metal plate

For multiple measurements it is possible to connect up to five sensors without mutual interferences. Warping is controlled by using (A-B) calculation

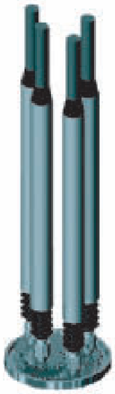


ZX-E Series (page B-61)
Smart Inductive Sensors

Automation and Inspection Equipment

130. Measurement of Watch Small Parts

The height and vertical interval of small parts of watch can be measured precisely even if small space.

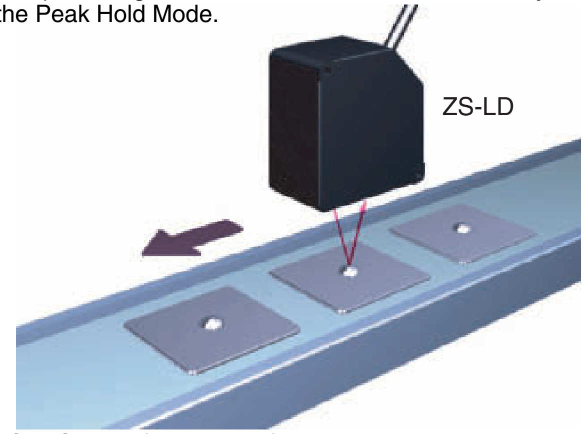


ZX-T Series (page B-77)

Smart Sensor (High Precision contact type)

131. Inspection of Small Rivet Height

The peak height of a small rivet can be measured by using the Peak Hold Mode.

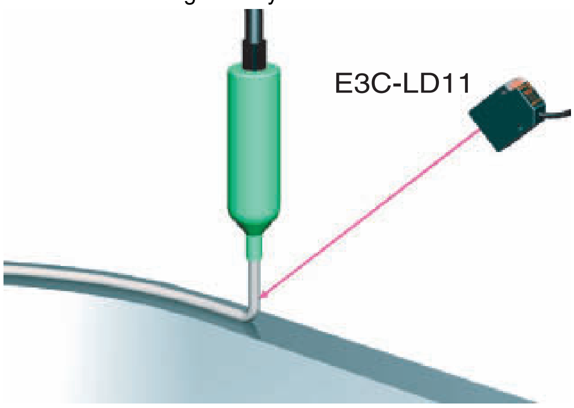


ZS-L Series (page B-25)

Smart Sensor (2-Dimensions CMOS and Laser Beam)

132. Confirming the Sealing Material

Long distance (1m) and small spot laser beam can inspect existance of the sealing stability.

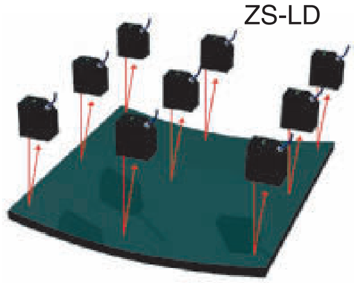


E3C-LD11 + E3C-LDA (CD)

Photoelectric Sensors with Separate Digital Amplifiers

133. Flattness Inspection of resin or metal

Stable flatness can be inspected even if the black resin or gloss metal at many points.

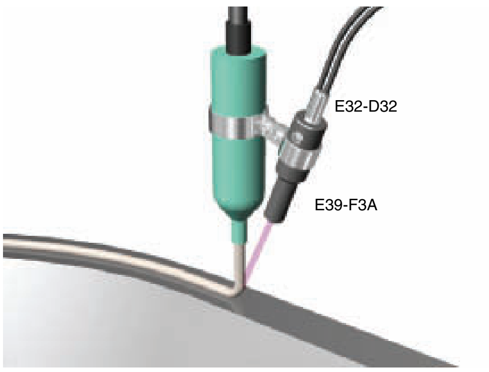


ZS-L Series (page B-25)

Smart Sensor (2-Dimensions CMOS and Laser Beam)

134. Confirming the Application of Sealing Material

The use of a small-diameter fiber head makes it possible to install the Fiber Unit and Lens Unit on the nozzle tip. The Lens Unit permits a stable detection of the sealing material.

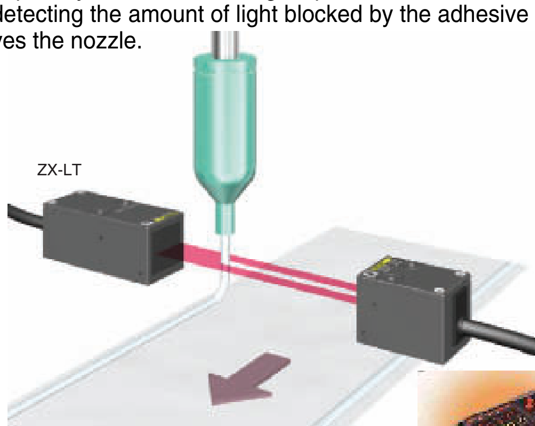


E32-D32 Fiber Unit (page A-200)

E39-F3A Lens Unit (page A-245)

135. Detecting and Determining Proper Quantity of Adhesive during Packing Box Assembly

The quantity of adhesive being dispensed can be monitored by detecting the amount of light blocked by the adhesive as it leaves the nozzle.

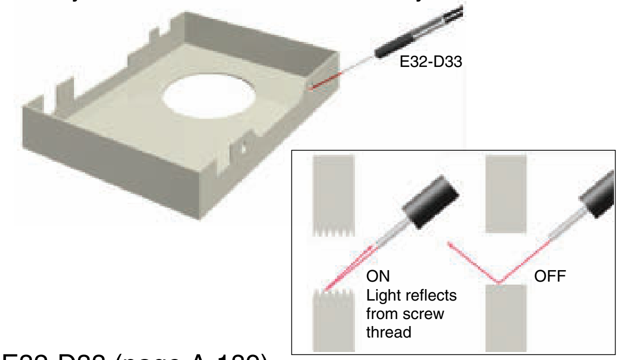


ZX-LT (page B-3)

Smart Sensors

136. Detection of Screw Threads

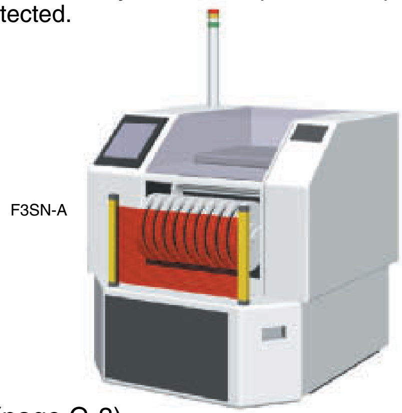
The E32-D33 Thin Head Fiber Unit is able to determine whether threads have been cut into aluminum die-cast workpieces. Because the light strikes at an angle, even extremely small threads can be accurately detected.



E32-D33 (page A-189)
Thin Head Fiber Unit

137. Safety Sensor to Protect People from Dangerous Machinery

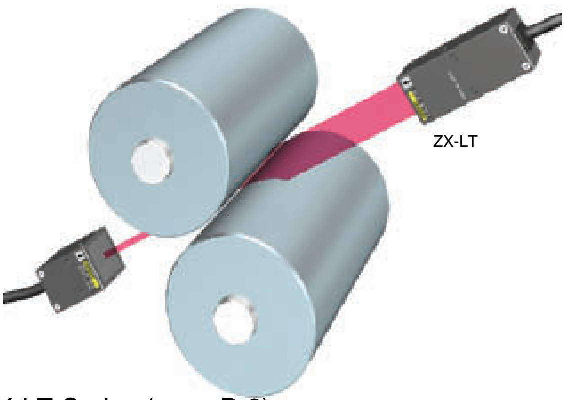
The entry of people into the danger zones on and around high-speed machinery, such as chip inserters, presses etc. can be detected.



F3SN-A (page G-3)
Safety Light Curtains

138. Measuring the Distance between Rollers

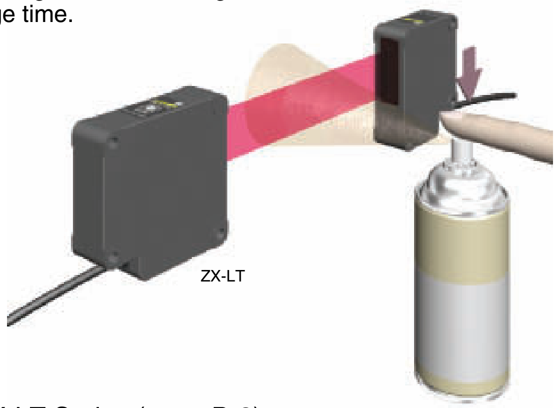
These Sensors ensure the distance between metal rollers to be measured.



ZX-LT-Series (page B-3)
Smart Sensors

139. Inspecting Spraying Coverage by Detecting the Spray Angle

The spray angle of a substance can be measured by detecting the amount of light that it blocks and the total blockage time.

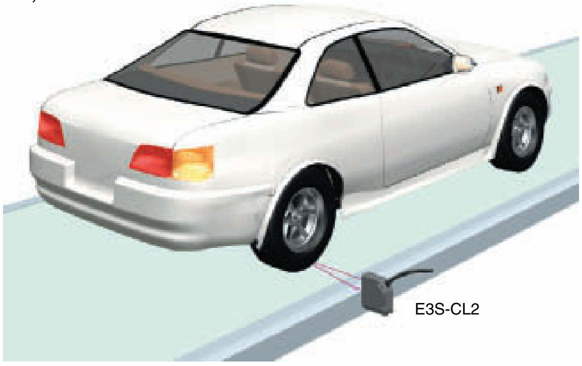


ZX-LT Series (page B-3)
Parallel Beam Linear Sensors with a Separate Amplifier

Rubber, Molding Machines, and Molds

140. Long-distance Detection of Black Tires

These sensors are minimally affected by backgrounds, enabling them to accurately detect black objects, such as tires, at a distance.



E3S-CL (page A-111)
Distance-controlled Photoelectric Sensors

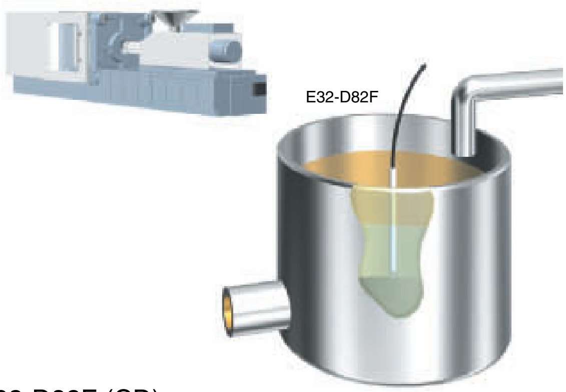
141. Positioning Dies in Injection Molding Machines

The strengthened axial load of this Rotary Encoder permits clamp positioning for the dies of injection molding machines.

E6C2-C/E6C3-C (page E-7)
Rotary Encoders

142. Detecting the Level of Heat-medium Oils

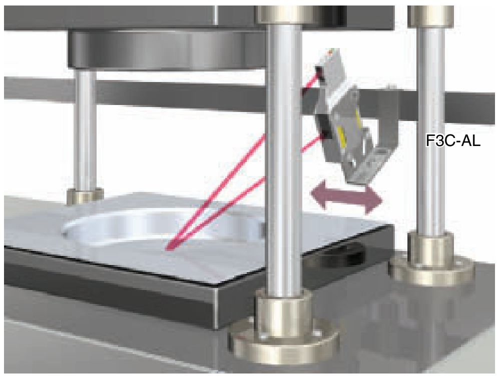
The 200°C heat resistance of these Sensors permits the use with extremely high-temperature liquids.



E32-D82F (CD)
Contact Liquid Level Sensors

143. Detecting Errors Due to Residual Materials in Press Dies

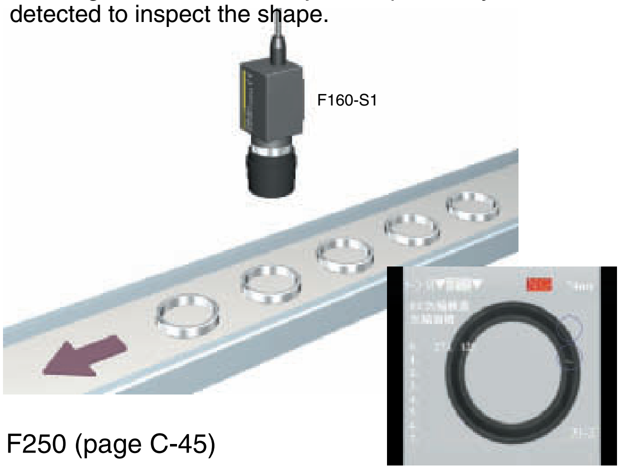
The edges of materials remaining inside press dies after the pressing process are detected, and an error is output.



F3C-AL (CD)
Distance-settable Laser Photoelectric Sensors

144. Inspecting Component Shapes

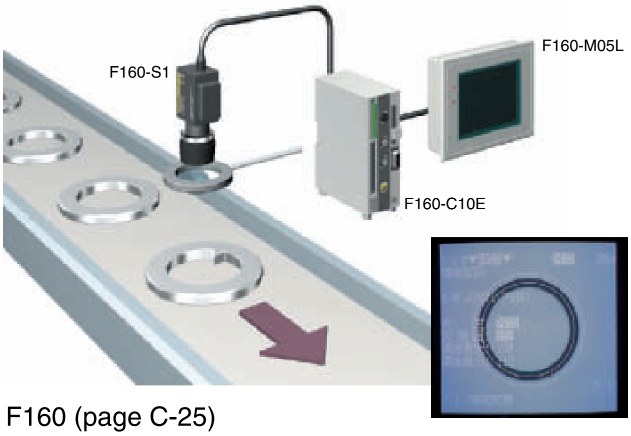
The edges of measured objects captured by camera are detected to inspect the shape.



F250 (page C-45)
High-performance Vision Sensor

145. Inspecting for Chipping or Burrs in Components

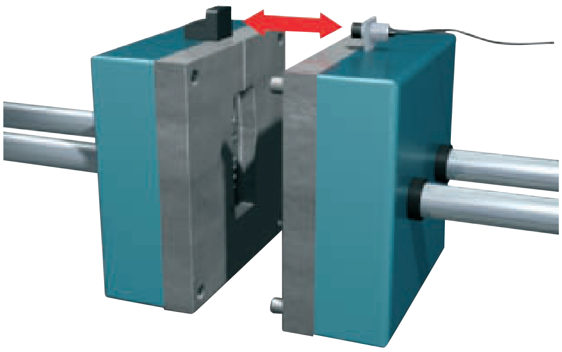
Chips, burrs, or light-colored dirt can be detected on curved or tapered components.



F160 (page C-25)
Vision Sensor

146. Gap control in mould press machines

ZX-E controls the minute tool-gap in a mould press machine and prevent the production of fault products. The sensor head is heat resistant up to 200 °C.



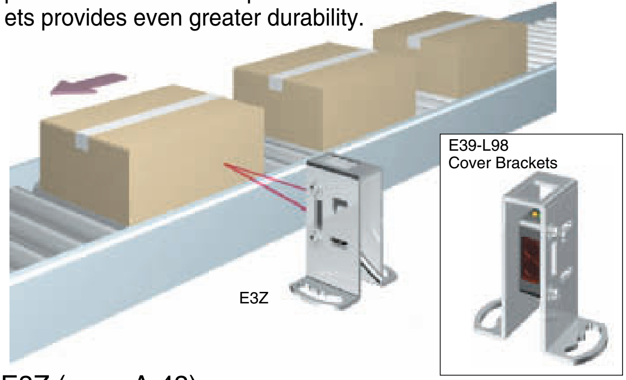
ZX-E Series (page B-61)
Smart Inductive Sensors

OMRON

Conveyance and Automatic Warehouses

147. Detecting Cardboard Boxes

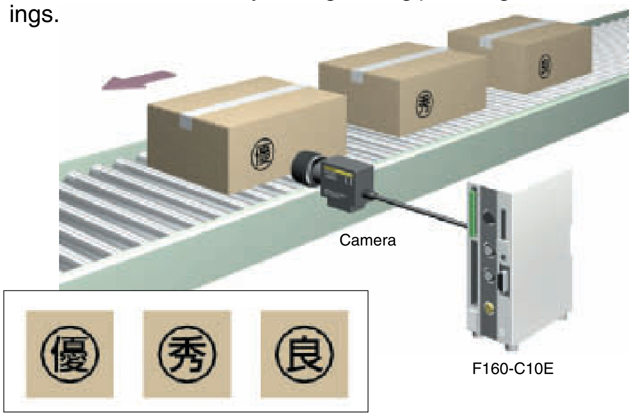
A diffuse reflective sensor can be used to detect cardboard boxes from a distance of up to 1 m. A retroreflective sensor permits detection from up to 4 m. The use of the Cover Brackets provides even greater durability.



E3Z (page A-43)
Photoelectric Sensors with a Built-in Amplifier
E39-L98 Cover Brackets

148. Sorting Packed Fruit Boxes by Grade

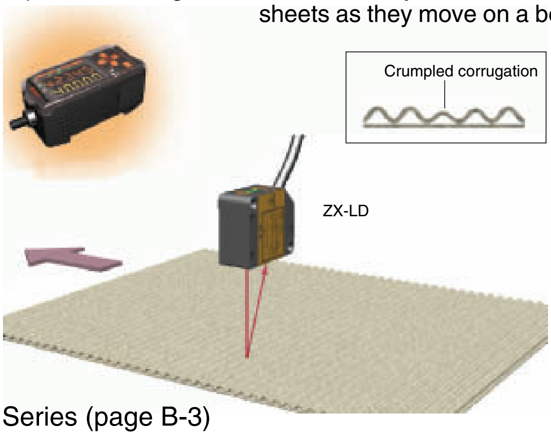
The boxes are sorted by distinguishing printed grade markings.



F160 (page C-25)
Vision Sensor

149. Inspecting the Height of Corrugations in Cardboard Boxes

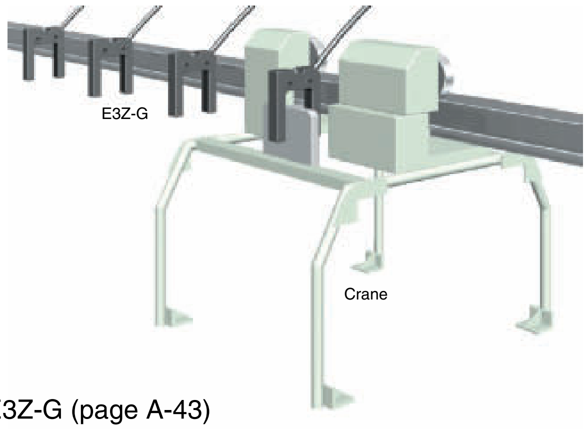
Crumpling can be detected by measuring the distance to the top of the corrugations in the inner layer of cardboard sheets as they move on a belt.



ZX Series (page B-3)
Smart Sensors

150. Warning Alarms for Cranes

The direction of crane movement can be distinguished, and the crane's entry into danger zones can be detected.

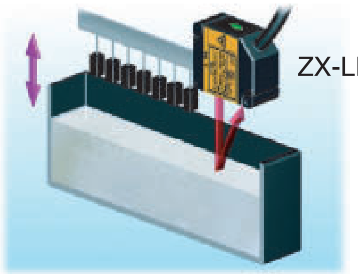


E3Z-G (page A-43)
Grooved-type Photoelectric Sensors with a Built-in Amplifier

Other Applications

151. Liquid Surface Inspection with Diffuse Reflection type Area Laser Beam

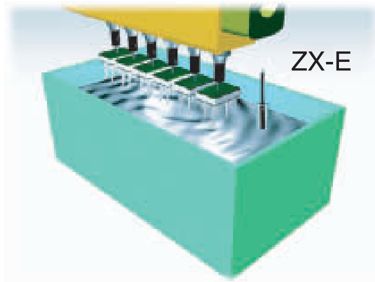
An inspection highly precise with the linear output if the liquid is colored and it can inspect for a short distance from the tank upper part.



ZX-L-N (page B-3)
Smart Sensor (Laser Type)

152. Liquid Surface Inspection with Linear Proximity Type

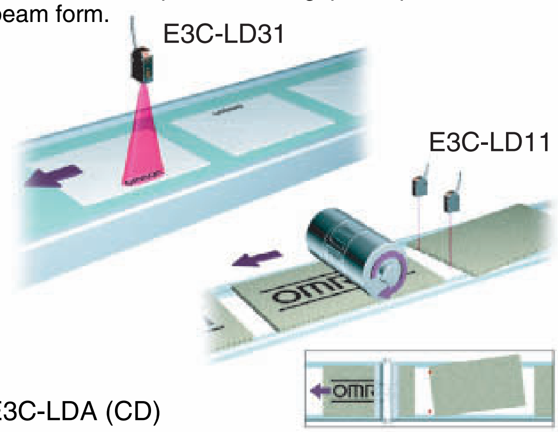
Precise measurement of the surface of liquid at the linear proximity which is excellent in environment-proof, if it is magnetic liquid and it can inspect for a short distance from the tank upper part.



ZX-E Series (page B-3)
Smart Sensor (Linear Proximity Type)

153. Inspection of a Mark and a Gap of Various Sheets

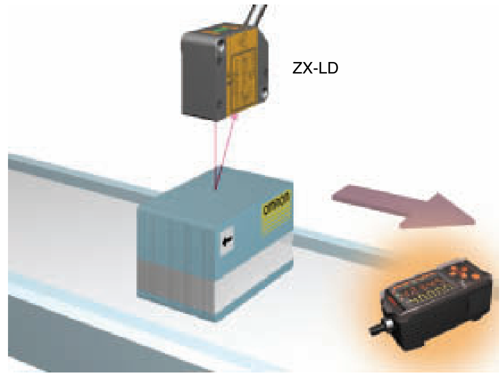
A mark and inspection of a gap are possible in various beam form.



E3C-LDA (CD)
Photoelectric Sensors with Separate Digital Amplifiers

154. Counting Cards

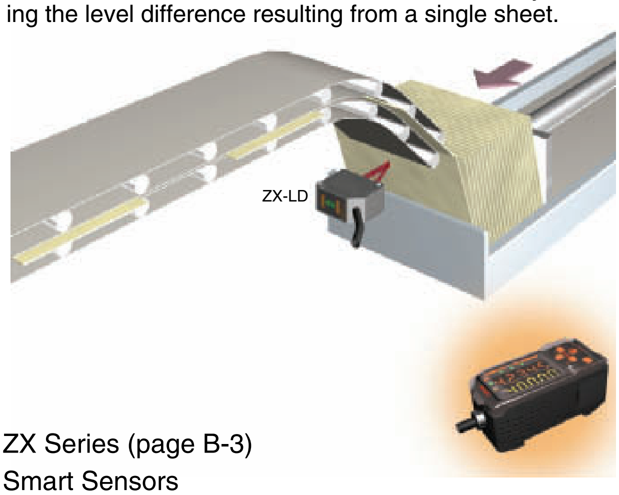
Bundles of cards, such as prepaid telephone cards, can be counted by detecting the card edges.



ZX Series (page B-3)
Smart Sensors

155. Counting Sheets of Paper

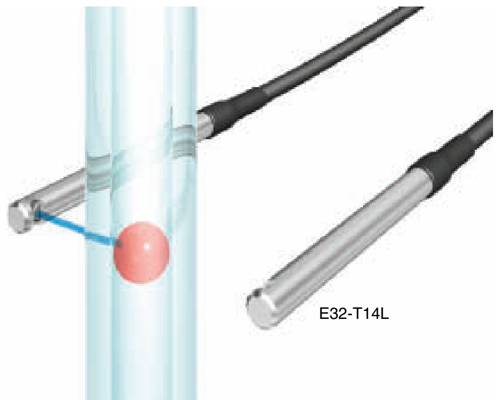
The number of sheets in a stack can be counted by detecting the level difference resulting from a single sheet.



ZX Series (page B-3)
Smart Sensors

156. Detecting Gas Flowmeter Balls

The red transparent ball in gas flowmeters can be detected with high stability by the Blue LED Teaching Fiber Amplifier.



E32-T14L Side-view Fiber Unit (page A-193)
E3X-DAB11-N Blue LED Teaching Fiber Amplifier

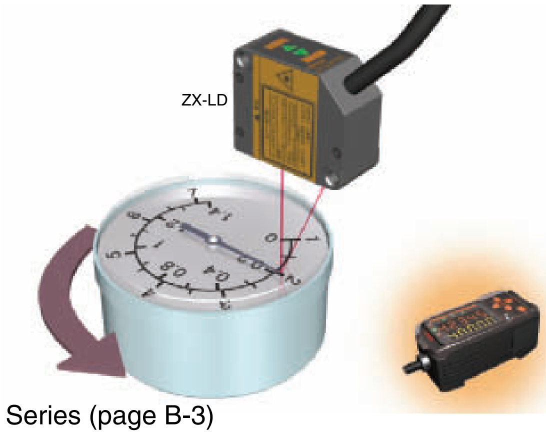
Applications

Other Applications

etc.

157. Inspecting the Gap between the Dial Plate and Indicator Needle in Pressure Indicators

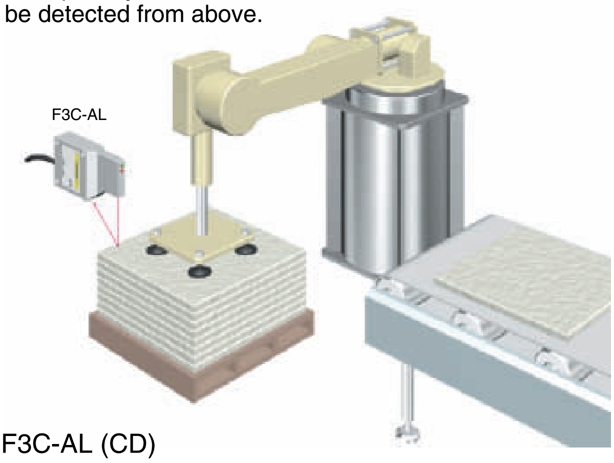
The gap between the dial plate and indicator needle can be measured through the transparent glass cover.



ZX Series (page B-3)
Smart Sensors

158. Detection of Remaining Boards for Construction Use

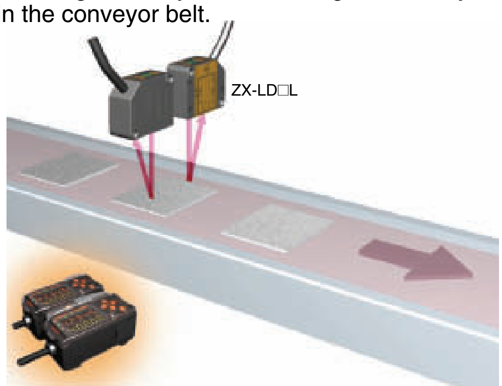
The quantity of boards or other construction materials can be detected from above.



F3C-AL (CD)
Distance-controlled Laser Photoelectric Sensors

159. Distinguishing Ceramic Types

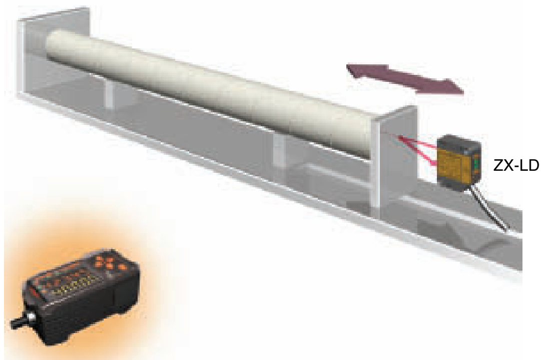
Using two Sensors, the changes in thickness can be measured with high stability, without being affected by fluctuations in the conveyor belt.



ZX Series (page B-3)
Smart Sensors

160. Inspecting the Length of Paper Tubes

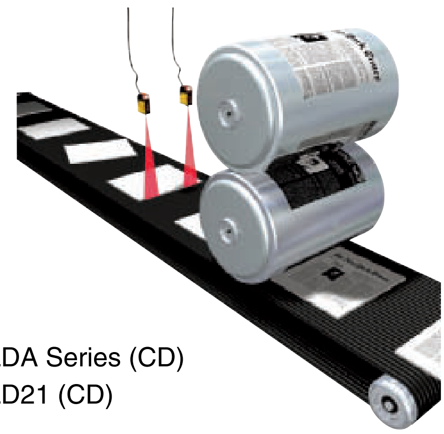
By using an end plate and detecting from the tube side, detection is possible without being affected by paper splinters.



ZX Series (page B-3)
Smart Sensors

161. Sheet alignment for printing and finishing process

E3C-LD21 detects the alignment of paper sheets before printing or before packaging. The twin output model allows to set up two threshold levels for tolerance



E3C-LDA Series (CD)
E3C-LD21 (CD)

Photoelectric Sensors

Overview Standard Photoelectric Sensors

Cylindrical Photoelectric Sensors

						
Housing	Cylindrical					
Model	E3F2					
Type	Standard, Axial					
Order reference	E3F2-LS	E3F2-DS1	E3F2-DS3	E3F2-R2	E3F2-R2R	E3F2-7
	Distance setting (BGS, FGS)	Diffuse reflective		Retroreflective		Through-beam
Housing material	Plastic (ABS), Brass, Stainless Steel					
Features	• cylindrical housing for easy mounting and installation • high quality for reliable object detection at excellent value for money • wide portfolio range for all standard applications					
	• thin beam for exact positioning • visible light for simple installation	• wide beam for reliable • detection of structured objects	• adjustable sensitivity for stable detection	• without adjuster for higher protection against tampering	• polarizing (MSR) for reliable detection of shiny objects	• cost efficient through beam solution
Max. Sensing Distance	0.1 m	0.1 m	0.3 m	2 m		7 m
Light source	Red LED	Infrared LED		Infrared LED	Red LED	Infrared LED
Key specifications	• Light ON/Dark ON selectable • 10 - 30 VDC • IP67 • IP69k 					
Housing size	M18					
Connection	Cable: PVC Cable connector: M8, M12, customer specific Connector: M12					
Page	A-17					

					
Housing	Cylindrical				
Model	E3F2				
Type	Standard, Radial		Long distance, Axial		
Order reference	E3F2-DS3☐41	E3F2-R2R☐41	E3F2-D1	E3F2-R4	E3F2-10
	Diffuse reflective	Retroreflective	Diffuse reflective	Retroreflective	Through-beam
Housing material	Plastic (ABS), Brass				
Features	• radial optics for easy mounting, installation and adjustment		• high power LEDs for increased sensing distance and increased reliability in dirty environments		
	• adjustable sensitivity for stable detection adjustable sensitivity for stable detection	• polarizing (MSR) for reliable detection of shiny objects	• adjustable sensitivity for stable detection	• polarizing (MSR) for reliable detection of shiny objects	• coaxial setup for precision detection • test input for system reliability check
Max. Sensing Distance	0.3 m	2 m (typical 3.1 m with reflector E39-R8)	1 m	4 m (typical 5.6 m with reflector E39-R8)	10 m
Light source	Infrared LED	Red LED	Infrared LED	Red LED	Infrared LED
Key specifications	• Light ON/Dark ON selectable • 10 - 30 VDC • IP67, IP69k				• Light ON/ Dark ON selectable • 12 - 24 VDC • IP67, IP69k
Housing size	M18				
Connection	Cable: PVC Cable connector: M8, M12, customer specific Connector: M12				
Page	A-17				

Square Photoelectric Sensors - General Purpose

Housing	Square			
Model	E3Z			
Type	Compact, general purpose			
Order reference	E3Z-LS	E3Z-D☐2 E3Z-D☐7	E3Z-R	E3Z-T☐2 E3Z-T☐7
	Distance setting (BGS, FGS)	Diffuse reflective	Retroreflective	Through-beam
Housing material	Plastic (PBT)			
Features	• Compact housing size and high power LED for excellent performance-size ratio. • Cest value-performance ratio for standard applications. • Intensive shielding for highest noise immunity (EMC). • Tough PBT housing for high mechanical resistance.			
	• Background suppression for reliable detection with changing backgrounds. • Foreground suppression for reliable detection of objects (e.g. glossy and structured) on conveyors.	• Standard beam for long distance detection.	• Polarizing (MSR) for reliable detection of shiny objects (red LED).	• High power infrared LED for increased sensing distance and high reliability in dirty environments.
Max. Sensing Distance	200 mm	1 m	4 m	15 m (typical 45 m)
Light source	Red LED Infrared LED			
Key specifications	• Light ON/Dark ON selectable • 10 - 24 VDC • IP67, IP69k 			
Housing size	11 x 17 x 31 mm (W x H x D)			
Connection	Cable: PVC Cable connector: M8, M12, customer specific Connector: M12			
Page	A-43			

Square Photoelectric Sensors - General Purpose

Housing	Square			
Model	E3T			
Type	Miniature			
Order reference	---	E3T-SL E3T-FD	E3T-SR	E3T-ST E3T-FT
	Distance setting (BGS, FGS)	Diffuse reflective	Retroreflective	Through-beam
Housing material	---	Plastic (PBT)		
Features		• Ultra small size with high output pin point LED where space is crucial. • 3.5 mm thin flat shape or 7 mm side side view shape.		
		• Thin beam for precision detection of miniature objects (min 0.15 mm dia).	• Thin visible beam for precision positioning.	• Unmatched precision - sensor size ratio.
Max. Sensing Distance		30 mm	200 mm	1 m
Light source		Red LED		
Key specifications		• Light ON or Dark ON • 10 - 24 VDC • IP67		
Housing size		Flat: 12 x 21 x 3.5 mm (W x H x D) Side view: 7 x 21 x 11 mm (W x H x D)		
Connection		Cable: PVC Cable connector: M8, M12, customer specific		
Page	A-67			

Housing	Square			
Model	E3NT			
Type	Long distance, high functionality, high protection			
Order reference	E3NT-L□-20	---	E3NT-R	E3NT-T
	Distance setting (BGS, FGS)	Diffuse reflective	Retroreflective	Through-beam
Housing material	Aluminium die cast			
Features	• Durable aluminium housing for highest resistance in harsh environments.			
	• One button teaching for quick set up. • Double triangulation for highest reliability detecting glossy objects. • Window heating for reliable operation in icy and foggy environments. • Analog output for distance information.		• Polarizing (MSR) for reliable detection of shiny objects.	
Max. Sensing Distance	3 m		16 m	
Light source	Infrared LED			
Key specifications	• Two freely configurable output (e.g. NO, NC, NO+NC, window function for BGS type (2 different switching points). • 10 - 30 VDC • IP67, IP69k 			
Housing size	27 x 89 x 65 mm (W x H x D)			
Connection	Connector: M12			
Page	A-83			

Square Photoelectric Sensors - General Purpose

					
Housing	Square				
Model	E3S-C				
Type	Compact, high protection				
Order reference	E3S-CD	E3S-CR	E3S-CT	E3S-CL1	E3S-CL2
	Diffuse reflective	Retroreflective	Through-beam	Distance setting (BGS, FGS)	
Housing material	Zinc diecast				
Features	• High water, oil and detergent resistance for long life in often cleaned or aggressive environments. • Enhanced performance at slightly larger housing compared with E3Z.				
	• Fuzzy logic interference prevention enables minimal mutual interference for close mounting of two sensors.	• Polarizing (MSR) for reliable detection of shiny objects.	• High power infrared LED for long distance detection. • Precision detection of miniature objects (min 0.5 mm dia) with slits .	• Minimal black/ white error (2%) for highest reliability in detecting different colored objects.	• Higher sensing distance but also higher black/white error compared to E3S-CL1. • Invisible light.
Max. Sensing Distance	2 m	3 m (typical 4 m)	30 m	200 mm	500 mm
Light source	Infrared LED	Red LED	Infrared LED	Red LED	Infrared LED
Key specifications	• Light ON/Dark ON selectable • 10 - 30 VDC • IP67				
Housing size	20 x 57 x 23 mm (W x H x D)			15 x 42 x 40 mm (W x H x D)	
Connection	Cable: PVC Cable connector: M8, M12, customer specific				
Page	A-101			A-111	

Housing	Square			
Model	E3G			
Type	Long distance			
Order reference	E3G-L7	---	E3G-R	---
	Distance setting (BGS, FGS)	Diffuse reflective	Retroreflective	Through-beam
Housing material	Plastic (PBT)	---	Plastic (PBT)	---
Features	• One-touch teaching for quick set up. • High power infrared LED for stable detection of structured objects in long distances.		• High power visible light LED for precision detection in long distances.	
Max. Sensing Distance	2 m		10 m	
Light source	Infrared LED		Red LED	
Key specifications	• Light ON/Dark ON selectable • 10 - 30 VDC • IP67		• Light ON/Dark ON selectable • 10 - 30 VDC • IP67	
Housing size	21 x 68 x 48 mm (W x H x D)		21 x 68 x 48 mm (W x H x D)	
Connection	Cable: PVC Cable connector: M8, M12, customer specific Connector: M12 (turnable)		Cable: PVC Cable connector: M8, M12, customer specific Connector: M12 (turnable)	
Page	(CD)		A-119	

Housing	Square				
Model	E3Z				
Type	Special functions within compact size E3Z family				
Order reference	E3Z-LS□3 E3Z-LS□8	E3Z-L	E3Z-D□1 E3Z-D□6	E3Z-T□1 E3Z-T□6	E3Z-T□2 E3Z-T□7
	Distance setting (BGS, FGS)	Diffuse reflective		Through-beam	
Housing material	Plastic (PBT)				
Features	• Compact housing size and high power LED for excellent performance-size ratio. • Best value-performance ratio for standard applications.				
	• Thin beam and 2 mm spot size.	• Narrow beam	• Wide beam	• Precision detection of miniature objects (min 0.2 mm dia) with slits. • Precision positioning through visible light. • Close mounting (in a stack) with mutual interference prevention filters.	• Ultra high power infrared LED for very long sensing distance and maximum reliability in dirty environments.
Application areas	• Precision positioning.	• Miniature object detection (0.1 mm dia).	• Reliable detection of structured and uneven objects.	• Precision detection. • Movement precision passage detection.	• Dusty environments • Passage detection over long distances.
Max. Sensing Distance	80 mm	90 mm (± 30 mm)	100 mm	10 m	30 m
Light source		Red LED	Infrared LED	Red LED	Infrared LED
Key specifications	• Light ON/Dark ON selectable • 10 - 24 VDC • IP67, IP69k				
Housing size	11 x 17 x 31 mm (W x H x D)				
Connection	Cable: PVC Cable connector: M8, M12, customer specific Connector: M8				
Page	A-43				

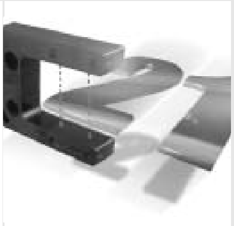
Housing	Square					
Model	E3Z-☐H			E3Z		
Type	Compact, tampering protection			Preventive maintenance		
Order reference	E3Z-D☐H E3Z-L☐H	E3Z-R☐H	E3Z-T☐H	E3Z-☐-G0☐ for 'Emission stop' E3Z-☐-G2☐ for 'Emission reduction' E3Z-☐-J0☐ for 'self diagnosis'		
	Diffuse reflective	Retroreflective	Through-beam	Diffuse reflective	Retroreflective	Through-beam
Housing material	Plastic (PBT)					
Features	• Sensors without sensitivity adjuster for maximum tampering protection.					
	• Same as for general purpose E3Z but without adjuster for			• Machine stop or sensor defect alarm output if beam interruption is too long. • Active sensor check by test input forcing state change at receiver. • Detection of dirt cover by power reduction.		
Application areas	• Conveying applications and other passage detections where malfunctions due to unskilled personal need to be prevented			• Preventive maintenance for all machines requiring maximum machine availability during production.		
Max. Sensing Distance	Same as for general purpose E3Z			Same as for general purpose E3Z		
Light source						
Key specifications						
Housing size						
Connection						
Page	A-43					

Special Square Photoelectric Sensors

					
Housing	Square				
Model	E3NT			E3G	
Type	Long distance, high functionality, high protection.			Special functions within long distance E3G family.	
Order reference	E3NT-L17 E3NT-L37	E3NT-LH	E3NT-L27 E3NT-L47	E3G-L1	E3G-L3
	Distance setting (BGS, FGS)			Distance setting (BGS, FGS)	
Housing material	Aluminium die cast			Plastic (PBT)	
Features	• Durable aluminium housing for highest resistance in harsh environments.			• One-touch teaching for quick set up.	
	• High response time.	• Window heating for reliable operation in humid and icy environments.	• Analog output for quick and easy distance information.	• Shine-proof optical system for reliable detection of different colored objects.	• Optimised sensing distance-minimal object size ratio.
Application areas	• Long distance counting applications.	• Object detection in low temperature (-40 °C) or areas with steam.	• Approach detection of moving objects.	• Passage detection of differently colored objects.	• Higher sensing distance passage detection of differently colored objects - requires larger objects than E3G-L1.
Max. Sensing Distance	2 m			50 mm	200 mm
Light source	Infrared LED			Red LED	Infrared LED
Key specifications	• Two freely configurable output (e.g. NO, NC, NO+NC, window function (2 different switching points). • 10 - 30 VDC • IP67, IP69k 			• Light ON/Dark ON selectable • 10 - 30 VDC • IP67	
Housing size	27 x 89 x 65 mm (W x H x D)			18 x 40 x 30 mm (W x H x D)	
Connection	Connector: M12			Cable: PVC Cable connector: M8, M12, customer specific Connector: M8	
Page	A-83			A-119	

					
Housing	Square				
Model	E3M-V	E3S-LS3	E3JK	F3C-AA	F3C-AL
Type	Mark Sensor	PCB detection sensor	All voltage (AC and DC)	Conveyor sensor	Distance settable Laser sensor
Order reference	E3MV	E3S-LS3	E3JK	F3C-AA	F3C-AL
	Distance setting	Diffuse reflective	Through beam Retroreflective Diffuse reflective	Distance setting (BGS, FGS)	Distance setting (BGS, FGS)
Housing material	Plastic (PBT)		Plastic (ABS)		
Features	• Auto-teaching for simple teaching during settup. • Coaxial optical system for reliable mark detection on laminated objects.	• Wide beam for reliable structured object detecion (objects with holes and different heights).	• 12 - 240 VDC or 24 - 240 VAC power supply voltage. • Product variety reduction through 'one sensor fits all requirements'.	• Special housing shape fitting between conveyor segments. • Reliable detection of multicolored objects even in changing backgrounds. • Optionally with integrated jamming control unit.	• Small spot for high precision detection and positioning.
Application areas	• Mark detection on food packages on conveyors.	• PCB detection on conveyors.	• Installations of all standard power supplies for minimal product variety.	• Conveyor belts	• Counting and positioning on conveyors.
Max. Sensing Distance	10+3 mm	60 mm	5 m	900 mm	700 mm
Light source	Green LED	Red LED	Red LED, Infrared LED	Infrared LED	Pulsed RED Laser class II
Key specifications	• 10 - 30 VDC • IP67	• Light ON • 12 - 24 VDC • IP40	• Light ON/ Dark ON or selectable • Relay output with 250 VAC, 3 A • IP64	• Dark ON • 10 - 30 VDC • IP54	• Light ON / Dark ON selectable • 10 - 30 VDC • IP40
Housing size	21 x 67.8 x 47.8 mm (W x H x D)	10 x 34 x 19 mm (W x H x D)	18 x 50 x 50 mm (W x H x D)	18 x 90 x 45 mm (W x H x D)	18 x 90 x 45 mm (W x H x D)
Connection	Cable: PVC Connector: M12	Cable: PVC Cable connector: M8	Cable: PVC	Cable connector: M12	Cable connector: M12
Page	A-133	A-145	A-149	(CD)	(CD)

Special Square Photoelectric Sensors

					
Housing	Square				
Model	E3S-G	E3MC	E3X-NL	E3Z-B	E3Z-G
Type	Mark Sensor	RGB Color sensor	Glossy object sensor	PET bottle sensor	Fork sensor
Order reference	E3S-GS1	E3MC	E3X-NL	E3Z-B	E3Z-G
	Through beam	Fixed distance	Fixed Diffuse reflective	Retroreflective	Through-beam
Housing material	Plastic	Zinc diecast	PBT and ABS	Plastic (PBT)	Plastic (PBT)
Features	• Simple installation and enhanced reliability against setup misalignment.	• 4 channel models for multi product teaching • analog output for continuous color differenciation	• Teaching and unique optical system for reliable and simple gloss level detection.	• Inner View optical system for reliable. PET bottle detection.	• Simple installation and enhanced reliability against setup misalignment. • 1 or 2 optical axis.
Application areas	• Mark detection on food packages on conveyors.	• Sorting of differently colored objects and bottles (with through beam fiber type). • Color shade quality control.	• Label detection • Glue detection	• Detection and counting of PET bottles on conveyors.	• Passage detection of cranes, hangsliders and objects.
Max. Sensing Distance	10 mm	60±10 mm 0 - 200 mm	10±3 mm 20±7 mm	2 m	25 mm
Light source	Green or Red LED	RGB LEDs	Red LED	Red LED	Infrared LED
Key specifications	• 12 - 24 VDC • IP65	• 12 - 24 VDC • IP66	• 12 - 24 VDC • IP50	• Light ON/Dark ON selectable • 12 - 24 VDC • IP67, IP69k	• Light ON/Dark ON selectable • 12 - 24 VDC • IP64
Housing size	20 x 55 x 60 mm (W x H x D) Forkopening: 10 x 35 mm	30 x 53 x 80 mm (W x H x D)	10.4 x 29 x 29 mm (W x H x D)	11 x 17 x 31 mm (W x H x D)	40 x 11 x 50 mm (W x H x D) Forkopening: 25 x 35 mm
Connection	Cable: PVC	Connector: M12	Cable: PVC	Cable: PVC Cable connector: M8, M12 Connector: M8	Cable: PVC Cable connector: M8, M12
Page	Please contact your OMRON representative	(CD)	(CD)	A-43	A-43

		
Housing		Square
Model	E3S-CR	F3UV
Type	Transparent bottle sensor	UV Power Monitor
Order reference	E3S-CR	F3UV
	Retroreflective	Intensity monitor
Housing material	Zinc diecast	Zinc diecast
Features	• Special optic design for reliable detection of glass bottles compensating 'double-detection-effect'.	• Reliable UV light intensity monitoring up to 300 mW/cm². • Heat resistant up to 300 °C.
Application areas	• Detection and counting of transparent glass bottles on conveyors.	• UV light deterioration in food processing. • Resin hardening process.
Max. Sensing Distance	1 m	n.a.
Light source	Red LED	n.a.
Key specifications	• Light ON/Dark ON selectable • 10 - 30 VDC • IP67	• Analog output 1 - 5 V • 12 - 24 VDC • IP30
Housing size	20 x 57 x 23 mm (W x H x D)	16.4 x 19.4 x 35.5 mm (W x H x D)
Connection	Cable: PVC Connector: M12	Cable: PVC
Page	A-157	(CD)

Cylindrical photoelectric sensors in M18 plastic, brass or stainless steel housings

E3F2

- Large standard portfolio in plastic, brass or stainless steel housings
- Long distance types for highest reliability in dirty environments
- Radial (90°) types for easy mounting and adjustment
- Background suppression model with high precision beam for highest accuracy
- AC and DC switching types

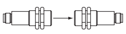
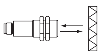
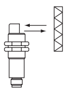
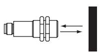
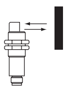
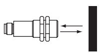
Features

- M18 DIN-sized cylindrical housing
- Housing materials: plastic, nickel plated brass and stainless steel
- Axial and radial types (with integrated 90°-optics)
- Enclosure rating IP67
- DC switching types with connectors for easy maintenance
- Full metal plug-in type
- Sensing distance separate types : 7 m, 10 m
- Retroreflective polarizing types: 2 m, 4 m
- Background suppression type: 10 cm
- Long detection distance (0.3 m, 1 m) with sensitivity adjuster for diffuse type
- Wide-beam characteristics (10 cm) for diffuse type
- Wide operating voltage range (10 to 30 VDC or 24 to 240 VAC)
- Short-circuit and reverse connection protection (DC switching type)
- UL and CSA approved (AC switching types)
- UL listed (DC switching types)

Selection Guide

DC-Switching Models

Housing Material: Plastic

Sensing method			Appearance	Connection method	Sensing distance	Model PNP output	Model NPN output
Through-beam	Multi purpose		 axial	pre-wired	7 m	**E3F2-7B4**	**E3F2-7C4**
				M12 connector		**E3F2-7B4-P1**	**E3F2-7C4-P1**
	- precision detection (*1) - test input			pre-wired	10 m	**E3F2-10B4**	**E3F2-10C4**
				M12 connector		**E3F2-10B4-P1**	**E3F2-10C4-P1**
Retro-reflective(*2)	Non-polarizing (without MSR function)		 axial	pre-wired	0.1 - 2 m(*3)	**E3F2-R2B4-E**	**E3F2-R2C4-E**
				M12 connector		**E3F2-R2B4-P1-E**	**E3F2-R2C4-P1-E**
	Polarizing (with MSR function)	Fixed sensitivity		pre-wired	0.1 - 4 m(*4)	**E3F2-R4B4F-E**	**E3F2-R4C4F-E**
				M12 connector		**E3F2-R4B4F-P1-E**	**E3F2-R4C4F-P1-E**
		Adjustable sensitivity		pre-wired		**E3F2-R4B4-E**	**E3F2-R4C4-E**
				M12 connector		**E3F2-R4B4-P1-E**	**E3F2-R4C4-P1-E**
	Non-polarizing (without MSR function)		 radial	pre-wired	0.1 - 2 m(*3)	–	–
				M12 connector		–	–
	Polarizing (with MSR function)			pre-wired		**E3F2-R2RB41-E**	**E3F2-R2RC41-E**
				M12 connector		**E3F2-R2RB41-P1-E**	**E3F2-R2RC41-P1-E**
Diffuse reflective	Fixed sensitivity Wide-beam characteristics		 axial	pre-wired	0.1 m	**E3F2-DS10B4-N**	**E3F2-DS10C4-N**
				M12 connector		**E3F2-DS10B4-P1**	**E3F2-DS10C4-P1**
	Adjustable sensitivity			pre-wired	0.3 m	**E3F2-DS30B4**	**E3F2-DS30C4**
				M12 connector		**E3F2-DS30B4-P1**	**E3F2-DS30C4-P1**
				pre-wired	1 m	**E3F2-D1B4**	**E3F2-D1C4**
				M12 connector		**E3F2-D1B4-P1**	**E3F2-D1C4-P1**
	Fixed sensitivity Wide-beam characteristics		 radial	pre-wired	0.1 m	–	–
				M12 connector		–	–
	Adjustable sensitivity			pre-wired	0.3 m	**E3F2-DS30B41**	**E3F2-DS30C41**
				M12 connector		**E3F2-DS30B41-P1**	**E3F2-DS30C41-P1**
Background suppression	Fixed sensing distance		 axial	pre-wired	10 cm	**E3F2-LS10B4**	**E3F2-LS10C4**
				M12 connector		**E3F2-LS10B4-P1**	**E3F2-LS10C4-P1**

(*1) with slit E39-ES18
(*2) Retroreflective models incl. reflectors E39-R1 or E39-R1S are also available
(*3) with reflector E39-R1
(*4) with reflector E39-R1S

Note: Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB4 2M or E3F2-R2RB4 5M). For other cable length please contact your OMRON sales representative.

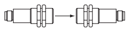
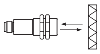
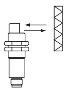
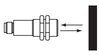
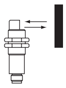
Housing material: Metal (Nickel plated brass)

Sensing method			Appearance	Connection method	Sensing distance	Model: PNP output	Model: NPN output
Through-beam	Multi purpose		axial	pre-wired	7 m	**E3F2-7B4-M**	**E3F2-7C4-M**
				M12 connector		**E3F2-7B4-M1-M**	**E3F2-7C4-M1-M**
	- precision detection - test input			pre-wired	10 m	**E3F2-10B4-M**	**E3F2-10C4-M**
				M12 connector		**E3F2-10B4-M1-M**	**E3F2-10C4-M1-M**
Retro-reflective(*1)	Non-polarizing (without MSR function)		axial	pre-wired	0.1 - 2 m(*2)	–	–
				M12 connector		–	–
	Polarizing (with MSR function)	Fixed sensivity		pre-wired		**E3F2-R2RB4-M-E**	**E3F2-R2RC4-M-E**
				M12 connector		**E3F2-R2RB4-M1-M-E**	**E3F2-R2RC4-M1-M-E**
				pre-wired	0.1 - 4 m(*3)	**E3F2-R4B4F-M-E**	**E3F2-R4C4F-M-E**
				M12 connector		**E3F2-R4B4F-M1-M-E**	**E3F2-R4C4F-M1-M-E**
		Adjustable sensivity		pre-wired		**E3F2-R4B4-M-E**	**E3F2-R4C4-M-E**
				M12 connector		**E3F2-R4B4-M1-M-E**	**E3F2-R4C4-M1-M-E**
	Non-polarizing (without MSR function)		radial	pre-wired	0.1 - 2 m(*2)	–	–
				M12 connector		–	–
	Polarizing (with MSR function)			pre-wired		**E3F2-R2RB41-M-E**	**E3F2-R2RC41-M-E**
				M12 connector		**E3F2-R2RB41-M1-M-E**	**E3F2-R2RC41-M1-M-E**
Diffuse reflective	Fixed sensing distance Wide-beam characteristics		axial	pre-wired	0.1 m	**E3F2-DS10B4-M**	**E3F2-DS10C4-M**
				M12 connector		**E3F2-DS10B4-M1-M**	**E3F2-DS10C4-M1-M**
	Adjustable sensing distance			pre-wired	0.3 m	**E3F2-DS30B4-M**	**E3F2-DS30C4-M**
				M12 connector		**E3F2-DS30B4-M1-M**	**E3F2-DS30C4-M1-M**
				pre-wired	1 m	**E3F2-D1B4-M**	**E3F2-D1C4-M**
				M12 connector		**E3F2-D1B4-M1-M**	**E3F2-D1C4-M1-M**
	Fixed sensing distance Wide-beam characteristics		radial	pre-wired	0.1 m	–	–
				M12 connector		–	–
	Adjustable sensing distance			pre-wired	0.3 m	**E3F2-DS30B41-M**	**E3F2-DS30C41-M**
				M12 connector		**E3F2-DS30B41-M1-M**	**E3F2-DS30C41-M1-M**
Background suppression	Fixed sensing distance		axial	pre-wired	10 cm	**E3F2-LS10B4-M**	**E3F2-LS10C4-M**
				M12 connector		**E3F2-LS10B4-M1-M**	**E3F2-LS10C4-M1-M**

(*1) Retroreflective models incl. reflector E39-R1 are also available
(*2) with reflector E39-R1
(*3) with reflector E39-R1S

Note: Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB4-M 2M or E3F2-R2RB4-M 5M). For other cable length please contact your OMRON sales representative.

Housing material: Metal (Stainless steel)

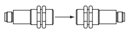
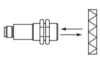
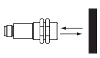
Sensing method		Appearance	Connection method	Sensing distance	Model PNP output	Model NPN output
Through-beam		 axial	pre-wired	7 m	**E3F2-7B4-S**	**E3F2-7C4-S**
			M12 connector		**E3F2-7B4-M1-S**	**E3F2-7C4-M1-S**
Retro-reflective(*1)	Non-polarizing (without MSR function)	 axial	pre-wired	0.1 - 2 m (with reflector E39-R1)	–	–
			M12 connector		–	–
	Polarizing (with MSR function)		pre-wired		**E3F2-R2RB4-S-E**	**E3F2-R2RC4-S-E**
			M12 connector		**E3F2-R2RB4-M1-S-E**	**E3F2-R2RC4-M1-S-E**
	Non-polarizing (without MSR function)	 radial	pre-wired		–	–
			M12 connector		–	–
	Polarizing (with MSR function)		pre-wired		–	–
			M12 connector		–	–
Diffuse reflective	Fixed sensitivity Wide-beam characteristics	 axial	pre-wired	0.1 m	**E3F2-DS10B4-S**	**E3F2-DS10C4-S**
			M12 connector		**E3F2-DS10B4-M1-S**	**E3F2-DS10C4-M1-S**
	Adjustable sensitivity		pre-wired	0.3 m	**E3F2-DS30B4-S**	**E3F2-DS30C4-S**
			M12 connector		**E3F2-DS30B4-M1-S**	**E3F2-DS30C4-M1-S**
	Fixed sensitivity Wide-beam characteristics	 radial	pre-wired	0.1 m	–	–
			M12 connector		–	–
	Adjustable sensitivity		pre-wired	0.3 m	–	–
			M12 connector		–	–
Background suppression		Please contact your OMRON sales representative for these models				

(*1) Retroreflective models incl. reflector E39-R1 are also available

Note: Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB4-S 2M or E3F2-R2RB4-S 5M). For other cable length please contact your OMRON sales representative.

AC-Switching Models

Housing material: Plastic

Sensing method		Appearance	Connection method	Sensing distance	Model Light-ON	Model Dark-ON
Through-beam		 axial	pre-wired	3 m	**E3F2-3Z1**	**E3F2-3Z2**
Retro-reflective(*1)	Non-polarizing (without MSR function)	 axial	pre-wired	0.1 - 2 m (with reflector E39-R1)	**E3F2-R2Z1-E**	**E3F2-R2Z2-E**
Diffuse reflective	Fixed sensing distance Wide-beam characteristics	 axial	pre-wired	0.1 m	**E3F2-DS10Z1-N**	**E3F2-DS10Z2-N**

(*1) Retroreflective models incl. reflector E39-R1 are also available

Note: Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2Z1 2M or E3F2-R2Z1 5M). For other cable length please contact your OMRON sales representative.

Accessories (Order Separately)

Name	Sensing distance (typical) [1.]	Model	Remark
Reflectors	0.1 - 3.7 m (axial) 0.1 - 2.4 m (radial)	**E39-R1**	60 x 40 mm (included in some models)
	0.1 - 4.3 m (axial)	**E39-R1S**	for E3F2-R4
	0.1 - 4.2 m (axial) 0.1 - 2.7 m (radial)	**E39-R7**	84 mm
	0.1 - 5.3 m (axial) 0.1 - 3.1 m (radial)	**E39-R8**	100 x 100 mm
	0.1 - 4.3 m (axial)	**E39-R40**	80 x 80 mm
Tape Reflectors		**E39-RSA**	35 x 10 mm
		E39-RSB	35 x 40 mm
		E39-RS3	80 x 70 mm
Lens Cap		**E39-F31**	
Mounting Bracket		**Y92E-B18**	screw mount
		Y92E-G18	quick access mounting
Slit		**E39-ES18**	for E3F2-10☐ - precision detection

For detailed information about Accessories, refer to the main chapter “Accessories” at the end of the document.
Note: 1 . Typical sensing distance corresponds to 80 % of the max. sensing distance. For details, please refer to “Engineering Data”.

Sensor I/O Connectors

Cord	Shape	Cable type		Model
Standard	Straight 	2 m	Four-wire type	**XS2F-D421-D80-A**
		5 m		**XS2F-D421-G80-A**
	L-shaped 	2 m		**XS2F-D422-D80-A**
		5 m		**XS2F-D422-G80-A**
Vibration-proof robot cable	Straight 	2 m		**XS2F-D421-D80-R**
		5 m		**XS2F-D421-G80-R**
	L-shaped 	2 m		**XS2F-D422-D80-R**
		5 m		**XS2F-D422-G80-R**

Ordering Information: type list

DC-Switching Models, plastic

Model	Sensing method, sensing distance	Appearance	Connection (cable-length)	Control output	Comments
E3F2-7B4 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	PNP	Receiver and Emitter
E3F2-7B4-P1	Through-beam, 7 m	axial	Connector	PNP	Receiver and Emitter
E3F2-7C4 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	NPN	Receiver and Emitter
E3F2-7C4-P1	Through-beam, 7 m	axial	Connector	NPN	Receiver and Emitter
E3F2-7DB4 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	PNP	Receiver only
E3F2-7DB4-P1	Through-beam, 7 m	axial	Connector	PNP	Receiver only
E3F2-7DC4 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	NPN	Receiver only
E3F2-7DC4-P1	Through-beam, 7 m	axial	Connector	NPN	Receiver only
E3F2-7L 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	N.A.	Emitter only
E3F2-7L -P1	Through-beam, 7 m	axial	Connector	N.A.	Emitter only
E3F2-10B4 2M	Through-beam, 10m	axial	Pre-wired (2m)*	PNP	Receiver and Emitter (precision detection and test input)
E3F2-10B4-P1	Through-beam, 10m	axial	Connector	PNP	Receiver and Emitter (precision detection and test input)
E3F2-10DB4 2M	Through-beam, 10m	axial	Pre-wired (2m)*	PNP	Receiver only (precision detection and test input)
E3F2-10DB4-P1	Through-beam, 10m	axial	Connector	PNP	Receiver only (precision detection and test input)
E3F2-10C4 2M	Through-beam, 10m	axial	Pre-wired (2m)*	NPN	Receiver and Emitter (precision detection and test input)
E3F2-10C4-P1	Through-beam, 10m	axial	Connector	NPN	Receiver and Emitter (precision detection and test input)
E3F2-10DC4 2M	Through-beam, 10m	axial	Pre-wired (2m)*	NPN	Receiver only (precision detection and test input)
E3F2-10DC4-P1	Through-beam, 10m	axial	Connector	NPN	Receiver only (precision detection and test input)
E3F2-10LB 2M	Through-beam, 10m	axial	Pre-wired (2m)*	PNP	Emitter only (precision detection and test input)
E3F2-10LB-P1	Through-beam, 10m	axial	Connector	PNP	Emitter only (precision detection and test input)
E3F2-DS10B4-N 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	PNP	Wide-beam characteristic
E3F2-DS10B4-P1	Diffuse reflective, 0.1 m	axial	Connector	PNP	Wide-beam characteristic
E3F2-DS10C4-N 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	NPN	Wide-beam characteristic
E3F2-DS10C4-P1	Diffuse reflective, 0.1 m	axial	Connector	NPN	Wide-beam characteristic
E3F2-DS30B4 2M	Diffuse reflective, 0.3 m	axial	Pre-wired (2 m)*	PNP	Sensitivity adjuster
E3F2-DS30B41 2M	Diffuse reflective, 0.3 m	radial	Pre-wired (2 m)*	PNP	Sensitivity adjuster
E3F2-DS30B41-P1	Diffuse reflective, 0.3 m	radial	Connector	PNP	Sensitivity adjuster
E3F2-DS30B4-P1	Diffuse reflective, 0.3 m	axial	Connector	PNP	Sensitivity adjuster
E3F2-DS30C4 2M	Diffuse reflective, 0.3 m	axial	Pre-wired (2 m)*	NPN	Sensitivity adjuster
E3F2-DS30C41 2M	Diffuse reflective, 0.3 m	radial	Pre-wired (2 m)*	NPN	Sensitivity adjuster
E3F2-DS30C41-P1	Diffuse reflective, 0.3 m	radial	Connector	NPN	Sensitivity adjuster
E3F2-DS30C4-P1	Diffuse reflective, 0.3 m	axial	Connector	NPN	Sensitivity adjuster
E3F2-D1B4 2M	Diffuse reflective, 1 m	axial	Pre-wired (2 m)*	PNP	Sensitivity adjuster
E3F2-D1B4-P1	Diffuse reflective, 1 m	axial	Connector	PNP	Sensitivity adjuster
E3F2-D1C4 2M	Diffuse reflective, 1 m	axial	Pre-wired (2 m)*	NPN	Sensitivity adjuster
E3F2-D1C4-P1	Diffuse reflective, 1 m	axial	Connector	NPN	Sensitivity adjuster
E3F2-LS10B4 2M	Background suppression, 10 cm	axial	Pre-wired (2 m)*	PNP	Background suppression
E3F2-LS10B4-P1	Background suppression, 10 cm	axial	Connector	PNP	Background suppression
E3F2-LS10C4 2M	Background suppression, 10 cm	axial	Pre-wired (2 m)*	NPN	Background suppression
E3F2-LS10C4-P1	Background suppression, 10 cm	axial	Connector	NPN	Background suppression
E3F2-R2B4 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	PNP	Non-polarizing
E3F2-R2B4-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	PNP	Non-polarizing, including reflector
E3F2-R2B4-P1	Retroreflective, 2 m	axial	Connector	PNP	Non-polarizing
E3F2-R2B4-P1-E	Retroreflective, 2 m	axial	Connector	PNP	Non-polarizing, including reflector
E3F2-R2C4 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	NPN	Non-polarizing
E3F2-R2C4-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	NPN	Non-polarizing, including reflector
E3F2-R2C4-P1	Retroreflective, 2 m	axial	Connector	NPN	Non-polarizing
E3F2-R2C4-P1-E	Retroreflective, 2 m	axial	Connector	NPN	Non-polarizing, including reflector

Model	Sensing method, sensing distance	Appearance	Connection (cable-length)	Control output	Comments
E3F2-R2RB41 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	PNP	Polarizing
E3F2-R2RB41-E 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	PNP	Polarizing, including reflector
E3F2-R2RB41-P1	Retroreflective, 2 m	radial	Connector	PNP	Polarizing
E3F2-R2RB41-P1-E	Retroreflective, 2 m	radial	Connector	PNP	Polarizing, including reflector
E3F2-R2RC41 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	NPN	Polarizing
E3F2-R2RC41-E 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	NPN	Polarizing, including reflector
E3F2-R2RC41-P1	Retroreflective, 2 m	radial	Connector	NPN	Polarizing
E3F2-R2RC41-P1-E	Retroreflective, 2 m	radial	Connector	NPN	Polarizing, including reflector
E3F2-R4B4 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, sensitivity adjuster
E3F2-R4B4-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4B4F 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, fixed sensitivity
E3F2-R4B4F-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, fixed sensitivity incl. reflector
E3F2-R4C4 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, sensitivity adjuster
E3F2-R4C4-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4C4F 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, fixed sensitivity
E3F2-R4C4F-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, fixed sensitivity incl. reflector
E3F2-R4B4-P1	Retroreflective, 4m	axial	Connector	PNP	Polarizing, sensitivity adjuster
E3F2-R4B4-P1-E	Retroreflective, 4m	axial	Connector	PNP	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4B4F-P1	Retroreflective, 4m	axial	Connector	PNP	Polarizing, fixed sensitivity
E3F2-R4B4F-P1-E	Retroreflective, 4m	axial	Connector	PNP	Polarizing, fixed sensitivity incl. reflector
E3F2-R4C4-P1	Retroreflective, 4m	axial	Connector	NPN	Polarizing, sensitivity adjuster
E3F2-R4C4-P1-E	Retroreflective, 4m	axial	Connector	NPN	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4C4F-P1	Retroreflective, 4m	axial	Connector	NPN	Polarizing, fixed sensitivity
E3F2-R4C4F-P1-E	Retroreflective, 4m	axial	Connector	NPN	Polarizing, fixed sensitivity incl. reflector

* Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB41 2M or E3F2-R2RB41 5M). For other cable length please contact your OMRON sales representative.

DC-Switching Models, metal (nickel plated brass)

Model	Sensing method, sensing range	Appearance	Connection (cable-length)	Control output	Comments
E3F2-7B4-M 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	PNP	Receiver and Emitter
E3F2-7B4-M1-M	Through-beam, 7 m	axial	Connector	PNP	Receiver and Emitter
E3F2-7C4-M 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	NPN	Receiver and Emitter
E3F2-7C4-M1-M	Through-beam, 7 m	axial	Connector	NPN	Receiver and Emitter
E3F2-7DB4-M 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	PNP	Receiver only
E3F2-7DB4-M1-M	Through-beam, 7 m	axial	Connector	PNP	Receiver only
E3F2-7DC4-M 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	NPN	Receiver only
E3F2-7DC4-M1-M	Through-beam, 7 m	axial	Connector	NPN	Receiver only
E3F2-7L-M 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	N.A	Emitter only
E3F2-7L-M1-M	Through-beam, 7 m	axial	Connector	N.A	Emitter only
E3F2-10B4-M 2M	Through-beam, 10m	axial	Pre-wired (2m)*	PNP	Receiver and Emitter (precision detection and test input)
E3F2-10B4-M1-M	Through-beam, 10m	axial	Connector	PNP	Receiver and Emitter (precision detection and test input)
E3F2-10DB4-M 2M	Through-beam, 10m	axial	Pre-wired (2m)*	PNP	Receiver only (precision detection and test input)
E3F2-10DB4-M1-M	Through-beam, 10m	axial	Connector	PNP	Receiver only (precision detection and test input)
E3F2-10C4-M 2M	Through-beam, 10m	axial	Pre-wired (2m)*	NPN	Receiver and Emitter (precision detection and test input)
E3F2-10C4-M1-M	Through-beam, 10m	axial	Connector	NPN	Receiver and Emitter (precision detection and test input)
E3F2-10DC4-M 2M	Through-beam, 10m	axial	Pre-wired (2m)*	NPN	Receiver only (precision detection and test input)
E3F2-10DC4-M1-M	Through-beam, 10m	axial	Connector	NPN	Receiver only (precision detection and test input)
E3F2-10LB-M 2M	Through-beam, 10m	axial	Pre-wired (2m)*	PNP	Emitter only (precision detection and test input)

Model	Sensing method, sensing range	Appearance	Connection (cable-length)	Control output	Comments
E3F2-10LB-M 2M	Through-beam, 10m	axial	Pre-wired (2m)*	PNP	Emitter only (precision detection and test input)
E3F2-10LB-M1-M	Through-beam, 10m	axial	Connector	PNP	Emitter only (precision detection and test input)
E3F2-DS10B4-M 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	PNP	Wide-beam characteristic
E3F2-DS10B4-M1-M	Diffuse reflective, 0.1 m	axial	Connector	PNP	Wide-beam characteristic
E3F2-DS10C4-M 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	NPN	Wide-beam characteristic
E3F2-DS10C4-M1-M	Diffuse reflective, 0.1 m	axial	Connector	NPN	Wide-beam characteristic
E3F2-DS30B41-M 2M	Diffuse reflective, 0.3 m	radial	Pre-wired (2 m)*	PNP	Sensitivity adjuster
E3F2-DS30B41-M1-M	Diffuse reflective, 0.3 m	radial	Connector	PNP	Sensitivity adjuster
E3F2-DS30B4-M 2M	Diffuse reflective, 0.3 m	axial	Pre-wired (2 m)*	PNP	Sensitivity adjuster
E3F2-DS30B4-M1-M	Diffuse reflective, 0.3 m	axial	Connector	PNP	Sensitivity adjuster
E3F2-DS30C41-M 2M	Diffuse reflective, 0.3 m	radial	Pre-wired (2 m)*	NPN	Sensitivity adjuster
E3F2-DS30C41-M1-M	Diffuse reflective, 0.3 m	radial	Connector	NPN	Sensitivity adjuster
E3F2-DS30C4-M 2M	Diffuse reflective, 0.3 m	axial	Pre-wired (2 m)*	NPN	Sensitivity adjuster
E3F2-DS30C4-M1-M	Diffuse reflective, 0.3 m	axial	Connector	NPN	Sensitivity adjuster
E3F2-D1B4-M 2M	Diffuse reflective, 1 m	axial	Pre-wired (2m)*	PNP	Sensitivity adjuster
E3F2-D1B4-M1-M	Diffuse reflective, 1 m	axial	Connector	PNP	Sensitivity adjuster
E3F2-D1C4-M 2M	Diffuse reflective, 1 m	axial	Pre-wired (2m)*	NPN	Sensitivity adjuster
E3F2-D1C4-M1-M	Diffuse reflective, 1 m	axial	Connector	NPN	Sensitivity adjuster
E3F2-LS10B4-M 2M	Background suppression, 10 cm	axial	Pre-wired (2m)*	PNP	Background suppression
E3F2-LS10B4-M1-M	Background suppression, 10 cm	axial	Connector	PNP	Background suppression
E3F2-LS10C4-M 2M	Background suppression, 10 cm	axial	Pre-wired (2m)*	NPN	Background suppression
E3F2-LS10C4-M1-M	Background suppression, 10 cm	axial	Connector	NPN	Background suppression
E3F2-R2RB41-M 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	PNP	Polarizing
E3F2-R2RB41-M1-M	Retroreflective, 2 m	radial	Connector	PNP	Polarizing
E3F2-R2RB41-M1-M-E	Retroreflective, 2 m	radial	Connector	PNP	Polarizing, including reflector
E3F2-R2RB41-M-E 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	PNP	Polarizing, including reflector
E3F2-R2RB4-M 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	PNP	Polarizing
E3F2-R2RB4-M1-M	Retroreflective, 2 m	axial	Connector	PNP	Polarizing
E3F2-R2RB4-M1-M-E	Retroreflective, 2 m	axial	Connector	PNP	Polarizing, including reflector
E3F2-R2RB4-M-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	PNP	Polarizing, including reflector
E3F2-R2RC41-M 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	NPN	Polarizing
E3F2-R2RC41-M1-M	Retroreflective, 2 m	radial	Connector	NPN	Polarizing
E3F2-R2RC41-M1-M-E	Retroreflective, 2 m	radial	Connector	NPN	Polarizing, including reflector
E3F2-R2RC41-M-E 2M	Retroreflective, 2 m	radial	Pre-wired (2 m)*	NPN	Polarizing, including reflector
E3F2-R2RC4-M 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	NPN	Polarizing
E3F2-R2RC4-M1-M	Retroreflective, 2 m	axial	Connector	NPN	Polarizing
E3F2-R2RC4-M1-M-E	Retroreflective, 2 m	axial	Connector	NPN	Polarizing, including reflector
E3F2-R2RC4-M-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	NPN	Polarizing, including reflector
E3F2-R4B4-M 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, sensitivity adjuster
E3F2-R4B4-M-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4B4F-M 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, fixed sensitivity
E3F2-R4B4F-M-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	PNP	Polarizing, fixed sensitivity incl. reflector
E3F2-R4C4-M 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, sensitivity adjuster
E3F2-R4C4-M-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4C4F-M 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, fixed sensitivity
E3F2-R4C4F-M-E 2M	Retroreflective, 4m	axial	Pre-wired (2m)*	NPN	Polarizing, fixed sensitivity incl. reflector
E3F2-R4B4-M1-M	Retroreflective, 4m	axial	Connector	PNP	Polarizing, sensitivity adjuster
E3F2-R4B4-M1-M-E	Retroreflective, 4m	axial	Connector	PNP	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4B4F-M1-M	Retroreflective, 4m	axial	Connector	PNP	Polarizing, fixed sensitivity
E3F2-R4B4F-M1-M-E	Retroreflective, 4m	axial	Connector	PNP	Polarizing, fixed sensitivity incl. reflector
E3F2-R4C4-M1-M	Retroreflective, 4m	axial	Connector	NPN	Polarizing, sensitivity adjuster

Model	Sensing method, sensing range	Appearance	Connection (cable-length)	Control output	Comments
E3F2-R4C4-M1-M-E	Retroreflective, 4m	axial	Connector	NPN	Polarizing, sensitivity adjuster, incl. reflector
E3F2-R4C4F-M1-M	Retroreflective, 4m	axial	Connector	NPN	Polarizing, fixed sensitivity
E3F2-R4C4F-M1-M-E	Retroreflective, 4m	axial	Connector	NPN	Polarizing, fixed sensitivity incl. reflector

* Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB41-M 2M or E3F2-R2RB41-M 5M). For other cable length please contact your OMRON sales representative.

DC-Switching Models, metal (stainless steel)

Model	Sensing method, sensing range	Appearance	Connection (cable-length)	Control output	Comments
E3F2-7B4-M1-S	Through-beam, 7 m	axial	Connector	PNP	Receiver and Emitter
E3F2-7B4-S 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	PNP	Receiver and Emitter
E3F2-7C4-M1-S	Through-beam, 7 m	axial	Connector	NPN	Receiver and Emitter
E3F2-7C4-S 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	NPN	Receiver and Emitter
E3F2-7DB4-M1-S	Through-beam, 7 m	axial	Connector	PNP	Receiver only
E3F2-7DB4-S 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	PNP	Receiver only
E3F2-7DC4-M1-S	Through-beam, 7 m	axial	Connector	NPN	Receiver only
E3F2-7DC4-S 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	NPN	Receiver only
E3F2-7L-M1-S	Through-beam, 7 m	axial	Connector	N.A.	Emitter only
E3F2-7L-S 2M	Through-beam, 7 m	axial	Pre-wired (2 m)*	N.A.	Emitter only
E3F2-DS10B4-M1-S	Diffuse reflective, 0.1 m	axial	Connector	PNP	Wide-beam characteristic
E3F2-DS10B4-S 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	PNP	Wide-beam characteristic
E3F2-DS10C4-M1-S	Diffuse reflective, 0.1 m	axial	Connector	NPN	Wide-beam characteristic
E3F2-DS10C4-S 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	NPN	Wide-beam characteristic
E3F2-DS30B4-M1-S	Diffuse reflective, 0.3 m	axial	Connector	PNP	Sensitivity adjuster
E3F2-DS30B4-S 2M	Diffuse reflective, 0.3 m	axial	Pre-wired (2 m)*	PNP	Sensitivity adjuster
E3F2-DS30C4-M1-S	Diffuse reflective, 0.3 m	axial	Connector	NPN	Sensitivity adjuster
E3F2-DS30C4-S 2M	Diffuse reflective, 0.3 m	axial	Pre-wired (2 m)*	NPN	Sensitivity adjuster
E3F2-R2RB4-M1-S	Retroreflective, 2 m	axial	Connector	PNP	Polarizing
E3F2-R2RB4-M1-S-E	Retroreflective, 2 m	axial	Connector	PNP	Polarizing, including reflector
E3F2-R2RB4-S 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	PNP	Polarizing
E3F2-R2RB4-S-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	PNP	Polarizing, including reflector
E3F2-R2RC4-M1-S	Retroreflective, 2 m	axial	Connector	NPN	Polarizing
E3F2-R2RC4-M1-S-E	Retroreflective, 2 m	axial	Connector	NPN	Polarizing, including reflector
E3F2-R2RC4-S 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	NPN	Polarizing
E3F2-R2RC4-S-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	NPN	Polarizing, including reflector

* Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2RB41-S 2M or E3F2-R2RB41-S 5M). For other cable length please contact your OMRON sales representative.

AC-Switching Models, plastic

Model	Sensing method, sensing range	Appearance	Connection (cable-length)	Control output	Comments
E3F2-3LZ 2M	Through-beam, 3 m	axial	Pre-wired (2 m)*	N.A.	Emitter only
E3F2-3DZ1 2M	Through-beam, 3 m	axial	Pre-wired (2 m)*	Light-ON	Receiver only
E3F2-3DZ2 2M	Through-beam, 3 m	axial	Pre-wired (2 m)*	Dark-ON	Receiver only
E3F2-3Z1 2M	Through-beam, 3 m	axial	Pre-wired (2 m)*	Light-ON	Receiver and Emitter
E3F2-3Z2 2M	Through-beam, 3 m	axial	Pre-wired (2 m)*	Dark-ON	Receiver and Emitter
E3F2-R2Z1 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	Light-ON	Non-polarizing
E3F2-R2Z2 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	Dark-ON	Non-polarizing
E3F2-R2Z1-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	Light-ON	Non-polarizing, including reflector
E3F2-R2Z2-E 2M	Retroreflective, 2 m	axial	Pre-wired (2 m)*	Dark-ON	Non-polarizing, including reflector
E3F2-DS10Z1-N 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	Light-ON	Wide-beam characteristic
E3F2-DS10Z2-N 2M	Diffuse reflective, 0.1 m	axial	Pre-wired (2 m)*	Dark-ON	Wide-beam characteristic

* Standard cable length is 2 m. Models provided with a 5 m long cable are available. When ordering, specify the cable length by adding the length of the cable (e.g. E3F2-R2Z1 2M or E3F2-R2Z1 5M). For other cable length please contact your OMRON sales representative.

Specifications

Ratings / Characteristics of DC Switching Models

Item		E3F2-7□	E3F2-10□	E3F2-R2□4-□	E3F2-R2R□	E3F2-R4□-□	E3F2-DS10□	E3F2-DS30□	E3F2-D1□4-□	E3F2-LS10□4-□
Sensing method		Through-beam		Retroreflective			Diffuse reflective			
		- multi purpose	- Precision detection [7.] - test input	Non-polarizing	Polarizing		Wide beam characteristic	Adjustable sensing distance		Background suppression
Power supply voltage		10 to 30 V DC	12 to 24 V DC	10 to 30 V DC						
Current consumption		50 mA max.		25 mA max.	30 mA max.		25 mA max.	30 mA max.		
Rated sensing distance [1.]		7 m	10 m	0.1 - 2 m (with reflector E39-R1)		0.1 - 4 m (with reflector E39-R1S)	0.1 m (5 x 5 cm white mat paper)	0.3 m (10 x 10 cm white mat paper)	1 m (30 x 30 cm white mat paper)	0.1 m (10 x 10 cm white mat paper)
Typical sensing distance for different reflector types (ref. to accessories) [2.]		–		E39-R1: 4.0 m E39-R7: 4.5 m E39-R8: 5.3 m	E39-R1: axial 3.7 m radial 2.4 m E39-R7: axial 4.2 m radial 2.7 m E39-R8: axial 5.3 m radial 3.1 m	E39-R1S: 4.3 m E39-R7: 4.8 m E39-R8: 5.6 m E39-R40: 4.3 m E39-RS3: 2 m	–			
Standard object		Opaque: 11 mm dia. min.		Opaque: 56 mm dia. min.			–			
Directional angle		3° to 20°					–			
Differential travel (hysteresis)		–					20% max.			5% max
Black/white error		–								3%
Response time		Operation and Reset: 2.5 ms max.				1 ms max	2.5 ms max.		1 ms max.	
Control output		Transistor (open collector), load current: 100 mA max. (residual voltage: 2 V max.)								
Power reset time		50 ms				100 ms max.	50 ms		100 ms	
Ambient illumination		Incandescent lamp:3000 lx max. / Sunlight:10000 lx max.								
Ambient temperature		Operating: -25 to 55 °C / Storage: -30 to 70 °C (with no icing or condensation)								
Ambient humidity		Operating: 35% to 85% / Storage: 35% to 95% (without condensation)								
Insulation resistance		20 M min. at 500 V DC between energized parts and case								
Dielectric strength		1000 VAC max., 50 / 60 Hz for 1 min between energized parts and case								
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude for 2 hrs each direction (X, Y, Z)								
Shock resistance		Destruction: 500 m/s^2 each direction (X, Y, Z)								
Enclosure ratings		IP67 [3.]; NEMA 1, 2, 4; IP69k after DIN 40050 part 9								
Light source		Infrared LED (880 nm/850 nm)			Red LED (660 nm)		Infrared LED (880 nm)			Red LED (660 nm)
Indicators		Light incident / power indicator for light source (red)	Output (orange) / light emission (red)	Light incident / power indicator for light source (red)		Light incident (red) / stability (green)	Light incident / power indicator for light source (red)		Light incident (red) / stability (green)	Output indicator (orange) / stability (green)
Sensitivity adjustment		Fixed				Fixed / Adjustable	Fixed	Adjustable		Fixed
Connection method		2 m, 5 m pre-wired cable (PVC, dia. 4 mm (18 / 0.12) [4.]) or M12-connector								
Test Input		–	[8.]	–						
Operation mode		Light-ON or Dark-ON selectable by wiring								
Weight (approx.)										
Plastic case	pre-wired (2 m)	120 g		60 g						
	connector	40 g		20 g						
Metal case	pre-wired (2 m)	180 g		90 g						
	connector	120 g		50 g						
Circuit protection		Output short-circuit and power supply reverse polarity								
Housing materials		Plastic (case: ABS; lens: PMMA)								
		Nickel brass	Nickel brass	–	Nickel brass	Nickel brass	Nickel brass	Nickel brass	Nickel brass	Nickel brass
		Stainless steel [5.]	–	–	Stainless steel [5.]	–	Stainless steel [5.]	Stainless steel [5.]	–	– [6.]

Note: 1 . For stable sensing distance in detail, please refer to "Engineering Data"
2 . Typical sensing distance corresponds to 80 % of the max. sensing distance.
3 . The enclosure rating IP67 of OMRON internal standards correspond to stricter test requirements than the standard IEC 60529 (refer to chapter "Precautions")
4 . For other cable materials (e.g. PUR) please contact your OMRON sales representative.
5 . Material-specification for stainless steel housing case: 1.4305 (W.-No.), 303 (AISI), 2346 (SS). For other stainless steel materials please contact your OMRON sales representative.
6 . Please contact your OMRON sales representative for the availability of stainless steel BGS types.
7 . with slit E39-ES18
8 . PNP models -B4: Vcc to Vcc -2.5 V: Emitting OFF (Source current: 3 mA max.) / Open or 0 to 2.5 V: Emitting ON (Leakage current: 0.1 mA max.)
NPN models -C4: 0 to 2.5 V: Emitting OFF (Source current: 3 mA max.) / Open or Vcc to Vcc -2.5 V: Emitting ON (Leakage current: 0.1 mA max.)

Ratings / Characteristics of AC Switching Models

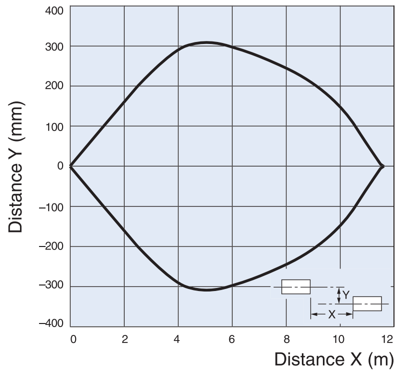
Item	**E3F2-3Z1 E3F2-3Z2**	**E3F2-R2Z1 E3F2-R2Z2**	**E3F2-DS10Z1 E3F2-DS10Z2**
Sensing method	Through-beam	Non-polarizing Retroreflective	Diffuse reflective (wide-beam characteristic)
Power supply voltage	24 to 240 VAC ±10 %, 50 / 60 Hz		
Current consumption	10 mA max.	5 mA max.	
Rated sensing distance[1.]	3 m	0.1 - 2 m (with reflector E39-R1)	0.1 m (5 x 5 cm white mat paper)
Typical sensing distance for different reflector types [2.]	–	E39-R1: 3,4 m E39-R7: 3,9 m E39-R8: 5,2 m	–
Detectable object	Opaque object: 11 mm min.	Opaque object: 56 mm min.	Opaque objects
Directional angle	3° to 20°		–
Differential travel	–		20 % max.
Response time	30 ms max.		
Control output	AC solid state (SCR) 200 mA max.; residual voltage: 5 V max. at 200 mA		
Power reset time	100 ms		
Ambient illumination	Incandescent lamp: 3000 lx max. Sunlight: 10000 lx max.		
Ambient temperature [5.]	Operating: -25 to 55 °C / Storage: -30 to 70 °C (with no icing or condensation)		
Ambient humidity	Operating: 35% to 85% / Storage: 35% to 95% (without condensation)		
Insulation resistance	20 M min. at 500 V DC between energized parts and case		
Dielectric strength	1500 VAC, 50 / 60 Hz for 1 min between energized parts and case		
Vibration resistance	10 to 55 Hz, 1.5 mm double amplitude for 2 hrs each direction (X, Y, Z)		
Shock resistance	500 m/sqr (approx. 50 g) for each direction (X, Y, Z)		
Enclosure rating	IP67 [3.]; NEMA 1, 2, 4; IP69k after DIN 40050 part 9		
Light source	Infrared LED (880 nm)		
Indicators	Light incident/power indicator for light source (red)		
Sensitivity adjustment	Fixed		
Connection method	2 m, 5 m pre-wired cable (PVC dia. 4 mm (14 / 0.15) [4.])		
Operation mode	Light-ON or Dark-ON (fixed)		
Circuit protection	None		
Weight (approx.)	110 g (pre-wired 2 m cable)		
Housing materials	Plastic (case: ABS; lens: PMMA)		

Note: 1 . For stable sensing distance in detail, please refer to "Engineering Data"
2 . Typical sensing distance corresponds to 80 % of the max. sensing distance.
3 . The enclosure rating IP67 of OMRON internal standards correspond to stricter test requirements than the standard IEC 60529 (refer to chapter "Precautions")
4 . For other cable materials (e.g. PUR) please contact your OMRON sales representative.

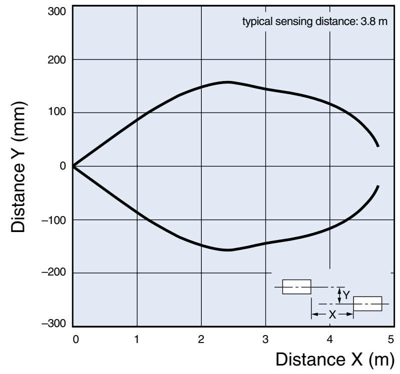
Engineering Data (Typical)

Operating Range (typical)

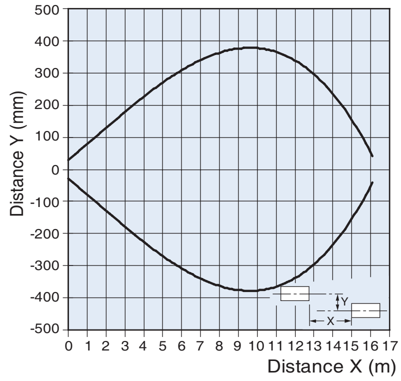
Through-beam Models (axial)
E3F2-7□4-□



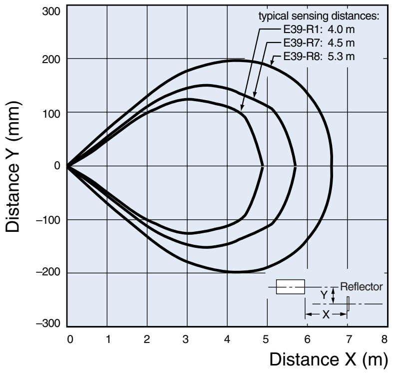
Through-beam Models (axial)
E3F2-3Z□



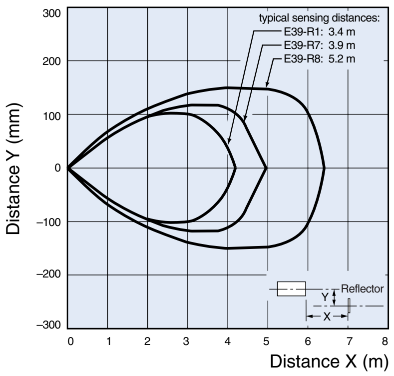
Through-beam Models (axial)
E3F2-10□



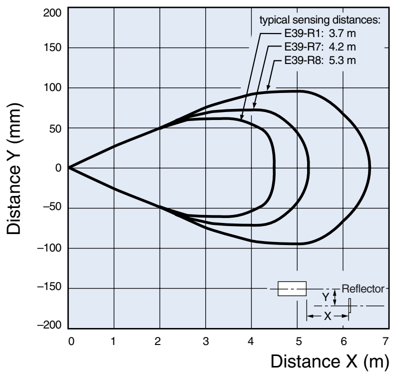
Retroreflective Models (axial)
E3F2-R2□4-□ (non polarizing)
and reflectors



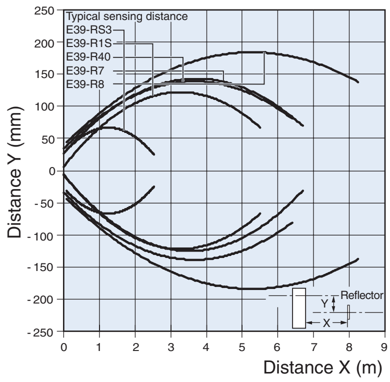
Retroreflective Models (axial)
E3F2-R2Z□ (non polarizing)
and reflectors



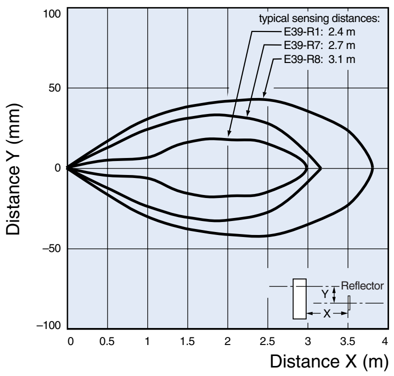
Retroreflective Models (axial)
E3F2-R2R□4-□ (polarizing)
and reflectors



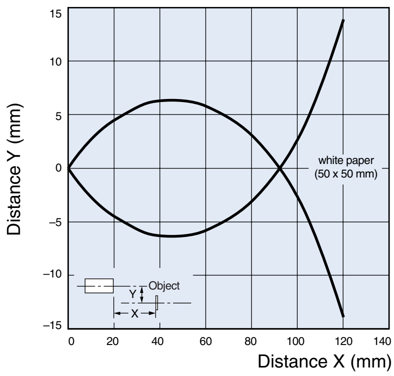
Retro-reflective Models (axial)
E3F2-R4□4□-□ (polarizing)



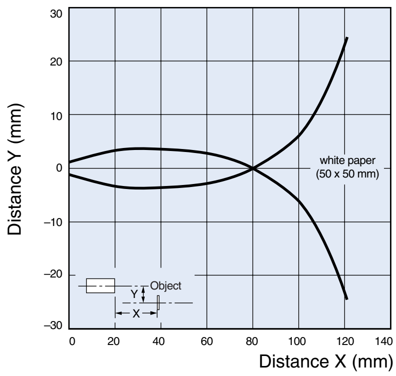
Retroreflective Models (radial)
E3F2-R2R□41-□ (polarizing)
and reflectors



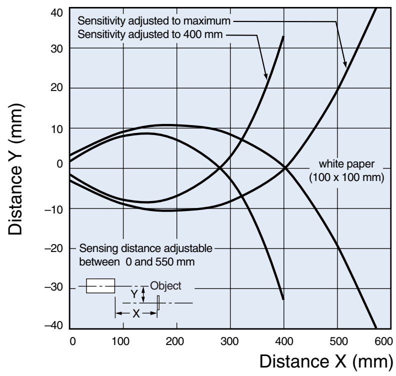
Diffuse reflective Models (axial)
E3F2-DS10□4-□ (wide-beam type)



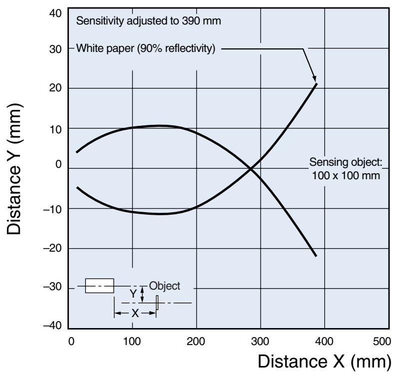
Diffuse reflective Models (axial)
E3F2-DS10Z-□ (wide-beam type)



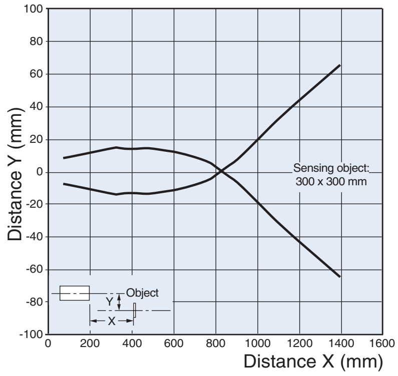
Diffuse reflective Models (axial)
E3F2-DS30□4-□



Diffuse reflective Models (radial)
E3F2-DS30□41-□

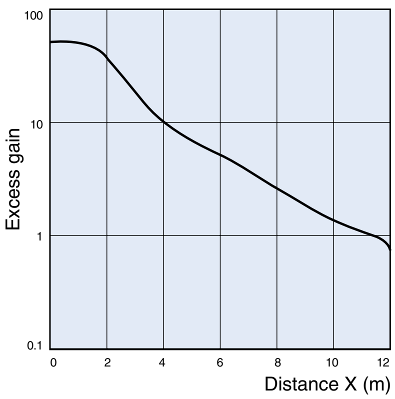


Diffuse reflective Models (axial)
E3F2-D1□4-□

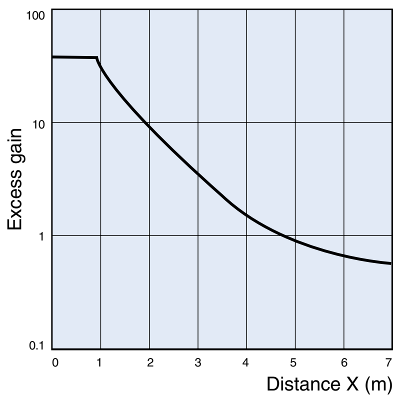


Excess Gain Ratio vs. Distance (typical)

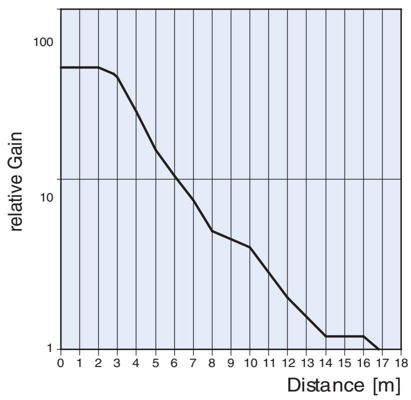
Through-beam Models (axial)
E3F2-7□4-□



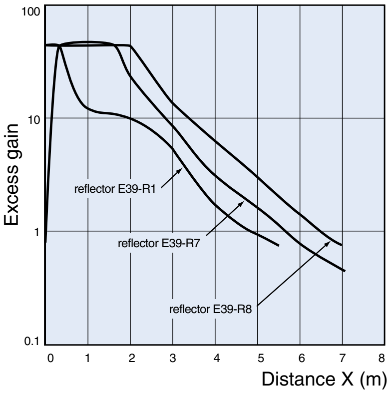
Through-beam Models (axial)
E3F2-3Z□



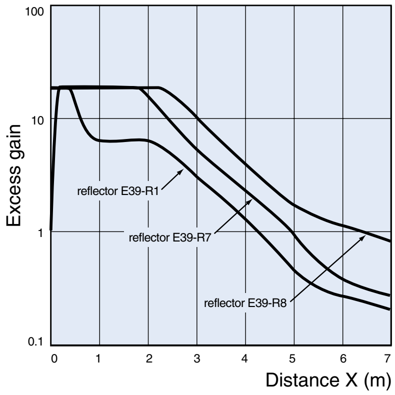
Through-beam Models (axial)
E3F2-10□



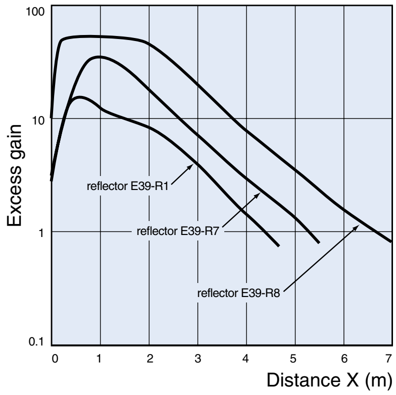
Retroreflective Models (axial)
E3F2-R2□4-□ (non polarizing)
and reflectors



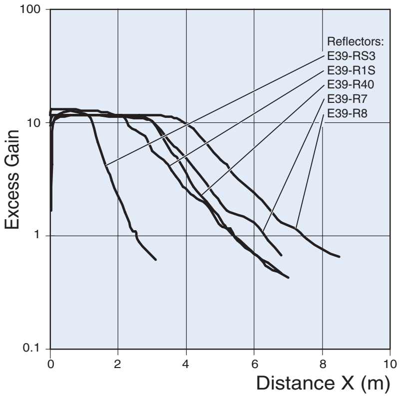
Retroreflective Models (axial)
E3F2-R2Z□ (non polarizing)
and reflectors



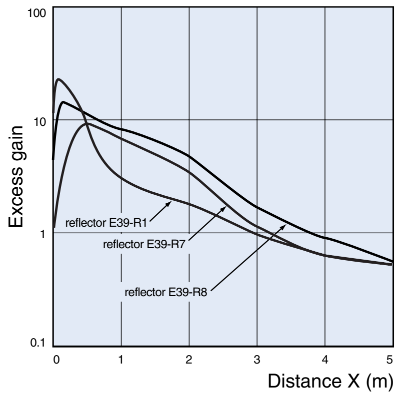
Retroreflective Models (axial)
E3F2-R2R□4-□ (polarizing)
and reflectors



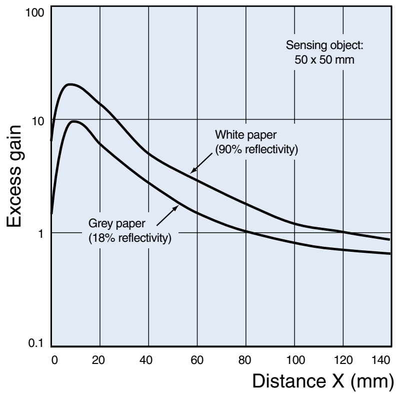
Retroreflective Models (axial)
E3F2-R4□4□-□



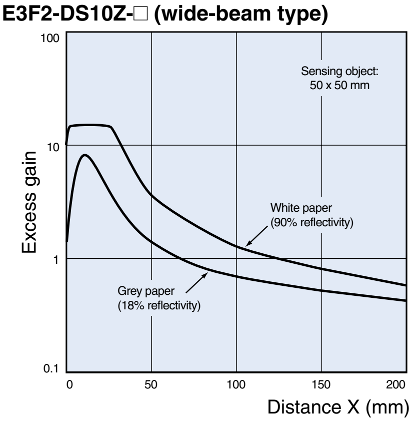
Retroreflective Models (radial)
E3F2-R2R□41-□ (polarizing)
and reflectors



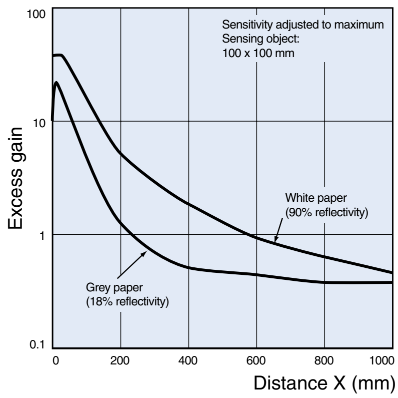
Diffuse reflective Models (axial)
E3F2-DS10□4-□ (wide-beam type)



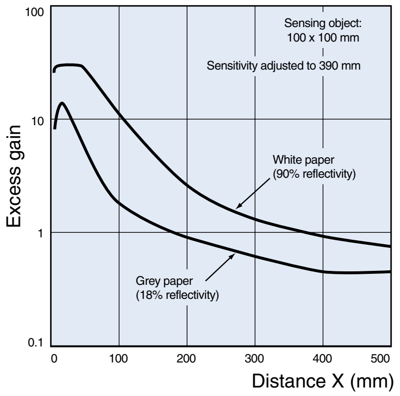
Diffuse reflective Models (axial)
E3F2-DS10Z-□ (wide-beam type)



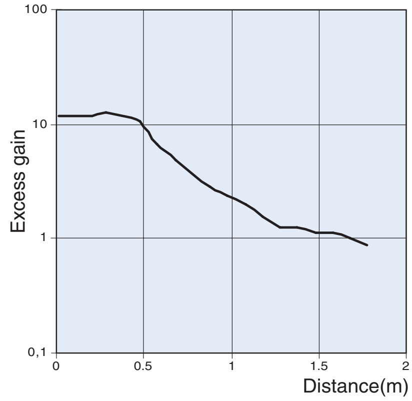
Diffuse reflective Models (axial)
E3F2-DS30□4-□



Diffuse reflective Models (radial)
E3F2-DS30□41-□

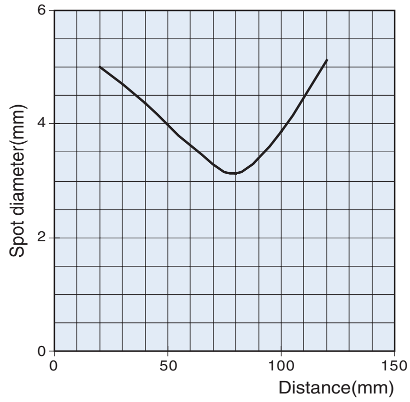


Diffuse reflective Models (axial)
E3F2-D1□4-□



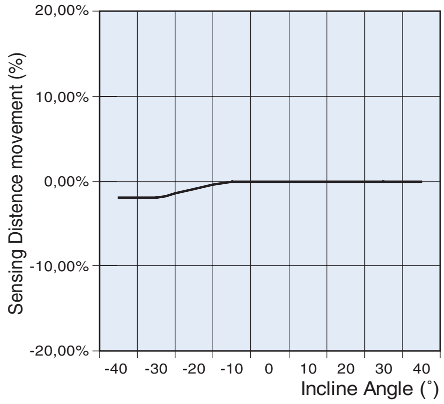
Light spot vs sensing distance

Background suppression Models
E3F2-LS□



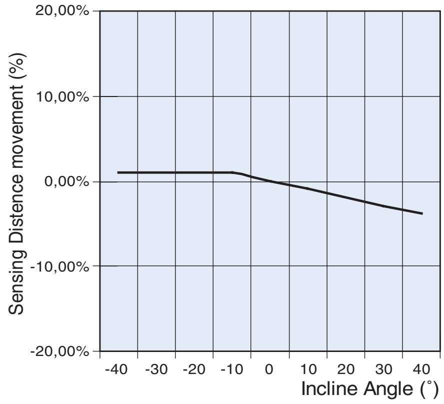
Incline (left and right)

Background suppression Models
E3F2-LS□



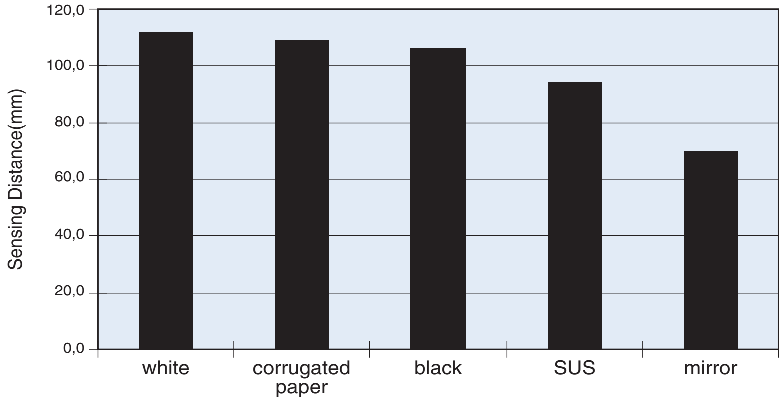
Incline (up and down)

Background suppression Models
E3F2-LS□



Object material vs sensing distance

Background suppression Models
E3F2-LS□

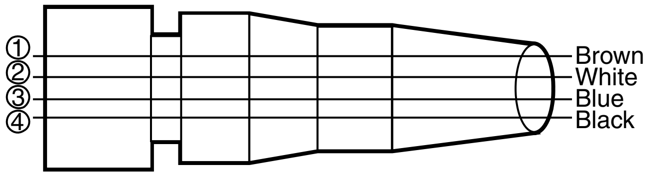


Operation

Output Circuits

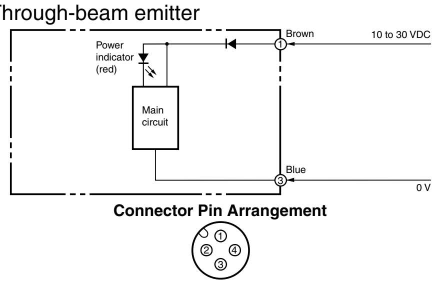
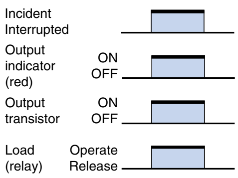
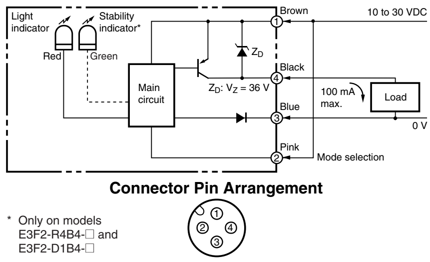
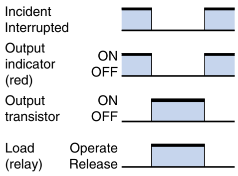
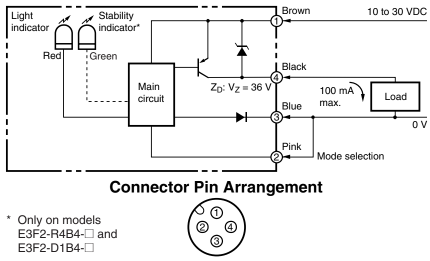
Structure of Sensor I/O Connector

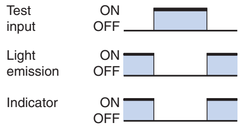
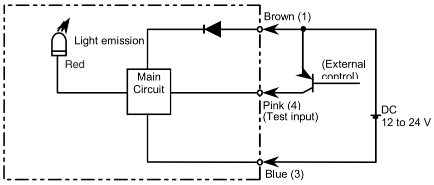
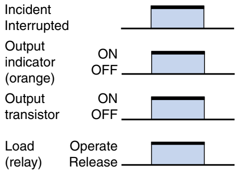
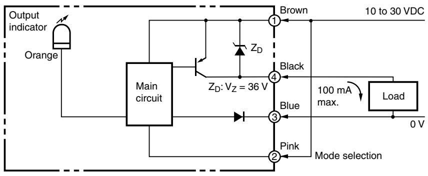
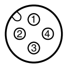
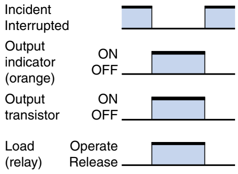
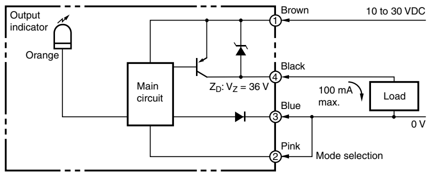
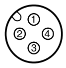
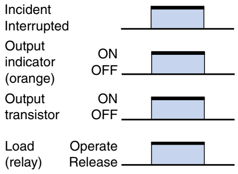
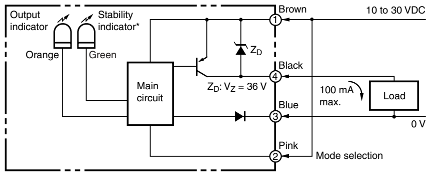
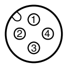
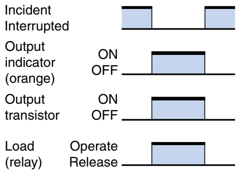
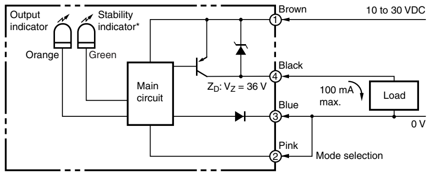
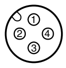
Classification	Wire color	Connector pin No.	Use
DC	Brown	①	Power supply (+V)
	White	②	Mode selection Lon/Don
	Blue	③	Power supply (0 V)
	Black	④	Output



XS2F-D42□-D80-□
XS2F-G42□-G80-□

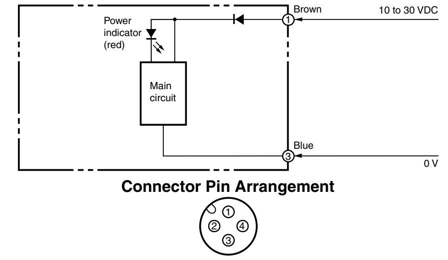
PNP Output

Model	Output transistor status	Timing chart	Connection method	Output circuit
	–	–	–	Through-beam emitter 
E3F2-□B4-□ (except for E3F2-10B4-□ and E3F2-LS10B4-□)	ON when light is incident. (Light-ON)		Connect the pink (Pin ②) and brown (Pin ①) cords or open the pink cord (Pin ②).	
	ON when light is interrupted. (Dark-ON)		Connect the pink (Pin ②) and blue (Pin ③) cords.	

Model	Output transistor status	Timing chart	Connection method	Output circuit
E3F2-10B4-□	–		–	Through-beam emitter 
	ON when light is incident. (Light-ON)		Connect the pink (Pin ②) and brown (Pin ①) cords or open the pink cord (Pin ②).	 **Connector Pin Arrangement** 
	ON when light is interrupted. (Dark-ON)		Connect the pink (Pin ②) and blue (Pin ③) cords.	 **Connector Pin Arrangement** 
E3F2-LS10B4-□	ON when light is incident. (Light-ON)		Connect the pink (Pin ②) and brown (Pin ①) cords or open the pink cord (Pin ②).	 **Connector Pin Arrangement** 
	ON when light is interrupted. (Dark-ON)		Connect the pink (Pin ②) and blue (Pin ③) cords.	 **Connector Pin Arrangement** 

Note: Terminal numbers for connector type.

NPN Output

<table>
<tr><th>Model</th><th>Output transistor status</th><th>Timing chart</th><th>Connection method</th><th>Output circuit</th></tr>
<tr><td rowspan="3">E3F2-□C4-□
(except for E3F2-10C4-□ and E3F2-LS10C4-□)</td><td>–</td><td></td><td>–</td><td>Through-beam emitter

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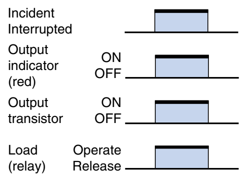
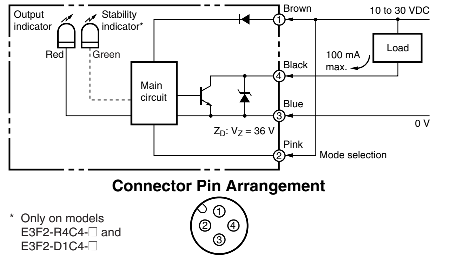
<tr><td>ON when light is incident. (Light-ON)</td><td>
</td><td>Connect the pink (Pin ②) and brown (Pin ①) cords or open the pink cord (Pin ②).</td><td>
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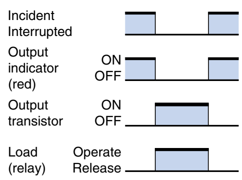
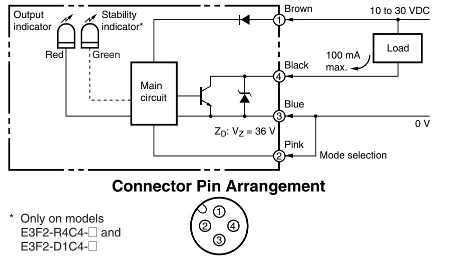
<tr><td>ON when light is interrupted. (Dark-ON)</td><td>
</td><td>Connect the pink (Pin ②) and blue (Pin ③) cords.</td><td>
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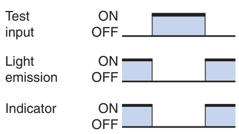
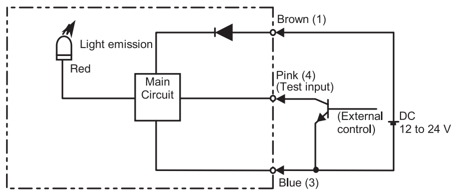
<tr><td rowspan="3">E3F2-10C4-□</td><td>–</td><td>
</td><td>–</td><td>Through-beam emitter

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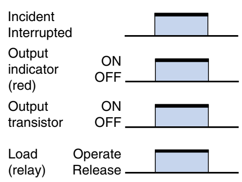
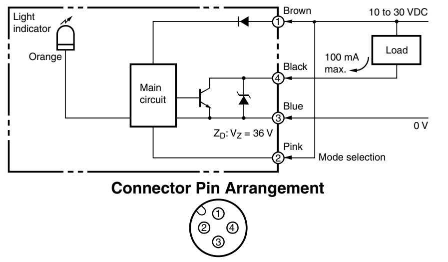
<tr><td>ON when light is incident. (Light-ON)</td><td>
</td><td>Connect the pink (Pin ②) and brown (Pin ①) cords or open the pink cord (Pin ②).</td><td>
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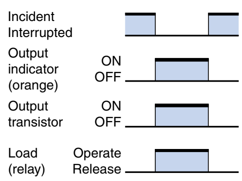
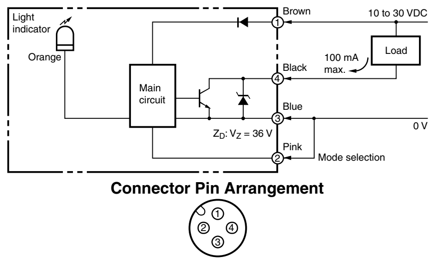
<tr><td>ON when light is interrupted. (Dark-ON)</td><td>
</td><td>Connect the pink (Pin ②) and blue (Pin ③) cords.</td><td>
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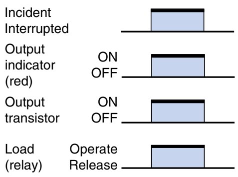
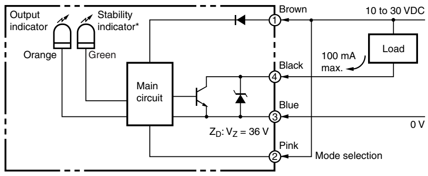
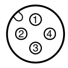
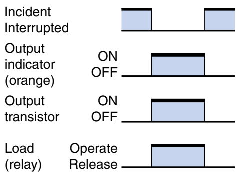
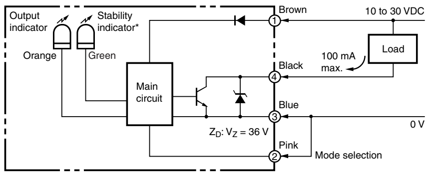
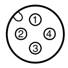
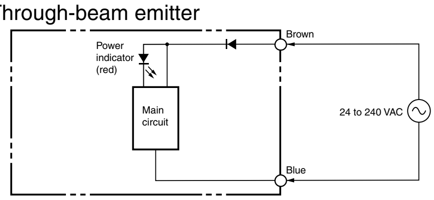
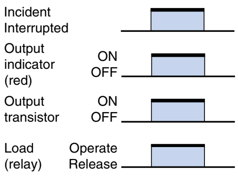
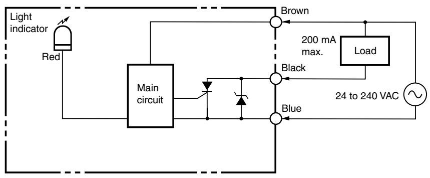
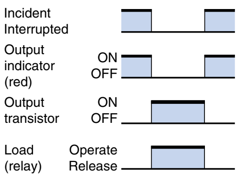
Model	Output transistor status	Timing chart	Connection method	Output circuit
E3F2-LS10C4-☐	ON when light is incident. (Light-ON)		Connect the pink (Pin ②) and brown (Pin ①) cords or open the pink cord (Pin ②).	 **Connector Pin Arrangement** 
	ON when light is interrupted. (Dark-ON)		Connect the pink (Pin ②) and blue (Pin ③) cords.	 **Connector Pin Arrangement** 

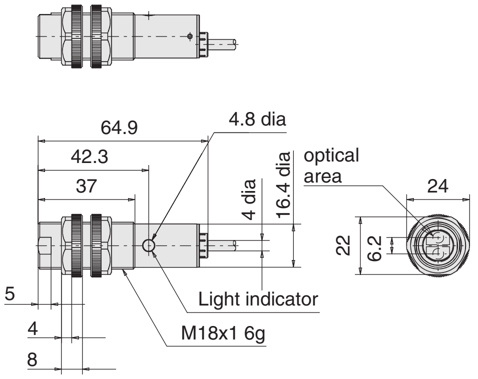
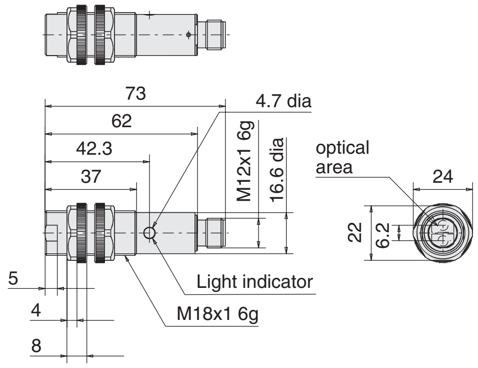
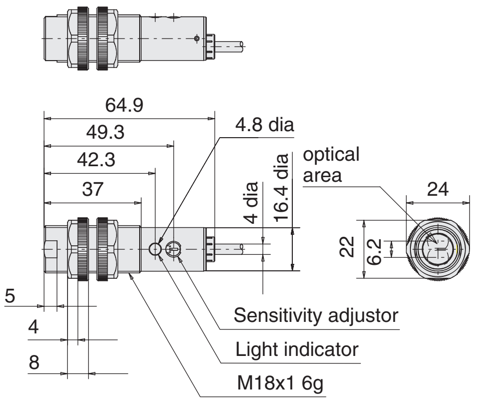
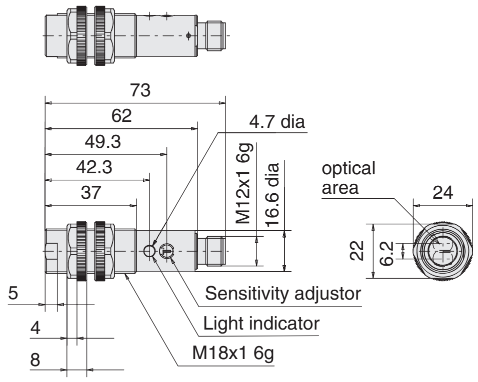
Note: Terminal numbers for connector type.

AC Output

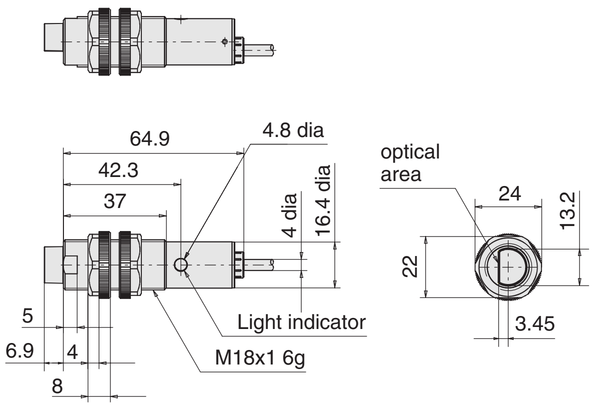
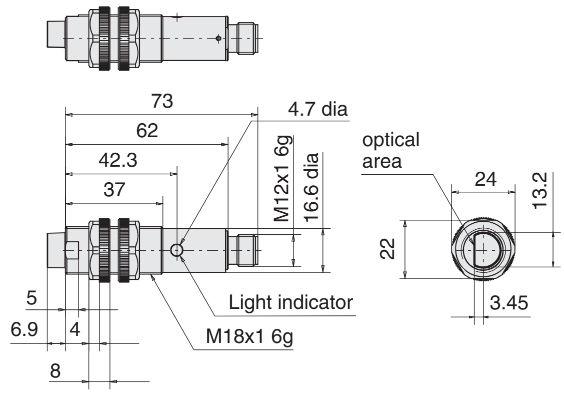
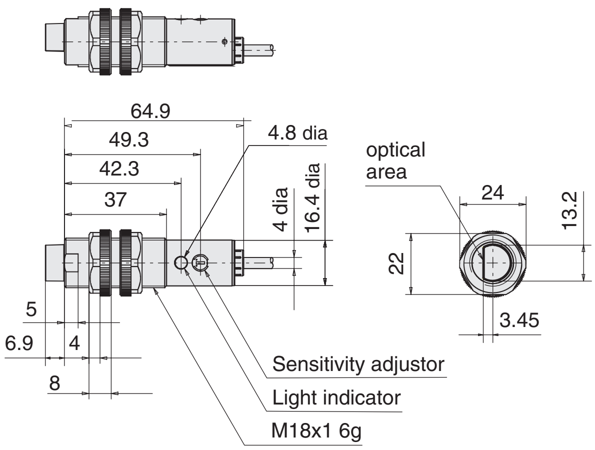
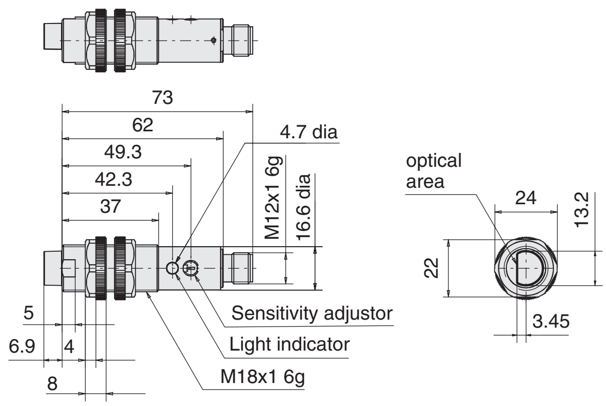
Model	Output transistor status	Timing chart	Connection method	Output circuit
E3F2-3LZ	–	–	–	Through-beam emitter 
E3F2-3Z1 E3F2-R2Z1 E3F2-DS10Z1-N	ON when light is incident. (Light-ON)		–	
E3F2-3Z2 E3F2-R2Z2 E3F2-DS10Z2-N	ON when light is interrupted. (Dark-ON)		–	

Dimensions Note: All units are in millimeters unless otherwise indicated

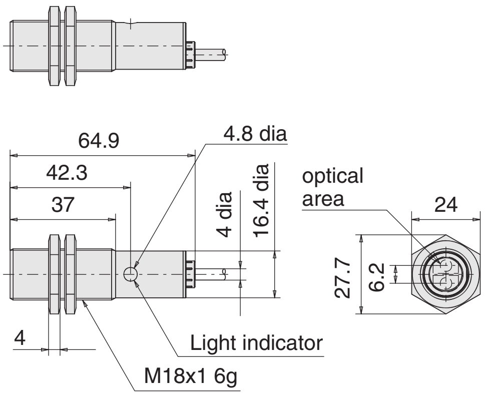
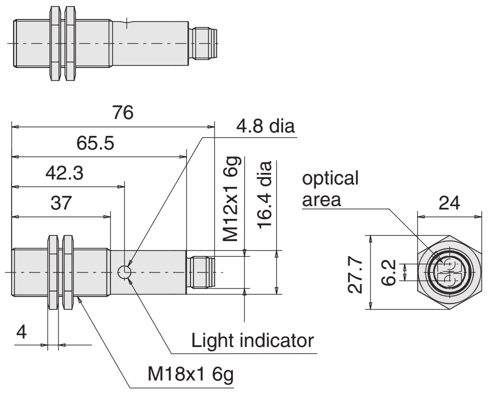
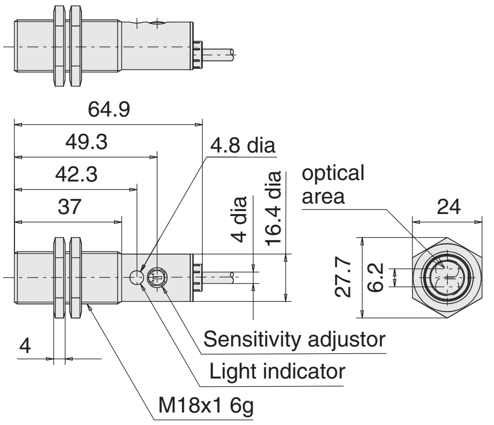
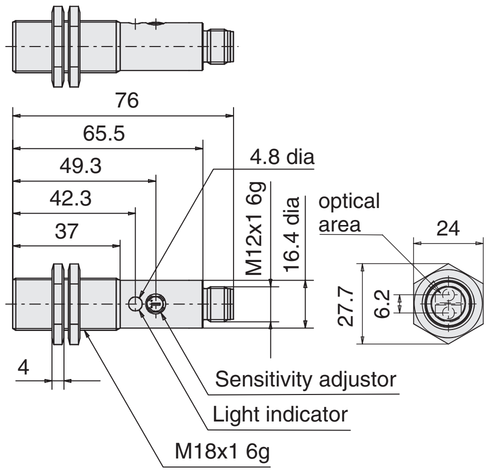
DC-Switching Models, plastic, axial type

<table>
<tr><th>Cable type</th><th>Connector type</th></tr>
<tr><td colspan="2">Without potentiometer</td></tr>
<tr><td>E3F2-7□
E3F2-10□
E3F2-R2□4
E3F2-DS10□4-N
E3F2-LS10□4
E3F2-R4□4F

</td><td>E3F2-7□-P1
E3F2-10□ –P1
E3F2-R2□4-P1
E3F2-DS10□4-P1
E3F2-LS10□4-P1
E3F2-R4□4F-P1

</td></tr>
<tr><td colspan="2">With potentiometer</td></tr>
<tr><td>E3F2-DS30□4
E3F2-D1□4

</td><td>E3F2-DS30□4-P1
E3F2-D1□4-P1

</td></tr>
</table>

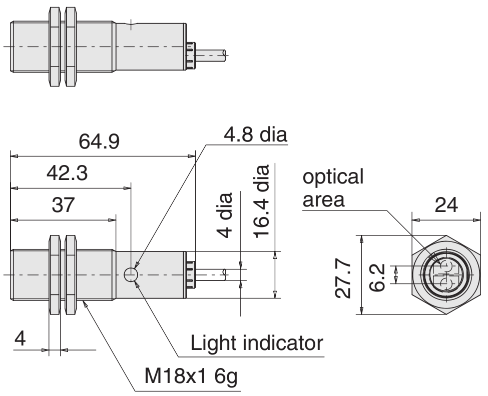
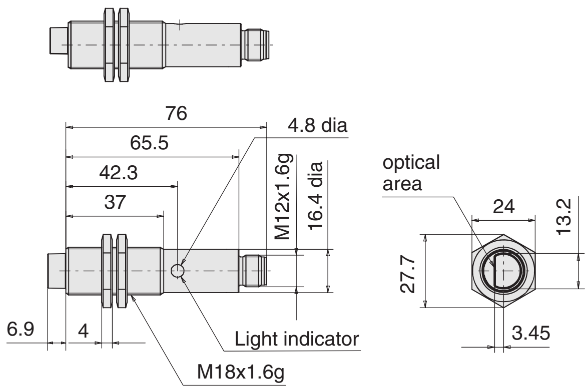
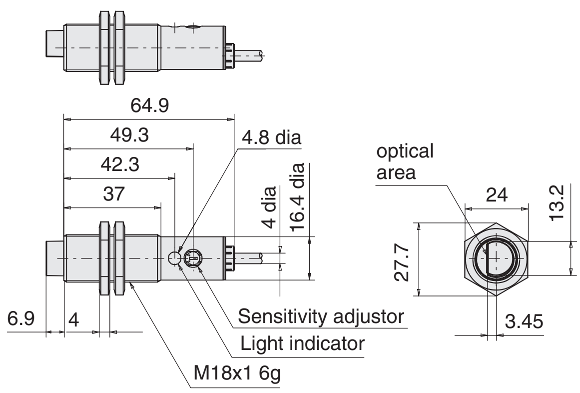
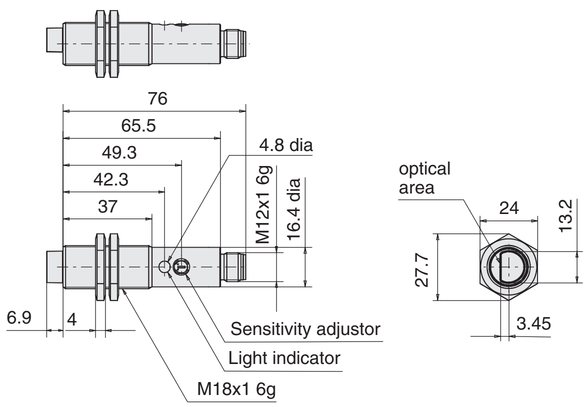
DC-Switching Models, plastic, radial type

<table>
<tr><th>Cable type</th><th>Connector type</th></tr>
<tr><td colspan="2">Without potentiometer</td></tr>
<tr><td>E3F2-R2R□41

</td><td>E3F2-R2R□41-P1

</td></tr>
<tr><td colspan="2">With potentiometer</td></tr>
<tr><td>E3F2-DS30□41

</td><td>E3F2-DS30□41-P1

</td></tr>
</table>

DC-Switching Models, metal (brass and stainless steel), axial type

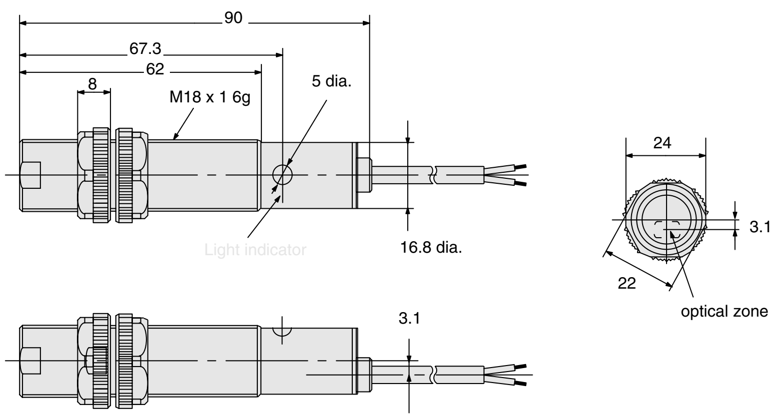
<table>
<tr><th>Cable type</th><th>Connector type</th></tr>
<tr><td colspan="2">Without potentiometer</td></tr>
<tr><td>E3F2-7□-M E3F2-7□-S
E3F2-10□-M
E3F2-R2R□4-M E3F2-R2R□4-S
E3F2-DS10□4-M E3F2-DS10□4-S
E3F2-LS10□4-M
E3F2-R4□4F-M
</td><td>E3F2-7□-M1-M E3F2-7□-M1-S
E3F2-10□-M1-M
E3F2-R2R□4-M1-M E3F2-R2R□4-M1-S
E3F2-DS10□4-M1-M E3F2-DS10□4-M1-S
E3F2-LS10□4-M1-M
E3F2-R4□4F-M1-M
</td></tr>
<tr><td colspan="2">With potentiometer</td></tr>
<tr><td>E3F2-DS30□4-M E3F2-DS30□4-S
E3F2-R4□4-M
E3F2-D1□4-M
</td><td>E3F2-DS30□4-M1-M E3F2-DS30□4-M1-S
E3F2-R4□4-M1-M
E3F2-D1□4-M1-M
</td></tr>
</table>

DC-Switching Models, metal (brass and stainless steel), radial type

Cable type	Connector type
Without potentiometer	
E3F2-R2R□41-M E3F2-R2R□41-S 	**E3F2-R2R□41-M1 E3F2-R2R□41-M1-S** 
With potentiometer	
E3F2-DS30□41-M E3F2-DS30□41-S 	**E3F2-DS30□41-M1-M E3F2-DS30□41-M1-S** 

AC-Switching Models, plastic, axial type

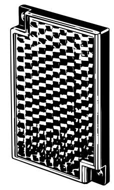
Cable type
Without potentiometer
E3F2-3Z□ **E3F2-R2Z□** **E3F2-DS10Z□-N**

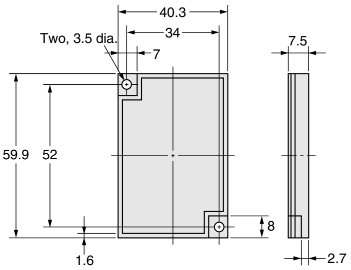


Accessories (Order Separately)

Reflectors

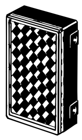
E39-R1
E39-R1S

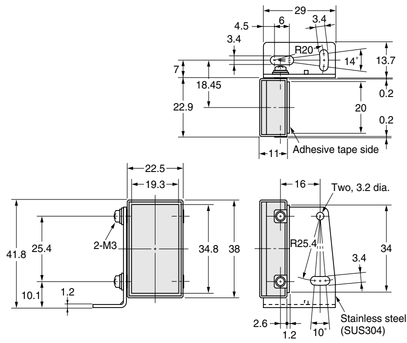




Material, reflective surface: acrylic
Rear surface: ABS

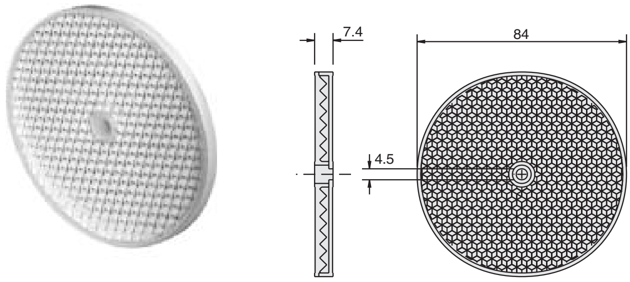
E39-R3



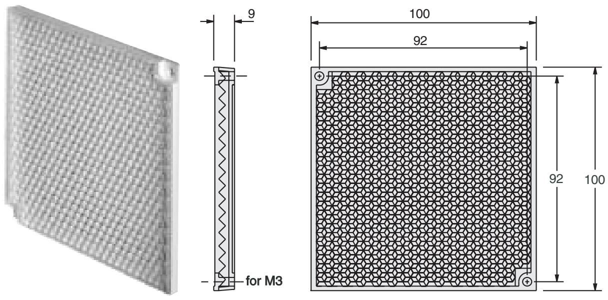


Material, reflective surface: acrylic
Rear surface: ABS

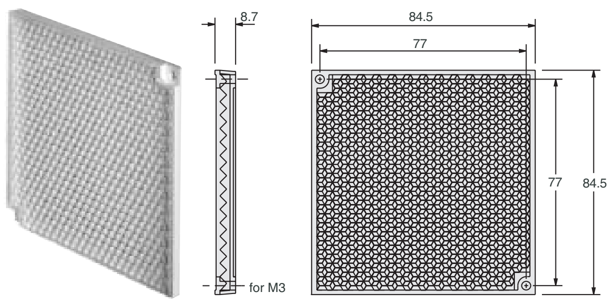
E39-R7



E39-R8

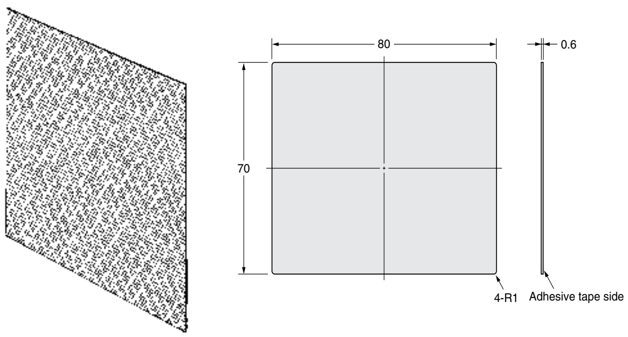


E39-R40

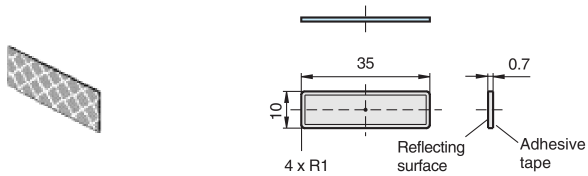


Tape Reflectors

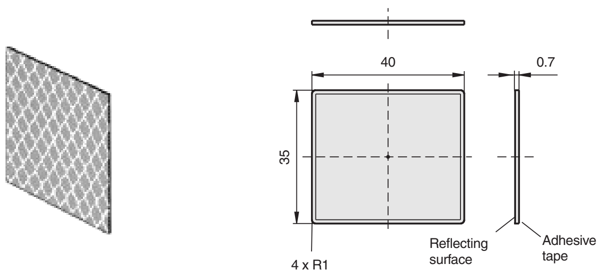
E39-RS3



E39-RS1

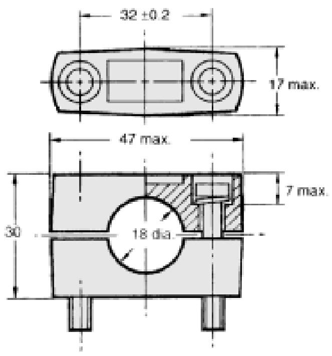


E39-RS2



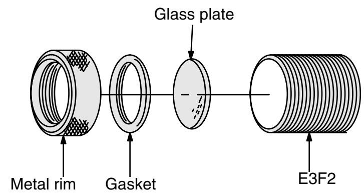
Installation

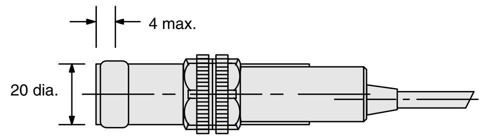
Mounting Bracket
Y92E-B18



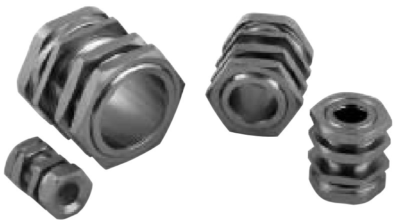
Note:
Hexagon bolt: M5 x 32
Material: plastic

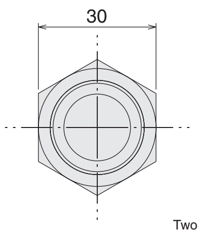
Lens Cap
E39-F31

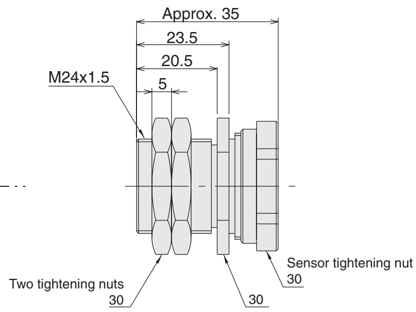




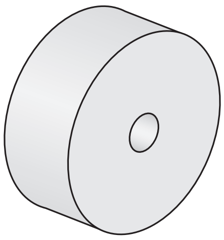
Mounting Bracket
Y92E-G18

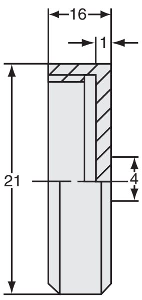






Slit (for precision detection with E3F2-10□)
E39-ES18





Precautions

The E3F2 Photoelectric Sensor is not a safety component for ensuring the safety of people which is defined in EC directive (91/368/EEC) and covered by separate European standards or by any other regulations or standards.

Degree of protection

The E3F2 photoelectric sensors have a degree of protection rated with IP67. In this case, the sensors have passed the OMRON heat shock test before the IP67-test of IEC 60529 (submersion at 1m water depth for 30 min). Afterwards the sensors have been tested according to the OMRON waterproof test.

Heat shock: Alternating, fast temperature changes between -25°C and +55°C are executed for 5 cycles and 1 hour for each temperature. Function and isolation are checked.

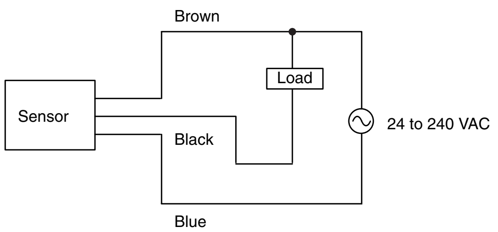
Water proof: The sensors are submerged alternating in water of +2°C and +55°C. 20 cycles with 1 hour for each temperature are executed. Function, water tightness and electrical isolation are checked.

Do not expose the photoelectric sensor to excessive shock during installation, keeping within IP 67 standards.

Wiring

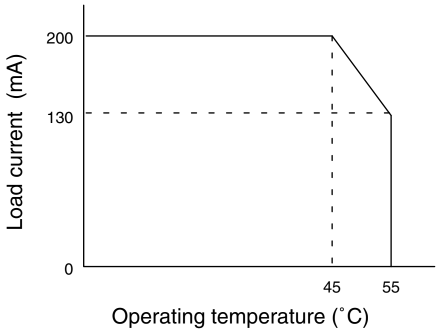
If the input/output lines of the photoelectric sensor are placed in the same conduit or duct as power lines or high-voltage lines, the photoelectric sensor could be induced to malfunction, or even be damaged by electrical noise. Separate the wiring, or use shielded lines as input/output lines to the photoelectric sensor.

Do not connect the black wire to the brown wire without a load. Direct connection of these wires may damage the photoelectric sensor (AC switching type).



When using the photoelectric sensor in the vicinity of an inverter motor, ensure to connect the protective earth ground wire of the motor to earth. Failure to ground the motor may result in malfunction of the sensor.

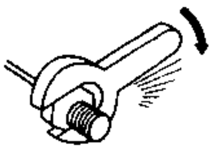
When you use the photoelectric sensor at temperatures exceeding 45°C, the load current must be within the described values as shown in the figure below.



Installation

Do not exceed a torque of

- 2.0 Nm (20 kgf cm) when tightening mounting nuts for plastic models
- 20.0 Nm (200 kgf cm) when tightening mounting nuts for metal models



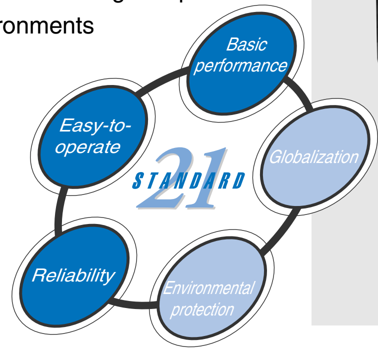
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

General purpose sensors in compact plastic housing

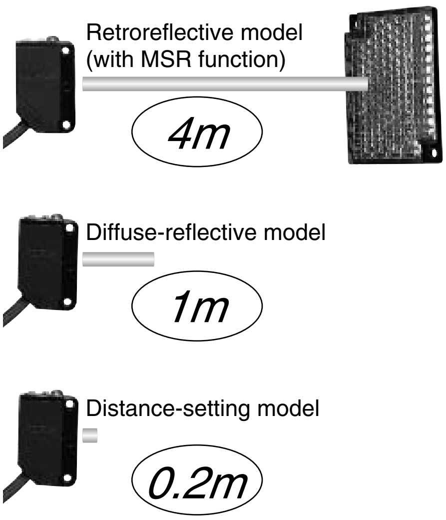
E3Z

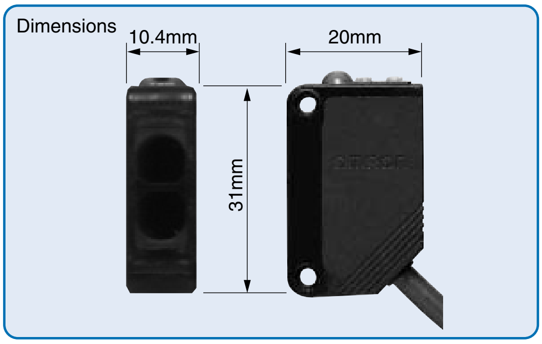
- Compact housing size and high power LED for excellent performance-size ratio
- IP67 and IP69k for highest protection in wet environments



Features

Basic performance



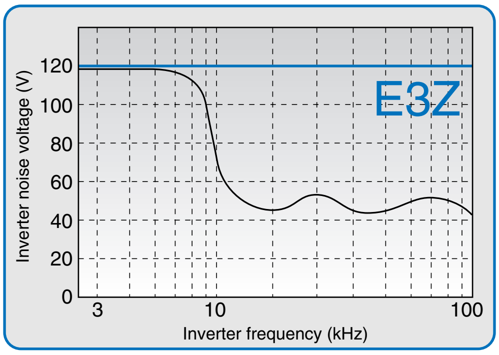


Reliability

Eliminates the influence of installation and on-site conditions, thus increasing the reliability of the line.

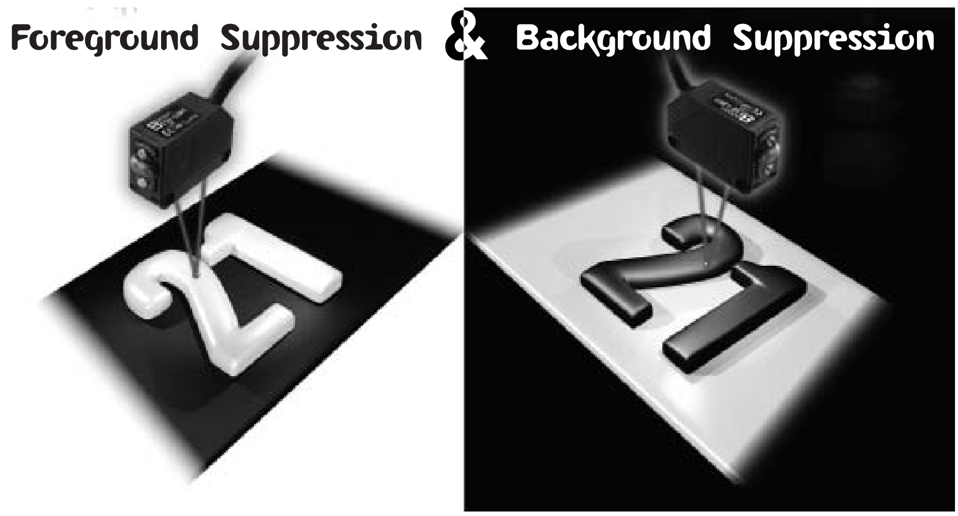
High protection against water and dust contaminants

High immunity to electrical interference, such as inverter drives.



Stability

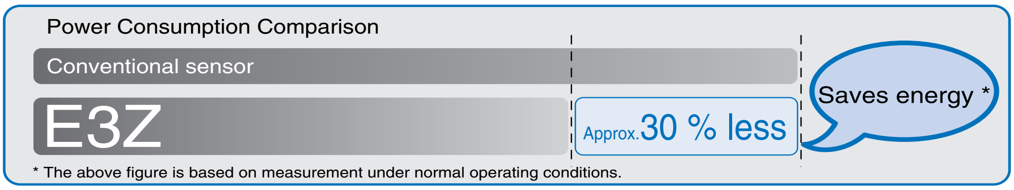
E3Z-series reliability covers a wide range of object/background combinations, so ensuring stable detection regardless of workpiece color or reflectivity.



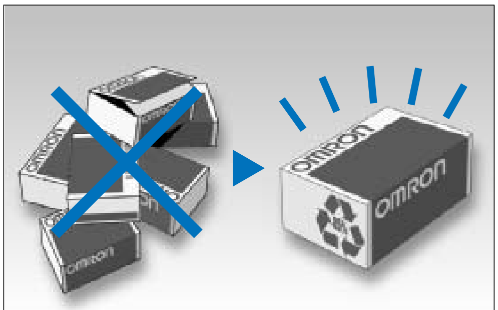
Environmental protection

Photoelectric Sensor with Built-in Amplifier

E3Z is environmental-friendly, energy-saving.



10-quantity packing reduces waste cartons.

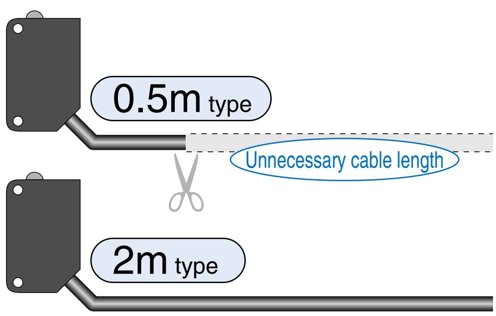


Recycled paper is used.

Packed in "combustible" polyethylene bags free of Styrofoam. *

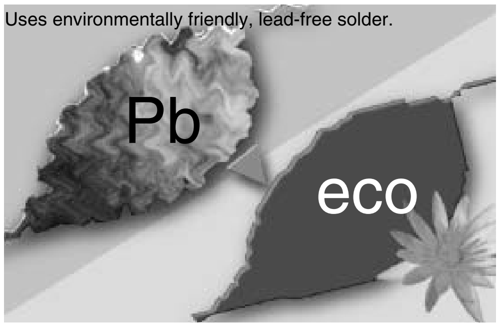
* If this bag is burned, dioxins hazardous to humans are minimal.

Standard models provided with a 0.5-m cable are available for the elimination of unnecessary cable length.



On-going elimination of materials containing lead.

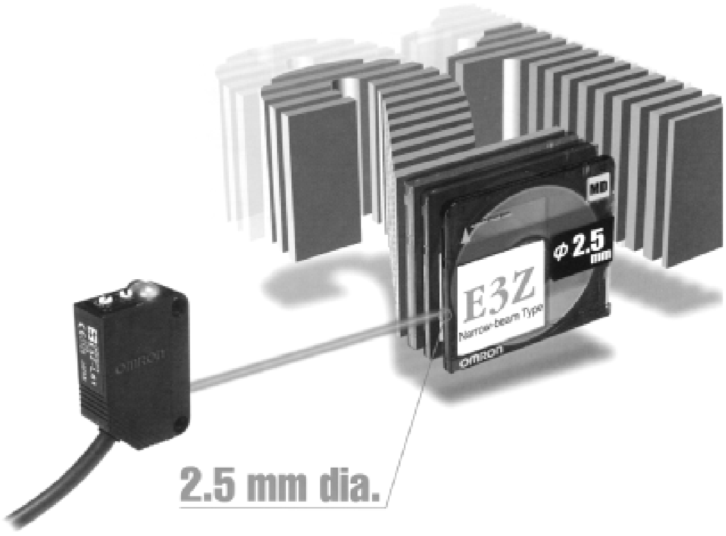
Uses environmentally friendly, lead-free solder.



Narrow Beam model

Ideal for detecting small objects with a small spot:

- Tiny objects as little as 0.1 mm in diameter can be detected with its 2.5-mm dia. spot.
- The thin beam enables detection through gaps or small holes.
- The high-intensity spot of light enables visual alignment of sensing spot position.



Transparent PET bottles

Stable detection of recyclable thin-wall PET bottles.

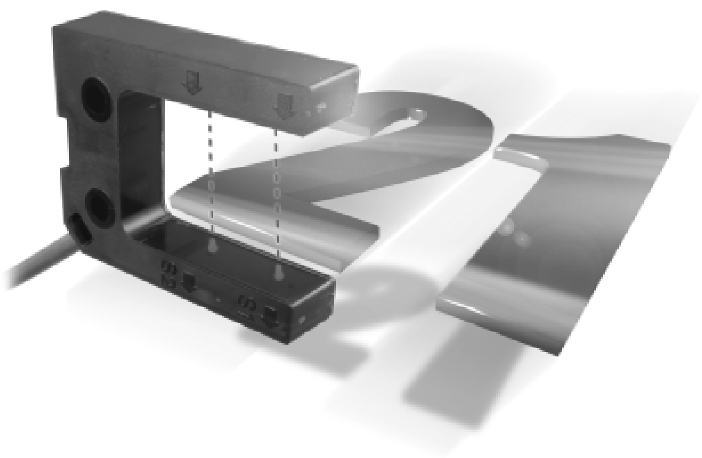
Standard-size transparent object sensor

- Uses OMRON's unique optical system ("Inner View") that can detect various shapes of PET bottles and transparent objects.
- Detects a wide range of bottles regardless of size and facets

Fork Sensor, single and dual beam versions

Fork design eliminates the need for optical axis adjustment.

- Two-axis models also available.
- Ideal for limit of travel monitoring.
- Condition monitoring.
- „Flag“ identification.

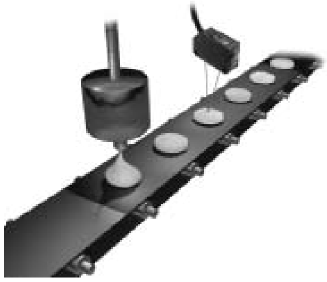


Applications

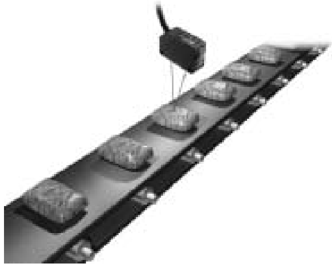
E3Z-LS background and foreground suppression models

Detecting covers on cosmetic products

Detecting pastries on conveyor belts

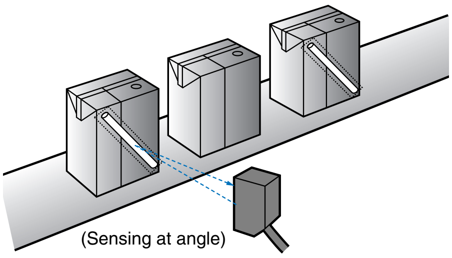


Detecting packaged chewing gum or candy

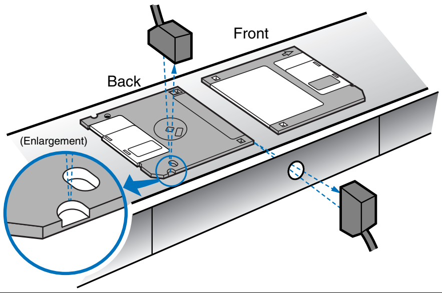


E3Z-L narrow beam models

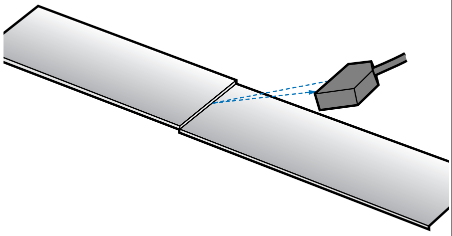
Checking for straws



Determining front/back or orientation of floppy disks

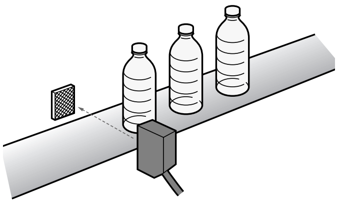


Detecting uneven joints

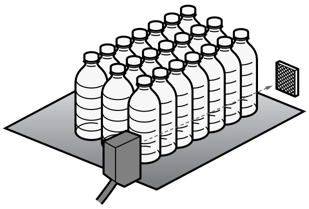


E3Z-B transparent object model

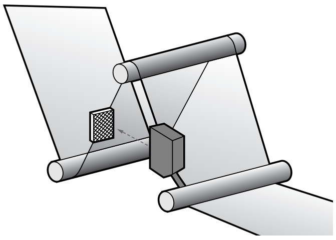
Transparent PET Bottle-related Detection - One bottle



Transparent PET Bottle related Detection - Multiple bottles (Stocker)

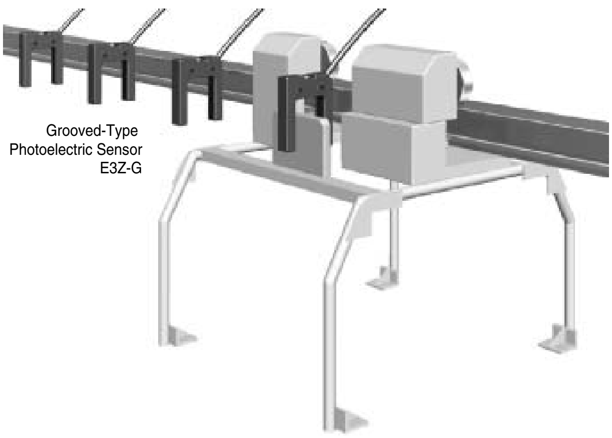


Detection of films and glass plates



E3Z-G grooved type model

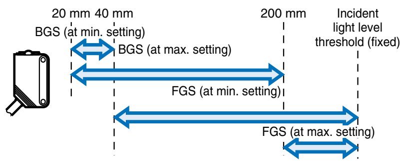
Crane and automated warehouse conveyor table passage inspection and positioning.



Ordering Information

Sensors

Red light / Infrared light

Sensor type	Shape	Connection method	Sensing distance	Model NPN output	Model PNP output
Through-beam		Pre-wired models (2 m)*1	30m	E3Z-T62	E3Z-T82
				E3Z-T62-G0*2	E3Z-T82-G0
		Connector type		E3Z-T67	E3Z-T87
				E3Z-T67-G0	E3Z-T87-G0
		Pre-wired models (2 m)*1	15m	E3Z-T61	E3Z-T81
		Connector type		E3Z-T66	E3Z-T86
		Pre-wired models (2 m)*1	10m	E3Z-T61A	E3Z-T81A
		Connector type		E3Z-T66A	E3Z-T86A
Retroreflective model (with M.S.R. function)	*3	Pre-wired (2 m)*1	4m [100mm] *4	E3Z-R61	E3Z-R81
		Connector type		E3Z-R66	E3Z-R86
Diffuse-reflective		Pre-wired models (2 m)*1	5 to 100 mm (wide view)	E3Z-D61	E3Z-D81
		Connector type		E3Z-D66	E3Z-D86
		Pre-wired models (2 m)*1, *5	1m	E3Z-D62	E3Z-D82
		Connector type		E3Z-D67	E3Z-D87
Thin beam type reflective model		Pre-wired models (2 m)*1	90±30mm	E3Z-L61	E3Z-L81
		Connector type		E3Z-L66	E3Z-L86
Distance-settable		Pre-wired models (2 m)*1		E3Z-LS61	E3Z-LS81
		Connector type		E3Z-LS66	E3Z-LS86
Transparent PET bottle type Retro-reflective model (without M.S.R. function)	*3	Pre-wired (2 m)*1	500mm [80mm] *4	E3Z-B61	E3Z-B81
		Connector type		E3Z-B66	E3Z-B86
		Pre-wired models (2 m)*1	2m [100mm] *4	E3Z-B62	E3Z-B82
		Connector type		E3Z-B67	E3Z-B87
Grooved type through-beam model	1	Pre-wired models (2 m)*1	25mm	E3Z-G61	E3Z-G81
	2			E3Z-G62	E3Z-G82
	1	Junction connector		E3Z-G61-M3J	E3Z-G81-M3J
	2			E3Z-G62-M3J	E3Z-G82-M3J

*1. Models provided with a 0.5-m cable are available. When ordering, specify the cable length by adding the code "0.5M" to the model number (e.g., E3Z-T61 0.5M).
*2. With „Emission Stop“ feature. Can be used to force a state change at the receiver (Sensor function test).
*3. Not attached. Please purchase the optional reflector (9 types) according to your application.
*4. The sensing distance specified is possible when the E39-R1S used. Figure in parentheses indicate the minimum required distance between the Sensor and Reflector.
*5. The connector joint type is available M12. Its model ends with -M1. (Example: E3Z-T61-M1J)

Accessories (Order Separately)

Slits

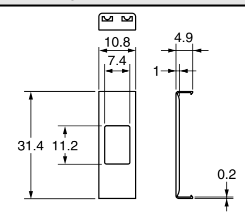
Slit width	Sensing distance (typical) E3Z-T□□	Sensing distance (typical) E3Z-T□□A	Minimum sensing object (typical)	Model	Quantity
0.5 mm dia.	50 mm	35 mm	0.2 mm dia.	E39-S65A	One set (contains slits for both the emitter and receiver)
1-mm dia.	200 mm	150 mm	0.4 mm dia.	E39-S65B	
2-mm dia.	800 mm	550 mm	0.7 mm dia.	E39-S65C	
0.5 x 10 mm	1 m	700 mm	0.2 mm dia.	E39-S65D	
1 x 10 mm	2.2 m	1.5 m	0.5 mm dia.	E39-S65E	
2 x 10 mm	5 m	3.5 m	0.8 mm dia.	E39-S65F	

Reflectors
Not provided with retroreflective models

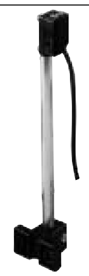
Name	Sensing distance (typical) *	Model	Quantity	Remarks
Reflectors	3 m [100 mm] (Rated value)	E39-R1	1	
	4 m [100 mm] (Rated value)	E39-R1S	1	
	500 mm [80 mm]	E39-R1S	1	for E3Z-B□1/6
	2 m [100 mm]			for E3Z-B□2/7
	5 m [100 mm]	E39-R2	1	
	2.5 m [100 mm]	E39-R9	1	
	3.5 m [100 mm]	E39-R10	1	
Fog preventing	500 mm [80 mm]	E39-R1K	1	for E3Z-B□1/6
	2 m [100 mm]			for E3Z-B□2/7
Small reflector	1.5 m [50 mm]	E39-R3	1	
Tape Reflector	700 mm [150 mm]	E39-RS1	1	
	1.1 m [150 mm]	E39-RS2	1	
	1.4 m [150 mm]	E39-RS3	1	

* Values in parentheses indicate the minimum required distance between the sensor and reflector.
Note: 1 . When using the reflector of other than the rated value, set the sensing distance to about 0.7 times of the typical example as a guideline.
2 . For details, refer to the "Reflector list".

Mutual interference prevention filter

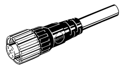
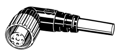
Sensing distance	Shape/dimensions	Model	Quantity	Remarks
3 m		E39-E11	2 sets each for emitters and receivers (total of 4 pcs.)	Can be used with the through-beam E3Z-T□□A. The arrow represents the polarizing direction. Changing the polarizing direction of the two adjacent emitters and receivers prevents mutual interference.

Mounting Brackets

Shape	Model	Quantity	Remarks	Shape	Model	Quantity	Remarks
	E39-L153	1	Mounting Brackets		E39-L150	One set	Sensor adjuster Easy mounting to aluminum frame/rail of conveyor or like, easy adjustment. For left-to-right adjustment
	E39-L104	1					
	9-L43	1	Horizontal type mounting bracket		E39-L151	One set	
	E39-L142	1	Horizontal type protective cover bracket		E39-L93□	One set	Sensor adjuster Easy mounting to aluminum frame/rail of conveyor or like, easy adjustment. For vertical angle adjustment
	E39-L44	1	Rear mounting bracket				
	E39-L98	1	Protective cover bracket		E39-L144	1	Vertical protective cover bracket

Note: 1 . If a through-beam model is used, order two Mounting Brackets for the emitter and receiver respectively.
2 . For details, refer to the "Mounting bracket list".

Sensor I/O Connectors

Size	Cable type	Shape		Cable length		Model
M8	Standard cable	Straight		2 m	4-wire type	XS3F-M421-402-A
				5 m		XS3F-M421-405-A
		L-shaped		2 m		XS3F-M422-402-A
				5 m		XS3F-M422-405-A
M12 (for -M1J)		Straight		2 m	3-wire type	XS2F-D421-DC0-A
				5 m		XS2F-D421-GC0-A
		L-shaped		2 m		XS2F-D422-DC0-A
				5 m		XS2F-D422-GC0-A

Rating/performance

Sensor type	Through-beam			Retroreflective model (with M.S.R. function)	Diffuse-reflective	
					wide-beam	standard-beam
Model — NPN output	E3Z-T62/T67	E3Z-T61/T66	E3Z-T61A/T66A	E3Z-R61/R66	E3Z-D61/D66	E3Z-D62/D67
Item — PNP output	E3Z-T82/T87	E3Z-T81/T86	E3Z-T81A/T86A	E3Z-R81/R86	E3Z-D81/D86	E3Z-D82/D87
Sensing distance	30 m	15 m	10 m	4 m (100 mm) * (When using the E39-R1S) 3 m (100 mm) * (When using the E39-R1)	100 mm (White paper 100 x 100 mm)	1 m (White paper 300 x 300 mm)
Setting range	---					
Reflectivity characteristic	---					
Spot Diameter	---					
Standard sensing object	Opaque: 12-mm dia. min.			Opaque: 75-mm dia. min.	---	
Min. sensing object	---					
Differential distance	---				20% max. of sensing distance	
Directional angle	Both emitter and receiver: 3° to 15°		Both emitter and receiver: 3° to 5°	2° to 10°	---	
Light source (wave length)	Infrared LED (870 nm)	Infrared LED (860 nm)	Red LED (700 nm)	Red LED (680 nm)	Infrared LED (860 nm)	
Power supply voltage	12 to 24 VDC ±10%, ripple (p-p) : 10% max.					
Current consumption	emitter: 15 mA receiver: 20 mA			30 mA max.		
Control output	Load power supply voltage 26.4 VDC max., load current 100 mA max. (residual voltage 2 V max.) Open collector output type (depends on the NPN/PNP output format) Light-ON/Dark-ON switch selectable					
BGS / FGS selection	---					
Protective circuits	Reverse polarity protection, output short-circuit protection, mutual interference prevention, output reverse protection	Protection from load short-circuit and reversed power supply connection		Reverse polarity protection, output short-circuit protection, mutual interference prevention, output reverse protection		
Response time	Operation or reset: 2 ms max.	Operation or reset: 1 ms max.				
Sensitivity adjustment	Single-turn adjustment					
Ambient illuminance	Incandescent lamp: 3,000 lux max. Sunlight 10,000 lux max.					
Ambient temperature	Operating: -25°C to 55°C, Storage: -40°C to 70°C (with no icing or condensation)					
Ambient humidity	Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)					
Insulation resistance	20 MΩ min. at 500 VDC					
Dielectric strength	1,000 VAC at 50/60 Hz for 1 minute					

* Values in parentheses indicate the minimum required distance between the sensor and reflector.

Rating/performance

Diffuse-reflective	Distance-settable	Retro-reflective for PET bottles (without MSR function)		Grooved-type	
narrow-beam		standard-beam	wide-beam		
E3Z-L61/66	E3Z-LS61/66	E3Z-B61/66	E3Z-B62/67	E3Z-G61	E3Z-G62
E3Z-L81/86	E3Z-LS81/86	E3Z-B81/86	E3Z-B82/87	E3Z-G81	E3Z-G82
90 ± 30 mm (White paper 100 x 100 mm)	BGS: White or black paper (100 x 100 mm): 20 mm to set distance FGS: White paper (100 x 100 mm): Set distance to 200 mm min. Black paper (100 x 100 mm): Set distance to 160 mm min.	500 mm (80 mm) * (When using the E39-R1S)	2 m (100 mm) * (When using the E39-R1S)	25 mm 1 optical axis	2 optical axis
---	White paper (100 x 100 mm): 40 to 200 mm Black paper (100 x 100 mm): 40 to 160 mm	---			
Refer to the diagram „Hysteresis Difference vs. Sensing Distance“	Black/white-error: 10% of set distance max.	---			
2.5 mm dia. (when sensing distance is 90 mm)	---				
---		Transparent round PET bottle 500 ml (65 mm dia.)		---	
0.1 mm dia. (copper wire)					

Red LED (650 nm)	Red LED (680 nm)	Red LED (660 nm)		Infrared LED (860 nm)	
12 to 24 VDC ±10%, ripple (p-p) : 10% max.					
30 mA max				25 mA max.	40 mA max.
Load power supply voltage 26.4 VDC max., load current 100 mA max. (residual voltage 2 V max.) Open collector output type (depends on the NPN/PNP output format) Light-ON/Dark-ON switch selectable					
---	BGS: Open or connected to GND FGS: Connected to Vcc	---			
Reverse polarity protection, output short-circuit protection, mutual interference prevention					
Operation or reset: 1 ms max.					
Single-turn adjustment	five-turn endless adjuster	Single-turn adjustment		---	
Incandescent lamp: 3,000 lux max. Sunlight 10,000 lux max.					
Operating: -25°C to 55°C, Storage: -40°C to 70°C (with no icing or condensation)					
Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)					
20 M min. at 500 VDC					
1,000 VAC at 50/60 Hz for 1 minute					

Rating/performance

Sensor type		Through-beam			Retroreflective model (with M.S.R. function)	Diffuse-reflective	
						wide-beam	standard-beam
Model	NPN output	E3Z-T62/T67	E3Z-T61/T66	E3Z-T61A/T66A	E3Z-R61/R66	E3Z-D61/D66	E3Z-D62/D67
Item	PNP output	E3Z-T82/T87	E3Z-T81/T86	E3Z-T81A/T86A	E3Z-R81/R86	E3Z-D81/D86	E3Z-D82/D87
Vibration resistance		10 to 55 Hz, 1.5-mm or 300m/s^2 double amplitude for 2 hours each in X, Y, and Z directions					
Shock resistance		Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions					
Protective structure		IEC 60529 IP67, IP69k after DIN 40050 part 9					
Connection method		Pre-wired (standard length: 2 m/500 mm)/M8 connector					
Indicator lamp		Operation indicator (orange), stability indicator (green) [Note that the emitter has the power indicator (orange) only]					
Weight (Packed state)	Pre-wired models (with 2-m cable)	Approx. 120 g			65 g		
	Connector type	30 g			Approx. 20 g		
Material	Case	PBT (polybutylene terephthalate)					
	Lens	Denatured polyacrylate resin	Methacylate resin				
Accessories		Instruction manual (The Reflector or Mounting Bracket is not provided with any of the above models.)					

Rating/performance

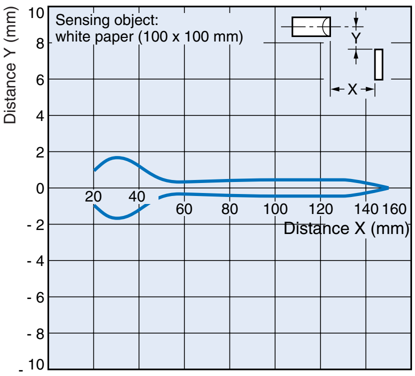
<table>
<tr><th>Diffuse-reflective</th><th rowspan="2">Distance-settable</th><th colspan="2">Retro-reflective for PET bottles (without MSR function)</th><th colspan="2" rowspan="2">Grooved-type</th></tr>
<tr><th>narrow-beam</th><th>standard-beam</th><th>wide-beam</th></tr>
<tr><td>E3Z-L61/66</td><td>E3Z-LS61/66</td><td>E3Z-B61/66</td><td>E3Z-B62/67</td><td>E3Z-G61</td><td>E3Z-G62</td></tr>
<tr><td>E3Z-L81/86</td><td>E3Z-LS81/86</td><td>E3Z-B81/86</td><td>E3Z-B82/87</td><td>E3Z-G81</td><td>E3Z-G82</td></tr>
<tr><td colspan="6">10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions</td></tr>
<tr><td colspan="6">Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions</td></tr>
<tr><td colspan="4">IEC 60529 IP67</td><td colspan="2">IEC 60529 IP64</td></tr>
<tr><td colspan="4">Pre-wired (standard length: 2 m/500 mm)/M8 connector</td><td colspan="2">Pull-out cable type (standard cable length: 2 m/500 mm) / connector relay type (standard cable length: 300 mm</td></tr>
<tr><td colspan="4">Operation indicator (orange), stability indicator (green)</td><td colspan="2">Operation indicator (orange)</td></tr>
<tr><td colspan="2">Approx. 65 g</td><td colspan="4">65 g</td></tr>
<tr><td colspan="4">Approx. 20 g</td><td colspan="2">30 g</td></tr>
<tr><td colspan="4">PBT (polybutylene terephthalate)</td><td colspan="2">ABS</td></tr>
<tr><td>Methacylate resin</td><td>Denaturated polyallylate</td><td colspan="4">Methacylate resin</td></tr>
<tr><td colspan="6">Instruction manual (The Reflector or Mounting Bracket is not provided with any of the above models.)</td></tr>
</table>

Caracteristic data (typical)

Operating Range

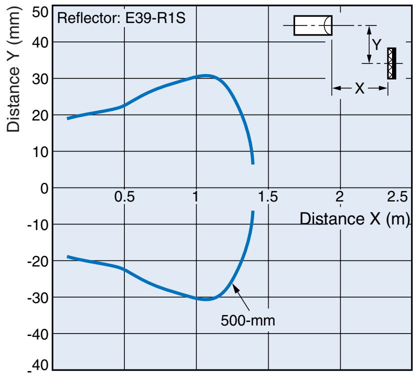
Narrow-beam

E3Z-L

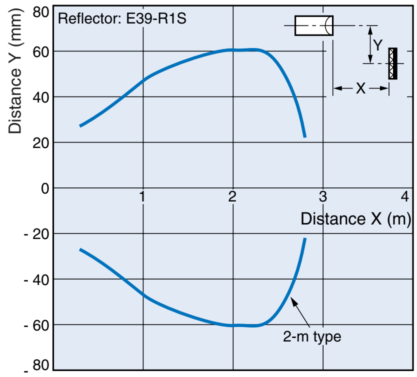


Retroreflective Models for transparent objects

E3Z-B□1/B□6 + E39-R1S
(optional reflector)

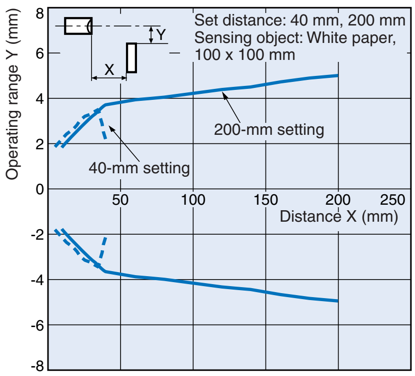


E3Z-B□2/B□7 + E39-R1S
(optional reflector)

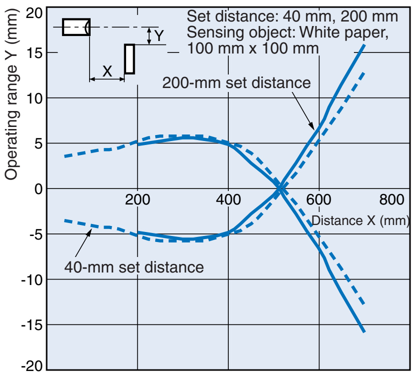


Distance-setting

E3Z-LS [BGS]



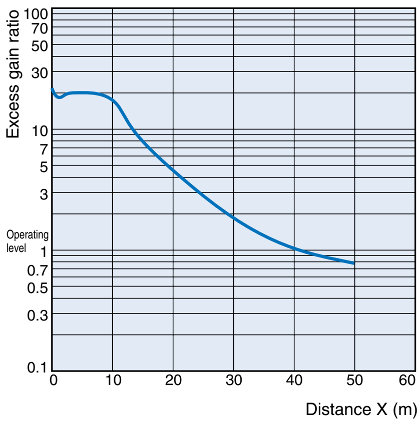
E3Z-LS [FGS]



Excess Gain vs. Distance

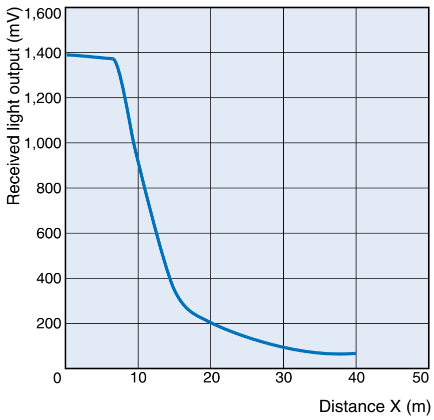
Through-beam

E3Z-T□1(T□6)



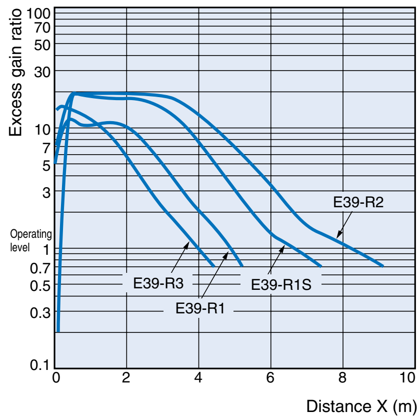
Through-beam

E3Z-T□A

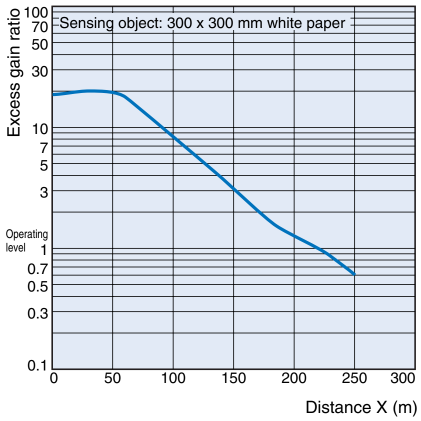


Retroreflective Models

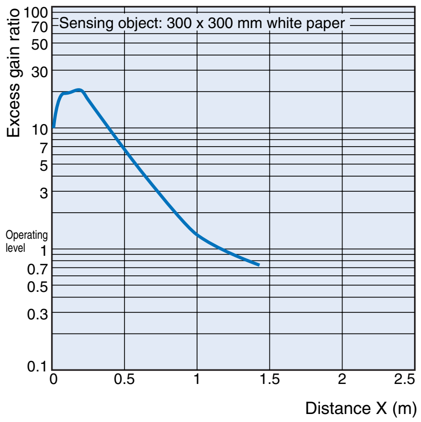
E3Z-R□1(R□6) + Reflectors



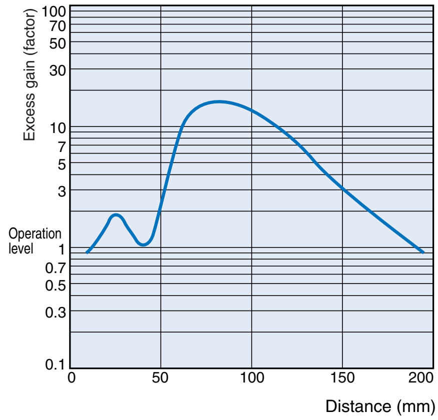
Diffuse-reflective
E3Z-D□1(D□6)



Diffuse-reflective
E3Z-D□2(D□7)

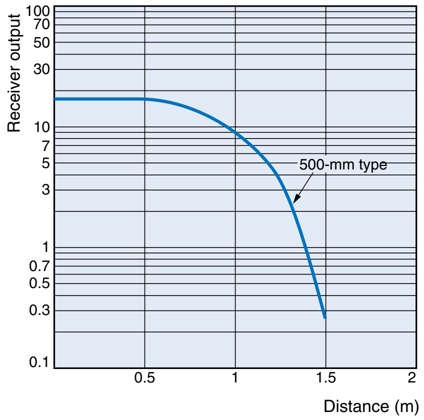


Narrow-beam
E3Z-L

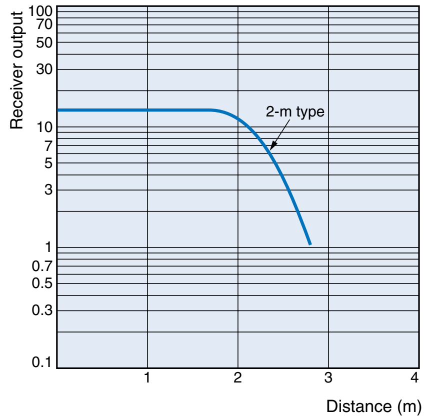


Retro-reflective for transparent objects

E3Z-B□1/B□6 + E39-R1S
(optional reflector)

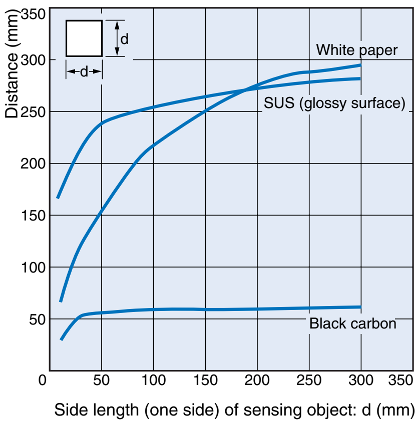


E3Z-B□2/B□7 + E39-R1S
(optional reflector)

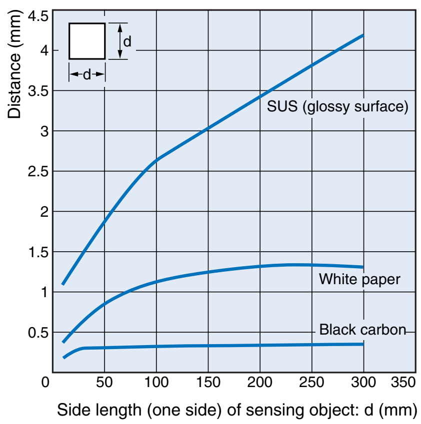


Distance vs. Size

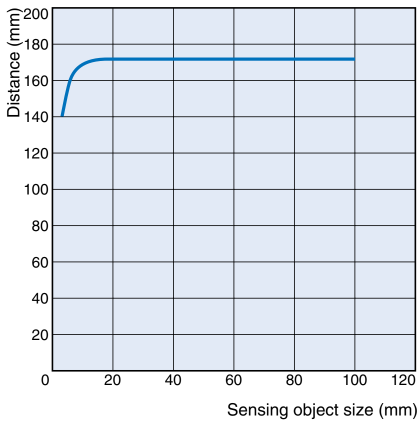
Diffuse-reflective
E3Z-D□1(D□6)



Diffuse-reflective
E3Z-D□2(D□7)



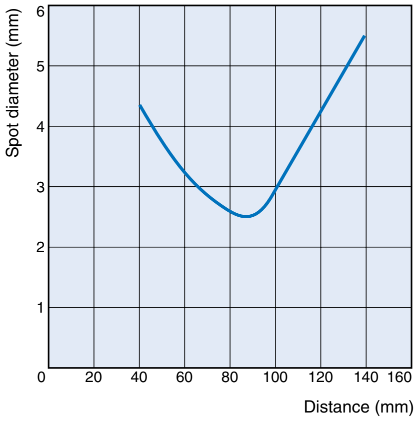
Narrow-beam
E3Z-L



Spot diameter vs. Distance

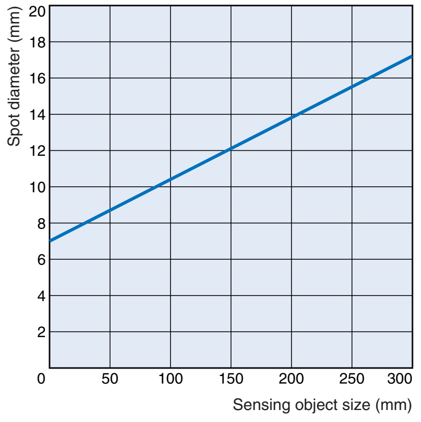
Narrow-beam

E3Z-L



Distance setting

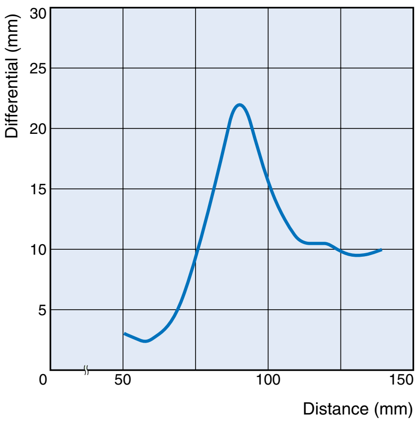
E3Z-LS



Differential travel / Hysteresis vs. Distance

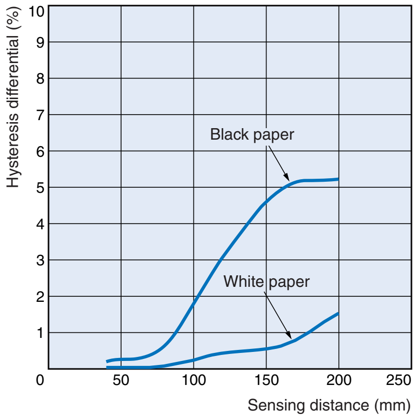
Narrow-beam

E3Z-L



Distance setting

E3Z-LS

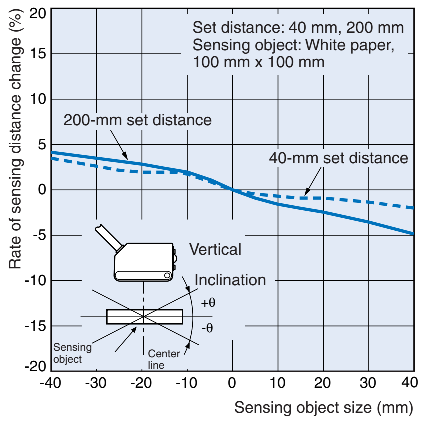


Inclination Characteristics

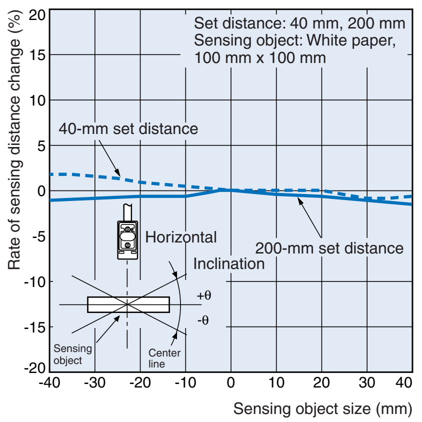
Distance setting

E3Z-LS

Vertical



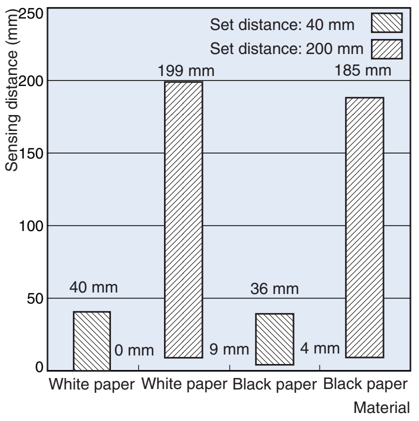
Horizontal



Short-distance Characteristics

Distance setting

E3Z-LS

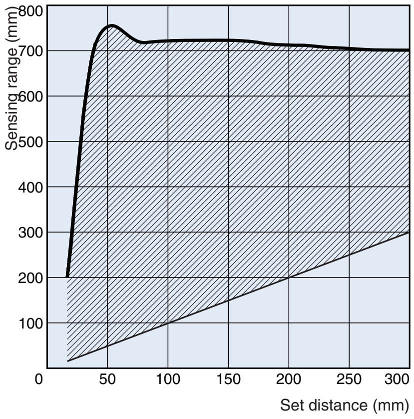


FGS Mode Set Distance vs. Sensing Range

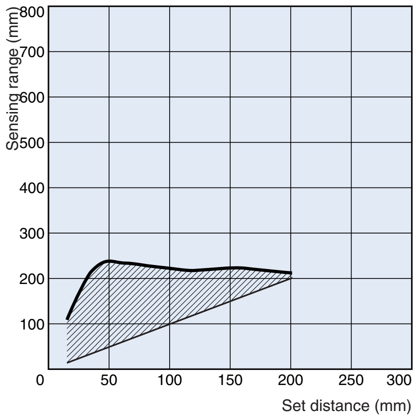
Distance setting

E3Z-LS

White Paper



Black Paper

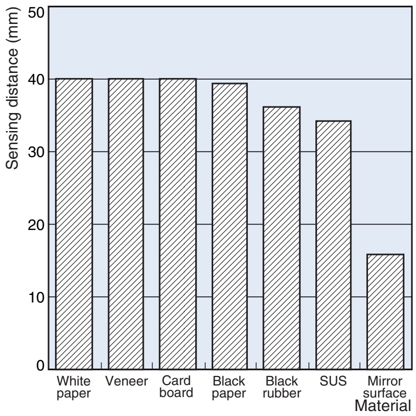


Sensing Distance vs. Material

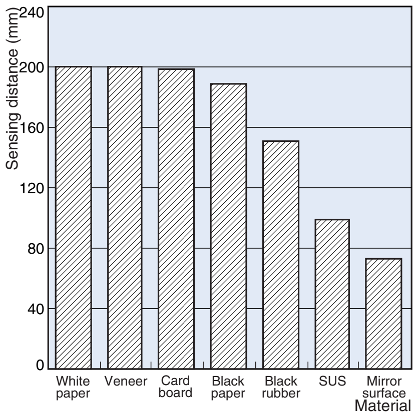
Distance setting

E3Z-LS

At Set Distance of 40 mm

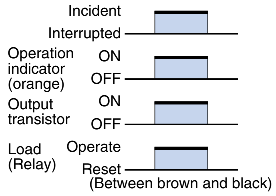
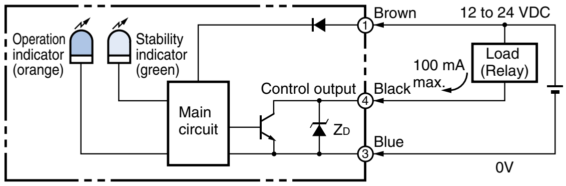
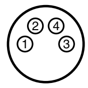
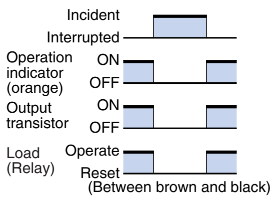
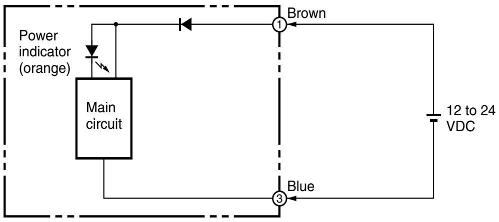
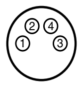
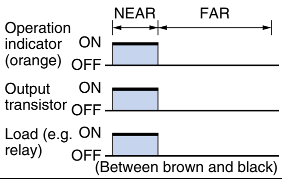
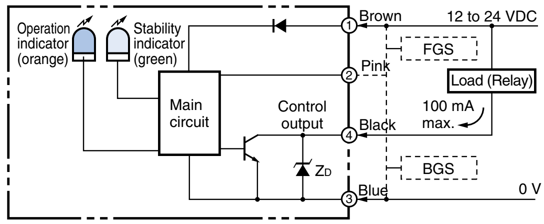
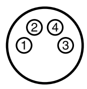
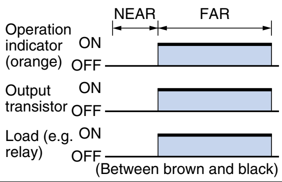
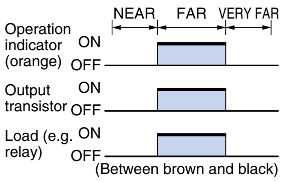
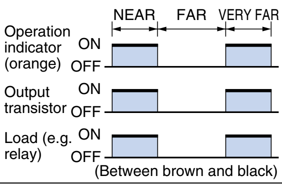
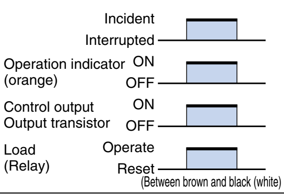
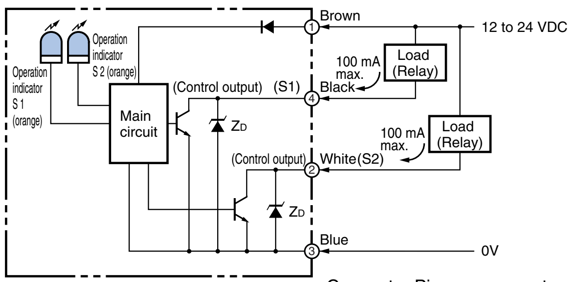
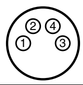
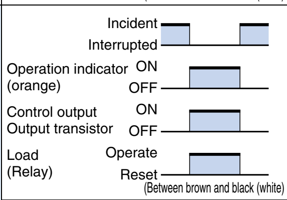


At Set Distance of 200 mm

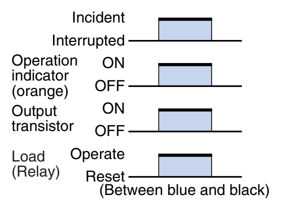
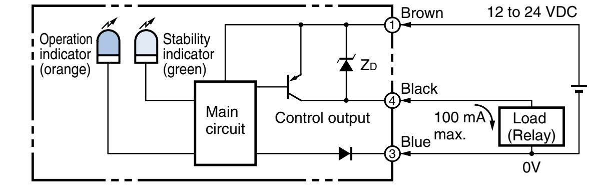
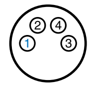
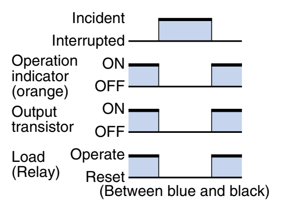
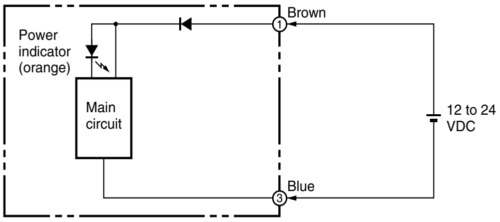
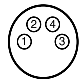
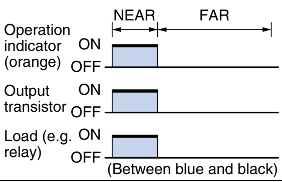
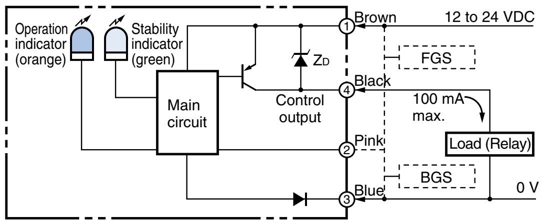
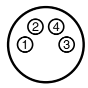
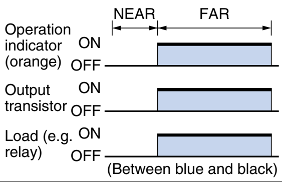
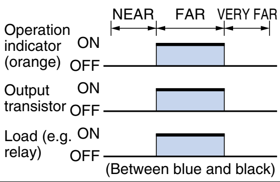
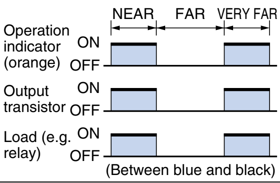
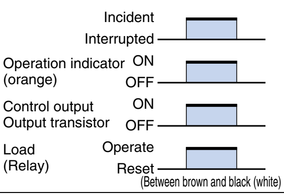
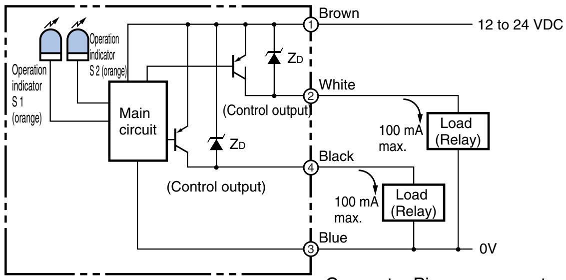
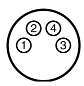
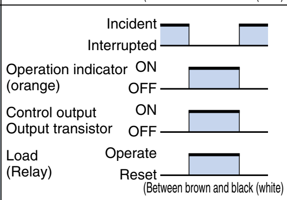


Output Circuit Diagram

NPN output

Model	Output transistor Status	Timing chart	Mode selection switch	Output circuit
E3Z-T61 E3Z-T66 E3Z-T61A E3Z-T66A E3Z-R61 E3Z-R66 E3Z-D61 E3Z-D62 E3Z-D67 E3Z-L61 E3Z-L66 E3Z-B61 E3Z-B62 E3Z-B66 E3Z-B67 E3Z-G61	Light ON		L ON (LIGHT ON)	Through-beam receiver Retroreflective model Diffuse-reflective model  Connector Pin Arrangement  Note: Terminal 2 is not used.
	Dark ON		D ON (DARK ON)	
	Through-beam emitter			 Connector Pin Arrangement  Note: Terminal 2 and 4 are not used.
E3Z-LS61 E3Z-LS66	Light ON		L ON (LIGHT ON)	 Connector Pin Arrangement  BGS: Either leave the pink wire (2) open or connect it to the blue wire (3). FGS: Connect the pink wire (2) to the brown wire (1).
	Dark ON		D ON (DARK ON)	
	Light ON		L ON (LIGHT ON)	
	Dark ON		D ON (DARK ON)	
E3Z-G62	Light ON		L ON (LIGHT ON)	 Connector Pin arrangement 
	Dark ON		D ON (DARK ON)	

PNP output

<table>
<tr><th>Model</th><th>Output transistor Status</th><th>Timing chart</th><th>Mode selection switch</th><th>Output circuit</th></tr>
<tr><td rowspan="3">E3Z-T81
E3Z-T86
E3Z-T81A
E3Z-T86A
E3Z-R81
E3Z-R86
E3Z-D81
E3Z-D86
E3Z-D82
E3Z-D87
E3Z-L81
E3Z-L86
E3Z-B81
E3Z-B82
E3Z-B86
E3Z-B87
E3Z-G81</td><td>Light ON</td><td></td><td>L ON
(LIGHT ON)</td><td rowspan="2">Through-beam receiver Retroreflective model Diffuse-reflective model

Connector Pin Arrangement

Note: Terminal 2 is not used.</td></tr>
<tr><td>Dark ON</td><td></td><td>D ON
(DARK ON)</td></tr>
<tr><td colspan="4">Through-beam emitter

Connector Pin Arrangement

Note: Terminal 2 and 4 are not used.</td></tr>
<tr><td rowspan="4">E3Z-LS81
E3Z-LS86</td><td>Light ON</td><td></td><td>L ON
(LIGHT ON)</td><td rowspan="4">
Connector Pin Arrangement

BGS: Either leave the pink wire (2) open or connect it to the blue wire (3).
FGS: Connect the pink wire (2) to the brown wire (1).</td></tr>
<tr><td>Dark ON</td><td></td><td>D ON
(DARK ON)</td></tr>
<tr><td>Light ON</td><td></td><td>L ON
(LIGHT ON)</td></tr>
<tr><td>Dark ON</td><td></td><td>D ON
(DARK ON)</td></tr>
<tr><td rowspan="2">E3Z-G82</td><td>Light ON</td><td></td><td>L ON
(LIGHT ON)</td><td rowspan="2">
Connector Pin arrangement
</td></tr>
<tr><td>Dark ON</td><td></td><td>D ON
(DARK ON)</td></tr>
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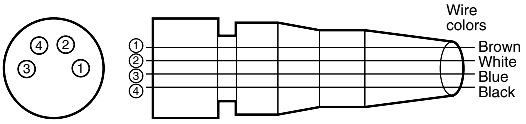
Connectors (Sensor I/O connectors)



XS3F-M421-402-A
XS3F-M421-405-A
XS3F-M422-402-A
XS3F-M422-405-A

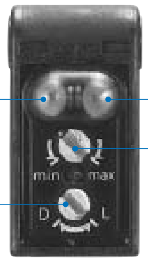
Class	Wire, outer jacket color	Connector pin No.	Application		
			Standard	E3Z-LS	E3Z-G62/82
For DC	Brown	①	Power supply (+V)		
	White	②	---	BGS / FGS selection	Output 2 (S2)
	Blue	③	Power supply (0 V)		
	Black	④	Output		Output 1 (S1)

Nomenclature:

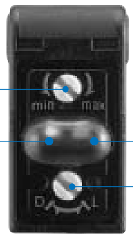
Through-beam
E3Z-T□□ Receiver
E3Z-T□□A Receiver

Diffuse-reflective
E3Z-D□□
E3Z-L□□

Retroreflective Models
E3Z-R□□
E3Z-B□□

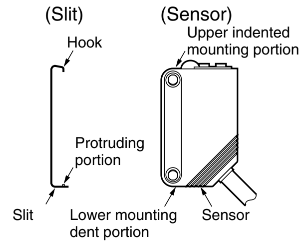


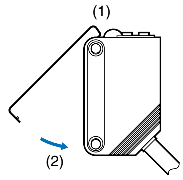
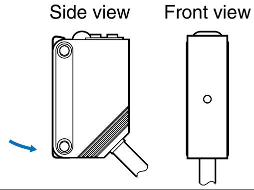
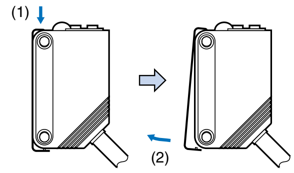
Distance-setting
E3Z-LS□□



Operation

Slit for through-beam model (Optional accessory: E39-S65A/B/C/D/E/F)



Mounting method	
Mounting method 1. Hook the upper protruding portions of the Slit to the upper indented mounting portion of the Sensor and adjust the position of the Slit so that the Slit will be parallel to the lens surface. 2. Press the lower protruding portion of the Slit onto the indented mounting portion of the Sensor until the Slit snaps in.	
Mounting condition	
Demounting method 1. Press the upper portion of the Slit. 2. Disconnect the lower protruding portion of the Slit from the Sensor and remove the Slit.	

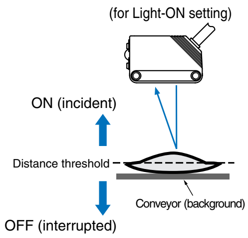
BGS / FGS Application for distance setting E3Z-LS

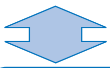
Simple Detection of Glossy, Uneven Objects

BGS (Background Suppression)

(for Light-ON setting)

Objects beyond the set distance, such as the conveyor, will not be detected. The hysteresis is 10% or less, so at a set distance of 40 mm, steps with a thickness of 4 mm can be detected on objects.



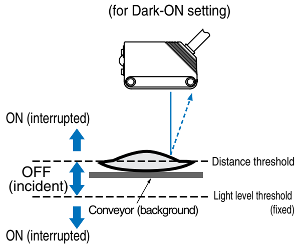


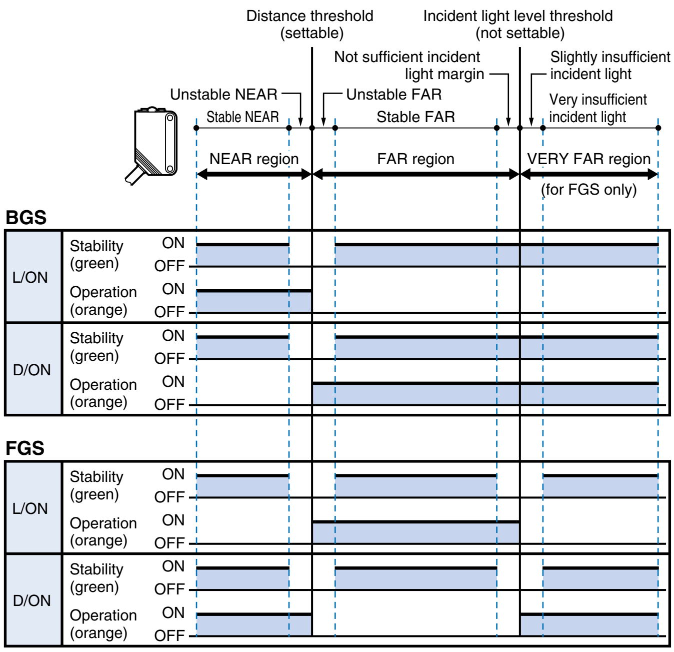
Selectable by Changing Cable Connection

FGS (Foreground Suppression)

(for Dark-ON setting)

Glossy, uneven objects are reliably detected because the OFF (incident) status occurs only when the conveyor is detected, and ON (interrupted) status occurs only when an object exists or when reflected light is not returned to the Sensor. (Depending on the shape of the object, an OFF-delay timer may be required.)





Precautions

⚠ Caution

Do not connect an AC power supply to the Sensor. If AC power (100 VAC or more) is supplied to the Sensor, it may explode or burn.

Be sure to abide by the following precautions for the safe operation of the Sensor.

Wiring

Power Supply Voltage and Output Load Power Supply Voltage

Make sure that the power supply to the Sensor is within the rated voltage range. If a voltage exceeding the rated voltage range is supplied to the Sensor, it may explode or burn.

Load Short-circuiting

Do not short-circuit the load, otherwise the Sensor may be damaged.

Connection without Load

Do not connect the power supply to the Sensor with no load connected, otherwise the internal elements may explode or burn.

Operating Environment

Do not use the Sensor in locations with explosive or flammable gas.

Correct Use

Design

Power Reset Time

The Sensor is ready to operate 100 ms after the Sensor is turned ON. If the load and Sensor are connected to independent power supplies respectively, be sure to turn ON the Sensor before supplying power to the load.

Wiring

Avoiding Malfunctions

If using the Photoelectric Sensor with an inverter or servomotor, always ground the FG (frame ground) and G (ground) terminals, otherwise the Sensor may malfunction.

Mounting

Mounting the Sensor

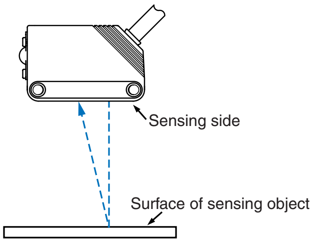
- If Sensors are mounted face-to-face, make sure that the optical axes are not in opposition to each other. Otherwise, mutual interference may result.
- Always install the Sensor carefully so that the aperture angle range of the Sensor will not cause it to be directly exposed to intensive light, such as sunlight, fluorescent light, or incandescent light.
- Do not strike the Photoelectric Sensor with a hammer or any other tool during the installation of the Sensor, or the Sensor will lose its water-resistive properties.
- Use M3 screws to mount the Sensor.
- When mounting the case, make sure that the tightening torque applied to each screw does not exceed 0.54 Nm.

M8 Connector

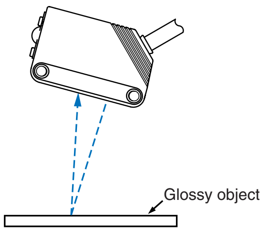
- Always turn OFF the power supply to the Sensor before connecting or disconnecting the metal connector.
- Hold the connector cover to connect or disconnect it.
- Secure the connector cover by hand. Do not use pliers, otherwise the connector may be damaged.
- If the connector is not connected securely, it may be disconnected by vibration or the proper degree of protection of the Sensor may not be maintained.

Distance setting models E3Z-LS

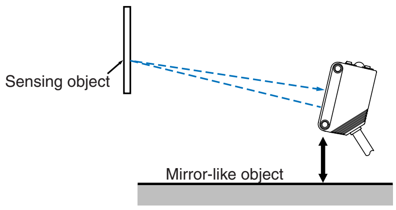
- Make sure that the sensing side of the Sensor is parallel with the surface of the sensing objects. Normally, do not incline the Sensor towards the sensing object.



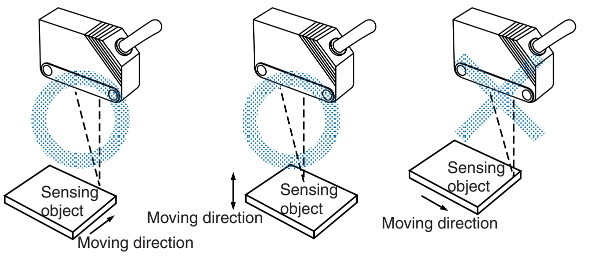
If the sensing object has a glossy surface, however, incline the Sensor by 5° to 10° as shown in the illustration, provided that the Sensor is not influenced by background objects.



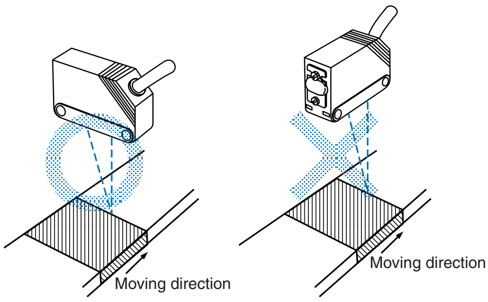
- If there is a mirror-like object below the Sensor, the Sensor may not operate stably. Therefore, incline the Sensor or separate the Sensor from the mirror-like object as shown below.



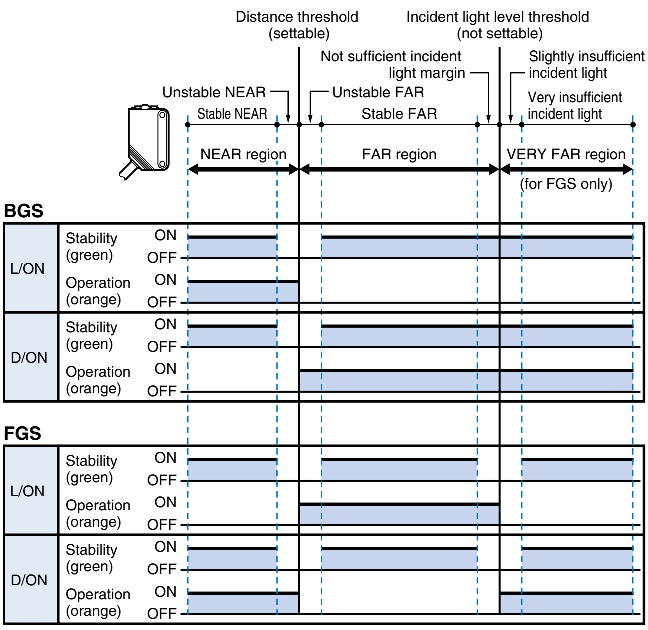
- Do not install the Sensor in the wrong direction. Refer to the following illustration.



Install the Sensor as shown in the following illustration if each sensing object greatly differs in color or material.



Adjustments-indicator operation



Note: 1 . If the stability indicator is lit, the detection/no detection status is stable within the rated ambient operating temperature (-25 to 55°C).
2 . The VERY FAR region is supported only for FGS. The incident light threshold is fixed and cannot be set. The distance to the incident light threshold depends on the color and gloss of the sensing object's surface.

Retro-reflective for transparent objects E3Z-B

Design

Bottles

The Sensor may be unable to achieve stable detection depending on the shape of bottles. Be sure to verify stable detection before using the Sensor.

Mounting

Sensor Mounting

If the Sensor fails to provide stable detection due to the shape of bottles, adjust the location and inclination of the Sensor.

Inspection and Maintenance

Cleaning

Never use paint thinners or other organic solvents to clean the surface of the product.

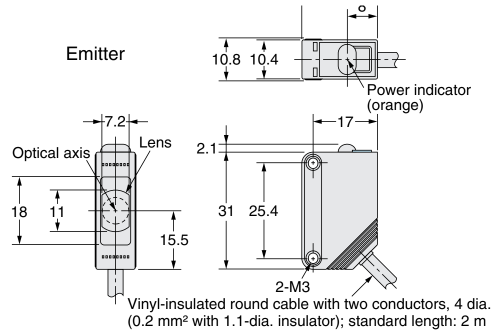
Dimensions (Unit: mm)

Sensors

Through-beam

Pre-wired

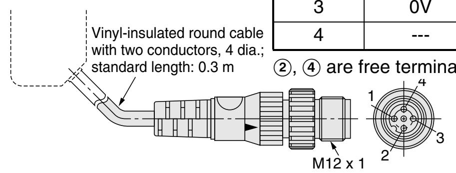
E3Z-T61
E3Z-T81
E3Z-T61A

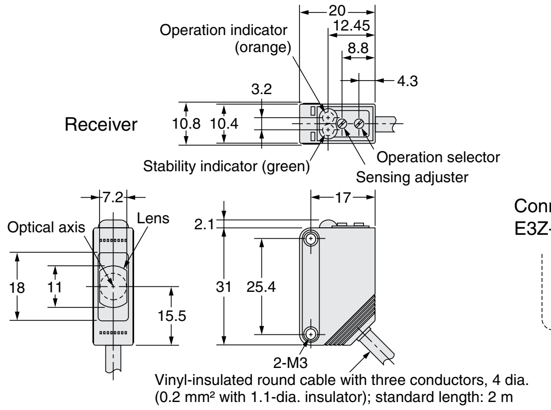


Connector relay models
E3Z-T61-M1J

Terminal No.	Specifications
1	+V
2	---
3	0V
4	---

②, ④ are free terminals.

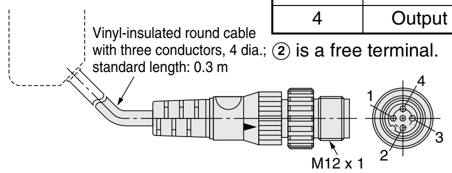




Connector relay models
E3Z-T61-M1J

Terminal No.	Specifications
1	+V
2	---
3	0V
4	Output

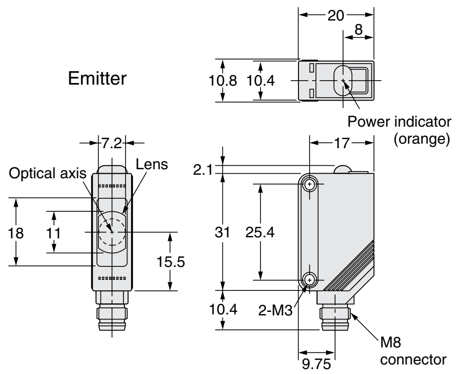
② is a free terminal.

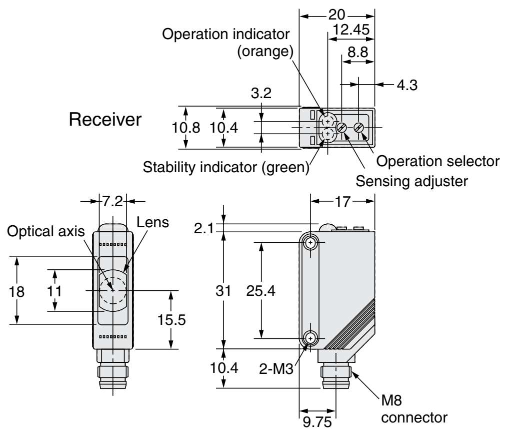


Through-beam

Connector type

E3Z-T66
E3Z-T86
E3Z-T66A





Retroreflective Models

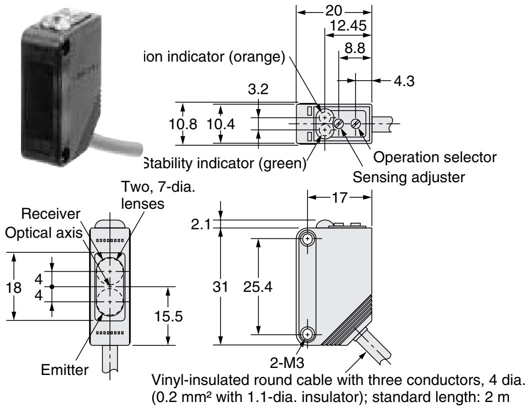
Pre-wired

E3Z-B61
E3Z-B62
E3Z-B81
E3Z-B82
E3Z-R61
E3Z-R81

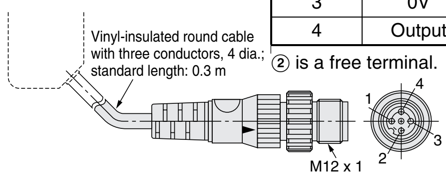
Diffuse-reflective

Pre-wired

E3Z-D61
E3Z-D81
E3Z-D62
E3Z-D82
E3Z-L61
E3Z-L81



Connector relay models
(E3Z-□□□-M1J)



Termi-nal No.	Specifica-tions
1	+V
2	---
3	0V
4	Output

② is a free terminal.

Retroreflective Models

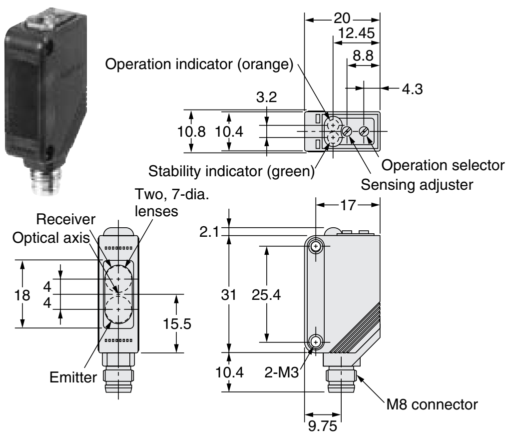
Connector type

E3Z-B66
E3Z-B67
E3Z-B86
E3Z-B87
E3Z-R66
E3Z-R86

Diffuse-reflective

Connector type

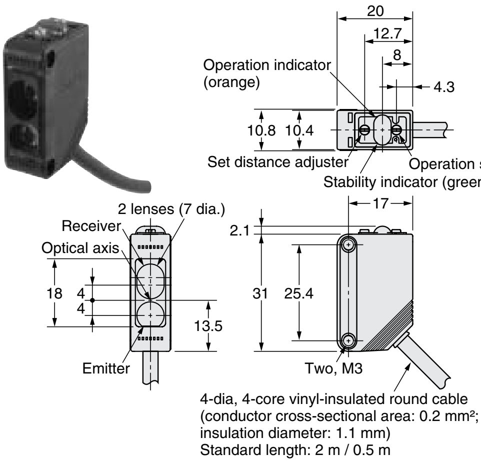
E3Z-D66
E3Z-D86
E3Z-D67
E3Z-D87
E3Z-L66
E3Z-L86



Distance-settable Models

Pre-wired models

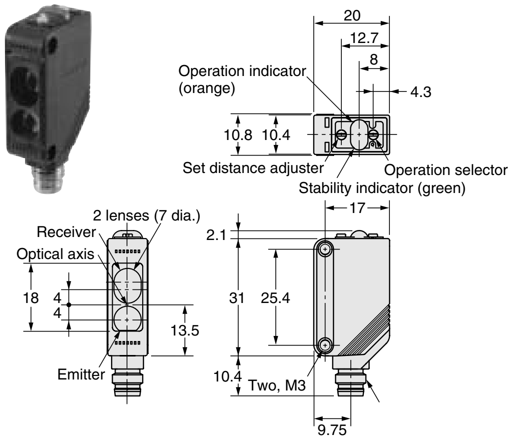
E3Z-LS61
E3Z-LS81



Distance-settable Models

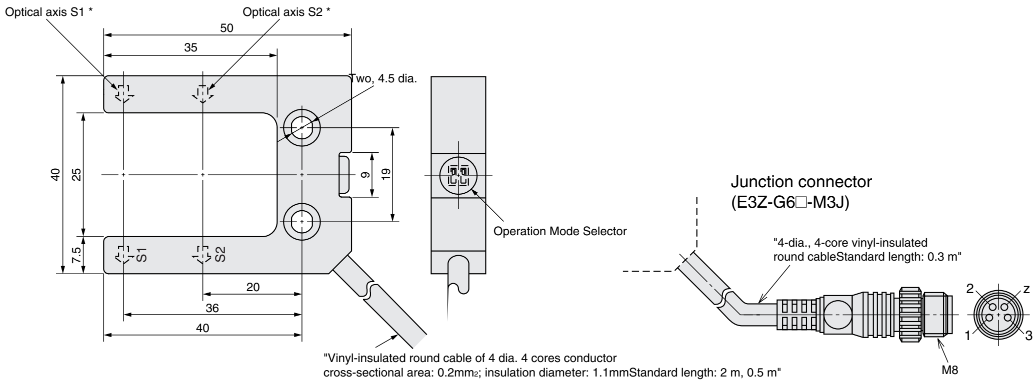
Connector type

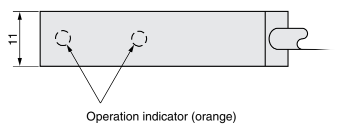
E3Z-LS66
E3Z-LS86



Grooved-type Models

E3Z-G



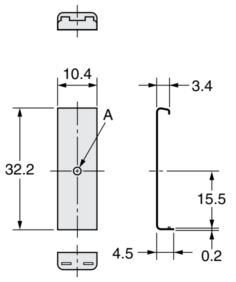


Note: 1. It is in a reflection side.
2. Both 1 and 2-axis models have S1; only 2-axis models have S2.
S1 output: black
S2 output: white

Accessories (Order Separately)

Slits

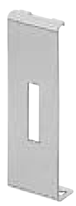
E39-S65A
E39-S65B
E39-S65C

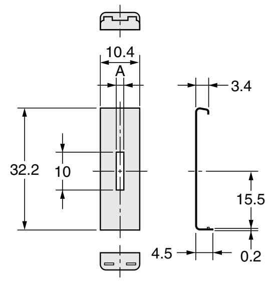


Model	Dimension A	Material
E39-S65A	0.5-mm dia.	Stainless steel (SUS301)
E39-S65B	1.0-mm dia.	
E39-S65C	2.0-mm dia.	

Slits

E39-S65D
E39-S65E
E39-S65F





Model	Dimension A	Material
E39-S65D	0.5	Stainless steel (SUS301)
E39-S65E	1.0	
E39-S65F	2.0	

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Ultra small size sensors in plastic housing

E3T

- Ultra small size with high power pin point LED where space is crucial
- 3.5 mm thin flat shape or 7 mm wide side view shape

Features

4 detection methods for selection according to work and space

Through-beam model

The side-view type has realized long, 1 m distance detection. Furthermore, it can detect a small, 0.5 mm or less dia. work with a pin-point beam (when slit is fitted). The visible light spot and narrow-visibility beam ensure a stable detection of lead frames and chip parts.

Diffuse reflective model

3.5 mm thin size and can be installed to a gap etc. The pin-point beam makes sensing position check easy, and the sensor is insensitive to the background and surrounding metal, ensuring stable detection.

Limited reflective model

Having the smallest size, this type can detect a merely 0.15 mm small object. In addition to this, it is insensitive to the background and surrounding metal, thus, ensuring a stable detection. The pin-point beam allows a clear vision of a red light spot, facilitating a sensing position check.

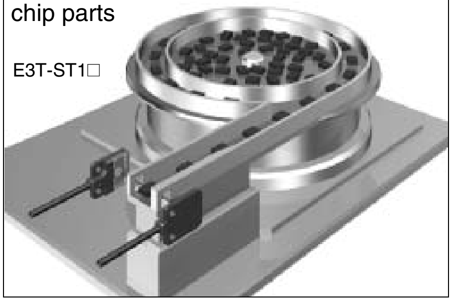
Retroreflective model

The world first coaxial Retroreflective type in this size. When used with a small reflector, this sensor completes 2 mm dia. small work detection and 200 mm sensing distance. The switch detects small works, such as IC chips on tape, and the pin-point beam makes optical axis adjustment easy, achieving stable detection.

Application

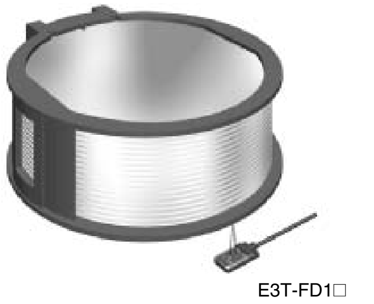
Through-beam

Detection of passing/staying parts on parts feeder
Stable detection of small works such as chip parts



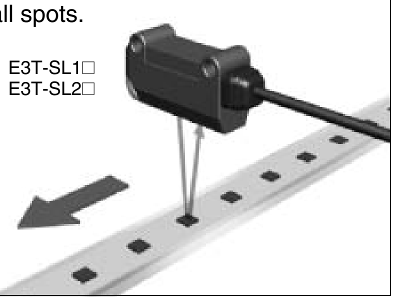
Diffuse-reflective

Detection of seated wafer cassette
Thin size. Can be mounted to a gap or like.



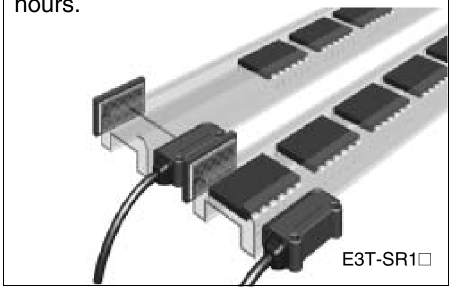
Limited reflective

Detection of chip parts on tape (Taping machine)
Can detect small parts on 1 mm dia. small spots.



Retroreflective Models

Detection of stick full of ICs (IC handler/DIP.SOP)
Retroreflection halves wiring man-hours.

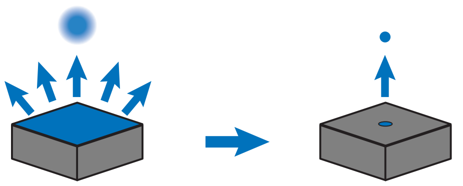


Features

The hyper LED issues a 0.8 mm dia. pin-point beam (E3T-SL1□) Small works can be detected

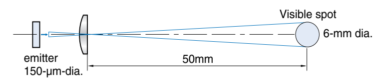
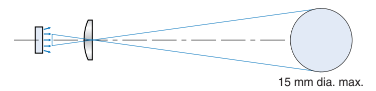
The hyper LED performs a high-output narrow-visibility beam of 0.8 mm spot diameter (E3T-SL1□). A red spot can be seen clearly and optical axis alignment and detection position check become easy. Besides, the LED is insensitive to the work color and background and can detect a small work securely.

High output pin-point light source LED (wave length: 650 mm)



The conventional LED emits light from its surface. It has a large degree of light dispersion, increasing the loss when creating a small beam.

The hyper LED emits light from a small point. It has a small degree of light dispersion, achieving a loss-free, high-output, narrow-visibility beam.

E3T-ST	
Conventional through-beam type	

One-chip photo IC ensures high reliability.

The incident photo diode and analog/digital signal processing circuit are integrated densely into the one-chip fully customized IC in use. This photoelectric sensor has high reliability in the ultra small size.

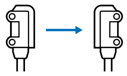
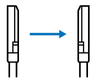
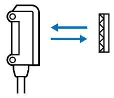
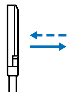
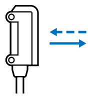
Equipped with OMRON's original FAO, this photoelectric sensor has achieved the world's first coaxial retroreflective type.

The FAO (FREE ANGLE OPTICS), or special beam splitter having multiple layers of dielectric films on a glass, has implemented the ultra small coaxial retroreflection. It can detect a small 2 mm dia. work, provides sensing position accuracy equivalent to that of the through-beam type, reducing wiring man-hours.

Ordering Information

Sensors

Red light

Sensor type	Shape		Connection method	Sensing distance	Output form	Model: NPN output *1	Model: PNP output
Through-beam	Side-view		Pre-wired models	1m	Light ON	E3T-ST11	E3T-ST13
					Dark ON	E3T-ST12	E3T-ST14
	Flat			500mm	Light ON	E3T-FT11	E3T-FT13
					Dark ON	E3T-FT12	E3T-FT14
Retroreflective	Side-view			200mm [10mm] *2	Light ON	E3T-SR11	E3T-SR13
					Dark ON	E3T-SR12	E3T-SR14
Diffuse reflective	Flat			5 to 30 mm	Light ON	E3T-FD11	E3T-FD13
					Dark ON	E3T-FD12	E3T-FD14
Limited reflective	Side-view			5 to 15 mm	Light ON	E3T-SL11	E3T-SL13
					Dark ON	E3T-SL12	E3T-SL14
				5 to 30 mm	Light ON	E3T-SL21	E3T-SL23
					Dark ON	E3T-SL22	E3T-SL24

*1. The robot cable type is available. Its type ends with "R". (Example: E3T-ST11R)

*2. Values in parentheses indicate the minimum required distance between the sensor and reflector.

Accessories (Order Separately)

Slits

Slit width	Sensing distance (typical)	Minimum sensing object (typical)	Model	Quantity	Remarks
0.5 mm dia.	100 mm	0.5 mm dia.	E39-S63	One each for Emitter and Receiver; common with Slit widths of 1 dia. and 0.5 dia.	(Plug-in type round slit) Can be used with the through-beam E3T-ST1□.
1 mm dia.	300 mm	1 mm dia.			
0.5 mm dia.	50 mm	0.5 mm dia.	E39-S64		(Plug-in type round slit) Can be used with the through-beam E3T-FT1□.
1 mm dia.	100 mm	1 mm dia.			

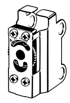
Reflectors

Name	Sensing distance (typical)	Minimum sensing object (typical)	Model	Quantity	Remarks
Small reflector	200 mm [10 mm] * (rated value)	2 mm dia.	E39-R4	1	Attached to the E3T-SR1□ Retroreflective model.
	100 mm (10 mm)*		E39-R37		---

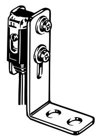
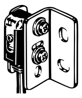
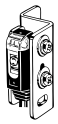
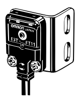
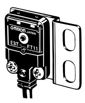
* Values in parentheses indicate the minimum required distance between the sensor and reflector.

Note: 1 . When the reflector used is other than the supplied one, set the sensing distance to about 0.7 times of the typical example as a guideline.
2 . Refer to the "Reflector list".

Sensitivity Adjustment Unit

Shape	Sensing distance (typical)	Model	Quantity	Remarks
	300 to 800 mm	E39-E10	1	For E3T-ST1□

Mounting Brackets

<table>
<tr><th>Shape</th><th>Model</th><th>Quantity</th><th>Remarks</th></tr>
<tr><td></td><td>E39-L116</td><td rowspan="5">1</td><td rowspan="3">Can be used with the side-view E3T-S□□□.</td></tr>
<tr><td></td><td>E39-L117</td></tr>
<tr><td></td><td>E39-L118</td></tr>
<tr><td></td><td>E39-L119</td><td rowspan="2">Can be used with the flat E3T-F□□□.</td></tr>
<tr><td></td><td>E39-L120</td></tr>
</table>

Note: 1 . If a through-beam model is used, order two Mounting Brackets for the emitter and receiver respectively.
2 . For details, refer to "Mounting bracket list".

Rating/performance

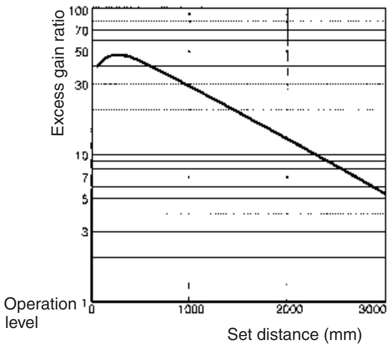
E3T-□□□□

Item	Through-beam				Retroreflective		Limited reflective				Diffuse reflective	
	Side-view		Flat		Side-view						Flat	
	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
Light-ON	-ST11	-ST13	-FT11	-FT13	-SR11	-SR13	-SL11	-SL13	-SL21	-SL23	-FD11	-FD13
Dark-ON	-ST12	-ST14	-FT12	-FT14	-SR12	-SR14	-SL12	-SL14	-SL22	-SL24	-FD12	-FD14
Sensing distance	1 m (Sensitivity Adjustment Unit is available)		500 mm		200 mm (10 mm) (see note) (with the E39-R4)		5 to 15 mm (50 x 50 mm white paper)		5 to 30 mm (50 x 50 mm white paper)		5 to 30 mm (50 x 50 mm white paper)	
Standard sensing object (white paper)	Opaque, 2 dia. min.				Opaque, 27 dia. min.		---					
Min. sensing object (typical)	Opaque, 2 dia. min.				2 dia. (sensing distance of 100 mm)		0.15 dia. (sensing distance of 10 mm)					
Differential travel	---						2 mm max.		6 mm max.		6 mm max.	
Directional angle	Emitter: 3° to 10° Receiver: 3 to 70°		Emitter: 3° to 13° Receiver: 3 to 70°		Emitter: 2° to 5°		---					
Light source (wave length)	Red LED ("Pin-point" LED) (λ=650 nm)											
Power supply voltage	12 to 24 VDC ±10%, ripple (p-p) 10% max.											24 VDC ±10%
Current consumption	Emitter/Receiver: 12 mA max.				20 mA max.							
Control output	Open collector, load current: 50 mA max. at 24 VDC, residual voltage: 1 V max., operation mode: Light ON or Dark ON (separate models)											
Circuit protection	Protection from reversed power supply connection and output short-circuit				Protection from reversed power supply connection, output short-circuit, and mutual interference							
Response time	1 ms max. each for operation and release											
Ambient illumination (on Receiver lens)	Incandescent lamp: 5,000 lx max. Sunlight: 10,000 lx max.											
Ambient temperature	Operating: -25°C to 55°C Storage: -40°C to 70°C (with no icing or condensation)											
Ambient humidity	Operating: 35% to 85% Storage: 35% to 95% (with no condensation)											
Insulation resistance	20 M min. (at 500 VDC)											
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min											
Vibration resistance	Destruction: 10 to 2,000 Hz, 1.5-mm double amplitude or 300 m/s² (approx. 30G) for 0.5 hrs each in X, Y, and Z directions											
Shock resistance	Destruction: 1,000 m/s² (approx. 100G) 3 times each in X, Y, and Z directions											
Degree of protection	IEC60529: IP67											
Connection method	Prewired (standard length: 2 m)											
Weight (with packaging)	Approx. 40 g				Approx. 20 g							
Materials	Case: PBT Lens and cover: Polycarbonate											
Accessories	Phillips-head screws (side-view type: M2 x 14, flat type: M2 x 8), nuts, spring washers, flat washers, instruction sheet, and Reflector (for retroreflective model only)											

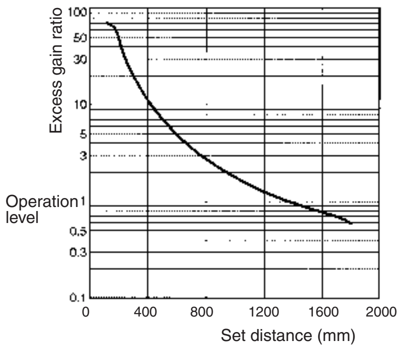
Engineering Data

Excess Gain vs. Set Distance (Typical)

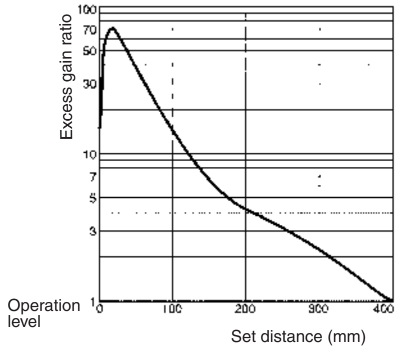
E3T-ST1□ (Through-beam)



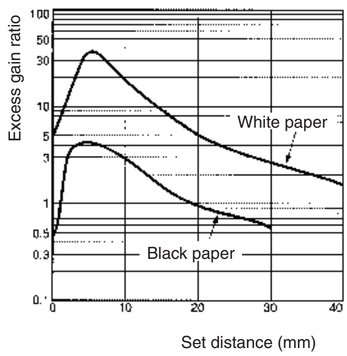
E3T-FT1□ (Through-beam)



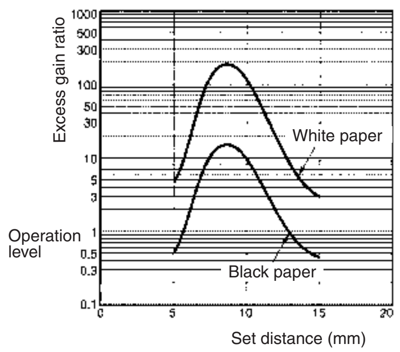
E3T-SR1□ with E39-R4 (Retroreflective)



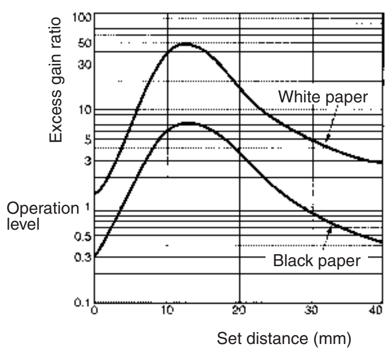
E3T-FD1□ (Diffuse Reflective)



E3T-SL1□ (Limited Reflective)



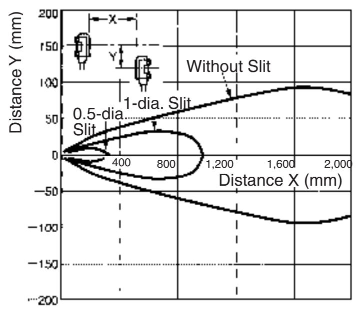
E3T-SL2□ (Limited Reflective)



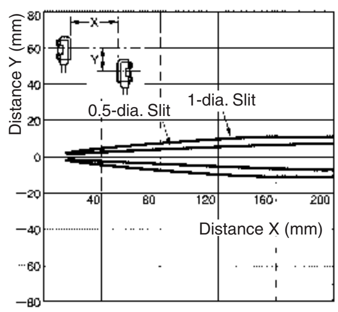
Parallel Operating Range (Typical)

(Through-beam)

E3T-ST1□ with Slit

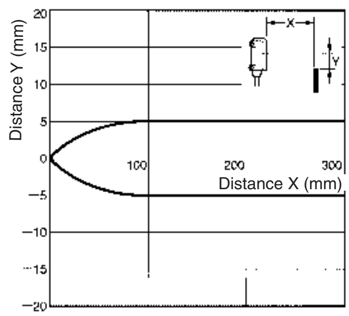


E3T-ST1□ with Slit (Enlarged graph)

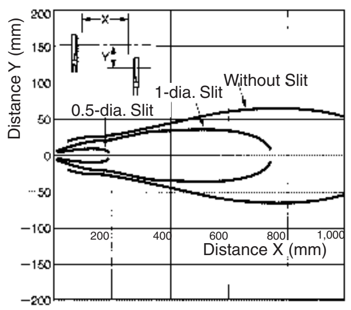


(Retroreflective)

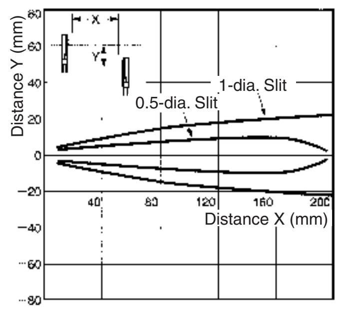
E3T-SR1□ with E39-R4



E3T-FT1□ with Slit



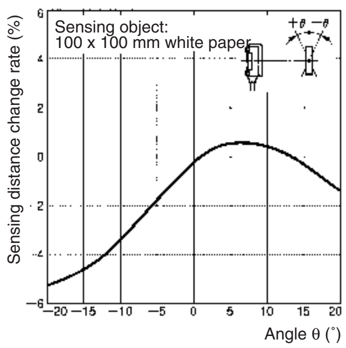
E3T-FT1□ with Slit (Enlarged graph)



Angle Characteristics (Typical)

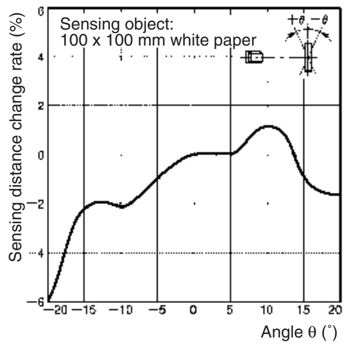
E3T-SL1□

(Up and Down)



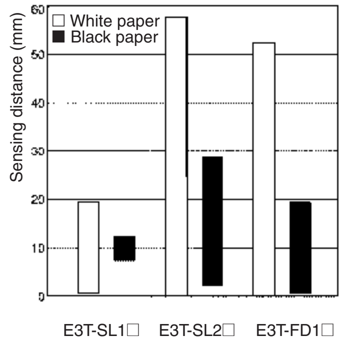
EE3T-SL1□

(Left and Right)



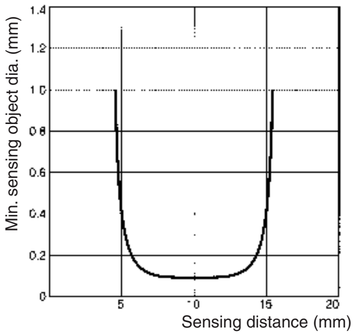
Close-distance Sensing Capability (Typical)

E3T-SL1□, E3T-SL2□, E3T-FD1□

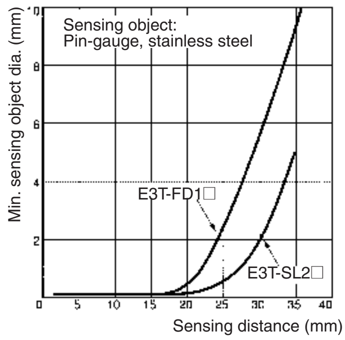


Sensing Object Size vs. Sensing Distance (Typical)

E3T-SL1□

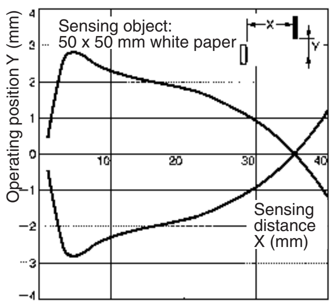


E3T-SL1□

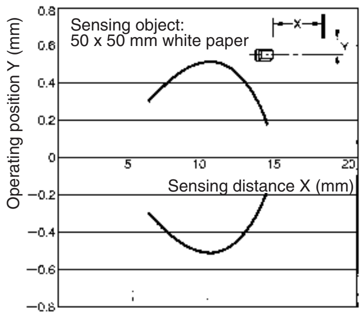


Operation Range (Typical)

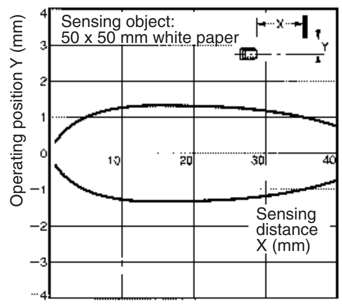
E3T-FD1□ (Diffuse Reflective)



E3T-SL1□ (Limited Reflective)

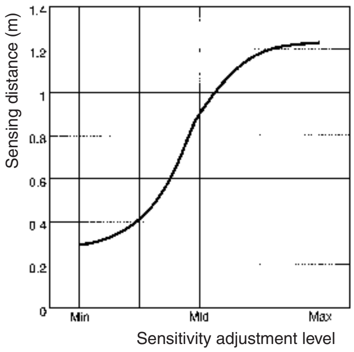


E3T-SL2□ (Limited Reflective)



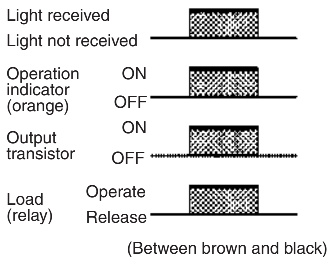
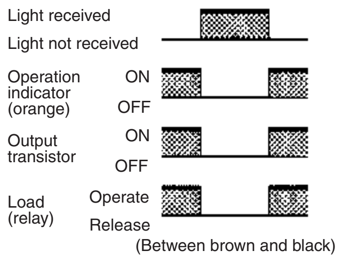
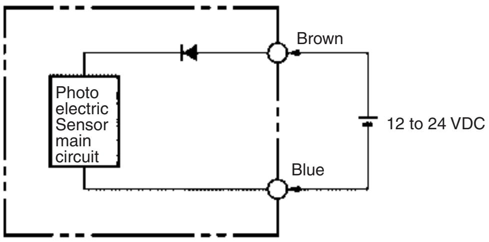
Sensing Distance Characteristics of Sensitivity Adjustment Unit (when completing optical axis adjustment)

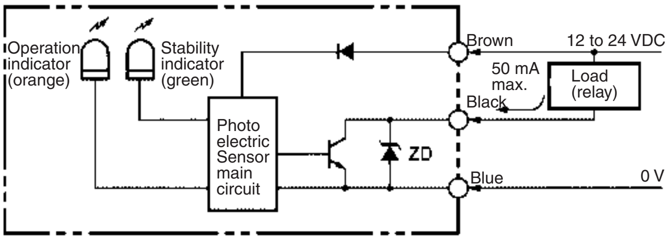
E3T-SL1□ with E39-E10



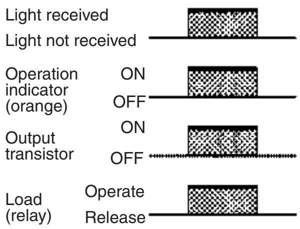
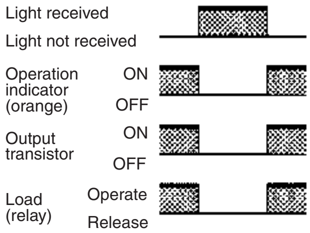
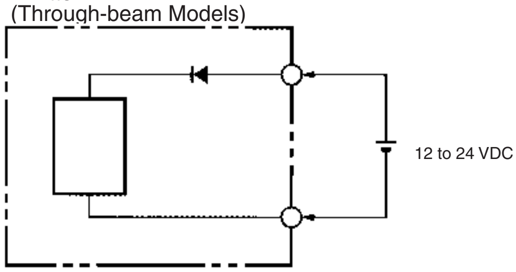
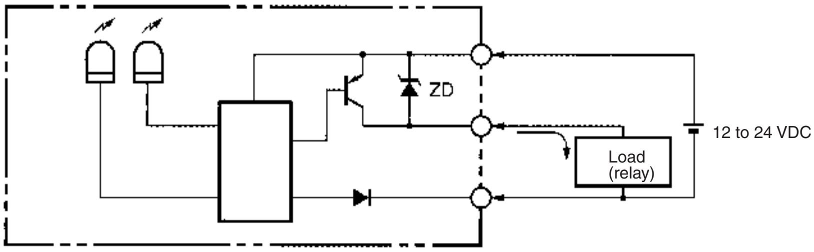
Operation

NPN Output Configuration

<table>
<tr><td>Model</td><td>E3T-□□□1</td><td>E3T-□□□2</td></tr>
<tr><td>State of output transistor</td><td>Light ON</td><td>Dark ON</td></tr>
<tr><td>Timing chart</td><td>
</td><td>
</td></tr>
<tr><td>Output circuit</td><td colspan="2">Emitter
(Through-beam Models)


Receiver (Through-beam Models),
Retroreflective, Diffuse Reflective, and Limited Reflective Models

</td></tr>
</table>

PNP Output Configuration

Model	E3T-□□□3	E3T-□□□4
State of output transistor	Light ON	Dark ON
Timing chart	 (Between brown and black)	 (Between brown and black)
Output circuit	Emitter (Through-beam Models)  Receiver (Through-beam Models), Retroreflective, Diffuse Reflective, and Limited Reflective Models 	

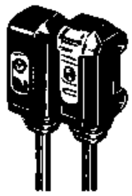
Dimensions

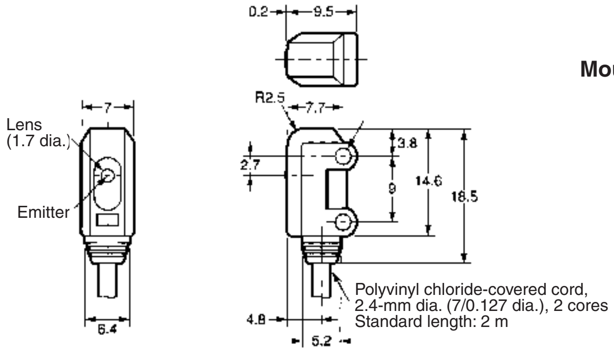
Note: All units are in millimeters unless otherwise indicated.

Photoelectric Sensors

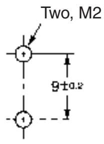
Through-beam Models (Side-view Type)

E3T-ST1□ (Emitter)

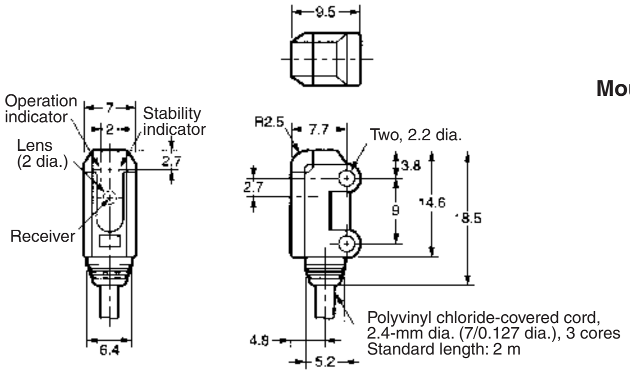




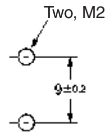
Mounting Holes



(Receiver)

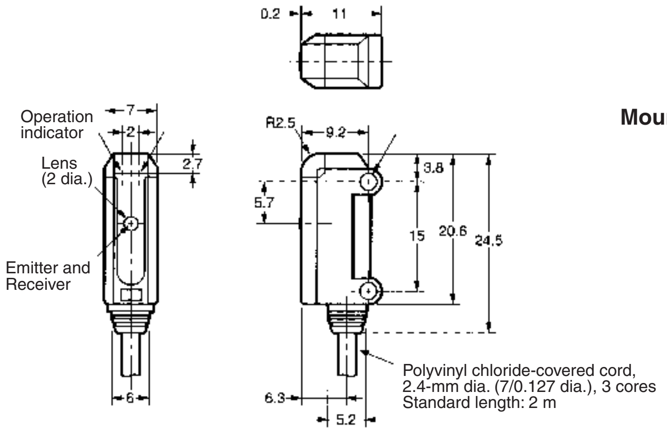


Mounting Holes

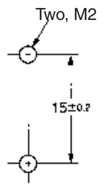


Retroreflective Models (Side-view Type)

E3T-SR1□

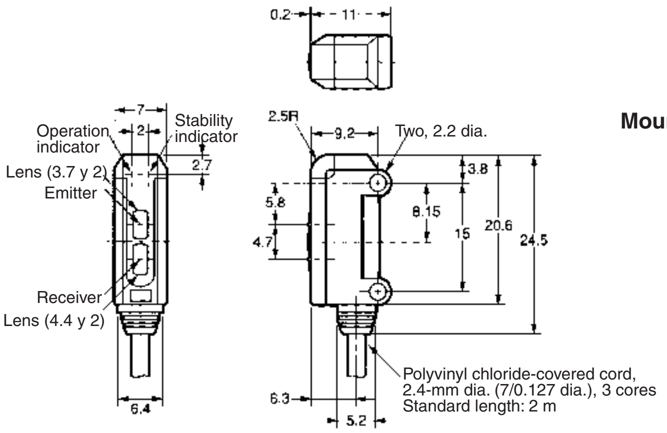


Mounting Holes

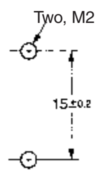


Limited Reflective Models (Side-view Type)

E3T-SL1□
E3T-SL2□

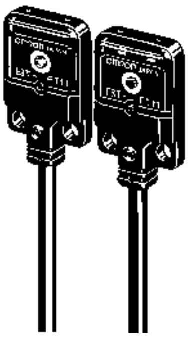


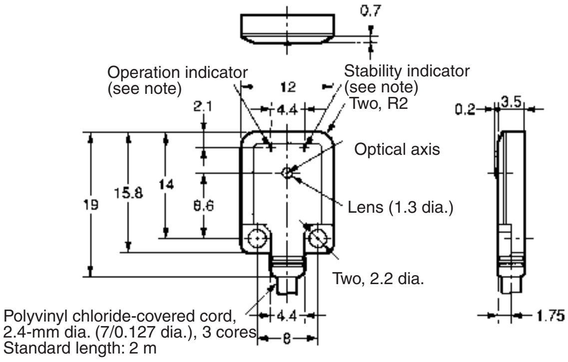
Mounting Holes



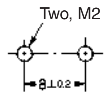
Through-beam Models (Flat Type)

E3T-FT1□
(Emitter, Receiver)





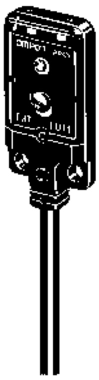
Mounting Holes

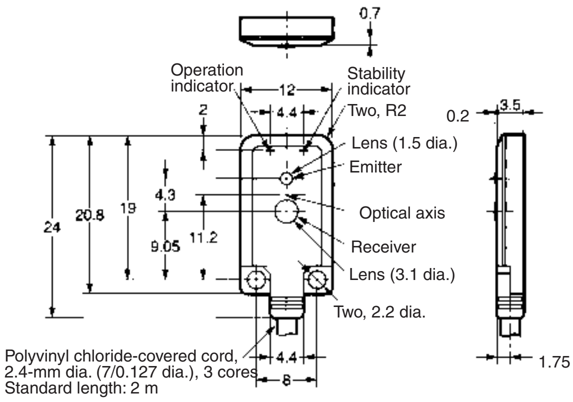


Note: For E3T-FT11/-FT13 and E3T-FT12/-FT14 Receivers only.

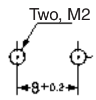
Diffuse Reflective Models (Flat Type)

E3T-FD1□





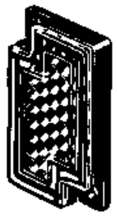
Mounting Holes

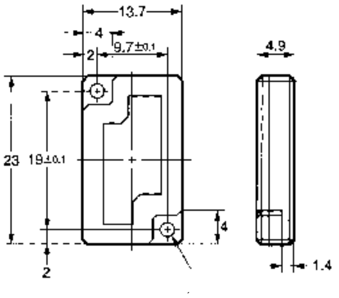


Accessories

Reflector (Attached to Retroreflective Models)

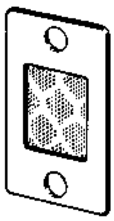
E39-R4



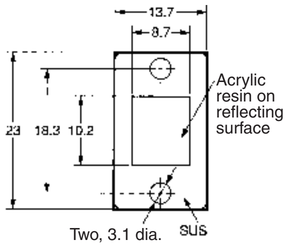


Material
Surface: Acryl
Back: ABS

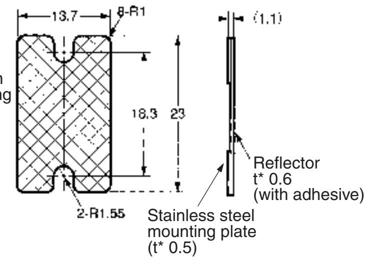
E39-R37



Mounting Plate



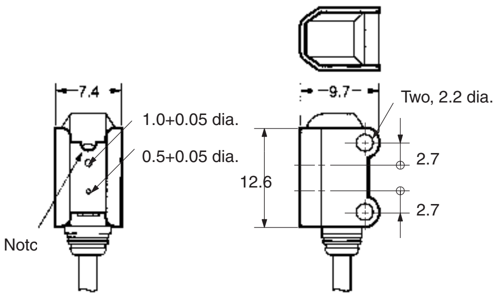
Reflector



Note: A reflector and a stainless steel mounting plate are supplied together as a set.

Slits (Order Separately)

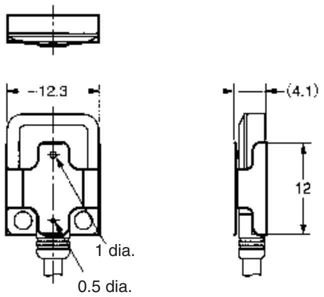
Through-beam E3T-ST1□ with E39-S63
With Slit mounted



Note: Align the notch direction of the Slit when installing on the Emitter and Receiver.

Material: 0.2-mm-thick stainless steel (SUS301)

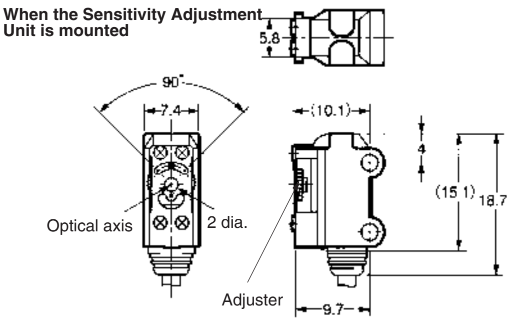
E39-S64 (for Through-beam E3T-FT1□)
With Slit mounted



Material: 0.2-mm-thick stainless steel (SUS301)

Sensitivity Adjustment Unit (for E3T-ST1□)

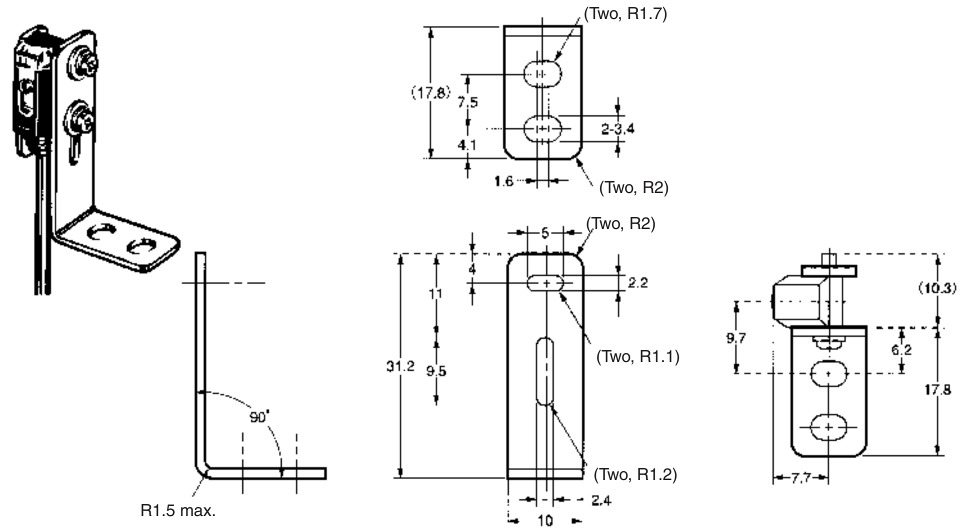
E39-E10



Material: Stainless steel (SUS301)

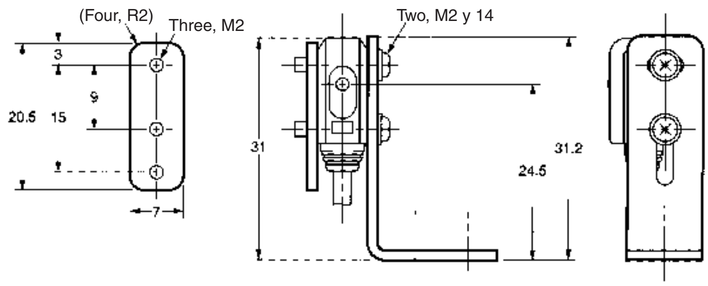
Mounting Brackets for E3T-S☐ (Order Separately)

E39-L116

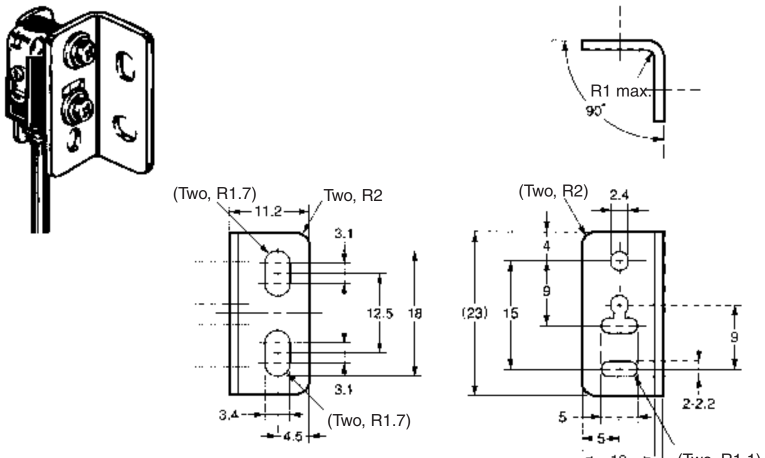


Material: 1.2-mm-thick stainless steel (SUS304)

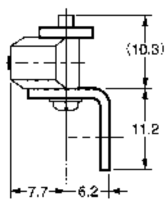
E3T-ST11 with E39-L116



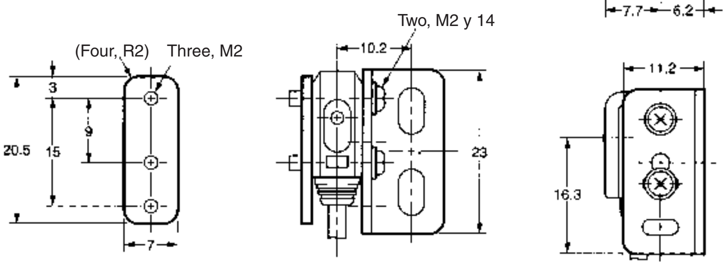
E39-L117



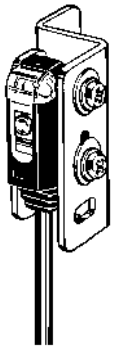
Material: 1.2-mm-thick stainless steel (SUS304)

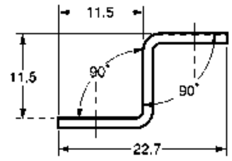


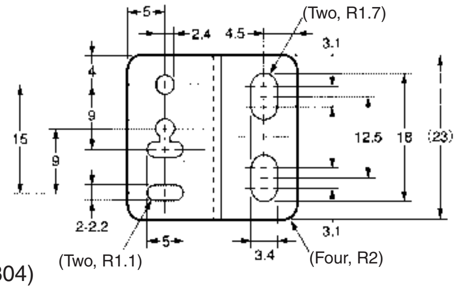
E3T-ST11 with E39-L117



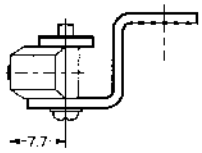
E39-L118



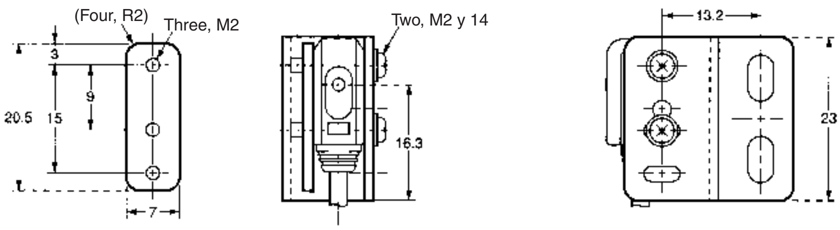




Material: 1.2-mm-thick stainless steel (SUS304)

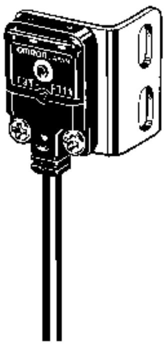


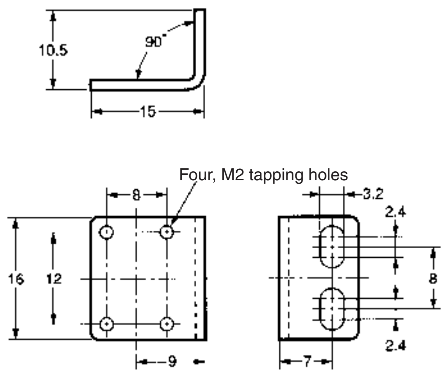
E3T-ST11 with E39-L118



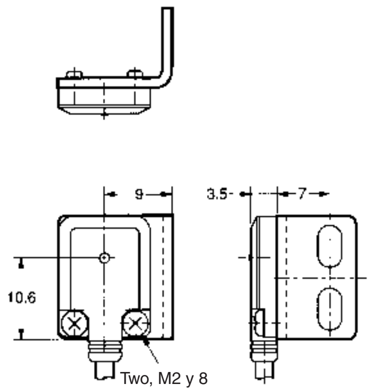
Mounting Brackets for E3T-FT1□/E3T-FD1□

E39-L119



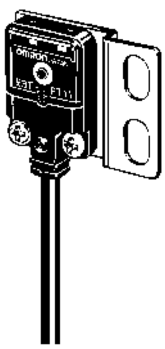


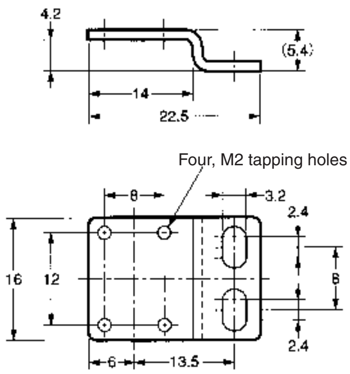
E3T-FT11 with E39-L119



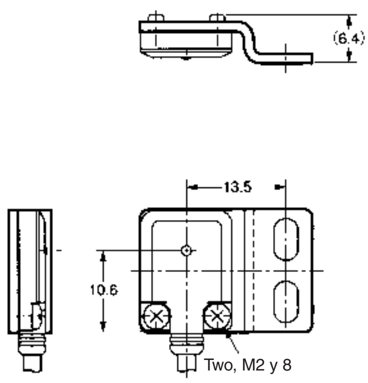
Material: 1.2-mm-thick stainless steel (SUS304)

E39-L120





E3T-FT11 with E39-L120



Material: 1.2-mm-thick stainless steel (SUS304)

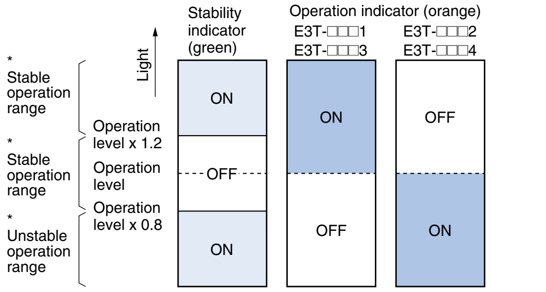
Precautions

For adjustment

Display

• The following graphs indicate the status of each operation level.

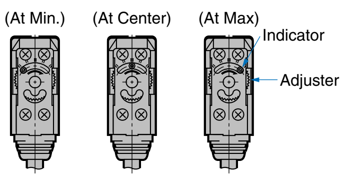
• Be sure to use the E3T within the stable operating range.



Note: If the E3T's operation level is set to the stable operation range, the E3T will be in most reliable operation without being influenced by temperature change, voltage fluctuation, dust, or setting change. If the operation level cannot be set to the stable operation range, pay attention to environmental changes while operating the E3T.

Use of E39-E10 Sensitivity Adjustment Unit

(Dark ON: E3T-ST12)



① Install the Unit on the Receiver.

② Set the adjustment dial of the sensitivity adjustment unit to Max. (Factory set to the Max. position)

③ After Sensor installation adjust the optical axis and secure the Sensor.

④ Place a work between the emitter and receiver, gradually turn the adjustment dial of the sensitivity unit to the Min position (CCW), and stop turning it when the operation indicator is turned ON and the stability indicator (green) is turned ON.

⑤ Remove the work and confirm that the operation indicator is turned OFF and the stability indicator (green) is turned ON. This completes the adjustment.

Note: If the light attenuation rate due to a work is 40% or less, the stability indicator is not turned ON whether or not light is received. When the variation of light is small (e.g. when sensing semi-transparent works), carefully perform preliminary testing.

Others

Do not install the E3T in the following places.

• Places where the E3T is exposed to direct sunlight.

• Places with high humidity and where condensation may result.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

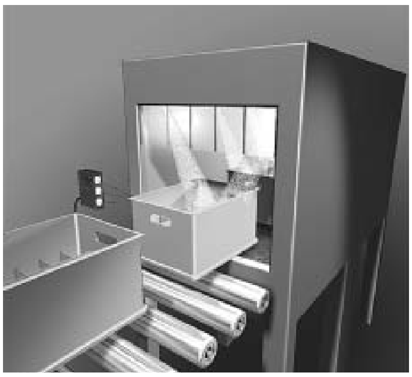
Harsh environment long distance photoelectric Sensor in metal housing

E3NT

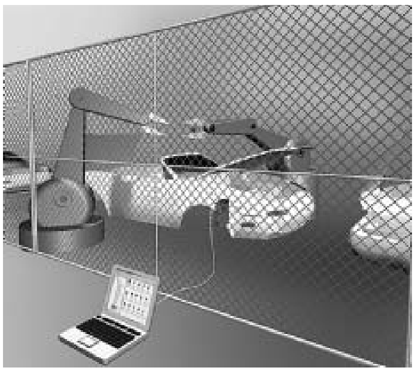
- 4 Diffuse reflective E3NT-L application optimized models:
  - Extra long distance type for setting distances up to 3 m
  - Window heating type for low temperature environments
  - Analog output type for distance information
  - Fast response type for high speed detection and counting
- Retro reflective E3NT-R models with sensing distance up to 16 m
- Two programmable outputs for 'window teaching'
- Double triangulation for stable detection of reflective objects
- IP67 and IP69k for highest resistance in wet environments

CE

Application



Condensation in often cleaned environments or due to rapid temperature changes is prevented by the completely sealed housing of the E3NT and the optional window heating.

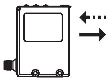
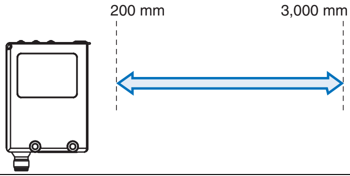
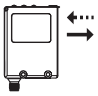
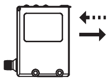
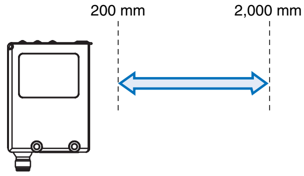
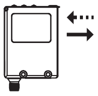
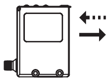
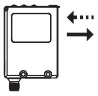
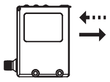
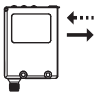
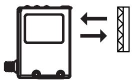
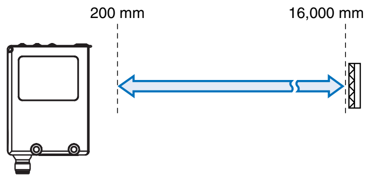
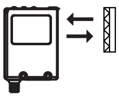


With the optic link, the sensor can be remotely set and checked while it is operating in an area where access is restricted.

This robust sensor is ideal for operation in harshest environments.

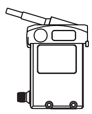
Ordering Information

Sensors

Sensing method	Type	Appearance	Connection method	Sensing / Setting distance	Model
Distance setting (BGS/FGS)	Long distance		M12 Connector (5-pole)	0.2 m .. 3.0 m (90% remission) 0.2 m .. 2.7 m (6% remission) 	E3NT-L17-20
					E3NT-L37-20
	Window heating			0.2 m .. 2.0 m 	E3NT-LH17
					E3NT-LH37
	Fast response				E3NT-L17
					E3NT-L37
	Analog and digital output				E3NT-L27
					E3NT-L47
Retro reflective (with MSR-polarisa-tion)	Long distance			0.2 m .. 16.0 m (with E39-R8) 	E3NT-R17
					E3NT-R37

Accessories (order separately)

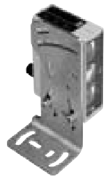
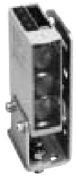
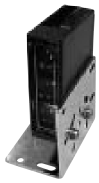
Optical data link

Communication method to sensor	Appearance	Communication method to PC	Model
IR data interface		RS232	E3NT-AL232 2M

Laser alignment aid

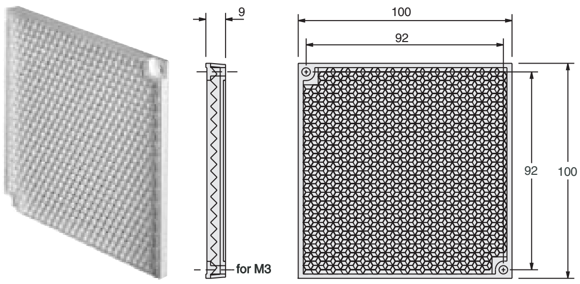
Max. distance for visible spot	Appearance	Operation time	Model
50 m		min. 5 hours with new battery	E3NT-AP1

Mounting brackets

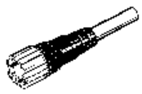
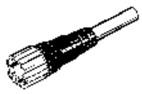
Appearance	Model	Qty.	Remarks
	E39-EL1	1	Universal mounting bracket
	E39-EL2	1	Adapter bracket (for use of the universal mounting bracket for not matching holes)
	E39-EL3	1	Adapter bracket replacing E3N with E3NT

Reflectors

E39-R8



Sensor I/O connectors

Size	Cable type	Shape		Cable length	Model
M12	Standard 5-pole	Straight		2m	XS2F-D521-DG0-A
				5m	XS2F-D521-GG0-A
		L-shape		2m	XS2F-D522-DG0-A
				5m	XS2F-D522-GG0-A
	Standard 4-pole (Pin 5 not connect-ed)	Straight		2m	934 401 101 (PVC)
					934 401 201 (PUR)
				5m	934 401 100 (PVC)
					934 401 200 (PUR)
		L-shape		2m	934 402 102 (PVC)
					934 402 201 (PUR)
				5m	934 402 100 (PVC)
					934 402 200 (PUR)

Rating/performance

Sensors

Item	Model				
	E3NT-L17 E3NT-L37	E3NT-L27 E3NT-L47	E3NT-LH17 E3NT-LH37	E3NT-L□7-20	E3NT-R
Sensor type	Diffuse reflective sensor with background suppression respectively foreground suppression				Retroreflective sensor
Signal evaluation	Double triangulation method				Polarization
Configuration	By push button on the sensor or with a PC connected via the optical data link E3NT-AL232 2m				
Operating modes	Background suppression, foreground suppression, background and foreground suppression (2-point window evaluation)				---
Light source	Infrared LED 850 - 880 nm				Red LED 660 nm
Rated sensing distance	2 m			3 m	16 m
Setting distance Sr	Distance – setting possible between				---
	0.2 ... 2.0 m (90 % remission) 0.2 ...1.7 m (6 % remission)		0.2 ... 2.0 m (90 % remission) 0.2 ...1.4 m (6 % remission)	0.2 ... 3.0 m (90 % remission) 0.2 ...2.7 m (6% remission)	0.2 ... 16.0 m
Standard measured object	Kodak gray card 90% (white), size: 200 x 200 mm				---
Blind zone	< 0.1 m				< 0.15 m
Black/white error (6%/90%)	< 15 % of setting distance Sr				---
Hysteresis (typical)	< 5 % of setting distance Sr or 4 cm (for white 90 %) < 10 % of setting distance Sr or 6 cm (for black 6 %)			< 10 % of setting distance Sr or 10 cm (for white) < 15 % of setting distance Sr or 10 cm (for black)	---
Repetition accuracy	< 5 % (of setting distance Sr) or 4 cm			< 5 % (of setting distance Sr) or 10 cm	---
Light spot diameter	< 40 mm in the case of Sr = 2 m				app. 100 mm*1 at 10 m
Minimum object size	> 40 mm				
Ambient light immunity to EN 60947-5-2:	Halogen lamps (100-120 Hz > 10,000 lux Fluorescent lamps (30 kHz) > 5,000 lux Energy saving lamps > 2,000 lux				
Utilization category to EN 60947-5-2	DC 12				
Rated operating voltage	+ 24 V DC, polarized				
Operating voltage range	+ 10 ... + 30 V DC			+ 11 ... + 30 V DC	+ 10 ... + 30 V DC
Current consumption	< 90 mA (display off) < 110 mA (display on)	< 100 mA (display off) < 120 mA (display on)	< 220 mA with front pane heating	< 110 mA (display off) < 130 mA (display on)	< 80 mA (display off) < 110 mA (display on)
Power-on delay	< 300 ms				
Input – / Output – pins	Pin 2 = Input (In 2) or output (Out 2), depending on configuration Pin 4 = Output (Out 1)				
	Pin 5 = Input (In 1)	Pin 5 = Analog output	Pin 5 = Input (In 1)		
Digital Outputs	User set functions (e.g. switching output, alarm output, ...)				
Output circuit	User set PNP (open collector), NPN (open collector) or complementary (push-pull)				
Output current	max. 100 mA				
Voltage drop	< 2.0 V				
Residual current	< 100 µA				
Circuit protection	Reversed power supply, overload, short-circuit (pulsed)				

Item		Model				
		E3NT-L17 E3NT-L37	E3NT-L27 E3NT-L47	E3NT-LH17 E3NT-LH37	E3NT-L□7-20	E3NT-R
Inputs		User set functions (e.g. teach-in, trigger, test, ...)				
	Input circuit	Voltage input +10 V ... U_{supply}			Voltage input +11 V ... U_{supply}	Voltage input +10 V ... U_{supply}
	Input pulse duration	min. 1 ms				
Analog Output			Current output 3..21mA: • 3 mA correspond to distance < 0.2 m • 4 ... 20 mA correspond to distance 0.2 m ... 2.0 m • 21 mA correspond to distance > 2.0 m (or no object)			
Switch-on/off time (T_{ON} / T_{OFF})		≤2.5 ms	≤5 ms	≤2.5 ms	≤20 ms	≤2.0 ms
Insulation resistance		20 MΩ at 500 V DC				
Insulation voltage strength		1,0 kV AC, 50/60 Hz (1 min)				
Impulse strength (insulation)		1,5 kV				
Dimensions (length x width x depth)		85 x 27 x 65 mm				
Materials						
	Housing	Powder-coated aluminum, sea-water resistant, 231 GD AlSi12 (Cu) (standard version)				
	Front pane	Glass				
	Keyboard	HTV silicone				
	Seals	RTV silicone				
Housing color		Grey, RAL 7030				
Assembly		Screw fastening by way of four M5 threads and two M5 through holes or with universal mounting bracket (order separately)				
Connection		M12 connector, 5-pole (piercing)				
Ambient temperature range		- 25 °C ... + 55 °C	- 10 °C ... + 55 °C (analog output)	- 40 °C ... + 55 °C	- 25 °C ... + 55 °C	
Storage temperature range		- 40 °C ... + 60 °C			- 40 °C ... + 70 °C	
Permissible relative humidity		35 % ... 95 %, no condensation				
Enclosure rating		IP 67 (EN 60529), IP 69k (DIN 40050)				
Protection class		II (50 V DC)				
Vibration resistance		± 1.5 mm, 1 h , 10 - 70 Hz (IEC 68-2-6)				
Shock resistance		300 m/s² (IEC 68-2-27)				
User set parameters		- Mode - Output function - Teach/set switching points - Output switching - Function on connector pin 2 and 5 - Switch-on and off delay - Type of switch-off time function - Type of display on the sensor - Keyboard lock - Energy saving mode - Display direction - Reset to factory defaults				

*1. see diagramm

Accessories

E3NT-AL 232 2 M

Item	
Dimensions (length x width x depth)	29.5 x 72.9 x 26.4 mm
Housing material	ABS and PMMA (IR transparent)
Housing colour	Black, RAL 9005
Assembly	Snap mounting on sensor
Connection	2 m connecting cable with 9-pole sub-D connector
Ambient temperature range	- 10 °C ... + 50 °C
Storage temperature range	- 40 °C ... + 60 °C
Permission relative humidity	35% ... 85%, no condensation
Degreee of protection to EN 60529 / IEC 529	IP 54
Emitted light	IR communication element 880 nm
Rated operating voltage	Via RS 232 interface from PC
Current consumption	6 mA

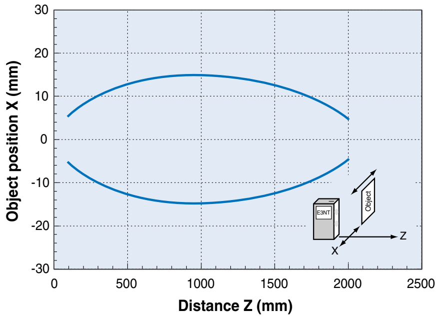
E3NT-AP1

Item	
Supply voltage	3 V DC
Battery type	Button battery Ø 11.6 mm, thickness: 5.4 mm, 3 Vm, type: CR1/3N
Ambient temperature range	+ 10 °C ... + 40 °C
Storage temperature range	- 40 °C ... + 60 °C (with no icing or condensation)
Ambient humidity	Operation and storage: 35% ... 85% (with no icing or condensation)
Ambient environment	No corrosive gases
Operation time period	min. 5 hours operation with 1 new battery
Degree of protection	IP20 (EN 60529)
Case material	Case: ABS/PC Base plate: Aluminium
Weight	Approx. 42 g
Accessories:	1 Instruction sheet, 1 battery type CR1/3N
Max. distance for a visible beam spot	about 50 m (depending on the ambient light and surface conditions)
Laser beam power	< 1 mW
Laser class	Laser Class II

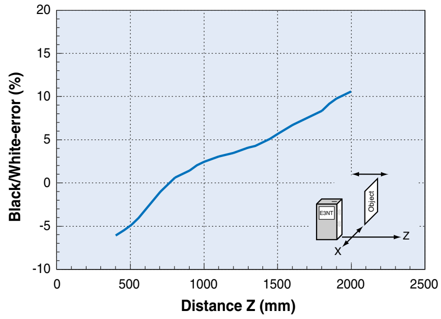
Characteristic data (typical)

E3NT-L17/L37 and E3NT-LH17/LH37

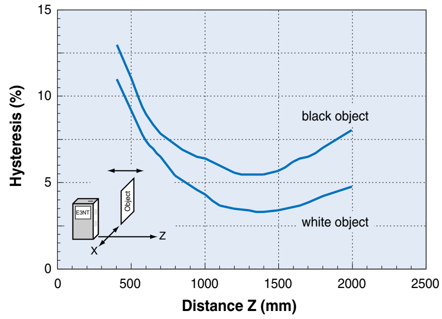
Operating range
(90% remission)



Black/White - Error
(6% - 90% remission)

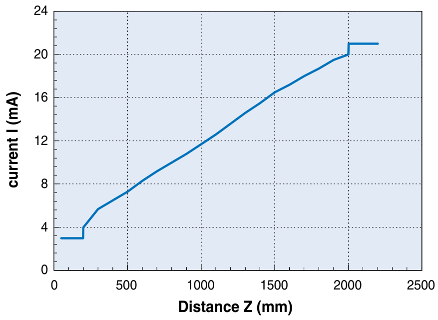


Hysteresis



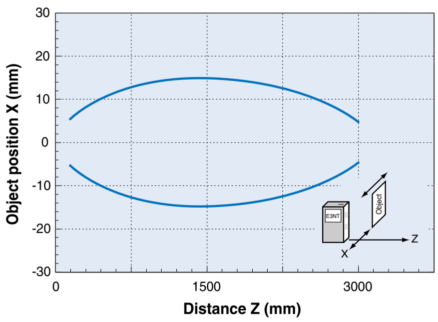
E3NT-L27/L47

Analog output current
(90% remission)

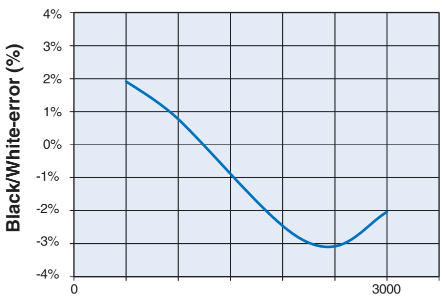


E3NT-L17-20 and E3NT-L37-20

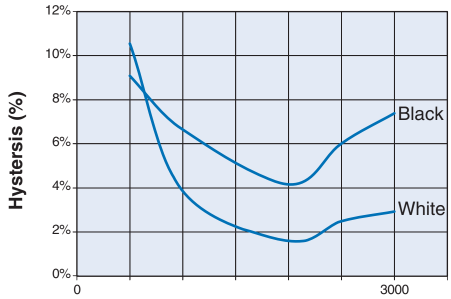
Parallel Operating range



Black/White - Error
(6% - 90% remission, typical)

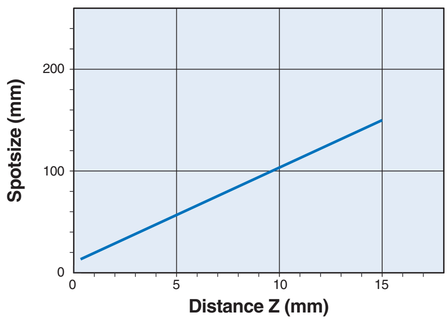


Hysteresis (typical)



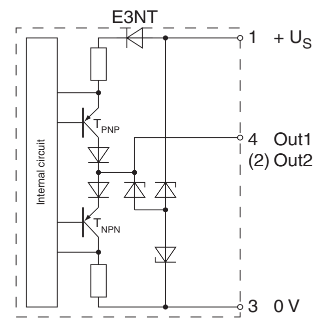
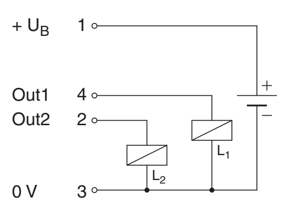
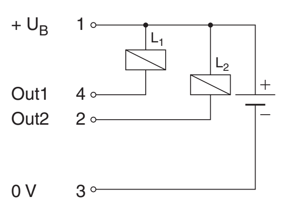
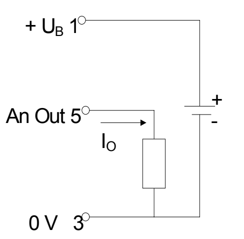
E3NT-R

Spotsize



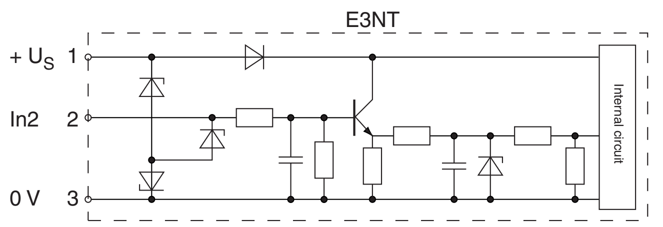
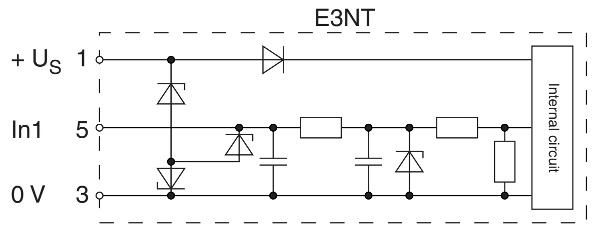
Circuit diagram

Output

Push-pull output circuit (Out1 at pin 4 / Out2 at pin 2)	Load connection		
	PNP	NPN	Analog
			

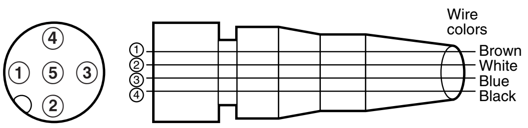
When use is made of the PNP or NPN output circuit, the output circuit that is not selected is deactivated. When used as a complementary output, NPN or PNP outputs act in antiphase as the switch state changes.

Input

In2 at pin 2	In1 at pin 5 (not available for analogue output models)
	

The sensor inputs are realised in positive logic and detect a positive voltage level of more than 1 ms duration as a valid signal if the voltage level is between 10 V and the power supply voltage.

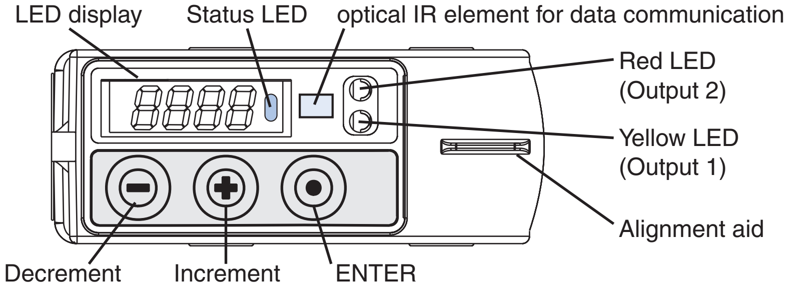
Connectors



Class	Wire jacket color	Connector pin no.	Application
For DC	Brown	1	Power supply (+V)
	White	2	Output or Input Out2 / In2
	Blue	3	Power supply (0V)
	Black	4	Output Out1
	Grey	5*	Analog Output or Input In1

* Not connected for standard 4-pole connectors

Nomenclature



LED display	The distance from the measured object and the names of the menu levels during set-up of the sensor are displayed by the 4-digit 7-segment LED display. The display appears as red digits or letters. If the sensor is set to a bar chart display, the distance from the measured object is displayed as a green LED bar chart.		
LED	The switching status and the stability of the two outputs are signalled as follows by two LEDs, visible from the top and the front of the sensor:		
	Yellow LED (Output 1)	ON	Object stably detected
		Blinking	Object not stable detected
		OFF	No object within range
	Red LED (Output 2)	ON	Object stably detected
		Blinking	Object not stable detected
		OFF	No object within range
	Status LED	ON	Set-up menu selected
		Blinking	Menu level with change of setting distance
		OFF	RUN (normal) mode

Operation

Setting the switching points

The switching points can either be user set (Teach-in mode) with a measured object positioned at the corresponding distance or can be set using the setting input, for remote setting.
For each output of the sensor (up to two), up to two switching points can be user set.
Only one switching point is active in the foreground and background suppression modes.
For the 2-point window evaluation mode, two switching points must be set.

Teaching the switching points in the normal mode

The sensor is set at the factory for both outputs to **BGS**, light on.

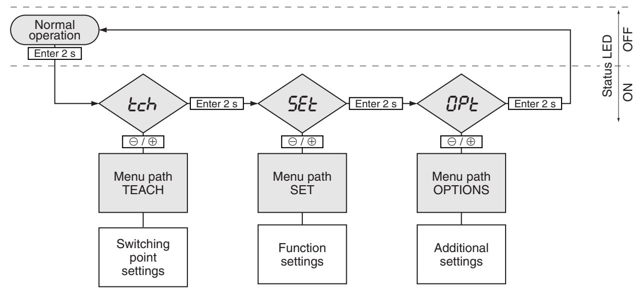
1. Place the target object in front of the sensor at the desired position.
2. Teach the switching point for output 1:

- Beginning with the ⊕ key, press it simultaneously with the ENTER ⊙ key. Threshold level is obtained and the output/ LED is updated. Status LED is blinking.
- Using the ⊕/⊖ keys an adjustment of the switching point is possible. The output/LED is updated immediately.
- Pressing the ENTER ⊙ key for more than 2 seconds or after 2 minutes without any activation of the keys, the sensor returns to normal operation. The status LED is turned off.

3. Teach the switching point for Output 2:

- Beginning with the ⊖ key, press it simultaneously with the ENTER ⊙ key.

Main menu structure



When the ENTER ⊙ key is pressed for 2 seconds, the sensor switches from the normal mode to the TEACH menu path. The sensor switches to each next menu path when the ENTER ⊙ key is repeatedly pressed for 2 seconds. In the menu paths, the required parameters can be selected by pressing ⊖ and ⊕ keys.

ℹ To skip a menu path, you can also press the ENTER key for 4 seconds.

ℹ [ENTER] Press the ENTER ⊙ key < 1 second

ℹ [ENTER 2s] Press the ENTER ⊙ key > 2 seconds.

TEACH menu

Menu items

Teaching Switching point A Output 1

Teaching Switching point B [1.] Output 1

Teaching Switching point C Output 2 [2.]

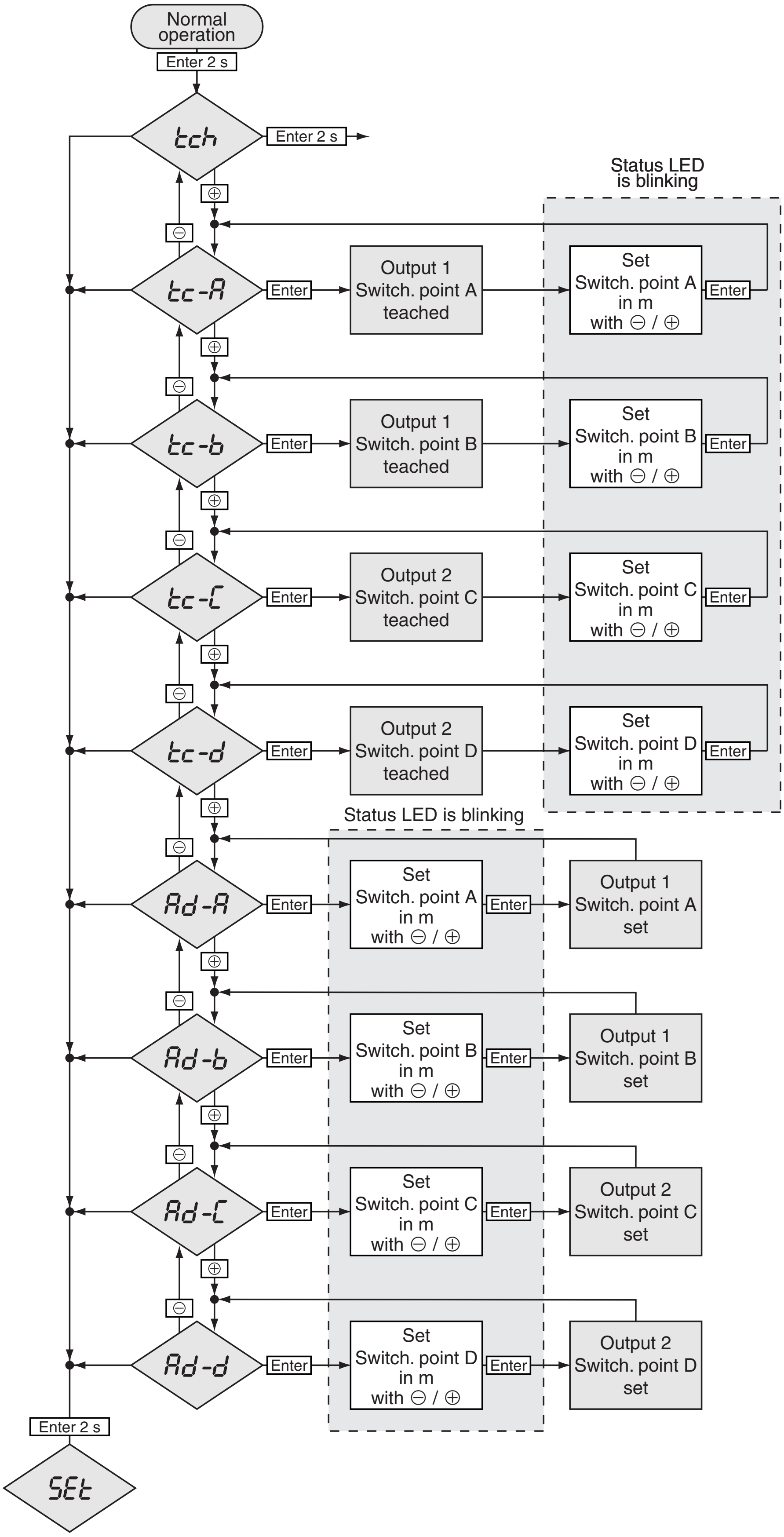
Teaching Switching point D [1.] Output 2 [2.]

Setting of Switching point A Output 1 0 ... 2.5 m in 1 cm increments

Setting of Switching point B [1.] Output 1 0 ... 2.5 m in 1 cm increments

Setting of Switching point C Output 2 [2.] 0 ... 2.5 m in 1 cm increments

Setting of Switching point D [1.] Output 2 [2.] 0 ... 2.5 m in 1 cm increments



1.) In the 2-point window evaluation mode, two switching points (A/B and C/D) can be set for each output. In the foreground and background suppression modes, only one switching point (A and C) can be set for each output. Then, only these switching points, A and C, can be set in the TEACH menu path. B and D switching points are not available.

2.) If connector pin 2 is set as an input, only the switching points for Output 1 can be set.

SET menu

Menu items

Function Output 1

Function Output 2 [1.)]

Switch-on delay [2.) 5.)] **Output 1**
0 ... 9999 ms
in 1 ms decrements

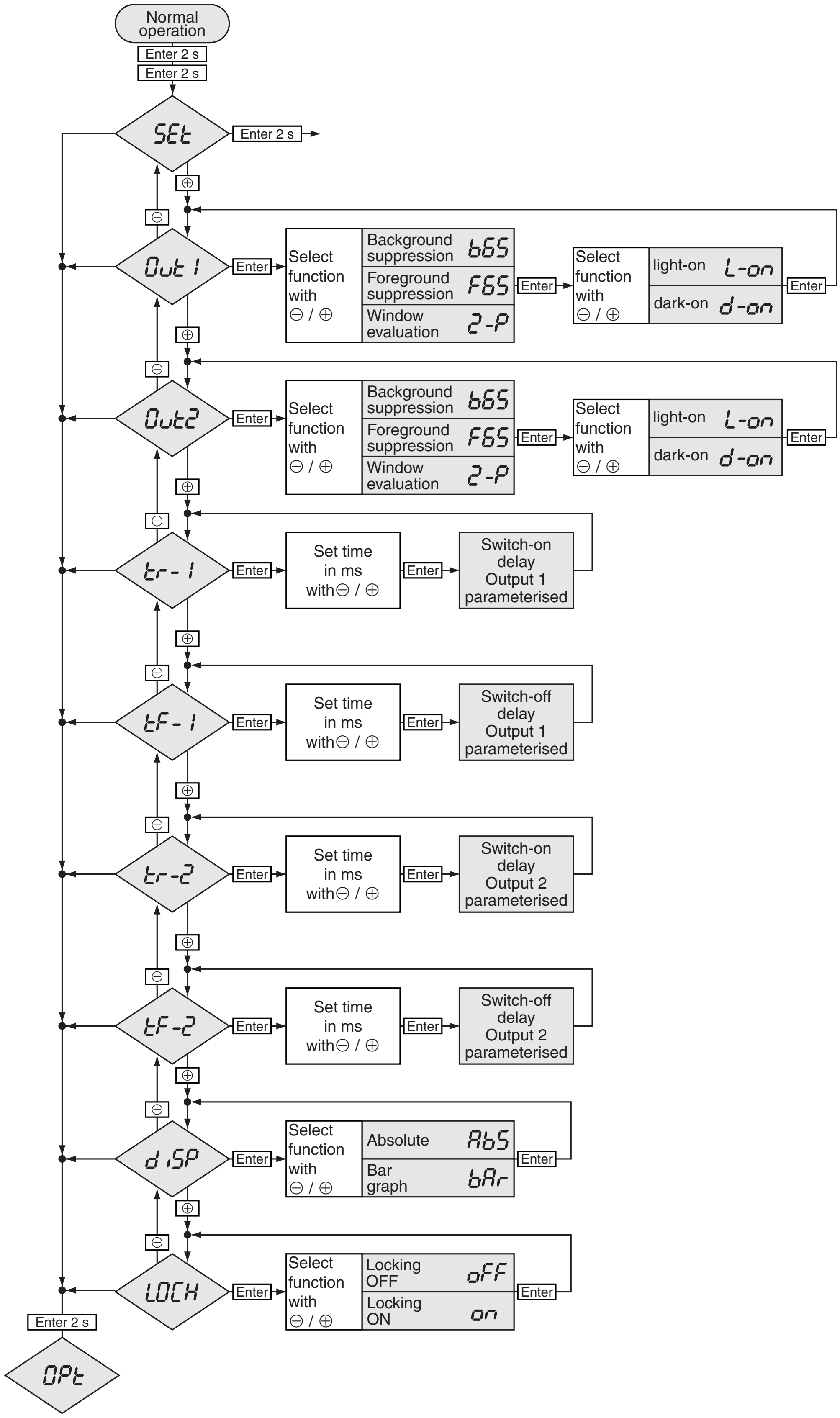
Switch-off delay [2.) 3.)] **Output 1**
0 ... 9999 ms
in 1 ms decrements

Switch-on delay [2.) 5.)] **Output 2** [1.)]
0 ... 9999 ms
in 1 ms decrements

Switch-off delay [2.) 3.)] **Output 2** [1.)]
0 ... 9999 ms
in 1 ms decrements

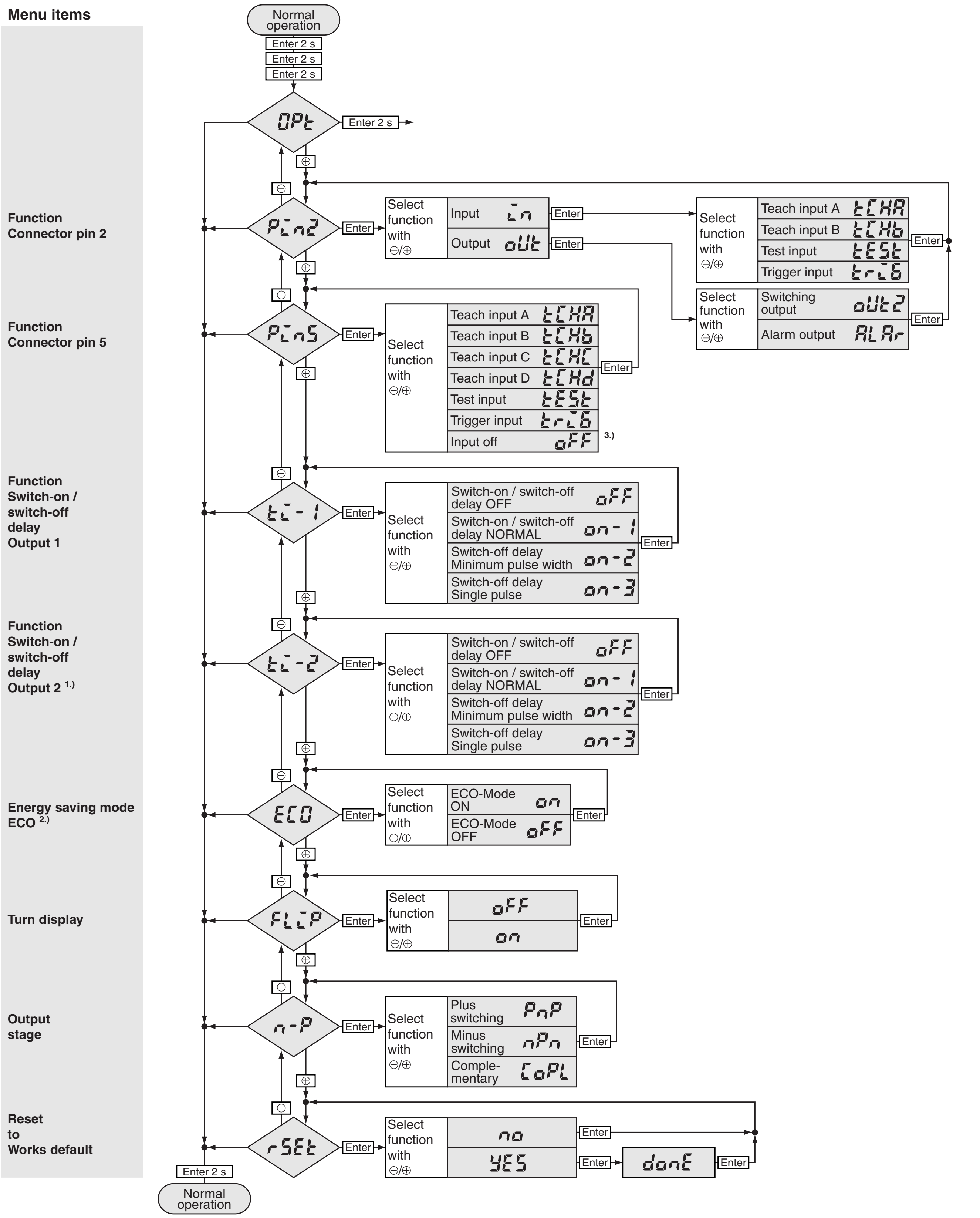
Distance display

Key lock [4.)]



1.) If connector pin 2 is set as an input, the switch-on/off delay function canonly be set for Output 1. A second switching output is not available.
2.) If the switch-on/off delay is off in the OPTIONS menu path, the switch-on/off delay parameters do not appear in the SET menu path.
3.) The outputs behave differently depending on the switch-off delay functionthat is set in the OPTIONS menu path.
4.) The key lock becomes active again when no keys have been pressed for approx. 5 minutes.
The key lock can be temporarily cancelled by pressing the ⊕ and ⊖ keys for 4 seconds.
5.) The On-delay-setting tr-1 or tr-2 are only available if the switch-on/off de-lay in the OPTIONS menu path is set to on-1.

OPTIONS menu



1.) If connector pin 2 is set as an input, the type of switch-on/off delay option can only be set for Output 1.
2.) If the ECO energy saving mode is on, the display is switched off if no keys are pressed for about 5 minutes. The display is switched on again when any key is pressed.
3.) Firmware 1.10 and higher

SET menu E3NT-R

Menu items

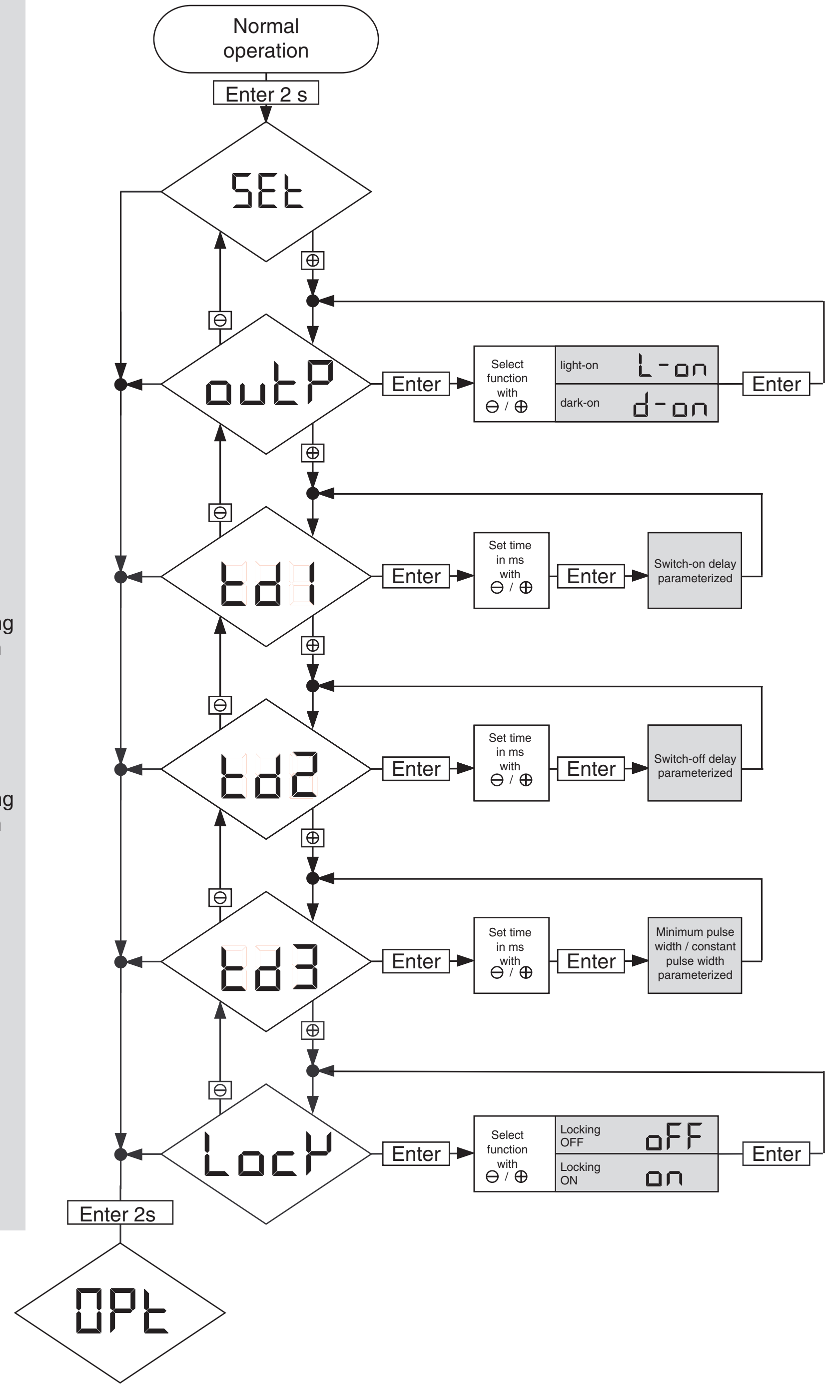
Function of switching output

Switch-on delay of switching output in ms (regarding to setting of delay function in OPT menu)

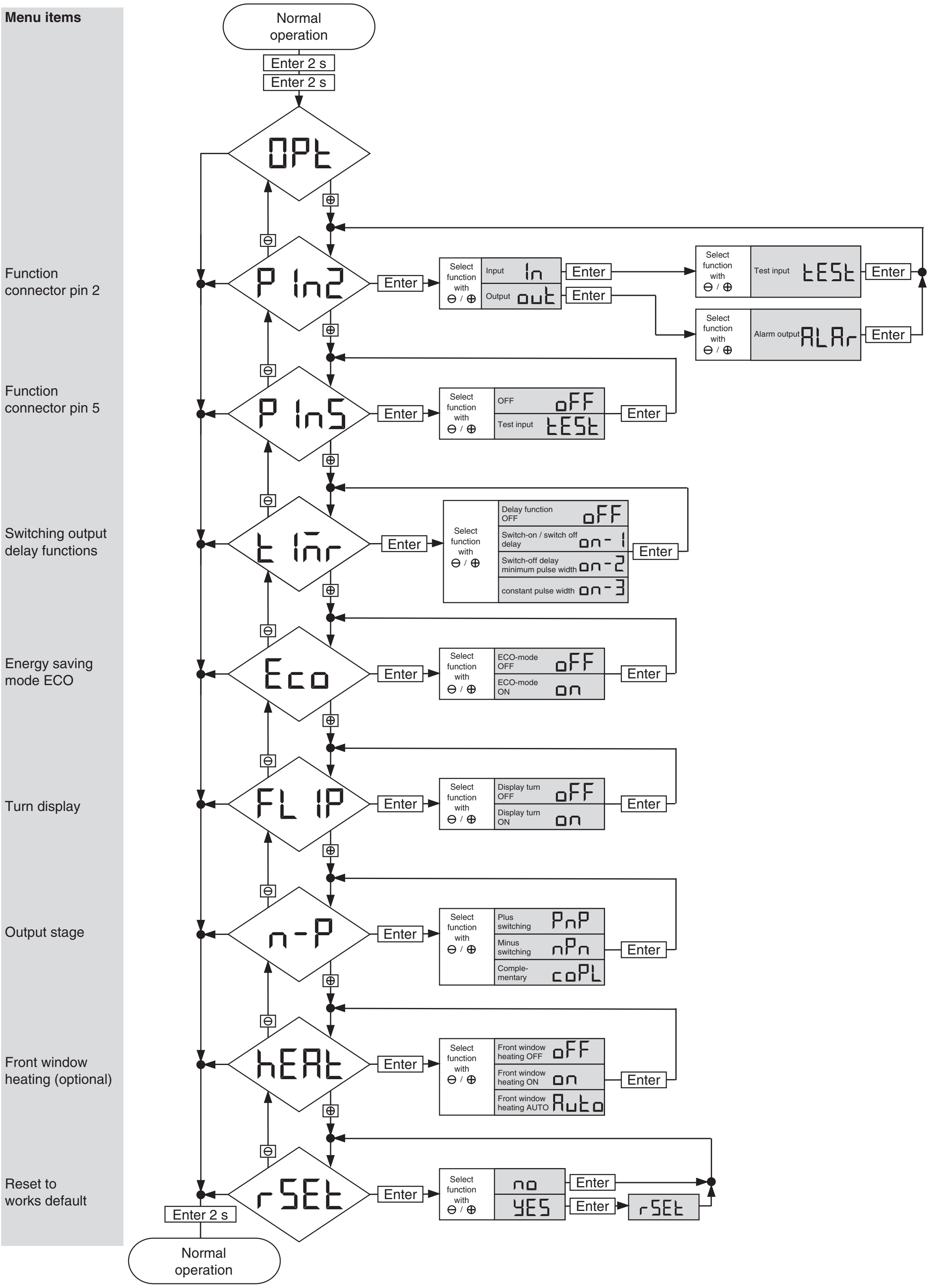
Switch-on delay of switching output in ms (regarding to setting of delay function in OPT menu)

minimum pulse width / constant pulse width of switching output in ms (regarding to setting of delay function in OPT menu)

Key lock



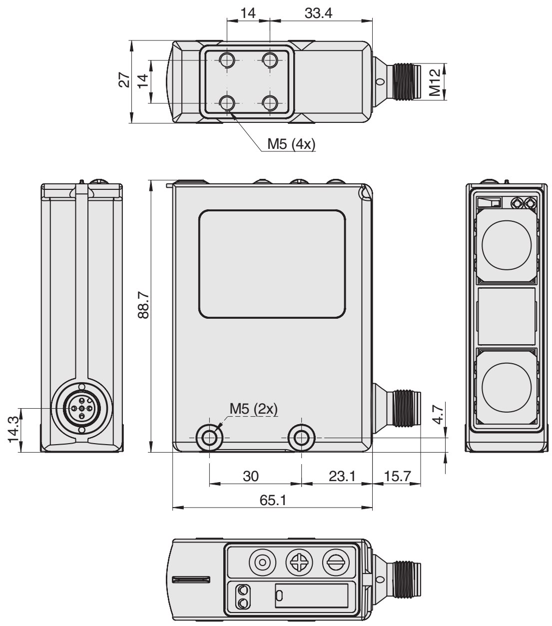
OPTIONS menu E3NT-R



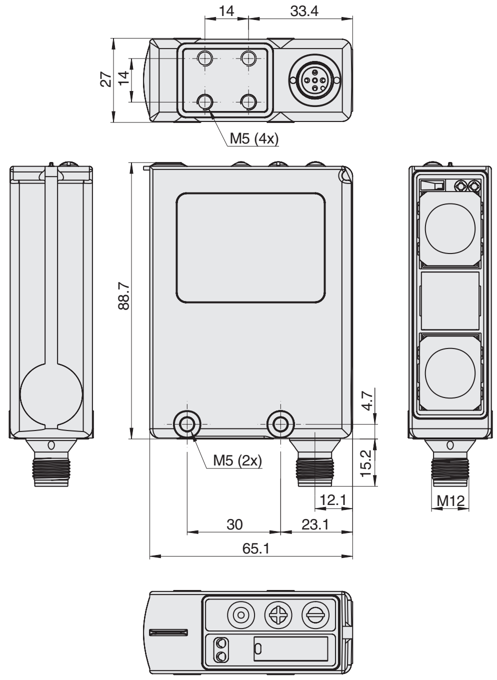
Dimensions

Sensors

E3NT-L17
E3NT-L27
E3NT-LH17



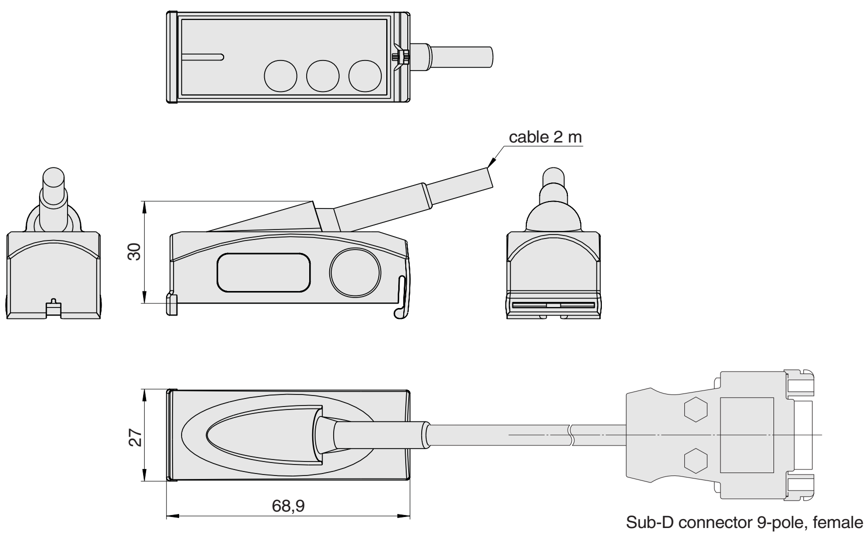
E3NT-L37
E3NT-L47
E3NT-LH37



Accessoires (order separately)

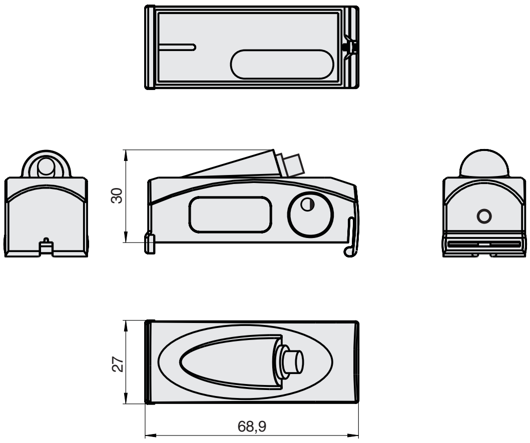
Optical data link

E3NT-AL232 2m



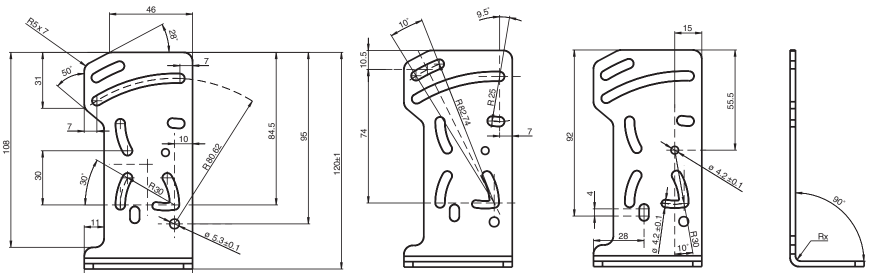
Laser alignment aid

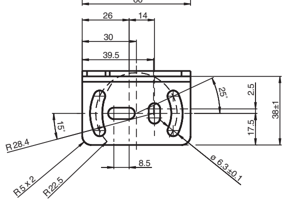
E3NT-AP1

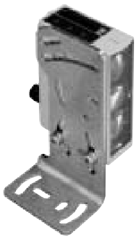


Universal mounting bracket

E39-EL1



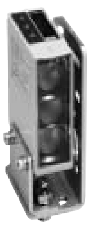




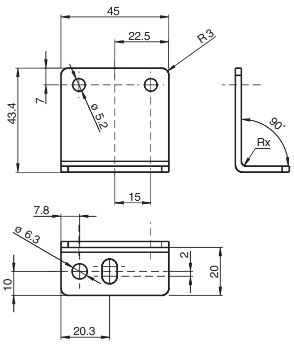
material: stainless steel 1.4305

Adapter bracket

E39-EL2

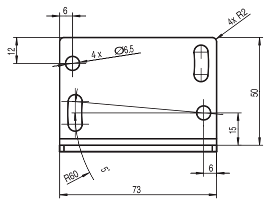


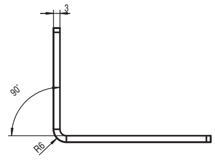
material: stainless steel 1.4305

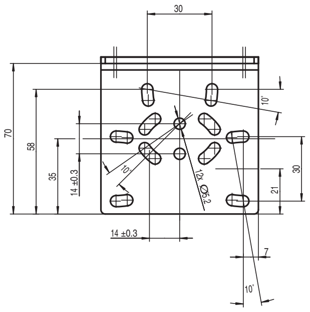


Replacement bracket for E3N with E3NT

E39-EL3







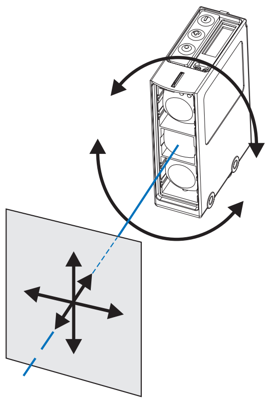
material: stainless steel 1.4305

Precautions

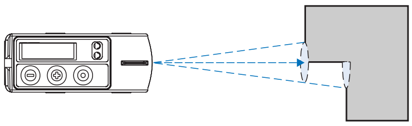
Mounting Directions

Sensor assembly

Contrary to sensors with single triangulation, E3NT with double triangulation, allows the measured object's direction of motion to be in all three directions. Thus, the rotatory position of the sensor about its optical axis can be chosen freely.



If the light spot is not completely on the same plane as the target object (minimum object size) the distance is not determined and malfunction can occur. If necessary a trigger signal or timer function has to be applied.

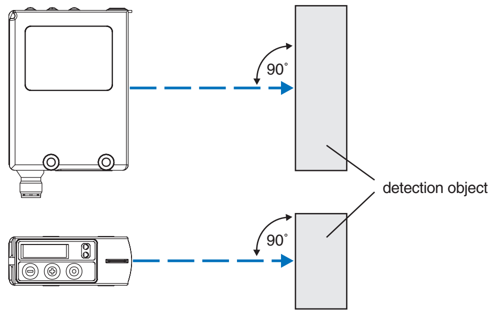


The sensor must be fitted so that:

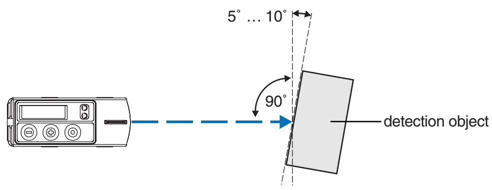
- It is correctly aligned before it is adjusted
- It is protected as far as possible against vibration and shock
- It is protected as far as possible against extraneous incident light
- It is protected as far as possible against damage and soiling
- Electrical connection is possible
- It is as accessible as far as possible for maintenance work
- Operation of the push buttons is possible
- The display is visible.

Sensor's assembly direction

As far as possible, the sensor's optical surface should be aligned parallel to the surface of the measured object.



If the measured object has a glossy, reflecting surface, the sensor's optical system should be tilted by 5 … 10° in relation to the surface of the measured object.



If there is a reflecting surface in parallel with the sensor's optical axis, this might lead to unstable switching states. Therefore, reflecting objects within the sensor's optical axis should be avoided.
If this should not be possible, the reflecting surface should not be parallel to the sensor's optical axis, but should be rotated by at least 10°.
Mirror-like objects can cause malfunction inside and outside the sensing range. Avoid mirror-like objects in or close to the optical axis.

Inspection and Maintenance

Cleaning

Do not use any scratching or abrasive cleaning materials. The protective pane of the optical system might get damaged.
The sensor requires no maintenance.
Remove dirt build up from the optical system and the display at regular intervals only with a soft, non abrasive fabric. Residual dirt may have influence on the switching point and display accuracy.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Oil-resistive, compact photoelectric sensor in metal housing

E3S-C

Features

Meets IP67/IP67G (oil tight) and NEMA 6P standards water/oil resistance

E3S-C meets the IP67 requirements of the IEC standards and 6P of the NEMA standards. E3S-C can be used worry-free in automotive assembly lines and other production lines where oil vapor exists. It can also be applied to food processing lines because it resists hydrogen peroxide, detergent and potassium hydroxide.

High shock resistance of 1,000 m/s^2

The industry's top-class photoelectric sensor features shock resistance of 1,000 m/s^2, which is as high as that of a proximity sensor at rated values, and vibration resistance of as high as 10 to 2,000 Hz.

Lineup of M12 metal connector joint type models

Lineup of water/oil/shock-resistant M12 metal connector joint type models are available. This series ensures ease of sensor replacement during maintenance.

NPN/PNP output selector

The operation panel has the NPN/PNP output selector. You need not prepare two NPN and PNP models for export. You need not worry about malfunctions due to noise, either.

Mutual interference prevention enhanced (Retroreflective, diffuse reflective models)

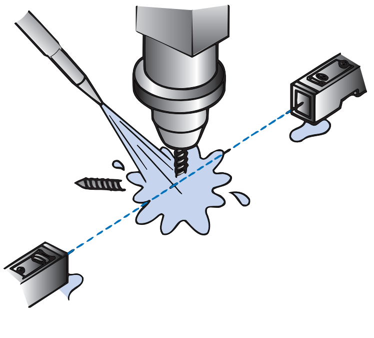
Fuzzy inference is introduced into the mutual interference prevention for the first time in the industry. This prevents a malfunction due to mutual interference, enabling two sensors to be mounted closely side by side.

Easy optical axis alignment

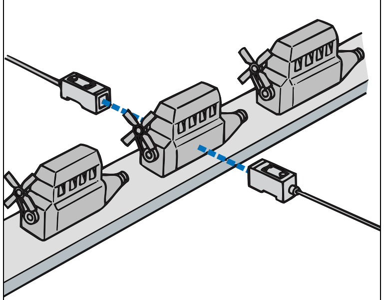
OMRON's original "automatic position compensation system" minimizes misalignment of mechanical and optical axes to merely ±2°. The optical axis is aligned perfectly by only installing the sensor.

Application

Drill breakage detection



Detection of engine block



IP67 ensures a worry-free use in oil mist environment.

Ordering Information

Sensors

Red light / Infrared light

Sensor type	Shape	Connection method	Sensing distance	Model
Through-beam	Horizontal Model	Pre-wired	30m	E3S-CT11
		Junction connector		E3S-CT11-M1J
		Plug-in connector		E3S-CT16
	Vertical Model	Pre-wired		E3S-CT61
		Junction connector		E3S-CT61-M1J
		Plug-in connector		E3S-CT66
Retroreflective Models	Horizontal Model	Pre-wired	3m	E3S-CR11
		Junction connector		E3S-CR11-M1J
		Plug-in connector		E3S-CR16
	Vertical Model	Pre-wired		E3S-CR61
		Junction connector		E3S-CR61-M1J
		Plug-in connector		E3S-CR66
Diffuse-reflective	Horizontal Model	Pre-wired	700mm	E3S-CD11
			2m	E3S-CD12
		Junction connector	700mm	E3S-CD11-M1J
			2m	E3S-CD12-M1J
		Plug-in connector	700mm	E3S-CD16
			2m	E3S-CD17
	Vertical Model	Pre-wired	700mm	E3S-CD61
			2m	E3S-CD62
		Junction connector	700mm	E3S-CD61-M1J
			2m	E3S-CD62-M1J
		Plug-in connector	700mm	E3S-CD66
			2m	E3S-CD67

Accessories (Order Separately)

Slits

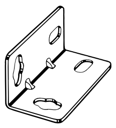
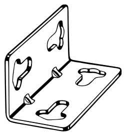
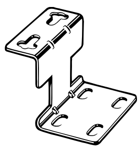
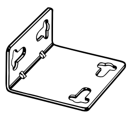
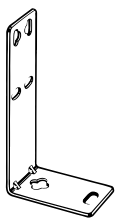
Slit width	Sensing distance	Minimum sensing object (typical)	Model	Quantity	Remarks
Width 0.5 mmx11 mm	1.8 m	0.5 mm dia.	E39-S61	1 each for emitter and receiver (total of 8 pcs.)	(Plug-in type long slit) Can be used with through-beam E3S-CT□1 (-M1J).
Width 1 mmx11 mm	3.5 m	1 mm dia.			
Width 2 mmx11 mm	7 m	2 mm dia.			
Width 4 mmx11 mm	15 m	2.6 mm dia.			

Reflectors

Name	Sensing distance (typical)	Model	Quantity	Remarks
Reflectors	3 m (rated value)	E39-R1	1	Attached to the Retroreflective E3S-CR□1 (-M1J).
	4 m	E39-R2	1	---
Small reflector	1.5 m	E39-R3	1	---
	750 mm	E39-R4	1	---
Tape Reflector	700 mm (50 mm) *	E39-RS1	1 pc.	The M.S.R. function is available.
	1,100 mm (100 mm) *	E39-RS2	1 pc.	
	1,400 mm (100 mm) *	E39-RS3	1 pc.	

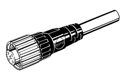
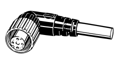
* Values in parentheses indicate the minimum required distance between the sensor and reflector.
Note: 1 . When the reflector used is other than the supplied one, set the sensing distance to about 0.7 times of the typical example as a guideline.

Mounting Brackets

Shape	Model	Quantity	Remarks
	E39-L102	1	Attached to the horizontal model.
	E39-L103	1	Attached to the vertical model.
	E39-L85	1	Mounting bracket designed to switch from E3S-□□□□□42, 44 to the vertical model of E3S-C.
	E39-L86	1	Mounting bracket designed to switch from E3S-□□□□□43 to the vertical model of E3S-C.
	E39-L87	1	---

Note: If a through-beam model is used, order two Mounting Brackets for the emitter and receiver respectively.

Sensor I/O Connectors

Cable	Shape	Cable length		Model
Standard cable	Straight 	2 m	3-wire type	XS2F-D421-DC0-A
		5 m		XS2F-D421-GC0-A
	L-shaped 	2 m		XS2F-D422-DC0-A
		5 m		XS2F-D422-GC0-A

Rating/performance

Sensor type / Item / Model	Through-beam	Retroreflective model (with M.S.R. function)	Diffuse-reflective	
	Horizontal E3S-CT11 (-M1J) Vertical E3S-CT61 (-M1J)	Horizontal E3S-CR11 (-M1J) Vertical E3S-CR61 (-M1J)	Horizontal E3S-CD11 (-M1J) Vertical E3S-CD61 (-M1J)	Horizontal E3S-CD12 (-M1J) Vertical E3S-CD62 (-M1J)
Sensing distance	30 m	3 m (When using the E39-R1)	700 mm (White paper 300 x 300 mm)	2 m (White paper 300 x 300 mm)
Standard sensing object	Opaque, 15dia. min.	Opaque: 75 mm dia. min.	---	
Differential distance	---		20% max. of sensing distance	
Directional angle	Both emitter and receiver: 3° to 15°	3° to 10°	---	
Light source (wave length)	Infrared LED (880 nm)	Red LED (700 nm)	Infrared LED (880 nm)	
Supply voltage	10 to 30 VDC [ripple (p-p) 10% included]			
Current consumption	Both emitter and receiver: 25 mA max.	40 mA max.		
Control output	Load supply voltage 30 VDC max., load current 100 mA max. (residual voltage NPN output: 1.2 V max., PNP output: 2.0 V max.) Open collector output type (NPN/PNP switch selectable) Light-ON/Dark-ON switch selectable			
Protective circuits	Reverse polarity protection, output short-circuit protection	Reverse polarity protection, output short-circuit protection, mutual interference prevention		
Response time	Operation or reset: 1 ms max.			Operation/reset: 2 ms max. each
Sensitivity adjustment	Single-turn adjustment		2-turn endless adjuster (with indicator)	
Ambient illuminance	(on Receiver lens) Incandescent lamp: 5,000 lux max. Sunlight: 10,000 lux max.			
Ambient temperature	Operating: -25°C to 55°C, Storage: -40°C to 70°C (with no icing or condensation)			
Ambient humidity	Operating: 35% to 85%RH, Storage: 35% to 95%RH (with no condensation)			
Insulation resistance	20 M min. at 500 VDC			
Dielectric strength	1,000 VAC at 50/60 Hz 1 minute			
Vibration resistance	10 to 2,000 Hz double amplitude 1.5 mm or 300 m/s^2 for 0.5 h in each of X, Y, Z directions			
Shock resistance	1000 m/s^2 (approx.- l00G) 3 times each in X, Y, and Z directions			
Protective structure	IEC Standard IP67, NEMA 6P (limited to indoors use) *			
Connection method	Pre-wired (standard length: 2 m), Junction connector (standard length: 300 mm)			
Weight (Packed state)	About 270 g (pre-wired type) About 230 g (M12 connector joint type)	About 160 g (pre-wired type) About 130 g (M12 connector joint type)	About 150 g (pre-wired type) About 110 g (M12 connector joint type)	
Material: Case	Zinc diecast			
Material: Operation panel cover	Polyethyl sulfon			
Material: Lens	Acrylics			
Material: Mounting Brackets	Stainless steel (SUS304)			
Accessories	Mounting bracket (with screws), adjusting screwdriver, instruction manual, reflector (Retroreflective model only)			

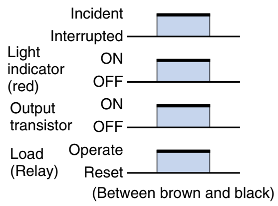
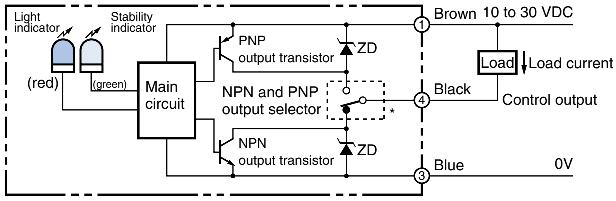
* NEMA (National Electrical Manufacturers Association) Standards

Output Circuit Diagram

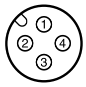
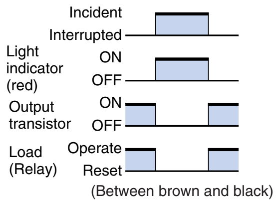
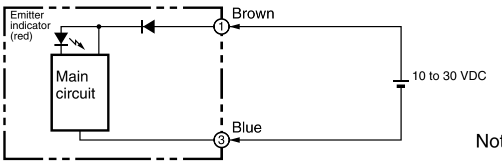
NPN output

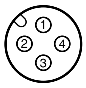
<table>
<tr><th>Model</th><th>Operating status of output transistor</th><th>Timing chart</th><th>Mode selec-tion switch</th><th>Output circuit</th></tr>
<tr><td rowspan="3">E3S-CT11(-M1J)
E3S-CT61(-M1J)

E3S-CR11(-M1J)
E3S-CR61(-M1J)

E3S-CD11(-M1J)
E3S-CD12(-M1J)
E3S-CD61(-M1J)
E3S-CD62(-M1J)</td><td>Light ON</td><td>
</td><td>L ON
(LIGHT ON)</td><td rowspan="2">Receiver (Through-beam Models)
Retroreflective, Diffuse Reflective, and Limited Reflective Models


* Note: Set the NPN and PNP output selector to NPN.

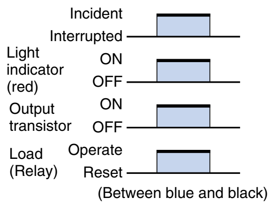
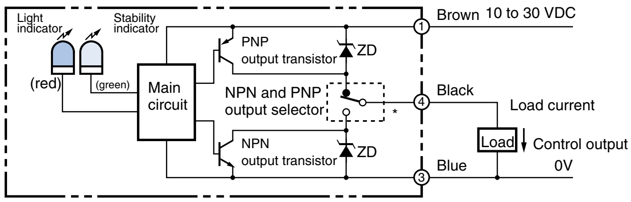
Connector Pin Arrangement

Note: Terminal 2 is not used.</td></tr>
<tr><td>Dark ON</td><td>
</td><td>D ON
(DARK ON)</td></tr>
<tr><td colspan="4">Emitter (Through-beam Models)


Connector Pin Arrangement

Note: Terminal 2 and 4 are not used.</td></tr>
</table>

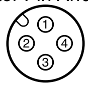
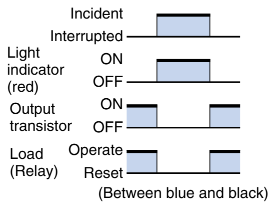
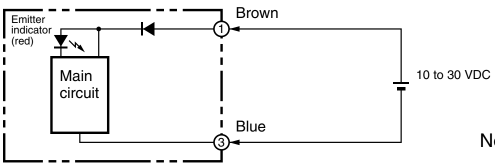
PNP output

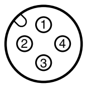
<table>
<tr><th>Model</th><th>Operating status of output transistor</th><th>Timing chart</th><th>Mode selec-tion switch</th><th>Output circuit</th></tr>
<tr><td rowspan="3">E3S-CT11(-M1J)
E3S-CT61(-M1J)

E3S-CR11(-M1J)
E3S-CR61(-M1J)

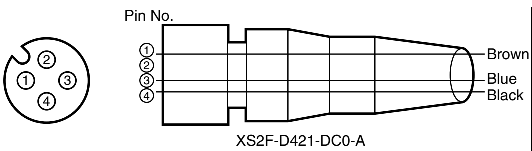
E3S-CD11(-M1J)
E3S-CD12(-M1J)
E3S-CD61(-M1J)
E3S-CD62(-M1J)</td><td>Light ON</td><td>
</td><td>L ON
(LIGHT ON)</td><td rowspan="2">Receiver (Through-beam Models)
Retroreflective, Diffuse Reflective, and Limited Reflective Models


* Note: Set the NPN and PNP output selector to PNP.

Connector Pin Arrangement

Note: Terminal 2 is not used.</td></tr>
<tr><td>Dark ON</td><td>
</td><td>D ON
(DARK ON)</td></tr>
<tr><td colspan="4">Emitter (Through-beam Models)


Connector Pin Arrangement

Note: Terminal 2 and 4 are not used.</td></tr>
</table>

Connectors (Sensor I/O connectors)



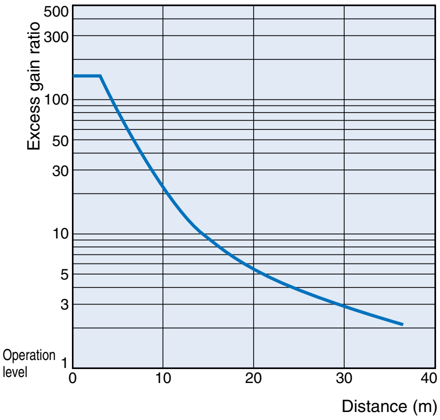
<table>
<tr><th>Class</th><th>Wire, outer jacket color</th><th>Connector pin No.</th><th>Application</th></tr>
<tr><td rowspan="4">For DC</td><td>Brown</td><td>1</td><td>+V</td></tr>
<tr><td>---</td><td>2</td><td>---</td></tr>
<tr><td>Blue</td><td>3</td><td>0V</td></tr>
<tr><td>Black</td><td>4</td><td>Output</td></tr>
</table>

Note: Pin 2 is open.

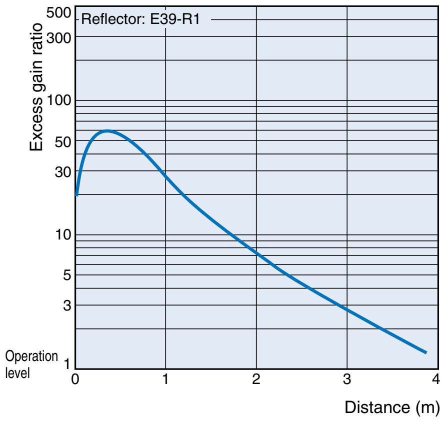
Characteristic data (typical)

Operating Range

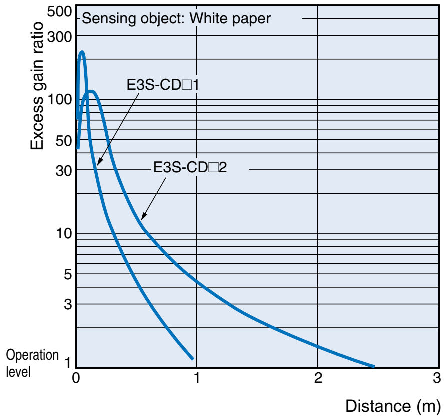
Through-beam
E3S-CT□1(-M1J)



Retroreflective Models
E3S-CR□1 (-M1J) + E39-R1 (supplied reflector)

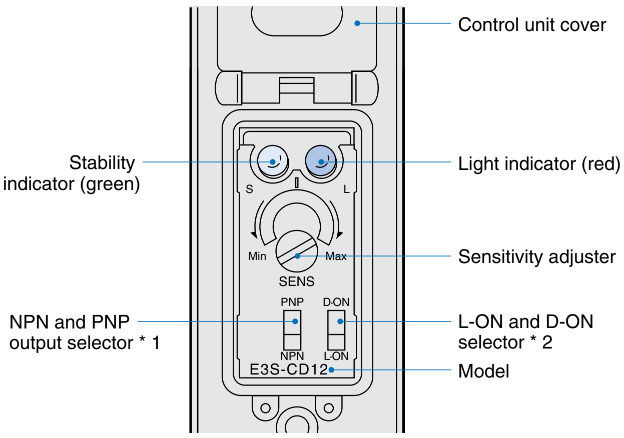


Diffuse-reflective
E3S-CD□□(-M1J)

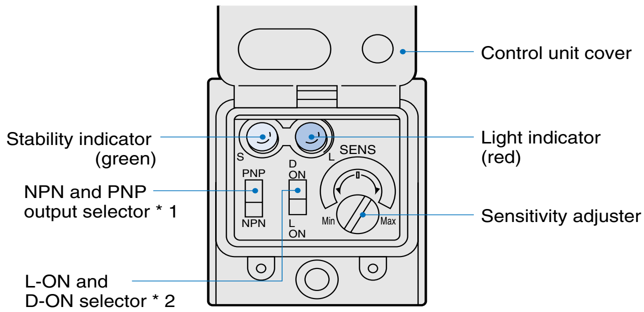


Nomenclature:

(Horizontal type)



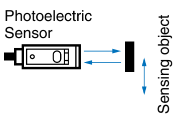
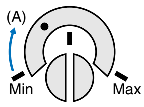
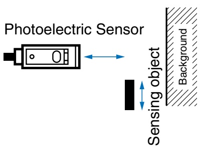
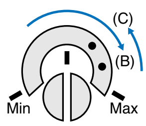
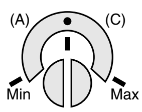
(Vertical type)



*1. The output transistor can be selected with the NPN/PNP output selector.
*2. The operation mode can be selected with the L/OND/ON selector.
Note: The through-beam and retroreflective models are different in sensitivity adjuster shape.

Operation

Sensitivity adjustment (diffuse reflective model, light-ON)

Sequence	Detection state	Sensitivity adjuster	Indicator state	Adjustment procedure
① Point A			ON→OFF Stability indicator (green); OFF→ON Light indicator (red)	Place a sensing object in the predetermined position, turn the sensitivity adjuster clockwise (increase sensitivity) until the incident indicator (red) is turned ON, and define this position as (A).
② Point B			ON→OFF Stability indicator (green); ON→OFF Light indicator (red)	Remove the sensing object, turn the sensitivity adjuster further clockwise until the incident indicator (red) is turned ON by a background object, and define this position as (B). Turn the sensitivity adjuster counterclockwise (decrease sensitivity) from (B) until the incident indicator (red) is turned OFF, and define this position as (C). When there is no background object, define the maximum adjuster position (Max) as (C).
③ Setting	---		ON Stability indicator (green); ON↔OFF Light indicator (red)	Set the adjuster in the middle of positions (A) and (C) (optimum sensitivity setting). Also make sure that the stability indicator (green) is turned ON when there is an object and when there is no object. When the indicator is not turned ON, recheck the detection method since there is a little allowance.

Unlike the conventional models, the E3S-C scarcely has sensitivity variations between products. Therefore, you need to make the above adjustment on only one diffuse reflective model of E3S-CD that will be used for detection under the same conditions, and match the indicator points of the other diffuse reflective models of E3S-CD with the above adjusted one. (You need not match the sensitivity of each sensor.)

Precautions

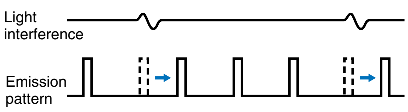
Correct Use

Design

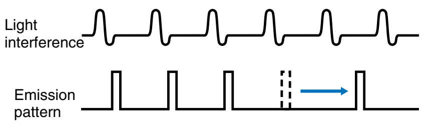
Fuzzy mutual interference prevention

When reflective photoelectric sensors are installed side by side, one sensor may receive the light from the other sensor, which may disturb the incident signal, causing a malfunction. The fuzzy mutual interference prevention monitors interfering light for a predetermined period of time before light is emitted, and imports the interfering light level and incident frequencies as data. Using these values, fuzzy inference is made to find the risk of malfunction to control the light emitting timing, reducing the risk.

(When risk is low)
Light is emitted after interfering light is gone.



(When risk is high)
Light is emitted after shifting to a gap of interfering light.



Wiring Considerations

Cable

• An oil-resistance cable is used to ensure oil resistance.
• The bending radius should be 25 mm or more.

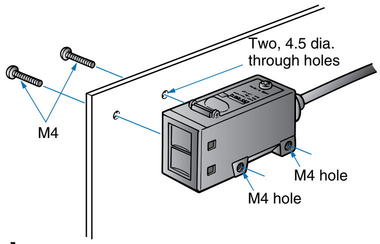
Installation

Sensor installation

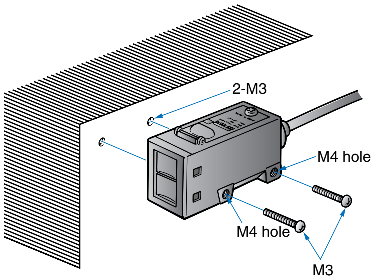
• Note that during the E35-C installation, hammering it will damage the water resistance function.
• Use an M4 screw, tightened to a torque of no more than 1.18 Nm.

(When using the mounting bracket)
• To set the sensor on the mechanical axis, use the optical axis locking holes.
• When the sensor cannot be set on the mechanical axis, move the E3S-C vertically and/or horizontally and set it in the center of the area where the incident indicator is turned ON. Make sure that the stability indicator is ON.

(Direct installation)
Install the E3S-C as shown below.
[M4 screwing]

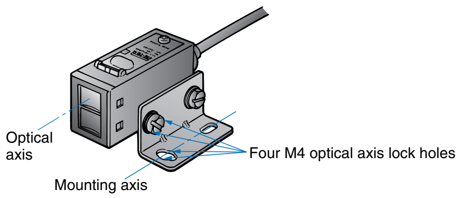


[M3 screwing]



Optical axis adjustment

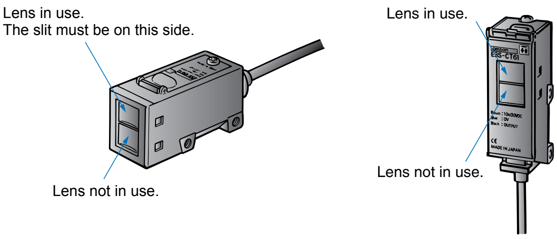
(Optical axis locking holes)
By fitting screws into the optical axis locking holes, the mounting bracket is set onto the mounting shaft of the mounting bracket.
For adjustment



Optical axis position of through-beam model

Unlike the conventional product, the through-beam model has two lenses, but the one actually used is as shown below. When fitting the slit, use it after matching the slit hole with the used lens.

(Horizontal model) (Vertical model)



Water Resistance

To ensure water resistance, tighten the operation panel cover screws to 0.34 Nm to 0.54 Nm torque.

Miscellaneous

Oil resistance/chemical resistance

- Though E3S-C has a high oil resistance, it may not be able to exhibit its performance depending on the oil type. Use oil in compliance with the following table.
- Regarding the oil resistance of E3S-C, it has passed tests on the oils given in the following table. Refer to the table for examining the oil to be used.

Testing oil classification	JIS classification	Product name	Dynamic viscosity (mm^2/s) at 40°C	PH
Lubricant	---	Velocity No. 3	2.02	---
Water-insoluble coolant	Class 2 No. 5	Daphne Cut	Not less than 10 to less than 50	
	Class 2 No. 11	Yushiron Oil No. 2ac	Less than 10	
Water-soluble coolant	Class W1 No. 1	Yushiroken EC50T-3	---	7 to 9.5
		Yushiron Lubic HWC68		7 to 9.9
	Class W1 No. 2	Gryton 1700D		7 to 9.2
	Class W2 No. 1	Yushiroken S50N		7 to 9.8

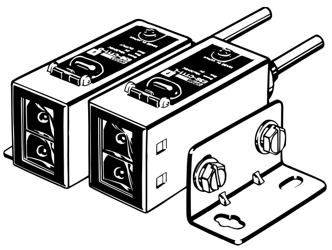
Note: 1 . The E3S-C was immersed in the oils in the above table at 50°C for 240 hours, and passed the test of 100-M or more insulation resistance.
2 . For use in the environment where the E3S-C is exposed to the oil other than those in the above table, use the dynamic viscosity and PH in the above table. Pre-examine the oils since the sensor may be affected by additives and like in the oils.

Dimensions (Unit: mm)

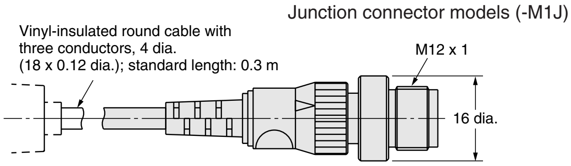
Sensors

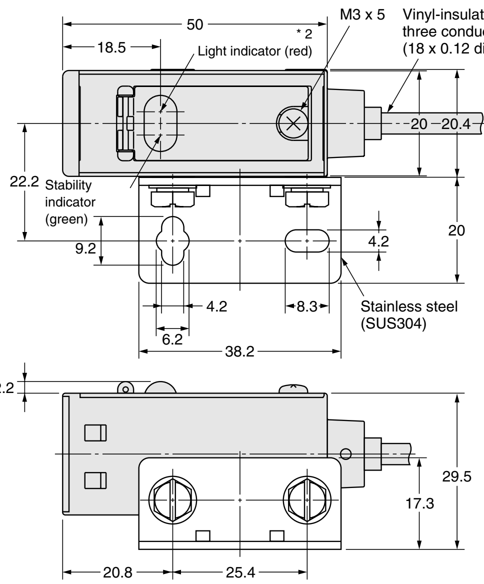
Through-beam model (horizontal model)

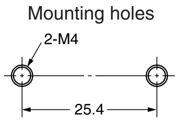
E3S-CT11(-M1J)

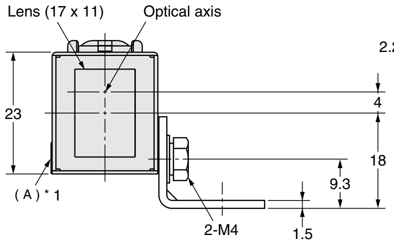


Emitter: E3S-CT□□-L
Receiver: E3S-CT□□-D





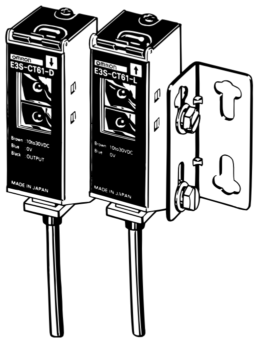




* Note: 1. Mounting bracket can be attached to side A.
2. The emitter for through-beam sensors have only the power supply indicator.
3. The cable for emitters for through-beam sensors is two-conductor, 4 dia. (27 x 12 dia.).

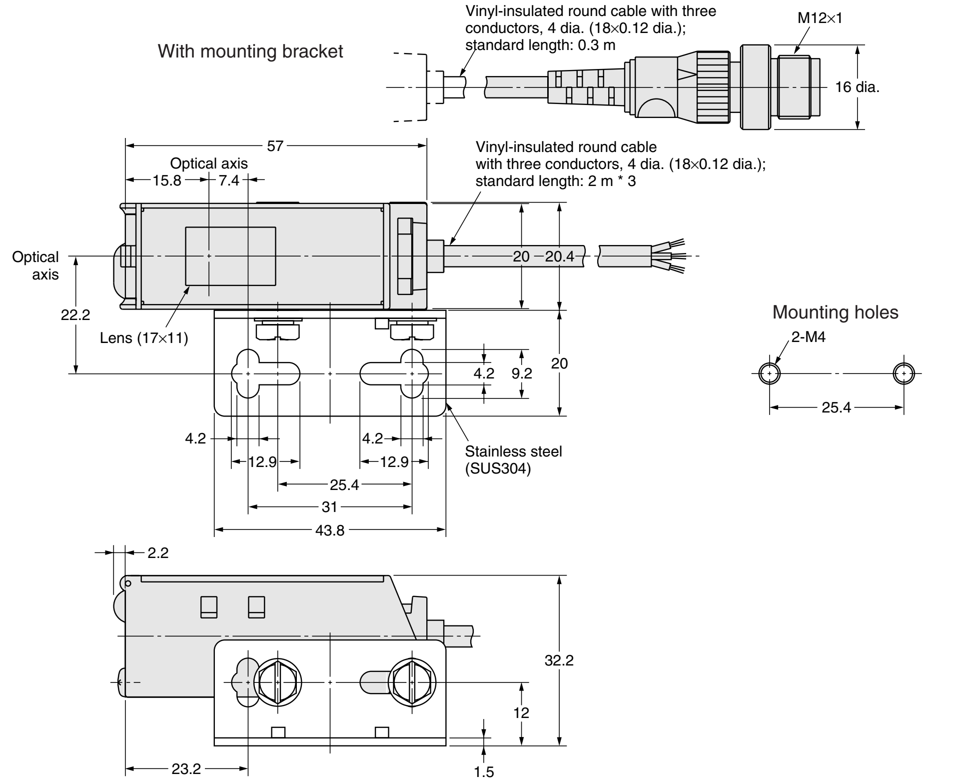
Through-beam model (vertical model)

E3S-CT61(-M1J)



With mounting bracket

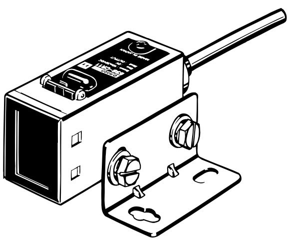
Junction connector models (-M1J)



* 1. Mounting bracket can be attached to side A.
* 2. The emitter for through-beam sensors have only the power supply indicator.
* 3. The cable for emitters for through-beam sensors is two-conductor, 4 dia. (27×12 dia.).

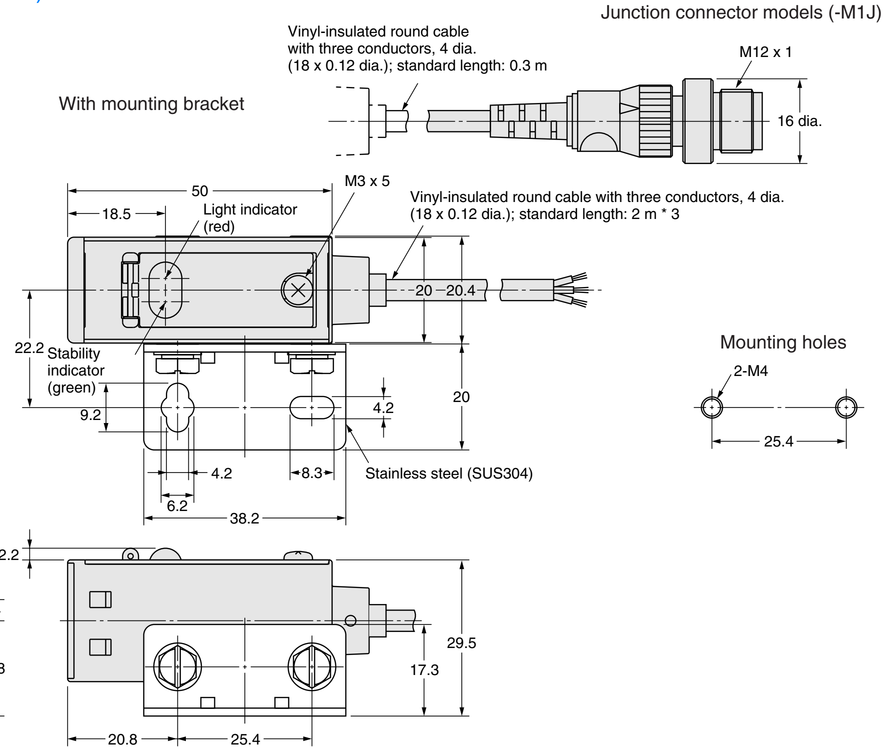
Retro/diffuse reflective model (horizontal model)

E3S-CR11(-M1J)
E3S-CD11(-M1J)
E3S-CD12(-M1J)



With mounting bracket

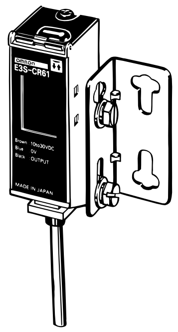
Junction connector models (-M1J)

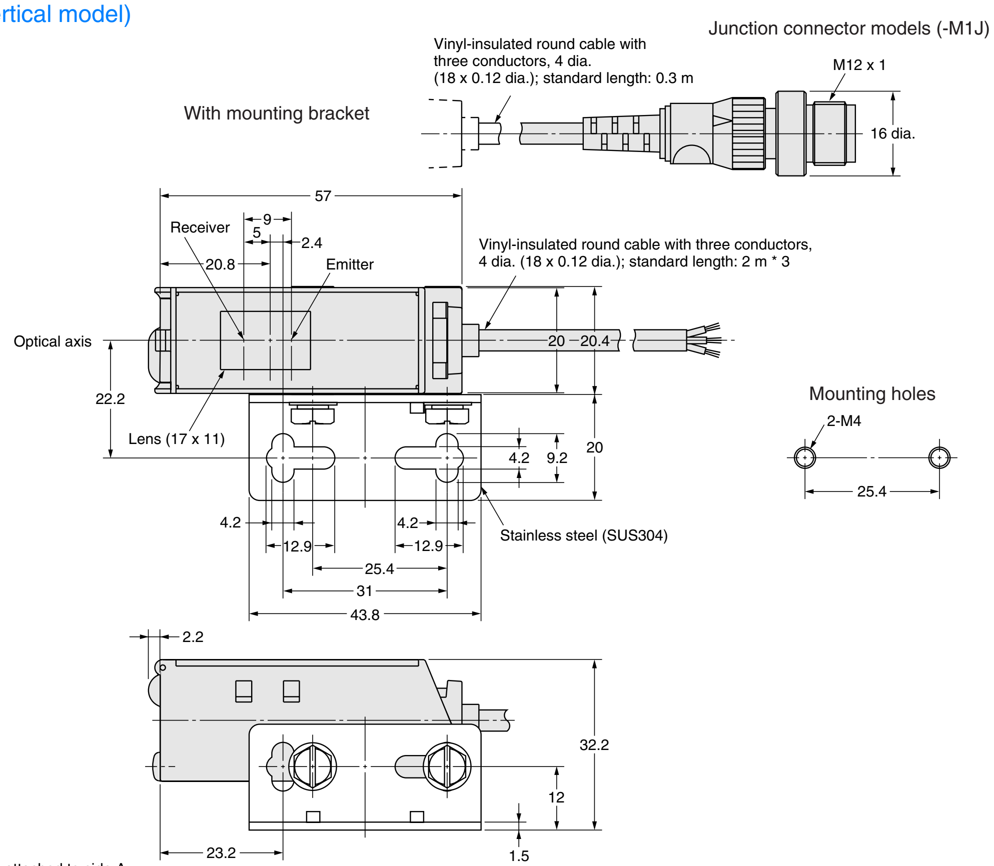


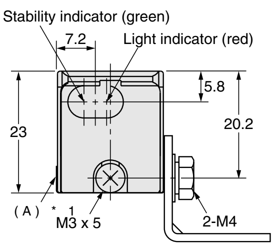
* Note: Mounting bracket can be attached to side A.

Retro/diffuse reflective model (vertical model)

E3S-CR61(-M1J)
E3S-CD61(-M1J)
E3S-CD62(-M1J)





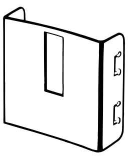


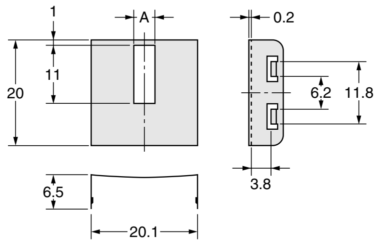
* Note: Mounting bracket can be attached to side A.

Accessories (Order Separately)

Plug-in type long slit (for through-beam model)

E39-S61





Dimension A (mm)	Material	Quantity
0.5	Stainless steel (SUS 304)	1 each for emitter and receiver (total of 8 pcs.)
1		
2		
4		

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Distance setting photoelectric sensor in metal housing

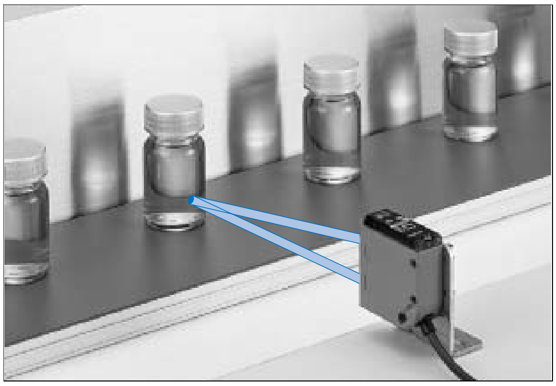
E3S-CL

- High water, oil and detergent resistance
- Minimal black/white error for highest reliability detecting different colored objects (E3S-CL1)

Features

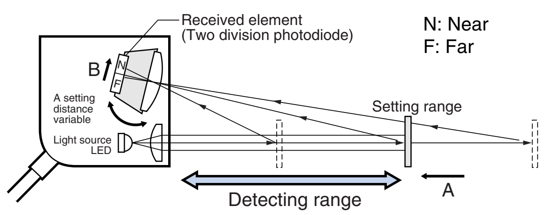
Eliminates Background Influences with a Hysteresis of Only 2% max. (E3S-CL1)

The hysteresis is the industry's minimum 2% max. (E3S-CL1). As a triangulation measuring is used, objects behind the setting distance cannot be detected. The sensor is insensitive to the influence of background objects of high reflectivity, and stable detects works on a conveyor from above. The hysteresis of the E3S-CL2 is 10% max. of the detecting distance (5% max. for white paper).

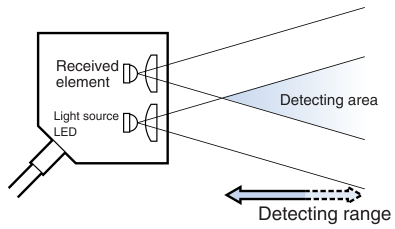


What Is Distance Setting? (Differences from other detecting system)

Distance-setting

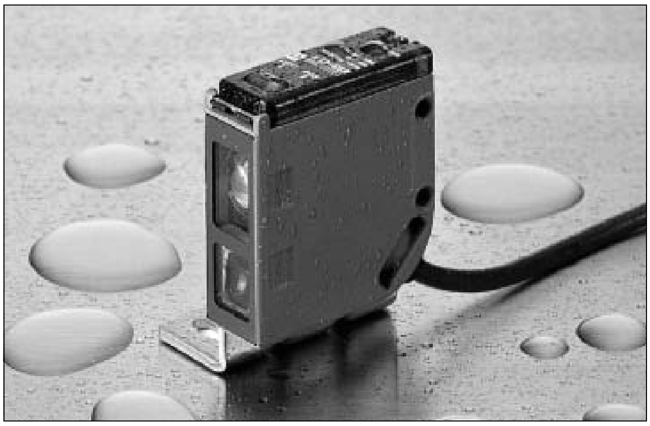
Features	When the sensing object moves in direction A, the center position of the reflected light moves in direction B. This is received by the 2-split photodiode and the place where the incident levels are the same on the N and F sides is defined as the setting distance. The object is detected by the incident circuit processing only when N F, and is not detected when N F. Therefore, detection is stable without being influenced by the work type and background objects.
Structure	

Diffuse-reflective

Features	Since the level of the reflected light is judged for detection , the sensing distance varies with the color, material and/or size of the work. A malfunction may occur if there is any object of high reflectivity in the background.
Structure	

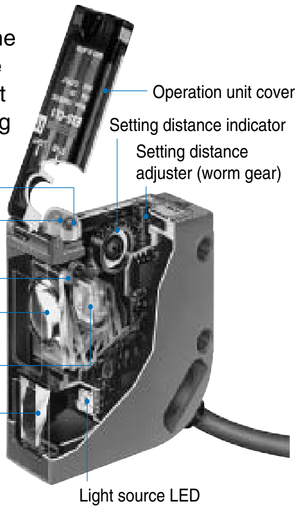
6-turn adjuster with indicator

- The 6-turn adjuster with indicator ensures ease of distance setting.
- Fine distance setting is possible.



Optical Technology of E3S-CL

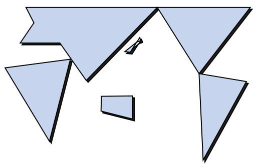
By turning the distance setting adjuster (worm gear), the rotation of the gear moves the cam to change the incident angle of the whole incident block (lens and photodiode), setting the distance.



- NPN/PNP Output Selectable.
- Light-ON/Dark-ON is also switch selectable.

Conforms to Applicable EN/IEC Standards

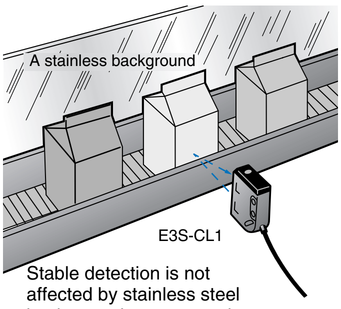
- The sensors satisfy the electrical safety (IEC947-5-2), noise resistance (IEC947-5-2, IEC801-2/3/4) and noise radiation restrictions (EN500 81-2, EN55011) required for photoelectric sensors.



Application

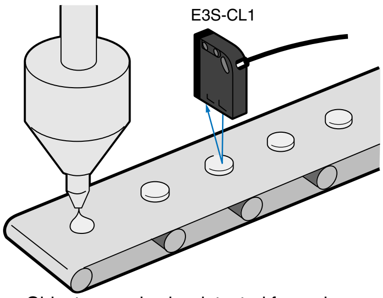
E3S-CL1

Detecting Milk Cartons



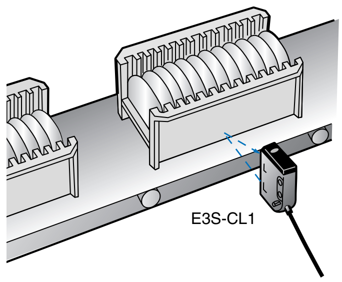
Stable detection is not affected by stainless steel background or carton colors.

Detecting Food Products on Conveyors



Objects can also be detected from above a conveyor.

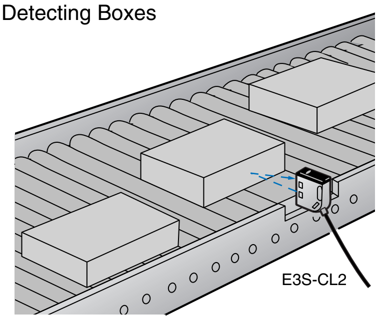
Detecting Wafer Cassettes



Easy distance setting with 6-turn adjustment and indicator.

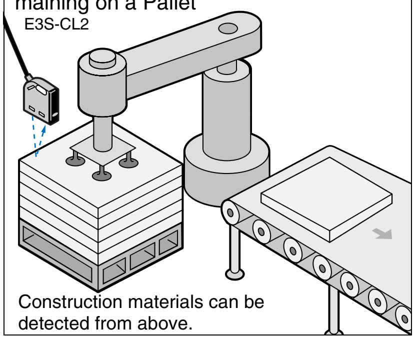
E3S-CL2

Detecting Boxes



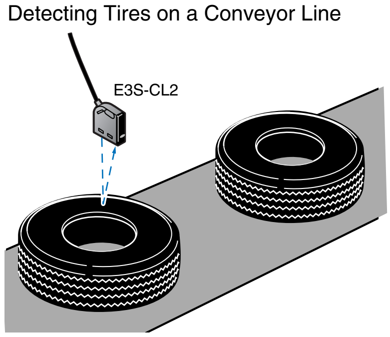
Stable detecting boxes regardless of box position.

Detecting Construction Materials (Boards) maining on a Pallet



Construction materials can be detected from above.

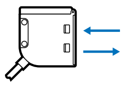
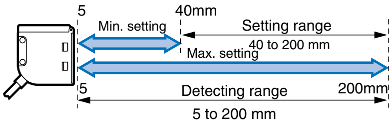
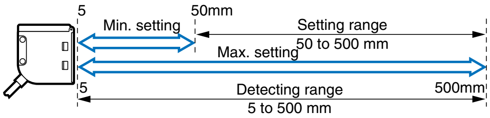
Detecting Tires on a Conveyor Line



Stable detecting black objects such as tires.

Ordering Information

Red light / Infrared light

Shape	Sensing/Setting range	Model
		E3S-CL1
		E3S-CL2

Rating/performance

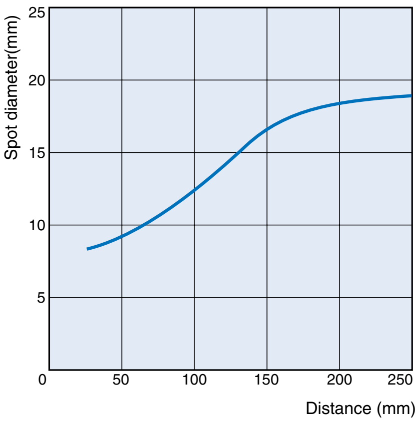
Sensing method / Item / Model		Distance-setting	
		E3S-CL1	E3S-CL2
Sensing		5 to 200 mm (White paper 200 x 200 mm) (Setting distance 200 mm)	5 to 500 mm (White paper 200 x 200 mm) (Setting distance 500 mm)
Setting range		40 to 200 mm (White paper 200 x 200 mm)	50 to 500 mm (White paper 200 x 200 mm)
Differential distance		2% max.	10% max.
Reflectivity characteristics (black/white error) *1		2% max.	10% max.
Light source (wave length)		Red LED (700 nm)	Infrared LED (860 nm)
Power supply voltage		10 to 30 VDC [ripple (p-p) 10% included]	
Current consumption		35 mA max.	50 mA max.
Control output		Load supply voltage 30 VDC max., load current 100 mA max. (residual voltage NPN output: 1.2 V max., PNP output: 2.0 V max.) Open collector output type (NPN/PNP switch selectable) Light-ON/Dark-ON switch selectable	
Protective circuits		Reverse polarity protection, output short-circuit protection, mutual interference prevention	
Response time		Operation or reset: 1 ms max.	Operation or reset: 2 ms max.
Distance setting		6-turn endless adjuster (with indicator)	
Ambient illuminance		Incandescent lamp: 5,000 lux max. Sunlight 10,000 lux max.	
Ambient temperature		Operating/Storage: -25°C to 55°C (with no icing or condensation)	
Ambient humidity		Operating/Storage: 35% to 85%RH (with no condensation)	
Insulation resistance		20 M min. at 500 VDC	
Dielectric strength		1,000 VAC at 50/60 Hz for 1 minute	
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions	
Shock resistance		Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions	
Protective structure		IEC Standard IP67, NEMA 6P (limited to indoor use) *2	IEC Standard IP67, NEMA 6P (limited to indoor use)
Connection method		Pre-wired models (standard length: 2 m)	
Weight (Packed state)		Approx. 170 g	
Ma-terial	Case	Zinc diecast	
	Operation panel cover	Polyethyl sulfon	
	Lens	Acrylics	
	Mounting Brackets	Stainless steel (SUS304)	
Accessories		Mounting bracket, hexagon bolt M4 x 12 (with spring washer, flat washer), adjusting screwdriver, instruction manual	

*1. Sensing distance difference between standard white paper (reflectivity 90%) and standard black paper (reflectivity 5%)
*2. NEMA (National Electrical Manufacturers Association) Standards

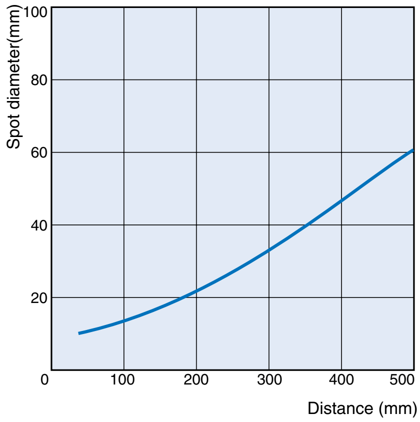
Characteristic data (typical)

Spot Diameter vs. Sensing Distance

E3S-CL1

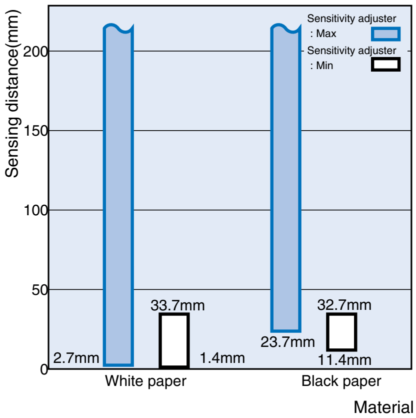


E3S-CL2

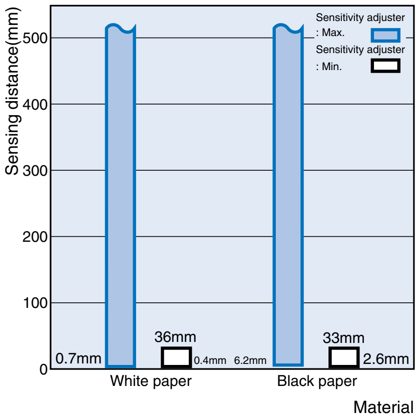


Short distance characteristic

E3S-CL1

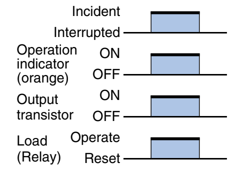
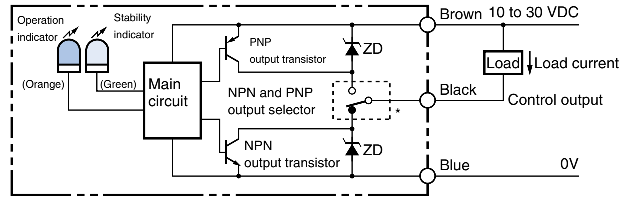
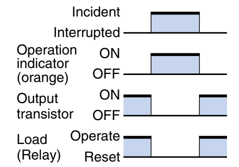


E3S-CL2

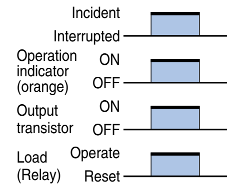
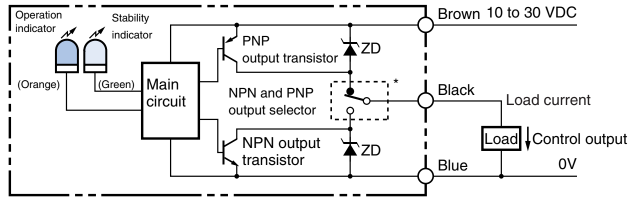
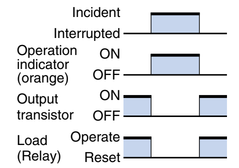


Output Circuit Diagram

NPN output

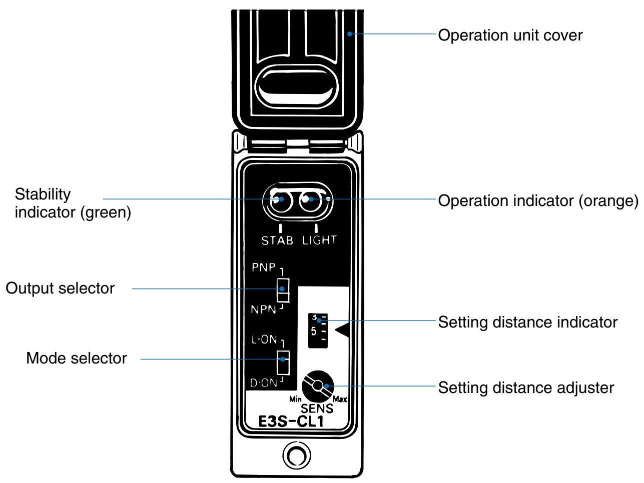
Model	Operating status of output transistor	Timing chart	Mode selection switch	Output circuit
E3S-CL1 E3S-CL2	Light ON		L ON (LIGHT ON)	* Please make a changeover switch into the NPN side.
	Dark ON		D ON (DARK ON)	

PNP output

Model	Operating status of output transistor	Timing chart	Mode selection switch	Output circuit
E3S-CL1 E3S-CL2	Light ON		L ON (LIGHT ON)	* Please make a changeover switch into the PNP side.
	Dark ON		D ON (DARK ON)	

Nomenclature:

Operation panel



Output selection switch

① When using the sensor with NPN output, move the switch to the NPN position.

② When using the sensor with PNP output, move the switch to the PNP position.

Mode selection switch

① When using the sensor with Light-ON, move the switch to the **L•ON** position.

② When using the sensor with Dark-ON, move the switch to the **D•ON** position.

Distance Adjuster

① Turning the distance setting adjuster clockwise (to the Max position) increases the detecting distance, and turning it counterclockwise (to the Min position) decreases the distance.

② The distance setting adjuster is a 6-turn endless adjuster ranging from the Min position to the Max position, and its number of turns is displayed on the setting distance indicator according to the rotation of the adjuster.

Operation

Sensitivity adjustment (distance setting type, Light-ON)

Sequence	Detection state	Position of distance setting adjuster	State of setting distance indicator	Indicator state	Adjustment Steps
(1) Point (A)	Photoelectric Sensor; Sensing object; Background object	(A); Min; Max	(A); 1; 3	Stability indicator (green): ON→OFF; Operation indicator (orange): OFF→ON	Place a sensing object in the predetermined position, turn the adjuster clockwise until the incident indicator (orange) is turned ON, and define this position as (A).
(2) Points (B), (C)	Photoelectric Sensor; Sensing object; Background object	(C); (B); Min; Max	(C); (B); 3; 5	Stability indicator (green): ON→OFF; Operation indicator (orange): ON→OFF	(1) If there is a background object, remove the sensing object, turn the adjuster further clockwise until the incident indicator (orange) is turned ON, and define this position as (B). Turn the adjuster counterclockwise from (B) until the incident indicator (orange) is turned OFF, and define this position as (C). (2) If there is no background object, define the maximum adjuster position (Max) as (C).
(3) Setting	---	(A); (C); Min; Max	(A); (C); 1; 3; 5	Stability indicator (green): ON; Operation indicator (orange): ON↔OFF	Set the adjuster in the middle of positions (A) and (C). Also make sure that the stability indicator (green) is turned ON when there is an object and when there is no object. When the indicator is not turned ON, reexamine the detection method since there is a little allowance.

Precautions

Correct Use

Design

Cable

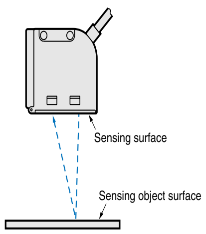
The oil-resistant cable is used to ensure oil resistance. (E3S-CL2)

Installation

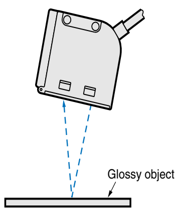
Sensor installation

Mounting orientation

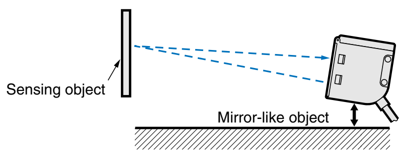
- Install the photoelectric sensor in such manner that its detection surface and the object surface are parallel (without inclination relative to the sensing object).



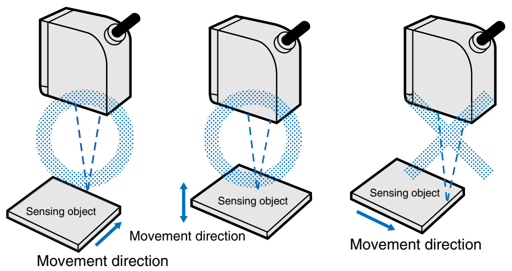
If the sensing object has a glossy surface, incline the Sensor by 5° to 10° as shown on the right. In this case, ensure that the Sensor is not influenced by any background objects.



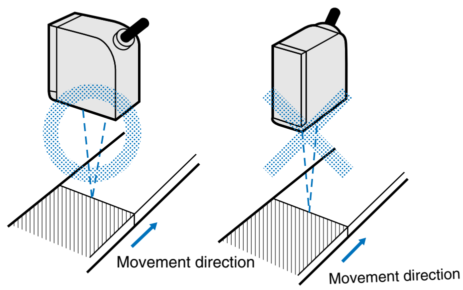
- If there is a mirror-smooth object under the photoelectric sensor, operation may become instable. Therefore, incline the photoelectric sensor as shown below or move it away from the object.



- Install the photoelectric sensor in either of the following orientations, being careful of the direction in which the sensing object will move.



- Also, when the color/material of the sensing object varies extremely, install the photoelectric sensor in either of the following orientations.



- Install the photoelectric sensor so that the sun, fluorescent lamp, incandescent lamp or any other strong light will not enter the directional angle range of the sensor.

Mounting Precautions

- Do not strike the Photoelectric Sensor with a hammer or any other tool during the installation of the Sensor, or the Sensor will loose its water-resistive properties.
- Use M4 screws.
- Tighten the screws to the torque of 1.2 Nm max.

Others

Oil resistance/chemical resistance (E3S-CL2)

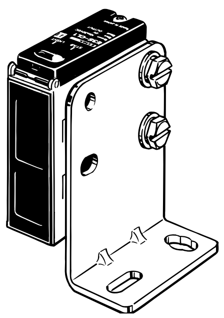
For the oil resistance ofE3S-CL2, the Sensor has passed tests on the oils given in the following table. Refer to the table for examining the oil to be used. Depending on the oil type, however, the Sensor may not be able to exhibit its performance.

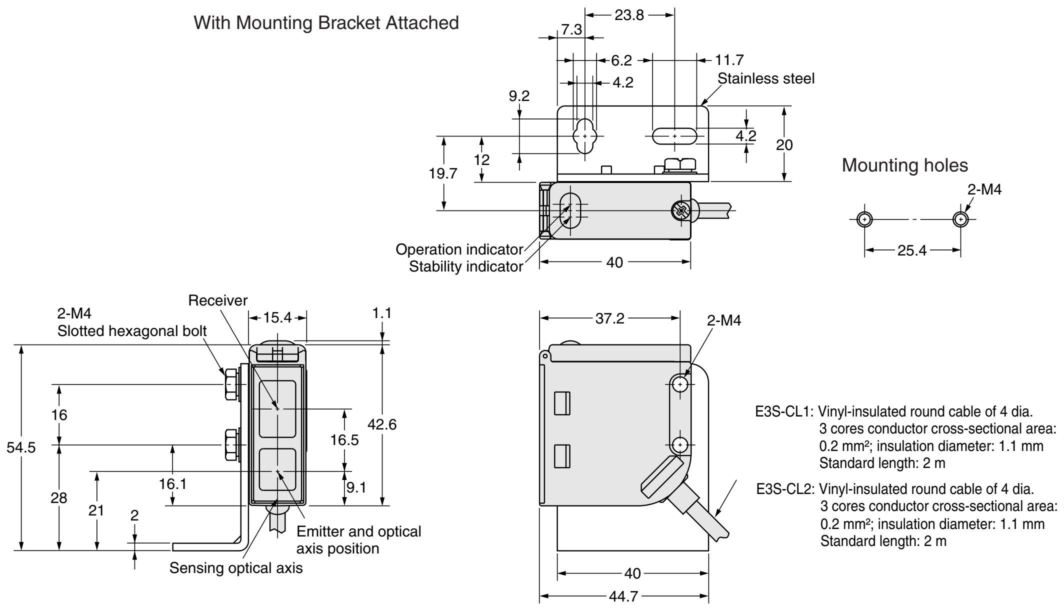
Testing oil classification	JIS classification	Product name	Dynamic viscosity (mm^2/s) at 40°C	PH
Lubricant	---	Velocity No. 3	2.02	---
Water-in-soluble coolant	Class 2 No. 5	Daphne Cut	Not less than 10 to less than 50	
	Class 2 No. 11	Yushiron Oil No. 2ac	Less than 10	
Water-soluble coolant	Class W1 No. 1	Yushiroken EC50T-3	---	7`9.5
		Yushiron Lubic HWC68		7`9.9
	Class W1 No. 2	Gryton 1700D		7`9.2
	Class W2 No. 1	Yushiroken S50N		7`9.8

Note: 1 . E3S-C was submerged in the oils in the above table at 50°C for 240 hours, and passed the test of 100-M or more insulation resistance.
2 . For use in the environment where E3S-C is exposed to the oil other than those in the above table, use the dynamic viscosity and PH in the above table. Pre-check the oils since the sensor may be affected by additives etc. in the oils.

Dimensions (Unit: mm)

E3S-CL1
E3S-CL2





Note: The output selector, mode selector and distance setting adjuster are exposed when the cover is opened.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Photoelectric switch with built-in amplifier (long distance) in plastic housing

E3G

Retroreflective Models

- Sensing Distance of 10 m, with polarized light to detect shiny objects.
- Operation stability monitored ba the stability indicator.

Distance-setting Models

- Distance setting models with a long 2 m sensing distance incorporate a teaching function.
- Set sensing area (zone setting) function allows detection of shiny objects with uneven surface.

Common Features

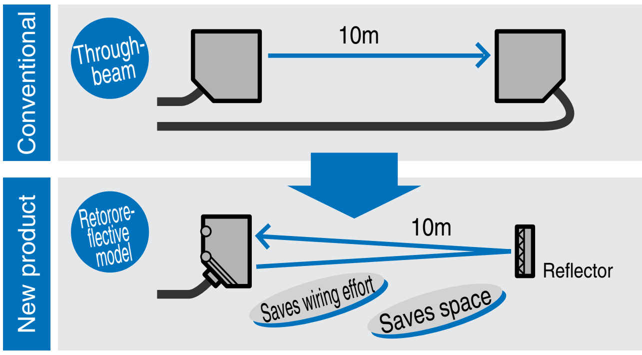
- Meets IEC IP67 requirements.
- M12 rotary connector, pre-wired or terminal block connection

Features

Retroreflective Models

Though the Size Is Compact, the Sensing Distance Is as Long as 10m.

Replace the conventional through-beam model with the retroreflective model for saving wiring and installation space.



Easy monitoring of Operation stability by means of stability indicator.

Distance-setting

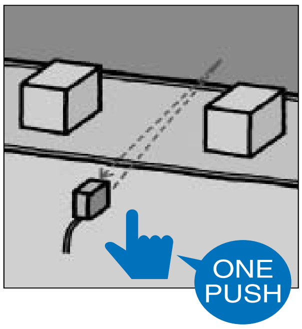
Distance-setting Models with a Long 2-m Sensing Distance Incorporate a Teaching Function

Sensitivity adjustment without being influenced by background objects is possible by simply pressing a button. Useful for teaching without a sensing object.

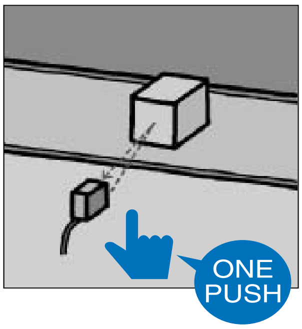
Easy Optimum Sensing Distance Adjustments

Teaching with and without a sensing object ensures highly accurate detection without influence from the background.

Without sensing object

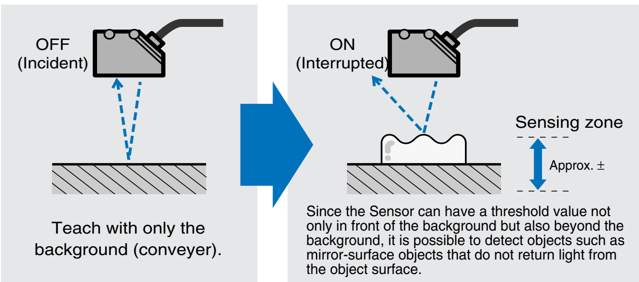


With sensing object



Zone Setting Function

Effective for detecting glossy objects, which were difficult to detect with conventional sensors. (D-ON)

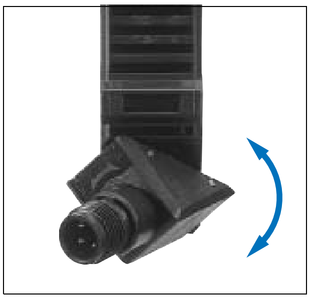


General

Select either transistor (NPN/PNP selectable) or relay output. Three connection methods (plus a model with a timer function). Select either a DC power supply or a variable power supply: 24 V to 240 VAC or 12 to 240 VDC).

IEC Standard IP67 Water Proofing

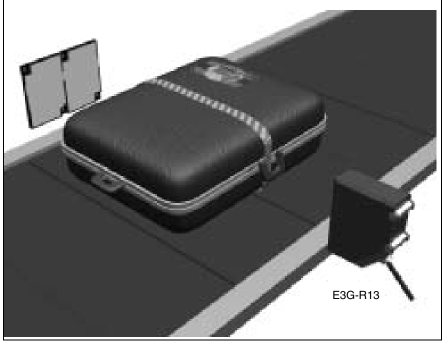
M12 Rotary Connector Available on Models with DC Power Supplies



Application

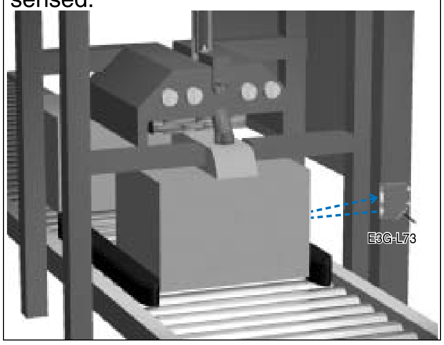
Detection of large works

Retroreflective model can make long-distance detection, saving wiring.

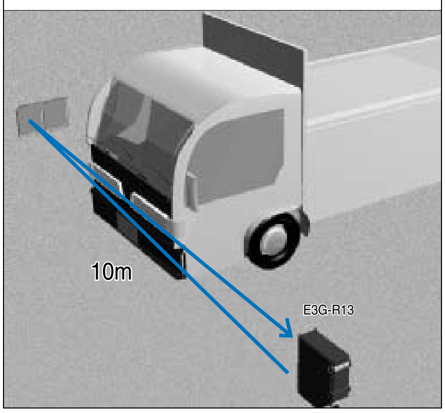


Detection of large corrugated cardboard

Just by installing the sensor on one side, only the boxes to be detected shall be sensed.



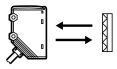
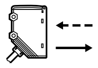
Detection of cars in multi-story parking lot



Ordering Information

Sensors

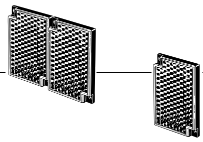
Red light   Infrared light

Sensor type	Shape	Connection method	Sensing distance	Timer function	Model: NPN/PNP selector	Model: Relay contact output
Retroreflective Models (with M.S.R. Function)		Pre-wired	10m [500mm]*	---	E3G-R13-G	---
		Connector type			E3G-R17-G	
		Terminal block			---	E3G-MR19-G
				ON or OFF delay 0 to 5 s (adjustable)		E3G-MR19T-G
Distance-setting		Pre-wired	White paper 300 × 300 mm 0.2 to 2 m	---	E3G-L73	---
		Connector type			E3G-L77	
		Terminal block			---	E3G-ML79-G
				ON or OFF delay 0 to 5 s (adjustable)		E3G-ML79T-G

* Values in parentheses indicate the minimum required distance between the sensor and reflector.

Accessories (Order Separately)

Reflectors

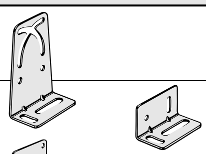
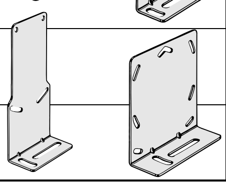
Shape	Sensing distance (typical)	Model	Quantity	Remarks
	10 m (500 mm) *	E39-R2	1	---
	6 m (100 mm) *	E39-R1S	1	---

* Values in parentheses indicate the minimum required distance between the sensor and reflector.

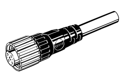
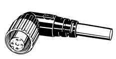
Terminal Protection Cover for Side-pullout Cable

Shape	Model	Quantity	Applicable type	Remarks
	E39-L129-G	1	E3G-MR19(T)-G E3G-ML79(T)-G	Provided with rubber bushing and cap for pullout prevention in horizontal direction

Mounting Brackets

Shape	Model	Quantity	Applicable type	Remarks
	E39-L131	1	E3G-R1□ E3G-L7□	---
	E39-L132	1		Rear-mounting use
	E39-L135	1	E3G-MR19(T)-G E3G-ML79(T)-G	Cable pulled out downwards
	E39-L136	1		---

Sensor I/O Connectors

Cable	Shape	Cable length		Model
Standard cable	Straight 	2 m	3-wire type	XS2F-D421-DC0-A
		5 m		XS2F-D421-GC0-A
	L-shaped 	2 m		XS2F-D422-DC0-A
		5 m		XS2F-D422-GC0-A

Rating/Performance

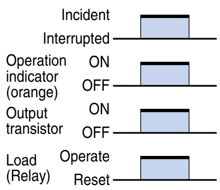
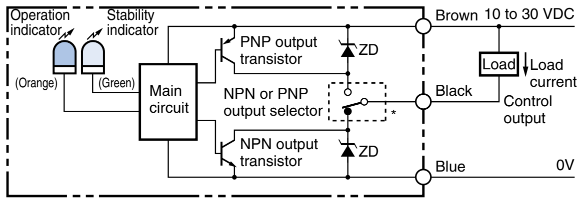
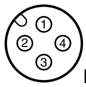
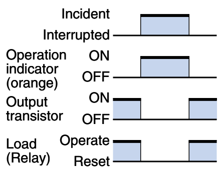
Sensor type / Item	Model	Retroreflective Models (M.S.R. function)				Distance-setting			
		E3G-R13-G	E3G-R17-G	E3G-MR19-G	E3G-MR19T-G	E3G-L73	E3G-L77	E3G-ML79-G	E3G-ML79T-G
Sensing distance		10 m (500 mm) * (When using the E39-R2)				0.2 to 2 m (White paper 300 x 300 mm)			
Setting distance		---				0.5 to 1.2 m (White paper 300 x 300 mm)			
Standard sensing object		Opaque: 80 dia. min.				---			
Hysteresis (typical)		---				10% of setting distance			
Directional angle		Sensor: 1° to 5°				---			
Reflectivity characteristics (black/white error)		---				±10% max. (At detection distance of 1m)			
Light source (wave length)		Red LED (700 nm)				Infrared LED (860 nm)			
Spot size		---				70 mm dia. max. (At detection distance of 1m)			
Power supply voltage		10 to 30 VDC [Ripple (p-p) 10% included]		12 to 240 VDC ±10% ripple (p-p) : 10% max. 24 to 240 VAC ±10% 50/60 Hz		10 to 30 VDC (Ripple (p-p) 10% included)		12 to 240 VDC ±10% ripple (p-p) : 10% max. 24 to 240 VAC ±10% 50/60 Hz	
Current/Power consumption		50 mA max.		2 W max.		60 mA max.		2 W max.	
Control output		Load supply voltage 30 VDC max., load current 100 mA max. (residual voltage NPN output: 1.2 V max., PNP output: 2 V max.) Open collector output type (NPN/PNP output switch selectable) L-ON/ D-ON switch selectable		Relay output: Switch-over contact 250 VAC 3A (cos =1) max. 30 VDC 3A max. L-ON/D-ON switch selectable		Load supply voltage 30 VDC max., load current 100 mA max. (residual voltage NPN output: 1.2 V max., PNP output: 2 V max.) Open collector output type (NPN/PNP output switch selectable) L-ON/ D-ON switch selectable		Relay output: Switch-over contact 250 VAC 3A (cos =1) max. 30 VDC 3A max. L-ON/D-ON switch selectable	
Life expectancy (relay output)	Mechanical	---		50,000,000 operations min. (switching frequency: 18,000 operations/h)		---		50,000,000 operations min. (switching frequency: 18,000 operations/h)	
	Electrical	---		100,000 operations min. (switching frequency: 1,800 operations/h)		---		100,000 operations min. (switching frequency: 1,800 operations/h)	
Protective circuits		Reverse polarity protection, output short-circuit protection, mutual interference prevention		Mutual interference prevention function		Reverse polarity protection, output short-circuit protection, mutual interference prevention		Mutual interference prevention function	
Response time		Operation/reset: 1 ms each		Operation/reset: 30 ms each		Operation/reset: 5 ms each		Operation/reset: 30 ms each	
Sensitivity adjustment		One-turn adjuster				Teaching method (NORMAL mode/ZONE mode)			
Timer function		---			ON delay/ OFF delay 0 to 5 s (Adjuster variable system)	---			ON delay/ OFF delay 0 to 5 s (Adjuster variable system)
Ambient illuminance		Incandescent lamp: 3,000 lux max. Sunlight 10,000 lux max.							
Ambient temperature		Operating: -25°C to 55°C, Storage: -30°C to 70°C (with no icing or condensation)							
Ambient humidity		Operating: 35% to 85%RH, Storage: 35% to 95%RH (with no condensation)							
Insulation resistance		20 M min. at 500 VDC							
Dielectric strength		1,000 VAC at 50/60 Hz for 1 minute		2,000 VAC at 50/60 Hz for 1 minute		1,000 VAC at 50/60 Hz for 1 minute		2,000 VAC at 50/60 Hz for 1 minute	
Vibration resistance		Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions							

* Values in parentheses indicate the minimum required distance between the sensor and reflector.

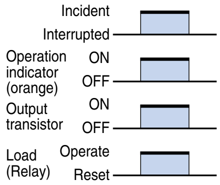
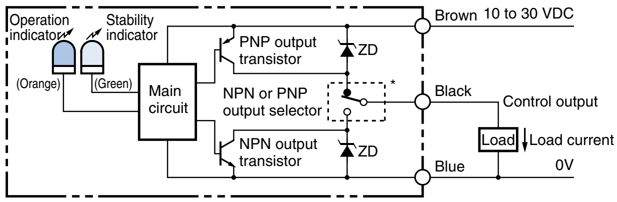
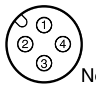
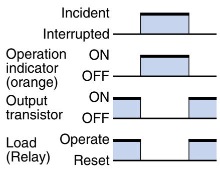
Sensor type / Item / Model		Retroreflective Models (M.S.R. function)				Distance-setting			
Item	Model	E3G-R13-G	E3G-R17-G	E3G-MR19-G	E3G-MR19T-G	E3G-L73	E3G-L77	E3G-ML79-G	E3G-ML79T-G
Shock resistance		500 m/s² 3 times in each of X, Y and Z directions							
Protective structure		IEC 60529 IP67 (with Protective Cover attached)							
Connection method		Pre-wired (standard length: 2 m)	M12 Connector	Terminal block		Pre-wired (standard length: 2 m)	M12 Connector	Terminal block	
Weight (Packed state)		Approx. 150 g	Approx. 50 g	Approx. 150 g			Approx. 50 g	Approx. 150 g	
Mate-rial	Case	PBT (polybutylene terephthalate)							
	Lens	Acrylics (PMMA)							
	Mounting Brackets	Stainless steel (SUS304)							
Accessories		Instruction sheet, and screwdriver for adjustment				Instruction sheet			

Output Circuit Diagram

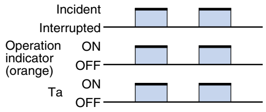
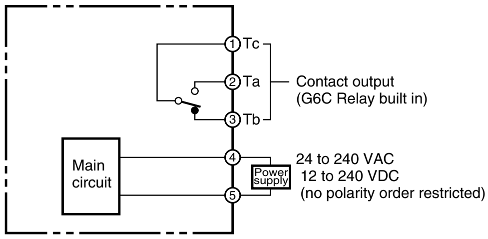
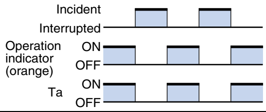
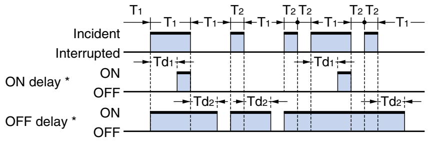
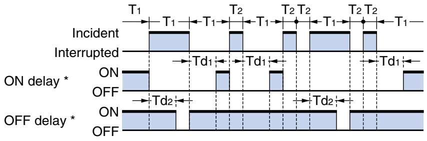
NPN output

Model	Operating status of output transistor	Timing chart	Mode selection switch	Output circuit
E3G-R13-G E3G-R17-G E3G-L73 E3G-L77	Light ON		L ON (LIGHT ON)	 * Set the NPN or PNP selector to NPN Connector Pin Arrangement  Note: Terminal 2 is not used.
	Dark ON		D ON (DARK ON)	

PNP output

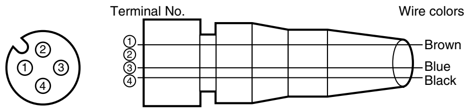
Model	Operating status of output transistor	Timing chart	Mode selection switch	Output circuit
E3G-R13-G E3G-R17-G E3G-L73 E3G-L77	Light ON		L ON (LIGHT ON)	 * Set the NPN or PNP selector to PNP Connector Pin Arrangement  Note: Terminal 2 is not used.
	Dark ON		D ON (DARK ON)	

Relay contact output

Timer function	Model	Timing chart	Mode selection switch	Output circuit
None	E3G-MR19-G E3G-ML79-G		L ON (LIGHT ON)	
			D ON (DARK ON)	
ON or OFF delay 0 to 5 s (adjustable)	E3G-MR19T-G E3G-ML79T-G		L ON (LIGHT ON)	
			D ON (DARK ON)	

* For ON and OFF, delay timers vary independently.
Note: Td1, Td2: Delay time (0 to 5 s), T1: Any period longer than delay time, T2: Any period shorter than delay time

Connectors (Sensor I/O connectors)



XS2F-D421-DC0-A
XS2F-D421-GC0-A
XS2F-D422-DC0-A
XS2F-D422-GC0-A

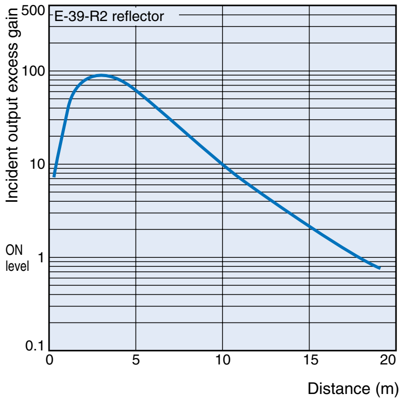
Class	Wire, outer jacket color	Connector pin No.	Application
For DC	Brown	1	Power supply (+V)
	-	2	-
	Blue	3	Power supply (0 V)
	Black	4	Output

Note: Pin 2 is not used.

Characteristic data (typical)

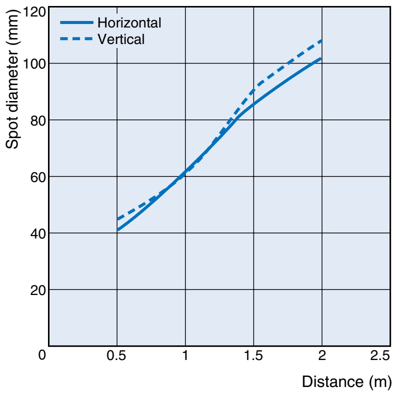
E3G-R/MR Retroreflective Models

Operating Range

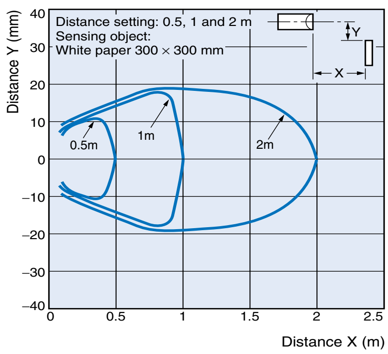


E3G-L/ML Distance-setting Models

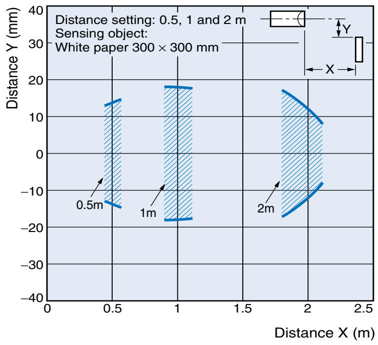
Spot Diameter vs. Sensing Distance



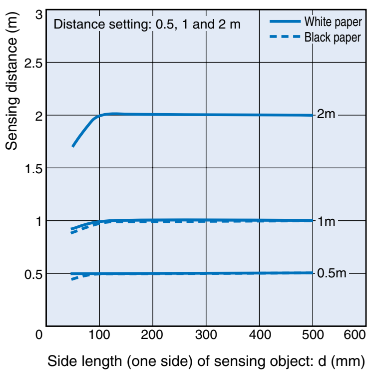
Sensing Zone (in NORMAL mode)



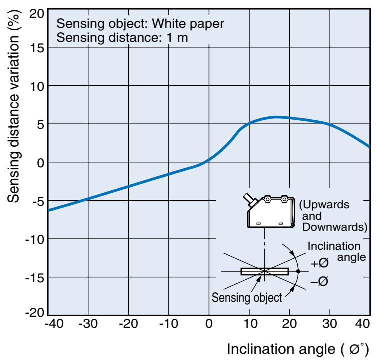
Sensing Zone in ZONE Mode



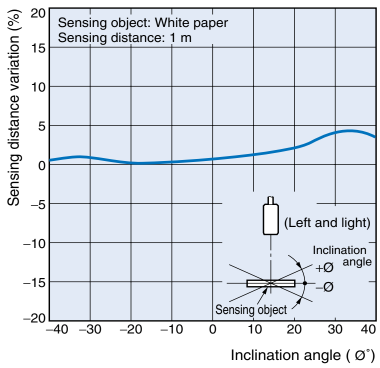
Sensing Object Size vs. Setting Distance



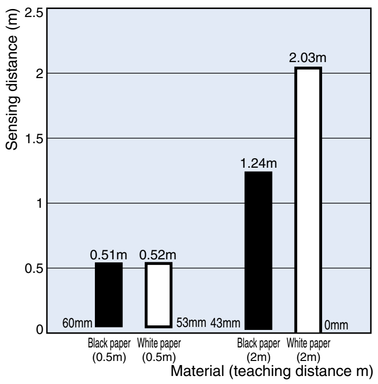
Sensing Object Angle Characteristics (Up and Down)



Sensing Object Angle (Left and Right)



Close-range Characteristics

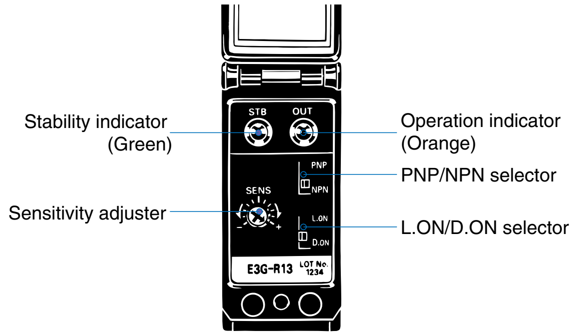


Nomenclature

Retroreflective Models

E3G-R13-G (Pre-wired model)

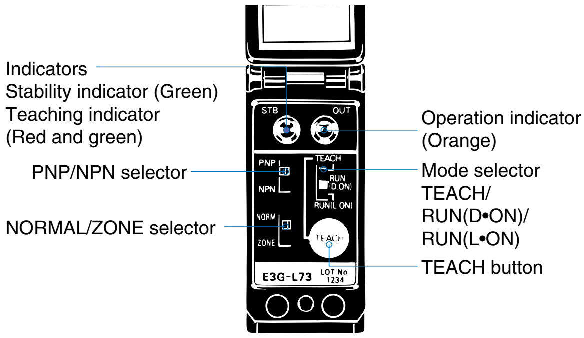
E3G-R17-G (Connector model)



Distance-setting

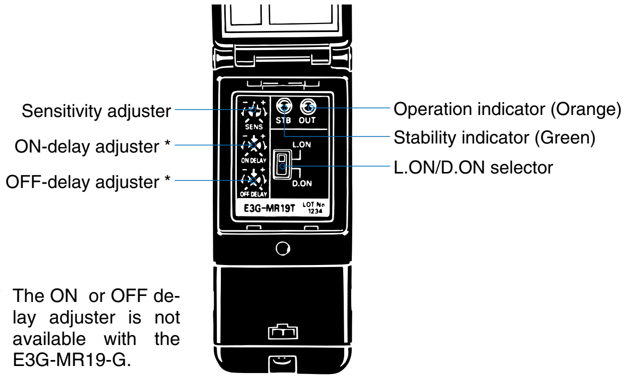
E3G-L73 (Pre-wired model)

E3G-L77 (Connector model)



E3G-MR19-G (Terminal Block Model)

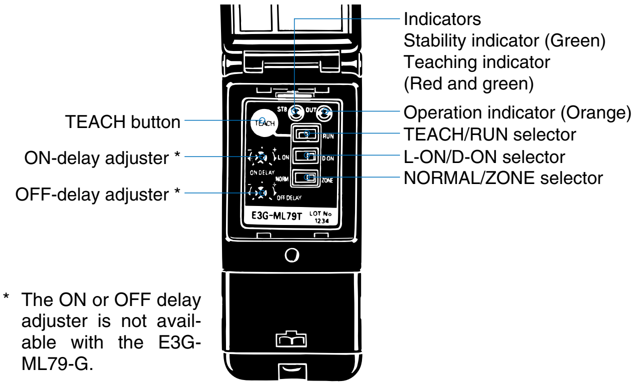
E3G-MR19T-G (Terminal Block Model with Timer)



* The ON or OFF delay adjuster is not available with the E3G-MR19-G.

E3G-ML79-G (Terminal Block Model)

E3G-ML79T-G (Terminal Block Model with Timer)



* The ON or OFF delay adjuster is not available with the E3G-ML79-G.

Operation

E3G-L/ML

Adjustment Steps

Procedure	Operation
1	Install, wire, and turn on the Sensor.
2	Perform distance setting (teaching). Refer to "Distance Setting (Teaching)".
3	Check that the mode selector is set to RUN.

Distance Setting (Teaching)

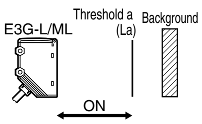
Select the most appropriate teaching method in reference to the following descriptions.

Application	Teaching without sensing objects (i.e., Teaching the background).	Setting a threshold in the middle between the background and sensing object for operation.	Detection of glossy objects in front of the background.	Setting the maximum sensing distance of the Sensor.
Teaching	Normal one-point teaching	Normal two-point teaching	Zone teaching	Maximum distance setting (in normal mode)
Setting method	Press the TEACH button with the background object.	Press the TEACH button with the background object.	Press the TEACH button with the background object (conveyor, etc.).	Press the TEACH button for longer than three seconds.
Set threshold	Threshold (a) is set to a distance in front of the background of 20% of the background distance.	Threshold (a) is set approximately in the middle between the background and sensing object.	Thresholds (a and b) are set in the sensing distance on condition that the difference between these thresholds is approximately 10% of the whole sensing distance.	The threshold is set in such manner that the stability indicator will turn ON at approximately 2 m if the sensing object is white paper.
Output ON range	The output is ON between the Sensor and La.	The output is ON between the Sensor and La.	The output is ON between La and Lb.	The output is ON whenever the sensing object is located between the Sensor and at a distance of 2.2 m.

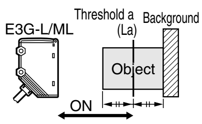
La: Distance equivalent to threshold (a)

Lb: Distance equivalent to threshold (b)

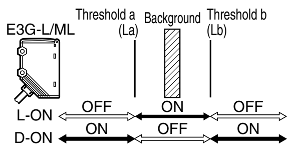
Normal Mode1. Normal One-point Teaching



2. Normal Two-point Teaching



Zone Mode Zone Teaching



Normal one-point teaching

Procedure	Operation
1	Set the mode selector to TEACH .
2	Set the NORMAL/ZONE mode selector to NORMAL .
3	Press the TEACH button with the background. The teaching indicator (red) will turn ON.
4	Set the mode selector to RUN . (Set to L-ON or D-ON mode.)

Note: Perform normal one-point teaching with the background.

Normal two-point teaching

Procedure	Operation
1	Set the mode selector to TEACH .
2	Set the NORMAL/ZONE mode selector to NORMAL .
3	Press the TEACH button with a sensing object. The teaching indicator (red) will turn ON.

Procedure	Operation
4	Move the sensing object and press the TEACH button with the background. If the teaching is successful, the teaching indicator (green) will turn ON. If the teaching is not successful, the teaching indicator (red) will flash.
5	When the teaching is successful, the setting is complete. Set the mode selector to RUN . (Use the operation mode selector to set L-ON/D-ON.) When the teaching is not successful, change the work position and setting distance again, and restart the setting from step "3".

Zone teaching

Pro-ce-dure	Operation
1	Set the mode selector to TEACH .
2	Set the NORMAL/ZONE mode selector to ZONE .
3	Press the TEACH button with the background. The teaching indicator (red) will turn ON and the teaching indicator (green) will then turn ON.
4	Set the mode selector to RUN . (Set to L-ON or D-ON mode.)

Note: Perform zone teaching with the background.

Maximum distance setting (in normal mode)

If you want to set the maximum distance of the sensor, set a maximum distance as depicted in the following procedure.

Pro-ce-dure	Operation
1	Set the mode selector to TEACH .
2	Set the NORMAL/ZONE mode selector to NORMAL .
3	Press the TEACH button 3 s or more. The teaching indicator (red) will turn ON. In 3 s, the teaching indicator (green) will turn ON.
4	When the teaching indicator (green) turns ON, the setting is complete. Set the mode selector to RUN . (Set to L-ON/D-ON.)

Precautions

Correct Use

E3G-R/MR

Design

Power Supply

A full-wave rectification power supply can be used with the E3G-MR19(T)-G.

Wiring Considerations

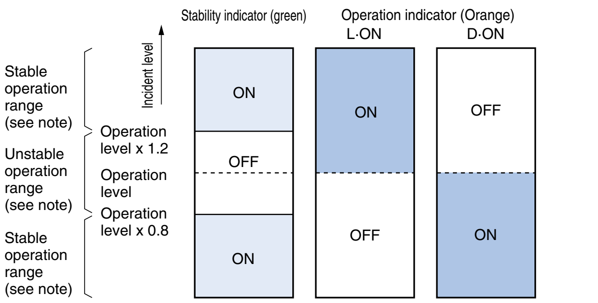
The tensile strength of the cable during operation should not exceed the values shown below.

Model	Tensile strength
E3G-R13-G E3G-MR19(T)-G	50 N max.
E3G-R17-G	10 N max.

● For adjustment

Display

- The following graphs indicate the status of each operation level.
- Set the E3G so that it will work within the stable operation range.



Note: If the operation level is set to the stable operation range, the E3G will operate with the highest reliability and without being influenced by temperature change, voltage fluctuation, dust, or setting change.

E3G-L/ML

Design

Power Supply

A full-wave rectification power supply can be used with the E3G-ML79(T)-G.

Wiring Considerations

The tensile strength of the cable during operation should not exceed the values shown below.

Model	Tensile strength
E3G-L73 E3G-ML79(T)-G	50 N max.
E3G-L77	10 N max.

Miscellaneous

EEPROM Write Error

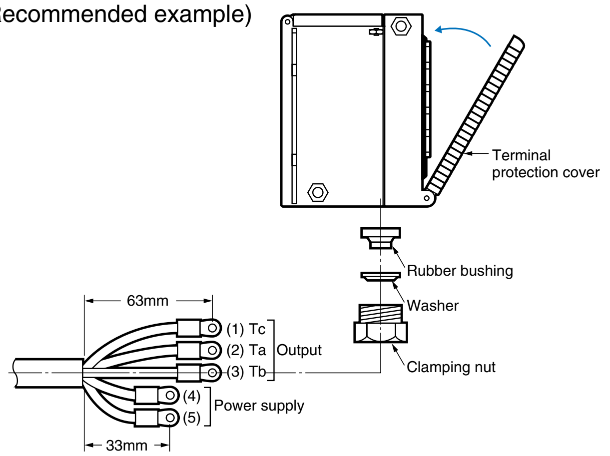
If a write error occurs (operation indicator flickers) due to power-off, static electricity or other noise in the teaching mode, perform teaching again.

E3G-M□(T)-G

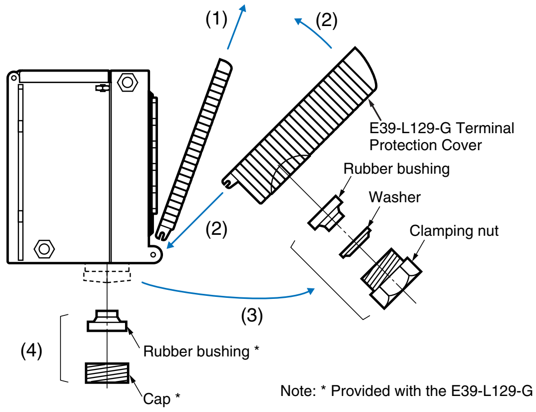
Wiring Considerations

- The cable with an external diameter of 6 to 8 mm is recommended.
- Securely tighten the cover to maintain water resistance and dust resistance. The thread size of the conduit socket is PG 13.5
- Do not tighten with the cable caught by the terminal protection cover. Otherwise, the water-resistant structure and like cannot be maintained.

(Recommended example)



• Changing to Side-pullout Cable from Vertical-pullout Cable



Pro-ce-dure	Operation
①	Remove the present cover.
②	Attach the E39-L129-G Terminal Protection Cover for side-pullout cable.
③	Remove the clamping nut, washer, and rubber bushing of the E3G. These are used for the side-pullout cable.
④	Attach the rubber bushing and cap provided with the E39-L129-G to the E3G as replacements.

All E3G Models

Design

Load Relay Contact

If a load is used that will spark when it is turned OFF (e.g. a contactor or valve), the usually closed side may be turned ON before the usually open side is turned OFF or vice versa. If both usually open output and usually closed output are used simultaneously, apply an surge suppressor to the load. (Refer to OMRON's "Switch/Relay/Connector (PCB Product) Catalog" for typical examples of surge suppressors.

Wiring Considerations

Connection/Wiring

The E3G has load short-circuit protection. If load short-circuit or like has occurred, the output turns OFF. Therefore, recheck the wiring and switch power on again. This resets the short-circuit protection circuit. Load short-circuit protection is activated when a current of 2 times or more of the rated load current flows. When using an L load, use the one the inrush current of which is less than 1.2 times of the rated load current.

Mounting

- If Sensors are mounted face-to-face, ensure that no optical axes cross each other. Otherwise, mutual interference may result.
- Be sure to install the Sensor carefully so that the directional angle range of the Sensor will not be directly exposed to intensive light, such as sunlight, fluorescent light, or incandescent light.
- Do not strike the Photoelectric Sensor with a hammer or any other tool during the installation of the Sensor, or the Sensor will loose its water-resistive properties.
- Use M4 screws for Sensor installation.
- For case installation, tighten it to the torque of 1.2 Nm max.

Water Resistance

Tighten the operation cover screws and terminal block cover screws to a torque of 0.3 to 0.5 Nm in order to ensure water resistivity.

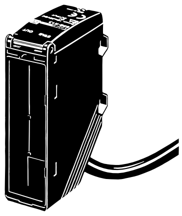
Dimensions (Unit: mm)

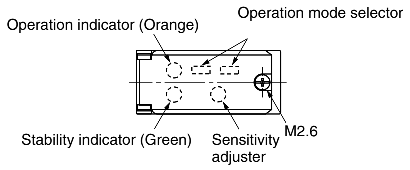
Sensors

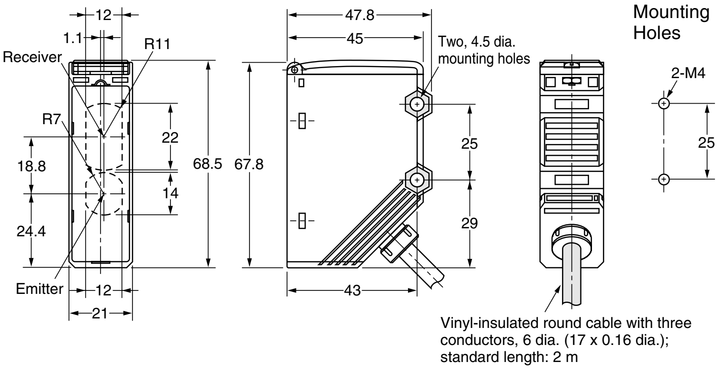
Retroreflective Models

Pre-wired

E3G-R13-G

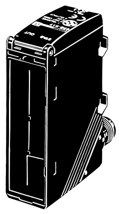




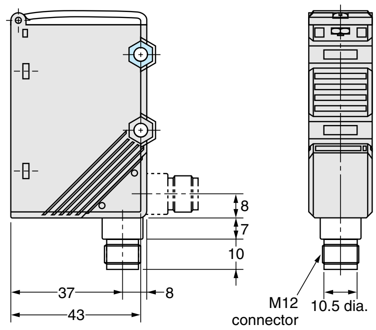


Connector type

E3G-R17-G

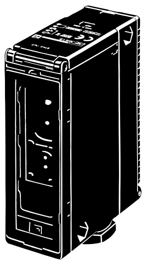


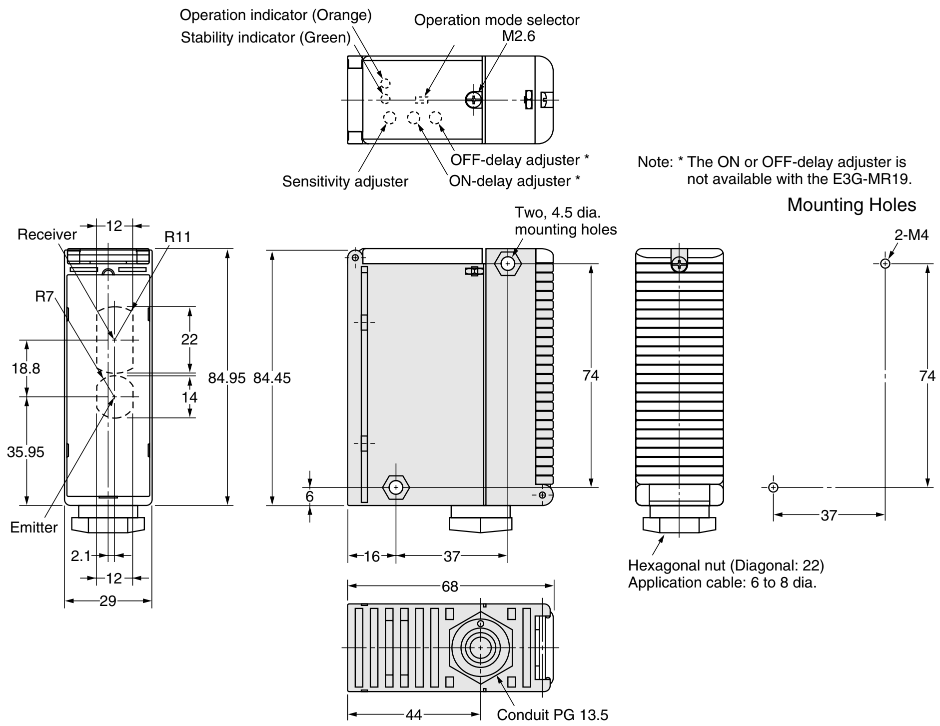
Note: All dimensions other than the ones specified below are the same as the corresponding dimensions of E3G-R13-G.



Terminal block

E3G-MR19-G
E3G-MR19T-G

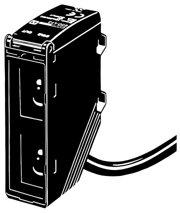


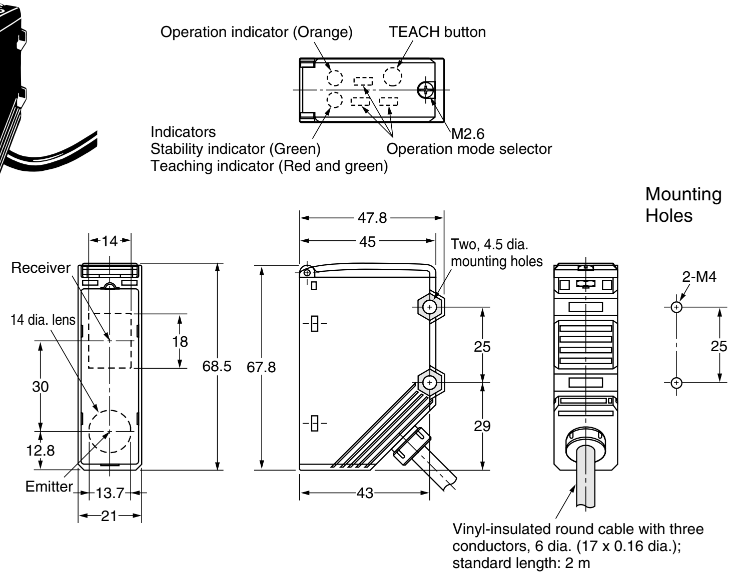


Distance-setting

Pre-wired

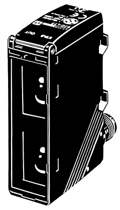
E3G-L73



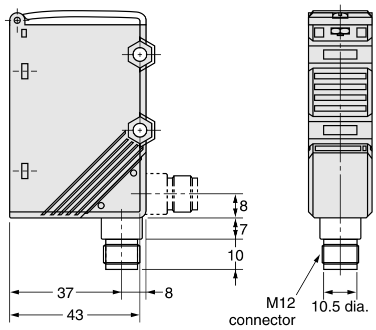


Connector type

E3G-L77

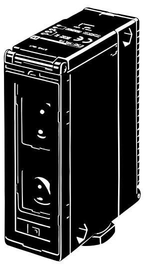


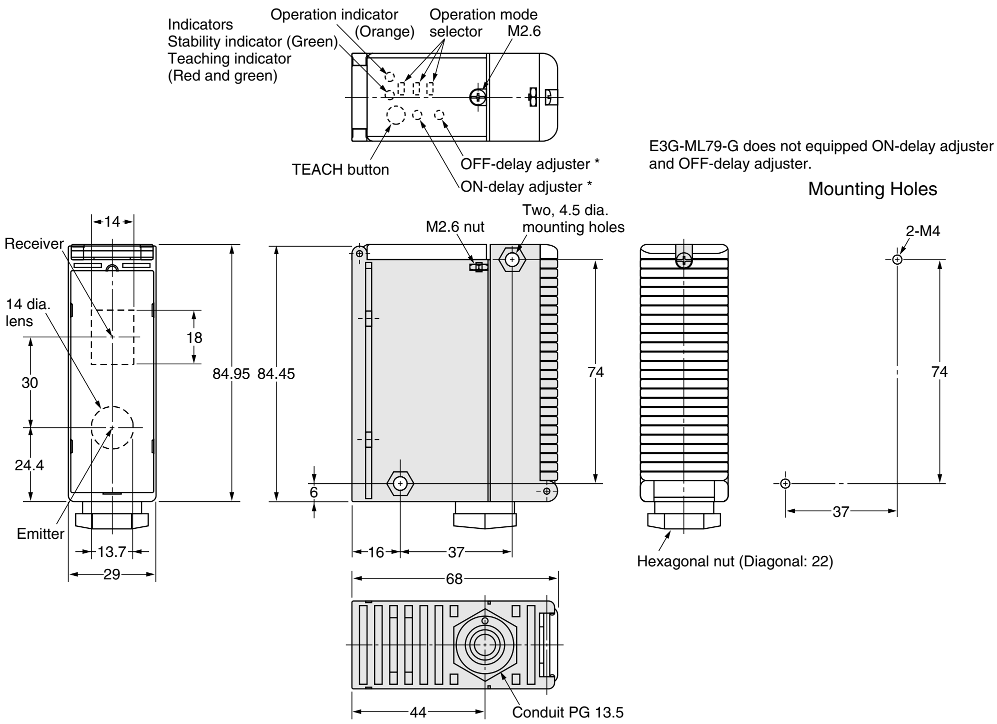
Note: The figures and dimensions not given are the same as those of E3G-L73-G shown on the left.



Terminal block

E3G-ML79-G
E3G-ML79T-G

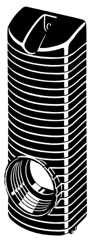


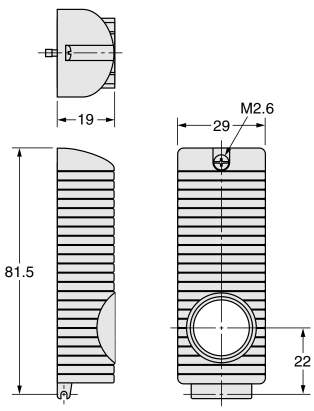


Accessories (Order Separately)

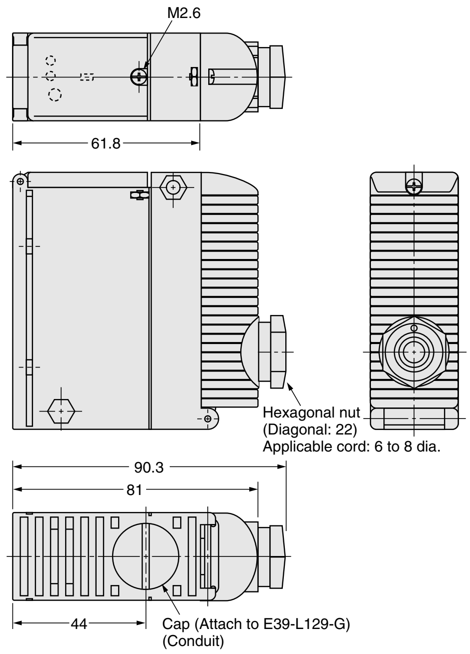
Terminal Protection Cover for Side-pullout Cable

E39-L129-G





Terminal Protection Cover for Side-pull-out Cable (Example of E3G-MR19-G)



Note: 1 . The cover is provided with a rubber bushing and cap to prevent the cable from being pulled out in vertical direction.

Reflectors and Mounting Brackets

H-3

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

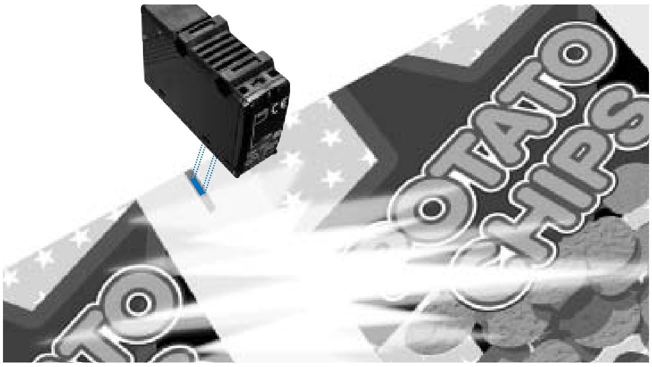
In the interest of product improvement, specifications are subject to change without notice.

Mark Sensor

E3M-V

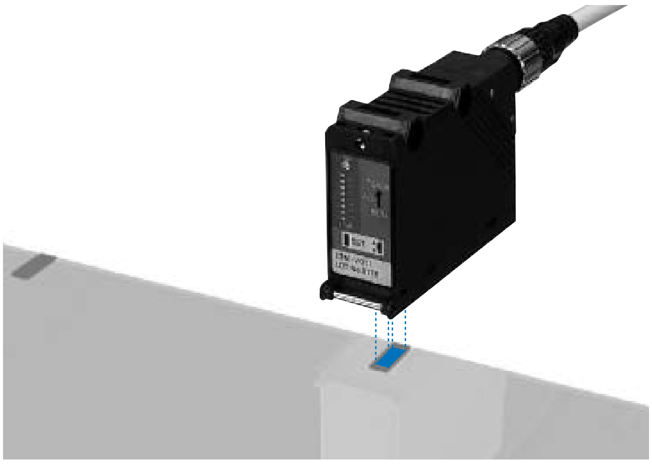
- Detects laminated or light-dispersing objects in stable operation without being influenced by mirror reflection.
- Double indication of the detection level and threshold level allows easy grasp of the operating status and easy adjustment.
- Automatically sets to the optimum threshold level while sensing objects are being conveyed and incorporates an auto-teaching function that discriminates between the mark and background and turns ON when the mark is detected.
- IP67 watertight construction with M12 rotary connector
- High response speed of 50 s and half the size of OMRON's conventional models.

Applications



Dependably Detects Marks on Laminated Sheets

The coaxial optical system ensures a long sensing distance and stable sensing characteristics over a wide angle range, even for objects that are distance-fluctuating or leaning at an angle, or for laminated objects with marks, which conventional models have difficulty in detecting

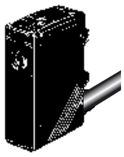


Auto-Teaching

An auto-teaching function automatically sets the threshold value upon a Remote Control input while the workpiece is moving. There is no need to position the mark at the optical spot.

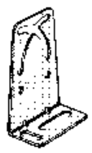
Ordering Information

Sensors

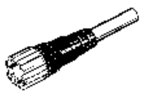
Shape	Connection method	Setting distance	Spot diameter	Model	
				NPN output	PNP output
	Connector type[1]	10+3 mm	1 x 4 mm	E3M-VG11	E3M-VG16
			4 x 1 mm	E3M-VG21	E3M-VG26
	Pre-wired		1 x 4 mm	E3M-VG12	E3M-VG17
			4 x 1 mm	E3M-VG22	E3M-VG27

1. Possible to switch between vertical or horizontal connection using the M12 rotary connector

Mounting Brackets

Shape	Model	Quantity	Remarks
	E39-L131	1	
	E39-L132	1	For rear mounting

Sensor I/O Connectors

Shape	Type	Cord type		Model
	Single-end connector (Straight)	2 m	4-wire cord	XS2F-D421-D80-A
		5 m		XS2F-D421-G80-A
	Single-end connector (L-shaped)	2 m		XS2F-D422-D80-A
		5 m		XS2F-D422-G80-A

Specifications

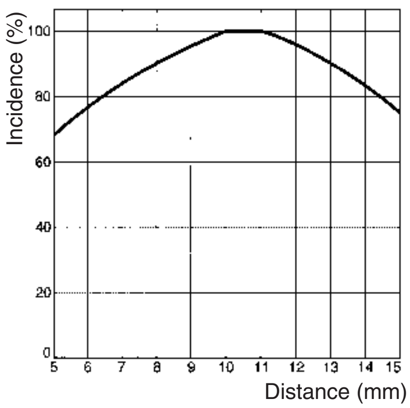
Ratings/Characteristics

Item	E3M-VG11	E3M-VG12	E3M-VG21	E3M-VG22	E3M-VG16	E3M-VG17	E3M-VG26	E3M-VG27
Sensing distance	10±3 mm							
Spot size (W x H)	1 x 4 mm		4 x 1 mm		1 x 4 mm		4 x 1 mm	
Light source (wave-length)	Green LED (525 nm)							
Power supply voltage	10 to 30 VDC, ripple (p-p) 10% max.							
Current consumption	100 mA max.							
Control output	Load power supply voltage: 30 VDC max. Load current: 100 mA max. (Residual voltage: 1.2 V max.) NPN open collector output type				Load power supply voltage: 30 VDC max. Load current: 100 ma max. (Residual voltage: 2 V max.) PNP open collector output type			
Remote control input[1]	ON: Short-circuited to 0 or 1.5 V max. (with a flow current of 1 mA max.) OFF: Open or V_{CC} - 1.5 V to V_{CC} (with a leakage current of 0.1 mA max.)				ON: V_{CC} - 1.5 V to V_{CC} (with an absorption current of 3 mA max.) OFF: Open or 1.5 V max. (with a leakage of 0.1 mA max.)			
Remote control output[1]	Load power supply voltage: 30 VDC max. Load current: 100 mA max. (Residual voltage: 1.2 V max.) NPN open collector output type				Load power supply voltage: 30 VDC max. Load current: 100 ma max. (Residual voltage: 2 V max.) PNP open collector output type			
Bank selection	Two banks selectable. Available for remote control only. (Refer to Remote Control Function.)							
Circuit protection	Protection from reversed power supply connection and load short-circuit							
Response time	ON: 50 μs max. OFF: 70 μs max.							
Ambient illumination (on receiver lens)	Incandescent lamp: 3,000 ℓx max. Sunlight: 10,000 ℓx max.							
Ambient temperature	Operating: -20°C to 55°C/Storage: -30°C to 70°C (with no icing)							
Ambient humidity	Operating: 35% to 85%/Storage: 35% to 95°C (with no condensation)							
Insulation resistance	20 M min. (at 500 VDC)							
Dielectric strength	1,000 VAC, 50/60Hz, 1 min.							
Vibration resistance[2]	Destruction: 10 to 55 Hz, 1-mm double amplitude or 150 m/s2 for 2 hrs each in X, Y, and Z directions							
Shock resistance[3]	Destruction: 500 m/s2 3 times each in X, Y, and Z directions							
Degree of protection	IEC60529 IP67 (with protective cover)							
Connection method	Connector	Pre-wired	Connector	Pre-wired	Connector	Pre-wired	Connector	Pre-wired
Weight with package box	Approx. 100 g							
Material	Case: Polybutylene terephthalate Lens: Acrylic (PMMA)							
Others	Instruction manual							

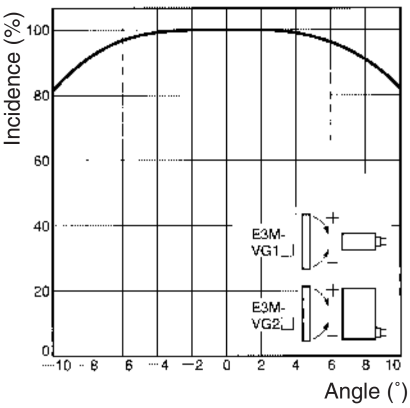
1. Remote controll input and answer-back output share the same signal line.
2. The Sensor withstands 0.75 mm double amplitude or 100 m/s^2 if the mounting bracket is attached to the sensor
3. The Sensor withstands 300 m/s^2 if the mounting bracket is attached to the sensor.

Engineering Data

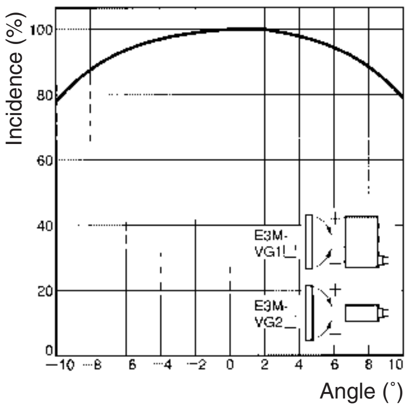
Sensing Distance vs. Incident Characteristics (Typical)
E3M-VG1□



Angle vs. Incident Characteristics (X Direction)
E3M-VG1□/VG2□



Angle vs. Incident Characteristics (Y Direction)
E3M-VG1□/VG2□

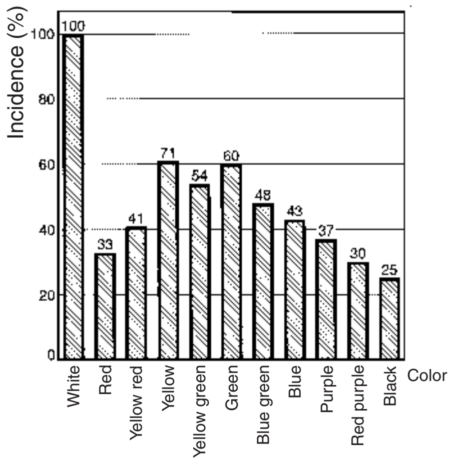


Color Sensing Capacity
E3M-VG□□

	White	Red	Yellow red	Yellow	Yellow green	Green	Blue green	Blue	Purple	Red purple	Black
White		○	○	○	○	○	○	○	○	○	○
Red	○		○	○	○	○	○	○	○	X	Δ
Yellow red	○	○		○	○	○	○	○	X	○	○
Yellow	○	○	○		○	○	○	○	○	○	○
Green yellow	○	○	○	○		○	○	○	○	○	○
Green	○	○	○	○	○		○	○	○	○	○
Blue green	○	○	○	○	○	○		Δ	○	○	○
Blue	○	○	○	○	○	○	Δ		Δ	○	○
Purple	○	○	X	○	○	○	○	Δ		○	○
Red purple	○	X	○	○	○	○	○	○	○		X
Black	○	Δ	○	○	○	○	○	○	○	X	

○: Detectable Δ: Detectable but unstable X: Not detectable

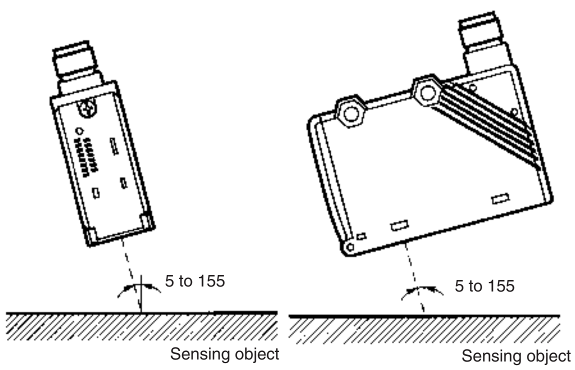
Differences in Incident by Color



Technical Guide

Glossy Sensing Objects

Incline the Sensor to detect glossy objects so that the Sensor will not be influenced by the mirror reflection of light and to ensure the stable sensing operation of the E3M-V.

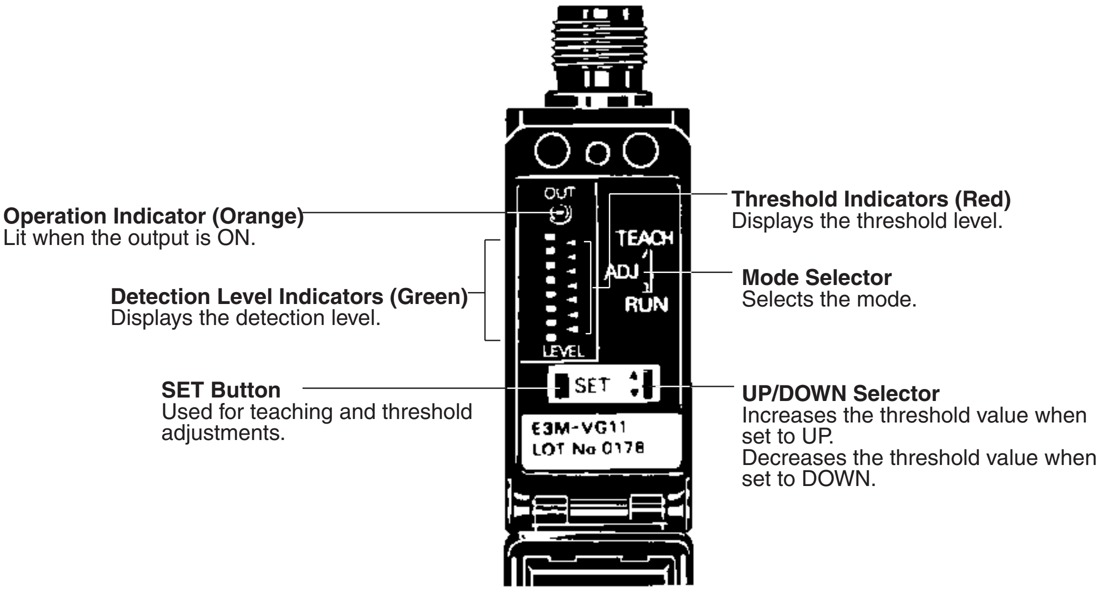


Standard Sensing Object (Color vs. Munsell)

Japan Color Enterprises Standard Color Card 230

11 standard colors	Munsell color notation
White	N9.5
Red	4R, 4.5/12.0
Yellow red	4YR, 6.0/11.5
Yellow	5Y, 8.5/11.0
Yellow green	3GY, 6.5/10.0
Green	3G, 6.5/9.0
Blue green	5BG, 4.5/10.0
Blue	3PB, 5.0/10.0
Purple	7P, 5.0/10.0
Red purple	6RP, 4.5/12.5
Black	N2.0

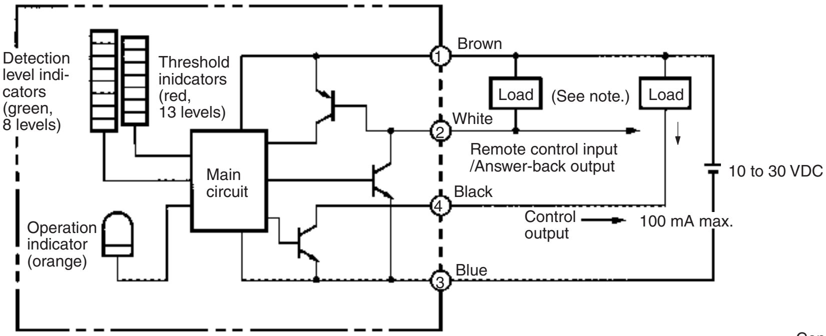
Nomenclature



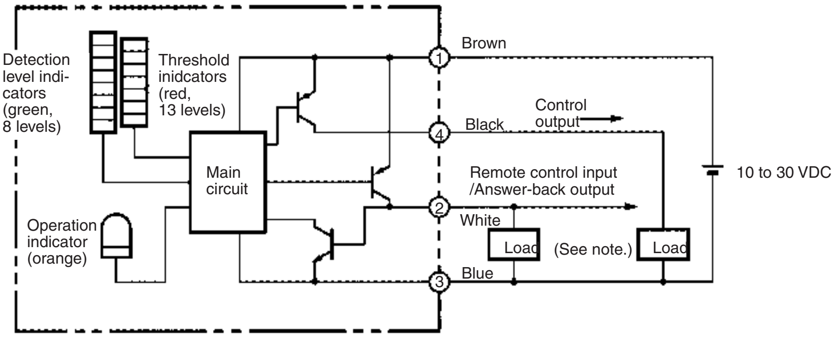
Operation

Output Circuits

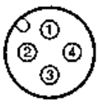
NPN (E3M-VG11, E3M-VG12, E3M-VG21, E3M-VG22)



PNP (E3M-VG16, E3M-VG17, E3M-VG26, E3M-VG27)



Connector Pin Arrangement



Adjustments

Adjustment Steps

1. Install, wire, and turn ON the Photomicrosensor.
2. Perform teaching (mark registration). Refer to *Mark Registration (Teaching)*.
3. Make fine adjustments of the threshold level if necessary. Refer to *Threshold Level Adjustments* on page A-139 .
4. Check that the mode selector is set to RUN.

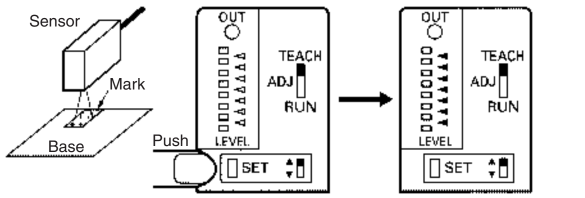
Mark Registration (Teaching)

Refer to the following for ideal teaching.

Application		
The base has a color pattern. The mark and base are clearly different in color.	The base has no color pattern. The mark and base are slightly different in color.	The base has no color pattern. Remote teaching with no positioning is desired.
One-point teaching	**Two-point teaching**	**Auto-teaching**
The default level is set and the output is ON when the mark is detected.	The threshold level is set between the color of the mark and base. The output is ON when the mark is detected.	The threshold level is set between color of the mark and base. The output is ON when the mark (i.e., the color with shorter passing time) is detected.

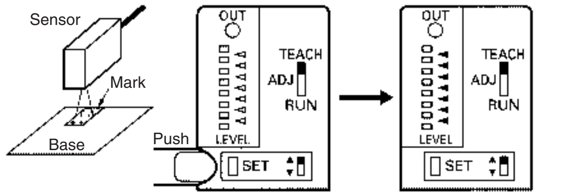
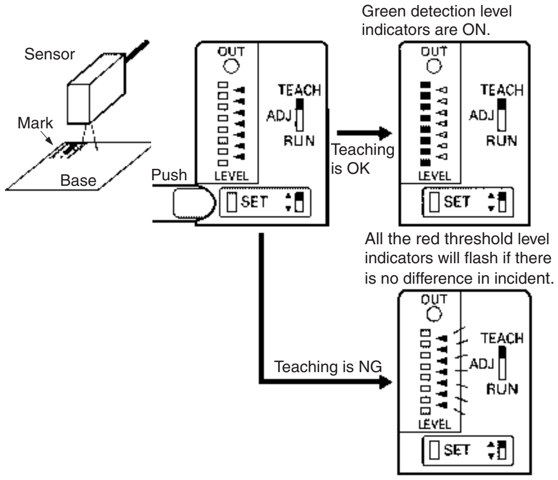
Refer to the following for each teaching method. Remote one- or two-point teaching is possible. Refer to *Remote Control Function*.

One-point Teaching

1	Set the mode selector to TEACH.
2	Locate the mark to the sensing position and press the SET button. Then all the red threshold indicators are ON.  Red threshold indicators are ON.
3	Set the mode selector to RUN. The output will be ON whenever the set mark is detected.

Note: By teaching on the base, reversed output as shown above (base: ON, mark: OFF) can be obtained.

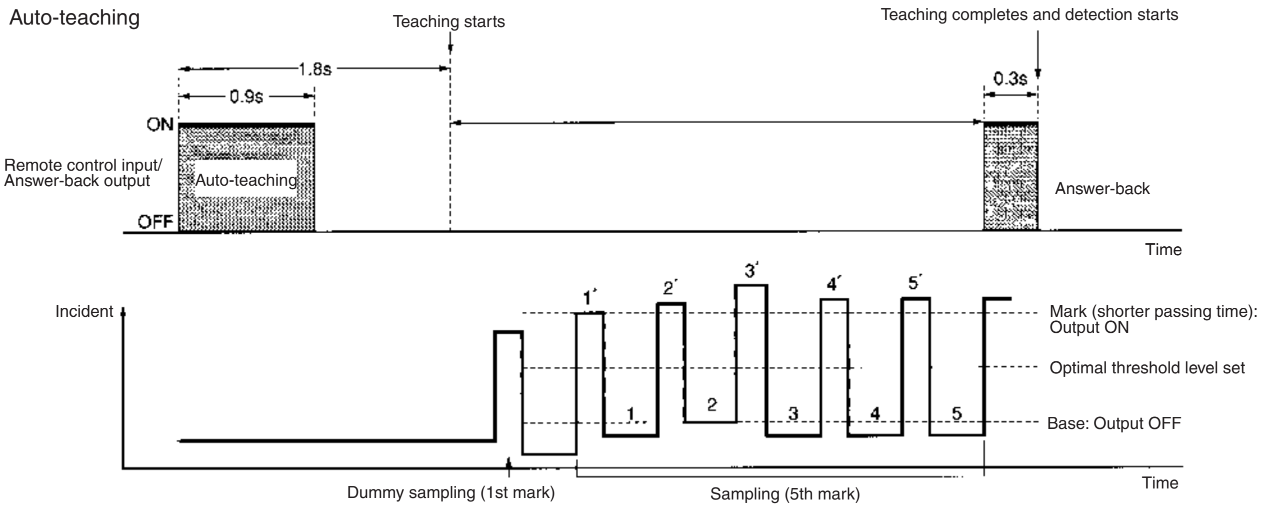
Two-point Teaching

1	Set the mode selector to TEACH.
2	Locate the mark to the sensing position and press the SET button. All the red threshold indicators will turn ON.  Red threshold indicators are ON.
3	If teaching is successfull, move the mark and press the SET button at the base. • If teaching is successfull, all the green detection level indicators are ON. • If teaching is unsuccessfull, all the red threshold level indicator flash. 
4	If teaching is successful, set the mode selector to RUN to complete the teaching operation. If teaching is unsuccessful, restart from the above step 2.

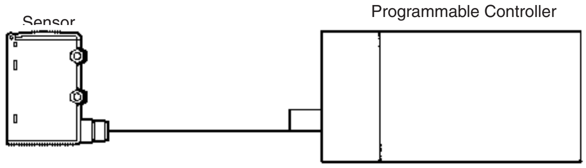
Note: Follow the above steps so that the output will be turned ON whenever the mark is detected. By taking the opposite steps, the output will be turned OFF whenever the mark is detected and turned ON whenever the base is detected.

Auto-teaching

1. Check that the mode selector is set to either RUN or ADJUST.
2. Input a 0.9-s pulse signal into the remote control I/O terminal.[1]
3. Auto-teaching starts when the mark is moved. When the mark passes six times, auto-teaching completes.
- If teaching is successful, answer-back output from the remote control I/O terminal will turn ON for 0.3 s.
- If teaching is unsuccessful, no answer-back signal will be output. Readjust using two-point teaching. (Teaching will be unsuccessful if there is no difference in incident between the mark and base.)
4. If the answer-back signal is ON, the whole teaching operation will be completed. The output will be turned ON whenever the mark (i.e., the color with shorter passing time) is detected.



Example of Connection to Programmable Controller



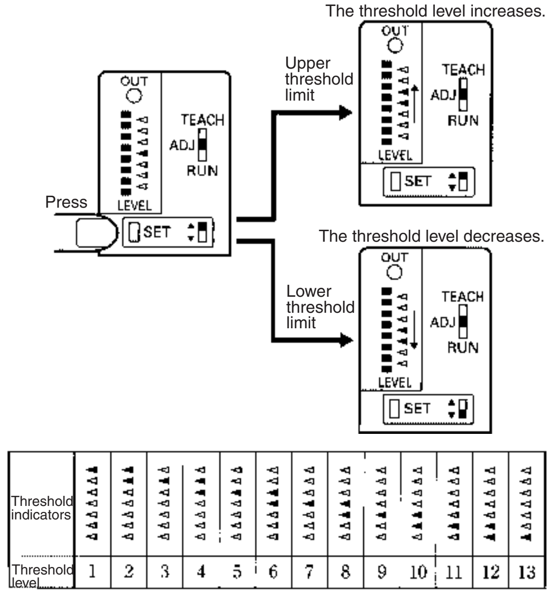
Note: Be sure to connect the E3M-V to the Programmable Controller as shown above.

Precautions when Using Automatic Teaching

Incorrect discrimination may be caused by automatic teaching in the following cases. Use one-point or two-point teaching in such cases.
- Color patterns exist in the base.
- Sensing objects change their positions.
- Sensing objects have protrusions or surface level differences.

Threshold Level Adjustments

It is possible to make fine adjustments of the threshold level after teaching. Such fine adjustments can be made remotely as well. Refer to *Remote control Function (Bank Selection, Mark Registration, and Threshold Adjustments)* on page A-140 .

1	Set the mode selector to ADJUST
2	Select the upper or lower threshold selector. Whenever the SET button is pressed, the threshold level will move. Two indicators will be lit together when the threshold level is an even level. 
3	After setting the level, set the mode selector to RUN.

1. Make sure that the input tolerance of each pulse is within ±0.1 s.

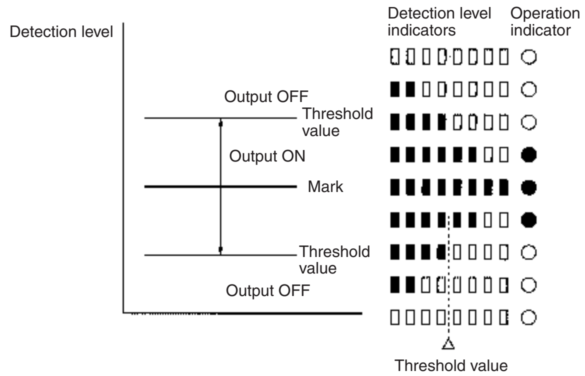
Detection Level Indicator

Detection Level Indicator

The control output of the E3M-V will be turned ON if the detection level exceeds the threshold level. The indication of the detection level varies with the teaching method.

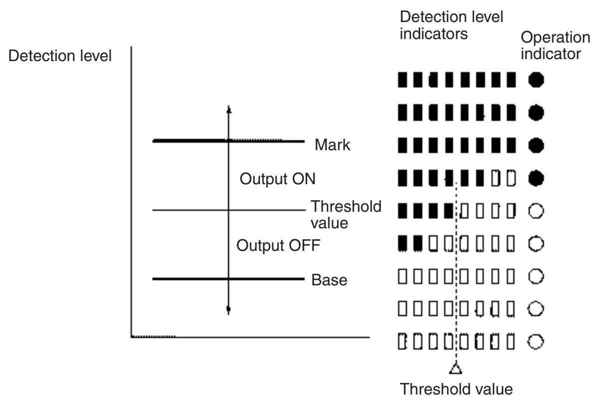
One-point Teaching

The upper and lower threshold values are set on the basis of the mark and the detection level indicators indicate the degree of color conformity to the mark's color.



Two-point or Auto-teaching

A single threshold value is set between the mark (registered first) and the base (registered next). The detection level indicators indicate the tolerance between the mark and base.

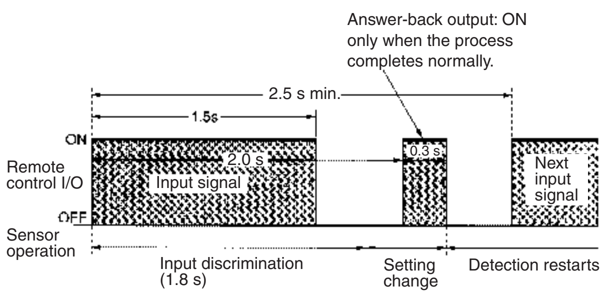


Remote control Function (Bank Selection, Mark Registration, and Threshold Adjustments)

Under Run Mode or Adjust Mode

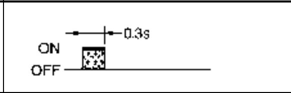
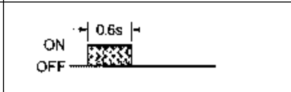
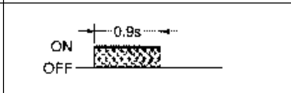
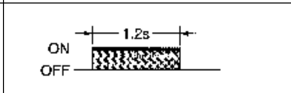
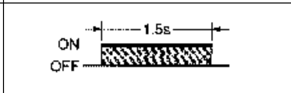
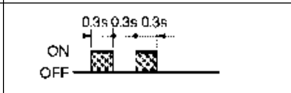
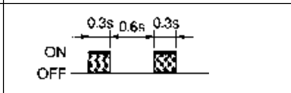
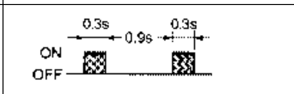
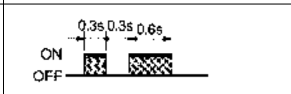
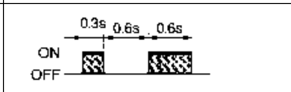
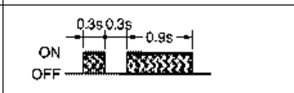
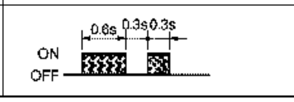
The input of any of the signals listed in the following table into the remote control I/O terminal allows remote control of the E3M-V. When the signal is accepted, answer-back output will be turned ON for 0.3 s. Only in the case of one-point teaching, however, can the signal be manually input, provided that the input is ON for 1.5 s or more.

Timing Chart



Note: If Signals are sent continuously, make sure that there is an interval of 2.5 s between signal inputs as shown above.

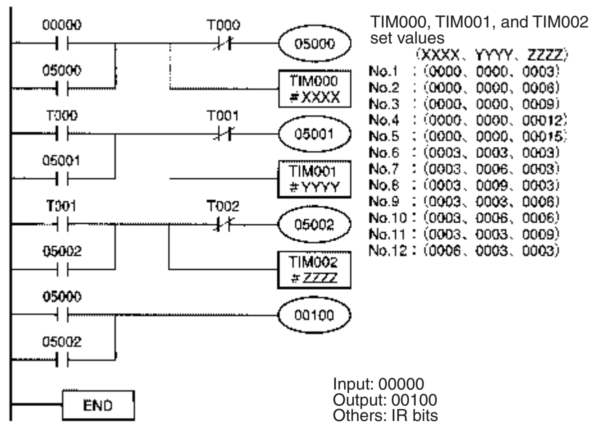
Control Signals

No.	Control signal	Function
1		Bank 1 is selected (operation indicator OFF in TEACH mode)
2		Bank 2 is selected (operation indicator ON in TEACH mode)
3		Auto-teaching
4		Two-point teaching (1st and 2nd)
5		One-point teaching (or input for 1.5 s min.)
6		Threshold level 1 is selected.
7		Threshold level 3 is selected.
8		Threshold level 5 is selected.
9		Threshold level 7 is selected.
10		Threshold level 9 is selected.
11		Threshold level 11 is selected.
12		Threshold level 13 is selected.

Note: The input error of each signal pulse must be within ± 0.1 s

Ladder Program Example

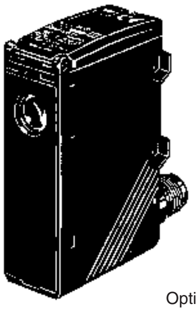
Control signals are input by a ladder program as shown below.



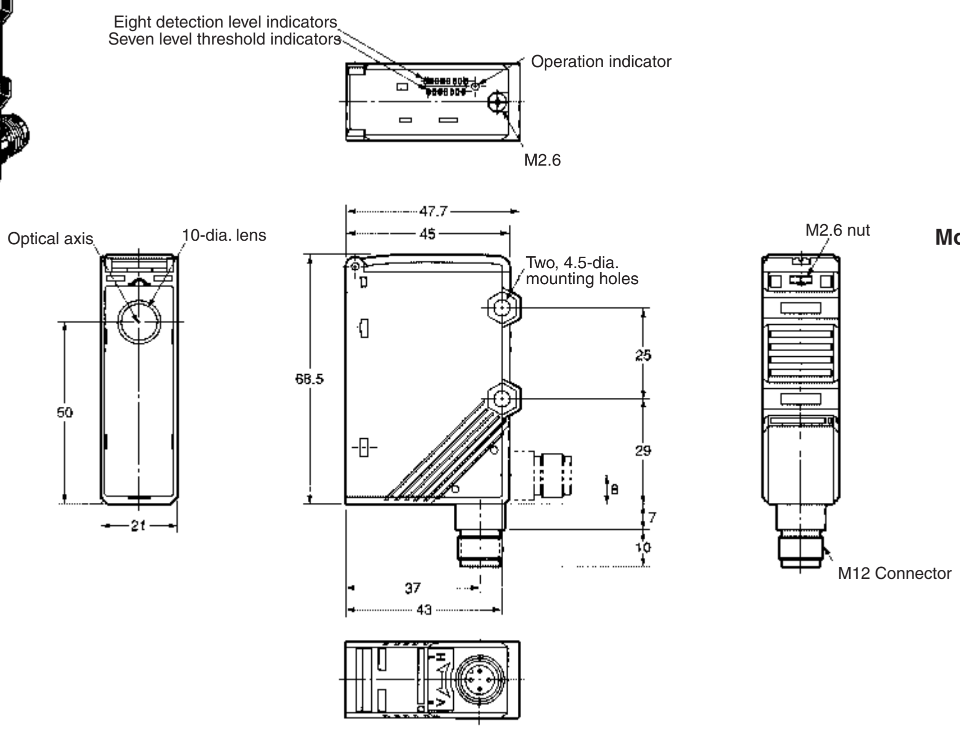
Dimensions

Note: All units are in millimeters unless otherwise indicated.

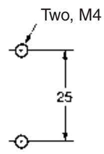
Mark Sensors



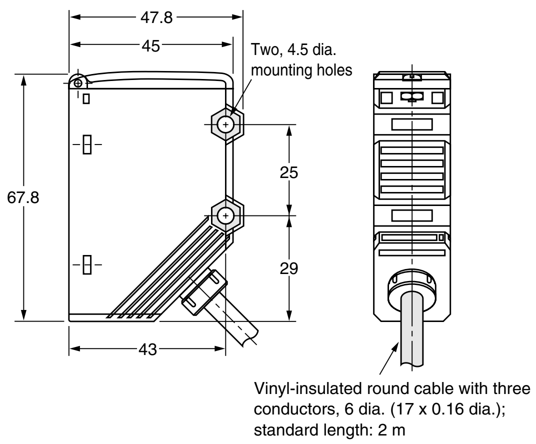
Connector Models



Mounting Holes



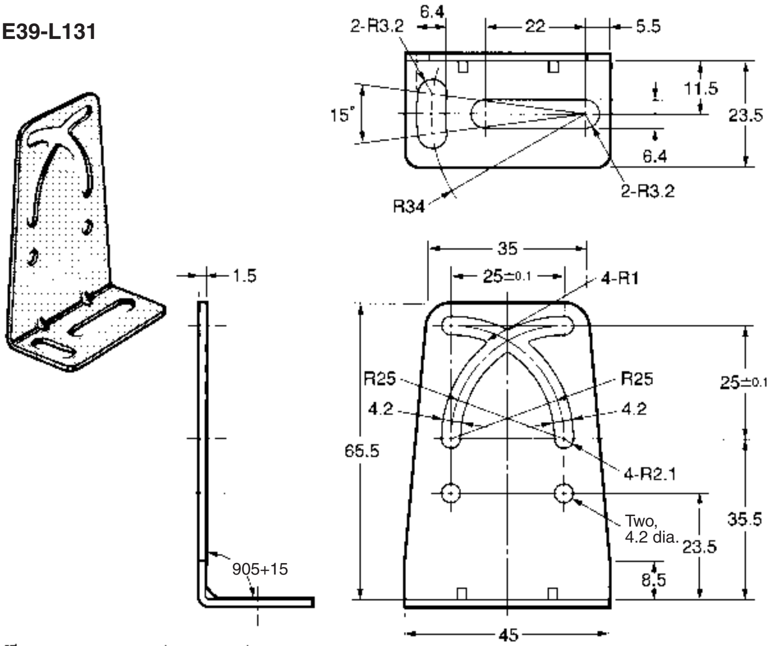
Pre-Wired Models



Accessories (Order Separately)

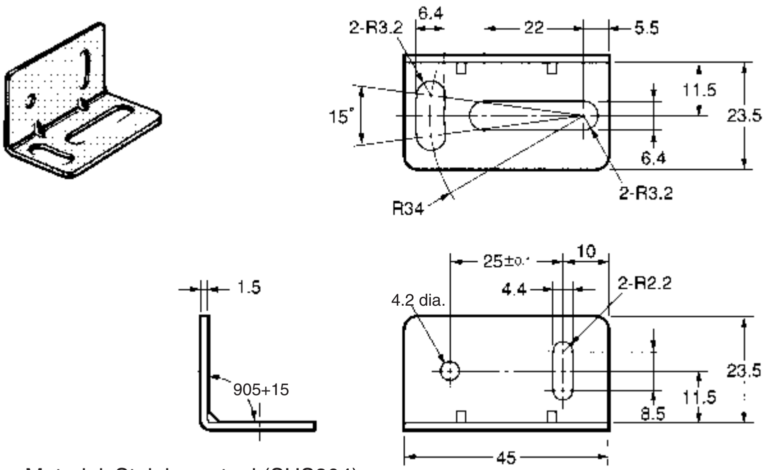
Mounting Brackets

E39-L131



Material: Stainless steel (SUS304)

E39-L132

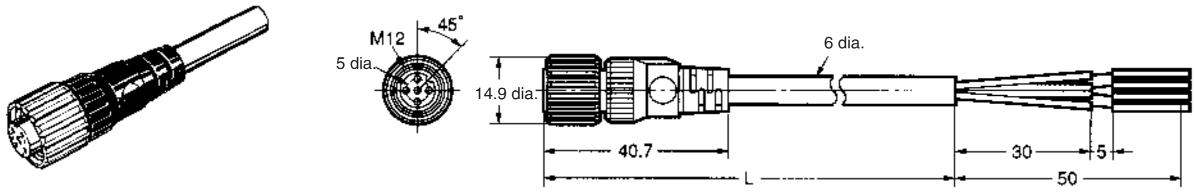


Material: Stainless steel (SUS304)

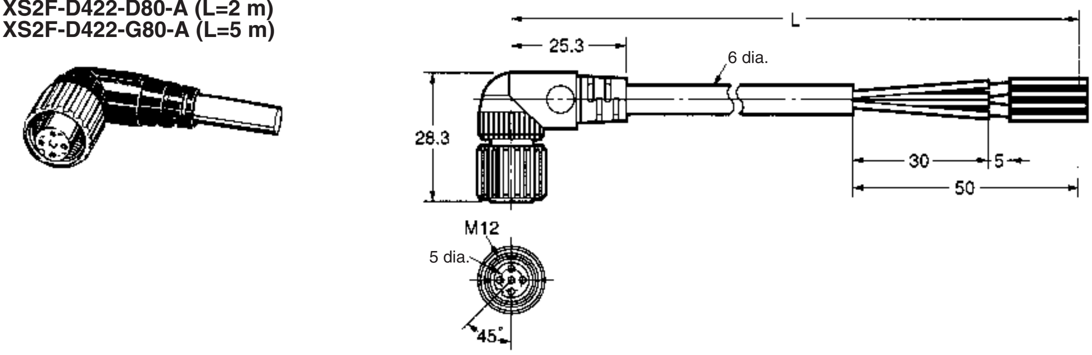
Sensor I/O Connectors

Single-end Connector (Straight Model)

XS2F-D421-D80-A (L=2 m)
XS2F-D421-G80-A (L=5 m)

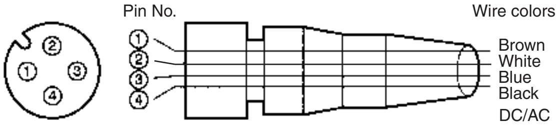


Single-end Connector (L-shaped Model)
XS2F-D422-D80-A (L=2 m)
XS2F-D422-G80-A (L=5 m)



Installation

Sensor I/O Connector



Note: 1 . pin No. 2 is not used.
2 . For details, refer to the *Sensor I/O Connectors Catalog (X065)*

Classification	Wire color	Connector pin No.	Use
DC	Brown	1	Power supply (+V)
	---	2	---
	Blue	3	Power supply (0V)
	Black	4	Output

Precautions

Observe the following precautions to ensure safety.

- Do not use the Sensor in locations subject to flammable or explosive gases.
- Do not use the Sensor in water or conductive solution.
- Do not disassemble, repair, or modify the Sensor.
- Use the Sensor under proper power supply specifications such as the use of AC or DC power supply.
- Do not apply any voltage or current exceeding the rated level.
- Be careful with the power supply polarities and wire correctly.
- Connect the loads correctly.
- Do not short-circuit both ends of loads.

Correct Use

Installation

Power Reset Time

Since the E3M-V is ready to detect objects from 100 ms max. after the E3M-V is turned ON, operate the remaining devices 100 ms after the Sensor is turned ON. If power is supplied to the E3M-V and the load independently, be sure to turn on the E3M-V first.

Power OFF

The E3M-V may output a single pulse when the control power supply is turned OFF. If the E3M-V is connected to a timer or counter to which power is supplied from an independent power supply, the E3M-V will be more likely to output a single pulse when the control power supply is turned OFF. Therefore, supply power to the timer or counter from the same power supply for the E3M-V.

Power Supply Type

No full-wave or half-wave rectified power supplies can be connected to the E3M-V.

Power Supply Connection

Be sure to ground the FG (frame ground) and G (ground) terminals if a switching regulator is connected to the E3M-V, otherwise the E3M-V may malfunction due to the switching noise of the switching regulator.

Wiring

Cable

The cable can be extended up to 100 m provided that the thickness of the cable is 0.3 mm2 minimum.

Repeated Cable Bending

The cable must not be bent repeatedly.

High-tension Lines

The power supply lines of the Sensor must not be wired alongside power lines or high-tension lines in the same conduit, otherwise the Sensor may become damaged or malfunction due to induction noise that may be generated from the power lines or high-tension lines. Route the lines separately or in a single conduit.

Cable Pulling Force

Do not pull cables with pulling forces exceeding 50N.

Mounting

Screw Tightening

Make sure that the casing is tightened to a maximum torque of 1.2 N o m.

Mounting Direction

When Sensors are mounted to face each other, make sure to adjust the optical axes so that the Sensors will not be mutually interfered.

Others

EEPROM Write Error

An EEPROM error may result if power supply to the Sensor fails or the Sensor is influenced by static noise, in which case the threshold level indicators will flash. Perform the teaching and threshold level setting of the E3M-V again.

M12 Metal Connector

Make sure to connect or disconnect the metal connector after turning off the E3M-V.

Make sure to hold the connector cover when connecting or disconnecting the metal connector.

Tighten the metal connector securely by hand. Do not use any tool, such as pliers, otherwise the metal connector may be damaged.

If the metal connector is not tightened securely, the metal connector may be disconnected by vibration and the proper degree of protection of the E3M-V may not be maintained.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Printed Circuit Board Sensor

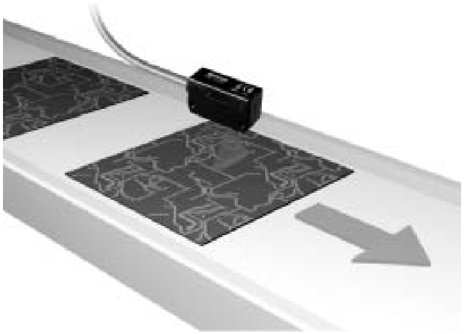
E3S-LS3

Printed circuit board sensor capable of stable detection without being affected by holes or notches.

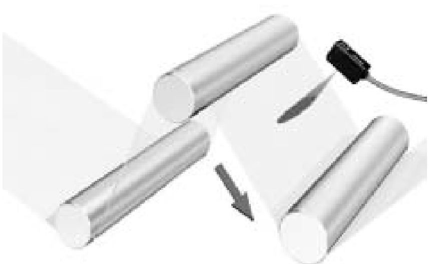
- Suitable for incorporation in devices (E3S-LS3☐).
- Wide range is suitable for component boards with high or irregularly shaped components (E3S-LS3☐W).

Applications

Detecting for PCBs



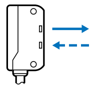
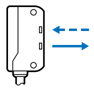
Transparent Film Sheet Detection



Detection for Wafer-cassette Mounting

Ordering Information

Red light

Sensor type	Shape	Connection method	Detection distance *	Timer function	Model	Output
Limited reflective		Pre-wired (2 m)	20 to 35 mm	Without	E3S-LS3N	NPN Light ON
			10 to 60 mm		E3S-LS3NW	
		Pre-wired (2 m)	20 to 35 mm	Without	E3S-LS3P	PNP Light ON
				With	E3S-LS3PT	
		Pre-wired M8 3-pin connector (0.3 m)		Without	E3S-LS3P-M5J	
				With	E3S-LS3PT-M5J	
		Pre-wired M8 4-pin connector (0.3 m)		Without	E3S-LS3P-M3J	
				With	E3S-LS3PT-M3J	
		Pre-wired (2 m)	10 to 60 mm	Without	E3S-LS3PW	
				With	E3S-LS3PWT	
		Pre-wired M8 3-pin connector (0.3 m)		Without	E3S-LS3PW-M5J	
				With	E3S-LS3PWT-M5J	
		Pre-wired M8 4-pin connector (0.3 m)		Without	E3S-LS3PW-M3J	
				With	E3S-LS3PWT-M3J	

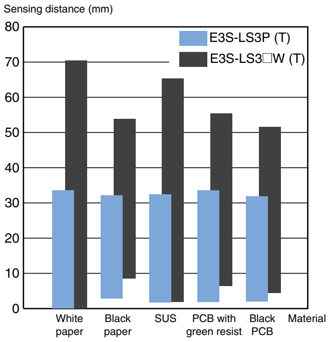
* Using 80 x 80 mm white art paper

Rating/performance

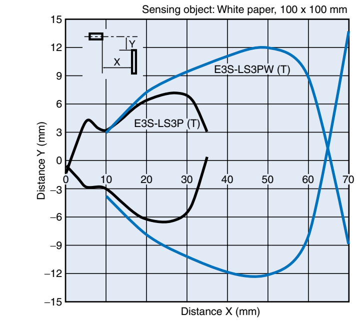
Item	Sensor type / Model	Limited reflective: E3S-LS3☐	E3S-LS3PT	E3S-LS3☐W	E3S-LS3PWT
Sensing	White art paper	20 to 35 mm		10 to 60 mm	
	Black paper *	20 to 30 mm		15 to 50 mm	
Light source (wave length)		Red LED (660 nm)			
Power supply voltage		12 to 24 VDC±10%, ripple (p-p) 10% max.			
Current consumption		25 mA max.			
Control output		Load power supply voltage: 24 VDC max.; Load current: 100 mA max., Residual voltage: 2 V max.; Operating mode: Light ON			
Response time		1 ms max. for operation and reset respectively			
Timer function		Available with E3S-LS3P(W)T models only. Time range: 0.1 to 1.0 s (adjustable)			
Ambient illuminance		Receiver side: Incandescent lamp: 5,000 lux max.			
Ambient temperature		Operating: -10 to 55°C (with no icing or condensation)			
Ambient humidity		Operating:35% to 85% (with no condensation)			
Insulation resistance		20 MΩ min. (at 500 VDC) between charged parts and the case			
Dielectric strength		1,000 VAC at 50/60 Hz for 1 minute between charged parts and the case			
Vibration resistance		10 to 55 Hz with a 1.5-mm double amplitude for 2 hrs each in X, Y and Z directions			
Shock resistance		500 m/s^2, 3 times each in X, Y and Z directions			
Protective structure		IEC60529 IP40			
Connection method		Pre-wired (standard length: 2 m)/Pre-wired M8 connector (standard length: 0.3 m)			
Indicators		Operation indicator (orange)			
Weight (Packed state)		Pre-wired models: Approx. 80 g; Pre-wired M8 connector: Approx. 45 g			
Material	Case	ABS			
	Lens	Acrylic			
Accessories		Instruction sheet, M3 screws,			

Characteristic data (typical)

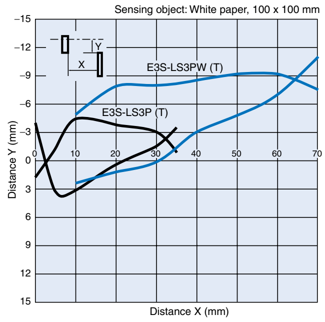
Sensing Distance vs. Materials



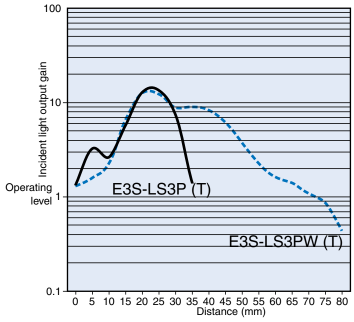
Operating Range (Left and Right)



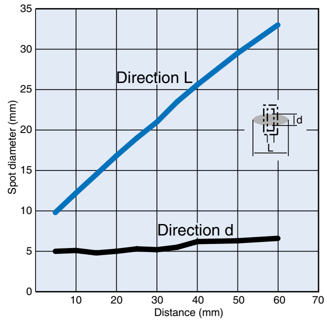
Operating Range (Up and Down)



Output vs. Set Distance

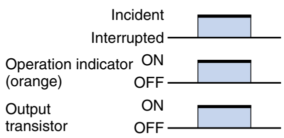
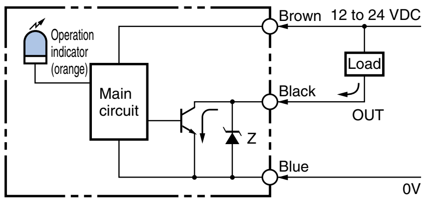
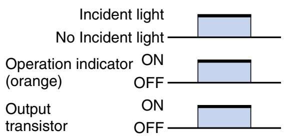
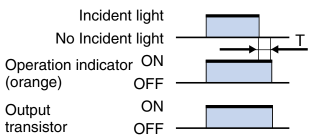


Spot Diameter vs. Sensing Distance



Output Circuit Diagram

NPN output (PNP output will be available soon)

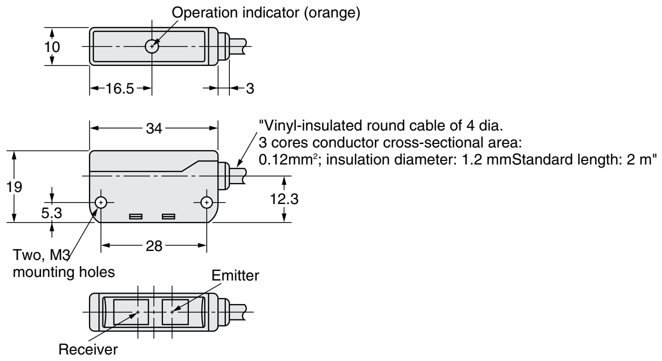
<table>
<tr><th>Model</th><th>Operating status of output transistor</th><th>Timing chart</th><th>Output circuit</th></tr>
<tr><td>E3S-LSN3
E3S-LS3NW</td><td rowspan="3">Light ON</td><td>
</td><td rowspan="3">
</td></tr>
<tr><td>E3S-LS3P
E3S-LS3PW</td><td>
</td></tr>
<tr><td>E3S-LS3PT
E3S-LS3PWT</td><td>

T: Off-delay timer (0.1 to 1.0 s)</td></tr>
</table>

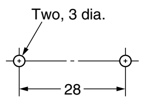
Dimensions (Unit: mm)

Note: All units are in millimeters unless otherwise indicated.

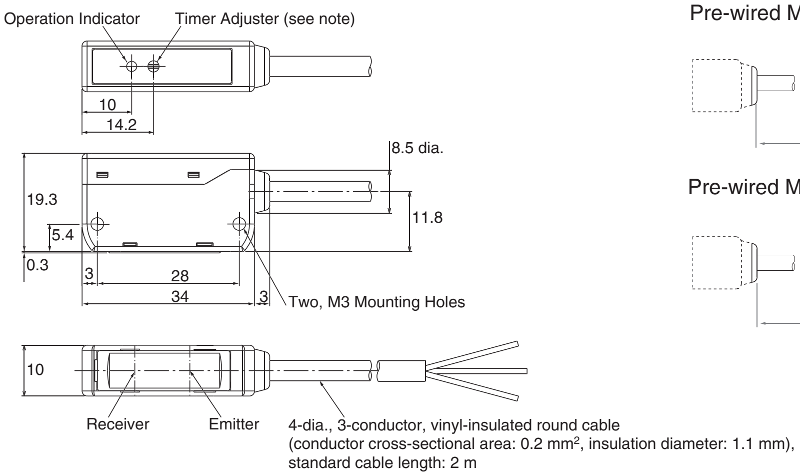
E3S-LS3N
E3S-LS3NW



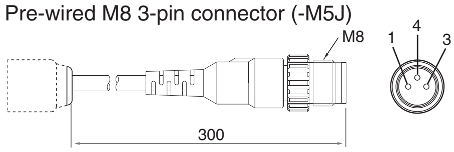
Mounting Holes



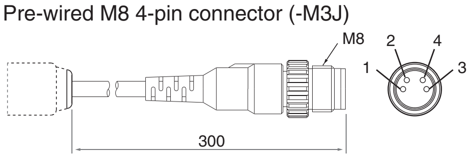
E3S-LS3□(T)(-M5J/-M3J)
E3S-LS3□W(T)(-M5J/-M3J)



Pre-wired M8 3-pin connector (-M5J)

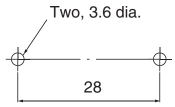


Pre-wired M8 4-pin connector (-M3J)



Terminal number	Specifications	
	-M5J	-M3J
1	+V	+V
2	–	Open
3	0 V	0 V
4	Output	Output

Mounting Holes



Note: The Timer Adjuster is only for the E3S-LS3PT and E3S-LS3PWT.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

 In the interest of product improvement, specifications are subject to change without notice.

All voltage photoelectric sensors

E3JK

- Built-in amplifier accepts wide supply voltage range.
- Slim, space-saving construction measures only 50 x 50 x 17.4 mm.
- Relay outputs with long life expectancy and high switching capacity (3 A, 250 V AC).
- Polarized retroreflective type available for glossy or shiny object detection.

Sensor type	Shape	Connection method	Sensing distance	Output form	Output		Model
Through-beam		Pre-wired models	5m	Light ON	Relay output		E3JK-5M1
				Dark ON			E3JK-5M2
				Light ON/ Dark ON (selectable)	DC transistor output		NPN: E3JK-5S3
Retroreflective model (with M.S.R. function)			2.5m (3m) *	Light ON	Relay output		E3JK-R2M1
				Dark ON			E3JK-R2M2
				Light ON/Dark ON (selectable)	DC transistor output	NPN	E3JK-R2S3
						PNP	E3JK-R2R3
Retroreflective model (without M.S.R. function)			4m (5m) *	Light ON	Relay output		E3JK-R4M1
				Dark ON			E3JK-R4M2
				Light ON/Dark ON (selectable)	DC transistor output (NPN)		E3JK-R4S3
Diffuse-reflective			300mm	Light ON	Relay output		E3JK-DS30M1
				Dark ON			E3JK-DS30M2
				Light ON/Dark ON (selectable)	DC transistor output (NPN)		E3JK-DS30S3

* The value within the parentheses indicates the sensing distance applied when the E39-R2 reflector is used.

Note: The UL-listed model ends with "-US". (Example: E3JK-5M1-US). Note that the DC transistor type of the E3JK is UL-unlisted.

Accessories (Order Separately)

Slits

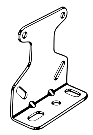
Slit width	Sensing distance		Minimum sensing object (typical)	Model	Quantity	Remarks
Width 1 mmx20 mm	E3JK-5□□	0.7 m	1 mm dia.	E39-S39	1 pc. each for emitter and receiver (total 2 pcs.)	(Seal type long slit) Can be used with the through-beam model E3JK-5□□.

Reflectors

Name	Sensing distance (typical)		Model	Quantity	Remarks
Reflectors	E3JK-R2□□	2.5 m (rated value)	E39-R1	1	Attached to the E3JK-R2□□. Attached to the E3JK-R4□□.
	E3JK-R4□□	4 m (rated value)			
	E3JK-R2□□	3 m	E39-R2	1	---
	E3JK-R4□□	5 m			
Small reflector	E3JK-R2□□	1 m (5 mm) *	E39-R3	1	---
Tape Reflector	E3JK-R2□□	750 mm (200 mm) *	E39-RS1	1	The M.S.R. function is available.
	E3JK-R2□□	1.2 m (200 mm) *	E39-RS2		
	E3JK-R2□□	1.5 m (200 mm) *	E39-RS3		

* Values in parentheses indicate the minimum required distance between the sensor and reflector.
Note: When the reflector used is other than the supplied one, set the sensing distance to about 0.7 times of the typical example as a guideline.

Mounting Brackets

Shape	Model	Quantity	Remarks
	E39-L40	1	Supplied with E3JK

Note: If a through-beam model is used, order two Mounting Brackets for the emitter and receiver respectively.

Rating/Performance

E3JK

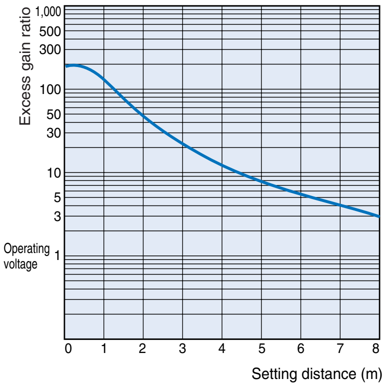
Item	Sensor type / Model	Through-beam		Retroflective model (with M.S.R. function)		Retroflective model (without M.S.R. function)		Diffuse-reflective	
		E3JK-5M□	E3JK-5S3	E3JK-R2M□	E3JK-R2□3	E3JK-R4M□	E3JK-R4S3	E3JK-DS30M□	E3JK-DS30S3
Sensing distance		5 m		2.5 m (When using the E39-R1)		4 m (When using the E39-R1)		300 mm (White paper 100x100 mm)	
Standard sensing object		Opaque 14.8 dia. min.		Opaque: 75 mm dia. min.				---	
Differential distance		---						20% max. of sensing distance	
Directional angle		Both emitter and receiver: 3°C to 20°C		1° to 5°				---	
Light source (wave length)		Infrared LED (950 nm)		Red LED (660 nm)				Infrared LED (950 nm)	
Power supply voltage		12 to 240 VDC ±10% ripple (p-p) : 10% max. 24 to 240 VAC ±10% 50/60 Hz							
Current consumption	DC	3 W max.		2 W max.					
	AC	3 W max.		2 W max.					
Control output		Relay output: 250VAC 3 A (cos =1) max., 5 VDC 10 mA min.	DC SSR Negative common 48 VDC 100 mA max. Leak current 0.1 mA max. With load short-circuit protection	Relay output: 250VAC 3 A (cos =1) max., 5 VDC 10 mA min.	DC SSR Negative or positive common 48 VDC 100 mA max. Leak current 0.1 mA max. With load short-circuit protection	Relay output: 250VAC 3 A (cos =1) max., 5 VDC 10 mA min.	DC SSR Negative common 48 VDC 100 mA max. Leak current 0.1 mA max. With load short-circuit protection	Relay output: 250VAC 3 A (cos =1) max., 5 VDC 10 mA min.	DC SSR Negative common 48 VDC 100 mA max. Leak current 0.1 mA max. With load short-circuit protection
Life expectancy (relay output)	Mechanical	50 million times or more (switching frequency 18,000 times/hour)							
	Electrical	100 thousand times or more (switching frequency 18,000 times/hour)							
Response time		30 ms max.	10 ms max.	30 ms max.	5 ms max.	30 ms max.	5 ms max.	30 ms max.	5 ms max.
Sensitivity adjustment		---						Single-turn adjustment	
Ambient illuminance		Incandescent lamp: 3,000 lux max.							
Ambient temperature		Operating: -25°C to 55°C, Storage: -30°C to 70°C (with no icing or condensation)							
Ambient humidity		Operating: 45% to 85%RH, Storage: 35% to 95%RH (with no condensation)							
Insulation resistance		20 M min. at 500 VDC							
Dielectric strength		1,500 VAC at 50/60 Hz for 1 minute							
Vibration resistance	Destruction	10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions							
	Malfunction	10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions							

Item	Sensor type / Model	Through-beam		Retroflective model (with M.S.R. function)		Retroflective model (without M.S.R. function)		Diffuse-reflective	
		E3JK-5M□	E3JK-5S3	E3JK-R2M□	E3JK-R2□3	E3JK-R4M□	E3JK-R4S3	E3JK-DS30M□	E3JK-DS30S3
Shock resistance	Destruction	Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions							
	Malfunction	Destruction: 100m/s^2 (approx. 10G) 3 times each in X, Y, and Z directions	Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions	Destruction: 100m/s^2 (approx. 10G) 3 times each in X, Y, and Z direc tions	Destruction: 500 m/s^2 for 3 times each in X, Y and Z directions	Destruction: 100m/s^2 (approx. 10G) 3 times each in X, Y, and Z direc tions	Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions	Destruction: 100m/s^2 (approx. 10G) 3 times each in X, Y, and Z direc tions	Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions
Protective structure		IEC60529 IP64							
Connection method		Pre-wired models (standard length: 2 m)							
Weight (Packed state)		Approx. 420 g		Approx. 250 g					
Material	Case	ABS							
	Lens	Acrylics							
	Mounting bracket	Steel							
Accessories		Mounting bracket (with screws), nuts, instruction manual, reflector (retroreflective model only)							

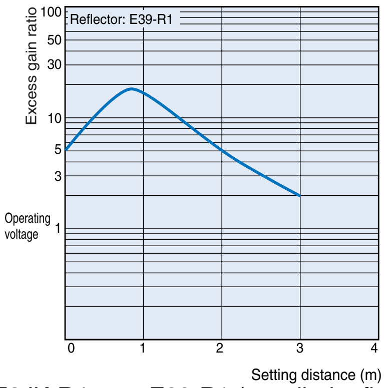
Characteristic data (typical)

Excess Gain Ratio vs. Setting Distance

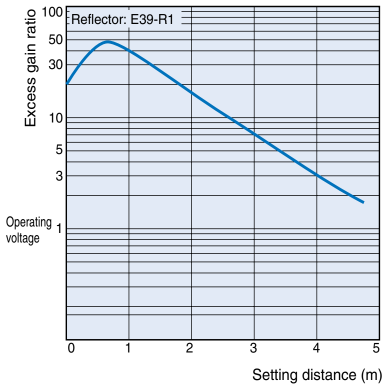
Through-beam model
E3JK-5□□



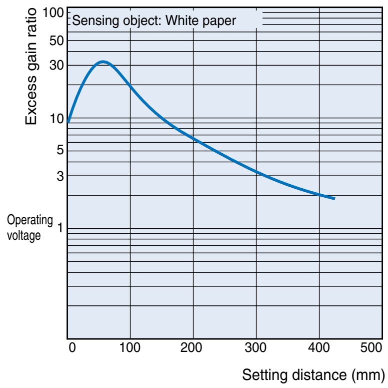
Retroreflective Models
E3JK-R2□□ + E39-R1 (supplied reflector)



E3JK-R4□□ + E39-R1 (supplied reflector)



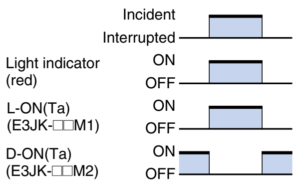
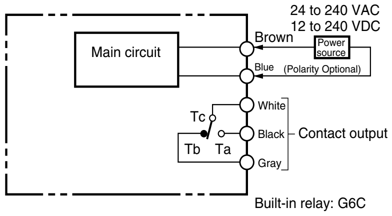
Diffuse-reflective
E3JK-DS30□□



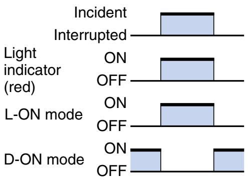
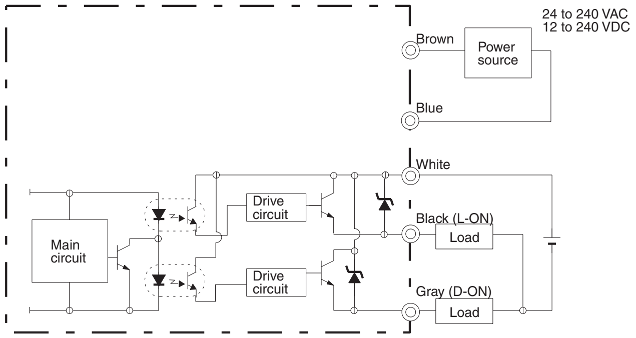
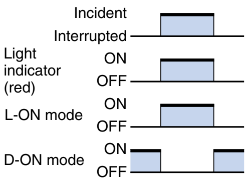
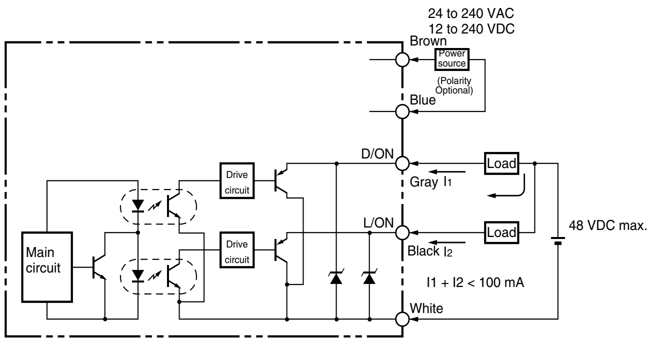
Output Circuit Diagram

E3JK

Relay output

Model	Timing chart	Output circuit
E3JK-5M1 E3JK-5M2 E3JK-R2M1 E3JK-R2M2 E3JK-R4M1 E3JK-R4M2 E3JK-DS30M1 E3JK-DS30M2		

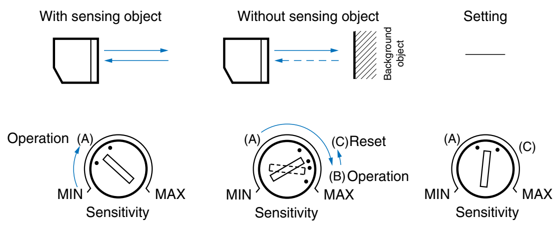
DC transistor output

Model	Timing chart	Output circuit
E3JK-5S3 E3JK-R2S3 E3JK-R4S3 E3JK-DS30S3		
E3JK-R2R3		 Note: The output stage leakage currents are 0.1 mA max., respectively.

Note: Connect to brown and blue on the emitter side.

Operation

Adjustment

<table>
<tr><th>Item
Model</th><th>Through-beam</th><th>Retroreflective Models</th><th>Diffuse-reflective</th></tr>
<tr><td>E3JK</td><td>Swing the receiver and emitter vertically and/or horizontally and set the adjuster in the center of the range where the indicator of the receiver turns ON.</td><td>Like the through-beam model, adjust the reflector and emitter/receiver. Since the directional angle of the emitter/receiver is 1 to 5°, adjust the emitter/receiver especially carefully.</td><td>

(1) If you have a sensing object as shown in the figure, turn the sensitivity adjuster clockwise (increase the sensitivity) until the indicator is turned ON, and define this adjuster position as (A).
(2) Remove the sensing object, turn the sensitivity adjuster clockwise until the indicator is turned ON by a background object, and define this position as (B).
(3) Turn the sensitivity adjuster counterclockwise (decrease the sensitivity) from (B) until the indicator is turned OFF, and define this position as (C).
(4) The position in the middle of (A) and (C) is the optimum position. If the indicator is not turned ON by the background object at the maximum sensitivity, set the adjuster in the middle of (A) and maximum sensitivity.
The sensitivity adjuster may be damaged if an excessive force is applied.</td></tr>
</table>

Precautions

Correct Use

E3JK

Design

Power Reset Time

The Sensor is ready to detect an object within 200 ms after it is turned ON. If Sensor and load are connected to separate power supplies, ensure to turn ON the Sensor first.

Wiring Considerations

Connection/Wiring

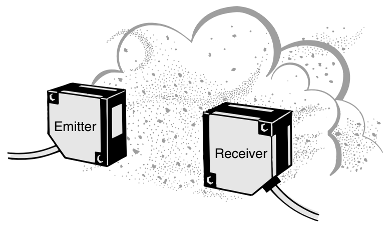
If the DC transistor output type is used, the sum of load currents of L-ON output (NO) and D-ON output (NC) should be within 100 mA. If the sum of load currents exceeds 100 mA, the load short-circuit protection may be activated. (The load short-circuit protection is reset by turning OFF the power of the photoelectric sensor.)

Miscellaneous

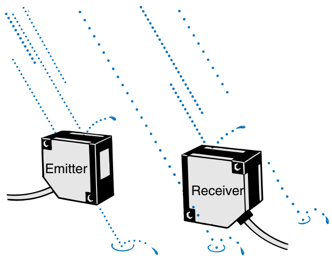
Ambient Conditions (Installation Area)

The E3JK will malfunction if installed in the following places.

- Places where the E3JK is exposed to a dusty environment.
- Places where corrosive gases are produced.



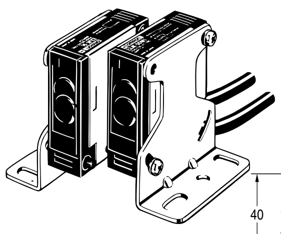
- Places where the E3JK is directly exposed to water, oil, or chemicals.



Dimensions (Unit: mm)

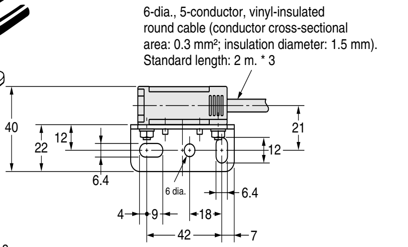
Sensors

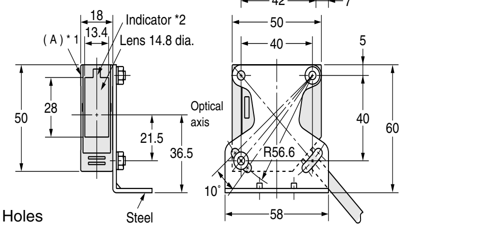
E3JK-5□□



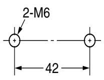
Emitter: E3JK-5L
Receiver: E3JK-5D□□

With Mounting Bracket Attached



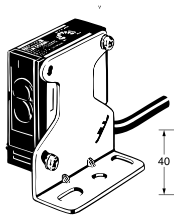


Mounting Holes

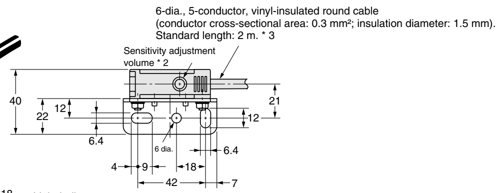


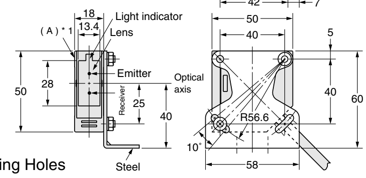
* 1.Mounting brackets can be used on the A side (Two, M4 x 20 attached) .
* 2.Emitter: Power indicator
  Receiver: Light indicator
* 3.Emitter includes 2-conductor.

E3JK-R2□□
E3JK-R4□□
E3JK-DS30□□

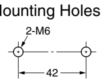


With Mounting Bracket Attached





Mounting Holes

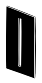


* 1. Mounting brackets can be used on the A side (Two, M4 x 20 attached) .
* 2. No sensitivity adjustment volume on the retororeflective model.

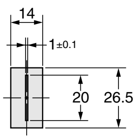
Accessories (Order Separately)

Seal type long slit (for E3JK)

E39-S39



Material: Polyester
0.1 mm thick



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

Transparent bottle sensor

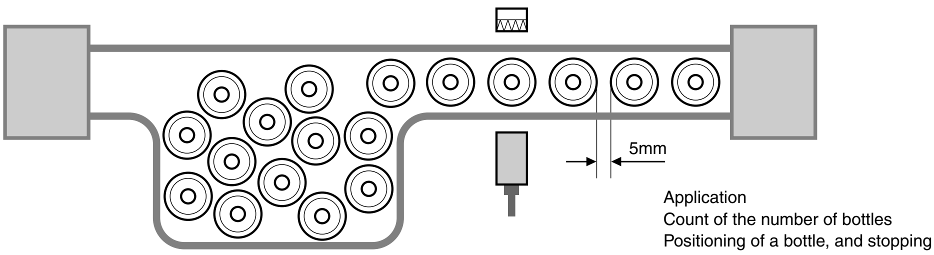
E3S-CR62/67

Ideal for detecting transparent glass and plastic containers

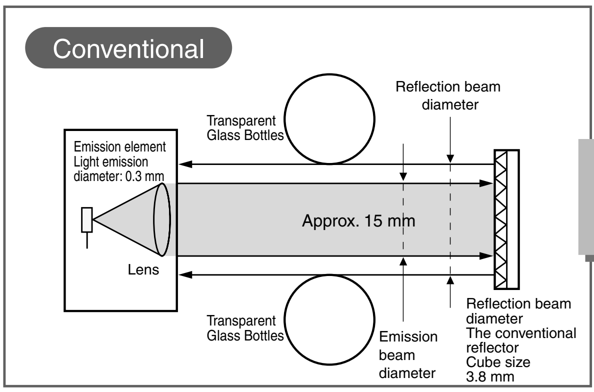
Features

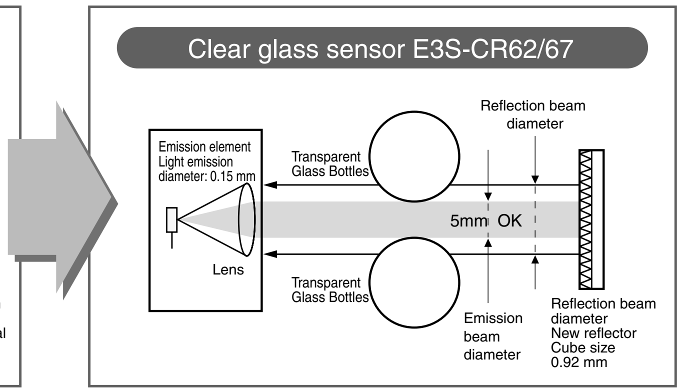
Stable operation even if container interval is shortened for higher productivity.

Stable detection of 5 mm gaps that previous regression reflection models were unable to detect because of a speed increase for higher productivity.



Bottle detection seen from the upper side

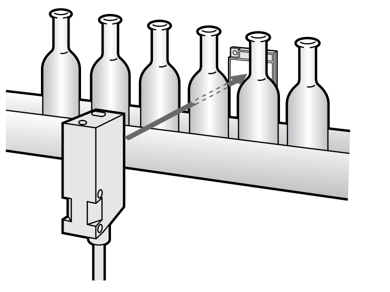




Application

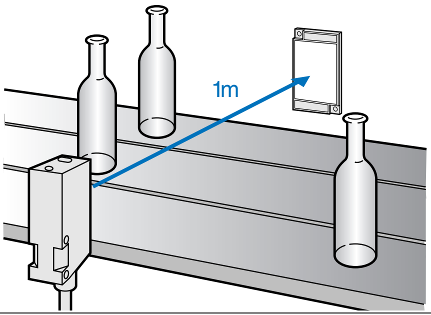
Narrow pin interval detection

Stable detection of 5 mm gaps that are not detectable by previous regression reflection models.



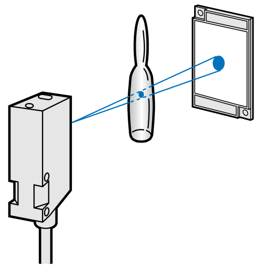
Wide detection range. Stable detection even at long distances.

Use of hyper-point LED as light source (1/2 light emission diameter of previous models) enables stable long-distance detection.



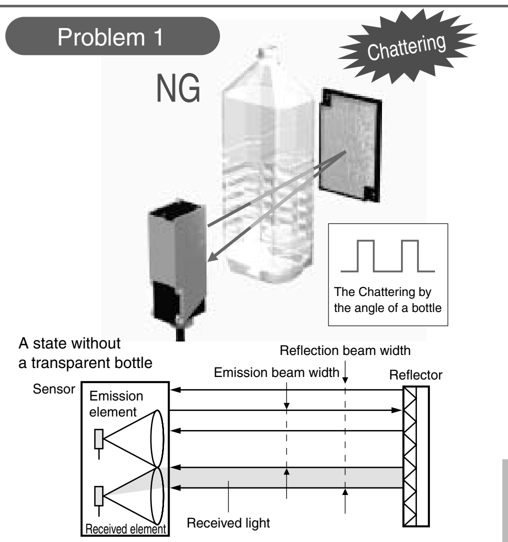
Stable detection of ampules and other small containers.

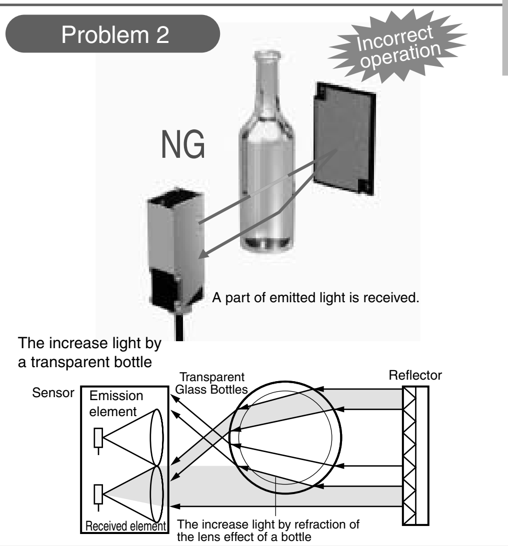
Visible spotlight for easy adjustment.



Features

We significantly increased the S/N ratio to enable a stable detection of PET bottles and various other transparent containers



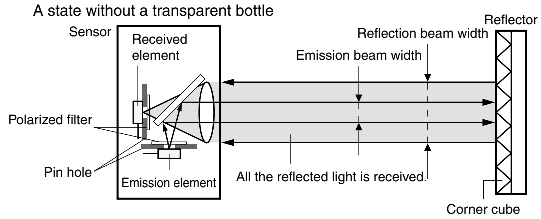


Clear glass sensor E3S-CR62/67

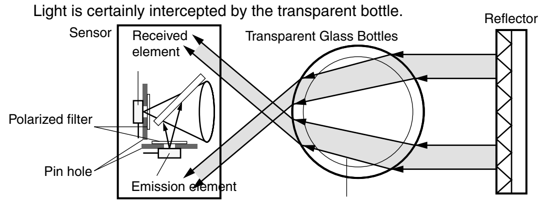
Adoption of the coaxial retroreflective model

Stable detection can be carried out also to the transparent bottle of various form and surface states.

A state without a transparent bottle

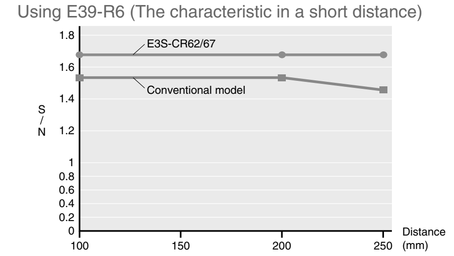


Light is certainly intercepted by the transparent bottle.

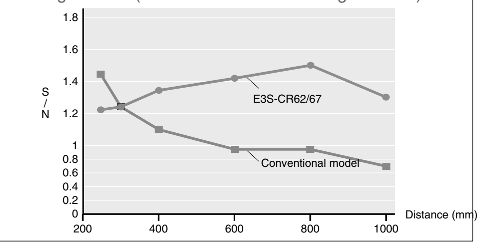


(Example)

Using E39-R6 (The characteristic in a short distance)



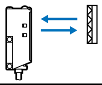
Using E39-R1 (The characteristic in a long distance)



Ordering Information

Sensors

Red light

Sensor type	Shape	Connection method	Sensing distance: Reflector E39-R6	Sensing distance: Reflector E39-R1	Model
Retroreflective Models		Pre-wired type	250mm	1m [250mm] *	E3S-CR62-C
		Connector type	250mm	1m [250mm] *	E3S-CR67-C

* Values in parentheses indicate the minimum required distance between the sensor and reflector.

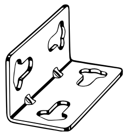
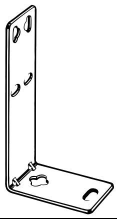
Accessories (Order Separately)

Reflectors

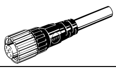
Name	Sensing distance	Model	Quantity	Remarks
Reflectors	250 mm	E39-R6	1	---
	1 m (250 mm) *	E39-R1	1	

* Values in parentheses indicate the minimum required distance between the sensor and reflector.

Mounting Brackets

Shape	Model	Quan-tity	Remarks
	E39-L103	1	Supplied with the product.
	E39-L87	1	---

Sensor I/O Connectors

Cable	Shape	Cable length		Model
Standard cable	Straight 	2 m	3-wire type	XS2F-D421-DC0-A
		5 m		XS2F-D421-GC0-A
	L-shape 	2 m		XS2F-D422-DC0-A
		5 m		XS2F-D422-GC0-A

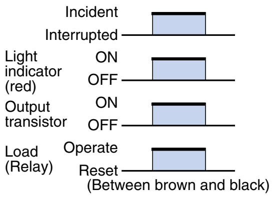
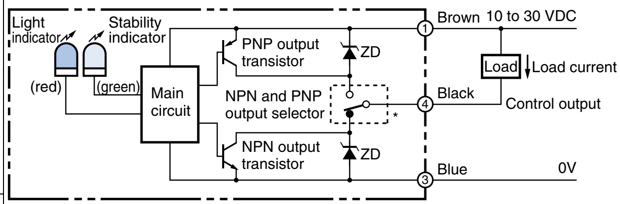
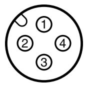
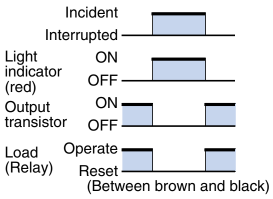
Rating/performance

Sensor type		Retroreflective Models (M.S.R. function)	
Item	Model	E3S-CR62-C	E3S-CR67-C
Sensing distance		250 mm (When using the E39-R6), 1 m (250 mm)*1 (When using the E39-R1)	
Standard sensing object		30 mm dia. X 150 mm glass tube (thickness: 1.8 mm)	
Directional angle		2 to 6°	
Light source (wave length)		Red LED (660 nm)	
Power supply voltage		10 to 30 VDC, ripple (p-p) : 10 % max.	
Current consumption		40 mA max.	
Control output		Load supply voltage: 30 VDC or less; load current 100 mA or less (residual voltage: NPN output 1.2 V or less, PNP output 2 V or less); open collector model (NPN/PNP output switching) light ON / dark ON switching	
Protective circuits		Load short protection, reverse connection protection, mutual interference protection function	
Response time		Operation or reset: 1 ms max.	
Sensitivity adjustment		2-turn endless adjuster (with indicator)	
Ambient illuminance		Incandescent lamp: 5,000 lux max. Sunlight 10,000 lux max.	
Ambient temperature		Operating: -25°C to 55°C, Storage: -40°C to 70°C (with no icing or condensation)	
Ambient humidity		Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)	
Insulation resistance		20 M min. at 500 VDC	
Dielectric strength		1,000 VAC at 50/60 Hz for 1 minute	
Vibration resistance		Destruction:10 to 2,000 Hz,1.5 mm double amplitude or 300 m/s^2 (approx. 30G) for 0.5 hrs each in x, y, and Z directions	
Shock resistance		1000 m/s^2 (approx. l00G) 3 times each in X, Y, and Z directions	
Protective structure		IEC Standard IP67 NEMA 6P (restricted to indoor use) *2	IEC Standard IP67 NEMA 6P (restricted to indoor use)
Connection method		Pre-wired models (standard length: 2 m)	Connector type
Weight (Packed state)		Approx. 115 g	Approx. 80 g
Mate-rial	Case	Zinc diecast	
	Lens	Acrylics	
	Display opera-tion panel	Polyethyl sulfon	
	Mounting Brackets	Stainless steel (SUS304)	
Accessories		Brackets (with screws), adjustment driver, operation manual	

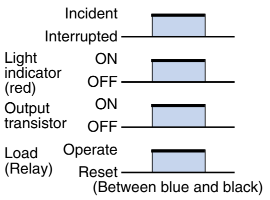
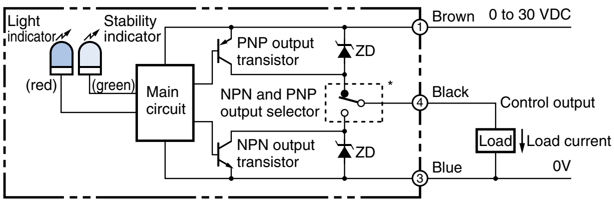
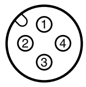
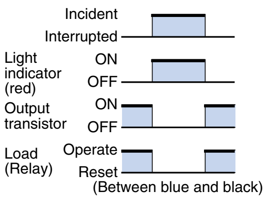
*1. Values in parentheses indicate the minimum required distance between the sensor and reflector.
*2. NEMA (National Electrical Manufacturers Association) Standard

Output Circuit Diagram

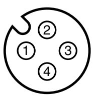
NPN output

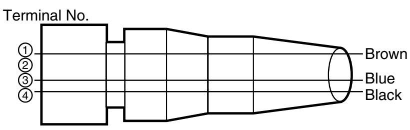
Model	Operating status of output transistor	Timing chart	Mode selection switch	Output circuit
E3S-CR62-C E3S-CR67-C	Light ON		L ON (LIGHT ON)	 * Please make a changeover switch into the NPN side. Connector Pin arrangement  Note: Pin 2 is not used.
	Dark ON		D ON (DARK ON)	

PNP output

Model	Operating status of output transistor	Timing chart	Mode selection switch	Output circuit
E3S-CR62-C E3S-CR67-C	Light ON		L ON (LIGHT ON)	 * Please make a changeover switch into the NPN side. Connector Pin arrangement  Note: Pin 2 is not used.
	Dark ON		D ON (DARK ON)	

Connectors (Sensor I/O connectors)



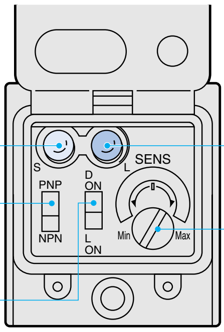


XS2F-D421-DC0-A

Class	Wire, outer	Connector pin	Application
For DC	Brown	1	+V
	-	2	-
	Blue	3	0V
	Black	4	Output

Note: Pin 2 is open.

Nomenclature

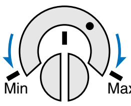
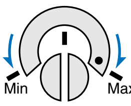


*1. Output transistor switching is possible by means of NPN/PNP output switch.
*2. Operation mode can be switched using L ON/D ON switch.

Operation

Sensitivity adjustment

The light source switch and reflective plate can be moved horizontally and vertically to set them in the center of the illumination area of the red incident light indicator lamp, allowing the operator to check whether the green stability indicator lamp is illuminated.

Sensing object	Detection state	Sensitivity adjuster	Indicator state	Adjustment procedure
Transparent pin or glass plate	Without sensing object	 Min Max	ON ON Stability indicator (green) Light indicator (red)	Turn sensitivity control from minimum to maximum and set at point where incoming light stabilizes.
Opaque object	Object detected, object not detected	 Min Max	ON ON Stability indicator (green) Light indicator (red)	If the object is larger than the lens diameter, set the sensitivity control to the maximum setting. If the object is the same size or smaller, turn the sensitivity control from minimum to maximum and set at point where incoming light stabilizes.

Precautions

Correct Use

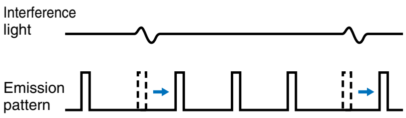
Design

Fuzzy mutual interference prevention

- If the light source switches for the reflective plates are arranged in a row, light from a neighboring light source switch may be received, causing erroneous light reception signals and errors.
- The fuzzy reciprocal interference prevention function monitors interference light for a certain period of time before illumination, and gathers data on the strength of the interference light and the frequency of incidence. It then determines the risk of error due to these two factors using fuzzy logic and controls the timing of illumination to reduce the risk.

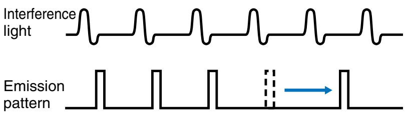
(When risk is low)

- Light is emitted after interfering light is gone.



(In case of high risk)

- Light is emitted after shifting to a gap of interfering light.



Bottles

In some cases, factors such as the shape of a bottle prevent stable detection. Please confirm that a correct detection is performed before use.

Wiring Considerations

Cable

- An oil resistant cable is used to ensure oil resistance. Avoid repeated bending of the cable.
- The bending radius should be 25 mm or more.

Avoiding Malfunctions

When using a photoelectric switch with an inverter or sub-motor, be sure to connect FG (frame ground pin) and G (ground pin). If not connected, errors may result.

Installation

Sensor installation

- When installing a photoelectric switch, avoid tapping with a hammer. This may damage the water resistance function.
- Use an M4 screw, tightened to a torque of no more than 1.18 Nm.

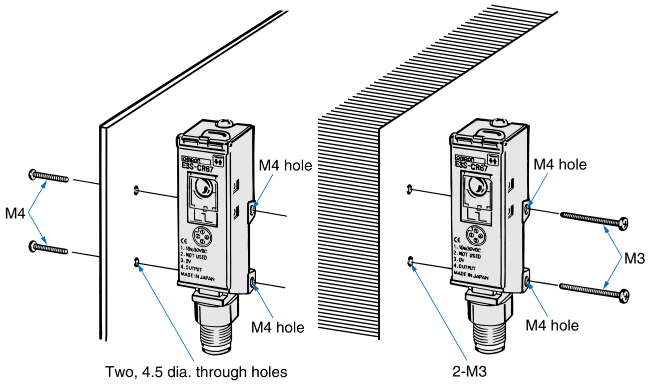
(When using the mounting bracket)

- To set the sensor on the mechanical axis, use the optical axis locking holes.
- When it is not possible to mount on the mechanical shift, move the photoelectric switch vertically or horizontally so that it is located in the center of the area illuminated by the incident light indicator lamp. Verify that the stability indicator lamp is on.

(Direct installation)

Install the photoelectric switch as shown in the following diagram.

Tighten M4 screw Tighten M3 screw



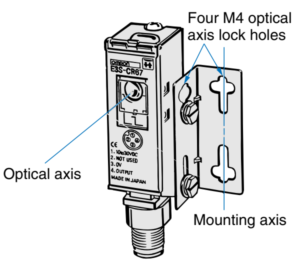
● For adjustment

Light axis adjustment

Adjust the optical axis of the clamp to the direction of detection object approach. The optical axis of the photoelectric switch is the same as the mounting axis of the clamp, enabling easy adjustment.

Optical axis locking hole

By fitting screws into the optical axis locking holes, the mounting bracket is set onto the mounting shaft of the mounting bracket.



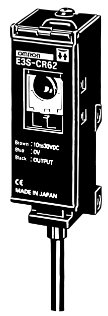
Dimensions (Unit: mm)

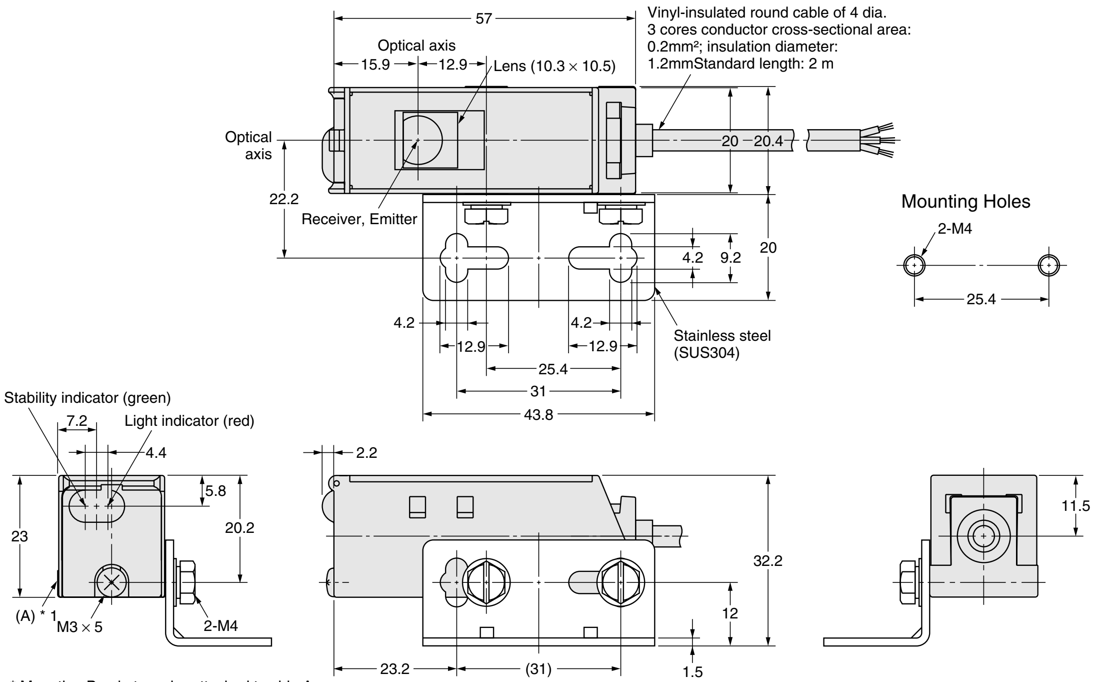
Sensors

Retroreflective Models

Pre-wired

E3S-CR62-C

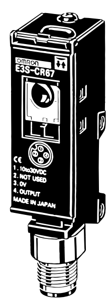


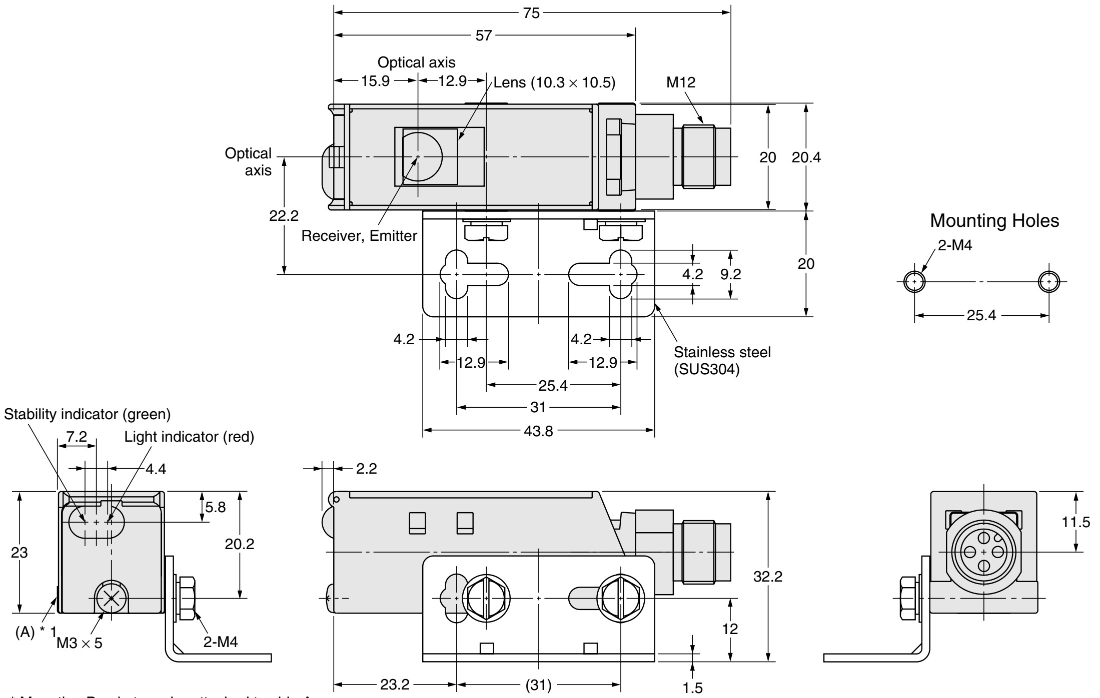


* Mounting Bracket can be attached to side A.

Connector type

E3S-CR67-C





* Mounting Bracket can be attached to side A.

Accessories (Order Separately)

H-3

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E268-E2-01-X In the interest of product improvement, specifications are subject to change without notice.

Standard fiber unit

E32

The fiber optic - E32 series provides for each sensing problem the optimum solution

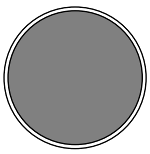
Omron offers with the E32-fiber optics series a huge range of fiber optic sensors for all automation tasks, whether it's for basic object detection, positioning, color analysis or high accuracy sensing.
Omrons takes a leading part in fiber technology with a long time experience in producing
fiber optic solutions for all kind of industry.

Everything from head size, sensing distance, mounting, beam size up to special heat - and chemical resistant materials can be chosen in order to best suit your application.
The E32 series provides for each sensing problem the optimum solution
On top of it, Omron provide customised fiber solutions based on your demand and specification, made in Germany.

Variation of fiber optics

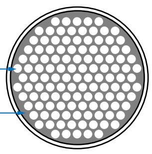
Flexible fiber models are indicated by an "R" at the end of the model number.

Flexible fiber contains multiple cores. These cores are all surrounded by cladding, giving a minimum bending radius of 1 mm. The fiber can be bent at right angles without affecting the light intensity. Handle it just like any other cable.



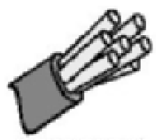
Conventional Fiber

Conventional fiber uses just one core and one cladding section. Bending the fiber may break it or reduce the light intensity.



Flexible Fiber

Flexible fiber contains multiple independent cores all surrounded by cladding. The fiber can be bent without breaking or reducing the light intensity.

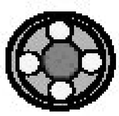


Fiber for robot application

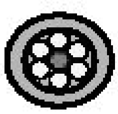
Individual cores in one bundle, Surrounded by cladding, Strong against repeatable bending.
Bending radius 4 mm

Coaxial fibers

The accuracy of coaxial fibers is very high, due to the special orientation of transmitter- and receiver fibers.
With the special lens unit, the spot beam can be reduced to min. 0,1 mm.

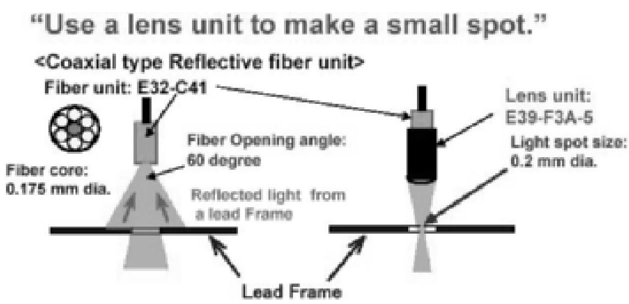


E32-EC31



E32-EC41

Coaxial fibers and lens unit (small spot)



Beam Spot variable type E39-F3A

Beam spot can be changed from 0.1 to 1 mm dia., applicable to various size of sensing objects.

Applicable fiber unit:

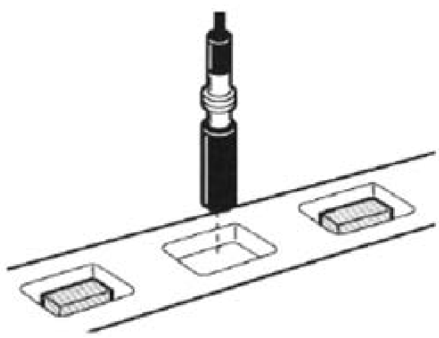
Beam spot 0.5 to 1 mm: E32-D32

Beam spot 0.1 to 0.6 mm: E32-C42

Long distance & Minute spot E39-F3B

Achieving 0.2 mm dia. spot & 15 mm sensing distance.

Detection of chips on embossed tape.



Applicable fiber unit:

E32-EC31

E32-EC41

Minute beam spot E39-F3A-5

Achieving 0.1 mm dia. spot & 7 mm sensing distance. Optimum solution for downsizing of electronic parts.

Detection of front or back of "0603" chips.

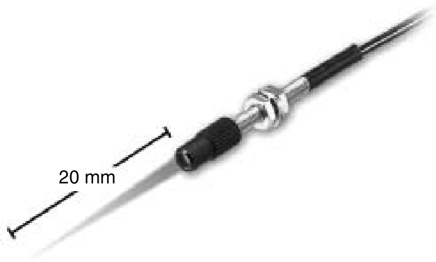
Applicable fiber unit:

E32-EC31

E32-EC41

Long distance type E39-F3C

Achieving 0.2 mm dia. spot & 20 mm sensing distance.

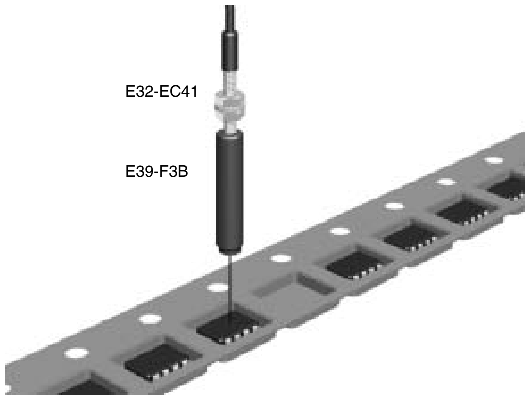


Detection of yarn for industrial sewing machine.

Applicable fiber unit:

E32-EC31
E32-EC41

Detection missing chips on embossed tape. Adding a lens unit to a fiber sensor permits the detection of very small workpieces at a detection distance of 17 mm with a 0.2 mm diameter spot.



E32-EC41 Fiber Unit
E39-F3B Lens Unit.

Fibers for Robot application
(Strong against repeatable bending)

Omron offers special fibers with independent cores in one bundle.

This fibers are very strong against repeatable bending and suitable for moving- and robot applications.

Moving-piece-mounting Fiber Unit E32-D11/D21

Detecting workpiece by robot hand

An allowable bending radius of 4 mm enables the E32-D11/D21 to withstand repeated bending, making it ideal applicable to moving parts subject to frequent bending

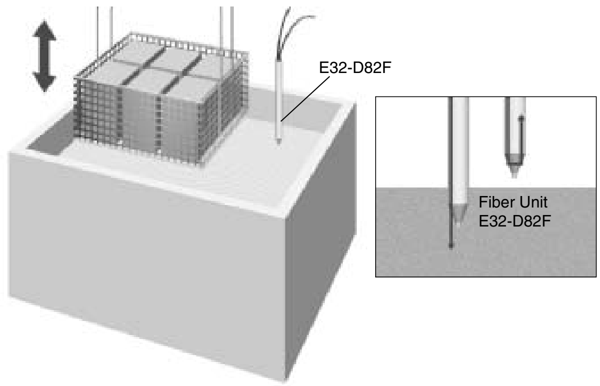
Liquid level detection

Direct contact type E32-D82F

The E32-D82F1 / E32-D82F2 are suitable for high accuracy detection of fluid level detection in tanks. The principle is based on the change of the refractive index when the sensor touches the medium. The fiber head is Teflon®[1] covered and therefore chemical resist and can be used for high temperature up to 200°C.

Level detection in heated chemicals

The fiber unit uses Teflon®[1] so that chemical levels can be precisely and directly detected in cleaning tanks or chemical processing tanks.

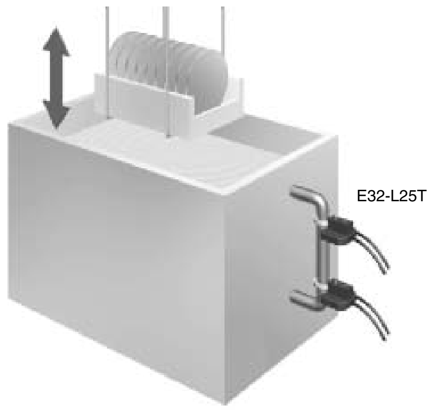


Tube mounting E32-L25T

Omron offers a variation of different level detection sensors. Depending on the mounting situation the applicable tube can be from 3,2 to 10mm dia. For special purpose the fiber material is Teflon®[1] covered and therefore chemical resist.

Chemical level detection with pipe mounting

A minimum level difference of 4 mm can be detected in stages to control resist liquid levels.



E32-D36F

The wide sensing area provide a stable liquid detection without influence of bubbles.

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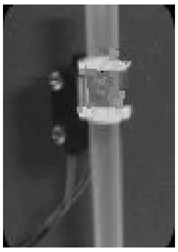
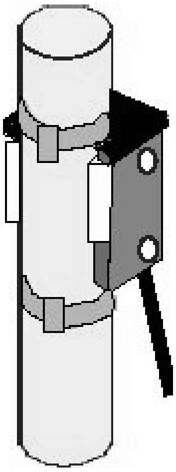
[1] Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluriode resin

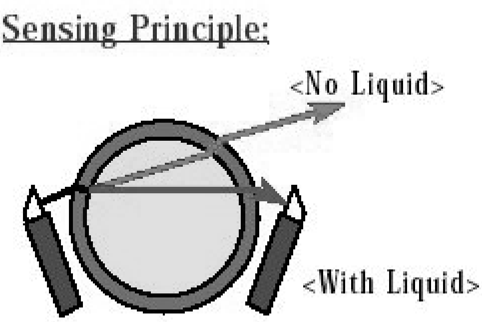
Due to the special sensing head there is no limitation to tube diameter, (thickness of tube max. 1,6 mm, bending radius 4 mm).





Product Features:

- Omron original optical design using prism to provide a great signal noise ratio. The wide area sensing method (11mm) is nearly not influenced by bubbles or water drops in a tube.
- E32-A1 has a fail-safe function output an faulty signal, which is the same as " No Liquid" signal when the fiber unit is accidentally broken or released from the fiber amplifier unit.
- Dark red resist liquid can stably be detected by a high power amplifier unit of E3X-DA-N which has an LED auto power control circuit.
- Fluorine resin coated, bundle type fiber cable (bending radius: 4 mm) can be cut freely.

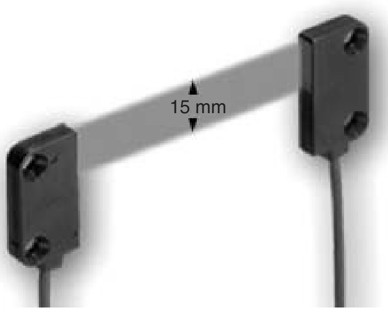


Area Type

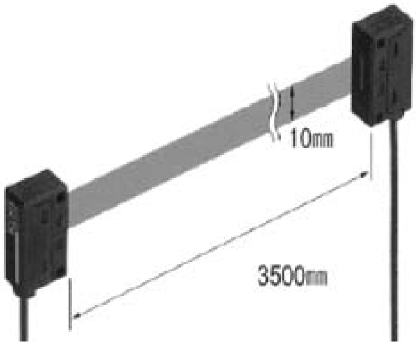
Omron offers a variation of area sensing fibers from 10 mm area up to 30 mm area. Due to the area the sensor can easily detect parts somewhere on a conveyer even when the parts are not very good guided.

Standard screen E32-T16P/-T16

E32-T16P standard screen fiber sensor, providing 11 mm width of area detection.



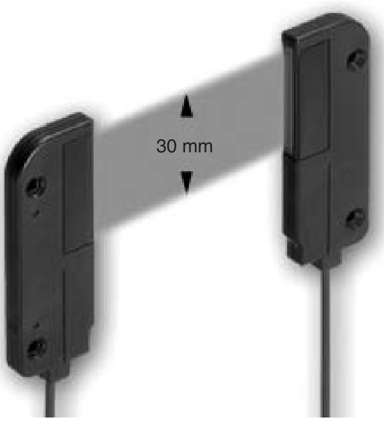
E32-T16 long distance screen sensor, providing 11 mm width & 3,500 mm max. distance of area detection.



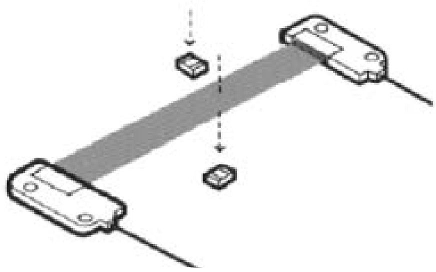
Wide Screen E32-T16WR

Widest screen in the industry

By the 30 mm wide optical screen, provide wide area detection.



Applicable to parts feeder for various size of parts.

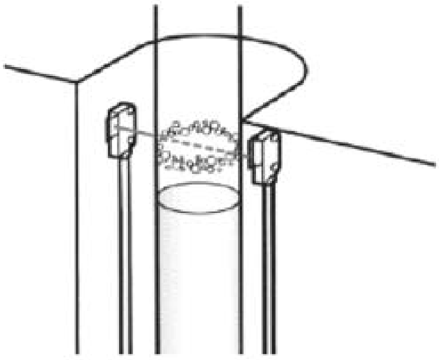


Side-view E32-T16J

First in the industry

By the adoption of prism, achieved side-view screen reflective sensor. Optimum for mounting to limited space.

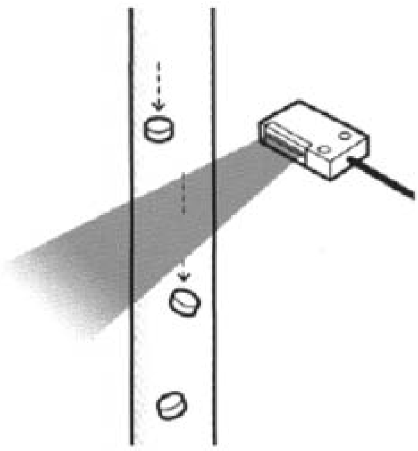
Detection of liquid level throug transparent tube.



Screen reflective E32-D36P1

Screen reflective sensor provide wide area detection and space saving mounting.

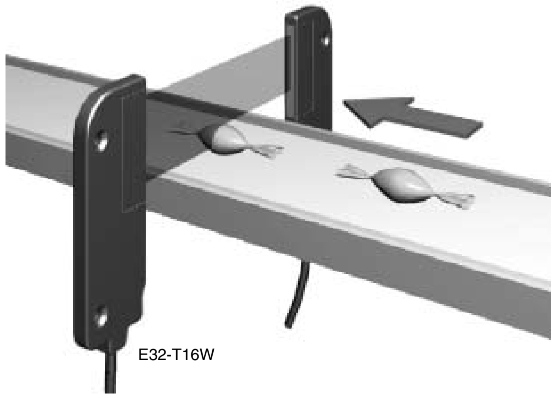
Detection of pills through transparent tube.



Area detecting fiber unit E32-T16W

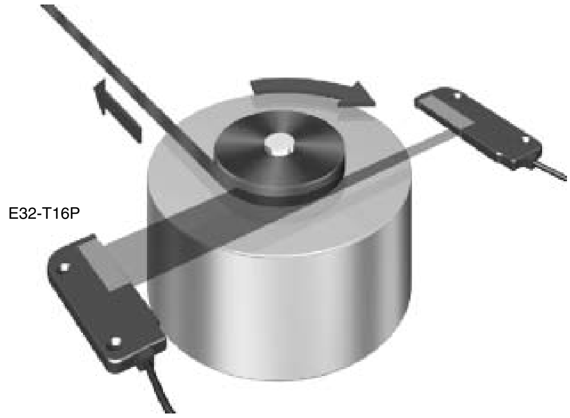
Detecting the front edge location of candies

Area detection using a screen fiber enables positioning of even irregularly shaped objects.



Area detecting fiber unit E32-T16P

Inspection of tape remaining in tape take-up application



Chemical resistant

Due to the Teflon®[1] covered sensor head and fiber, the sensor is resist against oil and chemicals. Also the combination of chemical- and temperature resistant for 200 °C is available.

Overview of chemical and temperature resistant fibers:

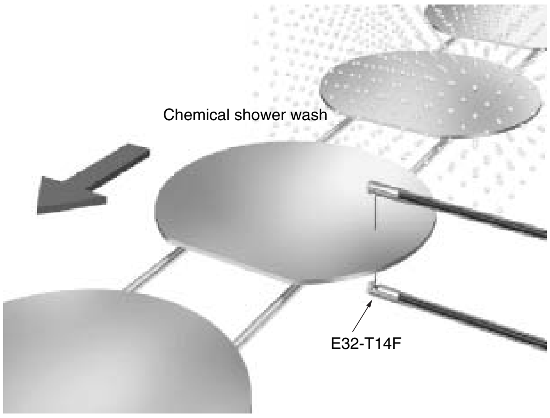
Temperature	Through Beam Type	Reflection Type
-40 °C to 200 °C	E32-T81F-S	
-30 °C to 70 °C	E32-T11F E32-T12F E32-T14F	E32-D12F

[1] Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluriode resin

Teflon®[1] side-view fiber unit E32-T14F

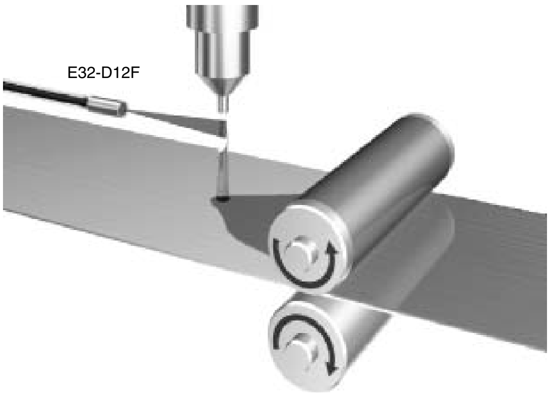
Detection on narrow lines for chemical washing

Teflon®[1] side view fiber units are ideal for applications requiring resistance to chemicals when the sensor can be installed on a narrow line.



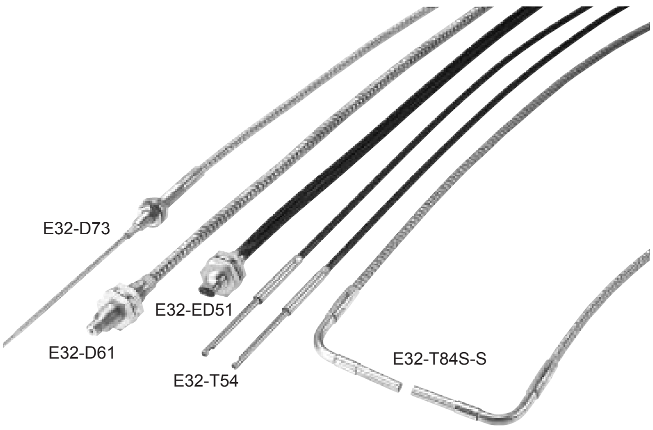
Chemical-resistant fiber unit E32-D12F

The E32-D12F can detect light reflected from oil drops. The Teflon®[1] fiber can also be safely used in an environment where oil is likely to be spattered.



Heat resistant fibers

Omron offers a huge variation of heat resistant fibers, beginning from 150 °C, Teflon®[1] covered and for extreme temperature resist up to 400 °C. For strong mechanical strength there are special fibers with stainless steel spiral tubes available.



[1] Teflon is a registered trademark of DuPont Company and Mitsui DuPont Chemical Company for their fluriode resin

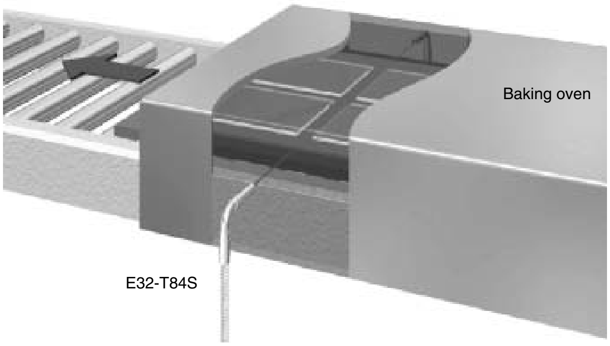
Overview of heat resistant fibers:

Temperature	Trough Beam Type	Reflection Type
150 °C	E32-T54	E32-ED51
	E32-ET51	
200 °C	E32-T84S-S	E32-D81R-S
	E32-T81R-S	E32-D81R
300 °C		E32-D61
350 °C	E32-T61-S	E32-D61-S
400 °C		E32-D73
		E32-D73-S

Heat-resistant, narrow beam fiber unit E32-T84S

Detecting glass substrates in baking ovens

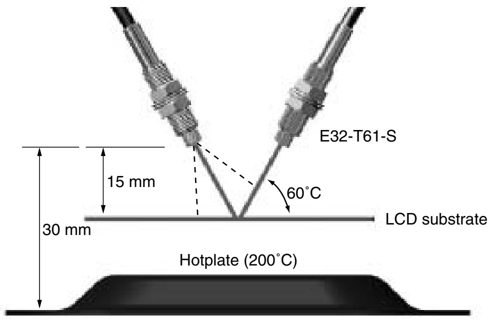
An L-shaped side-view sensor requiring little space and providing 200 °C heat resistance is used. The detection distance of 1,300 mm (for E3X-DA-N standard mode) is more then sufficient to detect even large glass substrates.



Heat-resistant fiber unit E32-T61-S

Detecting liquid crystal substrates in ovens

Regular reflective light from the LCD substrates is received with a fiber to detect the presence or absence of the substrates. The large spot ensures stable detection of substrates even if positioning is not completely consistent.



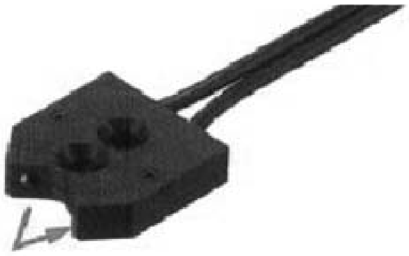
Limited reflective

Minute difference of displacement E32-L25L

Sensing distance: 7.2 ± 1.8 mm

Minute difference of displacement E32-L25/-L25A

Sensing distance: 3.3 mm



Minute difference & Side-view E32-L24L

With special optical lens

Sensing distance: 4 ± 2 mm

Detection of wafer

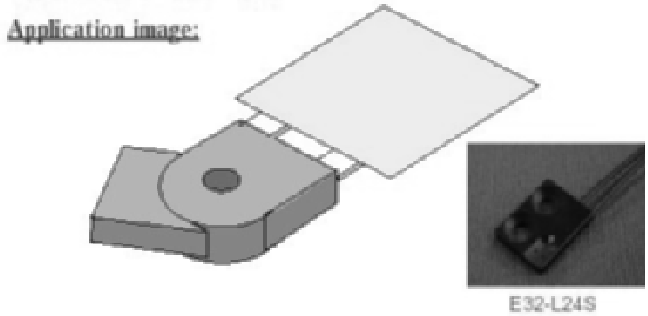
E32-L24S

Special optical design provides stable sensing

Sensing distance 0-4 mm

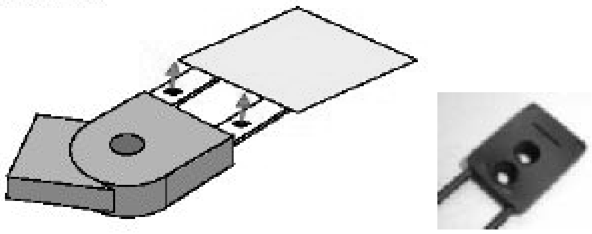
Convergent reflective fiber with a thin and compact housing.

Stable sensing even inclined glass



LCD edge positioning sensor E32-L16

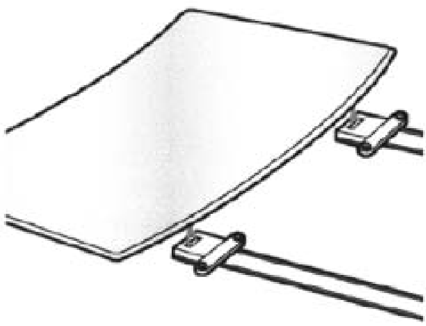
- E32L-16 can make super accurate positioning for an LCD glass sheet on a roboter hand
- E32-L16 can stably detect the inclined surface of LCD
- Ultra thin and small body can fit into robot hand.



Heat-resistive & precise positioning

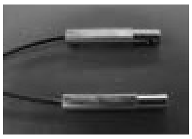
For precise positioning at the sensing range of 4 mm to 12 mm under high temperature environment.

Positioning of LCD (E32-L56E1/-L56E2)



Mapping sensors

With the narrow beam fibers of E32-A03 and E32-A04 Omron offers very successful fiber mapping sensors, with an opening angle of 1,5 for E32-A03 to 3 ° for E32-A04.



Depending on the amplifier mode the sensing distance can be set up from 500 to 1.100 mm.

Mapping fiber units E32-A03/-A04

Mapping wafers with a through-beam side-view sensor

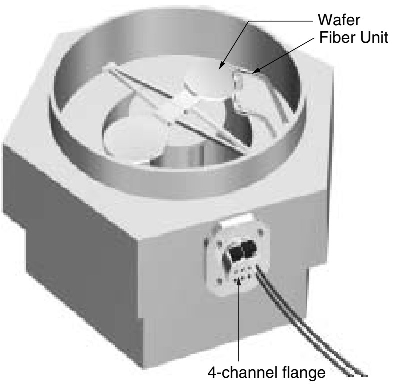
The narrow beam permits the detection of single wafers, even of wafers with mirror surfaces.

Vacuum resist sensors

Vacuum sensors E32-V

Detecting wafers in a vacuum conveyance system

The E32-V provides an easy-connecting fiber and easy-to-use 4-channel flange system, making it ideally applicable to vacuum systems.

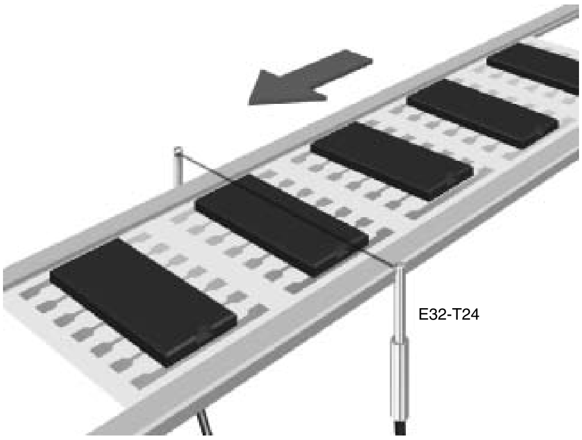


Side-view sensors

Thin side-view fiber unit E32-T24

Detecting rises in lead frames

Easy detection even in tight spaces, is possible with no sleeve bending.

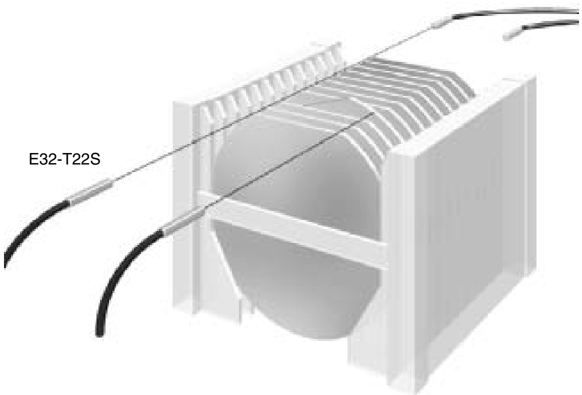


High precision

Narrow-view fiber unit E32-T22S

Checking orientation flat directions with a fiber unit

High-precision detection is possible using a narrow-view beam.

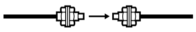


Sensing Distance

General purpose

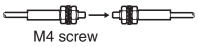
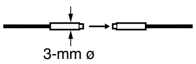
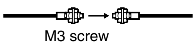
Throughbeam fiber units

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light
Infrared ray

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object *2) (Parentheses: Opaque object)	Model	Permissible bending radius
M4 Free-cut	 M4 screw	E3X-DA□-S	1,000 (4,000)*3 760 (4,000)*3 200 (1,500)	1.0 mm ø (0.005 mm ø)	E32-TC200	25 mm
		E3X-DAG□-S E3X-DAB□-S	100 (700) 75 (550) 45 (350)			
		E3X-DA□-N	950 (4,000)*3 760 (4,000)*3 280 (2,100)	1 mm ø (0.01 mm ø)		
		E3X-DAB #-N	100 (700) 75 (550) 45 (350)			
		E3X-DAH□-N	250 200 70			
		E3X-MDA	650 (4,000)*3 500 (3,700) 200 (1,500)	1.0 mm ø (0.005 mm ø)		
		E3X-NA□(V)	400 (3,000)	1.0 mm ø (0.03 mm ø)		
		E3X-NAG□	75 (550)			
		E3X-NA□F	120 (900)	1.0 mm ø (0.2 mm ø)		
M4 Free-cut		E3X-DA□-S	700 (4,000)*3 530 (3,700) 140 (970)	1.0 mm ø (0.005 mm ø)	E32-ET11R	1 mm
		E3X-DA□-N	670 (4,000) 530 (3,700)*3 200 (1,400)	1.0 mm ø (0.03 mm ø)		
		E3X-MDA	450 (3,100) 350 (2,400) 140 (970)	1.0 mm ø (0.005 mm ø)		
		E3X-NA□(V)	280 (2,100)	1.0 mm ø (0.03 mm ø)		
		E3X-NAG□	50 (375)			
		E3X-NA□F	80	1.0 mm ø (0.2 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. Longer sensing distance by using the lens unit E39-F1.

High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Green light	Red light
Infrared ray	

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object *2) (Parentheses: Opaque object)	Model	Permissible bending radius
M4 Fiber sheat material: fluorine resin Free-cut		E3X-DA☐-S	900 (4,000)*2 680 (3,600) 180 (930)	1.0 mm ø (0.005 mm ø)	E32-T11U NEW	4 mm
		E3X-DA#-N	850 (4,000)*3 680 (3,800)*3 250 (1,300)	1.0 mm ø (0.01 mm ø)		
		E3X-MDA	580 (3,000)*3 450 (2,300) 180 (930)	1.0 mm ø (0.005 mm ø)		
		E3X--NA#(V)	360	1.0 mm ø (0.003 mm ø)		
		E3X--NA#F	100	1.0 mm ø (0.02 mm ø)		
3 mm ø Free-cut		E3X-DA☐-S	700 530 140	1.0 mm ø (0.005 mm ø)	E32-T12R	1 mm
		E3X-DA☐-N	670*3 530 200	1 mm ø (0.01 mm ø)		
		E3X-MDA	450 350 140	1.0 mm ø (0.005 mm ø)		
		E3X-NA☐(V)	280	1.0 mm ø (0.03 mm ø)		
		E3X-NAG☐	50			
		E3X-NA☐F	80	1.0 mm ø (0.2 mm ø)		
M3 Possible to mount the E39-F5 reflective side-view conversion attachment Free-cut		E3X-DA☐-S	900 680 180	1.0 mm ø (0.005 mm ø)	E32-TC200A	25 mm
		E3X-DA☐-N	850 680 250	1 mm ø (0.01 mm ø)		
		E3X-MDA	580 450 180	1.0 mm ø (0.005 mm ø)		
		E3X-NA☐(V)	360	1.0 mm ø (0.03 mm ø)		
		E3X-NAG☐	65			
		E3X-NA☐F	100	1.0 mm ø (0.2 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. Longer sensing distance by using the lens unit E39-F1.

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light
Infrared ray

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object *2) (Parentheses: Opaque object)	Model	Permissible bending radius
M3 For detecting minute sensing objects Free-cut	M3 screw	E3X-DA☐-S	270 220 50	0.5 mm ø (0.005 mm ø)	E32-TC200E	10 mm
		E3X-DAG☐-S E3X-DAB☐-S	25 20 12			
		E3X-DA☐-N	250 220 90	0.5 mm ø (0.01 mm ø)		
		E3X-DAB#-N	25 20 12			
		E3X-MDA	170 130 50	0.5 mm ø (0.005 mm ø)		
		E3X-NA☐(V)	100	0.5 mm ø (0.03 mm ø)		
		E3X-NAG☐	20			
		E3X-NA☐F	30	0.5 mm ø (0.1 mm ø)		
M3 Free-cut	M3 screw	E3X-DA☐-S	160 130 30	0.5 mm ø (0.005 mm ø)	E32-ET21R	1 mm
		E3X-DA☐-N	150 130 50	0.5 mm ø (0.005 mm ø)		
		E3X-MDA	100 75 45	0.5 mm ø (0.01 mm ø)		
		E3X-NA☐(V)	60	0.5 mm ø (0.03 mm ø)		
		E3X-NAG☐	12			
		E3X-NA☐F	18	0.5 mm ø (0.1 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. Longer sensing distance by using the lens unit E39-F1.

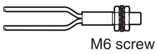
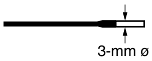
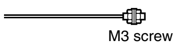
Diffuse reflective fibre units

High resolution mode | Standard mode | Super long-distance mode | Super high-speed mode | Green light | Red light | Infrared ray

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object (min. sensing object *2) (Parentheses: Opaque object)	Model	Permissible bending radius
M6 Free-cut		E3X-DA□-S	500 300 90	400x400 (0.005 mm ø)	E32-DC200	25 mm
		E3X-DAG□-S E3X-DAB□-S	32 25 16	100x100 (0.1 mm ø)		
		E3X-DA□-N	400 300 100	400x400 (0.01 mm ø)		
		E3X-DAB#-N	32 25 16	100x100 (0.1 mm ø)		
		E3X-DAH□-N	100 75 25	100x100 (0.01 mm ø)		
		E3X-MDA	300 210 90	400x400 (0.005 mm ø)		
		E3X-NA□(V)	150	200x200 (0.01 mm ø)		
		E3X-NAG□	25	50x50 (0.1 mm ø)		
		E3X-NA□F	50	75x75 (0.015 mm ø)		
M6 Free-cut		E3X-DA□-S	300 170 50	300x300 (0.005 mm ø)	E32-D11R	1 mm
		E3X-DA□-N	220 170 80	300x300 (0.01 mm ø)		
		E3X-MDA	300 170 50	300x300 (0.005 mm ø)		
		E3X-NA□(V)	90	150x150 (0.01 mm ø)		
		E3X-NAG□	15	25x25 (0.1 mm ø)		
		E3X-NA□F	30	50x50 (0.02 mm ø)		

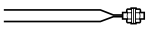
*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

High resolution mode | Standard mode | Super long-distance mode | Super high-speed mode | Green light | Red light | Infrared ray

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object (min. sensing object *2) (Parentheses: Opaque object)	Model	Permissible bending radius
M6 Fiber sheat material: fluorine resin Free-cut		E3X-DA□-S	300 170 50	300x300 (0.005 mm ø)	E32-D11U NEW	4 mm
		E3X-DA#-N	220 170 80	300x300 (0.01 mm ø)		
		E3X-MDA	170 120 50	300x300 (0.005 mm ø)		
		E3X--NA#(V)	90	150x150 (0.01 mm ø)		
		E3X--NA#F	30	50x50 (0.0015 mm ø)		
3 mm ø Free-cut		E3X-DA□-S	300 170 50	300x300 (0.005 mm ø)	E32-D12R	1 mm
		E3X-DA□-N	220 170 80	300x300 (0.01 mm ø)		
		E3X-MDA	170 120 50	300x300 (0.005 mm ø)		
		E3X-NA□(V)	90	150x150 (0.01 mm ø)		
		E3X-NAG□	15	25x25 (0.1 mm ø)		
		E3X-NA□F	30	50x50 (0.02 mm ø)		
M3 Free-cut		E3X-DA□-S	130 80 22	100x100 (0.005 mm ø)	E32-DC200E	10 mm
		E3X-DAG□-S E3X-DAB□-S	32 25 16	25x25 (0.2 mm ø)		
		E3X-DA□-N	100 80 30	100x100 (0.01 mm ø)		
		E3X-DAB#-N	8 6 4	25x25 (0.2 mm ø)		
		E3X-MDA	80 55 22	100x100 (0.005 mm ø)		
		E3X-NA□(V)	36	50x50 (0.01 mm ø)		
		E3X-NAG□	6	25x25 (0.1 mm ø)		
		E3X-NA□F	12	25x25 (0.02 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

□ High resolution mode ▣ Standard mode
■ Super long-distance mode ▢ Super high-speed mode
▭ Green light ▭ Red light ▬ Infrared ray

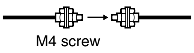
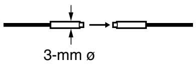
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object (min. sensing object *2) (Parentheses: Opaque object)	Model	Permissible bending radius
M3 (small ø) Free-cut	 	E3X-DA□-S	□50 ▣30 ▯8	50x50 (0.005 mm ø)	E32-ED21R	1 mm
		E3X-DA□-N	■40 ▣30 ▯10	50x50 (0.01 mm ø)		
		E3X-MDA	□30 ▣22 ▯8	50x50 (0.005 mm ø)		
		E3X-DA□-N	■40 ▣30 ▯10	50x50 (0.01 mm ø)		
		E3X-NA□(V)	▯15	25x25 (0.01 mm ø)		
		E3X-NA□F	▮5	25x25 (0.03 mm ø)		
3 mm ø (small ø) Free-cut	 	E3X-DA□-S	□50 ▣30 ▯8	50x50 (0.005 mm ø)	E32-D22R	1 mm
		E3X-DA□-N	■40 ▣30 ▯10	50x50 (0.01 mm ø)		
		E3X-MDA	□30 ▣22 ▯8	50x50 (0.005 mm ø)		
		E3X-NA□(V)	▯15	25x25 (0.01 mm ø)		
		E3X-NA□F	▮5	25x25 (0.03 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

Long-distance

Throughbeam fiber units

High resolution mode | Standard mode | Super long-distance mode | Super high-speed mode | Green light | Red light | Infrared ray

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object *2) (Parentheses:	Model	Permissible bending radius
M4 Free-cut		E3X-DA□-S	1,700 (4,000)*3 1,330 (3,200) 350 (840)	1.4 mm ø (0.01 mm ø)	E32-T11L	25 mm
		E3X-DAG□-S E3X-DAB□-S	150 120 75			
		E3X-DA□-N	1,660 (4,000) 1,330 (3,200) 490 (1,200)	1.4 mm ø (0.02 mm ø)		
		E3X-DAB#-N	150 120 75			
		E3X-DAH□-N	430 350 120			
		E3X-MDA	1,100 (2,600)*3 870 (2,000) 350 (840)	1.4 mm ø (0.01 mm ø)		
		E3X-NA□(V)	700 (2,000)	1.4 mm ø (0.03 mm ø)		
		E3X-NAG□	130 (370)			
		E3X-NA□F	210 (600)	1.4 mm ø (0.5 mm ø)		
3-mm ø Free-cut		E3X-DA□-S	1,700 1,330 350	1.4-mm ø (0.01-mm ø)	E32-T12L	
		E3X-DA□-N	1,660 1,330 490			
		E3X-MDA	1,100 870 350			
		E3X-NA□(V)	700	1.4 mm ø (0.03 mm ø)		
		E3X-NAG□	130			
		E3X-NA□F	210	1.4 mm ø (0.5 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. Longer sensing distance by using the lens unit E39-F

High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Green light	Red light
Infrared ray	

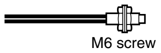
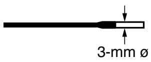
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object *2) (Parentheses:	Model	Permissible bending radius
M3 Free-cut	M3 screw	E3X-DA□-S	540 440 100	0.9 mm ø (0.005 mm ø)	E32-T21L	10 mm
		E3X-DA□-N	500 440 180	0.9 mm ø (0.01 mm ø)		
		E3X-MDA	340 260 100	0.9-mm ø (0.005-mm ø)		
		E3X-NA□(V)	200	0.9 mm ø (0.03 mm ø)		
		E3X-NAG□	40			
		E3X-NA□F	60	0.9 mm ø (0.2 mm ø)		
2-mm ø; small ø Free-cut	2-mm ø	E3X-DA□-S	540 440 100	0.9-mm ø (0.005-mm ø)	E32-T22L	
		E3X-DA□-N	500 440 180	0.9 mm ø (0.01 mm ø)		
		E3X-MDA	340 260 100	0.9 mm ø (0.005 mm ø)		
		E3X-NA□(V)	200	0.9 mm ø (0.03 mm ø)		
		E3X-NAG□	40			
		E3X-NA□F	60	0.9 mm ø (0.2 mm ø)		
M14; with lens; ideal for explosion-proof applications Free-cut	M14 screw	E3X-DA□-S	20,000*5 20,000*5 4,000*5	10 mm ø	E32-T17L	25 mm
		E3X-DA□-N	20,000*3 20,000 9,800	10 mm ø (0.01 mm ø)		
		E3X-MDA	13,000 10,000 4,000	10-mm ø		
		E3X-NA□(V)	14,000	10 mm ø (0.1 mm ø)		
		E3X-NA□F	4,200	10 mm ø (1.5 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. Longer sensing distance by using the lens unit E39-F

Long distance

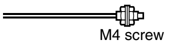
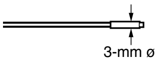
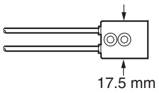
Diffuse reflective fiber units

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Green light / Red light / Infrared ray

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object *2 (min. sensing object: Gold wire)	Model	Permissible bending radius
M6 Free-cut		E3X-DA□-S	650 400 110	500x500 (0.005 mm ø)	E32-D11L	25 mm
		E3X-DAG□-S E3X-DAB□-S	44 35 22	100x100 (0.1 mm ø)		
		E3X-DA□-N	500 400 150	500x500 (0.01 mm ø)		
		E3X-DAB#-N	44 35 22	100x100 (0.1 mm ø)		
		E3X-DAH□-N	130 100 30	200x200 (0.01 mm ø)		
		E3X-MDA	400 270 110	500x500 (0.005 mm ø)		
		E3X-NA□(V)	200	250x250 (0.01 mm ø)		
		E3X-NAG□	35	50x50 (0.1 mm ø)		
		E3X-NA□F	65	100x100 (0.015 mm ø)		
3 mm ø; small ø Free-cut		E3X-DA□-S	400 230 70	300x300 (0.005 mm ø)	E32-D12	
		E3X-DA□-N	300 230 100	300x300 (0.01 mm ø)		
		E3X-MDA	230 160 70	300x300 (0.005 mm ø)		
		E3X-NA□(V)	120	150x150 (0.01 mm ø)		
		E3X-NAG□	20	25x25 (0.1 mm ø)		
		E3X-NA□F	40	50x50 (0.015 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light
Infrared ray

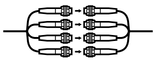
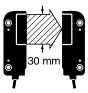
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object *2 (min. sensing object: Gold wire)	Model	Permissible bending radius
M4 Free-cut		E3X-DA□-S	210 130 35	200x200 (0.005 mm ø)	E32-D21L	10 mm
		E3X-DA□-N	160 130 45	200x200 (0.01 mm ø)		
		E3X-MDA	130 85 35	200x200 (0.005 mm ø)		
		E3X-NA□(V)	50	100x100 (0.01 mm ø)		
		E3X-NAG□	10	25x25 (0.1 mm ø)		
		E3X-NA□F	17	25x25 (0.015 mm ø)		
3 mm ø; small ø Free-cut		E3X-DA□-S	210 130 35	200x200 (0.005 mm ø)	E32-D22L	10 mm
		E3X-DA□-N	160 130 45			
		E3X-MDA	130 85 35			
		E3X-NA□(V)	50	100x100 (0.01 mm ø)		
		E3X-NAG□	10	25x25 (0.1 mm ø)		
		E3X-NA□F	17	25x25 (0.015 mm ø)		
Square head, super-long distance Free-cut		E3X-DA□-S	40 to 1,000 40 to 700 40 to 240	300x300	E32-D16 NEW	4 mm
		E3X-MDA	40 to 600 40 to 490 40 to 240			
		E3X-DA#-N	40~1,000 40~700 40~400			
		E3X--NA#(V)	40~400			
		E3X--NA#F	55~70			

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

Area sensing

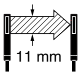
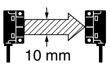
Throughbeam fiber units

High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Green light	Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Multi-point detection (4-head)		E3X-DA□-S	750 610 140	2 mm ø (0.1 mm ø)	E32-M21	25 mm
		E3X-DA□-N	700 610 250	2.0 mm ø (0.01 mm ø)		
		E3X-MDA	470 360 140	2 mm ø (0.1 mm ø)		
		E3X-NA□(V)	300	2.0 mm ø (0.03 mm ø)		
		E3X-NA□F	90	2.0 mm ø (0.3 mm ø)		
Detects in a 30 mm area Free-cut		E3X-DA□-S	2,300 1,800 450	(0.3 mm ø)*4	E32-T16W	10 mm
		E3X-DA□-N	2,300 1,800 660			
		E3X-MDA	1,400 1,100 450			
		E3X-NA□(V)	920	(0.5 mm ø)*3		
		E3X-NAG□	170			
		E3X-NA□F	270	(4.0 mm ø)*3		
		E3X-DA□-S	1,700 1,300 340	(0.3 mm ø)*4	E32-T16WR	1 mm
		E3X-DA□-N	1,700 1,300 500			
		E3X-MDA	1,100 860 340			
		E3X-NA□(V)	690	(0.5 mm ø)*3		
		E3X-NA□F	200	(4.0 mm ø)*3		

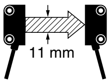
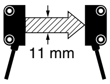
*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. The sensing distance is 100 mm, possible detection within specified area under static condition
*4. The sensing distance is 300 mm, possible detection within specified area under static condition.

High resolution mode
Super long-distance mode
Green light
Standard mode
Super high-speed mode
Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object *2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Side-view suitable for applications with limited spatial depth Free-cut		E3X-DA□-S	1,300 / 1,000 / 260	(0.2 mm ø)*4	E32-T16J	10 mm
		E3X-DA□-N	1,300 / 1,000 / 280			
		E3X-MDA	800 / 650 / 260			
		E3X-NA□(V)	520	(0.3 mm ø)*3		
		E3X-NAG□	95			
		E3X-NA□F	150	(2.0 mm ø)*3		
		E3X-DA□-S	980 / 750 / 190	(0.2 mm ø)*4	E32-T16JR	1 mm
		E3X-DA□-N	980 / 750 / 210			
		E3X-MDA	600 / 480 / 190			
		E3X-NA□(V)	390	(0.3 mm ø)*3		
		E3X-NA□F	110	(2.0 mm ø)*3		
Suitable for detecting over a 10 mm area; long distance Free-cut		E3X-DA□-S	3,700 / 2,800 / 740	(0.6 mm ø)*5	E32-T16	25 mm
		E3X-DA□-N	3,500 / 2,800 / 1,000			
		E3X-MDA	2,400 / 1,800 / 740			
		E3X-NA□(V)	1,500	(0.9 mm ø)*3		
		E3X-NAG□	275			
		E3X-NA□F	450	(1.5 mm ø)*3		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. The sensing distance is 100 mm, possible detection within specified area under static condition
*4. The sensing distance is 300 mm, possible detection within specified area under static condition.

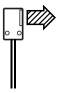
- High resolution mode
- Standard mode
- Super long-distance mode
- Super high-speed mode
- Green light
- Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object *2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Stable for detecting minute sensing objects in a wide area Free-cut		E3X-DA□-S	1,500 1,100 300	(0.2 mm ø)*4	E32-T16P	10 mm
		E3X-DA□-N	1,400 1,100 420			
		E3X-MDA	970 750 300			
		E3X-NA□(V)	600	(0.3 mm ø)*3		
		E3X-NAG□	110			
		E3X-NA□F	180	(2.0 mm ø)*3		
Stable detection of minute sensing objects, wide sensing area Free-cut		E3X-DA□-S	1,100 840 220	(0.2 mm ø)*4	E32-T16PR	1 mm
		E3X-DA□-N	1,050 840 320			
		E3X-MDA	730 560 220			
		E3X-NA□(V)	450	(0.3 mm ø)*3		
		E3X-NA□F	130	(2.0 mm ø)*3		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.
*3. The sensing distance is 100 mm, possible detection within specified area under static condition
*4. The sensing distance is 300 mm, possible detection within specified area under static condition.

Diffuse reflective fiber units

High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Green light	Red light

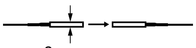
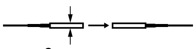
Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Side-view detection over wide areas Free-cut		E3X-DA□-S	250 150 45	300x300 (0.005 mm ø)	E32-D36P1	25 mm
		E3X-DA□-N	200 150 50	300x300 (0.01 mm ø)		
		E3X-MDA	150 100 45	300x300 (0.005 mm ø)		
		E3X-NA□(V)	75	100x100 (0.03 mm ø)		
		E3X-NA□F	25	50x50 (0.03 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

Small fiber head

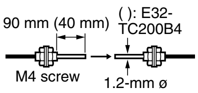
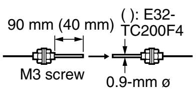
Throughbeam fiber unit

High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Green light	Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses:With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
2 mm ø For detecting minute sensing objects Free-cut		E3X-DA□-S	270 220 50	0.5 mm ø (0.005 mm ø)	E32-T22	10 mm
		E3X-DA□-N	250 220 90	0.5 mm ø (0.01 mm ø)		
		E3X-MDA	170 130 50	0.5 mm ø (0.005 mm ø)		
		E3X-NA□(V)	100	0.5 mm ø (0.03 mm ø)		
		E3X-NAG□	20			
		E3X-NA□F	30	0.5 mm ø (0.1 mm ø)		
2 mm ø For detecting minute sensing objects Free-cut		E3X-DA□-S	160 130 30	0.5 mm ø (0.005 mm ø)	E32-T22R	1 mm
		E3X-DA□-N	150 130 50	0.5 mm ø (0.01 mm ø)		
		E3X-MDA	100 75 30	0.5 mm ø (0.005 mm ø)		
		E3X-NA□(V)	60	0.5 mm ø (0.03 mm ø)		
		E3X-NA□F	18	0.5 mm ø (0.1 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

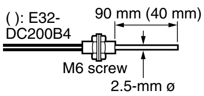
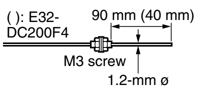
High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Green light	Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm) *1 (Parentheses: With E39-F1 Lens Unit)	Standard object *2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
1.2 mm ø with sleeve Free-cut	 	E3X-DA□-S	1,000 760 200	1.0 mm ø (0.005 mm ø)	E32-TC200B E32-TC200B4	25 mm
		E3X-DAG□-S E3X-DAB□-S	100 75 45			
		E3X-DA□-N	950 760 280	1 mm ø (0.01 mm ø)		
		E3X-DAB#-N	100 75 45			
		E3X-MDA	650 500 200	1.0 mm ø (0.005 mm ø)		
		E3X-NA□(V)	400	1.0 mm ø (0.03 mm ø)		
		E3X-NAG□	75			
		E3X-NA□F	120	1.0 mm ø (0.2 mm ø)		
0.9 mm ø with sleeve Free-cut	 	E3X-DA□-S	270 220 50	0.5 mm ø (0.005 mm ø)	E32-TC200F E32-TC200F4	10 mm
		E3X-DA□-N	250 220 90	0.5 mm ø (0.01 mm ø)		
		E3X-MDA	170 130 50	0.5 mm ø (0.005 mm ø)		
		E3X-NA□(V)	100	0.5 mm ø (0.03 mm ø)		
		E3X-NAG□	20			
		E3X-NA□F	30	0.5 mm ø (0.1 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

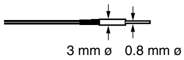
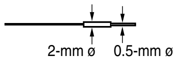
Diffuse reflective fiber units

High resolution mode / Super long-distance mode / Green light / Standard mode / Super high-speed mode / Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses:With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
2.5 mm ø with sleeve Free-cut		E3X-DA□-S	500 300 90	400x400 (0.005 mm ø)	E32-DC200B E32-DC200B4	25 mm
		E3X-DAG□-S E3X-DAB□-S	32 25 16	100x100 (0.1 mm ø)		
		E3X-DA□-N	400 300 100	400x400 (0.01 mm ø)		
		E3X-DAB#-N	32 25 16	100x100 (0.1 mm ø)		
		E3X-MDA	300 210 90	400x400 (0.005 mm ø)		
		E3X-NA□(V)	150	200x200 (0.01 mm ø)		
		E3X-NAG□	25	50x50 (0.1 mm ø)		
		E3X-NA□F	50	75x75 (0.015 mm ø)		
1.2 mm ø with sleeve Free-cut		E3X-DA□-S	130 80 22	100x100 (0.005 mm ø)	E32-DC200F E32-DC200F4	10 mm
		E3X-DA□-N	100 80 30	100x100 (0.01 mm ø)		
		E3X-MDA	80 55 22	100x100 (0.005 mm ø)		
		E3X-NA□(V)	36	50x50 (0.01 mm ø)		
		E3X-NAG□	6	25x25 (0.1 mm ø)		
		E3X-NA□F	12	25x25 (0.02 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light

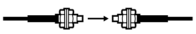
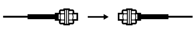
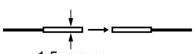
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses:With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
0.8 mm ø For detecting minute sensing objects Free-cut		E3X-DA□-S	25 16 4	25x25 (0.005 mm ø)	E32-D33	4 mm
		E3X-DA□-N	21 16 6	25x25 (0.01 mm ø)		
		E3X-MDA	16 10 4	25x25 (0.005 mm ø)		
		E3X-NA□(V)	10	25x25 (0.01 mm ø)		
		E3X-NA□F	3.3	25x25 (0.03 mm ø)		
0.5 mm ø For detecting very minute sensing objects		E3X-DA□-S	5 3 0.8	25x25 (0.005 mm ø)	E32-D331	
		E3X-DA□-N	4 3 1	25x25 (0.01 mm ø)		
		E3X-MDA	3 2 0.8	25x25 (0.005 mm ø)		
		E3X-NA□(V)	1.5	25x25 (0.01 mm ø)		
		E3X-NA□F	0.5	25x25 (0.05 mm ø)		

*1. Sensing distance based on white paper.
*2. Indicates values for standard mode.

Fiber for Robot Application R4 (Strong against repeatable bending)

Throughbeam fiber unit

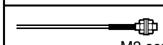
High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Green light	Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Ideal for mounting on moving sections (R4) Free-cut	 M4 screw	E3X-DA□-S	900 (4,000)*3 680 (3,600) 180 (930)	1.0 mm ø (0.005 mm ø)	E32-T11	4 mm
		E3X-DA□-N	850 (4,000)*3 680 (3,600) 250 (1,300)	1.0 mm ø (0.01 mm ø)		
		E3X-MDA	580 (3,000) 450 (2,300) 180 (930)	1.0 mm ø (0.005 mm ø)		
		E3X-NA□(V)	360	1.0 mm ø (0.03 mm ø)		
		E3X-NAG□	65			
		E3X-NA□F	100	1.0 mm ø (0.2 mm ø)		
	 M3 screw	E3X-DA□-S	240 200 45	0.5 mm ø (0.005 mm ø)	E32-T21	
		E3X-DA□-N	220 200 80	0.5 mm ø (0.01 mm ø)		
		E3X-MDA	150 110 45	0.5 mm ø (0.005 mm ø)		
		E3X-NA□(V)	100	0.5 mm ø (0.03 mm ø)		
		E3X-NAG□	18			
		E3X-NA□F	30	0.5 mm ø (0.1 mm ø)		
	 1.5-mm ø	E3X-DA□-S	240 200 45	0.5 mm ø (0.005 mm ø)	E32-T22B	
		E3X-DA□-N	220 200 80	0.5 mm ø (0.01 mm ø)		
		E3X-MDA	150 110 45	0.5 mm ø (0.005 mm ø)		
		E3X-NA□(V)	100	0.5 mm ø (0.03 mm ø)		
		E3X-NAG□	18			
		E3X-NA□F	30	0.5 mm ø (0.1 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Sensing distance by using the lens unit E39-F1.

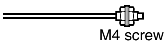
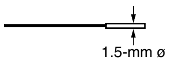
Diffuse reflection fiber units

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Ideal for mounting on moving sections (R4)	 M6 screw	E3X-DA☐-S	300 170 50	300x300 (0.005 mm ø)	E32-D11	4 mm
		E3X-DA☐-N	220 170 80	300x300 (0.01 mm ø)		
		E3X-MDA	170 125 50	300x300 (0.005 mm ø)		
		E3X-NA☐(V)	90	150x150 (0.01 mm ø)		
		E3X-NAG☐	15	25x25 (0.1 mm ø)		
		E3X-NA☐F	30	50x50 (0.015 mm ø)		
	 M3 screw	E3X-DA☐-S	50 30 8	50x50 (0.005 mm ø)	E32-D21	
		E3X-DA☐-N	40 30 10	50x50 (0.01 mm ø)		
		E3X-MDA	30 22 8	50x50 (0.005 mm ø)		
		E3X-NA☐(V)	15	25x25 (0.01 mm ø)		
		E3X-NA☐F	5	25x25 (0.02 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

High resolution mode
Super long-distance mode
Green light
Standard mode
Super high-speed mode
Red light

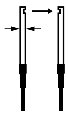
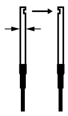
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Ideal for mounting on moving sections (R4)		E3X-DA□-S	110 70 20	100x100 (0.005 mm ø)	E32-D21B	4 mm
		E3X-DA□-N	90 70 25	100x100 (0.01 mm ø)		
		E3X-MDA	70 50 20	100x100 (0.005 mm ø)		
		E3X-NA□(V)	15	25x25 (0.01 mm ø)		
		E3X-NAG□	2.4	25x25 (0.1 mm ø)		
		E3X-NA□F	5	25x25 (0.02 mm ø)		
		E3X-DA□-S	50 30 8	50x50 (0.005 mm ø)	E32-D22B	
		E3X-DA□-N	40 30 10	50x50 (0.01 mm ø)		
		E3X-MDA	30 22 8	50x50 (0.005 mm ø)		
		E3X-NA□(V)	7	25x25 (0.01 mm ø)		
		E3X-NA□F	2.3	25x25 (0.02 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

Side view

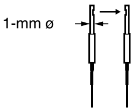
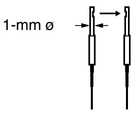
Throughbeam fiber units

High resolution mode | Standard mode
Super long-distance mode | Super high-speed mode
Green light | Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object*2) (Parentheses: Opaque object)	Model	Permissible bending radius
Long distance; space-saving Free-cut	 	E3x-DA□-S	600 460 120	1.0 mm ø (0.005 mm ø)	E32-T14L	25 mm
		E3x-DAG□-S E3x-DAB□-S	50 40 25			
		E3x-DA□-N	570 460 170	1 mm ø (0.01 mm ø)		
		E3x-DAB11-N	50 40 25			
		E3x-DAH□-N	150 120 40			
		E3x-MDA	390 300 120	1.0 mm ø (0.005 mm ø)		
		E3x-NA□(V)	240	1.0 mm ø (0.03 mm ø)		
		E3x-NAG□	45			
		E3x-NA□F	70	1.0 mm ø (0.2 mm ø)		
Space-saving Free-cut	 	E3x-DA□-S	270 210 50	1.0 mm ø (0.005 mm ø)	E32-T14LR	1 mm
		E3x-DA□-N	270 210 90	1 mm ø (0.01 mm ø)		
		E3x-MDA	170 130 50	1.0 mm ø (0.005 mm ø)		
		E3x-NA□(V)	110	1.0 mm ø (0.03 mm ø)		
		E3x-NA□F	33	1.0 mm ø (0.2 mm ø)		

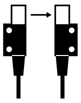
*1. Sensing distance beased on white paper.
*2. Indicates values for standard mode.

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Green light / Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object*2) (Parentheses: Opaque object)	Model	Permissible bending radius
Suitable for detecting minute sensing objects; small ø Free-cut		E3x-DA□-S	160 130 30	0.5 mm ø (0.005 mm ø)	E32-T24	10 mm
		E3x-DA□-N	150 130 55	0.5 mm ø (0.01 mm ø)		
		E3x-MDA	100 70 30	0.5 mm ø (0.005 mm ø)		
		E3x-NA□(V)	90	0.5 mm ø (0.03 mm ø)		
		E3x-NAG□	12			
		E3x-NA□F	27	0.5 mm ø (0.3 mm ø)		
Suitable for detecting minute sensing objects; small ø Free-cut		E3x-DA□-S	60 50 10	0.5 mm ø (0.005 mm ø)	E32-T24R	1 mm
		E3x-DA□-N	60 50 25	0.5 mm ø (0.01 mm ø)		
		E3x-MDA	35 27 10	0.5 mm ø (0.005 mm ø)		
		E3x-NA□(V)	30	0.5 mm ø (0.03 mm ø)		
		E3x-NA□F	9	0.5 mm ø (0.3 mm ø)		

*1. Sensing distance beased on white paper.
*2. Indicates values for standard mode.

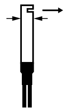
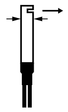
High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object (min. sensing object*2) (Parentheses: Opaque object)	Model	Permissible bending radius
Screw-mounting type Free-cut		E3x-DA□-S	4,500 3,400 900	4 mm ø (0.1 mm ø)	E32-T14	25 mm
		E3x-DAG□-S E3x-DAB□-S	320 260 160			
		E3x-DA□-N	4,000 3,400 1,250	4 mm ø (0.01 mm ø)		
		E3x-DAB11-N	320 260 160			
		E3x-DAH□-N	1,120 900 330			
		E3x-MDA	2,900 2,200 900	4 mm ø (0.1 mm ø)		
		E3x-NA□(V)	1,800	4.0 mm ø (0.03 mm ø)		
		E3x-NAG□	330			
		E3x-NA□F	540	4.0 mm ø (0.2 mm ø)		

*1. Sensing distance beased on white paper.
*2. Indicates values for standard mode.

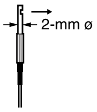
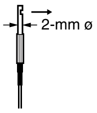
Diffuse reflective fiber units

High resolution mode | Standard mode | Super long-distance mode | Super high-speed mode | Green light | Red light | Infrared ray

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
6 mm ø Long distance Free-cut	6-mm ø 	E3x-DA□-S	200 110 36	200x200 (0.005 mm ø)	E32-D14L	25 mm
		E3x-DA□-N	150 110 50	200x200 (0.01 mm ø)		
		E3x-DAH□-N	35 25 10	50x50 (0.01 mm ø)		
		E3x-MDA	110 80 36	200x200 (0.005 mm ø)		
		E3x-NA□(V)	40	50x50 (0.03 mm ø)		
		E3x-NAG□	10	25x25 (0.3 mm ø)		
		E3x-NA□F	13	25x25 (0.03 mm ø)		
6 mm ø Free-cut	6-mm ø 	E3x-DA□-S	80 45 14	100x100 (0.005 mm ø)	E32-D14LR	1 mm
		E3x-DA□-N	60 45 25	100x100 (0.01 mm ø)		
		E3x-MDA	45 33 14	100x100 (0.005 mm ø)		
		E3x-NA□(V)	16	25x25 (0.03 mm ø)		
		E3x-NA□F	5			

*1. Sensing distance beased on white paper.
*2. Indicates values for standard mode.

High resolution mode | Standard mode
Super long-distance mode | Super high-speed mode
Green light | Red light | Infrared ray

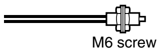
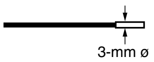
Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1				Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
2 mm ø small ø; space-saving Free.cut	 	E3x-DA□-S	50 30 8				50x50 (0.005 mm ø)	E32-D24	10 mm
		E3x-DA□-N	40 30 10				50x50 (0.01 mm ø)		
		E3x-MDA	30 22 8				50x50 (0.005 mm ø)		
		E3x-NA□(V)	15				25x25 (0.03 mm ø)		
		E3x-NAG□	2.4				25x25 (0.3 mm ø)		
		E3x-NA□F	5				25x25 (0.03 mm ø)		
	 	E3x-DA□-S	26 15 4				50x50 (0.005 mm ø)	E32-D24R	1 mm
		E3x-DA□-N	25 15 6				50x50 (0.01 mm ø)		
		E3x-MDA	15 10 4				50x50 (0.005 mm ø)		
		E3x-NA□(V)	7				25x25 (0.03 mm ø)		
		E3x-NA□F	2.3						

*1. Sensing distance beased on white paper.
*2. Indicates values for standard mode.

Coaxial fiber

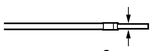
Diffuse reflective fiber units

- High resolution mode
- Standard mode
- Super long-distance mode
- Super high-speed mode
- Green light
- Red light
- Infrared ray

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
M6 coaxial; high-precision positioning Free-cut		E3X-DA□-S	500 300 90	500x500 (0.005 mm ø)	E32-CC200	25 mm
		E3X-DAG□-S E3X-DAB□-S	32 25 16	100x100 (0.1 mm ø)		
		E3X-DA□-N	400 300 100	500x500 (0.01 mm ø)		
		E3X-DAB#-N	32 25 16	100x00 (0.1 mm ø)		
		E3X-DAH□-N	100 75 25	100x100 (0.01 mm ø)		
		E3X-MDA	300 210 90	500x500 (0.005 mm ø)		
		E3X-NA□(V)	150	200x200 (0.01 mm ø)		
		E3X-NAG□	25	50x50 (0.1 mm ø)		
		E3X-NA□F	50	75x75 (0.015 mm ø)		
3 mm ø; small ø; coaxial; high-precision positioning Free-cut		E3X-DA□-S	250 150 45	300x300 (0.005 mm ø)	E32-D32L	25 mm
		E3X-DA□-N	200 150 50	300x300 (0.01 mm ø)		
		E3X-MDA	150 100 45	300x300 (0.005 mm ø)		
		E3X-NA□(V)	80	100x100 (0.01 mm ø)		
		E3X-NAG□	12	25x25 (0.1 mm ø)		
		E3X-NA□F	25	50x50 (0.02 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Refer to page “AB-” when using the optional lens unit

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light
Infrared ray

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
M3 coaxial high precision positioning Free-cut Small spot lens mountable (E39-F3A, F3A-5, F3B, F3C)	 M3 screw	E3X-DA□-S	120 75 22 Spot ø*3 • Adjustable in the range 0.1 to 0.6-mm ø	100x100 (0.005 mm ø)	E32-EC31	25 mm
		E3X-DA□-N	100 75 25 Spot ø Adjustable in the range 0.5 to 1.0 mm ø.	100x100 (0.01 mm ø)		
		E3X-MDA	75 50 22	100x100 (0.005 mm ø)		
		E3X-NA□(V)	40	50x50 (0.01 mm ø)		
		E3X-NAG□	6	25x25 (0.1 mm ø)		
		E3X-NA□F	13	25x25 (0.02 mm ø)		
M3 coaxial high precision positioning Free-cut Small spot lens mountable (E39-F3A, F3A-5, F3B, F3C)	 M3 screw	E3X-DA□-S	50 35 8 Spot ø • 0.1-mm ø • 0.2-mm ø • 4.0-mm ø max	50x50 (0.005 mm ø)	E32-EC41	
		E3X-DA□-N	45 35 10 Spot ø • 0.1 mm ø • 0.2 mm ø • 4.0 mm ø max.	50x50 (0.01 mm ø)		
		E3X-MDA	35 22 8	50x50 (0.005 mm ø)		
		E3X-NA□(V)	15	25x25 (0.01 mm ø)		
		E3X-NA□F	5	25x25 (0.02 mm ø)		
2 mm ø coaxial; high-precision positioning Small spot lens mountable (E39-F3A,)	 2-mm ø	E3X-DA□-S	50 35 8 Spot ø • Adjustable in the range 0.1 to 0.6-mm ø.	50x50 (0.005 mm ø)	E32-C42	
		E3X-DA□-N	45 35 10 Spot ø • Adjustable in the range 0.1 to 0.6 mm ø	50x50 (0.01 mm ø)		
		E3X-MDA	35 22 8	50x50 (0.005 mm ø)		
		E3X-NA□(V)	15	25x25 (0.01 mm ø)		
		E3X-NA□F	5	25x25 (0.02 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Refer to page “AB-” when using the optional lens unit

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Green light / Red light / Infrared ray

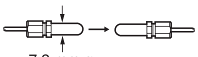
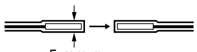
Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
2 mm ø coaxial; high-precision positioning Free-cut Small spot lens mountable (E39-F3A,)	 2-mm ø	E3X-DA□-S	120 75 22 Spot ø*3 • Adjustable in the range 0.1 to 0.6-mm ø	100x100 (0.005 mm ø)	E32-D32	25 mm
		E3X-DA□-N	100 75 25	100x100 (0.01 mm ø)		
		E3X-MDA	75 52 22	100x100 (0.005 mm ø)		
		E3X-NA□(V)	40	50x50 (0.01 mm ø)		
		E3X-NAG□	6	25x25 (0.1 mm ø)		
		E3X-NA□F	13	25x25 (0.02 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Refer to page "AB-" when using the optional lens unit

Chemical resistant

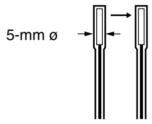
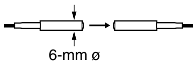
Throughbeam fiber unit

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Green light / Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Teflon-covered*3; round head that resists water drops Free-cut	 7.2-mm ø	E3X-DA□-S	2,500 2,000 520	4 mm ø (0.1 mm ø)	E32-T11F	4 mm
		E3X-MDA	1,600 1,300 520	4 mm ø (0.1 mm ø)		
Teflon-covered*3; withstands chemicals and harsh environments (operating ambient temperature: -30° C to 70° C) Free-cut	 5-mm ø	E3X-DA□-S	4,000 3,000 800	4 mm ø (0.1 mm ø)	E32-T12F	40 mm
		E3X-DA□-N	3,800 3,000 1,100	4 mm ø (0.01 mm ø)		
		E3X-MDA	2,600 2,000 800	4 mm ø (0.1 mm ø)		
		E3X-NA□(V)	1,600	4.0 mm ø (0.2 mm ø)		
		E3X-NAG□	300			
		E3X-NA□F	480	4.0 mm ø (0.7 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Teflon is a registered trademark of Dupont Company and Mitsui Dupont Company for their fluoride resin.

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Green light
Red light

Features	Appearance	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Teflon-covered*3; withstands chemicals and harsh environments; side-view (operating ambient temperature: -30° C to 70° C) Free-cut		E3X-DA☐-S	500 400 100	3 mm ø (0.1 mm ø)	E32-T14F	
		E3X-DA☐-N	600 400 150	3 mm ø (0.01 mm ø)		
		E3X-MDA	320 250 100	3 mm ø (0.1 mm ø)		
		E3X-NA☐(V)	200	3.0 mm ø (0.2 mm ø)		
		E3X-NAG☐	37			
		E3X-NA☐F	60	3.0 mm ø (0.7 mm ø)		
Teflon*3; withstands chemicals and harsh environments (operating ambient temperature: -40° C to 200° C)		E3X-DA☐-S	920 700 190	1.0 mm ø (0.005 mm ø)	E32-T81F-S	10 mm
		E3X-DA☐-N	880 700 260	1 mm ø (0.01 mm ø)		
		E3X-MDA	600 460 190	1.0 mm ø (0.005 mm ø)		
		E3X-NA☐(V)	350	1.0 mm ø (0.2 mm ø)		
		E3X-NA☐F	100	1.0 mm ø (0.5 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Teflon is a registered trademark of Dupont Company and Mitsui Dupont Company for their fluoride resin.

Diffuse reflective fiber units

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Green light / Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Teflon-covered*3; withstands chemicals and harsh environments (operating ambient temperature: -30° C to 70° C Free-cut	6-mm ø	E3X-DA□-S	160 95 30	200x200 (0.005 mm ø)	E32-D12F	40 mm
		E3X-DA□-N	120 95 45	200x200 (0.01 mm ø)		
		E3X-MDA	95 70 30	200x200 (0.005 mm ø)		
		E3X-NA□(V)	50	100x100 (0.03 mm ø)		
		E3X-NAG□	8	25x25 (0.3 mm ø)		
		E3X-NA□F	16	25x25 (0.03 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Teflon is a registered trademark of Dupont Company and Mitsui Dupont Company for their fluoride resin.

Heat resistant

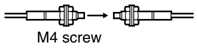
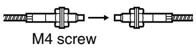
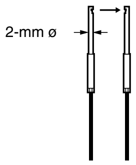
Throughbeam fiber unit

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Resists 150° C*3; fiber sheath fiber sheat material: fluorine resin (operating ambient temperature: -40° C to 150° C) Free-cut	M4 screw	E3X-DA□-S	1,000 760 200	1.5 mm ø (0.1 mm ø)	E32-ET51	35 mm
		E3X-DA□-N	950 760 280	1.5 mm ø (0.01 mm ø)		
		E3X-MDA	650 500 200	1.5 mm ø (0.1 mm ø)		
		E3X-NA□(V)	400	1.5 mm ø (0.03 mm ø)		
		E3X-NA□F	120	1.5 mm ø (1 mm ø)		

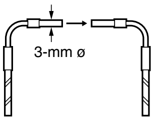
*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. For continuous operation, us the products within the temperature ranging from -40°C to 130°C.
*4. Indicates the heat resistant temperature at the fiber tip.
*5. Teflon is a registered trademark of the Dupont Company and the Mitsui Dupont Chemical Company for their fluoride resin.
*6. Longer sensing distance by using the lens unit E39-F1.

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Resists 200° C; flexible (R10); fiber sheath material: Teflon*5 (operating ambient temperature: -40° C to 200° C)		E3X-DA□-S	360 (2,650) / 280 (2,100) / 70 (520)	1.0 mm ø (0.005 mm ø)	E32-T81R-S NEW	10 mm
		E3X-DA□-N	350 / 280 / 100	1.5 mm ø (0.01 mm ø)		
		E3X-MDA	230 (1,700) / 180 (1,300) / 70 (520)	1.0 mm ø (0.005 mm ø)		
		E3X-NA□(V)	180	1.0 mm ø (0.2 mm ø)		
		E3X-NA□F	50	1.0 mm ø (0.5 mm ø)		
Resists 350° C*4, with spiral tube; high mechanical strength; fiber sheath material: stainless steel (operating ambient temperature: -60° C to 350° C)		E3X-DA□-S	600 (4,000)*6 / 450 (3,400) / 120 (900)	1.0 mm ø (0.005 mm ø)	E32-T61-S NEW	25 mm
		E3X-DA□-N	570 (4,000)*6 / 450 (3,400) / 170 (1,300)	1 mm ø (0.01 mm ø)		
		E3X-MDA	390 (3,000) / 300 (2,200) / 120 (900)	1.0 mm ø (0.005 mm ø)		
		E3X-NA□(V)	300 (3,000)	1.0 mm ø (0.03 mm ø)		
		E3X-NA□F	90	1.0 mm ø (0.5 mm ø)		
Side-view; resists 150° C*3; suitable for detecting minute sensing objects; fiber sheath material: fluorine resin (operating ambient temperature: –40° C to 150° C) Free-cut		E3X-DA□-S	300 / 230 / 60	1.0 mm ø (0.005 mm ø)	E32-T54	35 mm
		E3X-DA□-N	290 / 230 / 80	1 mm ø (0.01 mm ø)		
		E3X-MDA	190 / 150 / 60	1.0 mm ø (0.005 mm ø)		
		E3X-NA□(V)	130	1.0 mm ø (0.03 mm ø)		
		E3X-NA□F	35	1.0 mm ø (0.3 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. For continuous operation, us the products within the temperature ranging from -40°C to 130°C.
*4. Indicates the heat resistant temperature at the fiber tip.
*5. Teflon is a registered trademark of the Dupont Company and the Mitsui Dupont Chemical Company for their fluoride resin.
*6. Longer sensing distance by using the lens unit E39-F1.

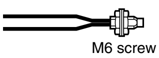
High resolution mode (white bar)	Standard mode (gray bar)	
Super long-distance mode (black bar)	Super high-speed mode (light gray bar)	
Red light (blue bar)		

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Resists 200° C*4; L-shaped; fiber sheath material: stainless steel SUS		E3X-DA□-S	1,750 1,300 350	1.7 mm ø (0.1 mm ø)	E32-T84S-S NEW	25 mm
		E3X-DA□-N	1,700 1,300 500	1.7 mm ø (0.01 mm ø)		
		E3X-MDA	1,100 870 350	1.7 mm ø (0.1 mm ø)		
		E3X-NA□(V)	700	1.7 mm ø (0.03 mm ø)		
		E3X-NA□F	210	1.7 mm ø (0.4 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. For continuous operation, us the products within the temperature ranging from -40°C to 130°C.
*4. Indicates the heat resistant temperature at the fiber tip.
*5. Teflon is a registered trademark of the Dupont Company and the Mitsui Dupont Chemical Company for their fluoride resin.
*6. Longer sensing distance by using the lens unit E39-F1.

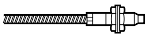
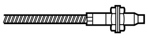
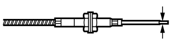
Diffuse reflective fiber unit

High resolution mode (white bar)	Standard mode (gray bar)	
Super long-distance mode (black bar)	Super high-speed mode (light gray bar)	
Red light (blue bar)		

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Resists 150° C*3; fiber sheath material: fluorine resin (operating ambient temperature: -40° C to 150° C) Free-cut		E3X-DA□-S	400 230 72	200x200 (0.005 mm ø)	E32-ED51	35 mm
		E3X-DA□-N	300 230 100	200x200 (0.01 mm ø)		
		E3X-MDA	230 165 72	100x100 (0.005 mm ø)		
		E3X-NA□(V)	120	150x150 (0.03 mm ø)		
		E3X-NA□F	40	50x50 (0.03 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. For continius operation use the product within a temperature range of -40° to 130°C.
*4. Indicates the heat-resistant temperature at the fiber tip.

High resolution mode
Super long-distance mode
Red light
Standard mode
Super high-speed mode

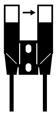
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Resists 200° C*4; fiber sheath material: fluorine resin (operating ambient temperature: -40° C to 200° C)	 M6 screw	E3X-DA□-S	150 90 27	200x200 (0.005 mm ø)	E32-D81R-S E32-D81R	10 mm
		E3X-DA□-N	120 90 30	200x200 (0.01 mm ø)		
		E3X-MDA	90 63 27	100x100 (0.005 mm ø)		
Resists 350° C*4; fiber sheath material: stainless steel (operating ambient temperature: -60° C to 350° C)	 M6 screw	E3X-DA□-S	150 90 27	200×200 (0.005 mm ø)	E32-D61-S NEW	25 mm
		E3X-MDA	90 60 27			
300°C Operating ambient temperature: -40 to +300°C Fiber sheath material: SUS	 M6 screw	E3X-DA□-N	120 90 30	200x200 (0.01 mm ø)	E32-D61 NEW	
		E3X-NA□(V)	45	100x100 (0.03 mm ø)		
		E3X-NA□F	15	25x25 (0.03 mm ø)		
400°C Operating ambient temperature: -40 to +400°C Fiber sheath material: SUS	 M4 screw 1.25-mm ø	E3X-DA□-N	80 60 20	100x100 (0.01 mm ø)	E32-D73	25 mm
		E3X-NA□(V)	30	50x50 (0.03 mm ø)		
		E3X-NA□F	10	25x25 (0.03 mm ø)		
Resists 400° C*4; fiber sheath material: stainless steel (operating ambient temperature: -40° C to 400° C)		E3X-DA□-S	100 60 18	200x200 (0.005 mm ø)	E32-D73-S NEW	
		E3X-MDA	60 40 18			

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. For continius operation use the product within a temperature range of -40° to 130°C.
*4. Indicates the heat-resistant temperature at the fiber tip.

Grooved

Throughbeam fiber unit

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode / Green light / Red light

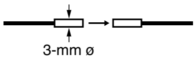
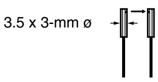
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)				Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Suitable for film sheet detection; no optical axis adjustment required; easy to mount Free-cut		E3X-DA□-S	10 10 10				4.0 mm ø (0.1 mm ø)	E32-G14	25 mm
		E3X-DAG□-S E3X-DAB□-S	10 10 10						
		E3X-DA□-N	10 10 10				4.0 mm ø (2.0 mm ø)		
		E3X-DAB#-N	10 10 10						
		E3X-DAH□-N	10 10 10						
		E3X-MDA	10 10 10				4.0 mm ø (0.1 mm ø)		
		E3X-NA□(V)	10						
		E3X-NAG□	10						
		E3X-NA□F	10				4.0.0 mm ø (1.0 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

Narrow Vision Field

Throughbeam fiber unit

High resolution mode
Standard mode
Super long-distance mode
Super high-speed mode
Red light

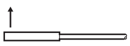
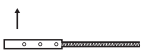
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1 (Parentheses: With E39-F1 Lens Unit)	Standard object*2 (min. sensing object) (Parentheses: Opaque object)	Model	Permissible bending radius
Suitable for detecting wafers Free-cut		E3X-DA□-S	2,500 1,900 500	1.7 mm ø (0.1 mm ø)	E32-T22S	25 mm
		E3X-DA□-N	2,300 1,900 700	1.7 mm ø (0.01 mm ø)		
		E3X-MDA	1,600 1,250 500	1.7 mm ø (0.1 mm ø)		
		E3X-NA□(V)	1,000	1.7 mm ø (0.5 mm ø)		
		E3X-NA□F	300			
Side-view; suitable for detecting wafers Free-cut		E3X-DA□-S	1,750 1,300 350	2 mm ø (0.1 mm ø)	E32-T24S	10 mm
		E3X-DA□-N	1,700 1,300 500	2 mm ø (0.01 mm ø)		
		E3X-MDA	1,100 870 350	2 mm ø (0.1 mm ø)		
		E3X-NA□(V)	700	2.0 mm ø (0.03 mm ø)		
		E3X-NA□F	210	2.0 mm ø (0.5 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

Limited-reflective

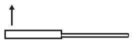
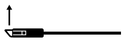
Diffuse reflective fiber units

High resolution mode
Super long-distance mode
Red light
Standard mode
Super high-speed mode

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Suitable for positioning of crystal glass Free-cut		E3X-DA□-S	0 to 15 0 to 15 0 to 15	100x100 Soda glass with reflection factor of 7%	E32-L16 NEW	25 mm
		E3X-DA#-N	0 to 15 0 to 15 0 to 15			
		E3X-MDA	0 to 15 0 to 15 0 to 15			
		E3X-NA#(V)	0 to 15			
		E3X-NA#F	0 to 13			
Suitable for positioning of crystal glass Free-cut		E3X-DA□-S	4 to 12 4 to 12 4 to 12		E32-L56E1 E32-L56E2	35 mm
		E3X-DA□-N	4 to 12 4 to 12 4 to 12			
		E3X-MDA	4 to 12 4 to 12 4 to 12			
		E3X-NA□(V)	4 to 12	---		
		E3X-NA□F	4 to 12			
Suitable for positioning of crystal glass Heat resists up to 300°C Free-cut		E3X-DA□-S	5 to 18 5 to 18 5 to 18	100x100 Soda glass with reflection factor of 7%	E32-L66 NEW	25 mm
		E3X-DA#-N	5 to 18 5 to 18 5 to 18			
		E3X-MDA	5 to 18 5 to 18 5 to 18			
		E3X-NA#(V)	5 to 18			
		E3X-NA#F	7 to 14			

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

☐ High resolution mode	■ Standard mode
■ Super long-distance mode	☐ Super high-speed mode
■ Red light	

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)[*1]				Standard object[*2] (min. sensing object: Gold wire)	Model	Permissible bending radius
Siutable for crystal glass detection Thin and compact type Free-cut		E3X-DA□-S	0 to 4 0 to 4 0 to 4				25x25 (0.005 mm ø)	E32-L24S NEW	10 mm
		E3X-DA#-N							
		E3X-MDA	0 to 4 0 to 4 0 to 4						
		E3X-NA#(V)	0 to 4				25x25		
		E3X-NA#F	0 to 4						
Detects wafers and small differences in height; (operating ambient tempera-ture: -40° C to 105° C); degree of protection: IEC60529 IP50 Free-cut		E3X-DA□-S	4±2 4±2 4±2				25x25 (0.005 mm ø)	E32-L24L	10 mm
		E3X-DA□-N	4 ±2 4 ±2 4 ±2				25x25 (0.01 mm ø)		
		E3X-MDA	4±2 4±2 4±2				25x25 (0.005 mm ø)		
		E3X-NA□(V)	4 ± 2				25x25 (0.015 mm ø)		
		E3X-NA□F	4 ± 2				25x25 (0.03 mm ø)		
		E3X-DA□-S	7.2±1.8 7.2±1.8 7.2±1.8				25x25 (0.005 mm ø)	E32-L25L	10 mm
		E3X-DA□-N	7.2 ±1.8 7.2 ±1.8 7.2 ±1.8				25x25 (0.01 mm ø)		
		E3X-MDA	7.2±1.8 7.2±1.8 7.2±1.8				25x25 (0.005 mm ø)		
		E3X-NA□(V)	7.2±1.8				25x25 (0.015 mm ø)		
		E3X-NA□F	7.2±1.8				25x25 (0.03 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

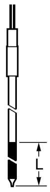
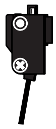
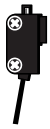
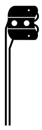
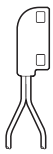
High resolution mode	Standard mode
Super long-distance mode	Super high-speed mode
Red light	

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1				Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Detects wafers and small differences in height; degree of protection: IEC60529 IP50 Free-cut		E3X-DA□-S	3.3 3.3 3.3				25x25 (0.005 mm ø)	E32-L25	25 mm
		E3X-DA□-N	3.3 3.3 3.3				25x25 (0.01 mm ø)		
		E3X-MDA	3.3 3.3 3.3				25x25 (0.005 mm ø)		
		E3X-NA□(V)	3.3				25x25 (0.015 mm ø)		
		E3X-NA□F	3.3				25 x 25 (0.03 mm ø)		
		E3X-DA□-S	3.3 3.3 3.3				25x25 (0.005 mm ø)	E32-L25A	25 mm
		E3X-DA□-N	3.3 3.3 3.3				25x25 (0.01 mm ø)		
		E3X-MDA	3.3 3.3 3.3				25x25 (0.005 mm ø)		
		E3X-NA□(V)	3.3				25x25 (0.015 mm ø)		
		E3X-NA□F	3.3				25x25 (0.03 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

Fluid-level Detection Fiber Units

Diffuse reflective fiber units

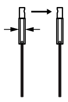
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Fluid contact type: unbendable section L 150 mm, 350 mm (two types); (operating ambient temperature: -40° C to 200° C)		E3X-DA□-S DA□-N E3X-MDA NA□(V NA□F	---	Pure water at 25° C	E32-D82F1 E32-D82F2	40 mm
Tube-mounting type; Light ON when fluid is present; minimal influence from bubbles and water drops Free-cut		E3X-DA□-S DA□-N E3X-MDA	Applicable tube: FEP, transparent tube,. 3.2, 6.4, 9.5 mm ø, wall thickness 1mm		E32-A01	4 mm
Tube-mounting type; light ON when fluid is present; minimal influence from bubbles and water drops Free-cut		E3X-DA□-S DA□-N E3X-MDA	Applicable tube: FEP, transparent tube,. 6- to 13 mm ø, wall thickness 1mm		E32-A02	
Tube-mounting type; dense mounting to detect level differences of 4 mm Free-cut		E3X-DA□-S DA□-N E3X-MDA	Applicable tube: FEP, transparent tube,. 8- to 10 mm ø, wall thickness 1mm		E32-L25T	10 mm
		NA□(V) NA□F	---	---		
Teflon*3-covered Tube-mounting type; unlimited tube diameter; minimal influence from bubbles and water drops Free-cut		E3X-DA□-S E3X-MDA	Applicable tube: Transparent tube Tube diameter: No restriction (Tube must be FEP or material with equivalent transparency)		E32-D36F	4 mm

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.
*3. Teflon is a registered trademark of Dupont Company and Mitsui Chemical Company for fluorine resin.

Mapping sensors

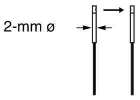
Diffuse reflective fiber units

High resolution mode / Standard mode / Super long-distance mode / Super high-speed mode

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Super-narrow vision field; side-view; opening angle: 1.5°; simple adjustment Free-cut	3-mm ø 	E3X-DA□-S	1,150 890 250	2 mm ø (0.1 mm ø)	E32-A03	1 mm
		DA□-N	1,100 890 500	2 mm ø (0.01 mm ø)		
		E3X-MDA	750 580 250	2 mm ø (0.1 mm ø)		
		NA□(V)	---	---		
		NA□F				

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

High resolution mode | Standard mode | Super long-distance mode | Super high-speed mode

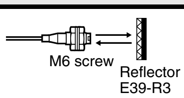
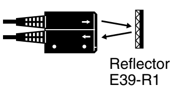
Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Super-narrow vision field; small; side-view; opening angle: 3°; simple adjust-ment Free-cut		E3X-DA□-S	460 340 100	1.2 mm ø (0.1 mm ø)	E32-A04	10 mm
		DA□-N	440 340 170	1.2 mm ø (0.01 mm ø)		
		E3X-MDA	300 220 100	1.2 mm ø (0.1 mm ø)		
		NA□(V)	---	---		
		NA□F				

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

Retroreflective

Diffuse reflective fiber

High resolution mode | Standard mode | Super long-distance mode | Super high-speed mode | Red light

Features	Shape	Applicable Amplifier Unit	Sensing distance (mm)*1	Standard object*2 (min. sensing object: Gold wire)	Model	Permissible bending radius
Opaque object detection Free-cut		E3X-DA□-S	10 to 250 10 to 250 10 to 250	35 mm ø (0.1 mm ø)	E32-R21 + E39-R3 (Attachment)	10 mm
		E3X-DA□-N	10 to 250 10 to 2 50 10 to 250			
		E3X-MDA	10 to 250 10 to 250 10 to 250			
		E3X-NA□(V)	10 to 250	35.0 mm ø (0.3 mm ø)		
		E3X-NA□F	10 to 250	35.0 mm ø (0.5 mm ø)		
Opaque object detection		E3X-DA□-S	150 to 1,500 150 to 1,500 150 to 1,500	35 mm ø (0.2 mm ø)	E32-R16 + E39-R1 (Attachment)	25 mm
		E3X-DA□-N	150 to 1,500 150 to 1,500 150 to 1,500			
		E3X-MDA	150 to 1,500 150 to 1,500 150 to 1,500			
		E3X-NA□(V)	150 to 1500	35.0 mm ø (0.6 mm ø)		
		E3X-NA□F	150 to 1000	35.0 mm ø (0.4 mm ø)		

*1. Sensing distance based an white paper.
*2. Indicates values for standard mode.

Rating/Performance

Fiber Units

Through-beam fiber unit

Item	Type/application	Long distance, general purpose, Thin fiber, side view	Flexible (break-resistant)	Chemical resistant	
			E32-T11, E32-T21, E32-T22B	E32-T12F, E32-T14F	E32-T81F
Ambient temperature	Operation	-40°C to 70°C (with no icing or condensation)			-40° to 200°C (with no icing or condensation)
	Storage				-40° to 110°C (with no icing or condensation)
Ambient humidity		Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)			
Admissible bending radius		25 mm min. (10 mm min. for 1 mm dia. fiber)	4 mm min.	40 mm min.	10 mm min.
Fiber sheath material		Black polyethylene	Vinyl chloride	Teflon (*) covered	
Protective structure		IEC 60529 IP67			

* Teflon is a registered trademark of the Dupont Company and the Mitsui Dupont Chemical Company for their fluoride resin.

Item	Type/application	Flexible					
		E32-T12R	E32-T22R	E32-T16WR	E32-T16JR E32-T16PR	E32-T24R	E32-T14LR E32-ET11R E32-ET21R
Ambient temperature	Operation	-40° to 70°C (with no icing or condensation)		-25°C to 55°C (with no icing or condensation)	-40° to 70°C (with no icing or condensation)		
	Storage	-40° to 70°C (with no condensation)					
Ambient humidity		Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)					
Admissible bending radius		1 mm min.					
Fiber sheath material		Mixed vinyl chloride	Black polyethylene	Mixed vinyl chloride		Black polyethylene	Mixed vinyl chloride
Protective structure		IEC 60529 IP67		IEC 60529 IP50		IEC 60529 IP67	

Item	Type/application	Heat resistant				
		300 °C	200°C		150°C	
		E32-T61-S	E32-T84S	E32-T81R-S	E32-ET51	E32-T54
Ambient temperature	Operation	-40° to 300°C *1 (with no icing or condensation)	-40° to 200°C (with no icing or condensation)	-40° to 200°C (with no icing or condensation)	-40° to 150°C *2 (with no incing or condensation)	
	Storage	-40° to 110°C (with no icing or condensation)				
Ambient humidity		Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)				
Admissible bending radius		25 mm min.		10 mm min.	35 mm min.	
Fiber sheath material		SUS303		Fluororesin		
Protective structure		IEC 60529 IP67				

*1 Since the heat resistance changes depending on the fiber area, refer to the external dimensions.
*2 For continuous operation, use the products within a temperature range of -40°C to 130°C

Type/application Item		Slot Sensor	Narrow vision field	Area sensing			
		E32-G14	E32-T22S E32-T24S	E32-T16W	E32-T16J	E32-T16	E32-T16P
Ambient tempera-ture	Operation	-40° to 70°C (with no icing or con-densation)		-25°C to 55°C (with no icing or condensation)	-40° to 70°C (with no icing or condensation)		
	Storage	-40° to 70°C (with no icing or condensation)					
Ambient humidity		Operating: 35% to 85% RH, storage: 35% to 95% RH (with no icing or condensation)					
Admissible bending radius		25 mm min.		10 mm min. (25 mm max. for E32-T16 only)			
Fiber sheath material		Black polyethylene	Mixed vinyl chloride	Vinyl chloride (black polyethylene for E32-T16 only)			
Protective structure		IEC 60529 IP67		IEC 60529 IP50 (IP67 for E32-T16 only)			

Type/application Item		Mapping Sensor	
		E32-A03	E32-A04
Ambient tempera-ture	Operation	-40° to 70°C (with no icing or condensation)	
	Storage		
Ambient humidity		Operating: 35% to 85% RH, storage: 35% to 95% RH (with no icing or condensation)	
Admissible bending radius		1 mm min.	10 mm min.
Fiber sheath material		Black polyethylene	
Protective structure		IEC 60529 IP50	

Fiber Units with Reflective Sensor

Type/application Item		Long distance, general purpose, thin fiber, side view	Coaxial				Flexible (resists breaking)
			E32-EC31	E32-EC41	E32-C42	E32-D32	E32-D11, E32-D21, E32-D21B, E32-D22B
Differential distance		20% max. of sensing distance					
Ambient tempera-ture	Operation	-40°C to 70°C (with no icing or condensation)					
	Storage						
Ambient humidity	Operation	35% to 85%RH (with no condensation)					
	Storage	35% to 95%RH (with no condensation)					
Admissible bending radius		25 mm min. (10 mm min. for 1 mm dia. fiber)	25 mm min.				4 mm min.
Fiber sheath material		Black polyethylene					Vinyl chloride
Protective structure		IEC 60529 IP67					

Type/application Item		Flexible			
		E32-D12R	E32-D22R, E32-D24R	E32-D14LR, E32-ED11R	E32-ED21R
Differential distance		20% max. of sensing distance			
Ambient tempera-ture	Operation	-40°C to 70°C (with no icing or condensation)			
	Storage				
Ambient humidity	Operation	35% to 85%RH (with no condensation)			
	Storage	35% to 95%RH (with no condensation)			
Admissible bending radius		1 mm min.			
Fiber sheath material		Mixed vinyl chloride	Black polyethylene	Mixed vinyl chloride	Black polyethylene
Protective structure		IEC 60529 IP67			

Item \ Type/application		Chemical resistance	Heat resistance			
			150°C	200°C	300 °C	400 °C
		E32-D12F	E32-ED51	E32-D81R	E32-D61	E32-D73
Differential distance		20% max. of sensing distance				
Ambient temperature	Operation	-30°C to 70°C (with no incing or condensation)	-40° to 150°C *1(with no incing or condensation)	-40° to 200°C (with no icing or condensation)	-40° to 300°C *2(with no icing or condensation)	-40° to 400°C (with no incing or condensation)
	Storage	-30°C to 70°C (with no incing or condensation)	-40° to 110°C (with no icing or condensation)			
Ambient humidity		Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)				
Admissible bending radius		40 mm min.	35 mm min.	10 mm min.	25 mm min.	
Fiber sheath material		Teflon (*3) covered	Fluororesin		SUS	
Protective structure		IEC 60529 IP67				

*1 For continuous operation, use the products within a temperature range of -40°C to 130°C
*2 Since the heat resistance changes depending on the fiber area, refer to the external dimensions on page AB- for details.
*3 Teflon is a registered trademark of the Dupont Company and the Mitsui Dupont Chemical Company for their fluoride resin.

Item \ Type/application		Retroreflective		Limited reflective		Area sensing
		E32-R21	E32-R16	E32-L25, E32-L25A	E32-L25L, E32-L24L	E32-D36P1
Differential distance		20% max. of sensing distance			5% max. of sensing distance	20% max. of sensing distance
Ambient temperature	Operation	-40° to 70°C (with no icing or condensation)	-25°C to 55°C (with no incing or condensation)	-40° to 70°C (with no icing or condensation)	-40°C to 105°C * (with no incing or condensation)	-40° to 70°C (with no icing or condensation)
	Storage	-40° to 70°C (with no icing or condensation)			-40°C to 95°C (with no incing or condensation)	-40° to 70°C (with no icing or condensation)
Ambient humidity		Operating: 35% to 85% RH, Storage: 35% to 95% RH (with no icing or condensation)				
Admissible bending radius		10 mm min.				25 mm min.
Fiber sheath material		Black polyethylene			Reinforced polyethylene	Black polyethylene
Protective structure		IEC 60529 IP67	IEC 60529 IP66	IEC 60529 IP50		---

* For continuous operation, use the products within a temperature range of -40°C to 90°C.

Item \ Type/application		Limited reflective
	Model	E32-L56E1/E32-L56E2
Standard sensing object		Soda glass (SCG) having 7% reflection factor T=0.7 end face radius chamfering
Work inclination		2°
Sensing position accuracy		+0.1/-0.3
Differential distance		20% max. of sensing distance
Ambient temperature	Operation	0°C to 70°C *
	Storage	-40° to 70°C
Ambient humidity	Operation	35% to 85%
	Storage	35% to 95%
Protective structure		IEC 60529 IP40
Material	Case	Aluminum
	Cover	SPCC steel sheet
	Lens	Glass (BK7)
	Fiber cladding	Fluororesin

* +200°C for short-time use.

Flexible fiber unit

The following fibers are available as flexible type (1 week). (Up to 10 sets) Contact your trading company for the prices, delivery time and types.

Flexible fiber (R1) type

Throughbeam

Application	Shape	Model
General purpose	M4 screw	E32-ET11R
General purpose	M3 screw	E32-ET21R
General purpose	3-mm ø	E32-T12R
Side view	3-mm ø	E32-T14LR
Area sensing	11 mm	E32-T16JR
Area sensing	11 mm	E32-T16PR
Area sensing	30 mm	E32-T16WR
Small fibre head	2-mm ø	E32-T22R
Narrow vision field	3-mm ø	E32-T22SR
Narrow vision field	3-mm ø	E32-T22SR
Small fibre head	1-mm ø	E32-T24R
Narrow vision field	3.5 x 3-mm ø.	E32-T24SR
Heat resistance	M6 screw	E32-T81R-S
General purpose	M3 screw	E32-TC200AR
General purpose	90 mm (40 mm) ( ): E32TC200B4R M4 screw 1.2-mm ø	E32-TC200B4R
General purpose	90 mm (40 mm) ( ): E32-TC200F4R M3 screw 0.9-mm ø	E32-TC200F4R

Reflective model

Application	Shape	Model
Mapping Sensor	3-mm ø	E32-A03
Coaxial fibre	M6 screw	E32-CC200R
General purpose	M6 screw	E32-D12R
Side view	6-mm ø	E32-D14LR
Small fibre heat	3-mm ø	E32-D22R
Side view	1-mm ø	E32-D24R
Coaxial fibre	3-mm ø	E32-D32LR
Coaxial fibre	2-mm ø	E32-D32R
Heat resisrant	M6 screw	E32-D81R
General purpose	( ): E32-DC200B4R 90 mm (40 mm) M6 screw 2.5 ø	E32-DC200B4R
General purpose	( ): E32-DC200B4R 90 mm (40 mm) M6 screw 2.5 ø	E32-DC200BR
General purpose	( ): E32-DC200F4R 90 mm (40 mm) M3 screw 1.2-mm ø	E32-DC200F4R
General purpose	( ): E32-DC200F4R 90 mm (40 mm) M3 screw 1.2-mm ø	E32-DC200FR
General purpose	M6 screw	E32-ED11R
General purpose	M3 screw	E32-ED21R
Limited reflective		E32-L24LR
Limited reflective		E32-L25LR
Liquid-level detection		E32-L25TR

Special compatibility of fiber units

Sensing distance (Unit: mm)

Fiber type	Amplifier type	Mode	Standard product	R5	R7.5	R10	R12.5
E32-TC200B	E3X-DA11-N	Super-long-distance	950	590	770	840	950
		Standard	760	470	610	670	760
		Super-high-speed	280	170	220	250	280
E32-TC200F		Super-long-distance	250	110	250	250	250
		Standard	220	100	220	220	220
		Super-high-speed	90	40	90	90	90
E32-DC200F		Super-long-distance	100	70	100	100	100
		Standard	80	55	80	80	80
		Super-high-speed	30	20	30	30	30

Long fiber type

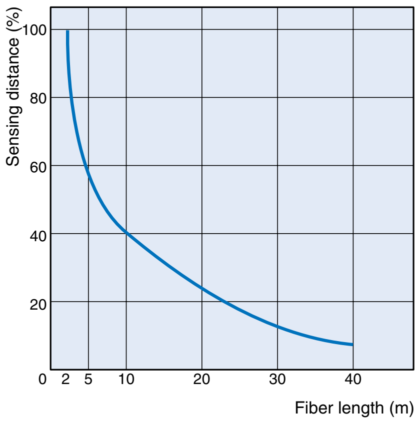
Applicable model (default type)

E32-T11L/-D11L, E32-TC200/-DC200, E32-TC200B/-DC200B, E32-TC200E/-DC200E, E32-TC200F/-DC200F, E32-TC200A4E32-T11/-D11

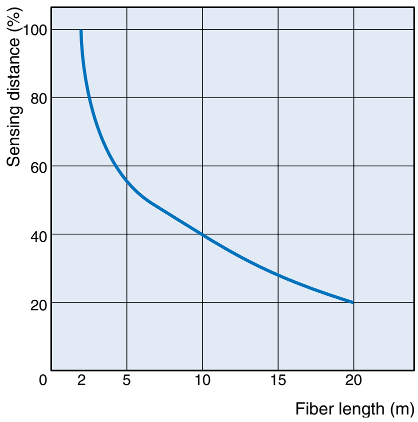
1 m increments in the range 6 m l 20 m [l=2 m, l=5 m (E32-T11L/E32-T11/E32-TC200/E32-DC200 only) are standard products.]

Fiber length vs. sensing distance

Through-beam fiber unit (assuming that the fiber length of 2 m is 100%)



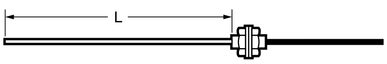
Reflective fiber unit (assuming that the fiber length of 2 m is 100%)



Different stainless steel tube length type

Applicable model

E32-TC200F (tube diameter 0.9 mm) E32-TC200B, E32-DC200F (tube diameter 1.2 mm) E32-DC200B (tube diameter 2.5 mm)



Can be produced within the range 10 mm L 120

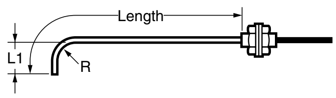
Tolerance: ±1 mm when L 40 mm, ±2 mm when L 40 mm (L=90 mm, L=40 mm is a standard product.)

Stainless steel tube front-end or root bent type

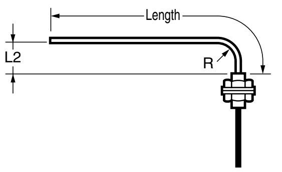
Applicable model

E32-TC200B, E32-TC200F, E32-DC200F

(When tube is bent at front end)



(When tube is bent at root)



Bending radius and L1, L2 dimensions (Unit: mm)

Bending radius	Control No.	L1		L2		SUS tube full length
		1	2	3	4	S□
R5	A	10	15	5	10	120 max.
R7.5	B	12.5	17.5	7.5	17.5	
R10	C	15	20	10	20	
R12.5	D	17.5	22.5	12.5	22.5	

Note: Only the products of the above dimensions can be manufactured. If the product is bent to other than the above dimension, the sleeve bender E39-F11 (option) is available.

Type list based on bending radius and L1, L2 dimensions

(When only L1 is specified) (Unit: mm)

Bending radius	L1 (±1)	Model
R5	10	E32-*1C200*2-S*3A1
	15	E32-□C200□-S□A2
R7.5	12.5	E32-□C200□-S□B1
	17.5	E32-□C200□-S□B2
R10	15	E32-□C200□-S□C1
	20	E32-□C200□-S□C2
R12.5	17.5	E32-□C200□-S□D1
	22.5	E32-□C200□-S□D2

*1 "T" for through-beam type, "D" for reflective type.
*2 B or "F" at the end of E32-TC200B.
*3 "50" for 50 mm full length. Full length 120 mm

(If only L2 is specified) (Unit: mm)

Bending radius	L2 (±1)	Model
R5	5	E32-*1C200*2-S*3A3
	10	E32-□C200□-S□A4
R7.5	7.5	E32-□C200□-S□B3
	17.5	E32-□C200□-S□B4
R10	10	E32-□C200□-S□C3
	20	E32-□C200□-S□C4
R12.5	12.5	E32-□C200□-S□D3
	22.5	E32-□C200□-S□D4

*1 "T" for through-beam type, "D" for reflective type.
*2 B or "F" at the end of E32-TC200B.
*3 "50" for 50 mm full length. Full length 120 mm

(When L1 and L2 are both specified) (Unit: mm)

Bending radius	L1 (±1)	L2 (±1)	Model
R5	10	5	E32-*1C200*2-A13
	10	10	E32-□C200□-A14
	15	5	E32-□C200□-A23
	15	10	E32-□C200□-A24
R7.5	12.5	7.5	E32-□C200□-B13
	12.5	17.5	E32-□C200□-B14
	17.5	7.5	E32-□C200□-B23
	17.5	17.5	E32-□C200□-B24
R10	15	10	E32-□C200□-C13
	15	20	E32-□C200□-C14
	20	10	E32-□C200□-C23
	20	20	E32-□C200□-C24
R12.5	17.5	12.5	E32-□C200□-D13
	17.5	22.5	E32-□C200□-D14
	22.5	12.5	E32-□C200□-D23
	22.5	22.5	E32-□C200□-D24

*1 "T" for through-beam type, "D" for reflective type.
*2 B or "F" at the end of E32-TC200B.

Precautions

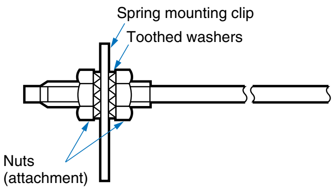
Fiber Units

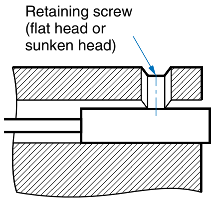
Installation

Tightening Force

The tightening force applied to the Fiber Unit should be as follows:

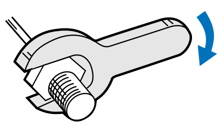
Screw-mounting Model Cylindrical Model





Fiber Units	Clamping torque
M3/M4 screw	0.78 Nm max.
M6 screw/6-mm dia. column	0.98 Nm max.
1.5-mm dia. column	0.2 Nm max.
2-mm dia./3-mm dia. column	0.29 Nm max.
E32-T12F 5-mm dia. Teflon model	0.78 Nm max.
E32-D12F 6-mm dia. Teflon model	
E32-T16	0.49 Nm max.
E32-R21	0.59 Nm max.
E32-M21	0.49 Nm max. for up to 5 mm from front end, 0.78 Nm max. for more than 5 mm from front end
E32-L25A	0.78 Nm max.
E32-T16P E32-T16PR E32-T24S E32-L24L E32-L25L E32-T16J E32-T16JR	0.29 Nm max.
E32-T16W E32-T16WR	0.3 Nm max.

Use a proper-sized wrench.

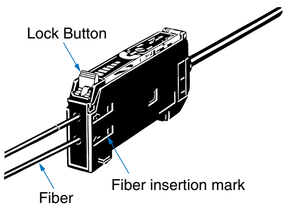


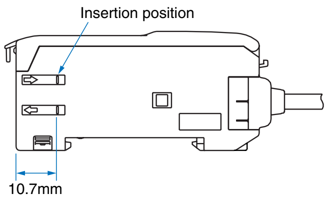
Fiber Connection and Disconnection

The E3X Amplifier Unit has a lock button. Connect or disconnect the fibers to or from the E3X Amplifier Unit using the following procedures:

1. Connection

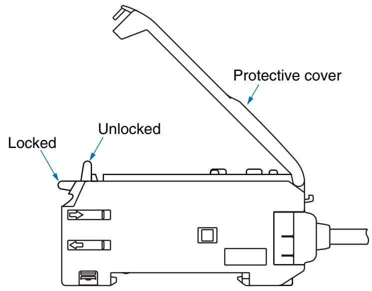
Open the protective cover, insert the fibers according to the fiber insertion marks on the side of the Amplifier Unit, and lower the lock button.





2. Disconnection

Remove the protective cover and raise the lock button to pull out the fiber.



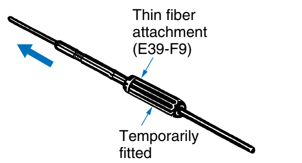
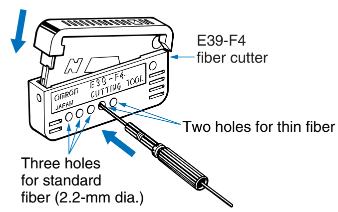
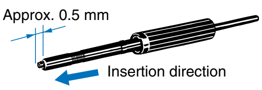
Note:To maintain the fiber properties, confirm that the lock is released before removing the fiber.

3. Precautions for Fiber Connection/Disconnection

Be sure to lock or unlock the lock button within an ambient temperature range between -10°C and 40°C.

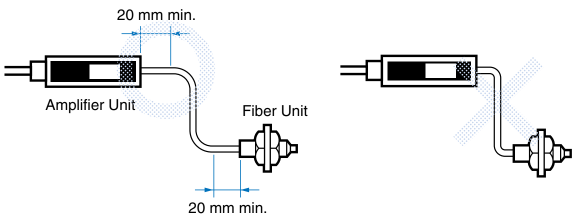
Cutting Fiber

- Insert a fiber into the Fiber Cutter and determine the length of the fiber to be cut.
- Press down the Fiber Cutter in a single stroke to cut the fiber.
- The cutting holes cannot be used twice. If the same hole is used twice, the cutting face of the fiber will be rough and the sensing distance will be reduced. Always use an unused hole.
- Cut a thin fiber as follows:

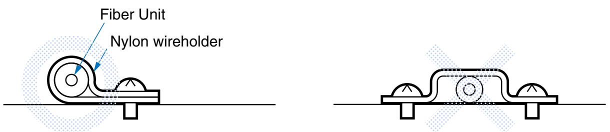
①	An attachment is temporarily fitted to a thin fiber before shipment.	
②	Secure the attachment after adjusting the position of it in the direction indicated by the arrow.	
③	Insert the fiber to be cut into the E39-F4.	
④	Finished state (proper cutting state)	 Note: Insert the fiber in the direction indicated by the arrow.

Connection

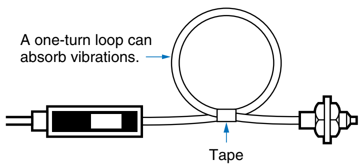
- Do not strain the fiber unit, e.g. do not apply tensile or compression force. (Within 9.8 Nm or 29.4 Nm) Use special care since the fiber is thin.
- The bending radius of the fiber unit should exceed the admissible bending radius given in "Type/standard price" and "Ratings/performance".
- Do not bend the edge of the fiber units (excluding the E32-T□R and E32-D□R).



- Do not apply excess force on the fiber units.

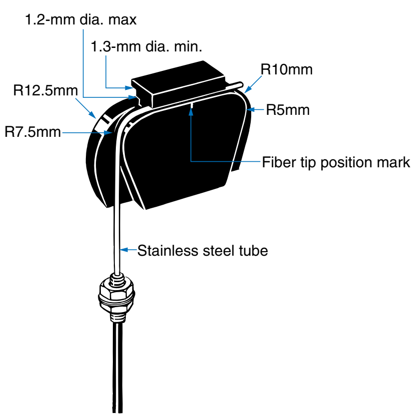


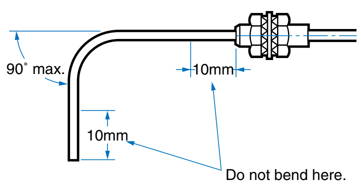
- The fiber head could be break from excessive vibration. To prevent this, the following is applied:



E39-F11 Sleeve Bender

- The bending radius of the stainless steel tube should be as large as possible. The smaller the bending radius becomes, the shorter the sensing distance will be.
- Insert the tip of the stainless steel tube to the sleeve bender and bend the stainless steel tube slowly along the curve of the sleeve bender (refer to the figure).



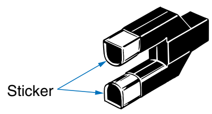


Heat-resistant fibers (E32-D51, E32-T51)

- The bending radius should be 35 mm up.
- The fiber connector E39-F10 cannot be used for extension.
- +130 max. for continuous operation at high temperature. The upper limit of the short-time operable temperature is +150

E32-T14/E32-G14

The presence of a reflective object at the front ends of the lenses may place the unit in an incident state. In this case, apply the supplied black seals to the front ends of the lenses.



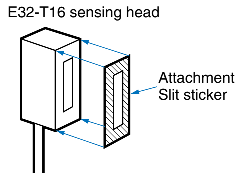
Wafer sensor (E32-L25 (A))

- Insert the fiber with a white line into the emission side of the amplifier.
- When installing the sensor head, tighten it to the 0.78Nm torque.
- Do not expose the sensor to water.

Supplied slit for E32-T16

When using the supplied slit, peel off the back paper and apply it along the outline of the sensing surface. For use at 45 mm or less, always fit a slit of 0.5 mm width.

Example



E32-M21

Set the four fibers at a sufficient distance to avoid interfering with each other.

Adjustment

E32-G14

Because of a short sensing distance, the incident level becomes excessive, disabling "without-work teaching". Use with/without-work teaching.

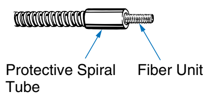
Accessories

Use of E39-R3 Reflector

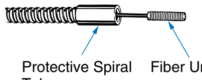
1. When using an adhesive tape on the rear face, apply it after washing off oil, dust, etc. with detergent from the place of application. The reflector cannot be installed if there remains oil, etc.
2. The E39-R3 cannot be used in places where it is exposed to oil or chemicals.

Protective Spiral Tubes

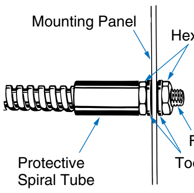
1. Insert a fiber to the protective spiral tube from the head connector side (screwed) of the tube.



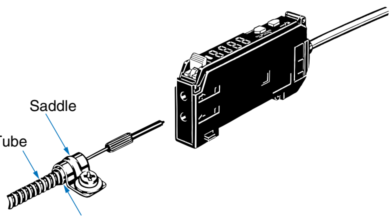
2. Push the fiber into the protective spiral tube. The tube should be straight so that the fiber is not twisted when inserted. Then turn the end cap of the spiral tube.



3. Secure the protective spiral tube at a suitable place with the attached nut.

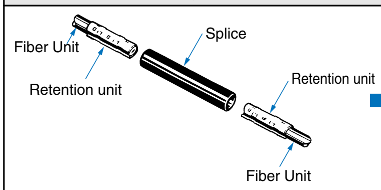
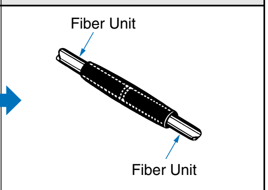


4. Use the attached saddle to secure the end cap of the protective spiral tube. To secure the protective spiral tube at a position other than the end cap, apply tape to the tube so that the portion becomes thicker in diameter.



E39-F10 Fiber Connector

Fit the connector in the following procedure.

①	②
	

- The fiber units should be as close as possible when they are connected. Sensing distance will be reduced by approximately 25% when fibers are connected.

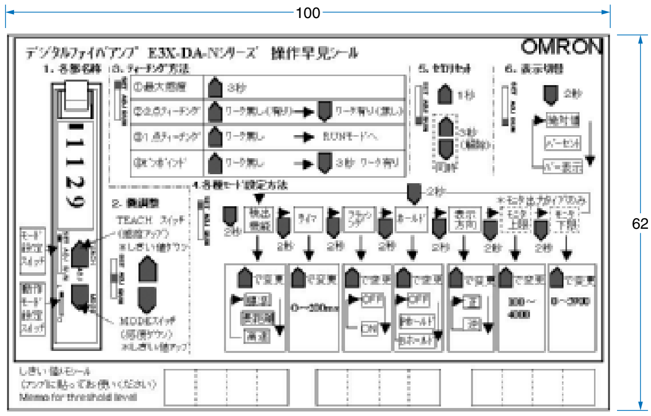
Only 2.2 mm dia. fibers can be connected.

For E3X-DA-N

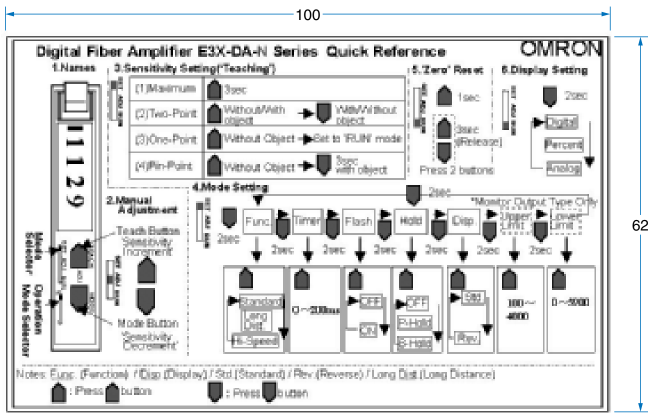
Operating Instructions Sticker E39-Y1

- Apply this seal next to the sensor.
- (1 English and 1 Japanese stickers per set)
- Material: (Front) Paper, (rear) adhesive tape

Japanese Sticker



English Sticker

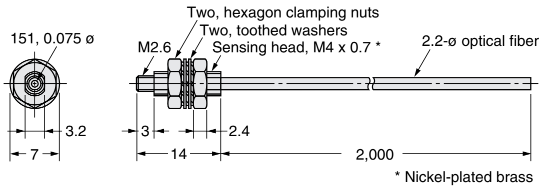


Dimensions

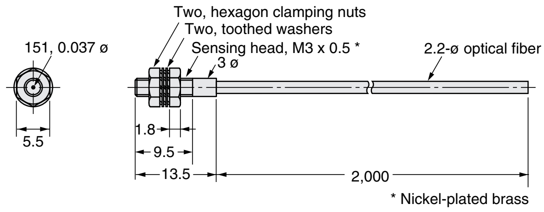
General purpose

Throughbeam

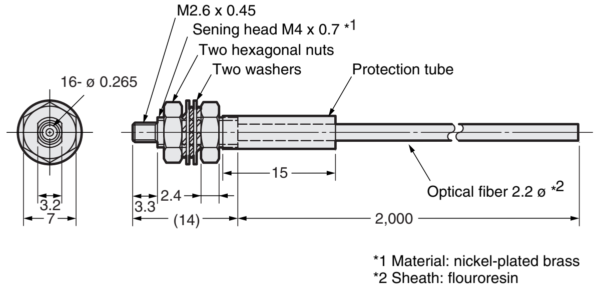
E32-ET11R



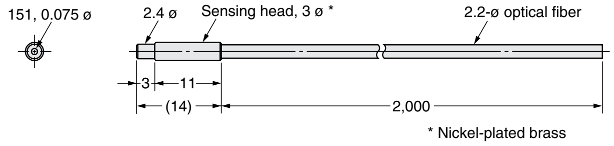
E32-ET21R



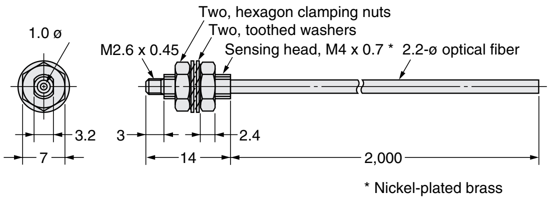
E32-T11U



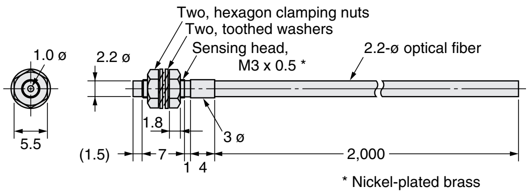
E32-T12R



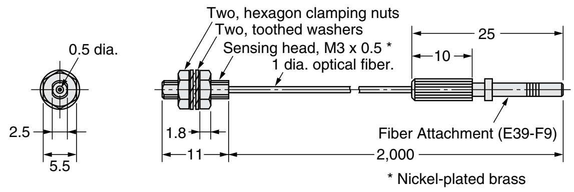
E32-TC200



E32-TC200A

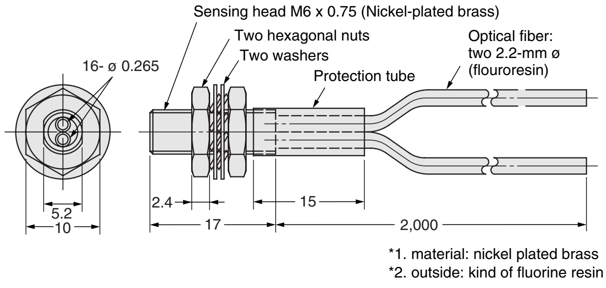


E32-TC200E

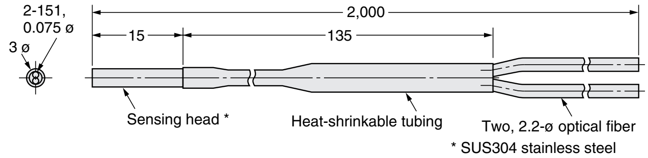


Diffuse reflective

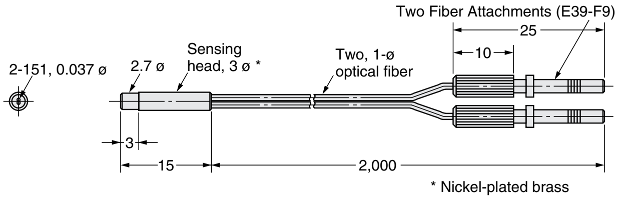
E32-D11U



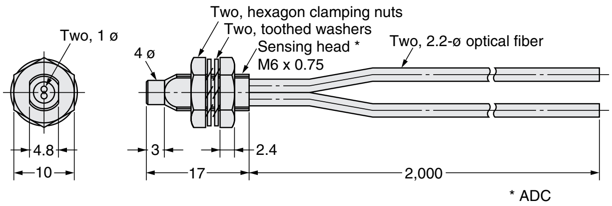
E32-D12R



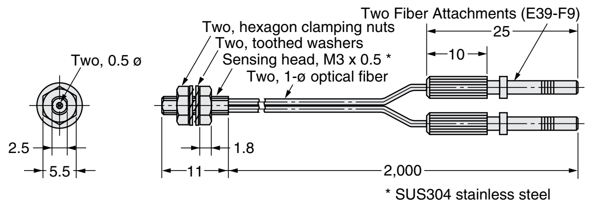
E32-D22R



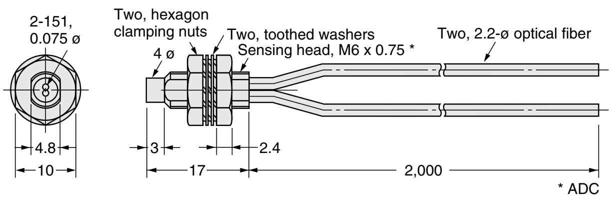
E32-DC200



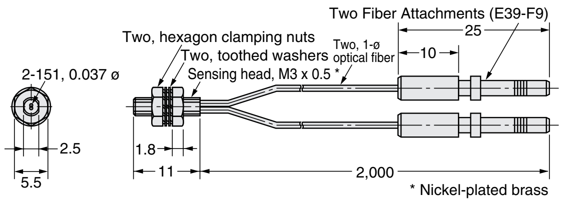
E32-DC200E



E32-ED11R



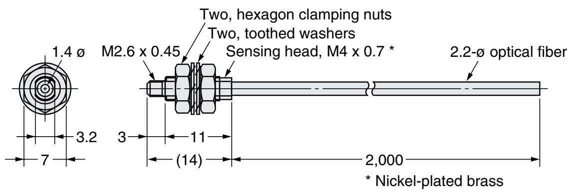
E32-ED21R



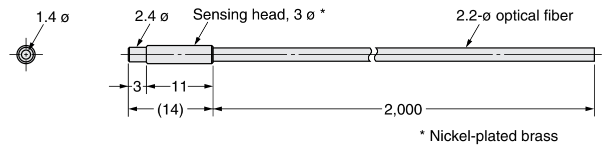
Long Distance

Throughbeam

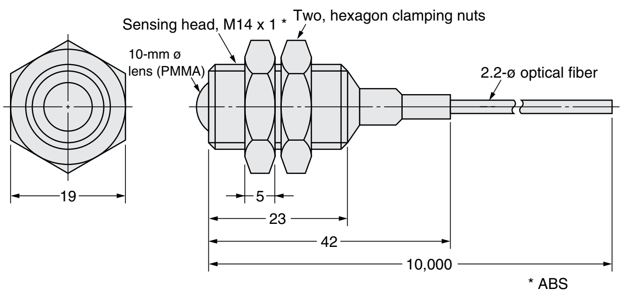
E32-T11L



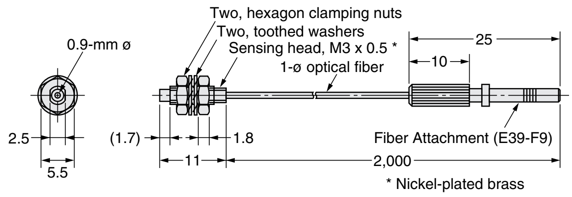
E32-T12L



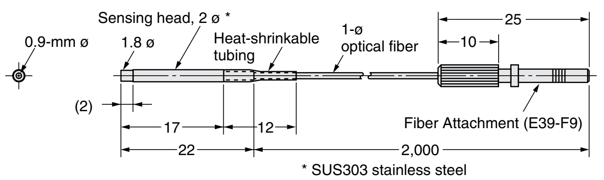
E32-T17L



E32-T21L

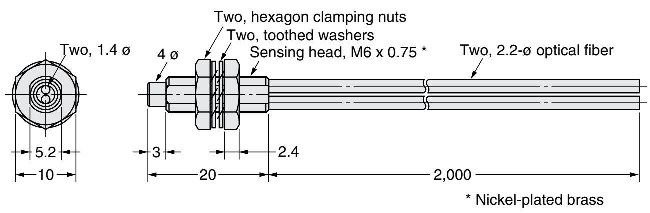


E32-T22L

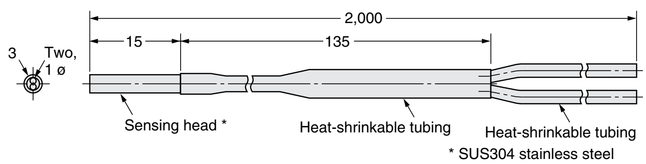


Diffuse reflective

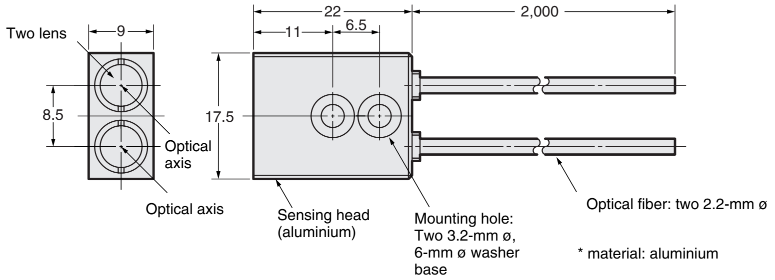
E32-D11L



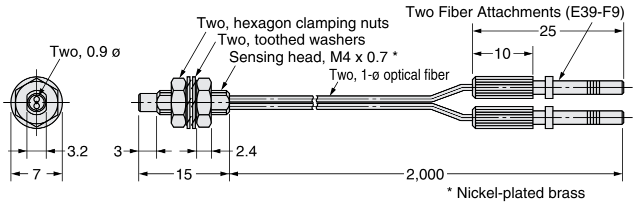
E32-D12



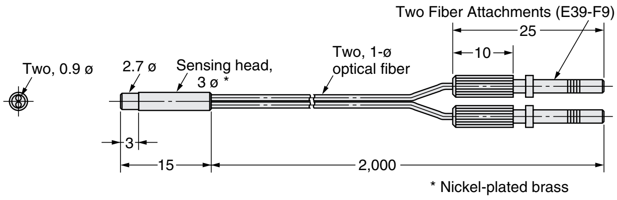
E32-D16



E32-D21L



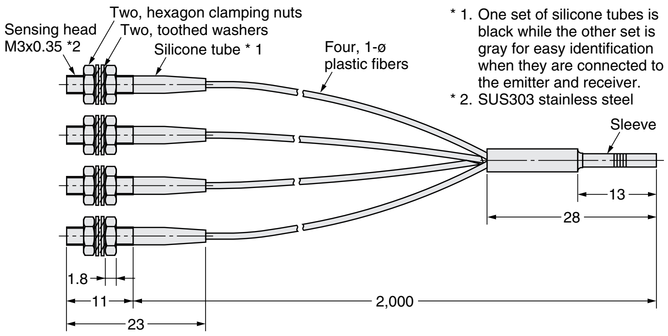
E32-D22L



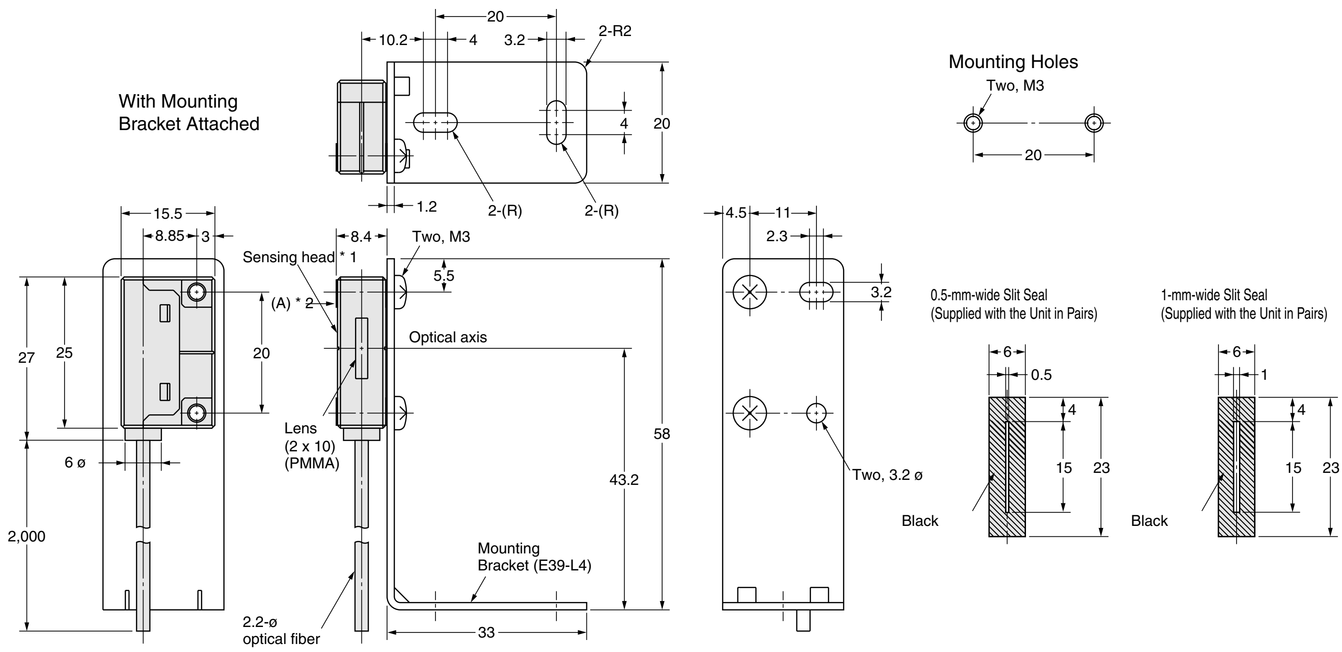
Area sensing

Throughbeam

E32-M21

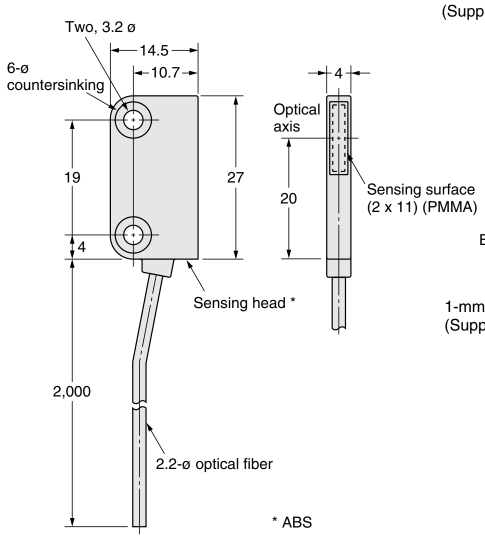


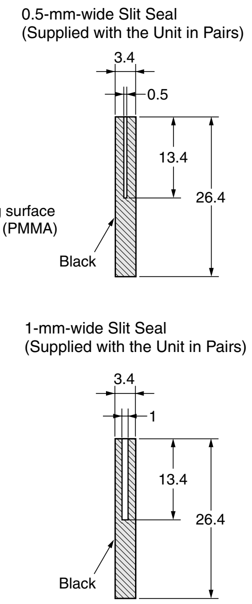
E32-T16

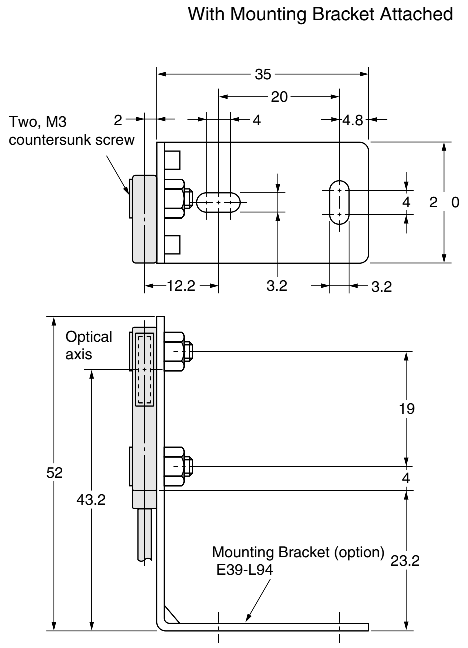


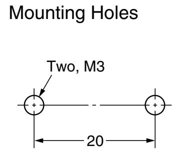
* 1. ABS
* 2. The Mounting Bracket can also be used on side A.

E32_T16P
E32_T16PR

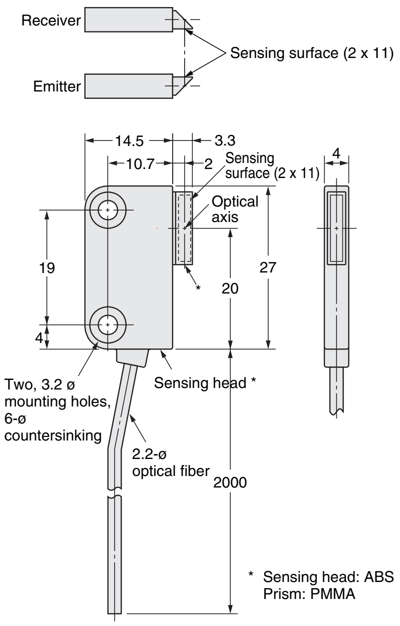




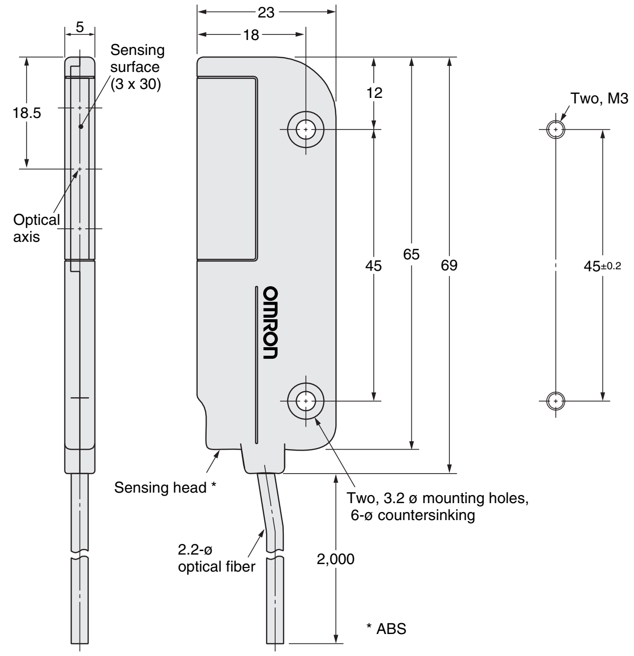




E32-T16
E32-T16JR

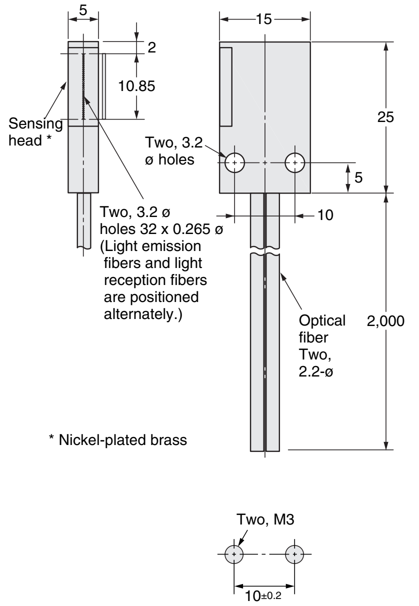


E32-T16W
E32-T16WR



Diffuse reflective

E32-D36P1

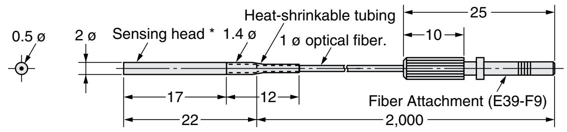


* Nickel-plated brass

Small fiber head

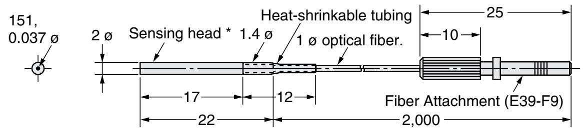
Throughbeam

E32-T22



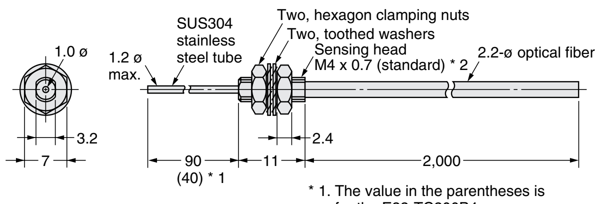
* SUS303 stainless steel

E32-T22R



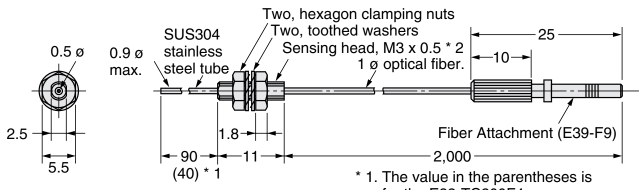
* SUS303 stainless steel

E32-TC200B
E32-TC200B4



* 1. The value in the parentheses is for the E32-TC200B4
* 2. Nickel-plated brass

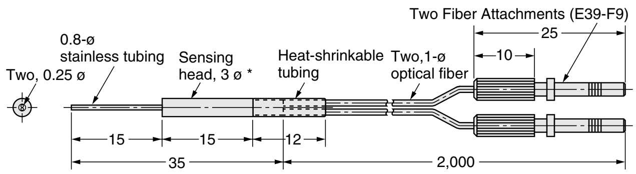
E32-TC200F
E32-TC200F4



* 1. The value in the parentheses is for the E32-TC200F4
* 2. Nickel-plated brass

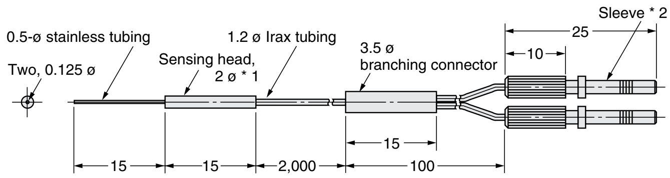
Diffuse reflective

E32-D33



* SUS303 stainless steel

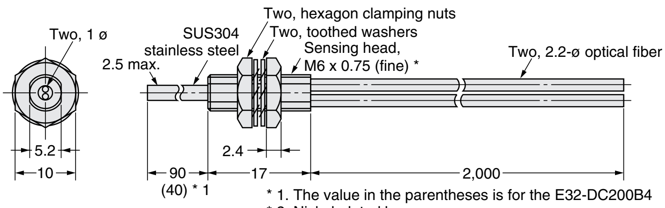
E32-D331



* 1. SUS303 stainless steel
* 2. Not removable

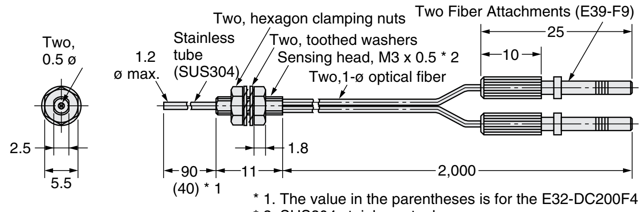
E32

E32-DC200B
E32-DC200B4



* 1. The value in the parentheses is for the E32-DC200B4
* 2. Nickel-plated brass

E32-DC200F
E32-DC200F4

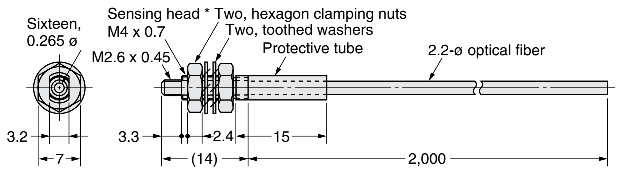


* 1. The value in the parentheses is for the E32-DC200F4
* 2. SUS304 stainless steel

Fiber for Robot Application R4

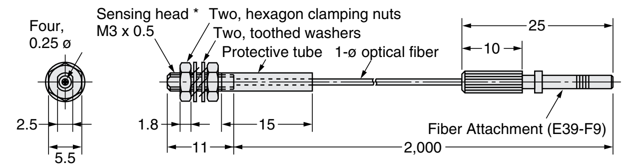
Throughbeam

E32-T11



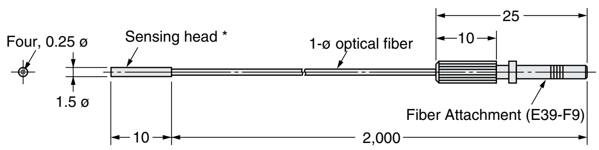
* Nickel-plated brass

E32-T21



* Nickel-plated brass

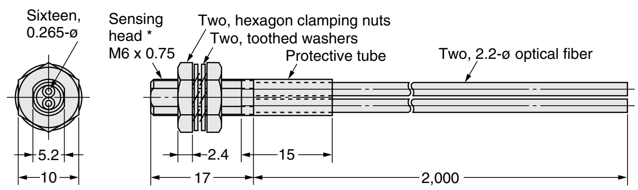
E32-T22B



* Nickel-plated brass

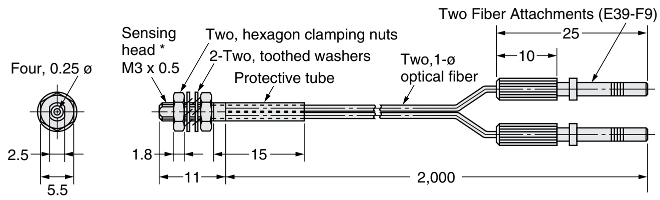
Diffuse reflective

E32-D11



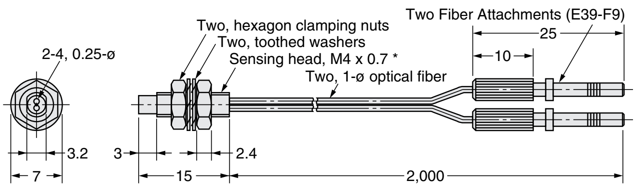
* Nickel-plated brass

E32-D21



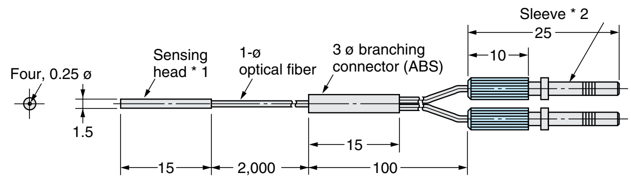
* Nickel-plated brass

E32-D21B



* SUS303 stainless steel

E32-D22B

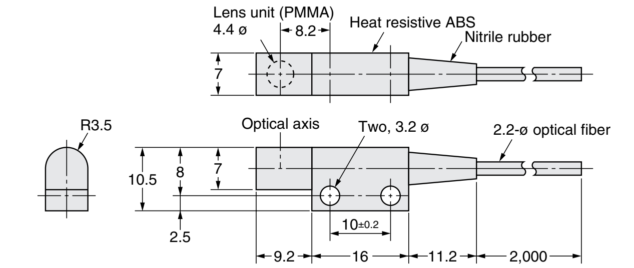


* 1. SUS304 stainless steel
* 2. Not removable

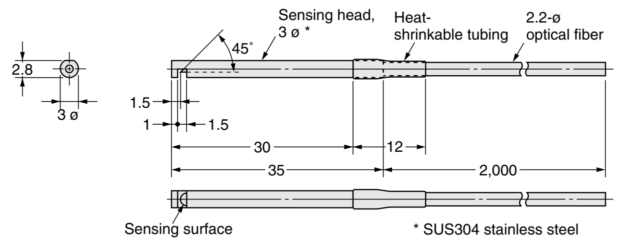
Side view

Throughbeam

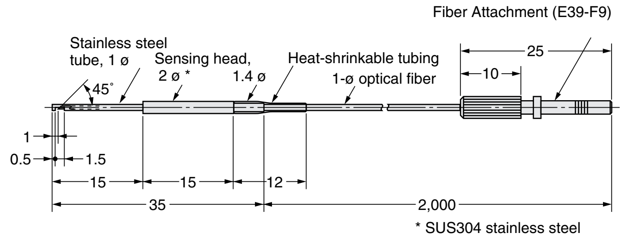
E32-T14



E32-T14L
E32-T14LR

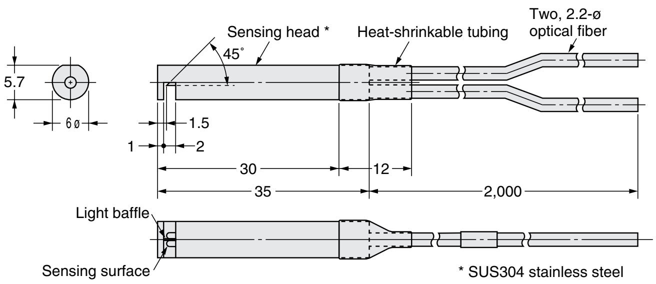


E32-T24
E32-T24R

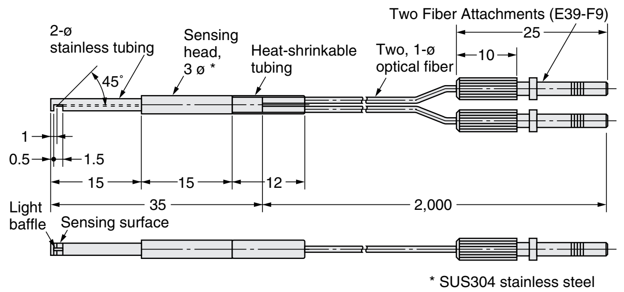


Diffuse reflective

E32-D14L
E32-D14LR



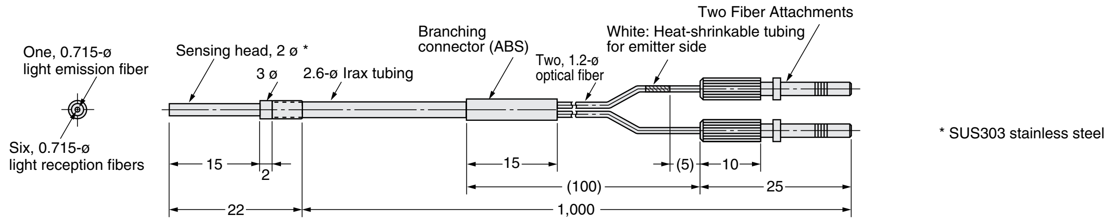
E32-D24
E32-D24R



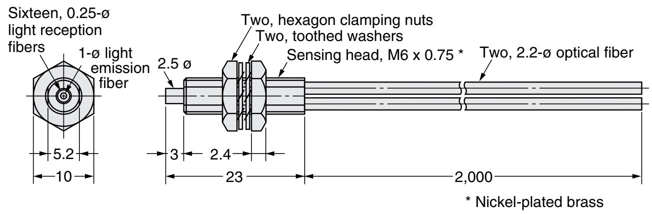
Coaxial fiber

Diffuse reflective

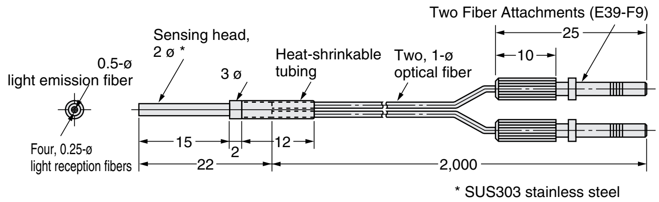
E32-C42



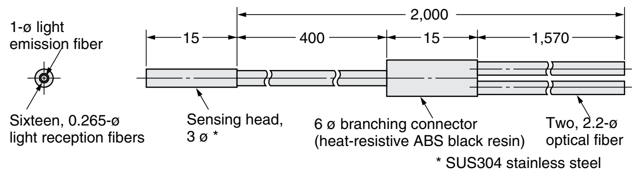
E32-CC200



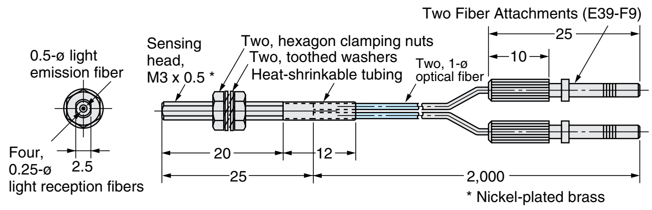
E32-D32



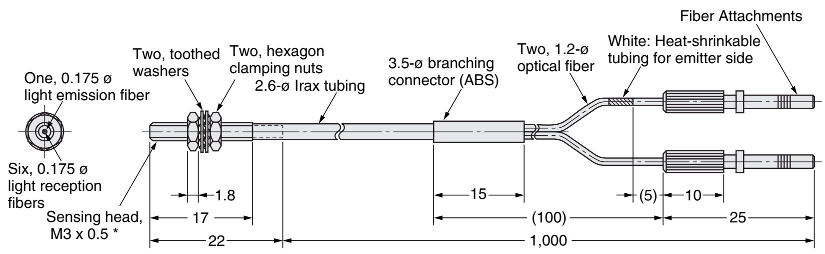
E32-D32L



E32-EC31



E32-EC41

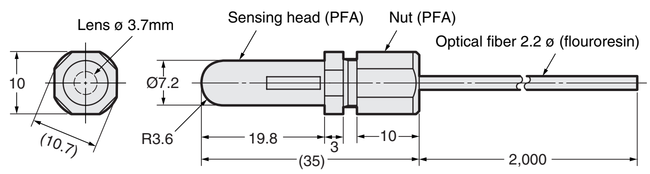


* SUS303 stainless steel

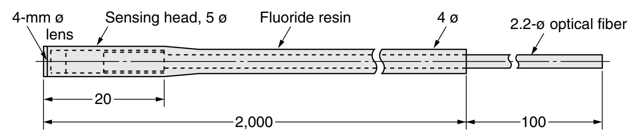
Chemical resistant

Throughbeam

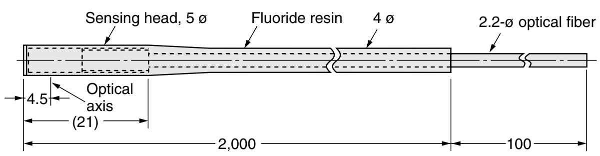
E32-T11F



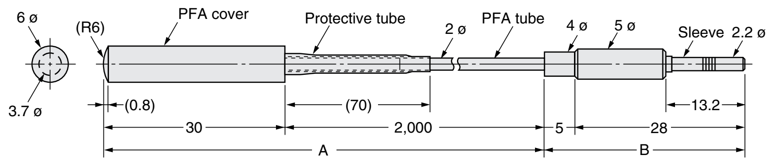
E32-T12F



E32-T14F

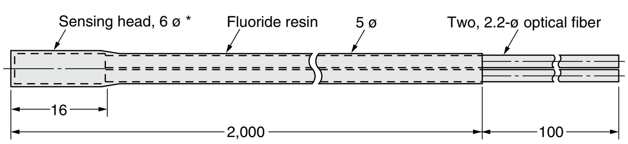


E32-T81F-S



Diffuse reflective

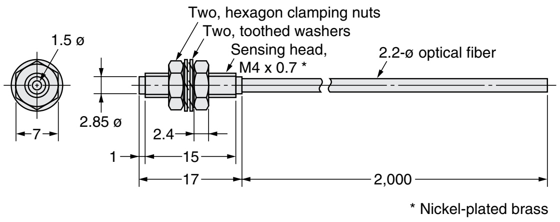
E32-D12F



Heat resistant

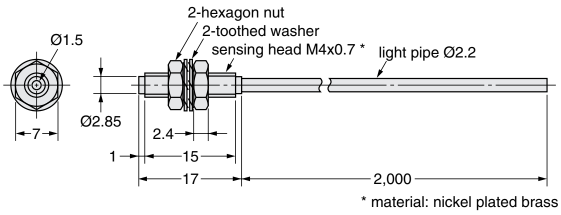
Throughbeam

E32-ET51



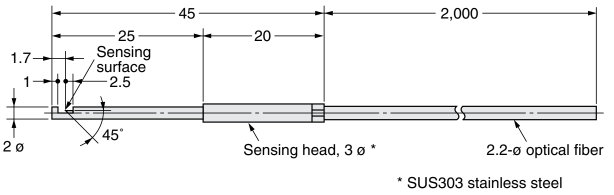
* Nickel-plated brass

E32-T51



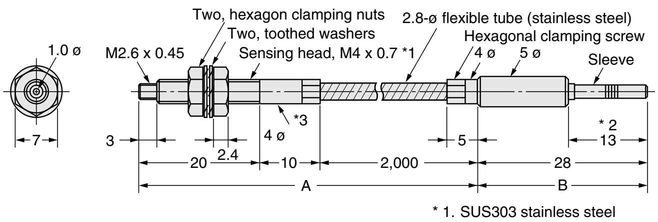
* material: nickel plated brass

E32-T54



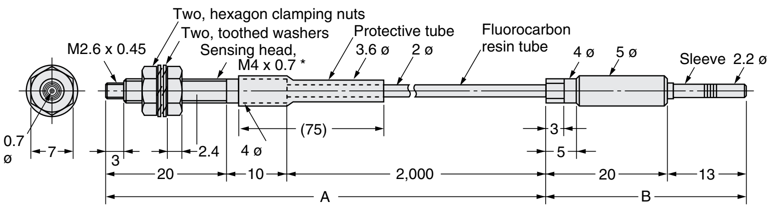
* SUS303 stainless steel

E32-T61-S



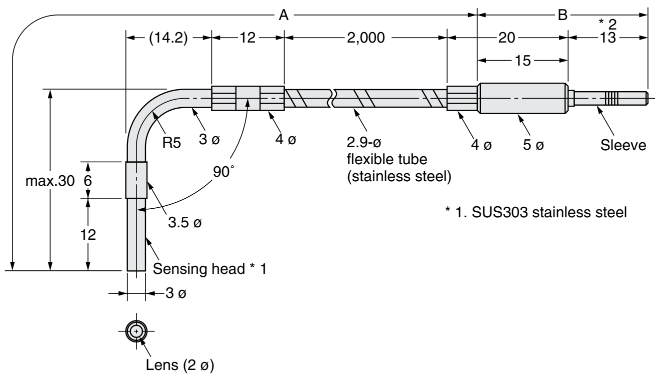
* 1. SUS303 stainless steel
* 3. Fiber length 10 m and more

E32-T81R-S



* SUS303 stainless steel

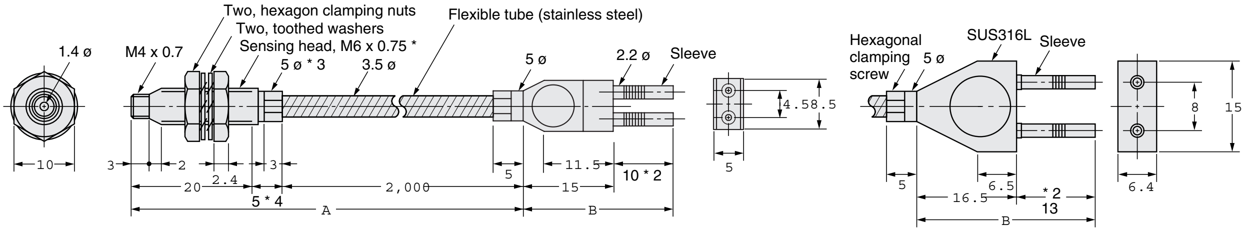
E32-T84S-S



* 1. SUS303 stainless steel

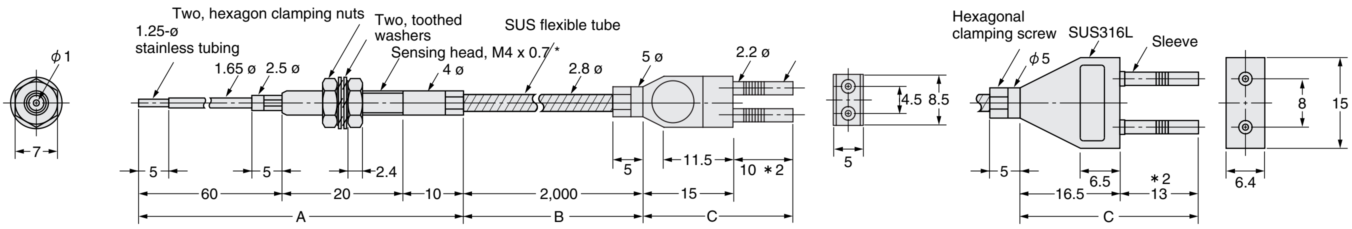
Diffuse reflective

E32-D61
E32-D61-S



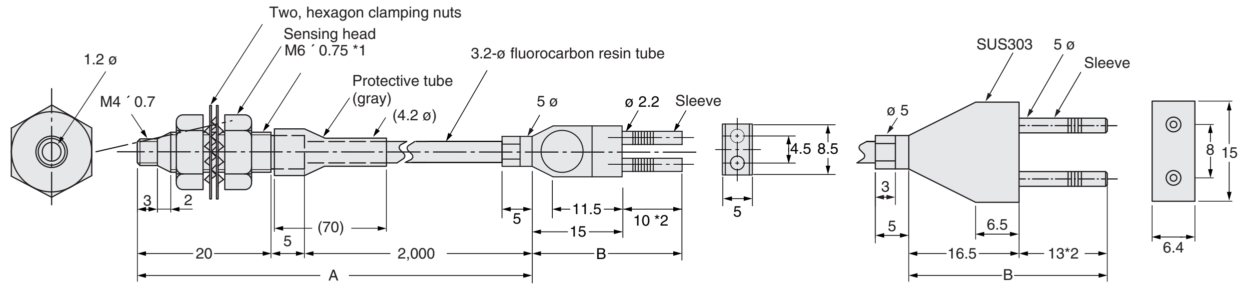
* 1. SUS303 stainless steel
* 3. Fiber length 10 m and more becomes 6-diameter.
* 4. Fiber length 10 m and more becomes 10-diameter.

E32-D73
E32-D73-S



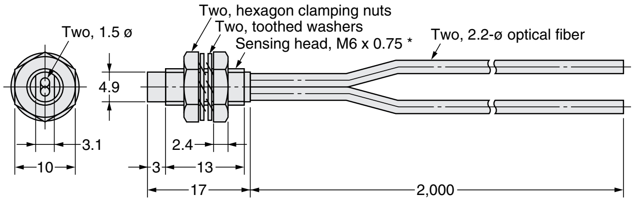
* 1. SUS303 stainless steel

E32-D81R
E32-D81R-S



* 1. SUS303 stainless steel

E32-ED51

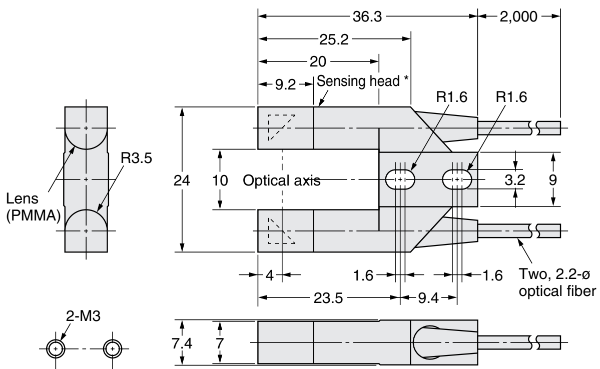


* Nickel-plated brass

Grooved

Throughbeam

E32-G14

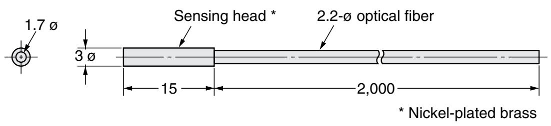


* ABS

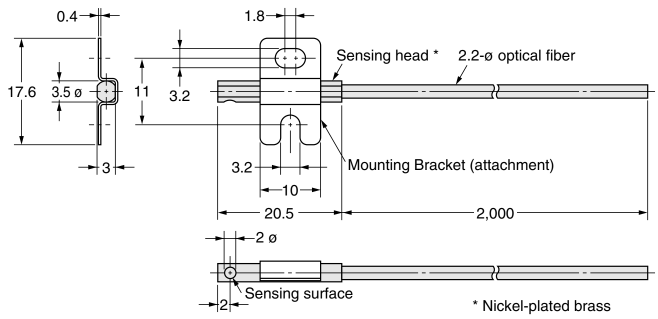
Narrow Vision Field

Throughbeam

E32-T22S



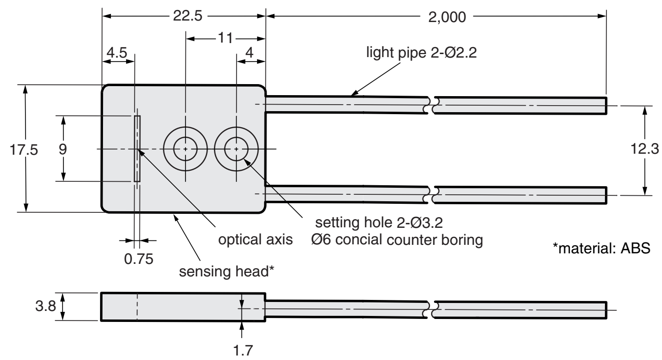
E32-T24S



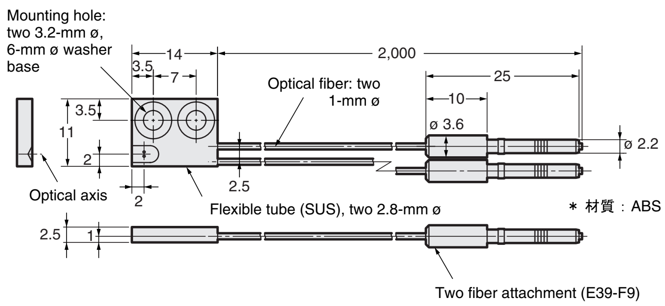
Limited-reflective

Diffuse reflective

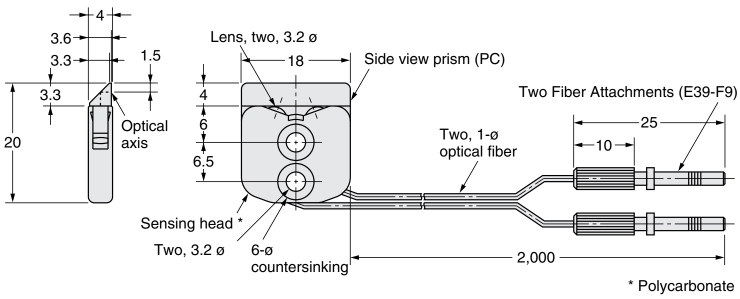
E32-L16



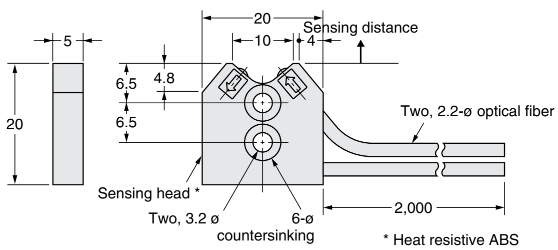
E32-L24S



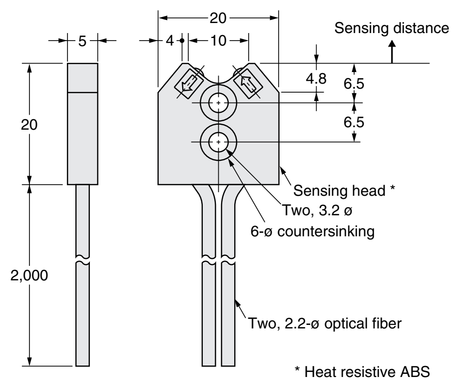
E32-L24L



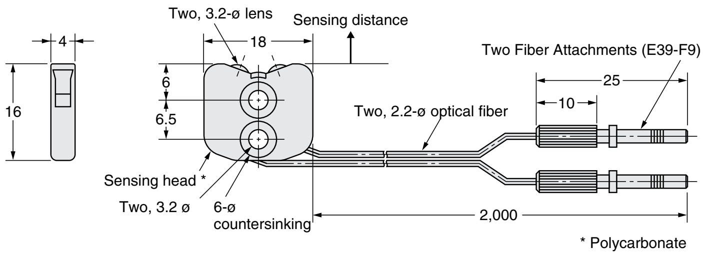
E32-L25



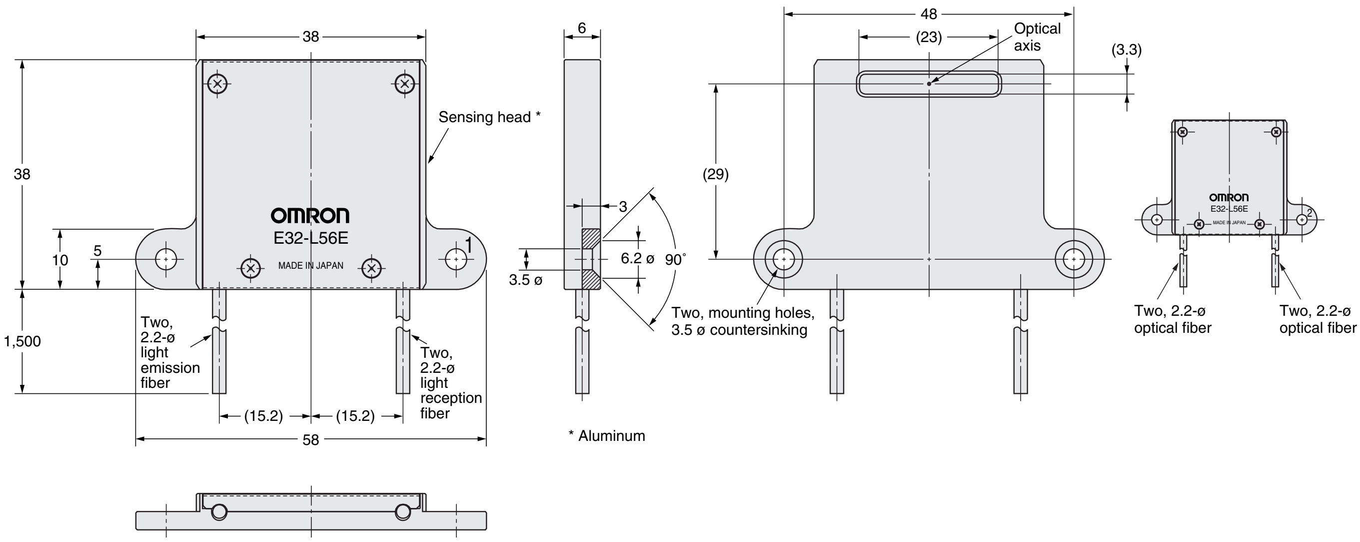
E32-L25A



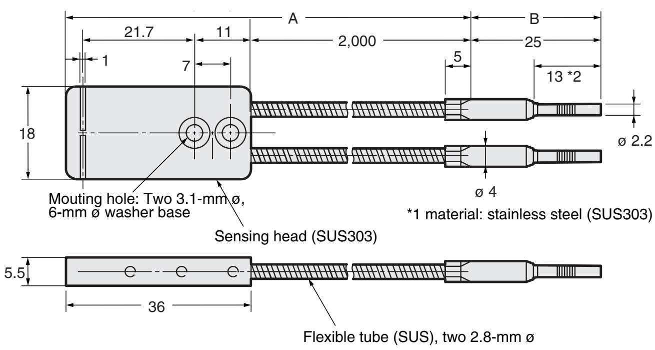
E32-L25L



E32-L56E1
E32-L56E2



E32-L66

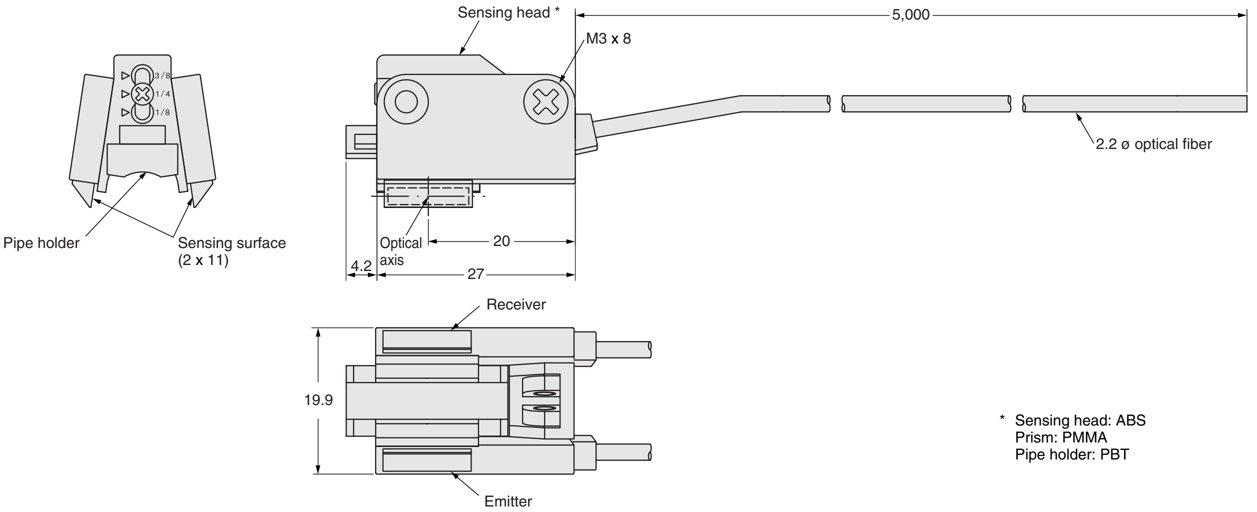


Note: Ambient temperature of A part is 300 degree C and of B part is 110 degree C.
When the part indicated by *2 is inserted into amplifier, ambient temperature of *2
part is the same as that of amplifier unit.

Fluid-level Detection Fiber Units

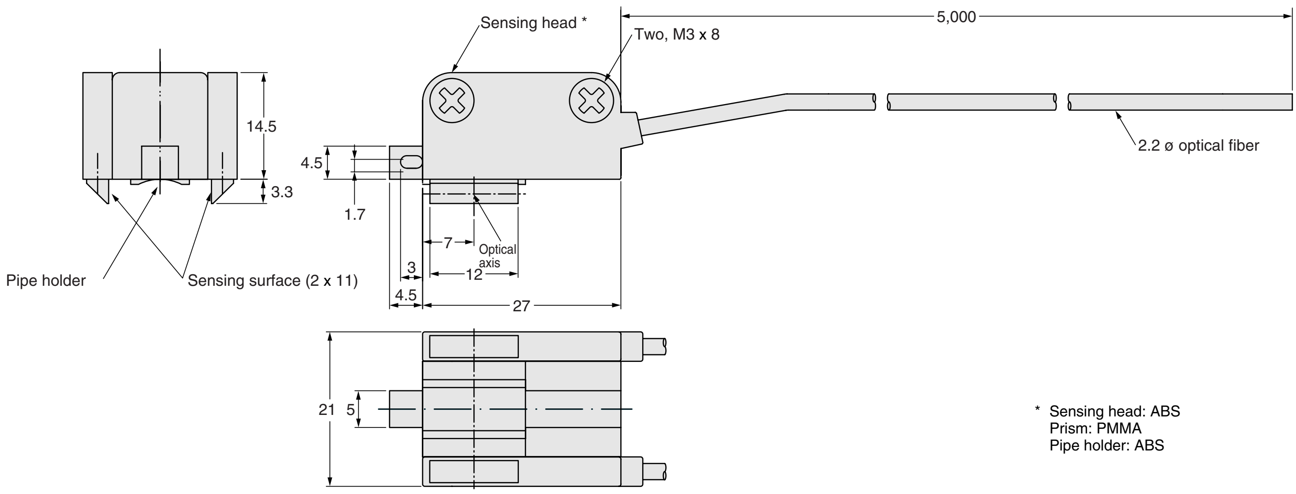
Diffuse reflective

E32-A01



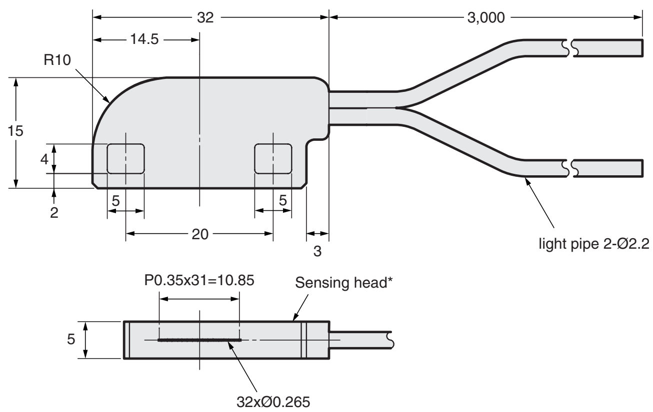
* Sensing head: ABS
Prism: PMMA
Pipe holder: PBT

E32-A02



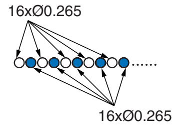
* Sensing head: ABS
Prism: PMMA
Pipe holder: ABS

E32-D36F

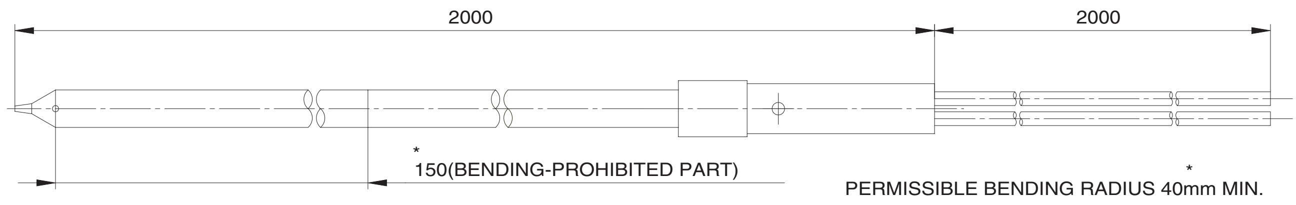


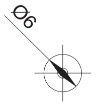
*material: polypropylene

Larger scaled cut-out of sensing



E32-D82F1
E32-D82F2

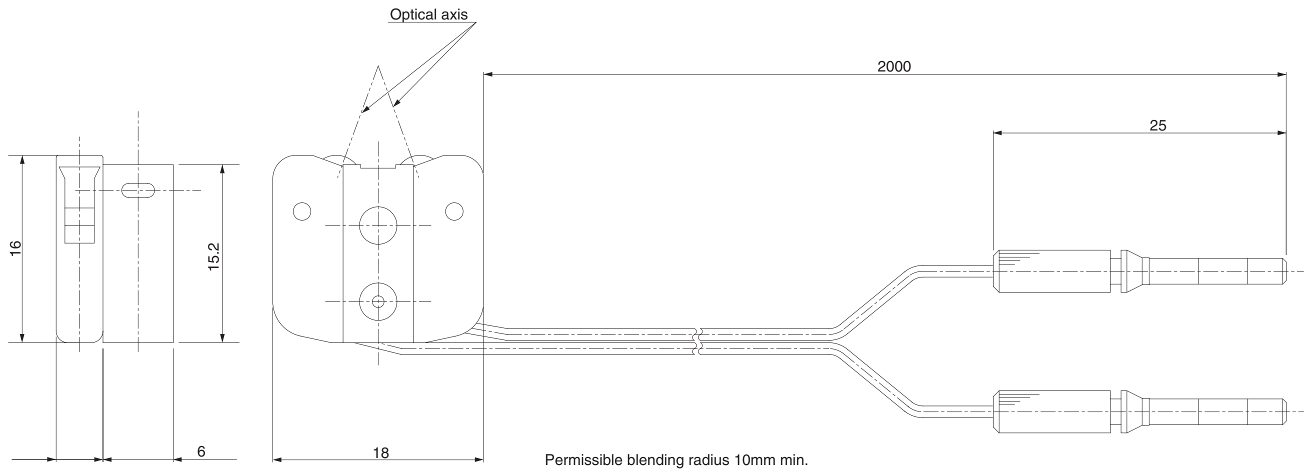




* E32-D82F1 : WITHIN 150mm OF FIBER TIP.
E32-D82F2 : WITHIN 350mm OF FIBER TIP.

* PLASTIC FIBER : 25mm MIN.

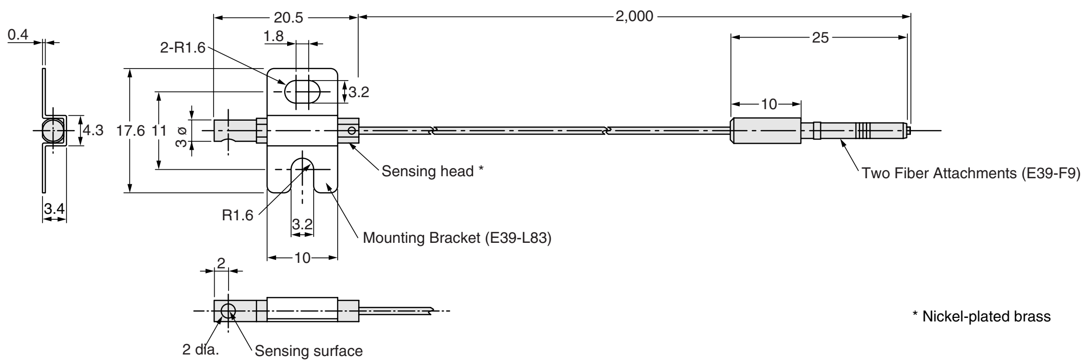
E32-L25T



Mapping sensors

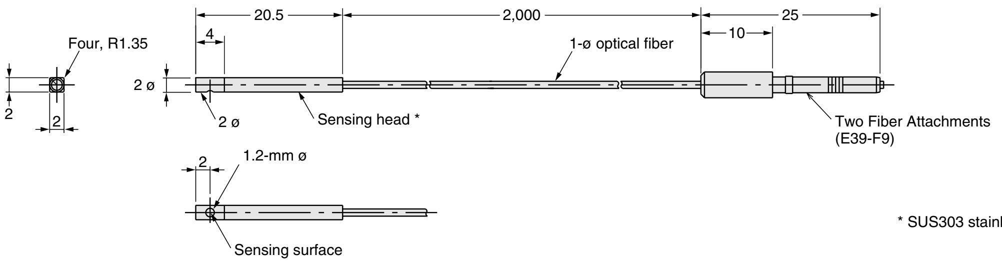
Diffuse reflective

E32-A03



* Nickel-plated brass

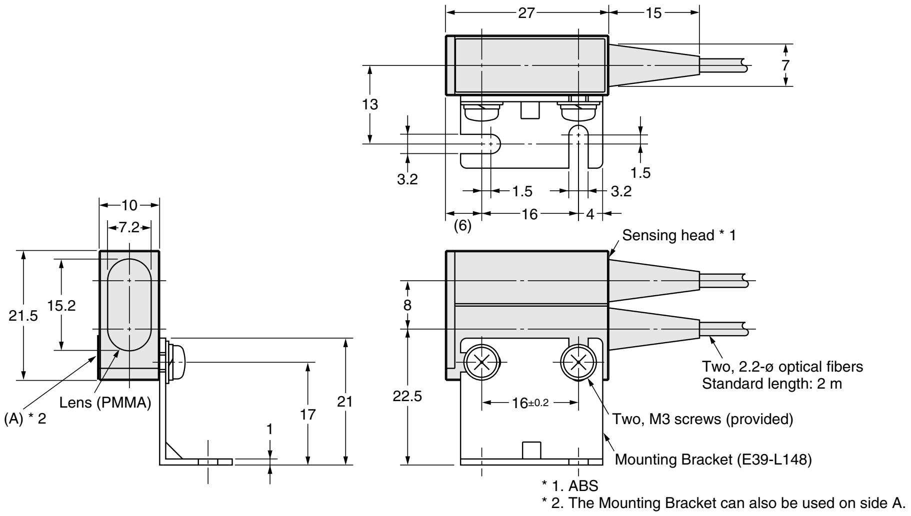
E32-A04



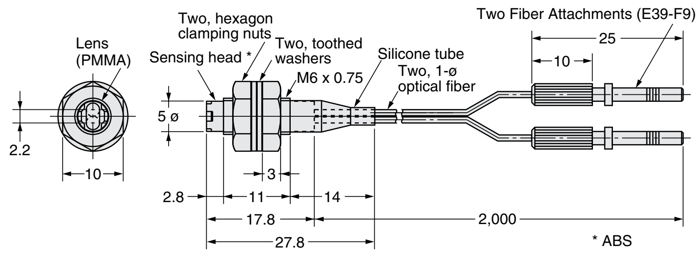
* SUS303 stainless steel

Retroreflective

E32-R16



E32-R21



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E21E-EN-01

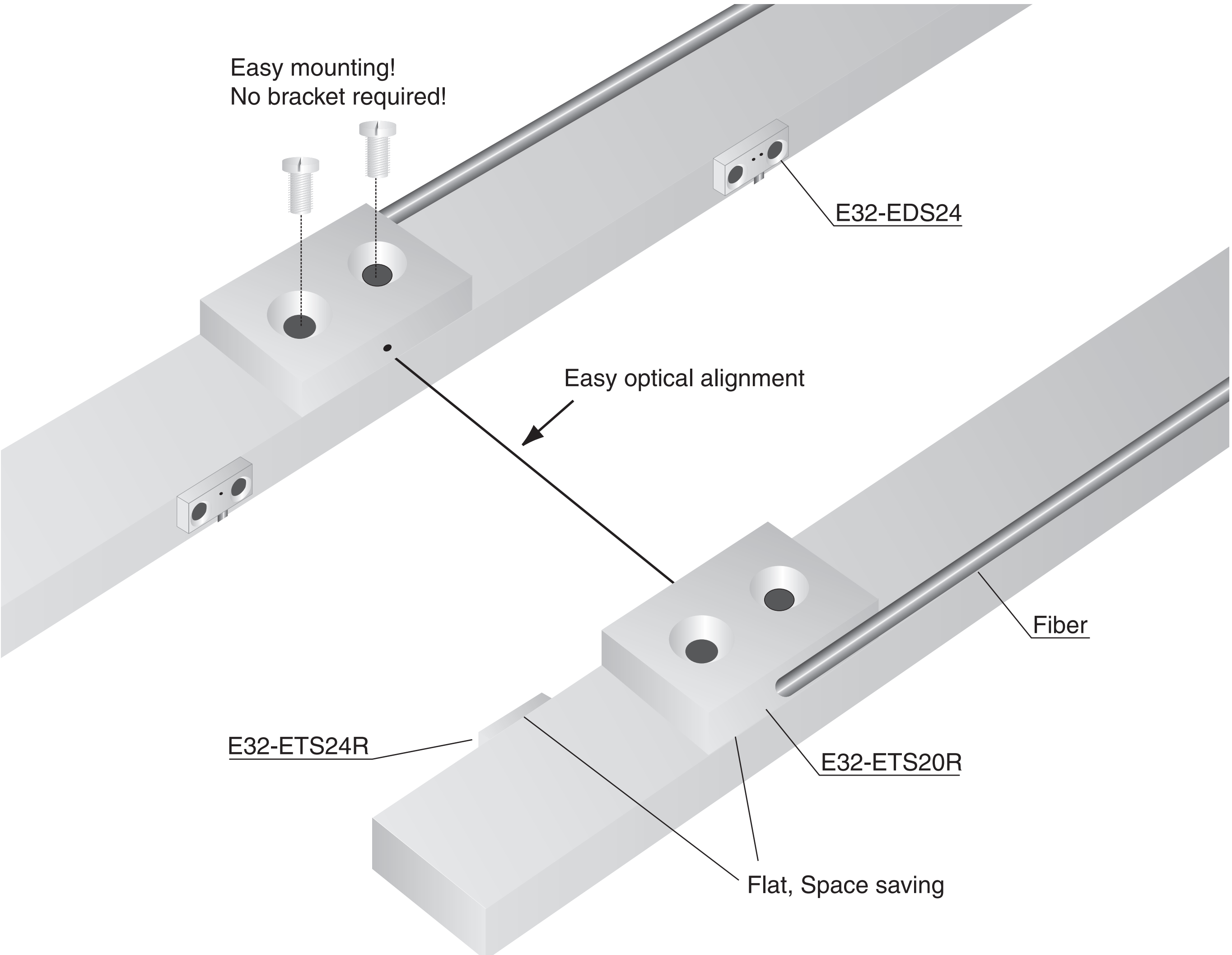
Fiber Unit

E32-ETS / EDS Series

Flat square shape for easy mounting

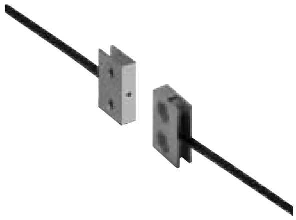
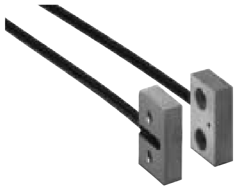
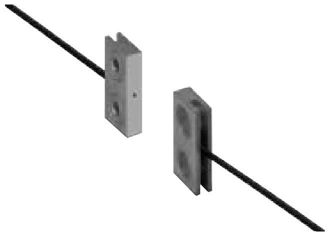
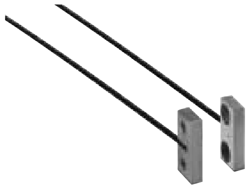
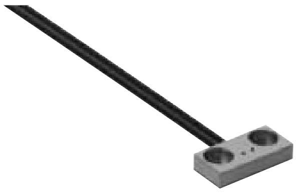
- Flat and space saving shape fits in narrow spaces
- Easy mounting and optical axis alignment
- No mounting bracket necessary, just fixing it with two screws
- Flexible fibers with 1 mm bending radius
- Strong Aluminium housing for rough ambient conditions

Application



Ordering Information

Sensors

Sensor Type	Product Code	Shape
Through Beam	E32-ETS10R 2M	
Through Beam, Side View	E32-ETS14R 2M	
Through Beam	E32-ETS20R 2M	
Through Beam, Side View	E32-ETS24R 2M	
Diffuse Reflection, Side View	E32-EDS24R 2M	

Amplifier Overview

Digital Amplifier

Amplifier Units

Amplifier Units with Cables

Item		Appearance	Functions	Model	
				NPN output	PNP output
Standard models			---	E3X-DA11-S	E3X-DA41-S
Mark-detecting models	Green LED		---	E3X-DAG11-S	E3X-DAG41-S
	Blue LED		---	E3X-DAB11-S	E3X-DAB41-S
Advanced models	Twin-output models		Area output, self-diagnosis, differential operation	E3X-DA11TW-S	E3X-DA41TW-S
	External-input models		Remote setting, counter, differential operation	E3X-DA11RM-S	E3X-DA41RM-S

Amplifier Units with Connectors

Item		Appearance	Functions	Model	
				NPN output	PNP output
Standard models			---	E3X-DA6-S	E3X-DA8-S
Mark-detecting models	Green LED		---	E3X-DAG6-S	E3X-DAG8-S
	Blue LED		---	E3X-DAB6-S	E3X-DAB8-S
Advanced models	Twin-output models		Area output, self-diagnosis, differential operation	E3X-DA6TW-S	E3X-DA8TW-S
	External-input models		Remote setting, counter, differential operation	E3X-DA6RM-S	E3X-DA8RM-S

Dual Channel Amplifier

Amplifier Units

Amplifier Units with Cables

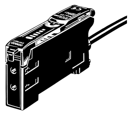
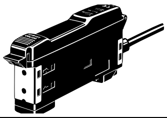
Item	Appearance	Functions	Model	
			NPN output	PNP output
2-channel models		AND/OR output	E3X-MDA11	E3X-MDA41

Amplifier Units with Connectors

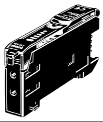
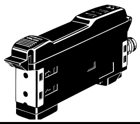
Item	Appearance	Functions	Model	
			NPN output	PNP output
2-channel models		AND/OR output	E3X-MDA6	E3X-MDA8

Manual Amplifier

Amplifier Units with Cables

Item	Shape	Control output	Model	
			NPN output	PNP output
Standard models		ON/OFF output	E3X-NA11	E3X-NA41
High-speed detection			E3X-NA11F	E3X-NA41F
Mark-detecting models			E3X-NAG11	E3X-NAG41
Water-resistant models			E3X-NA11V	E3X-NA41V

Anplifier Units with Connectors

Item	Shape	Applicable Connector (order separately)		Control output	Model	
					NPN output	PNP output
Standard models		Master	E3X-CN11	ON/OFF output	E3X-NA6	E3X-NA8
		Slave	E3X-CN12			
Water-resistant models (M8 Connector)		XS3F-M421-40□-A XS3F-M422-40□-A			E3X-NA14V	E3X-NA44V

Performance

Sensing Distance

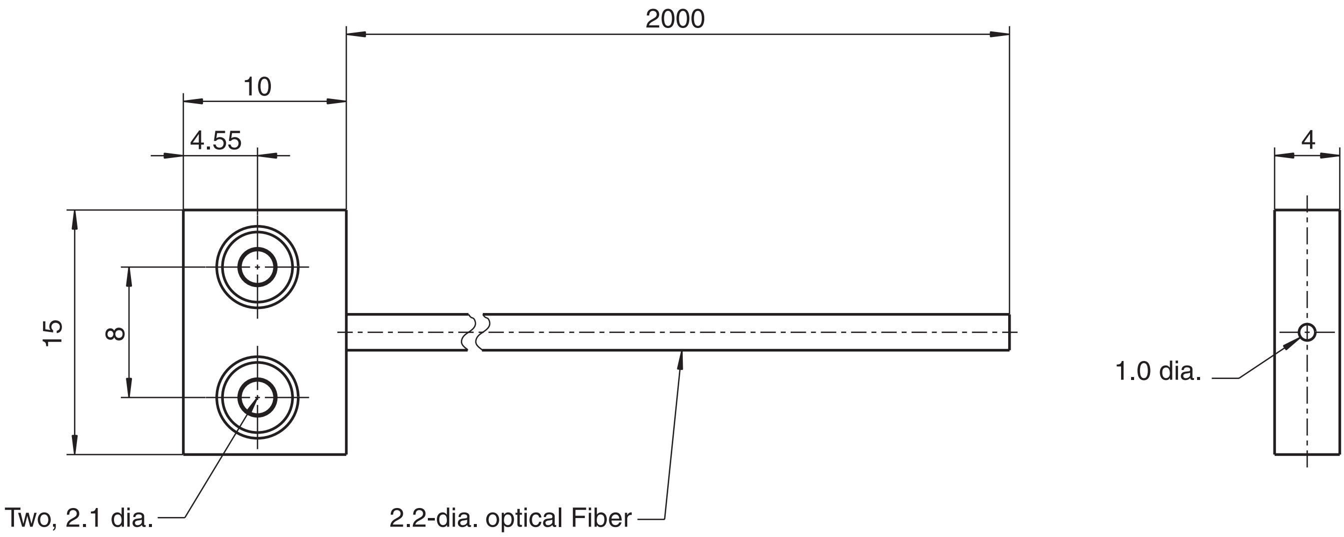
Amplifier	Mode	E32-ETS10R 2m	E32-ETS14R 2M	E32-ETS20R 2M	E32-ETS24R 2M	E32-EDS24R 2M
E3X-DA-N	Super long distance mode	700 mm	580 mm	150 mm	130 mm	45 mm
	Standard mode	560 mm	460 mm	120 mm	110 mm	35 mm
	Super high speed mode	200 mm	170 mm	40 mm	40 mm	10 mm
E3X-MDA	Super long distance mode	480 mm	430 mm	160 mm	160 mm	70 mm
	Standard mode	370 mm	330 mm	120 mm	120 mm	50 mm
	Super high speed mode	140 mm	130 mm	50 mm	50 mm	20 mm
E3X-DA-S	Super long distance mode	720 mm	630 mm	250 mm	240 mm	100 mm
	Standard mode	560 mm	480 mm	190 mm	180 mm	60 mm
	Super high speed mode	140 mm	125 mm	50 mm	45 mm	20 mm
E3X-NA41	Standard mode	420 mm	280 mm	100 mm	50 mm	17 mm
E3X-NAG41	Standard mode	100 mm	80 mm	25 mm	10 mm	2 mm
E3X-NA41F	Standard mode	140 mm	100 mm	30 mm	15 mm	4 mm

Specifications

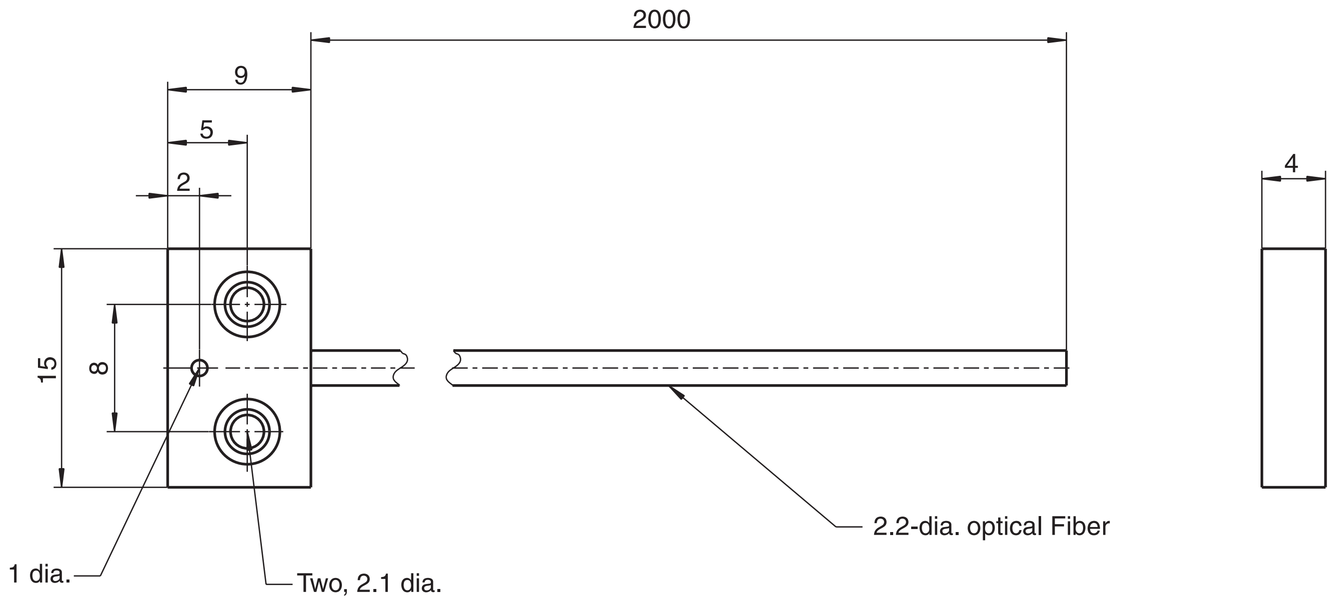
Item / Model / Type / Application (Operation / Storage)	Aluminium Square Shape				
	Through beam types				Reflective type
	E32-ETS10R	E32-ETS14R	E32-ETS20R	E32-ETS24R	E32-EDS24R
Ambient temperature	- 40°C to 70°C with no icing or condensation				
Ambient humidity	Operating: 35% to 95% RH, Storage: 35% to 95% with no icing or condensation				
Permission bending radius	1 mm				
Fiber sheat material	Black Polyehylene (PE)				
Fiber core	Acrylic resin (PMMA)				
Fiber diameter	2.2 mm	2.2 mm	1 mm	1 mm	1 mm
Protective structure	IEC 60529 IP 67				
Material sensorhead	Aluminium (AL)				

Dimensions

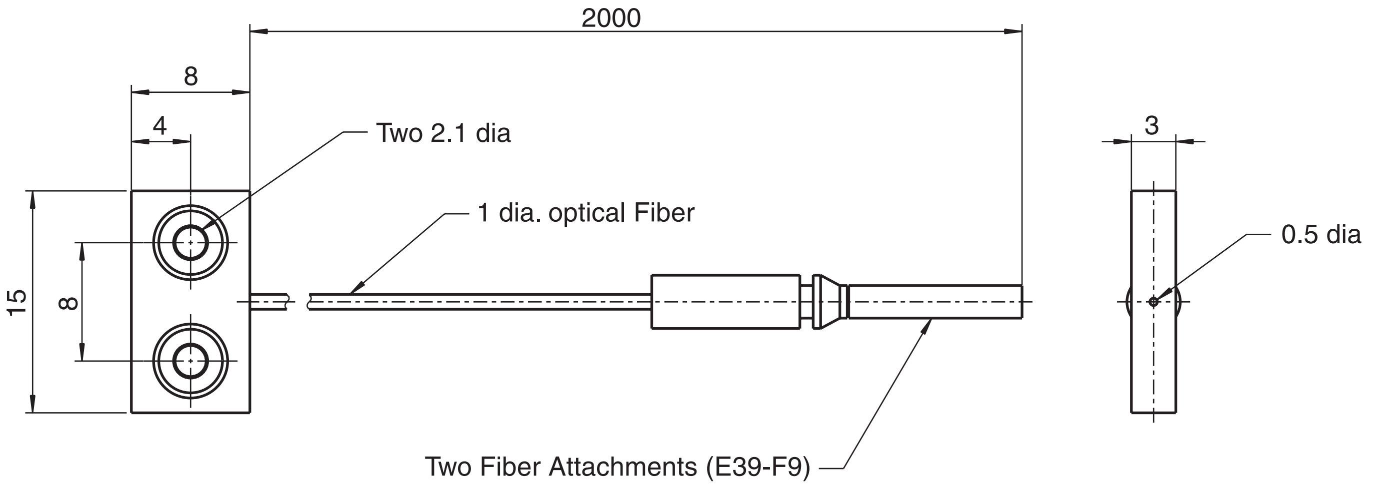
E32-ETS10R



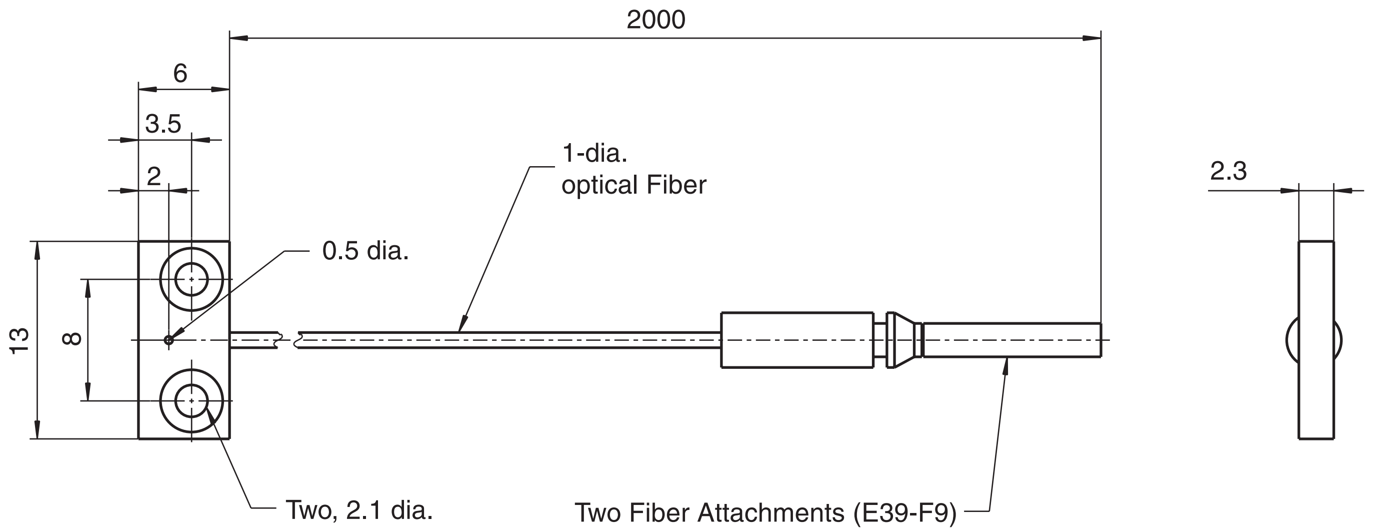
E32-ETS14R



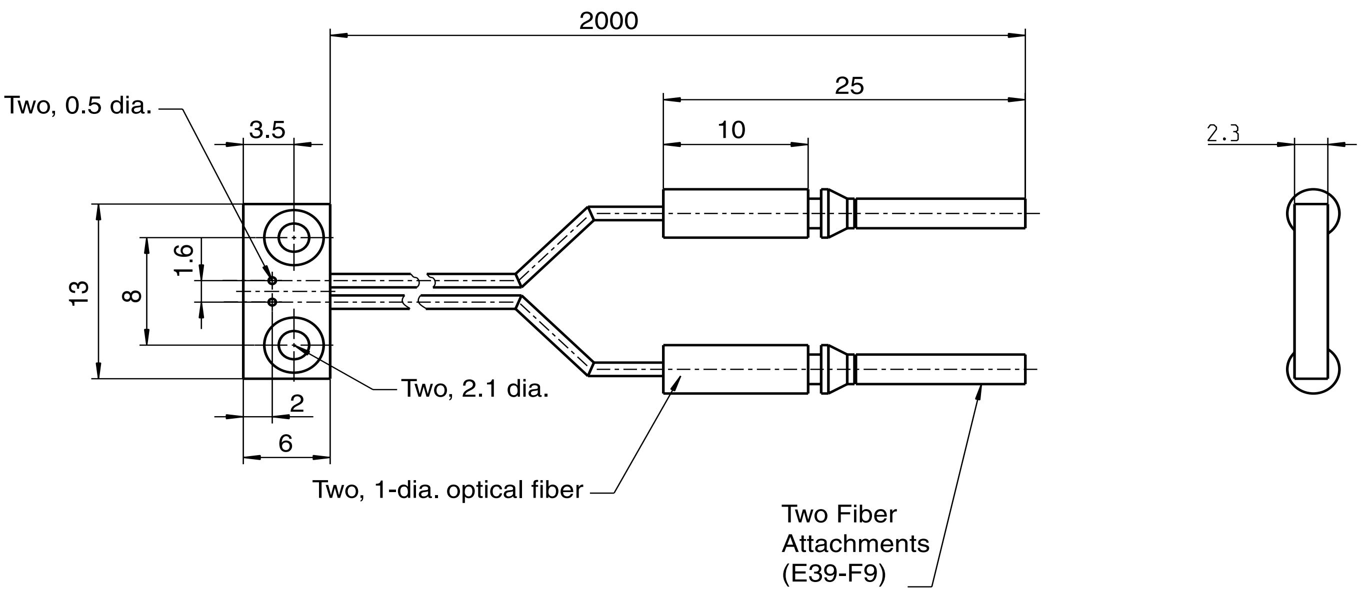
E32-ETS20R



E32-ETS24R



E32-EDS24R



Precautions

Fiber Units

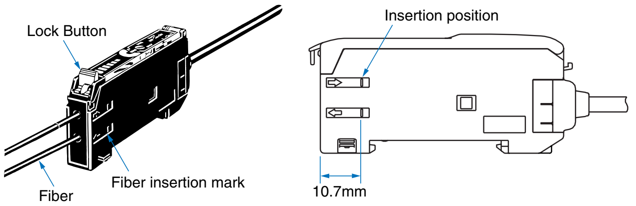
Installation

Fiber Connection and Disconnection

The E3X Amplifier Unit has a lock button. Connect or disconnect the fibers to or from the E3X Amplifier Unit using the following procedures:

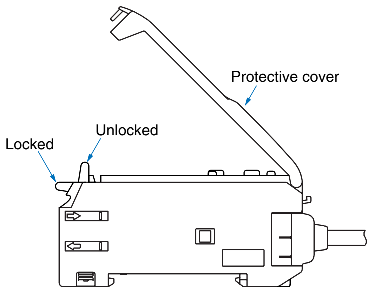
1. Connection

Open the protective cover, insert the fibers according to the fiber insertion marks on the side of the Amplifier Unit, and lower the lock button.



2. Disconnection

Remove the protective cover and raise the lock button to pull out the fiber.



Note:To maintain the fiber properties, confirm that the lock is released before removing the fiber.

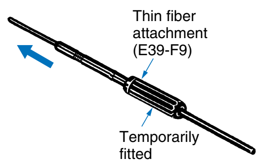
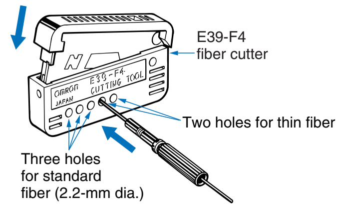
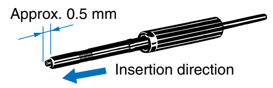
3. Precautions for Fiber Connection/Disconnection

Be sure to lock or unlock the lock button within an ambient temperature range between -10°C and 40°C.

Cutting Fiber

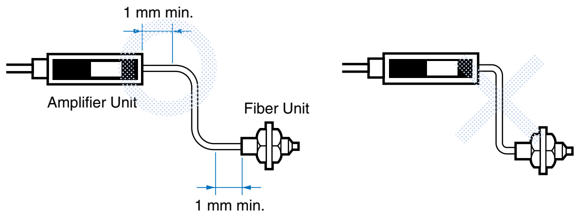
- Insert a fiber into the Fiber Cutter and determine the length of the fiber to be cut.
- Press down the Fiber Cutter in a single stroke to cut the fiber.
- The cutting holes cannot be used twice. If the same hole is used twice, the cutting face of the fiber will be rough and the sensing distance will be reduced. Always use an unused hole.

- Cut a thin fiber as follows:

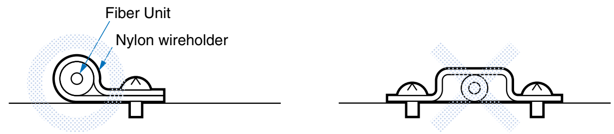
①	An attachment is temporarily fitted to a thin fiber before shipment.	
②	Secure the attachment after adjusting the position of it in the direction indicated by the arrow.	
③	Insert the fiber to be cut into the E39-F4.	
④	Finished state (proper cutting state)	 Note: Insert the fiber in the direction indicated by the arrow.

Connection

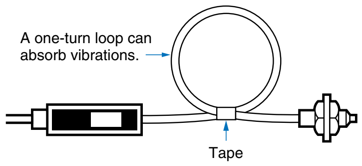
- Do not strain the fiber unit, e.g. do not apply tensile or compression force. (Within 0.98 Nm to 18 Nm) Use special care since the fiber is thin.
- The bending radius of the fiber unit should exceed the admissible bending radius given in "Type/standard price" and "Ratings/performance".
- Do not bend the edge of the fiber units (excluding the E32-T□R and E32-D□R).



- Do not apply excess force on the fiber units.

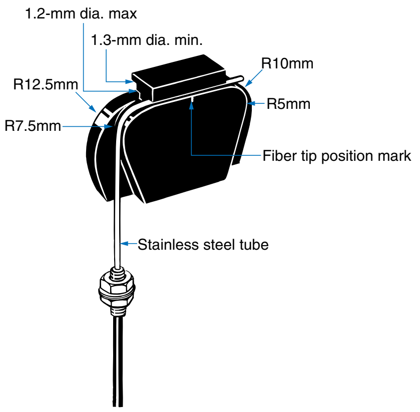


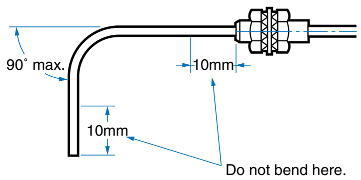
- The fiber head could be break from excessive vibration. To prevent this, the following is applied:



E39-F11 Sleeve Bender

- The bending radius of the stainless steel tube should be as large as possible. The smaller the bending radius becomes, the shorter the sensing distance will be.
- Insert the tip of the stainless steel tube to the sleeve bender and bend the stainless steel tube slowly along the curve of the sleeve bender (refer to the figure).





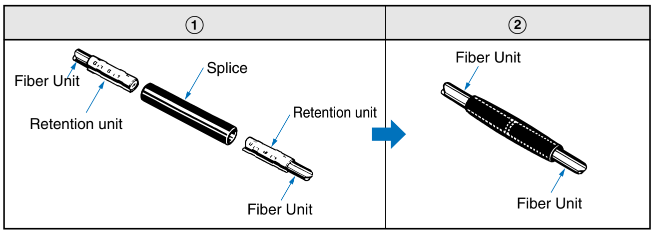
Accessories

Use of E39-R3 Reflector

1. When using an adhesive tape on the rear face, apply it after washing off oil, dust, etc. with detergent from the place of application. The reflector cannot be installed if there remains oil, etc.
2. The E39-R3 cannot be used in places where it is exposed to oil or chemicals.

E39-F10 Fiber Connector

Fit the connector in the following procedure.



- The fiber units should be as close as possible when they are connected. Sensing distance will be reduced by approximately 25% when fibers are connected.

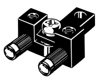
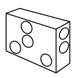
Only 2.2 mm dia. fibers can be connected.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Accessories for E32

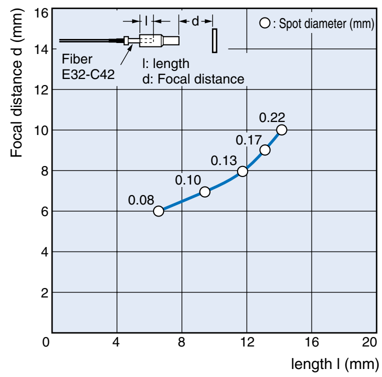
E32

Lens Unit

Shape	Application	Name	Model	Quantity	Applicable Fiber
	Increased sensing distance	Long distance lens units	E39-F1	A total of two pcs.: One each for emitter and receiver	E32-T11L E32-TC200 E32-T11R E32-T11 E32-T61-S E32-T81R-S
	Conversion of detection direction into side view	side view unit	E39-F2		
	Conversion of through-beam model into long distance reflective model	Lens-equipped reflective Unit	E39-F3	One set	
	Conversion of through-beam model into side view reflective model	Reflective side view conversion attachment	E39-F5	1	E32-TC200A
	Detection at 0.1 to 0.6 mm dia. small spot	Small spot lens unit (variable)	E39-F3A	1	E32-C42 (3 mm dia.)
	Detection at 0.5 to 1 mm dia. small spot				E32-D32 (3 mm dia.)
	Focal length 7 mm Detection at 0.1 mm dia. spot	Small spot lens unit (fixed)	E39-F3A-5	1	E32-EC41
	Detection at 0.5 mm dia. spot in 7 mm focal length				E32-EC31
	17 mm focal length Detection at 0.2 mm dia. spot	Long distance/small spot lens unit (fixed)	E39-F3B	1	E32-EC41
	17 mm focal length Detection at 0.5 mm dia. spot				E32-EC31
	Short body for space-saving, max. 4 mm dia. spot in long 20 mm distance	Long distance lens unit (fixed)	E39-F3C	1	E39-EC31 E32-EC41
		Long distance lens unit	E39-F1V	2	E32-T51V and E32-T54V

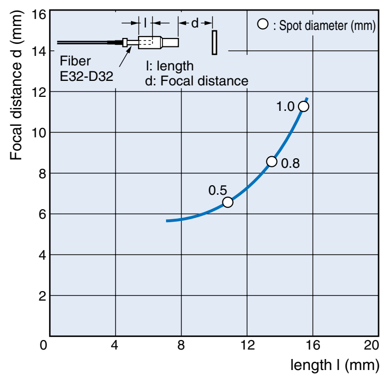
Beam spot characteristic

E39-F3A+E32-C42

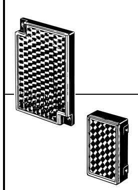


Beam spot characteristic

E39-F3A+E32-D32

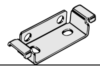
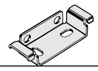
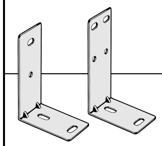
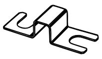


Reflectors

Shape	Name	Sensing distance (default)	Model	Quantity	Remarks
	Reflectors	1.5 m (150 mm) *	E39-R1	1	Retroreflective model attached to E32-R16.
	Small reflector	250 mm (25 mm) *	E39-R3	1	Retroreflective model attached to E32-R21.

* Values in parentheses indicate the minimum required distance between the sensor and reflector.

Mounting Brackets

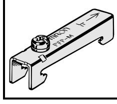
Shape	Applicable type	Model	Quantity	Remarks
	E3X-DA-N series	E39-L143	1	---
	E3X-DA□V	E39-L148		
	E32-T16	E39-L4	1*	Attached to the product.
	E32-T16P	E39-L94	2	---
	E32-T54V	E39-L54V	2	---

* For the through-beam type, please order two pcs. for the emitter and receiver.
Note: For details, refer to "Mounting bracket list".

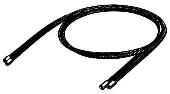
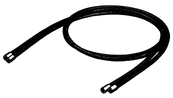
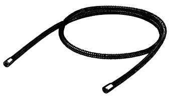
Operating Instructions Sticker

Model	Remarks
E39-Y1	Apply this seal to near the sensor.

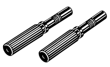
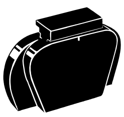
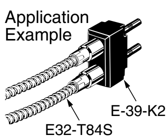
End Plate

Shape	Model	Quantity
	PFP-M	1

Protective Spiral Tubes

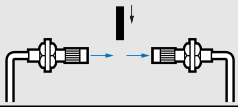
Shape	Application	Model	Tube length	Applicable Fiber
	For protection of fiber	E39-F32A5	500 mm	E32-DC200E E32-D21 E32-DC200F(4) E32-D21R
		E39-F32A	1 m	
		E39-F32B5	500 mm	E32-T21L E32-TC200F(4) E32-TC200E E32-T21 E32-EC31 E32-T21R
		E39-F32B	1 m	
		E39-F32C5	500 mm	E32-T11L E32-T11 E32-TC200 E32-T51 E32-TC200B(4) E32-T11R
		E39-F32C	1 m	
		E39-F32D5	500 mm	E32-D11L E32-D11 E32-DC200 E32-CC200 E32-DC200B(4) E32-ED51 E32-ED11R
		E39-F32D	1 m	

Other Accessories

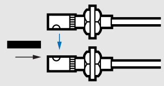
Shape	Application	Name	Model	Applicable Fiber	Remarks
	Used for free cutting of fiber	Fiber Cutter	E39-F4	All fiber unit models that enable free cut	Attached to the fibers that can be cut freely.
	Attachments for small diameter fibers for insertion into amplifier	Attachments for small diameter fibers	E39-F9	E32-T21L E32-DC200E E32-T22L E32-DC200F(4) E32-TC200E E32-D33 E32-T22 E32-ED21R E32-T22R E32-D21 E32-TC200F(4) E32-D32 E32-T21 E32-D24 E32-T24 E32-D24R E32-T24R E32-R21 E32-D21L E32-EC31 E32-ED21R E32-A03 E32-D22L E32-A04 E32-D22R	---
	Used for adding to fiber	Fiber Connector	E39-F10	E32-T11L E32-T14 E32-T12L E32-G14 E32-T17L E32-D11L E32-TC200 E32-DC200 E32-TC200A E32-DC200B(4) E32-TC200B(4) E32-D14L E32-T14L E32-D12	---
	Used for bending the sleeve of sleeved fiber	Sleeve Bender	E39-F11	E32-TC200B(4) E32-TC200F(4) E32-DC200F(4)	---
	Prevention of fiber unit mounting section from breakage	Protective Attachment	E39-K2	E32-T61-S E32-T84S	

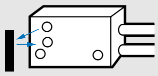
Rating/Performance

Lens Unit

Item		Name	Long distance lens units					
		Application	Increased sensing distance					
		Model	E39-F1					
		Sensor type	Through-beam 					
Applicable Fiber			E32-T11L	E32-TC200	E32-T61	E32-T11	E32-ET11R	E32-T81R-S
E3X-DA-N	Sensing distance	Super-long-distance	4,000 mm	4,000 mm *	4,000 mm *	4,000 mm *	4,000 mm *	2,600 mm
		Standard	3,200 mm	4,000 mm *	3,400 mm	3,600 mm	3,700 mm	2,100 mm
		Super-high-speed	1,200 mm	2,100 mm	1,300 mm	1,300 mm	1,400 mm	750 mm
Standard sensing object			Opaque: 4 mm dia. min.					
Directional angle			5 to 40°					
Differential distance			---					
Ambient temperature			Use the unit within the operating temperature range of the fiber used. When used with E32-T61-S, use the unit within the range -40 to +200°C.					
Material	Tube:		Brass					
	Lens		Optical glass					

* These models allow a longer sensing distance because their optical fiber length is 2 m.

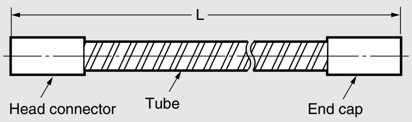
Item		Name	side view unit					
		Application	Conversion of detection direction into side view					
		Model	E39-F2					
		Sensor type	Through-beam 					
Applicable Fiber			E32-T11L	E32-TC200	E32-T61-S	E32-T11	E32-ET11R	E32-T81R-S
E3X-DA-N	Sensing distance	Super-long-distance	900 mm	800 mm	570 mm	780 mm	500 mm	350 mm
		Standard	800 mm	700 mm	450 mm	660 mm	400 mm	280 mm
		Super-high-speed	400 mm	300 mm	170 mm	250 mm	150 mm	100 mm
Standard sensing object			Opaque: 3 mm dia. min.					
Directional angle			20 to 60°					
Ambient temperature			Use the unit within the operating temperature range of the fiber used. When used with E32-T61-S, use the unit within the range -40 to +200°C.					
Material	Tube:		Brass					
	Lens		Optical glass					

Item			Name: Reflective side view conversion attachment unit
Application			Conversion of through-beam model into side view reflective model
Model			E39-F5
Sensor type			Reflective model 
Applicable Fiber			E32-TC200A
E3X-DA-N	Sensing distance (Standard sensing object)	White paper super-long-distance	1 to 130 mm (100 x 100 mm)
		White paper Standard	1 to 120 mm (100 x 100 mm)
		White paper super-high-speed	2 to 45 mm (100 x 100 mm)
Differential distance			20% max. of sensing distance
Ambient temperature			-40° to 70°C (with no icing or condensation)
Material	Base:		Brass
	Reflector:		Stainless steel

Lens Unit (E39-F3□ series)

Item		Spot lens unit							
Name		Spot lens unit							
Spot diameter		Adjustable in the range 0.5 to 1.0 mm dia.	Adjustable in the range 0.1 to 0.6 mm dia.	Focal length 7mm 0.5 mm dia. fixed	Focal length 7mm 0.1 mm dia. fixed	Focal length 17mm 0.5 mm dia. fixed	Focal length 17mm 0.2 mm dia. fixed	4 mm max. at 0 to 20 mm	
Model		E39-F3A		E39-F3A-5		E39-F3B		E39-F3C	
Applicable fiber type		E32-D32	E32-C42	E32-EC31	E32-EC41	E32-EC31	E32-EC41	E32-EC31	E32-EC41
Material	Tube:	Aluminum							
	Lens	Optical glass							

Protective Spiral Tubes

Item									
Model		E39-F32A5	E39-F32A	E39-F32B5	E39-F32B	E39-F32C5	E39-F32C	E39-F32D5	E39-F32D
Sensor type									
Ambient temperature		Operating/Storage: -40 to +150°C (Use the fiber placed inside within the operating temperature of that fiber)							
Ambient humidity		Operating: 35% to 85% Storage: 35% to 95%							
Bending radius		30 mm min.							
Tensile strength		Between head connector or end cap and tube: 1.5 Nm max., tube: 2 Nm max.							
Compression load		Tube: 29.4 N max.							
Material	Head connector	Brass nickel plating							
	End cap	Brass nickel plating							
	Tube	Stainless steel (SUS304)							

Dimensions

Accessories (Order Separately)

Reflectors H-3

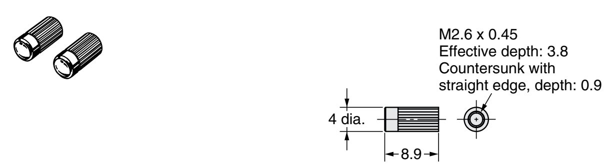
Mounting Brackets H-3

End Plate

PFP-M

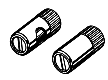
Lens Unit

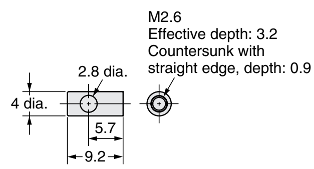
E39-F1 Long Distance Lens Units



Material: Tube: Brass Lens: Optical glass
Note: One set includes two units

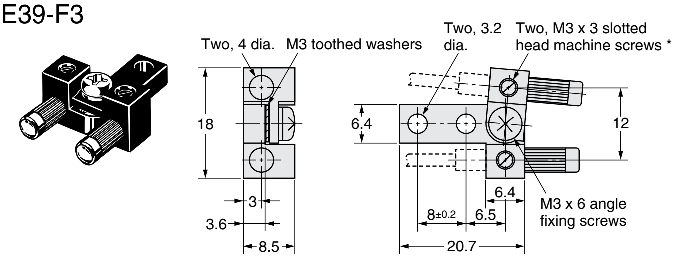
E39-F2 side view unit E39-F2





Material: Tube: Brass Lens: Optical glass
Note: One set includes two units

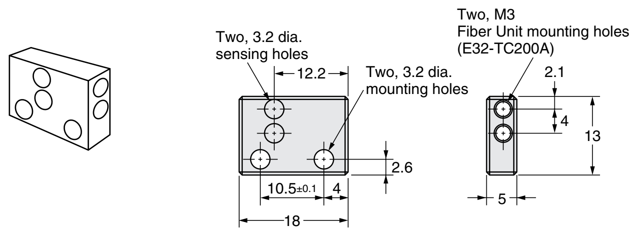
Lens-equipped Reflective Unit E39-F3



Material: Tube: Brass Base: Aluminum

* Fix the fiber head using the slotted head machines screw.
Do not insert the E39-F1 Lens.

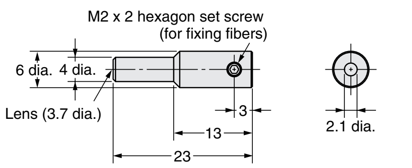
E39-F5 side view Reflective Unit



Material: Base: Brass Reflector Stainless steel

Note: Only the E32-TC200A can be mounted. When mounting it, remove all the supplied nuts and screw it into the E39-F5. (Screw it until it is stopped by the stopper.)

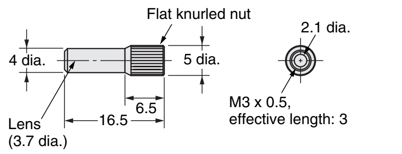
Small Spot Lens Unit E39-F3A



Material: Tube: Aluminum
Optical lens: Optical glass

Note: E32-D32 is a Lens Unit for the E32-C42.

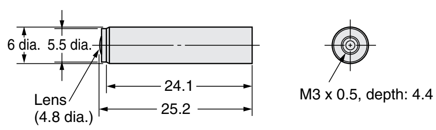
Small Spot Lens Unit E39-F3A-5



Material: Tube: Aluminum
Optical lens: Optical glass

Note: E32-C31 is a Lens Unit for the E32-C41.

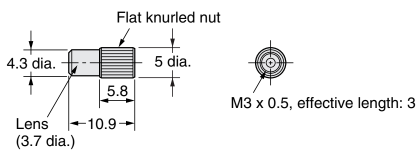
Small Spot Lens Unit E39-F3B



Material: Tube: Aluminum
Optical lens: Optical glass

Note: E32-C31 is a Lens Unit for the E32-C41.

Small Spot Lens Unit E39-F3C

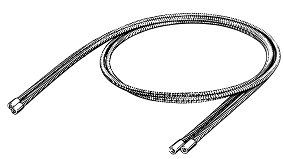


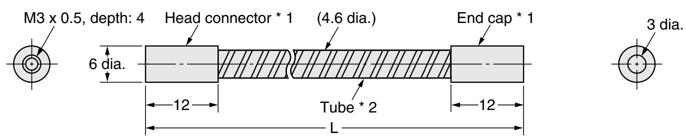
Material: Tube: Aluminum
Optical lens: Optical glass

Note: E32-C31 is a Lens Unit for the E32-C41.

Protective Spiral Tubes

E39-F32A/F32A5
E39-F32B/F32B5

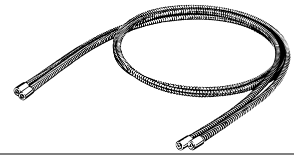


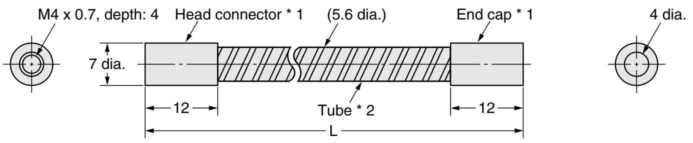


* 1. Nickel-plated brass
* 2. SUS304 stainless-steel

Note: 1 . L is as follows: E39-F32A and E39-F32B: 1,000 E39-F32A5, E39-F32B5: 500
2 . A pair of E39-F32A (5)'s is sold as E39-F32B (5)

E39-F32C, F32C5

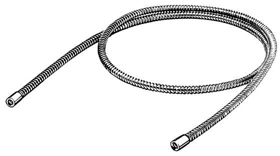


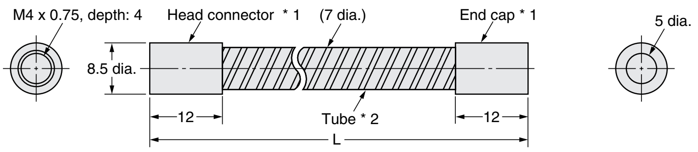


* 1. Nickel-plated brass
* 2. SUS304 stainless-steel

Note: L is as follows: E39-F32C: 1,000, E39-F32C5: 500

E39-F32D/F32D5



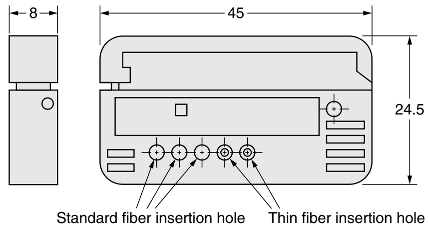


* 1. Nickel-plated brass
* 2. SUS304 stainless-steel

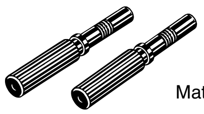
Note: L is as follows: E39-F32D: 1,000 E39-F32A5, E39-F32D5: 500

Other Accessories

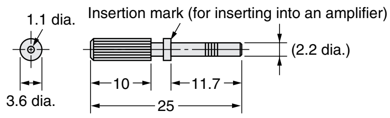
E39-F4 Fiber Cutter



E39-F9 Attachment for Thin Fiber

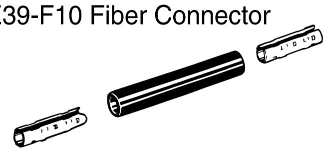


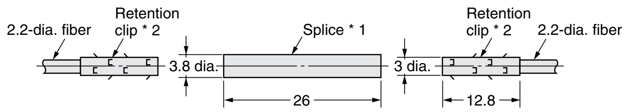
Material: ABS



Note: One set includes two units.
Included with Thin Fiber Unit.

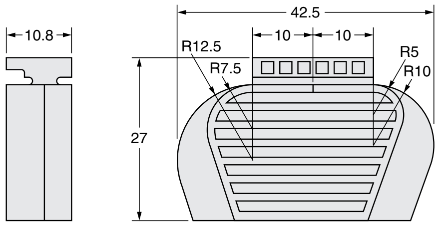
E39-F10 Fiber Connector



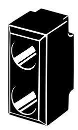


* 1. Polyester
* 2. Brass

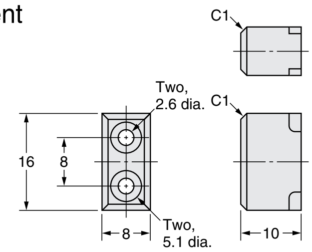
E39-F11 Sleeve Bender

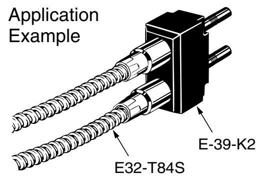


E39-K2 Protective Attachment



Material: ABS





ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Displacement Sensors / Width-measuring Sensors

Smart Laser Sensor

ZX-L *Unique Plug & Play Measurement Concept for Precise Measurement*

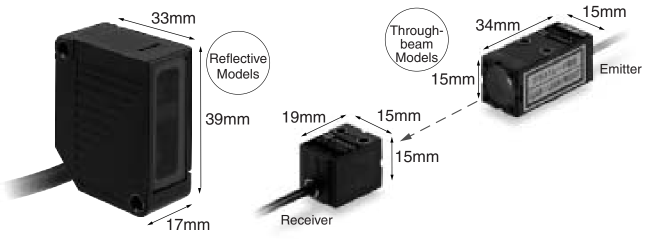
A multitude of "smart" functions packed in a small amplifier. Full line-up of heads for different detection methods and micron detection performance

Features

The world's smallest and lightest laser sensor.

It is the world's lightest. A body size similar to a photoelectric sensor permits space conservation and solves installation space problems.
Naturally, we have also achieved a high-speed response on the same level as a photoelectric sensor.

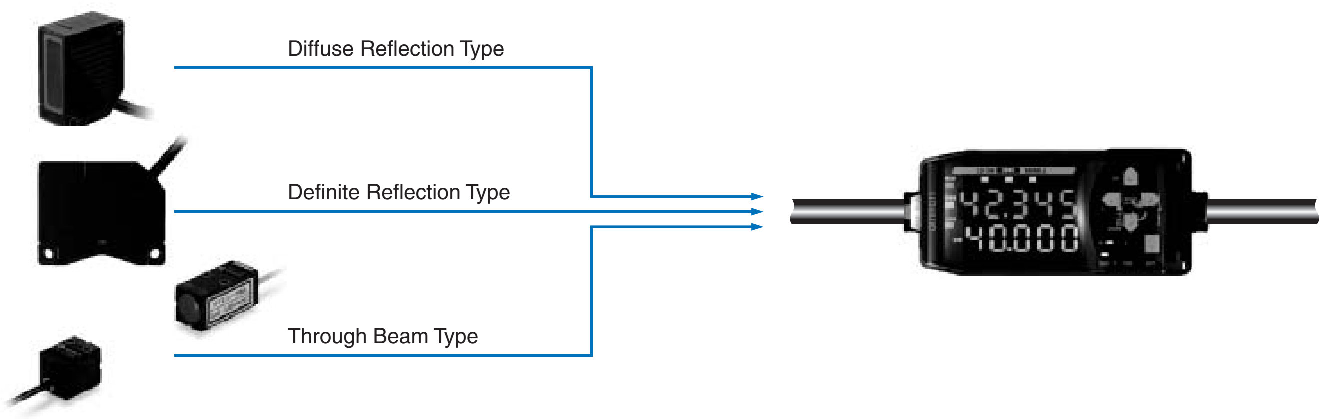
* High-speed sampling: 0.15 ms (response speed: 0.3 ms)



Platform architecture as a optimum solution

Platform architecture allows users to configure a variety range of sensor-heads to one amplifier.

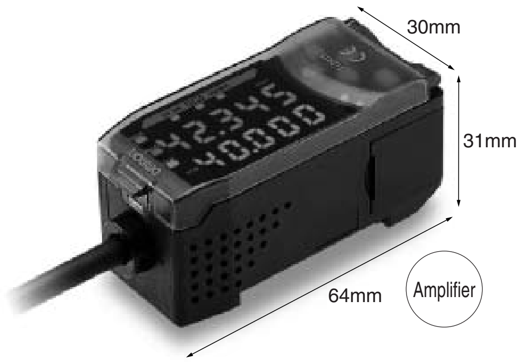
Plug & Play provides easy sensorhead replacement and easy maintenance.

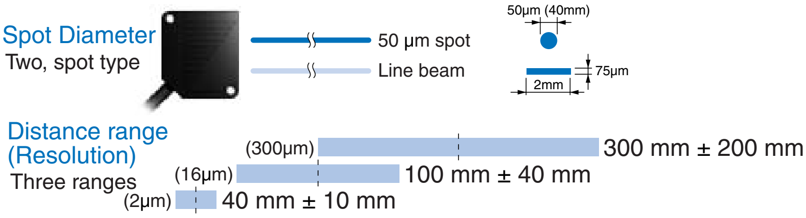


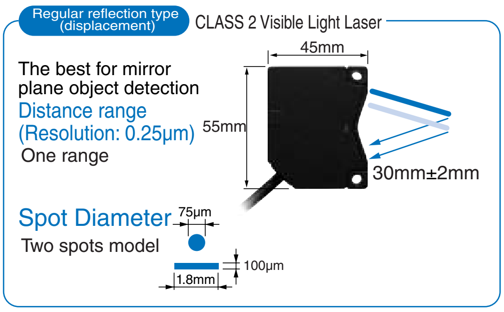
Our line-up includes 8 reflective-type models and 3 Through-beam-type models.

Reflective Models Class 2 visible-light laser

Minute work is detected by a spot beam, and regular work is detected by a line beam.
Smart adaptation to meet the needs of the application.
Furthermore, the system seamlessly covers a measurement range of 28 mm to 500 mm.



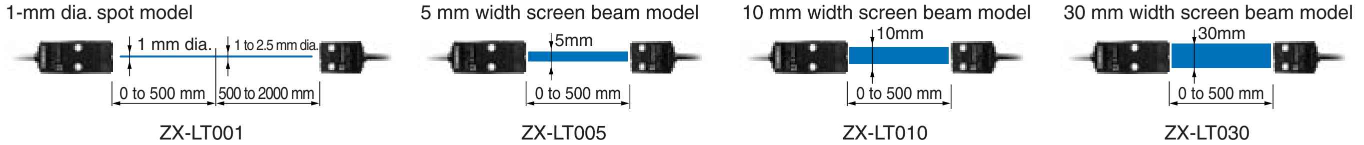




Through-beam Models Class 1 visible-light laser

High-precision positioning is accomplished with a 1 mm dia. spot beam, and area detection is accomplished with a 5 mm width / 10 mm width screen beam.

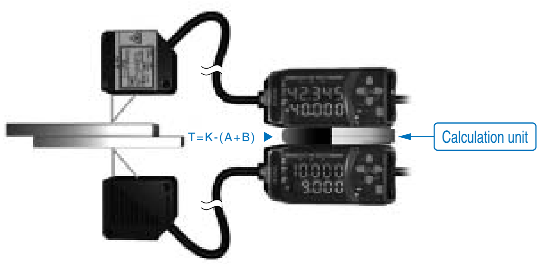
Measurement width and distance range (Resolution: 4mm)



Many useful functions are provided.

Calculation settings that eliminate the need for a digital panel meter Patent pending

A calculation unit can be inserted between two amplifiers to display the calculation results of two sensor units on one of the amplifiers. Settings are accomplished by simply entering the necessary parameters in one of the amplifiers.



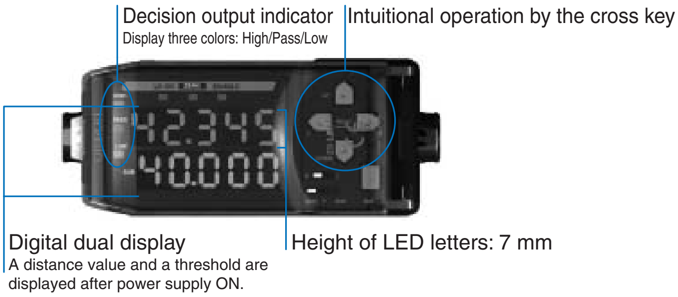
Includes a sensor life monitor.

The laser diode (LD) life is detected automatically and the operator alerted.

When LD deterioration is detected, the sub-display alerts you. This gives you time to take action before the LD dies.

Top priority is given to easy operation.

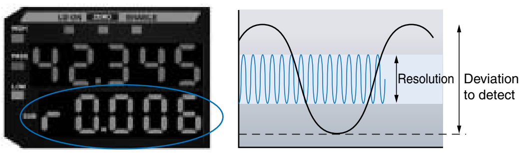
Sophisticated functions and high performance, with ease of use.
This is a key feature of the ZX-L-Series.
The interface comes from our E3X-DA-N* Digital Fiber Amplifier.
Feel how simple it is to operate.



*E3X-DA-N

Obtain the resolution with ease Patent pending

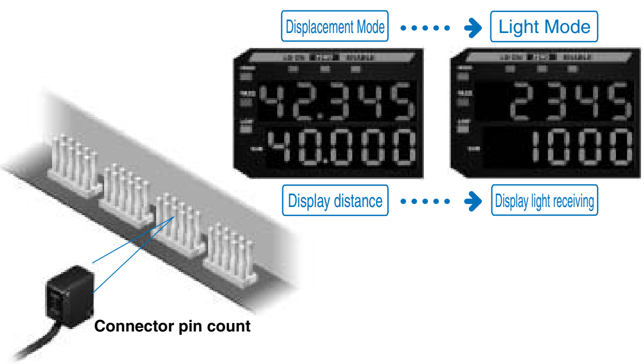
Simply perform detection of the work you wish to test, and you can check the resolution.
The resolution is displayed so you can check how much fluctuation there is to the threshold setting and decide whether detection is possible with certitude.



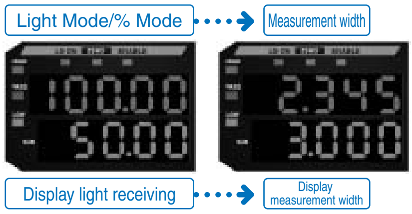
Reflective Models

Light intensity mode for high-performance laser photoelectric detection

Light intensity detection is possible using the minute spot of the laser beam. The sensor be used not only as a displacement meter, but also as a high-precision laser photoelectric sensor for detection of minute work with a background object and color difference. Select displacement mode or light intensity mode as appropriate for the application to establish the optimum function settings.



Through-beam Models



Multiple teaching functions.

Positioning / 2-point / auto-matching

Includes three types of teaching functions on the same level as a photoelectric sensor.

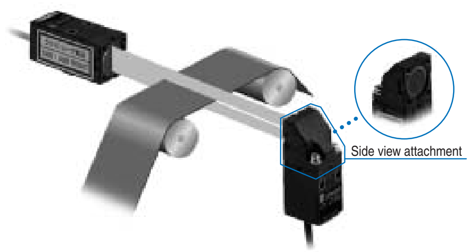
Positioning teaching
Ideal for high-precision positioning applications.

Two-point teaching
Ideal for detection of minute level differences between two points.

Automatic teaching
Ideal for applications where teaching is performed without stopping the work.

Install in any direction.

A side viewer attachment (optional) can be installed to enable various installations

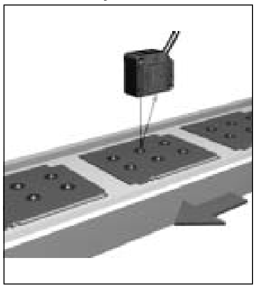


Wide variety of easy-to-use functions.

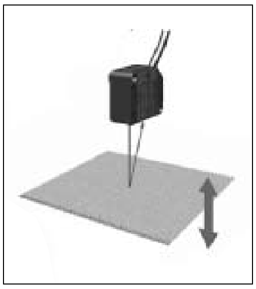
Scaling, display reverse, display off mode, ECO mode, change number of display digits, measurement processing (various timer functions and hold functions), threshold value settings, input/output settings, mutual interference (when using a computing unit), function lock, initial reset, zero reset, differential function, sensitivity selection, monitor focus, etc.

Application

NORMAL Height measurement of a minute object



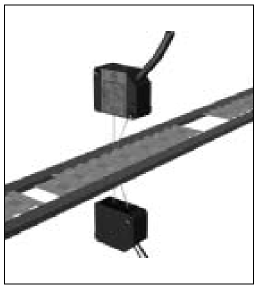
POSITION Face positioning



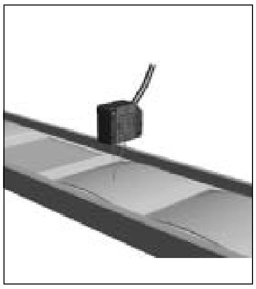
P-P Face swing/ eccentricity

EDGE Sheet count

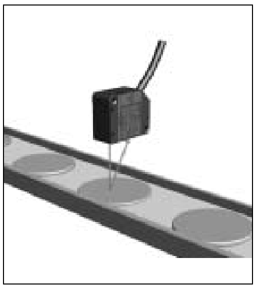
THICK Thickness of object with flutter



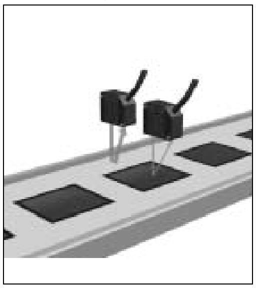
PEAK BOTTOM Detection of warping / level difference



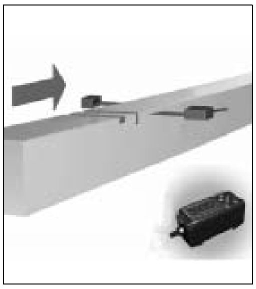
SELF Continuous measurement



A-B Detection of presence of thin object



APERTURE Gap detection

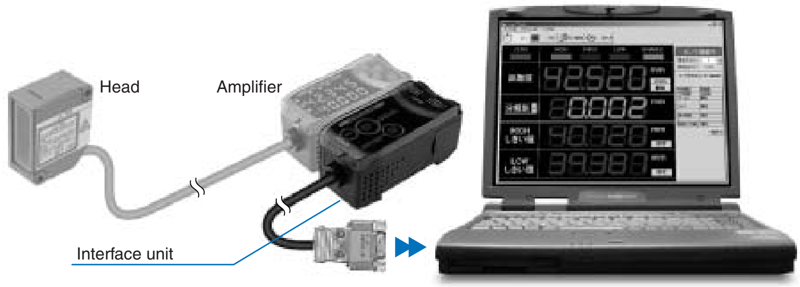


OUTSIDE Shape detection

Features

Connect to a computer for full use of sensor performance.

Use the computer monitor screen for enhanced panel display.
Easy processing of detection results such as waveform monitor and data logging results, which used to make system configuration more easy.



Quality control as you desire.

Data logging

Log detection data and manage a status history for effective and efficient quality control and implementation of countermeasures for problems.

*** Screen images may in some cases differ from the actual product.**

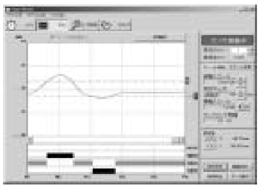
Settings are supported by a list display

Settings that are complicated if the amplifier panel must be used can be easily accomplished by referring to the Function menu. The settings can also be easily imported to and exported from a text editor.

Waveform monitoring function

Easy monitoring of waveforms, which was previously only possible with an oscilloscope. Plenty of easy-to-use functions, such as drag and drop threshold value setting.

Waveform monitoring



Summary of PC software specifications

Digital numerical value monitoring

- Tolerance direct threshold value setting
- Various teaching settings

Waveform monitoring

- Waveform collection
- Waveform observation/editing
- Waveform saving/reading

Data logging

- Various collection condition settings
- Supports Microsoft Excel

Configuration function

- Amplifier unit function settings (observation scaling, input scaling, etc.)
- Saving/reading of amplifier setting conditions

****Microsoft Excel is either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.**

Ordering Information

Sensors

Sensor head (reflection type)

Optical method	Beam shape	Sensing distance	Resolution *	Model
Diffuse-reflective	Spot beam	40 ± 10 mm	2 µm	**ZX-LD40**
		100 ± 40 mm	16 µm	**ZX-LD100**
		300 ± 200 mm	300 µm	**ZX-LD300**
	Line beam	40 ± 10 mm	2 µm	**ZX-LD40L**
		100 ± 40 mm	16 µm	**ZX-LD100L**
		300 ± 200 mm	300 µm	**ZX-LD300L**
Regular reflection type	Spot beam	30 ± 2 mm	0.25 µm	**ZX-LD30V**
	Line beam			**ZX-LD30VL**

* At average count of 4,096 times

Sensor head (transmissive type)

Optical method	Measurement width	Sensing distance	Resolution *	Model
Through-beam	1 mm dia.	0 to 2,000 mm	4 µm	**ZX-LT001**
	5 mm	0 to 500 mm		**ZX-LT005**
	10 mm			**ZX-LT010**
	30 mm		12 µm	**ZX-LT030**

* At average count of 64 times

Amplifier Units

Shape	Power supply	Output specifications	Model
	DC	NPN output	**ZX-LDA11-N**
		PNP output	**ZX-LDA41-N**

Note: Compatible with sensor head connection.

Accessories (Order Separately)

Computing unit

Shape	Model
	**ZX-CAL2**[*1]

[*1.] Calculation Units are required to connect two or more sensors

Side view attachment

Shape	Suitable sensor head	Model
	ZX-LT001 ZX-LT005	**ZX-XF12**
	ZX-LT010	**ZX-XF22**

Extension cable for robot application

Cable length	Model	Quantity
1m	**ZX-XC1R**	1 pc.
4m	**ZX-XC4R**	
8m	**ZX-XC8R**	
9m	**ZX-XC9R**	

"Smart monitor" communication interface and Setup Tool for Personal Computer and PLC

Shape	Name	Model
	ZX-L-series Communication Interface Unit	**ZX-SF11**
 + CD-ROM	ZX-series Communication Interface Unit + ZX-L-series Sensor Setup and Logging Software	**ZX-SFW11E V3**
CD-ROM	ZX-L-series Sensor Setup and Logging Software	**ZX-SW11E V3**

Two-sided connector cable (for extension)

Cable length	Model	Quantity
1 m	**ZX-XC1A**	1 pc.
4 m	**ZX-XC4A**	
8 m	**ZX-XC8A**	
9 m *	**ZX-XC9A**	

* Only for reflective types.

Rating/Performance

Sensor head (reflection type)

Item Model	ZX-LD40	ZX-LD100	ZX-LD300	ZX-LD30V	ZX-LD40L	ZX-LD100L	ZX-LD300L	ZX-LD30VL
Optical method	Diffuse reflection			Regular reflection	Diffuse reflection			Regular reflection
Light source (wave length)	Visible-light semiconductor laser (wavelength 650 nm, 1 mW or less, Class 2)							
Measurement center distance	40 mm	100 mm	300 mm	30 mm	40 mm	100 mm	300 mm	30 mm
Measurement range	±10 mm	±40 mm	±200 mm	±2 mm	±10 mm	±40 mm	±200 mm	±2 mm
Beam shape	Spot				Line			
Beam diameter *1	50 mm dia.	100 mm dia.	300 mm dia.	75 mm dia.	75 μm x 2mm	150 μm x 2 mm	450 μm x 2 mm	100 μm x 1.8 mm
Resolution*2	2 μm	16 μm	300 μm	0.25 μm	2 μm	16 μm	300 μm	0.25 μm
Linearity*3	±0.2% F.S. (entire range)	±0.2% F.S. (80 to 121 mm)	±2% F.S. (200 to 401 mm)	±0.2% F.S. (entire range)	±0.2% F.S. (32 to 49 mm)	±0.2% F.S. (80 to 121 mm)	±2% F.S. (200 to 401 mm)	±0.2% F.S. (entire range)
Temperature drift*4	±0.03% F.S./°C (±0.1% F.S./°C for ZX-LD300/ZX-LD300L)							
Ambient illuminance	Incandescent lamp: 3,000 lux max.							
Ambient temperature	Operating: 0°C to 50°C, Storage: -15°C to 60°C (with no icing or condensation)							
Ambient humidity	Operating/Storage: 35% to 85% RH (with no condensation)							
Insulation resistance	20 M Ω at 500 VDC							
Dielectric strength	1,000 VAC at 50/60 Hz for 1 minute							
Vibration resistance	10 to 150 Hz, 0.7 mm double amplitude for 80 minutes each in X, Y, and Z directions							
Shock resistance	300 m/s^2, 6 directions, 3 times each (up-down, left-right, forward-backward)							
Protective structure	IEC 60529 IP50			IEC Standard IP40	IEC 60529 IP50			IEC Standard IP40
Connection method	Junction connector (standard length: 500 mm)							
Weight (Packed state)	Approx. 150 g			Approx. 250 g	Approx. 150 g			Approx. 250 g
Material	Case: PBT (polybutylene terephthalate), Cover: Aluminum, Lens: Glass			Case, Cover: Aluminum Lens: Glass	Case: PBT (polybutylene terephthalate), Cover: Aluminum, Lens: Glass			Case, Cover: Aluminum Lens: Glass
Accessories	Operation manual, laser warning labels (English characters)							

*1. Beam diameter: This is the value of the measurement center distance (actual value), and is defined at 1/e^2 (13.5%) of the central light intensity. If there is stray light outside, the defined area and the area around the object has a higher reflectance than the object,

*2. Resolution: Indicates the amount of fluctuation (±3 δ) in the linear output when connected to the ZX-LDA. (The measured value when the average count of the ZX-LDA is set to 4,096 and our standard object (white ceramic) is used for the central distance.) This indicates the repeatability precision when the work is in a static state, and does indicate the distance precision. The resolution performance may not be satisfactory in a strong electromagnetic field.

*3. Linearity: This indicates the error with respect to the ideal straight line of the displacement output when measuring our standard object.

*4. Temperature characteristic: The value when the distance between the sensor and the object (our standard object) is fixed using an aluminum jig. (Measured at the measurement center distance.)

Note: When an object has a high reflectance, detection errors are possible outside the measurement range.

Sensor head (transmissive type)

Item Model	ZX-LT001		ZX-LT005	ZX-LT010	ZX-LT030
Optical method	Through-beam				
Light source (wave length)	Visible-light semiconductor laser (wavelength 650 nm, 1 mW or less, Class 1)				
Measurement width	1 mm dia.	1 to 2.5 mm dia.	5 mm	10 mm	30 mm
Sensing distance	0 to 500 mm	500 to 2,000 mm	0 to 500 mm		
Min. sensing object	8 mm dia. Opaque object	8 to 50 µm Opaque object	Opaque: 0.05 mm dia.	Opaque: 0.1 mm dia.	Opaque: 0.3 mm dia.
Resolution*1	4 µm*2	---	4 µm*3		12 µm
Temperature drift	0.2%F.S./°C				0.3%F.S./°C
Ambient illuminance	Incandescent lamp: 3,000 lux max.				Incandescent lamp: 10,000 lux max.
Ambient temperature	Operating: 0°C to 50°C, Storage: -25°C to 70°C (with no icing or condensation)				
Protective structure	IEC 60529 IP40				IP 40
Cable length	Can be extended to 10 m with the special extension cable.				
Material	Case: polyetherimide, case cover: polycarbonate, front cover: glass				Zinc-die-cast
Clamping torque	0.3 N^{2}m max.				
Accessories	Optical axis adjustment seal, sensor head - amplifier unit connector cable, operation manual				Mounting bracket

*1. The amount of fluctuation (±3 δ) of the linear output when connected to an amplifier unit, converted to a detection span.
*2. When the average count is 64.5 µm when the count is 32. The value when the smallest detection object shades the vicinity of the center of the 1 mm dia. detection span.
*3. When the average count is 64.5 µm when the count is 32.

Amplifier Units

Item Model	ZX-LDA11	ZX-LDA41
Measurement period	150 µs	
Possible average count settings *1	1/2/4/8/16/32/64/128/256/512/1,024/2,048/4,096 times	
Temperature drift	When reflective head is connected: 0.01% F.S./°C, when transmissive head is connected: 0.1% F.S./°C	
Linear output *2	4 to 20 mA/F.S., maximum load resistance of 300 Ω ±4 V (±5 V, 1 to 5 V *3), output impedance of 100 Ω	
Decision output (HIGH/ PASS/LOW: 3 outputs) *1	NPN open collector output, 30 VDC 50 mA max., residual voltage 1.2 V or less	PNP open collector output, 30 V DC 50 mA max., residual voltage 2 V or less
Laser OFF input / zero reset input / timing input / reset	When ON: supply voltage 1.5 V or less, when OFF: open circuit (maximum leakage current 0.1 mA or less)	When ON: supply voltage 1.5 V or less, when OFF: open circuit (maximum leakage current 0.1 mA or less)
Functions	Measurement value display, setting value and incident level and resolution display, scaling, display reverse, display off mode, ECO mode, change number of display digits, sample hold, peak hold, bottom hold, peak to peak hold, self peak hold, self-bottom hold, intensity mode, zero reset, initial reset, on-delay timer, off-delay timer, one-shot timer, differential, sensitivity selection, keeping clamp change, threshold value settings, positioning teaching, two-point teaching, automatic teaching, hiss width variable, timing input, reset input, monitor focus, (A-B) operation, (A+B) operation *4, mutual interference *4, laser degradation detection zero reset memory, function lock	
Indicator lamp	Operation indicator lamp: high (orange), pass (green), low (yellow), 7-segment digital main display (red), 7-segment digital sub-display (yellow), laser ON (green), zero reset (green), enable display (green)	
Power supply voltage	12 to 24 VDC ±10%, ripple (p-p) : 10% max.	
Current consumption	200 mA or less (when sensor is connected)	
Ambient temperature	Operating: 0°C to 50°C, Storage: -15°C to 60°C (with no icing or condensation)	
Ambient humidity	Operating/Storage: 35% to 85% RH (with no condensation)	
Insulation resistance	20 M Ω at 500 VDC	
Dielectric strength	1,000 VAC at 50/60 Hz for 1 minute	
Vibration resistance	10 to 150 Hz, 0.7 mm double amplitude for 80 minutes each in X, Y, and Z directions	
Shock resistance	300 m/s^2, 6 directions, 3 times each (up-down, left-right, forward-backward)	
Protective structure	---	
Connection method	Pre-wired models (standard length: 2 m)	
Weight (Packed state)	Approx. 350 g	
Material	Case: PBT (polybutylene terephthalate), Cover: Polycarbonate	
Accessories	Instruction manual	

*1. The response speed of linear output (when the sensitivity is fixed) is calculated as (measurement period) x (average count setting + 1).
The response speed of decision output (when the sensitivity is fixed) is calculated as (measurement period) x (average count setting + 1).
*2. Current/voltage can be switched using the switch on the bottom of the amplifier unit.
*3. Can be set with the monitor focus function.
*4. Computing unit is required.

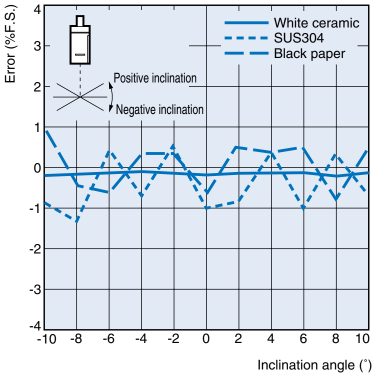
Characteristic data (typical)

Angle characteristics (reflective type)

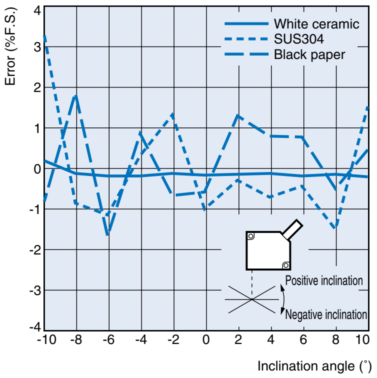
The angle characteristics are a plot of the inclination of the measured object vs. errors occurring in linear output at the measurement center distance.

ZX-LD40

Angular properties of vertical inclination

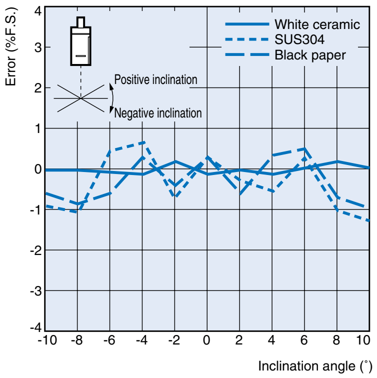


Angle characteristics with respect to horizontal inclination

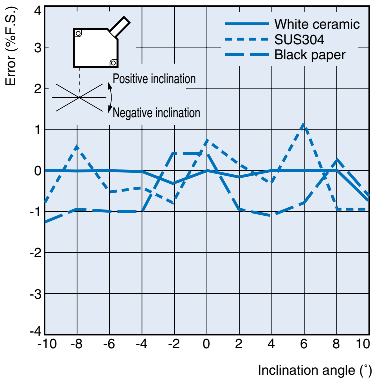


ZX-LD100

Angular properties of vertical inclination

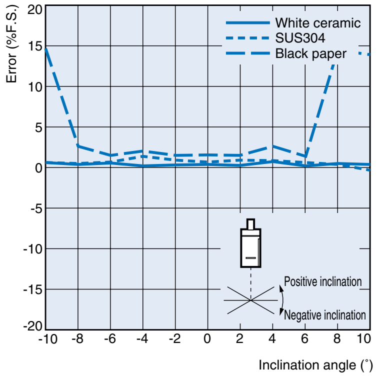


Angle characteristics with respect to horizontal inclination

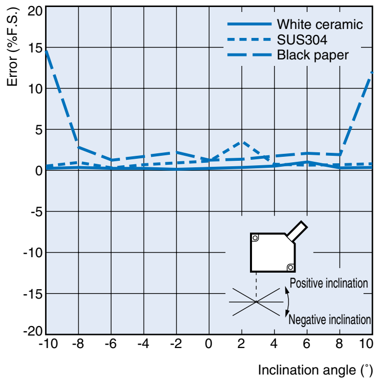


ZX-LD300

Angular properties of vertical inclination

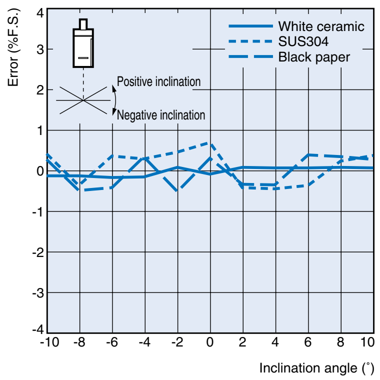


Angle characteristics with respect to horizontal inclination

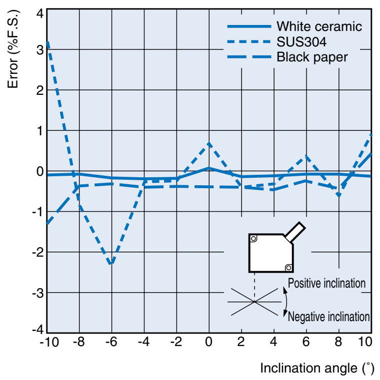


ZX-LD40L

Angular properties of vertical inclination

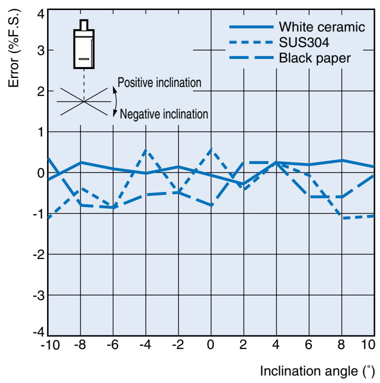


Angle characteristics with respect to horizontal inclination

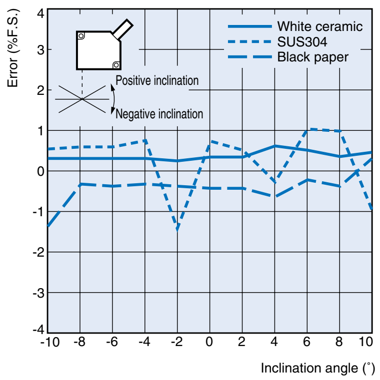


ZX-LD100L

Angular properties of vertical inclination

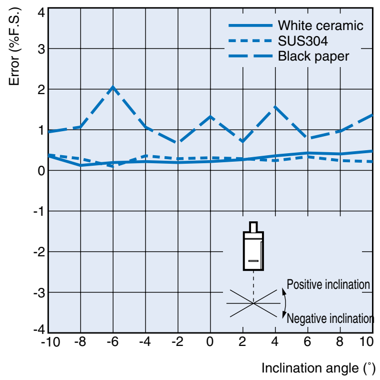


Angle characteristics with respect to horizontal inclination

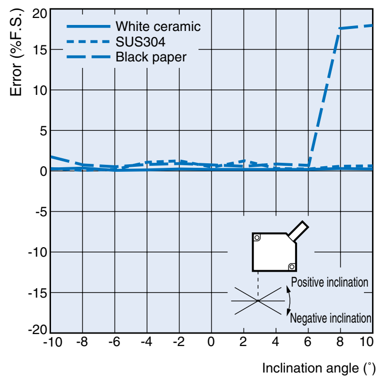


ZX-LD300L

Angular properties of vertical inclination

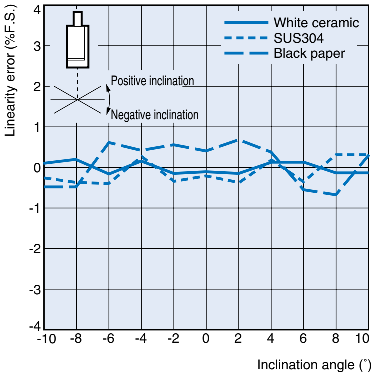


Angle characteristics with respect to horizontal inclination

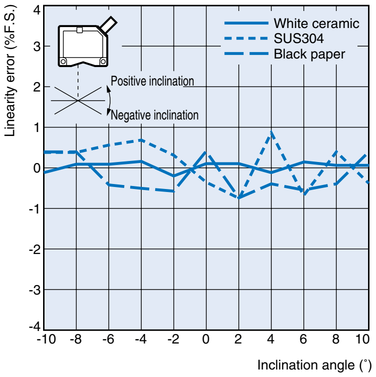


ZX-LD30V

Angular properties of vertical inclination

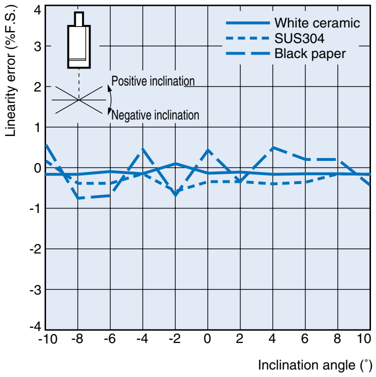


Angle characteristics with respect to horizontal inclination

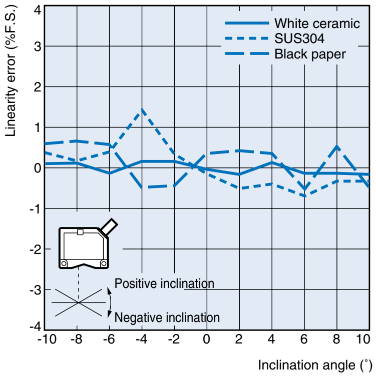


ZX-LD30VL

Angular properties of vertical inclination

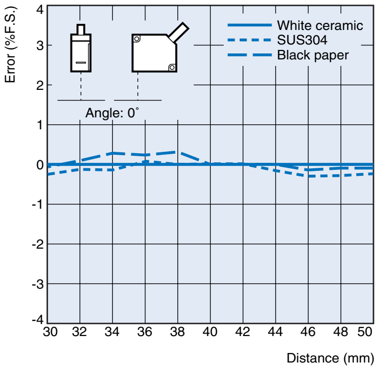


Angle characteristics with respect to horizontal inclination

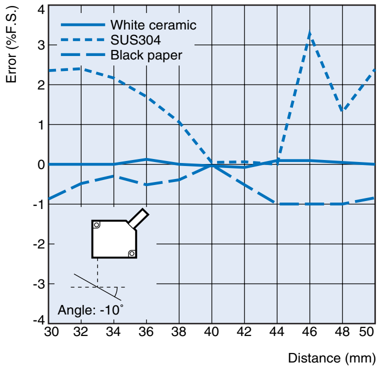


Linearity characteristics depending on material (reflective type)

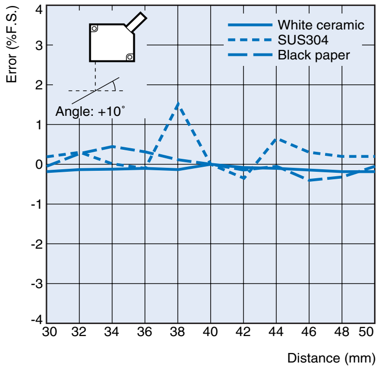
ZX-LD40
Inclination angle 0°



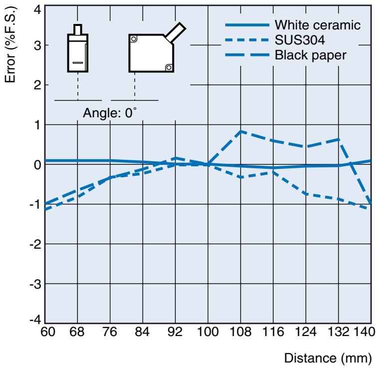
In case of a horizontal inclination
Inclination angle -10°



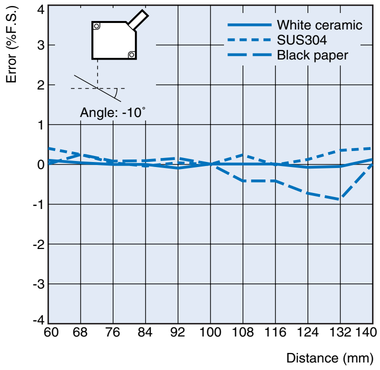
Inclination angle +10°



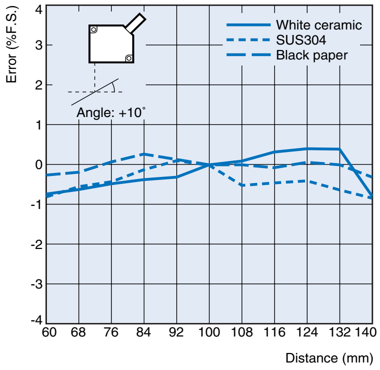
ZX-LD100
Inclination angle 0



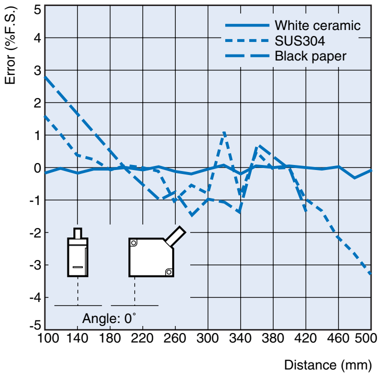
In case of a horizontal inclination
Inclination angle -10°



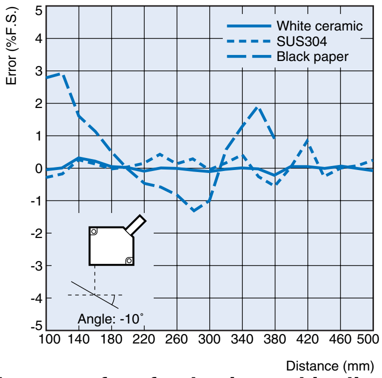
Inclination angle +10°



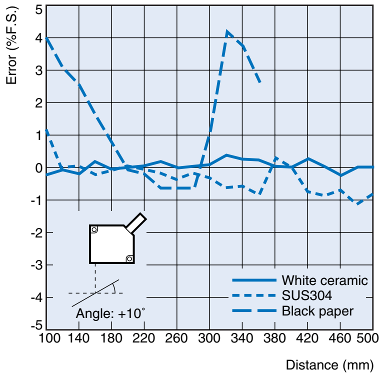
ZX-LD300
Inclination angle 0°



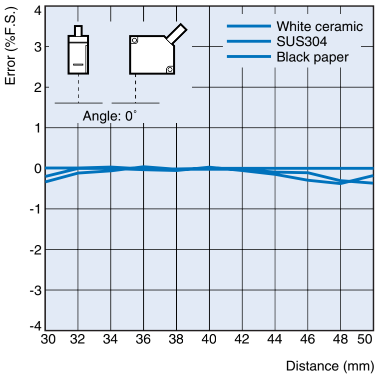
In case of a of a horizontal inclination
Inclination angle -10°



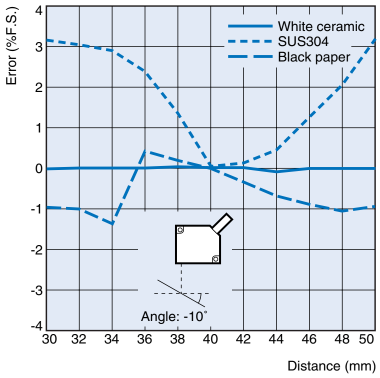
Inclination angle +10°



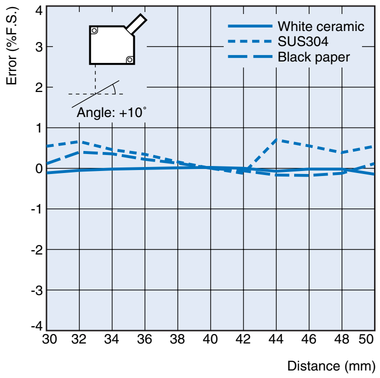
ZX-LD40L
Inclination angle 0°



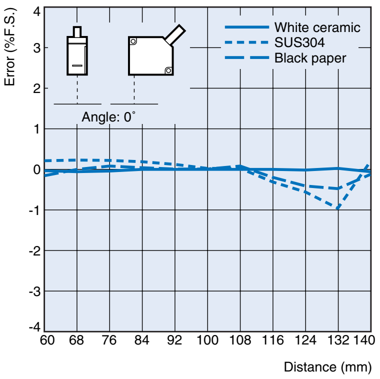
In case of a of a horizontal inclination
Inclination angle -10°



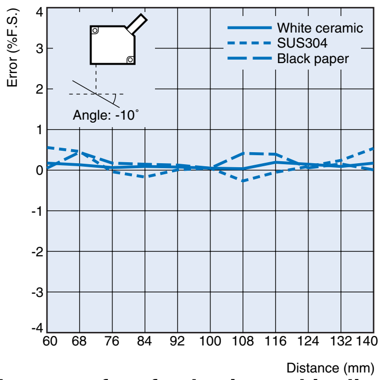
Inclination angle +10°



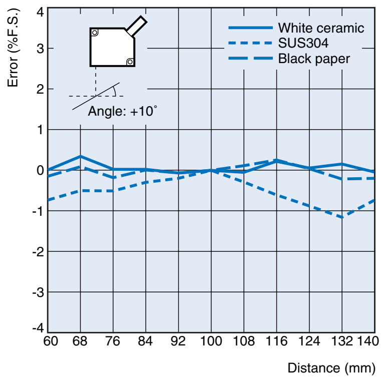
ZX-LD100L
Inclination angle 0°



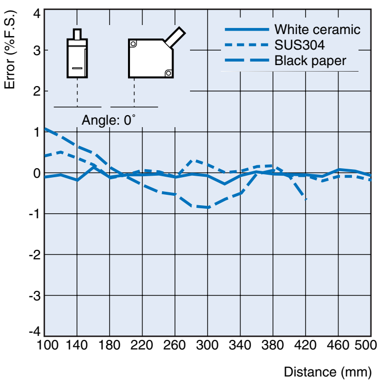
In case of a of a horizontal inclination
Inclination angle -10°



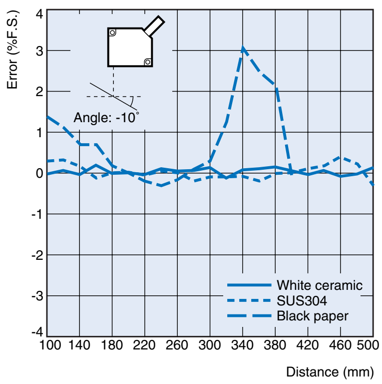
Inclination angle +10°



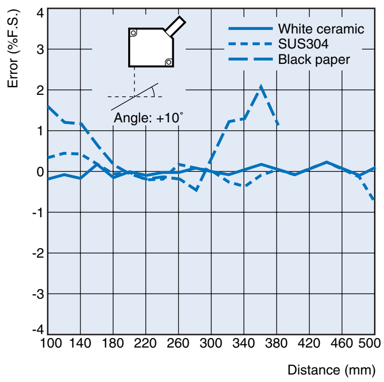
ZX-LD300L
Inclination angle 0°



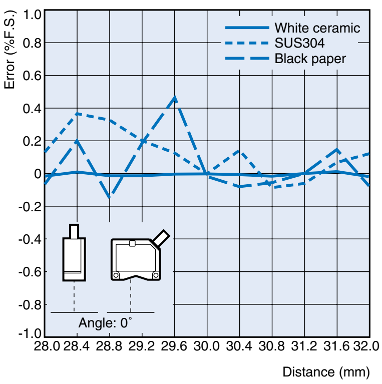
In case of a of a horizontal inclination
Inclination angle -10°



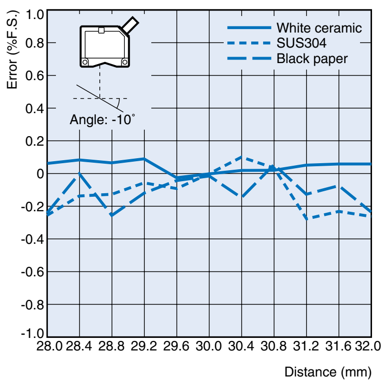
Inclination angle +10°



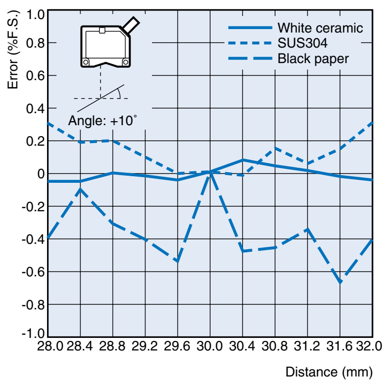
ZX-LD30V
Inclination angle 0°



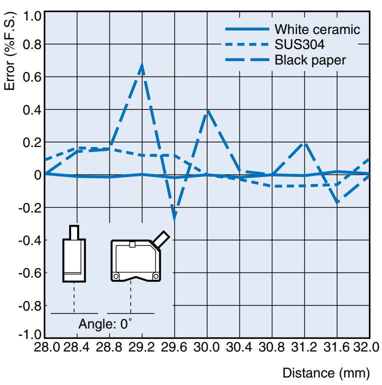
In case of a of a horizontal inclination
Inclination angle -10°



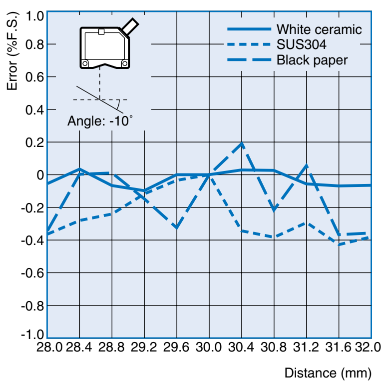
Inclination angle +10°



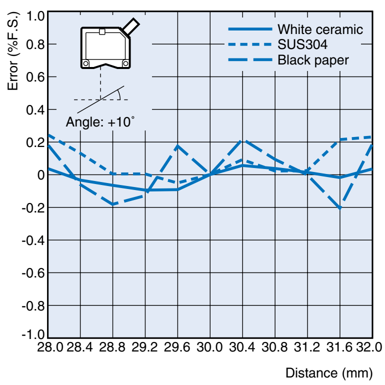
ZX-LD30VL
Inclination angle 0°



In case of of a a horizontal inclination
Inclination angle -10°

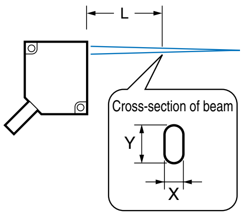


Inclination angle +10°



Spot diameter (reflective type)

Spot beam type



ZX-LD40

L	30 mm	40 mm	50 mm
X (m)	240 µm	40.0 µm	250 µm
Y (m)	350 µm	30.0 µm	370 µm

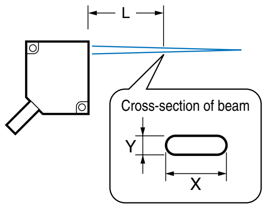
ZX-LD100

L	60 mm	100 mm	140 mm
X (m)	390 µm	100 µm	430 µm
Y (m)	620 µm	65.0 µm	650 µm

ZX-LD300

L	100 mm	300 mm	500 mm
X (m)	1,050 µm	180 µm	1,100 µm
Y (m)	450 µm	300 µm	850 µm

Line beam type



ZX-LD40L

L	30 mm	40 mm	50 mm
X (m)	2,000 µm	2,000 µm	2,000 µm
Y (m)	240 µm	50.0 µm	250 µm

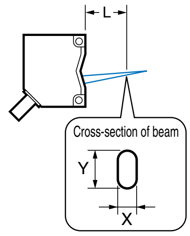
ZX-LD100L

L	60 mm	100 mm	140 mm
X (m)	2,000 µm	2,000 µm	2,000 µm
Y (m)	410 µm	100 µm	430 µm

ZX-LD300L

L	100 mm	300 mm	500 mm
X (m)	2,000 µm	2,000 µm	2,500 µm
Y (m)	750 µm	300 µm	650 µm

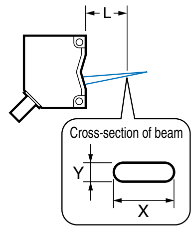
Spot beam type



ZX-LD30V

L	28 mm	30 mm	32 mm
X (m)	60.0 µm	30.0 µm	120 µm
Y (m)	50.0 µm	40.0 µm	90.0 µm

Line beam type

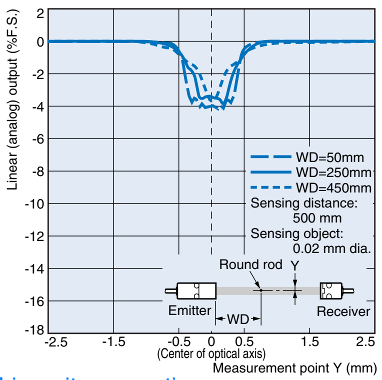


ZX-LD30VL

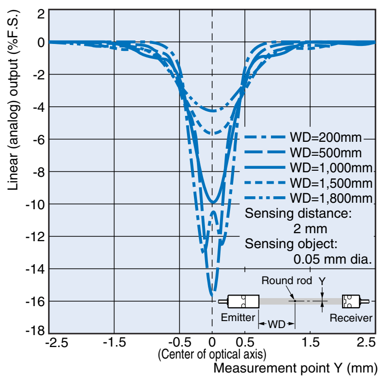
L	28 mm	30 mm	32 mm
X (m)	1,800 µm	1,800 µm	1,800 µm
Y (m)	90.0 µm	60.0 µm	110 µm

Detection object characteristics (transmissive type)

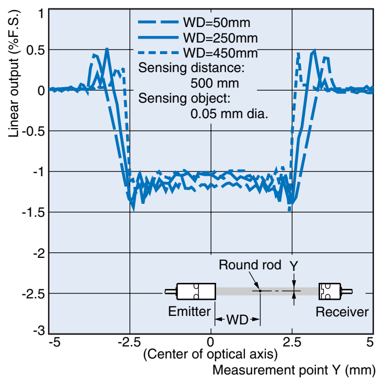
ZX-LT001 (Using a 0.02 mm dia. pin gauge)



ZX-LT001 (Using a 0.05 mm dia. pin gauge)



ZX-LT001 (Using a 0.05 mm dia. pin gauge)



Linearity properties

ZX-LT005

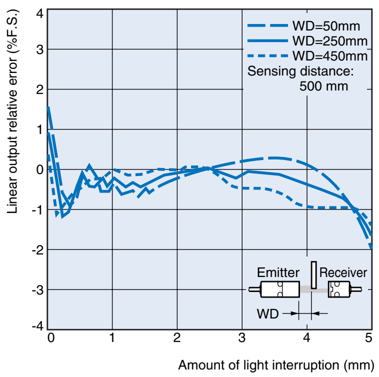
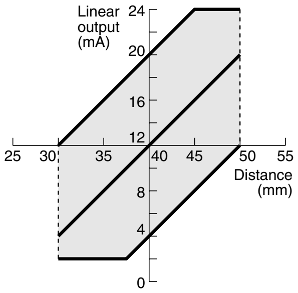


Diagram showing correlation between linear output and detection distance

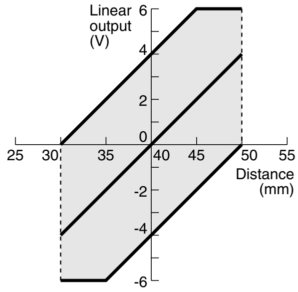
Current or voltage can be selected with the amplifier unit switch.

ZX-LD40/LD40L

(Current output)

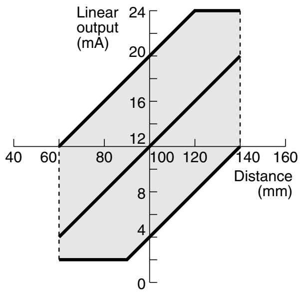


(Voltage output)

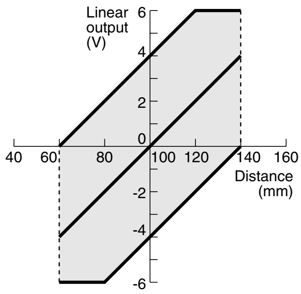


ZX-LD100/LD100L

(Current output)

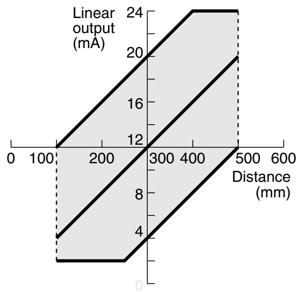


(Voltage output)

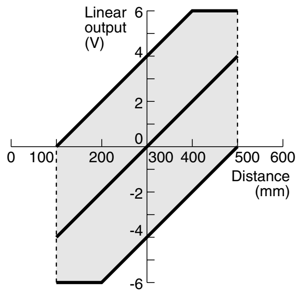


ZX-LD300/LD300L

(Current output)

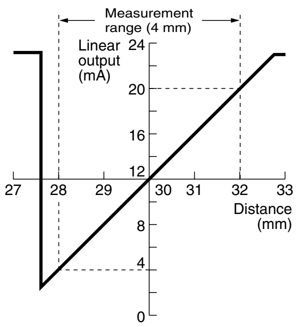


(Voltage output)

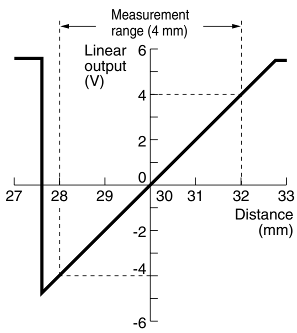


ZX-LD30V/LD30VL

(Current output)



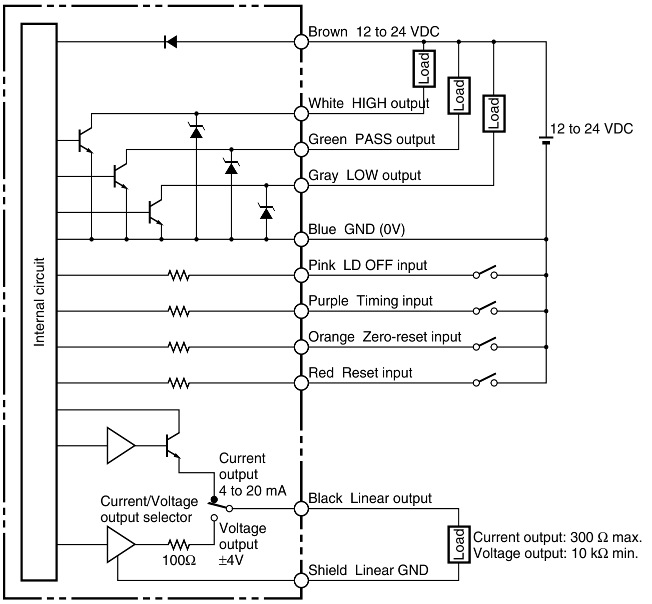
(Voltage output)



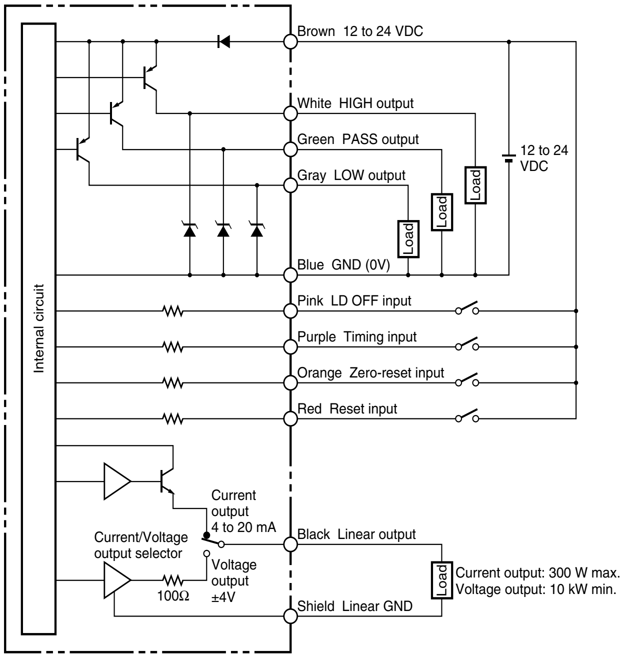
ZX-L

Input/output stage circuit schematic

NPN type: ZX-LDA11

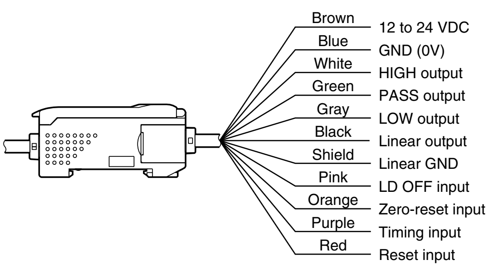


PNP type: ZX-LDA41



Connection

Amplifier Units

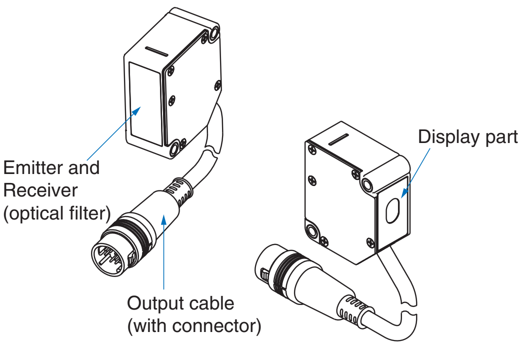


Note: 1 . In particular, when high resolution is necessary, provide a stable power source separate from other power systems.
2 . Damage may result if not wired correctly. (In particular, do not allow the linear output to contact other wires.)
3 . Green (0 V) is for the power supply. The outer covering of the shield wire (linear GND) is used for linear output along with the black wire (linear output). Even if you will not be using the linear output, connect the linear GND to GND (0 V).

Nomenclature:

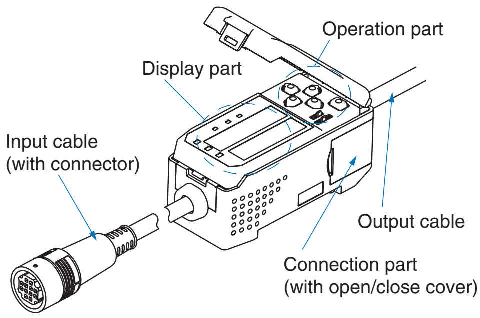
Sensor head (reflection type)

ZX-LD40
ZX-LD100
ZX-LD300
ZX-LD40L
ZX-LD100L
ZX-LD300L
ZX-LD30V
ZX-LD30VL



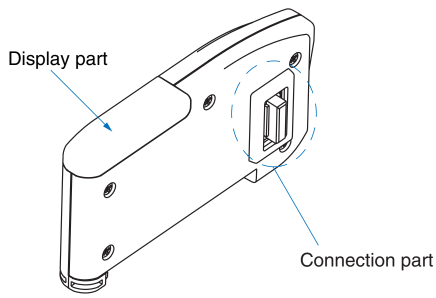
Amplifier Units

ZX-LDA11
ZX-LDA41



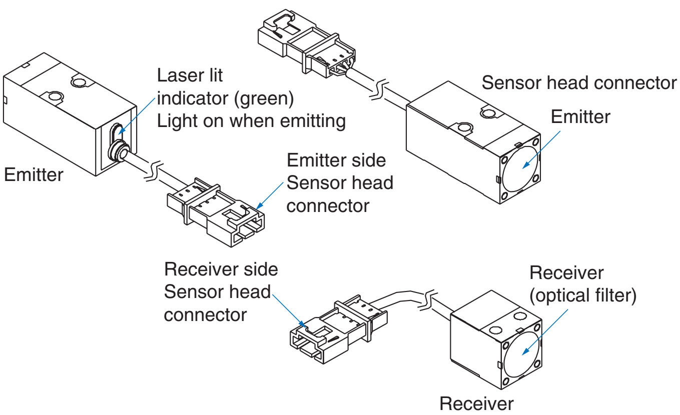
Computing unit

ZX-CAL-2



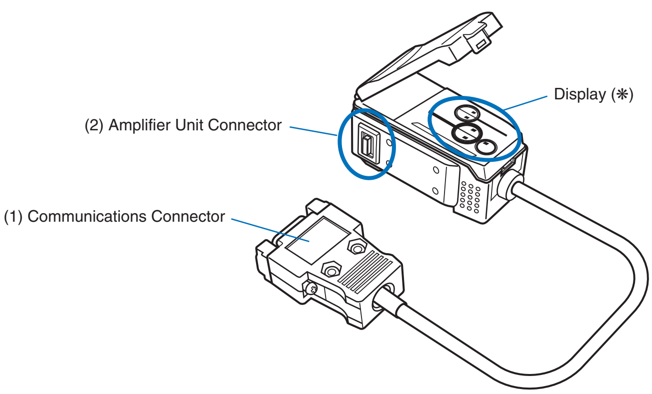
Sensor head (transmissive type)

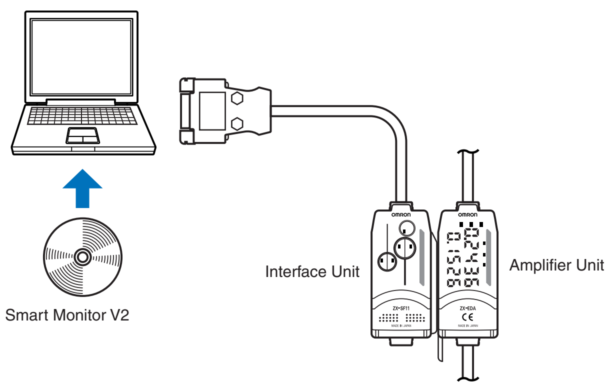
ZX-LT001
ZX-LT005
ZX-LT010



Communication interface

ZX-SF 11





Precautions

⚠ Warning

Laser safety

Safety measures are required for laser devices both in Japan and abroad. Brief explanations of three cases are given below, including use in Japan and assembling in Japan and then exporting to other countries.

Europe

The ZX-L-Series Sensor Heads are Class 1 and Class 2 Laser Products according to EN 60825-1 (IEC825-1).
(The outline is given in the following table.)

Summary of user precautions

Requirements subclause	Classification						
	Class 1	Class 1M	Class 2	Class 2M	Class 3R	Class 3B	Class 4
Laser safety iffucer 10.1	Not required but recommended for applications that involve direct viewing of the laser beam				Not required for visible emission Required for non-visible emission	Required	
Remote interlock 10.2	Not required					Connect to room or door circuits	
Key control 10.3	Not required					Remove key when not in use	
Beam attenuator	Not required					When in use prevents inadvertent exposure	
Emission indicator device	Not required				Indi cates laser is energized for nonvisible wave-lenghts	Indicates laser is energized	
Warning signs 10.5	Not required					Follow precautions on warning signs	
Beam path 10.6	Not required	Class 1M *1 as for Class 3B	Not required	Class 2M *2 as for Class 3B	Terminate beam at end of useful length		
Specular reflection 10.7	No requirements	Class 1M *1 as for Class 3B	No requirements	Class 2M *2 as for Class 3B	Prevent unintentional reflections		
Eye protection 10.8	No requirements					Required if engineering and administrative procedures not practicable and MPE exceeded	
Protective clothing 10.9	No requirements					Sometimes required	Specific requirements
Training 10.10	No requirements	Class 1M *1 as for Class 3R	No requirements	Class 2M *2 as for Class 3R	Required for all operator and maintenance personnel		

*1. Class 1M laser products that failed condition 1 of table 10. Not required for Class 1M laser products that failed condition 2 of table 10.
*2. Class 2M laser products that failed condition of table 10. Not required for Class 2M laser products that failed condition 2 of table 10.

Note: This table is intended to provide a convenient summary of precautions. See text of this standard for complete precautions.

ZX-LD□□□/ZX-LD30V□

Classification of reflective-type sensor heads

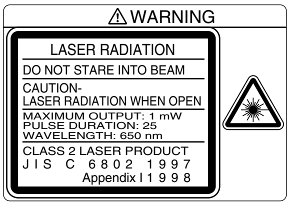
Class 2

Classification of reflective-type sensor head of ZX-LT□□□

Class 1

Laser-related labeling

The warning label at right is attached to the side of the sensor head.



Handing Instructions

The ZX-LD□□□/ZX-LD30V□ emits visible laser light. Do not look directly at the light. Terminate the light path of the laser beam before use. If a reflective mirror surface is in the light path, ensure that the reflected light path is enclosed in the beam. In cases where the light path must be open, ensure that it is kept away from eye-height.

(U.S.A.)

Exports of products equipped with this device to the U.S.A. are governed by the laser standards of the Food and Drug Administration of the U.S.A.
The ZX-L-Series Laser Series is classified as Class I and Class II device according to FDA (21 CFR1040.10).
Please inquire for detailed information on exporting to the U.S.A..

(Countries other than the U.S.A.)

- ZX-LD□□/ZX-LD30V@ reflective-type (displacement) sensor head: In countries other than Japan and the U.S.A., replace the warning label with the provided English label.
- For the ZX-LT□□□ transmissive-type (displacement) sensor head, the warning label already includes English, thus replacement is not necessary.
- With respect to exports to Europe, a different standard exists, Europe EN60825.

Correct Use

Design

Object

Some object materials and forms may not permit measurement, or may reduce the accuracy of measurement (transparent materials or materials with an extremely low reflectance; steeply inclined objects, etc.).

Power Supply and Wiring

- Do not connect or disconnect the connector while powered. Damage may result.
- Allow the system to warm up for about 10 minutes after turning on the power.
- Upon completed wiring, verify that the power source is wired correctly, that there are no incorrect connections that will cause load shorts, and that the load current is appropriate before turning on the power. Incorrect wiring may result in damage.
- When extending the cable, ensure that the overall length does not exceed 10 m from both the sensor head and the amplifier unit. If you need to extend the cable from the sensor head, use the optional extension cable (ZX-XC□A). For wiring from the amplifier unit, use the same type of shielded cable.
- If the power line is subject to surges, connect a surge protector.
- If you are using a computing unit, connect the linear GND terminals of the amplifier units.

Compatibility

The sensor head and amplifier unit are compatible. A sensor head purchased later can also be used.

Mutual Interference

This sensor head allows the amplifier units to be used in conjunction by connecting a computing unit (ZX-CAL) between the amplifier units.

Cleaning

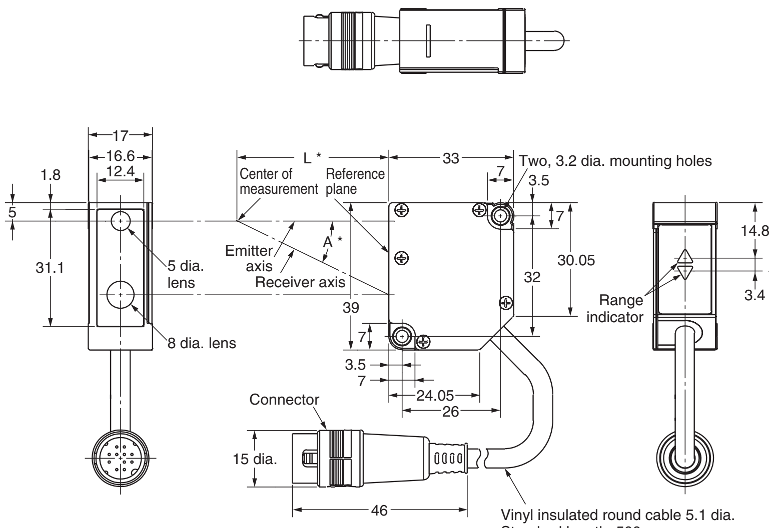
Do not use thinner, benzene, acetone, or kerosene, or similar chemicals.

Dimensions (Unit: mm)

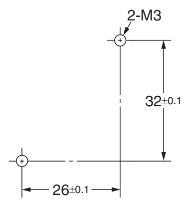
Sensors

Sensor head (diffuse reflection type)

ZX-LD40
ZX-LD100
ZX-LD300
ZX-LD40L
ZX-LD100L
ZX-LD300L



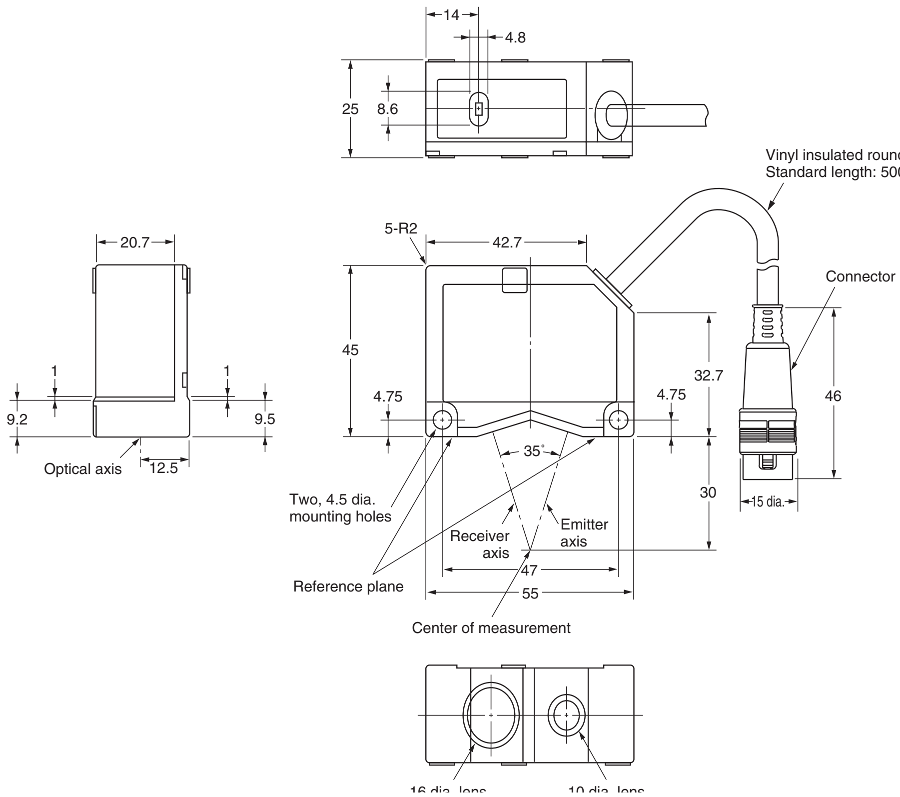
Mounting Holes



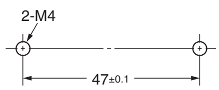
* ZX-LD40 (L) : L=40, A=23°
ZX-LD100 (L) : L=100, A=11°
ZX-LD300 (L) : L=300, A=3.8°

Sensor head (regular reflection type)

ZX-LD30V
ZX-LD30VL

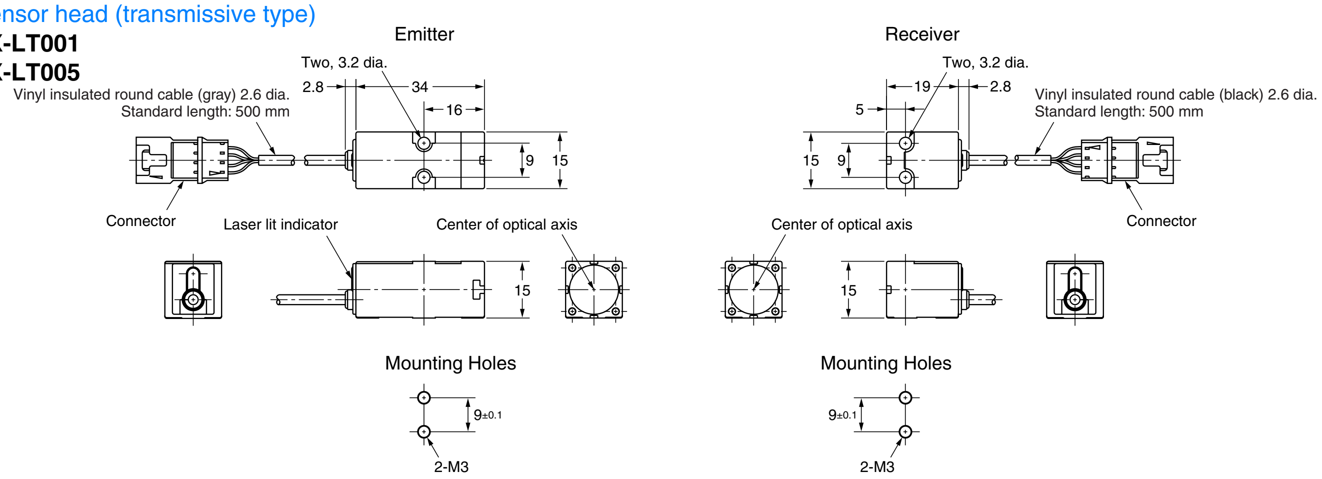


Mounting Holes



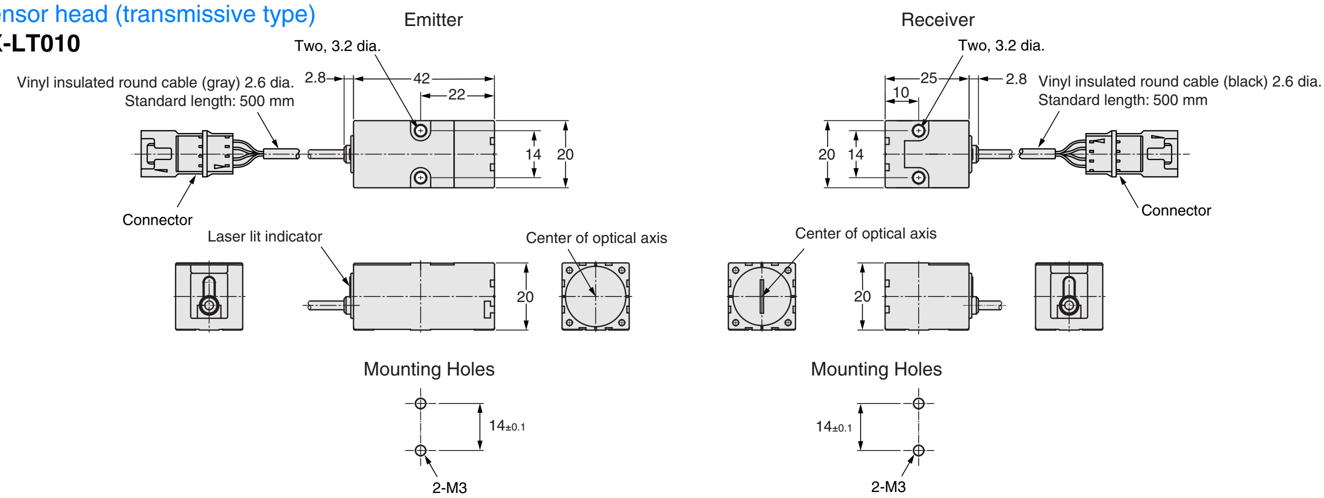
Sensor head (transmissive type)

ZX-LT001
ZX-LT005



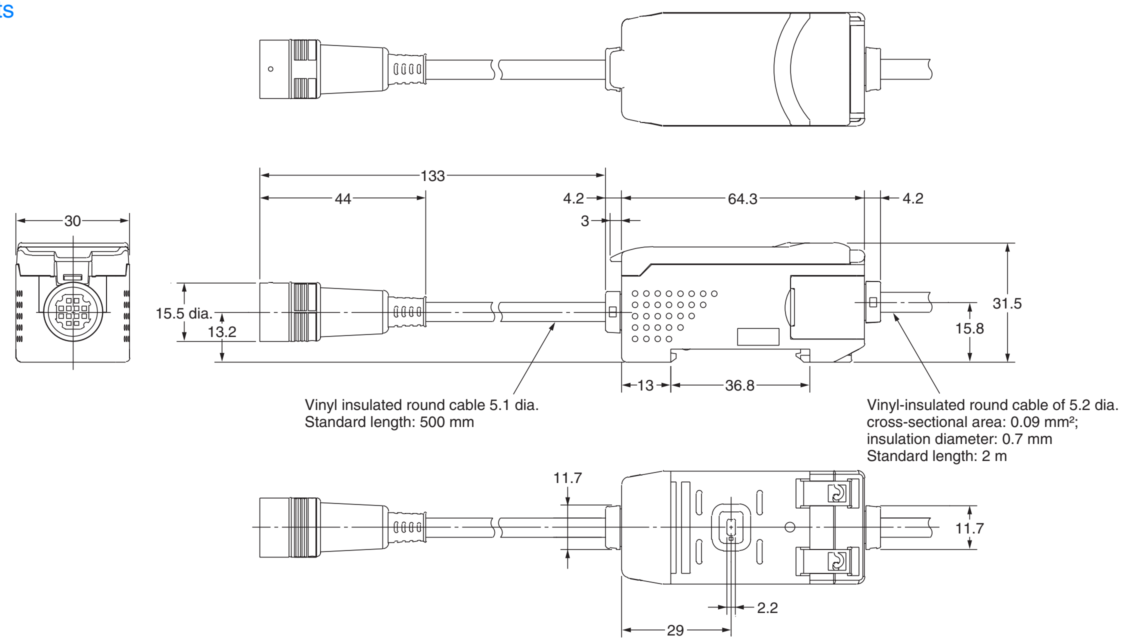
Sensor head (transmissive type)

ZX-LT010



Amplifier Units

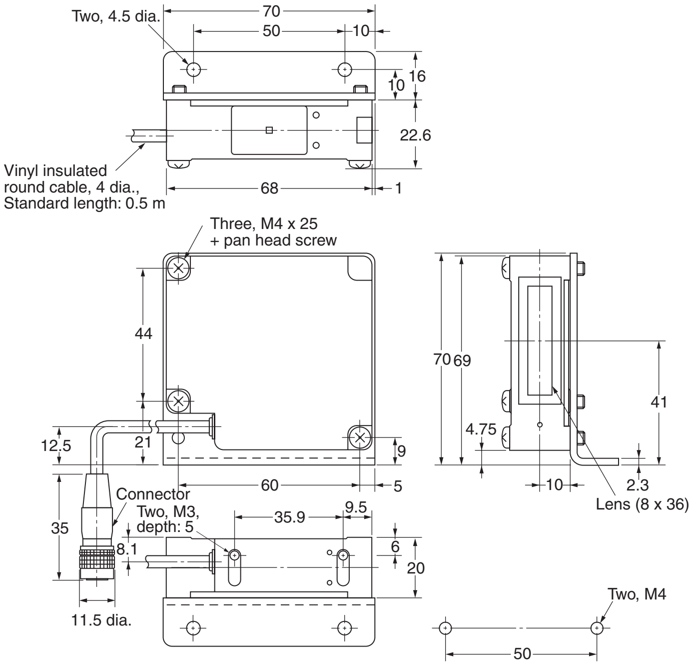
ZX-LDA11
ZX-LDA41



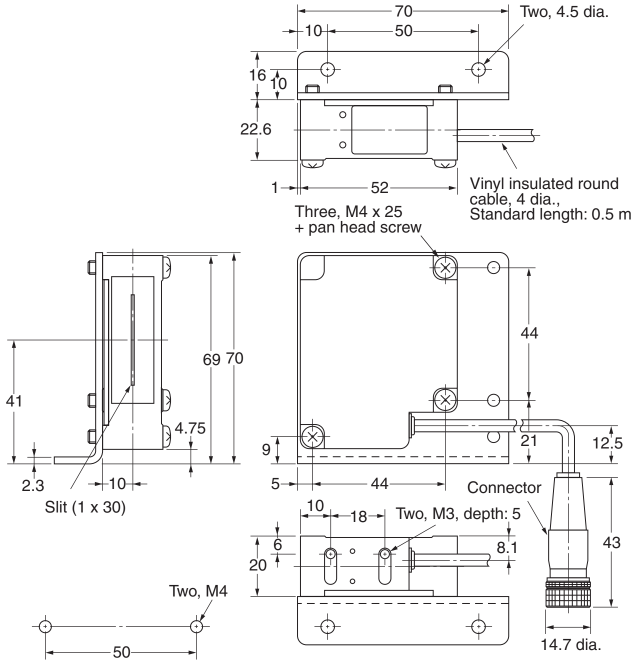
Sensor heads

ZX-LT030

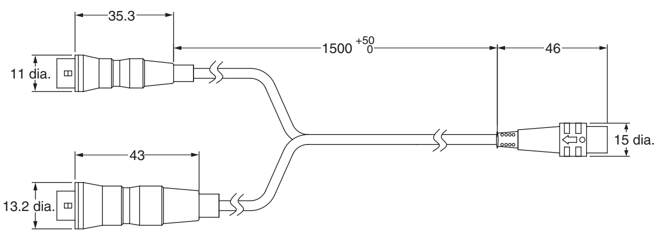
Emitter



Receiver

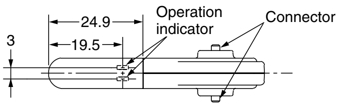


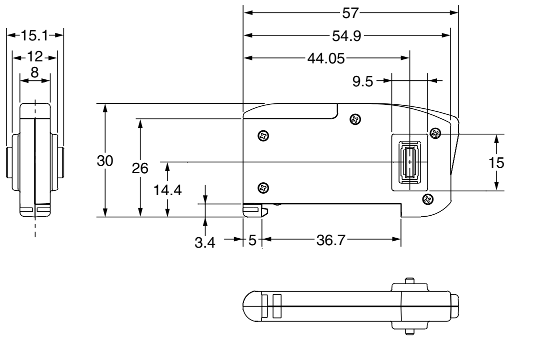
■ Sensor Head - Amplifier Connection Cable



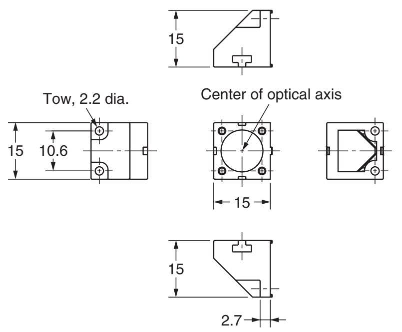
Accessories (Order Separately)

Computing unit
ZX-CAL2

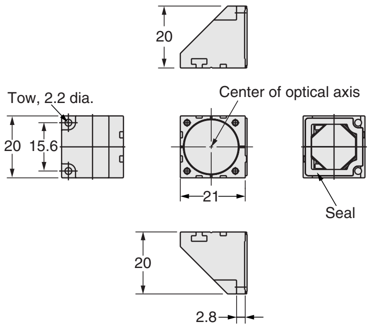




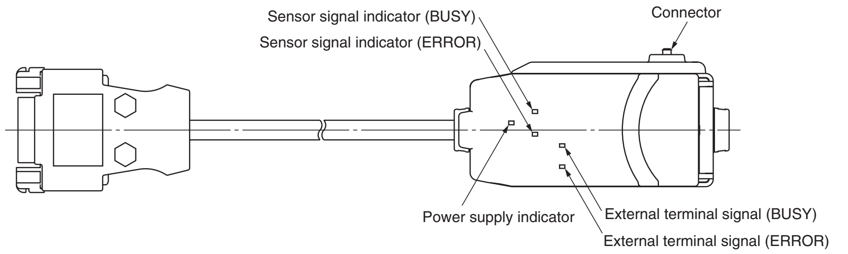
Side view attachment
ZX-XF12

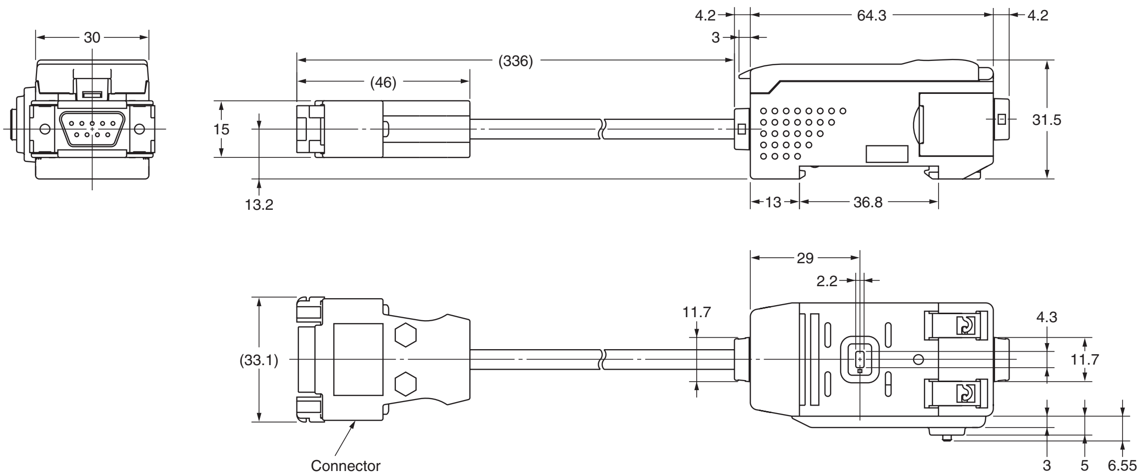


Side view attachment
ZX-XF22

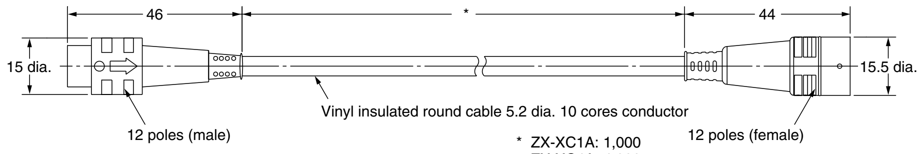


Communication interface unit for ZX
ZX-SF11





Two-sided connector cable (for extension)
ZX-XC1A (1 m)
ZX-XC4A (4 m)
ZX-XC8A (8 m)
ZX-XC9A (9 m)



* ZX-XC1A: 1,000
ZX-XC4A: 4,000
ZX-XC8A: 8,000
ZX-XC9A: 9,000

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

2D CMOS Laser Measuring Sensor

ZS-L Series

The smart way to get higher performance and more flexibility for your process.

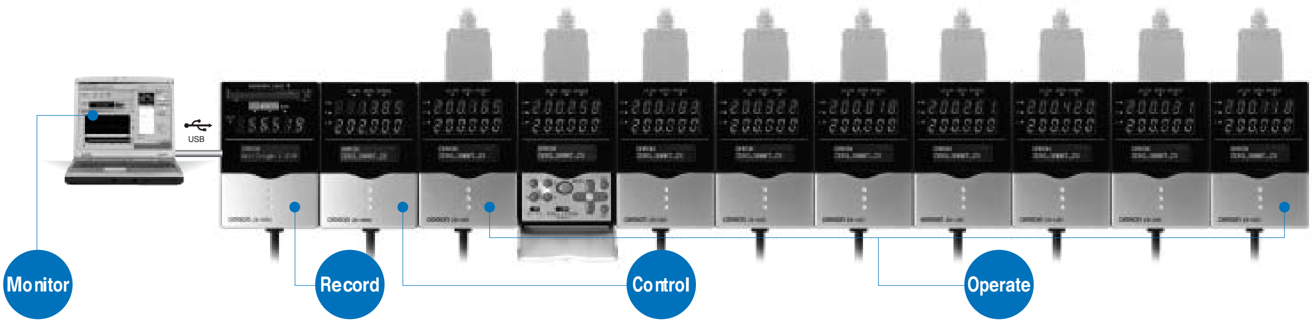
Features

The scalable platform for more flexibility

- Connect and expand up to 9 controllers
- Connect Multi-calculation controller for advanced calculations like evenness or flatness
- Connect Data storage module for process-data logging
- Connect PC software for easy system set up and signal monitoring
- Sensor head with 2D-CMOS technology with high dynamic sensing range for measuring black rubber, plastic, shiny, glass and mirrow surfaces
- Advanced application settings
- Easy reconfiguration and teaching

Measurement Tools:

- Hight measurement
- Step measurement
- Thickness measurement
- Flatness measurement
- Average measurement
- Excentricity
- Warpage/Evenness



Ordering Information

Sensors

Sensor Heads

Optical System	Sensing distance	Beam diameter	Resolution[*1]	Model
Diffuse reflection	50 ± 5 mm	900 x 60 µm	0.8 µm	ZS-LD50
	80 ± 15 mm	900 x 60 µm	2 µm	ZS-LD80
	200 ± 50 mm	900 x 100 µm	5 µm	ZS-LD200
Regular reflection	20 ± 1 mm	900 x 25 µm	0.25 µm	ZS-LD20T
	40 ± 2.5 mm	2,000 x 35 µm	0.4 µm	ZS-LD40T

*1. This is the peak-to-peak displacement conversion value in the displacement output at the measuring center distance in high-precision mode when the number of samples to average is set to 128 and the measuring mode is set to the high-resolution mode. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode.

Sensor Controllers

Shape	Supply Voltage	Control outputs	Model
	24 VDC	NPN outputs	ZS-LDC11
		PNP outputs	ZS-LDC41

Multi Controllers

Shape	Supply Voltage	Control outputs	Model
	24 VDC	NPN outputs	ZS-MDC11
		PNP outputs	ZS-MDC41

Data Storage Units

Shape	Supply Voltage	Control outputs	Model
	24 VDC	NPN outputs	ZS-DSU11
		PNP outputs	ZS-DSU41

Accessories (Sold Separately)

Controller Link

Shape	Model
	ZS-XCN

Panel Mount Adapter

Shape	Model	
	ZS-XPM1	For 1st Controller
	ZS-XPM2	For expansion (from 2nd Controller on

RS-232C Cable for Connecting to a Personal Computer

Shape	Model	Qty
	ZS-XRS2	1

Extension Cables for Sensor Heads

Cable length	Model	Qty
1 m	ZS-XC1A	1
4 m	ZS-XC4A	1
5 m	ZS-XC5B[*1,*2]	1
8 m	ZS-XC8A	1
10 m	ZS-XC10B[*1]	1

*1. Up to two ZS-XC□B Cables can be connected (22 m max.).
*2. A Robot Cable (ZS-XC5BR) is also available.

Logging Software

Name	Model
Smart Monitor Zero Professional	ZS-SW11E

Memory Card

Model	Model
F160-N64S(S)	64 MB
QM300-N128S	128 MB
F160-N256S	256 MB

Specifications

Sensor Heads

Item / Model	ZS-LD20T		ZS-LD40T		ZS-LD50		ZS-LD80		ZS-LD200	
Applicable Controllers	ZS-LDC Series									
Optical system	Regular reflection	Diffuse reflection	Regular reflection	Diffuse reflection	Diffuse reflection	Regular reflection	Diffuse reflection	Regular reflection	Diffuse reflection	Regular reflection
Measuring center distance	20 mm	6.3 mm	40 mm	30 mm	50 mm	47 mm	80 mm	78 mm	200 mm	200 mm
Measuring range	±1 mm	±1 mm	±2.5 mm	±2 mm	±5 mm	±4 mm	±15 mm	±14 mm	±50 mm	±48 mm
Light source	Visible semiconductor laser (wavelength: 650 nm, 1 mW max., Class 2)									
Beam diameter*1	900 x 25 μm		2,000 x 35 μm		900 x 60 μm		900 x 60 μm		900 x 100 μm	
Linearity*2	±0.1% F.S.									±0.25% F.S.
Resolution*3	0.25 μm		0.4 μm		0.8 μm		2 μm		5 μm	
Temperature characteristic*4	0.04% F.S./°C		0.02% F.S./°C		0.02% F.S./°C		0.01% F.S./°C		0.02% F.S./°C	
Sampling cycle*5	110 μs									
Indicators: NEAR indicator	Lights near the measuring center distance, and nearer than the measuring center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.									
Indicators: FAR indicator	Lights near the measuring center distance, and further than the measuring center distance inside the measuring range. Flashes when the measurement target is outside of the measuring range or when the received light amount is insufficient.									
Operating ambient illumination	Illumination on received light surface: 3,000 lx or less (incandescent light)									
Ambient temperature	Operating: 0 to 50°C, Storage: –15 to 60°C (with no icing or condensation)									
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)									
Degree of protection	Cable length 0.5 m: IP66, cable length 2 m: IP67									
Materials	Case: Aluminum die-cast, Front cover: Glass									
Cable length	0.5 m, 2 m									
Weight	Approx. 350 g									
Accessories	Laser labels (1 each for JIS/EN, 3 for FDA), Ferrite cores (2), Insure Locks (2), Instruction Sheet									

*1. Defined as $1/e^2$ (13.5 %) of the center optical intensity at the actual measurement center distance (effective value). The beam diameter is sometimes influenced by the ambient conditions of the workpiece, such as leaked light from the main beam.

*2. This is the error in the measured value with respect to an ideal straight line. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode of the ZS-LD20T/40T/50. Linearity may change according to the workpiece.

*3. This is the peak-to-peak displacement conversion value in the displacement output at the measuring center distance in high-precision mode when the number of samples to average is set to 128 and the measuring mode is set to the high-resolution mode. The standard workpiece is white aluminum ceramics in diffuse reflection mode and glass in the regular reflection mode.

*4. This is the value obtained at the measuring center distance when the Sensor and workpiece are fixed by an aluminum jig.

*5. This value is obtained when the measuring mode is set to the high-speed mode.

Sensor Controllers

ZS-LDC11/LDC41

Sensor Controllers		Model	ZS-LDC11	ZS-LDC41
No. of samples to average			1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096	
Number of mounted Sensors			1 per Sensor Controller	
External interface	Connection method		Serial I/O: connector, Other: pre-wired (standard cable length: 2 m)	
	Serial I/O	USB 2.0	1 port, Full Speed (12 Mbps), MINI-B	
		RS-232C	1 port, 115,200 bps max.	
	Outputs	Judgement outputs	3 outputs: HIGH, PASS, and LOW NPN open-collector, 30 VDC, 50 mA max., residual voltage: 1.2 V max.	3 outputs: HIGH, PASS, and LOW PNP open-collector, 50 mA max., residual voltage: 1.2 V max.
		Linear outputs	Selectable from 2 types of output, voltage or current (selected by slide switch on base). Voltage output: –10 to 10 V, output impedance: 40 . Current output: 4 to 20 mA, maximum load resistance: 300 .	
	Inputs	Laser OFF, ZERO reset timing, RESET	ON: Short-circuited with 0V terminal or 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)	ON: Short-circuited to supply voltage or within 1.5 V of supply voltage OFF: Open (leakage current: 0.1 mA max.)
Functions			Display: Measured value, threshold value, voltage/current, received light amount, and resolution Sensing: Mode, gain, measurement object, head installation Filter: Smooth, average, and differentiation Outputs: Scaling, various hold values, and zero reset I/O settings: Linear (focus/correction), judgements (hysteresis and timer), non-measurement, and bank (switching and clear) System: Save, initialization, measurement information display, communications settings, key lock, language, and data load	
Status indicators			HIGH (orange), PASS (green), LOW (orange), LDON (green), ZERO (orange), and ENABLE (green)	
Segment display		Main display	8-segment red LED, 6 digits	
		Sub-display	8-segment green LED, 6 digits	
LCD			16 digits x 2 rows, Color of characters: green, Resolution per character: 5 x 8 pixel matrix	
Setting inputs		Setting keys	Direction keys (UP, DOWN, LEFT, and RIGHT), SET key, ESC key, MENU key, and function keys (1 to 4)	
		Slide switch	Threshold switch (2 states: High/Low), mode switch (3 states: FUN, TEACH, and RUN)	
Power supply voltage			21.6 V to 26.4 VDC (including ripple)	

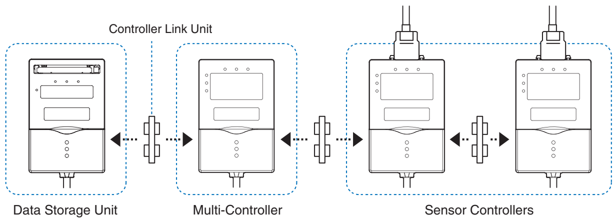
Sensor Controllers Model	ZS-LDC11	ZS-LDC41
Current consumption	0.5 A max. (when Sensor Head is connected)	
Ambient temperature	Operating: 0 to 50°C, Storage: –15 to 60°C (with no icing or condensation)	
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)	
Materials	Case: Polycarbonate (PC)	
Weight	Approx. 280 g (excluding packing materials and accessories)	
Accessories	Ferrite core (1), Instruction Sheet	

ZS-MDC11/MDC41 Multi-Controllers

Basic specifications are the same as those for the Sensor Controllers.
The following points, however, are different.
(1) Sensor Heads cannot be connected.
(2) A maximum 9 of Controllers can be connected. Control Link Units are required to connect Controllers.
(3) Processing functions between Controllers: Math functions

Controller Link Unit

Connection Using the ZS-XCN



Data Storage Units

Sensor Controllers Model			ZS-DSU11	ZS-DSU41
Number of mounted Sensor Heads			Cannot be connected	
Number of connectable Controllers			10 Controllers max. (ZS-MDC: 1 Controller, ZS-LDC: 9 Controllers max.)[*1]	
Connectable Controllers			ZS-LDC□□, ZS-MDC□□	
External interface	Connection method		Serial I/O: connector, Other: pre-wired (standard cable length: 2 m)	
	Serial I/O	USB 2.0	1 port, Full Speed (12 Mbps), MINI-B	
		RS-232C	1 port, 115,200 bps max.	
	Outputs		3 outputs: HIGH, PASS, and LOW NPN open-collector, 30 VDC, 50 mA max., residual voltage: 1.2 V max.	3 outputs: HIGH, PASS, and LOW PNP open-collector, 50 mA max., residual voltage: 1.2 V max.
	Inputs		ON: Short-circuited with 0V terminal or 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)	ON: Short-circuited to supply voltage or within 1.5 V of supply voltage OFF: Open (leakage current: 0.1 mA max.)
Data resolution			32 bits	
Functions	Logging trigger functions		Start and stop triggers can be set separately; external triggers, data triggers (self-triggers), and time triggers	
	Other functions		External banks, alarm outputs, saved data format customization, and clock	
Status indicators			OUT (orange), PWR (green), ACCESS (orange), and ERR (red)	
Segment display			8-segment green LEDs, 6 digits	
LCD			16 digits x 2 rows, Color of characters: green, Resolution per character: 5 x 8 pixel matrix	
Setting inputs		Setting keys	Direction keys (UP, DOWN, LEFT, and RIGHT), SET key, ESC key, MENU key, and function keys (1 to 4)	
		Slide switch	Threshold switch (2 states: High/Low), mode switch (3 states: FUN, TEACH, and RUN)	
Power supply voltage			21.6 V to 26.4 VDC (including ripple)	
Current consumption			0.5 A max.	
Ambient temperature			Operating: 0 to 50°C, Storage: –15 to 60°C (with no icing or condensation)	
Ambient humidity			Operating and storage: 35% to 85% (with no condensation)	
Materials			Case: Polycarbonate (PC)	
Weight			Approx. 280 g (excluding packing materials and accessories)	
Accessories			Ferrite core (1) Instruction Sheet, Tools for Data Storage Unit: CSV File Converter for Data Storage Unit, Smart Analyzer Macro Edition (Excel macros for analysis of collected data)	

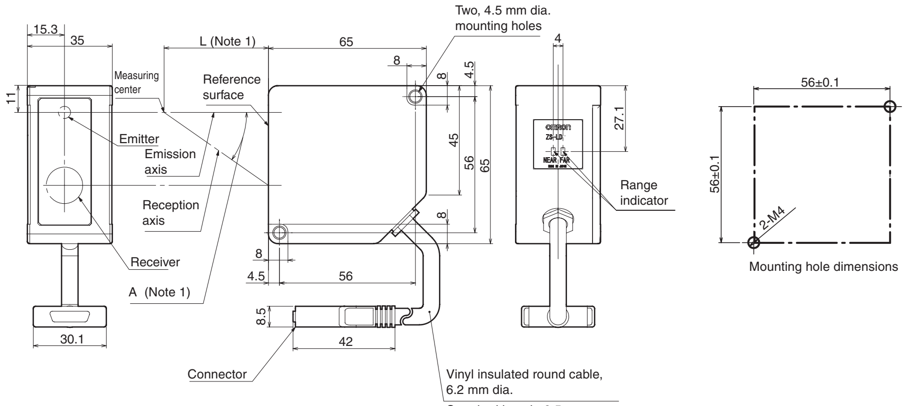
[*1] Control Link Units are required to connect Controllers.

Dimensions

Unit: mm

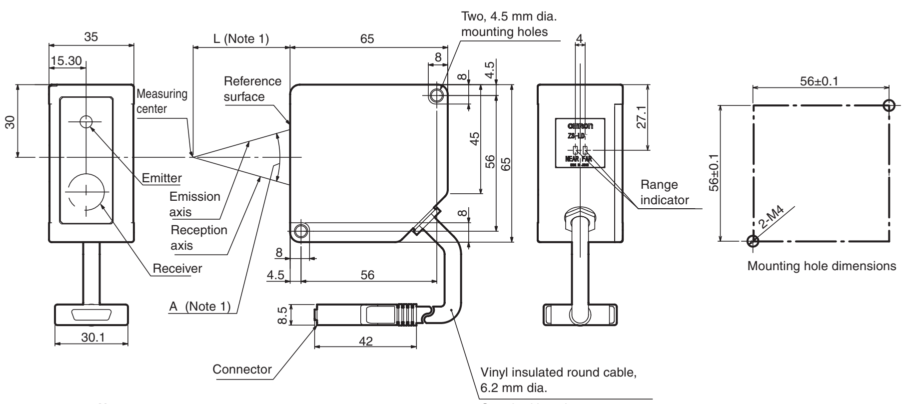
Sensor Heads

ZS-LD50/LD80/LD200



Note 1 ZS-LD50: L = 50, A = 25º
ZS-LD80: L = 80, A = 15º
ZS-LD200: L = 200, A = 8º

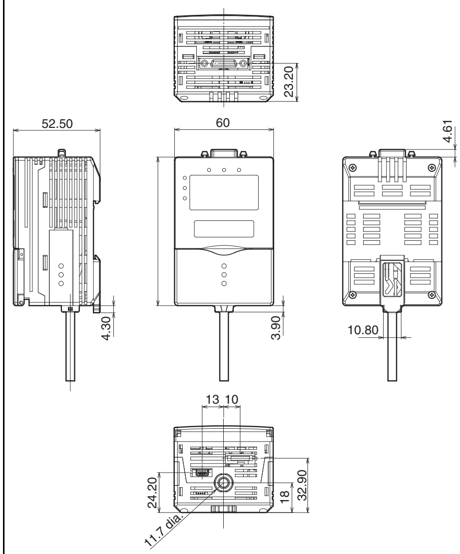
ZS-LD20T/LD40T



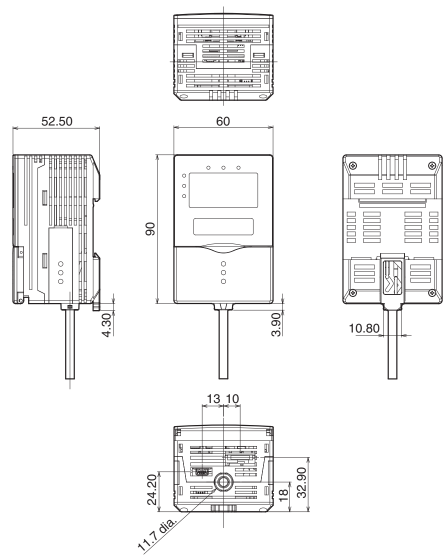
Note 1 ZS-LD20T: L = 20, A = 45º
ZS-LD40T: L = 80, A = 15º

Sensor Controllers

ZS-LDC11/LDC41

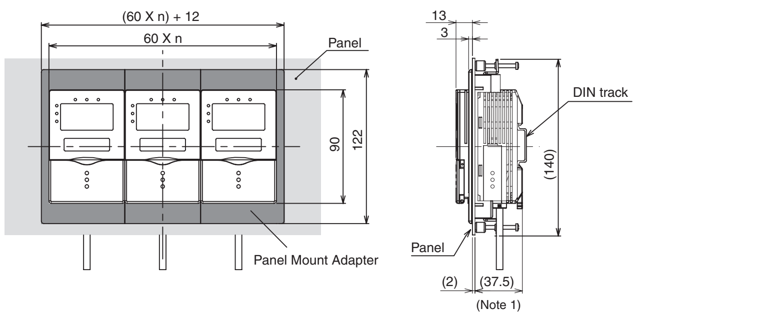


ZS-MDC11/MDC41 Multi-Controllers

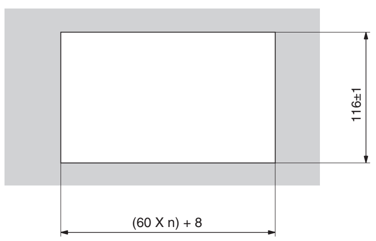


Panel Mount Adapters

ZS-XPM1/XPM2 (Dimension for Panel Mounting)



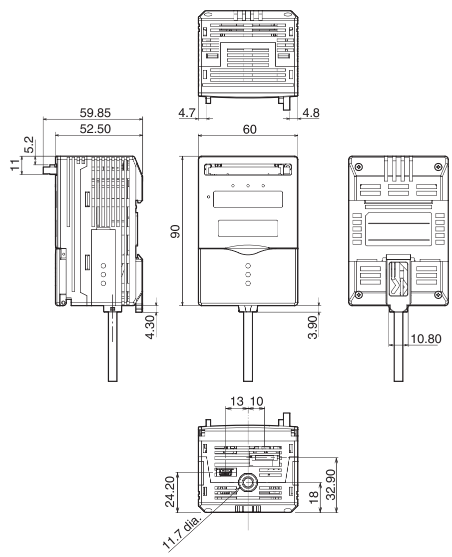
Panel cutout dimensions



Note 1: Dimensions are shown for a panel thickness of 2.0 mm.
n: Number of gang-mounted Controllers (1 to 11)

Data Storage Unit

ZS-DSU11/DSU41



ZS-L Series

Safety Precautions for Using Laser Equipment

Laser Label Indications

Attach the following warning label to the side of the ZS-L-series Sensor Head.

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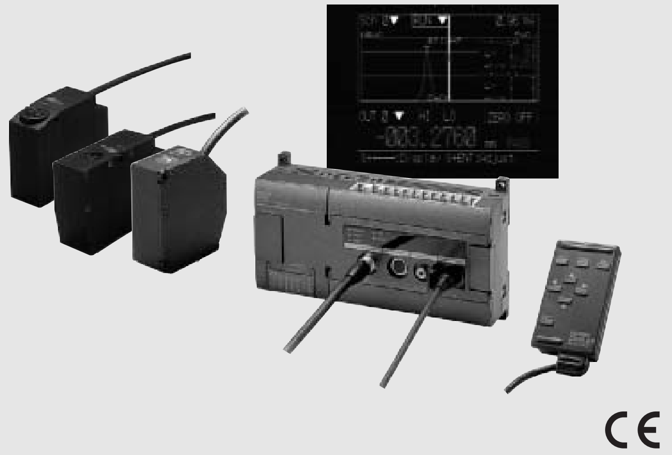
Cat. No. Z215-E2-01A-X In the interest of product improvement, specifications are subject to change without notice.

omron

High-precision Visual Displacement Measurement System

Z300

2-Dimensional CCD is Built in. A New Type of Displacement Sensor Utilizing the Best and Most Up-to-date Image Processing Technologies.



Z300

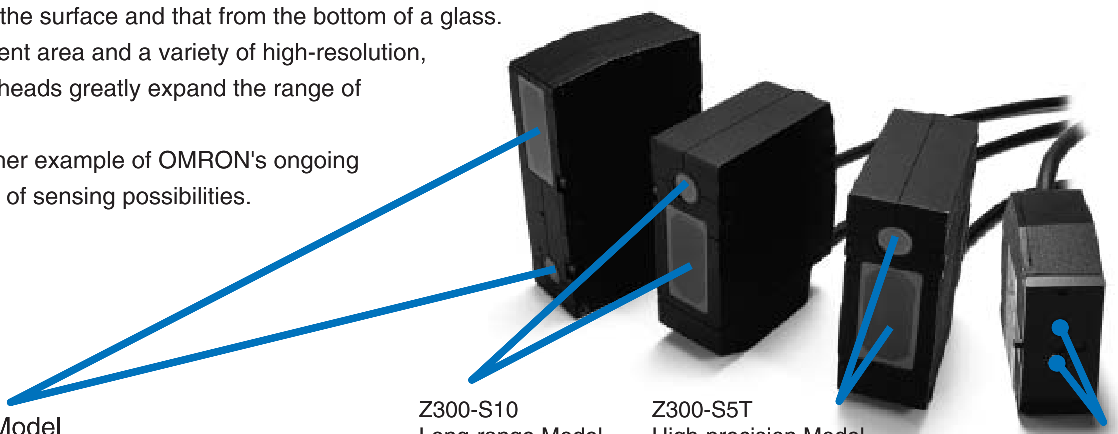
Features

Stable measurement of a transparent object or a glass.
A wide variety of sensor heads for enhanced detection possibilities.

OMRON's Z300 makes the notion that displacement sensors cannot perform stable measurement of a transparent object or a glass a thing of the past. The newly-developed 2-dimensional CCD (S-CCD) incorporated in the Z300, combined with upgraded performance of the controller, provides enhanced stability and accuracy in measurement of a transparent object. The latest algorithm employed by the Z300 enables optimal sensitivity even if there is a big difference between the amount of reflected light from the surface and that from the bottom of a glass.

Enhanced measurement area and a variety of high-resolution, long-distance sensor heads greatly expand the range of applications.

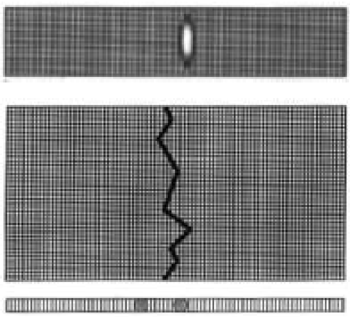
The Z300 is just another example of OMRON's ongoing challenge to the limits of sensing possibilities.

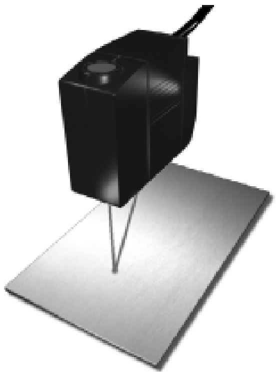


The innovative 2-dimensional CCD (S-CCD) is the key to the sensing performance.

The 2-dimensional CCD enables stable, high-speed measurement.

A conventional displacement sensor using a 1-dimensional CCD cannot deal with flutter influence to the output. Therefore, the sensor requires increased number of measurements for signal averaging, which leads to slow response time. The S-CCD with a 2-dimensional CCD has solved this disadvantage, by splitting the measurement point into 60 lines for measurement in finer detail. The value per each pixel is then averaged to produce a reliable output, free from flutter influence caused by the object's surface condition. Stable detection and high-speed processing is thus possible with the Z300.

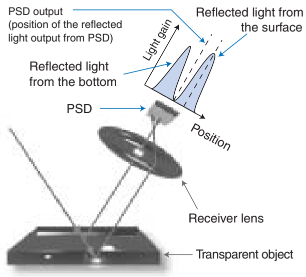




CCD makes a difference in measurement of a transparent object.

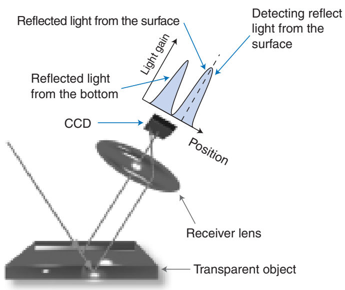
PSD sensor

A PSD sensor using diffuse reflection is virtually prevented from performing measurement due to insufficient reflection distribution from the surface. A sensor using the mirror reflection method, on the other hand, receives reflective light from the bottom or background of the object, which causes an error in determining the target position, impeding accurate measurement.



CCD sensor

A CCD using the mirror reflection method is a solution. It can extract only the light reflected off the surface of the target. Accurate measurement of a transparent object is possible without being affected by reflected light from the bottom or background of the object.



Monitoring as the object is being measured.
Measurement data can be recorded and played back.

Easy-to-see color display is another great feature of the Z300 (when connected to a color monitor). Monitoring at each key stage including test and adjustment, operation, or maintenance greatly facilitates efficient, error-free measurement.

Real-time monitoring

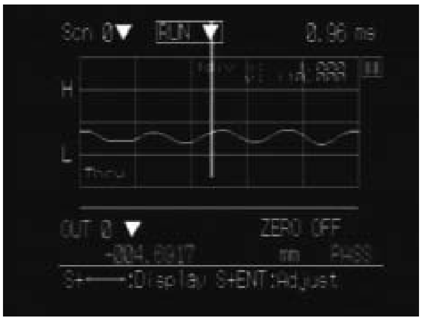
Digital monitor

The measured value is displayed. The use of two colors: green for "Pass" judgement, and red for "High/Low," enhances visual recognition of the measurement result.

Image monitor

Displays the position of measurement point as well as intensity of the reflected light.
Conveniently checks whether optimum measurement is taking place.

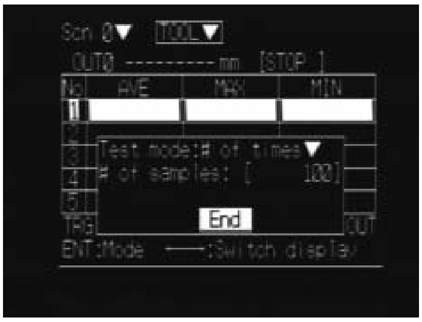
Trend monitor



Continuous measurement values during a certain period of time are shown in chronological order. Changes in the measured values of a moving or rotating object can be checked at a glance.

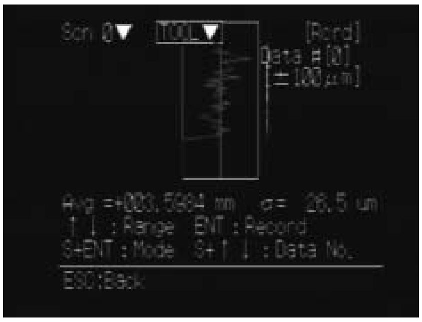
Monitoring during recording and playback

Test mode



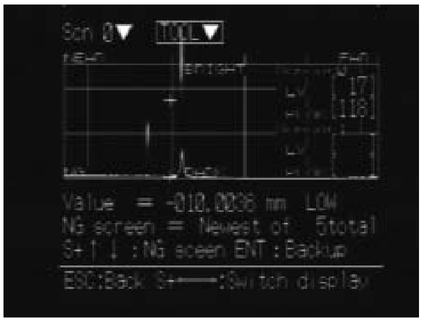
Any desired number of measurement data can be stored for testing with a workpiece.

Conditions during Test mode can be recorded and played back



Test measurement data obtained off-line can be saved for reference for actual in-line measurement.

NG (High/Low) judgement status is recorded and played back.

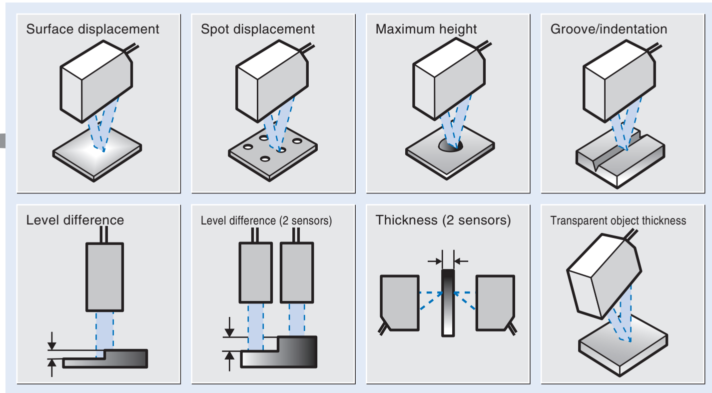


Up to 20 in-line NG data (information including reflected light condition and measurement data) can be recorded for workpiece analysis as well as for troubleshooting.

Interactive menus provide a variety of measurement functions.

Application menu

Settings for measurement methods are easily performed using the menu.
Just follow the guidance of the monitor screen.



Expert menu

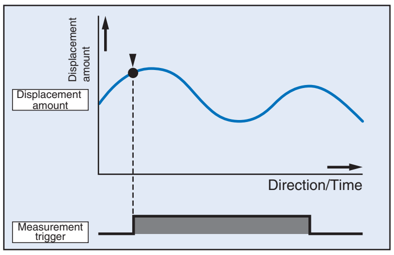
Expert menu is available for more advanced measurement. Detailed setting conditions can be conveniently programmed using the menu.

Enhanced hold functions widen the scope of application.

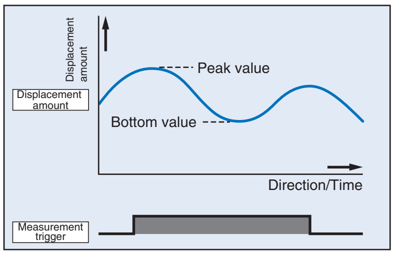
With discrete hold functions equipped within the controller, the Z300 provides a variety of trigger (measurement timing) functions, making otherwise difficult applications a reality — with ease.

Hold functions

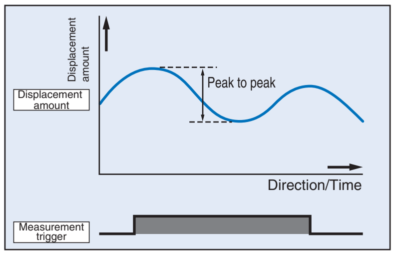
Sampling hold



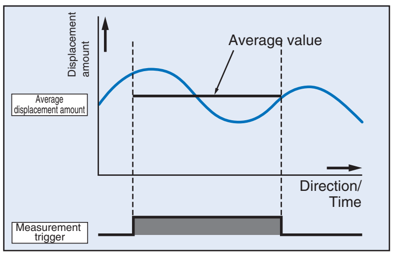
Peak hold (bottom)



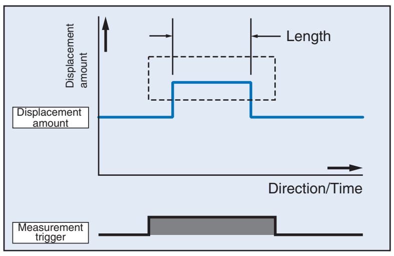
Peak to peak hold



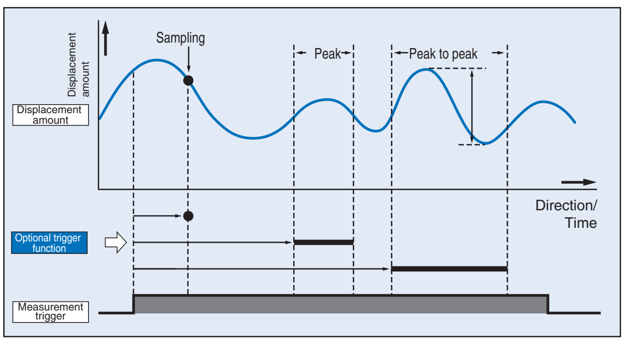
Average hold



Length hold



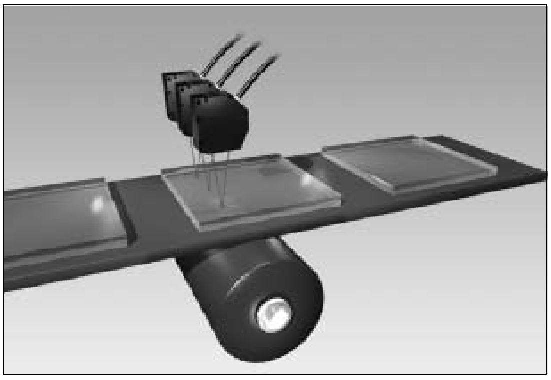
Selectable trigger function



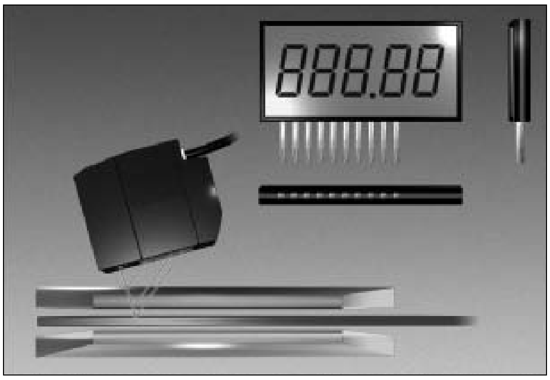
Measurement trigger can be set to the controller for desired measurement timing.

Application

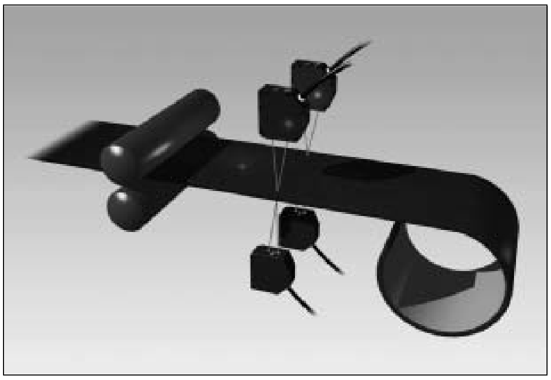
Measuring the thickness of transparent film



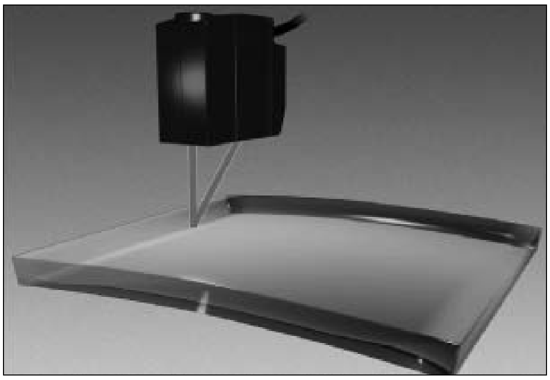
Measurement of electrode position in the display module



Measuring the thickness of sheet

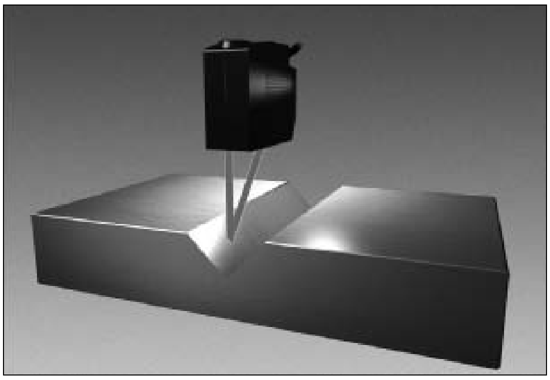


Measurement of warping in transparent plastic

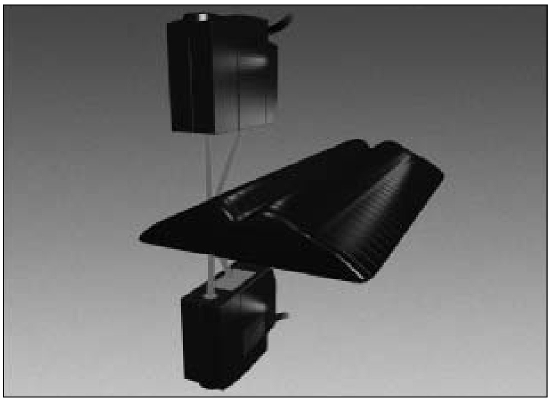


Inspecting the surface uniformity of a hard disk

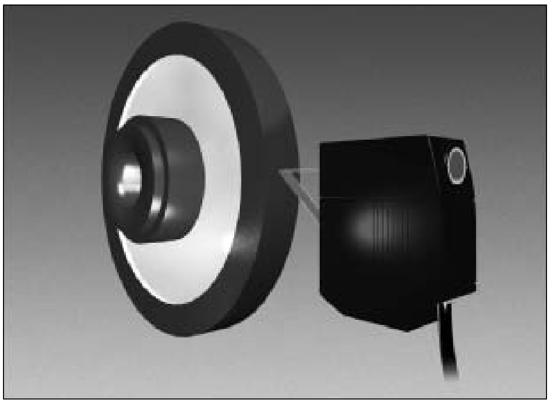
Shape measurement for welding robot control



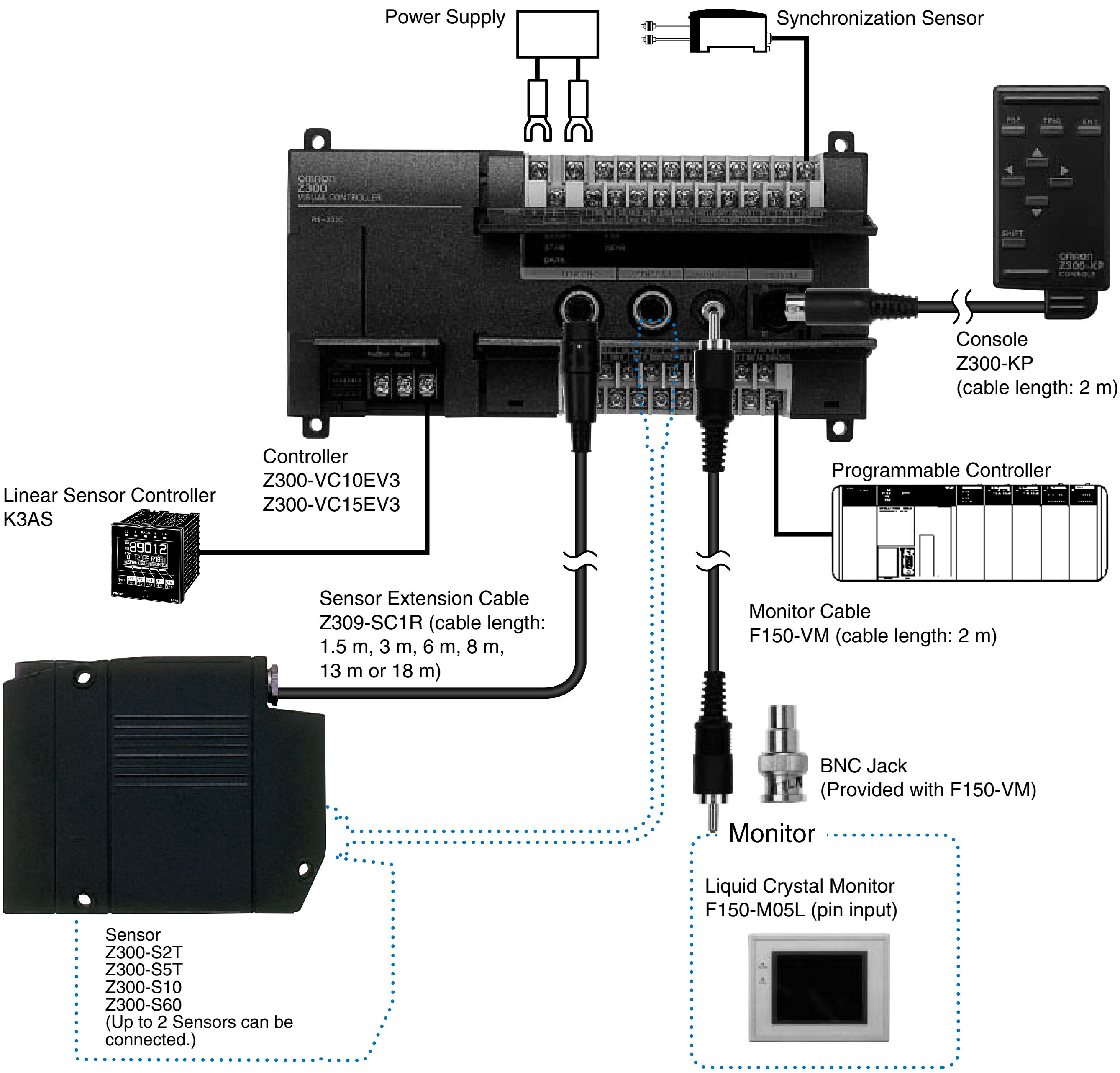
Measuring tire or black rubber thickness



Grinding measurement of a whetstone



System configuration



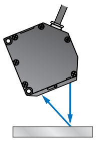
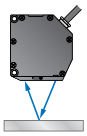
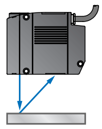
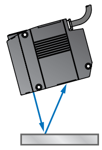
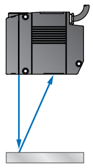
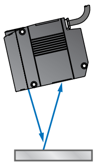
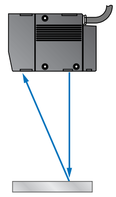
Ordering Information

Name Item	Model	Remarks
Sensor	**Z300-S2T**	
	Z300-S5T	
	Z300-S10	
	Z300-S60	
Controller	**Z300-VC10EV3**	NPN input/output
	Z300-VC15EV3	PNP input/output
Console	**Z300-KP**	
Liquid Crystal Monitor	**F150-M05L**	
Sensor Extension Cable	**Z309-SC1R** (See note)	Cable length: 1.5 m, 3 m, 6 m, 8 m, 13 m or 18 m
Monitor Cable	**F150-VM**	

Note: Specify the required cable length when ordering.

Rating/performance

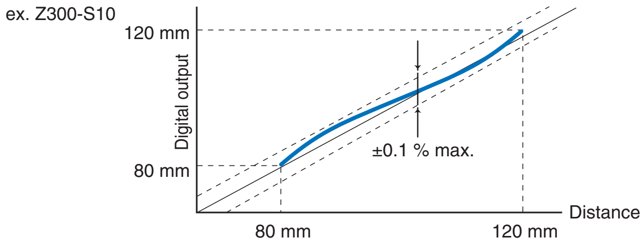
Sensor: Z300-S2T/Z300-S5T/Z300-S10/Z300-S60

Model	Z300-S2T		Z300-S5T		Z300-S10		Z300-S60
Measurement mode	Diffuse reflection	Mirror reflection	Diffuse reflection	Mirror reflection	Diffuse reflection	Mirror reflection	Diffuse reflection only
							
Distance to measurement center	±5.2 mm	20 mm (with beam cover attached: 16 mm)	±50 mm	±44 mm	±100 mm	±94 mm	±600 mm
Measurement range	±1 mm		±5 mm	±4 mm	±20 mm	±16 mm	±350 mm (F.S.700 mm)
Light source	Visible-light semiconductor laser (Wavelength: 650 nm, 1 mW max., Class 2)		Visible-light semiconductor laser (Wavelength: 670 nm, 1 mW max., Class 2)				Visible-light semiconductor laser (Wavelength: 658 nm, 15 mW max., Class 3B)
Beam dimensions (See note 1.)	20 μm × 300 μm (200 μm*) TYP. (distance to measurement center) * Measurement region		30 μm × 400 μm TYP. (distance to measurement center)		60 μm × 1000 μm TYP. (distance to measurement center)		0.3 mm × 16 (10.3*) mm (at 500 mm) * Measurement region
Linearity	±0.05 %F.S. (See note 2.)	±0.05 %F.S. (See note 3.)	±0.1 %F.S. (See note 4.)				±0.07 %F.S. (250 to 750 mm) ±0.1 %F.S. (750 to 950 mm) (See note 4.)
Resolution	0.4 μm (See notes 5 and 6.)		0.4 μm (See notes 7 and 9.)		1 μm (See notes 7 and 8.)		8 μm (at 350 mm) 40 μm (at 600 mm) (See notes 7 and 8.)
Sampling period (See note 10.)	540 μs						
LED indicators: NEAR indicator	Lights if the workpiece is close to the measurement center or is on the near side of the measurement center and inside the measurement region. Flashes if the workpiece is outside the measurement region or if the density is excessive or insufficient.						
LED indicators: FAR indicator	Lights if the workpiece is close to the measurement center or is on the far side of the measurement center and inside the measurement region. Flashes if the workpiece is outside the measurement region or if the density is excessive or insufficient.						
Temperature characteristic (See note 11.)	±0.01 %F.S./°C						
Environment resistance: Degree of protection	IEC IP64		IEC IP67				IEC IP66
Environment resistance: Ambient operating illumination	Illumination at light-receiving surface: 3,000 lx max., incandescent light						
Environment resistance: Ambient temperature	Operating: 0 to +50 °C, Storage: -15 to +60 °C (with no icing or condensation)						
Environment resistance: Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)						
Environment resistance: Vibration resistance	10 to 150 Hz (double amplitude: 0.35 mm) for 8 min. each in X, Y, and Z directions						
Materials	Unit: Die-cast aluminum; Cable sheathing: Heat-resistant chlorinated vinyl Connector: Zinc alloy and brass						
Cable length	2 m						50 cm
Minimum bending radius	68 mm						
Weight	Approx. 600 g (Unit: Approx. 350 g)		Approx. 800 g (Unit: Approx. 600 g)				Approx. 800 g (Unit: Approx. 700 g)
Accessories	3 ferrite cores, laser warning labels (English)						

Note: 1 . Defined at $1/e^2$ (13.5 %) of the density at the light center. Light may, however, be present outside this range and if the reflection factor of the light around the workpiece is high compared to the workpiece, measurement may be affected.

2 . Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard SUS blocks. The linearity varies with the type of workpiece.

3 . Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard quartz glass. The linearity varies with the type of workpiece.
4 . Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard white alumina ceramics. The linearity varies with the type of workpiece.



5 . Displacement conversion value for peak-to-peak of displacement output. These figures are for measurement of OMRON standard quartz glass (mirror reflection mode) or OMRON standard SUS blocks (diffuse reflection) at the measurement center.
In magnetic fields, it may not be possible to maintain resolution performance characteristics.
6 . These figures are for when the Sensor is connected to the Z300-VC10EV3/VC15EV3, the average number of measurements is 256, and M command RS-232C output is used.
7 . Displacement conversion value for peak-to-peak of displacement output (for measurement of OMRON standard white alumina ceramic at the measurement center).
In strong magnetic fields, it may not be possible to maintain resolution performance characteristics.
8 . With the Z300-VC10EV3/VC15EV3, at an average number of measurements of 64.
9 . With the Z300-VC10EV3/VC15EV3, at an average number of measurements of 512.
10. Value for measurement with 1 line (high speed) set in CCD Mode.
11. Value for measurement with the space between the Sensor and the workpiece (Z300-S5T/S10/S60: white alumina ceramic; Z300-S2T: quartz glass) secured with an aluminum jig.

Controller: Z300-VC10EV3/Z300-VC15EV3

Item	mode	VISUAL mode	NON-VISUAL mode
Performance specifications	Number of Sensors that can be mounted	2	1
	Number of scenes	16	1
	Image memory function	NG images: 20 scenes max.; Surrounding images: 4 scenes max.; Workpiece display images: 4 scenes max.	——
	Processing method	Gray center of gravity, edge centering	Edge centering
	Pre-image processing	Noise removal, smoothing	None
	Averaging/filtering	Average number of times (12 stages, 1 to 4096 times), HPF (high pass filter)	Average number of times (SLOW: 64 times; FAST: 1 time)
	Light intensity tracking function	Automatic (The light intensity tracking range can be specified.) Fixed (Select from 32 stages.)	Automatic (The light intensity tracking range can not be specified.) Fixed (Select either HIGH or LOW.)
	Applications	Select from the following 8 types: Surface displacement, spot displacement, maximum height, groove/indentation, level difference, transparent workpiece thickness, level difference (2 Sensors), or thickness (2 Sensors).	——
	Region specification	Region specification of line beam and displacement direction is possible.	——
	Two region measurement modes	Absolute coordinate mode and relative coordinate mode	——
	Hold functions	Sampling, peak, bottom, peak-to-peak, average, and length	——
	Two Sensor measurement modes	Simultaneous measurement and alternate measurement	——
	Measurement data	4 outputs per scene	1 output
	Equations	The following operations are possible for outputs 0 to 3: K+A, K-A, K+(A+B), K+(A-B), and K-(A+B) A and B: Specified measurement points K: Freed constant	——
	Results output	Judgement output (HIGH, PASS, LOW, ERROR) → RS-232C output → Terminal block output Measurement value output (measurement value) → RS-232C output → Terminal block output → Analog output	Analog output
	Terminal block	11 input points: $\overline{\text{TRIGGER}}$, $\overline{\text{HOLD-RESET}}$, $\overline{\text{LD-OFF}}$, $\overline{\text{ALL-ZERO}}$, $\overline{\text{ZERO0}}$, $\overline{\text{ZERO1}}$, $\overline{\text{RESET}}$, and DI 0 to DI 3 21 output points: $\overline{\text{DO0}}$ to $\overline{\text{DO20}}$	$\overline{\text{LD-OFF}}$
	Input/Output Type	Z300-VC10EV3: NPN Z300-VC15EV3: PNP	
	Monitor interface	1 channel (for pin jack or overscan monitor)	——
	Analog output resolution	The full scale for output can be divided into a maximum of 40000 gradations. Resolution (See note.) * 0.25 mV (±5 V), 0.4 μA (4 to 20 mA)	

Note: For measurement at an average number of times of 64 with an OMRON K3AS Linear Sensor Controller connected.

Item / mode		VISUAL mode	NON-VISUAL mode
General specifications	Supply voltage	21.6 to 26.4 VDC (including ripple)	
	Current consumption	1 A max. (with 2 Sensors connected)	
	Insulation resistance	20 MΩ min. between all DC external terminals and GR terminal (100 VDC Megger, with internal surge absorber removed)	
	Dielectric strength	1000 VAC, 50/60 Hz between all DC external terminals and GR terminal (with internal surge absorber removed)	
	Leakage current	10 mA max.	
	Noise resistance	1500 Vp-p; Pulse width: 0.1 μs/ 1 μs; Rising edge: 1-ns pulse	
	Vibration resistance	10 to 150 Hz (double amplitude: 0.1 mm) for 8 min. each in X, Y, and Z directions	
	Shock resistance	200 m/s^2, 3 times each in 6 directions	
	Ambient temperature	Operating: 0 to +50 °C, Storage: -15 to +60 °C (with no icing or condensation)	
	Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)	
	Ambient environment	No corrosive gases	
	Ground	Ground the Z300's ground terminal to less than 100 Ω	
	Degree of protection	IEC60529 IP20 (in-panel)	
	Case material	Controller: ABS	
	Weight (including packaging)	Approx. 1300 g (Unit: Approx. 700 g)	
	Accessories	2 manuals, 1 resistor (250 Ω, 1/2 W)	

Monitor

Item / Monitor / Model	Liquid Crystal Monitor F150-M05L
Size	5.5 inches
Type	TFT color liquid crystal
Resolution	320 × 240 dots
Input signal	NTSC composite video (1.0 V / 75 Ω)
Supply voltage	20.4 to 26.4 VDC
Current consumption	Approx. 700 mA
Ambient temperature	Operating: 0 °C to +50 °C, Storage: -25 °C to +65 °C (with no icing or condensation)
Ambient humidity	Operating and storage: 35 to 85 %RH (with no condensation)
Weight (including packaging)	Approx. 870 g (Unit: Approx. 610 g)
Accessories	Operation manual, 4 mounting brackets

Laser Safety

The Z300-S2T, Z300-Z5T and Z300-S10 Sensor Heads are Class 2 Laser Products according to EN60825-1 (IEC60825-1) and Class II Laser Product according to FDA (21 CFR1040.10) (see note). The Z300-S60 Sensor Head is a Class 3B and Class IIIB Laser Product, respectively. The Z300 Series is meant to be built into final system equipment. Pay special attention to the following precautions for the safe use of the product:

Note: Europe: Class 2 and Class 3B of EN60825-1: 1994 = IEC60825-1: 1993
U.S.A.: Class II and Class IIIB of FDA (21 CFR1040.10)

	Z300-S2T	Z300-S5T	Z300-S10	Z300-S60
Wavelength	650 nm	670 nm		658 nm
Peak power	1 mW max.			15 mW max.
Class	2			3B
Maximum pulse duration	7 ms			17.5 ms
Period	0.5 to 10 ms			0.5 to 25 ms

(1)Use this product as specified in the operation manual. Otherwise, you may be exposed to hazardous laser radiation.

(2)The Z300 series radiates laser beams in the visible light range. Do not expose your eyes directly to the laser radiation. Ensure that the laser beam path is terminated during use. If a mirror or shiny surface is positioned in the laser beam path, ensure that the reflected beam path is also terminated.
If the Unit must be used without terminating the laser beam path, position the laser beam path so that it is not at eye level.

(3)To avoid exposure to hazardous laser radiation, do not displace nor remove the protective housing during operation, maintenance, and any other servicing.

(4)The user should return the product to OMRON for all repair and servicing.

(5)As for countries other than those of Europe and the U.S.A., observe the regulations and standards specified by each country.

Precautions

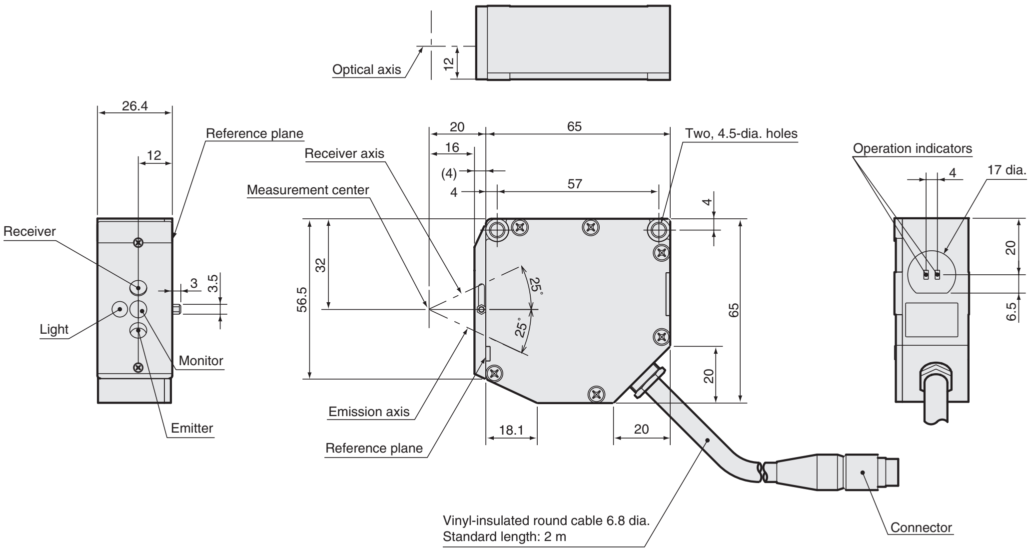
Warming up

After turning on the power, wait about 30 minutes before using the equipment. The circuits are not stable after turning on the power, and thus measured values tend to gradually drift.

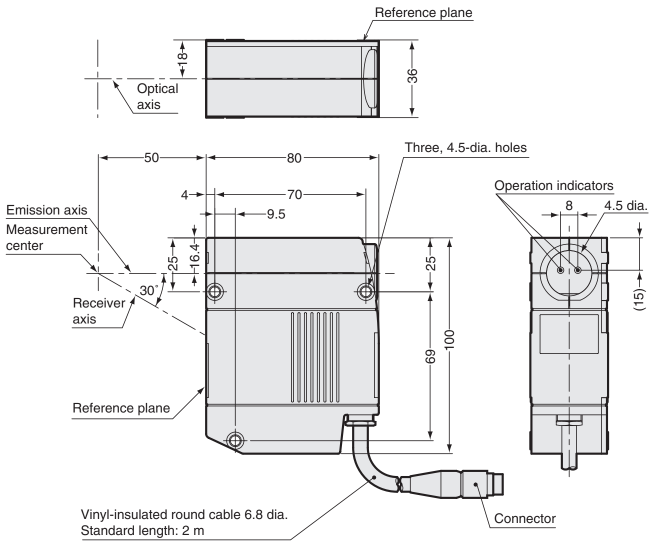
Dimensions (Unit: mm)

Sensor

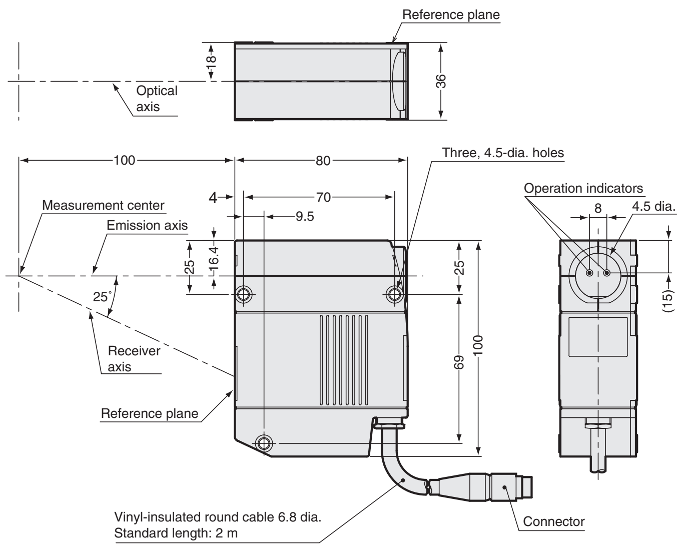
Z300-S2T



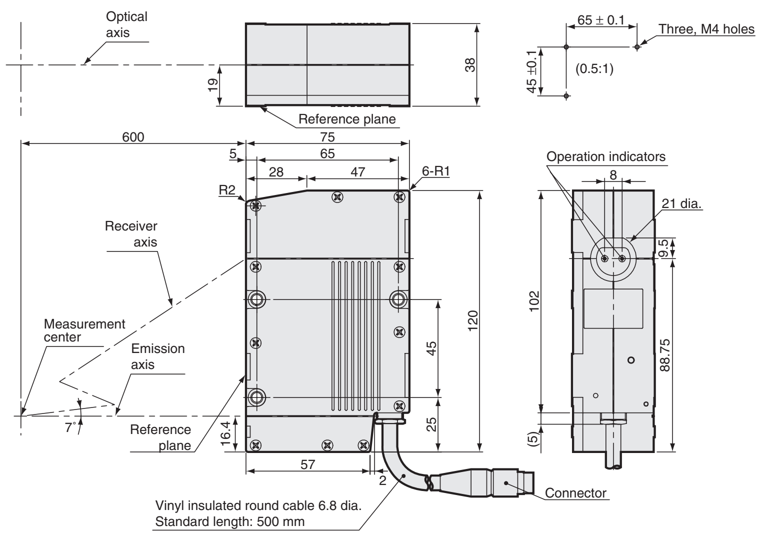
Z300-S5T



Z300-S10

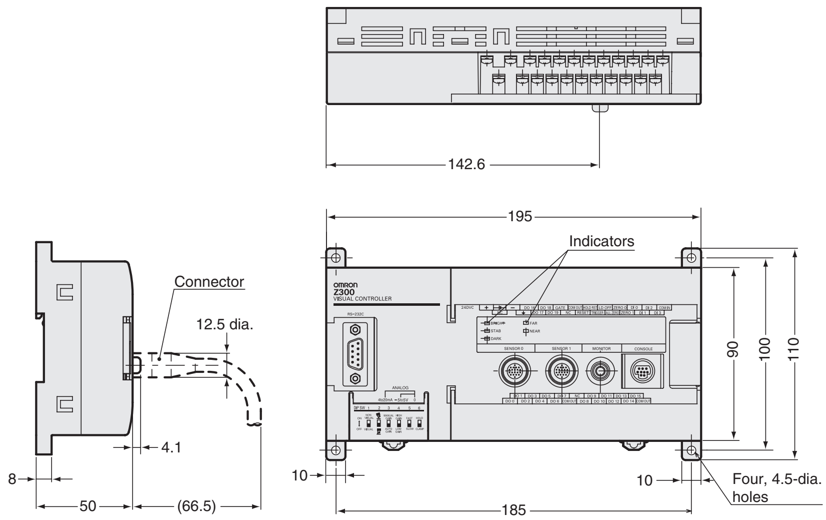


Z300-S60



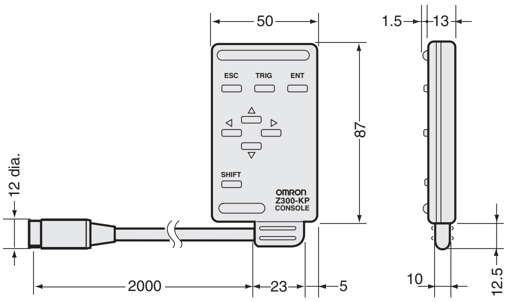
Controller

Z300-VC10EV3
Z300-VC15EV3



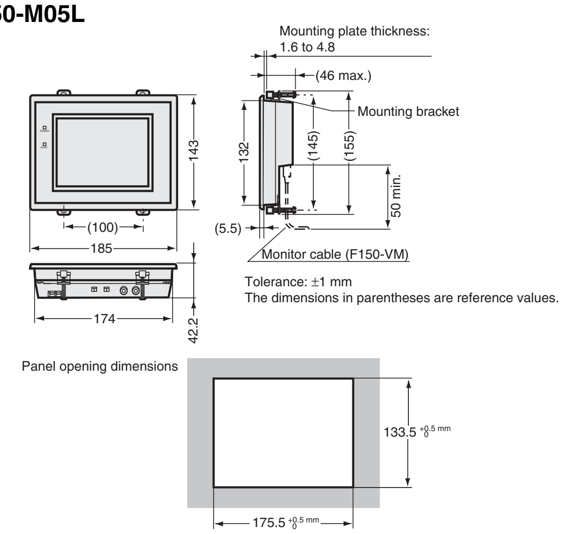
Console

Z300-KP



LCD monitor

F150-M05L



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. Q01E-EN-02

Profile Measuring System

Z500

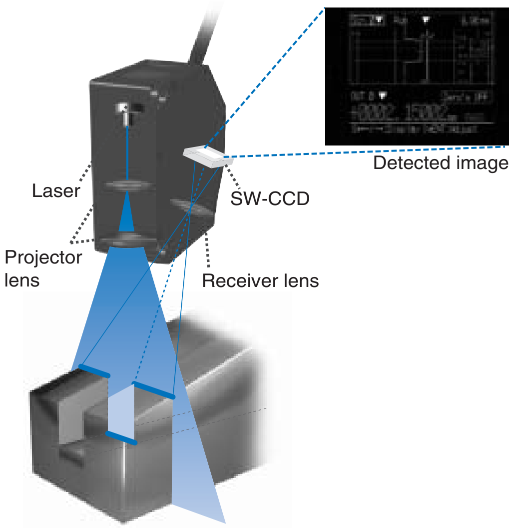
High-Precision Sensor that Measures and Displays an Object's Profile.

Features

OMRON's original line beam method provides a complete solution to profile measurement problems.

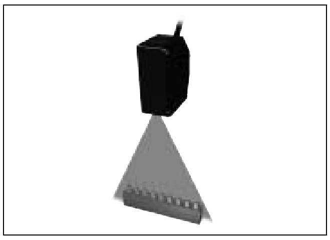
Conventional non-contact measurement of the profile of an object commonly uses a displacement sensor to measure the height of the object, by moving the object or the sensor.
However, this system has several disadvantages, such as lower measurement accuracy resulting from object or sensor movement as well as high system construction cost.
By utilizing a unique wide beam method and 2-dimensional CCD, OMRON's Z500 eliminates these problems.
Through its capability of measuring a diversely-shaped objects in a stable manner, the Z500 can meet a variety of application needs.

Principle of line beam method
A wide beam is applied to the object to be measured. A 2-dimensional CCD receives the reflected light to measure the 2-dimensional profile of the object.

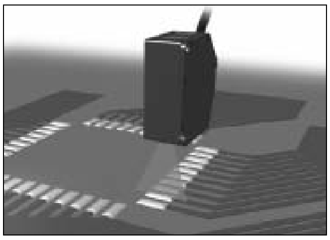


Application

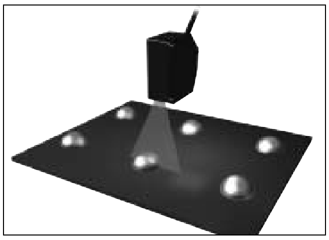
Measurement of connector pin configuration



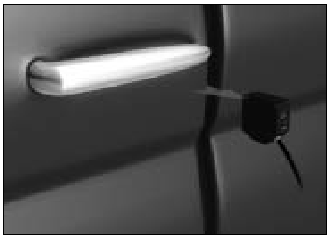
Height measurement for cream-soldered joint on PCB



Rivet height measurement



Door gap measurement

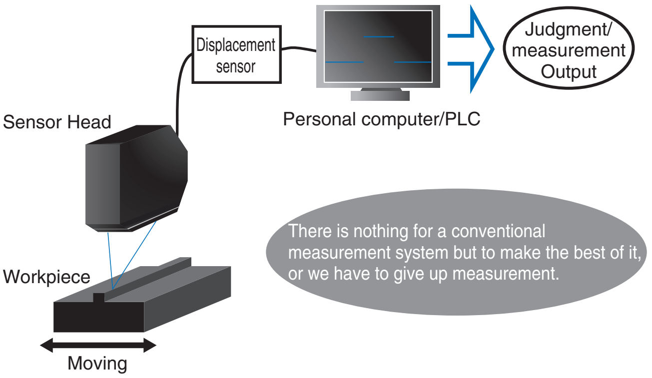


Features

Measures the shape of object instantly.

A complete solution to the disadvantages of conventional measurement systems.

Measurement by displacement sensor

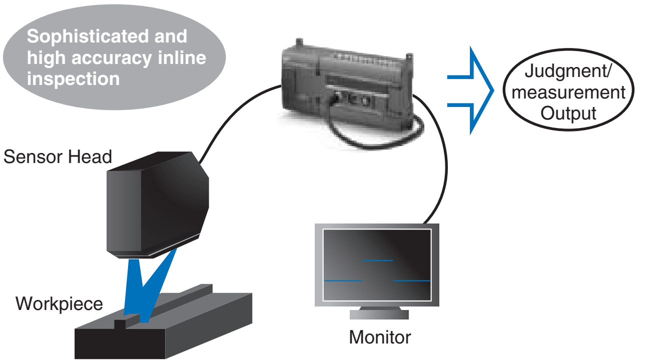


Problems to be resolved
- Object or sensor needs to be moved.
- Personal computer or other device is required for measurement data processing.

Increased system construction cost
Measurement accuracy deterioration caused by movement of object or sensor and data processing.
Measurement takes a long time.

When you use Z500, ---

Measurement by Z500 model



Enjoy the following advantages from Z500 !
- Moving the object or sensor is no longer necessary.
- Various data processing and calculation functions are performed automatically.

Lower system construction cost
Higher measurement accuracy
Shorter measurement time

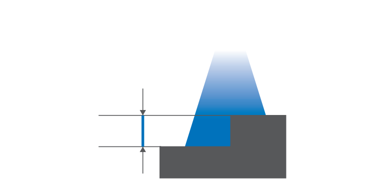
Accurate and stable measurement.

OMRON's original 2-dimensional SW-CCD and multiple light intensity control system enable stable measurement of objects with round shape and other surface conditions.

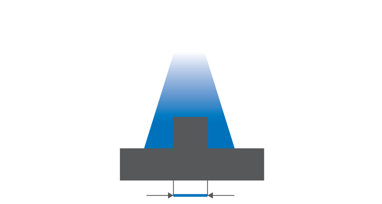
A variety of measurement items.

Various measurement items, such as level difference, width, and edge position, can be selected depending on the specific application.
Permitting simultaneous measurement of up to 8 items, the Z500 is applicable to various measurement purposes.

2-point level difference (Step: 2 pts)



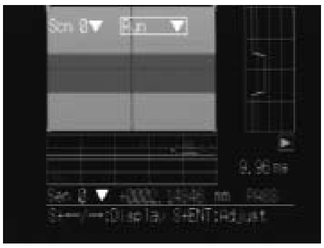
Width



Edge position

Four types of monitor screens

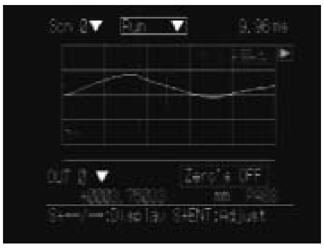
Measurement data can be displayed on 4 types of monitor screens.
These screens enable analysis and evaluation of measurement data from various viewpoints.



Profile monitor
Time-series change of profile (data on cross section height) can be checked on a 3D gray scale image.

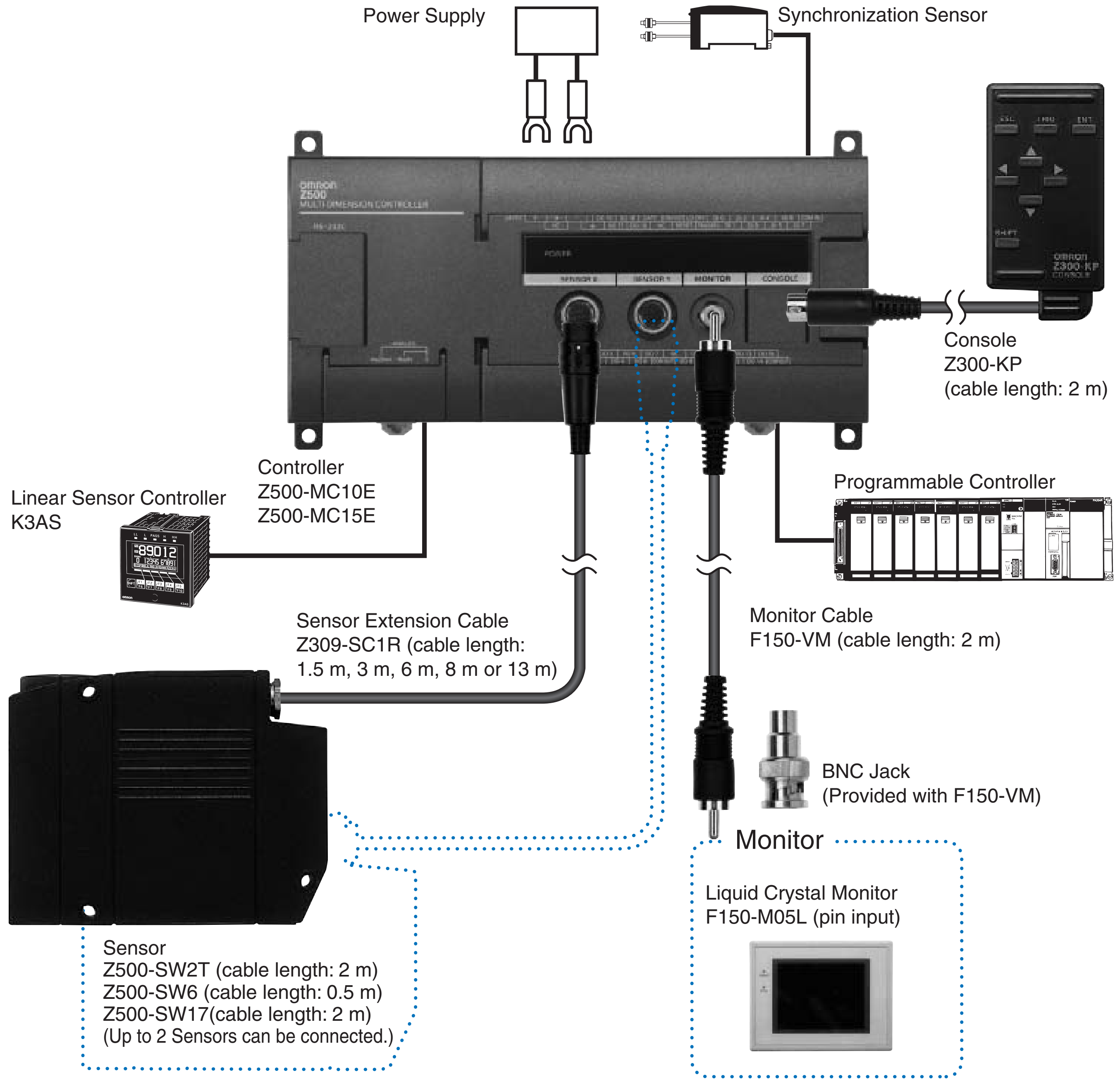
Image monitor
Both measurement data and profile image can be checked at the same time.

Digital monitor
Two or more measurement data can be checked at the same time.



Trend monitor
Time-series change of measurement data can be checked.

System configuration



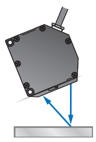
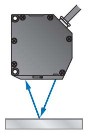
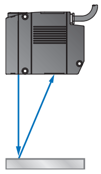
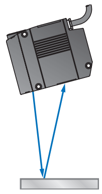
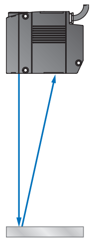
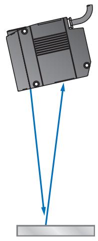
Ordering Information

Name / Item	Model	Remarks
Sensor	**Z500-SW2T**	Cable length: 2 m
	Z500-SW6	Cable length: 0.5 m
	Z500-SW17	Cable length: 2 m
Controller	**Z500-MC10E**	NPN input/output
	Z500-MC15E	PNP input/output
Console	**Z300-KP**	——
Liquid Crystal Monitor	**F150-M05L**	——
Sensor Extension Cable	**Z309-SC1R** (See note)	Cable length: 1.5 m, 3 m, 6 m, 8 m or 13 m
Monitor Cable	**F150-VM**	Cable length: 2 m

Note: Specify the required cable length when ordering.

Rating/Performance

Sensor Z500-SW2T/-SW6/-SW17

Item		Z500-SW2T		Z500-SW6		Z500-SW17	
Model / Measurement mode		Diffuse reflection	Mirror reflection	Diffuse reflection	Mirror reflection	Diffuse reflection	Mirror reflection
							
Distance to measurement center		5.2 mm	20 mm (with beam cover attached: 16 mm)	50 mm	44 mm	100 mm	94 mm
Measurement range		±0.8 mm		±5 mm	±4 mm	±20 mm	±16 mm
Light source		Visible-light semiconductor laser (See note 10) (Wavelength 650 nm, 1 mW max., Class 2)		Visible-light semiconductor laser (Wavelength 658 nm, 15 mW max., Class 3B)			
Beam dimensions (See note 1)		Reference distance: 20 µm × 4 mm TYP. (Measurement region: 2 mm)		Reference distance: 30 µm × 24 mm TYP. (Measurement region: 6 mm)		Reference distance: 60 µm × 45 mm TYP. (Measurement region: 17 mm)	
Linearity		±0.1 %F.S. (See note 3)	±0.1 %F.S. (See note 2)	±0.1 %F.S. (See note 4)			
Resolution		0.25 µm (See notes 5 and 6)		0.3 µm (See notes 7 and 8)		1 µm (See notes 7 and 8)	
Sampling cycle		9.94 ms					
LED indicators (LASER indicator)		Lit while laser is ON.					
Temperature characteristic (See note 9)		0.01 %F.S./°C					
Environ-ment resistance	Degree of protection	IEC IP64		IEC IP66			
	Ambient operating illumination	Illumination at light-receiving surface: 3,000 lx max., incandescent light					
	Ambient temperature	Operating: 0 to +50 °C, Storage: -15 to +60 °C (with no icing or condensation)					
	Ambient humidity	Operating and storage: 35 to 85 % RH (with no condensation)					
	Vibration resistance	10 to 150 Hz (single amplitude: 0.35 mm) for 80 min. each in X, Y, and Z directions					
Materials		Unit: Die-cast aluminum Cable sheathing: Heat-resistant chlorinated vinyl Connector: zinc alloy and brass					
Cable length		2 m		0.5 m		2 m	
Minimum bending radius		68 mm					
Weight (including packaging)		Approx. 600 g (Unit: Approx. 350 g)		Approx. 700 g (Unit: Approx. 600 g)		Approx. 800 g (Unit: Approx. 600 g)	
Accessories		3 ferrite cores, laser warning labels (English)					

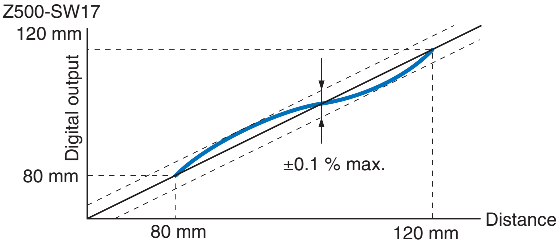
Note: 1 . Defined at $1/e^2$ (13.5%) of the density at the light center. Light may, however, be present outside this range and if the reflection factor of the light around the workpiece is high compared to the workpiece, measurement may be affected.

2 . Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard quartz glass. The linearity varies with the type of workpiece.

3 . Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard SUS blocks. The linearity varies with the type of workpiece.

4 . Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard white alumina ceramics. The linearity varies with the type of workpiece.

• Z500-SW17



5 . Displacement conversion value for peak-to-peak of displacement output. These figures are for measurement of OMRON standard quartz glass (mirror reflec-

tion mode) or OMRON standard SUS blocks (diffuse reflection mode) at the measurement center. In strong magnetic fields, it may not be possible to maintain resolution performance characteristics.

6 . These figures are for when the Sensor is connected to the Z500-MC10E/MC15E, the average number of measurements is 16. Measurement data are sent to PC via RS-232C cable for calculation of their average values.

7 . Displacement conversion value for peak-to-peak of displacement output (for measurement of OMRON standard white alumina ceramic at the measurement center). In strong magnetic fields, it may not be possible to maintain resolution performance characteristics.

8 . With the Z500-MC10E/MC15E, at an average number of measurements of 64. Measurement data are sent to PC via RS-232C cable for calculation of their average values.

9 . Value for measurement with the space between the Sensor and the workpiece (white alumina ceramic) secured with an aluminum jig.

10.Higher power laser type (Class 3B) is also available. For further information, please contact us.

Controller Z500-MC10E/MC15E

Item	Model / Input/Output Type	Z500-MC10E / NPN	Z500-MC15E / PNP
Perfor-mance specifica-tions	Number of Sensors that can be mounted	2	
	Number of scenes	16	
	Light intensity tracking function	Automatic (The light intensity tracking range can be specified)/Fixed (Select from 31 stages)/ Multiple (The light intensity range can be specified)	
	Measurement item	Select from the following 8 types: Height, Step: 2 pts, Step: 3 pts, Edge position, With, Edge center, Peak/Bottom, Define	
	Region specification	Region specification of line beam and displacement direction is possible.	
	Number of data to be stored	2048 points max.	
	Trigger function	Free/External 1/External 2/Auto	
	Results output	• Judgment output → RS-232C output → Terminal block output • Measurement value output (measurement value) → RS-232C output → Analog output	
	Terminal block	11 input points: $\overline{\text{TRIGGER}}$, $\overline{\text{LD-OFF}}$, $\overline{\text{RESET}}$, $\overline{\text{D10}}$ to $\overline{\text{D17}}$ 21 output points: $\overline{\text{DO0}}$ to $\overline{\text{DO19}}$, $\overline{\text{GATE}}$	
	Monitor interface	1CH (for pin jack or overscan monitor)	
	Analog output resolution	The full scale for output can be divided into a maximum of 40,000 gradations. Resolution (See note): 0.25 mV (±5 V), 0.4 µA (4 to 20 mA)	
General specifica-tions	Power supply voltage	21.6 to 26.4 VDC	
	Current consumption	1 A max. (with 2 Sensors connected)	
	Insulation resistance	20 MΩ min. between all DC external terminals and GR terminal (100 VDC megger) (with internal surge absorber removed)	
	Dielectric strength	1000 VAC, 50/60 Hz between all DC external terminals and GR terminal (with internal surge absorber removed)	
	Leakage current	10 mA max.	
	Noise resistance	1500 Vp-p; pulse width: 0.1 µs/1 µs, Rising edge: 1-ns pulse	
	Vibration resistance	10 to 150 Hz (double amplitude: 0.1 mm) for 8 min. each in X, Y, and Z directions	
	Shock resistance	200 m/s^2, 3 times each in 6 directions	
	Ambient temperature	Operating: 0 to +50 °C, Storage: -15 to +60 °C (with no icing or condensation)	
	Ambient humidity	Operating and storage: 35 to 85 %RH (with no condensation)	
	Ambient environment	No corrosive gases	
	Ground	Ground the Z500's ground terminal to less than 100 Ω	
	Degree of protection	IEC IP20 (in-panel)	
	Material	Unit: ABS	
	Weight (including packaging)	Approx. 1300 g (Unit: Approx. 700 g)	
	Accessories	2 manuals, 1 resistor (250 Ω, 1/2 W)	

Note: For measurement at an average number of times of 64 with an OMRON K3AS Linear Sensor Controller connected.

Monitor

Item / Monitor / Model	Liquid Crystal Monitor
	F150-M05L
Panel size	5.5 inches
Panel type	TFT color liquid crystal
Resolution	320 × 240 dots
Input signal	NTSC composite video (1.0 V/75 Ω)
Power supply voltage	20.4 to 26.4 VDC
Current consumption	Approx. 700 mA
Ambient temperature	Operating: 0 to +50 °C, Storage: -25 to +65 °C (with no icing or condensation)
Ambient humidity	Operating and storage: 35 to 85 %RH (with no condensation)
Weight (including packaging)	Approx. 870 g (Unit: Approx. 610 g)
Accessories	Operation manual, 4 mounting brackets

Laser Safety

The Z500-SW2T Sensor Head is a Class 2 Laser Product according to EN60825-1 (IEC60825-1) and Class II Laser Product according to FDA (21 CFR1040.10) (see note). The Z500-SW6 and Z500-SW17 Sensor Heads are Class 3B and Class IIIB Laser Products, respectively. The Z500 Series is meant to be built into final system equipment. Pay special attention to the following precautions for the safe use of the product:

Note: Europe: Class 2 and Class 3B of EN60825-1: 1994 = IEC60825-1: 1993
U.S.A.: Class II and Class IIIB of FDA (21 CFR1040.10)

	Z500-SW2T	Z500-SW6/Z500-SW17
Wavelength	650 nm	658 nm
Maximum pulse duration	10 ms	17.5 ms
Cycle	0.5 to 10 ms	0.5 to 25 ms
Peak power	1 mW max.	15 mW max.
Class	2	3B

(1)Use this product as specified in the operation manual. Otherwise, you may be exposed to hazardous laser radiation.

(2)The Z500 series radiates laser beams in the visible light range. Do not expose your eyes directly to the laser radiation. Ensure that the laser beam path is terminated during use. If a mirror or shiny surface is positioned in the laser beam path, ensure that the reflected beam path is also terminated. If the Unit must be used without terminating the laser beam path, position the laser beam path so that it is not at eye level.

(3)To avoid exposure to hazardous laser radiation, do not displace nor remove the protective housing during operation, maintenance, and any other servicing.

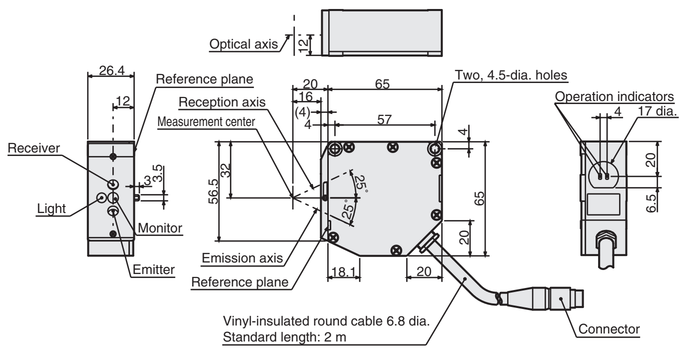
(4)The user should return the product to OMRON for all repair and servicing.

(5)As for countries other than those of Europe and the U.S.A., observe the regulations and standards specified by each country.

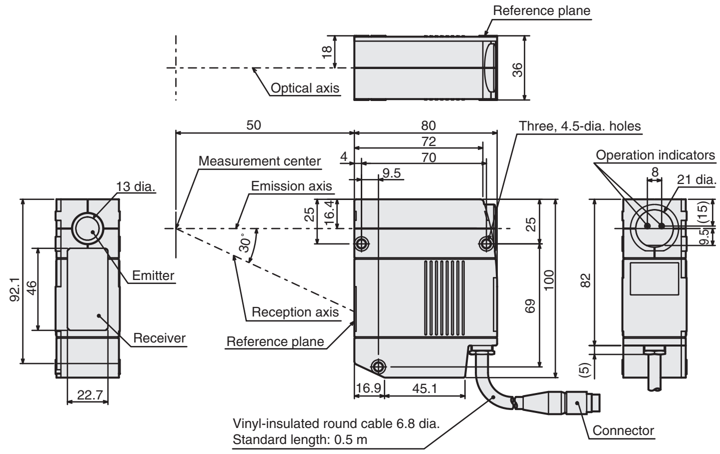
Dimensions (Unit: mm)

Sensor

Z500-SW2T

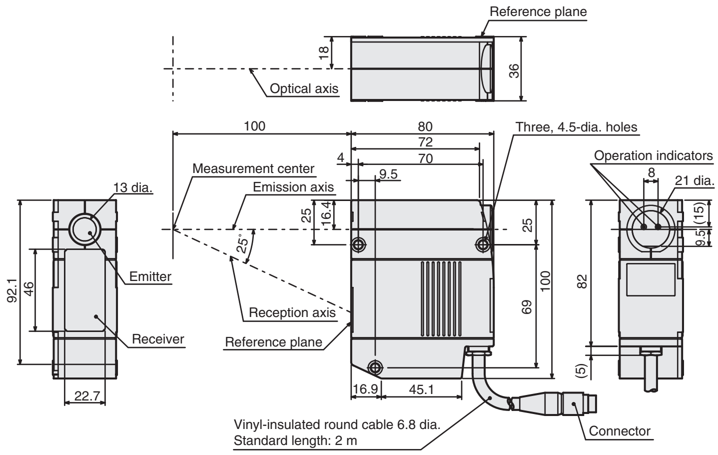


Z500-SW6



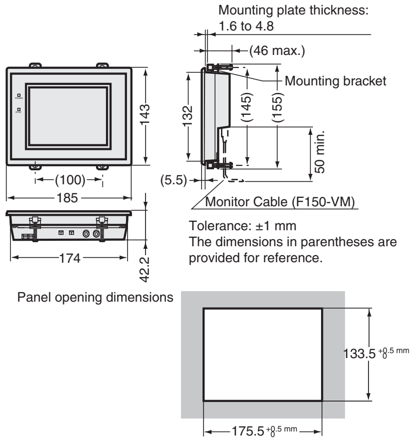
Sensor

Z500-SW17



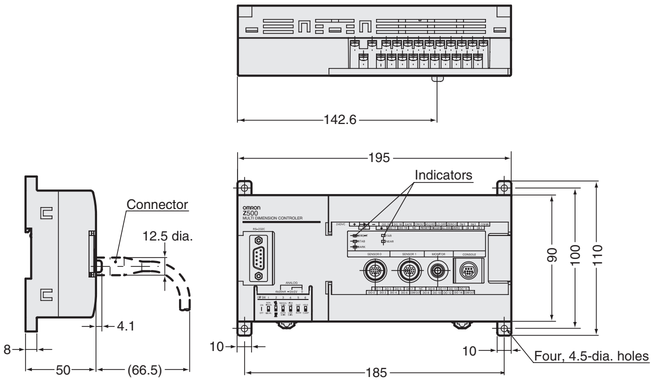
Liquid Crystal Monitor

F150-M05L



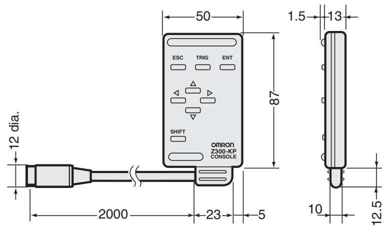
Controller

Z500-MC10E/MC15E



Console

Z300-KP



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. Q02E-EN-02 In the interest of product improvement, specifications are subject to change without notice.

Welding Bead Sensor

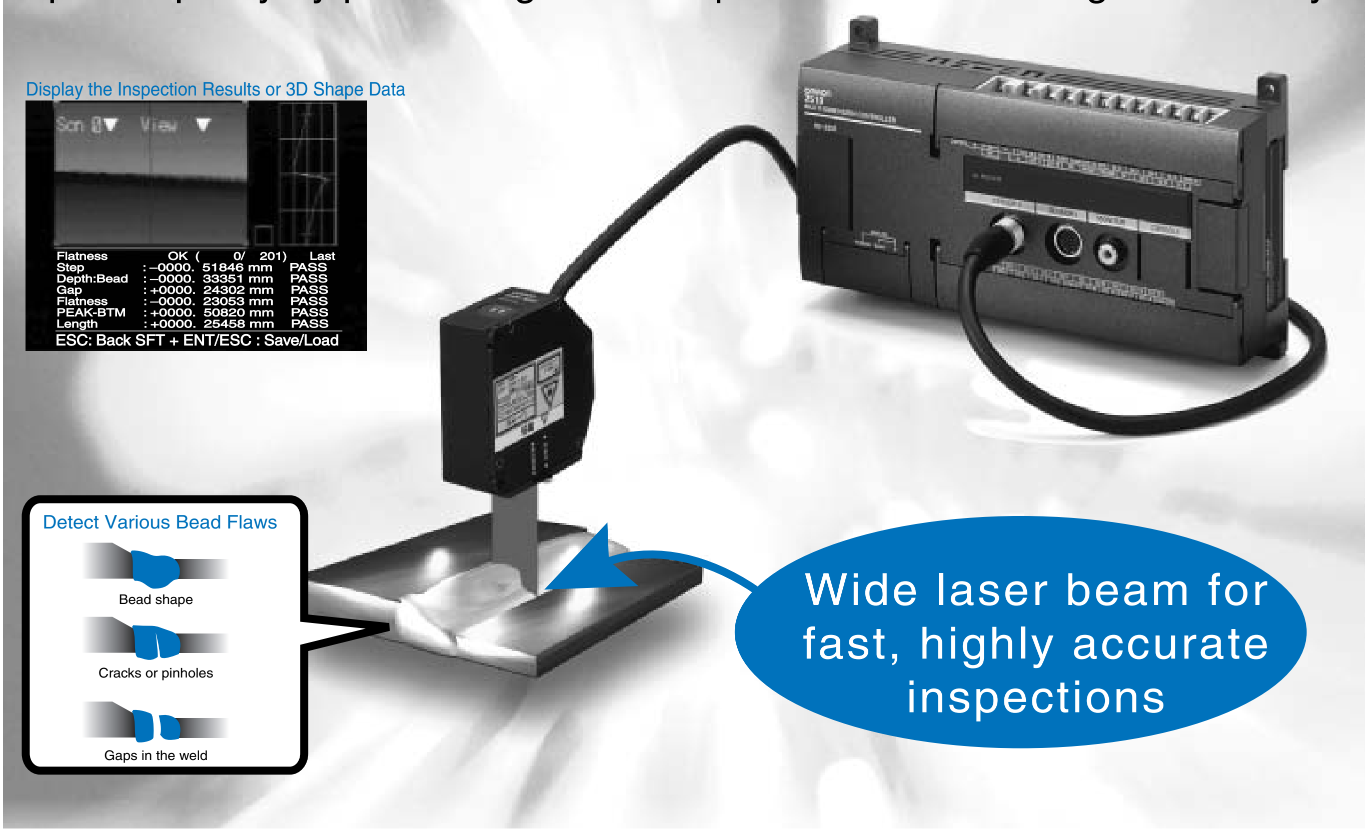
Z510

In-line Inspection of Welding Beads

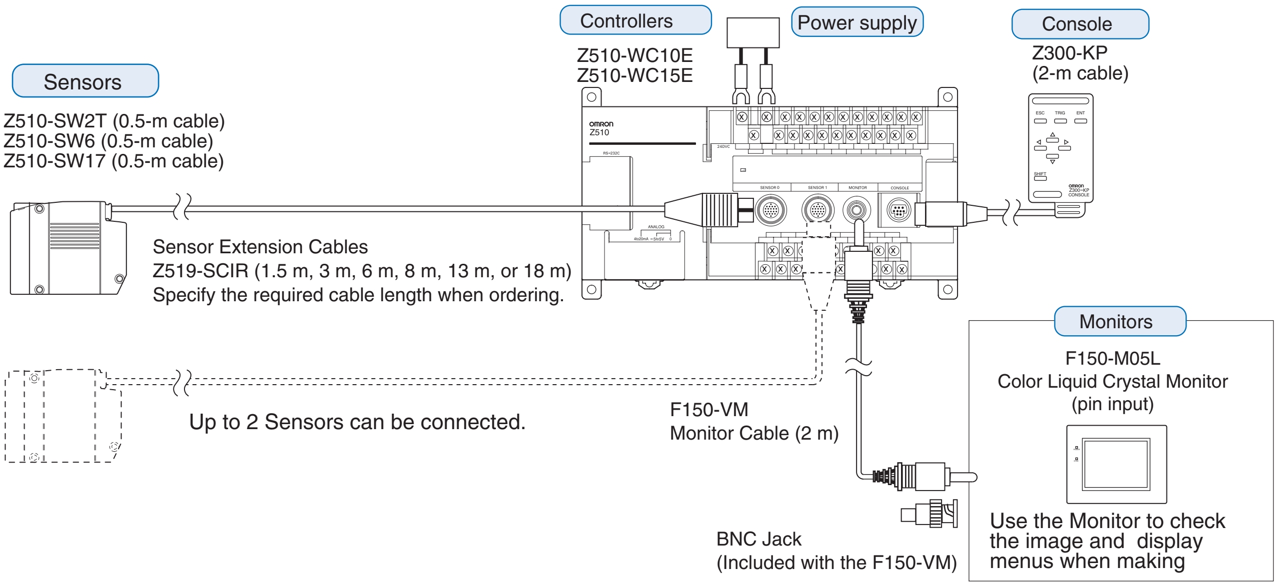
- Inspect for welding flaws by measuring the bead shape.
- Accumulate and output the profile data. Greatly simplify the management of welding bead quality.
- The high-speed 10-ms measurement period allows 100% in-line inspection.
- Automatic light intensity (brightness) adjustment provides stable measurement of fluctuating metal surfaces.
- The compact sensor head contains both the transmitter and receiver, so mounting space is not an issue.

Features

Improve quality by performing 100% inspection of weld strength uniformity.



Basic System Configuration



Specifications

Controllers:
Z510-WC10E and Z510-WC15E

General Specifications

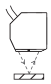
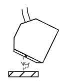
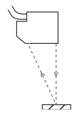
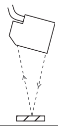
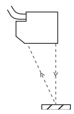
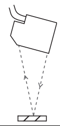
Item	Specification
Supply voltage	21.6 to 26.4 VDC
Current consumption	1 A max. (with 2 Sensors connected)
Insulation resistance	20 MΩ min. (at 100 V DC) between DC external terminals and GR terminal (with internal surge absorber removed)
Dielectric strength	1,000 VAC, 50/60 Hz between DC external terminals and GR terminal (with internal surge absorber removed)
Leakage current	10 mA max.
Noise resistance	1,500 V_{P-P}; pulse width: 0.1 µs/1 µs; rising edge: 1-ns pulse
Vibration resistance	10 to 150 Hz (double amplitude of 0.1 mm) for 8 minutes each in the X, Y, and Z directions
Shock resistance	200 m/s^2 3 times each in 6 directions
Ambient temperature	Operating: 0 to 50°C (with no icing or condensation) Storage: -15 to 60°C (with no icing or condensation)
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)
Atmosphere	No corrosive gases
Grounding	Less than 100 Ω
Degree of protection	IEC60529 IP20 (In-panel)
Material	Case: ABS

Characteristics

Item	Specification
Number of Sensors	Up to 2 Sensors can be connected.
Number of scenes	16
Light intensity tracking function	Automatic (The light intensity tracking range can be specified.) Fixed (Select one of 31 stages.)
Measurement items	Select one of the following 6 items: Deviation from reference surface, Bead height, Width, Bead change, Peak/Bottom, Inspection length
Region specification	A region can be specified in the direction of the line beam.
Data storage	2,048 points max.
Trigger function	Free-run, External 1, External 2, or Auto
Results output	• Judgement output — RS-232C output — Terminal block output • Measurement value output (measurement value) — RS-232C output — Analog output
Terminal block	8 input points: $\overline{\text{TRIGGER}}$, $\overline{\text{LD-OFF}}$, $\overline{\text{RESET}}$, $\overline{\text{DI0}}$, and $\overline{\text{DI4}}$ to $\overline{\text{DI7}}$ 12 output points: $\overline{\text{DO0}}$ to $\overline{\text{DO5}}$, $\overline{\text{DO8}}$, $\overline{\text{DO15}}$, $\overline{\text{DO17}}$ to $\overline{\text{DO19}}$, and $\overline{\text{GATE}}$
Monitor interface	1 channel (for pin jack or overscan monitor)
Analog output resolution	The full-scale output can be divided into 40,000 gradations max. Resolution (See note.): 0.25 mV (±5 V) 0.4 µA (4 to 20 mA)
Weight	Approx. 700 g (Controller only)

Note: This resolution is for measurements with an OMRON K3AS Linear Sensor Controller connected and values averaged over 64 measurements.

Sensors: Z510-SW2T, Z510-SW6, and Z510-SW17

Sensor model		Z510-SW2T		Z510-SW6		Z510-SW17	
Measurement mode		Mirror reflection	Diffuse reflection	Diffuse reflection	Mirror reflection	Diffuse reflection	Mirror reflection
							
Measurement distance at center		20 mm (16 mm with beam cover mounted)	5.2 mm	50 mm	44 mm	100 mm	94 mm
Measurement range		±0.8 mm		±5 mm	±4 mm	±20 mm	±16 mm
Light source		Visible semiconductor laser (Wavelength: 670 nm, 15 mW max., class 3B)		Visible semiconductor laser (Wavelength: 658 nm, 15 mW max., class 3B)			
Beam dimensions (See note 1.)		20 µm × 4 mm typical at the reference distance (2-mm measurement region)		30 µm × 24 mm typical at the reference distance (6-mm measurement region)		60 µm × 45 mm typical at the reference distance (17-mm measurement region)	
Linearity		±0.1% F.S. (See note 2.)	±0.1% F.S. (See note 3.)	±0.1% F.S. (See note 4.)			
Resolution		0.25 µm (See notes 5 and 6.)		0.3 µm (See notes 7 and 8.)		1 µm (See notes 7 and 8.)	
Sampling period		9.94 ms					
LED indicator (Laser indicator)		Lit when the laser is ON.					
Temperature characteristic (See note 9.)		0.01% F.S./°C					
Environmental resistance	Degree of protection	IP64		IP66			
	Ambient operating illumination	Illumination at light-receiver surface: 3,000 lx max. (incandescent light)					
	Ambient temperature	Operating: 0 to 50°C (with no icing or condensation) Storage: -15 to 60°C (with no icing or condensation)					
	Ambient humidity	Operating and storage: 35% to 85% (with no condensation)					
	Vibration (destruction)	10 to 150 Hz (double amplitude of 0.35 mm) for 8 minutes each in the X, Y, and Z directions					
Materials		Controller: Die-cast aluminum Cable sheathing: Heat-resistant PVC Connector: Zinc alloy and brass					
Cable length		0.5 m					
Minimum bending radius		68 mm					
Weight		Approx. 350 g		Approx. 600 g			

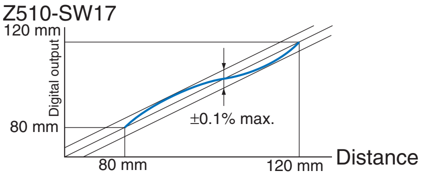
Note: 1. The minimum light intensity at the edges of the beam is defined as $1/e^2$ (13.5%) of the intensity at the center of the beam. Some light will scatter beyond this beam region and the measurement may be affected if the immediate vicinity around the workpiece is highly reflective.

2. This is the error with respect to the theoretical line of the displacement output when measuring the standard OMRON quartz glass. The linearity may vary depending on the workpiece being used.

3. This is the error with respect to the theoretical line of the displacement output when measuring a standard OMRON stainless-steel block. The linearity may vary depending on the workpiece being used.

4. This is the error with respect to the theoretical line of the displacement output when measuring the standard OMRON white alumina ceramic. The linearity may vary depending on the workpiece being used.

Z510-SW17



5. This is the displacement output's peak-to-peak displacement conversion value. These figures are for measurement of the standard OMRON quartz glass (mirror reflection) or standard OMRON stainless-steel block (diffuse reflection) at the center of the measurement region. The resolution performance characteristics may not be met when operating in a magnetic field.

6. These figures are for Sensors connected to a Z510-WC10E or Z510-WC15E and averaged over 16 measurements. The averaged data was transmitted to a PC through an RS-232C connection for storage and processing.

7. This is the displacement output's peak-to-peak displacement conversion value. (These figures are for measurement of the standard OMRON white alumina ceramic at the center of the measurement region.)
The resolution performance characteristics may not be met when operating in a strong magnetic field.

8. These figures are for Sensors connected to a Z510-WC10E or Z510-WC15E and averaged over 64 measurements. The averaged data was transmitted to a PC through an RS-232C connection for storage and calculations.

9. This is the value measured when the gap between the Sensor and workpiece (white alumina ceramic) is fixed with an aluminum jig.

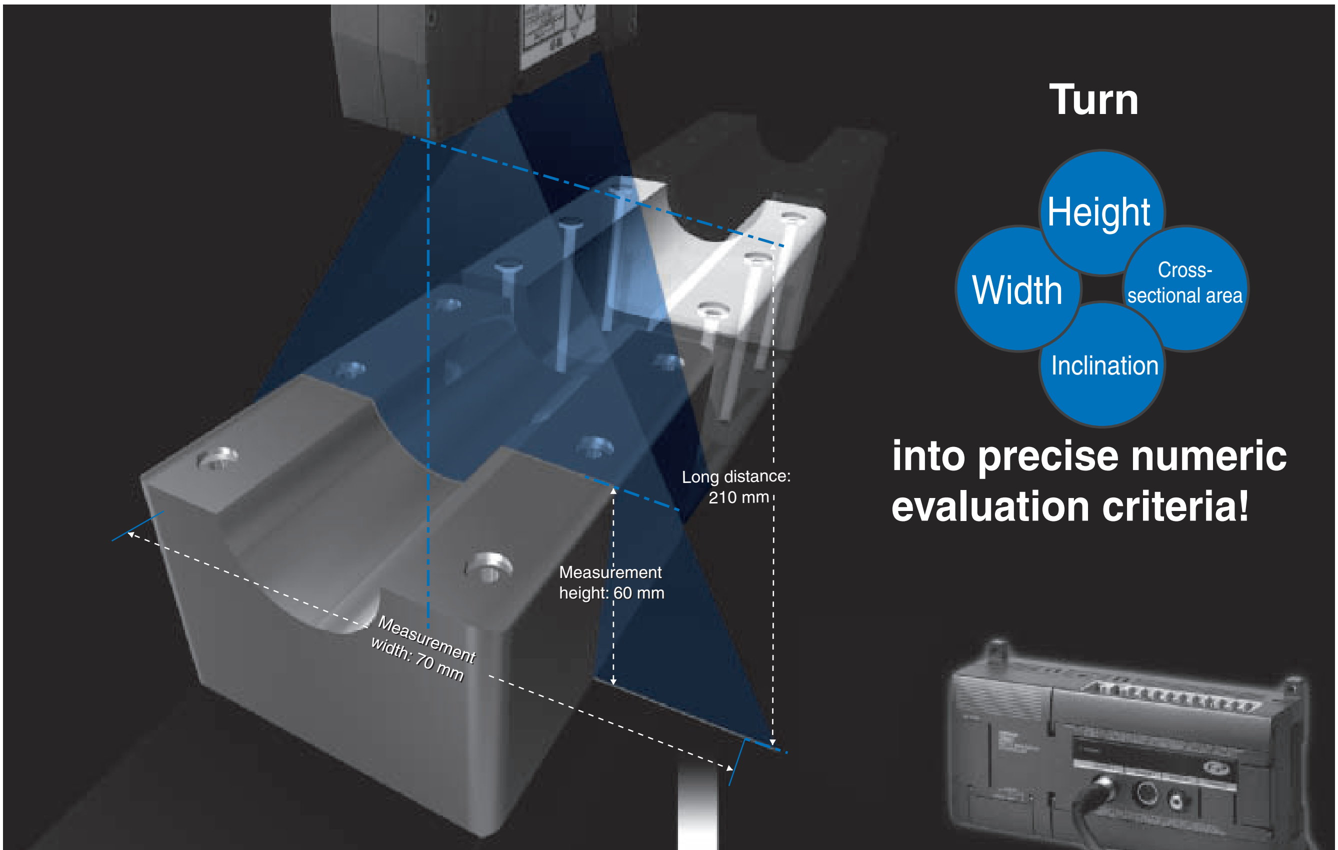
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Multi-Dimensional Sensor

Z550

• Inline profile inspections for workpieces made of metal, plastic, or other materials all at one time

Features



High-precision Measurements Over a Wide Area

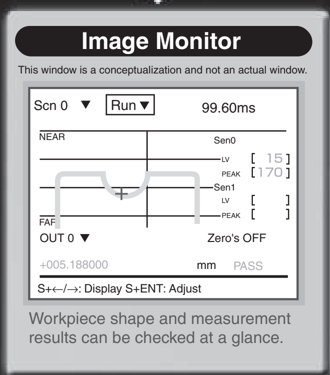
Height of measurement range: 60 mm, width of measurement range: 70 mm

Cross-sectional Measurements without Moving the Sensor or Target Object

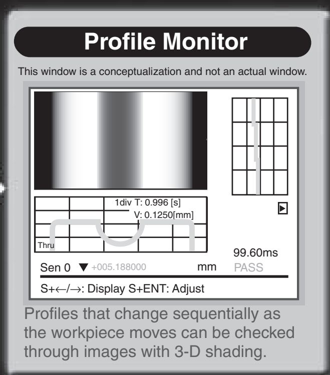
OMRON's unique 2-dimensional SW-CCD element and light sensitivity control ensure consistent measurements even on workpieces with curves and other surface shapes.

Complete Measurement Menus

Menu selections include items for measuring heights, 2- or 3-pt steps, edge positions, widths, edge centers, peaks/bottoms, cross-sectional areas, inclinations, average roughness, and maximum roughness. There are also menu items for user-defined continuous measurements (unrestricted calculations), trigger measurements, and logging measurements.



Workpiece shape and measurement results can be checked at a glance.



Profiles that change sequentially as the workpiece moves can be checked through images with 3-D shading.

Specifications

Z550-MC10/MC15 Controller

Model	Z550-MC10	Z550-MC15
I/O type	NPN	PNP
Power supply voltage	21.6 to 26.4 V DC	
Current consumption	1 A max. (with 2 sensors connected)	
Insulation resistance	Between the group of external DC terminals and the ground terminal: 20 MΩ max. (at 100 V DC) (when the built-in surge absorber is removed)	
Dielectric strength	Between the group of external DC terminals and the ground terminal: 1000 V AC at 50/60 Hz (when the built-in surge absorber is removed)	
Leakage current	10 mA max.	
Noise resistance	1,500 Vp-p; Pulse width: 0.1 ms/1 ms; Rising edge: 1-ns pulse	
Vibration resistance	10 to 150 Hz (at a double amplitude of 0.1 mm) for 8 minutes each in the X, Y, and Z directions	
Shock resistance	200 m/s^2; 3 times each in 6 directions	
Ambient temperature	0 to +50 °C at operation, -15 to +60 °C at storage (no icing or condensation)	
Ambient humidity	Operating and storage: 35% to 85% (no condensation)	
Ambient environment	No corrosive gases	
Ground	D-type ground (ground resistance of 100 W or less) * conventional class 3 ground	
Degree of protection	IEC60529 IP20 (in-panel)	
Materials	Console: ABS	
Weight	Approx. 0.7 kg	
Number of connectable sensors	Up to two Z550-SW70 sensors can be connected.	
Number of scenes	16	
Averagin number	9 levels (1 to 256 times)	
Sensor control	6 levels (varies depending on the sensor)	
Area specification function	Available	
Control of quantity of light	Multi-sensitivity adjustment (dynamic range or sampling interval takes precedence) fixed sensitivity, automatic sensitivity adjustment	
Measurement time[*1]	100 ms (at fixed sensitivity) 120 ms (at automatic sensitivity) 100 ms to 250 ms (when sampling interval takes precedence) 100 ms to 620 ms (when dynamic range takes precedence)	
Run Mode	Continuous measurement or trigger measurement	
Image pre-processing	Noise removal	
Measurement pre-processing	Interpolation processing, filter processing, Inclination compensation processing, Height and position compensation processing	
Detection method	Height position method, Reflectance method	
Measurement item	Height, Step: 2 pts, Step: 3 pts, Edge position, Width, Edge center, Peak/Bottom, Cross-sectional area, Inclination, Roughness, User-defined	
Logging function	The measurement results of up to 3,000 measurements can be stored. (It is possible to select the number ofmeasurements after which the measurement results will be stored.)	
Output pre-processing	Forced zero, Offset/span adjustment	
Profile data output	Up to 1024 height profiles can be output in one batch. The output format may be either ASCII code or binary format (when sending via XMODEM)	
Results output	Terminal block: Judgment result Analog: Measurement result RS-232C: Measurement result, judgment result, profile data	
Screen display	Image monitor, Trend monitor, Digital monitor, Profile monitor	
Tool function	Peripheral image display function, test measurement function	
Terminal blocks	11 input points: $\overline{\text{TRIGGER}}$, $\overline{\text{LD-OFF}}$, $\overline{\text{RESET}}$, $\overline{\text{DI0}}$ to $\overline{\text{DI7}}$ 21 output points: $\overline{\text{DO0}}$ to $\overline{\text{DO19}}$ and $\overline{\text{GATE}}$	
RS-232C (Baud rate)	Up to 115 kbps (at XMODEM transmission, external trigger measurement) Normally 38.4 kbps	
Monitor interface	1 channel (for pin jack or overscan monitor)	
Analog output resolution	The full output scale can be divided into a maximum of 40,000 divisions. Resolution[*2]: 0.25 mV (±5 V), 0.4 mA (4 to 20 mA)	

[*1.] The sampling interval varies depending on the measurement settings. Check the actual sampling interval on the image monitor.
[*2.] When performing measurement taking the average of every 64 measurements with an OMRON K3AS linear sensor controller connected.

Z550-SW70 Sensor

Sensor installation		Diffuse reflection only
Reference distance (direction of height)		210 mm (for 60-mm measurement range mode)
Measurement range	Direction of width	70 mm (at 200 mm-reference distance)
	Direction of height[*1]	±30 mm max. (for 60-mm measurement range mode)
Light source		Visible semiconductor laser (wave length: 658 nm, 15 mW max, class 3B)
Beam dimensions[*2]		120 µm x 75 mm typical at the 200 mm-reference distance
Resolution in the direction of width[*3]		0.1 mm
Resolution in the direction of height[*4]		10 µm
Linearity in the direction of height[*5]		±0.5% F.S.
LED indicator lamp		Lit when the laser is on
Temperature characteristic[*6]		0.1% F.S./°C
Operation environment robustness	Degree of protection	IP66
	Ambient operating illumination	Illumination at light-receiving surface: 3,000 lx max., incandescent light
	Ambient temperature	0 to +50°C at operation, -15 to +60°C at storage (no icing)
	Ambient humidity	Operating and storage: 35% to 85% (no condensation)
	Vibration (durability)	10 to 150 Hz (at a double amplitude of 0.35 mm) for 8 minutes each in the X, Y, and Z directions
Materials		Body: Aluminum die-cast Cable sheathing: Heat-resistant PVC Connector: Zinc alloy and brass
Cable length		0.5 m
Minimum bending radius		68 mm
Weight		Approx. 550g
Accessory		CLASS 3B Warning label (IEC60825-1: 1993 +A1: 1997) x 2

*1. For 60-mm measurement range mode

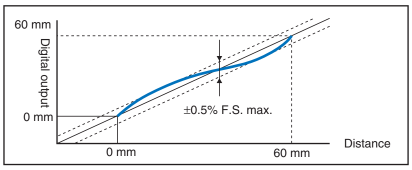
*2. Defined as $1/e^2$ (13.5%) of the central light intensity. Leakage of light is also present in areas other than those defined. Thus, there are some influences in cases where the reflection factor of the area surrounding the workpiece is higher than that of the workpiece itself.

*3. When an OMRON-standard workpiece (alumina ceramics) is placed at 200-mm distance, and edge position is measured. 60-mm measurement range mode is used. The average of 16 measurements is taken. Note that the resolution performance may not be satisfied in the presence of strong magnetic fields.

*4. When an OMRON-standard workpiece (alumina ceramics) is placed 200-mm away and the average height of all lines is measured. The measuring range is 60 mm and the average of 16 measurements is taken. Resolution performance, however, may not be satisfied in the presence of strong magnetic fields.

*5. The error in relation to an ideal straight line when the average height of all lines on an OMRON-standard workpiece (alumina ceramics) is measured. The measuring range is 60 mm. The degree of linearity may change depending on the workpiece.

60-mm Range Mode



*6. The value obtained at measurement with the space between the sensor and the workpiece fixed with an aluminum jig. The measurement range is 60 mm.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Smart Sensors (Inductive Displacement Type)

ZX-E Series

Smart Sensors that use the eddy current method are now available. Develop new applications with sub-micron sensing technology.

NEW

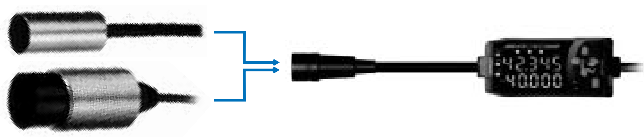
Features

Designed to meet your measurement needs

What's innovative about the ZX-E sensor is that the same amplifer unit can be attached to any one of five sensor headds; It's simply a matter of selecting the sensor head that best suits your measurement application. And there's total compatibility between all sensor heads and the amplifier, making maintenance quick and easy.

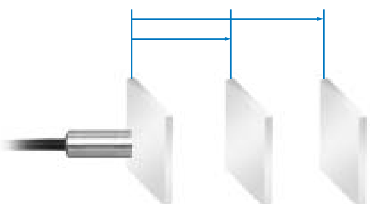
Plug & Play Concept

All sensor heads are fully compatible to the amplifier unit and can be selected based on application. Also for maintenance reason it is more efficient and cost saving to replace only the sensor head.



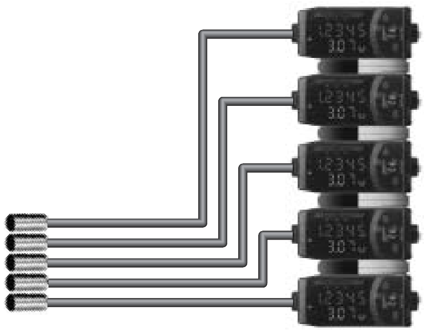
Simply Linearity Adjustment

With the ZX-E it is possible to adjust the linearity of the sensor for different types of metals, ferrous and non-ferrous. Using Omron's patented Linearity Adjustment Function you can perform a teaching function at 0%, 50% and 100% of the measurement distance from the object to the sensor head. The amplifier then confirms the result. This feature greatly reduces setting time.



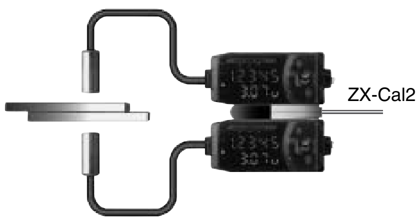
Mutual interference prevention function

Up to five sensors can be combined very closely together without any mutual interference occurring between them. This is achieved by placing a calculating unit (ZX-CAL2) between each sensor. With this unique feature multiple measurements can be made in a machine or a process.



Smart calculation function

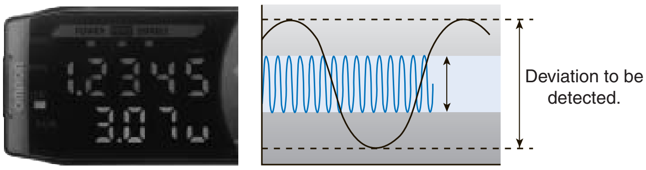
By inserting a 'calculation unit' (ZX-CAL2) between two amplifiers the thickness and difference measurements are easily obtained, and these results will be displayed on the amplifier. This technology, patented by Omron, eliminates the need for connecting a digital panel meter and the troubles one wiring and setting up associated with it.



Calculation unit for thickness-measurement

Easy-to-read resolution display

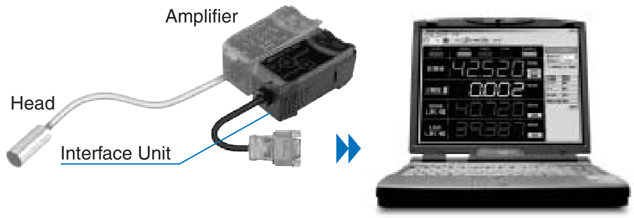
With Omron's resolution display function (patend pending), the resolution based on the object being measured is displayed and can be verified in realtime. It is easy to learn the margin for threshold values with this resolution display, allowing accurate judgements on whether or not detection is possible.



Easy-to-see resolution (patent pending)

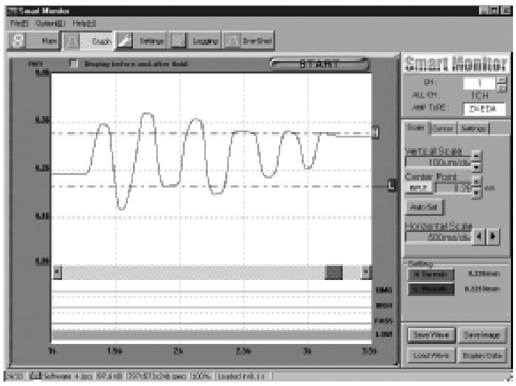
Intelligent Communiction

SmartMonitor V2 software makes sensor set-up easier!
With Omron's interface unit and SmartMonitor V2 software the ZX-E sensor can be easily connected to a Notebook or PC. The software is ideal for quickly and easily setting up parameters and values via the menu screen from a PC or using the serial port of a PLC. It offers full visualisation of all measured values on the spot. Threshold settings can be done using the Position Teach feature or by entering the values directly. All parameters and modes can be changed within seconds and interrupt time is kept to a minimum, which is very important in production processes. In addition, all settings can be saved on a computer, end reloaded based on production requirements.

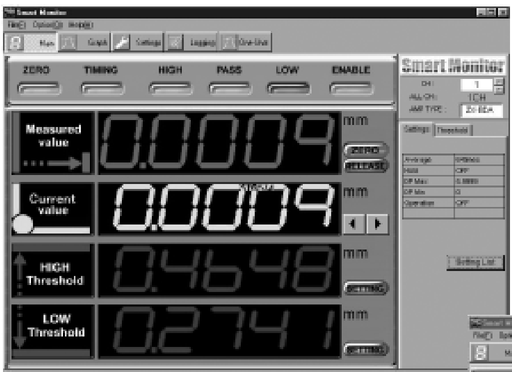


Smart Monitor software tool enables easy system set-up via PC or Notebook

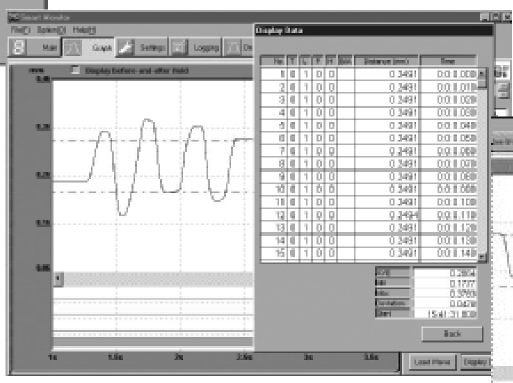
Data logging results can be processed using SmartMonitor V2 software and stored automatically (as an Excel csv file) for quality control information, leading to smoother production runs. Data can also be displayed in waveform during logging. Waveforms can be easily monitored and threshold values set simply by dragging an dropping. High-speed waveforms can be obtained and displayed in a one-shot operation. This innovative feature is ideal for use in high-speed processes, where the software can be used to generate a waveform.



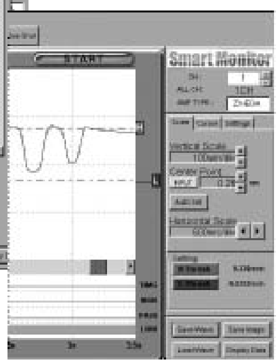
Wave form monitoring



Visualisation and monitoring of all saved data



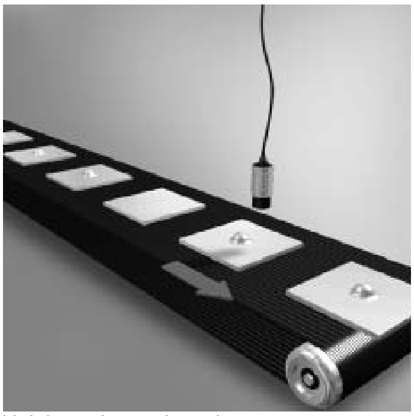
Data logging and processing

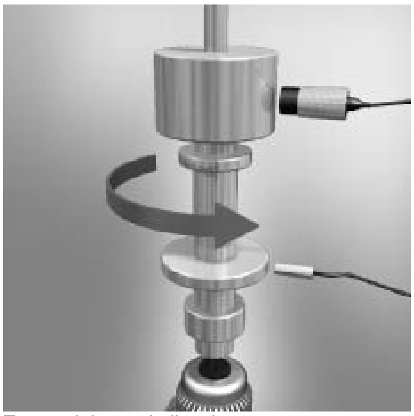


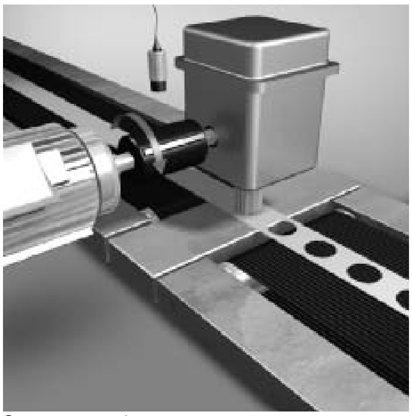
Threshold setting by drag & drop graphic function

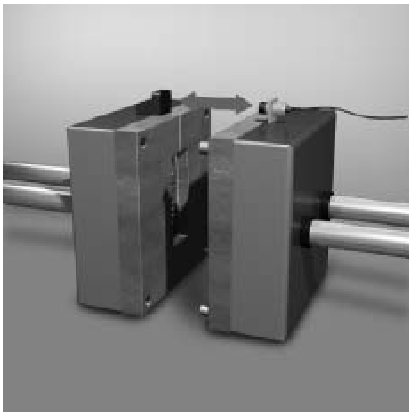
Application


Minute gap detection


Height and step detection


Eccentricity and vibration


Cutter control


Injection Moulding


Vertical packaging

Ordering Information

Sensors

Sensor Heads

Shape	Dimensions	Sensing distance	Accuracy *1	Model
Cylindrical	3 dia. x 18 mm	0.5 mm	1 µm	ZX-EDR5T
	5.4 dia. x 18 mm	1 mm		ZX-ED01T *2
	8 dia. x 22 mm	2 mm		ZX-ED02T *2
Screw-shaped	M10 x 22 mm	2 mm		ZX-EM02T *2
	M18 x 46.3 mm	7 mm		ZX-EM07MT *2

***1:** For an average count of 4,096.

***2:** Models with Protective Spiral Tubes are also available. Add a suffix of "-S" to the above model numbers when ordering. (Example: ZX-ED01T-S)

Amplifier Units

Appearance	Power supply	Output type	Model
	DC	NPN	ZX-EDA11
		PNP	ZX-EDA41

Note: Compatible connection with the Sensor Head.

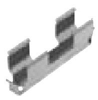
Accessories (Order Separately)

Calculating Unit

Appearance	Model
	ZX-CAL2 *

*Calculating Units are required to connect three or more Sensors.

Amplifier Mounting Brackets

Appearance	Model	Remarks
	ZX-XBE1	Attached to each Sensor Head
	ZX-XBE2	For DIN track mounting

SmartMonitor Sensor Setup Tool for Personal Computer Connection

Appearance	Name	Model
	ZX-series Communications Interface Unit	ZX-SF11
 + CD-ROM	ZX-series Communications Interface Unit + Setup Software	ZX-SFW11EV3
CD-ROM	ZX-series Sensor Setup and Logging Software	ZX-SW11EV3

Cables with Connectors on Both Ends (for Extension)

Cable length	Model	Quantity
1 m	ZX-XC1A	1
4 m	ZX-XC4A	
8 m	ZX-XC8A	

Specifications

Sensor Heads

Model			ZX-EDR5T	ZX-ED01T	ZX-ED02T/EM02T	ZX-EM07MT
Measurement range			0 to 0.5 mm	0 to 1 mm	0 to 2 mm	0 to 7 mm
Sensing object			Magnetic metals (Measurement ranges and linearities are different for non-magnetic metals. Refer to *Engineering Data* on B-67.)			
Standard reference object			18×18×3 mm		30×30×3 mm	60×60×3 mm
			Material: ferrous (S50C)			
Accuracy *1			1 µm			
Linearity *2			±0.5% F.S.			
Linear output range			Same as measurement range.			
Temperature characteristic *3 (including Amplifier Unit)			0.15% F.S./°C	0.07% F.S./°C		
Ambient temperature	Operating		0 to 50°C (with no icing or condensation)	−10 to 60°C (with no icing or condensation)		
	Storage		0 to 50°C (with no icing or condensation)	−20 to 70°C (with no icing or condensation)		
Ambient humidity			Operating and storage: 35% to 85% (with no condensation)			
Insulation resistance			50 MΩ min. (at 500 DC)			
Dielectric strength			1,000 VAC, 50/60 Hz for 1 min between charged parts and case			
Vibration resistance (destruction)			10 to 55 Hz with 1.5-mm double amplitude for 2 h each in X, Y, and Z directions			
Shock resistance (destruction)			500 m/s², 3 times each in X, Y, and Z directions			
Degree of protection (Sensor Head)			IEC60529, IP65	IEC60529, IP67		
Connection method			Connector relay (standard cable length: 2 m)			
Weight (packed state)			Approx. 120 g	Approx. 140 g		Approx. 160 g
Materials	Sensor Head	Case	Brass	Stainless steel	Brass	
		Sensing surface	Heat-resistant ABS			
	Preamplifier		PES			
Accessories			Amplifier Mounting Brackets (ZX-XBE1), Instruction Manual			

***1:** Accuracy: The resolution is the deviation (±3σ) in the linear output when connected to the ZX-EDA Amplifier Unit. The above values indicate the deviations observed 30 minutes after the power is turned ON.
(The resolution is measured with OMRON's standard reference object at 1/2 of the measurement range with the ZX-EDA set for the maximum average count of 4,096 per period.)
The resolution is given at the repeat accuracy for a stationary workpiece, and is not an indication of the distance accuracy. The resolution may be adversely affected under strong electromagnetic fields.
***2:** Linearity: The linearity is given as the error in an ideal straight line displacement output when measuring the standard reference object. The linearity and measurement values vary with the object being measured.
***3:** Temperature characteristic: The temperature characteristic is measured with OMRON's standard reference object at 1/2 of the measurement range.

Amplifier Units

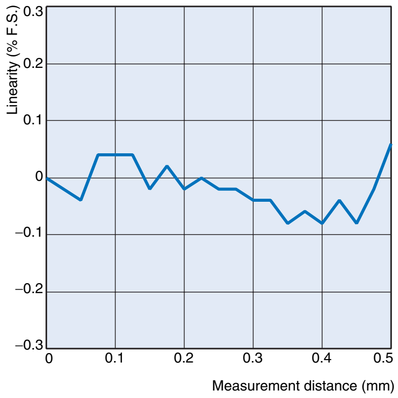
Model	ZX-EDA11	ZX-EDA41
Measurement period	150 μs	
Possible average count settings *1	1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024, 2,048, or 4,096	
Linear output *2	Current output: 4 to 20 mA/F.S., Max. load resistance: 300 Ω Voltage output:±4 V (±5 V, 1 to 5 V *3), Output impedance: 100 Ω	
Judgement outputs (3 outputs: HIGH/PASS/LOW)	NPN open-collector outputs, 30 VDC, 50 mA max. Residual voltage: 1.2 V max.	PNP open-collector outputs, 30 VDC, 50 mA max. Residual voltage: 2 V max.
Zero reset input, timing input, reset input, judgement output hold input	ON: Short-circuited with 0-V terminal or 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)	ON: Supply voltage short-circuited or supply voltage within 1.5 V OFF: Open (leakage current: 0.1 mA max.)
Function	- Measurement value display - Set value/output value/resolution display - Linearity adjustment (materials selection) - Scaling - Display reverse - Display OFF mode - ECO mode - Number of display digit changes - Sample hold - Peak hold - Bottom hold, peak-to-peak hold - Self-peak hold - Self-bottom hold - Average hold - Delay hold - Zero reset - Initial reset - Linearity initialization - ON-delay timer - OFF-delay timer - One-shot timer - Previous value comparison - Non-measurement setting - Direct threshold value setting - Position teaching - Automatic teaching - Hysteresis width setting - Timing inputs - Reset input - Judgement output hold input - Monitor focus - Linear output correction - (A-B) calculations *4 - (A+B) calculations *4 - K-(A+B) calculation *4 - Mutual interference prevention *4 - Sensor disconnection detection - Zero reset memory - Zero reset indicator - Key lock	
Indications	Judgement indicators: High (orange), pass (green), low (yellow), 7-segment main digital display (red), 7-segment sub-digital display (yellow), power ON (green), zero reset (green), enable (green)	
Voltage influence (including Sensor)	0.5% F.S. of linear output value at ±20% of power supply voltage	
Power supply voltage	12 to 24 VDC ±10%, Ripple (p-p): 10% max.	
Current consumption	140 mA max. with power supply voltage of 24 VDC (with Sensor connected)	
Ambient temperature	Operating and storage: 0 to 50°C (with no icing or condensation)	
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)	
Insulation resistance	20 MΩ min. (at 500 DC)	
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min	
Vibration resistance (destruction)	10 to 150 Hz with 0.7-mm double amplitude for 80 min each in X, Y, and Z directions	
Shock resistance (destruction)	300 m/s^2, 3 times each in 6 directions (up, down, left, right, forward, backward)	
Connection method	Prewired (standard cable length: 2 m)	
Weight (packed state)	Approx. 350 g	
Materials	Case: PBT (polybutylene terephthalate), Cover: Polycabonate	
Accessories	Instruction Manual	

***1:** The response speed of the linear output is calculated as the measurement period × (average count setting + 1) (with fixed sensitivity).
The response speed of the judgement outputs is calculated as the measurement period × (average count setting + 1) (with fixed sensitivity).
***2:** The output can be switched between a current output and voltage output using a switch on the bottom of the Amplifier Unit.
***3:** Setting is possible via the monitor focus function.
***4:** A Calculating Unit (ZX-CAL or ZX-CAL2) is required.

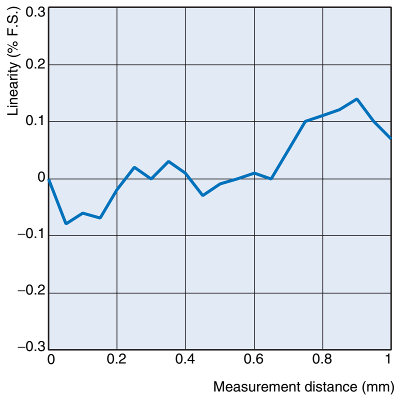
Engineering Data (Typical)

Measurement Distance vs. Linearity (with Linearity Adjusted for Standard Sensing Object)

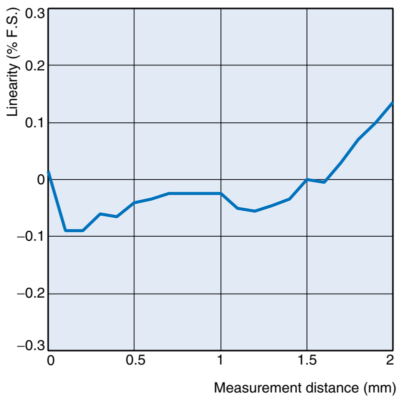
ZX-EDR5T



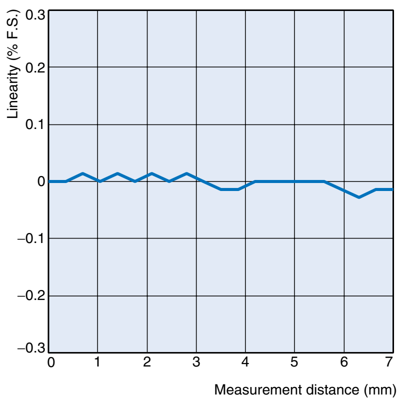
ZX-ED01T



ZX-ED02T/ZX-EM02T

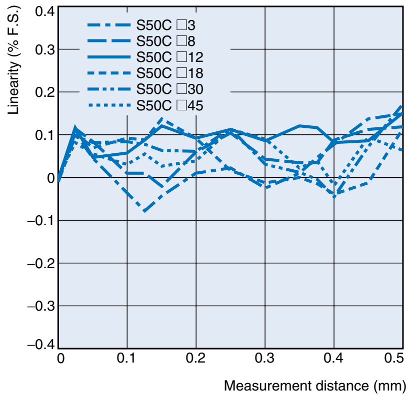


ZX-EM07MT

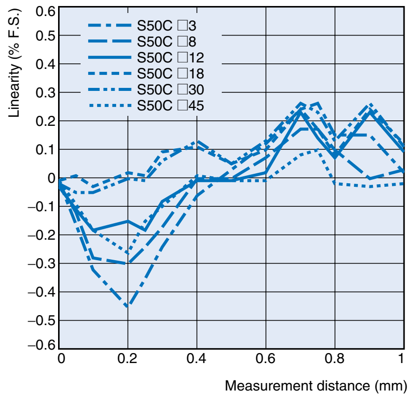


Size of Sensing Object vs. Linearity (with Linearity Adjusted for Each Sensing Object)

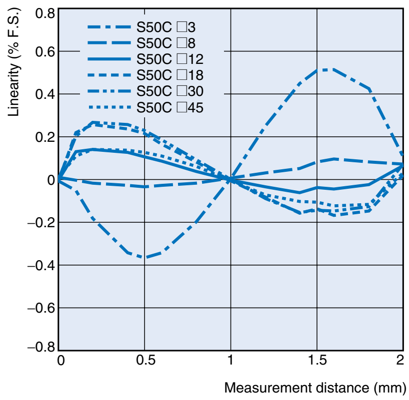
ZX-EDR5T



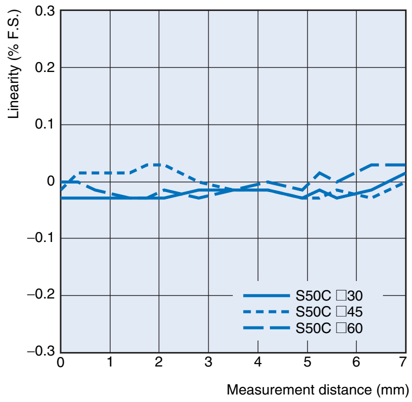
ZX-ED01T



ZX-ED02T/ZX-EM02T

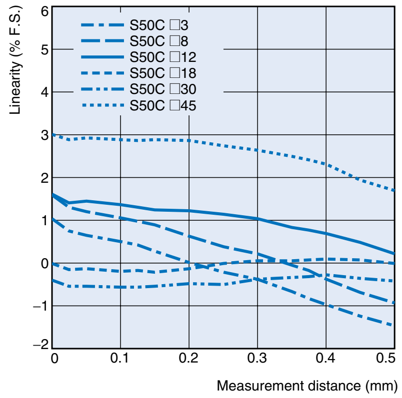


ZX-EM07MT

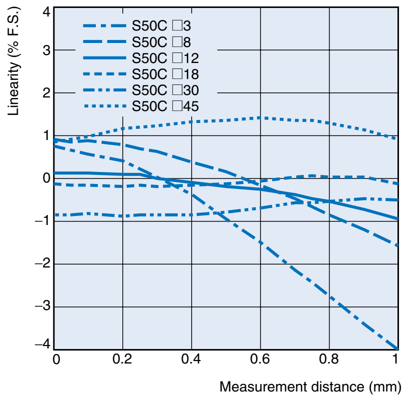


Size of Sensing Object vs. Linearity (with Linearity Adjusted for Standard Sensing Object)

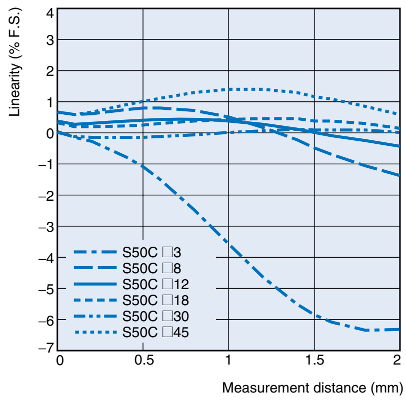
ZX-EDR5T



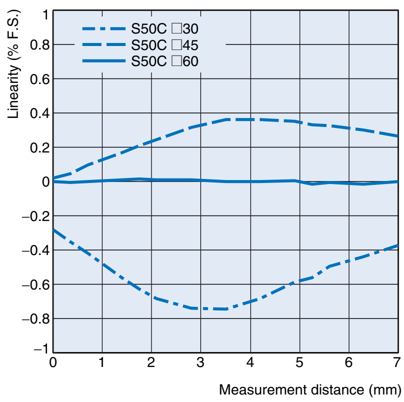
ZX-ED01T



ZX-ED02T/ZX-EM02T

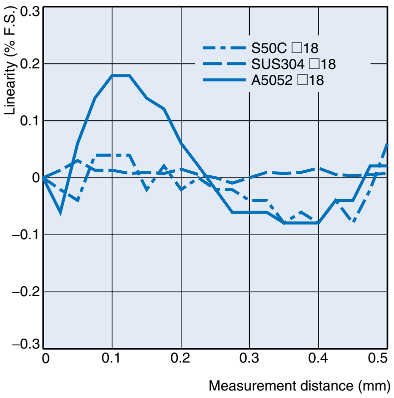


ZX-EM07MT

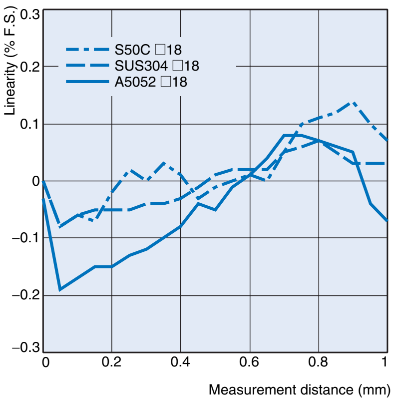


Material of Sensing Object vs. Linearity (with Linearity Adjusted for Each Sensing Object)

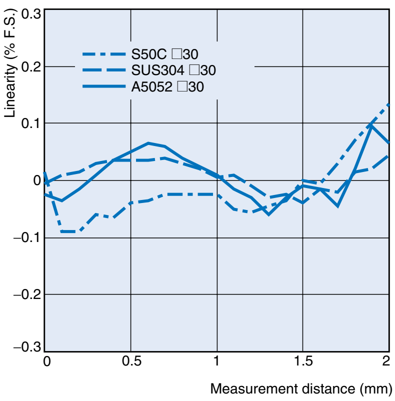
ZX-EDR5T



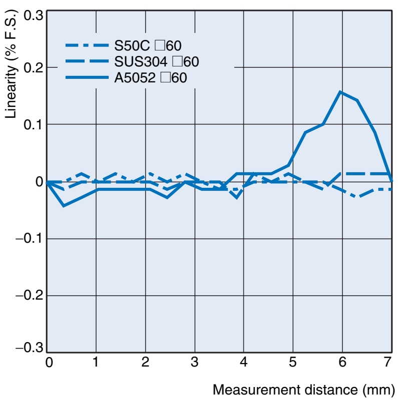
ZX-ED01T



ZX-ED02T/ZX-EM02T

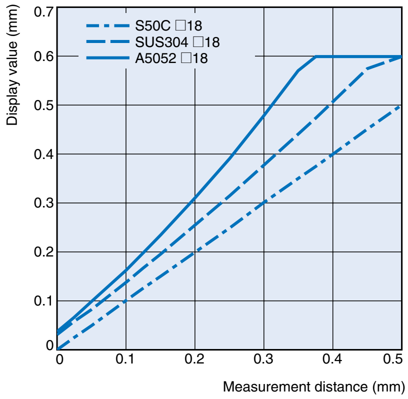


ZX-EM07MT

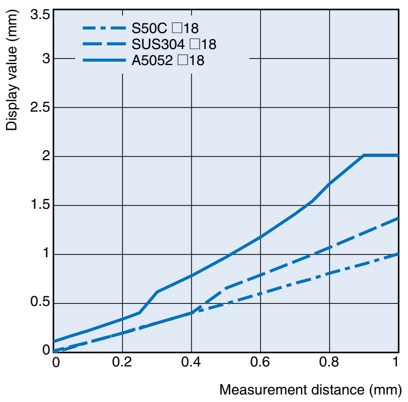


Material of Sensing Object vs. Linearity (with Linearity Adjusted for Standard Sensing Object and Iron)

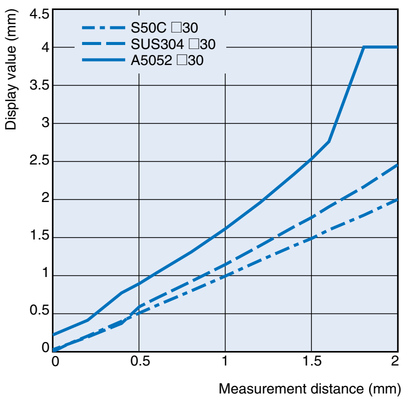
ZX-EDR5T



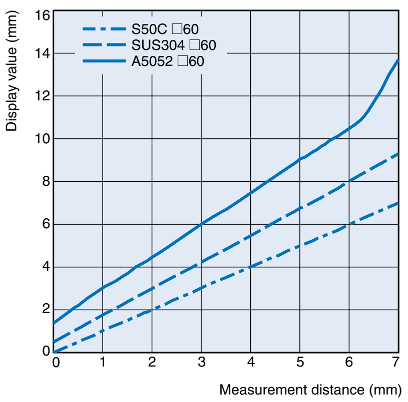
ZX-ED01T



ZX-ED02T/ZX-EM02T

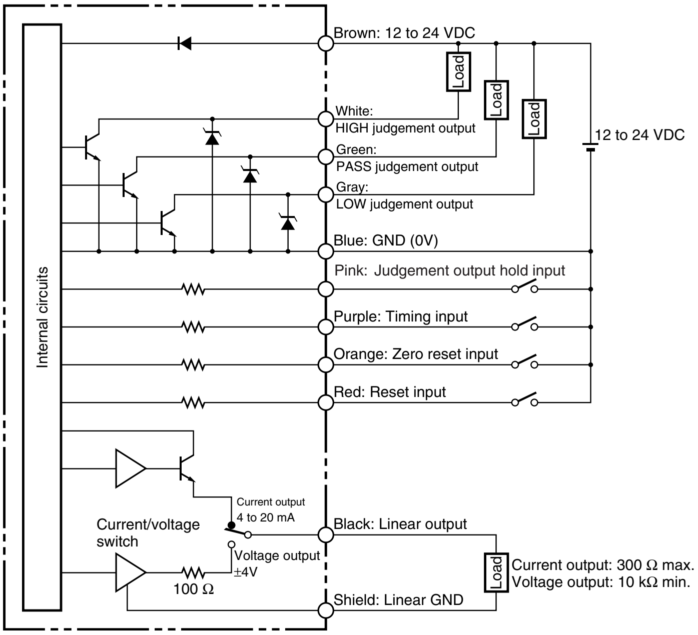


ZX-EM07MT

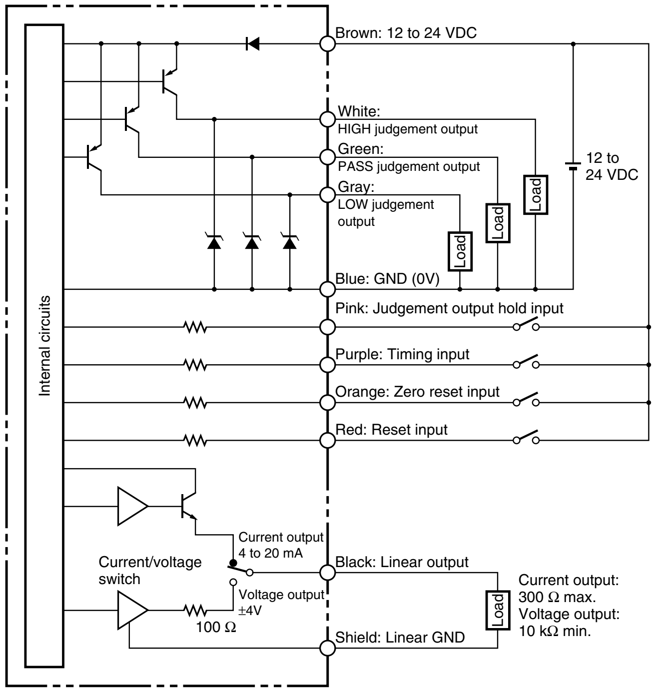


I/O Circuit Diagrams

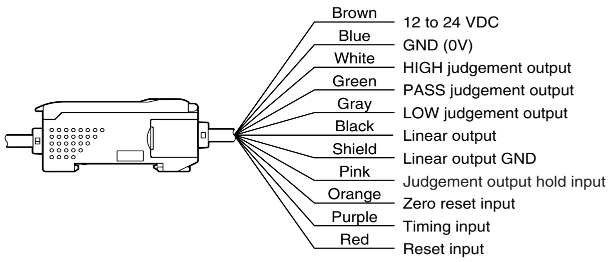
NPN Amplifier Unit: ZX-EDA11



PNP Amplifier Unit: ZX-EDA41



Connections: Amplifier Unit



Note 1. Use a separate stabilized power supply for the Amplifier Unit, particularly when high resolution is required.

2. Wire the Unit correctly. Incorrect wiring may result in damage to the Unit. (Do not allow wiring, particularly the linear output, to come into contact with other lines.)

3. Use the blue (0-V) line for the power supply and use the shield wire (linear output ground) together with the black (linear output) line for linear output. Each of these grounds must be used for the designed purpose. When not using the linear output, connect the linear output ground to the 0-V ground.

Part Names

Sensors

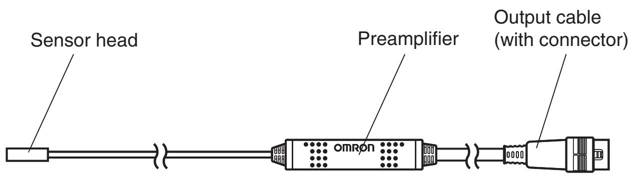
ZX-EDR5T

ZX-ED01T

ZX-ED02T

ZX-EM02T

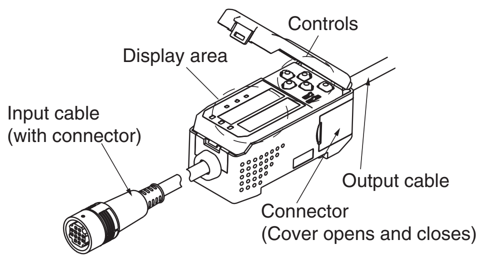
ZX-EM07MT



Amplifier Units

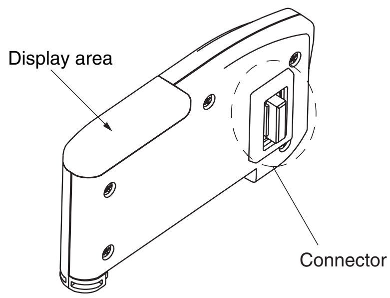
ZX-EDA11

ZX-EDA41



Calculating Unit

ZX-CAL / ZX-CAL2



Precautions

Design Precautions

Conform to the specified ratings and performance. Refer to *page B-65 Specifications* for details.

Objects of certain materials or shapes may not be detectable, or the detection accuracy may not be sufficiently high.

Environment

Do not operate the product in locations subject to flammable or explosive gases.

In order to ensure safe operation and maintenance, do not install the product in the vicinity of high-voltage devices or power equipment.

Wiring

Do not use the product at voltages exceeding the rated values. Doing so may result in damage.

Do not connect the product to an AC power supply or connect the power supply in reverse.

Do not short-circuit the load for open-collector output.

Do not lay the power cable for the product together with or in the same duct as high-voltage lines or power lines. Doing so may result in incorrect operation or damage due to induction.

Do not connect or disconnect connectors while the power is ON. Doing so may result in damage.

Adjustment

Setting

When setting threshold values, ensure that the Amplifier Unit's judgement output hold input line is ON so that there is no judgement output to external devices.

Other Precautions

Do not attempt to disassemble, repair, or modify the product.

Dispose of the product using standard procedures for industrial waste.

These Sensors are not compatible with the ZX-L□□ Smart Sensors (laser type). Do not connect combinations of ZX-E□□ Smart Sensors and ZX-L□□ Smart Sensors.

Correct Use

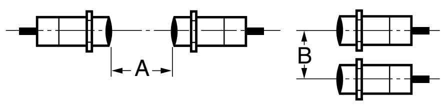
Design Precautions

Power Supplies

Allow a warm-up period of approximately 30 minutes after turning ON the power supply.

Mutual Interference

Up to 5 Sensor Heads can be used together by connecting the ZX-CAL/ZX-CAL2 Calculating Unit between Amplifier Units. When installing Sensor Heads facing each other or in parallel, separate them by the minimum distances given in the table below.



Mutual Interference

Model	A	B
ZX-EDR5T	5 mm	20 (3.1) mm
ZX-ED01T	10 mm	50 (5.4) mm
ZX-ED02T	20 mm	50 (8) mm
ZX-EM02T	20 mm	50 (10) mm
ZX-EM07MT	100 mm	150 (30) mm

Note: The figures in parentheses apply when the mutual interference prevention function is used.

Compatibility

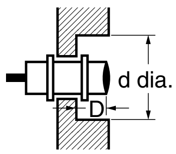
Sensors and Amplifier Units are mutually compatible. Sensors can be added or replaced individually.

Influence of High-frequency Electromagnetic Fields

Using the product in the vicinity of devices that generate high-frequency electromagnetic fields, such as ultrasonic cleaning equipment, high-frequency generators, transceivers, mobile phones, and inverters, may result in malfunction.

Influence of Metallic Objects

When installing the product, separate it from metallic objects by the distances shown below.



Influence of Metallic Objects

Model	d	D
ZX-EDR5T	8 mm	9 mm
ZX-ED01T	10 mm	
ZX-ED02T/EM02T	12 mm	
ZX-EM07MT	55 mm	20 mm

Wiring

Wiring Check

After wiring is completed, before turning ON the power, confirm that the power supply is connected correctly, that there are no faulty connections, such as load short-circuits, and that the load current is correct. Incorrect wiring may result in failure.

Cable Extension

Do not extend the cable for the Sensor and the Amplifier Unit to a length exceeding 10 m. Use a ZX-XC□A Extension Cable (sold separately) to extend the Sensor's cable. Extend the Amplifier Unit's cable using a shielded cable of the same type.

Power Supply

When using a commercially available switching regulator, ground the FG (frame ground) terminal.

If the power supply line is subject to surges, connect a surge absorber that meets the conditions of the operating environment.

Calculating Unit

When using a Calculating Unit, connect the linear output ground of the corresponding Amplifier Unit.

Connectors

Do not connect or disconnect connectors while the power is ON. Be sure hold to connectors by the cover when connecting or disconnecting.

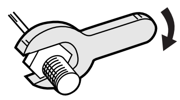
Mounting

Handling

When mounting the Sensor Head, do not apply excessive shock by, for example, using a hammer. Doing so may result in damage or a reduction in the level of water-proofing. Also, there are screw-shaped models that require a toothed washer to allow for a tolerance in the tightening torque for the nut.

Tightening Torque

Do not apply excessive torque when tightening the nut. Use a toothed washer if necessary.

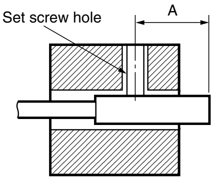


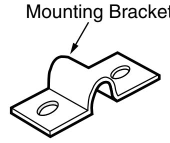
Model	Tightening torque
ZX-EM02T	15 N·m
ZX-EM07MT	

Note: The above figure applies for use with a toothed washer.

Mounting Cylindrical Models:

Tighten set screws with a tightening torque of 0.2 N·m max.





Y92E-F5R4 (for 5.4-dia. screws), sold separately

Model	A
ZX-EDR5T	9 to 18 mm
ZX-ED01T	
ZX-ED02T	11 to 22 mm

Installation Location

Do not install the product in the following locations.

- Locations subject to temperatures outside the specified range
- Locations subject to condensation due to sudden temperature changes
- Locations subject to humidity levels outside range 35% to 85%
- Locations subject to corrosive or flammable gases
- Locations subject to dust, salts, or metallic powder.
- Locations directly subject to vibrations and shocks
- Locations subject to direct sunlight
- Locations subject to splashes of water, oil, or chemicals
- Locations subject to strong electromagnetic or electrical fields

Maintenance and Inspection

- Be sure to turn OFF the power supply before adjusting or removing the Sensor Head.
- Cleaning:
  Do not use thinners, benzine, acetone, or kerosene for cleaning.

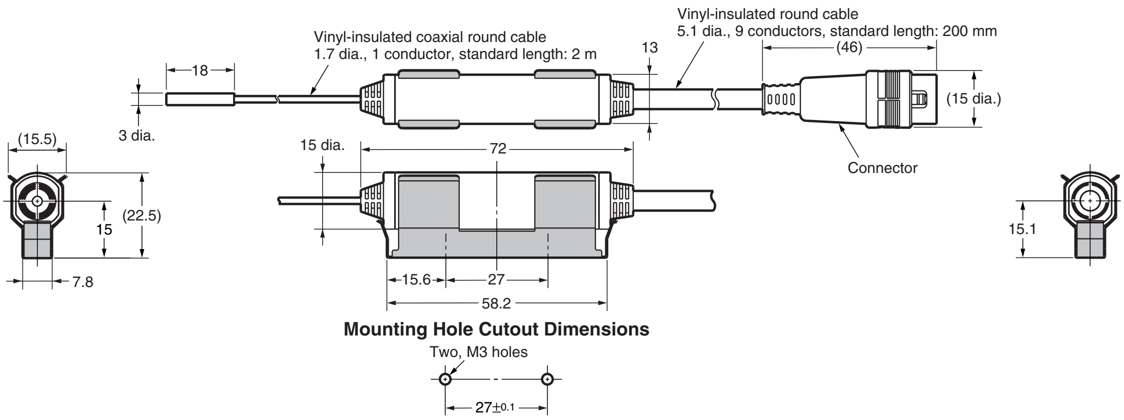
Dimensions

Sensors

Sensor Heads

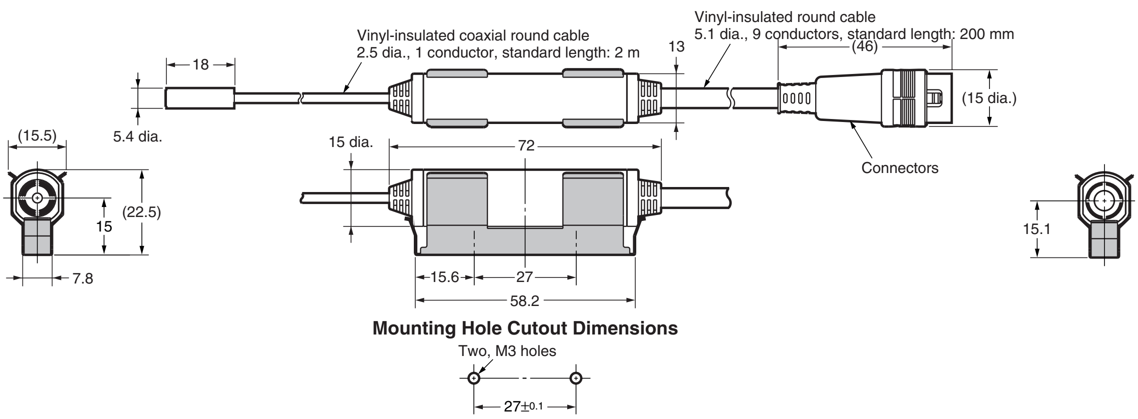
ZX-EDR5T

Dimensions with Mounting Bracket Attached



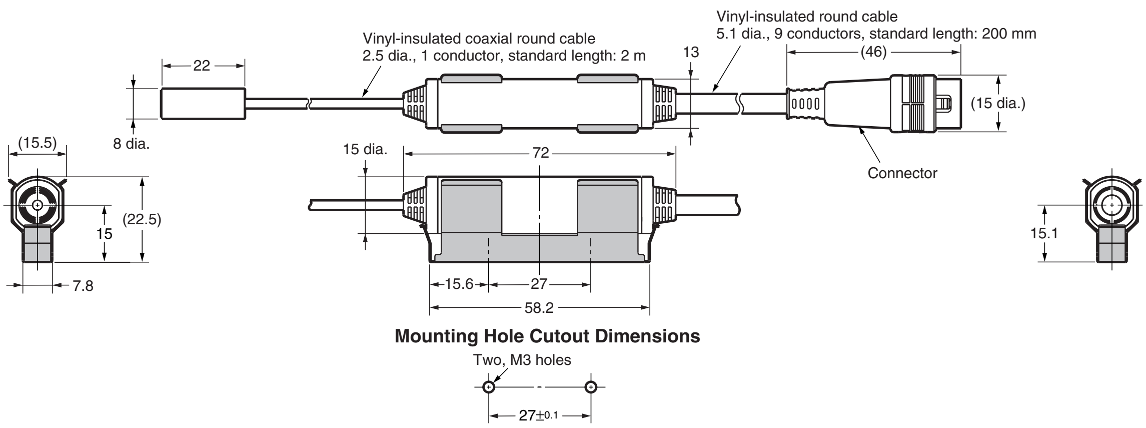
ZX-ED01T

Dimensions with Mounting Bracket Attached



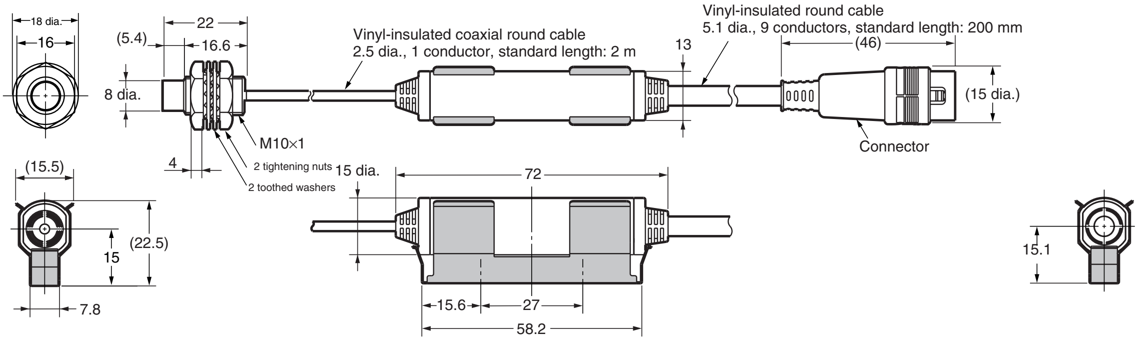
ZX-ED02T

Dimensions with Mounting Bracket Attached

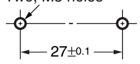


ZX-EM02T

Dimensions with Mounting Bracket Attached

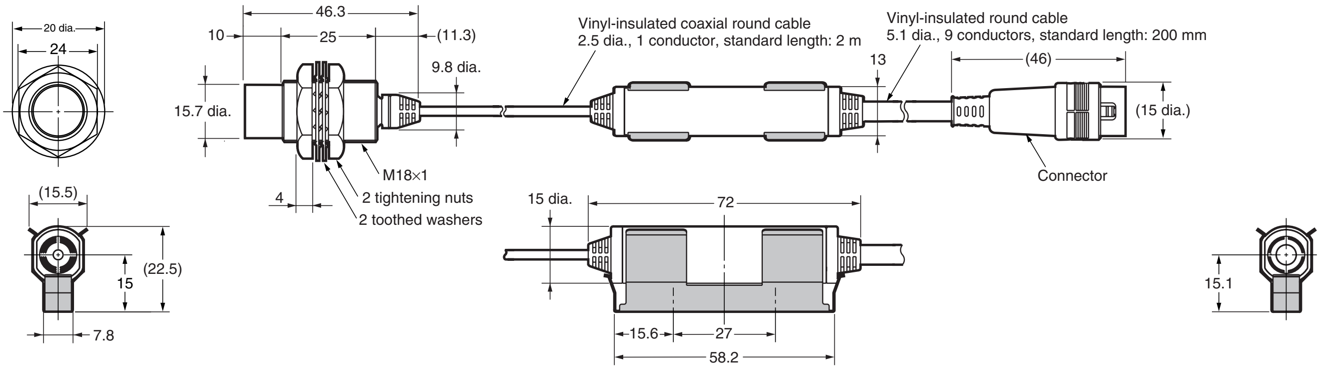


Mounting Hole Cutout Dimensions

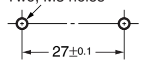


ZX-EM07MT

Dimensions with Mounting Bracket Attached

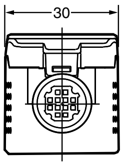


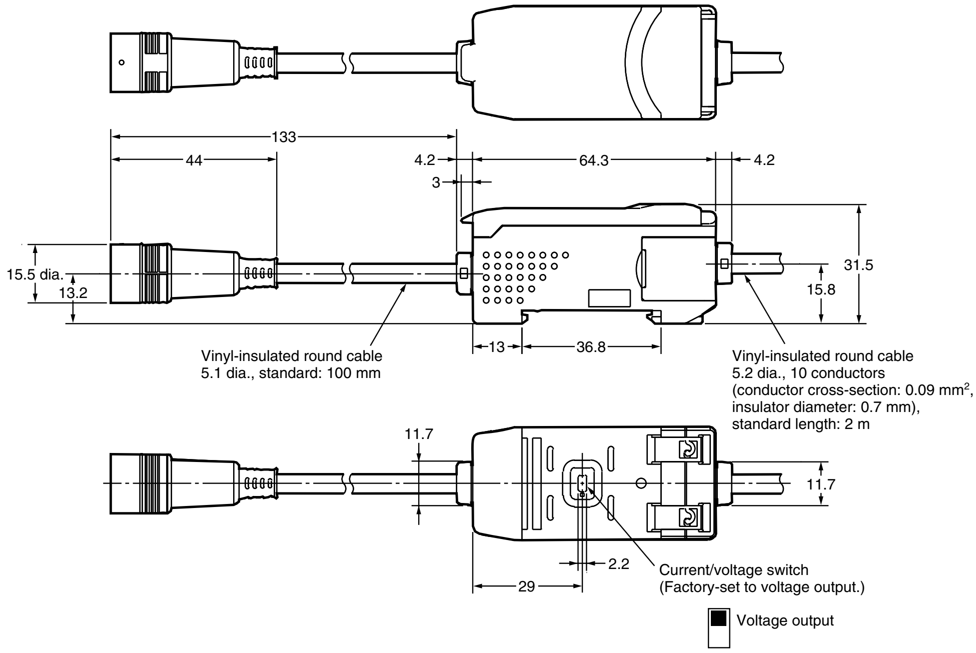
Mounting Hole Cutout Dimensions



Amplifier Units

ZX-EDA11
ZX-EDA41

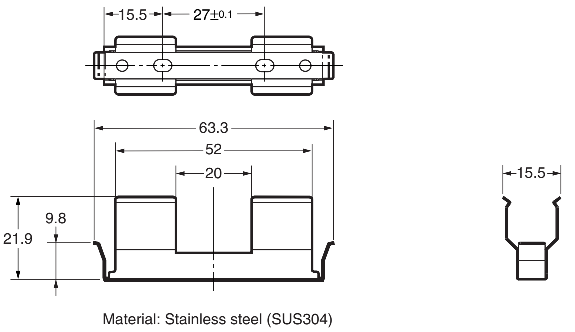




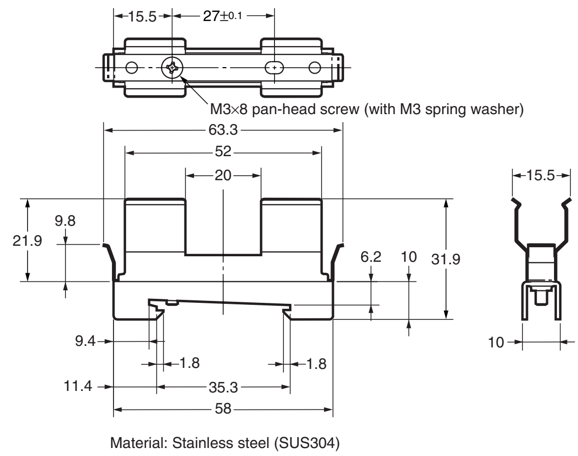
Accessories (Sold Separately)

Preamplifier Mounting Bracket

ZX-XBE1

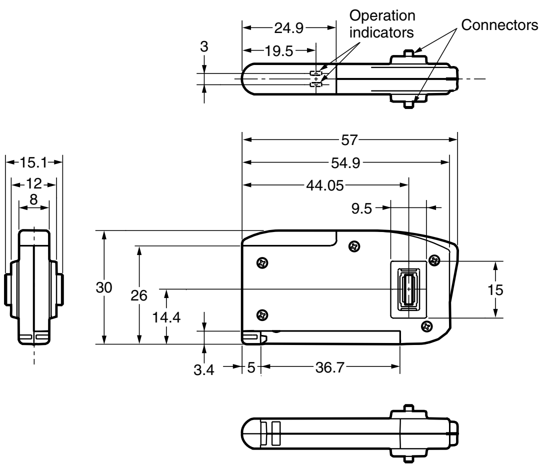


ZX-XBE2



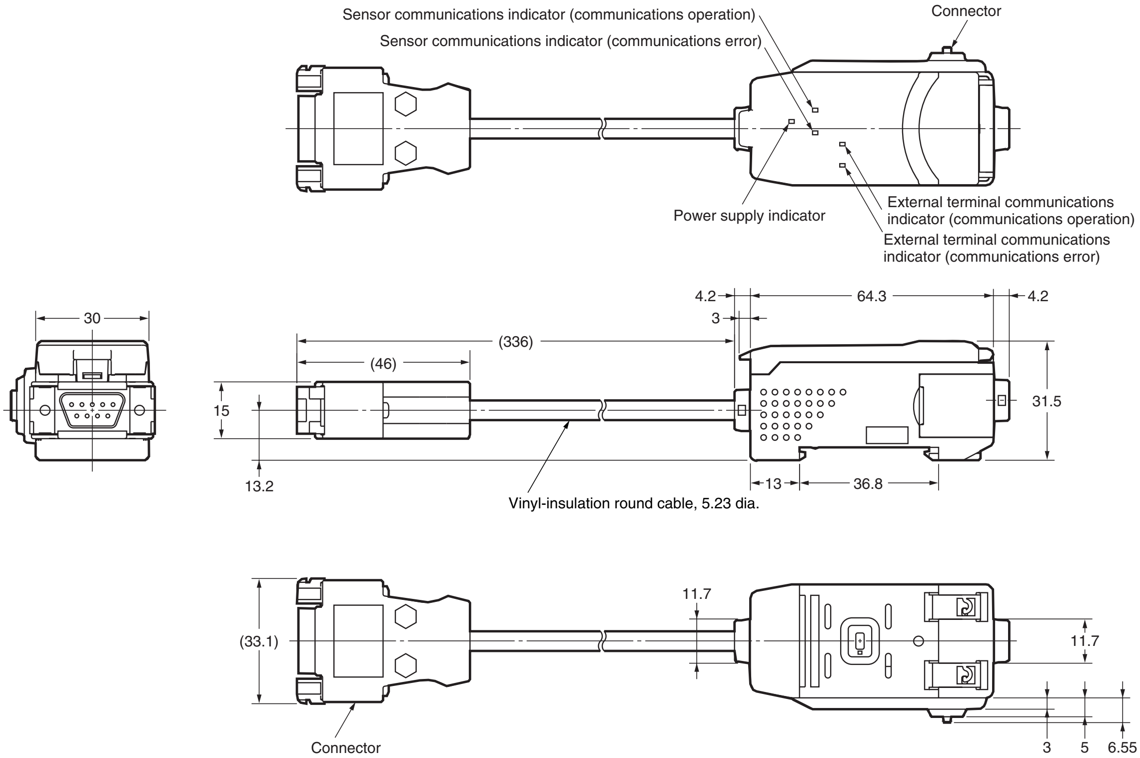
Calculating Unit

ZX-CAL/ZX-CAL2



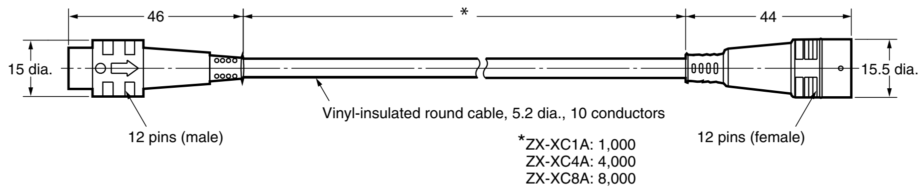
ZX-series Communications Interface Unit

ZX-SF11



Cables with Connectors on Both Ends (for Extension)

ZX-XC1A (1 m)
ZX-XC4A (4 m)
ZX-XC8A (8 m)



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Smart Sensor High precision contact type ZX-T Series

ZX-T Series

Ordering Information

Sensors

Sensor Heads

Size	Type	Sensing distance	Resolution (See note.)	Model
6 dia.	Short type	1 mm	0.1 µm	ZX-TDS01T
6 dia.	Standard type	4 mm	0.1 µm	ZX-TDS04T
6 dia.	Low measurement type	4 mm	0.1 µm	ZX-TDS04T-L

Note: The resolution refers to the minimum value that can be read when a ZX-TDA□1 Amplifier Unit is connected.

Amplifier Units

Appearance	Power supply	Output type	Model
	DC	NPN	ZX-TDA11
		PNP	ZX-TDA41

Accessories (Order Separately)

Calculating Unit

Appearance	Model
	ZX-CAL2

ZX-series Communicationys Interface Unit

Appearance	Model
	ZX-SF11

SmartMonitor Sensor Setup Tool for Personal Computer Connection

Appearance	Name	Model
	ZX-series Communications Interface Unit	ZX-SF11
 + CD-ROM	ZX-series Communications Interface Unit + ZX-series Sensor Setup Software Basic	ZX-SFW11EV3 *1, *2
CD-ROM	ZX-series Sensor Setup Software	ZX-SW11EV3 *2

Note: *1. When using the ZX-TDA11/41 with the SmartMonitor, either the ZX-SFW11EV3 or the ZX-SW11EV3 SmartMonitor must be used. Earlier versions cannot be used.
Note: *2. The ZX-SFW11EV3 SmartMonitor can be used for parameter setting, data logging and waveform monitoring.

Cables with Connectors on Both Ends (for Extension)*

Cable length	Model	Quantity
1 m	ZX-XC1A	1
4 m	ZX-XC4A	
8 m	ZX-XC8A	

Note: *Robot Cable models are also available.
The model numbers are ZX-XC□R.

Preamplifier Mounting Brackets

Appearance	Model	Remarks
	ZX-XBT1	Attached to each Sensor Head
	ZX-XBT2	For DIN track mounting

Cables with Connectors on Both Ends (for Extension)

Cable length	Model	Quantity
1 m	ZX-XC1A	1
4 m	ZX-XC4A	
8 m	ZX-XC8A	

Specifications

Sensor Heads

Item		ZX-TDS01T	ZX-TDS04T	ZX-TDS04T-L
Measurement range		1 mm	4 mm	
Maximum actuator travel distance		Approx. 1.5 mm	Approx. 5 mm	
Resolution (See note 1.)		0.1 µm		
Linearity (See note 2.)		0.3% F.S.		
Operating force (See note 3.)		Approx. 0.7 N		Approx. 0.25 N
Degree of protection (Sensor Head)		IEC60529, IP67		IEC60529, IP54
Mechanical durability		10,000,000 operations min.		
Ambient temperature		Operating: 0°C to 50°C (with no icing or condensation) Storage: −15°C to 60°C (with no icing or condensation)		
Ambient humidity		Operating and storage: 35% to 85% (with no icing or condensation)		
Temperature characteristic (See note 4.)	Sensor Head	0.03% F.S./°C		
	Preamplifier	0.01% F.S./°C		
Weight (packed state)		Approx. 100 g		
Materials	Sensor Head	Stainless steel		
	Preamplifier	Polycarbonate		
Accessories		Instruction manual, Preamplifier Mounting Brackets (ZX-XBT1)		

Note 1. The resolution is given as the minimum value that can be read when a ZX-TDA□1 Amplifier Unit is connected. This value is taken 15 minutes after turning ON the power with the average number of operations set to 256.
2. The linearity is given as the error in an ideal straight line displacement output.
3. These figures are representative values that apply for the measurement mid-point, and are for when the provided actuator is used, with the actuator moving downwards. If the actuator moves horizontally or upwards, the operating force will be reduced. Also, if an actuator other than the standard one is used, the operating force will vary with the weight of the actuator itself.
4. These figures are representative values that apply for the mid-point of the measurement range.

Amplifier Units

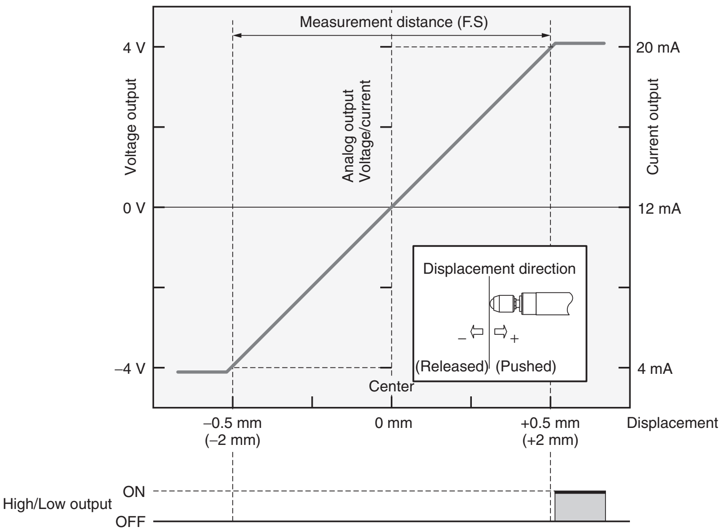
Item	ZX-TDA11	ZX-TDA41
Measurement period	1 ms	
Possible average count settings (See note 1.)	1, 16, 32, 64, 128, 256, 512, or 1,024	
Linear output (See note 2.)	Current output: 4 to 20 mA/F.S., Max. load resistance: 300 Ω Voltage output: ±4 V (±5 V, 1 to 5 V (See note 3.)), Output impedance: 100 Ω	
Judgement outputs (3 outputs: HIGH/PASS/LOW)	NPN open-collector outputs, 30 VDC, 30 mA max. Residual voltage: 1.2 V max.	PNP open-collector outputs, 30 VDC, 30 mA max. Residual voltage: 2 V max.
Zero reset input, timing input, reset input, judgement output hold input	ON: Short-circuited with 0-V terminal or 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)	ON: Supply voltage short-circuited or supply voltage of 1.5 V or less OFF: Open (leakage current: 0.1 mA max.)
Function	- Measurement value display- Present value/set value/output value display - Display reverse- ECO mode - Number of display digit changes - Sample hold- Peak hold- Bottom hold, peak-to-peak hold - Self-peak hold - Self-bottom hold- Zero reset - Initial reset- Direct threshold value setting- Position teaching - Hysteresis width setting- Timing inputs- Reset input - Judgement output hold input - Monitor focus- (A-B) calculations (See note 4.) - (A+B) calculations (See note 4.) - Sensor disconnection detection - Zero reset memory- Function lock- Non-measurement setting - Clamp value setting- Scale inversion- Zero reset indicator - Span adjustment- Warming-up display- Pressing force alarm	
Indicators	Judgement indicators: High (orange), pass (green), low (yellow), 7-segment main digital display (red), 7-segment sub-digital display (yellow), power ON (green), zero reset (green), enable (green)	
Power supply voltage	12 to 24 VDC ±10%, Ripple (p-p): 10% max.	
Current consumption	140 mA max. (with Sensor connected), For 24-VDC power supply voltage: 140 mA max. (with Sensor connected)	
Ambient temperature	Operating and storage: 0 to 50°C (with no icing or condensation)	
Temperature characteristic	0.03% F.S./°C	
Connection method	Prewired (standard cable length: 2 m)	
Weight (packed state)	Approx. 350 g	
Materials	Case: PBT (polybutylene terephthalate), Cover: Polycarbonate	

Note 1. The response speed of the linear output is calculated as the measurement period × (average count setting + 1).
The response speed of the judgement outputs is calculated as the measurement period × (average count setting + 1).
2. The output can be switched between a current output and voltage output using a switch on the bottom of the Amplifier Unit.
3. Setting is possible via the monitor focus function.
4. A Calculating Unit (ZX-CAL2) is required.

Characteristic Data

Output Characteristics
Voltage/Current Output

ZX-TDS01T/-S04T/-S04T-L

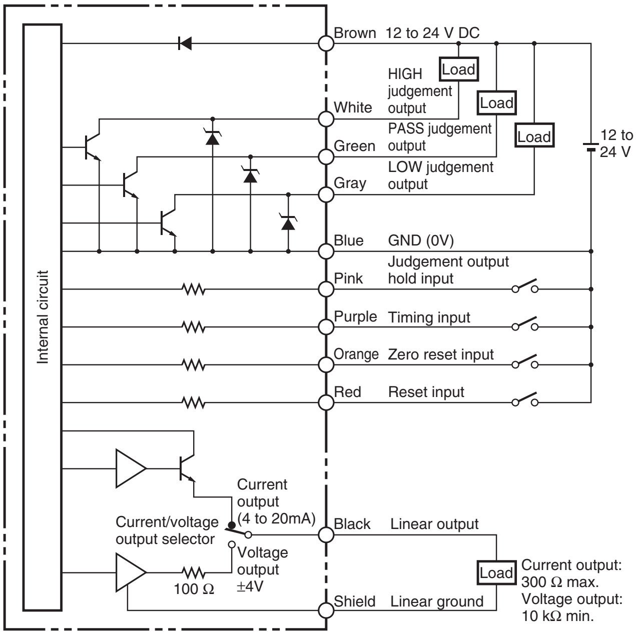


Note: To prevent destroying the Sensor Head, both the high and low judgment outputs will light if 101% of the upper limit of the measurement distance is reached.

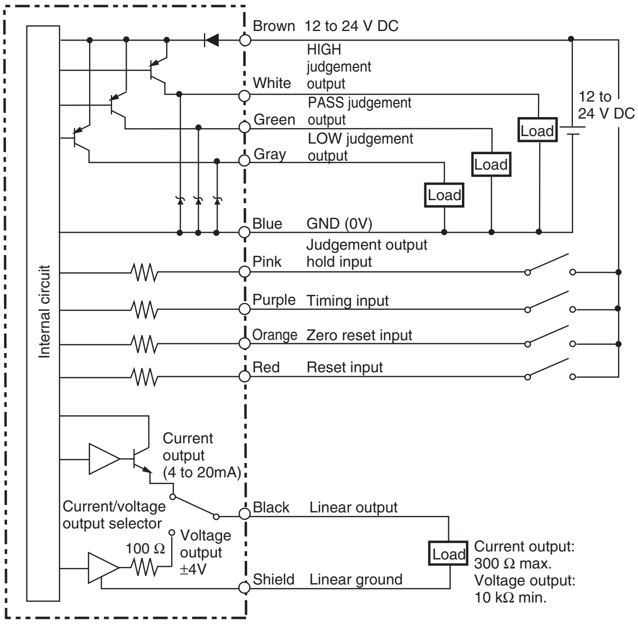
ZX-T Series

I/O Circuit Diagrams

NPN Amplifier Unit: ZX-TDA11

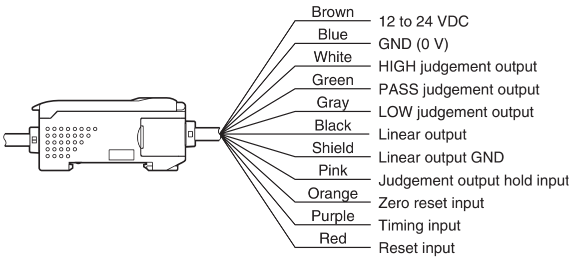


PNP Amplifier Unit: ZX-TDA41



Connectors

Amplifier Unit



Note 1. Use a stabilized power supply separate from other devices and power systems for the Amplifier Unit, particularly when high resolution is required.

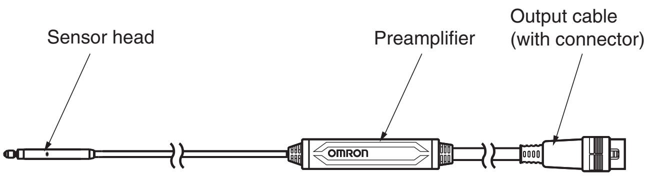
2. Always wire correctly. Incorrect wiring may damage the Unit. Use a different ground for the linear output from the normal ground.

3. The blue line (0 V) is the 0 V power supply line. The shield wire (linear output GND) is used together with the black line (linear output) to connect the linear output. Wire these lines correctly. Always ground the linear output terminal even when the linear output is not used.

Part Names

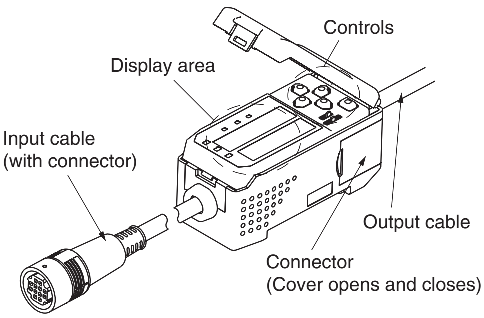
Sensor Heads

ZX-TDS01T
ZX-TDS04T
ZX-TDS04T-L



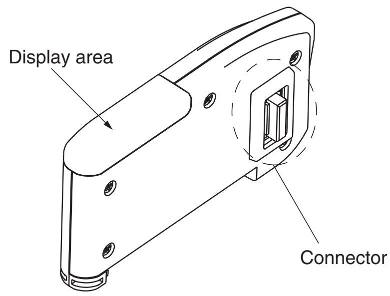
Amplifier Unit

ZX-TDA11
ZX-TDA41



Calculating Unit

ZX-CAL2



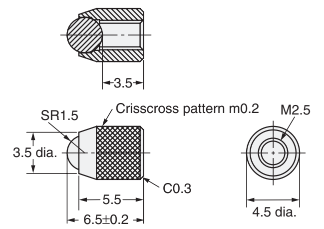
Options (Actuators)

Model		Type (material)	Screw section	Appearance	Application	Applicable Sensor (See note.) ZX-TDS□T
D5SN-	TB1	Ball type (steel)	Female screw M2.5 x 0.45		Measuring ordinary flat surfaces (standard actuator supplied with the ZX-TDS Series)	○
	TB2	Ball type (carbide steel)	Female screw M2.5 x 0.45		Measurements where abrasion resistance is critical Measured objects: Carbide (HR90) or lower.	○
	TB3	Ball type (ruby)	Female screw M2.5 x 0.45		Measurements where abrasion resistance is critical Measured objects: Carbide (HR90) or higher.	○
	TN1	Needle type (carbide steel)	Male screw M2.5 x 0.45		Measuring the bottom of grooves and holes	△
	TF1	Flat (carbide steel)	Male screw M2.5 x 0.45		Measuring spherical objects	△
	TA	Conversion Adapter (stainless steel)	Through-hole female screw M2.5 x 0.45		Mounting D5SN-TN1/-TF1 or commercially available actuators on ZX-TDS-series Sensors	○

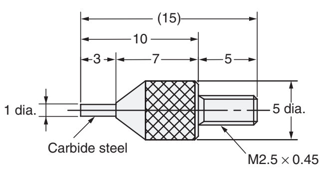
Note: ○ Replacement possible   △ Conversion Adapter required

Dimensions

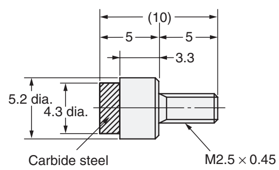
D5SN-TB1/TB2/TB3



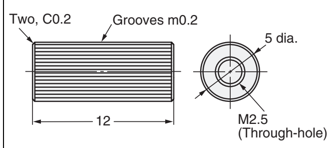
D5SN-TN1



D5SN-TF1

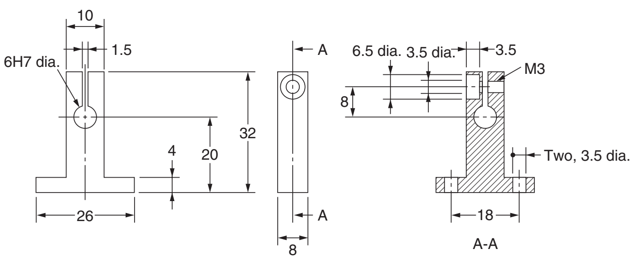


D5SN-TA



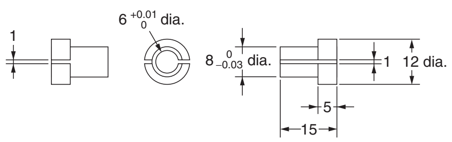
Mounting Jigs

Recommended Mounting Jigs for ZX-TDS Sensors



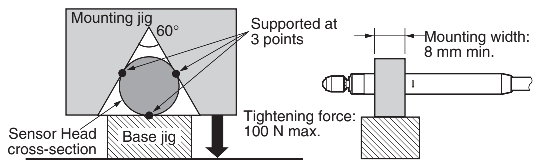
Tightening torque: 0.6 to 0.8 N·m (M3 screws)
Material: Aluminum

Mounting Jigs for an 8-diameter Stand



Material: Brass

Mounting with 3-point Support

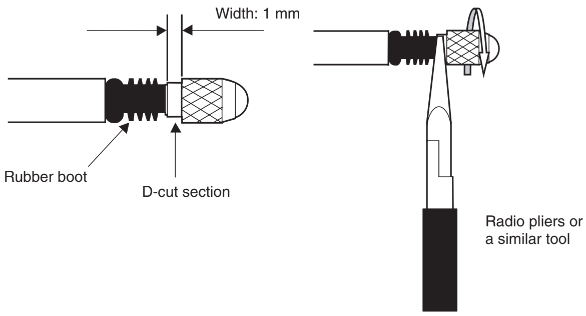


Replacing Actuators

Be careful not to damage the rubber boot with pliers or other tools when replacing the actuator.

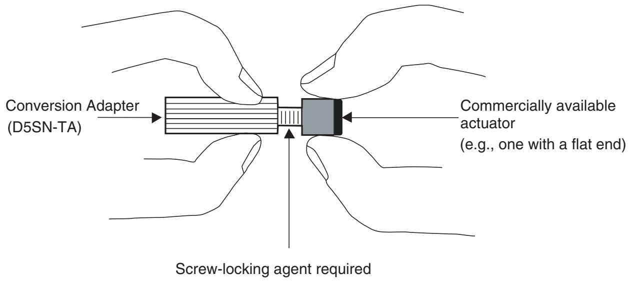
1. Remove the standard actuator.

- Hold the plunger's D-cut section with radio pliers or a similar tool while removing the actuator.
- If the replacement must be performed by holding the Sensor Head itself, ensure that a torque exceeding 0.15 N·m is not applied. Applying excessive torque may have an adverse affect on plunger operation.



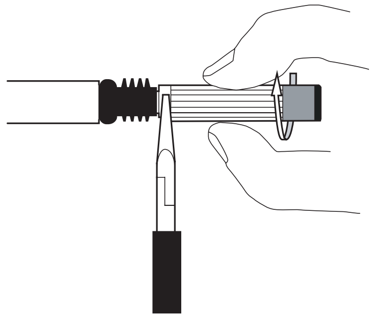
2. Mount the commercial actuator to the Conversion Adapter.

- Tighten the actuator securely, and ensure that there is no looseness.
- If necessary, apply a screw-locking agent. (Recommended: Three-Bond 1401B)



3. Mount the Conversion Adapter to the plunger.

- Hold the plunger's D-cut section with radio pliers or a similar tool while mounting and securing the Conversion Adapter.
- If the replacement must be performed by holding the Sensor Head itself, ensure that a torque exceeding 0.15 N·m is not applied. Applying excessive torque may have an adverse affect on plunger operation.



Precautions

Design Precautions

- Conform to the specified ratings and performance. Refer to *Specifications* on page B-78 for details.
- Measurements may not be possible or may not be accurate for some materials and shapes.
- The Sensor will be destroyed if the Actuator is pressed too far. Do not use the Actuator past the point where a pressing force alarm (OVER) is displayed.
- Do not remove the rubber boot. Without the rubber boot, foreign matter may enter the Sensor Head, possibly causing the Sensor Head to malfunction.
- Use suitable torque and force when mounting the Sensor. Refer to page B-81 for details.
- The Sensor may be destroyed if excessive force is applied.

Environment

- Do not operate the product in locations subject to flammable or explosive gases.
- In order to ensure safe operation and maintenance, do not install the product in the vicinity of high-voltage devices or power equipment.

Wiring

- Do not use the product at voltages exceeding the rated values. Doing so may result in damage.
- Do not connect the product to an AC power supply or connect the power supply in reverse.
- Do not short-circuit the load for open-collector output.

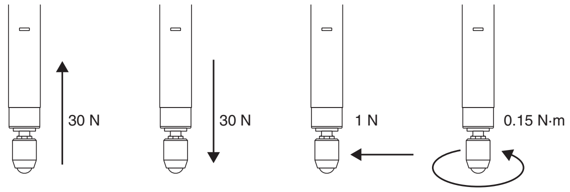
Correct Use

- System Design

Warming Up
After turning ON the power, allow the Smart Sensor to warm up for 15 minutes minimum prior to use.

Measurements
Do not expose the plunger to forces exceeding the limits in the following diagram. Doing so may damage the plunger.

ZX-TDS-Series Sensors



- Adjustments

Settings
When setting the threshold value with the Smart Sensor connected to an external device, turn ON the Amplifier Unit's judgement output hold input to prevent the judgement from being output to the external device.

- Compatibility

Sensors and Amplifier Units are mutually compatible. Sensors can be added or replaced individually.

- Influence of High-frequency Electromagnetic Fields

Using the product in the vicinity of devices that generate high-frequency electromagnetic fields, such as ultrasonic cleaning equipment, high-frequency generators, transceivers, mobile phones, and inverters, may result in malfunction.

Other Precautions

Do not attempt to disassemble, repair, or modify the product.

Dispose of the product using standard procedures for industrial waste.

These Sensors are not compatible with the ZX-L□□ Smart Sensors (laser type). Do not connect combinations of ZX-E□□ Smart Sensors and ZX-T□□ Smart Sensors.

Wiring

- Wiring Check

After wiring is completed, before turning ON the power, confirm that the power supply is connected correctly, that there are no faulty connections, such as load short-circuits, and that the load current is correct. Incorrect wiring may result in failure.

- Cable Extension

Do not extend the cable for the Sensor and the Amplifier Unit to a length exceeding 10 m. Use a ZX-XC□A Extension Cable (sold separately) to extend the Sensor's cable. Extend the Amplifier Unit's cable using a shielded cable of the same type.

- Power Supply

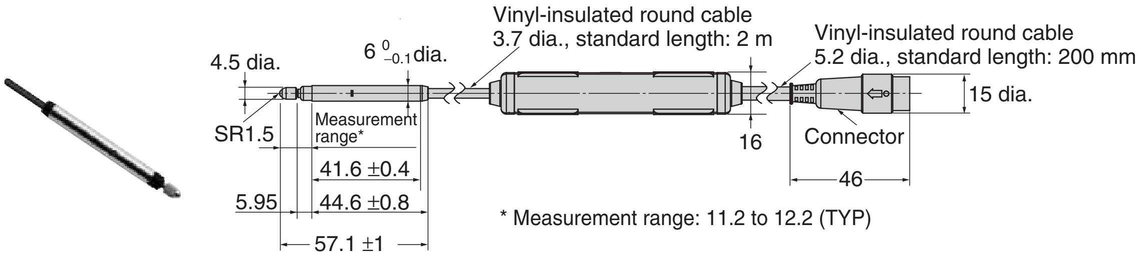
When using a commercially available switching regulator, ground the FG (frame ground) terminal.

If the power supply line is subject to surges, connect a surge absorber that meets the conditions of the operating environment.

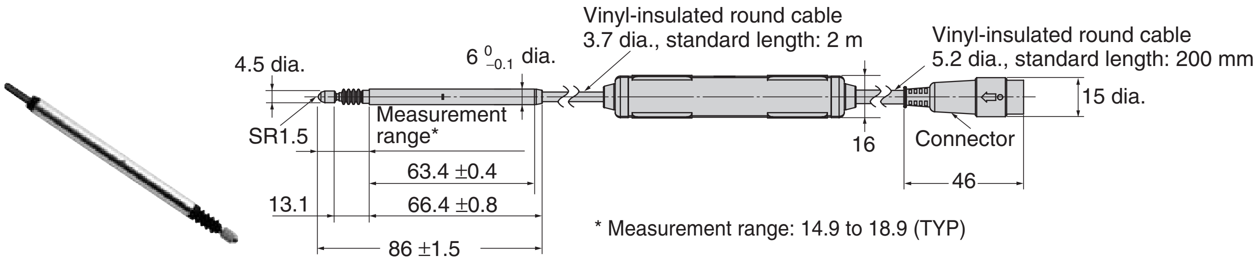
Dimensions

Sensors

ZX-TDS01T

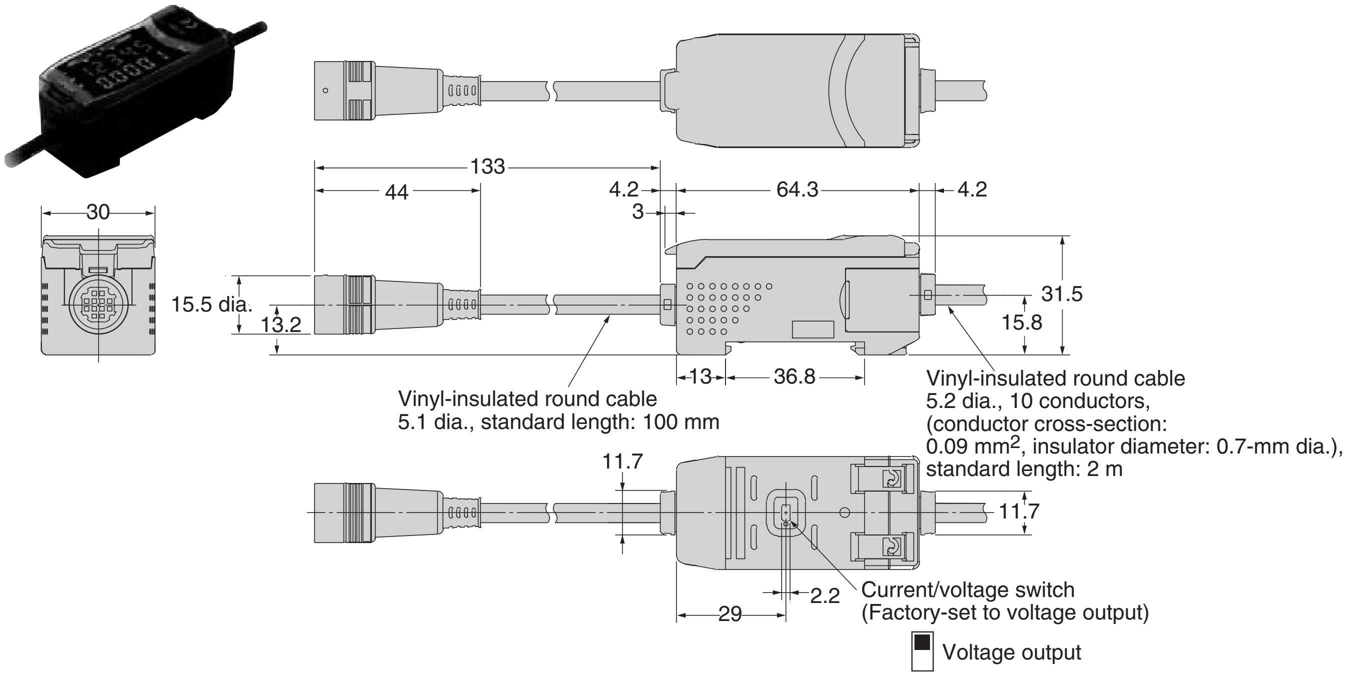


ZX-TDS04T
ZX-TDS04T-L



Amplifier Unit

ZX-TDA11
ZX-TDA41

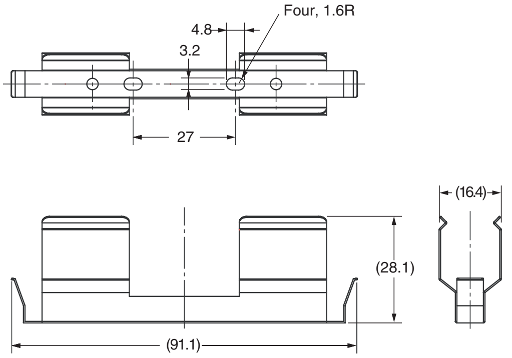


Accessories (Order Separately)

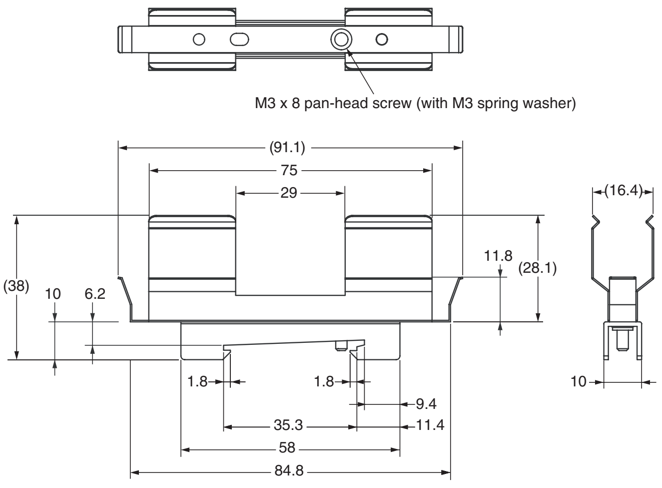
Preamplifier Mounting Bracket (Supplied with Each Sensor)

ZX-XBT1

ZX-XBT2 (For DIN Track Mounting)

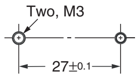


Material: Stainless steel



Material: Stainless steel

Mounting Hole Cutout Dimensions



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E345-E2-02-X In the interest of product improvement, specifications are subject to change without notice.

Vision Systems

Smart Sensors (with Ultra-High-Speed CCD Camera)

ZFV Series

NEW

ZFV

Ordering Information

Sets of Sensor Head and Amplifier Unit

Type	NPN	PNP
Narrow View/Single Function	ZFV-R1010	ZFV-R1015
Narrow View/Standard	ZFV-R1020	ZFV-R1025
Wide View/Single Function	ZFV-R5010	ZFV-R5015
Wide View/Standard	ZFV-R5020	ZFV-R5025

Sensor Heads

Appearance	Type	Working length	Sensing area	Model
	Narrow View	34 to 49 mm (variable)	5 4.6 mm (H V) to 9 8.3 mm (H V)	ZFV-SR10
	Wide View	38 to 194 mm (variable)	10 9.2 mm (H V) to 50 46 mm (H V)	ZFV-SR50

Amplifier Units

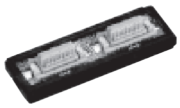
Appearance	Type	Power supply	Output type	Model
	Single Function	24 VDC 10%	NPN	ZFV-A10
			PNP	ZFV-A15
	Standard		NPN	ZFV-A20
			PNP	ZFV-A25

Accessories (Order Separately)

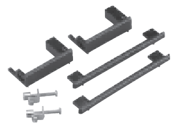
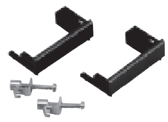
Data Storage Units

Appearance	Power supply	Output type	Model
	24 VDC	NPN	ZS-DSU11
		PNP	ZS-DSU41

Controller Link Unit

Appearance	Model
	ZS-XCN

Panel-mounting Adapter

Appearance	Model	
	ZS-XPM1	First Unit
	ZS-XPM2	Additional Units (for expansion)

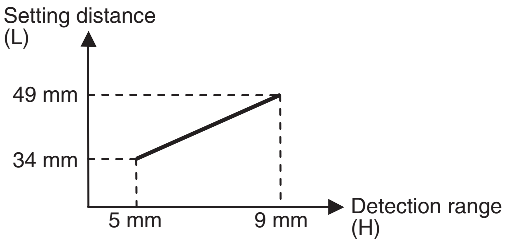
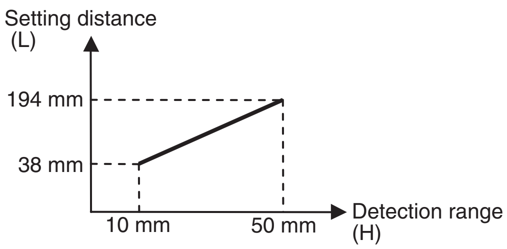
Sensor Head Extension Cable

Cable length	Model	Quantity
3 m	ZFV-XC3B (See note.)	1
8 m	ZFV-XC8B	1

Note: ZFV-XC3BR Robot Cable is also available.

Specifications

Sensor Heads

Item	ZFV-SR10 (Narrow View)	ZFV-SR50 (Wide View)
Setting distance (L)	34 to 49 mm	38 to 194 mm
Detection range (H × V)	5 × 4.6 mm to 9 × 8.3 mm	10 × 9.2 mm to 50 × 46 mm
Relation between setting distance and detection range		
Guide light	Provided (center, sensing area)	
Built-in lens	Focus: f15.65	Focus: f13.47
Object lighting method	Pulse lighting	
Object light source	Eight red LEDs	
Sensing element	1/3-inch CCD, partial scan	
Shutter	Electronic shutter, shutter time: 1/1,000 to 1/4,000	
Power supply voltage	15 VDC (Supplied from Amplifier Unit.)	
Current consumption	Approx. 200 mA	
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min	
Vibration resistance (destruction)	10 to 150 Hz, 0.35-mm single amplitude, 10 times each in X, Y, and Z directions for 8 min	
Shock resistance (destruction)	150 m/s^2, three times each in six directions (up/down, left/right, forward/backward)	
Ambient temperature	Operating: 0 to 40 C, Storage: 25 to 65 C (with no icing or condensation)	
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)	
Ambient atmosphere	Must be free of corrosive gas.	
Connection method	Prewired, Standard cable length: 2 m	
Degree of protection	IEC60529, IP65	
Materials	Case: ABS, Mounting bracket: PBT	
Weight	Approx. 200 g (including mounting bracket and cord)	
Accessories	Mounting bracket (1), Ferrite core (1), Instruction sheet	

Amplifier Units

Item		Single-function models		Standard models	
		ZFV-A10	ZFV-A15	ZFV-A20	ZFV-A25
Output method		NPN	PNP	NPN	PNP
Inspection items		Pattern (PTRN), Brightness (BRGT)		Patterns (PTRN), Brightness (BRGT), Area (AREA), Width (WID), Position (POSI), Count (CNT), Characters (CHAR)	
Teaching area		Rectangular, one area			
Teaching area size		Pattern (PTRN), Brightness (BRGT): Any rectangular area (256 × 256 max.) Area (AREA), Width (WID), Position (POSI), Count (CNT), Characters (CHAR): Any rectangular area (full screen max.)			
Sensing area		Full screen			
Resolution		468 432 (H V) max.			
Bank selection		Supported for 8 banks.			
Response time		Pattern (PTRN), Brightness (BRGT): High-speed: 4 ms, Standard: 8 ms, High-precision: 12 ms Area (AREA), Width (WID), Position (POSI), Count (CNT), Characters (CHAR): 128 128: 15 ms max.			
Other functions		Control output switching: ON for OK or ON for NG ON delay/OFF delay, One-shot output, "ECO" mode			
Output signals		(1) Control output (OUTPUT), (2) Enable output (ENABLE), (3) Error output (ERROR)			
Input signals		(1) Simultaneous measurement input (TRIG) or Continuous measurement input (TRIG), Switched by using menu. (2) Bank selection inputs (BANK1 to BANK3) (3) Workpiece still teaching (TEACH) or Workpiece moving teaching (TEACH), Switched by using menu.			
Connecting to ZS-DSU	Image logging trigger	Stores NG images or all images.			
	Sampling rate	ZFV measurement cycle (See note 1.)			
	Number of logged image	Logs up to 128 images in series			
	Number of connected	15 max. (ZFV: 5 Units max., ZS-LDC: 9 Units max., ZS-MDC (See note 2.): 1 Unit max.)			
	External bank function	Amplifier Unit setting data can be saved to the memory card as bank data. Reading bank data enables bank switching.			
Sensor Head interface		Digital interface			
Image display		Compact TFT 1.8-inch LCD (Display dots: 557 234)			
Indicators		Judgement result indicator (OUTPUT) Inspection mode indicator (RUN)			
Operation interface		Cursor keys (up, down, left, right) Setting key (SET) Escape key (ESC) Operating mode switching (slide switch) Menu switching (slide switch) Teaching/Display switching key (TEACH/VIEW)			
Power supply voltage		20.4 to 26.4 VDC (including ripple)			
Current consumption		600 mA max. (with Sensor Head connected)			
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min between leads and Amplifier Unit case			
Noise immunity		1 kV, Pulse rise: 5 ns, Pulse width: 50 ns, Burst duration: 15 ms, Cycle: 300 ms			
Vibration resistance		Destruction: 10 to 150 Hz, 0.1-mm single amplitude, 10 times each in X, Y, and Z directions for 8 min			
Shock resistance		Destruction: 150 m/s^2, three times each in six directions (up/down, left/right, forward/backward)			
Ambient temperature		Operating: 0 to 50 C Storage: 25 to 65 C (with no icing or condensation)			
Ambient humidity		Operating and storage: 35% to 85%			
Ambient atmosphere		Must be free of corrosive gas.			
Degree of protection		IEC60529, IP20			
Materials		Polycarbonate			
Weight		Approx. 300 g (including cord)			
Accessories		Ferrite core (1), Instruction sheet			

Note 1. This is the sampling rate when logging images. To log measurement data only, use the ZS-DSU settings.

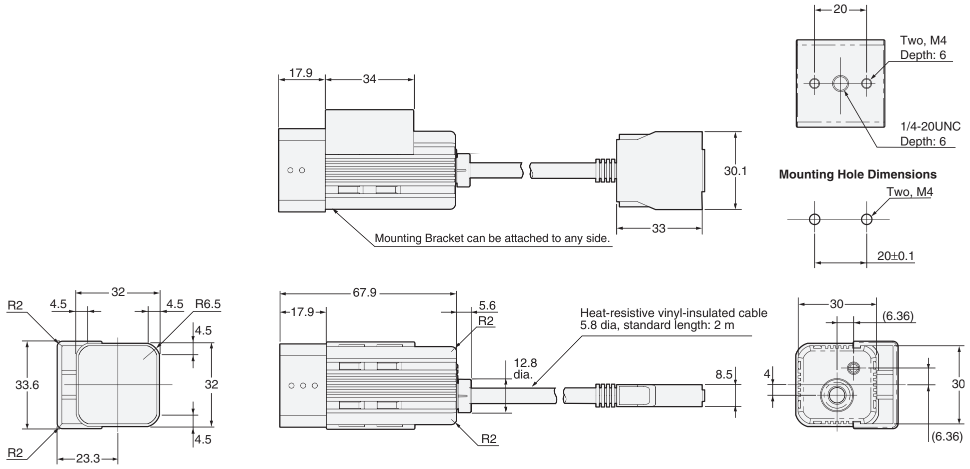
2. Image logging is not possible when the ZS-MDC is connected.

Dimensions

Note: All units are in millimeters unless otherwise indicated.

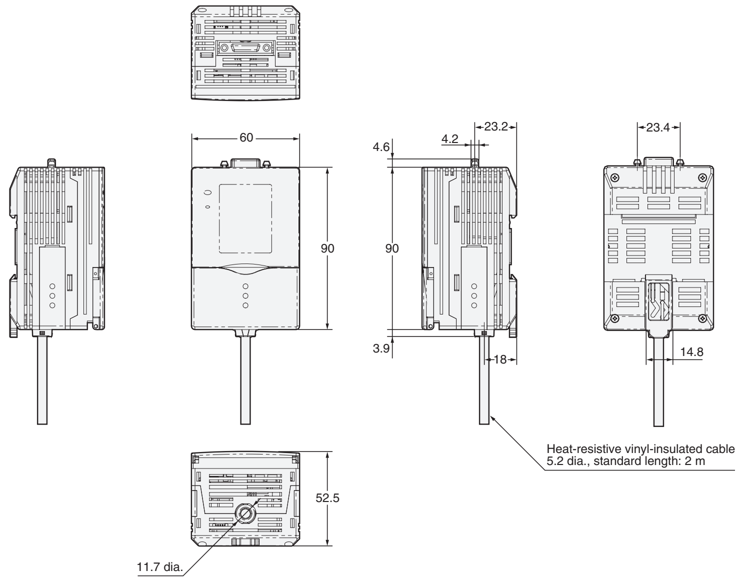
Sensor Heads

ZFV-SR□



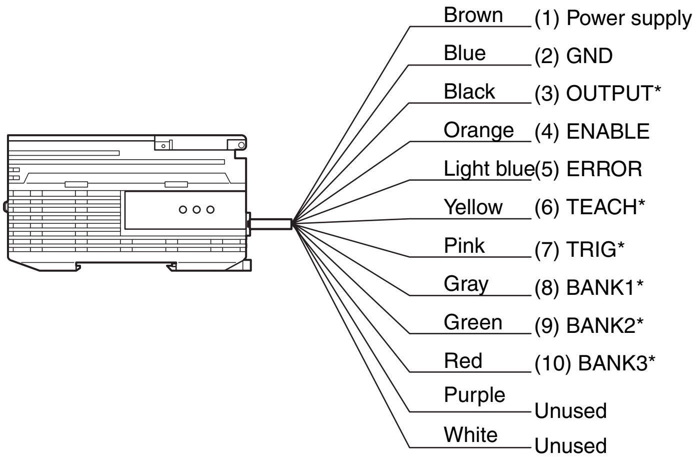
Amplifier Units

ZFV-A□



About the I/O cable

The following shows the leads that comprise the I/O cable.



* : Enabled only in the RUN mode

1. Power supply
This connects the power supply.
Supply power from a DC power supply unit that has a countermeasure (safety ultra-low voltage circuit) built-in for preventing high voltages from occurring.
Wire the power supply separately from other devices. Wiring them together or placing them in the same duct may cause induction, resulting in malfunction or damage.

2. GND

3. OUTPUT (control output)
This outputs judgment results.
This lead is interlocked with OUTPUT LED.

4. ENABLE (enable output)

5. ERROR (error output)
This turns ON when an error is generated.

6. TEACH (teaching input)
There are two teaching modes, workpiece stop teaching and workpiece move teaching. These teaching modes can be selected in the menu.

7. TRIG (measurement trigger input)
There are two measurement modes, synchronous measurement and continuous measurement. Which mode of measurement is to be performed in is selected in the menu.

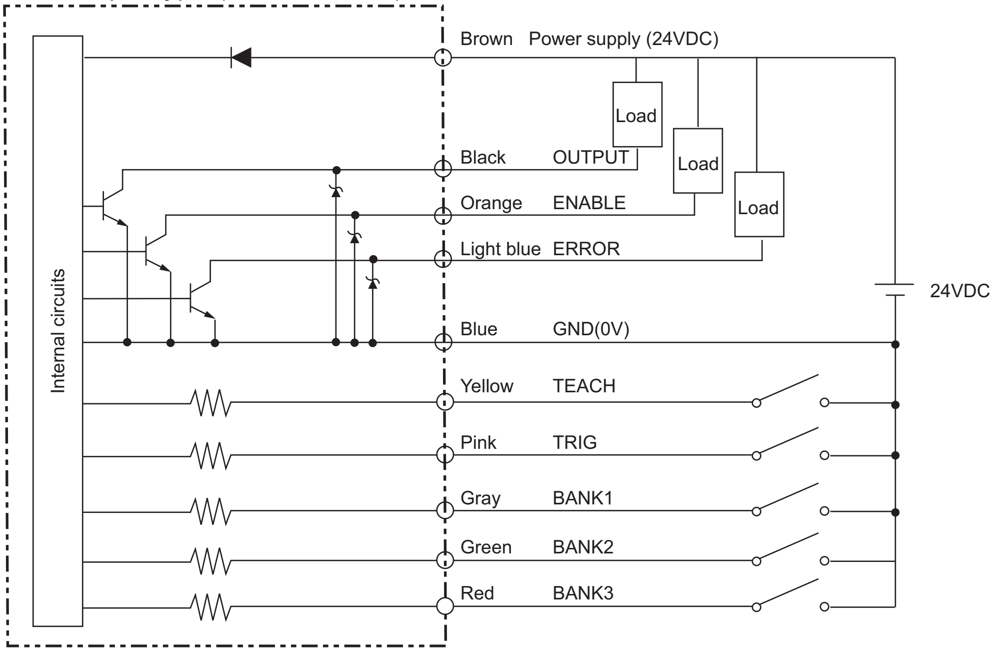
8. BANK1 (bank switching input 1)

9. BANK2 (bank switching input 2)

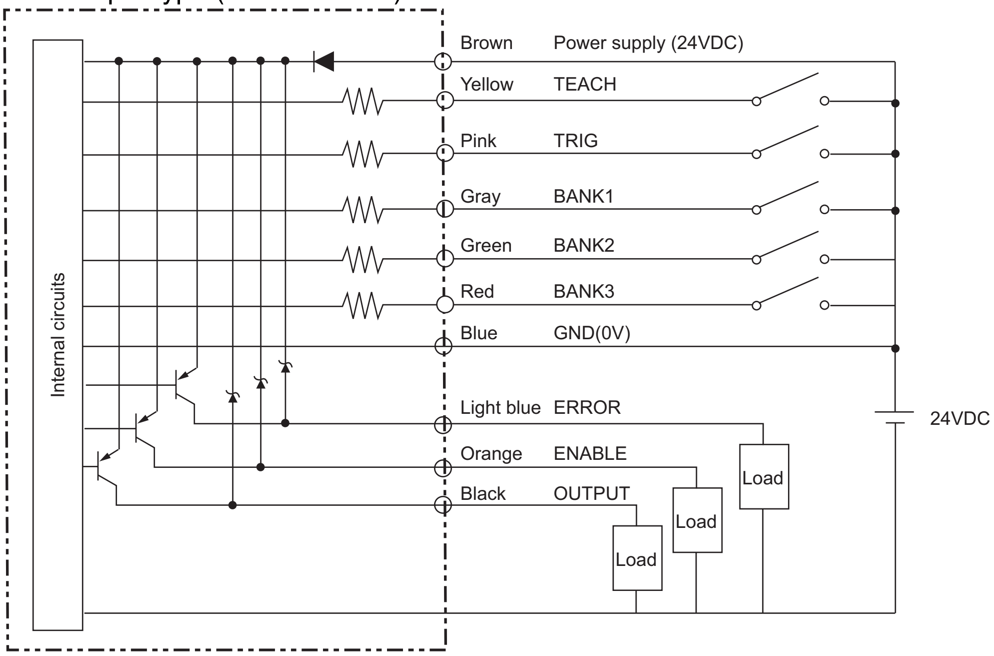
10. BANK3 (bank switching input 3)

I/O Circuit Diagrams

NPN output type (ZFV-A10/A20)



PNP output type (ZFV-A15/A25)



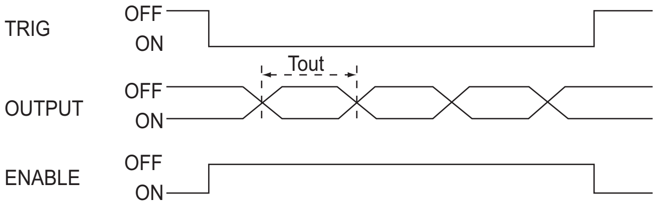
Timing charts

The following shows the timing charts when communication is performed with external devices.

Measurement

Continuous measurement

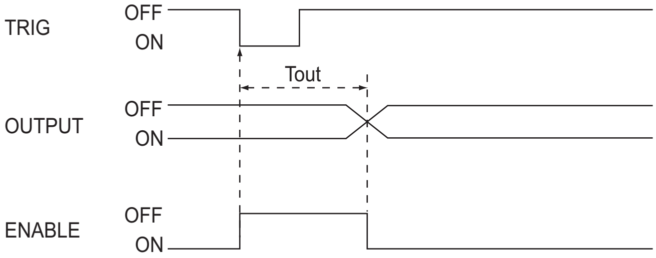
Measurement is performed continuously for the duration that the TRIG signal is ON.
The measurement result is updated, and output to external devices at each measurement cycle.



Tout: Measurement cycle
The measurement cycle changes depending on the setting.

Synchronous measurement

Measurement is performed only once in synchronous with the change in TRIG signal state from OFF to ON, and the result is output.



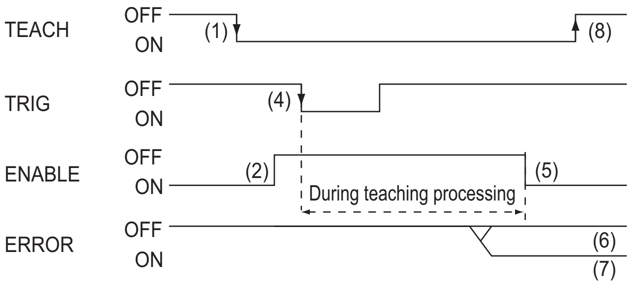
Tout: Measurement time.
The measurement time changes depending on the setting.

- The minimum ON width of the TRIG signal is 1 ms.
- The OUTPUT signal is held until the next measurement result is updated.
  Note, however, that when one-shot output is currently set, the OUTPUT signal is held for the preset time.

Teaching

Workpiece stop teaching

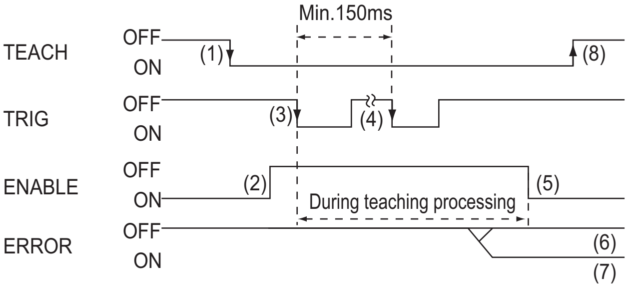
Teaching processing is performed according to TRIG signal input after the TEACH signal is input from the outside.
Measurement is not performed while teaching is being performed. Do not move the workpiece until teaching is completed.



1. Turn the TEACH signal ON.
2. Confirm that the ENABLE signal has turned OFF.
3. Make sure that the workpiece to be taught is in the teaching area.
4. Input the TRIG signal from the outside.
5. The ENABLE signal turns ON after teaching is completed. At this timing, check the state of the ERROR signal.
6. When teaching has been completed successfully, the ERROR signal stays OFF.
7. When teaching fails, the ERROR signal turns ON.
8. Turn the TEACH signal OFF, and end teaching processing.
   When teaching fails, the state before teaching was initiated is returned to. Perform teaching again.
   If the TEACH signal is turned OFF midway, teaching is disabled.

Workpiece move teaching

Use this teaching mode when the object cannot be stopped.
Teaching processing is divided up and performed in synchronous with the TRIG signal input after the TEACH signal is input from the outside.
Teaching must be processed six times.
Measurement is not performed while teaching is being performed.



1. Turn the TEACH signal ON from the outside.
2. Confirm that the ENABLE signal has turned OFF.
3. Input the TRIG signal at the timing for measuring the workpiece to be taught.
4. Repeat the input in step (3) six times. (Trigger inputs from the seventh time onwards are ignored.)
5. The ENABLE signal turns ON after teaching is completed. Check the state of the ERROR signal at this timing.
6. When teaching has been completed successfully, the ERROR signal stays OFF.
7. When teaching fails, the ERROR signal turns ON.
8. Turn the TEACH signal OFF, and end teaching processing.
   When teaching fails, the state before teaching was initiated is returned to. Perform teaching again.
   If the TEACH signal is turned OFF midway, teaching is disabled.

Bank switching

The bank No. can be switched when BANK1o BANK3 are connected as follows.

Bank No.	BANK1	BANK2	BANK3
BANK1	OFF	OFF	OFF
BANK2	ON	OFF	OFF
BANK3	OFF	ON	OFF
BANK4	ON	ON	OFF
BANK5	OFF	OFF	ON
BANK6	ON	OFF	ON
BANK7	OFF	ON	ON
BANK8	ON	ON	ON

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Vision Sensor

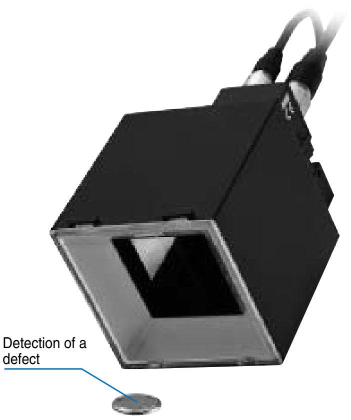
F150-3

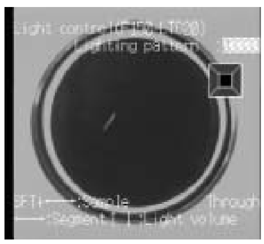
Perform settings in a conversational manner. The dialog menu artist "talks" to you.

Features

Intelligent lighting

Various types of lighting control make it possible to obtain a clear, stable image suitable for the inspection. The dome shape minimizes the effects of external light and permits damage inspection. Red and green light is mixed to allow inspection of a wide range of work.





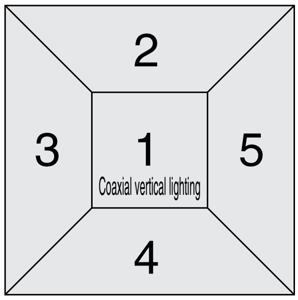
Inspection of button battery defect

Variety of lighting methods

The direction of lighting and the brightness can be changed. Coaxial lighting is also possible with the F150-SLC20. The optimum lighting method for the work can be selected.

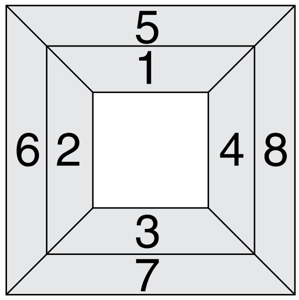
F150-SLC20
(Field of view: 20 mm)

Light intensity can be set separately to one of 8 levels for 5 illuminated areas.



F150-SLC50
(Field of view: 50 mm)

Light intensity can be set separately to one of 8 levels for 8 illuminated areas.



Control lighting from the menu

- The illumination area and light intensity are controlled from the controller menu. Settings can be easily changed without handling the lighting.
- The lighting is also treated as scene data, and thus can be changed along with other conditions when the model is changed.
- The controller manages the lighting setting as a digital value. This increases the reproducibility of the setting.

Features

Integrated camera and lens

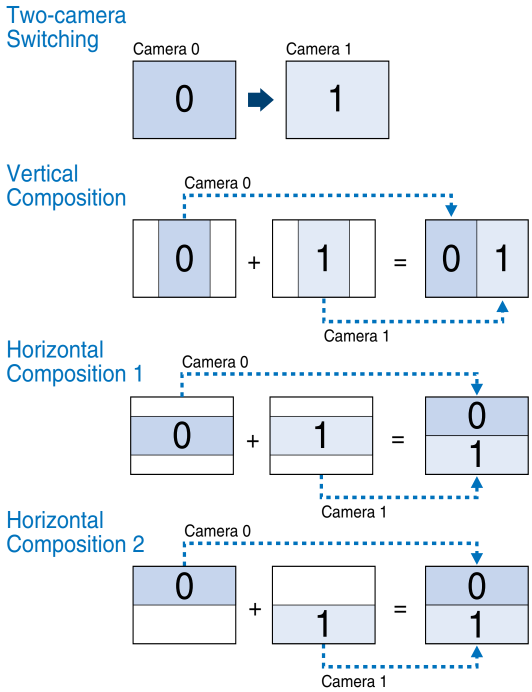
Camera setup is easy because the object-imaging camera is integrated into a single unit with the lighting apparatus and lens.

2-camera unit

We have made bi-directional, 2-line inspection easy and inexpensive.

A variety of image read-in methods

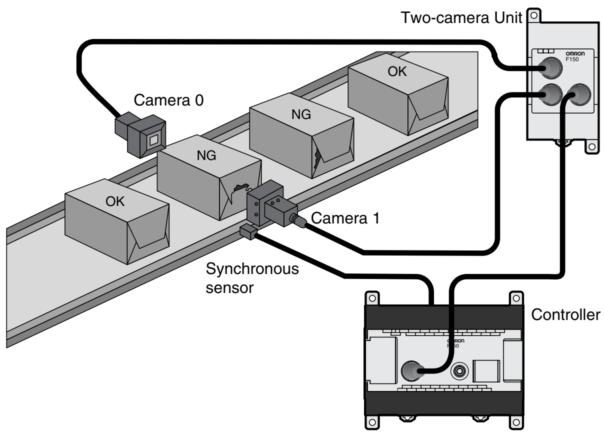
Images from two cameras can be read in at the same time. Read-in methods include successive changeover between the two cameras, and combination of the image from each camera into a single image.



Example of application using two cameras

Inspecting Boxes From Both Side

Simultaneously inspect both sides of a box using two cameras.



PCB Positioning

Determine the coordinates of position marks using two fields of vision.

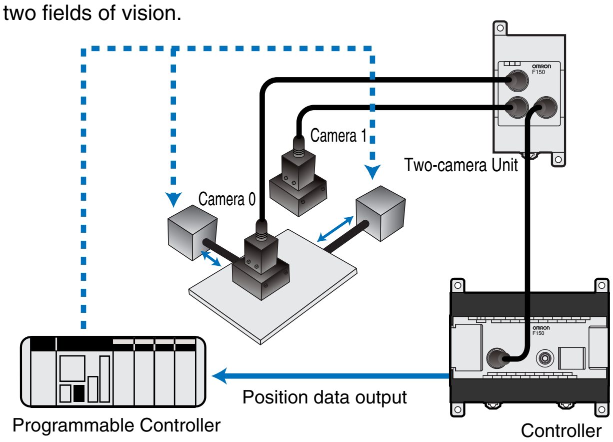


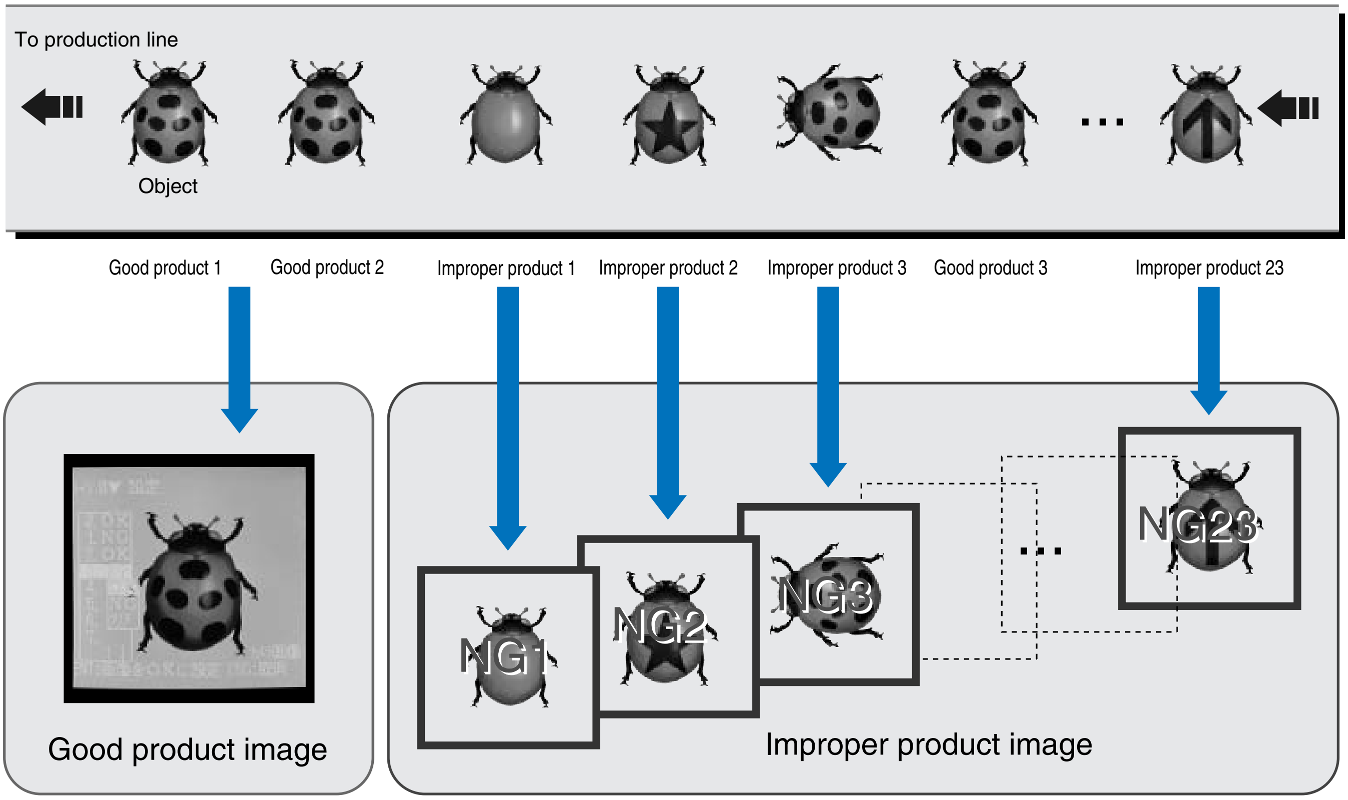
Image memory function

Up to 23 inspected images can be stored*.

You can check the image to see what kind of defect occurred. This serves as an aid to maintaining and improving the production line.

With respect to a stored image, measurement can be repeated and measurement conditions changed. This enables a dramatic reduction in setup time during initial installation.

*Can be stored before power is turned off. Storage of all images, including "good" images, is also possible.



Features

Compact frame shutter camera

- Compact with high resolution.
- An all-pixel reading method and square lattice CCD make it possible to obtain a clear and detailed image suitable for image processing.
- Equipped with an electronic shutter to handle high-speed lines.
- The shutter speed can be adjusted for each scene from the menu. Select the optimum shutter speed for the line speed and work.

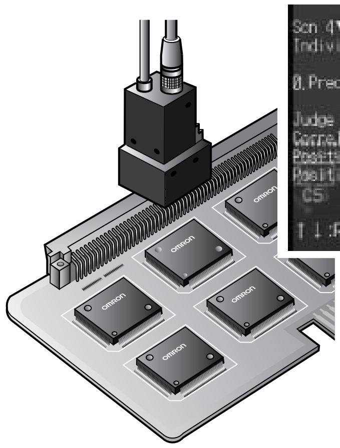
Image pre-processing

- Pre-processing such as smoothing, edge enhancement, edge extraction, and background cut-off allow you to obtain the optimum image for the inspection.
- Pre-processing can be performed in real time (simultaneously with image read-in).

Original image   Edge extraction

High-precision gray search

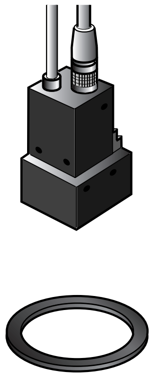
- Position measurement at sub-pixel precision is possible using 256 graduation gray search processing. This feature is ideal for high-precision positioning applications.




Measurement of fiducial mark positions on a printed circuit board

Damage/dirt inspection

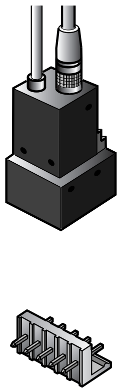
- Omron's proprietary algorithm enables fast and detailed inspection for visual defects such as chips, nicks, burrs, and dirt.
- Linear, circular and rectangular areas can be set, enabling inspection for a variety of defect shapes.




Rubber packing flare inspection

Gray edge measurement

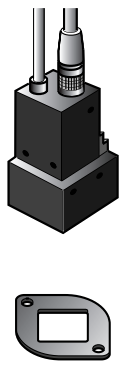
- High-precision (sub-pixel) measurement of work edge position is possible. Ideal for width and dimension inspection.
- Includes edge number and pitch measurement functions for support of IC and connector lead inspection.




Connector pin-pitch inspection

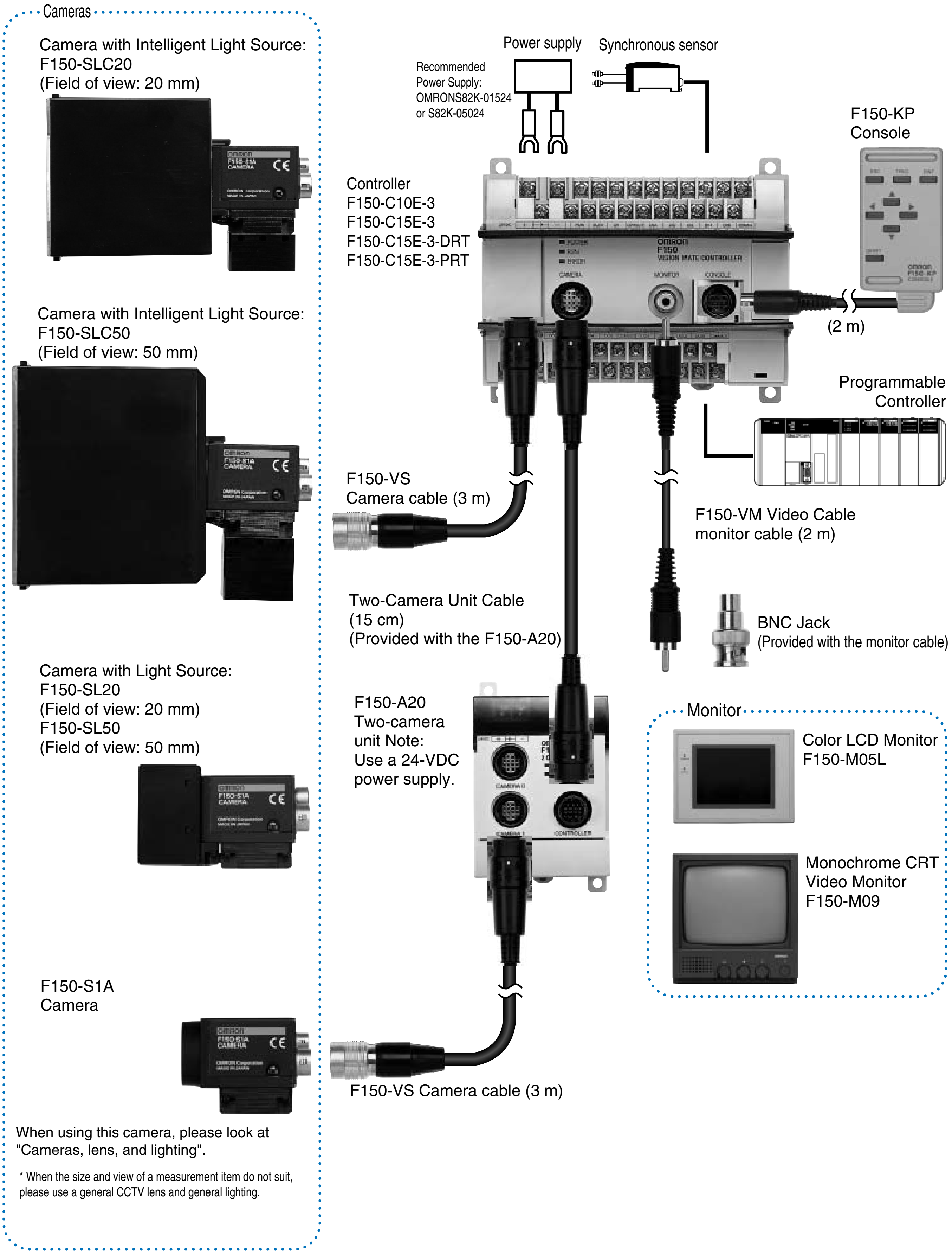
Output computation functions

- Measurement data computations such as the four arithmetical operations, minimum, maximum, distance between two points, and angle can be set from the menu.
- Up to 24 computations can be set, and decision and data output can be performed based on the computation results.



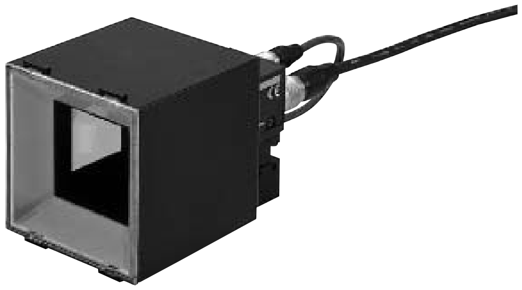

Hole-to-hole distance computation

System configuration



Camera with lighting

Camera with intelligent lighting



Camera with lighting

Model

Field of view: 20 mm	F150-SLC20
Field of view: 50 mm	F150-SLC50

*A lens and intelligent lighting are installed on the special camera (F150-S1A) for the F150.

Field of view: 20 mm	F150-SL20A
Field of view: 50 mm	F150-SL50A

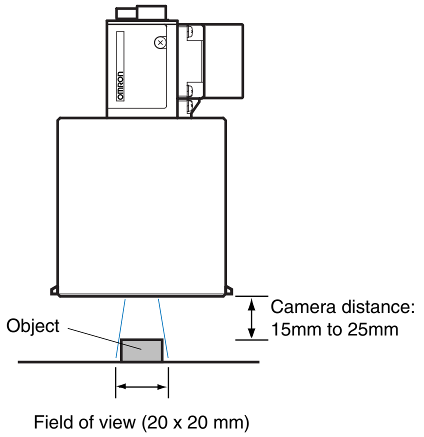
*A lens and lighting are installed on the special camera (F150-S1A) for the F150.

Distance to inspection object and field of view

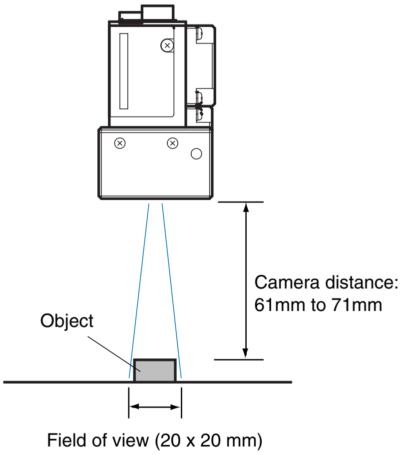
The camera distance is fixed.

Fix the camera at a distance that allows correct imaging of the inspected object.

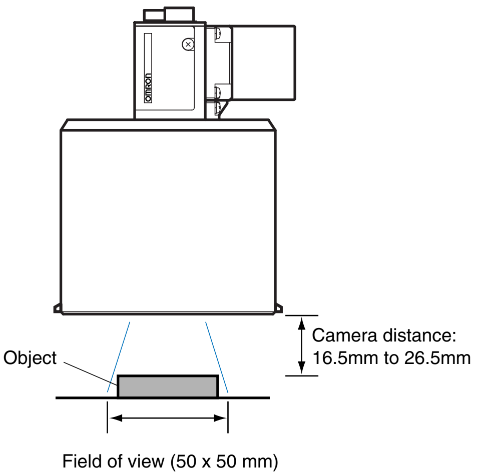
F150-SLC20



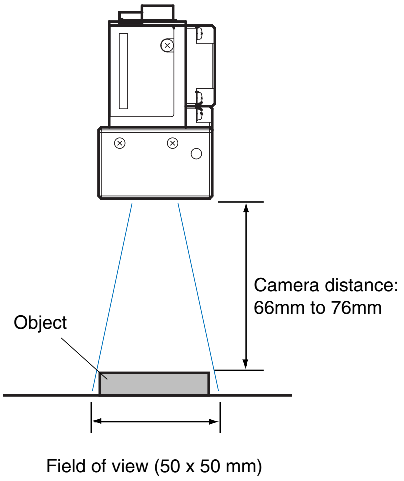
F150-SL20A



F150-SLC50



F150-SL50A



Ordering Information

Name		Model
Controller		F150-C10E-3 (NPN) F150-C15E-3 (PNP)
		F150-C10E-3-DRT (Compo Bus/D) F150-C15E-3-PRT (PROFIBUS)
Camera	Camera with intelligent lighting	F150-SLC20
		F150-SLC50
	Camera with lighting	F150-SL20A
		F150-SL50A
	Camera only	F150-S1A
2-camera unit		F150-A20
Console		F150-KP
LCD monitor		F150-M05L
Video monitor		F150-M09
Camera cable 3 m		F150-VS
Monitor cable 2 m		F150-VM

Rating/Performance

Controller: F150-C10E-3/C15E-3 and F150-C15E-3-PRT/DRT

Item	Specifications
Number of connected cameras	1 unit / 2 units (using the F150-A20)
Processing resolution	512 (H) x 484 (V)
Number of scenes	16 scenes (can be saved to a computer through the RS-232C)
Image memory function	Up to 23 images can be saved
Processing method	Grey Levels (256) / Binary
Image pre-processing	Smoothing, edge enhancement, edge extraction, background cut-off
Binary Levels	256 levels (per measurement area)
Position correction function	Correction directions: X, Y, Detection modes: binary center of gravity / main axis angle, model position: middle point, edge position
Number of measurement areas	16 areas/scene
Measured data	Area center of gravity, main axis angle, dark-light correlation value, dark-light search position, defect degree, edge position, edge number, density average, relative position
Calculation functions	Four arithmetic operations, distance, maximum value / minimum value, absolute value, others
Result output	Overall decision, computation result (decision) per measurement area, measurement/computation data (RS-232C and parallel output possible)
Monitor	1 ch (supports pin jack and over-scan monitor)
RS-232C	1 ch (Dsub 9-pin, female)
CompoBus/D	1 ch (F150-C10E-3-DRT)
PROFIBUS-DP	1 ch (F150-C15E-3-PRT)
Parallel input/output	F150-C10E-3 and F150-C15E-3: Inputs: 11points, outputs: 21 points F150-C10E-3-PRT/DRT: Inputs: 1 point, outputs: 5 points (including control inputs/outputs)
Power supply voltage	20.4 to 26.4 VDC
Current consumption	Approximately 0.5 A
Ambient temperature	Operating: 0 to +50°C, storage: -25 to +65°C (no ice formation or condensation)
Ambient humidity	Operating/storage: 35 to 85% RH (with no condensation)
Weight (Packed state)	Approximately 940 g (controller: 390 g)
Accessories	Three manuals, CompoBus/D connector (DRT type only), PROFIBUS-DP connector (PRT type only)

Camera
Camera with intelligent lighting: F150-SLC20/50
Camera with lighting: F150-SLC20A/50A
Camera: F150-SL20A/50A

Item		Specifications
Camera	Image pick-up	1/3 inch CCD
	Effective pixels	659(H) x 494(V)
	Shutter function	Electronic frame shutter Shutter speed: 1/100, 1/500, 1/2000, 1/10000 sec (can be changed from the menu)
Lens	Installation distance	F150-SLC20: 15 to 25 mm, F150-SLC50: 16.5 to 26.5 mm, F150-SL20A: 61 to 71 mm, F150-SL50A: 66 to 76 mm
	Field of view	F150-SLC20/SL20A:20 mm□, F150-SLC50/SL50A:50 mm□
Lighting unit	Light source	F150-SLC20/50: Red LED - green LED mixed F150-SL20A/50A: Red LED
	Light emission method	Pulse emission (sychronized with camera shutter)
Ambient temperature		Operating: 0 to +50°C, storage: -25 to +60°C (no icing or condensation)
Ambient humidity		Operating/storage: 35 to 85% RH (with no condensation)
Weight * Unit only		F150-SLC20: Approximately 280 g F150-SLC50: Approximately 370 g F150-SL20A/50A: Approximately 135 g F150-S1A: Approximately 80 g
Accessories		Instruction manual

Two-camera unit: F150-A20

Item	Specifications
Number of connected cameras	2 units
Camera mode	Two-camera switching, vertical division composite, horizontal division composite 1/2, one camera single-stand (camera 0/1)
Supply voltage	20.4 to 26.4 VDC
Current consumption	Approximately 0.3 A
Ambient temperature	Operating: 0 to +50°C, storage: -25 to +65°C (no ice formation or condensation)
Ambient humidity	Operating/storage: 35 to 85% RH (with no condensation)
Weight * Unit only	Approx. 220 g
Accessories	Operation manual, camera unit cable (1)

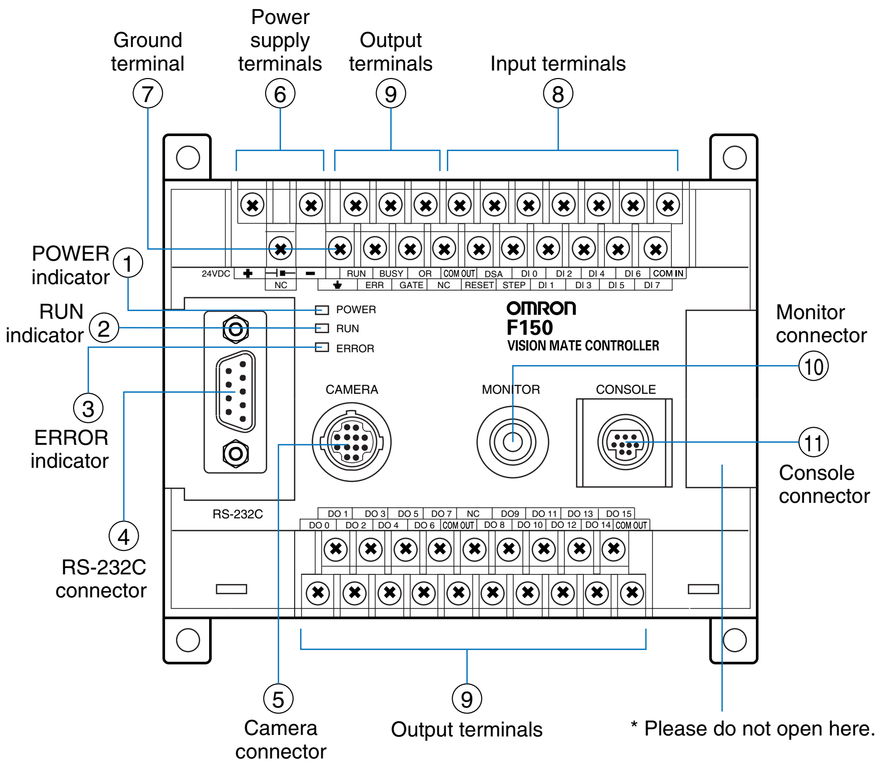
Note: Can be connected to an F150-C10-3 controller.

Monitor

Item / Product name Model	LCD monitor F150-M05L	Video monitor F150-MON
Size	5.5 type	9 inches
Type	TFT color LCD	CRT monochrome
Resolution	320 x 240 dots	800TV or higher (center)
Input signal	NTSC composite video (1.0 V / 75)	
Supply voltage	20.4 to 26.4 VDC	100 to 240 VAC (-15%, +10%)
Current consumption	Approx. 700 mA	Approx. 200 mA
Ambient temperature	Operating: 0 to +50°C, storage: -25 to +65°C (no ice formation or condensation)	Operating: -10 to +50°C, storage: -20 to +65°C (no ice formation or condensation)
Ambient humidity	Operating/storage: 35 to 85% RH (no ice formation or condensation)	10 to 90–RH (No condensation)
Weight * Unit only	Approx. 1 kg	Approx. 4.5 kg
Accessories	Operation manual, clamps (4)	Instruction manual

Part Names/Functions

F150-C10E-3/F150-C15E-3



① Lit while power is ON.

② Lit while the F150 is in Run Mode.

③ Lit when an error has occurred.

④ Connects the F150 to external devices such as personal computers or programmable controllers.

⑤ Connects the F150 to camera or two-camera unit.

⑥ Connects to the power supply.

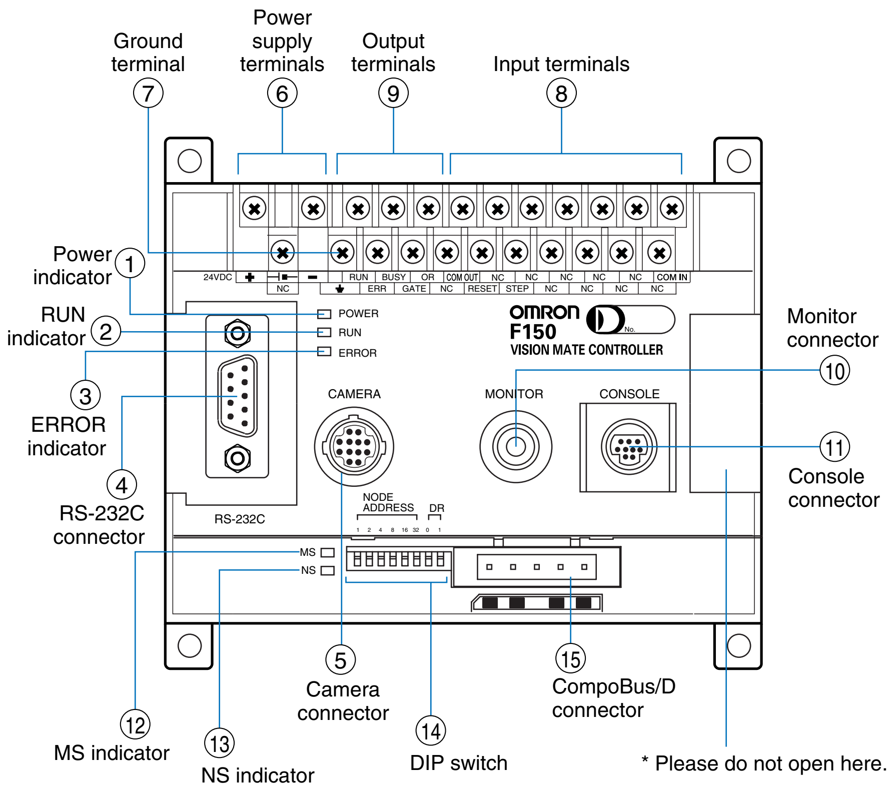
⑦ Connects to the ground wire.

⑧ ⑨ Connects to the F150 to external devices such as synchronous sensors or programmable controllers.

⑩ Connects to the monitor.

⑪ Connects to the console.

F150-C10E-3-DRT (CompoBus/D (DeviceNet) type)



① Lit while power is ON.

② Lit while the F150 is in Run Mode.

③ Lit when an error has occurred.

④ Connects the F150 to external devices such as personal computers or programmable controllers.

⑤ Connects the F150 to camera or two-camera unit.

⑥ Connects to the power supply.

⑦ Connects to the ground wire.

⑧ ⑨ Connects to the F150 to external devices such as synchronous sensors or programmable controllers.

⑩ Connects to the monitor.

⑪ Connects to the console.

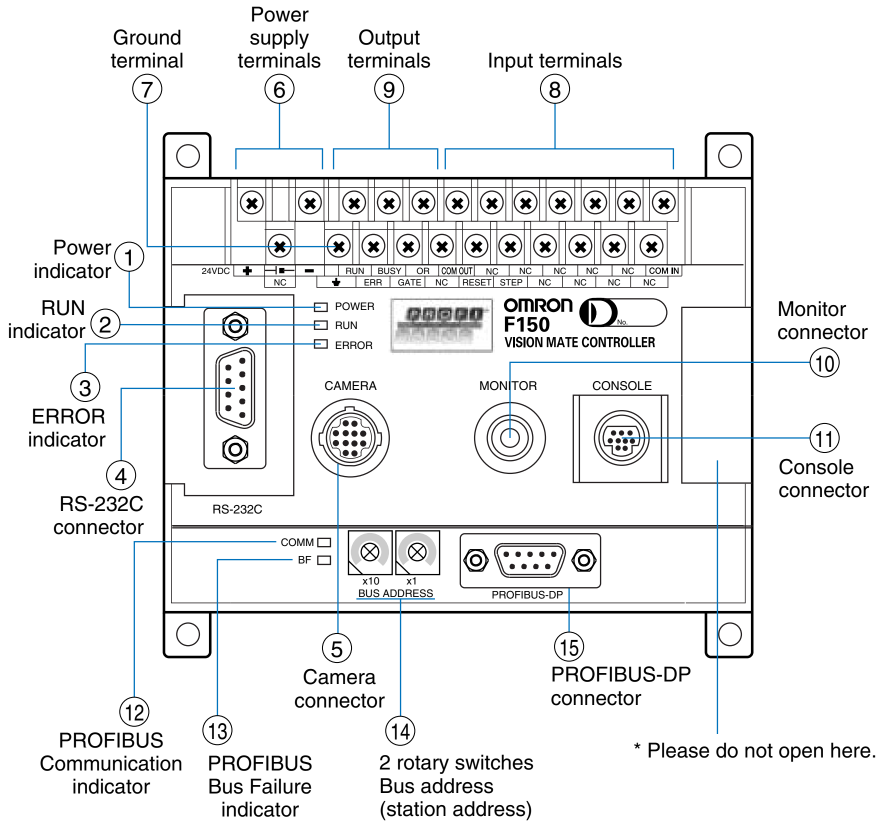
⑫ Indicates the state of F150 in CompoBus/D communication.

⑬ Indicates the state of F150 in CompoBus/D communication.

⑭ Set up the node address and communication speed of CompoBus/D communication.

⑮ Connects to the communication cable of a CompoBus/D network.

F150-C15E-3-PRT (PROFIBUS-DP type)

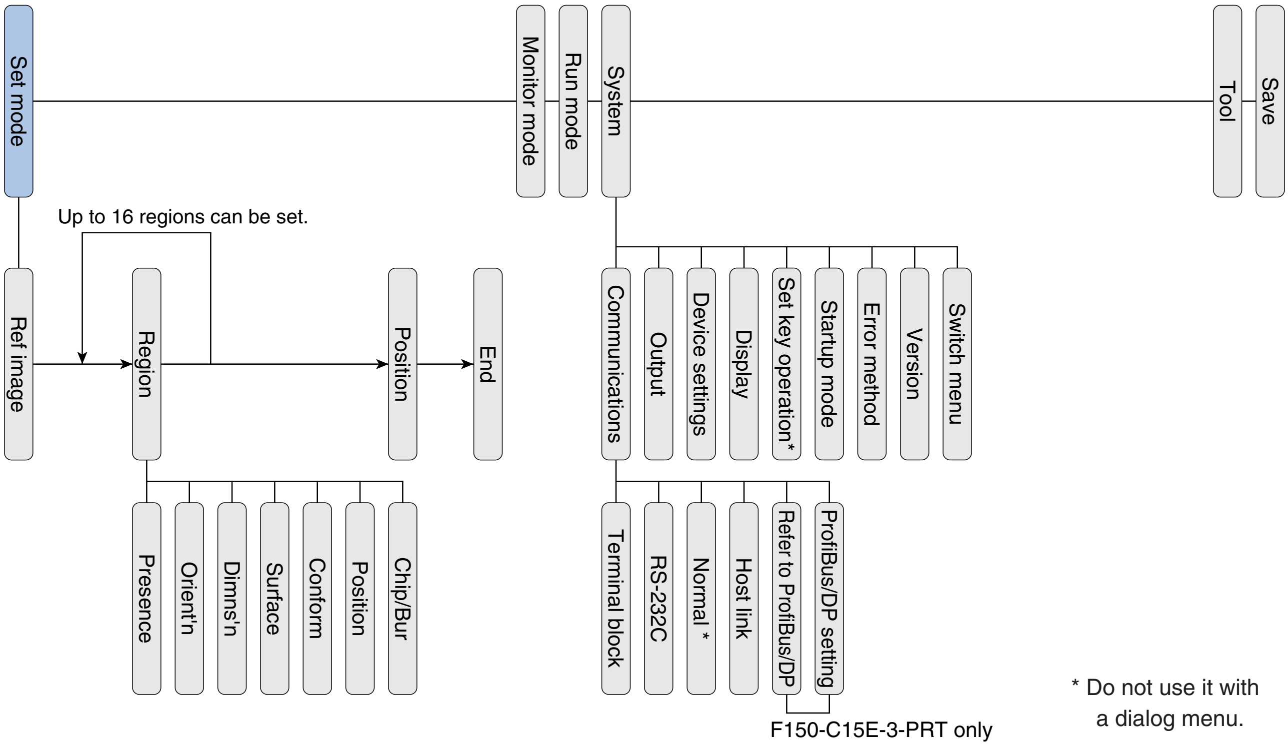


① Lit while power is ON.
② Lit while the F150 is in Run Mode.
③ Lit when an error has occurred.
④ Connects the F150 to external devices such as personal computers or programmable controllers.
⑤ Connects the F150 to camera or two-camera unit.
⑥ Connects to the power supply.
⑦ Connects to the ground wire.
⑧ ⑨ Connects to the F150 to external devices such as synchronous sensors or programmable controllers.
⑩ Connects to the monitor.
⑪ Connects to the console.
⑫ Indicates the state of F150 in PROFIBUS-DP communication.
⑬ Indicates the state of F150 in PROFIBUS-DP communication.
⑭ Set up the node address of PROFIBUS-DP communication.
⑮ Connects to the communication cable of a PROFIBUS-DP network.

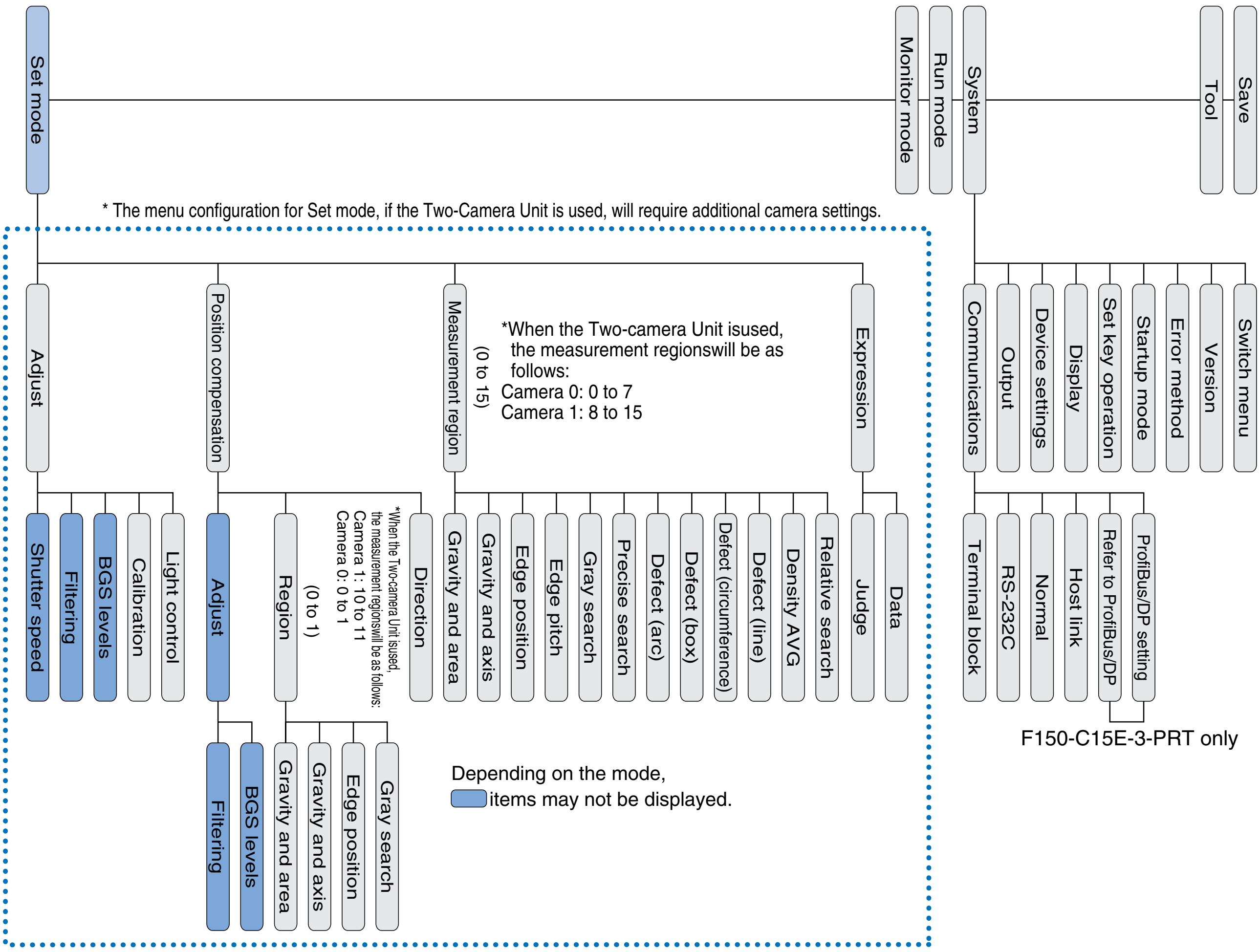
Function menu

Menu structure diagram

Dialog menu



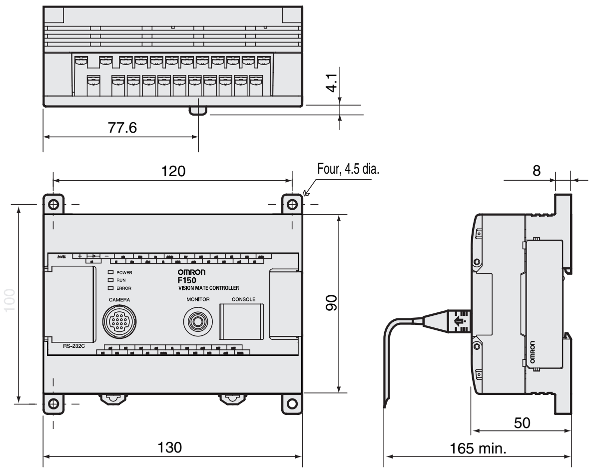
Expert menu



Dimensions (Unit: mm)

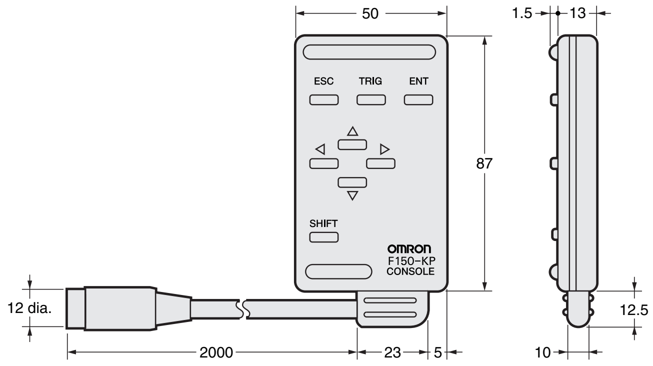
Controller

F150-C10E-3, F150-C50E-3,
F150-C15E-3-PRT,
F150-C10E-3-DRT



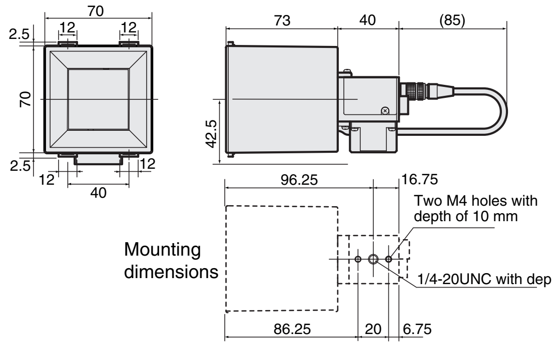
Console

F150-KP

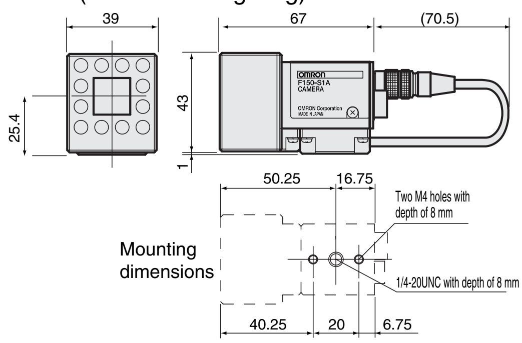


Camera

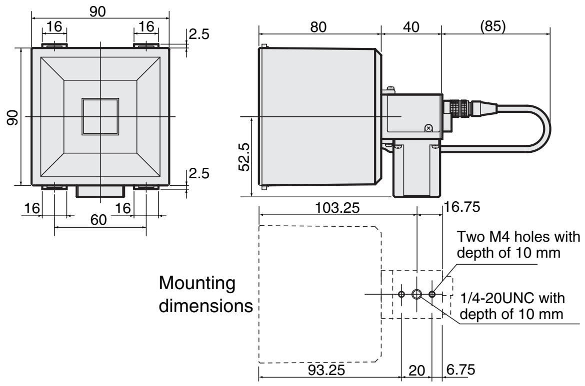
F150-SLC20 (camera with F150-LTC20 intelligent lighting)



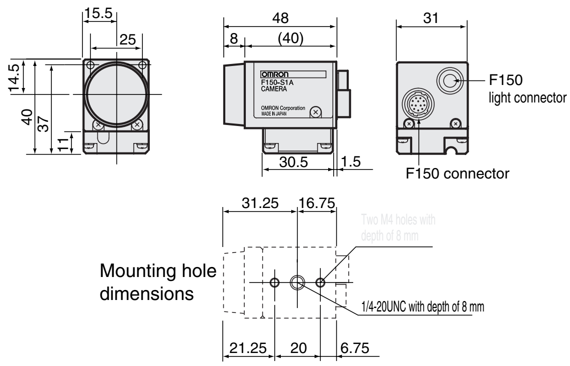
F150-SL20A/SL50A (camera with lighting)



F150-SLC50 (camera with F150-LTC50 intelligent lighting)

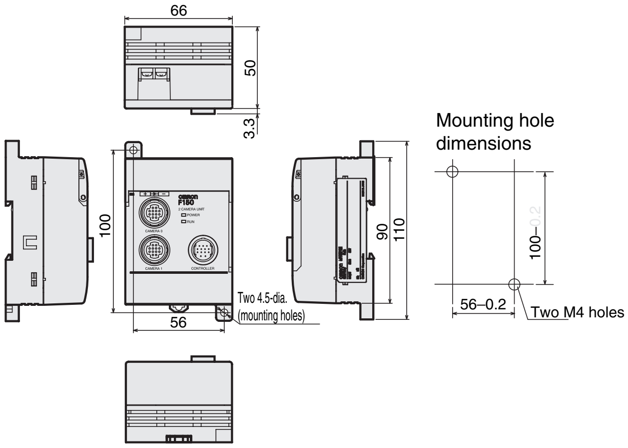


F150-S1A (camera only)



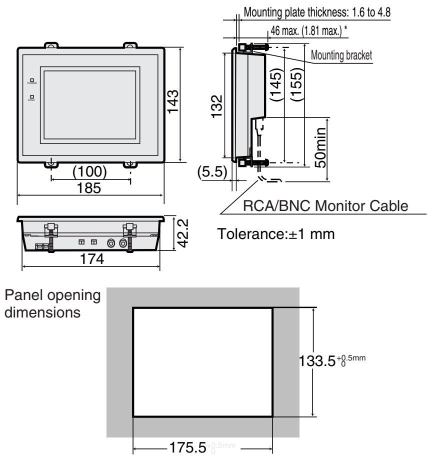
2-camera unit

F150-A20



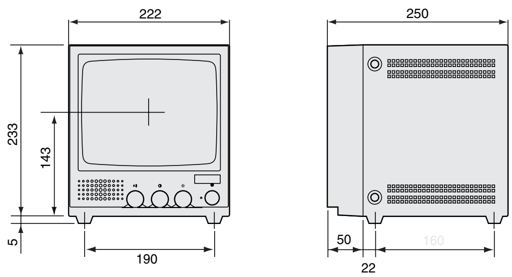
LCD monitor

F150-M05L



CRT monitor

F150-M09



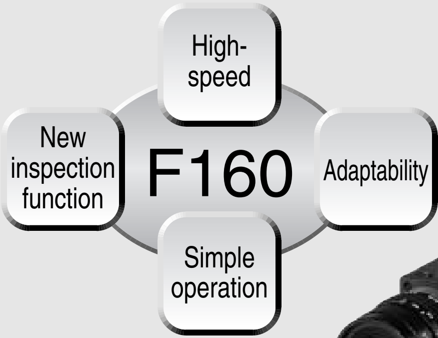
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. Q09E-EN-01 In the interest of product improvement, specifications are subject to change without notice.

Vision Sensor

F160

Impressive high speed opens up new possibilities



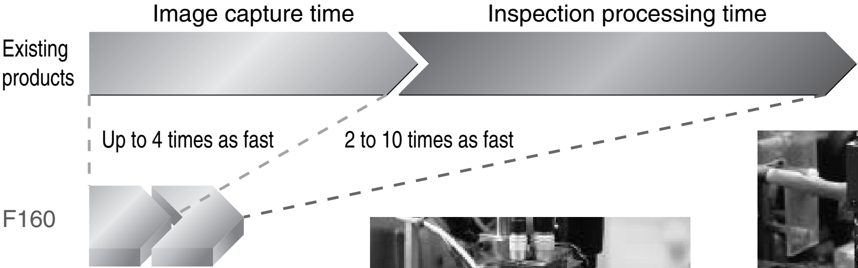
CE

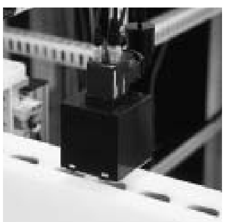
F160

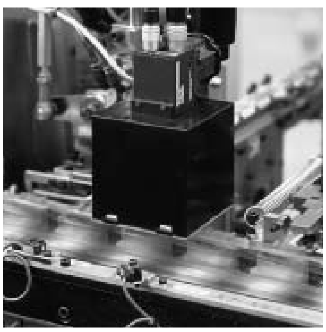
Features

Can be applied to ultra-fast manufacturing lines. Full range of detection features within the required cycle time. Contributes to improved detection quality.

The newly developed double-speed camera makes it possible to read in images as much as 4 times faster than previous speeds, and also achieves an impressive image processing speed 2 to 10 times faster than previous speeds. For example, using dark-light search processing in Figure 1, the camera can be used on ultra high-speed lines handling approximately 5000 pieces per minute. Because each single inspection is fast, multiple inspection tasks can be carried out with minimal increase in time. Inspection tasks that were previously impossible due to insufficient time can also be added for a big contribution to inspection quality.







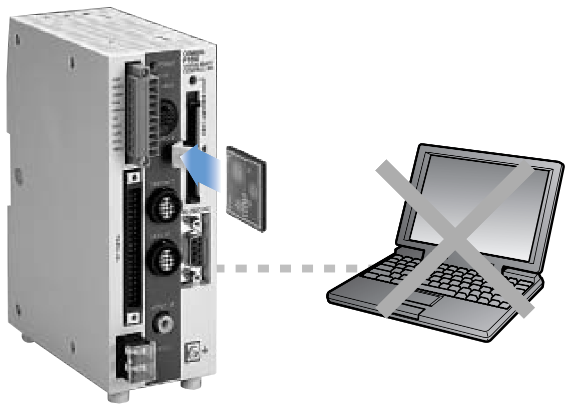
Example: Gray Search Processing (Picture 1)

Example: More than one inspection item

Features

Equipped with a memory card for low-cost introduction on multi-type lines and a dramatic increase in the number of scenes. Moreover, this is a single-stand system, thus, easily implemented.

The F160 unit is equipped with a memory card slot. The scene number can be easily increased by simply inserting a card. For example, a 128-MB card can store approximately 1000 scenes. (*) No more need to build a scene data communication system using computers.



* The number of scenes that can be stored varies depending on the scene settings.

Enhanced image memory function

Up to 35 measurement images or failure images can be stored. The most recent failure image can be displayed while measurement continues, enabling analysis of the failure without stopping the line.

Good product image

Improper product image

Wide range of camera variations

In addition to the double-speed camera, our F150 camera can also be connected. This lets you select the optimum camera for your speed, cost, and lighting needs.

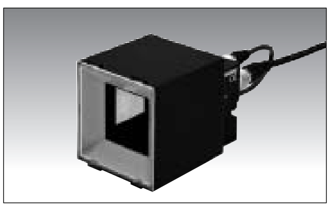
Double-speed camera

F160-S1/S2/SLC20/SLC50

Eight shutter speeds can be selected from the controller. An intelligent-lighting type is also available.

F150 camera

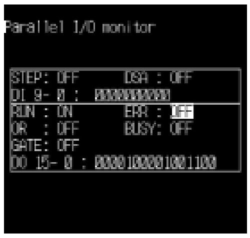
F150-S1AESLC20/SLC50ESL20A/SL50A



Compact and affordable. Intelligent lighting and small LED lighting types are also available.

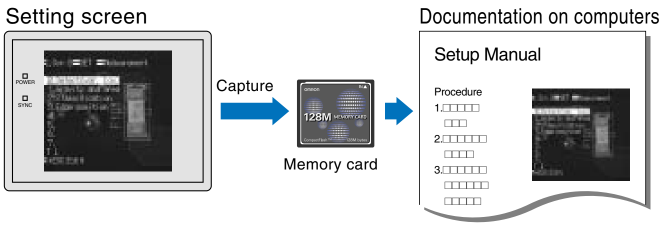
I/O monitor

The status of the input/output terminals can be displayed as a list. This is a big help for a wiring check during adjustment.



Screen capture function

Menu setting screens, measurement screens, and failure images can be captured and stored in the memory card. These images can be used in manuals and reports created on a computer.

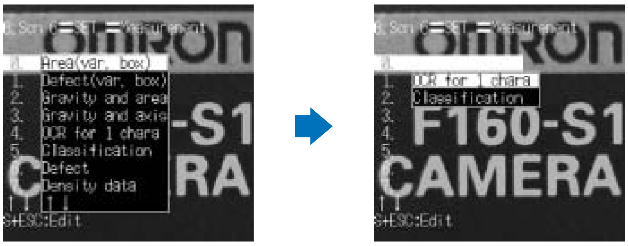


Features

Operation

Menu masking function

Menu items that should not be changed on-site can be hidden to prevent incorrect operation. This also improves operability and saves time when changing menu settings.



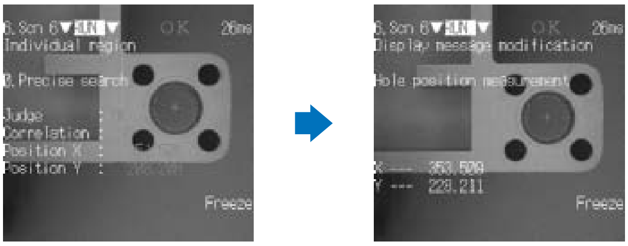
Password function

Operation access can be limited to personnel who have been issued a password. This contributes to increased security.

Screen

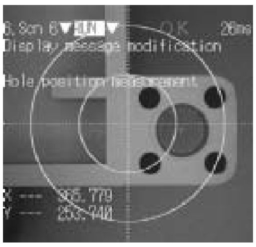
Screen messages

Change to the language used on-site. Can be displayed in any position on the screen.



Graphic drawing function

This allows you to draw straight lines, rectangles, cross-hair cursors, and other graphics. Graphics can be drawn on measurement positions as well.



Output

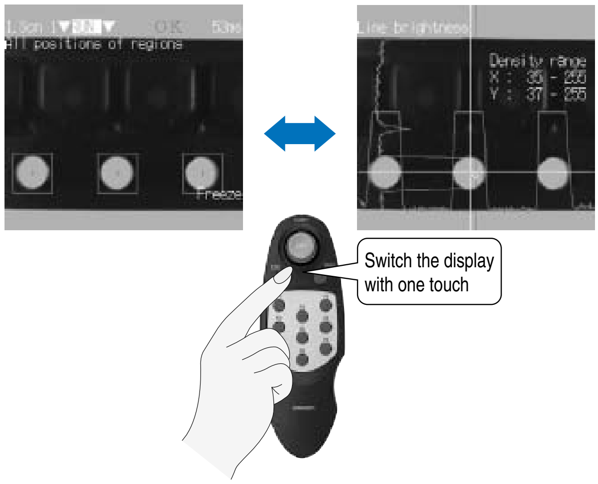
RS-232C format

The output format can be changed to meet the specifications of the system.

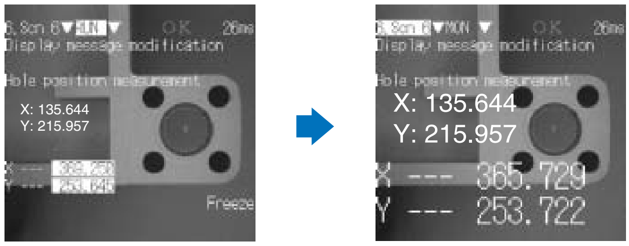
Short-cut key function

Frequently used operations can be assigned to special keys on the console. Switch menus at the touch of a key.

Measurement image Line-brightness display

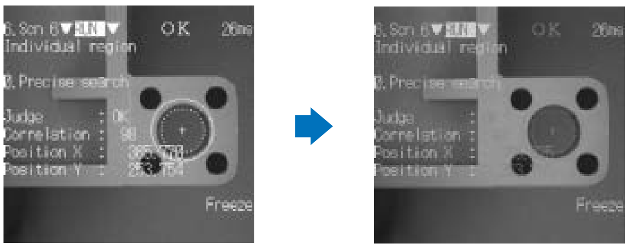


The character size can be selected, and even highlighting is possible.



Color display function

Colors can be added to displayed messages and graphics for easier viewing.



Dialog menu

Dialog-type menus allow even beginners an easy performance of settings.

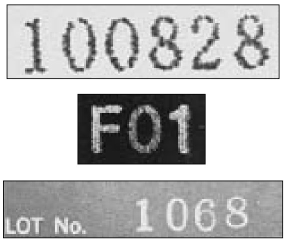
Features

QUEST Character Recognition

F160 uses OMRON's character recognition system - QUEST.
Features

- The user does not have to register characters.
- High discrimination level of similar characters.
- Adapts to fluctuations in shape and size.

Use for any type of character

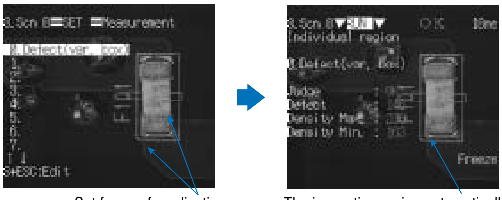


"Variable Box" Measurement for Defect Inspection

The measurement area can be set to change automatically when performing inspections for objects with varying sizes, such as electronic chip components. This feature ensures that the optimum measurement areas are always used for inspection.

Setting screen

Measurement screen

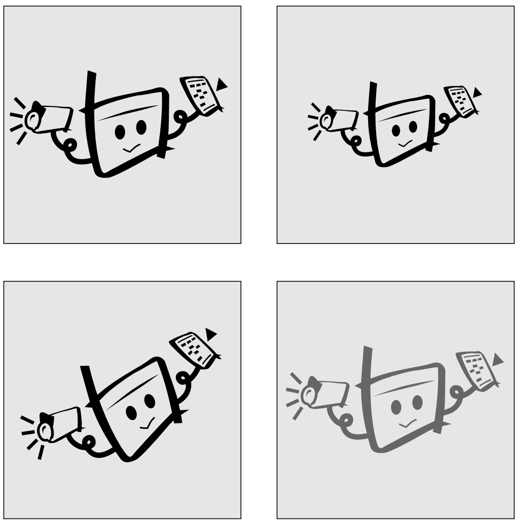


Set frames for adjusting the region size

The inspection region automatically adapts to the object size.

Flexible Search

This method performs a matching using more than one reference image and so F160 can perform inspection for objects with varying shapes. This feature helps to reduce incorrect evaluations.



Matching can be performed for products with varying shapes by using more than one reference image.

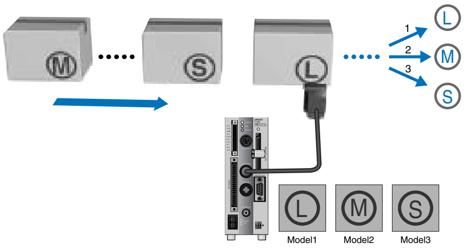
Rotation search

This function rotates the image while searching. Processing speed is 10 times higher than previous models. Angle interpolation enables high-precision angle detection.

Example: Searching in a rotation range of 360˚ with a skipping angle of 5˚.

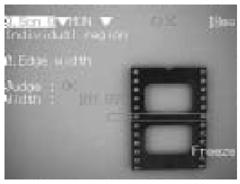
Classification

A search is performed using multiple stored models, and the best-matching model number is output. The flexible search function can also be used for work shapes.
Can handle variations in shape.



Edge width

The positions of both edges of an object are detected with high accuracy, and from this the width of the object is calculated. It is not necessary to set expressions for calculating the width.



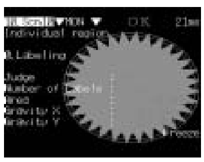
Position displacement compensation

F160 permits compensation using only the outline of the object, 2-stage position compensation, and setting priorities for the compensation direction.

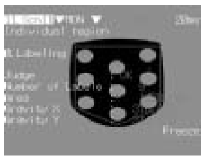
Compensation in the X direction followed by compensation in the Y direction.

Labeling

The number of labels (i.e., objects) inside the measurement area is counted. After they have been sorted according to area or center of gravity, the measurement data for specified labels is output.



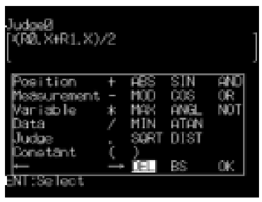
Counting gears



Inspecting the position and number of buttons

Expressions

Evaluation and data output based on a maximum of 32 expressions is possible. Up to 32 variables (representing other expressions) can be used, enabling more complex calculations.



Ordering information

Name		Model	Remarks
Controller		F160-C10E-2	NPN Input/Output
Controller		F160-C15E-2	PNP Input/Output
Double-speed camera	Camera with intelligent lighting	F160-SLC20	
		F160-SLC50	
	Camera only	F160-S1	
		F160-S2	With partial scan function.
Compatible F150 cameras	Camera with intelligent lighting	F150-SLC20	
		F150-SLC50	
	Camera with light	F150-SL20A	
		F150-SL50A	
	Camera only	F150-S1A	
Console		F160-KP	
		F150-KP	
Color LCD monitor		F150-M05L	
Monochrome CRT Video monitor		F150-M09	
Memory card		F160-N64S(S)	Memory capacity 64 MB
Camera cable		F150-VS	For Double-speed Camera and compatible F150 Cameras. Cable length: 3 m*1
Monitor cable		F150-VM	Cable length: 2 m*1
Parallel cable		F160-VP	Loose-wire cable for parallel I/O connectors. Cable length: 2 m

*1. Other length on request

Rating/Performance

Controller: F160-C10E-2/F160-C15E-2

Item Specifications	Conversational Menu Mode	Expert Menu Mode
Connectable cameras	F150-S1A/SL20A/SL50A/SLC20/SLC50, F160-S1/S2/SLC20/SLC50, etc.	
Number of cameras connectable	1	2
Number of pixels	512 x 484 (H x V)	
Number of scenes	32 scenes (Expansion possible using Memory Card)	
Image storage function	Maximum of 35 images stored	
Filtering	---	Smoothing (strong/weak), edge enhancement, edge extraction (horizontal, vertical, both horizontal and vertical), dilation, erosion, median, background suppression
Position displacement compensation	Set either automatically or manually Compensation directions: X, Y, and (360°) directions	Compensation directions: X, Y, and (360°)directions Detection methods: Binary center of gravity, axis angle, labeling, rotation search, gray search, edge position
Number of measurement regions	32 regions per scene	
Applications	7 types available (presence, orientation, dimensions,defects, conformity, position, chips and burs	---
Measurement data	Automatically selected according to the application	Gravity and area, gravity and axis, gray search, precise search, rotation search, flexible search, relative search, defect, area (variable box), defect (variable box), edge position, edge pitch, edge width, density average, labeling, OCR for 1 character, classification
Data operation functions (expressions)	---	Number: 32 expressions can be set for judgements, data, and variables used in other expressions. Operations: Arithmetic operations, square root, absolute value, remainder, distance, angle, maximum, minimum, SIN, COS, ATAN, AND, OR, NOT
Result output	Overall judgements, judgements for each measurement region	Overall judgements, judgements for each measurement region, expression results, measurement/expresion data
Functions for customizing operations	---	Menu masking , password setting, shortcut keys
Functions for customizing screens	---	Display items: Character strings (measured values, judgement results, times, user-specified characters, measurement region names) Specified parameters: Display color, position, size
Number of slots for Memory Cards	1	
Monitor interface	1 channel (color, monochrome)	
Serial communications	RS-232C/422A 1 channel	
Parallel I/O	13 inputs and 22 outputs including control I/O points	
Input/ Output type: NPN	F160-C10E	
Input/ Output type: PNP	F160-C15E	
Power supply voltage	20.4 to 26.4 VDC	
Current consumption	Approx. 1.6 A (when two F160-SLC50 Cameras connected)	
Ambient temperature	Operating: 0 to 50°C, Storage: -25 to 65°C (with no ice formation or condensation)	
Ambient humidity	Operating and storage: 35 to 85% (with no condensation)	
Dimensions	56 x 160 x 110 (W x H x D) mm (not including connectors and other protruding parts)	
Weight	Approx. 570 g (Controller only)	

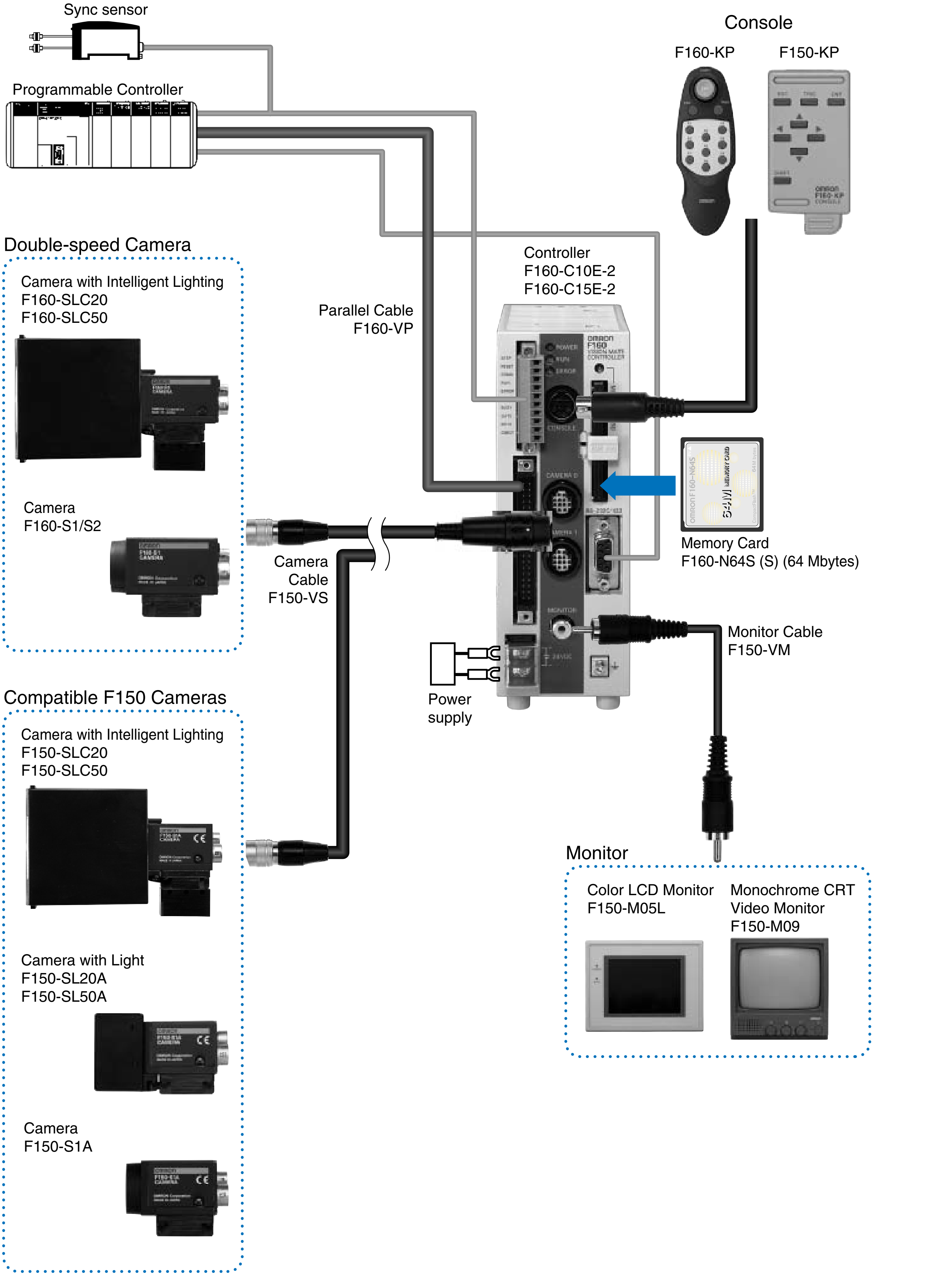
Double-speed camera: F160-S1/S2

Picture element	1/3“ Interline CCD
Effective pixels	659 x 44 (H x V)
Scanning method	1/60-s non-interlace (frame) mode, 1/120-s 2:1 interlace (field) mode
Shutter	Electronic shutter; select from 8 shutter-speed settings (1/120 to 1/20,000 s) using menu
Camera with Intelligent Lighting	F160-SLC20 (field of vision: 20 mm), F160-SLC50 (field of vision: 50 mm)
Ambient temperature	Operating: 0 to +50°C Storage: -25 to +60°C (with no icing or condensation)
Ambient humidity	Operating and Storage: 35 to 85% RH (with no condensation)
External Dimensions	31 x 40 x 54.5 (W x H x D) mm (not including connectors and other protruding parts)
Weight	Approx. 85 g (Camera only)

Monitor

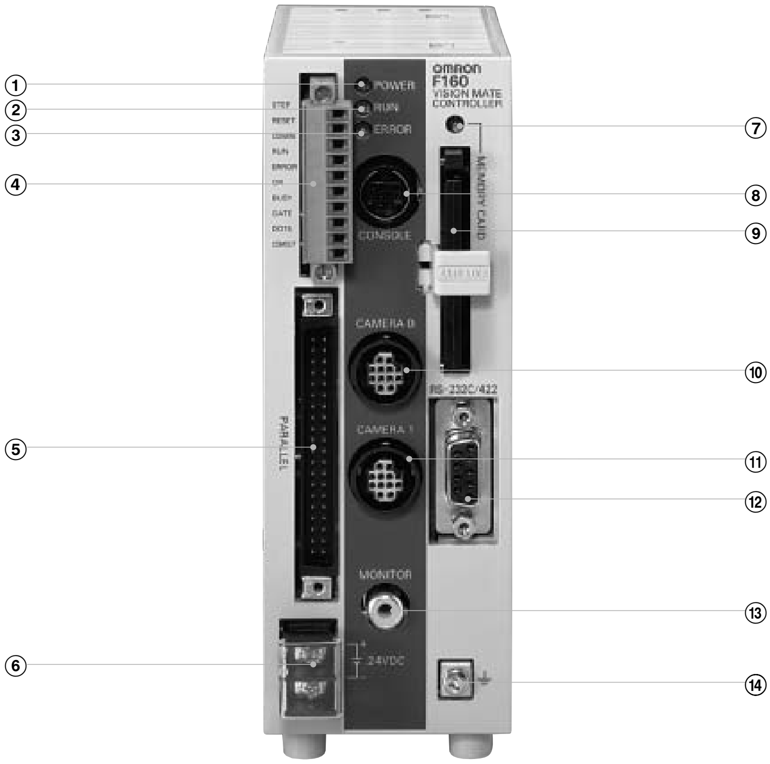
Item / Model number / Name	F150-M05L Color LCD monitor	F150-M09 Monochrome CRT Video Monitor
Size	5.5 inches	9 inches
Type	Liquid crystal color TFT	CRT monochrome
Resolution	320 x 240 dots	800TV or min. (at center)
Input signal	NTSC composite video (1.0 V / 75)	
Power supply voltage	20.4 to 26.4 VDC	100 to 240 VAC (-15%, +10%)
Current consumption	Approx. 700 mA	Approx. 400 mA
Ambient temperature	Operating: 0 to +50°C Storage: -25 to +65°C (with no icing or condensation)	Operating: -10 to +50°C Storage: -20 to +65°C (with no icing or condensation)
Ambient humidity	Operating or storage: 35% to 85% (with no condensation)	Operating or Storage: 10% to 90% (with no condensation)
Weight (Monitor only)	Approx. 610 g	Approx. 4.5 kg
Accessories	Instruction manual and 4 mounting brackets	Instruction manual

System configuration



Name and function of each part

F160-C10E/F160-C15E



① **POWER LED**
Illuminates while the power is on.

② **RUN LED**
Illuminates while the system is in measurement mode.

③ **ERROR LED**
Illuminates when a problem occurs.

④ **Input terminal (control line)**
Connects to a synchronous sensor or programmable controller.

⑤ **Input/output connector (data line)**
Connects to a synchronous sensor or programmable controller.

⑥ **Power terminal**
Connects to the power supply.

⑦ **Memory card LED**
Illuminates during memory access.

⑧ **Console connector**
Connects to the console.

⑨ **Memory card slot**
A memory card inserts into this slot.

⑩ **CAMERA 0 connector**
Connects to a camera.

⑪ **CAMERA 1 connector**
Connects to a camera.

⑫ **RS-232C/422 connector**
Connects to a computer or programmable controller.

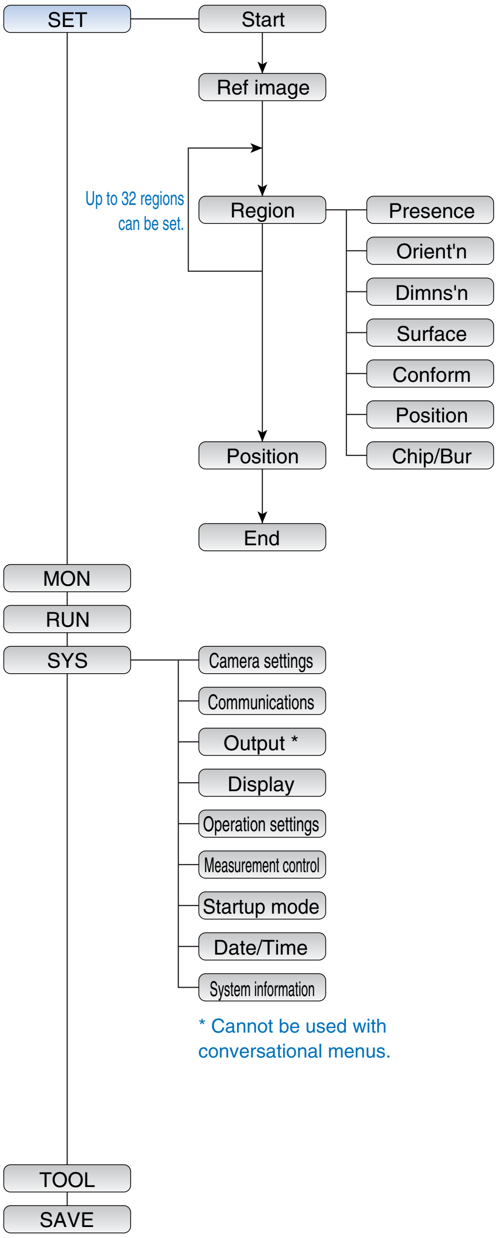
⑬ **Monitor connector**
Connects to a monitor.

⑭ **Ground terminal**
Connect the ground wire to this terminal.

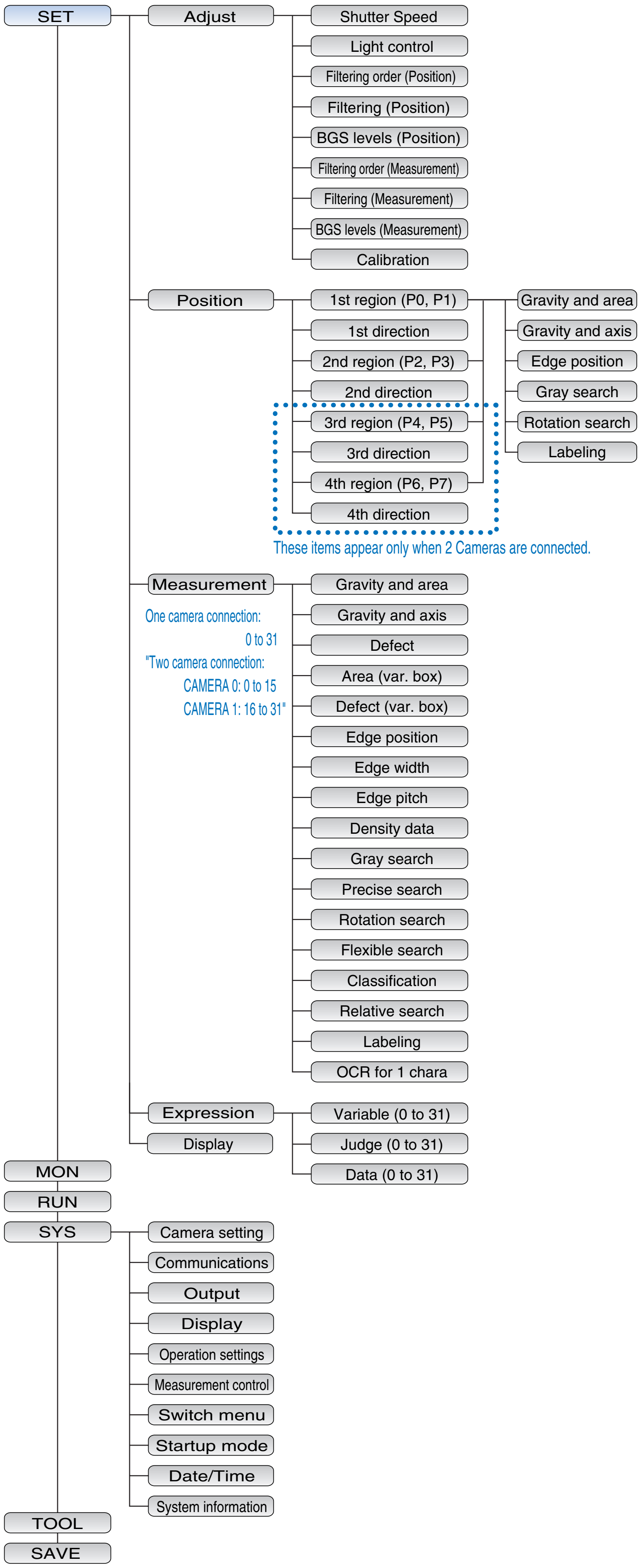
Function menu

Menu structure diagram

Dialog menu

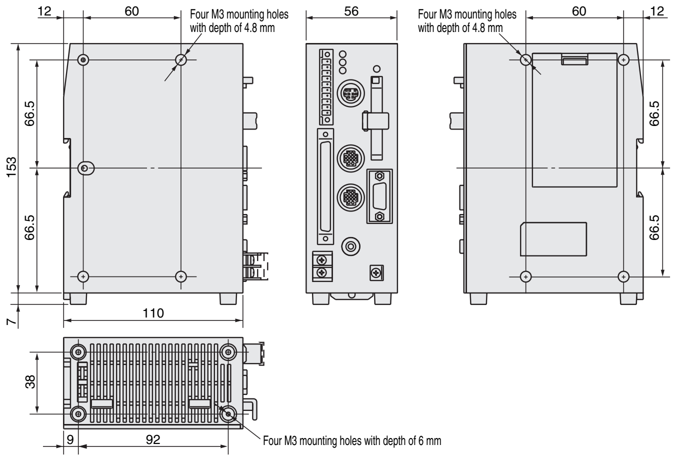


Expert menu

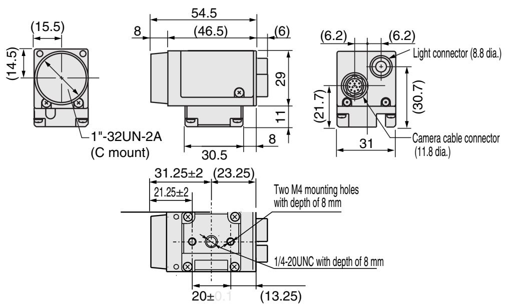


Dimensions (Unit: mm)

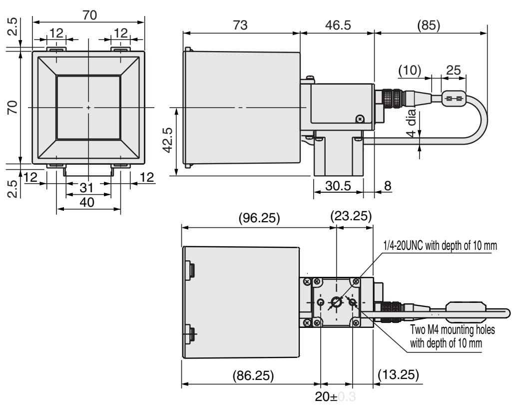
Controller
F160-C10E/F160-C15E



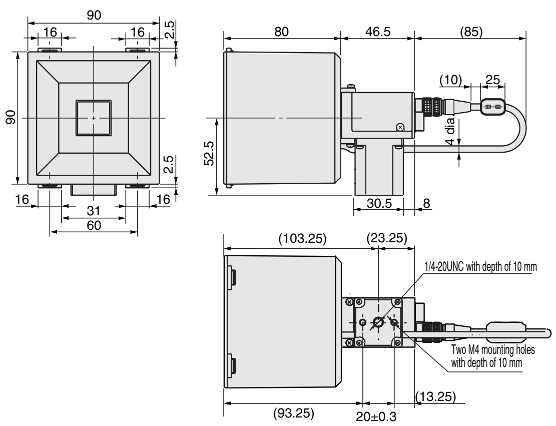
Double-speed camera
F160-S1/S2



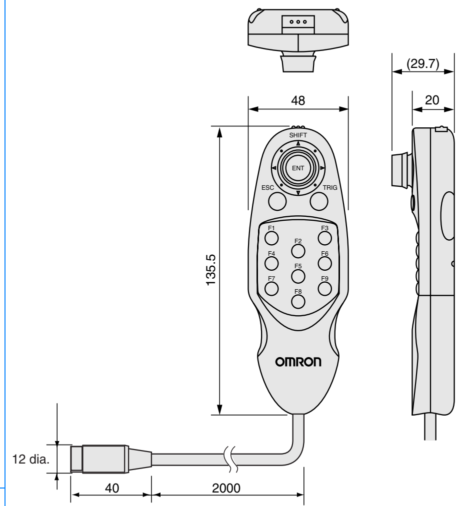
F160-SLC20 (with F150-LTC20 intelligent lighting)



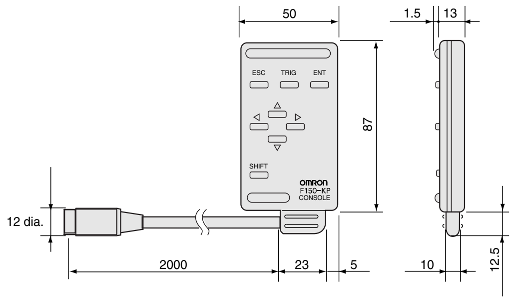
F160-SLC50 (with F150-LTC50 intelligent lighting)



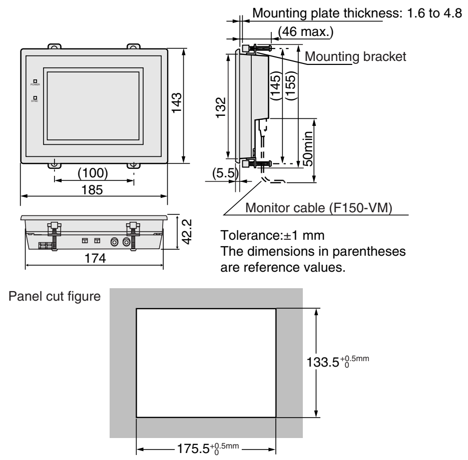
Console
F160-KP



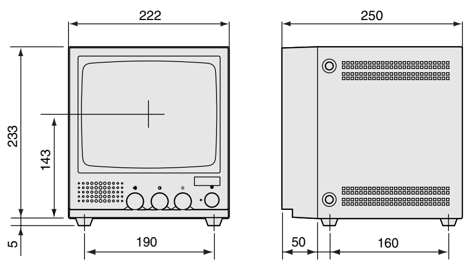
F150-KP



LCD monitor
F150-M05L



Video monitor
F150-M09



F160

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Vision Sensor

F210

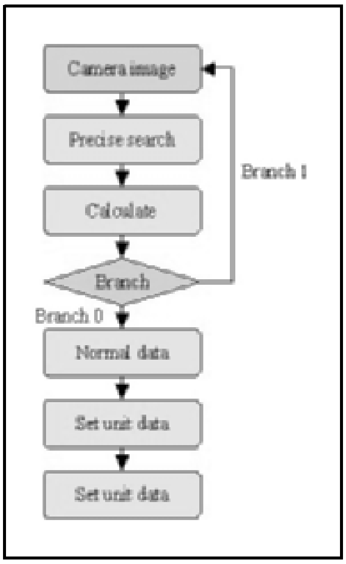
Features

Flow Menus

Flow Menus select the required processing items from the library, combining and linking them for you

Ideal for the following

- Stabilize measurement images by filtering the required number of times.
- Perform measurements according to workpiece tolerance by changing the measurement area baased on measurement results
- Periodically check for data variations by outputting the maximum and minimum values for each 10 measurements,



Features

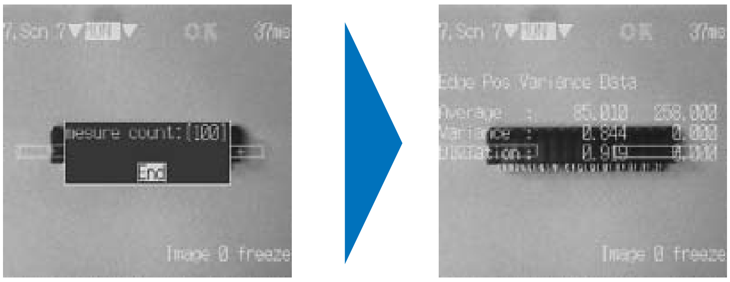
Macros

Augment Flow Menus using a PC text editor. The Software package can be edited using text commands to customize I/O controls, displays, and GUI

Programs can be created using only a text editor, with no need for any special development environment.

Ideal for the following

- Creating special menus.
- Displaying and outputting the date and time of NG measurements.
- Automatically saving NG images to a Memory Card.
- Changing the number of registered product types.

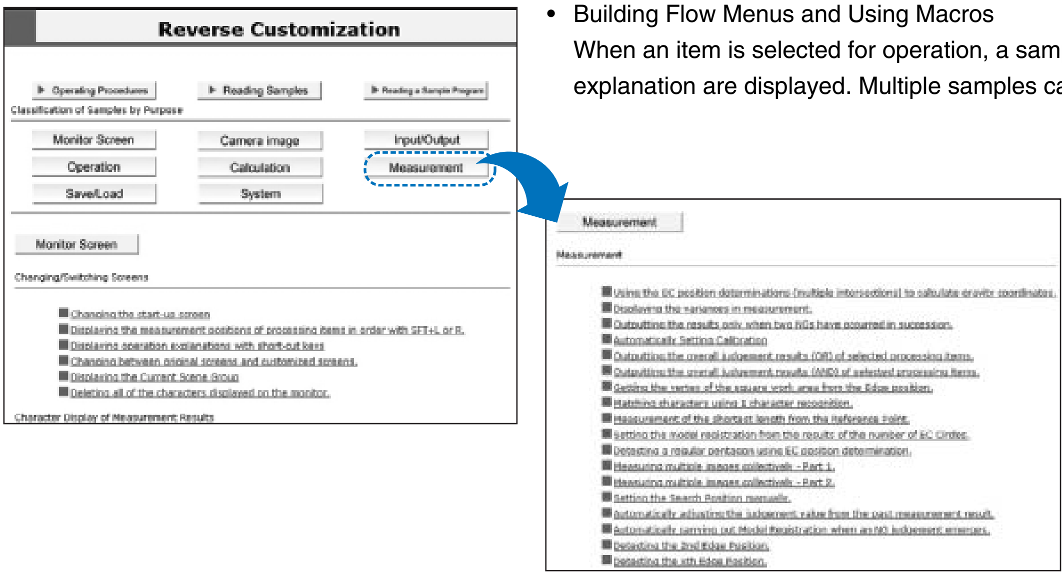


Special menus using macros

Customization Manual

The know-how from the past is incorporated in a manual so that Reverse Customization can be used to determine the best method to execute the desired process.

- Building Flow Menus and Using Macros
  When an item is selected for operation, a sample program and explanation are displayed. Multiple samples can be easily combined.



Ordering information

<table>
<tr><th colspan="2">Name</th><th>Model</th><th>Remarks</th></tr>
<tr><td colspan="2" rowspan="2">Controller</td><td>F210-C10</td><td>NPN Input/Output</td></tr>
<tr><td>F210-C15</td><td>PNP Input/Output</td></tr>
<tr><td rowspan="4">Double-speed camera</td><td rowspan="2">Camera with intelligent lighting</td><td>F160-SLC20</td><td></td></tr>
<tr><td>F160-SLC50</td><td></td></tr>
<tr><td rowspan="2">Camera only</td><td>F160-S1</td><td></td></tr>
<tr><td>F160-S2</td><td>With partial scan function.</td></tr>
<tr><td rowspan="5">Compatible F150 cameras</td><td rowspan="2">Camera with intelligent lighting</td><td>F150-SLC20</td><td></td></tr>
<tr><td>F150-SLC50</td><td></td></tr>
<tr><td rowspan="2">Camera with light</td><td>F150-SL20A</td><td></td></tr>
<tr><td>F150-SL50A</td><td></td></tr>
<tr><td>Camera only</td><td>F150-S1A</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Console</td><td>F160-KP</td><td></td></tr>
<tr><td>F150-KP</td><td></td></tr>
<tr><td colspan="2">Color LCD monitor</td><td>F150-M05L</td><td></td></tr>
<tr><td colspan="2">Monochrome CRT Video monitor</td><td>F150-M09</td><td></td></tr>
<tr><td colspan="2">Memory card</td><td>F160-N64S(S)</td><td>Memory capacity 64 MB</td></tr>
<tr><td colspan="2">Camera cable</td><td>F150-VS</td><td>For Double-speed Camera and compatible F150 Cameras.
Cable length: 3 m*1</td></tr>
<tr><td colspan="2">Monitor cable</td><td>F150-VM</td><td>Cable length: 2 m*1</td></tr>
<tr><td colspan="2">Parallel cable</td><td>F160-VP</td><td>Loose-wire cable for parallel I/O connectors.
Cable length: 2 m</td></tr>
</table>

*1. Other length on request.

F210

Processing Item Support

The F250-UM3FE (UM3ME) Application Software supports approximately 70 different processing items. These can be freely combined for inspections as needed. Image input, measurement support, branch control, results output, and results display can be used in common for all of the models (F210 and F250).

Image Input Functions

- Inputting Camera Images
- Switching Cameras
- Changing Filtering
- Filtering Again

Position Compensation Functions

Compensation	Processing item	Controller		Remarks
		F210	F250	
Position compensation in X, Y, and θ directions	Binary Position Compensation	YES	YES	---
	Circle Position Compensation	NO	YES	---
	EC Position Compensation	YES	YES	---
	Edge Position Compensation	YES	YES	---
	Model Position Compensation	NO	YES	Enables high-speed processing compared to the model position compensation #.
	Model Position Compensation #	YES	YES	---

General Measurement Functions

Application (measurement)		Processing item	Controller		Remarks
			F210	F250	
Size (area)		Binary Defect	YES	YES	Up to eight regions can be set per Unit, with results displayed in a list.
		Binary Gravity and Area	YES	YES	Only one region can be set per Unit. Menu levels are simple and easy to understand.
		Binary Area (Variable Box)	YES	YES	Used for inspecting measurement items with varying positions and sizes.
Position	Center-of-gravity detection (Processing time: Low) (X, Y)	Binary Defect	YES	YES	Up to eight regions can be set per Unit, with results displayed in a list.
		Binary Gravity and Area	YES	YES	Only one region can be set per Unit. Menu levels are simple and easy to understand.
		Binary Area (Variable Box)	YES	YES	Used for inspecting measurement items with varying positions and sizes.
	Coordinate detection (Processing time: High) (X, Y)	Gray Search	YES	YES	Uses gray models to detect positions in pixel units.
		Precise Search	YES	YES	Uses gray models to detect positions in sub-pixel units.
		Flexible Search	YES	YES	Multiple models are registered to enable searching even when there is variation.
		Pattern	NO	YES	Up to 64 regions can be registered per Unit, and high-speed processing is possible. (See note.)
		ECM Search	YES	YES	Uses edge code models so that processing is not affected by deformation or dirt.
		EC Positioning	YES	YES	No model registration is required. Searches using shape information such as "round" or "angular."
	Coordinate detection (Rotation in measurement item)	Rotation Positioning	NO	YES	High-speed processing is possible. (See note.)
		Rotation Search	YES	YES	---
	Dimensions measurement	Gray Edge Position_8	YES	YES	Up to eight regions can be set per Unit, with results displayed in a list.
		Gray Edge Position_1	YES	YES	Only one region can be set per Unit. Menu levels are simple and easy to understand.
		Gray Edge Width	YES	YES	---
	Position deviation detection	Relative Position	YES	YES	---

Note: These processing items are most effective when set immediately after image input processing item (Camera image input or Camera switching). Depending on conditions, however, high-speed processing may not be possible.

Application (measurement)	Processing item	Controller		Remarks
		F210	F250	
Defect	Surface Defect	YES	YES	Only one region can be set per Unit. Menu levels are simple and easy to understand.
	Density Defect	NO	YES	Up to eight regions can be set per Unit, with results displayed in a list. The number of Units can be reduced.
	Surface Defect (Variable Box)	YES	YES	Used for inspecting measurement items with varying positions and sizes.
	EC Defect	YES	YES	Uses edge codes for defect inspection so that processing is not affected by deformation or dirt.
	Fine Matching	YES	YES	Accurately detects differences with models.
Characters	QUEST Character Verification	YES	YES	Used to verify multiple characters.
	Lot Number OCR 1	YES	YES	Handles lot numbers that are changed daily, weekly, monthly, or annually.
	OCR for 1 Character	YES	YES	---
Angle	Binary Defect	YES	YES	Up to eight regions can be set per Unit, with results displayed in a list. The number of Units can be reduced.
	Binary Gravity and Angle	YES	YES	Only one region can be set per Unit. Menu levels are simple and easy to understand.
	Rotation Positioning	NO	YES	High-speed processing is possible. (See note.)
	Rotation Search	YES	YES	Used when the measurement item rotates.
	Circular Angle	YES	YES	Used only for circular measurement items. Enables higher-speed processing compared to Rotation Search. (See note.)
Quantities	Labeling	YES	YES	Counts up to 2,500.
	Label Data	YES	YES	Gets label measurement values from other Units.
	Edge Pitch	YES	YES	Gets the number, pitch, and width.
	EC Circle Count	YES	YES	Finds circles using "round" shape information so that processing is not affected even if the circles are deformed or dirty.
Shapes (correlation values)	Pattern	NO	YES	Up to 64 regions can be registered per Unit, enabling high-speed processing. (See note.)
	Flexible Search	YES	YES	Searching can be performed even if there is variation in model images.
	Fine Matching	YES	YES	Accurately detects differences with models.
Classification	Classification	NO	YES	Enables higher-speed processing compared to Classification #. (See note.)
	Classification #	YES	YES	---
Brightness	Density Data	YES	YES	---

Note: These processing items are most effective when set immediately after image input processing item (Camera image input or Camera switching). Depending on conditions, however, high-speed processing may not be possible.

Measurement Support Functions

- Calculation
- Get unit data
- Set unit data
- Wait
- Elapsed time
- Trend monitor

Results Output Functions

- Memory card data output
- DO data output
- Host link data output
- Normal data output
- DO judgement output

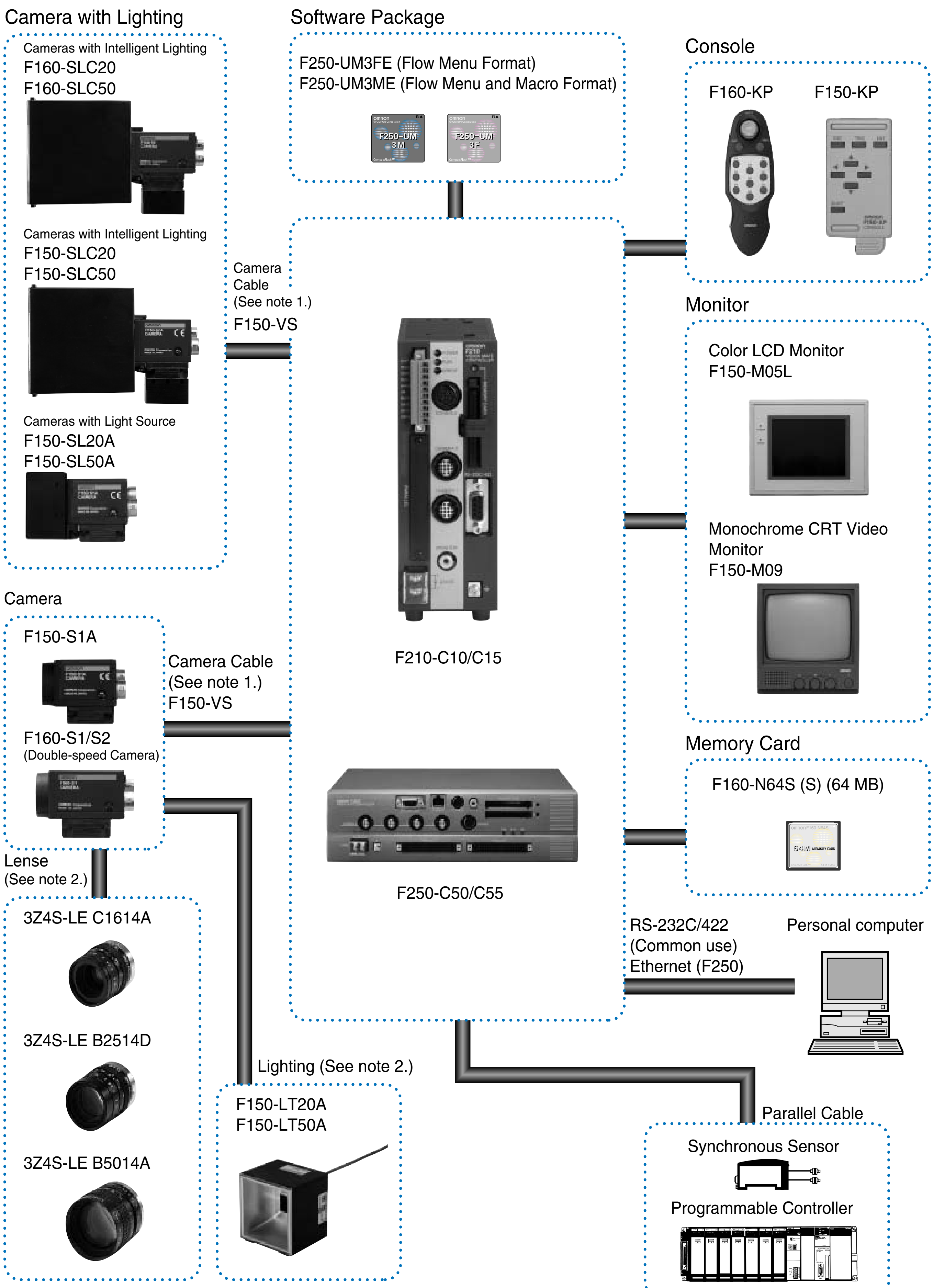
Branch Control Functions

- Conditional branch
- DI branch
- End

Results Display Functions

- String display
- Measurement display
- Judgement display
- Item display
- Time display
- Figure display
- Line results display
- Box display
- Circle display
- Cursor display
- Newest NG image display

System Configuration



Note 1: Separate robot cable specifications (F150-VSB) are available.
Note 2: In addition, lenses and lighting are available.

Rating/Performance

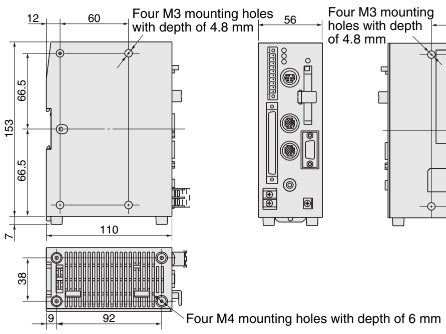
Controller

Item / Specifications	F210-C10/C15	F250-C50/C55
Connectable Cameras	F150-S1A/-SL20A/-SL50A/-SLC20/-SLC50, F160-S1/-S2/-SLC20/-SLC50, F300-S2R/-S3DR, etc.	
Number of Cameras connectable	2	4
Number of pixels	512 × 484 (H × V)	
Number of scenes	32 (Expansion possible using Memory Cards.)	
Image storage function	Maximum of 35 images stored	
Filtering	Smoothing (strong, weak), edge enhancement, edge extraction (horizontal, vertical, both), dilation, erosion, median, background suppression	
Operation and settings	Installing measurement items using application software, and combining and setting measurement items by menu operations	
Menu language	Japanese or English (Can be switched.)	
Trend monitor function	Supported	
Memory card slots	1	2
Monitor interface	1 channel	Composite video output: 1 channel, S-VIDEO output: 1 channel
Ethernet	Not supported.	10Base-T: 1 channel
Serial communications	RS-232C/422A: 1 channel	
Parallel I/O	13 inputs and 22 outputs	21 inputs and 46 outputs
Strobe interface	2 channels (included in parallel outputs)	4 channels (included in parallel outputs)
Power supply voltage	20.4 to 26.4 VDC	
Current consumption	Approx. 1.6 A (when two F160-SLC50 Cameras are connected)	Approx. 3.7 A (when four F160-SLC50 Cameras are connected)
Ambient temperature	Operating: 0 to 50°C Storage: -25 to 65°C (with no icing or condensation)	
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)	
External dimensions	56 × 160 × 110 (W × H × D) mm (not including connectors and other protruding parts)	270 × 81 × 197 (W × H × D) mm
Weight	Approx. 570 g (Controller only)	Approx. 2.7 kg (Controller only)

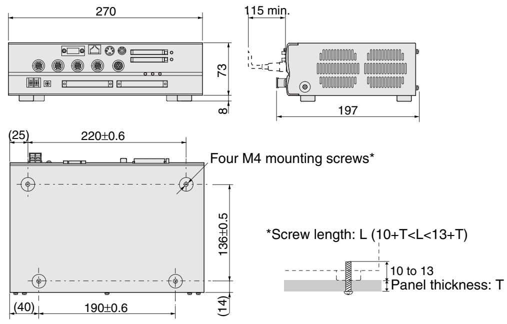
Dimensions

Unit: mm

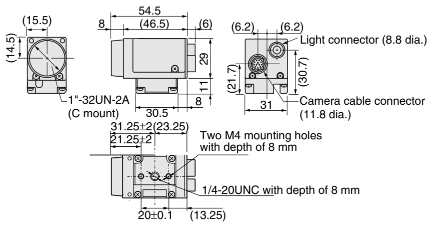
Controller
F210-C10/C15



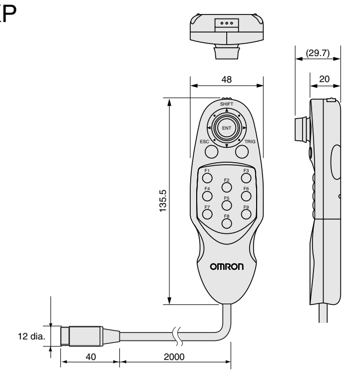
F250-C50/C55



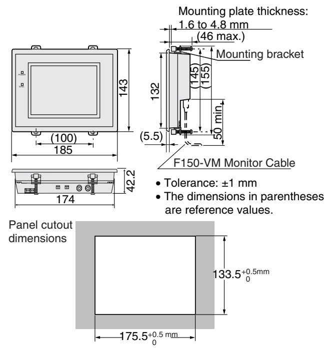
Camera
F160-S1/S2



Console
F160-KP



Liquid Crystal Monitor
F150-M05L



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

High-performance Vision Sensor

F250

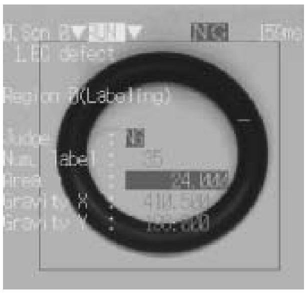
Advanced algorithm enables ultra high speed and maximum flexibility

Features

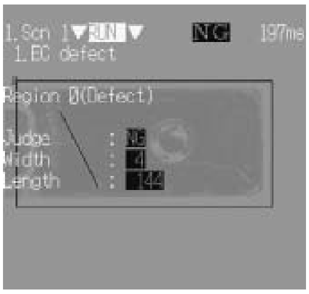
Inspection and positioning that was difficult with previous vision sensors is now surprisingly easy!

ED defect inspection

High-precision detection of minute defects that could not be detected previously .



Certain detection of rubber packing deformities.

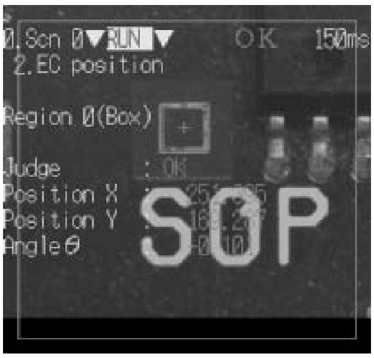


Detection of low-contrast defects on metal surfaces

EC positioning

High-precision position measurement even if the inside of the work changes or the view changes.

● Positioning of PWB fiducial marks



Low contrast

Revolution

Internal dirt

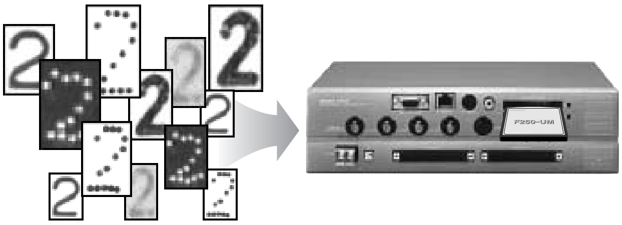
Features

QUEST character checking

Even if the shape or size of a character varies, "QUEST Logic" finds printed characters with certainty. The built-in dictionary makes "simple settings" possible.

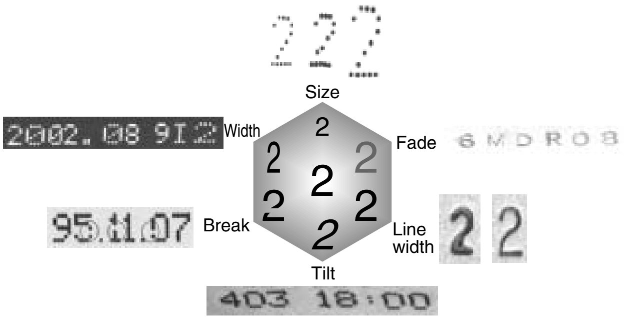
● No need to store a character dictionary

Various character fonts for factory automation have been prestored. This eliminates the need to store a dictionary or model names, and allows a dramatic reduction in man-hours for initial setup.



● The "six character variations" can also be recognized with certitude.

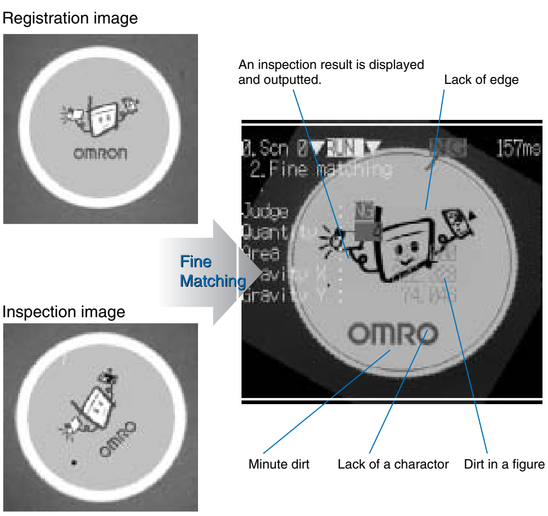
Checks characters printed on the production line such as "Best before" dates and lot numbers. Even if there are deviations in shape, size, or line width, the characters are accurately checked.



Fine matching

Detects differences from the stored "good" image quickly and with high accuracy. Dramatic improvement in ability to inspect characters and patterns with minute border defects.

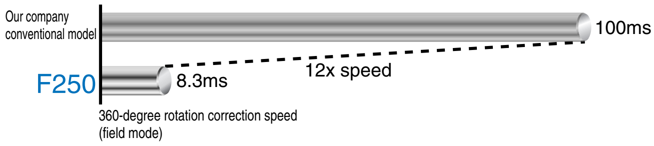
● Example of application to soft drink cap inspection



For fast increasing line speeds and ever stricter quality demands.

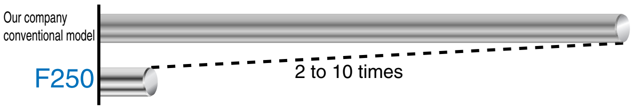
● Real time Revolution Search is amazing

Executes a real time search of 72 models. Even with works that rotate 360°, positioning corrections are completed at the same time as image read-in.



● Fast image processing

Inspection functions following camera image read-in are also up to 10 times faster thanks to a newly developed parallel processing technology.

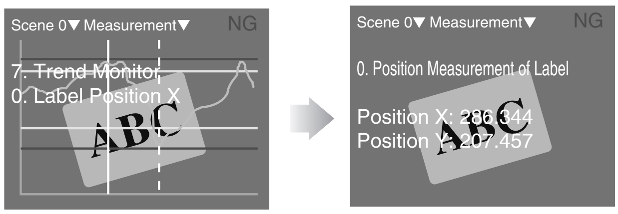


● Fast image read-in

The F160-S1 double-speed camera achieves a maximum image read-in speed of 8.3 ms.

"Non-stop" adjustment without stopping the line

All settings can be adjusted and reset while inspection continues. There is no need to stop the line for adjustments, subsequently, no capacity drops.

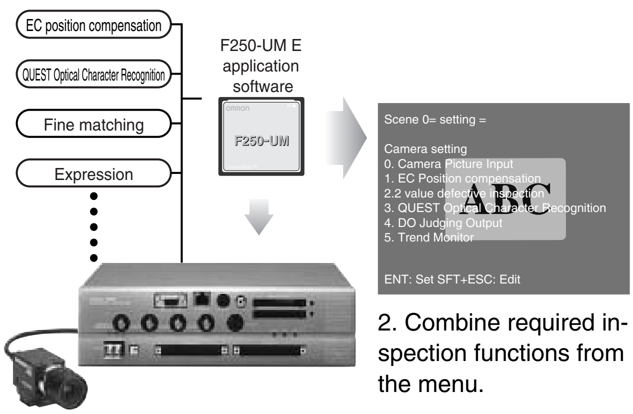


It adjusts checking an inspection history by the trend monitor.

Test measurement is performed as compared with previous NG picture.

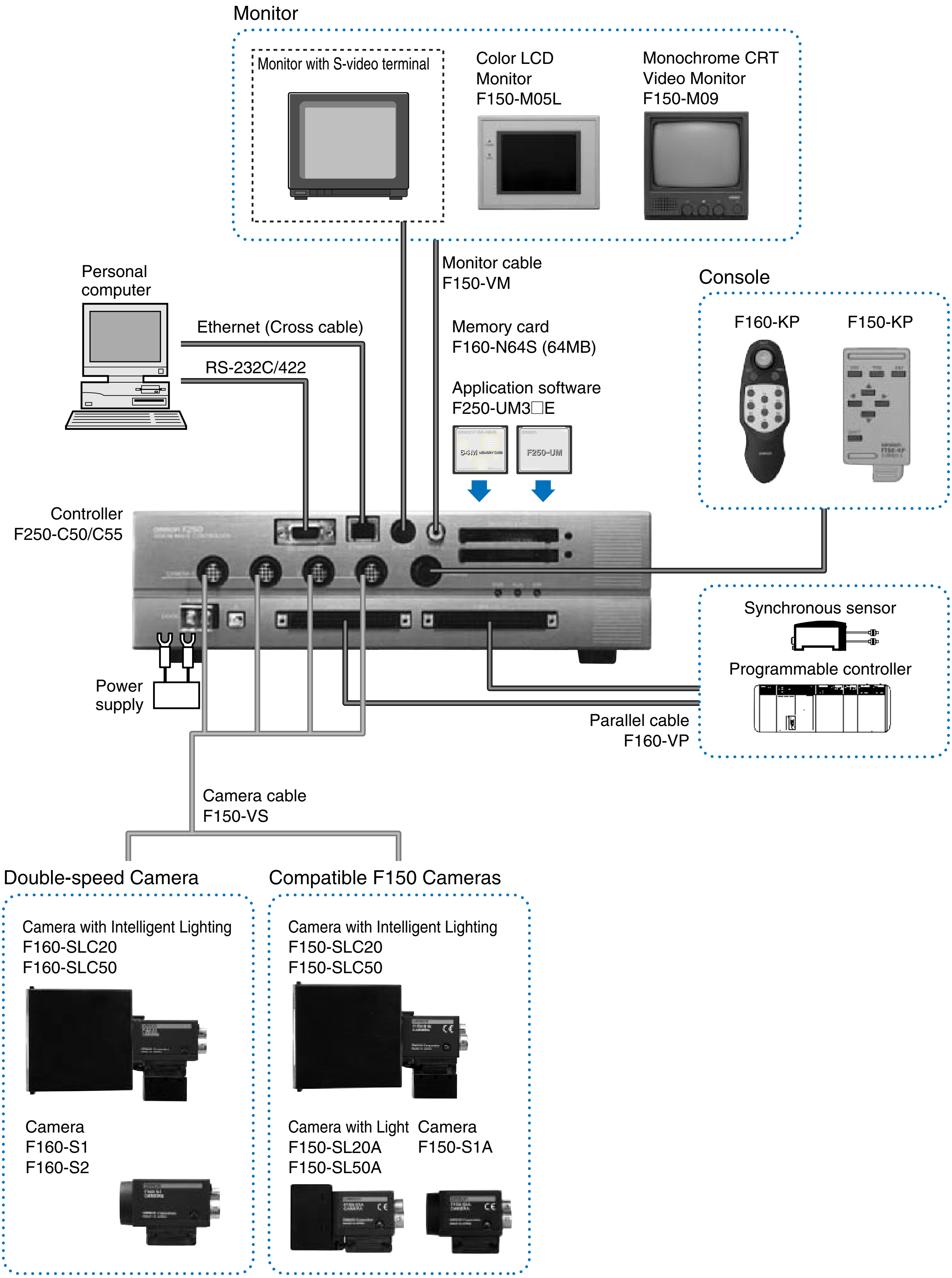
● Easy and flexible settings by means of software application

1. Functions needed for inspection are selected and installed from the software application.



2. Combine required inspection functions from the menu.

System configuration



Ordering Information

Name		Model	Remarks
Controller		F250-C50	NPN Input/Output
		F250-C55	PNP Input/Output
Double-speed camera	Camera with intelligent lighting	F160-SLC20	
		F160-SLC50	
	Camera only	F160-S1	
		F160-S2	Includes Partial Scan functionality
F150 Compatible cameras	Camera with intelligent lighting	F150-SLC20	
		F150-SLC50	
	Camera with lighting	F150-SL20A	
		F150-SL50A	
	Camera only	F150-S1A	
Console		F160-KP	
		F150-KP	
LCD monitor		F150-M05L	
Video monitor		F150-M09	
Memory card		F160-N64S(S)	Memory capacity 64 MB
Application software		F250-UM3ME	with Macro function
		F250-UM3FE	without Macro function
Camera cable		F150-VS	Length of cable for double-speed camera and F150 common camera: 3 m
Monitor cable		F150-VM	Cable length: 2 m
Parallel cable		F160-VP	Length of pigtail cable for parallel input/output connector: 2 m

Rating/Performance

Controller: F250-C50/C55

Connected camera	F150-S1A/SL20A/SL50A/SLC20/SLC50, F160-S1/S2/SLC20/SLC50
Number of connectable cameras	4
Processing resolution	512(H) x 484(V)
Number of scenes	32 scenes (expansion possible using memory card)
Image storage function	Maximum 35 images
Image pre-processing	Smoothing (strong/weak), edge enhancement, edge extraction (horizontal, vertical, both), erosion, dilation, median, background deletion
Operation and Settings	Install measurement routines from a software application, combine and establish settings for measurement routines from menus.
Menu language	Japanese/English (changeable)
Operation customization function	Password function, short-cut key function
Screen customization function	Display items: Character strings (measured values, decisions, time, any character string, measurement area names), graphics (straight lines, rectangles, circles, cross-hair cursors) Parameters specified: display color, postion, size
Non-stop adjustment function	Yes
Trend monitor function	Yes
Memory card slot	2 slots
Monitor	Composite video output: 1 CH, S-video output: 1 CH
Ethernet	10Base-T 1CH
Serial communication	RS-232C/422A 1CH
Parallel input/output	Inputs: 21 points, outputs: 46 points
Strobe	4 CH (included in parallel outputs)
Power supply voltage	20.4 to 26.4 VDC
Current consumption	Approximately 3.7 A (when four F160-SLC50 units are connected)
Ambient temperature	Operating: 0 to +50°C, storage: -25 to +65°C (no ice formation or condensation)
Ambient humidity	Operating/storage: 35 to 85% RH (with no condensation)
Dimensions	270(W) x 81(H) x 197(D)
Weight	Approximately 3.1kg (unit only)

Double-speed camera: F160-S1/S2

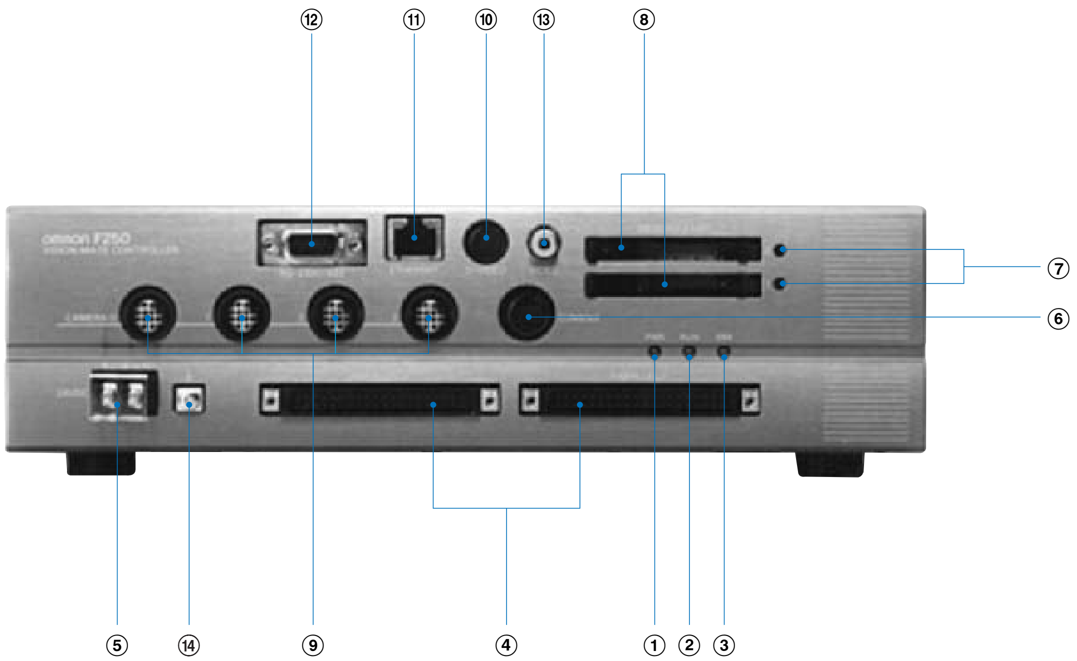
Picture element	1/3“ Interline CCD
Effective pixels	659 x 44 (H x V)
Scanning method	1/60-s non-interlace (frame) mode, 1/120-s 2:1 interlace (field) mode
Shutter	Electronic shutter; select from 8 shutter-speed settings (1/120 to 1/20,000 s) using menu
Camera with Intelligent Lighting	F160-SLC20 (field of vision: 20 mm), F160-SLC50 (field of vision: 50 mm)
Ambient temperature	Operating: 0 to +50°C Storage: -25 to +60°C (with no icing or condensation)
Ambient humidity	Operating and Storage: 35 to 85% RH (with no condensation)
External Dimensions	31 x 40 x 54.5 (W x H x D) mm (not including connectors and other protruding parts)
Weight	Approx. 85 g (Camera only)

Monitor

Model number / Item / Name	F150-M05L Color LCD monitor	F150-M09 Monochrome CRT Video Monitor
Size	5.5 inches	9 inches
Type	Liquid crystal color TFT	CRT monochrome
Resolution	320 x 240 dots	800TV or min. (at center)
Input signal	NTSC composite video (1.0 V / 75)	
Power supply voltage	20.4 to 26.4 VDC	100 to 240 VAC (-15%, +10%)
Current consumption	Approx. 700 mA	Approx. 400 mA
Ambient temperature	Operating: 0 to +50°C Storage: -25 to +65°C (with no icing or condensation)	Operating: -10 to +50°C Storage: -20 to +65°C (with no icing or condensation)
Ambient humidity	Operating or storage: 35% to 85% (with no condensation)	Operating or Storage: 10% to 90% (with no condensation)
Weight (Monitor only)	Approx. 610 g	Approx. 4.5 kg
Accessories	Instruction manual and 4 mounting brackets	Instruction manual

Name and function of each part

Controller: F250-C50/C55



① **POWER LED (green)**
Illuminates while the power is on.

② **RUN LED (orange)**
Illuminates while the system is in measurement mode.

③ **ERROR LED (red)**
Illuminates when a problem occurs.

④ **Input connectors 0, 1**
Connects to a synchronous sensor or programmable controller.

⑤ **Power terminal**
Connects to a DC power supply.

⑥ **Console connector**
Connects to the console.

⑦ **Memory card LEDs 0, 1**
Illuminates while power is supplied to the memory card.

⑧ **Memory card slots 0, 1**
A memory card or software application is inserted here.

⑨ **CAMERA 0 - 3 connectors**
Connects to a camera.

⑩ **Monitor connector (S-Video output)**
Connects to a monitor with an S-Video input

⑪ **Ethernet connector**
Connects to a computer.

⑫ **RS-232C/422 connector**
Connects to a computer or programmable controller.

⑬ **Monitor connector (composite video output)**
Connects to a monitor.

⑭ **Ground terminal**
Connect the ground wire to this terminal.

Function menu

Processing routine list

The F250-UME application software contains approximately 50 processing routines.

Image input related

Camera image input
Camera switch
Pre-processing change
Repeat preprocessing

Position compensation related

Binary position correction
Model position correction
Circular work position correction
Edge position correction
EC position correction
Scroll return
Scroll

General measurement related

QUEST character checking
Binary defect inspection
Density defect inspection
Fine matching
Pattern inspection
Sorting
EC defect inspection
EC circular piece count inspection
Rotation positioning
Dark-light edge position
ECM search
EC positioning
Lot number checking 1
Dark-light edge number
Density average/ deviation
Labeling
Label data

Measurement supplement related

Computing
Acquire processing unit data
Set processing unit data
Wait
Elapsed time
Trend monitor

Branch control related

Condition branch
DI branch
End

Result output related

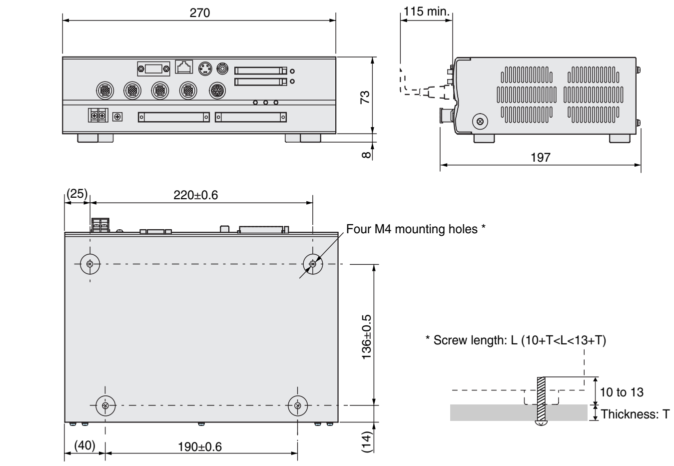
Memory card data output
DO data output
Significant link data output
Non-protocol data output
DO decision output

Result display related

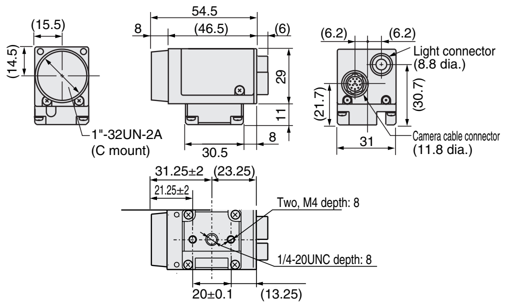
Any character display
Measured value display
Decision character display
Processing task name display
Measurement time display
Fixed graphic display
Straight line result display
Rectangle result display
Circle result display
Cross-hair cursor result display

Dimensions (Unit: mm)

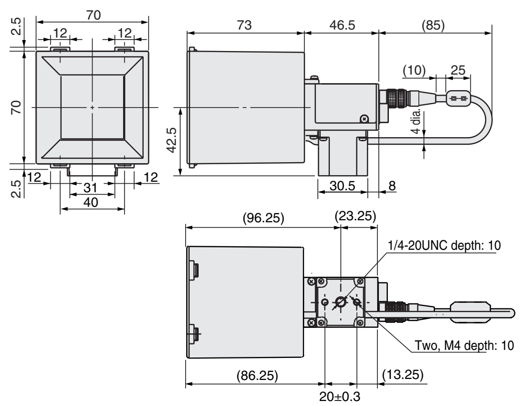
Controller
F250-C50/C55



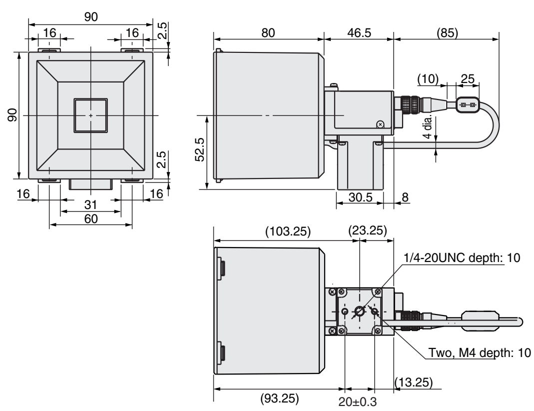
Double-speed camera
F160-S1/S2



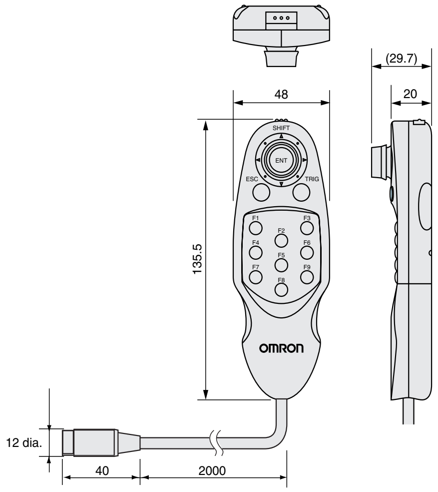
F160-SLC20 (with F150-LTC20 intelligent lighting)



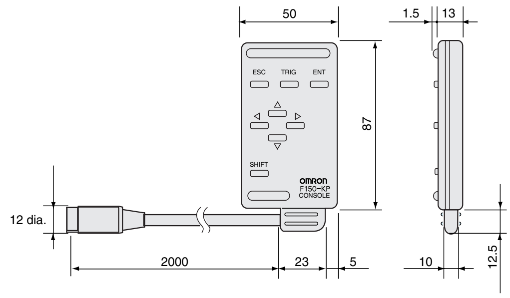
F160-SLC50 (with F150-LTC50 intelligent lighting)



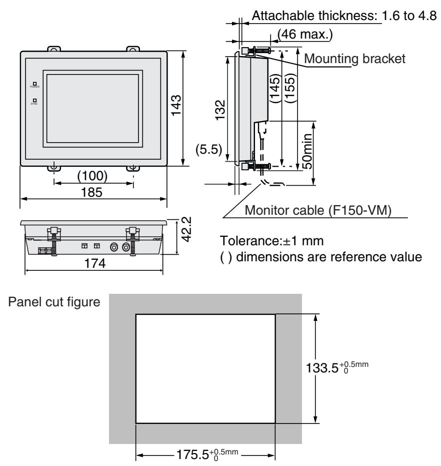
Console
F160-KP



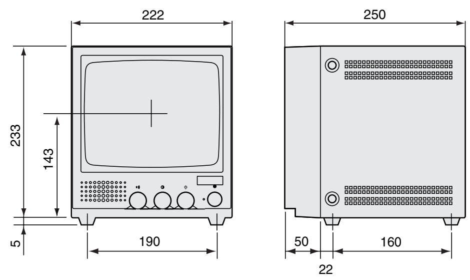
F150-KP



LCD monitor
F150-M05L



Video monitor
F150-M09



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Vision Sensor

F500

Network-compatible Sensor supports everything from high-precision detection to production and quality control

Features

The F500 enables high-precision inspections and measurements in the factory and then goes further to support easy construction of a production and quality control system for quality traceability.

High-precision Sensing

1-million-pixel Digital Interface Camera

Clear images are obtained by greatly reducing noise in high-resolution video signals.

User Customization for Even Simpler Operation

Various applications are supported through features like flow menus that flexibly handle even complicated applications and macros that enable user programming.

A Wealth of Algorithms to Achieve High-precision Measurements

High-precision measurements are achieved through original algorithms ideal for lowcontrast mark positioning, minute defect detection, and much more.

Applications Software

Build Flexible Applications

The F500 provides OMRON's new menu system called Flow Menus, which enable flexible measurements through menu settings including multiple filtering operations and conditional branches based on measurement results.

Easier to Use, Easy to Program

A Macro programming feature is provided to support measurement functions by enabling screen customization, I/O interface changes, measurement condition changes, and much more. Macros can be easily programmed using a simple text editor.

Storage for Production and Quality Control

Store inspection and measurement data for safe keeping. Provide feedback to quality control data, or analyze the data to improve quality. The stored data can be used in many ways.

Large Storage Capacity

Approximately 200 images minimum can be stored right in the Controller. Measurement images are stored without alteration for future use, such as repeating measurements to check measurement accuracy or attaching images to reports.

Remote Access and Operation across a Network

Easily achieve a production and quality control system using an IT environment that provides easy access to the production site and operating status.

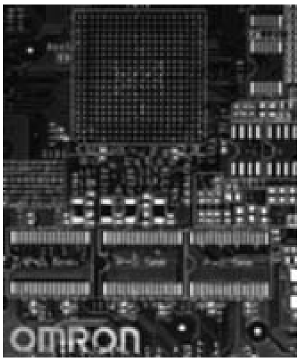
Remote Access and Operation

Data such as the operating status of the Vision Sensor and images resulting from inspections can be remotely accessed. Measurements, storage, and communications can be executed independently so that measurements will not stop even during random remote access.

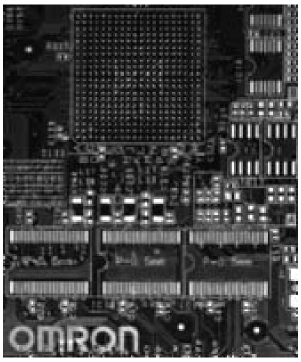
Flexible User Customization for Any Purpose

Benefits of Increased Resolution

Doubling the horizontal and vertical resolutions increases total resolution by a factor of four, enabling clear images for small or complicated workpieces.



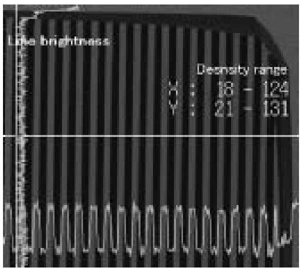
250,000 pixels (previous systems)



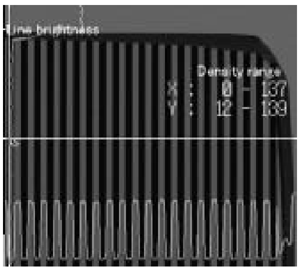
1 million pixels

1-million-pixel Camera with Digital Interface

The video signal noise that hurt measurement precision has been greatly reduced to enable inspections of minute foreign matter or damage as well as highprecision positioning.



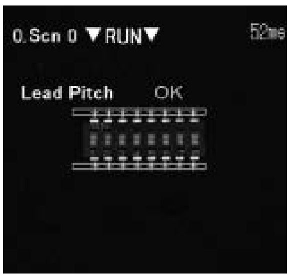
Line Brightness Image from an Analog Interface Camera



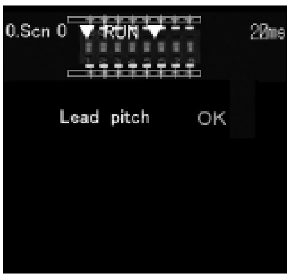
Line Brightness Image from a Digital Interface Camera

Partial Scan Function

Partial scans can be used to reduce the image reading time, which is often the bottleneck in measurement processing time.



Full Frame Reading



Partial Reading

Number of Pixels read	Reading time
1,024 x 1,024 pixels	48.3 ms
1,024 x 512 pixels	27.6 ms
1,024 x 256 pixels	16.3 ms
1,024 x 128 pixels	10.7 ms

Advanced Algorithms for High-precision Measurements

Positioning

ECM Searches

Edge code models are used for pattern searches. ECM searches are not easily affected by deformation and dirt, and can thus be very effective with low-contrast workpieces.

EC Positioning

Model registration is not required for EC positioning. Searching is possible with shape information, such as "circle," "rectangle," or "intersection." This achieves higher precision in measurements than conventional pattern matching methods.

Reference data: Repeatability is within 1/20 pixel (OMRON test data)

Appearance Inspections

EC Defect

Geometric information is used to measure minute defects or lowcontrast scratches in the measurement object at high precision. Stable detection is possible for applications like measuring deformation in O-rings.

EC Circle Count

Circles are searched for based on a circle of a specified size. Stable detection is possible without undue influence by deformation or dirt.

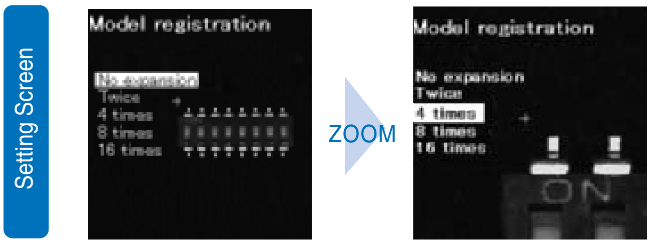
EC Circle Defect

Defects in circles, such as depressions and scorching in molded items, can be easily measured at high precision. The defect in the circle can be extracted even with a patterned background.

Reduced Work with Simple Operations

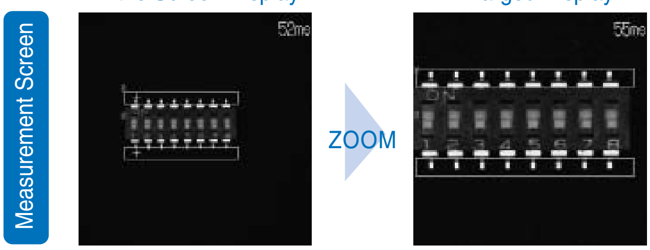
Zoom Function for 1-million-pixel Images

Zoom in to see detail clearly for easier setting and adjustment (display enlargement supported).



Entire Screen Display

Enlarged Display

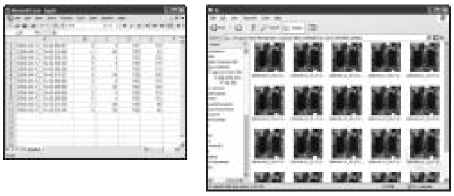


High-speed Serial USB Interface

A USB interface simplifies high-speed communications between the Vision Sensor and a computer. Communications can be used to handle measurement data, setting data, system data, image data, and more.

Networking to Access, Save, View and Edit Data

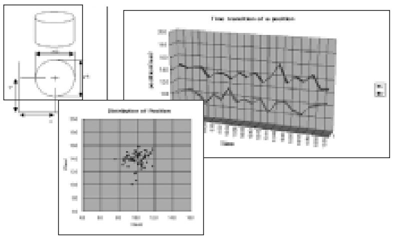
Batched Access and List Viewing of Logged Images[1]



The data stored in the Controller can be displayed in lists.

Access View

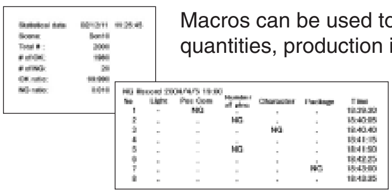
Batched Access and List Viewing of Measurement Data[1]



Links can be created to spreadsheet software to statistically process measurement results or display graphs. All measurement data can be saved for feedback to trend management or to monitor variations in measurement data.

Access View

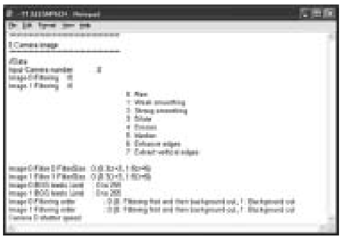
Log Production and Quality Control Information[1]



Macros can be used to total production quantities, production information such as fault rates, or NG products according to the type of inspection.

Access View

Managing and Transferring Setting Data[1]

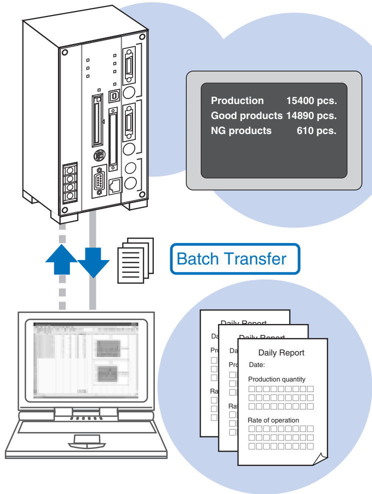


Files containing Vision Sensor setting data (such as scenes and system data) can be sent and received.

The software version of the Vision Sensor can also be easily upgraded.

Access Save View

Batch File Uploading[1]



The data saved in the Controller can be transferred to a computer as a batch upload. This function is useful when determining judgement values for initial settings or to back up data.

And because measurements and communications are executed independently, files can be uploaded without affecting the Vision Sensor's measurement operation.

Display and Edit Scene Data[1]

Scene data set in Vision Sensors connected to the network can be viewed and edited. The scene data displayed on the computer can also be printed.

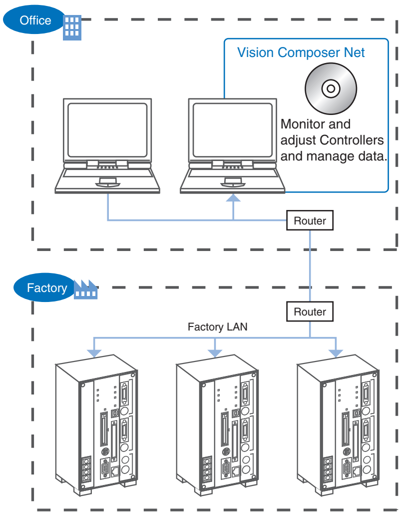
View Save

1 Scheduled for release soon.

F500

Remote Vision Sensor Operation in a Network Environment[1]

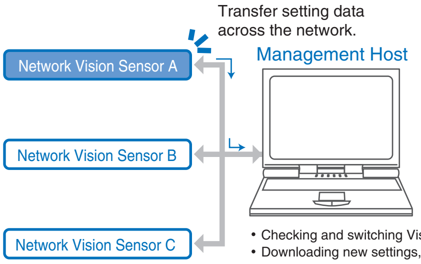
Vision Composer Net[1]



The Vision Composer Net software connects to OMRON Controllers to monitor and control operation, change settings, and perform other tasks.

Controllers can be connected across networks to monitor and adjust Controllers in the factory from an office.

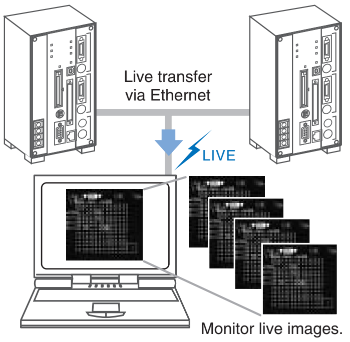
Download Setup Function[1]



Vision Sensors in different production lines can be easily set up.

Downloading is also useful when changing products or using new programs.

Live Monitoring Function



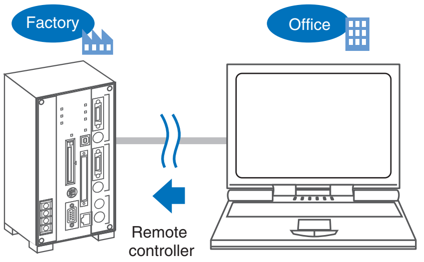
Vision Sensor images can be displayed in realtime on the computer via Ethernet. (See note 1.)
Live inspection images can also be monitored remotely. (See note 2.) And what's more, the images from several Controllers connected via the network can be monitored simultaneously on the computer screen.

Note 1: The transfer speed of live images depends on the network environment.
2: Remote monitoring is not possible through a firewall.

Remote Operations

Vision Sensor measurements can be started and stopped and scene data settings can be specified from a remote computer.

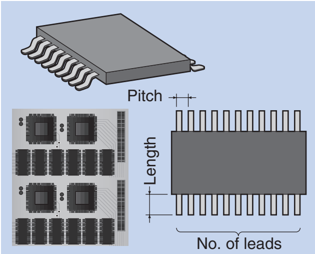
All operations that were previously possible from the Console can be performed remotely from a computer.



[1] Scheduled for release soon.

Applications

Connector and IC Lead Inspections



Sensing

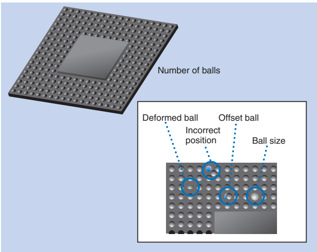
High-resolution inspection over a wide field of view is enabled by using a 1-million-pixel high-resolution camera.

And with macro functions, the statistics on lead pitch data and linear approximations of the lead ends are easily performed.

Storage & Network

Combining networking enables changing inspection devices, managing master data, and uploading statistical data files with macros.

BGA Inspections



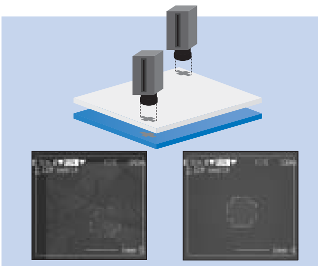
Sensing

High-resolution inspection over a wide field of view is also enabled by using a 1-million-pixel high-resolution camera with BGA inspection software. Variant BGA processing is also possible.

Storage & Network

Quality control data can be used effectively by storing inspection images in relation to lot numbers. Managing all of the product data on the host computer makes frequent changes to settings much smoother.

Positioning Liquid Crystal Boards



Sensing

EC processing, based on an original algorithm from OMRON, enables position inspections of low-contrast alignment marks. And using a Digital Interface Camera enables stable processing.
Macros can also be used to easily achieve original calibration methods, inspection data calculations, and much more.

Storage & Network

Managing productivity is also possible by saving and reviewing inspection images, detection data, and position compensation data.

Printing Defects

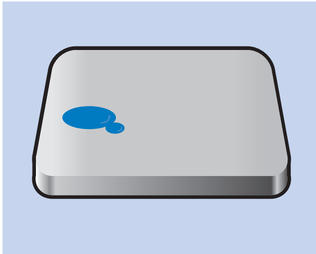
Sensing

Using a 1-million-pixel high-resolution camera provides high-precision inspections over a wide field of view.
Using macros enables saving images and inspection data classified by the type of fault.

Storage & Network

For initial system startup, data to determine judgement values and to troubleshoot problems can be accessed from a remote computer, reducing costs to a minimum.

Molded Product Defect Inspections

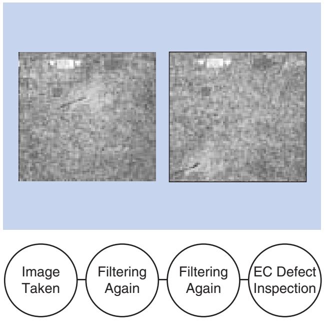


Sensing

Misshapen products, as well as contamination and scorching around molded products, can be detected. Setting is as easy as specifying the circle size to detect (i.e., the size of the defects) on limit samples displayed on the monitor.

With macros, statistics on good products, NG products, and fault rates for the inspections performed each day can be calculated and logged in a Memory Card.

Ceramic Board Defect Inspection

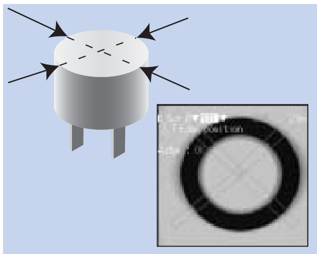


Sensing

Inspect for cracks on the surface of ceramic boards. Even if uneven lighting or rough surfaces show in the images, linear aspects can be consistently detected.

Using the flow menus enables conversion to more stable inspection by repeatedly filtering images.

Inspecting Electrolytic Capacitor Dimensions

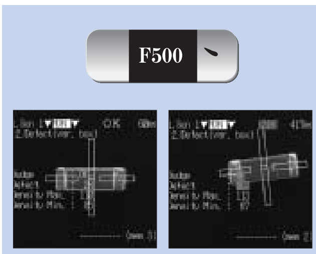


Sensing

The diameter of round workpieces can be measured at multiple points to determine if they are round or not.

With macros, deviations in inspection values can be stored in memory and statistics, such as minimum values, maximum values, and standard deviations, can be calculated.

Chip Capacitor Electrode Defect Inspection



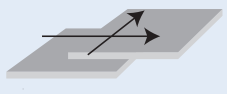
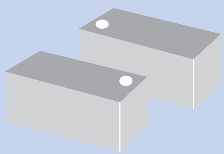
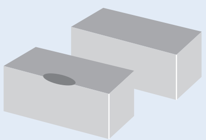
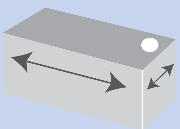
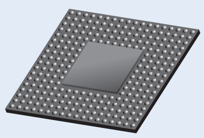
Sensing

Even if the size of the inspection object changes, the size of the inspection area adjusts to the external size to enable measurement. Misshapen products and contamination and scorching around products can be detected.

With macros, production statistics (e.g., number of good products, number of NG products, and fault rates) can be calculated and monitored onscreen.

List of Processing Items

Higher precision →

Processing Items	Binary Processing	Gray-scale Processing	EC Processing
Positioning			
	Gravity and Axis	Gray Search (x-y: Pixel Level) Precise Search (x-y: Subpixel Level) Rotation Search (x-y-θ: Subpixel Level) Circular Angle	ECM Search EC Positioning
Presence and Direction Inspections			
	Gravity and Area Binary Defect Labeling Label Data (counting possible)	Density Data (Average and Deviation) Gray Search (x-y: Pixel Level)	EC Circle Count
Appearance (Defect) Inspections			
	Area (Var. Box)	Density Defect # Defect Defect (Var. Box) Fine Matching Flexible Search	EC Circle Defect EC Defect
Dimensions			
		Edge Position_1 Edge Position_8 (Number of areas drawn differs.) Edge Width (Width between edges measured.) T-Edge Position	
Applications Packages			
		BGA	

The F500-UM Applications Software is used both with the F210 and F250.
Many other measurement functions are also supported by this software. For details, go to http://www.fa.omron.co.jp/sensing/

Flow Menus

Complete Image Processing Items

Image Input

The camera image is read synced on an external signal.

Switch Camera
The camera can be selected when two cameras are connected.

Changing Filtering
Filtering can be performed that is different from that performed when the image was read.

Filtering Again
Filtering can be performed many times for the same image.

Position Compensation

Binary Position Compensation
Positioning is compensated based on the center of gravity and axis angle found using binary processing.

EC Position Compensation
EC position compensation is effective for low-contrast marks that vary in size.

Edge Position Compensation
Positioning is compensated based on the outline of the workpiece found through edge processing.

Model Position Compensation
Positioning is compensated based on search points found by matching with registered models.

Scroll
Images read using X,Y coordinates and angle data found with measurement functions can be scrolled.

Reset Scroll
Images that have been scrolled can be reset to their original positions.

Measurement

Positioning
Presence and Direction Inspection
Appearance (Defect) Inspection
Dimension Inspection
Applications Package

Measurement Support

Calculation
Calculations, such as basic arithmetic, tangent, cosine, and distance calculations, can be performed on the measurement data found using measurement functions.

Macros

Elapsed Time
The processing time to a specified point in the process flow can be measured. This can be used for the required processing, such as canceling measurements for time delays.

Wait
The processing flow can be temporarily paused to place processing on standby for a set period of time.

Set Unit Data
Setting data can be overwritten.

Trend Monitor
Measurement time can be displayed on a graph along a time axis.

Branching Control

Conditional Branching
Measurement conditions can be changed based on measurement values and results.

DI Branching
Processing can be branched based on the input status of the parallel interface.

End
End indicates the end of the process flow. (No settings are required.)

Results Output

Memory Card Data
Measurement values can be output to a Memory Card inserted in the Controller.

DO Data
Measurement values can be output as binary or BCD data on the parallel interface.

DO Judgement
The OK/NG judgement results can be output on the parallel interface.

Host Link Data
OMRON's PLC Host Link communications can be used for measurement commands, judgement results, measurement values, and other data without special programming.

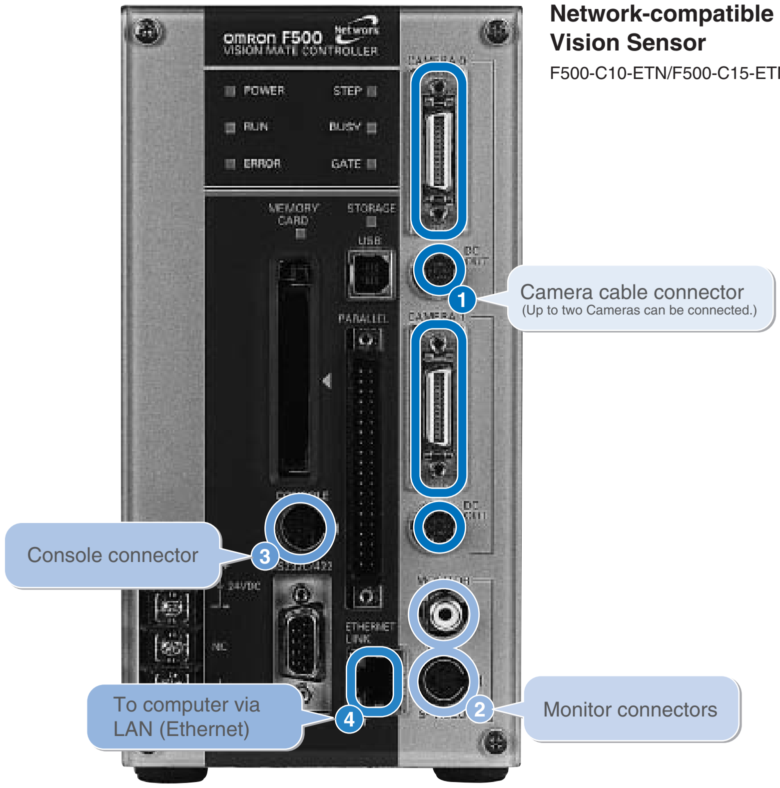
Normal Data
RS-232C communications can be used for measurement commands, judgement results, measurement values, and other data.

Data Logging
Measurement data and images can be stored inside the Controller.

Results Display

Display String
Display Measure
Display Judge
Display Item
Display Time
Display Figure
Display Line
Display Box
Display Circle
Display Cursor

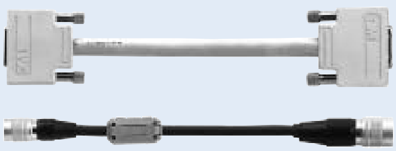
System Configuration



Network-compatible Vision Sensor
F500-C10-ETN/F500-C15-ETN

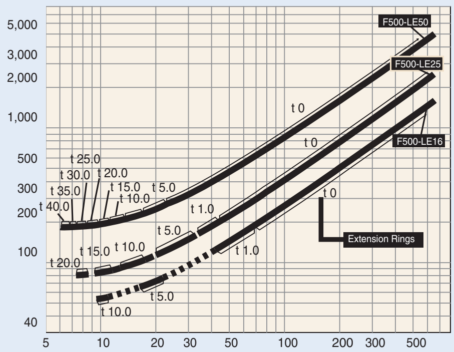
1

Camera Cable
F500-VS 2M



1-million-pixel Camera with Digital Interface
F500-S1

Optical Chart



High-resolution Lens

F500-LE16

F500-LE25

F500-LE50

2

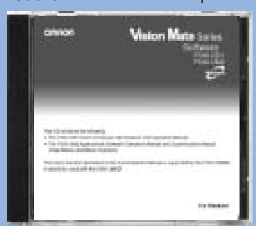
10.4-inch LCD Monitor
F500-M10L

3

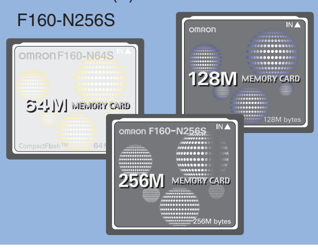
Consoles
F150-KP F160-KP

4

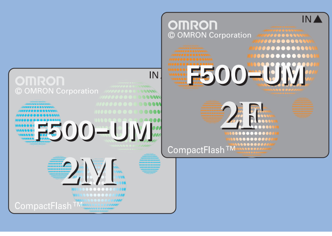
PC Support Software
F500-CD2E Vision Composer Net



Memory Cards
F160-N64S (S) QM300-N128S
F160-N256S



Applications Software
F500-UM2FE/UM2ME



* Scheduled for release soon.

Specifications

F500-C10-ETN / F500-C15-ETN

Connected Camera	F500-S1
No. of connectable Cameras	2
Processing resolution	1,024 (H) x 1,024 (V)
No. of scenes	32 (Can be increased using Memory Cards)
Image memory function	35 images max
Storage	256 MB non-volatile memory
Operation and setting	Measurement items installed using Applications Software. Menu operations used to combine measurement items. Vision Composer Net can be used for operation and settings.
Menu language	Japanese or English (switchable)
Serial communications	USB series B: 1 channel RS-232C/422: 1 channel
Network communications	Ethernet 100Base-TX/10Base-T
Parallel I/O	11 inputs, 22 outputs
Monitor Interface	Composite video output: 1 channel S-VIDEO output: 1 channel
Memory Card interface	Compact Flash card slot, 1 channel
Power supply voltage	20.4 to 26.4 V DC
Current consumption	2.1 A max. (with two F500-S1 Cameras connected)
Ambient temperature	Operating: 0 to 55°C Storage: -25 to 65°C with no icing or condensation
Ambient humidity	Operating / Storage: 35% to 85% with no condensation
Dimensions	100 x 198 x 134 mm (W x H x D) (without connectors and other protrusions)
Weight	Approx. 1.6 kg (Controller only)
Accessories	Ferrite core for console (1), Setup Manual

F500-S1

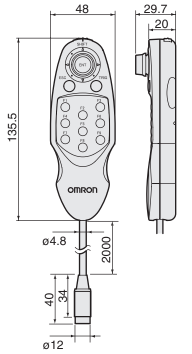
Picture elements	2/3-inch CCD
Pixel size	6.45 μm (H) x 6.45 μm (W)
Shutter	Electronic shutter, 10 shutter speeds (1/24 to 1/10,000 s), changed via menu
Partial function	Four settings
Communication interface	Conforms to Camera Link
Ambient temperature	Operating: 0 to 50°C Storage: -25 to 60°C with no icing or condensation
Ambient humidity	Operating / Storage: 30% to 85% with no condensation
Dimensions	50 x 40 x 90 mm (W x H x D) (without connectors and other protrusions)
Weight	Approx. 270 g
Accessories	Instruction Manual

System Requirements for F500-CD2E Vision Composer Net

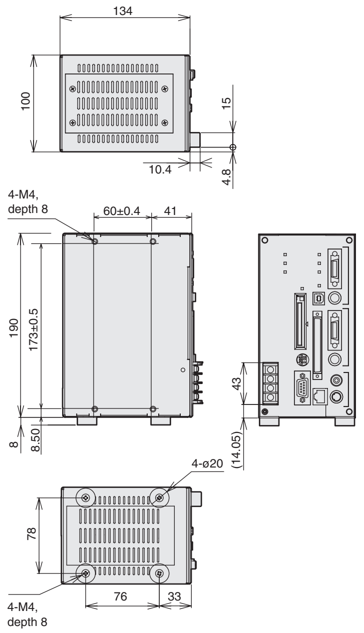
CPU		Pentium III 600 MHz min. (Pentium III 1 GHz min. recommended)
OS		Windows 2000 Professional, Service Pack 3 or higher Windows XP Home Edition, Service Pack 1 or higher Windows XP Professional, Service Pack 1 or higher
Memory		192 MB min. (256 MB min. recommended)
Hard disk		200 MB min. available space
Monitor		Resolution: 1,024 x 768 min. Display colors: High Color (16-bit) min. (True Color (32-bit) min. recommended)
Network		10BaseT-compliant network (100Base-TX recommended)
Vision Sensor	**Controller**	F500-C10-ETN/F500-C15-ETN
	Application Software	F500-UM Version 2.00 or higher

Dimensions

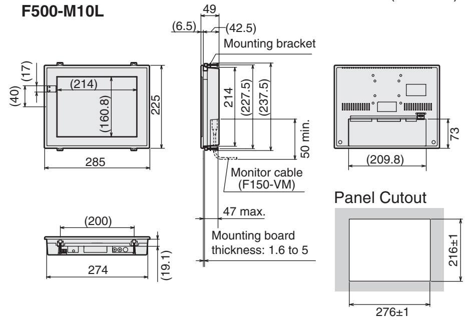
· Console
F160-KP (Unit: mm)



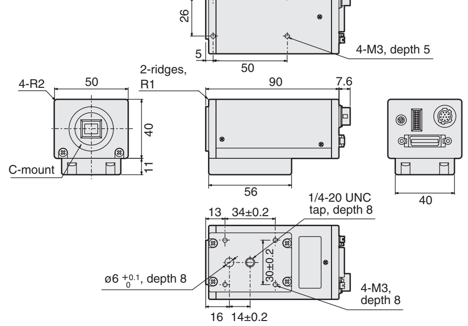
· Controller
F500-C10-ETN
F500-C15-ETN (Unit: mm)



· Monitor
F500-M10L (Unit: mm)



· Camera
F500-S1 (Unit: mm)



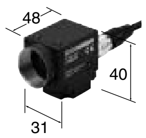
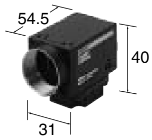
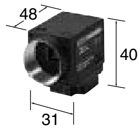
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

OMRON

The performance of the visual sensor varies greatly depending on the combination of camera, lens, and lighting. Refer to the following to create a suitable combination for your inspection purpose.

Camera Details

Model

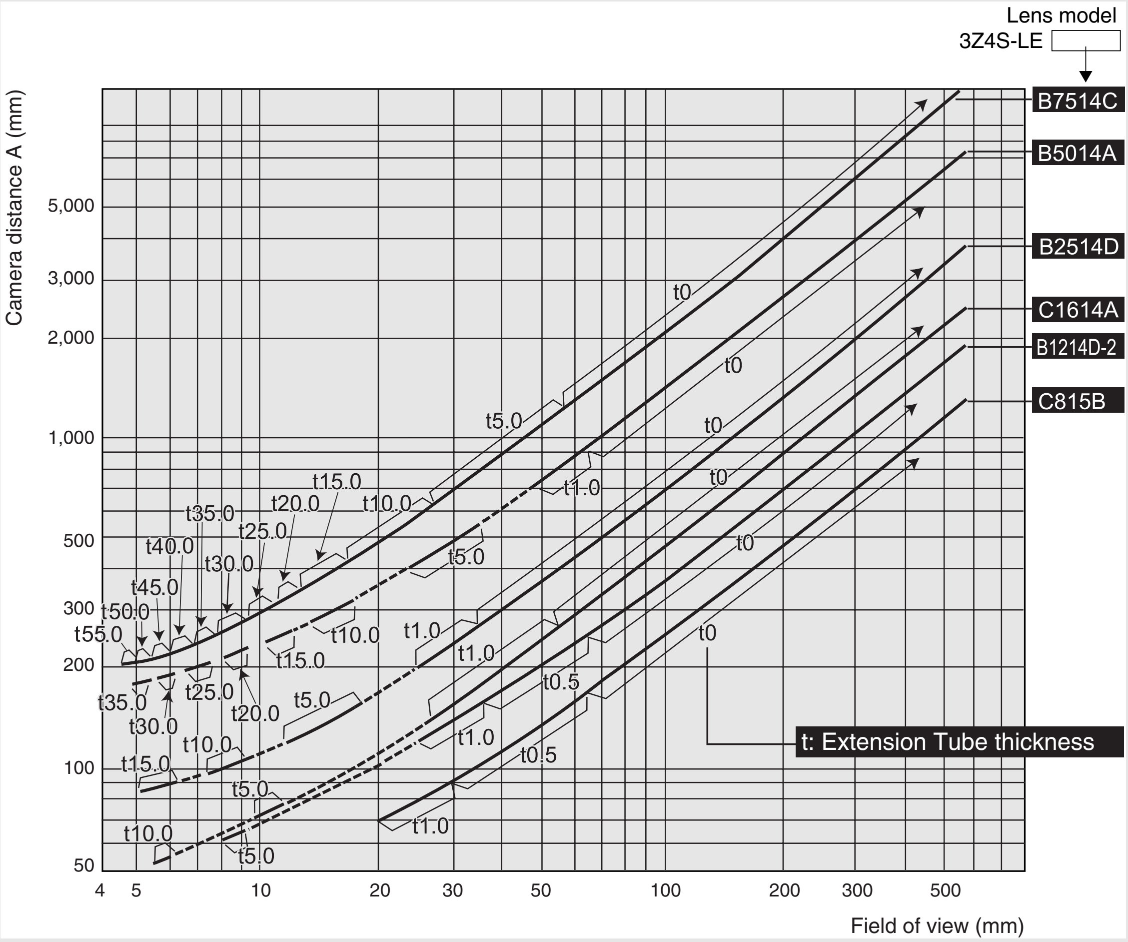
Item	Model	F150-S1A	F160-S1/S2	F400-S1
		Shutter camera		
Visual appearance				
Image pick-up		1/3 inch CCD fixed imaging element	1/3 inch color CCD	
Number of elements		659(H) x 494(V)		
Synchronization method		External synchronization		
Scanning method		Non-interlace method	Non-interlace method Interlace method	Non-interlace method
Lens mount		C mount		
Shutter speed (s)		1/100 1/500 1/2000 1/10000 (factory setting: 1/2000)	8 stages OFF to 1/20000 Changed by menu	1/100 1/500 1/2000 1/10000 (factory setting: 1/2000)
Weight (Unit only)		Approx. 70 g	Approx. 85 g	Approx. 70 g
Applicable camera cable		F150-VS		
Applicable controller	F150	O	X	X
	F160	O	O	X
	F210	O	O	X
	F250	O	O	X
	F400	X	X	O
	V530-R150	O	X	X
	V530-R160	O	X	X

Lens Details

Refer to the following optical graph to select a lens and connecting ring suitable for the field of view and the camera installation distance.

Optical graph

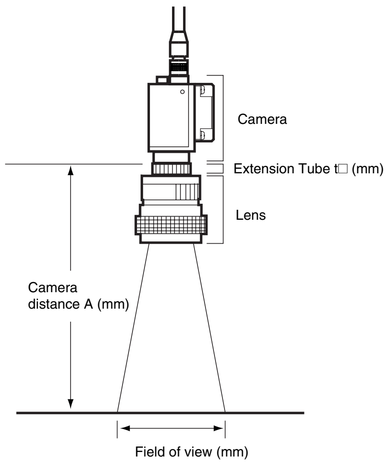
Camera models
F400-S1,
F150-S1A
F160-S1/S2



How to read the optical graphs

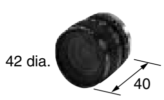
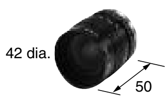
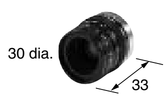
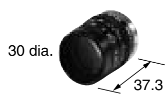
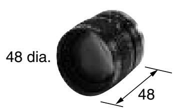
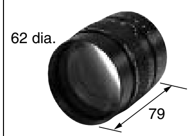
The horizontal axis of each optical graph is the field of view "L" (mm) and the vertical axis is the camera installation distance "A" (mm). Each line represents a lens, and the value "t" is the thickness of the connecting ring.

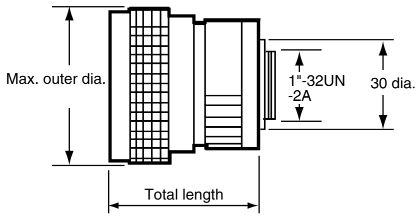
The values given in the optical graph are only approximate values. It is recommended that the camera distance is adjusted by sliding the Camera forward or backward to get the required field of view for actual operation



Ordering Information

Lens

Model / Item	CCTV lens					
	3Z4S-LE C815B	3Z4S-LE B1214D-2	3Z4S-LE C1614A	3Z4S-LE B2514D	3Z4S-LE B5014A	3Z4S-LE B7514C
Visual appearance						
Focal length	8.5 mm	12.5 mm	16.0 mm	25.0 mm	50.0 mm	75.0 mm
Brightness	F1.5	F1.4				
Filter size	M40.5 x P0.5		M27 x P0.5		M46 x P0.75	M58 x P0.75
Lock mechanism	With focus and aperture lock mechanism					---

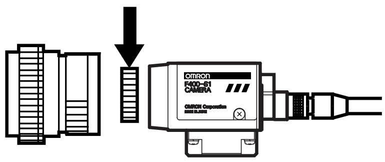


Extension ring

The extension ring is inserted between the lens and camera, and is used to adjust the focus.

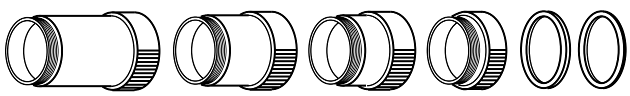
Combine 6 sheets for the desired thickness.

Extension Tube



Model	Maximum outer diameter	Thickness
3Z4S-LE EX-C6	31 mm dia.	Six-point set: 0.5 mm, 1 mm, 5 mm, 10 mm, 20 mm, 40 mm

Thickness: 40 mm 20mm 10mm 5mm 1.0mm 0.5mm



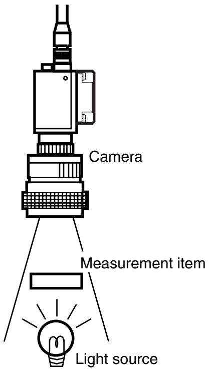
Note 1. Do not use multiple 0.5 mm and/or 1.0 mm extension rings in combination. It will not be possible to tighten the screws sufficiently.
2. Depending on vibration conditions, additional support may be necessary if the extension exceeds 30 mm.

Lighting

For accurate inspection, a stable image must be obtained. Select lighting that is suitable for your purpose and measurement object.

Lighting method

Back lighting



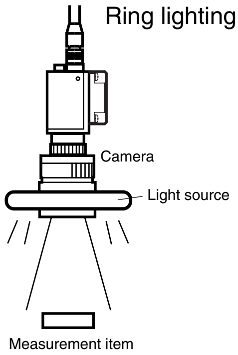
High contrast guarantees a stable image.

Application

Inspection of the shape of the object, positioning inspection, etc.

Reflective lighting

Ring lighting

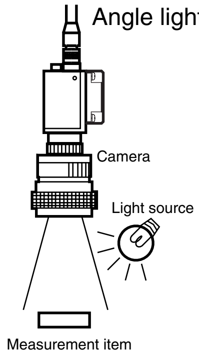


Even illumination is possible.

Application

Inspection of object surface

Angle lighting

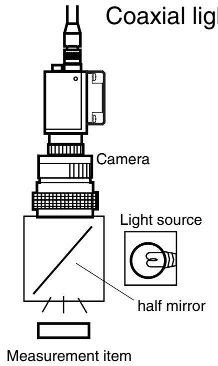


Detection using the difference between regular reflection and diffuse reflection is possible.

Application

Inspection for presence of object surface luster, etc.

Coaxial lighting



There are minimal shadows from bumps and depressions in the measurement object, enabling a stable image to be obtained.

Application

Surface inspection of relatively small objects, positioning, hole inspection, etc.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

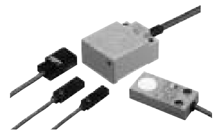
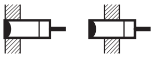
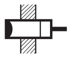
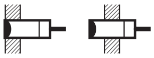
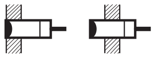
Inductive and Capacitive Sensors

General Purpose Inductive Proximity Switches

Overview

					
Housing	Cylindrical				
Model	E2A-M	E2A-S	E2F	E2E small diameter, TL, E2EL	E2A3
Type			Standard	Miniature	Long distance flush mounting
Housing Material	Brass	Stainless Steel	Plastic	Brass	
Features	• designed and tested for extra long life • highest quality consistancy in manufacturing • cost efficient solution		• high quality full body plastic housing for high water proof and chemical resistance requirements	• small diameters where mounting space is crucial	• long distance for flush mounting requirements
Key specifications	• NO, NC or NO+NC • DC 2-wire, DC 3-wire, DC 4-wire • 12 - 24 VDC (10 - 32 VDC) • IP67 • IP69k IP67 IP69k		• NO or NC • DC 3-wire • 12 - 24 VDC (10 -30 VDC) • IP67, IP68	• NO or NC • DC 3-wire • 12 - 24 VDC (10 - 32 VDC) • IP67	• NO or NC • DC 3-wire • 12 - 24 VDC (10 - 32 VDC) • IP67
Max sensing distance	M12: 8 mm M18: 16 mm M30: 30 mm	M8: 4 mm M12: 8 mm M18: 16 mm M30: 30 mm	M8: 1.5 mm M12: 2 mm M18: 5 mm M30: 10 mm	dia 4: 0.8 mm M5: 1 mm dia 5.4: 1 mm dia 6.5: 2 mm dia 8: 2 mm	M8: 3 mm M12: 6 mm M18: 11 mm M30: 20 mm
Connection	PVC M8, M12, customer specific Connector: M8, M12		PVC M8, M12, customer specific	PVC M8, M12, customer specific Connector: M8	PVC M8, M12, customer specific Connector: M8, M12
Page	D-9		D-29	E2E / Page D-45 TL / Page D-115 E2EL / Page D-99	D-35

General Purpose Inductive Proximity Switches

				
Housing	Square			
Model	TL-W	E2S	E2Q2	TL-T
Type	Standard (flat shape)	Miniature	Long distance	Standard (thin shape)
Housing Material	Plastic (ABS)	Plastic (polyarylate)	Plastic (PBT)	Plastic
Features	• High quality consistancy • High performance and cost efficient solution	• Small shapes where mounting space is crucial	• Long sensing distances • Changable postition of active face	• Thin shape for saving side-wall mounting
Key specifications	• NO or NC • DC 3-wire, (DC 2-wire) • 12 - 24 VDC (10 - 30 VDC) • IP67 	• NO or NC • DC 3-wire, DC 2-wire • 12 - 24 VDC • (10 - 30 VDC) • IP67 	• NO or NO+NC • DC 3-wire, DC 4-wire • 10 - 60 VDC • IP67 	• NO, NC or NO+NC • DC 3-wire, DC 4-wire • 12 - 24 VDC (10 - 30 VDC) • IP67 
Max sensing distance	25 x 8 x 5: 1.5 mm 22 x 8 x 6: 3 mm 31 x 18 x 10: 5 mm 53 x 40 x 23: 20 mm	19 x 6 x 2: 1.6 mm 23 x 8 x 8: 2.5 mm	67 x 40 x 40: 20, 30 or 40 mm 118 x 40 x 40: 20, 30 or 40 mm	xx: 4 mm
Connection	Cable: PVC	Cable: PVC	Connector: M12	Cable: PVC, PUR Connector: M8
Page	D-53	D-61	D-69	(CD)

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

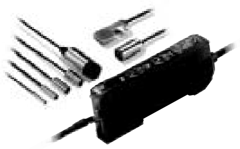
Cat. No. D12E-EN-01 In the interest of product improvement, specifications are subject to change without notice.

Special Purpose Inductive Proximity Switches

Overview

				
Housing	Cylindrical			
Model	E2AU	E2EZ	E2AX	E2EQ
Type	Vehicle usage certified (e1 mark)	AL and FE chip immune	ATEX 3D certified	Spatter resistance
Housing Material	Brass	Brass (ABS/ PBT sensing face)	Brass	Teflon coated brass (teflon sensing face)
Features	• E1 mark for mobile usage • High EMC immunity (additional test up to 100 V/m) • Cable breakage protection • Available on request for all E2A types	• Specialized sensing method for immunity against small sized metal objects (e.g. chips)	• ATEX Cat 3D certification	• Teflon coating for preventing the attachment of sputters in welding applications
Application areas	• Utility vehicles • Mobile construction equipment • RCVs (refuse collecting vehicles) • Mobile agricultural equipment (e.g. harvester)	• Metal cutting in machine tool industry	• Powder handling and packaging (flour packaging) • Wood cutting/ wood chip handling	• Welding applications
Key specifications	• NO • DC 3-wire • 12 - 24 VDC (10 - 32 VDC) • IP67, IP69k	• NO or NC (DC 2-wire only) • DC 3-wire, DC 2-wire • 12 - 24 VDC (10 - 30 VDC) • IP67	• NO • DC 3-wire • 12 - 24 VDC (10 - 32 VDC) • IP67, IP69k	• NO • DC 2-wire • 12 - 24 VDC (10 - 32 VDC) • IP67
Max sensing distance	M12: 4 mm M18: 8 mm M30: 15 mm	M12: 2 mm (DC 2-wire only) M18: 4 mm M30: 8 mm	M12: 4 mm M18: 8 mm M30: 15 mm	M12: 4 mm M18: 8 mm M30: 15 mm
Connection	Cable: PVC (2 m) Connector: M12	Cable: PVC Connector: M12	Connector: M12	Cable: PVC Connector: M12
Page	D-151	D-161	(CD)	D-171

Special Purpose Inductive Proximity Switches

				
Housing	Cylindrical			
Model	E2F, E2E	E2E	E2C-EDA	E2EL
Type	AC power supply	Oil resistant	High precision positioning	Increased switching frequency for high speed applications
Housing Material	Plastic, brass	Brass	Brass	Brass, stainless steel
Features	• 24 - 240 VAC direct switching	• tested oil restistance • designed for automative users	• Accuracy 1µm	• Up to 5kHz switching frequency
Application areas	• Installations without controller/PLC and 230 VAC power supply	• Automative manufacturing lines	• Precision positioning	• Counting • Rotation speed control • CAM
Key specifications	• NO, NC • AC 2-wire • 24 - 240 VAC • IP67	• NO, NC • DC 3-wire, DC 2-wire • 12 - 24 VDC (10 - 30 VDL) • IP 67	• 12 - 24 VDC (10 - 30 VDC) • IP67 (sensing heads) • IP50 (separate amplifier)	• NO, NC • DC 3-wire • 10 - 35 VDC • IP67
Max sensing distance	M8: 2 mm M12: 5 mm M18: 10 mm M30: 18 mm	M8: 4 mm M12: 8 mm M18: 14 mm M30: 20 mm	dia 3 mm: 0.6 mm dia 5.4 mm: 1 mm dia 8mm: 2 mm M10: 2 mm M18: 7 mm	dia 6.5 mm: 2 mm M8: 2 mm
Connection	Cable: PVC Cable: M12 Connector: M12	Cable: PVC Cable: M12 Connector: M12	Cable: PVC	Cable: PVC Cable connector: M8, M12, customer specific Connector: M8
Page	D-29	D-45	D-83	D-99

			
Housing	Cylindrical		
Model	E2EC	E2FQ	ZX-E
Type	Ultra flat/ sub miniature	Chemical resistance	High precision distance measurement
Housing Material	Brass (sensing face: ABS)	Teflon	
Features	• Ultra flat/ small size for applications where space is crucial • Dia 3 mm small housing size model • Ultra short 18 mm long M12 size housing model	• Teflon housing for increased chemical resistance	• 1 µm measurement resolution
Application areas	• Robotic applications (in robot hands)	• Application with aggressive chemicals (etching, cleaning, water treatment)	• Excentricity control
Key specifications	• NO, NC (DC 2-wire only) • DC 2-wire, DC 3-wire • 12 - 24 VDC (10 - 30 VDC) • IP67	• NO • DC 2-wire • 12 - 24 VDC (10 - 30 VDC) • IP67	• Linear 4 - 20 mA output • 12 - 24 VDC (10 - 30 VDC) • IP67
Max sensing distance	dia 3 mm: 0.8 mm dia 5.4 mm: 1.5 mm dia 8 mm: 3 mm M12: 4 mm	M12: 2 mm M18: 5 mm M30: 10 mm	dia 3 mm: 0.5 mm dia 5.4 mm: 1 mm dia 8 mm: 2 mm M10: 2 mm M18: 7 mm
Connection	Cable: PVC	Cable: PVC	Cable: PVC
Page	D-107	D-167	D-61

Overview

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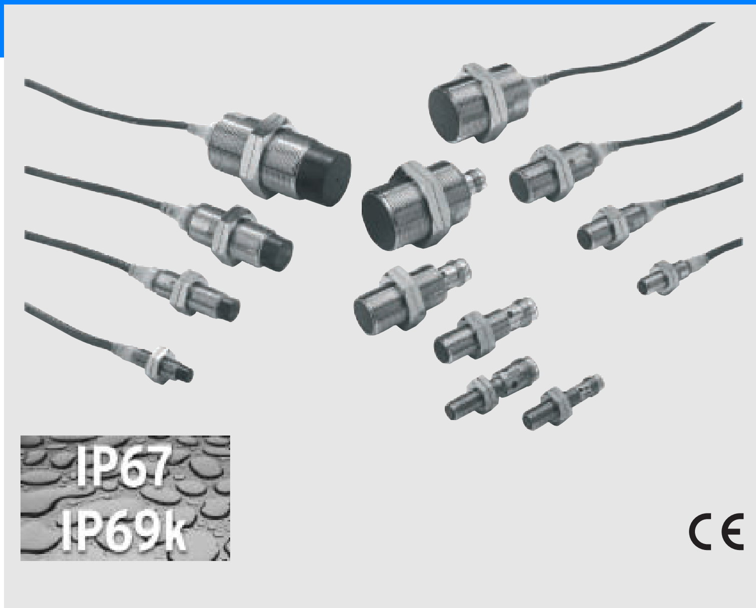
Cylindrical Proximity Sensor

E2A



High quality for extra long life in daily use

- wide portfolio range through modular concept
- designed and tested for extra long life
- IP67 and IP69k for highest protection in wet environments
- continuously high quality level through specialized manufacturing process
- DC 3-wire and DC 2-wire models
- Normally open (NO), normally closed (NC) and antivalent (NO+NC) models
- up to 30mm sensing distance
- Stainless steel and brass housings
- Pre-wired versions with different cable materials and diameters, M8 and M12 connector types, pre-wired types with cable end connectors

Ordering Information

DC 3-wire models (NO + NC: DC 4-wire) *2

Size		Sensing distance	Connection	Body material	Thread length (overall length)	Output configuration	Operation mode NO	Operation mode NC
M8	Shielded	2.0 mm	Pre-wired	Stainless steel*1	27 (40)	PNP	E2A-S08KS02-WP-B1 2M	E2A-S08KS02-WP-B2 2M
						NPN	E2A-S08KS02-WP-C1 2M	E2A-S08KS02-WP-C2 2M
					49 (62)	PNP	E2A-S08LS02-WP-B1 2M	E2A-S08LS02-WP-B2 2M
						NPN	E2A-S08LS02-WP-C1 2M	E2A-S08LS02-WP-C2 2M
			M12 connector		27 (43)	PNP	E2A-S08KS02-M1-B1	E2A-S08KS02-M1-B2
						NPN	E2A-S08KS02-M1-C1	E2A-S08KS02-M1-C2
					49 (65)	PNP	E2A-S08LS02-M1-B1	E2A-S08LS02-M1-B2
						NPN	E2A-S08LS02-M1-C1	E2A-S08LS02-M1-C2
			M8 connector (3-pin)		27 (39)	PNP	E2A-S08KS02-M5-B1	E2A-S08KS02-M5-B2
						NPN	E2A-S08KS02-M5-C1	E2A-S08KS02-M5-C2
					49 (61)	PNP	E2A-S08LS02-M5-B1	E2A-S08LS02-M5-B2
						NPN	E2A-S08LS02-M5-C1	E2A-S08LS02-M5-C2
			M8 connector (4-pin)		27 (39)	PNP	E2A-S08KS02-M3-B1	E2A-S08KS02-M3-B2
						NPN	E2A-S08KS02-M3-C1	E2A-S08KS02-M3-C2
					49 (61)	PNP	E2A-S08LS02-M3-B1	E2A-S08LS02-M3-B2
						NPN	E2A-S08LS02-M3-C1	E2A-S08LS02-M3-C2
	Non-shielded	4.0 mm	Pre-wired		27 (40)	PNP	E2A-S08KN04-WP-B1 2M	E2A-S08KN04-WP-B2 2M
						NPN	E2A-S08KN04-WP-C1 2M	E2A-S08KN04-WP-C2 2M
					49 (62)	PNP	E2A-S08LN04-WP-B1 2M	E2A-S08LN04-WP-B2 2M
						NPN	E2A-S08LN04-WP-C1 2M	E2A-S08LN04-WP-C2 2M
			M12 connector		27 (43)	PNP	E2A-S08KN04-M1-B1	E2A-S08KN04-M1-B2
						NPN	E2A-S08KN04-M1-C1	E2A-S08KN04-M1-C2
					49 (65)	PNP	E2A-S08LN04-M1-B1	E2A-S08LN04-M1-B2
						NPN	E2A-S08LN04-M1-C1	E2A-S08LN04-M1-C2
			M8 connector (3-pin)		27 (39)	PNP	E2A-S08KN04-M5-B1	E2A-S08KN04-M5-B2
						NPN	E2A-S08KN04-M5-C1	E2A-S08KN04-M5-C2
					49 (61)	PNP	E2A-S08LN04-M5-B1	E2A-S08LN04-M5-B2
						NPN	E2A-S08LN04-M5-C1	E2A-S08LN04-M5-C2
			M8 connector (4 pin)		27 (39)	PNP	E2A-S08KN04-M3-B1	E2A-S08KN04-M3-B2
						NPN	E2A-S08KN04-M3-C1	E2A-S08KN04-M3-C2
					49 (61)	PNP	E2A-S08LN04-M3-B1	E2A-S08LN04-M3-B2
						NPN	E2A-S08LN04-M3-C1	E2A-S08LN04-M3-C2

Size		Sensing distance	Connec-tion	Body material	Thread length (overall length)	Output confi-guration	Operation mode NO	Operation mode NC	Operation mode NO + NC
M12	Shiel-ded	4.0 mm	Pre-wired	Brass*3	34 (50)	PNP	E2A-M12KS04-WP-B1 2M	E2A-M12KS04-WP-B2 2M	E2A-M12KS04-WP-B3 2M
						NPN	E2A-M12KS04-WP-C1 2M	E2A-M12KS04-WP-C2 2M	E2A-M12KS04-WP-C3 2M
					56 (72)	PNP	E2A-M12LS04-WP-B1 2M	E2A-M12LS04-WP-B2 2M	E2A-M12LS04-WP-B3 2M
						NPN	E2A-M12LS04-WP-C1 2M	E2A-M12LS04-WP-C2 2M	E2A-M12LS04-WP-C3 2M
			M12 connector	Brass*3	34 (48)	PNP	E2A-M12KS04-M1-B1	E2A-M12KS04-M1-B2	E2A-M12KS04-M1-B3
						NPN	E2A-M12KS04-M1-C1	E2A-M12KS04-M1-C2	E2A-M12KS04-M1-C3
					56 (70)	PNP	E2A-M12LS04-M1-B1	E2A-M12LS04-M1-B2	E2A-M12LS04-M1-B3
						NPN	E2A-M12LS04-M1-C1	E2A-M12LS04-M1-C2	E2A-M12LS04-M1-C3
			M8 connector (3-pin)	Brass*3	34 (48)	PNP	E2A-M12KS04-M5-B1	E2A-M12KS04-M5-B2	n.a.
						NPN	E2A-M12KS04-M5-C1	E2A-M12KS04-M5-C2	n.a.
					56 (70)	PNP	E2A-M12LS04-M5-B1	E2A-M12LS04-M5-B2	n.a.
						NPN	E2A-M12LS04-M5-C1	E2A-M12LS04-M5-C2	n.a.
			M8 connector (4-pin)	Brass*3	34 (48)	PNP	E2A-M12KS04-M3-B1	E2A-M12KS04-M3-B2	n.a.
						NPN	E2A-M12KS04-M3-C1	E2A-M12KS04-M3-C2	n.a.
					56 (70)	PNP	E2A-M12LS04-M3-B1	E2A-M12LS04-M3-B2	n.a.
						NPN	E2A-M12LS04-M3-C1	E2A-M12LS04-M3-C2	n.a.
	Non-shiel-ded	8.0 mm	Pre-wired	Brass*3	34 (50)	PNP	E2A-M12KN08-WP-B1 2M	E2A-M12KN08-WP-B2 2M	E2A-M12KN08-WP-B3 2M
						NPN	E2A-M12KN08-WP-C1 2M	E2A-M12KN08-WP-C2 2M	E2A-M12KN08-WP-C3 2M
					56 (72)	PNP	E2A-M12LN08-WP-B1 2M	E2A-M12LN08-WP-B2 2M	E2A-M12LN08-WP-B3 2M
						NPN	E2A-M12LN08-WP-C1 2M	E2A-M12LN08-WP-C2 2M	E2A-M12LN08-WP-C3 2M
			M12 connector	Brass*3	34 (48)	PNP	E2A-M12KN08-M1-B1	E2A-M12KN08-M1-B2	E2A-M12KN08-M1-B3
						NPN	E2A-M12KN08-M1-C1	E2A-M12KN08-M1-C2	E2A-M12KS08-M1-C3
					56 (70)	PNP	E2A-M12LN08-M1-B1	E2A-M12LN08-M1-B2	E2A-M12LS08-M1-B3
						NPN	E2A-M12LN08-M1-C1	E2A-M12LN08-M1-C2	E2A-M12LS08-M1-C3
			M8 connector (3-pin)	Brass*3	34 (48)	PNP	E2A-M12KN08-M5-B1	E2A-M12KN08-M5-B2	n.a.
						NPN	E2A-M12KN08-M5-C1	E2A-M12KN08-M5-C2	n.a.
					56 (70)	PNP	E2A-M12LN08-M5-B1	E2A-M12LN08-M5-B2	n.a.
						NPN	E2A-M12LN08-M5-C1	E2A-M12LN08-M5-C2	n.a.
			M8 connector (4-pin)	Brass*3	34 (48)	PNP	E2A-M12KN08-M3-B1	E2A-M12KN08-M3-B2	n.a.
						NPN	E2A-M12KN08-M3-C1	E2A-M12KN08-M3-C2	n.a.
					56 (70)	PNP	E2A-M12LN08-M3-B1	E2A-M12LN08-M3-B2	n.a.
						NPN	E2A-M12LN08-M3-C1	E2A-M12LN08-M3-C2	n.a.
M18	Shiel-ded	8.0 mm	Pre-wired	Brass*3	39 (59)	PNP	E2A-M18KS08-WP-B1 2M	E2A-M18KS08-WP-B2 2M	E2A-M18KS08-WP-B3 2M
						NPN	E2A-M18KS08-WP-C1 2M	E2A-M18KS08-WP-C2 2M	E2A-M18KS08-WP-C3 2M
					61 (81)	PNP	E2A-M18LS08-WP-B1 2M	E2A-M18LS08-WP-B2 2M	E2A-M18LS08-WP-B3 2M
						NPN	E2A-M18LS08-WP-C1 2M	E2A-M18LS08-WP-C2 2M	E2A-M18LS08-WP-C3 2M
			M12 connector	Brass*3	39 (53)	PNP	E2A-M18KS08-M1-B1	E2A-M18KS08-M1-B2	E2A-M18KS08-M1-B3
						NPN	E2A-M18KS08-M1-C1	E2A-M18KS08-M1-C2	E2A-M18KS08-M1-C3
					61 (75)	PNP	E2A-M18LS08-M1-B1	E2A-M18LS08-M1-B2	E2A-M18LS08-M1-B3
						NPN	E2A-M18LS08-M1-C1	E2A-M18LS08-M1-C2	E2A-M18LS08-M1-C3
			M8 connector (3-pin)	Brass*3	39 (53)	PNP	E2A-M18KS08-M5-B1	E2A-M18KS08-M5-B2	n.a.
						NPN	E2A-M18KS08-M5-C1	E2A-M18KS08-M5-C2	n.a.
					61 (75)	PNP	E2A-M18LS08-M5-B1	E2A-M18LS08-M5-B2	n.a.
						NPN	E2A-M18LS08-M5-C1	E2A-M18LS08-M5-C2	n.a.
			M8 connector (4-pin)	Brass*3	39 (53)	PNP	E2A-M18KS08-M3-B1	E2A-M18KS08-M3-B2	n.a.
						NPN	E2A-M18KS08-M3-C1	E2A-M18KS08-M3-C2	n.a.
					61 (75)	PNP	E2A-M18LS08-M3-B1	E2A-M18LS08-M3-B2	n.a.
						NPN	E2A-M18LS08-M3-C1	E2A-M18LS08-M3-C2	n.a.
	Non-shiel-ded	16.0 mm	Pre-wired	Brass*3	39 (59)	PNP	E2A-M18KN16-WP-B1 2M	E2A-M18KN16-WP-B2 2M	E2A-M18KN16-WP-B3 2M
						NPN	E2A-M18KN16-WP-C1 2M	E2A-M18KN16-WP-C2 2M	E2A-M18KN16-WP-C3 2M
					61 (81)	PNP	E2A-M18LN16-WP-B1 2M	E2A-M18LN16-WP-B2 2M	E2A-M18LN16-WP-B3 2M
						NPN	E2A-M18LN16-WP-C1 2M	E2A-M18LN16-WP-C2 2M	E2A-M18LN16-WP-C3 2M
			M12 connector	Brass*3	39 (53)	PNP	E2A-M18KN16-M1-B1	E2A-M18KN16-M1-B2	E2A-M18KN16-M1-B3
						NPN	E2A-M18KN16-M1-C1	E2A-M18KN16-M1-C2	E2A-M18KS16-M1-C3
					61 (75)	PNP	E2A-M18LN16-M1-B1	E2A-M18LN16-M1-B2	E2A-M18LS16-M1-B3
						NPN	E2A-M18LN16-M1-C1	E2A-M18LN16-M1-C2	E2A-M18LS16-M1-C3
			M8 connector (3-pin)	Brass*3	39 (53)	PNP	E2A-M18KN16-M5-B1	E2A-M18KN16-M5-B2	n.a.
						NPN	E2A-M18KN16-M5-C1	E2A-M18KN16-M5-C2	n.a.
					61 (75)	PNP	E2A-M18LN16-M5-B1	E2A-M18LN16-M5-B2	n.a.
						NPN	E2A-M18LN16-M5-C1	E2A-M18LN16-M5-C2	n.a.
			M8 connector (4-pin)	Brass*3	39 (53)	PNP	E2A-M18KN16-M3-B1	E2A-M18KN16-M3-B2	n.a.
						NPN	E2A-M18KN16-M3-C1	E2A-M18KN16-M3-C2	n.a.
					61 (75)	PNP	E2A-M18LN16-M3-B1	E2A-M18LN16-M3-B2	n.a.
						NPN	E2A-M18LN16-M3-C1	E2A-M18LN16-M3-C2	n.a.

Size		Sensing distance	Connec-tion	Body material	Thread length (overall length)	Output confi-guration	Operation mode NO	Operation mode NC	Operation mode NO + NC
M30	Shiel-ded	15.0 mm	Pre-wired	Brass*3	44 (64)	PNP	E2A-M30KS15-WP-B1 2M	E2A-M30KS15-WP-B2 2M	E2A-M30KS15-WP-B3 2M
						NPN	E2A-M30KS15-WP-C1 2M	E2A-M30KS15-WP-C2 2M	E2A-M30KS15-WP-C3 2M
					66 (86)	PNP	E2A-M30LS15-WP-B1 2M	E2A-M30LS15-WP-B2 2M	E2A-M30LS15-WP-B3 2M
						NPN	E2A-M30LS15-WP-C1 2M	E2A-M30LS15-WP-C2 2M	E2A-M30LS15-WP-C3 2M
			M12 connector	Brass*3	44 (58)	PNP	E2A-M30KS15-M1-B1	E2A-M30KS15-M1-B2	E2A-M30KS15-M1-B3
						NPN	E2A-M30KS15-M1-C1	E2A-M30KS15-M1-C2	E2A-M30KS15-M1-C3
					66 (80)	PNP	E2A-M30LS15-M1-B1	E2A-M30LS15-M1-B2	E2A-M30LS15-M1-B3
						NPN	E2A-M30LS15-M1-C1	E2A-M30LS15-M1-C2	E2A-M30LS15-M1-C3
			M8 connector (3-pin)	Brass*3	44 (58)	PNP	E2A-M30KS15-M5-B1	E2A-M30KS15-M5-B2	n.a.
						NPN	E2A-M30KS15-M5-C1	E2A-M30KS15-M5-C2	n.a.
					66 (80)	PNP	E2A-M30LS15-M5-B1	E2A-M30LS15-M5-B2	n.a.
						NPN	E2A-M30LS15-M5-C1	E2A-M30LS15-M5-C2	n.a.
			M8 connector (4-pin)	Brass*3	44 (58)	PNP	E2A-M30KS15-M3-B1	E2A-M30KS15-M3-B2	n.a.
						NPN	E2A-M30KS15-M3-C1	E2A-M30KS15-M3-C2	n.a.
					66 (80)	PNP	E2A-M30LS15-M3-B1	E2A-M30LS15-M3-B2	n.a.
						NPN	E2A-M30LS15-M3-C1	E2A-M30LS15-M3-C2	n.a.
	Non-shiel-ded	20.0 mm	Pre-wired	Brass*3	44 (64) (See note.)	PNP	E2A-M30KN20-WP-B1 2M	E2A-M30KN20-WP-B2 2M	E2A-M30KN20-WP-B3 2M
						NPN	E2A-M30KN20-WP-C1 2M	E2A-M30KN20-WP-C2 2M	E2A-M30KN20-WP-C3 2M
		30.0 mm			66 (86)	PNP	E2A-M30LN30-WP-B1 2M	E2A-M30LN30-WP-B2 2M	E2A-M30LN30-WP-B3 2M
						NPN	E2A-M30LN30-WP-C1 2M	E2A-M30LN30-WP-C2 2M	E2A-M30LN30-WP-C3 2M
		20.0 mm	M12 connector	Brass*3	44 (58) (See note.)	PNP	E2A-M30KN20-M1-B1	E2A-M30KN20-M1-B2	E2A-M30KN20-M1-B3
						NPN	E2A-M30KN20-M1-C1	E2A-M30KN20-M1-C2	E2A-M30KN20-M1-C3
		30.0 mm			66 (80)	PNP	E2A-M30LN30-M1-B1	E2A-M30LN30-M1-B2	E2A-M30LN30-M1-B3
						NPN	E2A-M30LN30-M1-C1	E2A-M30LN30-M1-C2	E2A-M30LN30-M1-C3
		20.0 mm	M8 connector (3-pin)	Brass*3	44 (58) (See note.)	PNP	E2A-M30KN20-M5-B1	E2A-M30KN20-M5-B2	n.a.
						NPN	E2A-M30KN20-M5-C1	E2A-M30KN20-M5-C2	n.a.
		30.0 mm			66 (80)	PNP	E2A-M30LN30-M5-B1	E2A-M30LN30-M5-B2	n.a.
						NPN	E2A-M30LN30-M5-C1	E2A-M30LN30-M5-C2	n.a.
		20.0 mm	M8 connector (4-pin)	Brass*3	44 (58) (See note.)	PNP	E2A-M30KN20-M3-B1	E2A-M30KN20-M3-B2	n.a.
						NPN	E2A-M30KN20-M3-C1	E2A-M30KN20-M3-C2	n.a.
		30.0 mm			66 (80)	PNP	E2A-M30LN30-M3-B1	E2A-M30LN30-M3-B2	n.a.
						NPN	E2A-M30LN30-M3-C1	E2A-M30LN30-M3-C2	n.a.

*1. Material specifications for stainless steel housing case: 1.4305 (W.-No.), SUS 303 (AISI), 2346 (SS). Please contact your OMRON representative for other stainless steel materials.
*2. Please contact your OMRON representative for DC 2-wire models.
*3. Stainless steel models are also available. Please contact your OMRON representative.

Note: M30 non-shielded Models with double sensing distance and short barrels cannot be mounted due to the necessary separation distance from the surrounding metal. Standard sensing models are thus available.

Connectivity

The E2A sensors are available with the following connectors and cable materials:

Pre-wired models

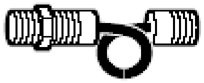
Standard cable lengths are 2m and 5m.
For other cable lengths please contact your OMRON representative.

Standard cable material: PVC (dia 4mm) -WP

Other available cable materials and sizes:

- PVC (dia 6mm)	-WS
- PUR/PVC – PUR jacket (dia 4mm)	-WA
- PUR/PVC – PUR jacket (dia 6mm)	-WB
- PVC robotic cable (dia 4mm)	-WR

Pre-wired models with cable end connectors



All pre-wired models can be fitted with cable and connectors.

Standard cable end connectors:

- M12	M1J
- M8 (4 pin)	M3J
- M8 (3 pin)	M5J

Other cable end connectors are available on request.

Connector models

Standard connectors: M12, M8 (4 or 3 pin) -M1, -M3, -M5

Model Number Legend

E2A□-□□□□□-□-□□-□□

1 2 3 4 5 6 7 8 9 10 11 12

Example: E2A-M12LS04-M1-B1 — Standard, M12, long barrel, shielded, Sn=4 mm, M12 connector, PNP-NO
E2A-S08KN04-WP-B1 5M — Standard, M8 stainless steel, short barrel, non-shielded, Sn=4 mm, pre-wired PVC cable, PNP-NO, cable length=5 m

1. Basic name

E2A

2. Sensing technology

Blank: Standard double distance

3. Housing shape and material

M: Cylindrical, metric threaded, brass
S: Cylindrical, metric threaded, stainless steel

4. Housing size

08: 8 mm
12: 12 mm
18: 18 mm
30: 30 mm

5. Barrel length

K: Standard length
L: Long body

6. Shield

S: Shielded
N: Non-shielded

7. Sensing distance

Numeral: Sensing distance: e.g. 02=2 mm, 16=16 mm

8. Kind of connection

WP: pre-wired, PVC, dia 4mm (standard)
WS: pre-wired, PVC, dia 6mm
WR: pre-wired, PVC, robotic cable, dia 4mm
WA: pre-wired, PUR/PVC (PUR jacket), dia 4mm
WB: pre-wired, PUR/PVC (PUR jacket), dia 6mm

M1: M12 connector (4 pin) *
M3: M8 connector (4 pin)
M5: M8 connector (3 pin)

M1J pre-wired with M12 cable end connector (4 pin)
M3J pre-wired with M8 cable end connector (4 pin)
M5J pre-wired with M8 cable end connector (3 pin)

9. Power source and output

B: DC, 3-wire, PNP open collector
C: DC, 3-wire, NPN open collector
D: DC, 2-wire
E: DC, 3-wire, NPN voltage output
F: DC, 3-wire, PNP voltage output

10. Operation mode

1: Normally open (NO)
2: Normally closed (NC)
3: Antivalent (NO+NC)

11. Specials (e.g., cable material, oscillating frequency)

12. Cable length

Blank: Connector type
Numeral: Cable length

Note: *In case of DC 2-wire models the M12 connector identifier is '-M1G'

Specifications

DC 3-wire Models / DC 4-wire (NO+NC)

Size		M8		M12	
Type		Shielded	Non-shielded	Shielded	Non-shielded
Item		**E2A-S08□S02-□□-B1** **E2A-S08□S02-□□-C1**	**E2A-S08□N04-□□-B1** **E2A-S08□N04-□□-C1**	**E2A-M12□S04-□□-B□** **E2A-M12□S04-□□-C□** **E2A-S12□S04-□□-B□** **E2A-S12□S04-□□-C□**	**E2A-M12□N08-□□-B□** **E2A-M12□N08-□□-C□** **E2A-S12□N08-□□-B□** **E2A-S12□N08-□□-C□**
Sensing distance		2 mm ± 10%	4 mm ± 10%	4 mm ± 10%	8 mm ± 10%
Setting distance		0 to 1.6 mm	0 to 3.2 mm	0 to 3.2 mm	0 to 6.4 mm
Differential travel		10% max. of sensing distance			
Target		Ferrous metal (The sensing distance decreases with non-ferrous metal.)			
Standard target (mild steel ST37)		8×8×1 mm	12×12×1 mm	12×12×1 mm	24×24×1 mm
Response frequency (See note 1.)		1,500 Hz	1,000 Hz	1,000 Hz	800 Hz
Power supply voltage (operating voltage range)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)			
Current consumption (DC 3-wire)		10 mA max.			
Output type		-B models: PNP open collector -C models: NPN open collector			
Control output	Load current (See note 2.)	200 mA max. (32 VDC max.)			
	Residual voltage	2 V max. (under load current of 200 mA with cable length of 2 m)			
Indicator		Operation indicator (Yellow LED)			
Operation mode (with sensing object approaching)		-B1/-C1 models: NO -B2/-C2 models: NC -B3/ -C3 models: NO+NC For details, refer to the timing charts. (See note 4.)			
Protection circuit		Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection		Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection	
Ambient air temperature		Operating: -40° C to 70° C, Storage: -40° C to 85° C (with no icing or condensation)			
Temperature influence (See note 2.)		±10% max. of sensing distance at 23° C within temperature range of -25° C to 70° C ±15% max. of sensing distance at 23° C within temperature range of -40° C to 70° C			
Ambient humidity		Operating: 35% to 95%, Storage: 35% to 95%			
Voltage influence		±1% max. of sensing distance in rated voltage range ±15%			
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case			
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current carry parts and case			
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions			
Shock resistance		500 m/s^2, 10 times each in X, Y and Z directions		1,000 m/s^2, 10 times each in X, Y and Z directions	
Standard and listings		IP67 after IEC 60529 IP69k after DIN 40050 EMC after EN60947-5-2 UL (CSA) E196555 (See note 3.)			
Connection method		Pre-wired models (standard is dia 4mm PVC cable with length = 2m). Please see chapter 'Connectivity' for details on different cable materials and lenghts and M8 or M12 connectors.			
Weight (packaged)	Pre-wired model	Approx. 65 g		Approx. 85 g	
	Connector model	M12 connector models: Approx. 20 g M8 connector models: Approx. 15 g		Approx. 35 g	
Material	Case	Stainless steel		Brass-nickel plated or stainless steel	
	Sensing surface	PBT			
	Cable	Standard cable is PVC dia 4mm. For other cable materials or diameters please refer to chapter 'Connectivity'			
	Clamping nut	Brass-nickel plated		Brass-nickel plated for brass models stainless steel for steel models	

Note 1. The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.

2. When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 100 mA max.,

3. UL (CSA) [E196555]: Use class 2 circuit only.

4. -B3/ -C3 NO+NC models are available in M12, M18 and M30 housings with M12 connectors, pre-wired and with cable end connectors.

DC 3-wire Models / DC 4-wire (NO+NC)

Size		M18		M30		
Type		Shielded	Non-shielded	Shielded	Non-shielded	Non-shielded
Item		**E2A-M18□S08-□□-B□ E2A-M18□S08-□□-C□ E2A-S18□S08-□□-B□ E2A-S18□S08-□□-C□**	**E2A-M18□N16-□□-B□ E2A-M18□N16-□□-C□ E2A-S18□N16-□□-B□ E2A-S18□N16-□□-C□**	**E2A-M30□S15-□□-B□ E2A-M30□S15-□□-C□ E2A-S30□S15-□□-B□ E2A-S30□S15-□□-C□**	**E2A-M30KN20-□□-B□ E2A-M30KN20-□□-C□ E2A-S30KN20-□□-B□ E2A-S30KN20-□□-C□**	**E2A-M30LN30-□□-B□ E2A-M30LN30-□□-C□ E2A-S30LN30-□□-B□ E2A-S30LN30-□□-C□**
Sensing distance		8 mm±10%	16 mm±10%	15 mm±10%	20 mm±10%	30 mm±10%
Setting distance		0 to 6.4 mm	0 to 12.8 mm	0 to 12 mm	0 to 16 mm	0 to 24 mm
Differential travel		10% max. of sensing distance				
Target		Ferrous metal (The sensing distance decreases with non-ferrous metal.)				
Standard target (mild steel ST37)		24×24×1 mm	48×48×1 mm	45×45×1 mm	60×60×1 mm	90×90×1 mm
Response frequency (See note 1.)		500 Hz	400 Hz	250 Hz	100 Hz	100 Hz
Power supply voltage (operating voltage range)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)				
Current consumption (DC 3-wire)		10 mA max.				
Output type		-B models: PNP open collector -C models: NPN open collector				
Control output	Load current (See note 2.)	200 mA max. (32 VDC max.)				
	Residual voltage	2 V max. (under load current of 200 mA with cable length of 2 m)				
Indicator		Operation indicator (Yellow LED)				
Operation mode (with sensing object approaching)		-B1/-C1 models: NO -B2/-C2 models: NC -B3/ -C3 models: NO+NC For details, refer to the timing charts.				
Protection circuit		Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection				
Ambient air temperature		Operating: -40° C to 70° C, Storage: -40° C to 85° C (with no icing or condensation)				
Temperature influence (See note 2.)		±10% max. of sensing distance at 23° C within temperature range of -25° C to 70° C ±15% max. of sensing distance at 23° C within temperature range of -40° C to 70° C				
Ambient humidity		Operating: 35% to 95%, Storage: 35% to 95%				
Voltage influence		±1% max. of sensing distance in rated voltage range ±15%				
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case				
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current carry parts and case				
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions				
Shock resistance		1,000 m/s^2, 10 times each in X, Y and Z directions				
Standard and listings		IP67 after IEC 60529 IP69k after DIN 40050 EMC after EN60947-5-2 UL (CSA) E196555 (See note 3.)				
Connection method		Pre-wired models (standard is dia 4mm PVC cable with length = 2m). Please see chapter 'Connectivity' for details on different cable materials and lenghts and M8 or M12 connectors.				
Weight (pak-kaged)	Pre-wired model	Approx. 160 g		Approx. 280 g	Approx. 280 g	Approx. 370 g
	Connector model	Approx. 70 g		Approx. 200 g	Approx. 200 g	Approx. 260 g
Material	Case	Brass-nickel plated or stainless steel				
	Sensing surface	PBT				
	Cable	Standard cable is PVC dia 4mm. For other cable materials or diameters please refer to chapter 'Connectivity'				
	Clamping nut	brass-nickel plated for brass models stainless steel for steel models				

Note 1. The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.

2. When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 100 mA max.

3. UL (CSA) [E196555]: Use class 2 circuit only.

DC 2-wire Models

	Size	M8		M12	
	Type	**Shielded**	**Non-shielded**	**Shielded**	**Non-shielded**
	Item	**E2A-S08□S02-D□**	**E2A-S08□N04-D□**	**E2A-M12□S04-D□** **E2A-S12□S04-D□**	**E2A-M12□N08-D□** **E2A-S12□N08-D□**
Sensing distance		2 mm ± 10%	4 mm ± 10%	4 mm ± 10%	8 mm ± 10%
Setting distance		0 to 1.6 mm	0 to 3.2 mm	0 to 3.2 mm	0 to 6.4 mm
Differential travel		10% max. of sensing distance			
Target		Ferrous metal (The sensing distance decreases with non-ferrous metal.)			
Standard target		8×8×1 mm	12×12×1 mm	12×12×1 mm	24×24×1 mm
Response frequency (See note 1.)		1,500 Hz	1,000 Hz	1,000 Hz	800 Hz
Power supply voltage (operating voltage range)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)			
Leakage current		0.8 mA max.			
Output type		DC 2 wire type			
Control output	Load current (See note 2.)	3 to 100 mA			
	Residual voltage	3 V max. (under load current of 100 mA with cable length of 2 m)			
Indicator (see timing chart)		NO type: Operation indicator (Yellow), Setting indicator (Red) NC type: Operation indicator (Yellow)			
Operation mode		-D1 models: NO -D2 models: NC			
Protection circuit		Surget suppressor, Short circuit protection			
Ambient temperature		Operating: -40° C to 70° C, Storage: -40° C to 85° C (with no icing or condensation)			
Temperature influence		±10% max. of sensing distance at 23° C within temperature range of -25° C to 70° C ±15% max. of sensing distance at 23° C within temperature range of -40° C to 70° C			
Ambient humidity		Operating: 35% to 95%, Storage: 35% to 95%			
Voltage influence		±1% max. of sensing distance in rated voltage range ±15%			
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case			
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current carry parts and case			
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions			
Shock resistance		500 m/s^2, 10 times each in X, Y and Z directions		1,000 m/s^2, 10 times each in X, Y and Z directions	
Standard and listings		IP67 after IEC 60529 IP69k after DIN 40050 EMC after EN60947-5-2 UL (CSA) E196555 (see note 3.)			
Connection method		Pre-wired models (standard is dia 4mm PVC cable with length = 2m). Please see chapter 'Connectivity' for details on different cable materials and lenghts and M8 or M12 connectors.			
Weight (packaged)	Pre-wired model	Approx. 65 g		Approx. 85 g	
	Connector model	M12 connector models: Approx. 20 g M8 connector models: Approx. 15 g		Approx. 35 g	
Material	Case	Stainless steel		Brass-nickel plated or stainless steel	
	Sensing surface	PBT			
	Cable	Standard cable is PVC dia 4mm. For other cable materials or diameters please refer to chapter 'Connectivity'			
	Clamping nut	Brass-nickel plated		Brass-nickel plated for brass models stainless steel for steel models	

Note 1. The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.

2. When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 50 mA max.

3. UL (CSA) [E196555]: Use class 2 circuit only.

DC 2-wire Models

	Size	M18		M30	
	Type	Shielded	Non-shielded	Shielded	Non-shielded
Item		E2A-M18□S08-D□ E2A-S18□S08-D□	E2A-M18□N16-D□ E2A-S18□N16-D□	E2A-M30□S15-D□ E2A-S30□S15-D□	E2A-M30□N30-D□ E2A-M30□N20-D□ E2A-S30□N30-D□ E2A-S30□N20-D□
Sensing distance		8 mm ± 10%	16 mm ± 10%	15 mm ± 10%	Short body: 20 m ± 10% Long body: 30 m± 10%
Setting distance		0 to 6.4 mm	0 to 12.8 mm	0 to 12 mm	Short body: 0 to 16 mm Long body: 0 to 24 mm
Differential travel		10% max. of sensing distance			
Target		Ferrous metal (The sensing distance decreases with non-ferrous metal.)			
Standard target		24x24x1 mm	48x48x1 mm	45x45x1 mm	Short body: 60x60x1 mm Long body: 90x90x1mm
Response frequency (See note 1.)		500 Hz	400 Hz	250 Hz	100 Hz
Power supply voltage (operating voltage range)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)			
Leakage current		0.8 mA max.			
Output type		DC 2 wire type			
Control output	Load current (See note 2.)	3 to 100 mA			
	Residual voltage	3 V max. (under load current of 100 mA with cable length of 2 m)			
Indicator (see timing chart)		NO type: Operation indicator (Yellow), Setting indicator (Red) NC type: Operation indicator (Yellow)			
Operation mode		-D1 models: NO -D2 models: NC			
Protection circuit		Surget suppressor, Short circuit protection			
Ambient temperature		Operating: -40° C to 70° C, Storage: -40° C to 85° C (with no icing or condensation)			
Temperature influence		±10% max. of sensing distance at 23° C within temperature range of -25° C to 70° C ±15% max. of sensing distance at 23° C within temperature range of -40° C to 70° C			
Ambient humidity		Operating: 35% to 95%, Storage: 35% to 95%			
Voltage influence		±1% max. of sensing distance in rated voltage range ±15%			
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case			
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current carry parts and case			
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions			
Shock resistance		500 m/s^2, 10 times each in X, Y and Z directions			
Standard and listings		IP67 after IEC 60529 IP69k after DIN 40050 EMC after EN60947-5-2 UL (CSA) E196555 (see note 3.)			
Connection method		Pre-wired models (standard is dia 4mm PVC cable with length = 2m). Please see chapter 'Connectivity' for details on different cable materials and lenghts and M8 or M12 connectors.			
Weight (packaged)	Pre-wired model	Approx. 160 g		Approx. 280 g	short body: 280 g long body: 370 g
	Connector model	Approx. 70 g		Approx. 200 g	short body: 200 g long body: 260 g
Material	Case	Brass-nickel plated or stainless steel			
	Sensing surface	PBT			
	Cable	Standard cable is PVC dia 4mm. For other cable materials or diameters please refer to chapter 'Connectivity'			
	Clamping nut	brass-nickel plated for brass models stainless steel for steel models			

Note 1. The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.

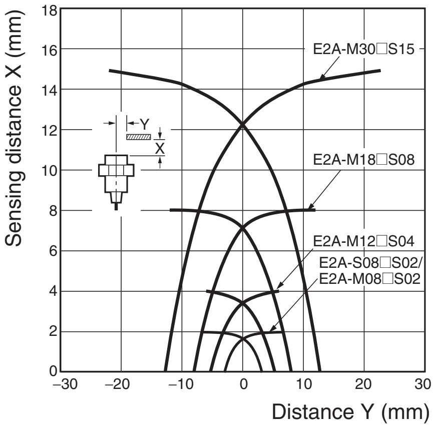
2. When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 50 mA max.

3. UL (CSA) [E196555]: Use class 2 circuit only.

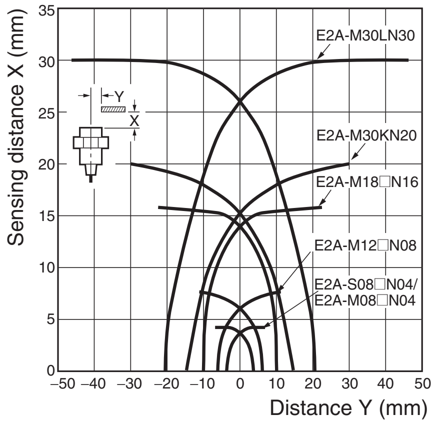
Engineering Data

Operating Range (Typical)

Shielded Models



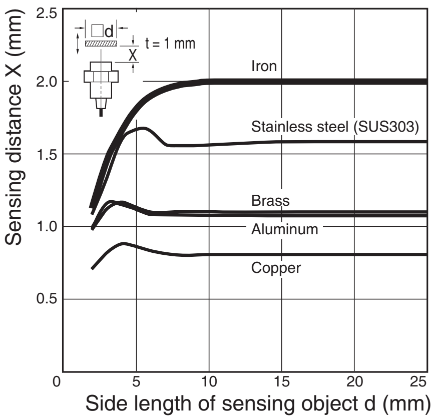
Non-shielded Models



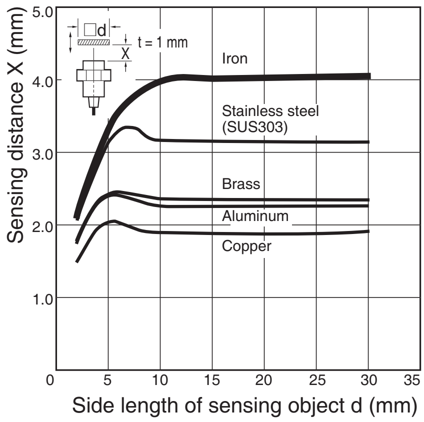
Influence of Sensing Object Size and Materials

Shielded Models

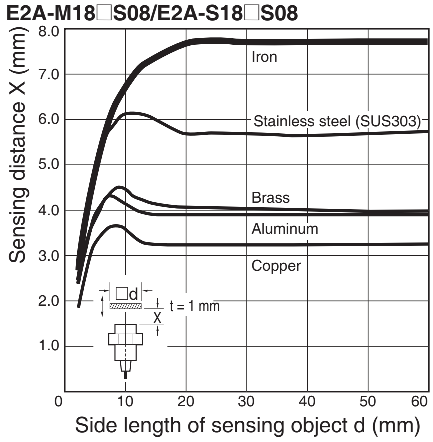
E2A-S08□S02



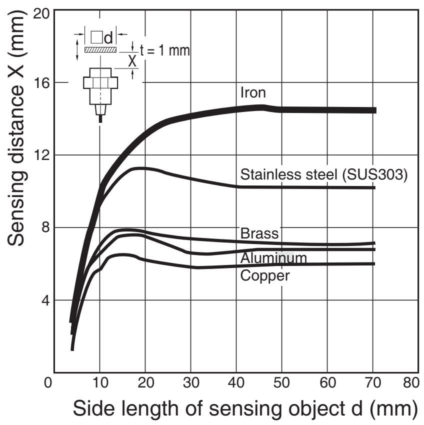
E2A-M12□S04/ E2A-S12□S04



E2A-M18□S08/E2A-S18□S08

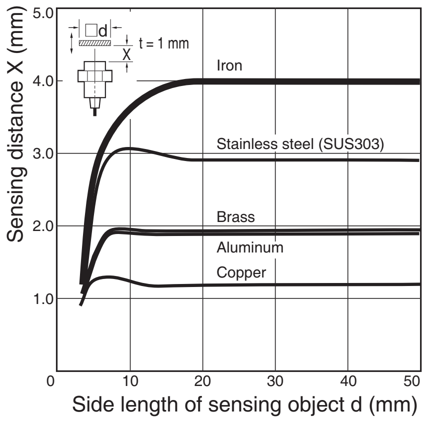


E2A-M30□S15/ E2A-S30□S15

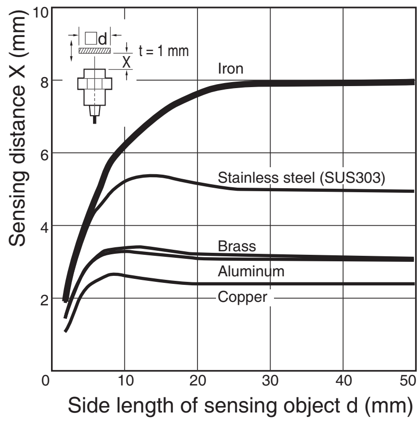


Non-shielded Models

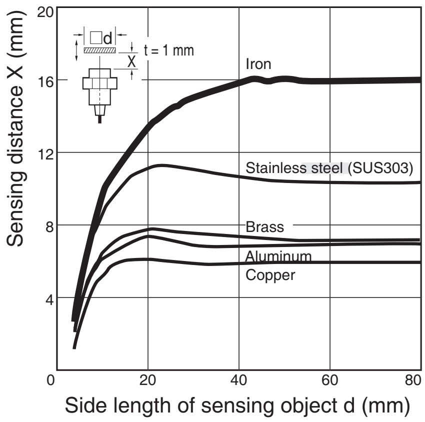
E2A-S08□N04



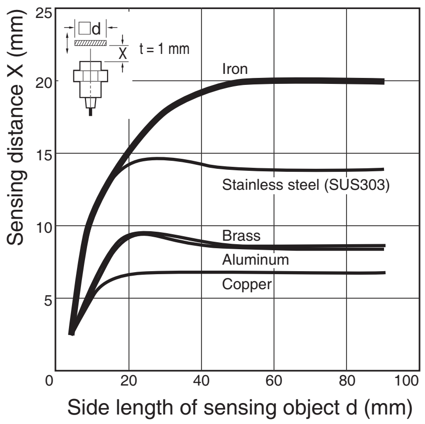
E2A-M12□N08/E2A-S12□N08



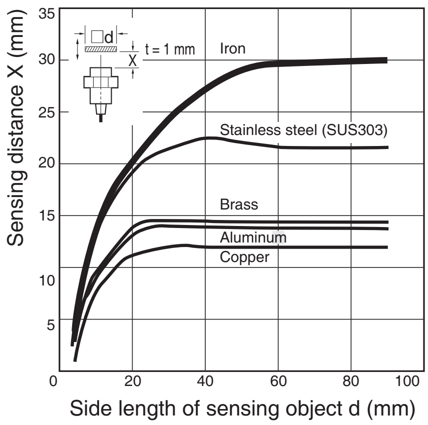
E2A-M18□N16/E2A-S18□N16



E2A-M30KN20/E2A-S30KN20



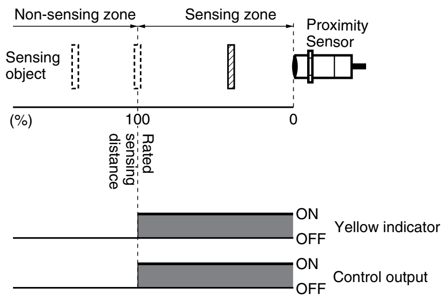
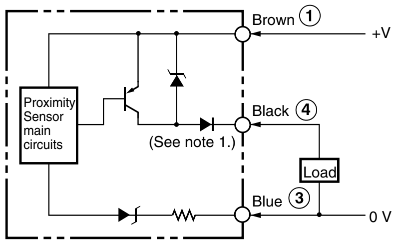
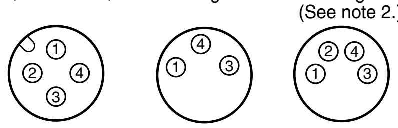
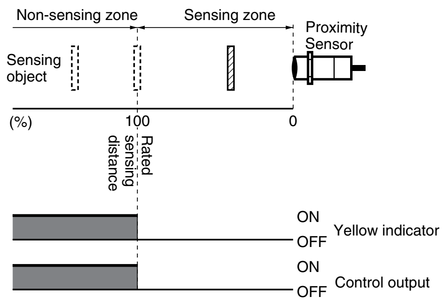
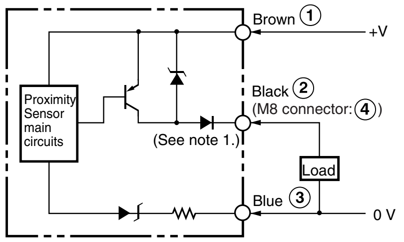
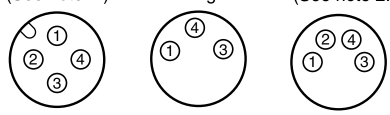
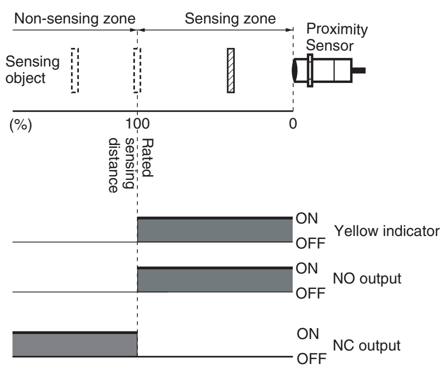
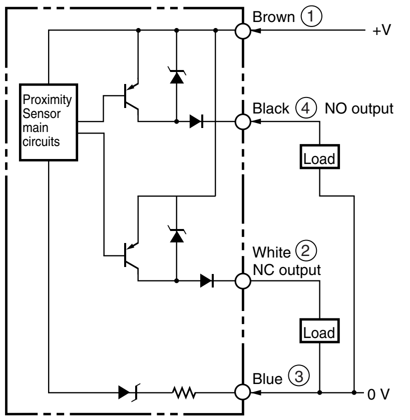
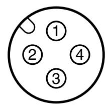
E2A-M30LN30/E2A-S30LN30



Operation

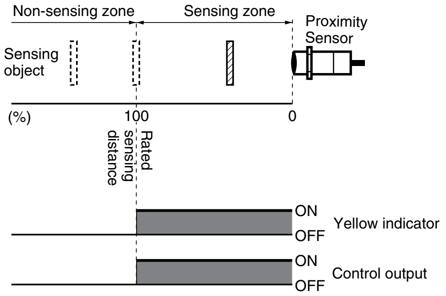
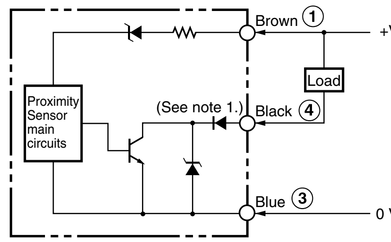
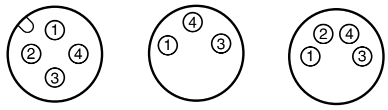
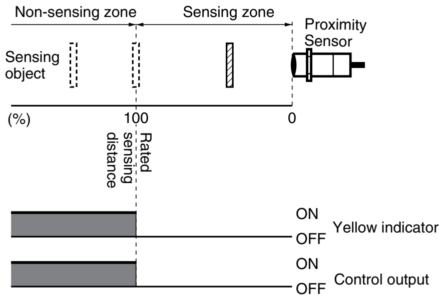
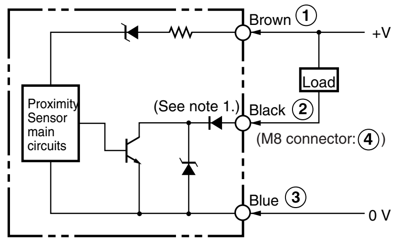
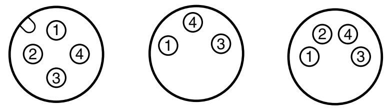
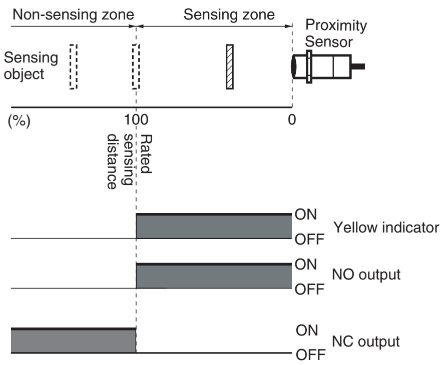
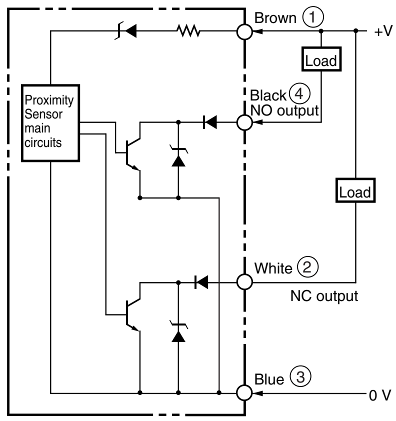
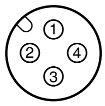
DC 3-wire models

PNP Output

Operation mode	Model	Timing chart	Output circuit
NO	E2A-□-□-B1		 **Note 1:** With M8 connector models, there is no output reverse polarity protection diode. M12 Connector Pin Arrangement (See note 2.) / M8 connector (3 pin) Pin Arrangement / M8 Connector (4 pin) Pin Arrangement (See note 2.)  **Note 2:** Pin 2 of the M12 connector and M8 connector is not used.
NC	E2A-□-□-B2		 **Note 1:** With M8 connector models, there is no output reverse polarity protection diode. M12 Connector Pin Arrangement (See note 2.) / M8 connector (3 pin) Pin Arrangement / M8 Connector (4 pin) Pin Arrangement (See note 2.)  **Note 2:** Pin 4 of the M12 connector and M8 connector is not used.
NO + NC	E2A-□-□-B3		 M12 Connector Pin Arrangement 

DC 3-wire models

NPN Output

<table>
<tr><th>Operation mode</th><th>Model</th><th>Timing chart</th><th>Output circuit</th></tr>
<tr><td>NO</td><td>E2A-☐-☐-C1</td><td></td><td>
Note 1: With M8 connector models, there is no output reverse polarity protection diode.
M12 Connector Pin Arrangement (See note 2.)
M8 connector (3 pin) Pin Arrangement
M8 Connector (4 pin) Pin Arrangement (See note 2.)

Note 2: Pin 2 of the M12 connector and M8 connector is not used.</td></tr>
<tr><td>NC</td><td>E2A-☐-☐-C2</td><td></td><td>
Note 1: With M8 connector models, there is no output reverse polarity protection diode.
M12 Connector Pin Arrangement (See note 2.)
M8 connector (3 pin) Pin Arrangement
M8 Connector (4 pin) Pin Arrangement (See note 2.)

Note 2: Pin 4 of the M12 connector and M8 connector is not used.</td></tr>
<tr><td>NO + NC</td><td>E2A-☐-☐-C3</td><td></td><td>
M12 Connector Pin Arrangement
</td></tr>
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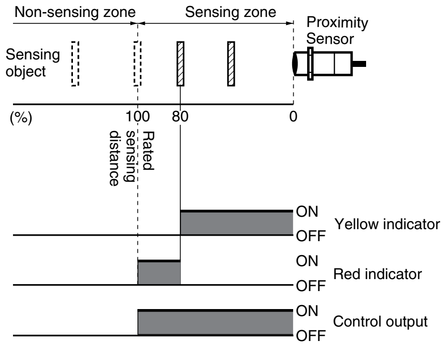
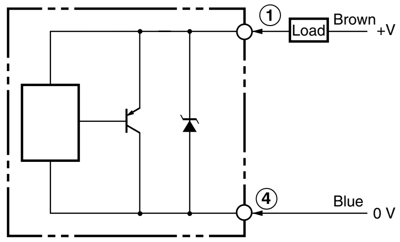
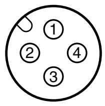
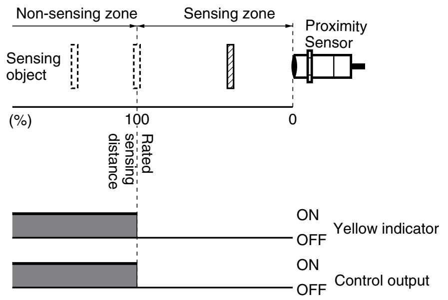
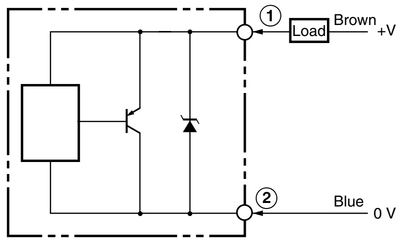
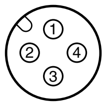
E2A

DC 2-wire models

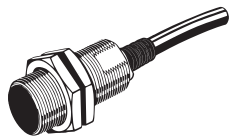
Output Circuit Diagrams (Operation)

Operation mode	Model	Timing chart	Output circuit
NO	E2A-☐-**D1**		 Load can be connected to +V or 0V side. M12 Connector Pin Arrangement 
NC	E2A-☐-**D2**		 Load can be connected to +V or 0V side. M12 Connector Pin Arrangement 

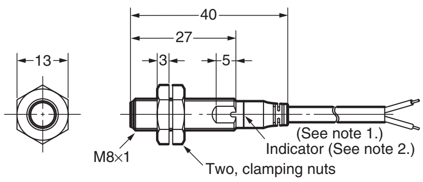
Dimensions

Note: All units are in millimeters unless otherwise indicated.

Pre-wired Models (Shielded)

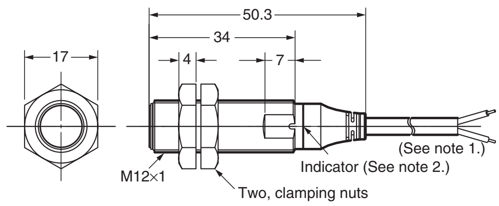


E2A-S08KS02-WP-□□



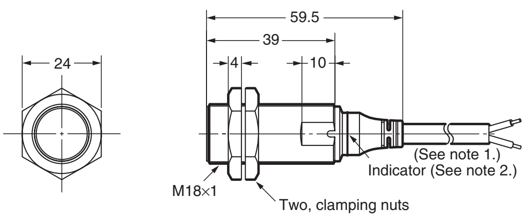
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M12KS04-WP-□□/E2A-S12KS04-WP-□



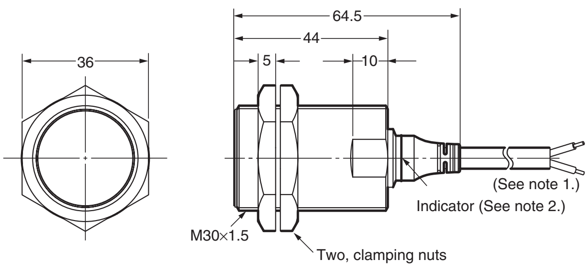
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)
3. for NO+NC (-B3 / -C3) models the total length is 4 mm longer

E2A-M18KS08-WP-□□/E2A-S18KS08-WP-□



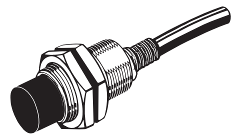
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M30KS15-WP-□□/E2A-S30KS15-WP-□

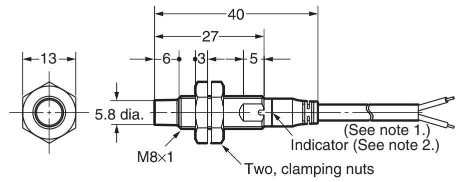


Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

Pre-wired Models (Non-shielded)

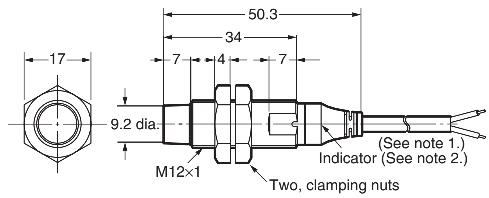


E2A-S08KN04-WP-□□



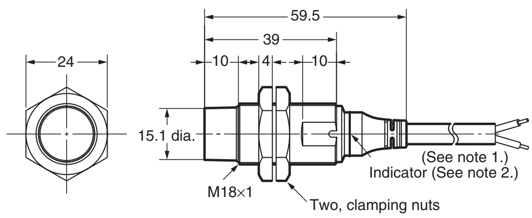
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M12KN08-WP-□□/E2A-S12KN08-WP-□



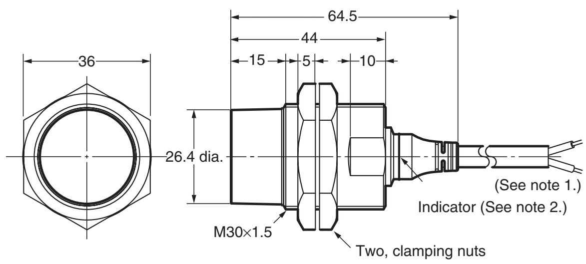
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)
3. for NO+NC (-B3 / -C3) models the total length is 4 mm longer

E2A-M18KN16-WP-□□/E2A-S18KN16-WP-□



Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

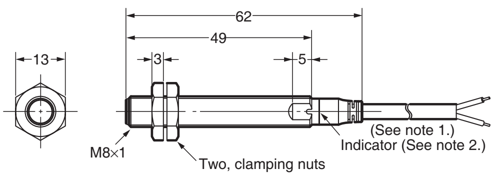
E2A-M30KN20-WP-□□/E2A-S30KN20-WP-□



Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

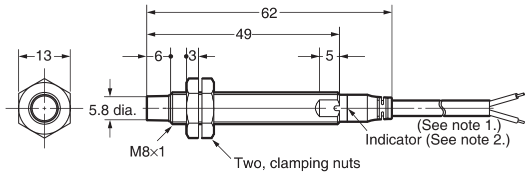
E2A

E2A-S08LS02-WP-□□



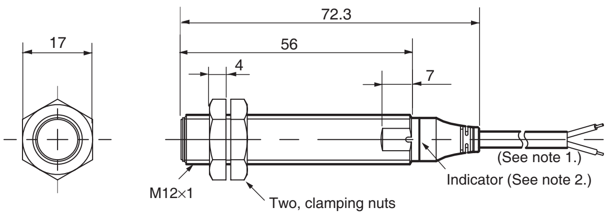
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-S08LN04-WP-□□



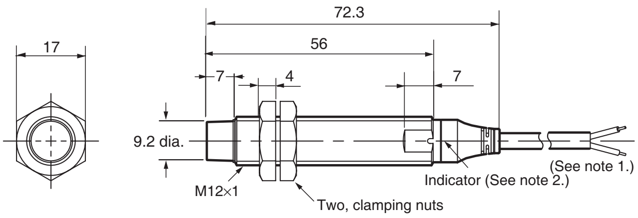
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M12LS04-WP-□□/E2A-S12LS04-WP-□



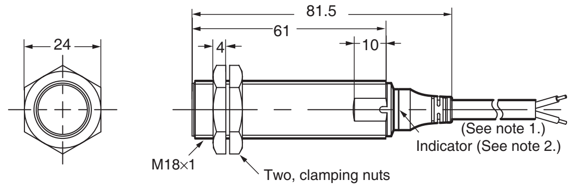
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M12LN08-WP-□□/E2A-S12LN08-WP-□



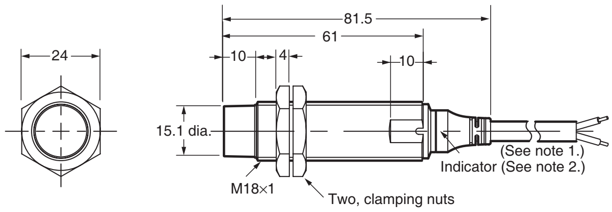
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M18LS08-WP-□□/E2A-S18LS08-WP-□



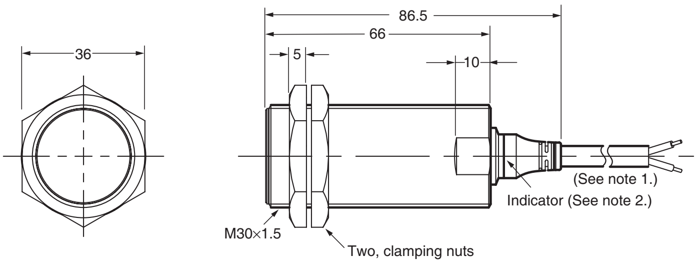
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M18LN16-WP-□□/E2A-S18LN16-WP-□



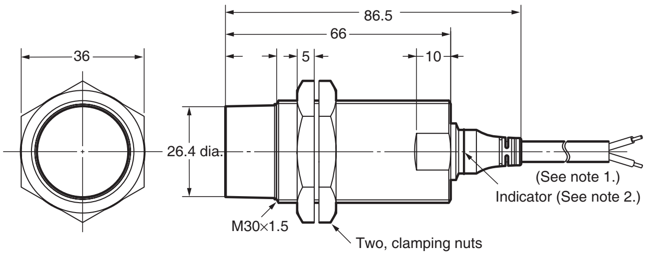
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M30LS15-WP-□□/E2A-S30LS15-WP-□



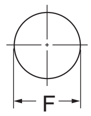
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M30LN30-WP-□□/E2A-S30LN30-WP-□



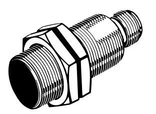
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm²; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

Mounting Hole Cutout Dimensions

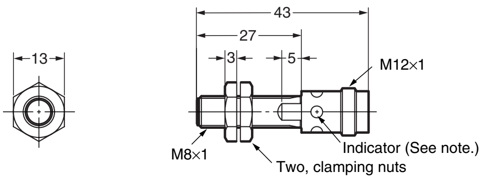


External diameter of Proximity Sensor	Dimension F (mm)
M8	8.5 dia. $^{+0.5}_{0}$
M12	12.5 dia. $^{+0.5}_{0}$
M18	18.5 dia. $^{+0.5}_{0}$
M30	30.5 dia. $^{+0.5}_{0}$

M12 Connector Models (Shielded)

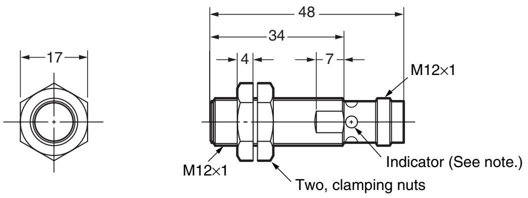


E2A-S08KS02-M1-□□



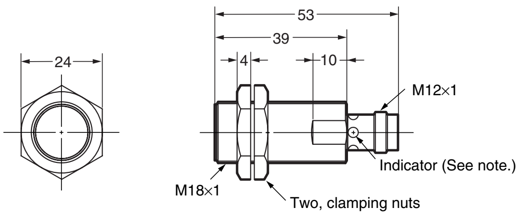
Note: Operation indicator (yellow LED, 4×90°)

E2A-M12KS04-M1-□□/E2A-S12KS04-M1-□



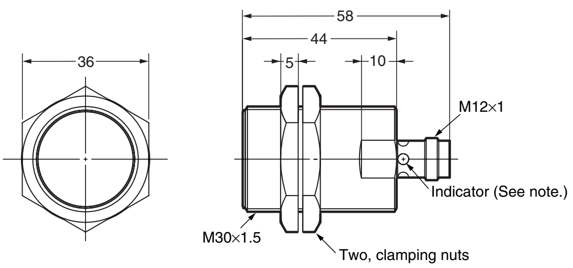
Note 1: Operation indicator (yellow LED, 4×90°)
Note 2: for NO+NC (-B3 / -C3) models the total length is 4 mm longer

E2A-M18KS08-M1-□□/E2A-S18KS08-M1-□



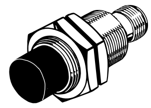
Note: Operation indicator (yellow LED, 4×90°)

E2A-M30KS15-M1-□□/E2A-S30KS15-M1-□

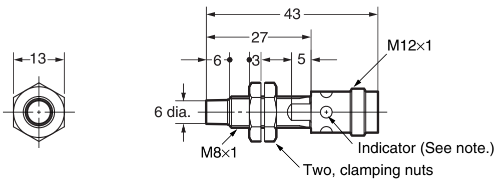


Note: Operation indicator (yellow LED, 4×90°)

M12 Connector Models (Non-shielded)

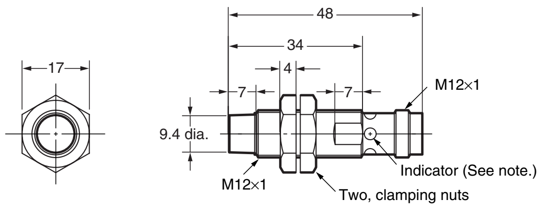


E2A-S08KN04-M1-□□



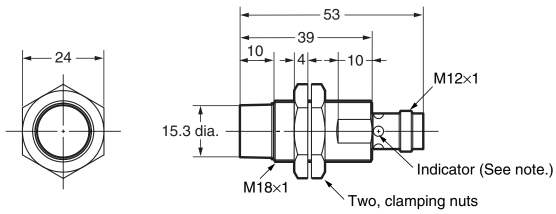
Note: Operation indicator (yellow LED, 4×90°)

E2A-M12KN08-M1-□□/E2A-S12KN08-M1-□



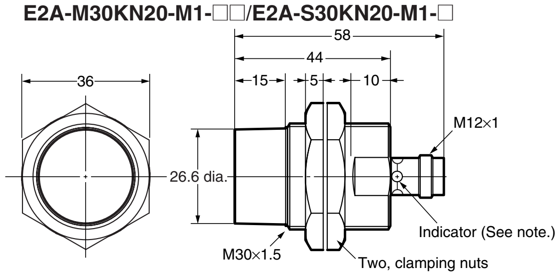
Note 1: Operation indicator (yellow LED, 4×90°)
Note 2: for NO+NC (-B3 / -C3) models the total length is 4 mm longer

E2A-M18KN16-M1-□□/E2A-S18KN16-M1-□



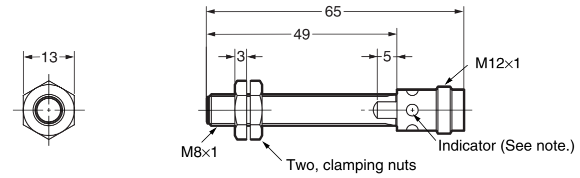
Note: Operation indicator (yellow LED, 4×90°)

E2A-M30KN20-M1-□□/E2A-S30KN20-M1-□



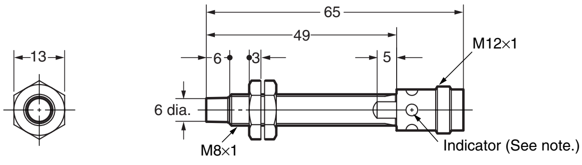
Note: Operation indicator (yellow LED, 4×90°)

E2A-S08LS02-M1-□□



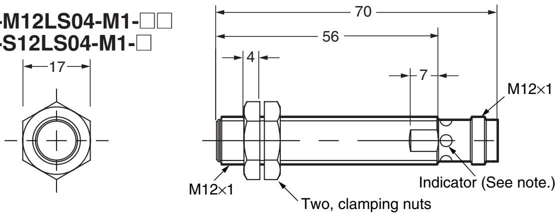
Note: Operation indicator (yellow LED, 4×90°)

E2A-S08LN04-M1-□□



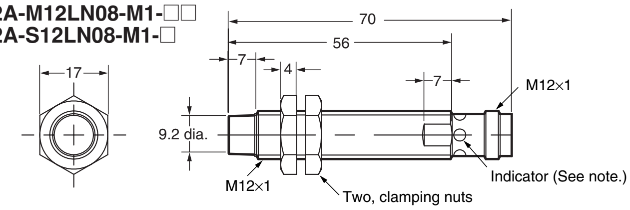
Note: Operation indicator (yellow LED, 4×90°)

E2A-M12LS04-M1-□□
E2A-S12LS04-M1-□



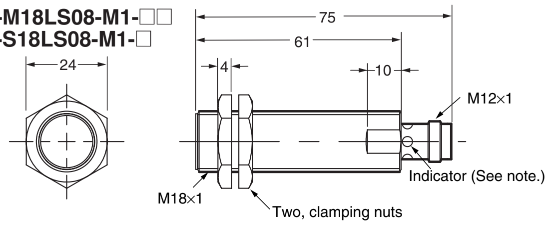
Note: Operation indicator (yellow LED, 4×90°)

E2A-M12LN08-M1-□□
E2A-S12LN08-M1-□



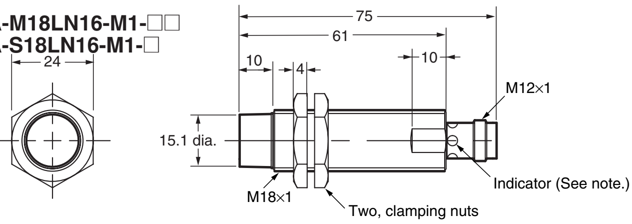
Note: Operation indicator (yellow LED, 4×90°)

E2A-M18LS08-M1-□□
E2A-S18LS08-M1-□



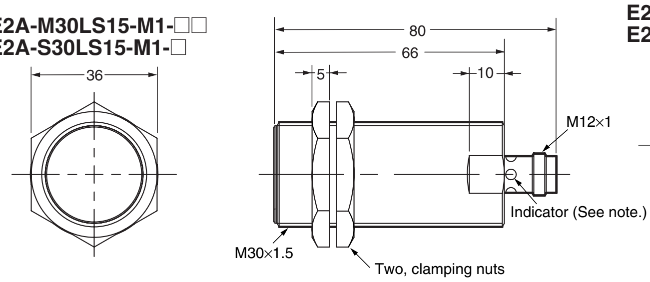
Note: Operation indicator (yellow LED, 4×90°)

E2A-M18LN16-M1-□□
E2A-S18LN16-M1-□



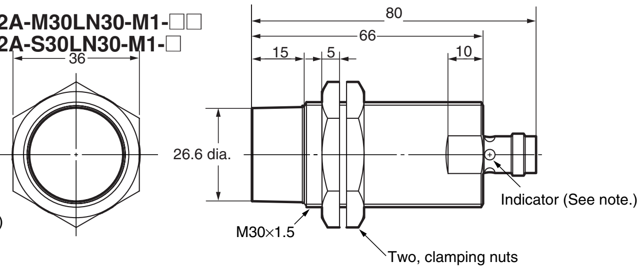
Note: Operation indicator (yellow LED, 4×90°)

E2A-M30LS15-M1-□□
E2A-S30LS15-M1-□



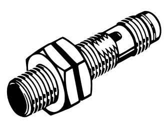
Note: Operation indicator (yellow LED, 4×90°)

E2A-M30LN30-M1-□□
E2A-S30LN30-M1-□

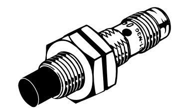


Note: Operation indicator (yellow LED, 4×90°)

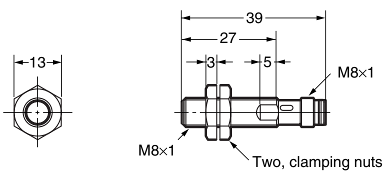
M8 Connector Models (Shielded)



M8 Connector Models (Non-shielded)

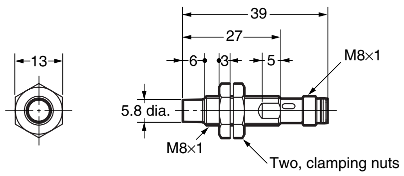


E2A-S08KS02-M5-□□/E2A-S08KS02-M3-□



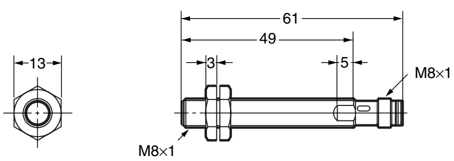
Note: Operation indicator (yellow LED, 4×90°)

E2A-S08KN04-M5-□□/E2A-S08KN04-M3-□



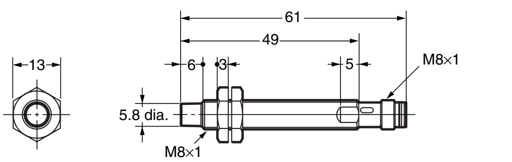
Note: Operation indicator (yellow LED, 4×90°)

E2A-S08LS02-M5-□□/E2A-S08LS02-M3-□



Note: Operation indicator (yellow LED, 4×90°)

E2A-S08LN04-M5-□□/E2A-S08LN04-M3-□



Note: Operation indicator (yellow LED, 4×90°)

Note: Please contact your OMRON sales representative for dimension drawings not listed here.

Precautions

Safety Precautions

Power Supply

Do not impose an excessive voltage on the E2A, otherwise it may be damaged. Do not impose AC current (100 to 240 VAC) on any DC model, otherwise it may be damaged.

Load Short-circuit

Do not short-circuit the load, or the E2A may be damaged.

The E2A's short-circuit protection function will be valid if the polarity of the supply voltage imposed is correct and within the rated voltage range.

Wiring

Be sure to wire the E2A and load correctly, otherwise it may be damaged.

Connection with No Load

Be sure to insert loads when wiring. Make sure to connect a proper load to the E2A in operation, otherwise it may damage internal elements.

Do not expose the product to flammable or explosive gases.

Do not disassemble, repair, or modify the product.

Correct Use

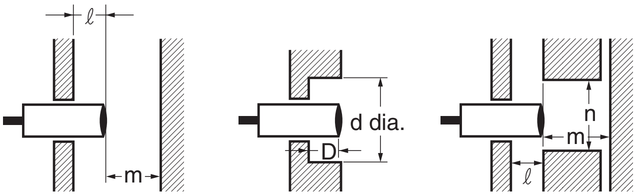
Designing

Power Reset Time

The Proximity Sensor is ready to operate within 100 ms (160ms for NO+NC -B3 / -C3 types) after power is supplied. If power supplies are connected to the Proximity Sensor and load respectively, be sure to supply power to the Proximity Sensor before supplying power to the load.

Effects of Surrounding Metal

When mounting the E2A within a metal panel, ensure that the clearances given in the following table are maintained.



(Unit: mm)

Type	Dimension	M8	M12	M18	M30 Short barrel	M30 Long barrel
Shielded	l	0	0	0 (See note 1.)	0 (See note 2.)	
	m	4.5	12	24	45	
	d	---	---	27	45	
	D	0	0	1.5	4	
	n	12	18	27	45	
Non-shielded	l	12	15	22	30	40
	m	8	20	48	70	90
	d	24	40	70	90	120
	D	12	15	22	30	40
	n	24	40	70	90	120

Note 1. In the case of using the supplied nuts.
If true flash mounting is necessary, apply a free zone of 1.5 mm.

2. In the case of using the supplied nuts.
If true flush mounting is necessary, apply a free zone of 4 mm.

Power OFF

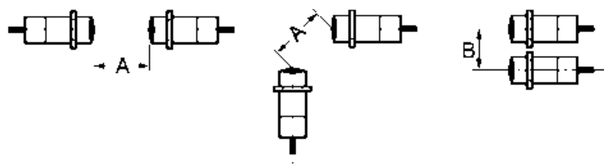
The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended that the load be turned OFF before turning OFF the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Mutual Interference

When installing two or more Sensors face-to-face or side-by-side, ensure that the minimum distances given in the following table are maintained.



(Unit: mm)

Type	Dimension	M8	M12	M18	M30 Short barrel	M30 Long barrel
Shielded	A	20	30	60	110	
	B	15	20	35	70	
Non-shielded	A	80	120	200	300	300
	B	60	100	120	200	300

Wiring

High-tension Lines

Wiring through Metal Conduit**:**
If there is a power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunctioning.

Cable Extension

Standard cable length is less than 200 m.

The tractive force is 50 N.

Mounting

The Proximity Sensor must not be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistivity.

Do not tighten the nut with excessive force. A washer must be used with the nut.

Type		Torque
M8	Stainless steel type	9 Nm
	Brass type	4 Nm
M12		30 Nm
M18		70 Nm
M30		180 Nm

Maintenance and Inspection

Periodically perform the following checks to ensure stable operation of the Proximity Sensor over a long period of time.

1. Check for mounting position, dislocation, looseness, or distortion of the Proximity Sensor and sensing objects.
2. Check for loose wiring and connections, improper contacts, and line breakage.
3. Check for attachment or accumulation of metal powder or dust.
4. Check for abnormal temperature conditions and other environmental conditions.
5. Check for proper lighting of indicators (for models with a set indicator.)

Never disassemble or repair the Sensor.

Environment

Water Resistivity

The Proximity Sensors are tested intensively on water resistance, but in order to ensure maximum performance and life expectancy avoid immersion in water and provide protection from rain or snow.

Operating Environment

Ensure storage and operation of the Proximity Sensor within the given specifications.

Inrush Current

A load that has a large inrush current (e.g., a lamp or motor) will damage the Proximity Sensor, in which case connect the load to the Proximity Sensor through a relay.

<SUITABILITY FOR USE>

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used.

<CHANGE IN SPECIFICATIONS>

Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

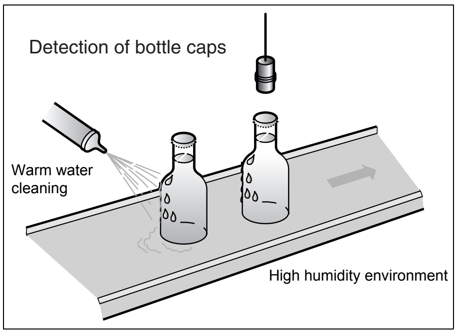
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cylindrical Proximity Sensor in Plastic Housing

E2F

- High quality full body plastic housing for high water proof requirements
- Polyarylate housing for light chemical resistance

Applications



Ordering Information

Sensors

Model		Sensing distance	Output specifications	Model Operating status NO	Model Operating status NC
Shielded	M8	1.5mm	DC 3-wire NPN	E2F-X1R5E1	E2F-X1R5E2
			AC 2-wire Models	E2F-X1R5Y1	E2F-X1R5Y2
	M12	2mm	DC 3-wire NPN	E2F-X2E1 *1	E2F-X2E2 *1
			AC 2-wire Models	E2F-X2Y1 *1	E2F-X2Y2 *1
	M18	5mm	DC 3-wire NPN	E2F-X5E1 *1	E2F-X5E2 *1
			AC 2-wire Models	E2F-X5Y1 *1 *2	E2F-X5Y2 *1 *2
	M30	10mm	DC 3-wire NPN	E2F-X10E1 *1	E2F-X10E2 *1
			AC 2-wire Models	E2F-X10Y1 *1 *2	E2F-X10Y2 *1 *2

*1. A different frequency type is available. (E2F-X□□5; e.g.E2F-X5E15)
*2. A short-circuit protection type is available. (E2F-X□Y□-53; e.g. E2F-X5Y1-53) Power supply voltage: 100 to 120 VAC

Accessories (Order Separately)

Rating/performance

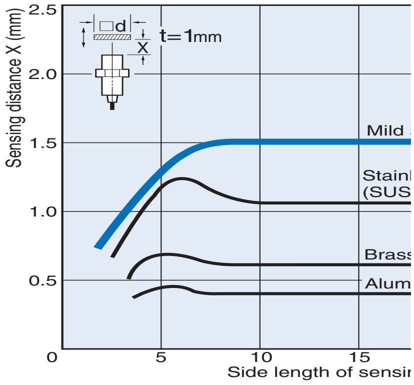
Item		E2F-X1R5E☐ E2F-X1R5Y☐	E2F-X2E☐ E2F-X2Y☐	E2F-X5E☐ E2F-X5Y☐	E2F-X10E☐ E2F-X10Y☐
Sensing distance		1.5 mm ±10%	2 mm ±10%	5 mm ±10%	10 mm ±10%
Setting distance		0 to 1.2 mm	0 to 1.6 mm	0 to 4 mm	0 to 8 mm
Differential distance		10% max.			
Sensing object		Ferrous metal (Sensitivity lowers with non-ferrous metals)			
Standard sensing object		Iron, 8 × 8 × 1 mm	Iron, 12 × 12 × 1 mm	Iron, 18 × 18 × 1 mm	Iron, 30 × 30 × 1 mm
Response frequency*1		E models: 2 kHz, Y models: 25 Hz	E models: 1.5 kHz, Y models: 25 Hz	E models: 600 Hz, Y models: 25 Hz	E models: 400 Hz, Y models: 25 Hz
Power supply(Operating voltage range)		E models: 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max. Y models: 24 to 240 VAC (20 to 264 VAC)			
Current consumption		E models: 17 mA max.			
Leakage current		Y models: 1.7 mA at 200 VAC			
Control output	Switching capacity	E models: 200 mA max. Y models: 5 to 100 mA		E models: 200 mA max. Y models: 5 to 300 mA	
	Residual voltage	E models: 2 V max. (load current: 200 mA with cable length: 2 m) Y models: Refer to the Specifications			
Indicator lamp		E models: Detection indicator (red LED) Y models: Operation indicator (red LED)			
Operating status (with sensing object approaching)		E1, Y1 models: ON E2, Y2 models: NC			
Protective circuits		E models: Reverse connection protection, load short-circuit protection, surge absorber Y models: None			
Ambient temperature		Operating/Storage: -25°C to 70°C (with no icing or condensation)			
Ambient humidity		Operating/Storage: 35% to 95%RH			
Temperature influence		A maximum fluctuation of ±10% max. of sensing distance at 23°C in temperature range of -25°C and 70°C			
Voltage influence		E models: ±2.5% max. of sensing distance within a range of ±15% of rated power supply voltage Y models: ±1% max. of sensing distance within a range of ±10% of rated power supply voltage			
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case			
Dielectric strength		E models: 1,000 VAC, 50/60 Hz for 1 min between current carry parts and case			
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions			
Shock resistance		Destruction: 1,000 m/s^2 for 10 times each in X, Y, and Z directions			
Protective structure		IEC IP67			
Connection method		Pre-wired models (standard length: 2 m)			
Weight (Packed state)		Approx.40g	Approx. 50 g	Approx. 130 g	Approx. 170 g
Material	Case	Polyarylate			
	Sensing surface				
	Clamping nut	Polyallylate resin			
Accessories		Instruction manual			

*1. The response frequencies are average values measured on condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.

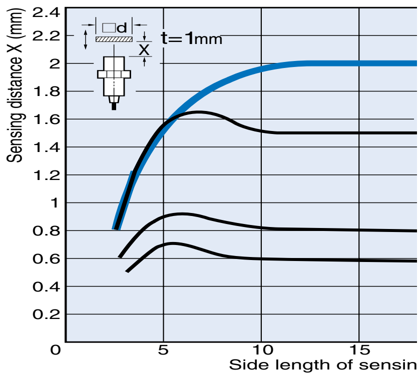
Characteristic data (typical)

Sensing Distance vs. Sensing Object

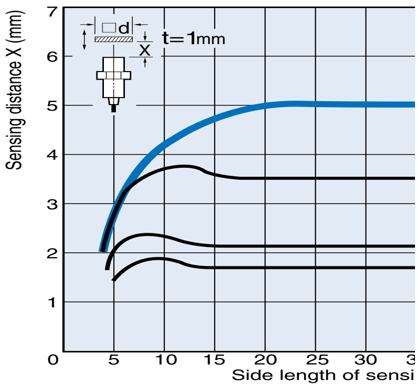
E2F-X1R5□□



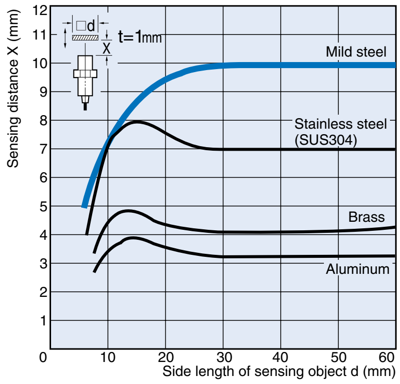
E2F-X2□□



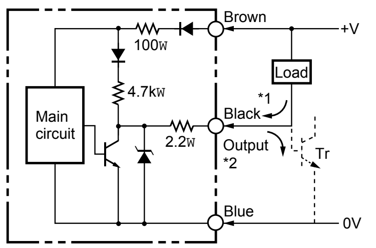
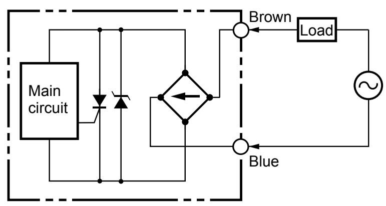
E2F-X5□□



E2F-X10□□



Output Circuit Diagram

Output	Operating status	Model	Timing chart	Output circuit
DC 3-wire	NO	E2F-X1R5E1 E2F-X2E1 E2F-X5E1 E2F-X10E1	Sensing object: Yes / No Load (between brown and black leads): Operates / Reset Output voltage (between black and blue leads): H / L Detection indicator: ON / OFF	 *1. 200 mA max. (source current) *2. When connecting to the transistor circuit.
	NC	E2F-X1R5E2 E2F-X2E2 E2F-X5E2 E2F-X10E2	Sensing object: Yes / No Load (between brown and black leads): Operates / Reset Output voltage (between black and blue leads): H / L Detection indicator: ON / OFF	
AC 2-wire Models	NO	E2F-X1R5Y1 E2F-X2Y1 E2F-X5Y1 E2F-X10Y1	Sensing object: Yes / No Load: Operates / Reset Detection indicator: ON / OFF	
	NC	E2F-X1R5Y2 E2F-X2Y2 E2F-X5Y2 E2F-X10Y2	Sensing object: Yes / No Load: Operates / Reset Detection indicator: ON / OFF	

E2F

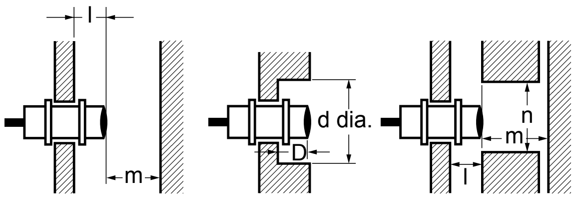
Precautions

Correct Use

Design

Effects of Surrounding Metal

Provide a minimum distance as shown in the table below between the Sensor and the surrounding metal.

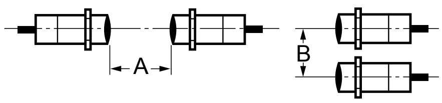


Effects of Surrounding Metal(Unit: mm)

Model　　　Item	l	d	D	m	n
E2F-X1R5□□	0	8	0	4.5	12
E2F-X2□□		12		8	18
E2F-X5□□		18		20	27
E2F-X10□□		30		40	45

Mutual Interference

When installing two or more Sensors face-to-face or side-by-side, ensure that the minimum distances given in the following table are maintained.



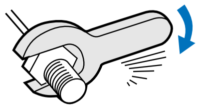
Mutual Interference (Unit: mm)

Model　　　Item	A	B
E2F-X1R5□□	20	15
E2F-X2□□	30 (20)	20(12)
E2F-X5□□	50 (30)	35 (18)
E2F-X10□□	100(50)	70(35)

Note: Figures in parentheses are for an E2F used in combination with an E2F (i.e., E2F-X□□□5) that is operating at a different frequency.

Mounting

Do not apply excessive torque when tightening any nuts.



Model	Tensile strength (torque)
E2F-X1R5□□	0.78 N•m
E2F-X2□□	
E2F-X5□□	2 N•m
E2F-X10□□	

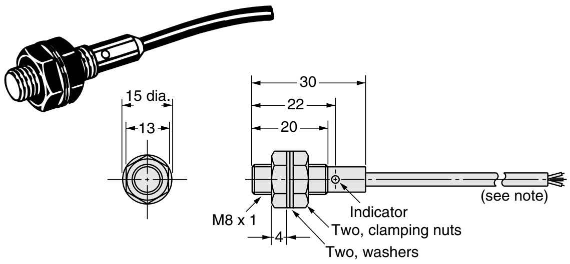
● Maintenance and Inspection

Do not use the AC 2-wire models (sensing surface is broken), where directly exposed to water. There is fear of an electric shock.

Dimensions (Unit: mm)

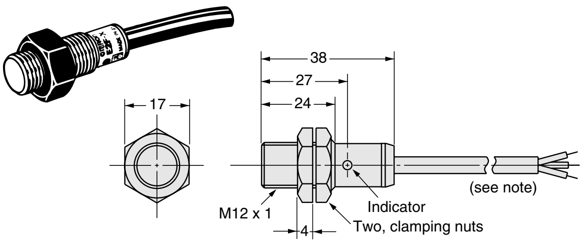
DC 3-wire Models

E2F-X1R5E□



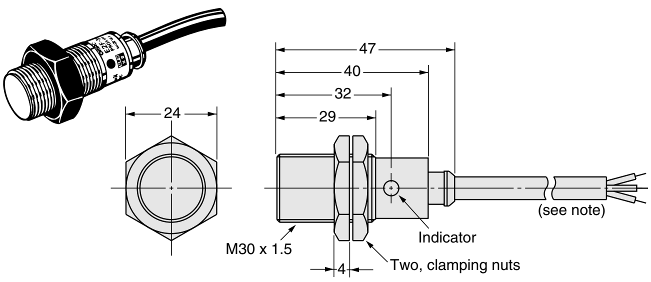
Note:
Vinyl-insulated round cord, 3.5 dia.,
3 cores (0.12 dia. x 13); Standard length: 2m

E2F-X2E□



Note:
Oil-and vibration-resistant,
vinyl-insulated round cord, 6 dia.,
0.5 dia. x 3 cores; Standard length: 2m
The cord can be extended up to 200 m
in an independent metal conduit.

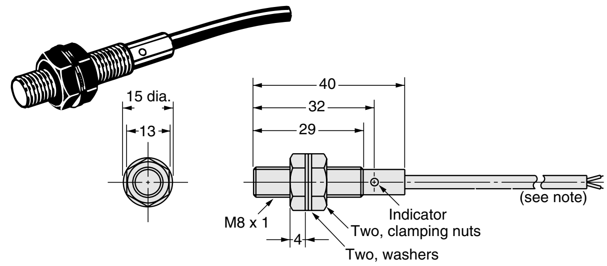
E2F-X5E□



Note:
Oil-and vibration-resistant,
vinyl-insulated round cord, 6 dia.,
0.5 dia. x 2 cores; Standard length: 2m
The cord can be extended up to 200 m
in an independent metal conduit.

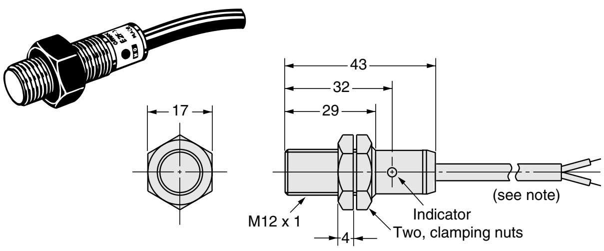
AC 2-wire Models

E2F-X1R5Y□



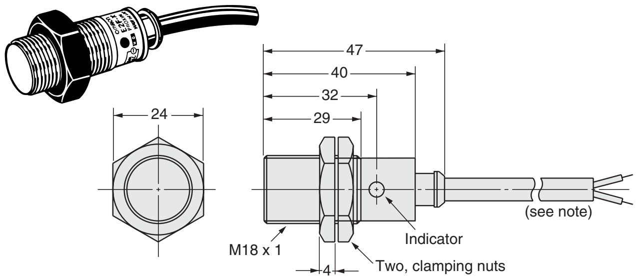
Note:
Vinyl-insulated round cord, 3.5 dia.,
3 cores (0.12 dia. x 13); Standard length: 2m

E2F-X2Y□



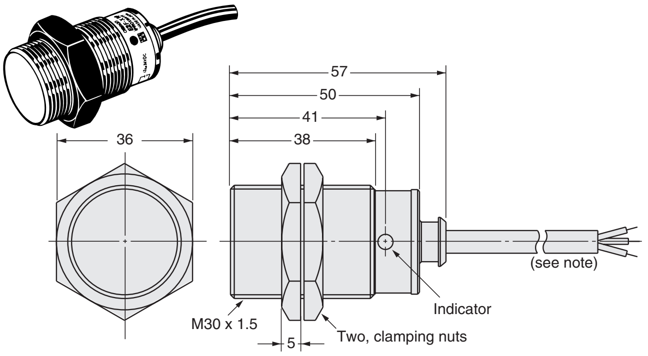
Note:
Oil-and vibration-resistant,
vinyl-insulated round cord, 6 dia.,
0.5 dia. x 2 cores; Standard length: 2m
The cord can be extended up to 200 m
in an independent metal conduit.

E2F-X5Y□



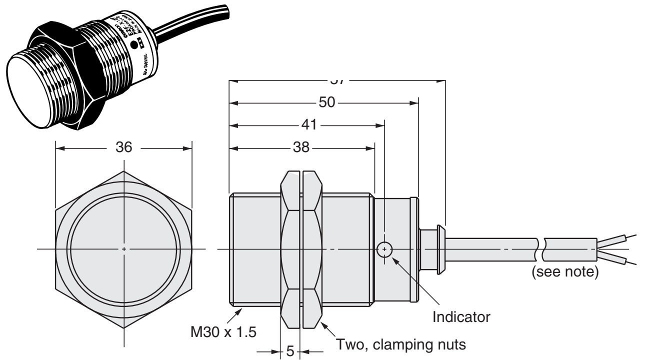
Note:
Oil-and vibration-resistant,
vinyl-insulated round cord, 6 dia.,
0.5 dia. x 2 cores; Standard length: 2m
The cord can be extended up to 200 m
in an independent metal conduit.

E2F-X10E□



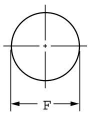
Note:
Oil-and vibration-resistant,
vinyl-insulated round cord, 6 dia.,
0.5 dia. x 3 cores; Standard length: 2m
The cord can be extended up to 200 m
in an independent metal conduit.

E2F-X10Y□



Note:
Oil-and vibration-resistant,
vinyl-insulated round cord, 6 dia.,
0.5 dia. x 2 cores; Standard length: 2m
The cord can be extended up to 200 m
in an independent metal conduit.

Mounting Hole Dimension



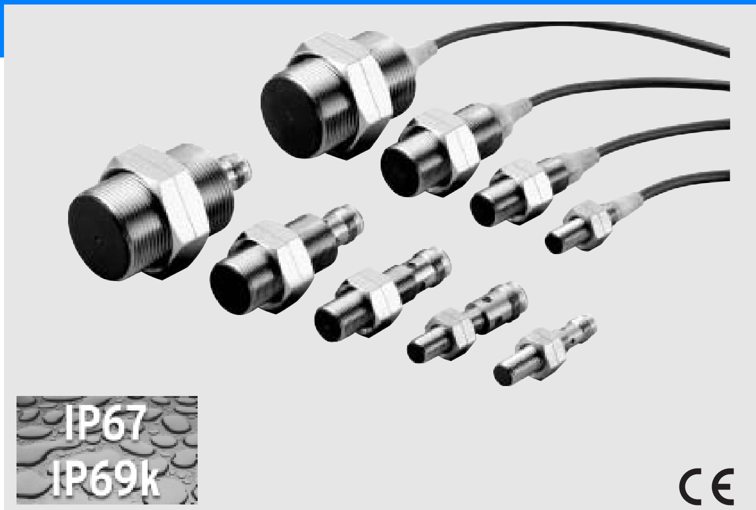
Model	E2F-X1R5□□	E2F-X2□□	E2F-X5□□	E2F-X10□□
F (mm)	8.5-mm dia. $^{+0}$	12.5-mm dia. $^{+0}$	18.5-mm dia. $^{+0}$	30.5-mm dia. $^{+0}$

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D07E-EN-01

Long Distance Cylindrical Proximity Sensor

E2A3



Extra long distance for increased protection and sensing performance

- triple distance proximity sensors for flush mounting requirements.
- designed and tested for extra long life.

Ordering Information

DC 3-wire Models

Size	Type	Sensing distance	Connection	Body material	Thread length	Output	Operation mode: NO	Operation mode: NC
M8	Shielded	3.0mm	Pre-wired	Stainless steel (See note.)	27 (40) mm	PNP	E2A3-S08KS03-WP-B1 2M	E2A3-S08KS03-WP-B2 2M
						NPN	E2A3-S08KS03-WP-C1 2M	E2A3-S08KS03-WP-C2 2M
			M12 connector		27 (44) mm	PNP	E2A3-S08KS03-M1-B1	E2A3-S08KS03-M1-B2
						NPN	E2A3-S08KS03-M1-C1	E2A3-S08KS03-M1-C2
			M8 connector (3-pin)		27 (40) mm	PNP	E2A3-S08KS03-M5-B1	E2A3-S08KS03-M5-B2
						NPN	E2A3-S08KS03-M5-C1	E2A3-S08KS03-M5-C2
M12	Shielded	6.0mm	Pre-wired	Brass	34 (50) mm	PNP	E2A3-M12KS06-WP-B1 2M	E2A3-M12KS06-WP-B2 2M
						NPN	E2A3-M12KS06-WP-C1 2M	E2A3-M12KS06-WP-C2 2M
			M12 connector		34 (49) mm	PNP	E2A3-M12KS06-M1-B1	E2A3-M12KS06-M1-B2
						NPN	E2A3-M12KS06-M1-C1	E2A3-M12KS06-M1-C2
M18	Shielded	11.0mm	Pre-wired	Brass	39 (60) mm	PNP	E2A3-M18KS11-WP-B1 2M	E2A3-M18KS11-WP-B2 2M
						NPN	E2A3-M18KS11-WP-C1 2M	E2A3-M18KS11-WP-C2 2M
			M12 connector		39 (54) mm	PNP	E2A3-M18KS11-M1-B1	E2A3-M18KS11-M1-B2
						NPN	E2A3-M18KS11-M1-C1	E2A3-M18KS11-M1-C2
M30	Shielded	20.0mm	Pre-wired	Brass	44 (65) mm	PNP	E2A3-M30KS20-WP-B1 2M	E2A3-M30KS20-WP-B2 2M
						NPN	E2A3-M30KS20-WP-C1 2M	E2A3-M30KS20-WP-C2 2M
			M12 connector		44 (59) mm	PNP	E2A3-M30KS20-M1-B1	E2A3-M30KS20-M1-B2
						NPN	E2A3-M30KS20-M1-C1	E2A3-M30KS20-M1-C2

Note: Material specifications for stainless steel housing case: 1.4305 (W.-No.), SUS303 (AISI), 2346 (SS).

Connectivity

E2A3 Sensors are available with the following connectors and cable materials:

Pre-wired Models

Standard cable lengths are 2 m and 5 m.
For other cable lengths, please contact your OMRON representative.

Standard cable material: PVC (4-mm dia.) -WP

Connector Models

Standard connectors: M12, M8 (3-pin) -M1, -M5

Model Number Legend

E2A□-□□□□□-□-□□-□□

1 2 3 4 5 6 7 8 9 10 11 12

Example: E2A3-M12KS06-M1-B1 Triple distance, M12, standard barrel, shielded, Sn = 6 mm, M12 connector, PNP-NO
E2A3-S08KS03-WP-B1 2M Triple distance, M8 stainless steel, standard barrel, shielded, Sn = 3 mm, pre-wired PVC cable, PNP-NO, cable length = 2 m

1. Basic name

E2A

2. Sensing technology

Blank: Standard double distance
3: Triple distance

3. Housing shape and material

M: Cylindrical, metric threaded, brass
S: Cylindrical, metric threaded, stainless steel

4. Housing size

08: 8 mm
12: 12 mm
18: 18 mm
30: 30 mm

5. Barrel length

K: Standard length
L: Long body

6. Shield

S: Shielded
N: Non-shielded

7. Sensing distance

Numeral: Sensing distance: e.g., 03 = 3 mm, 11 = 11 mm

8. Kind of connection

WP: Pre-wired, PVC, 4-mm dia.
M1: M12 connector (4-pin) *
M5: M8 connector (3-pin)

9. Power source and output

B: DC, 3-wire, PNP open collector
C: DC, 3-wire, NPN open collector

10. Operation mode

1: Normally open (NO)
2: Normally closed (NC)

11. Specials (e.g., cable material, oscillating frequency)

12. Cable length

Blank: Connector Model
Numeral: Cable length

Specifications

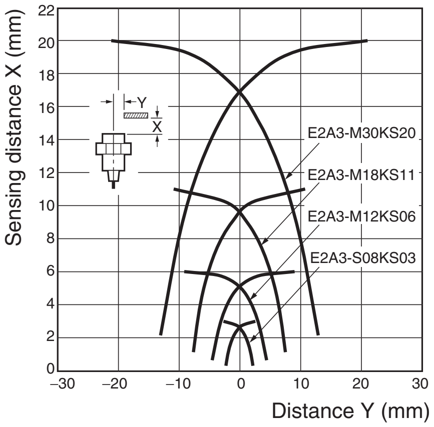
DC 3-wire Models

	Size	M8	M12	M18	M30
	Type	Shielded	Shielded	Shielded	Shielded
	Item	E2A3-S08KS03-□□-B□ E2A3-S08KS03-□□-C□	E2A3-M12KS06-□□-B□ E2A3-M12KS06-□□-C□	E2A3-M18KS11-□□-B□ E2A3-M18KS11-□□-C□	E2A3-M30KS20-□□-B□ E2A3-M30KS20-□□-C□
Sensing distance		3 mm ± 10%	6 mm ± 10%	11 mm ± 10%	20 mm ± 10%
Setting distance	Ambient temp. of -25 to 70°C	0 to 2.1 mm	0 to 4.2 mm	0 to 7.7 mm	0 to 14 mm
	Ambient temp. of -10 to 60°C	0 to 2.4 mm	0 to 4.8 mm	0 to 8.8 mm	0 to 16 mm
Differential travel		20% max. of sensing distance			
Target		Ferrous metal (The sensing distance decreases with non-ferrous metal.)			
Standard sensing object		9 × 9 × 1 mm	18 × 18 × 1 mm	33 × 33 × 1 mm	60 × 60 × 1 mm
Response frequency (See note 1.)		700 Hz	350 Hz	250 Hz	80 Hz
Power supply voltage (operating voltage range)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)			
Current consumption		10 mA max.			
Output type		-B models: PNP open collector -C models: NPN open collector			
Control output	Load current	200 mA max. (32 VDC max.)			
	Residual voltage	2 V max. (under load current of 200 mA with cable length of 2 m)			
Indicator		Operation indicator (Yellow LED)			
Operation mode		-B1/-C1 models: NO -B2/-C2 models: NC For details, refer to the timing charts.			
Protection circuits		Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection	Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection		
Ambient air temperature		Operating: -25°C to 70°C, Storage: -25°C to 70°C			
Temperature influence		±20% max. of sensing distance at 23°C within temperature range of -25°C to 70°C -10% to +20% of sensing distance at 23°C within temperature range of -10°C to 60°C			
Ambient humidity		Operating: 35% to 95%, Storage: 35% to 95%			
Voltage influence		±1% max. of sensing distance in rated voltage range ±15%			
Insulation resistance		50 MΩ min. (at 500 VDC) between current-carrying parts and case			
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current-carrying parts and case			
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions			
Shock resistance		500 m/s², 10 times each in X, Y, and Z directions	1,000 m/s², 10 times each in X, Y and Z directions		
Standards and listings		IP67 after IEC 60529 IP69K after DIN 40050 EMC after EN60947-5-2 UL (CSA) E196555 (See note 2.)			
Connection method		-WP models: Pre-wired Models (4-mm dia. PVC cable with length of 2 m) -M1 models: M12 4-pin Connector Models -M5 models: M8 3-pin Connector Models			
Weight (packed state)	Pre-wired Models	Approx. 65 g	Approx. 85 g	Approx. 160 g	Approx. 280 g
	Connector Models	M12 Connector Models: Approx. 20 g	Approx. 35 g	Approx. 70 g	Approx. 200 g
Material	Case	Stainless steel	Brass-nickel plated		
	Sensing surface	PBT			
	Cable	PVC			
	Clamping nut	Stainless steel	Brass-nickel plated		

Note 1. The response frequency is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object length between sensing objects, and a set distance of half the sensing distance.
2. UL (CSA) [E196555]: Use class 2 circuit only.

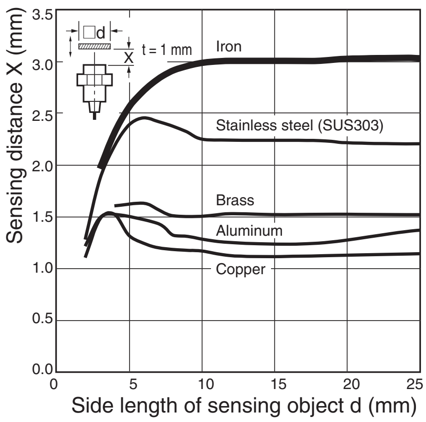
Engineering Data

Operating Range (Typical)

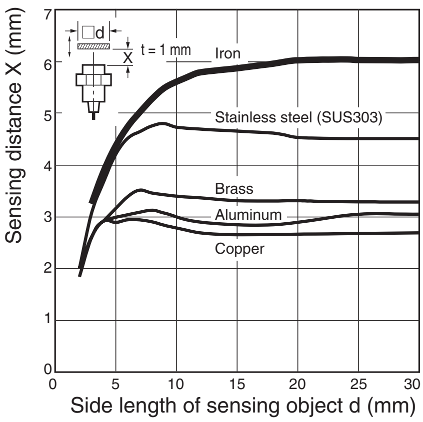


Influence of Sensing Object Size and Materials

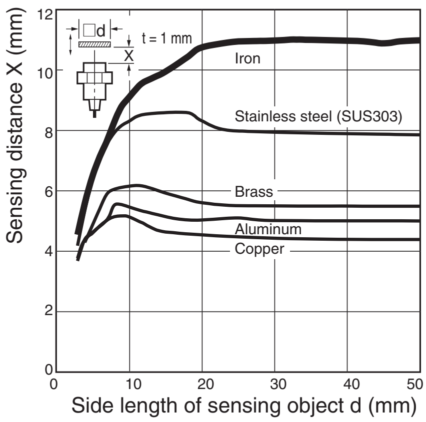
E2A3-S08KS03



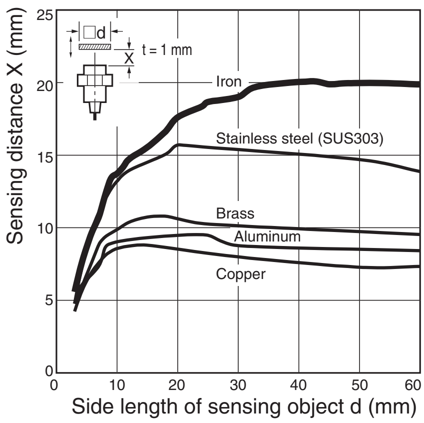
E2A3-M12KS06



E2A3-M18KS11



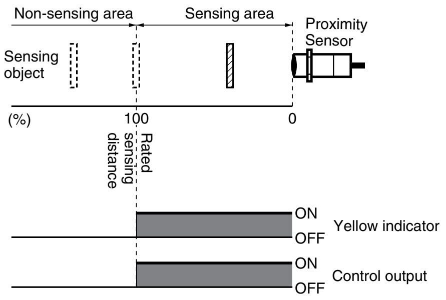
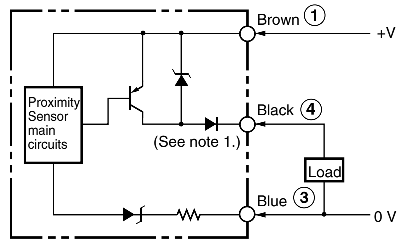
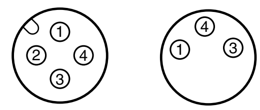
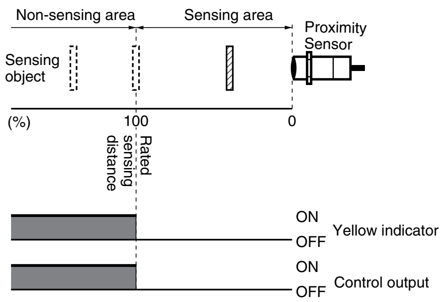
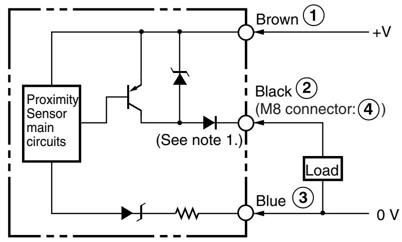
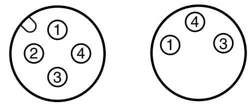
E2A3-M30KS20



Operation

DC 3-wire Models

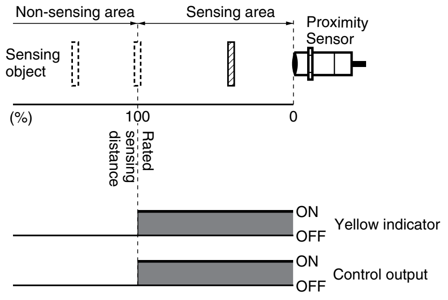
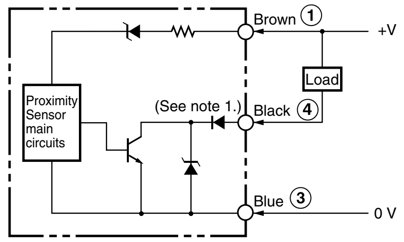
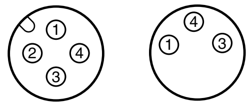
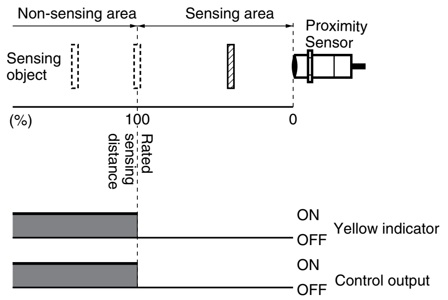
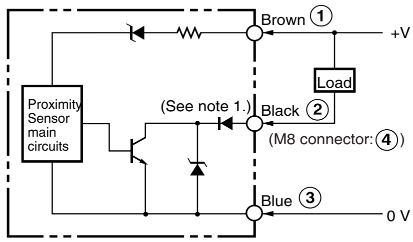
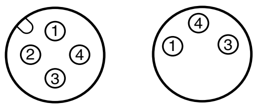
PNP Output

Operation mode	Model	Timing chart	Output circuit
NO	E2A3-□-□-B1		 **Note 1:** With M8 Size Models, there is no output reverse polarity protection diode. M12 Connector Pin Arrangement (See note 2.) M8 Connector (3-pin) Pin Arrangement  **Note 2:** Terminal 2 of the M12 connector is not used.
NC	E2A3-□-□-B2		 **Note 1:** With M8 Size Models, there is no output reverse polarity protection diode. M12 Connector Pin Arrangement (See note 2.) M8 Connector (3-pin) Pin Arrangement  **Note 2:** Terminal 4 of the M12 connector is not used.

E2A3

DC 3-wire Models

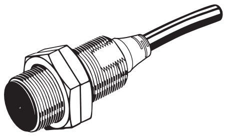
NPN Output

Operation mode	Model	Timing chart	Output circuit
NO	E2A3-□-□-C1		 **Note 1:** With M8 Size Models, there is no output reverse polarity protection diode. M12 Connector Pin Arrangement (See note 2.) M8 Connector (3-pin) Pin Arrangement  **Note 2:** Terminal 2 of the M12 connector is not used.
NC	E2A3-□-□-C2		 **Note 1:** With M8 Size Models, there is no output reverse polarity protection diode. M12 Connector Pin Arrangement (See note 2.) M8 Connector (3-pin) Pin Arrangement  **Note 2:** Terminal 4 of the M12 connector is not used.

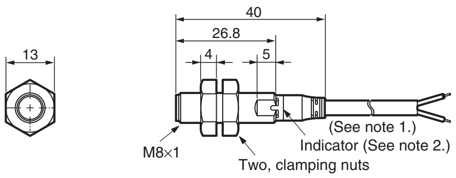
Dimensions

Note: All units are in millimeters unless otherwise indicated.

Pre-wired Models



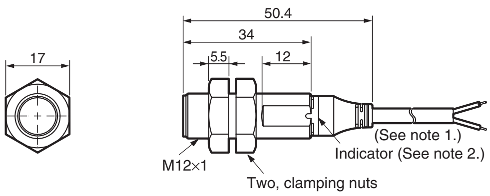
E2A3-S08KS03-WP-□□



Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.3 mm²; Insulator diameter: 1.3 mm), Standard length: 2 m

2. Operation indicator (yellow)

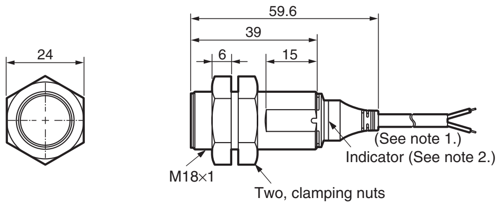
E2A3-M12KS06-WP-□□



Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.3 mm²; Insulator diameter: 1.3 mm), Standard length: 2 m

2. Operation indicator (yellow)

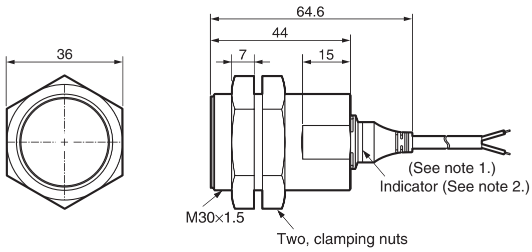
E2A3-M18KS11-WP-□□



Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.3 mm²; Insulator diameter: 1.3 mm), Standard length: 2 m

2. Operation indicator (yellow)

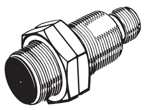
E2A3-M30KS20-WP-□□



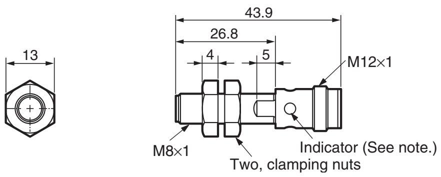
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.3 mm²; Insulator diameter: 1.3 mm), Standard length: 2 m

2. Operation indicator (yellow)

M12 Connector Models

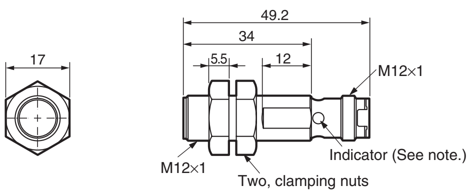


E2A3-S08KS03-M1-□□



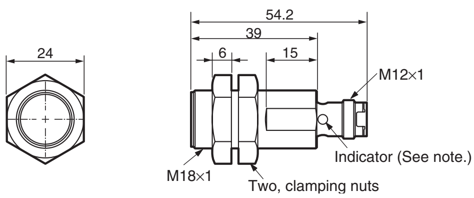
Note: Operation indicator (yellow LED, 4×90°)

E2A3-M12KS06-M1-□□



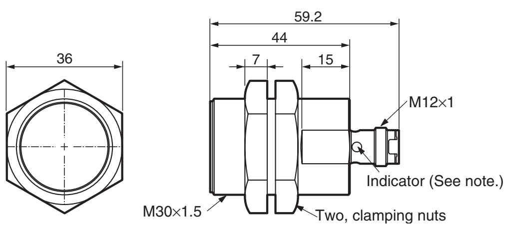
Note: Operation indicator (yellow LED, 4×90°)

E2A3-M18KS11-M1-□□



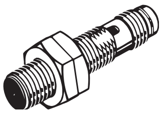
Note: Operation indicator (yellow LED, 4×90°)

E2A3-M30KS20-M1-□□

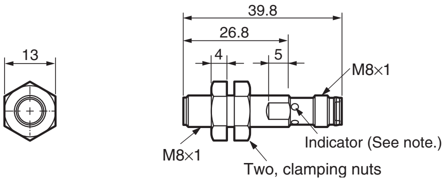


Note: Operation indicator (yellow LED, 4×90°)

M8 Connector Models

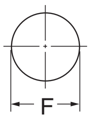


E2A3-S08KS03-M5-□□



Note: Operation indicator (yellow LED, 4×90°)

Mounting Hole Cutout Dimensions



External diameter of Proximity Sensor	Dimension F (mm)
M8	8.5 dia. $^{+0.5}_{0}$
M12	12.5 dia. $^{+0.5}_{0}$
M18	18.5 dia. $^{+0.5}_{0}$
M30	30.5 dia. $^{+0.5}_{0}$

Safety Precautions

Precautions for Safe Use

⚠ WARNING

This product is not designed or rated for ensuring safety of persons.
Do not it for such purposes.

Power Supply

Do not impose an excessive voltage on the E2A3, otherwise it may be damaged. Do not impose AC current (100 to 240 VAC) on any DC Model, otherwise it may be damaged.

Load Short-circuit

Do not short-circuit the load, or the E2A3 may be damaged.

The E2A3's short-circuit protection function will be valid if the polarity of the supply voltage is correct and within the rated voltage range.

Wiring

Be sure to wire the E2A3 and load correctly, otherwise it may be damaged.

Connection with No Load

Be sure to insert a load when wiring. Make sure to connect a proper load to the E2A3 during operation, otherwise it may damage internal elements.

Do not expose the product to flammable or explosive gases.

Do not disassemble, repair, or modify the product.

Precautions for Correct Use

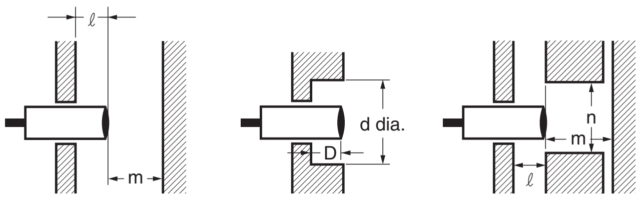
Designing

Power Reset Time

The Proximity Sensor is ready to operate within 100 ms after power is supplied. If separate power supplies are connected to the Proximity Sensor and load, be sure to supply power to the Proximity Sensor before supplying power to the load.

Effects of Surrounding Metal

When mounting the E2A3 within a metal panel, ensure that the clearances given in the following tables are maintained.



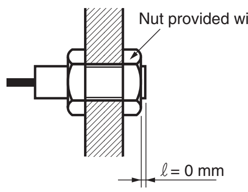
(Unit: mm)

Model	Dimension	M8		M12	
	Material of surrounding metal	Ferrous metal	Non-ferrous metal	Ferrous metal	Non-ferrous metal
E2A3 Shielded	l	0.5 (*)	2 (*)	2 (*)	1 (*)
	m	9		18	
	d	24		36	
	D	0.5	2	2	1
	n	24		36	

(Unit: mm)

Model	Dimension	M18		M30	
	Material of surrounding metal	Ferrous metal	Non-ferrous metal	Ferrous metal	Non-ferrous metal
E2A3 Shielded	l	4 (*)	2.5 (*)	6 (*)	4 (*)
	m	33		60	
	d	54		90	
	D	4	2.5	6	4
	n	54		90	

* Using the nuts provided with the E2A3 allows mounting in the way shown below.



Power OFF

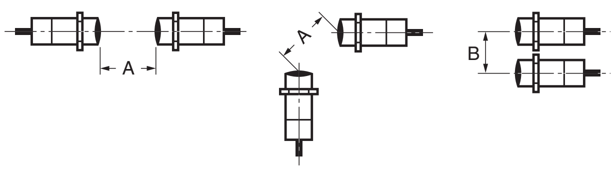
The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended that the load be turned OFF before turning OFF the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Mutual Interference

When installing two or more Sensors face-to-face or side-by-side, ensure that the minimum distances given in the following table are maintained.



(Unit: mm)

Type	Dimension	M8	M12	M18	M30
Shielded	A	25	35	70	110
	B	20	25	45	70

Wiring

High-tension Lines

Wiring through Metal Conduit**:**
If there is a power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunctioning.

Cable Extension

The standard cable length is less than 200 m.

The tractive force is 50 N.

Mounting

The Proximity Sensor must not be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistance.

Do not tighten the nut with excessive force. A washer must be used with the nut.

Type		Torque
M8	Stainless Steel Model	9 N·m
	Brass Model	---
M12		20 N·m
M18		60 N·m
M30		150 N·m

Maintenance and Inspection

Periodically perform the following checks to ensure stable operation of the Proximity Sensor over a long period of time.

1. Check for mounting position, dislocation, looseness, or distortion of the Proximity Sensor and sensing objects.
2. Check for loose wiring and connections, improper contacts, and line breakage.
3. Check for attachment or accumulation of metal powder or dust.
4. Check for abnormal temperature conditions and other environmental conditions.
5. Check for proper lighting of indicators (for models with a set indicator).

Never attempt to disassemble or repair the Sensor.

Environment

Water Resistivity

The Proximity Sensors are tested intensively on water resistance, but to ensure maximum performance and life expectancy, avoid immersion in water and provide protection from rain or snow.

Operating Environment

Store and operate the Proximity Sensor only within the given specifications.

Inrush Current

A load that has a large inrush current (e.g., a lamp or motor) will damage the Proximity Sensor. Connect the load to the Proximity Sensor through a relay.

<SUITABILITY FOR USE>

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used.

<CHANGE IN SPECIFICATIONS>

Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

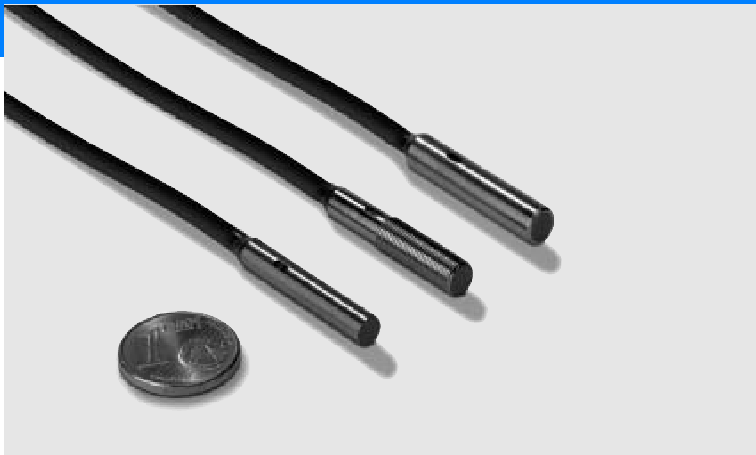
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Miniature Cylindrical Proximity Sensor

E2E

High performance in small sizes

- pre-wired and M8 connector models
- 4 mm, 5.4 mm and M5 sizes
- response frequency up to 3 kHz



Ordering Information

Size		Sensing Distance	Connection	Housing Material	Output	Operation mode NO	Operation mode NC
dia 4 mm	shielded	0.8mm	pre-wired	brass	PNP	E2E-CR8C1	E2E-CR8C2
					NPN	E2E-CR8C1	E2E-CR8C2
			M8 connector		PNP	E2E-CR8C1-M5	E2E-CR8C2-M5
					NPN	E2E-CR8C1-M5	E2E-CR8C2-M5
M5		1mm	pre-wired		PNP	E2E-X1B1	E2E-X1B2
					NPN	E2E-X1C1	E2E-X1C2
			M8 connector		PNP	E2E-X1B1-M5	E2E-X1B2-M5
					NPN	E2E-X1C1-M5	E2E-X1C2-M5
dia 5.4 mm			pre-wired		PNP	E2E-C1B1	E2E-C1B2
					NPN	E2E-C1C1	E2E-C1C2

E2E-C□C□/B□, E2E-X1C□/B□ DC 3-wire Models

		Size	4 dia.	M5	5.4 dia.
		Type	Shielded		
Item			E2E-CR8C□/B□	E2E-X1C□/B□	E2E-C1C□/B□
Sensing distance			0.8 mm ±15%	1 mm ±15%	
Set distance			0 to 0.5 mm	0 to 0.7 mm	
Differential travel			15% max. of sensing distance		
Sensing object			Ferrous metal (The sensing distance decreases with non-ferrous metal, refer to *Engineering Data*.)		
Standard sensing object			Iron: 5 x 5 x 1 mm		
Response speed (See note.)			3 kHz		
Power supply voltage (operating voltage range)			12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.		
Current consumption			17 mA max.		
Control output	**Load current**		Open-collector output 100 mA max. (at 30 VDC max.)		
	Residual voltage		2 V max. (Load current: 100 mA , Cable length: 2 m)		
Indicator			Operation indicator (red LED)		
Operation mode (with sensing object approaching)			C1/-B1 Models:NO C2/-B2 Models:NC For details, refer to *Timing Charts*.		
Protection circuits			Power supply reverse polarity protection, surge suppressor		
Ambient temperature			Operating/Storage: –25° C to 70° C (with no icing or condensation)		
Ambient humidity			Operating/Storage: 35% to 95%		
Temperature influence			±15% max. of sensing distance at 23° C in the temperature range of –25° C to 70° C		
Voltage influence			±2.5% max. of sensing distance in the rated voltage range ±15%		
Insulation resistance			50 MΩ min. (at 500 VDC) between current-carrying parts and case		
Dielectric strength			500 VAC at 50/60 Hz for 1 min between current-carrying parts and case		
Vibration resistance			10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions		

	Size	4 dia.	M5	5.4 dia.
	Type	Shielded		
Item		E2E-CR8C□/B□	E2E-X1C□/B□	E2E-C1C□/B□
Shock resistance		500 m/s^2 10 times each in X, Y, and Z directions		
Degree of protection		IEC 60529 IP67 (Pre-wired models: JEM standard IP67g (waterproof, oil-proof))		
Connection method		Pre-wired models (standard length 2 m), connector models		
Weight (packed state)	Pre-wired models	Approx. 60 g		
	Connector models	Approx. 12 g	Approx. 15 g	---
Material	Case	Stainless steel (SUS303)	Brass-nickel plated	
	Sensing surface	Heat-resistant ABS		
	Clamping nuts	Brass-nickel plated		
	Toothed washer	Iron-zinc plated		
Accessories		Instruction manual		

Note: The response speed is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.

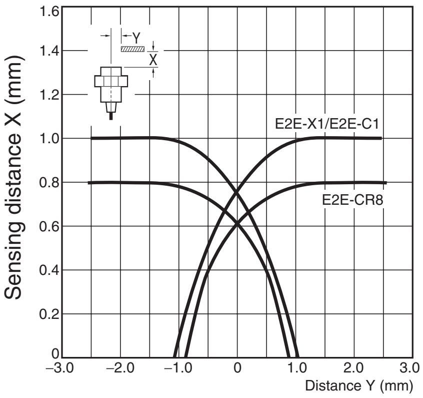
Engineering Data

E2E

Operating Range (Typical)

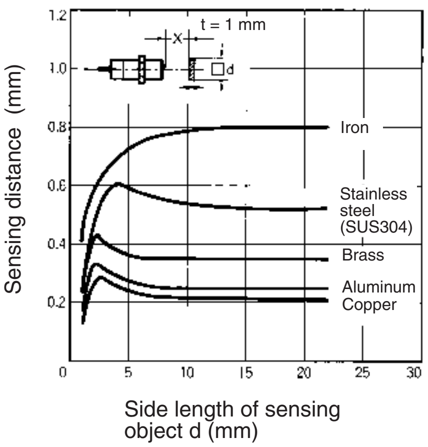
Shielded Models

E2E-C□C□/B□
E2E-X□C□/B□

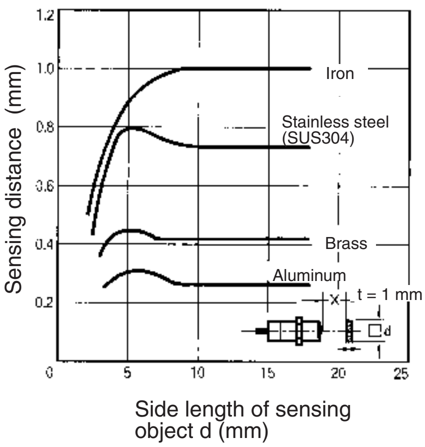


Sensing Distance vs. Sensing Object (Typical)

E2E-CR8□□



E2E-X1□□
E2E-C1□□

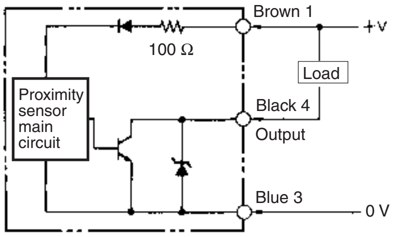


Output Circuits and Timing Charts

Output Circuits

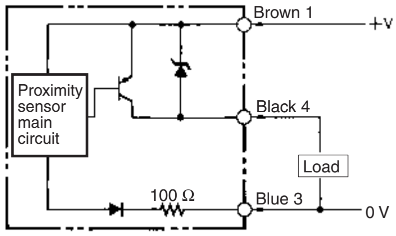
DC 3-wire Models

E2E-C/X□C□
NPN Open-collector Output



* Pin 4 is an NO contact, and pin 2 is an NC contact.

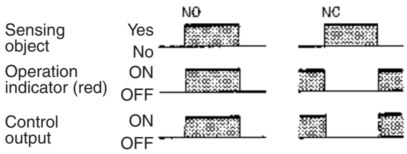
E2E-C/X□B□
PNP Open-collector Output



* Pin 4 is an NO contact, and pin 2 is an NC contact.

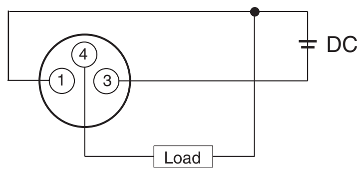
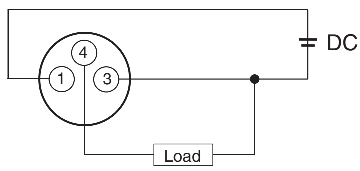
Timing Charts

E2E-C/X□C□/B□
NPN/PNP Open-collector Output



Pin Arrangement

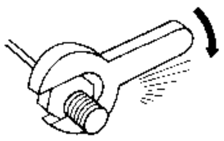
E2E-CR8C□/CR8B□/**X1C□**/**X1B□**-M5 DC 3-wire Models

Connector	Operation mode	Applicable models	Pin arrangement
M8-3pin	NO/NC	E2E-CR8C□-M5 E2E-X1C□-M5	
	NO/NC	E2E-CR8B□-M5 E2E-X1B□-M5	

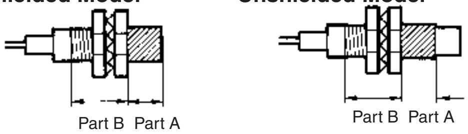
Precautions

Mounting

Do not tighten the nut with excessive force. A washer must be used with the nut.



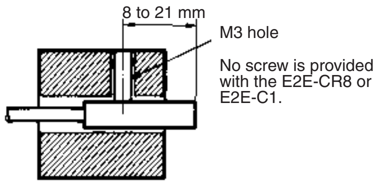
Shielded Model **Unshielded Model**



Note: The table below shows the tightening torques for part A and part B nuts. In the previous examples, the nut is on the sensor head side (part B) and hence the tightening torque for part B applies. If this nut is in part A, the tightening torque for part A applies instead.

Model	Part A		Part B
	Length	Torque	Torque
M5	1 N·m		

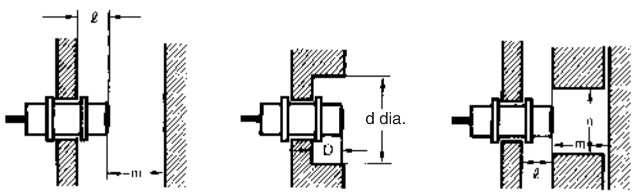
Refer to the following to mount the E2E-CR8 and E2E-C1 non-screw models.



Tighten the screw to a torque of 0.2 N·m maximum to secure the E2E-CR8 and a torque of 0.4 N·m maximum to secure the E2E-C1.

Effects of Surrounding Metal

When mounting the E2E within a metal panel, ensure that the clearances given in the following table are maintained. Failure to maintain these distances may cause deterioration in the performance of the sensor.



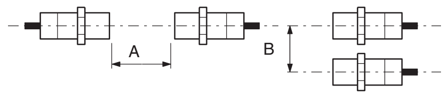
Model		Item	4 dia.	M5	5.4 dia.
E2E-X□C□ E2E-X□B□ E2E-C□C□ E2E-C□B□ DC 3-wire	Shielded	l	0 mm	0 mm	0 mm
		d	4 mm	5 mm	5.4 mm
		D	0 mm	0 mm	0 mm
		m	2.4 mm	3 mm	3 mm
		n	6 mm	8 mm	8 mm

Relationship between Sizes and Models

Model		Model No.
4 dia.	Shielded	E2E-CR8C□ E2E-CR8B□
M5		E2E-X1C□ E2E-X1B□
5.4 dia.		E2E-C1C□ E2E-C1B□

Mutual Interference

When installing two or more Sensors face to face or side by side, ensure that the minimum distances given in the following table are maintained.



Model		Item	4 dia.	M5	5.4 dia.
E2E-X□B□ E2E-X□C□ E2E-C□B□ E2E-C□C□ DC 3-wire	Shielded	A	20 mm		
		B	15 mm		

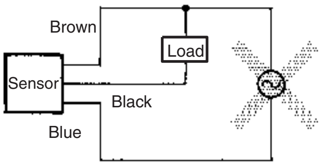
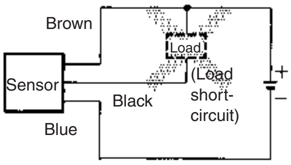
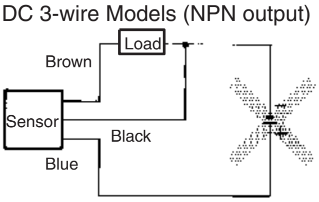
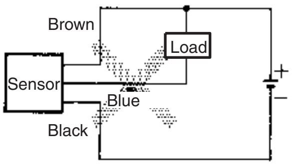
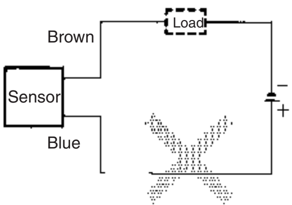
Note: Values in parentheses apply to Sensors operating at different frequencies.

⚠ WARNING

This product is not designed or rated for ensuring safety of persons.
Do not use it for such purposes.

Precautions for Safe Use

The colors in parentheses are previous wire colors.

Item	Examples
Power supply Do not impose an excessive voltage on the E2E, otherwise it may explode or burn. Do not impose 100 VAC on any E2E DC Model, otherwise it may explode or burn.	DC 3-wire Models  Incorrect
Load short-circuit Do not short-circuit the load, or the E2E may explode or burn. The E2E's short-circuit protection function is valid if the polarity of the supply voltage imposed is correct and within the rated voltage range.	DC 3-wire Models (NPN output)  Incorrect
Wiring Be sure to wire the E2E and load correctly, otherwise it may explode or burn.	DC 3-wire Models (NPN output)  Incorrect  Incorrect
Connection with no load Make sure to connect a proper load to the E2E in operation, otherwise it may explode or burn.	DC 3-wire Models  Incorrect

Precautions for Correct Use

Installation

Power Reset Time

The Proximity Sensor is ready to operate within 100 ms after power is supplied. If power supplies are connected to the Proximity Sensor and load respectively, be sure to supply power to the Proximity Sensor before supplying power to the load.

Power OFF

The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended to turn OFF the load before turning OFF the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Sensing Object

Metal Coating:
The sensing distances of the Proximity Sensor vary with the metal coating on sensing objects.

Wiring

High-tension Lines

Wiring through Metal Conduit
If there is a power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunctioning.

Cable Tractive Force

Do not pull on cables with tractive forces exceeding the following.

Diameter	Tractive force
4 dia. max.	30 N max.
4 dia. min.	50 N max.

Mounting

The Proximity Sensor must not be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistivity.

Environment

Water Resistivity

Do not use the Proximity Sensor underwater, outdoors, or in the rain.

Operating Environment

Be sure to use the Proximity Sensor within its operating ambient temperature range and do not use the Proximity Sensor outdoors so that its reliability and life expectancy can be maintained. Although the Proximity Sensor is water resistive, a cover to protect the Proximity Sensor from water or water soluble machining oil is recommended so that its reliability and life expectancy can be maintained.

Do not use the Proximity Sensor in an environment with chemical gas (e.g., strong alkaline or acid gasses including nitric, chromic, and concentrated sulfuric acid gases).

Connection to a PLC

Required Conditions

Connection to a PLC is possible if the specifications of the PLC and the Proximity Sensor satisfy the following conditions. (The meanings of the symbols are given below.)

1. The ON voltage of the PLC and the residual voltage of the Proximity Sensor must satisfy the following.
   $V_{ON} \leq V_{CC} - V_R$
2. The OFF current of the PLC and the leakage current of the Proximity Sensor must satisfy the following.
   $I_{OFF} \geq I_{leak}$
   (If the OFF current is not listed in the specifications, take it to be 1.3 mA.)
3. The ON current of the PLC and the control output (I_{OUT}) of the Proximity Sensor must satisfy the following.
   $I_{OUT(min)} \leq I_{ON} \leq I_{OUT(max)}$
   The ON current of the PLC will vary, however, with the power supply voltage and the input impedance used as shown in the following equation.
   $I_{ON} = (V_{CC} - V_R - V_{PC})/R_{IN}$

Example

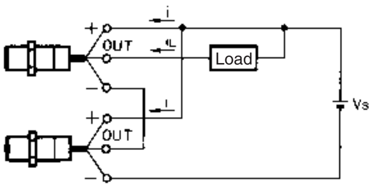
In this example, the above conditions are checked for when the PLC model is the C200H-ID212, the Proximity Sensor model is the E2E-X7D1-N, and the power supply voltage is 24 V.

1. V_{ON} (14.4 V) $\leq V_{CC}$ (20.4 V) – V_R (3 V) = 17.4 V: OK
2. I_{OFF} (1.3 mA) $\geq I_{leak}$ (0.8 mA): OK
3. I_{ON} = [V_{CC} (20.4 V) – V_R (3 V) – V_{PC} (4 V)]/R_{IN} (3 kΩ)
   ≈ 4.5 mA
   Therefore,
   $I_{OUT(min)}$ (3 mA) $\leq I_{ON}$ (4.5 mA): OK

V_{ON}: ON voltage of PLC (14.4 V)
I_{ON}: ON current of PLC (typ. 7 mA)
I_{OFF}: OFF current of PLC (1.3 mA)
R_{IN}: Input impedance of PLC (3 kΩ)
V_{PC}: Internal residual voltage of PLC (4 V)

V_R: Output residual voltage of Proximity Sensor (3 V)
I_{leak}: Leakage current of Proximity Sensor (0.8 mA)
I_{OUT}: Control output of Proximity Sensor (3 to 100 mA)
V_{CC}: Power supply voltage (PLC: 20.4 to 26.4 V)
Values in parentheses are for the following PLC model and Proximity Sensor model.
PLC: C200H-ID212
Proximity Sensor: E2E-X7D1-N

Note: please refer to complete E2E/E2E2 datasheet for details on E2E-X7D1-N

Model	Connection type	Method	Description
DC 3-wire	AND (serial connection)	**Correct** 	The Sensors connected together must satisfy the following conditions. i_L + (N –1) x i $\leq$ Upper-limit of control output of each Sensor V_S – N x $V_R \geq$ Load operating voltage N: No. of Sensors V_R: Residual voltage of each Sensor V_S: Supply voltage i: Current consumption of the Sensor i_L: Load current If the MY Relay, which operates at 24 VDC, is used as a load for example, a maximum of two Proximity Sensors can be connected to the load.

Dimensions

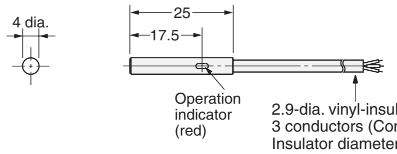
Note: All units are in millimeters unless otherwise indicated.

E2E

Model			DC 3-wire	
			Model No.	**Figure No.**
Pre-wired	**Shielded**	**4 dia.**	E2E-CR8□□	1
		M5	E2E-X1□□	3
		5.4 dia.	E2E-C1□□	2
Connector (M8-3 pin)	**Shielded**	**4 dia.**	E2E-CR8□□-M5	35
		M5	E2E-X1□□-M5	36

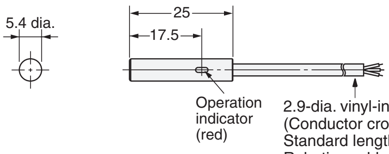
Pre-wired Models (Shielded)

Fig. 1 :   E2E-CR8□□



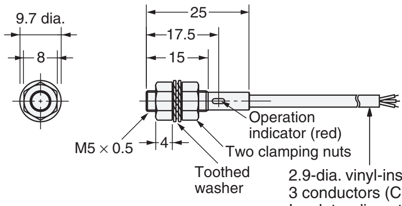
2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm², Insulator diameter: 0.9 mm),
Standard length: 2 m
Robotics cable Models: 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.05 mm),
Standard length: 2 m
The cable can be exteded up to 100 m (separate metal conduit).

Fig. 2 :   E2E-C1□□



2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm², Insulator diameter: 0.9 mm),
Standard length: 2 m
Robotics cable Models: 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.05 mm),
Standard length: 2 m
The cable can be exteded up to 100 m (separate metal conduit).

Fig. 3 :   E2E-X1□□



2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.14 mm², Insulator diameter: 0.9 mm),
Standard length: 2 m
Robotics cable Models: 2.9-dia. vinyl-insulated round cable with 3 conductors (Conductor cross section: 0.15 mm², Insulator diameter: 1.05 mm),
Standard length: 2 m
The cable can be exteded up to 100 m (separate metal conduit).

M8 (3 pin) Connector Models (Shielded)

Fig. 35 :   E2E-CR8□□-M5

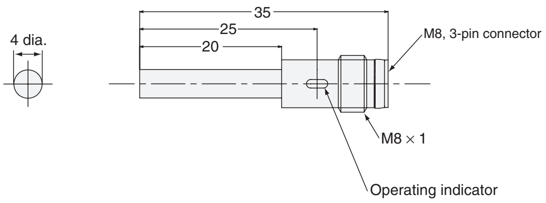
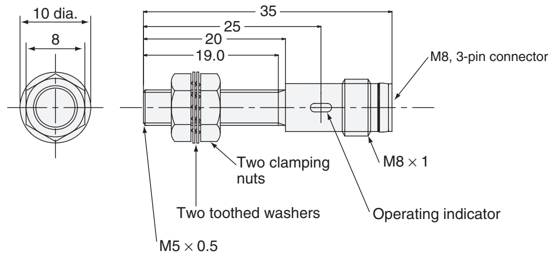
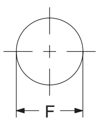


Fig. 36 :   E2E-X1□□-M5



Mounting Holes



Dimensions	M4	M5	5.4 dia.
F (mm)	$4.2^{+0.5}_{0}$ dia.	$5.5^{+0.5}_{0}$ dia.	$5.7^{+0.5}_{0}$ dia.

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Application Considerations

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NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D11E-EN-02

In the interest of product improvement, specifications are subject to change without notice.

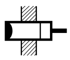
Standard Flat Inductive Proximity Sensors

TL-W

- Front and side facing surface
- IP67
- DC 2-wire and DC 3-wire models

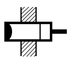
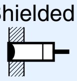
Ordering Information

DC 2-wire Models

Shape	Sensing distance	Model Output and operating status NO	NC
	5mm	**TL-W5MD1***1	**TL-W5MD2***1

*1. Models with different response frequency are available. These model numbers take the form TL-W5MD□5 (e.g., TL-W5MD15)

DC 3-wire Models

Shape	Sensing distance	Output specifications	Model Output and operating status PNP-NO	PNP-NC	NPN-NO	NPN-NC
	1.5mm	DC 3-wire	**TL-W1R5MB1**	---	**TL-W1R5MC1***1	---
	3mm		**TL-W3MB1**	**TL-W3MB2**	**TL-W3MC1***1	**TL-W3MC2**
	5mm		**TL-W5MB1**	**TL-W5MB2**	**TL-W5MC1***1	**TL-W5MC2**
	20mm		---	---	**TL-W20ME1***1	**TL-W20ME2***1
Shielded 	5mm	DC 3-wire	**TL-W5F1**	**TL-W5F2**	**TL-W5E1**	**TL-W5E2**

*1. Models with different response frequency are available. These model numbers take the form TL-W5MD□5 (e.g., TL-W5MD15)

Rating/Performance

DC 2-wire Models

Item Model		TL-W5MD□
Sensing distance		5 mm ±10%
Setting distance		0 to 4 mm
Differential distance		10% max.
Sensing object		Ferrous metal(Sensitivity decreases with non-ferrous metals)
Standard sensing object		Iron, 18 x 18 x 1 mm
Response frequency		0.5 kHz
Rated supply voltage (operating voltage)		12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.
Leakage current		0.8 mA max.
Control output	Switching capacity	3 to 100 mA
	Residual voltage	3.3 V max. (under load current of 100 mA with cable length of 2 m)
Indicator lamp		D1 models: Operation indicator (Red LED), Operation set indicator (Green LED) D2 models: Operation indicator (Red LED)
Operating status (with sensing object approaching)		D1 models: NO D2 models: NC
Protective circuits		Surge absorber, short-circuit protection
Ambient temperature		Operating/Storage: -25°C to 70°C (with no icing or condensation)
Ambient humidity		Operating/Storage: 35% to 95%RH (with no condensation)
Temperature influence		±10% max. of sensing distance at 23°C within a temperature range of -25°C and 70°C
Voltage influence		±2.5% max. of Sensing distance within a rated voltage range ±15%.
Insulation resistance		50 M min. (at 500 VDC) between energized parts and case
Dielectric strength		1,000 VAC for 1 min between energized parts and case
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions
Shock resistance		Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions
Protective structure		IEC60529 IP67
Connection method		Pre-wired models (standard length: 2 m)
Weight (Packed state)		Approx. 45 g
Material	Case	Heat-resistant ABS resin
	Sensing surface	
Accessories		Instruction manual

* The response frequencies for DC switching are average values measured under the condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.

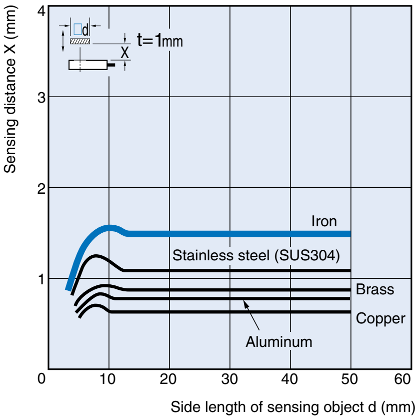
DC 3-wire Models

Item		TL-W1R5M□1	TL-W3M□□	TL-W5M□□	TL-W5E□/F□	TL-W20ME□
Sensing distance		1.5 mm ±10%	3 mm ±10%	5 mm ±10%		20 mm ±10%
Setting distance		0 to 1.2 mm	0 to 2.4 mm	0 to 4 mm		0 to 16 mm
Differential distance		10% max.				1% to 15% of sensing distance
Sensing object		Ferrous metal (refer to Engineering Data for non-ferrous metal on page E-55)				
Standard sensing object		Iron, 8 x 8 x 1 mm	Iron, 12 x 12 x 1 mm	Iron, 18 x 18 x 1 mm		Iron, 50 x 50 x 1 mm
Response frequency		1 kHz min.	600 Hz min.	500 Hz min.	300 Hz min.	40 Hz min.
Power supply (Operating voltage range)		12 to 24 VDC (10 to 30 VDC) ripple (p-p): 10% max.			10 to 30 VDC with a ripple (p-p) of 20% max.	12 to 24 VDC (10 to 30 VDC) ripple (p-p): 10% max.
Current consumption		15 mA max. at 24 VDC (no-load)		10 mA max.	15mA max. at 24 VDC (no-load)	8 mA at 12 VDC, 15 mA at 24 VDC
Control output	Switching capacity	NPN open collector 100 mA max. (30 VDC max.)		NPN open collector 12 VDC 50 mA max. (30 VDC max.) 24 VDC 100 mA max. (30 VDC max.)	200 mA	12 VDC 100mA max., 24 VDC 200 mA max.
	Residual voltage	1 V max. (under load current of 100 mA with cable length of 2 m)		1 V max. (under load current of 50 mA with cable length of 2 m)	2 V max. (under load current of 200 mA with cable length of 2 m)	1 V max. (under load current of 200 mA with cable length of 2 m)
Indicator lamp		Detection indicator (red LED)				
Operating status (with sensing object approaching)		NO	C1 models: NO C2 type: NC		E1 models, F1 models: NO E2 models, F2 models: NC	
Protective circuits		Reverse connection protection, surge absorber				
Ambient temperature		Operating/Storage: -25°C to 70°^C (with no icing or condensation)				
Ambient humidity		Operating/Storage: 35% to 95%RH (with no condensation)				
Temperature influence		±10% max. of sensing distance at 23°C within the temperature range of -25°C and 70°C				
Voltage influence		±2.5% max. of sensing distance within a range of ±10% of rated power supply voltage		±2.5% max. of sensing distance within a range of ±20% of rated power supply voltage	±2.5% max. of sensing distance within a range of ±10% of rated power supply voltage	
Insulation resistance		50 M min. (at 500 VDC) between energized parts and case				
Dielectric strength		1000 VAC 50/60 Hz for 1 min between energized part and case				
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions				
Shock resistance		Destruction: 500 m/s² for 3 times each in X, Y, and Z directions				Destruction: 500 m/s2 for 10 times each in X, Y, and Z directions
Protective structure		IEC60529 IP67				
Connection method		Pre-wired models (standard length: 2 m)				
Weight (Packed state)		30 g		Approx. 45 g	Approx. 70 g	Approx. 180 g
Material	Case	Heat-resistant ABS resin			Diecast aluminum	Heat-resistant ABS resin
	Sensing surface	Heat-resistant ABS resin				
Accessories		Mounting bracket, instruction manual		Instruction manual		

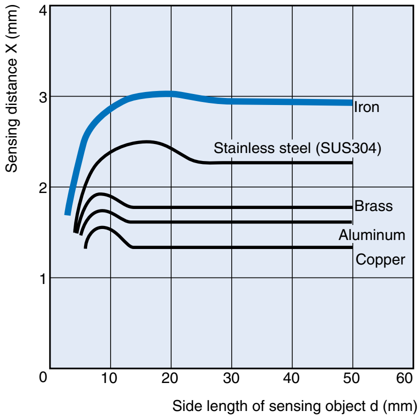
Characteristic data (typical)

Sensing Distance vs. Sensing Object

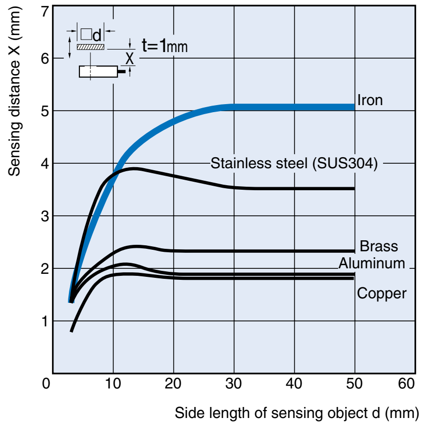
TL-W1R5M□



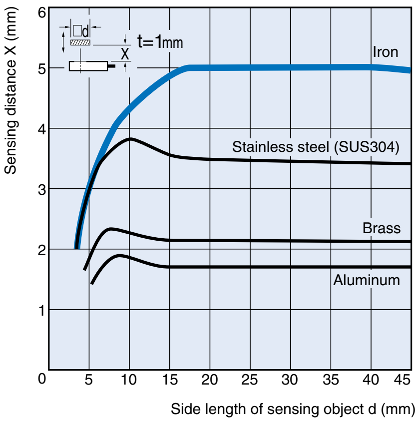
TL-W3M□



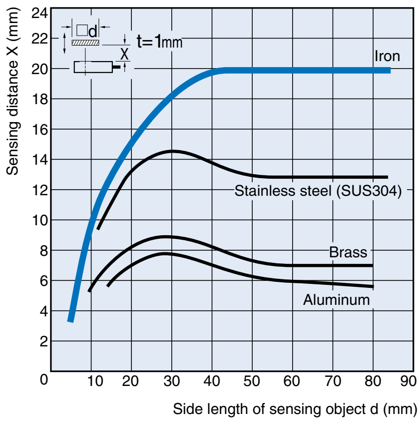
TL-W5MB□/C□



TL-W5E□/-W5F□/-W5MD□

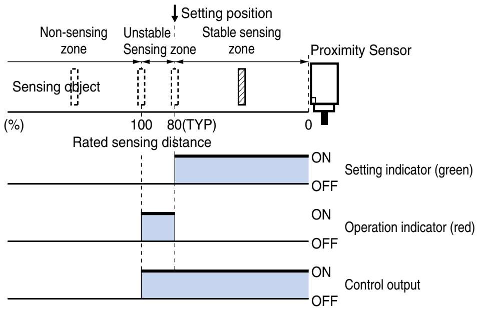
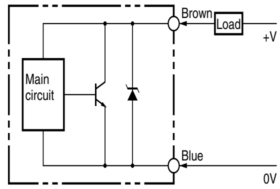


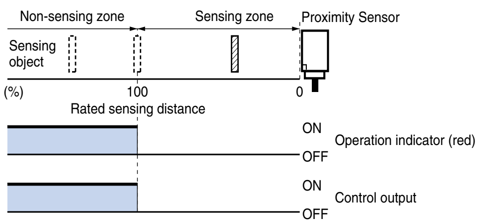
TL-W20□



Output Circuit Diagram

DC 2-wire Models

<table>
<tr><th>Operating status</th><th>Model</th><th>Timing chart</th><th>Output circuit</th></tr>
<tr><td>NO</td><td>TL-W5MD1</td><td>
</td><td rowspan="2">

Note:
The Load can be connected to either the +V and 0-V side.</td></tr>
<tr><td>NC</td><td>TL-W5MD2</td><td>
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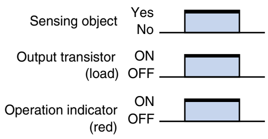
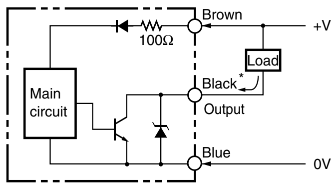
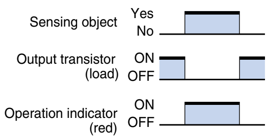
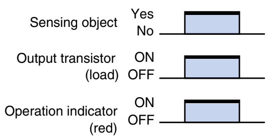
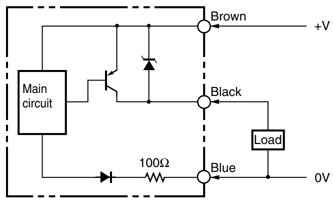
DC 3-wire Models

<table>
<tr><th>Operating status</th><th>Model</th><th>Timing chart</th><th>Output circuit</th></tr>
<tr><td>NO</td><td>TL-W1R5M□1
TL-W3M□1
TL-W5M□1</td><td>
</td><td rowspan="2">

* Maximum load current: 100 mA</td></tr>
<tr><td>NC</td><td>TL-W3M□2
TL-W5MC2</td><td>
</td></tr>
<tr><td>NO</td><td>TL-W1R5B1
TL-W3MB1
TL-W5MB1</td><td>
</td><td rowspan="2">
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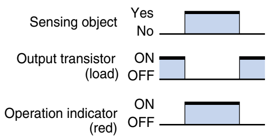
TL-W5MB2</td><td>
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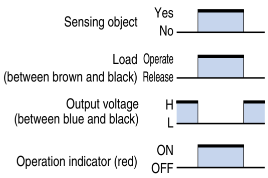
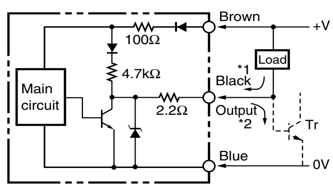
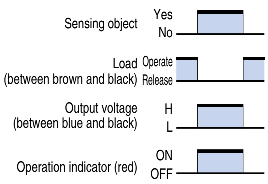
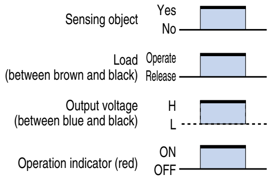
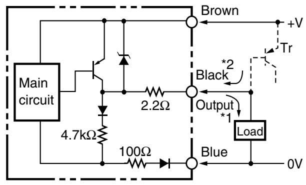
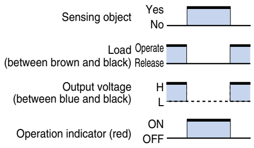
<tr><td>NO</td><td>TL-W5E1
TL-W20ME1</td><td>
</td><td rowspan="2">

* Maximum load current: 100 mA
* 2. Current flows in this direction
if the circuit incorporates the transistor.</td></tr>
<tr><td>NC</td><td>TL-W5E2
TL-W20ME2</td><td>
</td></tr>
</table>

TL-W

Operating status	Model	Timing chart	Output circuit
NO	**TL-W5F1**		 * 1. Maximum load current: 200 mA * 2. Current flows in this direction if the circuit incorporates the transistor.
NC	**TL-W5F2**		

Precautions

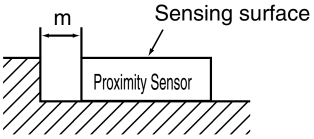
Correct Use

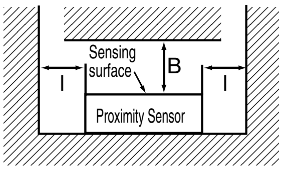
Design

Effects of Surrounding Metal

Provide a minimum distance between the Sensor and the surrounding metal as shown in the table below.

Front Surface Sensing Type (Not exceeding the sensor head height).



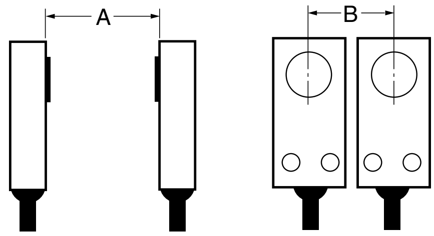


Effects of Surrounding Metal(Unit: mm)

Model / Length	l	m	n
TL-W1R5M□	2	0	8
TL-W3M□	3		12
TL-W5MD□	5		20
TL-W5M□			
TL-W20ME□	25	16	100
TL-W5E□/-W5F□	0	0	20

Mutual Interference

If two or more Sensors are mounted face to face or side by side, keep them separate at the following minimum distance.



Mutual Interference (unit: mm)

Model / Length	A	B
TL-W1R5M□	75 (50)	120(60)
TL-W3MC□	90 (60)	200(100)
TL-W5MD□	120(80)	60(30)
TL-W5MC□		
TL-W20ME□	200(100)	200(100)
TL-W5E□/-W5F□	50	35

Note: The above values in parentheses are applicable when using two sensors with different frequencies.

Installation

- Use M3 flat-head screws to install TL-W1R5M□ and
- TL-W3M□.
- Ensure that the resin cover should be tightened with
- a torque according to the following table.

Model	Tensile strength (torque)
TL-W1R5MC1	0.98 Nm
TL-W3MC□	
TL-W5MD□	
TL-W20M□	1.5 Nm

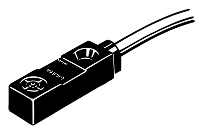
● Adjustment

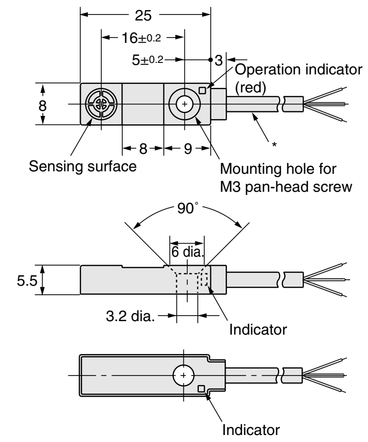
Power ON

Please note that the power injection AND connection generate an error pulse for approximately 1 ms.

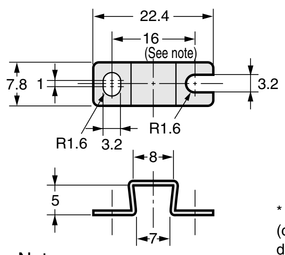
Dimensions (Unit: mm)

TL-W1R5M□1





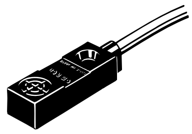
Mounting Bracket (Attachment)

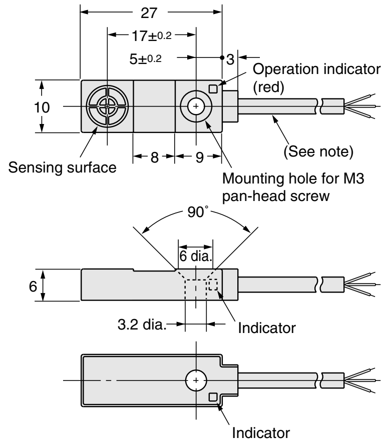


Note:
Mounting dimensions: 17±0.2

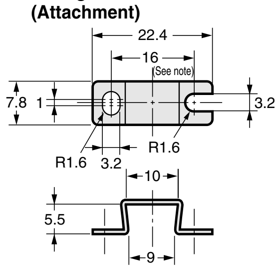
* Vinyl-insulated round cable with three conductors, 2.9 dia. (conductor cross-sectional area: 0.15 mm²; insulation diameter: 0.9 mm); standard length: 2 m

TL-W3M□□





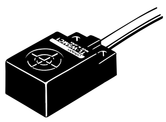
Mounting Bracket (Attachment)

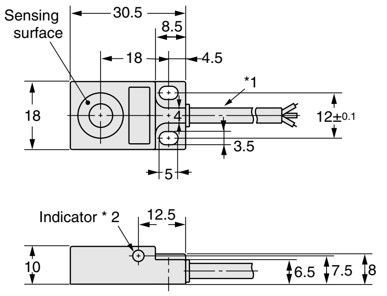


Note: Mounting dimensions: 17±0.2

* Vinyl-insulated round cable with three conductors, 2.9 dia. (conductor cross-sectional area: 0.14 mm²; insulation diameter: 0.9 mm); standard length: 2 m

TL-W5M□□

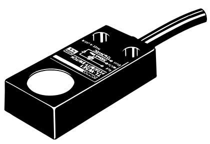


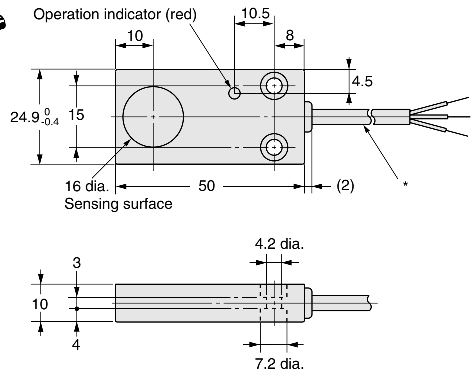


* 1. TL-W5MC1: Vinyl-insulated round cable with three conductors, 4 dia. (conductor cross-sectional area: 0.2 mm²; insulation diameter: 1.2 mm); standard length: 2 m
TL-W5MD□ : Vinyl-insulated round cable with two conductors, 4 dia. (conductor cross-sectional area: 0.3 mm²; insulation diameter: 1.3 mm); standard length: 2 m

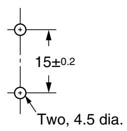
* 2. C type: Operation indicator (red)
D type: Operation indicator (red), Setting indicator (green)

TL-W5E□
TL-W5F□



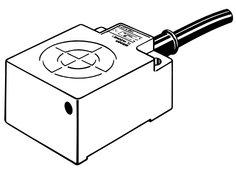


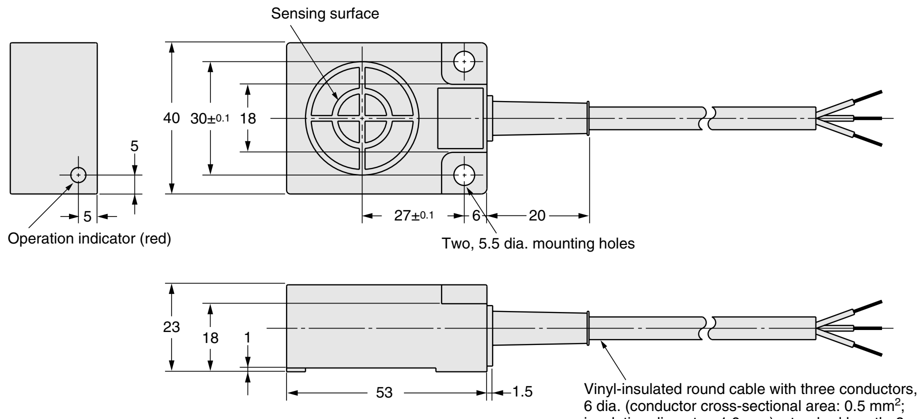
Mounting Holes



* Vinyl-insulated round cable with three conductors, 4 dia. (conductor cross-sectional area: 0.2mm²; insulation diameter: 1.2 mm); standard length: 2 m

TL-W20ME□





Vinyl-insulated round cable with three conductors, 6 dia. (conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm); standard length: 2 m

Miniature Square Inductive Proximity Sensor

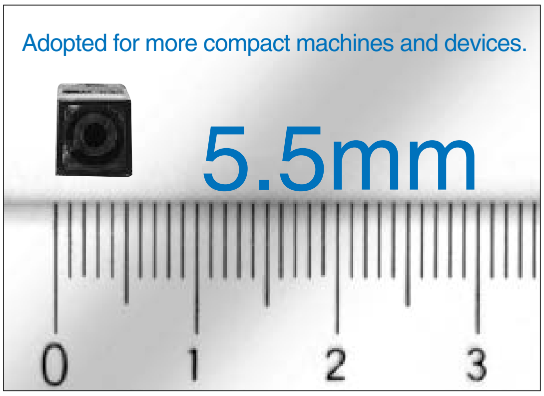
E2S

- Miniature housing with long sensing ranges
- Front ans side facing sensing surfaces

Features

5.5 mm Ultra small housing

The 5.5 mm x 5.5 mm type permits smaller, space-saving machines and devices.



1 kHz High-Speed Response

IP67 Environment-Resistant Types

Full sealing structure housing, degree of protection IEC60529 IP67.

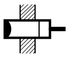
1/20 Low Current Consumption (Compared to conventional models)

Significantly lower current consumption. The 0.8 mA (for 24 VDC) leakage current for the DC 2-wire type has a ratio of approximately 1/20 compared to the conventional DC 3-wire type. Optimum solution for multiple-sensor applications such as cam switches.

Ordering Information

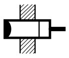
Sensors

DC 2-wire Models

Shape	Sensing surface	Sensing distance	Model: Operating status NO	Model: Operating status NC
Unshielded 	Front face	1.6mm	**E2S-W11 ***	**E2S-W12**
	End face		**E2S-Q11 ***	**E2S-Q12**
	Front face	2.5mm	**E2S-W21 ***	**E2S-W22**
	End face		**E2S-Q21 ***	**E2S-Q22**

* Models with different response frequency are available (NO only). These model numbers take the form E2S-□□□B (e.g., E2S-W11B)

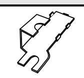
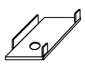
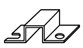
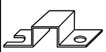
DC 3-wire Models

Shape	Sensing surface	Sensing distance	Output specifications	Model: Operating status NO	Model: Operating status NC
Unshielded 	Front face	1.6mm	NPN	**E2S-W13***	**E2S-W14**
	End face			**E2S-Q13***	**E2S-Q14**
	Front face	2.5mm		**E2S-W23***	**E2S-W24**
	End face			**E2S-Q23***	**E2S-Q24**
	Front face	1.6mm	PNP	**E2S-W15***	**E2S-W16**
	End face			**E2S-Q15***	**E2S-Q16**
	Front face	2.5mm		**E2S-W25***	**E2S-W26**
	End face			**E2S-Q25***	**E2S-Q26**

* Models with different response frequency are available (NO only). These model numbers take the form E2S-□□□B (e.g., E2S-W11B)

Accessories (Order Separately)

Mounting Brackets

Shape	Model	Quantity	Remarks
	**Y92E-C1R6**	1	Provided with E2S-□1□□
	**Y92E-C2R5**		Provided with E2S-□2□□
	**Y92E-D1R6**		---
	**Y92E-D2R5**		---

Nomenclature

E2S - □ □ □ □
① ② ③ ④ ⑤

① Compact square series

② Sensing direction
W: Front face sensing
Q: End face sensing

③ Size and sensing distance (standard sensing object)
1: 5.5 x 5.5 mm, 1.6 mm (iron)
2: 8 x 8 mm, 2.5 mm (iron)

④ Output
1: DC 2-wire NO
2: DC 2-wire NC
3: DC 3-wire NPN NO
4: DC 3-wire NPN NC
5: DC 3-wire PNP NO
6: DC 3-wire PNP NC

⑤ Different response frequency
No: Standard
B: Different response frequency

Rating/Performance

DC 2-wire Models

Item \ Model		E2S-W11 E2S-W12	E2S-Q11 E2S-Q12	E2S-W21 E2S-W22	E2S-Q21 E2S-Q22
Sensing surface		Front face	End face	Front face	End face
Sensing distance		1.6 mm ±10%		2.5 mm ±15%	
Setting distance		0 to 1.2 mm		0 to 1.9 mm	
Differential distance		10% max.			
Sensing object		Ferrous metal (Sensitivity lowers with non-ferrous metals)			
Standard sensing object		Iron, 12 x 12 x 1 mm		Iron, 15 x 15 x 1 mm	
Response frequency		1 kHz min.			
Rated supply voltage (operating voltage)		12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.			
Leakage current		0.8 mA max.			
Control output	Switching capacity	3 to 50 mA DC max.			
	Residual voltage	3 V max. (under load current of 50 mA with cable length of 1 m)			
Indicator lamp		□□1 models: Operation indicator(red LED), Operation set indicator(green LED) □□2 models: Operation indicator(red LED)			
Operating status (with sensing object approaching)		□□1 models: NO □□2 models: NC			

* The response frequencies for DC switching are average values measured under the condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.

DC 3-wire Models

Item \ Model		E2S-W13 E2S-W14	E2S-Q13 E2S-Q14	E2S-W23 E2S-W24	E2S-Q23 E2S-Q24	E2S-W15 E2S-W16	E2S-Q15 E2S-Q16	E2S-W25 E2S-W26	E2S-Q25 E2S-Q26
Sensing surface		Front face	End face	Front face	End face	Front face	End face	Front face	End face
Sensing distance		1.6 mm ±10%		2.5 mm ±15%		1.6 mm ±10%		2.5 mm ±15%	
Setting distance		0 to 1.2 mm		0 to 1.9 mm		0 to 1.2 mm		0 to 1.9 mm	
Differential distance		10% max.							
Sensing object		Ferrous metal							
Standard sensing object		Iron, 12 x 12 x 1 mm		Iron, 15 x 15 x 1 mm		Iron, 12 x 12 x 1 mm		Iron, 15 x 15 x 1 mm	
Response frequency		1 kHz min.							
Rated supply voltage (operating voltage)		12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.							
Current consumption		13 mA max. (24 VDC, unload)							
Control output	Switching capacity	NPN open collector 100 mA max. (30 VDC max.)				PNP open collector 50 mA max. (30 VDC max.)			
	Residual voltage	1 V max. (under load current of 50 mA with cable length of 1 m)							
Indicator lamp		Operation indicator (orange)							
Operating status (with sensing object approaching)		□□3 models: NO □□4 models: NC				□□5 models: NO □□6 models: NC			

* The response frequencies for DC switching are average values measured under the condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.

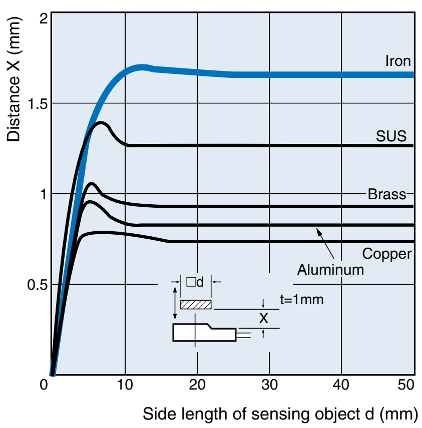
Specifications

Item / Model		E2S-□□□
Protective circuits		Reverse polarity connection and surge absorber
Ambient temperature		Operating: -25°C to 70°C, Storage: -40°C to 85°C (with no icing or condensation)
Ambient humidity		Operating: 35% to 90%RH, Storage: 35% to 95%RH (with no condensation)
Temperature influence		±15% max. of sensing distance at 23°C in temperature range of -25°C to 70°C
Voltage influence		±2.5% max. of sensing distance within a range of ±10% of rated supply voltage
Insulation resistance		50 M min. (at 500 VDC) between energized parts and case
Dielectric strength		1,000 VAC for 1 min between energized parts and case
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions
Shock resistance		Destruction: 500 m/s2 for 3 times each in X, Y, and Z directions
Protective structure		IEC60529 IP67
Connection method		Pre-wired models (Standard length: 3 m)
Weight (Packed state)		Approx. 10 g
Material	Case	Polyarylate
Accessories		Mounting Brackets

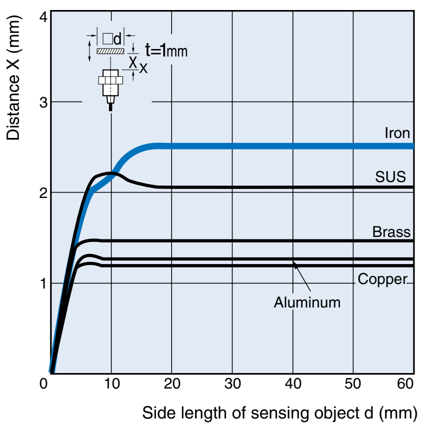
Characteristic data (typical)

Sensing Distance vs. Sensing Object

E2S-W1□/-Q1□

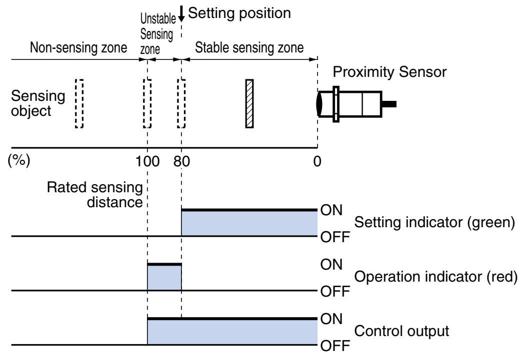
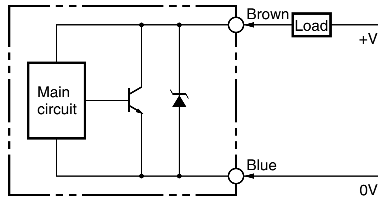
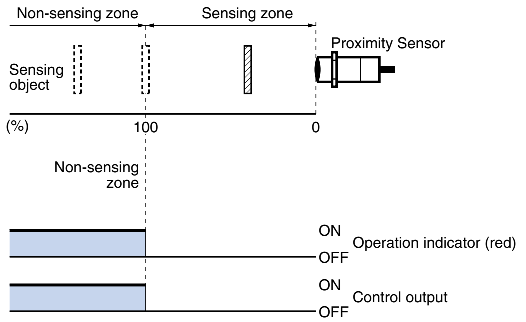


E2S-W2□/-Q2□



Output Circuit Diagram

DC 2-wire Models

<table>
<tr><th>Operating status</th><th>Model</th><th>Timing chart</th><th>Output circuit</th></tr>
<tr><td>NO</td><td>E2S-W11
E2S-W21
E2S-Q11
E2S-Q21</td><td>
</td><td rowspan="2">
</td></tr>
<tr><td>NC</td><td>E2S-W12
E2S-W22
E2S-Q12
E2S-Q22</td><td>
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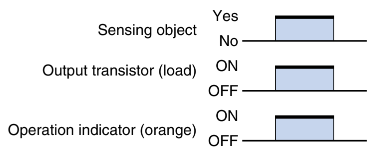
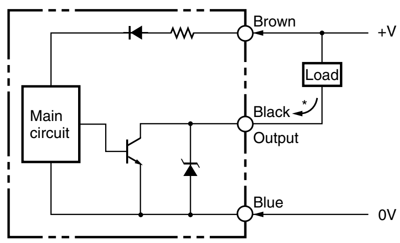
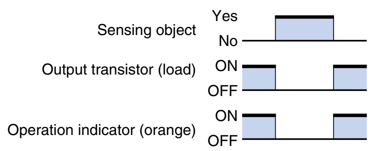
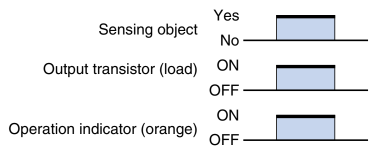
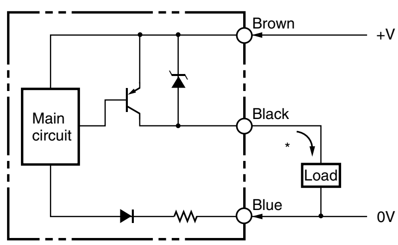
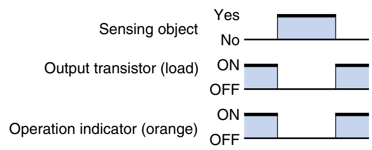
DC 3-wire Models

<table>
<tr><th>Operating status</th><th>Output specifications</th><th>Model</th><th>Timing chart</th><th>Output circuit</th></tr>
<tr><td>NO</td><td rowspan="2">NPN</td><td>E2S-W13
E2S-W23
E2S-Q13
E2S-Q23</td><td>
</td><td rowspan="2">

* Maximum load current: 50 mA</td></tr>
<tr><td>NC</td><td>E2S-W14
E2S-W24
E2S-Q14
E2S-Q24</td><td>
</td></tr>
<tr><td>NO</td><td rowspan="2">PNP</td><td>E2S-W15
E2S-W25
E2S-Q15
E2S-Q25</td><td>
</td><td rowspan="2">

* Maximum load current: 50 mA</td></tr>
<tr><td>NC</td><td>E2S-W16
E2S-W26
E2S-Q16
E2S-Q26</td><td>
</td></tr>
</table>

E2S

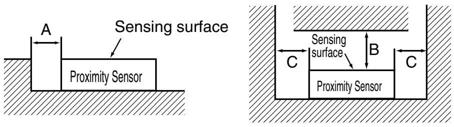
Precautions

Correct Use

Design

Effects of Surrounding Metal

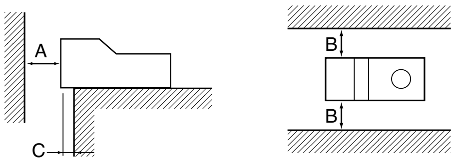
- Provide a minimum distance between the Sensor and the surrounding metal as shown in the table below.
- Front Surface Sensing Type (Not exceeding the sensor head height)



(Unit: mm)

Model Length	A	B	C
E2S-W1□	0	8	2
E2S-W2□		15	10

- End Surface Sensing Type



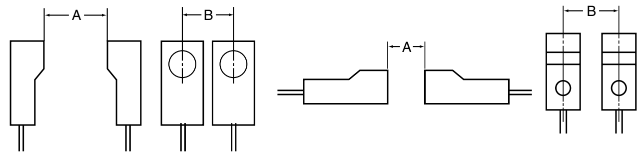
(Unit: mm)

Model Length	A	B	C
E2S-Q1□	8	3	2
E2S-Q2□	15	10	3

Mutual Interference

If more than one Sensor is located face to face or in parallel, be sure to maintain enough space between adjacent Sensors to suppress mutual interference as provided in the following diagram,.

- Front Surface Sensing Type
- End Surface Sensing Type



(Unit: mm)

Model Length	A	B
E2S-W(Q)1□	50 (40)	20 (5.5)
E2S-W1□	75 (50)	25 (8)

Note: The above values in parentheses are applicable when using two sensors with different frequencies.

Mounting

Tightening torgues

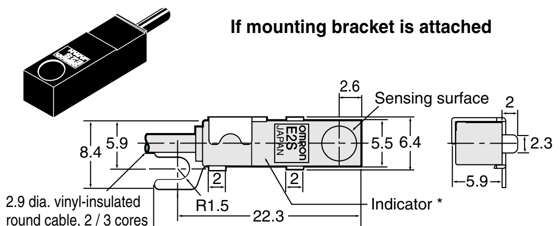
Do not tighten the E2S-W(Q)2□mounting screws to a torque exceeding 0.7 Nm.

Dimensions (Unit: mm)

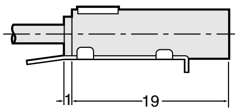
Sensors

E2S-W1□

If mounting bracket is attached

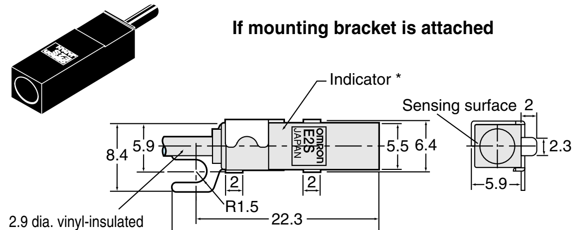


* E2S-W11□	Operation indicator (red) Setting indicator (green)
E2S-W12□	Operation indicator (red)
E2S-W13□ E2S-W14□ E2S-W15□ E2S-W16□	Operation indicator (orange)

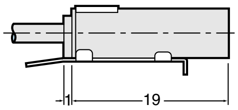


E2S-Q1□

If mounting bracket is attached

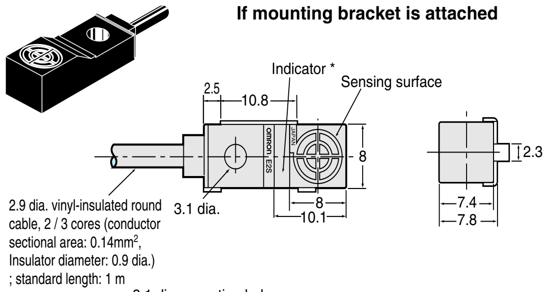


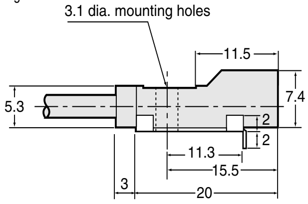
* E2S-Q11□	Operation indicator (red) Setting indicator (green)
E2S-Q12□	Operation indicator (red)
E2S-Q13□ E2S-Q14□ E2S-Q15□ E2S-Q16□	Operation indicator (red)



E2S-W2□

If mounting bracket is attached

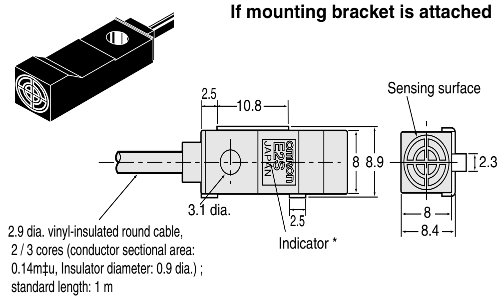


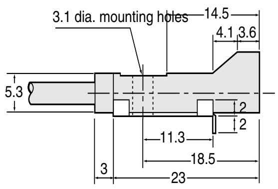


*E2S-W21□	Operation indicator (red) Setting indicator (green)
E2S-W22□	Operation indicator (red)
E2S-W23□ E2S-W24□ E2S-W25□ E2S-W26□	Operation indicator (orange)

E2S-Q2□

If mounting bracket is attached

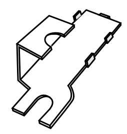


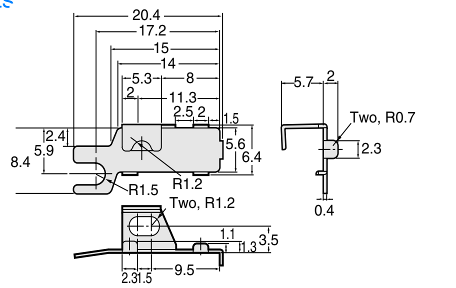


*E2S-Q21□	Operation indicator (red) Setting indicator (green)
E2S-Q22□	Operation indicator (red)
E2S-Q23□ E2S-Q24□ E2S-Q25□ E2S-Q26□	Operation indicator (orange)

Accessories (Order Separately*)

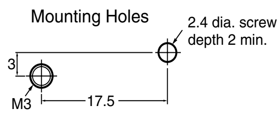
Mounting Brackets
Y92E-C1R6



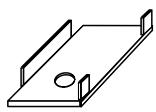


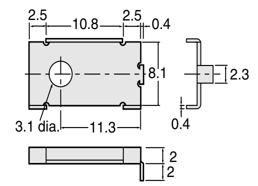
Material: Stainless steel (SUS304)

* Provided with E2S-□1□□



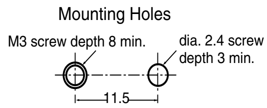
Mounting Brackets
Y92E-C2R5



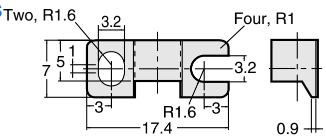


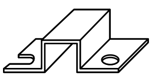
Material: Stainless steel (SUS304)

* Provided with E2S-□2□

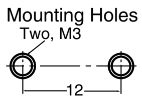


Mounting Brackets
Y92E-D1R6

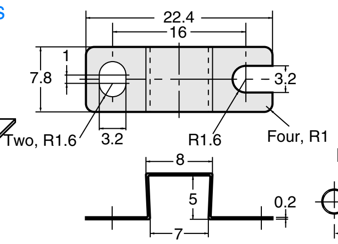


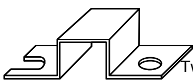


Material: Stainless steel (SUS304)

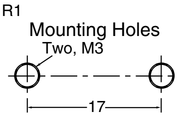


Mounting Brackets
Y92E-D2R5





Material: Stainless steel (SUS304)



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Long Distance Square Inductive Proximity Sensor

E2Q2

- Terminal Housing
- Active face direction changeable
- Easy to install and same mounting dimensions as a standard style electro-mechanical limit switch
- Integrated short circuit and reverse polarity protection
- Robust body with stainless steel screws

Square Proximity Sensor

Ordering Information

DC type

Sensing distance	Connection	Active face	Output		
				NO	NO + NC
20 mm shielded	Terminals	Changeable	NPN	E2Q2-N20E1-H	E2Q2-N20E3-☐
			PNP	E2Q2-N20F1-H	E2Q2-N20F3-☐
30 mm non-shielded			NPN		E2Q2-N30ME3-☐
			PNP		E2Q2-N30MF3-☐
40 mm non-shielded			NPN		E2Q2-N40ME3-☐
			PNP		E2Q2-N40MF3-☐

☐ = H: terminal conduit M20x1,5
U: terminal conduit 1/2“ NPT

AC type

Sensing distance	Connection	Active face	Output		
				NO	NO or NC
15 mm shielded	Terminals	Changeable	AC		E2Q2-N15Y4-☐
30 mm shielded			AC		E2Q2-N30MY4-☐

☐ = H: terminal conduit M20x1,5
U: terminal conduit 1/2“ NPT

Weld-Field Immune DC type (100mT)

Sensing distance	Connection	Active face	Output		
				NO	NO + NC
15 mm shielded	Terminal conduit ½“ NPT	Changeable	PNP	E2Q2-N15F1-51	

Weld-Field Immune AC type (100mT)

Sensing distance	Connection	Active face	Output		
				NO	NO or NC
15 mm shielded	Terminal conduit ½“ NPT	Changeable	AC		E2Q2-N15Y4-51

Rating/performance

DC type

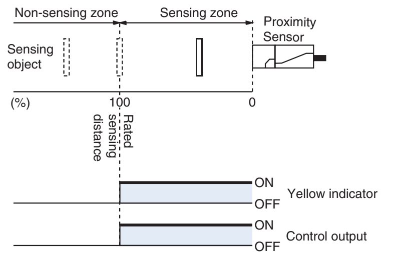
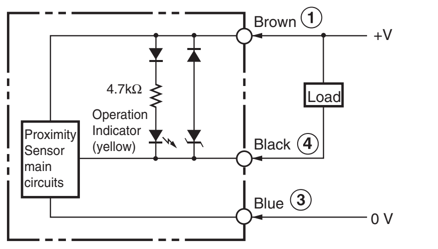
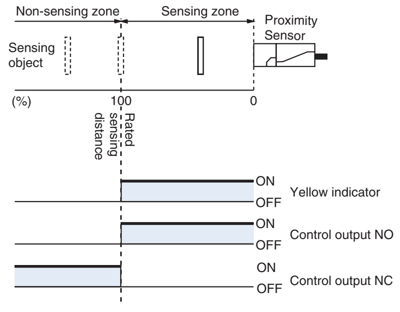
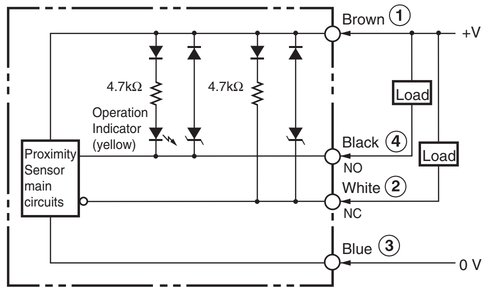
Model / Item		shielded		non-shielded	
		E2Q2-N15F1-51 weld-immune type	E2Q2-N20□□-□	E2Q2-N30□□-□	E2Q2-N40□□-□
Sensing distance Sn		15 mm ± 10%	20 mm ± 10%	30 mm ± 10%	40 mm ± 10%
Standard target size, L x W x H, Fe 37		45 x 45 x 1 mm	60 x 60 x 1 mm	90 x 90 x 1 mm	120 x 120 x 1 mm
Setting distance		0 to 12,15 mm	0 to 16,2 mm	0 to 24,3 mm	0 to 32,4 mm
Switching frequency		10 Hz (weld-field immune type)	150 Hz	100 Hz	30 Hz
Sensing object		Ferrous metals			
Differential travel		15% max. of sensing distance Sn			
Operating voltage		10 to 30 VDC	10 to 60 VDC		
Current consumption		20 mA max.		10 mA max.	20 mA max.
Control output	Type	E2Q2-N□□□E1-□□: NPN - NO E2Q2-N□□□E3-□□: NPN - NO + NC E2Q2-N□□□F1-□□: PNP - NO E2Q2-N□□□F3-□□: PNP - NO + NC			
	Load	200 mA max.			
	On-stage voltage drop	3 VDC max. (at 200 mA load current)			
Circuit protection		Reverse polarity, output short circuit			
Alternating magnetic field		100 mT	---		
Indicator		Operating indicator (yellow LED), operating voltage (green LED)			
Ambient temperature		Operating: -25° to 70°C			
Ambient humidity		35 to 95% RH			
Influence of temperature		± 10% max. of Sn at 23° in temperature range of -25° to 70°C			
Dielectric strength		1.500 VAC, 50/60 Hz for 1 min. between current carry parts and case			
Electromagnetic compatibility EMC		EN 60947-5-2			
Vibration resistance		10 to 55 Hz, 1 mm amplitude according IEC 60068-2-6			
Shock resistance		Approx. 30 G for 11 ms according to IEC 60068-2-27			
Protection degree		IEC 60529 IP 67			
Connection	Terminals	Up to 2,5 mm²			
Material	Case Terminal base	PBT Al PBT (...-H type)			
	Sensing face	PBT			
Approvals		CSA CERTIFIED UL LISTED			

AC type

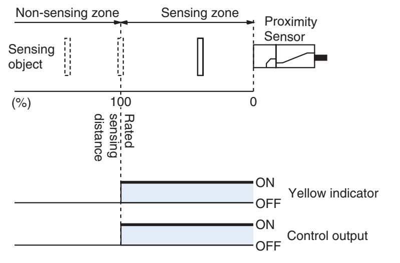
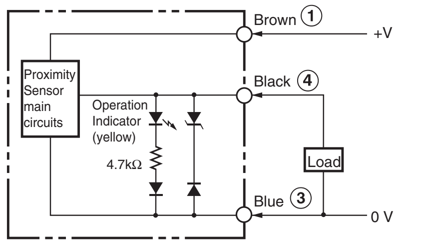
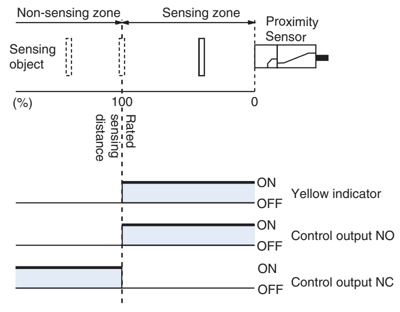
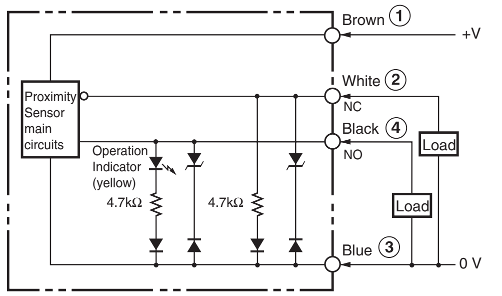
Item		shielded		non-shielded
Model		E2Q2-N15Y4-51 weld-immune type	E2Q2-N15□□-□	E2Q2-N30□□-□
Sensing distance Sn		15 mm ± 10%		30 mm ± 10%
Standard target size, L x W x H, Fe 37		45 x 45 x 1 mm		90 x 90 x 1 mm
Setting distance		0 to 12,15 mm		0 to 24,3 mm
Switching frequency		20 Hz		
Sensing object		Ferrous metals		
Differential travel		15% max. of sensing distance Sn		
Operating voltage		20 to 253 VAC		
Off-state current		2,5 mA max.	1,9 mA max.	
Control output	Type	AC - NO or NC		
	Load	500 mA max.		
		10 mA min.	8 mA min.	
	On-stage voltage drop	12 VAC max. (at 500 mA load current)		
Circuit protection		---		
Alternating magnetic field		100 mT	---	
Indicator		Operating indicator (yellow LED), operating voltage (green LED)		
Ambient temperature		Operating: -25° to 70°C		
Ambient humidity		35 to 95% RH		
Influence of temperature		± 10% max. of Sn at 23° in temperature range of -25° to 70°C		
Dielectric strength		1.500 VAC / 2500 VAC (E2Q2-...-H), 50/60 Hz for 1 min. between current carry parts and case		
Electromagnetic compatibility EMC		EN 60947-5-2		
Vibration resistance		10 to 55 Hz, 1 mm amplitude according IEC 60068-2-6		
Shock resistance		Approx. 30 G for 11 ms according to IEC 60068-2-27		
Protection degree		IEC 60529 IP 67		
Connection	Terminals	Up to 2,5 mm²		
Material	Case Terminal base	PBT Al PBT (...-H type)		
	Sensing face	PBT		
Approvals		CSA CERTIFIED	UL LISTED	

Output Circuit Diagram

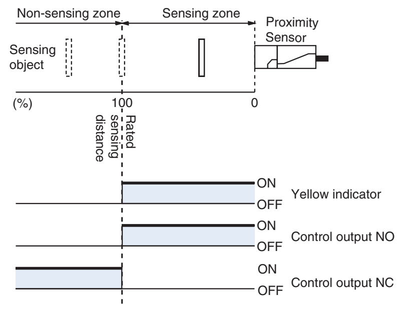
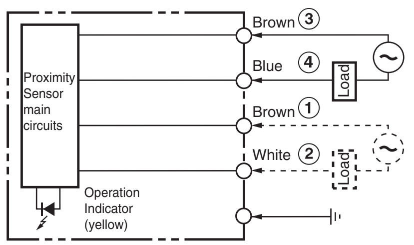
NPN output

Model	Operation mode	Timing chart	Output circuit
E2Q2-N20E1-H	NO		
E2Q2-N20E3-□ E2Q2-N30ME3-□ E2Q2-N40ME3-□	NO + NC		

PNP output

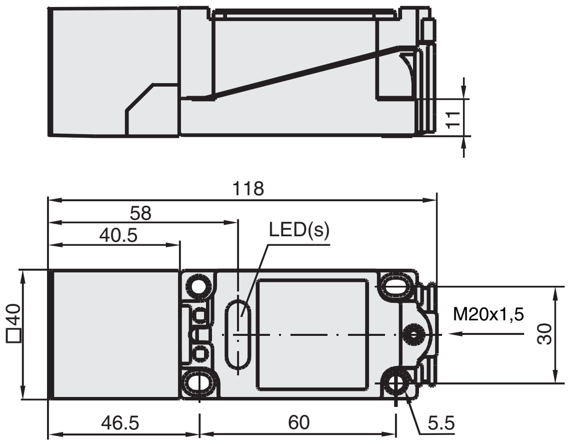
Model	Operation mode	Timing chart	Output circuit
E2Q2-N20F1-H E2Q2-N15F1-51	NO		
E2Q2-N20F3-□ E2Q2-N30MF3-□ E2Q2-N40MF3-□	NO + NC		

AC output

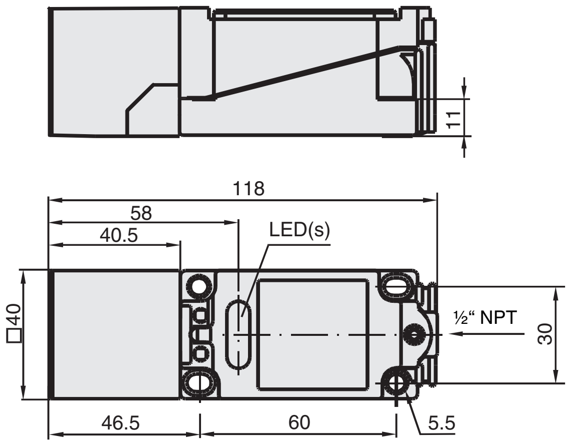
Model	Operation mode	Timing chart	Output circuit
E2Q2-N15Y4-51	NO or NC		 Note: Only one load allowed!

Dimensions (Unit: mm)

E2Q2-...-H type

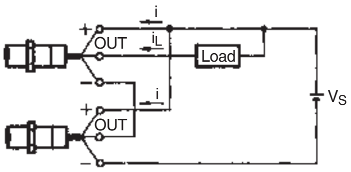
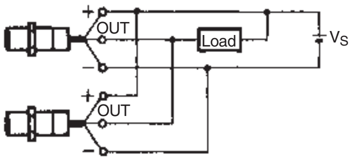


E2Q2-...-U and -51 type

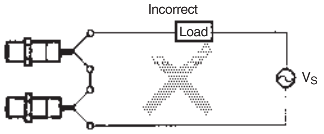
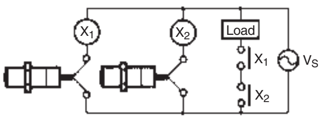
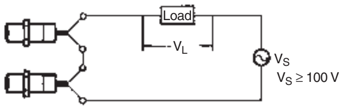
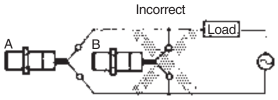
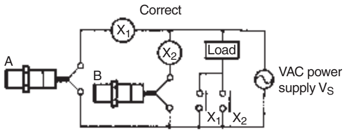


Connection

DC type

Connection type	Method	Description
AND (serial connection)	Correct 	The Sensors connected together must satisfy the following conditions: $i_L + (N-1) \times i \le$ Upper-limit of control output of each Sensor $V_S - N \times V_R \ge$ Load operating voltage N = No. of Sensors V_R = Residual voltage of each Sensor V_S = Supply voltage i = Current consumption of the Sensor i_L = Load current If the MY Relay, which operate at 24 VDC, is used as a load for example, a maximum of two Proximity Sensors can be connected to the load.
OR (parallel connec- tion)	Correct 	A minimum of three Sensors with current outputs can be connected in parallel. The number of Sensors connected in parallel varies with the Proximity Sensor model.

AC type

Connection type	Method	Description
AND (serial connection)	Incorrect  Correct  	If 100 or 200 VAC is imposed on the Proximity Sensors, V_L (i.e., the voltage imposed on the load) will be obtained from the following. $V_L = V_S$ - (residual voltage x no. of Proximity Sensors) (V) Therefore, if V_L is lower than the load operating voltage, the load will not operate. A maximum of three Proximity Sensors can be connected in series provided that the supply voltage is 100 V minimum.
OR (parallel connec- tion)	Incorrect  Correct 	In principle, more than two Proximity Sensors cannot be connected in parallel. Provided that Proximity Sensor A does not operate with Proximity Sensor B simultaneously and there is no need to keep the load operating continuously, the Proximity Sensors can be connected in parallel. In this case, however, due to the total leakage current of the Proximity Sensors, the load may not reset properly. It is not possible to keep the load operating continuously with Proximity Sensors A and B in simultaneous operation to sense sensing objects due to the following reason. When Proximity Sensor A is ON, the voltage imposed on Proximity Sensor A will drop to approximately 10 V and the load current flows into Proximity Sensor A, and when one of the sensing objects is close to Proximity Sensor B, Proximity Sensor B will not operate because the voltage imposed on Proximity Sensor B is 10 V, which is too low. When Proximity Sensor A is OFF, the voltage imposed on Proximity Sensor B will reach the supply voltage and Proximity Sensor B will be ON. Then, Proximity Sensor A as well as Proximity Sensor B will be OFF for approximately 10 ms, which resets the load for an instant. To prevent the instantaneous resetting of the load, use a relay as shown on the left.

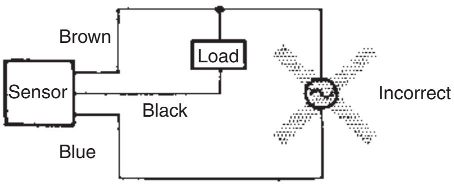
Precautions

⚠ Caution

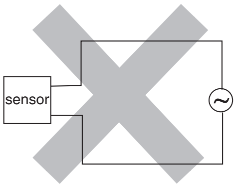
Power supply

Do not impose an excessive voltage on the E2Q2, otherwise it may explode or burn.

Do not connect an AC power supply to any DC model. If AC power (100 VAC or more) is supplied to the sensor, it may explode or burn.



Do not connect the AC types without load to the power supply. The sensor will be damaged.



Be sure to abide by the following precautions for the safe operation of the Sensor.

Wiring

Power Supply Voltage and Output Load Power Supply Voltage

Make sure that the power supply to the Sensor is within the rated voltage range. If a voltage exceeding the rated voltage range is supplied to the Sensor, it may explode or burn.

Load Short-circuiting

Do not short-circuit the load, otherwise the Sensor may be damaged.

Connection without Load

Do not connect the power supply to the Sensor with no load connected, otherwise the internal elements may explode or burn.

Operating Environment

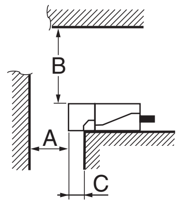
Do not use the Sensor in locations with explosive or flammable gas.

Correct Use

Design

Effects of Surrounding Metal

Provide a minimum distance between the Sensor and the surrounding metal as shown in the table below.

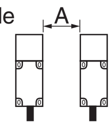


Effects of Surrounding Metal (Unit: mm)

Model Length	A	B	C
E2Q2-N15□□-□□ E2Q2-N20□□-□	45	0	0
E2Q2-N30M□□-□	90	250	30
E2Q2-N40M□□-□	120	300	40

Mutual Interference

If more than one Sensor is located in parallel, ensure to maintain enough space between adjacent Sensors to suppress mutual interference as provided in the following diagram.



Mutual Interference (Unit: mm)

Model Length	A
E2Q2-N15□□-□□ E2Q2-N20□□-□	40
E2Q2-N30M□□-□	120
E2Q2-N40M□□-□	150

Power Reset Time

The Sensor is ready to operate within 300 ms after the Sensor is turned ON. If the load and Sensor are connected to independent power supplies respectively, be sure to turn ON the Sensor before supplying power to the load.

Power OFF

The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended that the load be turned OFF before turning OFF the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Sensing Object

The sensing distance of the Proximity Sensor vary with the metal coating on sensing objects.

Wiring

High-tension cables

Wiring through Metal Conduit:

If there is power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunction.

Mounting

Mounting the Sensor

The Proximity Sensor must be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistivity.

Maintenance and Inspection

Periodically perform the following checks to ensure stable operation of the Proximity Sensor over a long period of time.

- Check for mounting position, dislocation, looseness or distortion of the Proximity Sensor and sensing objects.
- Check for loose wiring and connections, improper contacts and line breakage.
- Check for attachment or accumulation of metal powder or dust.
- Check for abnormal temperature conditions and other environmental conditions.

Never disassemble or repair the Sensor.

Environment

Water Resistivity

Do not use the Proximity Sensor underwater, outdoors or in the rain.

Operating Environment

Be sure to use the Proximity Sensor within its operating ambient temperature range and do not use the Proximity Sensor outdoors so that its reliability and life expectancy can be maintained. Although the Proximity Sensor is water resistive, a cover to protect the Proximity Sensor from water or water-soluble machining oil is recommended so that its reliability and life expectancy can be maintained.

Do not use the Proximity Sensor in an environment with chemical gas (e.g., strong alkaline or acid gasses including nitric, chromic and concentrated sulfuric acid gases).

Inrush Current

A load that has a large inrush current (e.g., a lamp or motor) will damage the Proximity Sensor, in this case connect the load to the Proximity Sensor through a Relay

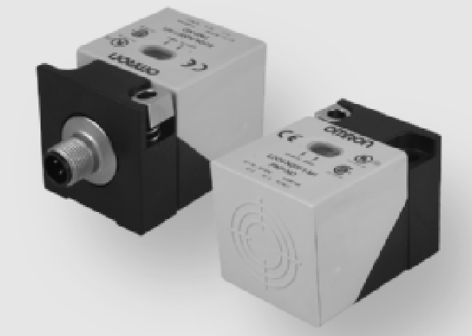
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

 In the interest of product improvement, specifications are subject to change without notice.

Long Distance Square Inductive Proximity Sensor

E2Q4

Square Proximity Sensor



- Slim, compact size
- M12 Plug-in connection
- Integrated short circuit and reverse polarity protection
- Active face positioning: Y-axis 15°, X-axis 90° incremets

Ordering Information

DC type

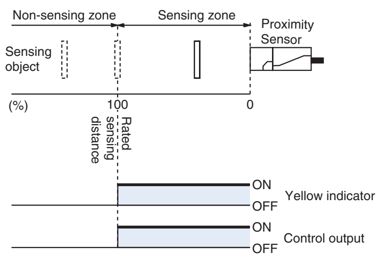
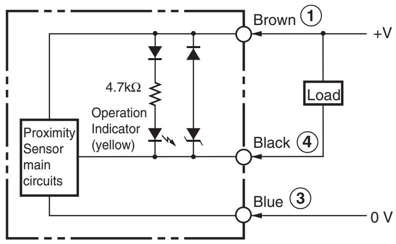
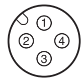
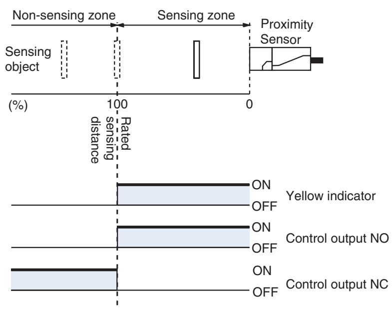
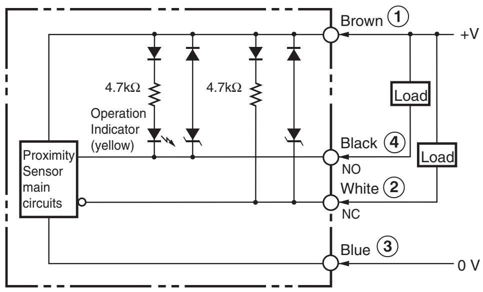
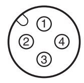
Sensing distance	Connection	Active face	Output		
				NO	NO + NC
20 mm shielded	Plug-in connector	Changable	NPN	E2Q4-N20E1-M1	E2Q4-N20E3-M1
			PNP	E2Q4-N20F1-M1	E2Q4-N20F3-M1
30 mm non-shielded			NPN	E2Q4-N30ME1-M1	E2Q4-N30ME3-M1
			PNP	E2Q4-N30MF1-M1	E2Q4-N30MF3-M1
40 mm non-shielded			NPN		E2Q4-N40ME3-M1
			PNP		E2Q4-N40MF3-M1

Rating/performance

		shielded	non-shielded	
Item	Model	E2Q4-N20□□-M1	E2Q4-N30M□□-M1	E2Q4-N40M□3-M1
Sensing distance Sn		20 mm ± 10%	30 mm ± 10%	40 mm ± 10%
Standard target size, L x W x H, Fe 37		60 x 60 x 1 mm	90 x 90 x 1 mm	120 x 120 x 1 mm
Setting distance		0 to 16,2 mm	0 to 24,3 mm	0 to 32,4 mm
Switching frequency		150 Hz		
Sensing object		Ferrous metals		
Differential travel		15% max. of sensing distance Sn		
Operating voltage		10 to 30 VDC		
Current consumption		20 mA max.		
Control output	Type	E2Q4-N□□□E1-□□: NPN - NO E2Q4-N□□□E3-□□: NPN - NO + NC E2Q4-N□□□F1-□□: PNP - NO E2Q4-N□□□F3-□□: PNP - NO + NC		
	Load	200 mA max.		
	On-stage voltage drop	3 VDC max. (at 200 mA load current)		
Circuit protection		Reverse polarity, output short circuit		
Indicator		Operating indicator (yellow LED), operating voltage (green LED)		
Ambient temperature		Operating: -25° to 70°C		
Ambient humidity		35 to 95% RH		
Influence of temperature		± 10% max. of Sn at 23° in temperature range of -25° to 70°C		
Dielectric strength		1.500 VAC, 50/60 Hz for 1 min. between current carry parts and case		
Electromagnetic compatibility EMC		EN 60947-5-2		
Vibration resistance		10 to 55 Hz, 1 mm amplitude according IEC 60068-2-6		
Shock resistance		Approx. 30 G for 11 ms according to IEC 60068-2-27		
Protection degree		IEC 60529 IP 67		
Connection	Connector	M12 plug, 4 pins		
Material	Case	PBT		
	Sensing face	PBT		
Approvals		CERTIFIED	LISTED	

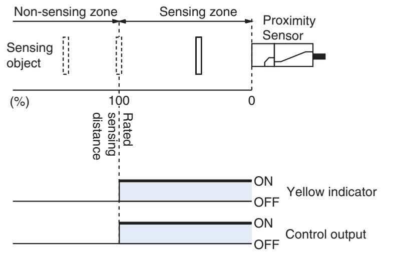
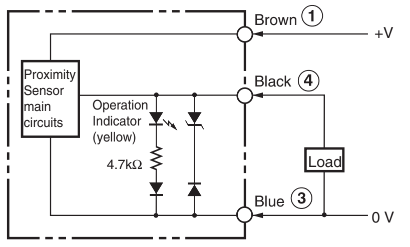
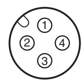
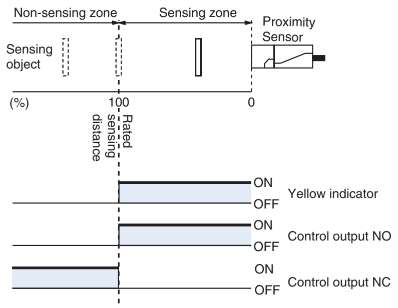
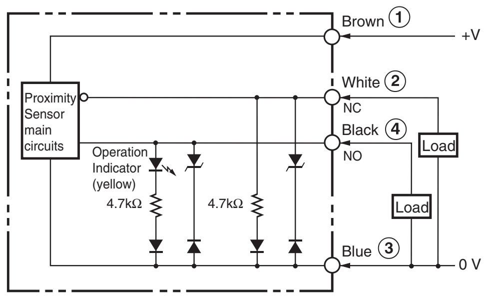
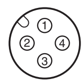
Output Circuit Diagramm

NPN output

Model	Operation mode	Timing chart	Output circuit
E2Q4-N20E1-M1 E2Q4-N30ME1-M1	NO		 Connector Pin Arrangement  Note: Terminal 2 is not used
E2Q4-N20E3-M1 E2Q4-N30ME3-M1 E2Q4-N40ME3-M1	NO + NC		 Connector Pin Arrangement 

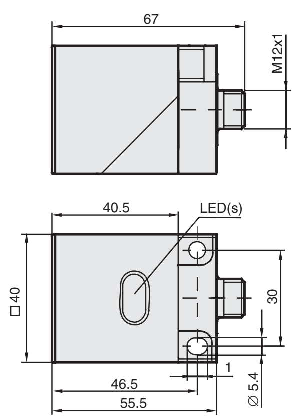
E2Q4

PNP output

Model	Operation mode	Timing chart	Output circuit
E2Q4-N20F1-M1 E2Q4-N30MF1-M1	NO		 Connector Pin Arrangement  Note: Terminal 2 is not used
E2Q4-N20F3-M1 E2Q4-N30MF3-M1 E2Q4-N40MF3-M1	NO + NC		 Connector Pin Arrangement 

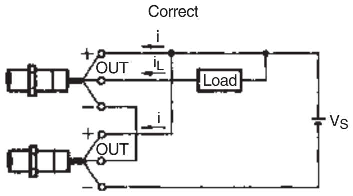
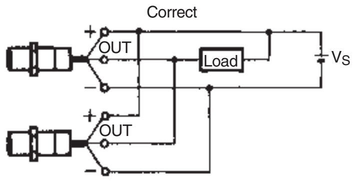
Dimensions (Unit:mm)

E2Q4-...-M1 type



Connection

DC type

Connection type	Method	Description
AND (serial connection)		The Sensors connected together must satisfy the following conditions: i_L + (N-1) x i ≤ Upper-limit of control output of each Sensor V_S - N x V_R ≥ Load operating voltage N = No. of Sensors V_R = Residual voltage of each Sensor V_S = Supply voltage i = Current consumption of the Sensor i_L = Load current If the MY Relay, which operate at 24 VDC, is used as a load for example, a maximum of two Proximity Sensors can be connected to the load.
OR (parallel connection)		A minimum of three Sensors with current outputs can be connected in parallel. The number of Sensors connected in parallel varies with the Proximity Sensor model.

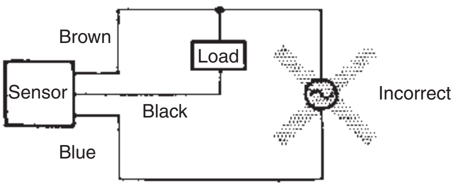
Precautions

⚠ Caution

Power supply

Do not impose an exessive voltage on the E2Q2, otherwise it may explode or burn.

Do not connect an AC power supply to any DC model. If AC power (100 VAC or more) is supplied to the sensor, it may explode or burn.



Be sure to abide by the following precautions for the safe operation of the Sensor.

Wiring

Power Supply Voltage and Output Load Power Supply Voltage

Make sure that the power supply to the Sensor is within the rated voltage range. If a voltage exceeding the rated voltage range is supplied to the Sensor, it may explode or burn.

Load Short-circuiting

Do not short-circuit the load, otherwise the Sensor may be damaged.

Connection without Load

Do not connect the power supply to the Sensor with no load connected, otherwise the internal elements may explode or burn.

Operating Environment

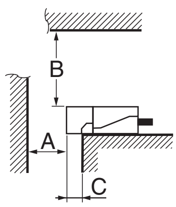
Do not use the Sensor in locations with explosive or flammable gas.

Correct Use

Design

Effects of Surrounding Metal

Provide a minimum distance between the Sensor and the surrounding metal as shown in the table below.

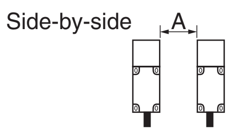


Effects of Surrounding Metal (Unit: mm)

Model Length	A	B	C
E2Q4-N20□□-M1	45	0	0
E2Q4-N30M□□-M1	90	250	30
E2Q4-N40M□□-M1	120	300	40

Mutual Interference

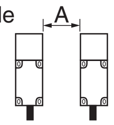
If more than one Sensor is located in parallel, ensure to maintain enough space between adjacent Sensors to suppress mutual interference as provided in the following diagram.



Mutual Interference (Unit: mm)

Model Length	A
E2Q4-N20□□-M1	40
E2Q4-N30M□□-M1	120

Side-by-side



Mutual Interference (Unit: mm)

Model Length	A
E2Q4-N40M□□-M1	150

Power Reset Time

The Sensor is ready to operate within 300 ms after the Sensor is turned ON. If the load and Sensor are connected to independent power supplies respectively, be sure to turn ON the Sensor before supplying power to the load.

Power OFF

The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended that the load be turned OFF before turning OFF the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Sensing Object

The sensing distance of the Proximity Sensor vary with the metal coating on sensing objects.

Wiring

High-tension cables

Wiring through Metal Conduit:

If there is power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunction.

Mounting

Mounting the Sensor

The Proximity Sensor must be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistivity.

Maintenance and Inspection

Periodically perform the following checks to ensure stable operation of the Proximity Sensor over a long period of time.

- Check for mounting position, dislocation, looseness or distortion of the Proximity Sensor and sensing objects.
- Check for loose wiring and connections, improper contacts and line breakage.
- Check for attachment or accumulation of metal powder or dust.
- Check for abnormal temperature conditions and other environmental conditions.

Never disassemble or repair the Sensor.

Environment

Water Resistivity

Do not use the Proximity Sensor underwater, outdoors or in the rain.

Operating Environment

Be sure to use the Proximity Sensor within its operating ambient temperature range and do not use the Proximity Sensor outdoors so that its reliability and life expectancy can be maintained. Although the Proximity Sensor is water resistive, a cover to protect the Proximity Sensor from water or water-soluble machining oil is recommended so that its reliability and life expectancy can be maintained.

Do not use the Proximity Sensor in an environment with chemical gas (e.g., strong alkaline or acid gasses including nitric, chromic and concentrated sulfuric acid gases).

Inrush Current

A load that has a large inrush current (e.g., a lamp or motor) will damage the Proximity Snesor, in this case connect the load to the Proximity Sensor through a Relay

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

High Precision Positioning Inductive Proximity Sensor

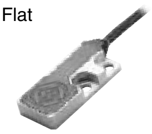
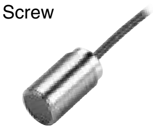
E2C-EDA

- 1 µm resolution
- Precision distance teaching

Ordering Information

Sensors

Sensor Heads

Type	Appearance		Sensing distance	Repeat accuracy	Model
Shielded	Cylindrical 	3 dia. × 18 mm	0.6 mm	1 µm	E2C-EDR6-F (See note 2.)
		5.4 dia. × 18 mm	1 mm	1 µm	E2C-ED01-□ (See notes 1, 2, and 3.)
		8 dia. × 22 mm	2 mm	2 µm	E2C-ED02-□ (See notes 1, 2, and 3.)
	Screw 	M10 × 22 mm	2 mm	2 µm	E2C-EM02-□ (See notes 1, 2, and 3.)
	Flat 	30 × 14 × 4.8 mm	5 mm	2 µm	E2C-EV05-□ (See notes 1, 2, and 3.)
Unshielded	Screw 	M18 × 46.3 mm	7 mm	5 µm	E2C-EM07M-□ (See notes 1, 2, and 3.)
Heat-resistant	Screw 	M12 × 22 mm	2 mm	2 µm	E2C-EM02H (See note 2.)

Note 1. A Protective Spiral Tube is provided with models ending in the suffix -S. (example: E2C-ED01-S).

2. Two cable lengths are available. (3-dia.: free-cut type, Heat-resistant type: standard-length only).
Overall length of the standard-length type: 2.5 m, Length from the Sensor Head to the Preamplifier: 2.0 m (Example: E2C-ED01)
Overall length of the free-cut type: 3.5 m, Length from the Sensor Head to the Preamplifier: 0.5 m for models ending in the suffix -F (example: E2C-ED01F).

3. Models ending in the suffix -S that come with Protective Spiral Tubes and free-cut models ending in the suffix -F are made-to-order products.

Amplifier Units

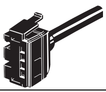
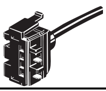
Amplifier Units with Cables

Item		Appearance	Functions	Model	
				NPN output	PNP output
Advanced models	Twin-output models		Area output, open circuit detection, differential operation	E2C-EDA11	E2C-EDA41
	External-input models		Remote setting, differential operation	E2C-EDA21	E2C-EDA51

Amplifier Units with Connectors

Item		Appearance	Functions	Model	
				NPN output	PNP output
Advanced models	Twin-output models		Area output, open circuit detection, differential operation	E2C-EDA6	E2C-EDA8
	External-input models		Remote setting, differential operation	E2C-EDA7	E2C-EDA9

Amplifier Unit Connectors (Order Separately)

Item	Appearance	Cable length	No. of conductors	Model
Master Connector		2 m	4	E3X-CN21
Slave Connector			2	E3X-CN22

Connector Ordering Precaution

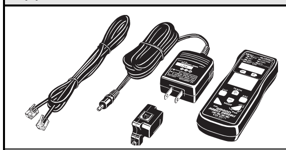
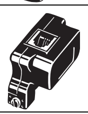
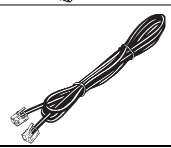
Amplifier Units and Connectors are sold separately.
Refer to the following tables when placing an order.

Amplifier Unit				Applicable Connector (Order Separately)	
Model	NPN output	PNP output		Master Connector	Slave Connector
Advanced models	E2C-EDA6	E2C-EDA8	+	E3X-CN21	E3X-CN22
	E2C-EDA7	E2C-EDA9			

When Using 5 Amplifier Units

Amplifier Units (5 Units)	+	1 Master Connector	4 Slave Connectors

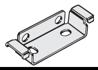
Mobile Console (Order Separately)

Appearance	Model	Remarks
	E3X-MC11-SV2 (model number of set)	Mobile Console with Head, Cable, and AC adapter provided as accessories
	E3X-MC11-C1-SV2	Mobile Console
	E3X-MC11-H1	Head
	E39-Z12-1	Cable (1.5 m)

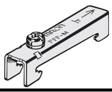
Note: Use the E3X-MC11-SV2 Mobile Console with E2C-EDA-series Amplifier Units. If you use a Mobile Console like the E3X-MC11-S, some functions may not operate.

Accessories (Order Separately)

Mounting Bracket

Appearance	Model	Quantity
	E39-L143	1

End Plate

Appearance	Model	Quantity
	PFP-M	1

Specifications

Sensor Heads

Item		Model	E2C-EDR6-F	E2C-ED01(-☐)	E2C-ED02(-☐)	E2C-EM02-☐)	E2C-EM07(-☐)	E2C-EV05(-☐)	E2C-EM02H
			3 dia. × 18 mm	5.4 dia. × 18 mm	8 dia. × 22 mm	M10 × 22 mm	M18 × 46.3 mm	30 × 14 × 4.8 mm	M12 × 22 mm
Sensing distance			0.6 mm	1 mm	2 mm		7 mm	5 mm	2 mm
Sensing object			Magnetic metal (The sensing distance will decrease when sensing non-magnetic metal. Refer to *Engineering Data* on 87.)						
Standard sensing object			5 × 5 × 3 mm		10 × 10 × 3 mm		22 × 22 × 3 mm	15 × 15 × 3 mm	20 × 20 × 3 mm
			Material: iron (S50C)						
Repeat accuracy (See note 1.)			1 µm		2 µm		5 µm	2 µm	
Hysteresis distance			Variable						
Temper-ature charac-teristic (See note 1.)	Sensor Head		0.3%/° C	0.08%/° C				0.04%/° C	0.2%/° C
	Preamplifier and Amplifier		0.08%/° C						
Ambient tempera-ture (See note 2.)	Operating		–10° C to 60° C (with no icing or condensation)						–10° C to 200° C (See note 3.)
	Storage		–10° C to 60° C (with no icing or condensation)	–20° C to 70° C (with no icing or condensation)					
Ambient humidity			Operating/storage: 35% to 85% (with no condensation)						
Insulation resistance			50 MΩ min. (at 500 VDC)						
Dielectric strength			1,000 VAC at 50/60 Hz for 1 min between current carry parts and case						
Vibration resistance			Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions						
Shock resistance			Destruction: 500 m/s² for 3 times each in X, Y, and Z directions						
Degree of protection			IEC60529 IP67						IEC60529 IP60 (See note 4.)
Connection method			Connector (standard cable length: 2.5 m (2 m between Head and Preamplifier) "-F" model cable length: 3.5 m (0.5 m between Head and Preamplifier)						
Weight (packed state)			Approx. 120 g (Models with protective spiral tube ("-S" models) are approx. 90 g heavier.)						
Material	Sensor Head	Case	Brass	Stainless steel	Brass			Zinc	Brass
		Sensing surface	Heat-resistant ABS						PEEK
		Clamp-ing nut	---			Nickel-plated brass		---	Nickel-plated brass
		Toothed washer	---			Zinc-plated iron		---	Zinc-plated iron
	Preamplifier		PES						
Accessories			Preamplifer Mounting Brackets, Instruction Manual						

Note 1. The repeat accuracy and temperature characteristic are for a standard sensing object positioned midway through the rated sensing distance.

2. A sudden temperature rise even within the rated temperature range may degrade characteristics.

3. For the Sensor Head only without the preamplifier (10 to 60° C). With no icing or condensation.

4. Do not operate in areas exposed to water vapor because the enclosure is not waterproof.

E2C-EDA

Amplifier Units

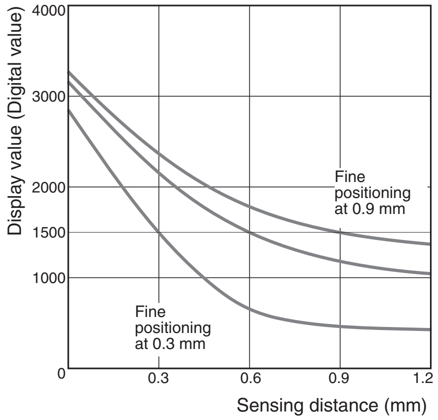
	Type	Advanced Models with Twin Outputs		Advanced Models with External Inputs	
Model	NPN output	E2C-EDA11	E2C-EDA6	E2C-EDA21	E2C-EDA7
Item	PNP output	E2C-EDA41	E2C-EDA8	E2C-EDA51	E2C-EDA9
Supply voltage		12 to 24 VDC ±10%, ripple (p-p): 10% max.			
Power consumption		1,080 mW max. (current consumption: 45 mA at power supply voltage of 24 VDC)			
Control output		Load power supply voltage: 26.4 VDC max.; NPN/PNP open collector output; load current: 50 mA max. (residual voltage: 1 V max.)			
Response time	Super-high-speed mode	150 μs for operation and reset respectively			
	High-speed mode	300 μs for operation and reset respectively			
	Standard mode	1 ms for operation and reset respectively			
	High-resolution mode	4 ms for operation and reset respectively			
Functions	Differential detection	Switchable between single edge and double edge detection mode Single edge: Can be set to 300 μs, 500 μs, 1 ms, 10 ms, or 100 ms Double edge: Can be set to 500 μs, 1 ms, 2 ms, 20 ms, or 200 ms.			
	Timer function	Select from OFF-delay, ON-delay, or one-shot timer. 1 ms to 5 s (1 to 20 ms set in 1-ms increments, 20 to 200 ms set in 10-ms increments, 200 ms to 1 s set in 100-ms increments, and 1 to 5 s set in 1 s-increments)			
	Zero-reset	Negative values can be displayed. (Threshold is not shifted.)			
	Initial reset	Settings can be returned to defaults as required.			
	Mutual interference prevention	Possible for up to 5 Units. (See note.) Intermittent oscillation method (Response time = (number of Units connected + 1) × 15 ms)			
	Hysteresis settings	Setting range: 10 to 4,000			
	I/O settings	Output setting (Select from channel 2 output, area output, self-diagnosis, or open circuit detection.)		Input setting (Select from teaching, fine positioning, zero-reset, synchronous detection.)	
Digital display		Select from the following: Incident level + threshold, incident level percentage +threshold, incident light peak level + incident light bottom level (updated with output), long bar display, incident level + peak hold, incident level + channel			
Display orientation		Switching between normal/reversed display is possible.			
Ambient temperature		Operating: When connecting 1 to 2 Units: –10°C to 55°C When connecting 3 to 5 Units: –10°C to 50°C When connecting 6 to 16 Units: –10°C to 45°C When used in combination with an EDR6-F When connecting 3 to 4 Units: –10°C to 50°C When connecting 5 to 8 Units: –10°C to 45°C When connecting 9 to 16 Units: –10°C to 40°C Storage: –20°C to 70°C (with no icing)			
Ambient humidity		Operating/storage: 35% to 85% (with no condensation)			
Insulation resistance		20 MΩ min. (at 500 VDC)			
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min			
Vibration resistance		Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions			
Shock resistance		Destruction: 500 m/s² for 3 times each in X, Y, and Z directions			
Degree of protection		IEC60529 IP50			
Connection method		Prewired	Connector	Prewired	Connector
Weight (packed state)		Approx. 100 g	Approx. 55 g	Approx. 100 g	Approx. 55 g
Material	Case	PBT (polybutylene terephthalate)			
	Cover	Polycarbonate			

Note: Communications are disabled if the detection mode is selected during super-high-speed sensing mode, and the communications functions for mutual interference prevention and the Mobile Console will not function.

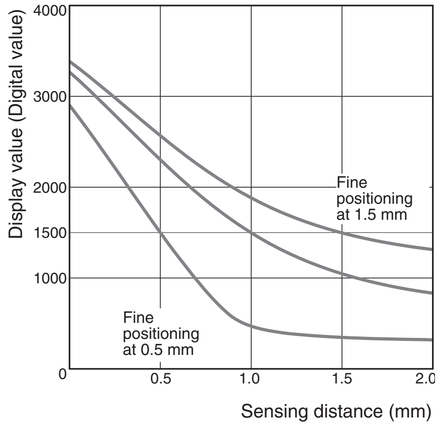
Engineering Data

Sensing Distance vs. Display Values

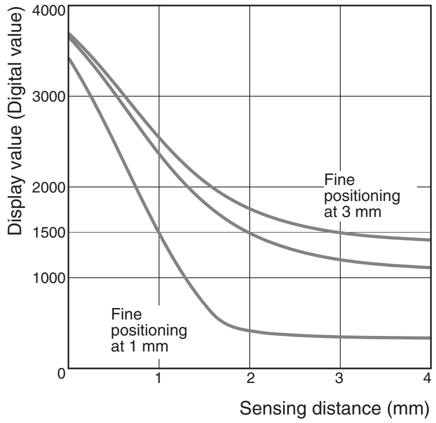
E2C-EDR6-F



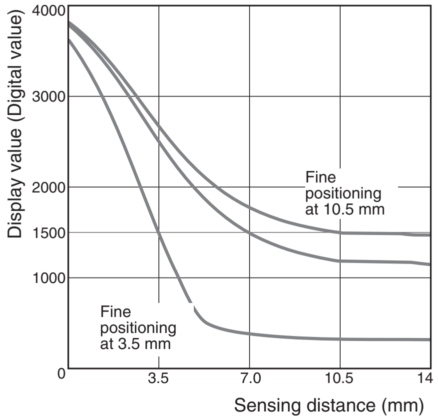
E2C-ED01(-□)



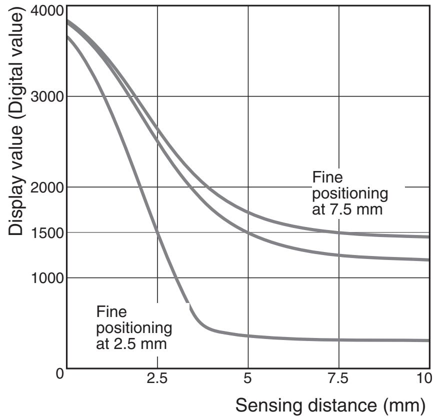
E2C-ED02(-□)/EM02(-□)



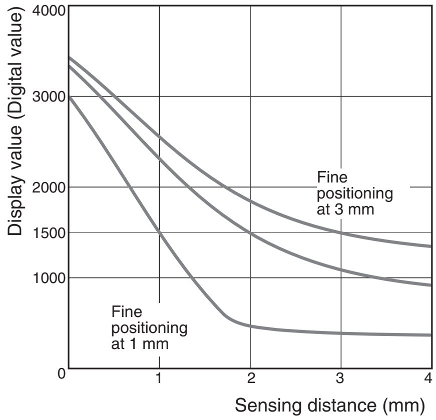
E2C-EM07(-□)



E2C-EV05(-□)

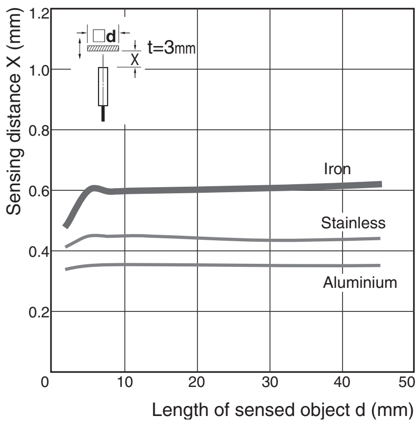


E2C-EM02H

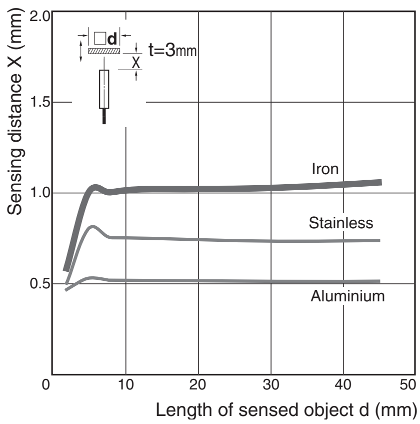


Influence of Sensing Object Size and Material

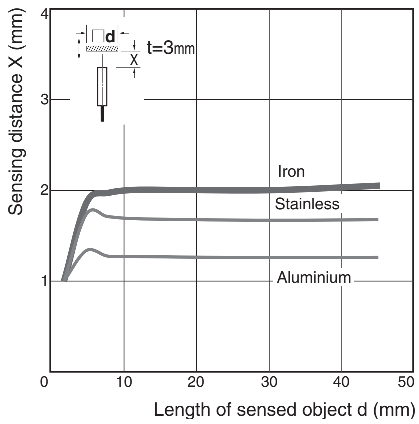
E2C-EDR6-F



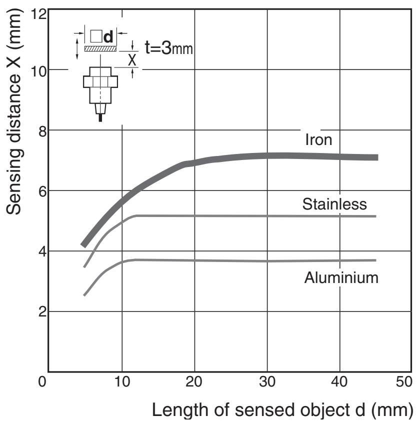
E2C-ED01(-□)



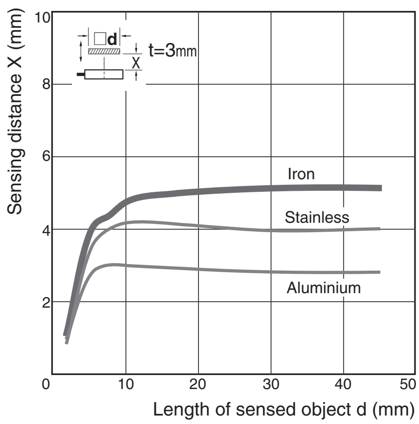
E2C-ED02(-□)/EM02(-□)



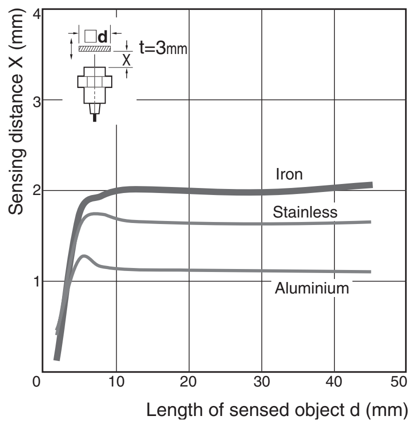
E2C-EM07(-□)



E2C-EV05(-□)

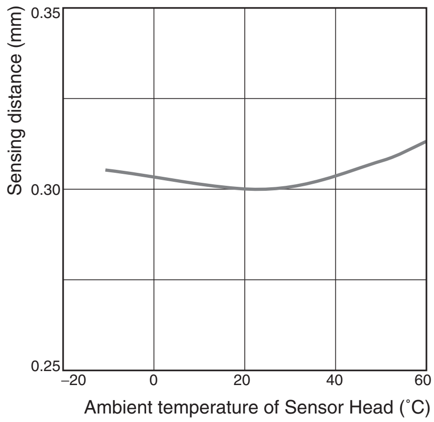


E2C-EM02H

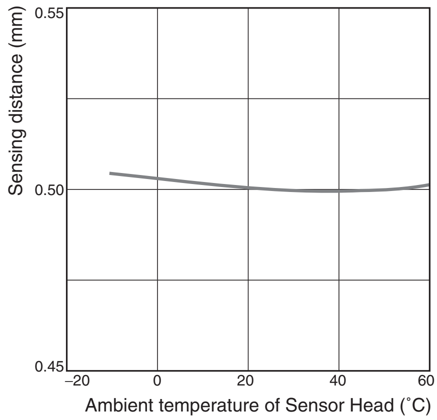


Influence of Sensor Head Temperature

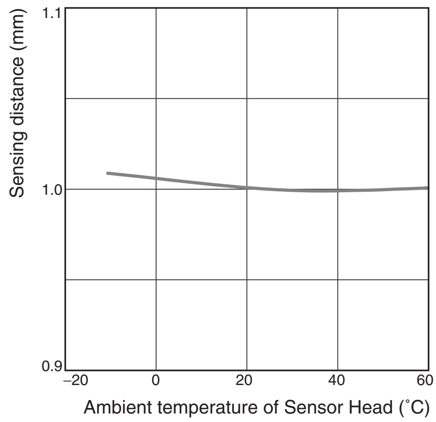
E2C-EDR6-F



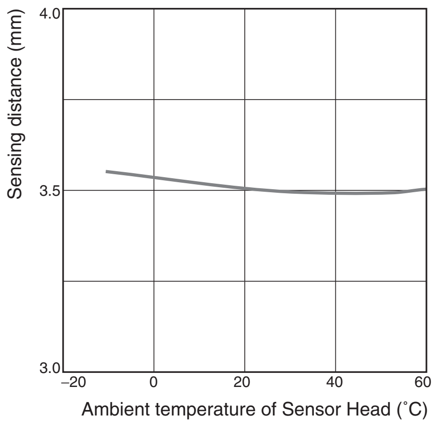
E2C-ED01(-□)



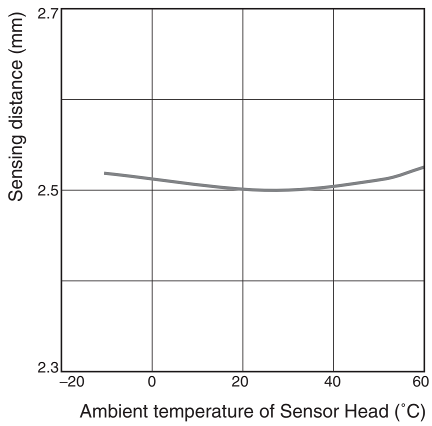
E2C-ED02(-□)/EM02(-□)



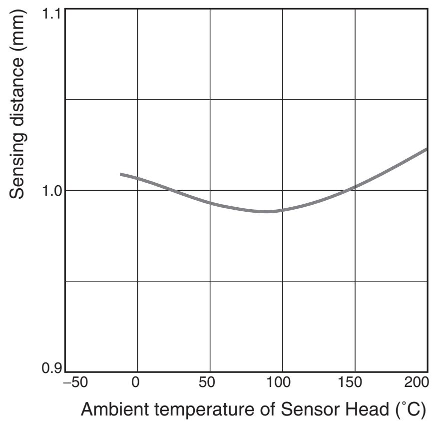
E2C-EM07(-□)



E2C-EV05(-□)

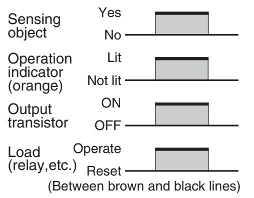
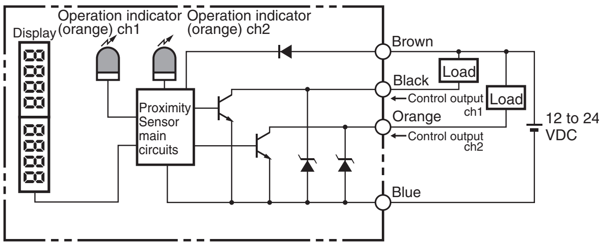
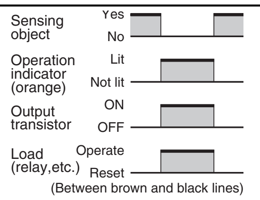
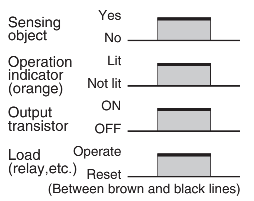
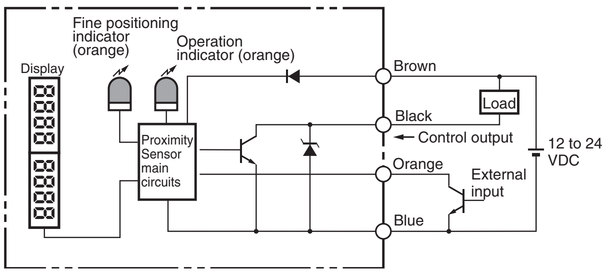
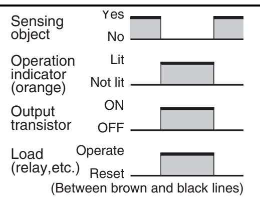


E2C-EM02H



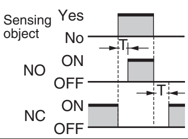
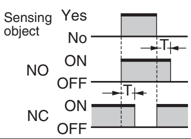
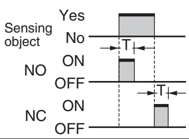
Operation

NPN Output

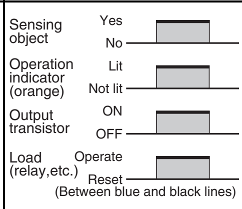
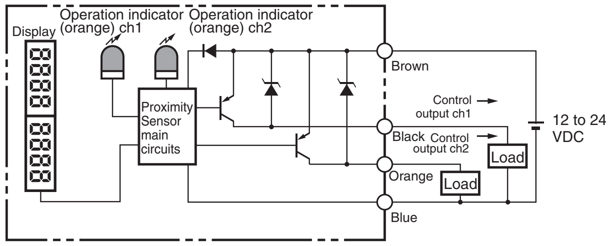
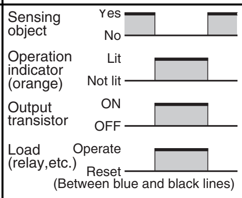
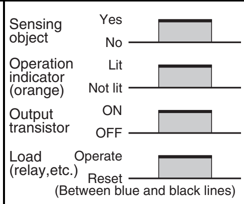
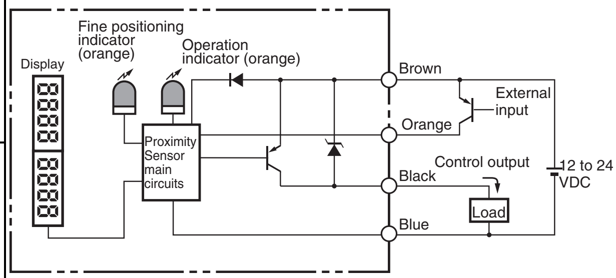
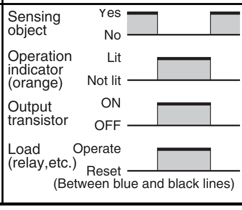
Model	Operation mode	Timing chart	Mode selector	Output circuit
E2C-EDA11 E2C-EDA6	NO (Normally open)		NO	
	NC (Normally closed)		NC	
E2C-EDA21 E2C-EDA7	NO (Normally open)		NO	
	NC (Normally closed)		NC	

Note 1. Setting Areas for Twin-output Models
Normally open: ON between the thresholds for Channel 1 and Channel 2
Normally closed: OFF between the thresholds for Channel 1 and Channel 2

2. Timing Charts for Timer Settings (T: Set Time)

ON delay	OFF delay	One shot
		

PNP Output

Model	Operation mode	Timing chart	Mode selector	Output circuit
E2C-EDA41 E2C-EDA8	NO (Normally open)		NO	
	NC (Normally closed)		NC	
E2C-EDA51 E2C-EDA9	NO (Normally open)		NO	
	NC (Normally closed)		NC	

Note 1. Setting Areas for Twin-output Models
Normally open: ON between the thresholds for Channel 1 and Channel 2
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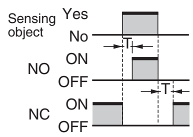
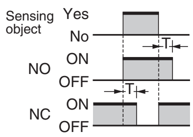
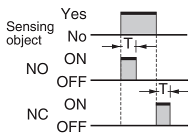
2. Timing Charts for Timer Settings (T: Set Time)

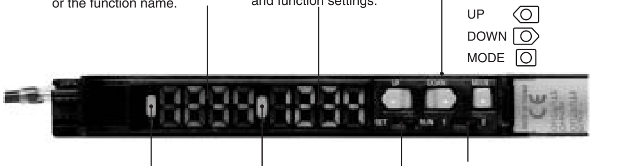
ON delay	OFF delay	One shot
		

Nomenclature

Amplifier Units

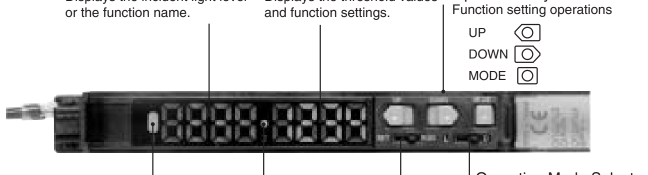
Twin-output Models

(E2C-EDA11/EDA41/EDA6/EDA8)



External-input Models

(E2C-EDA21/EDA51/EDA7/EDA9)



Precautions

Do not use this product in any safety device used for the protection of human lives.

Precautions for Correct Use

Do not use this product in operating atmospheres or environments outside the specified ratings.

Amplifier Units

Design

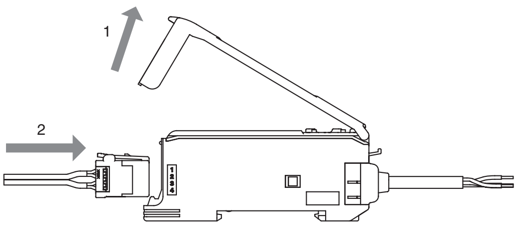
Power ON

The Sensor is ready to sense an object within 200 ms after turning the power ON. If the load and Sensor are connected to different power supplies, always turn ON the Sensor power first.

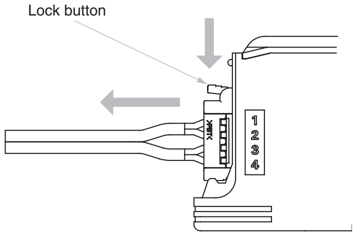
Connecting Sensor Heads

Connecting and Disconnecting Sensor Heads

1. Open the protective cover.
2. Making sure that the lock button is up, insert the fibers all the way to the back of the Connector insertion opening.

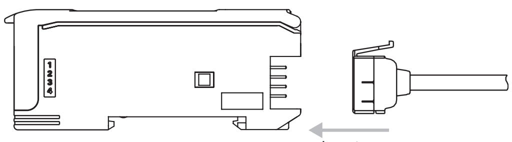


To disconnect the Sensor Head, pull out the fibers while pressing on the lock button.

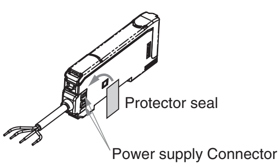


Connecting and Disconnecting Connectors
Connecting Connectors

1. Insert the Master or Slave Connector into the Amplifier Unit until it clicks into place.



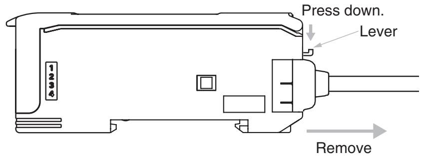
2. Apply the supplied seal to the non-connection surface of the Master/Slave Connector.



Note: Apply the seal to the grooved side.

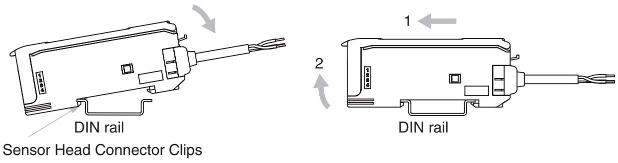
Disconnecting Connectors

1. Slide the Slave Amplifier Unit.
2. After the Amplifier Unit has been separated, press down on the lever on the Connector and remove it. (Do not attempt to remove Connectors without separating them from other Amplifier Units first.)

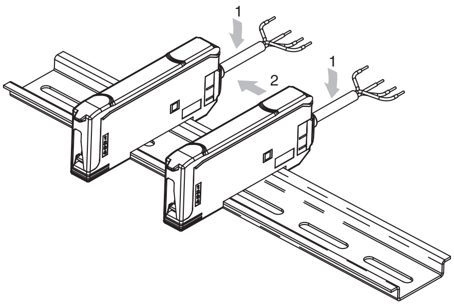


Installing and Removing Amplifier Units
Installing Amplifier Units

1. Install the Units one by one to the DIN rail.



2. Slide one Unit toward the other, match the clips at the front ends, and then bring them together until they "click."



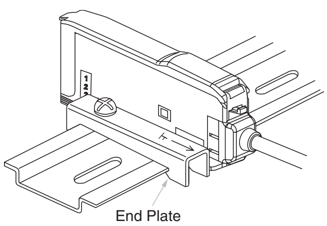
Removing Amplifier Units

Slide one Unit away from the other and remove them one by one. (Do not remove the connected Units together from the DIN rail.)

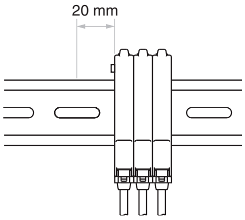
Note 1. When the Amplifier Units are connected to each other, the operable ambient temperature changes depending on the number of connected Amplifier Units. Check Specifications.
2. Before connecting or disconnecting the Units, always switch power OFF.

End Plate Mounting (PFP-M)

Mount End Plates on Amplifier Units to avoid movement due to vibration. When a Mobile Console is installed, mount the End Plate facing as shown in the following diagram.



Mounting a Communications Head for the Mobile Console
Leave a space of at least 20 mm on the left side of the Units for a Mobile Console Communications Head.



EEPROM Write Error
If the data is not written to the EEPROM correctly due to a power failure or static-electric noise, initialize the settings using the keys on the Amplifier Unit.

Optical Communications
When using more than one Amplifier Unit, mount the Units side-by-side. Do not slide or remove Units while they are in use.

Miscellaneous

Protective Cover
Be sure to put on the Protective Cover before use.

Mobile Console
Use the E3X-MC11-SV2 Mobile Console for E2C-EDA-series Amplifier Units. Other Mobile Consoles, such as the E3X-MC11, cannot be used.

Sensor Head and Amplifier Unit Connection
Be sure to use only specified Sensor Head and Amplifier Unit combinations. The E3C-LDA-series Photoelectric Sensor with Separate Digital Amplifier is not compatible, and the E2C-EDA must not be used with products from that series.

Warm-up
The digital display will slowly change until the circuits stabilize after the power is turned ON. It takes about 30 minutes after the power is turned ON before the E2C-EDA is ready to sense.

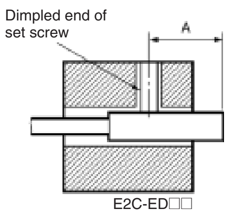
Maintenance Inspection
- Be sure to turn OFF the power before adjusting, connecting, or disconnecting the Sensor Head.
- Do not use thinner, benzene, acetone, or kerosene to clean the Sensor Head or Amplifier Unit.

Sensor Heads

Mounting

Mounting Sensor Heads
- Use the dimensions from the following table to mount unthreaded cylindrical models (E2C-ED-□□). Do not tighten screws with torque exceeding 0.2 N·m when mounting Sensor Heads.

Model	Tightening range A
E2C-EDR6-F	9 to 18 mm
E2C-ED01□□	9 to 18 mm
E2C-ED02□□	11 to 12 mm



- Use the torque given in the following table to tighten threaded cylindrical models (E2C-EM□□).

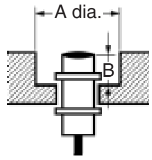
Model	Tightening torque
E2C-EM02□□	15 N·m max.
E2C-EM07M□□	15 N·m max.
E2C-EM02H□□	5.9 N·m max.

- Do not use torque exceeding 0.5 N·m to tighten screws when mounting flat models (E2C-EV□□).
- Use a bending radius of at least 8 mm for the Sensor Head cable.
- Use only the special extension cable to extend the cable between the Sensor Head and the Amplifier Unit. Consult your OMRON representative for details.

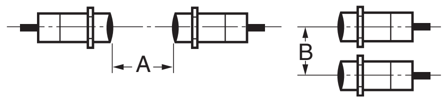
Effects of Surrounding Metal
- Provide a minimum distance between the Sensor and the surrounding metal as shown in the table below.

Effects of Surrounding Metal (Units: mm)

Model	Counterbore A	Protrusion B
E2C-EDR6-F	3.1	0
E2C-ED01□□	5.4	0
E2C-ED02□□	8	0
E2C-EM02□□	10	0
E2C-EM07M□□	35	20
E2C-EV05□□	14 × 30	4.8
E2C-EM02H□□	12	0



Mutual Interference
- If more than one Sensor Head is installed face to face or in parallel, make sure that the distances between two Units adjacent to each other are the same as or larger than the corresponding values shown in the following table.
- The distance between Sensor Heads may be narrower than specified with these Sensors because the Mutual Interference Prevention Function is used for optical communications between the Amplifier Units.



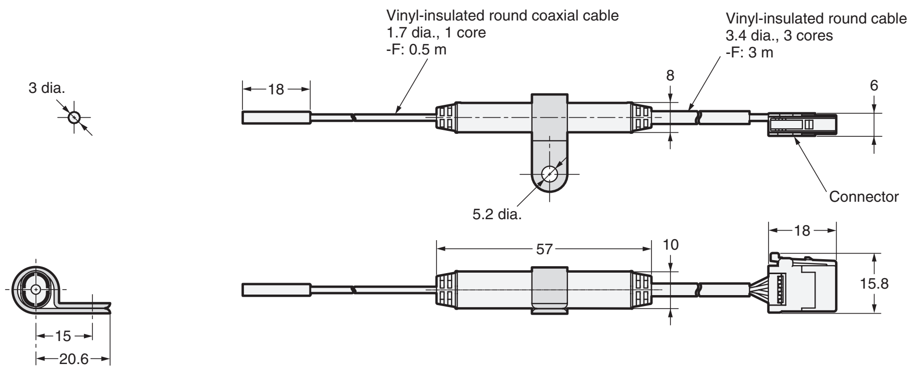
Mutual Interference (Units: mm)

Model	Face-to-face arrangement A	Parallel arrangement B	Face-to-face arrangement using the Mutual Interference Prevention Function A'	Parallel arrangement using the Mutual Interference Prevention Function B'
E2C-EDR6-F	14	10	3.5	3.1
E2C-ED01□□	45	20	9	5.4
E2C-ED02□□	35	30	21	8
E2C-EM02□□	36	30	21	10
E2C-EM07M□□	140	120	35	18
E2C-EV05□□	65	30	21	14
E2C-EM02H□□	45	30	21	12

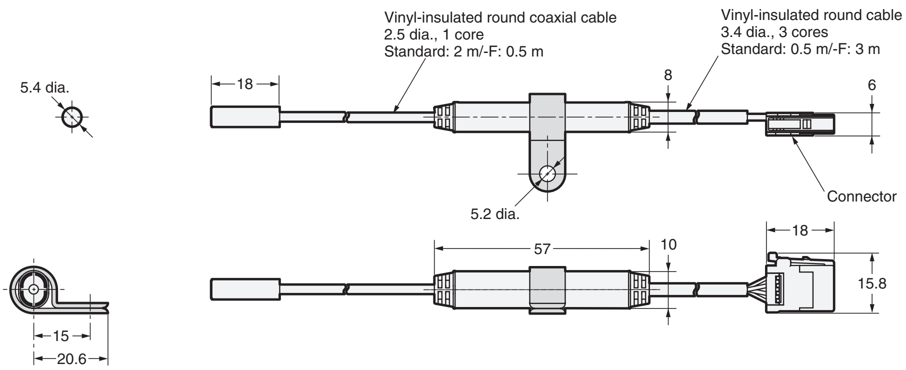
Dimensions

Sensors

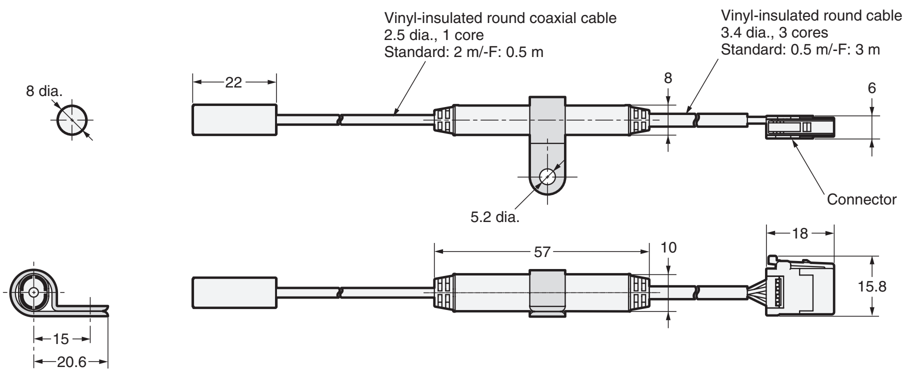
E2C-EDR6-F



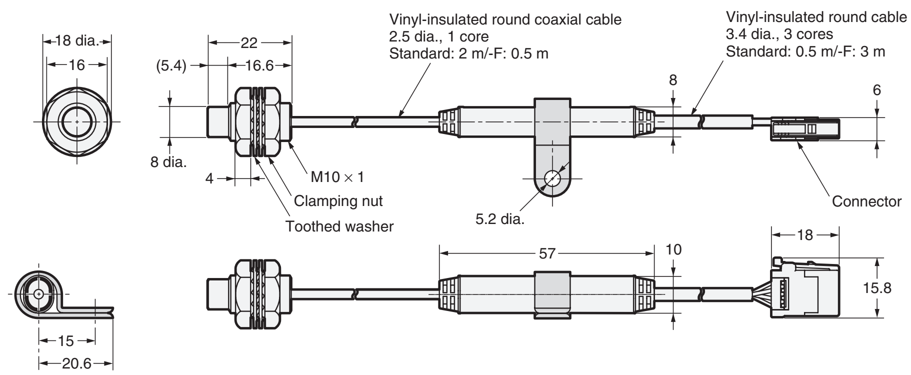
E2C-ED01(-F)



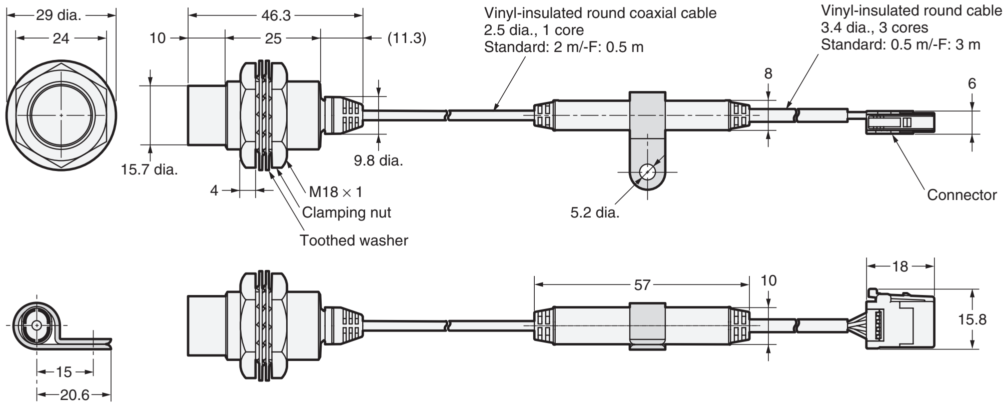
E2C-ED02(-F)



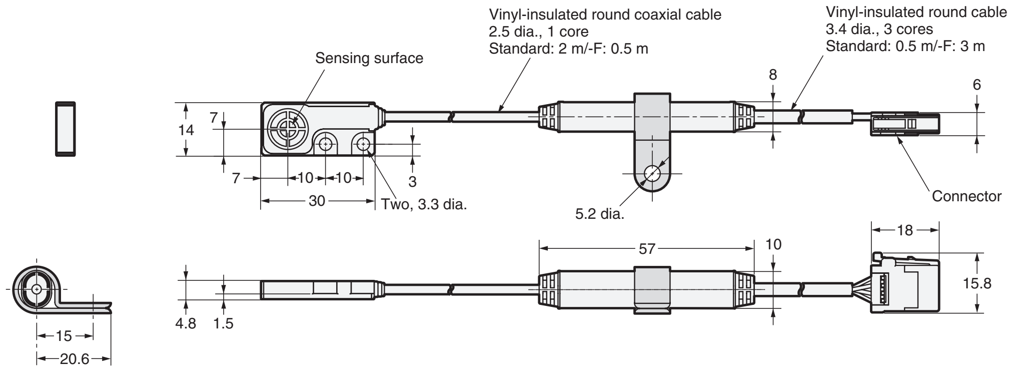
E2C-EM02(-F)

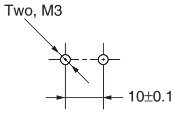


E2C-EM07M(-F)



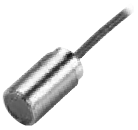
E2C-EV05(-F)

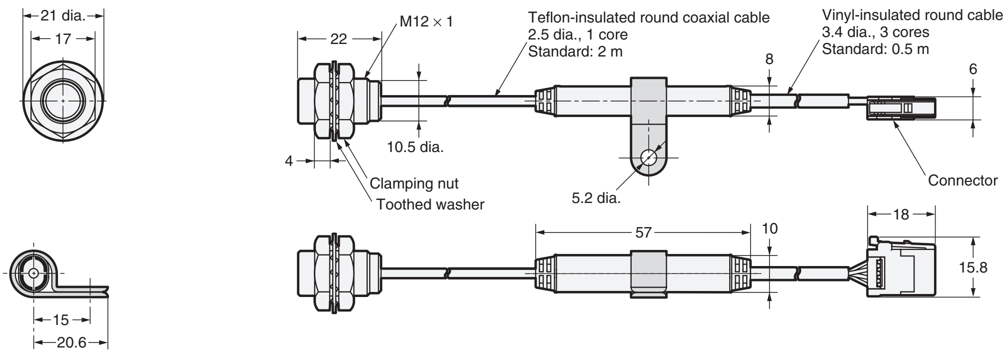




Mounting Holes

E2C-EM02H



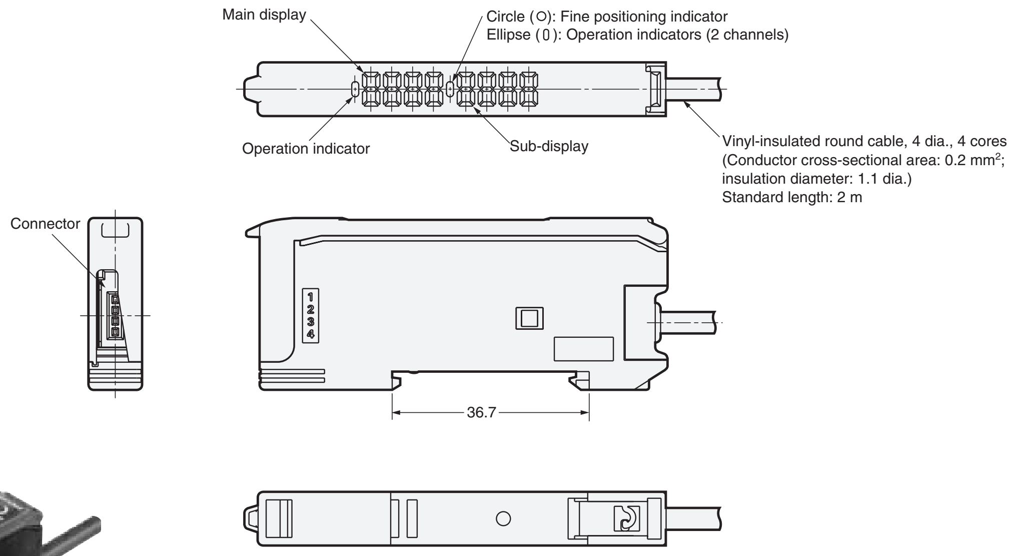


E2C-EDA

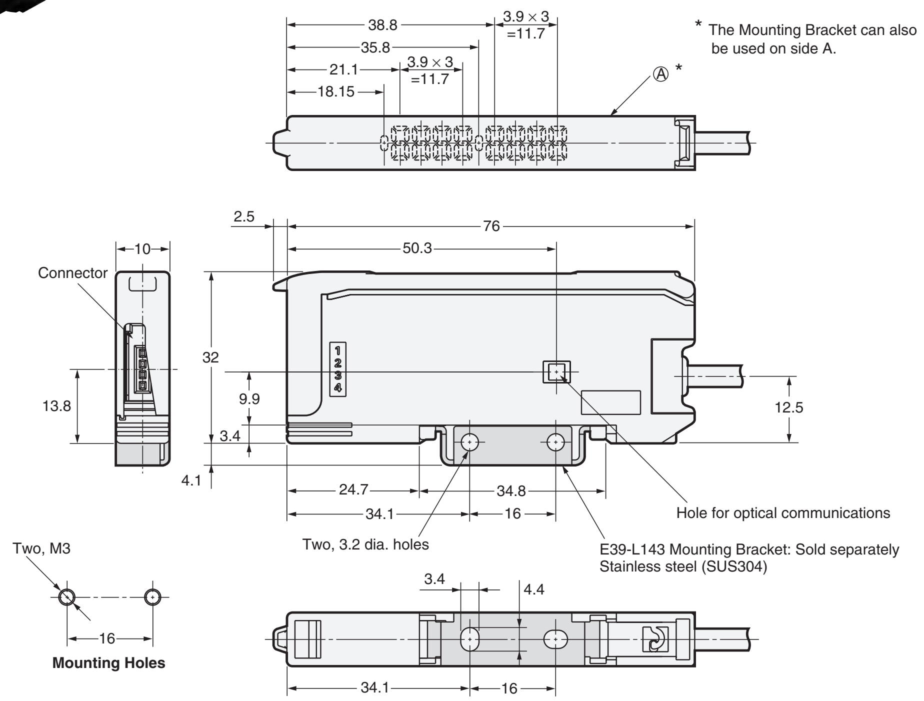
Amplifier Units

Amplifier Units with Cables

E2C-EDA11
E2C-EDA21
E2C-EDA41
E2C-EDA51

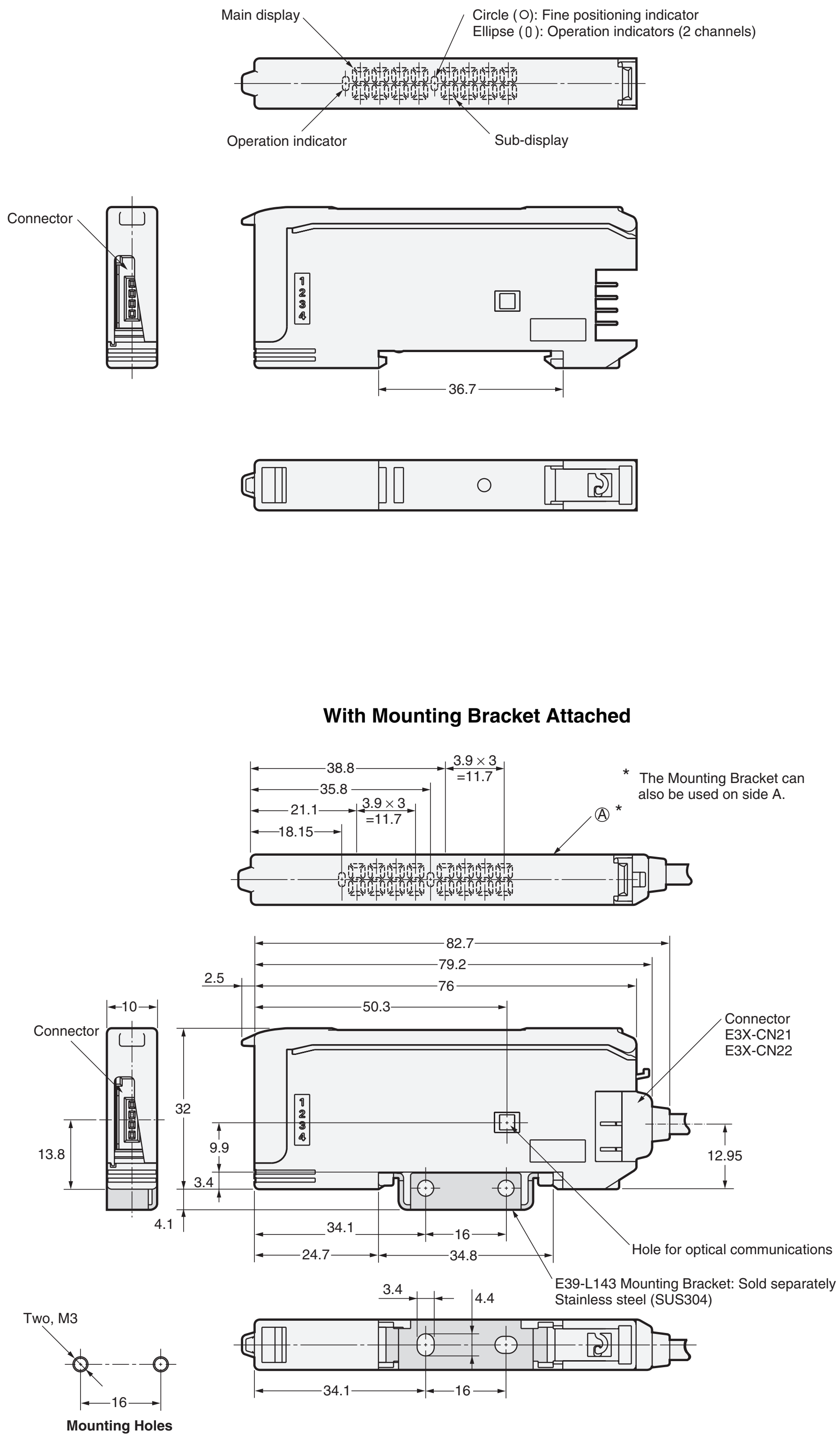


With Mounting Bracket Attached



Amplifier Units with Connectors

E2C-EDA6
E2C-EDA7
E2C-EDA8
E2C-EDA9



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D101-E2-01A-X In the interest of product improvement, specifications are subject to change without notice.

High Frequency Inductive Proximity Sensor

E2EL

Increased response frequency for high speed applications

- Max 5 kHz, switching frequency
- M8 or dia
- 6.5 mm housing
- Brass or stainless steel housing

Ordering Information

Cable types

Brass housing

Diameter	Length	Mounting	Sensing Distance	Output			
				NPN / NO	NPN / NC	PNP / NO	PNP / NC
Ø 6,5	30 mm	Shielded	1,5 mm	E2EL-C1R5E1 2M	E2EL-C1R5E2 2M	E2EL-C1R5F1 2M	E2EL-C1R5F2 2M
	32 mm	Non-shielded	2,0 mm	E2EL-C2ME1 2M	E2EL-C2ME2 2M	E2EL-C2MF1 2M	E2EL-C2MF2 2M
	45 mm	Shielded	1,5 mm	E2EL-C1R5E1-L 2M	E2EL-C1R5E2-L 2M	E2EL-C1R5F1-L 2M	E2EL-C1R5F2-L 2M
	47 mm	Non-shielded	2,0 mm	E2EL-C2ME1-L 2M	E2EL-C2ME2-L 2M	E2EL-C2MF1-L 2M	E2EL-C2MF2-L 2M
M8	30 mm	Shielded	1,5 mm	E2EL-X1R5E1 2M	E2EL-X1R5E2 2M	E2EL-X1R5F1 2M	E2EL-X1R5F2 2M
	32 mm	Non-shielded	2,0 mm	E2EL-X2ME1 2M	E2EL-X2ME2 2M	E2EL-X2MF1 2M	E2EL-X2MF2 2M
	45 mm	Shielded	1,5 mm	E2EL-X1R5E1-L 2M	E2EL-X1R5E2-L 2M	E2EL-X1R5F1-L 2M	E2EL-X1R5F2-L 2M
	47 mm	Non-shielded	2,0 mm	E2EL-X2ME1-L 2M	E2EL-X2ME2-L 2M	E2EL-X2MF1-L 2M	E2EL-X2MF2-L 2M

Stainless steel housing

Diameter	Length	Mounting	Sensing Distance	Output			
				NPN / NO	NPN / NC	PNP / NO	PNP / NC
Ø 6,5	30 mm	Shielded	2,0 mm	E2EL-C2E1-DS 2M	E2EL-C2E2-DS 2M	E2EL-C2F1-DS 2M	E2EL-C2F2-DS 2M
	45 mm	Shielded	2,0 mm	E2EL-C2E1-DSL 2M	E2EL-C2E2-DSL 2M	E2EL-C2F1-DSL 2M	E2EL-C2F2-DSL 2M
M8	30 mm	Shielded	2,0 mm	E2EL-X2E1-DS 2M	E2EL-X2E2-DS 2M	E2EL-X2F1-DS 2M	E2EL-X2F2-DS 2M
	45 mm	Shielded	2,0 mm	E2EL-X2E1-DSL 2M	E2EL-X2E2-DSL 2M	E2EL-X2F1-DSL 2M	E2EL-X2F2-DSL 2M

Plug types

Brass housing

Diameter	Length	Mounting	Sensing Distance	Output			
				NPN / NO	NPN / NC	PNP / NO	PNP / NC
Ø 6,5 / Plug M8	45 mm	Shielded	1,5 mm	E2EL-C1R5E1-M3	E2EL-C1R5E2-M3	E2EL-C1R5F1-M3	E2EL-C1R5F2-M3
	47 mm	Non-shielded	2,0 mm	E2EL-C2ME1-M3	E2EL-C2ME2-M3	E2EL-C2MF1-M3	E2EL-C2MF2-M3
	54 mm	Shielded	1,5 mm	E2EL-C1R5E1-M3L	E2EL-C1R5E2-M3L	E2EL-C1R5F1-M3L	E2EL-C1R5F2-M3L
	56 mm	Non-shielded	2,0 mm	E2EL-C2ME1-M3L	E2EL-C2ME2-M3L	E2EL-C2MF1-M3L	E2EL-C2MF2-M3L
M8 / Plug M8	45 mm	Shielded	1,5 mm	E2EL-X1R5E1-M3	E2EL-X1R5E2-M3	E2EL-X1R5F1-M3	E2EL-X1R5F2-M3
	47 mm	Non-shielded	2,0 mm	E2EL-X2ME1-M3	E2EL-X2ME2-M3	E2EL-X2MF1-M3	E2EL-X2MF2-M3
	54 mm	Shielded	1,5 mm	E2EL-X1R5E1-M3L	E2EL-X1R5E2-M3L	E2EL-X1R5F1-M3L	E2EL-X1R5F2-M3L
	56 mm	Non-shielded	2,0 mm	E2EL-X2ME1-M3L	E2EL-X2ME2-M3L	E2EL-X2MF1-M3L	E2EL-X2MF2-M3L
M8 / Plug M12	44 mm	Shielded	1,5 mm	E2EL-X1R5E1-M1	E2EL-X1R5E2-M1	E2EL-X1R5F1-M1	E2EL-X1R5F2-M1
	46 mm	Non-shielded	2,0 mm	E2EL-X2ME1-M1	E2EL-X2ME2-M1	E2EL-X2MF1-M1	E2EL-X2MF2-M1
	60 mm	Shielded	1,5 mm	E2EL-X1R5E1-M1L	E2EL-X1R5E2-M1L	E2EL-X1R5F1-M1L	E2EL-X1R5F2-M1L
	62 mm	Non-shielded	2,0 mm	E2EL-X2ME1-M1L	E2EL-X2ME2-M1L	E2EL-X2MF1-M1L	E2EL-X2MF2-M1L

Specifications

Brass type

Type			**Ø** 6,5		**M8**	
Operating voltage			10 to 35 VDC			
Rated supply voltage			24 VDC			
Current consumption			max. 15 mA at 24 VDC			
Sensing object			Ferrous metals			
Mounting ((s)hielded, (n)on-shielded) *1			s	n	s	n
Operating distance in mm			1,5	2,0	1,5	2,0
Tolerance of operating distance			±10%			
Standard target size in mm (L x W x H in mm, FE 37)			6,5x6,5x1		8x8x1	
Differential travel			1 % ... 15 % of operating distance			
Max. response frequency in kHz			5,0			
Control output		Type	E2EL-...	E1 type: NPN-NO		
				E2 type: NPN-NC		
				F1 type: PNP-NO		
				F2 type: PNP-NC		
		Max-Load	200 mA			
		Max-on-state Voltage drop	2,5 VDC (at 200mA load current and with 2 m cable)			
Circuit protection			Reverse polarity, output short-circuit			
Indicator			Operating indicator (yellow LED)			
Ambient temperature			Operating: -25° to 70°C			
Humidity			35 to 95 % RH			
Influence of temperature			± 10 % max. of Sn at 23°C in temperature range of -25° to 70°C			
Dielectric strength			1.500 VAC, 50/60 Hz for 1 min. between current carry parts and case			
Electromagnetic compatibility EMC			EN 60947-5-2			
Vibration resistance			Destruction: 10 to 70 Hz, 1,5 mm double amplitude for 1 hour each in X, Y and Z directions			
Shock resistance			Destruction: 300 m/s² (approx. 30 G) for 6 times each in X, Y and Z directions			
Enclosure rating			IP 67 (EN 60947-1)			
Connection *2		Pre-wired	2 m PVC-cable, 3 x 0,14 mm²			
		Connector	M8 plug			
Weight in g	Pre-wired	long	45		50	
		short	43		48	
	Connector	long	10		15	
		short	8		13	
Material		Case	Brass			
		Sensing face	PBTP			

*1. For detailed mounting instruction please refer to page D-105
*2. PUR cable and different length on request.

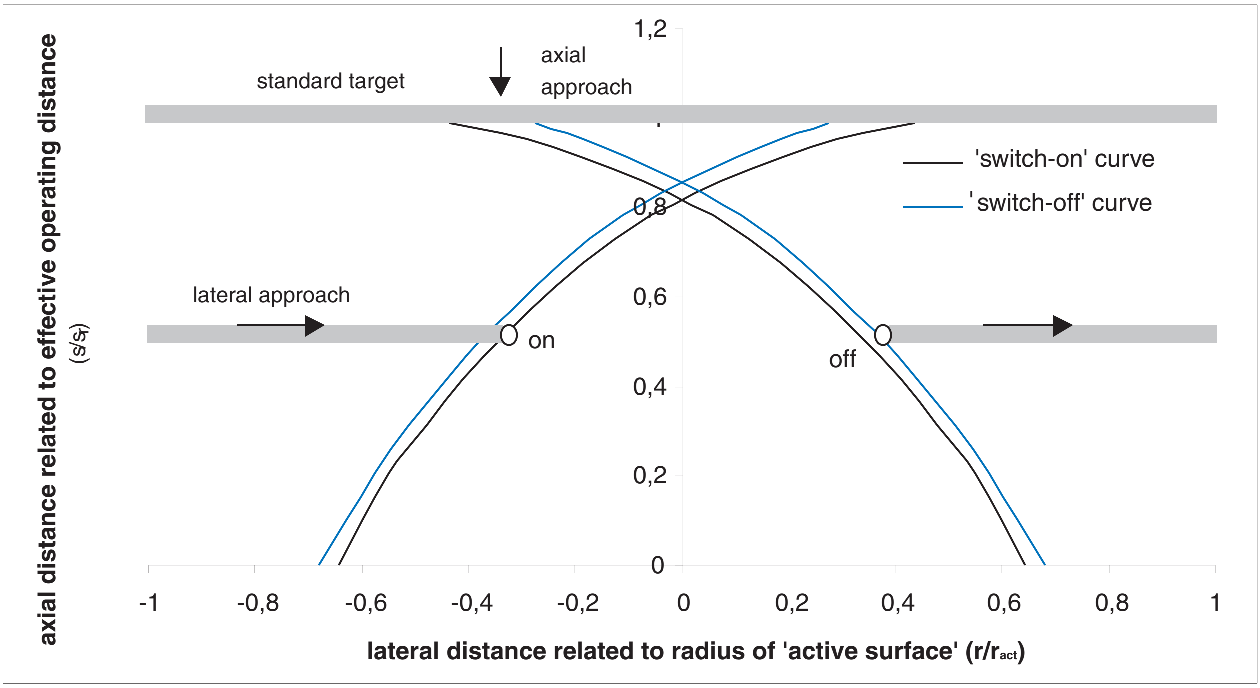
Stainless steel type

Type			Ø 6,5	M8
Operating voltage			10 to 35 VDC	
Rated supply voltage			24 VDC	
Current consumption			max. 15 mA at 24 VDC	
Sensing object			Ferrous metals	
Mounting *1			shielded	
Operating distance in mm			2,0	
Tolerance of operating distance			±10%	
Standard target size in mm (L x W x H in mm, FE 37)			6,5x6,5x1	8x8x1
Differential travel			1 % ... 15 % of operating distance	
Max. response frequency in kHz			4,0	
Control output		Type	E2EL-... E1 type: NPN-NO E2 type: NPN-NC F1 type: PNP-NO F2 type: PNP-NC	
		Max-Load	200 mA	
		Max-on-state Voltage drop	2,5 VDC (at 200mA load current and with 2 m cable)	
Circuit protection			Reverse polarity, output short-circuit	
Indicator			Operating indicator (yellow LED)	
Ambient temperature			Operating: -25° to 70°C	
Humidity			35 to 95 % RH	
Influence of temperature			± 10 % max. of Sn at 23°C in temperature range of -25° to 70°C	
Dielectric strength			1.500 VAC, 50/60 Hz for 1 min. between current carry parts and case	
Electromagnetic compatibility EMC			EN 60947-5-2	
Vibration resistance			Destruction: 10 to 70 Hz, 1,5 mm double amplitude for 1 hour each in X, Y and Z directions	
Shock resistance			Destruction: 300 m/s² (approx. 30 G) for 6 times each in X, Y and Z directions	
Enclosure rating			IP 67 (EN 60947-1)	
Connection *2		Pre-wired	2 m PVC-cable, 3 x 0,14 mm²	
		Connector	-	M8 plug
Weight in g	Pre-wired	long	45	50
		short	43	48
	Connector	long	-	10
		short	-	-
Material		Case	stainless steel 1.4305 / AISI 303	
		Sensing face	PBTP	

*1. For detailed mounting instruction please refer to page D-105
*2. PUR cable and different length on request.

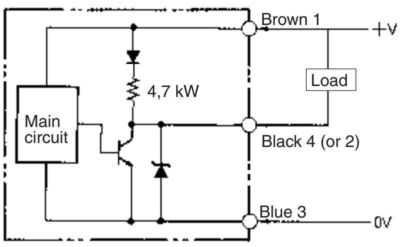
Engineering data

Standardized characteristic for lateral approach

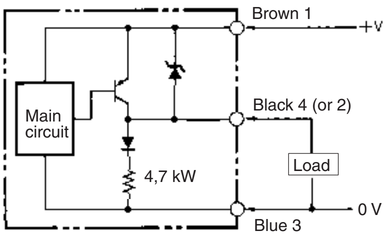


Output Circuit Diagram and Timing Chart

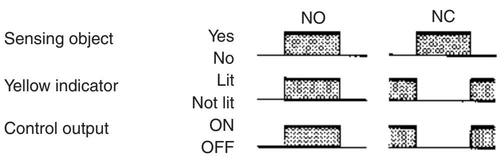
E2EL-□E□
NPN Output



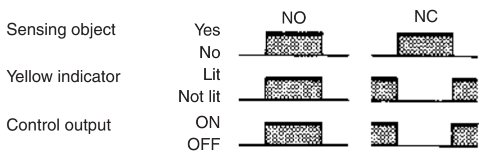
E2EL-□F□
PNP Output



E2EL-□E□
NPN Output

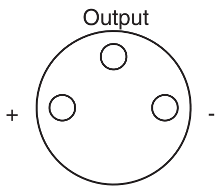


E2EL-□F□
PNP Output



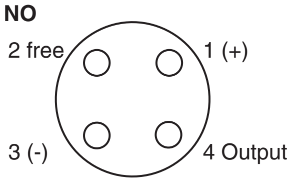
Pin Arrangement at Connector Types

1. Connector M8 (viewed to plug pins)

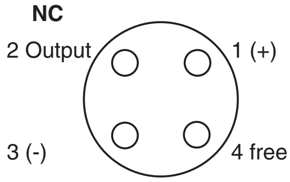


2. Connector M12 (viewed to plug pins)

NO



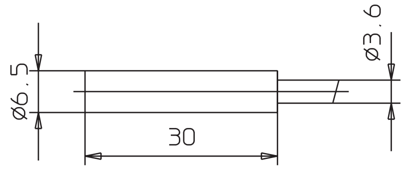
NC



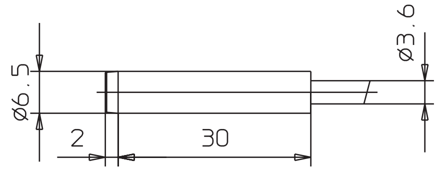
Dimensions

Cable types

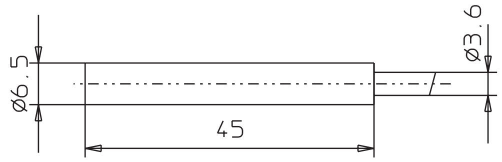
E2EL-C1□R5 2M, E2EL-C2□-DS 2M



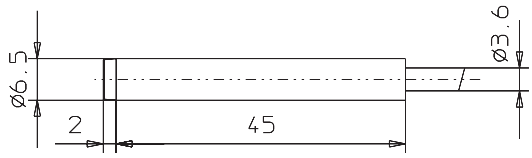
E2EL-C2M□ 2M



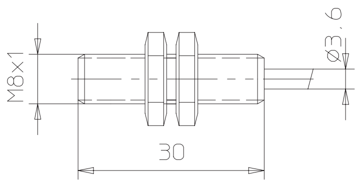
E2EL-C1R5□-L 2M, E2EL-C2□-DSL 2M



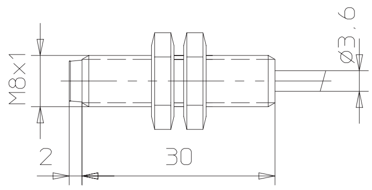
E2EL-C2M□-L 2M



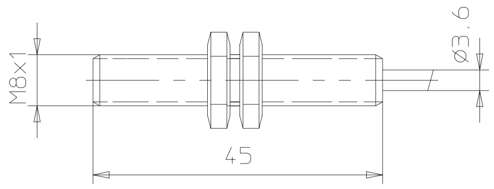
E2EL–X1R5□ 2M, E2EL–X2□–DS 2M



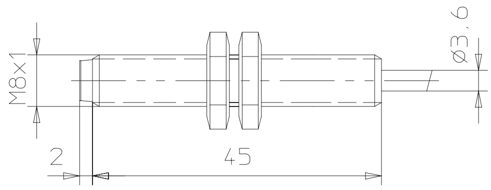
E2EL–X2M □2M



E2EL–X1R5□–L 2M, E2EL–X2 □–DSL 2M

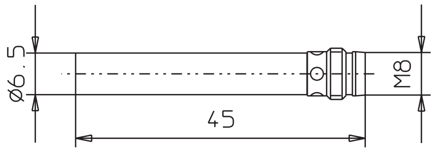


E2EL–X2M□–L 2M

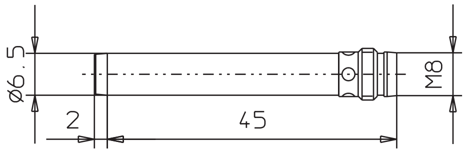


Plug types

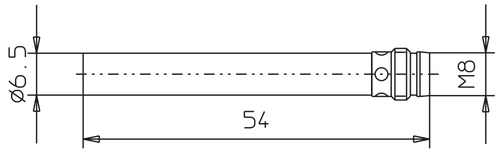
E2EL-C1R5□-M3



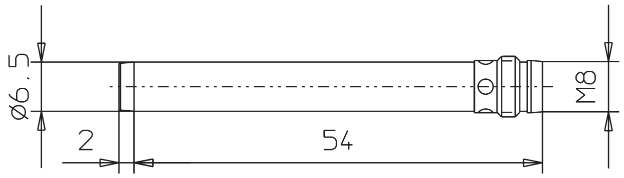
E2EL-C2M□-M3



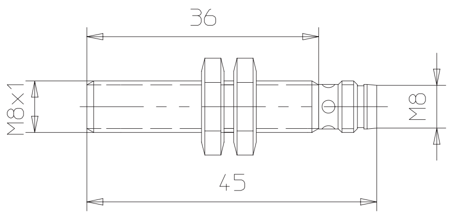
E2EL-C1R5□-M3L



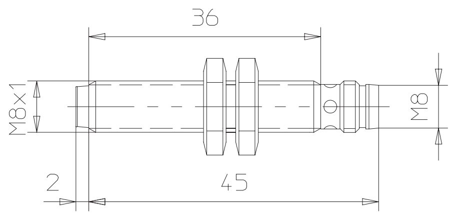
E2EL-C2M□-M3L



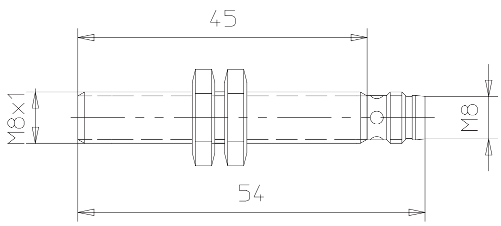
E2EL–X1R5□–M3



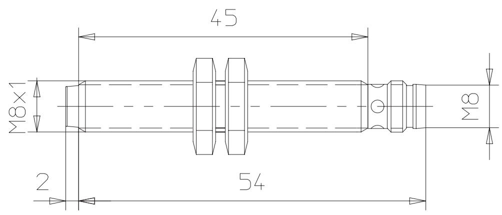
E2EL–X2M□–M3



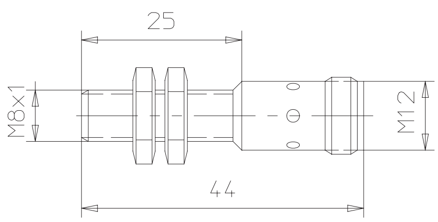
E2EL–X1R5□–M3L, E2EL–X2 □DM3S



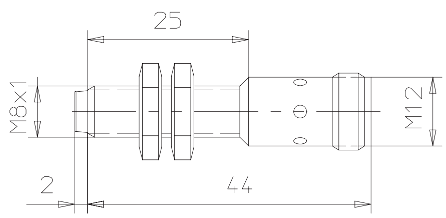
E2EL–X2M □-M3L



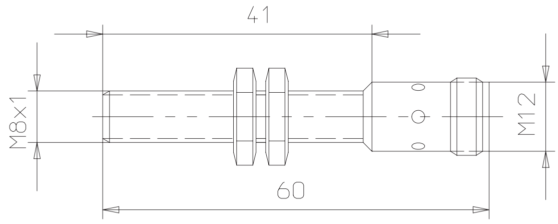
E2EL–X1R5□–M1



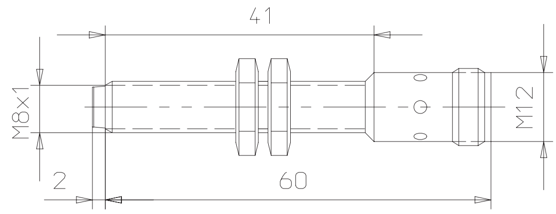
E2EL–X2M□–M1



E2EL–X1R5□–M1L

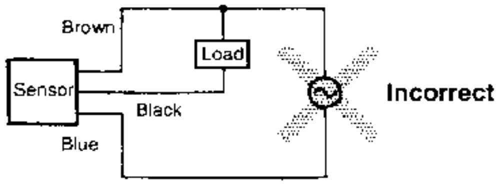
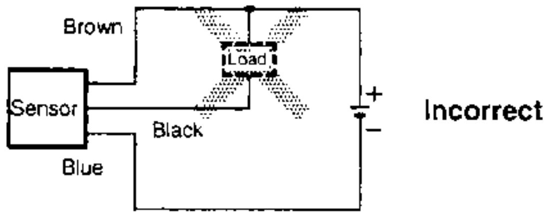
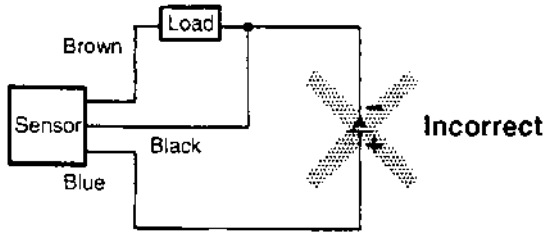


E2EL–X2M□–M1L



Installation

Caution

Item	Examples
Power Supply Do not impose an excessive voltage on the E2EL, otherwise it may explode or burn. Do not impose 24 VAC on any E2EL model, otherwise it may explode or burn.	
Load short-circuit Do not short-circuit the load, or the E2EL may explode or burn. The E2EL's short-circuit protection function is valid, if the polarity of the supply voltage imposed is incorrect and within the rated voltage range.	
Wiring Be sure to wire the E2EL and load correctly, otherwise it may explode or burn.	

Correct Use

Installation

Power Reset Time

The Proximity Sensor is ready to operate within 100 ms after power is supplied. If power supplies are connected to the Proximity Sensor and load respectively, be sure to supply power to the Proximity Sensor before supplying power to the load.

Power OFF

The Proximity Sensor may output a pulse signal when it is turned off. Therefore, it is recommended to turn off the load before turning off the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Sensing Object

Metal Coating:
The sensing distance of the Proximity Sensor vary with the metal coating on sensing objects.

Wiring

High-tension Lines

Wiring through Metal Conduit
If there is a power or high-tension line near the cord of the Proximity Sensor, wire the cord through an independent metal conduit to prevent against Proximity Sensor damage or malfunctioning.

Core Tractive Force

Do not pull cords with the tractive force exceeding the following:
pull force (N) = 20 x cable diameter (mm)

Mounting

The Proximity Sensor must not be subjected to excessive shock with a ha mmer when it is installed, otherwise the Proximity Sensor may be damaged or lose the water-resistivity.

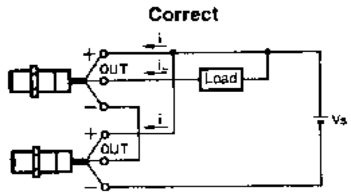
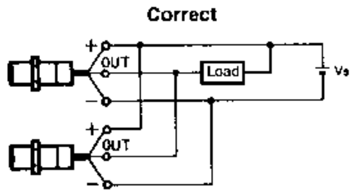
Environment

Water-Resistivity

Do not use the Proximity Sensor underwater, outdoors or in the rain.

Operating Environment

Be sure to use the Proximity Sensor within operating ambient temperature range and do not use the Proximity Sensor outdoors so that its reliability and life expectancy can be maintained. Although the Proximity Sensor is water resistive, a cover to protect the Proximity Sensor from water or soluble machining oil is reco mmended so that its reliability and life expectancy can be maintained. Do not use the Proximity Sensor in an environment with chemical gas (e. G., strong alkaline or acid gases including nitric, chromic, and concentrated sulfuric acid gases).

Item	Examples	Item
AND (serial connection)		The Sensors connected together must satisfy the following conditions: iL + (N-1) x i = Upper-limit of control output of each Sensor VS - N x VR = Load operating voltage N = No. of Sensors VR = Residual voltage of each Sensor VS = Supply voltage i = Current consumption of the Sensor iL = Load current If the MY Relay, which operate at 24 VDC, is used as a load for example, a maximum of two Proximity Sensors can be connected to the load.
OR (parallel connection)		The number of Sensors connected in parallel varies with the Proximity Sensor model.

Effects of Surrounding Metal

Shielded types:

Shielded types allow direct installation on metal plates in an embedded manner without performance change. A minimum distance of 3sn is required between the active surface and a metallic surface in front of the device. (Fig. 1).
For SUS shielded types the following minimum distances are required to avoid performance change (see Fig.2 and table below):

Shielded SUS Types	Free zone
E2EL-2☐-DS	0,5 mm

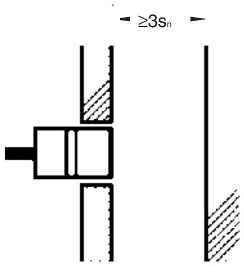


Fig.1: Shielded type (except SUS)

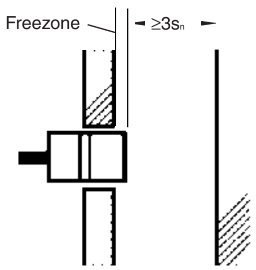


Fig.2: Shielded SUS type

Non-shielded types:

Installation of non-shielded types in metal require the minimum distances according to Fig. 3.

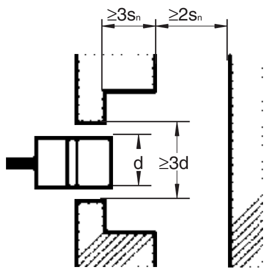


Fig.3: Non-shielded type

Ultra Small Inductive Proximity Sensor

E2EC

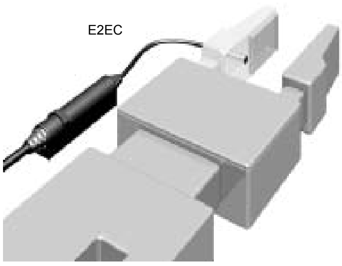
Subminiature Sensor for demanding mounting conditions

- 3 mm dia sensing head for most demanding mounting conditions
- 18 mm long ultra short M12 size housing

Applications

Check of a robot hand chucking

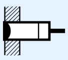
The proximity sensor which can be attached to a moving part like a chucking robot.



Ordering Information

Sensors

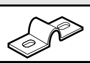
DC 2-wire

Shape		Sensing distance	Model: Operating status: NO	Model: Operating status: NC
Shield 	3-mm dia. *	0.8mm	E2EC-CR8D1	E2EC-CR8D2
	5.4-mm dia. *	1.5mm	E2EC-C1R5D1	E2EC-C1R5D2
	8-mm dia. *	3mm	E2EC-C3D1	E2EC-C3D2
	M12*	4mm	E2EC-X4D1	E2EC-X4D2

Note: A different frequency type is available. (E2EC-□□5; e.g.E2EC-CR8D15)

Accessories (Order Separately)

Mounting Brackets

Shape	Model	Applicable models
	**Y92E-F5R4**	E2EC-C1R5D□

Rating/performance

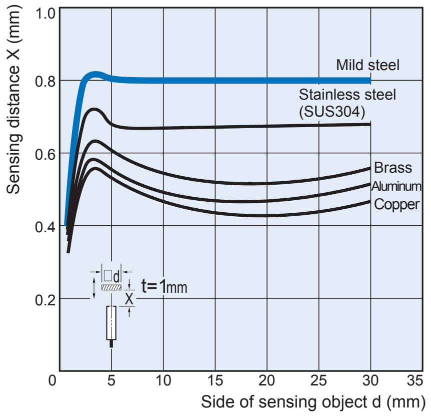
Item / Type / Model		DC 2-wire			
		E2EC-CR8D□	E2EC-C1R5D□	E2EC-C3D□	E2EC-X4D□
Sensing distance		0.8 mm ±15%	1.5 mm ±10%	3 mm ±10%	4 mm ±10%
Setting distance		0 to 0.56 mm	0 to 1.05 mm	0 to 2.1 mm	0 to 2.8 mm
Differential distance		10% max.			
Sensing object		Ferrous metal (Sensitivity lowers with non-ferrous metals)			
Standard sensing object		Iron, 5 × 5 × 1 mm		Iron, 8 × 8 × 1 mm	Iron, 12 × 12 × 1 mm
Response frequency		1.5 kHz		1 kHz	
Power supply (Operating voltage range)		12 to 24 VDC (10 to 30 VDC) ripple (p-p): 10% max.			
Current consumption		---			
Leakage current		0.8 mA max.			
Control output	Switching capacity	5 to 100 mA			
	Residual voltage	3.0 V max. (under load current of 100 mA with cable length of 2 m)			
Indicator lamp		D1 type: Operation indicator (red LED), Operation set indicator (green LED) D2 type: Operation indicator (red LED)			
Operating status (with sensing object approaching)		D1 models: NO D2 models: NC			
Protective circuits		Surge absorber, short-circuit protection			
Ambient temperature		Operating/Storage: -25° C to 70° C (with no icing or condensation)			
Ambient humidity		Operating/Storage: 35% to 95%RH (with no condensation)			
Temperature influence		±20%max. of sensing distance at 23° in temperature range of -25° to 70°			
Voltage influence		±2.5% max. of sensing distance within a range of ±15% of rated power supply voltage			
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case			
Dielectric strength		1,000 VAC for 1 min between current carry parts and case			
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions			
Shock resistance		Destruction: 1,000 m/s^2 for 10 times each in X, Y, and Z directions			
Protective structure		IEC60529 IP67			
Connection method		Pre-wired models (standard length: 2 m)			
Weight (Packed state)		Approx. 45 g			
Material	Case	Brass			
	Sensing surface	ABS			
Accessories		Mounting bracket, instruction manual			

* The response frequencies for DC switching are average values measured on condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.

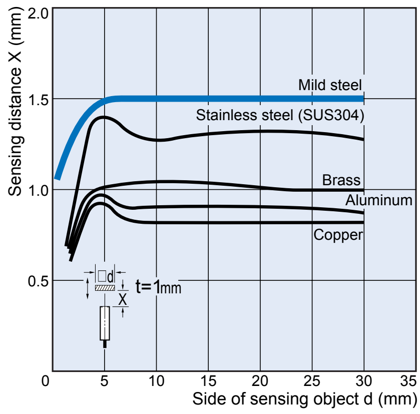
Characteristic data (typical)

Sensing Distance vs. Sensing Object

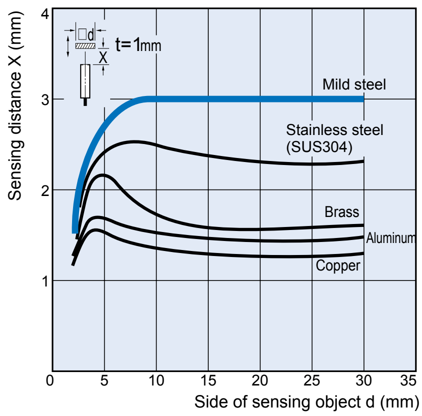
E2EC-CR8D1



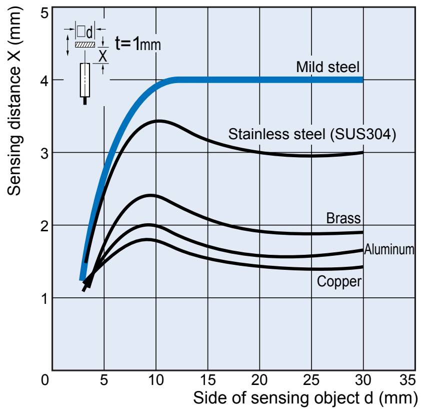
E2EC-C1R5D1



E2EC-C3D1



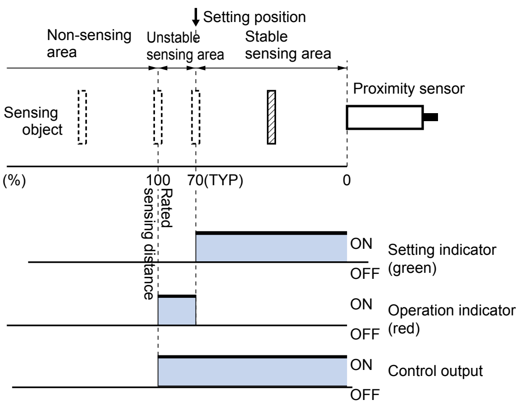
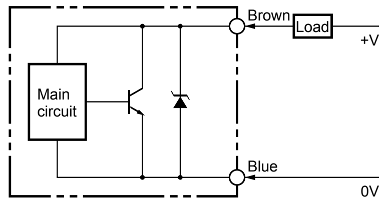
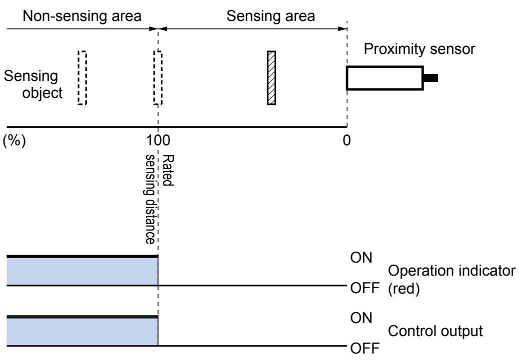
E2EC-X4D1



E2EC

Output Circuit Diagram

DC 2-wire Models

Operating status	Model	Timing chart	Output circuit
NO	**E2EC-CR8D1** **E2EC-C1R5D1** **E2EC-C3D1** **E2EC-X4D1**		 Note: The load can be connected to either the +V or 0-V side.
NC	**E2EC-CR8D2** **E2EC-C1R5D2** **E2EC-C3D2** **E2EC-X4D2**		

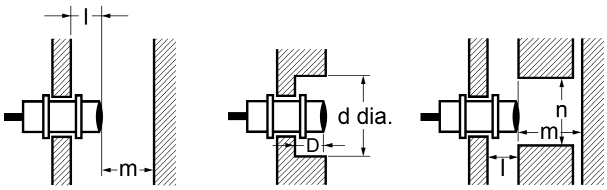
Precautions

Correct Use

Design

Effects of Surrounding Metal

Provide a minimum distance as shown in the table below between the Sensor and the surrounding metal.

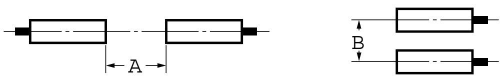


Effects of Surrounding Metal(Unit: mm)

Model / Item	l	d	D	m	n
E2EC-CR8D☐	0	3	0	2.4	6
E2EC-C1R5D☐		5.4		4.5	10.8
E2EC-C3D☐		8		9	16
E2EC-X4D☐		12		12	24

Mutual Interference

If more than one Sensor is located face-to-face or in parallel, be sure to maintain enough space, as provided in the following diagram, between adjacent Sensors to suppress mutual interference.



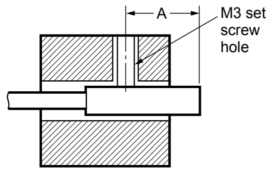
Mutual Interference(Unit: mm)

Model / Item	A	B
E2EC-CR8D☐	18 (4)	6 (3)
E2EC-C1R5D☐	15 (8)	10.8 (5.4)
E2EC-C3D☐	30 (15)	16 (8)
E2EC-X4D☐	40 (20)	24 (12)

Note: The above values in parentheses are applicable when using two sensors with different frequencies.

Mounting

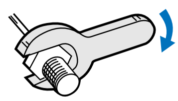
- Refer to the following table for the torque and tightening ranges applied to mount unthreaded E2EC-C models.



Permissible Tightening Torque

Model	Tightening range	Set-screw tightening torque
E2EC-CR8D☐	6 to 10 mm	0.49 N•m
E2EC-C1R5D☐	8 to 16 mm	
E2EC-C3D☐		0.98 N•m

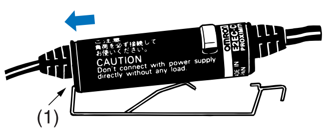
- The tightening torque applied to the E2EC-X4D (I.e., models with column screws) must be 120 kgf•cm (12 N•m) max.



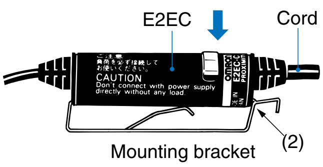
Mounting Bracket for DC 2-wire Models

Mounting

1. Insert the amplifier into the trapezoidal end (I.e., the fixing side) of the mounting bracket.

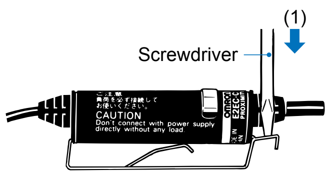


2. Press the other end of the amplifier onto the bracket.

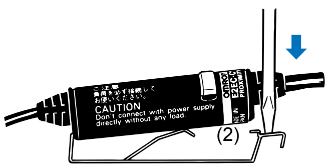


Removal

1. Lightly press the hook of the mounting bracket with a flat-blade screwdriver.



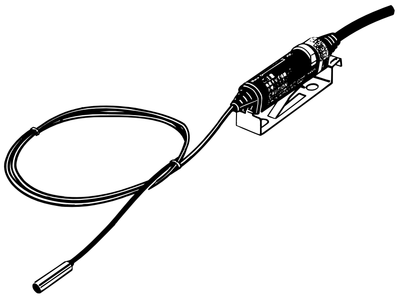
2. The amplifier will automatically spring loose from the mounting bracket.



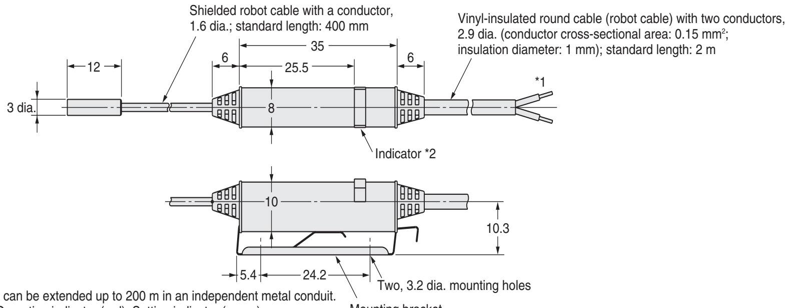
Dimensions (Unit: mm)

Sensors

E2EC-CR8D□

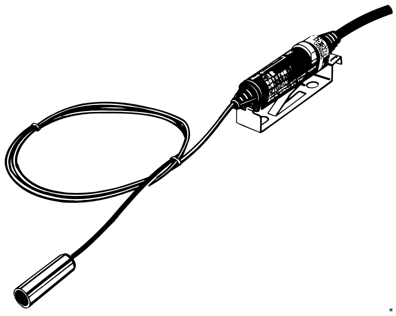


With Mounting Blanket Attached

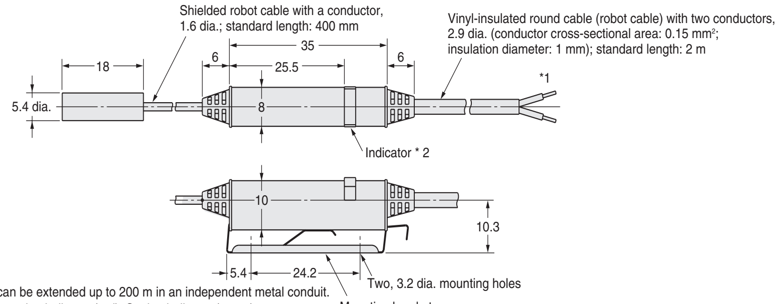


*1. The cable can be extended up to 200 m in an independent metal conduit.
*2. D1 type: Operation indicator (red), Setting indicator (green)

E2EC-C1R5D□

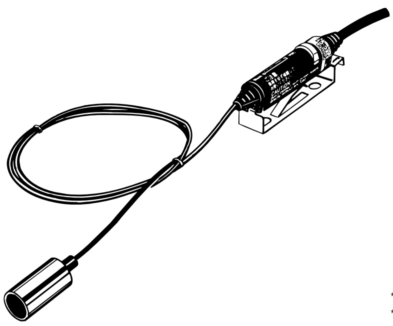


With Mounting Blanket Attached

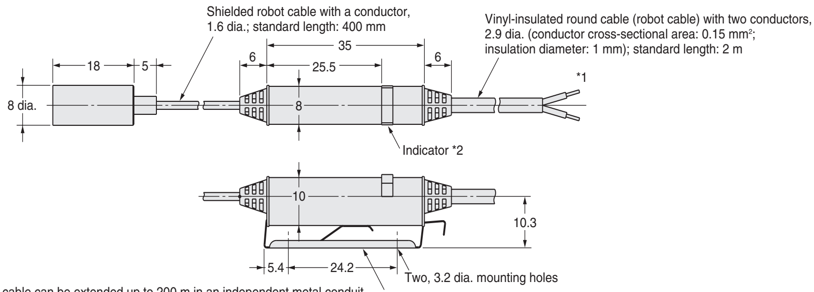


1. The cable can be extended up to 200 m in an independent metal conduit.
* 2. D1 type: Operation indicator (red), Setting indicator (green)

E2EC-C3D□

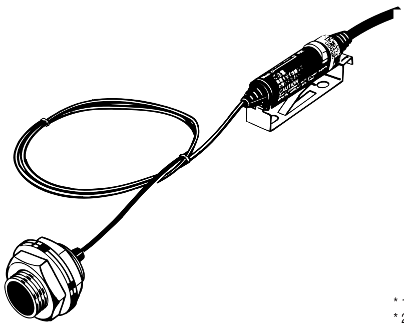


With Mounting Blanket Attached

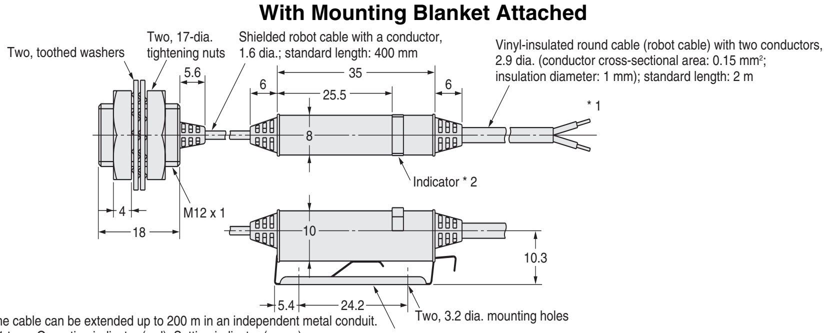


* 1. The cable can be extended up to 200 m in an independent metal conduit.
* 2. D1 type: Operation indicator (red), Setting indicator (green)
D2 type: Operation indicator (red)

E2EC-X4D□

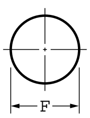


With Mounting Blanket Attached



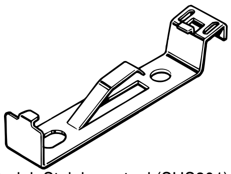
* 1. The cable can be extended up to 200 m in an independent metal conduit.
* 2. D1 type: Operation indicator (red), Setting indicator (green)
D2 type: Operation indicator (red)

Mounting Holes

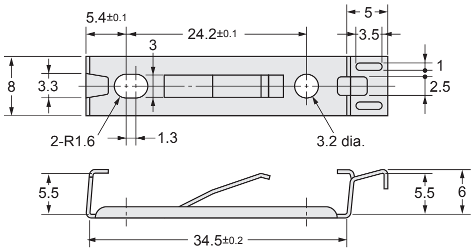


Model	F (mm)
E2EC-CR8D□	3.3-mm dia. +0.
E2EC-C1R5D□	5.7-mm dia. +0.
E2EC-C3D□	8.5-mm dia. +0.
E2EC-X4D□	12.5-mm dia.+0.

Mounting Brackets



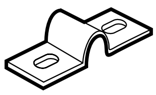
Material: Stainless steel (SUS301)
Note: It is attached to the DC 2-wire sensors.



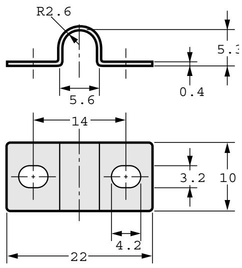
Accessories (Order Separately)

Mounting Brackets

Y92E-F5R4



Material: Stainless steel (SUS304)
Note: E2EC-C1R5D applicable to head of □



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D09E-EN-01

Smooth Barrel Proximity Sensors

TL

Cylindrical dia 8 mm all-metal housing with M8 plug connection or pre-wired

Ordering information

Short barrel type

Versions			S_n (mm)	Output			
				NPN		PNP	
Size	Type			NO	NC	NO	NC
8 mm	Shielded	Connector	1.5	TL-C1R5E1-M3-E1	TL-C1R5E2-M3-E1	TL-C1R5F1-M3-E1	TL-C1R5F2-M3-E1
		Pre-wired		TL-C1R5E1-E1	TL-C1R5E2-E1	TL-C1R5F1-E1	TL-C1R5F2-E1
	Non-shielded	Connector	2	TL-C2ME1-M3-E1	TL-C2ME2-M3-E1	TL-C2MF1-M3-E1	TL-C2MF2-M3-E1
		Pre-wired		TL-C2ME1-E1	TL-C2ME2-E1	TL-C2MF1-E1	TL-C2MF2-E1

Long barrel type

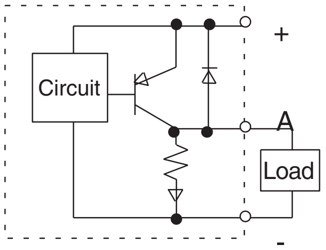
Versions			S_n (mm)	Output			
				NPN		PNP	
Size	Type			NO	NC	NO	NC
8 mm	Shielded	Connector	1.5	TL-C1R5E1-M3-E2	TL-C1R5E2-M3-E2	TL-C1R5F1-M3-E2	TL-C1R5F2-M3-E2
		Pre-wired		TL-C1R5E1-E2	TL-C1R5E2-E2	TL-C1R5F1-E2	TL-C1R5F2-E2
	Non-shielded	Connector	2	TL-C2ME1-M3-E2	TL-C2ME2-M3-E2	TL-C2MF1-M3-E2	TL-C2MF2-M3-E2
		Pre-wired		TL-C2ME1-E2	TL-C2ME2-E2	TL-C2MF1-E2	TL-C2MF2-E2

Specifications

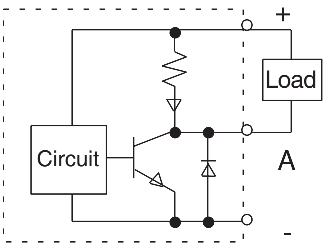
Type	8 mm Ø	
	TL-C1R5□□-E1 TL-C1R5□□-E2	TL-C2M□□-E1 TL-C2M□□-E2
Sensing distance (Sn)	1.5 mm ± 10%	2 mm ± 10%
Power supply	10 to 35 V DC	
Power consumption	15 mA max.	
Object St 37	8 x 8 x 1 mm	
Switching hysteresis	1 to 15 %	
Switching frequency	5 kHz	
Temperature dependency	10% max.	
Ambient temperature	-25° to 70° C	
Switching output	300 mA max.	
Residual voltage	2.5 V max.	
Function display	1 LED	
Degree of protection	IP 65	
Housing material	Nickel-plated brass	

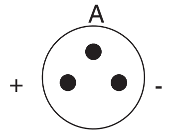
Output circuits

PNP output



NPN output



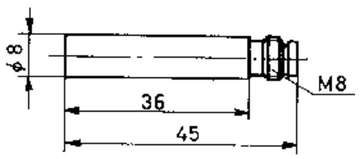


Reduction factors (typical values)

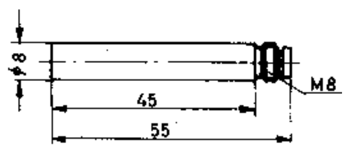
Chrome-nickel	Sn x 0.9
Brass	Sn x 0.5
Aluminium	Sn x 0.45
Copper	Sn x 0.4

Dimensions (mm)

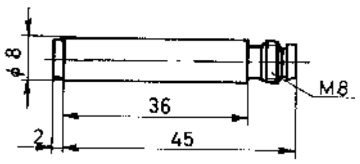
TL-C1R5□□-E1



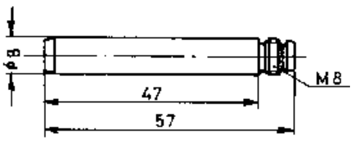
TL-C1R5□□-E2



TL-C2M□□-E1

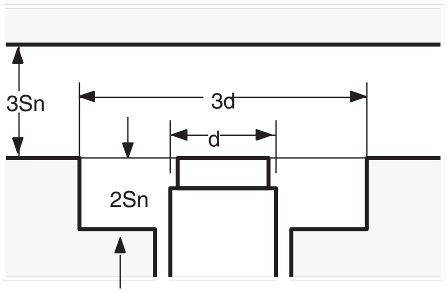


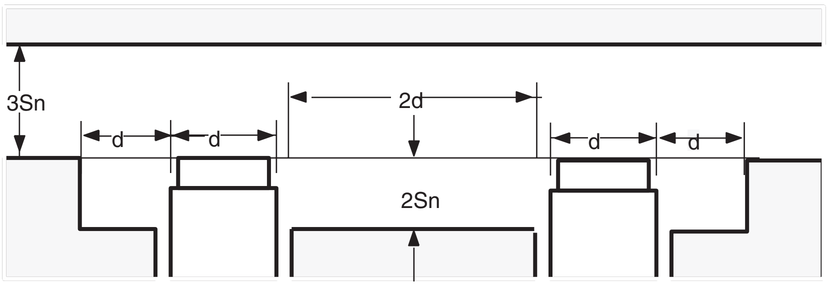
TL-C2M□□-E2



Installation

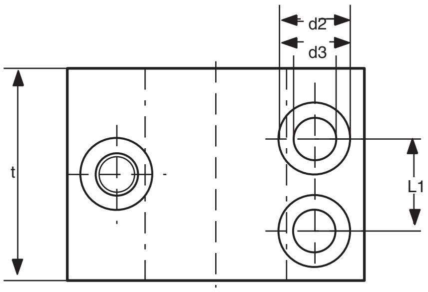
The minimum clearances indicated below must always be maintained in the case of non-shielded mounted types.

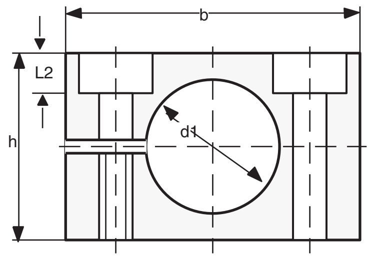




Installation accessories

Type	d1	d2	d3	L1	L2	w	h	d	Material
Y92E-B8-E1	8.0	6.0	3.2	7.5	3.3	20	12	16	Brass
Y92E-B8-E2	8.0	6.0	3.2	7.5	3.3	20	14	16	Plastic





TL

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D05E-EN-01

Oil resistant Cylindrical Proximity Sensor (Automotive)

E2E

Designed and tested for Automotive assembly lines

- tested oil resistance on commonly used lubricants in Automotive industry

Ordering Information

E2E

DC 2-wire/Pre-wired Models

Self-diagnostic output function	Size		Sensing distance	Model	
				NO	NC
Yes	Shielded	M12	3 mm	E2E-X3D1S (See note 1.)	---
		M18	7 mm	E2E-X7D1S (See note 1.)	---
		M30	10 mm	E2E-X10D1S (See note 1.)	---
	Unshielded	M12	8 mm	E2E-X8MD1S (See note 1.)	---
		M18	14 mm	E2E-X14MD1S (See note 1.)	---
		M30	20 mm	E2E-X20MD1S (See note 1.)	---
No	Shielded	M8	2 mm	E2E-X2D1-N (See notes 2 and 3.)	E2E-X2D2-N (See note 3.)
		M12	3 mm	E2E-X3D1-N (See notes 1, 2 and 3.)	E2E-X3D2-N (See note 3.)
		M18	7 mm	E2E-X7D1-N (See notes 1, 2 and 3.)	E2E-X7D2-N (See note 3.)
		M30	10 mm	E2E-X10D1-N (See notes 1, 2 and 3.)	E2E-X10D2-N
	Unshielded	M8	4 mm	E2E-X4MD1 (See notes 2 and 3.)	E2E-X4MD2
		M12	8 mm	E2E-X8MD1 (See notes 1, 2 and 3.)	E2E-X8MD2
		M18	14 mm	E2E-X14MD1 (See notes 1, 2 and 3.)	E2E-X14MD2
		M30	20 mm	E2E-X20MD1 (See notes 1, 2 and 3.	E2E-X20MD2

*1. In addition to the above models, E2E-X☐☐15 models (e.g., E2E-X3D15-N), which are different in frequency from the above models, are available.
*2. E2E models with a robotics cable are available as well. The model number of a model with a robotics cable has the suffix “-R” (e.g., E2E-X3D1-R).
*3. Cables with a length of 5 m are also available. Specify the cable length at the end of the model number (e.g., E2E-X3D1-N 5M).

DC 2-wire/Connector Models

Connector	Self-diagnostic output function	Size		Sensing distance	Model NO	Model NC
M12	Yes	Shielded	M12	3 mm	E2E-X3D1S-M1	---
			M18	7 mm	E2E-X7D1S-M1	---
			M30	10 mm	E2E-X10D1S-M1	---
		Unshielded	M12	8 mm	E2E-X8MD1S-M1	---
			M18	14 mm	E2E-X14MD1S-M1	---
			M30	20 mm	E2E-X20MD1S-M1	---
	No	Shielded	M8	2 mm	E2E-X2D1-M1G	E2E-X2D2-M1G
			M12	3 mm	E2E-X3D1-M1G (See note.)	E2E-X3D2-M1G
			M18	7 mm	E2E-X7D1-M1G (See note.)	E2E-X7D2-M1G
			M30	10 mm	E2E-X10D1-M1G (See note.)	E2E-X10D2-M1G
		Unshielded	M8	4 mm	E2E-X4MD1-M1G	E2E-X4MD2-M1G
			M12	8 mm	E2E-X8MD1-M1G (See note.)	E2E-X8MD2-M1G
			M18	14 mm	E2E-X14MD1-M1G (See note.)	E2E-X14MD2-M1G
			M30	20 mm	E2E-X20MD1-M1G (See note.)	E2E-X20MD2-M1G
M8		Shielded	M8	2 mm	E2E-X2D1-M3G	E2E-X2D2-M3G
		Unshielded		4 mm	E2E-X4MD1-M3G	E2E-X4MD2-M3G

Note: In addition to the above models, E2E-X☐D15-M1G models (e.g., E2E-X3D15-M1G), which are different in frequency from the above models, are available.

DC 2-wire/Pre-wired Connector Models

Size		Sensing distance	Operation mode	Polarity	Model
Shielded	M12	3 mm	NO	Yes	E2E-X3D1-M1GJ
				No	E2E-X3D1-M1J-T
	M18	7 mm		Yes	E2E-X7D1-M1GJ
				No	E2E-X7D1-M1J-T
	M30	10 mm		Yes	E2E-X10D1-M1GJ
				No	E2E-X10D1-M1J-T
Unshielded	M12	8 mm		Yes	E2E-X8MD1-M1GJ
	M18	14 mm			E2E-X14MD1-M1GJ
	M30	20 mm			E2E-X20MD1-M1GJ

*1. A model with no polarity has a residual voltage of 5 V, which must be taken into consideration together with the interface condition (the PLC's ON voltage, for example) when connecting the Proximity Sensor to a load.
*2. The standard cable length is 300 mm. Models are also available with 500 mm and 1 m cables.

Connector Pin Assignments of DC 2-wire Model

The connector pin assignments of each new E2E DC 2-wire conforms to IEC947-5-2 Table III.
The following E2E models with conventional connector pin assignments are available as well.

Size		Operation mode	Model	Size		Operation mode	Model
Shielded	M8	NO	E2E-X2D1-M1	Unshielded	M8	NO	E2E-X4MD1-M1
		NC	E2E-X2D2-M1			NC	E2E-X4MD2-M1
	M12	NO	E2E-X3D1-M1		M12	NO	E2E-X8MD1-M1
		NC	E2E-X3D2-M1			NC	E2E-X8MD2-M1
	M18	NO	E2E-X7D1-M1		M18	NO	E2E-X14MD1-M1
		NC	E2E-X7D2-M1			NC	E2E-X14MD2-M1
	M30	NO	E2E-X10D1-M1		M30	NO	E2E-X20MD1-M1
		NC	E2E-X10D2-M1			NC	E2E-X20MD2-M1

DC 3-wire/Pre-wired Models

Size		Sensing distance	Output configuration	Model
Shielded	M8	1.5 mm	NPN NO	E2E-X1R5E1 (See notes 1 and 2.)
			NPN NC	E2E-X1R5E2
			PNP NO	E2E-X1R5F1
			PNP NC	E2E-X1R5F2
	M12	2 mm	NPN NO	E2E-X2E1 (See notes 1, 2, 3, and 4.)
			NPN NC	E2E-X2E2 (See notes 3 and 4.)
			PNP NO	E2E-X2F1
			PNP NC	E2E-X2F2
	M18	5 mm	NPN NO	E2E-X5E1 (See notes 1, 2, 3, and 4.)
			NPN NC	E2E-X5E2 (See notes 3 and 4.)
			PNP NO	E2E-X5F1
			PNP NC	E2E-X5F2
	M30	10 mm	NPN NO	E2E-X10E1 (See notes 1, 2, 3, and 4.)
			NPN NC	E2E-X10E2 (See notes 3 and 4.)
			PNP NO	E2E-X10F1
			PNP NC	E2E-X10F2
Unshielded	M8	2 mm	NPN NO	E2E-X2ME1 (See note 2.)
			NPN NC	E2E-X2ME2
			PNP NO	E2E-X2MF1
			PNP NC	E2E-X2MF2
	M12	5 mm	NPN NO	E2E-X5ME1 (See notes 1, 2, 3, and 4.)
			NPN NC	E2E-X5ME2 (See notes 3 and 4.)
			PNP NO	E2E-X5MF1
			PNP NC	E2E-X5MF2
	M18	10 mm	NPN NO	E2E-X10ME1 (See notes 1, 2, 3, and 4.)
			NPN NC	E2E-X10ME2 (see notes 3 and 4.)
			PNP NO	E2E-X10MF1
			PNP NC	E2E-X10MF2
	M30	18 mm	NPN NO	E2E-X18ME1 (See notes 1, 2, 3, and 4.)
			NPN NC	E2E-X18ME2 (See notes 3 and 4.)
			PNP NO	E2E-X18MF1
			PNP NC	E2E-X18MF2

Note: 1. Cables with a length of 5 m are also available. Specify the cable length at the end of the model number (e.g., E2E-X2E1 5M).
2. Models with a robotics cable are also available. These models are E2E-X□E1-R (e.g., E2E-X5E1-R).
3. Models with a different frequency are also available. These models are E2E-X□E□5 (e.g., E2E-X5E15).
4. These models have e-CON connectors (0.3 m cable length), which is indicated by the suffix "-ECON" (e.g., E2E-X2E1-ECON).

AC 2-wire/Pre-wired Models

Size		Sensing distance	Operation mode	Model
Shielded	M8	1.5 mm	NO	E2E-X1R5Y1
			NC	E2E-X1R5Y2
	M12	2 mm	NO	E2E-X2Y1 (See notes 1 and 2.)
			NC	E2E-X2Y2
	M18	5 mm	NO	E2E-X5Y1 (See notes 1 and 2.)
			NC	E2E-X5Y2
	M30	10 mm	NO	E2E-X10Y1 (See notes 1 and 2.)
			NC	E2E-X10Y2
Unshielded	M8	2 mm	NO	E2E-X2MY1
			NC	E2E-X2MY2
	M12	5 mm	NO	E2E-X5MY1 (See notes 1 and 2.)
			NC	E2E-X5MY2
	M18	10 mm	NO	E2E-X10MY1 (See note 1.)
			NC	E2E-X10MY2
	M30	18 mm	NO	E2E-X18MY1 (See note 1.)
			NC	E2E-X18MY2

Note: 1. Models with a different frequency are also available. These models are E2E-X□Y□5 (e.g., E2E-X5Y15).
2. Cables with a length of 5 m are also available. Specify the cable length at the end of the model number (e.g., E2E-X2Y1 5M).

DC 3-wire/Connector Models

Connector	Size		Sensing distance	Output configuration	Model
M12	Shielded	M8	1.5 mm	NPN NO	E2E-X1R5E1-M1
				NPN NC	E2E-X1R5E2-M1
				PNP NO	E2E-X1R5F1-M1
				PNP NC	E2E-X1R5F2-M1
		M12	2 mm	NPN NO	E2E-X2E1-M1
				NPN NC	E2E-X2E2-M1
				PNP NO	E2E-X2F1-M1
				PNP NC	E2E-X2F2-M1
		M18	5 mm	NPN NO	E2E-X5E1-M1
				NPN NC	E2E-X5E2-M1
				PNP NO	E2E-X5F1-M1
				PNP NC	E2E-X5F2-M1
		M30	10 mm	NPN NO	E2E-X10E1-M1
				NPN NC	E2E-X10E2-M1
				PNP NO	E2E-X10F1-M1
				PNP NC	E2E-X10F2-M1
	Unshielded	M8	2 mm	NPN NO	E2E-X2ME1-M1
				NPN NC	E2E-X2ME2-M1
				PNP NO	E2E-X2MF1-M1
				PNP NC	E2E-X2MF2-M1
		M12	5 mm	NPN NO	E2E-X5ME1-M1
				NPN NC	E2E-X5ME2-M1
				PNP NO	E2E-X5MF1-M1
				PNP NC	E2E-X5MF2-M1
		M18	10 mm	NPN NO	E2E-X10ME1-M1
				NPN NC	E2E-X10ME2-M1
				PNP NO	E2E-X10MF1-M1
				PNP NC	E2E-X10MF2-M1
		M30	18 mm	NPN NO	E2E-X18ME1-M1
				NPN NC	E2E-X18ME2-M1
				PNP NO	E2E-X18MF1-M1
				PNP NC	E2E-X18MF2-M1
M8	Shielded	M8	1.5 mm	NPN NO	E2E-X1R5E1-M3
				NPN NC	E2E-X1R5E2-M3
				PNP NO	E2E-X1R5F1-M3
				PNP NC	E2E-X1R5F2-M3
	Unshielded	M8	2 mm	NPN NO	E2E-X2ME1-M3
				NPN NC	E2E-X2ME2-M3
				PNP NO	E2E-X2MF1-M3
				PNP NC	E2E-X2MF2-M3

AC 2-wire/Connector Models

Size		Sensing distance	Operation mode	Model
Shielded	M12	2 mm	NO	E2E-X2Y1-M1
			NC	E2E-X2Y2-M1
	M18	5 mm	NO	E2E-X5Y1-M1
			NC	E2E-X5Y2-M1
	M30	10 mm	NO	E2E-X10Y1-M1
			NC	E2E-X10Y2-M1
Unshielded	M12	5 mm	NO	E2E-X5MY1-M1
			NC	E2E-X5MY2-M1
	M18	10 mm	NO	E2E-X10MY1-M1
			NC	E2E-X10MY2-M1
	M30	18 mm	NO	E2E-X18MY1-M1
			NC	E2E-X18MY2-M1

AC/DC 2-wire/Pre-wired Models

Size		Sensing distance	Operation mode	Model
Shielded	M12	3 mm	NO	E2E-X3T1
	M18	7 mm		E2E-X7T1 (See note 2.)
	M30	10 mm		E2E-X10T1

*1. These models do not conform to CE standards.
*2. Cables with a length of 5 m are also available as standard models. Specify the cable length at the end of the model number (e.g., E2E-X7T1 5M).

Specifications

Ratings/Characteristics

E2E

E2E-X□D□ DC 2-wire Models

Item		M8		M12		M18		M30	
Type		Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
		E2E-X2D□	E2E-X4MD□	E2E-X3D□	E2E-X8MD□	E2E-X7D□	E2E-X14MD□	E2E-X10D□	E2E-X20MD□
Sensing distance		2 mm ±10%	4 mm ±10%	3 mm ±10%	8 mm ±10%	7 mm ±10%	14 mm ±10%	10 mm ±10%	20 mm ±10%
Set distance (See note 1.)		0 to 1.6 mm	0 to 3.2 mm	0 to 2.4 mm	0 to 6.4 mm	0 to 5.6 mm	0 to 11.2 mm	0 to 8.0 mm	0 to 16.0 mm
Differential travel		15% max. of sensing distance		10% max. of sensing distance					
Sensing object		Ferrous metal (The sensing distance decreases with non-ferrous metal, refer to *Engineering Data*.)							
Standard sensing object		Iron, 8 x 8 x 1 mm	Iron, 20 x 20 x 1 mm	Iron,12 x 12 x 1 mm	Iron,30 x 30 x 1 mm	Iron, 18 x 18 x 1 mm	Iron, 30 x 30 x 1 mm	Iron,30 x 30 x 1 mm	Iron, 54 x 54 x 1 mm
Response speed (See note 2.)		1.5 kHz	1.0 kHz	1.0 kHz	0.8 kHz	0.5 kHz	0.4 kHz	0.4 kHz	0.1 kHz
Power supply voltage (operating voltage range)		12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.							
Leakage current		0.8 mA max.							
Control output	Load current	3 to 100 mA Diagnostic output: 50 mA for -D1(5)S models							
	Residual voltage (See note 3.)	3 V max. (Load current: 100 mA, Cable length: 2 m. M1J-T models only: 5 V max.)							
Indicator		D1 Models: Operation indicator (red LED), setting indicator (green LED) D2 Models: Operation indicator (red LED)							
Operation mode (with sensing object approaching)		D1 Models: NO D2 Models: NC For details, refer to *Timing Charts*.							
Diagnostic output delay		0.3 to 1 s							
Protection circuits		Surge suppressor, output load short-circuit protection (for control and diagnostic output)							
Ambient temperature		Operating: –25°C to 70°C, Storage: –40°C to 85°C (with no icing or condensation)							
Ambient humidity		Operating/Storage: 35% to 95% (with no condensation)							
Temperature influence		±15% max. of sensing distance at 23°C in the temperature range of –25°C to 70°C		±10% max. of sensing distance at 23°C in the temperature range of –25°C to 70°C					
Voltage influence		±1% max. of sensing distance in the rated voltage range ±15%							
Insulation resistance		50 MΩ min. (at 500 VDC) between current-carrying parts and case							
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current-carrying parts and case							
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions							
Shock resistance		500 m/s² 10 times each in X, Y, and Z directions		1,000 m/s² 10 times each in X, Y, and Z directions					
Degree of protection		IEC 60529 IP67 (Pre-wired models, pre-wired connector models: JEM standard IP67g (waterproof and oil-proof))							
Connection method		Pre-wired models (standard length: 2 m), connector models, pre-wired connector models (standard length: 0.3 m)							
Weight (packed state)	Pre-wired models	Approx. 60 g		Approx. 70 g		Approx. 130 g		Approx. 175 g	
	Pre-wired connector models	---		Approx. 40 g		Approx. 70 g		Approx. 110 g	
	Connector models	Approx. 15 g		Approx. 25 g		Approx. 40 g		Approx. 90 g	
Material	Case	Stainless steel (SUS303)		Brass-nickel plated					
	Sensing surface	PBT (polybutylene terephthalate)							
	Clamping nuts	Brass-nickel plated							
	Toothed washer	Iron-zinc plated							
Accessories		Instruction manual							

Note: 1. Use the E2E within the range in which the setting indicator (green LED) is ON (except D2 models).
2. The response speed is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.
3. The residual voltage of each E2E model with the model number suffix “-M1J-T” is 5 V. When connecting an E2E model with the suffix “-M1J-T” to a device, make sure that the device can withstand the residual voltage.

E2E-X□E□/F□ DC 3-wire Models

Size		M8		M12		M18		M30	
Type		Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
Item		E2E-X1R5E□/F□	E2E-X2ME□/F□	E2E-X2E□/F□	E2E-X5ME□/F□	E2E-X5E□/F□	E2E-X10ME□/F□	E2E-X10E□/F□	E2E-X18ME□/F□
Sensing distance		1.5 mm ±10%	2 mm ±10%	2 mm ±10%	5 mm ±10%	5 mm ±10%	10 mm ±10%	10 mm ±10%	18 mm ±10%
Set distance		0 to 1.2 mm	0 to 1.6 mm	0 to 1.6 mm	0 to 4.0 mm	0 to 4.0 mm	0 to 8.0 mm	0 to 8.0 mm	0 to 14.0 mm
Differential travel		10% max. of sensing distance							
Sensing object		Ferrous metal (The sensing distance decreases with non-ferrous metal, refer to *Engineering Data*.)							
Standard sensing object		Iron, 8 x 8 x 1 mm	Iron, 12 x 12 x 1 mm	Iron, 12 x 12 x 1 mm	Iron, 15 x 15 x 1 mm	Iron, 18 x 18 x 1 mm	Iron, 30 x 30 x 1 mm	Iron, 30 x 30 x 1 mm	Iron, 54 x 54 x 1 mm
Response speed (See note 1.)		2.0 kHz	0.8 kHz	1.5 kHz	0.4 kHz	0.6 kHz	0.2 kHz	0.4 kHz	0.1 kHz
Power supply voltage (operating voltage range) (See note 2.)		12 to 24 VDC (10 to 40 VDC), ripple (p-p): 10% max.							
Current consumption		13 mA max.							
Control output	**Load current (See note 2.)**	200 mA max.							
	Residual voltage	2 V max. (Load current : 200 mA, Cable length: 2 m)							
Indicator		Operation indicator (red LED)							
Operation mode (with sensing object approaching)		E1 F1 Models: NO E2 F2 Models: NC For details, refer to *Timing Charts*.							
Protection circuits		Power supply reverse polarity protection, surge suppressor, output load short-circuit protection							
Ambient temperature (See note 2)		Operating/Storage: –40° C to 85° C (with no icing or condensation)							
Ambient humidity		Operating/Storage: 35% to 95% (with no icing)							
Temperature influence		±15% max. of sensing distance at 23° C in the temperature range of –40° C to 85° C ±10% max. of sensing distance at 23° C in the temperature range of –25° C to 70° C							
Voltage influence		±1% max. of sensing distance in the rated voltage range ±15%							
Insulation resistance		50 MΩ min. (at 500 VDC) between current-carrying parts and case							
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current-carrying parts and case							
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions							
Shock resistance		500 m/s² 10 times each in X, Y, and Z directions		1,000 m/s² 10 times each in X, Y, and Z directions					
Degree of protection		IEC 60529 IP67 (Pre-wired models: JEM standard IP67g (waterproof and oil-proof))							
Connection method		Pre-wired models (standard length 2 m), connector models							
Weight (packed state)	**Pre-wired models**	Approx. 65 g		Approx. 75 g		Approx. 150 g		Approx. 195 g	
	Connector models	Approx. 15 g		Approx. 25 g		Approx. 40 g		Approx. 90 g	
Material	**Case**	Stainless steel (SUS303)		Brass-nickel plated					
	Sensing surface	PBT (polybutylene terephthalate)							
	Clamping nuts	Brass-nickel plated							
	Toothed washer	Iron-zinc plated							
Accessories		Instruction manual							

Note: 1. The response speed is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.

2. When using an E2E with an M8 connector at an ambient temperature range between 70° C and 85° C, supply 10 to 30 VDC to the E2E and make sure that the E2E has a control output of 100 mA maximum.

E2E-X□Y□ AC 2-wire Models

Size	M8		M12		M18		M30	
Type	**Shielded**	**Unshielded**	**Shielded**	**Unshielded**	**Shielded**	**Unshielded**	**Shielded**	**Unshielded**
Item	**E2E-X1R5Y□**	**E2E-X2MY□**	**E2E-X2Y□**	**E2E-X5MY□**	**E2E-X5Y□**	**E2E-X10MY□**	**E2E-X10Y□**	**E2E-X18MY□**
Sensing distance	1.5 mm ±10%	2 mm ±10%	2 mm ±10%	5 mm ±10%	5 mm ±10%	10 mm ±10%	10 mm ±10%	18 mm ±10%
Set distance	0 to 1.2 mm	0 to 1.6 mm	0 to 1.6 mm	0 to 4.0 mm	0 to 4.0 mm	0 to 8.0 mm	0 to 8.0 mm	0 to 14.0 mm
Differential travel	10% max. of sensing distance							
Sensing object	Ferrous metal (The sensing distance decreases with non-ferrous metal, refer to *Engineering Data*.)							
Standard sensing object	Iron, 8 x 8 x 1 mm	Iron,12 x 12 x 1 mm	Iron, 12 x 12 x 1 mm	Iron, 15 x 15 x 1 mm	Iron, 18 x 18 x 1 mm	Iron, 30 x 30 x 1 mm	Iron, 30 x 30 x 1 mm	Iron, 54 x 54 x 1 mm
Response speed	25 Hz							
Power supply voltage (operating voltage range) (See note 1.)	24 to 240 VAC, 50/60 Hz (20 to 264 VAC)							
Leakage current	1.7 mA max.							
Control output: Load current (See note 2.)	5 to 100 mA		5 to 200 mA		5 to 300 mA			
Control output: Residual voltage	Refer to *Engineering Data*.							
Indicator	Operation indicator (red LED)							
Operation mode (with sensing object approaching)	Y1 Models: NO Y2 Models: NC For details, refer to *Timing Charts*.							
Protection circuit	Surge suppressor							
Ambient temperature (See notes 1 and 2.)	Operating/Storage: –25°C to 70°C (with no icing or condensation)		Operating/Storage: –40°C to 85°C (with no icing or condensation)					
Ambient humidity	Operating/Storage: 35% to 95% (with no condensation)							
Temperature influence	±10% max. of sensing distance at 23°C in the temperature range of –25°C to 70°C		±15% max. of sensing distance at 23°C in the temperature range of –40°C to 85°C ±10% max. of sensing distance at 23°C in the temperature range of –25°C to 70°C					
Voltage influence	±1% max. of sensing distance in the rated voltage range ±15%							
Insulation resistance	50 MΩ min. (at 500 VDC) between current-carrying parts and case							
Dielectric strength	4,000 VAC at 50/60 Hz for 1 min between current-carrying parts and case (2,000 VAC for M8 Models)							
Vibration resistance	10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions							
Shock resistance	500 m/s² 10 times each in X, Y, and Z directions		1,000 m/s² 10 times each in X, Y, and Z directions					
Degree of protection	IEC 60529 IP67 (Pre-wired models: JEM standard IP67g (waterproof, oil-proof))							
Connection method	Pre-wired models (standard length 2 m), connector models							
Weight (packed state): Pre-wired models	Approx. 60 g		Approx. 70 g		Approx. 130 g		Approx. 175 g	
Weight (packed state): Connector models	Approx. 15 g		Approx. 25 g		Approx. 40 g		Approx. 90 g	
Material: Case	Stainless steel (SUS303)		Brass-nickel plated					
Material: Sensing surface	PBT (polybutylene terephthalate)							
Material: Clamping nuts	Brass-nickel plated							
Material: Toothed washer	Iron-zinc plated							
Accessories	Instruction manual							

Note: 1. When supplying 24 VAC to any of the above models, make sure that the operating ambient temperature range is over –25°C.
2. When using an M18-or M30-sized E2E within an ambient temperature of 70°C to 85°C, make sure that the E2E has a control output of 5 to 200 mA max.

AC/DC 2-wire Models

		Size	M12	M18	M30
		Type	Shielded		
Item			E2E-X3T1	E2E-X7T1	E2E-X10T1
Sensing distance			3 mm ±10%	7 mm ±10%	10 mm ±10%
Set distance			0 to 2.4 mm	0 to 5.6 mm	0 to 8.0 mm
Differential travel			10% max. of sensing distance		
Sensing object			Ferrous metal (The sensing distance decreases with non-ferrous metal, refer to *Engineering Data*.)		
Standard sensing object			Iron, 12 x 12 x 1 mm	Iron, 18 x 18 x 1 mm	Iron, 30 x 30 x 1 mm
Response speed (See note 1.)	**DC**		1.0 kHz	0.5 kHz	0.4 kHz
	AC		25 Hz		
Power supply voltage (operating voltage range) (See note 2.)			24 to 240 VDC (20 to 264 VDC)/48 to 240 VAC (40 to 264 VAC)		
Leakage current			1 mA DC max., 2 mA AC max.		
Control output	**Load current**		5 to 100 mA		
	Residual voltage		6.0 VDC max. (Load current: 100 mA, Cable length: 2 m) 10 VAC max. (Load current: 5 mA , Cable length: 2 m)		
Indicator			Operation indicator (red LED), setting indicator (green LED)		
Operation mode (with sensing object approaching)			NO For details, refer to *Timing Charts*.		
Protection circuits			Output load short-circuit protection (at 20 to 40 VDC), Surge suppressor		
Ambient temperature			Operating: –25°C to 70°C, Storage: –40°C to 85°C (with no icing or condensation)		
Ambient humidity			Operating/Storage: 35% to 95% (with no condensation)		
Temperature influence			±10% max. of sensing distance at 23°C in the temperature range of –25°C to 70°C		
Voltage influence			±1% max. of sensing distance in the rated voltage range ±15%		
Insulation resistance			50 MΩ min. (at 500 VDC) between current-carrying parts and case		
Dielectric strength			4,000 VAC at 50/60 Hz for 1 min between current-carrying parts and case		
Vibration resistance			10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions		
Shock resistance			1,000 m/s^2 10 times each in X, Y, and Z directions		
Degree of protection			IEC 60529 IP67 (JEM standard IP67g (waterproof, oil-proof))		
Connection method			Pre-wired Models (standard length 2 m)		
Weight (packed state)			Approx. 80 g	Approx. 140 g	Approx. 190 g
Material	**Case**		Brass-nickel plated		
	Sensing surface		PBT (polybutylene terephthalate)		
	Clamping nuts		Brass-nickel plated		
	Toothed washer		Iron-zinc plated		
Accessories			Instruction manual		

Note: 1. The response speed is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.
2. Power supply voltage waveform: Use a sine wave for the power supply. Using a rectangular AC power supply may result in faulty reset.

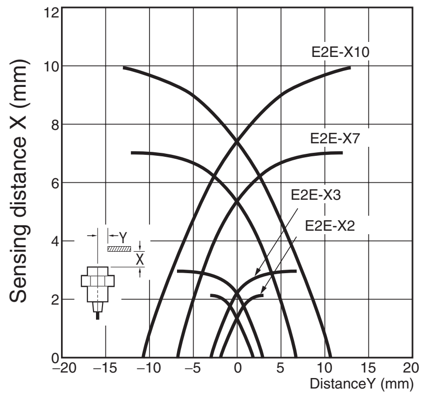
Engineering Data

E2E

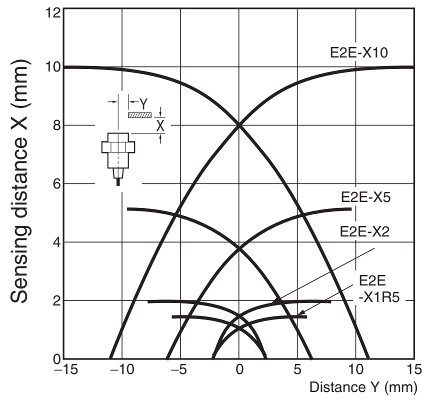
Operating Range (Typical)

Shielded Models

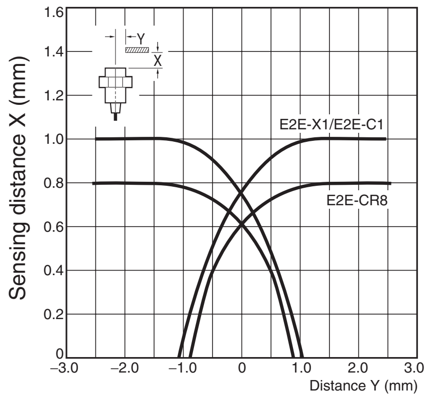
E2E-X□D□
E2E-X□T1



E2E-X□E□/F□
E2E-X□Y□

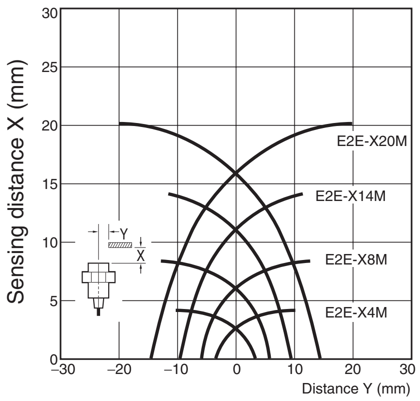


E2E-C□C□/B□
E2E-X□C□/B□

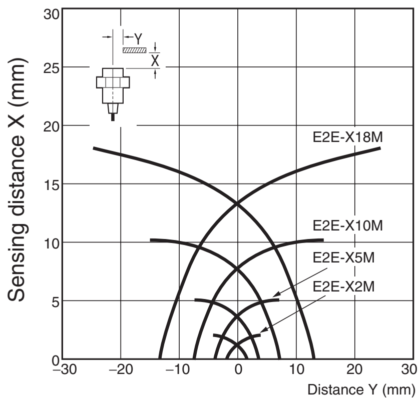


Unshielded Models

E2E-X□MD□

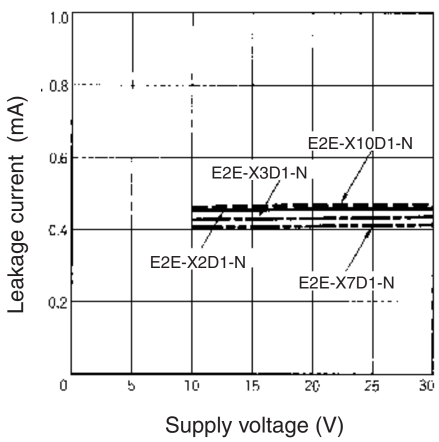


E2E-X□ME□/F□
E2E-X□MY□

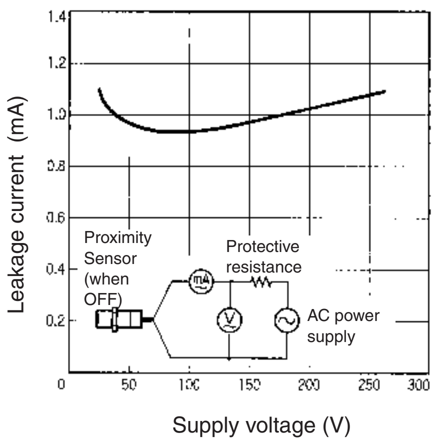


Leakage Current (Typical)

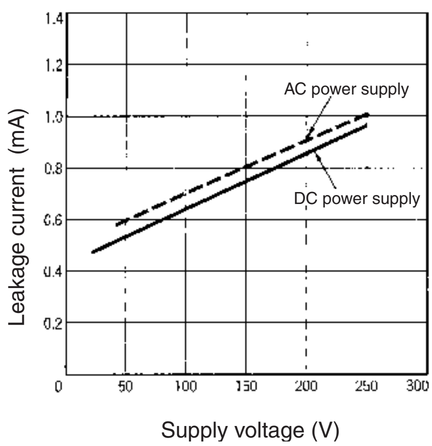
E2E-X□D□



E2E-X□Y□

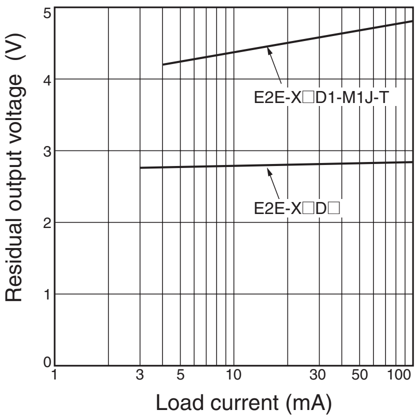


E2E-X□T1
DC/AC

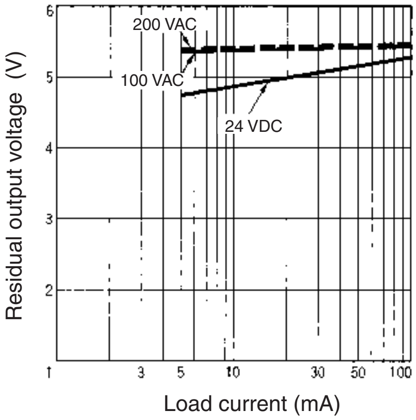


Residual Output Voltage (Typical)

E2E-X□D□

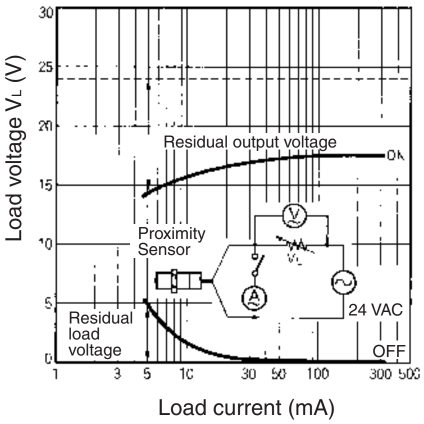


E2E-X□T1

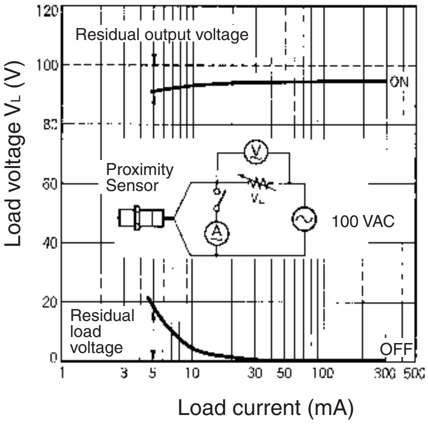


E2E-X□Y□

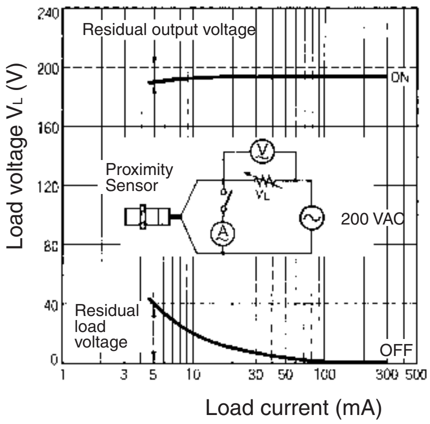
24 VAC



100 VAC

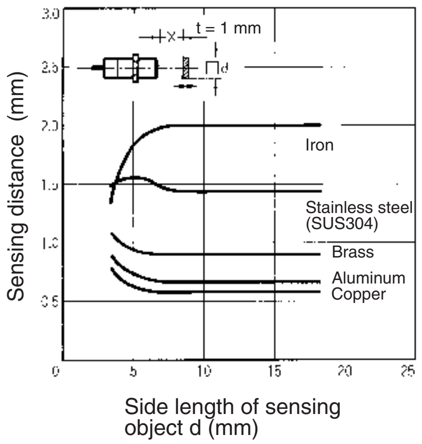


200 VAC

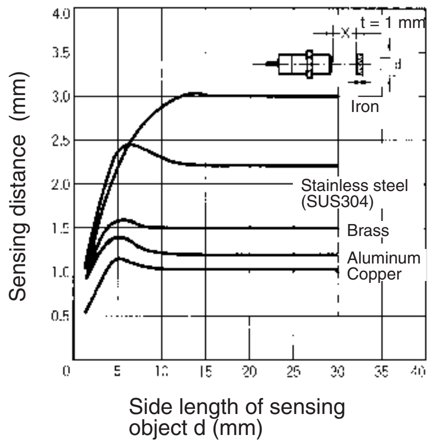


Sensing Distance vs. Sensing Object (Typical)

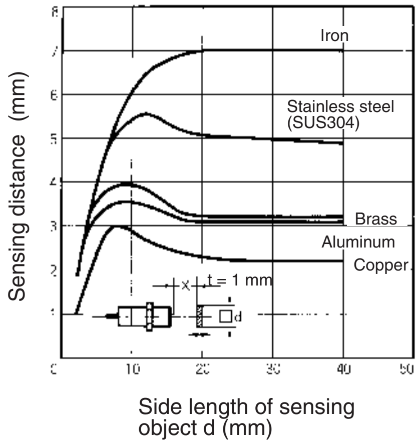
E2E-X2D□



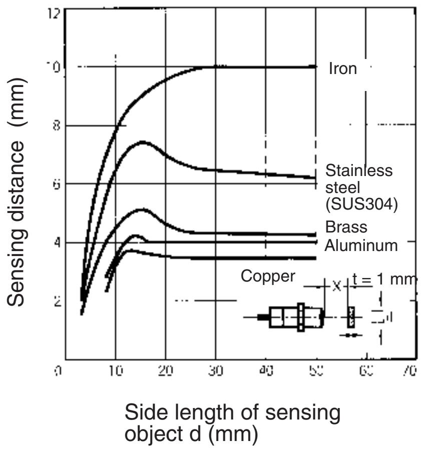
E2E-X3D□
E2E-X3T1



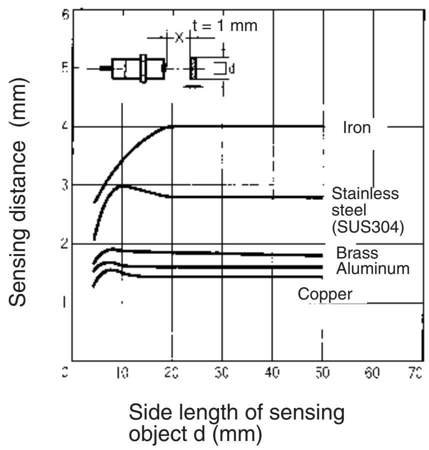
E2E-X7D□
E2E-X7T1



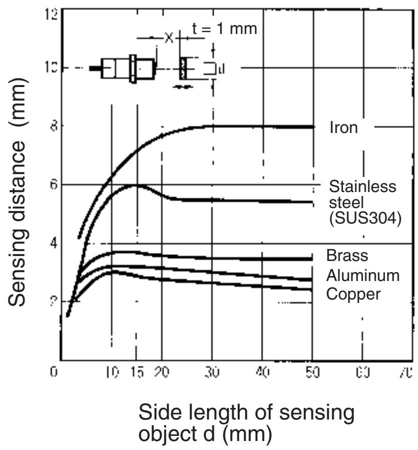
E2E-X10D□
E2E-X10T1



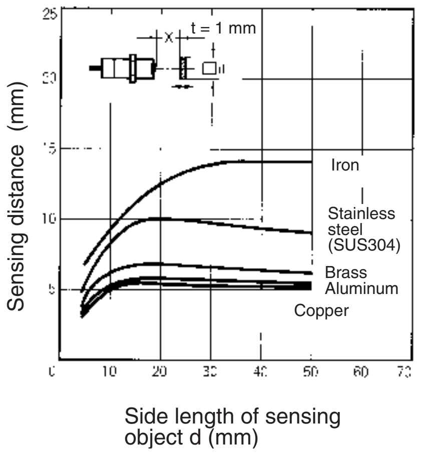
E2E-X4MD□



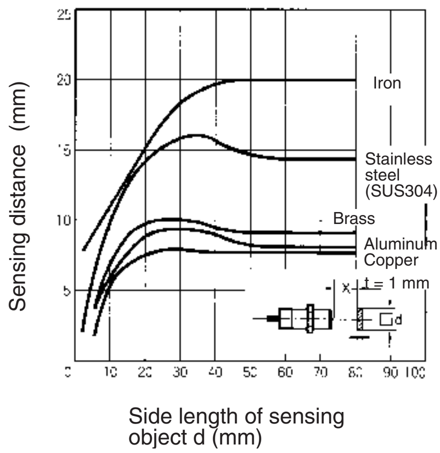
E2E-X8MD□



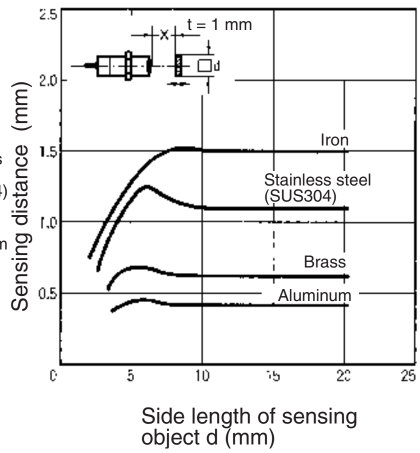
E2E-X14MD□



E2E-X20MD□

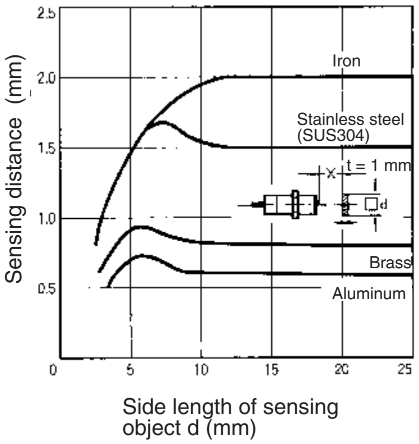


E2E-X1R5E□/F□
E2E-X1R5Y□

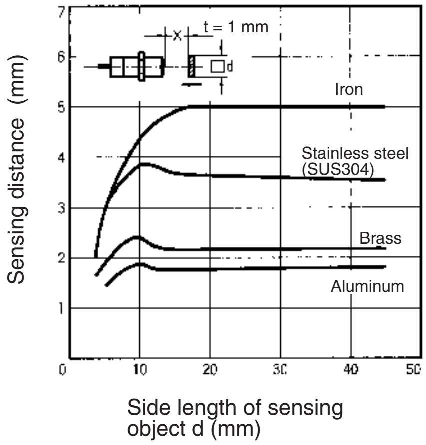


E2E

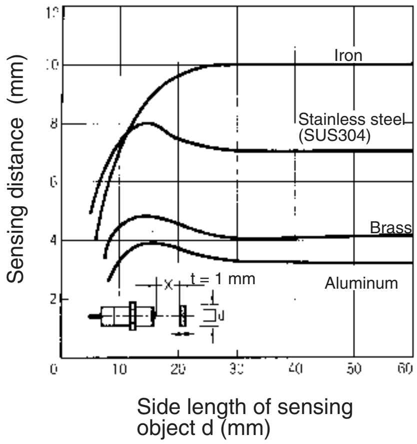
E2E-X2E□/F□
E2E-X2Y□



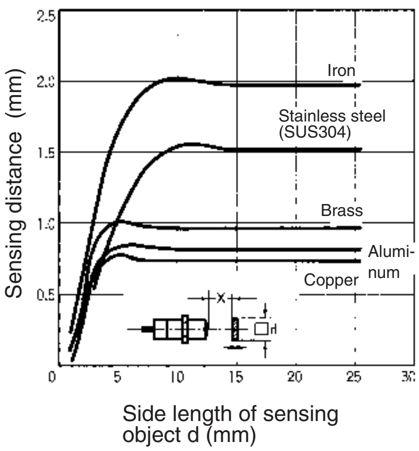
E2E-X5E□/F□
E2E-X5Y□



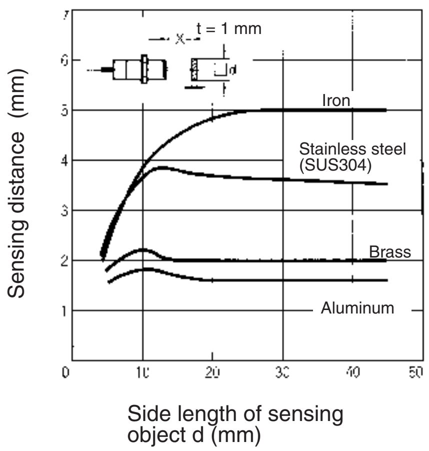
E2E-X10E□F□
E2E-X10Y□



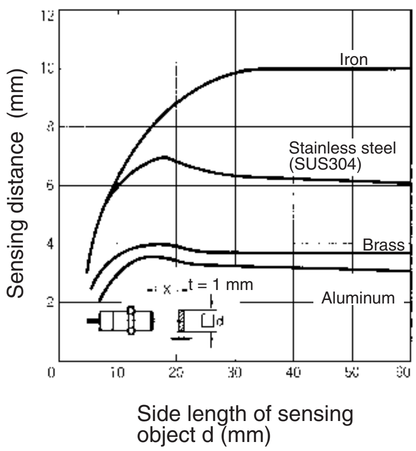
E2E-X2ME□/F□
E2E-X2MY□



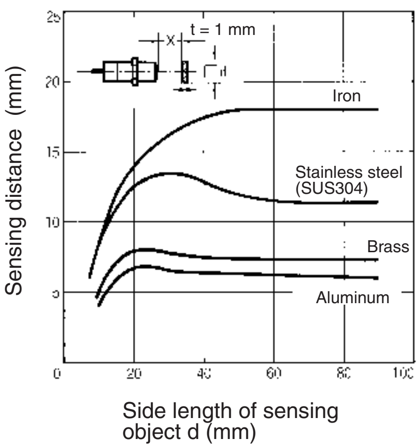
E2E-X5ME□/F□
E2E-X5MY□



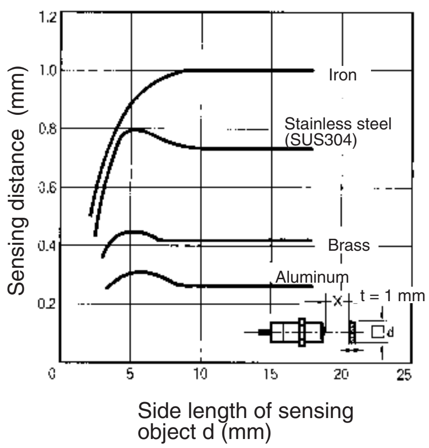
E2E-X10ME□/F□
E2E-X10MY



E2E-X18ME□/F□
E2E-X18MY□



E2E-X1□□



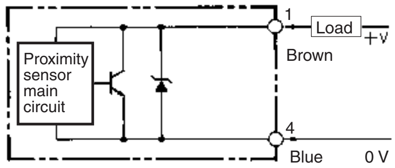
Output Circuits and Timing Charts

Output Circuits

E2E

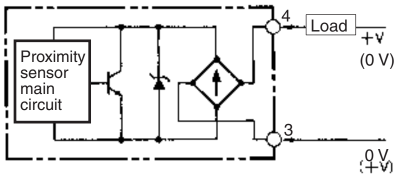
E2E-X□D□ DC 2-wire Models

E2E-X□D1
Without Diagnostic Output



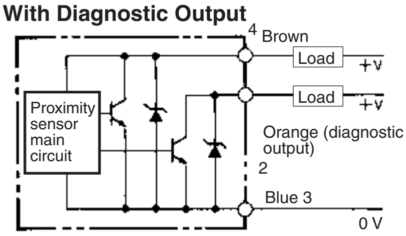
Note: 1. The load can be connected to either the +V or 0 V side.
2. The pin numbers in the above diagram are for the -M□G(J). For the -M1, pin 4 is +V and pin 3 is 0 V.

E2E-X□D1-M1J-T
No Polarity



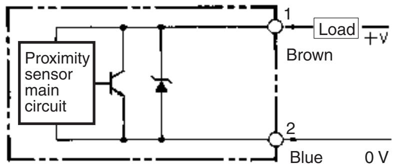
Note: 1. The load can be connected to either the +V or 0 V side.
2. The E2E-X□D1-M1J-T has no polarity. Therefore, terminals 3 and 4 have no polarity.

E2E-X□D1S
With Diagnostic Output



Note: Connect both the loads to the +V side of the control output and diagnostic output.

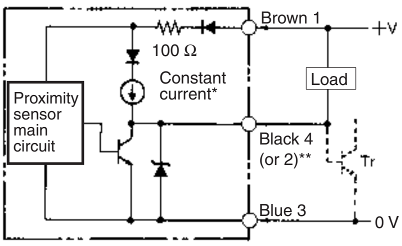
E2E-X□D2
Without Diagnostic Output



Note: 1. The load can be connected to either the +V or 0 V side.
2. The pin numbers in the above diagram are for the -M□G. For -M1 models, pin 2 is +V and pin 3 is 0 V.

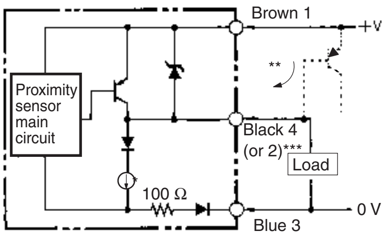
DC 3-wire Models

E2E-X□E□
NPN Output



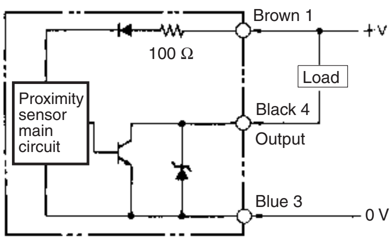
* Constant current output is 1.5 to 3 mA.
** Pin 4 is an NO contact, and pin 2 is an NC contact.

E2E-X□F□
PNP Output

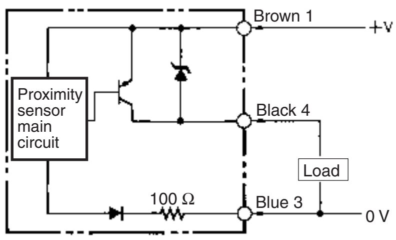


* Constant current output is 1.5 to 3 mA.
** When connecting to a Tr circuit.
*** Pin 4 is an NO contact, and pin 2 is an NC contact.

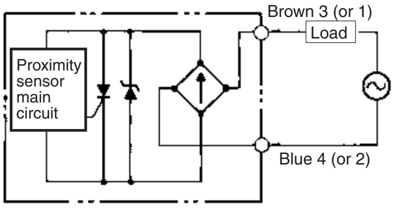
E2E-C/X□C□
NPN Open-collector Output



E2E-C/X□B□
PNP Open-collector Output

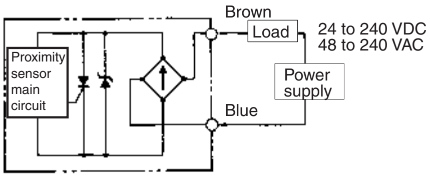


E2E-X□Y□ AC 2-wire Models



Note: For connector models, the connection between pins 3 and 4 uses an NO contact, and the connection between pins 1 and 2 uses an NC contact.

E2E-X□T1 AC/DC 2-wire Models



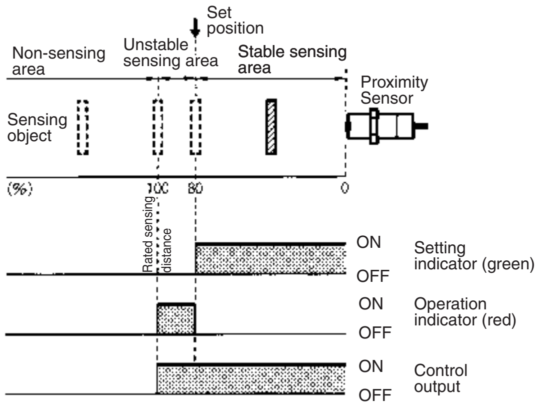
Note: The load can be connected to either the +V or 0 V side.
There is no need to be concerned about the polarity (Brown/Blue) of the Proximity Sensor.

Timing Charts

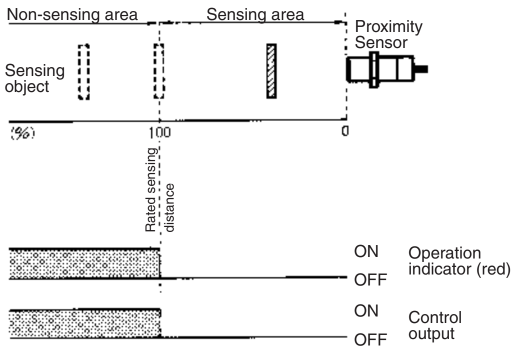
E2E

E2E-X□D□ DC 2-wire Models
E2E-X□T1 AC/DC 2-wire Models

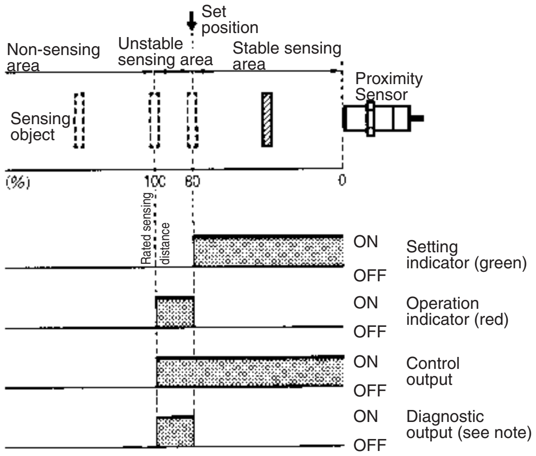
E2E-X□D1
E2E-X□T1
NO Models



E2E-X□D2
NC Models



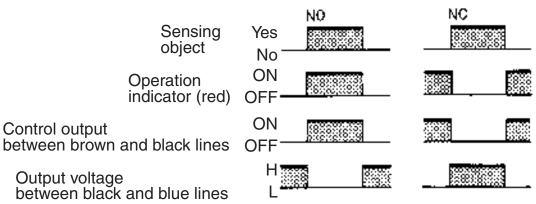
E2E-X□D1S



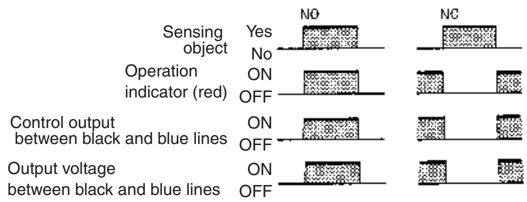
Note: The diagnostic output of the E2E-X□D1S is ON when there is a coil burnout or the sensing object is located in the unstable sensing range for 0.3 s or more.

DC 3-wire Models

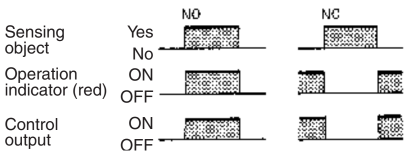
E2E-X□E□
NPN Output



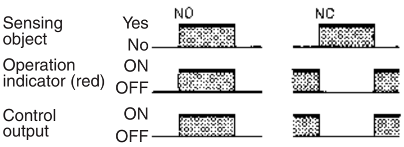
E2E-X□F□
PNP Output



E2E-C/X□C□/B□
NPN/PNP Open-collector Output



E2E-X□Y□ AC 2-wire Models



E2E

Installation

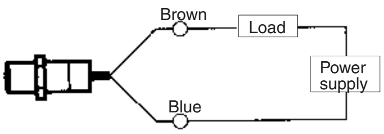
Connection

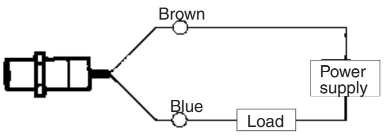
E2E

E2E-X□D□
DC 2-wire Models
(Without Diagnostic Output)

E2E-X□Y□
AC 2-wire Models

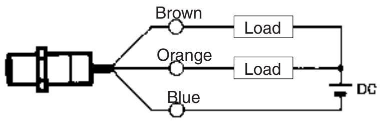
E2E-X□T1
AC/DC 2-wire Models





Note: The load can be connected as shown above.

E2E-X□D1S
DC 3-wire Models
(With Diagnostic Output)

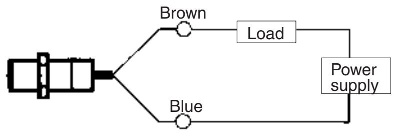


Note: The control output and diagnostic output share the negative common terminal. Therefore, the loads must be connected to the positive sides of the control output and diagnostic output.

E2E-X□D1-M1J-T
DC 2-wire Models
(No Polarity)

E2E-X□Y□
AC 2-wire Models

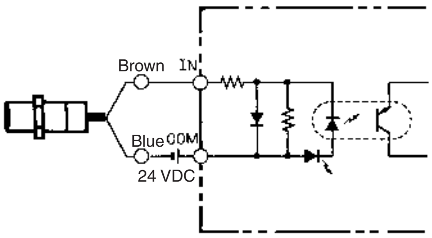
E2E-X□T1
AC/DC 2-wire Models



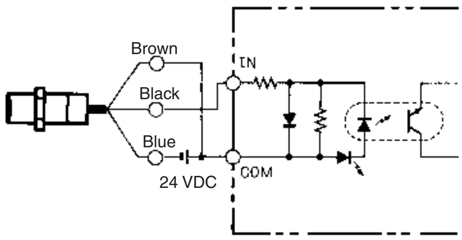
Note: There is no need to be concerned about the polarity (Brown/Blue) of the Proximity Sensor.

Connected to PC

E2E-X□D□
DC 2-wire Models

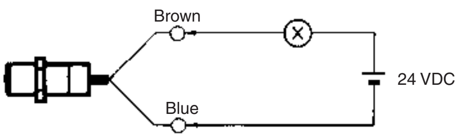


E2E-X□E□
DC 3-wire Models

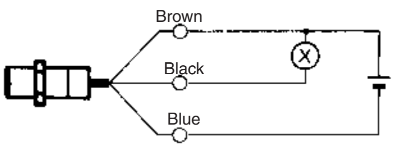


Connected to Relay Load

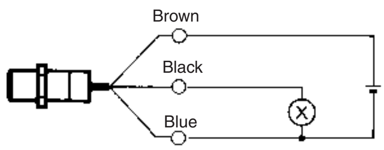
E2E-X□D□
DC 2-wire Models



E2E-X□E□
DC 3-wire Models

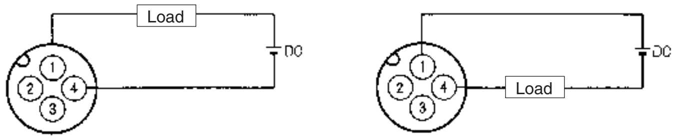
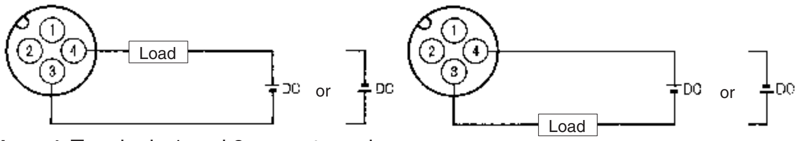
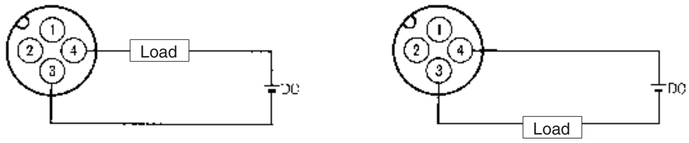
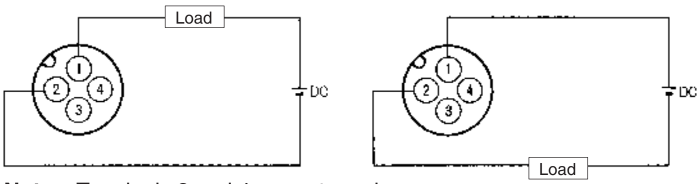
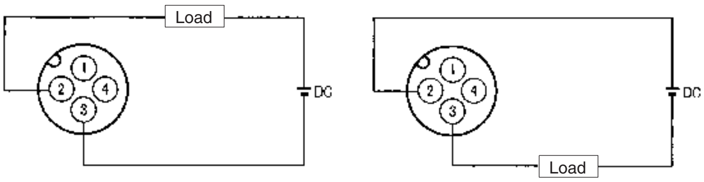
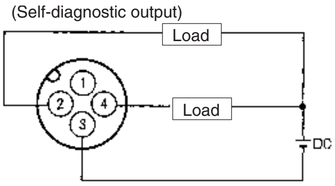
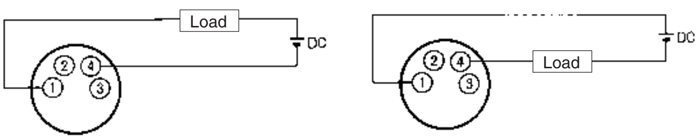
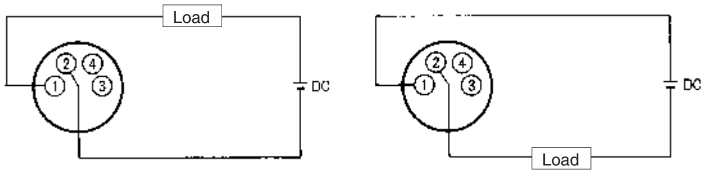


E2E-X□F□
DC 3-wire Models



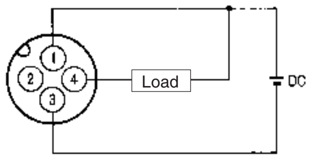
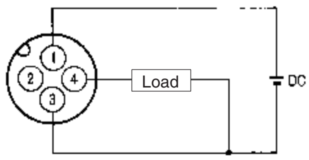
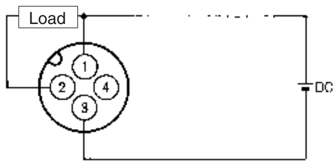
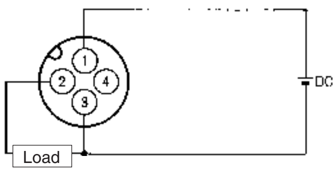
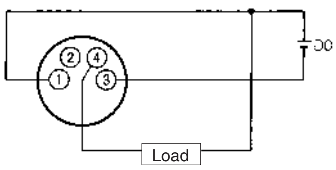
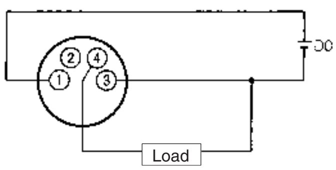
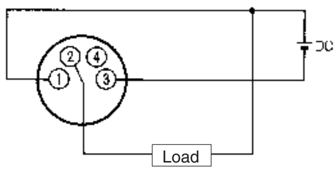
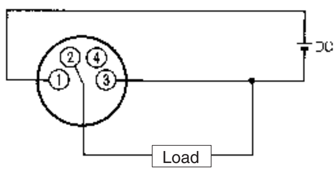
Pin Arrangement

E2E-X□D□-M□ DC 2-wire Models

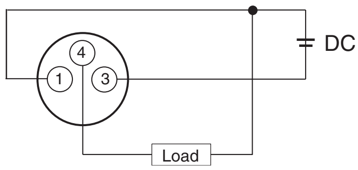
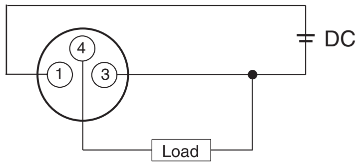
Connector	Self-diagnostic output	Operation mode	Applicable models	Pin arrangement
M12	No	NO	E2E-X□D1-M1G□ (See note.)	 **Note:** Terminals 2 and 3 are not used.
			E2E-X□D1-M1J-T	 **Note: 1.** Terminals 1 and 2 are not used. **2.** Terminals 3 and 4 has no polarity.
			E2E-X□D1-M1	 **Note:** Terminals 1 and 2 are not used.
		NC	E2E-X□D2-M1G (See note.)	 **Note:** Terminals 3 and 4 are not used.
			E2E-X□D2-M1	 **Note:** Terminal 1 is not used.
	Yes	NO	E2E-X□D1S-M1	 **Note:** Terminals 1 is not used.
M8	No	NO	E2E-X□D1-M3G	 **Note:** Terminals 2 and 3 are not used.
		NC	E2E-X□D2-M3G	 **Note:** Terminals 3 and 4 are not used.

Note: The above pin arrangements conform to IEC standards.

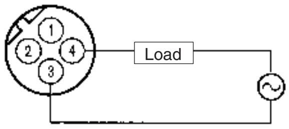
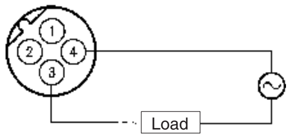
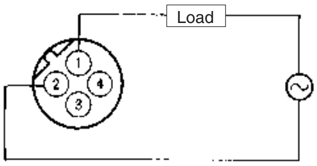
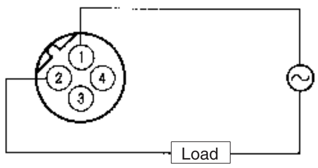
E2E-X☐E/F☐-M☐ DC 3-wire Models

Connector	Operation mode	Applicable models	Pin arrangement
M12	NO	E2E-X☐E1-M1	 **Note:** Terminal 2 is not used.
		E2E-X☐F1-M1	 **Note:** Terminal 2 is not used.
	NC	E2E-X☐E2-M1	 **Note:** Terminal 4 is not used.
		E2E-X☐F2-M1	 **Note:** Terminal 4 is not used.
M8	NO	E2E-X☐E1-M3	 **Note:** Terminal 2 is not used.
		E2E-X☐F1-M3	 **Note:** Terminal 2 is not used.
	NC	E2E-X☐E2-M3	 **Note:** Terminal 4 is not used.
		E2E-X☐F2-M3	 **Note:** Terminal 4 is not used.

E2E-CR8C□/CR8B□/X1C□/X1B□-M5 DC 3-wire Models

Connector	Operation mode	Applicable models	Pin arrangement
M8-3pin	NO/NC	E2E-X1C□-M5	
	NO/NC	E2E-X1B□-M5	

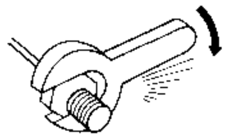
E2E-X□Y□-M1 AC 2-wire Models

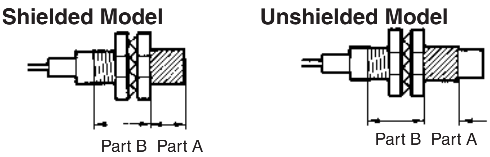
Operation mode	Applicable models	Pin arrangement
NO	E2E-X□Y1-M1	  **Note:** Terminals 1 and 2 are not used.
NC	E2E-X□Y2-M1	  **Note:** Terminals 3 and 4 are not used.

Precautions

Mounting

Do not tighten the nut with excessive force. A washer must be used with the nut.



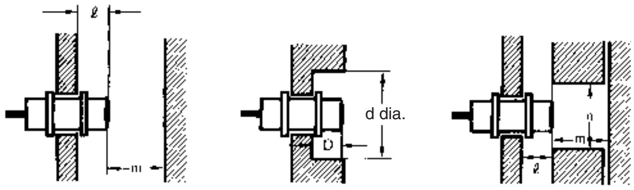


Note: The table below shows the tightening torques for part A and part B nuts. In the previous examples, the nut is on the sensor head side (part B) and hence the tightening torque for part B applies. If this nut is in part A, the tightening torque for part A applies instead.

Model		Part A		Part B
		Length	Torque	Torque
M8	Shielded	9 mm	9 N·m	12 N·m
	Unshielded	3 mm		
M12		30 N·m		
M18		70 N·m		
M30		180 N·m		

Influence of Surrounding Metal

When mounting the E2E within a metal panel, ensure that the clearances given in the following table are maintained. Failure to maintain these distances may cause deterioration in the performance of the sensor.



Model		Item	M8	M12	M18	M30
E2E-X□D□ DC 2-wire E2E-X□T1 AC/DC 2-wire	Shielded	l	0 mm	0 mm	0 mm	0 mm
		d	8 mm	12 mm	18 mm	30 mm
		D	0 mm	0 mm	0 mm	0 mm
		m	4.5 mm	8 mm	20 mm	40 mm
		n	12 mm	18 mm	27 mm	45 mm
	Unshielded	l	12 mm	15 mm	22 mm	30 mm
		d	24 mm	40 mm	70 mm	90 mm
		D	12 mm	15 mm	22 mm	30 mm
		m	8 mm	20 mm	40 mm	70 mm
		n	24 mm	40 mm	70 mm	90 mm
E2E-X□E□ E2E-X□F□ DC 3-wire E2E-X□Y□ AC 2-wire	Shielded	l	0 mm	0 mm	0 mm	0 mm
		d	8 mm	12 mm	18 mm	30 mm
		D	0 mm	0 mm	0 mm	0 mm
		m	4.5 mm	8 mm	20 mm	40 mm
		n	12 mm	18 mm	27 mm	45 mm
DC 3-wire E2E2-X□Y□ AC 2-wire	Unshielded	l	6 mm	15 mm	22 mm	30 mm
		d	24 mm	40 mm	55 mm	90 mm
		D	6 mm	15 mm	22 mm	30 mm
		m	8 mm	20 mm	40 mm	70 mm
		n	24 mm	36 mm	54 mm	90 mm

Relationship between Sizes and Models

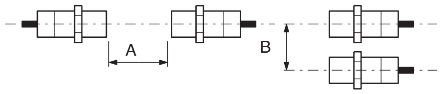
E2E

Model		Model No.
M8	Shielded	E2E-X2D□ E2E-X1R5E□/F□ E2E-X1R5Y□
	Unshielded	E2E-X4MD□ E2E-X2ME□/F□ E2E-X2MY□
M12	Shielded	E2E-X3D□ E2E-X2E□/F□ E2E-X2Y□ E2E-X3T1
	Unshielded	E2E-X8MD□ E2E-X5ME□/F□ E2E-X5MY□
M18	Shielded	E2E-X7D□ E2E-X5E□/F□ E2E-X5Y□ E2E-X7T1
	Unshielded	E2E-X14MD□ E2E-X10ME□/F□ E2E-X10MY□

Model		Model No.
M30	Shielded	E2E-X10D□ E2E-X10E□/F□ E2E-X10Y□ E2E-X10T1
	Unshielded	E2E-X20MD□ E2E-X18ME□/F□ E2E-X18MY□

Mutual Interference

When installing two or more Sensors face to face or side by side, ensure that the minimum distances given in the following table are maintained.



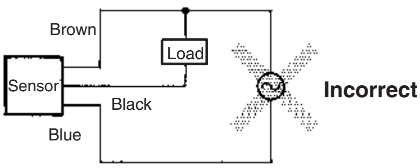
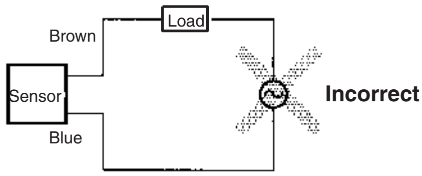
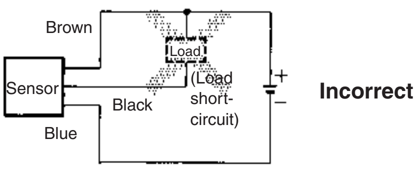
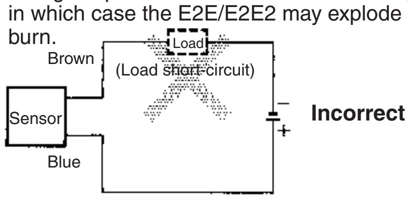
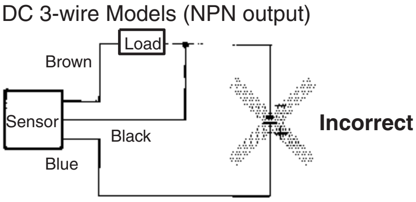
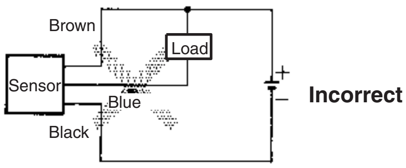
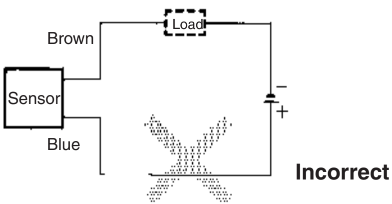
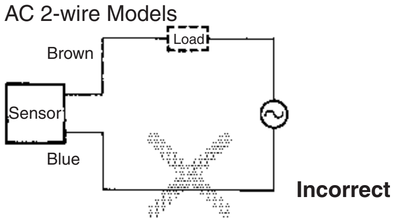
Model		Item	M8	M12	M18	M30
E2E-X☐D☐ DC 2-wire E2E-X☐T1 AC/DC 2-wire	Shielded	A	20 mm	30 (20) mm	50 (30) mm	100 (50) mm
		B	15 mm	20 (12) mm	35 (18) mm	70 (35) mm
	Unshielded	A	80 mm	120 (60) mm	200 (100) mm	300 (100) mm
		B	60 mm	100 (50) mm	110 (60) mm	200 (100) mm
E2E-X☐E☐ E2E-X☐F☐ DC 3-wire E2E-X☐Y☐ AC 2-wire	Shielded	A	20 mm	30 (20) mm	50 (30) mm	100 (50) mm
		B	15 mm	20 (12) mm	35 (18) mm	70 (35) mm
	Unshielded	A	80 mm	120 (60) mm	200 (100) mm	300 (100) mm
		B	60 mm	100 (50) mm	110 (60) mm	200 (100) mm

⚠ WARNING

This product is not designed or rated for ensuring safety of persons.
Do not use it for such purposes.

Precautions for Safe Use

The colors in parentheses are previous wire colors.

Item	Examples	
Power supply Do not impose an excessive voltage on the E2E, otherwise it may explode or burn. Do not impose 100 VAC on any E2E DC Model, otherwise it may explode or burn.	DC 3-wire Models 	DC 2-wire Models 
Load short-circuit Do not short-circuit the load, or the E2E may explode or burn. The E2E short-circuit protection function is valid if the polarity of the supply voltage imposed is correct and within the rated voltage range.	DC 3-wire Models (NPN output) 	DC 2-wire Models The following diagram shows that the load is short-circuited while the polarity of the supply voltage imposed on the E2E/E2E2 is wrong, in which case the E2E/E2E2 may explode or burn. 
Wiring Be sure to wire the E2E and load correctly, otherwise it may explode or burn.	DC 3-wire Models (NPN output) 	
Connection with no load Make sure to connect a proper load to the E2E in operation, otherwise it may explode or burn.	DC 3-wire Models 	AC 2-wire Models 

E2E

Precautions for Correct Use

Installation

Power Reset Time

The Proximity Sensor is ready to operate within 100 ms after power is supplied. If power supplies are connected to the Proximity Sensor and load respectively, be sure to supply power to the Proximity Sensor before supplying power to the load.

Power OFF

The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended to turn OFF the load before turning OFF the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Sensing Object

Metal Coating:
The sensing distances of the Proximity Sensor vary with the metal coating on sensing objects.

Wiring

High-tension Lines

Wiring through Metal Conduit

If there is a power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunctioning.

Connecting Load to AC/DC 2-wire Sensor

Refer to the following before using AC or DC 2-wire Proximity Sensors.

Surge Protection

Although the Proximity Sensor has a surge absorption circuit, if there is any machine that has a large surge current (e.g., a motor or welding machine) near the Proximity Sensor, connect a surge absorber to the machine.

Leakage Current

When the Proximity Sensor is OFF, the Proximity Sensor has leakage current. Refer to page 127 Leakage Current Characteristics. In this case, the load is imposed with a small voltage and the load may not be reset. Before using the Proximity Sensor, make sure that this voltage is less than the load reset voltage. The AC 2-wire Proximity Sensor cannot be connected to any card-lift-off relay (e.g., the G2A) because contact vibration of the relay will be caused by the leakage current and the life of the relay will be shortened.

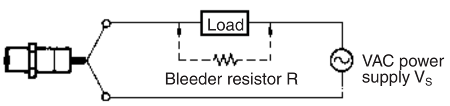
Loads with Large Inrush Currents (E2E-X☐T☐)

Connecting a load that has a large inrush current (e.g., a lamp or motor) may result in a malfunction due to the inrush current causing a load short-circuit.

Countermeasures Against Leakage Current

AC 2-wire Models

Connect a bleeder resistor as the bypass for the leakage current so that the current flowing into the load will be less than the load reset current.
As shown in the following diagram, connect the bleeder resistor so that the current flowing into the Proximity Sensor will be 10 mA minimum and the residual voltage imposed on the load will be less than the load reset voltage.



Refer to the following to calculate the bleeder resistance and the allowable power of the bleeder resistor.

$R \leq V_S/(10 - I)$ (kΩ)

$P > V_S^2/R$ (mW)

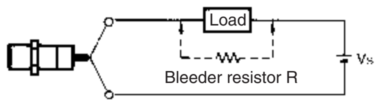
P: The allowable power of the bleeder resistor. (The actual power capacity of the bleeder resistor must be at least a few times as large as the allowable power of the bleeder resistor.)

I: Load current (mA)

The following resistors are recommended.
100 VAC (supply voltage): A resistor with a resistance of 10 kΩ maximum and an allowable power of 3 W minimum
200 VAC (supply voltage): A resistor with a resistance of 20 kΩ maximum and an allowable power of 10 W minimum
If these resistors generate excessive heat, use a resistor with a resistance of 10 kΩ maximum and an allowable power of 5 W minimum at 100 VAC and a resistor with a resistance of 20 kΩ maximum and an allowable power of 10 W minimum at 200 VAC instead.

DC 2-wire Models

Connect a bleeder resistor as the bypass for the leakage current so that the current flowing into the load will be less than the load reset current.



Refer to the following to calculate the bleeder resistance and the allowable power of the bleeder resistor.

$R \leq V_S/(i_R - i_{OFF})$ (kΩ)

$P > V_S^2/R$ (mW)

P: The allowable power of the bleeder resistor. (The actual power capacity of the bleeder resistor must be at least a few times as large as the allowable power of the bleeder resistor.)

i_R: Leakage current of Sensors (mA)

i_{OFF}: Release current of load (mA)

The following resistors are recommended.
12 VDC (supply voltage): A resistor with a resistance of 15 kΩ maximum and an allowable power of 450 mW minimum
24 VDC (supply voltage): A resistor with a resistance of 30 kΩ maximum and an allowable power of 0.1 W minimum

Cable Tractive Force

Do not pull on cables with tractive forces exceeding the following.

Diameter	Tractive force
4 dia. max.	30 N max.
4 dia. min.	50 N max.

Mounting

The Proximity Sensor must not be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistivity.

Environment

Water Resistivity

The Proximity Sensors are tested intensively on water resistance, but in order to ensure maximum performance and life expectancy avoid immersion in water and provide protection from rain or snow.

Operating Enviroment

Ensure the usage of the Proximity Sensor within its operating ambient temperature range and do not use the Proximity Sensor outdoors so that its reliability and life expectancy can be maintained. Although the Proximity Sensor is water resistive, a cover to protect the Proximity Sensor from water or water soluble machining oil is recommended so that its reliability and life expectancy can be maintained.
Do not use the Proximity Sensor in an environment with chemical gas (e.g., strong alkaline or acid gasses including nitric, chromic, and concentrated sulfuric acid gases).

Connection to a PLC

Required Conditions

Connection to a PLC is possible if the specifications of the PLC and the Proximity Sensor satisfy the following conditions. (The meanings of the symbols are given below.)

1. The ON voltage of the PLC and the residual voltage of the Proximity Sensor must satisfy the following.
   $V_{ON} \leq V_{CC} - V_R$
2. The OFF current of the PLC and the leakage current of the Proximity Sensor must satisfy the following.
   $I_{OFF} \geq I_{leak}$
   (If the OFF current is not listed in the specifications, take it to be 1.3 mA.)
3. The ON current of the PLC and the control output (I_{OUT}) of the Proximity Sensor must satisfy the following.
   $I_{OUT(min)} \leq I_{ON} \leq I_{OUT(max)}$
   The ON current of the PLC will vary, however, with the power supply voltage and the input impedance used as shown in the following equation.
   $I_{ON} = (V_{CC} - V_R - \underline{V_{PC}})/R_{IN}$

Example

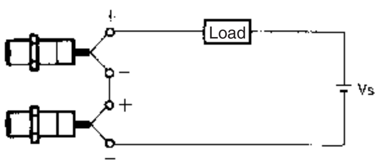
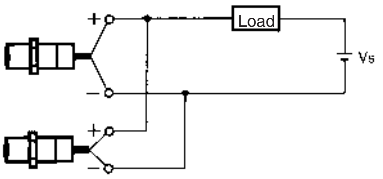
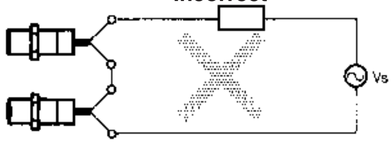
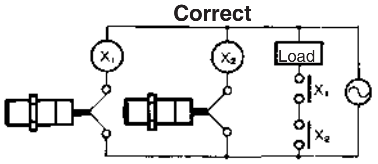
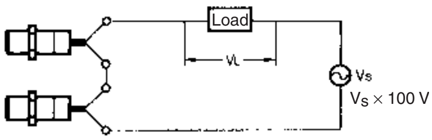
In this example, the above conditions are checked for when the PLC model is the C200H-ID212, the Proximity Sensor model is the E2E-X7D1-N, and the power supply voltage is 24 V.

1. V_{ON} (14.4 V) $\leq V_{CC}$ (20.4 V) – V_R (3 V) = 17.4 V: OK
2. I_{OFF} (1.3 mA) $\geq I_{leak}$ (0.8 mA): OK
3. I_{ON} = [V_{CC} (20.4 V) – V_R (3 V) – $\underline{V_{PC}\text{ (4 V)}]/R_{IN}\text{ (3 k}\Omega)}$
   ≈ 4.5 mA
   Therefore,
   $I_{OUT(min)}$ (3 mA) $\leq I_{ON}$ (4.5 mA): OK

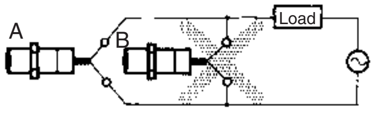
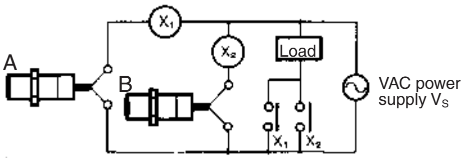
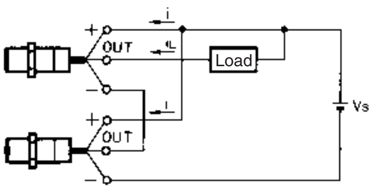
V_{ON}: ON voltage of PLC (14.4 V)
I_{ON}: ON current of PLC (typ. 7 mA)
I_{OFF}: OFF current of PLC (1.3 mA)
R_{IN}: Input impedance of PLC (3 kΩ)
V_{PC}: Internal residual voltage of PLC (4 V)
V_R: Output residual voltage of Proximity Sensor (3 V)
I_{leak}: Leakage current of Proximity Sensor (0.8 mA)
I_{OUT}: Control output of Proximity Sensor (3 to 100 mA)
V_{CC}: Power supply voltage (PLC: 20.4 to 26.4 V)
Values in parentheses are for the following PLC model and Proximity Sensor model.
PLC: C200H-ID212
Proximity Sensor: E2E-X7D1-N

Precautions for AC/DC 2-wire Proximity Sensors in Operation

Connection

Model	Connection type	Method	Description
DC 2-wire	AND (serial connection)	Correct 	The Sensors connected together must satisfy the following conditions. $V_S - N \times V_R \geq$ Load operating voltage N: No. of Sensors V_R: Residual voltage of each Sensor V_S: Supply voltage If each Proximity Sensor is not supplied with the rated voltage and current, the indicator will not be lit properly or unnecessary pulses may be output for approximately 1 ms.
	OR (parallel connection)	Correct 	The Sensors connected together must satisfy the following conditions. $N \times i \leq$ Load reset current N: No. of Sensors i: Leakage current of each Sensor If the MY Relay, which operates at 24 VDC, is used as a load for example, a maximum of four Proximity Sensors can be connected to the load.
AC 2-wire	AND (serial connection)	Incorrect  Correct  	If 100 or 200 VAC is imposed on the Proximity Sensors, V_L (i.e., the voltage imposed on the load) will be obtained from the following. $V_L = V_S$ – (residual voltage x No. of Proximity Sensors) (V) Therefore, if V_L is lower than the load operating voltage, the load will not operate. A maximum of three Proximity Sensors can be connected in series provided that the supply voltage is 100 V minimum.

E2E

Model	Connection type	Method	Description
AC 2-wire	OR (parallel connection)	**Incorrect**  **Correct** 	In principle, more than two Proximity Sensors cannot be connected in parallel. Provided that Proximity Sensor A does not operate with Proximity Sensor B simultaneously and there is no need to keep the load operating continuously, the Proximity Sensors can be connected in parallel. In this case, however, due to the total leakage current of the Proximity Sensors, the load may not reset properly. It is not possible to keep the load operating continuously with Proximity Sensors A and B in simultaneous operation to sense sensing objects due to the following reason. When Proximity Sensor A is ON, the voltage imposed on Proximity Sensor A will drop to approximately 10 V and the load current flows into Proximity Sensor A, and when one of the sensing objects is close to Proximity Sensor B, Proximity Sensor B will not operate because the voltage imposed on Proximity Sensor B is 10 V, which is too low. When Proximity Sensor A is OFF, the voltage imposed on Proximity Sensor B will reach the supply voltage and Proximity Sensor B will be ON. Then, Proximity Sensor A as well as Proximity Sensor B will be OFF for approximately 10 ms, which resets the load for an instant. To prevent the instantaneous resetting of the load, use a relay as shown on the left.
DC 3-wire	AND (serial connection)	**Correct** 	The Sensors connected together must satisfy the following conditions. $i_L + (N - 1) \times i \leq$ Upper-limit of control output of each Sensor $V_S - N \times V_R \geq$ Load operating voltage N: No. of Sensors V_R: Residual voltage of each Sensor V_S: Supply voltage i: Current consumption of the Sensor i_L: Load current If the MY Relay, which operates at 24 VDC, is used as a load for example, a maximum of two Proximity Sensors can be connected to the load.

Dimensions

Note: All units are in millimeters unless otherwise indicated.

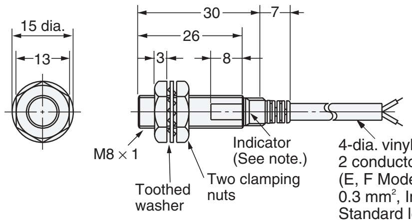
E2E

Model			DC 2-wire		DC 3-wire		AC 2-wire		AC/DC 2-wire	
			Model No.	Figure No.	Model No.	Figure No.	Model No.	Figure No.	Model No.	Figure No.
Pre-wired	**Shielded**	**M8**	E2E-X2D□-N	4	E2E-X1R5E□/F□	4	E2E-X1R5Y□	6		
		M12	E2E-X3D□-N	8	E2E-X2E□/F□	8	E2E-X2Y□	10	E2E-X3T1	12
		M18	E2E-X7D□-N	13	E2E-X5E□/F□	13	E2E-X5Y□	13	E2E-X7T1	13
		M30	E2E-X10D□-N	15	E2E-X10E□/F□	15	E2E-X10Y□	15	E2E-X10T1	15
	Unshield-ed	**M8**	E2E-X4MD□	5	E2E-X2ME□/F□	5	E2E-X2MY□	7	---	---
		M12	E2E-X8MD□	9	E2E-X5ME□/F□	9	E2E-X5MY□	11		
		M18	E2E-X14MD□	14	E2E-X10ME□/F□	14	E2E-X10MY□	14		
		M30	E2E-X20MD□	16	E2E-X18ME□/F□	16	E2E-X18MY□	16		
Connector (M12)	**Shielded**	**M8**	E2E-X2D□-M1(G)	17	E2E-X1R5E□-M1/ F□-M1	17	---	---	---	---
		M12	E2E-X3D□-M1(G)	19	E2E-X2E□-M1 /F□-M1	19	E2E-X2Y□-M1	21		
		M18	E2E-X7D□-M1(G)	23	E2E-X5E□-M1 /F□-M1	23	E2E-X5Y□-M1	23		
		M30	E2E-X10D□-M1(G)	25	E2E-X10E□-M1 /F□-M1	25	E2E-X10Y□-M1	25		
	Unshield-ed	**M8**	E2E-X4MD□-M1(G)	18	E2E-X2ME□-M1 /F□-M1	18	---	---	---	---
		M12	E2E-X8MD□-M1(G)	20	E2E-X5ME□-M1 /F□-M1	20	E2E-X5MY□-M1	22		
		M18	E2E-X14MD□-M1(G)	24	E2E-X10ME□-M1/ F□-M1	24	E2E-X10MY□-M1	24		
		M30	E2E-X20MD□-M1(G)	26	E2E-X18ME□-M1/ F□-M1	26	E2E-X18MY□-M1	26		
Connector (M8)	**Shielded**	**M8**	E2E-X2D□-M3G	27	E2E-X1R5E□-M3/ F□-M3	27	---	---	---	---
	Unshield-ed		E2E-X4MD□-M3G	28	E2E-X2ME□-M3 /F□-M3	28				
Pre-wired connector	**Shielded**	**M12**	E2E-X3D1-M1GJ	29	---	---	---	---	---	---
		M18	E2E-X7D1-M1GJ	31						
		M30	E2E-X10D1-M1GJ	33						
	Unshield-ed	**M12**	E2E-X8MD1-M1GJ	30	---	---	---	---	---	---
		M18	E2E-X14MD1-M1GJ	32						
		M30	E2E-X20MD1-M1GJ	34						
Pre-wired connector (no polari-ty)	**Shielded**	**M12**	E2E-X3D1-M1J-T	29	---	---	---	---	---	---
		M18	E2E-X7D1-M1J-T	31						
		M30	E2E-X10D1-M1J-T	33						

Note: 1. Two clamping nuts and one toothed washer are provided with M8 to M30 Models.
2. The model numbers of Pre-wired M8 to M30 Models are laser-marked on the milled section and cable section.

Pre-wired Models (Shielded)

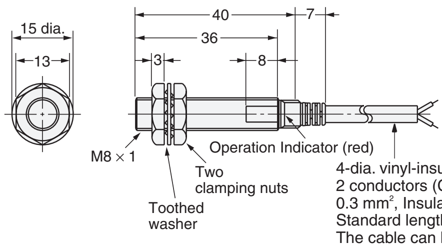
Fig. 4 : E2E-X2D☐-N
E2E-X1R5E☐/F☐



4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E, F Models)(Conductor cross section: 0.3 mm², Insulator diameter: 1.3 mm), Standard length: 2 m
Robotics cable Models: 4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E Models)(Conductor cross section: 0.3 mm², Insulator diameter: 1.27 mm), Standard length: 2 m
The cable can be exteded up to 200 m (separate metal conduit).

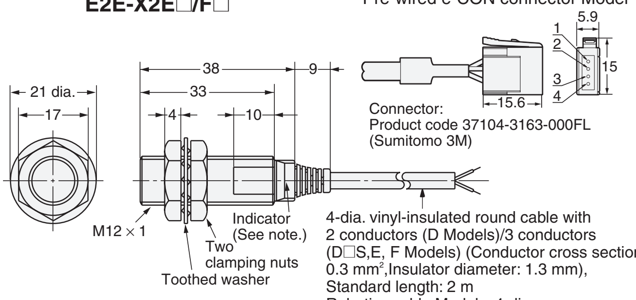
Note: D Models: Operation indicator (red), setting indicator (green);
E, F Models: Operation indicator (red)

Fig. 6 : E2E-X1R5Y☐



4-dia. vinyl-insulated round cable with 2 conductors (Conductor cross section: 0.3 mm², Insulator diameter: 1.3 mm), Standard length: 2 m
The cable can be exteded up to 200 m (separate metal conduit).

Fig. 8 : E2E-X3D☐-N
E2E-X2E☐/F☐

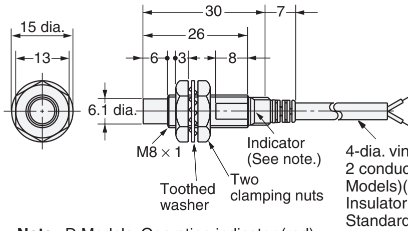


4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (D☐S,E, F Models) (Conductor cross section: 0.3 mm²,Insulator diameter: 1.3 mm), Standard length: 2 m
Robotics cable Models: 4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E Models) (Conductor cross section: 0.3 mm², Insulator diameter: 1.27 mm), Standard length: 2 m
The cable can be extended (separate metal conduit) up to 200 m (control output) or up to 100 m (diagnostic output).

Note: D Models:
Operation indicator (red), setting indicator (green);
E, F Models:
Operation indicator (red)

Pre-wired Models (Unshielded)

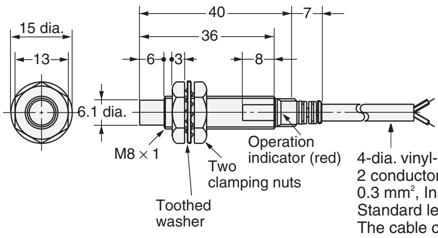
Fig. 5 : E2E-X4MD☐
E2E-X2ME☐/F☐



4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E, F Models)(Conductor cross section: 0.3 mm², Insulator diameter: 1.3 mm), Standard length: 2 m
Robotics cable models: 4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E Models)(Conductor cross section: 0.3 mm², Insulator diameter: 1.27 mm), Standard length: 2 m
The cable can be exteded up to 200 m (separate metal conduit).

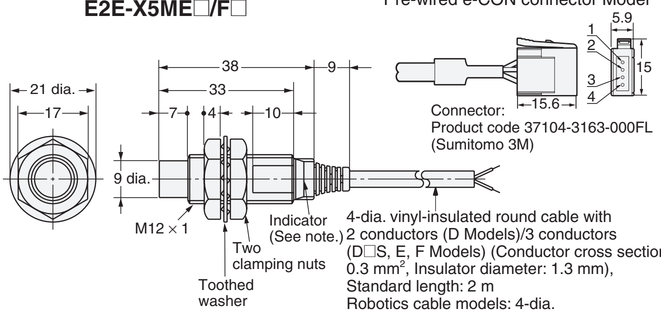
Note: D Models: Operation indicator (red), setting indicator (green);
E, F Models: Operation indicator (red)

Fig. 7 : E2E-X2MY☐



4-dia. vinyl-insulated round cable with 2 conductors (Conductor cross section: 0.3 mm², Insulator diameter: 1.3 mm), Standard length: 2 m
The cable can be exteded up to 200 m (separate metal conduit).

Fig. 9 : E2E-X8MD☐
E2E-X5ME☐/F☐

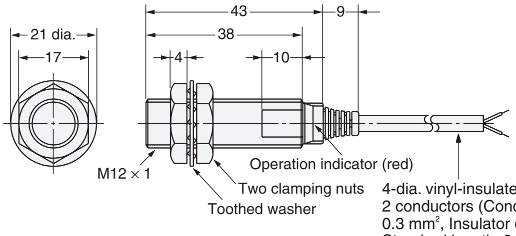


4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (D☐S, E, F Models) (Conductor cross section: 0.3 mm², Insulator diameter: 1.3 mm), Standard length: 2 m
Robotics cable models: 4-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E Models) (Conductor cross section: 0.3 mm², Insulator diameter: 1.27 mm), Standard length: 2 m
The cable can be extended (separate metal conduit) up to 200 m (control output) or up to 100 m (diagnostic output).

Note: D Models:
Operation indicator (red), setting indicator (green);
E, F Models:
Operation indicator (red)

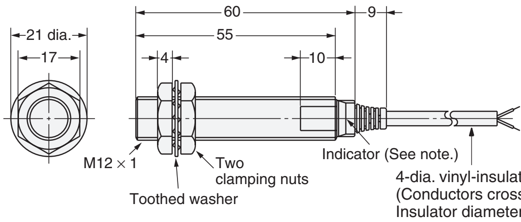
Pre-wired Models (Shielded)

Fig. 10 : E2E-X2Y□



4-dia. vinyl-insulated round cable with 2 conductors (Conductors cross section: 0.3 mm^2, Insulator diameter: 1.3 mm), Standard length: 2 m
The cable can be extended up to 200 m (separate metal conduit).

Fig. 12 : E2E-X3T1

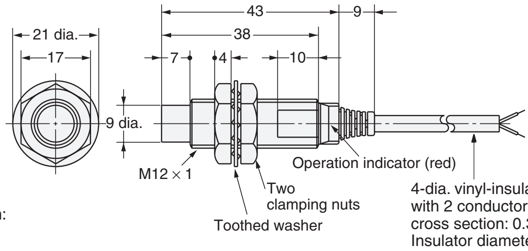


4-dia. vinyl-insulated round cable with 2 conductors (Conductors cross section: 0.3 mm^2, Insulator diameter: 1.3 mm), Standard length: 2 m
The cable can be extended up to 200 m (separate metal conduit).

Note: Operation indicator (red), setting indicator (green)

Pre-wired Models (Unshielded)

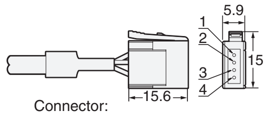
Fig. 11 : E2E-X5MY□



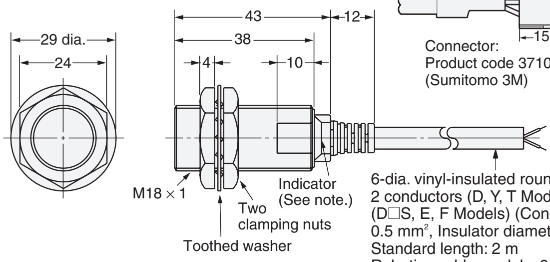
4-dia. vinyl-insulated round cable with 2 conductors (Conductors cross section: 0.3 mm^2, Insulator diameter: 1.3 mm), Standard length: 2 m
The cable can be extended up to 200 m (separate metal conduit).

Fig. 13 : E2E-X7D□-N/ E2E-X5E□/F□ E2E-X5Y□/E2E-X7T1

Pre-wired e-CON connector Model



Connector:
Product code 37104-2206-000FL
(Sumitomo 3M)

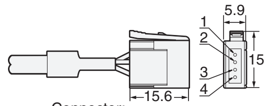


6-dia. vinyl-insulated round cable with 2 conductors (D, Y, T Models)/3 conductors (D□S, E, F Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.9 mm)
Standard length: 2 m
Robotics cable models: 6-dia. vinyl-insulated round cable with 2 conductors (D Models)/ 3 conductors (E Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.74 mm)
Standard length: 2 m
The cable can be extended (separate metal conduit) up to 200 m (control output) or up to 100 m (diagnostic output).

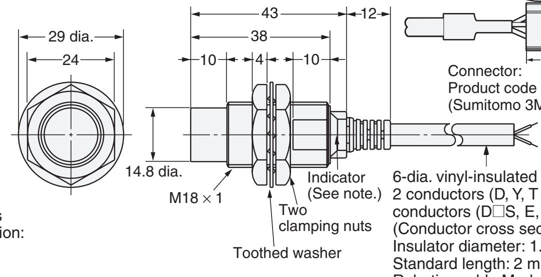
Note: D, T Models: Operation indicator (red), setting indicator (green);
E, F, Y Models: Operation indicator (red)

Fig. 14 : E2E-X14MD□/ E2E-X10ME□/F□ E2E-X10MY□

Pre-wired e-CON connector Model



Connector:
Product code 37104-2206-000FL
(Sumitomo 3M)

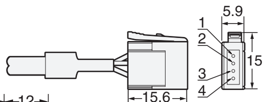


6-dia. vinyl-insulated round cable with 2 conductors (D, Y, T Models)/3 conductors (D□S, E, F Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.9 mm)
Standard length: 2 m
Robotics cable Models: 6-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.74 mm)
Standard length: 2 m
The cable can be extended (separate metal conduit) up to 200 m (control output) or up to 100 m (diagnostic output).

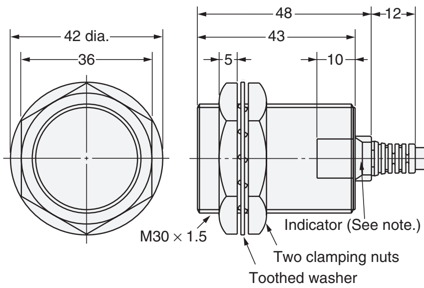
Note: D Models: Operation indicator (red), setting indicator (green);
E, F, Y Models:
Operation indicator (red)

Fig. 15 : E2E-X10D□-N/ E2E-X10E□/F□ E2E-X10Y□/ E2E-X10T1

Pre-wired e-CON connector Model



Connector:
Product code
37104-2206-000FL
(Sumitomo 3M)

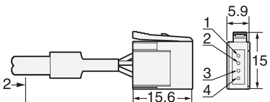


6-dia. vinyl-insulated round cable with 2 conductors (D, Y, T Models)/3 conductors (D□S, E, F Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.9 mm),
Standard length: 2 m
Robotics cable Models: 6-dia. vinyl-insulated round cable with 2 conductors (D Models)/3 conductors (E Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.74 mm),
Standard length: 2 m
The cable can be extended (separate metal conduit) up to 200 m (control output) or up to 100 m (diagnostic output).

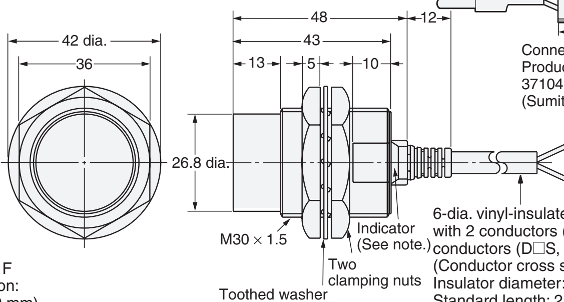
Note: D, T Models: Operation indicator (red), setting indicator (green);
E,F,Y Models: Operation indicator (red)

Fig. 16 : E2E-X20MD□/ E2E-X18ME□/F□ E2E-X18MY□

Pre-wired e-CON connector Model



Connector:
Product code
37104-2206-000FL
(Sumitomo 3M)

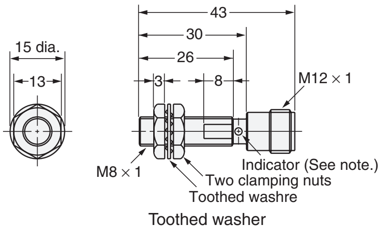


6-dia. vinyl-insulated round cable with 2 conductors (D, Y, T Models)/3 conductors (D□S, E, F Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.9 mm),
Standard length: 2 m
Robotics cable Models: 6-dia. vinyl-insulated round cable with 2 conductors (D Models)/ 3 conductors (E Models) (Conductor cross section: 0.5 mm^2, Insulator diameter: 1.74 mm),
Standard length: 2 m
The cable can be extended (separate metal conduit) up to 200 m (control output) or up to 100 m (diagnostic output).

Note: D Models:
Operation indicator (red),
setting indicator (green);
E, F, Y Models: Operation indicator (red)

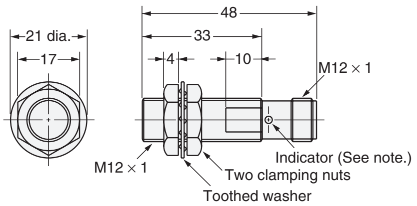
M12 Connector Models (Shielded)

Fig. 17 : E2E-X2D□-M1(G)
E2E-X1R5E□-M1/F□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F Model: Operation indicator (red)

Fig. 19 : E2E-X3D□-M1(G)
E2E-X2E□-M1/F□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F Model: Operation indicator (red)

Fig. 21 : E2E-X2Y□-M1

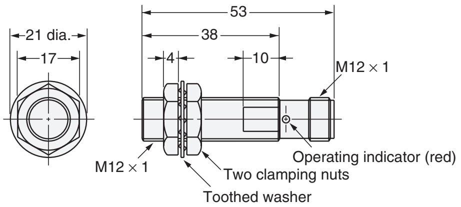
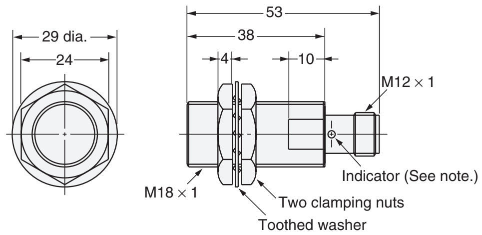
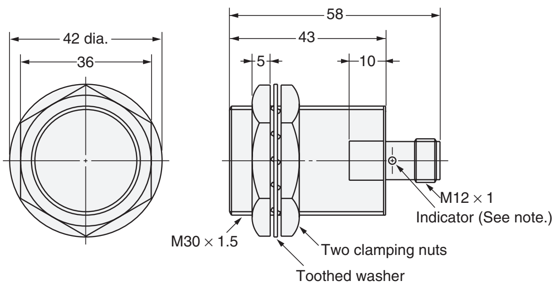


Fig. 23 : E2E-X7D□-M1(G)/E2E-X5E□-M1/F□-M1
E2E-X5Y□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F, Y Model: Operation indicator (red)

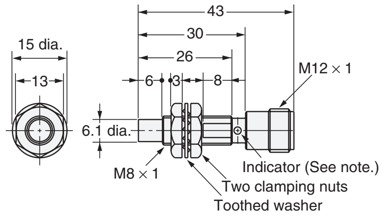
Fig. 25 : E2E-X10D□-M1(G)/E2E-X10E□-M1/F□-M1
E2E-X10Y□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F, Y Model: Operation indicator (red)

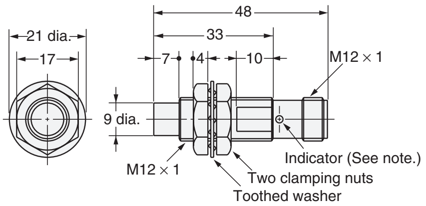
M12 Connector Models (Unshielded)

Fig. 18 : E2E-X4MD□-M1(G)
E2E-X2ME□-M1/F□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F Model: Operation indicator (red)

Fig. 20 : E2E-X8MD□-M1(G)
E2E-X5ME□-M1/F□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F Model: Operation indicator (red)

Fig. 22 : E2E-X5MY□-M1

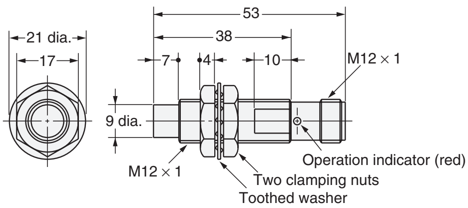
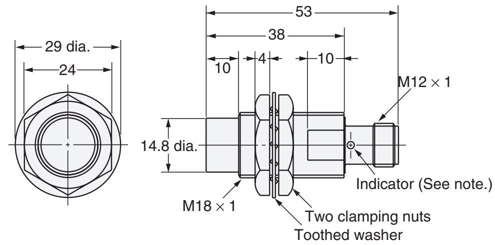
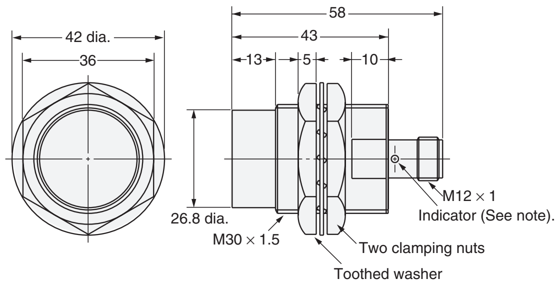


Fig. 24 : E2E-X14MD□-M1(G)/E2E-X10ME□-M1/F□-M1
E2E-X10MY□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F, Y Model: Operation indicator (red)

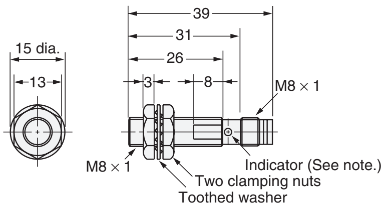
Fig. 26 : E2E-X20MD□-M1(G)/E2E-X18ME□-M1/F□-M1
E2E-X18MY□-M1



Note: D Models: Operation indicator (red), setting indicator (green)
E, F, Y Model: Operation indicator (red)

M8 Connector Models (Shielded)

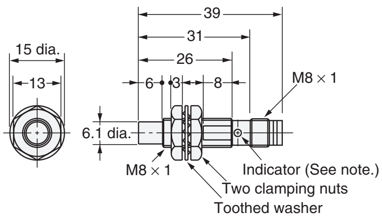
Fig. 27 : E2E-X2D□-M3G/E2E-X1R5E□-M3/F□-M3



Note: D models: Operation indicator (red), setting indicator (green)
E, F model: Operation indicator (red)

M8 Connector Models (Unshielded)

Fig. 28 : E2E-X4MD□-M3G/E2E-X2ME□-M3/F□-M3



Note: D models: Operation indicator (red), setting indicator (green)
E, F model: Operation indicator (red)

Pre-wired M12 Connector Models

Fig. 29 : E2E-X3D1-M1GJ
E2E-X3D1-M1J-T

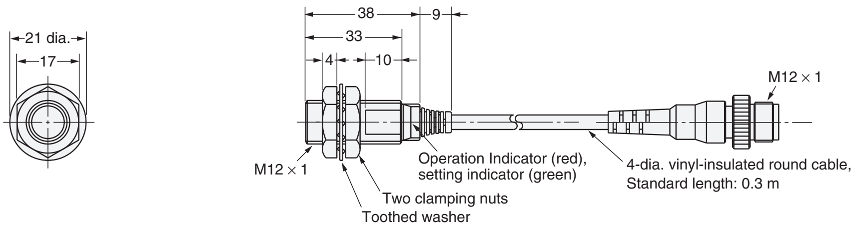


Fig. 30 : E2E-X8MD1-M1GJ

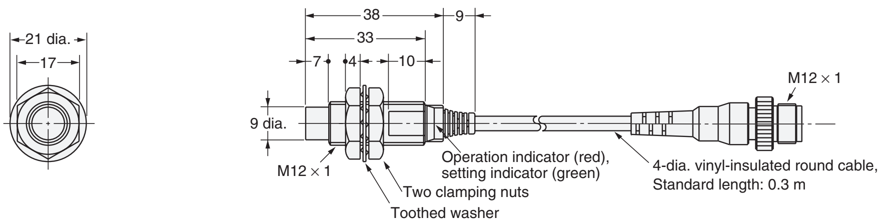
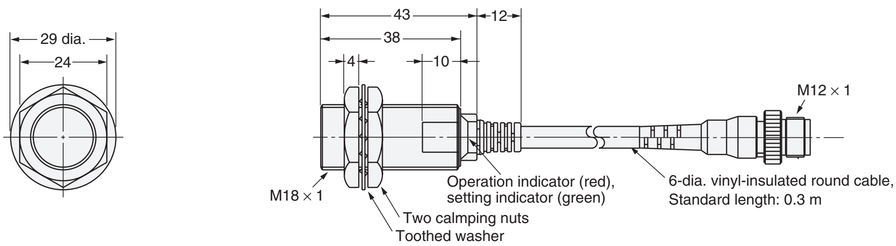


Fig. 31 : E2E-X7D1-M1GJ
E2E-X7D1-M1J-T



Pre-wired M12 Connector Models

Fig. 32 : E2E-X14MD1-M1GJ

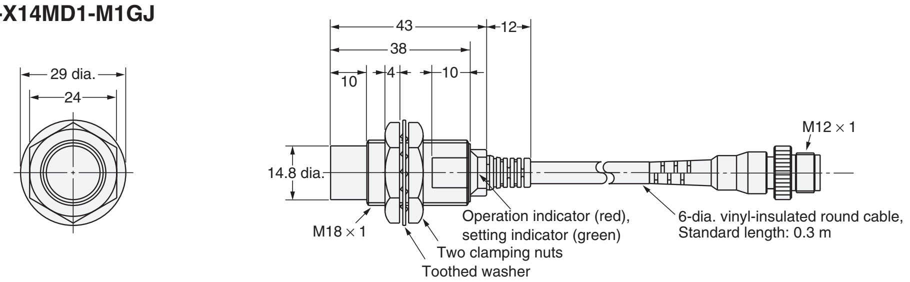


Fig. 33 : E2E-X10D1-M1GJ
E2E-X10D1-M1J-T

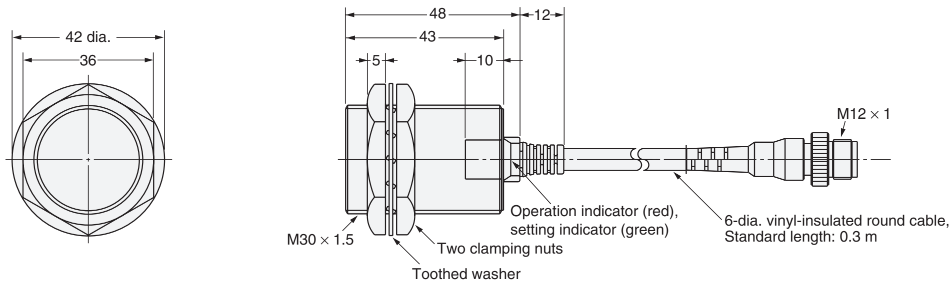
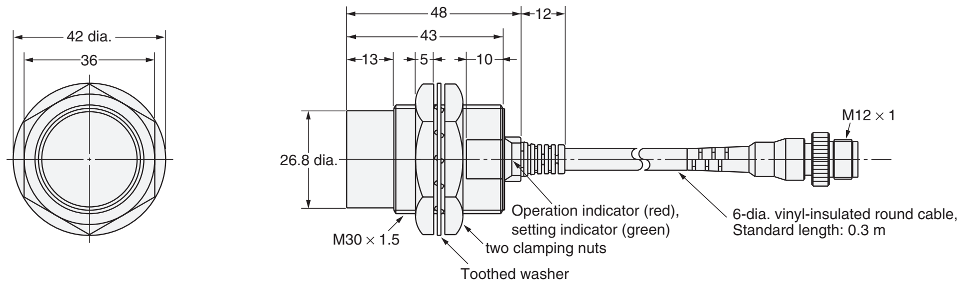
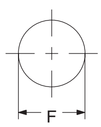


Fig. 34 : E2E-X20MD1-M1GJ



Mounting Holes



Dimensions	M8	M12	M18	M30
F (mm)	$8.5^{+0.5}_{\ 0}$ dia.	$12.5^{+0.5}_{\ 0}$ dia.	$18.5^{+0.5}_{\ 0}$ dia.	$30.5^{+0.5}_{\ 0}$ dia.

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OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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Application Considerations

SUITABILITY FOR USE

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Know and observe all prohibitions of use applicable to this product.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Disclaimers

CHANGE IN SPECIFICATIONS

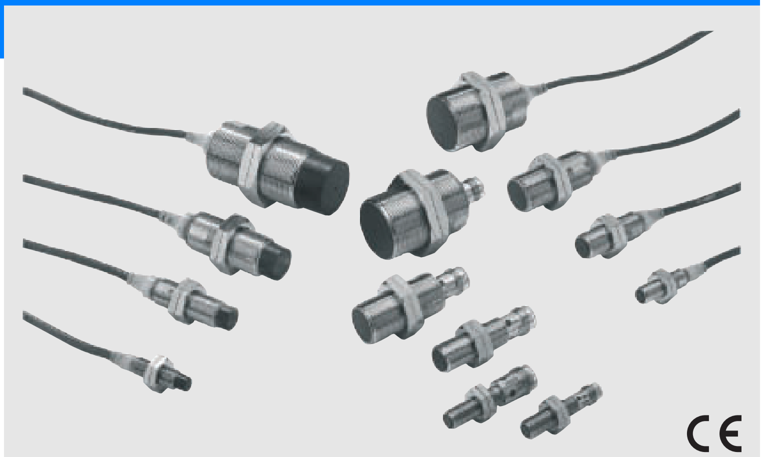
Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

Cylindrical Proximity Sensor for Mobile Usage

E2AU



Designed and tested to keep your machines moving

- IP69k tested and certified for highest water resistance
- e1 type approval (according to automotive directive 95/54/EC)
- EMC noise tested up to 100 V/m (ISO 11452-2)

Ordering Information

DC 3-wire models

Size		Sensing distance	Connection	Body material	Thread length (overall length)	Output configuration	Operation mode NO
M12	Shielded	4.0 mm	Pre-wired	Brass	34 (50)	PNP	E2AU-M12KS04-WP-B1 2M
					56 (72)	PNP	E2AU-M12LS04-WP-B1 2M
			M12 connector	Brass	34 (48)	PNP	E2AU-M12KS04-M1-B1
					56 (70)	PNP	E2AU-M12LS04-M1-B1
M18	Shielded	8.0 mm	Pre-wired	Brass	39 (59)	PNP	E2AU-M18KS08-WP-B1 2M
					61 (81)	PNP	E2AU-M18LS08-WP-B1 2M
			M12 connector	Brass	39 (53)	PNP	E2AU-M18KS08-M1-B1
					61 (75)	PNP	E2AU-M18LS08-M1-B1
M30	Shielded	15.0 mm	Pre-wired	Brass	44 (64)	PNP	E2AU-M30KS15-WP-B1 2M
					66 (86)	PNP	E2AU-M30LS15-WP-B1 2M
			M12 connector	Brass	44 (58)	PNP	E2AU-M30KS15-M1-B1
					66 (80)	PNP	E2AU-M30LS15-M1-B1

Model Number Legend

E2A□-□□□□□-□-□□-□□

1 2 3 4 5 6 7 8 9 10 11 12

Example: E2A-M12LS04-M1-B1 — Standard, M12, long barrel, shielded, Sn=4 mm, M12 connector, PNP-NO
E2A-S08KN04-WP-B1 5M — Standard, M8 stainless steel, short barrel, non-shielded, Sn=4 mm, pre-wired PVC cable, PNP-NO, cable length=5 m

1. Basic name

E2A

2. Sensing technology

Blank: Standard double distance
3: Triple distance
U: Mobile Usage
X: Explosion hazarduous environments

3. Housing shape and material

M: Cylindrical, metric threaded, brass
S: Cylindrical, metric threaded, stainless steel

4. Housing size

08: 8 mm
12: 12 mm
18: 18 mm
30: 30 mm

5. Barrel length

K: Standard length
L: Long body

6. Shield

S: Shielded
N: Non-shielded

7. Sensing distance

Numeral: Sensing distance: e.g. 02=2 mm, 16=16 mm

8. Kind of connection

WP: pre-wired, PVC, dia 4mm (standard)
WS: pre-wired, PVC, dia 6mm
WR: pre-wired, PVC, robotic cable, dia 4mm
WA: pre-wired, PUR/PVC (PUR jacket), dia 4mm
WB: pre-wired, PUR/PVC (PUR jacket), dia 6mm

M1: M12 connector (4 pin) *
M3: M8 connector (4 pin)
M5: M8 connector (3 pin)

M1J pre-wired with M12 cable end connector (4 pin)
M3J pre-wired with M8 cable end connector (4 pin)
M5J pre-wired with M8 cable end connector (3 pin)

9. Power source and output

B: DC, 3-wire, PNP open collector
C: DC, 3-wire, NPN open collector
D: DC, 2-wire
E: DC, 3-wire, NPN voltage output
F: DC, 3-wire, PNP voltage output

10. Operation mode

1: Normally open (NO)
2: Normally closed (NC)
3: Antivalent (NO+NC)

11. Specials (e.g., cable material, oscillating frequency)

12. Cable length

Blank: Connector type
Numeral: Cable length

Note: *In case of DC 2-wire models the M12 connector identifier is '-M1G'

Specifications

DC 3-wire Models

Size		M12
Type		Shielded
Item		E2A-M12□S04-□□-B1
Sensing distance		4 mm ± 10%
Setting distance		0 to 3.2 mm
Differential travel		10% max. of sensing distance
Target		Ferrous metal (The sensing distance decreases with non-ferrous metal.)
Standard target (mild steel ST37)		12×12×1 mm
Response frequency (See note 1.)		1,000 Hz
Power supply voltage (operating voltage range)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)
Current consumption (DC 3-wire)		10 mA max.
Output type		PNP open collector
Control output	Load current (See note 2.)	200 mA max. (32 VDC max.)
	Residual voltage	2 V max. (under load current of 200 mA with cable length of 2 m)
Indicator		Operation indicator (Yellow LED)
Operation mode (with sensing object approaching)		-B1
Protection circuit		Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection
Ambient air temperature		Operating: -40°C to 70°C, Storage: -40°C to 85°C (with no icing or condensation)
Temperature influence (See note 2.)		±10% max. of sensing distance at 23°C within temperature range of -25°C to 70°C ±15% max. of sensing distance at 23°C within temperature range of -40°C to 70°C
Ambient humidity		Operating: 35% to 95%, Storage: 35% to 95%
Voltage influence		±1% max. of sensing distance in rated voltage range ±15%
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current carry parts and case
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions
Shock resistance		1,000 m/s^2, 10 times each in X, Y and Z directions
Standard and listings		IP67 after IEC 60529 IP69k after DIN 40050 EMC after EN60947-5-2 UL (CSA) E196555 (See note 3.) EMC after 95/54/EC EMC after ISO11452-2
Connection method		Pre-wired models (dia 4mm PVC cable with length = 2m). M12 connector models
Weight (packaged)	Pre-wired model	Approx. 85 g
	Connector model	Approx. 35 g
Material	Case	Brass-nickel plated
	Sensing surface	PBT
	Cable	Standard cable is PVC dia 4mm.
	Clamping nut	Brass-nickel plated

Note 1. The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.

2. When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 100 mA max.,

3. UL (CSA) [E196555]: Use class 2 circuit only.

DC 3-wire Models / DC 4-wire

Size		M18	M30
Type		Shielded	Shielded
Item		**E2A-M18□S08-□□-B1**	**E2A-M30□S15-□□-B1**
Sensing distance		8 mm±10%	15 mm±10%
Setting distance		0 to 6.4 mm	0 to 12 mm
Differential travel		10% max. of sensing distance	
Target		Ferrous metal (The sensing distance decreases with non-ferrous metal.)	
Standard target (mild steel ST37)		24×24×1 mm	45×45×1 mm
Response frequency (See note 1.)		500 Hz	250 Hz
Power supply voltage (operating voltage range)		12 to 24 VDC. Ripple (p-p): 10% max. (10 to 32 VDC)	
Current consumption (DC 3-wire)		10 mA max.	
Output type		PNP open collector	
Control output	Load current (See note 2.)	200 mA max. (32 VDC max.)	
	Residual voltage	2 V max. (under load current of 200 mA with cable length of 2 m)	
Indicator		Operation indicator (Yellow LED)	
Operation mode (with sensing object approaching)		-B1	
Protection circuit		Output reverse polarity protection, Power source circuit reverse polarity protection, Surge suppressor, Short-circuit protection	
Ambient air temperature		Operating: -40°C to 70°C, Storage: -40°C to 85°C (with no icing or condensation)	
Temperature influence (See note 2.)		±10% max. of sensing distance at 23°C within temperature range of -25°C to 70°C ±15% max. of sensing distance at 23°C within temperature range of -40°C to 70°C	
Ambient humidity		Operating: 35% to 95%, Storage: 35% to 95%	
Voltage influence		±1% max. of sensing distance in rated voltage range ±15%	
Insulation resistance		50 MΩ min. (at 500 VDC) between current carry parts and case	
Dielectric strength		1,000 VAC at 50/60 Hz for 1 min between current carry parts and case	
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y and Z directions	
Shock resistance		1,000 m/s^2, 10 times each in X, Y and Z directions	
Standard and listings		IP67 after IEC 60529 IP69k after DIN 40050 EMC after EN60947-5-2 UL (CSA) E196555 (See note 3.) EMC after 95/94/EC EMC after ISO11452-2	
Connection method		Pre-wired models (dia 4mm PVC cable with length = 2m). M12 connector models.	
Weight (pakka-ged)	Pre-wired model	Approx. 160 g	Approx. 280 g
	Connector model	Approx. 70 g	Approx. 200 g
Material	Case	Brass-nickel plated	
	Sensing surface	PBT	
	Cable	Standard cable is PVC dia 4mm.	
	Clamping nut	brass-nickel plated for brass models stainless steel for steel models	

Note 1. The response frequency is an average value. Measurement conditions are as follows: standard target, a distance of twice the standard target distance between targets, and a setting distance of half the sensing distance.

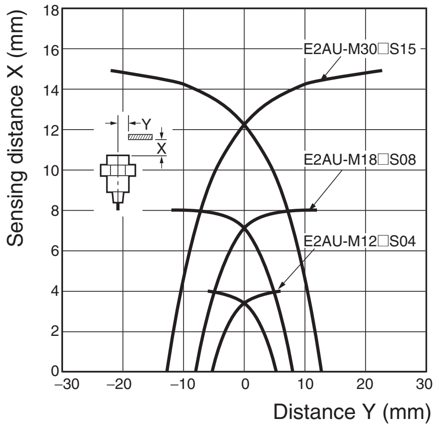
2. When using any model at an ambient temperature between -40°C and -25°C and a power voltage between 30 and 32 VDC, use a load current of 100 mA max.

3. UL (CSA) [E196555]: Use class 2 circuit only.

Engineering Data

Operating Range (Typical)

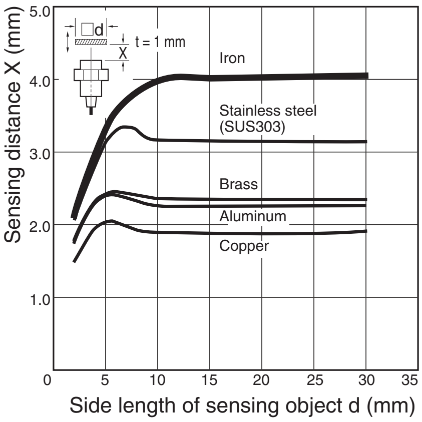
Shielded Models



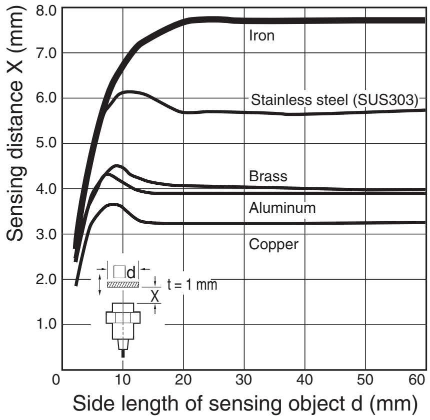
Influence of Sensing Object Size and Materials

Shielded Models

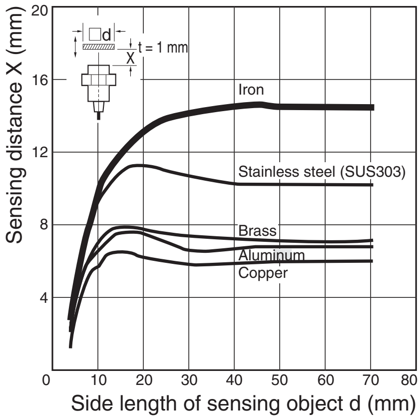
E2AU-M12□S04/ E2A-S12□S04



E2AU-M18□S08/E2A-S18□S08



E2AU-M30□S15/ E2A-S30□S15

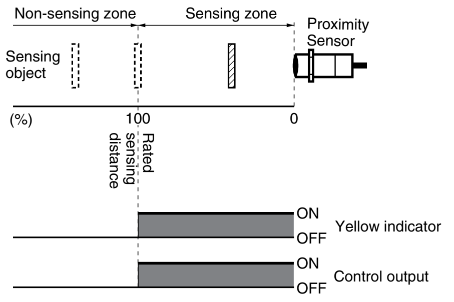
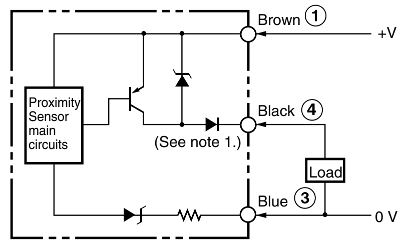
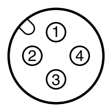


E2AU

Operation

DC 3-wire models

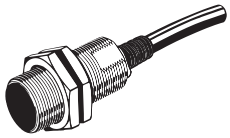
PNP Output

Operation mode	Model	Timing chart	Output circuit
NO	E2AU-□-□-B1	 	 **Note 1:** With M8 connector models, there is no output reverse polarity protection diode. M12 Connector Pin Arrangement (See note 2.)  **Note 2:** Terminal 2 of the M12 connector is not used.

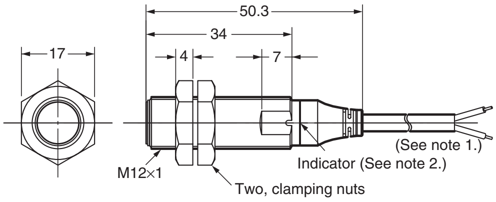
Dimensions

Note: All units are in millimeters unless otherwise indicated.

Pre-wired Models (Shielded)

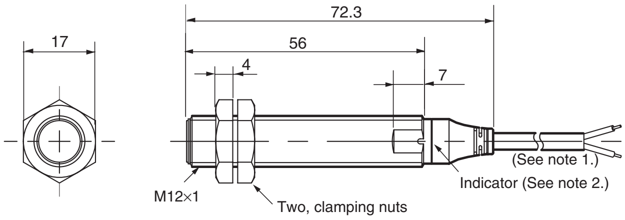


E2AU-M12KS04-WP-□□



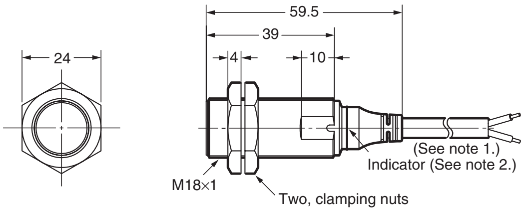
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm^2; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2A-M12LS04-WP-□□



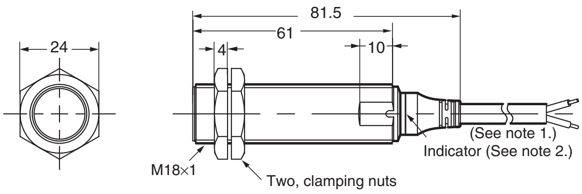
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm^2; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2AU-M18KS08-WP-□□



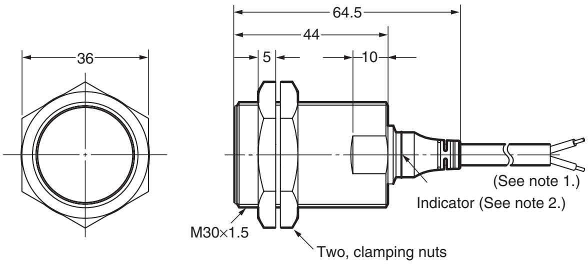
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm^2; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2AU-M18LS08-WP-□□



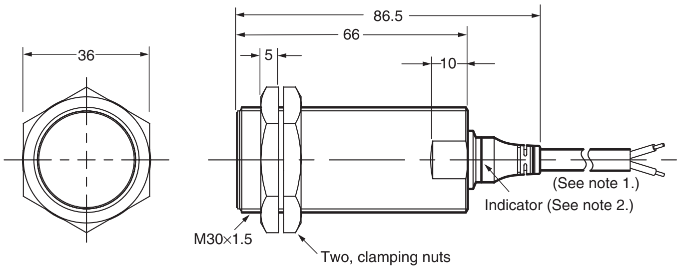
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm^2; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2AU-M30KS15-WP-□□



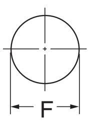
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm^2; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

E2AU-M30LS15-WP-□□



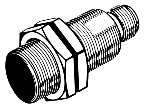
Note 1. 4-dia. vinyl-insulated round cable with 3 conductors (conductor cross section: 0.3 mm^2; insulator diameter: 1.3 mm); standard length: 2 m
2. Operation indicator (yellow)

Mounting Hole Cutout Dimensions

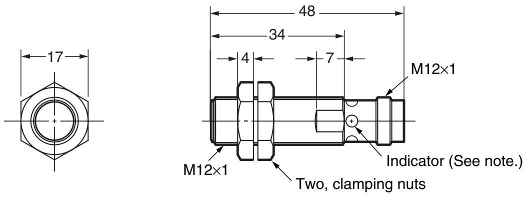


External diameter of Proximity Sensor	Dimension F (mm)
M12	12.5 dia. $^{+0.5}_{0}$
M18	18.5 dia. $^{+0.5}_{0}$
M30	30.5 dia. $^{+0.5}_{0}$

M12 Connector Models (Shielded)

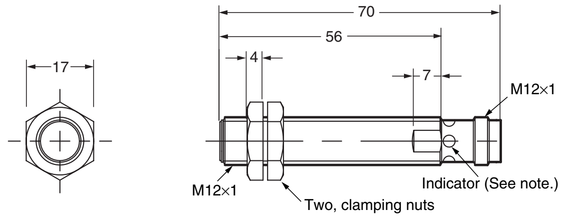


E2AU-M12KS04-M1-□□



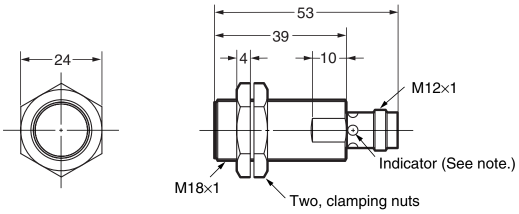
Note 1: Operation indicator (yellow LED, 4×90°)

E2AU-M12LS04-M1-□□



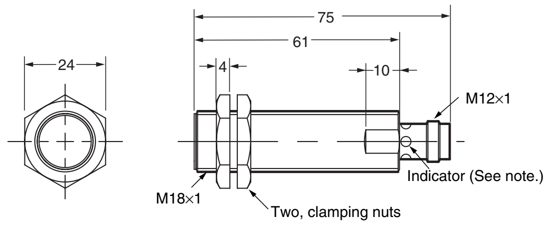
Note: Operation indicator (yellow LED, 4×90°)

E2AU-M18KS08-M1-□□



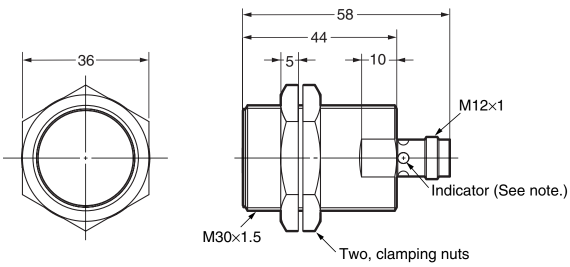
Note: Operation indicator (yellow LED, 4×90°)

E2AU-M18LS08-M1-□□



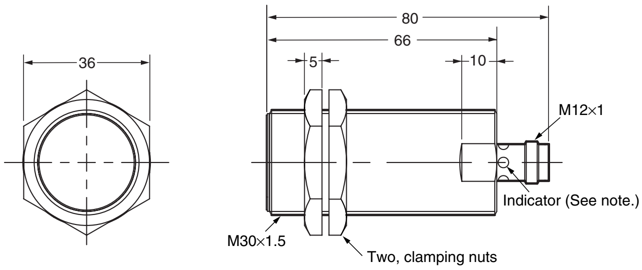
Note: Operation indicator (yellow LED, 4×90°)

E2AU-M30KS15-M1-□□



Note: Operation indicator (yellow LED, 4×90°)

E2AU-M30LS15-M1-□□



Note: Operation indicator (yellow LED, 4×90°)

Precautions

Safety Precautions

Power Supply

Do not impose an excessive voltage on the E2AU, otherwise it may be damaged. Do not impose AC current (100 to 240 VAC) on any DC model, otherwise it may be damaged.

Load Short-circuit

Do not short-circuit the load, or the E2AU may be damaged.

The E2AU's short-circuit protection function will be valid if the polarity of the supply voltage imposed is correct and within the rated voltage range.

Wiring

Be sure to wire the E2AU and load correctly, otherwise it may be damaged.

Connection with No Load

Be sure to insert loads when wiring. Make sure to connect a proper load to the E2AU in operation, otherwise it may damage internal elements.

Do not expose the product to flammable or explosive gases.

Do not disassemble, repair, or modify the product.

Correct Use

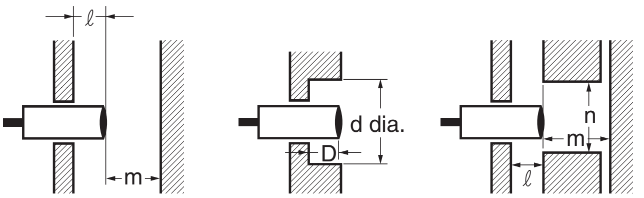
Designing

Power Reset Time

The Proximity Sensor is ready to operate within 100 ms after power is supplied. If power supplies are connected to the Proximity Sensor and load respectively, be sure to supply power to the Proximity Sensor before supplying power to the load.

Effects of Surrounding Metal

When mounting the E2AU within a metal panel, ensure that the clearances given in the following table are maintained.



(Unit: mm)

Type	Dimension	M12	M18	M30 Short barrel	M30 Long barrel
Shielded	l	0	0 (See note 1.)	0 (See note 2.)	
	m	12	24	45	
	d	---	27	45	
	D	0	1.5	4	
	n	18	27	45	
Non-shielded	l	15	22	30	40
	m	20	48	70	90
	d	40	70	90	120
	D	15	22	30	40
	n	40	70	90	120

Note 1. In the case of using the supplied nuts.
If true flash mounting is necessary, apply a free zone of 1.5 mm.

2. In the case of using the supplied nuts.
If true flush mounting is necessary, apply a free zone of 4 mm.

Power OFF

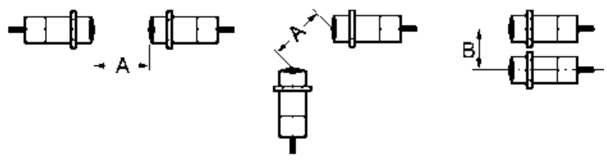
The Proximity Sensor may output a pulse signal when it is turned OFF. Therefore, it is recommended that the load be turned OFF before turning OFF the Proximity Sensor.

Power Supply Transformer

When using a DC power supply, make sure that the DC power supply has an insulated transformer. Do not use a DC power supply with an auto-transformer.

Mutual Interference

When installing two or more Sensors face-to-face or side-by-side, ensure that the minimum distances given in the following table are maintained.



(Unit: mm)

Type	Dimension	M12	M18	M30 Short barrel	M30 Long barrel
Shielded	A	30	60	110	
	B	20	35	70	
Non-shielded	A	120	200	300	300
	B	100	120	200	300

Wiring

High-tension Lines

Wiring through Metal Conduit**:**
If there is a power or high-tension line near the cable of the Proximity Sensor, wire the cable through an independent metal conduit to prevent against Proximity Sensor damage or malfunctioning.

Cable Extension

Standard cable length is less than 200 m.

The tractive force is 50 N.

Mounting

The Proximity Sensor must not be subjected to excessive shock with a hammer when it is installed, otherwise the Proximity Sensor may be damaged or lose its water-resistivity.

Do not tighten the nut with excessive force. A washer must be used with the nut.

Type	Torque
M12	30 Nm
M18	70 Nm
M30	180 Nm

Maintenance and Inspection

Periodically perform the following checks to ensure stable operation of the Proximity Sensor over a long period of time.

1. Check for mounting position, dislocation, looseness, or distortion of the Proximity Sensor and sensing objects.
2. Check for loose wiring and connections, improper contacts, and line breakage.
3. Check for attachment or accumulation of metal powder or dust.
4. Check for abnormal temperature conditions and other environmental conditions.
5. Check for proper lighting of indicators (for models with a set indicator.)

Never disassemble or repair the Sensor.

Environment

Water Resistivity

The Proximity Sensors are tested intensively on water resistance, but in order to ensure maximum performance and life expectancy avoid immersion in water and provide protection from rain or snow.

Operating Environment

Ensure storage and operation of the Proximity Sensor within the given specifications.

Inrush Current

A load that has a large inrush current (e.g., a lamp or motor) will damage the Proximity Sensor, in which case connect the load to the Proximity Sensor through a relay.

<SUITABILITY FOR USE>

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used.

<CHANGE IN SPECIFICATIONS>

Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

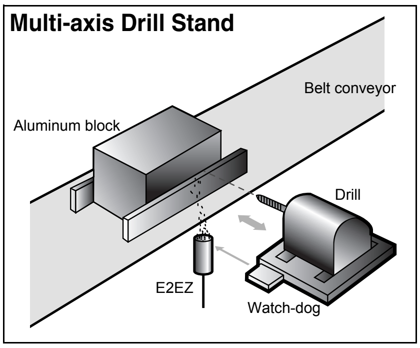
Cat. No. D10E-EN-01 In the interest of product improvement, specifications are subject to change without notice.

Anti-Aluminum Cut Chips Models

E2EZ

Specialized sensing method for immunity against small sized metal objects (e.g. aluminium chips)

Applications



Ordering Information

Sensors

Pre-wired Models

Shape		Sensing distance	Output specifications	Model Operating status NO	Model Operating status NC
Shielded	M18	4mm	DC 3-wire NPN	**E2EZ-X4C1**	---
			DC 2-wire	**E2EZ-X4D1-N**	**E2EZ-X4D2-N**
			AC 2-wire Models	**E2EZ-X4Y1**	---
	M30	8mm	DC 3-wire NPN	**E2EZ-X8C1**	---
			DC 2-wire	**E2EZ-X8D1-N**	**E2EZ-X8D2-N**
			AC 2-wire Models	**E2EZ-X8Y1**	

Connector Models

Shape		Sensing distance	Output specifications	Model Operating status NO	Model Operating status NC
Shielded	M18	4mm	DC 2-wire models (3) and (4) pin arrangement	**E2EZ-X4D1-M1J** *NEW*	---
			DC 2-wire models (1) and (4) pin arrangement	**E2EZ-X4D1-M1GJ** *NEW*	---
	M30	8mm	DC 2-wire models (3) and (4) pin arrangement	**E2EZ-X8D1-M1J** *NEW*	---
			DC 2-wire models (1) and (4) pin arrangement	**E2EZ-X8D1-M1GJ** *NEW*	---

Accessories (Order Separately)

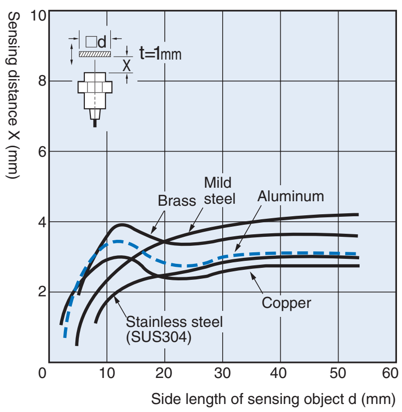
Sensor I/O Connectors

Shape	Cable length	Sensor I/O Connectors	Applicable proximity sensor models
Straight type	2 m	**XS2F-D421-DD0**	E2EZ-X4D☐-M1J
	5 m	**XS2F-D421-GD0**	
L type	2 m	**XS2F-D422-DD0**	E2EZ-X8D☐-M1J
	5 m	**XS2F-D422-GD0**	
Straight type	2 m	**XS2F-D421-DA0-A**	E2EZ-X4D☐-M1GJ
	5 m	**XS2F-D421-GA0-A**	
L type	2 m	**XS2F-D422-DA0-A**	E2EZ-X8D☐-M1GJ
	5 m	**XS2F-D422-GD0-A**	

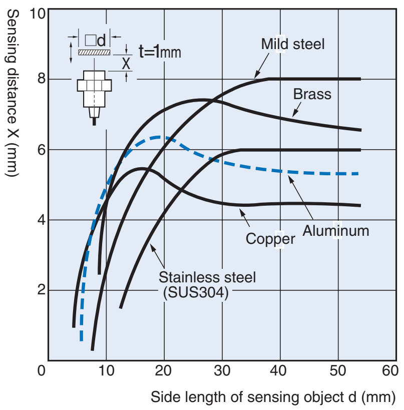
Characteristic data (typical)

Sensing Distance vs. Sensing Object

E2EZ-X4☐



E2EZ-X8☐



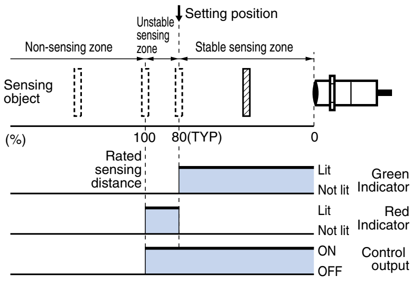
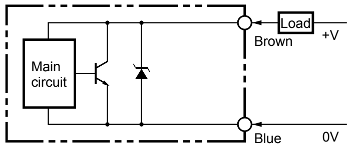
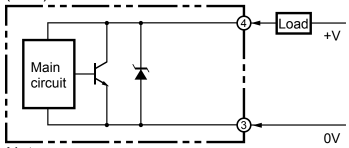
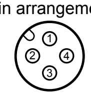
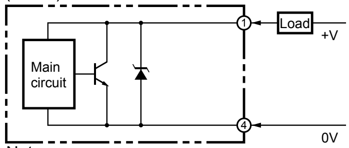
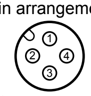
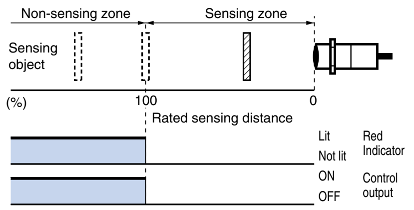
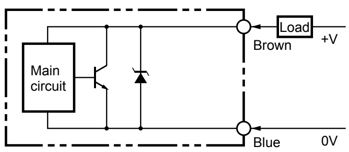
Rating/performance

Model / Item	E2EZ-X4C1 E2EZ-X4Y1	E2EZ-X8C1 E2EZ-X8Y1	E2EZ-X4D□-N E2EZ-X4D□-M1J E2EZ-X4D□-M1GJ	E2EZ-X8D□-N E2EZ-X8D□-M1J E2EZ-X8D□-M1GJ
Sensing distance	4 mm ±10%	8 mm ±10%	4 mm ±10%	8 mm ±10%
Setting distance*1	0 to 3.2 mm	0 to 6.4 mm	0 to 3.2 mm	0 to 6.4 mm
Differential distance	20% max. of sensing distance			
Sensing object	Ferrous metal (Sensitivity lowers with non-ferrous metals)			
Standard sensing object	Iron, 30 × 30 × 1 mm	Iron, 54 × 54 × 1 mm	Iron, 30 × 30 × 1 mm	Iron, 54 × 54 × 1 mm
Response frequency*2	C models: 12 Hz Y models: 5 Hz	C models: 8 Hz Y models: 5 Hz	100 Hz	30 Hz
Rated supply voltage (operating voltage)	C models: 12 to 24 VDC, ripple (p-p) : 10% max., (10 to 30 VDC)		12 to 24 VDC (10 to 30 VDC) ripple (p-p): 10% max.	
Current consumption	C models: 15 mA max.		---	
Leakage current	Y models: 2 mA max. (at 100 VAC), 3 mA max. (at 200 VAC)		0.8 mA max.	
Control output: Switching capacity	C models: NPN open collector output 12 VDC 100 mA max. (30 VDC max.) Y models: 10 to 200 mA		3 to 100 mA	
Control output: Residual voltage	C models: 2 V max. (load current: 200 mA with cable length: 2 m) Y models: Refer to the Specifications		3.0 V max. (under load current of 100 mA with cable length of 2 m)	
Indicator lamp	C models: Detection indicator (red LED) Y models: Operation indicator (red LED)		D1 models: Operation indicator (red LED), Operation set indicator (green LED) D2 models: Operation indicator (red LED)	
Operating status (with sensing object approaching)	NO		D1 models: NO D2 models: NC NO	
Protective circuits	C models: Reverse connection protection, load short-circuit protection, surge absorber Y models: None		Surge absorber, short-circuit protection	
Ambient temperature	Operating/Storage: 0°C to 50°C (with no icing or condensation)			
Ambient humidity	Operating/Storage: 35% to 95%RH (with no condensation)			
Temperature influence	±20% max. of sensing distance within a temperature range of 0°C to 50°C based on the sensing distance at a temperature of 23°C.			
Voltage influence	E models: ±2.5% max. of sensing distance within a range of ±10% of rated power supply voltage Y models: ±1% max. of sensing distance within a range of ±10% of rated power supply voltage		±2.5% max. of sensing distance within a range of ±10% of rated power supply voltage	
Insulation resistance	50 MΩ min. (at 500 VDC) between current carry parts and case			
Dielectric strength	C type: 1,000 VAC, 50/60 Hz for 1 min.)		1000 VAC 50/60 Hz for 1 min between current carrying part and case	
Vibration resistance	10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions			
Shock resistance	Destruction: 1,000 m/s² for 10 times each in X, Y, and Z directions			
Protective structure	IEC60529 IP67			
Connection method	Pre-wired (standard length: 2 m) Connector Extension Models			
Weight (Packed state)	Approx. 170 g	Approx. 270 g	E2EZ-X4D□-N Approx. 160 g E2EZ-X4D□-M1J Approx. 90 g E2EZ-X4D□-M1GJ Approx. 90 g	E2EZ-X8D□-N Approx. 220 g E2EZ-X8D□-M1J Approx. 160 g E2EZ-X8D□-M1G Approx. 160 g
Material	Case: Brass, Sensing face: Heat-resistant ABS resin Screw: Brass, Mounting nut: Steel			
Accessories	Instruction manual			

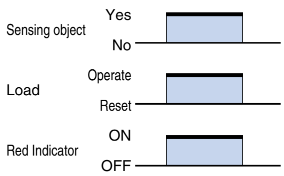
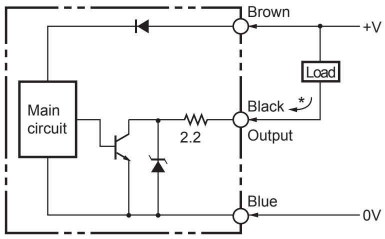
*1. Use within a range where the green indicator is lit.
*2. The response frequencies for DC switching are average values measured on condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.

Output Circuit Diagram

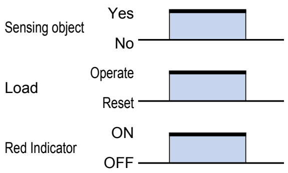
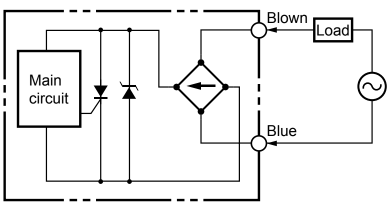
DC 2-wire Models

Operating status	Model	Timing chart	Output circuit
NO	E2EZ-X4D1-N E2EZ-X8D1-N		 Note: The load can be connected to either the +V or the 0-V line.
	E2EZ-X4D1-M1J E2EZ-X4D1-M1GJ E2EZ-X8D1-M1J E2EZ-X8D1-M1GJ		(M1J)  Pin arrangement  Note: Terminals ① and ② are not used. Note: The load can be connected to either the +V or the 0-V line. (M1GJ)  Pin arrangement  Note: Terminals ② and ③ are not used. Note: The load can be connected to either the +V or the 0-V line.
NC	E2EZ-X4D2-N E2EZ-X8D2-N		 Note: The load can be connected to either the +V or the 0-V line.

DC 3-wire Models

Operating status	Model	Timing chart	Output circuit
NO	E2EZ-X4C1 E2EZ-X8C1		 * Load current: 100mA max. at 12 V and 200 mA max. at 24 V

AC 2-wire Models

Operating status	Model	Timing chart	Output circuit
NO	E2EZ-X4Y1 E2EZ-X8Y1		

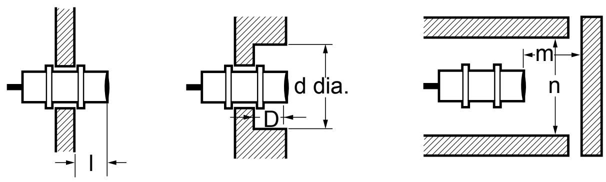
Precautions

Correct Use

Design

Effects of Surrounding Metal

Provide a minimum distance as shown in the table below between the Sensor and the surrounding metal.



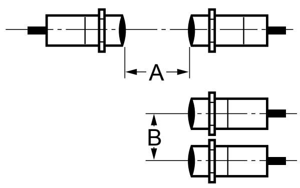
Effects of Surrounding Metal (Unit: mm)

Model	Surrounding (Item)	l	d	D	m	n
E2EZ-X4□	Steel	0	18	0	16	27
	Aluminum	5	40	5		54
E2EZ-X8□	Steel	0	30	0	32	45
	Aluminum	10	70	10		90

Mutual Interference

When installing two or more E2EZ face to face or side by side, ensure that the minimum distances given in the following table maintained.

Mutual Interference (Unit: mm)



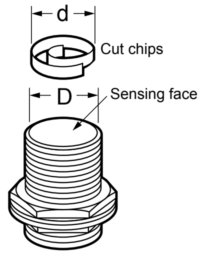
Model (Item)	A	B
E2EZ-X4□	40	50
E2EZ-X8□	60	100

Aluminum and Cast Iron Cut Chips

A detection signal will not be output if aluminum or cast iron cut chips are stuck to the sensing face. Under the following conditions, however, the proximity sensor may output detection signals, in which case remove the cut chips from the sensing face.

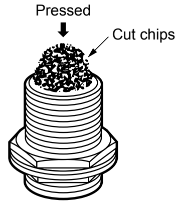
(1) About the external diameter (d) of a cut chip and the diameter (D) of the sensing surface

If the external diameter (d) of a cut chip is two-thirds the diameter (D) of the sensing face as shown in the illustration.



(Unit: mm)

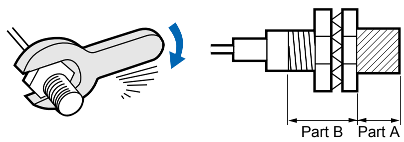
Model (Length)	D
E2EZ-X4□	16
E2EZ-X8□	28



(2) If cut chips are pressed onto the sending face as shown in the illustration.

Mounting

Do not tighten the nut with excessive force. A washer must be used with the nut.

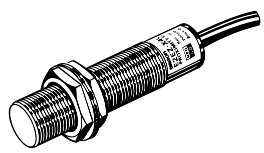


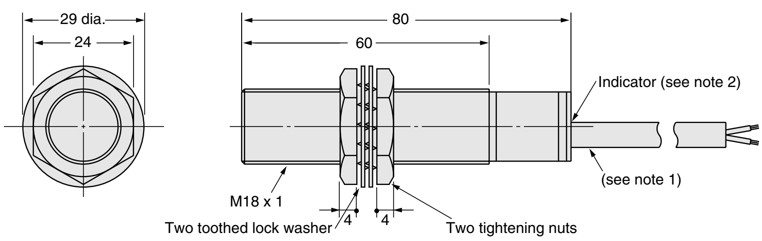
Note: 1 . The table below shows the tightening torques for part A and part B nuts. In the previous examples, the nut is on the sensor head side (part B) and hence the tightening torque for part B applies. If this nut is in part A, the tightening torque for part A applies instead.
2 . The table below shows the value of tightening torques when using toothed washers.

Model (Tightening torgues)	Part A: Length (mm)	Part A: Tensile strength (torque)	Part B: Tensile strength (torque)
E2EZ-X4C1 E2EZ-X4Y1	20	15 N•m	29 N•m
E2EZ-X8C1 E2EZ-X8Y1	22	29 N•m	39 N•m
E2EZ-X4D□-□	29	15 N•m	---
E2EZ-X8D□-□	26	39 N•m	78 N•m

Dimensions (Unit: mm)

E2EZ-X4C1
E2EZ-X4Y1



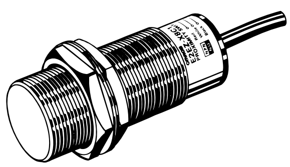


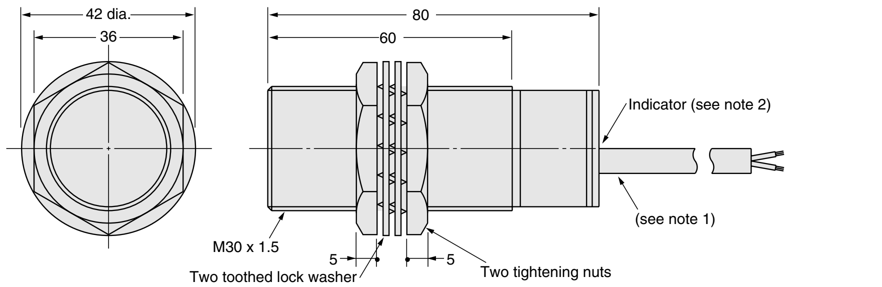
Note:
1. E2EZ-X4B1 and E2EZ-X4CI:
A 6 dia., 3-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm) is used.
Standard length: 2 m

E2EZ-X4Y1
A 6 dia., 2-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm) is used.
Standard length: 2 m

2. B, C Type: Detection indicator (red)
Y Type: Operation indicator (red)

E2EZ-X8C1
E2EZ-X8Y1



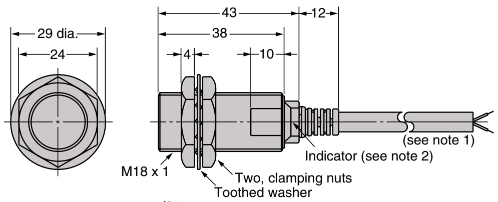


Note:
1. E2EZ-X8B1 and E2EZ-X8CI:
A 6 dia., 3-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm) is used.
Standard length: 2 m

E2EZ-X8Y1
A 6 dia., 2-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm) is used.
Standard length: 2 m

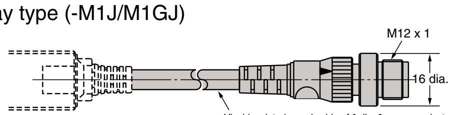
2. B, C Type: Detection indicator (red)
Y Type: Operation indicator (red)

E2EZ-X4D☐-N



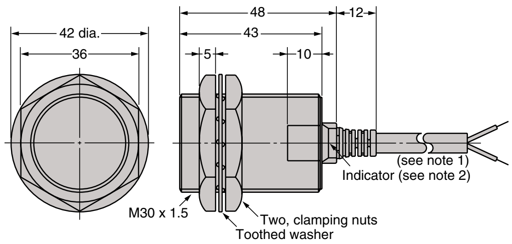
Note:
A 6 dia., 2-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm) is used.
Standard length: 2m
Cable extension (through a single metal conduit): 200 m max.
2. D1 type: Operation indicator (red);
Operation set indicator (green)
D2 type: Operation indicator (red)

Connector relay type (-M1J/M1GJ)



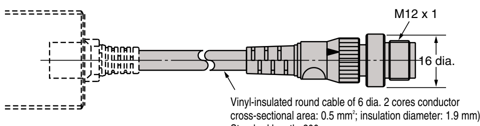
Vinyl-insulated round cable of 6 dia. 2 cores conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm)
Standard length: 300 mm

E2EZ-X8D☐-N



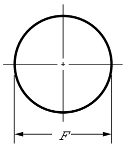
Note:
A 6 dia., 2-conductor, vinyl-insulated round cable (conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm) is used.
Standard length: 2m
Cable extension (through a single metal conduit): 200 m max.
2. D1 type: Operation indicator (red);
Operation set indicator (green)
D2 type: Operation indicator (red)

Connector relay type(-M1J/M1GJ)



Vinyl-insulated round cable of 6 dia. 2 cores conductor cross-sectional area: 0.5 mm²; insulation diameter: 1.9 mm)
Standard length: 300 mm

Mounting Holes



Model	F (mm)
E2EZ-X4☐	18.5-mm dia. +0
E2EZ-X8☐	30.5-mm dia. +0

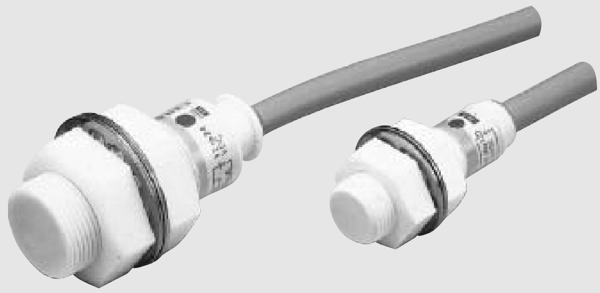
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D028-E2-04-X In the interest of product improvement, specifications are subject to change without notice.

Chemical Resistant Inductive Proximity Sensor

E2FQ

Teflon housing for increased chemical and detergent resistance*



Note:1.

* Teflon is a registered trademark of Dupont Company and Mitsui Dupont Chemical Company for their fluoride resin.

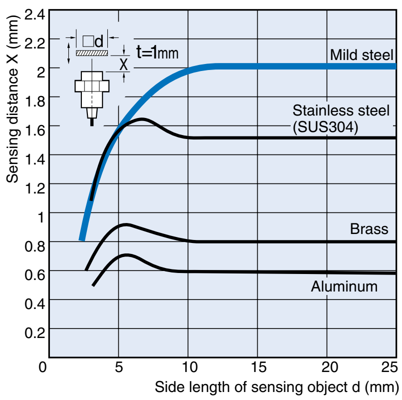
Ordering Information

Shape		Sensing distance	DC 3-wire models			DC 2-wire models		AC 2-wire models	
			PNP (NO)	NPN (NO)	Response frequency	NO	Response frequency	NO	Response frequency
Shielded	M12	2mm	E2FQ-X2F1	E2FQ-X2E1	1.5 kHZ	E2FQ-X2D1	800 Hz	---	---
	M18	5mm	E2FQ-X5F1	E2FQ-X5E1	600 Hz	E2FQ-X5D1	500 Hz	E2FQ-X5Y1	25 HZ
	M30	10mm	E2FQ-X10F1	E2FQ-X10E1	400 Hz	E2FQ-X10D1	300 Hz	E2FQX10Y1	

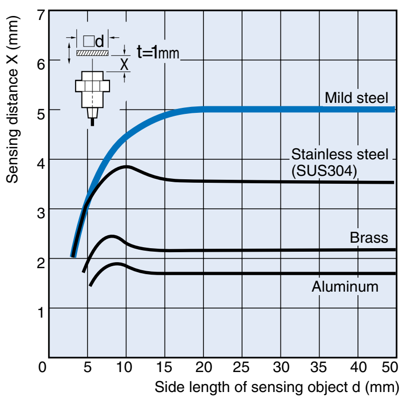
Characteristic data (typical)

Sensing Distance vs. Sensing Object

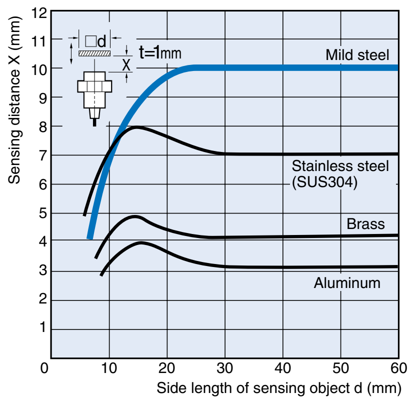
E2FQ-X2□



E2FQ-X5□



E2FQ-X10□



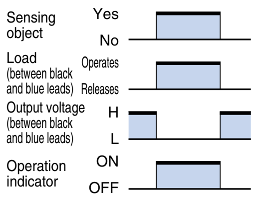
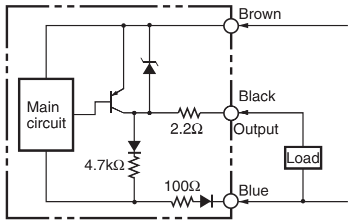
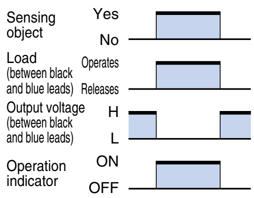
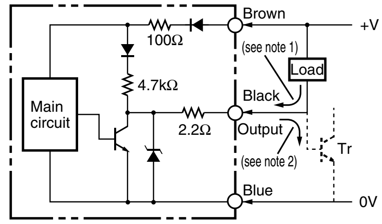
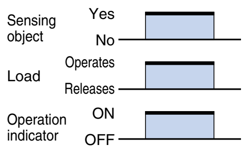
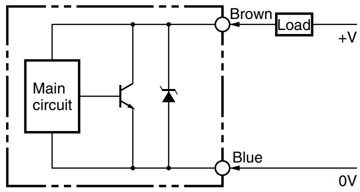
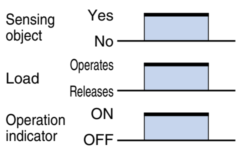
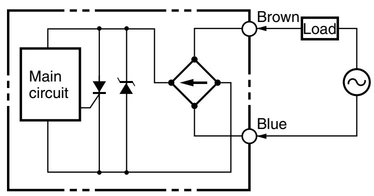
Note: 1 . CE mark certification in progress at time of catalog printing. Please contact your OMRON representative for the current status.

Rating/Performance

Item / Model		E2FQ-X2□	E2FQ-X5□	E2FQ-X10□
Sensing distance		2 mm ±10%	5 mm ±10%	10 mm ±10%
Setting distance		0 to 1.6 mm	0 to 4 mm	0 to 8 mm
Differential distance		E1, F1, Y1 models: 10% max. of sensing distance		
Sensing object		Ferrous metal (Sensitivity lowers with non-ferrous metals)		
Standard sensing object (mild steel)		12 x 12 x 1 mm	18 x 18 x 1 mm	30 x 30 x 1 mm
Response frequency*1		E1, F1 models: 1.5 kHz D1 models: 800 Hz	E1, F1 models: 600 Hz, D1 models: 500 Hz	E1, F1 models: 400 Hz, D1 models: 300 Hz
			Y1 models: 25 Hz	
Power supply (Operating voltage range)		E1, F1 models: 12 to 24 VDC, ripple (p-p) : 10% max., (10 to 30 VDC) D1 models: 12 to 24 VDC, ripple (p-p) : 20% max., (10 to 36 VDC)		
Current consumption		E1, F1 models: 17 mA max.		
Leakage current		D1 models: 0.8 mA max., Y models: 5 to 300 mA		
Control output	Switching capacity	E1, F1 models: 200 mA max., D1 models: 5 to 100 mA DC, Y models: 5 to 300 mA		
	Residual voltage	E1, F1 models: 2 V max. (load current: 200 mA with cable length: 2 m) Y models: Refer to the Specifications. D1 models: 4.0 V max. (under load current of 100 mA with cable length of 2 m)		
Indicator lamp		E,D models: detection indicator (red), Y models: operation indicator (red)		
Operating status (with sensing object approaching)		E1, F1 models, D1 models and Y1 models: NO		
Protective circuits		E1, F1 models: Protection for reverse polarity, load short circuit, surge voltage		
Ambient temperature		Operating/Storage: -25°C to 70°C (with no icing or condensation)		
Ambient humidity		Operating/Storage: 35% to 95%RH (with no condensation)		
Temperature influence		10% max. of sensing distance at 23°C within temperature range of -25°C to 70°C		
Voltage influence		E1, F1 models: ±2.5% max. of sensing distance within rated voltage range ±15%		
Insulation resistance		50 M min. (at 500 VDC) between energized parts and case		
Dielectric strength		E1, F1, D1 models: 1,000 VAC 50/60 Hz for 1 min between energized parts and case		
Vibration resistance		Destruction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions		
Shock resistance		Destruction: 500 m/s^2 for 10 times each in X, Y, and Z directions	Destruction: 1,000 m/s^2 for 10 times each in X, Y, and Z directions	
Protective structure		IEC60529 IP67		
Connection method		Pre-wired models (standard length: 2 m)		
Weight (Packed state)		Approx. 70 g	Approx. 130 g	Approx. 170 g
Material	Case	Teflon *2		
	Sensing surface			
Accessories		Instruction manual		

*1. The response frequencies for DC switching are average values measured on condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.
*2. Teflon is a registered trademark of Dupont Company and Mitsui Dupont Chemical Company for their fluoride resin.

Output Circuit Diagram

Operating status	Output specifications	Model	Timing chart	Output circuit
NO	PNP	**E2FQ-X□F1**		
	NPN	**E2FQ-X□E1**		 Note: 1. 200 mA max.(load current) 2. When a transistor is connected
	DC 2-wire	**E2FQ-X□D1**		 Note: The load can be connected to either the +V or the 0-V line.
	AC 2-wire Models	**E2FQ-X□Y1**		

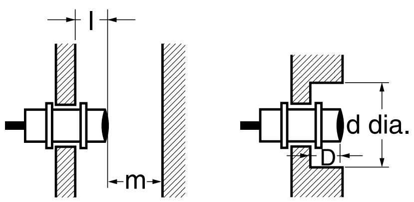
Precautions

Correct Use

Design

Effects of Surrounding Metal

Provide a minimum distance between the Sensor and the surrounding metal as shown in the table below.



Effects of Surrounding Metal (Unit: mm)

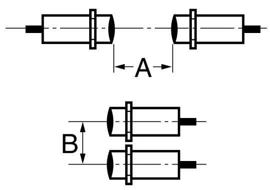
Model \ Item	l	d	D	m	n
E2FQ-X2□	0	12	0	8	18
E2FQ-X5□		18		20	27
E2FQ-X10□		30		40	45

Mutual Interference

If more than one Proximity Sensor is installed face to face or in parallel, ensure that the distances between two Units adjacent to each other are the same as or larger than the corresponding values shown in the following table.

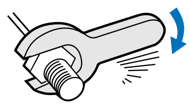
Mutual Interference (Unit: mm)

Model \ Item	A	B
E2FQ-X2□	30	20
E2FQ-X5□	50	35
E2FQ-X10□	100	70



Installation

Do not tighten the nut with excessive force. A washer must be used with the nut.



Note: The table below shows the value of tightening torques when using toothed washers.

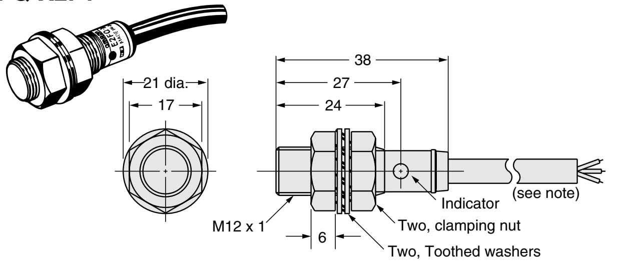
Model \ Torque	Tensile strength (torque)
E2FQ-X2□	0.98 Nm
E2FQ-X5□	2 Nm
E2FQ-X10□	

Others

Chemical resistance

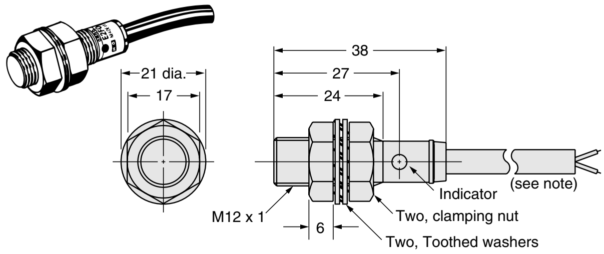
Dimensions (Unit: mm)

E2FQ-X2E1
E2FQ-X2F1



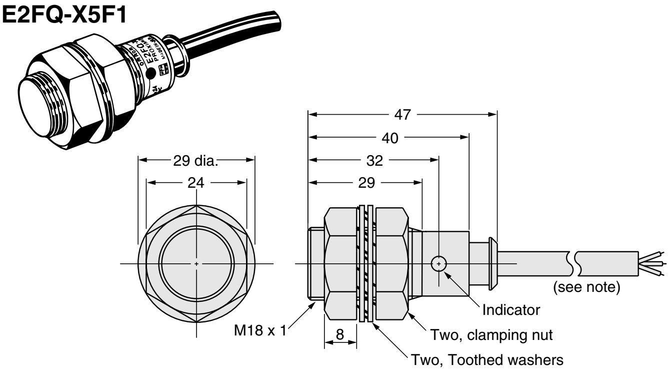
Note:
Oil-resistant, vibration-resistant, and fire-retardant vinyl-insulated round cord, 6 dia. x 3 cores, standard length: 2 m
The cord can be extended in an independent conduit for 200 m maximum.

E2FQ-X2D1



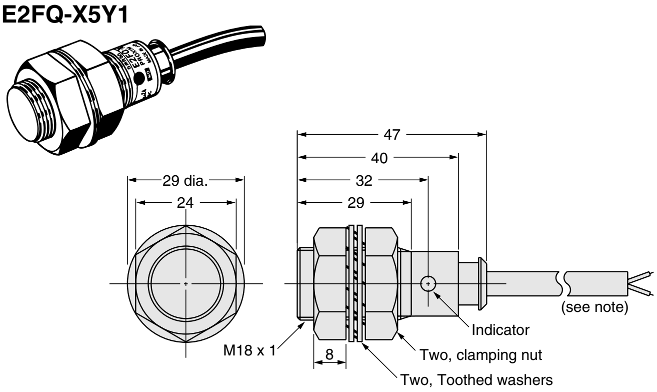
Note:
Oil-resistant, vibration-resistant, and fire-retardant vinyl-insulated round cord, 6 dia. x 2 cores, standard length: 2 m
The cord can be extended in an independent conduit for 200 m maximum.

E2FQ-X5E1
E2FQ-X5F1



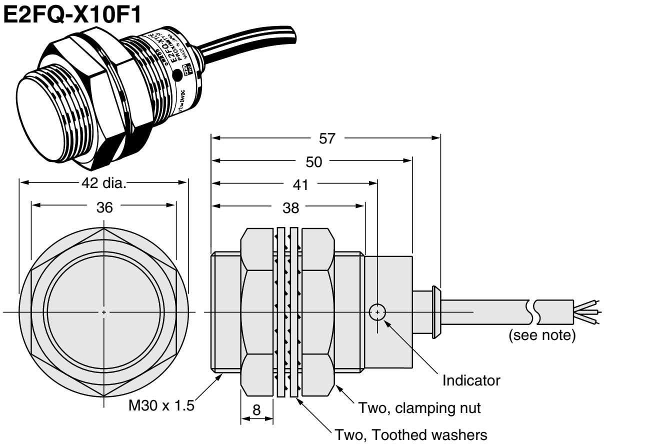
Note:
Oil-resistant, vibration-resistant, and fire-retardant vinyl-insulated round cord, 6 dia. x 3 cores, standard length: 2 m
The cord can be extended in an independent conduit for 200 m maximum.

E2FQ-X5D1
E2FQ-X5Y1



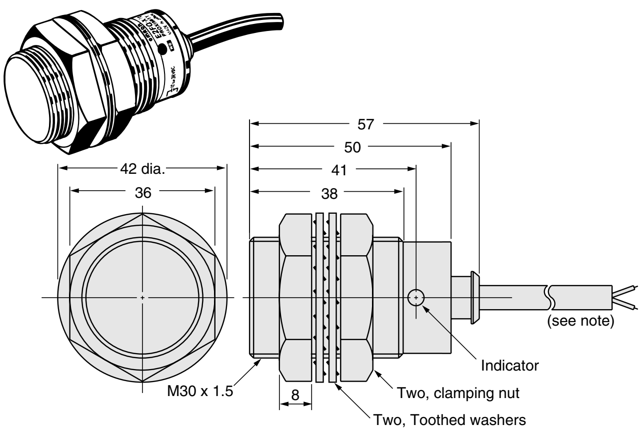
Note:
Oil-resistant, vibration-resistant, and fire-retardant vinyl-insulated round cord, 6 dia. x 2 cores, standard length: 2 m
The cord can be extended in an independent conduit for 200 m maximum.

E2FQ-X10E1
E2FQ-X10F1



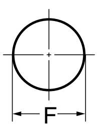
Note:
Oil-resistant, vibration-resistant, and fire-retardant vinyl-insulated round cord, 6 dia. x 3 cores, standard length: 2 m
The cord can be extended in an independent conduit for 200 m maximum.

E2FQ-X10D1
E2FQ-X10Y1



Note:
Oil-resistant, vibration-resistant, and fire-retardant vinyl-insulated round cord, 6 dia. x 2 cores, standard length: 2 m
The cord can be extended in an independent conduit for 200 m maximum.

Mounting Holes



Model	F (mm)
E2FQ-X2□	12.5 mm dia. $^{+0.5}_{0}$
E2FQ-X5□	18.5 mm dia. $^{+0.5}_{0}$
E2FQ-X10□	30.5 mm dia. $^{+0.5}_{0}$

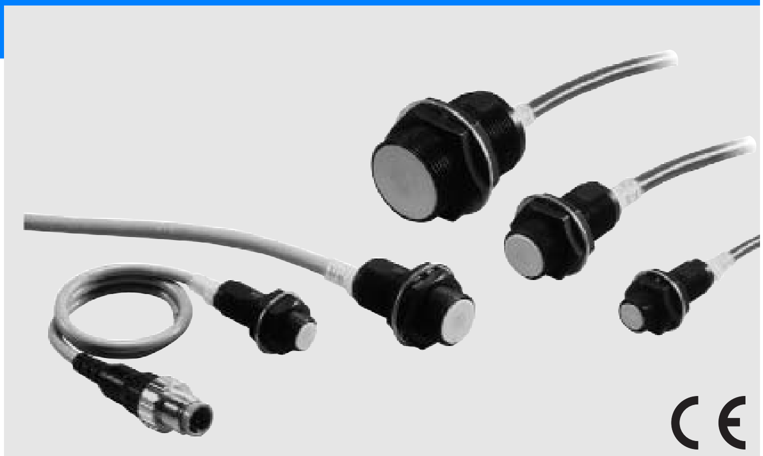
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

Spatter Immune Proximity Sensors

E2EQ

A Series of Spatter-resistant Proximity Sensors with a Teflon-coated Metal Housing



* Teflon is a registered trademark of Dupont Company and Mitsui Dupont Chemical Company for their fluoride resin.

Ordering Information

Sensors

● Pre-wired Models

Extended-distance type

Shape		Sensing distance	Output specifications	Operating status	Model
Shielded	M12	4mm	DC 2-wire	NO	E2EQ-X4X1
	M18	8mm			E2EQ-X8X1
	M30	15mm			E2EQ-X15X1

Standard

Shape		Sensing distance	Output specifications	Operating status	Model
Shielded	M12	3mm	DC 2-wire	NO	E2EQ-X3D1
	M18	7mm			E2EQ-X7D1
	M30	10mm			E2EQ-X10D1

● Plug-in Models

Extended-distance type

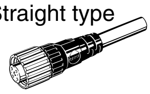
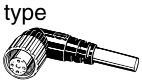
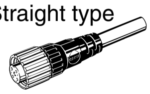
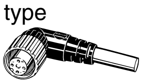
Shape		Sensing distance	Output specifications	Operating status	Model
Shielded	M12	4mm	DC 2-wire models (3) and (4) Pin arrangement	NO	E2EQ-X4X1-M1J
	M18	8mm			E2EQ-X8X1-M1J
	M30	15mm			E2EQ-X15X1-M1J

Standard

Standard		Sensing distance	Output specifications	Operating status	Model
Shielded	M12	3mm	DC 2-wire models (1) and (4) Pin arrangement	NO	E2EQ-X3D1-M1GJ
	M18	7mm			E2EQ-X7D1-M1GJ
	M30	10mm			E2EQ-X10D1-M1GJ

Accessories (Order Separately)

Sensor I/O Connectors

Shape	Cable length	Sensor I/O Connectors	Applicable proximity sensor models
Straight type 	2 m	**XS2F-D421-DCO-A**	E2EQ-X□X1-M1J
	5 m	**XS2F-D421-GCO-A**	
L type 	2 m	**XS2F-D422-DCO-A**	
	5 m	**XS2F-D422-GCO-A**	
Straight type 	2 m	**XS2F-D421-DA0-A**	E2EQ-X□D1-M1GJ
	5 m	**XS2F-D421-GA0-A**	
L type 	2 m	**XS2F-D422-DA0-A**	
	5 m	**XS2F-D422-GA0-A**	

Rating/Performance

Long-distance type

Item / Model		E2EQ-X4X1 E2EQ-X4X1-M1J	E2EQ-X8X1 E2EQ-X8X1-M1J	E2EQ-X15X1 E2EQ-X15X1-M1J
Sensing distance		4 mm ±10%	8 mm ±10%	15 mm ±10%
Setting distance*1		0 to 3.2 mm	0 to 6.4 mm	0 to 12 mm
Differential distance		15% max. of sensing distance		
Standard sensing object (mild steel)		12 x 12 x 1 mm	18 ± 18 ± 1 mm	30 ± 30 ± 1 mm
Response frequency*2		1 kHz	0.5 kHz	0.25 kHz
Control output	Switching capacity	3 to 100 mA		
	Residual voltage*3	5.0 V max. (under load current of 100 mA with cable length of 2 m)		
Operating status (with sensing object approaching)		C1 models: NO		
Protective circuits		Surge absorber, load short-circuit protection		
Ambient temperature		Operating: -25°C to 70°C, Storage: -40°C to 85°C (with no icing or condensation)		
Temperature influence		±15% max. of sensing distance at 23°C within temperature range of -40°C to 85°C ±10% max. of sensing distance at 23°C within temperature range of -25°C to70°C		±15% max. of sensing distance at 23°C within temperature range of -25°C to 70°C
Voltage influence		±1% max. of Sensing distance in rated voltage range ±15%.		
Shock resistance		Destruction: 1,000 m/s^2 for 10 times each in X, Y, and Z directions		
Connection method		Pre-wired (standard length: 2 m) Connector Extension Models		
Weight (Packed state)	Pre-wired	65 g	Approx. 140 g	Approx. 190 g
	Junction connector	Approx. 20 g	Approx. 40g	Approx. 90 g

*1. Use within a range where the green indicator is lit.
*2. The response frequencies for DC switching are average values.
*3. Since residual voltage is 5 V, use it after checking interface requirements with the connection devices.

Standard

Item \ Model		E2EQ-X3D1 E2EQ-X3D1-M1GJ	E2EQ-X7D1 E2EQ-X7D1-M1GJ	E2EQ-X10D1 E2EQ-X10D1-M1GJ
Sensing distance		3 mm ±10%	7 mm ±10%	10 mm ±10%
Setting distance		0 to 2.4 mm	0 to 5.6 mm	0 to 8 mm
Differential distance		10% max.		
Standard sensing object (mild steel)		12 x 12 x 1 mm	18 x 18 x 1 mm	30 x 30 x 1 mm
Response frequency		1 kHz	500 Hz	400 Hz
Control output	Switching capacity	3 to 100 mA		
	Residual voltage	3.0 V max. (under load current of 100 mA with cable length of 2 m)		
Operating status (with sensing object approaching)		NO		
Protective circuits		Surge absorber, short-circuit protection		
Ambient temperature		Operating/Storage: -25°C to 70°C (with no icing or condensation)		
Temperature influence		±10% max. of sensing distance at 23°C within temperature range of -25°C and 70°C		
Voltage influence		±2.5% max. of Sensing distance within rated voltage range ±15%.		
Shock resistance		Destruction: 1,000 m/s^2 for 10 times each in X, Y, and Z directions		
Connection method		E2EQ-X□D1: Pre-wired models (Standard length: 2 m) E2EQ-X□D1-M1GJ type: Connector relay models (Standard length: 300 mm)		
Weight (Packed state)	Pre-wired	Approx. 120 g	Approx. 160 g	Approx. 220 g
	Junction connector	Approx. 80 g	Approx. 110 g	Approx. 190 g

* The response frequencies for DC switching are average values measured on condition that the distance between each sensing object is twice as large as the size of the sensing object and the sensing distance set is half of the maximum sensing distance.

General

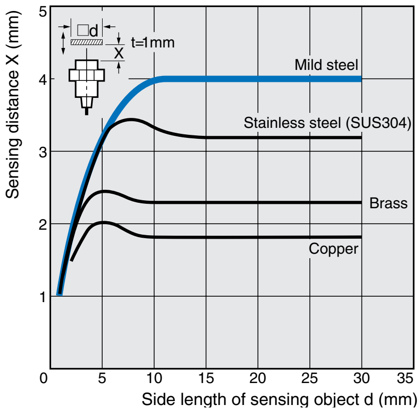
Item \ Model		E2EQ-X4X1 E2EQ-X4X1-M1J E2EQ-X3D1 E2EQ-X3D1-M1GJ	E2EQ-X8X1 E2EQ-X8X1-M1J E2EQ-X7D1 E2EQ-X7D1-M1GJ	E2EQ-X15X1 E2EQ-X15X1-M1J E2EQ-X10D1 E2EQ-X10D1-M1GJ
Sensing object		Ferrous metal (Sensitivity lowers with non-ferrous metals)		
Rated supply voltage (operating voltage)		12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.		
Leakage current		0.8 mA max.		
Indicator lamp		Operation indicator (red), operation setting indicator (green)		
Ambient humidity		Operating/Storage: 35% to 95%RH (with no condensation)		
Insulation resistance		50 M min. (at 500 VDC) between energized parts and case		
Dielectric strength		1,000 VAC for 1 min between energized parts and case		
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions		
Protective structure		IEC60529 IP67		
Material	Case	Teflon resin coating (base: brass) *		
	Sensing surface	Teflon resin *		
Accessories		Instruction manual		

* Teflon is a registered trademark of Dupont Company and Mitsui Dupont Chemical Company for their fluoride resin.

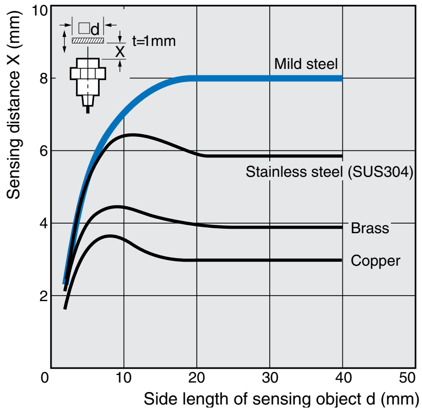
Characteristic data (typical)

Sensing Distance vs. Sensing Object

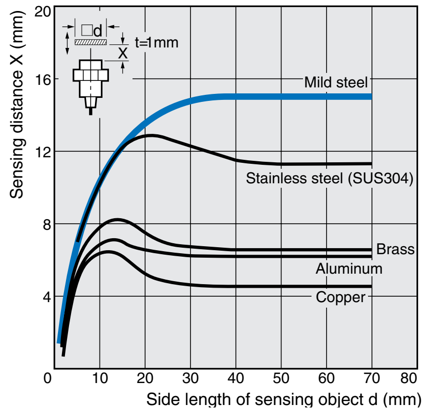
E2EQ-X4X1(-M1J)



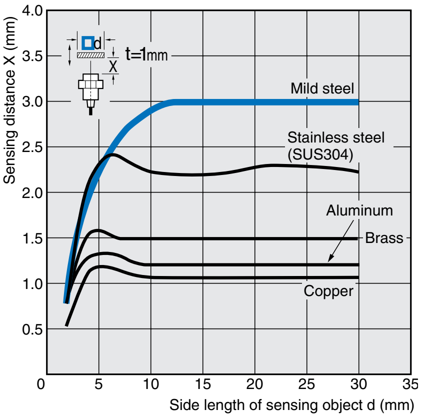
E2EQ-X8X1(-M1J)



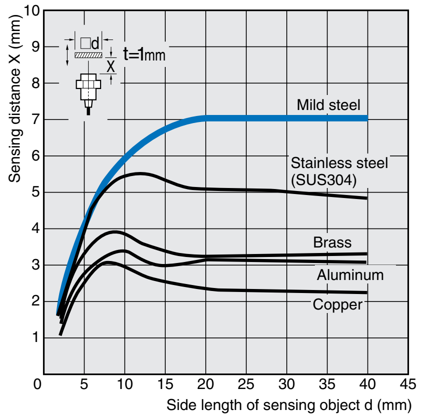
E2EQ-X15X1(-M1J)



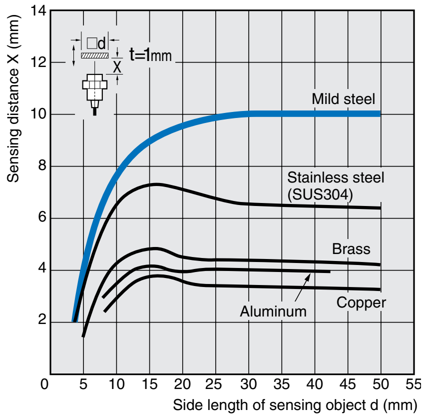
E2EQ-X3D1(-M1GJ)



E2EQ-X7D1(-M1GJ)

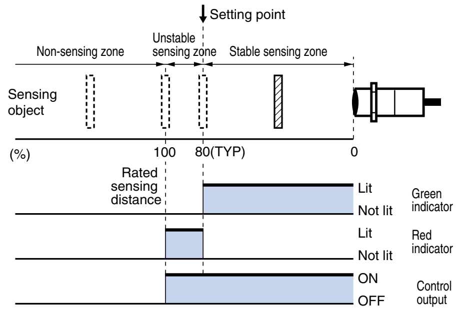
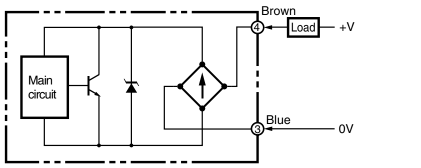
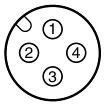


E2EQ-X10D1(-M1GJ)

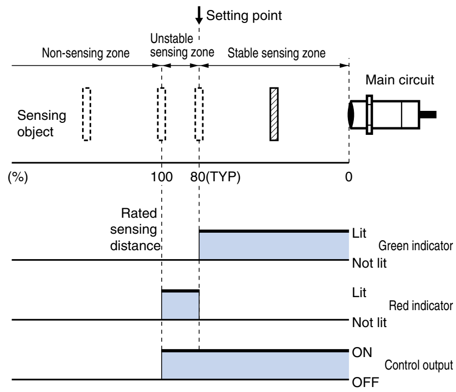
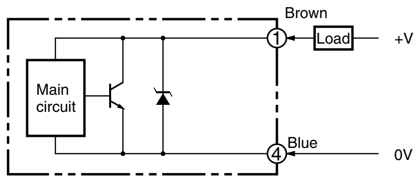
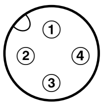


Output Circuit Diagram

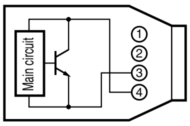
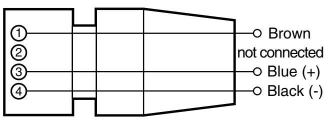
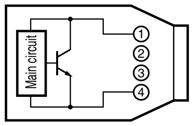
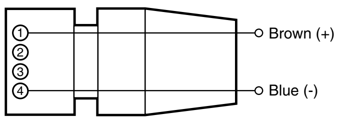
Extended-distance type

Model	Operating status	Timing chart	Output circuit
E2EQ-X4X1 **E2EQ-X8X1** **E2EQ-X15X1** **E2EQ-X4X1-M1J** **E2EQ-X8X1-M1J** **E2EQ-X15X1-M1J**	**NO**		 Note: 1. The load can be connected to either the +V or the 0-V line. 2. Since there is no polarity, there is no need to pay attention to the brown or blue polarity. Wiring  Note: Terminals ② and ③ are not used.

Standard

Model	Operating status	Timing chart	Output circuit
E2EQ-X3D1 **E2EQ-X7D1** **E2EQ-X10D1** **E2EQ-X3D1-M1GJ** **E2EQ-X7D1-M1GJ** **E2EQ-X10D1-M1GJ**	**NO**		 Note: The Load can be connected to either the +V or the 0-V line. Wiring  Note: Terminals ② and ③ are not used.

Connecting Plug-in models

Model	E2EQ-X□X1-M1J		E2EQ-X□D1-M1GJ	
Connection	Connector relay type E2EQ-X□X1-M1J 	Sensor I/O Connectors XS2F-D42□-□C0-A 	Connector relay type E2EQ-X□D1-M1GJ 	Sensor I/O Connectors XS2F-D42□-□A0-A 

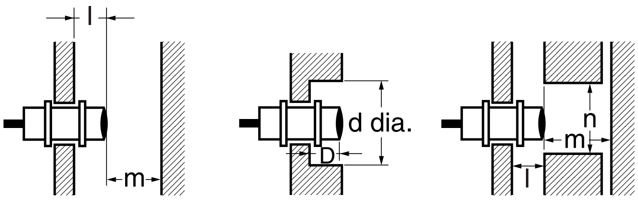
Precautions

Correct Use

Design

Effects of Surrounding Metal

Provide a minimum distance between the Sensor and the surrounding metal as shown in the table below.

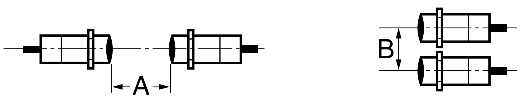


Effects of Surrounding Metal (Unit: mm)

Model / Item	l	d	D	m	n
E2EQ-X4X1(-M1J)	2.4	18	2.4	12	18
E2EQ-X8X1(-M1J)	3.6	27	3.6	24	27
E2EQ-X15X1(-M1J)	6	45	6	45	45
E2EQ-X3D11(-M1GJ)	0	12	0	8	18
E2EQ-X7D1(-M1GJ)		18		20	27
E2EQ-X10D1(-M1GJ)		30		40	45

Mutual Interference

If more than one Proximity Sensor is installed face to face or in parallel, make sure that the distances between two Units adjacent to each other are the same as or larger than the corresponding values shown in the following table.

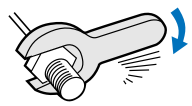


Mutual Interference(Unit: mm)

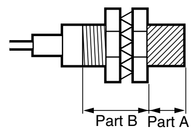
Model / Item	A	B
E2EQ-X4X1(-M1J)	30	20
E2EQ-X8X1(-M1J)	60	35
E2EQ-X15X1(-M1J)	110	90
E2EQ-X3D1(-M1GJ)	30	20
E2EQ-X7D1(-M1GJ)	50	35
E2EQ-X10D1(-M1GJ)	100	70

Mounting

Do not tighten the nut with excessive force. A washer must be used with the nut.



Shielded Model



Note: 1. The table below shows the tightening torques for part A and part B nuts. In the previous examples, the nut is on the sensor head side (part B) and hence the tightening torque for part B applies. If this nut is in part A, the tightening torque for part A applies instead.

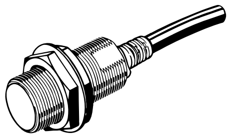
2. The table below shows the value of tightening torques when using toothed washers.

Model / Torque	Part A: Length (mm)	Part A: Torque	Part B: Torque
E2EQ-X4X1(-M1J)	---	30 Nm	
E2EQ-X8X1(-M1J)		70 Nm	
E2EQ-X15A(-M1J)		180 Nm	
E2EQ-X3D1(-M1GJ)	24	15 Nm	---
E2EQ-X7D1(-M1GJ)	29		
E2EQ-X10D1(-M1GJ)	26	39 Nm	78 Nm

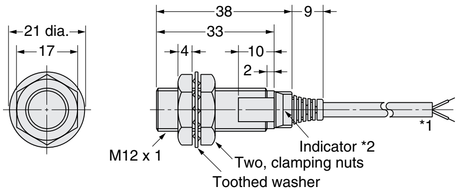
Dimensions (Unit: mm)

● Pre-wired Models

Extended-distance type

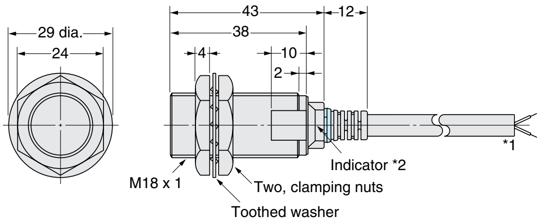


E2EQ-X4X1



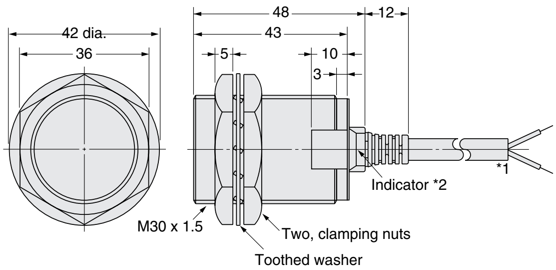
*1: Vinyl-insulated round cable (flame-resistant), 4 dia.
2/3 conductors (conducting cross-sectional area: 0.3 mm²/insulator diameter: 1.3 mm
Standard length: 2m
Cable extension (through a single metal conduit): 200m max.
*2: Operation indicator (red) and setting indicator (green).

E2EQ-X8X1



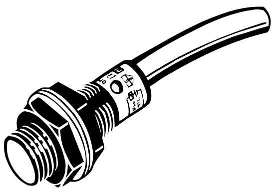
*1: Vinyl-insulated round cable (flame-resistant), 6 dia.
2/3 conductors (conducting cross-sectional area: 0.5 mm²/insulator diameter: 1.9 mm
Standard length: 2m
Cable extension (through a single metal conduit): 200m max.
*2: Operation indicator (red) and setting indicator (green).

E2EQ-X15X1

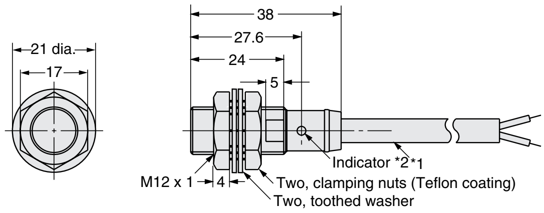


*1: Vinyl-insulated round cable (flame-resistant), 6 dia.
2/3 conductors (conducting cross-sectional area: 0.5 mm²/insulator diameter: 1.9 mm
Standard length: 2m
Cable extension (through a single metal conduit): 200m max.
*2: Operation indicator (red) and setting indicator (green).

Standard

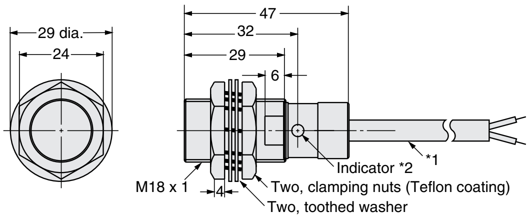


E2EQ-X3D1



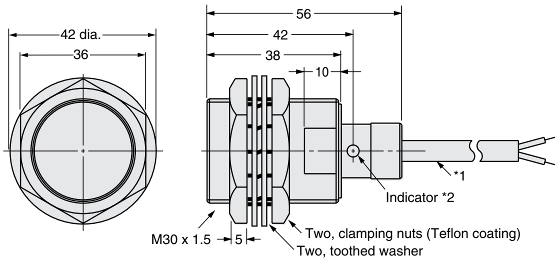
*1: Vinyl-insulated round cable (flame-resistant), 6 dia., 2 conductors (conducting cross-sectional area: 0.5 mm²/insulator diameter: 1.9 mm
Standard length: 2m
Cable extension (through a single metal conduit): 200m max.
*2: Operation indicator (red) and setting indicator (green).

E2EQ-X7D1



*1: Vinyl-insulated round cable (flame-resistant), 6 dia., 2 conductors (conducting cross-sectional area: 0.5 mm²/insulator diameter: 1.9 mm
Standard length: 2m
Cable extension (through a single metal conduit): 200m max.
*2: Operation indicator (red) and setting indicator (green).

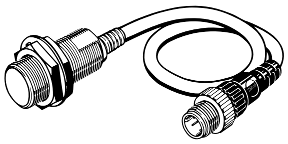
E2EQ-X10D1



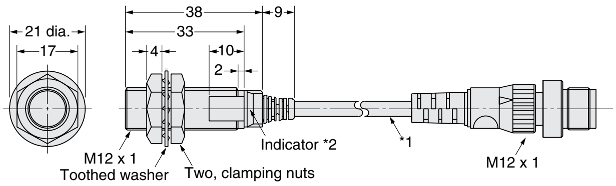
*1: Vinyl-insulated round cable (flame-resistant), 6 dia., 2 conductors (conducting cross-sectional area: 0.5 mm²/insulator diameter: 1.9 mm
Standard length: 2m
Cable extension (through a single metal conduit): 200m max.
*2: Operation indicator (red) and setting indicator (green).

● Plug-in Models

Extended-distance type

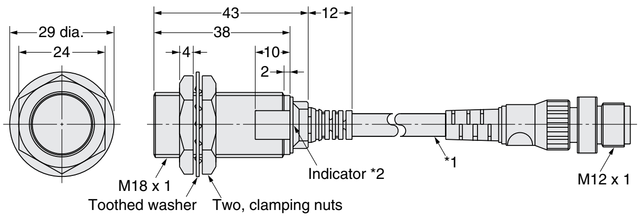


E2EQ-X4X1-M1J



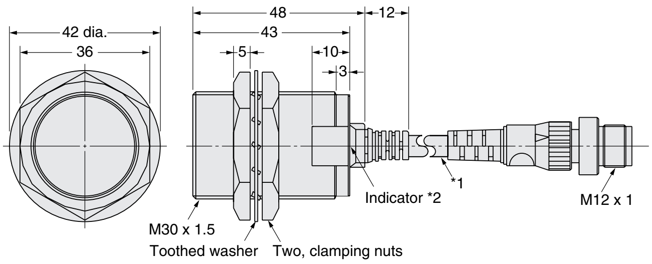
*1: Vinyl-insulated round cable (flame-resistant), 4 dia. (Conducting cross-sectional area: 0.3 mm²; insulator diameter: 1.3 mm)
Standard length: 300 mm
*2: Operation indicator (red) and setting indicator (green).

E2EQ-X8X1-M1J



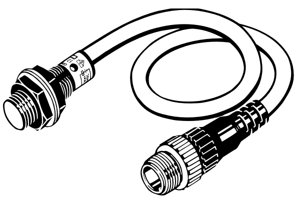
*1: Vinyl-insulated round cable (flame-resistant), 5 dia. (Conducting cross-sectional area: 0.5 mm²; insulator diameter: 1.9 mm)
Standard length: 300 mm
*2: Operation indicator (red) and setting indicator (green).

E2EQ-X15X1-M1J

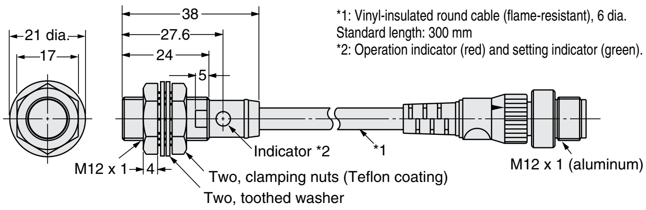


*1: Vinyl-insulated round cable (flame-resistant), 5 dia. (Conducting cross-sectional area: 0.5 mm²; insulator diameter: 1.9 mm)
Standard length: 300 mm
*2: Operation indicator (red) and setting indicator (green).

Standard

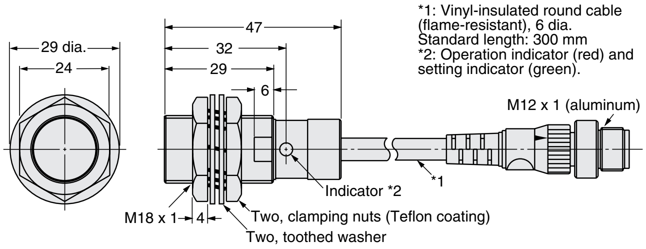


E2EQ-X3D1-M1GJ



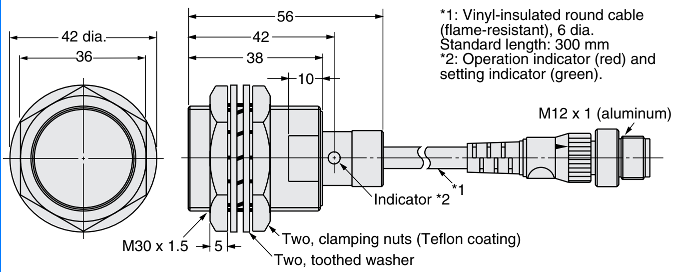
*1: Vinyl-insulated round cable (flame-resistant), 6 dia.
Standard length: 300 mm
*2: Operation indicator (red) and setting indicator (green).

E2EQ-X7D1-M1GJ



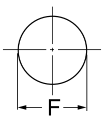
*1: Vinyl-insulated round cable (flame-resistant), 6 dia.
Standard length: 300 mm
*2: Operation indicator (red) and setting indicator (green).

E2EQ-X10D1-M1GJ



*1: Vinyl-insulated round cable (flame-resistant), 6 dia.
Standard length: 300 mm
*2: Operation indicator (red) and setting indicator (green).

Mounting Holes



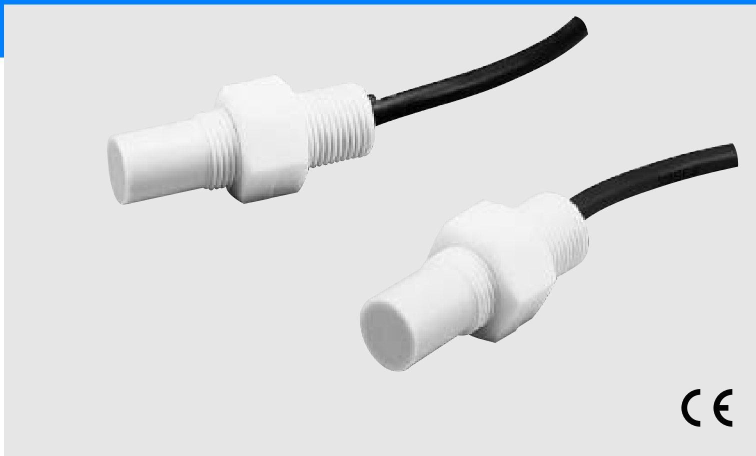
Outer diameter	M12	M18	M30
F (mm)	12.5 dia$^{+0.5}$	18.5 dia.$^{+0.5}$	30.5 dia.$^{+0.5}$

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D055-E2-03-X In the interest of product improvement, specifications are subject to change without notice.

Inductive Proximity Sensor

E2KQ-X



Proximity Sensor with Easy Sensing Distance Adjustment and Teflon* Coating Effective Oil and Chemical Resistance

- Oil and chemical-resistant Teflon case.
- Sensitivity adjuster ensures easy sensing distance adjustment according to the sensing object.
- Incorporates a cord connector with an indicator providing high visibility.

* Teflon is a registered trademark of Dupont Company and Mitsui Dupont Chemical Company for their fluoride resin.

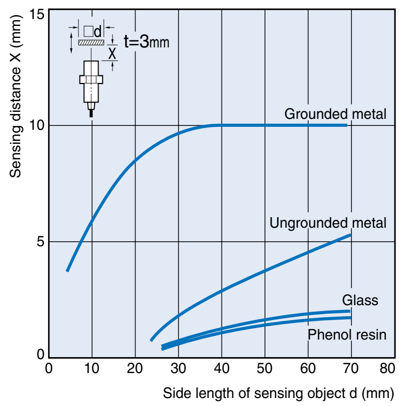
Ordering Information

Shape		Sensing distance	Output	Operating status	Model
Unshielded	M18	6 to 10 mm	DC 3-wire NPN	**NO** *	**E2KQ-X10ME1**

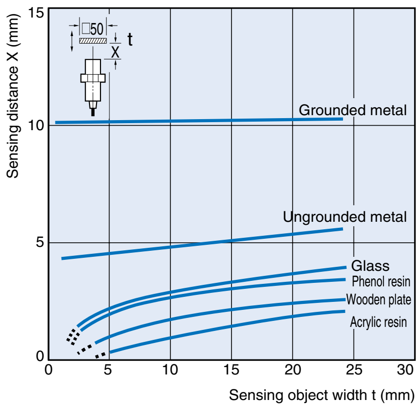
* NC models available (E2KQ-X10ME2)

Characteristic data (typical)

Sensing Distance vs. Sensing Object



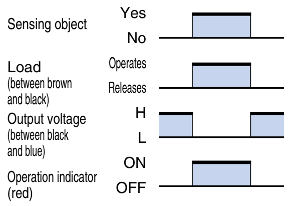
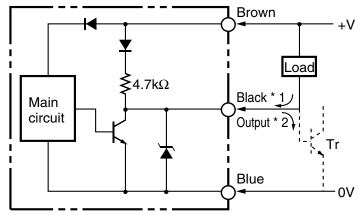
Sensing Object Thickness and Material vs. Sensing Distance



E2KQ-X

Output Circuit Diagram

DC 3-wire Models

Operating status	Model	Timing chart	Output circuit
NO	**E2KQ-X10ME1**		 * 1. 100 mA max. (load current) * 2. When a transistor is connected

Rating/Performance

Item	Model	E2KQ-X
Sensing distance *		10 mm
Sensing distance adjustable range		6 to 10 mm
Differential distance		4% to 20% of sensing distance
Sensing object		Conductors and dielectrics
Standard sensing object		with grounded metal: 50 x 50 x 1t mm
Response frequency		35 Hz
Rated supply voltage (operating voltage)		12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.
Current consumption		15 mA max.
Control output	Switching capacity	100 mA
	Residual voltage	1.5 V max. (under load current of 100 mA with cable length of 2 m)
Indicator lamp		Detection indicator (red LED)
Operating status (with sensing object approaching)		Refer to previous pages for details of operating chart of output circuits.
Protective circuits		Reverse connection protection, surge absorber
Ambient temperature		Operating: -10°C to 55°C, Storage: -25°C to 55°C (with no icing or condensation)
Ambient humidity		Operating/Storage: 35% to 85%RH (with no condensation)
Temperature influence		±15% max. of sensing distance at 23°C in the temperature range of -10°C and 55°C
Voltage influence		2% max. sensing distance within a range of 80% to 120% of the rated supply voltage.
Insulation resistance		50 M min. (at 500 VDC) between energized parts and case
Dielectric strength		500 VAC 50/60 Hz for 1 min between energized part and case
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions
Shock resistance		Destruction: 500 m/s² for 3 times each in X, Y, and Z directions
Protective structure		IEC IP66
Connection method		Pre-wired models (standard length: 2 m)
Weight (Packed state)		Approx. 150 g
Material	Case, Sensing surface	Fluororesin
	Clamping nut	
Accessories		Instruction sheet and screwdriver for adjustment

* This sensing distance is possible with a standard sensing object. Refer to Engineering Data for sensing distances of other materials.

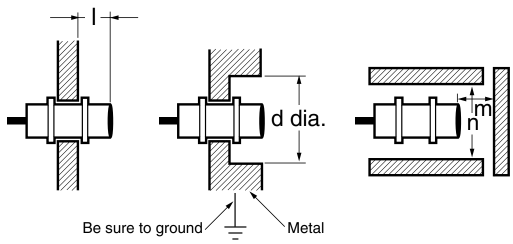
Precautions

Correct Use

Design

Effects of Surrounding Metals

If E2K-X is embedded in metal, maintain at least the following distances between E2K-X and the metal.



* Ensure to ground the metal object, otherwise E2KQ-X will not be in stable operation.

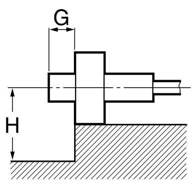
Effects of Surrounding Metal **(Unit: mm)**

Model / Length	l	d	m	n
E2KQ-X10ME1	30	75	18	90

If a mounting bracket is used, be sure that at least the following distances are maintained.

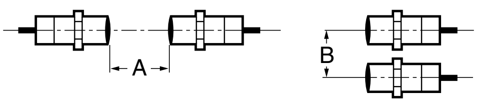
Effects of Surrounding Metal **(Unit: mm)**

Model / Length	G	H
E2KQ-X10ME1	30	35



Mutual Interference

If more than one Sensor is located face to face or in parallel, provide sufficient space between adjacent Sensors to suppress mutual interference as indicated in the following diagram.



Mutual Interference **(Unit: mm)**

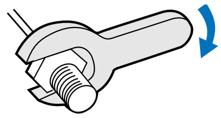
Model / Length	A	B
E2KQ-X10ME1	200	32

Effect of High-frequency Electro-magnetic Field

E2KQ-X may malfunction if there is an ultrasonic washer, high-frequency generator, transceiver, or inverter nearby. For a typical measure refer to the "Noise" with Common precautions of a photoelectric sensor in Rear B-page.

Installation

The tightening torque must not exceed the following value.



Model	Tensile strength (torque)
E2KQ-X10ME1	0.6 Nm

● Adjustment

Sensing object

The maximum sensing distance will decrease if the sensing object is a metal or dielectric object that is not grounded.

- Sensing Object Material E2K-C can detect almost any type of object. The sensing distance of E2K-C, however, will vary with the electrical characteristics of the object, such as the conductance and inductance of the object, and the water content and capacity of the object. The maximum sensing distance of E2K-C will be available if the object is made of grounded metal.
- Ensure a constant ambient operating temperature during the indirect detection of objects.

Miscellaneous

Ambient Conditions

Ensure that the E2K-X is free from sprayed water, oil, chemical, or condensation, otherwise E2K-X may malfunction by detecting them as sensing objects.

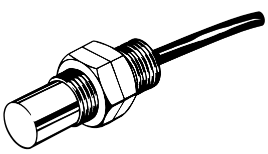
Environment

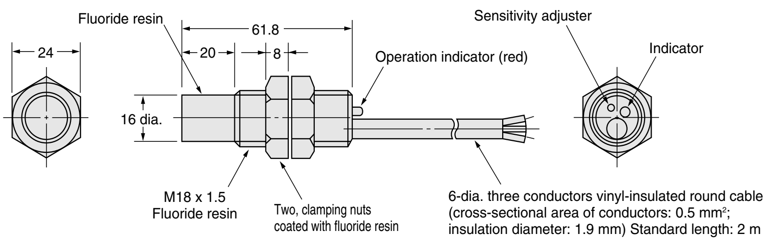
E2KQ-X has a water-resistant design. To increase the reliability of E2KQ-X in operation, however, it is recommended that E2KQ-X is free from sprayed water or machining oil.

The cord is not coated with Teflon, which must be taken into consideration when installing the E2KQ-X.

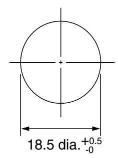
Dimensions (Unit: mm)

E2KQ-X10ME1





Mounting Dimensions



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Long-distance Capacitive Proximity Sensor

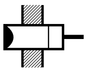
E2K-C

Capacitive Proximity Sensor with Adjustable Sensitivity

- Detects both metallic and non-metallic objects (glass, lumber, water, oil, plastic, etc.) without direct contact.
- DC models acquire CE marking

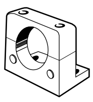
Ordering Information

Sensors

Shape	Sensing distance	Model		
		Output specifications	Operating status	
			NO	NC
Unshielded  34 dia.	3 to 25mm	DC 3-wire NPN DC 3-wire PNP	**E2K-C25ME1** **E2-KC25MF1**	**E2K-C25ME2** **E2K-C25MF2**

Accessories (Order Separately)

Mounting Brackets

Shape	Model	Quantity	Remarks
	**Y92E-A34**	1	Supplied with the product.

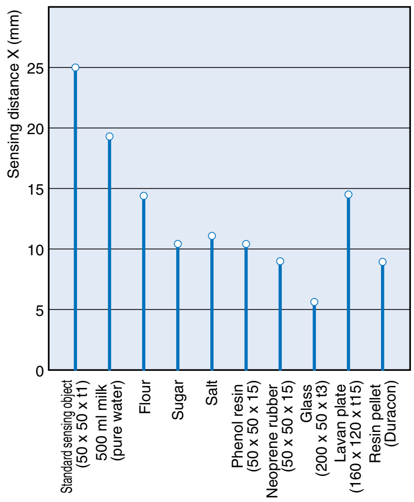
Rating/Performance

Item	Model	E2K-C25M□1	E2K-C25M□2
Sensing distance *		25 mm	
Sensing distance adjustable range		3 to 25 mm	
Sensing object		Conductors and dielectrics	
Standard sensing object		with grounded metal: 50 x 50 x 1t mm	
Differential distance		15% max. of sensing distance (when adjusted to 25 mm ±10% with standard object)	
Response frequency		70 Hz	
Power supply(Operating voltage range)		12 to 24 VDC, ripple (p-p): 10% max.,(10 to 40 VDC)	
Current consumption		E models: 10 mA max. at 12 VDC, 16 mA max. at 24 VDC	
Leakage current		Y models: 1 mA max. at 100 VAC (50/60 Hz) with output turned OFF., 2 mA max. at 200 VAC (50/60 Hz) with output turned OFF.	
Control output	Switching capacity	200 mA max.	
	Residual voltage	2 V max. (under load current of 200 mA with cable length of 2 m)	
Indicator lamp		Detection indicator (red LED)	
Operating status (with sensing object approaching)		E1, Y1 models: NO E2, Y2 models: NC	
Protective circuits		Reverse connection protection, surge absorber	
Ambient temperature		Operating/Storage: -25°C to 70°C (with no icing or condensation)	
Ambient humidity		Operating/Storage: 35% to 95%RH (with no condensation)	
Temperature influence		±15%max. of sensing distance at 23° within temperature range -10°C to 55°C	
Voltage influence		±2% max. of sensing distance at a voltage between 85% and 115% of the rated power supply voltage	
Insulation resistance		50 M min. (at 500 VDC) between current carry parts and case	
Dielectric strength		1000 VAC 50/60 Hz for 1 min between energized part and case	
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions	
Shock resistance		Destruction: 500 m/s^2 for 10 times each in X, Y, and Z directions	
Protective structure		IEC 60529 IP66	
Connection method		Pre-wired models (standard length: 2 m)	
Weight (Packed state)		Approx. 200 g	
Material	Case	Heat-resistant ABS resin	
	Sensing surface		
Accessories		Mounting bracket, instruction manual	

* The set distances are sensing distances applicable to standard sensing objects. Refer to Engineering Data for sensing distances applicable to other types of objects.

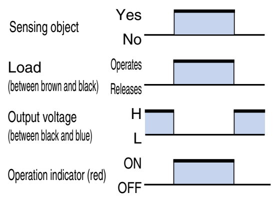
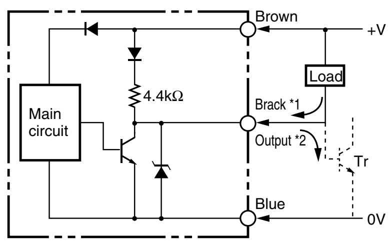
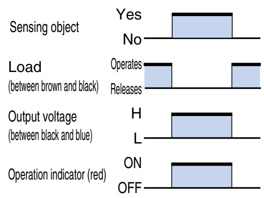
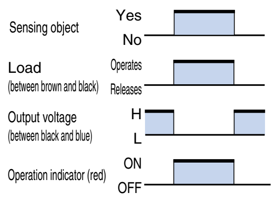
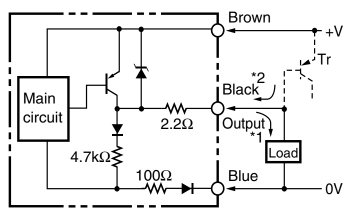
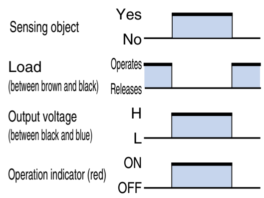
Characteristic data (typical)

Sensing Distance Change by Sensing Object (Typical)



Output Circuit Diagram

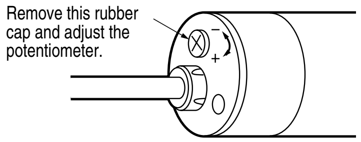
DC 3-wire Models

Operating status	Model	Timing chart	Output circuit
NO	E2K-C25ME1		 * 1. 200 mA max. (load current) * 2. When a transistor is connected
NC	E2K-C25ME2		
NO	E2K-C25MF1		 * 1. Maximum load current: 200 mA * 2. Current flows in this direction if the circuit incorporates the transistor.
NC	E2K-C25MF2		

Operation

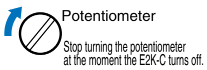
Sensitivity adjustment

Remove the rear rubber cap of the E2K-C and turn the potentiometer in the hole to adjust the sensitivity of the E2K-C.

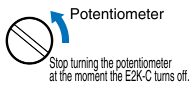


The sensing distance increases by turning the potentiometer clockwise and decreases by turning the potentiometer counterclockwise. The potentiometer can make 15±3 valid turns and then make slip turns because the potentiometer does not have a stopper. The slip turns will not, however, damage the potentiometer.

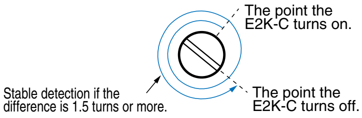
1. Slowly turn the potentiometer clockwise until the E2K-C turns on with no sensing object.



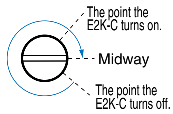
2. Turn the potentiometer counterclockwise until the E2K-C turns off with the sensing object located within the sensing distance.



3. The E2K-C will be in stable operation if there is a difference of 1.5 turns or more between the points the E2K-C is turned on and off, otherwise the E2K-C will not be in stable operation.



4. Set the potentiometer midway between the two points.



5. If the distance of each sensing object varies, take step 2 with the sensing object located at the farthest sensing distance to be applied.

Precautions

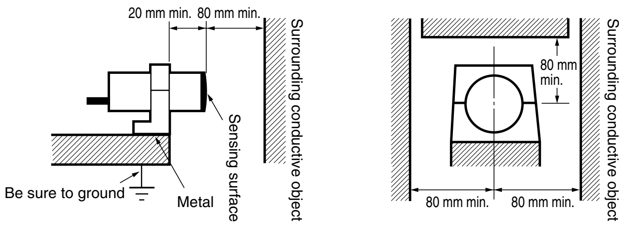
Correct Use

Design

Effects of Surrounding Metal

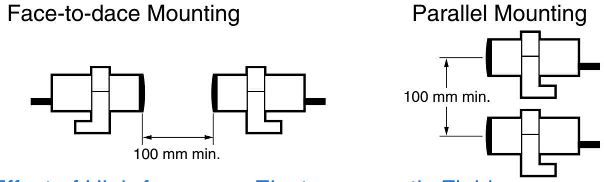
During Proximity Sensor installation provide a distance of 80 mm min. from the surrounding metal objects to prevent the Sensor from being affected by metal objects other than the sensing object.

If installing the Sensor with the L-shaped mounting bracket, provide a distance of 20 mm min. between the face of the sensing head and the mounting bracket.



Mutual Interference

Space the two Sensors at a distance exceeding 100 mm to prevent mutual interference.



Effect of High-frequency Electro-magnetic Field

The E2K-C may malfunction if there is an ultrasonic washer, high-frequency generator, transceiver, or inverter nearby.

Sensing Object

- Sensing Object Material. The E2K-C can detect almost any type of object. The sensing distance of the E2K-C, however, will vary with the electrical characteristics of the object, such as the conductance and inductance of the object, and the water content and capacity of the object. The maximum sensing distance of E2K-C will be available if the object is made of grounded metal.
- Indirect Detection. In the case of the detection of objects in metal containers, each metal container must have a non-metallic window.

Miscellaneous

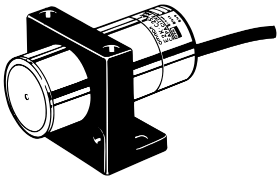
Organic Solvents

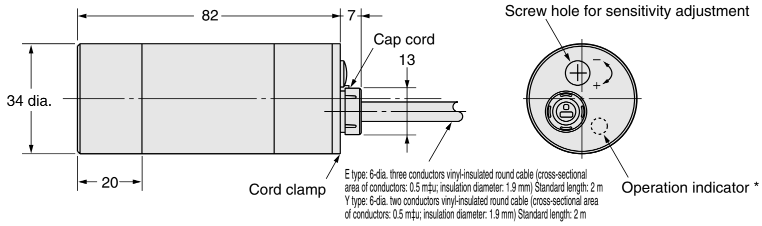
E2K-C has a case made of heat-resistant ABS resin. Be sure that the case is free from organic solvents or solutions containing organic solvents.

Dimensions (Unit: mm)

Sensors

E2K-C25M□□

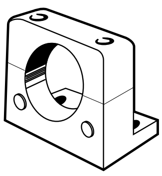


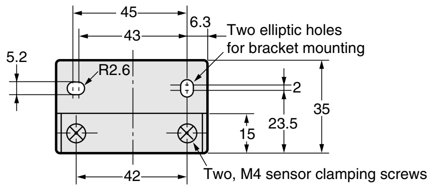


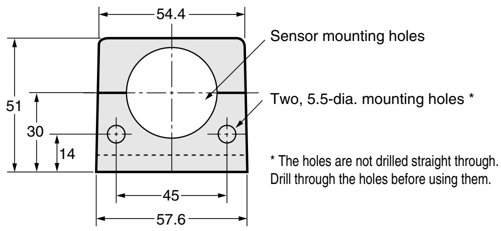
* E models: Detection indicator (red); Y models: Operation indicator (red)

Accessories (Order Separately)*

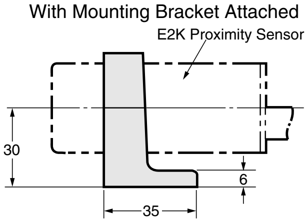
L-shaped Mounting Bracket Y92E-A34







With Mounting Bracket Attached



* Attached to the product.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

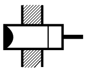
Cat. No. D016-E2-04-X In the interest of product improvement, specifications are subject to change without notice.

Flat Type Capacitive Proximity Sensor

E2K-F

Low-profiled Capacitive Proximity Sensor providing Flexible Installation

Ordering Information

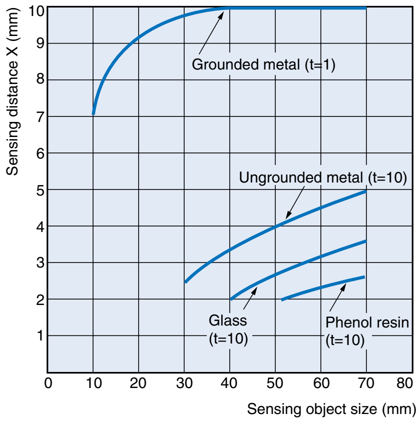
Shape	Sensing distance	Output specifications	Operating status	Model
Flat type Unshielded 	10 mm	DC 3-wire NPN	NO	**E2K-F10MC1**
			NC	**E2K-F10MC2**
	4 to 10 mm		NO	**E2K-F10MC1-A**
			NC	**E2K-F10MC2-A**

Rating/Performance

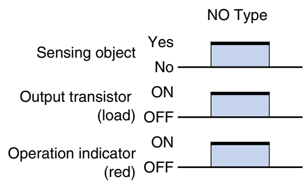
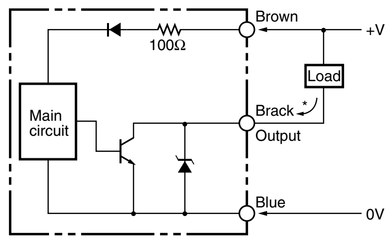
Item	E2K-F10MC1 E2K-F10MC2	E2K-F10MC1-A E2K-F10MC2-A
Sensing distance	10 mm ±10%	4 to 10 mm ±10%
Setting distance	0 to 7.5 mm	
Differential distance	15% max. sensing distance	
Sensing object	Conductors and dielectrics	
Standard sensing object	with grounded metal: 50 x 50 x 1 mm	
Response frequency	100 Hz	
Rated supply voltage (operating voltage)	12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max.	
Current consumption	10 mA max. (24VDC)	
Control output: Switching capacity	NPN open collector 100 mA max. (under 30 VDC)	
Control output: Residual voltage	1.5 V max. (under load current of 100 mA with cable length of 2 m)	
Indicator lamp	Detection indicator (red LED)	
Operating status (with sensing object approaching)	NO	
Protective circuits	Reverse connection protection, surge absorber	
Ambient temperature	Operating/Storage: -10°C to 55°C (with no icing or condensation)	
Ambient humidity	Operating/Storage: 35% to 95%RH	
Temperature influence	±15% max. of sensing distance at 23°C within the temperature range of -10°C and 55°C	
Voltage influence	±2.5% max. of sensing distance within a range of ±10% of rated supply voltage	
Insulation resistance	50 M min. (at 500 VDC) between energized parts and case	
Dielectric strength	500 VAC 50/60 Hz for 1 min between energized part and case	
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5 mm double amplitude for 2 hours each in X, Y, and Z directions	
Shock resistance	Destruction: 500 m/s^2 for 3 times each in X, Y, and Z directions	
Protective structure	IEC 60529 IP66	IEC 60529 IP64
Connection method	Pre-wired models (standard length: 2 m)	
Weight (Packed state)	Approx. 35 g	
Material: Case	Heat-resistant ABS resin	
Material: Sensing surface		
Accessories	Instruction manual	

Characteristic data (typical)

Sensing Distance vs. Sensing Object



Output Circuit Diagram

Operating Chart	
Output circuit	 * 100 mA max. (load current)

Precautions

Correct Use

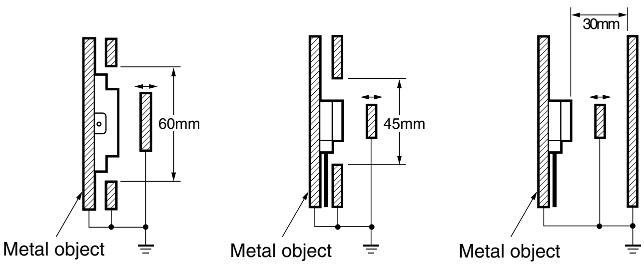
Design

Sensing Object Material

E2K-F can detect almost any type of object. The sensing distance of E2K-F, however, will vary with the electrical characteristics of the object, such as the conductance and inductance of the object, as well as the water content and capacity of the object. The maximum sensing distance of E2K-F will be available if the object is made of grounded metal. There are objects that cannot be detected indirectly. Therefore test E2K-F in a trial operation with the objects before using E2K-F in actual applications.

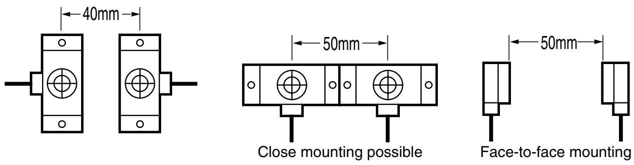
Effects of Surrounding Metal

Separate E2K-F from ambient metals as shown below.



Mutual Interference

If installing more than one E2K-F face to face or side by side, separate them as shown below.



Effect of High-frequency Electro-magnetic Field

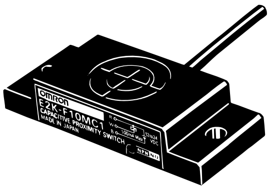
E2K-F may malfunction if an ultrasonic washer, high-frequency generator, transceiver, or inverter are nearby.
For a typical measure, refer to the "Noise" with Common precautions of a photoelectric sensor in Rear B-page.

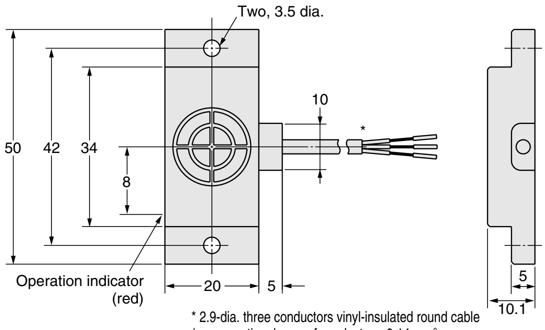
Wiring Considerations

The characteristics of E2K-F will not change if the cord is extended. Keep in mind that voltage drops may occur due to the cord extension, thus, ensure that the total cord length does not exceed 200 m.

Dimensions (Unit: mm)

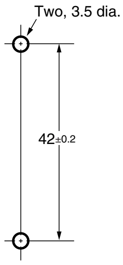
E2K-F





* 2.9-dia. three conductors vinyl-insulated round cable (cross-sectional area of conductors: 0.14 mm^2; insulation diameter: 0.9 mm)
Standard length: 2 m

Mounting Holes



E2K-F

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D018-E2-02A-X

Rotary Encoders

Incremental Rotary Encoder OD 25 dia.

E6A2-C

Compact with an External Diameter of 25 mm

- Meets positioning requirements. It is a lineup type with a starting point output (phase Z).
- Ensures maximum measurement precision.
- An additional series of models with 25 dia. ensuring a resolution of 500 P/R.
- ● Shock resistance strengthened by metal disk. (600 P/R max.) Patent

Ordering Information

Sensors

Output phase	Power supply voltage	Output form	Resolution (pulse/rotation)	Model
A	5 to 12 VDC	NPN voltage output	10, 60, 100, 200, 300, 360	**E6A2-CS3E**
			500	
		NPN open collector	10, 60, 100, 200, 300, 360	**E6A2-CS3C**
			500	
	12 to 24VDC		10, 60, 100, 200, 300, 360	**E6A2-CS5C**
			500	
A, B	5 to 12 VDC	NPN voltage output	100, 200, 360	**E6A2-CW3E**
			500	
		NPN open collector	100, 200, 360	**E6A2-CW3C**
			500	
	12 to 24VDC		100, 200, 360	**E6A2-CW5C**
			500	
A, B, Z	5 to 12 VDC	NPN voltage output	100, 200, 360	**E6A2-CWZ3E**
			500	
		NPN open collector	100, 200, 360	**E6A2-CWZ3C**
			500	
	12 to 24VDC		100, 200, 360	**E6A2-CWZ5C**
			500	

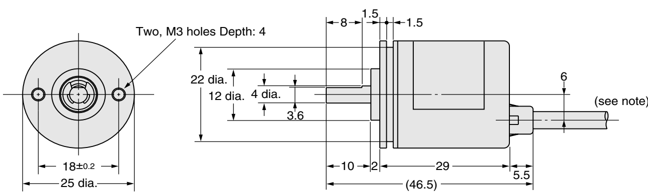
Note: For order placement add the resolution (pulses per revolution) between the part number. For example, E6A2-CS3E 60 P/R.

Accessories (Order Separately)

Item	Model	Remarks
Coupling	**E69-C04B**	Supplied with the product.
Servo Mounting Bracket	**E69-1**	Provided with the E6A2-CWZ□

Dimensions (Unit: mm)

E6A2



Note:
Vinyl-insulated round cable of 4 dia. 5 cores conductor cross-sectional area: 0.15mm²; insulation diameter: 0.9mm Standard length: 500mm

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. Q018-E2-03-X

Incremental Rotary Encoder OD 40 dia.

E6B2-C

General-Purpose Incremental Rotary Encoder With Large Shaft 40 dia.

- A wide operating voltage range from 5 to 24 VDC (open collector model).
- High resolution models (2000 pulses per revolution) substantially improve measuring accuracy
- Easy-to-adjust zero index (phase Z) with origin indicating function
- A large load of 30 N in the radial direction and 20 N in the thrust direction are permitted.
- The load short-circuit and reversed connection protecting circuit assure high operation reliability.
- Available with Line Driver output (100 m max. extension available)
- Shock resistance strengthened by metal disk. (600 P/R max.) (Patent)

Ordering Information

Sensors

Power supply voltage	Output form	Resolution (pulse/rotation)	Model
5 to 24 VDC	NPN open collector output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500 1,800, 2,000	**E6B2-CWZ6C**
12 to 24VDC	PNP open collector output	100, 200, 360, 500, 600, 1,000, 2,000	**E6B2-CWZ5B**
5 to 12 VDC	NPN voltage output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 1,000, 1,200, 1,500 1,800, 2,000	**E6B2-CWZ3E**
5 VDC	Line driver output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 1,000, 1,024, 1,200, 1,500 1,800, 2,000	**E6B2-CWZ1X**

Note: When ordering, add the resolution (pulses per revolution) between the part number. For example, E6B2-CWZ6C 100 P/R.

Accessories (Order Separately)

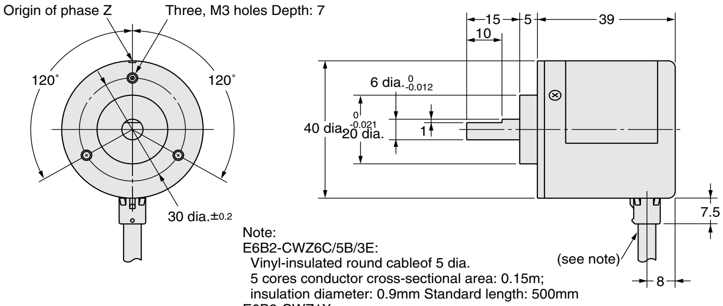
Item	Model	Remarks
Coupling	**E69-C06B**	Attachment
	E69-C68B	Different end diameter
	E69-C610B	Different end diameter
	E69-C06M	Metal construction
Flanges	**E69-FBA**	---
	E69-FBA02	E69-2 Mounting Bracket included
Mounting Bracket	**E69-2**	---

E6B2-C

Dimensions (Unit: mm)

Sensors

E6B2



Note:
E6B2-CWZ6C/5B/3E:
Vinyl-insulated round cableof 5 dia.
5 cores conductor cross-sectional area: 0.15m;
insulation diameter: 0.9mm Standard length: 500mm
E6B2-CWZ1X:
Vinyl-insulated round cable of 5 dia. 8 cores conductor
cross-sectional area: 0.2mm²; insulation diameter: 1.0mm Standard length: 500mm

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. Q085-E2-03-X In the interest of product improvement, specifications are subject to change without notice.

Incremental Rotary Encoder OD 50 dia. (thin)

E6C2-C/E6C3-C

Tough & Easy

- Drip-proof, oil-proof construction meets IP64F standards
- Shaft withstanding heavy loads, 80 N radially, 50 N thrust (axially)
- Protective Circuit Output Shorting
- Space-saving, A-slant cable protrusion for easy installation
- Shock resistance strengthened by metal disk.
  E6C2-C: 600P/R max.
  E6C3-C□H: 500P/R max.

Ordering Information

Sensors

	Power supply voltage	Output form	Resolution (pulse/rotation)	Model
Standard models	5 to 24 VDC	NPN open collector output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	**E6C2-CWZ6C**
			720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	
	12 to 24VDC	PNP open collector output	100, 200, 360, 500, 600	**E6C2-CWZ5B**
			1,000, 2,000	
	5 to 12 VDC	NPN voltage output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	**E6C2-CWZ3E**
			720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	
	5 VDC	Line driver output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	**E6C2-CWZ1X**
			720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	
8 dia. tough model	12 to 24VDC	Complimentary output	100, 200	**E6C3-CWZ5GH**
			300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600	
	5 to 12 VDC	NPN voltage output	100, 200	**E6C3-CWZ3EH**
			300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600	
	5 to 12 VDC	Line driver output	100, 200	**E6C3-CWZ3XH**
			300, 360, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000, 2,048, 2,500, 3,600	

Note: For order placement add the resolution (pulses per revolution) between the part number. For example, E6C2-CWZ6C 100P/R.

Accessories (Order Separately)

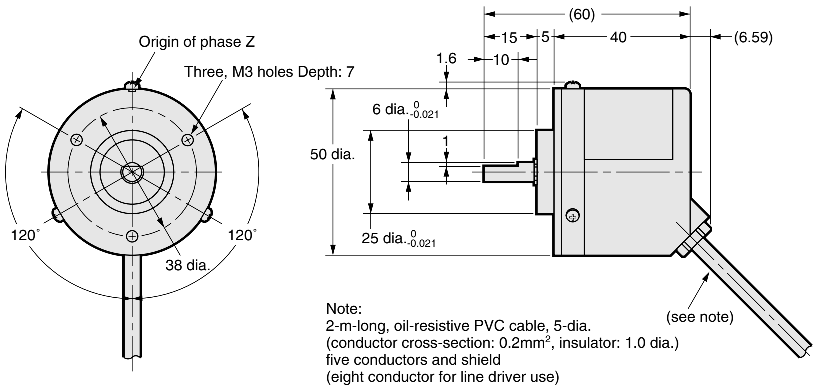
Item	Model	Applicable Rotary Encoders	Remarks
Coupling	**E69-C06B**	E6C2-CWZ□	---
	E69-C68B	E6C3-CWZ□/□H	Diameter of ends: 6 to 8 dia.
	E69-C06M	E6C2-CWZ□	Metal construction
	E69-C08B	E6C3-CWZ□H	---
Flanges	**E69-FCA**	E6C2-CWZ□	
	E69-FCA02		
	E69-FCA03	E6C3-CWZ□H	
	E69-FCA04		
Mounting Bracket	**E69-2**	---	Provided with the E69-FCA02 and E69-FCA04 Flange.

Dimensions (Unit: mm)

Sensors

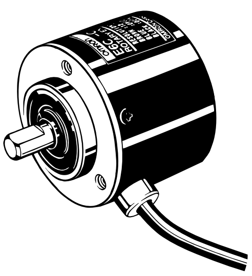
Standard

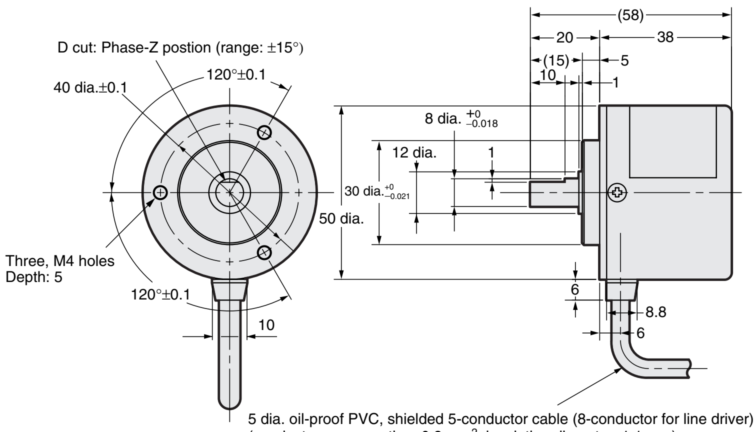
E6C2-CWZ□□



Solid 8 dia. Shaft Model

E6C3-CWZ□□H





ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

 In the interest of product improvement, specifications are subject to change without notice.

Incremental Rotary Encoder 60 mm dia.

E6F-C

The Strongest Shaft for Tough Jobs

- The strongest shaft of any OMRON Incremental Encoder (120 N in radial direction and 50 N in thrust direction).
- Water- and oil-proof structure (IP65f)
- Output short-circuit protection circuit to reduce risks from incorrect wiring.
- Complementary output model can be used with extension cable
- Shock resistance strengthened by metal disk. (600 P/R max.) Patent

Ordering Information

Sensors

Supply voltage	Output form	Resolution (pulse/rotation)	Model
12 to 24VDC	Complimentary output	100, 200, 360, 500, 600	**E6F-CWZ5G**
		1000	

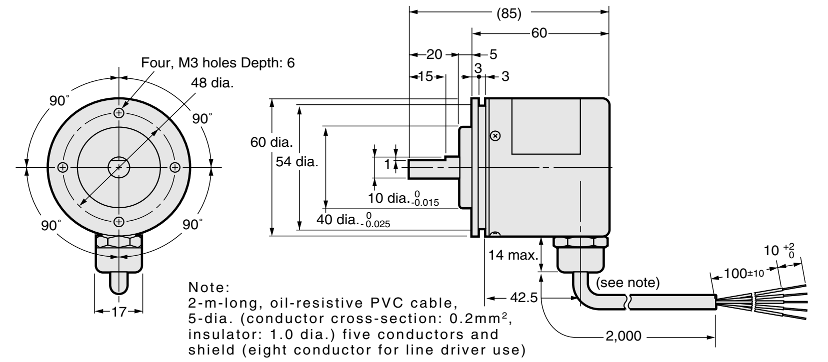
Accessories (Order Separately)

Item	Model	Remarks
Coupling	**E69-C10B**	---
	E69-C610B	Different end diameter
	E69-C10M	Metal construction
Mounting Bracket	**E69-2**	Three brackets in a set; included with the Encoder.

Dimensions (Unit: mm)

Sensors

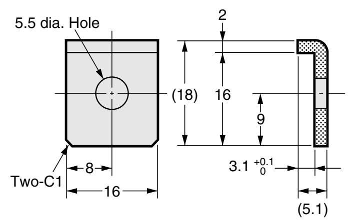
E6F-CWZ5G



Accessories (Order Separately)

Servo Mounting Bracket

E69-2



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E284-E2-02-X

Absolute Rotary Encoder

E6C3-A

An Encoder That Offers Durability and Convenience

- IP65f drip-proof, oil-proof construction achieved with seal bearing.
- 8-mm-dia stainless steel shaft withstands a shaft loading of 80 N and 50 N respectively in the radial and thrust directions.
- Absolute Rotary Encoders have a metal slit plate to ensure high resistance to shock.
- Combining Absolute Rotary Encoders with a Programmable Controller or Cam Positioner allows ideal angle control.
- Bears CE markings (EMC Directives) and conforms to EN/IEC standards, making it suitable for the European market.

Ordering Information

Sensors

Supply voltage	Output form	Output code	Resolution (pulse/rotation)	Connection method	Model
12 to 24VDC	NPN open collector output	Gray code	256	Connector type	**E6C3-AG5C-C**
			256, 360, 720, 1,024	Pre-wired type	**E6C3-AG5C**
		Binary	32, 40		**E6C3-AN5C**
		BCD	6, 8, 12		**E6C3-AB5C**
	PNP open collector output	Gray code	256, 360, 720, 1,024		**E6C3-AG5B**
		Binary	32, 40		**E6C3-AN5B**
		BCD	6, 8, 12		**E6C3-AB5B**
5 VDC	NPN voltage output	Binary	256		**E6C3-AN1E**
12 VDC					**E6C3-AN2E**

Note: 1 . When ordering, specify the resolution in addition to the model numbers. (Example: E6C3-AG5C 360P/R 1M)
2 . Models with 2-m cables are also available as standard products. Specify the cable length at the end of the model number. (Example: E6C3-AG5C 360P/R 2M)
3 . When connecting to the H8PS, be sure to use the E6C3-AG5C-C 256P/R.

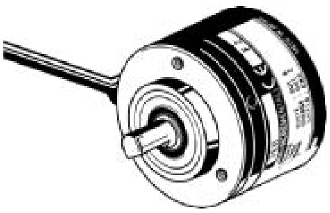
Accessories (Order Separately)

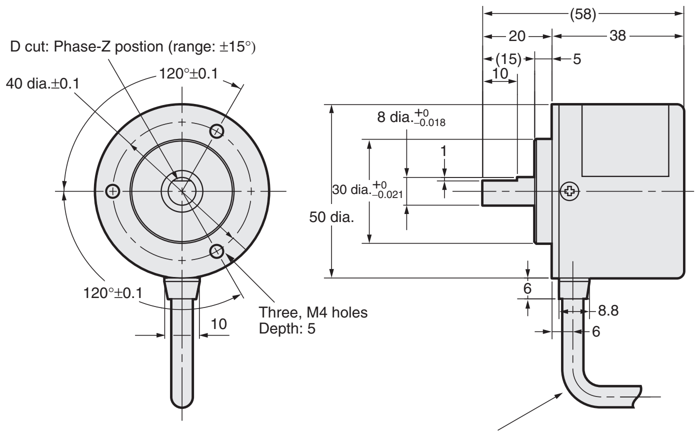
Item	Model	Remarks	
Coupling	**E69-C08B**	---	
	E69-C68B	Diameters of ends: 6 to 8 dia.	
Flange	**E69-FCA03**	---	
	E69-FCA04	E69-2 Servo Mounting Bracket provided.	
Servo Mounting Bracket	**E69-2**	Provided with the E69-FCA04 Flange.	
Extension Cable	**E69-DF5**	5 m	Applicable for the E6C3-AG5C-C. 15- and 98-m-long Extension Cables are also available.
	E69-DF10	10 m	
	E69-DF20	30 m	

Dimensions (Unit: mm)

Sensors

E6C3-A□5□
E6C3-AN□E

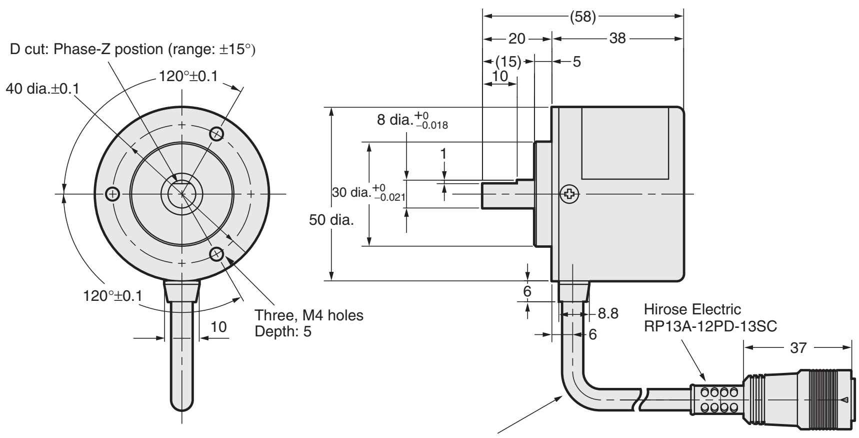




6 dia. oil-proof PVC, shielded 12-conductor cable
(conductor cross-section: 0.2 mm^2; insulation diameter: 1.1 mm)
Standard length: 1 m

Note: E69-C08B is sold separately.

E6C3-AG5C-C



6-dia. oil-proof PVC, shielded 12-conductor cable
(conductor cross-section: 0.2 mm^2; insulation diameter: 1.1 mm)
Standard length: 1 m

Note: E69-C08B is sold separately.

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To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Absolute Rotary Encoder

E6F-A

Rugged construction providing high-precision timing detection for automatic machines operation

- Stronger shaft and higher durability (120 N in radial direction and 50 N in thrust direction) than previous E6F Encoders.
- Drip-proof construction meets IP64F standards
- High resolution models (1024 pulses max. per revolution)
- Faster response for high-speed control applications (grey code: 20 kHz).
- Shock resistance strengthened by metal disk. Patent

Ordering Information

Sensors

Supply voltage	Output form	Output code	Resolution (pulses/revolution)	Connection method	Model
12 to 24 VDC	NPN open collector	BCD	360	Pre-wired	**E6F-AB5C**
12 to 24 VDC	NPN open collector	BCD	360	Connector type	**E6F-AB5C-C**
12 to 24 VDC	PNP open collector	BCD	360	Pre-wired	**E6F-AB5B**
12 to 24 VDC	PNP open collector	Gray code	256, 360, 720, 1,024	Pre-wired	**E6F-AG5B**

Note: 1 . For order placement add the resolution (pulses per revolution) between the part number. For example, E6F-AG5B 256 P/R.
2 . E6F-AB5C-C applied for rotary positioner connection.

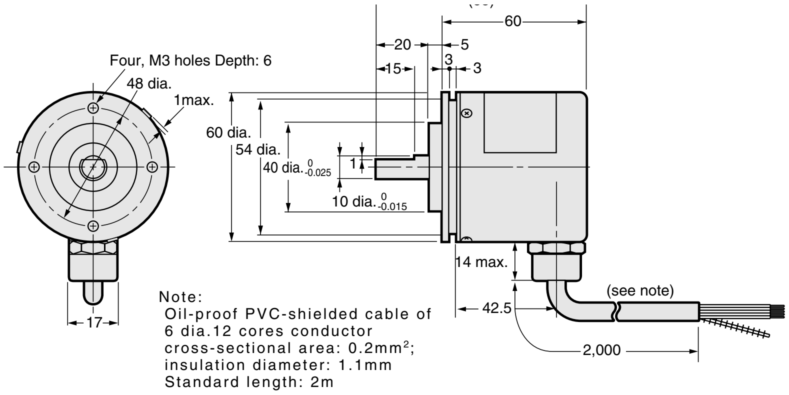
Accessories (Order Separately)

Item	Model	Remarks
Coupling	**E69-C10B**	Supplied with pre-wired models
Coupling	**E69-C610B**	Different end diameter
Coupling	**E69-C10M**	Metal construction
Mounting Bracket	**E69-2**	Supplied with the product (set of 3)
Extension Cable	**E69-DF5**	Standard stock models: 5 m, 10 m. In addition to this 15 m, 20 m and 98 m are available.

Dimensions (Unit: mm)

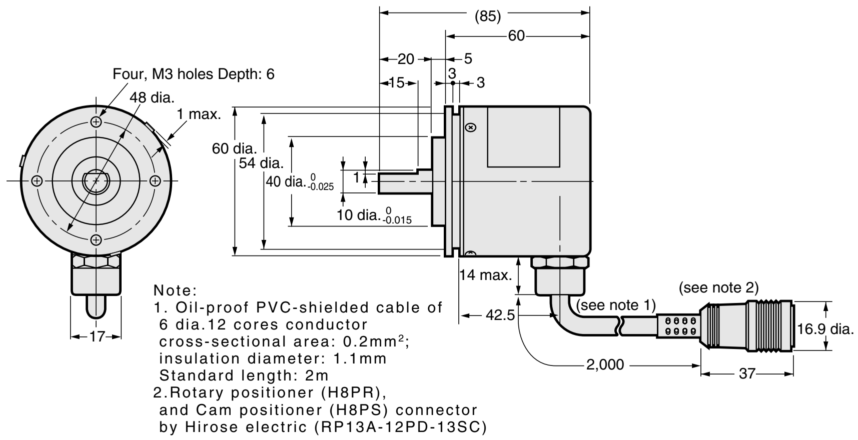
Sensors

E6F-AB5C
E6F-AG5B
E6F-AB5B



E69-C10B is attached.

E6F-AB5C-C



E69-C10B is sold separately.

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To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

Pressure Sensors

Safety Sensors / Components

Safety Light Curtain / Multi-Beam Safety Sensor

F3SN-A/F3SH-A

- Type 4 sensor complying with IEC and EN standards (IEC61496-1, -2, EN61496-1). Complies with EU machine directives (certified by BG/DEMKO).
- Detection height = Sensor length meets the user's requirements
- Detection height 189 to 1822 mm. Sensing distance 7 and 10 m.
- Various functions can be set by means of setting console.
- Equipped with a LED bar for easy adjustment of the optical axis and quick detection of failures.

Features

Select the optimum safety sensor for the application. Omron provides two safety types, the "Safety Light Curtain" and the "Multi-Beam Safety Sensor".

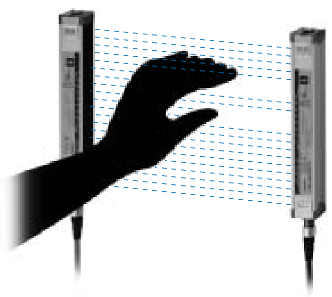
Finger protection

Safety light curtain

F3SN-A□□□□P14(H)

Sensing distance : 7 m

- Minimum detectable object: 14 mm dia. (9 mm optical axis pitch)
- Detection height: 189 to 1611 mm



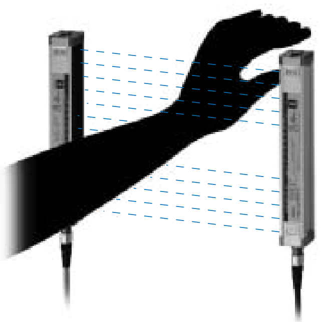
Hand protection

Safety light curtain

F3SN-A□□□□P25

Sensing distance : 10 m

- Minimum detectable object: 25 mm dia. (15 mm optical axis pitch)
- Detection height: 217 to 1822 mm



For presence inspection with a horizontal installation, types with minimum detectable object sizes of 40 mm (optical axis pitch: 30 mm) and 70 mm (optical axis pitch: 60 mm) can also be manufactured. (Please contact your OMRON Representative.)

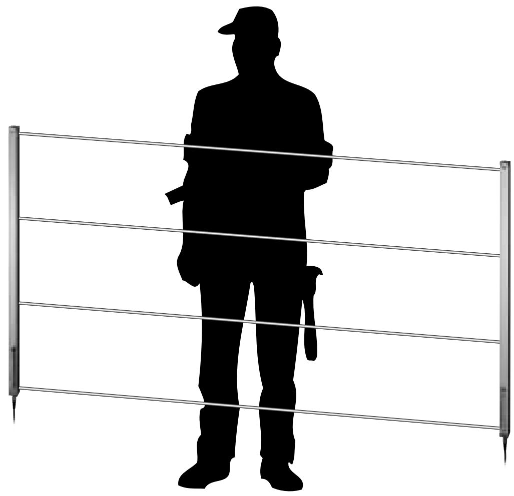
Body protection

Multi-beam safety curtain

F3SH-A09P03

Sensing distance : 10 m

- Number of optical axes: 4 beams (300 mm optical axis pitch)

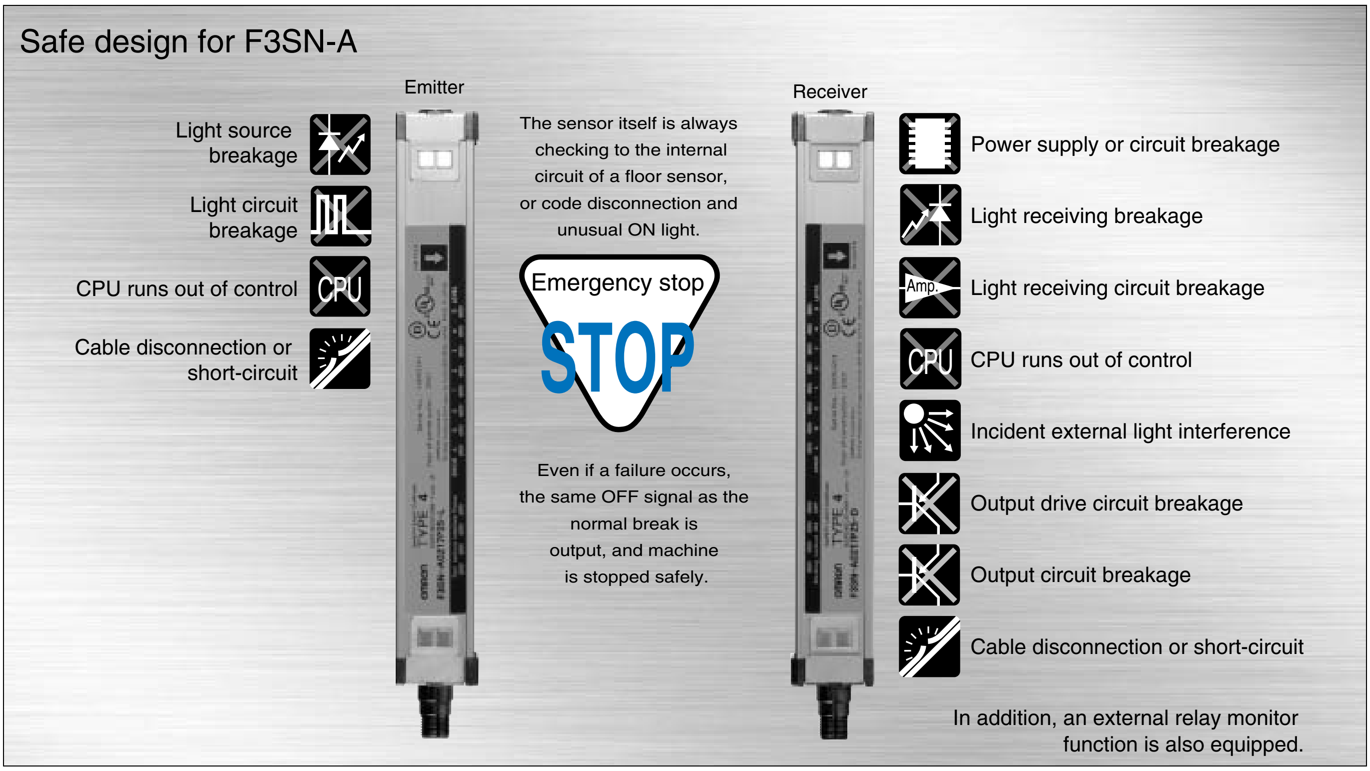


F3SN-A/F3SH-A

Features

A superior standard of safety design prevents machine accidents.

Wide-range implementation of fail-safe design. **Self-failure diagnosis triggers output shut off.**

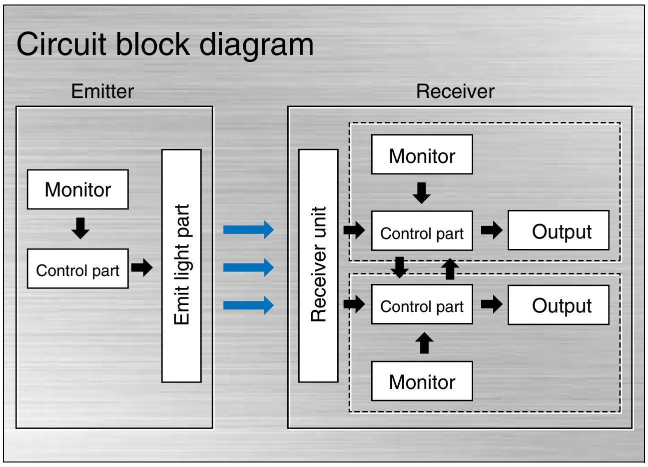


Technology-supported safety design

Safety is top priority based on the maximum standards of safety design and FMEA analysis.

Fail-safe design based on dual CPUs for mutual checking and duplex signal processing and output circuits. Relentless pursuit of safety based FMEA analysis * to prove safe operation.

* FMEA: Failure Mode and Effects Analysis



Meets global safety standards for safety sensors.

Type 4 sensors complying with IEC and EN standards

Complies with international standards IEC61496-1 and IEC61496-2, and EN standard EN61496-1, which are state-of-the-art "musts" for safety sensors.

Complies with EU directives

Certification of compliance with EC testing and EMC directives received from DEMKO and BG.

Received UL certification for models for the U.S. and Canada.

(Can be used in machines subject to OSHA rules and ANSI standards.)

Received UL listing and UL listing for Canadian safety standards based on UL508 and IEC61496-1/2. Can be used in machines subject to OSHA directives (29 CFR 1910.212), which are directives related to labor safety in the U.S. Meets also the requirements of ANSI/RIA R15.06-1999, a U.S. standard for industrial robots.

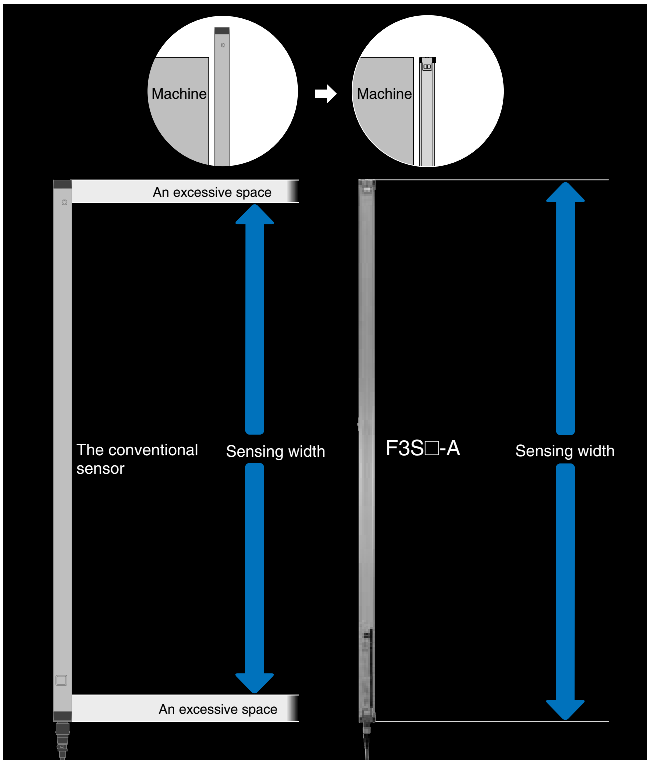
UL CE IEC61496-1 IEC61496-2 Type 4

Features

We provide the perfect size for use in hazardous areas.

A new concept that perfectly fits the needs of the user.

The detection height equals to the sensor length. Excess space has been minimized.

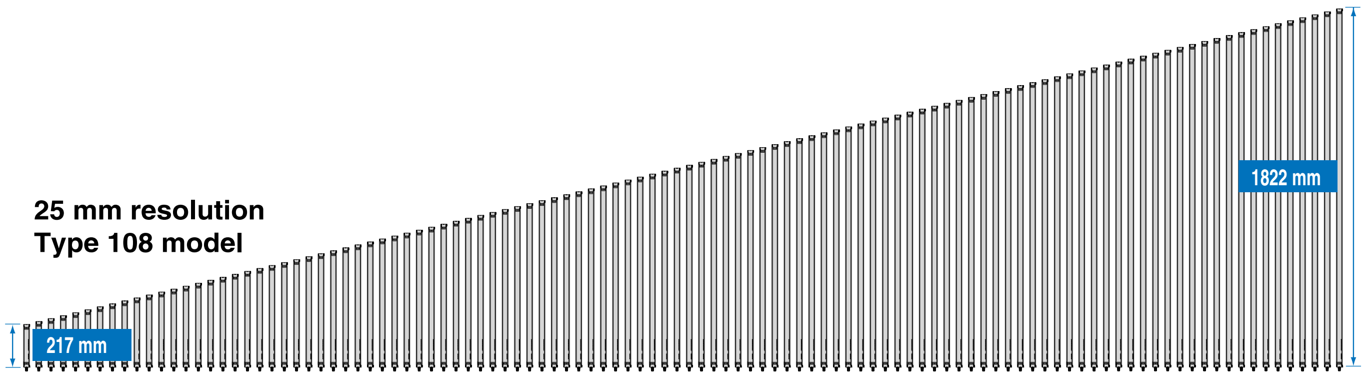


Up to 3 sets can be connected in series. Mutual interference can be prevented.

A standard type and a link-up type with a connector can be combined to connect up to 3 sets in series.

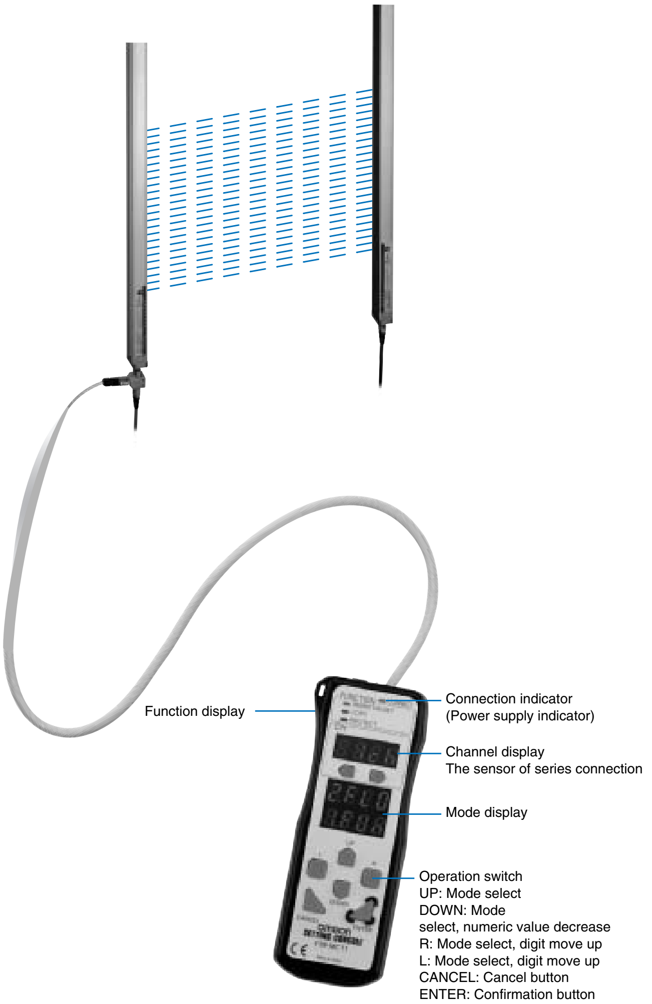
Note: When you order for a series connection type, please place an order with model-code F3SN-A□□□□P□□ -01.

Select the optimum length



Features

The setting console--the first in the industry--allows you an easy and safe setting of various functions.



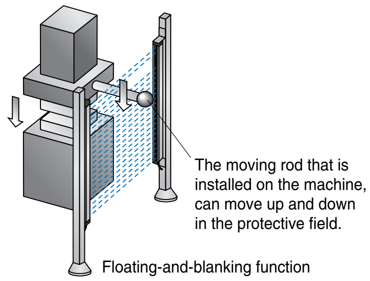
Includes two types of blanking functions

Blanking function for changing the detection pattern of the safety light curtain.

Basic pattern 1: Floating blanking function

This function allows you to disable an unspecified 1, 2, or 3 optical axes. If more than the set optical axes is interrupted, the output shuts off.

(Example of floating blanking function)

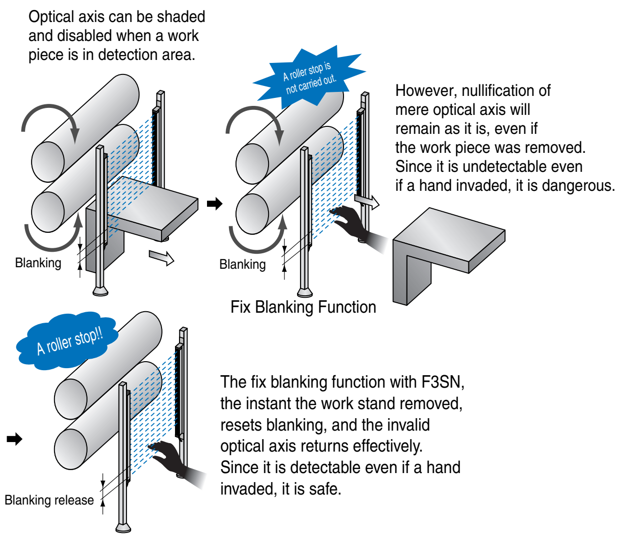


Floating-and-blanking function

Basic pattern 2: Fixed blanking function

Specific optical axes are masked by teaching and disabled.

(Example of fixed blanking function)



Fix Blanking Function

Other functions to be set with the setting console

- Auxiliary outputs: Outputs such as ON at Dark, ON at Light, light intensity diagnosis, and lockout can be selected.
- Large indicator lamp outputs: large indicator lamp outputs can be selected from ON at Dark, ON at Light, light intensity diagnosis, and lockout.
- External device monitoring function: Allows you to monitor the feedback of external devices.
- Interlock function: Interlocks can be set at power-on and restart.
- Setting copy function: Allows you to copy the settings of one sensor to another sensor.
- Protect function: Changing of sensor settings can be prohibited and restricted.

F3SH-A Multi-beam safety sensor

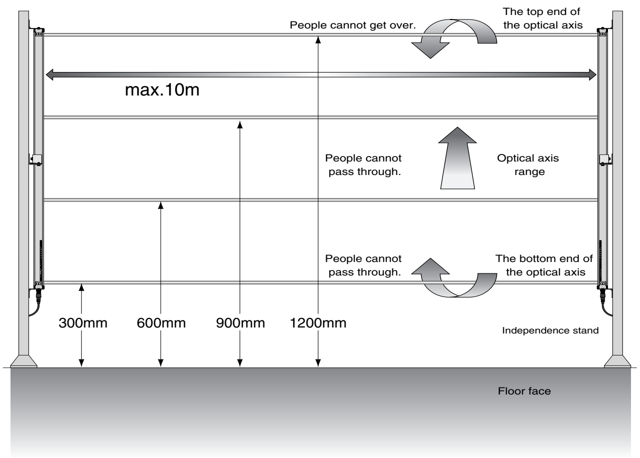
Recommended dimensions of EN standard for F3SH-A (4-optical axis multi-beam) Human body detection achieved

4 optical axes at a 300 mm pitch. Detects break by entire body.

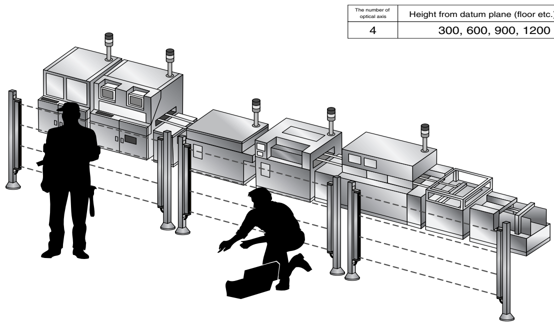
In EN Standard EN999 (machine safety: positioning of protective devices in relation to the approach speed of human body parts), the values in the following table are recommended as the most effective regarding the height from the reference surface (floor, etc.) of each optical axis of the 4 optical axis multi-beam sensor.

The optical axis pitch of the F3SH-A matches the recommended pitch, and, thus, in the installation shown in the following diagram, every type of intrusion is detected, including intrusion by passing under the lowest optical axis and intrusion by passing over the highest optical axis.

(Installation example based on EN999 recommended dimensions for multi-beam safety sensors)



The number of optical axis	Height from datum plane (floor etc.) (mm)
4	300, 600, 900, 1200



Easy safety application

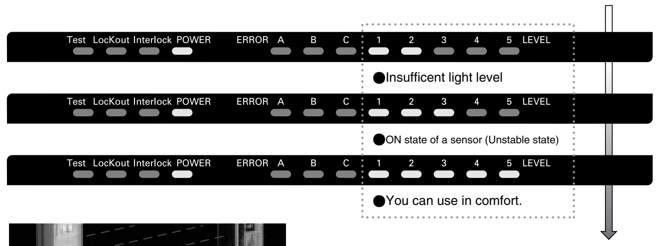
Various safety functions are implemented. Can be adapted to various safety circuit system configurations.

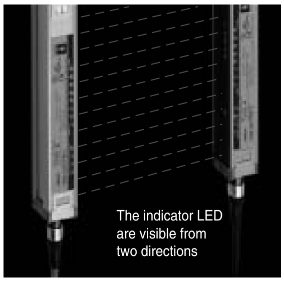
- Interlock function
- Auto reset / manual reset can be selected
- External device monitoring function

Equipped with LED bar for easy use.

Easy optical axis adjustment using LED displays. Enables certain installation.

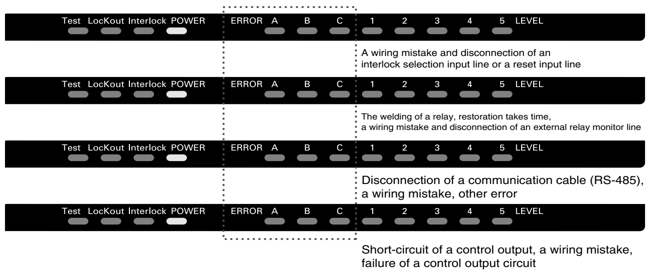
- Optical axis adjustment indicator (green only)





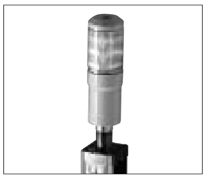
Error modes can be clearly indicated to provide a safety backup.

Error display example (red only)



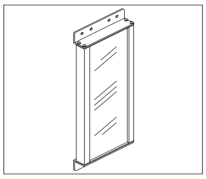
Full lineup of accessories (optional)

●Large-sized display indicator F39-A



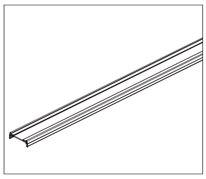
When connecting, a series connection model (model end number -01) is required.The setting console can select the kind of signal.

●Reflecting mirror F39-MDG



When the optical axis from an emitter is reflected at the angle of 90 degrees with using a mirror, the 2nd plane and the 3rd plane can be protected by one set of sensors. Sensing distance is lowered 15% per mirror.

●Spatter protection cover F39-HN



- Protective tube
- Slit cover
- Free location brackets
- Muting controller
- PSDI controller

F3SN-A/F3SH-A

Ordering information

Sensors

Safety light curtain

Infrared ray

Minimum detection object	Optical axis pitch	Shape	Sensing distance	Number of optical axes	Detection width	Series connection, connector	Model*1
14 mm dia. (Finger protection)	9 mm		0.2 to 7m	21 to 179 (odd numbers only)	189 to 1,611 mm (18 mm each)	No	F3SN-A□□□□P14 F3SN-A□□□□P14H
						Yes	F3SN-A□□□□P14-01*2 F3SN-A□□□□P14H-01
25 mm dia. (Hand protection)	15 mm		0.2 to 10m	13 to 120	217 to 1,822 mm (25 mm each)	No	F3SN-A□□□□P25
						Yes	F3SN-A□□□□P25-01
40 mm dia. (for presence protection)	30 mm		0.2 to 10m	7 to 60	217 to 1,807 mm	No	F3SN-A□□□□P40
						Yes	F3SN-A□□□□P40-01
70 mm dia. (for presence detection)	60 mm		0.2 to 10m	5 to 30	277 to 1,777 mm	No	F3SN-A□□□□P70
						Yes	F3SN-A□□□□P70-01

*1. □□□□ in the model name indicates the detection width (mm).
*2. F3SN-A□□□□P14-01is a customized model. For order placement, please contact your OMRON representative.

Multi-beam safety sensor

Infrared ray

Optical axis pitch	Shape	Sensing distance	Number of optical axes	Distance between optical axes at each end	Series connection, connector	Model
Body protection		0.2 to 10m	4	900 mm	No	F3SH-A09P03
					Yes	F3SH-A09P03-01

Accessories (Order Separately)

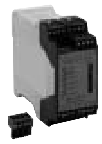
Control Unit

Appearance	Output	Model	Remarks
	Relay, 3NO + 1NC	**F3SP-B1P**	For connection with the F3SN-A, and F3SH-A, use F39-JC□B cables fitted with connectors at both ends.

Safety Relay Unit

Appearance	Output	Model	Remarks
	Relay, 3NO	**G9SA-300-SC**	For connection with the F3SN-A, and F3SH-A, use F39-JC☐C cables fitted with connectors at both ends.

Muting Controller

Appearance	Model	Remarks
	**F3SP-U2P-TGR** **F3SP-U4P-TGR**	For connection with the F3SN-A, and F3SH-A, use F39-JC☐A cables fitted with connectors at single end.

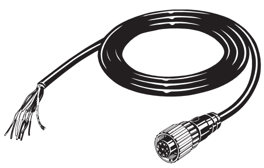
Setting Console

Appearance	Model	Accessories
	**F39-MC11**	One branching connector, one connector cap, 2-m cable, instruction manual

Branching Connector

Appearance	Model	Remarks
	**F39-CN1**	Purchase this connector when needed additionally for installing the F39-MC11.

Single-ended Connector Cable (For Emitter and Receiver Set)

Appearance	Cable length	Specification	Model
	3 m	M 12 connector (8 pin)	**F39-JC3A**
	7 m		**F39-JC7A**
	10 m		**F39-JC10A**
	15 m		**F39-JC15A**

Double-ended Connector Cable (For Emitter and Receiver Set)

Appearance	Cable length	Specification	Model	Application
	0.2 m	M12 connector (8 pins)	**F39-JCR2B**	Series connection or connection with F3SP-B1P
	0.5 m		**F39-JCR5B**	
	3 m		**F39-JC3B**	
	5 m		**F39-JC5B**	Connection with F3SP-B1P (see note 1)
	7 m		**F39-JC7B**	
	10 m		**F39-JC10B**	
	15 m		**F39-JC15B**	
	20 m		**F39-JC20B**	
	0.2 m	M12 connector (8 pins)	**F39-JCR2C**	Connection with G9SA-300-SC (see notes 1 and 2)
	1 m		**F39-JC1C**	
	3 m		**F39-JC3C**	
	7 m		**F39-JC7C**	
	10 m		**F39-JC10C**	
	15 m		**F39-JC15C**	

Note: 1. Cannot be used for series-connection purpose.

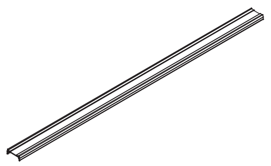
2. When two or more cables have to be used for connection with the G9SA-300-SC, connect the necessary number of F39-JC☐B cables to one F39-JC☐C cable.
(Example) When a 35 m long cable is required, connect two F39-JC☐B cables to one F39-JC☐C.

External Indicators (Separate Models for Emitters and Receivers)

Appearance	Specification	Indicator	Type	Model
	M12 connector for PNP output	Red	Emitter	**F39-A01PR-L**
			Receiver	**F39-A01PR-D**
		Green	Emitter	**F39-A01PG-L**
			Receiver	**F39-A01PG-D**

Note: These indicators are used for connecting with series-connection type emitters/receivers (models ending in -01). The desired turn-ON timing (type of signal) can be selected on setting console.

Spatter protection covers (1 set of 2 covers for both Emitter and receiver)

Shape	Applicable models	Model
	F3SN-A□□□□P14	F39-HN□□□□-14
	F3SN-A□□□□P25 F3SN-A□□□□P25-01	F39-HN□□□□-25
	F3SH-A09P03	F39-HH09-03

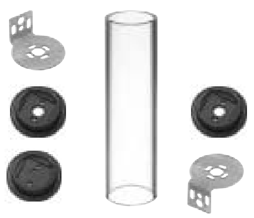
Note: □□□□ in the model name indicates the 4-digit sensor detection width (in sensor models).

Refection mirror (15% sensing distance attenuation)

Mirror material	Width (mm)	Thickness (mm)	Length (mm)	Model
Glass mirror	125	31	310	F39-MDG0310
			460	F39-MDG0460
			607	F39-MDG0607
			750	F39-MDG0750
			907	F39-MDG0907
			1,057	F39-MDG1057
			1,207	F39-MDG1207
			1,357	F39-MDG1357
			1,500	F39-MDG1500
			1,657	F39-MDG1657

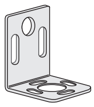
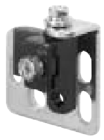
Note: Other sizes are available upon request

IP67 environment-resistant Enclosure (A Package of tube, Gasket, and Bracket; see note)

Appearance	Applicable sensor	Model
	F3SN-A□□□□P14(-01)	**F39-HP□□□□-14**
	F3SN-A□□□□P25(-01) F3SN-A□□□□P40(-01) F3SN-A□□□□P70(-01)	**F39-HP□□□□-25**
	F3SH-A09P03(-01)	**F39-HPH09-03**

Note: Purchase 2 sets when using both an emitter and a receiver.

Mounting Bracket for Sensor (Optional)

Appearance	Specification	Model	Remarks
	Wall mounting bracket Material: Iron (zinc plating) (see note)	**F39-L18**	For emitter: 2 pcs. For receiver: 2 pcs. Total: 4pcs./set
	Free-location bracket Materials: Zinc die-cast (zinc plating) Note: Not provided with an angle deflection mechanism for beam control.	**F39-L19**	Minimum order quantity: 1 pc.
	Free-location bracket Materials Sensor fixing element: Zinc die-cast (zinc plating) Mounting bracket: Iron (zinc plating) Note: Provided with an angle deflection mechanism for beam control	**F39-L20**	Minimum order quantity: 1 pc.

Note: Use these brackets for sensors having an operating range where no intermediate bracket is required (with an operating range of less than 640 mm)

List of Safety Light Curtains

F3SN-A□□□□P14, F3SN-A□□□□P14-01, F3SN-A□□□□P14H-01

Model	Detec-tion height	Number of optical axes
F3SN-A0189P14 (-01)	189	21
F3SN-A0207P14 (-01)	207	23
F3SN-A0225P14 (-01)	225	25
F3SN-A0243P14 (-01)	243	27
F3SN-A0261P14 (-01)	261	29
F3SN-A0279P14 (-01)	279	31
F3SN-A0297P14 (-01)	297	33
F3SN-A0315P14 (-01)	315	35
F3SN-A0333P14 (-01)	333	37
F3SN-A0351P14 (-01)	351	39
F3SN-A0369P14 (-01)	369	41
F3SN-A0387P14 (-01)	387	43
F3SN-A0405P14 (-01)	405	45
F3SN-A0423P14 (-01)	423	47
F3SN-A0441P14 (-01)	441	49
F3SN-A0459P14 (-01)	459	51
F3SN-A0477P14 (-01)	477	53
F3SN-A0495P14 (-01)	495	55
F3SN-A0513P14 (-01)	513	57
F3SN-A0531P14 (-01)	531	59
F3SN-A0549P14 (-01)	549	61
F3SN-A0567P14 (-01)	567	63
F3SN-A0585P14 (-01)	585	65
F3SN-A0603P14 (-01)	603	67
F3SN-A0621P14 (-01)	621	69
F3SN-A0639P14 (-01)	639	71
F3SN-A0657P14 (-01)	657	73

Model	Detec-tion height	Number of optical axes
F3SN-A0675P14 (-01)	675	75
F3SN-A0693P14 (-01)	693	77
F3SN-A0711P14 (-01)	711	79
F3SN-A0729P14 (-01)	729	81
F3SN-A0747P14 (-01)	747	83
F3SN-A0765P14 (-01)	765	85
F3SN-A0783P14 (-01)	783	87
F3SN-A0801P14 (-01)	801	89
F3SN-A0819P14 (-01)	819	91
F3SN-A0837P14 (-01)	837	93
F3SN-A0855P14 (-01)	855	95
F3SN-A0873P14 (-01)	873	97
F3SN-A0891P14 (-01)	891	99
F3SN-A0909P14 (-01)	909	101
F3SN-A0927P14 (-01)	927	103
F3SN-A0945P14 (-01)	945	105
F3SN-A0963P14 (-01)	963	107
F3SN-A0981P14 (-01)	981	109
F3SN-A0999P14 (-01)	999	111
F3SN-A1017P14 (-01)	1,017	113
F3SN-A1035P14 (-01)	1,035	115
F3SN-A1053P14 (-01)	1,053	117
F3SN-A1071P14 (-01)	1,071	119
F3SN-A1089P14 (-01)	1,089	121
F3SN-A1107P14 (-01)	1,107	123
F3SN-A11125P14 (-01)	1,125	125

Model	Detec-tion height	Number of optical axes
F3SN-A1143P14H(-01)	1143	127
F3SN-A1161P14H(-01)	1161	129
F3SN-A1179P14H(-01)	1179	131
F3SN-A1197P14H(-01)	1197	133
F3SN-A1215P14H(-01)	1215	135
F3SN-A1233P14H(-01)	1233	137
F3SN-A1251P14H(-01)	1251	139
F3SN-A1269P14H(-01)	1269	141
F3SN-A1287P14H(-01)	1287	143
F3SN-A1305P14H(-01)	1305	145
F3SN-A1323P14H(-01)	1323	147
F3SN-A1341P14H(-01)	1341	149
F3SN-A1359P14H(-01)	1359	151
F3SN-A1377P14H(-01)	1377	153
F3SN-A1395P14H(-01)	1395	155
F3SN-A1413P14H(-01)	1413	157
F3SN-A1431P14H(-01)	1431	159
F3SN-A1449P14H(-01)	1449	161
F3SN-A1467P14H(-01)	1467	163
F3SN-A1485P14H(-01)	1485	165
F3SN-A1503P14H(-01)	1503	167
F3SN-A1521P14H(-01)	1521	169
F3SN-A1539P14H(-01)	1539	171
F3SN-A1557P14H(-01)	1557	173
F3SN-A1575P14H(-01)	1575	175
F3SN-A1593P14H(-01)	1593	177
F3SN-A1611P14H(-01)	1611	179

Highlighted products are prefered stock types

F3SN-A□□□□P25, F3SN-A□□□□P25-01

Model	Detection height	Number of optical axes
F3SN-A0217P25 (-01)	217	13
F3SN-A0232P25 (-01)	232	14
F3SN-A0247P25 (-01)	247	15
F3SN-A0262P25 (-01)	262	16
F3SN-A0277P25 (-01)	277	17
F3SN-A0292P25 (-01)	292	18
F3SN-A0307P25 (-01)	307	19
F3SN-A0322P25 (-01)	322	20
F3SN-A0337P25 (-01)	337	21
F3SN-A0352P25 (-01)	352	22
F3SN-A0367P25 (-01)	367	23
F3SN-A0382P25 (-01)	382	24
F3SN-A0397P25 (-01)	397	25
F3SN-A0412P25 (-01)	412	26
F3SN-A0427P25 (-01)	427	27
F3SN-A0442P25 (-01)	442	28
F3SN-A0457P25 (-01)	457	29
F3SN-A0472P25 (-01)	472	30
F3SN-A0487P25 (-01)	487	31
F3SN-A0502P25 (-01)	502	32
F3SN-A0517P25 (-01)	517	33
F3SN-A0532P25 (-01)	532	34
F3SN-A0547P25 (-01)	547	35
F3SN-A0562P25 (-01)	562	36
F3SN-A0577P25 (-01)	577	37
F3SN-A0592P25 (-01)	592	38
F3SN-A0607P25 (-01)	607	39
F3SN-A0622P25 (-01)	622	40
F3SN-A0637P25 (-01)	637	41
F3SN-A0652P25 (-01)	652	42
F3SN-A0667P25 (-01)	667	43
F3SN-A0682P25 (-01)	682	44
F3SN-A0697P25 (-01)	697	45
F3SN-A0712P25 (-01)	712	46
F3SN-A0727P25 (-01)	727	47
F3SN-A0742P25 (-01)	742	48

Model	Detection height	Number of optical axes
F3SN-A0757P25 (-01)	757	49
F3SN-A0772P25 (-01)	772	50
F3SN-A0787P25 (-01)	787	51
F3SN-A0802P25 (-01)	802	52
F3SN-A0817P25 (-01)	817	53
F3SN-A0832P25 (-01)	832	54
F3SN-A0847P25 (-01)	847	55
F3SN-A0862P25 (-01)	862	56
F3SN-A0877P25 (-01)	877	57
F3SN-A0892P25 (-01)	892	58
F3SN-A0907P25 (-01)	907	59
F3SN-A0922P25 (-01)	922	60
F3SN-A0937P25 (-01)	937	61
F3SN-A0952P25 (-01)	952	62
F3SN-A0967P25 (-01)	967	63
F3SN-A0982P25 (-01)	982	64
F3SN-A0997P25 (-01)	997	65
F3SN-A1012P25 (-01)	1,012	66
F3SN-A1027P25 (-01)	1,027	67
F3SN-A1042P25 (-01)	1,042	68
F3SN-A1057P25 (-01)	1,057	69
F3SN-A1072P25 (-01)	1,072	70
F3SN-A1087P25 (-01)	1,087	71
F3SN-A1102P25 (-01)	1,102	72
F3SN-A1117P25 (-01)	1,117	73
F3SN-A1132P25 (-01)	1,132	74
F3SN-A1147P25 (-01)	1,147	75
F3SN-A1162P25 (-01)	1,162	76
F3SN-A1177P25 (-01)	1,177	77
F3SN-A1192P25 (-01)	1,192	78
F3SN-A1207P25 (-01)	1,207	79
F3SN-A1222P25 (-01)	1,222	80
F3SN-A1237P25 (-01)	1,237	81
F3SN-A1252P25 (-01)	1,252	82
F3SN-A1267P25 (-01)	1,267	83
F3SN-A1282P25 (-01)	1,282	84

Model	Detection height	Number of optical axes
F3SN-A1297P25 (-01)	1,297	85
F3SN-A1312P25 (-01)	1,312	86
F3SN-A1327P25 (-01)	1,327	87
F3SN-A1342P25 (-01)	1,342	88
F3SN-A1357P25 (-01)	1,357	89
F3SN-A1372P25 (-01)	1,372	90
F3SN-A1387P25 (-01)	1,387	91
F3SN-A1402P25 (-01)	1,402	92
F3SN-A1417P25 (-01)	1,417	93
F3SN-A1432P25 (-01)	1,432	94
F3SN-A1447P25 (-01)	1,447	95
F3SN-A1462P25 (-01)	1,462	96
F3SN-A1477P25 (-01)	1,477	97
F3SN-A1492P25 (-01)	1,492	98
F3SN-A1507P25 (-01)	1,507	99
F3SN-A1522P25 (-01)	1,522	100
F3SN-A1537P25 (-01)	1,537	101
F3SN-A1552P25 (-01)	1,552	102
F3SN-A1567P25 (-01)	1,567	103
F3SN-A1582P25 (-01)	1,582	104
F3SN-A1597P25 (-01)	1,597	105
F3SN-A1612P25 (-01)	1,612	106
F3SN-A1627P25 (-01)	1,627	107
F3SN-A1642P25 (-01)	1,642	108
F3SN-A1657P25 (-01)	1,657	109
F3SN-A1672P25 (-01)	1,672	110
F3SN-A1687P25 (-01)	1,687	111
F3SN-A1702P25 (-01)	1,702	112
F3SN-A1717P25 (-01)	1,717	113
F3SN-A1732P25 (-01)	1,732	114
F3SN-A1747P25 (-01)	1,747	115
F3SN-A1762P25 (-01)	1,762	116
F3SN-A1777P25 (-01)	1,777	117
F3SN-A1792P25 (-01)	1,792	118
F3SN-A1807P25 (-01)	1,807	119
F3SN-A1822P25 (-01)	1,822	120

Highlighted products are prefered stock types

F3SN-A□□□□P40, F3SN-A□□□□P40-01

Model	Detection height	Number of optical axes
F3SN-A0217P40(-01)	217	7
F3SN-A0247P40(-01)	247	8
F3SN-A0277P40(-01)	277	9
F3SN-A0307P40(-01)	307	10
F3SN-A0337P40(-01)	337	11
F3SN-A0367P40(-01)	367	12
F3SN-A0397P40(-01)	397	13
F3SN-A0427P40(-01)	427	14
F3SN-A0457P40(-01)	457	15
F3SN-A0487P40(-01)	487	16
F3SN-A0517P40(-01)	517	17
F3SN-A0547P40(-01)	547	18
F3SN-A0577P40(-01)	577	19
F3SN-A0607P40(-01)	607	20
F3SN-A0637P40(-01)	637	21
F3SN-A0667P40(-01)	667	22
F3SN-A0697P40(-01)	697	23
F3SN-A0727P40(-01)	727	24

Model	Detection height	Number of optical axes
F3SN-A0757P40(-01)	757	25
F3SN-A0787P40(-01)	787	26
F3SN-A0817P40(-01)	817	27
F3SN-A0847P40(-01)	847	28
F3SN-A0877P40(-01)	877	29
F3SN-A0907P40(-01)	907	30
F3SN-A0937P40(-01)	937	31
F3SN-A0967P40(-01)	967	32
F3SN-A0997P40(-01)	997	33
F3SN-A1027P40(-01)	1027	34
F3SN-A1057P40(-01)	1057	35
F3SN-A1087P40(-01)	1087	36
F3SN-A1117P40(-01)	1117	37
F3SN-A1147P40(-01)	1147	38
F3SN-A1177P40(-01)	1177	39
F3SN-A1207P40(-01)	1207	40
F3SN-A1237P40(-01)	1237	41
F3SN-A1267P40(-01)	1267	42

Model	Detection height	Number of optical axes
F3SN-A1297P40(-01)	1297	43
F3SN-A1327P40(-01)	1327	44
F3SN-A1357P40(-01)	1357	45
F3SN-A1387P40(-01)	1387	46
F3SN-A1417P40(-01)	1417	47
F3SN-A1447P40(-01)	1447	48
F3SN-A1477P40(-01)	1477	49
F3SN-A1507P40(-01)	1507	50
F3SN-A1537P40(-01)	1537	51
F3SN-A1567P40(-01)	1567	52
F3SN-A1597P40(-01)	1597	53
F3SN-A1627P40(-01)	1627	54
F3SN-A1657P40(-01)	1657	55
F3SN-A1687P40(-01)	1687	56
F3SN-A1717P40(-01)	1717	57
F3SN-A1747P40(-01)	1747	58
F3SN-A1777P40(-01)	1777	59
F3SN-A1807P40(-01)	1807	60

F3SN-A□□□□P70, F3SN-A□□□□P70-01

Model	Detection height	Number of optical axes
F3SN-A0277P70(-01)	277	5
F3SN-A0337P70(-01)	337	6
F3SN-A0397P70(-01)	397	7
F3SN-A0457P70(-01)	457	8
F3SN-A0517P70(-01)	517	9
F3SN-A0577P70(-01)	577	10
F3SN-A0637P70(-01)	637	11
F3SN-A0697P70(-01)	697	12
F3SN-A0757P70(-01)	757	13
F3SN-A0817P70(-01)	817	14

Model	Detection height	Number of optical axes
F3SN-A0877P70(-01)	877	15
F3SN-A0937P70(-01)	937	16
F3SN-A0997P70(-01)	997	17
F3SN-A1057P70(-01)	1057	18
F3SN-A1117P70(-01)	1117	19
F3SN-A1177P70(-01)	1177	20
F3SN-A1237P70(-01)	1237	21
F3SN-A1297P70(-01)	1297	22
F3SN-A1357P70(-01)	1357	23
F3SN-A1417P70(-01)	1417	24

Model	Detection height	Number of optical axes
F3SN-A1477P70(-01)	1477	25
F3SN-A1537P70(-01)	1537	26
F3SN-A1597P70(-01)	1597	27
F3SN-A1657P70(-01)	1657	28
F3SN-A1717P70(-01)	1717	29
F3SN-A1777P70(-01)	1777	30
F3SN-A1657P70(-01)	1657	28
F3SN-A1717P70(-01)	1717	29
F3SN-A1777P70(-01)	1777	30

Rating/Performance (see the operation manual for details)

Sensors

F3SN-A/F3SH-A

Model / Item						
Model	Stand-alone	F3SN-A□□□□P14 (see notes 1 and 8)	F3SN-A□□□□P25 (see note 1)	F3SN-A□□□□P40 (see note 1)	F3SN-A□□□□P70 (see note 1)	F3SH-A09P03
Item	Series connection	F3SN-A□□□□P14-01 (see notes 1, 2 and 8)	F3SN-A□□□□P25-01 (see note 1)	F3SN-A□□□□P40-01 (see note 1)	F3SN-A□□□□P70-01 (see note 1)	F3SH-A09P03-01
Sensor type		Type 4 Safety Light Curtain				
Applicable safety category		4, 3, 2, 1, B				
Operating range		0.2 to 7 m	0.2 to 10 m			
Beam pitch (P)		9 mm	15 mm	30 mm	60 mm	300 mm
Number of beams (n)		21 to 179 (odd numbers only)	13 to 120	7 to 60	5 to 30	4
Protective height (PH)		189 to 1611 mm PH = n × P	217 to 1822 mm PH = (n – 1) × P + 37	217 to 1807 mm PH = (n – 1) × P + 37	277 to 1777 mm PH = (n – 1) × P + 37	——
Outermost beam gap		——				900 mm
Detection capability		Non-transparent: 14 mm in diameter	Non-transparent: 25 mm in diameter	Non-transparent: 40 mm in diameter	Non-transparent: 70 mm in diameter	——
Effective aperture angle (EAA)		Within ±2.5° for the emitter and receiver at a detection distance of at least 3 m according to IEC 61496-2				
Light source (luminous wavelength)		Infrared LED (870 nm)				
Supply voltage (Vs)		24 VDC ±10% (ripple p-p 10% max.)				
Current consumption (under no-load conditions)	Emitter	Up to 50 beams: 140 mA max., 51 to 85 beams: 155 mA max., 86 beams and more: 170 mA max., 210 mA max. for 179 beams				140 mA max.
	Receiver	Up to 50 beams: 100 mA max., 51 to 85 beams: 110 mA max., 86 beams and more: 120 mA max., 140 mA max. for 179 beams				100 mA max.
OSSD		Two PNP transistor outputs, load current 300 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)				
Auxiliary output (non-safety output)		One PNP transistor output, load current 50 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)				
External indicator output (non-safety output) (see note 3)		One PNP transistor output, load current 40 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)				
Output operation mode		OSSD output: Light-ON Auxiliary output: Dark-ON (can be changed by the F39-MC11) External indicator output: Light-ON (can be changed by the F39-MC11) (see note 3)				
Input voltage		For test input, interlock selection input, reset input, and external relay monitor input voltages; ON voltage: 9 to 24 V (with a sink current of 3 mA max.), OFF voltage: 0 to 1.5 V or open				
Test functions		Self-test (after power ON, and during operation, one cycle during response time) External test (light emission stop function by test input)				
Mutual interference prevention function (see note 3)		Time-shared beam projection system by series connection Number of series connected light curtains: Up to 3 sets Number of beams: Up to 240 beams Length of the series connection cable: 3 m max.				
Safety-related functions		Auto reset/manual reset (interlock) (see note 4) EDM (External Device Monitoring) Fixed blanking (see note 5) Floating blanking (see note 5)				Auto reset mode/manual reset mode (interlock) (see note 4) EDM (External Device Monitoring)
Protection		Output short-circuit protection, reverse polarity protection				
Response time (under stable light incident condition)		ON to OFF: 10 to 15.5 ms max., 19,5 ms max. for 179 beams OFF to ON: 40 to 78 ms max.				ON to OFF: 10 ms max. OFF to ON: 40 ms max.
Startup waiting time		1 s max.				
Ambient light intensity		Incandescent lamp: 3000 lx max. (light intensity on the receiver surface) Sunlight: 10000 lx max. (light intensity on the receiver surface)				
Ambient temperature		Operating: –10 to +55 °C, storage: –30 to +70 °C (with no icing or condensation)				
Ambient humidity		Operating/storage: 35 to 95% RH (with no condensation)				
Insulation resistance		20 MΩ min. (at 500 VDC)				
Dielectric strength voltage		1000 VAC 50/60 Hz 1 min.				
Vibration resistance (malfunction)		10 to 55 Hz, double amplitude: 0.7 mm, X, Y and Z directions: 20 sweeps				
Shock resistance (malfunction)		100 m/s^2, X, Y and Z directions: 1000 times				
Degree of protection		IP65 (IEC60529)				
Connection method		M12 connector (8 pins)				
Weight (in packaging)		Calculate with the following equation: Weight of light curtain with protective height of 189 mm to 738 mm: (g) = (Protective height + 100) × 2 + 1300 Weight of light curtain with protective height of 747 mm to 1402 mm: (g) = (Protective height + 100) × 2 + 1700 Weight of light curtain with protective height of 1417 mm to 1822 mm: (g) = (Protective height + 100) × 2 + 2100				
Materials		Case: Aluminum, cap: Zinc die-cast, optical cover: PMMA (acrylic resin)				
Accessories		Test rod (see note 6), instruction manual, error mode label, mounting brackets (top and bottom), mounting brackets (intermediate) (see note 7)				

Model / Item		F3SN-A□□□□P14 (see notes 1 and 8)	F3SN-A□□□□P25 (see note 1)	F3SN-A□□□□P40 (see note 1)	F3SN-A□□□□P70 (see note 1)	F3SH-A09P03
Model	Stand-alone	F3SN-A□□□□P14 (see notes 1 and 8)	F3SN-A□□□□P25 (see note 1)	F3SN-A□□□□P40 (see note 1)	F3SN-A□□□□P70 (see note 1)	F3SH-A09P03
Item	Series connection	F3SN-A□□□□P14-01 (see notes 1, 2 and 8)	F3SN-A□□□□P25-01 (see note 1)	F3SN-A□□□□P40-01 (see note 1)	F3SN-A□□□□P70-01 (see note 1)	F3SH-A09P03-01
Applicable standard		IEC61496-1, EN61496-1 Type 4 ESPE (Electro-Sensitive Protective Equipment) IEC61496-2 Type 4 AOPD (Active Opto-electronic Protective Devices)				

Note: 1 . The 4 digits in □□□□ in the model number represent the protective height. Use the formula given in the information on protective height specifications to calculate the height.
For example, if the beam gap is 9 mm, and the No. of beams is 21, the protective height will be 9 × 21 = 189 mm. The model with this protective height is F3SN-A0189P14.
2 . F3SN-A□□□□P14-01 is a customized model. Consult with your OMRON representative when ordering this model.
3 . Models ending in -01 only.
4 . For the factory setting, the manual reset mode is set to the "start/restart" interlock.
Using the F39-MC11 can select either the start interlock or the restart interlock.
5 . For the factory setting, the function is not set. It can be enabled with the F39-MC11.
6 . Not provided with the F3SN-A□□□□P70 and F3SH-A.
7 . The intermediate mounting bracket is supplied with the following types:
Types which have the total length of the light curtain from 640 mm to 1280 mm: 1 set for each of emitter and receiver.
Types which have the total length of the light curtain over 1280 mm: 2 sets for each of emitter and receiver.
8 . For sizes above 1,125 mm add „H" after P14, e.g. F3SN-A1143P14H. Ask for supplemental manual.

Accessories

Control unit

Item / Model		F3SP-B1P	G9SA-300-SC (See note)
Applicable sensor		F3SN-A, F3SH-A	
Supply voltage		24 VDC ±10%	
Power consumption		1.7 W DC max. (does not include the sensor's current consumption)	24 VDC: 0.7 WDC max. (does not include the sensor's current consumption)
Operating time		100 ms max. (does not include the sensor's response time)	300 ms max. (does not include the sensor's response time and bouncetime)
Response time		10 ms max. (does not include the sensor's response time)	10 ms max. (does not include the sensor's response time and bouncetime)
Relay output	No. of contact	3 NO + 1 NC	3 NO
	Rated load	25 VAC, 5 A (cos diameter = 1), 30 VDC, 5 A L/R = 0 ms	250 VAC, 5 A
	Rated carry voltage	5 A	
Connection method	Between sensor's	M12 connector (8 pins)	
	Other	Terminal block	
Weight (in packaging)		Approx. 280 g	Approx. 300 g
Accessory		Instruction manual	

Note: 1 . For further details on the G9SA-300-SC, refer to the G9SA catalogue.

Setting console

Item / Model	F39-MC11
Applicable sensor	F3SN-A, F3SH-A
Supply voltage	24 V DC ±10% (supplied from sensor)
Connection method	Special cable (accessory)
Weight (Packed state)	360 g
Accessories	Branch connector (1), special cable (2 m), connector cap (1), operation manual

For details on the setting console, see the manual included with the product.

Large indicator lamps

Item / Model	F39-A01PR-L (for emitter) F39-A01PR-D (for light receiver)	F39-A01PG-L (for emitter) F39-A01PG-D (for light receiver)
Applicable sensor	F3SN-A□□□□P□□-01 F3SH-A09P03-01	
Light source	Red LED	Green LED
Supply voltage	24 V DC ±10% (supplied by sensor)	
Current consumption	40 mA or less (supplied by sensor)	
Connection method	M12 connector (8-pin)	
Weight (Packed state)	80 g	

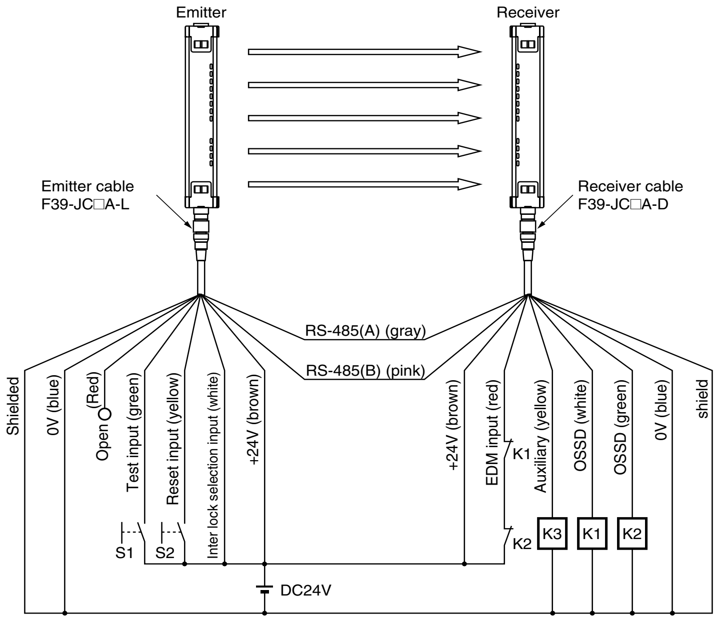
Environment-resistant Enclosure

Item / Model	F39-HP□□□□-14	F39-HP□□□□-25 F39-HPH09-03
Applicable sensor	F3SN-A□□□□P14(-01)	F3SN-A□□□□P25(-01)/P40(-01)/P70(-01), F3SH-A09P03(-01)
Operating range characteristics	0.2 to 6 m	0.2 to 10 m
Degree of protection (see note)	IP67 (IEC60529)	
Materials	Case: Acrylic resin, rubber: NBR60, mounting bracket: SUS316L, screw: SUS316L	

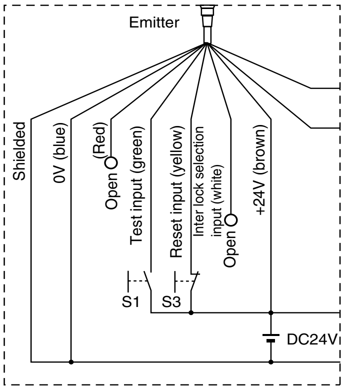
Note: To conform to IP67, tighten the screws according to the "Cautions for Use" as described in the manual packaged together with the product.

Connection

Using a manual reset function and an external device monitoring function



When using a auto reset function



S1: External test switch
S2: Interlock/lockout reset switch
S3: Lock-out reset switch (if the switch is not needed, connect to 24 V DC)
K1, K2: Relays for control of dangerous parts of machine.
K3: Load, PLC, etc. (for monitor)

Note: If you do not intend to use the external relay monitor, connect the auxiliary output that is set for dark: ON operation to the external relay monitor input, or use F39-MC11 to disable the external relay monitor function.

Correct Usage

This catalog is intended as a guide for product selection. Be sure to use the instruction manual provided with the product for actual operation.

Regulations and Standards

1. "Type Approval" specified in the Chapter 44. 2 of the Industrial Safety and Health Law in Japan does not apply to independent units of the F3SN-A/F3SH-A sensors. This law applies to systems incorporated with the sensor's.
   When using the F3SN-A/F3SH-A sensor in Japan as "safety devices for presses or shearing machines" as specified in the Chapter 42 of the same law, apply for approval as a system.

2. (1) The F3SN-A/F3SH-A is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Annex IV, B, Safety Components, Item 1.

   (2) The F3SN-A/F3SH-A complies with the following regulations and standards:
   1. EU Regulations
      - Machinery Directive: Directive 98/37/EC
      - EMC Directive: Directive 89/336/EEC
   2. European standards: EN61496-1 (TYPE 4 ESPE), prEN61496-2 (TYPE 4 AOPD)
   3. International standards: IEC61496-1 (TYPE 4 ESPE), IEC61496-2 (TYPE 4 AOPD)
   4. American standards: UL61496-1 (type 4 ESPE), UL61496-2 (type 4 AOPD), UL508, UL1998, CAN/CSA22.2 No. 14, CAN/CSA22.2 No. 0.8
   5. JIS standards: JIS B9704-1 (type 4 ESPE), JIS B9704-2 (type 4 AOPD)

   (3) The F3SN-A/F3SH-A received the following approvals from the EU accredited body DEMKO A/S:
   - EC Type-Examination in accordance with the EU Machinery Directive (TYPE 4 ESPE)
   - Certificate of a competent body for EMC
   - DEMKO Type Approval
     Type 4 ESPE (EN61496-1)
     Type 4 AOPD (prEN61496-2)

   (4) The F3SN-A/F3SH-A received the following approvals from the Third Party Assessment Body UL:
   - Certificate of UL listing for US and Canadian safety standards
     Both of which are: TYPE 4 ESPE (UL61496-1), TYPE 4 AOPD (UL61496-2)

   (5) The F3SN-A/F3SH-A received the following approvals from BG-PRUFZERT of Germany:
   - BG test and approval mark
     License
     Type 4 ESPE (EN61496-1)
     Type 4 AOPD (prEN61496-2)

3. The F3SN-A/F3SH-A is designed according to the following standards. To make sure that the F3SN-A/F3SH-A complies with the following standards and regulations, you are asked to design and use it as provided by any other related standards, laws, and regulations. (Underlined regulations are applicable to the F3SN-A only.) Consult UL or other standardization bodies if you have any questions.
   - EN415-4, <u>prEN691, EN692, prEN693</u> (European standards)
   - OSHA 29 CFR 1910. 212 (US Industrial Safety and Health Regulation)
   - <u>OSHA 29 CFR 1910. 217</u> (US Industrial Safety and Health Regulation)
   - <u>ANSI B11. 1 - B11. 19</u> (US standard)
   - ANSI/RIA 15. 06 (US standard)

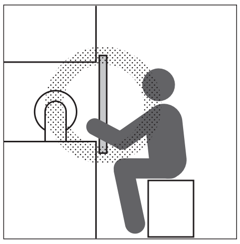
Detection zone and intrusion path

F3SN-A Safety Light Curtain

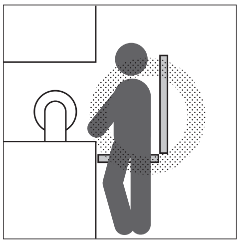
Install protective structures around the machine so that you must pass through the detection zone of the F3SN-A to reach a hazardous part of the machine.
Install the F3SN-A so that some part of the operator's body remains in the detection zone at all times when the operator works in a hazardous area. Failure to do so may result in serious injury.

Correct Installation

A hazardous part of a machine can be reached only by passing through the sensor detection zone.

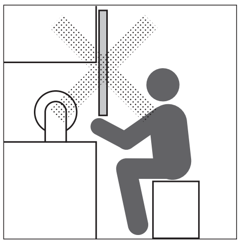


Some part of the operator's body remains in the detection zone while they are working.

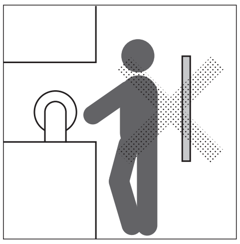


Incorrect Installation

A hazardous part of a machine can be reached without passing through the sensor detection zone.



A worker is between the sensor detection zone and a hazardous part of a machine.



F3SH-A Multi-beam Safety Sensor

Install protective structures around the machine so that you must pass through the detection zone of the F3SH-A to reach a hazardous part of the machine.
If it is possible for an operator to get between the sensor's detection zone and the hazardous part of the machine, design the system so that machinery cannot start up automatically. Make sure that machinery cannot restart while the operator is in the hazardous area. Position the switch for restarting machinery in a location from which the status of the hazardous area can be seen clearly. The switch position location must be a place where the switch cannot be operated from within the hazardous area.
Failure to do so may result in serious injury.

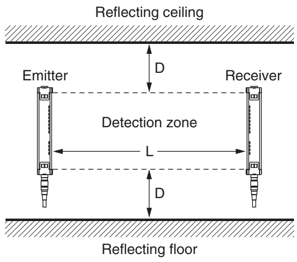
Use of the fixed blanking function

After setting the fixed blanking, check that the F3SN-A detects a test rod at any position in the detection zone through which a person can reach the hazardous part of the machine. If any positions are found by check above, install protective structures to prevent intrusion, which the F3SN-A can not detect.
Failure to do so may result in serious injury.

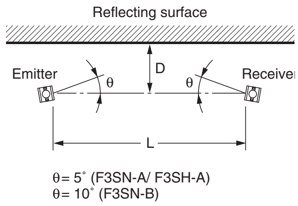
Distances from reflective surfaces

Be sure to install the F3SN-A/F3SH-A to minimize the effects of reflection from nearby surfaces.
Failure to do so may cause detection to fail and may result in serious injury.

Side View



Top View



Install the F3SN-A/F3SH-A with minimum Distance D shown above from reflective surfaces (highly reflective surfaces) such as metal walls, floors, ceilings, and work pieces.

Distance between emitter and receiver (Operating range L)	Minimum installation distance D
	F3SN-A/ F3SH-A
0. 2 to 3 m	0.13 m
over 3 m	L/2 × tan 2.5° = L × 0.044 (m)

Safety distance

Always maintain a safe distance (S) between the light curtain and a hazardous part of a machine.
Failure to do so causes the machine to fail to stop before an operator reaches the dangerous area and may result in serious injury.

Use of the floating blanking increases the size of the detection capability. To calculate a safety distance, be sure to use the increased size of the detection capability.
Failure to do so causes the machine to fail to stop before an operator reaches the dangerous area and may result in serious injury.

The "safety distance" is the minimum distance that must be maintained between the F3SN-A/F3SH-A and a hazardous part of a machine in order to stop the machine before someone or something reaches it. The safety distance is calculated based on the following equation when a person moves perpendicular to the detection zone of a light curtain.

Safety distance (S) = Intrusion speed into the detection zone (K)
× Total response time for the machine and light curtain (T)
+ Additional distance calculated based on the detection capability of the light curtain (C) .... (1)

The safety distance varies with national standards and individual machine standards. The equation is also different if the direction of intrusion is not perpendicular to the detection zone of the light curtain. Be sure to refer to related standards.

F3SN-A Safety Light Curtain

Reference

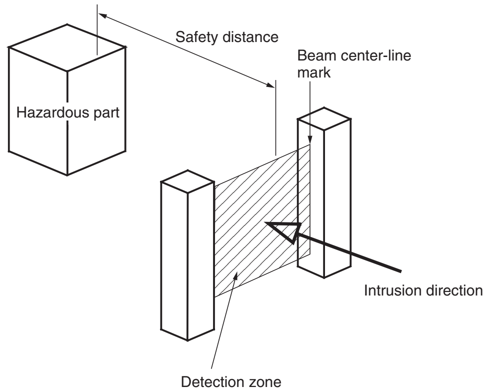
Method for calculating safety distance as provided by European Norm EN999 (for intrusion perpendicular to the detection zone)

Detection capability: 40mm or less

Substitute K = 2000 mm/s and C = 8 (d – 14 mm) in equation (1) and calculate as shown below.

S = 2000 mm/s × (Tm + Ts) + 8 (d – 14 mm) .... (2)
Where: S = Safety distance (mm)
Tm = Machine response time (s) (See note 1)
Ts = Light curtain response time (s) (See note 2)

d = Detection capability of the light curtain (mm)



e. g.:
Tm = 0.05 s, Ts = 0.01 s, d = 14 mm:
S = 2000 mm/s × (0.05 s + 0.01 s) + 8 (14 mm – 14 mm) = 120 mm

Use S = 100 mm if the result of equation (2) is less than 100 mm. Recalculate using the following equation with K = 1600 mm/s if the result is over 500 mm.

S = 1600 mm/s × (Tm + Ts) + 8 (d – 14 mm)..........................(3)

Use S = 500 mm if the result from equation (3) is less than 500 mm.

Detection capability: over 40mm

Substitute K = 1600 mm/s and C = 850 mm in equation (1) and calculate as shown below.

S = 1600 mm/s × (Tm + Ts) + 850
Where: S = Safety distance (mm)
Tm = Machine response time (s) (See note 1)
Ts = Light curtain response time (s) (See note 2)

e. g.:
Tm = 0.05 s, Ts = 0.01 s:
S = 1600 mm/s × (0.05 s + 0.01 s) + 850 mm = 946 mm

Note: 1 . The machine response time refers to the maximum time from the moment the machine receives a stop signal to the moment the hazardous part of the machine stops. The machine response time should be measured on actual machines. The machine response time should be measured and confirmed periodically.

Response Time Table

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SNA□□□□ P14(-01)	180 to 450	20 to 50	10.0 ms	40 ms
	459 to 765	51 to 85	12.5 ms	50 ms
	774 to 1080	86 to 120	15.0 ms	60 ms
	1089 to 1125	121 to 125	15.5 ms	62 ms

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SN-A□□□□ P25(-01)	217 to 772	13 to 50	10.0 ms	40 ms
	787 to 1297	51 to 85	12.5 ms	50 ms
	1312 to 1822	86 to 120	15.0 ms	60 ms

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SN-A□□□□ P40(-01)	217 to 757	7 to 25	10.0 ms	40 ms
	787 to 1297	26 to 43	12.5 ms	50 ms
	1327 to 1807	44 to 60	15.0 ms	60 ms

Model	Protective height (mm)	Number of beams	Response time	
			ON to OFF	OFF to ON
F3SN-A□□□□ P70(-01)	277 to 757	5 to 13	10.0 ms	40 ms
	817 to 1297	14 to 22	12.5 ms	50 ms
	1357 to 1777	23 to 30	15.0 ms	60 ms

- Response time for series connected types is calculated as follows: (F3SN-A)
  For 2 sets:
  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + 3 ms
  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + 12 ms
  For 3 sets:
  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + Response time of Light curtain 3 + 4 ms
  Response time (ON to OFF): Response time of Light curtain 1 + Response time of Light curtain 2 + Response time of Light curtain 3 + 16 ms
- Response time of F3SP-B1P is 10 ms, operation time is 100 ms.

1 . The light curtain response time refers to the time required for output to change from ON to OFF.
2 . When using the F3SP-B1P, determine the safety distance by adding the response time of the F3SP-B1P to that of the F3SN given in the table above.

Reference

Method for calculating the safety distance as provided by ANSI B11. 19 (US)
Safety distance (S) = Intrusion speed into the detection zone (K)
Response time (Ts + Tc + Tr + Tbm) + Additional distance (Dpf)

Where:
K = Intrusion speed (Recommended value in OSHA standards
is 1600 mm/s)
ANSI B11. 19. does not define Intrusion speed (K). When determining K, consider possible factors including physical ability of operators.
Ts = Time required for machine to stop (s)
Tr = Light curtain response time (s) (See note)
Tc = Maximum response time required for machine control circuit to apply brake (s)
Tbm = Additional time (s)
If the machine is provided with a brake monitor, Tbm = brake monitor setting time – (Ts + Tc). If not provided with a brake monitor, it is recommended to determine a value more than 20% of (Ts + Tc) as the additional time.
Dpf = Additional distance.
Dpf is calculated as follows based on ANSI standards:
Dpf = 3.4 × (d – 7.0) where d is the detection capability of the light curtain (mm).

e. g.:
Assume that: K = 1600 mm/s, Ts + Tc = 0.06 s,
Brake monitor setting time = 0.1s, Tr = 0.01s, d = 14 mm.
Then:
Tbm = 0.1 – 0.06 = 0.04 s
Dpf = 3.4 – (14 – 7.0) = 23.8 mm
S = 1600 × (0.06 + 0.01 – 0.04) + 23.8 = 199.8 mm

Note: The light curtain response time refers to the time required for output to change from ON to OFF.

Reference

Method for calculating the safety distance as provided by ANSI/RIA R15.06 (US) (for intrusion perpendicular to the detection zone)
Safety distance (Ds) = K × (Ts + Tc + Tr) + Dpf

Where:

K = Intrusion speed: 1600 mm/s min.
Ts = Maximum stop time of machine/equipment (s)
Tc = Maximum stop time of control system (s)
Tr = Light curtain response time (s)
Os = Diameter of the smallest detectable object (mm)
Dpf = Additional distance (mm)

Assume that the sensor is installed with the lowest beam height above the floor at 300 mm and the highest beam height above the floor at 1200 mm, with the diameter of the smallest detectable object being 64 mm or less. Then, Dpf is determined from:

Dpf = 3.4 × (Os – 6.875 mm).

If the diameter of the smallest detectable object is more than 64 mm, Dpf is calculated to be 900 mm.

e. g.:

- F3SN-A□□□□P40 Safety Light Curtain

Assume that K = 1600 mm/s, Ts + Tc = 0.06 s, Tr = 0.01 s, and Os = 40 mm.
Then:

S = 1600 × (0.06 + 0.01) + Dpf
= 1600 × (0.06 + 0.01) + 3. 4 (40 – 6.875)
= 225 mm

- F3SN-A□□□□P70 Safety Light Curtain

Assume that K = 1600 mm/s, Ts + Tc = 0.06 s, Tr = 0.01 s, and Dpf = 900 mm.
Then:

S = 1600 × (0.06 + 0.01) + 900
= 1012 mm

Note: The light curtain response time refers to the time required for output to change from ON to OFF.

F3SH-A Multi-beam Safety Sensor

Reference

Method for calculating safety distance as provided by European Norm EN999 (for intrusion perpendicular to the detection zone)

Substitute K = 1600 mm/s and C = 850 mm in equation (1) and calculate as shown below.

S = 1600 mm/s × (Tm + Ts) + 850
Where:
S = Safety distance (mm)
Tm = Machine response time (s) (See note 1)
Ts = Sensor response time (s) (See note 2)

e. g.:
Tm = 0.05 s, Ts = 0.01 s:
S = 1600 mm/s × (0.05 s + 0.01 s) + 850 mm = 946 mm

Note: 1 . The machine response time refers to the maximum time from the moment the machine receives a stop signal to the moment the hazardous part of the machine stops. The machine response time should be measured on actual machines. The machine response time should be measured and confirmed periodically.
2 . The sensor response time refers to the time required for output to change from ON to OFF.

Installation

How to prevent mutual interference

The emitter and the receiver to be set facing each other should be a pair of the same set. Erroneous combination may create a zone where objects cannot be detected.

Do not use the sensors for a system where the beam is reflected, or object detection may be disabled. In such an application, use a beam path diversion mirror to prevent the beam reflected from an object from entering the receiver.

When installing two or more pairs of the F3SN-A/F3SN-B/F3SH-A, take necessary measures to prevent mutual interference. Examples of such measures include electrical interconnection and the use of baffle plates.

Correct Use

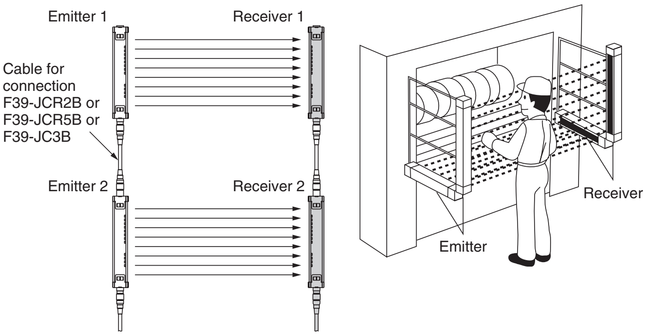
Installation

How to prevent mutual interference

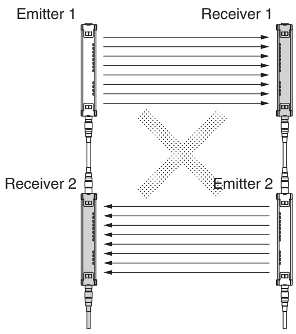
Series connection (Up to 3 sets, 240 beams, sensor models ending in -01, -03, -04, and -05 are required for series connection)

Two or more pairs of the F3SN-A can be connected in series. When connected in series, the F3SN-A sensors generate beams in a time-sharing manner. Thus, they prevent mutual interference and ensure safety.

Correct

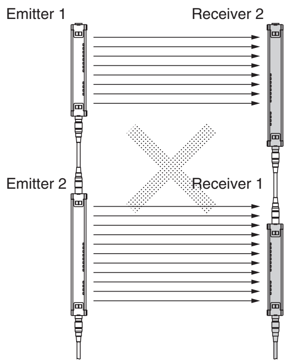


Incorrect



Do not connect the emitter and receiver in series, or a lockout condition will result.

Incorrect



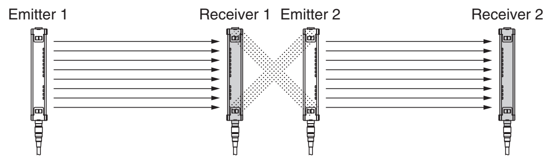
Do not combine an emitter with a receiver of a different pair. This will cause a lockout condition and detection of objects will be disabled.

When not connected

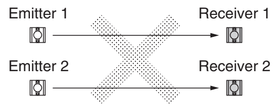
When installing two or more pairs of light curtains independently from each other due to inconvenience of wiring or other reason, take proper measures to prevent mutual interference. If mutual interference occurs, a lockout condition will result for the F3SN-A/F3SH-A.

- **Installation which may cause mutual interference**

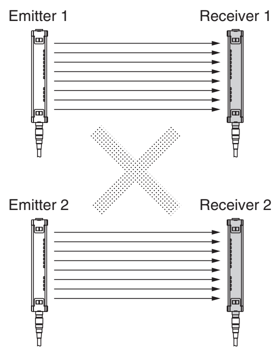
Incorrect



Incorrect



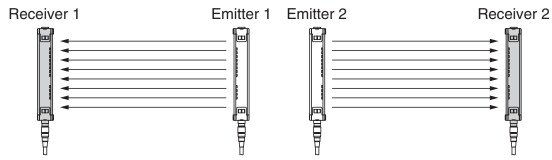
Incorrect



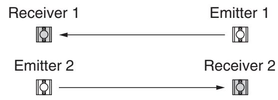
- **Installation to prevent mutual interference**

(1) Install so that the two light curtains emit in the opposite directions (staggered).

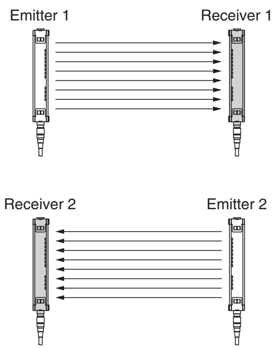
Correct



Correct

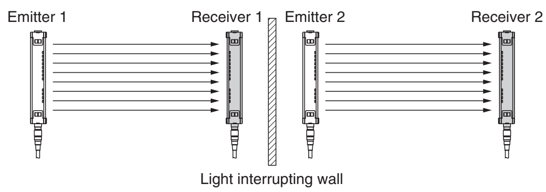


Correct



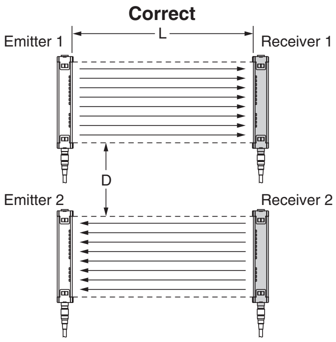
(2) Install a light interrupting wall in between sensors.

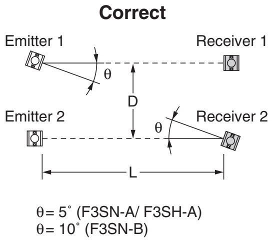
Correct



F3SN-A/F3SH-A

(3) Install the light curtains facing away from the one another to eliminate mutual interference.





Distance between emitter and receiver (Operating range L)	Minimum installation distance D
	F3SN-A/ F3SH-A
0. 2 to 3 m	0.26 m
over 3 m	L × tan 5° = L × 0.088 (m)

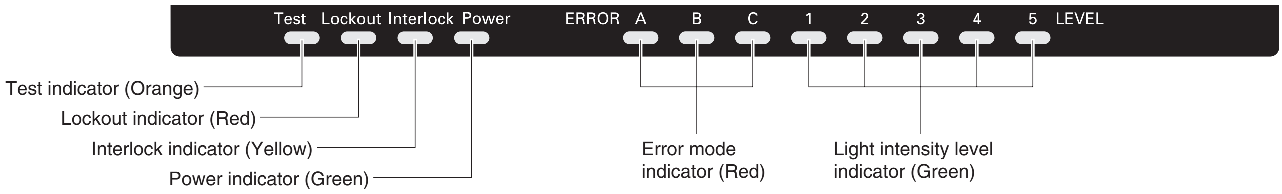
(4) Use a F39-HS spatter protection slit cover.

Operating range

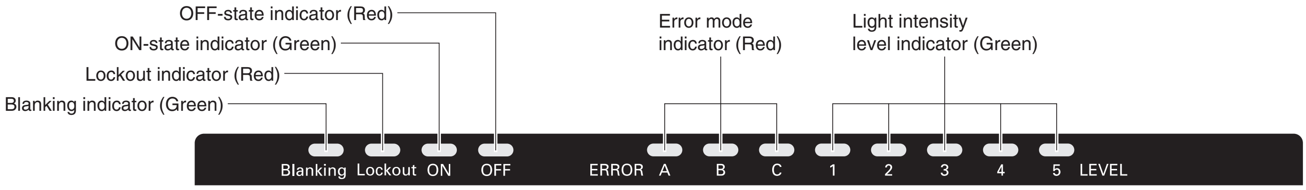
If the distance between the emitter and the receiver is less than 0.2 m, there is a possibility of chattering. Be sure to use the sensors within the rated operating range.

Names and Functions of Parts

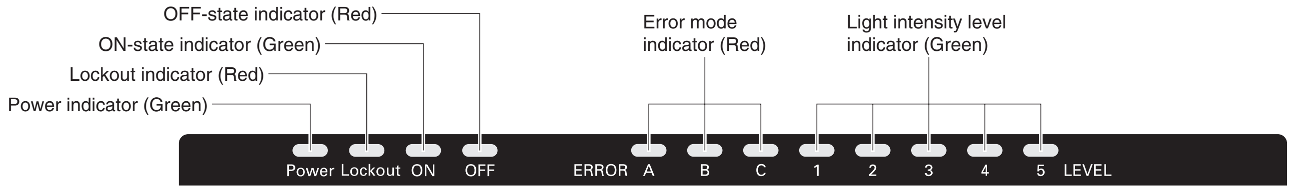
Emitter (F3SN-A/ F3SH-A)



Receiver (F3SN-A)



Receiver (F3SH-A)



Function

Power indicator	Lit when power is supplied (always lit) .... F3SN-A, F3SH-A Emitter Lit when power is supplied, flashing when the F39-MC11 is connected ...... F3SH-A Receiver (see note)
Interlock indicator	Lit during interlock condition
Lockout indicator	Flashing during lockout condition
Test indicator	Lit during external test (see note)
ON-state indicator	Lit when OSSD outputs are in ON-state
OFF-state indicator	Lit when OSSD outputs are in OFF-state
Blanking indicator (F3SN-A only)	Lit when blanking is set, flashing when the F39-MC11 is connected (see note)

Note: As a preventive maintenance feature, these indicators will flash after a lapse of 30000 hours.

	1	2	3	4	5	Light intensity level
Light intensity level indicator (Lit / Not lit)	Lit	Lit	Lit	Lit	Lit	200% and above of ON threshold level
	Lit	Lit	Lit	Lit	Not lit	150 to 200% of ON threshold level
	Lit	Lit	Lit	Not lit	Not lit	100 to 150% of ON threshold level
	Lit	Lit	Not lit	Not lit	Not lit	75 to 100% of ON threshold level
	Lit	Not lit	Not lit	Not lit	Not lit	50 to 75% of ON threshold level
	Not lit	Not lit	Not lit	Not lit	Not lit	Less than 50% of ON threshold level

	A	B	C	Cause of error
Error mode indicator (Flashing / Not lit)	Flashing	Not lit	Not lit	The Interlock selection input line or the reset input line is not wired correctly or became open.
	Not lit	Flashing	Not lit	Relay contact is welded. Releasing time of the relay takes too long. The EDM input line is not wired correctly or became open.
	Not lit	Not lit	Flashing	Communication line (RS-485) is not wired correctly, became open, or causes other errors.
	Flashing	Flashing	Not lit	One of the OSSD outputs is shorted or is not wired correctly. Other failure in OSSD outputs.
	Not lit	Flashing	Flashing	Mutual interference. Interference light is received.
	Flashing	Not lit	Flashing	Types of the receiver and emitter are not the same. Numbers of the receiver and emitter connected in series are not the same.
	Flashing	Flashing	Flashing	External noise. Internal hardware failure of the receiver or the emitter.

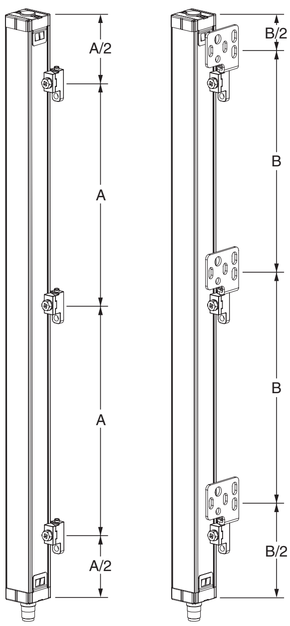
Installation

How to attach mounting bracket (F39-L19/L20)

To fully utilize the performance of sensors, locate the F39-L19/L20 mounting brackets in the number satisfying the dimensions "A" and "B" in the sensor longitudinal direction.

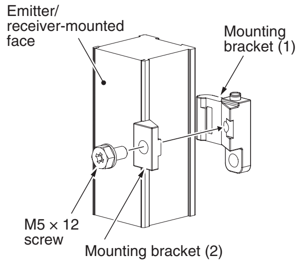
- For the F39-L19
  Spacing "A": 670 mm max.
- For the F39-L20
  Spacing "B": 400 mm max.

Note: When installing sensors at locations susceptible to vibration and shock, increase the number of mounting brackets.



Mounting bracket	Screw × length (mm)	Tightening torque
F39-L19	M5 × 12 screw	2.0 N·m
F39-L20	M4 × 8 screw	1.2 N·m

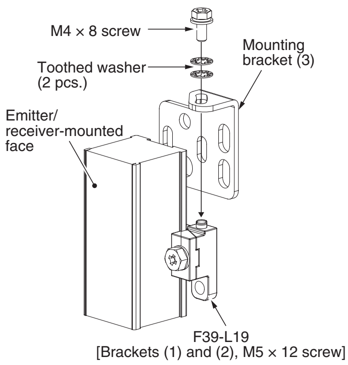
F39-L19



Brackets and screws included in one set

- Mounting bracket (1) 1
- Mounting bracket (2) 1
- M5 × 12 screw 1

F39-L20



Brackets and screws included in one set

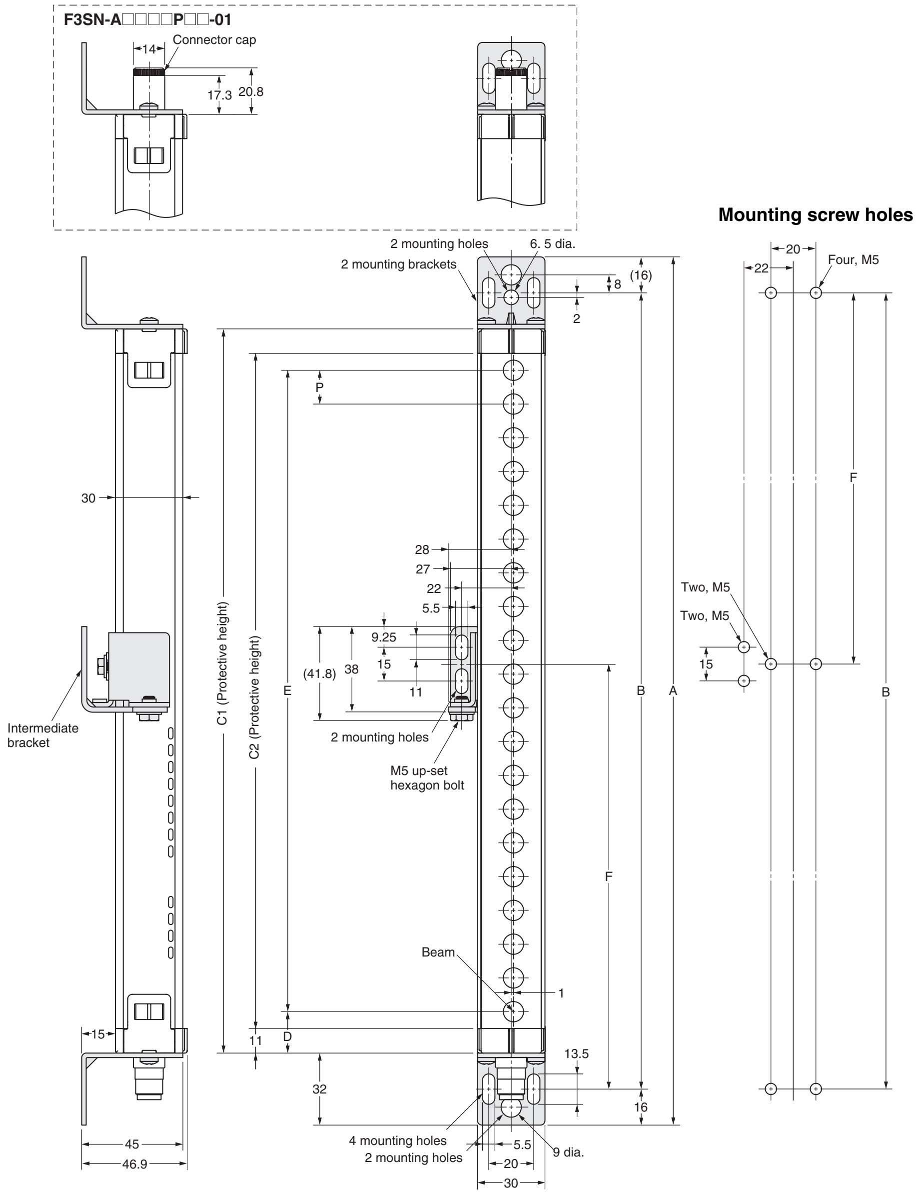
- Mounting bracket (1) 1
- Mounting bracket (2) 1
- M5 × 12 screw 1
- Mounting bracket (3) 1
- M4 × 8 screw 1
- Toothed washer 2

Dimensions

(Unit: mm)

Main unit

F3SN-A□□□□P□□
F3SN-A□□□□P□□-01



Dimensions according to the model can be calculated by using the following equations.

- F3SN-A□□□□P14(-01)

  Dimension C2 (protective height): 4 digits in the model name
  Dimension A = C2 + 86
  Dimension B = C2 + 54
  Dimension D = 15.5
  Dimension E = C2 – 9
  Dimension F: See the table below.
  Dimension P = 9

C2 (protective height)	Number of intermediate mounting bracket	Dimension F (see note)
to 0620	0	——
0621 to 1125	1	F = B/2

Note: If value F obtained from the above equation is not used, set F to 670 mm or less.

- F3SN-A□□□□P25(-01)/P40(-01)/P70(-01), F3SN-B□□□□P25/P40/P70

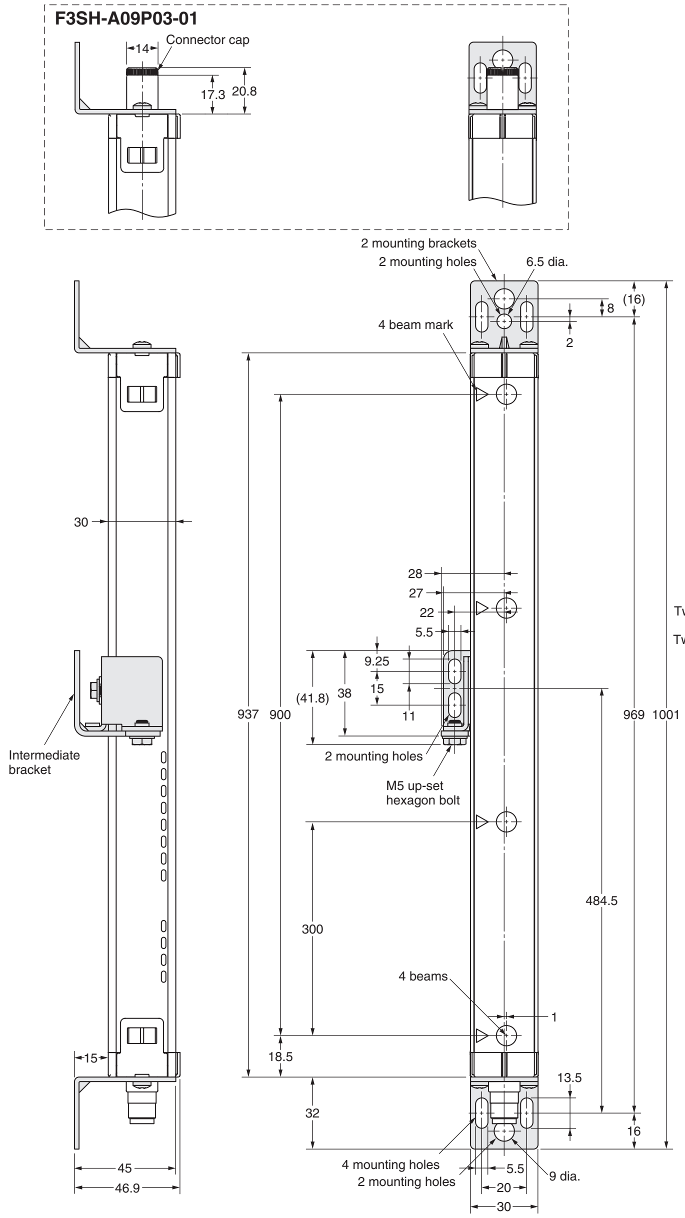
  Dimension C1 (protective height): 4 digits in the model name
  Dimension A = C1 + 64
  Dimension B = C1 + 32
  Dimension D = 18.5
  Dimension E = C1 – 37
  Dimension F: See the table below.

C1 (protective height)	Number of intermediate mounting bracket	Dimension F (see note)
to 0640	0	——
0641 to 1280	1	F = B/2
1281 to 1822	2	F = B/3

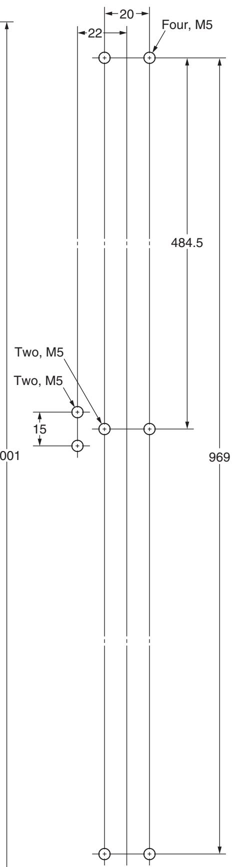
Dimension P: See the table below

Detection capability	Dimension P
25	15
40	30
70	60

F3SH-A09P03
F3SH-A09P03-01



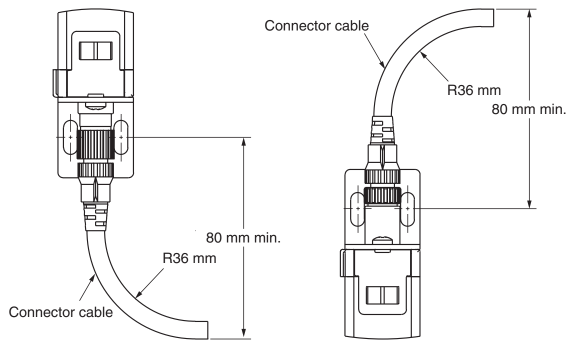
Mounting screw holes



Mounting Precautions

Note: 1 . The mounting bracket (3) (see Mounting brackets (intermediate)) is shown on the left-hand side of the sensor as an example. If the mounting bracket (3) is on the right-hand side of the sensor then the mounting holes must also be on the right-hand side.

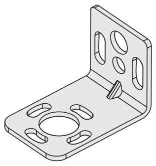
2 . When using with the cable bent, allow at least the dimensions shown on the right.
(Minimum bending radius of cable: R36 mm.)



F3SN-A/F3SH-A

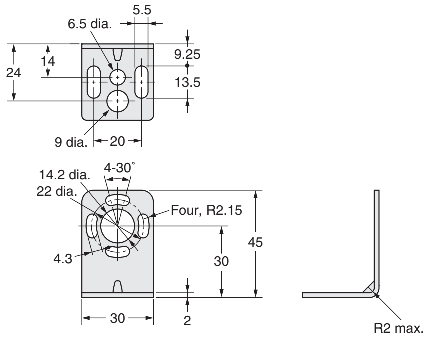
Accessories

Mounting bracket (top and bottom)

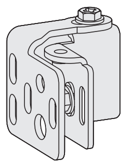


Material: Iron (zinc plating)

Note: Provided with the product.

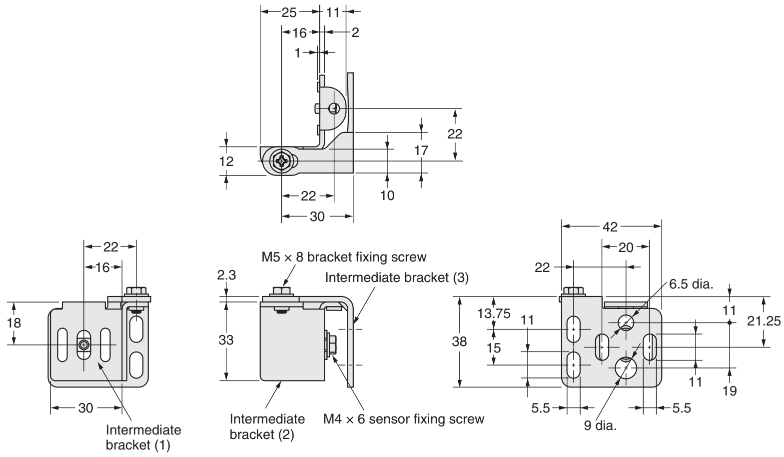


Mounting brackets (intermediate)



Material: Iron (zinc plating)

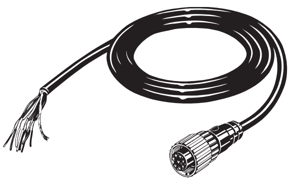
Note: Provided with the product.
The number of brackets required depends on the total length of the Sensor.



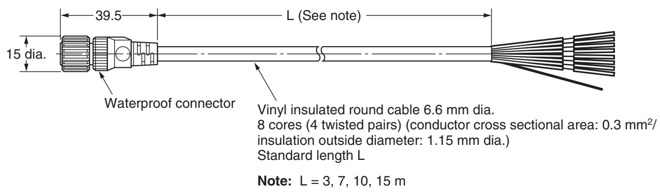
Accessories (Optional)

Single-ended connector cable

F39-JC3A (L = 3 m)
F39-JC7A (L = 7 m)
F39-JC10A (L = 10 m)
F39-JC15A (L = 15 m)



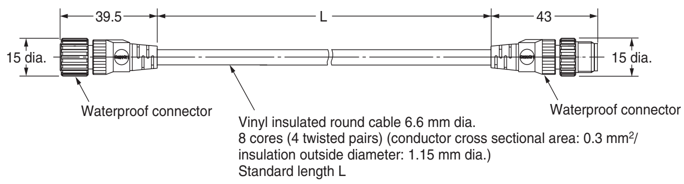
Color: Emitter (gray)
Receiver (black)



Double-ended connector cable

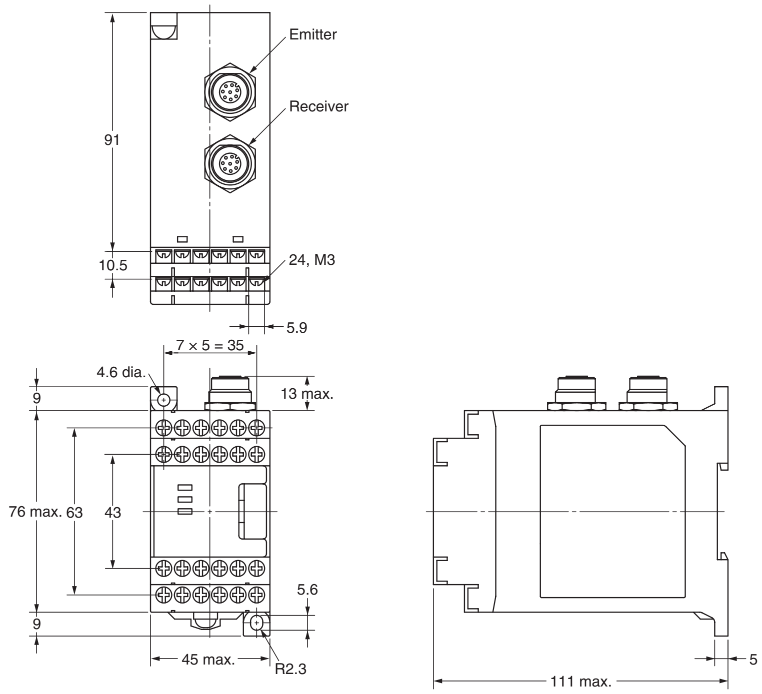
F39-JCR2B (L = 0.2 m)
F39-JCR5B (L = 0.5 m)
F39-JC3B (L = 3 m)
F39-JC5B (L = 5 m)
F39-JC7B (L = 7 m)
F39-JC10B (L = 10 m)
F39-JC15B (L = 15 m)
F39-JC20B (L = 20 m)
F39-JCR2C (L = 0.2 m)
F39-JC1C (L = 1 m)
F39-JC3C (L = 3 m)
F39-JC7C (L = 7 m)
F39-JC10C (L = 10 m)
F39-JC15C (L = 15 m)

Color: Emitter (gray)
Receiver (black)

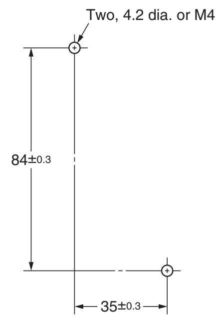


Control unit

F3SP-B1P

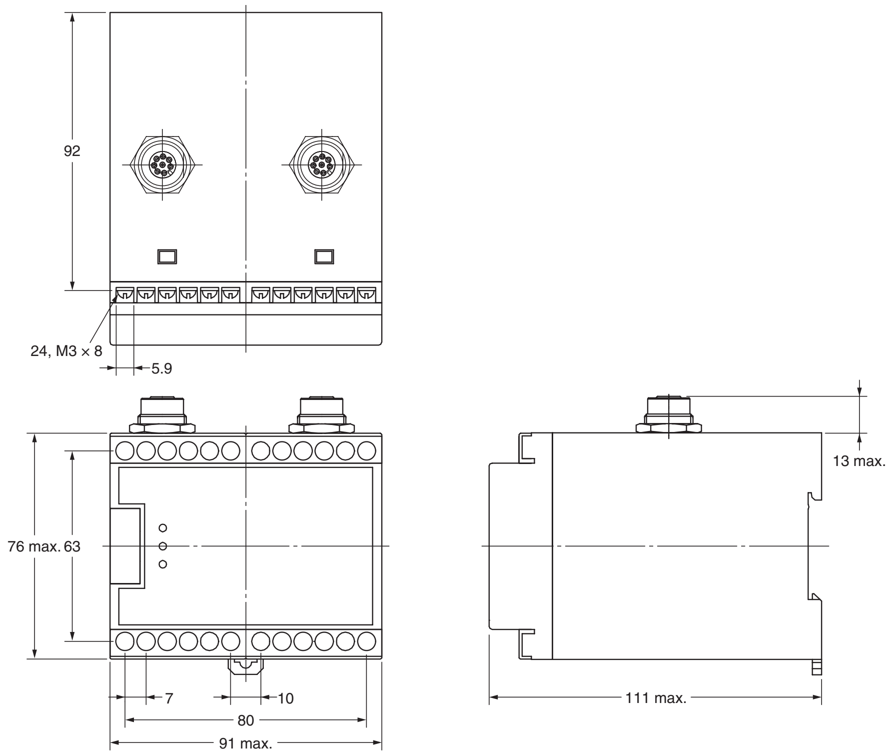


Mounting screw holes



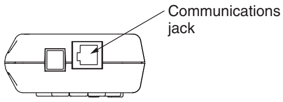
Safety relay unit

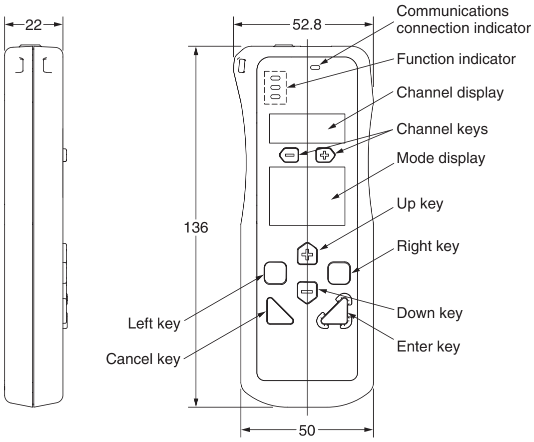
G9SA-300-SC



Setting console

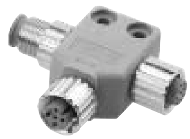
F39-MC11

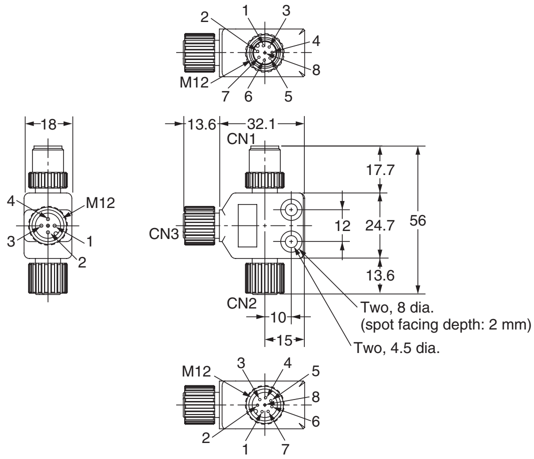




Branching connector (supplied with F39-MC11)

F39-CN1

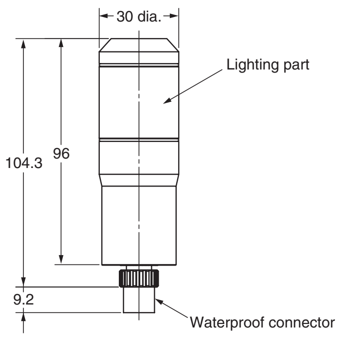




CN1	Connector cable
CN2	Sensor
CN3	Setting console

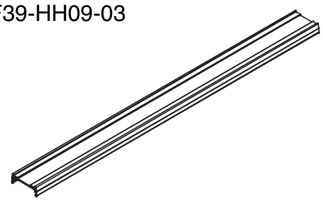
External indicator

F39-A01PR-L/-D
F39-A01PG-L/-D

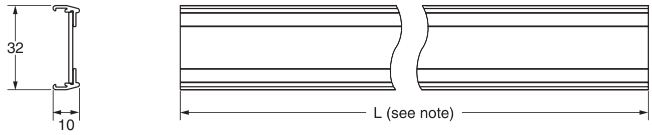


Spatter protection cover

F39-HN□□□□-14
F39-HN□□□□-25
F39-HH09-03



Protection cover

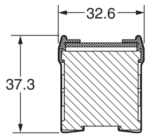


Note: L is as follows.

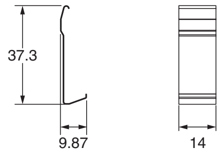
F39-HN□□□□-14	L = □□□□ mm
F39-HN□□□□-25	L = □□□□ – 22 mm
F39-HH09-03	L = 915 mm

Materials: PC (transparent area)
ABS (non-transparent area)

Mounting dimensions



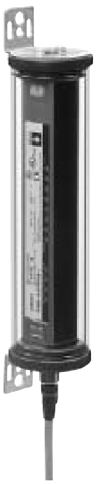
Fixing bracket

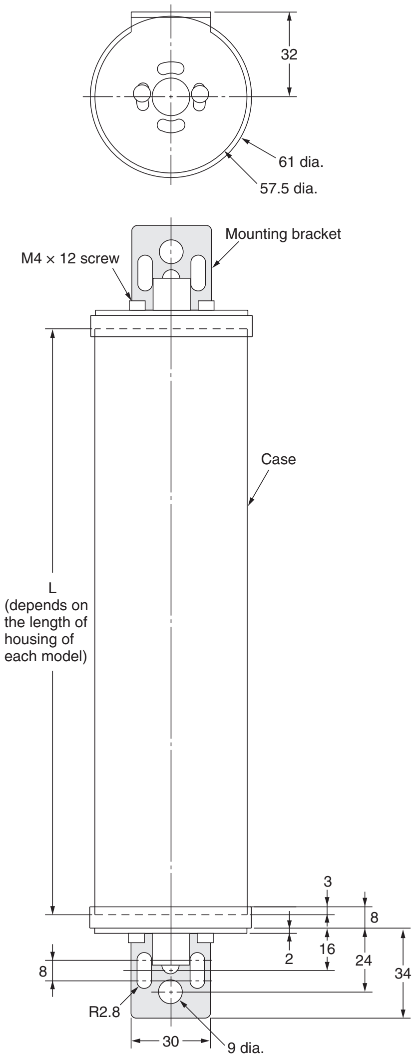


Materials: SUS

Environment-resistant enclosure

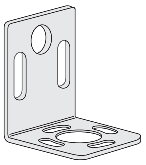
F39-HP□□□□-14
F39-HP□□□□-25
F39-HPH09-03

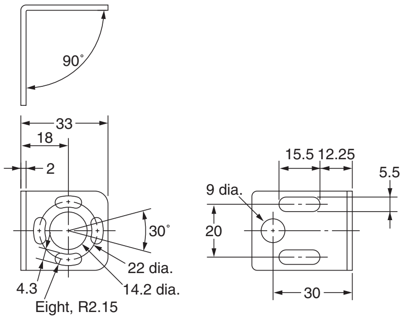




Wall mounting bracket

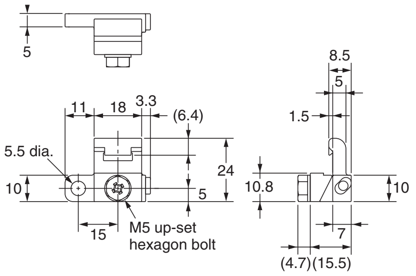
F39-L18



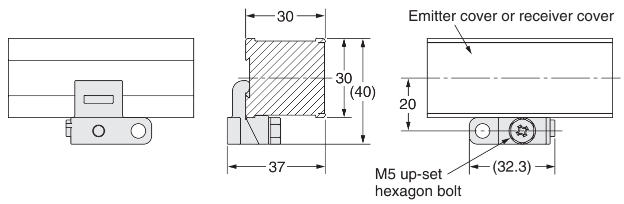


Free-location bracket

F39-L19

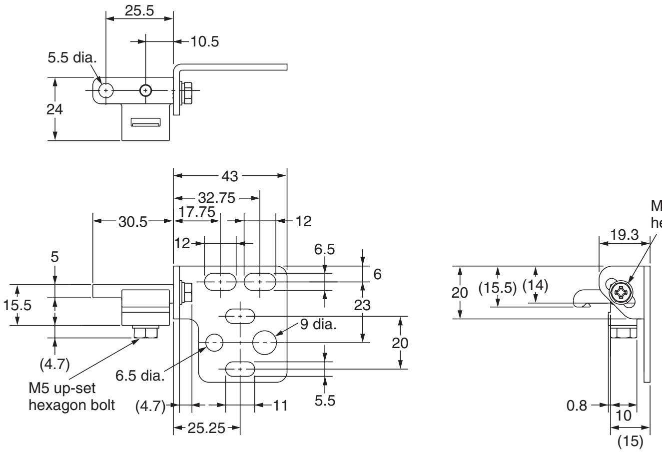


Mounting

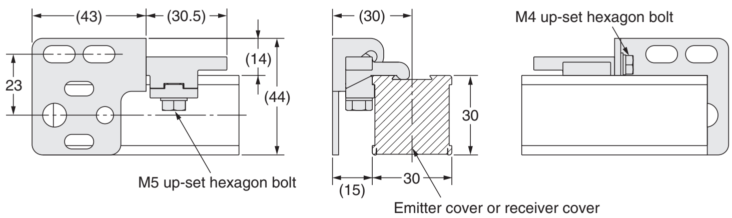


Free-location bracket

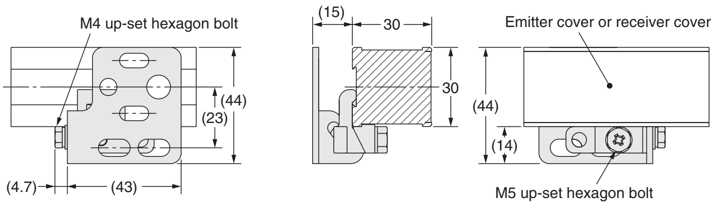
F39-L20



Side mounting



Back mounting



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

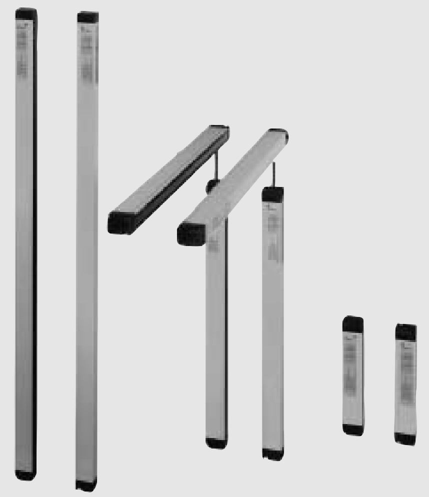
In the interest of product improvement, specifications are subject to change without notice.

Safety Light Curtain

F3S-B

Suitable for Detecting Human Bodies in a Dangerous Area

Safety Design for Category 2.



Features

- The F3S-B is a type 2 Safety Light curtain intended to be used as or with the safety related parts of the control system of a machine to category 2, 1 or B as defined in the European standard EN954-1.
- Compliance with IEC 61496-2, EN 61496-1 standards and machine and EMC directive.
- Received certificates from Notified Bodies as Type 2 ESPE (Electro-Sensitive-Protective-Equipment).
- UL/CSA approved.
- Pursuing safety with high level of safety design and FMEA.
- Series configuration of two units is possible.
- Units available with an axis pitch of 25 mm (hand protection), 50 mm (arm protection) or 75 mm (body protection) in protective height ranging from 300 mm to 1650 mm.
- Human body detection system without a dedicated control box.
- M12 Connector

Ordering Information

F3S-B $\boxed{M}$ $\boxed{36}$ $\boxed{2}$ $\boxed{P}$ $\boxed{12}$ - $\boxed{L}$

blank	Stand-alone
M	Master unit for series connection
S	Slave unit for series connection
36	No. of optical axis (4-66)
2	25 mm optical pitch
5	50 mm optical pitch
7	75 mm optical pitch
blank	Slave unit
P	PNP outputs

blank	Complete set of emitter and receiver
L	Emitter unit only
D	Receiver unit only
blank	Stand-alone or slave unit
12	No. of optical axis of the connected slave unit for 25 mm optical pitch type: 12, 18, 24, or 30 for 50 mm optical pitch type: 06, 09, 12, or 15 for 75 mm optical pitch type: 04, 06, 08, or 10

Stand-alone	Master unit	Slave unit	Optical resolution	No. of optical axes	Protective height	Weight (without accessories)
F3S-B122P	F3S-BM122P□□	F3S-BS122	30 mm	12	300 mm	0.9 kg
F3S-B182P	F3S-BM182P□□	F3S-BS182		18	450 mm	1.2 kg
F3S-B242P	F3S-BM242P□□	F3S-BS242		24	600 mm	1.5 kg
F3S-B302P	F3S-BM302P□□	F3S-BS302		30	750 mm	1.8 kg
F3S-B362P	F3S-BM362P□□	-		36	900 mm	2.1 kg
F3S-B422P	F3S-BM422P□□	-		42	1,050 mm	2.5 kg
F3S-B482P	F3S-BM482P□□	-		48	1,200 mm	2.8 kg
F3S-B542P	F3S-BM542P□□	-		54	1,350 mm	3.1 kg
F3S-B602P	F3S-BM602P□□	-		60	1,500 mm	3.4 kg
F3S-B662P	F3S-BM662P□□	-		66	1,650 mm	3.7 kg
F3S-B065P	F3S-BM065P□□	F3S-BS065	55 mm	6	300 mm	0.9 kg
F3S-B095P	F3S-BM095P□□	F3S-BS095		9	450 mm	1.2 kg
F3S-B125P	F3S-BM125P□□	F3S-BS125		12	600 mm	1.5 kg
F3S-B155P	F3S-BM155P□□	F3S-BS155		15	750 mm	1.8 kg
F3S-B185P	F3S-BM185P□□	-		18	900 mm	2.1 kg
F3S-B215P	F3S-BM215P□□	-		21	1,050 mm	2.5 kg
F3S-B245P	F3S-BM245P□□	-		24	1,200 mm	2.8 kg
F3S-B275P	F3S-BM275P□□	-		27	1,350 mm	3.1 kg
F3S-B305P	F3S-BM305P□□	-		30	1,500 mm	3.4 kg
F3S-B335P	F3S-BM335P□□	-		33	1,650 mm	3.7 kg
F3S-B047P	F3S-BM047P□□	F3S-BS047	80 mm	4	300 mm	0.9 kg
F3S-B067P	F3S-BM067P□□	F3S-BS067		6	450 mm	1.2 kg
F3S-B087P	F3S-BM087P□□	F3S-BS087		8	600 mm	1.5 kg
F3S-B107P	F3S-BM107P□□	F3S-BS107		10	750 mm	1.8 kg
F3S-B127P	F3S-BM127P□□	-		12	900 mm	2.1 kg
F3S-B147P	F3S-BM147P□□	-		14	1,050 mm	2.5 kg
F3S-B167P	F3S-BM167P□□	-		16	1,200 mm	2.8 kg
F3S-B187P	F3S-BM187P□□	-		18	1,350 mm	3.1 kg
F3S-B207P	F3S-BM207P□□	-		20	1,500 mm	3.4 kg
F3S-B227P	F3S-BM227P□□	-		22	1,650 mm	3.7 kg

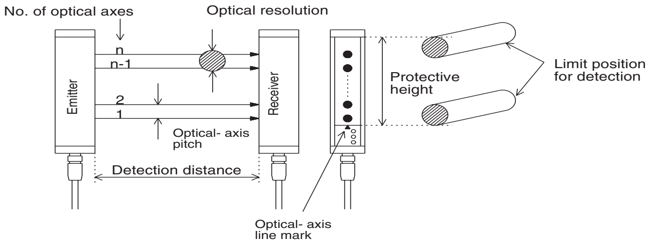
Nomenclature

Protective height

The F3S-B can detect in the area indicated by "Protective height" in the figure below. The protective height is from "the Optical-axis line mark above the indicator area" to "the end of the yellow metal case".

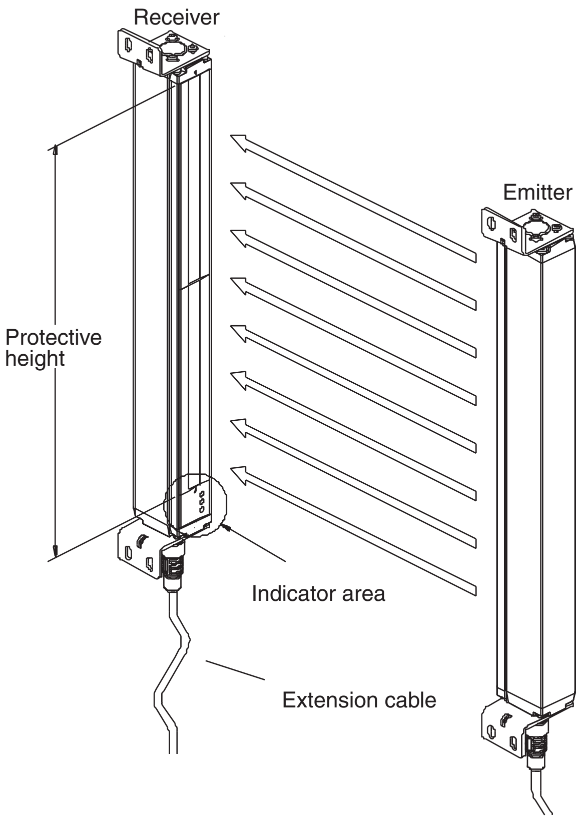
Optical-axis line mark

The center line for optical axes is indicated by the triangle mark. This position is a reference line for measuring safety distance.



Stand-alone type

This is the most common configuration, and it is used to protect a hazardous part of a machine when approached from one direction only.

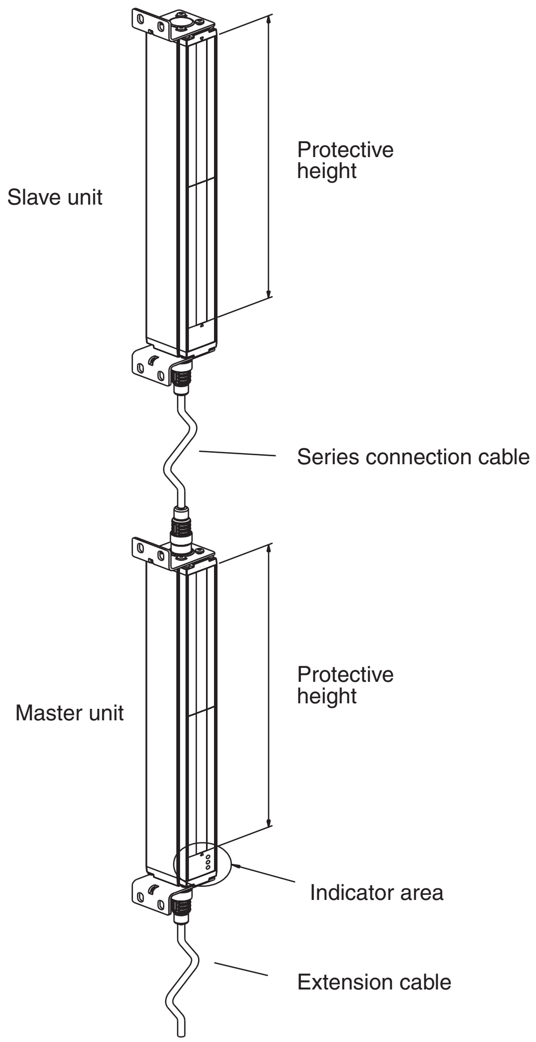


Series connection types

When your application requires an additional protective zone, for example, to prevent someone from staying behind a primary detection zone, the F3S-B may be connected in series. The system consists of a master unit, a slave unit, and a series connection cable, type F39-JB1B.

The series connection allows up to 96 axes and 2.4 m of protective height in total.

Series connection types have the same characteristics as a stand-alone types. When the detection zone of the master unit or that of the slave unit is interrupted, the outputs of the master unit go to the OFF-state.



Note: Slave unit does not have indicators.
Master unit and slave unit need to be ordered separately.

F3S-B

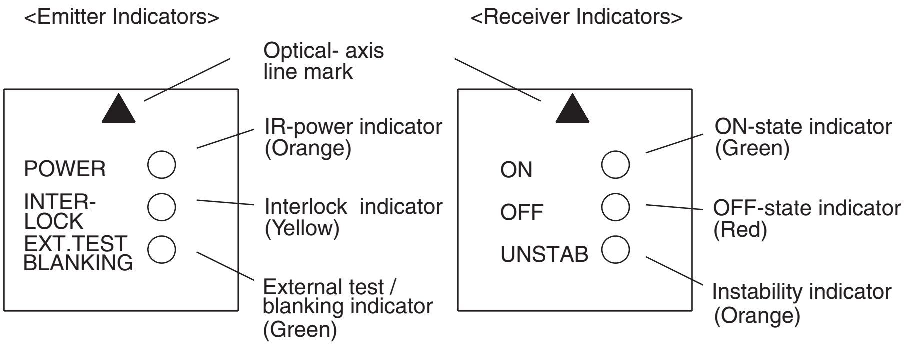
Rating and Performance

Type	F3S-B□□□P[*1] Stand-alone			F3S-BM□□□P□□[*1] Master unit for series connection			F3S-BS□□□[*1] Slave unit for series connection		
No. of optical axes	12 to 66	6 to 33	4 to 22	12 to 66	6 to 33	4 to 22	12 to 30	6 to 15	4 to10
Optical-axis pitch	25 mm	50 mm	75 mm	25 mm	50 mm	75 mm	25 mm	50 mm	75 mm
Optical resolution (Detection capability)	Non-transparent: in diameter								
	30 mm	55 mm	80 mm	30 mm	55 mm	80 mm	30 mm	55 mm	80 mm
Protective height	300 / 450 / 600 / 750 / 900 / 1,050 / 1,200 / 1,350 / 1,500 / 1,650 mm						300 / 450 / 600 / 750 mm		
Detection distance	0.3 to 5.0 m, up to 8 m on request								
Response time	ON to OFF: See table “Response Time” OFF to ON[*2]: Default 100 ms (selectable with F39-U1E, 80 to 400 ms)								
Startup waiting time	2 s max.								
Supply voltage: Vs	24 VDC ± 20% (including 5 Vp-p ripple)								
Current consumption	400 mA max. (under no-load conditions)								
Light source	Infrared LED (880 nm wavelength). Lifetime: 50,000 hrs. at 25 °C.								
Effective aperture angle	Within ± 5° for the emitter and receiver at a detection distance of at least 3 m according to IEC 61496-2								
Operating mode	Light ON								
Control output	Two PNP transistor outputs, load current 200 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)								
Instability output	PNP transistor output (not safety-related control output), activated during an insufficient light detection, failure detection and connection with F39-E1, load current 100 mA max., residual voltage 2 V max. (except for voltage drop due to cable extension)								
Protection circuit	Output short-circuit protection, power supply reverse connection protection								
Start/restart interlock function	Mode selection before power ON by connecting ”Interlock selection input” line to: Active: No connection or 0 to 2.5 VDC, 3 mA max. Inactive: Instability output line Reset of start/restart interlock by connecting ”Interlock selection input” line to: Interlock reset: 17 VDC to Vs, 20 mA max. Duration time 15 to 2,500 ms								
External test function	Mode selection by connecting ”External test input” line to: Active: 17 VDC to Vs, 10 mA max. Duration time at least 15 ms Inactive: No connection or 0 to 2.5 VDC, 2 mA max.								
Relay monitoring function (optional)	Default inactive, selectable with F39-U1E Relay monitoring input line with NC contact connected, Available level: 17 VDC to Vs, 10 mA max. Allowed relay delay time[*3]: Selectable between 20 and 300 ms Termination when not selected: No connection or 0 to 2.5 VDC, 2 mA max.								
Start interlock function (optional)	Default inactive, selectable with F39-U1E								
Blanking function (optional)	Default inactive, selectable with F39-U1E								
Indicator	See ”Indicators”						No indicators		
Connection method	For Extension cable: 8 pins, M12 connector For Series connection cable: 6 pins, M12 connector								
Ambient temperature	During operation: –10 to 55 °C (with no freezing) During storage: –25 to 70 °C								
Ambient humidity	During operation: 35 to 85 %RH (with no condensation) During storage: 35 to 95 %RH								
Insulation resistance	20 MΩ min. (at 500 VDC)								
Dielectric strength voltage	1,000 VAC 50/60 Hz for 1 min								
Degree of protection	IEC60529 IP65								
Vibration resistance	Normal operation: 10 to 55 Hz, double-amplitude: 0.7mm, X, Y and Z directions 20 sweeps								
Shock resistance	Normal operation: 100 m/s^2 [10 G], X, Y and Z directions: 1000 times								
Materials	Case: Aluminum Front cover: PMMA (acrylic resin) End caps: PA6								
Size (cross section)	30 x 40 mm								

Type	F3S-B□□□P*1 Stand-alone	F3S-BM□□□P□□ *1 Master unit for series connection	F3S-BS□□□*1 Slave unit for series connection
Accessories	Test rod*3, mounting brackets (top and bottom), mounting brackets (intermediate)*4, mounting plates*5, Instruction manual*5		
Applicable standard	IEC(EN)61496-1 TYPE 2 ESPE (Electro-Sensitive Protective Equipment) IEC 61496-2 TYPE 2 AOPD (Active Opto-electronic Protective Devices)		

Note: 1 . For detailed type names and optical specifications, see „Type Naming Rule“
2 . Nominal value (set time). The accuracy is -0 ... +70% of the ON to OFF response time.
3 . Only with F3S-B□□□2P and BM□□□2P□□.
4 . For the 1,050 mm protective height and longer types.
5 . Only with F3S-B□□□P□ and BM□□2P□□.

Indicators



Emitter	IR-power indicator: Interlock indicator: External test/ blanking indicator:	Lit when emitting. Lit during start/restart interlock or start interlock. Lit during external test. / Flashing when using blanking function.
Receiver	ON-state indicator: OFF-state indicator: Instability indicator:	Lit when receiving light. Lit with interrupted light. Flashing during connection with F39-E1 or with failure. Lit with an insufficient light reception or failure. Flashing during connection with F39-E1.

Table of Response Time

Stand-alone type

	Response time [ms]		Response time [ms]		Response time [ms]
F3S-B122P	20	F3S-B065P	20	F3S-B047P	20
F3S-B182P	20	F3S-B095P	20	F3S-B067P	20
F3S-B242P	20	F3S-B125P	20	F3S-B087P	20
F3S-B302P	23	F3S-B155P	20	F3S-B107P	20
F3S-B362P	27	F3S-B185P	20	F3S-B127P	20
F3S-B422P	30	F3S-B215P	21	F3S-B147P	20
F3S-B482P	34	F3S-B245P	22	F3S-B167P	20
F3S-B542P	37	F3S-B275P	24	F3S-B187P	20
F3S-B602P	41	F3S-B305P	26	F3S-B207P	20
F3S-B662P	45	F3S-B335P	28	F3S-B227P	21

Series connection types

The following chart shows the response time of combinations of a master unit and a slave unit connected in series. For example, the response time of the combination of F3S-BM122P30 and F3S-BS302 is 30 ms.

	Response time [ms]			
Slave unit F3S- Master unit	BS122	BS182	BS242	BS302
F3S-BM122P□□	20	23	27	30
F3S-BM182P□□	23	27	30	34
F3S-BM242P□□	27	30	34	37
F3S-BM302P□□	30	34	37	41
F3S-BM362P□□	34	37	41	45
F3S-BM422P□□	37	41	45	49
F3S-BM482P□□	41	45	49	54
F3S-BM542P□□	45	49	54	57
F3S-BM602P□□	49	54	57	61
F3S-BM662P□□	54	57	61	65

	Response time [ms]			
Slave unit F3S- Master unit	BS047	BS067	BS087	BS107
F3S-BM047P□□	20	20	20	20
F3S-BM067P□□	20	20	20	20
F3S-BM087P□□	20	20	20	20
F3S-BM107P□□	20	20	20	20
F3S-BM127P□□	20	20	20	21
F3S-BM147P□□	20	20	21	23
F3S-BM167P□□	20	21	23	24
F3S-BM187P□□	21	23	24	25
F3S-BM207P□□	23	24	25	26
F3S-BM227P□□	24	25	26	27

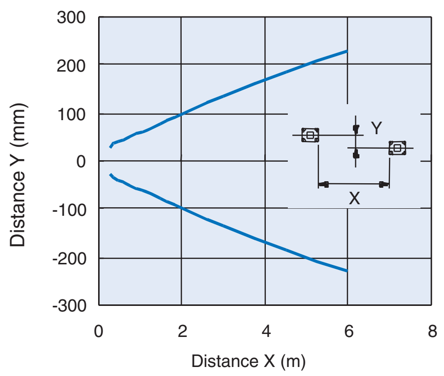
	Response time [ms]			
Slave unit F3S- Master unit	BS065	BS095	BS125	BS155
F3S-BM065P□□	20	20	20	21
F3S-BM095P□□	20	20	21	22
F3S-BM125P□□	20	21	22	24
F3S-BM155P□□	21	22	24	26
F3S-BM185P□□	22	24	26	28
F3S-BM215P□□	24	26	28	30
F3S-BM245P□□	26	28	30	32
F3S-BM275P□□	28	30	32	34
F3S-BM305P□□	30	32	34	35
F3S-BM335P□□	32	34	35	37

Characteristic data

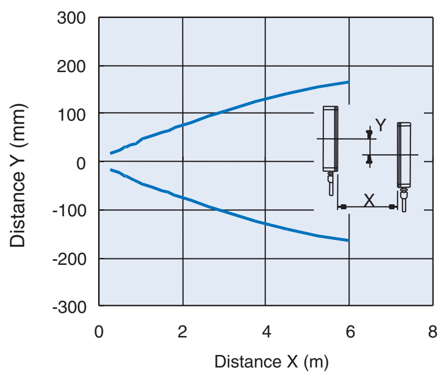
Operating Range

F3S-B122P

Parapendicular to Center Line of Lenses

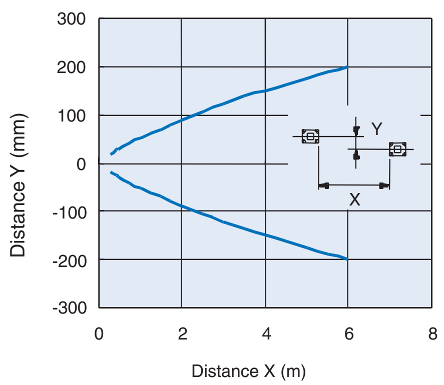


Parallel to Center Line of Lenses

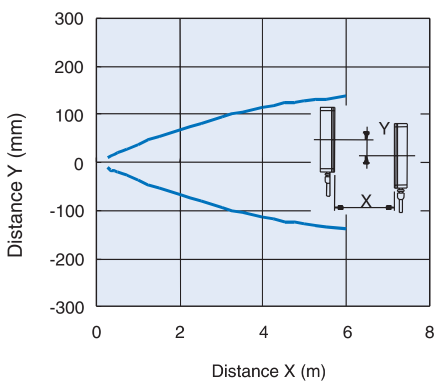


F3S-B662P

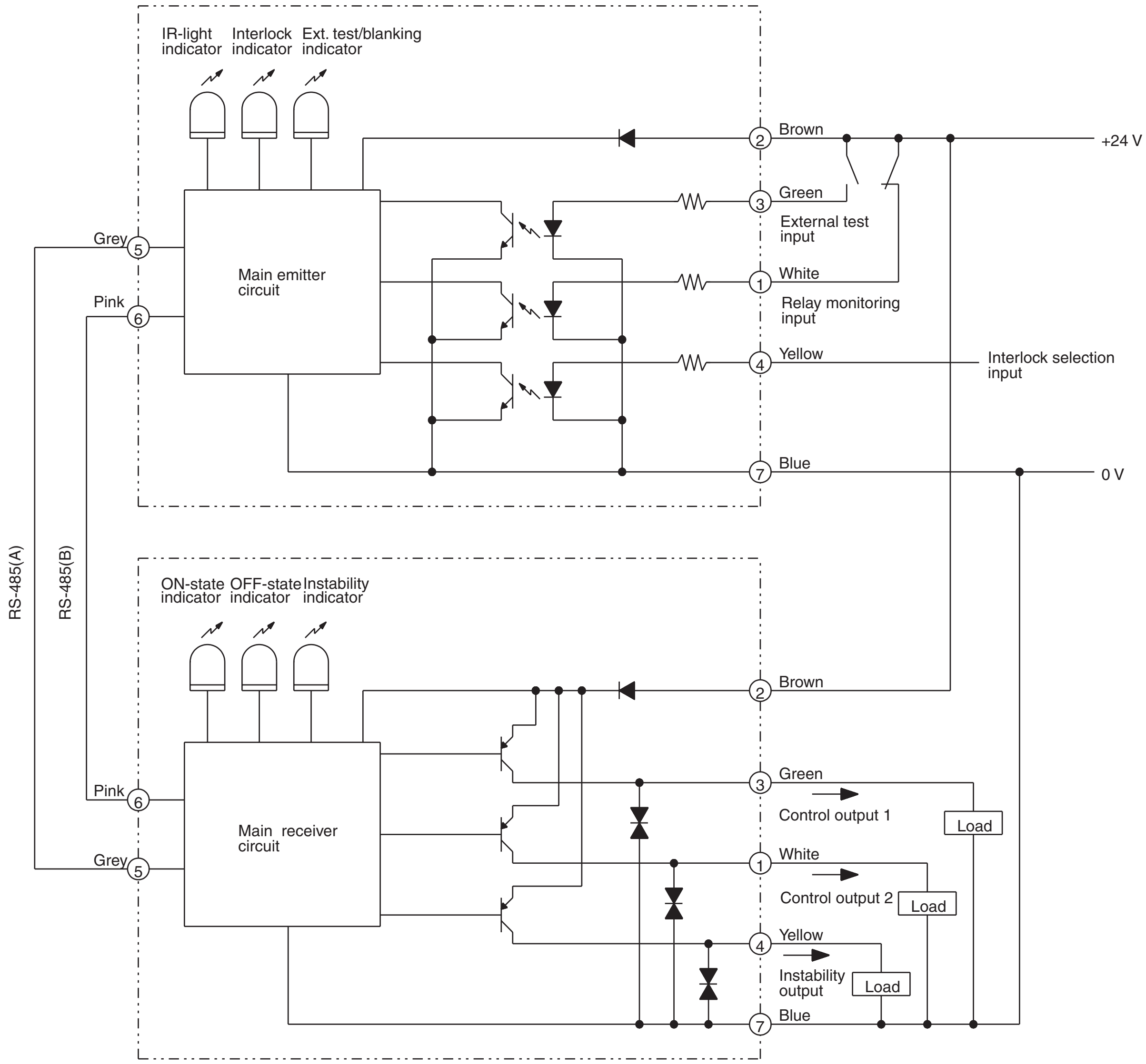
Parapendicular to Center Line of Lenses



Parallel to Center Line of Lenses



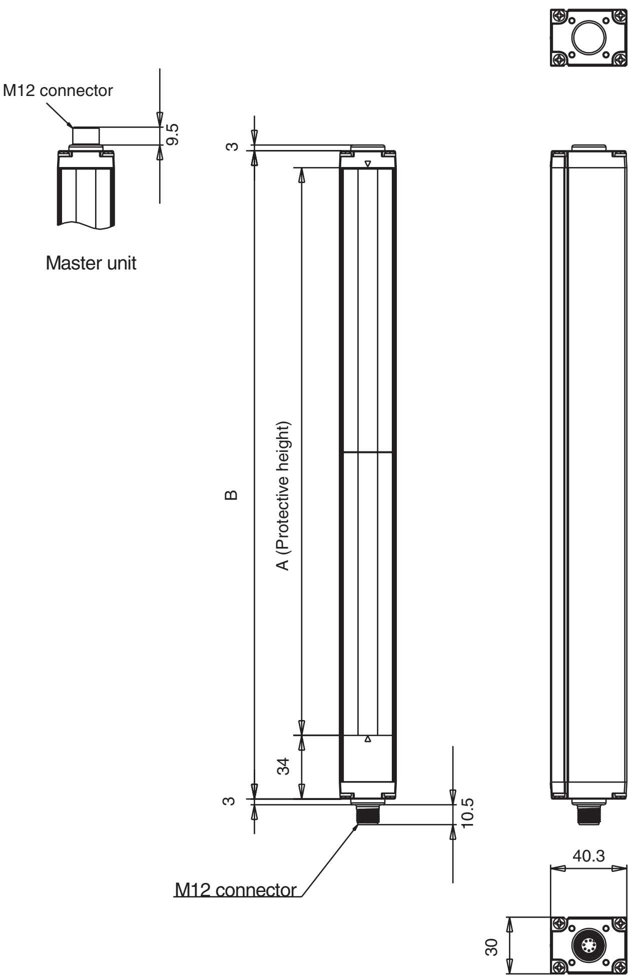
I/O Circuit Diagram



Dimensions

Safety Light Curtain

F3S-B

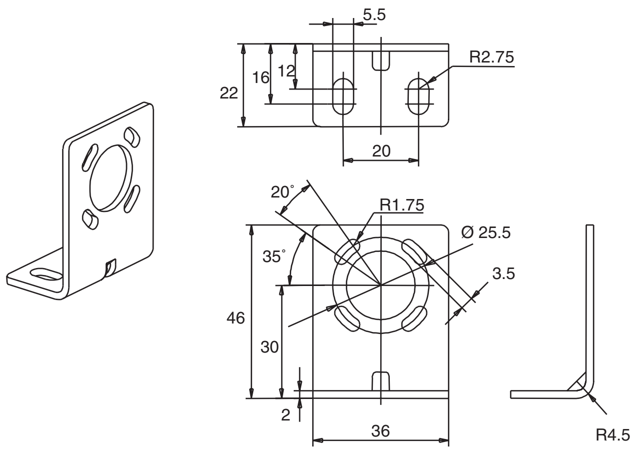


Type	**A** Protective height	**B** Full length
F3S-B122, -B065, -B047	300	343
F3S-B182, -B095, -B067	450	493
F3S-B242, -B125, -B087	600	643
F3S-B302, -B155, -B107	750	793
F3S-B362, -B185, -B127	900	943
F3S-B422, -B215, -B147	1050	1093
F3S-B482, -B245, -B167	1200	1243
F3S-B542, -B275, -B187	1350	1393
F3S-B602, -B305, -B207	1500	1543
F3S-B662, -B335, -B227	1650	1693

Note:All units are in Millimeters unless otherwise indicated.

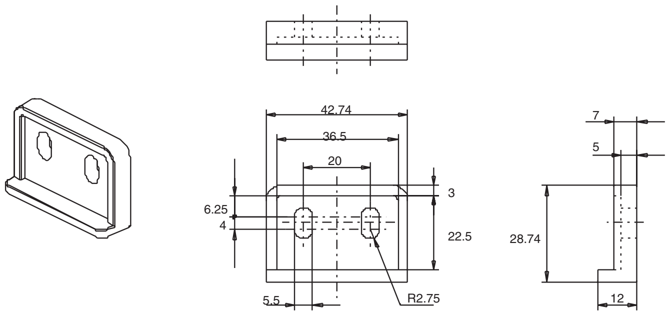
Accessoires

Mounting Bracket (Top and Bottom)



Mounting Plate

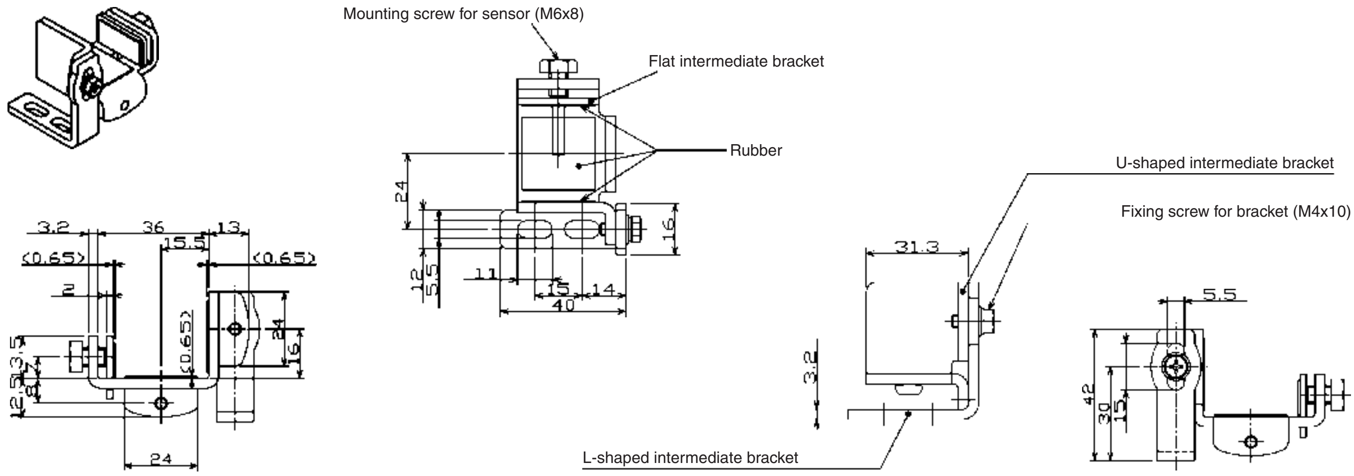
Only supplied with types which have a protective height of 1050 mm or longer (Including intermediate brackets). Only needed for rear mounting



F3S-B

Intermediate Mounting Bracket

Only needed for types which have a protective height of 1050 mm or longer



Options (Order Separately)

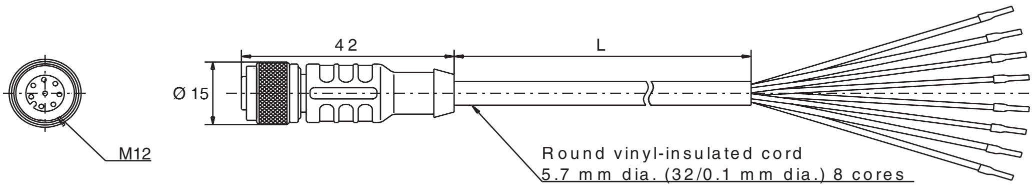
Extension Cable

(Set of 2: Emitter > gray, Receiver > black)

F39-JB1A (L = 3 m)

F39-JB2A (L = 7 m)

F39-JB3A (L = 10 m)

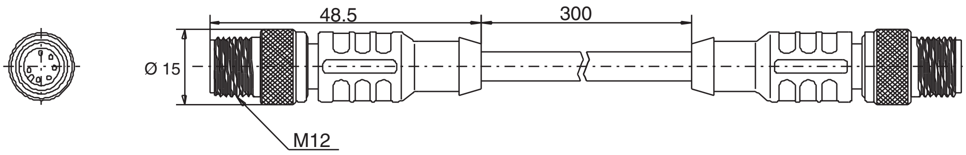


Unit: mm

Series Connection Cable

(Set of 2: Emitter > gray, Receiver > black)

F39-JB1B



Unit: mm

Optional Function Kit

F39-EU1E

This set includes the following items:

- F39-U1E OptionalFunction Software
- F39-E1 Interface Unit
- F39-JB1C Interface Cable

The F39-U1E Optional Function Software is the WINDOWS®-based software for use with the F39-E1 Interface Unit to program the F3S-B Safety Light Curtain, and provided with one 3.5 inch floppy disk. This software has the following features:

- Set the following functions to the F3S-B
  - Start interlock function
  - Relay monitoring function
  - Blanking function
- Display each axis and each input line condition of the F3S-B
- Change the ON delay time

Note: The F3S-B is not in normal operation during connection with the F39-E1. The control outputs are held in their OFF-state. For detailed information please refer to “Details of F39-EU1E” in this data sheet.

⚠WARNING

After setting the blanking function, check that the F3S-B detects a test rod at any position in the F3S-B detection zone through which a person reaches the hazardous part of the machine. If any positions are found by check above, install protective structures to there to prevent intrusion which F3S-B can not detect. Failure to do so may result in serious injury.

Perform the installation check and the periodical inspection described in the F3S-B manual.

Disconnect the outputs of the F3S-B from the load when programming it using the F39-U1E software and with F39-E1 interface unit. Failure to do so may result in serious injury.

Do not connect the F39-E1 to a power supply with a voltage higher than 24 VDC +20 %. Do not connect the F39-E1 to an AC power supply.

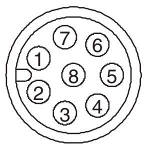
Installation

Wiring

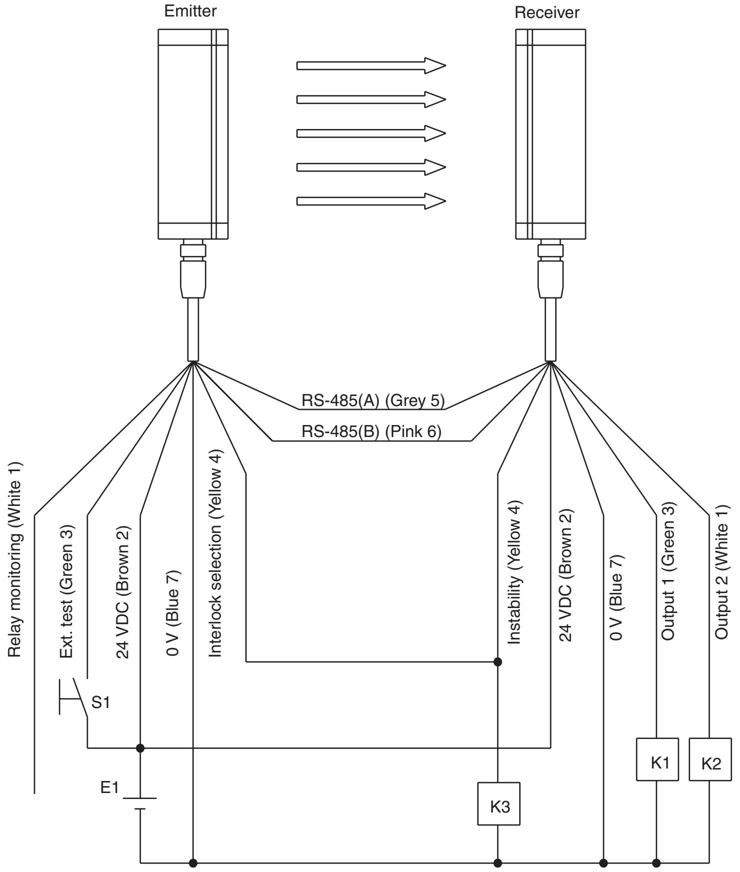
Disconnect all sources of power before wiring the F3S-B to a machine.

- Connect the emitter extension cable (F39-JBxA-L optional, gray color outer jacket) to the emitter. (The emitter uses gray color plastic caps.)
- Connect the receiver extension cable (F39-JBxA-D optional, black color outer jacket) to the receiver. (The receiver unit uses black color plastic caps.)
- Connect the 0 V line of the power supply directly to protective earth (PE).

Note: Note:Be sure to wire correctly. Failure to do so may damage the F3S-B.

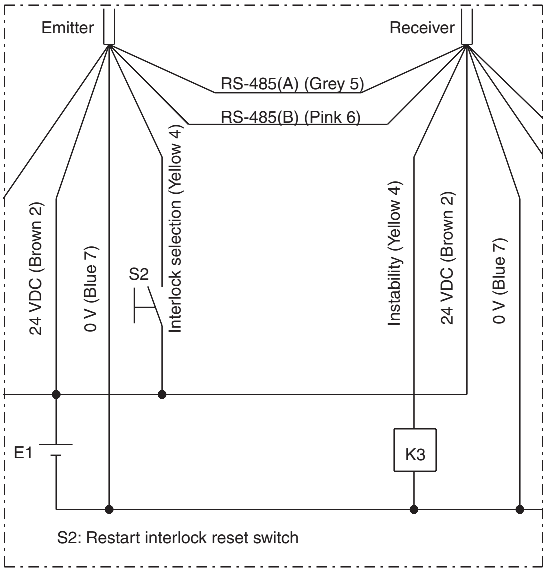
Front View	Pin No.	Signal Name		Wire Color of Extension Cable
		Receiver	Emitter	
	1	Control output 2	Relay monitoring input	White
	2	24 VDC	24 VDC	Brown
	3	Control output 1	External test input	Green
	4	Instability output	Interlock selection input	Yellow
	5	RS-485 (A)	RS-485 (A)	Grey
	6	RS-485 (B)	RS-485 (B)	Pink
	7	0 V	0 V	Blue
	8	N.C. / reserved*1	N.C. / reserved	Red

*1. N.C. / reserved: do not connect

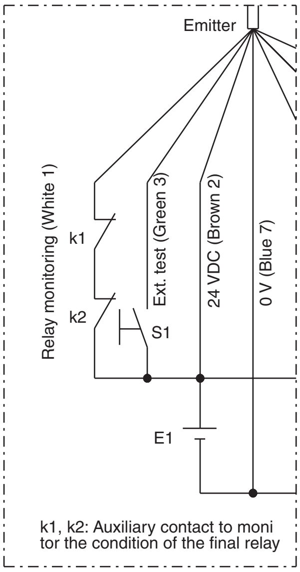


E1: 24 VDC Power supply
S1: External test switch
K1, K2: Relay
K3: Relay to indicate unstable condition

When using START/RESTART FUNCTION



When using optional RELAY MONITORING FUNCTION



Details of F39-EU1E Optional Function Kit

1. Installation

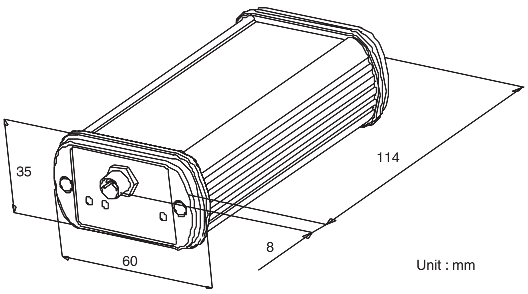
1.1 Preparation

⚠WARNING

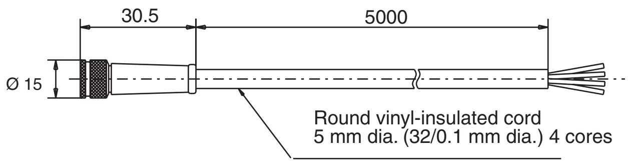
Perform the installation check and the periodical inspection described in the F3S-B manual.
Do not disassemble, repair or modify the F39-E1.
Do not use the F39-E1 in flammable or explosive environments.

To use the F39-U1E software, the following items are necessary.

- Personal Computer (not included)
  - Windows® 95, Windows® 98, or Windows NT®
  - 133MHz Pentium® processor or better
  - 32MB RAM or higher for Windows® 95 and Windows® 98
  - 64MB RAM or higher for Windows NT®
  - A 115kBd RS-232 serial interface port or better
- F39-E1 Interface Unit



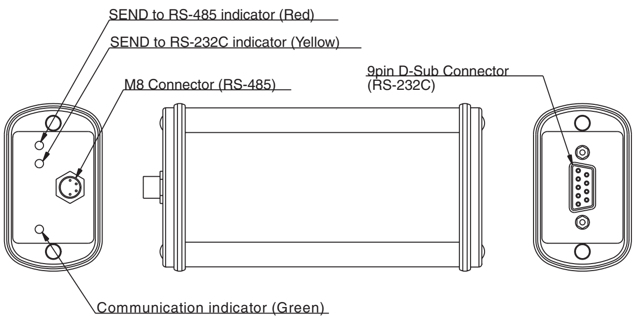
- F39-JB1C Interface cable 5 m cable length, M8 connector (4 pins)



Unit : mm

- RS-232C cable (not included)

1.2 Component Names and Functions of the F39-E1 Interface Unit



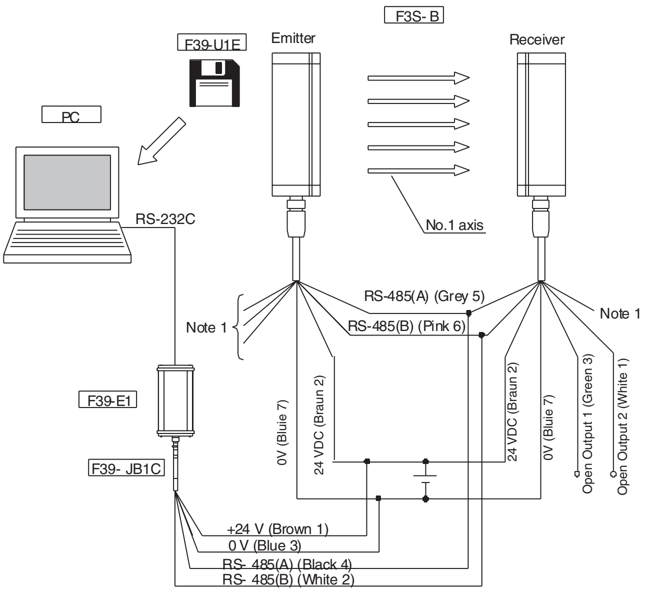
SEND to RS-485 Indicator (Red)
Lit when the F39-E1 sends data to the F3S-B via RS-485.
SEND to RS-232C Indicator (Yellow)
Lit when the F39-E1 sends data to the PC via RS-232C.
COMMUNICATION Indicator (Green)
Flashing during communication between the F3S-B and the F39-E1.

1.3 Hardware Connection

⚠WARNING

Disconnect the outputs of the F3S-B from the load when programming it using the F39-U1E software and with F39-E1 interface unit. Failure to do so may result in serious injury.
Do not connect the F39-E1 to a power supply with a voltage higher than 24 VDC +20 %.
Do not connect the F39-E1 to an AC power supply.

1.3.1 Wiring Diagram



Note 1: See the instruction manual of F3S-B for wiring

1.3.2 Wiring Procedure

1. Connect the F3S-B (see the instruction manual of the F3S-B for wiring.)
2. Connect the Interface cable (F39-JB1C) to the Interface unit (F39-E1).
3. Connect the 4 wires of the Interface cable to each appropriate line of the F3S-B.
4. Connect an RS-232C cable to the PC and the Interface unit.

1.4 Software-Installation

Copy the file „F39-U1E_ver#.#.exe“ and F39-U1E_ver#.#dat from the enclosed 3.5-inch floppy disk onto the hard disk of the PC.

2. Function Description

2.1 Start Interlock

When the Start interlock function is used, the F3S-B does not go to the ON-state automatically after power ON. Interrupting one or more axes resets the start interlock condition of the F3S-B then starts normal operation. The duration of the interruption must be equal or shorter as defined in the „Max. interruption time (sec)“.

Max. Interruption Time

The max interruption time can be set between 0.3 and 2 s.

Note: In the case both the Start interlock and the Start/restart interlock are selected, only the Start/restart interlock will be activate.

Start/Restart interlock is a function which is selected by wiring. Refer to the instruction manual of the F3S-B for more detailed information.

2.2 Relay Monitoring

MPCEs (Machine Primary Control Elements) are usually relays or contactors used to control hazardous movement directly. The state of the MPCEs can be checked with the Relay monitoring function.
A voltage of 17 VDC to Vs (Supplied voltage to F3S-B) has to be applied to the Relay monitoring input through the NC contacts of the MPCEs when the F3S-B control outputs are in the OFF-state (see the F3S-B manual for wiring information). To ensure this logic relation, the MPCEs must be safety approved types, with forcibly guided contacts.
Allowed Relay Delay Time
The allowed relay delay time can be set between 20 and 300 ms. This delay time has to be set at least 20 milliseconds shorter than the Outputs ON delay time.

2.3 Outputs ON Delay

You can set the ON delay time of control outputs between 80 and 400 ms. This corresponds to the time which the control outputs go to ON-state after the detection zone is not interrupted.

Note: 1 . When the Relay monitoring function is also used, the ON delay time must meet the formula below.
2 . ON delay time   Allowed relay delay time + 20 ms After the Relay monitoring function is set, if the ON delay time does not meet the above formula, the ON delay time will be changed automatically into "Allowed relay delay time" + 20 ms.

2.4 Blanking

With the Blanking function, one or more axes can be disabled. This function is useful in an application where a part of the F3S-B detection zone is always interrupted. The Manual-setting and the Teaching-setting are available to select the blanked axes.

Note: 1 . In the case the blanked zone is not filled with structure completely and remains some opening, the opening must be filled with the protective structure.
2 . All axes can not be disabled. At least one axis needs to be active.

3. Ratings and Performance

Type	F39-E1 Interface unit
Supply voltage	24 VDC ± 20% (including 5 Vp-p ripple)
Current Consumption	120 mA max.
Interface	RS-232C interface, RS-485 interface
Indicator	See 1-2
Connection method	RS-485: 4pins, M 8 connector
	RS-232C: D-SUB connector, 9 pins
Protection circuit	RS 485 protection against wrong wiring
Ambient Temperature	During operation: –10 to 55° C (with no freezing)
	During storage: –25 to 70° C
Ambient Humidity	During operation : 35 to 85% RH (with no condensation)
Ambient Humidity	During storage: 35 to 95% RH
Insulation Resistance	20 MΩ min. (at 500 VDC)
Dielectric strength voltage	500 VAC 50/60 Hz for 1 min.
Degree of Protection	IEC60529 IP20
Shock resistance	Normal operation: 150 m/s^2 [15 G], ±X, ±Y and ±Z directions: 3 times
Vibration resistance	Normal operation: 10 to 55 Hz, double-amplitude: 0.3mm, X, Y and Z directions: 10 sweeps
Cable length	RS-485 cable: 5 m (4 pin 0.25 mm^2)
	RS-232C cable: Standard
Materials	Case: Aluminum
Size	122 x 60 x 35 mm
Conformity	EMC Directive

Precautions

⚠WARNING

1. Do not use the F3S-B on machines that can not be stopped by electrical control in case of an emergency.
2. Do not use the F3S-B in flammable or explosive environments
3. Always maintain the safety distance between F3S-B and a hazardous part of the machine. Serious injury may result if the machine does not stop before someone reaches the hazardous part.
4. Install protective structures around a machine so that you must pass through the detection zone to reach a hazardous part of the machine.
5. Install F3S-B so that some parts of the operator's body remain in the detection zone at all times when the operator works in the hazardous area.
6. Failure to do so may result in serious injury.

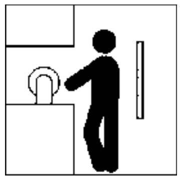
Correct installation

A hazardous part of a machine can be reached only by passing through the sensor detection zone.

Some part of the operator's body remains in the detection zone while they are working.

Incorrect installation

A hazardous part of the machine can be reached without passing through the sensor detected zone.

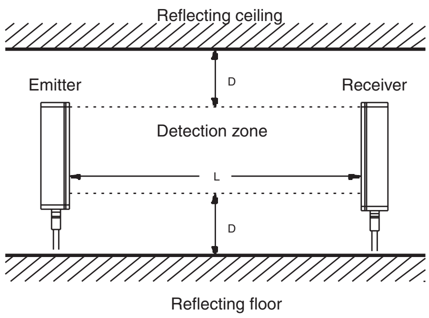


A worker is between the sensor detection zone and a hazardous part of a machine.

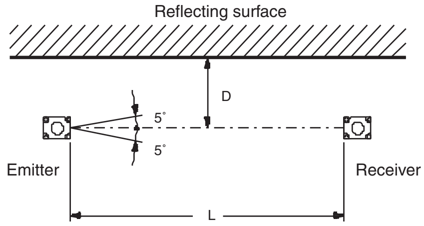
⚠WARNING

1. Be sure to install the F3S-B to minimize the effects of reflections from reflective surfaces. Failures to do so will create an inability to detect and may result in serious injury
2. Install the F3S-B with a minimum distance D as shown below form the reflective surface (highly reflective surfaces) like metal walls, floors, ceilings, and work pieces.

<Side View>



<Top View>

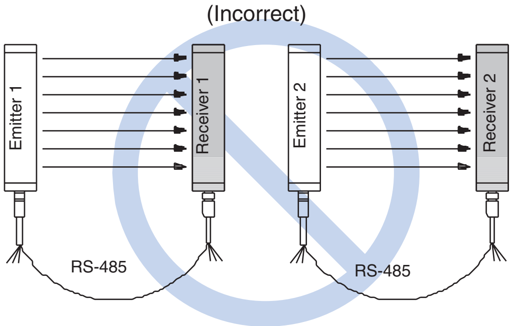


Distance between emitter and receiver (detection distance L)	Minimum installation distance D
0.3 to 3 m	0.26 m
3 to 5 m	L x tan 5° = L x 0.088 (m)

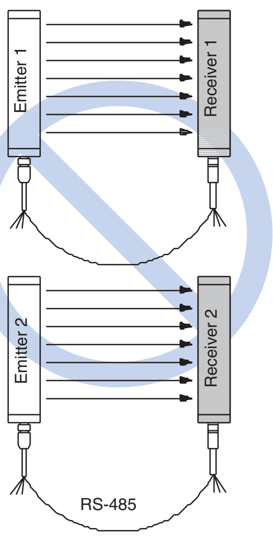
⚠WARNING

When using multiple sets of the F3S-B, install them so that mutual interference is not incurred.

(Incorrect)



(Incorrect)



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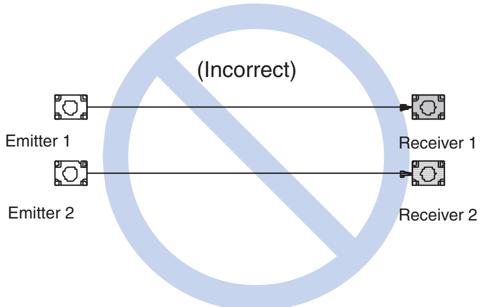
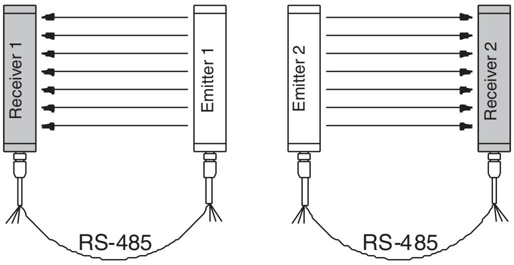


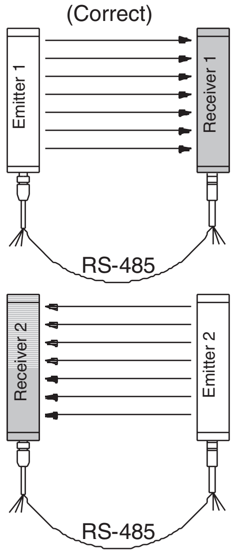
Alternate emitters and receivers

Correct installations are shown below to prevent mutual interference.

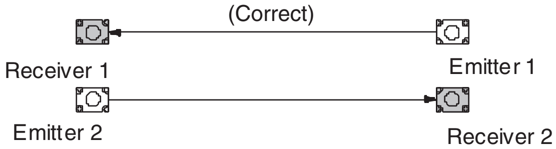
(Correct)



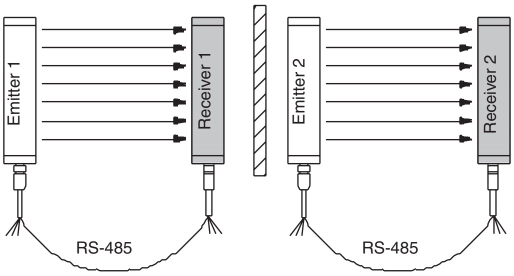
(Correct)



(Correct)

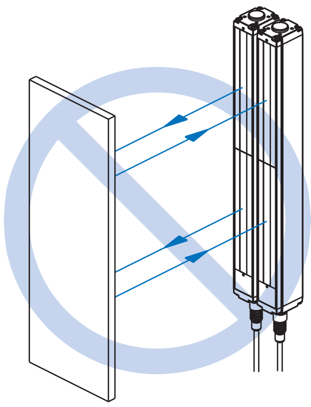


(Correct)



⚠WARNING

1. The F3S-B is a TYPE 2 Electro-sensitive protective equipment, intended to be used as or with the safety related part of control system to category 2, 1 or B as defined in the European standard EN954-1.
   Do not use the F3S-B in category 3 or 4 systems.
2. A qualified person, as determind by local regulations, must confirm that installation, inspection and maintenance are implemented correctly.
3. Do not short the output lines to the +24 V line. Doing so will cause the output to be always ON, creating a hazardous situation.
4. Do not connect the F3S-B to a power supply with voltage higher than 24 VDC + 20%. Do not connect the F3S-B to an AC power supply.
5. Be sure to conduct inspections regularly.
6. The F3S-B cannot be used in applications where hazardous projectiles may exit the protected zone.
7. Do not disassemble, repair or modify the F3S-B.
8. DC power supply units must satisfy all of the conditions below so that the F3S-B can comply with the applicable standards IEC 61496-1 and UL 508.
   (1.) The power supply voltage must be within rating (24 VDC ± 20%).
   (2.) The power supply is connected only to the F3S-B and to the electro-sensitive protective function of the F3S-B, such as a safety controller and muting sensors, and it has enough rated current for all the devices.
   (3.) The power supply uses double or reinforced insulation between the primary and secondary circuits.
   (4.) The power supply automatically resets overcurrent protection characteristics (voltage drop).
   (5.) The power supply maintains an output holding time of at least 20 ms.
   (6.) FG (frame ground terminal) must be connected to PE (protective earth) when using a commercially available switching regulator.
   (7.) The power supply must have output characterisitics required for the power source for Class 2 Circuit or Limited Voltage / Current Circuit as defined in UL508.
   (8.) The power supply must conform to regulatory requirements and standards, regarding EMC and electrical equipment safety, of the country where the F3S-B is installed and where machinery will be operated, for example: The EMC Directive (industrial environment) and the Low Voltage Directive in EU.
9. Do not use the F3S-B in a direct retroreflective configuration. Otherwise detection may fail.



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety sensor for Palletisers

F3S-TGR-SB□C series

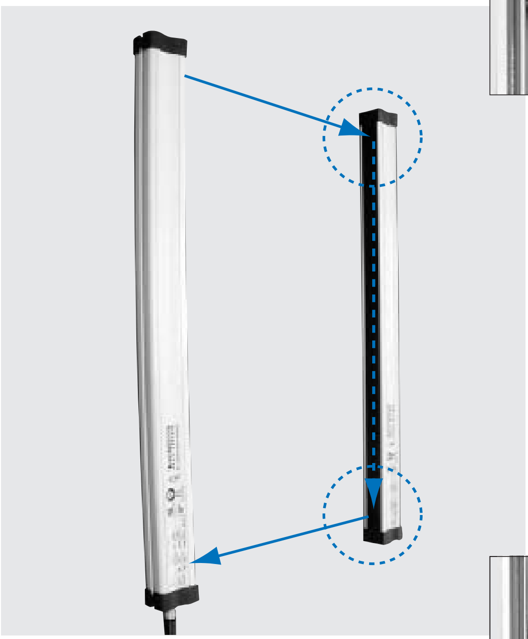
Features

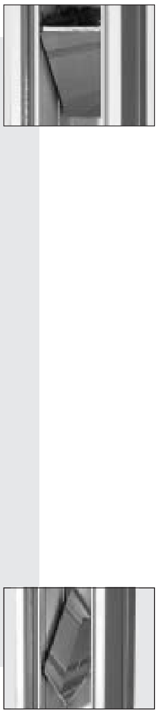
For Palletiser

F3S-TGR-SB□C series has been developed especially for Palletisers and wrapping machine access protection applications.

Active - Passive system and Plug and play

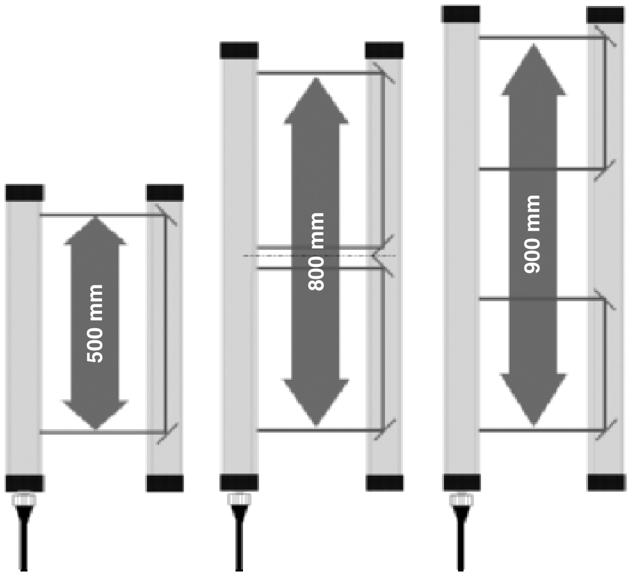
By using a mirror system we can achieve an active - passive multi beam system. This active passive system will improve installation time and reduce costs.





3 Different types available

We provide 3 different Types as following:
- 2 beam Type (beam pitch 500 mm)
- 3 beam Type (beam pitch 400 mm)
- 4 beam Type (beam pitch 300 mm)



Muting functions are integrated

Following Muting functions are integrated:
- Muting sensor inputs
- Muting Lamp output
- Override input (120 second max)
- Test / Reset input
- Interlock function and Test Reset input

F3S-TGR

Decentralized Muting connection Box

Furthermore, using a F39-TGR-SB-CMB1, it's possible to reduce the wiring time and wiring material for the muting Sensors and Muting Lamp etc.

To Barrier

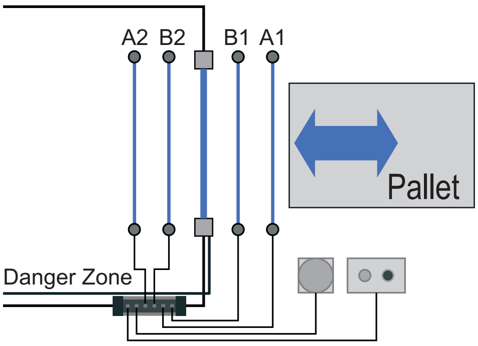
To Cabinet

In the conventional solution all wires from the light curtain, mute sensors, lamp, reset are wired back to the mute controller in the control cabinet (See Ex. 1)
As you can see this solution need JUST ONE WIRE to the cabinet (See Ex. 2)

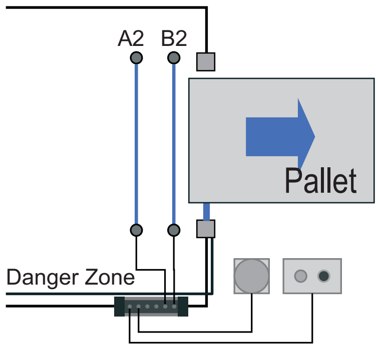
Ex. 1 Ex. 2

Multiple mute connections are possible

1. PARALLEL MUTING and TWO WAY direction

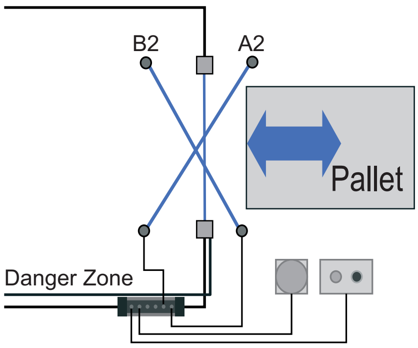


2. PARALLEL MUTING and ONE WAY direcion

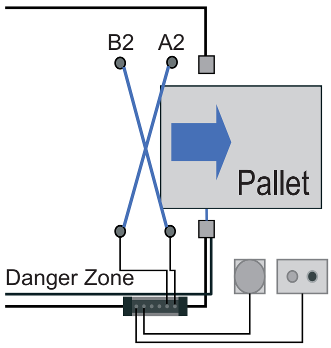


Please add MTL*. Ex. F3S-TGR-SB4-K1CMTL

3. CROSS MUTING and TWO WAY direction



4. CROSS MUTING and ONE WAY direction



Please add MTL*. Ex. F3S-TGR-SB4-K1CMTL

Reference

Muting Lamp | Override and Test Switch | F3S-TGR-SB□-K□C | Muting sensor | F3S-TGR-SB-CMB□

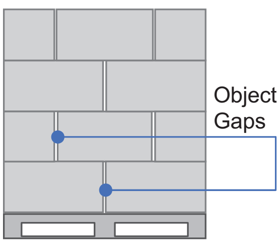
Mechanical Guard *MTL has a special software inside of F3S-TGR-SB□C which works to finalize a Muting function.

Muting Sensors Recommendation

It is recommended to use the E3Z or E3G as muting sensor. Please refer to the E3Z datasheet *Cat.No. E701-E2-Cat04-01* and the E3G datasheet *Cat.No. E278-E2-Cat04-03*.

SOLUTION 1: Object Gaps

In many palletiser applications there is a gap between objects on the pallet. The Muting function may not work correctly because of this gap. To avoid the mutual interruption, we recommend to Use E3G□□□□T as muting sensor. E3G-□□□□T has ON delay timer internally (0 to 5 seconds)



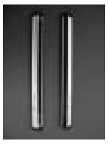
SOLUTION 2: Misalignment of pallets

When using a CROSS MUTING system, It may cause that unexpected behavior when the pallets get out of alignment then E3G□□□□T also solves the problem by OFF delay timer (0 to 5 seconds).

List of Models

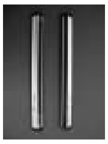
Safety Multi beam Sensors

F3S-TGR-SB2-K□C Mirror Reflection Type (Type 2)

Shape	Number of optical axes	Sensing Distance	Beam Pitch	Model
	2	0.5 to 6 m	500	F3S-TGR-SB2-K2C-500(MTL)*
	3	0.5 to 5 m	400	F3S-TGR-SB2-K3C-800(MTL)*
	4		300	F3S-TGR-SB2-K4C-900(MTL)*

*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

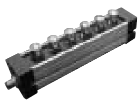
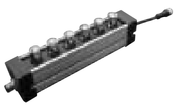
F3S-TGR-SB4-K□C Mirror Reflection Type (Type 4)

Shape	Number of optical axes	Sensing Distance	Beam Pitch	Model
	2	0.5 to 6 m	500	F3S-TGR-SB4-K2C-500(MTL)*
	3	0.5 to 5 m	400	F3S-TGR-SB4-K3C-800(MTL)*
	4		300	F3S-TGR-SB4-K4C-900(MTL)*

*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

Muting Connecting Box (Order Separately)

Flexible Connecting Box

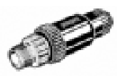
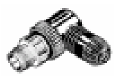
Appearance	SLC Connection Type	Other connection	Model
	M12 8pin connector without cable	4 x Muting sensor connection (4pin) 1 x Muting Lamp M12 (4pin) 1 x Override/Test input M12 (4pin) 1 x cabinet connection M12 (8pin)	F39-TGR-SB-CMB1
	M12 8pin connector with 100 mm cable		F39-TGR-SB-CMB2

Accessories (Order Separately)

Connector Cable

Appearance	Cable length	Specification	Model
	2 m	M12 connector (8pin Socket) For cabinet connection (From F3S-TGR-SB□-K□C or F3S-TGR-SB-CMB□)	F39-TGR-SB4-CVLB2R
	5 m		F39-TGR-SB4-CVLB5R
	10 m		F39-TGR-SB4-CVLB10R
	2 m	M12 connector (4pin Plug) For Muting sensor, Muting Lamp connection and Override/Test connection	F39-TGR-SB4-CVLB2MC

Connector Plug Assemblies, Screw-on Type

Appearance	Cable connection direction	Specification	Connection method	Applicable cable diameter	Model
	Straight	DC only 4pin Plug	Screw-on	3 dia. (3 to 4 dia.)	XS2G-D4S5
	Right angle				XS2G-D4S6

Muting Lamp

Appearance	Specification	Model
	24 V DC	F39-A11

Bulb for Maintenance

Appearance	Specification	Model
	24 V DC 3 W E14	F39-A11MB

Laser alignment Kit

Appearance	Model
	F39-LKK2-SB

Rating and Performance

Safety sensors

F3S-TGR-SB□-K□C

Item	Model	
	F3S-TGR-SB4-K□C-□□□(MTL)*	F3S-TGR-SB2-K□C-□□□(MTL)*
Sensor type	Type 4	Type 2
Applicable safety category	4, 3, 2, 1, B	2, 1, B
Operating range	F3S-TGR-SB□-K2C 0.5 - 6 m F3S-TGR-SB□-K3C/K4C 0.5 - 6 m	
Beam pitch and Number of beam	F3S-TGR-SB□-K2C 500 mm 2 beam with mirror F3S-TGR-SB□-K3C 400 mm 3 beam with mirror F3S-TGR-SB□-K4C 300 mm 4 beam with mirror	
Outermost beam gap	F3S-TGR-SB□-K2C 500 mm F3S-TGR-SB□-K3C 800 mm F3S-TGR-SB□-K4C 900 mm	
Effective aperture angle (EAA)	Within ±2.5°	Within ±5°
Light source	Infrared LED (880 nm)	
Power supply	24 VDC ± 20%	
Current Consumption	420 mA	
OSSD	Two PNP transistor outputs, 250 mA each. (500 mA sum)	
Output operation mode	Light - ON	
Test functions	Self-test (after power ON and during operation, one cycle during response time)	
Protection	Output short-circuit protection, Reverse Polarity protection	
Response time	ON to OFF 16ms max OFF to ON 300 ms (Maximum Power-ON time is 900 ms)	
Ambient temperature	Operating: -10 to +55 °C (with no dew condensation)	
Ambient humidity	15% to 95% (non condensing)	
Metal housing (Al) painted	Yellow (RAL 1303 F14)	
Degree of protection	IP65	
Accessories	M6 T-Bolt x 8, M6 Nut x 8 Mounting fixture x 4	
Applicable standards	EN61496-1; 1997 prEN61496-2; 1997	

*. If you want to have a ONE WAY direction Type, (see Page D-26) Please add the MTL behind of Model Name. Ex. F3S-TGR-SB4-K2C-500MTL

Muting Connecting Box

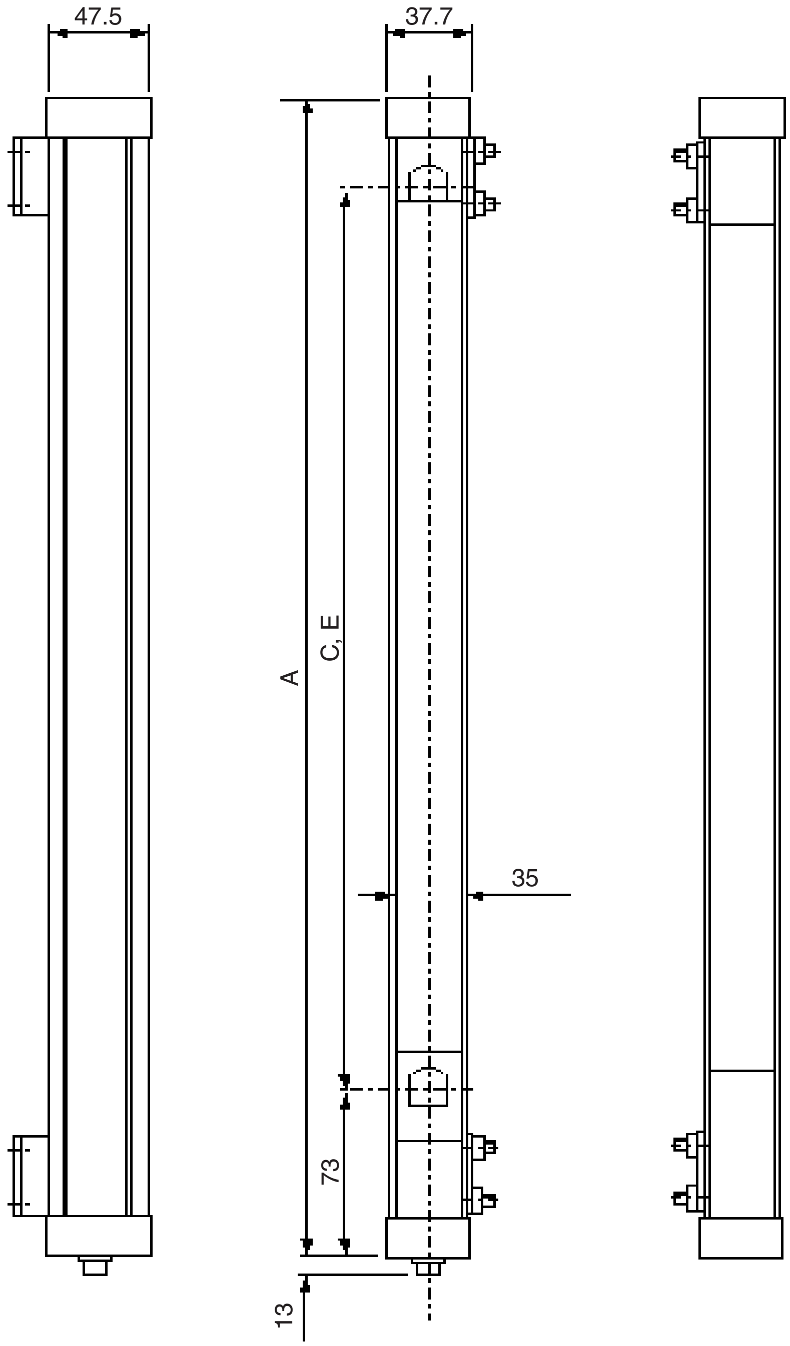
F3S-TGR-SB-CMB□

Item Model		F39-TGR-SB-CMB□
Power supply		24 VDC ± 20%
Consumption		10 W max
Ambient temperature		During operation: -10 to +55 °C (with no dex condensation)
Ambient humidity		15% to 95% (non condensing)
RX connector		M12 8 pins female
Cabinet connector		M12 8 pins male
Sensor connector		4 x M12 4 pins female
Muting indicator		M12 4 pins female
Test / Override connectors		M12 4 pins female
Metal housing (Al) painted		Yellow (RAL 1303 F14)
Degree of protection		IP65
Material	Case	Aluminium
	Connector	Brass with nickel plate
	Front Cover	Aluminium
Weight		0.5 kg
Accessories		M6 T-Bolt x 4, M6 Nut x 4 Mounting fixture x 2, Connector cover x 2

Item Model	F39-TGR-SB-CMB□
Applicable standards	93/68/EEC DIN V VDE 0801:1990 and am.A1:1994 EN 50081-2:1993 EN 55022:1998

Dimensions

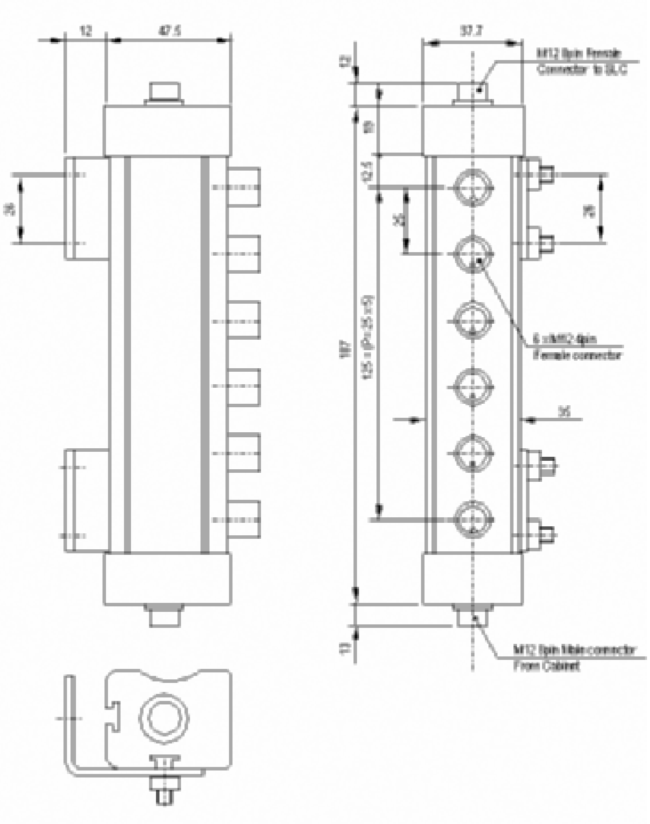
F3S-TGR-SB-K□C-□□□ with Mounting Brackets



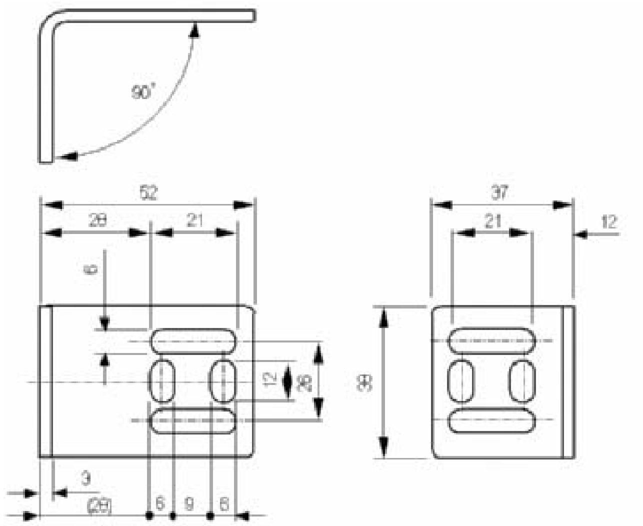
Model	A	C	E
F3S-TGR-SB□-K2C500	614 mm	500 mm	500 mm
F3S-TGR-SB□-K3C800	914 mm	800 mm	400 mm
F3S-TGR-SB□-K4C900	1,014 mm	900 mm	300 mm

F39-TGR-SB-CMB1

Muting connection box

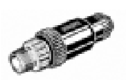


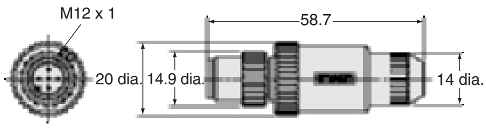
Mounting bracket (Common bracket for F3S-TGR-SB□-K□C and F39-TGR-SB-CMB□



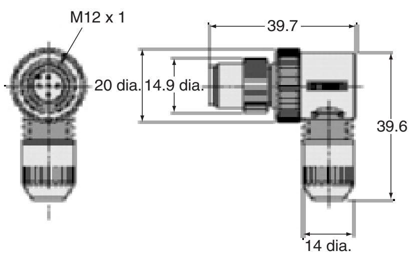
Connector Plug Assemblies, Screw-on Type

XS2G-D4S5





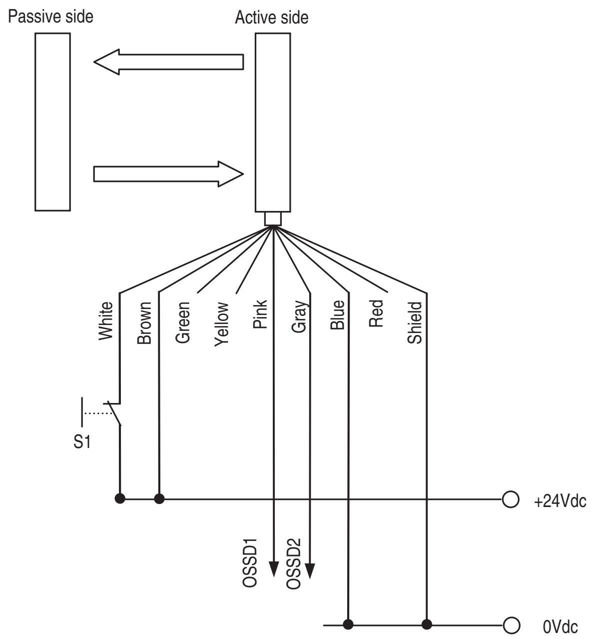
XS2G-D4S6

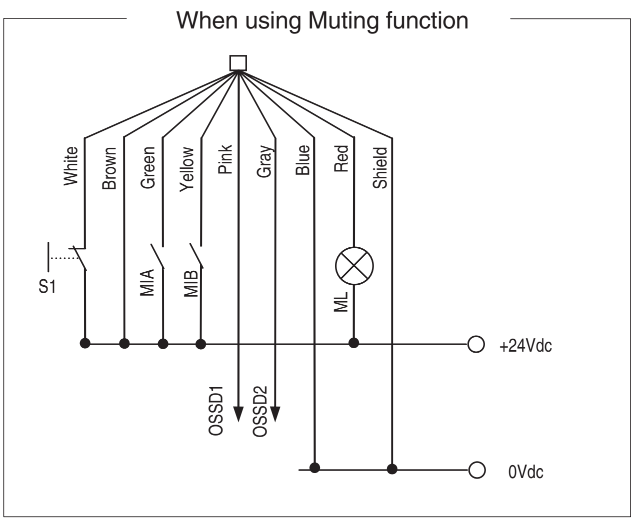


Connection

F3S-TGR-SB□-K□C

Connection example





S1: External Test / Interlock reset Switch

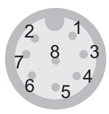
MIA : Muting input A

MIB : Muting input B

ML : Muting Lamp

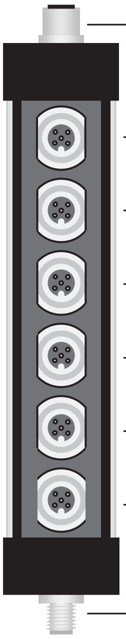
In case of Cat 4 (EN954-1), OSSD1/2 must be connected Safety Relay Unit (G9SA, G9SB-301B etc.) with feedback monitor

Pin reference

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

F3S-TGR-SB-CMB□

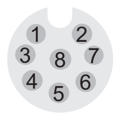
Pin and Plug reference



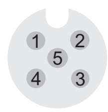
1) To Barrier (F3S-TGR-SB series)
   M12 8pin connector (Female) *1
2) Muting Sensor B2
   M12 5pin connector (Female)
3) Muting Sensor A2
   M12 5pin connector (Female)
4) Muting Sensor B1
   M12 5pin connector (Female)
5) Muting Sensor A1
   M12 5pin connector (Female)
6) Muting Lamp
   M12 5pin connector (Female)
7) Test/Override
   M12 5pin connector (Female)
8) From Cabinet
   M12 8pin connector (Male)

*1 In case of F3S-TGR-SB-CMB2,
M12 8pin connector with 100 mm cable

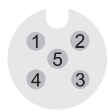
1) To F3S-TGR-SB Series

Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

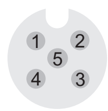
2), 3) 4), 5) Wiring of Muting Sensor connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	No connect	White
	3	0 V	Blue
	4	PNP Input	Black

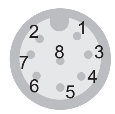
6) Wiring of Muting Lamp connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	No connect	White
	3	No connect	Blue
	4	0 V	Black

7) Test/Override connection

Front View	Pin No.	Signal Name	Wire Color
	1	+24 Vdc	Brown
	2	Test input	White
	3	No connect	Blue
	4	Override input	Black

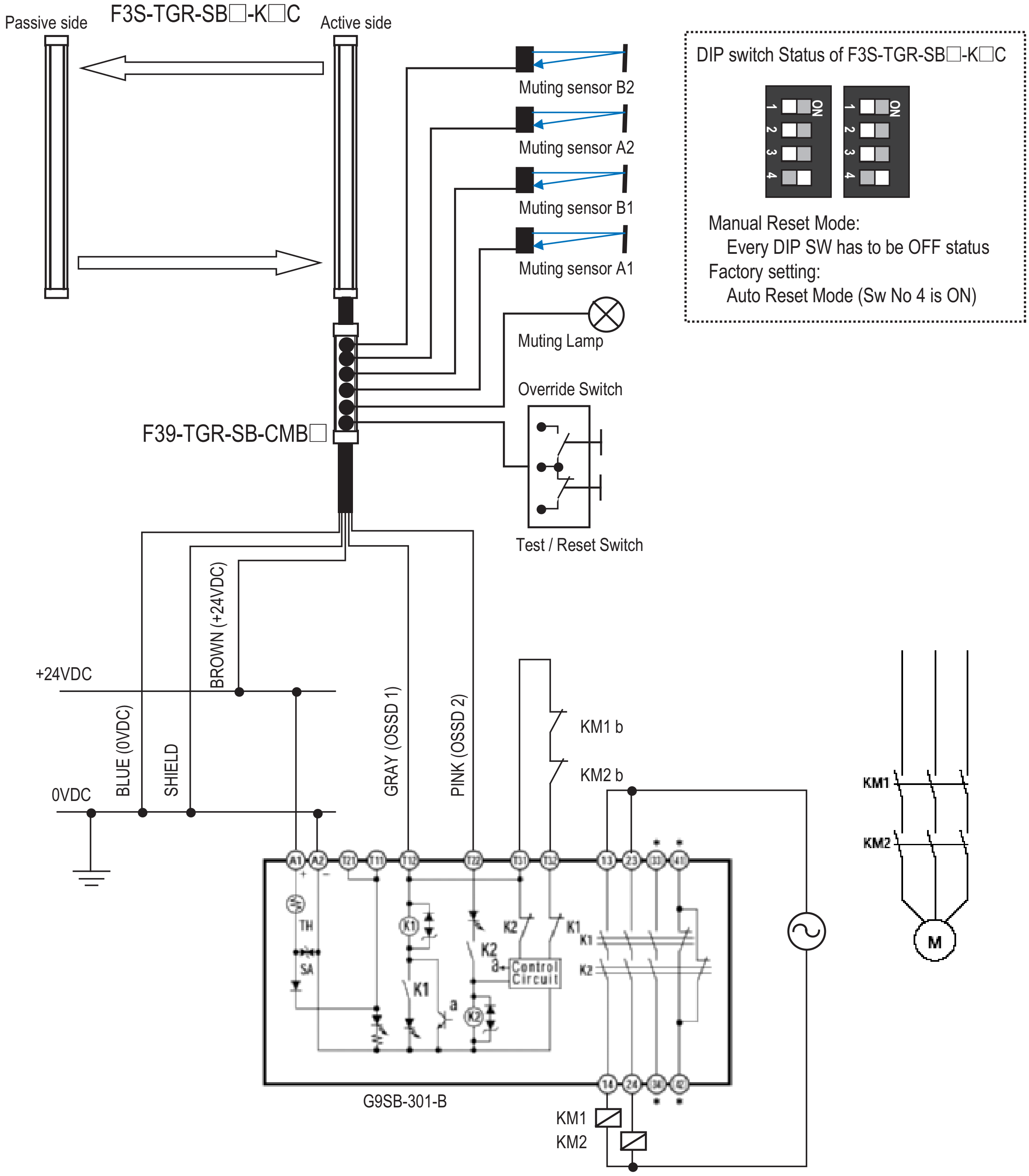
8) From Cabinet

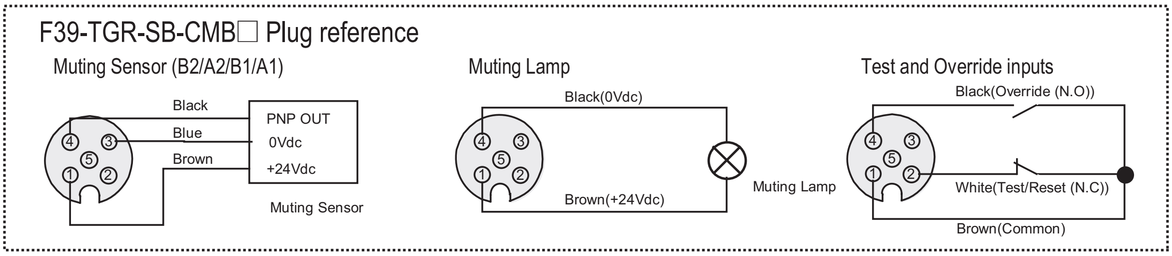
Front View	Pin No.	Signal Name	Wire Color
	1	Test and Reset Input	White
	2	+24 Vdc	Brown
	3	Muting A Input	Green
	4	Muting B Input	Yellow
	5	OSSD1 (OUT1)	Gray
	6	OSSD2 (OUT2)	Pink
	7	0 Vdc	Blue
	8	Muting Lamp (0 Vdc)	Red

Application

Manual Reset Mode (by Safety barrier)

F3S-TGR-SB4-K2C / F39-TGR-SB-CMB☐ / G9SB-200-B or 301-B





ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E19E-EN-01 In the interest of product improvement, specifications are subject to change without notice.

Safety light curtain for long distance detection

F3SL

20-m long-distance detection. Safety light curtain (Type 4) is ideal for detection of intrusion of human bodies in large machines and conveyor lines.

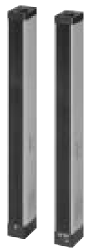
Features

- Complies with IEC standards, EN standards, and North American standards. EC-based certification from TÜV for EU machine directives. Can be used as a safety guard for satisfaction of OSHA requirements for on-site labor safety in North America.
- Special controller not needed. Detection of human body intrusion is possible using just the sensor unit.
- Includes "Start/restart interlock function" to prevent automatic reset of output.
- Includes floating blanking function (disables 1 or 2 non specific beams) and Fixed Blanking (disables specific beams)
- Built-in EDM (External Device Monitor). Feedback check is possible without a controller

Ordering Information

Sensors

Infrared ray

Sensor type	Shape	Sensing distance	Operating mode	Detection width (mm)	Model
Through-beam		0.3 to 20m	Light ON	351	F3SL-A0351P30
				523	F3SL-A0523P30
				700	F3SL-A0700P30
				871	F3SL-A0871P30
				1,046	F3SL-A1046P30
				1,219	F3SL-A1219P30
				1,394	F3SL-A1394P30
				1,570	F3SL-A1570P30
				1,746	F3SL-A1746P30
				1,920	F3SL-A1920P30
				2,095	F3SL-A2095P30

Accessories (Order Separately)

Special cable (please order one each for the emitter and the receiver)

Cable length	Specifications	Model	
		For emitter	For receiver
10 m	Connector	F39-JL10A-L	F39-JL10A-D
15 m		F39-JL15A-L	F39-JL15A-D
30 m		F39-JL30A-L	F39-JL30A-D

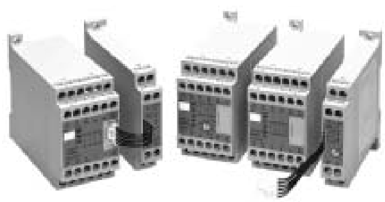
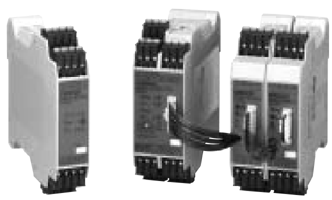
Refection mirror (15% sensing distance attenuation)

Mirror material	Width (mm)	Thickness (mm)	Length (mm)	Model
Glass mirror	125	31	460	F39-MDG460
			607	F39-MDG0607
			750	F39-MDG0750
			907	F39-MDG0907
			1,057	F39-MDG1057
			1,357	F39-MDG1357
			1,500	F39-MDG1500
			1,657	F39-MDG1657
			1,807	F39-MDG1807

Note: Other sizes are available upon request.

Safety Relay Unit

For controlling the outputs we recommend to use safety relay units G9SA or G9SB

Appearance	Output	Model
	Expandable relay unit series with up to 8 safety relay outputs. Time delay for stop category 1 can be realized. (Please refer to page G-109)	G9SA series
	Small size safety relay unit with 17.5 mm and 22.5 mm size. Up to 3 safety relay outputs are available. (Please refer to page G-123)	G9SB series
	Fletible and expandable safety unit with sol-id state outputs	G9SX series

Rating/performance

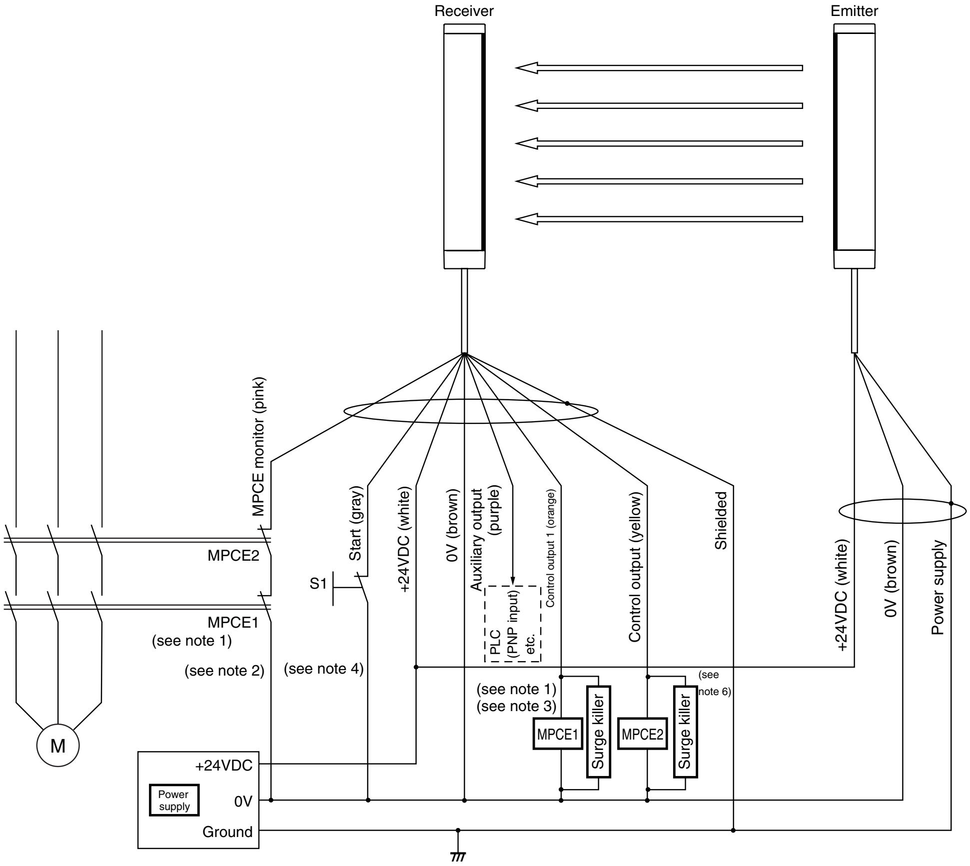
Item / Model	F3SL-A0351P30	F3SL-A0523P30	F3SL-A0700P30	F3SL-A0871P30	F3SL-A1046P30	F3SL-A1219P30	F3SL-A1394P30	F3SL-A1570P30	F3SL-A1746P30	F3SL-A1920P30	F3SL-A2095P30
Sensing distance	0.3 to 20 m										
Optical axis pitch	22 mm										
Number of optical axes	16	24	32	40	48	56	64	72	80	88	96
Protective height	351 mm	523 mm	700 mm	871 mm	1,046mm	1,219mm	1,394mm	1,570mm	1,746mm	1,920mm	2,095mm
Min. sensing object	Opaque object, 30-mm dia. or greater (52-mm or 74-mm dia. when using floating blanking)										
Effective Aperture angle	Emitter/receiver: ±2.5° or less each (based on IEC61496-2 at detection distance of 3 m or greater)										
Light source (wave length)	Infrared LED (850 nm)										
Power supply voltage	24 V DC ±20% including 5% ripple (p-p)										
Startup time after turning on power	3 s max.										
Current consumption	Emitter: 285 mA or less, receiver: 1.4 A or less (including load output current)										
Control output	PNP transistor outputs x 2, load current 500 mA or less (residual voltage 2 V or less) (excluding voltage drop due to cable extension), Light ON										
Auxiliary output	Same signal as control output: PNP transistor outputs x 1 output (non-safety output), load current 100 mA or less (residual voltage 1 V or less) (excluding voltage drop due to cable extension)										
Protective circuits	Output load short circuit protection, reverse power connection protection										
Safety functions	Start/restart interlock function (select enable/disable with DIP switch) • Blanking functions ① Channel select (fixed blanking) ② Floating blanking ③ No blanking (initial setting) Select ①, ②, or ③ with DIP switch. The optical axes for ① fixed blanking are set by a teach button.										
Diagnosis functions	• Self diagnosis functions when the power is turned on • External relay (MPCE) monitor function (connect external relay monitor input wire to contact b of external relay, 50 mA 24 V DC)										
Response time ON→OFF	20 ms max.				25 ms max.			30 ms max.		35 ms max.	
Ambient temperature	Operating/Storage: 0°C to 55°C (with no icing or condensation)										
Ambient humidity	Operating./Storage: 35% to 95% RH (no condensation)										
Vibration resistance	Malfunction / durability: 10 to 50 Hz, amplitude 0.7 mm, 20 sweeps each in X, Y, and Z directions										
Shock resistance	Wrong operation / durability: 100 m/s2, 1,000 times each in X, Y, and Z directions										
Protective Degree	IEC Standard IP65										
Connection method	M12 Connector										
Weight (Packed state)	11kg max.										
Material: Case	Aluminum										
Accessories	Test rod, mounting brackets (upper/lower), operation manual, special hex wrench for program button access, test load resistors (1 kΩ, 2 resistors), surge protector (2)										
Applicable standards	IEC (EN) 61496-1 TYPE4 ESPE *1 IEC61496-2 TYPE4 AOPD *2										

*1) ESPE (Electro-Sensitive Protective Equipment)
*2) AOPD (Active Opto-electronic Protective Devices)

F3SL

Connection

Wire the F3SL only after all power has been turned off.

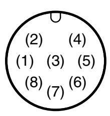


M: Mechanical drive unit including 3-phase motor
S1: Start switch for interlock reset (NC contact)
MPCE1, MPCE2: Contactor or safety relay with compulsory guide mechanism (G7SA is recommended)

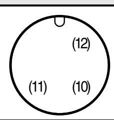
Note: 1 . Please use a safety relay with forcibly guided contacts (such as the G7SA) for MPCE1 and MPCE2, which are relays that perform ultimate control of the machine.
2 . If you do not intend to use the MPCE monitor function, short the MPCE monitor line (pink) to power supply 0 V.
3 . If a load is not connected to control output 1 and control output 2, an error will result and normal operation will not take place. For testing purposes during installation or at other times, connect the 10 kΩ resistors included with the operation manual to the MPCE1 and MPCE2 positions.
4 . If you intend to use auto start mode, short the start line (gray) to power supply 0 V.
5 . Take care when wiring not to make any mistakes regarding the cable colors. In particular, the wire colors of the power supply line (+ 24 V DC: white, 0 V: brown) are different from the regular sensor wires.
6 . Connect the provided surge protector in parallel with MPCE1 and MPCE2.

Wiring method

Receiver unit connector

Front view diagram	Pin No.	Signal name Receiver	Wire color of special cable
	1	Control output 1 (OSSD1)	Orange
	2	0V	Brown
	3	Shielded	---
	4	+DC24V	White
	5	Auxiliary output (AUXIL-	Purple
	6	MPCE monitor	Pink
	7	Start	Gray
	8	Control output 2 (OSSD2)	Yellow

Emitter unit connector

Front view diagram	Pin No.	Signal name Emitter	Wire color of special cable
	10	Shielded	---
	11	+DC24V	White
	12	0V	Brown

Special cable (purchased separately)

For emitter (3-pin)		For receiver (8-pin)		Cable length
F39-JL10A-L	Black connec- tor	F39-JL10A-D	Red connec- tor	10 m
F39-JL15A-L		F39-JL15A-D		15 m
F39-JL30A-L		F39-JL30A-D		30 m

Note: Please order one each for the emitter and the receiver.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety Single Beam Sensor & Controller

E3FS series with F3SP-U3P-TGR and F3SP-U5P-TGR

Features

The E3FS is a type 2 Safety Single beam sensor intended to be used with the control units F3SP-U3P -TGR and F3SP-U5P-TGR.

- Safety Single Beam (E3FS)
  1) Up to Category 2 (EN954-1)
     Type2 ESPE and Type2 AOPD.
     Approved by TÜV Product Service
  2) High protection against water
     IP67 (IEC60529)
  3) Small Sensor
     M18 x 65 mm
  4) 4 different model available
     Plastic case (with cable type and connector type)
     Brass case (with cable type and connector type)
- Muting Controller for Safety single beam sensor (F3SP-U3P-TGR and F3SP-U5P-TGR)
  1) Muting functions are integrated
     Muting inputs
     Override function
     Muting Lamp output
     Interlock function and Test Reset input
  2) 2 different model available
     2 beam unit (F3SP-U3P-TGR)
     4 beam unit (F3SP-U5P-TGR)
  3) Small Controller
     2 beam unit W=22.5 mm
     4 beam unit W=45.0 mm

Ordering Information

Safety Single beam Sensors (Type 2)

E3FS-10B4 series

Appearance	Case material	Operation distance	Model	
	Plastic	0 to10 m	Cable Type	E3FS-10B4
			Plug Type	E3FS-10B4-P1
	Nickel Brass		Cable Type	E3FS-10B4-M
			Plug Type	E3FS-10B4-M1-M

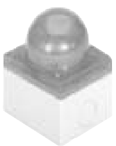
Controller for Safety Single beam Sensors

F3SP-UxP series

Appearance	Sensors	Output contacts	Width	Model
	1 to 2 Safety Single beam sensors	2 NO 2.5 A	22.5 mm	F3SP-U3P-TGR
	1 to 4 Safety Single beam sensors		45 mm	F3SP-U5P-TGR

Accessories

Muting Lamp

Appearance	Model
	F39-A11

Bulb for Maintenance

Appearance	Specification	Model
	24 V DC 3 W E14	F39-A11MB

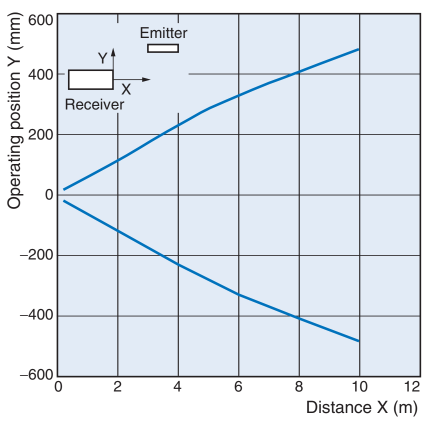
Rating and Performance

Sensors

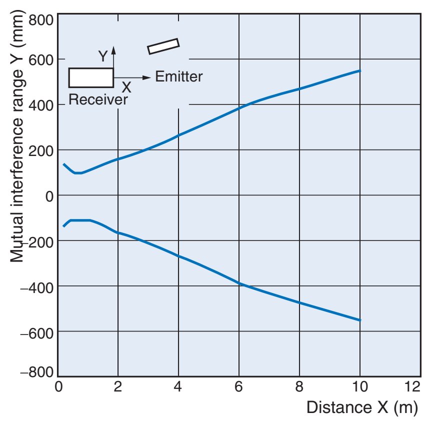
E3FS-10B4 series

Sensing method		Through-beam
Controller		F3SP-U3P-TGR, F3SP-U5P-TGR
Supply voltage		24 VDC ± 10% (ripple p-p 10% max.)
Effective aperture angle (EAA)		±5° (at 3 m)
Current consumption		Emitter:50 mA max. Receiver:25 mA max.
Sensing distance		10 m
Standard sensing object		Opaque object: 11 mm min. in diameter
Response time		2.0 ms (E3FS only) Response time of controller = Response time of the system
Control output		PNP transistor output, load current: 100 mA max., residual voltage: 2 V max. (Except for voltage drop due to cable extension)
Test input (Emitter)		21.5 to 24 VDC: Emitter OFF (source current: 3 mA max.) Open or 0 to 2.5 V: Emitter ON (leakage current: 0.1 mA max.)
Power supply reset time		100 ms
Ambient light intensity		Incandescent lamp: 3.000 lx max. (light intensity on the receiver surface) Sunlight: 10,000 lx max. (light intensity on the receiver surface)
Ambient temperature		Operating: -10 to 55°C, storage: -30 to 70°C (with no icing or condensation)
Ambient humidity		Operating: 35% to 85%, storage: 35% to 95% (with no icing or condensation)
Insulation resistance		20 MΩ min. (at 500 VDC)
Dielectric strength		1,000 VAC 50/60 Hz 1 min
Vibration resistance	Malfunction	10 to 55 Hz, double amplitude: 1.5 mm, 2 h each in the X, Y, and Z directions
	Operating limit	10 to 55 Hz, double amplitude: 0.7 mm, 50 min each in the X, Y, and Z directions
Shock resistance	Malfunction	500 m/s² (approx. 50 G), 3 times each in the X, Y, and Z directions
	Operating limit	100 m/s² (approx. 10 G), 1,000 times in the X, Y, and Z directions
Degree of protection		IP67 (IEC standard)
Light source		Infrared LED
Operation indicators		Emitter: Emitting (orange) Receiver: Output ON (green), Output OFF (red)
Protection		Output short-circuit protection, reverse polarity protection
Weight (in packaging)		E3FS-10B4 2M (ABS resin case): approx. 150 g for 1 set (weight without cable: approx. 55 g) E3FS-10B4-M1-M (metal case): approx. 125 g for 1 set
Applicable standard		IEC61496-1, EN61496-1 Type 2 ESPE (Electro-Sensitive Protective Equipment) IEC61496-2, prEN61496-2 Type 2 AOPD (Active Opto-electronic Protective Devices)
Accessories		Emitter, Receiver, four nuts for mounting, and an instruction manual

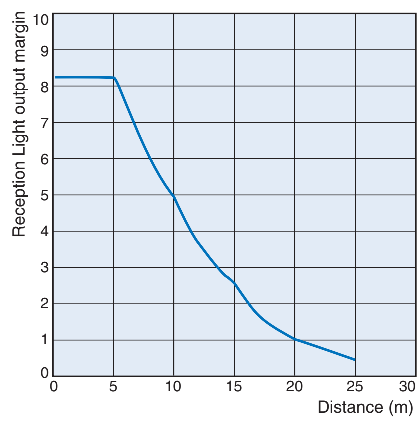
Parallel Operating Range



Mutual interference Range



Excess Gain Ratio



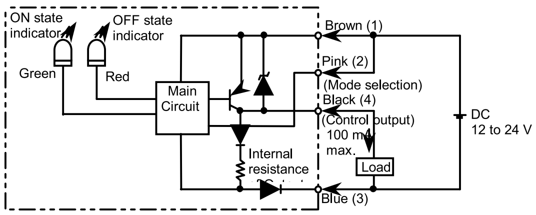
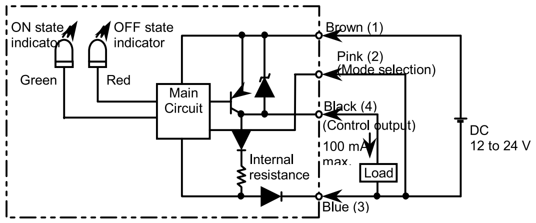
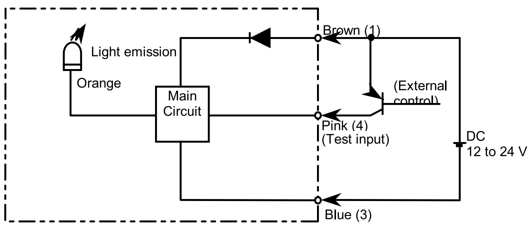
Controllers

F3SP-U series

	F3SP-U3P	F3SP-U5P
Number of sensors	1 to 2 Safety Single beam sensor	1 to 4 Safety Single beam Sensor
Width	22.5 mm	45 mm
Muting Input	2 Inputs	4 Inputs
Safety related function	Override function Muting Lamp Connection Interlock System (Automatic and manual reset)	
Power supply voltage	24 VDC ±10%	
Power consumption	420 mA max.	
Output contacts	2 NO 2.5 A (protected by fuse), 115 V AC max.	2 NO 2.5 A (protected by fuse), 250 V AC max.
Indicators	6 LED for status and diagnostics	
Enclosure rating	IP20	
Terminal	16 screw terminals, Detachable blocks with ’4pin’	32 screw terminals, Detachable blocks with ’4pin’
Response time	≤30 ms	
Ambient temperature	Operation: -10°C +55°C	
Housing material	Plastic; DIN rail mounting	
Weight	0.3 kg	

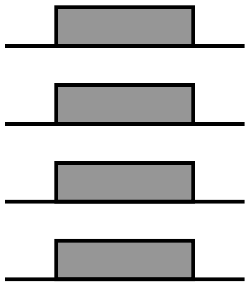
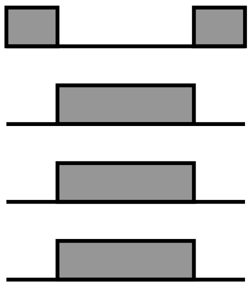
Operating Instructions

Output Circuit

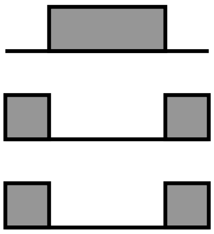
Model	Connection method	Output transistor	Output circuit
E3FS-10DB4 2M E3FS-10DB4-P1 E3FS-10DB4-M 2M E3FS-10DB4-M1-M Receiver circuit	Connect the pink and brown wire	ON when light is incident (Light-ON)	
	Connect the pink and blue wire	ON when light is interrupted (Dark-ON)	
E3FS-10LB 2M E3FS-10LB-P1 E3FS-10LB-M 2M E3FS-10LB-M1-M Emitter circuit			

Timing Chart

Output mode and timing chart

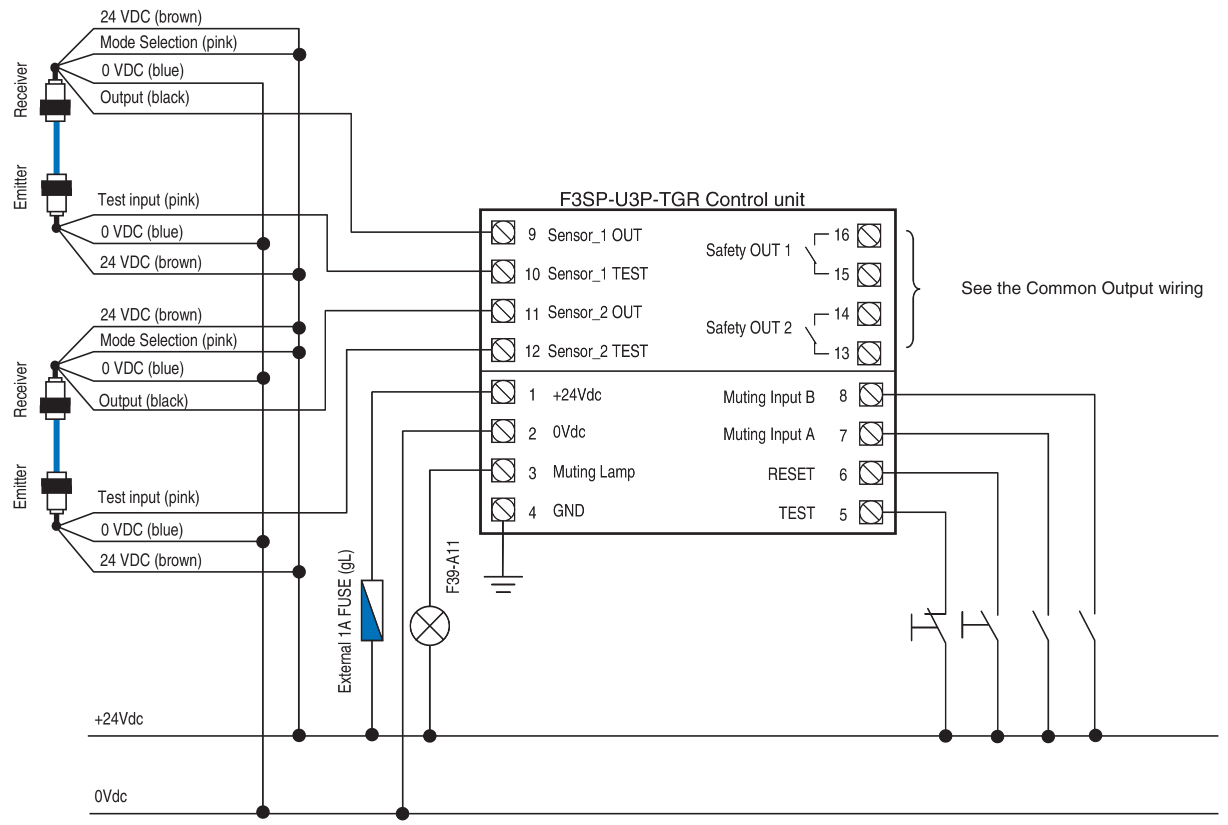
Receiver connection		Connect Pink (2) to Brown(1)	Connect Pink (2) to Blue (3)
Mode of output		ON when Incident (Light ON)	ON when interrupted (Dark ON)
Light Incident Light interrupted Indicator Control output Load (Relay)	 Green Red ON OFF ON OFF		

Emitting timing chart

		Timing chart
Test input Light emission Indicator	ON OFF ON OFF ON OFF	

Connection

F3SP-U3P Manual Reset (Cat2)



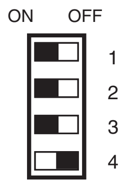
WARNING: Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened contacts must be connected in series.

WARNING: The power supply of Safety sensors must be taken from the same supply of F3S-U3P-TGR unit.

Dip Switch setting

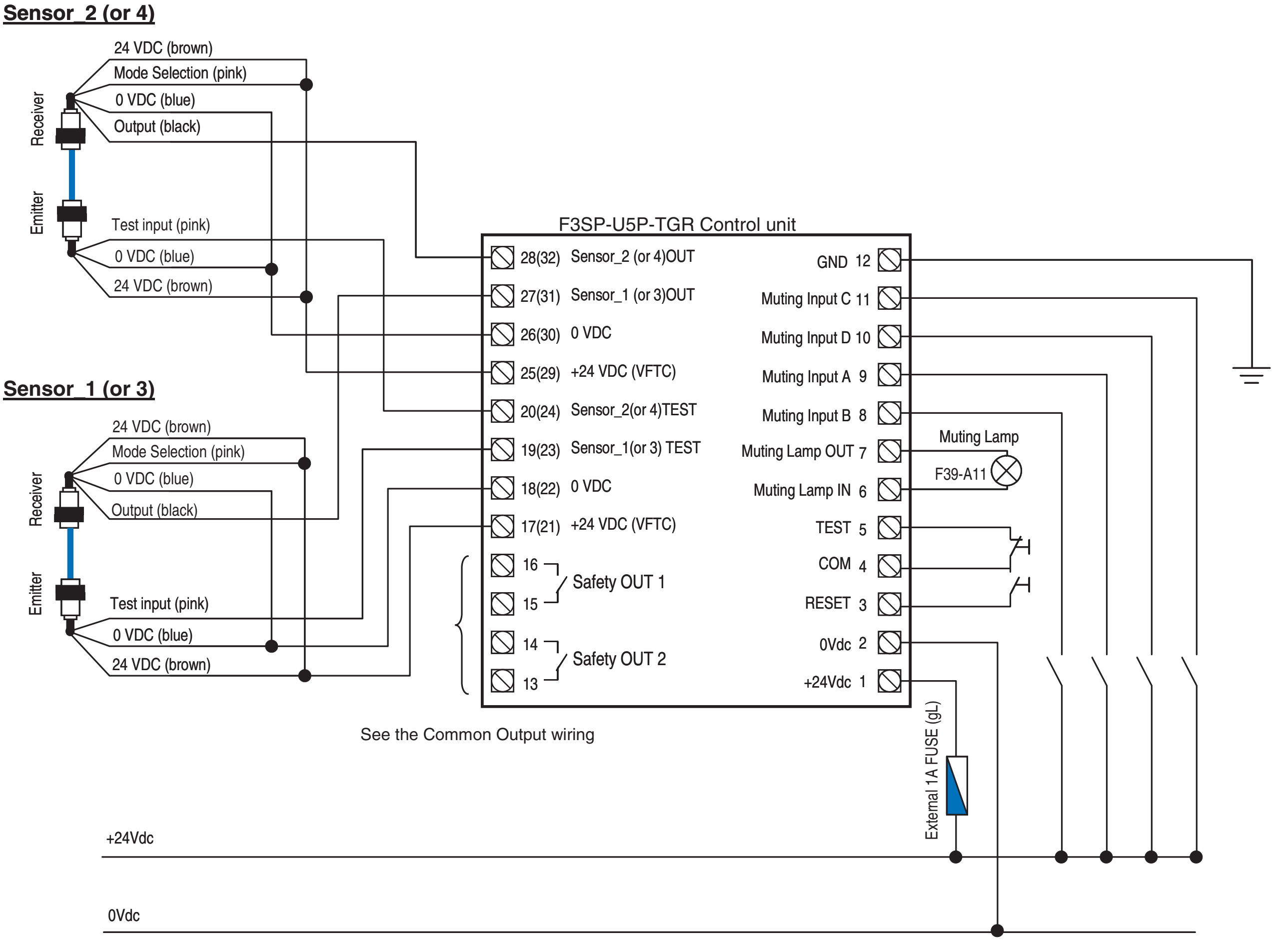
	Function	ON	OFF
4	Not used	--------------	--------------
3	Muting Activate	It will be muting Sensor_1 only	**It will be muting both Sensor**
2	Muting Duration	Infinite	**60 Second**
1	Reset mode	**Auto Reset**	Manual Reset

The **underlines** are initial setting (Factory setting)



Factory setting

F3SP-U5P Manual Reset (Cat 2)

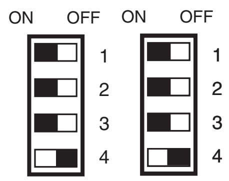


WARNING: Both safety contacts OUT1 and OUT2 must be connected. If the machine has a single locking circuit, the two normally opened con tacts must be connected in series.

Dip Switch setting

	Function	ON	OFF
4	Not used	--------------	--------------
3	Muting Activate	Muting inputs A-B act on the sensor_1. Muting inputs C-D act on the sensor_2. Other sensor 3-4 continue to work	**Muting inputs A-B act on the sensor 1 and 2. Muting inputs C-D act on the sensor 3 and 4.**
2	Muting Duration	Infinite	**60 Second**
1	Reset mode	**Auto Reset**	Manual Reset

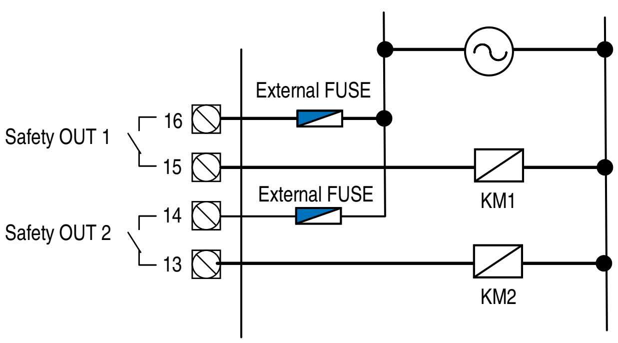
The **underlines** mean initial setting (Factory setting)



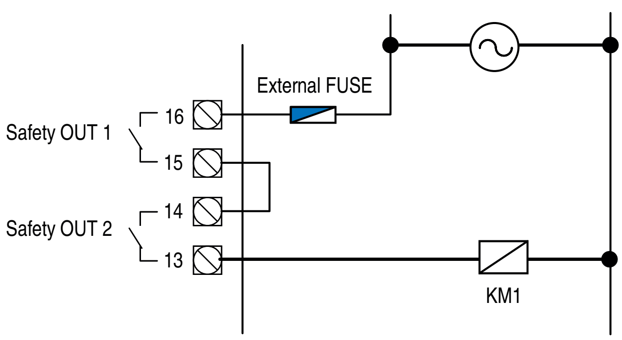
Factory setting

Common Output wiring

In case of 2 load



In case of 1 load



E3FS

Precautions for Correct Use

⚠ Warning

OMRON's Single-beam Safety Sensor input Module (B1 Module) from the F3SX Series is the only controller that can be used for the E3FS-10B4□□□ (type 2). Normal operation may not be possible if another Single-beam Sensor Controller is used.

The Sensor cannot be used as part of a safety system when the mode selection input of the Single-beam Safety Sensor Receiver is connected to 0 V because the Sensor will turn ON when light is interrupted (Dark ON). Be sure to connect the mode selection input to 24 VDC if you want the Sensor to turn ON when light is incident (Light ON).

Safety Distance

The safety distance is the minimum distance that must be maintained between the Sensor and a hazardous part of the machine in order to stop the machine before someone or something reaches it. The safety distance is calculated based on the following equation when a person moves perpendicular to the detection zone of the Sensor.

Safety distance (S)= Intrusion speed into the detection zone (K)
x Total response time for the machine and Sensor
+ Additional distance calculated based on the detection capability of the Sensor (C)

The safety distance varies with the national standards and individual machine standards. The equation is also different if the direction of intrusion is not perpendicular to the detection zone of the Sensor. Be sure to refer to the related standards.

Here T = T1 + T2 + T3, where
T1 = Maximum machine stop time (s)
T2 = Sensor response time (s)
(From ON to OFF: 2.0 ms for the E3FS)
T3 = F3SP response time (s)
(From ON to OFF: Refer to Response Time.)

The maximum stop time for a machine is the time it takes to actually stop dangerous parts after the machine receives a stop signal from the F3SP.

⚠ Warning

Measure the actual maximum stop time for the machine and the periodical check it to see if the time changes.

Reference: Method for Calculating Safety Distance as Defined in the European Standard EN999 (with Intrusion Perpendicular to the Detection Zone)

K and C are as follows for the Single-beam Safety Sensors.

1) When a Single-beam Safety Sensor is used alone (when the risk assessment indicates that a single beam is sufficient)
K = 1600 mm/s
C = 1200 mm
Height of the beam from the ground or from a reference surface: 750 mm (EN999 recommendation)

2) When multiple Single-beam Safety Sensors are installed at different heighte.
K = 1600 mm/s
C = 850 mm

The beam heights in the following table are the EN999 recommendations.

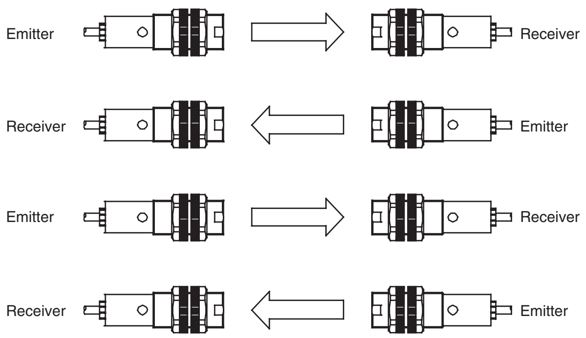
No. of beams	Height from the reference surface (example: the floor)
2	400 mm, 900 mm
3	300 mm, 700 mm, 1,100 mm
4	300 mm, 600 mm, 900 mm, 1,200 mm

Note: Refer to the F3SN/F3SH instruction manuals for details on Safety Light curtains and Multi-beam Safety Sensord.

Preventing Mutual Interference

Observe the following items during installation to prevent Single-beam Safety Sensors from interfering with each other or with Safety Light Curtains.

- Leave adequate space between the Sensors during installation. (Refer to the instruction manuals for the E3FS.)
- Use baffle plates to seperate Sensors.
- Alternate Emitters and Receivers during installation. (See the figure below.)



Check for mutual interference between Single-beam Safety Sensors or Safety Light Curtains connected to the same or different Control Units before finalizing placement and starting normal operation.

⚠ Warning

When installing multiple Safety Light Curtains, Multi-beam Safety Sensors, and Single-beam Safety Sensors, take necessary steps to prevent mutual interference. Otherwise detection may fail and serious injury may result.

Dimensions

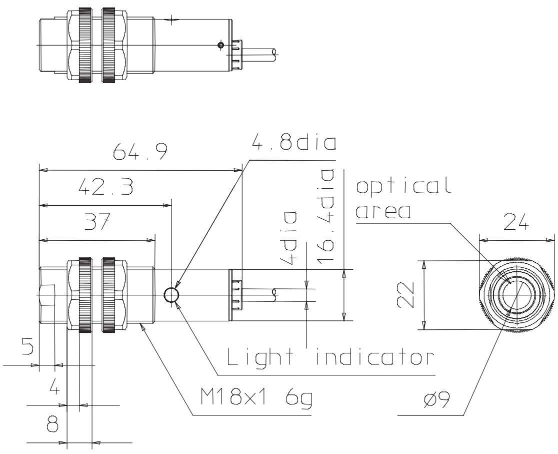
Note: All units are in millimeters unless otherwise indicated

Plastic housing

Cable type:

E3FS-10LB

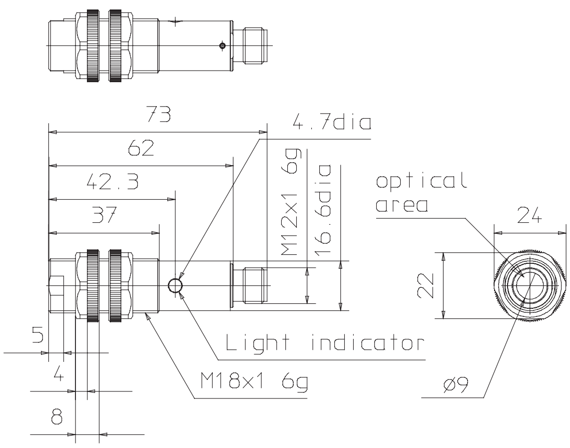
E3FS-10DB4



Connector type:

E3FS-10LB-P1

E3FS-10DB4-P1

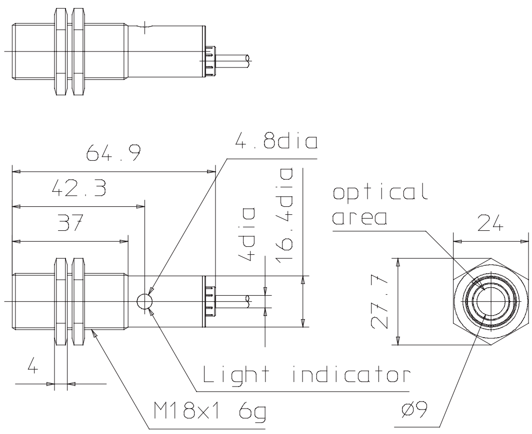


Metallic housing

Cable type:

E3FS-10LB-M

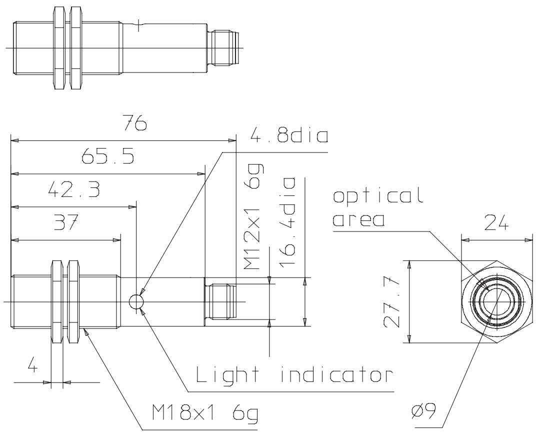
E3FS-10DB4-M



Connector type:

E3FS-10LB-M1-M

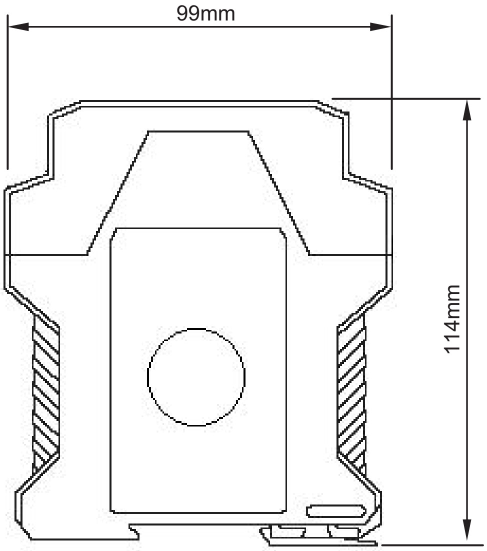
E3FS-10DB4-M1-M

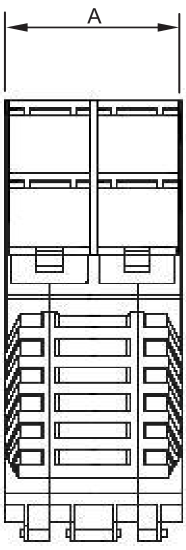


E3FS

Controller

F3SP-U3P and F3SP-U5P





Model	A
F3SP-U3P-TGR	22.5 mm
F3SP-U5P-TGR	45 mm

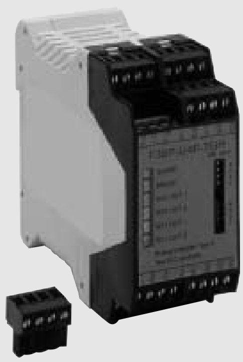
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Muting Controller for Safety Light Curtain

F3SP-U4P

Muting controller for one or two Safety Light Curtain.

- **High functionality (two independent muting functions, override function, automatic and manual reset).**
- **Category 2 or 4 depending on safety light curtain.**
- **Only 45 mm width**
- **Double output safety relay.**
- **6 LED for status and diagnostics.**
- **Detachable terminals for easy installation.**
- **Controlls 1 or 2 safety light curtains**
- **TÜV approved**

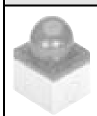


List of Models

Controller

Description		Model
	Muting Controller for Safety Light Curtain F3S-B, F3SN and F3SH	F3SP-U4P-TGR

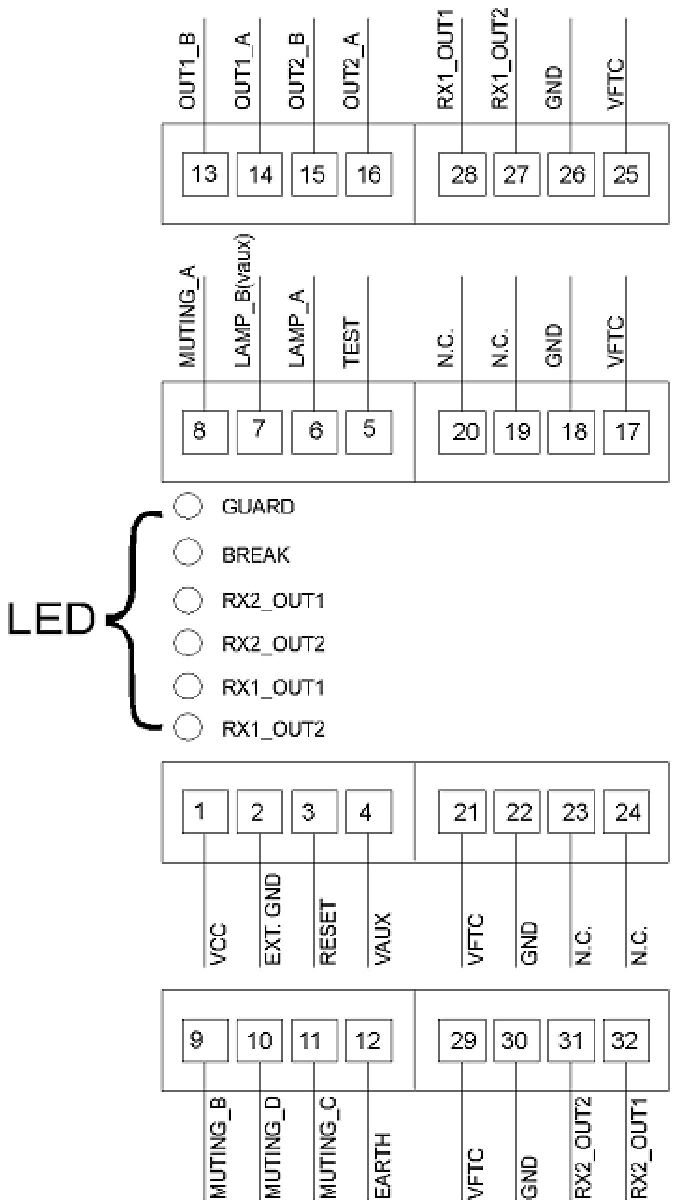
Accessories

Description		Model
	Muting lamp	F39-A11

Rating / performance

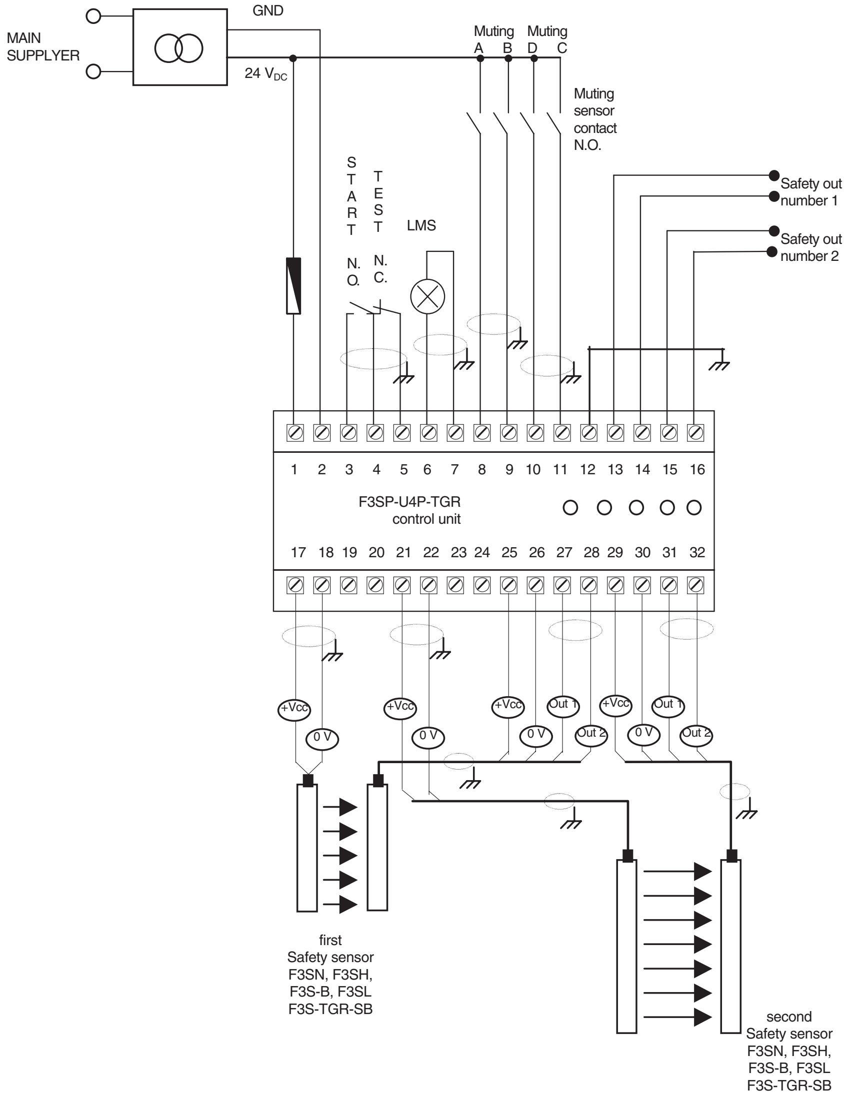
	F3SP-U4P-TGR
Power supply voltage	24 VDC ±10%
Power consumption	420 mA max. (excl. SLC power consumption)
Output contacts	2 NO 2,5 A (protected by fuse)
Indicators	6 LEDs for status and diagnostics.
Enclosure rating	IP20
Terminal	32 screw terminals (1,5 mm²), detachable blocks with 4 screws each
Response time	≤30 ms
Ambient temperature	Operating: -10 °C +55 °C
Housing material	Plastic, DIN rail mounting
Weight	0,6 kg

Pin Overview

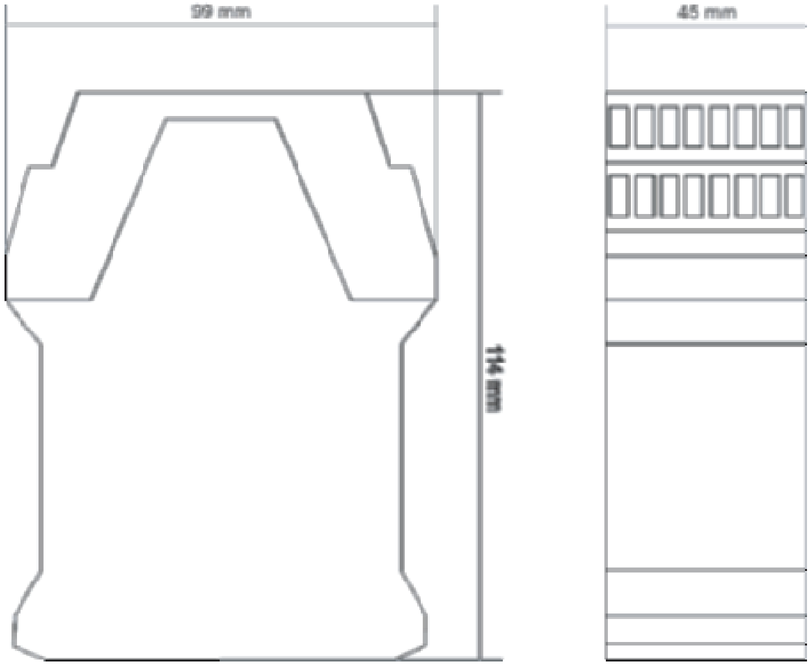


Wiring Example

Control unit F3SP-U4P-TGR in a mixed configuration that allowes the use of several OMRON safety light curtains and perimetrical guards.



Dimensions



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E28E-EN-01 In the interest of product improvement, specifications are subject to change without notice.

DeviceNet Safety System

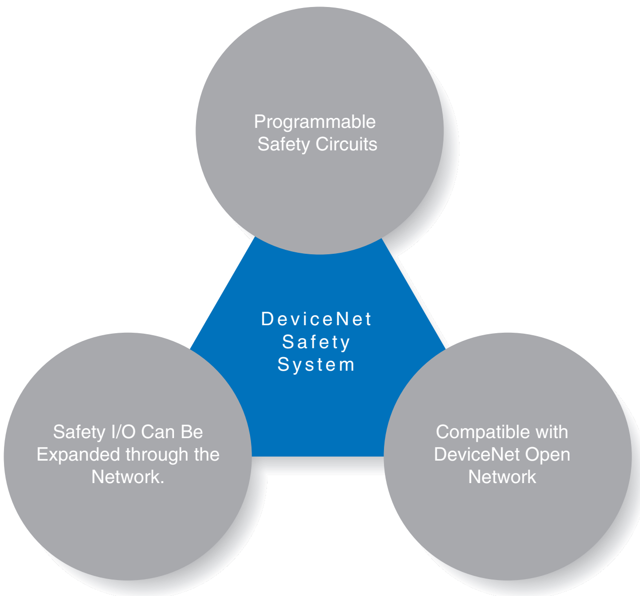
NE1A/DST1

Omron now offers a DeviceNet compatible Safety System, that can be used 3-ways: as a Stand-alone controller, as a Safety network expandable with remote I/O blocks, or combined with DeviceNet to form a combined Network.

- Conforms to Global Safety Standards
- Individual I/O LED status and error indicators
- USB Programming Port
- IEC 61508 SIL 3
- EN954-1 Category 4
- UL1604 Class 1, Div. 2 Group A,B,C,D

Product Information

Introducing a Safety Network System that dramatically alters previous safety design.
Programmable safety circuits are incorporated to facilitate efficient designing and modifications. Moreover, Safety I/O Terminals can be added to increase safety I/O capacity for distributed allocation through the network. DeviceNet wiring on the existing network can be used as is, facilitating efficient design by expanding on the existing system.
The programmability of safety circuits, expandability of I/O using the network, and compatibility with the DeviceNet open network effects major changes to the framework of previous safety design systems.



Complies with the Highest Safety Standards in the world

The DeviceNet Safety System conforms to IEC 61508 SIL3 for functional safety, and EN 954-1 Category 4 for machine safety, complying with the world's highest level of safety standards.

IEC 61508 SIL 3

Safety circuits must be able to function to provide safety at anytime. Conversely, the degree of lack of safety is used as the indicator. In IEC 61508, safety is defined as the Probability of Failure per Hour, or PFH. Based on this, the SIL (Safety Level) is classified into four levels. SIL 3 indicates a probability of dangerous failure of once in 1,000 years, which is the highest level in machine safety.

EN 954-1 Safety Category 4

EN standards evaluate the level of machine risk and require the incorporation of risk minimization measures. In EN 954-1, five safety categories have been established, with Safety Category 4 indicating designs that require the highest safety design level. This category is demanded for machines with the highest level of danger, wherein "serious injury (severed limbs, death, etc.) will occur frequently, with little chance of escaping danger." This category demands that a single fault (failure) in any part of the machine, or a series of faults, will not lead to loss of the machine's safety functions.

NE1A-SCPU01 Safety Network Controller

Programmable Safety Control

- Incorporates 16 safety inputs and 8 safety outputs.
  Functions as a compact safety PLC even without using a network.
- Construct safety circuits easily with special Function Blocks.
- Up to 128 Function Blocks can be used.

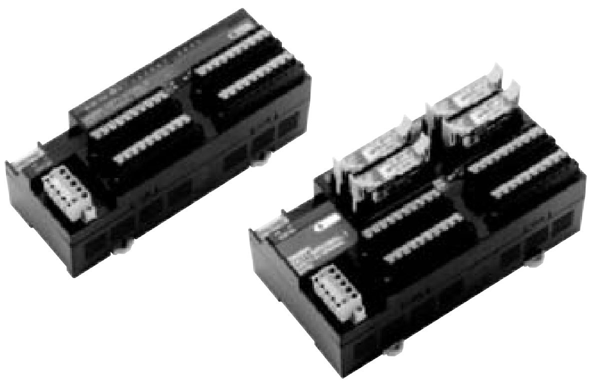
DeviceNet Safety Communications Functions

- Provides DeviceNet Safety Master functionality.
  Connect up to 16 Safety Slaves.
  Expand using up to sixteen Input Slaves with 12 points each (192 points total) and eight I/O Slaves with 16 points each (128 points total).
- Safety Slave functionality is also included. Interlock control can be incorporated between Safety Network Controllers.

DeviceNet Slave Functionality

- Monitor safety I/O and status information from the DeviceNet Master.

DST1-series Safety I/O Terminals



Safety Input and Safety I/O Models Available

- Safety inputs: 12-point model (DST1-ID12SL-1)
- Safety I/O: 8-point/8-point model (DST1-MD16SL-1)
- Safety I/O: 4-point/4-point (relay outputs) model (DST1-MRD08SL-1)

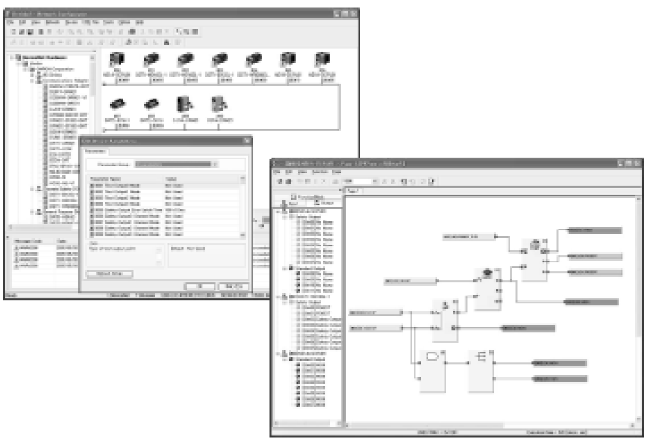
DeviceNet Slave Functionality

- Safety I/O and status information can be allocated as a DeviceNet Slave.
- Maintenance functions are provided for measuring the number of operations or the operating time for safety devices.

Easy Wiring

- Superior construction and preventive maintenance using clamp connectors.

WS02-CFSC1-E Safety Network Configurator



Network Configurator Functions

- Includes previous DeviceNet Configurator functions.
- Performs setup for the DeviceNet Safety network configuration.

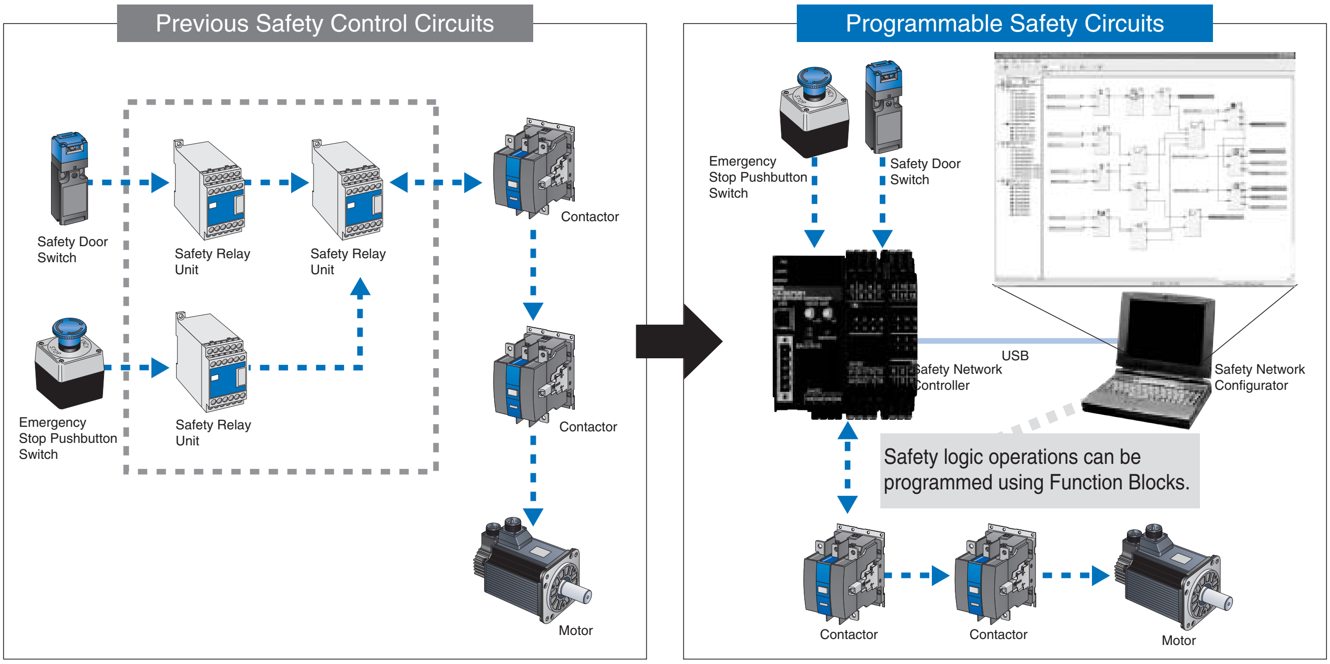
Programming Functions

- I/O configuration functions for Safety Network Controllers and Safety I/O Terminals.
- Programming functions for safety circuits.
- Monitor programs.

Stand-Alone Programmable Controller

Programmable Safety Circuits

Until now, safety design involved combining safety relays to configure safety control circuits. This process involved tedious wiring, and moreover, any changes required direct modification of the wiring. The DeviceNet Safety System uses programmable safety circuits, dramatically improving the ease of design and modification.

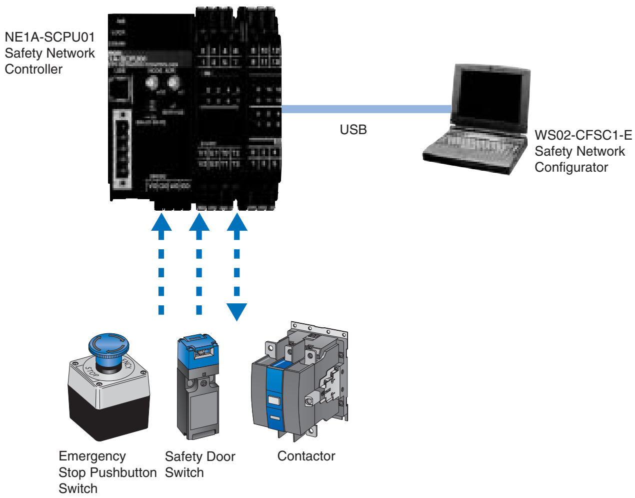


System Configuration 1

Configuration Example for High-speed Safety I/O Response Using Small Number of Points

- NE1A-SCPU01
- WS02-CFSC1-E

Delivers high-speed I/O response in a single Unit with up to 16 safety inputs and 8 safety outputs.



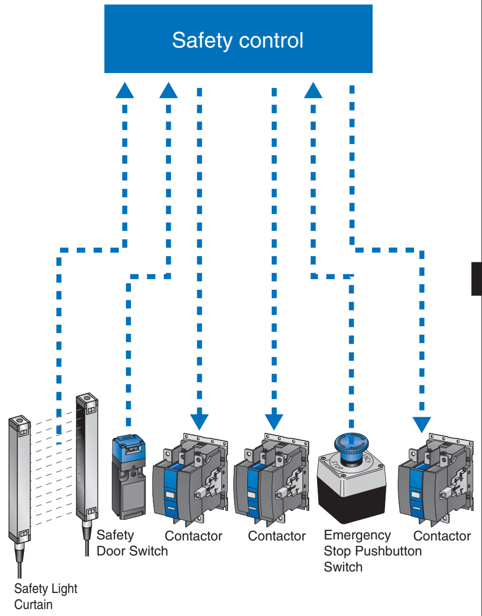
NE1A/DST1

Safety Network

Expand Safety I/O Through Networks

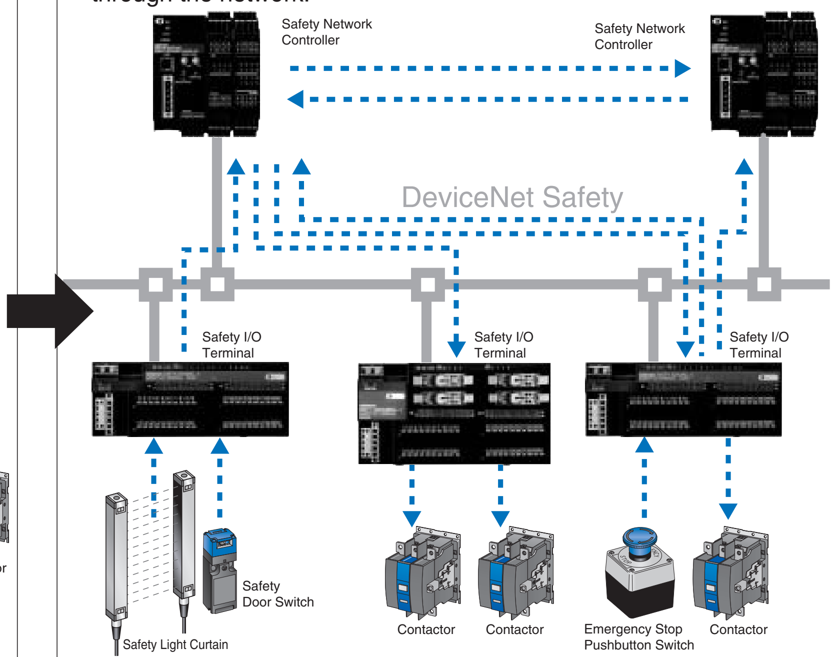
Safety components distributed over many different installation locations required long and complicated wiring.
Replacing the wiring with a network between safety components greatly improves productivity

Previous Machine Connections



Connecting Devices Using DeviceNet Safety

By using Safety I/O Terminals, safety I/O can be expanded easily through the network.



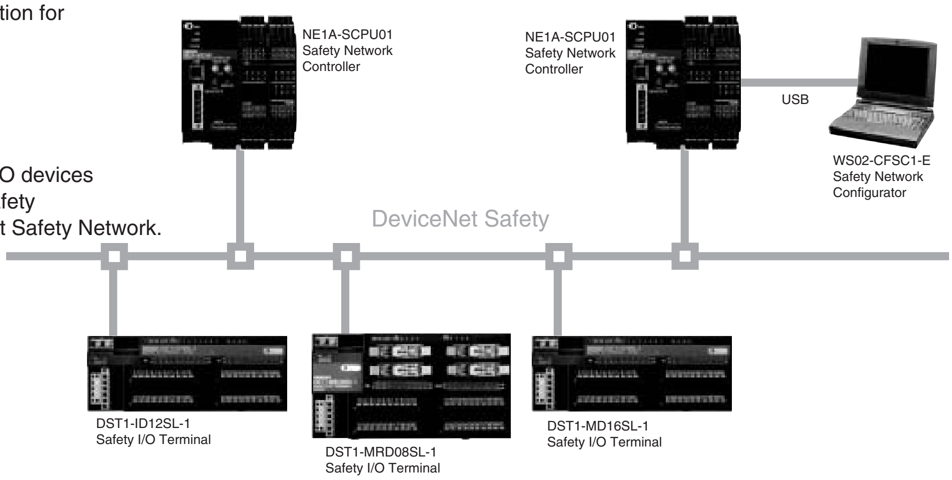
Expand a Safety Network Controller using up to sixteen Input Slaves with 12 points each (192 points total), and up to eight I/O Slaves with 16 points each (128 points total).

System Configuration 2

Example of Safety I/O Configuration for Distributed Hazard Sources

- NE1A-SCPU01
- DST1 Series
- WS02-CFSC1-E

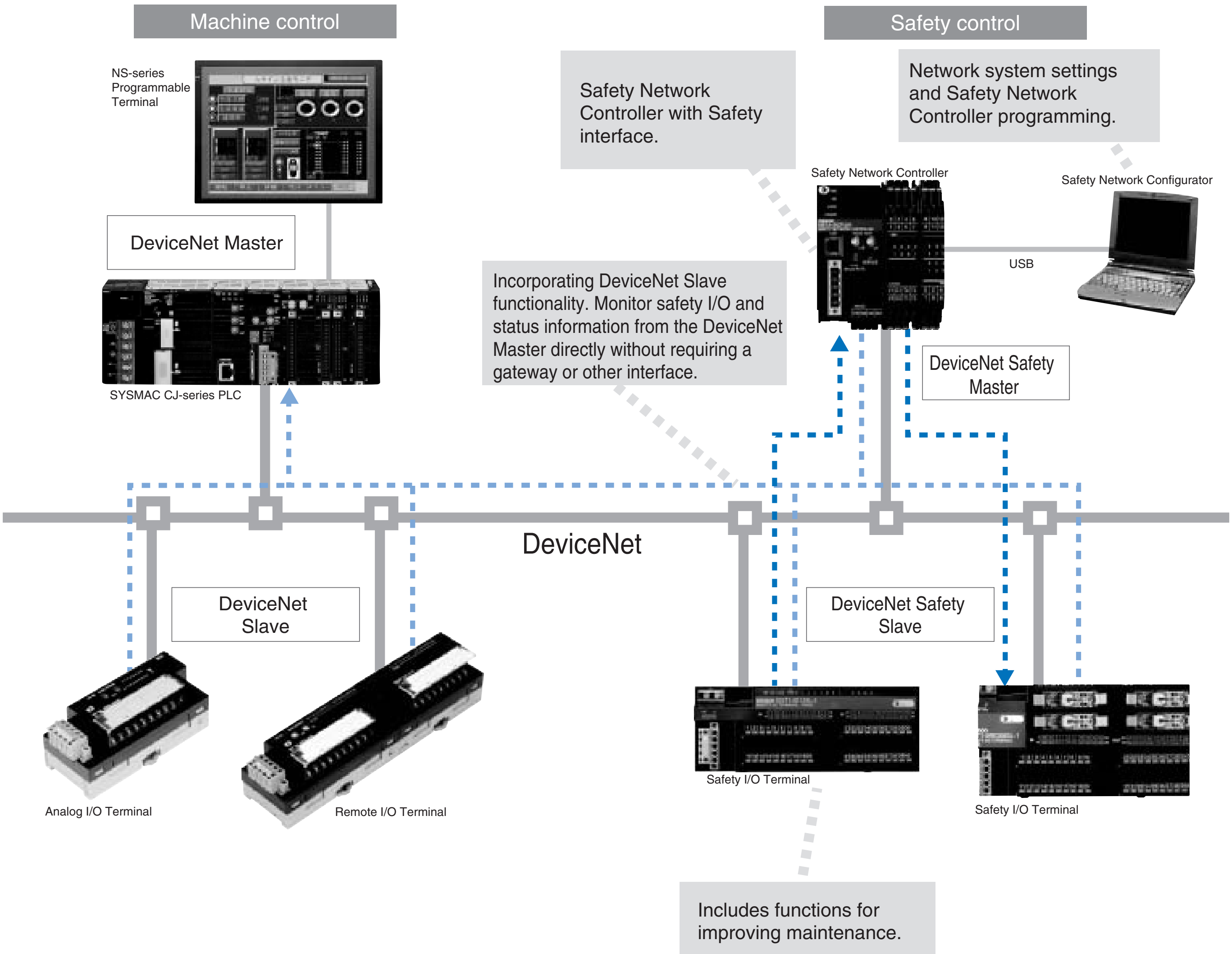
Distributed allocation of safety I/O devices can be achieved easily using Safety I/O Terminals and the DeviceNet Safety Network.



Combined Safety / DeviceNet Network

Compatible with the DeviceNet Open Network

Linking machine control is indispensable for achieving total control. By linking to machine control data, safety control can be monitored from the PLC, enabling the location of an error to be identified in an instant and improving maintenance.
DeviceNet Safety System utilizes the DeviceNet wiring from the existing network as is.

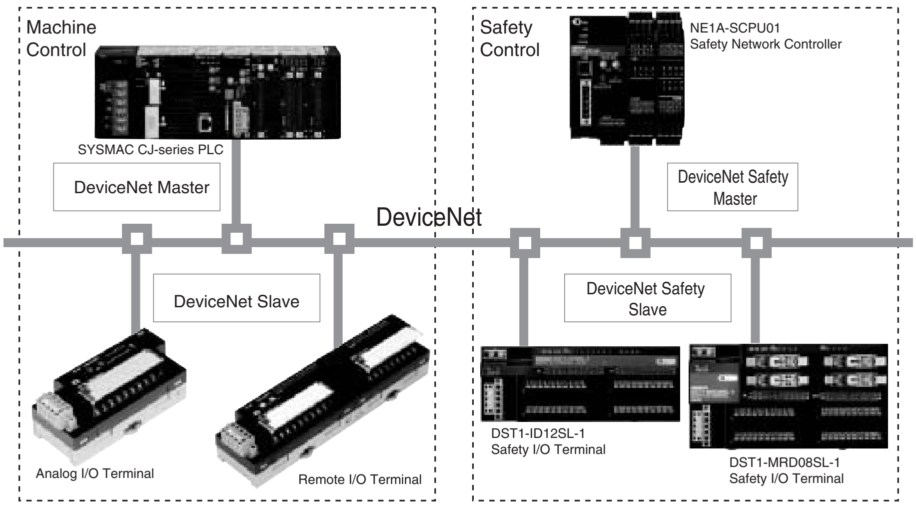


System Configuration 3

System Configuration Example for Total Control of Machine Control and Safety Control

- SYSMAC CJ Series
- NE1A-SCPU01
- DST1 Series
- WS02-CFSC1-E

The DeviceNet Network can be used to monitor the status of safety I/O and safety circuits on the DeviceNet Safety Network from existing DeviceNet Masters or other PLCs.



Ordering Information

Safety I/O Terminals

Appearance	Appearance Description	Part Number
Safety Network Controller 	16 PNP Inputs 8 PNP Outputs 4 Test Outputs 128 Function Block Programming Removable Cage Clamp Terminals	NE1A-SCPU01

IP20 Safety I/O Terminals

Appearance	Appearance Description	Part Number
Input Terminal 	12 PNP Inputs 4 Test Outputs Removable Cage Clamp Terminals	DST1-ID12SL-1
Mixed I/O Terminal 	8 PNP Inputs 8 PNP Outputs 4 Test Outputs Removable Cage Clamp Terminals	DST1-MD16SL-1
Mixed I/O Terminal 	4 PNP Inputs 4 relay Outputs (4 x 2-single pole) 4 Test Outputs Removable Cage Clamp Terminals	DST1-MRD08SL-1

Software

Appearance	Appearance Description	Part Number
Safety Network Configurator 	Installation Disk (CD-ROM) IBM PC/AT Compatible Windows 2000 or XP	WS02-CFSC1-E (English Version)

Specifications

NE1A-SCPU01

General Specifications

DeviceNet communications power supply voltage		11 to 25 VDC (supplied from communications connector)
Unit power supply voltage		20.4 to 26.4 VDC (24 VDC 15% +10%)
I/O power supply voltage		
Consumption current	Communications power supply	24 VDC, 15 mA
	Internal circuit power supply	24 VDC, 230 mA
Overvoltage category		II
Noise immunity		Conforms to IEC 61131-2
Vibration resistance		10 to 57 Hz: 0.35 mm, 57 to 150 Hz: 50 m/s2
Shock resistance		150 m/s2: 11 ms
Mounting method		35-mm DIN Track
Ambient operating temperature		-10 to +55°C
Ambient operating humidity		10% to 95% (with no condensation)
Ambient storage temperature		-40 to +70°C
Degree of protection		IP20
Weight		460 g max.

Safety Input Specifications

Input type	Sinking inputs (PNP)
ON voltage	11 VDC min. between each input terminal and G1
OFF voltage	5 VDC min. between each input terminal and G1
OFF current	1 mA max.
Input current	4.5 mA

Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.5 A max. per output
Residual voltage	1.2 V max. between each output terminal and V2
Leakage current	0.1 mA max.

Test Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.7 A max. per output (See note.)
Residual voltage	1.2 V max. between each output terminal and V1
Leakage current	0.1 mA max.

Note: Total simultaneous ON current: 1.4 A

Standards

Certifying body	Standards
TÜV Rheinland	EN954-1:1996, EN60204-1:1997, EN61000-6-2:2001, EN61000-6-4:2001, EN418:1992, IEC61508 part1-7/ 12.98-05.00, IEC61131-2/02.03, NFPA 79-2002, ANSI RIA15.06-1999, ANSI B11.19-2003
UL	UL1998 (pending), NFPA79 (pending), UL508, CSA22.2 No14, UL1604

Note: For details on operating precautions and other information required to use the product, be sure to read the following operation manual: DeviceNet Safety Network Controller Operation Manual (Z906)

DST1-□SL-1

General Specifications

DeviceNet communications power supply voltage		11 to 25 VDC (supplied from communications connector)
Unit power supply voltage		20.4 to 26.4 VDC (24 VDC 15% +10%)
I/O power supply voltage		
Consumption current	Communications power supply	DST1-ID12SL-1/MD16SL-1: 100 mA DST1-MRD08SL-1: 110 mA
Overvoltage category		II
Noise immunity		Conforms to IEC 61131-2
Vibration resistance		10 to 57 Hz: 0.35 mm, 57 to 150 Hz: 50 m/s2
Shock resistance		DST1-ID12SL-1/MD16SL-1: 150 m/s² 11 ms DST1-MRD08SL-1: 100 m/s² 11 ms
Mounting method		35-mm DIN Track
Ambient operating temperature		-10 to +55°C
Ambient operating humidity		10% to 95% (with no condensation) DST1-MRD08SL-1: 10% to 85% (with no condensation)
Ambient storage temperature		-40 to +70°C
Degree of protection		IP20
Weight		DST1-ID12SL-1/MD16SL-1: 420 g DST1-MRD08SL-1: 600 g

Safety Input Specifications

Input type	Sinking inputs (PNP)
ON voltage	11 VDC min. between each input terminal and G1
OFF voltage	5 VDC min. between each input terminal and G1
OFF current	1 mA max.
Input current	6 mA

Note: For details on operating precautions and other information required to use the product, be sure to read the following operation manual: DeviceNet Safety DST1-series Safety I/O Terminals Operation Manual (Z904)

Safety Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.5 A max. per output
Residual voltage	1.2 V max. between each output terminal and V2
Leakage current	0.1 mA max.

Test Output Specifications

Output type	Sourcing outputs (PNP)
Rated output current	0.7 A max. per point
Residual voltage	1.2 V max. between each output terminal and V1
Leakage current	0.1 mA max.

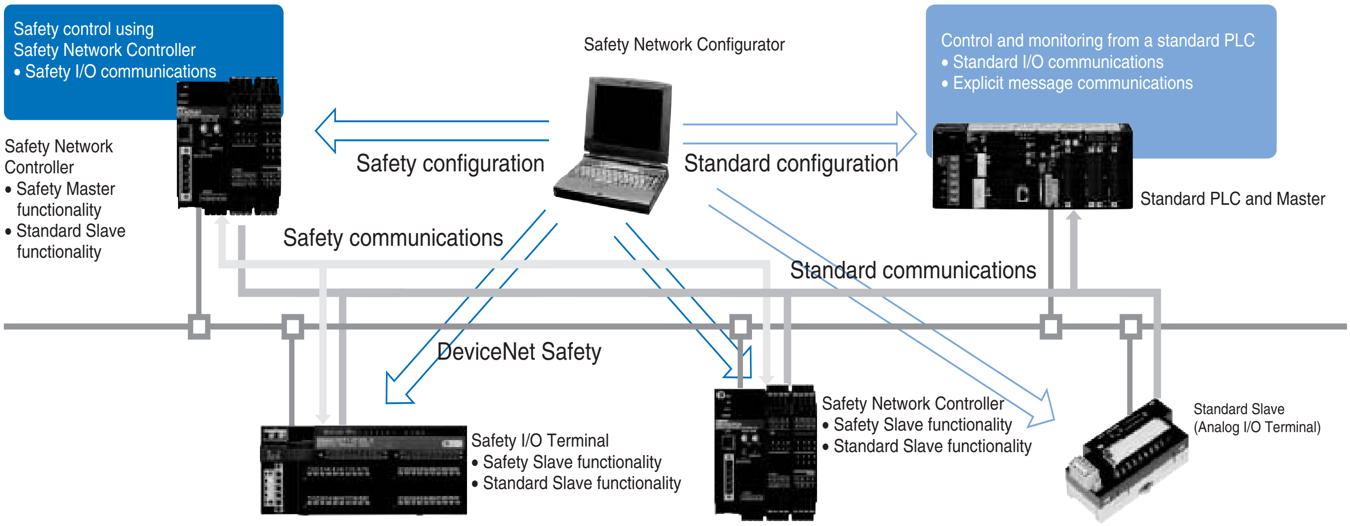
Safety Output Specifications for Realy Outputs

Relays	G7SA-2A2B, EN 50205 Class A
Minimum applicable load	1 mA at 5 VDC
Rated load for a resistive load	240 VAC: 2 A, 30 VDC: 2 A
Rated load for an inductive load	2 A at 240 VAC (cos =0.3), 1 A at 24 VDC
Mechanical life expectancy	5,000,000 operations min. (switching frequency of 7,200 operations/h)
Electrical life expectancy	100,000 operations min. (at rated load and switching frequency of 1,800 operations/h)

Standards

Certifying body	Standards
TÜV Rheinland	EN954-1/12.96, EN60204-1/12.97, EN61000-6-2/10.01, EN61000-6-4/10.01,EN418/1992, IEC61508 part1-7/ 12.98-05.00,IEC61131-2/02.03, NFPA 79-2002,ANSI RIA15.06-1999, ANSI B11.19-2003
UL	UL1998, NFPA79, UL508, CSA22.2 No14, UL1604 (DST1-ID12SL-1 and DST1-MD16SL-1 only)

WS02-CFSC1-E
System Configuration



General Specifications

Compatible computer	IBM PC/AT or compatible
CPU	Pentium 300 MHz min.
OS	Windows 2000 or XP
Supported languages	English
Memory	128 Mbytes min.
Hard disk	40 Mbytes min. available space
Monitor	Display functionality of S-VGA monitor or higher
CD-ROM	One CD-ROM drive min.
Communications port	Either of the following communications ports is required. • USB port: For online communications via SNC USB port (USB1.1) • DeviceNet Interface Card (3G8E2-DRM21-EV1): For online communications via DeviceNet.

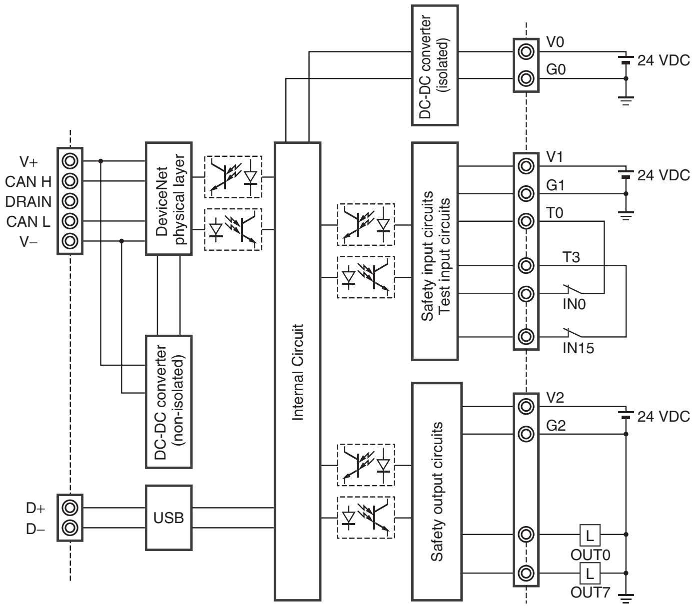
Note: Windows is a registered trademark of Microsoft.
IBM is a registered trademark of International Business Machines Corp.

Manuals

Description	Reference Number
Devicenet Safety Network Controller Operation Manual	Z906
Devicenet Safety DST1-series Safety I/O Terminals Operation Manual	Z904
Devicenet Safety System Configuration Manual	Z905

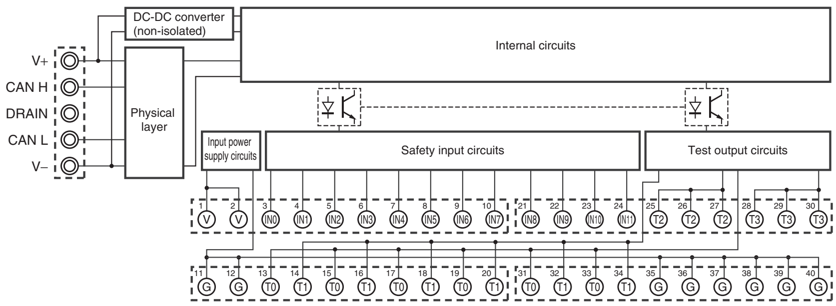
Internal Circuit Configuration

NE1A-SCPU01

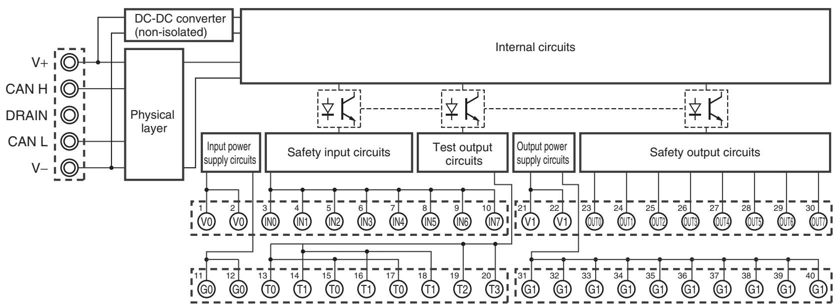


Safety I/O Terminals

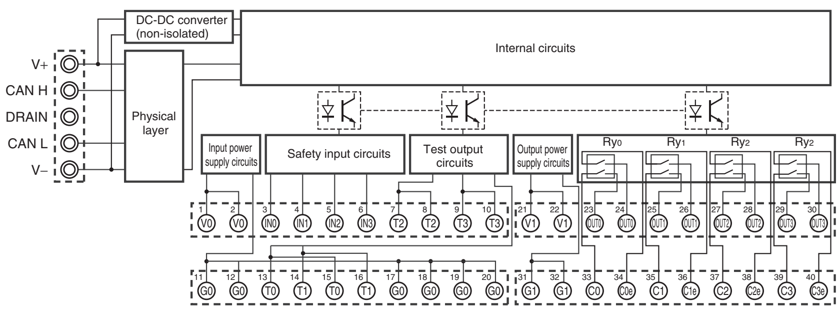
DST1-ID12SL-1



DST1-MD16SL-1



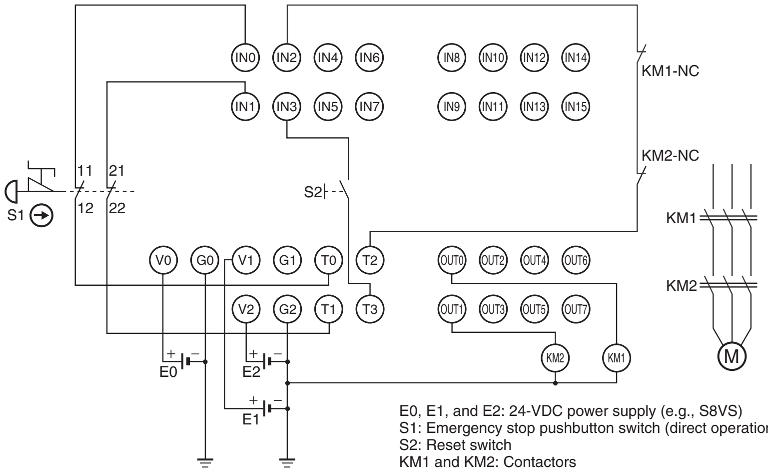
DST1-MRD08SL-1



Wiring Diagrams

NE1A-SCPU01

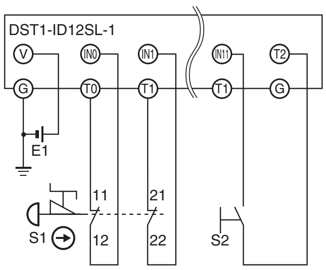
Emergency Stop Applications (Manual Reset)



E0, E1, and E2: 24-VDC power supply (e.g., S8VS)
S1: Emergency stop pushbutton switch (direct operation mechanism)
S2: Reset switch
KM1 and KM2: Contactors

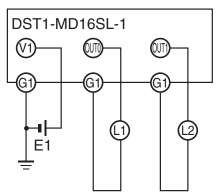
Safety I/O Terminals

● Emergency Stop Switch and Reset



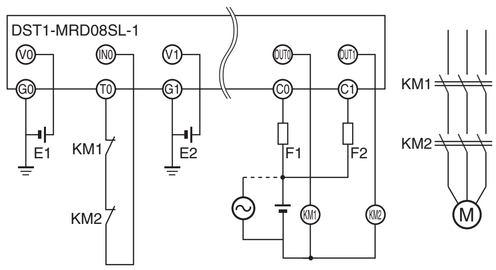
E1: 24-VDC Power Supply (e.g., S8VS)
S1: Emergency stop pushbutton switch (direct operation mechanism)
S2: Reset switch

● Safety Outputs



E1: 24-VDC Power Supply (e.g., S8VS)
L1 and L2: Loads

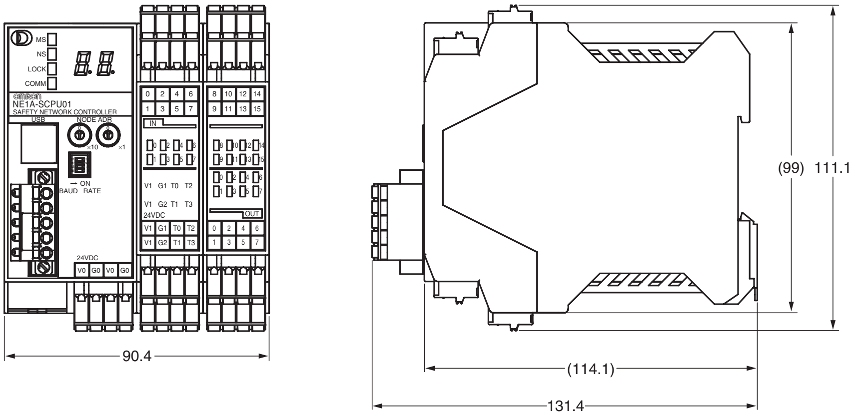
● Safety Output and Output Feedback



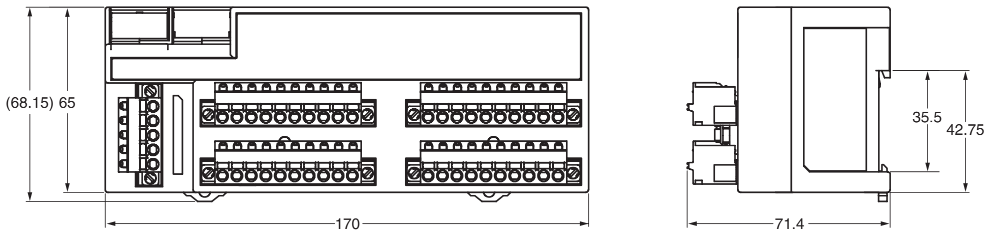
E1: 24-VDC Power Supply (e.g., S8VS)
KM1 and KM2: Contactors
F1 and F2: Fuses

Dimensions

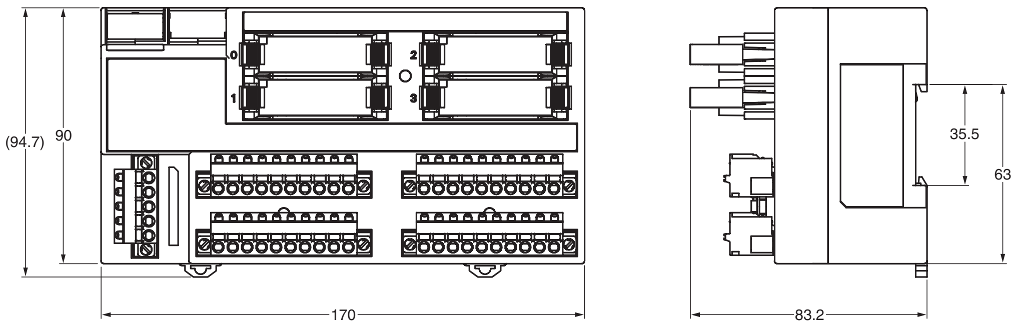
NE1A-SCPU01



DST1-ID12SL-1
DST1-MD16SL-1



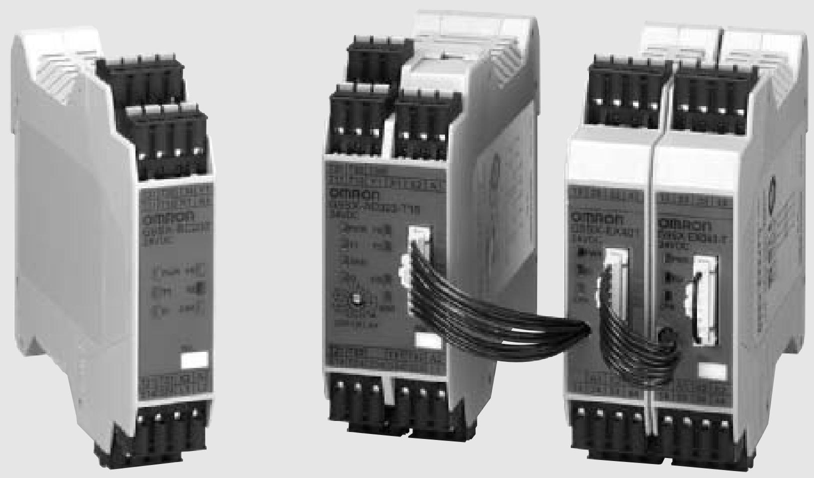
DST1-MRD08SL-1



Flexible Safety Unit

G9SX

Logical AND Function in combination with clever I/O Expansion and Diagnosis offers Flexibility, Transparency and Availability



NEW

- Facilitates clear and transparent segmentation of your safety system
- Solid-state outputs for long live, and relay expansion units for up to 25 outputs per path.
- Detailed LED indications enable easy diagnosis
- Small size saves space.
- Clever Feeback outputs to feed status into control system
- Approved for compliance to EN954-1 (cat4) and IEC/EN61508 (SIL3) by TÜV Produkt Service
- Approved by UL and CSA for global market.

Note: Refer to *Precautions* on page G-103.

Model Number Legend

G9SX-□□□□□-□□□-□□

1 2 3 4 5 6

1. **Functions**
   AD: Advanced Unit
   BC: Basic Unit
   EX: Expansion Unit
2. **Output Configuration (Instantaneous Safety Outputs)**
   0: None
   2: 2 outputs
   3: 3 outputs
   4: 4 outputs
3. **Output Configuration (OFF-delayed Safety Outputs)**
   0: None
   2: 2 outputs
   4: 4 outputs
4. **Output Configuration (Auxiliary Outputs)**
   1: 1 output
   2: 2 outputs
5. **Max. OFF-delay Time**
   Advanced Unit
   T15: 15 s
   Basic Unit
   No indicator: No OFF delay
   Expansion Unit
   No indicator: No OFF delay
   T: OFF delay
6. **Terminal Block Type**
   RT: Screw terminals
   RC: Spring-cage terminals

Ordering Information

List of Models

Advanced Unit

Safety outputs		Auxiliary outputs	No. of input channels	Max. OFF-delay time (See note 1.)	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed (See note 2.)						
3 (solid state) (See note 3.)	2 (solid state) (See note 3.)	2 (solid state) (See note 4.)	1 or 2 channels	15 s	24 VDC	Screw terminals	G9SX-AD322-T15-RT
						Spring-cage terminals	G9SX-AD322-T15-RC

Note: 1. The OFF-delay time can be set in 16 steps as follows:
T15: 0/0.2/0.3/0.4/0.5/0.6/0.7/1/1.5/2/3/4/5/7/10/15 s
2. The OFF-delayed output becomes an instantaneous output by setting the OFF-delay time to 0 s.
3. P channel MOS FET transistor output
4. PNP transistor output

Basic Unit

Safety outputs		Auxiliary outputs	No. of input channels	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
2 (solid state) (See note 1.)	---	2 (solid state) (See note 2.)	1 or 2 channels	24 VDC	Screw terminals	G9SX-BC202-RT
					Spring-cage terminals	G9SX-BC202-RC

Note: 1. P channel MOS FET transistor output
2. PNP transistor output

Expansion Unit

Safety outputs		Auxiliary outputs	OFF-delay time	Rated voltage	Terminal block type	Model
Instantaneous	OFF-delayed					
4 PST-NO (contact)	---	1 (solid state) (See note 1.)	---	24 VDC	Screw terminals	G9SX-EX401-RT
					Spring-cage terminals	G9SX-EX401-RC
---	4 PST-NO (contact)		(See note 2.)		Screw terminals	G9SX-EX041-T-RT
					Spring-cage terminals	G9SX-EX041-T-RC

Note: 1. PNP transistor output
2. The OFF-delay time is synchronized to the OFF-delay time setting in the connected G9SX-AD-☐ Advanced Unit.

Specifications

Ratings

Power input

Item	G9SX-AD322-□	G9SX-BC202-□	G9SX-EX-□
Rated supply voltage	24 VDC		
Operating voltage range	−15% to 10% of rated supply voltage		
Rated power consumption (See note.)	4 W max.	3 W max.	2 W max.

Note: Power consumption of loads not included.

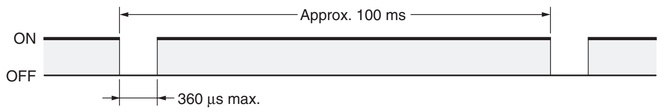
Inputs

Item	G9SX-AD322-□	G9SX-BC202-□
Safety input	Operating voltage: 20.4 VDC to 26.4 VDC, internal impedance: approx. 2.8 kΩ	
Feedback/reset input		

Outputs

Item	G9SX-AD322-□	G9SX-BC202-□
Instantaneous safety output OFF-delayed safety output (See note 1.)	P channel MOS FET transistor output Load current: Using 2 outputs or less: 1 A DC max. (See note 2.) Using 3 outputs or more: 0.8 A DC max.	P channel MOS FET transistor output Load current: Using 1 output: 1 A DC max. (See note 2.) Using 2 outputs: 0.8 A DC max.
Auxiliary output	PNP transistor output Load current: 100 mA max.	

Note: 1. While safety outputs are in the ON state, the following signal sequence is output continuously for diagnosis. When using the safety outputs as input signals to control devices (i.e. Programmable Controllers), consider the OFF pulse shown below.



2. The following derating is required when Units are mounted side-by-side.
G9SX-AD322-□/G9SX-BC202-□: 0.4 A max. load current

Expansion Unit

Item	G9SX-EX-□
Rated load	250 VAC, 3A / 30 VDC, 3A (resistive load)
Rated carry current	3 A
Maximum switching voltage	250 VAC, 125 VDC

Characteristics

Item		G9SX-AD322-□	G9SX-BC202-□	G9SX-EX-□
Over-voltage category (IEC/EN 60664-1)		II		II (Safety relay outputs 13 to 43 and 14 to 44: III)
Operating time (OFF to ON state) (See note 1.)		50 ms max. (Safety input: ON) (See note 2.) 100 ms max. (Logical AND connection input: ON) (See note 3.)	50 ms max. (Safety input: ON)	30 ms max. (See note 4.)
Response time (ON to OFF state) (See note 1.)		15 ms max.		10 ms max. (See note 4.)
ON-state residual voltage		3.0 V max. (safety output, auxiliary output)		
OFF-state leakage current		0.1 mA max. (safety output, auxiliary output)		
External connection impedance		100 Ω max. and 10 nF max.		---
Reset input time (Reset button pressing time)		100 ms min.		
Accuracy of OFF-delay time (See note 5.)		Within ±5% of the set value	---	Within ±5% of the set value
Insulation resistance	**Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together**	20 MΩ min. (by 100 VDC megger)	---	---
	Between all terminals connected together and DIN rail		20 MΩ min. (at 100 VDC)	100 MΩ min. (at 500 VDC)

<table>
<tr><th colspan="2">Item</th><th>G9SX-AD322-□</th><th>G9SX-BC202-□</th><th>G9SX-EX-□</th></tr>
<tr><td rowspan="4">Dielectric strength</td><td>Between logical AND connection terminals, and power supply input terminals and other input and output terminals connected together</td><td rowspan="2">500 VAC for 1 min</td><td>---</td><td>---</td></tr>
<tr><td>Between all terminals connected together and DIN rail</td><td>500 VAC for 1 min</td><td rowspan="2">1,200 VAC for 1 min</td></tr>
<tr><td>Between different poles of outputs</td><td rowspan="2">---</td><td rowspan="2">---</td></tr>
<tr><td>Between safety relay outputs connected together and other terminals connected together</td><td>2,200 VAC for 1 min</td></tr>
<tr><td colspan="2">Vibration resistance</td><td colspan="3">Frequency: 10 to 55 to 10 Hz, 0.375-mm single amplitude (0.75-mm double amplitude)</td></tr>
<tr><td rowspan="2">Mechanical shock resistance</td><td>Destruction</td><td colspan="3">300 m/s^2</td></tr>
<tr><td>Malfunction</td><td colspan="3">100 m/s^2</td></tr>
<tr><td rowspan="2">Durability</td><td>Electrical</td><td colspan="2">---</td><td>100,000 cycles min.
(rated load, switching frequency: 1,800 cycles/hour)</td></tr>
<tr><td>Mechanical</td><td colspan="2">---</td><td>5,000,000 cycles min.
(switching frequency: 7,200 cycles/hour)</td></tr>
<tr><td colspan="2">Ambient temperature</td><td colspan="3">−10 to 55°C (no icing or condensation)</td></tr>
<tr><td colspan="2">Ambient humidity</td><td colspan="3">25% to 85%</td></tr>
<tr><td colspan="2">Terminal tightening torque (See note 6.)</td><td colspan="3">0.5 N·m</td></tr>
<tr><td colspan="2">Weight</td><td>Approx. 160 g</td><td>Approx. 100 g</td><td>Approx. 145 g</td></tr>
</table>

Note: 1. When two or more Units are connected by logical AND, the operating time and response time are the sum total of the operating times and response times, respectively, of all the Units connected by logical AND.

2. Represents the operating time when the safety input turns ON with all other conditions set.

3. Represents the operating time when the logical AND input turns ON with all other conditions set.

4. This does not include the operating time or response time of Advanced Units that are connected.

5. This does not include the operating time or response time of internal relays in the G9SX-EX-□.

6. For the G9SX-□-RT (with screw terminals) only

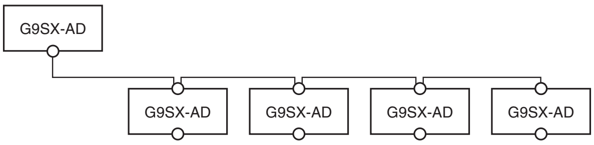
Logical AND Connection

Item	G9SX-AD322-□	G9SX-BC202-□	G9SX-EX-□
Number of Units connected per logical AND output	4 Units max.		---
Total number of Units connected by logical AND (See note 2.)	20 Units max.		---
Number of Units connected in series by logical AND	5 Units max.		---
Max. number of Expansion Units connected (See note 3.)	---		5 Units
Maximum cable length for logical AND input	100 m		---

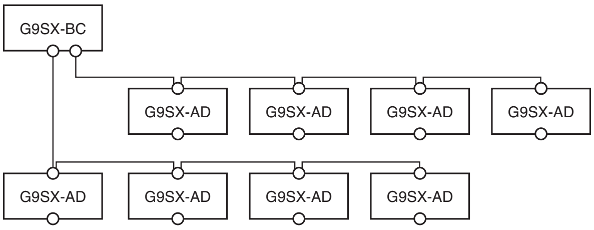
Note: 1. See Logical AND Connection Combinations below for details.
2. The number of G9SX-EX401-□ Expansion Units or G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) not included.
3. G9SX-EX401-□ Expansion Units and G9SX-EX041-T-□ Expansion Units (OFF-delayed Model) can be mixed.

Logical AND Connection Combinations

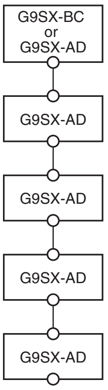
1. One logical AND connection output from an Advanced Unit can be logical AND connected to up to four Advanced Units.



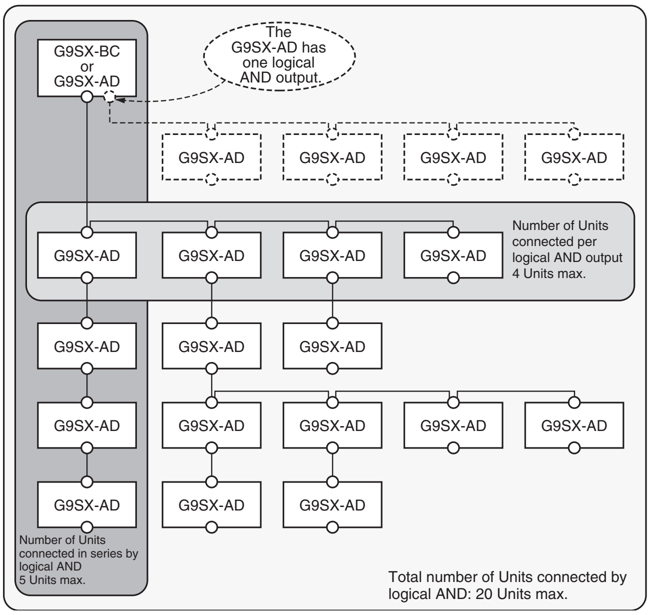
2. Two logical AND outputs from a Basic Unit can be logical AND connected to up to eight Advanced Units.



3. Any Advanced Unit with logical AND input can be logical AND connected to Advanced Units on up to five tiers.



4. The largest possible system configuration contains a total of 20 Advanced and Basic Units. In this configuration, each Advanced Unit can have up to five Expansion Units.



Response Time and Operating Time

The following table shows the response time for two or more Units that are logical AND connected.

Item / Tier	Block flow diagram	Max. response time (not including Expansion Units) (See note 1.)	Max. response time (including Expansion Units) (See note 2.)	Max. operating time (not including Expansion Units) (See note 3.)	Max. operating time (including Expansion Units) (See note 4.)
First tier	 ↓ Advanced Unit or Basic Unit	15 ms	25 ms	50 ms	80 ms
Second tier	↓ Advanced Unit	30 ms	40 ms	150 ms	180 ms
Third tier	↓ Advanced Unit	45 ms	55 ms	250 ms	280 ms
Fourth tier	↓ Advanced Unit	60 ms	70 ms	350 ms	380 ms
Fifth tier	↓ Advanced Unit ↓ 	75 ms	85 ms	450 ms	480 ms

Note: 1. The maximum response time (not including Expansion Units) in this block flow diagram is the time it takes the output from the Unit on the lowest tier to switch from ON to OFF after the input to the Unit on the highest tier switches from ON to OFF.

2. The maximum response time (including Expansion Units) in this block flow diagram is the time it takes the output from the Expansion Unit connected to the Unit on the lowest tier to switch from ON to OFF after the input to the Unit on the highest tier switches from ON to OFF.

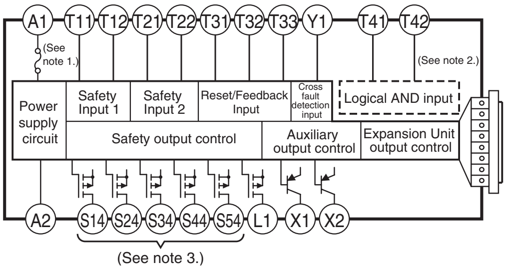
3. The maximum operating time (not including Expansion Units) in this block flow diagram is the time it takes the output from the Unit on the lowest tier to switch from OFF to ON after the input to the Unit on the highest tier switches from OFF to ON.

4. The maximum operating time (including Expansion Units) in this block flow diagram is the time it takes the output from the Expansion Unit connected to the Unit on the lowest tier to switch from OFF to ON after the input to the Unit on the highest tier switches from OFF to ON.

Connections

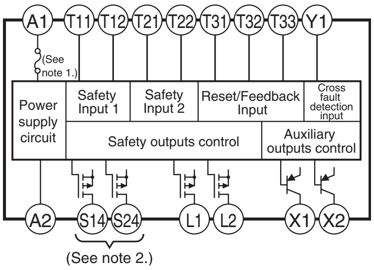
Internal Connection

G9SX-AD-322-T15-□ (Advanced Unit)



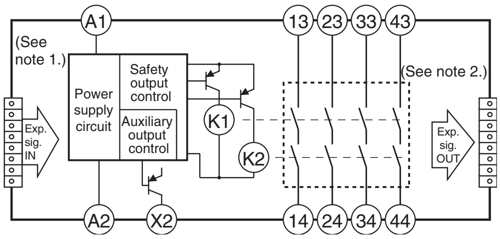
Note: 1. Internal power supply circuit is not isolated.
2. Logical AND input is isolated.
3. Outputs S14 to S54 are internally redundant.

G9SX-BC202-□ (Basic Unit)



Note: 1. Internal power supply circuit is not isolated.
2. Outputs S14 and S24 are internally redundant.

G9SX-EX401-□/G9SX-EX041-T-□ (Expansion Unit / Expansion Unit OFF-delayed model)



Note: 1. Internal power supply circuit is not isolated.
2. Relay outputs are isolated

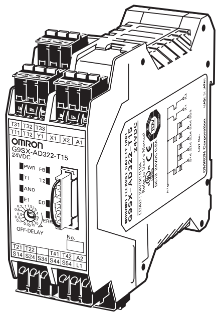
G9SX

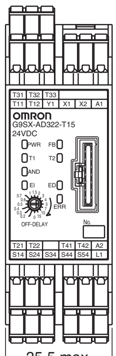
Dimensions

Note: All units are in millimeters unless otherwise indicated.

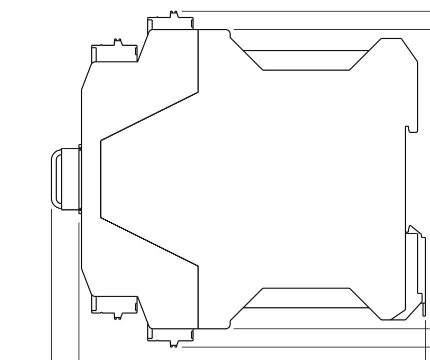
Advanced Unit

G9SX-AD322-□



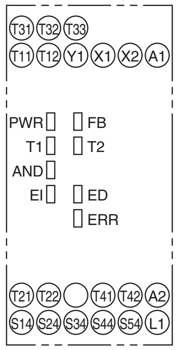


* Typical dimension



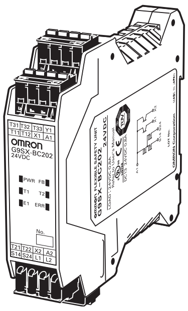
Note: 1. Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

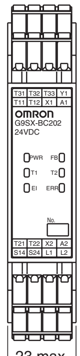
Terminal arrangement



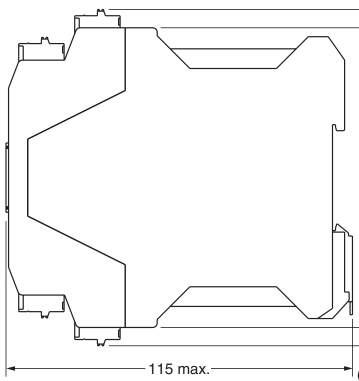
Basic Unit

G9SX-BC202-□



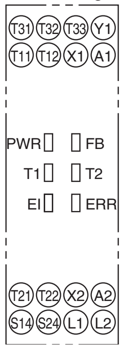


* Typical dimension



Note: 1. Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

Terminal arrangement

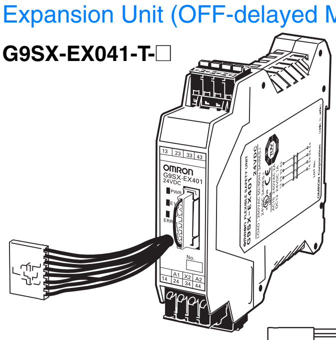


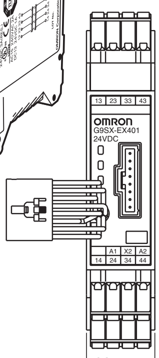
Expansion Unit

G9SX-EX401-□

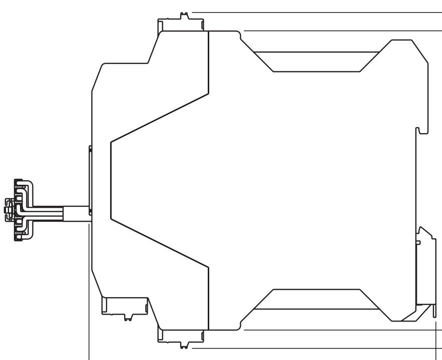
Expansion Unit (OFF-delayed Model)

G9SX-EX041-T-□





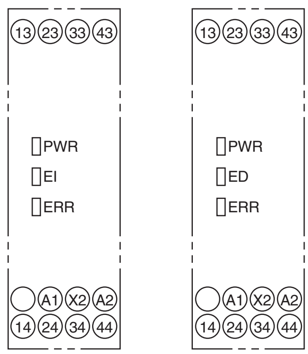
* Typical dimension



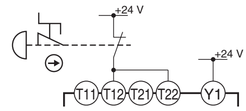
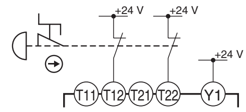
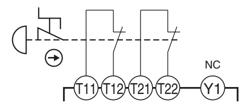
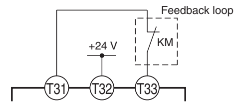
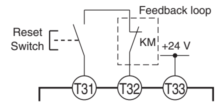
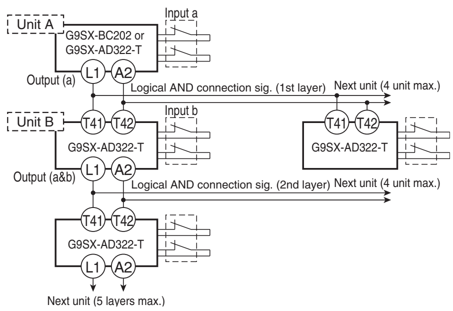
Note: 1. Above outline drawing is for -RC terminal type.
2. For -RC terminal type only.

Terminal arrangement

G9SX-EX401-□ (Expansion Unit) | G9SX-EX041-T-□ (Expansion Unit with OFF Delay)



Wiring of Inputs and Outputs

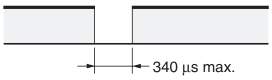
Signal name	Terminal name	Description of operation	Wiring
Power supply input	A1, A2	The input terminals for power supply. Connect the power source to the A1 and A2 terminals.	Connect the power supply plus (24 VDC) to the A1 terminal. Connect the power supply minus (GND) to the A2 terminal.
Safety input 1	T11, T12	To set the safety outputs in the ON state, the HIGH state signals must be input to both safety input 1 and safety input 2. Otherwise the safety outputs cannot be in the ON state.	Corresponds to Safety Category 2 (EN954-1) 
Safety input 2	T21, T22		Corresponds to Safety Category 3 (EN954-1) 
			Corresponds to Safety Category 4 (EN954-1) 
Feedback/reset input	T31, T32, T33	To set the safety outputs in the ON state, the ON state signal must be input to T33. Otherwise the safety outputs cannot be in the ON state.	Auto reset 
		To set the safety outputs in the ON state, the signal input to T32 must change from the OFF state to the ON state, and then to the OFF state. Otherwise the safety outputs cannot be in the ON state.	Manual reset 
Logical AND connection input	T41, T42	The logical AND connection means that one unit (Unit A) outputs a safety signal "a" to a subsequent unit (Unit B) and Unit B calculates the logical multiplication (AND) of the signal "a" and safety signal "b", which is input to Unit B. Thereby the logic of the safety output of Unit B is "a" AND "b". To set the safety outputs of the subsequent Unit in the ON state, its logical AND connection preset switch must be set to AND (enable) and the HIGH state signal must be input to T41 of the subsequent unit.	
Cross fault detection input	Y1	Selects the mode for the failure detecting (cross fault detecting) function for the safety inputs of G9SX corresponding to the connection of the cross fault detection input.	Keep Y1 open when using T11, T21. (Wiring corresponding to category 4) Connect Y1 to 24 VDC when not using T11, T21. (Wiring corresponding to category 2 or 3, or when connecting safety sensors)
Instantaneous safety output	S14, S24, S34	Turns ON/OFF according to the state of the safety inputs, feedback/reset inputs, and logical AND connection inputs. During OFF-delay state, the Instantaneous safety outputs are not able to turn ON.	Keep these outputs open when not used.
OFF-delayed safety output	S44, S54	OFF-delayed safety outputs. The OFF-delay time is set by the OFF-delay preset switch. When the delay time is set to zero, these outputs can be used as non-delay outputs.	Keep these outputs open when not used.
Logical connection output	L1, L2	Outputs a signal of the same logic as the instantaneous safety outputs.	Keep these outputs open when not used.
Auxiliary monitor output	X1	Outputs a signal of the same logic as the instantaneous safety outputs	Keep these outputs open when not used.
Auxiliary error output	X2	Outputs when the error indicator is lit or blinking.	Keep these outputs open when not used.

Connecting Safety Sensors and the G9SX

1. When connecting safety sensors to the G9SX, the Y1 terminal must be connected to 24 VDC. The G9SX will detect a connection error, if the Y1 terminal is open.

2. In many cases, safety sensor outputs include an OFF-shot pulse for self diagnosis. The following condition of test pulse is applicable as safety inputs for the G9SX.

- OFF-shot pulse width of the sensor, during the ON-state: 340 μs max. OMRON safety sensors comply to this specification. For 3rd party products refer to OSSD specification

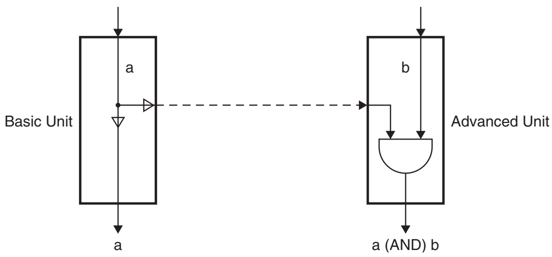


Operation

Functions

Logical AND Connection

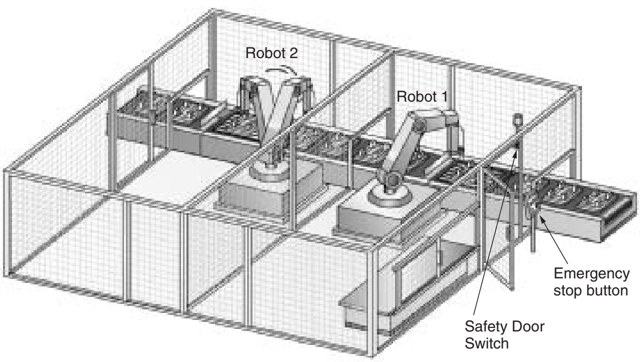
The logical AND connection means that the Basic Unit (or Advanced Unit) outputs a safety signal "a" to an Advanced Unit, and the Advanced Unit calculates the logical multiplication (AND) of the safety signal "a" and safety signal "b." The safety output of an Advanced Unit with the logical AND connection shown in the following diagram is "a" AND "b".

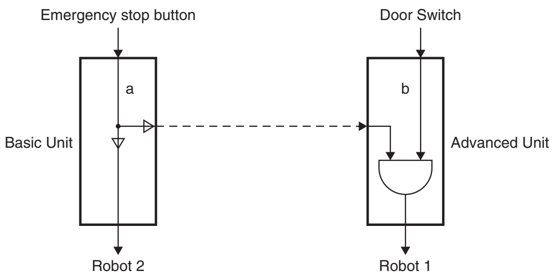


This is illustrated using the application in the following diagram as an example. The equipment here has two hazards identified as Robot 1 and Robot 2, and it is equipped with a safety door switch and an emergency stop button. You may have overall control where both Robot 1 and Robot 2 are stopped every time the emergency stop button is pressed. You may also have partial control where only Robot 1, which is closest to the door, is stopped when the door is opened. In that case, Robot 2 will continue to operate.

The actual situation using a G9SX for this application is shown in this example.

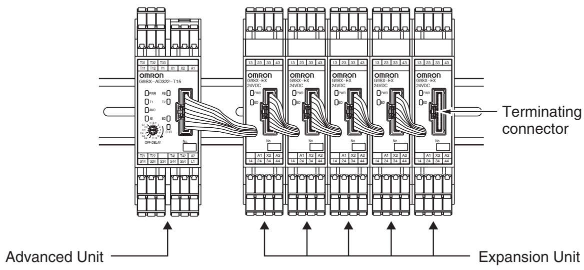
(Note: The logical AND setting on the Advanced Unit must be set to AND (enabled).)





Connecting Expansion Units

- The G9SX-EX and G9SX-EX-T Expansion Units can be connected to a G9SX-AD-☐ Advanced Unit to increase the number of safety outputs. (They cannot be connected to a Basic Unit.)
- A maximum of five Expansion Units can be connected to one Advanced Unit. This may be a combination of G9SX-EX Instantaneous types and G9SX-EX-T OFF-delayed types.
- Remove the terminating connector from the receptacle on the Advanced Unit and insert the Expansion Unit cable connector into the receptacle. Insert the terminating connector into the receptacle on the Expansion Unit at the very end (rightmost).
- When Expansion Units are connected to an Advanced Unit, make sure that power is supplied to every Expansion Unit. (Refer to the following diagram for actual Expansion Unit connection.)

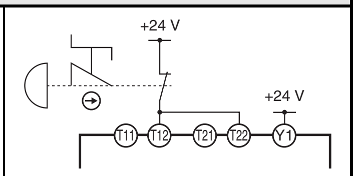
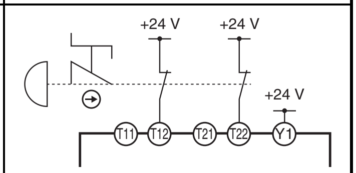
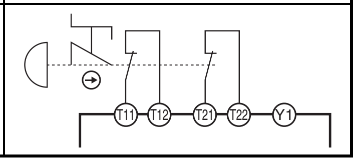


Setting Procedure

1. Cross Fault Detection (Advanced Unit/Basic Unit)

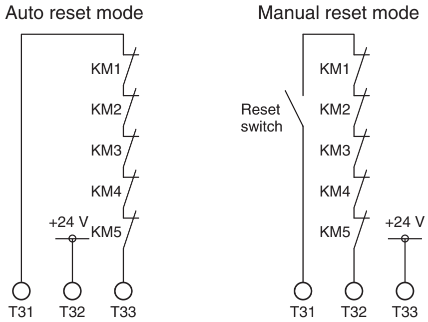
Set the cross fault detection mode for safety inputs by shorting Y1 to 24 V or leaving it open. When cross fault detection is set to ON, short-circuit failures are detected between safety inputs T11-T12 and T21-22. When a cross fault is detected, the following will occur.

1. The safety outputs and logical AND outputs lock out.
2. The LED error indicator is lit.
3. The error output (auxiliary output) turns ON.

Cross fault detection	Wiring	
OFF	Corresponds to Safety Category 2	
	Corresponds to Safety Category 3	
ON	Corresponds to Safety Category 4	

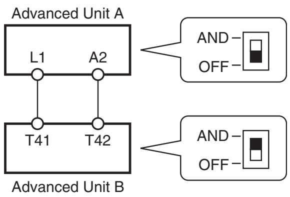
2. Reset Mode (Advanced Unit/Basic Unit)

Set the reset mode using feedback/reset input terminals T31, T32, and T33.
Auto reset mode is selected when terminal T32 is shorted to 24 V and manual reset mode is selected when terminal T33 is shorted to 24 V.



3. Setting Logical AND Connection (Advanced Unit)

When connecting two or more Advanced Units (or Basic Units) by logical AND connection, set the logical AND connection preset switch on the Advanced Unit that is on the input side (Advanced Unit B in the following diagram) to AND.



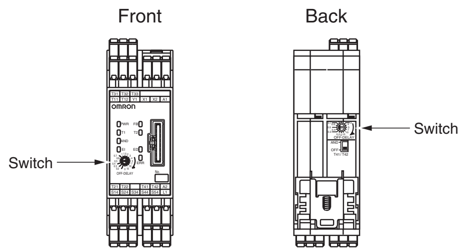
Note: 1. A setting error will occur and Advanced Unit B will lock out if the logical AND setting switch on the Unit is set to OFF.

2. Set the logical AND setting switch on Advanced Unit A to OFF or an error will occur.

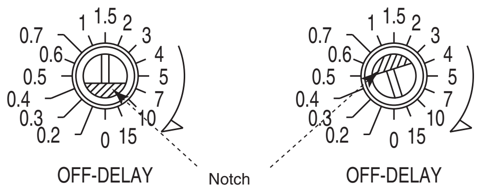
3. A logical AND input cannot be sent to a Basic Unit.

4. Setting the OFF-delay Time (Advanced Unit)

The OFF-delay preset time on an Advanced Unit is set from the OFF-delay time preset switch (1 each on the front and back of the Unit). Normal operation will only occur if both switches are identically set. An error will occur if the switches are not identically set.



Refer to the following illustration for details on setting switch positions.



Example 1: 0-second OFF-delay setting

Example 2: 1-second OFF-delay setting

⚠ Make sure AND and off delay time is set properly. Otherwise safety outputs remain in safe off state.

LED Indicators

Marking	Color	Name	G9SA-AD	G9SX-BC	G9SX-EX	G9SX-EX-T	Function	Reference
PWR	**Green**	**Power supply indicator**	❍	❍	❍	❍	Lights up while power is supplied.	---
T1	**Orange**	**Safety input #1 indicator**	❍	❍	---	---	Lights up while a HIGH state signal is input to T12. Blinks when an error relating to safety input #1 occurs.	(See note.)
T2	**Orange**	**Safety input #2 indicator**	❍	❍	---	---	Lights up while a HIGH state signal is input to T22. Blinks when an error relating to safety input #2 occurs.	
FB	**Orange**	**Feedback/ reset input indicator**	❍	❍	---	---	Lights up in the following cases: With automatic reset while a HIGH state signal is input to T33. With manual reset while a HIGH state signal is input to T32. Blinks when an error relating to feedback/reset input occurs.	
AND	**Orange**	**Logical AND input indicator**	❍	---	---	---	Lights up while a HIGH state signal is input to T41. Blinks when an error relating to logical AND connection input occurs.	
EI	**Orange**	**Safety output indicator**	❍	❍	❍	---	Lights up while the Instantaneous safety outputs (S14, S24, S34) are in the ON-state. Blinks when an error relating to the instantaneous safety output occurs.	
ED	**Orange**	**OFF-delayed safety output indicator**	❍	---	---	❍	Lights up while OFF-delayed safety outputs (S44, S54) are in the ON-state. Blinks when an error relating to OFF-delayed safety output occurs.	
ERR	**Red**	**Error indicator**	❍	❍	❍	❍	Lights up or blinks when an error occurs.	

Note: Refer to *Fault Detection* on the next page for details.

Settings Indication (at Power ON)

Settings for the G9SX can be checked by the orange indicators for approx. 3 seconds after the power is turned ON. During this settings indication period, the ERR indicator will light, however the auxiliary error output will remain OFF

Indicator	Item	Setting position	Indicator status	Setting mode	Setting status
T1	Cross fault detection mode	Y1 terminal	Lit	Detection mode	Y1 = open
			Not lit	Non-detection mode	Y1 = 24 VDC
FB	Reset mode	T32 or T33 terminal	Lit	Manual reset mode	T33 = 24 VDC
			Not lit	Auto reset mode	T32 = 24 VDC
AND	Logical AND connection input mode	Logical AND connection preset switch	Lit	Enable logical AND input	“AND”
			Not lit	Disable logical AND input	“OFF”

Fault Detection

When the G9SX detects a fault, the ERR indicator and/or other indicators light up or blink to inform the user about the fault.

Check and take necessary measures referring to the following table, and then re-supply power to the G9SX.

(Advanced Unit/Basic Unit)

ERR indicator	Other indicator	Fault	Expected causes of the fault	Check points and measures to take
Blinks	---	Fault due to electro-magnetic disturbance or of internal circuits.	1) Excessive electro-magnetic disturbance 2) Failure of the internal circuit	1) Check the disturbance level around the G9SX and the related system. 2) Replace with a new product.
Lights up	T1 blinks	Fault involved with safety input 1	1) Failure involving the wiring of safety input 1 2) Incorrect setting of cross fault detection input 3) Failure of the circuit of safety input 1	1) Check the wiring to T11 and T12. 2) Check the wiring to Y1. 3) Replace with a new product.
	T2 blinks	Fault involved with safety input 2	1) Failure involving the wiring of safety input 2 2) Incorrect setting of cross fault detection input 3) Failure of circuits of safety input 2	1) Check the wiring to T21 and T22. 2) Check the wiring to Y1. 3) Replace with a new product.
	FB blinks	Faults involved with feedback/reset input	1) Failures involving the wiring of feedback/reset input. 2) Failures of the circuit of feedback/reset input	1) Check the wiring to T31, T32 and T33. 2) Replace with a new product.
		Fault in Expansion Unit	1) Improper feedback signals from Expansion Unit 2) Abnormal supply voltage to Expansion Unit 3) Failure of the circuit of safety relay contact outputs	1) Check the connecting cable of Expansion Unit and the connection of the termination socket. 2) Check the supply voltage to Expansion Unit. **Note:** Make sure that all Expansion units' PWR indicators are lit. 3) Replace the Expansion Unit with a new one.
	EI blinks	Fault involved with instantaneous safety outputs or logical connection outputs or auxiliary monitor output	1) Failure involving the wiring of instantaneous safety outputs 2) Failure of the circuit of Instantaneous safety outputs 3) Failure involving the wiring of the logical connection output 4) Failure of the circuit of the logical connection output 5) Failure involving the wiring of the auxiliary monitor output 6) Impermissible high ambient temperature	1) Check the wiring to S14, S24, and S34. 2) Replace with a new product. 3) Check the wiring to L1 and L2. 4) Replace with a new product. 5) Check the wiring to X1. 6) Check the ambient temperature and spacing around the G9SX.
	ED blinks	Fault involved with OFF-delayed safety outputs	1) Failure involving the wiring of OFF-delayed safety relay contact outputs 2) Incorrect set values for OFF-delay time 3) Failure of the circuit of OFF-delayed safety relay contact outputs 4) Impermissible high ambient temperature	1) Check the wiring to S44 and S54 2) Confirm the set values of the two OFF-delay time preset switches. 3) Replace with a new product. 4) Check the ambient temperature and spacing around the G9SX.
	AND blinks	Fault involved with logical AND connection input	1) Failure involving the wiring of the logical AND connection input 2) Incorrect setting for the logical AND connection input 3) Failure of the circuit of the logical AND connection input	1) Check the wiring to T41 and T42 **Note:** Make sure that the wiring length for the T41 or T42 terminal is less than 100 meters. **Note:** Make sure that the logical AND connection signal is branched for less than 4 units. 2) Confirm the set value of the logical AND connection preset switch. 3) Replace with a new product.
	All indicators except PWR blink	Supply voltage outside the rated value	1) Supply voltage outside the rated value	1) Check the supply voltage to Expansion Units.

When indicators other than the ERR indicator blink, check and take necessary actions referring to the following table.

ERR indicator	Other indicators		Fault	Expected cause of the fault	Check points and measures to take
○ Off	T1 T2	Blink	Mismatch between input 1 and input 2.	The input status between input 1 and input 2 is different, due to contact failure or a short circuit of safety input device(s) or a wiring fault.	Check the wiring from safety input devices to the G9SX. Or check the input sequence of safety input devices. After removing the fault, turn both safety inputs to the OFF state.

(Expansion Unit)

ERR indicator	Other indicators	Fault	Expected cause of the faults	Check points and measures to take
● Light up	---	Fault involved with safety relay outputs of Expansion Units	1) Welding of relay contacts 2) Failure of the internal circuit	Replace with a new product.

Precautions

Precautions for Correct Use

Serious injury may possibly occur due to breakdown of safety outputs.
Do not connect loads beyond the rated value to the safety outputs.

Serious injury may possibly occur due to loss of required safety functions.
Wire G9SX properly so that supply voltages or voltages for loads do NOT touch the safety inputs accidentally or unintentionally.

Serious injury may possibly occur due to damages of safety inputs.
Apply protection circuitry against back electromotive force in case connecting inductive loads to safety outputs.

Serious injury may possibly occur due to loss of safety functions. Use devices appropriate for the application and the condition where G9SX is used.

Control Devices	Requirements
Emergency stop switch	Use approved devices with Direct Opening Mechanism complying with IEC/EN 60947-5-1
Door interlocking switch Limit switch	Use approved devices with Direct Opening Mechanism complying with IEC/EN 60947-5-1 and capable of switching micro loads of 24VDC, 5mA.
Safety Sensor	Use approved devices complying with the relevant product standards, regulations and rules in the country where it is used. Consult a certification body to assess that the entire system satisfies the required safety category level.
Relay with forcibly guided contacts	Use approved devices with forcibly guided contacts complying with EN 50205. For feedback purpose use devices with contacts capable of switching micro loads of 24VDC, 5mA.
Contactor	Use contactors with forcibly guided mechanism to input the signal to Feedback/Reset input of G9SX through the NC contact of the contactor. For feedback purpose use devices with contacts capable of switching micro loads of 24VDC, 5mA. Failure to open contacts of a contactor cannot be detected by monitoring its auxiliary NC contact without forcibly guided mechanism.
Other devices	Evaluate whether devices used are appropriate to satisfy the requirements of safety category level.

Precautions for Safe Use

1. Use G9SX within an enclosure with IP54 protection or higher of IEC/EN60529.

2. Incorrect wiring may lead to loss of safety function. Wire conductors correctly and verify the operation of G9SX before commissioning the system in which G9SX is incorporated.

3. Do not apply DC voltages exceeding the rated voltages, or any AC voltages to the G9SX power supply input.

4. Use DC supply satisfying requirements below to prevent electric shock.
- DC power supply with double or reinforced insulation, for example, according to IED/EN60950 or EN50178 or a transformer according to IEC/EN61558.
- DC supply satisfies the requirement for class 2 circuits or limited voltage/current circuit stated in UL 508.

5. Apply properly specified voltages to G9SX inputs.
Applying inappropriate voltages cause G9SX to fail to perform its specified function, which leads to the loss of safety functions or damages to G9SX

6. Auxiliary error outputs and auxiliary monitoring outputs are NOT safety outputs. Do not use auxiliary outputs as any safety output. Such incorrect use causes loss of safety function of G9SX and its relevant system.
Also Logical connection outputs can only be used for logical connections between G9SXs.

7. After installation of G9SX, qualified personnel should confirm the installation, and should conduct test operations and maintenance. The qualified personnel should be qualified and authorized to secure the safety on each phases of design, installation, running, maintenance and disposal of system.

8. A person in charge, who is familiar to the machine in which G9SX is to be installed, should conduct and verify the installation.

9. Turn OFF the signal to Safety input or Logical AND connection input every 24hours and make sure G9SX operates without faults by checking the state of the ERR indicator.

10. Do not dismantle, repair, or modify G9SX. It may lead to loss of its safety functions.

11. Use only appropriate components or devices complying with relevant safety standards corresponding to the required level of safety categories.
Conformity to requirements of safety category is determined as an entire system.
It is recommended to consult a certification body regarding assessment of conformity to the required safety level.

12. OMRON shall not be responsible for conformity with any safety standards regarding to customer's entire system.

13. Disconnect G9SX from power supply when wiring, to prevent electric shock or unexpected operation.

14. Be cautious not to have your fingers caught when attaching terminal sockets to the plugs on G9SX.

15. The lifetime of G9SX depends on the conditions of switching of its outputs. Be sure to conduct its test operation under actual operating conditions in advance and use it within appropriate switching cycles

16. Do not use in combustible gases or explosive gases. Arcs or heat generated by switching elements of G9SX can lead to fire or explosion.

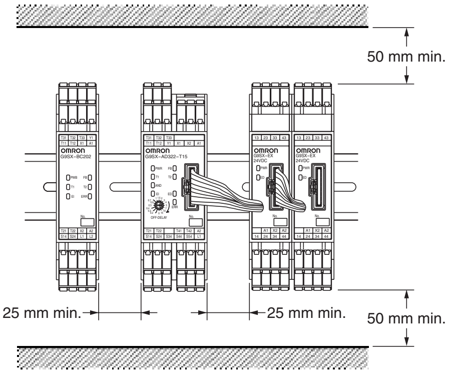
Precautions for Correct Use

1. Handle with care
Do not drop G9SX to the ground or expose to excessive vibration or mechanical shocks. G9SX may be damaged and may not function properly.

2. Conditions of storage
Do not store in such conditions stated below.
a. In direct sunlight
b. At ambient temperatures out of the range of −10 to 55°C.
c. At relative humidity out of the range of 25% to 85% or under such temperature change that causes condensation.
d. In corrosive or combustible gases
e. With vibration or mechanical shocks out of the rated values.
f. Under splashing of water, oil, chemicals
g. In the atmosphere containing dust, saline or metal powder.
G9SX may be damaged and may not function properly.

3. Mounting
Mount G9SX to DIN rails with attachments (TYPE PFP-M, not incorporated to this product), not to drop out of rails by vibration etc. especially when the length of DIN railing is short compared to the widths of G9SX.

4. Following spacing around G9SX should be available to apply rated current to outputs of G9SX and for enough ventilation and wiring:
   a. At least 25 mm beside side faces of the Advanced Unit (G9SX-AD322-□-□) and side faces of the Basic Unit (G9SX-BC202-□).
   b. At least 50 mm above top face of G9SX and below bottom face of G9SX.



5. Wiring
   a. For model G9SX-□-RT (with screw terminals)
      - Use the following to wire to G9SX-□-RT.

Solid wire	0.2 to 2.5mm^2 AWG24 to AWG12
Stranded wire (Flexible wire)	0.2 to 2.5mm^2 AWG24 to AWG12

      - Tighten each screw with a specified torque of 0.5 to 0.6Nm, or the G9SX may malfunction or generate heat.
      - Strip the cover of wire no longer than 7mm.
   b. For model G9SX-□-RC (with spring-cage terminals)
      - Use the following to wire to G9SX-□-RC

Solid wire	0.2 to 2.5mm^2 AWG24 to AWG12
Stranded wire	0.34 to 1.5mm^2 AWG22 toAWG16

      - It is recommended that stranded wire should be terminated with insulation-covered bar terminal (DIN 46228-4 standard compatible type) at its ends before using for connection.
6. When connecting Expansion Units (G9SX-EX□-□) to Advanced Unit (G9SX-AD322-□-□):
   a. Follow the procedure below:
      - Remove the termination connector from the receptacle on Advanced Unit (G9SX-AD322-□-□),
      - Insert the head of the connecting cable of Expansion Unit to the receptacle on the Advanced Unit
      - Set the termination connector to the receptacle on the Expansion Unit at the end position. When Advanced Unit is used without expansion units, leave the termination connector set on the Advanced Unit.
   b. Do not remove the termination connector or the connecting cable of the Expansion Unit while the system is operating.
   c. Before applying supply voltage, confirm that the connecting sockets and plugs are locked firmly.
   d. All of the Expansion Units should be supplied with its specified voltages within 10s after the connected Advanced Unit is supplied with voltage.
      Otherwise, Advanced Unit detects the power-supply error for the Expansion Units.
7. Use cables with length less than 100m to connect to Safety Inputs, Feed-back/Reset inputs, or between Logical AND connection inputs and Logical connection outputs, respectively.
8. Set the time duration of OFF-delay to an appropriate value that does not cause the loss of safety function of system.
9. Logical connection between Units:
   a. When using Logical AND connection inputs, set the Logical connection preset switch to 'AND' position for the units which the logical connection signal are input to.
   b. Connect Logical connection outputs appropriately to Logical AND connection inputs of the relevant unit. Verify the operation of G9SX before commissioning the system.
   c. When configuring the safety related system, be sure to consider that the delay of response time caused by logical connections do not degrade the safety function of the system.
10. To determine safety distance to hazards, take into account the delay of Safety outputs caused by the following time:
    a. Response time of Safety inputs
    b. Response time of Logical AND connection input
       (See also "Ratings and specifications, note 5")
    c. Preset off-delay time
    d. Accuracy of off-delay time
11. Start entire system after more than 5s have passed since applying supply voltage to all G9SXs in the system.
12. G9SX may malfunction due to electro-magnetic disturbances. Be sure to connect the terminal A2 to ground. To suppress electrical noise, apply a surge absorber to the coil of inductive load.
13. Devices connected to G9SX may operate unexpectedly. When replacing G9SX, disconnect it from power supply.
14. Adhesion of solvent such as alcohol, thinner, trichloroethane or gasoline on the product should be avoided. Such solvents make the marking on G9SX illegible and cause deterioration of parts.
15. Do NOT mix AC load and DC load to be switched in one G9SX-EX□-□. When switching of both AC load and DC load is necessary, connect more than two G9SX-EX□-□ and use each unit for AC load and DC load exclusively.

Category of EN 954-1

In the condition shown in *Application Examples*, G9SX can be used for the corresponding categories up to category 4.
This does NOT mean that G9SX can always be used for required category under all the similar conditions and situations.
Conformity to the categories must be assessed as a whole system.
When using G9SX for safety categories, be sure to confirm the conformity as a whole system.

1. Input the signals to both of the Safety inputs (T11-T12 and T21-T22)
2. Input a signal to the Safety inputs (T11-T12 and T21-T22) through switches with Direct Opening Mechanism.
   When using limit switches, at least one of them must have Direct Opening Mechanism.
3. When connecting Safety sensor with G9SX, use TYPE 4 safety sensor.
4. Input the signal through a NC contact of the contactor to Feedback/Reset input (T31-T32 for manual reset or T31-T33 for auto reset).(Refer to *Application Examples*)
5. Keep Cross fault detection mode input (Y1) open. However, when connecting devices with self-diagnosis function, such as safety sensors, apply 24VDC to Y1.
6. Be sure to Connect A2 to ground.
7. When using a G9SX-EX-□-□ Expansion Unit, connect fuses with a current rating of 3.15 A max. to the safety relay outputs to prevent the contacts from welding.

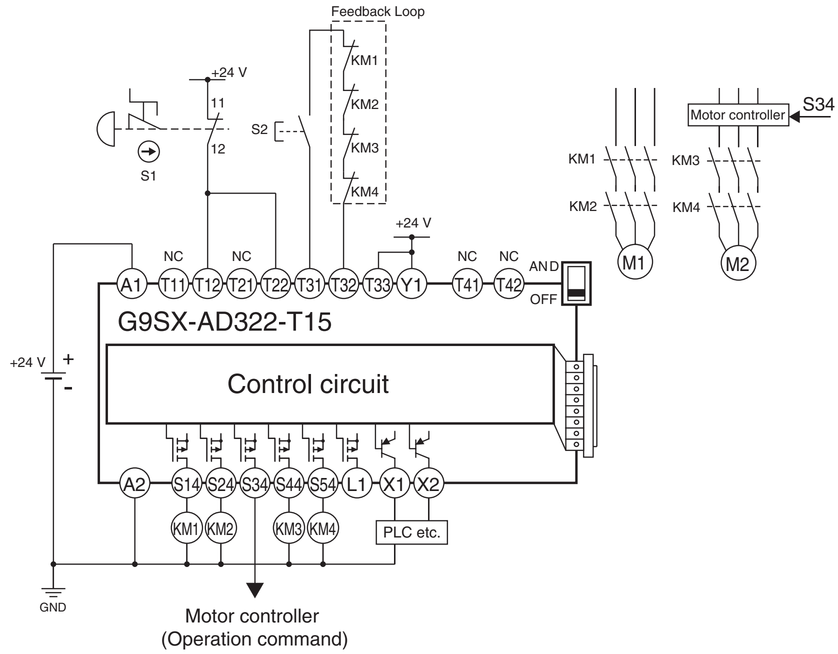
Compliance with International Standards

G9SX-AD-□/G9SX-BC-□/G9SX-EX-□

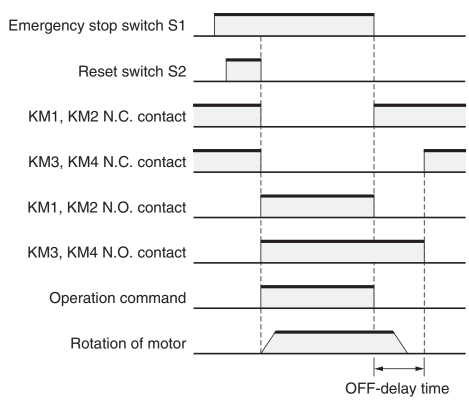
- Approved by TÜV Product Service
  EN50178
  IEC/EN60204-1
  EN954-1 Cat.4
  IEC/EN61508 SIL3
  IEC/EN61000-6-2
  IEC/EN61000-6-4
- Approved by UL
  UL508
  UL1998
  NFPA79
  IEC61508
- Approved by CSA
  CAN/CSA C22.2 No.142

Application Examples

G9SX-AD322-T15 (24 VDC) (1-channel Emergency Stop Switch Input / Manual Reset)



Timing chart



S1: Emergency stop switch

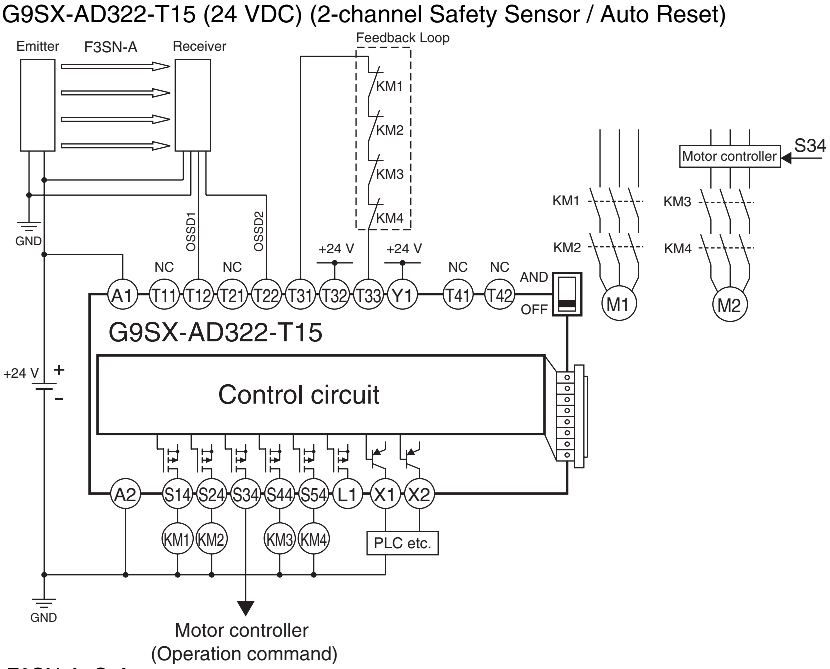
S2: Reset switch S2

KM1 to KM4: Contactor

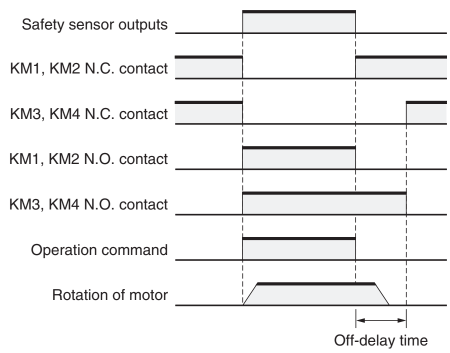
M1, M2: 3-phase motor

Note: This example corresponds to category 2 (EN 954-1)

G9SX-AD322-T15 (24 VDC) (2-channel Safety Sensor / Auto Reset)



Timing chart



F3SN-A: Safety sensor

KM1 to KM4: Contactor

M1, M2: 3-phase motor

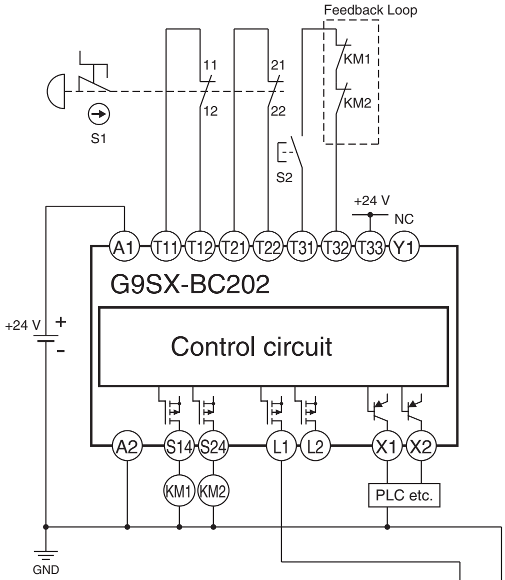
Note: 1. This example corresponds to category 4 (EN 954-1)

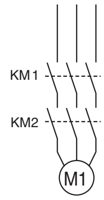
2. For further information of settings and wiring, refer to the catalog or instruction manual of the connected sensor.

3. Use safety sensors with PNP outputs.

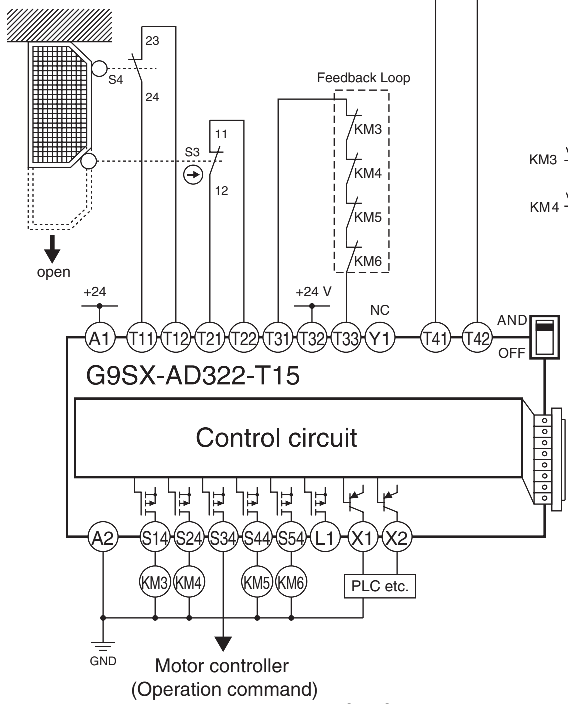
G9SX

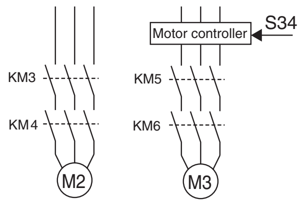
G9SX-BC202 (24 VDC) (2-channel Emergency Stop Switch Input / Manual Reset) +
G9SX-AD322-T15 (24 VDC) (2-channel Safety Limit Switch Input / Auto Reset)





S1: Emergency Stop Switch
S2: Reset Switch
KM1, KM2: Contactor
M1: 3-phase motor

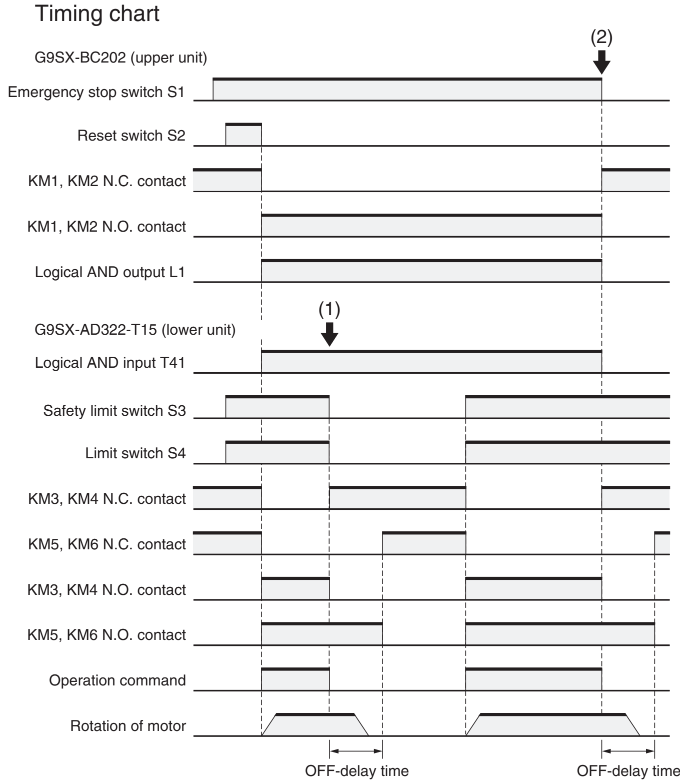




S3: Safety limit switch
S4: Limit switch
KM3 to KM6: Contactor
M2, M3: 3-phase motor

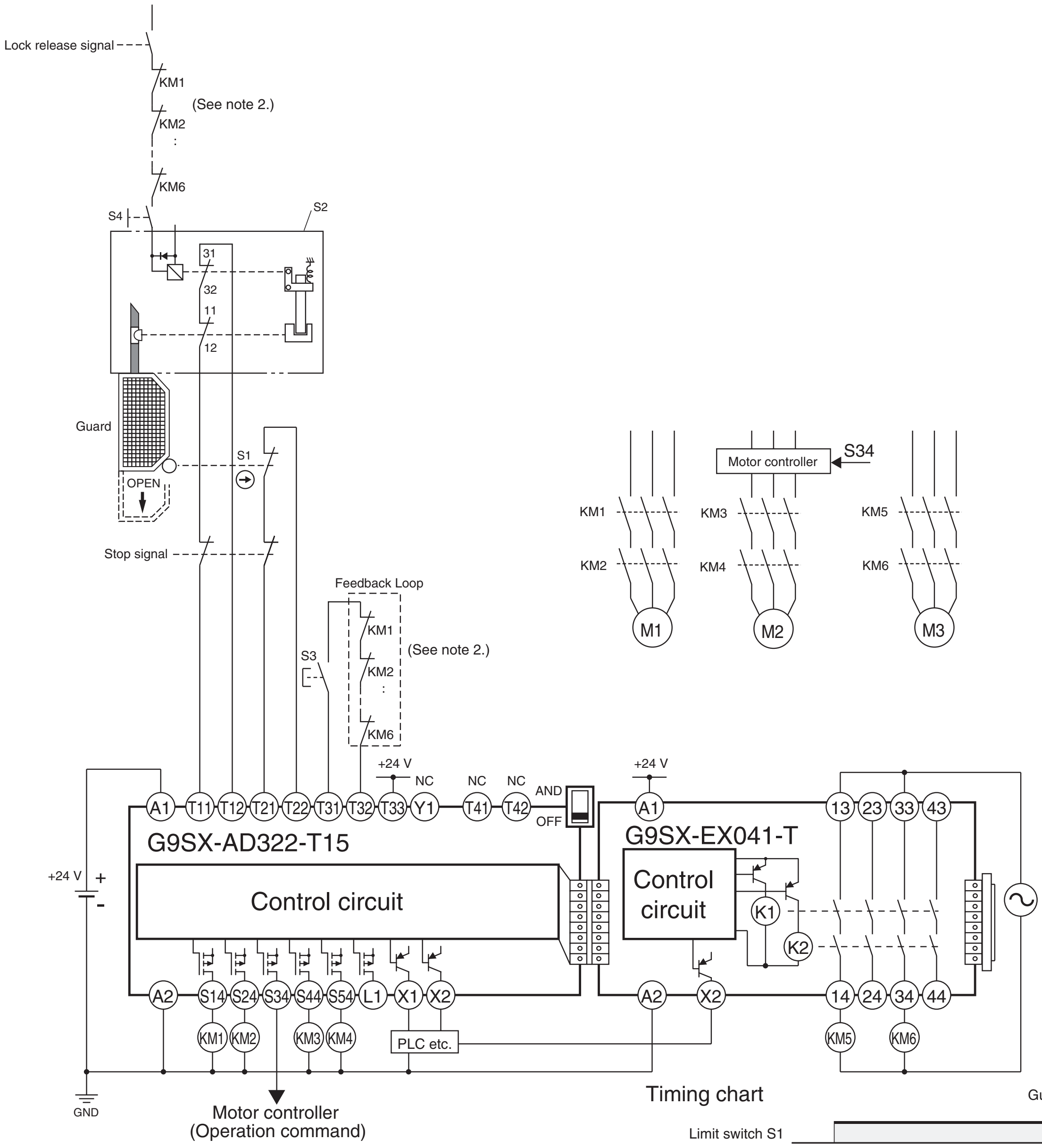
Note: This example corresponds to category 4 (EN 954-1).

Timing chart



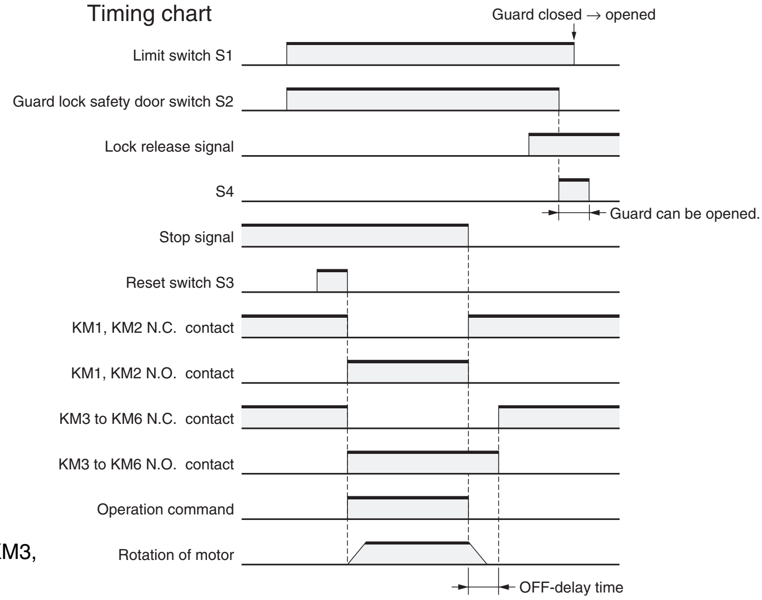
(1) Door opened: Only the lower Unit stops
(2) Emergency stop button pressed: Both the upper and lower Unit stop

G9SX-AD322-T15 (24 VDC) + G9SX-EX041-T (24 VDC)
(Guard Lock Safety Door Switch (Mechanical Lock), 2-channel Safety Limit Switch Inputs / Manual Reset)



S1: Safety limit switch
S2: Guard lock safety door switch
S3: Reset switch
S4: Lock release switch
KM1 to KM6: Contactor
M1 to M3: 3-phase motor

Timing chart



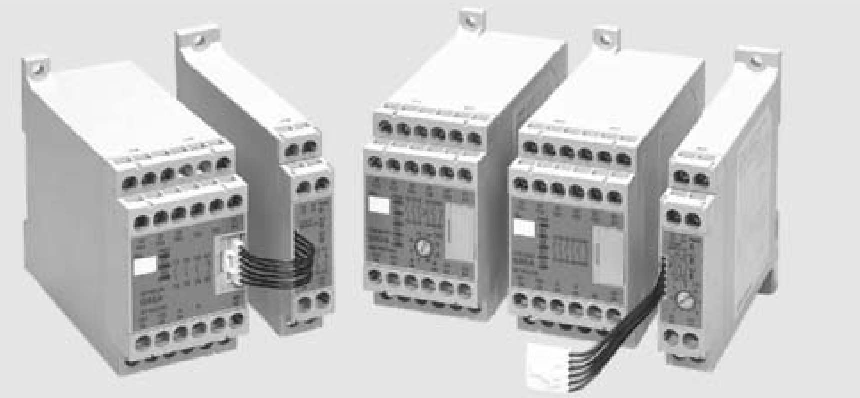
Note: 1. This example corresponds to category 4 (EN 954-1)
2. Connect the N.C. contacts of contactors KM1, KM2, KM3, KM4, KM5, and KM6 in series.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety Relay Unit

G9SA

The G9SA Series Offers a Complete Line-up of Compact Units.



- Four kinds of 45-mm wide Units are available:
  A 3-safety contact model, a 5-safety contact model, and models with 3 safety contacts and 2 OFF-delay safety contacts.
  Also available are 17.5-mm wide Expansion Units with 3 safety contacts and 3 OFF-delay safety contacts.
- Two hand controller (type III C, EN 574)
- Simple expansion connection.
- OFF-delay models have 15-step OFF-delay settings.
- Conforms to EN standards. (BG approval)
- Approved by UL and CSA.
- Both DIN track mounting and screw mounting are possible.
- Suitable for PNP OSSD outputs of safety sensors, F3SN, F3SH, F3S-B, F3S-TGR, F3SL

Ordering Information

Emergency-stop Units

Main contacts	Auxiliary contact	Number of input channels	Rated voltage	Model	Category
3PST-NO	SPST-NC	1 channel or 2 channels possible	24 VAC/VDC	G9SA-301	4
			100 to 240 VAC		
5PST-NO	SPST-NC	1 channel or 2 channels possible	24 VAC/VDC	G9SA-501	
			100 to 240 VAC		

Emergency-stop OFF-delay Units

Main contacts	OFF-delay contacts	Auxiliary contact	Number of input channels	OFF-delay time	Rated voltage	Model	Category
3PST-NO	DPST-NO	SPST-NC	1 channel or 2 channels possible	7.5 s	24 VAC/VDC	G9SA-321-T075	Main contacts: 4 OFF-delay contacts: 3
					100 to 240 VAC		
				15 s	24 VAC/VDC	G9SA-321-T15	
					100 to 240 VAC		
				30 s	24 VAC/VDC	G9SA-321-T30	
					100 to 240 VAC		

Note: The following 15-step OFF-delay time settings are available:
T075: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, and 7.5 s
T15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 s
T30: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 s

Two-hand Controller

Main contacts	Auxiliary contact	Number of input channels	Rated voltage	Model	Category
3PST-NO	SPST-NC	2 channels	24 VAC/VDC	G9SA-TH301	4 (IIIc, EN574)
			100 to 240 VAC		

Expansion Unit

The Expansion Unit connects to a G9SA-301, G9SA-501, G9SA-321, or G9SA-TH301.

Main contacts	Auxiliary contact	Model	Category
3PST-NO	SPST-NC	G9SA-EX301	4

G9SA

Expansion Units with OFF-delay Outputs

The Expansion Unit connects to a G9SA-301, G9SA-501, G9SA-321, or G9SA-TH301.

Main contact form	Auxiliary contact	OFF-delay time	Model	Category
3PST-NO	SPST-NC	7.5 s	G9SA-EX031-T075	3
		15 s	G9SA-EX031-T15	
		30 s	G9SA-EX031-T30	

Note: The following 15-step OFF-delay time settings are available:
T075: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, and 7.5 s
T15: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 s
T30: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and 30 s

Model Number Legend

G9SA-□□□□□□-□□□□
1 2 3 4 5 6

1. **Function**
   None: Emergency stop
   EX: Expansion Unit
   TH: Two-hand Controller
2. **Contact Configuration (Safety Output)**
   0: None
   3: 3PST-NO
   5: 5PST-NO
3. **Contact Configuration (OFF-delay Output)**
   0: None
   2: DPST-NO
   3: 3PST-NO
4. **Contact Configuration (Auxiliary Output)**
   0: None
   1: SPST-NC
5. **Input Configuration (for G9SA-301/501/321)**
   None: 1-channel or 2-channel input possible
6. **OFF-delay Time (Max. setting time)**
   None: No OFF-delay
   T075: 7.5 seconds
   T15: 15 seconds
   T30: 30 seconds

Specifications

Ratings

Power Input

Item	G9SA-301/TH301	G9SA-501	G9SA-321-T□
Power supply voltage	24 VAC/VDC:24 VAC, 50/60 Hz, or 24 VDC 100 to 240 VAC:100 to 240 VAC, 50/60 Hz		
Operating voltage range	85% to 110% of rated power supply voltage		
Power consumption (See note.)	24 VAC/VDC: 1.8 VA/1.7 W max. 100 to 240 VAC: 9 VA max.	24 VAC/VDC: 2.8 VA/2.6 W max. 100 to 240 VAC: 11 VA max.	24 VAC/VDC: 3.5 VA/3.3 W max. 100 to 240 VAC: 12.5 VA max.

Note: When an Expansion Unit is connected, the power consumption is increased by 2 VA/2 W max.

Inputs

Item	G9SA-301/321-T□/TH301	G9SA-501
Input current (See note.)	40 mA max.	60 mA max.

Note: When an Expansion Unit is connected, the input current is increased by 30 mA max.

Contacts

Item	G9SA-301/501/321-T□/TH301/EX301/EX031-T□
	Resistive load (cos ϕ=1)
Rated load	250 VAC, 5 A
Rated carry current	5 A

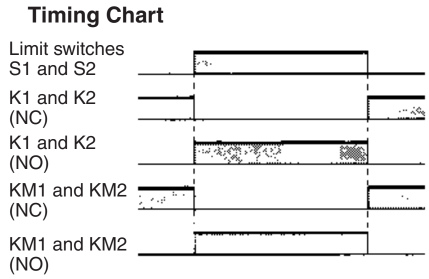
Characteristics

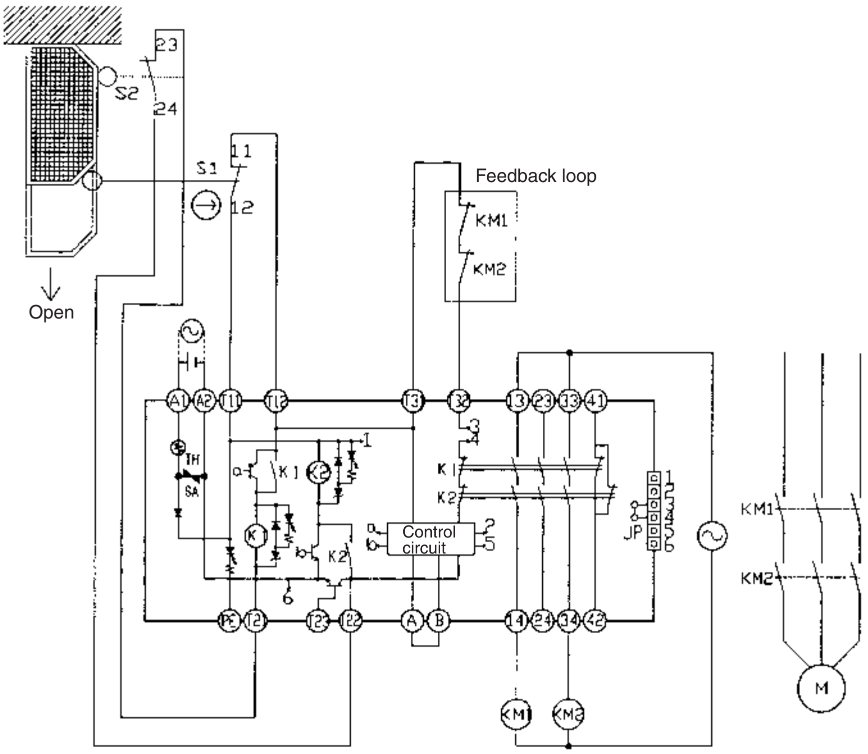
Item		G9SA-301/TH301	G9SA-501/321-T□	G9SA-EX301/EX031-T□
Contact resistance (see note 1)		100 mΩ		
Operating time		30 ms max. (not including bounce time)		
Response time (see note 2)		10 ms max. (not including bounce time)		
Insulation resistance (see note 3)		100 MΩ min. (at 500 VDC)		
Dielectric strength	Between different outputs	2,500 VAC, 50/60 Hz for 1 min		
	Between inputs and outputs			
	Between power inputs and outputs			
	Between power inputs and other inputs (only for 100 to 240-V models)			
Vibration resistance		10 to 55 Hz, 0.75-mm double amplitude		
Shock resistance	Destruction	300 m/s^2		
	Malfunction	100 m/s^2		
Durability	Mechanical	5,000,000 operations min. (at approx. 7,200 operations/hr)		
	Electrical	100,000 operations min. (at approx. 1,800 operations/hr)		
Minimum permissible load (reference value)		5 VDC, 1 mA		
Ambient temperature		Operating:-25°C to 55°C (with no icing or condensation) Storage:-25°C to 85°C (with no icing or condensation)		
Ambient humidity		Operating:35% to 85% Storage:35% to 85%		
Terminal tightening torque		0.98 N·m		
Weight (see note 4)		Approx. 210 g	Approx. 270 g	Approx. 130 g
Approved standards		EN954-1, EN60204-1, EN574 (-TH301), UL508, CSA C22.2 No. 14		
EMC		EMI: EN55011 group 1 class A EMS: EN50082-2 group 1		

Note: 1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.
2. The response time is the time it takes for the main contact to open after the input is turned OFF.
3. The insulation resistance was measured with 500 VDC at the same places that the dielectric strength was checked.
4. Weight shown is for 24-VAC/VDC type. For 100 to 240-VAC type, add approximately 20 g.

Application Examples

G9SA-301 (24 VAC/VDC) with 2-channel Limit Switch Input/Auto-reset

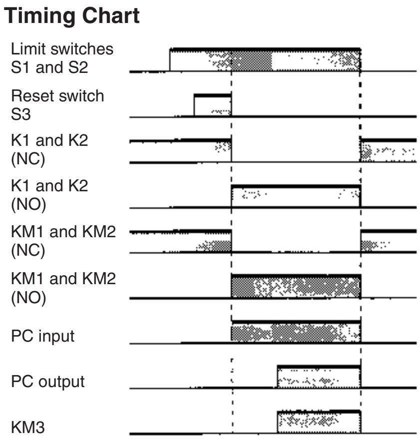


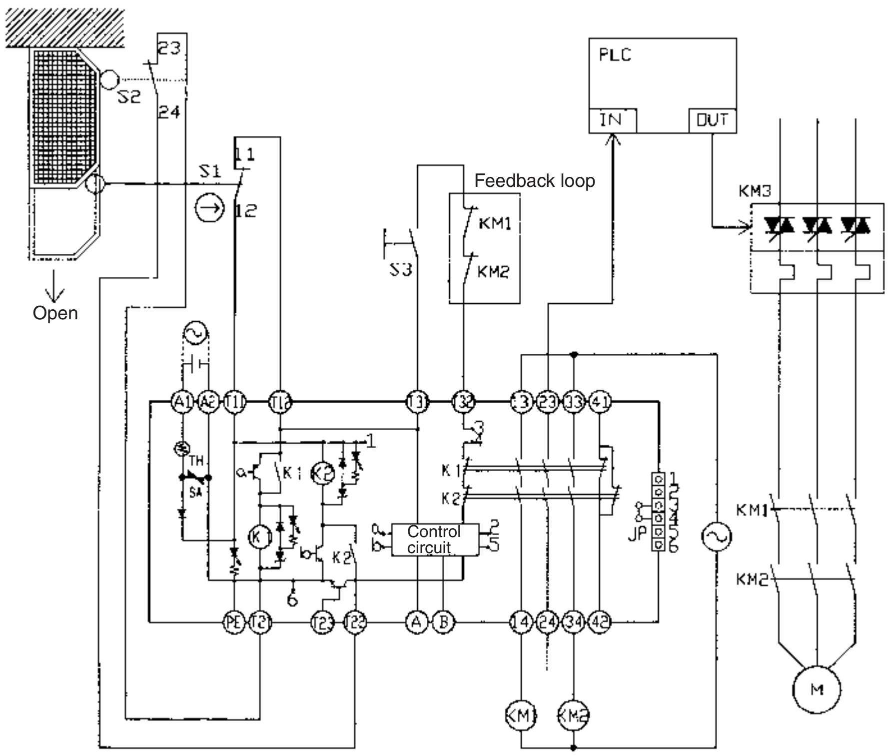


S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Note: This circuit achieves EN954-1 Safety Category 4.

G9SA-301 (24 VAC/VDC) with 2-channel Limit Switch Input/Manual-reset

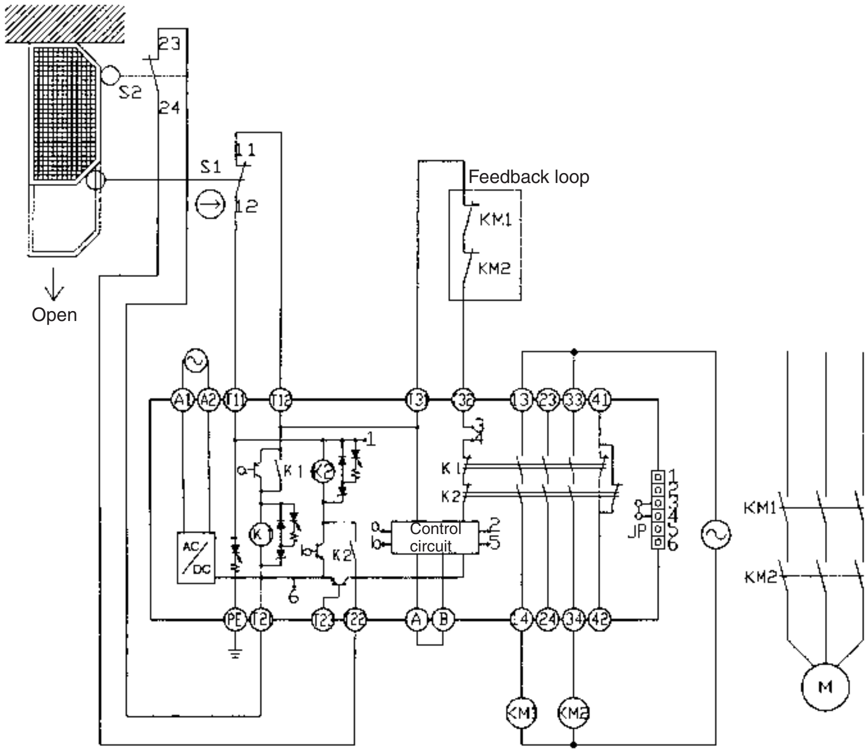




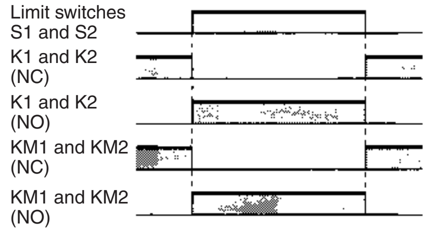
S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
S3: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: Solid-state Contactor
M: 3-phase motor

Note: This circuit achieves EN954-1 Safety Category 4.

G9SA-301 (100 to 240 VAC) with 2-channel Limit Switch Input/Auto-reset



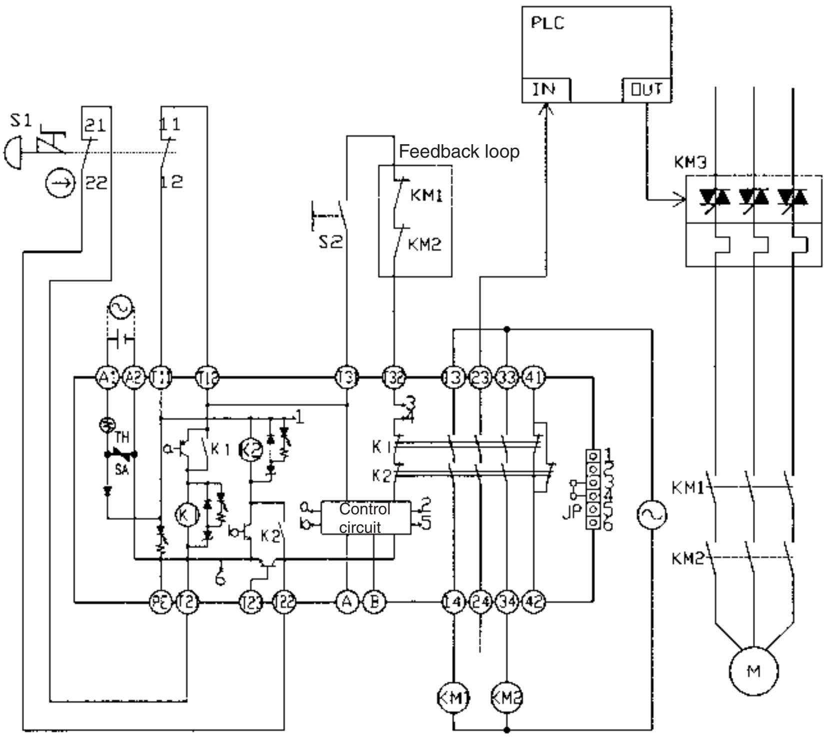
Timing Chart



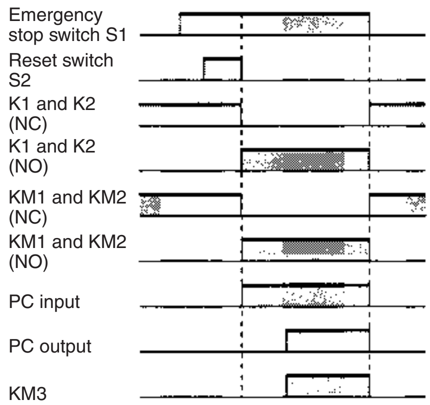
S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Note: This circuit achieves EN954-1 Safety Category 4.

G9SA-301 (24 VAC/VDC) with 2-channel Emergency Stop Switch Input/Manual-reset



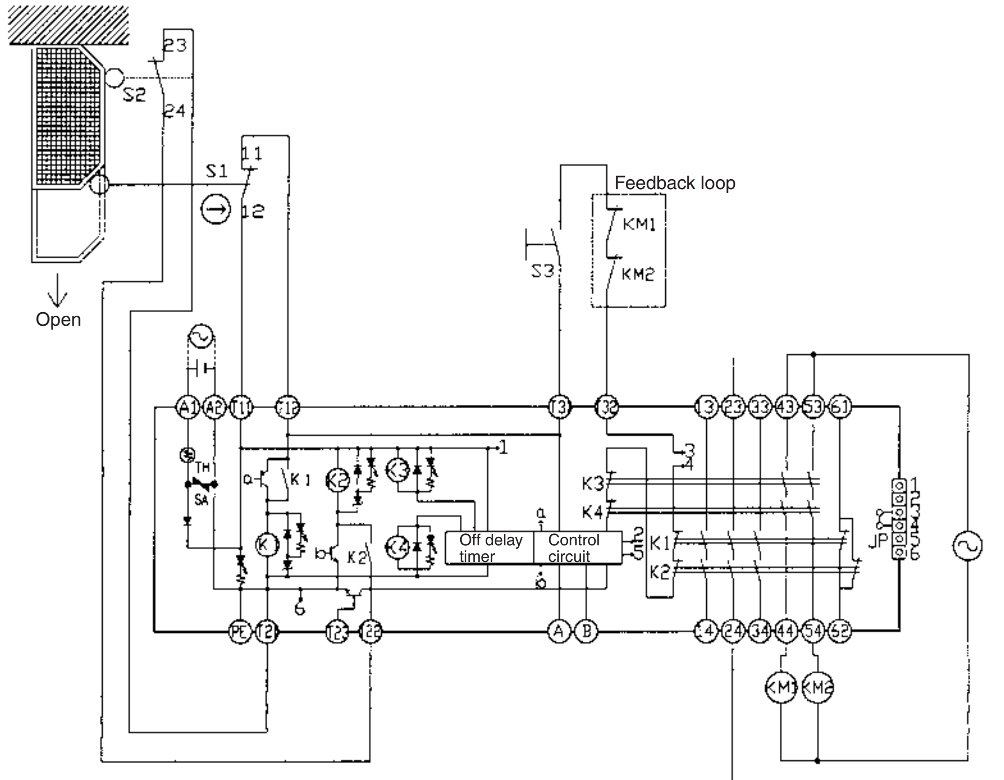
Timing Chart

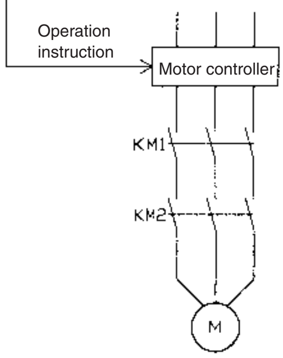


S1: Emergency stop switch with direct opening mechanism (A165E or A22E)
S2: Reset switch
KM1 and KM2: Magnetic Contactor
KM3: Solid-state Contactor
M: 3-phase motor

Note: This circuit achieves EN954-1 Safety Category 4.

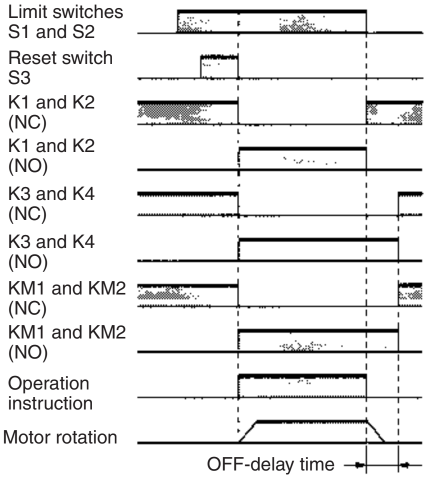
G9SA-321-T□ (24 VAC/VDC) with 2-channel Limit Switch Input/Manual-reset





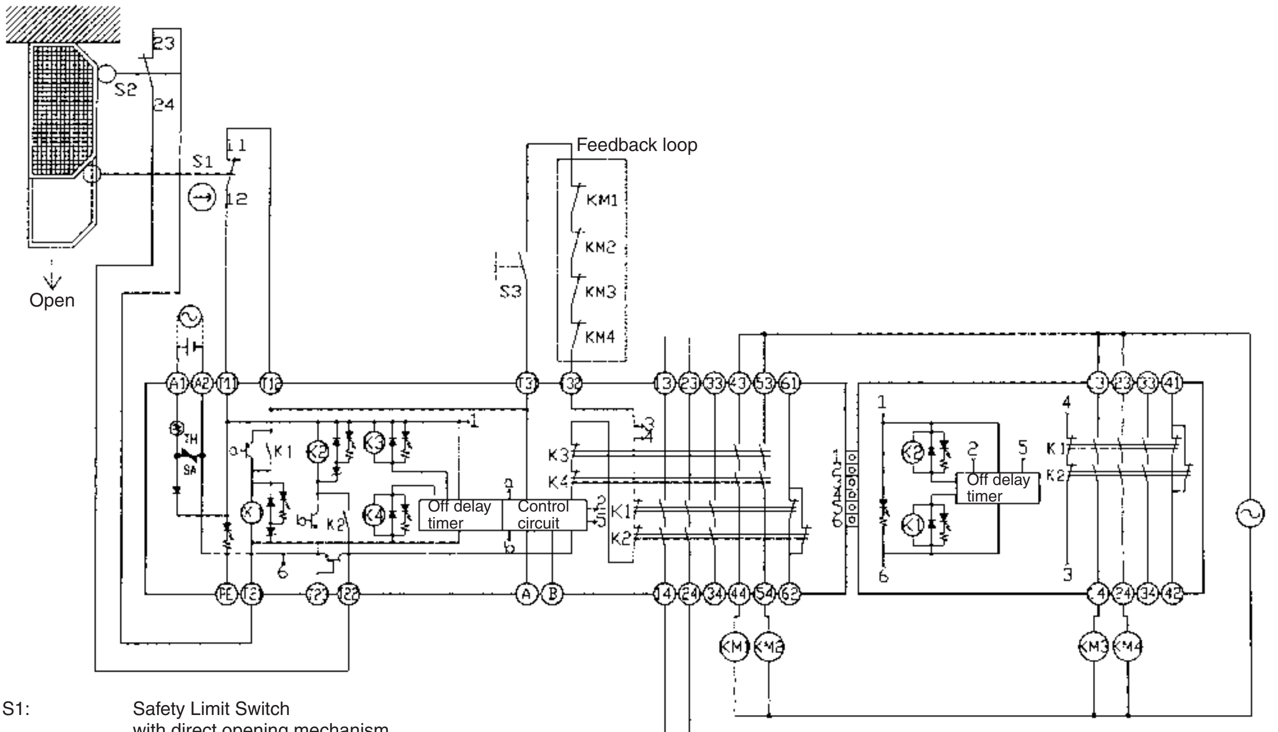
S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
S3: Reset switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

Timing Chart

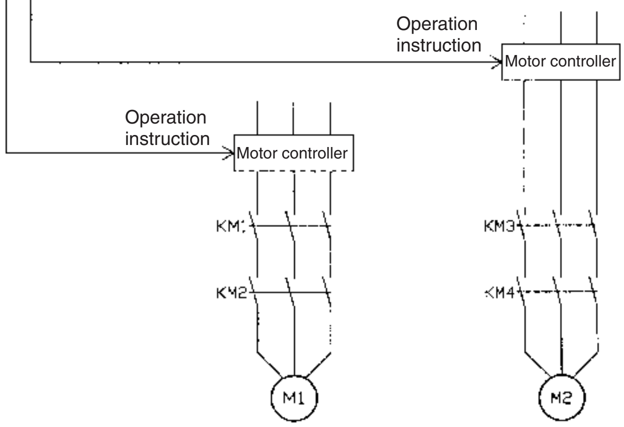


Note: This circuit achieves EN954-1 Safety Category 4. The OFF-delay output, however, achieves EN954-1 Safety Category 3.

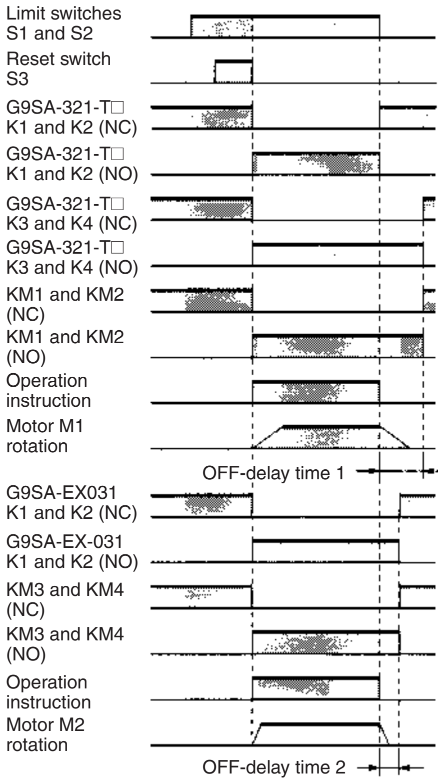
G9SA-321-T□ (24 VAC/VDC) + G9SA-EX031-T□ with 2-channel Limit Switch Input/Manual-reset



S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
S3: Reset switch
KM1, KM2, KM3, and KM4: Magnetic Contactor
M1, M2: 3-phase motor



Timing Chart



Note: This circuit achieves EN954-1 Safety Category 4. The OFF-delay output, however, achieves EN954-1 Safety Category 3.

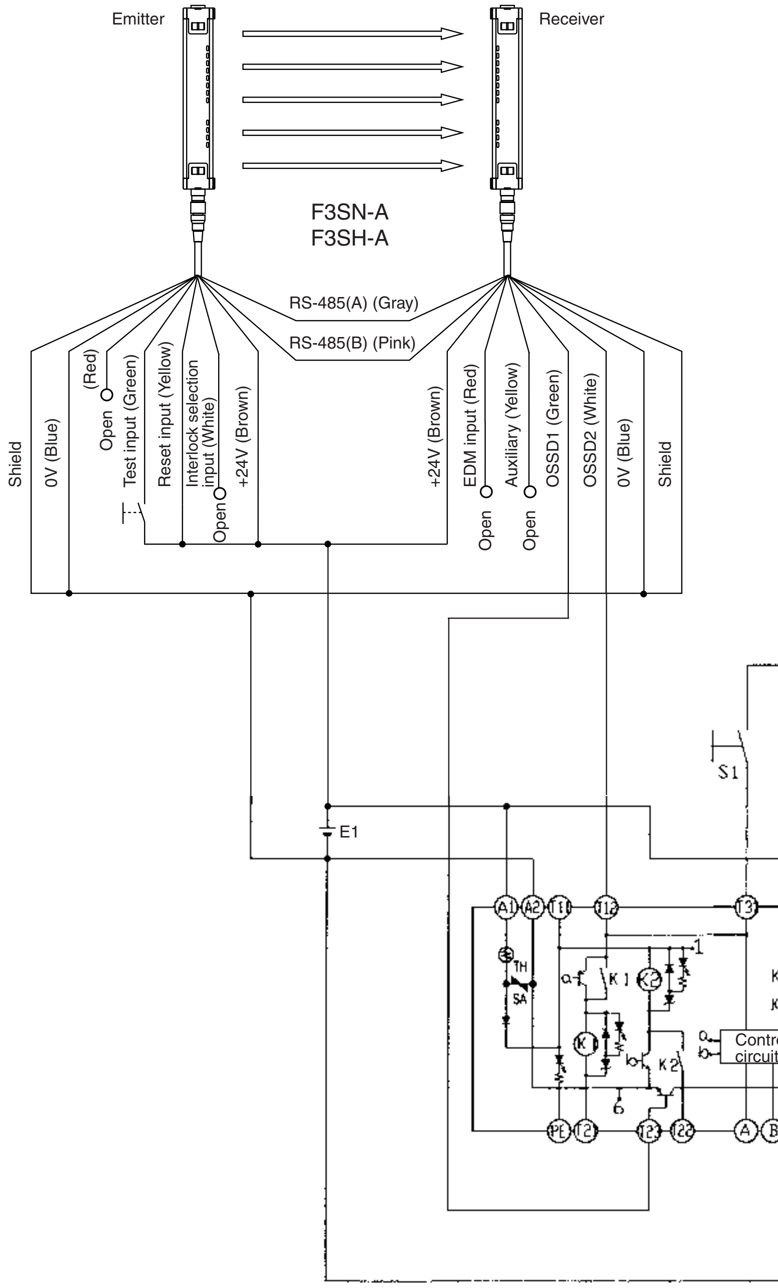
G9SA

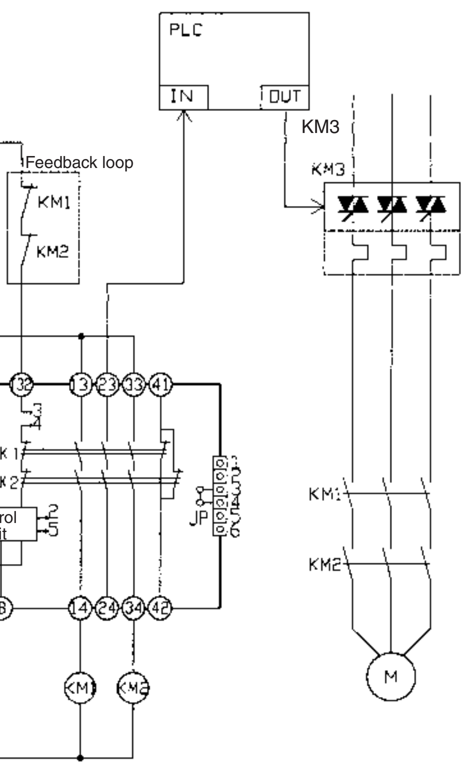
G9SA-301 (24 VAC/VDC) with 2-channel Safety Area Sensor/Manual-reset

Timing Chart

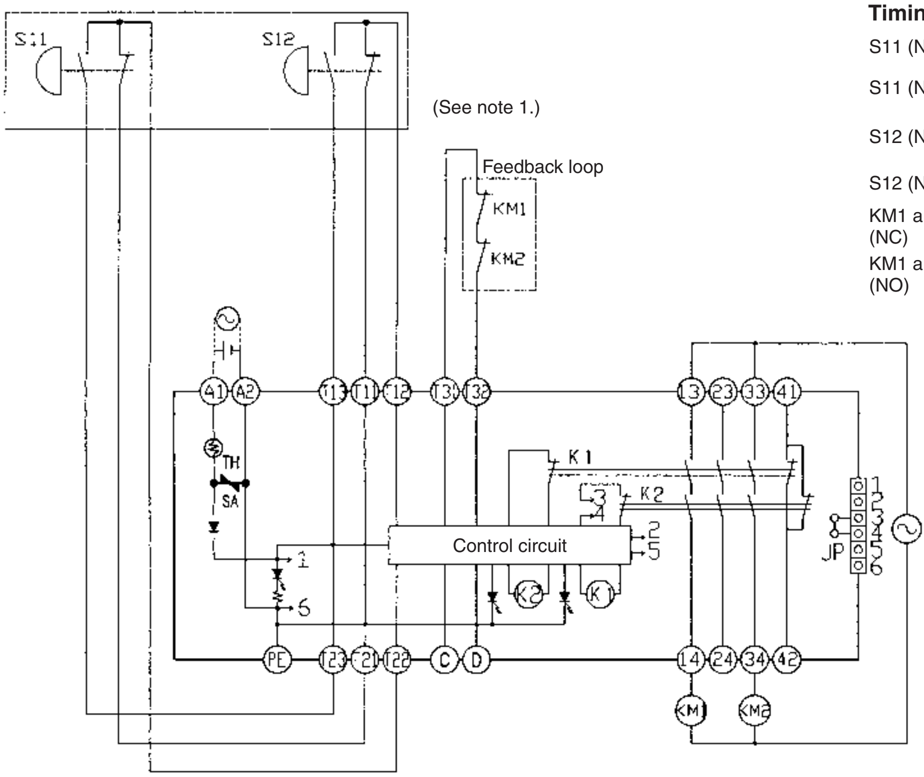
F3SN-A:	Safety area sensor
S1:	Reset switch
KM1 and KM2:	Magnetic Contactor
KM3:	Solid-state Contactor
M:	3-phase motor
E1:	24-VDC Power Supply

Note: This circuit achieves EN954-1 Safety Category 4.

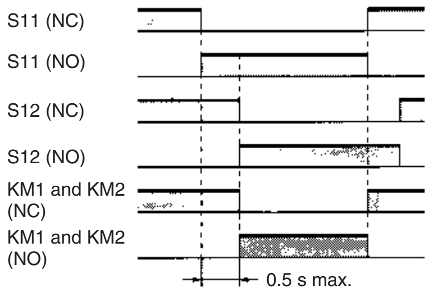




G9SA-TH301 (24 VDC) with 2-hand Inputs/Auto-reset



Timing Chart



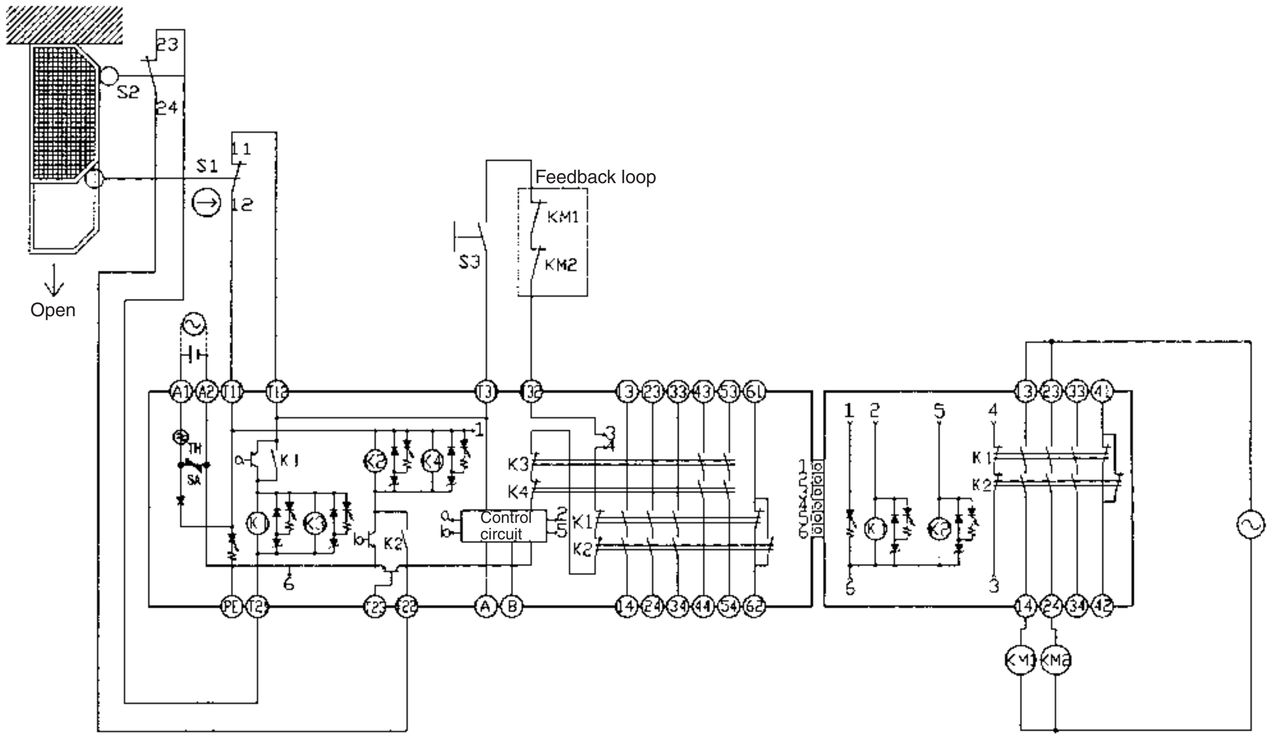
Input time difference operates only when the difference is 0.5 s max.

S11, S12: Two-hand pushbutton switches
KM1 and KM2: Magnetic Contactor

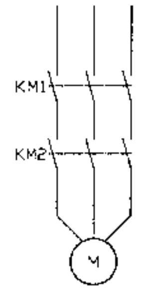
Note: 1. Use a 1NC+1NO switch for S11 and S12.

2. This circuit achieves EN954-1 Safety Category 4.
Typ III C (EN 574)

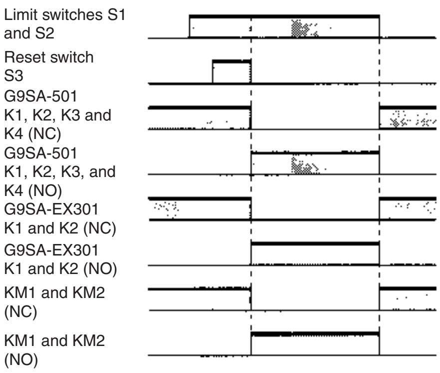
G9SA-501 (24 VAC/VDC) and G9SA-EX301 with 2-channel Limit Switch Input/Manual-reset



S1: Safety Limit Switch with direct opening mechanism (D4N or D4B)
S2: Limit switch
S3: Reset switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor



Timing Chart

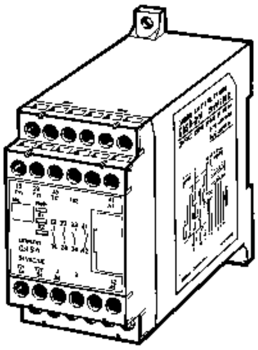


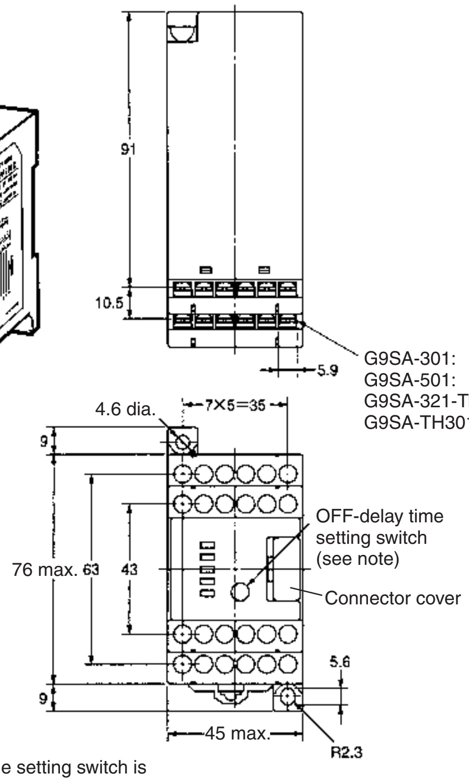
Note: This circuit achieves EN954-1 Safety Category 4.

Dimensions

Note: All units are in millimeters unless otherwise indicated. The diagrams are drawn in perspective.

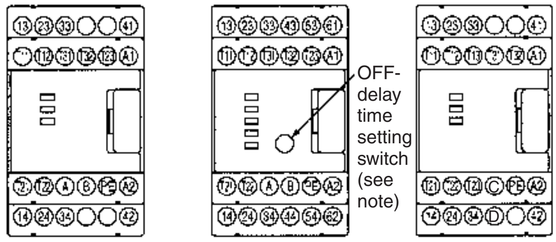
G9SA-301
G9SA-501
G9SA-321-T☐
G9SA-TH301

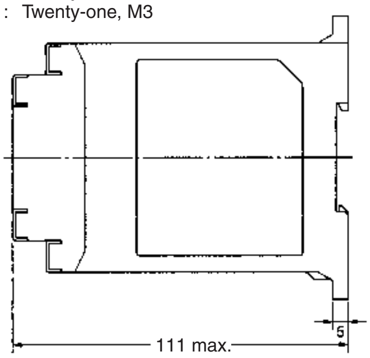




G9SA-301: Twenty, M3
G9SA-501: Twenty-four, M3
G9SA-321-T☐: Twenty-four, M3
G9SA-TH301: Twenty-one, M3

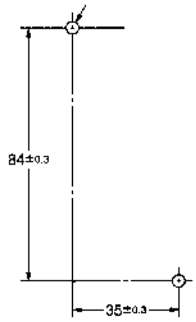
Terminal Arrangement





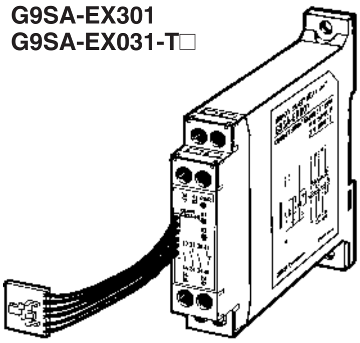
Mounting Holes

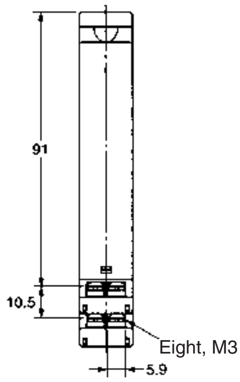
Two, 4.2 dia. or M4



Note: The OFF-delay time setting switch is found on the G9SA-321-T☐ only.

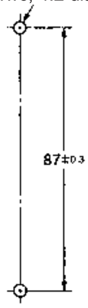
G9SA-EX301
G9SA-EX031-T☐





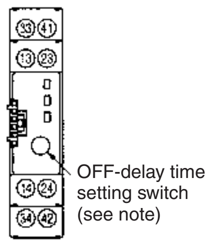
Mounting Holes

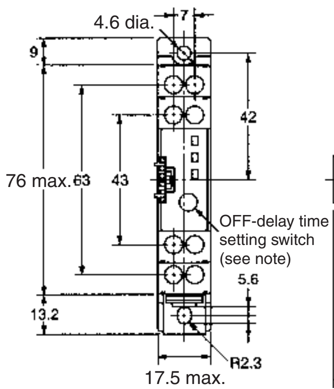
Two, 4.2 dia. or M4

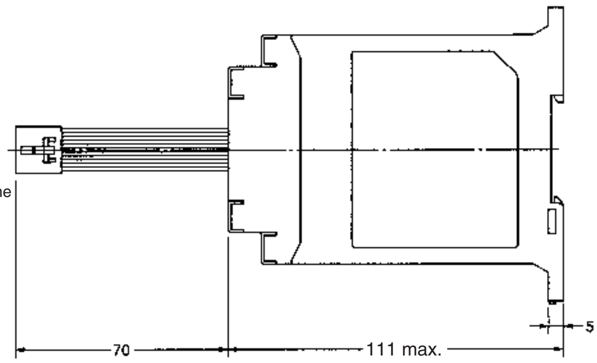


Terminal Arrangement

G9SA-EX301
G9SA-EX031-T☐







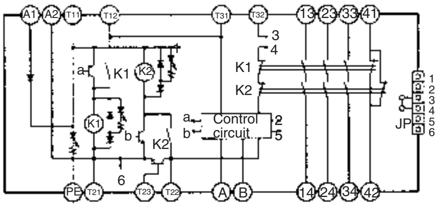
Note: The OFF-delay time setting switch is found on the G9SA-EX031-T☐ only.

G9SA

Installation

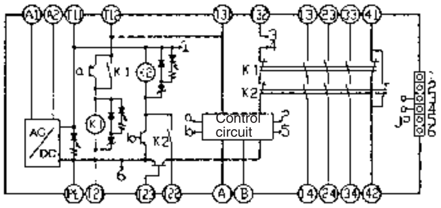
Internal Connections

G9SA-301 (24 VAC/VDC)



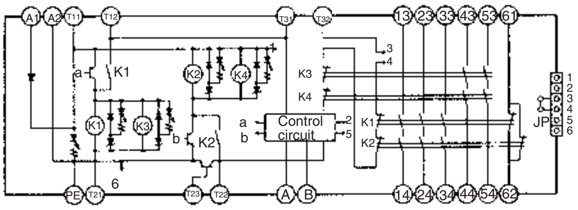
(See note 3.) (See note 1.)

G9SA-301 (100 to 240 VAC)



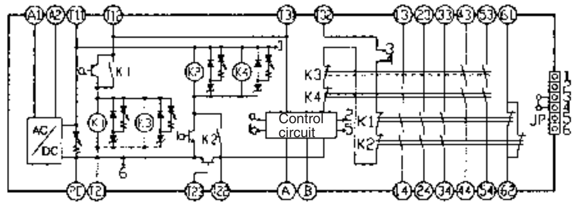
(See note 3.)(See note 1.)

G9SA-501 (24 VAC/VDC)



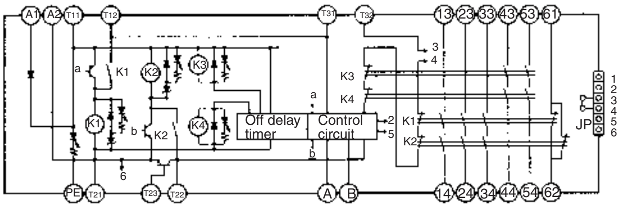
(See note 3.) (See note 1.)

G9SA-501 (100 to 240 VAC)



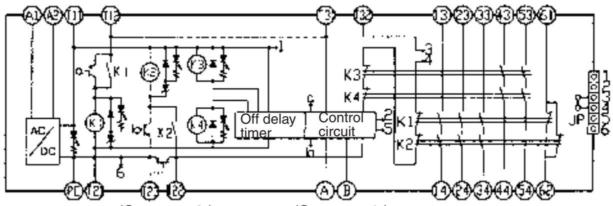
(See note 3.)(See note 1.)

G9SA-321-T□ (24 VAC/VDC)



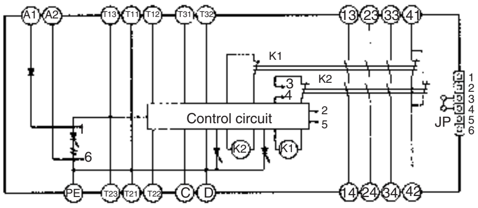
(See note 3.) (See note 1.)

G9SA-321-T□ (100 to 240 VAC)



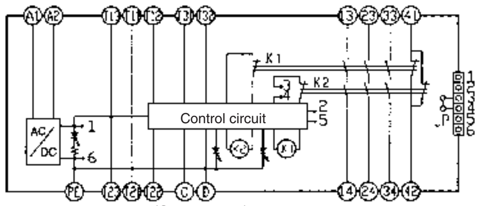
(See note 3.) (See note 1.)

G9SA-TH301 (24 VAC/VDC)



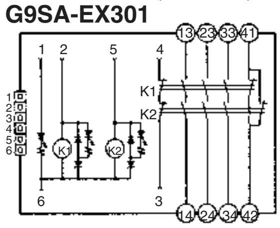
(See note 2.)

G9SA-TH301 (100 to 240 VAC)

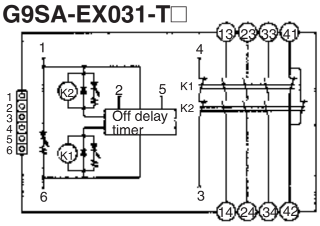


(See note 2.)

G9SA-EX301



G9SA-EX031-T□



Note: 1. Use terminals A and B to switch reset mode.
A to B open: Manual reset
A to B closed: Auto-reset

2. Use terminals C and D to switch input conditions.
C to D open: DPDT input.
C to D closed: DPST-NC input. (Make sure T11 and T21 are open.)

3. Use terminal T23 with + common 2-channel input. When using T23, make sure that T21 and T22 are open. For 1-channel input, make sure T12 and T23 are closed.

4. With 100 to 240-VAC type, be sure to connect PE to a protective ground. With 24-VAC/VDC type, if the power supply is not connected to a protective ground, be sure to connect PE to a protective ground.

5. With 24-VAC/VDC type, the power supply terminals A1 and A2 have polarities. A2 is the negative pole.

Precautions

Do not touch the terminal area of the Relays or the socket terminal area (charged area) while power is ON. Electric shock will result.

Wiring

Turn OFF the G9SA before wiring the G9SA. Do not touch the terminals of the G9SA while the power is turned ON, because the terminals are charged and may cause an electric shock.

Use the following to wire the G9SA.
Stranded wire: 0.75 to 1.5 mm^2
Solid wire: 1.0 to 1.5 mm^2

Tighten each screw to a torque of 0.78 to 1.18 N·m, or the G9SA may malfunction or generate heat.

External inputs connected to T11 and T12 or T21 and T22 of the G9SA-301 must be no-voltage contact inputs.

PE is a ground terminal.

When a machine is grounded at the positive, the PE terminal should not be grounded.

Mounting Expansion Units

Turn OFF the G9SA before connecting the Expansion Unit.

When an Expansion Unit is being used, remove the connector cover from the G9SA Safety Relay Unit (G9SA-301, G9SA-501, G9SA-321□, or G9SA-TH301) and insert the connector of the Expansion Unit's connector cable.

Applicable Safety Category (EN954-1)

G9SA-series Relays meet the requirements of Safety Category 4 of the EN954-1 standards when they are used as shown in the examples provided by OMRON. The Relays may not meet the standards in some operating conditions. The OFF-delay output of models G9SA-321-T□ and EX031-T□, however, conform to Safety Category 3.

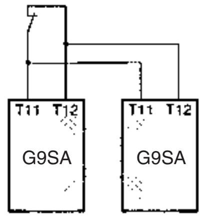
The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

Mounting Multiple Units

When mounting multiple Units close to each other, the rated current will be 3 A. Do not apply a current higher than 3 A.

Connecting Inputs

If using multiple G9SA models, inputs cannot be made using the same switch. This is also true for other input terminals.



Earth Short

A positive thermistor is built into the G9SA circuits, so you can detect earth short breakdowns and breakdown shorts between channel 1 and channel 2. If the short breakdown is canceled, reset is automatic.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. J121-E2-03A-X In the interest of product improvement, specifications are subject to change without notice.

Safety Relay Unit

G9SB

Ultra Slim Safety Relay Unit

- Models of width 17.5 mm available with 2 or 3 safety contacts. Models of width 22.5 mm with 3 safety contacts and auxiliary contact are also available.
- Conforms to EN standards. (TÜV approval)
- DIN track mounting possible.
- Slim size controller dedicated for safey sensors F3SN, F3SH, F3S-B, F3S-TGR, F3SL, F3S-J

Ordering Information

Main contacts	Auxiliary contact	Number of input channels	Reset mode	Input type	Rated voltage	Model	Category (EN954-1)	Size
DPST-NO 2 safety contacts	None	2 channels	Auto-reset	Inverse	24 VAC/VDC	G9SB-2002-A	4	17.5 mm
		1 channel or 2 channels		+ common		G9SB-200-B		
		2 channels	Manual-reset	Inverse		G9SB-2002-C		
		1 channel or 2 channels		+ common		G9SB-200-D		
3PST-NO 3 safety contacts	SPST-NC	None (direct breaking)	Auto-reset	---	24 VDC	G9SB-3010	3	17.5 mm
		2 channels		Inverse	24 VAC/VDC	G9SB-3012-A	4	22.5 mm
		1 channel or 2 channels		+ common		G9SB-301-B		
		2 channels	Manual-reset	Inverse		G9SB-3012-C		
		1 channel or 2 channels		+ common		G9SB-301-D		

Model Number Legend

G9SB-□□□□□ □

1 2 3 4 5 6

1. **Function**
   None: Emergency stop
2. **Contact Configuration (Safety Output)**
   2: DPST-NO
   3: 3PST-NO
3. **Contact Configuration (OFF-delay Output)**
   0: None
4. **Contact Configuration (Auxiliary Output)**
   0: None
   1: SPST-NC
5. **Input Configuration**
   None: 1-channel or 2-channel input possible
   0: None (direct breaking)
   2: 2-channel input
6. **Miscellaneous**
   A: Auto-reset, inverse input
   B: Auto-reset, + common input
   C: Manual-reset, inverse input
   D: Manual-reset, + common input

Specifications

Ratings

Power Input

Item	G9SB-200□-□	G9SB-3010	G9SB-301□-□
Power supply voltage	24 VAC/VDC: 24 VAC, 50/60 Hz, or 24VDC 24 VDC: 24 VDC		
Operating voltage range	85% to 110% of rated power supply voltage		
Power consumption	1.4 VA/1.4 W max.	1.7 W max.	1.7 VA/1.7 W max.

Inputs

Item	G9SB-200□-□	G9SB-3010	G9SB-301□-□
Input current	25 mA max.	60 mA max. (See note.)	30 mA max.

Note: Indicates the current between terminals A1 and A2.

Contacts

Item	G9SB-200□-□	G9SB-3010	G9SB-301□-□
	Resistive load (cos =1)		
Rated load	250 VAC, 5 A		
Rated carry current	5 A		

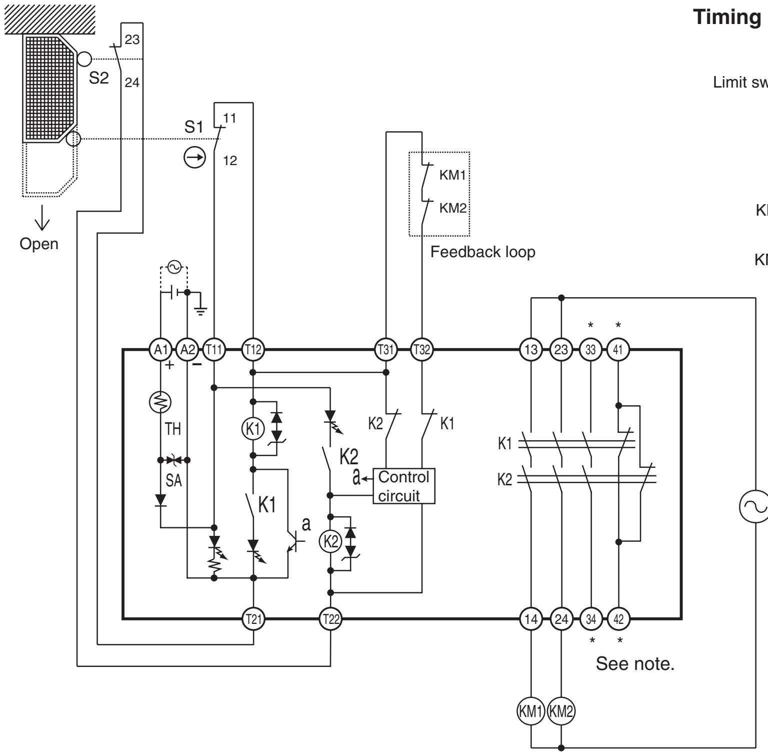
Characteristics

Item		G9SB-200□-□	G9SB-3010	G9SB-301□-□
Contact resistance (See note 1.)		100 mΩ		
Operating time (See note 2.)		30 ms max.		
Response time (See notes 2 and 3.)		10 ms max.		
Insulation resistance (See note 4.)		100 MΩ min. (at 500 VDC)		
Dielectric strength	Between different outputs	2,500 VAC, 50/60 Hz for 1 min		
	Between inputs and outputs			
	Between power inputs and outputs			
Vibration resistance		10 to 55 to 10 Hz, 0.375-mm single amplitude (0.75-mm double amplitude)		
Shock resistance	Destruction	300 m/s²		
	Malfunction	100 m/s²		
Durability	Mechanical	5,000,000 operations min. (at approx. 7,200 operations/hr)		
	Electrical	100,000 operations min. (at approx. 1,800 operations/hr)		
Minimum permissable load (reference value)		5 VDC, 1 mA		
Ambient operating temperature		-25 to 55°C (with no icing or condensation)		
Ambient operating humidity		35% to 85%		
Terminal tightening torque		0.5 N·m		
Weight		Approx. 115 g	Approx. 135 g	Approx. 120 g
Approved standards		EN954-1, EN60204-1, UL508, CSA C22.2 No. 14		
EMC		EMI: EN55011 group 1 class A EMS: EN50082-2		

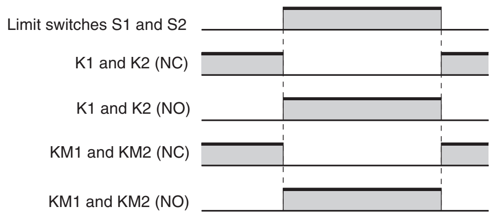
Note: 1. The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.
2. The bounce time is not included in the figure for operating time.
3. The response time is the time it takes for the main contact to open after the input is turned OFF.
4. The insulation resistance was measured with 500 VDC at the same places that the dielectric strength was checked.

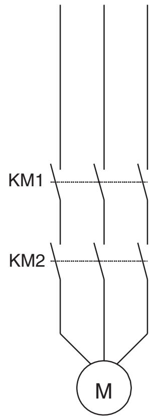
Application Examples

G9SB-2002-A (24 VAC/VDC) or G9SB-3012-A (24 VAC/VDC) with 2-channel Limit Switch Input/Auto-reset



Timing Chart



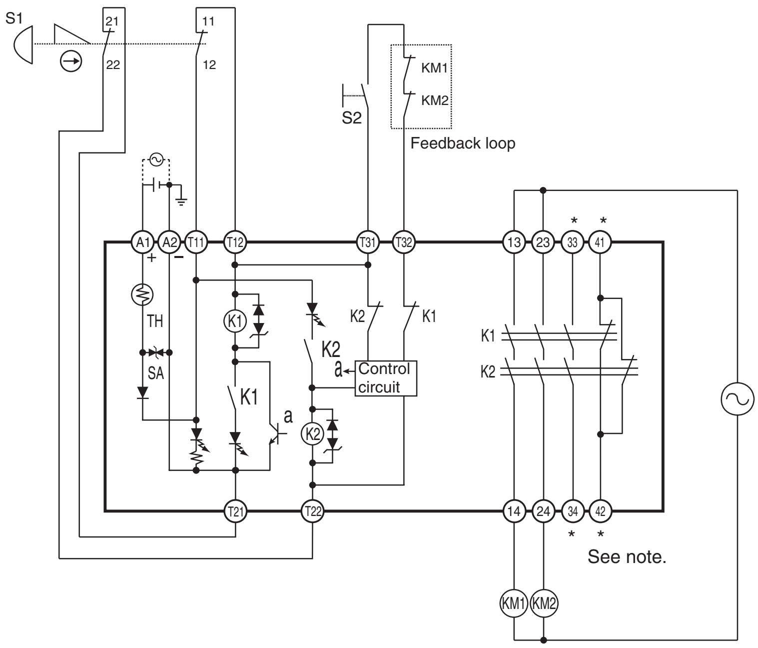


S1:	Safety limit switch with direct opening mechanism (D4N or D4B)
S2:	Limit switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor

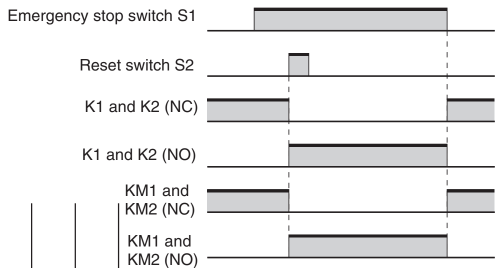
Note: Only the G9SB-3012-A model has terminals 33-34 and 41-42.

Note: 1. External connections and timing charts for G9SB-200-B/301-B models are the same as those for G9SB-2002-A/3012-A models.
2. This circuit conforms to EN954-1 Safety Category 4.

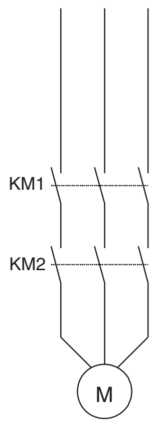
G9SB-2002-C (24 VAC/VDC) or G9SB-3012-C (24 VAC/VDC) with 2-channel Emergency Stop Switch Input/Manual-reset



Timing Chart



Note: Output turns ON with the rising edge of reset switch S2, but will not operate if there is a short breakdown in S2.

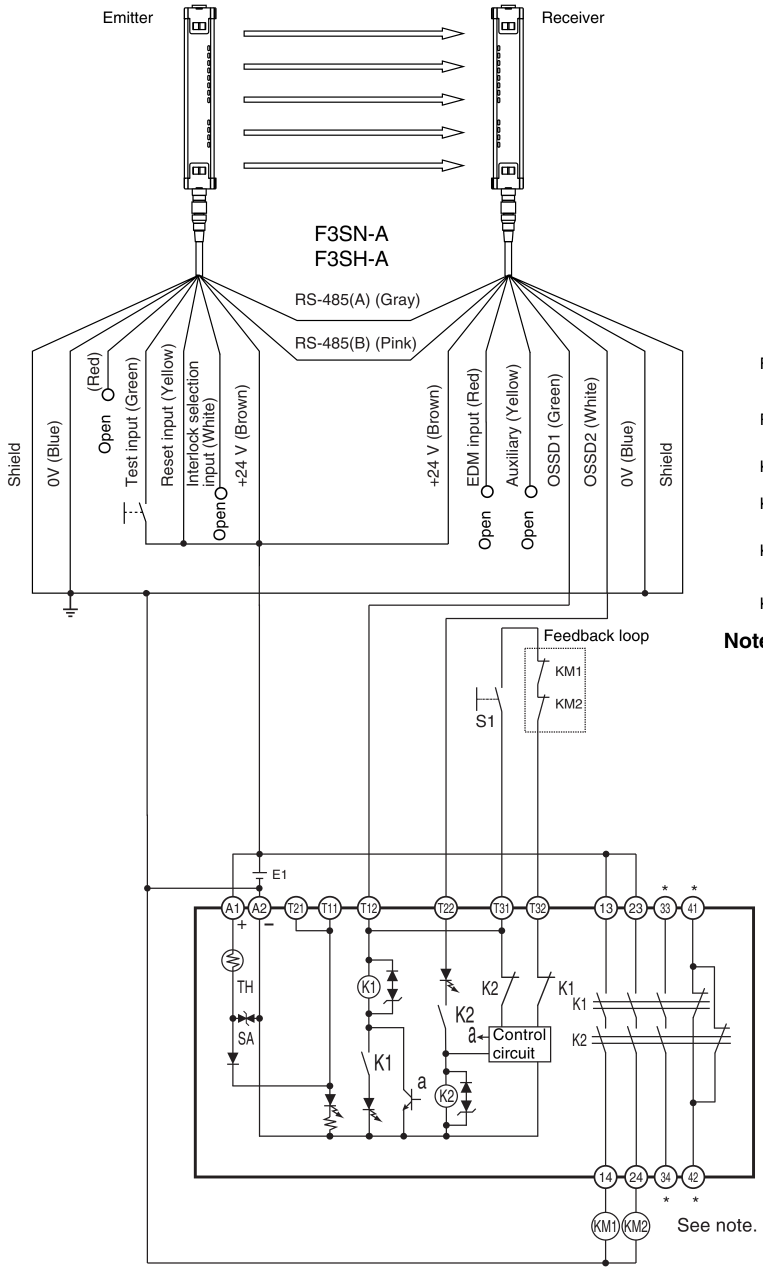


S1:	Emergency stop switch with direct opening mechanism (A165E, A22E)
S2:	Reset switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor

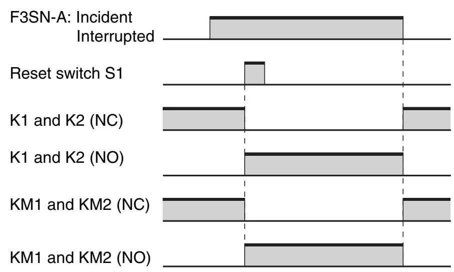
Note: Only the G9SB-3012-C model has terminals 33-34 and 41-42.

Note: 1. External connections and timing charts for G9SB-200-D/301-D models are the same as those for G9SB-2002-C/3012-D models.
2. This circuit conforms to EN954-1 Safety Category 4.

G9SB-200-D (24 VAC/VDC) or G9SB-301-D (24 VAC/VDC) with 2-channel Safety Area Sensor/Manual-reset

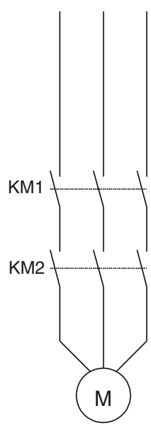


Timing Chart



Note: Output turns ON with the rising edge of reset switch S1, but will not operate if there is a short breakdown in S1.

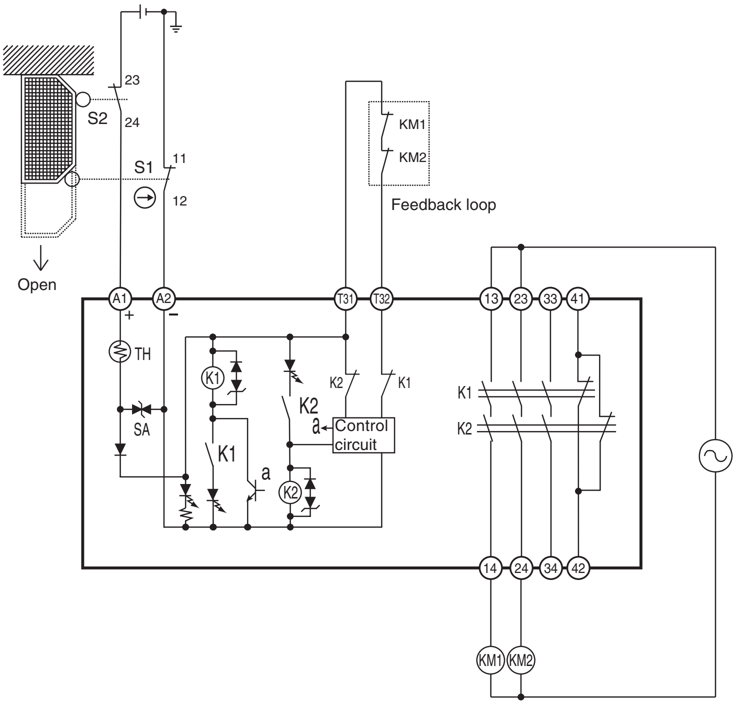
F3SN-A:	Safety Area Sensor
S1:	Reset switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor
E1:	24-VDC power supply



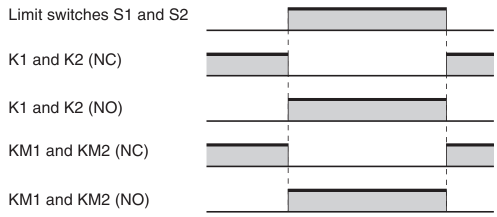
Note: Only the G9SB-301-D model has terminals 33-34 and 41-42.

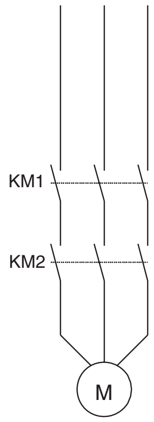
Note: This circuit conforms to EN954-1 Safety Category 4.

G9SB-3010 (24 VDC) with 2-channel Limit Switch Input/Auto-reset



Timing Chart





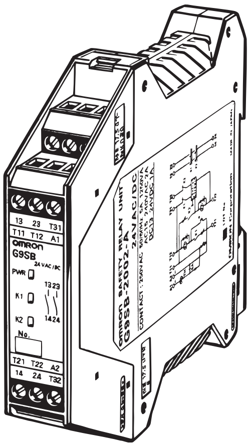
S1:	Safety limit switch with direct opening mechanism (D4D or D4B)
S2:	Limit switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor

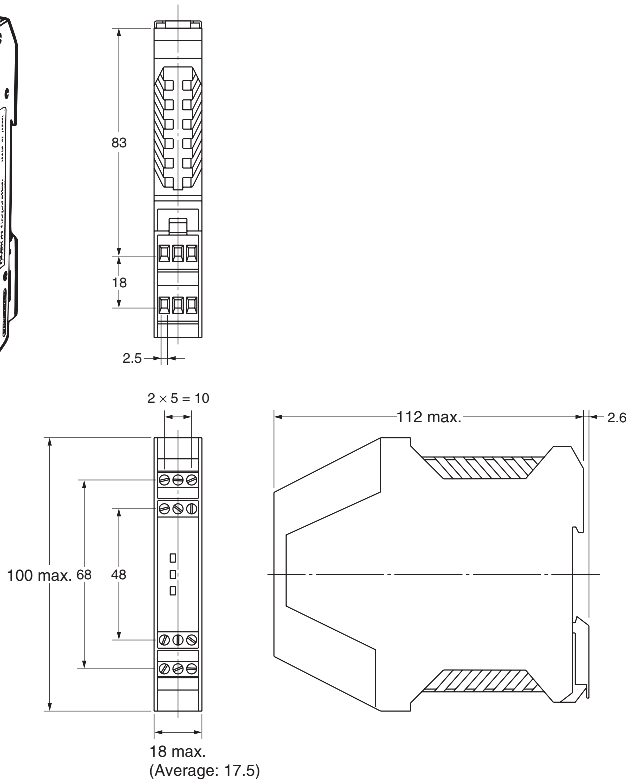
Note: This circuit conforms to EN954-1 Safety Category 3.

G9SB

Dimensions

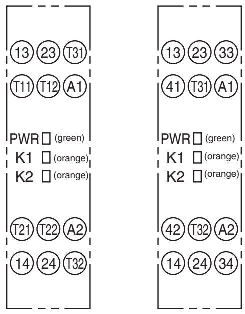
G9SB-200□-□
G9SB-3010



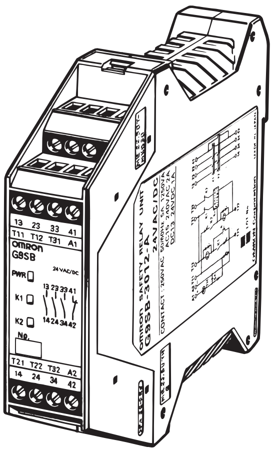


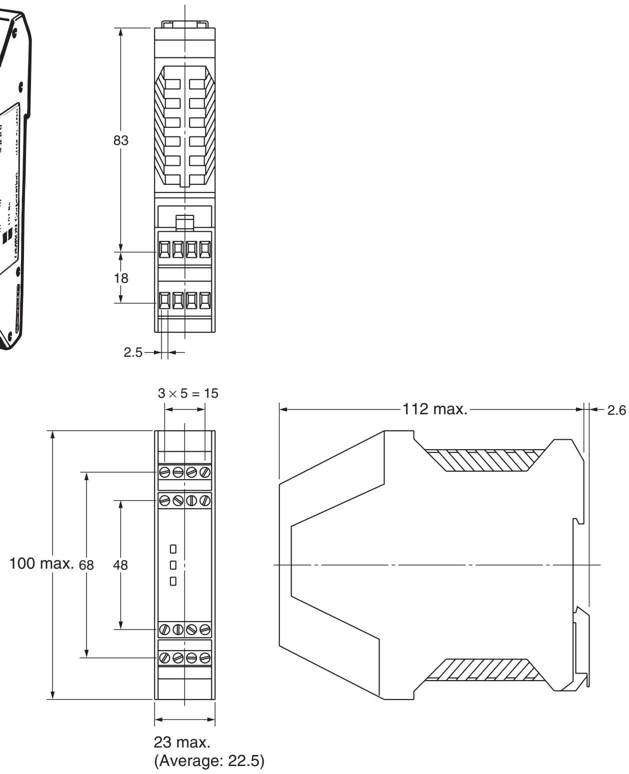
Terminal Arrangement

G9SB-200□-□ **G9SB-3010**



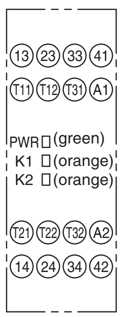
G9SB-301-□





Terminal Arrangement

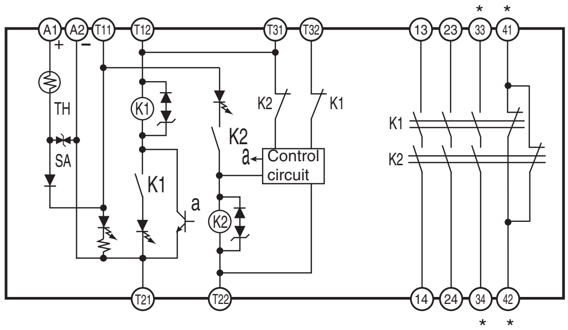
G9SB-200□-□



Installation

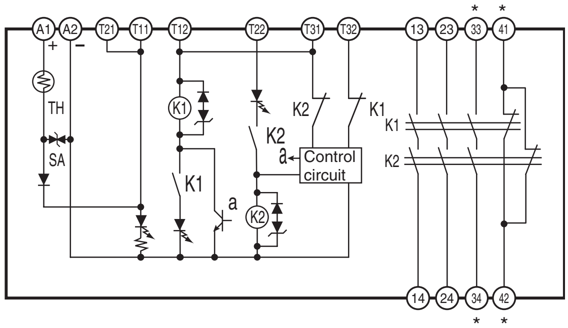
Internal connections

G9SB-2002-A/C (24 VAC/VDC)
G9SB-3012-A/C (24 VAC/VDC)



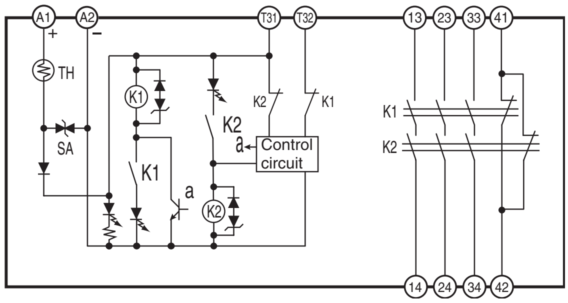
See note 2.

G9SB-200-B/D (24 VAC/VDC)
G9SB-301-B/D (24 VAC/VDC)



See note 2.

G9SB-3010 (24 VDC)



Note: 1. For 1-channel input with G9SB-□□□-B/D models, short terminals T12 and T22.
It is not possible to wire G9SB-□□□2-A/C models for 1-channel input.
2. Only G9SB-301□-□ models have terminals 33-34 and 41-42.

G9SB

Precautions

Wiring

Turn OFF the G9SB before wiring. Do not touch the terminals of the G9SB while the power is turned ON, because the terminals are charged and may cause an electric shock.

Use the following to wire the G9SB.

Stranded wire:0.2 to 2.5 mm^2

Solid wire:0.2 to 2.5 mm^2

Tighten each screw to a torque of 0.5 to 0.6 N·m, or the G9SB may malfunction or generate heat.

External inputs connected to T11 and T12 or T21 and T22 of the G9SB must be no-voltage contact inputs.

Applicable Safety Category

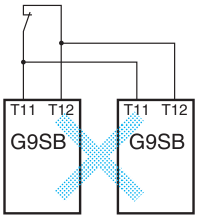
G9SB-200□-□/301□-□ meet the requirements of Safety Category 4 of the EN954-1 standards when they are used as shown in the examples provided by OMRON. Relays may not meet the standards in some operating conditions. The G9SB-3010 can be applied to Safety Category 3 of the EN954-1 using double breaking. The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

Mounting Multiple Units

When mounting multiple Units close to each other, the rated current will be 3 A. Do not apply a current higher than 3 A.

Connecting Inputs

If using multiple G9SB models, inputs cannot be made using the same switch. This is also true for other input terminals.



Earth Short

A positive thermistor is built into the G9SB circuits, so you can detect earth short breakdowns and breakdown shorts between channel 1 and channel 2. (Detection of breakdown shorts between channel 1 and channel 2 is supported for G9SB-2002-□/3012-□ models only.)

Note: In order to detect earth short breakdowns, connect the minus side of the power supply to ground.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety-door Switch

D4NS

Multi-contact, Labor-saving, Environment-friendly, Next-generation Safety-door Switch

- Lineup includes three contact models with 2NC/1NC and 3NC contact forms in addition to the previous contact forms 1NC/1NO, and 2NC.
- M12-connector models are available, saving on labor and simplifying replacement.
- Standardized gold-clad contacts provide high contact reliability.
- Applicable to both standard loads and micro loads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.

Model Number Structure

Model Number Legend

Switch

D4NS-□□□
1 2 3

1. **Conduit/Connector size**
   1: Pg13.5 (1-conduit)
   2: G1/2 (1-conduit)
   3: 1/2-14NPT (1-conduit)
   4: M20 (1-conduit)
   5: Pg13.5 (2-conduit)
   6: G1/2 (2-conduit)
   7: 1/2-14NPT compatible (2-conduit model with M20 conduit size includes an M20-to-1/2-14NPT conversion adapter)
   8: M20 (2-conduit)
   9: M12 connector (1-conduit)
2. **Built-in Switch**
   A: 1NC/1NO (slow-action)
   B: 2NC (slow-action)
   C: 2NC/1NO (slow-action)
   D: 3NC (slow-action)
   E: 1NC/1NO (MBB contact)
   F: 2NC/1NO (MBB contact)
3. **Head Mounting Direction**
   F: Four mounting directions possible (Front-side mounting at shipping)

Note: An order for the head part or the switch part alone cannot be accepted.
The Operation Key is sold separately.

Operation Key

D4DS-K□
1

1. **Operation Key Type**
   1: Horizontal mounting
   2: Vertical mounting
   3: Adjustable mounting (Horizontal)
   5: Adjustable mounting (Horizontal/ Vertical)

D4NS

Ordering Information

List of Models

Switches (Operation Keys are sold separately.)

(shaded): Models with approved direct opening contacts.

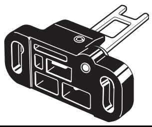
Type	Contact configuration		Conduit opening/Connector	Model
1-conduit	Slow-action	1NC/1NO	Pg13.5	D4NS-1AF (note 3)
			G1/2	D4NS-2AF
			1/2-14NPT	D4NS-3AF
			M20	D4NS-4AF (note 3)
		2NC	Pg13.5	D4NS-1BF (note 3)
			G1/2	D4NS-2BF
			1/2-14NPT	D4NS-3BF
			M20	D4NS-4BF (note 3)
		2NC/1NO	Pg13.5	D4NS-1CF (note 3)
			G1/2	D4NS-2CF
			1/2-14NPT	D4NS-3CF
			M20	D4NS-4CF (note 3)
		3NC	Pg13.5	D4NS-1DF
			G1/2	D4NS-2DF
			1/2-14NPT	D4NS-3DF
			M20	D4NS-4DF (note 3)
	Slow-action MBB contact	1NC/1NO	Pg13.5	D4NS-1EF
			G1/2	D4NS-2EF
			1/2-14NPT	D4NS-3EF
			M20	D4NS-4EF (note 3)
		2NC/1NO	Pg13.5	D4NS-1FF
			G1/2	D4NS-2FF
			1/2-14NPT	D4NS-3FF
			M20	D4NS-4FF (note 3)
2-conduit	Slow-action	1NC/1NO	Pg13.5	D4NS-5AF
			G1/2	D4NS-6AF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7AF
			M20	D4NS-8AF
		2NC	Pg13.5	D4NS-5BF (note 3)
			G1/2	D4NS-6BF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7BF
			M20	D4NS-8BF (note 3)
		2NC/1NO	Pg13.5	D4NS-5CF
			G1/2	D4NS-6CF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7CF
			M20	D4NS-8CF (note 3)
		3NC	Pg13.5	D4NS-5DF
			G1/2	D4NS-6DF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7DF
			M20	D4NS-8DF
	Slow-action MBB contact	1NC/1NO	Pg13.5	D4NS-5EF
			G1/2	D4NS-6EF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7EF
			M20	D4NS-8EF
		2NC/1NO	Pg13.5	D4NS-5FF
			G1/2	D4NS-6FF
			M20, includes M20-to-1/2-14NPT conversion adapter	D4NS-7FF
			M20	D4NS-8FF
1-conduit, with connector	Slow-action	1NC/1NO	M12 connector	D4NS-9AF (note 3)
		2NC		D4NS-9BF (note 3)
	Slow-action MBB contact	1NC/1NO		D4NS-9EF (note 3)

Note: 1. The recommended models for equipment and machinery being exported to Europe are those with an M20 or Pg13.5 conduit sizes, and for North America, the recommended models are those with a 1/2-14NPT conduit sizes.

2. Resin is used as the material for the D4NS housing and head. Use the metal D4BS Safety-door Switch for applications requiring greater mechanical strength.

3. Prefered stock item

Operation Keys

Type	Model
Horizontal mounting 	D4DS-K1
Vertical mounting 	D4DS-K2
Adjustable mounting (Horizontal) 	D4DS-K3
Adjustable mounting (Horizontal/Vertical) 	D4DS-K5

Specifications

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening) GS-ET-15	B0306 39656052
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL508, CSA C22.2 No. 14)

A300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1) (This applies for the Switch only. The degree of protection for the key hole is IP00.)	
Durability (See note 4.)	**Mechanical**	1,000,000 operations min.	
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC	
Operating speed		0.05 to 0.5 m/s	
Operating frequency		30 operations/minute max.	
Direct opening force (See note 6.)		60 N min.	
Direct opening travel (See note 6.)		10 mm min.	
Contact resistance		25 mΩ max.	
Minimum applicable load (See note 7.)		Resistive load of 1 mA at 5 VDC (N-level reference value)	
Rated insulation voltage (U_i)		300 V	
Protection against electric shock		Class II (double insulation)	
Pollution degree (operating environment)		3 (EN60947-5-1)	
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity	2.5 kV
		Between terminals of different polarities	4 kV
		Between other terminals and uncharged metallic parts	6 kV
Insulation resistance		100 MΩ min.	
Contact gap		2 x 2 mm min	
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude	
Shock resistance	**Destruction**	1,000 m/s^2 min.	
	Malfunction	300 m/s^2 min.	
Conditional short-circuit current		100 A (EN60947-5-1)	
Rated open thermal current (I_{th})		10 A (EN60947-5-1)	
Ambient temperature		Operating: -30°C to 70°C with no icing	
Ambient humidity		Operating: 95% max.	
Weight		Approx. 96 g (D4NS-1CF)	

Note: 1. The above values are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4NS in places where foreign material may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

4. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

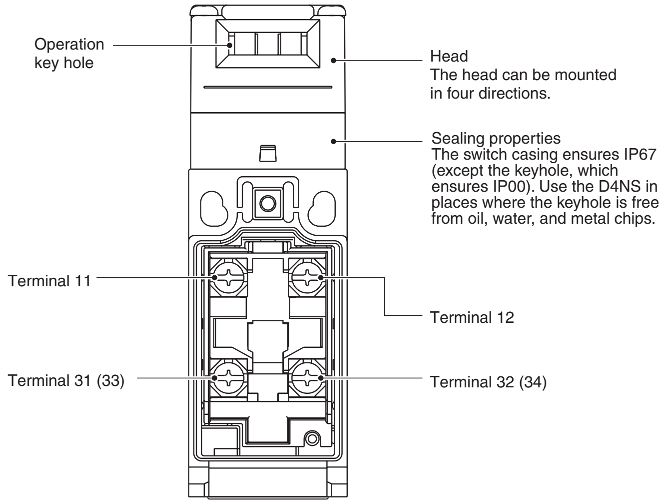
6. These figures are minimum requirements for safe operation.

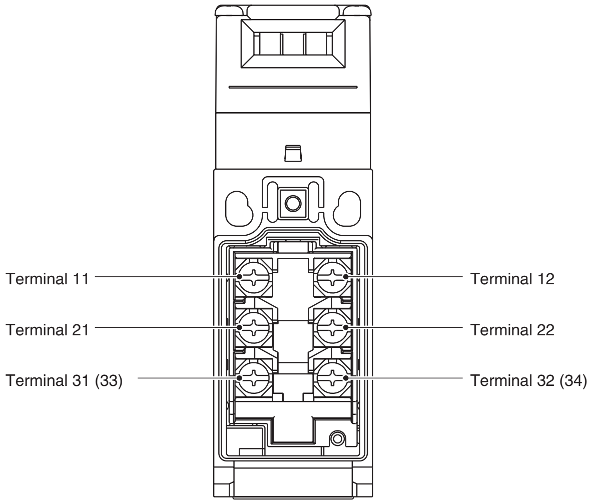
7. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

Nomenclature

Structure

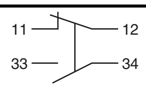
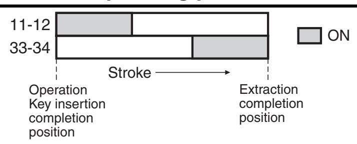
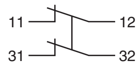
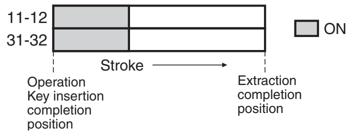
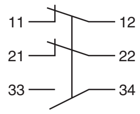
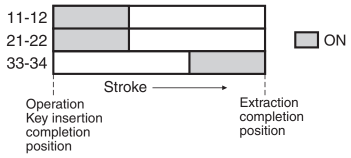
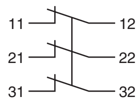
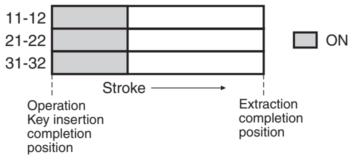
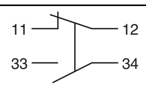
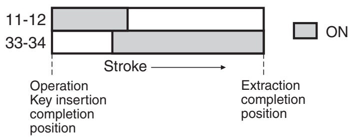
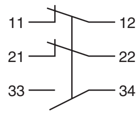
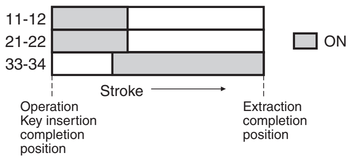
D4NS-□A□, D4NS-□B□, D4NS-□E□
D4NS-□C□, D4NS-□D□, D4NS-□F□





Note: The 2-conduit models have the same terminal arrangement.

Contact Form (Diagrams Show State with Key Inserted)

Model	Contact	Contact form	Operating pattern	Remarks
D4NS-□A□	1NC/1NO			Only NC contacts 11-12 have an approved direct opening mechanism. The terminals 11-12 and 33-34 can be used as unlike poles.
D4NS-□B□	2NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. The terminals 11-12 and 31-32 can be used as unlike poles.
D4NS-□C□	2NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4NS-□D□	3NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4NS-□E□	1NC/1NO MBB			Only NC contacts 11-12 have an approved direct opening mechanism. The terminals 11-12 and 33-34 can be used as unlike poles.
D4NS-□F□	2NC/1NO MBB			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

Note: MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

D4NS

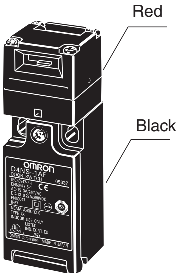
Dimensions/Operating Characteristics

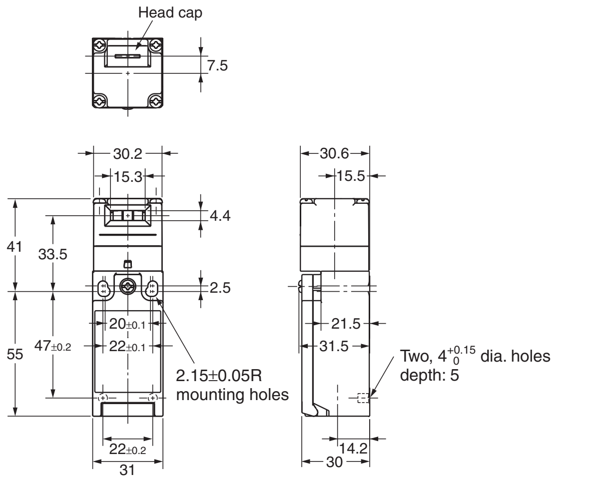
Note: All units are in millimeters unless otherwise indicated.

Switches

1-conduit Models

D4NS-1□F
D4NS-2□F
D4NS-3□F
D4NS-4□F



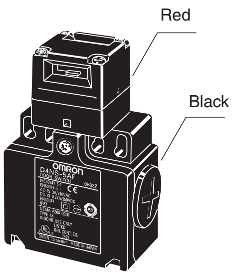


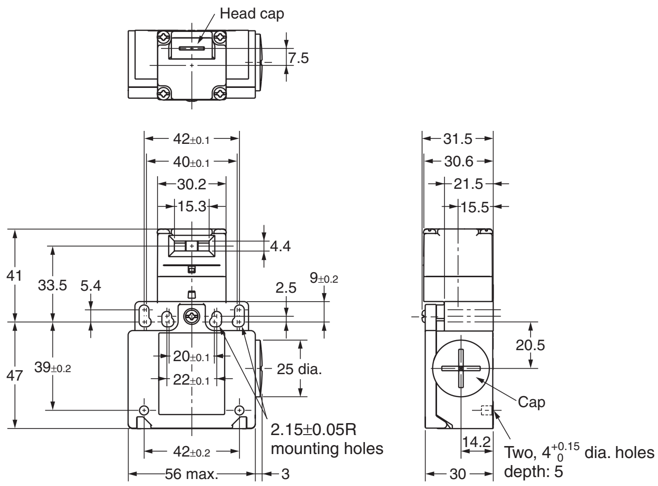
Operating characteristics	D4NS-1□F D4NS-2□F D4NS-3□F D4NS-4□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

* Always maintain the above operating characteristics for safe use.

2-conduit Models

D4NS-5□F
D4NS-6□F
D4NS-7□F
D4NS-8□F



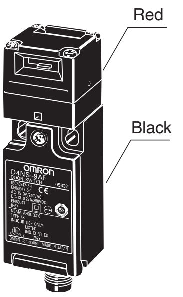


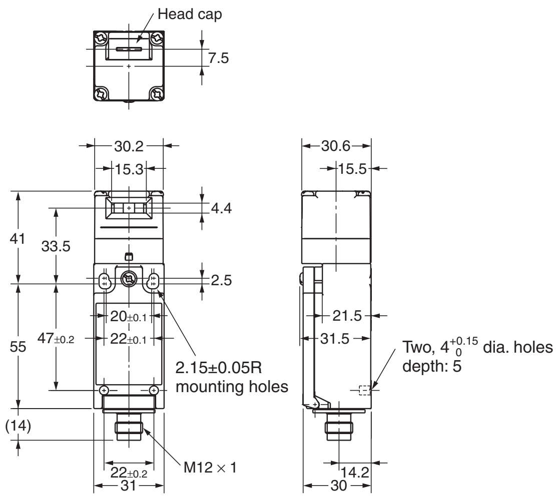
Operating characteristics	D4NS-5□F D4NS-6□F D4NS-7□F D4NS-8□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

* Always maintain the above operating characteristics for safe use.

1-conduit Connector Models

D4NS-9□F





Operating characteristics	D4NS-9□F
Key insertion force Key extraction force	15 N max. 30 N max.
Pretravel (PT)	6±3 mm
Total travel (TT)	(28 mm)
Direct opening force* Direct opening stroke*	60 N min. 10 mm min.

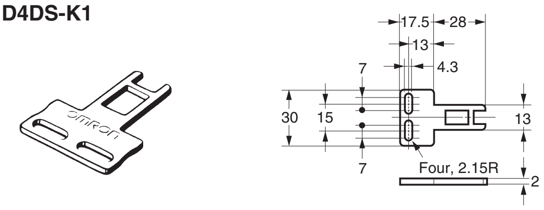
* Always maintain the above operating characteristics for safe use.

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

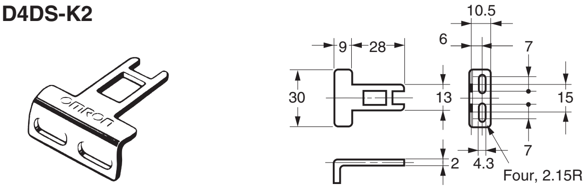
Operation Keys

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

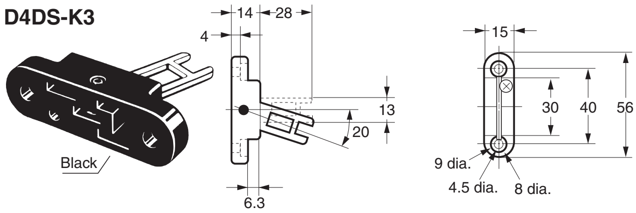
D4DS-K1



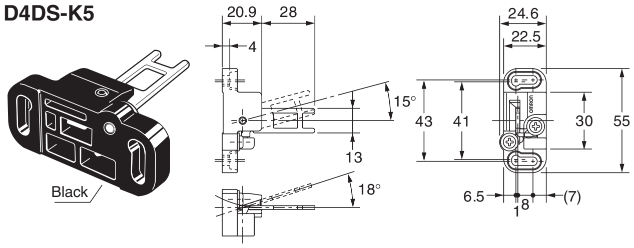
D4DS-K2



D4DS-K3



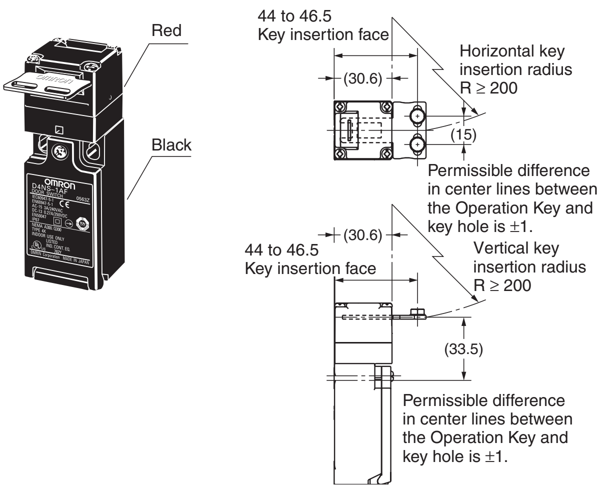
D4DS-K5



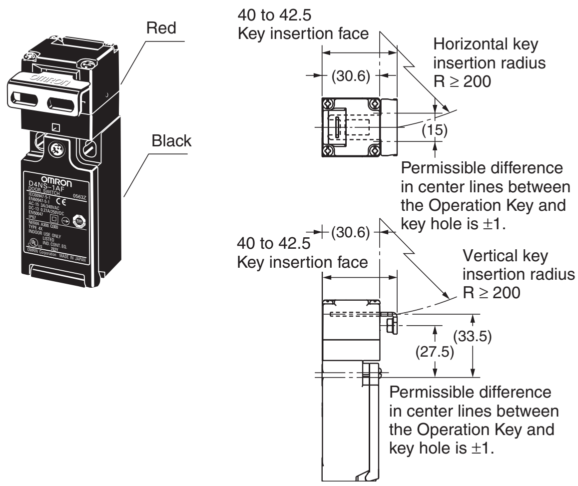
With Operation Key Inserted (Relationship between Insertion Radius and Insertion Hole)

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

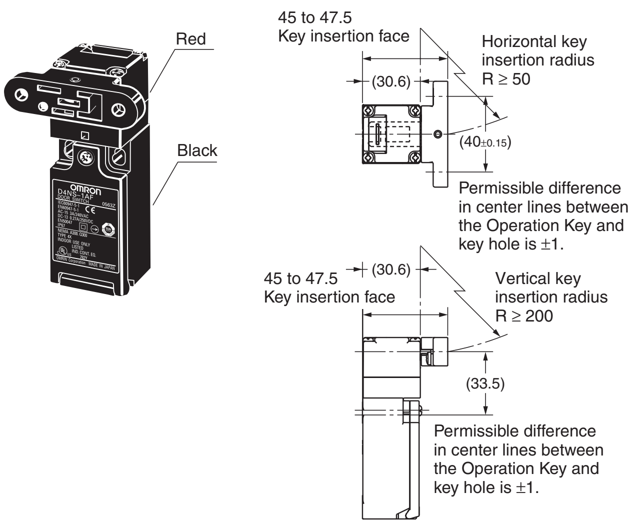
D4NS-1□F + D4DS-K1



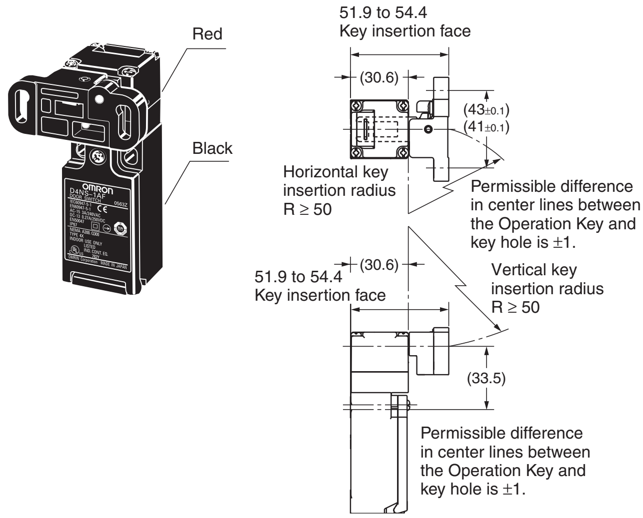
D4NS-1□F + D4DS-K2



D4NS-1□F + D4DS-K3



D4NS-1□F + D4DS-K5



Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions.

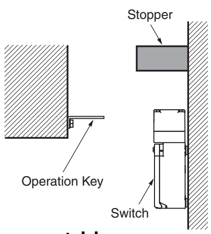
⚠ CAUTION

Do not dismount the operation key from the door intentionally and insert it to the switch with the door open. Machine may start operating and injury or death may be caused.

Do not use metal connector or conduit with this switch. The broken conduit hole may cause electrical shock hazard.

Precautions for Safe Use

- Be careful not to drop your D4NS, or the switch will not fully exhibit its ability.
- Do not disassemble or remodel your D4NS in any case, or the D4NS will not operate normally.
- Do not use the switch where explosive gas, ignitable gas, or any other harmful gasses may be present.
- Install operation key so that it will not hit the operator when the door is open. Injury may be caused.
- Do not use the switch in the oil and in the water. IP67(EN60947-5-1)
- Though the switch body is protected from the ingress of dust or water, avoid the ingress of foreign substance through the key hole on the head.
  Otherwise, wear in short time or break may be caused
- Do not put the electric power when wiring.
- Be sure to install a cover after the wiring.
  Do not put the electric power when opening a cover.
- Connect the fuse to the switch in series to prevent it from short circuit damage.
  The value of the breaking current of the fuse must be increased to cover the rated current by 150 to 200%. When using the switch with EN rating, use 10 A fuse, type gI or gG that complies with IEC 60269.
- Keep the electrical load below the rated value.
- On the switching of general loads (250VAC/3A), do not operate two circuits or more at the same time. Otherwise, insulation performance may be degraded.
- The durability of the switch is seriously affected by operating conditions.
  Evaluate the switch under actual working conditions before permanent installation.
- Please mention in machine manufacturer's Instruction. Manual that the user must not repair nor maintain the switch and must contact machine manufacturer for them.
- Do not use the switch as a stopper.
  Be sure to install a stopper as shown in the following illustration to prevent the edge of the operation key from inadvertently hitting the switch directly.



Precautions for Correct Use

1. Environment

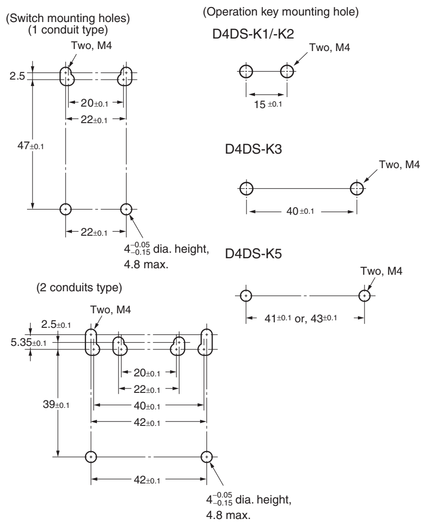
- The switch is intended for indoor use only.
- Do not use your D4NS outdoor, or the switch will malfunction.
- Do not use your D4NS in the atmosphere of hazardous gases (H_2S, SO_2, NH_3, HNO_3, Cl_2, etc.) or high temperature and humidity, or it will cause the imperfect closing of the contacts or the breakage thereof stemming from corrosion.
- Do not use the switch under any of the conditions mentioned below.
  - Frequent temperature range.
  - High humidity or dew condensation may be generated.
  - Where the switch is subject to severe vibration.
  - Where the metal dust, oil, or chemical is sprayed inside the door.
  - Where thinner is applied.

2. Mounting method

- Mounting Screw Tightening Torque
  Loose mounting may result in malfunction.
  Fasten the screws to the specified torque.

Terminal screw	0.6 to 0.8 N·m
Cover clamping screw	0.5 to 0.7 N·m
Head clamping screw	0.5 to 0.6 N·m
Operation Key clamping screw (See item 4)	2.4 to 2.8 N·m
Body clamping screw (See item 4)	0.5 to 0.7 N·m
Conduit mounting connection (see item 10,11), M12 changing adaptor	1.8 to 2.2 N·m
	1.4 to 1.8 N·m (1/2-14NPT)
Cap screw	1.3 to 1.7 N·m

- Switch, operation key
  - The switch and operation key will be fastened to specified torque in item 2 with M4 screws and washers.
  - Secured more by the studs like below picture 4-0.05/-0.15 dia., 4.8 max. height at the lower two which are inserted from back side of switch.



  - Do not use the operation key other than dedicated OMRON's. Otherwise switch may be damaged.
  - Be sure that the operation key can be inserted properly to key hole with a tolerance of ± 1 mm.

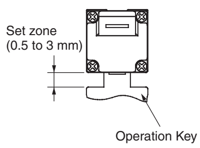
3. Head direction

The rotation of the switch head may be adjusted to any of the four directions by loosening the head clamping screws at the four corners of the head.

4. Securing of the door

If the operation key is pulled in the opening direction due to a force caused by vibration, by the door weight, or by a cushion attached to the door.

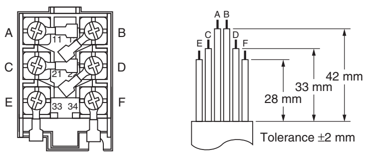
The closed door must be secured with a hook or by similar means.



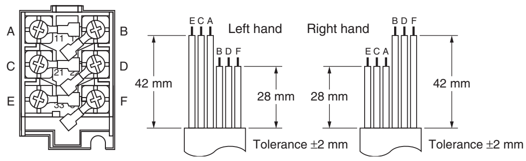
5. Wiring

- When connect with insulation tubes and terminals, connect the terminals as shown in the following figure and wire without overriding to the case and the cover. Adequate conductor size is AWG 20 to 18 (0.5 to 0.75 mm^2).
  Wire leads as shown in the following figure. Otherwise, the switch cover does not fit.

(1 conduit type)



(2 conduits type)

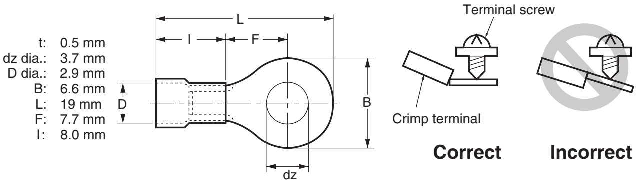


- Do not push the ring connector and the likes into the opening between the parts in order to prevent the case from being broken and deformed.
- Use terminals having the thickness of 0.5 mm or less to avoid the contact between the terminal and the switch case inside.

  The below listed the terminals have thickness of 0.5 mm or less.

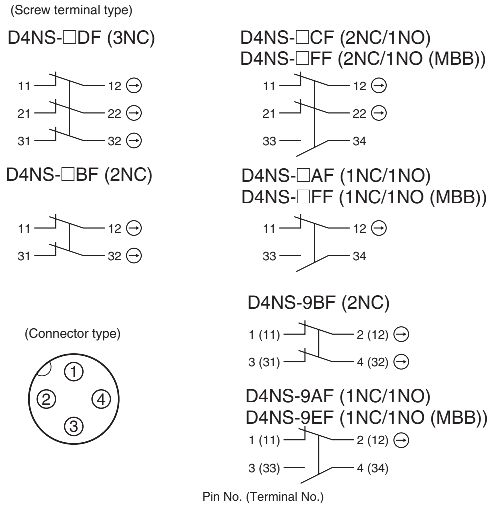
Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG22 to 20

J.S.T is a Japanese manufacturer.



6. Contact arrangement

- The following show a safety contact and an auxiliary contact for 3 contacts and 2 contacts types.



Suitable socket is Type XS2F (OMRON).

7. Socket tightening (connector type)

Do not use any tools, such as pliers, otherwise the socket connector may become damaged. Connect the socket connector to the connector threads of the D4NS. Then firmly turn the socket connector by hand so that the connector threaded portion will be completely covered by the socket connector so that space will be almost 0.

Make sure, however, that the socket connector is tightened securely, otherwise the rated degree of protection of the D4NS may not be maintained. Furthermore, the socket connector may be loosened by vibration.

8. Conduit opening

Use the connectors recommended in clause 9 and tighten the connector with specified torque in clause 2. An excessive torque will bring a case breakage.

Apply sealing tape between connector and conduit opening so that the enclosure will conform to IP67.

Use a cable with a suitable diameter for the connector.

For unused conduit opening, apply a conduit cap provided and tighten it to specified torque in clause 2.

9. Recommendation of connector

Use the connector with thread section of 9 mm long or less. In the case of the connector with longer thread section, protruded part may interfere with the other parts inside the body. Use below listed connector to secure IP67.

Size	Manufacture	Type	Adequate cable Diameter
G1/2	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	S-13.5 5301-5030	6.0 to 12.0 mm
M20	LAPP	ST-M20 × 1.5 5311-1020	7.0 to 13.0 mm
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
	HEYCO		4.3 to 11.9 mm
M12	LAPP	ST-M12 × 1.5 5301-1000	3.5 to 7.0 mm

When use LAPP's products, use together with a seal packing which is sold separately (Type names, JPK-16, GP-13.5, GPM20. GPM12 is for M12 connector) and tighten with proper tightening torque.

LAPP is a German manufacturer.

Ohm Denki is a Japanese manufacturer.

HEYCO is an American manufacturer.

Before using the 2 conduit type 1/2-14NPT connector, attach the appended changing adapter to the switch, and wind the seal tape about the joint of the adapter and switch.

When use M12 conduit type, connect the above listed connector, after tightened the M12 changing adaptor to the switch.

The M12 changing adaptor is enclosed with the packing.

10. Storage

Do not keep the switch in dusty, humid place and any place where gas may be present for example H2S, SO2, NH3, HNO3, Cl2.

11. Others

- Do not impose excessive force on the key top while the operation key is inserted into the switch body or drop the switch with the operation key inserted to avoid the deformation of the key or the breakage of the switch body.
- Confirm that the seal rubber has no abnormality and then use it. If the seal rubber is displaced or floated, or if foreign matters adhere to the seal rubber, the seal rubber will lose its sealing capability.
- Do not use any screw other than correct one, or the sealing capability of the seal rubber will deteriorate.
- Please do a regular check in premeditation for this switch.

D4NS

Production Termination

Following the release of the D4NS, production of the D4DS will be terminated.

Date of Production Termination

Production of the D4DS Series will be terminated in July 2006.

Date of Substitute Product Release

Sale of the D4NS Series commenced in July 2003.

Product Replacement

1. Dimensions
   The D4DS and D4NS have basically the same structure, and use the same mounting method, Operation Keys, mounting hole and Operation Key insertion positions. The multi-contact structure and the extra 4 mm in length, however, are different.
2. Terminal Numbers
   For the 2-contact model, the terminals 21, 22, 23, and 24 on the D4DS are 31, 32, 33, and 34 on the D4NS.
3. Recommended Terminals
   If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

Comparison of the D4DS and Substitute Products

Model	D4NS-□
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Very similar
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

List of Recommended Substitute Products

Switch

D4DS product	Recommended substitute product
D4DS-15FS	D4NS-1AF
D4DS-25FS	D4NS-2AF
D4DS-35FS	D4NS-3AF
D4DS-55FS	D4NS-5AF
D4DS-65FS	D4NS-6AF
D4DS-1AFS	D4NS-1BF
D4DS-2AFS	D4NS-2BF
D4DS-3AFS	D4NS-3BF
D4DS-5AFS	D4NS-5BF
D4DS-6AFS	D4NS-6BF

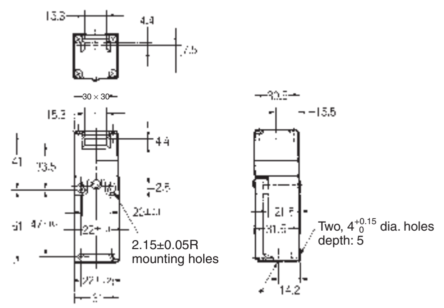
Operation Key

- D4DS-K1
- D4DS-K2
- D4DS-K3
- D4DS-K5

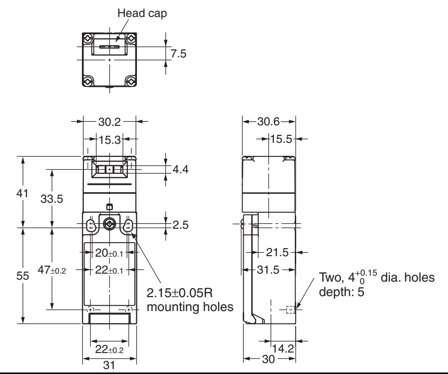
All of the above Operation Keys can be used with the D4NS.

Dimensions (Unit: mm)

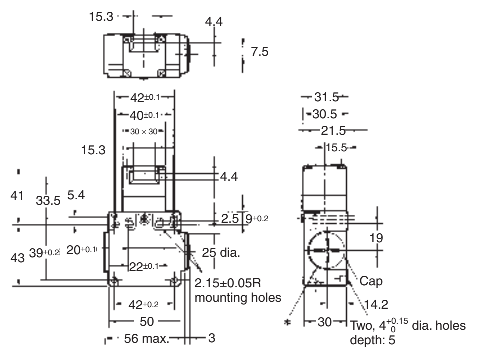
Discontinued Models (1-conduit D4DS)



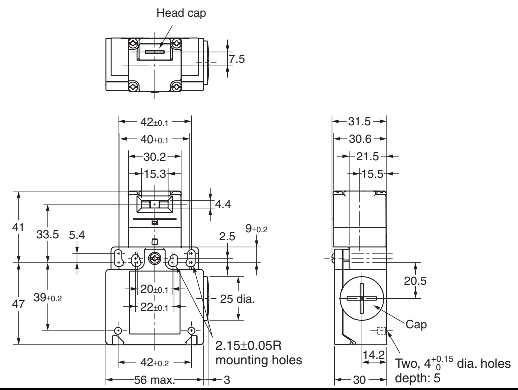
Replacement products (1-conduit D4NS)



Discontinued Model (2-conduit D4DS)



Replacement products (2-conduit D4NS)



⚠ WARNING

This catalog is a guide to help customers select the proper safety product. Observe the following items when choosing products, select the right product for your device or equipment, and develop a safety-related system to fully utilize the product's functions.

Setting up a risk assessment system

The items listed in this catalog must be used properly in terms of product location as well as product performance and functionality. Part of the process of selecting and using these products should include the introduction and development of a risk assessment system early in the design development stage to help identify potential dangers in your equipment that will optimize safety product selection. A badly designed risk assessment system often results in poor choices when it comes to safety products.

• Related international standard: ISO 14121 "Principles of risk assessment."

Safety policy

When developing a safety system for the devices and equipment that use safety products, make every effort to understand and conform to the entire series of international and industrial standards available, such as the examples given below.

• Related international standards: ISO/DIS 12100 "Basic concepts, general principles for design"
IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems."

Role of safety products

Safety products have functions and mechanisms that ensure safety as defined by standards. These functions and mechanisms are designed to attain their full potential within safety-related systems. Make sure you fully understand all functions and mechanisms, and use that understanding to develop systems that will ensure optimal usage.

• Related international standard: ISO 14119 "Interlocking devices associated with guards- Principles for design and selection."

Installing safety products

Make sure that properly educated and trained engineers are selected to develop your safety-related system and to install safety products in devices and equipment.

• Related international standards: ISO/DIS 12100 "Basic Concepts, general principles for design."
IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems."

Observing laws and regulations

Safety products should conform to pertinent laws, regulations and standards, but make sure that they are used in accordance with the laws, regulations and standards of the country where the devices and equipment incorporating these products are distributed.

• Related international standard: IEC 60204 "Electrical equipment of machines."

Observing usage precautions

Carefully read the specifications and precautions listed in this catalog for your product as well as all items in the Operating Manual packed with the product to learn usage procedures that will optimize your choice. Any deviation from precautions will lead to unexpected device or equipment failure not anticipated by safety-related systems or fire originating from equipment failure.

Transferring devices and equipment

When transferring devices and equipment, be sure to keep one copy of the Operating Manual and pack another copy with the device or equipment so the person receiving it will have no problem operating it.

• Related international standards: ISO/DIS 12100 "Basic concepts, general principles for design"
IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems."

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

 In the interest of product improvement, specifications are subject to change without notice.

Safety-door Switch

D4BS

Safety-door Switch's Special Operation Key Directly Pulls Apart the Contacts from Each Other and Contributes to the Safety of the Production Site

- Conforms to EN (TÜV) standards corresponding to the CE marking.
- Approved by UL, CSA, BIA, and SUVA standards.
- The switch contact is opened by a direct opening mechanism (NC contacts only) when the protective cover is opened. The EN-approved direct opening mechanism is indicated by ⊖ on the Switch.
- Degree of protection of the switch box: IP67 (EN60947-5-1).
- Series includes models with gold-plated contacts for handling the micro-load range.
- Metric conduit types available.

Model Number Structure

Model Number Legend

Switch

D4BS - □ □ □ S

1 2 3

1. Conduit

1: PG13.5 (1 conduit)
2: G1/2 (1 conduit)
3: 1/2-14NPT (1 conduit)
4: M20
5: PG13.5 (3-conduit)
6: G1/2 (3-conduit)
7: 1/2-14NPT (3-conduit)
8: M20 (3-conduit)

2. Built-in Switch

5: 1NC/1NO (slow-action)
6: 1NC/NO (slow-action), gold-plated contacts
A: 2NC (slow-action)
B: 2NC (slow-action), gold-plated contacts

3. Head Mounting Direction

F: Four mounting directions possible (front-side mounting at shipping)

Operation Key

D4BS - K □

1

1. Operation Key Type

1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (Horizontal)

Ordering Information

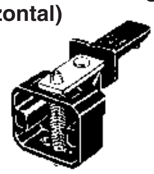
List of Models

Switches

Type	Mounting direction		Conduit size	1NC/1NO (Slow-action)	2NC (Slow-action)
1-conduit	Front-side mounting		Pg13.5	D4BS-15FS	D4BS-1AFS
			G1/2	D4BS-25FS	D4BS-2AFS
			M20	D4BS-45FS	D4BS-4AFS
3-conduit			Pg13.5	D4BS-55FS	D4BS-5AFS
			G1/2	D4BS-65FS	D4BS-6AFS
			M20	D4BS-85FS	D4BS-8AFS

Prefered stock item

Operation Keys (Order Separately)

Type	Model
Horizontal mounting 	D4BS-K1
Vertical mounting 	D4BS-K2
Adjustable mounting (Horizontal) 	D4BS-K3

Specifications

Approved Standards

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9351022 (Direct opening: approved)
UL	UL508	E76675
CSA	CSA C22.2 No. 14	LR45746
BIA	GS-ET-15	9303323
SUVA	SUVA	E6187.d

Standards and EC Directives

Conforms to the following EC Directives:
Machinery Directive
Low Voltage Directive
EN50041
EN1088

Approved Standard Ratings

TÜV (EN60947-5-1)

Utilization category	AC-15
Rated operating current (Ie)	2 A
Rated operating voltage (Ue)	400 V

Note: Use a 10-A fuse type a gl or gG that conforms to IEC269 as a short-circuit protection device.

UL/CSA (UL508, CSA C22.2 No. 14)

A600

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		
480 VAC		15 A	1.5 A		
600 VAC		12 A	1.2 A		

Characteristics

Degree of protection (see note 2)	IP67 (EN60947-5-1)
Durability (see note 3)	Mechanical:1,000,000 operations min. Electrical:500,000 operations min. (10 A at 250 VAC, resistive load)
Operating speed	0.1 m/s to 0.5 m/s
Operating frequency	30 operations/min max.
Rated frequency	50/60 Hz
Contact gap	2 x 2 mm min.
Direct opening force (see note 4)	19.61 N min. (EN60947-5-1)
Direct opening travel (see note 4)	20 mm min. (EN60947-5-1)
Full stroke	23 mm min.
Insulation resistance	100 MΩ min. (at 500 VDC) between terminals of same or different polarity, between each terminal and ground, and between each terminal and non-current-carrying metal part
Contact resistance	25 mΩ max. (initial value)
Rated insulation voltage (U_i)	600 V (EN60947-5-1)
Conventional enclosed thermal current (I_{the})	20 A (EN60947-5-1)
Dielectric strength (Uimp)	Impulse dielectric strength (U_{imp}) 4 kV (EN60947-5-1) between terminals of same or different polarity, between current-carrying metal parts and ground, and between each terminal and non-current-carrying metal part
Switching overvoltage	1,500 V max. (EN60947-5-1)
Conditional short-circuit current	100 A (EN60947-5-1)
Pollution degree (operating environment)	3 (EN60947-5-1)
Insulation class	Class I (with ground terminal)
Vibration resistance	Malfunction: 10 to 500 Hz, 0.65-mm single amplitude
Shock resistance	Destruction:1,000 m/s² min. (IEC68-2-27) Malfunction:300 m/s² min. (IEC68-2-27)
Ambient temperature	Operating:-40°C to 80°C (with no icing)
Ambient humidity	Operating:95% max.
Weight	Approx. 285 g (in the case of D4BS-15FS)

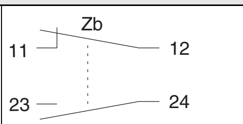
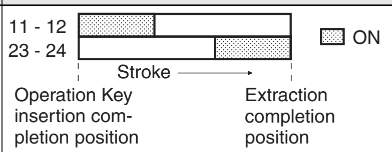
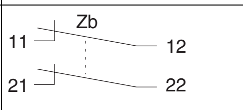
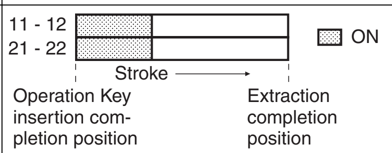
Note: 1. The above values are initial values.

2. Although the switch box is protected from dust, oil, or water penetration, do not use the D4BS in places where dust, oil, water, or chemicals may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

3. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. Contact your OMRON sales representative for more detailed information on other operating environments.

4. These figures are minimum requirements for safe operation.

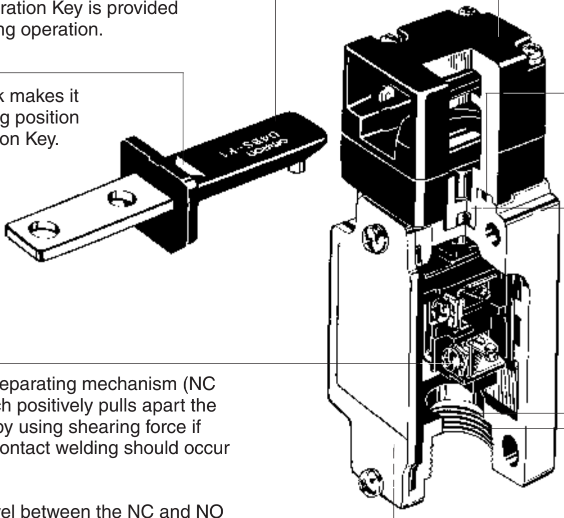
Contact Form (Diagrams Show State with Key Inserted)

Model	Contact form		Diagram	Remarks
D4BS-□5□S	1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. Terminals 11-12 and 23-24 can be used as unlike poles.
D4BS-□A□S	2NC			NC contacts 11-12 and 21-22 have an approved direct opening mechanism. Terminals 11-12 and 21-22 can be used as unlike poles.

Note: The terminal numbers are in accordance with EN50013, and the contact symbols are in accordance with IEC947-5-1.

D4BS

Nomenclature



Operation Key
D4BS's exclusive-use Operation Key is provided to assure accurate switching operation.

Set Zone Mark
A triangular Set Zone Mark makes it easy to adjust the operating position when inserting the Operation Key.

Built-in Switch
A shearing force contact separating mechanism (NC contact) is employed, which positively pulls apart the contacts from each other by using shearing force if any abnormality such as contact welding should occur in the contact area.

There is a difference in level between the NC and NO terminal, which assures easy wiring.

Head
The switch head is coated with easy-to-see red paint. The mounting direction of the switch head can be varied to any of the four directions.

Seal Ring (NBR)

Oil Seal (NBR)
The operation plunger employs an oil seal, with which the switch box meets the requirements of IP67 (the sealing capability of the Operation Key's insertion mouth is IP00).

Seal Packing (NBR)

Conduit Opening
Available in four different types of conduit threads: Pg 13.5, G1/2, or 1/2-14NPT, M20.

Ground Terminal Screw
A ground terminal is provided to improve safety. (Built into the Unit.)

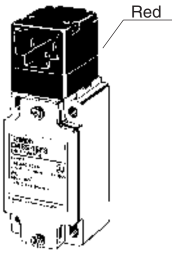
Dimensions

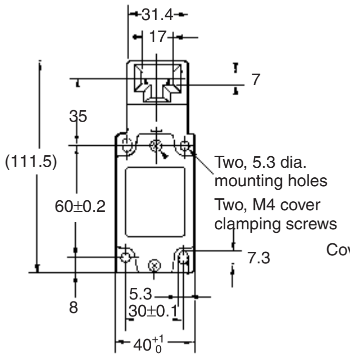
Note: 1. All units are in millimeters unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
3. The conduit thread varies with the model as follows:.

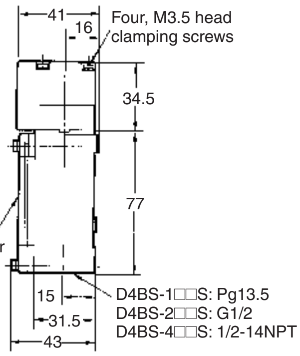
Conduit thread	Model
Pg 13.5	D4BS-1□□S, D4BS-5□□S
G1/2	D4BS-2□□S, D4BS-6□□S
M20	D4BS-4□□S, D4BS-8□□S

Switches

1-conduit
D4BS-1□□S
D4BS-2□□S
D4BS-4□□S

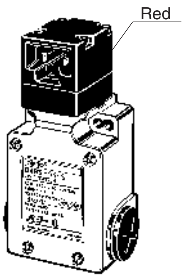


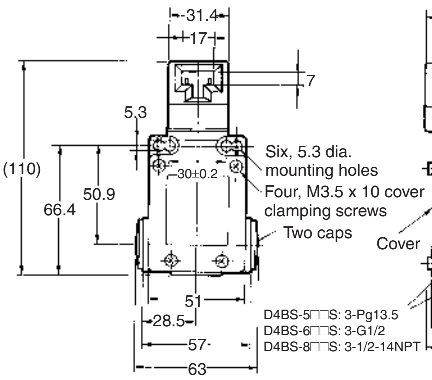


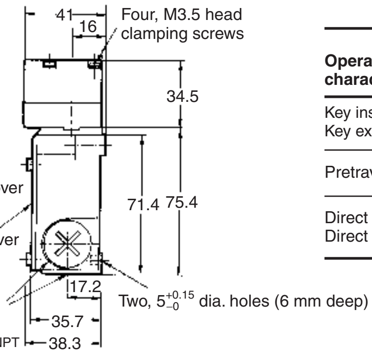


Operating characteristics	D4BS-1□□S D4BS-2□□S D4BS-4□□S
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Pretravel (PT)	10±5 mm
Direct opening force Direct opening stroke	19.61 N min. 20 mm min.

3-conduit
D4BS-5□□S
D4BS-6□□S
D4BS-8□□S



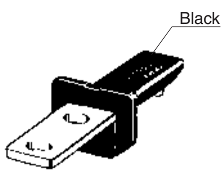


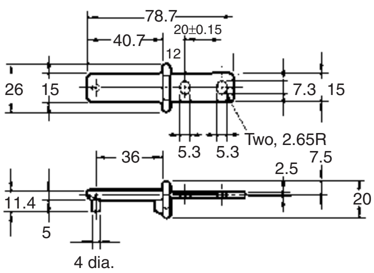


Operating characteristics	D4BS-5□□S D4BS-6□□S D4BS-8□□S
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Pretravel (PT)	10±5 mm
Direct opening force Direct opening stroke	19.61 N min. 20 mm min.

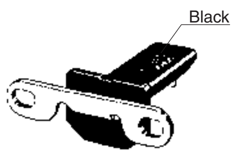
Operation Keys

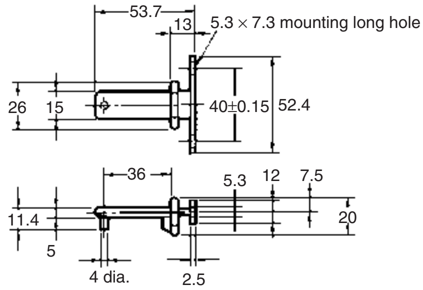
D4BS-K1



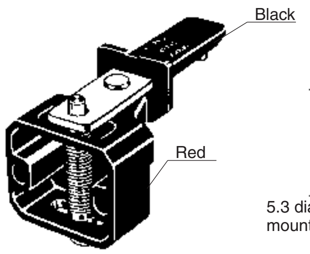


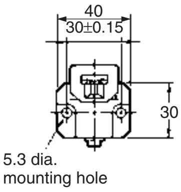
D4BS-K2

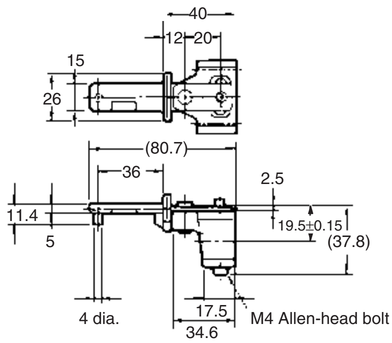




D4BS-K3



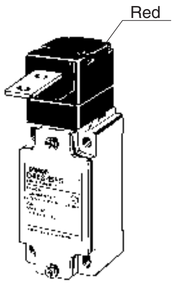


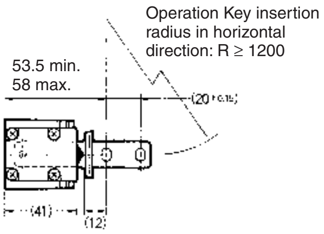


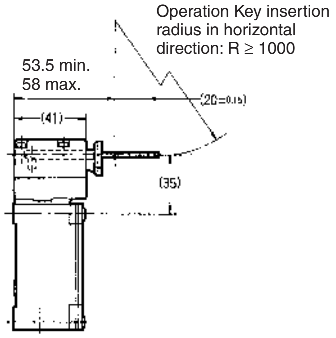
With Operation Key Inserted

Horizontal Mounting

D4BS-1□□S +D4BS-K1
D4BS-2□□S +D4BS-K1
D4BS-4□□S +D4BS-K1

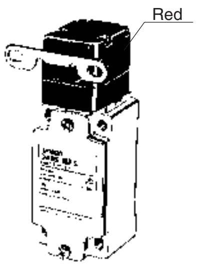


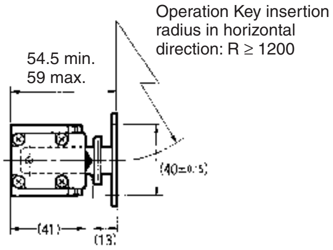


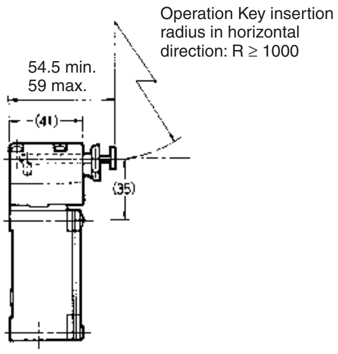


Vertical Mounting

D4BS-1□□S +D4BS-K2
D4BS-2□□S +D4BS-K2
D4BS-4□□S +D4BS-K2

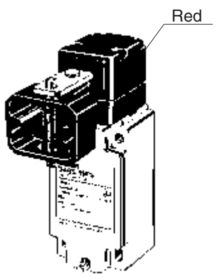


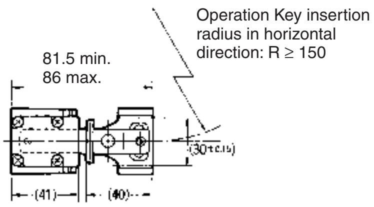


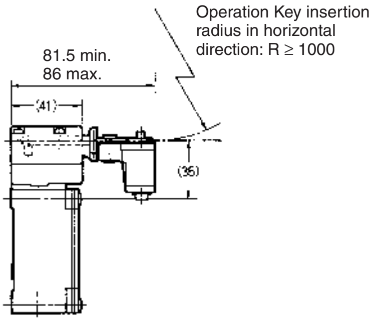


Adjustable Mounting (Horizontal)

D4BS-1□□S +D4BS-K3
D4BS-2□□S +D4BS-K3
D4BS-4□□S +D4BS-K3







Note: "R" is the Operation Key insertion radius.

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Precautions

Do not dismount the Operation Key from the door intentionally and insert it to the Switch with the door open. Machine may start operating and injury or death may be caused.

Mount the Operation Key at a location where it will not come in contact with users when the door is opened or closed.

When operating the D4BS as a part of a safety category circuit to prevent injury, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, tighten the switch body and Operation Key with one-way screws or equivalents or install a switch protection cover and warning label for safety purposes to prevent easy removal of the D4BS.

Connect the fuse to the D4BS in series to prevent it from short-circuit damage. The value of the breaking current of the fuse must be calculated by multiplying rated current by 150% to 200%. When using the D4BS with EN ratings, use 10-A fuse Type gI or gG that complies with IEC60269.

Correct Use

Operating Environment

Make sure in advance that the environment is suitable, with no oil, water, or chemicals, as these may cause the seal to deteriorate, resulting in faulty contact, faulty isolation, current leakage, or burning.

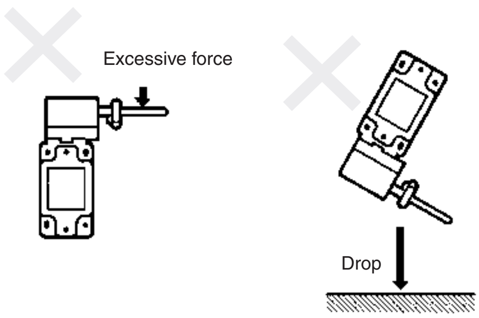
Do not use the D4BS in the following locations:

- Locations subject to severe temperature changes
- Locations subject to high temperatures or condensation
- Locations subject to severe vibration
- Locations where the product may come into direct contact with processing waste or dust

Operation Key

Be sure to use a special Operation Key only. Do not operate the D4BS with anything other than the special Operation Key, otherwise the D4BS may break or the safety of the system may not be maintained.

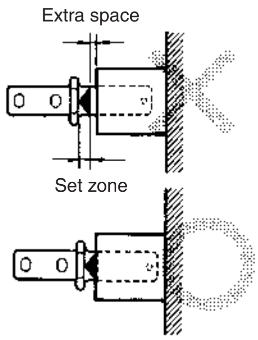
Do not impose excessive force on the Operation Key inserted into the D4BS or drop the D4BS with the Operation Key inserted, otherwise the Operation Key may deform or break.



Secure the Operation Key with a one-way screw, or an equivalent, so that the Operation Key cannot be easily removed.

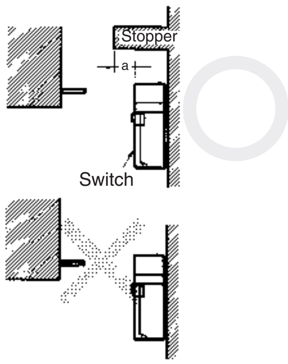
Securing the Door

If the Operation Key on the closed door is pulled outside the set zone by a force caused by vibration, the door's weight, or the door cushion rubber, the switch contact may be opened (causing the machinery to stop) or the D4BS may be damaged. Secure the door with hooks so that it will remain within the set zone.



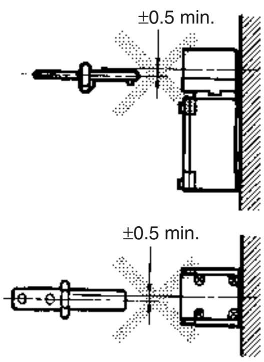
Mounting

Do not use the Switch as a stopper. Be sure to install a stopper as shown in the following illustration when mounting the Switch. The range of space "a" must be determined according to the available set zone of the Operation Key.



Refer to *Dimensions* for the mounting dimension of the Operation Key and mount the Operation Key correctly. The Operation Key will soon become damaged or worn out if it is not mounted correctly.

Make sure that the Operation Key can be inserted properly with a tolerance of ±0.5 mm in the upward, downward, left, or right direction, otherwise the D4BS may soon become damaged.

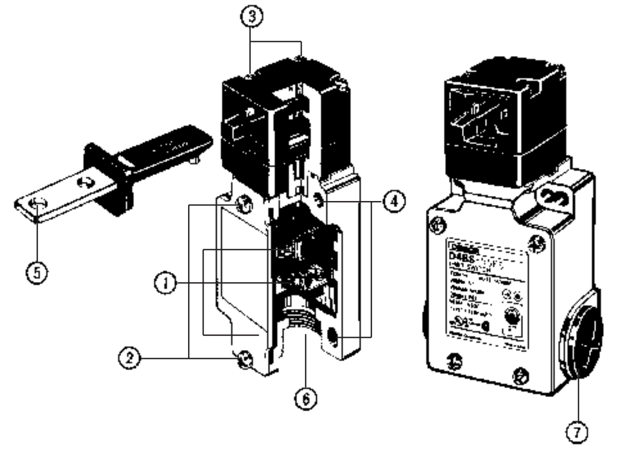


Other

Make sure that the D4BS is located outside the safety door and that no metal dust, oil, or chemical will be sprayed onto the D4BS. Otherwise, the D4BS may soon fail to operate due to the penetration of metal dust, oil, or chemical.

Tightening Torque

Be sure to tighten each screw of the D4BS properly, otherwise the D4BS may malfunction.



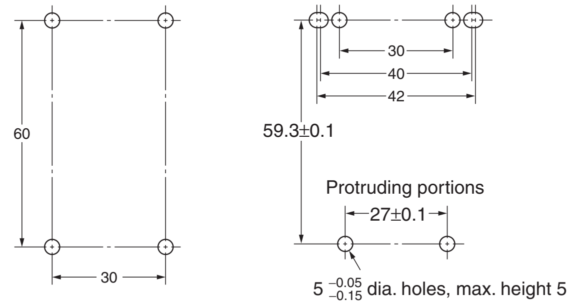
No.	Type	Torque
1	M3.5 terminal screw (including ground terminal screw)	0.59 to 0.78 N·m
2	Cover mounting screw (see note 1)	1.18 to 1.37 N·m
3	Head mounting screw	0.78 to 0.98 N·m
4	M5 body mounting screw (see note 2)	4.90 to 5.88 N·m
5	Operation Key mounting screw	2.35 to 2.75 N·m
6	Connector	1.77 to 2.16 N·m
7	Cap screw	1.27 to 1.67 N·m

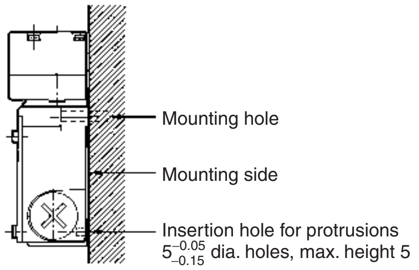
Note: 1. Apply a torque of 0.78 o 0.88 N·m if the D4BS is a three-conduit model.

2. Apply a torque of 4.90 to 5.88 N·m in the case of an Allen-head bolt. If it is a pan head screw, apply a torque of 2.35 to 2.75 N·m.

Mounting Dimensions (M5)

Standard Model **Three-conduit Model**

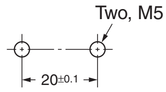




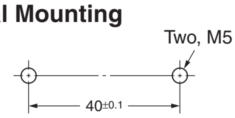
The D4BS can be mounted more securely by adding two protruding portions, each of which is 5 mm maximum in height and $5^{-0.05}/_{-0.15}$ mm in diameter as shown below.

Operating Key Mounting Dimensions

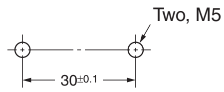
Horizontal Mounting



Vertical Mounting



Adjustable Mounting (Horizontal)



Changes in Head Mounting Direction

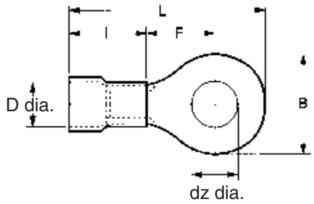
By removing the screws on the four corners of the head, the head can be reset in any of four directions. The head direction can be changed with or without the Operation Key inserted in the head. Make sure that no foreign materials penetrate through the head and that the head is tightened securely within the proper torque range.

Wiring

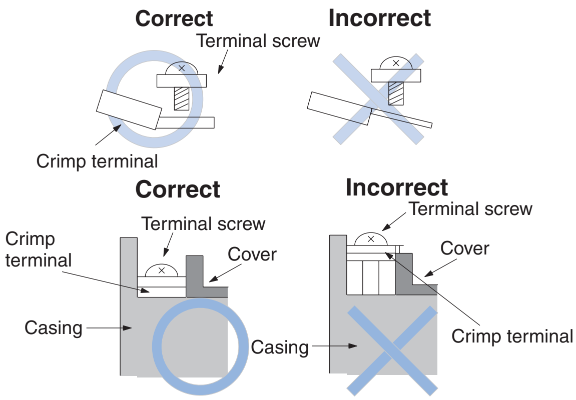
Do not connect the lead wires directly to the terminals. Connect the lead wires through insulation tubes and M3.5 crimp terminals. Tighten each terminal screw within the proper torque range.

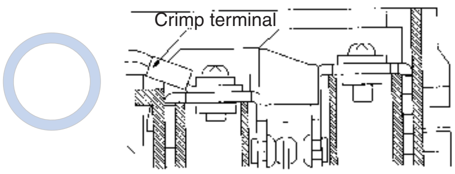
The proper lead wire is AWG20 to AWG14 (0.5 to 2.5 mm²) in size.

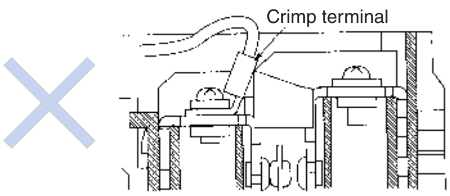
dz dia.:	3.7
D dia.:	4.5
B:	7.0
L:	20.2
F:	7.7
I:	9.0 (mm)



Make sure that all crimp terminals are correctly connected and located within the casing or cover as shown below.







Connector

Tighten the connector to a suitable torque. Excessive tightening torque may damage the casing.

When using a 1/2-14NPT conduit, apply sealing tape between connector and conduit opening so that the enclosure will confirm to IP67. If using a Pg13.5 conduit, use an ABS-08 Pg13.5 connector or an ABS-12 Pg13.5 connector (manufactured by Nippon Flex).

Use a connector (SC Series, sold separately) suitable for the outer diameter of the cable.

When wiring a 3-conduit model, securely tighten the cap screw provided for unused conduit openings.

Maintenance and Repairs

The user must not maintain or repair equipment incorporating any D4BS model. Contact the manufacturer of the equipment for any maintenance or repairs required.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

 In the interest of product improvement, specifications are subject to change without notice.

Guard Lock Safety-door Switch

D4NL

Lead-free, Environment-friendly Design

- Contains no harmful substances, such as lead or cadmium, reducing the burden on the environment.
- Models with 4-contact and 5-contact built-in switches are available.
- Key holding force of 1,300 N min.
- Can be used for either standard loads or microloads.
- Lineup includes models with a conduit size of M20.
- IP67 degree of protection.
- Operation key compatible to D4DS, D4NS and D4GL.

Model Number Structure

Model Number Legend

Switch

D4NL-□□□□-□□□
1 2 3 4 5 6 7

1. **Conduit Size**
   - 1: Pg13.5
   - 2: G1/2
   - 4: M20
2. **Built-in Switch (with Door Open/Closed Detection Switch and Lock Monitor Switch Contacts)**
   - A: 1NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
   - B: 1NC/1NO slow-action contacts plus 2NC slow-action contacts
   - C: 2NC slow-action contacts plus 1NC/1NO slow-action contacts
   - D: 2NC slow-action contacts plus 2NC slow-action contacts
   - E: 2NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
   - F: 2NC/1NO slow-action contacts plus 2NC slow-action contacts
   - G: 3NC slow-action contacts plus 1NC/1NO slow-action contacts
   - H: 3NC slow-action contacts plus 2NC slow-action contacts
3. **Head Mounting Direction and Material**
   - F: Four mounting directions possible (Front-side mounting at time of delivery)/plastic
   - D: Four mounting directions possible (Front-side mounting at time of delivery)/metal
4. **Door Lock and Release**
   - A: Mechanical lock/24-VDC solenoid release
   - B: Mechanical lock/110-VAC solenoid release
   - C: Mechanical lock/230-VAC solenoid release
   - G: 24-VDC solenoid lock/mechanical release
   - H: 110-VAC solenoid lock/mechanical release
   - J: 230-VAC solenoid lock/mechanical release
5. **Indicator**
   - B: 10 to 115 VAC/VDC (orange LED indicator)
   - E: 100 - 230V VAC (orange neon lamp indicator)
6. **Release Key Type**
   - Blank: Standard
   - 4: Special release key
7. **Release Key Position**
   - Blank: Bottom
   - S: Front

Operation Key

D4DS-K□
1

1. **Operation Key Type**
   - 1: Horizontal mounting
   - 2: Vertical mounting
   - 3: Adjustable mounting (horizontal)
   - 5: Adjustable mounting (horizontal/vertical)

Ordering Information

List of Models

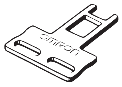
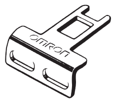
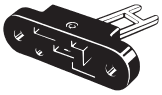
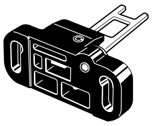
For 110V and 230V version ask your local OMRON Representative

Switches (Operation Keys are sold separately.)

: Models with approved direct opening contacts. **Prefered stock item***

Head material	Release key position	Release key type	Solenoid voltage/ indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Approved direct opening NC contact	Conduit opening	Model
Plastic	Bottom	Standard	Solenoid: 24 VDC Orange LED: 10 to 115 VAC/VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	**Pg13.5**	**D4NL-1AFA-B***
						G1/2	D4NL-2AFA-B
						M20	**D4NL-4AFA-B***
					1NC/1NO+2NC	Pg13.5	D4NL-1BFA-B
						G1/2	D4NL-2BFA-B
						M20	D4NL-4BFA-B
					2NC+1NC/1NO	**Pg13.5**	**D4NL-1CFA-B***
						G1/2	D4NL-2CFA-B
						M20	**D4NL-4CFA-B***
					2NC+2NC	Pg13.5	D4NL-1DFA-B
						G1/2	D4NL-2DFA-B
						M20	D4NL-4DFA-B
					2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFA-B
						G1/2	D4NL-2EFA-B
						M20	**D4NL-4EFA-B***
					2NC/1NO+2NC	Pg13.5	D4NL-1FFA-B
						G1/2	D4NL-2FFA-B
						M20	D4NL-4FFA-B
					3NC+1NC/1NO	Pg13.5	D4NL-1GFA-B
						G1/2	D4NL-2GFA-B
						M20	D4NL-4GFA-B
					3NC+2NC	Pg13.5	D4NL-1HFA-B
						G1/2	D4NL-2HFA-B
						M20	D4NL-4HFA-B
				Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	**Pg13.5**	**D4NL-1AFG-B***
						G1/2	D4NL-2AFG-B
						M20	**D4NL-4AFG-B***
					1NC/1NO+2NC	Pg13.5	D4NL-1BFG-B
						G1/2	D4NL-2BFG-B
						M20	D4NL-4BFG-B
					2NC+1NC/1NO	**Pg13.5**	**D4NL-1CFG-B***
						G1/2	D4NL-2CFG-B
						M20	**D4NL-4CFG-B***
					2NC+2NC	Pg13.5	D4NL-1DFG-B
						G1/2	D4NL-2DFG-B
						M20	D4NL-4DFG-B
					2NC/1NO+1NC/1NO	Pg13.5	D4NL-1EFG-B
						G1/2	D4NL-2EFG-B
						M20	**D4NL-4EFG-B***
					2NC/1NO+2NC	Pg13.5	D4NL-1FFG-B
						G1/2	D4NL-2FFG-B
						M20	D4NL-4FFG-B
					3NC+1NC/1NO	Pg13.5	D4NL-1GFG-B
						G1/2	D4NL-2GFG-B
						M20	D4NL-4GFG-B
					3NC+2NC	Pg13.5	D4NL-1HFG-B
						G1/2	D4NL-2HFG-B
						M20	D4NL-4HFG-B

Operation Keys

Type	Model
Horizontal mounting 	D4DS-K1
Vertical mounting 	D4DS-K2
Adjustable mounting (Horizontal) 	D4DS-K3
Adjustable mounting (Horizontal/Vertical) 	D4DS-K5

Specifications

Standards and EC Directives

Applicable EC Directives and Standards

- Machinery Directive
- Low Voltage Directive
- EN1088
- EN60204-1
- GS-ET-19

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	(See note 1.)
UL (See note 2.)	UL508, CSA C22.2 No.14	E76675

Note: 1. Consult your OMRON representative for details.
2. Approval for CSA C22.2 No. 14 is authorized by the UL mark.

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL508, CSA C22.2 No. 14) A300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Solenoid Coil Characteristics

Item	24 VDC	110 VAC	230 VAC
Rated operating voltage (100% ED)	24 VDC +10%/−15%	110 VAC ±10%	230 VAC ±10%
Current consumption	Approx. 200 mA	Approx. 50 mA	Approx. 30 mA
Insulation	Class F (130°C max.)		

Indicator Characteristics

Item	LED
Rated voltage	10 to 115 VAC/VDC
Current leakage	Approx. 1 mA
Color (LED)	Orange

Characteristics

Degree of protection (see note 2)		IP67 (EN60947-5-1) (This applies for the Switch only. The degree of protection for the key hole is IP00.)	
Durability (see note 3)	**Mechanical**	1,000,000 operations min.	
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (see note 4)	
Operating speed		0.05 to 0.5 m/s	
Operating frequency		30 operations/minute max.	
Rated frequency		50/60 Hz	
Contact gap		2 x 2 mm min	
Direct opening force (see note 5)		60 N min. (EN60947-5-1)	
Direct opening travel (see note 5)		10 mm min. (EN60947-5-1)	
Holding force (see note 6)		1,300 N min.	
Insulation resistance		100 MΩ min. (at 500 VDC)	
Minimum applicable load (see note 7)		Resistive load of 1 mA at 5 VDC (N-level reference value)	
Rated insulation voltage (U_i)		300 V (EN60947-5-1)	
Rated open thermal current (I_{th})		10 A (EN60947-5-1)	
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity	2.5 kV
		Between terminals of different polarities	4 kV
		Between other terminals and uncharged metallic parts	6 kV
Conditional short-circuit current		100 A (EN60947-5-1)	
Pollution degree (operating environment)		3 (EN60947-5-1)	
Protection against electric shock		Class II (double insulation)	
Contact resistance		25 mΩ max. per contact (initial value)	
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude	
Shock resistance	**Destruction**	1,000 m/s² min.	
	Malfunction	300 m/s² min. (100 m/s² min. for the lock monitor switch)	
Ambient temperature		Operating: −10° C to 55° C with no icing	
Ambient humidity		Operating:95% max.	
Weight		Approx. 370 g (D4NL-IAFA-B)	

Note: 1. The above values are initial values.

2. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4NL in places where foreign material may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

3. The durability is for an ambient temperature of 5° C to 35° C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

4. If the ambient temperature is greater than 35° C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

5. These figures are minimum requirements for safe operation.

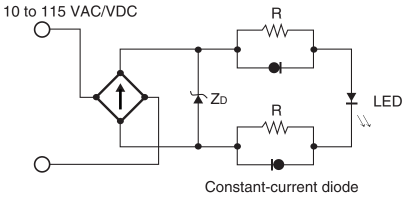
6. This figure is based on the GS-ET-19 evaluation method.

7. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

Connections

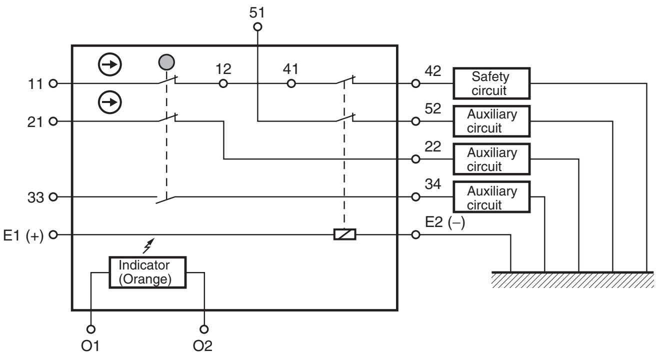
Indicator

Internal Circuit Diagram



Circuit Connection Example

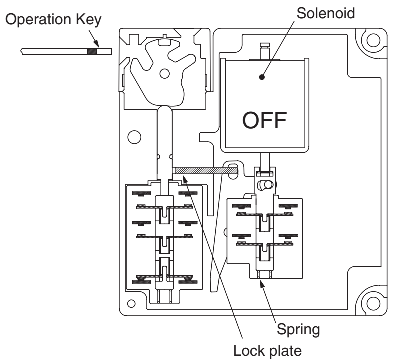
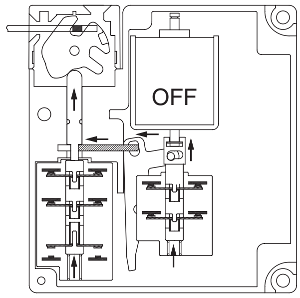
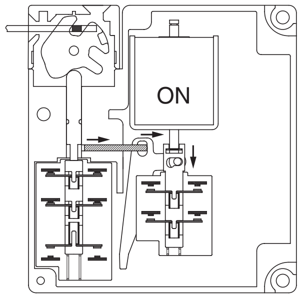
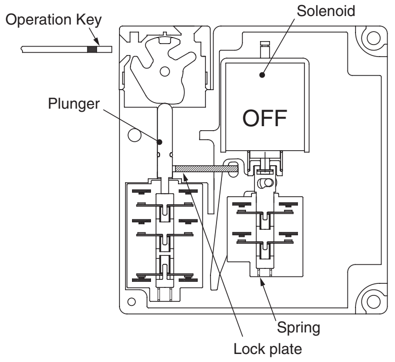
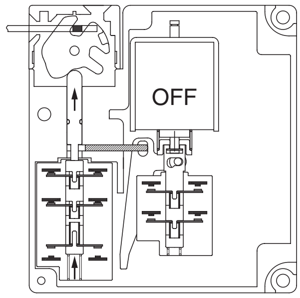
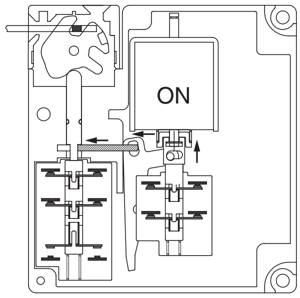
- Terminals 12 and 41 are connected internally and so connect terminals 11 and 42 for safety-circuit input. (GS-ET-19)
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit input (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 above). Connect the terminals individually when using as auxiliary-circuit input (e.g., terminals 21 and 22 for safety-door open/closed monitoring and terminals 51 and 52 for monitoring the lock status).
- In the connection example on the right, terminals 21 and 22 and terminals 51 and 52 are used as auxiliary-circuit input.



- Direct opening contacts used as safety-circuit input are indicated with the ⊖ mark. Terminals 11 and 12 and terminals 21 and 22 are direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2.
  If an indicator is connected in parallel to a direct opening contact, when the indicator breaks, a short-circuit current will be generated, possibly resulting in an installation malfunction.
- Do not switch standard loads for more than 2 circuits at the same time. Otherwise, the level of insulation may decrease.
- The 24-VDC solenoid has polarity. Be sure to connect terminals with the correct polarity.

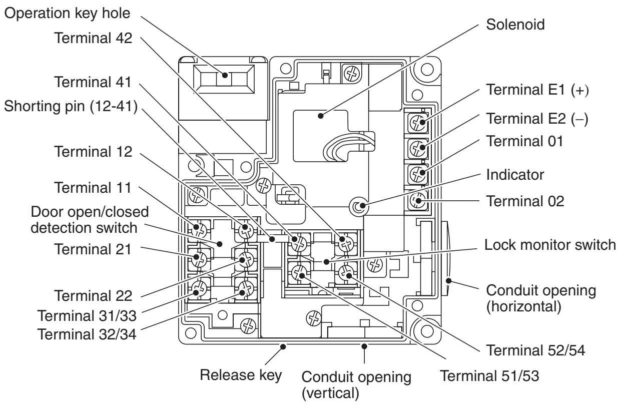
Operation Method

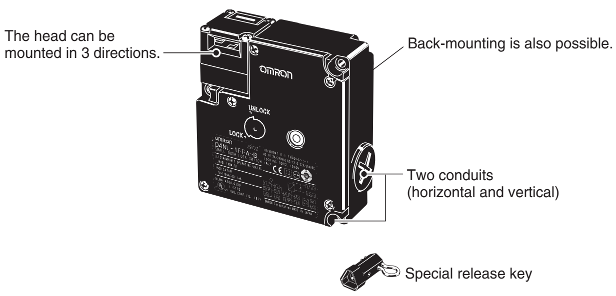
Operation Principles

Mechanical lock models		 When the Operation Key is inserted, it is locked by the lock spring. The door will stay locked even if there is a power interruption.	 The solenoid is released only when the lock is turned ON.
Solenoid lock models		 If the solenoid is OFF, the door will not be locked when the Operation Key is inserted. This means that the door can be opened and closed easily when replacing work-pieces or parts.	 The door is locked only when the solenoid is turned ON. This means that the door will be unlocked if there is a power interruption and so this model cannot be used in sys-tems that would maintain a hazardous state (e.g., systems requiring toxic gases, high temperatures, or gears that would continue to turn due to inertia).

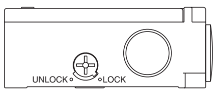
Nomenclature

Structure

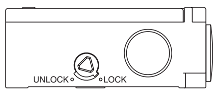




Standard Release Key (Bottom View)



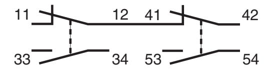
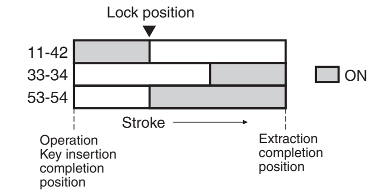
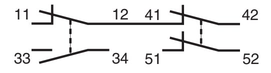
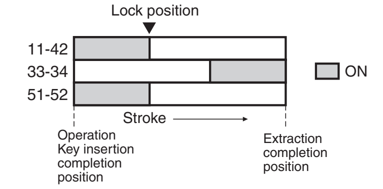
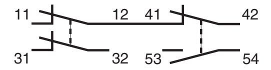
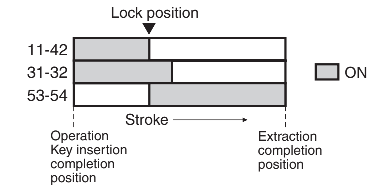
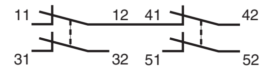
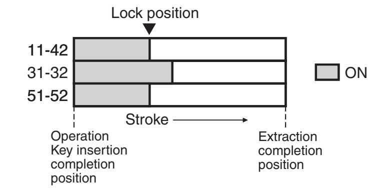
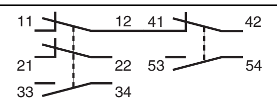
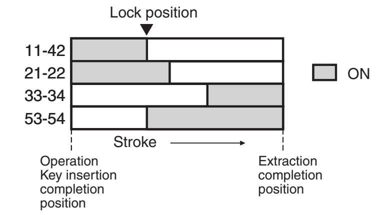
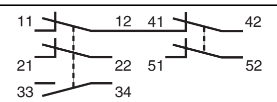
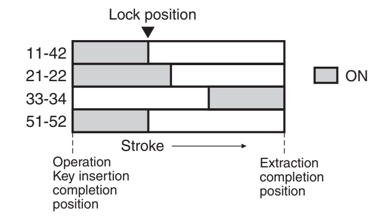
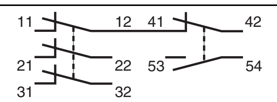
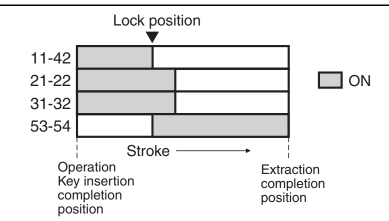
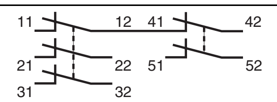
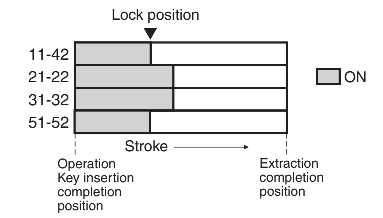
Special Release Key (Bottom View)



Note: Terminal numbers vary with the model.

Contact Form

Indicates conditions where the Key is inserted and the lock is applied. Terminals 12 and 41 are connected internally (as per GS-ET-19).

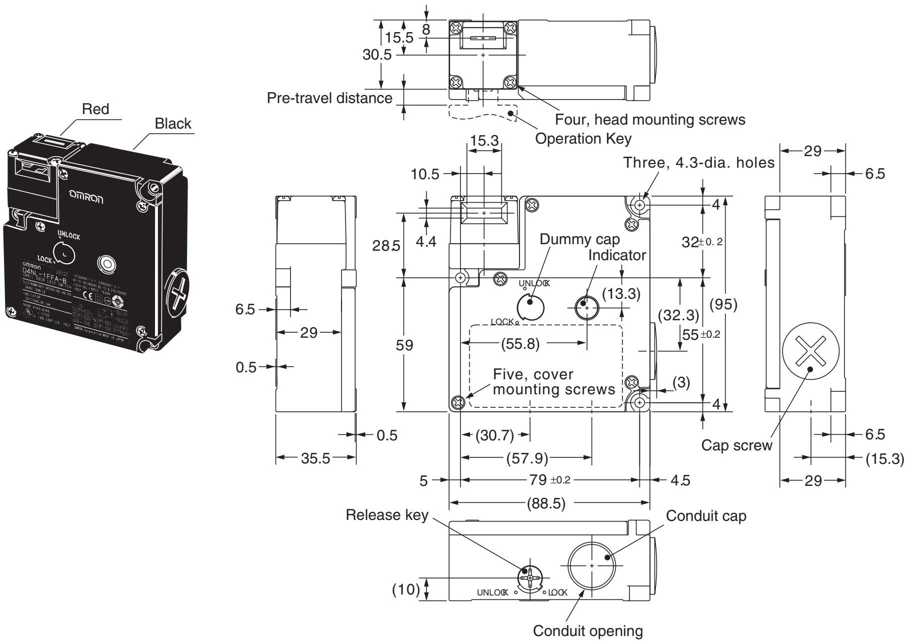
Model	Contact	Contact form	Operating pattern	Remarks
D4NL-□AF□-□	1NC/1NO + 1NC/1NO			Only NC contacts 11-12 and 41-42 have an approved direct opening mechanism. The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4NL-□BF□-□	1NC/1NO + 2NC			Only NC contacts 11-12, 41-42, and 51-52 have an approved direct opening mechanism. The terminals 11-42, 33-34, and 51-52 can be used as unlike poles.
D4NL-□CF□-□	2NC + 1NC/1NO			Only NC contacts 11-12, 31-32, and 41-42 have an approved direct opening mechanism. The terminals 11-42, 31-32, and 53-54 can be used as unlike poles.
D4NL-□DF□-□	2NC + 2NC			Only NC contacts 11-12, 31-32, 41-42, and 51-52 have an approved direct opening mechanism. The terminals 11-42, 31-32, and 51-52 can be used as unlike poles.
D4NL-□EF□-□	2NC/1NO + 1NC/1NO			Only NC contacts 11-12, 21-22, and 41-42 have an approved direct opening mechanism. The terminals 11-42, 21-22, 33-34, and 53-54 can be used as unlike poles.
D4NL-□FF□-□	2NC/1NO + 2NC			Only NC contacts 11-12, 21-22, 41-42, and 51-52 have an approved direct opening mechanism. The terminals 11-42, 21-22, 33-34, and 51-52 can be used as unlike poles.
D4NL-□GF□-□	3NC + 1NC/1NO			Only NC contacts 11-12, 21-22, 31-32, and 41-42 have an approved direct opening mechanism. The terminals 11-42, 21-22, 31-32, and 53-54 can be used as unlike poles.
D4NL-□HF□-□	3NC + 2NC			Only NC contacts 11-12, 21-22, 31-32, 41-42 and 51-52 have an approved direct opening mechanism. The terminals 11-42, 21-22, 31-32, and 51-52 can be used as unlike poles.

Dimensions

Note: All units are in millimeters unless otherwise indicated

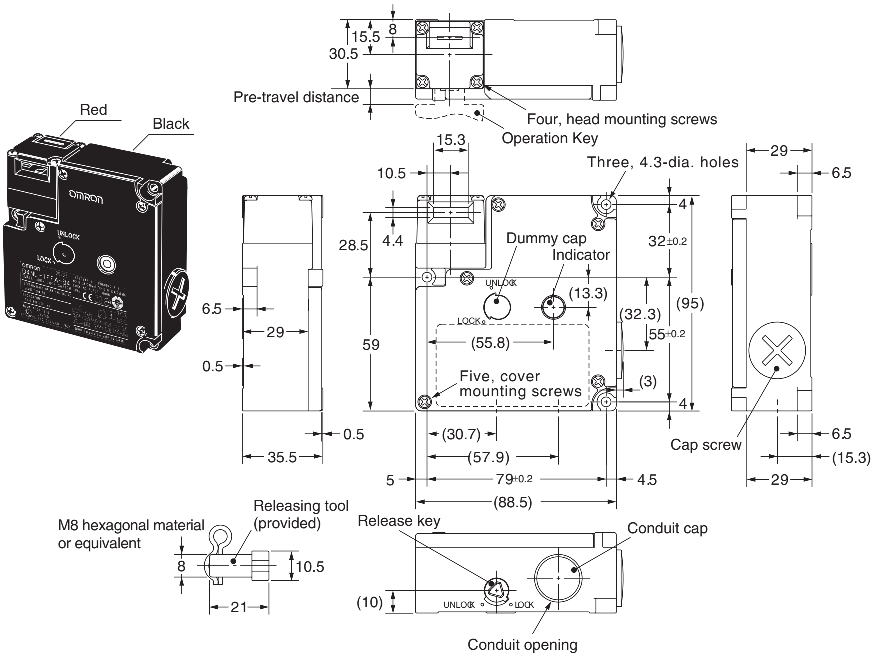
Switches

D4NL-□□□□-B



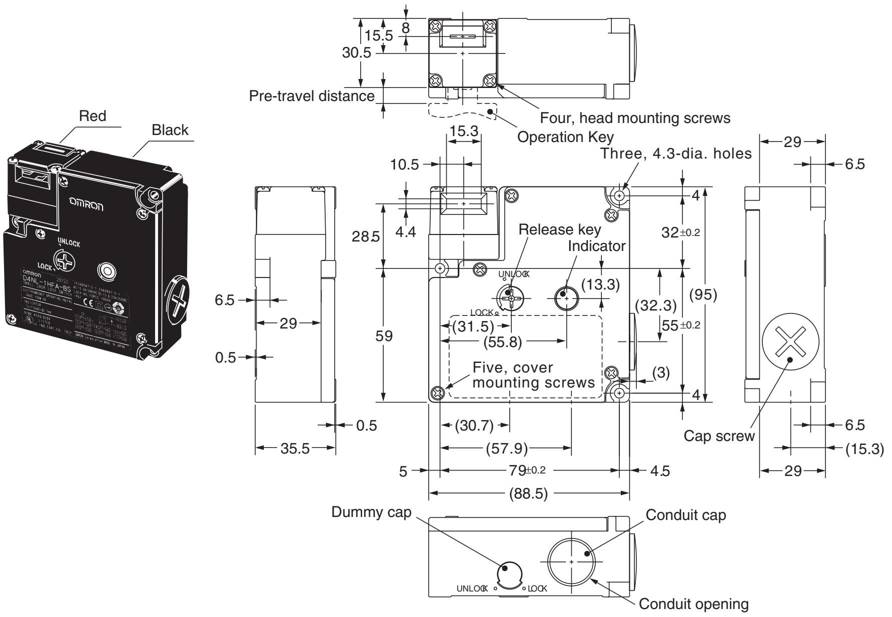
Operating characteristics	D4NL-□□□□-B
Key insertion force **Key extraction force**	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

D4NL-□□□□-B4



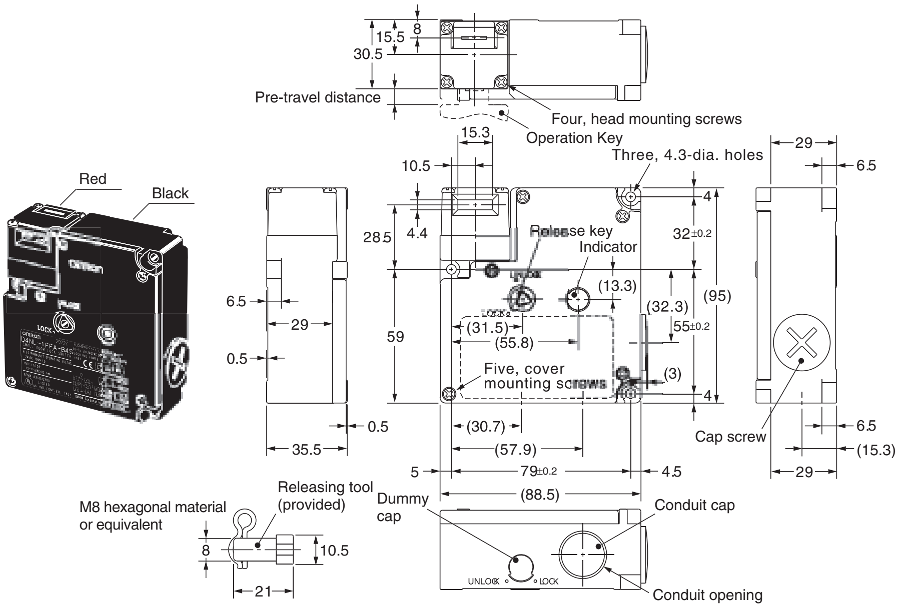
Operating characteristics	D4NL-□□□□-B4
Key insertion force **Key extraction force**	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

D4NL-□□□□-BS



Operating characteristics	D4NL-□□□□-BS
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

D4NL-□□□□-B4S

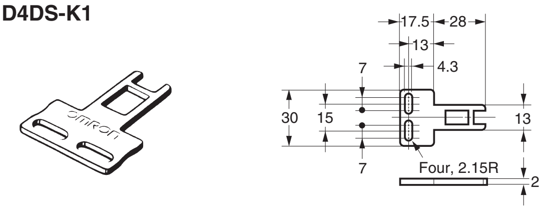


Operating characteristics	D4NL-□□□□-B4S
Key insertion force Key extraction force	15 N max. 30 N max.
Pre-travel distance	9 mm max.
Movement before being locked	3 mm min.

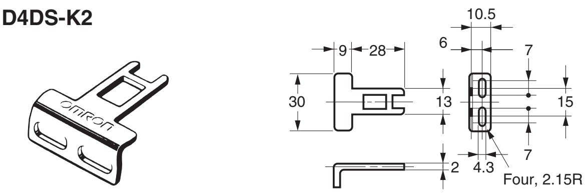
Operation Keys

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

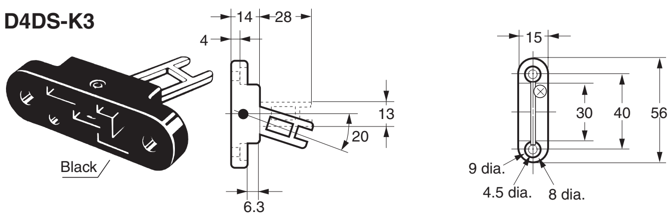
D4DS-K1



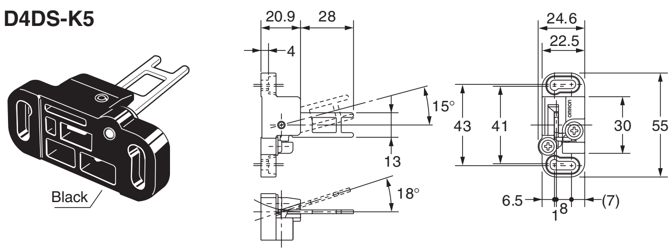
D4DS-K2



D4DS-K3



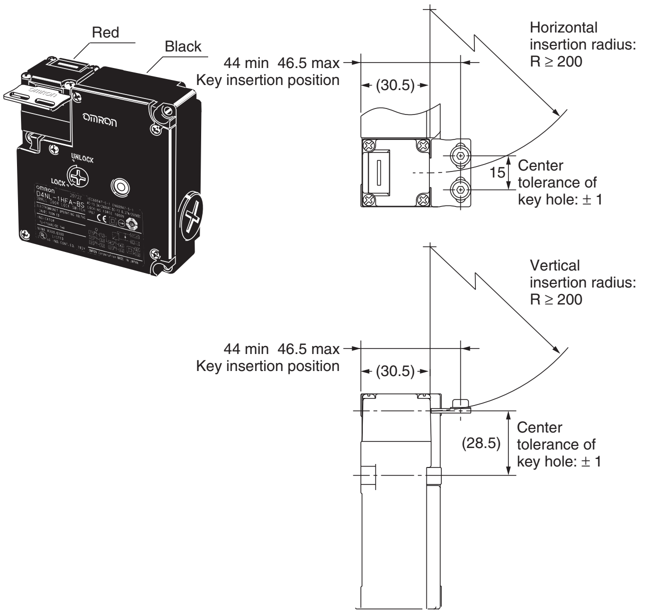
D4DS-K5



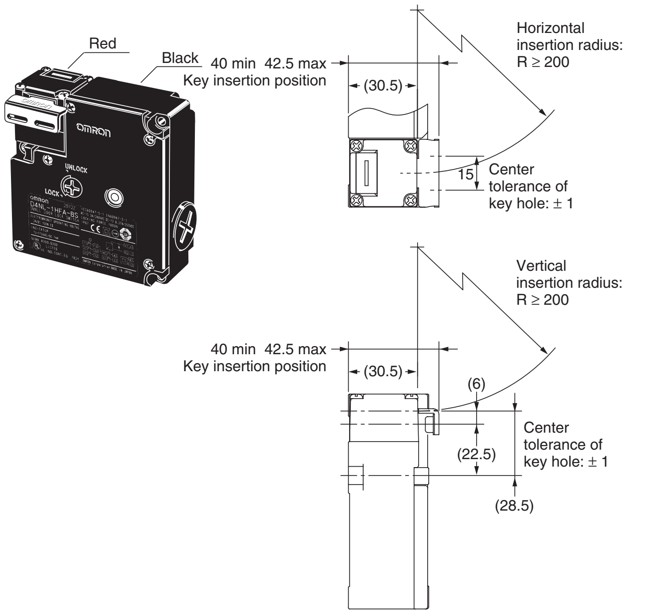
D4NL

With Operation Key Inserted

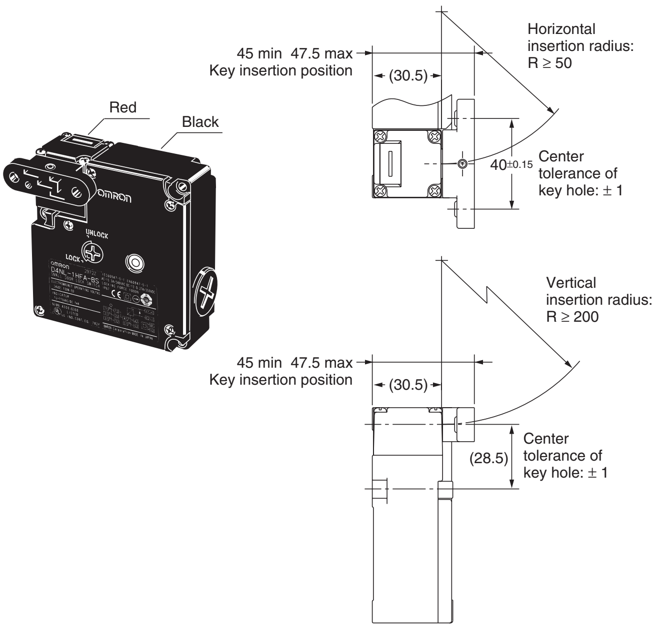
D4NL + D4DS-K1



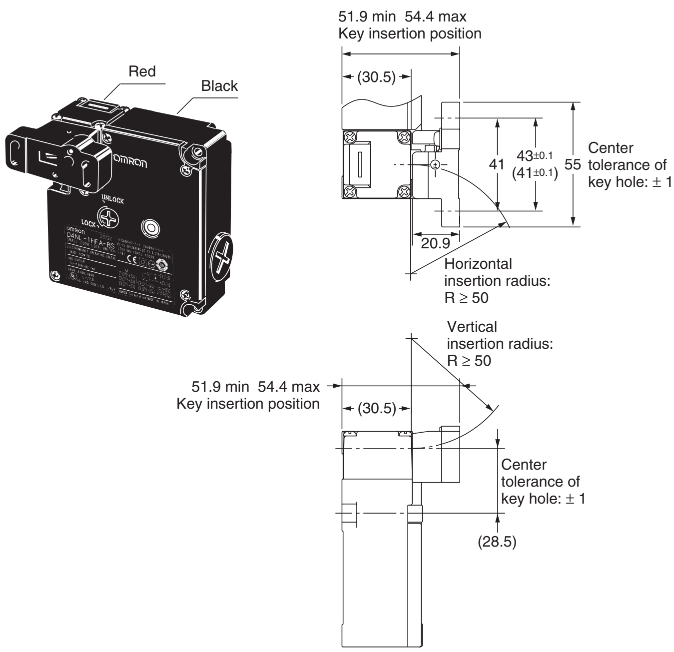
D4NL + D4DS-K2



D4NL + D4DS-K3

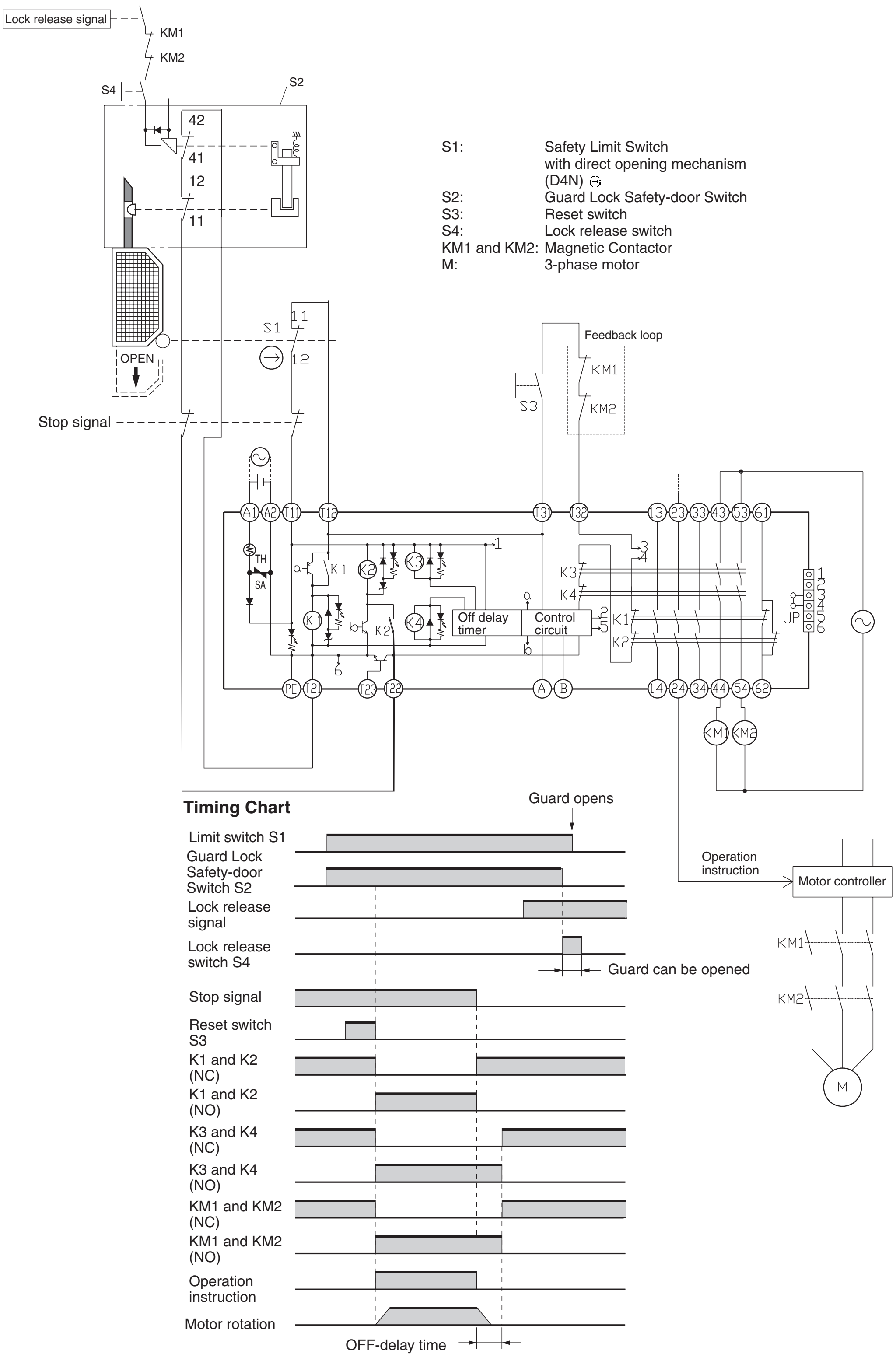


D4NL + D4DS-K5



Application Examples

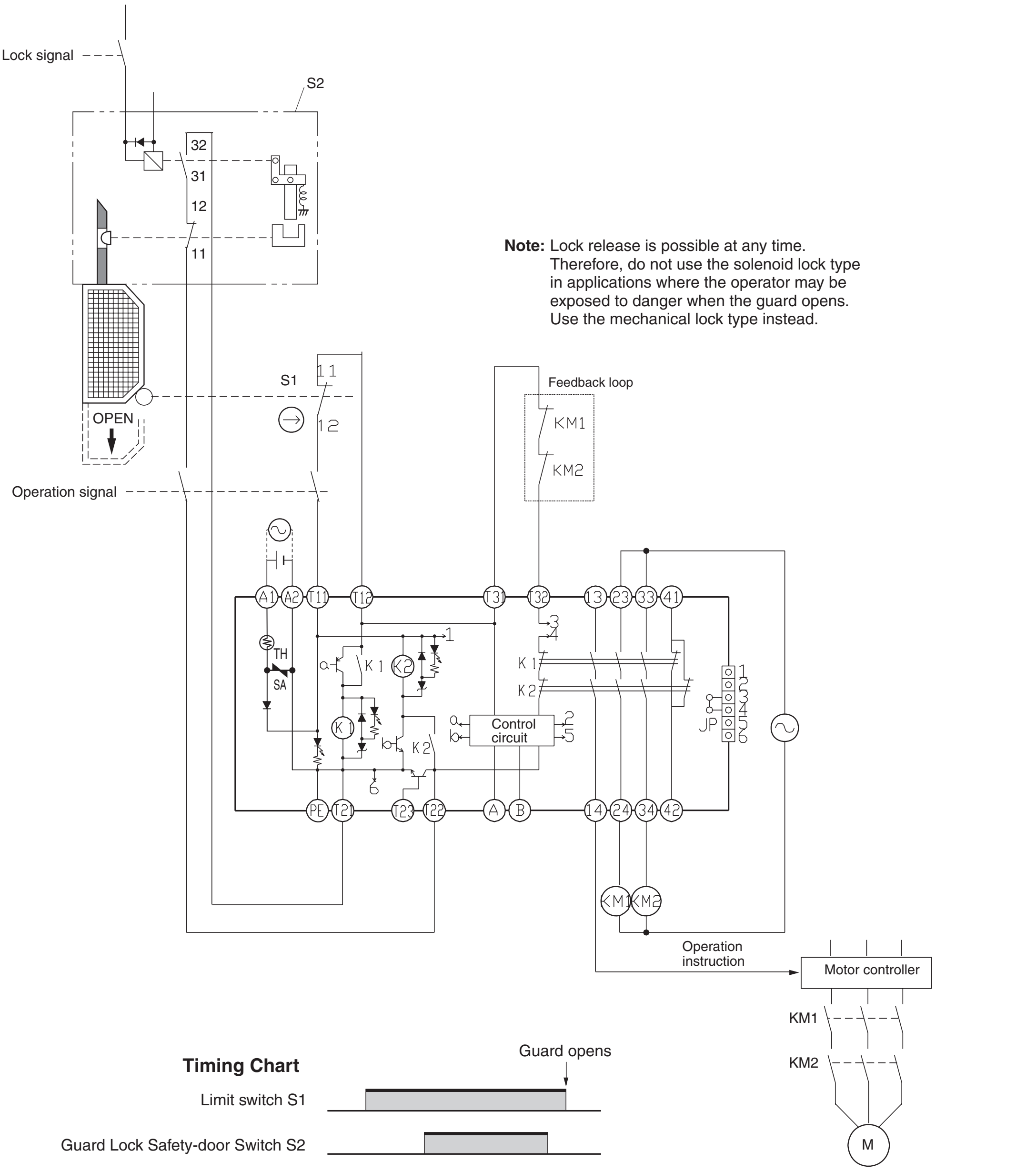
G9SA-321-T□ (24 VAC/VDC) + D4NL-□□□A-□, □□□B-□, □□□C-□ (Mechanical Lock Type) + D4D-□520N Circuit Diagram



S1:	Safety Limit Switch with direct opening mechanism (D4N)
S2:	Guard Lock Safety-door Switch
S3:	Reset switch
S4:	Lock release switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor

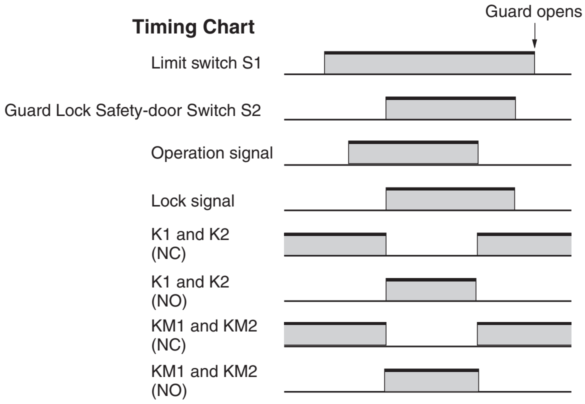
D4NL

G9SA-301 (24 VAC/VDC) + D4NL-□□□G-□, □□□H-□, □□□J-□ (Solenoid Lock Type) + D4D-□520N Circuit Diagram



Note: Lock release is possible at any time. Therefore, do not use the solenoid lock type in applications where the operator may be exposed to danger when the guard opens. Use the mechanical lock type instead.

Timing Chart



S1:	Safety Limit Switch with direct opening mechanism (D4N)
S2:	Guard Lock Safety-door Switch
KM1 and KM2:	Magnetic Contactor
M:	3-phase motor

Precautions

⚠ Caution

Do not insert the Operation Key with the door open. The machine may operate and damage may result.

⚠ Caution

Do not use metal connectors or conduits with this switch. Damage to the broken conduit hole may cause electric shock.

⚠ Caution

Change the head direction after changing the release key to the UNLOCK position. Do not change the head direction with the cover removed. Failure to observe these points may result in Switch malfunction or damage.

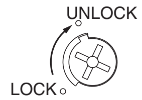
Holding Force

- Do not apply a force exceeding the specified holding force. Doing so may break the Switch and the machine may continue to operate.
- Either install another locking component (e.g., a stop) in addition to the Switch, or use a warning sticker or an indicator showing the lock status so that a force exceeding the specified holding force is not applied.

Safety Precautions

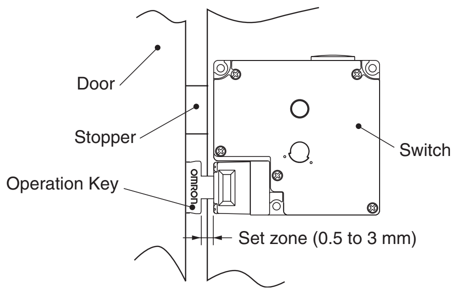
- The Switch contacts can be used for either standard loads or microloads. Once a contact has been used to switch a standard load, however, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.
- Turn OFF the power before disassembling the Switch or touching any internal parts. Not doing so may result in electric shock.
- Mount the Operation Key in a location where it will not come in contact with users when the door is opened or closed. Otherwise, injury may result.
- Do not impose excessive force on the Operation Key when it is inserted into the Switch or drop the Switch with the Operation Key inserted. Otherwise, the Operation Key may be deformed or the Switch may be broken.
- Observe the specified insertion radius for the Operation Key and insert it in a direction perpendicular to the key hole.
- Do not use the Switch in starting circuits. (Use for safety confirmation signals.)
- When using the Switch in emergency-stop circuits or other safety circuits that have a direct impact on human lives, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, prevent easy removal by, for example, mounting the Switch and Operation Key with one-way screws or attaching a protective cover and warning label.
- In order to prevent short-circuit damage to the Switch, connect a fuse to the Switch in series. Use a fuse with a breaking current of 1.5 to 2 times the rated current. To conform to EN ratings, use a IEC269-compliant 10-A fuse type gI or gG.
- Turn the power OFF when wiring. After wiring is completed, be sure to mount the cover before use.
- In order to prevent burning due to overvoltage, insert a protective fuse in the solenoid circuits.
- Do not use the Switch where explosive gas, flammable gas, or any other dangerous gas may be present.
- Ensure that the load current does not exceed the rated current.
- Be sure to wire the terminals correctly.
- Be sure to evaluate the Switch under actual operating conditions after installation.
- Do not drop the package or the product. Do not disassemble internal parts.

Release Key



- The release key is used to unlock the Switch in case of emergency or if the power supply to the Switch stops.
- If the release key setting is changed from LOCK to UNLOCK using an appropriate tool, the lock will be released and the safety door can be opened (mechanical lock models only).
- After setting the release key to UNLOCK in order to, for example, change the head direction or perform maintenance, be sure to return it to LOCK setting before resuming operation.
- When the Switch is used for the door of a machine room to ensure the safety of people performing adjustment work inside, if the release key is set to UNLOCK, the door will not be locked when the door is closed and no power will be supplied to the equipment.
- Do not use the release key to start or stop machines.
- The auxiliary lock must only be released by authorized personnel.
- Do not impose a force exceeding 1 N·m on the release key screws. The release key may be damaged and may not operated properly.
- To prevent the release key from being used by unauthorized personnel, set it to LOCK and seal it with seal wax.

Mounting



- Do not use the Switch as a stopper. To prevent the door from coming into contact with the flange of the Operation Key, be sure to mount the Switch with a stopper as shown above.
- When the Switch is used for a hinged door at a location near to the hinged side, where the Operation Key's insertion radius is comparatively small, if an attempt is made to open the door beyond the lock position, the force imposed will be much larger than for locations far from the hinged side, and the lock may be damaged.

Solenoid Lock Models

The solenoid lock locks the door only when power is supplied to the solenoid. Therefore, the door will be unlocked if the power supply to the solenoid stops. Therefore, do not use solenoid lock models for machines that may be operating and dangerous even after the machine stops operating.

Correct Use

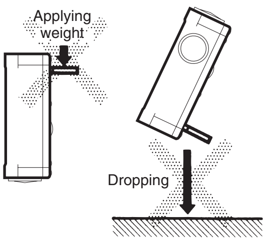
Operating Environment

- This Switch is for indoor use only. Do not use it outdoors. Otherwise, it may malfunction.
- Do not use the Switch in the following locations:
  - Locations subject to severe temperature changes
  - Locations subject to high humidity levels or condensation
  - Locations subject to severe shocks or vibrations
  - Locations where the Switch may come in contact with metal dust, oil, or chemicals
  - Locations subject to thinner, detergent, or other solvents.
- Although the Switch itself is protected from dust or water penetration, ensure that foreign material does not penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.
- Do not use the Switch submerged in oil or water, or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch interior. (The IP67 degree of protection specification for the Switch pertains to the amount of water penetration after the Switch is submerged in water for a certain period of time.)

Life Expectancy

The life expectancy of the Switch will vary with the switching conditions. Before applying the Switch, test it under actual operating conditions and be sure to use it at a switching frequency that will not lower its performance.

Operation Key



- Use the designated OMRON Operation Key with the Switch. Using another Operation Key may result in Switch damage.
- Do not impose excessive force on the Operation Key when it is inserted into the Switch or drop the Switch with the Operation Key inserted. Otherwise, the Operation Key may be deformed or the Switch may be broken.

Mounting

Tightening Torque

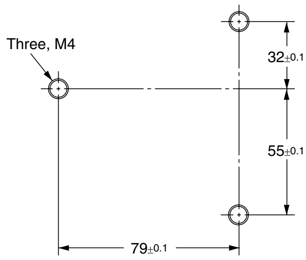
Be sure to tighten each screw of the Switch properly. Loose screws may result in malfunction.

Type	Tightening torque
Terminal screw	0.59 to 0.78 N·m
Cover mounting screw	0.49 to 0.69 N·m
Head mounting screw	0.49 to 0.59 N·m
Operation Key mounting screw	2.35 to 2.75 N·m
Switch mounting screw	0.49 to 0.69 N·m
Connector	1.77 to 2.16 N·m
Cap screw	1.27 to 1.67 N·m

Switch and Operation Key Mounting

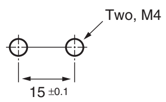
- Mount the Switch and Operation Key securely to the applicable tightening torque with M4 screws.

Mounting Hole Dimensions for Switch

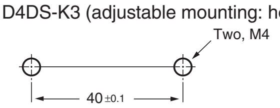


Mounting Hole Dimensions for Operation Key

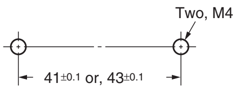
D4DS-K1/-K2 (horizontal/vertical mounting)



D4DS-K3 (adjustable mounting: horizontal)



D4DS-K5 (adjustable mounting: vertical)



- If the Switch is back-mounted, the release key can only be operated from the bottom and the indicator cannot be used.
- Use the designated OMRON Operation Key with the Switch. Using another Operation Key may result in Switch damage.
- Ensure that the alignment offset between the Operation Key and the key hole does not exceed ±1 mm.

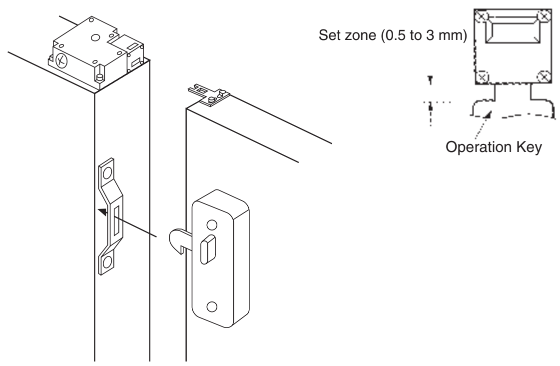
Head Direction

By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions.

Ensure that no foreign matter penetrates the interior of the Switch.

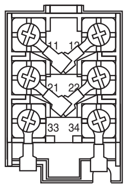
Securing the Door

When the door is closed (with the Operation Key inserted), it may be pulled beyond the set zone because of, for example, the door's weight, or the door cushion rubber. Also, if a load is applied to the Operation Key, the door may fail to unlock properly. Use hooks to ensure that the door stays within the set zone (0.5 to 3 mm).



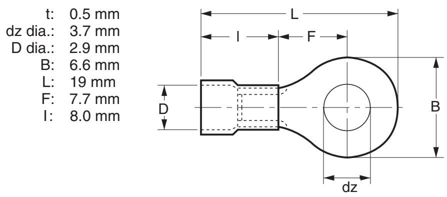
Wiring

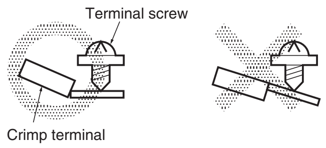
Wiring Precautions



- When connecting to the terminals via insulating tube and M3.5 crimp terminals, cross the crimp terminals as shown above so that they do not rise up onto the case or the cover. Applicable lead wire size: AWG20 to AWG18 (0.5 to 0.75mm^2).
- When connecting lead wires directly to terminals, perform wiring securely so that there are no loose wire strands.
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use lead wires of an appropriate length. Not doing so may cause the cover to rise.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacturer	Model
J.S.T.	FV0.5-3.7





Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the proper torque. The case may be damaged if an excessive tightening torque is applied.
- In order to ensure IP67 degree of protection, wrap sealing tape around the conduit end of the connector.
- Be sure that the outer diameter of the cable connected to the connector is correct.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. The conduit cap is provided with the Switch.

Recommended Connectors

Use a connector with a screw section not exceeding 11 mm, otherwise the screws will protrude into the case interior. The connectors given in the following table have connectors with screw sections not exceeding 11 mm.

Use the following connectors to ensure conformance to IP67.

Size	Manufacturer	Model	Applicable cable diameter
$G^{1}/_{2}$	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	S-13.5 5301-5030	5.0 to 12.0 mm
M20	LAPP	ST-M20 ∗1.5 5311-1020	7.0 to 13.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, or GPM20), and tighten with the applicable torque. Seal packing is sold separately.

Maintenance and Repairs

The user must not perform repairs or maintenance. Contact the machine manufacturer if repairs or maintenance are required.

Storage

Do not store the Switch in locations where harmful gases (e.g., H_2S, SO_2, NH_3, HNO_3, or Cl_2) or dust are present, or in locations subject to high humidity levels.

Miscellaneous

- Do not touch the solenoid. The temperature of the solenoid increases when current is passed.
- In conditions requiring greater rigidity, sealing performance, and oil resistance, use OMRON's D4BL.
- Perform regular inspections.

Production Termination

Following the release of the D4NL, production of the D4DL will be terminated.

Date of Production Termination

Production of the D4DL Series will be terminated in November 2003.

Date of Substitute Product Release

Sale of the D4NL Series commenced in October 2002.

Product Replacement

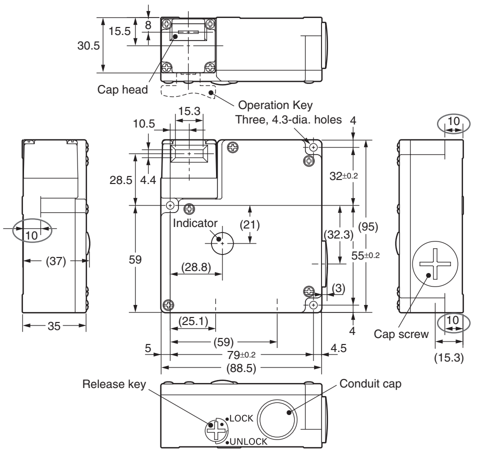
The D4DL and D4NL have basically the same structure, and use the same mounting method and Operation Keys. There are differences, however, in the external appearance and the mounting sections.

Comparison of the D4DL and Substitute Products

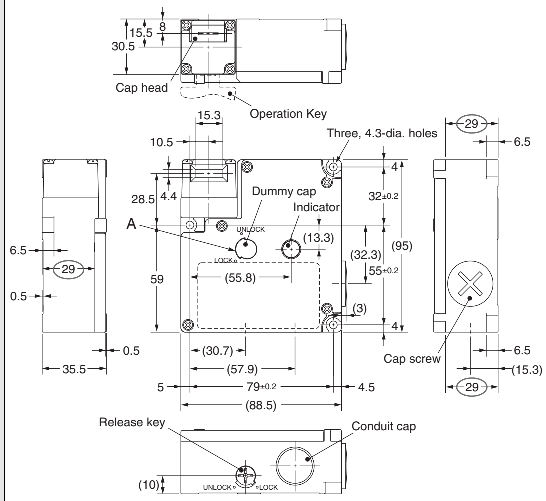
Model	D4NL-□
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Very similar
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

Dimensions

Discontinued Model (D4DL)



Replacement products (D4NL Series)



The above diagram is for Switches with the release key on the bottom. For Switches with the release key on the front, interchange the positions of the release key and dummy cap (A).

Differences: The depth of the M4 mounting screw holes is 29 mm for the D4NL, as opposed to 10 mm for the D4DL. Therefore, when replacing the D4DL with the D4NL, use M4 screws that are 19 mm longer than the ones used before.

List of Recommended Substitute Products

Switch

D4DL product	Recommended substitute product	Substitute with M20 conduit
D4DL-1CFA-B	D4NL-1AFA-B, D4NL-1BFA-B	D4NL-4AFA-B, D4NL-4BFA-B
D4DL-2CFA-B	D4NL-2AFA-B, D4NL-2BFA-B	
D4DL-1DFA-B	D4NL-1CFA-B, D4NL-1DFA-B	D4NL-4CFA-B, D4NL-4DFA-B
D4DL-2DFA-B	D4NL-2CFA-B, D4NL-2DFA-B	
D4DL-1CFG-B	D4NL-1AFG-B, D4NL-1BFG-B	D4NL-4AFG-B, D4NL-4BFG-B
D4DL-2CFG-B	D4NL-2AFG-B, D4NL-2BFG-B	
D4DL-1DFG-B	D4NL-1CFG-B, D4NL-1DFG-B	D4NL-4CFG-B, D4NL-4DFG-B
D4DL-2DFG-B	D4NL-2CFG-B, D4NL-2DFG-B	
D4DL-1CFB-B	D4NL-1AFB-B, D4NL-1BFB-B	D4NL-4AFB-B, D4NL-4BFB-B
D4DL-2CFB-B	D4NL-2AFB-B, D4NL-2BFB-B	
D4DL-1DFB-B	D4NL-1CFB-B, D4NL-1DFB-B	D4NL-4CFB-B, D4NL-4DFB-B
D4DL-2DFB-B	D4NL-2CFB-B, D4NL-2DFB-B	
D4DL-1CFH-B	D4NL-1AFH-B, D4NL-1BFH-B	D4NL-4AFH-B, D4NL-4BFH-B
D4DL-2CFH-B	D4NL-2AFH-B, D4NL-2BFH-B	
D4DL-1DFH-B	D4NL-1CFH-B, D4NL-1DFH-B	D4NL-4CFH-B, D4NL-4DFH-B
D4DL-2DFH-B	D4NL-2CFH-B, D4NL-2DFH-B	
D4DL-1CFC-EW	D4NL-1AFC-E, D4NL-1BFC-E	D4NL-4AFC-E, D4NL-4BFC-E
D4DL-2CFC-EW	D4NL-2AFC-E, D4NL-2BFC-E	
D4DL-1DFC-EW	D4NL-1CFC-E, D4NL-1DFC-E	D4NL-4CFC-E, D4NL-4DFC-E
D4DL-2DFC-EW	D4NL-2CFC-E, D4NL-2DFC-E	
D4DL-1CFJ-EW	D4NL-1AFJ-E, D4NL-1BFJ-E	D4NL-4AFJ-E, D4NL-4BFJ-E
D4DL-2CFJ-EW	D4NL-2AFJ-E, D4NL-2BFJ-E	
D4DL-1DFJ-EW	D4NL-1CFJ-E, D4NL-1DFJ-E	D4NL-4CFJ-E, D4NL-4DFJ-E
D4DL-2DFJ-EW	D4NL-2CFJ-E, D4NL-2DFJ-E	
D4DL-1CFA-B-HT	D4NL-1AFA-B4, D4NL-1BFA-B4	D4NL-4AFA-B4, D4NL-4BFA-B4
D4DL-2CFA-B-HT	D4NL-2AFA-B4, D4NL-2BFA-B4	
D4DL-1DFA-B-HT	D4NL-1CFA-B4, D4NL-1DFA-B4	D4NL-4CFA-B4, D4NL-4DFA-B4
D4DL-2DFA-B-HT	D4NL-2CFA-B4, D4NL-2DFA-B4	
D4DL-1CFG-B-HT	D4NL-1AFG-B4, D4NL-1BFG-B4	D4NL-4AFG-B4, D4NL-4BFG-B4
D4DL-2CFG-B-HT	D4NL-2AFG-B4, D4NL-2BFG-B4	
D4DL-1DFG-B-HT	D4NL-1CFG-B4, D4NL-1DFG-B4	D4NL-4CFG-B4, D4NL-4DFG-B4
D4DL-2DFG-B-HT	D4NL-2CFG-B4, D4NL-2DFG-B4	

Note: With standard products, terminals 12 and 41 are connected with a shorting pin. In cases where D4DL terminals 11 and 12 and terminals 41 and 42 are currently being used independently, remove the shorting pin.

Note: Operation Key

- D4DS-K1
- D4DS-K2
- D4DS-K3
- D4DS-K5

All of the above Operation Keys can be used with the D4NL.

Guard Lock Safety-door Switch

D4GL

Environment-friendly Switch with Direct Opening Contacts

- Contains no harmful substances, such as lead or cadmium, reducing the burden on the environment.
- Slim safety-door switch with an electromagnetic lock or unlock mechanism.
- Models with 4-contact and 5-contact built-in switches are available.
- Capable of a holding force of 1,000 N min.
- Can be used for either standard loads or microloads.
- Lineup includes models with a conduit size of M20.
- Patent and industrial design approval pending.

Model Number Structure

Model Number Legend

Switch

D4GL-□□□□-□□

1 2 3 4 5 6

1. Conduit Size

1: Pg13.5
2: G1/2
4: M20

2. Built-in Switch (with Door Open/Closed Detection Switch and Lock Monitor Switch Contacts)

A: 1NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
B: 1NC/1NO slow-action contacts plus 2NC slow-action contacts
C: 2NC slow-action contacts plus 1NC/1NO slow-action contacts
D: 2NC slow-action contacts plus 2NC slow-action contacts
E: 2NC/1NO slow-action contacts plus 1NC/1NO slow-action contacts
F: 2NC/1NO slow-action contacts plus 2NC slow-action contacts
G: 3NC slow-action contacts plus 1NC/1NO slow-action contacts
H: 3NC slow-action contacts plus 2NC slow-action contacts

3. Head Mounting Direction and Material

F: Four mounting directions possible (Front-side mounting at time of delivery)/plastic

4. Door Lock and Release

A: Mechanical lock/24-VDC solenoid release
G: 24-VDC solenoid lock/mechanical release

5. Indicator

B: 24 VDC (orange/green LED indicator)

6. Release Key Type

Blank: Standard release key
4: Special release key

Operation Key

D4DS-K□

1

1. Operation Key Type

1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (horizontal)
5: Adjustable mounting (horizontal/vertical)

Ordering Information

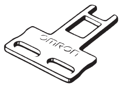
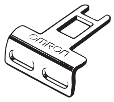
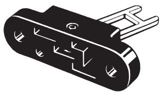
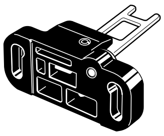
List of Models

Switches (Operation Keys are sold separately.)

▇: Models with approved direct opening contacts. **Prefered stock item***

Head material	Release key type	Solenoid voltage/ indicator	Lock and release types	Contact configuration (door open/closed detection switch and lock monitor switch contacts) (slow-action) Approved direct opening NC contact	Conduit size	Model
Plastic	Standard	Solenoid: 24 VDC Orange/green LED: 24 VDC	Mechanical lock Solenoid release	1NC/1NO+1NC/1NO	Pg13.5	**D4GL-1AFA-A***
					G1/2	D4GL-2AFA-A
					M20	**D4GL-4AFA-A***
				1NC/1NO+2NC	Pg13.5	D4GL-1BFA-A
					G1/2	D4GL-2BFA-A
					M20	D4GL-4BFA-A
				2NC+1NC/1NO	Pg13.5	**D4GL-1CFA-A***
					G1/2	D4GL-2CFA-A
					M20	**D4GL-4CFA-A***
				2NC+2NC	Pg13.5	D4GL-1DFA-A
					G1/2	D4GL-2DFA-A
					M20	D4GL-4DFA-A
				2NC/1NO+1NC/1NO	Pg13.5	D4GL-1EFA-A
					G1/2	D4GL-2EFA-A
					M20	**D4GL-4EFA-A***
				2NC/1NO+2NC	Pg13.5	D4GL-1FFA-A
					G1/2	D4GL-2FFA-A
					M20	D4GL-4FFA-A
				3NC+1NC/1NO	Pg13.5	D4GL-1GFA-A
					G1/2	D4GL-2GFA-A
					M20	D4GL-4GFA-A
				3NC+2NC	Pg13.5	D4GL-1HFA-A
					G1/2	D4GL-2HFA-A
					M20	D4GL-4HFA-A
			Solenoid lock Mechanical release	1NC/1NO+1NC/1NO	Pg13.5	**D4GL-1AFG-A***
					G1/2	D4GL-2AFG-A
					M20	**D4GL-4AFG-A***
				1NC/1NO+2NC	Pg13.5	D4GL-1BFG-A
					G1/2	D4GL-2BFG-A
					M20	D4GL-4BFG-A
				2NC+1NC/1NO	Pg13.5	**D4GL-1CFG-A***
					G1/2	D4GL-2CFG-A
					M20	**D4GL-4CFG-A***
				2NC+2NC	Pg13.5	D4GL-1DFG-A
					G1/2	D4GL-2DFG-A
					M20	D4GL-4DFG-A
				2NC/1NO+1NC/1NO	Pg13.5	D4GL-1EFG-A
					G1/2	D4GL-2EFG-A
					M20	**D4GL-4EFG-A***
				2NC/1NO+2NC	Pg13.5	D4GL-1FFG-A
					G1/2	D4GL-2FFG-A
					M20	D4GL-4FFG-A
				3NC+1NC/1NO	Pg13.5	D4GL-1GFG-A
					G1/2	D4GL-2GFG-A
					M20	D4GL-4GFG-A
				3NC+2NC	Pg13.5	D4GL-1HFG-A
					G1/2	D4GL-2HFG-A
					M20	D4GL-4HFG-A

Operation Keys (Order Separately)

Type	Model
Horizontal mounting 	D4DS-K1
Vertical mounting 	D4DS-K2
Adjustable mounting (Horizontal) 	D4DS-K3
Adjustable mounting (Horizontal/Vertical) 	D4DS-K5

Specifications

Standards and EC Directives

Applicable EC Directives and Standards

- Machinery Directive
- Low Voltage Directive
- EN1088
- EN60204-1
- GS-ET-19

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	(See note 1.)
UL (See note 2.)	UL508, CSA C22.2 No.14	E76675

Note: 1. Consult your OMRON representative for details.
2. Approval for CSA C22.2 No. 14 is authorized by the UL mark.

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	0.75 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device.

UL/CSA (UL508, CSA C22.2 No. 14)

C300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	2.5 A	15 A	1.5 A	1,800 VA	180 VA
240 VAC		7.5 A	0.75 A		

Q300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
125 VAC	2.5 A	0.55 A	0.55 A	69 VA	69 VA
250 VAC		0.27 A	0.27 A		

Solenoid Coil Characteristics

Item	24 VDC
Rated operating voltage (100% ED)	24 VDC ±10%
Current consumption	Approx. 200 mA
Insulation	Class F (130° C max.)

Indicator Characteristics

Item	LED
Rated voltage	24 VDC
Current leakage	Approx. 3 mA
Color (LED)	Orange/Green

Characteristics

Degree of protection (See note 2.)		IP67 (EN60947-5-1) (This applies for the Switch only. The degree of protection for the key hole is IP00.)	
Durability (See note 3.)	**Mechanical**	1,000,000 operations min.	
	Electrical	500,000 operations min. for a resistive load of 4 mA at 24 VDC; 150,000 operations min. for a resistive load of 1 A at 125 VAC in 2 circuits and 4 mA at 24 VDC in 2 circuits (See note 4.)	
Operating speed		0.05 to 0.5 m/s	
Operating frequency		30 operations/minute max.	
Rated frequency		50/60 Hz	
Contact gap		2 x 2 mm min.	
Direct opening force (See note 5.)		60 N min. (EN60947-5-1)	
Direct opening travel (See note 5.)		10 mm min. (EN60947-5-1)	
Holding force (See note 6.)		1,000 N min.	
Insulation resistance		100 MΩ min. (at 500 VDC)	
Minimum applicable load (See note 7.)		Resistive load of 4 mA at 24 VDC (N-level reference value)	
Rated insulation voltage (U_i)		300 V (EN60947-5-1)	
Conventional enclosed thermal current (I_{the})		2.5 A (EN60947-5-1)	
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity	2.5 kV
		Between terminals of different polarities	4 kV
		Between the solenoid and uncharged metallic parts and between the solenoid and ground	---
		24-VDC solenoid	0.8 kV
		Between other terminals and uncharged metallic parts and between other terminals and ground	4 kV
Conditional short-circuit current		100 A (EN60947-5-1)	
Pollution degree (operating environment)		3 (EN60947-5-1)	
Protection against electric shock		Class II (double insulation)	
Closed-circuit counterelectromotive force		1,500 V max. (EN60947-5-1)	
Contact resistance		25 mΩ max. (initial value)	
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude	
Shock resistance	**Destruction**	1,000 m/s^2 min.	
	Malfunction	300 m/s^2 min.	
Ambient temperature		Operating: −10°C to 55°C with no icing	
Ambient humidity		Operating: 95% max.	
Weight		Approx. 400 g (D4GL-1AFA-A)	

Note: 1. The above values are initial values.

2. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4GL in places where foreign material may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

3. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

4. If the ambient temperature is greater than 35°C, do not pass the 1-A, 125-VAC load through more than 2 circuits.

5. These figures are minimum requirements for safe operation.

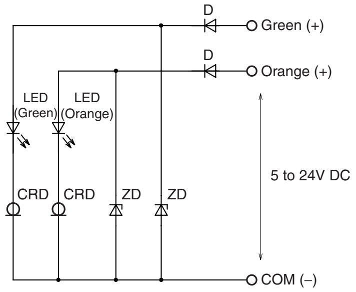
6. This figure is based on the GS-ET-19 evaluation method.

7. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

Connections

Indicator

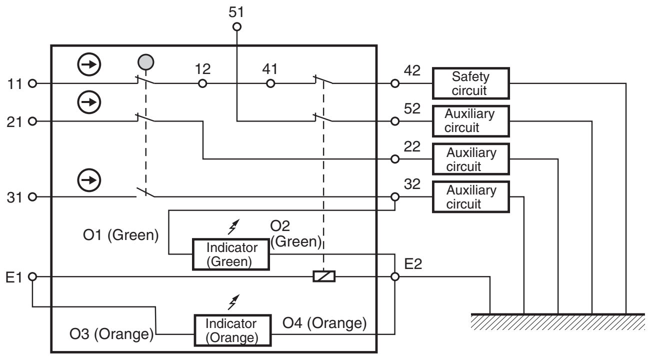
Internal Circuit Diagram



Circuit Connection Example

- Terminals 12 and 41 are connected internally and so connect terminals 11 and 42 for safety-circuit input. (BIA GS-ET-19)
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit input (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 above). Connect the terminals individually when using as auxiliary-circuit input (e.g., terminals 21 and 22 for safety-door open/closed monitoring and terminals 51 and 52 for monitoring the lock status).
- In the following connection example, terminals 21 and 22 and terminals 51 and 52 are used as auxiliary-circuit input.

Connection Example for D4GL-1HFA-A



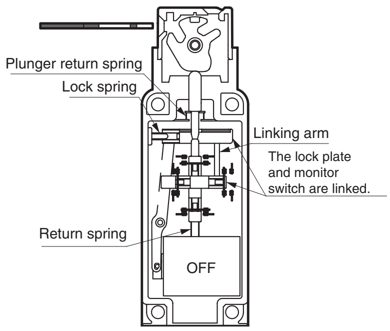
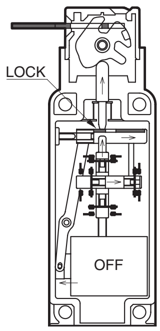
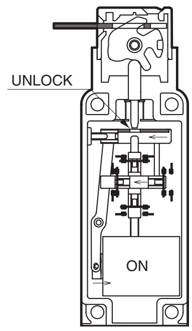
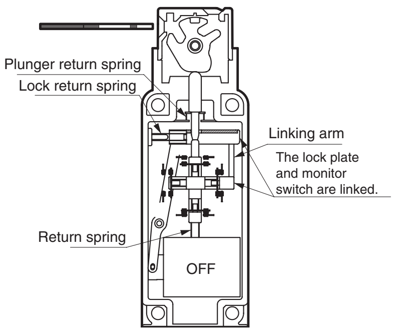
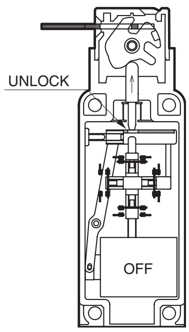
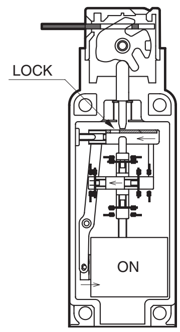
- Direct opening contacts used as safety-circuit input are indicated with the mark. Terminals 11 and 12 and terminals 21 and 22 are direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2.
- Although the 3 lines are connected at the time of delivery, rewire them as necessary for the application.
- The following table shows the connection configuration required to make the green indicator light when the door is closed and the orange indicator light when the solenoid turns ON.

Indicator	Terminal number	Lead wire color	Connected terminal number
Green indicator	O1	Green	32
Orange indicator	O2	Orange	E1
Common	O3	Black	E2

- If an indicator is connected in parallel to a direct opening contact, when the indicator breaks, a short-circuit current will be generated, possibly resulting in an installation malfunction.
- Do not switch standard loads for more than 2 circuits at the same time. Otherwise, the level of insulation may decrease.
- The solenoid has polarity. Be sure to connect terminals with the correct polarity.

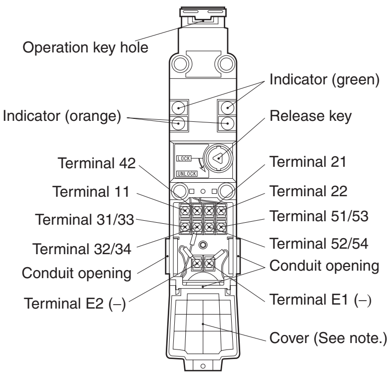
Operation Method

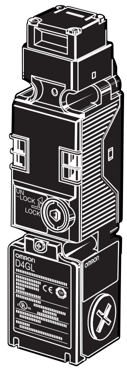
Operation Principles

<table>
<tr>
<td>Mechanical lock models</td>
<td></td>
<td>
When the door is closed, it is locked by the lock spring. The door will stay locked even if there is a power interruption.</td>
<td>
The solenoid is released only when the lock is turned ON.</td>
</tr>
<tr>
<td>Solenoid lock models</td>
<td></td>
<td>
If the solenoid is OFF, the door will not be locked when it is closed. This means that the door can be opened and closed easily when replacing workpieces or parts.</td>
<td>
The door is locked only when the solenoid is turned ON. This means that the door will be unlocked if there is a power interruption and so this model cannot be used in systems that would maintain a hazardous state (e.g., systems requiring toxic gases, high temperatures, or gears that would continue to turn due to inertia).</td>
</tr>
</table>

Nomenclature

Structure

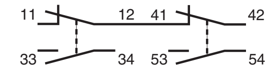
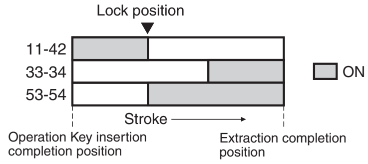
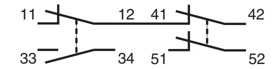
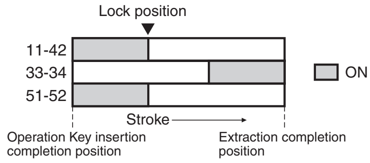
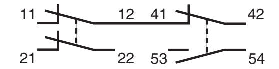
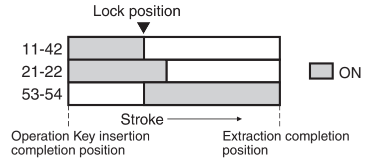
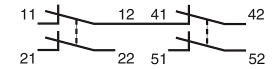
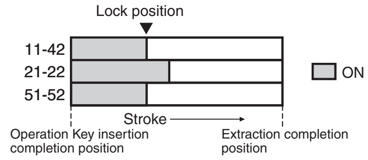
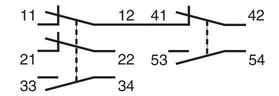
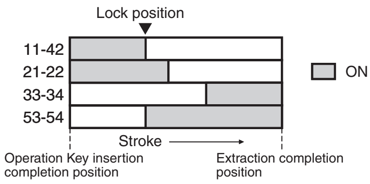
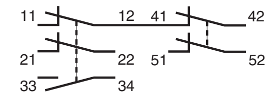
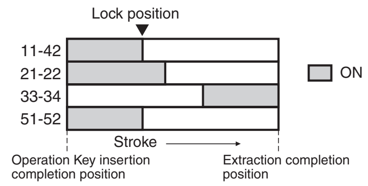
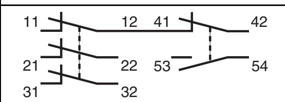
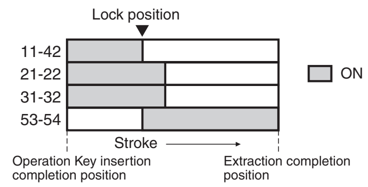
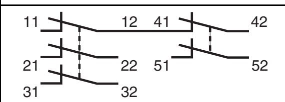
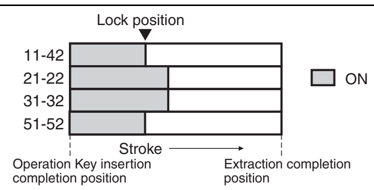




Note: Terminal numbers vary with the model. Confirm terminal numbers by referring to the cover on the back of the Switch.

Contact Form

Indicates conditions where the Key is inserted and the lock is applied. Terminals 12 and 41 are connected internally (as per BIA GS-ET-19).

Model	Contact	Contact form (door open/closed detection switch and lock monitor switch contacts)	Operating pattern	Remarks
D4GL-□AF□-□	1NC/1NO + 1NC/1NO			Only NC contact 11-12 has an approved direct opening mechanism. The terminals 11-42, 33-34, and 53-54 can be used as unlike poles.
D4GL-□BF□-□	1NC/1NO + 2NC			Only NC contact 11-12, has an approved direct opening mechanism. The terminals 11-42, 33-34, and 51-52 can be used as unlike poles.
D4GL-□CF□-□	2NC + 1NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-42, 21-22, and 53-54 can be used as unlike poles.
D4GL-□DF□-□	2NC + 2NC			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-42, 21-22, and 51-52 can be used as unlike poles.
D4GL-□EF□-□	2NC/1NO + 1NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-42, 21-22, 33-34, and 53-54 can be used as unlike poles.
D4GL-□FF□-□	2NC/1NO + 2NC			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-42, 21-22, 33-34, and 51-52 can be used as unlike poles.
D4GL-□GF□-□	3NC + 1NC/1NO			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. The terminals 11-42, 21-22, 31-32, and 53-54 can be used as unlike poles.
D4GL-□HF□-□	3NC + 2NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. The terminals 11-42, 21-22, 31-32, and 51-52 can be used as unlike poles.

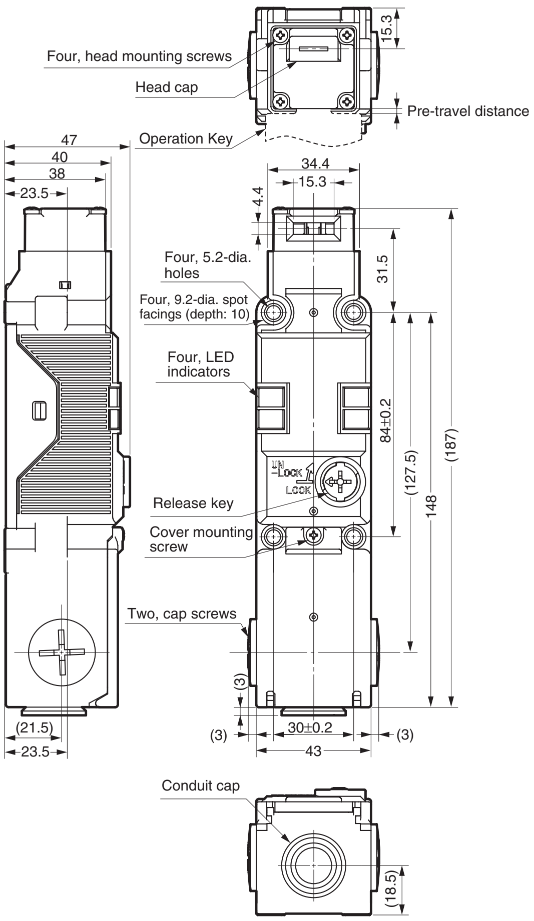
D4GL

Dimensions

Note: All units are in millimeters unless otherwise indicated.

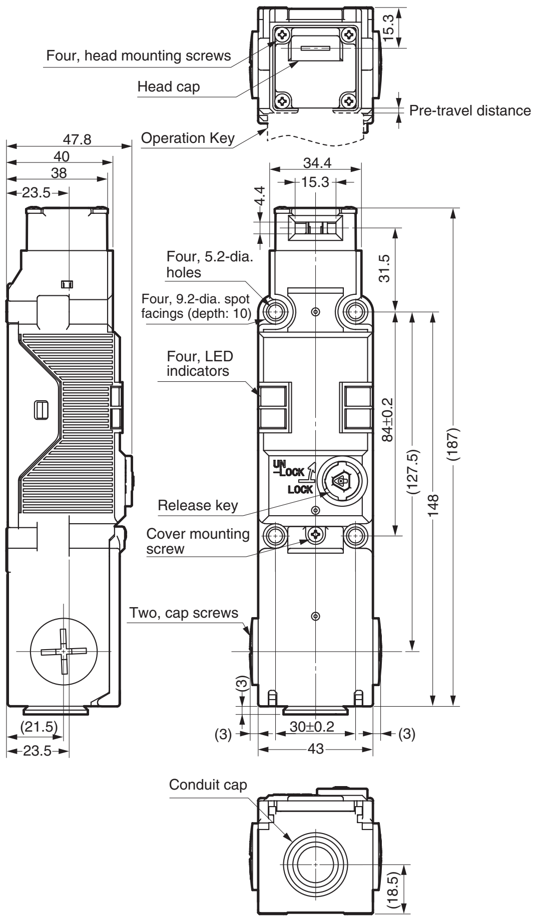
Switches

D4GL-□□□□-A



Operating characteristics	D4GL-□□□□-A
Key insertion force **Key extraction force**	15 N max. 40 N max.
Pre-travel distance	10 mm max.
Movement before being locked	4 mm min.

D4GL-□□□□-A4

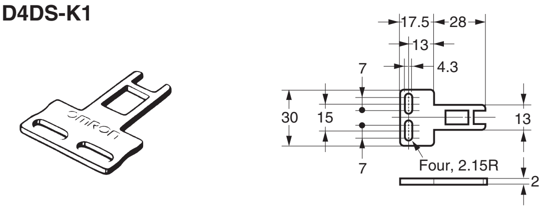


Operating characteristics	D4GL-□□□□-A4
Key insertion force **Key extraction force**	15 N max. 40 N max.
Pre-travel distance	10 mm max.
Movement before being locked	4 mm min.

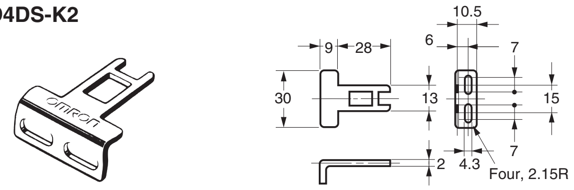
Operation Keys

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

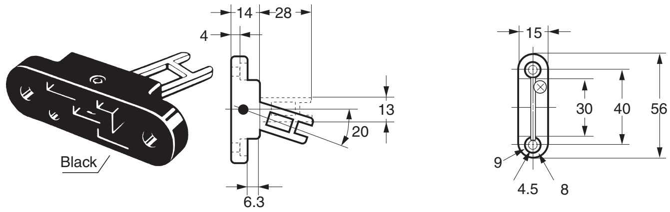
D4DS-K1



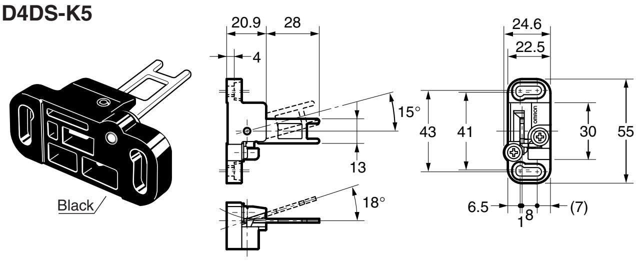
D4DS-K2



D4DS-K3

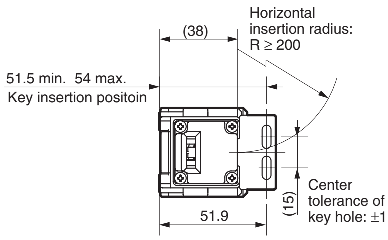


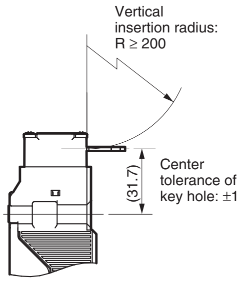
D4DS-K5



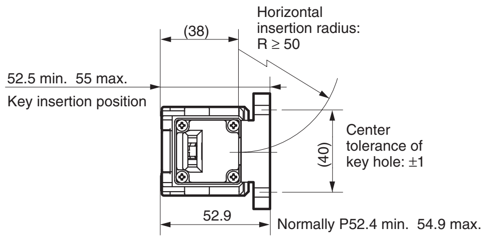
With Operation Key Inserted

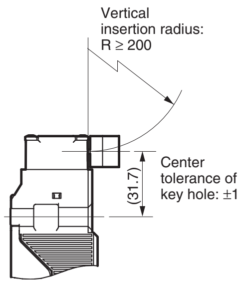
D4GL + D4DS-K1



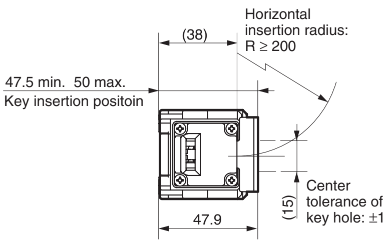


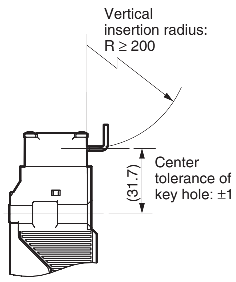
D4GL + D4DS-K3



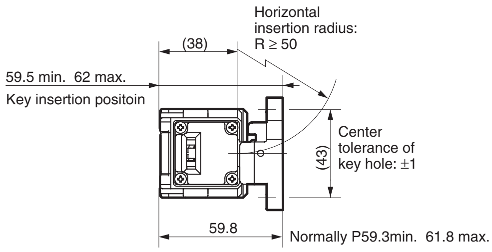


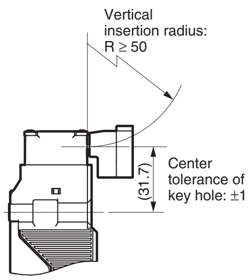
D4GL + D4DS-K2





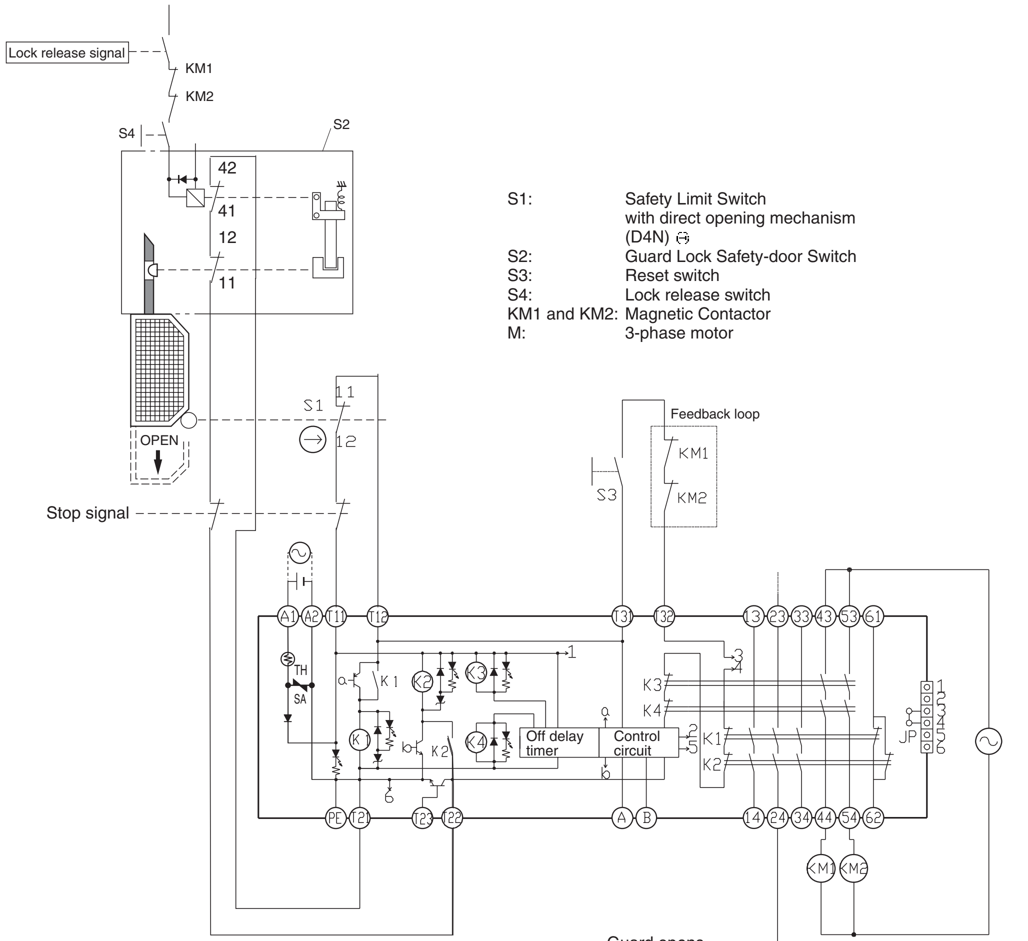
D4GL + D4DS-K5



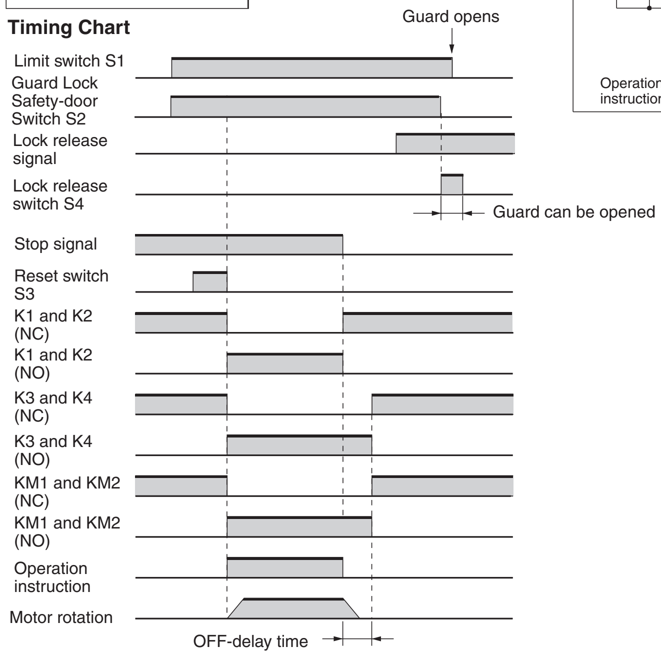


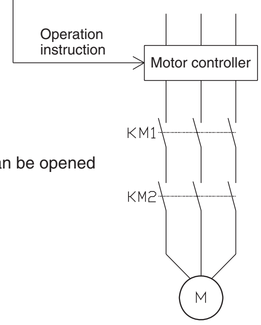
Application Examples

G9SA-321-T□ (24 VAC/VDC) + D4GL-□□□A-□ (Mechanical Lock Type) + D4D-□520N Circuit Diagram



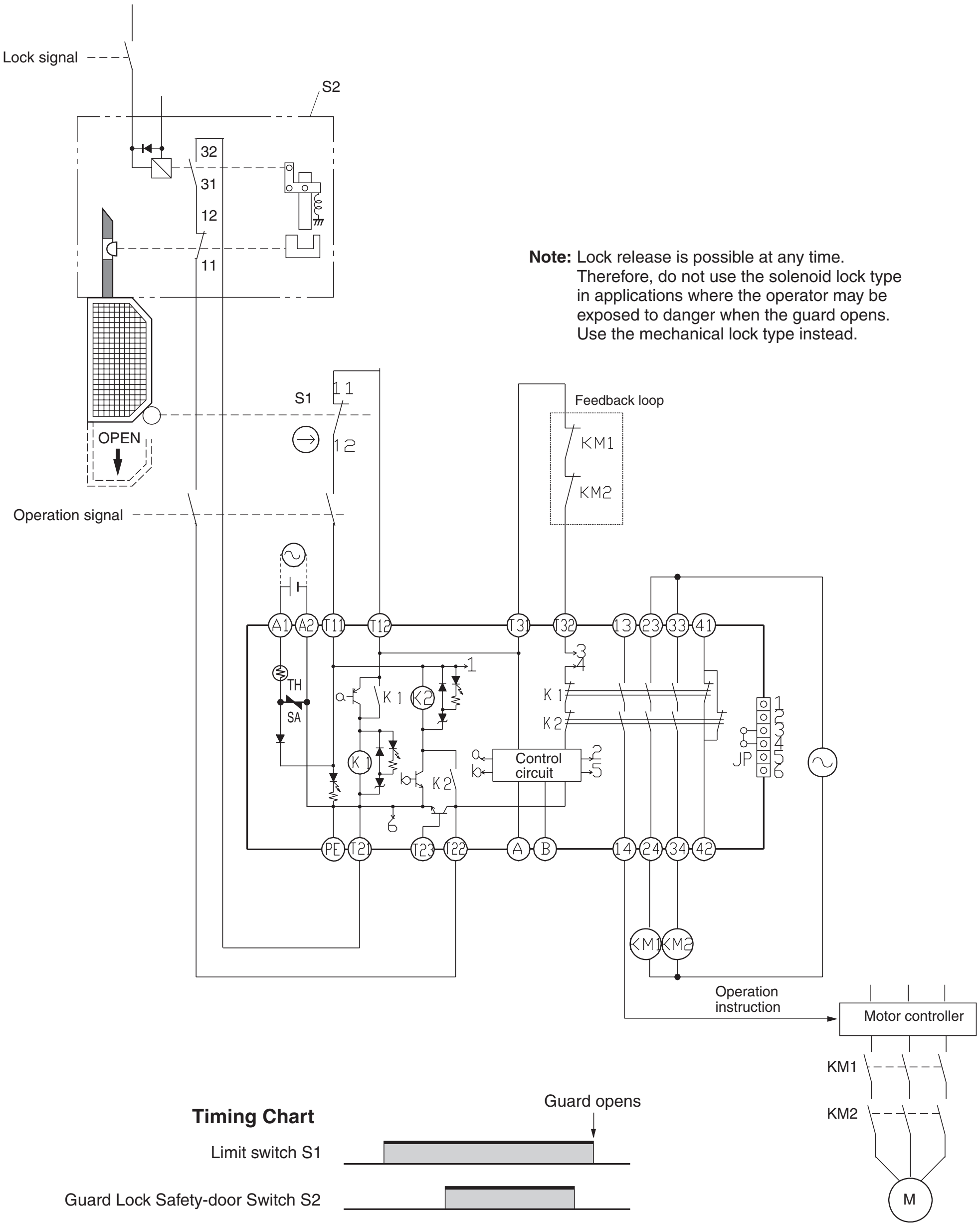
S1: Safety Limit Switch with direct opening mechanism (D4N)
S2: Guard Lock Safety-door Switch
S3: Reset switch
S4: Lock release switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

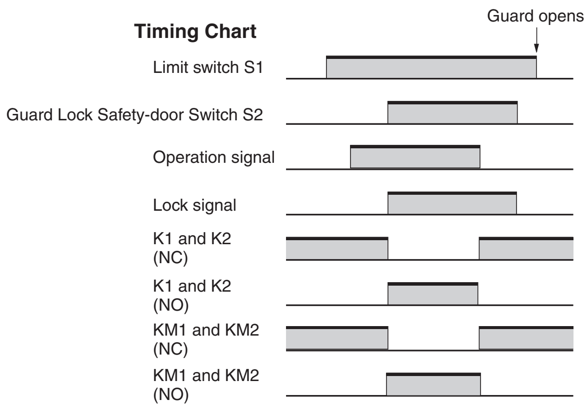




G9SA-301 (24 VAC/VDC) + D4GL-□□□G-□ (Solenoid Lock Type) + D4D-□520N Circuit Diagram

Note: Lock release is possible at any time. Therefore, do not use the solenoid lock type in applications where the operator may be exposed to danger when the guard opens. Use the mechanical lock type instead.





S1: Safety Limit Switch with direct opening mechanism (D4N)
S2: Guard Lock Safety-door Switch
KM1 and KM2: Magnetic Contactor
M: 3-phase motor

D4GL

Precautions

⚠ Caution

Do not insert the Operation Key with the door open. The machine may operate and damage may result.

⚠ Caution

Do not use metal connectors or conduits with this switch. Damage to the broken conduit hole may cause electric shock.

⚠ Caution

Change the head direction after inserting the Operation Key or changing the release key to the UNLOCK position. Otherwise, the switch may malfunction and damage may result.

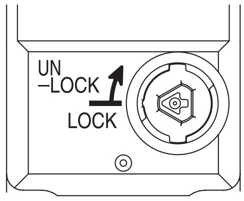
Holding Force

- Do not apply a force exceeding the specified holding force. Doing so may break the Switch and the machine may continue to operate.
- Either install another locking component (e.g., a stop) in addition to the Switch, or use a warning sticker or an indicator showing the lock status so that a force exceeding the specified holding force is not applied.

Safety Precautions

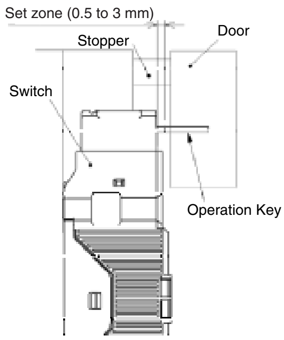
- Turn OFF the power before disassembling the Switch or touching any internal parts. Not doing so may result in electric shock.
- Mount the Operation Key in a location where it will not come in contact with users when the door is opened or closed. Otherwise, injury may result.
- Do not impose excessive force on the Operation Key when it is inserted into the Switch or drop the Switch with the Operation Key inserted. Otherwise, the Operation Key may be deformed or the Switch may be broken.
- Observe the specified insertion radius for the Operation Key and insert it in a direction perpendicular to the key hole.
- Do not use the Switch in starting circuits. (Use for safety confirmation signals.)
- When using the Switch in emergency-stop circuits or other safety circuits that have a direct impact on human lives, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, prevent easy removal by, for example, mounting the Switch and Operation Key with one-way screws or attaching a protective cover and warning label.
- In order to prevent short-circuit damage to the Switch, connect a fuse to the Switch in series. Use a fuse with a breaking current of 1.5 to 2 times the rated current. To conform to EN ratings, use a IEC269-compliant 10-A fuse type gI or gG.
- Turn the power OFF when wiring. After wiring is completed, be sure to mount the cover before use.
- In order to prevent burning due to overvoltage, insert a protective fuse in the solenoid circuits.
- Do not use the Switch where explosive gas, flammable gas, or any other dangerous gas may be present.
- Ensure that the load current does not exceed the rated current.
- Be sure to wire the terminals correctly.
- Be sure to evaluate the Switch under actual operating conditions after installation.
- Do not drop the package or the product. Do not disassemble internal parts.

Release Key



- The release key is used to unlock the Switch in case of emergency or if the power supply to the Switch stops.
- If the release key setting is changed from LOCK to UNLOCK using an appropriate tool, the lock will be released and the safety door can be opened (mechanical lock models only).
- After setting the release key to UNLOCK in order to, for example, change the head direction or perform maintenance, be sure to return it to LOCK setting before resuming operation.
- When the Switch is used for the door of a machine room to ensure the safety of people performing adjustment work inside, if the release key is set to UNLOCK, the door will not be locked when the door is closed and no power will be supplied to the equipment.
- Do not use the release key to start or stop machines.
- The auxiliary lock must only be released by authorized personnel.
- Do not impose excessive force on the release key screws. The release key may be damaged and may not operated properly.
- To prevent easy release of the auxiliary lock by unauthorized personnel, set it to LOCK and seal it with seal wax.

Mounting



- Do not use the Switch as a stopper. To prevent the door from coming into contact with the flange of the Operation Key, be sure to mount the Switch with a stopper as shown above.
- When the Switch is used for a hinged door at a location near to the hinged side, where the Operation Key's insertion radius is comparatively small, if an attempt is made to open the door beyond the lock position, the force imposed will be much larger than for locations far from the hinged side, and the lock may be damaged.

Solenoid Lock Models

The solenoid lock locks the door only when power is supplied to the solenoid. Therefore, the door will be unlocked if the power supply to the solenoid stops. Therefore, do not use solenoid lock models for machines that may be operating and dangerous even after the machine stops operating.

Correct Use

Operating Environment

- This Switch is for indoor use only. Do not use it outdoors. Otherwise, it may malfunction.
- Do not use the Switch in the following locations:
  - •Locations subject to severe temperature changes
  - •Locations subject to high humidity levels or condensation
  - •Locations subject to severe vibration
  - •Locations where the Switch may come in contact with metal dust, oil, or chemicals
  - •Locations subject to thinner, detergent, or other solvents
- Although the switch itself is protected from dust or water penetration, ensure that foreign material does not penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.
- Do not use the Switch submerged in oil or water, or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch interior. (The IP67 degree of protection specification for the Switch pertains to the amount of water penetration after the Switch is submerged in water for a certain period of time.)

Life Expectancy

The life expectancy of the Switch will vary with the switching conditions. Before applying the Switch, test it under actual operating conditions and be sure to use it at a switching frequency that will not lower its performance.

Mounting

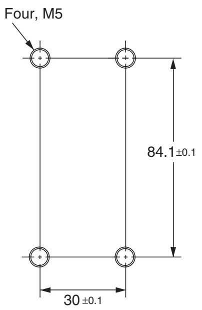
Tightening Torque

Be sure to tighten each screw of the Switch properly. Loose screws may result in malfunction.

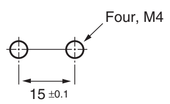
Terminal screw	0.4 to 0.5 N·m
Cover mounting screw	0.5 to 0.7 N·m
Head mounting screw	0.5 to 0.6 N·m
Operation Key mounting screw	2.4 to 2.8 N·m
Switch mounting screw	1.3 to 1.5 N·m
Connector	1.8 to 2.1 N·m
Cap screw	1.3 to 1.7 N·m

Switch and Operation Key Mounting

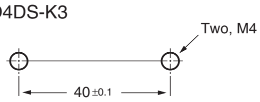
- Mount the Switch and Operation Key securely to the applicable tightening torque with M5 screws.



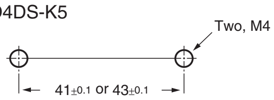
D4DS-K1/-K2



D4DS-K3



D4DS-K5

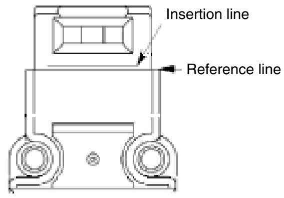


- Use the designated OMRON Operation Key with the Switch. Using another Operation Key may result in Switch damage.
- Ensure that the alignment offset between the Operation Key and the key hole does not exceed ±1 mm.

Head Direction

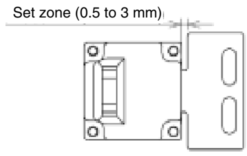
By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions.

Ensure that no foreign matter penetrates the interior of the Switch. Also, insert the head until the insertion line engraved on the head is hidden by the reference line on the Switch, as shown in the following diagram.



Securing the Door

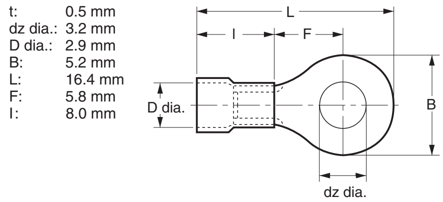
When the door is closed (with the Operation Key inserted), it may be pulled beyond the set zone because of, for example, the door's weight, or the door cushion rubber. Also, if a load is applied to the Operation Key, the door may fail to unlock properly. Use hooks to ensure that the door stays within the set zone.

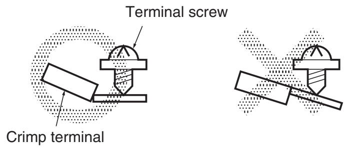


Wiring

Wiring Precautions

- Applicable lead wire size: AWG22 to AWG24.
- When connecting lead wires directly to terminals, perform wiring securely so that there are no loose wire strands.
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use lead wires of an appropriate length. Not doing so may cause the cover to rise.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case.



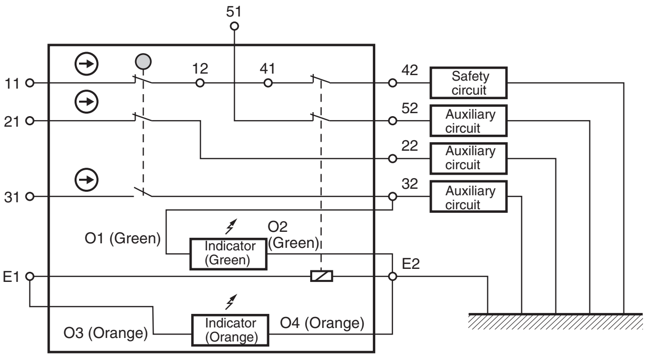


D4GL

Circuit Connection Example

- Terminals 12 and 41 are connected internally and so connect terminals 11 and 42 for safety-circuit input. (BIA GS-ET-19)
- Connect terminals 21 and 22 and terminals 51 and 52 in series when using as safety-circuit input (redundancy circuit for terminals 11 and 12 and terminals 41 and 42 above). Connect the terminals individually when using as auxiliary-circuit input (e.g., terminals 21 and 22 for safety-door open/closed monitoring and terminals 51 and 52 for monitoring the lock status).
- In the following connection example, terminals 21 and 22 and terminals 51 and 52 are used as auxiliary-circuit input.

Connection Example for D4GL-1HFA-A



- Direct opening contacts used as safety-circuit input are indicated with the mark. Terminals 11 and 12, terminals 21 and 22, and terminals 31 and 32 are direct opening contacts.
- Connect the indicators in parallel to the auxiliary circuits or terminals E1 and E2.
- Although the 3 lines are connected at the time of delivery, rewire them as necessary for the application.
- The following table shows the connection configuration required to make the green indicator light when the door is closed and the orange indicator light when the solenoid turns ON.

Indicator	Terminal number	Lead wire color	Connected terminal number
Green indicator	O1	Green	32
Orange indicator	O2	Orange	E1
Common	O3	Black	E2

- If an indicator is connected in parallel to a direct opening contact, when the indicator breaks, a short-circuit current will be generated, possibly resulting in an installation malfunction.
- Do not switch standard loads for more than 2 circuits at the same time. Otherwise, the level of insulation may decrease.
- The solenoid has polarity. Be sure to connect terminals with the correct polarity.

Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the proper torque. The case may be damaged if an excessive tightening torque is applied.
- In order to ensure IP67 degree of protection, wrap sealing tape around the conduit end of the connector.
- Be sure that the outer diameter of the cable connected to the connector is correct.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. The conduit cap is provided with the Switch.

Recommended Connectors

Use a connector with a screw section not exceeding 10 mm, otherwise the screws will protrude into the case interior. The connectors given in the following table have connectors with screw sections not exceeding 10 mm.

Size	Manufacturer	Model	Applicable cable diameter
$G^1/_2$	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	OHM ELECTRIC CO.	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	S-13.5 5301-5030	5.0 to 12.0 mm
M20	LAPP	ST-M20 *1.5 5311-1020	7.0 to 13.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, or GPM20), and tighten with the applicable torque. Seal packing is sold separately.

Maintenance and Repairs

The user must not perform repairs or maintenance. Contact the machine manufacturer if repairs or maintenance are required.

Storage

Do not store the Switch in locations where harmful gases (e.g., H_2S, SO_2, NH_3, HNO_3, or Cl_2) or dust are present, or in locations subject to high humidity levels.

Miscellaneous

- In conditions requiring greater rigidity, sealing performance, and oil resistance, use OMRON's D4BL.
- Perform regular inspections.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Guard Lock Safety-door Switch

D4BL

Protective Doors Are Locked Until Machines Completely Stop Operating

- A mechanical lock is applied automatically when the Operation Key is inserted. A high level of safety is achieved using a mechanism where the lock is only released when voltage is applied to the solenoid.
- Conforms to EN (TÜV) standards corresponding to the CE marking.
- Approved by UL, CSA, BIA, and SUVA standards.
- The switch contact is opened by a direct opening mechanism (NC contacts only) when the protective cover is opened. Direct opening mechanism that is EN-approved is indicated by ⊖ on the switch.
- Auxiliary release key ensures easy maintenance and unlocks the door in the case of a power failure.
- Tough aluminum die-cast body incorporating a switch box with degree of protection satisfying IP67, UL, and CSA TYPE6P, 13.
- Equipped with a horizontal and vertical conduit opening.
- Models incorporating easy-to-see indicators for monitoring and those using an adjustable Operation Key for a double door are available.
- The mounting direction of the head can be changed to allow the Operation Key to be inserted from four directions.
- Metric conduit types available

Model Number Structure

Model Number Legend

Switch

D4BL -□ □ □ □ -□
1 2 3 4 5

1. Conduit Size (2-conduit)
1: PG13.5
2: G1/2
3: 1/2-14NPT
4: M20

2. Built-in Switch (with Safety Switch and Lock Monitor Switch Contacts)
C: 1NC/1NO (slow-action) + 1NC (slow-action)
D: 2NC (slow-action) + 1NC (slow-action)

3. Head Mounting Direction
R: Four mounting directions possible (right-side mounting at shipping)

4. Door Lock and Release (Auxiliary Release Key is Incorporated by All Models)
A: Mechanical lock/24-VDC solenoid release
B: Mechanical lock/110-VAC solenoid release
G: 24-VDC Solenoid lock/Mechanical release

5. Indicator
Blank: Without indicator
A: 10 to 115 VAC or VDC driving (with orange and green LED indicator unit)

Operation Key (Order Separately)

D4BL - K□
1

1. Operation Key Type
1: Horizontal mounting
2: Vertical mounting
3: Adjustable mounting (Horizontal)

Ordering Information

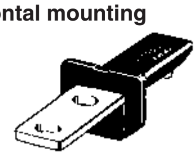
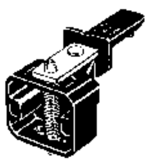
List of Models

Switches

Lock method	Conduit size	Voltage for solenoid	Without indicator 1NC/1NO+ 1NC (Slow-action)	With LED indicator 1NC/1NO+ 1NC (Slow-action)	Without indicator 2NC+ 1NC (Slow-action)	With LED indicator 2NC+ 1NC (Slow-action)
Mechanical lock	PG13.5	24 VDC	D4BL-1CRA	D4BL-1CRA-A	D4BL-1DRA	D4BL-1DRA-A
		110 VAC	D4BL-1CRB	D4BL-1CRB-A	D4BL-1DRB	D4BL-1DRB-A
	G1/2	24 VDC	D4BL-2CRA	D4BL-2CRA-A	D4BL-2DRA	D4BL-2DRA-A
		110 VAC	D4BL-2CRB	D4BL-2CRB-A	D4BL-2DRB	D4BL-2DRB-A
	M20	24 VDC	D4BL-4CRA	D4BL-4CRA-A	D4BL-4DRA	D4BL-4DRA-A
		110 VAC	D4BL-4CRB	D4BL-4CRB-A		
Solenoid lock	Pg 13.5	24 VDC	D4BL-1CRG	D4BL-1CRG-A	D4BL-1DRG	D4BL-1DRG-A
	G1/2	24 VDC	D4BL-2CRG	D4BL-2CRG-A	D4BL-2DRG	D4BL-2DRG-A
	M20	24 VDC		D4BL-4CRG-A		

Prefered model

Operation Keys (Order Separately)

Mounting type	Model
Horizontal mounting 	D4BL-K1
Vertical mounting 	D4BL-K2
Adjustable mounting (Horizontal) 	D4BL-K3

Specifications

Approved Standards

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9451050 (Direct opening: approved)
BIA	GS-ET-19	Mechanical lock: 9402293 Solenoid lock: 1998 20462-01
SUVA	SUVA	E6186/2.d
UL	UL508	E76675
CSA	CSA C22.2, No.14	LR45746

Standards and EC Directives

Conforms to the following EC Directives:
Machinery Directive
Low Voltage Directive
EN1088

Approved Standard Ratings

TÜV (EN60947-5-1)

Item	Standard model	Indicator model
Utilization category	AC-15	AC-15
Rated operating current (Ie)	3 A	6 A
Rated operating voltage (Ue)	250 V	115 V

Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device.

UL/CSA (UL508, CSA C22.2 No. 14)

A300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Note: The UL/CSA approved rating for products with indicators (-A) is 6 A/115 VAC.

Characteristics

Degree of protection	IP67 (See note 2.)
Durability (See note 3.)	Mechanical:1,000,000 operations min. Electrical:500,000 operations min. (10-A resistive load at 250 VAC)
Operating speed	0.05 to 0.5 m/s
Operating frequency	30 operations/min max.
Rated frequency	50/60 Hz
Operating characteristics	Direct opening force:19.61 N min. (EN60947-5-1) Direct opening travel:20 mm min. (EN60947-5-1) All stroke:23 mm min.
Holding force	700 N min. (GS-ET-19)
Insulation resistance	100 MΩ min. (at 500 VDC)
Rated insulation voltage (U_i)	300 V (EN60947-5-1)
Conventional enclosed thermal current (I_{the})	10 A (EN60947-5-1)
Dielectric strength (U_{imp})	Impulse dielectric strength (U_{imp}) 4 kV (EN60947-5-1) between terminals of different polarity, between each terminal and ground, and between each terminal and non-current-carrying metal part; 2.5 kV between solenoid and ground (EN60947-5-1)
Conditional short-circuit current	100 V (EN60947-5-1)
Pollution degree (operating environment)	3 (EN60947-5-1)
Protection against electric shock	Class I (with ground terminal)
Switching overvoltage	1,500 V max. (EN60947-5-1)
Contact resistance	50 mΩ max. (initial value)
Vibration resistance	Malfunction: 10 to 55 Hz, 0.35-mm single amplitude
Shock resistance	Destruction:1,000 m/s² min. (IEC68-2-27) Malfunction:300 m/s² min. (IEC68-2-27)
Ambient temperature	Operating:–10°C to 55°C (with no icing)
Ambient humidity	Operating:95% max.
Weight	Approx. 800 g

Note: 1. The above values are initial values.

2. Although the switch box is protected from dust, oil or water penetration, do not use the D4BL in places where dust, oil, water, or chemicals may penetrate through the key hole on the head, otherwise Switch damage or malfunctioning may occur.

3. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%.

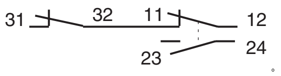
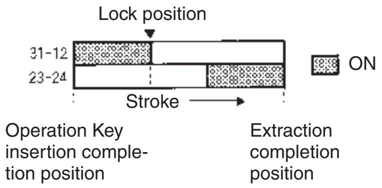
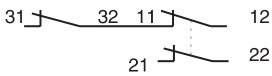
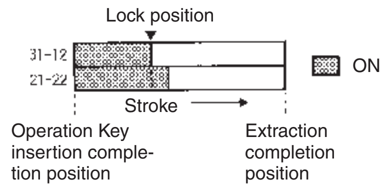
Solenoid Coil Characteristics

Item	24-VDC mechanical lock models	110-VAC mechanical lock models	24-VAC solenoid lock models
Rated operating voltage	24 VDC $^{+10\%}/_{-15\%}$ (100% ED)	110 VAC ±10% (50/60 Hz)	24 VDC $^{+10\%}/_{-15\%}$ (100% ED)
Current consumption	Approx. 300 mA	Approx. 98 mA	Approx. 300 mA
Insulation	Class F (130°C or less)		

Indicator Characteristics

Item	**LED**
Rated voltage	10 to 115 VAC/VDC
Current leakage	Approx. 1 mA
Color (LED)	Orange, green

Contact Form (Diagrams Show State with Key Inserted and Lock Engaged)

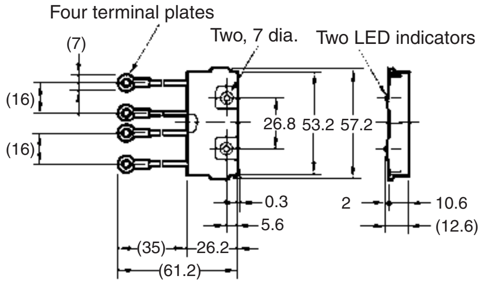
Model	Contact		Diagram	Remarks
D4BL-□C□□-□	1NC/ 1NO+1NC	 	 	Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. The terminals 11-12 and 23-24 can be used as unlike poles.
D4BL-□D□□-□	2NC+1NC	 	 	NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. The terminals 11-12 and 21-22 can be used as unlike poles.

Note: The EN-approved direct opening mechanism is indicated by on the switch.

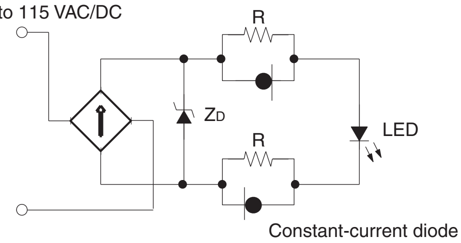
Connections

Indicator Unit

Dimensions



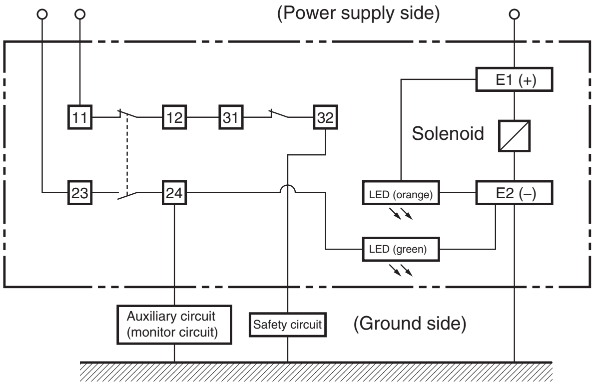
Internal Circuit



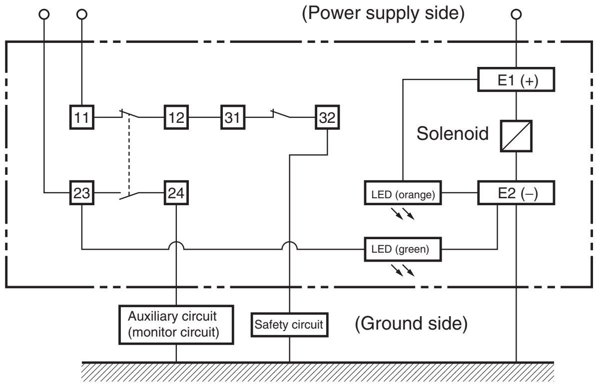
Circuit Connection Example

- Do not connect the indicators to the safety contact terminals (11-12-31-32) or the safety circuit side.
- When using indicators, connect them to the auxiliary circuit side (monitor circuit) or the solenoid input terminals as shown below.
- The indicators can be used to confirm the open/closed status of the door, the ON/OFF status of the power supply, and the ON/OFF status of the solenoid.
- Do not connect the indicators in parallel with the direct opening contact. If the indicators are broken, a short-circuit current may flow, causing equipment to malfunction.
- The 24-VDC solenoid terminals have polarity. Confirm the polarity before wiring.
- Be sure to use a special pushbutton switch to stop and start machinery and release locks.

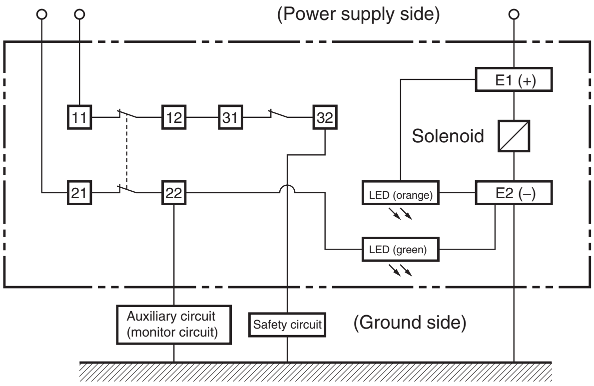
**1. Orange: Lights when the solenoid turns ON.
Green: Lights when the door opens.**



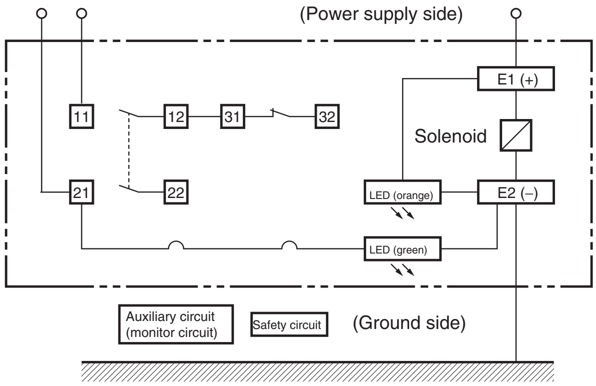
**2. Orange: Lights when the solenoid turns ON.
Green: Lights when power turns ON.**



**3. Orange: Lights when the solenoid turns ON.
Green: Lights when door closes.**

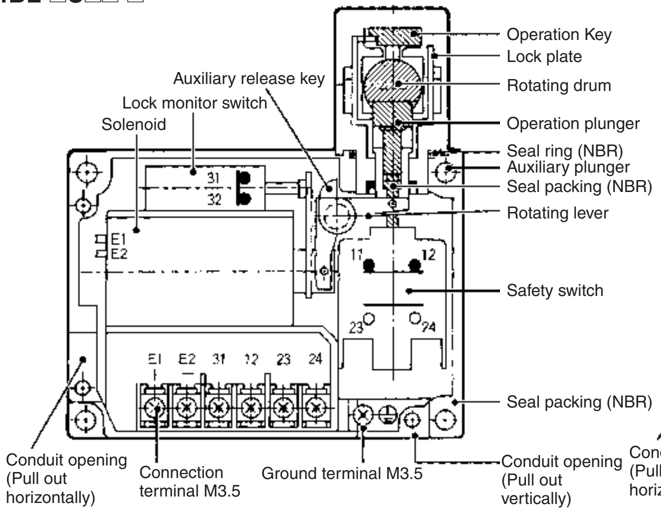


**4. Orange: Lights when the solenoid turns ON.
Green: Lights when power turns ON.**

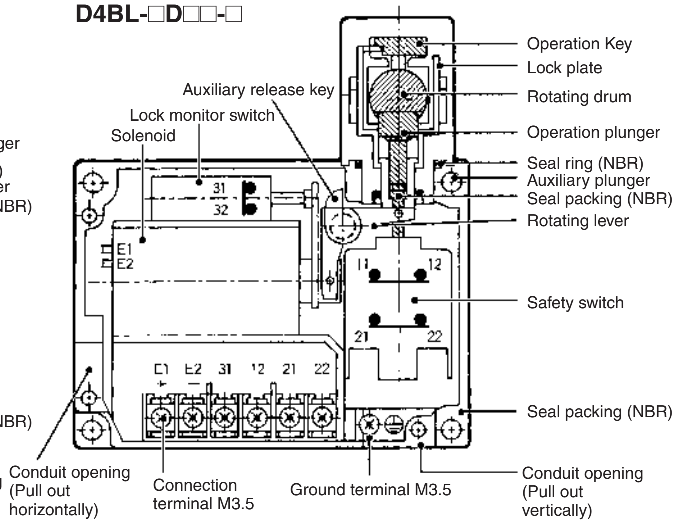


Nomenclature

D4BL-□C□□-□



D4BL-□D□□-□



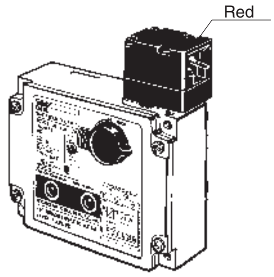
Dimensions

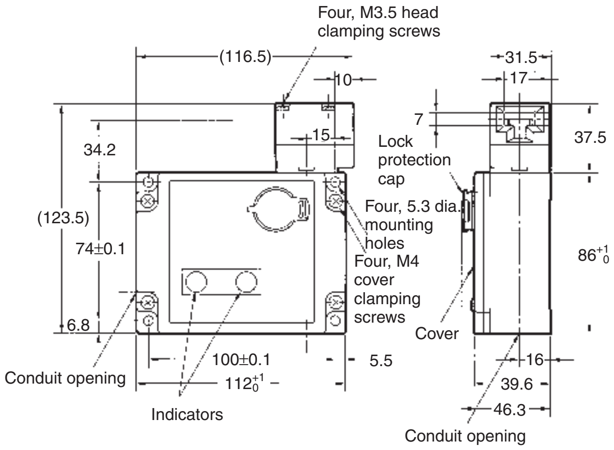
Note: 1. All units are in millimeters unless otherwise indicated.

2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Switches

D4BL-□□□□-□



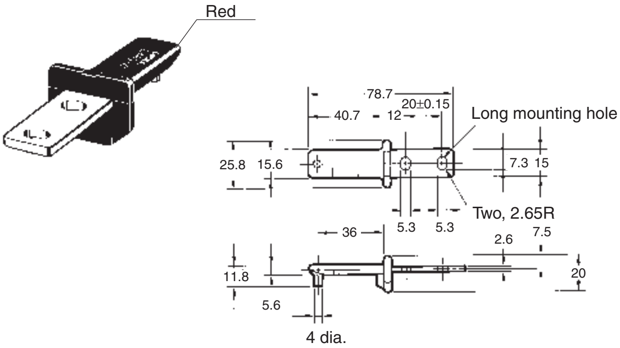


Operating Characteristics	D4BL-□□□□
Key insertion force Key extraction force	19.61 N max. 19.61 N max.
Movement before being locked	15 mm max.

Operation Keys

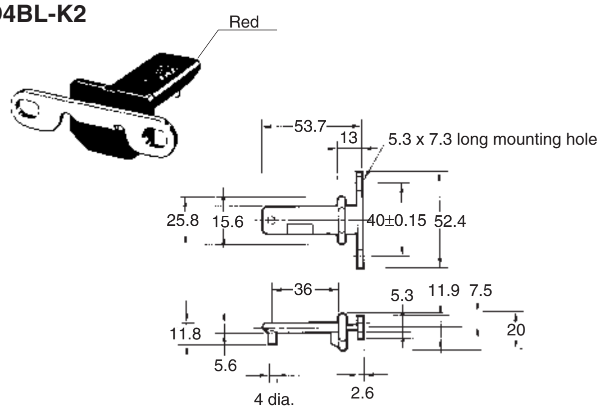
Horizontal Mounting

D4BL-K1



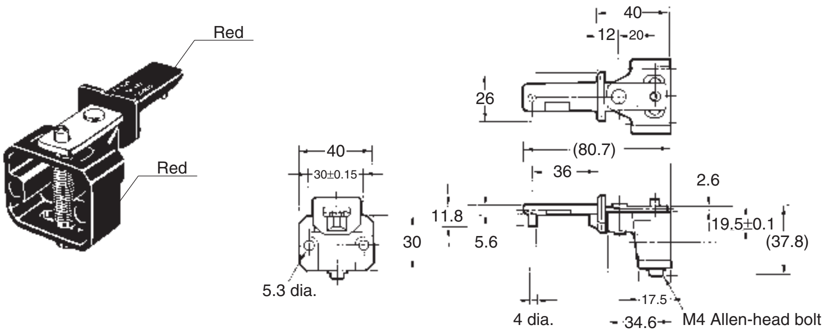
Vertical Mounting

D4BL-K2



Adjustable Mounting (Horizontal)

D4BL-K3

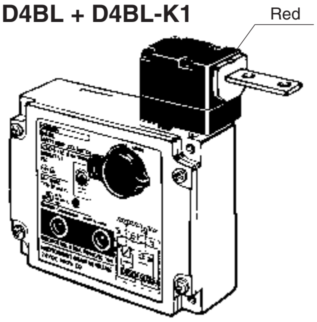


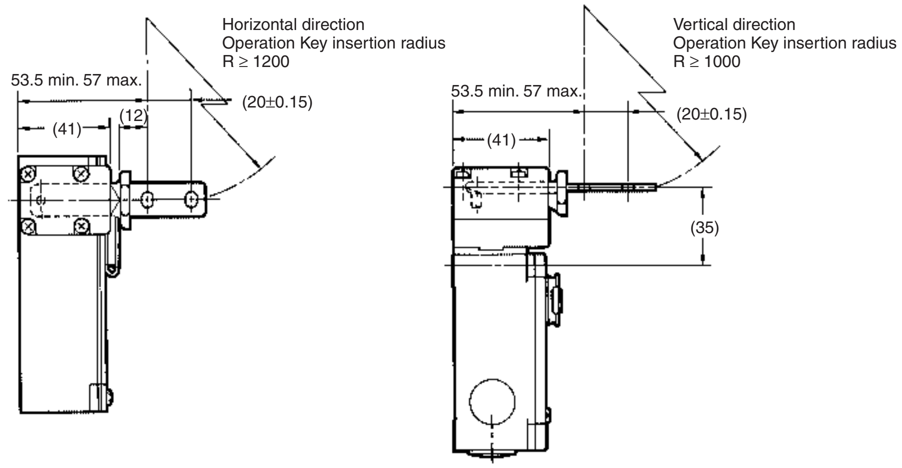
D4BL

With Operation Key Inserted

Horizontal Mounting

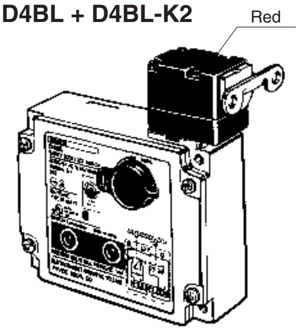
D4BL + D4BL-K1

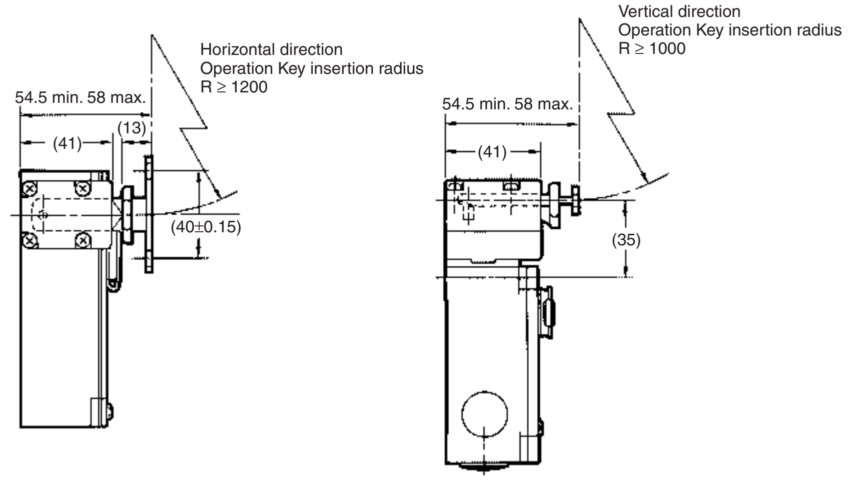




Vertical Mounting

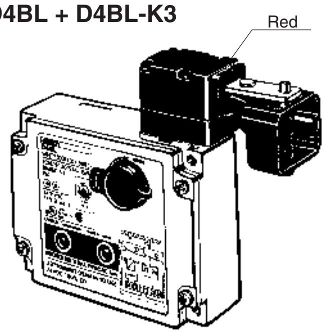
D4BL + D4BL-K2

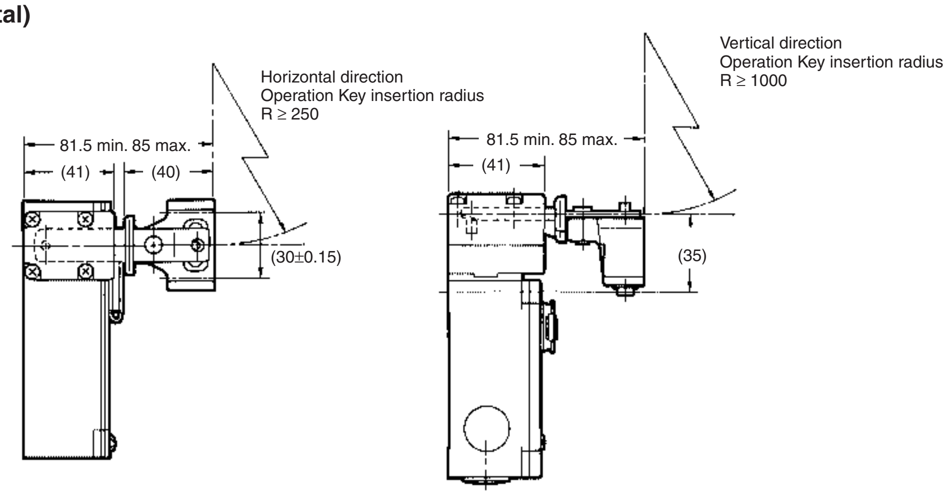




Adjustable Mounting (Horizontal)

D4BL + D4BL-K3





Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

2. In the above diagrams, the Operation Key is inserted from the front.

Precautions

Do not insert the Operation Key to the Switch with the door open. Before using the machine, be sure to remove the shock-absorbing damper, which is provided before shipping. Otherwise the machine may start operating and injury may be caused.

Mount the Operation Key at a location where it will not come in contact with users when the door is opened or closed.

When operating the D4BL as a part of a safety circuit or an emergency stop circuit to prevent injury, operate the NC contacts that have a direct opening mechanism in direct opening mode. For safety purposes, tighten the switch body and Operation Key with one-way screws or equivalents or install a switch protection cover and warning label for safety purposes to prevent easy removal of the D4BL.

Connect the fuse to the D4BL in series to prevent it from short-circuit damage. The value of the breaking current of the fuse must be calculated by multiplying rated current by 150% to 200%.

When using the D4BL with EN ratings, use 10-A fuse Type gI or gG that complies with IEC60269.

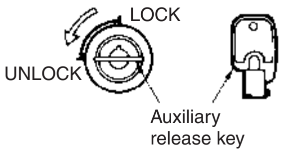
In order to prevent the D4BL from burning due to overvoltage, insert a protection fuse into the solenoid circuit.

If the D4BL is imposed with force exceeding the lock strength, the D4BL may break and the equipment may continue to operate.

Auxiliary Release Key

The auxiliary release key is used to unlock the D4BL in case of emergency or in case the power supply to the D4BL fails.

Use an appropriate tool to set the auxiliary release key to UNLOCK so that the lock will be released and the door can be opened.



The auxiliary release key applied to the door of a machine room ensures the safety of people adjusting the equipment in the machine room. If the auxiliary release key is set to UNLOCK, the door will not be locked when the door is closed and no power will be supplied to the equipment.

To lock the door, set the auxiliary release key to LOCK.

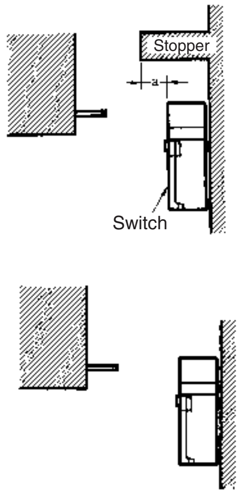
Do not use the auxiliary release key to start or stop machines.

To prevent the auxiliary release key from being handled carelessly by unauthorized people, seal the auxiliary release key with sealing wax and the provided seal cap to ensure IP67.

Make sure that the auxiliary release key is kept with the person in charge.

Before attaching the cover to the D4BL, make sure that the auxiliary release key position is set to LOCK.

Stopper



Do not use the Switch as a stopper. When mounting the Switch, be sure to locate a stopper as shown in the following illustration to prevent the top of the Operation Key from hitting the switch head.

Correct Use

Operating Environment

Due to the wear and tear of the sealing of the D4BL, water and some types of oil and chemical sprayed onto the D4BL may cause contact or insulation failures, current leakages, or fires.

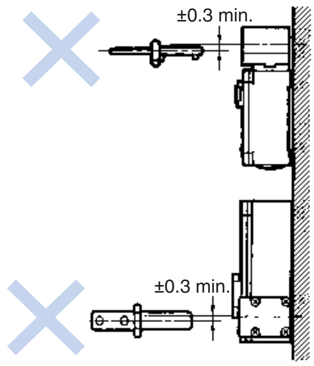
Do not use the D4BL in the following locations.

- Locations subject to severe temperature changes
- Locations subject to high temperatures or condensation
- Locations subject to severe vibration
- Locations where the product may come in contact with metal dust, oil, or chemicals

Operation Key

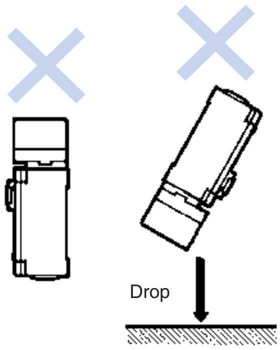
The D4BL is provided with a shock-absorbing damper to protect the D4BL from damage that may result from dropping the D4BL during transportation. Be sure to remove the damper after mounting the D4BL.

The mounting tolerance of the Operation Key is ±0.3 mm vertically or horizontally. Be sure to mount the D4BL correctly without leaning, otherwise the D4BL may soon break or wear out.



Do not drop the D4BL with the Operation Key inserted, otherwise the Operation Key may deform or break.

D4BL



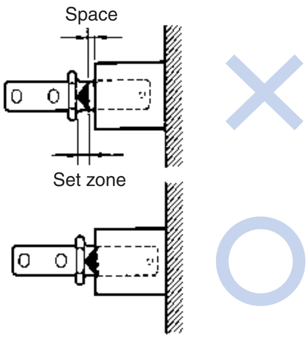
The head is constructed so that it cannot be operated with tools such as screwdrivers. Always use OMRON's Operation Key to operate the head in order to ensure the safety of the machine and protect the D4BL from damage.

The Operation Key provided for the D4BL is not compatible with that of the D4BS.

Mount the Operation Key and secure it with one-way screws or equivalents to prevent easy removal of the D4BL.

Securing the Door

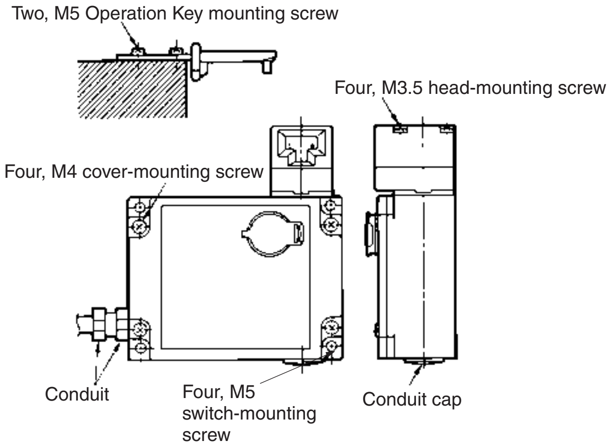
If the Operation Key on the closed door is pulled outside the set zone by a force caused by vibration, the door's weight, or the door cushion rubber, the D4BL may be damaged. Secure the door with hooks so that it will remain within the set zone.



Tightening Torque

Be sure to tighten each screw of the D4BL properly, otherwise the D4BL may malfunction.

	Type	Torque
1	M3.5 terminal screw (including terminal screw)	0.59 to 0.78 N·m
2	Cover mounting screw	1.18 to 1.37 N·m
3	Head mounting screw	0.78 to 0.98 N·m
4	M5 body mounting screw	4.90 to 5.88 N·m
5	Operation Key mounting screw	2.35 to 2.75 N·m
6	Connector	1.77 to 2.16 N·m
7	Cap screw	1.27 to 1.67 N·m

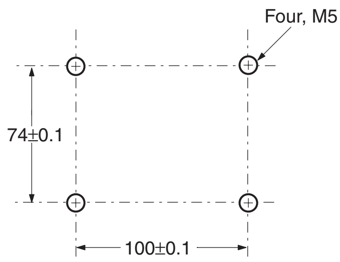


Switch and Operation Key Mounting

Mount the D4BL and Operation Key with four M5 screws with washers and tighten each screw to the specified torque.

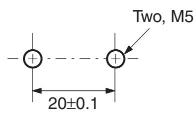
Mounting Dimensions

Switch Mounting Dimensions

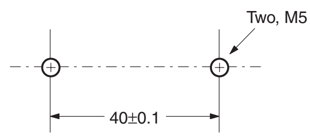


Operation Key Mounting Holes

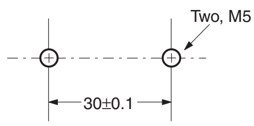
- Horizontal Mounting
  D4BL-K1



- Vertical Mounting
  D4BL-K2



- Adjustable Mounting (Horizontal)
  D4BL-K3

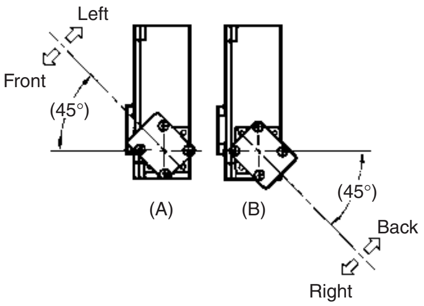


Head Directions

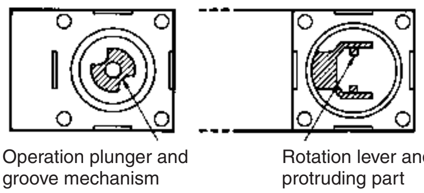
The head can be mounted in four directions. To remove the head, turn the head by 45° as shown in figures A and B below.

To change the direction of the head, make sure that the protruding part of the rotating lever engages with the groove of the plunger. Then turn the head clockwise or counterclockwise to the desired direction. At that time, make sure that the groove of the plunger is located under the rotating lever. If the direction of the head is not set when the plunger is rotated by 45°, the groove of the plunger presses the rotating lever. The head, plunger, or the built-in switch may be damaged as a result.

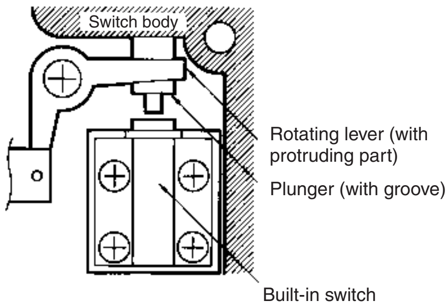
Head Direction Changes



Head Bottom View **Switch Top View**



Normal Positions of Rotating Lever and Plunger



Be sure to check the mechanical lock and solenoid release functions when mounting the D4BL.

If the head direction is changed, recheck the tightening torque of each of screw. Make sure that no foreign materials will penetrate through the key hole on the head.

Mounting the Cover

When tightening the cover, first check the specified torque, and then tighten each screw to the that torque. Also, make sure that no foreign matter has entered the switch.

When mounting the cover, make sure that the cover and switch box are properly aligned.

Processing and Connecting Cable/Conduit

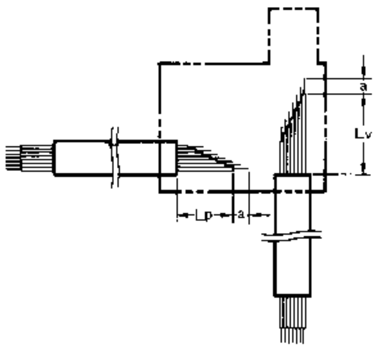
The following procedures are recommended for mounting and wiring the indicator unit securely.

In order to ensure IP67, use OMRON's SC-□M and Nippon Flex's ABS-08Pg13.5 and ABS-12 Pg13.5 Connectors.

Recommended cable: UL2464-type cable that is 20 to 18 AWG (0.5 to 1.0 mm^2) in size and has seven conductors

If the 1/2-14NPT is used, cover the cable and conduit end with sealing tape in order to ensure IP67. Tighten the connector to a torque of 1.77 to 2.16 N·m.

Connect the indicator unit after connecting the seven-conductor cable.

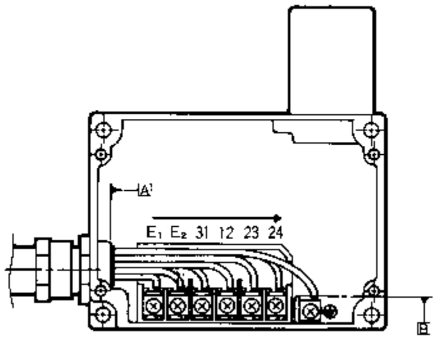


Terminal no.	Lp (mm)	Lv (mm)	a (mm)
E_1	30±2	80±2	
E_2	35±2	75±2	
31	45±2	60±2	
12	55±2	50±2	8±1
23 (21)	65±2	45±2	
24 (22)	70±2	35±2	
⏚	90±2	50±2	

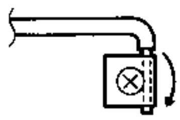
Properly attach and securely tighten the provided conduit cap to the unused conduit opening when wiring the D4BL.

Cable Connection Example

1. Connect the wires to the terminals in the order shown below for wiring efficiency.

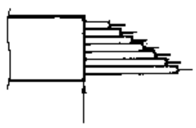


Tighten each wired terminal clockwise to a torque of 0.59 to 0.78 N·m.



Twist the wire two or three times and make sure that no bare wire exists outside the terminal when tightening the terminal.

2. The insulation sheath of the seven-conductor cable must come into contact with the wall of the conduit mouth, side A or side B.



Insulation sheath edge

Maintenance and Repairs

Contact your OMRON representative for any repair or maintenance work on the D4BL. The D4BL must not be maintained or repaired by any unauthorized party.

Others

Do not touch the solenoid because the solenoid radiates heat while power is being supplied.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

Compact Non-contact Door Switch

D40B

Detects the open/closed state of doors without making contact and has high resistance to the environment.

- Detects the open/closed state of doors without making contact by combining a special magnetic actuator and switch. The switching mechanism is not easily disabled.
- The non-contact operation prevents the creation of particles due to abrasion.
- The actuator and switch can be washed in water. There are no keyholes where dirt can accumulate, making it easy to keep machinery clean.
- Small distortions in the door and mechanical discrepancies can be absorbed in the allowable operating range of the magnetic actuator and switch.
- Conforms to Category 3.

Model Number Structure

Model Number Legend

Sensor

D40B-□□□□
1 2 3 4

1. **Type**
   1: Standard Sensor
   2: Elongated Sensor
   3: High-temperature Type Sensor
2. **Auxiliary Output**
   B: None
   D: 1 NC
   E: 1 NO
3. **Cable Length**
   3: 3 m
   5: 5 m
   10: 10 m
4. **Wiring Method**
   None: Pre-wired
   C: Connector (switch side only)

Controller

D40B-J□
1

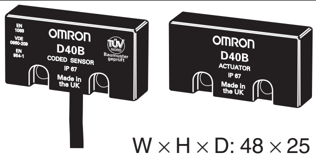
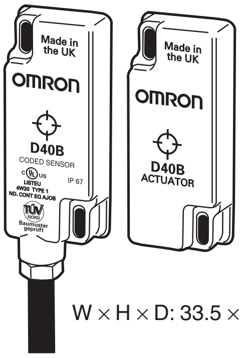
1. **Type**
   1: One main contact + one auxiliary contact (See note.)
   2: Two main contacts + one auxiliary contact (See note.)

Note: The auxiliary contacts use non-safety output.

Ordering Information

List of Models

Sensors (Switches/Actuators)

Classification	Shape	Auxiliary output	Cable length	Model
Standard Sensor	 W × H × D: 48 × 25 × 12	None	3 m	D40B-1B3
			10 m	D40B-1B10
		1 NC	3 m	D40B-1D3
			10 m	D40B-1D10
Elongated Sensor	 W × H × D: 19 × 82 × 19	None	3 m	D40B-2B3
			10 m	D40B-2B10
		1 NC	3 m	D40B-2D3
			10 m	D40B-2D10
High-temperature Type Sensor	 W × H × D: 33.5 × 78.5 × 16	1 NC	5 m	D40B-3D5C
		1 NO		D40B-3E5C

Note: A Sensor used in combination with a Controller is classified Category 3.

Controllers

Safety contacts	Auxiliary contacts/output (See note 2.)	Rated voltage	Model
1 NO	1 NC (See note 1.)	24 VAC/VDC	D40B-J1
2 NO	1 NC	24 VAC/VDC 110/230 VAC	D40B-J2

Note: 1. MOS output.
2. Non-safety output.

Accessories

Classification	Model
Fuse	D9M-P1

Specifications

Sensor (Switch/Actuator)

Item / Type	Standard Sensor	Elongated Sensor	High-temperature Type Sensor
Switching distance (See note 1.) (nominal value)	OFF→ON: 5 mm ON→OFF: 15 mm		OFF→ON: 9 mm ON→OFF: 17 mm
Actuator approach speed (See note 2.)	17 mm/s min.		
Operating temperature	−10 to +55°C		−25 to +125°C
Operating humidity	90% at +50°C		
Degree of protection	IP67		
Material	ABS		Stainless steel
Mounting method	M4 screws		
Mounting screw tightening torque	1 N·m		

Note: 1. These values represent the distances at which OFF changes to ON (approaching) or ON changes to OFF (separating) when the switch and actuator's target marks are aligned and the sensing surfaces have the same orientation.

2. If the approach speed is less than the specified value, the Controller's safety contact output may not turn ON, even if the distance is less than the switching distance.

Controller

Ratings

Power Supply

Item / Type	D40B-J1	D40B-J2
Power supply voltage	24 VAC/DC	24 VAC/DC or 110/230 VAC (selectable)
Allowable voltage range	Power supply voltage ±15%	
Power consumption	2.0 VA max.	4.0 VA max.

Switch

Item / Type		D40B-J1	D40B-J2
Rated load	**Safety contacts**	250 VAC, 4 A, cosϕ = 1 30 VDC, 2 A, cosϕ = 1	
	Auxiliary contacts/output (See note.)	230 VAC, 100 mA, cosϕ = 1 24 VDC, 100 mA, cosϕ = 1	250 VAC, 4 A, cosϕ = 1 30 VDC, 2 A, cosϕ = 1

Note: D40B-J1: MOS output; D40B-J2: Contact output.

Characteristics

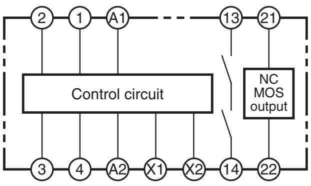
Item / Type		D40B-J1	D40B-J2
Contact resistance		100 mΩ (not including auxiliary output)	100 mΩ
Auxiliary output ON resistance		36 Ω (nominal value)	---
Response time		25 ms max.	
Insulation resistance		100 MΩ (at 500 VDC)	
Dielectric strength	**Between output poles**	1,500 VAC 1 min.	
	Between inputs and outputs		
	Between power supply and outputs		
Vibration resistance		10 to 55 Hz, 1-mm single amplitude, IEC68-2-6	
Shock resistance		30G, 11 ms, IEC68-2-27	
Durability	**Mechanical**	1,000,000 operations min.	
	Electrical	100,000 operation min. (at the rated load)	
Minimum rated current for safety contacts		10 VAC/VDC, 10 mA (reference values)	
Operating temperature		−10 to +55 °C	
Operating humidity		90% at +50 °C.	
Mounting method		35 mm DIN Track (Screw mounting is not possible.)	
Terminal screw tightening torque		1 N·m	
Weight		147 g	590 g

Approved Standards

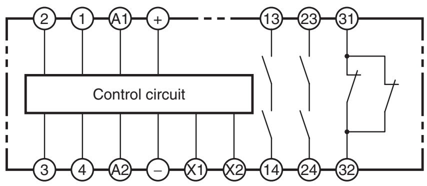
- EN standards certified by TÜV Nord
  EN954-1
  EN/IEC60204-1
  EN/IEC60947-5-3
- UL508, CSA C22.2 No. 14
- EN1088 conformance

Internal Connection Diagram

D40B-J1



D40B-J2



Note: 1. If a 100/230 VAC power supply is used, connect it to the A1 and A2 terminals. Do not connect the power supply to the + and –terminals.

2. If a 24 VDC power supply is used, connect it to the + and – terminals. Do not connect the power supply to the A1 and A2 terminals.

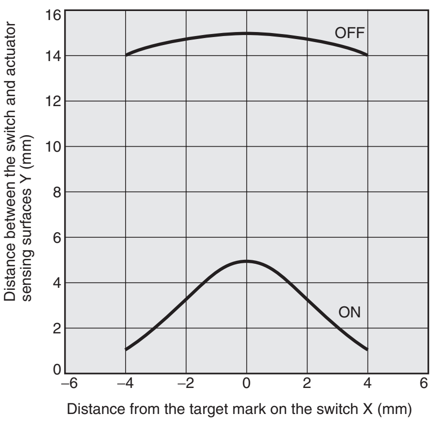
WARNING

Do not connect a 100/230 VAC power supply to the + and –terminals.
Doing so may result in electric shock.

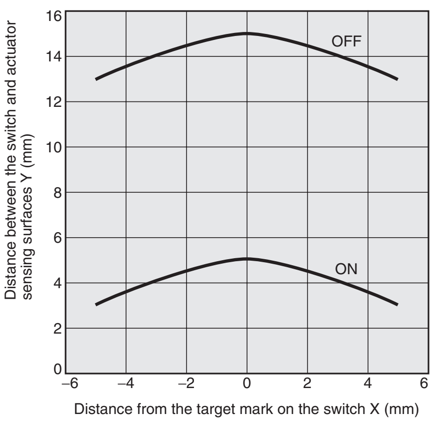
Engineering Data

Detection Ranges

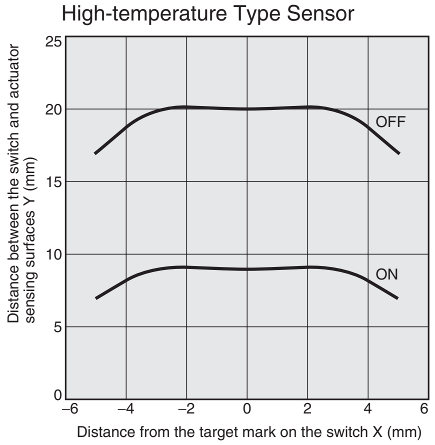
Standard Sensor



Elongated Sensor



High-temperature Type Sensor



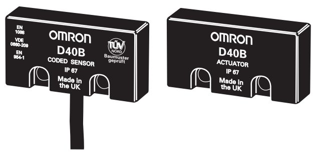
Dimensions

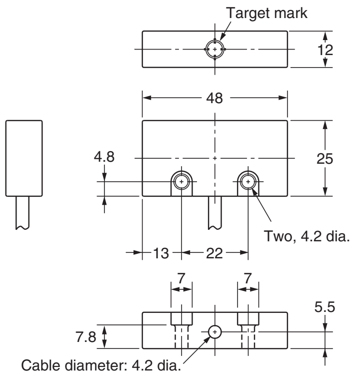
Note: All units are in millimeters unless otherwise indicated.

Sensor (Switch/Actuator)

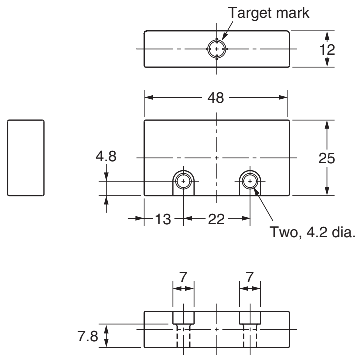
Standard Sensor

D40B-1B3
D40B-1B10
D40B-1D3
D40B-1D10





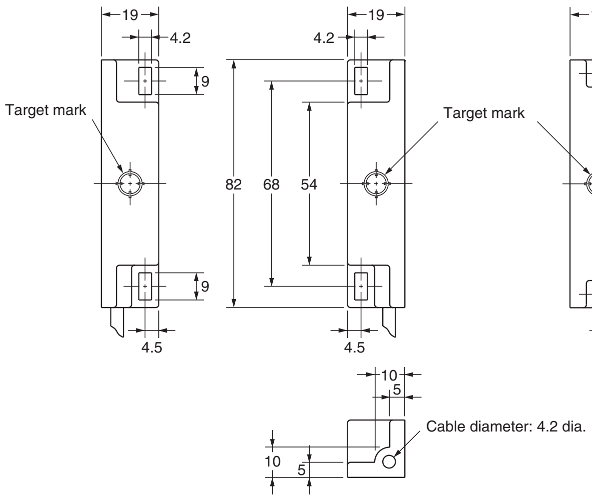
(Switch)



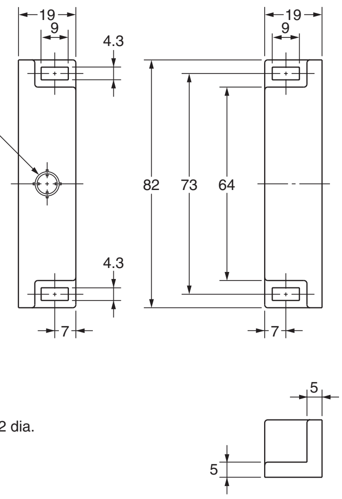
(Actuator)

Elongated Sensor

D40B-2B3
D40B-2B10
D40B-2D3
D40B-2D10



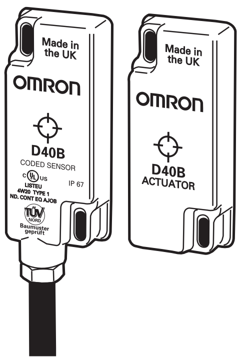
(Switch)



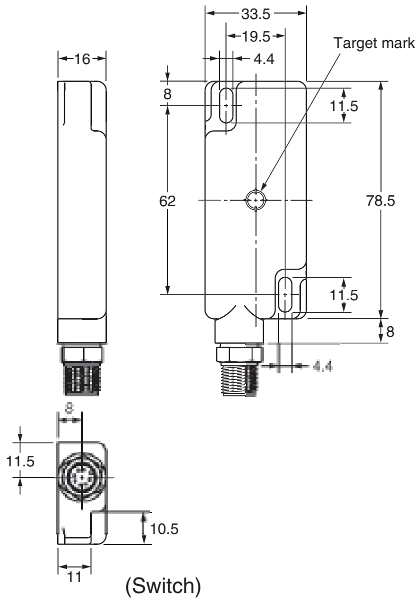
(Actuator)

High-temperature Type Sensor

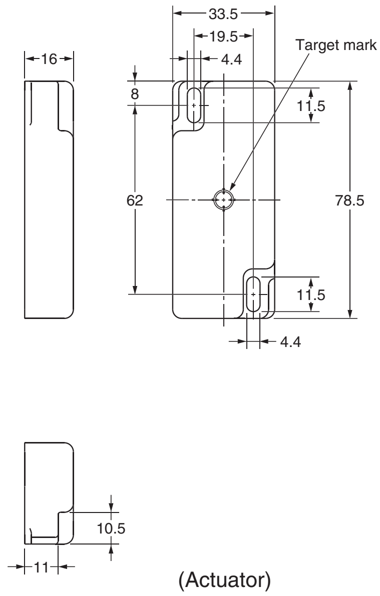
D40B-3D5C
D40B-3E5C



Note: A cable with connectors is included.



(Switch)



(Actuator)

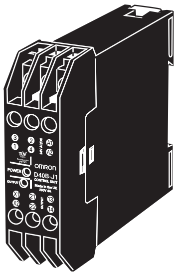
D40B

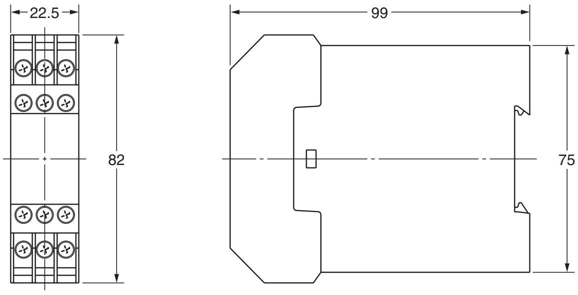
Controller

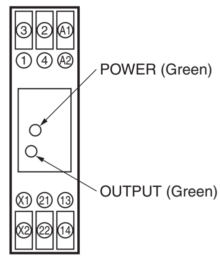
1-pole Controller

D40B-J1

Terminal Arrangement



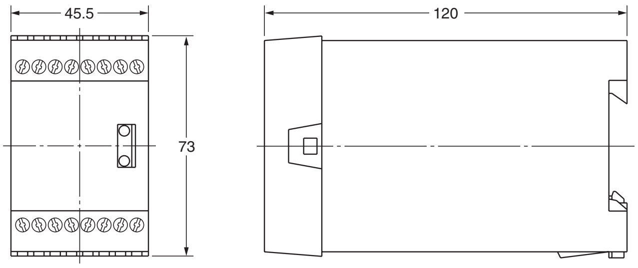


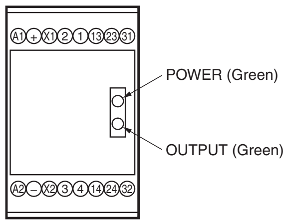


2-pole Controller

D40B-J2

Terminal Arrangement

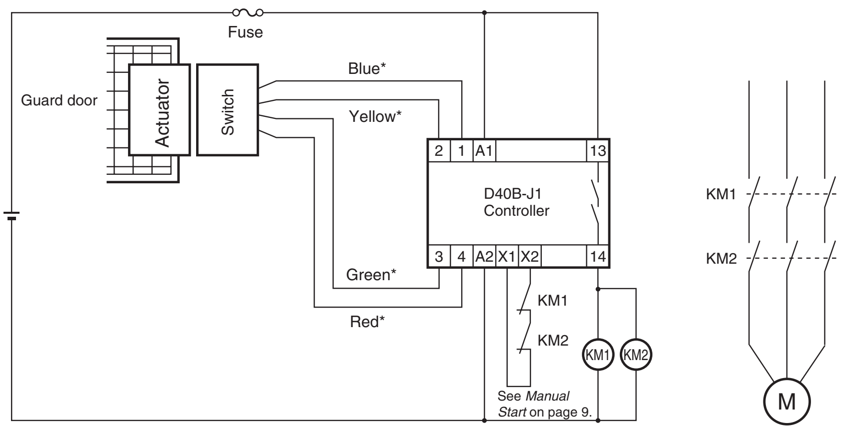




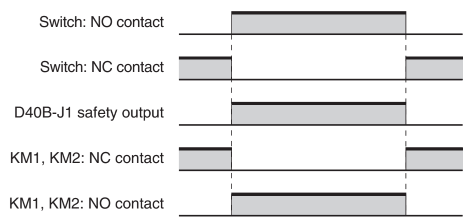
Application Examples

Wiring Example for 1 Sensor and 2 Contactors (with D40B-J1): Auto-reset

The configuration in this example is for auto-reset and contactor monitoring.



Operation Flowchart

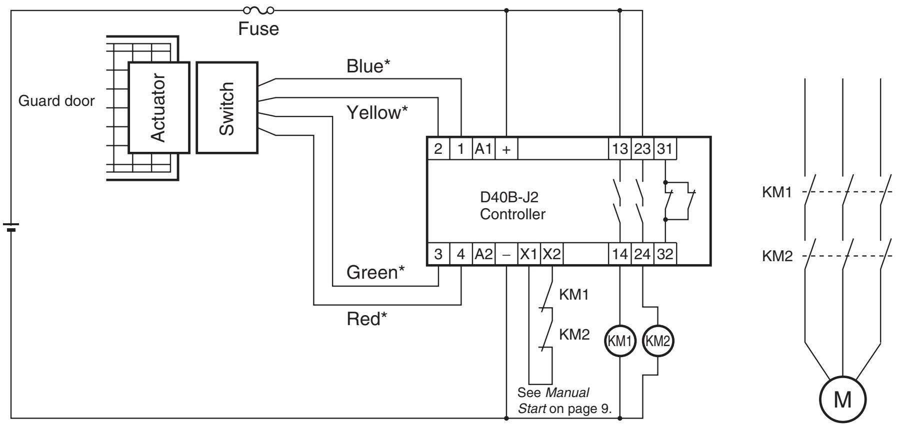


Note: The circuit in this example is equivalent to a Category 3 circuit.

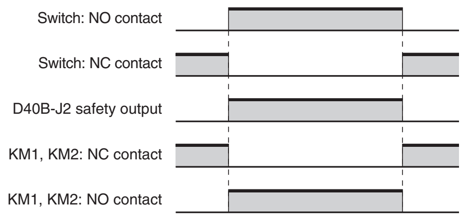
*This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to *Sensor and Controller Connection Examples* on page 10.

Wiring Example for 1 Sensor and 2 Contactors (with D40B-J2): Auto-reset

The configuration in this example is for auto-reset and contactor monitoring.



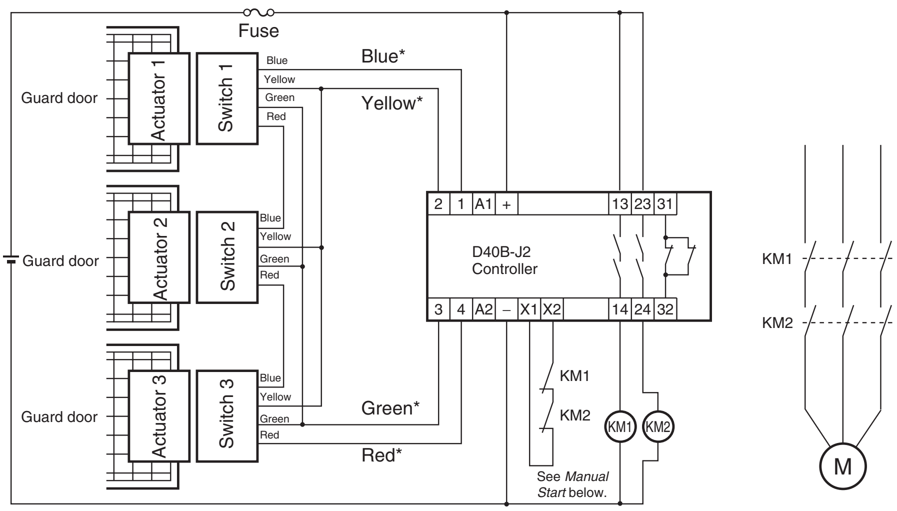
Operation Flowchart



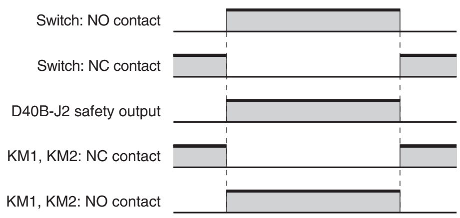
Note: The circuit in this example is equivalent to a Category 3 circuit.
*This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to *Sensor and Controller Connection Examples* on page 10.

Wiring Example for 3 Sensors and 2 Contactors (with D40B-J2): Auto-reset

The configuration in this example is for auto-reset and contactor monitoring.



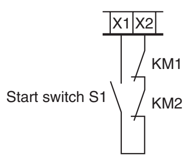
Operation Flowchart



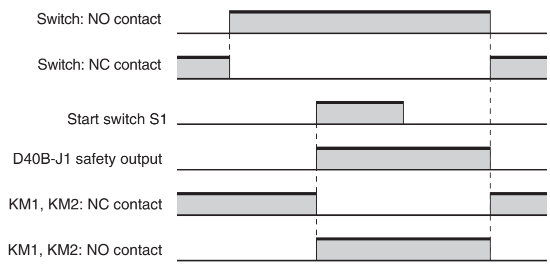
Note 1: The circuit in this example is equivalent to a Category 3 circuit.
Note 2: If two or more Sensors are connected to one Controller, all of the guard doors must open and close independently. If two or more doors open and close at the same time, it is possible that a fault may not be detected.
Note 3: Up to six Sensors can be connected to a single Controller.
*This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to *Sensor and Controller Connection Examples* on page 10.

Manual Start

If manual start is required, insert start switch S1 between X1 and X2 as shown below. Monitored start is not possible.



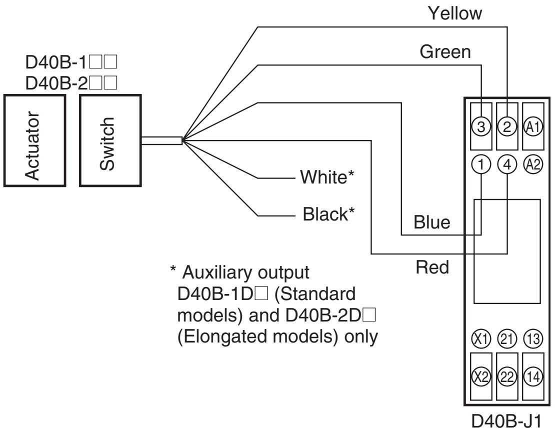
Operation Flowchart



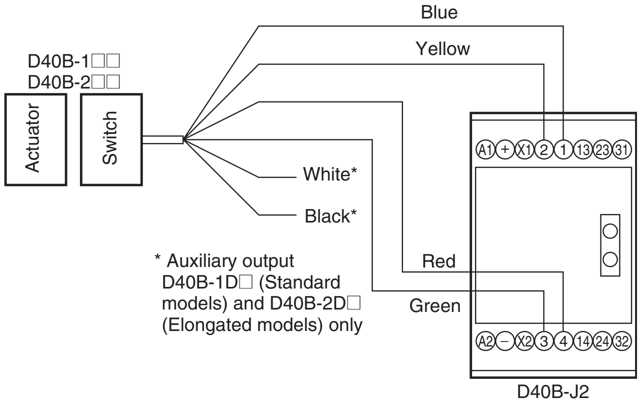
D40B

Sensor and Controller Connection Examples

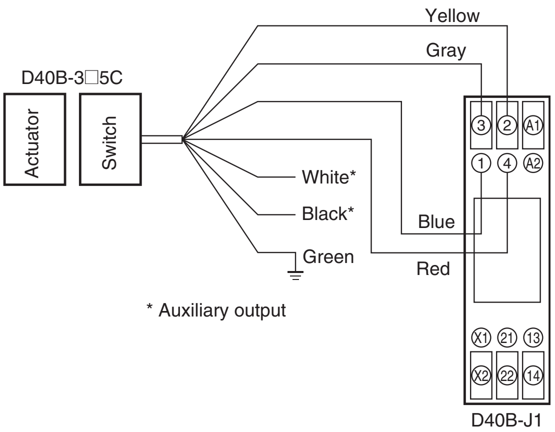
Connection between Standard or Elongated Sensor and 1-pole Controller



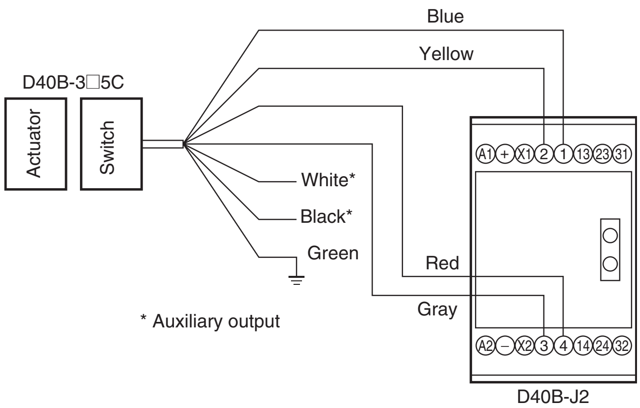
Connection between Standard or Elongated Sensor and 2-pole Controller



Connection between High-temperature Type Sensor and 1-pole Controller



Connection between High-temperature Type Sensor and 2-pole Controller



Safety Precautions

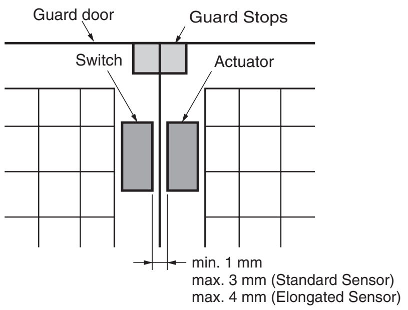
⚠ WARNING

Be sure to turn OFF the power before performing wiring. Do not touch charge parts (e.g., terminals) while power is ON. Doing so may result in electric shock.

Do not allow the actuator to come close to the switch with the door open. Doing so may cause machinery to start operating and may result in injury.

⚠ CAUTION

Use guard stops in the way shown below to ensure that the switch and actuator do not make contact when the guard door is closed.



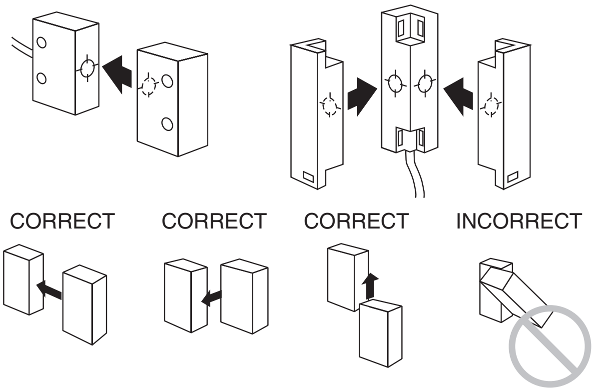
Application Precautions

- Do not use the product in locations subject to explosive or flammable gases.
- Do not use load currents exceeding the rated value.
- Be sure to wire each conductor correctly.
- Be sure to confirm correct operation after completing mounting and adjustment.
- Do not drop or attempt to disassemble the product.
- Be sure to use the correct combination of switch and actuator.
- Use a power supply of the specified voltage. Do not use power supplies with large ripples or power supplies that intermittently generate incorrect voltages.
- Capacitors are consumable and require regular maintenance and inspection.

Precautions for Safe Use

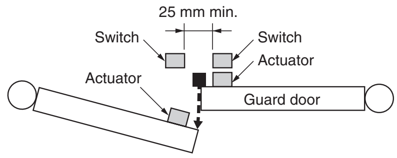
Mounting Direction of Switch and Actuator

The Sensor will not operate properly if the switch and actuator come towards each other diagonally. The Sensor will, however, operate properly if the switch and actuator come towards each other head-on, horizontally or vertically (as long as the faces have the same orientation).



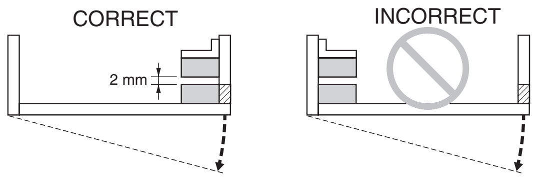
Mutual Interference

If the switch and actuator are mounted in parallel, be sure to separate them by at least 25 mm, as shown below.



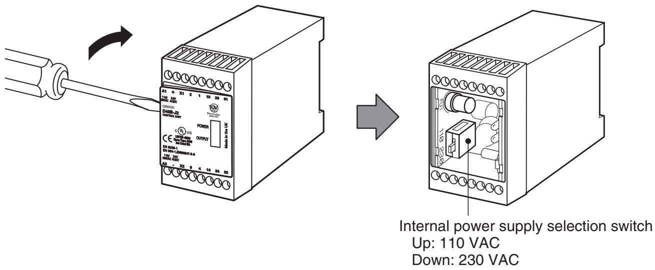
Using for Hinged Doors

On hinged doors, install the Sensor at an opening edge as shown below.



Switching Power Supply Voltage (D40B-J2 Only)

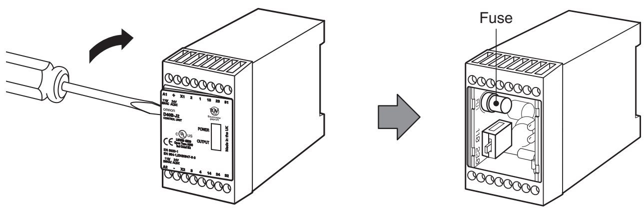
- Turn OFF the power to the Controller.
- Open the Controller's front cover with a flat-bladed screwdriver.
- Change the power supply voltage as required with the internal power supply selection switch. The switch is factory-set to 230 VAC.



Fuse Replacement Method (D40B-J2 Only)

Note: The D40B-J1 has an automatic recovery mechanism and so fuse replacement is not necessary.

- Turn OFF the power to the Controller.
- Open the Controller's front cover with a flat-bladed screwdriver.
- Replace the fuse (D9M-P1). (See page 198.)



Applicable Safety Category (EN954-1)

This product can be used in environments classified as Safety Category 3 according to the requirements of European standard EN954-1. This evaluation, however, is based on circuit configuration examples proposed by OMRON. The standard may not apply in some operating conditions.

The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

Handling

Do not drop the product or subject it to excessive shocks or vibration. Doing so may result in faults or malfunctions.

Solvents

Ensure that solvents, such as alcohol, thinner, trichloroethane, or gasoline do not adhere to the product. Solvents may cause markings to fade and components to deteriorate.

Installation Location

Do not install the product in the following locations. Doing so may result in product failure or malfunction.

- Locations subject to direct sunlight.
- Locations subject to temperatures outside the range 25 to 55 °C.
- Locations subject to humidity levels outside the range 35% to 85% or subject to condensation due to extreme temperature changes.
- Locations subject to corrosive or flammable gases.
- Locations subject to shocks or vibration in excess of the product ratings.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to dust (including iron dust) or salts.

Take appropriate and sufficient countermeasures when using the product in the following locations.

- Locations subject to static electricity or other forms of noise.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supply lines.

Wiring

Perform wiring using wire with the following dimensions.
Stranded wire: 2.5 mm^2
Solid wire: 4.0 mm^2

Tighten the terminal screws with the specified torque. Not doing so may result in malfunction or abnormal heat generation.
Terminal screw tightening torque: 1 N·m

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Miniature Safety-door Hinge Switch

D4NH

New series Safety-door Hinge Switch Designed for sace saving guaring in Machines and safety Equipment

- Lineup includes three contact models with 2NC/1NO and 3NC contacts in addition to the 1NC/1NO, and 2NC versions. Version with MBB contacts meet applications for avdanced requirements.
- M12-connector models are available, saving on labor and simplifying maintenance.
- Standardized gold-clad contacts provide high contact reliability Can be used with both standard loads and micro-loads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.

Be sure to read the “Safety Precautions” on page G-214.

Note: Contact your sales representative for details on models with safety standard certification.

Model Number Structure

D4NH-□□□
1 2 3

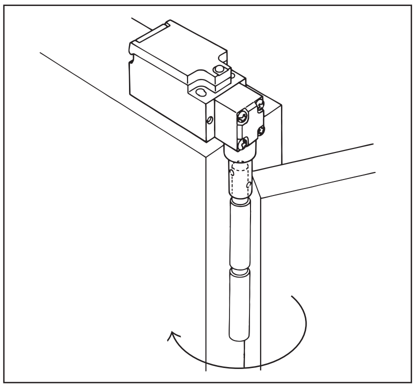
1. Conduit/Connector size
1: Pg13.5 (1-conduit)
2: G1/2 (1-conduit)
3: 1/2-14NPT (1-conduit)
4: M20 (1-conduit)
5: Pg13.5 (2-conduit)
6: G1/2 (2-conduit)
7: 1/2-14NPT (2-conduit)
8: M20 (2-conduit)
9: M12 connector (1-conduit)

2. Built-in Switch
A: 1NC/1NO (slow-action)
B: 2NC (slow-action)
C: 2NC/1NO (slow-action)
D: 3NC (slow-action)
E: 1NC/1NO (MBB contact) (slow-action)
F: 2NC/1NO (MBB contact) (slow-action)

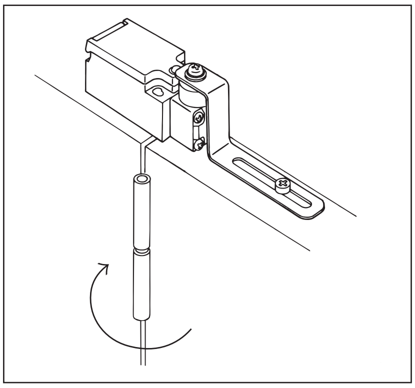
3. Actuator
AS: Shaft
BC: Arm lever

Application Examples (Protective Door Safety Measures)

Shaft Actuator



Arm Lever Actuator



Ordering Information

List of Models

Switches

Actuator	Conduit size		Built-in switch mechanism		
			1NC/1NO (Slow-action)	2NC (Slow-action)	2NC/1NO (Slow-action)
Shaft	1-conduit	Pg13.5	D4NH-1AAS	D4NH-1BAS	D4NH-1CAS
		G1/2	D4NH-2AAS	D4NH-2BAS	D4NH-2CAS
		1/2-14NPT	D4NH-3AAS	D4NH-3BAS	D4NH-3CAS
		M20	D4NH-4AAS	D4NH-4BAS	D4NH-4CAS
		M12 connector	D4NH-9AAS	D4NH-9BAS	---
	2-conduit	Pg13.5	D4NH-5AAS	D4NH-5BAS	D4NH-5CAS
		G1/2	D4NH-6AAS	D4NH-6BAS	D4NH-6CAS
		1/2-14NPT (See note 3.)	D4NH-7AAS	D4NH-7BAS	D4NH-7CAS
		M20	D4NH-8AAS	D4NH-8BAS	D4NH-8CAS
Arm lever	1-conduit	Pg13.5	D4NH-1ABC	D4NH-1BBC	D4NH-1CBC
		G1/2	D4NH-2ABC	D4NH-2BBC	D4NH-2CBC
		1/2-14NPT	D4NH-3ABC	D4NH-3BBC	D4NH-3CBC
		M20	D4NH-4ABC	D4NH-4BBC	D4NH-4CBC
		M12 connector	D4NH-9ABC	D4NH-9BBC	---
	2-conduit	Pg13.5	D4NH-5ABC	D4NH-5BBC	D4NH-5CBC
		G1/2	D4NH-6ABC	D4NH-6BBC	D4NH-6CBC
		1/2-14NPT (See note 3.)	D4NH-7ABC	D4NH-7BBC	D4NH-7CBC
		M20	D4NH-8ABC	D4NH-8BBC	D4NH-8CBC

Actuator	Conduit size		Built-in switch mechanism		
			3NC (Slow-action)	1NC/1NO MBB (Slow-action)	2NC/1NO MBB (Slow-action)
Shaft	1-conduit	Pg13.5	D4NH-1DAS	D4NH-1EAS	D4NH-1FAS
		G1/2	D4NH-2DAS	D4NH-2EAS	D4NH-2FAS
		1/2-14NPT	D4NH-3DAS	D4NH-3EAS	D4NH-3FAS
		M20	D4NH-4DAS	D4NH-4EAS	D4NH-4FAS
		M12 connector	---	D4NH-9EAS	---
	2-conduit	Pg13.5	D4NH-5DAS	D4NH-5EAS	D4NH-5FAS
		G1/2	D4NH-6DAS	D4NH-6EAS	D4NH-6FAS
		1/2-14NPT (See note 3.)	D4NH-7DAS	D4NH-7EAS	D4NH-7FAS
		M20	D4NH-8DAS	D4NH-8EAS	D4NH-8FAS
Arm lever	1-conduit	Pg13.5	D4NH-1DBC	D4NH-1EBC	D4NH-1FBC
		G1/2	D4NH-2DBC	D4NH-2EBC	D4NH-2FBC
		1/2-14NPT	D4NH-3DBC	D4NH-3EBC	D4NH-3FBC
		M20	D4NH-4DBC	D4NH-4EBC	D4NH-4FBC
		M12 connector	---	D4NH-9EBC	---
	2-conduit	Pg13.5	D4NH-5DBC	D4NH-5EBC	D4NH-5FBC
		G1/2	D4NH-6DBC	D4NH-6EBC	D4NH-6FBC
		1/2-14NPT (See note 3.)	D4NH-7DBC	D4NH-7EBC	D4NH-7FBC
		M20	D4NH-8DBC	D4NH-8EBC	D4NH-8FBC

Prefered types

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. All models have slow-action contacts with approved direct opening mechanisms on NC contacts only.

3. The 1/2-14NPT 2-conduit models include an M20-to-1/2-14NPT changing adaptor.

Specifications

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088
  GS-ET-15

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	B03 11 39656 061
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL508, CSA C22.2 No. 14)

A300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Q300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55 A	0.55 A	69 VA	69 VA
250 VDC		0.27 A	0.27 A		

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1)
Durability (See note 4.)	Mechanical	1,000,000 operations min.
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC
Operating speed		2 to 360°/s (See note 6.)
Operating frequency		30 operations/minute max.
Contact resistance		25 mΩ max.
Minimum applicable load (See note 7.)		Resistive load of 1 mA at 5 VDC (N-level reference value)
Rated insulation voltage (U_i)		300 V
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		Level 3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity: 2.5 kV
		Between terminals of different polarities: 4 kV
		Between other terminals and uncharged metallic parts: 6 kV
Insulation resistance		100 MΩ min.
Contact gap		Snap-action: 2 x 9.5 mm min Slow-action: 2 x 2 mm min
Vibration resistance	Malfunction	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	Destruction	1,000 m/s²
	Malfunction	300 m/s²
Conditional short-circuit current		100 A (EN60947-5-1)
Rated open thermal current (I_{th})		10 A (EN60947-5-1)
Ambient temperature		Operating: −30°C to 70°C with no icing
Ambient humidity		Operating: 95% max.
Weight		Approx. 87 g (D4NH-1AAS) Approx. 97 g (D4NH-1ABC)

Note: 1. The values in the table on the previous page are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4NH in places where foreign material such as dust, dirt, oil, water, or chemicals may penetrate through the head. Otherwise, premature wear, Switch damage or malfunctioning may occur.

4. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

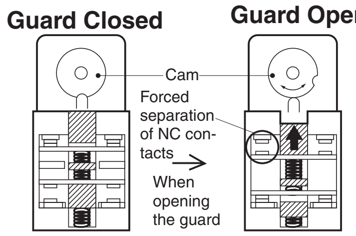
5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

6. For safe use, make sure that the allowable operating speed is not exceeded.

7. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

Structure, Names, and Functions

Structure (D4NH-□□BC)

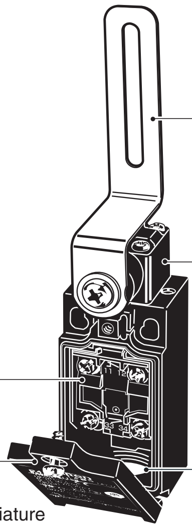


When the guard is opened, the cam that is directly coupled to the shaft rotates to press the Switch in the direction shown by the (vertical) arrow. This action separates the contacts to stop the machine.

Built-in Switch
The built-in switch has a direct opening mechanism that forcibly separates the NC contact even when there is contact deposit.

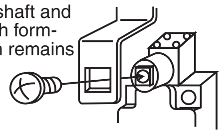
Cover
The cover, with a hinge on its lower part, can be opened by removing the screw of the cover, which ensures ease of maintenance and wiring.

* The housing and head of the D4NH are made of resin. Use D4BS Miniature Electromagnetic Lock Safety Door Limit Switches for applications requiring safety door switches of tough, high-sealing, or oil-resistant construction.



Arm Lever
The arm lever is mounted upwards in the center position before shipping. To change the position, loosen the arm lever mounting screw, dismount the arm lever, and mount the arm lever in the left or right position.

The joint between the shaft and arm lever is formed with form-lock construction which remains secure even when the screw becomes loose.



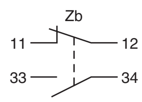
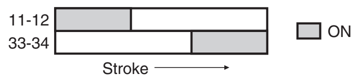
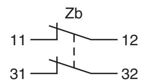
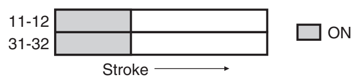
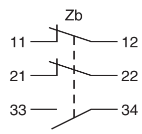
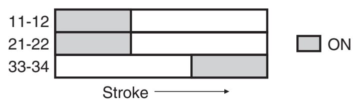
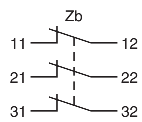
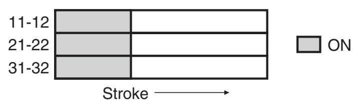
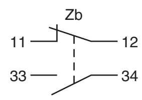
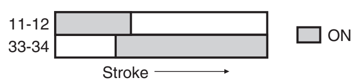
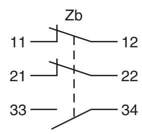
Head
The head can be mounted in four directions.

Conduit
A wide variety of conduits is available.

Size	1-conduit	2-conduit
Pg13.5	Yes	Yes
G1/2	Yes	Yes
1/2-14NPT	Yes	Yes
M20	Yes	Yes
M12 Connector	Yes	---

Note: M12 connector types are not available for Switches with three contacts.

Contact Form

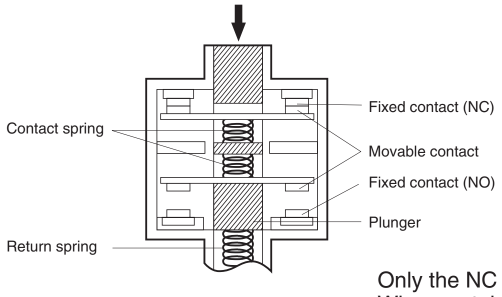
Model	Contact	Contact form	Operating pattern	Remarks
D4NH-□A□	1NC/1NO			Only NC contacts 11-12 have an approved direct opening mechanism. The terminals 11-12 and 33-34 can be used as unlike poles.
D4NH-□B□	2NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. The terminals 11-12 and 31-32 can be used as unlike poles.
D4NH-□C□	2NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4NH-□D□	3NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4NH-□E□	1NC/1NO MBB			Only NC contacts 11-12 have an approved direct opening mechanism. The terminals 11-12 and 33-34 can be used as unlike poles.
D4NH-□F□	2NC/1NO MBB			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

Note: 1. Terminals are numbered according to EN50013. Contact forms are according to EN60947-5-1.

2. MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

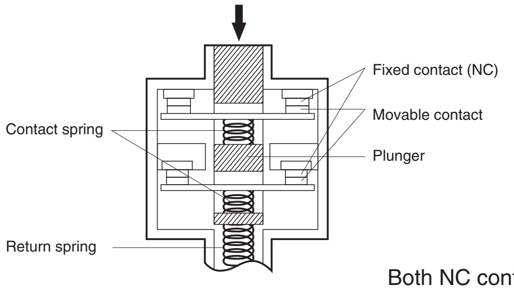
Direct Opening Mechanism

1NC/1NO Contact (Slow-action)



Only the NC contact side has a direct opening mechanism. When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in. (Conforms to EN60947-5-1 Direct Opening Operation.)

2NC Contact (Slow-action)



Both NC contacts have a direct opening mechanism. When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in. (Conforms to EN60947-5-1 Direct Opening Operation.)

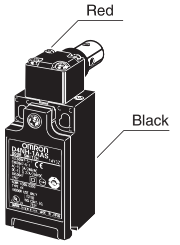
Dimensions

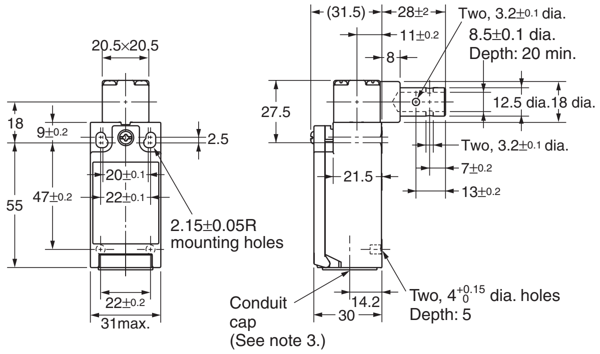
Switches

Note: All units are in millimeters unless otherwise indicated.

Shaft Type with 1 Conduit

D4NH-1□AS D4NH-2□AS
D4NH-3□AS D4NH-4□AS
D4NH-9□AS (See note 4.)

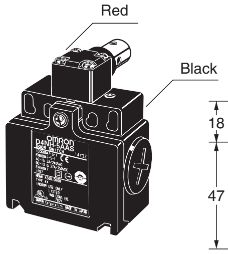


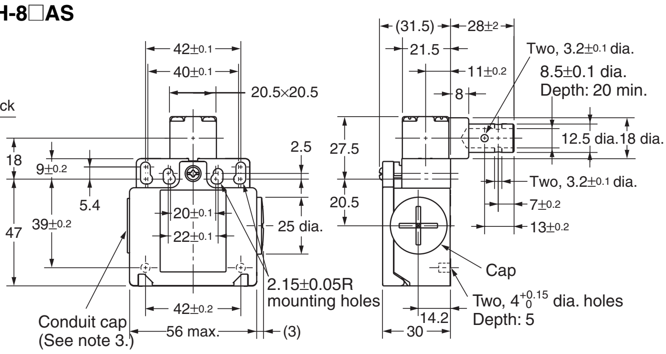


OF max.	0.15 N·m
PT 1 (NC) PT 2 (NO)	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. DOF min.	18° 1 N·m

Shaft Type with 2 Conduits

D4NH-5□AS D4NH-6□AS
D4NH-7□AS D4NH-8□AS



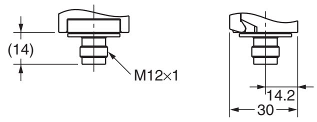


OF max.	0.15 N·m
PT 1 (NC) PT 2 (NO)	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. DOF min.	18° 1 N·m

Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to the following diagram for details on M12 connectors.

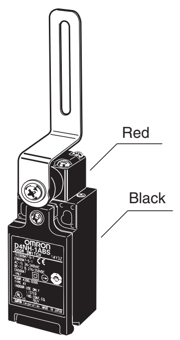
1-conduit M12 Connector

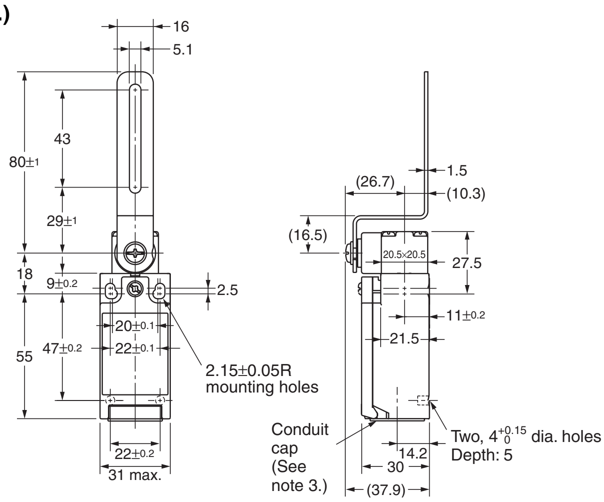
D4NH-9□□□



Arm Lever Type with 1 Conduit

D4NH-1□BC D4NH-2□BC
D4NH-3□BC D4NH-4□BC
D4NH-9□BC (See note 4.)

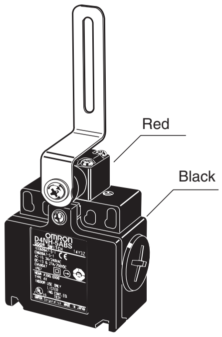


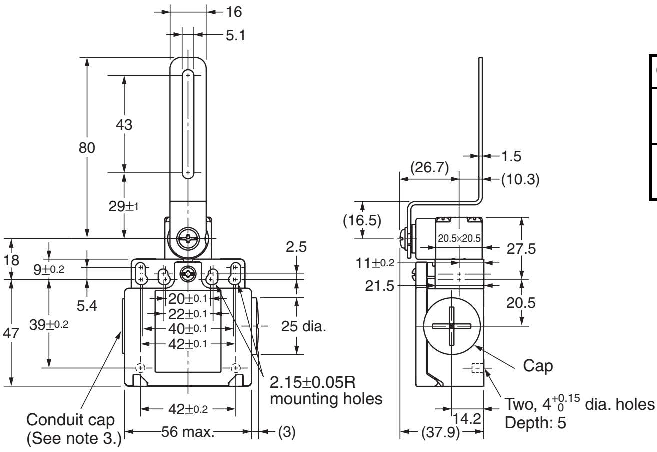


OF max.	0.15 N·m
PT 1 (NC) PT 2 (NO)	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. DOF min.	18° 1 N·m

Arm Lever Type with 2 Conduits

D4NH-5□BC D4NH-6□BC
D4NH-7□BC D4NH-8□BC



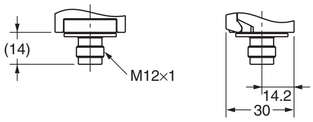


OF max.	0.15 N·m
PT 1 (NC) PT 2 (NO)	(7°) (MBB: 10°) (19°) (MBB: 5°)
DOT min. DOF min.	18° 1 N·m

Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to the following diagram for details on M12 connectors.

1-conduit M12 Connector

D4NH-9□□□

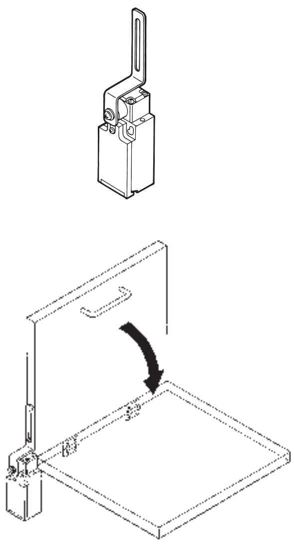


Application Examples of Arm Lever Use

Note: Be sure to evaluate the Switch under actual working conditions after installation.

When Installing at the Center

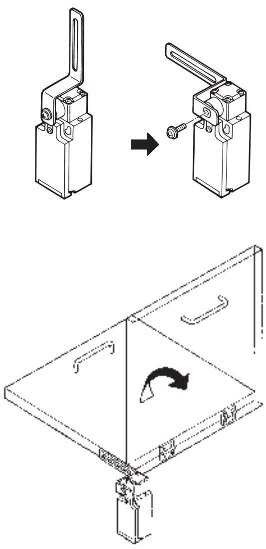
The arm lever is set for center installation at the time of shipment.



Note: Install the arm lever so that it will not rotate more than 90°.

When Installing to the Left

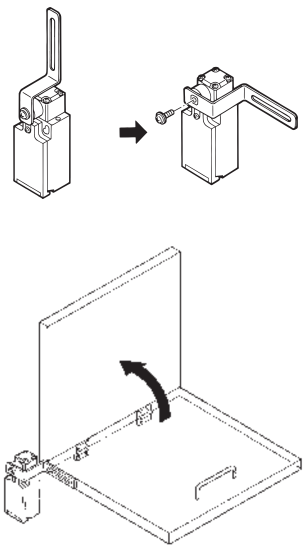
Remove the screw and arm lever, position the arm lever to the left, and then secure it with the screw.



Note: Install the arm lever so that it will not rotate more than 180°.

When Installing to the Right

Remove the screw and arm lever, position the arm lever to the right, and then secure it with the screw.



Note: Install the arm lever so that it will not rotate more than 180°.

Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions for Switches and Safety Limit Switches.

⚠ CAUTION

Do not use metal connectors or metal conduits with this Switch. Doing so may occasionally result in electric shock.

Precautions for Safe Use

- Do not drop the Switch. Doing so may result in the Switch not performing to its full capacity.
- Do not attempt to disassemble or modify the Switch. Doing so may cause the Switch to malfunction.
- Do not use the Switch where explosive gas, flammable gas, or any other hazardous gas may be present.
- Install the Switch in a location away from close body contact. Not doing so may result in malfunction.
- Do not use the Switch submerged in oil or water, or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch interior. (The IP67 degree of protection specification for the Switch refers to water penetration while the Switch is submersed in water for a specified period of time.)
- Protect the head from foreign material. Subjecting the head to foreign material may result in premature wear or damage to the Switch. Although the switch body is protected from penetration by dust or water, the head is not protected from penetration by minute particles or water.
- Turn the power OFF before wiring. Doing so may result in electric shock.
- Install a cover after wiring. Not doing so may result in electric shock.
- Connect a fuse to the Switch in series to protect the Switch from short-circuit damage. Use a fuse with a breaking current 1.5 to 2 times larger than the rated current. To conform to EN ratings, use an IEC60269-compliant 10-A fuse type gI or gG.
- Do not switch circuits for two or more standard loads (250 VAC, 3 A) at the same time. Doing so may adversely affect insulation performance.
- The durability of the Switch is greatly affected by operating conditions. Evaluate the Switch under actual working conditions before permanent installation and use within a number of switching operations that will not adversely affect the Switch's performance.
- Be sure to indicate in the machine manufacturer's instruction manual that the user must not attempt to repair or maintain the Switch and must contact the machine manufacturer for any repairs or maintenance.
- If the Switch is to be used in an emergency stop circuit or in a safety circuit for preventing accidents resulting in injuries or deaths, use a model that has an NC contact equipped with a direct opening mechanism and make sure that the Switch operates in the direct opening mode.

Precautions for Correct Use

Environment

- The Switch is intended for indoor use only.
- Do not use the Switch outdoors. Doing so may cause the Switch to malfunction.
- Do not use the Switch where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) are present or in locations subject to high temperature and humidity. Doing so may result in damage to the Switch caused by contact failure or corrosion.
- Do not use the Switch under any of the following conditions.
  - Locations subject to extreme temperature changes.
  - Locations where high humidity or condensation may occur.
  - Locations subject to excessive vibration.
  - Locations where metal dust, processing waste, oil, or chemicals may penetrate through the protective door.
  - Locations subject to detergents, thinner, or other solvents.

Mounting Method

Mounting Screw Tightening Torque

Tighten each of the screws to the specified torque. Loose screws may result in malfunction of the Switch within a short time.

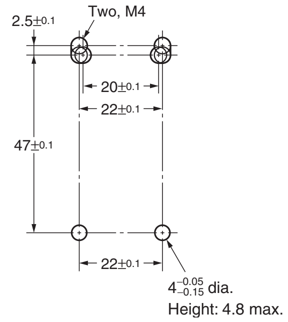
Terminal screw	0.6 to 0.8 N·m
Cover clamping screw	0.5 to 0.7 N·m
Head clamping screw	0.5 to 0.6 N·m
Arm lever clamping screw	1.6 to 1.8 N·m
Body clamping screw	0.5 to 0.7 N·m
Conduit mounting connection, M12 adaptor	1.8 to 2.2 N·m
	1.4 to 1.8 N·m (1/2-14NPT)
Cap screw	1.3 to 1.7 N·m

Switch Mounting

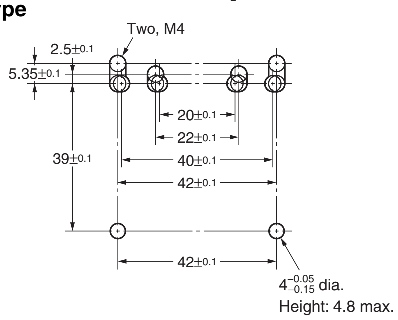
- Mount the Switch using M4 screws and washers and tighten the screws to the specified torque.
- For safety, use screws that cannot be easily removed, or use an equivalent measure to ensure that the Switch is secure.
- Secure the Switch with two M4 bolts and washers. Provide studs with a diameter of $4^{-0.05}/_{-0.15}$ and a height of 4.8 mm max. at two places, inserting into the holes at the bottom of the Switch as shown below so that the Switch is firmly fixed at four points.

Switch Mounting Holes

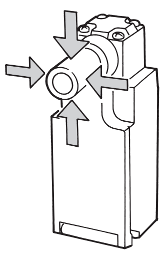
One-conduit Type



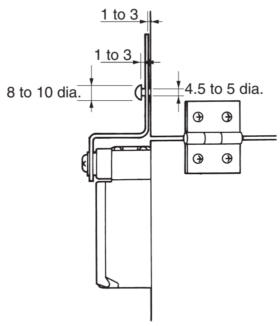
Two-conduit Type



- Mount the shaft or arm lever securely with a one-way screw, or an equivalent so that the shaft or arm lever cannot be easily removed.
- Align the rotational center of the shaft with the door, so that the switch shaft and head will not be subjected to mechanical stress when the door opens or closes.
  Do not impose a force of 50 N or more on the shaft.



Be sure that the arm lever and door are mounted as shown in the following diagram so that the arm lever and head are not subjected to mechanical stress when the door opens or closes.



Changing the Head Direction

By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions. Be sure that no foreign material will enter the head during a change in direction.

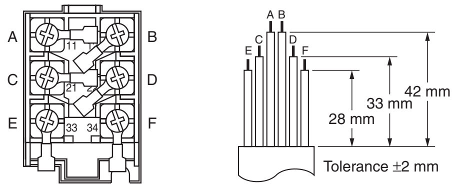
Arm Lever Mounting Position

The arm lever is mounted upwards in the center position before shipping. To change the position, loosen the arm lever mounting screw, dismount the arm lever, and mount the arm lever in the left or right position.

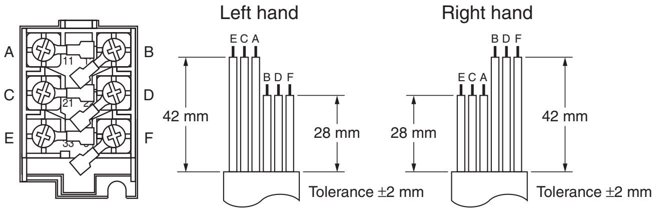
Wiring

- When connecting to the terminals via insulating tube and M3.5 crimp terminals, arrange the crimp terminals as shown below so that they do not rise up onto the case or the cover. Applicable lead wire size: AWG20 to AWG18 (0.5 to 0.75 mm^2).
  Use lead wires of an appropriate length, as shown below. Not doing so may result in excess length causing the cover to rise and not fit properly.

One-conduit Type (3 Poles)



Two-conduit Type (3 Poles)

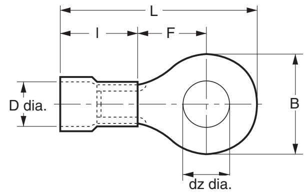


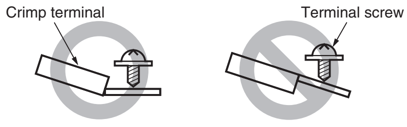
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG20 (0.5 mm^2)

J.S.T is a Japanese manufacturer.

t: 0.5 mm
dz dia.: 3.7 mm
D dia.: 2.9 mm
B: 6.6 mm
L: 19 mm
F: 7.7 mm
I: 8.0 mm



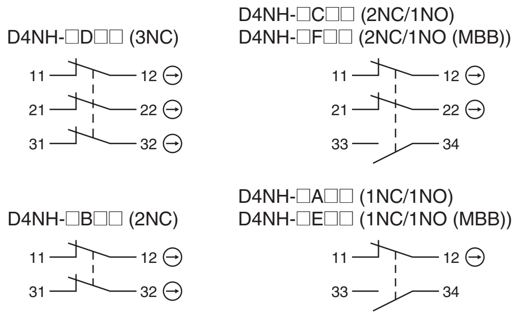


Correct **Incorrect**

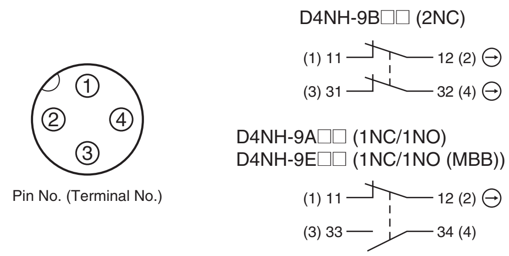
Contact Arrangement

- The following diagrams show the contact arrangements used for screw terminal types and connector types.

Screw Terminal Type



Connector Type



- Applicable socket: XS2F (OMRON).
- Refer to the G010 *Connector Catalog* for details on socket pin numbers and lead wire colors.

Socket Tightening (Connector Type)

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection (IP67) may not be maintained and vibration may loosen the socket connector.

Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.
- When using 1/2-14NPT, wind sealing tape around the joint between the connector and conduit opening so that the enclosure will conform to IP67.
- Use a cable with a suitable diameter for the connector.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. Tighten the conduit cap to the specified torque. The conduit cap is provided with the Switch (2-conduit types).

Recommended Connectors

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended connectors to ensure conformance to IP67.

Size	Manufacturer	Model	Applicable cable diameter
G1/2	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	ST-13.5 5301-5030	6.0 to 12.0 mm
M20	LAPP	ST-M20 × 1.5 5311-1020	7.0 to 13.0 mm
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
M12	LAPP	ST-M12 × 1.5 5311-1000	3.5 to 7.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque. Seal packing is sold separately.

LAPP is a German manufacturer. Ohm Denki is a Japanese manufacturer.

Before using an M12 type, attaching the provided changing adaptor to the Switch and then connect the recommended connector.

Before using a 2-conduit 1/2-14NPT type, attach the provided changing adaptor to the Switch and then connect the recommended connector.

Storage

Do not store the Switch in locations where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) or dust is present, or in locations subject to high temperatures and humidity.

Others

- Do not allow the load current to exceed the rated value.
- Confirm that the seal rubber has no defects before use.
  If the seal rubber is displaced or raised, or has foreign particles adhered to it, the sealing capability of the seal rubber will be adversely affected.
- Use the correct cover mounting screws only, or the sealing capability of the seal rubber will deteriorate.
- Inspect the Switch regularly.
- Use the following recommended countermeasures to prevent telegraphing when using adjustable or long levers.

1. Make the rear edge of the dog smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
2. Design the circuit so that no error signal will be generated.
3. Use or set a Switch that is operated in one direction only.

Production Termination

Following the release of the D4NH, production of the D4DH will be terminated.

Date of Production Termination

Production of the D4DH Series will be terminated in March 2006.

Product Replacement

1. Dimensions
   The D4DH and D4NH use the same mounting method, and mounting hole. The multi-contact structure and the extra 4 mm in length, however, are different.
2. Terminal Numbers
   For the 2-contact model, the terminals 21, 22, 23, and 24 on the D4DH are 31, 32, 33, and 34 on the D4NH.
3. Recommended Terminals
   If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

Comparison of the D4DH and Substitute Products

Model	D4NH
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Completely compatible
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

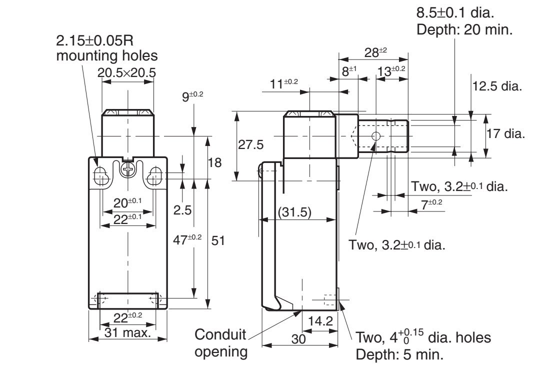
List of Recommended Substitute Products

Using M screws is recommended to comply with European standards. Therefore, the M20 conduit model is recommended for use in new designs.

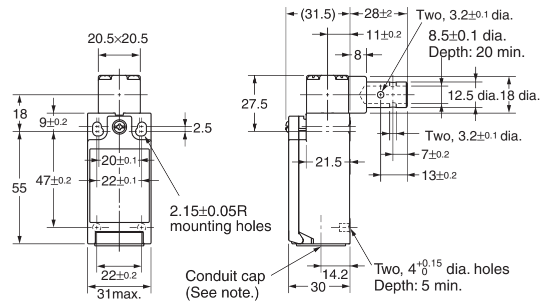
D4DH product to be discontinued	Recommended substitute product	D4DH product to be discontinued	Recommended substitute product
D4DH-15AS	D4NH-1AAS	D4DH-1AAS	D4NH-1BAS
D4DH-25AS	D4NH-2AAS	D4DH-2AAS	D4NH-2BAS
D4DH-35AS	D4NH-3AAS	D4DH-3AAS	D4NH-3BAS
D4DH-55AS	D4NH-5AAS	D4DH-5AAS	D4NH-5BAS
D4DH-65AS	D4NH-6AAS	D4DH-6AAS	D4NH-6BAS
D4DH-15BC	D4NH-1ABC	D4DH-1ABC	D4NH-1BBC
D4DH-25BC	D4NH-2ABC	D4DH-2ABC	D4NH-2BBC
D4DH-35BC	D4NH-3ABC	D4DH-3ABC	D4NH-3BBC
D4DH-55BC	D4NH-5ABC	D4DH-5ABC	D4NH-5BBC
D4DH-65BC	D4NH-6ABC	D4DH-6ABC	D4NH-6BBC

Dimensions (Unit: mm)

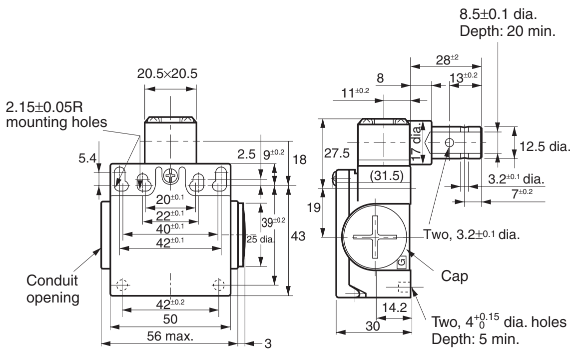
Discontinued Models (1-conduit D4DH)



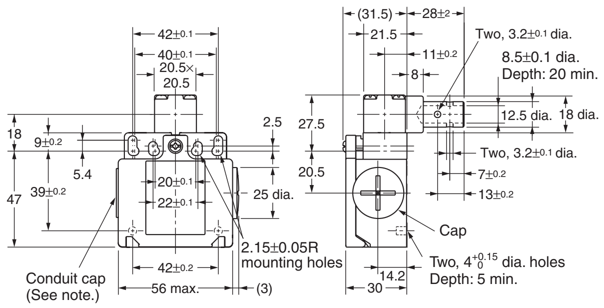
Replacement Products (1-conduit D4NH)



Discontinued Models (2-conduit D4DH)



Replacement Products (2-conduit D4NH)



D4NH

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

Miniature Safety Limit Switch

D4N

Safety Limit Switches compatible to the Popular D4D, Providing a Full Lineup Conforming to International Standards

Note: Contact your sales representative for details on models with safety standard certification.

- Lineup includes three contact models with 2NC/1NO and 3NC in addition to the 1NC/1NO, and 2NC contact models. Models with MBB contacts are available too.
- M12-connector models are available, saving on labor and simplifying maintenance.
- Standardized gold-clad contacts provide high contact reliability.
  Can be used with both standard loads and microloads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.
- Conforms to EN115 and EN81-1.
- Lineup includes both slow-action and snap-action models with Zb contacts.

Be sure to read the *Safety Precautions* on page G-237.

Model Number Structure

Model Number Legend

D4N-□□□□
1 2 3

1. Conduit/Connector size
1: Pg13.5 (1-conduit)
2: G1/2 (1-conduit)
3: 1/2-14NPT (1-conduit)
4: M20 (1-conduit)
5: Pg13.5 (2-conduit)
6: G1/2 (2-conduit)
7: 1/2-14NPT (2-conduit)
8: M20 (2-conduit)
9: M12 connector (1-conduit)

2. Built-in Switch
1: 1NC/1NO (snap-action)
2: 2NC (snap-action)
A: 1NC/1NO (slow-action)
B: 2NC (slow-action)
C: 2NC/1NO (slow-action)
D: 3NC (slow-action)
E: 1NC/1NO (MBB contact-/-slow-action)
F: 2NC/1NO (MBB contact-/-slow-action)

3. Head and Actuator
20: Roller lever (resin lever, resin roller)
22: Roller lever (metal lever, resin roller)
25: Roller lever (metal lever, metal roller)
26: Roller lever (metal lever, bearing roller)
2G: Adjustable roller lever, form lock (metal lever, resin roller)
2H: Adjustable roller lever, form lock (metal lever, rubber roller)
31: Top plunger
32: Top roller plunger
62: One-way roller arm lever (horizontal)
72: One-way roller arm lever (vertical)
80: Cat whisker
87: Plastic rod
RE: Fork lever lock (right operation)
LE: Fork lever lock (left operation)

Ordering Information

List of Models

Switches with Two Contacts

Actuator	Conduit size		Built-in switch mechanism							
			1NC/1NO (Snap-action)		2NC (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Roller lever (resin lever, resin roller)	1-conduit	Pg13.5		D4N-1120		D4N-1220		D4N-1A20		D4N-1B20
		G1/2		D4N-2120		D4N-2220		D4N-2A20		D4N-2B20
		1/2-14NPT		D4N-3120		D4N-3220		D4N-3A20		D4N-3B20
		M20		D4N-4120		D4N-4220		D4N-4A20		D4N-4B20
		M12 connector		D4N-9120		D4N-9220		D4N-9A20		D4N-9B20
	2-conduit	Pg13.5		D4N-5120		D4N-5220		D4N-5A20		D4N-5B20
		G1/2		D4N-6120		D4N-6220		D4N-6A20		D4N-6B20
		M20		D4N-8120		D4N-8220		D4N-8A20		D4N-8B20
Roller lever (metal lever, resin roller)	1-conduit	Pg13.5		D4N-1122		D4N-1222		D4N-1A22		D4N-1B22
		G1/2		D4N-2122		D4N-2222		D4N-2A22		D4N-2B22
		1/2-14NPT		D4N-3122		D4N-3222		D4N-3A22		D4N-3B22
		M20		D4N-4122		D4N-4222		D4N-4A22		D4N-4B22
		M12 connector		D4N-9122		D4N-9222		D4N-9A22		D4N-9B22
	2-conduit	Pg13.5		D4N-5122		D4N-5222		D4N-5A22		D4N-5B22
		G1/2		D4N-6122		D4N-6222		D4N-6A22		D4N-6B22
		M20		D4N-8122		D4N-8222		D4N-8A22		D4N-8B22
Roller lever (metal lever, metal roller)	1-conduit	Pg13.5		D4N-1125		D4N-1225		D4N-1A25		D4N-1B25
		G1/2		D4N-2125		D4N-2225		D4N-2A25		D4N-2B25
		1/2-14NPT		D4N-3125		D4N-3225		D4N-3A25		D4N-3B25
		M20		D4N-4125		D4N-4225		D4N-4A25		D4N-4B25
		M12 connector		D4N-9125		D4N-9225		D4N-9A25		D4N-9B25
Roller lever (metal lever, bearing roller)	1-conduit	Pg13.5		D4N-1126		D4N-1226		D4N-1A26		D4N-1B26
		G1/2		D4N-2126		D4N-2226		D4N-2A26		D4N-2B26
		1/2-14NPT		D4N-3126		D4N-3226		D4N-3A26		D4N-3B26
		M20		D4N-4126		D4N-4226		D4N-4A26		D4N-4B26
		M12 connector		D4N-9126		D4N-9226		D4N-9A26		D4N-9B26
Plunger	1-conduit	Pg13.5		D4N-1131		D4N-1231		D4N-1A31		D4N-1B31
		G1/2		D4N-2131		D4N-2231		D4N-2A31		D4N-2B31
		1/2-14NPT		D4N-3131		D4N-3231		D4N-3A31		D4N-3B31
		M20		D4N-4131		D4N-4231		D4N-4A31		D4N-4B31
		M12 connector		D4N-9131		D4N-9231		D4N-9A31		D4N-9B31
	2-conduit	Pg13.5		D4N-5131		D4N-5231		D4N-5A31		D4N-5B31
		G1/2		D4N-6131		D4N-6231		D4N-6A31		D4N-6B31
		M20		D4N-8131		D4N-8231		D4N-8A31		D4N-8B31
Roller plunger	1-conduit	Pg13.5		D4N-1132		D4N-1232		D4N-1A32		D4N-1B32
		G1/2		D4N-2132		D4N-2232		D4N-2A32		D4N-2B32
		1/2-14NPT		D4N-3132		D4N-3232		D4N-3A32		D4N-3B32
		M20		D4N-4132		D4N-4232		D4N-4A32		D4N-4B32
		M12 connector		D4N-9132		D4N-9232		D4N-9A32		D4N-9B32
	2-conduit	Pg13.5		D4N-5132		D4N-5232		D4N-5A32		D4N-5B32
		G1/2		D4N-6132		D4N-6232		D4N-6A32		D4N-6B32
		M20		D4N-8132		D4N-8232		D4N-8A32		D4N-8B32
One-way roller arm lever (horizontal)	1-conduit	Pg13.5		D4N-1162		D4N-1262		D4N-1A62		D4N-1B62
		G1/2		D4N-2162		D4N-2262		D4N-2A62		D4N-2B62
		1/2-14NPT		D4N-3162		D4N-3262		D4N-3A62		D4N-3B62
		M20		D4N-4162		D4N-4262		D4N-4A62		D4N-4B62
		M12 connector		D4N-9162		D4N-9262		D4N-9A62		D4N-9B62
	2-conduit	Pg13.5		D4N-5162		D4N-5262		D4N-5A62		D4N-5B62
		G1/2		D4N-6162		D4N-6262		D4N-6A62		D4N-6B62
		M20		D4N-8162		D4N-8262		D4N-8A62		D4N-8B62

Prefered types

Actuator	Conduit size		Built-in switch mechanism							
			1NC/1NO (Snap-action)		2NC (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
One-way roller arm lever (vertical) 	1-conduit	Pg13.5		D4N-1172		D4N-1272		D4N-1A72		D4N-1B72
		G1/2		D4N-2172		D4N-2272		D4N-2A72		D4N-2B72
		1/2-14NPT		D4N-3172		D4N-3272		D4N-3A72		D4N-3B72
		M20		D4N-4172		D4N-4272		D4N-4A72		D4N-4B72
		M12 connector		D4N-9172		D4N-9272		D4N-9A72		D4N-9B72
	2-conduit	Pg13.5		D4N-5172		D4N-5272		D4N-5A72		D4N-5B72
		G1/2		D4N-6172		D4N-6272		D4N-6A72		D4N-6B72
		M20		D4N-8172		D4N-8272		D4N-8A72		D4N-8B72
Adjustable roller lever, form lock (metal lever, resin roller) 	1-conduit	Pg13.5		D4N-112G		D4N-122G		D4N-1A2G		D4N-1B2G
		G1/2		D4N-212G		D4N-222G		D4N-2A2G		D4N-2B2G
		1/2-14NPT		D4N-312G		D4N-322G		D4N-3A2G		D4N-3B2G
		M20		D4N-412G		D4N-422G		D4N-4A2G		D4N-4B2G
		M12 connector		D4N-912G		D4N-922G		D4N-9A2G		D4N-9B2G
	2-conduit	G1/2		D4N-612G		D4N-622G		D4N-6A2G		D4N-6B2G
		M20		D4N-812G		D4N-822G		D4N-8A2G		D4N-8B2G
Adjustable roller lever, form lock (metal lever, rubber roller) 	1-conduit	Pg13.5		D4N-112H		D4N-122H		D4N-1A2H		D4N-1B2H
		G1/2		D4N-212H		D4N-222H		D4N-2A2H		D4N-2B2H
		1/2-14NPT		D4N-312H		D4N-322H		D4N-3A2H		D4N-3B2H
		M20		D4N-412H		D4N-422H		D4N-4A2H		D4N-4B2H
		M12 connector		D4N-912H		D4N-922H		D4N-9A2H		D4N-9B2H
	2-conduit	G1/2		D4N-612H		D4N-622H		D4N-6A2H		D4N-6B2H
		M20		D4N-812H		D4N-822H		D4N-8A2H		D4N-8B2H

Prefered types

Note: It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

Switches with Three Contacts and MBB Contacts

Actuator	Conduit size		Built-in switch mechanism							
			2NC/1NO (Snap-action)		3NC (Snap-action)		1NC/1NO MBB (Slow-action)		2NC/1NO MBB (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Roller lever (resin lever, resin roller) 	1-conduit	Pg13.5		D4N-1C20		D4N-1D20		D4N-1E20		D4N-1F20
		G1/2		D4N-2C20		D4N-2D20		D4N-2E20		D4N-2F20
		1/2-14NPT		D4N-3C20		D4N-3D20		D4N-3E20		D4N-3F20
		M20		D4N-4C20		D4N-4D20		D4N-4E20		D4N-4F20
		M12 connector		---		---		D4N-9E20		---
	2-conduit	Pg13.5		D4N-5C20		D4N-5D20		D4N-5E20		D4N-5F20
		G1/2		D4N-6C20		D4N-6D20		D4N-6E20		D4N-6F20
		M20		D4N-8C20		D4N-8D20		D4N-8E20		D4N-8F20
Roller lever (metal lever, resin roller) 	1-conduit	Pg13.5		D4N-1C22		D4N-1D22		D4N-1E22		D4N-1F22
		G1/2		D4N-2C22		D4N-2D22		D4N-2E22		D4N-2F22
		1/2-14NPT		D4N-3C22		D4N-3D22		D4N-3E22		D4N-3F22
		M20		D4N-4C22		D4N-4D22		D4N-4E22		D4N-4F22
		M12 connector		---		---		D4N-9E22		---
	2-conduit	Pg13.5		D4N-5C22		D4N-5D22		D4N-5E22		D4N-5F22
		G1/2		D4N-6C22		D4N-6D22		D4N-6E22		D4N-6F22
		M20		D4N-8C22		D4N-8D22		D4N-8E22		D4N-8F22
Roller lever (metal lever, metal roller) 	1-conduit	Pg13.5		D4N-1C25		D4N-1D25		D4N-1E25		D4N-1F25
		G1/2		D4N-2C25		D4N-2D25		D4N-2E25		D4N-2F25
		1/2-14NPT		D4N-3C25		D4N-3D25		D4N-3E25		D4N-3F25
		M20		D4N-4C25		D4N-4D25		D4N-4E25		D4N-4F25
		M12 connector		---		---		D4N-9E25		---

Prefered types

D4N

Actuator	Conduit size		Built-in switch mechanism							
			2NC/1NO (Snap-action)		3NC (Snap-action)		1NC/1NO MBB (Slow-action)		2NC/1NO MBB (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Roller lever (metal lever, bearing roller)	1-conduit	Pg13.5		D4N-1C26		D4N-1D26		D4N-1E26		D4N-1F26
		G1/2		D4N-2C26		D4N-2D26		D4N-2E26		D4N-2F26
		1/2-14NPT		D4N-3C26		D4N-3D26		D4N-3E26		D4N-3F26
		M20		D4N-4C26		D4N-4D26		D4N-4E26		D4N-4F26
		M12 connector		---		---		D4N-9E26		---
Plunger	1-conduit	Pg13.5		D4N-1C31		D4N-1D31		D4N-1E31		D4N-1F31
		G1/2		D4N-2C31		D4N-2D31		D4N-2E31		D4N-2F31
		1/2-14NPT		D4N-3C31		D4N-3D31		D4N-3E31		D4N-3F31
		M20		D4N-4C31		D4N-4D31		D4N-4E31		D4N-4F31
		M12 connector		---		---		D4N-9E31		---
	2-conduit	Pg13.5		D4N-5C31		D4N-5D31		D4N-5E31		D4N-5F31
		G1/2		D4N-6C31		D4N-6D31		D4N-6E31		D4N-6F31
		M20		D4N-8C31		D4N-8D31		D4N-8E31		D4N-8F31
Roller plunger	1-conduit	Pg13.5		D4N-1C32		D4N-1D32		D4N-1E32		D4N-1F32
		G1/2		D4N-2C32		D4N-2D32		D4N-2E32		D4N-2F32
		1/2-14NPT		D4N-3C32		D4N-3D32		D4N-3E32		D4N-3F32
		M20		D4N-4C32		D4N-4D32		D4N-4E32		D4N-4F32
		M12 connector		---		---		D4N-9E32		---
	2-conduit	Pg13.5		D4N-5C32		D4N-5D32		D4N-5E32		D4N-5F32
		G1/2		D4N-6C32		D4N-6D32		D4N-6E32		D4N-6F32
		M20		D4N-8C32		D4N-8D32		D4N-8E32		D4N-8F32
One-way roller arm lever (horizontal)	1-conduit	Pg13.5		D4N-1C62		D4N-1D62		D4N-1E62		D4N-1F62
		G1/2		D4N-2C62		D4N-2D62		D4N-2E62		D4N-2F62
		1/2-14NPT		D4N-3C62		D4N-3D62		D4N-3E62		D4N-3F62
		M20		D4N-4C62		D4N-4D62		D4N-4E62		D4N-4F62
		M12 connector		---		---		D4N-9E62		----
	2-conduit	Pg13.5		D4N-5C62		D4N-5D62		D4N-5E62		D4N-5F62
		G1/2		D4N-6C62		D4N-6D62		D4N-6E62		D4N-6F62
		M20		D4N-8C62		D4N-8D62		D4N-8E62		D4N-8F62
One-way roller arm lever (vertical)	1-conduit	Pg13.5		D4N-1C72		D4N-1D72		D4N-1E72		D4N-1F72
		G1/2		D4N-2C72		D4N-2D72		D4N-2E72		D4N-2F72
		1/2-14NPT		D4N-3C72		D4N-3D72		D4N-3E72		D4N-3F72
		M20		D4N-4C72		D4N-4D72		D4N-4E72		D4N-4F72
		M12 connector		---		---		D4N-9E72		---
	2-conduit	Pg13.5		D4N-5C72		D4N-5D72		D4N-5E72		D4N-5F72
		G1/2		D4N-6C72		D4N-6D72		D4N-6E72		D4N-6F72
		M20		D4N-8C72		D4N-8D72		D4N-8E72		D4N-8F72
Adjustable roller lever, form lock (metal lever, resin roller)	1-conduit	Pg13.5		D4N-1C2G		D4N-1D2G		D4N-1E2G		D4N-1F2G
		G1/2		D4N-2C2G		D4N-2D2G		D4N-2E2G		D4N-2F2G
		1/2-14NPT		D4N-3C2G		D4N-3D2G		D4N-3E2G		D4N-3F2G
		M20		D4N-4C2G		D4N-4D2G		D4N-4E2G		D4N-4F2G
		M12 connector		---		---		D4N-9E2G		---
	2-conduit	G1/2		D4N-6C2G		D4N-6D2G		D4N-6E2G		D4N-6F2G
		M20		D4N-8C2G		D4N-8D2G		D4N-8E2G		D4N-8F2G
Adjustable roller lever, form lock (metal lever, rubber roller)	1-conduit	Pg13.5		D4N-1C2H		D4N-1D2H		D4N-1E2H		D4N-1F2H
		G1/2		D4N-2C2H		D4N-2D2H		D4N-2E2H		D4N-2F2H
		1/2-14NPT		D4N-3C2H		D4N-3D2H		D4N-3E2H		D4N-3F2H
		M20		D4N-4C2H		D4N-4D2H		D4N-4E2H		D4N-4F2H
		M12 connector		---		---		D4N-9E2H		---
	2-conduit	G1/2		D4N-6C2H		D4N-6D2H		D4N-6E2H		D4N-6F2H
		M20		D4N-8C2H		D4N-8D2H		D4N-8E2H		D4N-8F2H

Prefered types

Note: It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

General-purpose Switches with Two Contacts

Actuator	Conduit size		Built-in switch mechanism							
			1NC/1NO (Snap-action)		2NC (Snap-action)		1NC/1NO (Slow-action)		2NC (Slow-action)	
			Direct opening	Model	Direct opening	Model	Direct opening	Model	Direct opening	Model
Fork lever lock (right operation)	1-conduit	G1/2	---	---	---	---	---	D4N-2ARE	---	D4N-2BRE
		1/2-14NPT						D4N-3ARE		D4N-3BRE
		M20						D4N-4ARE		D4N-4BRE
	2-conduit	G1/2	---		---		---	D4N-6ARE	---	D4N-6BRE
		M20						D4N-8ARE		D4N-8BRE
Fork lever lock (left operation)	1-conduit	G1/2	---		---		---	D4N-2ALE	---	D4N-2BLE
		1/2-14NPT						D4N-3ALE		D4N-3BLE
		M20						D4N-4ALE		D4N-4BLE
	2-conduit	G1/2	---		---		---	D4N-6ALE	---	D4N-6BLE
		M20						D4N-8ALE		D4N-8BLE
Cat whisker	1-conduit	G1/2	---	D4N-2180	---	D4N-2280	---	---	---	D4N-2B80
		1/2-14NPT		D4N-3180		D4N-3280				D4N-3B80
		M20		D4N-4180		D4N-4280				D4N-4B80
	2-conduit	G1/2	---	D4N-6180	---	D4N-6280	---		---	D4N-6B80
		M20		D4N-8180		D4N-8280				D4N-8B80
Plastic rod	1-conduit	G1/2	---	D4N-2187	---	D4N-2287	---		---	D4N-2B87
		1/2-14NPT		D4N-3187		D4N-3287				D4N-3B87
		M20		D4N-4187		D4N-4287				D4N-4B87
	2-conduit	G1/2	---	D4N-6187	---	D4N-6287	---		---	D4N-6B87
		M20		D4N-8187		D4N-8287				D4N-8B87

Prefered types

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. Mechanically speaking, these models are basic limit switches.

WARNING

Do not use general purpose switch models for applications that require form lock for safety reasons

D4N

General-purpose Switches with Three Contacts and MBB Contacts

Actuator	Conduit size		Built-in switch mechanism							
			Direct opening	2NC/1NO (Slow-action)	Direct opening	3NC (Slow-action)	Direct opening	1NC/1NO MBB (Slow-action)	Direct opening	2NC/1NO MBB (Slow-action)
Fork lever lock (right operation) 	1-conduit	G1/2	---	D4N-2CRE	---	D4N-2DRE	---	D4N-2ERE	---	D4N-2FRE
		1/2-14NPT		D4N-3CRE		D4N-3DRE		D4N-3ERE		D4N-3FRE
		M20		D4N-4CRE		D4N-4DRE		D4N-4ERE		D4N-4FRE
	2-conduit	G1/2	---	D4N-6CRE	---	D4N-6DRE	---	D4N-6ERE	---	D4N-6FRE
		M20		D4N-8CRE		D4N-8DRE		D4N-8ERE		D4N-8FRE
Fork lever lock (left operation) 	1-conduit	G1/2	---	D4N-2CLE	---	D4N-2DLE	---	D4N-2ELE	---	D4N-2FLE
		1/2-14NPT		D4N-3CLE		D4N-3DLE		D4N-3ELE		D4N-3FLE
		M20		D4N-4CLE		D4N-4DLE		D4N-4ELE		D4N-4FLE
	2-conduit	G1/2	---	D4N-6CLE	---	D4N-6DLE	---	D4N-6ELE	---	D4N-6FLE
		M20		D4N-8CLE		D4N-8DLE		D4N-8ELE		D4N-8FLE
Cat whisker 	1-conduit	G1/2	---	---	---	D4N-2D80	---	---	---	---
		1/2-14NPT				D4N-3D80				
		M20				D4N-4D80				
	2-conduit	G1/2	---		---	D4N-6D80	---		---	
		M20				D4N-8D80				
Plastic rod 	1-conduit	G1/2	---		---	D4N-2D87	---		---	
		1/2-14NPT				D4N-3D87				
		M20				D4N-4D87				
	2-conduit	G1/2	---		---	D4N-6D87	---		---	
		M20				D4N-8D87				

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. Mechanically speaking, these models are basic limit switches.

⚠ WARNING

Do not use general purpose switch models for applications that require form lock for safety reasons

Specifications

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088 (slow-action models only)
  GS-ET-15

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	B03 11 39656 061
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL508, CSA C22.2 No. 14)

A300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Q300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55 A	0.55 A	69 VA	69 VA
250 VDC		0.27 A	0.27 A		

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1)
Durability (See note 4.)	**Mechanical**	15,000,000 operations min. (See note 7.)
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC
Operating speed		1 mm/s to 0.5 m/s (D4-1120)
Operating frequency		30 operations/minute max.
Contact resistance		25 mΩ max.
Minimum applicable load (See note 6.)		Resistive load of 1 mA at 5 VDC (N-level reference value)
Rated insulation voltage (U_i)		300 V
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		Level 3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity: 2.5 kV
		Between terminals of different polarities: 4 kV
		Between other terminals and uncharged metallic parts : 6 kV
Insulation resistance		100 MΩ min.
Contact gap		Snap-action: 2 x 0.5 mm min Slow-action: 2 x 2 mm min
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	**Destruction**	1,000 m/s^2 min.
	Malfunction	300 m/s^2 min.
Conditional short-circuit current		100 A (EN60947-5-1)
Rated open thermal current (I_{th})		10 A (EN60947-5-1)
Ambient temperature		Operating: −30°C to 70°C with no icing
Ambient humidity		Operating: 95% max.
Weight		Approx. 82 g (D4N-1120) Approx. 99 g (D4N-5120)

Note: 1. The above values are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4N in places where foreign material such as dust, dirt, oil, water, or chemicals may penetrate through the head. Otherwise, premature wear, Switch damage or malfunctioning may occur.

4. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

6. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

7. The mechanical durability of fork lever lock models is 10,000,000 operations min.

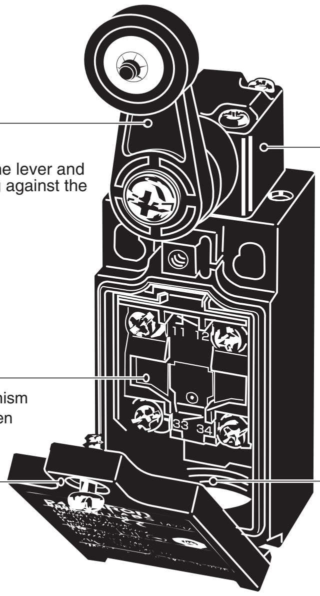
Structure, Names, and Functions

Structure

Safety-oriented Lever Setting (Form-lock construction)
Grooves which engage the lever are cut in the lever and rotary shaft to prevent the lever from slipping against the rotary shaft.
There are resin-lever and metal-lever types.

Built-in Switch
The built-in switch has a direct opening mechanism that forcibly separates the NC contact even when there is contact deposit.

Cover
The cover, with a hinge on its lower part, can be opened by removing the screw of the cover, which ensures ease of maintenance and wiring.



Head
The direction of the switch head can be varied to any of the four directions. (Roller plunger models can be mounted in either of two directions at a 90˚ angle.)

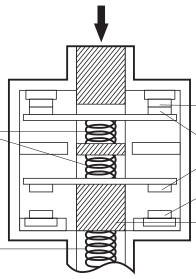
Conduit Opening
A wide variety of conduits is available.

Size	1-conduit	2-conduit
Pg13.5	Yes	Yes
G1/2	Yes	Yes
1/2-14NPT	Yes	Yes
M20	Yes	Yes
M12 connector	Yes	---

Note: M12 connector types are not available for Switches with three contacts.

Direct Opening Mechanism

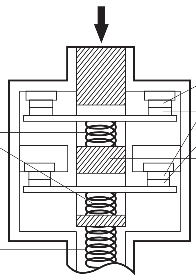
1NC/1NO Contact (Slow-action)



Conforms to EN60947-5-1 Direct Opening Operation

(Only the NC contact side has a direct opening mechanism.)
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

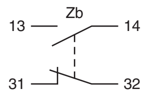
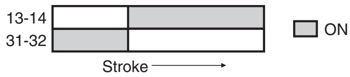
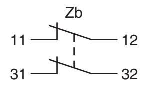
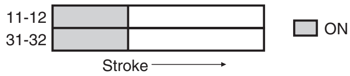
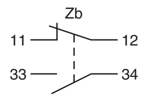
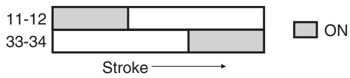
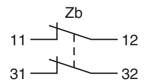
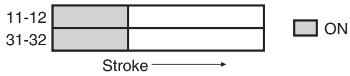
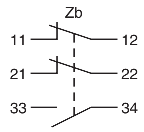
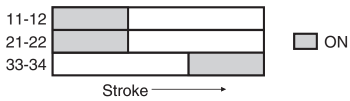
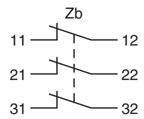
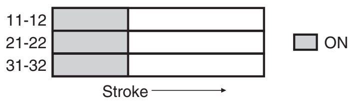
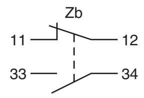
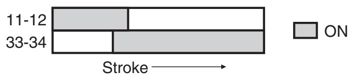
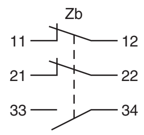
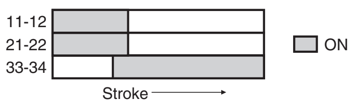
2NC Contact (Slow-action)



Conforms to EN60947-5-1 Direct Opening Operation

(Both NC contacts have a direct opening mechanism.)

Contact Form

Model	Contact	Contact form	Operating pattern	Remarks
D4N-□1□	1NC/1NO (Snap-action)			Only NC contacts 31-32 have an approved direct opening mechanism. The terminals 13-14 and 31-32 can be used as unlike poles.
D4N-□2□	2NC (Snap-action)			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-□A□	1NC/1NO (Slow-action)			Only NC contacts 11-12 have an approved direct opening mechanism. The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-□B□	2NC (Slow-action)			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-□C□	2NC/1NO (Slow-action)			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4N-□D□	3NC (Slow-action)			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.
D4N-□E□	1NC/1NO MBB (Slow-action)			Only NC contacts 11-12 have an approved direct opening mechanism. The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-□F□	2NC/1NO MBB (Slow-action)			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-12, 21-22 and 33-34 can be used as unlike poles.

Note: 1. Terminals are numbered according to EN50013 and the contact forms are according to IEC947-5-1.

2. MBB (Make Before Break) contacts have an overlapping structure, so that before the normally closed contact (NC) opens, the normally open contact (NO) closes.

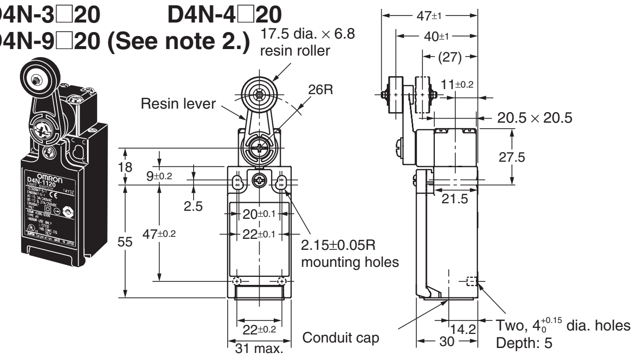
Dimensions

Switches

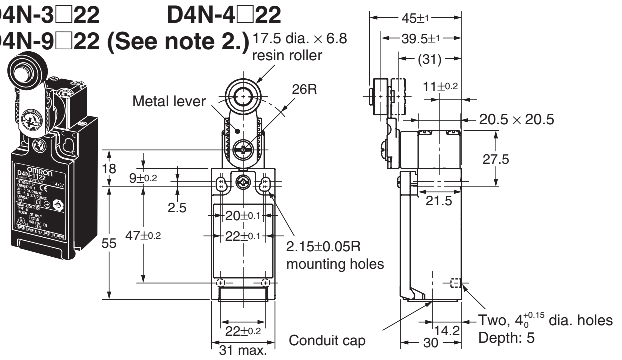
Note: All units are in millimeters unless otherwise indicated.

1-conduit Models

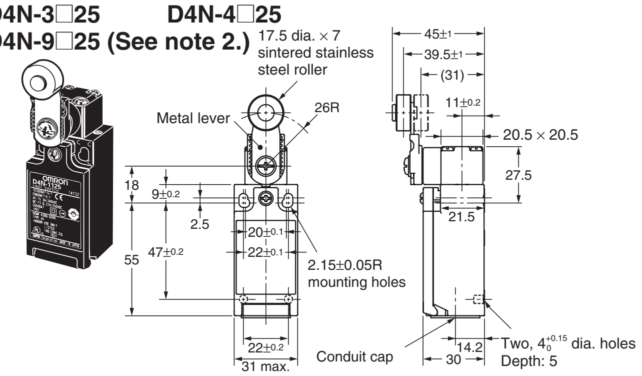
Roller Lever (Resin Lever, Resin Roller)
D4N-1□20 D4N-2□20
D4N-3□20 D4N-4□20
D4N-9□20 (See note 2.)



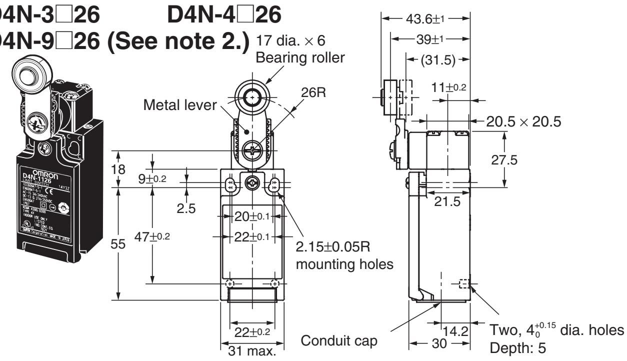
Roller Lever (Metal Lever, Resin Roller)
D4N-1□22 D4N-2□22
D4N-3□22 D4N-4□22
D4N-9□22 (See note 2.)



Roller Lever (Metal Lever, Metal Roller)
D4N-1□25 D4N-2□25
D4N-3□25 D4N-4□25
D4N-9□25 (See note 2.)



Roller Lever (Metal Lever, Bearing Roller)
D4N-1□26 D4N-2□26
D4N-3□26 D4N-4□26
D4N-9□26 (See note 2.)



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Refer to page G-231 for details on M12 connectors.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□120 D4N-□220 D4N-□B20 D4N-□D20	D4N-□122 D4N-□222 D4N-□B22 D4N-□D22	D4N-□125 D4N-□225 D4N-□B25 D4N-□D25	D4N-□126 D4N-□226 D4N-□B26 D4N-□D26
OF max.	5.0 N			
RF min.	0.5 N			
PT	18° to 27°			
OT min.	40°			
MD max. (See note 2.)	14°			
OP	---			
TT (See note 3.)	(80°)			
DOT min. (See note 4.)	50°			
DOF min. (See note 4.)	20 N			

Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. Only for snap-action models.
3. Reference value.
4. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

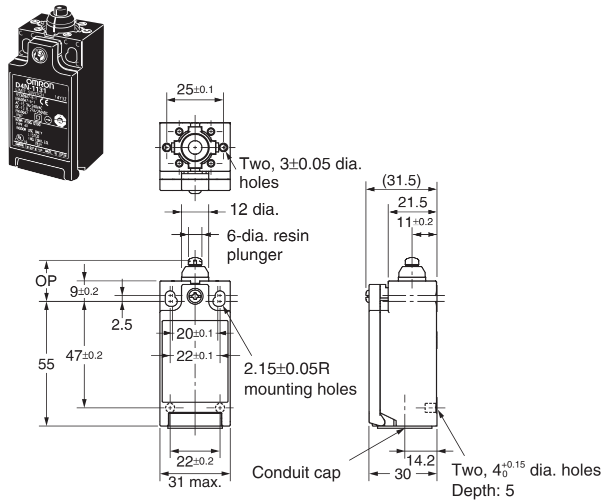
Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A20 D4N-□C20 D4N-□E20 D4N-□F20	D4N-□A22 D4N-□C22 D4N-□E22 D4N-□F22	D4N-□A25 D4N-□C25 D4N-□E25 D4N-□F25	D4N-□A26 D4N-□C26 D4N-□E26 D4N-□F26
OF max.	5.0 N			
RF min.	0.5 N			
PT (See note 1.)	18° to 27°			
PT (2nd) (See note 2.)	(44°)			
PT (See note 3.)	27.5° to 36.5°			
PT (2nd) (See note 4.)	(18°)			
OT min.	40°			
OP	---			
TT (See note 5.)	(80°)			
DOT min. (See note 6.)	50°			
DOF min. (See note 6.)	20 N			

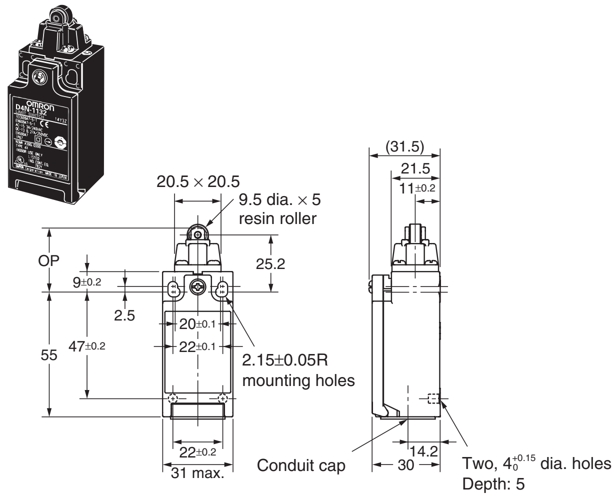
Note: 1. These PT values are possible when the NC contacts are open (OFF).
2. These PT values are possible when the NO contacts are closed (ON).
3. Only for MBB models.
4. Reference values for MBB models only.
5. Reference values.
6. ⚠ For safe use, always make sure that the minimum values or greater are provided.

1-conduit Models

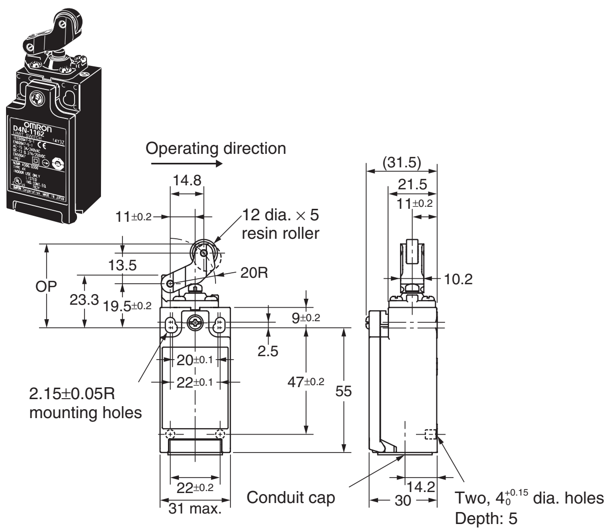
Plunger
D4N-1□31　D4N-2□31
D4N-3□31　D4N-4□31
D4N-9□31 (See note 2.)



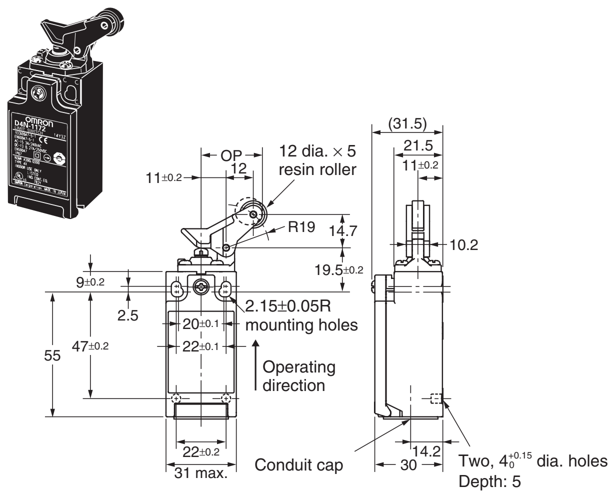
Roller Plunger
D4N-1□32　D4N-2□32
D4N-3□32　D4N-4□32
D4N-9□32 (See note 2.)



One-way Roller Arm Lever (Horizontal)
D4N-1□62　D4N-2□62
D4N-3□62　D4N-4□62
D4N-9□62 (See note 2.)



One-way Roller Arm Lever (Vertical)
D4N-1□72　D4N-2□72
D4N-3□72　D4N-4□72
D4N-9□72 (See note 2.)



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Refer to page G-231 for details on M12 connectors.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□131 D4N-□231 D4N-□B31 D4N-□D31	D4N-□132 D4N-□232 D4N-□B32 D4N-□D32	D4N-□162 D4N-□262 D4N-□B62 D4N-□D62	D4N-□172 D4N-□272 D4N-□B72 D4N-□D72
OF max.	6.5 N	6.5 N	5.0 N	5.0 N
RF min.	1.5 N	1.5 N	0.8 N	0.8 N
PT max.	2 mm	2 mm	4 mm	4 mm
OT min.	4 mm	4 mm	5 mm	5 mm
MD max. (See note 2.)	1 mm	1 mm	1.5 mm	1.5 mm
OP	18.2 ±0.5 mm	28.6 ±0.8 mm	37 ±0.8 mm	27 ±0.8 mm
TT (See note 3.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOT min. (See note 4.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm
DOF min. (See note 4.)	20 N	20 N	20 N	20 N

Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.

2. Only for snap-action models.

3. Reference value.

4. Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A31 D4N-□C31 D4N-□E31 D4N-□F31	D4N-□A32 D4N-□C32 D4N-□E32 D4N-□F32	D4N-□A62 D4N-□C62 D4N-□E62 D4N-□F62	D4N-□A72 D4N-□C72 D4N-□E72 D4N-□F72
OF max.	6.5 N	6.5 N	5.0 N	5.0 N
RF min.	1.5 N	1.5 N	0.8 N	0.8 N
PT max. (See note 1.)	2 mm	2 mm	4 mm	4 mm
PT (2nd) (See note 2.)	(2.9 mm)	(2.9 mm)	(5.2 mm)	(4.3 mm)
PT max. (See note 3.)	2.8 mm	2.8 mm	4 mm	4 mm
PT (2nd) (See note 4.)	(1 mm)	(1 mm)	(1.5 mm)	(1.5 mm)
OT min.	4 mm	4 mm	5 mm	5 mm
OP	18.2 ±0.5 mm	28.6 ±0.8 mm	37 ±0.8 mm	27 ±0.8 mm
OP (See note 5.)	17.4 ±0.5 mm	28 ±0.8 mm	36 ±0.8 mm	26.1 ±0.8 mm
TT (See note 6.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOT min. (See note 7.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm
DOF min. (See note 7.)	20 N	20 N	20 N	20 N

Note: 1. These PT values are possible when the NC contacts are open (OFF).

2. These PT values are possible when the NO contacts are closed (ON).

3. Only for MBB models.

4. Reference values for MBB models.

5. Only for MBB models.

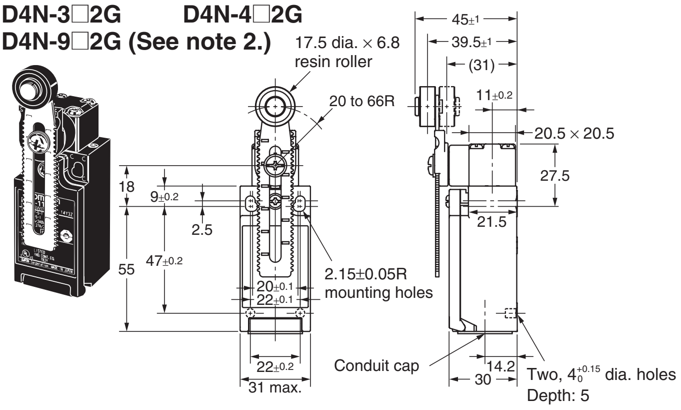
6. Reference value.

7. For safe use, always make sure that the minimum values or greater are provided.

1-conduit Models

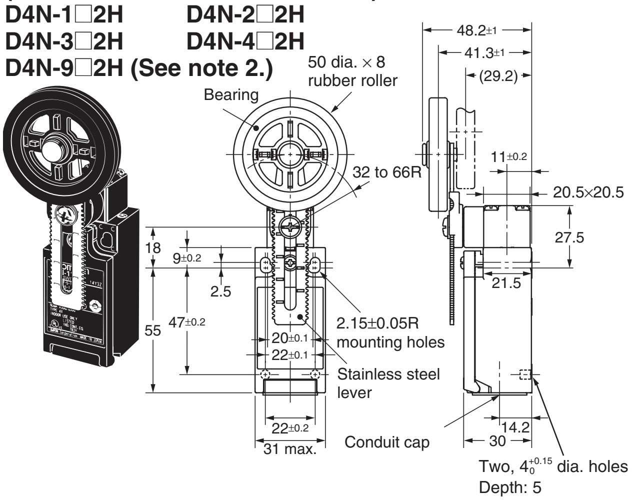
Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)

D4N-1□2G D4N-2□2G
D4N-3□2G D4N-4□2G
D4N-9□2G (See note 2.)



Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)

D4N-1□2H D4N-2□2H
D4N-3□2H D4N-4□2H
D4N-9□2H (See note 2.)



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Refer to following diagrams for details on M12 connectors.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□12H D4N-□22H D4N-□B2H D4N-□D2H	D4N-□12G D4N-□22G D4N-□B2G D4N-□D2G (See note 2.)
OF max.	4.5 N	
RF min.	0.4 N	
PT	18° to 27°	
OT min.	40°	
MD max. (See note 3.)	14°	
OP	---	
TT (See note 4.)	(80°)	
DOT min. (See note 5.)	50°	
DOF min. (See note 5.)	20 N	

Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. The operating characteristics of these Switches were measured with the roller lever set at 32 mm.
3. Only for snap-action models.
4. Reference value.
5. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

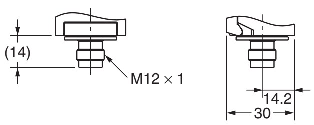
Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A2H D4N-□C2H D4N-□E2H D4N-□F2H	D4N-□A2G D4N-□C2G D4N-□E2G D4N-□F2G (See note 1.)
OF max.	4.5 N	
RF min.	0.4 N	
PT (See note 2.)	18° to 27°	
PT (2nd) (See note 3.)	(44°)	
PT (See note 4.)	27.5° to 36.5°	
PT (2nd) (See note 5.)	(18°)	
OT min.	40°	
OP	---	
TT (See note 6.)	(80°)	
DOT min.	50°	
DOF min. (See note 7.)	20 N	

Note: 1. The operating characteristics of these Switches were measured with the roller lever set at 32 mm.
2. This PT value is possible when the NC contacts are open (OFF).
3. This PT value is possible when the NO contacts are closed (ON).
4. Only for MBB models.
5. Reference value for MBB models only.
6. Reference value.
7. ⚠ For safe use, always make sure that the minimum values or greater are provided.

1-conduit M12 Connector

D4N-9□□□

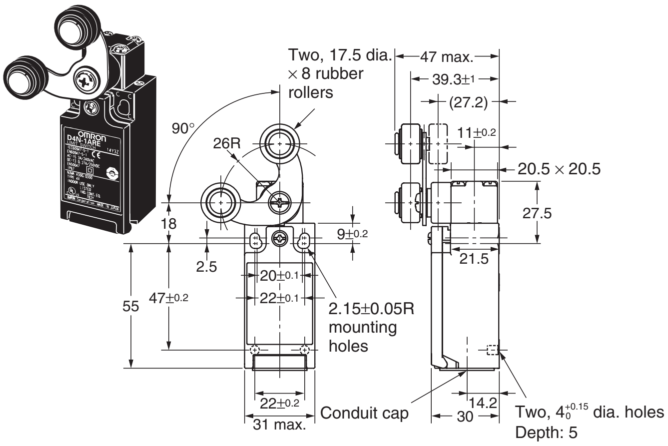


D4N

1-conduit Models

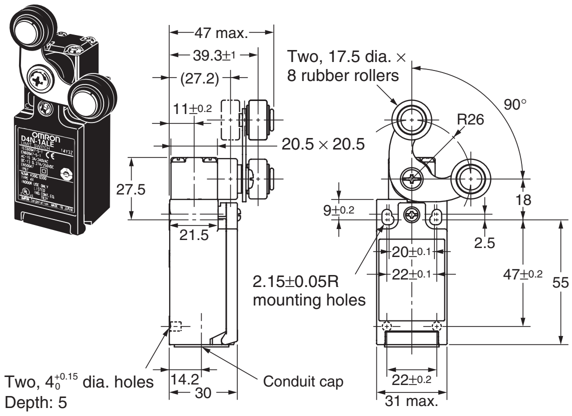
Fork Lever Lock (Right Operation)

D4N-1□RE D4N-2□RE
D4N-3□RE D4N-4□RE



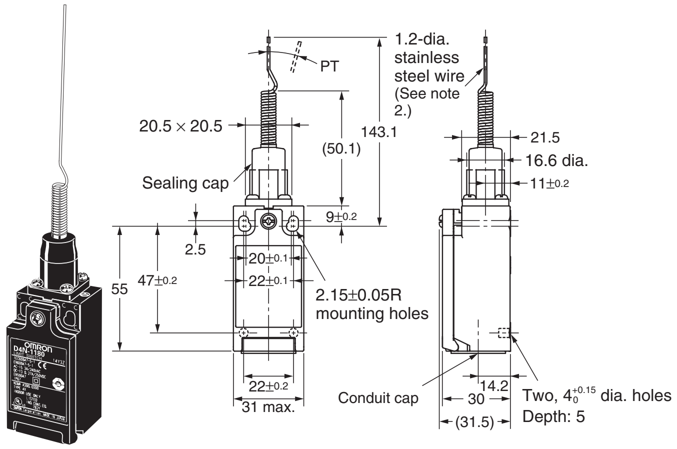
Fork Lever Lock (Left Operation)

D4N-1□LE D4N-2□LE
D4N-3□LE D4N-4□LE



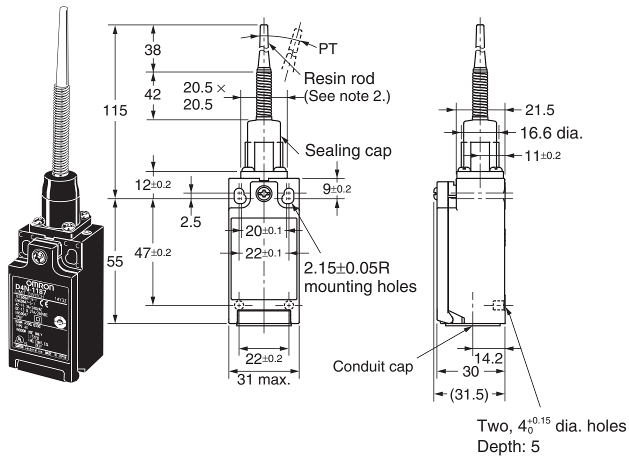
Cat Whisker

D4N-1□80 D4N-2□80
D4N-3□80 D4N-4□80



Plastic Rod

D4N-1□87 D4N-2□87
D4N-3□87 D4N-4□87



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Use the dog within 35 mm of the tip of the actuator and keep the total travel to 70 mm or less.

Slow-action (1NC/1NO) (2NC/1NO) (2NC) (3NC)

Model	D4N-□□RE	D4N-□□LE
Force necessary to reverse the direction of the lever: max.	6.4 N	6.4 N
Movement until the lever reverses	55 ±10°	55 ±10°
Movement until switch operation (NC)	6.5° (MBB: 10°)	6.5° (MBB: 10°)
Movement until switch operation (NO)	18.5° (MBB: 5°)	18.5° (MBB: 5°)

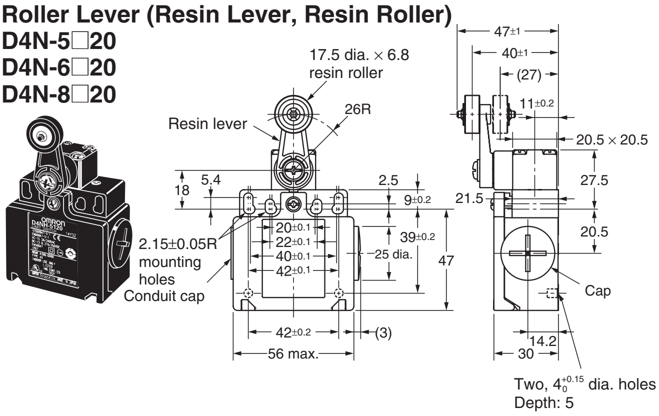
Note: Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

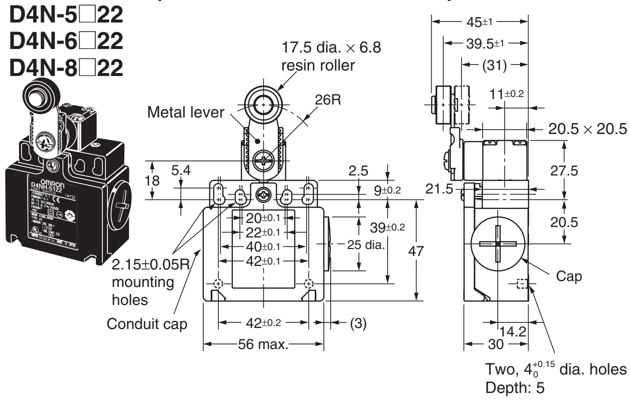
Model	D4N-□□80	D4N-□□87
OF max.	1.5 N	1.5 N
PT max.	15°	15°

2-conduit Models

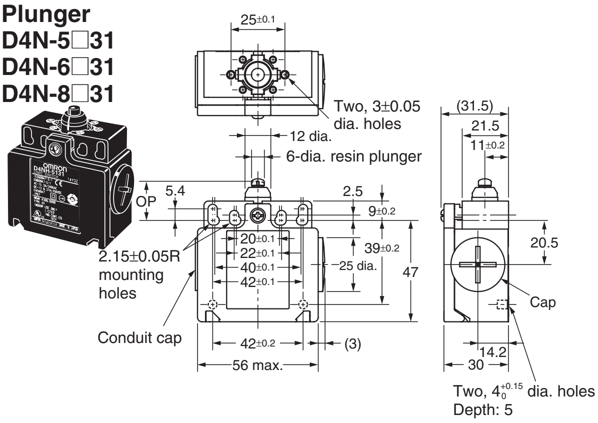
Roller Lever (Resin Lever, Resin Roller)
D4N-5□20
D4N-6□20
D4N-8□20



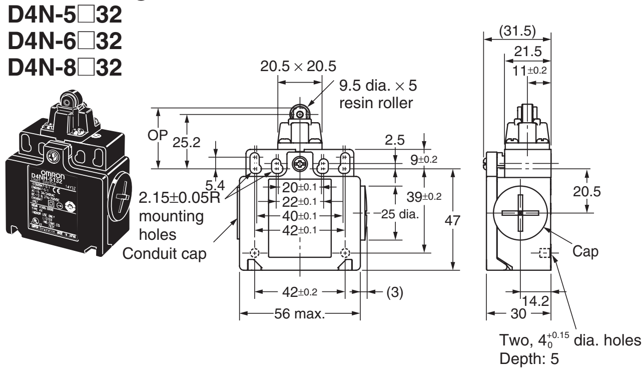
Roller Lever (Metal Lever, Resin Roller)
D4N-5□22
D4N-6□22
D4N-8□22



Plunger
D4N-5□31
D4N-6□31
D4N-8□31



Roller Plunger
D4N-5□32
D4N-6□32
D4N-8□32



Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□120 D4N-□220 D4N-□B20 D4N-□D20	D4N-□122 D4N-□222 D4N-□B22 D4N-□D22	D4N-□131 D4N-□231 D4N-□B31 D4N-□D31	D4N-□132 D4N-□232 D4N-□B32 D4N-□D32
OF max.	5 N	5 N	6.5 N	6.5 N
RF min.	0.5 N	0.5 N	1.5 N	1.5 N
PT	18° to 27°	18° to 27°	2 mm	2 mm
OT min.	40°	40°	4 mm	4 mm
MD max. **(See note 2.)**	14°	14°	1 mm	1 mm
OP	---	---	18 ±0.5 mm	28.2 ±0.8 mm
TT **(See note 3.)**	(80°)	(80°)	(6 mm)	(6 mm)
DOT min. **(See note 4.)**	50°	50°	3.2 mm	3.2 mm
DOF min. **(See note 4.)**	20 N	20 N	20 N	20 N

Note:
1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. Only for snap-action models.
3. Reference value.
4. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

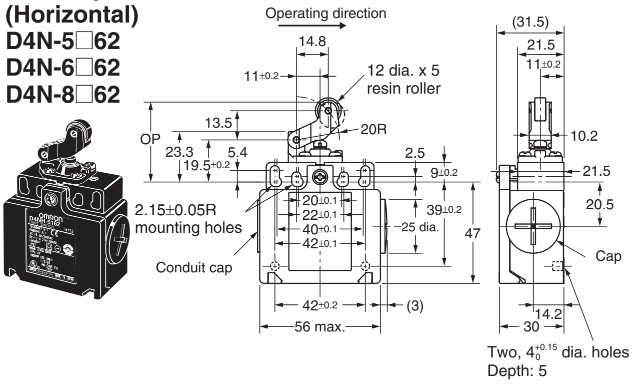
Slow-action (1NC/1NO) (2NC/1NO)

Model	D4N-□A20 D4N-□C20 D4N-□E20 D4N-□F20	D4N-□A22 D4N-□C22 D4N-□E22 D4N-□F22	D4N-□A31 D4N-□C31 D4N-□E31 D4N-□F31	D4N-□A32 D4N-□C32 D4N-□E32 D4N-□F32
OF max.	5 N	5 N	6.5 N	6.5 N
RF min.	0.5 N	0.5 N	1.5 N	1.5 N
PT **(See note 1.)**	18° to 27°	18° to 27°	2 mm	2 mm
PT (2nd) **(See note 2.)**	(44°)	(44°)	(2.9 mm)	(2.9 mm)
PT **(See note 3.)**	27.5° to 36.5°	27.5° to 36.5°	2.8 mm	2.8 mm
PT (2nd) **(See note 4.)**	(18°)	(18°)	(1 mm)	(1 mm)
OT min.	40°	40°	4 mm	4 mm
OP	---	---	18 ±0.5 mm	28.2 ±0.8 mm
OP **(See note 5.)**	---	---	17.4 ±0.5 mm	28 ±0.8 mm
TT **(See note 6.)**	(80°)	(80°)	(6 mm)	(6 mm)
DOT min. **(See note 7.)**	50°	50°	3.2 mm	3.2 mm
DOF min. **(See note 7.)**	20 N	20 N	20 N	20 N

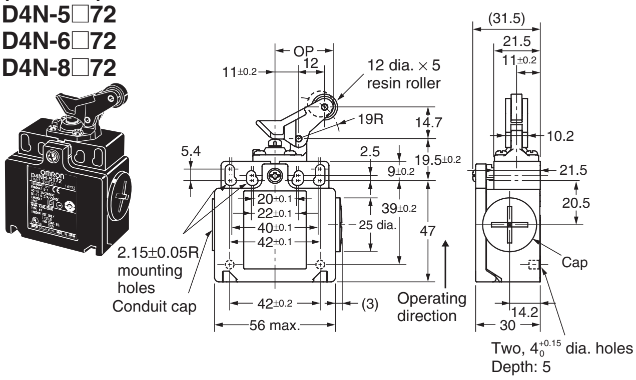
Note:
1. This PT value is possible when the NC contacts are open (OFF).
2. This PT value is possible when the NO contacts are closed (ON).
3. Only for MBB models.
4. Reference value for MBB models.
5. Only for MBB models.
6. Reference value.
7. ⚠ For safe use, always make sure that the minimum values or greater are provided.

2-conduit Models

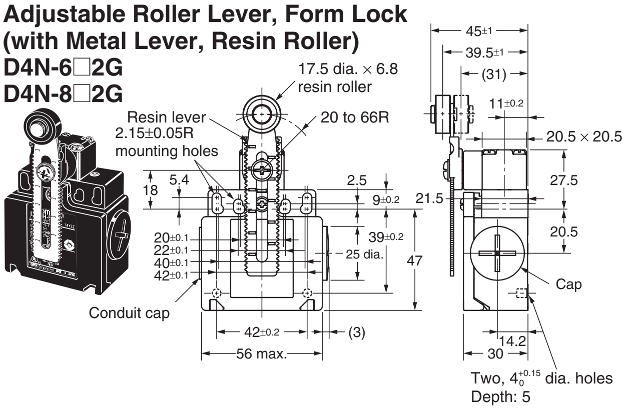
One-way Roller Arm Lever (Horizontal)
D4N-5□62
D4N-6□62
D4N-8□62



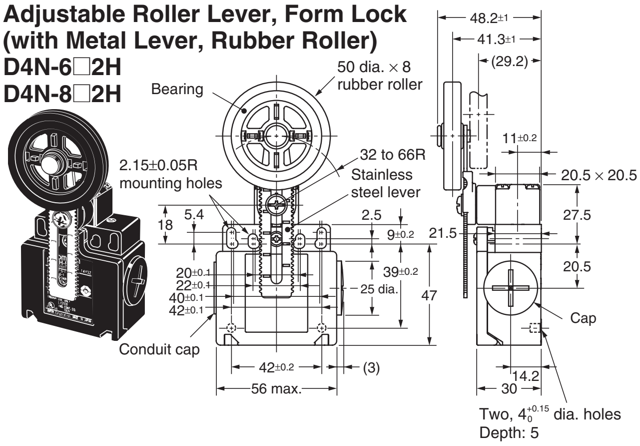
One-way Roller Arm Lever (Vertical)
D4N-5□72
D4N-6□72
D4N-8□72



Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)
D4N-6□2G
D4N-8□2G



Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)
D4N-6□2H
D4N-8□2H



Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Snap-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□162 D4N-□262 D4N-□B62 D4N-□D62	D4N-□172 D4N-□272 D4N-□B72 D4N-□D72	D4N-□12G D4N-□22G D4N-□B2G D4N-□D2G (See note 2.)	D4N-□12H D4N-□22H D4N-□B2H D4N-□D2H (See note 3.)
OF max.	5.0 N	5.0 N	4.5 N	4.5 N
RF min.	0.8 N	0.8 N	0.4 N	0.4 N
PT max.	4 mm	4 mm	18° to 27°	18° to 27°
OT min.	5 mm	5 mm	40°	40°
MD max. **(See note 4.)**	1.5 mm	1.5 mm	14°	14°
OP	37 ±0.8 mm	27 ±0.8 mm	---	---
TT **(See note 5.)**	(9 mm)	(9 mm)	(70°)	(70°)
DOT min. **(See note 6.)**	5.8 mm	4.8 mm	50°	50°
DOF min. **(See note 6.)**	20 N	20 N	20 N	20 N

Note:
1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. The operating characteristics of these Switches were measured with the roller lever set at 30 mm.
3. The operating characteristics of these Switches were measured with the roller lever set at 31 mm.
4. Only for snap-action models.
5. Reference value.
6. ⚠ Only for slow-action models. For safe use, always make sure that the minimum values or greater are provided.

Slow-action (1NC/1NO) (2NC/1NO)

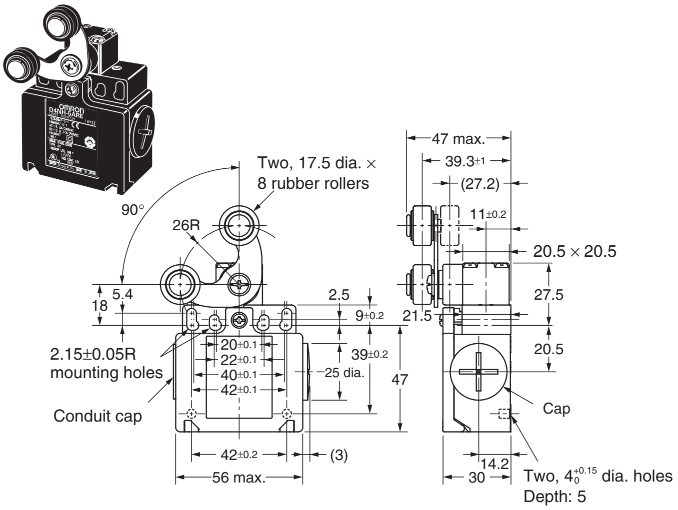
Model	D4N-□A62 D4N-□C62 D4N-□E62 D4N-□F62	D4N-□A72 D4N-□C72 D4N-□E72 D4N-□F72	D4N-□A2G D4N-□C2G D4N-□E2G D4N-□F2G (See note 1.)	D4N-□A2H D4N-□C2H D4N-□E2H D4N-□F2H (See note 2.)
OF max.	5.0 N	5.0 N	4.5 N	4.5 N
RF min.	0.8 N	0.8 N	0.4 N	0.4 N
PT max. **(See note 3.)**	4 mm	4 mm	18° to 27°	18° to 27°
PT (2nd) **(See note 4.)**	(5.2 mm)	(4.3 mm)	(44°)	(44°)
PT max. **(See note 5.)**	4 mm	4 mm	27.5° to 36.5°	27.5° to 36.5°
PT (2nd) **(See note 6.)**	(1.5 mm)	(1.5 mm)	(18°)	(18°)
OT min.	5 mm	5 mm	40°	40°
OP	37 ±0.8 mm	27 ±0.8 mm	---	---
OP **(See note 7.)**	36 ±0.8 mm	26.1 ±0.8 mm	---	---
TT **(See note 8.)**	(9 mm)	(9 mm)	(70°)	(70°)
DOT min. **(See note 9.)**	5.8 mm	4.8 mm	50°	50°
DOF min. **(See note 9.)**	20 N	20 N	20 N	20 N

Note:
1. The operating characteristics of these Switches were measured with the roller lever set at 30 mm.
2. The operating characteristics of these Switches were measured with the roller lever set at 31 mm.
3. This PT value is possible when the NC contacts are open (OFF).
4. This PT value is possible when the NO contacts are closed (ON).
5. Only for MBB models.
6. Reference value for MBB models only.
7. Only for MBB models.
8. Reference value.
9. ⚠ For safe use, always make sure that the minimum values or greater are provided.

2-conduit Models

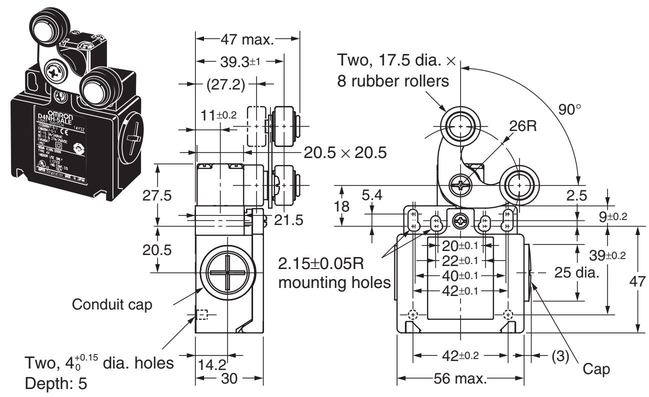
Fork Lever Lock (Right Operation)

D4N-5□RE D4N-6□RE
D4N-7□RE D4N-8□RE



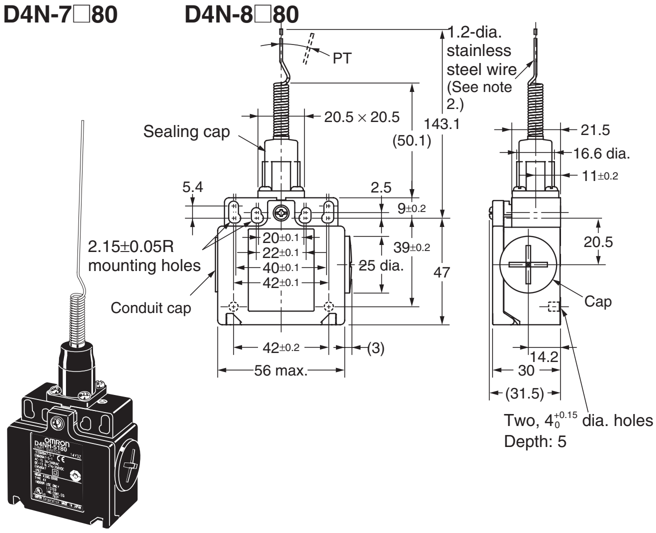
Fork Lever Lock (Left Operation)

D4N-5□LE D4N-6□LE
D4N-7□LE D4N-8□LE



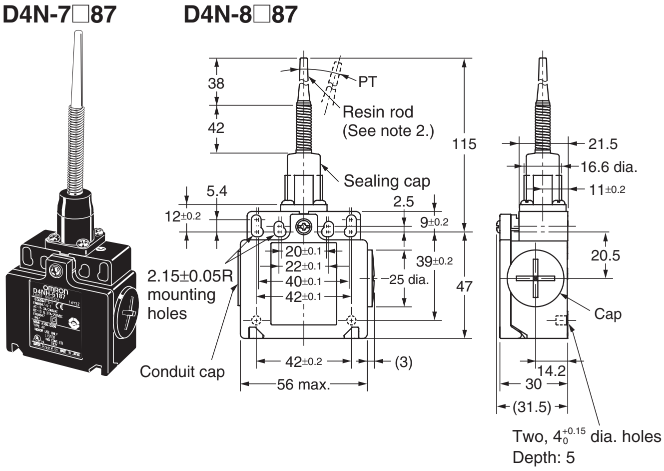
Cat Whisker

D4N-5□80 D4N-6□80
D4N-7□80 D4N-8□80



Plastic Rod

D4N-5□87 D4N-6□87
D4N-7□87 D4N-8□87



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Use the dog within 35 mm of the tip of the actuator and keep the total travel to 70 mm or less.
3. The usable range of the moving part is 1/3 or less of the entire spring length from the end of the spring.

Slow-action (1NC/1NO) (2NC), Slow-action (2NC) (3NC)

Model	D4N-□□RE	D4N-□□LE
Force necessary to reverse the direction of the lever: max.	6.4 N	6.4 N
Movement until the lever reverses	55 ±10°	55 ±10°
Movement until switch operation (NC)	(6.5°)	(6.5°) (MBB: 10°)
Movement until switch operation (NO)	(18.5°)	(18.5°) (MBB: 5°)

Note: Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.

Snap-action (1NC/1NO), Slow-action (2NC) (3NC)

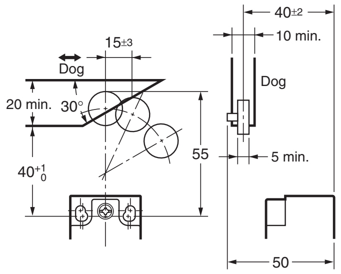
Model	D4N-□□80	D4N-□□87
OF max.	1.5 N	1.5 N
PT max.	15°	15°

D4N

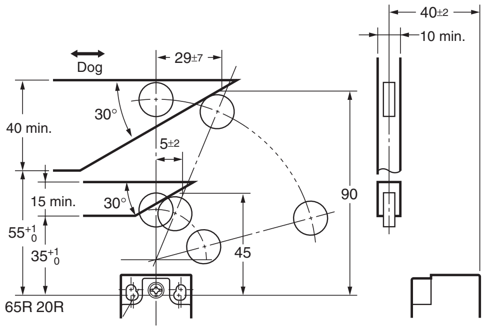
Levers

Refer to the following for the angles and positions of the watchdogs (source: EN50047.)

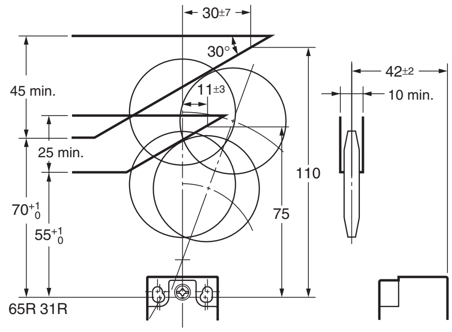
Roller Lever (D4N-□□20)



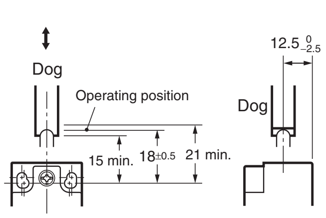
Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller) (D4N-□□2G) (Reference Values)



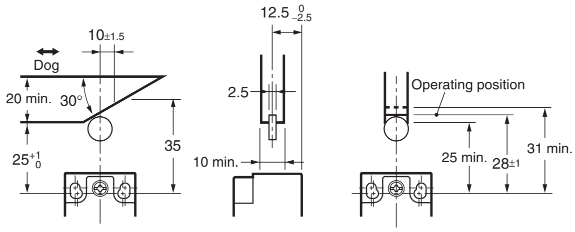
Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller) (D4N-□□2H) (Reference Values)



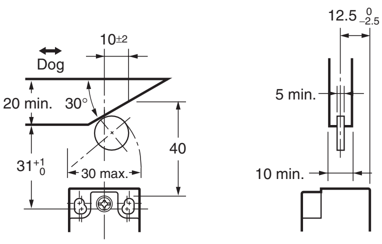
Sealed Plunger (D4N-□□31)



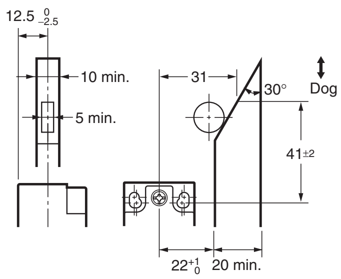
Roller Plunger (D4N-□□32)



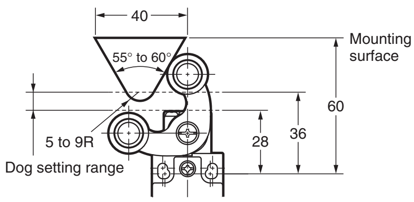
One-way Roller Arm Lever (Horizontal) (D4N-□□62)



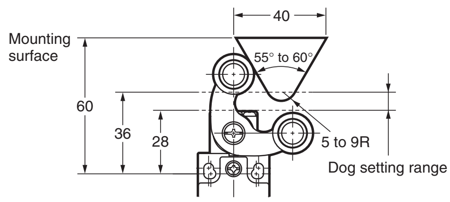
One-way Roller Arm Lever (Vertical) (Reference Values) (D4N-□□72)



Fork Lever Lock (Right Operation) (D4N-□□RE)



Fork Lever Lock (Left Operation) (D4N-□□LE)



Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions for Switches and Safety Limit Switches.

⚠ CAUTION

Do not use metal connectors or metal conduits with this Switch. Doing so may occasionally result in electric shock.

Precautions for Safe Use

- Do not drop the Switch. Doing so may result in the Switch not performing to its full capacity.
- Do not attempt to disassemble or modify the Switch. Doing so may cause the Switch to malfunction.
- Do not use the Switch where explosive gas, flammable gas, or any other hazardous gas may be present.
- Do not use the Switch submerged in oil or water, or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch interior. (The IP67 degree of protection specification for the Switch refers to water penetration while the Switch is submersed in water for a specified period of time.)
- Protect the head from foreign material. Subjecting the head to foreign material may result in premature wear or damage to the Switch. Although the switch body is protected from penetration by dust or water, the head is not protected from penetration by minute particles or water.
- Turn the power OFF before wiring. Doing so may result in electric shock.
- Install the cover after wiring. Not doing so may result in electric shock.
- Connect a fuse to the Switch in series to protect the Switch from short-circuit damage. Use a fuse with a breaking current 1.5 to 2 times larger than the rated current. To conform to EN ratings, use an IEC60269-compliant 10-A fuse type gI or gG.
- Do not switch circuits for two or more standard loads (250 VAC, 3 A) at the same time. Doing so may adversely affect insulation performance.
- The durability of the Switch is greatly affected by operating conditions. Evaluate the Switch under actual working conditions before permanent installation and use within a number of switching operations that will not adversely affect the Switch's performance.
- Be sure to indicate in the machine manufacturer's instruction manual that the user must not attempt to repair or maintain the Switch and must contact the machine manufacturer for any repairs or maintenance.
- Check the Switches before use and inspect regularly, replacing them when necessary. If a Switch is kept pressed for an extended period of time, the components may deteriorate quickly, and the Switch may not release.

Precautions for Correct Use

Environment

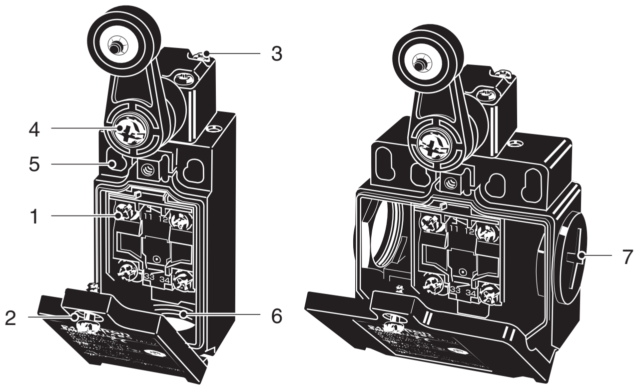
- The Switch is intended for indoor use only.
- Do not use the Switch outdoors. Doing so may cause the Switch to malfunction.
- Do not use the Switch where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) are present or in locations subject to high temperature and humidity. Doing so may result in damage to the Switch caused by contact failure or corrosion.
- Do not use the Switch under any of the following conditions.
  - Locations subject to extreme temperature changes.
  - Locations where high humidity or condensation may occur.
  - Locations subject to excessive vibration.
  - Locations where metal dust, processing waste, oil, or chemicals may penetrate through the protective door.
  - Locations subject to detergents, thinner, or other solvents.

Mounting Method

Mounting Screw Tightening Torque

Tighten each of the screws to the specified torque. Loose screws may result in malfunction of the Switch within a short time.

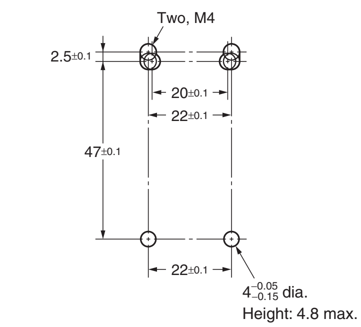
1	Terminal screw	0.6 to 0.8 N·m
2	Cover clamping screw	0.5 to 0.7 N·m
3	Head clamping screw	0.5 to 0.6 N·m
4	Lever clamping screw	1.6 to 1.8 N·m
5	Body clamping screw	0.5 to 0.7 N·m
6	Conduit mounting connection, M12 adaptor	1.8 to 2.2 N·m (except 1/2-14NPT)
		1.4 to 1.8 N·m (1/2-14NPT)
7	Cap screw	1.3 to 1.7 N·m



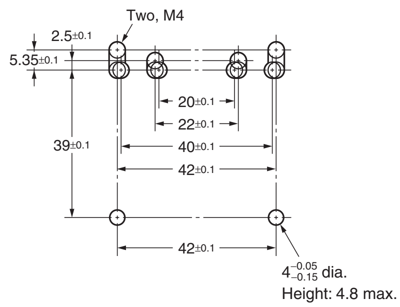
Switch Mounting

- Mount the Switch using M4 screws and washers and tighten the screws to the specified torque.
- For safety, use screws that cannot be easily removed, or use an equivalent measure to ensure that the Switch is secure.
- Secure the Switch with two M4 bolts and washers. Provide studs with a diameter of $4^{-0.05}/_{-0.15}$ and a height of 4.8 mm max. at two places, inserting into the holes at the bottom of the Switch as shown below so that the Switch is firmly fixed at four points.

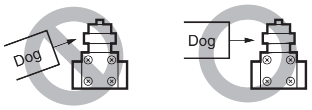
Switch Mounting Holes One-conduit Type



Two-conduit Type



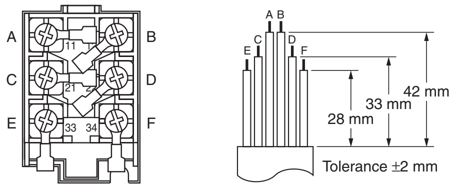
- Make sure that the dog contacts the actuator at a right angle. Applying a load to the switch actuator (roller) on a slant may result in deformation or damage of the actuator or rotary shaft.



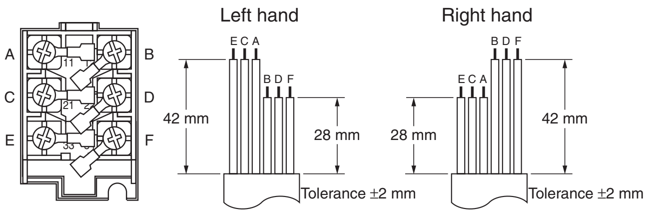
Wiring

- When connecting to the terminals via insulating tube and M3.5 crimp terminals, arrange the crimp terminals as shown below so that they do not rise up onto the case or the cover. Applicable lead wire size: AWG20 to AWG18 (0.5 to 0.75 mm^2).
  Use lead wires of an appropriate length, as shown below. Not doing so may result in excess length causing the cover to rise and not fit properly.

One-conduit Type (3 Poles)



Two-conduit Type (3 Poles)

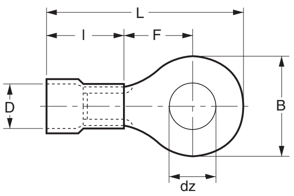


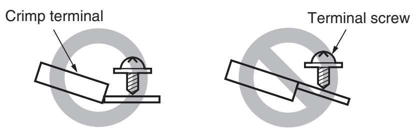
- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG20 (0.5 mm^2)

J.S.T is a Japanese manufacturer.

t: 0.5 mm
dz dia.: 3.7 mm
D dia.: 2.9 mm
B: 6.6 mm
L: 19 mm
F: 7.7 mm
I: 8.0 mm



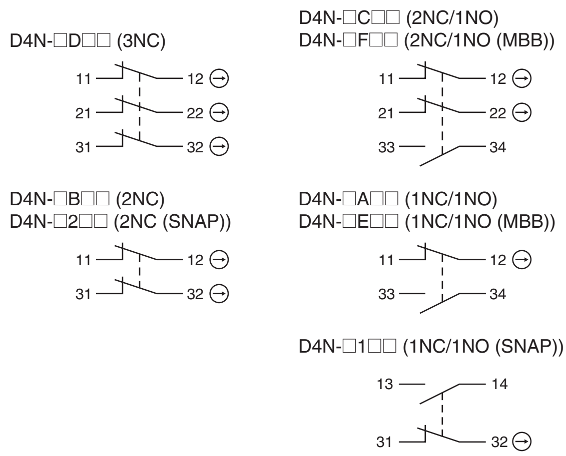


Correct **Incorrect**

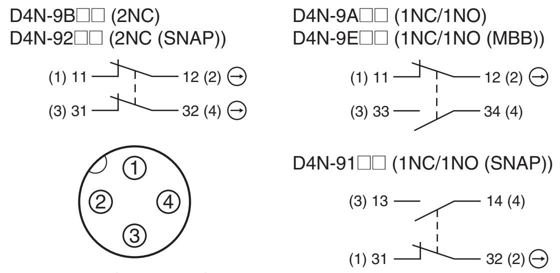
Contact Arrangement

- The following diagrams show the contact arrangements used for screw terminal types and connector types.

Screw Terminal Type



Connector Type



Pin No. (Terminal No.)

- Applicable socket: XS2F (OMRON).
- Refer to the G010 *Connector Catalog* for details on socket pin numbers and lead wire colors.

Socket Tightening (Connector Type)

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection (IP67) may not be maintained and vibration may loosen the socket connector.

Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.
- When using 1/2-14NPT, wind sealing tape around the joint between the connector and conduit opening so that the enclosure will conform to IP67.
- Use a cable with a suitable diameter for the connector.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. Tighten the conduit cap to the specified torque. The conduit cap is provided with the Switch (2-conduit types).

Changing the Lever

The lever mounting screws can be used to set the lever position to any position in a 360° angle at 7.5° increments. Grooves are incised on the lever and rotary shaft that engage to prevent the lever from slipping against the rotary shaft. The screws on adjustable roller lever models can also loosened to change the length of the lever.

Remove the screws from the front of the lever before mounting the lever in reverse (front/back), and set the level so that operation will be completed before exceeding a range of 180° on the horizontal.

Recommended Connectors

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended connectors to ensure conformance to IP67.

Size	Manufacturer	Model	Applicable cable diameter
G1/2	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	ST-13.5 5301-5030	6.0 to 12.0 mm
M20	LAPP	ST-M20 × 1.5 5311-1020	7.0 to 13.0 mm
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
M12	LAPP	ST-M12 × 1.5 5311-1000	3.5 to 7.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque. Seal packing is sold separately.

LAPP is a German manufacturer. Ohm Denki is a Japanese manufacturer.

Before using an M12 type, attaching the provided changing adaptor to the Switch and then connect the recommended connector.

Before using a 2-conduit 1/2-14NPT type, attach the provided changing adaptor to the Switch and then connect the recommended connector.

Storage

Do not store the Switch in locations where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) or dust is present, or in locations subject to high temperatures and humidity.

Others

- Do not allow the load current to exceed the rated value.
- Confirm that the seal rubber has no defects before use.
  If the seal rubber is displaced or raised, or has foreign particles adhered to it, the sealing capability of the seal rubber will be adversely affected.
- Use the correct cover mounting screws only, or the sealing capability of the seal rubber will deteriorate.
- Inspect the Switch regularly.
- Make sure that foreign particles do not enter the head when removing the screws from the four corners to change the head position in any of the four directions.
- Use the following recommended countermeasures to prevent telegraphing when using adjustable or long levers.

1. Make the rear edge of the dog smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
2. Design the circuit so that no error signal will be generated.
3. Use or set a Switch that is operated in one direction only.

Production Termination

Following the release of the D4N, production of the D4D-N will be terminated.

Date of Production Termination

Production of the D4D-N Series will be terminated in March 2006.

Product Replacement

1. Dimensions
The D4D-N and D4N use the same mounting method, and mounting hole. The multi-contact structure and the extra 4 mm in length, however, are different.

2. Terminal Numbers
For the 2-contact slow-action model, the terminals 21, 22, 23, and 24 on the D4D-N are 31, 32, 33, and 34 on the D4N.

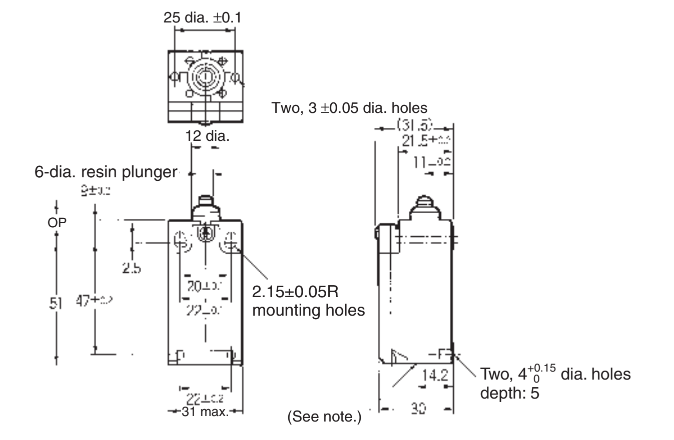
3. Recommended Terminals
If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

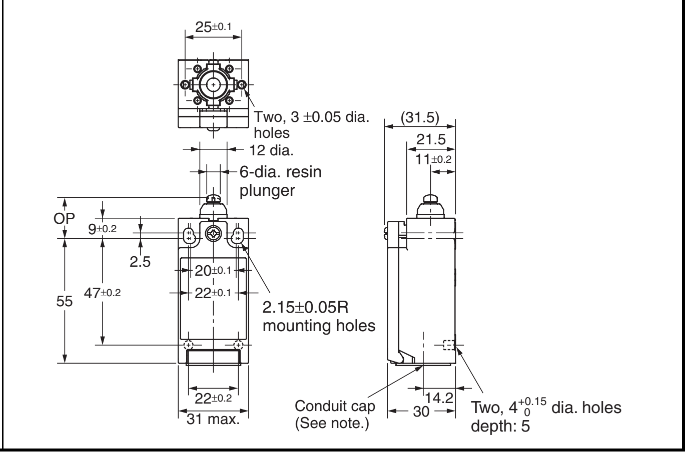
Comparison of the D4D-N and Substitute Products

Model	D4N
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Completely compatible
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

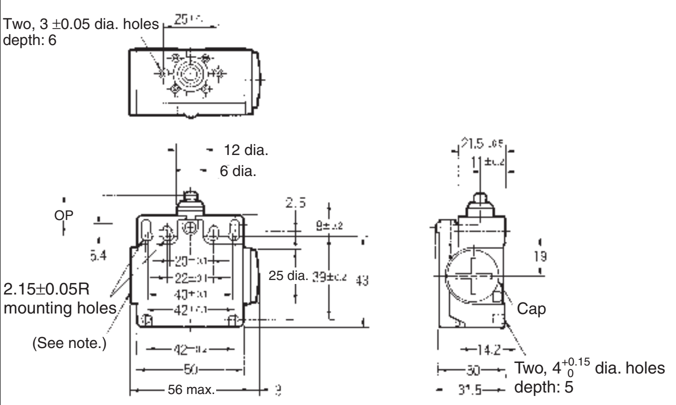
Dimensions (Unit: mm)

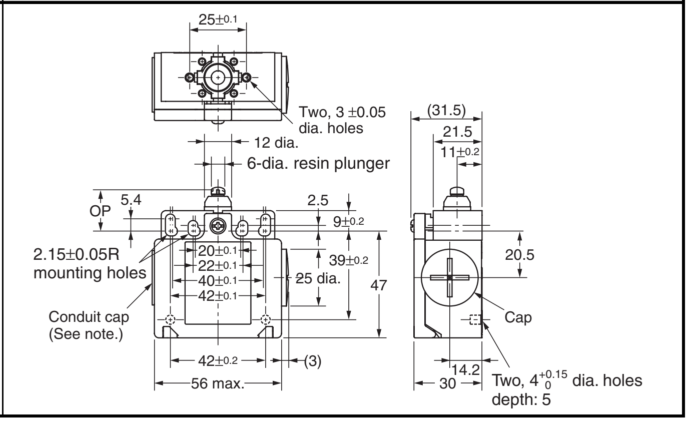
Discontinued Models (1-conduit Plunger-type D4D-N)	Replacement Products (1-conduit Plunger-type D4N)





Discontinued Models (2-conduit Plunger-type D4D-N)	Replacement Products (2-conduit Plunger-type D4N)





List of Recommended Substitute Products

: The actuator on the D4D-N is a non-safety type. The D4N is recommended for safety applications (form lock type). Be sure to mount it correctly.

: M screws are recommended to comply with European standards. Therefore, the M20 type is recommended as a substitute when the PG13.5 conduit-type is not available in a D4N model.

Safety Limit Switches

D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product
D4D-1120N	D4N-1120	D4D-1520N	D4N-1A20	D4D-1A20N	D4N-1B20
D4D-2120N	D4N-2120	D4D-2520N	D4N-2A20	D4D-2A20N	D4N-2B20
D4D-3120N	D4N-3120	D4D-3520N	D4N-3A20	D4D-3A20N	D4N-3B20
D4D-5120N	D4N-5120	D4D-5520N	D4N-5A20	D4D-5A20N	D4N-5B20
D4D-6120N	D4N-6120	D4D-6520N	D4N-6A20	D4D-6A20N	D4N-6B20
D4D-1122N	D4N-1122	D4D-1522N	D4N-1A22	D4D-1A22N	D4N-1B22
D4D-2122N	D4N-2122	D4D-2522N	D4N-2A22	D4D-2A22N	D4N-2B22
D4D-3122N	D4N-3122	D4D-3522N	D4N-3A22	D4D-3A22N	D4N-3B22
D4D-5122N	D4N-5122	D4D-5522N	D4N-5A22	D4D-5A22N	D4N-5B22
D4D-6122N	D4N-6122	D4D-6522N	D4N-6A22	D4D-6A22N	D4N-6B22
D4D-1125N	D4N-1125	D4D-1525N	D4N-1A25	D4D-1A25N	D4N-1B25
D4D-2125N	D4N-2125	D4D-2525N	D4N-2A25	D4D-2A25N	D4N-2B25
D4D-3125N	D4N-3125	D4D-3525N	D4N-3A25	D4D-3A25N	D4N-3B25
D4D-1131N	D4N-1131	D4D-1531N	D4N-1A31	D4D-1A31N	D4N-1B31
D4D-2131N	D4N-2131	D4D-2531N	D4N-2A31	D4D-2A31N	D4N-2B31
D4D-3131N	D4N-3131	D4D-3531N	D4N-3A31	D4D-3A31N	D4N-3B31
D4D-5131N	D4N-5131	D4D-5531N	D4N-5A31	D4D-5A31N	D4N-5B31
D4D-6131N	D4N-6131	D4D-6531N	D4N-6A31	D4D-6A31N	D4N-6B31
D4D-1132N	D4N-1132	D4D-1532N	D4N-1A32	D4D-1A32N	D4N-1B32
D4D-2132N	D4N-2132	D4D-2532N	D4N-2A32	D4D-2A32N	D4N-2B32

D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product
D4D-3132N	D4N-3132	D4D-3532N	D4N-3A32	D4D-3A32N	D4N-3B32
D4D-5132N	D4N-5132	D4D-5532N	D4N-5A32	D4D-5A32N	D4N-5B32
D4D-6132N	D4N-6132	D4D-6532N	D4N-6A32	D4D-6A32N	D4N-6B32
D4D-1162N	D4N-1162	D4D-1562N	D4N-1A62	D4D-1A62N	D4N-1B62
D4D-2162N	D4N-2162	D4D-2562N	D4N-2A62	D4D-2A62N	D4N-2B62
D4D-3162N	D4N-3162	D4D-3562N	D4N-3A62	D4D-3A62N	D4N-3B62
D4D-5162N	D4N-5162	D4D-5562N	D4N-5A62	D4D-5A62N	D4N-5B62
D4D-6162N	D4N-6162	D4D-6562N	D4N-6A62	D4D-6A62N	D4N-6B62
D4D-1172N	D4N-1172	D4D-1572N	D4N-1A72	D4D-1A72N	D4N-1B72
D4D-2172N	D4N-2172	D4D-2572N	D4N-2A72	D4D-2A72N	D4N-2B72
D4D-3172N	D4N-3172	D4D-3572N	D4N-3A72	D4D-3A72N	D4N-3B72
D4D-5172N	D4N-5172	D4D-5572N	D4N-5A72	D4D-5A72N	D4N-5B72
D4D-6172N	D4N-6172	D4D-6572N	D4N-6A72	D4D-6A72N	D4N-6B72
D4D-112HN	D4N-112H	D4D-152HN	D4N-1A2H	D4D-1A2HN	D4N-1B2H
D4D-212HN	D4N-212H	D4D-252HN	D4N-2A2H	D4D-2A2HN	D4N-2B2H
D4D-312HN	D4N-312H	D4D-352HN	D4N-3A2H	D4D-3A2HN	D4N-3B2H

General-purpose Limit Switches

D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product	D4D-N product to be discontinued	Recommended substitute product
D4D-1121N	D4N-112G	D4D-15REN	D4N-1ARE	D4D-1AREN	D4N-1BRE
D4D-2121N	D4N-212G	D4D-25REN	D4N-2ARE	D4D-2AREN	D4N-2BRE
D4D-3121N	D4N-312G	D4D-35REN	D4N-3ARE	D4D-3AREN	D4N-3BRE
D4D-5121N	D4N-512G	D4D-55REN	D4N-5ARE	D4D-5AREN	D4N-5BRE
D4D-6121N	D4N-612G	D4D-65REN	D4N-6ARE	D4D-6AREN	D4N-6BRE
D4D-1127N	D4N-112H	D4D-15LEN	D4N-1ALE	D4D-1ALEN	D4N-1BLE
D4D-2127N	D4N-212H	D4D-25LEN	D4N-2ALE	D4D-2ALEN	D4N-2BLE
D4D-3127N	D4N-312H	D4D-35LEN	D4N-3ALE	D4D-3ALEN	D4N-3BLE
D4D-5127N	D4N-512H	D4D-55LEN	D4N-5ALE	D4D-5ALEN	D4N-5BLE
D4D-6127N	D4N-612H	D4D-65LEN	D4N-6ALE	D4D-6ALEN	D4N-6BLE
D4D-1180N	D4N-4180	D4D-1521N	D4N-1A2G	D4D-1A21N	D4N-1B2G
D4D-2180N	D4N-2180	D4D-2521N	D4N-2A2G	D4D-2A21N	D4N-2B2G
D4D-3180N	D4N-3180	D4D-3521N	D4N-3A2G	D4D-3A21N	D4N-3B2G
D4D-5180N	D4N-8180	D4D-5521N	D4N-5A2G	D4D-5A21N	D4N-5B2G
D4D-6180N	D4N-6180	D4D-6521N	D4N-6A2G	D4D-6A21N	D4N-6B2G
D4D-1187N	D4N-4187	D4D-1527N	D4N-1A2H	D4D-1A27N	D4N-1B2H
D4D-2187N	D4N-2187	D4D-2527N	D4N-2A2H	D4D-2A27N	D4N-2B2H
D4D-3187N	D4N-3187	D4D-3527N	D4N-3A2H	D4D-3A27N	D4N-3B2H
D4D-5187N	D4N-8187	D4D-5527N	D4N-5A2H	D4D-5A27N	D4N-5B2H
D4D-6187N	D4N-6187	D4D-6527N	D4N-6A2H	D4D-6A27N	D4N-6B2H
				D4D-1A80N	D4N-4B80
				D4D-2A80N	D4N-2B80
				D4D-3A80N	D4N-3B80
				D4D-5A80N	D4N-8B80
				D4D-6A80N	D4N-6B80
				D4D-1A87N	D4N-4B87
				D4D-2A87N	D4N-2B87
				D4D-3A87N	D4N-3B87
				D4D-5A87N	D4N-8B87
				D4D-6A87N	D4N-6B87

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Safety Limit Switch

D4B-□N

- Snap-action or slow-action contact for accurate switching with safe operation via a direct opening mechanism with metal deposition between mating contacts.
- Two sets of contacts: one (NC) for safety category circuit and the other (NO) for control circuit.
- Contacts opened by direct opening mechanism (NC contacts only), thus preventing faulty operation due to factors such as metal deposition.
- Wide standard operating temperature range:
  –40°C to 80°C (standard type).
- Safety of lever settings ensured using a mechanism that engages a gear between the operating position indicator plate and the lever.
- Equipped with a mechanism that indicates the applicable operating zone, as well as push-button switching to control left and right motion.
- Conforms to EN (TÜV) standards corresponding to the CE marking.
- 3-conduit switches are available.
- Metric conduit types available.

Model Number Structure

Model Number Legend

D4B-□□□□N

1 2 3

1. Conduit

1: PG13.5 (1-conduit)
2: G1/2 (PF1/2) (1-conduit)
3: 1/2-14NPT (1-conduit)
4: M20
5: PG13.5 (3-conduit)
6: G1/2 (PF1/2) (3-conduit)
7: 1/2-14NPT (3-conduit)
8: M20 (3-conduit)

2. Built-in Switch

1: 1NC/1NO (snap-action)
3: 1NC/1NO (slow-action) gold-plated contacts
5: 1NC/1NO (slow-action) (see note)
A: 2NC (slow-action)
B: 2NC (slow-action) gold-plated contacts

Note: Excluding D4B-□□81N and D4B-□□87N models.

3. Actuator

00: Switch box (without head)
11: Roller lever (standard)
16: Adjustable roller lever
17: Adjustable rod lever
1R: Roller lever (conventional D4B-compatible)
70: Top plunger
71: Top roller plunger
81: Coil spring
87: Plastic rod

Ordering Information

List of Models

Safety limit switch, mechanical form lock

Switches (EN50041)

Actuator		Conduit size								
		PG13.5 (see note 2)			G1/2			M20		
		1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)
Side rotary	Roller lever (form A)	D4B-1111N	D4B-1511N	D4B-1A11N	D4B-2111N	D4B-2511N	D4B-2A11N	D4B-4111N	D4B-4511N	D4B-4A11N
	Adjustable roller lever (see note 1)	D4B-1116N	D4B-1516N	D4B-1A16N	D4B-2116N	D4B-2516N	D4B-2A16N	D4B-4116N	D4B-4516N	D4B-4A16N
	Adjustable rod lever (form D) (see note 1)	D4B-1117N	D4B-1517N	D4B-1A17N	D4B-2117N	D4B-2517N	D4B-2A17N	D4B-4117N	D4B-4517N	D4B-4A17N
Top plunger	Plain (form B)	D4B-1170N	D4B-1570N	D4B-1A70N	D4B-2170N	D4B-2570N	D4B-2A70N	D4B-4170N	D4B-4570N	D4B-4A70N
	Roller (form C)	D4B-1171N	D4B-1571N	D4B-1A71N	D4B-2171N	D4B-2571N	D4B-2A71N	D4B-4171N	D4B-4571N	D4B-4A71N
Wobble lever (see note 1)	Coil spring	D4B-1181N	---	D4B-1A81N	D4B-2181N	---	D4B-2A81N	D4B-4181N	---	
	Plastic rod	D4B-1187N	---	D4B-1A87N	D4B-2187N	---	D4B-2A87N	D4B-4187N	---	

Note: 1. Mechanically speaking, these models are basic limit switches.

2. The D4B-□N is a Limit Switch conforming to European standards, and PG13.5 is commonly used in Europe.

3-conduit Switch

Actuator		Conduit size								
		PG13.5 (see note 2)			G1/2			M20		
		1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)	1NC/1NO (Snap-action)	1NC/1NO (Slow-action)	2NC (Slow-action)
Side rotary	Roller lever (form A)	D4B-5111N	D4B-5511N	D4B-5A11N	D4B-6111N	D4B-6511N	D4B-6A11N	D4B-8111N	---	---
	Adjustable roller lever (see note 1)	D4B-5116N	D4B-5516N	D4B-5A16N	D4B-6116N	D4B-6516N	D4B-6A16N	D4B-8116N	---	---
	Adjustable rod lever (form D) (see note 1)	D4B-5117N	D4B-5517N	D4B-5A17N	D4B-6117N	D4B-6517N	D4B-6A17N	D4B-8117N	---	---
Top plunger	Plain (form B)	D4B-5170N	D4B-5570N	D4B-5A70N	D4B-6170N	D4B-6570N	D4B-6A70N	---	---	---
	Roller (form C)	D4B-5171N	D4B-5571N	D4B-5A71N	D4B-6171N	D4B-6571N	D4B-6A71N	D4B-8171N	---	D4B-8A71N
Wobble lever (see note 1)	Coil spring	D4B-5181N	---	D4B-5A81N	D4B-6181N	---	D4B-6A81N	---	---	---
	Plastic rod	D4B-5187N	---	D4B-5A87N	D4B-6187N	---	D4B-6A87N	---	---	---

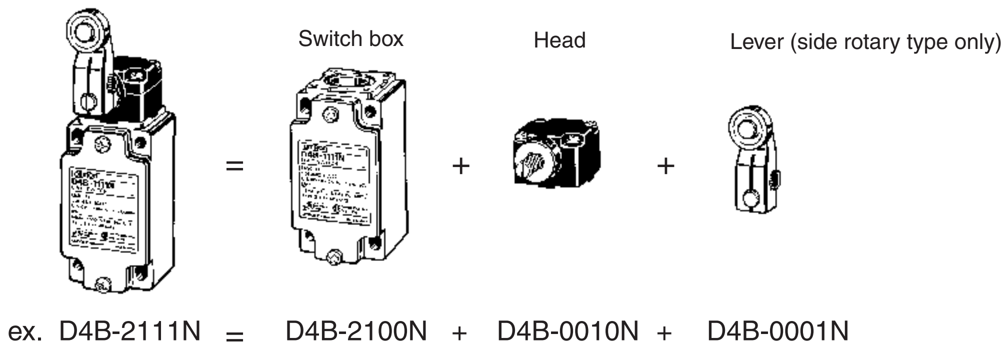
Note: 1. Mechanically speaking, these models are basic limit switches.

2. The D4B-□N is a Limit Switch conforming to European standards, and M20/PG13.5 is commonly used in Europe.

3. The wobble lever models are ordinary limit switches and are not approved under EN, GS, and SUVA's Direct Opening Certificate.

Replacement Part

Because the D4B-□N employs a block mounting construction, the switch box, operating head, and lever (side rotary type only) may be ordered as a complete assembly or individually as replacement parts. (Replacement parts are not available as a switch box and head assembly or as a head and lever assembly.)



Switch Box

	EN50041			3-conduit type		
	PG13.5	G1/2	1/2-14NPT	PG13.5	G1/2	1/2-14NPT
1NC/1NO (Snap-action)	D4B-1100N	D4B-2100N	D4B-3100N	D4B-5100N	D4B-6100N	D4B-7100N
1NC/1NO (Slow-action)	D4B-1500N	D4B-2500N	D4B-3500N	D4B-5500N	D4B-6500N	D4B-7500N
2NC (Slow-action)	D4B-1A00N	D4B-2A00N	D4B-3A00N	D4B-5A00N	D4B-6A00N	D4B-7A00N

Operating Heads

Actuator	Type	Model
Side rotary	Standard	D4B-0010N
Top plunger	Plain	D4B-0070N
	Roller	D4B-0071N
Wobble lever	Coil spring	D4B-0081N
	Plastic rod	D4B-0087N

Levers (for Side Rotary Switches)

Actuator	Length	Diameter of roller	Model
Standard	31.5	17.5 dia.	D4B-0001N
Adjustable roller lever	25 to 89	19 dia.	D4B-0006N
Adjustable rod lever	145 max.	---	D4B-0007N
Interchangeable with D4B-0001	33.7	19 dia.	D4B-000RN

Note: Other types of lever are also available.

Specifications

Approved Standards

Snap-action Models

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9851083 (Direct opening: approved) R9151372 (Direct opening: approval pending) (See note 1.)
UL	UL508	E76675
CSA	C22.2 No. 14	LR45746
BIA (See note 2.)	GS-ET-15	1-conduit: 9202158 3-conduit: 9309655

Note: 1. Adjustable roller lever, adjustable rod lever, coil spring, and plastic rod models only.

2. Not including adjustable roller lever, adjustable rod lever, coil spring, and plastic rod models.

Slow-action Models

Agency	Standard	File No.
TÜV Rheinland	EN60947-5-1	R9151643 (Direct opening: approved) (See note)
UL	UL508	E76675
CSA	C22.2 No. 14	LR45746
BIA (See note.)	GS-ET-15	1-conduit: 9202158 3-conduit: 9309655
SUVA (See note.)	SUVA	1-conduit: E6188/ 1.d 3-conduit: E6189/ 1.d

Note: Not including adjustable roller lever, adjustable rod lever, coil spring, and plastic rod models.

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN1088
  EN50041

Approved Standard Ratings

TÜV Rheinland: EN60947-5-1

Utilization category	AC-15
Rated operating current (I_e)	2 A
Rated operating voltage (U_e)	400 V

Note: As protection against short-circuiting, use either a gI-type or gG-type 10-A fuse that conforms to IEC269.

UL/CSA: (UL508, CSA C22.2 No. 14)

A600

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC 240 VAC 480 VAC 600 VAC	10 A	60 A 30 A 15 A 12 A	6 A 3 A 1.5 A 1.2 A	7,200 VA	720 VA

Characteristics

Item		Snap-action	Slow-action
Durability (see note 3)	Mechanical	30,000,000 operations min.	10,000,000 operations min.
	Electrical	500,000 operations min. (at a 250 VAC, 10-A resistive load)	
Operating speed		1 mm/s to 0.5 m/s	
Operating frequency		Mechanical:120 operations/min Electrical:30 operations/min	
Rated frequency		50/60 Hz	
Insulation resistance		100 MΩ min. (at 500 VDC) between terminals of the same polarity and between each terminal and non-current-carrying part	
Contact resistance		25 mΩ max. (initial value)	
Dielectric strength (U_{imp})			
	Between terminals of same polarity	U_{imp} 2.5 kV	U_{imp} 4 kV
	Between terminals of different polarity	---	U_{imp} 4 kV
	Between current-carrying metal parts and ground	U_{imp} 4 kV	U_{imp} 4 kV
	Between each terminal and non-current-carrying parts	U_{imp} 4 kV	U_{imp} 4 kV
Rated insulation voltage (U_i)		600 VAC (EN60947-5-1)	
Counter electromotive voltage at switching		1,500 VAC max. (EN60947-5-1)	
Operating environmental pollution level		3 (EN60947-5-1)	
Conditional short-circuit current		100 A (EN60947-5-1)	
Conventional enclosed thermal current (I_{the})		20 A (EN60947-5-1)	
Electric shock protection class		Class I (with ground terminal)	
Vibration resistance		Malfunction:10 to 55 Hz, 0.75 mm single amplitude	
Shock resistance		Destruction:1,000 m/s^2 min. Malfunction:300 m/s^2 min.	
Ambient temperature		Operating:–40°C to 80°C (with no icing) (see note 4)	
Ambient humidity		Operating:95% max.	
Degree of protection		IP67 (EN60947-5-1)	
Weight		Approx. 250 g	

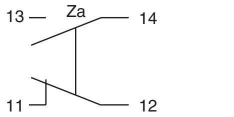
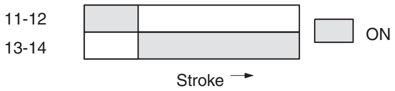
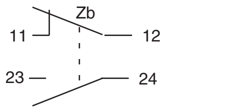
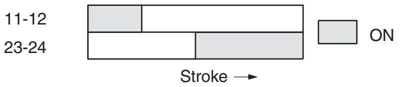
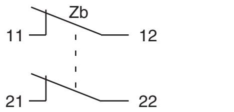
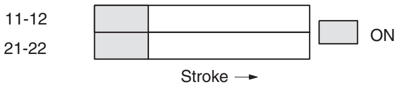
Note: 1. The above values are initial values.
2. The above values may vary depending on the model. Consult your OMRON sales representative for details.
3. The durability is for an ambient temperature of 5°C to 35°C and ambient humidity of 40% to 70%. For further conditions, consult your OMRON sales representative.
4. –25°C to 80°C for the flexible-rod type.

Operating Characteristics

Model	D4B-□□11N	D4B-□□16N (see note 1)	D4B-□□17N (see note 2)	D4B-□□70N	D4B-□□71N	D4B-□□81N	D4B-□□87N
OF max.	9.41 N		2.12 N	18.63 N		1.47 N	
RF min.	1.47 N		0.29 N	1.96 N		---	
PT	21±3°			2.0 mm max.		15° max.	
PT (2nd) (see note 3)	(45°)			(3.0 mm)		---	
OT min.	50°			5.0 mm		---	
MD max. (see note 4)	12°			1.0 mm		---	
DOT min.	35° (Slow-action models) 55° (Snap-action models)			3.2 mm		---	
DOF min.	19.61 N			49.03 N		---	
TT	(75°)			7.0 mm		---	
FP max.	---			38 mm	51 mm	---	
OP	---			35±1 mm	48±1 mm	---	

Note: 1. The operating characteristics of these Switches were measured with the roller lever set at 31.5 mm.
2. The operating characteristics of these Switches were measured with the rod lever set at 140 mm.
3. Only for slow-action models.
4. Only for snap-action models.

Contact Form (EN50013)

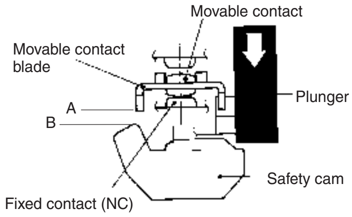
Model	Contact		Diagrams	Explanation
D4B-□1□N	1NC/1NO (Snap-action)			Only NC contact 11-12 has an approved direct opening mechanism. Terminal numbers 11-12 and 13-14 cannot be used as unlike poles.
D4B-□5□N	1NC/1NO (Slow-action)			Only NC contact 11-12 has an approved direct opening mechanism. Terminal numbers 11-12 or 23-24 can be used as unlike poles.
D4B-□A□N	2NC (Slow-action)			Both NC contacts 11-12 and 21-22 have an approved direct opening mechanism. Terminal numbers 11-12 and 21-22 can be used as unlike poles.

Direct Opening Mechanism

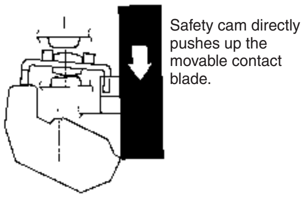
1NO/1NC Contact (Snap-action)

If metal deposition between mating contacts occurs on the NC contact side, they can be pulled apart by the shearing force and tensile force generated when part B of the safety cam or plunger engages part A of the movable contact blade. When the safety cam or plunger is moved in the direction of the arrow, the Limit Switch releases.

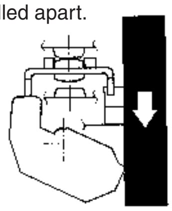
1. When metal deposition occurs.



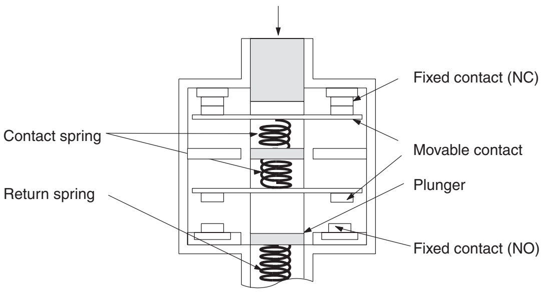
2. When contacts are being pulled apart.



3. When contacts are completely pulled apart.



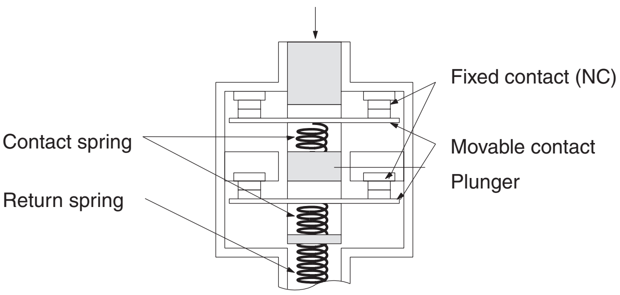
1NC/1NO Contact (Slow-action)



Conforms to EN60947-5-1 Direct Opening

When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

2NC Contact (Slow-action)



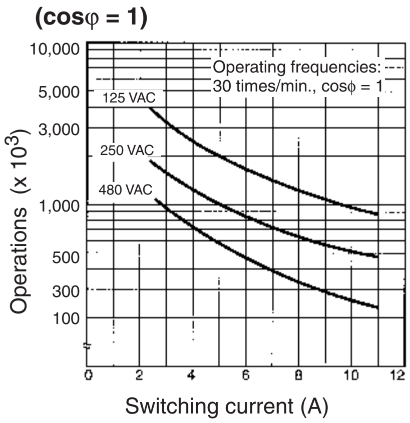
Conforms to EN60947-5-1

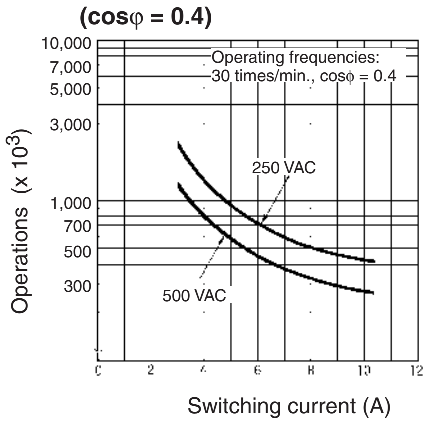
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.

is marked on the product to indicate approval of direct opening.

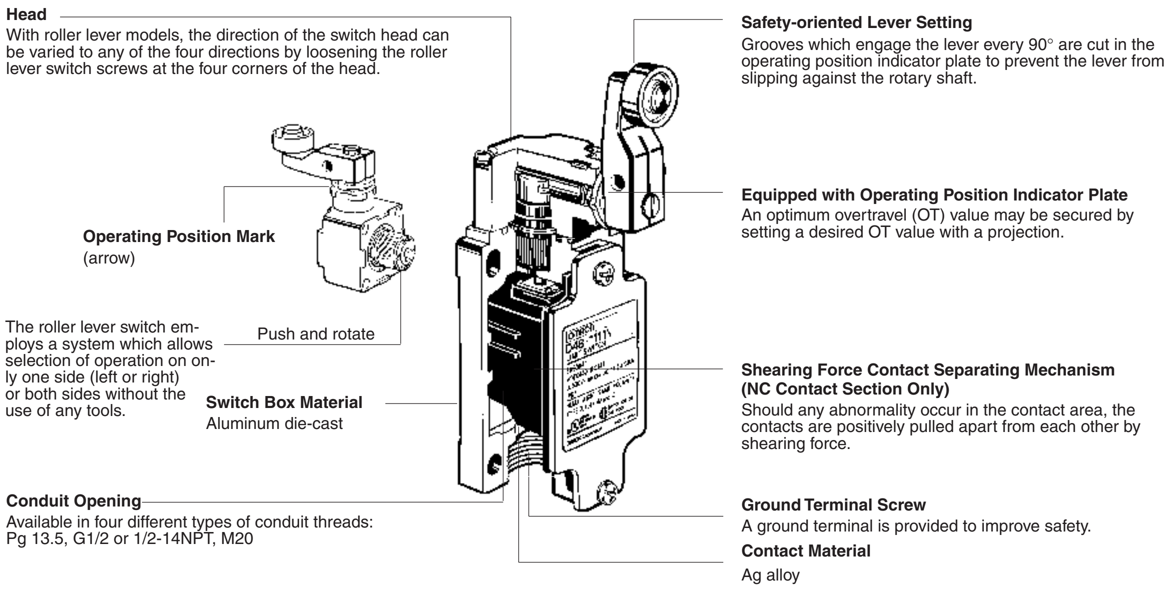
Engineering Data

Electrical Durability (Snap-action)





Nomenclature



Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.

2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

3. When placing your order, specify the conduit type by adding a code from the list below to the blank box of the following model numbers as shown below.

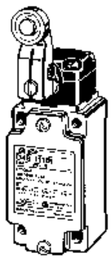
Standard Switches	3-conduit Switches
1: PG 13.5	5: PG 13.5
2: G 1/2	6: G 1/2
3: 1/2-14NPT	7: 1/2-14NPT
4: M20	8: M20

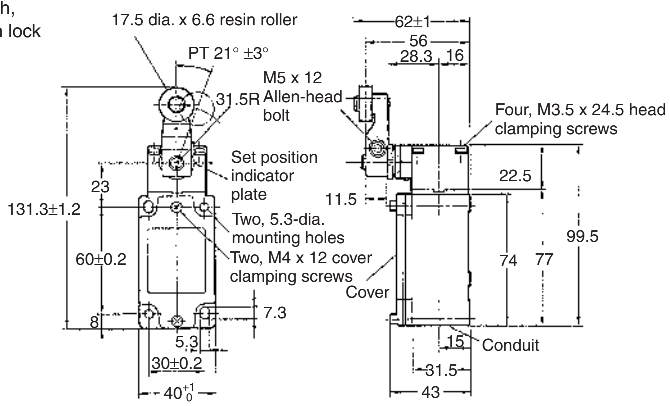
Switches

Roller Lever

D4B-□□11N

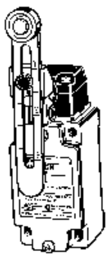
safety limit switch, mechanical form lock

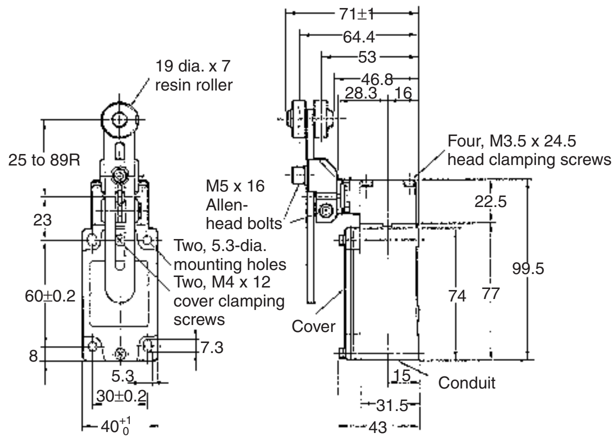




Adjustable Roller Lever

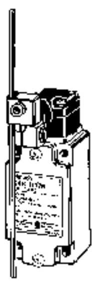
D4B-□□16N

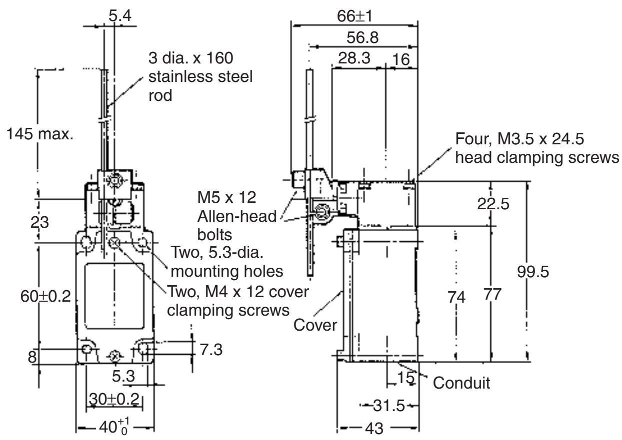




Adjustable Rod Lever

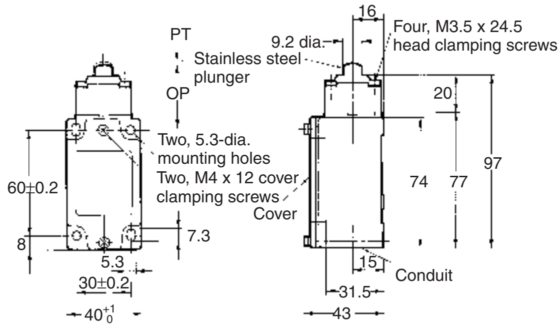
D4B-□□17N





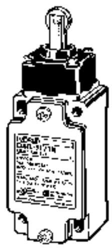
Top Plunger

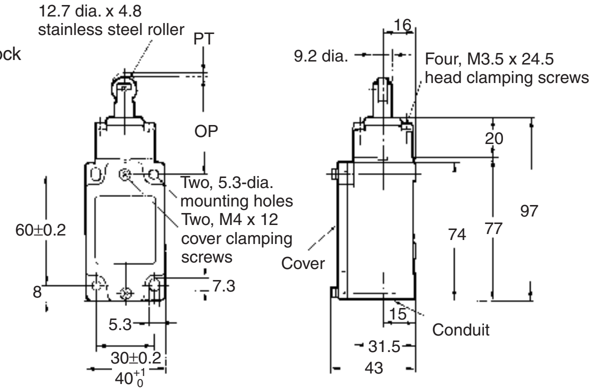
D4B-□□70N safety limit switch, mechanical form lock



Top Roller Plunger

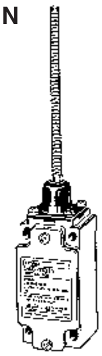
D4B-□□71N safety limit switch, mechanical form lock

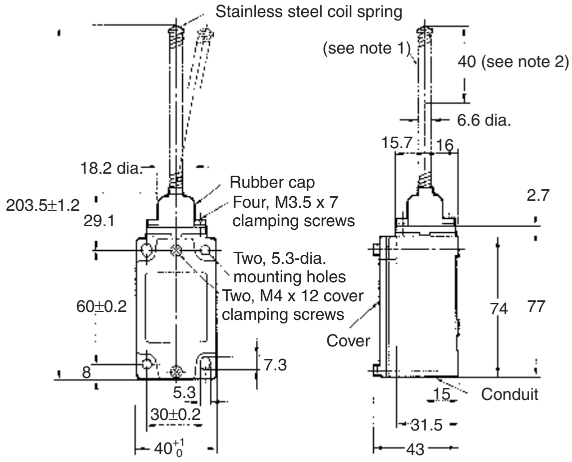




Coil Spring

D4B-□□81N



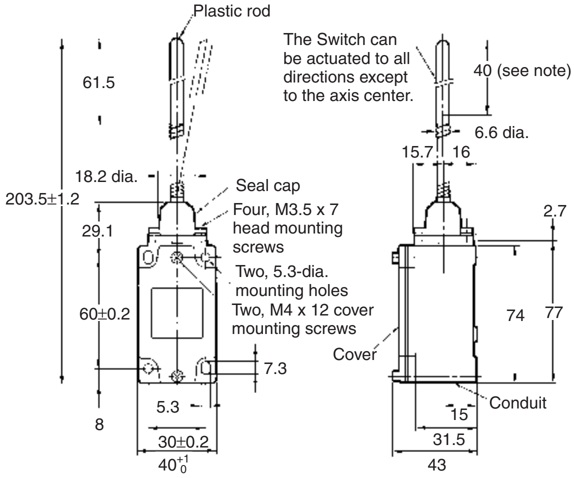


Note: 1. The coil spring may be operated from any directions except axial directions (↓).

2. Be sure to adjust the dog to within 40 mm from the top end of the coil spring.

Plastic Rod

D4B-□□87N



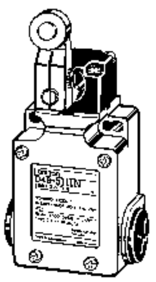
Note: Be sure to adjust the dog to within 40 mm from the top end of the plastic rod.

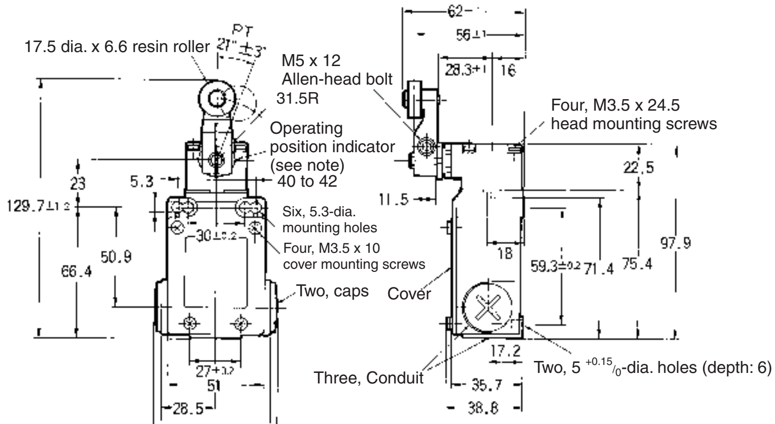
D4B-□N

3-conduit Switches

Roller Lever safety limit switch, mechanical form lock

D4B-□□11N

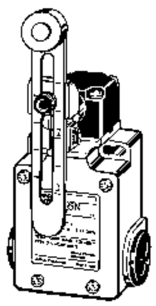


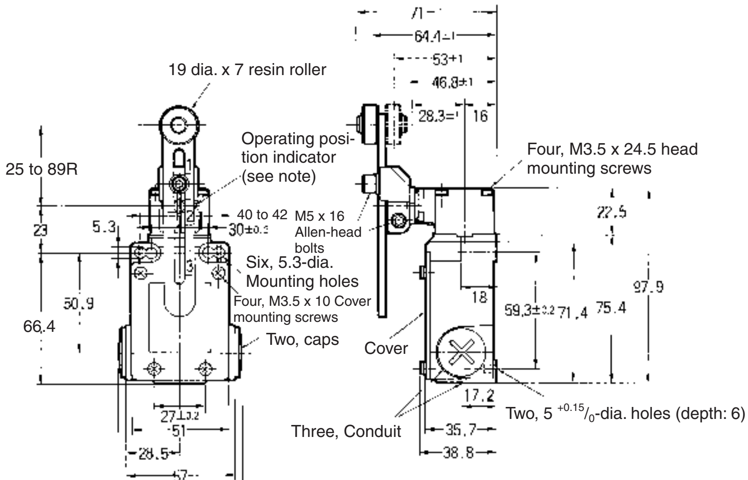


Note: The lever can be set to any desired position by turning the operating position indicator.

Adjustable Roller Lever

D4B-□□16N

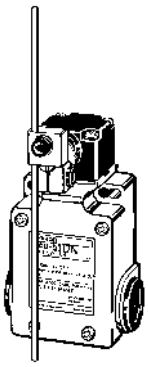


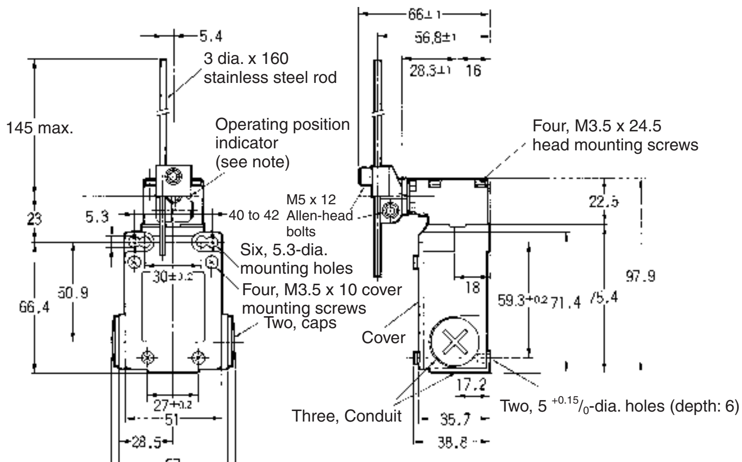


Note: The lever can be set to any desired position by turning the operating position indicator.

Adjustable Rod Lever

D4B-□□17N



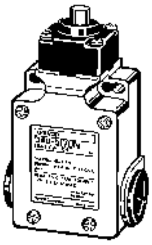


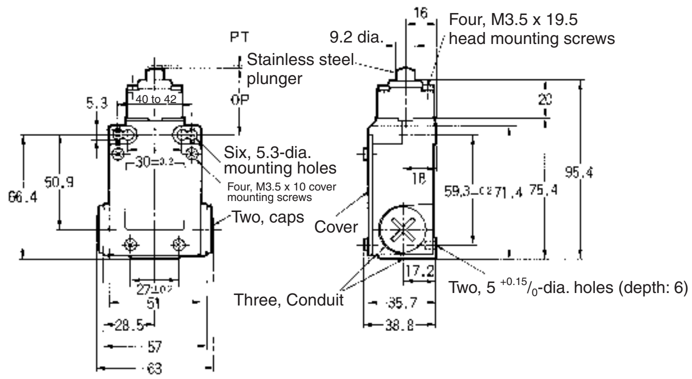
Note: The lever can be set to any desired position by turning the operating position indicator.

Top Plunger

D4B-□□70N

safety limit switch, mechanical form lock

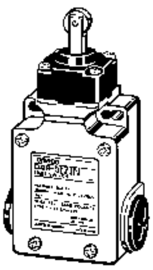


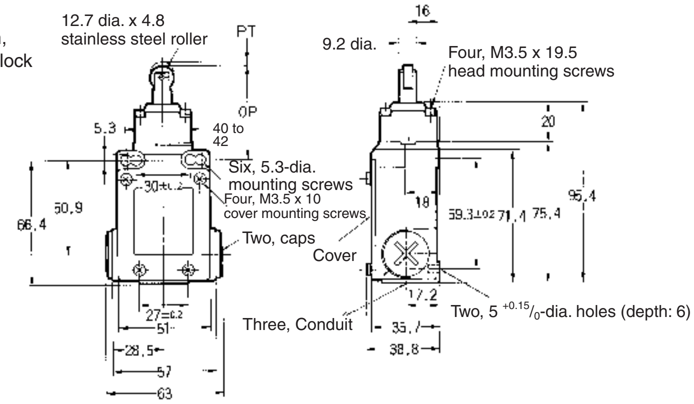


Top Roller Plunger

D4B-□□71N

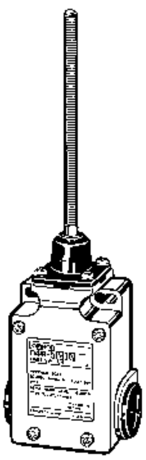
safety limit switch, mechanical form lock

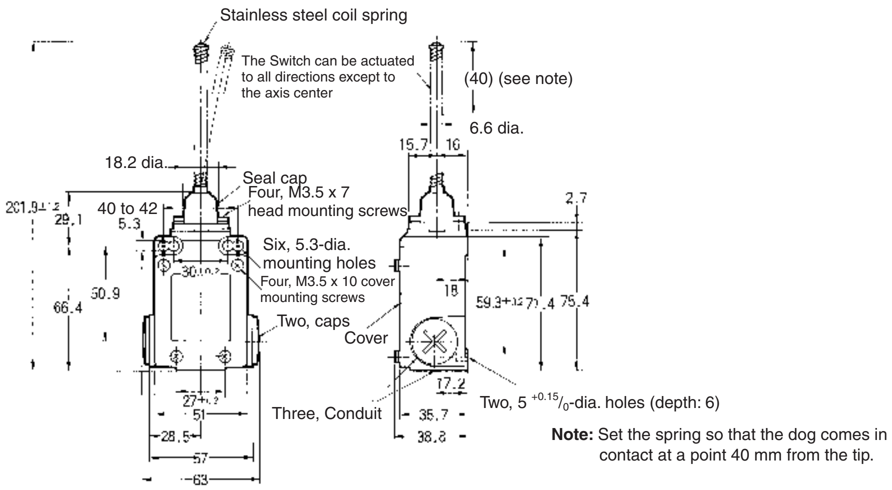




Coil Spring

D4B-□□81N

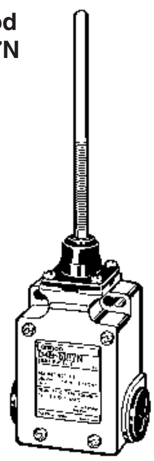


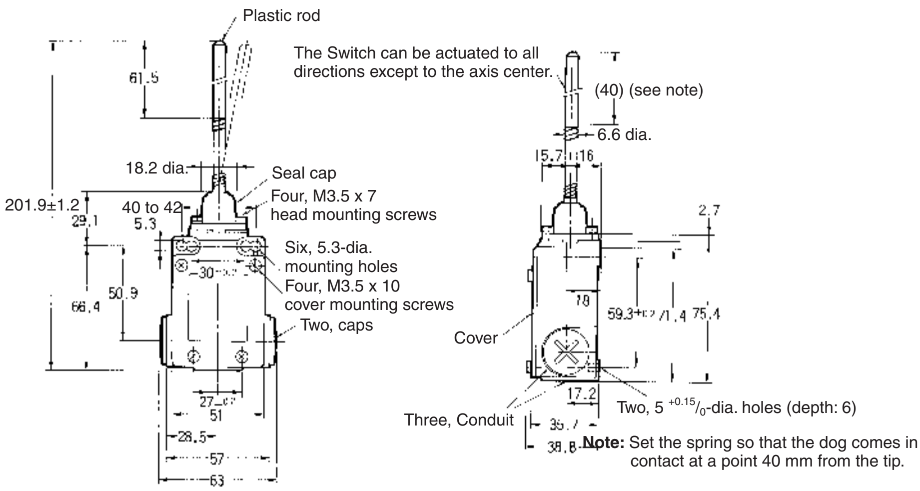


Note: Set the spring so that the dog comes in contact at a point 40 mm from the tip.

Plastic Rod

D4B-□□87N

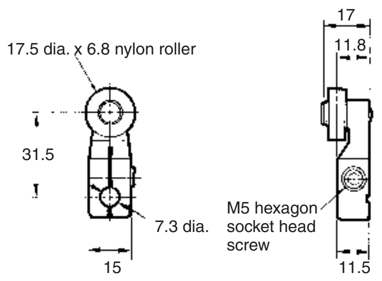




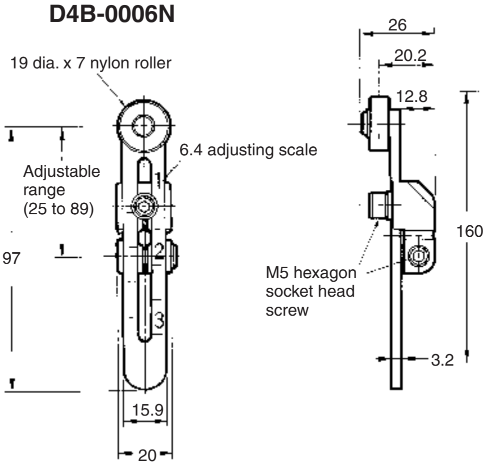
Note: Set the spring so that the dog comes in contact at a point 40 mm from the tip.

Levers

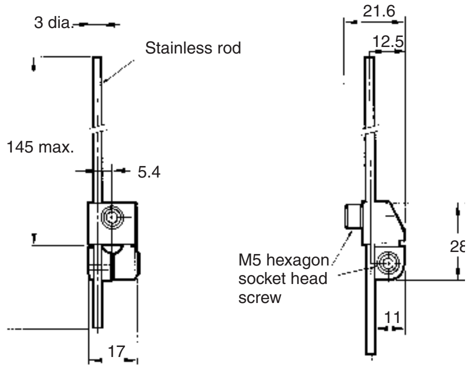
Roller Lever D4B-0001N
mechanical form lock



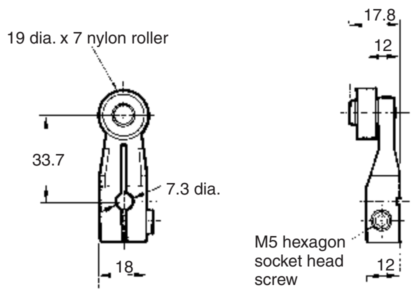
Adjustable Roller Lever D4B-0006N



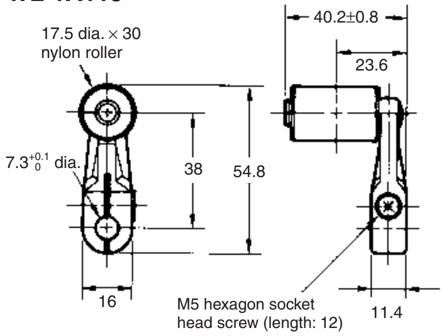
Adjustable Rod Lever D4B-0007N



Roller Lever (compatible with previous D4B model) D4B-000RN
mechanical form lock

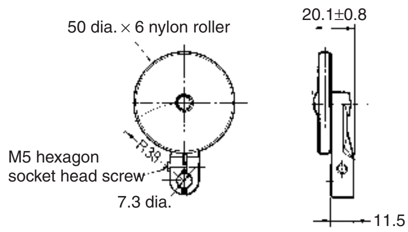


Roller Lever WL-1A118



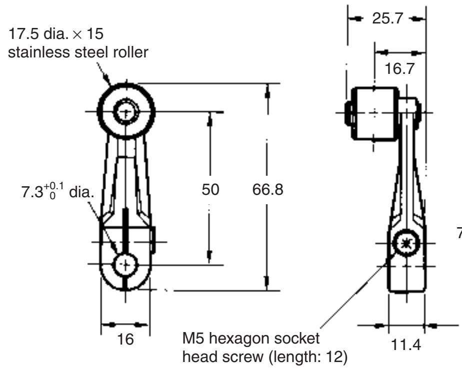
Note: Reverse the indicator plate when mounting.

Roller Lever WL-1A106



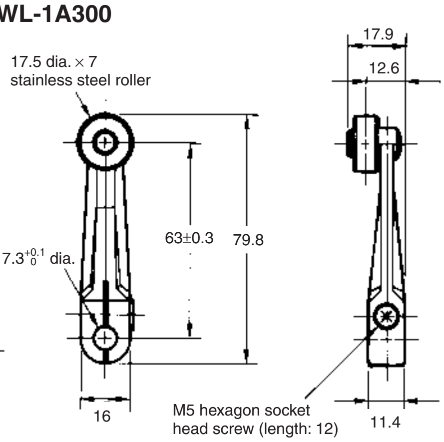
Note: Reverse the indicator plate when mounting.

Roller Lever WL-1A206
mechanical form lock



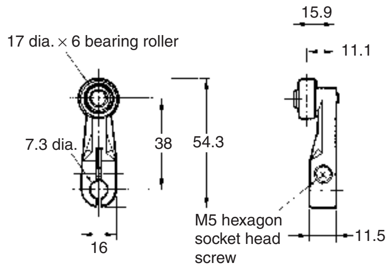
Note: Reverse the indicator plate when mounting.

Roller Lever WL-1A300



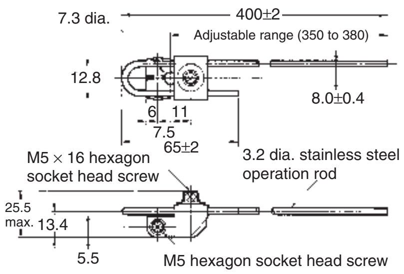
Note: Reverse the indicator plate when mounting.

Roller Lever WL-1A400



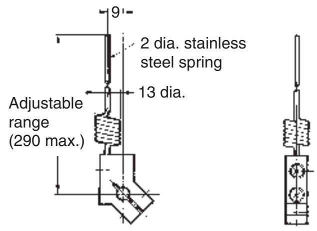
Note: Reverse the indicator plate when mounting.

Adjustable Rod Lever
WL-3A100



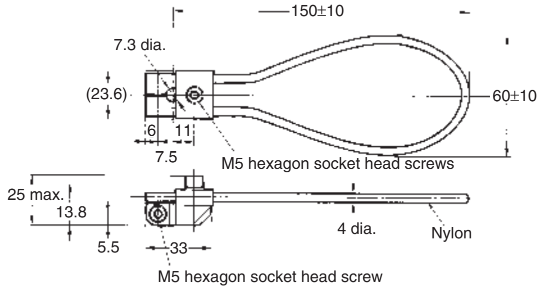
Note: Reverse the indicator plate when mounting.

Spring Rod Lever
WL-4A201



Note: Reverse the indicator plate when mounting.

Resin Loop Lever
D4A-F00



Note: Reverse the indicator plate when mounting.

Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Safety Limit Switch specifications are satisfied with D4B-□□□□AN Levers only.

D4B-□N

Precautions

If the D4B-□N is applied to a safety category circuit for prevention of injury, use the D4B-□N model that has an NC contact equipped with a direct opening mechanism, and make sure that the D4B-□N operates in the direct opening mode. Furthermore, secure the D4B-□N with screws or equivalent parts that are tightened in a single direction so that the D4B-□N cannot be easily removed. Then provide a protection cover for the D4B-□N and post a warning label near the D4B-□N.

In order to protect the D4B-□N from damage due to short-circuiting, connect a fuse breaking a current 1.5 to 2 times higher than the rated current in parallel with the D4B-□N.

If an application satisfying EN standards is to employ the D4BL, apply the 10-A gI or gG fuse approved by IEC269.

Do not apply the D4B-□N to the door without applying a stopper to the door.

If the D4B-□N is used with the actuator normally pressed, the D4B-□N may malfunction or may soon have reset failures. Be sure to check and replace the D4B-□N regularly.

Correct Use

Operating Environment

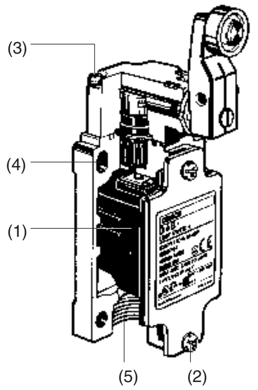
The D4B-□N is for indoor use. The D4B-□N may malfunction if the D4B-□N is used outdoors. Be sure to use a model with a lever-type actuator for outdoor use instead.

Do not use the D4B-□N in the following locations:

- Locations subject to severe temperature changes
- Locations subject to high temperatures or condensation
- Locations subject to severe vibration
- Locations where the product may come in contact with metal dust, oil, or chemicals

Tightening Torque

Be sure to tighten each screw of the D4B-□N properly, otherwise the D4B-□N may malfunction.



	Type	Torque
1	M3.5 terminal screw	0.59 to 0.78 N·m
2	Cover-mounting screw (see note)	1.18 to 1.37 N·m
3	Head mounting screw	0.78 to 0.98 N·m
4	M5 body mounting screw	4.90 to 5.88 N·m
5	Connector	1.77 to 2.16 N·m
6	Cap screw (for three-conduit models)	1.27 to 1.67 N·m

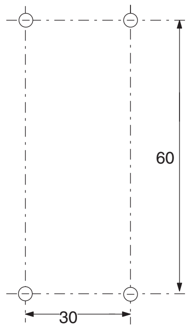
Note: Apply a tightening torque of 0.78 to 0.88 N·m to conduit models.

Mounting

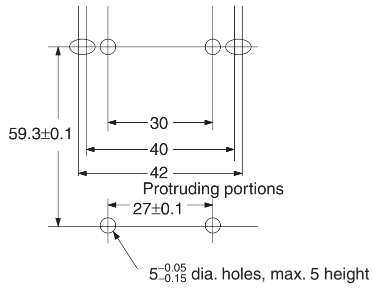
Use four M5 screws with washers to mount the standard model. Be sure to apply the proper torque to tighten each screw. The D4B-□N can be mounted more securely by using the four screws plus two $5^{-0.05}/_{-0.15}$-mm protruding parts, each of which has a maximum height of 4.8 mm as shown below.

Mounting Dimensions (M5)

Standard Model



3-conduit Model



Changes in Actuator Mounting Position

To change the angle of the lever, loosen the Allen-head bolts on the side of the lever.

The operating position indicator plate has protruding parts which engage with the lever, thus allowing changes to the lever position by 90°.

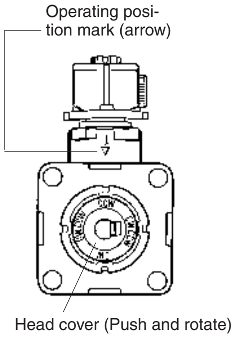
The back of the operating position indicator plate has no protruding parts. The lever can be set at any angle by attaching the operating position indicator plate to the Switch so that this side will face the lever. In this case, however, the D4B-□N will not be approved by SUVA or BIA. Make sure that the lever engages with the operating position indicator plate securely so that the lever will not slip.

Changes in Head Mounting Position

By removing the screws on the four corners of the head, the head can be reset in any of four directions. Make sure that no foreign materials will penetrate through the head.

CW, CCW or Two-way Operation

The head of Side Rotary Switches can be converted in seconds to CW, CCW, or two-way operation. The conversion procedure follows.



Procedure

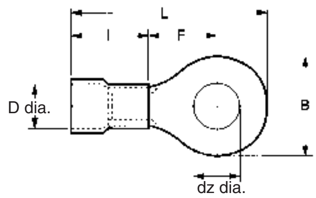
1. Dismount the head by loosening the four screws that secure it.
2. Turn over the head to set the desired operation (CW, CCW, or both). The desired operation can be selected by setting the mode selector knob shown in the figure. This knob is factory set to the "CW + CCW" (two-way operation) position.
3. Set the CW hole on the head at the operation position mark (arrow) for clockwise operation or set the CCW hole right at the arrow for counterclockwise operation. In either case, be sure to set the hole position exactly at the arrow point.

Wiring

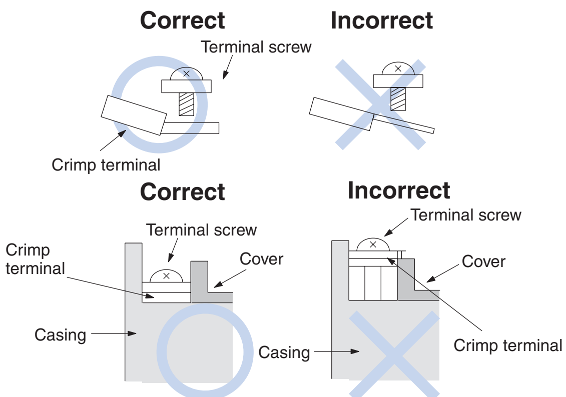
Do not connect the bare lead wires directly to the terminals but be sure to connect each of them by using an insulation tube and M3.5 round crimp terminals and tighten each terminal screw within the specified torque range.

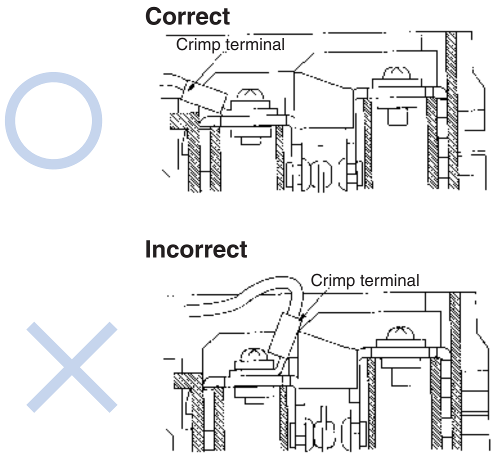
The proper lead wire is 20 to 14 AWG (0.5 to 2.5 mm²) in size.

dz dia.:	3.7
D dia.:	4.5
B:	7.0
L:	20.2
F:	7.7
l:	9.0 (mm)



Make sure that all crimp terminals come into contact with the casing or cover as shown below, otherwise the cover may not be mounted properly or the D4B-□N may malfunction.





Connector

Make sure that each connector is tightened within the specified torque range. The casing may be damaged if the connector is tightened excessively.

If the 1/2-14NPT is used, cover the cable and conduit end with sealing tape in order to ensure IP67.

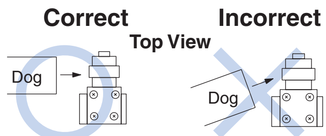
The Pg13.5 connector must be Nippon Flex's ABS-08Pg13.5 or ABS-12 Pg13.5.

Use OMRON's SC-series connector which is suited to the cable in diameter.

Properly attach the provided conduit cap to the unused conduit opening and securely tighten the cap screw within the specified torque when wiring the D4B-□N.

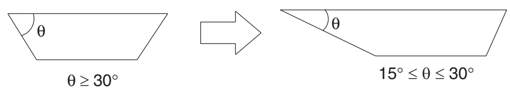
Others

The load for the actuator (roller) of the Switch must be imposed on the actuator in the horizontal direction, otherwise the actuator or the rotating axis may be deformed or damaged.



When using a long lever model like the D4B-□□16N or D4B-□□17N, the Switch may telegraph. To avoid telegraphing, take the following precautions.

1. Set the lever to operate in one direction. For details, see page G-257, *CW, CCW or Two-way Operation*.
2. Modify the rear end of the dog to an angle of 15° to 30° as shown below or to a secondary-degree curve.



3. Modify the circuit so as not to detect the wrong operating signals.

Small Safety Limit Switch

D4F

A Smaller Limit Switch than Ever Previously Produced. Ideal for Applications to Small-scale Machinery and Equipment

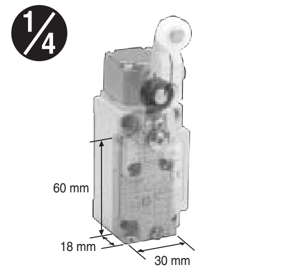
- A noticeable reduction to 1/4 the size of OMRON's conventional model.
- High-sensitivity safety limit switch.
- Built-in switches with two- or four-contact construction are available.
- Degree of protection: IP67 (EN60947-5-1)
- Patent and design pending.

Features

A Dramatic Reduction in Size

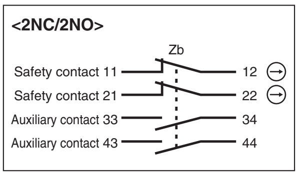
The volume is reduced to one quarter of the volume of our company's conventional types of limit switches (30 (W) × 18 (L) × 60 mm (H)). Optimal for the downsizing of machinery and equipment.

Compared with conventional type



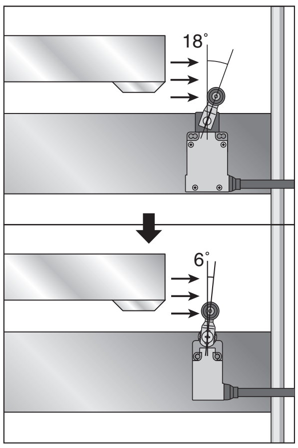
Four-contact Construction is Available

D4F models of two-contact construction (1NC/1NO and 2NC) and those of four-contact construction (2NC/2NO and 4NC) are available. The auxiliary contact can be used for monitoring input of control circuits and indicator lighting.



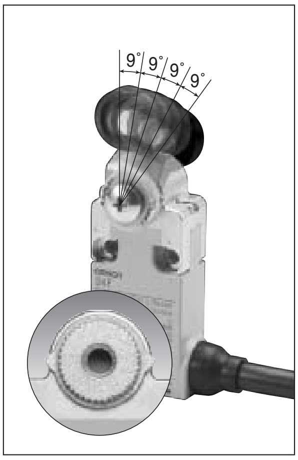
High-sensitivity and Space-saving

The conventional types of limit switches with a direct opening mechanism required 18 degrees for a movement until operation because its direct opening point is long (Our company's conventional types of limit switches).
The D4F requires 6 degrees to respond.
On the table that allows machine tools etc. to move at an increasing speed, the moment the dog pushes the actuator, the D4F responds.
With the development of smaller versions of machines, the D4F saves space and fits in a smaller space.



Positioning in Steps of 9 Degrees

For a roller lever type of switch, grooves are incised on the body and the cam of the actuator, to allow positioning in steps of 9 degrees.



D4F

OMRON

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN60204-1
  EN1088
  EN50047
  EN81
  EN115
  GS-ET-15
  JIS C 8201-5-1

Approved Standards

Agency	Standards	File No.
TÜV Product service	EN60947-5-1 (Direct opening: approved)	(See note 1.)
UL (See note 2.)	UL508 CSA C22.2 No.14	E76675

Note: 1. Contact your Omron sales representative.
2. Approval has been obtained for CSA C22.2 No. 14 under UL.

Ordering Information

Model Number Legend

D4F-□□-□□
1 2 3 4

1. **Built-in Switch**
   1: 1NC/1NO (slow-action)
   2: 2NC (slow-action)
   3: 2NC/2NO (slow-action)
   4: 4NC (slow-action)

2. **Actuator**
   02: Roller plunger (Metallic roller)
   20: Roller lever (Metallic lever, resin roller)

3. **Cable Length**
   1: 1 m
   3: 3 m
   5: 5 m

4. **Pull-outing direction of cable**
   R: Horizontal
   D: Vertical

List of Models

Actuator	Cable length	Cable direction	Built-in switch			
			1NC/1NO (slow-action)	2NC (slow-action)	2NC/2NO (slow-action)	4NC (slow-action)
Roller lever (Metallic lever, resin roller) 	1 m	Horizontal	D4F-120-1R	D4F-220-1R	D4F-320-1R	D4F-420-1R
		Vertical	D4F-120-1D	D4F-220-1D	D4F-320-1D	D4F-420-1D
	3 m	Horizontal	D4F-120-3R	D4F-220-3R	D4F-320-3R	D4F-420-3R
		Vertical	D4F-120-3D	D4F-220-3D	D4F-320-3D	D4F-420-3D
	5 m	Horizontal	D4F-120-5R	D4F-220-5R	D4F-320-5R	D4F-420-5R
		Vertical	D4F-120-5D	D4F-220-5D	D4F-320-5D	D4F-420-5D
Roller plunger (Metallic roller) 	1 m	Horizontal	D4F-102-1R	D4F-202-1R	D4F-302-1R	D4F-402-1R
		Vertical	D4F-102-1D	D4F-202-1D	D4F-302-1D	D4F-402-1D
	3 m	Horizontal	D4F-102-3R	D4F-202-3R	D4F-302-3R	D4F-402-3R
		Vertical	D4F-102-3D	D4F-202-3D	D4F-302-3D	D4F-402-3D
	5 m	Horizontal	D4F-102-5R	D4F-202-5R	D4F-302-5R	D4F-402-5R
		Vertical	D4F-102-5D	D4F-202-5D	D4F-302-5D	D4F-402-5D

Prefered items

Specifications

Approved Standard Ratings

TÜV (EN60947-5-1)

Item Utilization category	AC-15	DC-13
Rated operating current (Ie)	0.75 A	0.27 A
Rated operating voltage (Ue)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device.

UL/CSA (UL508, CSA C22.2 No. 14)

C300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	2.5 A	15 A	1.5 A	1,800 VA	180 VA
240 VAC		7.5 A	0.75 A		

Q300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55 A	0.55 A	69 VA	69 VA
250 VDC		0.27 A	0.27 A		

Characteristics

Degree of protection (See note 1.)		IP67 (EN60947-5-1)
Durability (See note 2.)		Mechanical: 10,000,000 times min. Electrical: 1,000,000 times min. (4-mA resistive load at 24 VDC, 4 circuits) 150,000 times min. (1-A resistive load at 125 VAC, 2 circuits / 4-mA resistive load at 24 VDC, 2 circuits) (See note 3.)
Operating speed		1 mm/s to 0.5 m/s
Operating frequency		Mechanical: 120 operations/minute Electrical: 30 operations/minute
Insulation resistance		100 MΩ min. (at 500 VDC) between terminals of the same polarities, between terminals of different polarities, between current-carrying metal parts and grounds, and between each terminal and non-current carrying metal parts
Minimum applicable load (See note 4.)		4-mA resistive load at 24 VDC, 4 circuits (Level N reference value)
Contact resistance (See note 5.)		300 mΩ max. (initial value with 1-m cable), 500 mΩ max. (initial value with 3-m cable), 700 mΩ max. (initial value with 5-m cable)
Dielectric strength		Between terminals of same polarities: Uimp 2.5 kV (EN60947-5-1) Between terminals of different polarities: Uimp 4 kV (EN60947-5-1) Between current-carrying metal parts and grounds: Uimp 4 kV (EN60947-5-1) Between each terminal and non-current carrying metal parts: Uimp 4 kV (EN60947-5-1)
Conditional short-circuit current		100 A (EN60947-5-1)
Pollution degree (operating environment)		3 (EN60947-5-1)
Conventional free air thermal current (Ith)		2.5 A (EN60947-5-1)
Protection against electric shock		Class I (with a ground wire)
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	**Destruction**	1,000 m/s^2 min.
	Malfunction	300 m/s^2 min.
Ambient temperature		Operating: −30°C to 70°C (with no icing)
Ambient humidity		Operating: 95% max.
Cable		UL2464 No. 22 AWG, finishing O.D.: 8.3 mm
Weight		Approx. 190 g (D4F-102-1R, with 1-m cable) Approx. 220 g (D4F-120-1R, with 1-m cable)

Note:
1. The degree of protection shown above is based on the test method specified in EN60947-5-1. Be sure to confirm in advance the sealing performance under the actual operating environment and conditions.
2. Durability values are calculated at an operating temperature of 5°C to 35°C, and an operating humidity of 40% to 70%. Contact your OMRON sales representative for more detailed information on other operating environments.
3. When the ambient temperature is 35°C or higher, do not apply 1 A at 125 VAC to more than two circuits.
4. The value will vary depending on factors such as the switching frequency, the ambient environment, and the reliability level. Be sure to confirm correct operation with the actual load before application.
5. The contact resistance was measured with 0.1 A at 5 to 8 VDC with a fall-of-potential method.

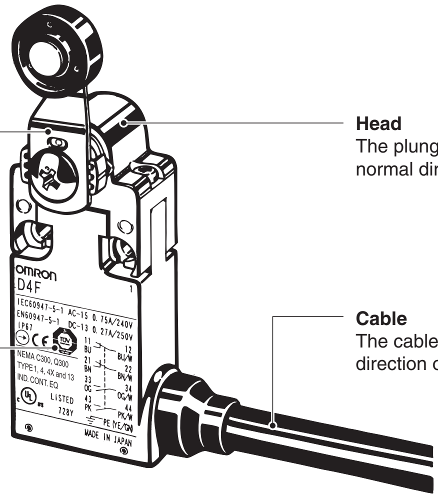
Operating Characteristics

Slow-action (1NC/1NO, 2NC, 2NC/2NO, and 4NC)

Model Operating Characteristics	D4F-□20-□R D4F-□20-□D	D4F-□02-□R D4F-□02-□D
Operating force max.: OF (See note 1.)	5 N	12 N
Release force min.: RF (See note 2.)	0.5 N	1.5 N
Pretravel: PT1 (11-12 and 21-22)	6±3° (NC)	1 mm max. (NC)
: PT1 (31-32 and 41-42)	9±3° (NC)	1.3 mm max. (NC)
: PT2 (See note 3.)	(12°) (NO)	(1.2 mm) (NO)
Overtravel min.: OT	40°	3.2 mm
Operating position: OP (11-12 and 21-22)	——	29.4±1 mm
: OP (31-32 and 41-42)	——	29±1 mm
Total travel: TT (See note 3.)	(55°)	(4.5 mm)
Min. direct opening travel: DOT (See note 4.)	18°	1.8 mm
Min. direct opening force: DOF	20 N	20 N

Note:
1. The OF value is the maximum load that opens an NC contact (11-12, 21-22, 31-32, 41-42).
2. The RF value is the minimum load that closes an NC contact (11-12, 21-22, 31-32, 41-42).
3. The PT2 and TT values are reference values.
4. The D4F is used in accordance with EN81 and EN115 at a minimum DOT of 30° and 2.8 mm.

Nomenclature



Lever
Improved safety of the lever-setting (Form lock configuration). Many grooves are incised on the lever and the rotating shaft that mesh with each other to prevent a slip between the lever and the rotating shaft.
The lever can be set for positioning in steps of 9 degrees.

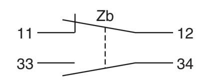
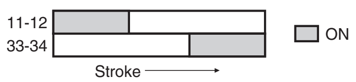
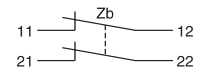
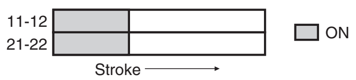
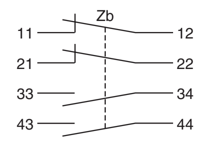
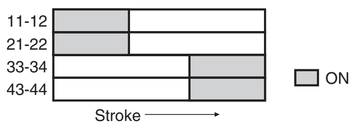
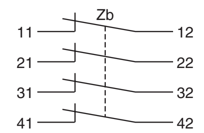
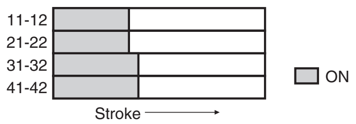
Built-in Switch
Has a direct opening mechanism separating the contacts when the NC contacts are welded.

Head
The plunger type of actuator can be used in a normal direction and reverse direction.

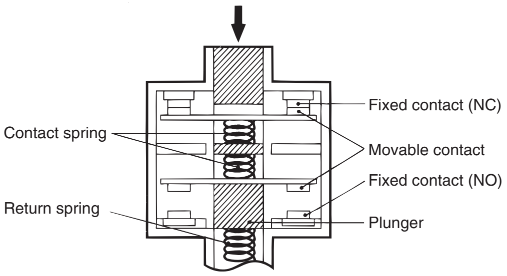
Cable
The cable can be pulled out in a horizontal direction or in a vertical direction.

Operation

Contact Form

Model	Contact		Diagram	Remarks
D4F-1□-□□	1NC/1NO (slow-action)			Only NC contact 11-12 has an approved direct opening mechanism. (→) The terminals 11-12 and 33-34 can be used as unlike poles.
D4F-2□-□□	2NC (slow-action)			NC contacts 11-12 and 21-22 have an approved direct opening mechanism. (→) The terminals 11-12 and 21-22 can be used as unlike poles.
D4F-3□-□□	2NC/2NO (slow-action)			NC contacts 11-12 and 21-22 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22, 33-34 and 43-44 can be used as unlike poles.
D4F-4□-□□	4NC (slow-action)			NC contacts 11-12, 21-22, 31-32 and 41-42 have an approved direct opening mechanism. (→) The terminals 11-12, 21-22, 31-32 and 41-42 can be used as unlike poles.

Direct Opening Mechanism
1NC/1NO Contact (slow-action)

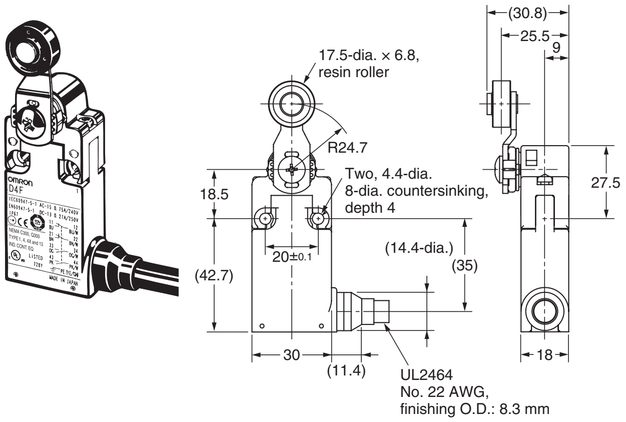


Conforms to EN60947-5-1 Direct Opening (→).
(Only the NC contacts have a direct opening function.)
When metal weld occurs, the NC contacts are separated from each other by pushing in the plunger.

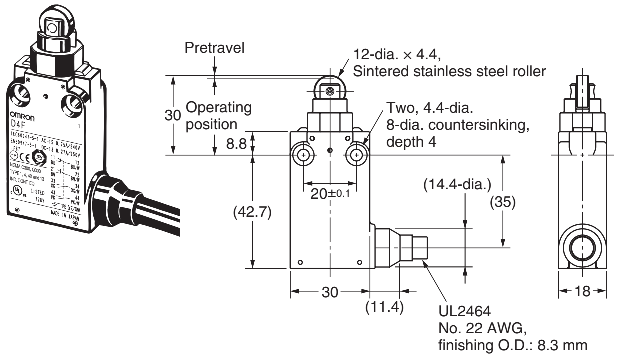
Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.
2. Each dimension has a tolerance of 0.4 mm unless otherwise specified.

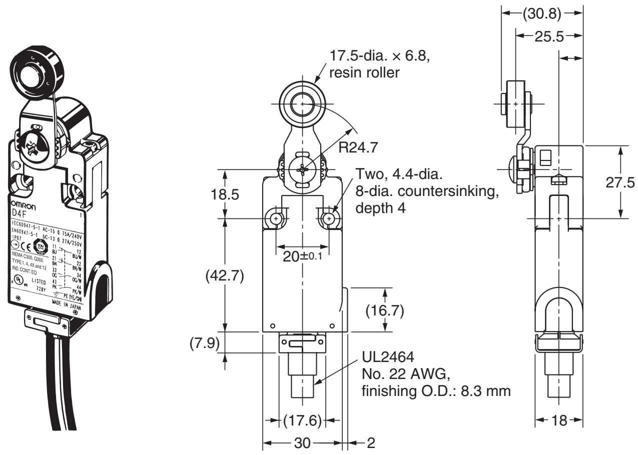
Roller lever (Metallic lever, resin roller)
D4F-□20-□R



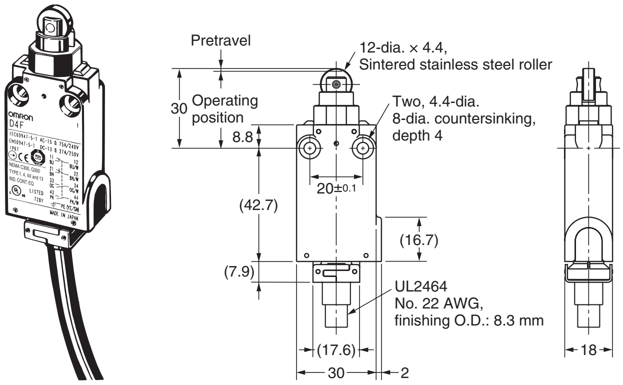
Roller plunger (Metallic roller)
D4F-□02-□R



Roller lever (Metallic lever, resin roller)
D4F-□20-□D



Roller plunger (Metallic roller)
D4F-□02-□D



D4F

Precautions

NOTICE

Be sure to connect a ground line, otherwise an electric shock may occur.

If the D4F is to be used as a switch in an emergency stop circuit or in a safety circuit for preventing accidents resulting in injuries or deaths, use NC contacts with a forced release mechanism and set the D4F so that it will operate in direct opening mode.
For safety, install the Switch using one-way rotational screws or other similar means to prevent it from easily coming off. Protect the D4F with an appropriate cover and post a warning sign near the D4F in order to ensure the safety.

To prevent the D4F from damage due to circuit short-circuiting, connect a fuse with a breaking current 1.5 to 2 times larger than the rated current of the D4F in series to the D4F.

If the D4F is used under EN-approved conditions, use a gI or gG 10-A fuse approved by IEC269.

Actuation of the Switch over a long time may deteriorate parts of the Switch and a return failure may result. Be sure to check the condition of the Switch regularly.

Do not supply electric power when wiring.

Do not use the Switch where explosive gas, flammable gas, or any other dangerous gas may be present.

Keep the electrical load below the rated value.

Never wire to a wrong terminal.

Be sure to evaluate the Switch under actual working conditions after installation.

Do not drop or disassemble the D4F.

Do not use in closely contacted mounting.

Do not use the Switch as a stopper.

Conduct periodic inspections.

Do not use it in an activating circuit. (Use it as a safety signal.)

Contacts of the D4F can be used both for ordinary load and microload; however, once the contact is opened or closed with an ordinary load, it cannot be used for a load smaller than that. The contact surface may be rough, which impairs the reliability of contacting.

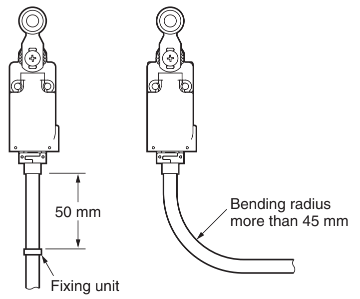
Handling of cables

Cables cannot be flexed repeatedly.

The cable is fixed with sealing materials on the bottom of the switch. When excessive force may be imposed on the cable, fasten the cable with a fixing unit at a distance of 50 mm from the bottom of the switch as shown.

Do not pull or press the cable at an excessive force (50 N max.).

When bending the cable, secure the cable with more than 45-mm bending radius so as not to cause damage to the insulator or sheath of the cable. Doing so may result in current leakage or burning.



When wiring, be sure to prevent penetration of a liquid such as water or oil through the cable end.

Operating Environment

Keep the D4F away from oil and water, as these may enter the casing. (Though the switch construction complies with IP67 and prevents immersion of water even when held in water for a specified time, its use is not guaranteed when it is immersed in a liquid.)

Make sure in advance that the environment is suitable, with the presence of oil, water, or chemicals, as these may cause the seal to deteriorate, resulting in faulty contact, faulty isolation, current leakage, or burning.

Do not use the D4F in the following locations:

- Locations subject to corrosive gas
- Locations with severe changes in temperature
- Locations with excessive humidity that may cause condensation
- Locations with excessive vibration
- Locations that may be covered with processing chips or dust
- Locations subject to high temperature or excessive humidity

Correct Use

Operating Environment

The D4F is for indoor use only.
Do not use the D4F outdoors. Otherwise, the D4F may malfunction.

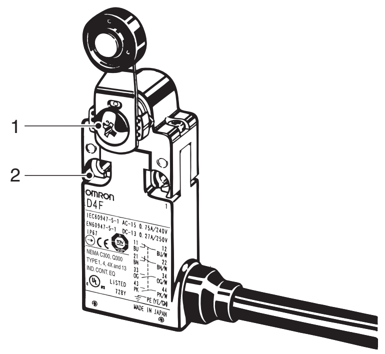
Durability

The life of the D4F will vary with the switching conditions. Before applying the D4F, test the D4F under actual operating conditions and be sure to use the D4F in actual operation within switching times that will not lower the performance of the D4F.

Tightening Torque

Be sure to tighten each screw of the D4F properly, otherwise the D4F may soon malfunction.

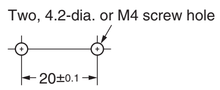
No.	Type	Proper tightening torque
1	Lever mounting screw (M5)	2.4 to 2.8 N·m
2	Body mounting screw (M4)	1.18 to 1.37 N·m



Mounting

Use two M4 screws and washers to mount the D4F securely. The D4F can be mounted more securely with proper tightening torque.

Mounting Holes (Unit: mm)



Changing the lever angle

Unfasten the screw that holds the lever to set the position of the lever at any angle through 360° (in steps of 9°).

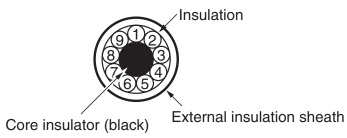
After unfastening the screws that hold the lever, mount the lever the other way (normal side or reverse side). Set an angle of the lever to complete adjustment within a range in which the lever does not touch the switch body.

Wiring

Identifying Wires

Identify wires according to the color (with or without white lines) of the insulation on the wire.

Cross section



Wire Colors

No.	Color of insulation	No.	Color of insulation
1	Blue/white	6	Brown
2	Orange /white	7	Pink
3	Pink/white	8	Orange
4	Brown/white	9	Blue
5	Green/yellow		

Note: "Blue/white, orange/white, pink/white, or brown/white" means that the cover is blue, orange, pink, or brown with a white line.

Terminal Numbers

Identify terminal numbers based on the color (with or without white lines) of the insulation on the wire.

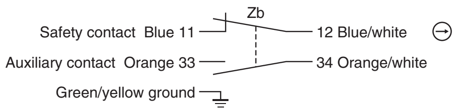
The safety and auxiliary contacts of D4F models of four-terminal contact construction and those of two-terminal contact construction are described below.

The safety contacts are direct-opening NC contacts (11-12 and 21-22); they are used for safety circuits, and each of them is indicated with the appropriate mark ⊖.

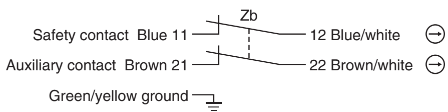
Auxiliary contacts are used to check (to monitor) the operating state of the switch, which are equivalent to NO contacts (33-34 and 43-44) or NC contacts (31-32 and 41-42).

The NC contacts 31-32 and 41-42 of auxiliary contacts (orange or pink) can be used as safety contacts.

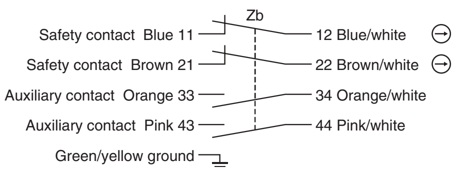
<1NC/1NO>



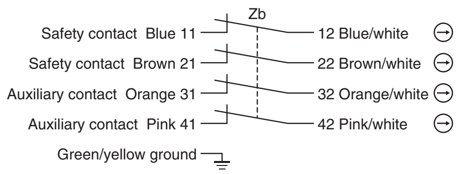
<2NC>



<2NC/2NO>



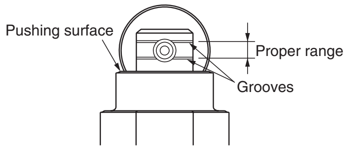
<4NC>



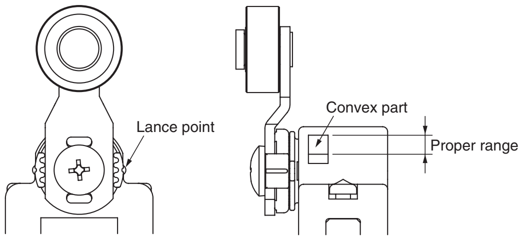
Cut the black core insulator and all unused wires at the end of the external insulation sheath when wiring the cable.

Operating

To set the plunger stroke correctly, press-fit the plunger until the top of the pushing surface comes between two grooves on the plunger.

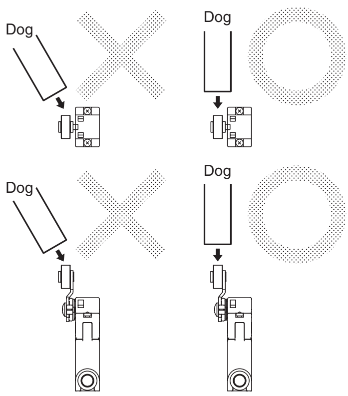


To set the roller lever stroke correctly, push the dog and cam until the the lance point comes within the range of the convex part that is the correct setting position.



Others

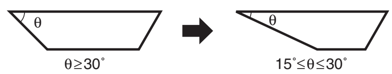
Actuating the switch from an angle other than 90 degrees to the switch face may deform or damage the actuator, or deform or damage the rotary spindle, so make sure that the dog is straight.



Do not remove the head. Otherwise, a failure may occur.

To avoid telegraphing, take the following precautions.

1. Set the switch to operate in one direction.
2. Modify the rear end of the dog to an angle of 15° to 30° as shown below or to a secondary-degree curve.



3. Modify the circuit so as not to detect the wrong operating signals.

SI Units Conversion Table

To fully comply with international standards, this catalogue is based on the International System of Units (SI).

D4F

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

In the interest of product improvement, specifications are subject to change without notice.

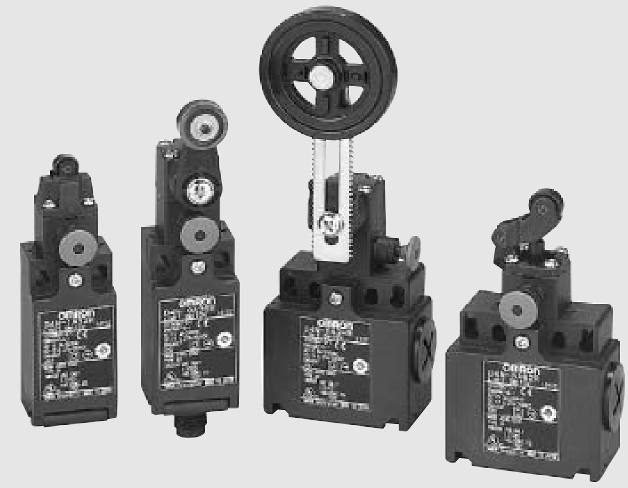
Miniature Manual Reset Limit Switch

D4N-□R

New Series of manual-reset Limit Switch

- Lineup includes three contact models with 2NC/1NO and 3NC contacts in addition to the 1NC/ 1NO, and 2NC version. Version with MBB contacts meet applications for avdanced requirements.
- M12-connector models are available, saving on labor and simplifying maintenance.
- Standardized gold-clad contacts provide high contact reliability. Can be used with both standard loads and micro-loads.
- Free of lead, cadmium, and hexavalent chrome, reducing the burden on the environment.
- Conforms to EN115 and EN81-1.

Be sure to read the "Safety Precautions" on page G-277.



Note: Contact your sales representative for details on models with safety standard certification.

Model Number Structure

D4N-□□□□R

1 2 3

1. Conduit/Connector size

1: Pg13.5 (1-conduit)
2: G1/2 (1-conduit)
3: 1/2-14NPT (1-conduit)
4: M20 (1-conduit)
5: Pg13.5 (2-conduit)
6: G1/2 (2-conduit)
7: 1/2-14NPT (M20 2-conduit with 1/2-14NPT changing adaptor included)
8: M20 (2-conduit)
9: M12 connector (1-conduit)

2. Built-in Switch

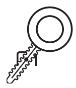
A: 1NC/1NO (slow-action)
B: 2NC (slow-action)
C: 2NC/1NO (slow-action)
D: 3NC (slow-action)

3. Head and Actuator

20:Roller lever (resin lever, resin roller)
2G:Adjustable roller lever, form lock (metal lever, resin roller)
2H:Adjustable roller lever, form lock (metal lever. rubber roller)
31:Top plunger
32:Top roller plunger
62:One-way roller arm lever (horizontal)
72:One-way roller arm lever (vertical)

Ordering Information

List of Models

Actuator	Conduit size		Built-in switch mechanism			
			1NC/1NO (Slow-action)	2NC (Slow-action)	2NC/1NO (Slow-action)	3NC (Slow-action)
Roller lever (resin lever, resin roller) 	1-conduit	Pg13.5	D4N-1A20R	D4N-1B20R	D4N-1C20R	D4N-1D20R
		G1/2	D4N-2A20R	D4N-2B20R	D4N-2C20R	D4N-2D20R
		1/2-14NPT	D4N-3A20R	D4N-3B20R	D4N-3C20R	D4N-3D20R
		M20	D4N-4A20R	D4N-4B20R	D4N-4C20R	D4N-4D20R
		M12 connector	D4N-9A20R	D4N-9B20R	---	---
	2-conduit	Pg13.5	D4N-5A20R	D4N-5B20R	D4N-5C20R	D4N-5D20R
		G1/2	D4N-6A20R	D4N-6B20R	D4N-6C20R	D4N-6D20R
		1/2-14NPT (See note 2.)	D4N-7A20R	D4N-7B20R	D4N-7C20R	D4N-7D20R
		M20	D4N-8A20R	D4N-8B20R	D4N-8C20R	D4N-8D20R
Adjustable roller lever, form lock (metal lever, resin roller) 	1-conduit	Pg13.5	D4N-1A2GR	D4N-1B2GR	D4N-1C2GR	D4N-1D2GR
		G1/2	D4N-2A2GR	D4N-2B2GR	D4N-2C2GR	D4N-2D2GR
		1/2-14NPT	D4N-3A2GR	D4N-3B2GR	D4N-3C2GR	D4N-3D2GR
		M20	D4N-4A2GR	D4N-4B2GR	D4N-4C2GR	D4N-4D2GR
		M12 connector	D4N-9A2GR	D4N-9B2GR	---	---
	2-conduit	Pg13.5	D4N-5A2GR	D4N-5B2GR	D4N-5C2GR	D4N-5D2GR
		G1/2	D4N-6A2GR	D4N-6B2GR	D4N-6C2GR	D4N-6D2GR
		1/2-14NPT (See note 2.)	D4N-7A2GR	D4N-7B2GR	D4N-7C2GR	D4N-7D2GR
		M20	D4N-8A2GR	D4N-8B2GR	D4N-8C2GR	D4N-8D2GR
Adjustable roller lever, form lock (metal lever, rubber roller) 	1-conduit	Pg13.5	D4N-1A2HR	D4N-1B2HR	D4N-1C2HR	D4N-1D2HR
		G1/2	D4N-2A2HR	D4N-2B2HR	D4N-2C2HR	D4N-2D2HR
		1/2-14NPT	D4N-3A2HR	D4N-3B2HR	D4N-3C2HR	D4N-3D2HR
		M20	D4N-4A2HR	D4N-4B2HR	D4N-4C2HR	D4N-4D2HR
		M12 connector	D4N-9A2HR	D4N-9B2HR	---	---
	2-conduit	Pg13.5	D4N-5A2HR	D4N-5B2HR	D4N-5C2HR	D4N-5D2HR
		G1/2	D4N-6A2HR	D4N-6B2HR	D4N-6C2HR	D4N-6D2HR
		1/2-14NPT (See note 2.)	D4N-7A2HR	D4N-7B2HR	D4N-7C2HR	D4N-7D2HR
		M20	D4N-8A2HR	D4N-8B2HR	D4N-8C2HR	D4N-8D2HR
Plunger 	1-conduit	Pg13.5	D4N-1A31R	D4N-1B31R	D4N-1C31R	D4N-1D31R
		G1/2	D4N-2A31R	D4N-2B31R	D4N-2C31R	D4N-2D31R
		1/2-14NPT	D4N-3A31R	D4N-3B31R	D4N-3C31R	D4N-3D31R
		M20	D4N-4A31R	D4N-4B31R	D4N-4C31R	D4N-4D31R
		M12 connector	D4N-9A31R	D4N-9B31R	---	---
	2-conduit	Pg13.5	D4N-5A31R	D4N-5B31R	D4N-5C31R	D4N-5D31R
		G1/2	D4N-6A31R	D4N-6B31R	D4N-6C31R	D4N-6D31R
		1/2-14NPT (See note 2.)	D4N-7A31R	D4N-7B31R	D4N-7C31R	D4N-7D31R
		M20	D4N-8A31R	D4N-8B31R	D4N-8C31R	D4N-8D31R
Roller plunger 	1-conduit	Pg13.5	D4N-1A32R	D4N-1B32R	D4N-1C32R	D4N-1D32R
		G1/2	D4N-2A32R	D4N-2B32R	D4N-2C32R	D4N-2D32R
		1/2-14NPT	D4N-3A32R	D4N-3B32R	D4N-3C32R	D4N-3D32R
		M20	D4N-4A32R	D4N-4B32R	D4N-4C32R	D4N-4D32R
		M12 connector	D4N-9A32R	D4N-9B32R	---	---
	2-conduit	Pg13.5	D4N-5A32R	D4N-5B32R	D4N-5C32R	D4N-5D32R
		G1/2	D4N-6A32R	D4N-6B32R	D4N-6C32R	D4N-6D32R
		1/2-14NPT (See note 2.)	D4N-7A32R	D4N-7B32R	D4N-7C32R	D4N-7D32R
		M20	D4N-8A32R	D4N-8B32R	D4N-8C32R	D4N-8D32R

Prefered types

Actuator	Conduit size		Built-in switch mechanism			
			1NC/1NO (Slow-action)	2NC (Slow-action)	2NC/1NO (Slow-action)	3NC (Slow-action)
One-way roller arm lever (horizontal) 	1-conduit	Pg13.5	D4N-1A62R	D4N-1B62R	D4N-1C62R	D4N-1D62R
		G1/2	D4N-2A62R	D4N-2B62R	D4N-2C62R	D4N-2D62R
		1/2-14NPT	D4N-3A62R	D4N-3B62R	D4N-3C62R	D4N-3D62R
		M20	D4N-4A62R	D4N-4B62R	D4N-4C62R	D4N-4D62R
		M12 connector	D4N-9A62R	D4N-9B62R	---	---
	2-conduit	Pg13.5	D4N-5A62R	D4N-5B62R	D4N-5C62R	D4N-5D62R
		G1/2	D4N-6A62R	D4N-6B62R	D4N-6C62R	D4N-6D62R
		1/2-14NPT (See note 2.)	D4N-7A62R	D4N-7B62R	D4N-7C62R	D4N-7D62R
		M20	D4N-8A62R	D4N-8B62R	D4N-8C62R	D4N-8D62R
One-way roller arm lever (vertical) 	1-conduit	Pg13.5	D4N-1A72R	D4N-1B72R	D4N-1C72R	D4N-1D72R
		G1/2	D4N-2A72R	D4N-2B72R	D4N-2C72R	D4N-2D72R
		1/2-14NPT	D4N-3A72R	D4N-3B72R	D4N-3C72R	D4N-3D72R
		M20	D4N-4A72R	D4N-4B72R	D4N-4C72R	D4N-4D72R
		M12 connector	D4N-9A72R	D4N-9B72R	---	---
	2-conduit	Pg13.5	D4N-5A72R	D4N-5B72R	D4N-5C72R	D4N-5D72R
		G1/2	D4N-6A72R	D4N-6B72R	D4N-6C72R	D4N-6D72R
		1/2-14NPT (See note 2.)	D4N-7A72R	D4N-7B72R	D4N-7C72R	D4N-7D72R
		M20	D4N-8A72R	D4N-8B72R	D4N-8C72R	D4N-8D72R

Note: 1. It is recommended that M20 be used for Switches to be exported to Europe and 1/2-14NPT be used for Switches to be exported to North American countries.

2. The 1/2-14NPT 2-conduit models include an M20-to-1/2-14NPT changing adaptor.

Specifications

Standards and EC Directives

- Conforms to the following EC Directives:
  Machinery Directive
  Low Voltage Directive
  EN50047
  EN1088
  GS-ET-15

Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN60947-5-1 (approved direct opening)	B03 11 39656 061
UL (See note.)	UL508, CSA C22.2 No.14	E76675

Note: Approval for CSA C22.2 No. 14 is authorized by the UL mark.

CCC (China Compulsory Certification) Mark

Agency	Standard	File No.
CQC	GB14048.5	Under application

Approved Standard Ratings

TÜV (EN60947-5-1)

Item / Utilization category	AC-15	DC-13
Rated operating current (I_e)	3 A	0.27 A
Rated operating voltage (U_e)	240 V	250 V

Note: Use a 10-A fuse type gI or gG that conforms to IEC269 as a short-circuit protection device. This fuse is not built into the Switch.

UL/CSA (UL508, CSA C22.2 No. 14)

A300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
120 VAC	10 A	60 A	6 A	7,200 VA	720 VA
240 VAC		30 A	3 A		

Q300

Rated voltage	Carry current	Current		Volt-amperes	
		Make	Break	Make	Break
125 VDC	2.5 A	0.55 A	0.55 A	69 VA	69 VA
250 VDC		0.27 A	0.27 A		

Characteristics

Degree of protection (See note 3.)		IP67 (EN60947-5-1)
Durability (See note 4.)	**Mechanical**	1,000,000 operations min.
	Electrical	500,000 operations min. for a resistive load of 3 A at 250 VAC (See note 5.) 300,000 operations min. for a resistive load of 10 A at 250 VAC
Operating speed		1 mm/s to 0.5 m/s (D4N-1A20R)
Operating frequency		30 operations/minute max.
Contact resistance		25 mΩ max.
Minimum applicable load (See note 6.)		Resistive load of 1 mA at 5 VDC (N-level reference value)
Rated insulation voltage (U_i)		300 V
Protection against electric shock		Class II (double insulation)
Pollution degree (operating environment)		Level 3 (EN60947-5-1)
Impulse withstand voltage (EN60947-5-1)		Between terminals of the same polarity: 2.5 kV
		Between terminals of different polarities: 4 kV
		Between other terminals and uncharged metallic parts: 6 kV
Insulation resistance		100 MΩ min.
Contact gap		Snap-action: 2 x 0.5 mm min Slow-action: 2 x 2 mm min
Vibration resistance	**Malfunction**	10 to 55 Hz, 0.75-mm single amplitude
Shock resistance	**Destruction**	1,000 m/s^2
	Malfunction	300 m/s^2
Conditional short-circuit current		100 A (EN60947-5-1)
Rated open thermal current (I_{th})		10 A (EN60947-5-1)
Ambient temperature		Operating: −30°C to 70°C with no icing
Ambient humidity		Operating: 95% max.
Weight		Approx. 92 g (D4N-1A20R)

Note: 1. The above values are initial values.

2. Once a contact has been used to switch a standard load, it cannot be used for a load of a smaller capacity. Doing so may result in roughening of the contact surface and contact reliability may be lost.

3. The degree of protection is tested using the method specified by the standard (EN60947-5-1). Confirm that sealing properties are sufficient for the operating conditions and environment beforehand. Although the switch box is protected from dust or water penetration, do not use the D4N-☐R in places where foreign material such as dust, dirt, oil, water, or chemicals may penetrate through the head. Otherwise, premature wear, Switch damage or malfunctioning may occur.

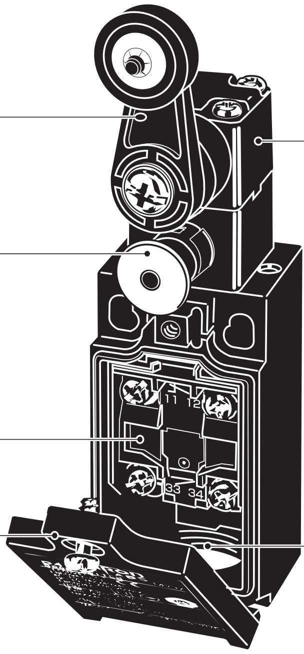
4. The durability is for an ambient temperature of 5°C to 35°C and an ambient humidity of 40% to 70%. For more details, consult your OMRON representative.

5. If the ambient temperature is greater than 35°C, do not pass the 3-A, 250-VAC load through more than 2 circuits.

6. This value will vary with the switching frequency, environment, and reliability level. Confirm that correct operation is possible with the actual load beforehand.

Structure, Names, and Functions

Structure



Safety-oriented Lever Setting
Grooves which engage the lever are cut in the lever and rotary shaft to prevent the lever from slipping against the rotary shaft. The actuator locks (self-holding) when it moves to the lock position.

Reset Head (Blue)
The direction of the reset head can be adjusted to any of the four directions.

Built-in Switch
The built-in switch has a direct opening mechanism that forcibly separates the NC contact even when there is contact deposit.

Cover
The cover, with a hinge on its lower part, can be opened by removing the screw of the cover, which ensures ease of maintenance and wiring.

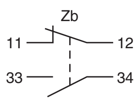
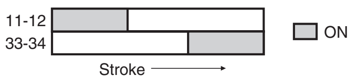
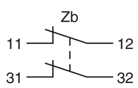
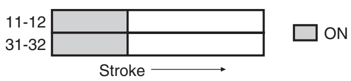
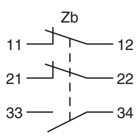
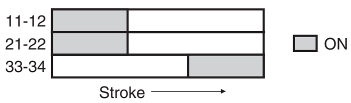
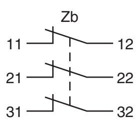
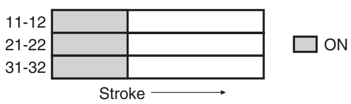
Head
With roller lever models, the direction of the switch head can be adjusted to any of the four directions by loosening the roller lever switch screws at the four corners of the head.

Conduit
A wide variety of conduits is available.

Size Box	1-conduit model	2-conduit mode
Pg13.5	Yes	Yes
G1/2	Yes	Yes
1/2-14NPT	Yes	Yes
M20	Yes	Yes
M12 connector	Yes	---

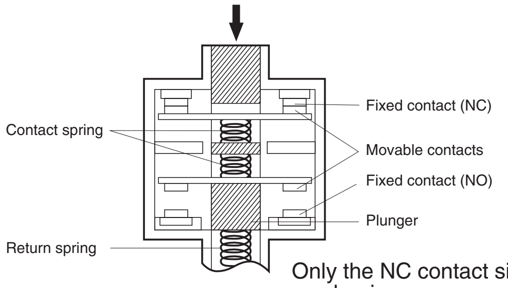
Note: M12 connector types are not available for Switches with three contacts.

Contact Form

Model	Contact	Contact form	Operating pattern	Remarks
D4N-☐A☐R	1NC/1NO			Only NC contacts 11-12 have an approved direct opening mechanism. The terminals 11-12 and 33-34 can be used as unlike poles.
D4N-☐B☐R	2NC			Only NC contacts 11-12 and 31-32 have an approved direct opening mechanism. The terminals 11-12 and 31-32 can be used as unlike poles.
D4N-☐C☐R	2NC/1NO			Only NC contacts 11-12 and 21-22 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 33-34 can be used as unlike poles.
D4N-☐D☐R	3NC			Only NC contacts 11-12, 21-22, and 31-32 have an approved direct opening mechanism. The terminals 11-12, 21-22, and 31-32 can be used as unlike poles.

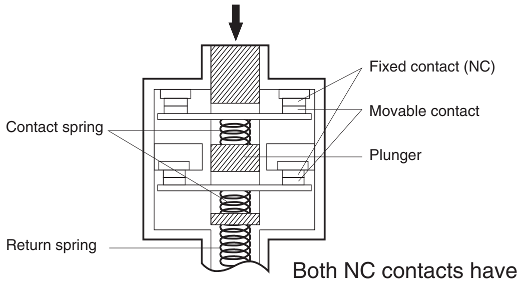
Direct Opening Mechanism

1NC/1NO Contact (Slow-action)



Only the NC contact side has a direct opening mechanism.
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.
(Conforms to EN60947-5-1 Direct Opening Operation.)

2NC Contact (Slow-action)



Both NC contacts have a direct opening mechanism.
When metal deposition occurs, the contacts are separated from each other by the plunger being pushed in.
(Conforms to EN60947-5-1 Direct Opening Operation.)

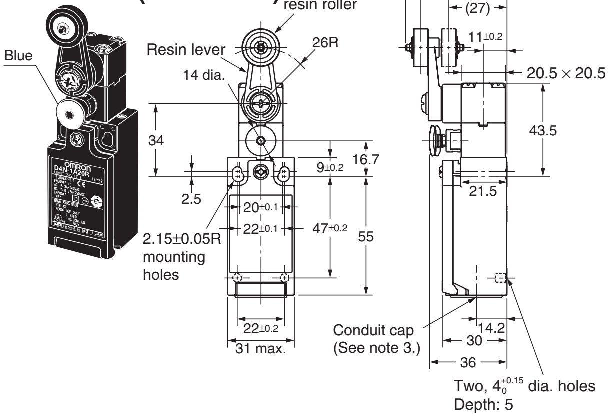
Dimensions

Switches

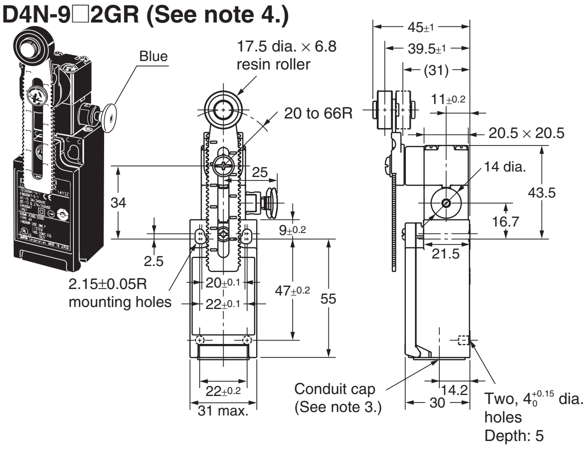
Note: All units are in millimeters unless otherwise indicated.

1-conduit Models

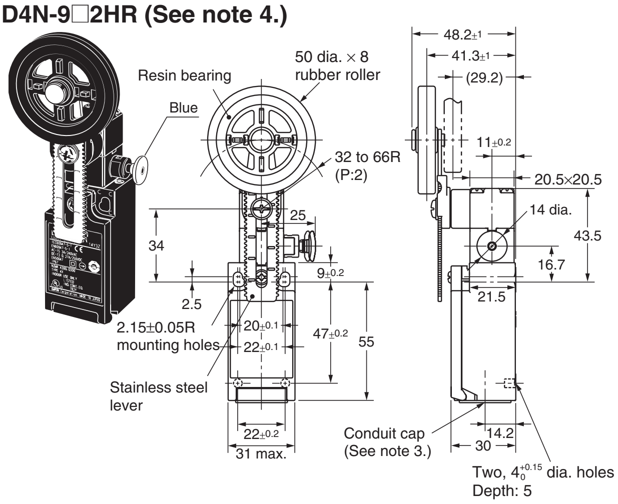
Roller Lever (Resin Lever, Resin Roller)
D4N-1□20R D4N-2□20R
D4N-3□20R D4N-4□20R
D4N-9□20R (See note 4.)



Adjustable Roller Lever, Form Lock
(with Metal Lever, Resin Roller)
D4N-1□2GR D4N-2□2GR
D4N-3□2GR D4N-4□2GR
D4N-9□2GR (See note 4.)



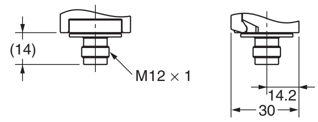
Adjustable Roller Lever, Form Lock
(with Metal Lever, Rubber Roller)
D4N-1□2HR D4N-2□2HR
D4N-3□2HR D4N-4□2HR
D4N-9□2HR (See note 4.)



Model	D4N-□□20R	D4N-□□2GR (See note 2.)	D4N-□□2HR
LF max.	6.4 N	5.6 N	5.4 N
LT max.	55°	55°	55°
PT 1 (See note 3.)	18 to 27°	18 to 27°	18 to 27°
(PT 2) (See note 4.)	(44°)	(44°)	(44°)
(TT) (See note 5.)	80°	80°	80°
DOF min. (See note 6.)	20 N	20 N	20 N
DOT min. (See note 6.)	50°	50°	50°

1-conduit M12 Connectors

D4N-9□□□R

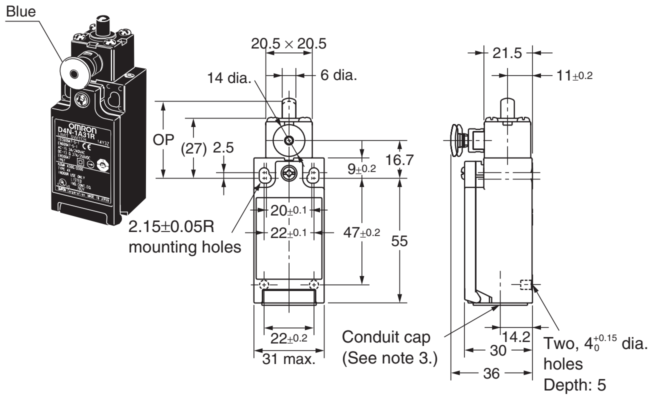


Note:
1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to the following diagram for details on M12 connectors.

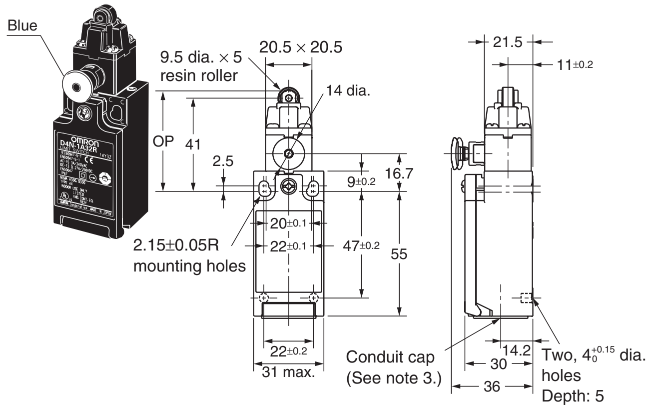
Note:
1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. The operating characteristics of these Switches were measured with the roller lever set at 32 mm.
3. These PT values are possible when the NC contacts are open (OFF).
4. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
5. Nominal value.
6. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

1-conduit Models

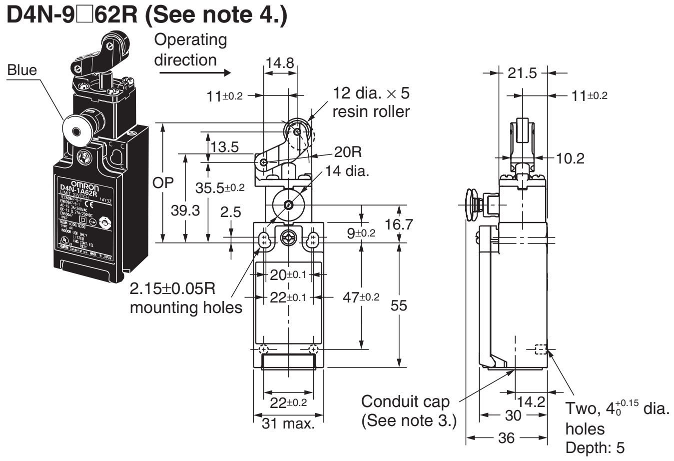
Plunger
D4N-1□31R D4N-2□31R
D4N-3□31R D4N-4□31R
D4N-9□31R (See note 4.)



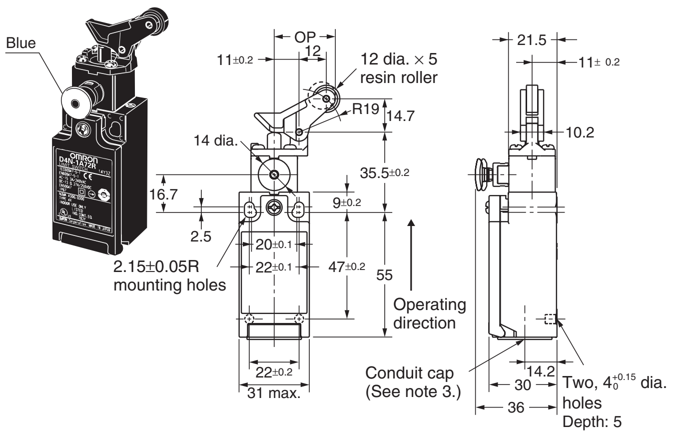
Roller Plunger
D4N-1□32R D4N-2□32R
D4N-3□32R D4N-4□32R
D4N-9□32R (See note 4.)



One-way Roller Arm Lever (Horizontal)
D4N-1□62R D4N-2□62R
D4N-3□62R D4N-4□62R
D4N-9□62R (See note 4.)



One-way Roller Arm Lever (Vertical)
D4N-1□72R D4N-2□72R
D4N-3□72R D4N-4□72R
D4N-9□7R2 (See note 4.)



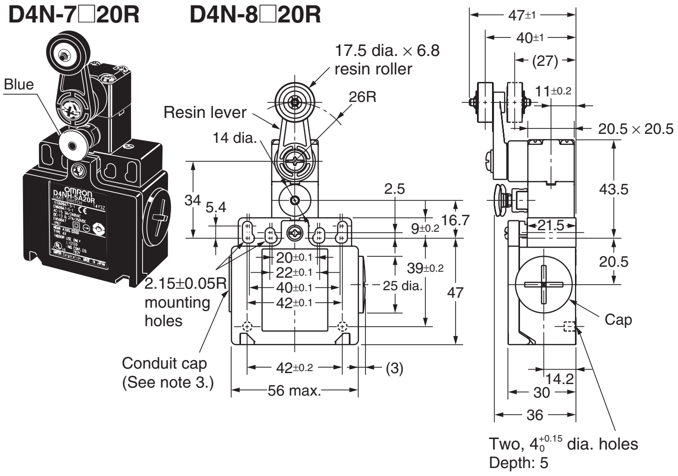
Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.
4. Refer to page 273 for details on M12 connectors.

Model	D4N-□□31R	D4N-□□32R	D4N-□□62R	D4N-□□72R
LF max.	10.8 N	10.8N	7.5 N	7.9 N
LT max.	4.5 mm	4.5 mm	7 mm	7 mm
PT 1 (See note 2.)	2 mm	2 mm	4 mm	4 mm
(PT 2) (See note 3.)	(2.9 mm)	(2.9 mm)	(5.2 mm)	(4.3 mm)
OP	34 ±0.5 mm	44.4 ±0.8 mm	53 ±0.8 mm	27 ±0.8 mm
(TT) (See note 4.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOF min. (See note 5.)	20 N	20 N	20 N	20 N
DOT min. (See note 5.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm

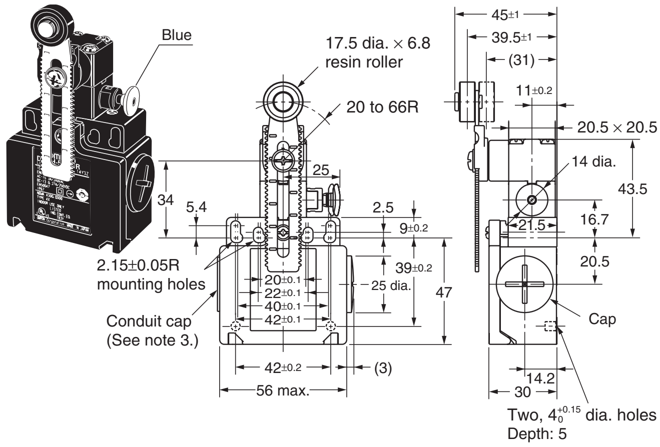
Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. These PT values are possible when the NC contacts are open (OFF).
3. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
4. Nominal value.
5. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

2-conduits Models

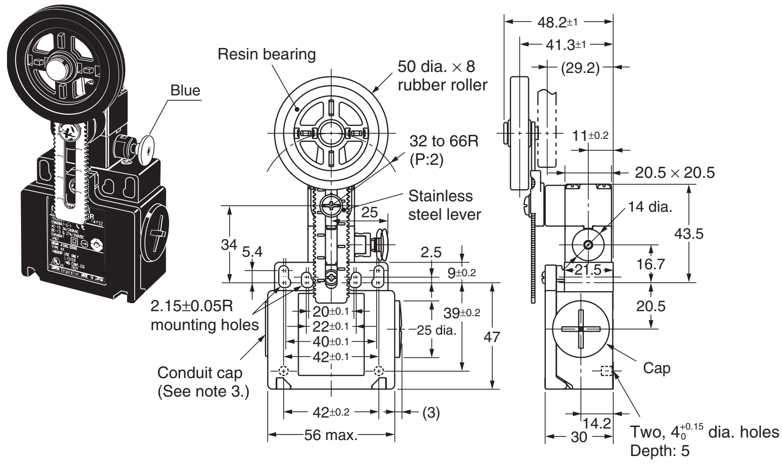
Roller Lever (Resin Lever, Resin Roller)
D4N-5□20R D4N-6□20R
D4N-7□20R D4N-8□20R



Adjustable Roller Lever, Form Lock (with Metal Lever, Resin Roller)
D4N-5□2GR D4N-6□2GR
D4N-7□2GR D4N-8□2GR



Adjustable Roller Lever, Form Lock (with Metal Lever, Rubber Roller)
D4N-5□2HR D4N-6□2HR
D4N-7□2HR D4N-8□2HR



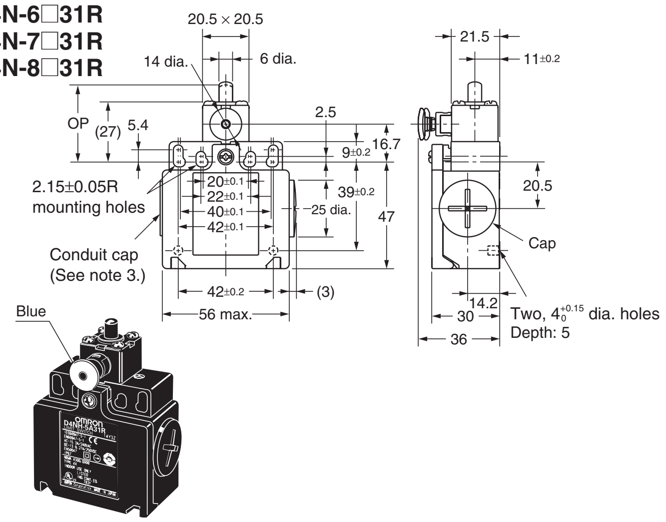
Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.

Model	D4N-□□20R	D4N-□□2GR	D4N-□□2HR
LF max.	6.4 N	5.6 N	5.4 N
LT max.	55°	55°	55°
PT 1 (See note 2.)	18° to 27°	18° to 27°	18° to 27°
(PT 2) (See note 3.)	(44°)	(44°)	(44°)
(TT) (See note 4.)	80°	80°	80°
DOF min. (See note 5.)	20 N	20 N	20 N
DOT min. (See note 5.)	50°	50°	50°

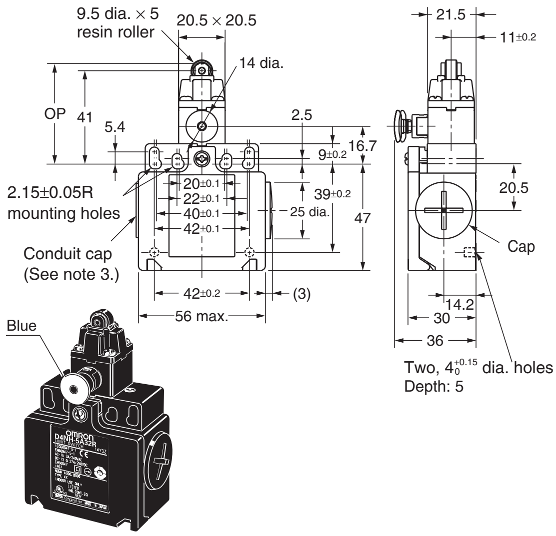
Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. These PT values are possible when the NC contacts are open (OFF).
3. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
4. Nominal value.
5. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

2-conduits Models

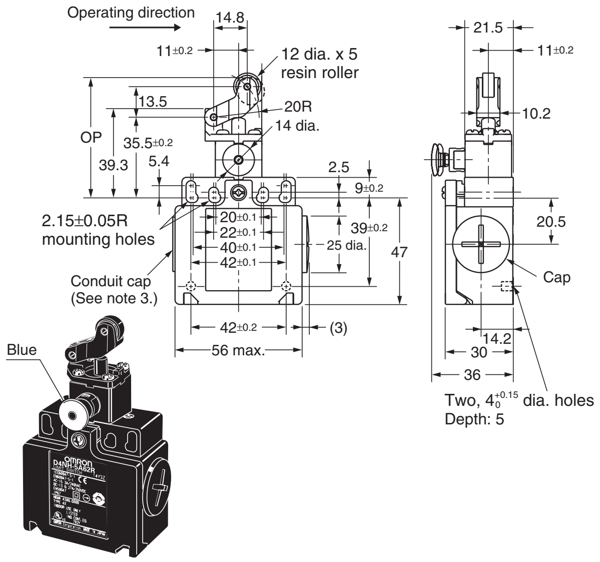
Plunger
D4N-5□31R
D4N-6□31R
D4N-7□31R
D4N-8□31R



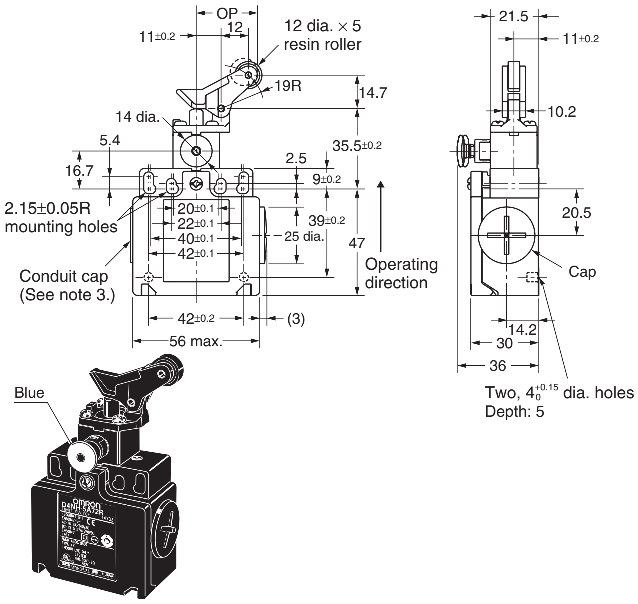
Roller Plunger
D4N-5□32R **D4N-6□32R**
D4N-7□32R **D4N-8□32R**



One-way Roller Arm Lever (Horizontal)
D4N-5□62R **D4N-6□62R**
D4N-7□62R **D4N-8□62R**



One-way Roller Arm Lever (Vertical)
D4N-5□72R **D4N-6□72R**
D4N-7□72R **D4N-8□72R**



Note: 1. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
2. Variation occurs in the simultaneity of contact opening/closing operations of 2NC and 3NC contacts. Check contact operation.
3. There are a minimum of five turns of the screw thread for a Pg13.5 conduit opening and four turns minimum for a G 1/2 conduit opening.

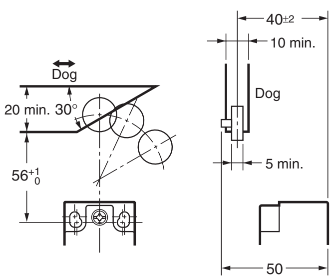
Model	D4N-□□31R	D4N-□□32R	D4N-□□62R	D4N-□□72R
LF max.	10.8 N	10.8N	7.5 N	7.9 N
LT max.	4.5 mm	4.5 mm	7 mm	7 mm
PT 1 max. (See note 2.)	2 mm	2 mm	4 mm	4 mm
(PT 2) (See note 3.)	(2.9 mm)	(2.9 mm)	(5.2 mm)	(4.3 mm)
OP	34 ±0.5 mm	44.4 ±0.8 mm	53 ±0.8 mm	27 ±0.8 mm
(TT) (See note 4.)	(6 mm)	(6 mm)	(9 mm)	(9 mm)
DOF min. (See note 5.)	20 N	20 N	20 N	20 N
DOT min. (See note 5.)	3.2 mm	3.2 mm	5.8 mm	4.8 mm

Note: 1. Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/1NO, and 3NC contacts. Check contact operation.
2. These PT values are possible when the NC contacts are open (OFF).
3. These PT values are nominal values possible when the NO contacts are closed (ON). (1NC/1NO models only)
4. Nominal value.
5. Load and stroke values for the direct opening mechanism. For safe use, always make sure that the minimum values or greater are provided.

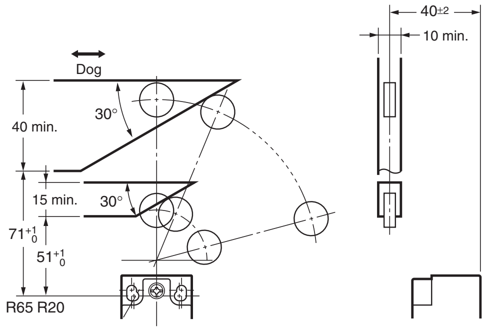
Levers

Refer to the following diagrams for the angles and positions of the dogs.

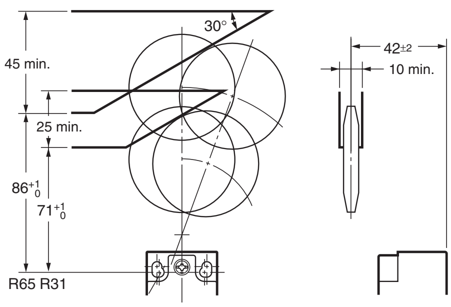
Roller Lever
(D4N-□□20R)



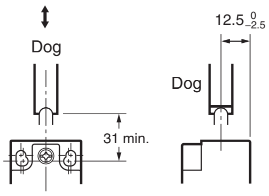
Adjustable Roller Lever, Form Lock
(with Metal Lever, Resin Roller)
(D4N-□□2GR)



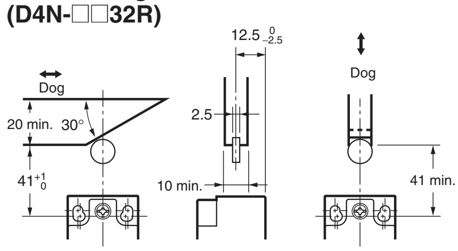
Adjustable Roller Lever, Form Lock
(with Metal Lever, Rubber Roller)
(D4N-□□2HR)



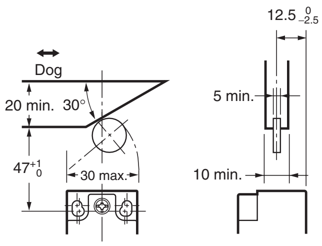
Sealed Plunger
(D4N-□□31R)



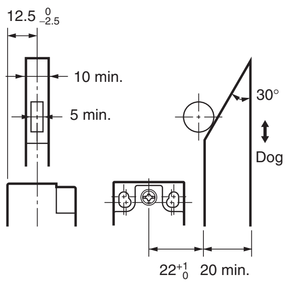
Roller Plunger
(D4N-□□32R)



One-way Roller Arm Lever
(Horizontal)
(D4N-□□62R)



One-way Roller Arm Lever
(Vertical)
(D4N-□□72R)



Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Safety Precautions

Refer to *OMRON SAFETY COMPONENTS SERIES (Y106)* for common precautions for Switches and Safety Limit Switches.

⚠ CAUTION

Do not use metal connectors or metal conduits with this Switch. Doing so may occasionally result in electric shock.

Precautions for Safe Use

- Do not drop the Switch. Doing so may result in the Switch not performing to its full capacity.
- Do not attempt to disassemble or modify the Switch. Doing so may cause the Switch to malfunction.
- Do not use the Switch where explosive gas, flammable gas, or any other hazardous gas may be present.
- Install the Switch in a location away from close body contact. Not doing so may result in malfunction.
- Do not use the Switch submerged in oil or water, or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch interior. (The IP67 degree of protection specification for the Switch refers to water penetration while the Switch is submersed in water for a specified period of time.)
- Protect the head from foreign material. Subjecting the head to foreign material may result in premature wear or damage to the Switch. Although the switch body is protected from penetration by dust or water, the head is not protected from penetration by minute particles or water.
- Turn the power OFF before wiring. Doing so may result in electric shock.
- Install the cover after wiring. Not doing so may result in electric shock.
- Connect a fuse to the Switch in series to protect the Switch from short-circuit damage. Use a fuse with a breaking current 1.5 to 2 times larger than the rated current. To conform to EN ratings, use an IEC60269-compliant 10-A fuse type gI or gG.
- Do not switch circuits for two or more standard loads (250 VAC, 3 A) at the same time. Doing so may adversely affect insulation performance.
- The durability of the Switch is greatly affected by operating conditions. Evaluate the Switch under actual working conditions, before permanent installation and use within a number of switching operations that will not adversely affect the Switch's performance.
- Be sure to indicate in the machine manufacturer's instruction manual that the user must not attempt to repair or maintain the Switch and must contact the machine manufacturer for any repairs or maintenance.

- If the Switch is to be used in an emergency stop circuit or in a safety circuit for preventing accidents resulting in injuries or deaths, use a model that has an NC contact equipped with a direct opening mechanism and make sure that the Switch operates in the direct opening mode. Furthermore, secure the Switch with screws or equivalent parts that are tightened in a single direction so that the Switch cannot be easily removed. Then provide a protection cover for the Switch and post a warning label near the Switch.
- Make sure that the actuator is pushed into the lock position. Not doing so may result in the actuator becoming unlocked, causing an accident.
- Always reset the Switch manually. Not doing so may result in damage to the reset function.
- When the Switch locks due to a fault in the system, be sure to reset the Switch manually before resupplying power after confirming the safety of the system.
- Check the Switches before use and inspect regularly, replacing them when necessary. If a Switch is kept pressed for an extended period of time, the components may deteriorate quickly, and the Switch may not release.
- When using the Switch as a safety component, be sure to check the system design for both operational and circuit safety.

Precautions for Correct Use

Environment

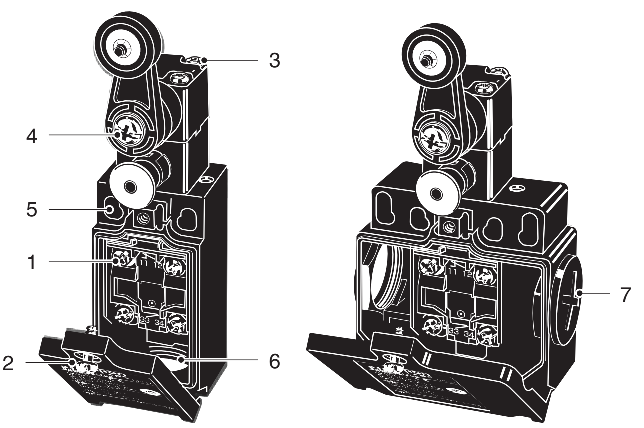
- The Switch is intended for indoor use only.
- Do not use the Switch outdoors. Doing so may cause the Switch to malfunction.
- Do not use the Switch where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) are present or in locations subject to high temperature and humidity. Doing so may result in damage to the Switch caused by contact failure or corrosion.
- Do not use the Switch under any of the following conditions.
  - Locations subject to extreme temperature changes.
  - Locations where high humidity or condensation may occur.
  - Locations subject to excessive vibration.
  - Locations where metal dust, processing waste, oil, or chemicals may penetrate through the protective door.
  - Locations subject to detergents, thinner, or other solvents.

Mounting Method

Mounting Screw Tightening Torque

Tighten each of the screws to the specified torque. Loose screws may result in malfunction of the Switch within a short time.

1	Terminal screw	0.6 to 0.8 N·m
2	Cover clamping screw	0.5 to 0.7 N·m
3	Head clamping screw	0.5 to 0.6 N·m
4	Lever clamping screw	1.6 to 1.8 N·m
5	Body clamping screw	0.5 to 0.7 N·m
6	Conduit mounting connection, M12 adaptor	1.8 to 2.2 N·m (except 1/2-14NPT)
		1.4 to 1.8 N·m (1/2-14NPT)
7	Cap screw	1.3 to 1.7 N·m

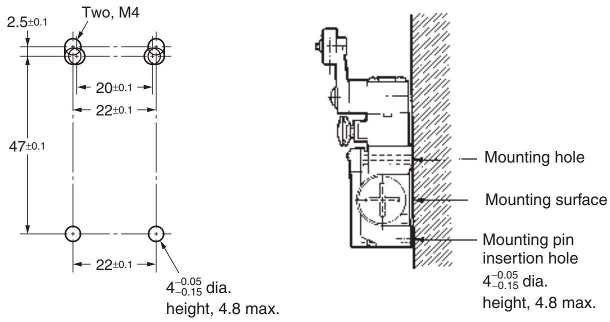


Switch Mounting

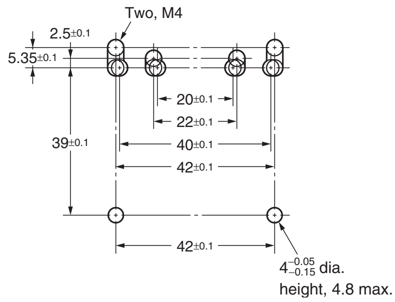
- Mount the Switch using M4 screws and washers and tighten the screws to the specified torque.
- For safety, use screws that cannot be easily removed, or use an equivalent measure to ensure that the Switch is secure.
- Secure the Switch with two M4 bolts and washers. Provide studs with a diameter of $4^{0.05}/_{0.15}$ and a height of 4.8 mm max. at two places, inserting into the holes at the bottom of the Switch as shown below so that the Switch is firmly fixed at four points.

Switch Mounting Holes

One-conduit Type



Two-conduit Type



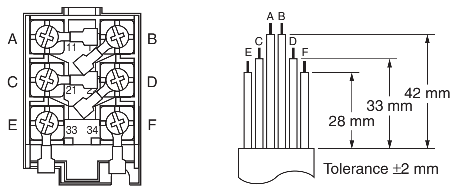
Changing the Head Direction

By removing the four screws of the head, the mounting direction of the head can be changed. The head can be mounted in four directions. Be sure that no foreign material will enter the head during a change in direction.

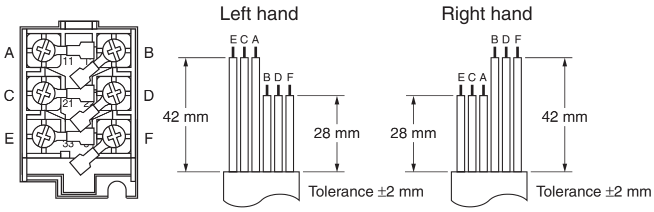
Wiring

- When connecting to the terminals via insulating tube and M3.5 crimp terminals, arrange the crimp terminals as shown below so that they do not rise up onto the case or the cover. Applicable lead wire size: AWG20 to AWG18 (0.5 to 0.75 mm^2).
  Use lead wires of an appropriate length, as shown below. Not doing so may result in excess length causing the cover to rise and not fit properly.

One-conduit Type (3 Poles)



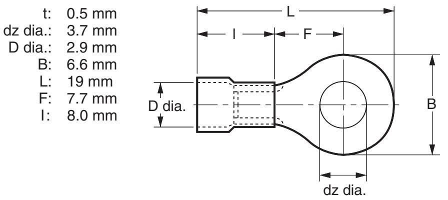
Two-conduit Type (3 Poles)



- Do not push crimp terminals into gaps in the case interior. Doing so may cause damage or deformation of the case.
- Use crimp terminals not more than 0.5 mm in thickness. Otherwise, they will interfere with other components inside the case. The crimp terminals shown below are not more than 0.5 mm thick.

Manufacture	Type	Wire size
J.S.T.	FV0.5-3.7 (F type) V0.5-3.7 (straight type)	AWG20 (0.5 mm^2)

J.S.T is a Japanese manufacturer.

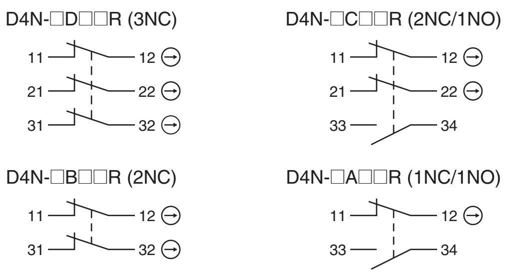


Correct **Incorrect**

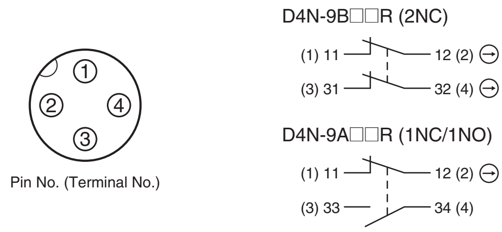
Contact Arrangement

- The following diagrams show the contact arrangements used for screw terminal types and connector types.

Screw Terminal Type



Connector Type



- Applicable socket: XS2F (OMRON).
- Refer to the G010 *Connector Catalog* for details on socket pin numbers and lead wire colors.

Socket Tightening (Connector Type)

- Turn the socket connector screws by hand and tighten until no space remains between the socket and the plug.
- Make sure that the socket connector is tightened securely. Otherwise, the rated degree of protection (IP67) may not be maintained and vibration may loosen the socket connector.

Conduit Opening

- Connect a recommended connector to the opening of the conduit and tighten the connector to the specified torque. The case may be damaged if an excessive tightening torque is applied.
- When using 1/2-14NPT, wind sealing tape around the joint between the connector and conduit opening so that the enclosure will conform to IP67.
- Use a cable with a suitable diameter for the connector.
- Attach and tighten a conduit cap to the unused conduit opening when wiring. Tighten the conduit cap to the specified torque. The conduit cap is provided with the Switch (2-conduit types).

Recommended Connectors

Use connectors with screws not exceeding 9 mm, otherwise the screws will protrude into the case interior, interfering with other components in the case. The connectors listed in the following table have connectors with thread sections not exceeding 9 mm. Use the recommended connectors to ensure conformance to IP67.

Size	Manufacturer	Model	Applicable cable diameter
G1/2	LAPP	ST-PF1/2 5380-1002	6.0 to 12.0 mm
	Ohm Denki	OA-W1609	7.0 to 9.0 mm
		OA-W1611	9.0 to 11.0 mm
Pg13.5	LAPP	S-13.5 5301-5030	6.0 to 12.0 mm
M20	LAPP	ST-M20 × 1.5 5311-1020	7.0 to 13.0 mm
1/2-14NPT	LAPP	ST-NPT1/2 5301-6030	6.0 to 12.0 mm
M12	LAPP	ST-M12 × 1.5 5301-1000	3.5 to 7.0 mm

Use LAPP connectors together with seal packing (JPK-16, GP-13.5, GPM20, or GPM12), and tighten to the specified tightening torque. Seal packing is sold separately.

LAPP is a German manufacturer. Ohm Denki is a Japanese manufacturer.

Before using an M12 type, attaching the provided changing adaptor to the Switch and then connect the recommended connector.

Before using a 2-conduit 1/2-14NPT type, attach the provided changing adaptor to the Switch and then connect the recommended connector.

Storage

Do not store the Switch in locations where hazardous gases (e.g., H_2S, SO_2, NH_3, HNO_3, Cl_2) or dust is present, or in locations subject to high temperatures and humidity.

Others

- Do not allow the load current to exceed the rated value.
- Confirm that the seal rubber has no defects before use.
  If the seal rubber is displaced or raised, or has foreign particles adhered to it, the sealing capability of the seal rubber will be adversely affected.
- Use the correct cover mounting screws only, or the sealing capability of the seal rubber will deteriorate.
- Inspect the Switch regularly.
- With rubber roller lever models, the rubber roller may turn white over time, but this will not affect the quality of operation.
- Use the following recommended countermeasures to prevent telegraphing when using adjustable or long levers.

1. Make the rear edge of the dog smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
2. Design the circuit so that no error signal will be generated.
3. Use or set a Switch that is operated in one direction only.

Production Termination

Following the release of the D4N-R, production of the D4D-R will be terminated.

Date of Production Termination

Production of the D4D-R Series will be terminated in March 2006.

Product Replacement

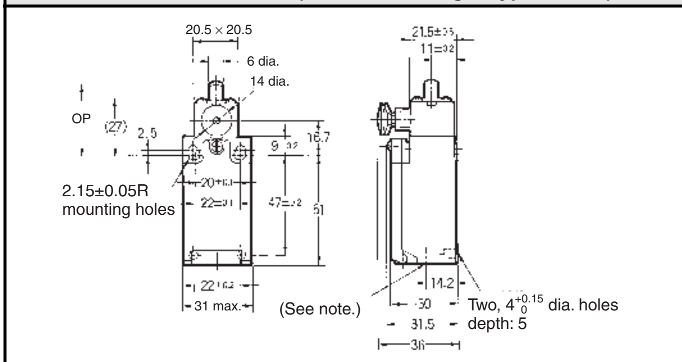
1. **Dimensions**
   The D4D-R and D4N-R use the same mounting method, and mounting hole. The multi-contact structure and the extra 4 mm in length, however, are different.
2. **Terminal Numbers**
   For the 2-contact model, the terminals 21, 22, 23, and 24 on the D4D-R are 31, 32, 33, and 34 on the D4N-R.
3. **Recommended Terminals**
   If the recommended terminals are not used, the Switch may not be compatible. Make sure that the Switch is compatible with the terminals.

Comparison of the D4D-R and Substitute Products

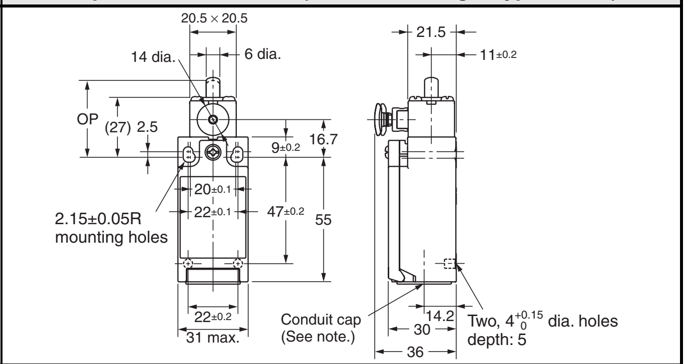
Model	D4N-R
Switch color	Very similar
Dimensions	Very similar
Wiring/connection	Significantly different
Mounting method	Completely compatible
Ratings/performance	Very similar
Operating characteristics	Very similar
Operating method	Completely compatible

Dimensions (Unit: mm)

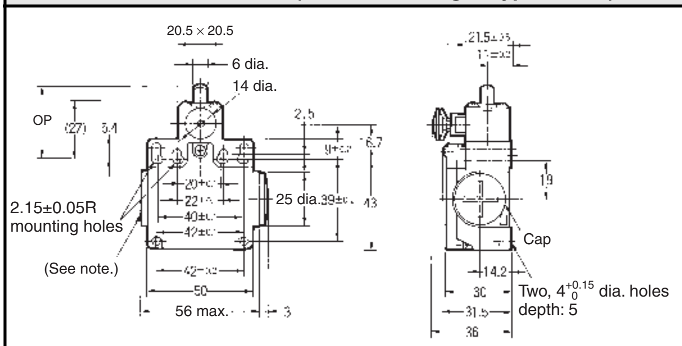
Discontinued Models (1-conduit Plunger-type D4D-R)



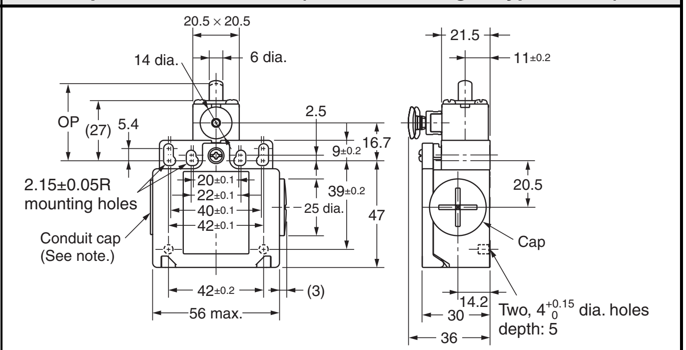
Replacement Products (1-conduit Plunger-type D4N-R)



Discontinued Models (2-conduit Plunger Type D4D-R)



Replacement Products (2-conduit Plunger Type D4N-R)



List of Recommended Substitute Products

: The actuator on the D4D-R is a non-safety type. The D4N-R is recommended for safety applications (form lock type). Be sure to mount it correctly. Using M screws is recommended to comply with European standards. Therefore, the M20 conduit model is recommended for use in new designs.

Safety Limit Switch

D4D-R product to be discontinued	Recommended substitute product
D4D-1520R	D4N-1A20R
D4D-2520R	D4N-2A20R
D4D-3520R	D4N-3A20R
D4D-5520R	D4N-5A20R
D4D-6520R	D4N-6A20R
D4D-1531R	D4N-1A31R
D4D-2531R	D4N-2A31R
D4D-3531R	D4N-3A31R
D4D-5531R	D4N-5A31R
D4D-6531R	D4N-6A31R
D4D-1532R	D4N-1A32R
D4D-2532R	D4N-2A32R
D4D-3532R	D4N-3A32R
D4D-5532R	D4N-5A32R
D4D-6532R	D4N-6A32R
D4D-1562R	D4N-1A62R
D4D-2562R	D4N-2A62R
D4D-3562R	D4N-3A62R
D4D-5562R	D4N-5A62R
D4D-6562R	D4N-6A62R
D4D-1572R	D4N-1A72R
D4D-2572R	D4N-2A72R
D4D-3572R	D4N-3A72R
D4D-5572R	D4N-5A72R
D4D-6572R	D4N-6A72R
D4D-152HR	D4N-1A2HR
D4D-252HR	D4N-2A2HR
D4D-352HR	D4N-3A2HR
D4D-1521R	D4N-1A2GR
D4D-2521R	D4N-2A2GR
D4D-3521R	D4N-3A2GR
D4D-5521R	D4N-5A2GR
D4D-6521R	D4N-6A2GR
D4D-1527R	D4N-1A2HR
D4D-2527R	D4N-2A2HR
D4D-3527R	D4N-3A2HR
D4D-5527R	D4N-5A2HR
D4D-6527R	D4N-6A2HR

D4D-R product to be discontinued	Recommended substitute product
D4D-1A20R	D4N-1B20R
D4D-2A20R	D4N-2B20R
D4D-3A20R	D4N-3B20R
D4D-5A20R	D4N-5B20R
D4D-6A20R	D4N-6B20R
D4D-1A31R	D4N-1B31R
D4D-2A31R	D4N-2B31R
D4D-3A31R	D4N-3B31R
D4D-5A31R	D4N-5B31R
D4D-6A31R	D4N-6B31R
D4D-1A32R	D4N-1B32R
D4D-2A32R	D4N-2B32R
D4D-3A32R	D4N-3B32R
D4D-5A32R	D4N-5B32R
D4D-6A32R	D4N-6B32R
D4D-1A62R	D4N-1B62R
D4D-2A62R	D4N-2B62R
D4D-3A62R	D4N-3B62R
D4D-5A62R	D4N-5B62R
D4D-6A62R	D4N-6B62R
D4D-1A72R	D4N-1B72R
D4D-2A72R	D4N-2B72R
D4D-3A72R	D4N-3B72R
D4D-5A72R	D4N-5B72R
D4D-6A72R	D4N-6B72R
D4D-1A2HR	D4N-1B2HR
D4D-2A2HR	D4N-2B2HR
D4D-3A2HR	D4N-3B2HR
D4D-1A21R	D4N-1B2GR
D4D-2A21R	D4N-2B2GR
D4D-3A21R	D4N-3B2GR
D4D-5A21R	D4N-5B2GR
D4D-6A21R	D4N-6B2GR
D4D-1A27R	D4N-1B2HR
D4D-2A27R	D4N-2B2HR
D4D-3A27R	D4N-3B2HR
D4D-5A27R	D4N-5B2HR
D4D-6A27R	D4N-6B2HR

Warranty and Application Considerations

Read and Understand this Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS, OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used.

Know and observe all prohibitions of use applicable to this product.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Disclaimers

PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON *Warranty and Limitations of Liability.*

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons. Consult with your OMRON representative at any time to confirm actual specifications of purchased product.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. C132-E2-01-X In the interest of product improvement, specifications are subject to change without notice.

Emergency Stop Switch

A165E

Mounting Aperture of 16 mm

- Modular construction, easy installation
- Direct opening mechanism with minimum contact separation of 3 mm in accordance with EN60947-5-1, ⊖. (only for NC contacts)
- Conforms to EN418, EN60947-5-1.
- Includes a safety lock to prevent misuse.
- Features separate construction that allows the Switch to be separated for easier wiring and one-piece-like construction that allows easier handling.
- High reliability, IP65
- Short mounting depth, less than 28.5 mm below panel
- Quick and easy assembly, snap-in Switch.
- A165E is identifiable, clearly visible and will stop a dangerous process, without creating additional hazards.

Model Number Structure

Model Number Legend

A165E-□□-□-□
1 2 3 4

1. Lighted/Non-lighted
None: Non-lighted
L: Lighted

2. Head Size
S: 30 mm dia.
M: 40 mm dia.

3. Illumination (Operation Voltage/Rated Voltage)
None: Non-lighted
24D: LED (24 VDC)

4. Contacts
01: SPST (NC)
02: DPST (NC)
03U: TPST (NC)
One-body, non-lighted models only

A165E

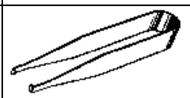
Ordering Information

List of Models

Illumination	Rated voltage	Pushbutton color	Pushbutton size	Terminal	Contact	Standard load (125 VAC at 5 A, 250 VAC at 3 A, 30 VDC at 3 A)
LED	24 VDC	Red	30 dia.	Solder terminal	SPST-NC	A165E-LS-24D-01
					DPST-NC	A165E-LS-24D-02
None	---				SPST-NC	A165E-S-01
					DPST-NC	A165E-S-02
					TPST-NC	A165E-S-03U
LED	24 VDC		40 dia.		SPST-NC	A165E-LM-24D-01
					DPST-NC	A165E-LM-24D-02
None	---				SPST-NC	A165E-M-01
					DPST-NC	A165E-M-02
					TPST-NC	A165E-M-03U

Note: The above models have a surface indication of "RESET." Models with "STOP" indication are also available. For further information, contact your OMRON representative.

Accessories (Order Separately)

Item	Appearance	Type	Model	Precautions
Yellow Plate		Yellow, 45 dia.	A16Z-5070	Use this as an emergency stop nameplate.
Panel Plug		Rectangular	A16ZJ-3003	Used for covering the panel cutouts for future panel expansion.
		Square	A16ZA-3003	
		Round	A16ZT-3003	
Tightening Tool		---	A16Z-3004	Useful for repetitive mounting. Be careful not to tighten excessively.
Extractor		---	A16Z-5080	Convenient for extracting the Switch and Lamp.

Specifications

Approved Standards

Recognized Organization	Standards	File No.
UL, cUL (see note)	UL508	E41515
AZCO	EN60947-5-1	C9805501

Note: UL: UL508, cUL: CSA C22 No. 14

Approved Standard Ratings

UL, cUL

Rated voltage	Rated current	
	A165E series	A165E-U series
125 VAC 250 VAC 30 VDC	5 A (General use) 3 A (General use) 3 A (Resistive)	1 A (General use) 0.5 A (General use) 1 A (Resistive)

Ratings

Switch Ratings

Rated voltage	Resistive load	
	A165E series	A165E□-U series
125 VAC 250 VAC 30 VDC	5 A 3 A 3 A	1 A 0.5 A 1 A
Minimum applicable load	150 mA at 5 VDC	1 mA at 5 VDC

Characteristics

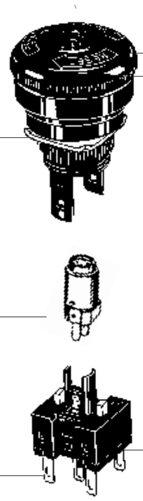
Item		Emergency Stop Switch
Allowable operating frequency	Mechanical	20 operations/minute max.
	Electrical	10 operations/minute max.
Insulation resistance		100 MΩ min. (at 500 VDC)
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min between terminals of same polarity 2,000 VAC, 50/60 Hz for 1 min between terminals of different polarity and also between each terminal and ground 1,000 VAC, 50/60 Hz for 1 min between lamp terminals (see note)
Vibration resistance	Malfunction	10 to 55 Hz, 1.5-mm double amplitude (malfunction within 1 ms)
Shock resistance	Destruction	500 m/s^2
	Malfunction	300 m/s^2 max. (malfunction within 1 ms), 150 m/s^2 max. In case of A165E□U series
Durability	Mechanical	100,000 operations min.
	Electrical	100,000 operations min.
Ambient temperature		Operating:-10°C to 55°C (with no icing or condensation) Storage:-25°C to 65°C (with no icing or condensation)
Ambient humidity		Operating:35% to 85%
Electric shock protection class		Class II
PTI (tracking characteristic)		175
Degree of contamination		3
Weight		Approx. 16 g (in case of DPDT Switches)

Note: LED not mounted. Test them with the LED removed.

Operating Characteristics

Features	Characteristics
Operating force (OF) max.	14.7 N
Releasing force (RF) min.	0.1 N·m
Pretravel (PT)	3.5±0.5 mm (3±0.5 mm In case of A165E□U series)

Nomenclature



Protective Structure and Terminal Type
- **Protective Structure**
  Oil-resistant IP65
- **Terminal Type**
  Solder terminals
  (tab terminals #110)

Lamp
- LED lamp

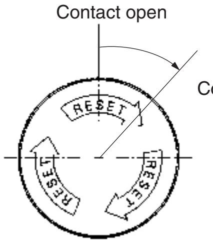
Illumination Colors
- LED Illumination
  Red
- Non-lighted
  Red

Illumination Method
- LED

Switch Specifications
- **Standard Loads**
  5 A at 125 VAC
  3 A at 250 VAC
  3 A at 30 VDC

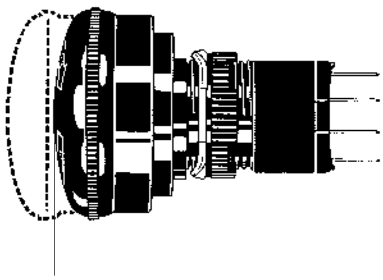
Note: A165E Emergency Stop Switch must be ordered as a set.
No LED is installed for the non-lighted model.

Push-lock, Turn-reset System Prevents Misuse



Safety Lock Prevents Misuse

Even if an object or person touches the pushbutton by mistake, the contact will not be released unless the pushbutton reaches the lock position.

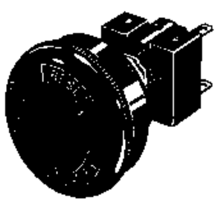


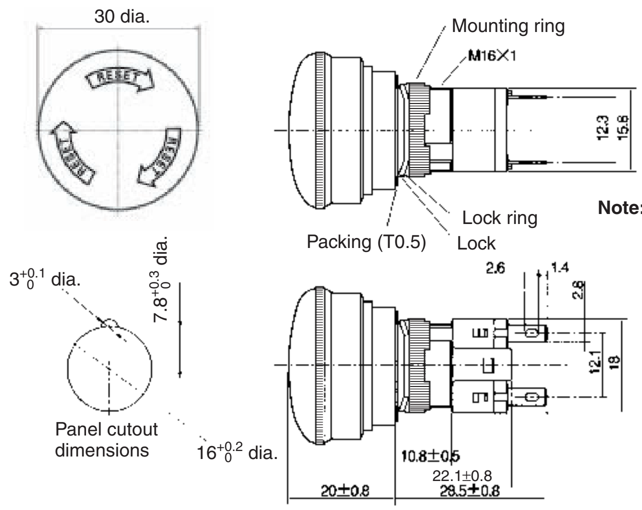
Dimensions

Note: All units are in millimeters unless otherwise indicated.

A165E

Non-lighted models
30 mm diameter



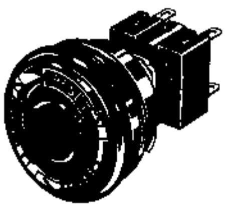


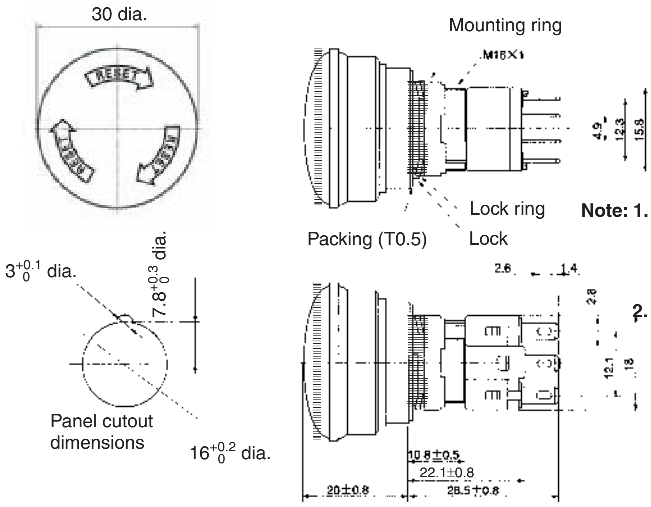
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

Lighted models
30 mm diameter



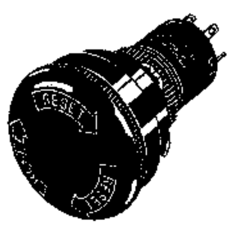


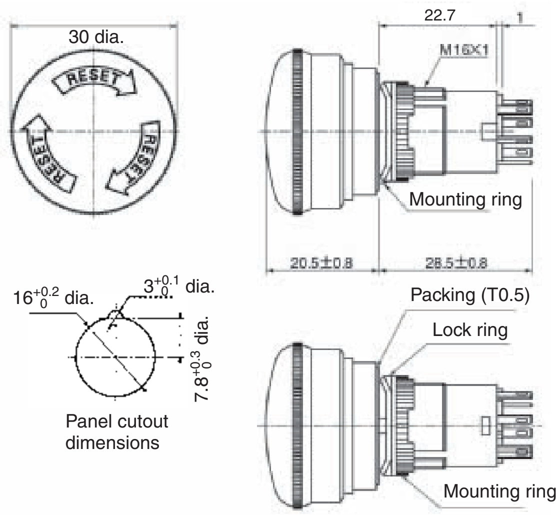
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E□U

One-body models
30 mm diameter



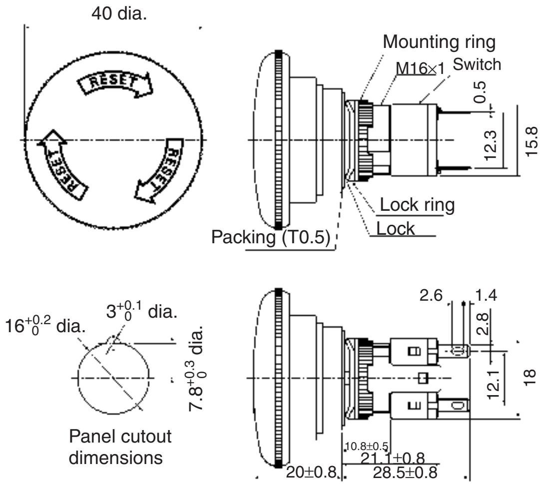


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E

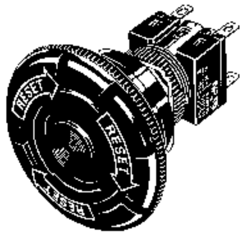
A165E
Non-lighted models
40 mm diameter

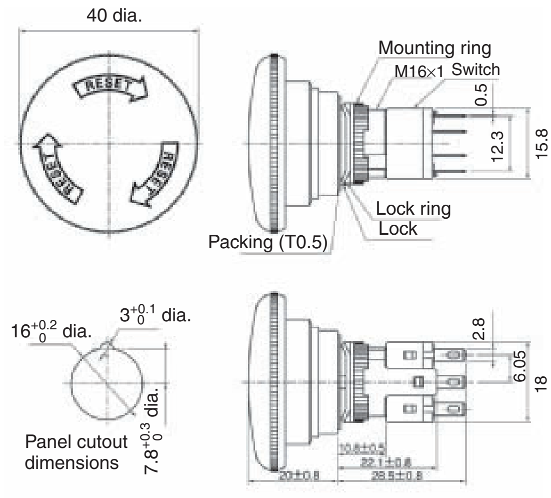


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E
Lighted models
40 mm diameter

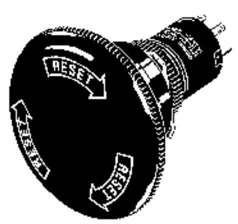


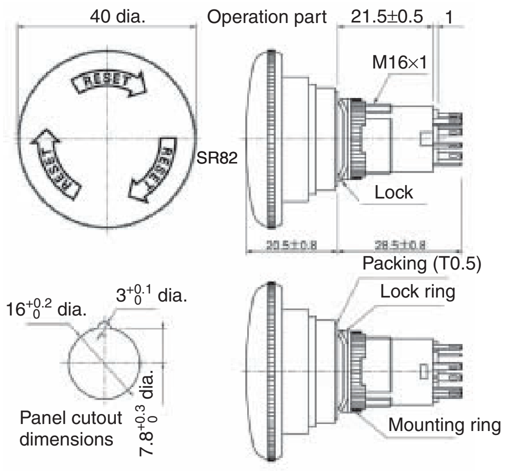


Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

A165E□U
Non-lighted,
one-body models
40 mm diameter





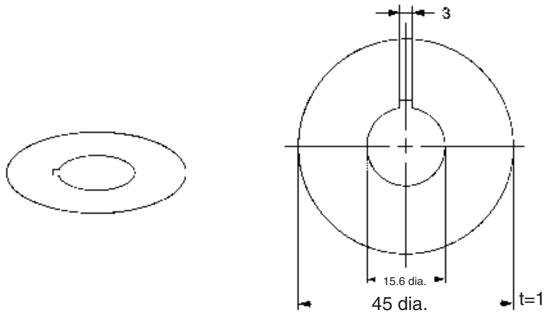
Note: 1. When applying a coating such as paint to the panel, dimensions after the coating must satisfy the specified dimensions.

2. Recommended panel thickness: 0.5 to 3.2 mm.

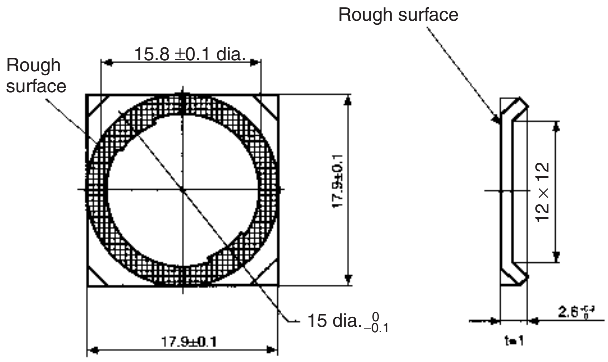
Accessories

Yellow Plate (Vinyl Chloride)

A16Z-5070

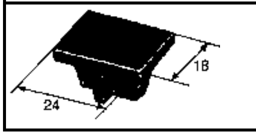
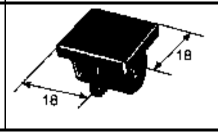
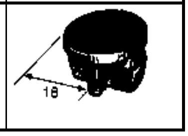


Lock Ring



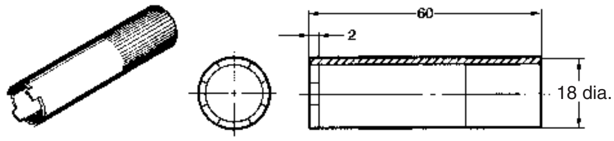
Panel Plugs

Select an appropriate Panel Plug according to the panel design and mount from the front side of the panel. Panel cutout dimensions are the same as those for the Switch.

Rectangular	Square	Round
		

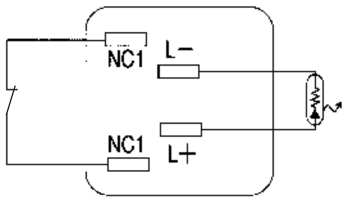
Screw Fitting

A16Z-3004

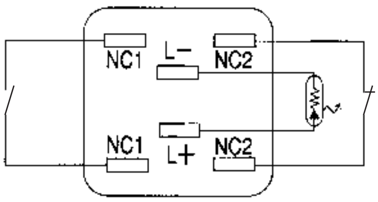


Terminal Arrangement

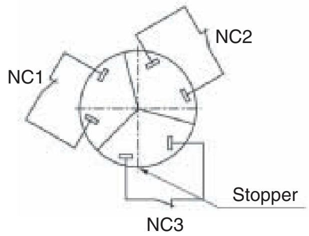
SPST Switches



DPST Switches



TPST Switches



Note: The L+ and L– terminals are not available with the non-lighted models.

A165E

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Relays with Forcibly Guided Contacts

G7SA

Slim Relays with Forcibly Guided Contacts Conforming to EN Standards

- EN50205 Class A, approved by VDE.
- Ideal for use in safety circuits in production machinery.
- Four-pole and six-pole Relays are available.
- The Relay's terminal arrangement simplifies PCB pattern design.
- Reinforced insulation between inputs and outputs.
  Reinforced insulation between poles.
- UL, CSA approval.

Ordering Information

Relays with Forcibly Guided Contacts

Type	Sealing	Poles	Contacts	Rated voltage	Model
Standard	Flux-tight	4 poles	3PST-NO, SPST-NC	24 VDC[*1]	G7SA-3A1B
			DPST-NO, DPST-NC		G7SA-2A2B
		6 poles	5PST-NO, SPST-NC		G7SA-5A1B
			4PST-NO, DPST-NC		G7SA-4A2B
			3PST-NO, 3PST-NC		G7SA-3A3B

[*1] 12 VDC, 21 VDC, 48 VDC are available on request.

Sockets

Type		LED indicator	Poles	Rated voltage	Model
Track-mounting	Track mounting and screw mounting possible	No	4 poles	---	P7SA-10F
			6 poles		P7SA-14F
		Yes	4 poles	24 VDC	P7SA-10F-ND
			6 poles		P7SA-14F-ND
Back-mounting	PCB terminals	No	4 poles	---	P7SA-10P
			6 poles		P7SA-14P

Model Number Legend

G7SA-□A□B
1 2

1. NO Contact Poles
- 2: DPST-NO
- 3: 3PST-NO
- 4: 4PST-NO
- 5: 5PST-NO

2. NC Contact Poles
- 1: SPST-NC
- 2: DPST-NC
- 3: 3PST-NC

Specifications

Ratings

Coil

Rated voltage	Rated current	Coil resistance	Must-operate voltage	Must-release voltage	Max. voltage	Power consumption
24 VDC	4 poles: 15 mA 6 poles: 20.8 mA	4 poles: 1,600 Ω 6 poles: 1,152 Ω	75% max. (V)	10% min. (V)	110% (V)	4 poles: Approx. 360 mW 6 poles: Approx. 500 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of ±15%.

2. Performance characteristics are based on a coil temperature of 23°C.

3. The value given for the maximum voltage is for voltages applied instantaneously to the Relay coil (at an ambient temperature of 23°C) and not continuously.

Contacts

Load	Resistive load (cos φ =1)
Rated load	6 A at 250 VAC, 6 A at 30 VDC
Rated carry current	6 A
Max. switching voltage	250 VAC, 125 VDC
Max. switching current	6 A
Max. switching capacity (reference value)	1,500 VA, 180 W

Characteristics

Sockets

Model	Continuous current	Dielectric strength	Insulation resistance
P7SA-14□	6 A (see note 1)	2,500 VAC for 1 min. between poles	100 MΩ min. (see note 2)

Note: 1. If the P7SA-1□F is used between 55 and 85°C, reduce the continuous current (from 6 A) by 0.1 A for every degree.
2. Measurement conditions: Measurement of the same points as for the dielectric strength at 500 VDC.
3. When using the P7SA-1□F-ND at 24 VDC, use at an ambient operating temperature from -25 to 55°C.

Relays with Forcibly Guided Contacts

Contact resistance		100 mΩ max. (The contact resistance was measured with 1 A at 5 VDC using the voltage-drop method.)
Operating time (see note 2)		20 ms max.
Response time (see note 2)		10 ms max. (The response time is the time it takes for the normally open contacts to open after the coil voltage is turned OFF.)
Release time (see note 2)		20 ms max.
Maximum operating frequency	Mechanical	36,000 operations/hr
	Rated load	1,800 operations/hr
Insulation resistance		100 MΩ min. (at 500 VDC) (The insulation resistance was measured with a 500-VDC megger at the same places that the dielectric strength was measured.)
Dielectric strength (see notes 3, 4)		Between coil contacts/different poles: 4,000 VAC, 50/60 Hz for 1 min (2,500 VAC between poles 3-4 in 4-pole Relays or poles 3-5, 4-6, and 5-6 in 6-pole Relays.) Between contacts of same polarity: 1,500 VAC, 50/60 Hz for 1 min
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction	1,000 m/s^2
	Malfunction	100 m/s^2
Durability	Mechanical	10,000,000 operations min. (at approx. 36,000 operations/hr)
	Electrical	100,000 operations min. (at the rated load and approx. 1,800 operations/hr)
Min. permissible load (see note 5) (reference value)		5 VDC, 1 mA
Ambient temperature (see note 6)		Operating:-40°C to 85°C (with no icing or condensation) Storage:-40°C to 85°C (with no icing or condensation)
Ambient humidity		Operating:35% to 85% Storage:35% to 85%
Weight		4 poles: Approx. 22 g 6 poles: Approx. 25 g
Approved standards		EN61810-1 (IEC61810-1), EN50205, UL508, CSA22.2 No. 14

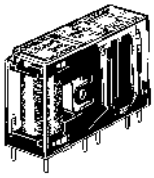
Note: 1. The values listed above are initial values.
2. These times were measured at the rated voltage and an ambient temperature of 23°C. Contact bounce time is not included.
3. Pole 3 refers to terminals 31-32 or 33-34, pole 4 refers to terminals 43-44, pole 5 refers to terminals 53-54, and pole 6 refers to terminals 63-64.
4. When using a P7SA Socket, the dielectric strength between coil contacts/different poles is 2,500 VAC, 50/60 Hz for 1 min.
5. Min. permissible load is for a switching frequency of 300 operations/min.
6. When operating at a temperature between 70°C and 85°C, reduce the rated carry current (6 A at 70°C or less) by 0.1 A for each degree above 70°C.

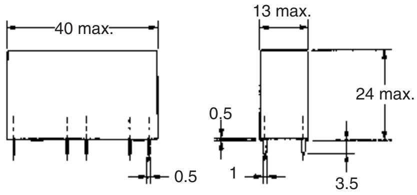
Dimensions

Note: All units are in millimeters unless otherwise indicated. The diagrams are drawn in perspective.

Relays with Forcibly Guided Contacts

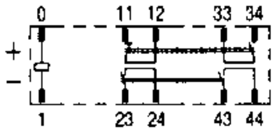
G7SA-3A1B
G7SA-2A2B



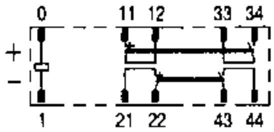


Terminal Arrangement/ Internal Connection Diagram (Bottom View)

G7SA-3A1B

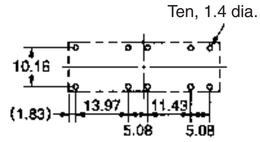


G7SA-2A2B



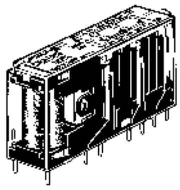
Printed Circuit Board Design Diagram (Bottom View)

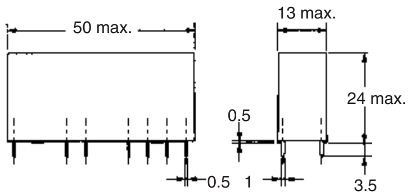
(±0.1 tolerance)



Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

G7SA-5A1B
G7SA-4A2B
G7SA-3A3B

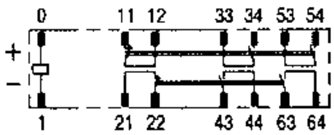




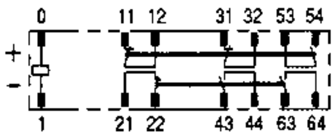
Terminal Arrangement/ Internal Connection Diagram (Bottom View)

G7SA-5A1B

G7SA-4A2B

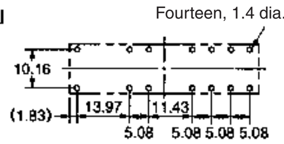


G7SA-3A3B



Printed Circuit Board Design Diagram (Bottom View)

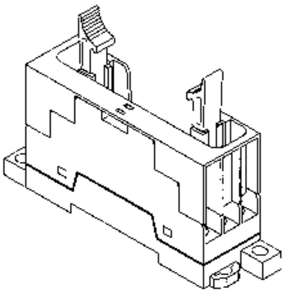
(±0.1 tolerance)

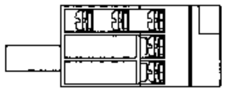


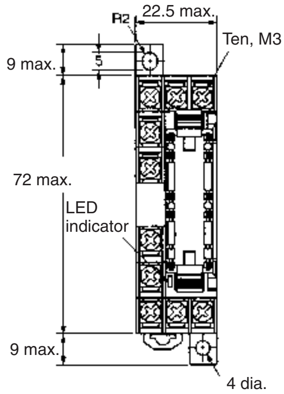
Note: Terminals 23-24, 33-34, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

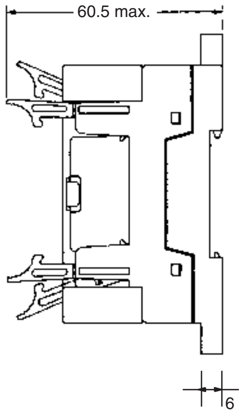
Track-mounting Socket

P7SA-10F, P7SA-10F-ND







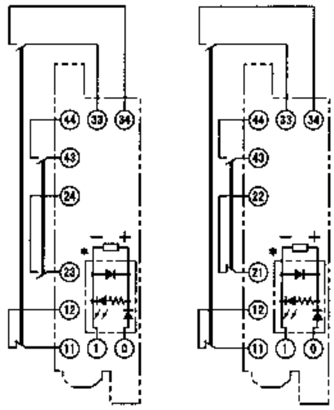


Note: The socket is shown with the finger cover removed.

Note: Only the -ND Sockets have LED indicators.

Terminal Installation/Internal Connection Diagram (Top View)

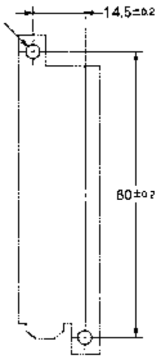
G7SA-3A1B Mounted **G7SA-2A2B Mounted**



* This display circuit is available only for "-ND" models.

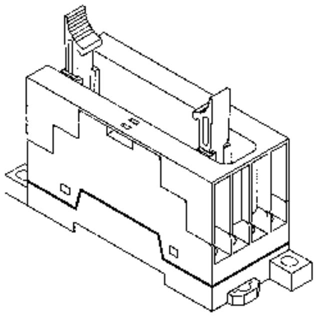
Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

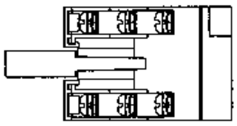
Mounting Hole Placement Diagram (Top View)

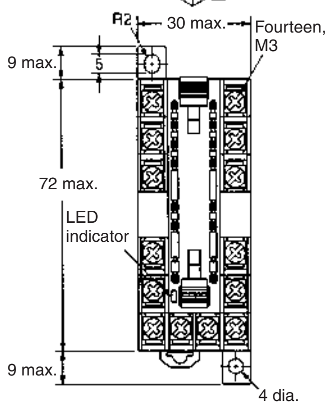


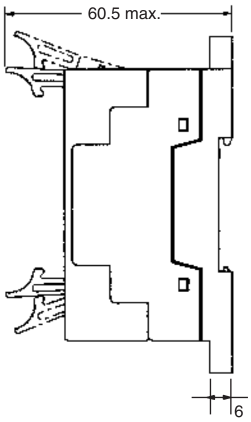
Track-mounting Socket

P7SA-14F, P7SA-14F-ND







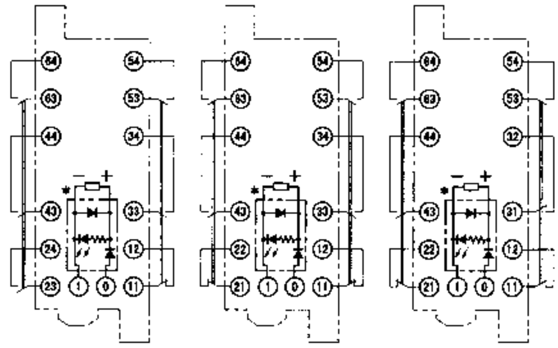


Note: The socket is shown with the finger cover removed.

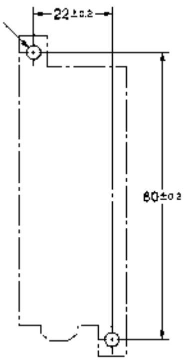
Note: Only the -ND Sockets have LED indicators.

Terminal Arrangement/Internal Connection Diagram (Top View)

G7SA-5A1B Mounted **G7SA-4A2B Mounted** **G7SA-3A3B Mounted**



Mounting Hole Placement Diagram (Top View)

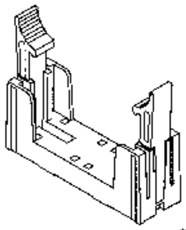


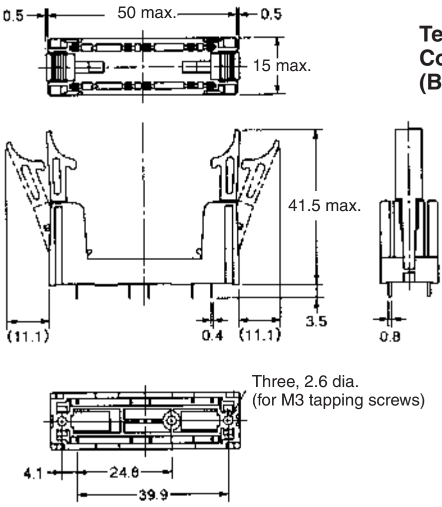
* This display circuit is available only for "-ND" models.

Note: Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

G7SA

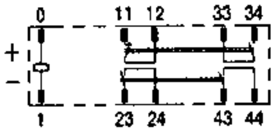
P7SA-10P Back-mounting Socket (for PCB)



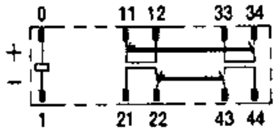


Terminal Arrangement/Internal Connection Diagram (Bottom View)

G7SA-3A1B Mounted

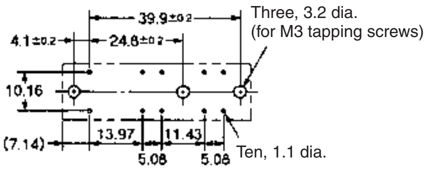


G7SA-2A2B Mounted



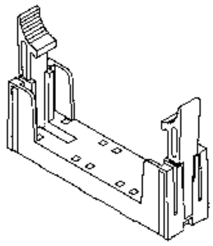
Mounting Hole Placement (Bottom View)

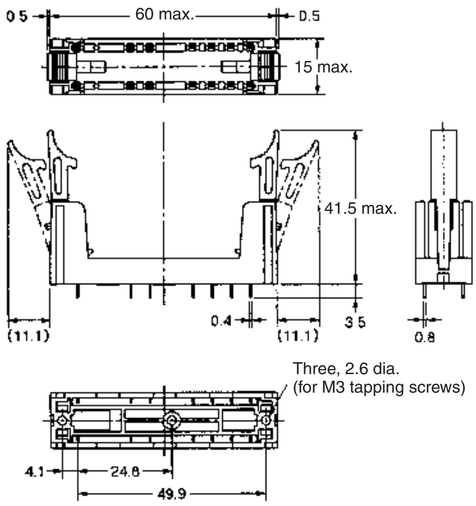
(±0.1 tolerance)



Note: Terminals 23-24, 33-34, and 43-44 are normally open. Terminals 11-12 and 21-22 are normally closed.

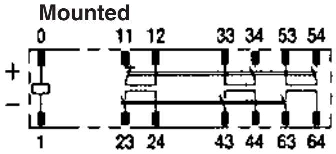
P7SA-14P Back-mounting Socket (for PCB)



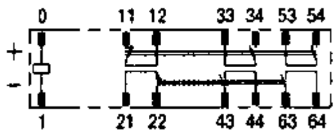


Terminal Arrangement/Internal Connection Diagram (Bottom View)

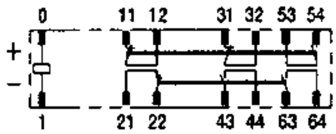
G7SA-5A1B Mounted



G7SA-4A2B Mounted

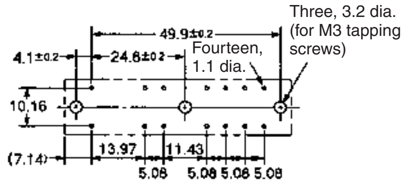


G7SA-3A3B Mounted



Mounting Hole Placement (Bottom View)

(±0.1 tolerance)



Note: Terminals 23-24, 33-34, 43-44, 53-54, and 63-64 are normally open. Terminals 11-12, 21-22, and 31-32 are normally closed.

Precautions

Do not touch the terminal area of the Relays or the socket terminal area (charged area) while power is ON. Electric shock will result.

Relays with Forcibly Guided Contacts

A Relay with Forcibly Guided Contacts is a Relay with which a safety category circuit can be configured.

Wiring

Use one of the following wires to connect to the P7SA-10F/10F-ND/14F/14F-ND.
Stranded wire:0.75 to 1.5 mm^2
Solid wire:1.0 to 1.5 mm^2

Tighten each screw of the P7SA-10F/10F-ND/14F/14F-ND to a torque of 0.98 N·m securely.

Wire the terminals correctly with no mistakes in coil polarity, otherwise the G7SA will not operate.

Cleaning

The G7SA is not of enclosed construction. Therefore, do not wash the G7SA with water or detergent.

Forcibly Guided Contacts (from EN50205)

If an NO contact becomes welded, all NC contacts will maintain a minimum distance of 0.5 mm when the coil is not energized. Likewise if an NC contact becomes welded, all NO contacts will maintain a minimum distance of 0.5 mm when the coil is energized.

Correct Use

Relays with Forcibly Guided Contacts

While the Relay with Forcibly Guided Contacts has the previously described forcibly guided contact structure, it is basically the same as an ordinary relay in other respects. Rather than serving to prevent malfunctions, the forcibly guided contact structure enables another circuit to detect the condition following a contact weld or other malfunction. Accordingly, when a contact weld occurs in a Relay with Forcibly Guided Contacts, depending on the circuit configuration, the power may not be interrupted, leaving the Relay in a potentially dangerous condition (as shown in Fig. 1.)
To configure the power control circuit to interrupt the power when a contact weld or other malfunction occurs, and to prevent restarting until the problem has been eliminated, add another Relay with Forcibly Guided Contacts or similar Relay in combination to provide redundancy and a self-monitoring function to the circuit (as shown in Fig. 2).
The G9S/G9SA Safety Relay Unit, which combines Relays such as the Relay with Forcibly Guided Contacts in order to provide the above-described functions, is available for this purpose. By connecting a contactor with appropriate input and output to the Safety Relay Unit, the circuit can be equipped with redundancy and a self-monitoring function.

Fig 1

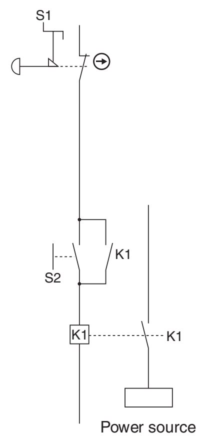
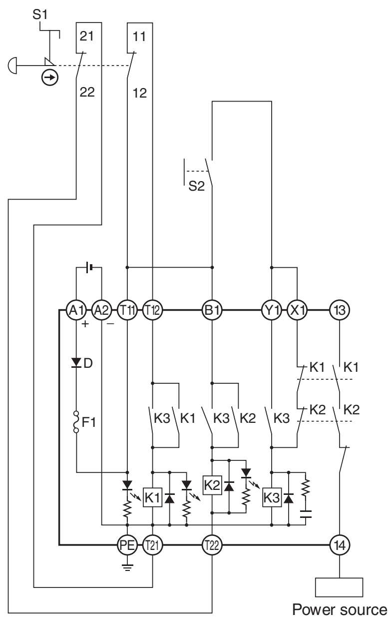


Fig 2



ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Enabling Switch

A4E

3-position Enabling Switch for Safer Robot Operation

- Clicking feel.
- Conforms to U.S. standards (ANSI/RIA R15.06-1999) for 3-position switches.
- Can be mounted in two directions.

Model Number Structure

Model Number Legend

A4E-□□□□□□
1 2 3 4 5 6

1. **Total output number**
   B: Two outputs
   C: Four outputs
2. **Enable outputs**
   2: Two contact outputs
3. **Release monitor outputs**
   0: None
   1: One contact output
4. **Grip monitor outputs**
   0: None
   1: One contact output
5. **Mounting bracket**
   S: No mounting bracket
   H: Horizontal mounting bracket
   V: Vertical mounting bracket
6. **Cover**
   S: No cover
   A: Rubber cover

Ordering Information

List of Models

Model	Specification
A4E-B200SS	Two outputs, no mounting bracket, no rubber seal
A4E-B200HS	Two outputs, horizontal mounting, no rubber seal
A4E-B200VS	Two outputs, vertical mounting, no rubber seal
A4E-B200VA	Two outputs, vertical mounting, with rubber seal
A4E-C211SS	Four outputs, no mounting bracket, no rubber seal
A4E-C211HS	Four outputs, horizontal mounting, no rubber seal
A4E-C211VS	Four outputs, vertical mounting, no rubber seal
A4E-C211VA	Four outputs, vertical mounting, with rubber seal

Approved Standards

EN 60947-5-1

UL 508

CSA C22.2 No. 14

Specifications

Ratings

Rated insulation voltage	250 V
Rated ON current	2.5 A
Rated load	24 VDC, 300 mA (inductive load) 125 VAC, 1 A (resistive load)
Minimum applicable load	24 VDC, 4 mA
Impulse withstand voltage	4.0 kV between terminals of different polarity, 2.5 kV between terminals of same polarity
Ambient temperature	-10°C to 55°C (with no icing)
Ambient humidity	35% to 85% (with no condensation)
Storage temperature	-25°C to 65°C

Structure

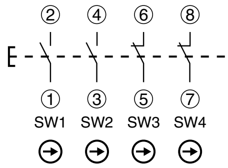
Contact form	4-contact type:2NO (enable output) 1NC (release output) 1NC (grip output) Direct opening for all contacts (See note)
	2-contact type:2NO (enable output) Direct opening for all contacts (See note)
Operating pattern	During operation: OFF-ON-OFF During reset: OFF-OFF momentary 3-position operation
Terminal shape	Solder terminals

Note: Direct opening only during grip.

Characteristics

Insulation resistance	100 M min. (at 500 VDC)
Contact resistance	100 m max. (initial value)
Vibration resistance	10 to 55 Hz, 0.75-mm single amplitude min.
Shock resistance	150 m/s^2
Mechanical durability	OFF-ON: 1,000,000 operations min. OFF-ON-OFF (direct opening): 100,000 operations min.
Electrical durability	100,000 operations min.
Degree of protection	IP65 (rubber seal type only)

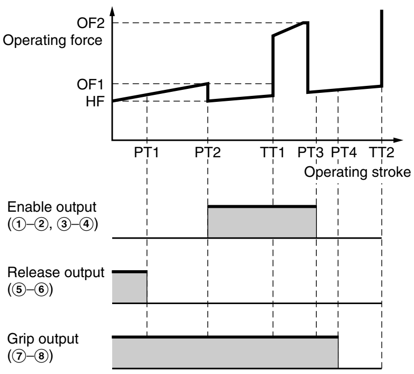
Contact form



SW1, SW2: Enable output
SW3: Release output
SW4: Grip output

Note: SW3 and SW4 are for 4-contact types only.

Operating Characteristics



Operating stroke

Symbol	Name	A4E-B200□S	A4E-B200VA (See note.)	A4E-C211□S	A4E-C211VA (See note.)
PT1	Release output (ON)	---	---	1 mm max.	1.2 mm max.
PT2	Enable output (ON)	3.2 mm max.	3.4 mm max.	3.2 mm max.	3.4 mm max.
TT1	Max. enable holding position	Approx. 4 mm	Approx. 4.2 mm	Approx. 4 mm	Approx. 4.2 mm
PT3	Enable direct opening position	5.4 mm max.	5.6 mm max.	5.4 mm max.	5.6 mm max.
PT4	Grip output (ON)	---	---	5.4 mm min.	5.4 mm min.
TT2	Max. stroke	Approx. 6.5 mm	Approx. 6.7 mm	Approx. 6.5 mm	Approx. 6.7 mm

Note:Not including the rise of the rubber cover (0.5 mm max.).

Operating force (reference values)

Symbol	Name	A4E-B200□S	A4E-B200VA	A4E-C211□S	A4E-C211VA
OF1	Enable operating force	7 N max.	14 N max.	7 N max.	14 N max.
HF (See note)	Enable holding force	Approx. 5.5 N	Approx. 8 N	Approx. 5.5 N	Approx. 8 N
OF2	Grip operating force	35 N max.	40 N max.	35 N max.	40 N max.

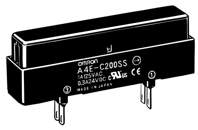
Note: HF indicates “holding force”.

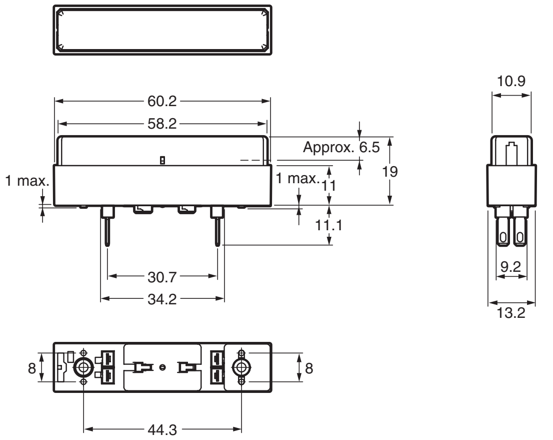
Dimensions

Note: All units are in millimeters unless otherwise indicated.

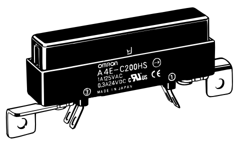
2-contact type

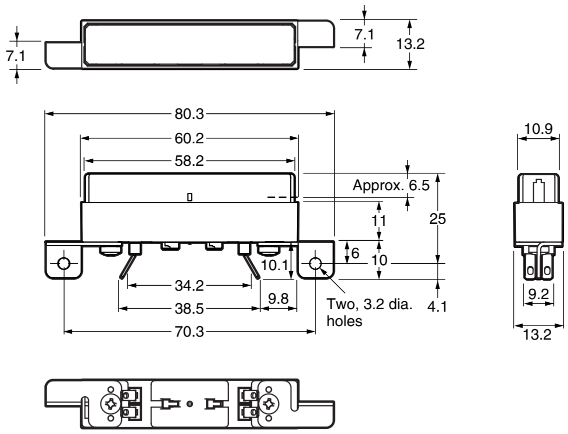
No mounting bracket
A4E-B200SS





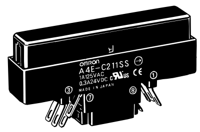
Horizontal mounting
A4E-B200HS

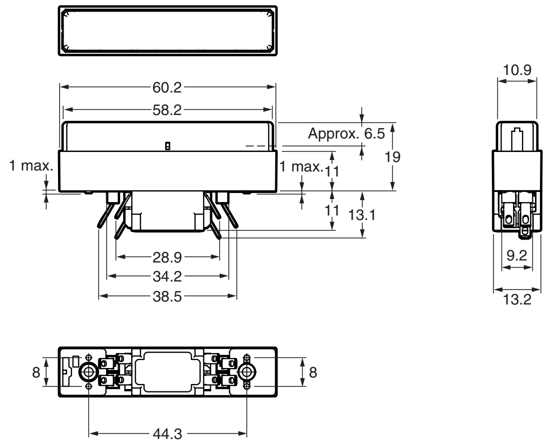




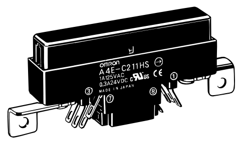
4-contact type

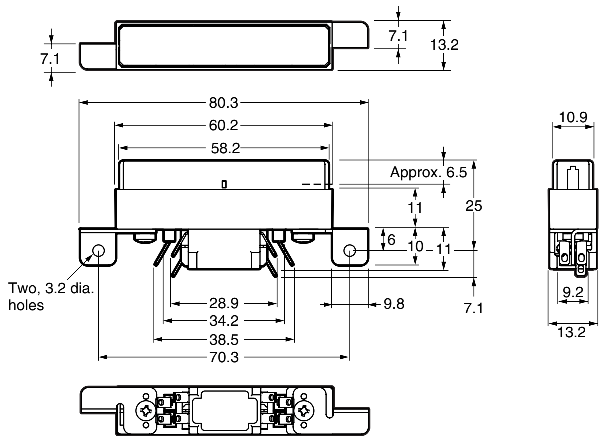
No mounting bracket
A4E-C211SS





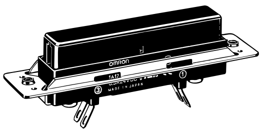
Horizontal mounting
A4E-C211HS

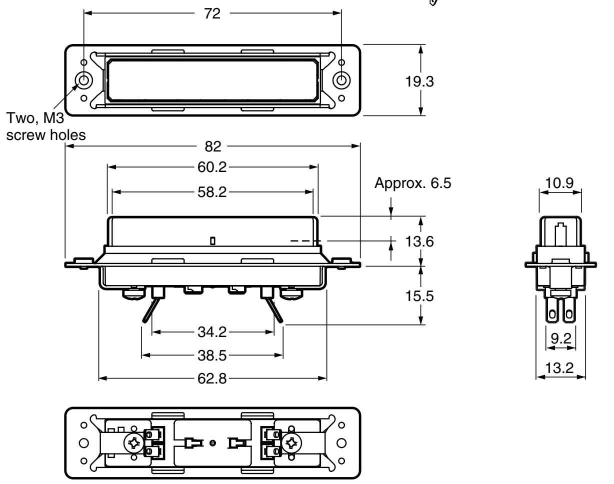




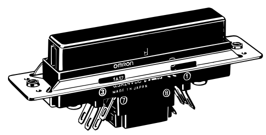
A4E

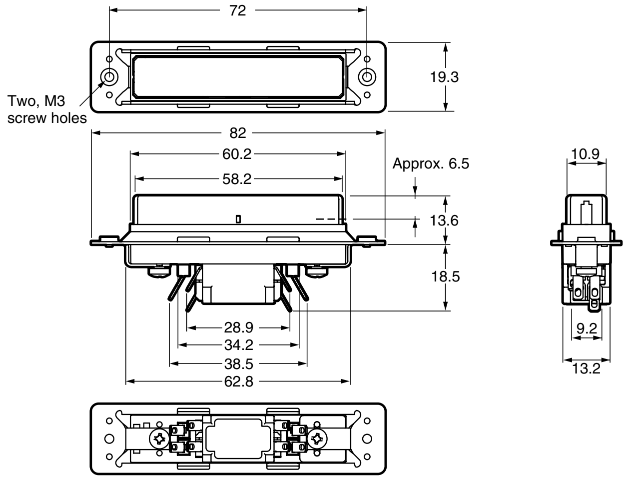
Vertical mounting
A4E-B200VS



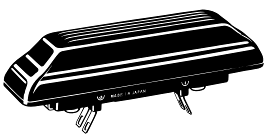


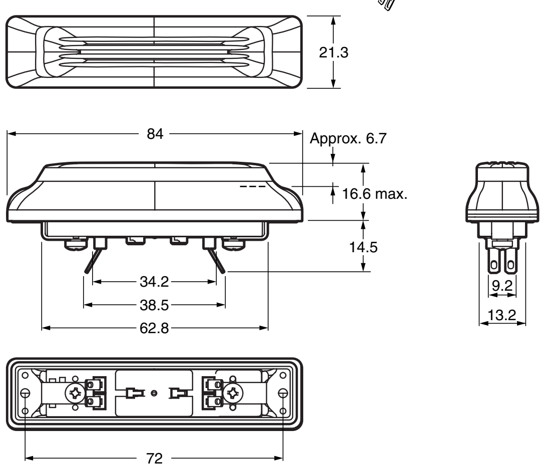
Vertical mounting
A4E-C211VS



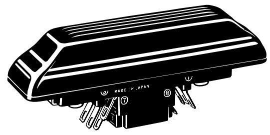


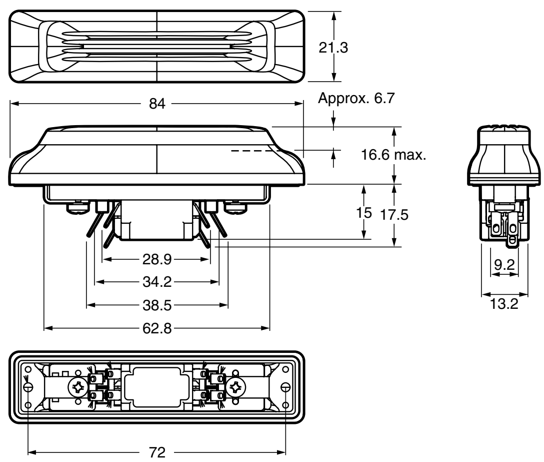
Vertical mounting with
rubber seal
A4E-B200VA





Vertical mounting with
rubber seal
A4E-C211VA





Precautions

WARNING

Do not wire the Switch or touch any terminal of the Switch while power is being supplied. Doing so may result in electric shock.

WARNING

Always use the Switch in a system that is operated directly by hand. Do not operate the Switch with a mechanical actuator. Insufficient Switch strength may result in damage to the Switch, electric shock, or fire.

CAUTION

Design a safe system for using the Switch, based on a risk assessment that takes into account all reasonably foreseeable malfunctions.

CAUTION

Determine the Switch mounting direction and structural design only after thorough risk assessment. For example, in a structure where the Switch protrudes from the pendant perimeter, the weight of the pendant itself could place the Switch into the enable condition and operate the machine. Likewise, in a buried structure where the Switch lies below the surface of the pendant, the Switch may not enter the grip condition when pressed and thus fail to stop the machine.

CAUTION

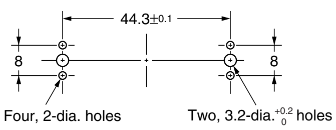
Configure the system so that the machine operates only when the Switch is in the enable position.

Correct Use

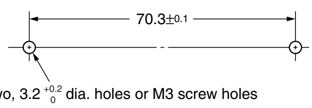
Mounting

Use M3 screws and flat washers or spring washers to mount the Switch securely. Use a tightening torque of 0.39 to 0.59 Nm.

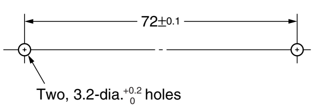
No-mounting-bracket type



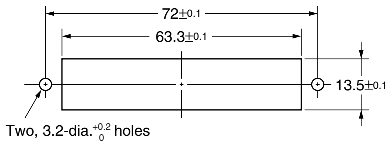
Horizontal mounting type



Vertical mounting type



Vertical mounting type with rubber seal



Wiring

- Use an appropriate wire size (0.5 to 0.75 mm^2) for the applied voltage and carry current.
- Do not use a #110 tab receptacle.
- Wire according to the terminal numbers. Mistaken wiring may damage the Switch and result in fire.
- Wire according to the terminal arrangement.
- Use good-quality 6:4 (tin:lead) solder.
- Use a resin flux cored solder.
- Do not use a liquid or chlorine type flux.
- Perform soldering within 3 s using a 30-W max. soldering iron (temperature at the tip of the soldering iron: 350°C max.). Insulate with an insulation tube.
- Do not move the terminal for at least one minute after soldering.
- Do not apply a force that would deform the terminal when wiring.

Operating Environment

Prior to using the Switch in places that are subject to contact by oil spray or chemicals, check the effect of those substances on the Switch.

Some types of oil spray and chemicals will degrade the sealing capability, which may result in faulty contact, defective insulation, ground fault, or burning damage.

Improper Operating Environment

- Do not use the Switch in places that are subject to sudden temperature change.
- Do not use the Switch in places that are subject to high temperatures and condensation.
- Do not use the Switch in places that are subject to strong vibration.
- Do not use the Switch in places that are subject to direct contact with machine filings or dust.

Storage

- Do not store the Switch in places with hydrogen sulfide or other corrosive gas or sea breeze.
- Do not store the Switch in places where the level of dust is high enough to be visible.
- Do not store the Switch in direct sunlight.
- Do not impose excessive force on the Switch during storage. Otherwise, the Switch may deform.

Handling

- Do not drop the Switch. Otherwise, the Switch may malfunction.
- Do not apply strong vibration or shock to the Switch. Otherwise, the Switch may malfunction or be damaged.
  Do not contact the Switch with sharp objects. Otherwise, the Switch may be scratched. Scratches on the operating portion of the Switch may result in problems both in appearance and operation.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. C123-E2-01-X

Common Precautions for safety switch

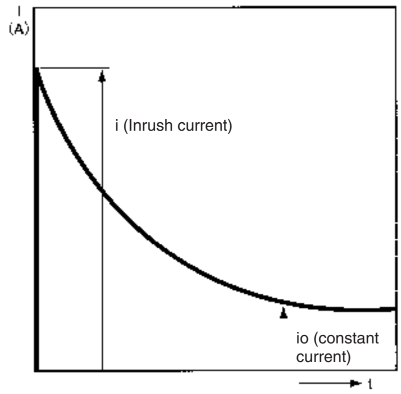
For the individual precautions for each Switch, refer to the precautions for the Switch.

Cautions

- Do not touch the charged switch terminals while the Limit Switch has carry current, otherwise an electric shock may be received.
- Do not assemble the Limit Switch or touch the interior of the Limit Switch while power is connected to the Limit Switch, otherwise an electric shock may be received.

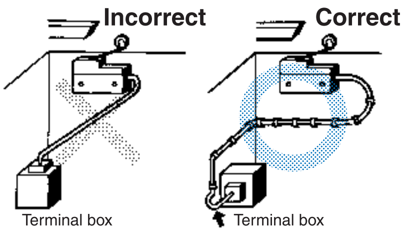
Correct Use

- If the Limit Switch incorporates a ground terminal, be sure to ground it through an appropriate wire, otherwise an electric shock may be received.
- Be sure to connect a fuse with a breaking current 1.5 to 2 times the rated current to the Limit Switch in parallel in order to protect the Limit Switch from damage due to short–circuiting.
- Maintain an appropriate insulation distance between wires connected to the Limit Switch.
- If the Limit Switch has no ground terminal, ground the mounting panel to which the Limit Switch is mounted unless the Limit Switch is of double insulation construction falling under class II. Such models (e.g., the D4D–N, D4D–R or D4DS) ensure good insulation characteristics. Therefore, no ground terminals are incorporated.
- Do not use the Limit Switch in places with flammable or explosive gas without taking any countermeasures taken against explosion or fires. Otherwise switching arcs or heat radiation may cause a fire or explosion.
  Be sure to protect the Limit Switch with appropriate explosion–proof barriers or use a Limit Switch of explosion–proof construction. The Explosion–proof Limit Switch is not available for use in all types of gas or locations. Refer to the *Explosion–proof Device General Catalog* for details.
- The life of the Limit Switch greatly varies with switching conditions. Before using the Limit Switch, be sure to test the Limit Switch under actual conditions. Make sure that the number of switching operations is within the permissible range.
  If a deteriorated Switch is used continuously, insulation failures, contact weld, contact failures, switch damage, or switch burnout may result.
- Some types of load have a great difference between normal current and inrush current. Make sure that the inrush current is within the permissible value. The greater the inrush current in the closed circuit is, the greater the contact abrasion or shift will be. Consequently, contact weld, contact separation failures, or insulation failures may result. Furthermore, the Limit Switch may become broken or damaged.



Wiring

- If the wiring method is incorrect, the wires may get caught by some object or the lead wires may be pulled excessively. Make sure that the lead wires are connected without extraordinary force and that the wires are supported securely.



- Pay the utmost attention so that each terminal is wired correctly. If the terminal is wired incorrectly, the Limit Switch will not function. Furthermore, not only will the Limit Switch have a bad influence on the external circuit, the Limit Switch itself may become damaged or burnt.

Mounting

- Do not modify the actuator, otherwise the operating characteristics and performance of the actuator will change.
- Do not enlarge the mounting holes of the Limit Switch or modify the Limit Switch, otherwise insulation failures or housing damage may result. If the Limit Switch has a force separation mechanism, a modification of the Limit Switch may cause injury.
- Do not apply oil, grease, or other lubricants to the moving parts of the actuator, otherwise the actuator may not operate correctly. Furthermore, intrusion of oil, grease, or other lubricants inside the Limit Switch may cause failures in the Limit Switch.
- Mount the Limit Switch and secure it with the specified screws tightened to the specified torque along with flat washers and springs. The actuator of the Limit Switch mounted to a panel with excessive tightening torque may not operate correctly if the Limit Switch is a pushbutton model.

- Be sure to wire the Limit Switch so that the conduit opening is free of metal powder or any other impurities.
- If glue or bonding agent is applied, make sure that it does not adhere to the movable parts or intrude inside the Limit Switch, otherwise the Limit Switch may not work correctly or cause contact failure. Some types of glue or bonding agent may generate a gas that may have a bad influence on the Limit Switch. Pay the utmost attention when selecting the glue or locking agent.
- Do not drop or disassemble the Limit Switch, otherwise the Limit Switch will not be capable of full performance. Furthermore, the Limit Switch may become broken or burnt.
- If the contacts are not turned ON or OFF over a long time, the contacts may become oxidized. Consequently, the reliability of the contacts may decrease, which may result in accidents.
- Actuation of the Limit Switch over a long time may deteriorate parts of the Limit Switch and a releasing failure may result. Be sure to check the condition of the Limit Switch regularly.
- Some models allow changes in head directions. When changing the head of such a model, make sure that the head is free of any foreign substance. Tighten each screw of the head to the rated torque.
- Be sure to take measures so that no foreign material, oil, or water will penetrate into the Limit Switch through the conduit opening. Be sure to attach a connector suited to the cable thickness and tighten the connector securely to the rated torque.
- Apply Limit Switch models incorporating a force–separation function, such as the D4BS or D4BL, for safety doors or emergency stop circuits.
- Do not impose shock or vibration on the actuator while it is fully pressed. Otherwise, the actuator will partially abrade and an actuation failure may result.

Limit Switch Operation

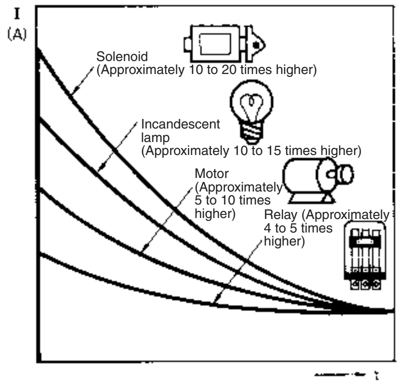
- The Limit Switch in actual operation may cause accidents that cannot be foreseen from the design stage. Therefore, the Limit Switch must be practically tested before actual use.
- When testing the Limit Switch, be sure to apply the actual load condition together with the actual operating environment.
- All the performance ratings in this catalog are provided under the following conditions unless otherwise specified.

Inductive load:	A minimum power factor of 0.4 (AC) or a maximum time constant of 7 ms (DC)
Lamp load:	An inrush current 10 times higher than the normal current
Motor load:	An inrush current 8 times higher than the normal current

The rated values are obtained from tests conducted in accordance with JIS C4508.

1. Ambient temperature: +5° C to 35° C
2. Ambient humidity: 40% to 70%.

Note: An inductive load causes a problem especially in DC circuitry. Therefore, it is essential to know the time constants (L/R) of the load.

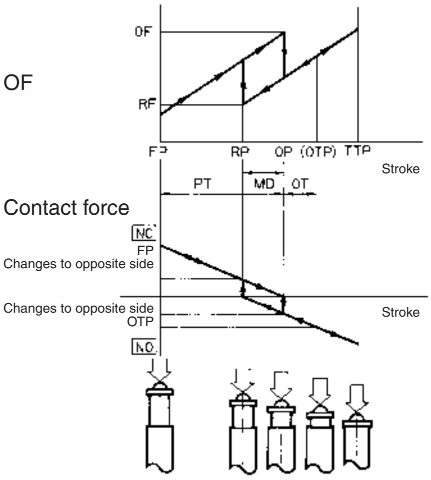


Mechanical Characteristics

Operating Force, Stroke, and Contact Characteristics

- The following graph indicates the relationship between operating force and stroke or stroke and contact force. In order to operate the Limit Switch with high reliability, it is necessary to use the Limit Switch within an appropriate contact force range. If the Limit Switch is used in the normally closed condition, the dog must be installed so that the actuator will return to the FP when the actuator is actuated by the object. If the Limit Switch is used in the normally open condition, the actuator must be pressed to 70% to 100% of the OT (i.e., 60% to 80% of the TT) and any slight fluctuation must be absorbed by the actuator.
- If the full stroke is set close to the OP or RP, contact instability may result. If the full stroke is set to the TTP, the actuator or switch may become damaged due to the inertia of the dog. In that case, adjust the stroke with the mounting panel or the dog. Refer to page G-314, *Dog Design*, page G-315, *Stroke Settings vs. Dog Movement Distance*, and page G-315, *Dog Surface* for details.
- The following graph shows an example of changes in contact force according to the stroke. The contact force near the OP or RP is unstable, and the Limit Switch cannot main-

tain high reliability. Furthermore, the Limit Switch cannot withstand strong vibration or shock.



Mechanical Conditions

- The actuator must be selected according to the operating method.
- Check the operating speed and switching frequency.
  1. If the operating speed is extremely low, the switching of the movable contact will become unstable, thus resulting in incorrect contact or contact weld.
     If the operating speed is extremely low or the pushbutton needs to be set between the FP and OP, consult your OMRON representative in advance.
  2. If the operating speed is extremely high, the Limit Switch may break due to shock. If the switching frequency is high, the switching of the contacts cannot catch up with the switching frequency. Make sure that the switching frequency is within the rated switching frequency. If a higher switching frequency is required, use of a proximity sensor is recommended.
- Do not impose excessive force on the actuator, otherwise the actuator may become damaged or not operate correctly.
- Make sure that the stroke is set within the suitable range specified for the model, or otherwise the Limit Switch may break.
- Make sure that the operating direction of the actuator is parallel to the axis of the actuator if the actuator is a pushbutton type. If they are not in parallel, partial abrasion may result and the actuator may soon become damaged. Refer to page G-313, *Operation* for details.

Electrical Characteristics

Electrical Conditions

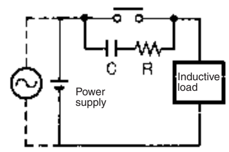
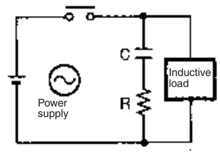
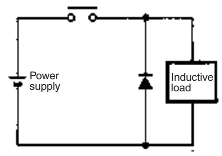
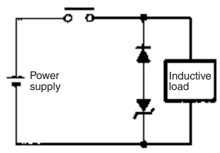
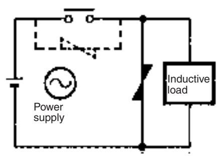
- The switching load capacity of the Limit Switch greatly varies between AC and DC. Always be sure to apply the rated load. The control capacity will drastically drop if it is a DC load. This is because a DC load has no current zero–cross point, unlike an AC load. Therefore, if an arc is generated, it may continue comparatively for a long time. Furthermore, the current direction is always the same, which results in a contact relocation phenomena whereby the contacts easily stick to each other and do not separate when the surfaces of the contacts are uneven.
- If the load is inductive, counter–electromotive voltage will be generated. The higher the voltage is, the higher the generated energy will be, which will increase the abrasion of the contacts and contact relocation phenomena. Be sure to use the Limit Switch within the rated conditions.
- If the load is a minute voltage or current load, use a dedicated Limit Switch for minute loads. The reliability of silver–plated contacts, which are used by standard Limit Switches, will be insufficient if the load is a minute voltage or current load.

Contact Protective Circuit

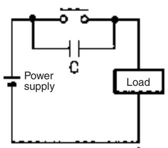
Apply a contact protective circuit to extend the contact life, prevent noise, and suppress the generation of carbide or nitric acid. Be sure to apply the contact protective circuit correctly, otherwise an adverse effect may occur.

The following provides typical examples of contact protective circuits. If the Limit Switch is used in an excessively humid location for switching a load that easily generates arcs, such as an inductive load, the arcs may generate NOx, which will change into HNO_3 if it reacts with moisture. Consequently, the internal metal parts may corrode and the the Limit Switch may fail. Be sure to select the ideal contact preventive circuit from the following.

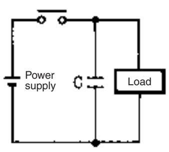
Typical Examples of Contact Protective Circuits

Circuit example		Applicable current		Feature	Element selection
		AC	DC		
CR circuit		*	Yes	*When AC is switched, the load impedance must be lower than the CR impedance.	C: 1 to 0.5 μF x switching current (A) R: 0.5 to 1 Ω x switching voltage (V) The values may change according to the characteristics of the load. The capacitor suppresses the spark discharge of current when the contacts are open. The resistor limits the inrush current when the contacts are closed again. Consider the roles of the capacitor and resistor and determine ideal capacitance and resistance values through testing. Use a capacitor that has a low dielectric strength. When AC is switched, make sure that the capacitor has no polarity.
		Yes	Yes	The operating time will be greater if the load is a relay or solenoid. Connecting the CR circuit in parallel to the load is effective when the power supply voltage is 24 or 48 V and in parallel to the contacts when the power supply voltage is 100 to 200 V.	
Diode method		No	Yes	Energy stored in the coil is changed into current by the diode connected in parallel to the load. Then the current flowing to the coil is consumed and Joule heat is generated by the resistance of the inductive load. The reset time delay with this method is longer than that in the CR method.	The diode must withstand a peak inverse voltage 10 times higher than the circuit voltage and a forward current as high or higher than the load current.
Diode and Zener diode method		No	Yes	This method will be effective if the reset time delay caused by the diode method is too long.	Use a Zener diode at a low Zener voltage.
Varistor method		Yes	Yes	This method makes use of constant–voltage characteristic of the varistor so that no high–voltage is imposed on the contacts. This method causes a reset time delay. Connecting a varistor in parallel to the load is effective when the supply voltage is 24 to 48 V and in parallel to the contacts when the supply voltage is 100 to 200 V.	——

Do not apply contact protective circuits as shown below.



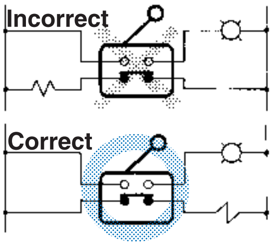
This circuit effectively suppresses arcs when the contacts are OFF. The capacitor will be changed, however, when the contacts are OFF. Consequently, when the contacts are ON again, short-circuited current from the capacitance may cause contact weld.



This circuit effectively suppresses arcs when the contacts are OFF. When the contacts are ON again, however, charge current will flow to the capacitor, which may result in contact weld.

Switching a DC inductive load is usually more difficult than switching a resistive load. By using an appropriate contact protective circuit, however, switching a DC inductive load will be as easy as switching a resistive load.

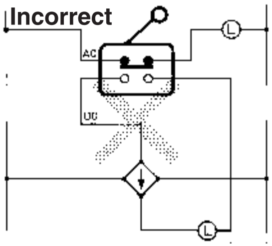
- Do not contact a single Limit Switch to two power supplies that are different in polarity or type.
  Power Connection Examples
  (Connection of Different Polarities)



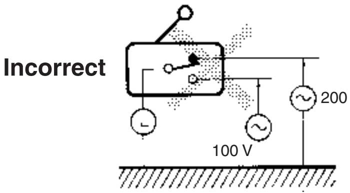
Incorrect Power Connection Example

(Connection of Different Power Supplies)

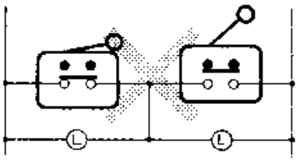
There is a risk of AC and DC mixing.



- Do not design a circuit where voltage is imposed between contacts, otherwise contact weld may result.



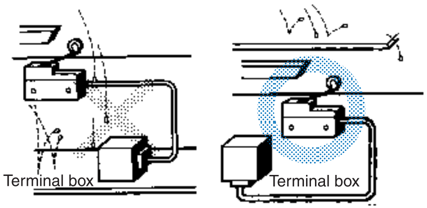
- Do not use a circuit that will short–circuit if an error occurs, otherwise the charged part may melt and break off.



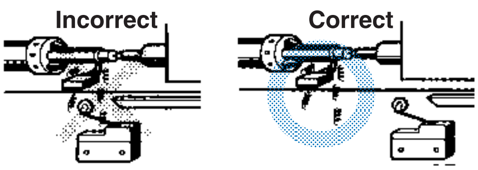
- Application of Limit Switch to a Low–voltage, Low–current Electronic Circuit.
  1. If bouncing or chattering of the contacts results and causes problems, take the following countermeasures.
     (a) Insert an integral circuit.
     (b) Suppress the generation of pulse from the contact bouncing or chattering of the contacts so that it is less than the noise margin of the load.
  3. Conventional silver–plated contacts are not suited to this application. Use gold–plated contacts, which are ideal for handling minute voltage or current loads.
  4. The contacts of the Limit Switch used for an emergency stop must be normally open.
- In order to protect the Limit Switch from damage due to circuit short–circuiting, be sure to connect a quick–response fuse with a breaking current 1.5 to 2 times larger than the rated current to the Limit Switch in parallel. Some models (e.g., the D4B–N and D4BS) specify the types of fuses. In that case, be sure to use the specified fuses.

Operating Environment

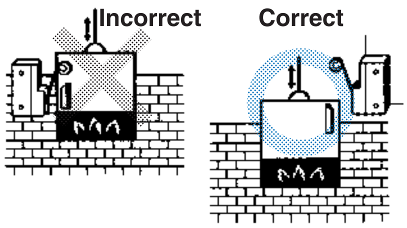
- If the Limit Switch used in locations with oil or water spray or excessive dust is not a water–resistive model or of sealed construction, be sure to protect the Limit Switch with a protective cover so that the Limit Switch will not be directly exposed to them.



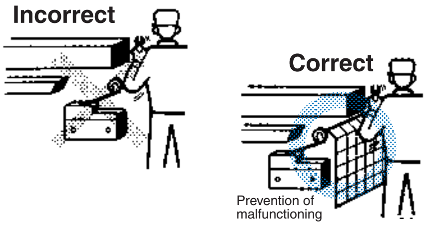
- The materials of Limit Switch may change in quality or deteriorate, if the Limit Switch is used outdoors or any other location where the Limit Switch is exposed to special machining oil. Consult your OMRON representative before selecting the model.
- Be sure to install the Limit Switch so that the Limit Switch is free from dust or metal powder. The actuator and the switch casing must be protected from the accumulation of dust or metal powder.



- Do not use the Limit Switch in locations where the Limit Switch is exposed to hot water at a temperature greater than 60° C or steam.
- Do not use the Limit Switch under temperatures or other environmental conditions not within the specified ranges. The rated permissible ambient temperature range varies with the model. Refer to the specifications in this catalog. If the Limit Switch is exposed to radical temperature changes, the thermal shock may deform the Limit Switch and the Limit Switch may malfunction.



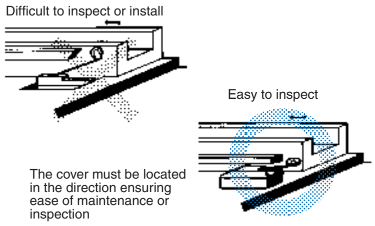
- Be sure to protect the Limit Switch with a cover if the Limit Switch is in a location where the Limit Switch may be actuated by mistake or where the Limit Switch is likely cause an accident.



- Make sure to install the Limit Switch in locations free of vibration, shock, or resonance. If vibration or shock is continuously imposed on the Limit Switch, contact failure, malfunction, or decrease in service life may be caused by abrasive powder generated from the internal parts. If excessive vibration or shock is imposed on the Limit Switch, the contacts may malfunction or become damaged.
- Do not use the Limit Switch with silver–plated contacts for long periods if the switching frequency of the Limit Switch is comparatively low or the load is minute. Otherwise, sulfuric film will be generated on the contacts and contact failures may result. Use the Limit Switch with gold–plated contacts or use a dedicated Limit Switch for minute loads instead.
- Do not use the Limit Switch in locations with corrosive gas, such as sulfuric gas (H_2S or SO_2), ammonium gas (NH_3), nitric gas (HNO_3), or chlorine gas (Cl_2), or high temperature and humidity. Otherwise, contact failure or corrosion damage may result.
- If the Limit Switch is used in locations with silicone gas, arc energy may create silicon dioxide (SiO2) on the contacts and a contact failure may result. If there is silicone oil, silicone sealant, or wire covered with silicone close to the Limit Switch, attach a contact protective circuit to suppress the arcing of the Limit Switch or eliminate the source of silicone gas generation.

Regular Inspection and Replacement

- If the Limit Switch is normally closed with low switching frequency (e.g., once or less than once a day), a reset failure may result due to the deterioration of the parts of the Limit Switch. Regularly inspect the Limit Switch and make sure that the Limit Switch is in good working order.
- In addition to the mechanical life or electrical life of the Limit Switch described previously, the life of the Limit Switch may decrease due to the deterioration of each part, especially rubber, resin, and metal. Regularly inspect the Limit Switch and replace any part that has deteriorated in order to prevent accidents from occurring.
- Be sure to mount the Limit Switch securely in a clean location to ensure ease of inspection and replacement. The Limit Switch with operation indicator is available, which is ideal if the location is dark or does not allow easy inspection or replacement.



Storage of Limit Switch

- When storing the Limit Switch, make sure that the location is free of corrosive gas, such as H_2S, SO_2, NH_3, HNO_3, or Cl_2, or dust and does not have a high temperature or humidity.
- Be sure to inspect the Limit Switch before use if it has been stored for three months or more.

Typical Problems, Probable Causes, and Remedies

<table>
<tr><th colspan="2">Problem</th><th>Probable Cause</th><th>Remedy</th></tr>
<tr><td rowspan="15">Mechanical failure</td><td rowspan="9">1. The actuator does not operate.
2. The actuator does not return to the free position (FP).
3. The actuator has been deformed.
4. The actuator is worn.
5. The actuator has been damaged.</td><td>The shape of the cam is incorrect.</td><td rowspan="4">• Change the design of the cam and smooth the contacting surface of the cam.
• Scrutinize the suitability of the actuator.
Make sure that the actuator does not bounce.</td></tr>
<tr><td>The contacting surface of the dog is rough.</td></tr>
<tr><td>The actuator in use is not suitable.</td></tr>
<tr><td>The operating direction of the actuator is not correct.</td></tr>
<tr><td>The operation speed is excessively high.</td><td>• Attach a decelerating device or change the mounting position of the Limit Switch.</td></tr>
<tr><td>Excessive stroke.</td><td>• Change the stroke.</td></tr>
<tr><td>The rubber or grease hardened due to low temperature.</td><td>• Use a cold–resistive switch.</td></tr>
<tr><td>The accumulation of sludge, dust, or cuttings.</td><td rowspan="2">• Use a drip–proof model or one with high degree of protection.
• Use a protection cover and change the solvent and materials.</td></tr>
<tr><td>Dissolution, expansion, or swelling damage to the rubber parts of the driving mechanism.</td></tr>
<tr><td rowspan="3">There is a large deviation in operating position (with malfunctioning involved).</td><td>Damage to and wear and tear of the internal movable spring.</td><td rowspan="3">• Regularly inspect the Limit Switch.
• Use a better quality switch.
• Tighten the mounting screws securely. Use a mounting board.</td></tr>
<tr><td>Wear and tear of the internal mechanism.</td></tr>
<tr><td>The loosening of the mounting screws.</td></tr>
<tr><td rowspan="3">The terminal part wobbles. (The mold part has been deformed.)</td><td>Overheating due to a long soldering time.</td><td rowspan="2">• Solder the Limit Switch quickly.
• Change the lead wire according to the carry current and ratings.</td></tr>
<tr><td>The Limit Switch has been connected to and pulled by thick lead wires with excessive force.</td></tr>
<tr><td>High temperature or thermal shock resulted.</td><td>• Use a temperature–resistive switch or change mounting positions.</td></tr>
</table>

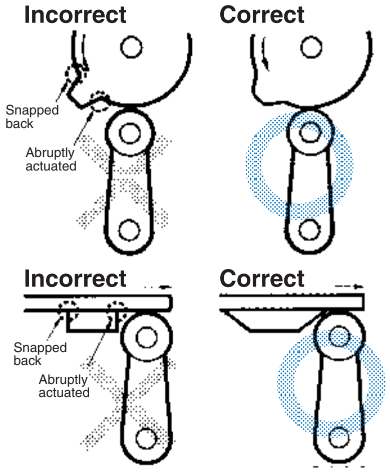
Problem		Probable Cause	Remedy
Failures related to chemical or physical characteristics	Contact chattering	Vibration or shock is beyond the rated value.	• Attach an anti–vibration mechanism. • Attach a rubber circuit to the solenoid. • Increase the operating speed (with an accelerating mechanism).
		Shock has been generated from a device other than the Limit Switch.	
		Too–slow operating speed.	
	Oil or water penetration	The sealing part has not been tightened sufficiently.	• Use a drip–proof or waterproof switch. • Use the correct connector and cable. (Use a sealed connector for sealed switches.) • Use a switch with terminals sealed with resin.
		The wrong connector has been selected and does not conform to the cable.	
		The wrong switch has been selected.	
		The terminal part is not molded.	
		The Limit Switch has been burnt or carbonated due to the penetration of dust or oil.	
	Deterioration of the rubber part	The expansion and dissolution of the rubber caused by solvent or lubricating oil.	• Use an oil–resistant rubber or Teflon bellows. • Use a weather–resistant rubber or protective cover. • Use a switch with a protective cover or a metal bellows.
		Cracks due to direct sunlight or ozone.	
		Damage to the rubber caused by scattered or heated cuttings.	
	Corrosion (cracks)	The oxidation of metal parts resulted due to corrosive solvent or lubricating oil.	• Use an anti–corrosive switch. • Change the lubricating oil. • Change mounting positions. • Use a crack–resistant material.
		The Limit Switch has been operated in a corrosive environment, near the sea, or on board a ship.	
		The electrical deterioration of metal parts of the Limit Switch resulted due to the ionization of cooling water or lubricating oil.	
		The cracking of alloyed copper due to rapid changes in temperature.	
Failures related to electric characteristics	No actuation or no current breakage caused by contact weld.	Inductive interference in the DC circuit.	• Add an erasing circuit.
		Carbon generated on the surface of the contacts due to switching operations.	• Use a switch with a special alloy contact or use a sealed switch.
		A short–circuit or contact weld due to the deformation and relocation of the contacts.	• Reduce the switching frequency or use a switch with a large switching capacity.
		Contact weld due to an incorrectly connected power source.	• Change the circuit design.
		Foreign materials or oil penetrated into the contact area.	• Use a protective box.

Outdoor Use

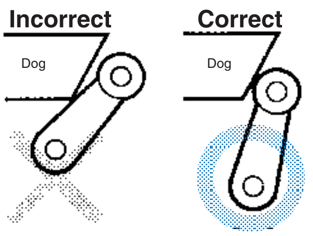
- When using the Limit Switch outdoors, make sure that the Limit Switch is a sealed model. The Limit Switch with IP67 sealing construction does not necessarily mean that the mechanical parts are also of IP67 construction.
- The rubber material exposed to ozone may deteriorate. Check that the rubber parts are environment–resistive, such as chloroprene, silicone, or fluorine rubber.
- If the Limit Switch is used in places with sludge or dust powder sprays, make sure that the mechanical parts are sealed with a rubber cap.
- Due to capillary attraction, rainwater may enter the Limit Switch through the lead wires or sheath. Be sure to cover the wire connections in a terminal box so that they are not directly exposed to rainwater.
- If the Limit Switch is used outdoors, the steel parts of the Limit Switch (such as the screws and plunger parts) may corrode. Consider the use of outdoor models or proximity sensors in such cases.
- The expression “Limit Switch is used outdoors” refers to an environment where the Limit Switch is exposed directly to rainwater or sunlight (e.g., multi–story parking lots) excluding locations with corrosive gas or salty breezes.
  The Limit Switch used outdoors may not release due to icing and may not satisfy standards for indoor use.

Operation

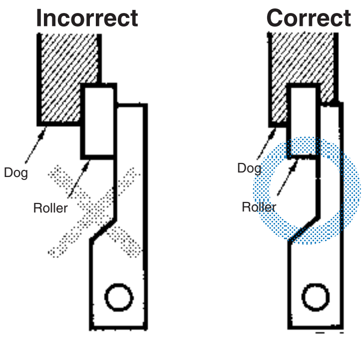
- Carefully determine the position and shape of the cam so that the actuator will not abruptly snap back, thus causing shock. In order to operate the Limit Switch at a comparatively high speed, use an object or cam that keeps the Limit Switch turned ON for a sufficient time so that the relay or valve will be sufficiently energized.
- The shape of the object or cam has a large influence on the life and operating accuracy of the Limit Switch. The cam must be smooth in shape.



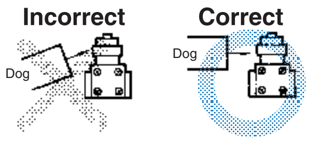
- Appropriate force must be imposed on the actuator by the cam or another object in both rotary operation and linear operation. If the object touches the lever as shown below, the operating position will not be stable.



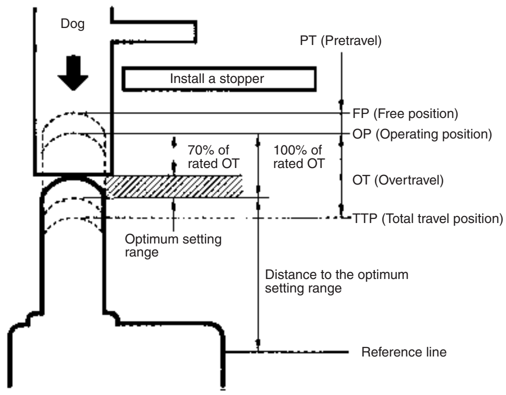
- Unbalanced force must not be imposed on the actuator. Otherwise, wear and tear on the actuator may result.



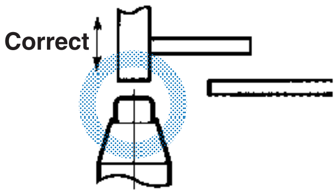
- In the case of a roller–type actuator, the object must touch the actuator at a right angle. Otherwise, the actuator or shaft may deform or break.



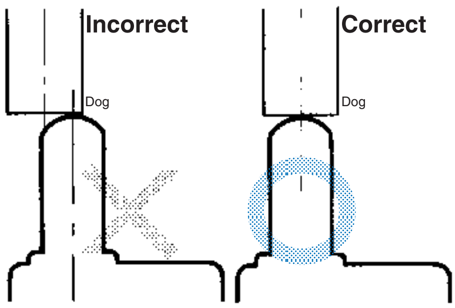
- Make sure that the actuator does not exceed the OT (overtravel) range, otherwise the Limit Switch may malfunction. When mounting the Limit Switch, be sure to adjust the Limit Switch carefully while considering the whole movement of the actuator.



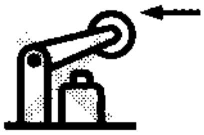
- The Limit Switch may soon malfunction if the OT is excessive. Therefore, adjustments and careful consideration of the position of the Limit Switch and the expected OT of the actuator are necessary when mounting the Limit Switch.



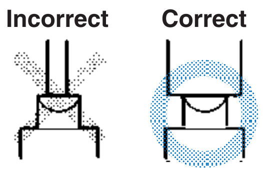
- When using a pin–plunger–type actuator, make sure that the stroke of the actuator and the movement of the object are located along a single straight line.



- Be sure to use the Limit Switch according to the characteristics of the actuator. If a roller arm lever actuator is used, do not attempt to actuate the Limit Switch in the direction shown below.



- Do not modify the actuator to change the OP.
- In the case of a long actuator of an adjustable roller lever type, the following countermeasures against lever shaking are recommended.
  1. Make the rear edge of the object smooth with an angle of 15° to 30° or make it in the shape of a quadratic curve.
  2. Design the circuit so that no error signal will be generated.
  3. Use or set a switch that is actuated in one direction only.
- In the case of a bevel plunger–type actuator, make sure that the width of the object is wider than that of the plunger.



Dog Design

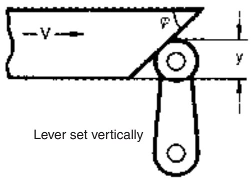
Operating Speed, Dog Angle, and Relationship with Actuator

Before designing a dog, carefully consider the operating speed and angle of the dog and their relationship with the shape of the actuator. The optimum operating speed of a standard dog at an angle of 30° to 45° is 0.5 m/s maximum.

Roller Lever Models

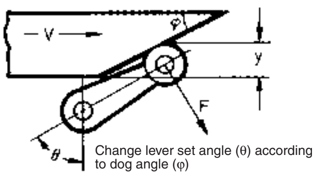
1.Non–overtravel Dog

Dog speed: 0.5 m/s max. (standard speed)



φ	$V_{max.}$ (m/s)	y
30°	0.4	0.8 (TT)
45°	0.25	80% of total travel
60°	0.1	
60° to 90°	0.05 (low speed)	

Dog speed: 0.5 m/s x V x 2 m/s

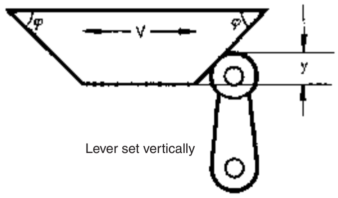


θ	φ	$V_{max.}$ (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

2.Overtravel Dog

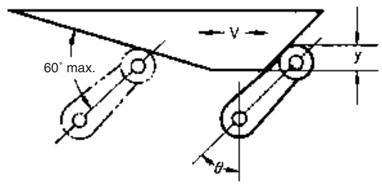
Dog speed: 0.5 m/s max.



φ	$V_{max.}$ (m/s)	y
30°	0.4	0.8 (TT)
45°	0.25	80% of total travel
60°	0.1	
60° to 90°	0.05 (low speed)	

Dog speed: 0.5 m/s min.

If the speed of the overtravel dog is comparatively high, make the rear edge of the object smooth at an angle of 15° to 30° or make it in the shape of a quadratic curve. Then lever shaking will be reduced.



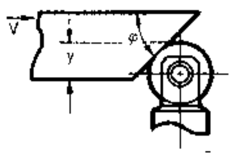
θ	φ	$V_{max.}$ (m/s)	y
45°	45°	0.5	0.5 to 0.8 (TT)
50°	40°	0.6	0.5 to 0.8 (TT)
60° to 55°	30° to 35°	1.3	0.5 to 0.7 (TT)
75° to 65°	15° to 25°	2	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 50% and 80% (or 50% and 70%).

Plunger Models

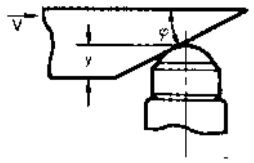
If the dog overrides the actuator, the front and rear of the dog may be the same in shape, provided that the dog is not designed to be separated from the actuator abruptly.

Roller Plunger



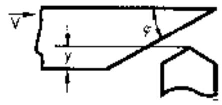
φ	$V_{max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Ball Plunger



φ	$V_{max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

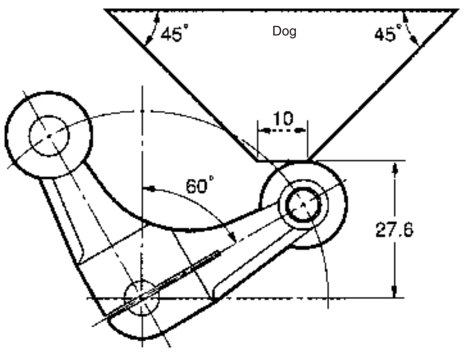
Bevel Plunger



φ	$V_{max.}$ (m/s)	y
30°	0.25	0.6 to 0.8 (TT)
20°	0.5	0.5 to 0.7 (TT)

Note: The above y values indicate the ratio ranges based on TT (total travel). Therefore, the optimum pressing distance of the dog is between 60% and 80% (or 50% and 70%).

Fork Lever Lock Models

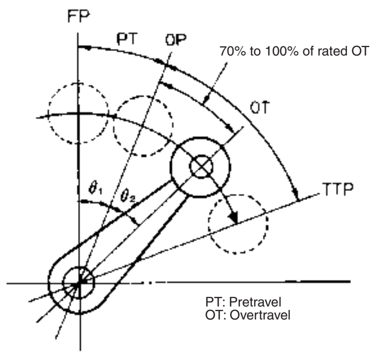


Note: Design the shape of the dog so that it does not come in contact with the other roller lever when the actuator is inverted.

Stroke Settings vs. Dog Movement Distance

- The following provides information on stroke settings based on the movement distance of the dog instead of the actuator angle.
  The following is the optimum stroke of the Limit Switch

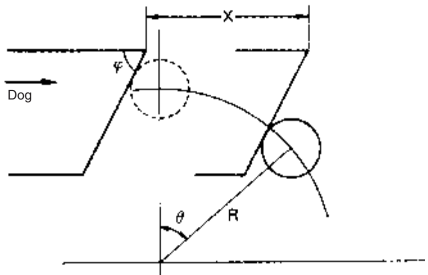
  Optimum stroke: PT + (Rated OT x 0.7 to 1.0)
  The angle converted from the above: $\theta_1 + \theta_2$



- The movement distance of the dog based on the optimum stroke is expressed by the following formula.

  Movement distance of dog

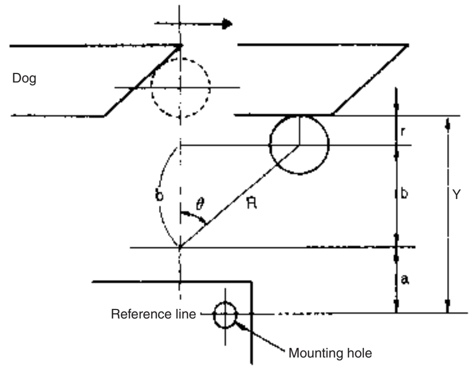
$$X = R\sin\theta + \frac{R(1-\cos\theta)}{\tan\varphi} \text{ (mm)}$$



φ: Dog angle
θ: Optimum stroke angle
R: Actuator length
X: Dog movement distance

- The distance between the reference line and the bottom of the dog based on the optimum stroke is expressed by the following formula.

$$Y = a + b + r \text{ (mm)}$$



a: Distance between reference line and actuator fulcrum
b: R cosθ
r: Roller radius
Y: Distance between reference line and bottom of dog

Dog Surface

- The surface of dog touching the actuator should be 6.3 S in quality and hardened at approximately H450V.
- For smooth operation of the actuator, apply molybdenum disulfide grease to the actuator and the dog touching the actuator. This is ideal for Limit Switches of drip–proof construction and Multiple Limit Switch models.

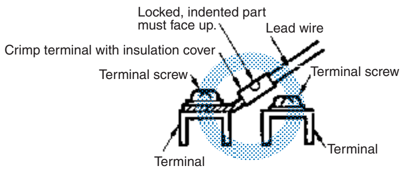
Maintenance and Repairs

- The user must not maintain or repair the system. Consult the manufacturer of the system for maintenance or repairs.

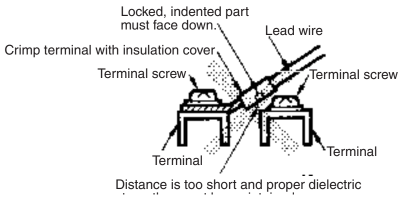
Others

- The Limit Switch has contacts that must be free of silicone gas, otherwise a contact failure may result. Therefore, do not apply cable covered with silicone, silicone sealant, or silicone grease to the Limit Switch.
- The sealing of the standard Limit Switch uses nitrile butadien rubber (NBR), which is highly oil resistive. The NBR exposed to different types of oil or chemical may, however, deteriorate, swell, or shrink. Contact your OMRON representative for details.
- OMRON shall not guarantee the performance and characteristics of any actuator, plunger, or lever modified by the user.
- When using the Limit Switch with a long lever or long rod lever, make sure that the lever is in the downward direction.
- In order to ensure high contact reliability, the correct Limit Switch must be selected according to the load. For details, refer to the precautions for minute load models in this catalog.
- The leads must be wired as shown below.

Correct Method



Wrong Method



SI Units

To conform to the international standards, this datasheet adopts the SI international system for units (SI: Systeme International d'Unites). Refer to the following tables to convert values indicated in conventional units.

SI Unit Conversion

(Shaded units are non–SI units.)

Acceleration	m/s^2	G
	1	$1.01972\ 10^{-1}$
	9.80665	1

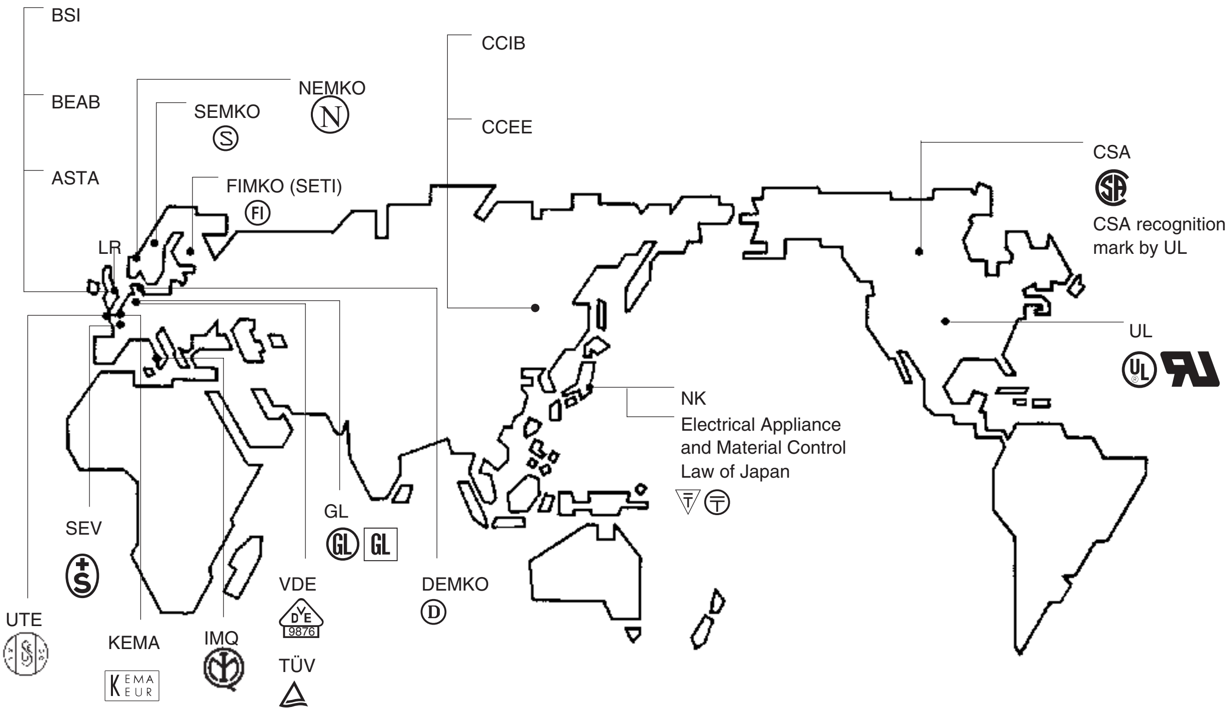
Force	N	kgf
	1	$1.01972\ 10^{-1}$
	9.80665	1

Torque	Nm	kgf•cm	kgf•m
	1	1.01972 10	$1.01972\ 10^{-1}$
	$9.80665\ 10^{2}$	1	$1\ 10^{-2}$
	9.80665	$1\ 10^{2}$	1

Pressure	Pa	kPa	kgf/cm^2	mmHg (Torr)	mmH_2O
	1	$1\ 10^{-3}$	$1.01972\ 10^{-5}$	$7.50062\ 10^{-3}$	$1.01972\ 10^{-1}$
	$1\ 10^{3}$	1	$1.01972\ 10^{-2}$	7.50062	$1.01972\ 10^{2}$
	$9.80665\ 10^{4}$	9.80665 10	1	$7.35559\ 10^{2}$	$1\ 10^{4}$
	$1.33322\ 10^{2}$	$1.33322\ 10^{-1}$	$1.35951\ 10^{-3}$	1	1.35951 10

Standards

National Standards



Note: For detailed information about applicable standards, refer to the relevant catalog.

International Standards

IEC (International Electrotechnical Commission)

The IEC is a standardization commission founded in 1908 to promote unification and coordination of international standards relating to electricity. It is headquartered in Geneva, Switzerland.

IEC standards are provided to accomplish the aim of the above. The IEC strongly recommends all the member nations of the IEC to establish domestic standards that conform with those of the IEC.

At present, there are 50 member nations in the IEC. Based on reports from member nations on the latest science technologies in those nations, IEC standards are issued as technological standards relating to electricity. Established international safety standards provided by various countries and accepted worldwide are based on IEC standards.

In order to simplify approval procedures for electrical devices and promote smooth international trade, there is an international scheme called CB Scheme (Certification Body Scheme), which is authorized by IEC standards. Based on the CB Scheme, safety tests on electrical devices are conducted and certificates are issued if the devices are proved to meet IEC standards. Products issued with such certificates are acceptable in 30 countries in the world.

North America

UL Standards (Underwriters Laboratories INC.)

A nonprofit organization established in 1894 by the American association of fire insurance companies.

Underwriters Laboratories (abbreviated to UL hereafter) conducts approval testing on all kinds of electrical products. In many U.S. cities and states, UL approval is legally required on all electrical items sold.

In order to obtain UL approval on an electrical product, all major internal components also require UL approval.

UL offers two classifications of approvals, the listing mark and the recognition mark.

A Listing Mark constitutes a entirely approval of a product. Products display the Listing Mark shown below.

Listing Mark

The Recognition Mark applies to the components used in a product, and therefore constitutes a more conditional approval of a product. Products display the Recognition Mark shown below.

Recognition Mark

The UL and CSA are unifying their standards with the adoption of a mutual approval system. Furthermore, they are adjusting their standards so that they will be in conformity with IEC standards.

Since October 1992, UL has been approved as a CO (council organization) and TO (test organization) by the SCC (Standard Council of Canada). This authorizes UL to conduct safety tests and certify products conforming to Canadian standards. The above marks are UL marks for products certifying that the products meet Canadian standards.

The designs of the listing marks and recognition marks have been revised as shown below. These marks have been effective since November 1998. The previous marks are valid until November 2007.

LISTING MARKS

	Marks for US	Marks for Canada	Marks for US and Canada
Previous mark			
New mark			

RECOGNITION MARKS

	Marks for US	Marks for Canada	Marks for US and Canada
Previous mark			
New mark			

CSA Standards (Canadian Standards Association)

This association descended from a nonprofit, non–government standardization organization established in 1919. In addition to industrial standardization, the association now carries out safety testing on electrical products.

CSA has closer ties to government agencies than UL, so that electrical products not approved by CSA cannot be sold in Canada. Non–approved goods being sold illegally may have to be withdrawn.

CSA approval is known as “certification,” and consequently, CSA–approved equipment is referred to as “certified equipment.” Products display the mark shown below. For a conditional certification, products display component acceptance mark.

The CSA is adjusting its standards so that they will be in conformity with UL and IEC standards.

Certification Mark

China

GB (Guojia Biaozhun) Chinese National Standards

The GB are established Chinese national standards based on IEC standards.

Products such as home electronics appliances (e.g., televisions, washing machines, and microwave ovens), for which GB standards are obligatory, must be approved by CCIB (China Commodity Inspection Bureau) and CCEE (China Commission for Conformity Certification of Electrical Equipment). The marks shown below are respective marks of recognition.

CCIB Mark CCEE Mark

Shipping Standards

LR (Lloyd’s Register of Shipping)

These are the standards of the Lloyd’s Register of Shipping, headquartered in London. All of the OMRON control components approved in LR are UMS ships, the unmanned engine-room ship classification in the Lloyd’s Register.

Unlike the safety standards such as UL, the devices are checked to ensure that they can function sufficiently under the environmental conditions when they are used in ships.

When a device is approved, Lloyd’s Register doesn’t apply the passing mark on the product, but includes it on the list of approved products that it publishes every year.

NK (Nippon Kaiji Kyokai)

Nippon Kaiji Kyokai (NK), which was established in 1899 under a different name for the purpose of ensuring the safety of vessels and the maintenance of maritime environmental conditions, has been using the present name since 1946.

Automation equipment and devices receive tests and inspections based on the provisions of the steel–ship regulations and can be formally approved if the tests are passed.

Testing at the production factory can be partially or entirely omitted when automation equipment and devices that have been formally approved are installed on ships.

As a general rule, manufacturers of approved products indicate that the products being shipped have been approved. (It is also acceptable to affix a label to products which require it.)

Japan

Electrical Appliance and Material Control Law of Japan

The EAMCL was substantially revised in July 1995 in conformity with IEC standards, such as IEC335. Consequently, the previously–used symbol for second–grade appliances was abolished while the symbol for first–grade appliances remained unchanged. Furthermore, the range of applicable products has been greatly revised.

	First–grade appliance	Second–grade appliance
Previous symbol	282 products	216 products
Present symbol	165 products	333 products (no markings)

Europe

EN (European Norm) Standards

As part of EC unification, 18 European countries are going to integrate their national safety standards into EN standards. When EN standards come into effect, they shall apply as the unified standards in Europe in place of the current safety standards.

EN standards related to electricity are based on IEC standards and include requirements relating to countermeasures against electric shocks. EN codes consist of the prefix "EN" followed by five figures beginning with the figure 6 (e.g., EN60204).

Industrial products exported to Europe must satisfy IEC standards if the products do not fall under EN standards.

Industrial products exported to European countries from Japan or North America or traded between European countries must satisfy EN standards. Furthermore, 12 types of industrial products, such as machines, low–voltage devices, and EMC equipment, must bear CE markings. CE markings on a product indicate that the product meets safety standards specified by all related EC directives. For example, an industrial machine must satisfy the EC Machinery Directive, Low–voltage Directive (LVD), and EMC requirements.

CE Marking

The following marks of recognition are used in European countries in accordance with EN standards.

VDE (Verband Deutscher Elektrotechniker e.V.) in Germany (applicable to electrical appliances only)		TÜV (applicable to electrical appliances, machines and automobiles	
VDE Mark	Monitoring Mark	TÜV Rheinland	TÜV Product Service
DEMKO (Danmarks Elektriske Materielkontrol)		KEMA (Keuring van Electrotechnische Materialen Nederland B.V.)	
NEMKO (Norges Elektriske Materiellkontroll)		UTE (Union Technique De Electricite)	
FIMKO (Finlands Material Kontroll)		IMQ (Instituto Italiano del Marchio di Qualita)	
BSI (British Standards Institution) Britain (applicable to industrial products)		SEMKO (Svenska Elektriska Materielkontroll Anstalten)	
BEAB (British Electrotechnical Approval Board) Britain (applicable to home electronics products)		SEV (Schweizer Elektrotechnischer Verein)	
ASTA (ASTA Certification Services) Britain (applicable to general products)			

List of Approved Models

UL Standards

Safety Switches

Model	Rating	Standard No.	File No.
D4N	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)	UL508	E76675
D4F	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A)		
D4B–N	A600 (Carry current: 10 A)		
D4BS	A600 (Carry current: 10 A)		
D4BL	A300 (Carry current: 10 A)		
D4N–R	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)		
D4NS	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)		
D4NL	A300 (Carry current: 10 A)		
D4GL	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A)		
D4NH	A300 (Carry current: 10 A) Q300 (Carry current: 2.5 A)		
D4GS–N	C300 (Carry current: 2.5 A), Q300 (Carry current: 2.5 A)		

Note: 1. Approval on some models may have been given on representative models. For further information on standard approvals, contact your OMRON sales representative.
2. The standard number shown above is the number the applicable standard and the file number is the approval report number.

Pushbutton Switches

Model	Rating	Standard No.
A165E	5 A, 125 VAC 3 A, 250 VAC 3 A, 30 VDC	UL508
A165E□03U	1 A, 125 VAC 0.5 A, 250 VAC 1 A, 30 VDC	UL508
A22E	6 A, 250 VAC 10 A, 105 VAC	UL508

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9S-2001 G9S-2002	DPST-NO	24 VDC	5 A, 240 VAC (Resistive)	E95399
G9S-301	3PST-NO/ SPST-NC	24 VDC, 24, 100, 120, 240 VAC		
G9S-501	5PST-NO/ SPST-NC			
G9S-321-T□ (see note 1)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-301	3PST-NO/ SPST-NC	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	E41515
G9SA-501	5PST-NO/ SPST-NC			
G9SA-321-T□ (see note 2)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-TH301	3PST-NO/ SPST-NC			
G9SA-EX301				
G9SA-EX031-T□ (see note 2)	3PST-NO+ SPST-NC (OFF-delay)			
G9SX-EX□	4PST-NO	24 VDC	3 A, 250 VAC (Resistive)	see datasheet

Model	Number of poles	Operating coil	Contact rating	File No.
G9SB-200□-□	DPST-NO	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	E76675
G9SB-301□-□	3PST-NO/ SPST-NC			
G9SB-3010		24 VDC		
CQM1-SF200	DPST-NO	24 VDC	5 A, 250 VAC (Resistive)	
CS1W-SF200				

Note: 1. T□: T01, T015, T03, T04, T05, T06, T10, T30
2. T□: T075, T15, T30

Safety Relays

Model	Number of poles	Operating coil	Contact rating	File No.
G7S–4A2B	4PST–NO/ DPST–NC	24 VDC	6 A per pole, 20 A total, 277 VAC (Resistive)	E41515
G7S–3A3B	3PST–NO/ 3PST–NC			
G7SA–3A1B	3PST–NO/ SPST–NC		6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	
G7SA–2A2B	DPST–NO/ DPST–NC			
G7SA–5A1B	5PST–NO SPST–NC			
G7SA–4A2B	4PST–NO DPST–NC			
G7SA–3A3B	3PST–NO/ 3PST–NC			

Safety Area Sensors (Listing Certified)

Model	File No,	Ratings/remarks
F3SN-A F3SH-A	E199694	Input: 24 VDC Output: PNP open collector, 300 mA (24 VDC) Type 4 ESPE/AOPD
F3S-B	E199694	Input: 24 VDC Output: PNP open collector or NPN open collector, 200 mA (24 VDC) Type 2 ESPE/AOPD
F3SS	NRTL certification by CSA	---
F3SL	E199694	Type 4 ESPE/AOPD

CSA Standards

Safety Switches

Model	Rating	Standard No.	File No.
D4BS	A600 (Carry current: 10 A)	CSA C22.2 No. 14	LR45746
D4DS	A600 (Carry current: 10 A)		
D4BL	A300 (Carry current: 10 A)		
D4DL	A300 (Carry current: 10 A)		
D4DH	A600 (Carry current: 10 A)		

Note: 1. Approval on some models may have been given on representative models. For further information on standard approvals, contact your OMRON sales representative.
2. The standard number shown above is the number the applicable standard and the file number is the approval report number.

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9S-2001 G9S-2002	DPST-NO	24 VDC	5 A, 240 VAC (Resistive)	LR35535
G9S-301	3PST-NO/ SPST-NC	24 VDC, 24, 100, 120, 240 VAC		
G9S-501	5PST-NO/ SPST-NC			
G9S-321-T□ (see note 1)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-301	3PST-NO/ SPST-NC	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	
G9SA-501	5PST-NO/ SPST-NC			
G9SA-321-T□ (see note 2)	3PST-NO/ SPST-NC+ DPST-NO (OFF-delay)			
G9SA-TH301	3PST-NO/ SPST-NC			
G9SA-EX301				
G9SA-EX031-T□ (see note 2)	3PST-NO+ SPST-NC (OFF-delay)			
G9SB-200□-□	DPST-NO	24 VDC, 24 VAC	5 A, 250 VAC (Resistive)	203880 (LR35535)
G9SB-301□-□	3PST-NO/ SPST-NC			
G9SB-3010		24 VDC		
CQM1-SF200	DPST-NO	24 VDC	5 A, 250 VAC (Resistive)	
CS1W-SF200				
G9SX-EX□	4PST-NO	24 VDC	3 A, 250 VAC (Resistive)	see datasheet

Note: 1. T□: T01, T015, T03, T04, T05, T06, T10, T30
2. T□: T075, T15, T30
3. Approval of G9SA models with AC power supplies is pending (as of June 2001).

Safety Area Sensors

Model	File No,	Ratings/remarks
F3SN-A F3SH-A	(cUL listing based on Canadian safety standards) Refer to UL standards.	Input: 24 VDC Output: PNP open collector, 300 mA (24 VDC) Type 4 ESPE/AOPD
F3S-B	(cUL listing based on Canadian safety standards) Refer to UL standards.	Input: 24 VDC Output: PNP open collector or NPN open collector, 200 mA (24 VDC) Type 2 ESPE/AOPD
F3SS	LR90200 (CSA C22.2 No. 205)	---
F3SL	(cUL listing based on Canadian safety standards) Refer to UL standards.	Type 4 ESPE/AOPD

Safety Relays

Model	Number of poles	Operating coil	Contact rating	File No.
G7SA-3A1B	3PST-NO/ SPST-NC	24 VDC	6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	LR35535 (CSA C22.2 N0. 14)
G7SA-2A2B	DPST-NO/ DPST-NC			
G7SA-5A1B	5PST-NO SPST-NC			
G7SA-4A2B	4PST-NO DPST-NC			
G7SA-3A3B	3PST-NO/ 3PST-NC			
G7S-4A2B	4PST-NO/ DPST-NC	24 VDC	6 A per pole, 20 A total, 277 VAC (Resistive)	
G7S-3A3B	3PST-NO/ 3PST-NC			
G7SA-4A2B-E	4PST-NO DPST-NC	24 VDC	NO contact: 10 A per pole, 20 A total, 277 VAC (Resistive) NC contact: 6 A per pole, 20 A total, 277 VAC (Resistive)	
G7SA-3A3B-E	3PST-NO/ 3PST-NC			

Safety Limit Switches

Model	Rating	Standard No.	File No.
D4B-N	A600 (Carry current: 10 A)	CSA C22.2 No. 14	LR45746

VDE Standards

Safety Relays

Model	Number of poles	Operating coil	Contact rating	Approval No.
G7S–4A2B	4PST–NO/ DPST–NC	24 VDC	6 A 240 VDC (Resistive)	No. 6611 (IEC255) (VDE0435) (EN50205)
G7S–3A3B	3PST–NO/ 3PST–NC			
G7SA–3A1B	3PST–NO/ SPST–NC		6 A, 250 VAC (Resistive) 6 A, 30 VDC (Resistive)	No. 125547 (EN61810–1) (EN50205) (EN60255–23)
G7SA–2A2B	DPST–NO/ DPST–NC			
G7SA–5A1B	5PST–NO/ SPST–NC			
G7SA–4A2B	4PST–NO/ DPST–NC			
G7SA–3A3B	3PST–NO/ 3PST–NC			

Note: Applicable standard numbers are given in parentheses.

TÜV Standards

Limit Switches

Model	Rating	Standard No.	Approval No.
D4N–R	AC–15 3 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1 EN81, EN115 pending	B031139656061
D4BS	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 IEC947–5–1	R9351022
D4N	AC–15 3 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1	B031139656061
D4F	AC–15 0.75 A 240 V 50/60 Hz	EN60947–5–1 GS–ET–15	B0203 39656029
D4B–N	AC–15 2 A 400 V 50/60 Hz	EN60947–5–1 IEC947–5–1	Slow–action: R9151643 Snap–action: J9851083
D4NH	AC–15 3 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1	B031139656061
D4NS	AC–15 3 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1	B030639656052
D4GL	AC–15 0.75 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1 GS–ET–19	B0207 39656039
D4NL	AC–15 3 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1 GS–ET–19	B0207 39656040
D4BL	AC–15 3 A 250 V 50/60 Hz (LED type: AC–15 6 A 115 V 50/ 60 Hz	EN60947–5–1 IEC947–5–1 GS–ET–19	R9451050
D4GS–N	AC–15 0.75 A 240 V 50/60 Hz DC–13 0.27 A 250 V	EN60947–5–1	J2051125

BIA Standards

Limit Switches

Model	Models rated	Standard No.	Approval No.
D4B–N	Positive opening models approved except adjustable levers, coils, springs, and plastic rods	GS–ET–15, EN60947–5–1	9202158 and 9309655
D4BS	All D4BS models	GS–ET–15, EN60947–5–1	9303323
D4BL	All D4BL models	GS–ET–19, EN60947–5–1	Mechanical: 9402293 Solenoid: 1998, 20462–01

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9S–2001 G9S–2002	DPST–NO	24 VDC	5 A, 240 VAC (Resistive)	R974021 (EN60204–1) (EN954–1)
G9S–301	3PST–NO/ SPST–NC	24 VDC, 24, 100, 120, 240 VAC		
G9S–501	5PST–NO/ SPST–NC			
G9S–321–T□ (see note)	3PST–NO/ SPST–NC+DPST–NO (OFF–delay)			

Note: T□: T01, T015, T03, T04, T05, T06, T10, T30

SUVA Standards

Limit Switches

Model	Models rated	Approved No.
D4B–N	Positive opening models approved except adjustable levers, coils, springs, and plastic rods	E6188.d and E6189.d
D4BS	All D4BS models	E6187.d
D4BL	All D4BL models	E6186/1.d

BG Standards

Safety Relay Units

Model	Number of poles	Operating coil	Contact rating	File No.
G9SA–301	3PST–NO/ SPST–NC	24 VDC, 24 VAC	5A, 250 VAC (Resistive)	000115
G9SA–501	5PST–NO/ SPST–NC			000135
G9SA–321–T☐ (see note 1)	3PST–NO/ SPST–NC+ DPST–NO (OFF–delay)			000137
G9SA–TH301	3PST–NO/ SPST–NC			
G9SA–EX301	3PST–NO/ SPST–NC			000135
G9SA–EX031–T☐ (see note 1)	SPST–NC+ 3PST–NO (OFF–delay)			000137

Note: 1. T☐: T075, T15, T30

List of Models Conforming to EN/IEC Standards

Safety Door Switches

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
D4BS	YES	up to 4	EN60947-5-1 IEC60947-5-1	---	TÜV, Rheinland	R9351022	Not applicable			
D4BL						R9451050				
D4GS-N						J2051125				
D4N			EN60947-5-1		TÜV, Product Service	B0311396560 61				
D4N-B										
D4NH										
D4NS						B0306396505 2				
D4GL						B0207396560 39				
D4NL						B0207396560 40				

Safety Sensor

Model	CE marking	Safety category	Machinery Directive			Basic requirements of EMC Directive		
			Applicable directive	Approving agency	File No.	Applicable directive	Approving agency	File No.
F3SN-A F3SH-A	YES (EMC Directive)	4	EN61496-1 ESPE Type 4 IEC61496-1 ESPE Type 4 IEC61496-2 AOPD Type 4	DEMKO	Certificate No. 129794-01	89/336/EEC	DEMKO	Certificate No. 129794-02
F3S-B		2	EN61496-1 ESPE Type 2 IEC61496-1 ESPE Type 2 IEC61496-2 AOPD Type 2	TÜV Hannover/Sachsen Anhalt			TÜV Nord	Certificate 08/205/B1-PM28890
F3SS		4	IEC61496-1 ESPE Type 4 IEC61496-2	TÜV Rheinland	BB9911039	IEC61496-1 compatibility according to TÜV Rheinland. Declaration of conformity to EMC Directive based on certification. Declaration of conformity certificate numbers: MSCS 128A (F3SS) MSCS 129A (F3SL)		
F3SL					BB9910071			
E3FS		2	98/37/EC EN61469-1 prEN91496-2 type2	TÜV Product Service	Z20108426690 01	89/336/EEC	TÜV Product Service	
F3SP-U1P F3SP-U3P F3SP-U5P			98/37/EC IEC61496-1		Z10030718453 015			
F3SP-U2P F3SP-U4P		4	98/37/EC IEC61496-1					
F3SP-P1P			98/37/EC IEC61496-1 IEC61496-2					

Safety Relay Unit

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
G9SA	YES	4 (see note 1)	EN60204-1 EN954-1	---	BG	(see note 4)	EN55011	EN50082-2	TÜV, Product Service	E8 00 04 39656 001
G9S		4 (see note 2)			BIA	R974021				(see note 5)
G9SA (24 VAC/ VDC)		4 (see note 1)			BG	(see note 6)		EN61000-6-2		E8 02 03 39656 035
G9SA (100 to 240 VAC)									TÜV, Rheinland	Report No. 02062204 002 Registration No. AE2051327 02

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
G9SB-200□-□ G9SB-301□-□	YES	4	EN60204-1 EN954-1	---	TÜV, Rheinland	968/EZ 120.00/01	EN55011	EN61000-6-2	TÜV, Rheinland	Report No. 02160619 002 Registration No. AV2-50003726
G9SB-3010		3 (see note 3)								
CQM1-SF200		4				968/EZ 110.00/00				Report No. P2062560E 01 Registration No. AE2051219 01
CS1W-SF200										Report No. P2062873E 01 Registration No. AE2051220 01
G9SX						see datasheet	EN61000-6	EN61000-6-2		see datasheet J150-E2-Cat04-01

Note: 1. OFF-delay contact of G9SA-321/EX031 falls in Category 3.
2. OFF-delay output of G9S-321 and G9S-2001 falls in Category 3.
3. G9SB-3010 falls in Category 3 with double breaking.
4. G9SA-301: 00115, 501/EX301: 00135, 321/EX031: 00137, TH301: 01013
5. G9S-301/501/321: E8 97 05 22868 026; G9S-2001/2002: E8 98 03 32014 005
6. G9SA-301: 00115, 501/EX301: 00135, 321/EX031: 00137, TH301: 01013 (24 VAC/VDC)
G9SA-301: 02067, 501: 02063, 321: 02065, TH301: 01013 (100 to 240 VAC)

Safety Relays

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
G7SA	Not applicable	For Systems up to cat. 4	EN61810-1	EN50205	VDE	No. 125547	Not applicable			
G7S			IEC60255 (VDE0435)	prEN50205		No. 6611				

Safety Limit Switches

Model		CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
				Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
D4B-□N	Snap-action	YES	4	EN60947-5-1 IEC60947-5-1	---	TÜV, Rheinland	J9851083	Not applicable			
D4D-□N	Snap-action				EN81 (Elevators) EN115 (Escalators, conveyors)		JJ9950233				
D4B-□N	Slow-action						R9151643				
D4N-□R						TÜV, Product Service	Pending				
D4F							B02033965 6029				

Emergency Stop Switches

Model	CE marking	Safety category	Basic requirements of Machinery Directive/Low–voltage Directive				Basic requirements of EMC Directive			
			Applicable standard No.	Application standard No.	Approving agency	File No./ Applicable period	EMI standard No.	EMS standard No.	Approving agency	File No./ Applicable period
A165E Series (separate construction)	YES	4	EN60947-5-1	---	TÜV, Product Service	B021039656 044	Not applicable			
A22E Series						B021039656 043				
A165E-□-03U (one-body construction)						B021039656 045				

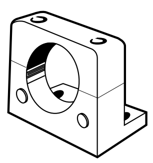
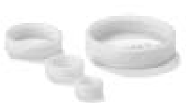
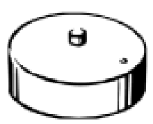
Accessories

Accessories

Accessories for photoelectric, inductive and capacitive sensors

For cylindrical shapes

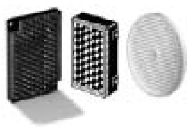
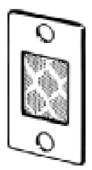
Mounting accessories, covers and slits

Shape	Product group	Type	Housing material	Features	Order reference	Applicable sensors
	Mounting brackets	general purpose - screw fix	plastic	- cost efficient mounting bracket - for M8, M12, M18, M30 - surface mounting	Y92E-B	- E3F2 - E2A - E2F
				for dia 34 mm	Y92E-A34	E2K-C
		quick access - snap fix		- snap fix for quick sensor access - for M8, M12, M18, M30 - surface mounting	Y92E-BC	- E3F2 (metal housing) - E2A (metal housing)
		quick access - clamp fix	stainless steel	- clamp fix for quick sensor access with exact repositioning - for M8, M12, M18, M30 - through mounting	Y92E-G	
	Protective covers	general purpose sensor head protection	polyarylate	- for M8, M12, M18, M30 - for shielded and unshielded	Y92E-E	- E2A (- E2F)
		sputter protection for sensor head	silicone rubber	- increased protection in weld fields - for M12, M18, M30 - for shielded	Y92E□-2	
		general purpose lens protection	metal rim with glas cover		E39-F31	E3F2

Shape	Product group	Type	Housing material	Features	Order reference	Applicable sensors
	Slits	slit cover	polyarylate	- slit cover for precision detection and positioning with through beam photo sensors - for M18	Y92E-ES18	E3F2-10

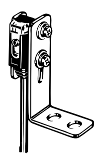
Accessories for photoelectric sensors

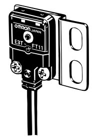
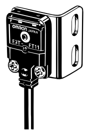
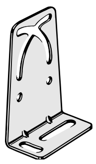
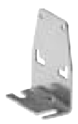
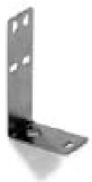
For all shapes

Shape	Type	Housing material			Order reference	Applicable Sensors
	General purpose reflectors	- ABS - acrylic surface	- square or round shapes - plate or tape reflectors - direct reflective or polarizing - direct mount or bracket mount	- size from 23 x 14 mm up to 100 x 100 mm - IP67	E39-R	- retroreflective photo electric sensors - non polarizing - retroreflective photo electric sensors - polarizing (MSR)
	Harsh environment reflectors	- mounting plate stainless steel - reflector acrylic	- direct mount or bracket mount	- size 14 x 13 x 1 mm - IP67	E39-R37	- E3F2-R☐-S - E3S-CR
	Non-fogging reflector	- ABS - acrylic surface	- anti-fogging coating	- size 40 x 60 x 7.5 mm - IP67	E39-R1K	
	Adjustment aid for sensivity adjuster	Polycarbonate			E39-G2	- photo electric sensors with adjustable potentiometers

For square shapes

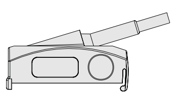
Mounting and protection

Shape	Type	Housing material	Features	Mounting type	Order reference	Applicable Sensors
	General purpose mounting	Stainless steel (SUS 304)	inclination angle adjustment	side wall mounting	E39-L43	E3Z
				back wall mounting	E39-L44	
			horizontal and inclination angle adjustment	surface mounting	E39-L104	
				back wall mounting	E39-L117	E3T-S
				surface mounting	E39-L116	

Shape	Type	Housing material	Features	Mounting type	Order reference	Applicable Sensors
	General purpose mounting	Stainless steel (SUS 304)		side wall mounting	E39-L120	E3T-F
				back wall mounting	E39-L119	
			horizontal angle adjustment		E39-L132	E3G-R
			inclination angle adjustment	side and back wall mounting	E39-L131	
				surface mounting	- E39-L139 - E39-L140	E3G-L
				surface and back wall mounting (depending on sensor model)	- E39-L87 - E39-L102 - E39-L103	E3S-C
	Side protection			protective side wall mounting	E39-L118	E3T-S

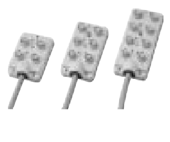
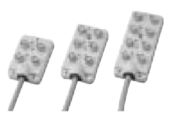
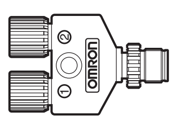
Shape	Type	Housing material	Features	Mounting type	Order reference	Applicable Sensors
	Full protection	Stainlless steel (SUS 304)	inclination angle adjustment	protective side wall mounting	E39-L142	E3Z (pre-wired types)
			horizontal angle adjustment	protective surface mounting	E39-L144	
					E39-L98	- E3Z - E3S-C (horizontal)
					E39-L97	E3S-C (vertical)
	Telescope mounting		- 360° horizontal rotation - max telescope length	side and back wall mounting	- E39-L150 - E39-L151	- E3Z - E39-R3
			3D rotation around x, y, and z-axis	side wall, back wall and surface mounting	E39-L93	
			Extension pipe with XY joint	pipe mounting	E39-L93XY	E39-L93
			Reflector adapter for E39-L93	telescope mount-ing	E39-L96	- E39-R1 - E39-R1S

Slit, filters and other accessories

Shape	Type	Features	Mounting type	Order reference	Applicable Sensors
	Precision detection slit cover	- slit width from dia 0.5 mm for min object size detection of dia 0.2 mm	snap on	E39-S65	E3Z-T
				- E39-S63 - E39-S64	E3T-□T
				E39-S61	E3S-CT
	Mutual interference prevention	polarizing filter for close mounting of multiple sensors		E39-E11	E3Z-T□A
	Adjustment aid	adjustment aid for sensitivity adjustment		E39-E10	E3T-ST1
	Laser aid	beam adjustment aid with laser pointer	snap on	E3NT-AP1	E3NT
	IR data interface	- IR data interface for PC programming - via RS232 or USB		E3NT-AL232	

Cable connectors and wiring accessories

Shape	Product group	Type	Housing material	Features	Key specifications	Order reference	Applicable Sensors
	Cable connectors	General purpose M12 connector	- PVC cable - brass nut	available resistance levels: - standard cable - vibration proof robotic cable - fire retardant cable - screw nut	- 3 A rated current - AC or DC - 4 or 5 pin - IP67	XS2	- sensors with built in M12 4-pin connector (-M1) - sensors with M12 4-pin cable end connector (-M1J) - E3NT (5-pin cable connector)
			- PVC cable - ZnAl Cu, optionally V2A or V4A nut	- silicone-free - screw nut - optional LED (screw nut models)	- 4 A rated current - AC or DC - 4 or 5 pin - IP67, IP68, IP69k	Y92E-M12	- sensors with built in M12 4-pin connector (-M1) - sensors with M12 4-pin cable end connector (-M1J) - E3NT (4-pin and 5-pin cable connector)
		Special environment M12 connector		- halogene-free - silicone-free - oil resistant - screw nut			
		Small size M8 4-pin connector	- PVC cable - brass nut	- screw nuts or snap-in - reduced outer diameter for space saving - standard or vibration proof cable	- 1 A rated current - 125 V DC - 4 pin - IP67	XS3	- sensors with built in M8 4-pin connector (-M3) - sensors with M8 4-pin cable end connector (-M3J)
		General purpose M8 connector	- PVC or PVC/PUR cable - brass nuts	- screw nuts or snap-in - optional LED (screw nut angled models)	- 4 A rated current - 60 V DC - 3 to 4 pin - IP67, IP68	Y92E-M08	- 4-pin or 3-pin connector (-M3 or -M5) - sensors with M8 4-pin or 3-pin cable end connector (-M3J or -M5J)

Shape	Product group	Type	Housing material	Features	Key specifications	Order reference	Applicable Sensors
	Extended wiring accessories	M12 I/O connector terminal boxes	- PBT case - brass connectors	- flat size - for M12 connectors - 4, 6 or 8 contacts per box	- 4 A / port - 10 or 30 V DC - 4 or 5-pin - IP67	XW3B	for all sensors connected via M12 4-pin connections & cables
		Waterproof cover for M12 I/O connector	brass	water proof cover for IP67 rating of X3WB		XS2Z-12	
		M8 I/O connector terminal boxes	- PA 6 case - brass connectors	- cable and connector box connection - for M8 connectors - 4, 6, 8, 10 or 12 contacts per box	- 2 A / port - 10 to 30 V DC - 3 or 4-pin - IP67	934 47	for all sensors connected via M12 3-pin or 4-pin connections & cables
		M12 T-joind and Y-joint plugs	- PVC cable - brass nut	- daisy chain model for 'AND' configurations (T-joint) - direct wiring models for 'OR' configurations (Y-joint) - bifurcate models for signal splitting - aggregate models for reduced wiring	- 3 A rated current - DC - 4-pin - IP67	XS2R	- sensors with built-in M12 4-pin connector (-M1) - sensors with M12 4-pin cable end connector (-M1J)
		M8 Y-joint plugs	- PBT case - brass connectors	- direct wiring models for 'OR' configurations - aggregate models for reduced wiring	- 1 A rated current - 125 V DC - 4-pin - IP67	XS3R	- sensors with built in M8 4-pin connector (-M3) - sensors with M8 4-pin cable end connector

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

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