Overview

1-1 FQ-series Vision Sensors

FQ-series Vision Sensors are real-color Sensors with integrated processing. They can be used in operation without other devices. A Touch Finder or special computer setup software can be used to set up and monitor the Sensors.
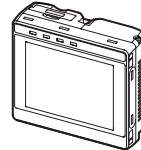
Setup, Image Confirmation, and Logging Tools

Touch Finder

FQ Vision Sensor

Used to check images and set the inspection parameters. It can also be used to save measurement results and check status during operation.

PC Tool

Includes the camera, lighting, measurement processor, and I/O functions.
After the Sensor has been set up, it can be operated alone to perform inspections without the Touch Finder or PC Tool.
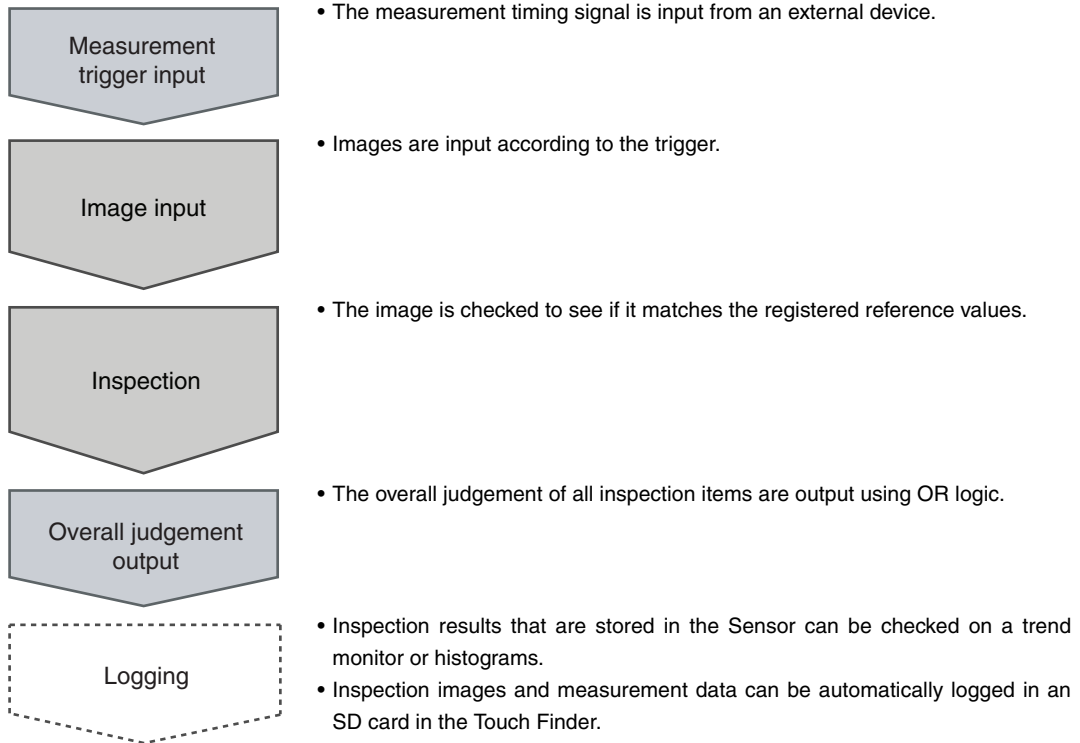
The same functions as those that are provided by the Touch Finder can be performed from a computer. The PC Tool is available free of charge to customers who register as members.

FQ-series Vision Sensors are available in standard models or in single-function models for easier application. The main differences are given in the following table.

Model	Standard models	Single-function models
Model number	FQ-S2□□□□□	FQ-S1□□□□□
Number of simultaneous inspections	32	1
Number of registered scenes	32	8
Position compensation	Supported	Not supported

1-2 Measurement Processing

This section describes the basic flow of Sensor measurement processing.

Measurement trigger input	• The measurement timing signal is input from an external device.
Image input	• Images are input according to the trigger.
Inspection	• The image is checked to see if it matches the registered reference values.
Overall judgement output	• The overall judgement of all inspection items are output using OR logic.
Logging	• Inspection results that are stored in the Sensor can be checked on a trend monitor or histograms. • Inspection images and measurement data can be automatically logged in an SD card in the Touch Finder.

1-3 Startup Display and Display Elements

Startup Display

1 **The Sensor is automatically detected by the Touch Finder or PC Tool when power supply to the Sensor and Touch Finder (or the computer running the PC Tool) is turned ON.**
The Auto Connect Display will appear if the Sensor cannot be detected. Check that cables are connected correctly to the Sensor and Touch Finder, and then press [Auto Connect].
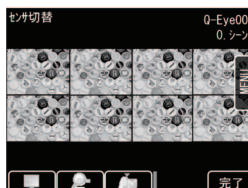

Note

If the Sensor is still not detected after pressing [Auto Connect], refer to the following information.

NTLPxREFERENCE P.000

---

2 **When the Sensor is detected, the following display will appear.**

• The Setup Mode will appear if a Sensor that has not been set up is connected.

• The Run Mode will appear if a Sensor that has been set up is connected.

• If multiple Sensors are connected, the images of the Sensors that are automatically detected will appear.
Press the Sensor that you want to switch to.

Note

When the Touch Finder or PC Tool is started, IP addresses are automatically set for each Sensor.
To allocate specific IP addresses, set the IP address of each Sensor and the Touch Finder.
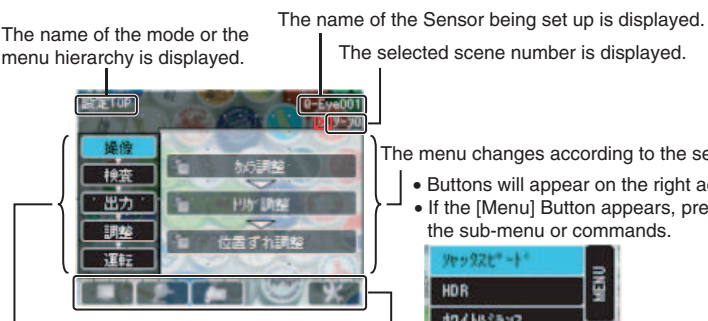
NTLPxREFERENCE P.000

Display Elements

FQ-series Vision Sensors have a Setup Mode and a Run Mode.
Refer to the following information for menu items.

📖 p.70

Setup Mode

In Setup Mode, you can set the image input conditions, inspection parameters, and I/O settings for the Sensor.

The name of the mode or the menu hierarchy is displayed.

The name of the Sensor being set up is displayed.

The selected scene number is displayed.

The menu changes according to the selected tab page.

- Buttons will appear on the right according to the mode.
- If the [Menu] Button appears, pressing it will display the sub-menu or commands.

The setup flow is shown by these five tabs.

  [Image]: Used to adjust the image.

 [Inspect]: Used to set the inspection items.

  [In/Out]: Used to set the I/O.

    [Test]: Used to test and adjust the set inspections.

    [Run]: Used to switch to Run Mode.

This button menu is always displayed.

	Only-image Button:	Used to switch between displaying the image and messages, or only the image.
	Display Button:	Used to switch the displayed image or zoom the image.
	Capture Button:	Used to capture the image being displayed.
	Tool Button:	Used to call tool functions, such as switching the Run Mode pattern, saving data, or switching scenes.

Note

The Display Button can be used to switch between the following images.

- Through: The image that is currently being input by the camera will appear.
- Freeze: The image that was input for the input trigger will appear.
- Log: A logged image will appear.
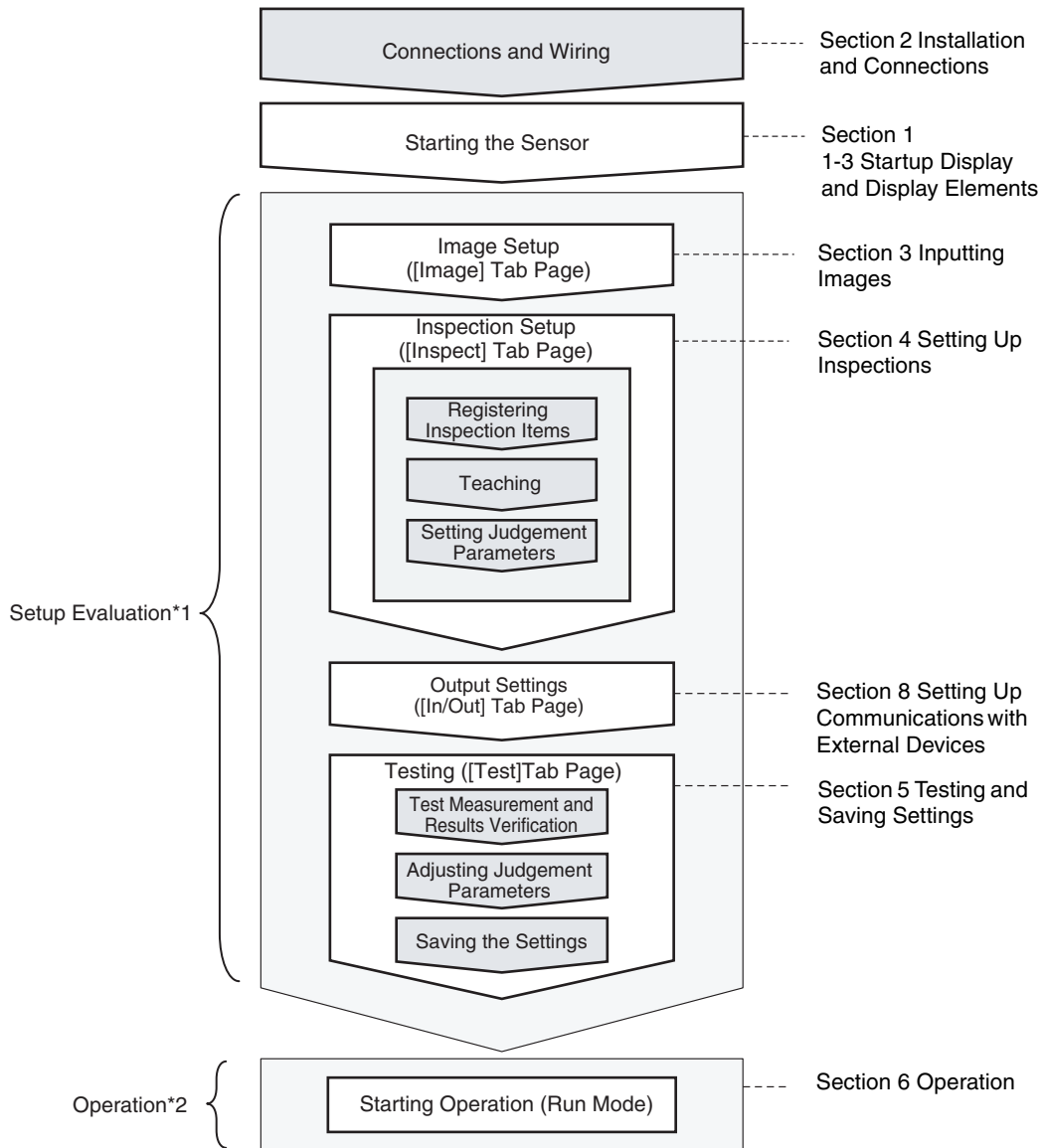- File: An image saved in external memory will appear.

Run Mode

In Run Mode, an external signal such as the trigger input is received, measurements are performed, and then measurement results are output.

📖 p.63

1-4 Basic Operational Flow

The following flow shows the basic operation of FQ-series Vision Sensors.

Flow	Reference
Connections and Wiring	Section 2 Installation and Connections
Starting the Sensor	Section 1 1-3 Startup Display and Display Elements
Image Setup ([Image] Tab Page)	Section 3 Inputting Images
Inspection Setup ([Inspect] Tab Page) — Registering Inspection Items / Teaching / Setting Judgement Parameters	Section 4 Setting Up Inspections
Output Settings ([In/Out] Tab Page)	Section 8 Setting Up Communications with External Devices
Testing ([Test]Tab Page) — Test Measurement and Results Verification / Adjusting Judgement Parameters / Saving the Settings	Section 5 Testing and Saving Settings
Starting Operation (Run Mode)	Section 6 Operation

Setup Evaluation*1 — (Image Setup through Testing)

Operation*2 — Starting Operation (Run Mode)

*1: In Setup Mode, the Sensor can be set up and adjusted, but it cannot perform I/O for external devices, such as PLCs.

*2: In Run Mode, the Sensor performs actual operations. It can perform I/O for external devices, such as PLCs.

The basic operating procedure is outlined in the *Quick Startup Guide* enclosed with the product. Also refer to this guide as required.
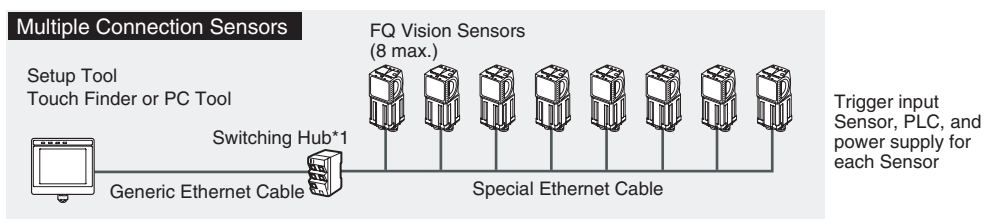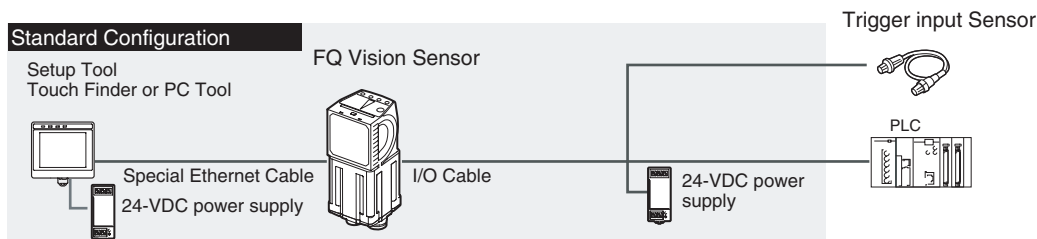
Installation and Connections

2-1 System Configuration

The Sensor is designed to be used with the following products.

Connect the Sensor with a Setup/Monitoring Tool and external devices as required.

Standard Configuration

Setup Tool
Touch Finder or PC Tool

FQ Vision Sensor

Trigger input Sensor

PLC

Special Ethernet Cable

I/O Cable

24-VDC power supply

24-VDC power supply

Multiple Connection Sensors

Setup Tool
Touch Finder or PC Tool

FQ Vision Sensors
(8 max.)

Trigger input Sensor, PLC, and power supply for each Sensor

Switching Hub*1

Generic Ethernet Cable

Special Ethernet Cable

*1: Always use a switching hub for the hub.

Product	Model number	Application
FQ Vision Sensor	FQ-S□□□□□	This is the unit that performs inspections.
Touch Finder	FQ-D3□	A software tool used to set Sensors and confirm images.
PC Tool	---	The PC Tool can be used in place of the Touch Finder. If you register as a SYSMAC member, you can download the free PC Tool as a special service to purchasers. Refer to the SYSMAC Member Registration Sheet for member registration procedures and the download procedure for special member software.
Special Ethernet Cable	FQ-WN0□□	Connects the Sensor to the Touch Finder or computer.
Generic Ethernet Cable	---	Connects the switching hub to the Touch Finder or computer. (STP (shielded twisted-pair) cable, category 5e or 6, impedance: 100 Ω)
I/O Cable	FQ-WD0□□	Connects the Sensor to the power supply and external devices.
Switching hub	W4S1-0□□	Used to connect multiple Sensors to one Touch Finder or PC Tool.

Important

It is not recommended to connect network devices other than PLCs on the same network as the Touch Finder or computer. If another device is connected, the responsiveness of displays and settings of the Touch Finder or computer may become slow. If another device needs to be connected to the network, check the operating conditions of each Sensor.
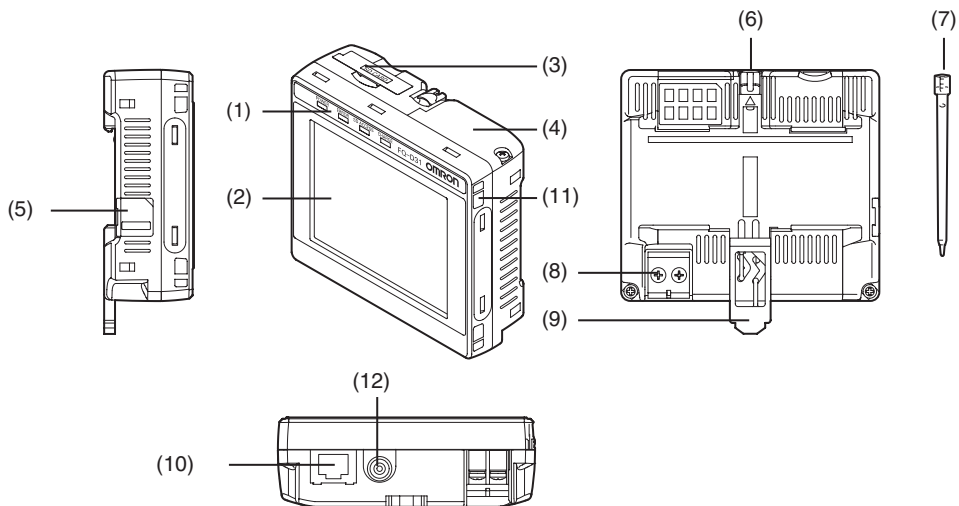
2-2 Part Names and Functions

FQ Vision Sensor
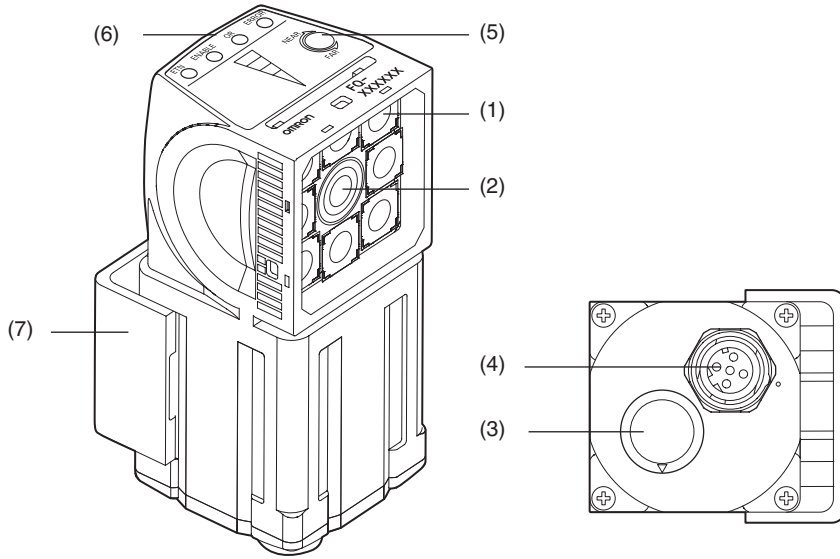
No.	Name		Description
(1)	Lighting		LEDs for illumination are mounted here.
(2)	Light receiver		Images are input from the receiver.
(3)	I/O Cable connector		An I/O Cable is used to connect the Sensor to the power supply and external devices.
(4)	Ethernet cable connector		An Ethernet cable is used to connect the Sensor to the Touch Finder or a computer.
(5)	Focus adjustment screw		Used to adjust the focus of the image.
(6)	Operation indicators	OR	Lights orange when the OR signal turns ON.
		ENT	Lights orange when Ethernet is connected.
		ERROR	Lights red when an error occurs.
		BUSY	Lights green when the Sensor is executing a process.
(7)	Mounting Bracket		Used to secure the Sensor in place. The Mounting Bracket can be attached to the front, left side, right side, or back of the Sensor.

Touch Finder

No.	Name		Description
(1)	Operation indicators	POWER	Lights green when power is supplied to the Touch Finder.
		ERROR	Lights red when an error occurs.
		SD ACCESS	Lights yellow when an SD card is inserted. Flashes yellow when the SD card is being accessed.
		CHARGE[*1]	Lights orange when the Battery is charging.
(2)	LCD/touch panel		Displays the setting menu, measurement results, and images input by the camera. The touch panel is used to change the settings.
(3)	SD card		An SD card can be inserted.
(4)	Battery cover[*1]		The Battery is mounted behind this cover. Remove the cover when mounting or removing the Battery.
(5)	Power supply switch		Used to turn the power supply to the Touch Finder ON and OFF.
(6)	Touch pen holder		The touch pen can be stored in here when it is not being used.
(7)	Touch pen		Used to operate the touch panel. Attach the strap on the touch pen to the touch pen strap holder before using the Touch Finder.
(8)	DC power supply connector		Used to connect a DC power supply. p.15
(9)	Slider		Used to mount the Touch Finder to a DIN Track.
(10)	Ethernet port		Used when connecting the Touch Finder to the Sensor with an Ethernet cable.
(11)	Strap holder		This is a holder for attaching the strap.
(12)	AC power supply connector[*1]		Used to connect the AC adapter.

*1: Applicable to the FQ-D31 only.

2-3 Installation

Installing the Sensor

Installation Procedure

**1** **Align the tabs on one side of the Mounting Bracket with the slot on the Sensor.**
The FQ-XL Mounting Bracket can be attached to the back, side, or front of the Sensor.

Mounting Bracket

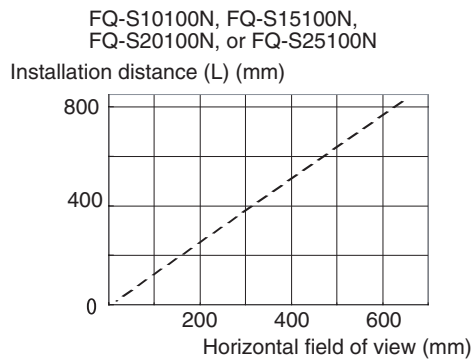**2** **Press the Mounting Bracket onto the Sensor until the other tabs click into place.**
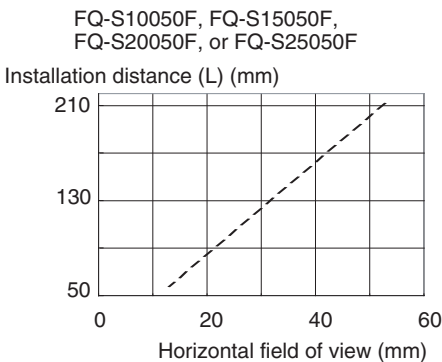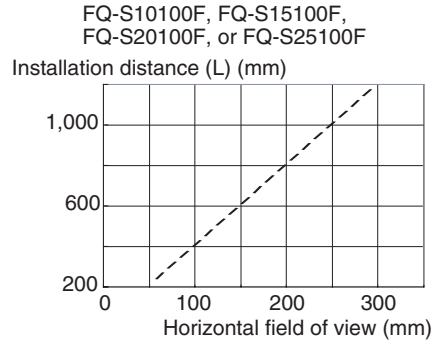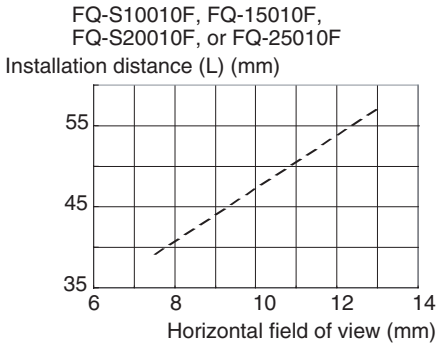
3 **Use optical charts to check the field of view and installation distance of the Sensor so that it is mounted at the correct position.**
Tightening torque

M4: 1.2 N·m

Horizontal field of view

Vertical field of view

Installation distance (L)
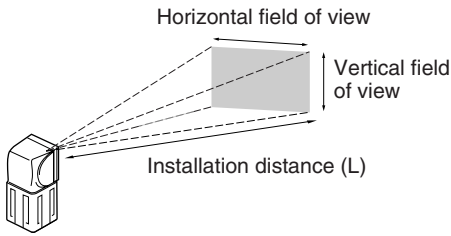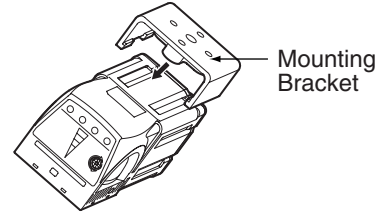
The optical chart indicates the horizontal field of view. The vertical field of view will be approximately 60% of the horizontal field of view.

FQ-S10010F, FQ-15010F, FQ-S20010F, or FQ-25010F

Installation distance (L) (mm)

Horizontal field of view (mm)

FQ-S10100F, FQ-S15100F, FQ-S20100F, or FQ-S25100F

Installation distance (L) (mm)

Horizontal field of view (mm)

FQ-S10050F, FQ-S15050F, FQ-S20050F, or FQ-S25050F

Installation distance (L) (mm)

Horizontal field of view (mm)

FQ-S10100N, FQ-S15100N, FQ-S20100N, or FQ-S25100N

Installation distance (L) (mm)
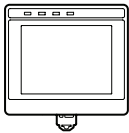

Horizontal field of view (mm)

Removal Procedure

1 **Insert a flat-blade screwdriver between the Mounting Bracket and the Sensor case on either side and remove the Mounting Bracket.**
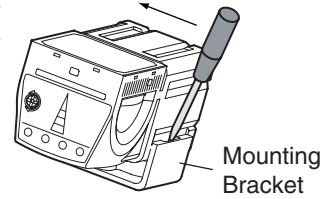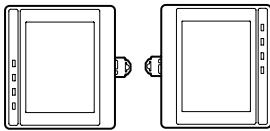
Mounting
Bracket

Installing the Touch Finder

Installation Precautions

Install the Touch Finder in the following orientation to allow sufficient heat dissipation.
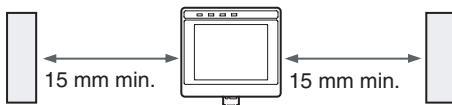
Do not mount it in the following orientations.

Important

• To improve ventilation, leave space on both sides of the Touch Finder. The distance between the Touch Finder and other devices should be at least that shown in the following diagram.

15 mm min.   15 mm min.

• Make sure that the ambient temperature is 50°C or lower. If it exceeds 50°C, install an cooling fan or an air conditioner and maintain the temperature at 50°C or lower.
• To prevent interference by noise, do not mount the Sensor on panels which contain high-voltage devices.
• To keep the level of noise from the surrounding environment to a minimum, install the Sensor and Touch Finder at least 10 m away from power lines.

Mounting to DIN Track

Installation Procedure

1 **Press the slider on the Touch Finder to the top.**

2 **Hook the clip at the top of the Touch Finder on to the DIN Track.**

*3* **Press the Touch Finder onto the DIN Track until the bottom clip clicks into place.**
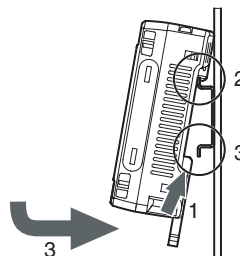
Important

- Attach End Plates (sold separately) on the sides of the Touch Finder on the DIN Track.
- If other devices will be installed next to the Touch Finder on the same DIN Track, make sure that sufficient space is kept between the devices as indicated on previous page.
- Always hook the clip at the top of the Touch Finder on the DIN Track first. If the lower clip is hooked on first, the Touch Finder will not be mounted very securely.
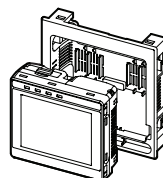
Removal Procedure

1 **Pull down on the slider on the Touch Finder.**

2 **Lift the Touch Finder at the bottom and remove it from the DIN Track.**
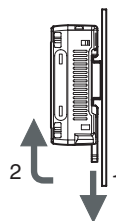
Mounting to a Control Panel

The Touch Finder can be mounted on a panel using the FZ-XPT Panel Mount Adapter.

1 **Set the Touch Finder in the Panel Mount Adapter.**

2 **Create holes in the panel for mounting.**
Refer to the following page for hole dimensions.

NTLPxREFERENCE P.000

3 **Connect the cable to the Touch Finder.**

4 **Mount the Touch Finder with the Panel Mount Adapter from the front of the panel.**

5 **Hook the hooks on the Mounting Bracket in the two short holes of the Panel Mount Adapter and secure them with screws.**

Mounting Bracket

6 **Check that the Touch Finder is attached properly to the Panel.**
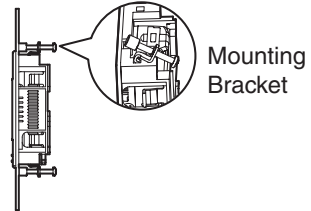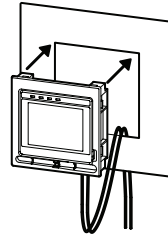
Using the Touch Finder as a Portable Device (with Battery)

The Touch Finder with a Battery can be used as a portable device. Use the strap when carrying it to prevent dropping it.

There are two types of straps (FQ-XH, sold separately), a Neck Strap and a Hand Strap.
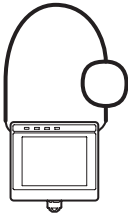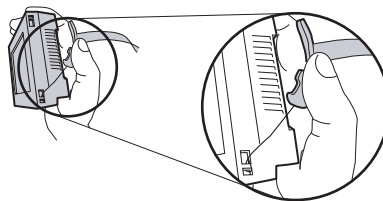
Neck Strap   Hand Strap

1 **Attach the Mini-strap to the Touch Finder.**
There are a total of four holes for attaching the Mini-strap on the left and on the right of the Touch Finder.

2 **Connect the Neck Strap or Hand Strap to the Mini-strap.**

Mini-strap   Neck Strap or Hand Strap

2-4 Wiring

Wiring the Sensor

Connect the I/O Cable to the I/O Cable connector located at the bottom of the Sensor. Wire the signal lines to the I/O Cable.

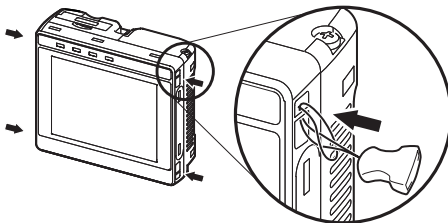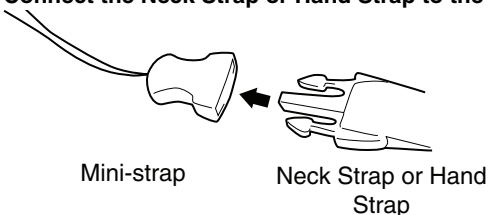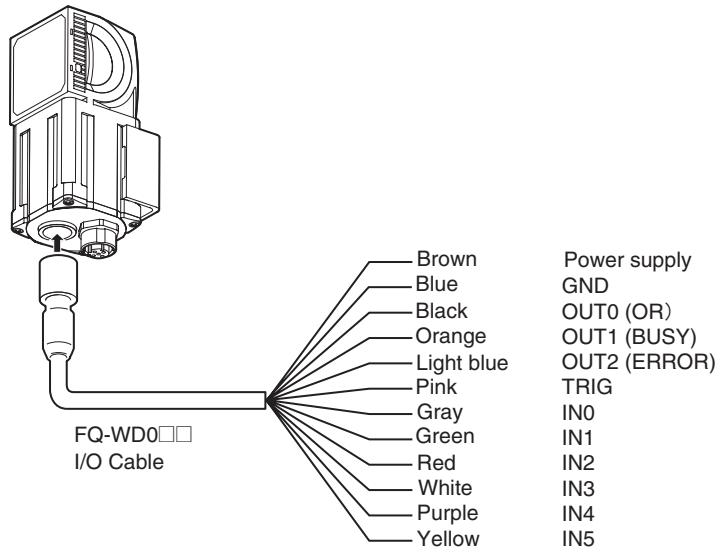| Color	Signal
Brown	Power supply
Blue	GND
Black	OUT0 (OR)
Orange	OUT1 (BUSY)
Light blue	OUT2 (ERROR)
Pink	TRIG
Gray	IN0
Green	IN1
Red	IN2
White	IN3
Purple	IN4
Yellow	IN5

FQ-WD0☐☐
I/O Cable

Important

Cut off lines that are not required so that they do not come into contact the other signal lines.

| Classification	Signal	Application
Power supply	Power supply (24 V)	These terminals are for the external power supply (24 V).
	GND	**Important** Wire the power supply separately from other devices. If other devices are wired together or the same duct is used for wiring, the influences of electromagnetic induction may cause the Sensor to malfunction or may damage it.
Inputs	TRIG	This terminal is for the trigger signal input.
	IN0 to IN5	These are the command input terminals.
Outputs	OUT0 (OR)	This is an output signal. In the default settings, it is assigned to an OR output signal (overall judgement). The assignment can be changed to an individual judgement signal from OR0 to OR31.
	OUT1 (BUSY)	This is an output terminal. In the default settings, it is assigned to the BUSY output signal. The assignment can be changed to an individual judgement signal from OR0 to OR31.
	OUT2 (ERROR)	This is an output signal. In the default settings, it is assigned to the ERROR output signal. The assignment can be changed to an individual judgement signal from OR0 to OR31.

Note

The assignments of I/O signals can be changed.

I/O Signal Circuit Diagrams

The following diagrams show external wiring examples that measures the input image when a trigger input is received, and then outputs the judgement result. The actual external wiring will depend on the measuring method.

📖 Measurement procedure: NTLPxREFERENCE Page ntlp???
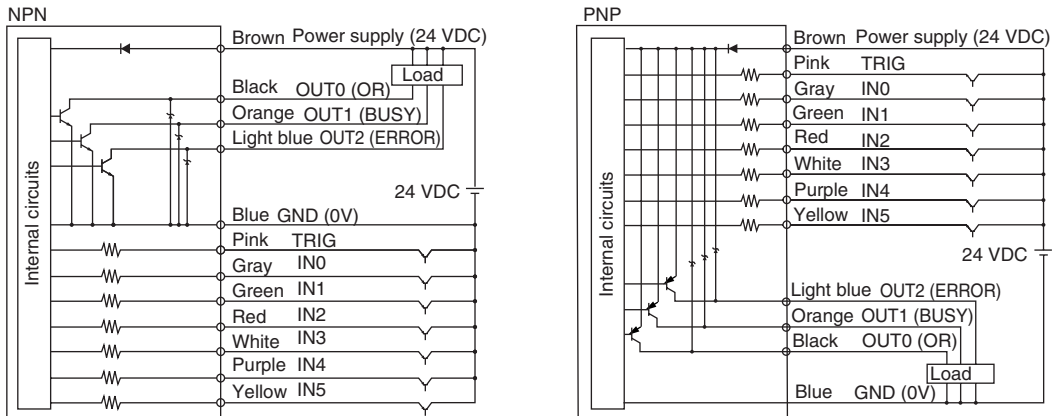
Important

Preventing Chattering

- The Sensor is equipped with an anti-chattering function, but if the chattering results in a signal of 100 μs or longer, a faulty input will occur. (Input signals of 99 μs or shorter are ignored. Signals of 100 μs or longer are treated as input signals.)
- Use no-contact output devices (e.g., SSR or PLC transistor output) for the input signals. If contacts (e.g., relay) are used, contact bound may cause the trigger to be input again during execution of a measurement.
- If the input signal is turned ON while the BUSY signal is ON, an error will occur and the ERROR signal will turn ON (the ERROR indicator will light). Therefore, set up an interlock in the ladder program so that input signals are not input while the BUSY signal is ON.

Power Supply Specifications

Use a power supply that meets the following specifications. (The power supply is sold separately.)

Item	Description
Power supply voltage	24 VDC (21.6 to 26.4 V)
Output current	3.75 A
Recommended Power Supply	S8VS-09024 (24 VDC, 3.75 A)

Important

Supply power from a DC power supply for which measures have been applied to prevent high voltages (e.g., a safety overvoltage circuit).

If UL certification is required for the overall system, use a UL Class II DC power supply.

Wiring the Touch Finder

Power Supply Wiring

Power Supply Specifications

Use a power supply that meets the following specifications. (The power supply is sold separately.)

Item	Description
Power supply voltage	24 VDC (21.6 to 26.4 V)
Output current	2.5 A min.
Recommended Power Supply	S8VS-06024 (24 VDC, 2.5 A)
External power supply terminal screws	M3 (tightening torque: 0.54 N·m)
Recommended power line wire size	AWG16 to AWG22 (length of 5 m max.)

Important

Supply power from a DC power supply for which measures have been applied to prevent high voltages (e.g., a safety overvoltage circuit).

If UL certification is required for the overall system, use a UL Class II DC power supply.

Connecting the Power Supply

1 Loosen the two terminal screws using a Phillips screwdriver.

2 Attach crimp terminals to the power lines.
Secure the positive and negative lines as indicated using M3 screws.
Power supply tightening torque: 0.54 N·m

24 VDC
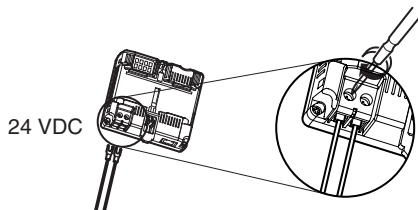
Charging the Battery

This section describes how to charge and install the FQ-D31 Battery and provides applicable precautions.

Charge the Battery while it is attached to the Touch Finder.

Inputting Images

3-1 Switching the Sensor for Setup

If multiple Sensors are connected to a single Touch Finder or computer, switch to the Sensor that you want to set up.

1 Press [Run].

2 Then press [Switch to Run mode].

3 Press ![icon] − [Switch Sensor].

4 Switch to the Sensor to be set up.

5 Press ![icon] − [Sensor settings] to return to Setup Mode.

3-2 Inputting High-quality Images

Adjusting the Focus

▶ **[Image]** − **[Camera setup]**

1 **Display the Camera Setup Display.**
The focus can be seen as a numerical value. The higher the value, the better the focus.

Focus

2 **Manually adjust the focus using the focus adjustment screw on the Sensor while checking the input image and focus value on the Touch Finder.**
In the default settings, the field of view is set to the narrowest setting.

Focus adjustment screw

Turn clockwise to focus on closer objects.
(The field of view will narrow.)

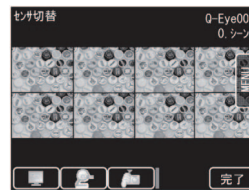Turn the screw counterclockwise to focus on objects at a distance. (The field of view will widen.)
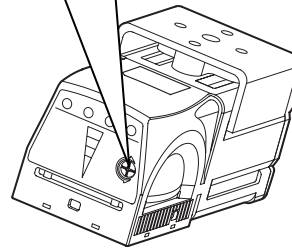
Important

Turn the focus adjustment screw clockwise or counterclockwise a little bit to make sure that it doesn't stop rotating, then make the adjustment.
Do not force the screw if it does not rotate anymore. This may damage the Sensor.

Making Dark Images Brighter

The image can be made brighter by increasing the brightness value.

Dark   Bright

Brightness of image

0   100
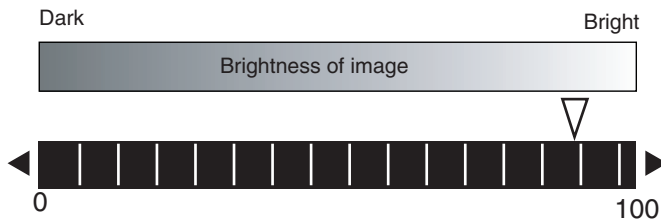
▶ **[Image] − [Camera setup]**

1 **Press [Menu] - [Brightness] on the right side of the display.**

2 **Move the bar to the left or right to adjust the brightness.**

Moving it to the right will make the image brighter, while moving it to the left will reduce the brightness of the image.

Press [AUTO] to automatically adjust the brightness according to the image.

Important

The exposure time will be longer for larger values. This may cause the image to blur if the object is moving fast. If the Sensor is used on a high-speed line, check that the images are not blurred under actual operating conditions.

Inputting Clear Images of Moving Objects

Images of objects that are moving quickly can be input more clearly if the brightness is reduced.

Fast   Moving speed   Slow

0   100

Exposure time

10 μs   2 ms
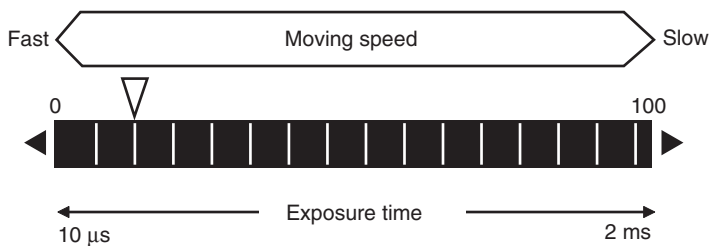
▶ **[Image] – [Camera setup] – [Menu] – [Brightness]**

📖 Adjusting the brightness: p.22

Important

The image becomes darker the smaller the value. Because the image becomes darker, if the Sensor is used in a dark environment, make sure that the darkness of the image does not alter the consistency of the measurements.

Inputting High-quality Images of Metallic and other Shiny Surfaces

When objects with shiny surfaces are being inspected, the lighting may be reflected off the surface and affect the image. Reflected light affects an image when the Sensor receives a specular light reflected off the object. To input an image without reflections, one of the following two functions can be employed.

Function	Description
HDR (High Dynamic Range)	If objects have contrasting light and dark areas, the dynamic range can be made wider to improve the quality of the images.
Polarizing filter	Specular reflections can be eliminated from an image by attaching a polarizing filter to the Sensor.

• Selection Tips

• When the measurement object can be made stationary	→ Use the HDR function.
• When the measurement object cannot be made stationary	→ Use a polarizing filter.

HDR Function

When objects have contrasting light and dark areas, the dynamic range can be made wider to improve the quality of the images. It is effective especially for objects with strong variations in light and dark colors, or when there is a mixture of light and dark objects.
Observe the following precautions.

- Make sure that the measurement object is stationary before using the HDR function.
  Images that are input using different shutter speeds are combined, so if the object moves while the image is being input, the image will become blurred.
- Images with different brightnesses are combined, so the resulting image will have a lower degree of contrast.

Note

If the reflections cannot be sufficiently removed using the HDR function, use a polarizing filter as well.

▶ **[Image]** − **[Camera setup]**

1 **Press [Menu]** − **[Brightness] on the right side of the display.**

2 **Press the [HDR] Button to enable the HDR function.**
The enabled range will appear in green on the brightness adjustment bar.

3 **Press the [AUTO] Button.**
The best HDR mode parameters will be set automatically.
If the automatic selection doesn't achieve the desired results, manually switch the HDR mode to select the ideal mode.
Every time you press the [HDR] Button, the setting will change in the following order.
Low to Middle to High to OFF to Low
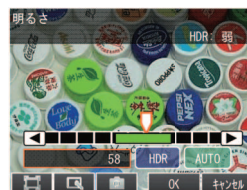
Note

Low, middle, and high indicate the dynamic range for combining the images.

Inputting images with a wide dynamic range

Low
Middle
High

Using a Polarizing Filter

Specular reflections can be eliminated from an image by attaching a FQ-XF1 Polarizing Filter to the Sensor. This can be used even if the object is moving.

Observe the following precautions.
• The brightness of the image will be reduced by one-fourth compared to when no filter is used.
• If the image is too dark, adjust the brightness.

    📖 p.22

• Mounting the Filter

    1   **Hook the filter in the hole at the top of the Sensor.**

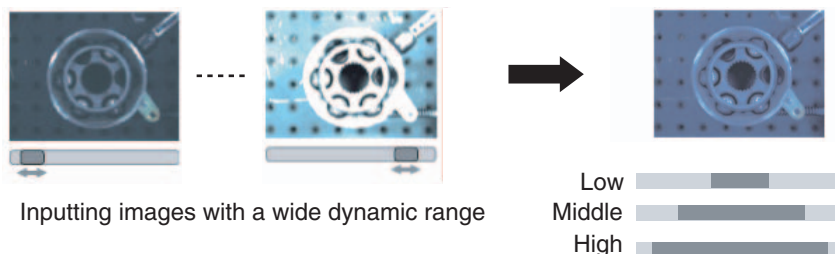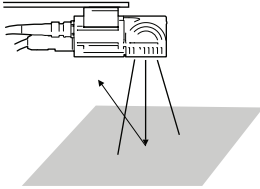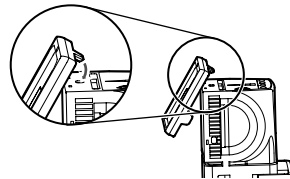   *2*   **Using the top section as a pivot point, pull down the filter so that it attaches to the Sensor.**
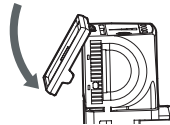
Adjusting the Colors of the Image (White Balance)

If external lighting is used, the image may appear as having different colors than the actual object. If this is the case, adjust the white balance.
If the lighting built in to the Sensor is used, the white balance is already adjusted. No setting is required in this case.

▶ **[Image]** – **[Camera setup]**

    1   **Input a picture of white paper or cloth.**

    2   **Press [Menu] – [White balance] on the right side of the display.**

    3   **Press the [Auto] Button. The Sensor will automatically adjust the colors.**

    4   **Move the bar to the left (light) or right (dark) to fine-tune the colors.**

    5   **Press [OK].**

3-3 Positioning the Object

For inspection of objects at the correct timing, images must be input when the object appears in front of the camera.

Images can be taken with the workpiece at the center of the frame using the following functions.

Function	Description
Position compensation	Even if the orientation of the objects is not consistent, position compensation is automatically calculated and applied for each measurement so that correct measurements can be made.
Trigger delay	A delay can be applied from when the trigger (the TRIG signal) is input until when the image is input, to synchronize the timing of image input with the speed of the moving objects.

Position Compensation

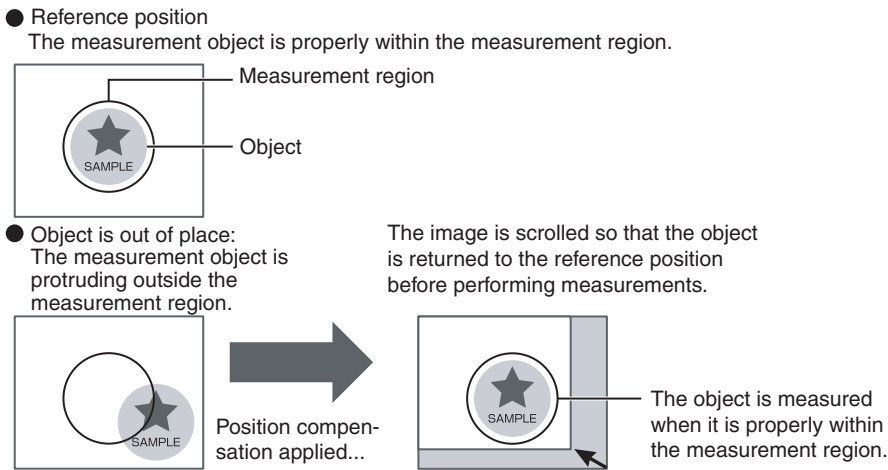Measurement objects that are not in the same position or orientation are recognized and their images are scrolled or rotated so that they match the registered image. Measurements are then performed on the moved images.

However, the processing time will be longer because position compensation must be applied each time a measurement is performed.

● Reference position
The measurement object is properly within the measurement region.

Measurement region

Object

SAMPLE

● Object is out of place:
The measurement object is protruding outside the measurement region.

The image is scrolled so that the object is returned to the reference position before performing measurements.

SAMPLE

Position compen- sation applied...

SAMPLE

The object is measured when it is properly within the measurement region.

▶ [Image] – [Position compensation] – [Mode status]

1 Press [ON] for position compensation.

2 Press [Settings].

3 Press [Teach].

4 Adjust the image so that the measurement object is in the center.

5 Press [Menu] − [Model region] on the right side of the display and move the rectangle so that the mark for position compensation is inside it.

6 Press [Teach].
The mark and reference position for position compensation will be registered.

7 Press [OK] to save the settings.

Drag the center to move the rectangle.

Drag a corner to size the rectangle.

Adjusting the Judgement Parameters

Set how similar the image must be to the registered image for position compensation to be applied.

▶ **[Image] – [Position compensation] – [Settings] – [Judgement]**

   1   **Set the correlation range for an OK judgement.**

       📖 Operating procedures: p.33

Measures to Stabilize Position Correction

• Inclined Measurement Objects

The range of image rotation can be widened by adjusting the [Angle range].
The adjustment menu for the angle range is on the [Details] Tab Page.

• Low Mark Contrast and Inconsistent Correlations

Areas with high contrast are registered as model registration sections.
The adjustment procedure is the same as for the search function.
Or, adjust the brightness to increase the contrast of the mark.

    📖 Making dark images brighter: p.22

• Inconsistent Marks and Inconsistent Correlations

Inconsistent portions can be masked so that are omitted from matching.

Operating procedures for other functions are basically the same as those for searching.
Refer to the following information.

    📖 Unstable search results: p.35

Increasing the Speed of Position Compensation

The following two methods can be used to reduce processing time.
• Reduce the range in which searches are performed for the model.
• Reduce the range of applicable rotation angles.
The adjustment menu for the angle range is on the [Details] Tab Page.

Operating procedures for other functions are basically the same as those for searching.
Refer to the following information.

    📖 Unstable search results: p.35

Offsetting the Trigger Input and Image Input Timing

If the object arrives at the same position but the image is not input when it is in the center of the frame because of the trigger timing, adjust the timing using the trigger delay.
If the object position is unstable, this function cannot be used for making adjustments.

Delay time
Delay from when the trigger is input until
when Sensor input is started.

Trigger input Sensor
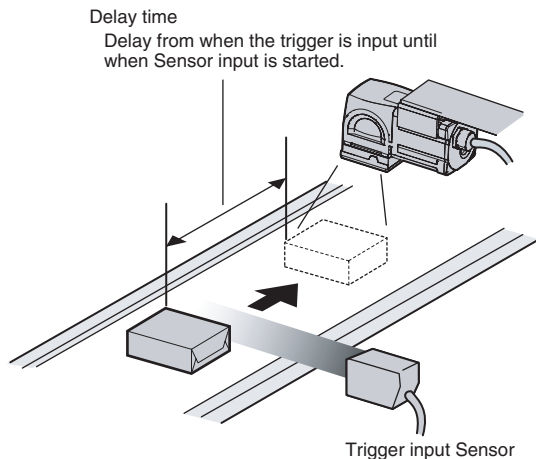
▶ **[Image]** − **[Trigger setup]** − **[Trigger delay]**

1 **Press [Run] on the Trigger Delay Display.**

2 **A TRIG signal is input.**
Images are input continuously.
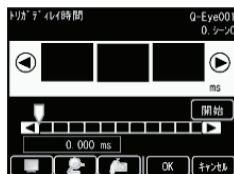
3 **Select the image with the measurement object in the center using [◀] and [▶].**

4 **Press the image.**

5 **Press [OK].**
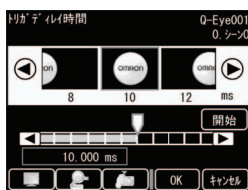
| Note |

The delay time can be set using the adjustment bar or by directly entering a value.
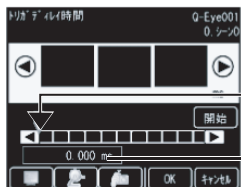
Move the bar to the left or right.

Or

Directly input the delay time.

3-4 Preventing Mutual Interference of Multiple Sensors

When the same trigger signal is input to multiple Sensors, the lighting from one Sensor may affect the measurements of the other Sensors. This is called mutual interference. This kind of interference can be prevented offsetting the image input timing of each Sensor from when the trigger signal is received.
Example:
A trigger (i.e., the TRIG signal) is input to Sensor 0 and Sensor 1 at the same time.
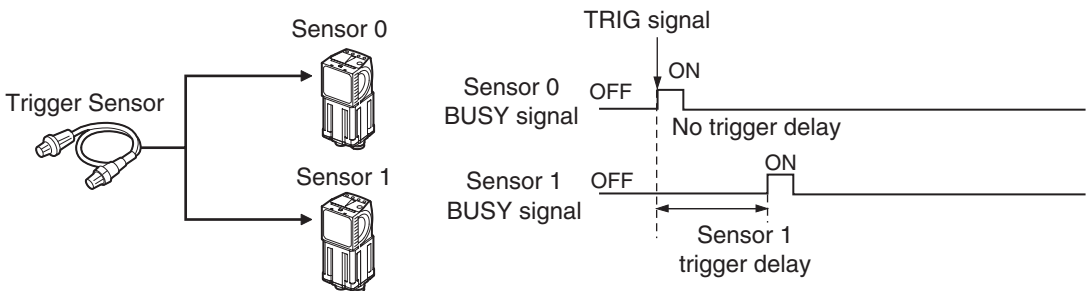
Sensor 0 immediately begins image input when the trigger is input.
Sensor 1 begins image input after the specified time has passed.

1 **Change to the setup for to Sensor 1.**

📖 P.20

2 **Press [Image] – [Trigger setup] – [Trigger delay].**

3 **Set the trigger input delay time for Sensor 1.**

📖 P.27

Important
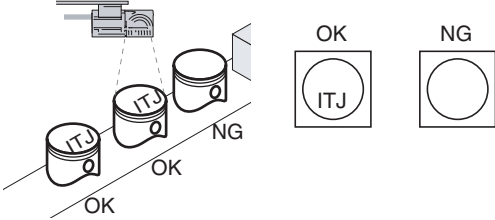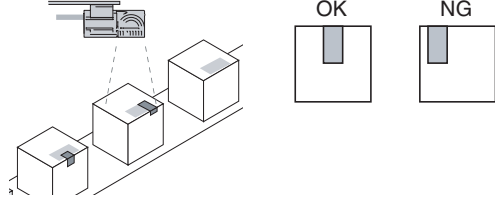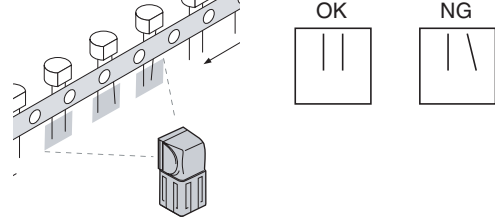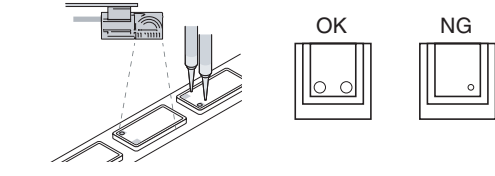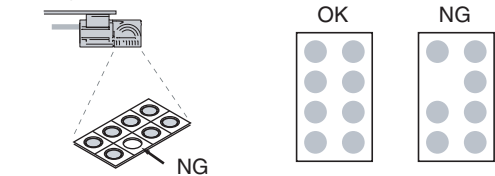
• Check the thumbnail images and adjust the delay time so that the object is in the center.
• The delay time for preventing mutual interference must be longer than the shutter time.
  When the lighting built into the Sensor is used, the shutter time is 2 ms max. Therefore make the delay at least 2 ms.

Setting Up Inspections

4-1 Inspection Item Selection Guide

This section describes how to select inspection items depending on the intended inspection.

Inspection	Example	Inspection items used	Refer-ence
Judging according to shapes	Judging if there is a mark	Search	p.33
Judging according to positions	Inspecting the position offset of a seal	Edge Position	p.39
Judging according to widths	Inspecting the width between lead wires	Edge Width	p.44
Judging according to sizes	Judging if there is silver paste	Area	p.47
Judging according to colors	Detecting parts	Color Data	p.51

4-2 Setup Procedure for Inspection Items

The basic steps for setting up inspection items are shown below.

| **Step 1** | Registering Inspection Items |

▼

| **Step 2** | Teaching |

▼

| **Step 3** | Setting Judgement Parameters |
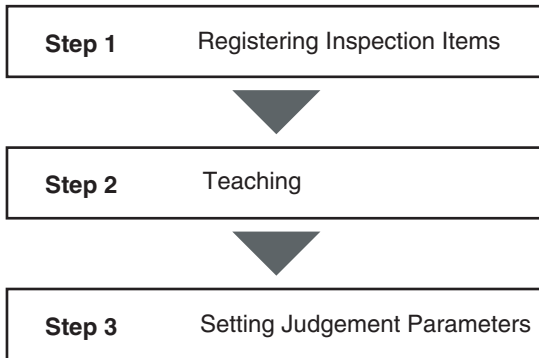
If measurements are unstable

| **Step 4** | Setting Detailed Items |

▼

| **Step 5** | Re-teaching* |
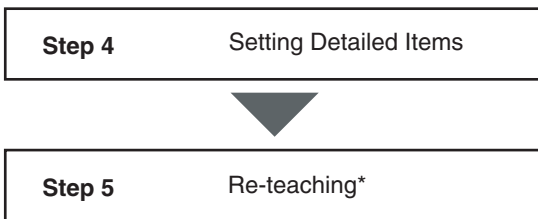
*: Re-teaching is required not only after setting detailed items, but also after changing the registered model, changing the range for inputting images or when color extraction is set.

> **Note**
>
> - Only one inspection item can be used with a single-function model (FQ-S1).
> - Up to 32 inspection items can be combined and used with a standard model (FQ-S2).

4-3 Registering Inspection Items

Registering New Inspection Items

1 Press [Inspect] after the input image has been adjusted.
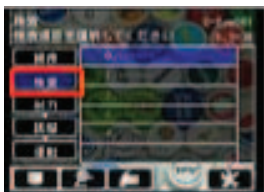
2 Press an unused inspection item number.
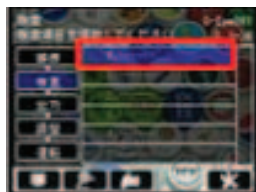
3 Press [Add item] on the menu.

4 Select an inspection item, such as [Search].

When registering multiple inspection items, press the inspection item number after 1.--- and set it in the same way.

Setting Registered Inspection Items

1 Press the number of the inspection item to be set.
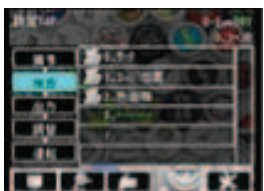
2 Press [Setting] on the menu.
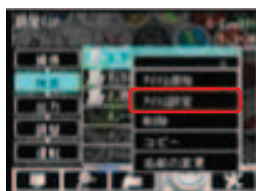
Deleting Registered Inspection Items

1 Press the number of the inspection item to be deleted.

2 Press [Delete] on the menu.

Note

Executing Similar Inspection Items in Different Places
→ Copy an inspection item that is already registered: [Copy].
→ Change the name of an inspection item: [Rename].

4-4　Inspecting with the Search Inspection Item

Search Inspection Item

A unique section of the measurement object is registered as an image pattern (called a model) and the section that is most similar to the model is found in the measurement region.

The similarity (called the correlation) is judged OK if it is within the set judgement parameters.

This function is suitable for applications that determine good and faulty products depending on whether it has a particular image pattern.

Sample Settings

Model
(desired image pattern)

Detected position

Search region (region to search for the model)

Sample Measurement

Search for sections that are similar to the model.

OK　　　　　NG
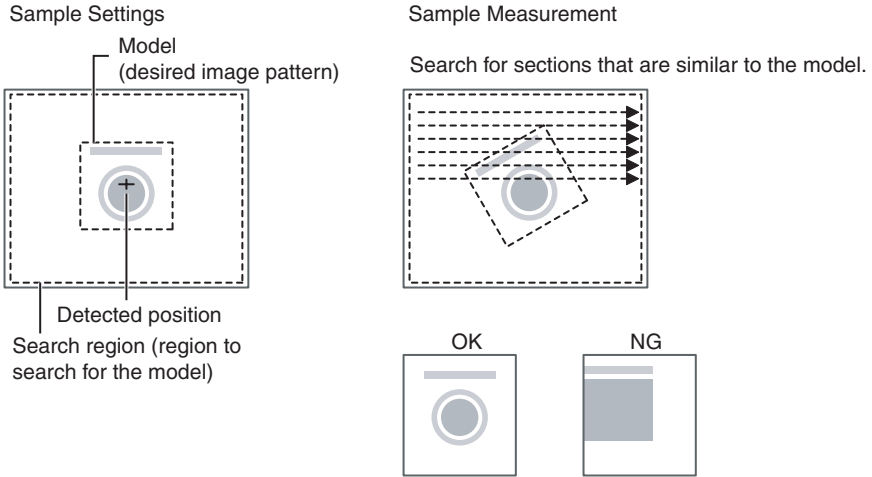
Operating Procedure for Search Inspection Item

Step 1　Selecting Inspection Items

▶ **[Inspect]**

1　**Press [Search].**

　　　Registering inspection items: p.32

Step 2   Teaching

▶ **[Inspect]** − **[Search]** − **[Settings] Tab Page**

   1 **Press [Teach].**

   2 **Input an image of the object to use as the inspection
reference.**

   3 **Press [Menu] – [Model region] on the right side of the
display.**

Drag the center to move the rectangle.
Drag a corner to size
the rectangle.

   4 **Move the rectangle to the location to be inspected.**

   5 **Press [Teach] on the lower right of the display.**
The basic settings will be registered when teaching has
been completed.

   6 **Press [OK] to end teaching.**

The following data is registered as the inspection reference.

Item	Parameter	Description
Basic settings	Model data	Register the model image in the model registration location.
	Reference position X	Register the center coordinates (X, Y) of the model at the model registration location.
	Reference position Y	

Step 3   Setting Judgement Parameters

▶ **[Inspect]** − **[Search]** − **[Settings] Tab Page**

   1 **Press [Judgement].**

   2 **Set the correlation range for an OK judgement.**
Continuous measurements will be performed for the im-
ages that are displayed.

Lower limit   Upper limit

   3 **Press [OK] to enter the value.**
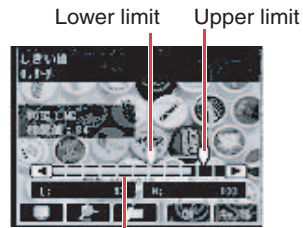
Blue for OK. Red for NG.

Parameter	Setting	Description
Correlation	Range: 0 to 100 Default: Lower limit: 60, Upper limit: 100	Register the upper and lower limits of the correlation for an OK judgement.

Unstable Search Results

Inclined Measurement Objects

Adjust the [Angle range] parameter to increase the range in which a search is made for the model.
The Search inspection item judges whether an image is OK or NG according to the correlation with a previously registered image pattern. For this reason, if the object is at an angle, the correlation is reduced and the image may be judged as NG. To achieve an OK judgement for the same image pattern even when the object is at an angle, the rotation range must be widened.

▶ **[Inspect] – [Search] – [Details] Tab Page**

Parameter	Setting	Description
Angle range	• OFF (default) • ±5°, ±10°, ±15°, ±20°, ±25°, ±30°, ±35°, ±40°, or ±45°	A search is performed within the set angle range. The larger the angle range, the longer the processing time. **Important** If you change the angle range, perform teaching again. 📖 p.34

Correlation Is Inconsistent Due to Low Contrast

Adjust the brightness to improve the contrast of the mark.

📖 Adjust the brightness: p.22

Correlation Is Inconsistent Due to Variations in the Measurement Object

Inconsistent portions can be masked so that they are omitted from matching.

📖 Model masking: p.37

Increasing Processing Speed

The following two methods can be used to reduce processing time.
• **Reduce the range in which a search is performed for the model.**

📖 Changing the measurement region: p.38

• **Reduce the angle range setting.**

Adjust the [Angle range] parameter to reduce the range in which a search for the model is performed.

📖 Setting the angle range: p.35

Editing the Model and Measurement Regions

This section describes how to edit the following regions.

Model registration region

Measurement region
(region that is searched for the model)
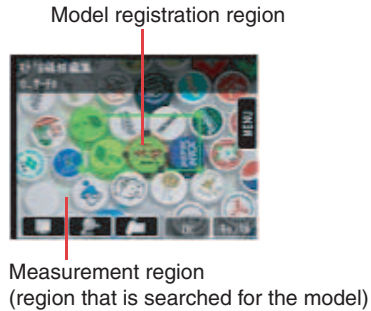
Changing the Model Registration Region to a Shape Other Than a Rectangle

One rectangular region is registered as the default model registration region.
Other than rectangles, circles and polygons can be set as the model registration regions.

▶ **[Inspect]** − **[Search]** − **[Settings] Tab Page** − **[Teach]**

1 **Press [Menu] – [Delete] in the model registration display.**
The rectangle will be deleted.

2 **Press [Append] in [Menu].**

3 **Press the shape of the region that you want to use.**

4 **Draw the region.**

| Note |

Up to 8 shapes can be combined to create a region for one model.

Masking Parts of the Model

The model registration region can be formed freely by combining enabled and disabled regions.
Example:

Figure 1: Enabled range

Figure 2: Disabled range

The gray section is the model region.

Figure 3: Enabled range
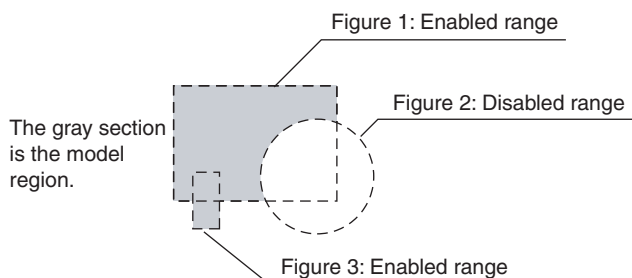
▶ **[Inspect]** – **[Search]** – **[Settings] Tab Page** – **[Teach]**

1 **Draw the figure according to the section that you want to mask.**

📖 p.36

2 **Press [Menu] – [Model region] – [Menu] – [OR/NOT] while the figure to be masked is selected.**
The selected area will be removed from the model.
Every time you press [OR/NOT], the area will switch between being enabled and disabled.

   OR: Enabled range
   NOT: Disabled range

Fine-tuning the Position of the Region

This section describes the console which is useful to fine-tune the position of the measurement region or the model registration region in 1-pixel increments.

▶ **[Inspect]** – **[Search]** – **[Settings] Tab Page** – **[Teach]**

1 **Press [Menu] – [Console] on the right side of the display where you draw the region.**
The console will appear.

2 **Use the cross-key to align the figure with the search object.**
The position of the figure can be adjusted by pressing the cross-key. Pressing it once will change the coordinate values by one pixel.

Coordinates

Important

If the model region is changed, perform teaching again.

📖 p.34

Changing the Measurement Region

The region within which the model is searched can be changed. In the default settings, the whole display is set as the measurement region.

▶ **[Inspect] – [Search] (or other inspection item) – [Settings] Tab Page – [Teach]**

1 **Press [Menu] – [Meas. region] on the right of the display.**
The [Meas. Region] Display will appear.

2 **Adjust the size and position of the measurement region.**
   • Change the size.
     Press the frame at one corner.
     The processing time can be shortened by making the region smaller.
   • Change the position.
     When all corners of the frame are green, the figure can be moved by dragging it from the center.

Measurement Data That Can Be Logged

The following values can be logged as measurement data.

Parameter	Setting	Description
Correlation	0 to 100	This is the measured correlation.

Errors

Errors in Teaching

A teaching error message will appear if the contrast of the image within the model registration region is too low. Select a region with a larger contrast between light and dark areas compared to the region that was registered as the model and re-register it as the model.

4-5 Inspecting with the Edge Position Inspection Item

Edge Position

Changes in color within the measurement region are used to detect the position of the specified color.

If the offset between that position and the reference position (called the "edge offset") is within the value set for the judgement parameter, the judgement will be OK.

This function is suitable for applications that determine good and faulty products depending on the position where there is a color change.

Sample Settings

Measurement region

Edge search direction

Color of edge to be found

Sample Measurement

An edge is detected within the region according to set direction and color.

OK   NG
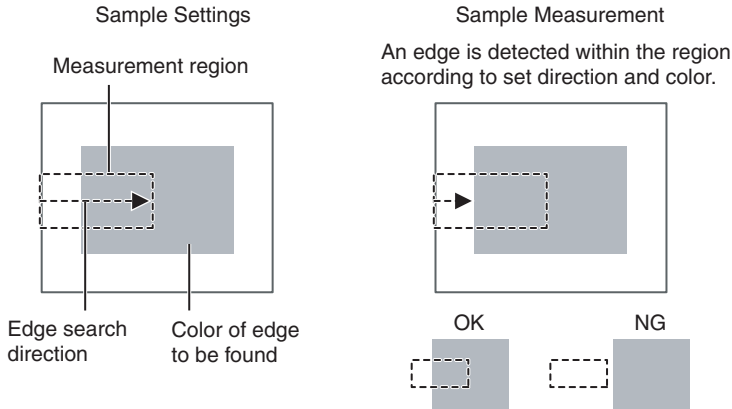
Operating Procedure for Edge Position

Step 1   Selecting Inspection Items

▶ **[Inspect]**

1 **Press [Edge position].**

📖 Registering inspection items: p.32

Step 2   Teaching

1 **Press [Teach].**

2 **Input an image of the object to use as the inspection reference.**

3 **Press [Menu] − [Meas. region] on the right of the display.**

4 **Move the rectangle to the location to be inspected.**

5 **Press [Teach] on the lower right of the display.**
The basic settings will be registered when teaching has been completed.

6 **Press [OK] to end teaching.**

The middle arrow is the direction for detecting an edge.

Drag the center to move the rectangle.　Drag a corner to size the rectangle.

📖 Changing the measurement region: p.38

The following data is registered as basic inspection data.

Item	Parameter	Description
Basic settings	Extract color	The edge color will be automatically extracted if an extract color is not set.
	Reference position X	The reference coordinates (X, Y) of the position are set automatically.
	Reference position Y	

Step 3   Adjusting Judgement Parameters

1 **Press [Judgement].**

2 **Set the range within which the edge position is judged as OK.**
Continuous measurements will be performed for the images that are displayed.

3 **Press [OK] to enter the value.**

Lower limit   Upper limit

Blue for OK. Red for NG.

Item	Parameter	Setting	Description
Judgement Parameter	Edge offset	Range: −9,999 to 9,999 Default: Lower limit: −50, Upper limit: 50	Set the upper and lower limits from the reference position as the offset within which the judgement will be OK.

Unstable Edge Position Results

There Is an Edge But It Cannot Be Detected

▶ **[Inspect]** − **[Edge Position]** − **[Details] Tab Page**

Parameter	Setting	Description
Edge level	Range: 0 to 100 Default: 50 Setting resolution: 1	Set the density level of the edge. The edge point is found based on a threshold that is set for a color change. **Important** If you change the edge level, perform teaching again.

Note

Edge Level

An edge is detected in the following way.

1. The density distribution of the entire measurement region is determined.
2. The minimum density is 0%. The maximum density is 100%.
3. An area where the density changes by the specified edge level is detected as an edge.
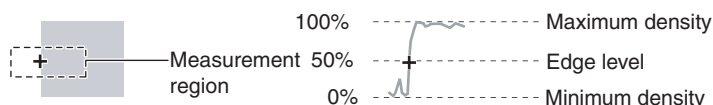
Noise Is Mistaken as an Edge

▶ **[Inspect]** − **[Edge Position]** − **[Details] Tab Page**

Parameter	Setting	Description
Noise level	Range: 0 to 422 Default: 10 Setting resolution: 1	Sets the density level to be considered as noise. If the difference between the maximum density and minimum density of the density region is below the noise level, it will be assumed that there is no edge. Increase this value if noise is incorrectly detected as an edge. **Important** If you change the noise level, perform teaching again.

Note

Noise Level

The maximum and minimum density values within the edge detection region are determined. If the difference is less than the noise level, it is assumed that there are no edges. Normally there is no problem with the default value of 10, but if noise is mistakenly detected as an edge, make this value higher.

Within the Region

Max. density − Min. density < Noise level → No edge found → Measurement result: NG

Max. density − Min. density ≥ Noise level → Edge found → Perform measurement

60 − 15 > 30
Judges that there is an edge and performs measurements.

25 − 10 < 30
Judges that there is no edge (measurement result is NG).

Screen Display When the Edge Level and Noise Level Are Changing

A bar showing the threshold level moves up and down on the graphic as the edge level/noise level value changes.

A cross-key cursor will also appear at the detected edge position and the result will change.

Edge level

Noise level
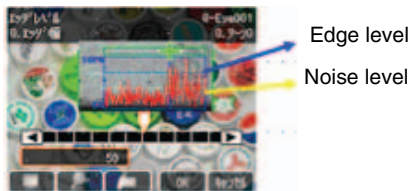
Undesired Edge Position Is Automatically Detected When Teaching

Manually set the color of the edge that you want to detect.

▶ **[Inspect] – [Edge Position] – [Settings] Tab Page – [Teach]**

1 **Press [Menu] – [Set color.] on the right side of the display.**

2 **Press [ON].**

3 **Press [Menu] – [Set color.] on the right of the display.**

4 **Press the color that you want to use to extract an edge.**
The specified color will be extracted.

5 **Press [Teach] again.**

(Only a rectangle can be used to specify the region.)

Note

It is also possible to specify colors using the color palette.
The RGB values of the extraction color can be checked and adjusted using the color palette.
If you press [Menu] – [Color palette], a color palette will appear.

When a color is pressed on the color palette, its RGB values will be displayed.

Increasing Processing Speed for Edge Position

Make the measurement region smaller to reduce the processing time.

📖 Changing the measurement region: p.38

Measurement Data That Can Be Logged for Edge Position

The following values can be logged as measurement data.

Measured item	Range of value	Description
Edge offset	−9,999 to 9,999	This is the offset from the measured reference position.

Errors

Errors in Teaching

A teaching error message will appear if the edge position cannot be detected when teaching. Perform the following.
• If the color of the measurement object has changed from the specified color, set the color again and try teaching again.
• If there is an edge and it cannot be detected, adjust the [Noise level] on the [Details] Tab Page and try teaching again.

If an edge is not detected when teaching, (0,0) will be registered as the reference position. If the result is OKed when there is not edge, set the judgement parameters for a reference position of (0,0).

Edge Not Found

The measured edge position will be (0,0). Perform the following.
• If a color was specified, make sure the color of the measurement object has not changed from the specified color.
• Set the color again if necessary.
• If there is an edge and it cannot be detected, make sure the [Edge level] parameter on the [Details] Tab Page is correct.

📖 Edge level: p.41

4-6 Inspecting with the Edge Width Inspection Item

Edge Width Inspection Item

This inspection item inspects the width of the measurement object using a change in color between two areas of the measurement region.

When the distance and reference width of the two colors are within the range of the judgement parameters, the image is judged as OK.

This function is suitable for applications to determine the type of a part or whether a part exists or not depending on the width.

Sample Settings   Sample Measurement

Measurement region   Edges are searched from
                                     two directions and the
                                     distance is calculated.

Color of edge to be found   OK   NG

Operating Procedure for Edge Width Inspection Item

Step 1   Selecting Inspection Items

▶ **[Inspect]**

1   **Press [Edge Width].**

📖 Registering search items: p.32

Step 2   Teaching

1   **Press [Teach].**

2   **Input an image of the object to use as the inspection reference.**

Drag the center to move the rectangle.
Drag a corner to size the rectangle.

3   **Press [Menu] − [Meas. region] on the right of the display.**

4   **Move the rectangle to the location to be inspected.**

5   **Press [Teach] on the lower right of the display.**
The basic settings will be registered when teaching has been completed.

6   **Press [OK] to end teaching.**

📖 Changing the measurement region: p.38

The following data is registered as the inspection reference.

Item	Parameter	Description
Basic settings	Extract color	The edge color will be automatically detected if an extract color is not set.
	Reference width	The reference edge width is set automatically.

Step 3   Adjusting the Judgement Parameters

1   **Press [Judgement].**

2   **Set the edge width range for an OK judgement.**
Continuous measurements will be performed for the images that are displayed.

Lower limit   Upper limit

3   **Press [OK] to enter the value.**
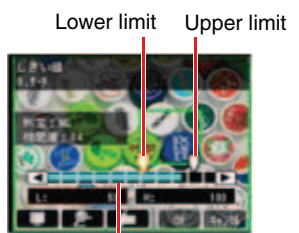
Blue for OK. Red for NG.

Item	Parameter	Setting	Description
Judgement Parameter	Edge Width	Range: −9,999 to 9,999 Default: Lower limit: −50, Upper limit: 50	Set the upper and lower limits of the reference width for an OK judgement.

Unstable Edge Width Results

If the inspection result is not stable, adjust the [Edge level], [Noise level], and [Set color.] parameters.

📖 p.41

Increasing Edge Width Processing Speed

Make the measurement region smaller to reduce the processing time.

   📖   Changing the measurement region: p.38

Measurement Data That Can Be Logged for Edge Width

The following values can be logged as measurement data.

Measured item	Range of value	Description
Edge Width	−9,999 to 9,999	This is the measured edge width.

Errors

Errors in Teaching

A teaching error message will appear if the edge position cannot be detected when teaching. Perform the following.
- If the color of the measurement object has changed from the specified color, set the color again and try teaching again.
- If there is an edge and it cannot be detected, adjust the [Noise level] on the [Details] Tab Page and try teaching again.

If an edge is not detected when teaching, 0 will be registered as the reference edge width. If the result is OKed when there is not edge, set the judgement parameters for a reference position of 0.

Edge Not Found

The measured edge width will be 0. Perform the following.
- If a color was specified, make sure the color of the measurement object has not changed from the specified color.
- Set the color again if necessary.
- If there is an edge and it cannot be detected, make sure the [Edge level] parameter on the [Details] Tab Page is correct.
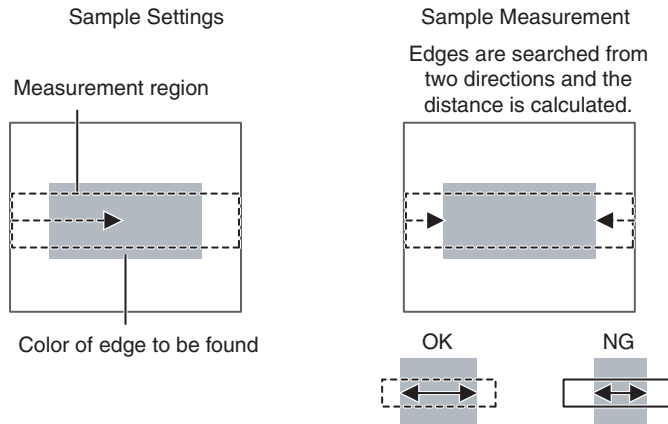
   📖   Edge level: p.41

4-7 Inspecting with the Area Inspection Item

Area Inspection Item

The measurement region is inspected for an area with the specified color.

If the offset between that area and the reference area is within the value set for the judgement parameter, the judgement will be OK.

This function is suitable for applications such as inspecting labels.

Sample Settings

Measurement region

Specified color

Sample Measurement
Judges according to the
number of pixels (area) of the
specified color.

OK   NG
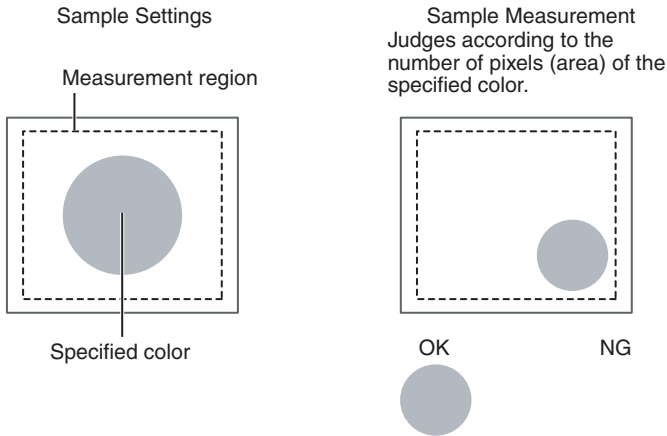
Operating Procedure for Area

Step 1   Selecting Inspection Items

▶ **[Inspect]**

1   **Press [Area].**

Registering inspection items: p.32

Step 2   Teaching

1   **Press [Teach].**

2   **Input an image of the object to use as the inspection reference.**

3   **Press [Menu] − [Meas. region] on the right of the display.**

4   **Move the rectangle to the location to be inspected.**

5   **Press [Teach] on the lower right of the display.**
The basic settings will be registered when teaching has been completed.

6   **Press [OK] to end teaching.**

Drag the center to move the rectangle.
Drag a corner to size the rectangle.

Changing the measurement region: p.38

The following data is registered as the inspection reference.

Item	Parameter	Description
Basic settings	Extract color	If the extract color has not been set, the target color will be automatically extracted.
	Reference area	The area to use as a reference is set automatically.

Step 3   Adjusting Judgement Parameters

1   **Press [Judgement].**

2   **Set the area range for an OK judgement.**
Continuous measurements will be performed for the images that are displayed.

3   **Press [OK] to enter the value.**

Lower limit   Upper limit

Blue for OK. Red for NG.

Item	Parameter	Setting	Description
Judgement Parameter	Area	Range: −9,999,999 to 9,999,999 Default: Lower limit: −1,000, Upper limit: 1,000	Set the upper and lower limits for an OK judgement. The set range is the difference between the reference area and the measured areas.

Unstable Area Results

The Desired Color Cannot Be Detected

Add a specific color or enlarge the color range.

Extraction Is Automatically Performed for an Undesired Color When Teaching

Manually set the color for which to measure the area.

▶ **[Inspect] – [Area] – [Settings] Tab Page – [Teach]**

1　**Press [Menu] – [Set color] on the right of the display.**

2　**Press the color for which you want to measure the area.**

Areas with that color will be automatically detected.
Continuous measurements will be performed for the images that are displayed.
Only the extracted color will appear on the display.

3　**Press [Teach].**

Note

Registering Up to Four Colors

Set the colors using the color palette.
Press [Menu] – [Color palette] to display the color palette.
If the *Color inv.* Option is selected, the color outside the region will become the selected color.
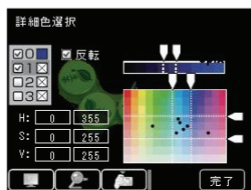
Making the Extract Color Easier to Check

• The display for the extracted color can be switched by using [Menu] – [Display Setting].
(The following display patterns can be selected for the extracted color: [Measurement Image], [All Color Image] (default), [Selected Color Image], or [Binary Image].)
• Press [Menu] – [Background color] to change the display for colors other than the extraction color.
(The color can be chosen from [Black] (default), [White], [Red], [Green], or [Blue].)

Increasing Processing Speed for Area

Make the measurement region smaller to reduce the processing time.

📖 Changing the measurement region: p.38

Measurement Data That Can Be Logged for Area

The following values can be logged as measurement data.

Measured item	Range of value	Description
Area	−9,999,999 to 9,999,999	This is the measured area of the color.

Errors

Errors in Teaching

A teaching error message will appear if the reference area registered during teaching is 0. Perform the following.
• If the color of the measurement object has changed from the specified color, set the color again and try teaching again.

If the specified color is not found during teaching, the reference area will be registered as 0. If having no area is OK, adjust the judgement parameters with this value as the reference.

4-8 Inspecting with Color Data Inspection Item

Color Data Inspection Item

The average color of the measurement region is determined, and the difference from the registered color is used for inspection. When the difference between the average color and the reference color (the color difference) is within the limits set in the judgement parameters, the image is judged as OK.

This function is suitable for applications that determine whether a part exists by the difference in color.

Sample Settings   Sample Measurement

Measurement region

Judges using the average color of the measurement region.

OK   NG
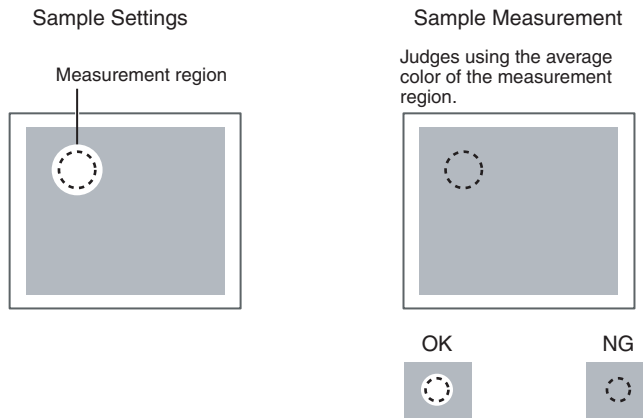
Operating Procedure for Color Data Inspection Item

Step 1   Selecting Inspection Items

▶ **[Inspect]**

1 **Press [Color Data].**

📖 Registering inspection items: p.32
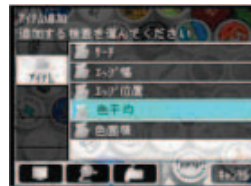
Step 2   Teaching

▶ **[Inspect]** − **[Color Data]** − **[Settings] Tab Page**

1   **Press [Teach].**

2   **Input an image of the object to use as the inspection reference.**

3   **Press [Menu]** − **[Meas. region] on the right of the display.**

4   **Move the rectangle to the location to be inspected.**

5   **Press [Teach] on the lower right of the display.**
The basic settings will be registered when teaching has been completed.

6   **Press [OK] to end teaching.**

Drag the center to move the rectangle.
Drag a corner to size the rectangle.

📖 Changing the measurement region: p.38

The following data is registered as the inspection reference.

Item	Parameter	Description
Basic settings	Hue	The hue to use as a reference is set automatically.
	Saturation	The saturation to use as a reference is set automatically.
	Brightness	The brightness to use as a reference is set automatically.

Step 3   Adjusting Judgement Parameters

▶ **[Inspect]** − **[Color Data]** − **[Settings] Tab Page**

1   **Press [Judgement].**

2   **Set the range of average colors that are to be judged as OK.**
Continuous measurements will be performed for the images that are displayed.

3   **Press [OK] to enter the value.**

Lower limit   Upper limit

Blue for OK. Red for NG.

Item	Parameter	Setting	Description
Judgement Parameter	Color Dif.	Range: −999 to 999 Default: Lower limit: −50, Upper limit: 50	Sets the upper and lower limits of the difference between the average color and reference color that is to be judged as OK.

Measurement Data That Can Be Logged (Color Data)

The following values can be logged as measurement data.

Measured item	Range of value	Description
Color Dif.	−999 to 999	This is the measured color difference.

Increasing Processing Speed for Color Data

Make the measurement region smaller to reduce the processing time.

Changing the measurement region: p.38

MEMO

Testing and Saving Settings

5-1 Performing Test Measurements

After completing the settings in the [Image], [Inspect], and [In/Out] Tab Pages, move to the Test Tab Page.
The displayed image is measured automatically. This is called a test measurement. An overall judgement of all inspection items can be performed.
Test measurements can be performed for through images (default) or saved images.

Performing Test Measurements with Samples

▶ **[Test] − [Continuous test]**

1 Press [Graphics+Details].

2 Input an image of a previously prepared object. Check the judgement results.

Note

The same six types of displays are available for the [Continuous test] on the [Test] Tab Page as in Run Mode, i.e., [Graphic], [Graphics + Details], [Statistical data], [All Results/Region], [Trend monitor], and [Histogram].

📖 Changing the Run Mode display: NTLPxREFERENCE Page XX

Performing Test Measurements with Saved Images (Re-measuring)

FQ-series Sensors can save inspected images in the Sensor's built-in memory or on an SD card. Test measurements can be performed using these saved images.
This function is useful for adjusting the judgement parameters when objects are not available.

▶ **[Test] − [Continuous test]**

1 Press 🖼️ − [Display].

2 **Select [Log] or [File].**

Images in the Sensor's built-in
memory: Press *Log.*

Images on the SD card: Press *File.*

3 **The display switches to the saved image and mea-
surements are taken again.**

📖 Saving images: NTLPxREFERENCE Page XX

5 Testing and Saving Settings

5-2 Shortening the Measurement Takt Time

Checking the Measurement Takt Time

The measurement time of FQ-series Sensors can be checked from the Setup or Run Mode display.

Setup Mode

Measurement time

The measurement time is the time taken from when a trigger is input until when all measurement processes are executed.

During the measurement time, the FQ-series Sensor will not accept the next trigger. This means that the measurement time is the basic measurement takt time.

Inputting a trigger

Measurement time
= Measurement takt time

Image input | Measurement | File logging | Display
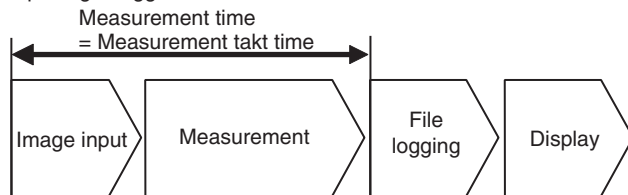
Increasing Image Input Speed

With the partial input function, it is possible to input only images that are in the region that is necessary for measurements.

The image measurement region becomes smaller and thus the image input time is shortened.

▶ **[Image]** − **[Camera setup]**

1   **Press [Menu] – [Partial input] on the right side of the display.**

2   **Change the input size.**

Important

If you use partial input, perform teaching again.

5-3 Adjusting the Judgement Parameters

Adjusting Inspection Parameters While Looking at Measurement Results

If images cannot be judged correctly, you can move directly from the Setup Mode display to the judgement parameters display to make adjustments.

▶ **[Test] – [Continuous test] – (Either display)**

1 Press [Menu] − [Adjust judgement] on the right of the display.

2 Adjust the judgement parameters.

Upper limit
Lower limit
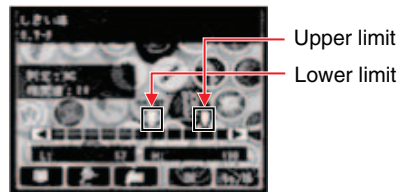
Preparing a Number of Good and Faulty Products and Setting the Best Judgement Parameters

The judgement parameters of the selected inspection items can be automatically adjusted by using actual workpieces which are considered as good or faulty products.

▶ **[Test] − [Continuous test]**

1 Move to the inspection item for which you want to automatically adjust the judgement parameters and press [Menu] – [Auto adjustment] on the right side of the display.

2 Display a sample image of a good object and press [OK sample]. Display a sample image of a bad object and press [NG sample].

3 Repeat these steps for at least two samples each.

4 Press [OK].
The best judgement parameters will be set automatically.

5-4 Adjusting All Inspection Items Together

All Teach

This function is useful if you want to update the reference of a good product for all inspection items.
For example, it can be used in situations where the lot of the measurement object changes, which results in a slight color change.

▶ **[Test] – [Continuous test] – [All results/Region]**

1 **Press [Menu] – [All teach] on the right side of the display.**
The [All teach] display will appear.

2 **Press [Teach].**
Teaching will be performed for the entire region.

Move All

The positions of the regions for all inspection items can be changed at once.
This function is useful if positions are offset when the line process changes by a line switchover.

▶ **[Test] – [Continuous test] – [All results/Region] – [Menu] – [All teach]**

1 **Press [Menu] – [Move all] on the right side of the display.**

2 **Drag the figure to move all regions at once.**

3 **Press [Menu] – [Console] to fine-tune the position of the region.**

4 **Press [OK].**
The change will be registered and the display will return to the [All teach] display.

Use the cross-key to adjust the position of the region.

5 **Press [Teach].**
Teaching will be performed for the entire region.

5-5 Checking a List of All Inspection Item Results

Individual judgement results for all inspection items can be checked in a list.
The individual inspection items can be selected to change the judgement parameters.

▶ **[Test]** − **[Continuous test]**

1 **Press [All results/Region] to display the list.**
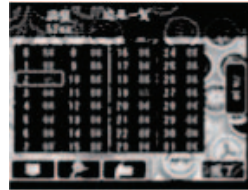
Note

Judgement parameters can also be changed from this display.
Select an inspection item and press [Menu] – [Adjust judgement].
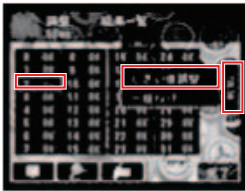
5-6   Saving Data to the Sensor before Turning OFF the Power Supply

When you have finished setting up the Sensor in Setup Mode, execute [Save data] to save the data.
If you switch to Run Mode without saving the data, a message will appear asking you to save the data. If the message appears, make sure that you save the data.

Important

Do not turn the power supply OFF while data is being saved. The data that is being saved may become corrupted.

▶ **[Test]**

1   Press [Save data].

2   Press [Yes].
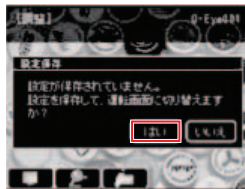
Note

• Scene data and system data can be saved in this way.

    📖 Scene data and system data details: NTLPxREFERENCE Page xx

• Measurement data and image data cannot be saved in this way.

    📖 Logging inspection data: NTLPxREFERENCE Page xx

• Settings data can also be backed up to an external memory.

    📖 Saving settings: NTLPxREFERENCE Page 104

Operation

6 Operation

6-1 Starting Operation

When test measurements and adjustments in Setup Mode have been finished, the display moves to Run Mode and actual inspections begin.

Run Mode Display

The present display name will appear.

Overall judgement

Measurement processing time
The time taken from when an image is input until all measurements have been completed.

Inspection results can be displayed in six formats, such as in a list or as a trend graph.
p.65

These buttons are displayed both in Setup and Run Mode.
p.4

Selected inspection item

Connected Sensor name

Selected scene number

Sub-menu

Tool Button or OK Button

Moving to Run Mode

You can move from Setup Mode to Run Mode by using the following procedure.

1 Press [Run].

2 Press [Switch to Run mode].

Note

- Returning to Setup Mode
  Press [   ] and press [Sensor settings].

- Signal Status When Moving to Run Mode
  When moving to Run Mode, the signal will change as shown below and data can be input from and output to an external device.

Display — Setup Mode — Run Mode

BUSY signal — ON — OFF

The BUSY signal that was always ON will turn OFF.
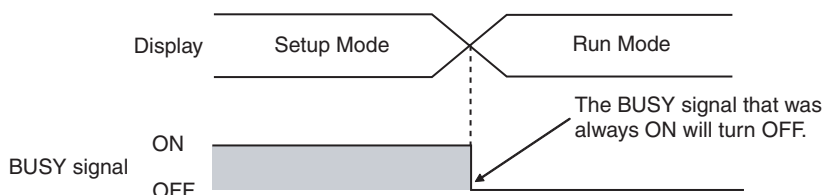
6-2 Changing the Run Mode Display

There are six types of displays that can be used, as shown below.
Select the display that is appropriate for the application and purpose.

Checking the Judgement Results of Inspection Items		Checking the Overall Judgement Result History
Graphics	**Graphics + Details**	**Statistical Data**

The image and region currently being measured will appear.

In addition to [Graphics Only] display, individual judgement results and measurement values of selected inspection items will appear.

The currently measured image and history of the overall judgement results (measurement count, NG count, and NG rate) will appear.

Checking the Judgements of All Inspection Items in a List	Displaying Measurement Result Histories	
All Results/Region (Standard Models Only)	**Trend Monitor**	**Histogram**

The judgement results of all inspection items can be checked in a list.
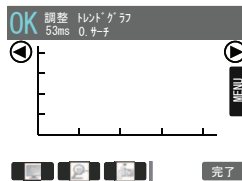
The statistical data for the currently selected inspection item can be checked against time.

📖 p.66
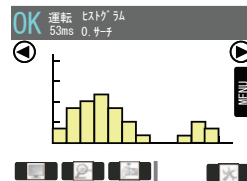
The distribution of inspection results of the currently selected inspection item can be checked.

📖 p.66

▶ 🔲 **(Run Mode)** − **[Select display]**

Specifying the Startup Run Mode Display

The display that appears when power supply is turned ON can be changed.
The default setting is [Graphics].

▶ 🔲 **(Run Mode)** − **[TF settings]** − **[Startup display]** − **[Display pattern]**

Changing the Inspection Item Results to Display

You can change the inspection results of the currently displayed inspection item to the inspection results of the next inspection item.

Switches to the previous inspection item.
　Switches to the next inspection item.

6 Operation

6-3 Checking the Trend of Measurement Results with Graphs

Measurement result histories can be checked using the trend monitor and histograms.

Trend Monitor

Changes in the measurement values of the selected inspection item against time can be observed from the graph. It becomes possible to predict when malfunctions may occur or to analyze the cause of the malfunction by checking the trends in the measurement values. The most recent 1,000 measurement values are displayed on the graph.

• [Trend Monitor] Display

Switches the display to the previous inspection item number.

Measurement values

Switches the display to the next inspection item number.

Upper limit of judgement values

Lower limit of judgement values

Order of occurrence

Changes in the measured value of the selected inspection item are displayed against time in a graph.
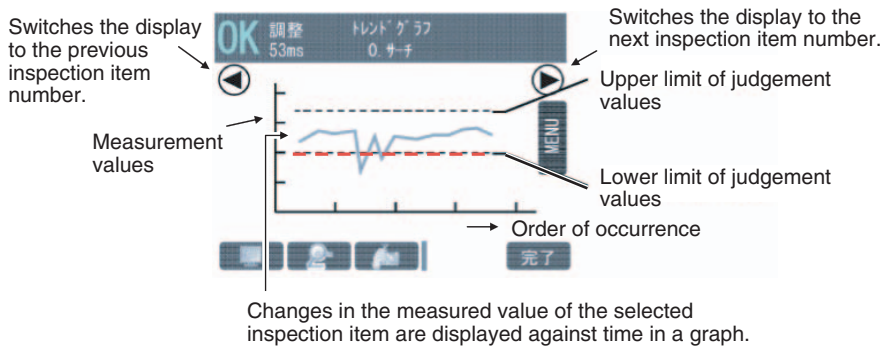
▶ (Run Mode) − [Select display] − [Trend Monitor]

Arranging the Trend Monitor Display

The display range for the vertical axis and display conditions for the horizontal axis can be changed. However, the display range and the number of data settings are disabled when a display other than the trend monitor is displayed.

• Changing the Display Range of the Vertical Axis

1 Press [Menu] − [Display range] on the right of the trend monitor.

2 Set the minimum and maximum values of the measurement values.

• Changing the Number of Values That Are Displayed

1 Press [Menu] − [Number of data] on the right of the trend monitor.

2 Select the number of values from 200, 400, and 1,000.

> **Note**
>
> • Trend monitor data is held until the power supply is turned OFF.
> • You can select whether to display all data on the trend monitor or only data for which the overall judgement is NG. Logging settings are applied to the trend monitor as well.
>   However, they are not applied to trend monitor when it is displayed in Setup Mode.
>
> 📖 Check recent inspection trends (recent results logging): NTLPxREFERENCE Page 100

Histograms

The distribution of each measurement value can be checked on a histogram.

The most recent 1,000 measurement values are displayed on a graph.

Switches the display to the previous inspection item number.

Switches the display to the next inspection item number.

Number of measurement values

Measurement values

This is equivalent to the judgement value of the selected inspection item.
The distribution of measurement values is displayed in a histogram.
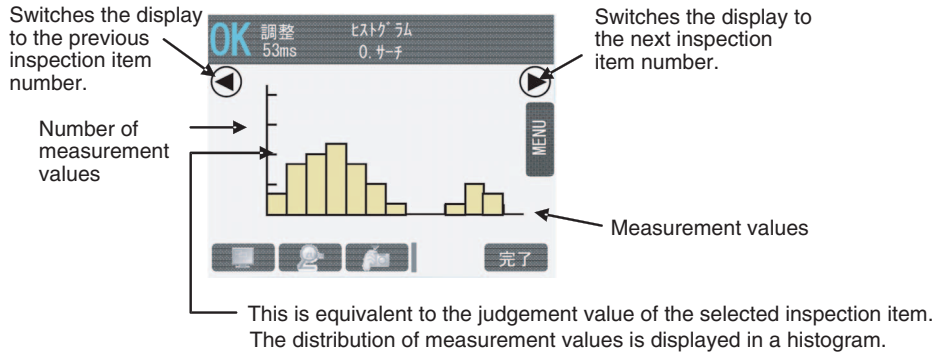
▶ 　　　 (Run Mode) − [Select display] − [Histogram]

> **Note**

- Histogram data is held until the power supply is turned OFF.
- You can select whether to display all data in the histogram or only data for which the overall judgement is NG.
  Logging settings are applied to the histogram as well.
  However, they are not applied to histograms displayed in Setup Mode.

  📖Check recent inspection trends (recent results logging): NTLPxREFERENCE Page 100

6 Operation

6-4   Adjusting Judgement Parameters without Stopping Measurements

This Sensor enables inspection parameters to be adjusted while measurements are being performed.
Downtime can be eliminated with this feature because the production line does not have to be stopped while making adjustments.

Preparations

This function is switched OFF as a default to prevent it from inadvertently working during operation.
Turn ON the function if you want to use it.

▶   (Setup Mode) – [Sensor settings] – [Adjust judgement]

   1   **Press [ON].**

Changing the Judgement Parameters in Run Mode

This section describes how to change the judgement parameters without stopping measurement in Run Mode.

▶ **Run Mode**

   1   **Select the inspection item for which you want to adjust the inspection parameters using the ◀ and ▶ Buttons.**

   2   **Press [Menu] – [Adjust judgement].**

   3   **Change the adjustment parameters with the slider.**

   4   **Press [OK].**
              The judgement results with the changed judgement parameters will appear.

Important

The changed judgement parameters will not be reflected in the measurement result until [OK] is pressed.

Setting Up Communications with External Devices

8-1 Checking Operation with the Default Settings

This section describes the basic connections and signal flow with external devices.
With the default settings, the Sensor operates in the following manner.

Trigger Sensor   FQ Vision Sensor   External device

(1) Measurement trigger input   (3) Judgement results output

(2) Measurements performed

(1) Measurement trigger input (TRIG signal) — ON / OFF

The trigger to perform measurements once is turned ON.

You can confirm if measurements are in progress.

(2) Executing measurement processing (BUSY signal) — ON / OFF

ON while measurements are in progress

This signal stays ON until the next measurement trigger can be input.

Turned ON when overall judgement is NG.

(3) Judgement results output (overall judgement: OR signal)

Retained until the next judgement results are output.

> **Important**
>
> - Create the ladder program to control the TRIG and IN5 input signals so that they do not turn ON while the BUSY signal is ON. If not, a TRIG input error will occur and the ERROR signal will turn ON.
> - Operation When the Sensor Power Supply Is Turned ON
>   The BUSY signal will operate as shown below when the Sensor's power supply is turned ON.
>   Create the ladder program in the PLC or other external device so that the BUSY signal is ignored while it turns OFF, ON, and OFF again for ntlp??? ms plus ntlp??? ms after the power supply is turned ON.

Power supply — 24 V / 0 V

● ms   ★ ms   Turns ON when the Sensor can begins measuring.

BUSY — ON / OFF

Sensor system is initializing
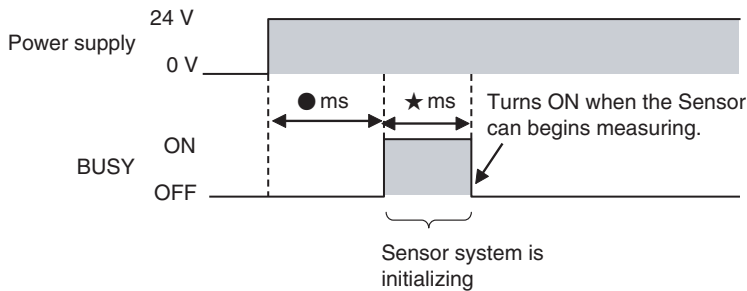
Changing the Operation

The following changes can be made depending on the system configuration and application.

Type of change	Change	Reference
Changing the type of measurement trigger	Performing continuous measurements	p.72
Changing the output method of the judgement results	Obtaining individual judgement results	p.75
	Adjust the judgement output timing	p.77
	Changing the judgement output ON conditions	p.79

8-2 Setting the Measurement Trigger

The measurement trigger can be chosen from the following two types:
• One-shot measurement: One measurement is performed for each external trigger.
• Continuous measurement: Measurements are performed continuously.

Performing One Measurement for Each External Trigger

A measurement trigger is input as the TRIG signal from a proximity sensor, PLC, or other external device.
One measurement is performed when the TRIG signal turns ON.
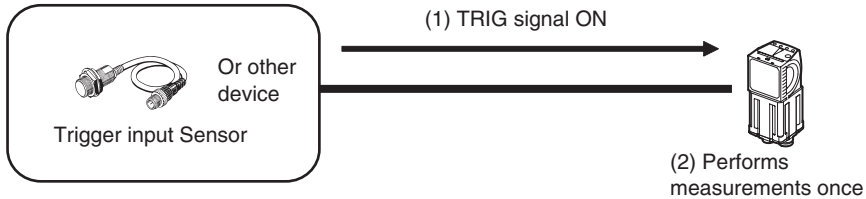
Wiring

Color	Signal	Description
Pink	TRIG	Trigger signal
Black	OUT0 (OR)	Overall judgement (default assignment)
Orange	OUT1 (BUSY)	Processing in progress (default assignment)

The signals shown at the left are used.
Refer to the following information for signal wiring.

📖 NTLPxREFERENCE p.000

Timing Chart
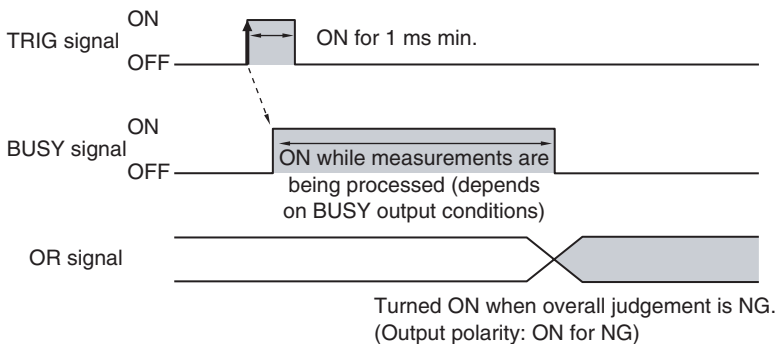
1. Turn ON the TRIG signal while the BUSY signal is OFF.
2. Measurement begins and the BUSY signal is turned ON during the measurement process.
3. When the measurement has been finished, the measurement result is output using an OR signal, and the BUSY signal is turned OFF. [1]

*1: You can also set the signal to be turned OFF after data logging, image logging, or displaying results in the [BUSY output].

Settings

▶ **[Image]** − **[Trigger setup]** − **[Trigger source]**
Press [External trigger] (default).

Sample Ladder Program

Enter the following ladder program so that the TRIG signal turns ON only while the BUSY signal is OFF.
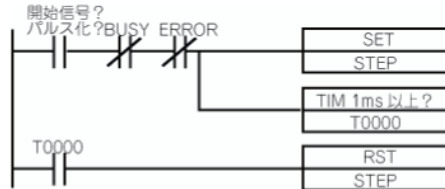
Performing Continuous Measurements

The measurement trigger for starting continuous measurements is the IN0 to IN5 signals input from an external device, such as a sensor or PLC.
Immediately after a measurement is performed, the next measurement is performed.
This is repeated while a continuous measurement command is input with the IN0 to IN5 signals.

(1) IN5 signal ON (IN0 to IN4 are OFF)

Or other device

PLC

(2) Performs continuous measurements
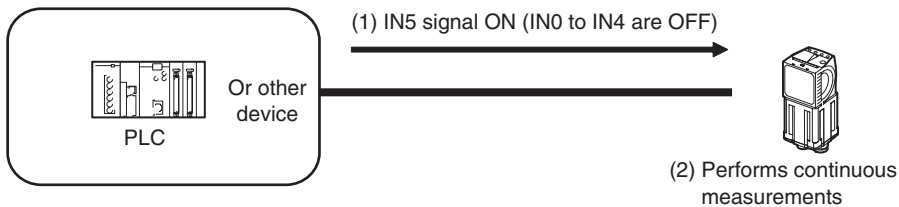
| Note |

• This function can be used only when the input mode is set to Expanded Mode.

Wiring

Color	Signal	State	Description
Gray	IN0	OFF	Command parameters for continuous measurements
Green	IN1	OFF	
Red	IN2	OFF	
White	IN3	OFF	
Purple	IN4	OFF	
Yellow	IN5	ON	Command input for continuous measurements
Black	OUT0 (OR)	--	Overall judgement (default assignment)
Orange	OUT1 (BUSY)	--	Processing in progress (default assignment)

The signals shown at the left are used.
Refer to the following information for signal wiring.

NTLPxREFERENCE p.000

Timing Chart
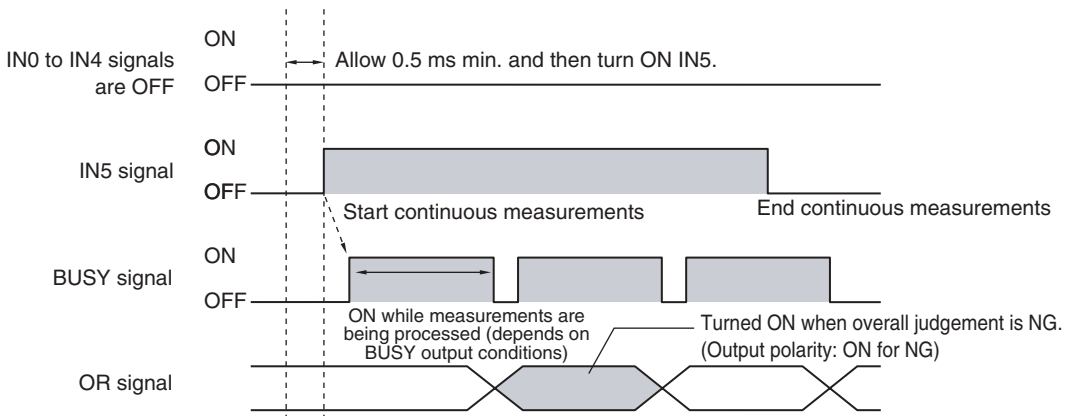
1. Turn ON IN5 while IN0 to IN4 are OFF. If status is held while the BUSY signal is OFF, continuous measurements will begin and the BUSY signal will switch ON and OFF for each measurement process.
2. Continuous measurements end when IN5 is turned OFF.

Settings

• Trigger Type
▶ **[Image]** − **[Trigger setup]** − **[Trigger source]**
Press [External trigger] (default).

• Input Mode
▶ **[In/Out]** − **[I/O setting]** − **[Input]** − **[Input mode]**
Press [Expanded mode].

Sample Ladder Program

Enter the following ladder program so that IN0 to IN4 are turned OFF and IN5 is turned ON while the BUSY signal is OFF.

8-3 Setting the Outputs

Accessing the Overall Judgement Result

When the results of the inspection items are judged, if even one individual judgement result is NG, the OR output signal is turned ON.

Individual judgement results

Inspection item 0 → OK

Inspection item 1 → NG

Overall judgement

NG (OR signal ON)

Inspection item 31 → OK

If there is even one NG judgement, the overall judgement will be NG and the output will be turned ON.
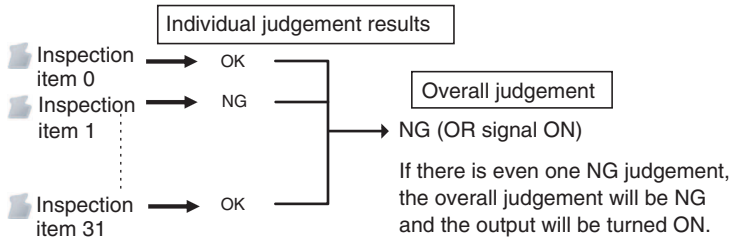
Note

The overall judgement result output signal can also be turned ON when all individual judgement results are OK.

Changing the judgement output ON condition: NTLPxREFERENCE Page 121

Wiring

Color	Signal	Description
Black	OUT0 (OR)	Overall judgement (default assign-ment)

The signals shown at the left are used.
Refer to the following information for signal wiring.

NTLPxREFERENCE p.000

Timing Chart

The OR signal that is output is held until the next overall judgement is output.

TRIG signal — ON / OFF — ON for 1 ms min.

BUSY signal — ON / OFF — ON while measurements are being processed (depends on BUSY output conditions)

OR signal — Overall judgement *1

Turned ON when overall judgement is NG.
(Output polarity: ON for NG)
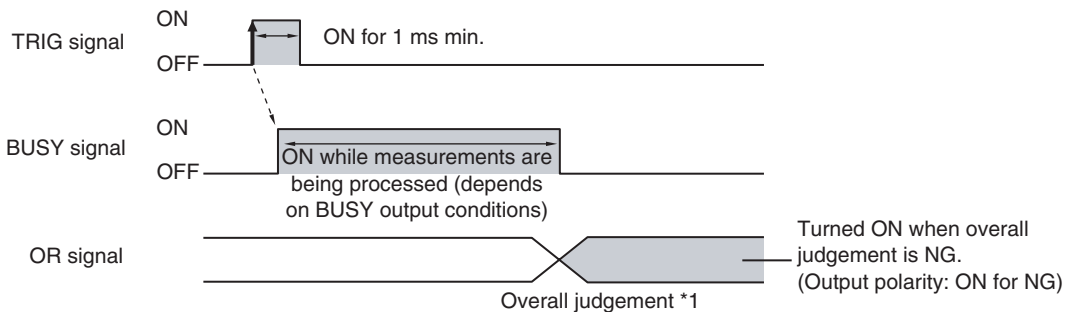
*1: The timing for updating the OR signal is when the measurement results are finalized, regardless of the output settings of the BUSY signal (BUSY output conditions).

Note

The timing for updating the OR signal and the ON time after judgement processing can be changed.

Adjusting the judgement output timing: NTLPxREFERENCE Page 119

• Trigger Type

▶ **[Image]** − **[Trigger setup]** − **[Trigger source]**

Press [External trigger] (default).

• Input Mode

▶ **[In/Out]** − **[I/O setting]** − **[Input]** − **[Input mode]**

Press [Standard mode] (default).

Obtaining Individual Judgement Results

Up to three judgement results of individual inspection items (individual judgement signals OR0 to OR31) can be assigned to terminals OUT0 to OUT2 and output to external devices.

Output terminal	Output signals that can be assigned
OUT0	• OR (default) • OR0 to OR31
OUT1	• BUSY (default) • OR0 to OR31
OUT2	• ERROR (default) • OR0 to OR31

Wiring

Example: Signals are assigned to terminals OUT0 to OUT2 as shown below.

• OUT0: Inspection number 2 (OR2)
• OUT1: Inspection number 5 (OR5)
• OUT2: Inspection number 14 (OR14)

Color	Signal	Description
Black	OUT0 (OR2)	Outputs the judgement for OR2.
Orange	OUT1 (OR5)	Outputs the judgement for OR5.
Light blue	OUT2 (OR14)	Outputs the judgement for OR14.

The signals shown at the left are used.
Refer to the following information for signal wiring.

📖 NTLPxREFERENCE p.000

As described above, if terminals OUT0 to OUT2 are all assigned to individual judgement output signals, the BUSY signal and ERROR signal assigned as the default settings will no longer be output.

Timing Chart

Output OR0 to OR31 signals are held until the next judgement output.

TRIG signal — ON — OFF — ON for 1 ms min.

BUSY signal — ON — OFF — ON while measurements are being processed (depends on BUSY output conditions)

Example:
OR0 signal — Turned ON when individual judgement is NG. (Output polarity: ON for NG)

OR1 signal — Turned ON when individual judgement is NG. (Output polarity: ON for NG)
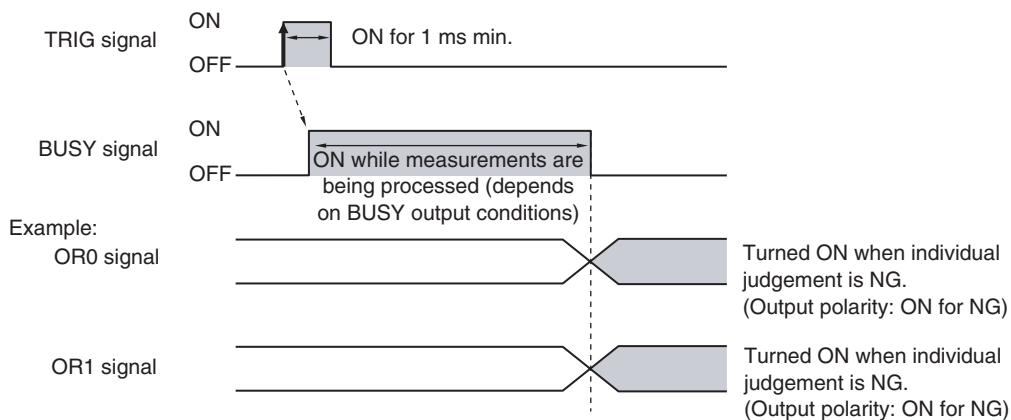
Note

The timing for updating the OR0 to OR31 signals and the ON time after judgement processing can be changed.

Adjusting the judgement output timing: NTLPxREFERENCE Page 119

Settings

▶ **[In/Out]** − **[I/O setting]** − **[Output]**

1 **Press [OUT0].**

2 **Press [OR2].**
OR2 output signal was assigned to OUT0.

3 **Assign the others in the following manner.**
OUT1: OR5

OUT2: OR14

Adjust the Judgement Output Timing

The output timing of the OR signal or OR0 to OR31 signals can be selected from two modes depending on the external device.

Selecting the OFF Timing

• Level output (default)

The status of the output OR signal is held until the next OR signal is output.

ON for 1 ms min.

TRIG signal	ON / OFF
BUSY signal	ON while measurements are being processed (depends on BUSY output conditions)
OR signal	ON / OFF

NG   OK

Overall judgement
(Output polarity: ON for NG)

Held until the next
judgement result is output
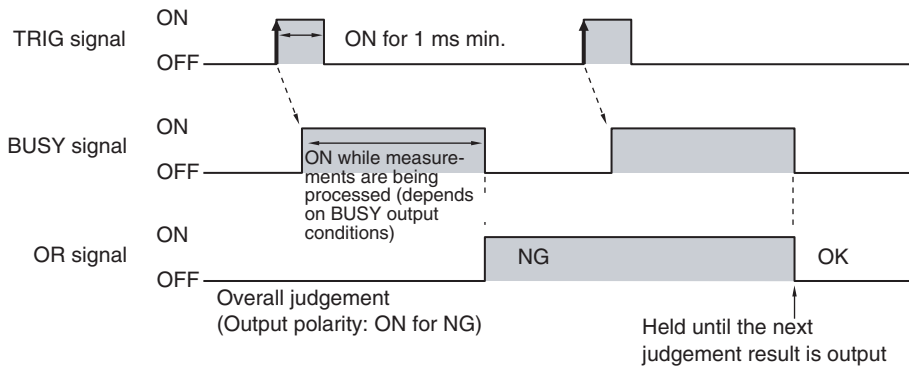
• One-shot output

The status of the output OR signal is turned OFF after a specified time has passed. (Setting range: 0 to 999 ms)

ON for 1 ms min.

TRIG signal — ON / OFF

BUSY signal — ON while measurements are being processed (depends on BUSY output conditions)

OR signal — ON / OFF

NG   OK

Overall judgement
(Output polarity: ON for NG)

One-shot
output time   Turns OFF.
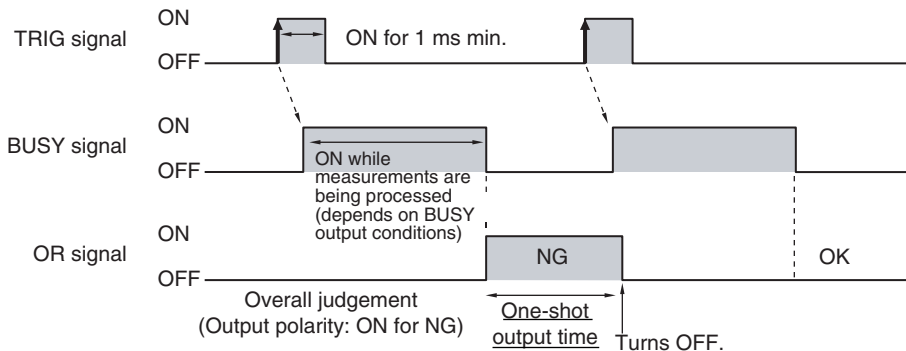
Delaying the Output Timing

When using one-shot output, the output timing of the OR signal can be delayed. (Setting range: 0 to 999 ms)

ON for 1 ms min.

TRIG signal — ON / OFF

BUSY signal — ON while measurements are being processed (depends on BUSY output conditions)

OR signal — ON / OFF

NG

Overall judgement
(Output polarity: ON for NG)

One-shot
output delay   Held for the one-shot
output time.
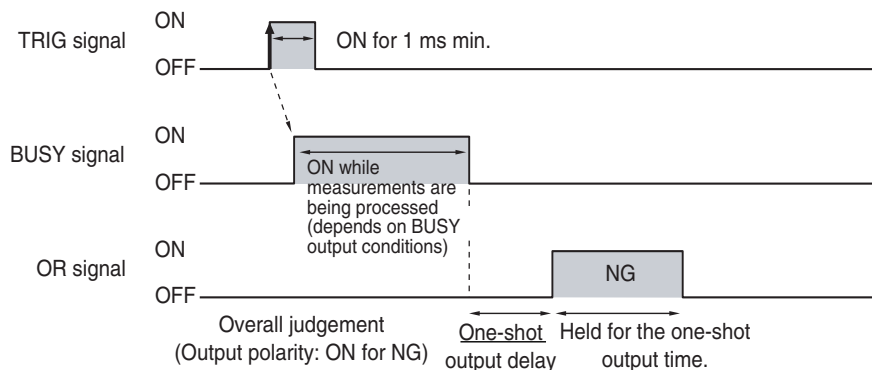
Settings

▶ **[In/Out]** − **[I/O setting]** − **[Output]**

1   **Press [Output mode] and press [Level output] or [One-shot output].**

2   **Press [Output Delay] and set the one-shot output delay.**

3   **Press [Output time] and set the one-shot output time.**

Item		Description
Output mode	One-shot output	After the measurement results are finalized, if the judgement output ON condition is met, the OR signal is turned ON for the one-shot output time. It is then turned OFF once the specified time has expired.
	Level output (default)	The judgement is output after measurement results are finalized and the ON/OFF status of the OR signal is held until it is changed for the next inspection result.
Output delay		When one-shot output mode is selected, this parameter sets the delay from when an inspection is completed until when the OR signal turns ON. (Setting range: 0 to 999 ms)
Output time		When one-shot output mode is selected, this parameter sets the time that the OR signal is ON. (Setting range: 0 to 999 ms)

Important

When one-shot output is selected as the output mode, make the following value smaller than the trigger input period.

• One-shot delay time + One-shot output time

Changing the Judgement Output ON Conditions

The ON condition for the OR signal or the OR0 to OR31 signals can be set to be output when the judgement results are OK or when they are NG. The default setting is when they are NG.

Settings

▶ **[In/Out] – [I/O setting] – [Output] – [Output polarity]**

Item		Description
Output polarity	OK: ON	The output is turned ON if the judgement is OK. For the overall judgement, the output is turned ON if all judgements are OK.
	NG: ON (default)	The output is turned ON if the judgement is NG. For the overall judgement, the output is turned ON if even one judgements is NG.

8-4 Controlling the Sensor from an External Device

The following Sensor functions can be controlled with command inputs from an external device without connecting the Touch Finder.

Function	Description	Reference
Switching the scene	This command changes the scene when the line process changes.	p.80
Re-registering the model or reference color	This command re-registers the judgement references for inspection when levels are changed.	p.81
Clearing an error	This command turns the ERROR signal OFF.	p.83
Continuous measurement	Continuous measurement is performed while this command is input.	p.72

Changing the Scene

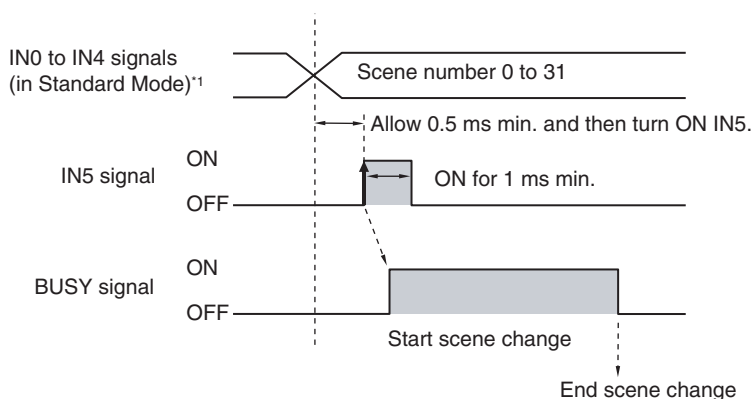This section describes how to change the line process by changing the scene.

Wiring

Color	Signal	State		Description
		Input Mode		
		Standard Mode	Expanded Mode	
Gray	IN0	Scene number (0 to 31)	Scene number (0 to 15)	Specifies the scene number.
Green	IN1			
Red	IN2			
White	IN3			
Purple	IN4		ON	
Yellow	IN5	ON		Trigger to change the scene
Orange	OUT1 (BUSY)	--		Processing in progress (default)

The signals shown at the left are used.
Refer to the following information for signal wiring.

NTLPxREFERENCE P.000

Timing Chart

IN0 to IN4 signals (in Standard Mode)[*1]   Scene number 0 to 31

Allow 0.5 ms min. and then turn ON IN5.

IN5 signal   ON / OFF   ON for 1 ms min.

BUSY signal   ON / OFF

Start scene change

End scene change

*1: In Expanded Mode, specify scene numbers 0 to 15 using the IN0 to IN3 signals.

1 Specify the scene number with the IN0 to IN4 signals. (Standard Mode)
2 Turn ON the IN5 signal while the BUSY signal is ON to change the scene to the specified scene.
3 The BUSY signal turns ON while the scene is being switched.

Settings

▶ **[In/Out]** − **[I/O setting]** − **[Input]** − **[Input mode]**
The scene numbers that can be used depend on the input mode.
Standard Mode (default): Scene 0 to 31
Expanded Mode: Scene 0 to 15

Sample Ladder Program

Enter the ladder program so that IN5 turns ON only while BUSY is OFF.

Start signal	End signal	BUSY	ERROR	
				0 hex（00000）を IN4～IN0に転送？
T0000				TIM?ms T0000
				IN5をSET？
End signal	Start signal	BUSY?	ERROR?	IN5をRST？

Registering the Inspection Reference Again

The model and reference color can be re-registered with commands from an external device, such as a PLC, based on the image that was just input when the line process was changed.

Inspection item	Re-registered data
Search	Model data
Color data	S.Color (hue, saturation, and brightness)
Edge Position, Edge Width, Area	None

Note

- Application is possibly only from the Run Mode
- Only applicable to Search and Color Data inspection items.
- If the parameter is applicable to more than one inspection item, it will be re-registered for all inspection items.

Settings

When using this function, set the input mode to *Expanded mode* in advance.
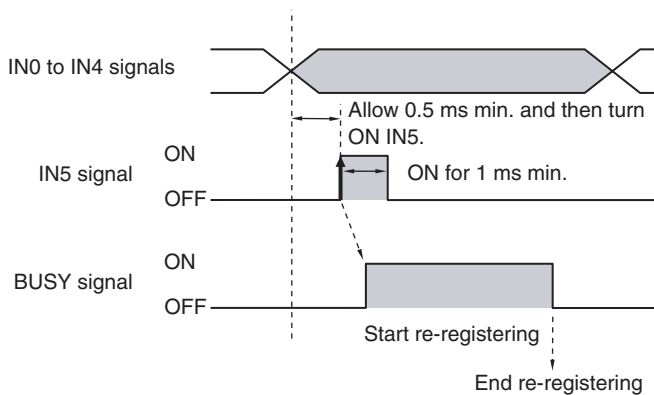▶ **[In/Out]** − **[I/O setting]** − **[Input]** − **[Input mode]**

Wiring

Color	Signal	State	Description
Gray	IN0	OFF	Command parameter for registering the model again
Green	IN1	OFF	
Red	IN2	OFF	
White	IN3	ON	
Purple	IN4	OFF	
Yellow	IN5	ON	Command input for registering the model again
Orange	OUT1 (BUSY)	--	Processing in progress (default)

The signals shown at the left are used.

Refer to the following information for signal wiring.

NTLPxREFERENCE p.000

Timing Chart

IN0 to IN4 signals

Allow 0.5 ms min. and then turn ON IN5.

IN5 signal   ON   OFF

ON for 1 ms min.

BUSY signal   ON   OFF

Start re-registering

End re-registering

1 Turn OFF IN 0 to IN4 and turn ON IN3.
2 Turn ON the IN5 signal while the BUSY signal is OFF to register the model data and reference color again from the image that was just input.
3 The BUSY signal turns ON while the parameters are being re-registered.

Sample Ladder Program

Enter the ladder program so that IN5 turns ON only while BUSY is OFF.

Start signal   End signal   BUSY   ERROR

0 hex（00000)を
IN4～IN0に転送？

T0000

TIM?ms T0000

IN5をSET？

End signal   Start signal   BUSY?   ERROR?

IN5をRST？

Turning the ERROR Signal OFF

The ERROR signal turns ON when an error occurs.

After removing the cause of the error, turn the ERROR signal OFF using one of the following methods.

Method 1: Input an error clear command from an external device such as a PLC.

Method 2: Input a measurement trigger again.

(For example, turn the TRIG signal ON during a one-shot measurement.)

The ERROR signal will turn OFF when measurement is executed correctly.

> **Note**
>
> This function can be used in Run Mode only.

Settings

When using this function, set the input mode to *Expanded mode* in advance.

▶ **[In/Out]** − **[I/O setting]** − **[Input]** − **[Input mode]**

Wiring

| Color	Signal	State	Description
Gray	IN0	OFF	Command parameter for clearing errors
Green	IN1	OFF	
Red	IN2	ON	
White	IN3	OFF	
Purple	IN4	OFF	
Yellow	IN5	ON	Command input for clearing errors
Orange	OUT1 (BUSY)	--	Processing in progress (default)
Light blue	OUT2 (ERROR)	--	ERROR signal (default)

The signals shown at the left are used.

Refer to the following information for signal wiring.

NTLPxREFERENCE p.000

Timing Chart
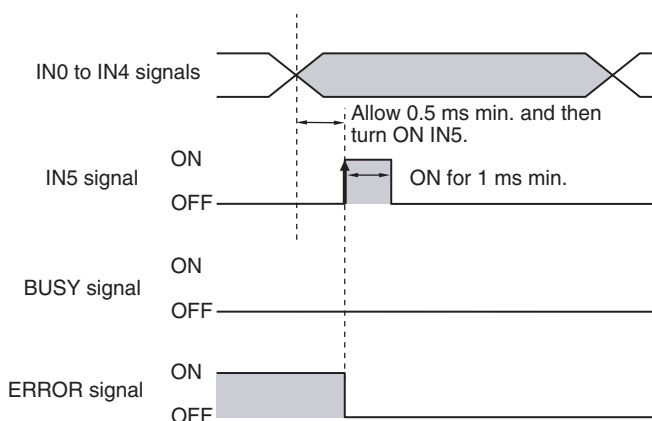
1 Turn OFF IN0 to IN1 and IN3 to IN4 and turn ON IN2.
2 Turn ON the IN5 signal while the BUSY signal is OFF to clear the error.

IN0 to IN4 signals

Allow 0.5 ms min. and then turn ON IN5.

IN5 signal — ON / OFF — ON for 1 ms min.

BUSY signal — ON / OFF

ERROR signal — ON / OFF

Sample Ladder Program

Enter the ladder program so that IN5 turns ON only while BUSY is OFF.

```
Start    End
signal   signal  BUSY    ERROR
                                 0 hex（00000）を
                                 IN4～IN0に転送？

T0000                            TIM?ms T0000
                                 IN5をSET？
End      Start
signal   signal  BUSY？  ERROR？
                                 IN5をRST？
```

8-5 Setting Up Ethernet

When the Sensor is used with a Touch Finder, IP addresses are automatically assigned. No settings are required to use Ethernet.

However, if a Sensor or Touch Finder is connected to a network where a PLC or computer is already connected, the Ethernet must be set to be compatible with the existing network.

• Sensor

▶   **(Run Mode)** − **[Sensor settings]** − **[Ethernet]**

    1   **Set [Auto connection] to [OFF].**

    2   **Set the IP address and subnet mask according to the network settings.**

• Touch Finder

▶   **(Setup Mode)** − **[TF settings]** − **[Ethernet]**

    1   **Set [Auto connection] to [OFF].**

    2   **Set the IP address and subnet mask according to the network settings.**

MEMO