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PRT1-COM & GT1 Series

PROFIBUS-DP MULTIPLE I/O TERMINAL

OPERATION MANUAL

OMRON

PRT1-COM
GT1 Series
PROFIBUS-DP
MULTIPLE I/O TERMINAL
Operation Manual

Produced December 1999

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠ **DANGER**	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **Caution**	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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About this Manual:

This manual describes the installation and operation of the PROFIBUS-DP MULTIPLE I/O TERMINAL. A modular system of I/O units (GT1 Series) connected by a communication unit (PRT1-COM) to PROFIBUS-DP. The manual includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempt-ing to install and operate the PROFIBUS-DP Communication Unit and Multiple I/O units. **Be sure to read the precautions provided in the following section.**

Section 1 gives a brief description of PROFIBUS-DP.

Section 2 describes the specification and installation of the PRT1-COM in a PROFIBUS-DP Network.

Section 3 provides an overview of the MULTIPLE I/O TERMINAL, including its features and functions.

Section 4 provides the basic procedure for operation and includes an actual example.

Section 5 provides some examples of programs used with the Counter Unit.

Section 6 provides the specifications for the basic I/O Units, the transistor Input and Output Units, and Relay Output Units.

Section 7 provides the specifications for Special I/O Units, including the Analog Input and Output Unit, and the Counter Unit.

Section 8 provides characteristics for communications by the PROFIBUS-DP Communication unit and describes how to calculate the times required for communication between the various I/O units.

Section 9 describes the troubleshooting procedures and maintenance operations.

Appendix A provides a listing of the PRT1-COM GSD file.

Appendix B provides an overview of connectable devices.

!WARNING	Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

PRECAUTIONS

This section provides general precautions for using the Programmable Controller (PC) Systems and related devices.

The information contained in this section is important for the safe and reliable application of PC Systems. You must read this section and understand the information contained before attempting to set up or operate a PC System.

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1 Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent):

- Personnel in charge of installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.

2 General Precautions

This manual provides information for programming and operating OMRON PC Systems. Be sure to read this manual before attempting to use the software and keep this manual close at hand for reference during operation.

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

⚠ **WARNING** It is extremely important that a PC System and all PC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PC System to the above mentioned applications.

3 Safety Precautions

⚠ **WARNING** Never attempt to disassemble any Units while power is being supplied. Doing so may result in serious electrical shock or electrocution.

⚠ **WARNING** Never touch any of the terminals while power is being supplied. Doing so may result in serious electrical shock or electrocution.

4 Operating Environment Precautions

Do not operate the control system in the following places:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to shock or vibration.
- Locations subject to exposure to water, oil, or chemicals.

- Take appropriate and sufficient countermeasures when installing systems in the following locations:
  - Locations subject to static electricity or other forms of electrical interference.
  - Locations subject to strong electromagnetic fields.
  - Locations subject to possible exposure to radioactivity.
  - Locations close to power supplies.

⚠ **Caution** The operating environment of the PC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PC System. Be sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

5 Application Precautions

Observe the following precautions when using the MULTIPLE I/O TERMINAL.

⚠ **WARNING** Failure to abide by the following precautions could lead to serious or possibly fatal injury. Always heed these precautions.

- Always ground the system to 100 Ω or less when installing the system to protect against electrical shock.
- Always turn OFF the power supply to the system before attempting any of the following. Performing any of the following with the power supply turned ON may lead to electrical shock:
  - Mounting or removing any Units (e.g., I/O Units, CPU Unit, etc.) or memory cassettes.
  - Assembling any devices or racks.
  - Connecting or disconnecting any cables, connectors, or wiring.

⚠ **Caution** Failure to abide by the following precautions could lead to faulty operation of or damage to the MULTIPLE I/O TERMINAL. Always heed these precautions.

- Use the Units only with the power supplies and voltages specified in the operation manuals. Other power supplies and voltages may damage the Units.
- Take measures to stabilize the power supply to conform to the rated supply if it is not stable.
- Provide circuit breakers and other safety measures to provide protection against shorts in external wiring.
- Do not apply voltages exceeding the rated input voltage to Input Units. The Input Units may be destroyed.
- Do not apply voltages exceeding the maximum switching capacity to Output Units. The Output Units may be destroyed.
- Install all Units according to instructions in the operation manuals. Improper installation may cause faulty operation.
- Be sure to tighten Backplane screws, terminal screws, and cable connector screws securely.
- Do not attempt to take any Units apart, to repair any Units, or to modify any Units in any way.
- Do not use communications cables or I/O cables in parallel to or close to high-tension, high-rate current carrying lines. Doing so may cause faulty operation

- Be sure to install the MULTIPLE I/O TERMINAL in the proper direction. Not doing so may cause faulty operation.
- When attaching Units to the DIN rail, be sure to attach them securely. Not doing so may cause the Units to be damaged.
- Use this product within the specified ranges for communications distances and connection distances. Not doing so may lead to faulty operation.
- Use the specified cables when making communications connections. Not doing so may cause faulty operation.
- Be sure to wire the communications paths, the communications power supplies, the internal power supplies, and the I/O power supplies correctly. Use voltages for the power supplies that are within the specified ranges. Not doing so may cause malfunction.
- Do not, under any circumstances, use this product with loads exceeding the contact rating values. Doing so may cause deterioration of insulation and damage.
- The life-expectancy of the relays depends greatly on the switching conditions. Before practical use of the product, perform a trial operation of the product in the actual conditions in which it will be used. Use the product at a switching frequency that will allow efficient operation. Continued use of the product in conditions causing reduced efficiency will cause deterioration of insulation and damage.
- Connection Cables
    - Before switching ON power supplies, check that the connectors are mounted securely.
    - Check that the connectors for the I/O Unit interfaces are securely locked.
- Tightening Torques
  Check that all the screws for the Units are tightened to the correct torque. Not doing so may cause faulty operation.
    - Internal power supplies, I/O power supplies, terminal screws:
      0.3 to 0.5 N • m
    - Communications cable, communications connector screws:
      0.25 to 0.35 N • m
    - High-density I/O Unit connector screws: 0.25 to 0.35 N • m
- Cleaning
    - Do not used thinner-based products for cleaning. Doing so may dissolve attachment areas or cause discoloration.
- Power Supply
    - Use separate power supplies for communications power supplies, internal power supplies, I/O power supplies, load power supplies, and encoder power supplies. Not doing so may lead to faulty operation.

⚠ Caution The following precautions are necessary to ensure the general safety of the system. Always heed these precautions.

- Provide double safety mechanisms to handle incorrect signals that can be generated by broken signal lines or momentary power interruptions.
- Provide external interlock circuits, limit circuits, and other safety circuits in addition to any provided within the PC System to ensure safety.

6 EC Directives

The MULTIPLE I/O TERMINAL conforms to EMC and Low Voltage Directives as follows:

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards (see the following note). Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer.

EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Low Voltage Directive

Always ensure that devices (Relay Units) operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards (IEC255).

The MULTIPLE I/O TERMINALS that comply with EC Directives must be installed as follows:

1, 2, 3...

1. MULTIPLE I/O TERMINALS are designed for installation inside control panels. All MULTIPLE I/O TERMINALS must be installed within control panels.
2. Used reinforced insulation or double insulation for the DC power supplies used for the communications power supply, internal circuit power supply, and the I/O power supplies.
3. MULTIPLE I/O TERMINAL products that meet EC Directives also meet the Common Emission Standard (EN50081-2). However, radiated emission (at 10 m) will vary with the overall configuration of the control panel, other devices connected to the control panel, and other conditions. You must therefore confirm that EC Directives are satisfied for the overall machine or device.

SECTION 1
PROFIBUS-DP

This section gives a brief description of PROFIBUS-DP.

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1-1 Introduction

Standard EN50170-2

PROFIBUS (**Pro**cess **Fi**eld**Bus**) is a vendor-independent, open fieldbus standard for a wide range of applications in manufacturing, process and building automation. Vendor independence and openness are guaranteed by the PROFIBUS standard EN50170-2. With PROFIBUS, devices of different manufacturers can communicate without special interface adjustments.

The PROFIBUS family consists of three compatible versions:

High speed

PROFIBUS-DP

DP stands for **D**ecentralised **P**eriphery. It is optimised for high speed and low-cost interfacing, especially designed for communication between automation control systems and distributed I/O at the device level.

Process Automation

PROFIBUS-PA

PA stands for **P**rocess **A**utomation. It permits sensors and actuators to be connected on one common bus line even in intrinsically-safe areas. It permits data communication and power supply over the bus using 2-wire technology according to the international standard IEC 1158-2.

Higher level

PROFIBUS-FMS

FMS stands for **F**ieldbus **M**essage **S**pecification. This version is the general-purpose solution for communication tasks at a higher level. Powerful services open up a wide range of applications and provide great flexibility. It can also be used for extensive and complex communications tasks.

Uniform bus access protocol

PROFIBUS-DP and PROFIBUS-FMS use the same transmission technology and a uniform bus access protocol. Thus, both versions can be operated simultaneously on the same cable. However, FMS field devices cannot be controlled by DP masters or vice versa.

⚠ Caution It is not possible to exchange one of these family members by another family member. This will cause faulty operation.

The remainder of this Operation Manual only describes PROFIBUS-DP.

1-2 Protocol architecture

OSI

The PROFIBUS-DP protocol architecture is oriented on the Open System Interconnection (OSI) reference model in accordance with the international standard ISO 7498.

	DP-Profiles
	DP-Extensions
User Interface Layer	DP Basic Functions
(7) Application Layer	NOT DEFINED
(6) Presentation Layer	
(5) Session Layer	
(4) Transport Layer	
(3) Network Layer	
(2) Data Link Layer	Fieldbus Data Link (FDL)
(1) Physical Layer	RS-485 / Fibre Optics

OSI layer model of PROFIBUS-DP

Layer 1, 2 and user interface

PROFIBUS-DP uses layers 1 and 2, and the user interface. Layers 3 to 7 are not defined.

Layer 1 (physical layer) defines the physical transmission characteristics.

Layer 2 (data link layer) defines the bus access protocol.

This streamlined architecture ensures fast and efficient data transmission. The application functions which are available to the user, as well as the system and device behaviour of the various PROFIBUS-DP device types, are specified in the user interface.

Transmission medium

RS-485 transmission technology or fibre optics are defined as transmission medium. RS-485 transmission is the most frequently used transmission technology. Its application area includes all areas in which high transmission speed and simple inexpensive installation are required. Twisted pair shielded copper cable with one conductor pair is used.

Easy installation

The RS-485 transmission technology is very easy to handle. Installation of the twisted pair cable does not require expert knowledge. The bus structure permits addition and removal of stations or step-by-step commissioning of the system without influencing the other stations. Later expansions have no effect on stations which are already in operation.

Various transmission speeds between 9.6 kbit/s and 12 Mbit/s can be selected. One unique transmission speed is selected for all devices on the bus when the system is commissioned.

Cable length

The maximum cable length depends on the transmission speed (see section 2-3-1). The length can be increased by the use of repeaters. The use of more than 3 repeaters in series is not recommended.

1-3 Device types

PROFIBUS-DP distinguishes between master devices and slave devices.

Master devices

Master devices control the data communication on the bus. PROFIBUS-DP allows more then one master in the network. A master can send messages without an external request, as long as it holds the bus access right (the token). Masters are also called active stations in the PROFIBUS-DP standard.

DPM1, DPM2

There are two types of master devices: DP master class 1 (DPM1) and DP master class 2 (DPM2).

A DPM1 is a central controller, which exchanges information with the decentralised stations (i.e. DP slaves) within a specified message cycle.

DPM2 devices are programmers, configuration devices or operator panels. They are used during commissioning for configuration of the DP system or for operation and monitoring purposes.

Slave devices

Slave devices are peripheral devices. Typical slave devices include input/output devices, valves, drives and measuring transmitters. They do not have bus access rights and they can only acknowledge received messages or send messages to the master when requested to do so. Slaves are also called passive stations.

The PRT1-COM is a modular slave device.

1-4 PROFIBUS-DP characteristics

1-4-1 Bus Access Protocol

Layer 2

The bus access protocol is defined by layer 2. This protocol also includes data security and the handling of the transmission protocols and messages.

Medium Access Control

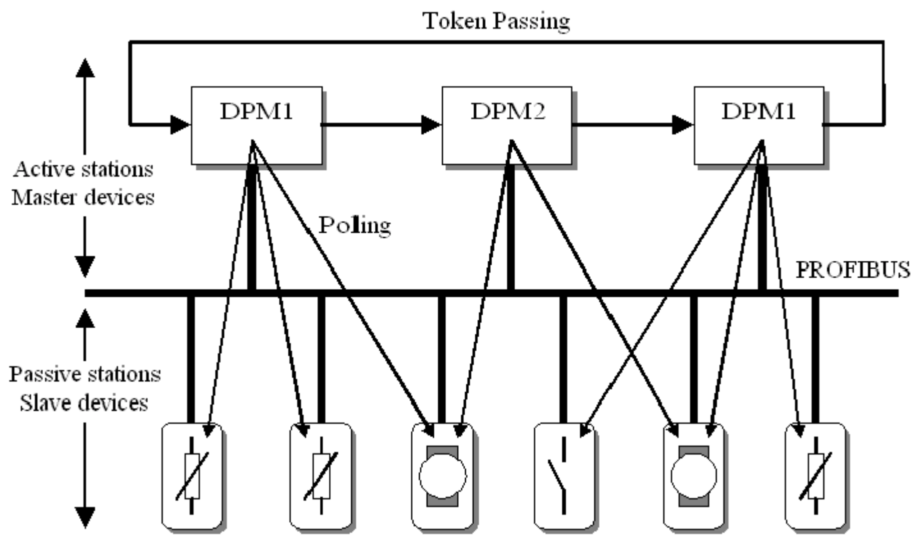
The Medium Access Control (MAC) specifies the procedures, which determine when a station is permitted to transmit data. A token passing procedure is used to handle the bus access between master devices, and a polling procedure is used to handle the communication between a master device and its assigned slave device(s).

Token passing

The token passing procedure guarantees that the bus access right (the token) is assigned to each master within a precisely defined time frame. The token message, a special message for passing access rights from one master to the next master, must be passed around the logical token ring - once to each master - within a specified target rotation time.

Polling procedure

The polling or master-slave procedure permits the master, which currently owns the token, to access its assigned slaves. The picture below shows a possible configuration.



Token passing and Slave polling mechanisms

The configuration shows three active stations (masters) and six passive stations (slaves).

The three masters form a logical token ring. When an active station receives the token message, it can perform its master role for a certain period of time. During this time it can communicate with all assigned slave stations in a master-slave communication relationship. In addition a DPM2 master can take the initiative to communicate with DPM1 master stations in a master-master communication relationship.

Multi-peer communication

In addition to logical peer-to-peer data transmission, PROFIBUS-DP provides multi-peer communication (broadcast and multicast).

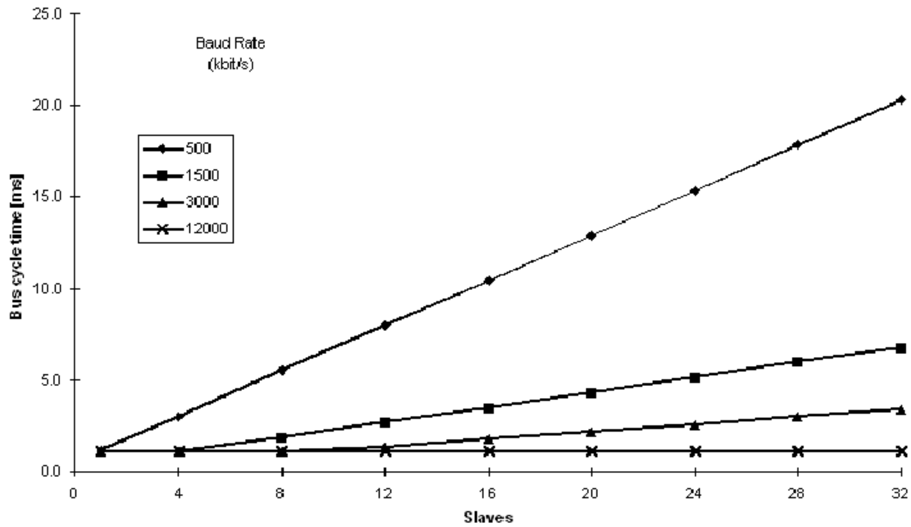
Broadcast communication:	an active station sends an unacknowledged message to all other stations (master and slaves).
Multicast communication:	an active station sends an unacknowledged message to a predetermined group of stations (master and slaves).

1-4-2 Data throughput

Transmission time

At 12 Mbit/s, PROFIBUS-DP requires approximately 1 ms for the transmission of 512 bits of input data and 512 bits of output data distributed over 32 stations.

The figure below shows the typical PROFIBUS-DP transmission time depending on the number of stations and the transmission speed. The data throughput will decrease when more than one master is used.



Bus cycle time vs number of slaves

Conditions: Each slave has 2 bytes of input data and 2 bytes of output data.

1-4-3 Diagnostics functions

Extensive diagnostics

The extensive diagnostic functions of PROFIBUS-DP enable fast location of faults. The diagnostic messages are transmitted over the bus and collected at the master. These messages are divided into three levels:

Device related diagnostics

- Device related diagnostics

  This diagnostic level concerns the general operational status of the whole device (e.g. overtemperature or low voltage).

Module related diagnostics

- Module related diagnostics

  This diagnostic level indicates that a fault is present in a specific I/O range (e.g. an 8-bit output module) of a station.

Channel related diagnostics

- Channel related diagnostics

  This diagnostic level indicates an error at an individual input or output (e.g. short circuit on output 5).

1-4-4 Protection mechanisms

Time monitoring

PROFIBUS-DP provides effective protection functions against parameterisation errors or failure of the transmission equipment. Time monitoring is provided at the DP master and at the DP slaves. The monitoring interval is specified during the configuration.

At the master

- Protection mechanism at the master.

  The DPM1 master monitors data transmission of its active slaves with the Data_Control_Timer. A separate control timer is used for each slave. This timer expires, when correct data transmission does not occur within the monitoring interval.

  If the master's Auto_Clear Mode has been enabled, the DPM1 will exit its Operate state, switches the outputs of all assigned slaves to fail-safe status and changes to its Clear status (see also section 1-4-5).

At the slave

- Protection mechanisms at the slave.

  The slave uses the watchdog control to detect failures of the master or the transmission line. If no data communication with the master occurs within the watchdog control interval, the slave automatically switches its outputs to the fail-safe status. This mechanism can be enabled or disabled for each individual slave.

  Also, access protection is available for the inputs and outputs of the DP slaves operating in multi-master systems. This ensures that direct access can only be performed by the authorised master. For all other masters, the slaves offer an image of their inputs and outputs, which can be read from any master, even without access rights.

1-4-5 Network states

PROFIBUS-DP distinguishes four different network states.

Off-line

- Off-line

  Communication between all PROFIBUS-DP devices on a network is stopped.

Stop

- Stop

  Communication between DPM1 and DP slaves is stopped. Only communication between DPM1 and DPM2 is possible.

Clear

- Clear

  DPM1 master attempts to set parameters, check the configuration, and subsequently perform data exchange with its associated DP-slaves. The data exchange comprises reading the inputs of the DP-slaves and writing zeros to the outputs of the DP-slaves.

Operate

- Operate

  DPM1 master exchanges data with its assigned slaves, inputs are read and outputs are written. Beside this, the DPM1 cyclically sends its local status to all assigned DP slaves (using a multicast message) at a configurable time interval.

Auto_clear

When an error occurs during the data exchange phase of the DPM1, the 'Auto_clear' configuration parameter determines the subsequent actions. If this parameter is set to false, the DPM1 remains in the Operate state. If set to true, the DPM1 switches the outputs of all assigned DP slaves to the fail-safe state and the network state changes to the Clear state.

1-5 Device Data Base files

Plug-and-play

DDB-file, GSD-file

To achieve simple plug-and-play configuration of the PROFIBUS-DP network, the characteristic features of a device are specified in a file. This file is called a DDB-file (Device Data Base file) or a GSD-file (Gerätestammdaten file). The GSD files are prepared individually by the vendor for each type of device, according a fixed format. Some parameters are mandatory, some have a default value and some are optional.

The device data base file is divided into three parts:

General section

- General specifications

  This section contains vendor and device names, hardware and software release versions, station type and identification number, protocol specification and the baud rates supported.

DP-master section

- DP master-related specifications

  This section contains all parameters, which only apply to DP master devices (e.g. maximum memory size for master parameter set, maximum number of entries in the list of active stations or the maximum number of slaves the master can handle).

DP-slave section

- DP slave-related specifications

  This section contains all specifications related to slaves (e.g. minimum time between two slave poll cycles, specification of the inputs and outputs and consistency of the I/O data).

Configurator

The device data base file of each device is loaded in the configurator and downloaded to the master device.

Refer to the Operation Manual of the PROFIBUS-DP Master Unit (W349) for usage of the GSD file in the master's configuration software.

1-6 Profiles

Exchanging devices

To enable the exchange of devices from different vendors, the user data has to have the same format. The PROFIBUS-DP protocol does not define the format of user data, it is only responsible for the transmission of this data.

The format of user data may be defined in so called profiles. Profiles can reduce engineering costs since the meaning of application-related parameters is specified precisely. Profiles have been defined for specific areas like drive technology, encoders, and for sensors / actuators.

SECTION 2
Installation of PROFIBUS-DP Network

This section describes the installation of the PRT1-COM within the PROFIBUS-DP Network

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2-1 PROFIBUS-DP MULTIPLE I/O TERMINAL

The PROFIBUS-DP MULTIPLE I/O TERMINAL is a system with a communication Unit and various MULTIPLE I/O Units.

The communication Unit (PRT1-COM) connects the MULTIPLE I/O Units to the PROFIBUS-DP Network. A maximum of eight MULTIPLE I/O Units can be connected to one PRT1-COM.

The PRT1-COM Unit is described in this section, the total MULTIPLE I/O TERMINAL system is described in the next section.

2-2 Communication Unit PRT1-COM

2-2-1 Specification of PRT1-COM

Item		Specification
Model		PRT1-COM
Internal power supply	Voltage range	24VDC +10% - 15% (20.4 to 26.4 VDC)
	Unit current consumption	0.18 A max. (at 24 VDC)
	Maximum current	0.6 A (with maximum output to I/O Unit) the capacity required for the internal power supply of the Communication Unit can be obtained using the following formula: Communication Unit internal power supply current = Communication Unit internal current consumption + total current Consumption for the I/O Unit interfaces.
	Inrush current	30 A max.
I/O Unit interface	Number of Units connected	8 Units max.
	Total number of inputs / outputs	Total inputs (IN): 128 bytes max. Total outputs (OUT): 128 bytes max.
	Rated output Current	0.3 A max.
	Overcurrent Protection function.	105% of rated current or higher. When an over-current occurs, the power supply to the I/O Units will remain OFF until the PRT1-COM power supply is turned OFF and ON again.
Noise immunity		1,500 V p-p Pulse width: 0.1 to 1 ms, Pulse rise time: 1 ns (via noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s^2
Shock resistance		200 m/s^2
Dielectric strength		500 VAC (between isolated circuits)
Ambient temperature		-10 °C to 55 °C
Ambient humidity		25% to 85% (with no condensation)
Operating atmosphere		No corrosive gases
Storage temperature		-25 °C to 65 °C
EMC directives		EN50081-2, EN50082-2
Mounting		DIN 35-mm rail
Mounting strength		100 N
Terminal strength		100 N
I/O Unit interface connector lock strength		50 N
Weight		Approx. 165 g

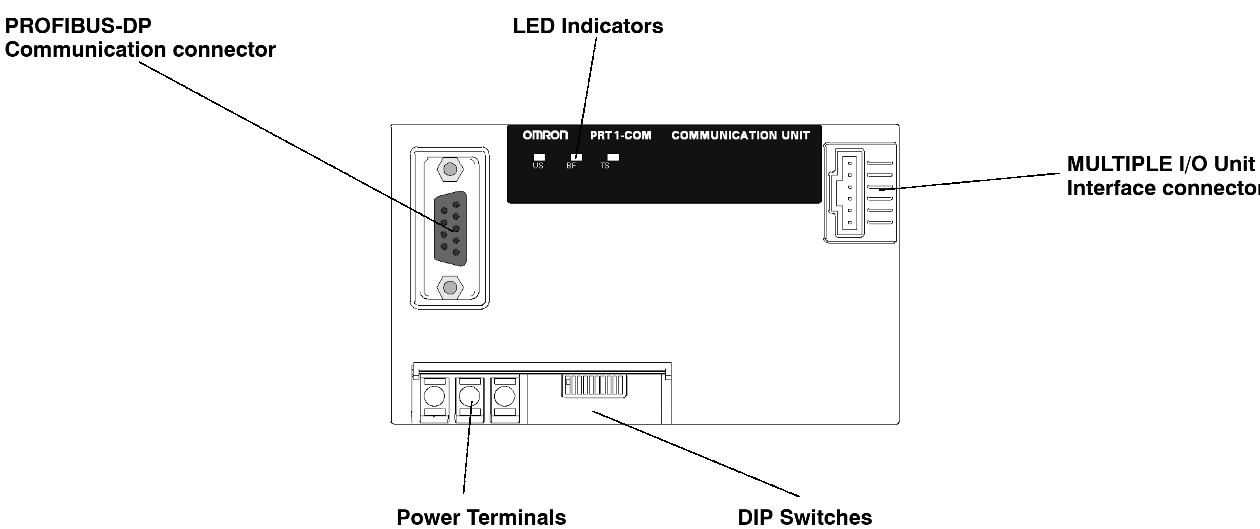
Characteristics of PROFIBUS-DP

Applicable standard	EN 50170 vol. 2
Type	PROFIBUS-DP SLAVE
Bus connector	9-pin sub-D female
Bus termination	Not included
Baud rates (Auto-detect)	9.6 k, 19.2 k, 45.45 k, 93.75 k, 187.5 k, 500 k, 1.5 M, 3 M, 6 M, 12 M bits/s
PROFIBUS address range	0 to 125
Communication cable	Type A (EN 50170-2)
Minimum slave interval time	1 ms
Input data	4 status bytes + max. 128 data bytes
Output data	max. 128 data bytes
Supported PROFIBUS-DP functions	• Data_Exchange • Slave_Diag • Set_Prm • Chk_Cfg • Global Control (SYNC, FREEZE, CLEAR) • Get_Cfg • RD_Inp • RD_Outp
PROFIBUS-DP GSD file	OC_047D.GSD

Note This product has been tested in the test laboratory of PNO (PROFIBUS Nutzerorganisation) and has been approved as conforming to the PROFIBUS-DP standard. (EN 50170-2)

2-2-2 PRT1-COM Components

The following overview shows the various components of PRT1-COM.



Power Terminals Connect to the power supply for operation and connect to the functional earth.

MULTIPLE I/O Unit interface Connects to the MULTIPLE I/O Unit communication cable.

Led Indicators

PRT1-COM has 3 LEDs to indicate the status of the Unit.

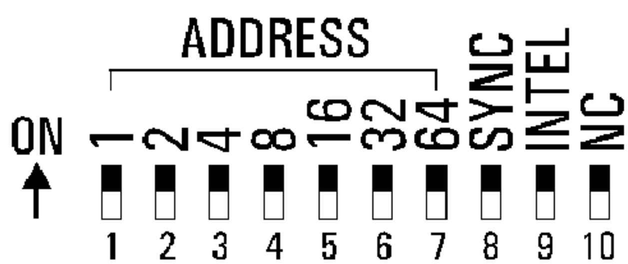
1. The Unit specific status is indicated with the US-LED
2. The BF-LED indicates the status of PROFIBUS-DP
3. The MULTIPLE I/O Bus status is indicated with the TS-LED

US LED	Colour	Description	
Unit **S**tatus	Bicolor Green / Red	OFF	PWR not OK
		Green ON	Unit OK
		Green BLINK	Initialising
		Red ON	Unit error

BF LED	Color	Description	
Bus **F**ailure (Profibus-DP)	Red	OFF	No errors
		ON	• Response monitoring time has elapsed. The master did not address PRT1-COM within the configured watchdog time. • PRT1-COM was not parameterised or not properly configured on start-up.

TS LED	Color	Description	
Terminal **S**tatus (multiple I/O)	Bicolor Green / Red	OFF	Power overload
		Green ON	Communication OK
		Green BLINK	Special I/O Unit Error
		Red ON	• Bus error • Configuration error • End station error • Max. I/O Unit over • Basic I/O Unit Error

DIP Switch Settings



Switch	Name	Purpose
1 to 7	ADDRESS	PROFIBUS-DP station address All OFF = station address 0, (default, see Note) All ON = station address 127
8	SYNC	Data exchange method: Synchronous / Asynchronous OFF = Asynchronous, (default) ON = Synchronous
9	INTEL	Double byte transfer method: INTEL / Motorola OFF = Motorola, (default) ON = Intel
10	NC	Reserved for system use. Always off

PROFIBUS-DP address setting is default set to 0.

– This setting should always be changed to appropriate value.
– Station addresses 126 and 127 are invalid and should not be used.
- Do not use station address 0 in combination with the C200HW-PRM21 PROFIBUS-DP Master.

Data exchange method

1. Asynchronous mode:
   The MULTIPLE I/O Bus transmit/receive cycles are independent of the messages being transmitted/received at the PROFIBUS-DP interface.
2. Synchronous mode:
   A MULTIPLE I/O Bus transmit/receive cycle will only be initiated if new data has been received at the PROFIBUS-DP interface.

More information can be found in: section 8-1-4.

Note Synchronous mode has no meaning when only input MULTIPLE I/O Units are attached. In this case the switch setting is ignored and asynchronous mode is used.

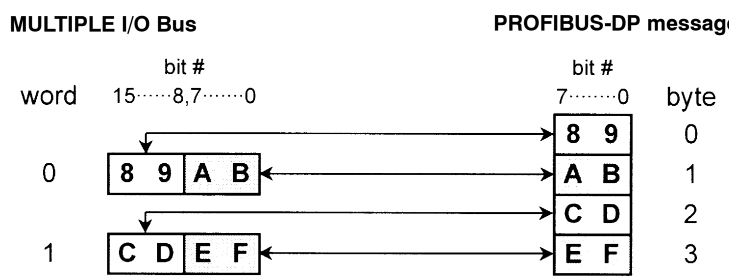
Double byte transfer method

The INTEL switch is used for selection of the little-endian/big-endian mode, to define the transfer method for double-byte data transfer between PROFIBUS-DP and MULTIPLE I/O Bus.

This allows for adjustment of the data format if required by the PROFIBUS-DP master.

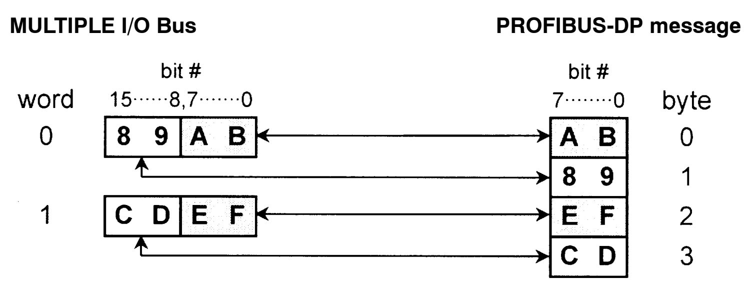
1. Big-endian mode (Often referred to as Motorola mode):

The first byte transmitted over PROFIBUS-DP is the most-significant byte whereas the second byte is the least-significant byte.



2. Little-endian mode (Often referred to as Intel mode):

The first byte transmitted over PROFIBUS-DP is the least-significant byte whereas the second byte is the most-significant byte.



Note Changing the transfer method to 'Little-endian' mode will also have impact on the transfer of the status bytes, see also section 3-2-4.

Mounting

Mount the Unit on DIN 35-mm rail using the DIN Track Mounting Hook.

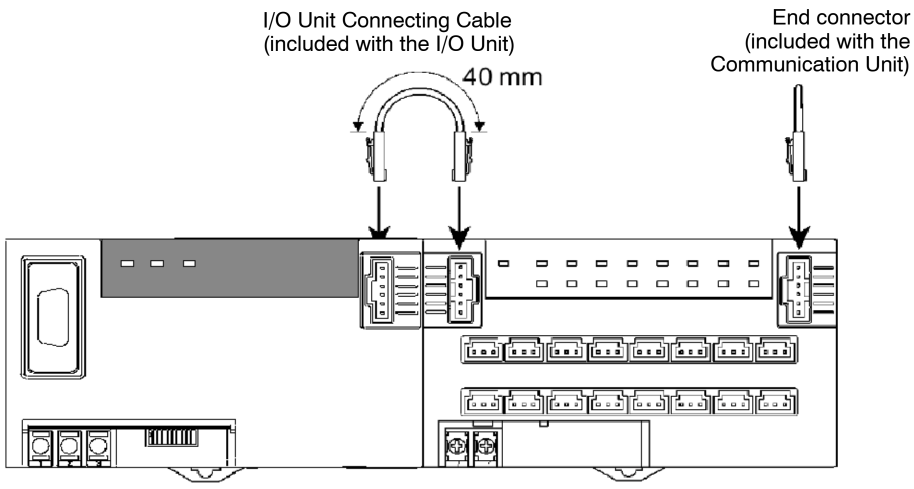
I/O Unit Bus Connectors

The I/O Unit Bus connectors on the MULTIPLE I/O Units must be connected with the appropriate cables to provide I/O Unit interface and allow power to be supplied to the I/O Units.

An End connector cable must be connected to the right-side connector of the last I/O Unit (terminator).

One I/O Unit connecting cable (cable length 40 mm) is included with each I/O Unit. One End connector is supplied with the Communication Unit. An I/O Unit connecting cable with a cable length of 1 m (GCN1-100) is sold separately.

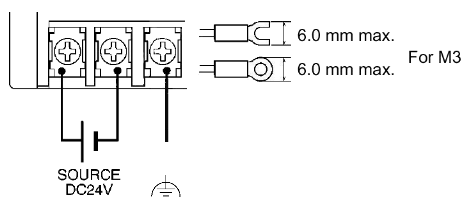
Connect the I/O Unit connecting cable to the right connector on the Communication Unit and to the left connector of the I/O Unit as shown in the following figure.



Be sure to connect the End connector to the right I/O Unit Bus connector of the last I/O Unit.

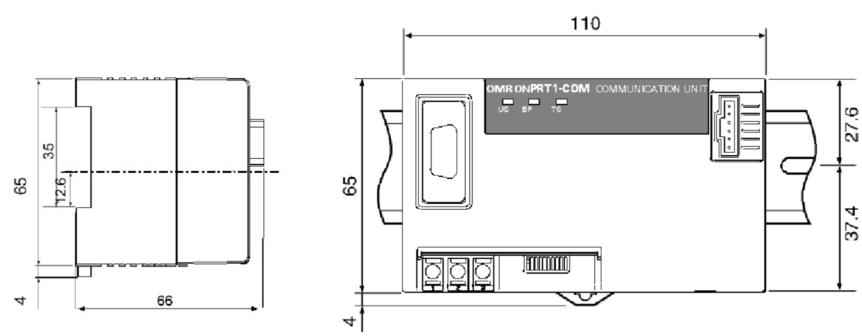
Wiring

Provide the internal power supply as shown in the following diagram.



is connected to the shield of the PROFIBUS-DP connector.

Dimensions



Side view Front view

2-3 Setting up a PROFIBUS-DP network

2-3-1 Fieldbus cabling

Bus structure

All PROFIBUS-DP devices are connected in a line structure. Each RS485 bus segment may contain up to 32 stations (masters, slaves, repeaters). When more than 32 stations are required, repeaters must be used to link the individual bus segments. The bus must be terminated at the beginning and at the end of each segment.

Cable type

The standard EN50170-2 specifies the use of shielded twisted pair cables with the following parameters (PROFIBUS-DP line type A):

PROFIBUS-DP Cable parameters

Parameter	Value
Impedance	135 to 165 Ω (3~20 MHz)
Capacitance per unit length	< 30 pF/m
Loop resistance	< 110 Ω/km
Core diameter	> 0.64 mm
Core cross section	> 0.34 mm^2 (22 AWG)

Cable

The PROFIBUS-DP User Group recommends the following colour coding for the data signal lines:

A-line - green

B-line - red

Maximum length

The maximum length of the cable depends on the transmission speed. The cable lengths specified in the table below are based on the above cable specifications.

Cable length vs. Baud rate

Baud rate (kbit/s)	length/segment (m)
9.6, 19.2, 45.45, 93.75	1200
187.5	1000
500	400
1500	200
3000, 6000, 12000	100

Stub lines

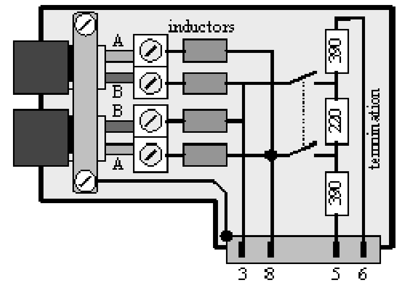
Stub lines should be avoided for data transmission speeds of more than 500 kbit/s. Plug connectors available on the market permit the incoming data cable and the outgoing data cable to be connected directly in the plug connector. This means that stub lines do not have to be used, and the bus plug connector can be connected and disconnected at all times without interrupting data communication with the other stations.

Fieldbus connector

The connector plug to connect to the PRT1-COM is a 9-pin male sub-D connector, preferably with a metal case, conducting screws and a solder lip for connecting the shield of the cable. The cable should at least be connected to pin 3 (B-line) and pin 8 (A-line) of the connector.

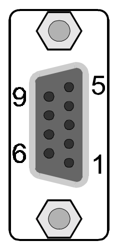
At baud rates over 1.5 Mbit/s, always use special PROFIBUS-DP connectors with built-in series inductances, to ensure that cable reflections caused by the capacitive load of each unit are minimised.

Connectors with built-in inductors and termination resistors, as shown here, are available from various manufacturers.



PROFIBUS-DP Connector with built-in inductors and termination

PROFIBUS-DP Connector



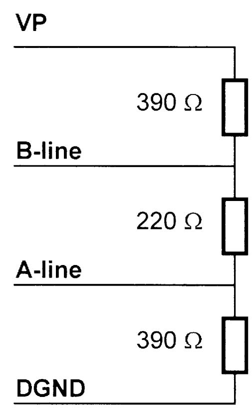
Pin No.	Signal	Description
1	Shield	Shield / protective ground
2	–	–
3	B-line	Data signal
4	RTS	Direction control signal for repeaters (TTL)
5	DGND	Data ground for terminator resistance (0 Vdc)
6	VP	Supply voltage for terminator resistance (+5Vdc)
7	–	–
8	A-line	Data signal
9	–	–
Case	Shield	Protective ground

RTS

The signal RTS (TTL signal relative to DGND) is meant for the direction control of repeaters in case repeaters without self control capability are used.

VP, DGND

The signals VP and DGND are meant to power an externally mounted bus terminator (see figure). The powering of the 220 Ω termination resistor ensures a defined idle state potential on the data lines. To ensure proper functioning up to the highest baud rate, the bus cable has to be terminated at both ends of the cable.



PROFIBUS-DP Termination

Shielding

To ensure electro-magnetic compatibility (EMC), the shield of the cable should be connected to the metal case and to pin 1 of the connector.

If the Unit is installed within a control cabinet, the cable shield of the incoming bus cable should be electrically connected to a grounding rail as close as possible to the cable lead-through using a shield grounding clamp or similar. The cable shield should continue within the cabinet to the fieldbus device and be connected there in accordance with the manufacturers instructions.

Ensure that the PLC and the control cabinet in which the device is mounted have the same ground potential by providing a large-area metallic contact to ground (use e.g. galvanised steel to ensure a good connection). Grounding rails should not be attached to painted surfaces.

If the above measures are observed, electro-magnetic interference is diverted through the cable’s shield.

You may find further information about

- Commissioning of PROFIBUS-DP equipment
- Testing the PROFIBUS-DP cable and bus connectors
- Determining the loop resistance
- Testing for correct bus termination
- Determining the segment length and cable route
- Other test methods
- Example of an equipment report

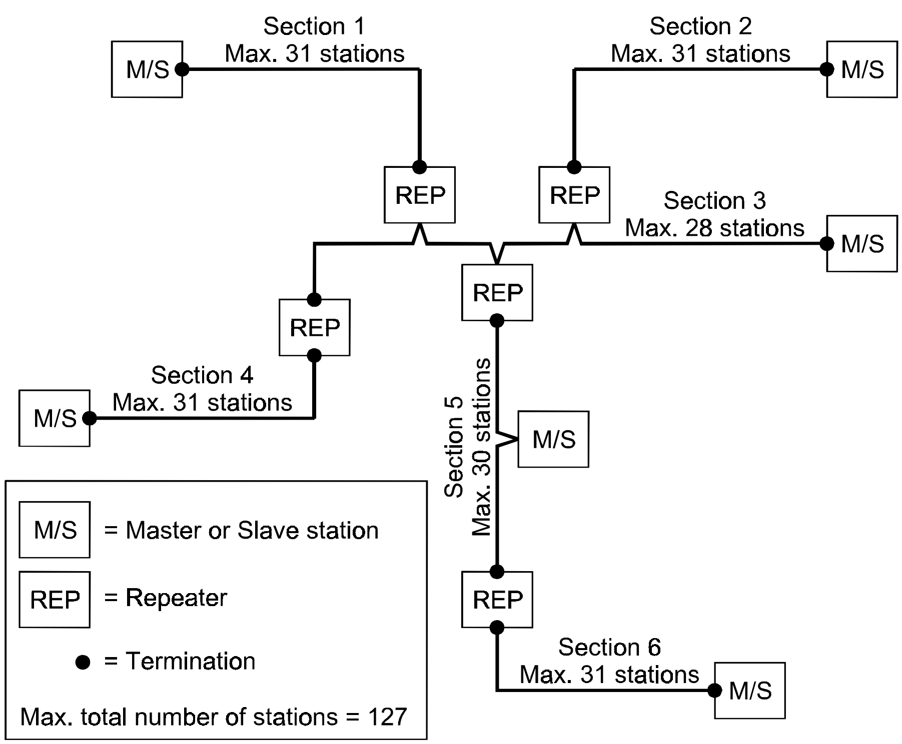
in the PROFIBUS-DP guideline ”Installation Guideline for PROFIBUS-DP/FMS” (PNO Order No- 2.112), which is available at every regional PROFIBUS-DP User Organisation.

Repeaters

The maximum communication distance can be increased by the use of repeaters. The repeater must be included in the count of the number of stations per segment. Even though repeaters do not have a node address, they represent an electrical load on the bus segment like any master or slave station.

If a repeater is located at the end of a bus segment, it should provide bus termination as well.

It is recommended to limit the number of repeaters in series between any two stations in the system to a maximum of three units, as shown in the following example (3 repeaters are encountered in communication between section 6 and sections 1, 2 and 4).



Example of a PROFIBUS system using repeaters

2-3-2 Configuring PROFIBUS-DP system

After making the physical connections of the network, the PROFIBUS-DP system needs to be configured. For each master and its assigned slaves, a configuration has to be defined using a dedicated configuration program.

Configurator

The configurator provides the master with information about:

- The slaves that are connected to the master.
- The assignment of slaves to groups for broadcast / multicast messages.
- The mapping of the slaves into the memory of the master.
- The bus parameters (e.g. baud rate, target rotation time etc.).

C200HW-PRM21

For more details about the configurator for the C200HW-PRM21 Master Unit, refer to OMRON Catalog No. W349-E1.

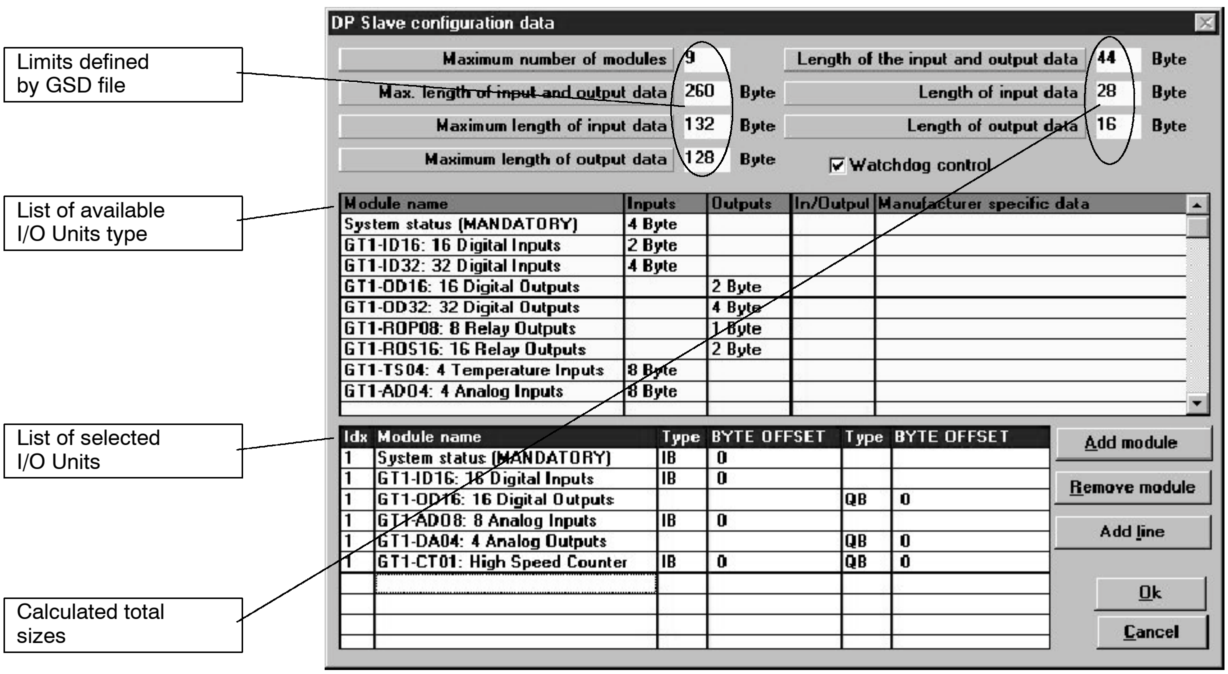
GSD file

To configure a master Unit to communicate with the PRT1-COM together with the MULTIPLE I/O Units, the PRT1-COM device database file OC_047D.GSD is required. Based on the contents of this file, the configuration program for the master Unit will allow the user to select the MULTIPLE I/O Units.

Example

The example below shows a configuration screen of the PRT1-COM. Here the PRT1-COM is configured as a slave with 5 MULTIPE I/O Units.

The terms input and output are to be interpreted as seen from the PROFIBUS-DP master unit.



PRT1-COM Configuration example

Note The System status module is mandatory. It is required for the PRT1-COM, and shall always be returned to the master, no matter how many I/O Units have been connected. It **must** be selected as the first "I/O Unit".

The list of selected I/O Units should exactly match the attached MULTIPLE I/O Units. The first I/O Unit (in the example specified in the second row: GT1-ID16-1) should be placed next to the PRT1-COM. The consecutive selected I/O Units should be physically placed in this order from left to right. The last I/O Unit (example: GT1-CT01) should be placed at the right end. This I/O Unit requires the End connector.

Check configuration

Upon startup of the PROFIBUS-DP communication, the master will send a Chk_Cfg message so that PRT1-COM can verify that the master's expected I/O configuration for the PRT1-COM is correct.

On power-up PRT1-COM determines an I/O table of the attached I/O Units. The I/O table is compared with the I/O configuration by:

– Amount of I/O bytes per I/O Unit

– Consistency per I/O Unit

– Order of I/O Units (physical position)

If it does not match completely, PRT1-COM will give a negative response to the PROFIBUS-DP master and will not exchange I/O data.

Re-use the configurator program again to match the selected I/O Units with the physically attached I/O Units in case the configuration is changed.

SECTION 3
MULTIPLE I/O TERMINAL

This section provides an overview of the MULTIPLE I/O TERMINAL, including its features and functions.

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- 3-1-2 System Configuration 24
- 3-1-3 Features 24
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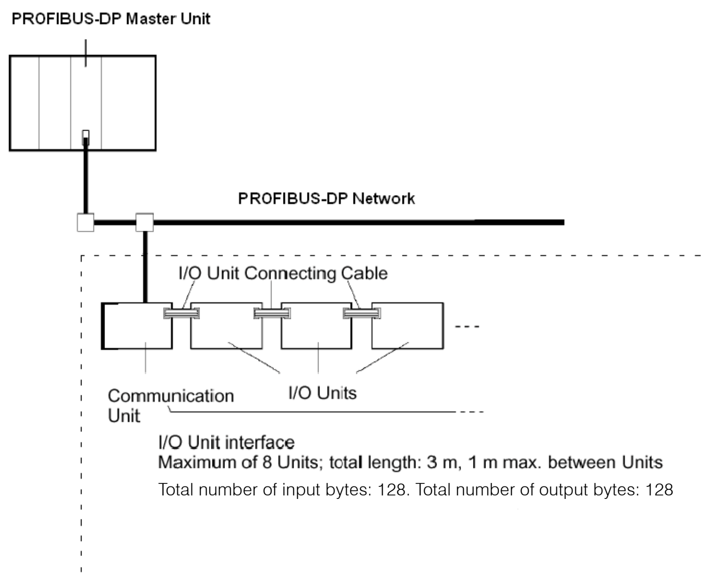
- 3-2-1 I/O Unit Interface Specifications 29
- 3-2-2 Exchanging Data 31
- 3-2-3 Allocating I/O 32
- 3-2-4 I/O Unit Interface Status 33
- 3-2-5 I/O Configuration Changes 35

3-1 MULTIPLE I/O TERMINAL

3-1-1 Overview

A MULTIPLE I/O TERMINAL is a modular PROFIBUS-DP Slave that consists of a Communication Unit providing an interface to one or more I/O Units. The I/O Unit interface supports up to 8 I/O Units and a total of up to 128 byte input + 128 byte output. I/O Units are connected using simple connections via I/O Unit Connecting Cables. Allocation and address settings on the I/O Unit interface are not required, enabling simple, flexible distributed I/O control.

3-1-2 System Configuration



3-1-3 Features

Simple Connections

The Communication Unit and the I/O Units are separate, and the Communication Unit and the I/O Units are connected through an I/O Unit interface. I/O can be expanded simply by connecting additional I/O Units to the I/O Unit interface.

Status Notification

Status information about the I/O Unit interface is transmitted as input data to the PROFIBUS-DP Master Unit (two words).

Many Types of I/O Unit

The following I/O Units are available.

- 16- or 32-point Transistor Input Units (terminal block, connector, 25-pin D-sub connector, or high-density connector)
- 16- or 32-point Transistor Output Units (terminal block, connector, 25-pin D-sub connector, or high-density connector)
- 8-point/16-point Relay Output Unit
- 4- or 8-point Analog Input Unit (terminal block or connector)
- 4-point Analog Output Unit (terminal block or connector)
- 1-point Pulse Input Unit (high-speed counter)

An I/O-intensive System Can be Built at Low Cost

Compared with fixed I/O Terminals, a high cost-performance ratio can be achieved if I/O Units are used.

3-1-4 Communication Units and I/O Units

Communication Unit

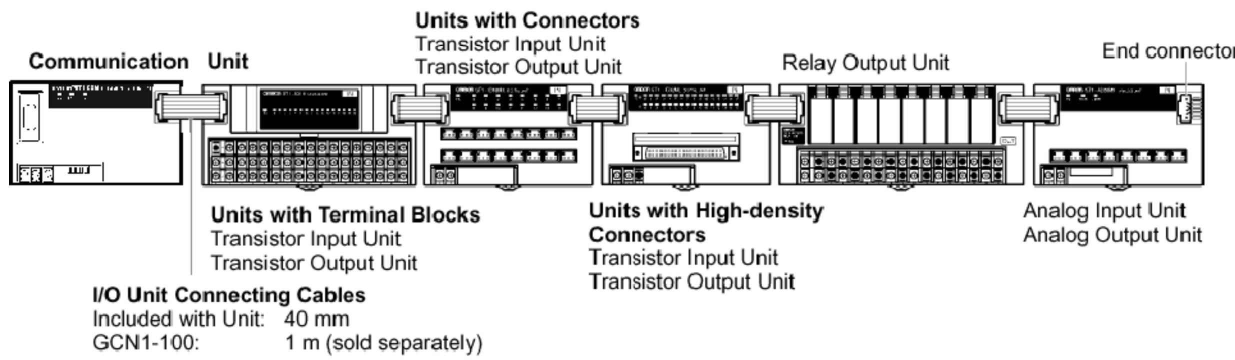
The Communication Unit interfaces the I/O Units to the PROFIBUS-DP Network.

- It automatically recognizes the configuration of the I/O Units when the I/O Unit interface is initialised.
- It notifies the connection status (status information) of the I/O Units to the PROFIBUS-DP Master Unit.
- It provides a dip-switches to set the stations address of the MULTIPOINT I/O TERMINAL as a PROFIBUS-DP Slave.

I/O Units

There are various I/O Units that can be connected to the I/O Unit interface.

- I/O Units are connected to the Communication Unit using an I/O Unit Connecting Cable (included with the I/O Unit, a 1-m I/O Unit Connecting Cable (GCN1-100) is also available).
- No address or baud rate settings are required on the I/O Units.
- The connection order of I/O Units is flexible.



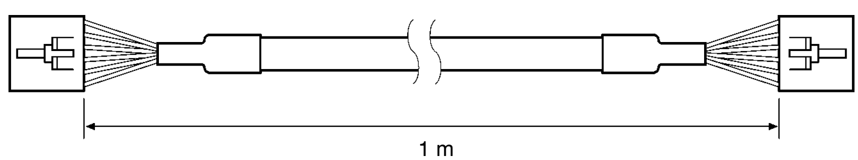
3-1-5 List of Models

Unit		I/O points	Words allocated in PC memory		I/O connections	Model number	Remarks	Unit power supply voltage	Installation
			Input	Output					
Communication Unit		None	Status two words	0 words	None	PRT1-COM	---	24 VDC (supplied from outside)	DIN track
Basic I/O Units	Transistor Input Units	16 inputs	1 word	0 words	M3 terminal block	GT1-ID16 GT1-ID16-1	NPN PNP		
		16 inputs	1 word	0 words	Connectors (made by MOLEX)	GT1-ID16MX GT1-ID16MX-1	NPN PNP		
		16 inputs	1 word	0 words	Connectors (made by FUJITSU)	GT1-ID16ML GT1-ID16ML-1	NPN PNP		
		16 inputs	1 word	0 words	Connectors (25-pin D-sub connectors)	GT1-ID16DS GT1-ID16DS-1	NPN PNP		
		32 inputs	2 words	0 words	High-density connector (made by FUJITSU)	GT1-ID32ML GT1-ID32ML-1	NPN PNP		
	Transistor Output Units	16 outputs	0 words	1 word	M3 terminal block	GT1-OD16 GT1-OD16-1	NPN PNP		
		16 outputs	0 words	1 word	Connectors (made by MOLEX)	GT1-OD16MX GT1-OD16MX-1	NPN PNP		
		16 outputs	0 words	1 word	Connectors (made by FUJITSU)	GT1-OD16ML GT1-OD16ML-1	NPN PNP		
		16 outputs	0 words	1 word	Connectors (25-pin D-sub connectors)	GT1-OD16DS GT1-OD16DS-1	NPN PNP		
		32 outputs	0 words	2 words	High-density connector (made by FUJITSU)	GT1-OD32ML GT1-OD32ML-1	NPN PNP		
	Relay Output Units	8 outputs	0 words	1 word	M3 terminal block	GT1-ROP08	---		
		16 outputs	0 words	1 word	M3 terminal block	GT1-ROS16	---		

Unit		I/O points	Words allocated in PC memory		I/O connections	Model number	Remarks	Unit power supply voltage	Installation
			Input	Output					
Special I/O Units (See note.)	Analog Input Units	4 inputs	4 words	0 word	M3 terminal block	GT1-AD04	Inputs: 4 to 20 mA, 0 to 20 mA, 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V	24 VDC (supplied from outside)	DIN track
		8 inputs	8 words	0 word	Connectors (made by MOLEX)	GT1-AD08MX			
	Analog Output Units	4 outputs	0 words	4 words	M3 terminal block	GT1-DA04	Outputs: 4 to 20 mA, 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V		
		4 outputs	0 words	4 words	Connectors (made by MOLEX)	GT1-DA04MX	Outputs: 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V		
	Counter Units	1 input	3 words	3 words	M3 terminal block	GT1-CT01	1 external input 2 external outputs		

Note The front-panel indicators and other parts of Analog Input Units, Analog Output Units, and Counter Units differ from those of other I/O Units. These Units belong to a group called Special I/O Units.

An end connector is attached to the Communication Unit, and a 40-mm I/O Unit Connecting Cable is included with each I/O Unit. Several I/O Unit Connecting Cables are also available.



Number:	Length:
GCN1 - 010	10 cm
GCN1 - 030	30 cm
GCN1 - 040	40 cm
GCN1 - 060	60 cm
GCN1 - 100 (see figure)	1 m

Applicable Connectors

The applicable connectors are shown in the following table.

<table>
<tr><th colspan="3">Connector</th><th>Model number</th><th>Remarks</th></tr>
<tr><td rowspan="9">Connectors made by MOLEX</td><td>Pressure-welded</td><td>Housing</td><td>52109-0390</td><td>For AWG#24</td></tr>
<tr><td rowspan="8">Crimp</td><td>Housing</td><td>51030-0330 (See note.)</td><td></td></tr>
<tr><td rowspan="2">Reeled contacts</td><td>50083-8014</td><td>For AWG#24 to 30</td></tr>
<tr><td>50084-8014</td><td>For AWG#22 to 24</td></tr>
<tr><td rowspan="2">Loose contacts</td><td>50083-8114 (See note.)</td><td>For AWG#24 to 30</td></tr>
<tr><td>50084-8114</td><td>For AWG#22 to 24</td></tr>
<tr><td rowspan="2">Crimping tool</td><td>57036-5000</td><td>For AWG#22 to 26</td></tr>
<tr><td>57037-5000 (See note.)</td><td>For AWG#24 to 30</td></tr>
<tr><td colspan="2"></td><td></td></tr>
<tr><td rowspan="3">Connectors made by FUJITSU corresponding to 16-point connectors</td><td colspan="2">Soldered</td><td>FCN361J024-AU</td><td></td></tr>
<tr><td colspan="2">Pressure-welded</td><td>FCN367J024-AU/F</td><td></td></tr>
<tr><td colspan="2">Crimp</td><td>FCN363J024-AU</td><td></td></tr>
<tr><td rowspan="2">Recommended connectors corresponding to 25-pin D-sub connectors</td><td colspan="2">Hood</td><td>XW2S-2513</td><td>OMRON</td></tr>
<tr><td colspan="2">Plug</td><td>XW2A-2501</td><td>OMRON</td></tr>
<tr><td rowspan="3">Connectors made by FUJITSU corresponding to high-density connectors</td><td colspan="2">Soldered</td><td>FCN361J040-AU</td><td></td></tr>
<tr><td colspan="2">Pressure-welded</td><td>FCN367J040-AU/F</td><td></td></tr>
<tr><td colspan="2">Crimp</td><td>FCN363J040-AU</td><td></td></tr>
</table>

Note Refer to page 173, *High-density Connector Cables for MULTIPLE I/O TERMINALs* for details.

3-2 Functions

3-2-1 I/O Unit Interface Specifications

Item		Specification
Communications method		Special protocol
Number of I/O Units		8 Units max.
Maximum number of data bytes		Input data: 128 bytes Output data: 128 bytes
Communications distance	Total length	3 m max.
	Between Units	1 m max. (Cable included with Unit is 40 mm.)
Communications power supply		Supplied from the Communication Unit to the I/O Unit (0.3 A max.)
Relationship to PROFIBUS-DP		After the I/O Unit interface is established, PROFIBUS-DP communications continue normally, even if an error occurs on the I/O Unit interface.
Addresses		Automatically recognised when the power to the Communication Unit is turned ON.
I/O configuration		Automatically recognised when the power to the Communication Unit is turned ON. If the configuration is changed while the power supply is ON, a configuration error will occur.
Self-diagnostic functions	Configuration errors	The I/O Unit configuration is constantly checked while power is supplied. If a mismatch occurs while the power is turned ON, I/O refreshing for all I/O Units is stopped.
	Special I/O Unit errors	Errors are detected in the Special I/O Units (Analog Input, Analog Output Units, and Counter Units) on the I/O Unit interface.
	I/O Unit interface errors	Communications stop when there is no communications response from an I/O Unit. Communications stop when there is no specific response from the last I/O Unit (terminator). Communications stop when nine or more I/O Units are connected.
	Power supply overload to I/O Units	The power supply to the I/O Units and I/O refreshing for all I/O Units are stopped when the power supply to the I/O Units through the Communication Unit exceeds 0.3 A.
Error detection		Frame error check; CRC-CCITT check

I/O Interface Current Consumption

Make sure that the power supply from the Communication Unit to the I/O Units is less than the total rated output current (300 mA). The I/O interface current consumption for each I/O Unit is shown in the following table.

I/O Unit	I/O interface current consumption
GT1-ID16(-1)	35 mA max.
GT1-ID16MX(-1)	35 mA max.
GT1-ID16ML(-1)	35 mA max.
GT1-ID16DS(-1)	35 mA max.
GT1-ID32ML(-1)	55 mA max.
GT1-OD16(-1)	35 mA max.
GT1-OD16MX(-1)	35 mA max.
GT1-OD16ML(-1)	35 mA max.
GT1-OD16DS(-1)	35 mA max.
GT1-OD32ML(-1)	65 mA max.
GT1-ROP08	40 mA max.
GT1-ROS16	50 mA max.
GT1-AD04	50 mA max.
GT1-AD08MX	50 mA max.
GT1-DA04	50 mA max.
GT1-DA04MX	50 mA max.
GT1-CT01	90 mA max.

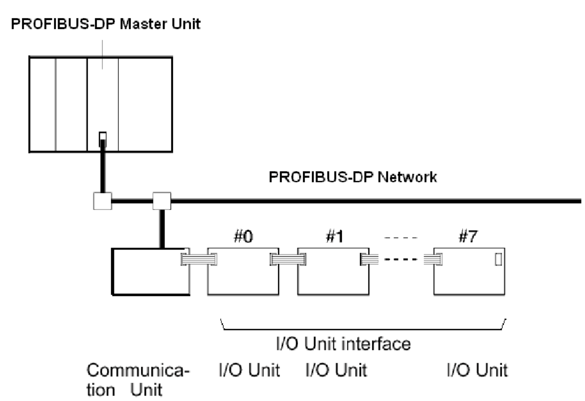
Calculation Example

When three GT1-ID32ML Input Units and three GT1-OD16 Output Units are used, the total current consumption is calculated as follows:

(GT1-ID32ML current consumption) x 3 Units
+ (GT1-OD16 current consumption) x 3 Units
= 55 mA x 3 + 35 mA x 3 = 270 mA ≤ 300 mA

I/O Unit Interface Addresses

The addresses of the I/O Units on the I/O Unit interface are automatically set when the Communication Unit is started. The addresses are from 0 to 7 in ascending order from the I/O Units closest to the Communication Unit.

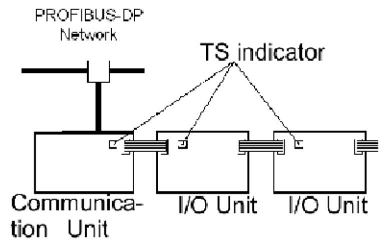


Checking the I/O Unit Interface Status

The following two methods are used to check the I/O Unit interface status:

- Checking the Communication Unit and I/O Unit indicators
- Checking the status of the Communication Unit

Indicators

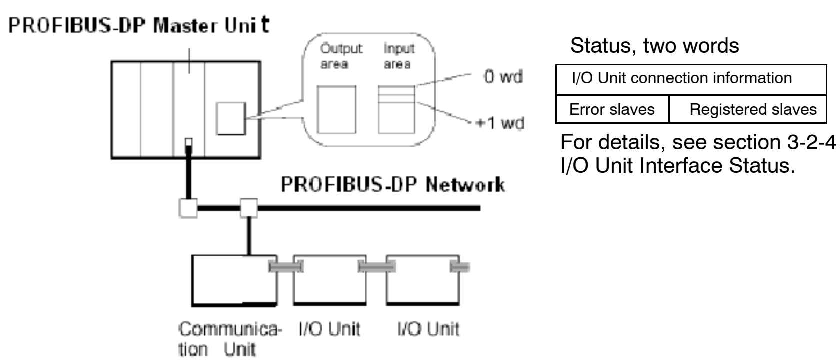


Unit	Normal	Error
Communication Unit	TS Indicator: green ON	TS indicator I/O Unit interface error: red ON Special I/O Unit error: green BLINKING Maximum power supply overload to I/O Units: OFF
I/O Units	TS indicator: green ON U.ERR indicator: OFF PWR indicator: green ON	TS indicator I/O Unit interface error: red ON U.ERR indicator Special I/O Unit error: red ON PWR indicator No internal power supply: OFF

For details, refer to page 161, *Troubleshooting via Indicators*.

Checking the I/O Unit Interface Status

The first two words of the CPU Unit allocation input area are always allocated to the status of the I/O Unit interface received via PROFIBUS-DP.



3-2-2 Exchanging Data

Initialization

When the Communication Unit is started, it automatically recognizes the configuration of the I/O Units and registers this status as the normal configuration (in RAM memory). At the same time, addresses 0 to 7 are allocated to the I/O Units in ascending order from the I/O Unit closest to the Communication Unit. This I/O table is compared with the PROFIBUS-DP Chk-cfg message. These processes are performed each time the power is turned ON.

Note
1. If the configuration of the I/O Units is to be changed, a number of precautions must be noted. For details, see *3-2-5 I/O Configuration Changes*.
2. For details of data exchange timing, see *8-1-1 I/O Response Time*.

Error Processing

Even if an error occurs in the I/O Unit interface after initialization is completed, PROFIBUS-DP communications will continue normally. Therefore, an error processing program section must be included in the CPU Unit to check the status of the Communication Unit for errors that have occurred and to identify the error type and location.

3-2-3 Allocating I/O

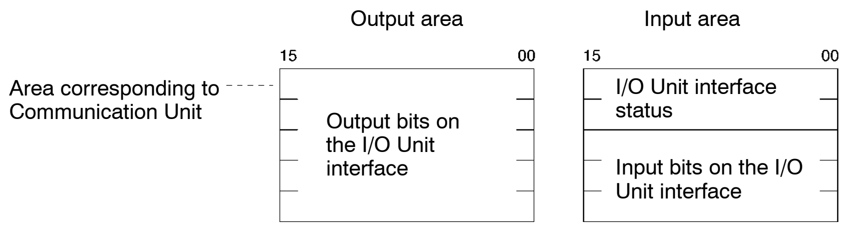
This section explains how words for a MULTIPLE I/O TERMINAL are allocated in the output area and input area of the Master. For details of remote I/O functions in the output area and input area of the Master such as word specification, fixed allocation, and user-set allocation, refer to the *PROFIBUS-DP Master Unit Operation Manual (W349)*.

Output Area

The output area contains output bits in the same order as the I/O Units are connected on the I/O Unit interface.

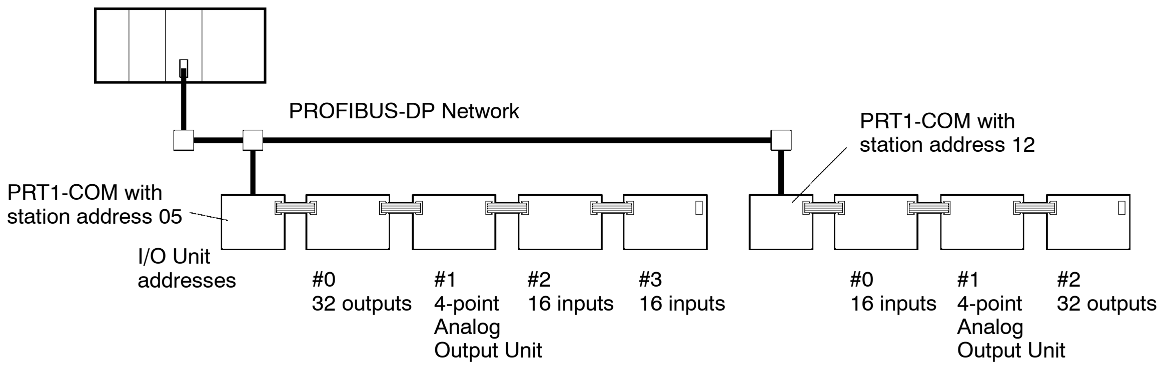
Input Area

The input area contains the Communication Unit status (two words), and input bits in the same order as the I/O Units are connected on the I/O Unit interface.



The input and output bits for the I/O Unit interface are allocated in the PROFIBUS-DP input and output areas in 16-point (one word) increments.

Example: C200HW Series with PRM21 default I/O mapping



Output area

Area allocated to station address 05	IR50	32 output bits for Unit #0
	IR51	
	IR52	4 analog outputs for Unit #1
	IR53	
	IR54	
	IR55	
Area allocated to station address 12	IR56	4 analog outputs for Unit #1
	IR57	
	IR58	
	IR59	
	IR60	32 output bits for Unit #2
	IR61	

Input area

Area allocated to station address 05	IR350	**I/O Unit interface status for station 05**
	IR351	
	IR352	16 input bits for Unit #2
	IR353	16 input bits for Unit #3
Area allocated to station address 12	IR354	**I/O Unit interface status for station 12**
	IR355	
	IR356	16 input bits for Unit #0

3-2-4 I/O Unit Interface Status

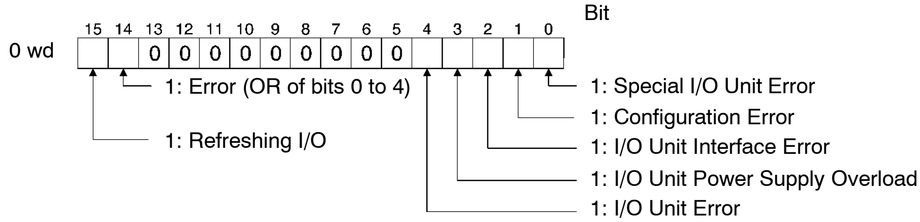
The following I/O Unit interface status is maintained in the CPU Unit.

- I/O Unit connection information (I/O Unit interface status)
- Registered I/O Unit addresses
- Error I/O Unit addresses

As shown in the following diagram, the status consists of two words. The first two words of the Communication Unit allocation input area in the CPU Unit are allocated for this status. Include a program section in the CPU Unit to check this status and perform error processing.

	15 … 8	7 … 0
0 wd	I/O Unit connection information	
+1 wd	Error I/O Unit addresses	Registered I/O Unit addresses

I/O Unit Connection Information



Bit	Flag name	Meaning	Content
15	Refreshing I/O	Refreshing I/O	1: Communications between the Communication Unit and I/O Units is normal. 0: Communications error (no response is received from an I/O Unit)
14	Error	OR of bits 0 to 4	1: Any one of bits 0 to 4 is ON 0: Bits 0 to 4 are all OFF
4	Multipoint I/O Unit Error	A multipoint I/O Unit error was detected.	1: Unit error 0: Unit normal
3	I/O Unit Power Supply Overload	An overcurrent to an I/O Unit was detected.	1: Overcurrent detected 0: Normal
2	I/O Unit Interface Error	An I/O Unit interface error was detected. Data Transfer Error: In the I/O Unit interface, there was no response to a command after the fixed time has elapsed. Alternatively, the response expected to be returned from the end I/O Unit (terminator) was not received. Too many I/O Units: Nine or more I/O Units are connected.	1: I/O Unit interface error 0: Normal
1	Configuration Error	The I/O configuration was changed after the Communication Unit was started.	1: I/O configuration change after startup 0: No I/O configuration change during startup
0	Special I/O Unit Error	An error occurred in a Special I/O Unit.	1: Special I/O Unit error 0: Special I/O Unit normal

Note The high and low bytes in this status word are swapped when the transfer mode is set to Little Endian (see section 2-2-2).

Abnormal I/O Unit Addresses and Registered I/O Unit Addresses

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit
+1 wd	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	

The bits corresponding to I/O Unit with errors are turned ON. Bits 8 to 15 correspond to addresses 0 to 7.
1: Error
0: No error, or not part of network

The bits corresponding to registered I/O Units are turned ON. Bits 0 to 7 correspond to addresses 0 to 7.
1: Registered
0: Not registered

Note The high and low bytes in this status word are swapped when the transfer mode is set to Little Endian (see section 2-2-2).

3-2-5 I/O Configuration Changes

The I/O Unit interface automatically recognizes the I/O Unit configuration each time the Communication Unit is started up.

Note
1. If the I/O Unit configuration is changed while the Communication Unit is turned ON, a configuration error will occur. Do not change the I/O Unit configuration while power is being supplied to the Communication Unit.
2. If a configuration error occurs on the I/O Unit interface, I/O refreshing of all I/O Units will stop. Even if a configuration error occurs, communications with the PROFIBUS-DP Network will continue, using the initial I/O Unit configuration. An error processing program section must therefore be included in the CPU Unit to regularly check whether or not a configuration error has occurred (status bit 1) and to process abnormal I/O Unit addresses.

If the I/O configuration is changed, then the PROFIBUS-DP System should be reconfigured, see 2-3-2.

SECTION 4
Hardware Setup and Operational Check

This section provides the basic procedure for operation and includes an actual example.

4-1 Basic Procedure 38
4-2 Specific Example 39

4-1 Basic Procedure

The basic operating procedure is shown below. For details about settings and connections, refer to *PROFIBUS-DP Master Operation Manual (W349)*. For explanations about Slave Units, refer to *Section 6 Basic I/O Unit Specifications* and *Section 7 Special I/O Unit Specifications*.

1 Determine the MULTIPLE I/O TERMINAL I/O specifications.

Inputs:	Number of points/input type/connection type
Outputs:	Number of points/input type/connection type
Analog inputs:	Number of points
Analog outputs:	Number of points
Pulse Input (Counter):	Number of points

2 Select the I/O Units.

Communication Unit (1)	+	Transistor Input			+	Transistor Output			Relay Output		+	Analog	Analog	Counter
		Terminal block	Connector	High-density connector		Terminal block	Connector	High-density connector	Terminal block			Input	Output	Input
		16 points	16 points	32 points		16 points	16 points	32 points	16 points	8 points		8 points	4 points	1 points
		Unit	Unit	Unit		Unit	Unit	Unit	Unit	Unit		Unit	Unit	Unit

3 Check the specifications.

The total current supplied from the Communication Unit to each I/O Unit (I/O Unit interface current consumption) is 0.3 A max.

4 Mount and connect the Communication Unit and I/O Units.

Mount Units on DIN rail (DIN 35-mm track: all Units).

Connect I/O Unit Connecting Cables and end connector.

Connect Communication Unit internal power supply (24 VDC –15%/+10%).

Connect I/O power supply (24 VDC –15%/+10%) for each Transistor Input/Output Unit and Relay Output Unit.

Connect I/O power supply (24 VDC –15%/+10%) for each Analog Input/Output Unit and power supply for each Counter Unit encoder, using a separate power supply from the above.

Connect I/O to each I/O Unit.

5 Set the DIP switches for the Communication Unit, Analog Input Units, and Analog Output Units.

Set the PROFIBUS-DP address of the Communication Unit.

Set the Analog Input Unit and Analog Output Unit ranges and other specifications.

6 Connect to the PROFIBUS-DP Master Unit.

Connect the Communication Unit to the PROFIBUS-DP Master Unit using the PROFIBUS-DP Communications Cable.

7 Turn ON the power.

Turn ON the PC power supply.

Turn ON the I/O power supply to individual I/O Units.

Turn ON the Communication Unit internal power supply.

8 Configure PROFIBUS-DP system.

Configure all connected MULTIPLE I/O Units in de PROFIBUS-DP master.

9 Check the operation.

Check the I/O Unit interface status.

Check the indicators on all Units.
The following indications are normal:

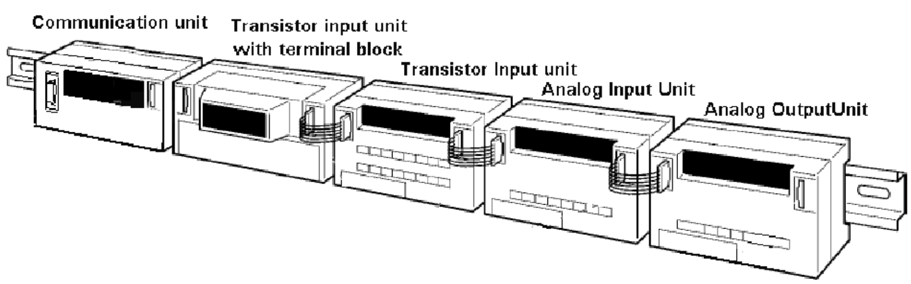
Communication Unit US indicator:	green ON
Communication Unit BF indicator:	OFF
TS indicators for I/O Units and Communicaton Unit:	green ON

Check that the data for the I/O words allocated in the I/O memory of the CPU Unit of the PC is being correctly read and written by the CPU Unit.

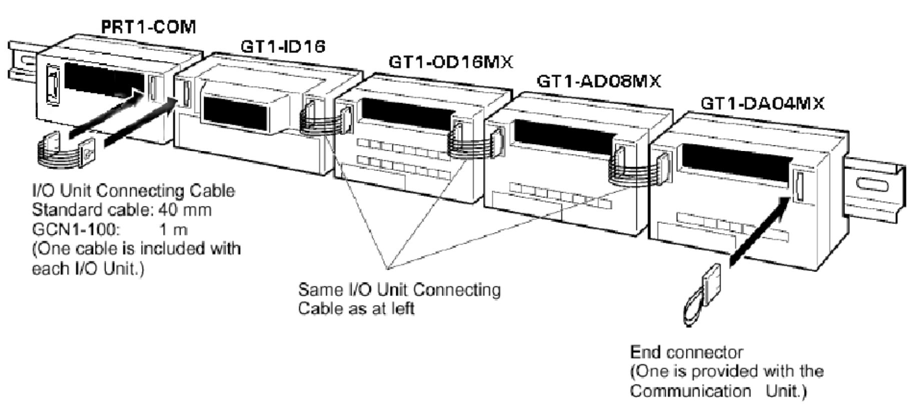
4-2 Specific Example

1, 2, 3...

1. Determine the MULTIPLE I/O TERMINAL I/O specifications.
   Each Communication Unit for the MULTIPLE I/O TERMINAL can be connected to a combined total of 128 input and output bytes (64 words) max. (This figure does not include the 2 words of the input area allocated to the I/O Unit interface status.)
   In this example, the following configuration will be used:
   - Inputs: 16 digital inputs (2 words)
   - Outputs: 16 digital outputs (2 words)
   - Analog Input: 8 inputs (8 words)
   - Analog Output: 4 outputs(4 words)
2. Select the I/O Units.
   - PRT1-COM Communication Unit: 1 Unit
   - GT1-ID16 Transistor Input Unit, with terminal block: 1 Unit
   - GT1-OD16MX Transistor Output Unit, with connector: 1 Unit
   - GT1-AD08MX Analog Input Unit, 8 inputs: 1 Unit
   - GT1-DA04MX Analog Output Unit: 4 outputs: 1 Unit
3. Check the specifications.
   - Check that the total I/O Unit interface current consumption is less than 0.3 A. In this example, the total is calculated as follows:
     Transistor Input Unit (35 mA) + Transistor Output Unit (35 mA) + Analog Input Unit (50 mA) + Analog Output Unit (50mA)
     =170 mA
4. Mount and connect the Communication Unit and I/O Units.
   - **Mounting on the DIN rail**

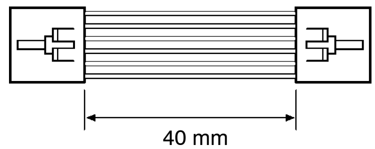


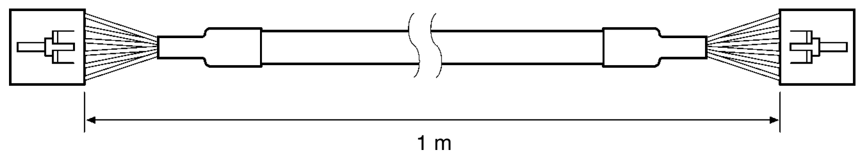
   - **Connecting I/O Unit Connecting Cable**



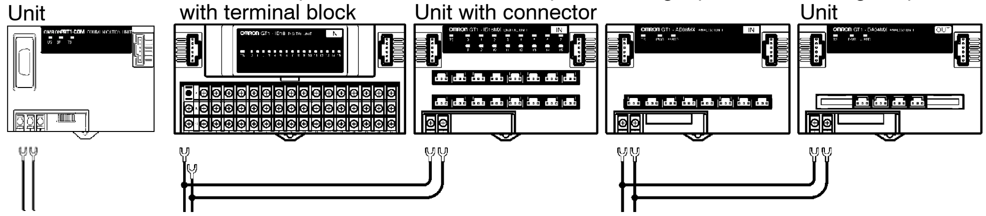
To connect each pair of Units, connect I/O Unit interface communications connector 2 on the Unit closer to the Communication Unit to I/O Unit interface communications connector 1 on the Unit closer to the end Unit.

Note The connecting cable for the I/O Unit is shown below.





• Connecting Communication Unit and I/O Unit Power



Note Be sure to separate the communications power supply, the internal power supply for the Communication Unit and the CPU Bus Unit, and the power supplies for the I/O Units. If the same power supply is used, malfunction due to noise may occur.

The capacity required for the Communication Unit internal power supply, can be obtained using the following formula:
Communication Unit internal power supply current
= Communication Unit internal current consumption + Sum of I/O Unit Interface current consumption

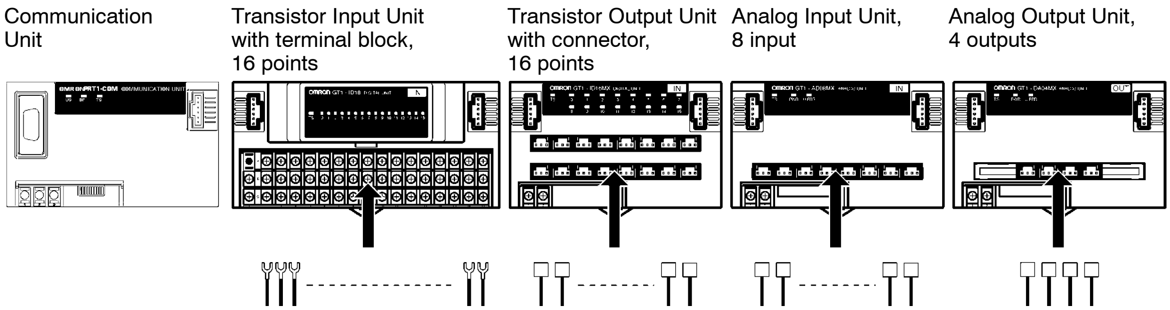
Note The above formula applies when a voltage of 24-VDC is supplied to the Communication Unit internal power supply terminals. If the supplied voltage becomes lower, the current consumption will increase. Select a device for the power supply that will allow a degree of variation.
When selecting a power supply, take inrush current into consideration.
The following OMRON products are recommended for the 24-VDC power supply:

S82K-05024:	100 to 120/200 to 240 VAC, 50 W
S82K-10024:	100 to 120/200 to 240 VAC, 100 W
S82J-5524:	100 to 120 VAC, 50 W
S82J-5024:	100 to 120 VAC, 100 W

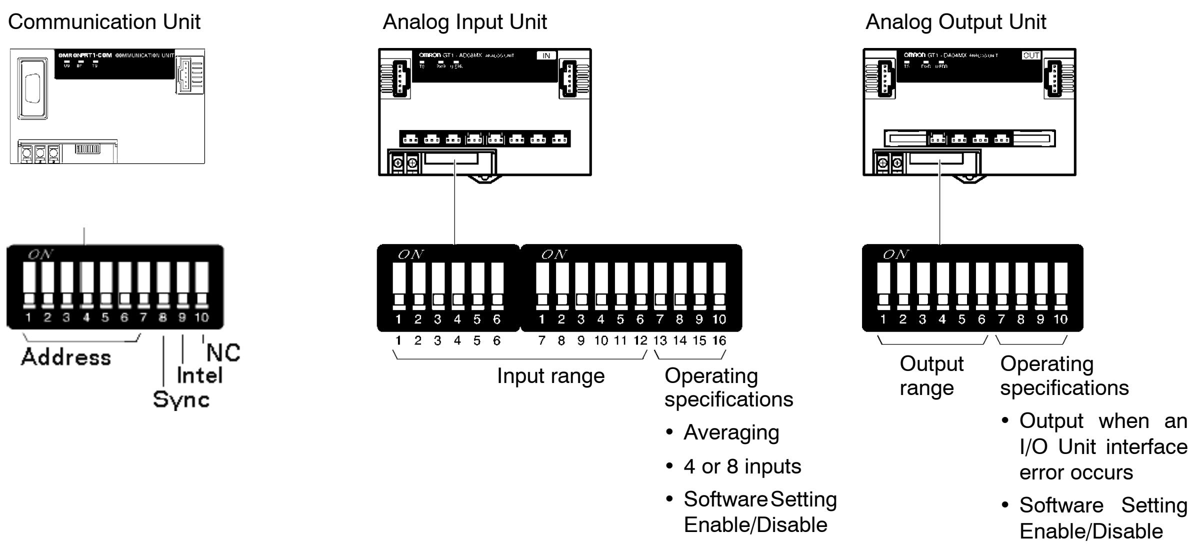
For details of the I/O Unit interface current consumption for the Units, refer to page 30, *I/O Interface Current Consumption*.

Select power supplies for the I/O Units that are suitable for the load currents to be used and the Units' internal drive currents (refer to page 53).

• Connecting I/O Units to I/O



5. Set the DIP switches for the Communication Unit, Analog Input Unit, and Analog Output Unit.



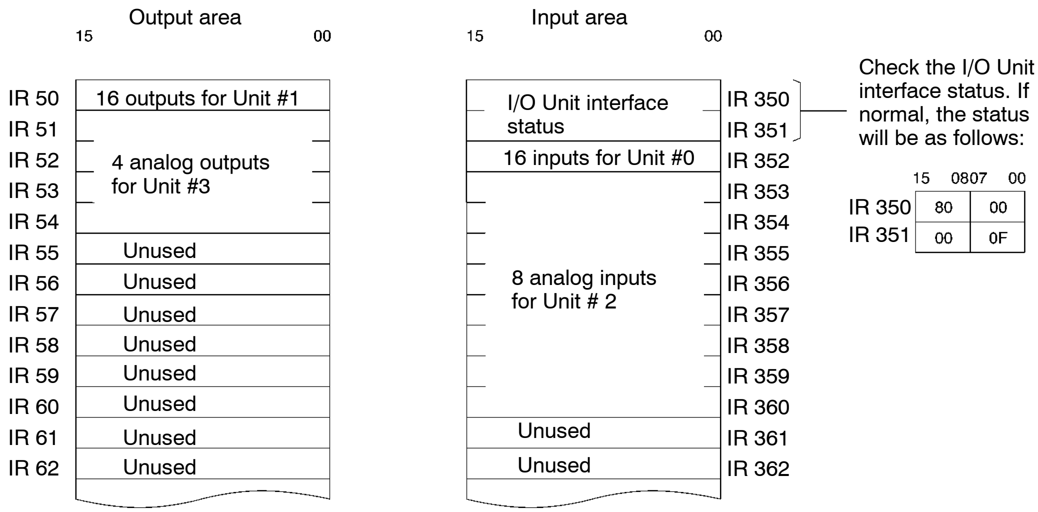
6. Connect to the PROFIBUS-DP Master Unit.
7. Turn ON the power.
8. Configure PROFIBUS-DP System, see paragraph 2-3-2.

9. Check the operation. Check all indicators, TS and US should lit green, BF and U.ERR should not be lit.

   • Checking the I/O Unit Interface Status

   Example:

   The following allocations will be used for status when the default allocations are used for C200HW PROFIBUS-DP Master Unit with one Communication unit connected.



- The first two words of the input area is automatically allocated for the I/O Unit interface status information. This allocation cannot be changed.
- Words are allocated for the input/output data for each I/O Unit in the order that the I/O Units are connected (I/O Unit interface addresses 0 to 3) in the input area (input) and the output area (output).

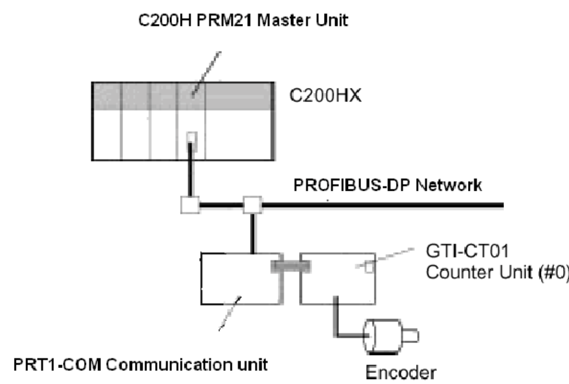
SECTION 5
Sample Programs

This section provides some examples of programs used with the Counter Unit.

5-1 Examples of Counter Unit Operation 44
5-1-1 Counter Unit Word Allocation for Functions 44
5-1-2 Present Count Value Reading 47
5-1-3 Counter Setting and Execution 47
5-1-4 Count Restart Operation after Error Clearance 49

5-1 Examples of Counter Unit Operation

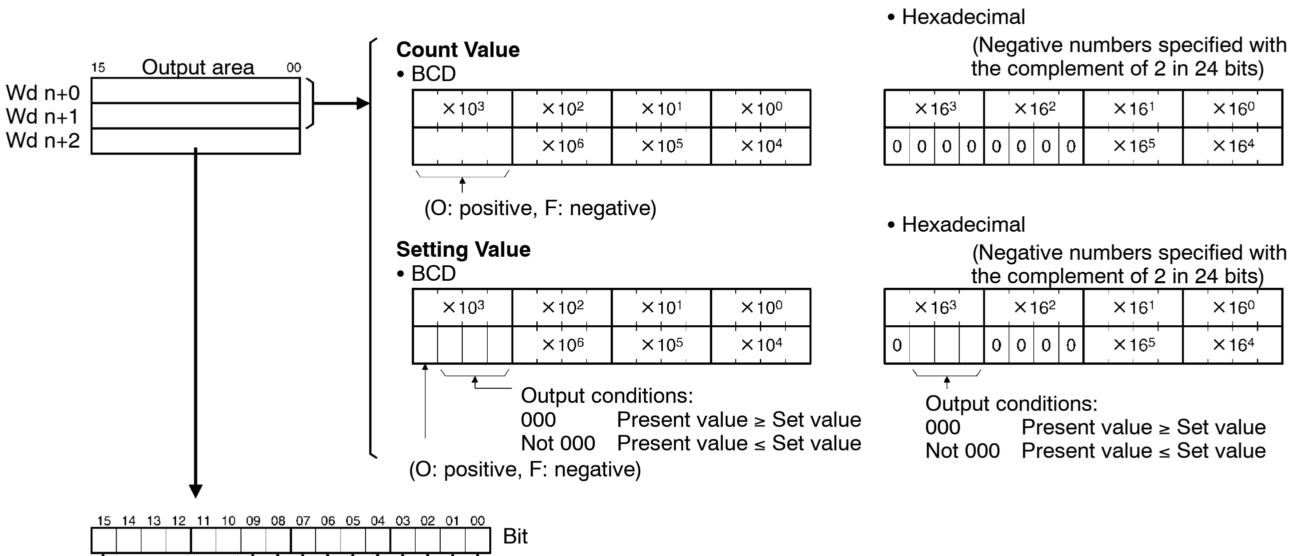
This section, using the system configuration shown below as an example, explains how to use the Counter Unit.



5-1-1 Counter Unit Word Allocation for Functions

Setting and control for the Counter Unit is executed by writing to the allocated area in the output area of the Master, and status check and monitoring is executed by reading the allocated area in the input area of the Master. The allocated area for the Counter Unit, with the system configuration shown above, is given below (this example is for fixed allocation). For details about area allocation for a Counter Unit in the area used by a MULTIPLE I/O TERMINAL, refer to *3-2-3 Allocating I/O*.

Output Area



Bit 00: Set value 1 (0: Not set, 1: Set)
Bit 01: Set value 2 is set (0: Not set, 1: Set)
Bit 02: Count value is set (0: Not set, 1: Set)
Bit 03: Data code change (0: BCD, 1: Hex.)
Bit 04: Set value 1 reading (0: Not read, 1: Read)
Bit 05: Set value 2 reading (0: Not read, 1: Read)
Bit 06: Count value reading (0: Not read, 1: Read)
Bit 07: Internal resetting (0→1: Resetting)
Bit 08: External output 1 (0: Disabled, 1: Enabled)
Bit 09: External output 2 (0: Disabled, 1: Enabled)
Bit 10, 11: Count mode selection:

Bit 11	Bit 12	
0	0	No mode change
0	1	Directional input mode
1	0	Phase difference ×4 mode
1	1	Phase difference ×1 mode

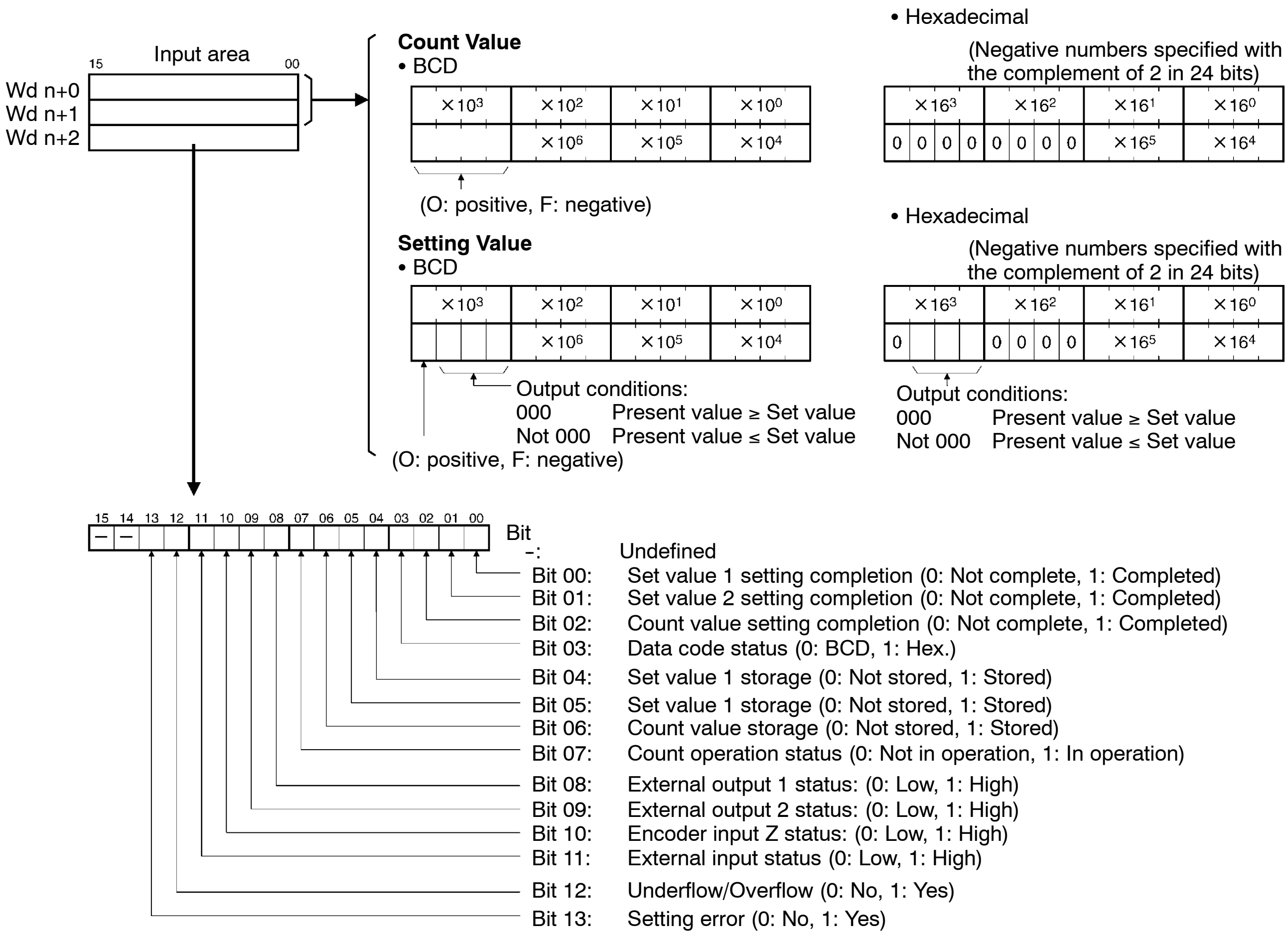
Bits 12 to 14: Reset mode selection:

Bit 14	Bit 13	Bit 12	
0	0	0	No mode change
0	0	1	Z
0	1	0	IN
0	1	1	Z • IN
1	0	0	Internal
1	0	1	Z • Internal
1	1	0	IN • Internal
1	1	1	Z • IN • Internal

Z: Encoder input, Z. IN: External Input.
Internal: Internal reset bit. •: AND condition.

Bit 15: I/O Unit interface error setting
(0: Count stop • Initialize, 1: Count continue)

Input Area


Input area
15
00
Wd n+0
Wd n+1
Wd n+2
Count Value
• BCD
×10³ ×10² ×10¹ ×10⁰
×10⁶ ×10⁵ ×10⁴
(O: positive, F: negative)
• Hexadecimal
(Negative numbers specified with the complement of 2 in 24 bits)
×16³ ×16² ×16¹ ×16⁰
0 0 0 0 0 0 0 0 ×16⁵ ×16⁴
Setting Value
• BCD
×10³ ×10² ×10¹ ×10⁰
×10⁶ ×10⁵ ×10⁴
Output conditions:
000 Present value ≥ Set value
Not 000 Present value ≤ Set value
(O: positive, F: negative)
• Hexadecimal
(Negative numbers specified with the complement of 2 in 24 bits)
×16³ ×16² ×16¹ ×16⁰
0 0 0 0 0 ×16⁵ ×16⁴
Output conditions:
000 Present value ≥ Set value
Not 000 Present value ≤ Set value
15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00
Bit
-: Undefined
Bit 00: Set value 1 setting completion (0: Not complete, 1: Completed)
Bit 01: Set value 2 setting completion (0: Not complete, 1: Completed)
Bit 02: Count value setting completion (0: Not complete, 1: Completed)
Bit 03: Data code status (0: BCD, 1: Hex.)
Bit 04: Set value 1 storage (0: Not stored, 1: Stored)
Bit 05: Set value 1 storage (0: Not stored, 1: Stored)
Bit 06: Count value storage (0: Not stored, 1: Stored)
Bit 07: Count operation status (0: Not in operation, 1: In operation)
Bit 08: External output 1 status: (0: Low, 1: High)
Bit 09: External output 2 status: (0: Low, 1: High)
Bit 10: Encoder input Z status: (0: Low, 1: High)
Bit 11: External input status (0: Low, 1: High)
Bit 12: Underflow/Overflow (0: No, 1: Yes)
Bit 13: Setting error (0: No, 1: Yes)

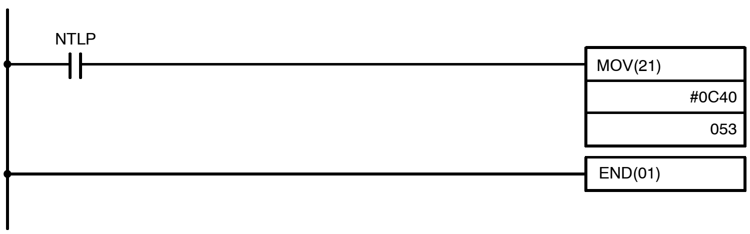
5-1-2 Present Count Value Reading

If the following bits in the output area for the Counter Unit have been set to ON, the set values or the present count value (count value) will always be read to words m and m+1 in the input area.

To read set value 1:	Output area word n+2, bit 04
To read set value 2:	Output area word n+2, bit 05
To read count value:	Output area word n+2, bit 06

The simplest example of a program to commence count operation and obtain the count value is given in the following. For details refer to *7-3 Counter Unit*.

Note
1. To execute counting, it is necessary to set the count mode. If the count mode is changed during count operation, however, the count value will be cleared to 0.
2. Setting and reading will not be executed if a bit with a higher priority is ON. As shown in the following example, therefore, it is recommended that word n+2 be used with the MOV instruction.



When execution of count value reading is indicated (execution conditions are ON), set the following conditions:

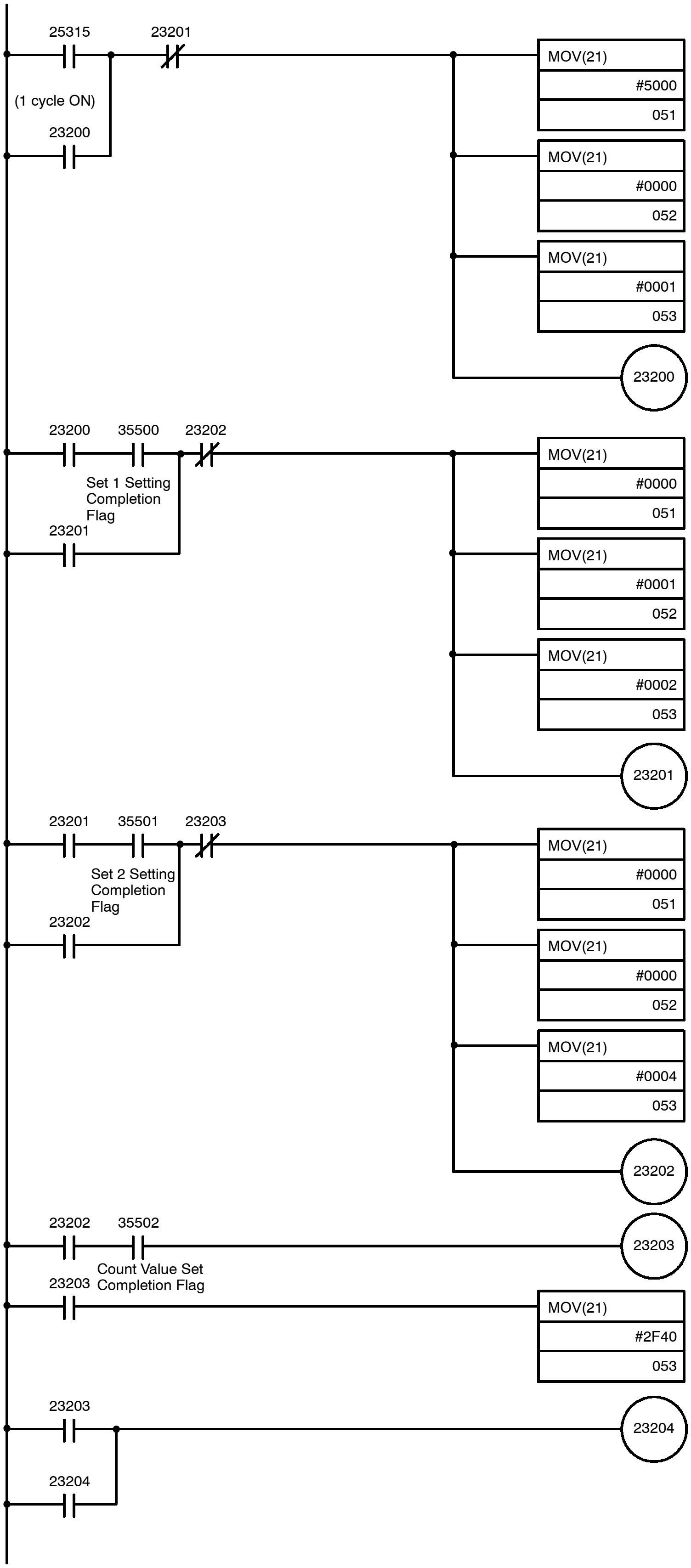
- Word 53
  - Bit 03: Data code BCD
  - Bit 06: Count value reading
  - Bits 10, 11: Count mode phase difference ×1

The count value will subsequently be sent to words m and m+1 (353, 354) of the Counter Unit automatically.

5-1-3 Counter Setting and Execution

When the program is executed, the necessary settings for the Counter Unit will be made, and count operation will start. During count operation, external outputs 1 and 2 of the Counter Unit will automatically switch ON or OFF, according to the count value.

Note It will be necessary to reset all the settings, including the set values, present value and count mode, every time the Counter Unit is turned ON.



When the program starts, set value 1 will be set under the following conditions:

- Words 51, 52
  - Set value 1: +5000 (BCD)
  - Output conditions: Present value ≥ Set value 1
- Word 53
  - Bit 00: Setting value 1 set
  - Bit 03: Data code BCD

Bit 23200 is a Step Advance Flag.

When the Step Advance Flag 23200 turns ON and set value 1 has been set, set value 2 will be set under the following conditions:

- Words 51, 52
  - Set value 2: +10000 (BCD)
  - Output conditions: Present value ≥ Set value 2
  - Bit 01: Set value 2 set
  - Bit 03: Data code BCD

Bit 23201 is a Step Advance Flag.

When the Step Advance Flag 23201 turns ON and set value 2 has been set, the count value will be set under the following conditions:

- Words 51, 52
  - Count value: 0 (BCD)
- Word 53
  - Bit 02: Count value set
  - Bit 03: Data code BCD

Bit 23202 is a Step Advance Flag.

When the Step Advance Flag 23202 is ON and the count value has been set, the Step Advance Flag 23203 turns ON.

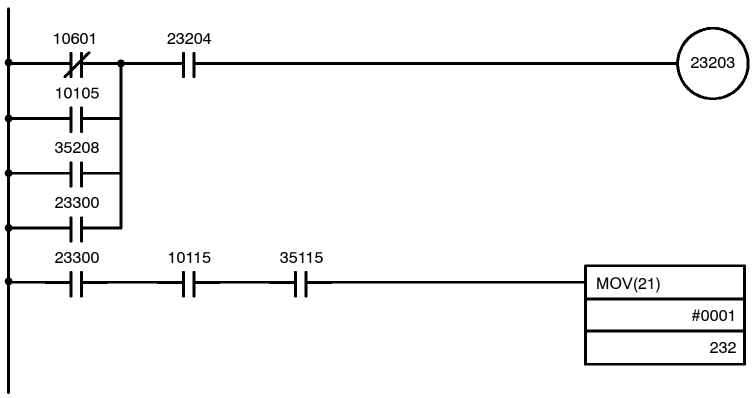
When the Step Advance Flag 23203 turns ON, the initial settings are complete. Commence count operation under the following conditions:

- Word 53
  - Bit 03: Data code BCD
  - Bit 06: Count value read
  - Bit 08: External output 1 enabled
  - Bit 09: External output 2 enabled
  - Bit 10, 11: Count mode phase difference ×1
  - Bits 12 to 14: External input, reset mode
  - Bit 15: Count stop during I/O Unit Interface error

When the settings and operations for the counter have been completed, the Step Advance Flag 23204 turns ON.

5-1-4 Count Restart Operation after Error Clearance

If power supply from the I/O Unit interface to the Counter Unit is interrupted, the Counter Unit will stop count operation. It will be necessary to restart the count operation. When the Counter Unit is restarted, all settings, such as the setting values, the present value, and the count mode will be cleared. These settings must be reset. By adding the following program to the program described in the previous section, *5-1-3 Counter Setting and Execution*, the settings will be reset automatically when the Counter Unit is restarted, and it will be possible to resume count operations. An example of the program used, along with an explanation of that program appears below. For details about the status area of the Master Unit, refer to *PROFIBUS-DP Operation Manual (W349)*.



If any of the following occur after the Counter Unit setting and start-up have been completed (and 23204 is ON), the Step Advance Bit 23300 turns ON in order to reset the settings for the Counter Unit.

- The Communication Unit Bit (node number 01 = 10601) for the Master Unit normal Slave information area is OFF (error).
- Bit 5 (10105) for the Master status area (1) is ON
- The Counter Unit Bit (#0 = 35208) for the error I/O Unit address in the I/O Unit interface status area is ON (error).

When the Step Advance Flag 23300 turns ON for resetting, if all of the following conditions are satisfied, the Counter Unit will start up normally and communications will be possible. Therefore, the Step Advance Flag 23200 will turn ON. The previously described setting and execution program will be re-executed.

- Bit 15 (10115) of the Master status area is ON
- Bit 15 (35115) of I/O Unit connection information in the I/O Unit interface status area is ON (I/O refresh in progress)

SECTION 6
Basic I/O Unit Specifications

This section provides the basic specifications for the I/O Units including Communication Units, Transistor Input and Output Units, and Relay Output Units.

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6-1 Common Specifications for Basic I/O Units

For details of the differences between Units, refer to the explanations for the relevant Units.

General Specifications

Item		Specification
I/O power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $^{+10\%}/_{-15\%}$)
Noise immunity		1,500 V p-p Pulse width 0.1 to 1 μs Pulse rise time: 1 ns (via noise simulator)
Vibration resistance		Relay output unit: 10 to 55 Hz, 1.0-mm double amplitude or 70 m/s^2 Others: 10 to 150 Hz, 1.0-mm double amplitude or 70 m/s^2
Shock resistance		200 m/s^2
Dielectric strength		500 VAC (between isolated circuits)
Ambient temperature		–10°C to 55°C
Ambient humidity		25% to 85% (with no condensation)
Operating atmosphere		No corrosive gases
Storage temperature		–25°C to 65°C
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2
Mounting		DIN 35-mm track
Mounting strength		100 N
Terminal strength		100 N
I/O Unit interface connector lock strength		50 N

Input Specifications for Transistor Input Unit

Item	Specification
ON voltage	15 VDC min. (between each input terminal and V and each input terminal and G)
OFF voltage	5 VDC max. (between each input terminal and V and each input terminal and G)
OFF current	1 mA max.
Input current	6 mA max./point at 24 VDC (between each input terminal and V and each input terminal and G)
ON delay time	1.5 ms max.
OFF delay time	1.5 ms max.
Insulation resistance	20 MΩ min. at 250 VDC (between isolated circuits)
Isolation method	Photocoupler

Output Specifications for Transistor Output Unit

Item	Specification
Rated output current	0.5 A/point
Residual voltage	1.2 V max. at 0.5 A DC (between each output terminal and V and each output terminal and G)
Leakage current	0.1 mA max. at 24 VDC (between each output terminal and V and each output terminal and G)
ON delay time	0.5 ms max.
OFF delay time	1.5 ms max.
Insulation resistance	20 MΩ min. at 250 VDC (between isolated circuits)
Isolation method	Photocoupler

Note For details about output specifications of Relay Output Units, refer to the explanations for the relevant Units.

Current Consumption and Weight

The following table shows the current consumption, the weight and the connector-lock strength for the I/O Units.

Model	I/O Unit interface power supply current	I/O power supply current	Weight	Connector-lock strength
GT1-ID16(-1)	35 mA max.	---	Approx. 330 g	---
GT1-ID16MX(-1)	35 mA max.	---	Approx. 175 g	50 N
GT1-ID16ML(-1)	35 mA max.	---	(see note)	100 N
GT1-ID16DS(-1)	35 mA max.	---	(see note)	100 N
GT1-ID32ML(-1)	55 mA max.	---	Approx. 195 g	100 N
GT1-OD16(-1)	35 mA max.	9 mA max.	Approx. 330 g	---
GT1-OD16MX(-1)	35 mA max.	9 mA max.	Approx. 150 g	50 N
GT1-OD16ML(-1)	35 mA max.	9 mA max.	(see note)	100 N
GT1-OD16DS(-1)	35 mA max.	9 mA max.	(see note)	100 N
GT1-OD32ML(-1)	65 mA max.	11 mA max.	Approx. 165 g	100 N
GT1-ROP08	40 mA max.	350 mA max. (inrush current 30 A max.)	Approx. 405 g	---
GT1-ROS16	50 mA max.	250 mA max. (inrush current 30 A max.)	Approx. 320 g	---
GT1-AD04	50 mA max.	100 mA max. (inrush current 30 A max.)	Approx. 200 g	---
GT1-AD08MX	50 mA max.	100 mA max. (inrush current 30 A max.)	Approx. 180 g	50 N
GT1-DA04	50 mA max.	100 mA max. (inrush current 30 A max.)	Approx. 200 g	---
GT1-DA04MX	50 mA max.	100 mA max. (inrush current 30 A max.)	Approx. 180 g	50 N
GT1-CT01	90 mA max.	9 mA max.	Approx. 250 g	---

Note Weight will be made available when the Unit is put out on sale.

6-1-1 TS Indicator

The TS indicator is a 2-color LED. The color of the TS indicator, and whether it is lit or not, indicate the following:

Indicator	Color	State	Meaning
TS	Green	Lit	Normal communications
	Red	Lit	I/O Unit interface error
	---	Not lit	Under initialization, or no power supplied

Note The meanings of the TS indicator for Communication Units, differ from those for I/O Units. For details, refer to page 162.

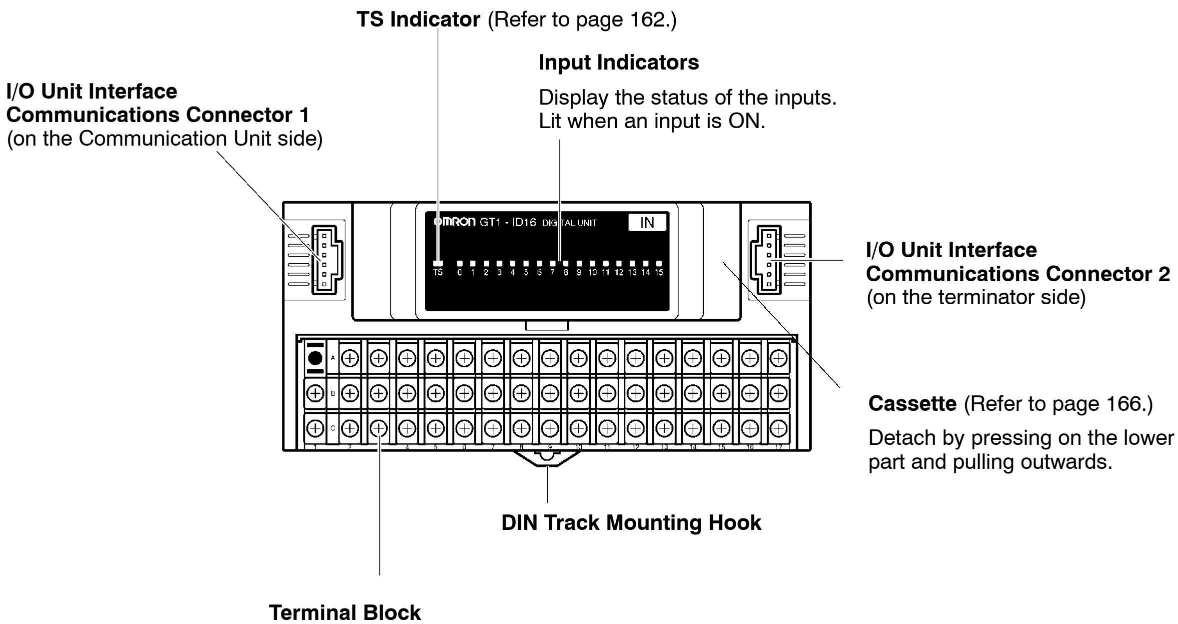
6-2 Transistor Input Units

6-2-1 GT1-ID16 Transistor Input Unit with Terminal Block (NPN)

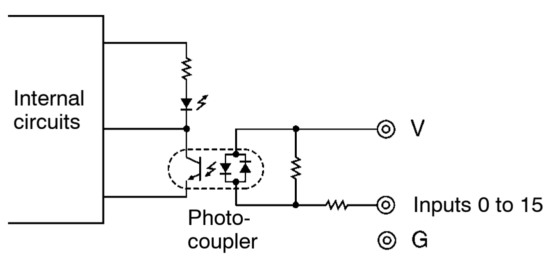
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	12 points max.

Components



Internal Circuits

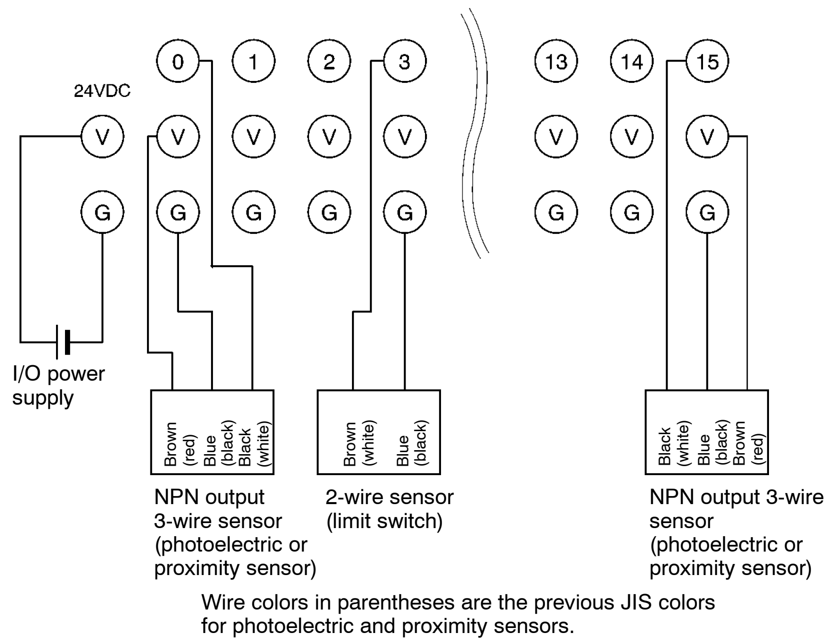


Terminal Arrangement

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Row A		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Row B	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Row C	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G

Terminal numbers

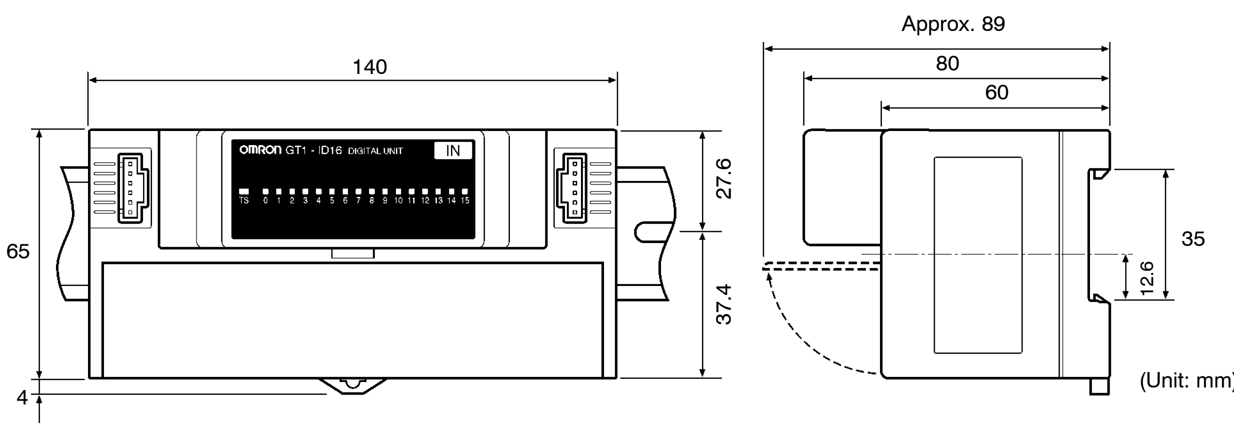
Wiring



Note

1. V terminals and G terminals are respectively connected internally. When the I/O power is being supplied, the power can be supplied to the input devices from the V terminals and G terminals. Current supplied in this way, however, must be less than 1 A.
2. Make sure there are no more than 12 inputs turned ON at the same time.

Dimensions



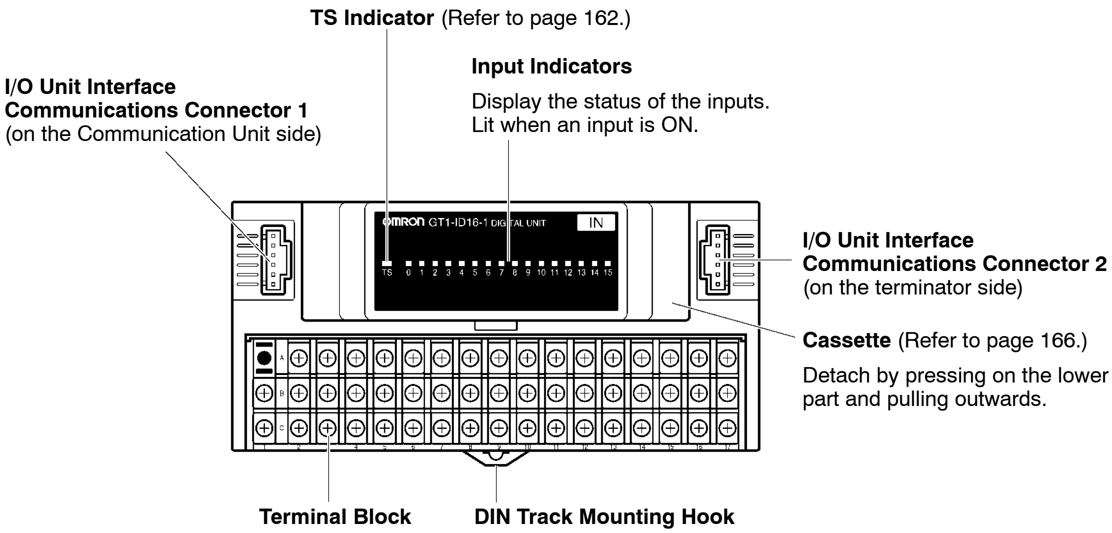
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-2 GT1-ID16-1 Transistor Input Unit with Terminal Block (PNP)

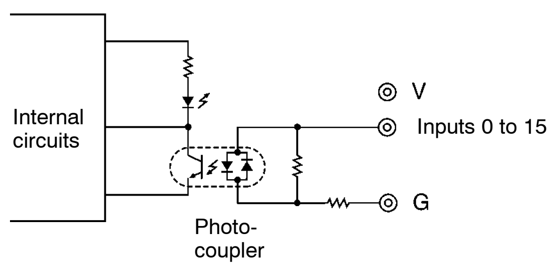
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	12 points max.

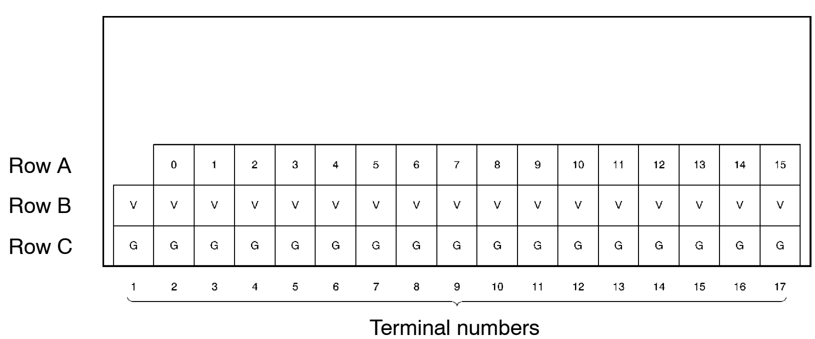
Components



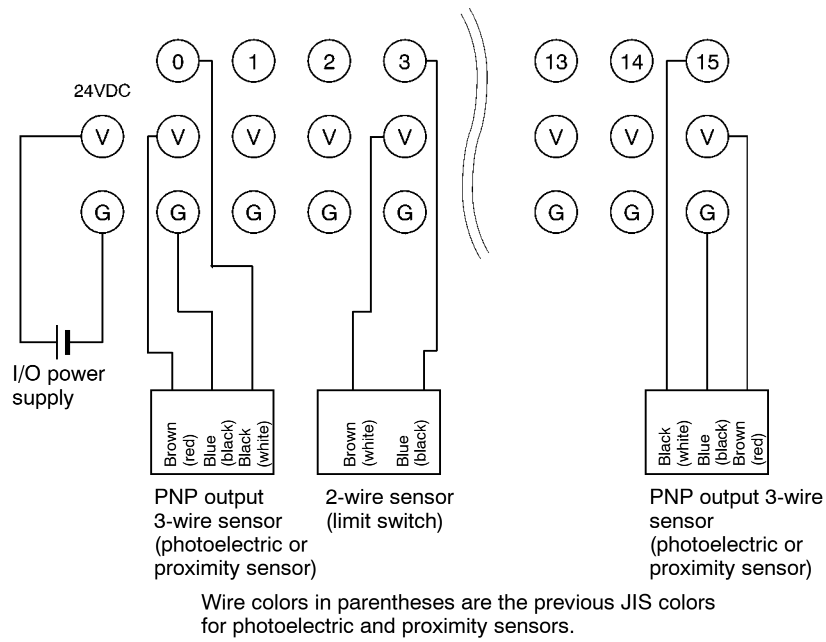
Internal Circuits



Terminal Arrangement

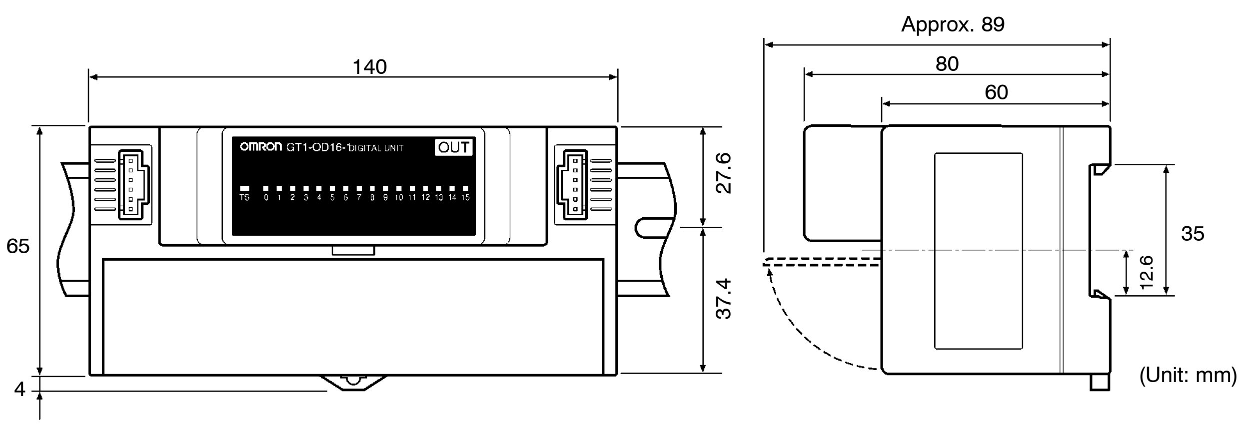


Wiring



Note
1. V terminals and G terminals are respectively connected internally. When the I/O power is being supplied, the power can be supplied to the input devices from the V terminals and G terminals. Current supplied in this way, however, must be less than 1 A.
2. Make sure there are no more than 12 inputs are turned ON at the same time

Dimensions



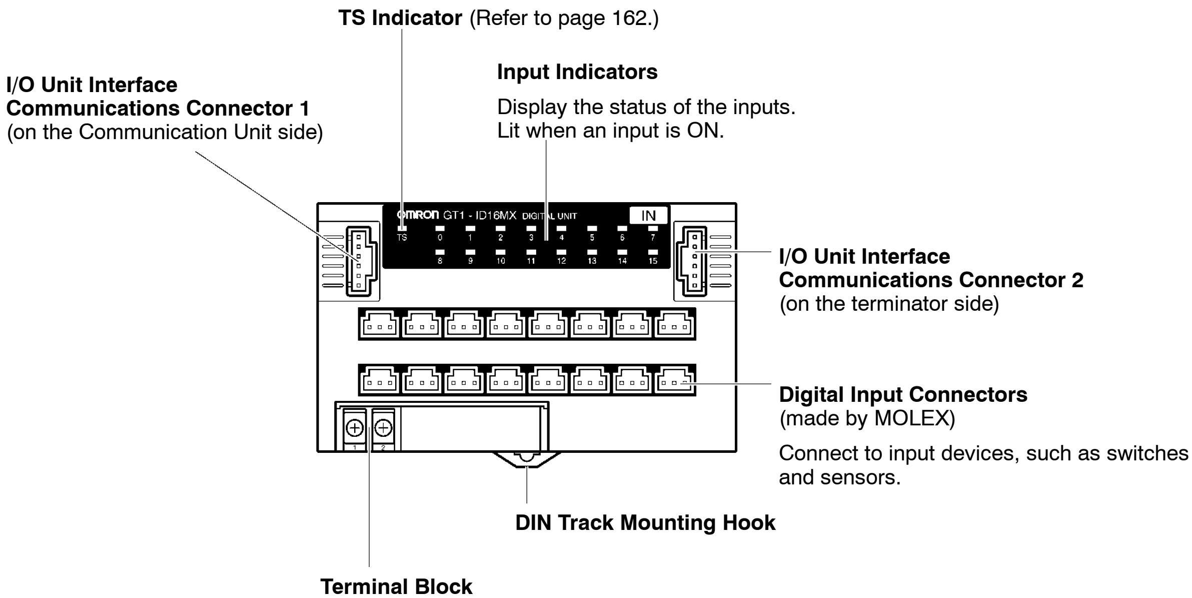
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-3 GT1-ID16MX Transistor Input Unit with Connector (NPN)

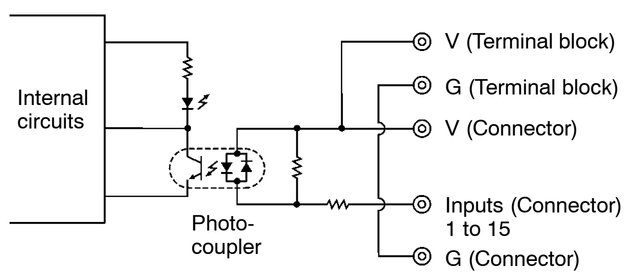
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	16 points max.

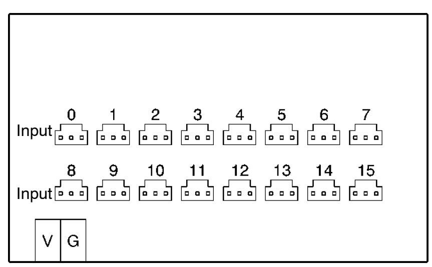
Components



Internal Circuits

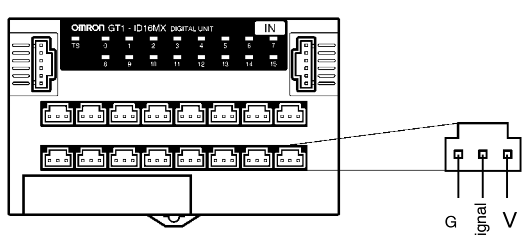


Terminal Arrangement



Connector Pin Arrangement

The arrangement of the connectors is shown in the following diagram.



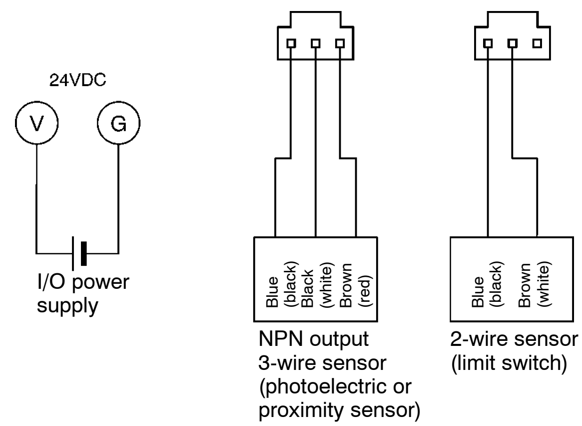
Wiring

Attach MOLEX connectors to the Transistor Input Unit and connect them to external devices.

Applicable Connectors

Manufac-turer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
	Crimp	Housing	50-57-9403	
		Reeled contacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
		Loose contacts	16-02-0096	For AWG#24 to 30
			16-02-0102	For AWG#22 to 24
		Crimping tool	570-36-5000	For AWG#22 to 26
			11-01-0209	For AWG#24 to 30

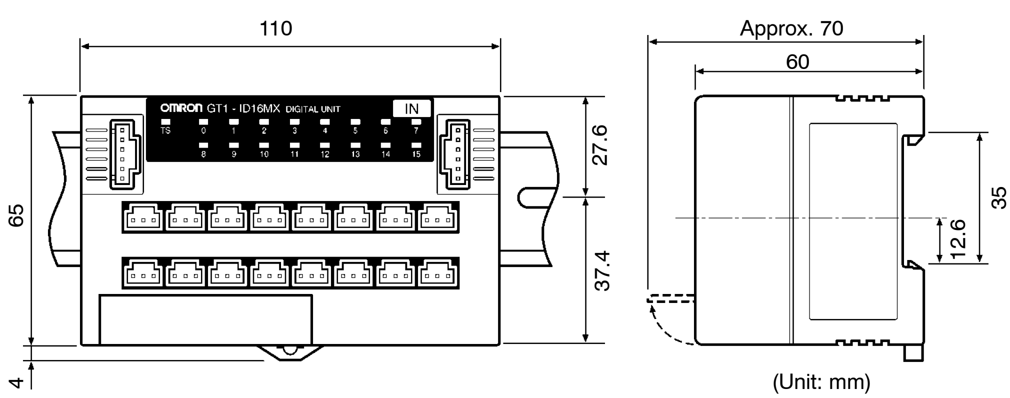
Wiring Example



Wire colors in parentheses are the previous JIS colors for photoelectric and proximity sensors.

Note V terminals and V connector pins, as well as G terminals and G connector pins, are internally connected. When the I/O power is being supplied from a terminal block, the power can be supplied to the input devices from the V and G connectors. Current supplied in this way, however, must be less than 1 A.

Dimensions



(Unit: mm)

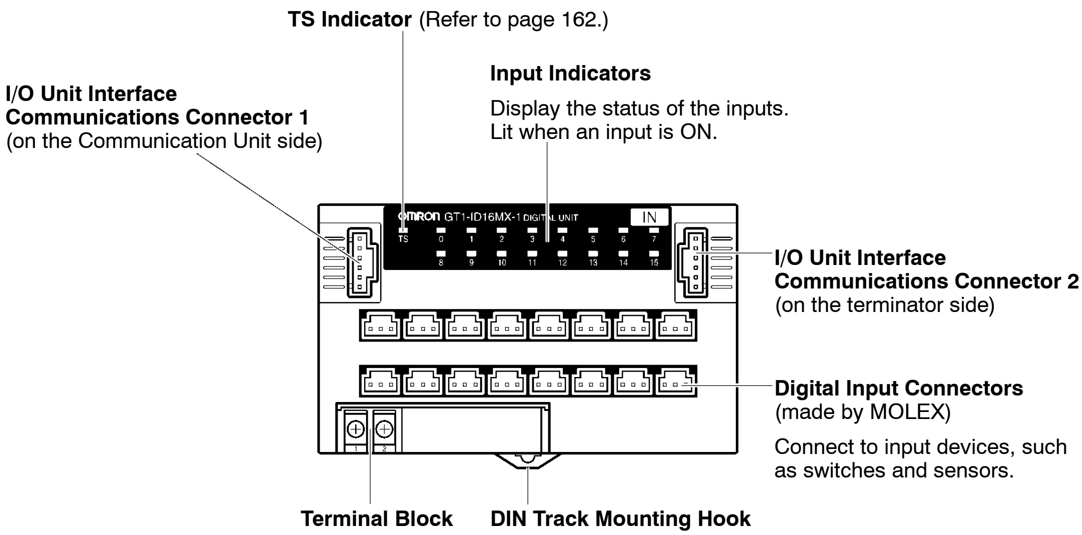
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-4 GT1-ID16MX-1 Transistor Input Unit with Connector (PNP)

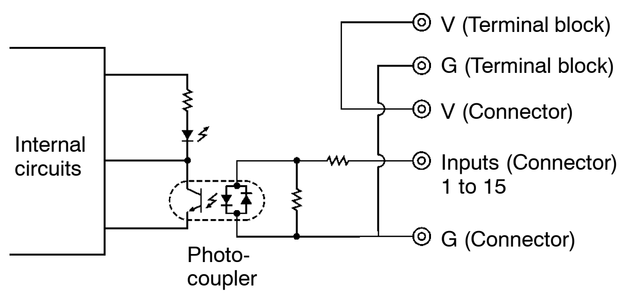
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	16 points max.

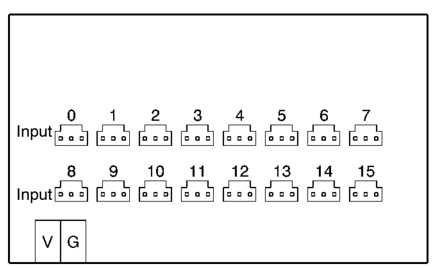
Components



Internal Circuits

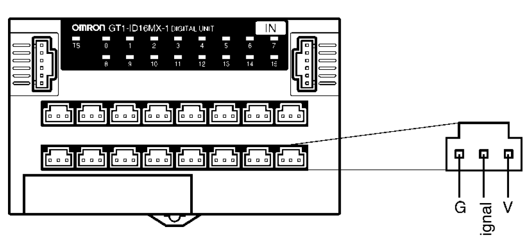


Terminal Arrangement



Connector Pin Arrangement

The arrangement of the connectors is shown in the following diagram.



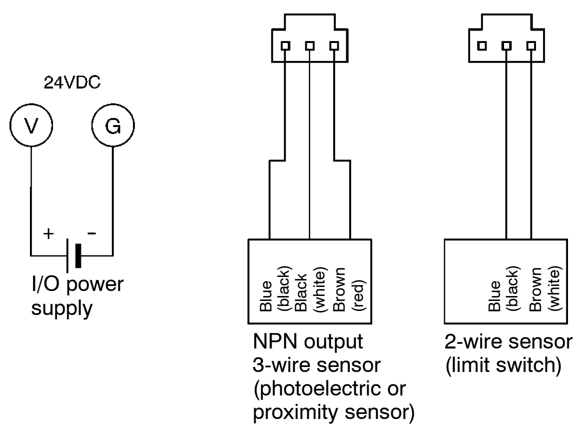
Wiring

Attach MOLEX connectors to the Transistor Input Unit and connect them to external devices.

Applicable Connectors

Manufac-turer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
	Crimp	Housing	50-57-9403	
		Reeled con-tacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
		Loose con-tacts	16-02-0096	For AWG#24 to 30
			16-02-0102	For AWG#22 to 24
		Crimping tool	570-36-5000	For AWG#22 to 26
			11-01-0209	For AWG#24 to 30

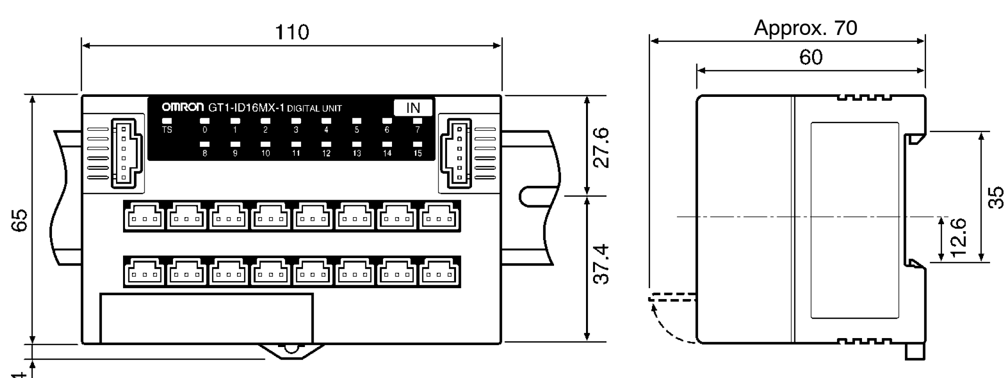
Wiring Examples



Wire colors in parentheses are the previous JIS colors for photoelectric and proximity sensors.

Note V terminals and V connector pins, as well as G terminals and G connector pins, are internally connected. When the I/O power is being supplied from a terminal block, the power can be supplied to the input devices from the V and G connectors. Current supplied in this way, however, must be less than 1 A.

Dimensions



(Unit: mm)

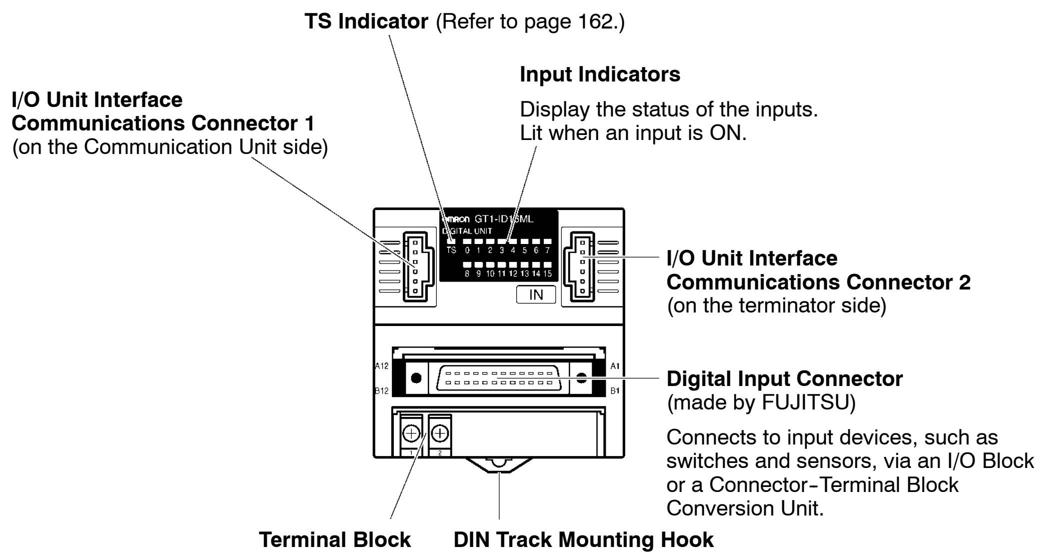
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-5 GT1-ID16ML Transistor Input Unit with Connector (NPN)

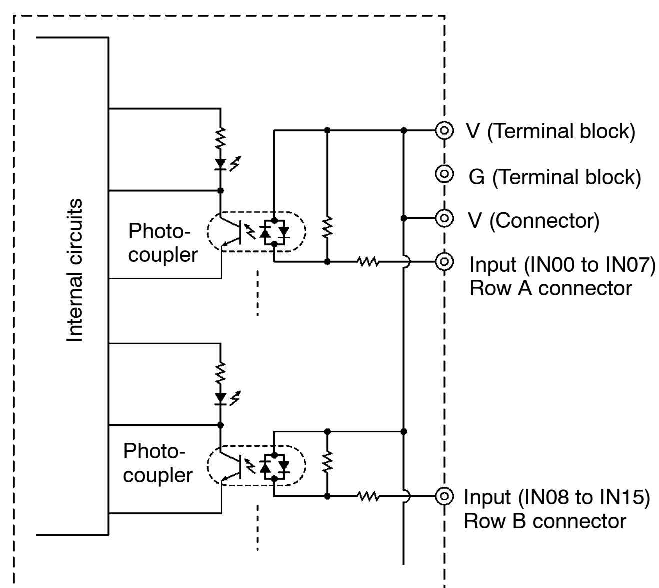
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	12 points max.

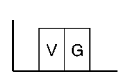
Components



Internal Circuits

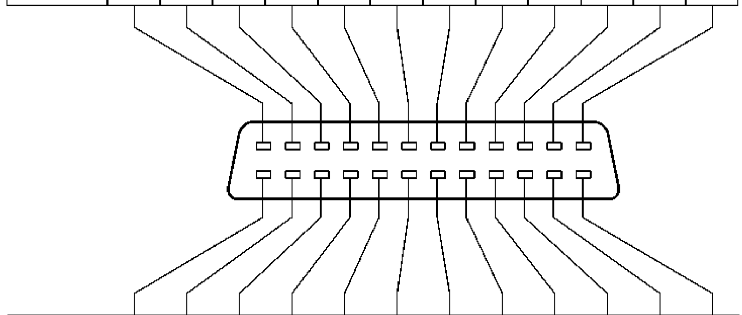


Terminal Arrangement



Connector Pin Arrangement

Pin number	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
Function	NC	NC	NC	V	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00



Pin number	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
Function	NC	NC	NC	V	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08

Wiring

Attach a FUJITSU connector to the Transistor Input Unit and connect it to the external devices.

Applicable Connectors

Three types of connectors can be attached to the cable depending to the assembly method. When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

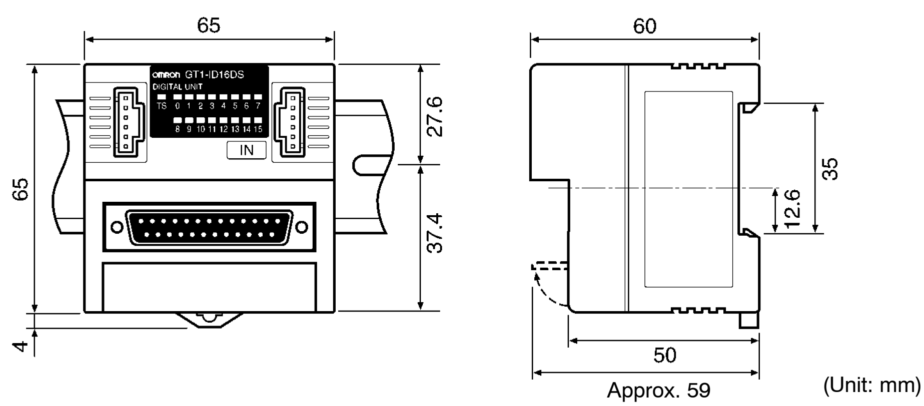
Cables with Connectors

When a Transistor Input Unit with a high-density connector is to be connected to an OMRON I/O Block or a Connector-Terminal Block Conversion Unit, use the cables listed in the following table (sold separately).

Manufacturer	Model number	Device
OMRON	XW2Z-□□□A	Connector-Terminal Block Conversion Unit XW2B-20G4 or XW2B-20G5
	G79-□□□C	I/O Block G7TC-I□16

Note Make sure there are no more than 12 points are turned ON at the same time.

Dimensions



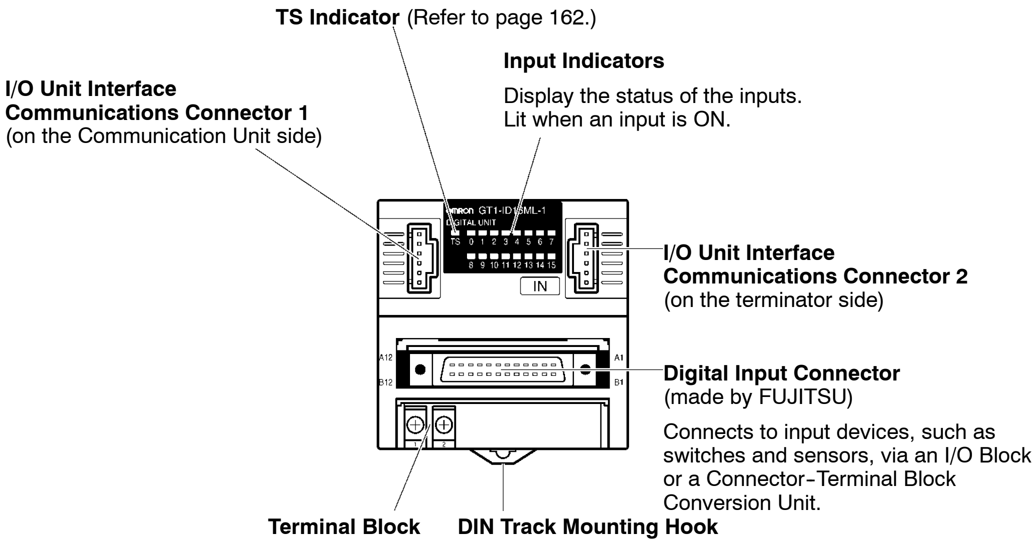
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-6 GT1-ID16ML-1 Transistor Input Unit with Connector (PNP)

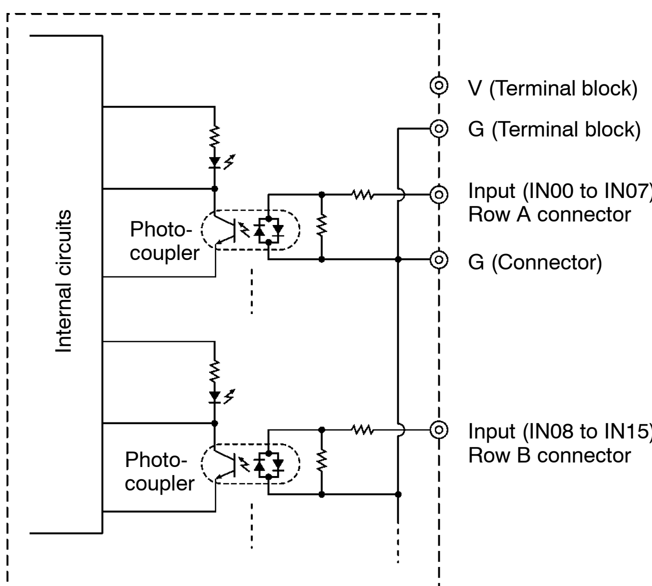
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	12 points max.

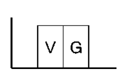
Components



Internal Circuits

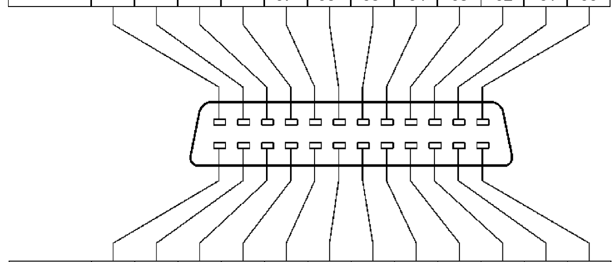


Terminal Arrangement



Connector Pin Arrangement

Pin number	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
Function	NC	NC	NC	G	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00



Pin number	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
Function	NC	NC	NC	G	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08

Wiring

Attach a FUJITSU connector to the Transistor Input Unit and connect it to the external devices.

Applicable Connectors

Three types of connectors can be attached to the cable depending to the assembly method. When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

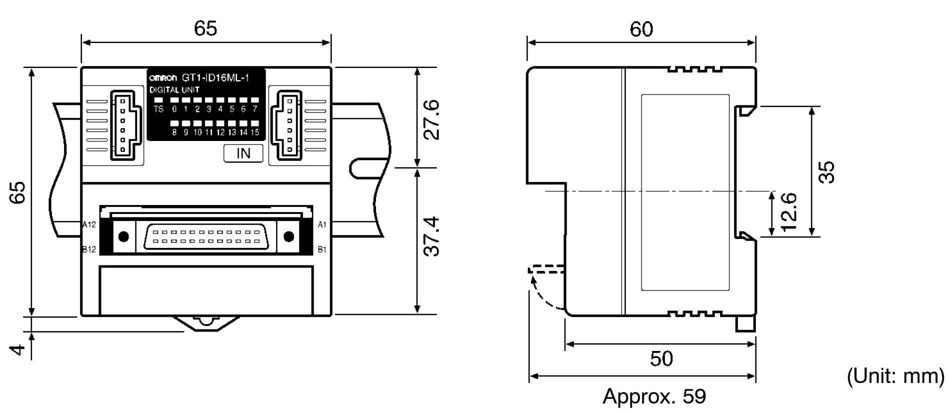
Cables with Connectors

When a Transistor Input Unit with a high-density connector is to be connected to an OMRON I/O Block or a Connector–Terminal Block Conversion Unit, use the cables listed in the following table (sold separately).

Manufacturer	Model number	Device
OMRON	XW2Z-□□□A	Connector–Terminal Block Conversion Unit XW2B-20G4 or XW2B-20G5

Note Make sure there are no more than 12 points are turned ON at the same time.

Dimensions



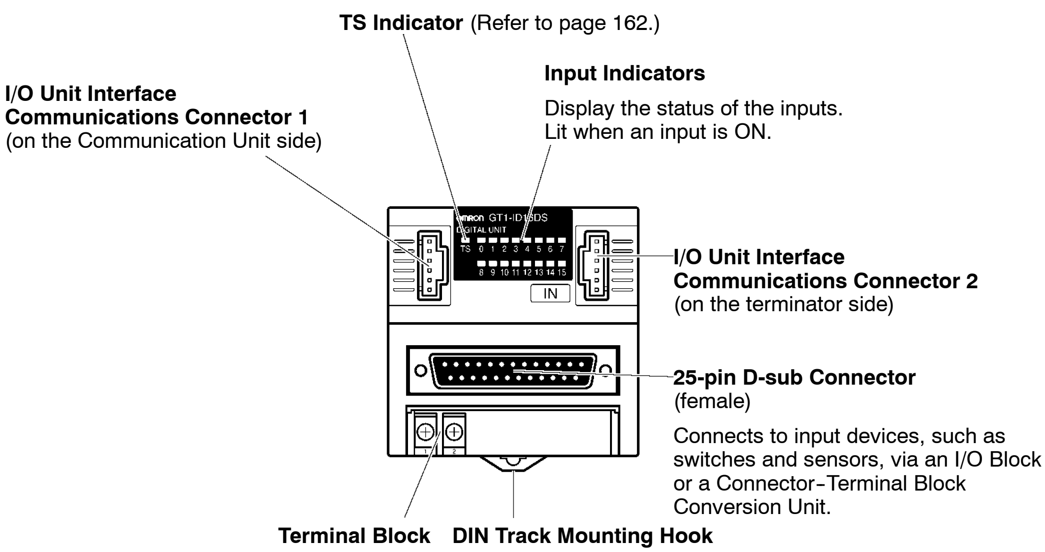
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-7 GT1-ID16DS Transistor Input Unit with Connector (NPN)

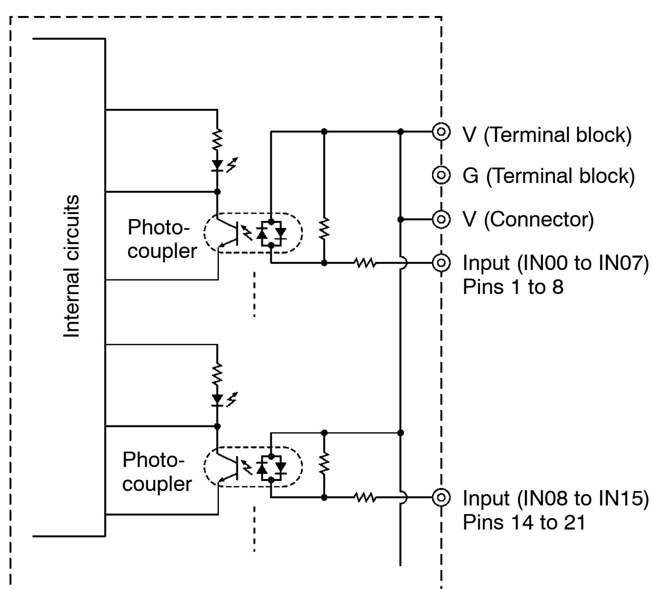
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	12 points max.

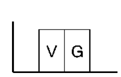
Components



Internal Circuits

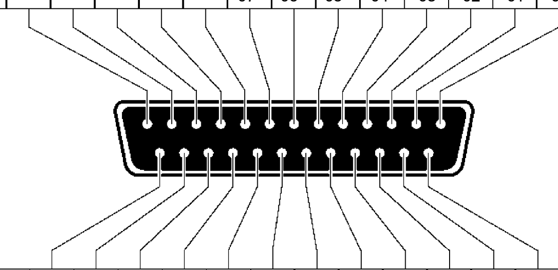


Terminal Arrangement



Connector Pin Arrangement

Pin number	13	12	11	10	9	8	7	6	5	4	3	2	1
Function	NC	NC	NC	V	G	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00



Pin number	25	24	23	22	21	20	19	18	17	16	15	14
Function	NC	NC	V	G	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08

Wiring

Attach a 25-pin D-sub connector to the Transistor Input Unit and connect it to the external devices.

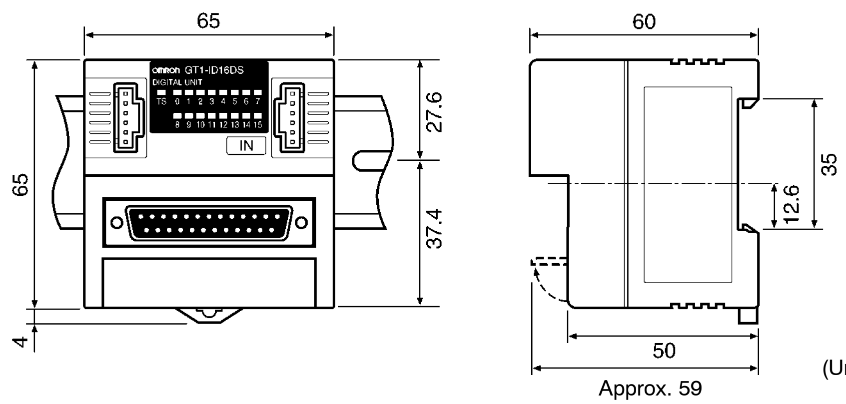
Applicable Connectors

When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
OMRON	XW2S-2513	Hood
	XW2A-2501	Plug

Note Make sure there are no more than 12 points are turned ON at the same time.

Dimensions



(Unit: mm)

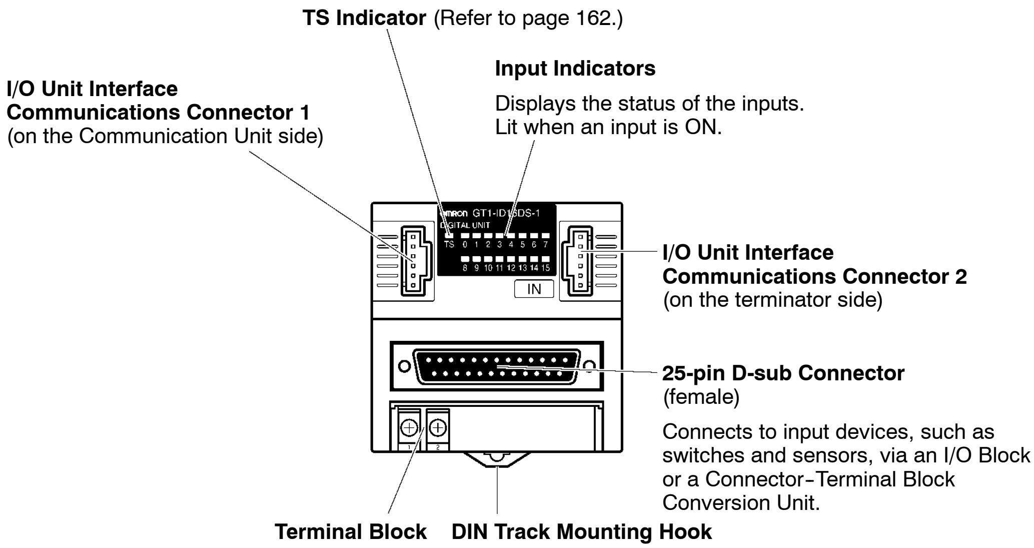
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-8 GT1-ID16DS-1 Transistor Input Unit with Connector (PNP)

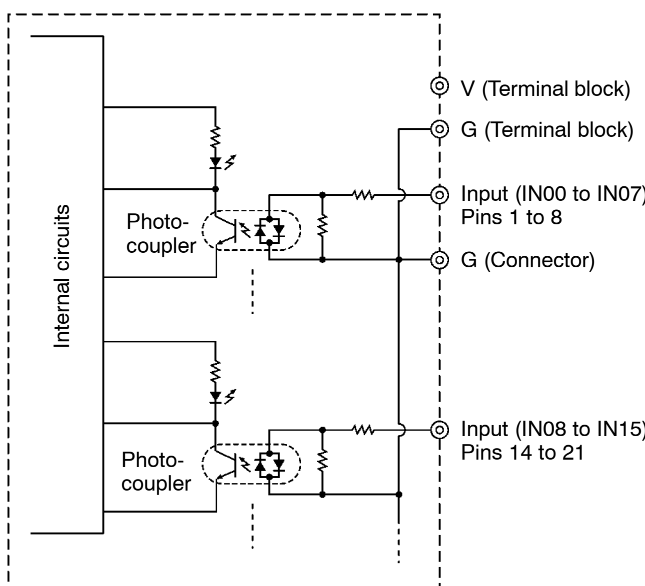
Input Specifications

Item	Specifications
Number of input points	16 points
Number of points that can be ON simultaneously	12 points max.

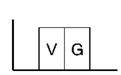
Components



Internal Circuits

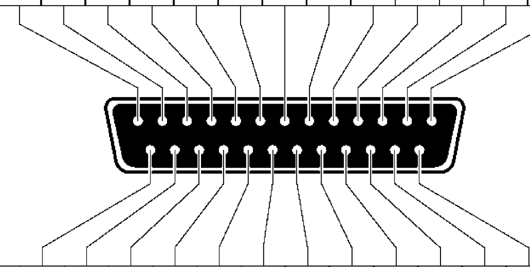


Terminal Arrangement



Connector Pin Arrangement

Pin number	13	12	11	10	9	8	7	6	5	4	3	2	1
Function	NC	NC	NC	V	G	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00



Pin number	25	24	23	22	21	20	19	18	17	16	15	14
Function	NC	NC	V	G	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08

Wiring

Attach a 25-pin D-sub connector to the Transistor Input Unit and connect it to the external devices.

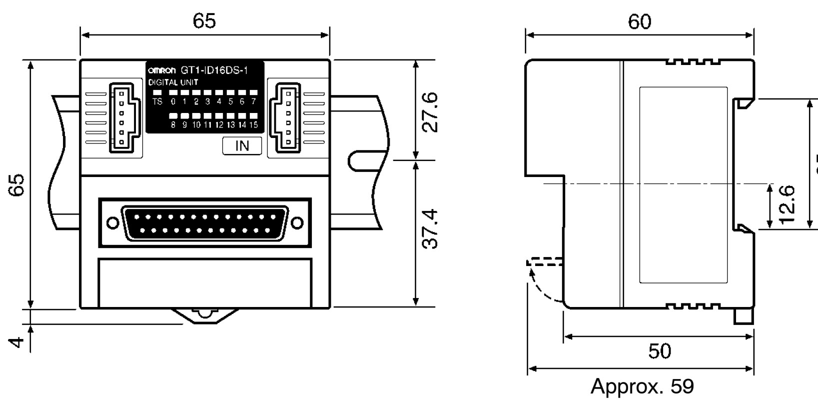
Applicable Connectors

When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
OMRON	XW2S-2513	Hood
	XW2A-2501	Plug

Note Make sure there are no more than 12 points are turned ON at the same time.

Dimensions



(Unit: mm)

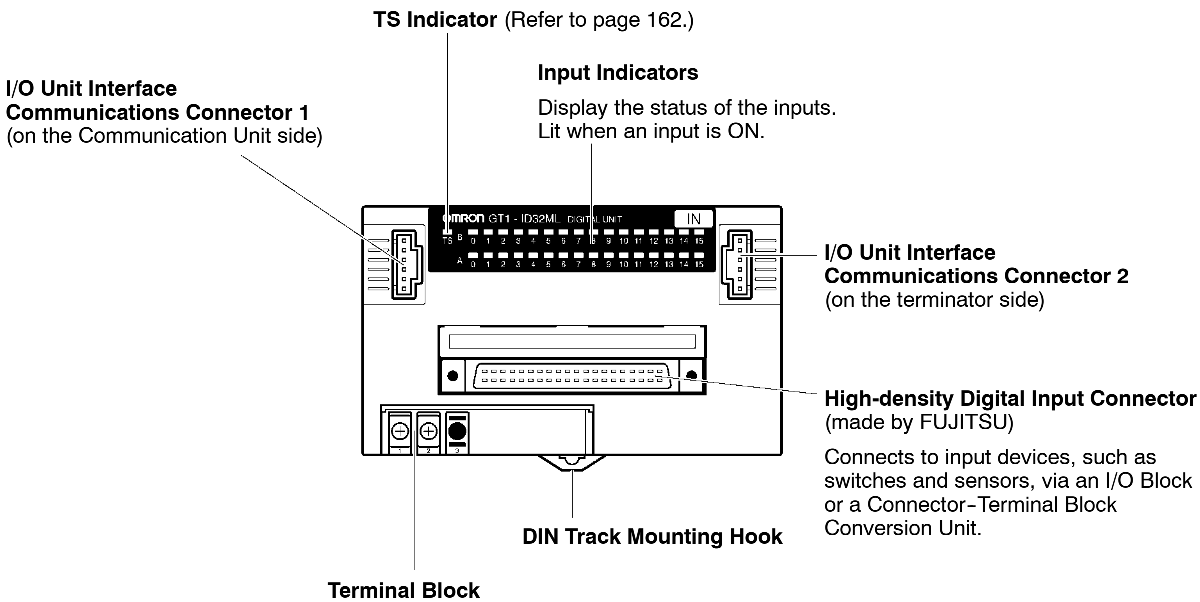
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-9 GT1-ID32ML Transistor Input Unit with High-density Connector (NPN)

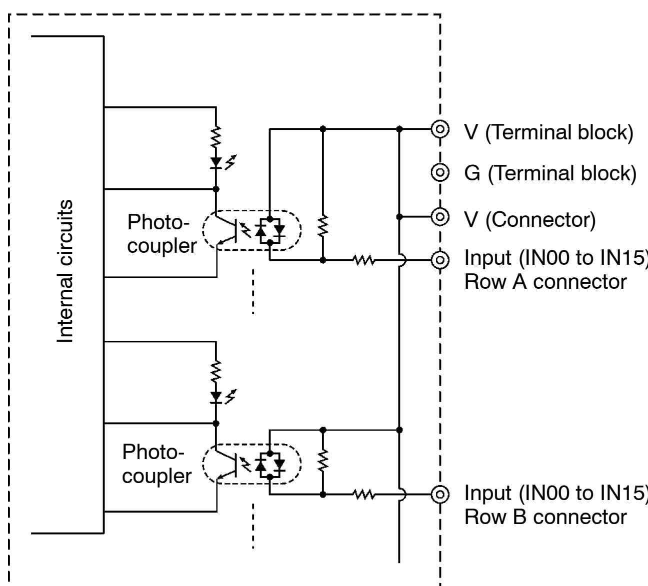
Input Specifications

Item	Specifications
Number of input points	32 points
Number of points that can be ON simultaneously	16 points max.

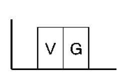
Components



Internal Circuits

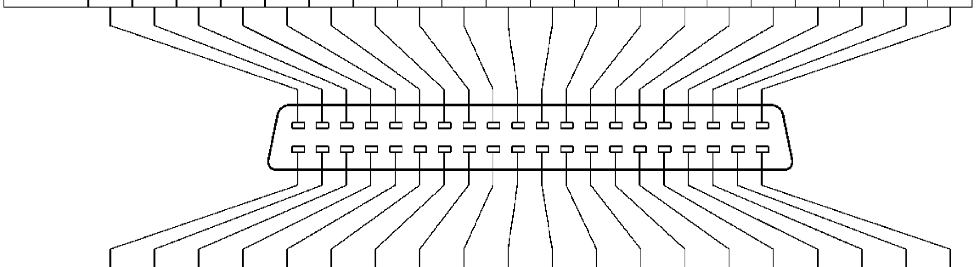


Terminal Arrangement



Connector Pin Arrangement

Pin number	A20	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	
Function	NC	NC	V	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08	V	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00	m word



Pin number	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	
Function	NC	NC	V	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08	V	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00	m+1 word

Wiring

Attach a FUJITSU connector to the Transistor Input Unit and connect it to the external devices.

Applicable Connectors

Three types of connectors can be attached to the cable depending to the assembly method. When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
FUJITSU	FCN361J040-AU	Soldered
	FCN363J040-AU	Crimp
	FCN367J040-AU/F	Pressure-welded

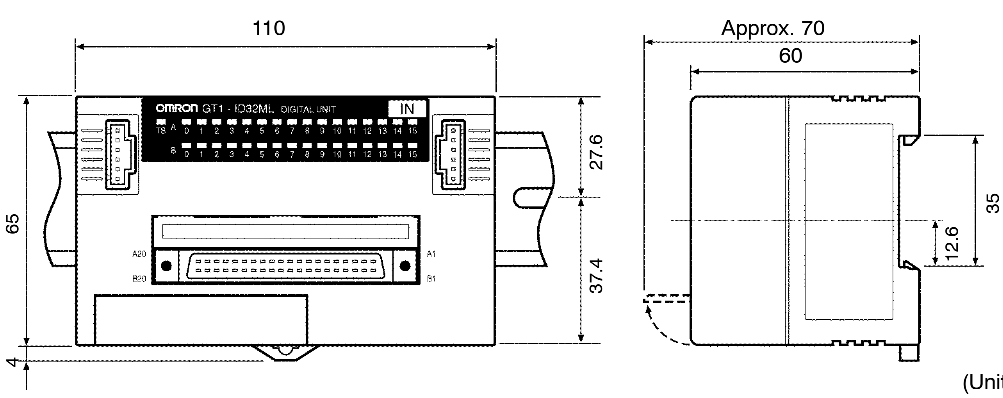
Cables with Connectors

When a Transistor Input Unit with a high-density connector is to be connected to an OMRON I/O Block or a Connector–Terminal Block Conversion Unit, use the cables listed in the following table (sold separately).

Manufacturer	Model number	Device
OMRON	XW2Z-□□□B	Connector–Terminal Block Conversion Unit XW2B-40G4 or XW2B-40G5
	G79-I□C-□	I/O Block G7TC-I□16

Note Make sure there are no more than 16 points are turned ON at the same time.

Dimensions



(Unit: mm)

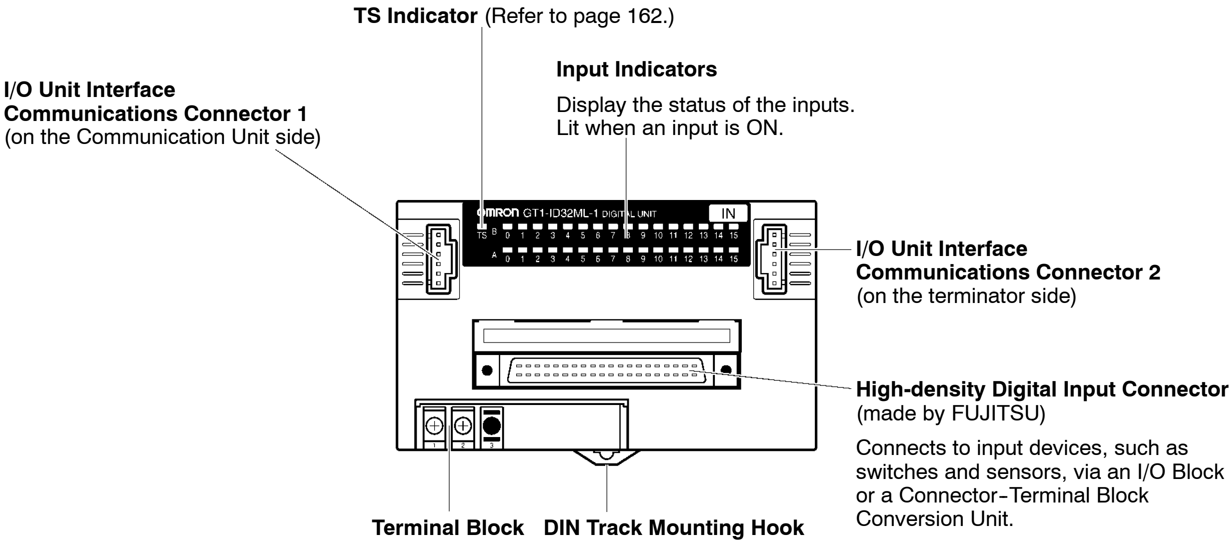
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-2-10 GT1-ID32ML-1 Transistor Input Unit with High-density Connector (PNP)

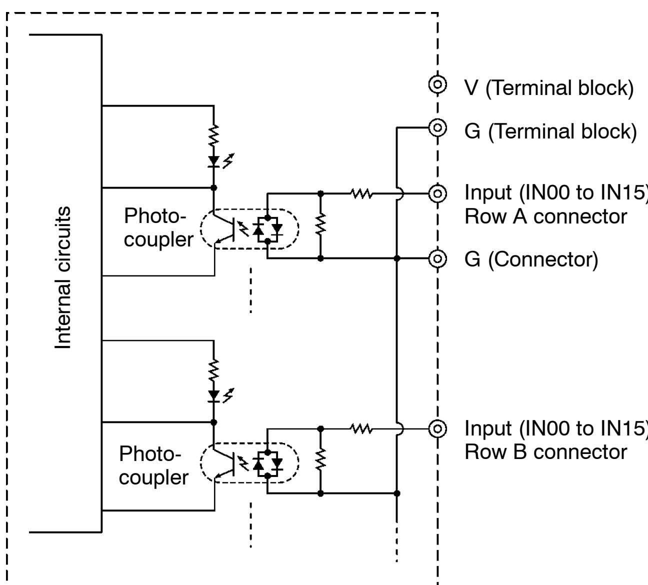
Input Specifications

Item	Specifications
Number of input points	32 points
Number of points that can be ON simultaneously	16 points max.

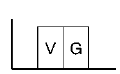
Components



Internal Circuits



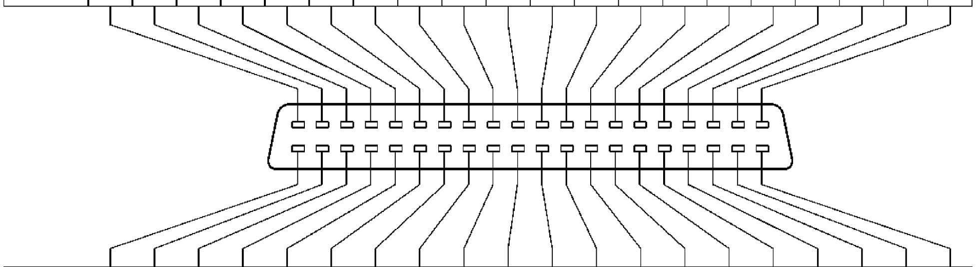
Terminal Arrangement



Connector Pin Arrangement

Pin number	A20	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
Function	NC	NC	G	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08	G	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00

m word



Pin number	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
Function	NC	NC	G	IN 15	IN 14	IN 13	IN 12	IN 11	IN 10	IN 09	IN 08	G	IN 07	IN 06	IN 05	IN 04	IN 03	IN 02	IN 01	IN 00

m+1 word

Wiring

Attach a FUJITSU connector to the Transistor Input Unit and connect it to the external devices.

Applicable Connectors

Three types of connectors can be attached to the cable depending to the assembly method. When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
FUJITSU	FCN361J040-AU	Soldered
	FCN363J040-AU	Crimp
	FCN367J040-AU/F	Pressure-welded

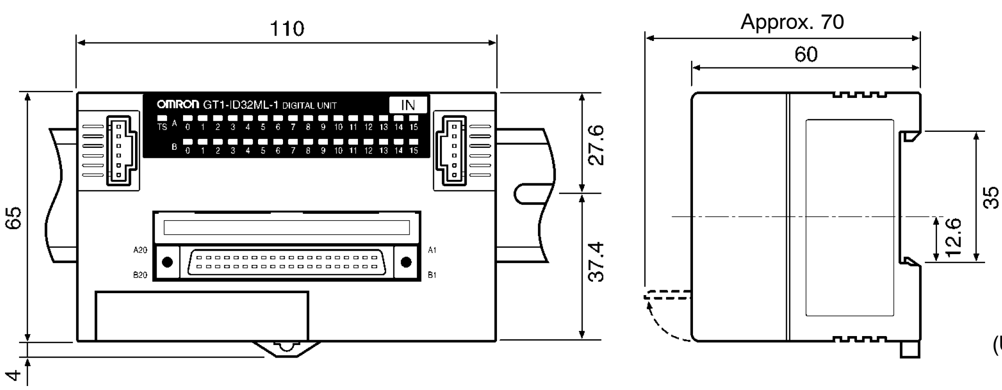
Cables with Connectors

When a Transistor Input Unit with a high-density connector is to be connected to an OMRON I/O Block or a Connector–Terminal Block Conversion Unit, use the cables listed in the following table (sold separately).

Manufacturer	Model number	Device
OMRON	XW2Z-□□□B	Connector–Terminal Block Conversion Unit XW2B-40G4 or XW2B-40G5

Note Make sure there are no more than 16 points are turned ON at the same time.

Dimensions



(Unit: mm)

Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

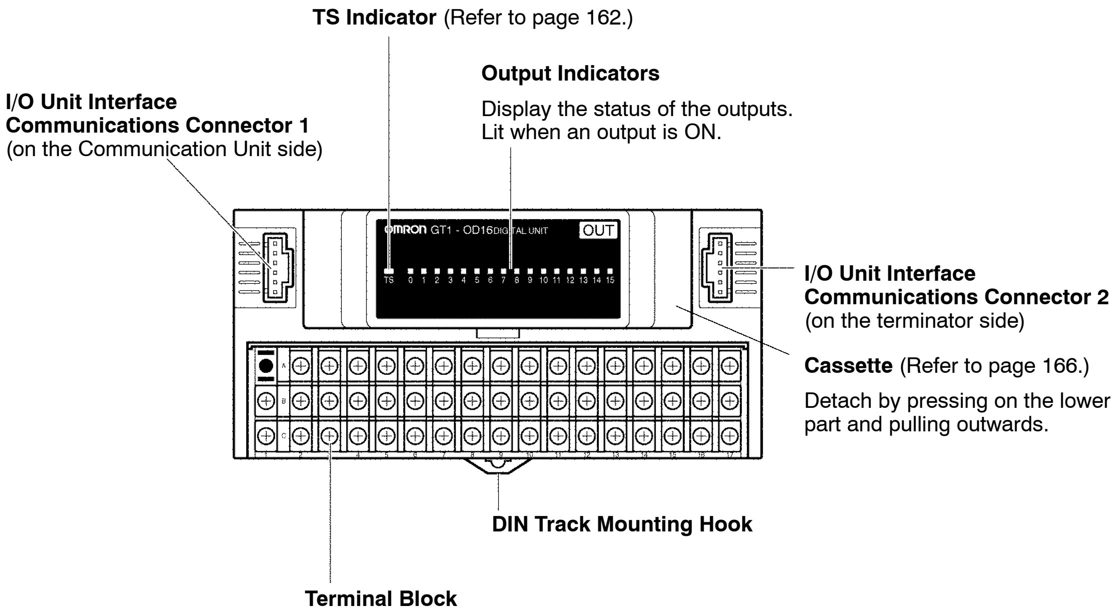
6-3 Transistor Output Units

6-3-1 GT1-OD16 Transistor Output Unit with Terminal Block (NPN)

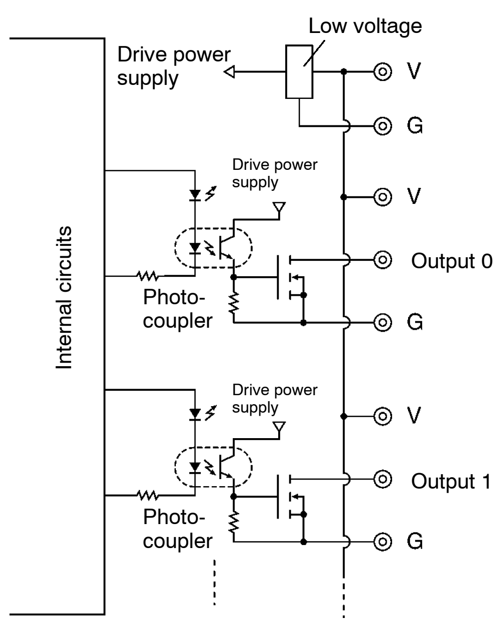
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	4 A max.

Components



Internal Circuits

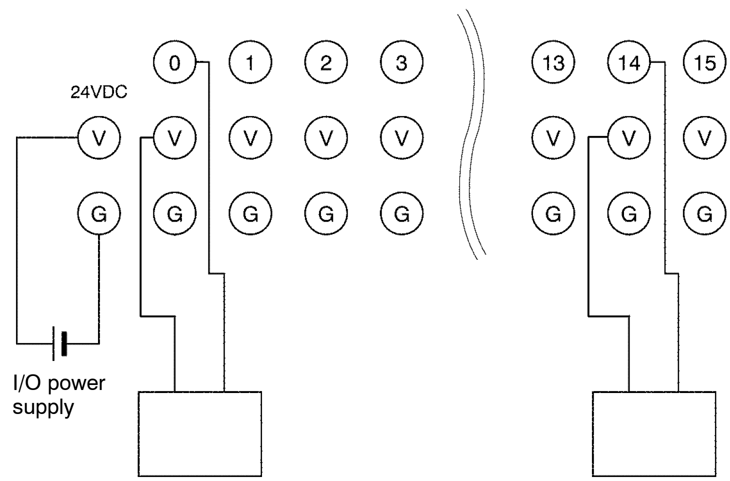


Terminal Arrangement

Row A		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Row B	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Row C	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

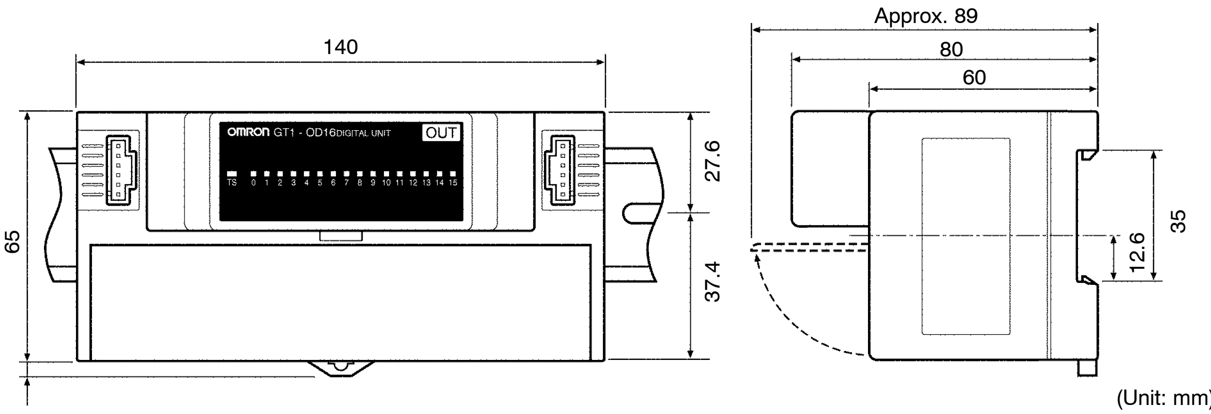
Terminal numbers

Wiring



Note V terminals and G terminals are respectively connected internally. When the I/O power is being supplied, the power can be supplied to the output devices from the V terminals and G terminals. Current supplied in this way, however, must be less than 4 A.

Dimensions



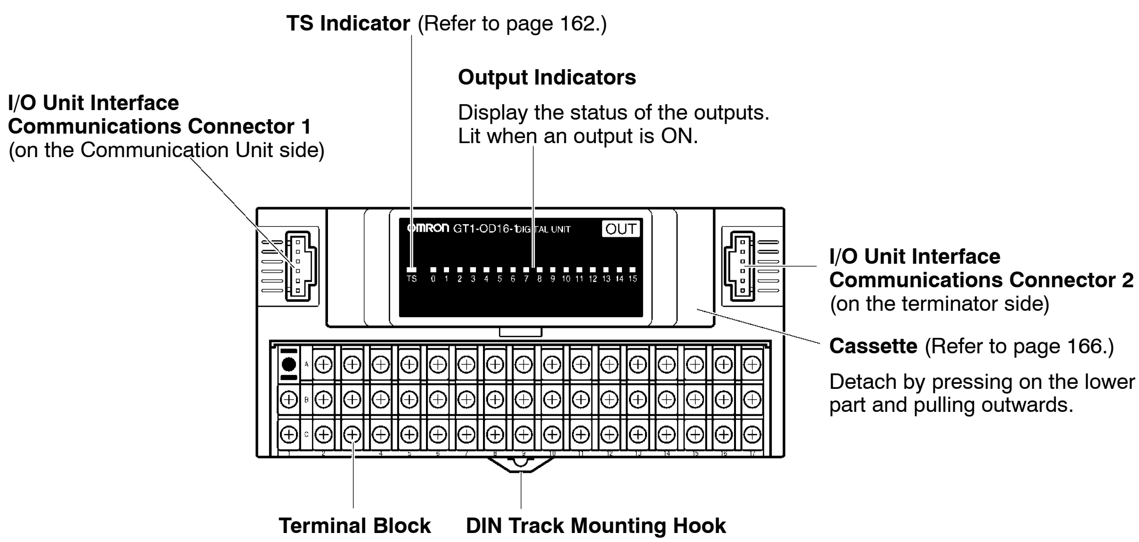
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-2 GT1-OD16-1 Transistor Output Unit with Terminal Block (PNP)

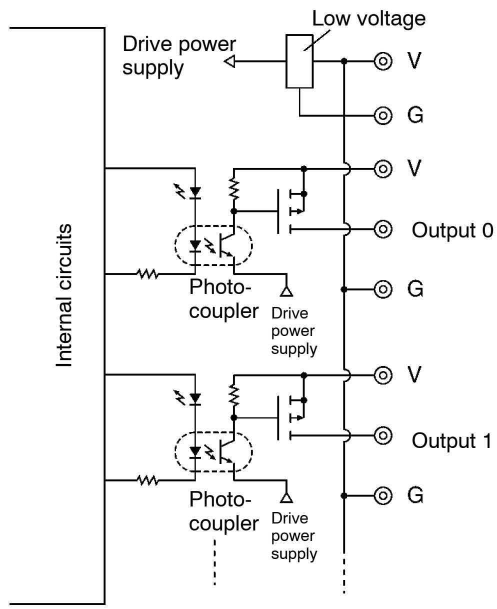
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	4 A max.

Components



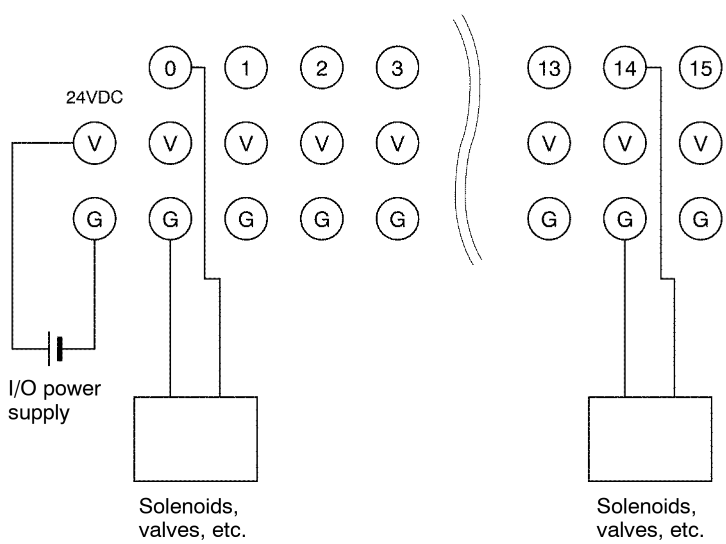
Internal Circuits



Terminal Arrangement

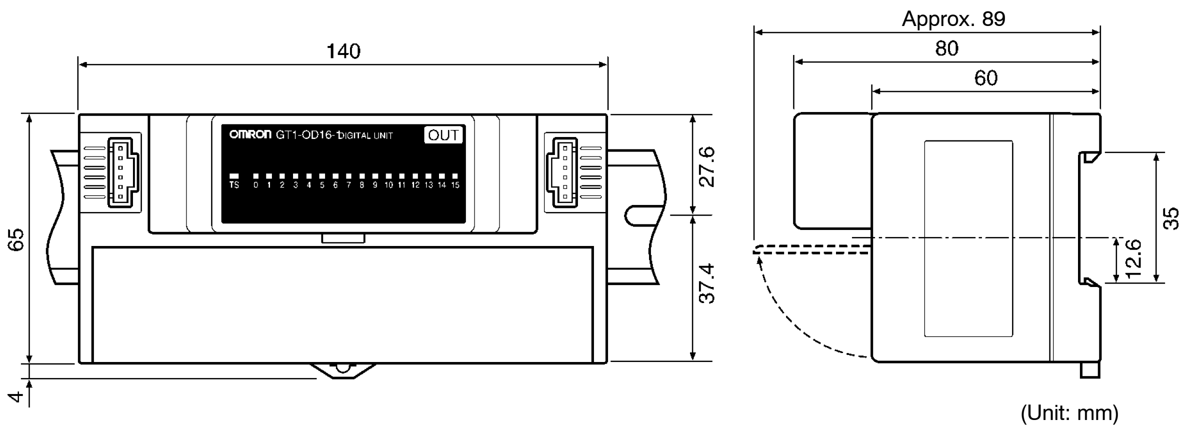
Row A		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Row B	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Row C	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Terminal numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Wiring



Note V terminals and G terminals are internally connected. When the I/O power is being supplied, the power can be supplied to the output devices from the V terminals and G terminals. Current supplied in this way, however, must be less than 4 A.

Dimensions



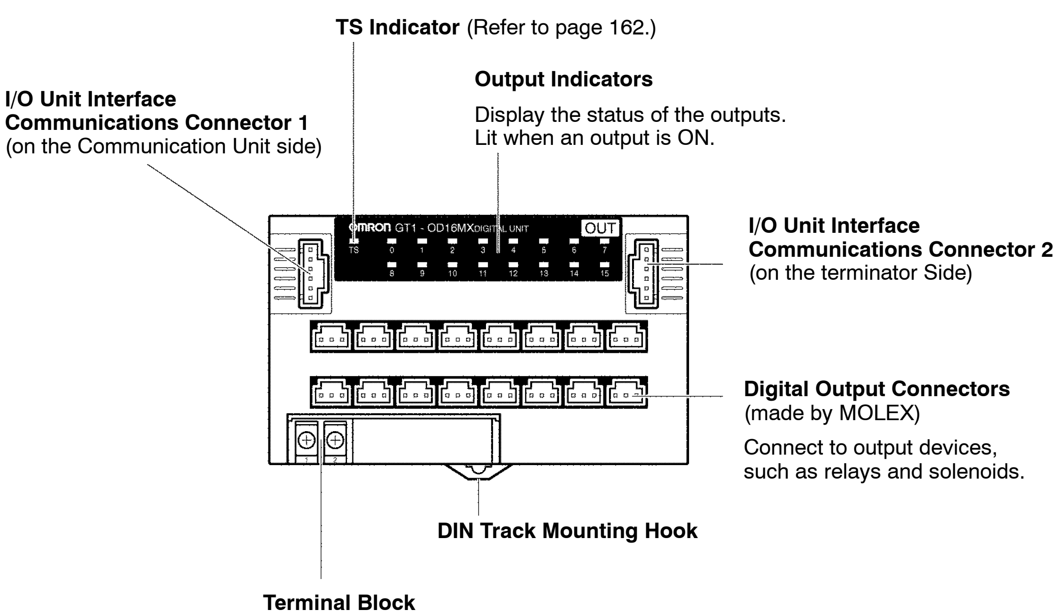
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-3 GT1-OD16MX Transistor Output Unit with Connector (NPN)

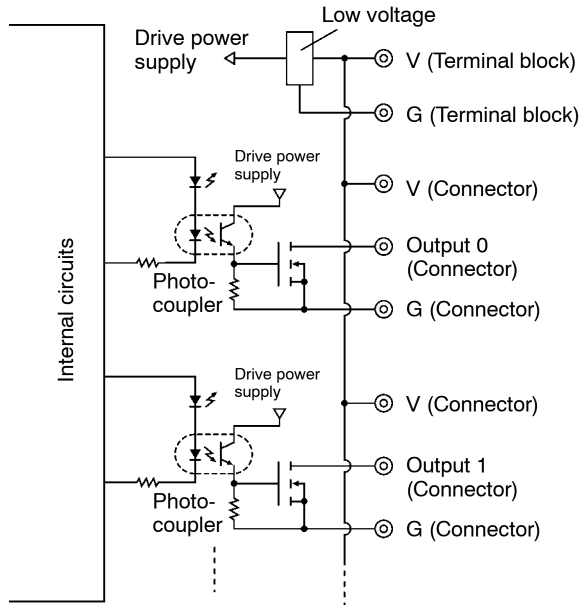
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	2 A max.

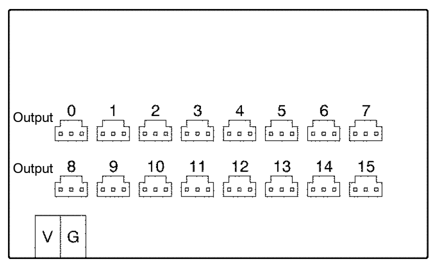
Components



Internal Circuits

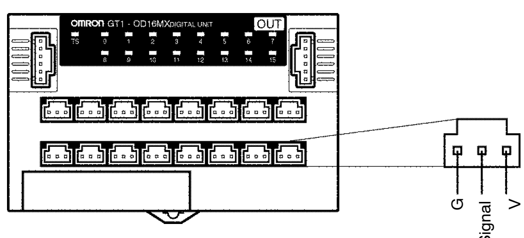


Terminal Arrangement



Connector Pin Arrangement

The following diagram shows the pin arrangement for the connector.



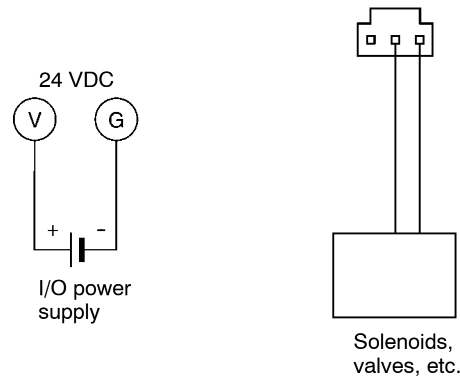
Wiring

Attach MOLEX connectors to the Transistor Output Unit and connect them to external devices.

Applicable Connectors

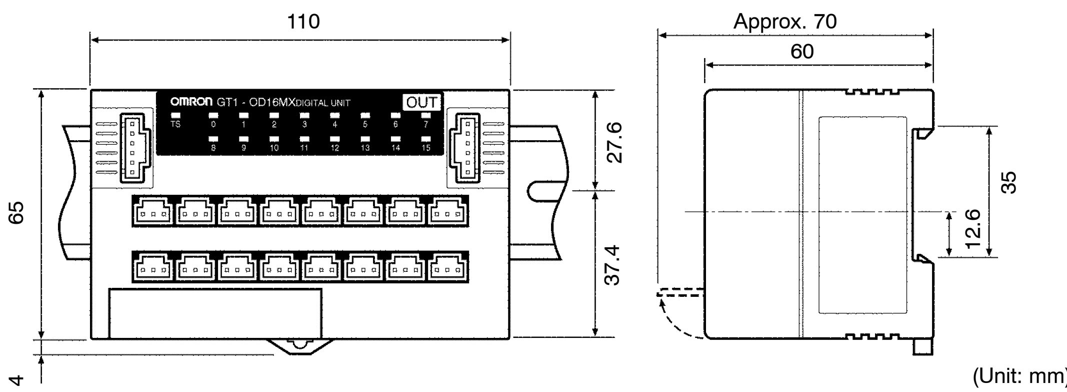
Manufac-turer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
	Crimp	Housing	50-57-9403	
		Reeled contacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
		Loose contacts	16-02-0096	For AWG#24 to 30
			16-02-0102	For AWG#22 to 24
		Crimping tool	570-36-5000	For AWG#22 to 26
			11-01-0209	For AWG#24 to 30

Wiring Examples



Note V terminals and V connector pins, as well as G terminals and G connector pins, are internally connected. When the I/O power is being supplied from a terminal block, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2 A.

Dimensions



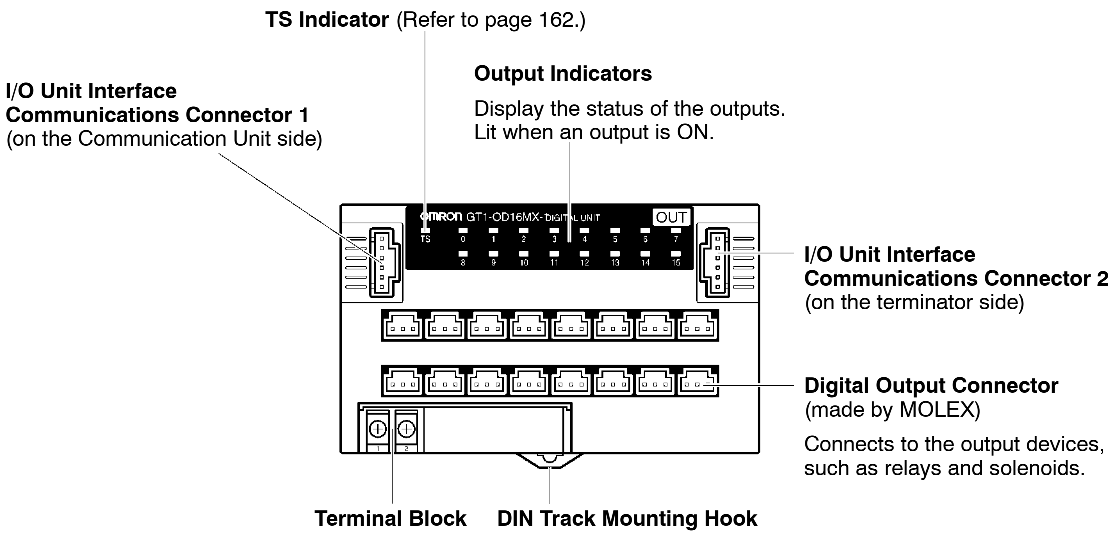
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-4 GT1-OD16MX-1 Transistor Output Unit with Connector (PNP)

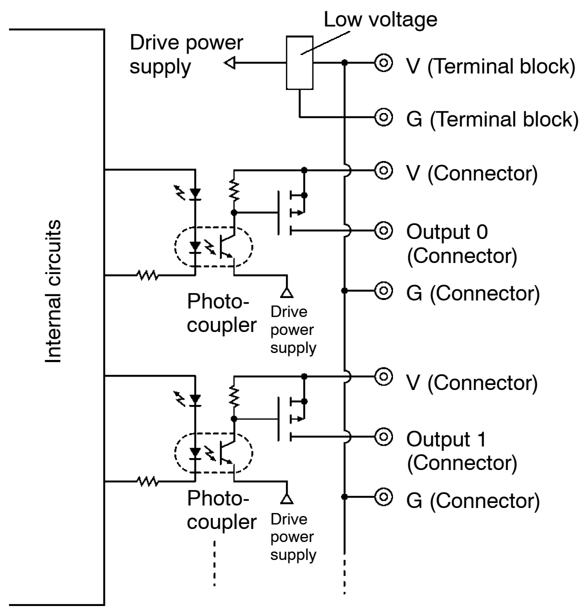
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	2 A max.

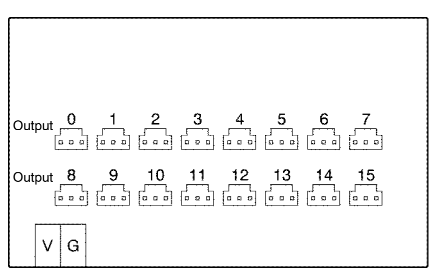
Components



Internal Circuits

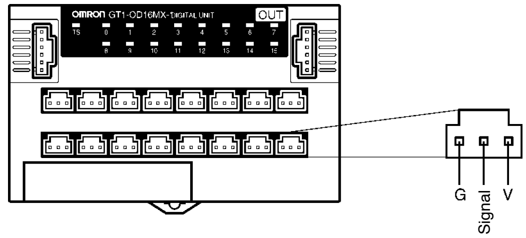


Terminal Arrangement



Connector Pin Arrangement

The following diagram shows the pin arrangement for the connector.



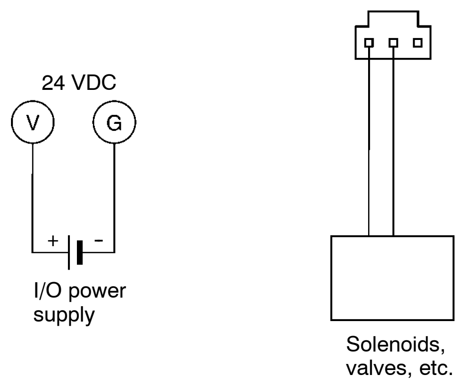
Wiring

Attach MOLEX connectors to the Transistor Output Unit and connect them to external devices.

Applicable Connectors

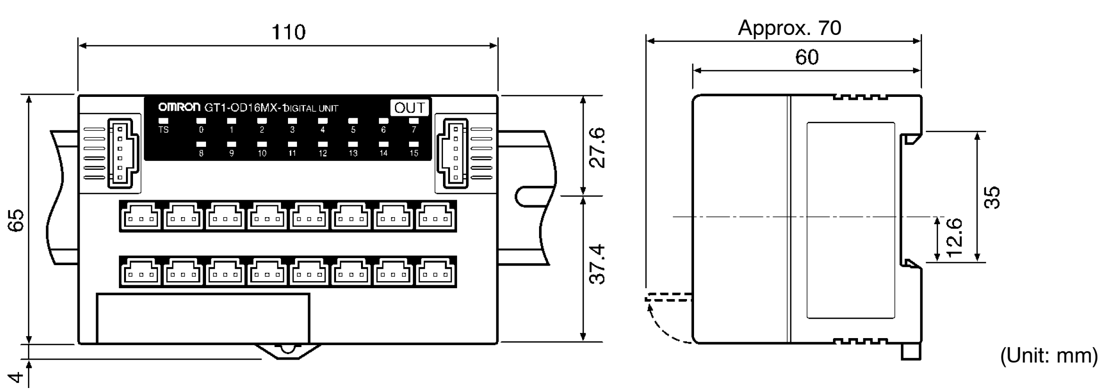
Manufac-turer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
	Crimp	Housing	50-57-9403	
		Reeled contacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
		Loose contacts	16-02-0096	For AWG#24 to 30
			16-02-0102	For AWG#22 to 24
		Crimping tool	570-36-5000	For AWG#22 to 26
			11-01-0209	For AWG#24 to 30

Wiring Examples



Note V terminals and V connector pins, as well as G terminals and G connector pins, are internally connected. When the I/O power is being supplied from a terminal block, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2 A.

Dimensions



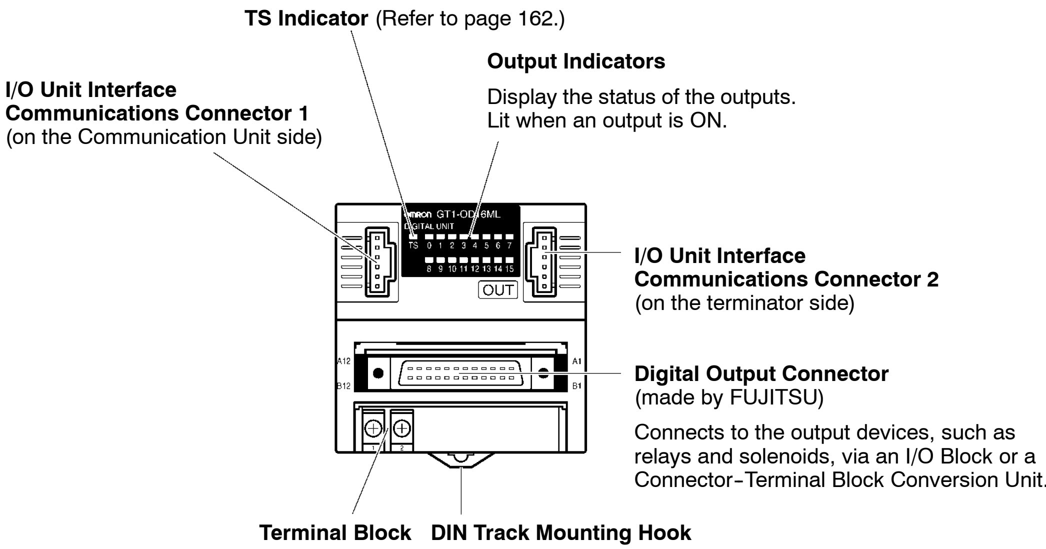
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-5 GT1-OD16ML Transistor Output Unit with Connector (NPN)

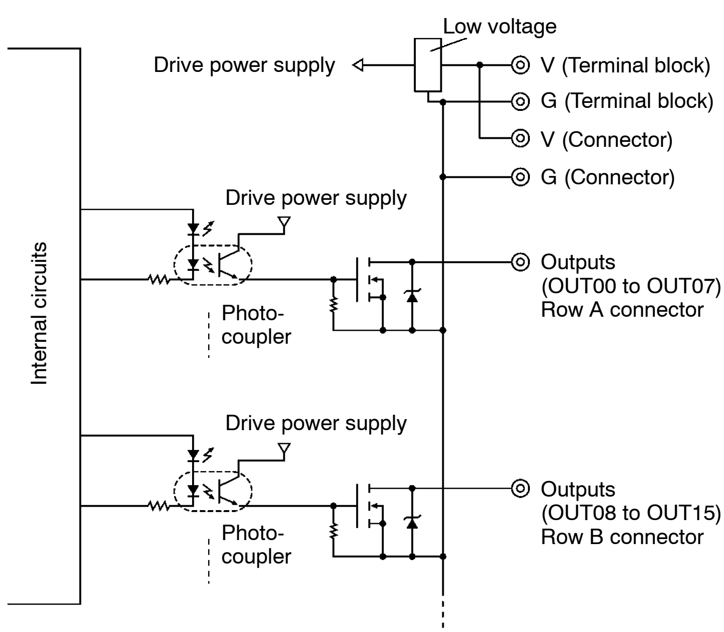
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	With connectors: 2 A max. With terminal block: 2.5 A max.

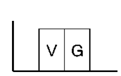
Components



Internal Circuits

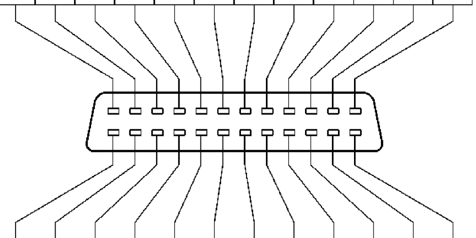


Terminal Arrangement



Connector Pin Arrangement

Pin number	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
Function	V	NC	V	G	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01	OUT 00



Pin number	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
Function	V	NC	V	G	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09	OUT 08

Wiring

Attach a FUJITSU connector to the Transistor Output Unit and connect to external devices.

Applicable Connectors

Three types of connectors can be attached to the cable, depending to the assembly method. When creating your own cables, use one of the following connectors.

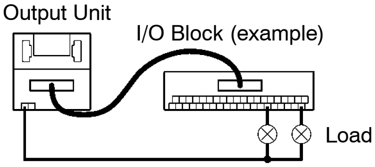
Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

Connector Cables

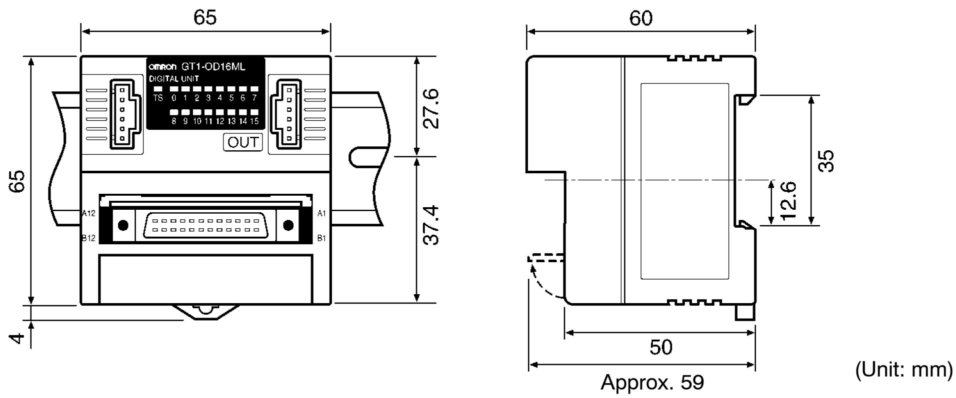
When a Transistor Output Unit (connector) is to be connected to an OMRON I/O Block or a Connector–Terminal Block Conversion Unit, use the cables (sold separately) listed in the following table.

Manufacturer	Model number	Corresponding device
OMRON	XW2Z-□□□A	Connector–Terminal Block Conversion Unit XW2B-20G4 XW2B-20G5
	G79-□□□C	I/O Block G7TC-OC16 G70D-SOC16 G70D-FOM16 G70A-ZOC16-3 M7F

Note V terminals and G terminals are respectively connected internally. When the I/O power is being supplied, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2 A. If, instead of using the V and G connectors, the power supply is wired to the terminal block as shown in the following diagram, the current supplied must be less than 2.5 A.



Dimensions



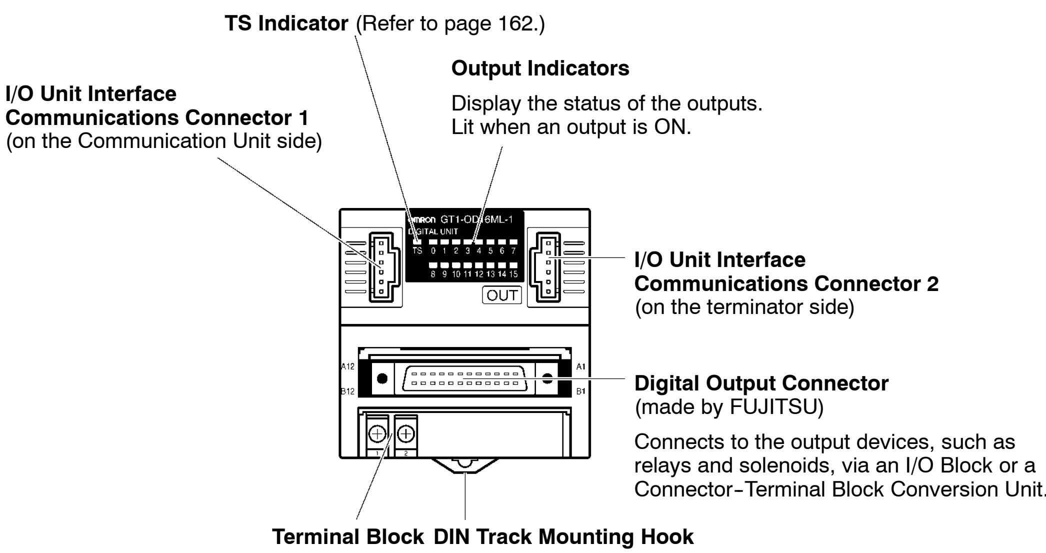
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-6 GT1-OD16ML-1 Transistor Output Unit with Connector (PNP)

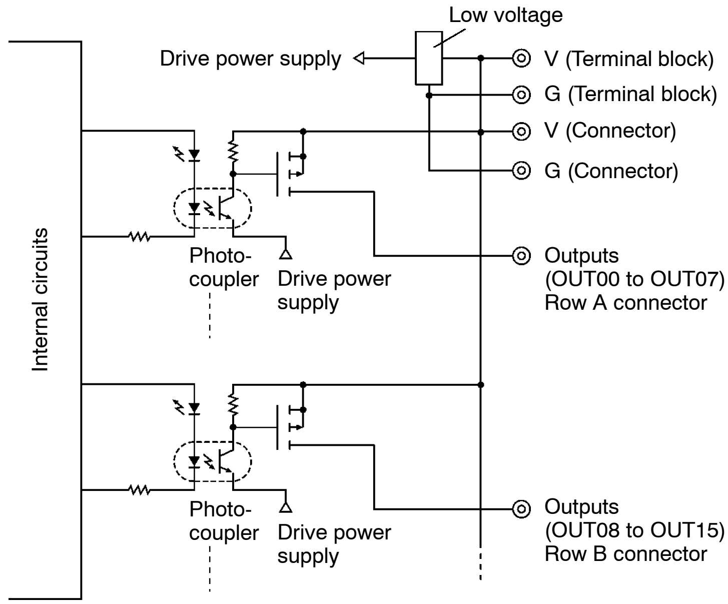
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	With connectors: 2 A max. With terminal block: 2.5 A max.

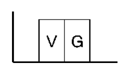
Components



Internal Circuits

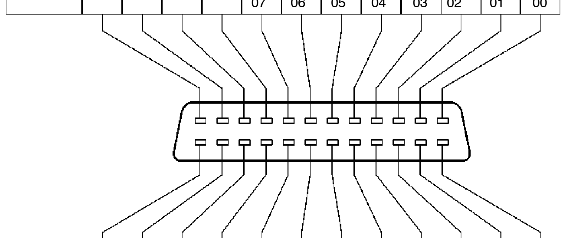


Terminal Arrangement



Connector Pin Arrangement

Pin number	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
Function	NC	NC	V	G	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01	OUT 00



Pin number	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
Function	NC	NC	V	G	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09	OUT 08

Wiring

Attach a FUJITSU connector to the Transistor Output Unit and connect it to external devices.

Applicable Connectors

Three types of connectors can be attached to the cable, depending to the assembly method. When creating your own cables, use one of the following connectors.

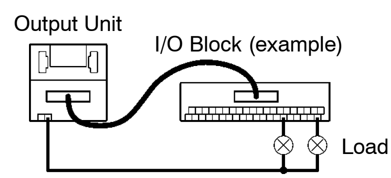
Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

Connector Cables

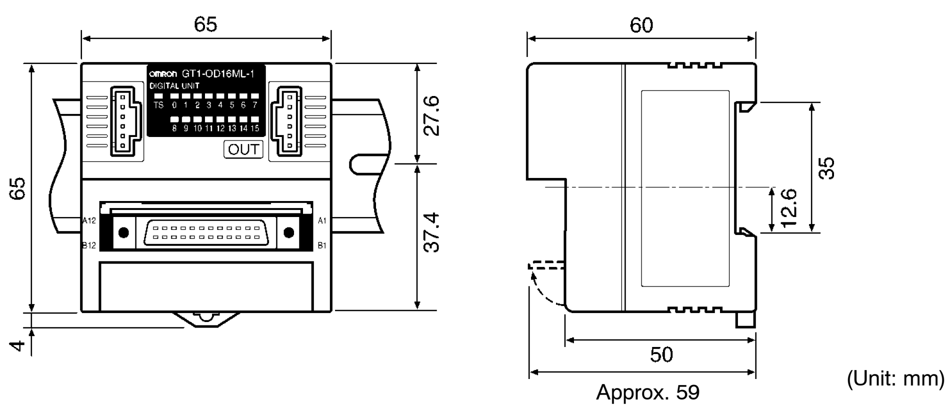
When a Transistor Output Unit (connector) is to be connected to an OMRON I/O Block or a Connector-Terminal Block Conversion Unit, use the cables (sold separately) listed in the following table.

Manufacturer	Model number	Corresponding device
OMRON	XW2Z-□□□A	Connector-Terminal Block Conversion Unit XW2B-20G4 XW2B-20G5
	G79-□□□C	I/O Block G7TC-OC16-1 G70D-SOC16-1 G70D-FOM16-1 G70A-ZOC16-4 M7F

Note V terminals and G terminals are internally connected. When the I/O power is being supplied, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2 A. If, instead of using the V and G connectors, the power supply is wired to the terminal block as shown in the following diagram, the current supplied must be less than 2.5 A.



Dimensions



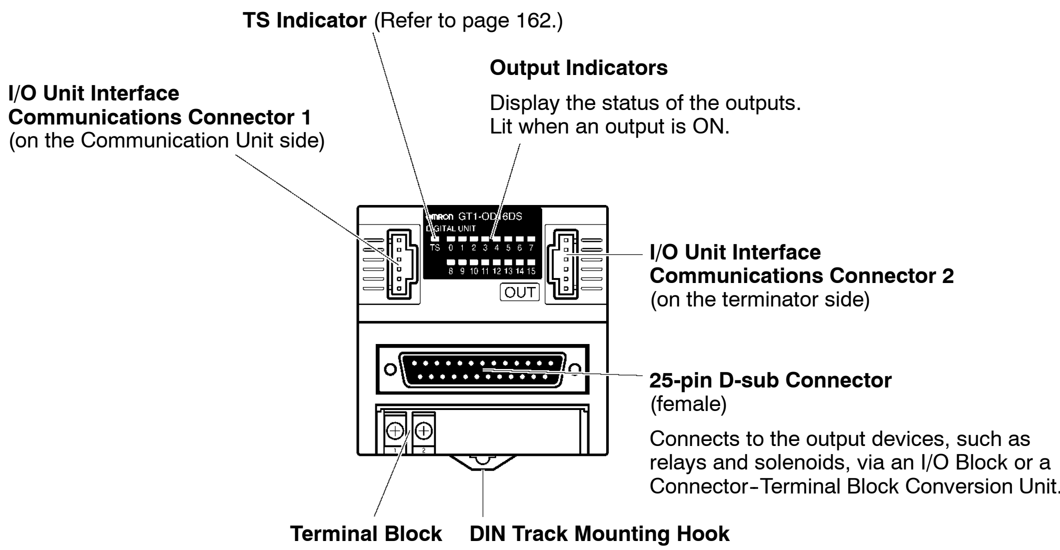
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-7 GT1-OD16DS Transistor Output Unit with Connector (NPN)

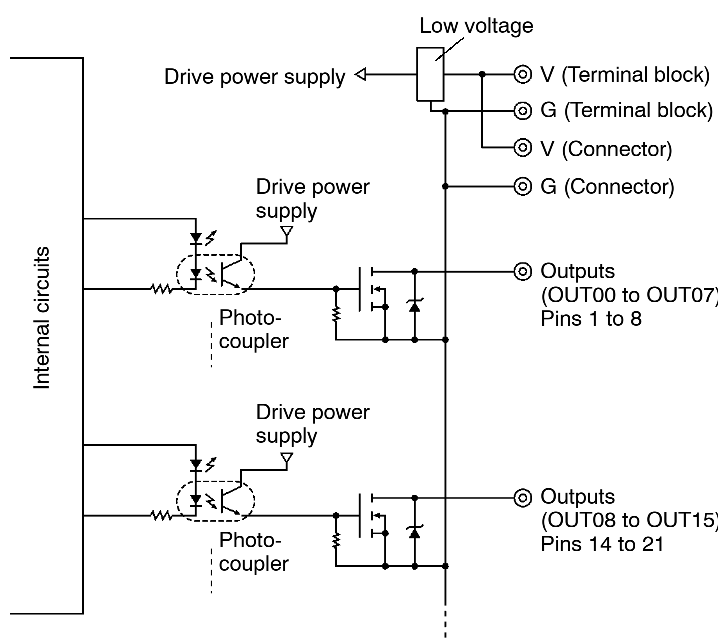
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	2.5 A max.

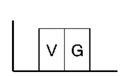
Components



Internal Circuits

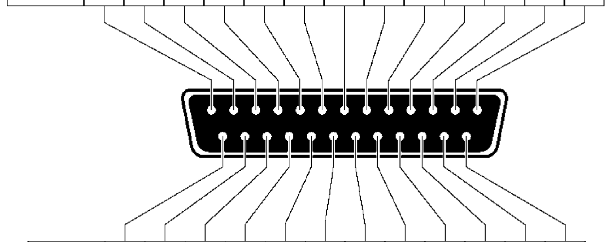


Terminal Arrangement



Connector Pin Arrangement

Pin number	13	12	11	10	9	8	7	6	5	4	3	2	1
Function	NC	NC	NC	V	G	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01	OUT 00



Pin number	25	24	23	22	21	20	19	18	17	16	15	14
Function	NC	NC	V	G	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09	OUT 08

Wiring

Attach a 25-pin D-sub connector to the Transistor Input Unit and connect it to the external devices.

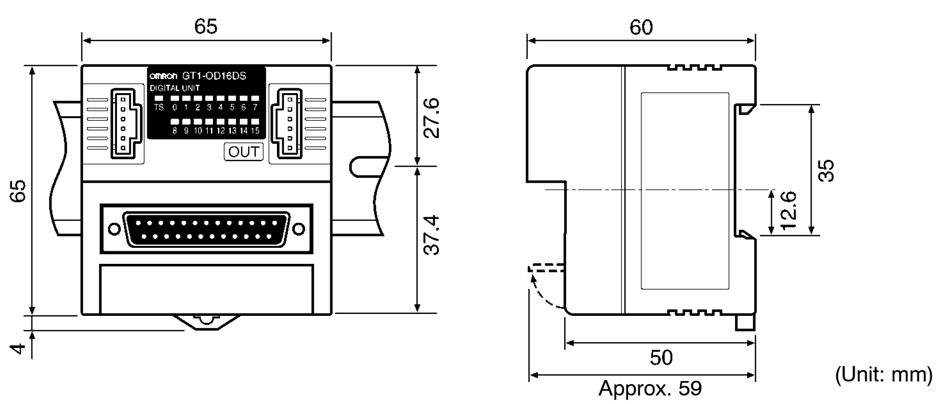
Applicable Connectors

When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
OMRON	XW2S-2513	Hood
	XW2A-2501	Plug

Note V terminals and G terminals are internally connected. When the I/O power is being supplied, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2.5 A.

Dimensions



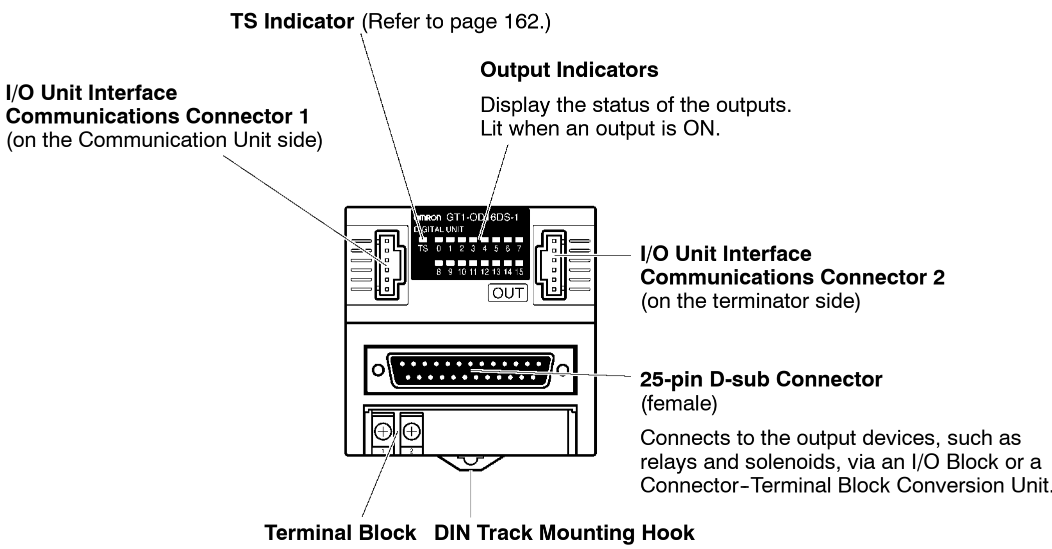
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-8 GT1-OD16DS-1 Transistor Output Unit with Connector (PNP)

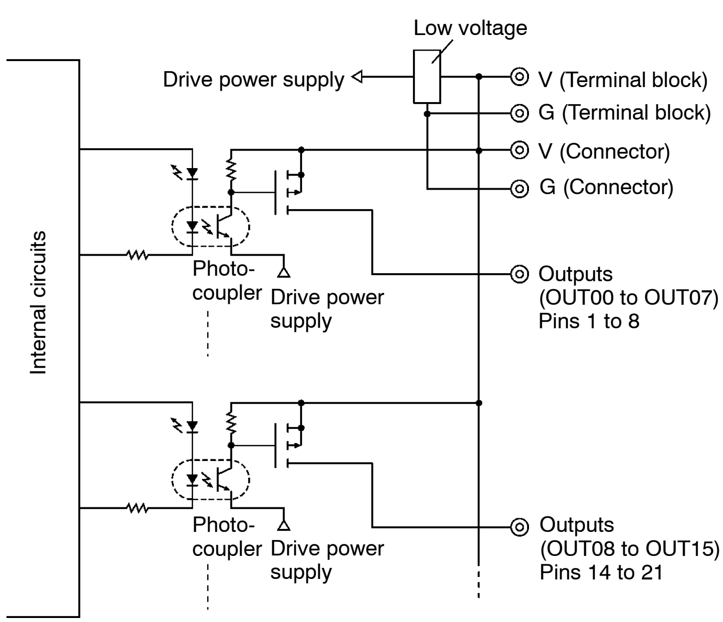
Output Specifications

Item	Specifications
Number of outputs	16 points
Current per common	2.5 A max.

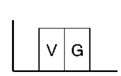
Components



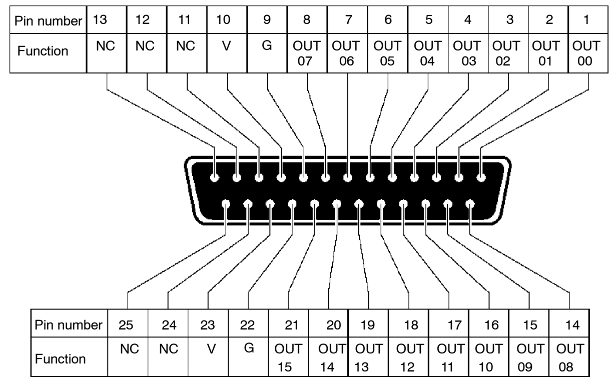
Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



Wiring

Attach a 25-pin D-sub connector to the Transistor Output Unit and connect it to external devices.

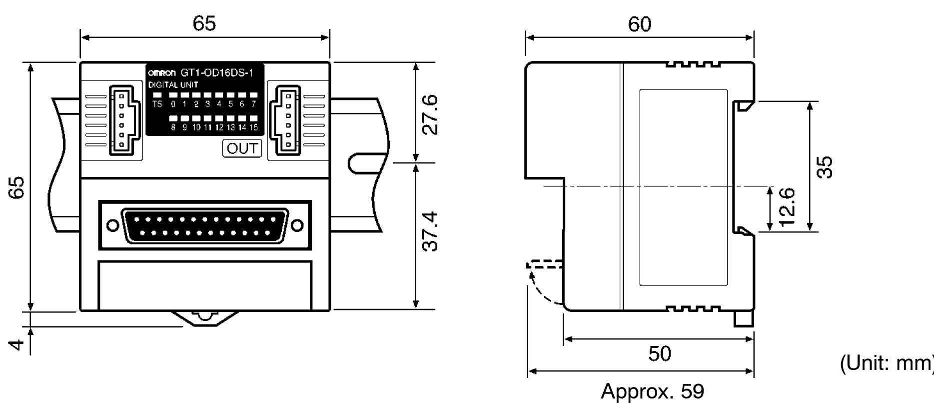
Applicable Connectors

When creating your own cables, use one of the following connectors.

Manufacturer	Model number	Remarks
OMRON	XW2S-2513	Hood
	XW2A-2501	Plug

Note V terminals and G terminals are internally connected. When the I/O power is being supplied, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2.5 A.

Dimensions



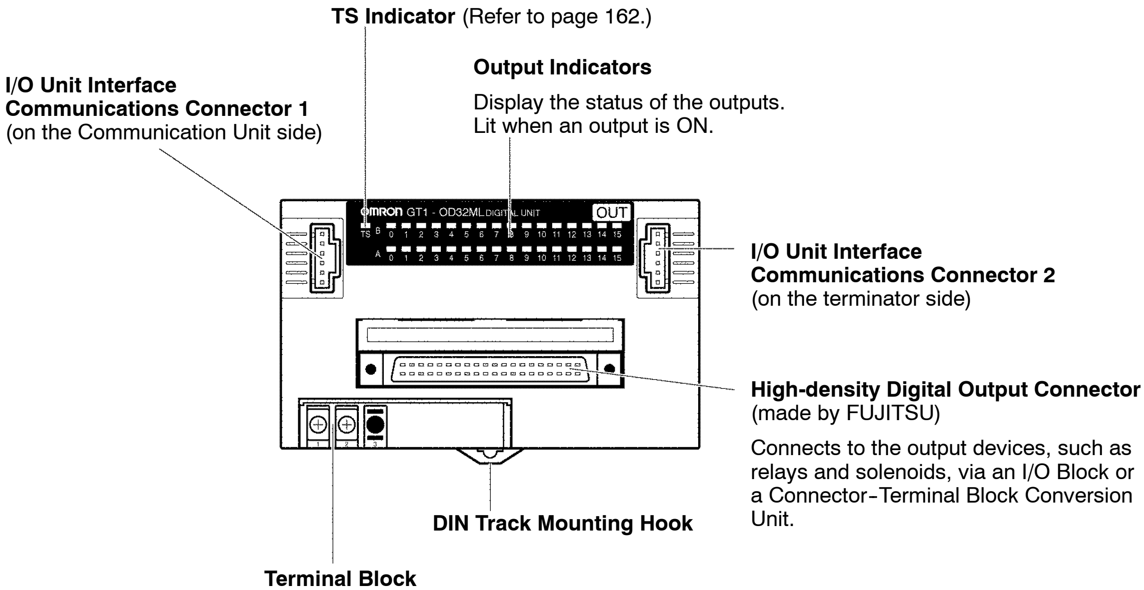
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-9 GT1-OD32ML Transistor Output Unit with High-density Connector (NPN)

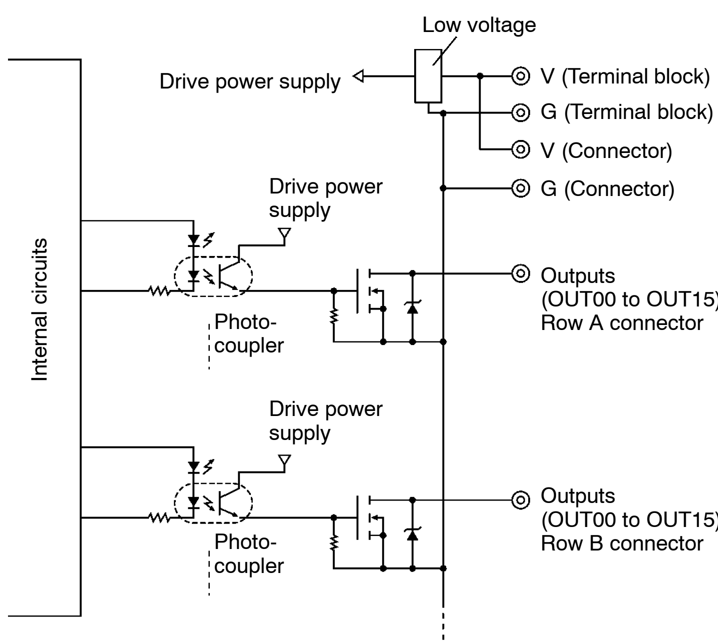
Output Specifications

Item	Specifications
Number of outputs	32 points
Current per common	With connectors: 2 A max. With terminal board: 4 A max.

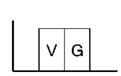
Components



Internal Circuits

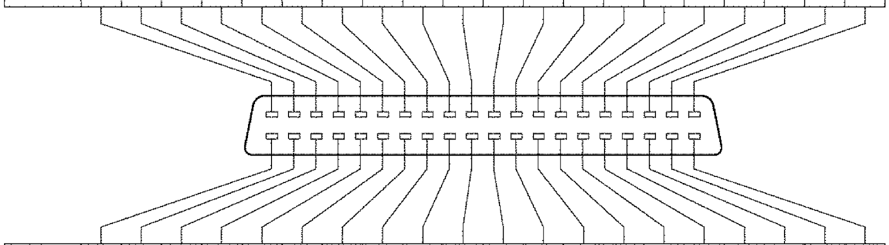


Terminal Arrangement



Connector Pin Arrangement

Pin number	A20	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	
Function	V	G	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09	OUT 08	V	G	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01	OUT 00	m word



Pin number	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	
Function	V	G	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09	OUT 08	V	G	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01	OUT 00	m+1 word

Wiring

Attach a FUJITSU connector to the Transistor Output Unit and connect it to external devices.

Applicable Connectors

Three types of connectors can be attached to the cable, depending to the assembly method. When creating your own cables, use one of the following connectors.

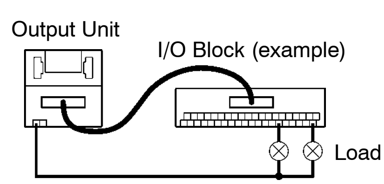
Manufacturer	Model number	Remarks
FUJITSU	FCN361J040-AU	Soldered
	FCN363J040-AU	Crimp
	FCN367J040-AU/F	Pressure-welded

Connector Cables

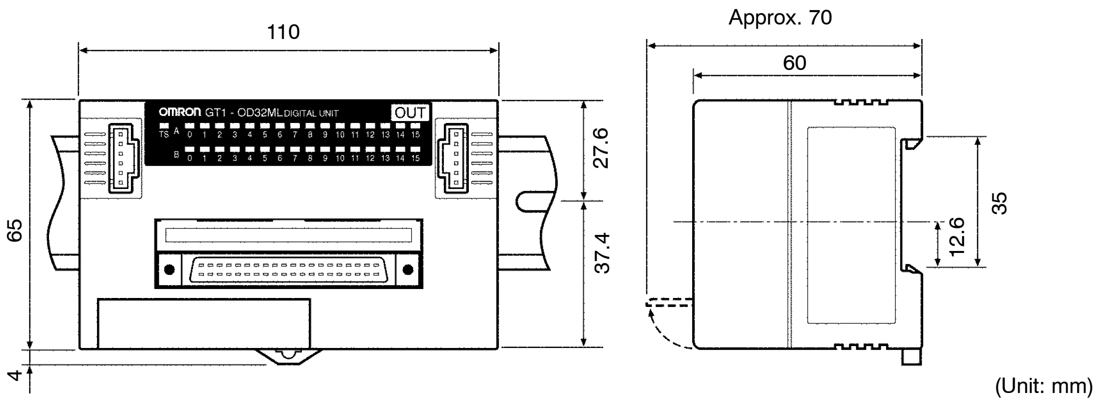
When a Transistor Output Unit (high-density connector) is to be connected to an OMRON I/O Block or a Connector-Terminal Block Conversion Unit, use the cables (sold separately) listed in the following table.

Manufacturer	Model number	Corresponding device
OMRON	XW2Z-□□□B	Connector-Terminal Block Conversion Unit XW2B-40G4 XW2B-40G5
	G79-O□C-□	I/O Block G7TC-OC16, G7TC-OC08 G70D-SOC16, G70D-FOM16 G70A-ZOC16-3 M7F

Note V terminals and G terminals are internally connected. When the I/O power is being supplied, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2 A. If, instead of using the V and G connectors, the power supply is wired to the terminal block as shown in the following diagram, the current supplied must be less than 4 A.



Dimensions



(Unit: mm)

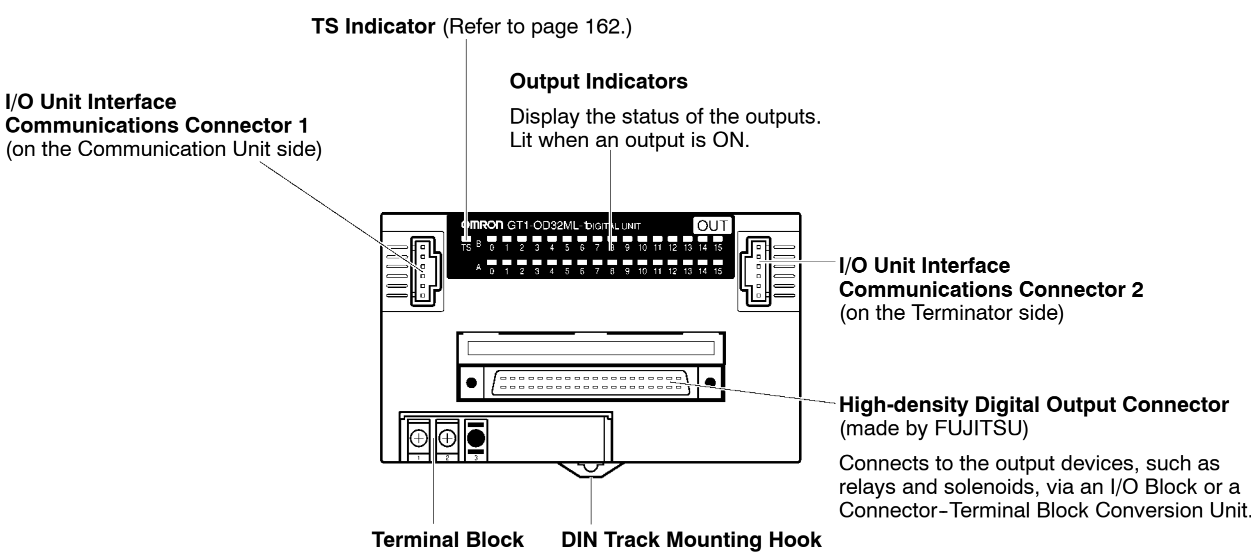
Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-3-10 GT1-OD32ML-1 Transistor Output Unit with High-density Connector (PNP)

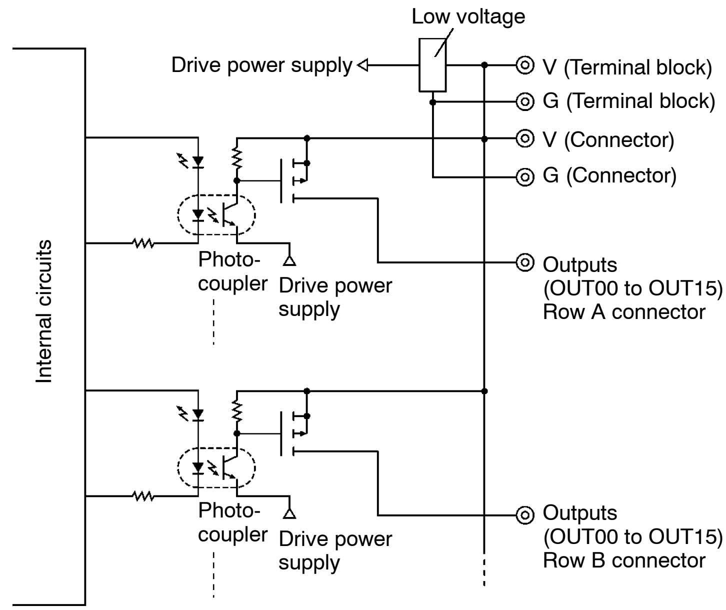
Output Specifications

Item	Specifications
Number of outputs	32 points
Current per common	With connectors: 2 A max. With terminal block: 4 A max.

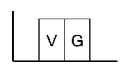
Components



Internal Circuits

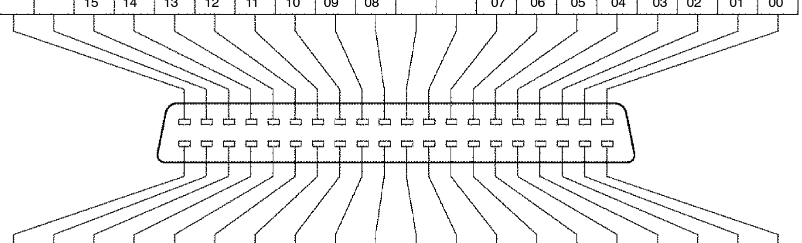


Terminal Arrangement



Connector Pin Arrangement

Pin number	A20	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	
Function	V	G	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09	OUT 08	V	G	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01	OUT 00	m word



Pin number	B20	B19	B18	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	
Function	V	G	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 09	OUT 08	V	G	OUT 07	OUT 06	OUT 05	OUT 04	OUT 03	OUT 02	OUT 01	OUT 00	m+1 word

Wiring

Attach a FUJITSU connector to the Transistor Output Unit and connect it to external devices.

Applicable Connectors

Three types of connectors can be attached to the cable, depending to the assembly method. When creating your own cables, use one of the following connectors.

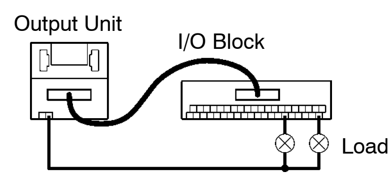
Manufacturer	Model number	Remarks
FUJITSU	FCN361J040-AU	Soldered
	FCN363J040-AU	Crimp
	FCN367J040-AU/F	Pressure-welded

Connector Cables

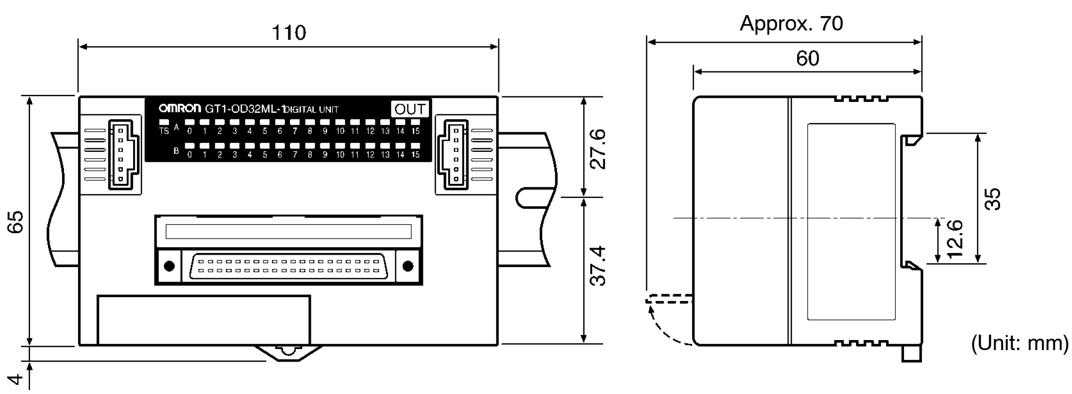
When a Transistor Output Unit (high-density connector) is to be connected to an OMRON I/O Block or a Connector-Terminal Block Conversion Unit, use the cables (sold separately) listed in the following table.

Manufacturer	Model number	Corresponding device
OMRON	XW2Z-□□□B	Connector-Terminal Block Conversion Unit XW2B-40G4 XW2B-40G5
	G79-O□C-□	I/O Block G7TC-OC16-1 G70D-SOC16-1 G70D-FOM16-1 G70A-ZOC16-4 M7F

Note V terminals and G terminals are internally connected. When the I/O power is being supplied, the power can be supplied to the output devices from the V and G connectors. Current supplied in this way, however, must be less than 2 A. If, instead of using the V and G connectors, the power supply is wired to the terminal block as shown in the following diagram, the current supplied must be less than 4 A.



Dimensions



Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

6-4 Relay Output Units

6-4-1 GT1-ROP08 Relay Output Unit with Power Relay

Output Specifications

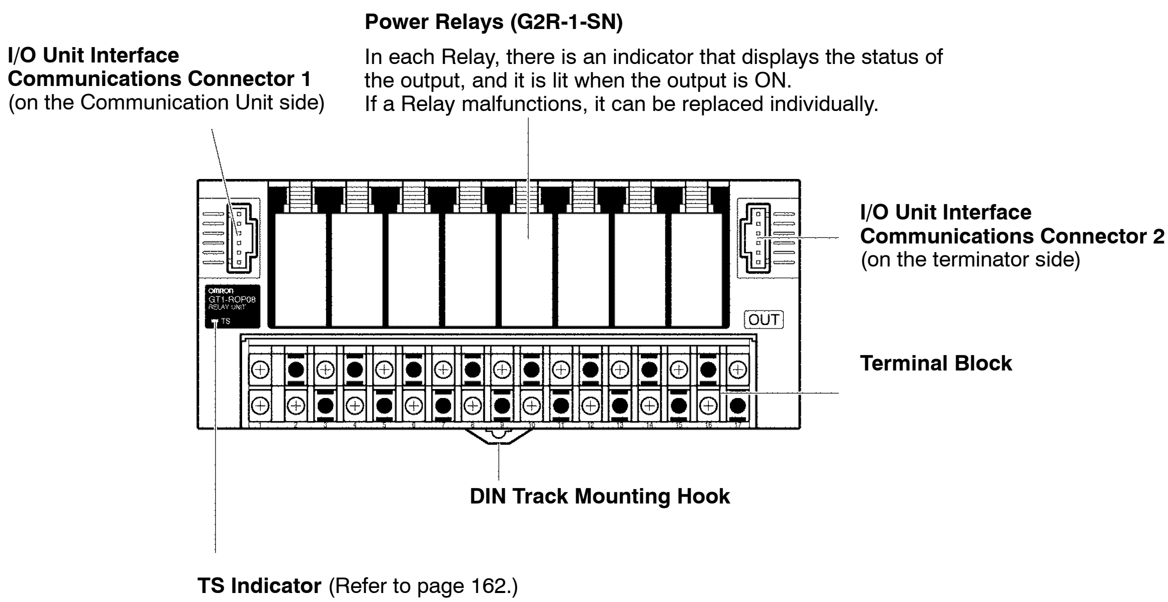
Item	Specifications
Number of outputs	8 points
Relay	Power Relay (G2R-1-SN)
Rated load (resistive load)	5 A at 250 VAC/5 A at 30 VDC
Rated thermal current	5 A
Maximum switching voltage	250 VAC/125 VDC
Maximum switching current	5 A
Minimum permissible load	100 mA at 5 VDC (P level reference value)
Insulation resistance	1,000 MΩ

Reference Data

For details about the Relay characteristics, refer to G2R-1-SN in the *PCB Relays Catalog (X033)*. The following table shows the life expectancy for the G2R-1-SN Relay.

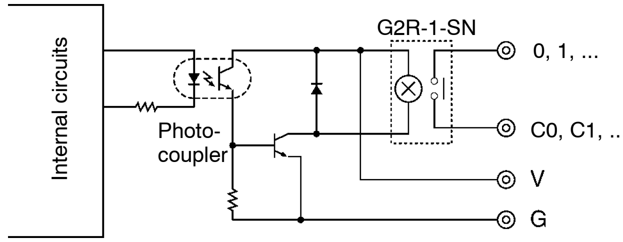
Item	Number of operations	Notes
Mechanical life expectancy	20,000,000 operations min.	Switching frequency: 18,000 times/hour (At ambient temperature 23°C with rated load)
Electrical life expectancy	100,000 operations min.	Switching frequency: 1,800 times/hour (At ambient temperature 23°C with rated load)

Components



Note For details on how to replace Relays, refer to page 165.

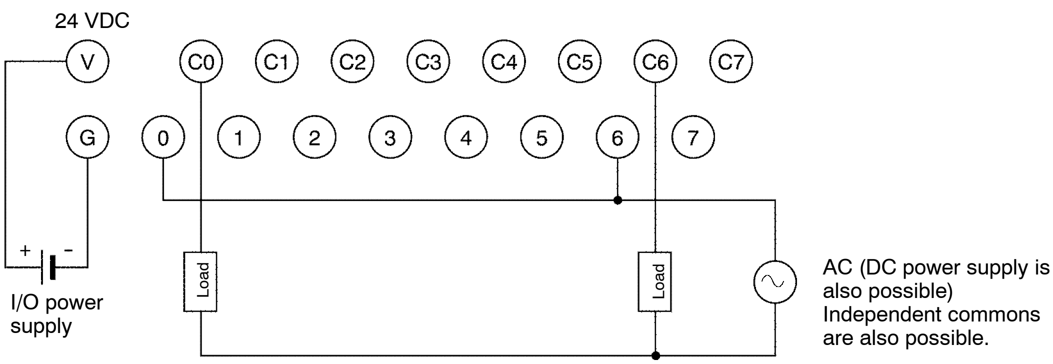
Internal Circuits



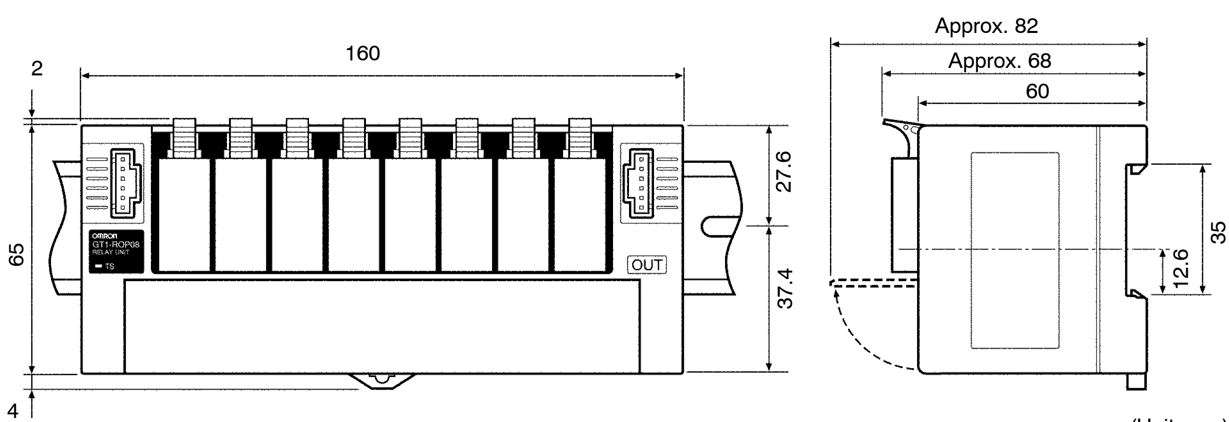
Terminal Arrangement

V		C0		C1		C2		C3		C4		C5		C6		C7
G	0		1		2		3		4		5		6		7	

Wiring



Dimensions



(Unit: mm)

Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

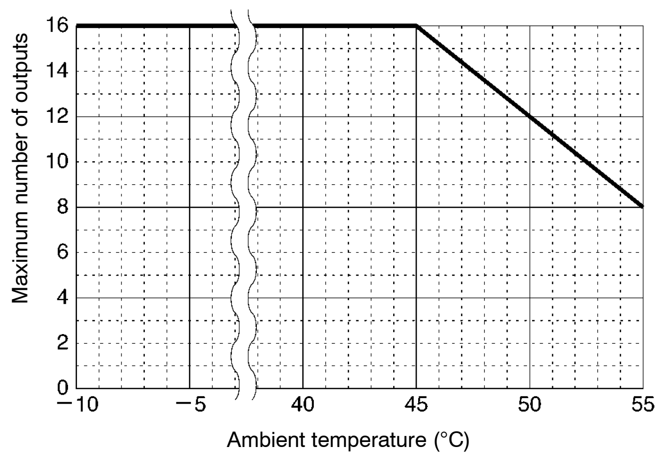
6-4-2 GT1-ROS16 Relay Output Unit with Miniature Relay

Output Specifications

Item	Specifications
Number of outputs	16 points
Relay	Miniature Relay (G6D-1A 24 VDC)
Rated load (resistive load)	2 A at 250 VAC/2 A at 30 VDC
Rated thermal current	2 A
Maximum switching voltage	250 VAC/30 VDC
Maximum switching current	2 A
Minimum permissible load	10 mA at 5 VDC (P level reference value)
Insulation resistance	1,000 MΩ

Reference Data

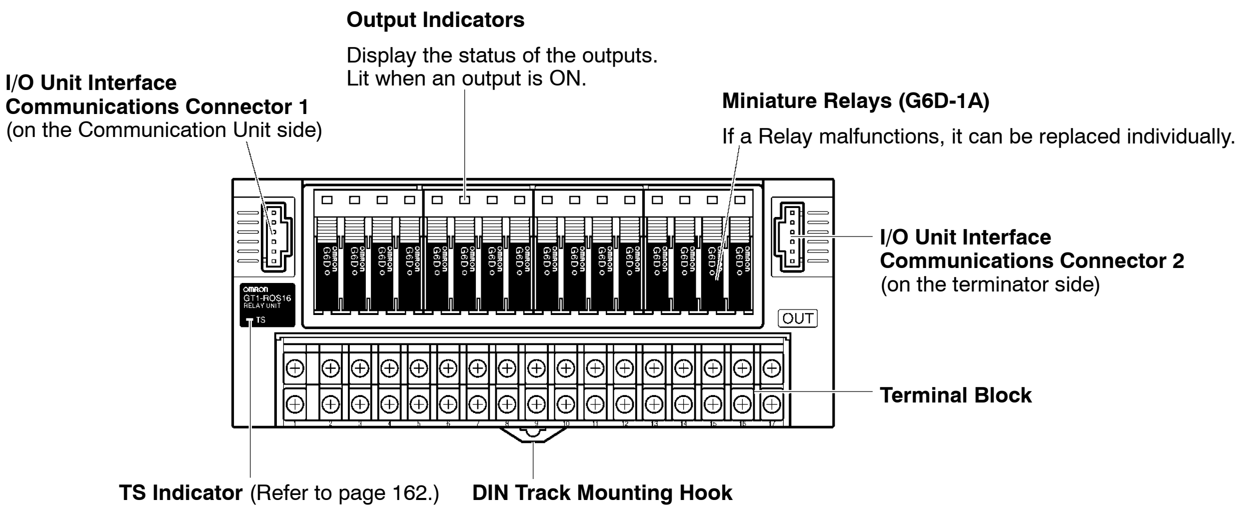
For details about the Relay characteristics, refer to G6D-1A in the *PCB Relays Catalog (X033)*. The following table shows how the number of outputs that can be ON simultaneously varies with the ambient temperature.



The following table shows the life-expectancy for the G6D-1A Relay.

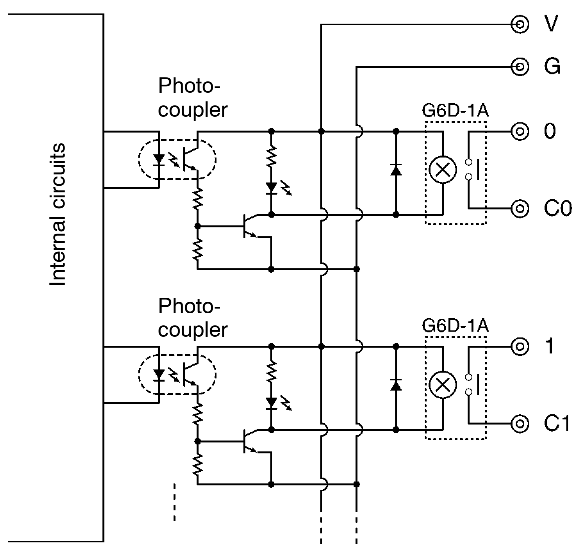
Item	Number of operations	Notes
Mechanical life expectancy	20,000,000 operations min.	Switching frequency: 18,000 times/hour (At ambient temperature 23°C with rated load)
Electrical life expectancy	100,000 operations min.	Switching frequency: 1,800 times/hour (At ambient temperature 23°C with rated load)

Components



Note For details on how to replace Relays, refer to page 165.

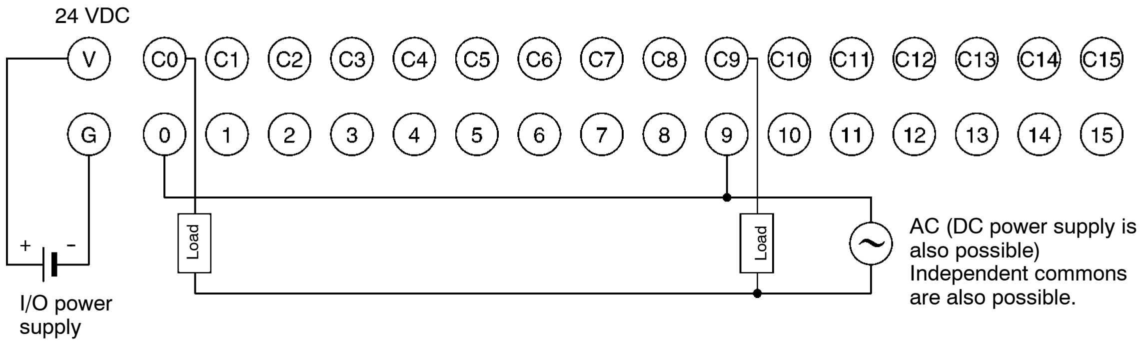
Internal Circuits



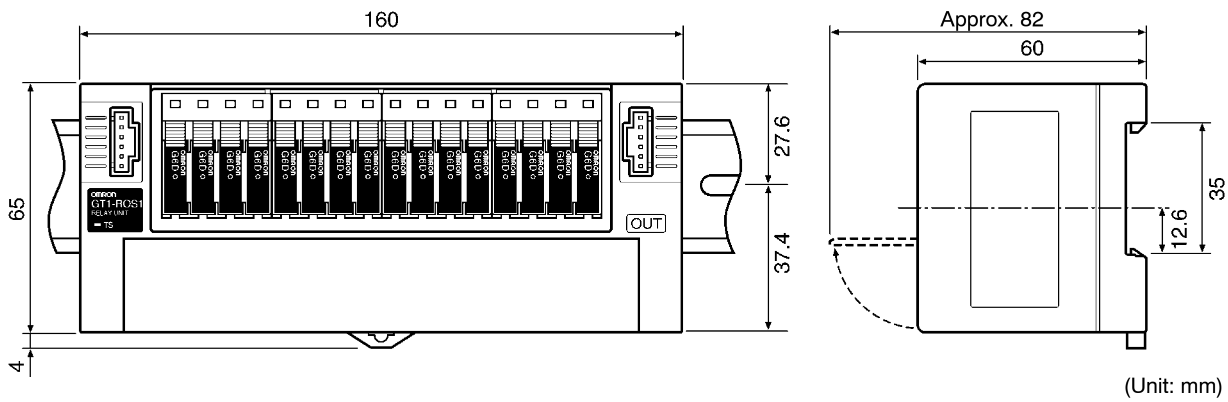
Terminal Arrangement

V	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
G	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Wiring



Dimensions



Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

SECTION 7
Special I/O Unit Specifications

This section provides the specifications for Special I/O Units, including the Analog Input and Output Unit, and the Counter Unit as well as setting with a Configurator.

7-1 Analog Input Units 104

7-1-1 Specifications 104

7-2 Analog Output Units 120

7-2-1 Specifications 120

7-3 Counter Units 133

7-1 Analog Input Units

7-1-1 Specifications

GT1-AD04

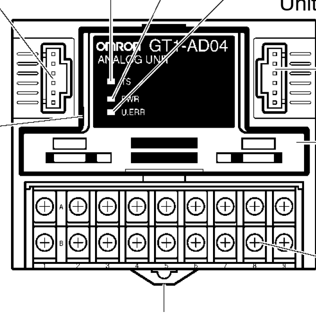
General Specifications

Item		Specification
I/O connections		Terminal block (M3)
Number of inputs		4 points (Master Unit uses 4 input words.)
Internal power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $^{+10\%}/_{-15\%}$)
	Current consumption in Unit (inrush current)	100 mA max. (inrush current 30 A max.)
Current consumption (I/O Unit interface)		50 mA max.
Noise immunity		1,500 V p-p Pulse width: 0.1 to 1 μs Startup pulse: 1 ns (via noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s^2
Shock resistance		200 m/s^2
Dielectric strength		500 VAC (between isolated circuits)
Ambient temperature		–10°C to 55°C
Ambient humidity		25% to 85% (with no condensation)
Operating atmosphere		No corrosive gases
Storage temperature		–25°C to 65°C
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2
Mounting		DIN 35-mm track
Mounting strength		100 N
Terminal strength		100 N
Connector lock strength		I/O Unit interface connector: 50 N
Weight		Approx. 200 g

Characteristics

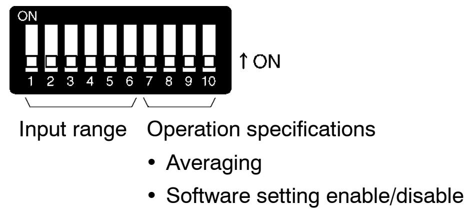
Item		Specification: Voltage inputs	Specification: Current inputs
Input signal range		0 to 5 V, 1 to 5 V, 0 to 10 V, or −10 to 10 V	0 to 20 mA or 4 to 20 mA
Max. signal input		±15 V	±30 mA
Input impedance		1 MΩ min.	Approx. 250 Ω
Resolution		1/6000 (FS)	
Accuracy	25°C	±0.3% FS	±0.4% FS
	−10°C to 55°C	±0.6% FS	±0.8% FS
Conversion time		With 4 inputs: 4 ms/4 points	
Converted output data (Binary)		Binary (4-digit hexadecimal) −10- to 10-V range: F448 to 0 to 0BB8 full scale Other signal ranges: 0000 to 1770 full scale	
Averaging function		Settable (via DIP switch)	
Open circuit detection		Provided. (with a range of 1 to 5 V or 4 to 20 mA)	
Dielectric strength		500 VAC; detected current 1 mA (between communications section and analog input, and between internal power supply and analog input)	
Isolation method		Photocoupler insulation (between communications part and analog input) (no insulation between analog inputs)	

Components



DIP Switch Settings

The DIP switch is on the left side of the Cassette of the Analog Input Unit (GT1-AD04). Detach the Cassette from the Unit in order to make DIP switch settings. The following diagram shows the functions of the DIP switch.



The following table summarizes the DIP switch settings. (All pins are factory-set to OFF.)

Pin(s)	Function	Settings	Meaning
1 to 6	Input range	“Input Range Settings” (see below)	
7	Averaging (see page 110)	OFF	No averaging is performed. (factory-set)
		ON	Averaging is performed.
8, 9	Reserved for system use	OFF	Must be set to OFF. (factory-set)
10	Software setting enable/disable	OFF	Set the input range with pins 1 to 6. (factory-set)
		ON	Input range setting by software is enabled. (see note 1)

Note

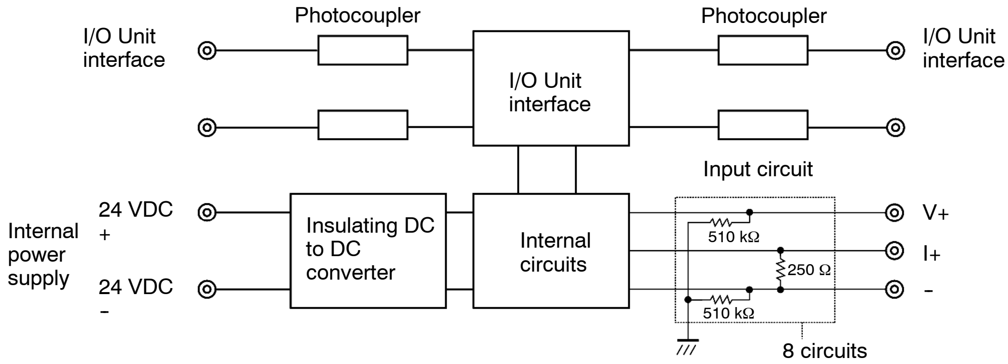
1. The feature of setting the Input range by software can not be used with PRT1-COM.
2. Before detaching or attaching the Cassette or making DIP switch settings, ensure that the power supply to the I/O Unit (including power supply to I/O Unit interface) is OFF.

Input Range Settings

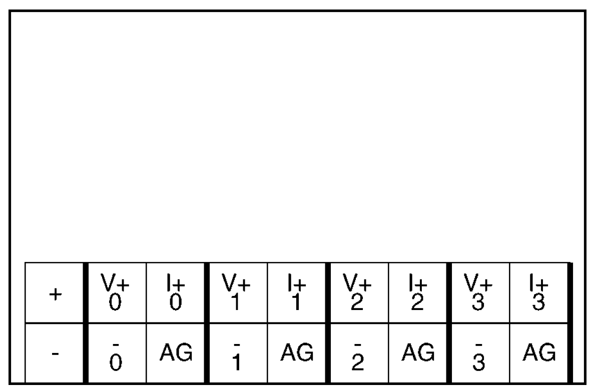
As shown in the following table, the DIP switch input range settings are for two inputs each.

Pin 1	Pin 2	Pin 3	Input range for inputs 0 and 1
Pin 4	Pin 5	Pin 6	Input range for inputs 2 and 3
OFF	OFF	OFF	0 to 5 V
ON	OFF	OFF	1 to 5 V
OFF	ON	OFF	0 to 10 V
ON	ON	OFF	–10 to 10 V
OFF	OFF	ON	4 to 20 mA
ON	OFF	ON	0 to 20 mA
Other than the above			Cannot be set

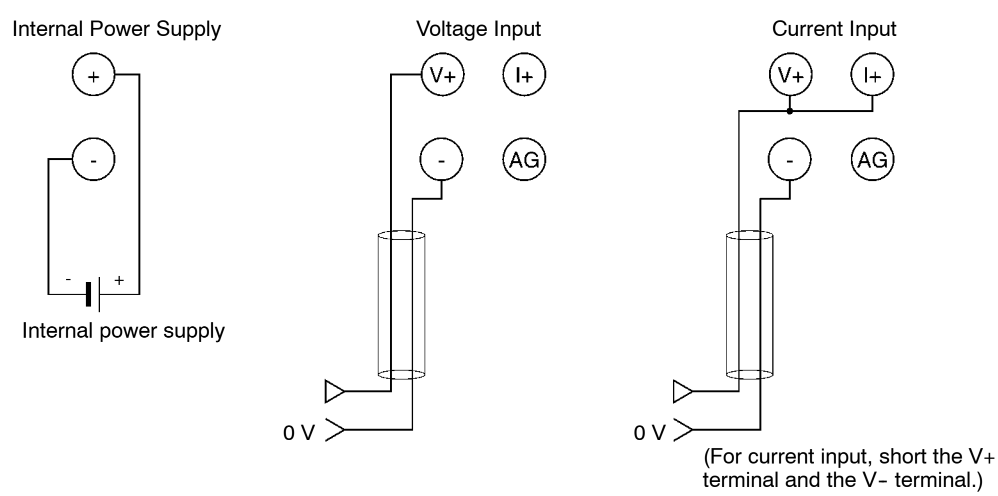
Internal Circuits



Terminal Arrangement



Wiring

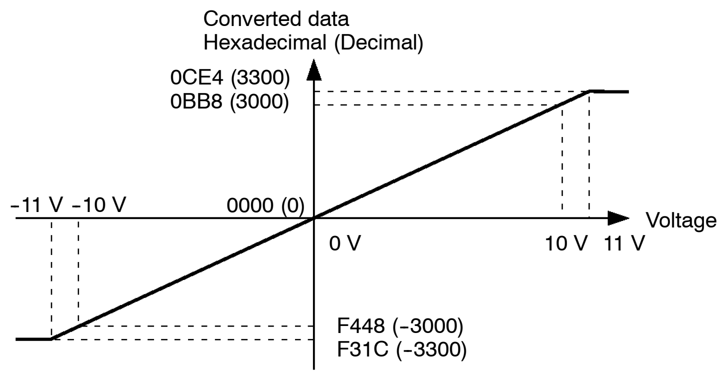


Input Ranges and Converted Data

The Analog Input Unit converts analog input data to digital values. The digital values depend on the input signal ranges, as shown in the following diagrams. When the input exceeds the specified range, the AD conversion data will be fixed at either the lower limit or upper limit.

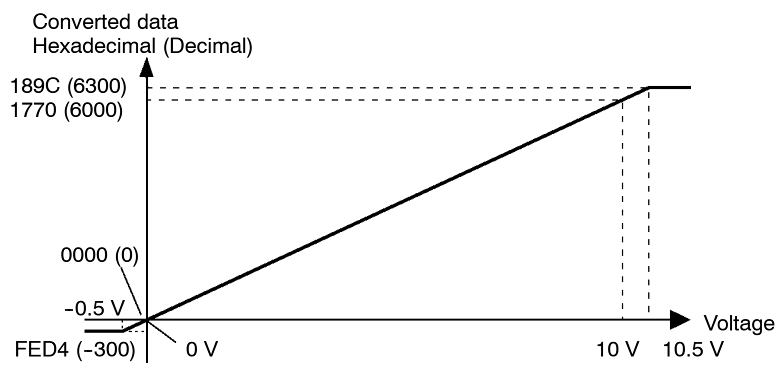
-10 to 10 V

The -10- to 10-V range corresponds to the hexadecimal values F448 to 0BB8 (-3000 to 3000). The entire data range is F31C to 0CE4 (-3300 to 3300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 V (0000 Hex).



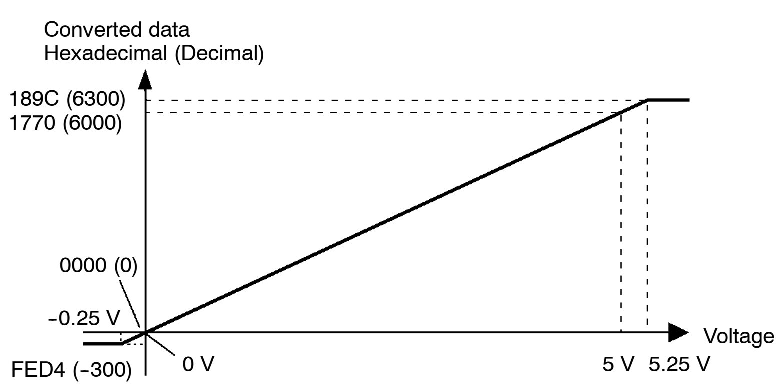
0 to 10 V

The 0- to 10-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 V (0000 Hex).



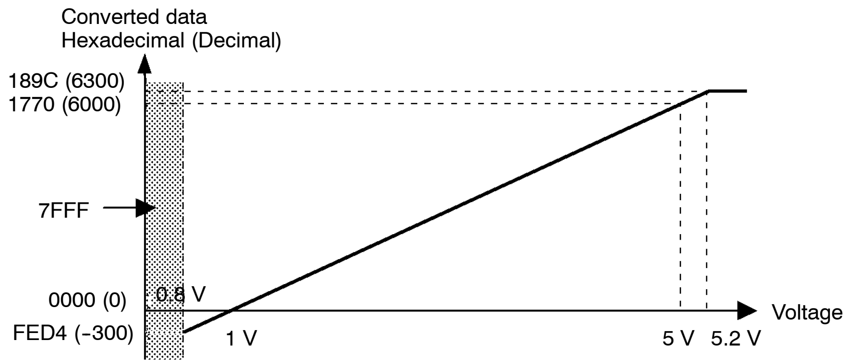
0 to 5 V

The 0- to 5-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 V (0000 Hex).



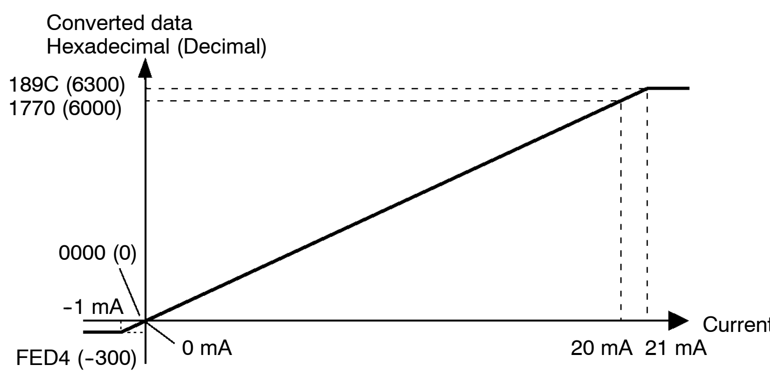
1 to 5 V

The 1- to 5-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). If the input voltage falls below 0.8 V, the open-circuit detection function will activate and the converted data will be set to 7FFF.



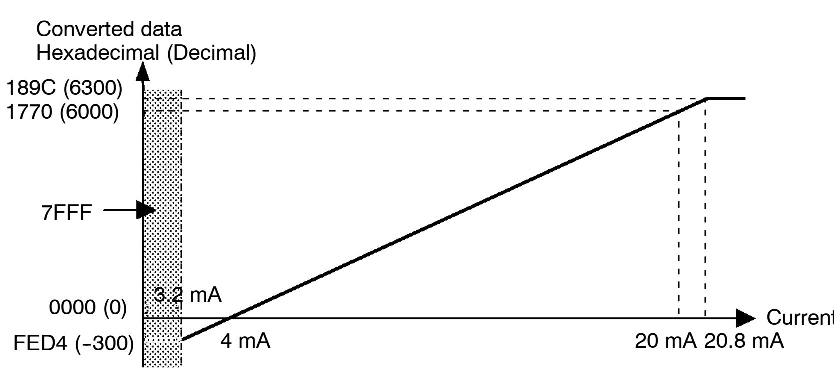
0 to 20 mA

The 0- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 mA (0000 Hex).



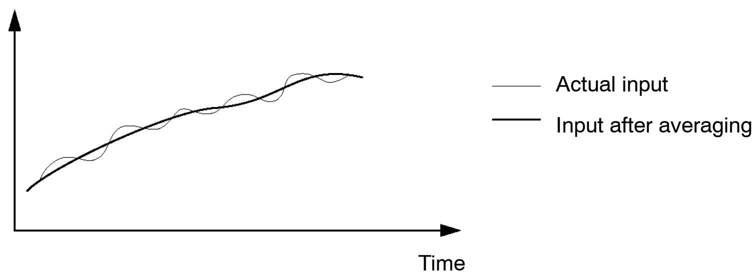
4 to 20 mA

The 4- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). If the input current falls below 3.2 mA, the open-circuit detection function will activate and the converted data will be set to 7FFF.



Averaging Function Setting

The averaging function can be enabled for all inputs (0 through 3) by turning ON pin 7 of the DIP switch. The averaging function outputs the average (a moving average) of the last eight input values as the converted value. Use this function to smooth inputs that vary like the one in the following diagram.



Note The time required for refreshing converted data remains one ms/point when the averaging function is enabled. The first communications data after the power is turned ON will be output after averaging eight samples.

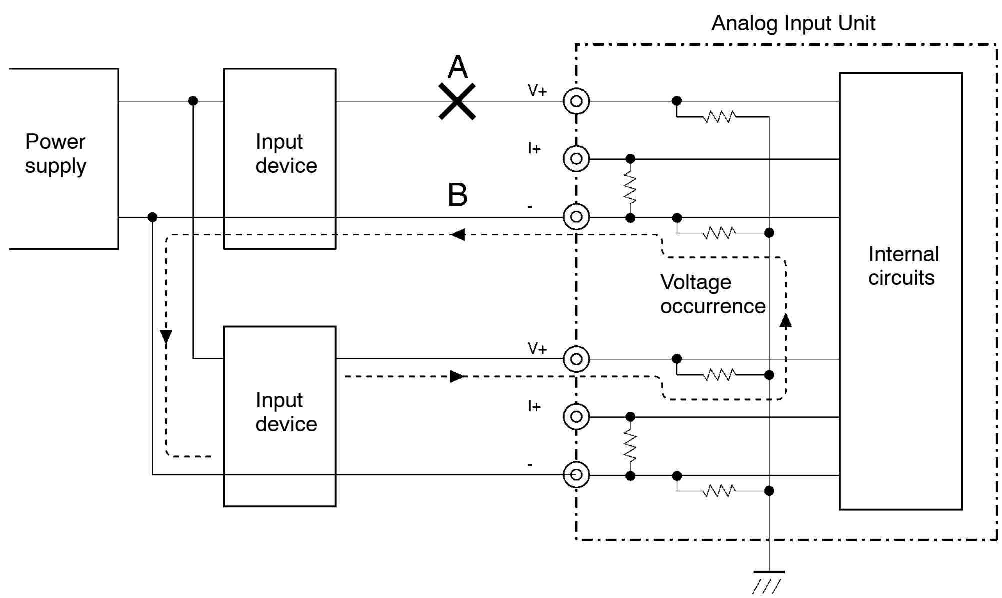
Open-circuit Detection Function

The open-circuit detection function is activated when the input range is set to 1 to 5 V and the voltage drops below 0.6 V, or when the input range is set to 4 to 20 mA and the current drops below 2.4 mA. When the open-circuit detection function is activated, the converted data will be set to 7FFF.

The open-circuit detection function is enabled or cleared when data is converted. If the input returns to the convertible range, the open-circuit detection is cleared automatically and the output returns to the normal range.

Common Power Supply for Input Devices

If an open-circuit occurs when more than one input device is using the same power supply, and voltage input is being supplied, the following situation will occur (this does not apply when current input is being supplied).



If an open-circuit occurs at A in the above diagram, a sneak circuit will be created in the direction of the arrow, and even though the circuit is open, a voltage will exist. This voltage will be approximately 1/3 to 1/2 of the output of the input devices in the part of the circuit that is not open. (The same will apply if an open circuit occurred at B.) With such a voltage present in the circuit, the open-circuit will not be detected. When voltage input is being supplied, either set up the input devices so that they are not using the same power supply, or use isolators for each input.

Converted Data

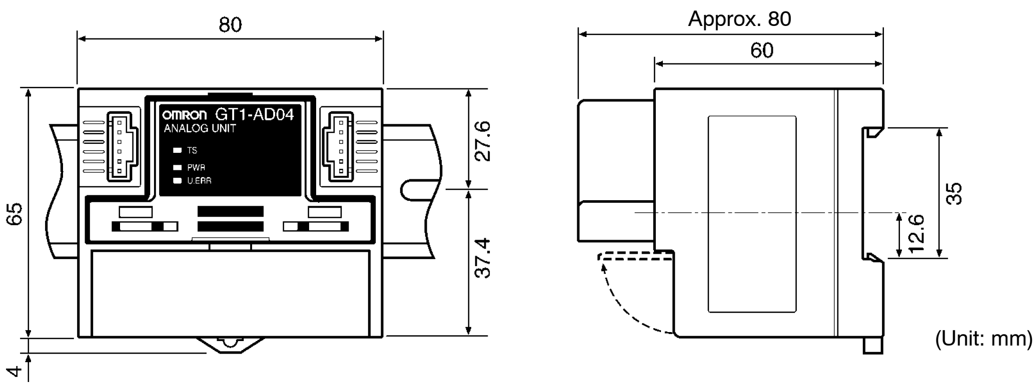
	Bit 15–0
First word	Input 0 converted data
First word + 1	Input 1 converted data
First word + 2	Input 2 converted data
First word + 3	Input 3 converted data

If the conversion data is a negative number, it is expressed as a two's complement. To obtain an absolute value from this two's complement, the NEG instruction is useful.

Conversion Time

The conversion data is refreshed every 4 ms for all 4 points.

Dimensions



Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

GT1-AD08MX

General Specifications

Item		Specification
I/O connections		Connectors (made by MOLEX)
Number of inputs		Either 8 points or 4 points (set with the DIP switch) (Master Unit uses 8 input words or 4 input words.)
Internal power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $^{+10\%}/_{-15\%}$)
	Current consumption in Unit (inrush current)	100 mA max. (inrush current 30 A max.)
Current consumption (I/O Unit interface)		50 mA max.
Noise immunity		1,500 V p-p Pulse width: 0.1 to 1 μs Startup pulse: 1 ns (via noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s^2
Shock resistance		200 m/s^2
Ambient temperature		–10°C to 55°C
Ambient humidity		25% to 85% (with no condensation)
Operating atmosphere		No corrosive gases
Storage temperature		–25°C to 65°C
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2
Mounting		DIN 35-mm track
Mounting strength		100 N
Terminal strength		100 N
Connector lock strength		I/O Unit interface connector: 50 N Analog input connector: 50 N
Weight		Approx. 180 g

Characteristics

Item		Specification	
		Voltage inputs	Current inputs
Input signal range		0 to 5 V, 1 to 5 V, 0 to 10 V, or −10 to 10 V	0 to 20 mA or 4 to 20 mA
Max. signal input		±15 V	±30 mA
Input impedance		1 MΩ min.	Approx. 250 Ω
Resolution		1/6000 (FS)	
Accuracy	25°C	±0.3% FS	±0.4% FS
	−10°C to 55°C	±0.6% FS	±0.8% FS
Conversion time		With 8 inputs: 8 ms/8 points With 4 inputs: 4 ms/4 points (Select using the DIP switch.)	
Converted output data (Binary)		Binary (4-digit hexadecimal) −10- to 10-V range: F448 to 0 to 0BB8 full scale Other signal ranges: 0000 to 1770 full scale	
Averaging function		Settable (via DIP switch)	
Open circuit detection		Provided. (with a range of 1 to 5 V or 4 to 20 mA)	
Dielectric strength		500 VAC; detected current 1 mA (between communications section and analog input, and between internal power supply and analog input)	
Isolation method		Photocoupler insulation (between communications part and analog input) (no insulation between analog inputs)	

Components

TS Indicator (refer to page 162.)

Shows the communications status of the I/O Unit interface.
Normal communications: Lit green
I/O Unit interface error: Lit red
During initialization, or with no power supply: Not lit

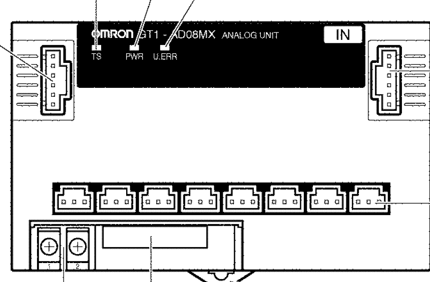
PWR Indicator

Internal power being supplied: Lit green
No internal power supply: Not lit

I/O Unit Interface Communications Connector 1
(on the Communication Unit side)

U.ERR Indicator (Refer to page 163.)

Unit error: Lit red
Unit normal: Not lit



I/O Unit Interface Communications Connector 2
(on the terminator side)

Analog Input Connectors
(made by MOLEX)

Connect to analog input devices.

DIP Switch (Refer to page 114.)

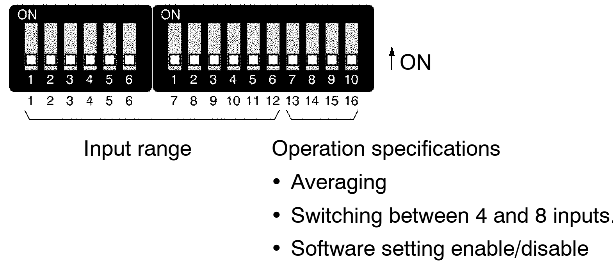
Pins 1 to 12: Input range
Pin 13: Averaging
Pin 14: Number of inputs (4/8)
Pin 15: Reserved for system use (OFF)
Pin 16: Software setting enable/disable

DIN Track Mounting Hook

Internal Power Supply Terminals

DIP Switch Settings

The following diagram shows the functions of the DIP switch.



The following table summarizes the DIP switch settings. (All pins are factory-set to OFF.)

Pin(s)	Function	Settings	Meaning
1 to 12	Input range	"Input Range Settings" (see below)	
13	Averaging (see page 118)	OFF	No averaging is performed. (factory-set)
		ON	Averaging is performed.
14	8-point/4inputs switching (see page 117)	OFF	8 inputs (factory-set)
		ON	4 inputs (inputs 0, 2, 4, and 6 are enabled)
15	Reserved for system use	OFF	Must be set to OFF. (factory-set)
16	Software setting enable/disable	OFF	Set the input range with pins 1 to 12. (factory-set)
		ON	Input range setting by software (see note) is enabled.

Note The feature of setting the Input range by software can not be used with PRT1-COM.

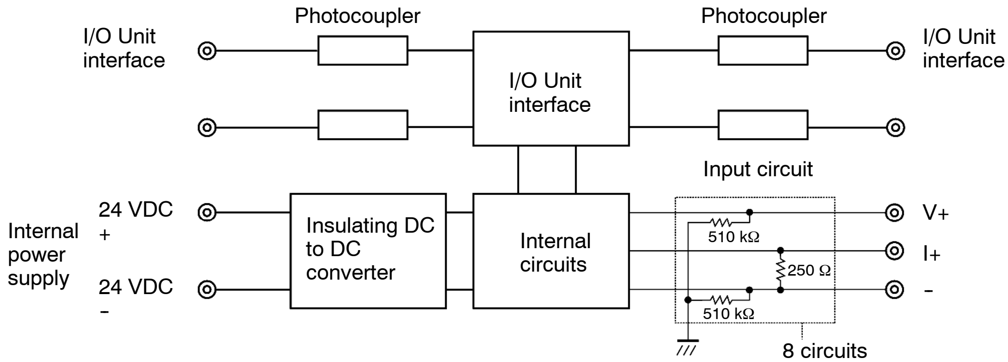
Make sure the I/O Unit power supply (including the I/O Unit interface power supply) is OFF when setting the DIP switch.

Input Range Settings

As shown in the following table, the DIP switch input range settings are for two inputs each.

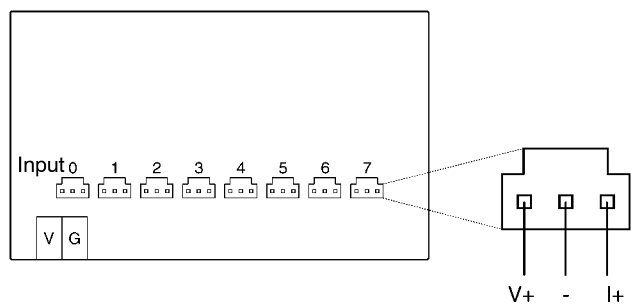
Pin 1	Pin 2	Pin 3	Input range for inputs 0 and 1
Pin 4	Pin 5	Pin 6	Input range for inputs 2 and 3
Pin 7	Pin 8	Pin 9	Input range for inputs 4 and 5
Pin 10	Pin 11	Pin 12	Input range for inputs 6 and 7
OFF	OFF	OFF	0 to 5 V
ON	OFF	OFF	1 to 5 V
OFF	ON	OFF	0 to 10 V
ON	ON	OFF	–10 to 10 V
OFF	OFF	ON	4 to 20 mA
ON	OFF	ON	0 to 20 mA
Other than the above			Cannot be set

Internal Circuits



Terminal/Connector Pin Arrangement

The arrangements of the terminals, the connectors and the connector pins are shown in the following diagram.

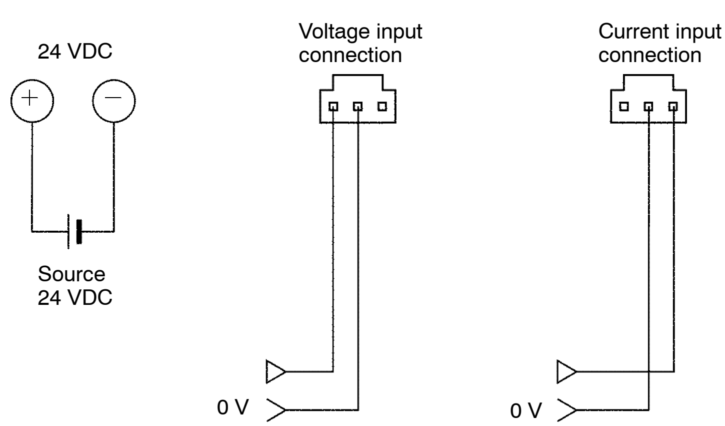


Wiring

Attach MOLEX connectors to the analog input connectors, and connect the inputs as shown in the following diagram, depending on whether voltage inputs or current inputs are being used.

Applicable Connectors

Manufac-turer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
	Crimp	Housing	50-57-9403	
		Reeled contacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
		Loose contacts	16-02-0096	For AWG#24 to 30
			16-02-0102	For AWG#22 to 24
		Crimping tool	570-36-5000	For AWG#22 to 26
			11-01-0209	For AWG#24 to 30

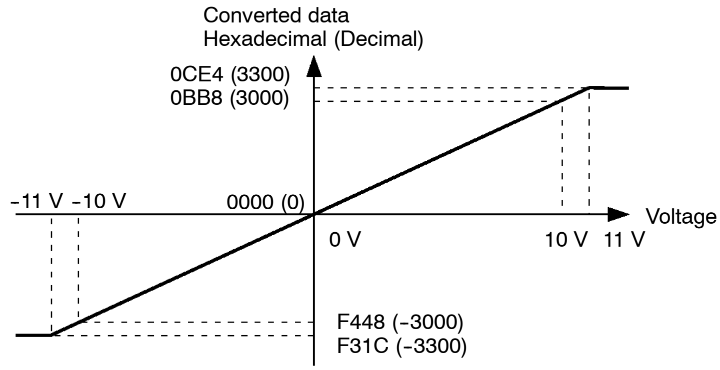


Input Ranges and Converted Data

The Analog Input Unit converts analog input data to digital values. The digital values depend on the input signal ranges, as shown in the following diagrams. When the input exceeds the specified range, the AD conversion data will be fixed at either the lower limit or upper limit.

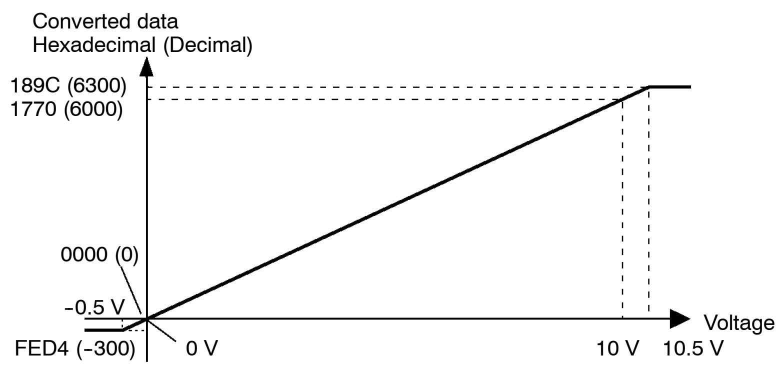
–10 to 10 V

The –10- to 10-V range corresponds to the hexadecimal values F448 to 0BB8 (–3000 to 3000). The entire data range is F31C to 0CE4 (–3300 to 3300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 V (0000 Hex).



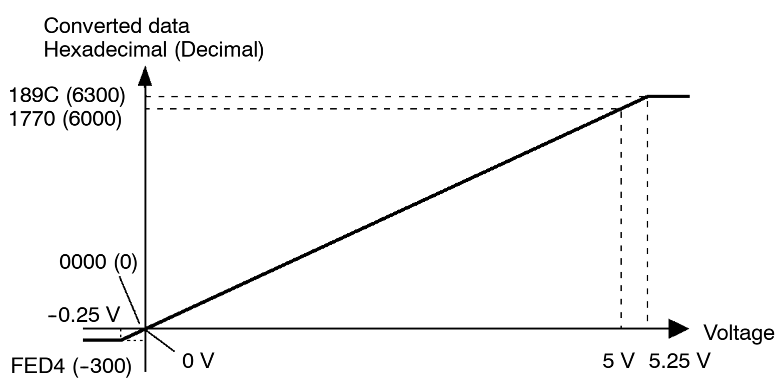
0 to 10 V

The 0- to 10-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 V (0000 Hex).



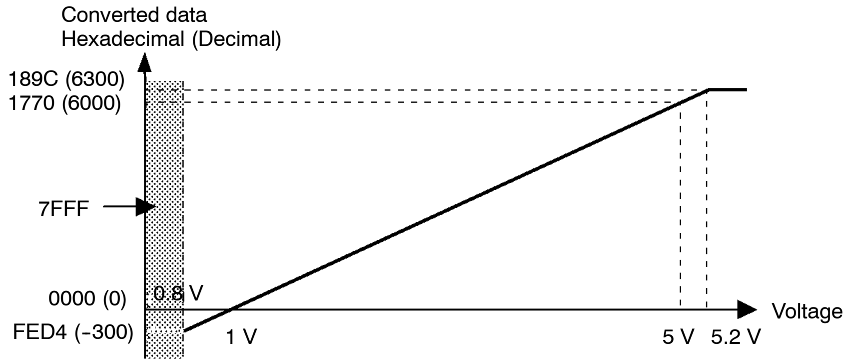
0 to 5 V

The 0- to 5-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 V (0000 Hex).



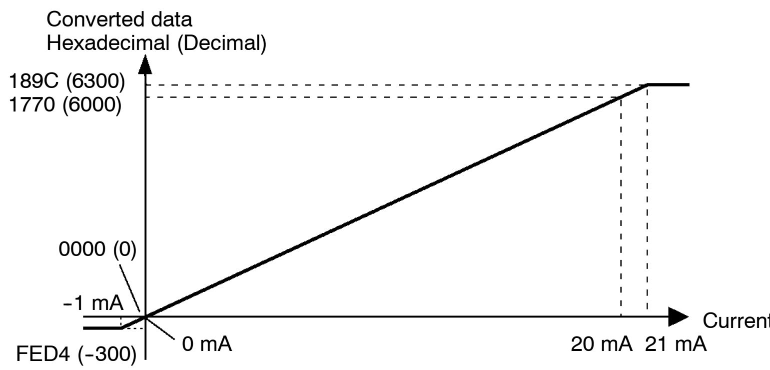
1 to 5 V

The 1- to 5-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). If the input voltage falls below 0.8 V, the open-circuit detection function will activate and the converted data will be set to 7FFF.



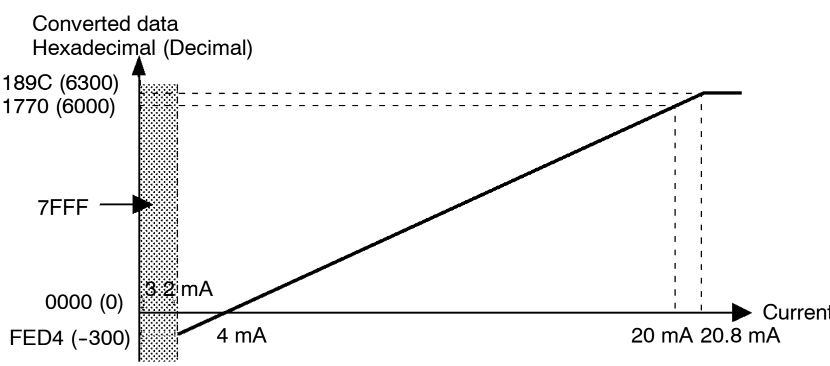
0 to 20 mA

The 0- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 mA (0000 Hex).



4 to 20 mA

The 4- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (–300 to 6300). If the input current falls below 3.2 mA, the open-circuit detection function will activate and the converted data will be set to 7FFF.



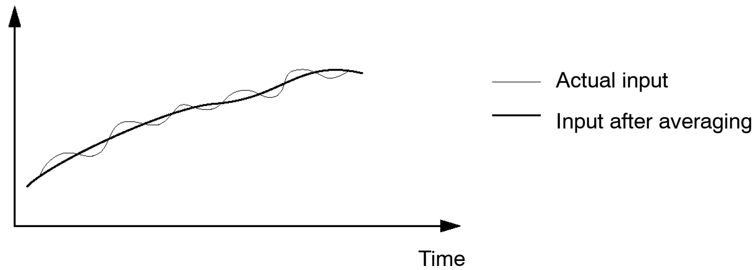
Number of Inputs

The number of inputs can be limited to four by turning ON pin 14 of the DIP switch. Changing the number of inputs from eight to four reduces the sampling time from 8 ms to 4 ms, providing faster conversion.

If four inputs are used, the number of words allocated to the Input Unit in the PC is also reduced to 4 words. When only four inputs are used, inputs 0, 2, 4 and 6 are used (i.e., inputs 1, 3, 5 and 7 cannot be used.)

Averaging Function Setting

The averaging function can be enabled for all inputs (0 through 7) by turning ON pin 13 of the DIP switch. The averaging function outputs the average (a moving average) of the last eight input values as the converted value. Use this function to smooth inputs that vary like the one in the following diagram.



Note The time required for refreshing converted data remains 1 ms/point when the averaging function is enabled. The first communications data after the power is turned ON will be output after averaging eight samples.

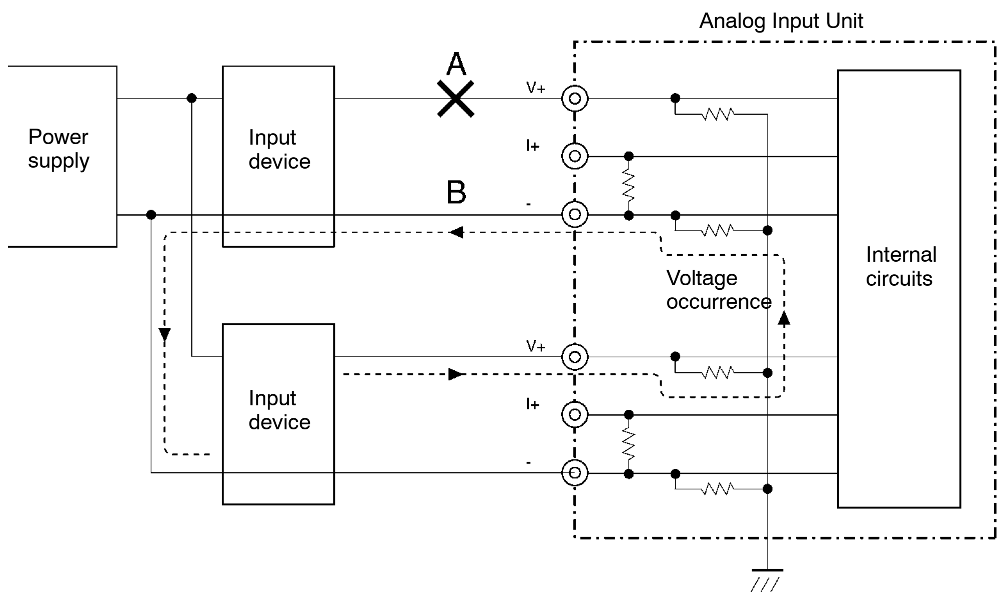
Open-circuit Detection Function

The open-circuit detection function is activated when the input range is set to 1 to 5 V and the voltage drops below 0.6 V, or when the input range is set to 4 to 20 mA and the current drops below 2.4 mA. When the open-circuit detection function is activated, the converted data will be set to 7FFF.

The open-circuit detection function is enabled or cleared when data is converted. If the input returns to the convertible range, the open-circuit detection is cleared automatically and the output returns to the normal range.

Common Power Supply for Input Devices

If an open-circuit occurs when more than one input device is using the same power supply, and voltage input is being supplied, the following situation will occur (this does not apply when current input is being supplied).



If an open-circuit occurs at A in the above diagram, a sneak circuit will be created in the direction of the arrow, and even though the circuit is open, a voltage will exist. This voltage will be approximately 1/3 to 1/2 of the output of the input devices in the part of the circuit that is not open. (The same will apply if an open circuit occurred at B.) With such a voltage present in the circuit, the open-circuit will not be detected. When voltage input is being supplied, either set up the input devices so that they are not using the same power supply, or use isolators for each input.

Converted Data

For 8 Inputs

	Bit 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
First word	Input 0 converted data
First word + 1	Input 1 converted data
First word + 2	Input 2 converted data
First word + 3	Input 3 converted data
First word + 4	Input 4 converted data
First word + 5	Input 5 converted data
First word + 6	Input 6 converted data
First word + 7	Input 7 converted data

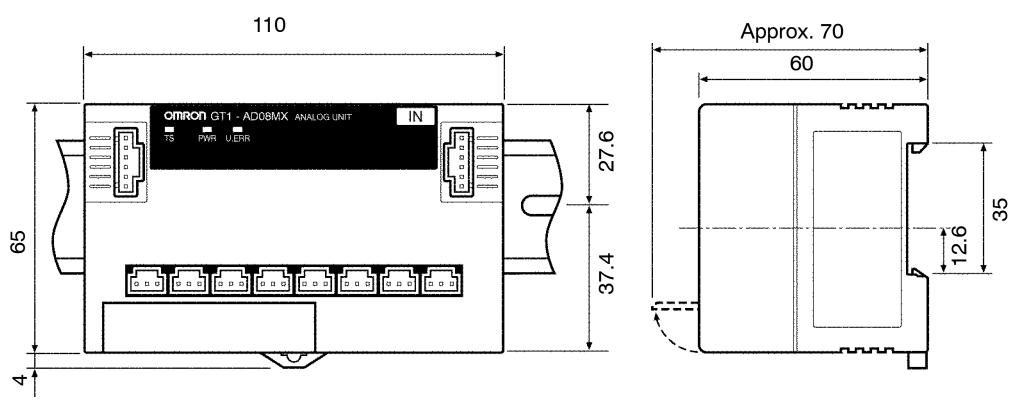
For 4 Inputs

	Bit 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
First word	Input 0 converted data
First word + 1	Input 1 converted data
First word + 2	Input 2 converted data
First word + 3	Input 3 converted data

If the conversion data is a negative number, it is expressed as a two's complement. To obtain an absolute value from this two's complement, the NEG instruction is useful.

Conversion Time The conversion data is refreshed every 8 ms for all 8 points. With 4 inputs, the data is converted every 4 ms for all 4 points.

Dimensions



(Unit: mm)

Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

7-2 Analog Output Units

7-2-1 Specifications

GT1-DA04 (Available Soon)

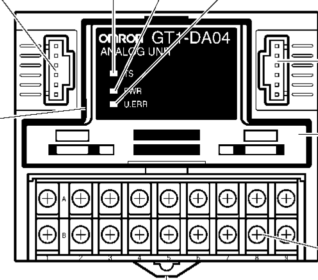
General Specifications

Item		Specification
I/O connections		Terminal block (M3)
Number of outputs		4 outputs (allocated four words in the Master Unit)
Internal power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $^{+10\%}/_{-15\%}$)
	Current consumption in Unit (inrush current)	100 mA max. (inrush current 30 A max.)
Current consumption (I/O Unit interface)		50 mA max.
Noise immunity		1,500 V p-p Pulse width: 0.1 to 1 µs Startup pulse: 1 ns (via noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s^2
Shock resistance		200 m/s^2
Ambient temperature		−10°C to 55°C
Ambient humidity		25% to 85% (with no condensation)
Operating atmosphere		No corrosive gases
Storage temperature		−25°C to 65°C
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2
Mounting		DIN 35-mm track
Mounting strength		100 N
Terminal strength		100 N
Connector lock strength		I/O Unit interface connector: 50 N
Weight		Approx. 200 g

Characteristics

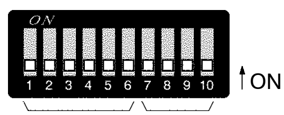
Item		Specification	
		Voltage outputs	Current outputs
Output signal range		0 to 5 V, 1 to 5 V, 0 to 10 V, or −10 to 10 V	4 to 20 mA
Allowable external output load resistance		5 KΩ min.	600 Ω min.
External output impedance		0.5 Ω max.	---
Resolution		1/6000 (full scale)	
Accuracy	25°C	±0.4% FS	
	−10°C to 55°C	±0.8% FS	
Conversion time		4 ms/4 points	
Converted output data (Binary)		Binary −10- to 10-V range: F448 to 0 to 0BB8 full scale Other signal ranges: 0000 to 1770 full scale	
Dielectric strength		500 VAC; detected current 1 mA (between communications section and analog output, and between internal power supply and analog output)	
Isolation method		Photocoupler insulation (between communications part and analog output) (no insulation between analog outputs)	

Components



DIP Switch Settings

The following diagram shows the functions of the DIP switch.



The following table summarizes the DIP switch settings. (All pins are factory-set to OFF.)

Pin(s)	Function	Settings	Meaning
1 through 6	Output range	Output range settings (See below.)	
7	Reserved for system use	OFF	Must be set to OFF.
8, 9	Clear at minimum or clear at maximum output setting (See below.)	8 9 Output OFF OFF Clear at minimum (see below) OFF ON Clear at maximum (see below) ON OFF Clear at 0 V (for −10 to 10 V) Clear at minimum (other than the above) ON ON Hold	
10	Reserved for system use	OFF	Set the output range, and clear at minimum/maximum outputs with pins 1 to 9. (factory-set)
		ON	Output range setting (see note) by software.

Note

1. The feature of setting the Input range by software can not be used with PRT1-COM.
2. Make sure the I/O Unit power supplies (including the I/O Unit interface power supply) are OFF when setting the DIP switch.

3. With an Analog Output Unit, output for communications errors is enabled using the switch on the Analog Output Unit. It does not depend on the Communication Unit “hold/clear communications error” setting.

Output Range Settings

As shown in the following table, the DIP switch output range settings are for two outputs each.

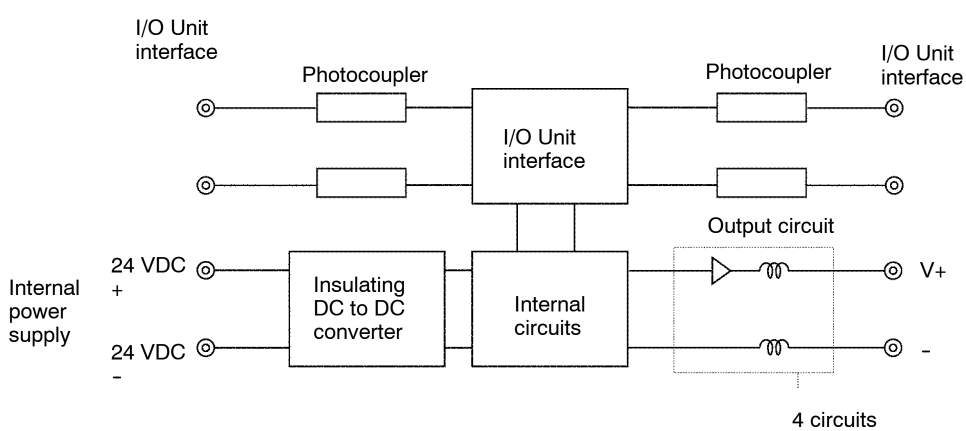
Pin 1	Pin 2	Pin 3	Output range settings for outputs 0 and 1
Pin 4	Pin 5	Pin 6	Output range settings for outputs 2 and 3
OFF	OFF	OFF	0 to 5 V (factory-set)
ON	OFF	OFF	1 to 5 V
OFF	ON	OFF	0 to 10 V
ON	ON	OFF	–10 to 10 V
OFF	OFF	ON	4 to 20 mA
Other than the above			Cannot be set

Clear at Minimum and Clear at Maximum Outputs

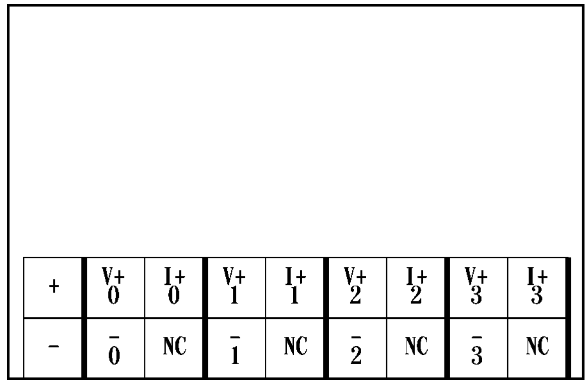
When clear at minimum or clear at maximum is set using DIP switch pins 8 and 9, a communications error will be output according to the output range, as shown in the following table.

Output signal range	Clear at minimum	Clear at maximum	Clear at 0 V
0 to 5 V	–0.25 V	5.25 V	–0.25 V
1 to 5 V	0.8 V	5.2 V	0.8 V
0 to 10 V	–0.5 V	10.5 V	–0.5 V
–10 to 10 V	–11 V	11 V	0 V
4 to 20 mA	3.2 mA	20.8 mA	3.2 mA

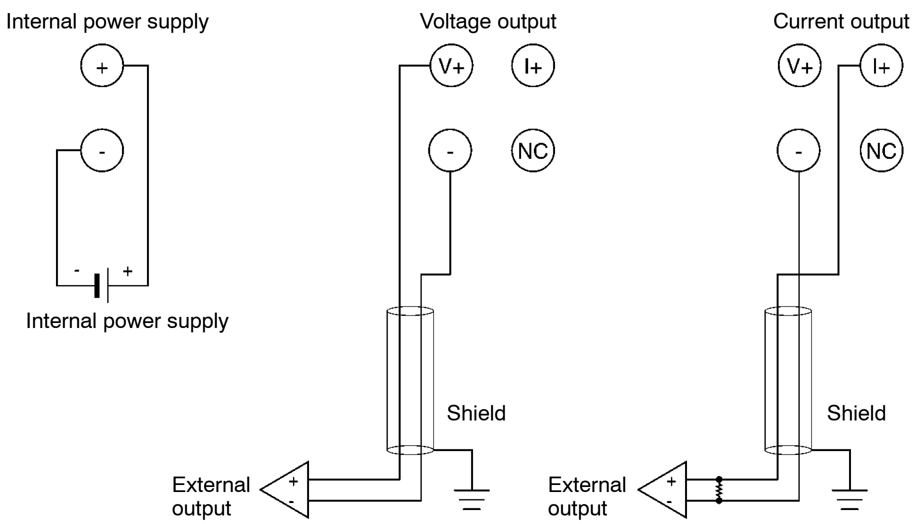
Internal Circuits



Terminal Arrangement



Wiring

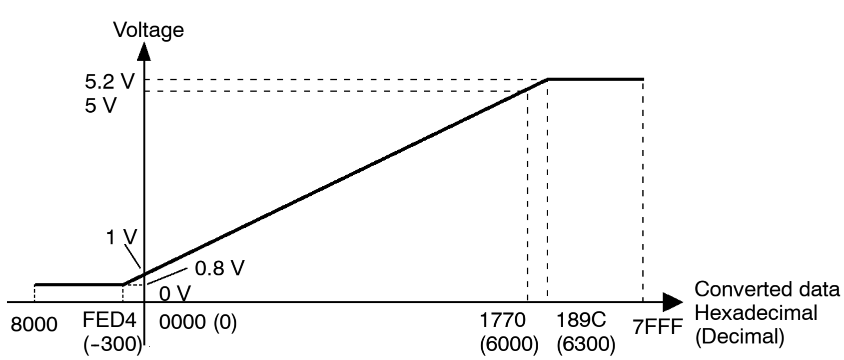


Output Ranges and Converted Data

The Analog Output Unit converts the digital output data to analog values. The analog values depend on the output signal ranges, as shown in the following diagrams.

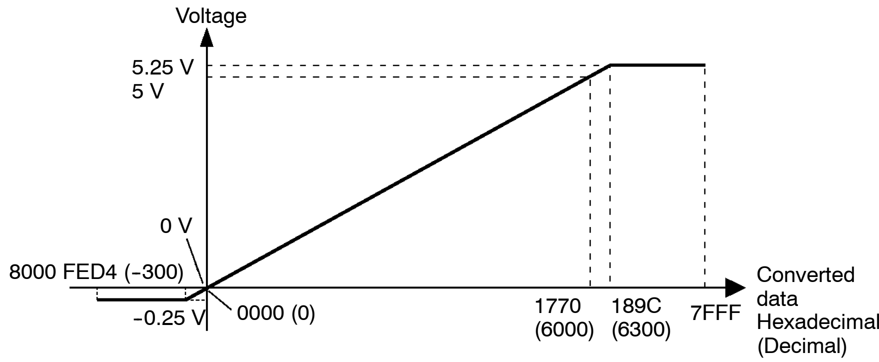
1 to 5 V

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 1 to 5 V. The entire output range is 0.8 to 5.2 V.



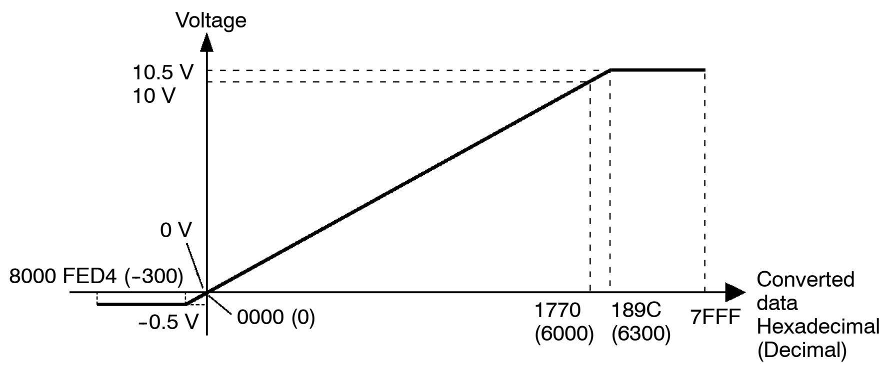
0 to 5 V

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 0 to 5 V. The entire output range is -0.25 to 5.25 V.



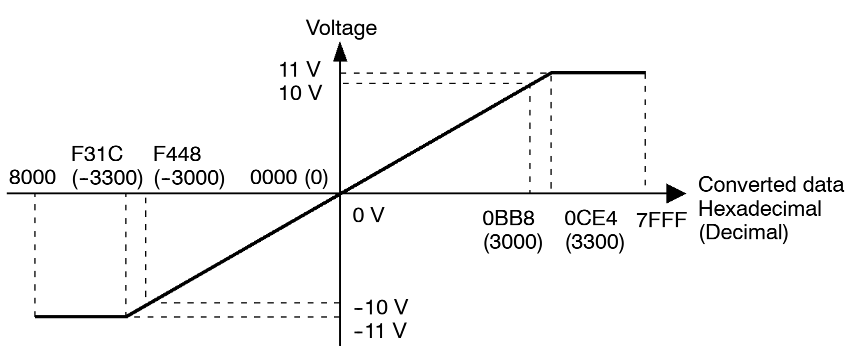
0 to 10 V

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 0 to 10 V. The entire output range is -0.5 to 10.5 V.



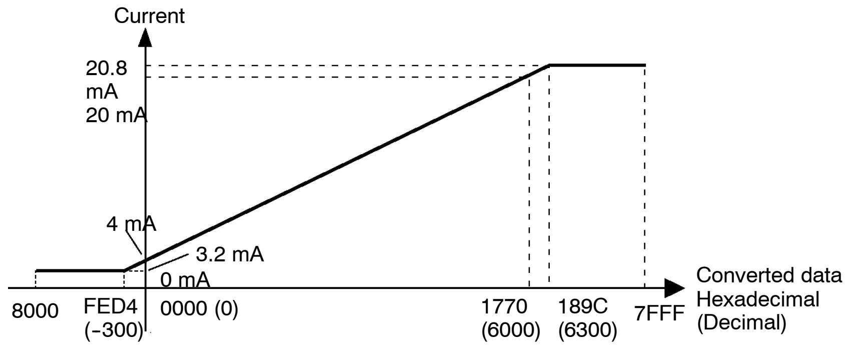
-10 to 10 V

The hexadecimal values F448 to 0BB8 (-3000 to 3000) correspond to an analog voltage range of -10 to 10 V. The entire output range is -11 to 11 V. Specify a negative voltage as a two's complement (16 bits).



4 to 20 mA

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog current range of 4 to 20 mA. The entire output range is 3.2 to 20.8 mA.



Output Status after Communications Error

The Configurator or pins 8 and 9 of the DIP switch can be used to determine the status of the outputs after a communications error occurs in CompoBus/D or I/O Unit interface communications. The following settings are possible:

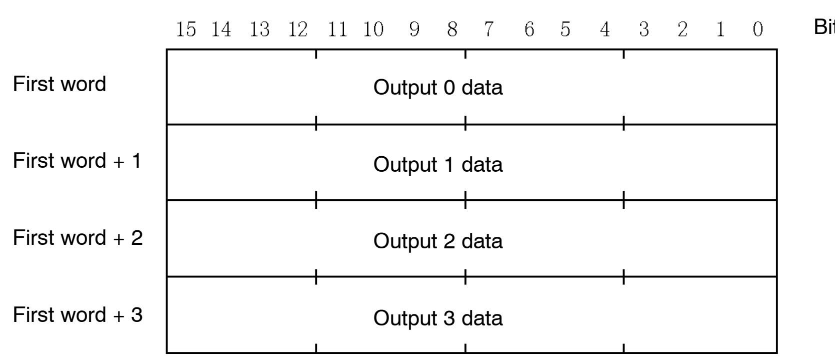
- Hold (maintain previous output status)
- Clear at minimum (clear at the lower limit of the output signal range)
- Clear at maximum (clear at the upper limit of the output signal range)
- Clear at 0 V (for –10 to 10 V only)

When the clear at minimum, clear at maximum, or clear at 0 V setting is used, the output data will be as shown in the following table.

Output signal range	Clear at minimum	Clear at maximum	Clear at 0 V
0 to 5 V	–0.25 V	5.25 V	–0.25 V
1 to 5 V	0.8 V	5.2 V	0.8 V
0 to 10 V	–0.5 V	10.5 V	–0.5 V
–10 to 10 V	–11 V	11 V	0 V
4 to 20 mA	3.2 mA	20.8 mA	3.2 mA

Converted Data

Output the converted data to the Master as shown in the following diagram.

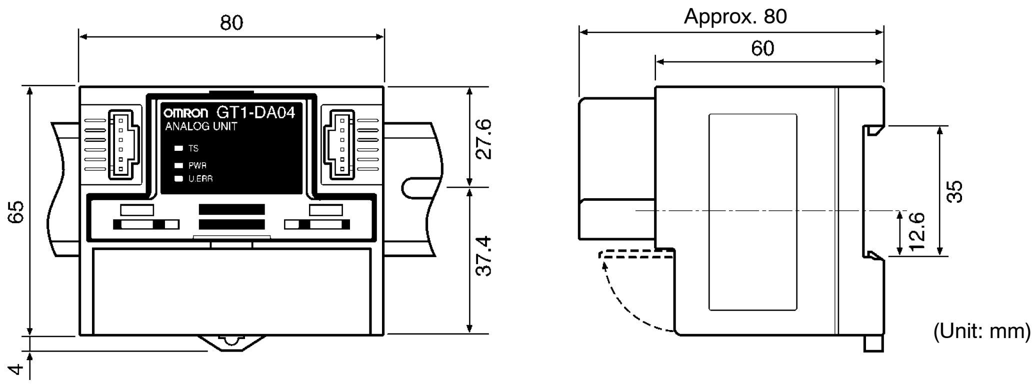


When a negative voltage is to be output, specify the conversion data as the two's complement. To obtain a two's complement from an absolute value, the NEG instruction is useful.

Conversion Time

The conversion data is refreshed every 4 ms for all 4 points.

Dimensions



Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

GT1-DA04MX

General Specifications

Item		Specification
I/O connections		Connectors (made by MOLEX)
Number of outputs		4 outputs (allocated four words in the Master Unit)
Internal power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $^{+10\%}/_{-15\%}$)
	Current consumption in Unit (inrush current)	100 mA max. (inrush current 30 A max.)
Current consumption (I/O Unit interface)		50 mA max.
Noise immunity		1,500 V p-p Pulse width: 0.1 to 1 μs Startup pulse: 1 ns (via noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s^2
Shock resistance		200 m/s^2
Ambient temperature		−10°C to 55°C
Ambient humidity		25% to 85% (with no condensation)
Operating atmosphere		No corrosive gases
Storage temperature		−25°C to 65°C
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2
Mounting		DIN 35-mm track
Mounting strength		100 N
Terminal strength		100 N
Connector lock strength		I/O Unit interface connector: 50 N Analog input connector: 50 N
Weight		Approx. 180 g

Characteristics

Item		Specification
Output signal range		0 to 5 V, 1 to 5 V, 0 to 10 V, or −10 to 10 V (Current output not possible)
Allowable external output load resistance		5 KΩ min.
External output impedance		0.5 Ω max.
Resolution		1/6000 (full scale)
Accuracy	25°C	±0.4% FS
	−10°C to 55°C	±0.8% FS
Conversion time		4 ms/4 points
Converted output data (Binary)		Binary −10- to 10-V range: F448 to 0 to 0BB8 full scale Other signal ranges: 0000 to 1770 full scale
Dielectric strength		500 VAC; detected current 1 mA (between communications section and analog output, and between internal power supply and analog output)
Isolation method		Photocoupler insulation (between communications part and analog output) (no insulation between analog outputs)

Components

TS Indicator (Refer to page 162.)

Shows the communications status of the I/O Unit interface.
Normal communications: Lit green
I/O Unit interface error: Lit red
During initialization, or with no power supply: Not lit

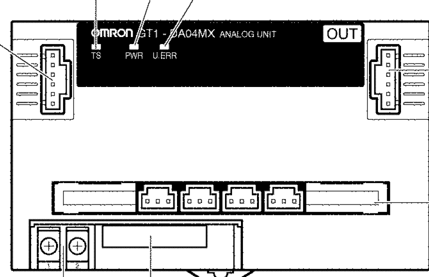
PWR Indicator

Internal power being supplied: Lit green
No internal power supply: Not lit

I/O Unit Interface Communications Connector 1
(on the Communication Unit side)

U.ERR Indicator (Refer to page 163.)

Unit error: Lit red
Unit normal: Not lit



I/O Unit Interface Communications Connector 2
(on the terminator side)

Analog Output Connectors
(made by MOLEX)

Connect to an analog output devices.

DIN Track Mounting Hook

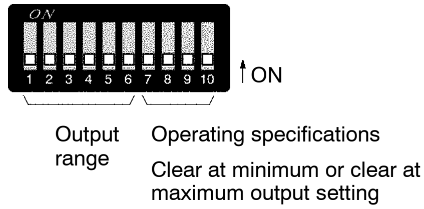
DIP Switch
(Refer to page 128.)

Pin 1 to 6: Output range
Pin 7: Reserved for system use (OFF)
Pin 8, 9: Clear at minimum/maximum output
Pin 10: Software setting enable/disable

Internal Power Supply Terminals

DIP Switch Settings

The following diagram shows the functions of the DIP switch.



The following table summarizes the DIP switch settings. (All pins are factory-set to OFF.)

Pin(s)	Function	Settings	Meaning
1 through 6	Output range	Output range settings (See below.)	
7	Reserved for system use	OFF	Must be set to OFF.
8, 9	Clear at minimum or clear at maximum output setting (See below.)	8 9 OFF OFF OFF ON ON OFF ON ON	Output Clear at minimum (see below) Clear at maximum (see below) Clear at 0 V (for −10 to 10 V) Clear at minimum (other than the above) Hold
10	Reserved for system use	OFF	Set the output range, and clear at minimum/maximum outputs with pins 1 to 9. (factory-set)
		ON	Output range setting (see note) by software.

Note

1. The feature of setting the Input range by software can not be used with PRT1-COM.
2. Make sure the I/O Unit power supplies (including the I/O Unit interface power supply) are OFF when setting the DIP switch.
3. With an Analog Output Unit, outputs for communications errors is enabled using the switch on the Analog Output Unit. It does not depend on the Communication Unit “hold/clear communications error” setting.

Output Range Settings

As shown in the following table, the DIP switch output range settings are for two outputs each.

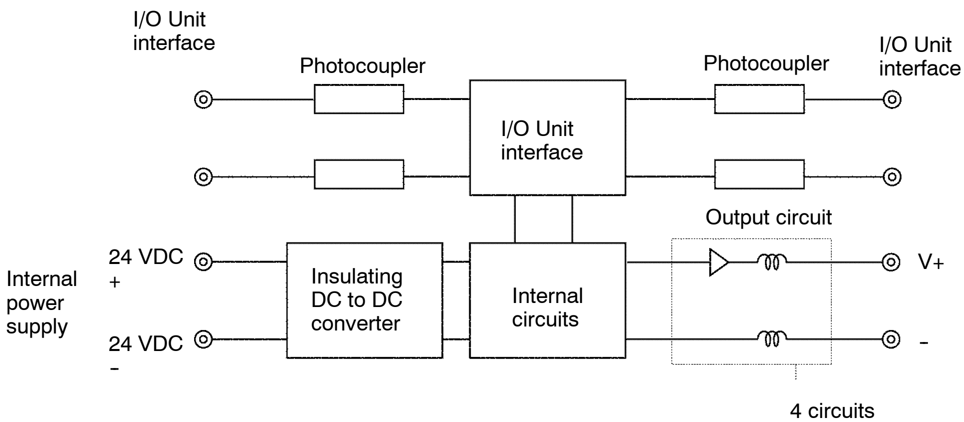
Pin 1	Pin 2	Pin 3	Output range settings for outputs 0 and 1
Pin 4	Pin 5	Pin 6	Output range settings for outputs 2 and 3
OFF	OFF	OFF	0 to 5 V (factory-set)
ON	OFF	OFF	1 to 5 V
OFF	ON	OFF	0 to 10 V
ON	ON	OFF	−10 to 10 V
Other than the above			Cannot be set

Clear at Minimum and Clear at Maximum Outputs

When clear at minimum or clear at maximum is set using DIP switch pins 8 and 9, a communications error will be output according to the output range, as shown in the following table.

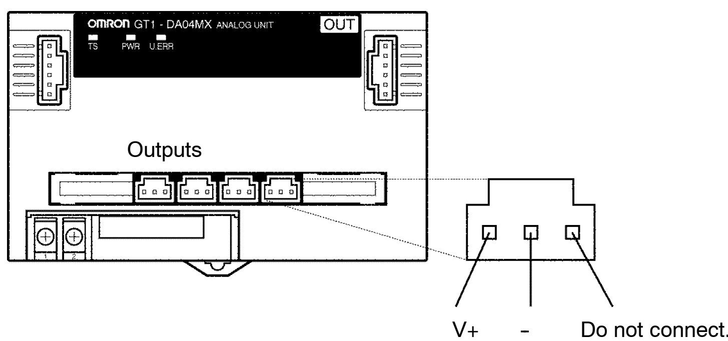
Output signal range	Clear at minimum	Clear at maximum	Clear at 0 V
0 to 5 V	−0.25 V	5.25 V	−0.25 V
1 to 5 V	0.8 V	5.2 V	0.8 V
0 to 10 V	−0.5 V	10.5 V	−0.5 V
−10 to 10 V	−11 V	11 V	0 V

Internal Circuits



Terminal/Connector Pin Arrangement

The arrangements of the terminals, the connectors and the connector pins are shown in the following diagram.

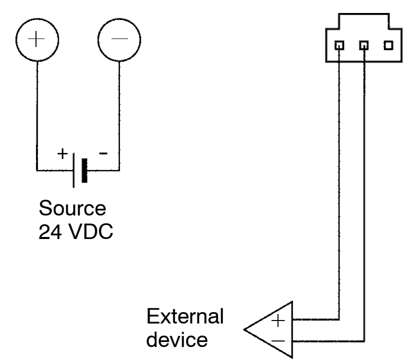


Wiring

Attach MOLEX connectors to the analog output connectors, and connect the outputs as shown in the following diagram.

Applicable Connectors

Manufac-turer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
	Crimp	Housing	50-57-9403	
		Reeled contacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
		Loose contacts	16-02-0096	For AWG#24 to 30
			16-02-0102	For AWG#22 to 24
		Crimping tool	570-36-5000	For AWG#22 to 26
			11-01-0209	For AWG#24 to 30

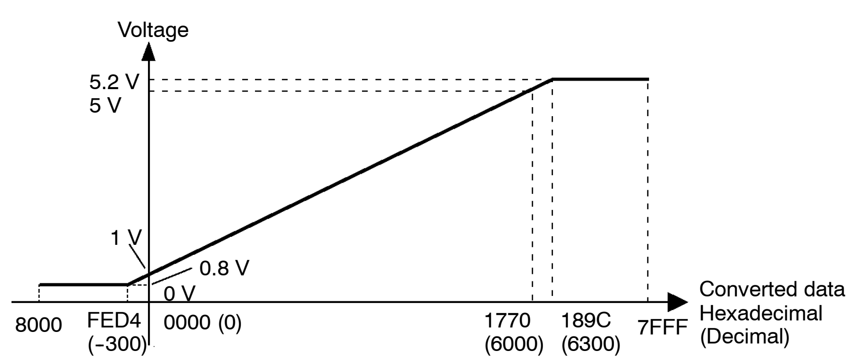


Output Ranges and Converted Data

The Analog Output Unit converts the digital output data to analog values. The analog values depend on the output signal ranges, as shown in the following diagrams.

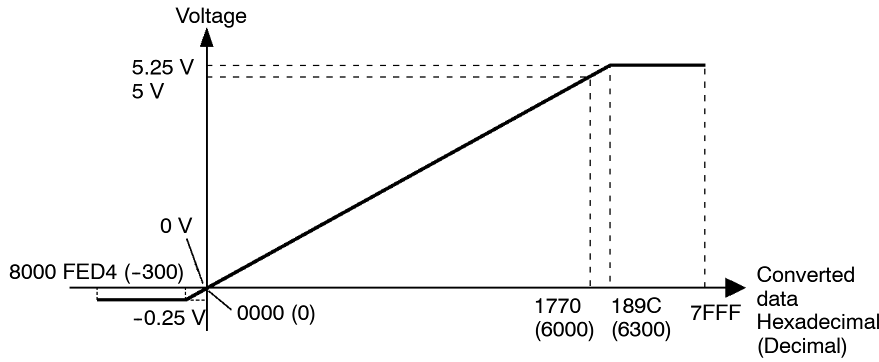
1 to 5 V

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 1 to 5 V. The entire output range is 0.8 to 5.2 V.



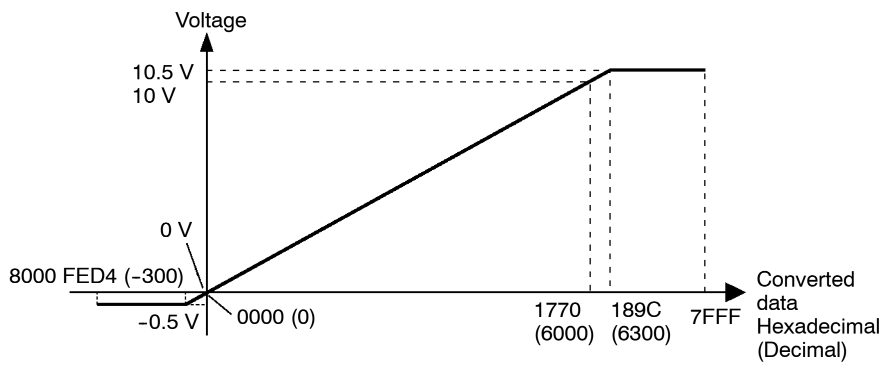
0 to 5 V

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 0 to 5 V. The entire output range is -0.25 to 5.25 V.



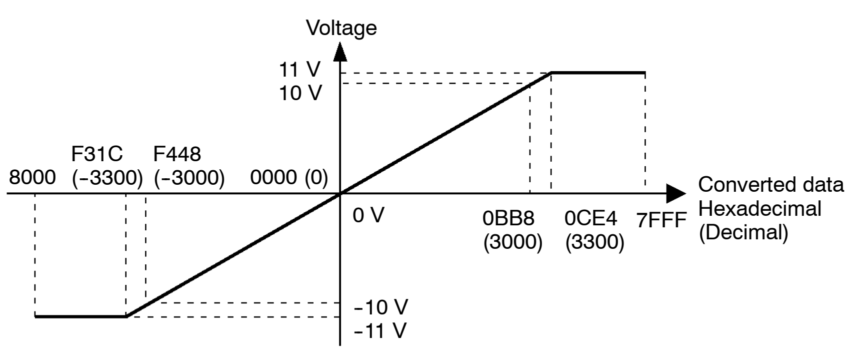
0 to 10 V

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 0 to 10 V. The entire output range is -0.5 to 10.5 V.



-10 to 10 V

The hexadecimal values F448 to 0BB8 (-3000 to 3000) correspond to an analog voltage range of -10 to 10 V. The entire output range is -11 to 11 V. Specify a negative voltage as a two's complement (16 bits).



Output Status after Communications Error

Pins 8 and 9 of the DIP switch determine the status of the outputs after a communications error occurs in CompoBus/D or I/O Unit interface communications.

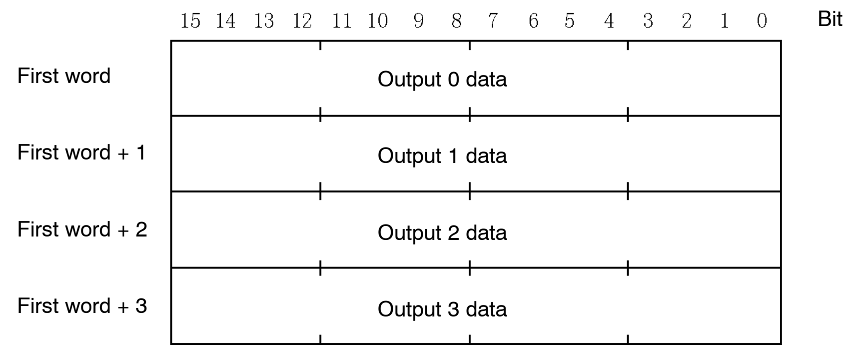
Settings		Output status after communications error
Pin 8	**Pin 9**	
OFF	OFF	Clear at minimum (Clear at the lower limit of the output signal range.)
OFF	ON	Clear at maximum (Clear at the upper limit of the output signal range.)
ON	OFF	Clear at 0 V (for −10 to 10 V only) Clear at minimum (other than the above)
ON	ON	Hold (Maintain previous output status.)

When the clear at minimum, clear at maximum, or clear at 0 V setting is used, the output data is as shown in the following table.

Output signal range	Clear at minimum	Clear at maximum	Clear at 0 V
0 to 5 V	−0.25 V	5.25 V	−0.25 V
1 to 5 V	0.8 V	5.2 V	0.8 V
0 to 10 V	−0.5 V	10.5 V	−0.5 V
−10 to 10 V	−11 V	11 V	0 V

Converted Data

Output the converted data to the Master as shown in the following diagram.

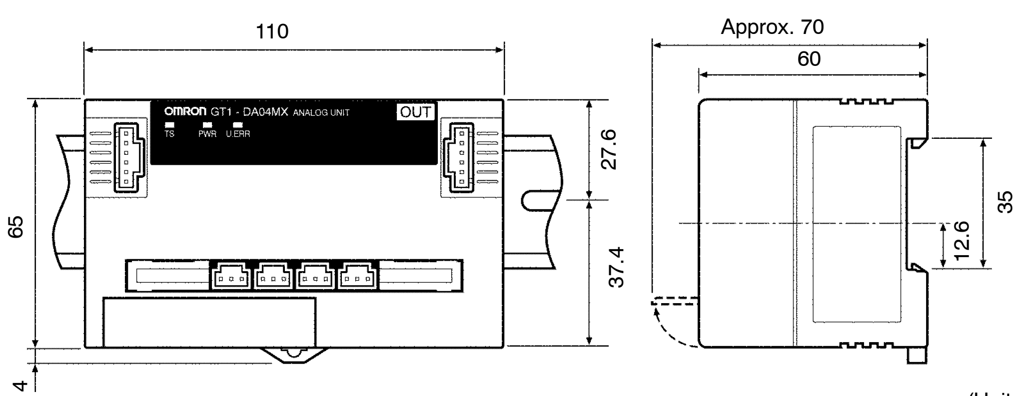


When a negative voltage is to be output, specify the conversion data as the two's complement. To obtain a two's complement from an absolute value, the NEG instruction is useful.

Conversion Time

The conversion data is refreshed every 4 ms for all 4 points.

Dimensions



(Unit: mm)

Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

7-3 Counter Units

GT1-CT01

General Specifications

Item		Specification
I/O connections		Terminal block (M3)
Number of I/O		Encoder input: 1 point (A, B, Z) External input: 1 point (IN) External output: 2 points (OUT 1, OUT 2) (Allocated 3 input words and 3 output words on the Master)
Internal power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $^{+10\%}/_{-15\%}$)
	Current consumption in Unit (inrush current)	Encoder input: 0 External input: 0 External output: 9 mA max.
Current consumption (I/O Unit interface)		90 mA max.
Noise immunity		1,500 V p-p Pulse width: 0.1 to 1 µs Startup pulse: 1 ns (via noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s^2
Shock resistance		200 m/s^2
Dielectric strength		500 VAC (between isolated circuits)
Ambient temperature		–10°C to 55°C
Ambient humidity		25% to 85% (with no condensation)
Operating atmosphere		No corrosive gases
Storage temperature		–25°C to 65°C
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2
Mounting		DIN 35-mm track
Mounting strength		100 N
Terminal strength		100 N
Connector lock strength		I/O Unit interface connector: 50 N
Weight		Approx. 250 g

Characteristics

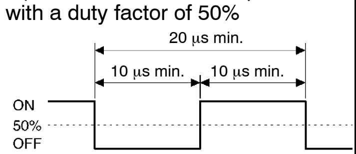
Item		Specification
Number of counters		1
Operating modes		Linear counter
Count inputs	Input signals	Encoder input (A, B, Z)
	Signal levels	24 VDC
	Types of inputs	Differential phase pulse inputs Pulse and direction inputs
	Counting rate	50 kHz (kcps)
	Counting range	–8,388,608 to 8,388,607 (24 bit binary)
	Others	The multiple function (× 1, × 4) can be selected for differential phase pulse input
External inputs	Input signals	External input (IN)
	Signal levels	24 VDC
External outputs	Outputs	External outputs (OUT1, OUT 2)
	Switching capacity	0.5 A/point at 24 VDC

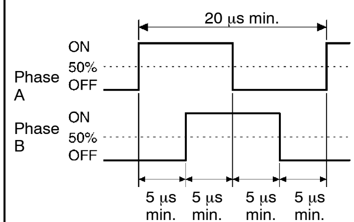
Note When connecting an encoder, use an incremental encoder that has a power supply voltage of 24 VDC and open-collector output. The following OMRON Encoders are recommended:

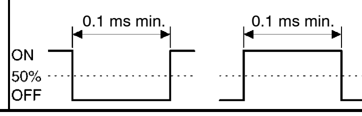
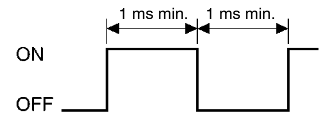
E6B2-CWZ6C
E6H-CWZ6C

Input Specifications (Encoder Input: A, B, Z, External Input: IN)

Item	Specification	
	Encoder input (A, B, Z)	External input (IN)
ON voltage	19.2 VDC min. (between each input terminal and V)	15 VDC min. (between each input terminal and V)
OFF voltage	4 VDC max. (between each input terminal and V)	5 VDC max. (between each input terminal and V)
OFF current	1.0 mA max.	1.0 mA max.
Input current	18 mA max./point at 24 VDC (between each input terminal and V)	6 mA max./point at 24 VDC (between each input terminal and V)
ON response time	---	1.0 ms max.
OFF response time	---	1.0 ms max.
Insulation resistance	20 MΩ min. at 250 VDC (between isolated circuits)	
Isolation method	Photocoupler	

<table>
<tr><th rowspan="2">Item</th><th colspan="2">Specification</th></tr>
<tr><th>Encoder input (A, B, Z)</th><th>External input (IN)</th></tr>
<tr><td>Number of circuits</td><td>1 count input point</td><td>1 point</td></tr>
<tr><td>Minimum response pulse</td><td>Encoder Inputs A and B
Waveform
Input rising time/falling time:
3 µs max. at 50 kHz with pulses with a duty factor of 50%


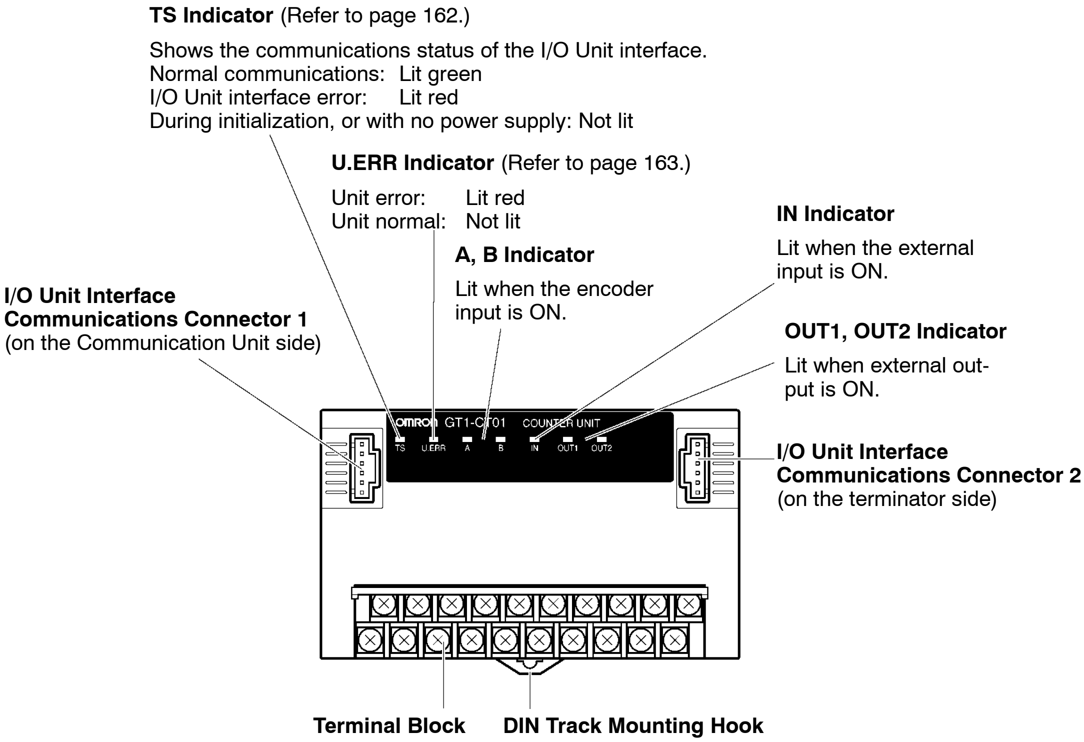
Relationship between A and B phases with offset phase input


Encoder Input Z

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

Output Specifications (External Output: OUT1, OUT2)

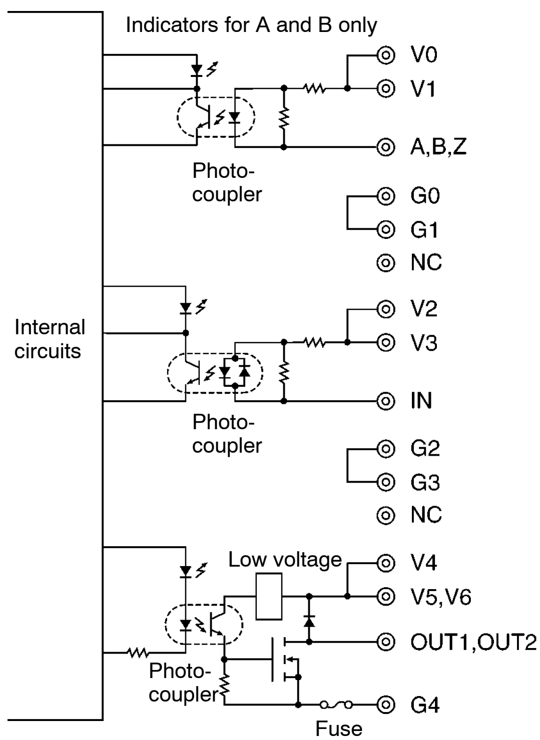
Item	Specification
Rated output current	0.5 A/point
Residual voltage	1.2 V max. at 0.5 A DC (between each output terminal and V and each output terminal and G)
Leakage current	0.1 mA max. at 24 VDC (between each output terminal and V and each output terminal and G)
ON response time	0.5 ms max.
OFF response time	1.5 ms max.
Insulation resistance	20 MΩ min. at 250 VDC (between isolated circuits)
Isolation method	Photocoupler
Number of circuits	2 points

Components

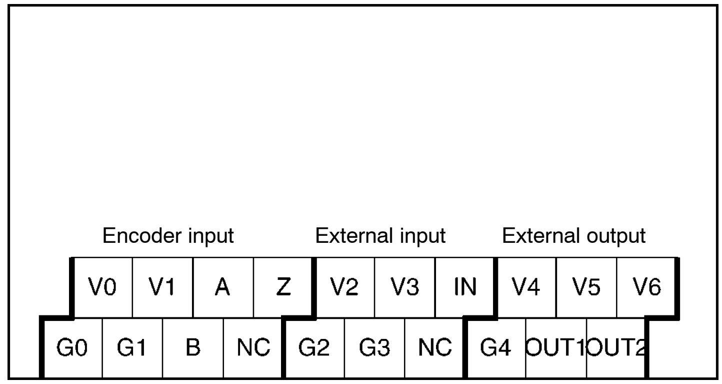


Note Setting for the Counter Unit is carried out in a PC word (output area allocated to the Counter Unit).

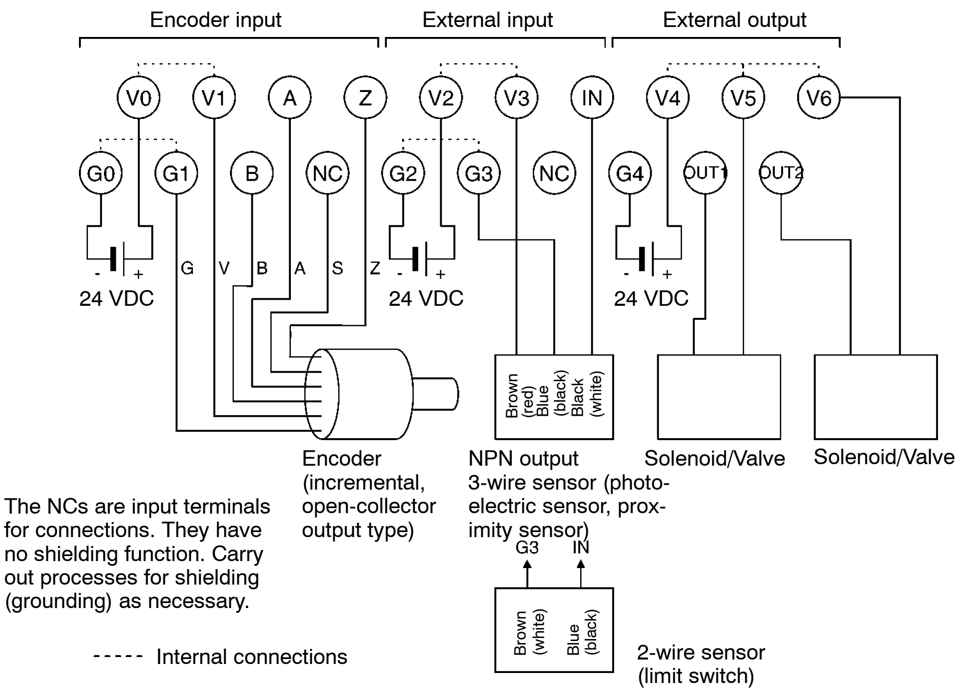
Internal Circuits



Terminal Arrangement



Wiring



Note Do not use the same power supply for the encoder as that used for other I/O Units or communications.

Count Mode

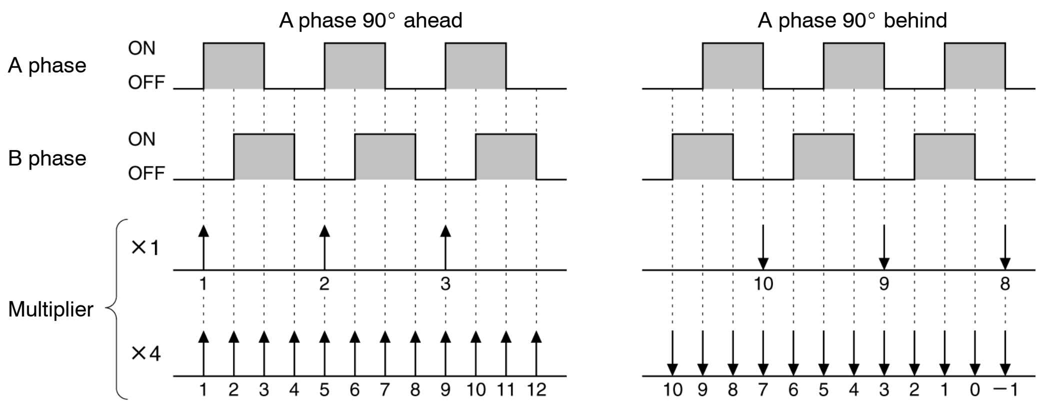
The following count modes can be used with the Counter Unit.

Note If the count mode is changed during count operations, the present value will be cleared to 0.

Differential Phase Pulse Inputs

When the A phase is 90° in advance of the B phase, the input is read as forward rotation and the count is incremented. When the A phase is 90° behind the B phase, the input is read as reverse rotation and the count is decremented. When input is made with differential phase pulse input, the multiple function (×1, ×4) can be used. The following table shows how the multiple function will operate according to the phases of A and B.

Multiple function	A phase 90° ahead	A phase 90° behind
×1	Count is incremented at rising edge of A-phase input	Count is decremented at falling edge of A-phase input
×4	Count is incremented at rising edge and falling edge of A-phase input and B-phase input	Count is decremented at rising edge and falling edge of A-phase input and B-phase input

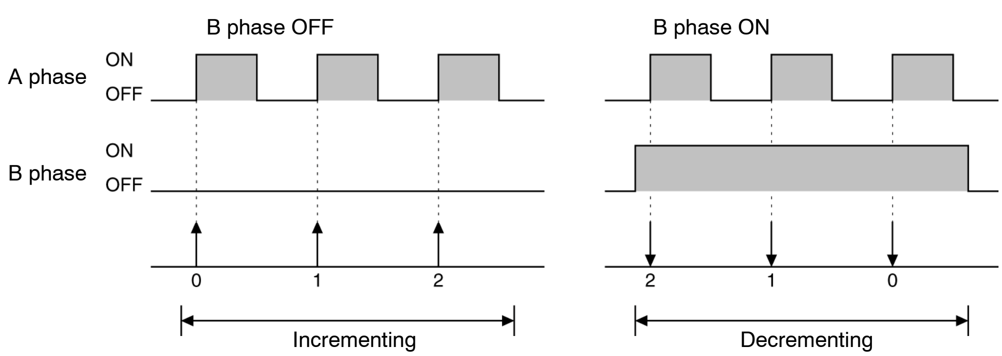


Note When using differential phase pulse input at a multiple function setting of ×4, the count number for each revolution of the encoder will be 4 times the resolution of the encoder. Use an encoder that is compatible with the counting range.

Pulse and Direction Inputs

Phase A is a pulse signal and phase B is a direction signal. Counting will operate in the following way.

Phase B OFF	Phase B ON
Count is incremented at the rising edge of the A-phase input	Count is decremented at the rising edge of the A-phase input



Note Switching B phase (direction input) ON and OFF, must be carried out with A phase (pulse input) switched OFF.

Count Value and External Outputs

Counting Range and Underflow/Overflow

The Counter Unit performs counting in the range –8,388,608 to +8,388,607. If the count value goes outside this range, underflow or overflow will be registered, and counting will stop.

Note
1. When counting is stopped because of underflow or overflow, it can be restarted using count value set or reset. For details about count value set or reset, refer to page 141, *Setting and Reading the Count Value and Set Values*.
2. When underflow/overflow occurs, bit 12 in word m+2 of the input area will come ON. For details, refer to page 144, *Word Functions*.
3. The Counter Unit will not perform counting until the count mode has been set. When the Counter Unit is switched ON, however, if the count mode is already set in word n+2 of the output area, counting will start in the specified mode.

Set Values 1, 2 and External Outputs

The Counter Unit can set the 2 values, set value 1 and set value 2 , and output the comparison result, obtained by comparing these values with the count value, to external outputs 1 and 2. (The comparison result for set value 1 is output to external output 1 and the comparison result for set value 2 is output to external output 2.) Output conditions and external output enable/disable can be set separately for the set values.

Output Conditions:
The following output conditions can be set separately for each of the set values.
Present value ≤ Set value: When the count value is less than or equal to the set value, the external output will be ON.
Present value ≥ Set value: When the count value is greater than of equal to the set value, the external output will be ON.

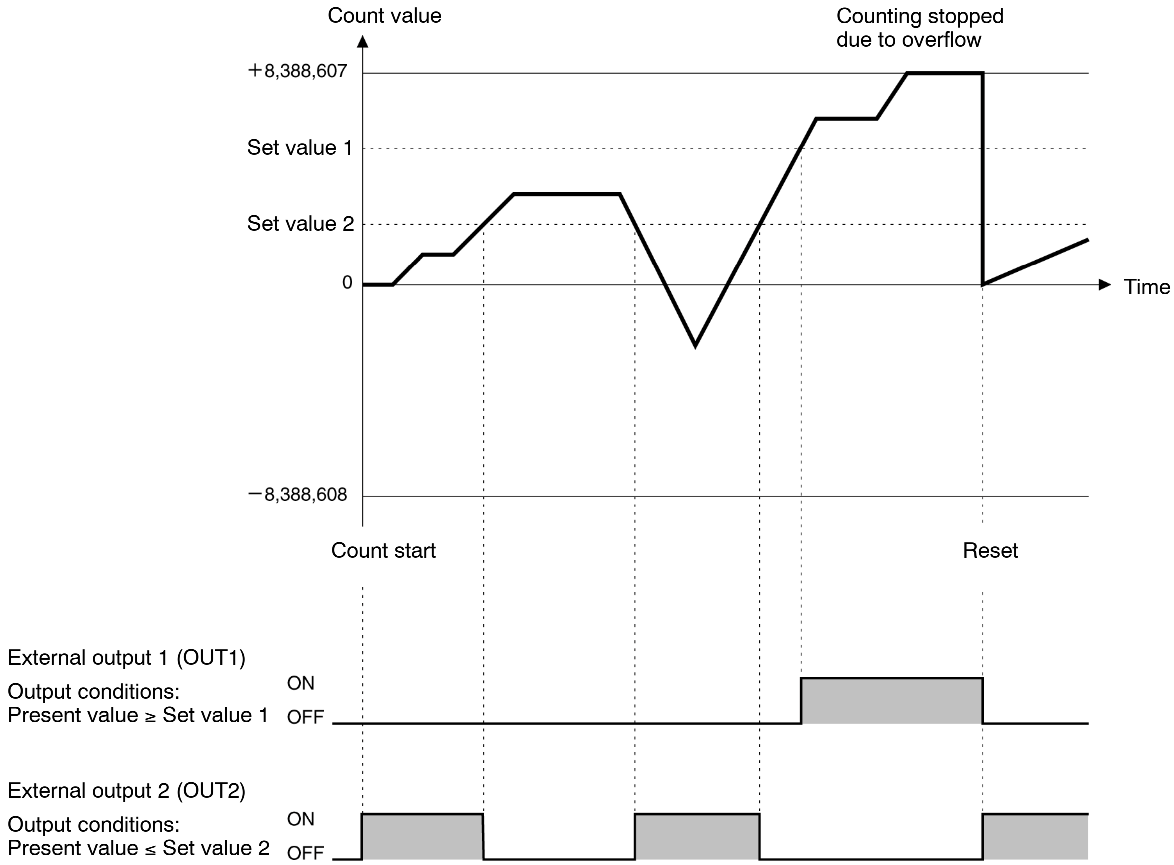
External Output Enable/Disable:
Actual external output will only be made when the External Output Enable Bits (bits 08 and 09 in word n+2 of the output area) are ON. If the External Output Enable Bits are OFF, external output will remain OFF, even if the output conditions are satisfied.

Bit 08 in word n+2: External Output 1 Enable Bit (ON: enable, OFF: disable)

Bit 09 in word n+2: External Output 2 Enable Bit (ON: enable, OFF: disable)

Note
1. Set values 1 and 2, and the output conditions are set in words n, n+1 of the output area. For details about how to make the settings, refer to the following *Setting and Reading the Count Value and Set Values*.

2. The count values and set values can be set in BCD or hexadecimal.



Setting and Reading the Count Value and Set Values

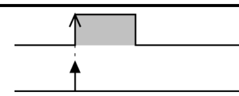
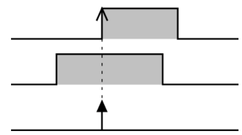
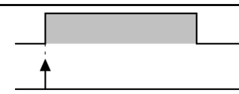
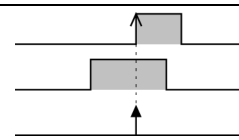
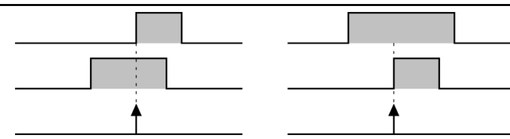
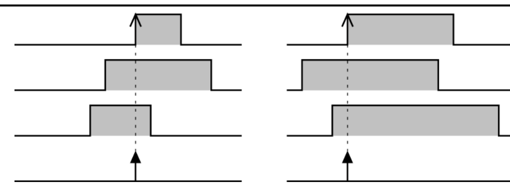
Count value setting refers to the procedure required to change the present value of the count as required, whereas count value reset refers to the process required to reset the present count value to 0.

Count Value Reset

The count value can be reset using combinations of the following 3 inputs.

Encoder input Z
External input
The internal Reset Bit (bit 07 in word n+2 of the output area)

The possible combinations (reset modes) are shown in the following table.

Reset mode	Input	Counter reset condition and timing
1	Encoder input Z	Encoder input Z Reset 
2	External input	External input Reset 
3	Encoder input Z + external input	Encoder input Z External input Reset 
4	Internal Reset Bit	Internal Reset Bit Reset 
5	Encoder input Z + internal Reset Bit	Encoder input Z Internal Reset Bit Reset 
6	External output + internal Reset Bit	External output Internal Reset Bit Reset 
7	Encoder input Z + external input + internal Reset Bit	Encoder input Z External input Internal Reset Bit Reset 

Note

1. Setting of the reset mode is performed in bits 12 to 14 in word n+2 of the output area.
2. The Counter Unit will execute reset with the first count following the fulfillment of the reset conditions.
3. Encoder input Z is only effective for the rising edge. When using the encoder input Z under AND conditions with other inputs, ensure that encoder input Z will turn ON last.
4. When repeating reset for the count value, allow an interval of at least 0.1 ms before switching ON the encoder input Z and at least 1 ms before switching ON the external inputs.
5. It is not possible to execute ON/OFF timing for the internal Reset Bit with perfect accuracy, due to the communications time required for remote I/O communications.

Count Value Setting

The count value (the present value) for the Counter Unit can be set as required, to any value in range –8,388,608 to +8,388,607. Count value setting can be performed in BCD or hexadecimal.

Note

1. Count value setting is performed by setting a value in words n, n+1 of the output area as shown below, and switching ON the Count Value Setting Bit (word n+2, bit 02).
2. Specify whether the setting will be made in BCD or in hexadecimal in the Data Code Switching Bit (word n+2, bit 03).

3. Count value setting can be performed regardless of whether or not count operation is being carried out. Due to the communications time required for remote I/O communications, however, timing for setting cannot be performed with perfect accuracy during count operation.

BCD (Data Code Switching Bit OFF)

Word n+1				Word n			
Sign	$\times 10^6$	$\times 10^5$	$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$

For 1-digit hexadecimal set in the following way:

0: Positive
F: Negative

Hexadecimal (Data Code Switching Bit ON)

Word n+1										Word n			
0	0	0	0	0	0	0	0	$\times 16^5$	$\times 16^4$	$\times 16^3$	$\times 16^2$	$\times 16^1$	$\times 16^0$

When setting negative numbers, use the 24-bit 2's complement (the last 24 bits of the 32-bit 2's complement).
Example: To set –10,000
–10,000 (decimal) → FFFF D8F0 Hex (32 bit 2's complement) → FF D8F0 Hex (24 bit 2's complement)

Reading the Count Value

By switching ON the Count Value Reading Bit (word n+2, bit 06), the count value can be read and stored in words m, m+1 of the input area. The format of the stored value will be the same as that at setting.

Note
1. The value will be stored in either BCD or hexadecimal, according to the setting of the Data Code Switching Bit (word n+2, bit 03).
2. Reading of the count value can be performed regardless of whether or not count operation is being carried out. Due to the communications time required for remote I/O communications, however, timing for reading cannot be performed with perfect accuracy during count operation.

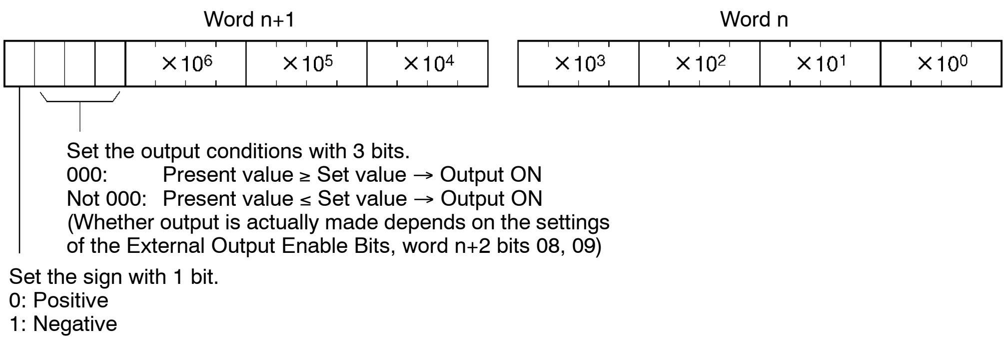
Setting of Set Values 1 and 2

Set values 1 and 2 can be set separately, to values in range –8,388,608 to +8,388,607. When this is performed, the output conditions will also be set. Setting of the set values can be performed in either BCD or hexadecimal.

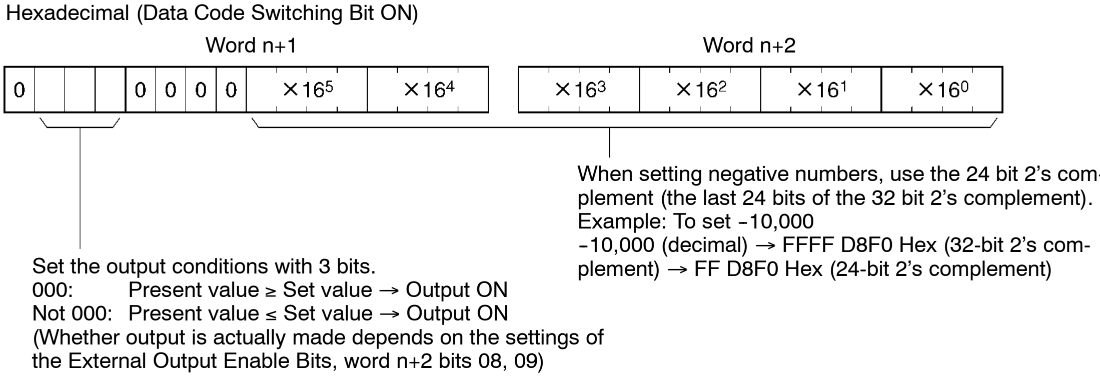
Note
1. To make the set value settings, set the values in words n and n+1 of the output area, as shown below, and switch the Set Value 1 Setting Bit (word n+2, bit 00) or the Set Value 2 Setting Bit (word n+2, bit 01) ON.
2. Specify whether the setting will be made in BCD or in hexadecimal in the Data Code Switching Bit (word n+2, bit 03).

3. Setting of the set values can be performed regardless of whether or not count operation is being carried out. Due to the communications time required for remote I/O communications, however, timing for setting cannot be made with perfect accuracy during count operation.

BCD (Data Code Switching Bit OFF)



Hexadecimal (Data Code Switching Bit ON)



Reading Set Values 1 and 2

By switching ON the Set Value 1 Reading Bit (word n+2, bit 04) or the Set Value 2 Reading Bit (word n+2, bit 05), the set values can be read and stored in words m, m+1 of the input area. When this is performed, the set output conditions will also be read. The format of the stored value will be the same as that at setting.

Note The values will be stored in either BCD or hexadecimal, according to the setting of the Data Code Switching Bit (word n+2, bit 03).

Word Functions

The Counter Unit is allocated output word 3 and input word 3 in the allocated area of the Master. Readings of the settings and status of the Counter Unit are made from the Master via this area.

This section describes the functions of the words that the Counter Unit uses.

In the following explanation, word n refers to the first word in the output area, and m word refers to the first word in the input area.

Note
1. For details about allocation in the allocation area in the Master, refer to the *PROFIBUS-DP Master Operation Manual (W349)*.
2. If the power supply from the I/O unit interface to the Counter Unit stops, the Counter Unit will stop count operations. If this happens, it will be necessary to start up the Counter Unit again. Furthermore, when this is carried out, the present value, the set values, and the count modes will all be cleared and so these settings will also have to be made again.

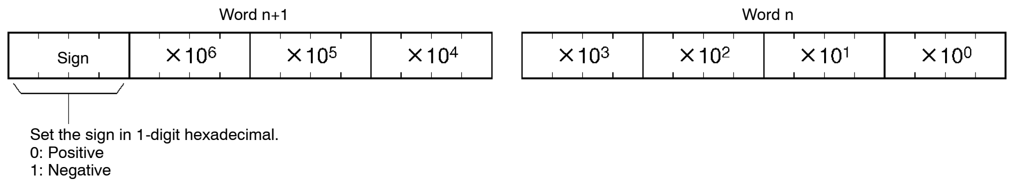
Output Word Functions

<table>
<tr><th>Word</th><th>Bit</th><th>Function</th></tr>
<tr><td>Wd n</td><td>00 to 15</td><td rowspan="2">

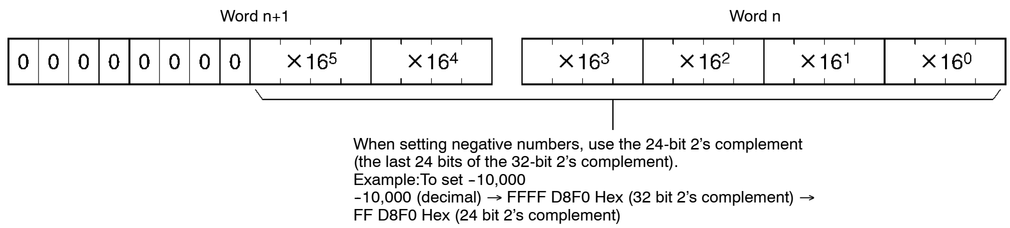
Setting Count Value

At the rising edge of the Count Value Setting Bit (word n+2, bit 2) starts, the value is read and set.

BCD (Data Code Switching Bit OFF)



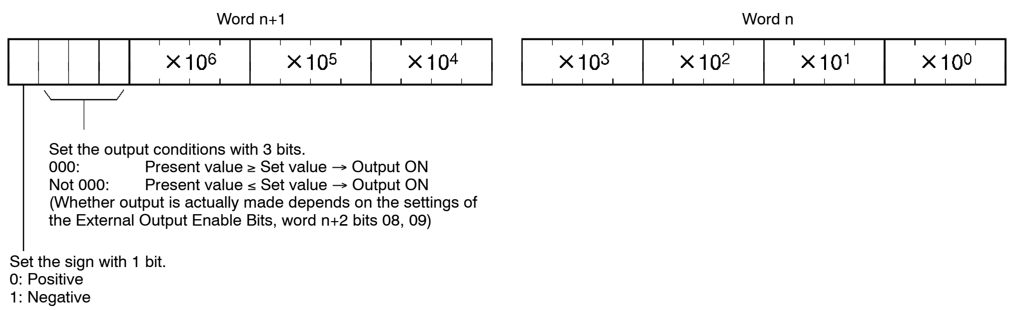
Hexadecimal (Data Code Switching Bit ON)



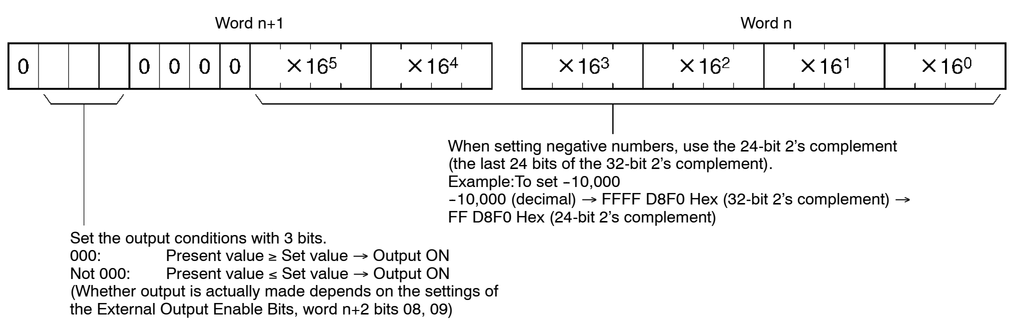
Setting Set Values

At the rising edge of the Set Value 1 Setting Bit (word n+2, bit 0) or the Set Value 2 Setting Bit (word n+2, bit 1) starts, the value is read and set.

BCD (Data Code Switching Bit OFF)



Hexadecimal (Data Code Switching Bit ON)



Setting Range

<table>
<tr><th>Value (decimal)</th><th>BCD (sign + 7 digits)</th><th>Hexadecimal (6 digits)</th></tr>
<tr><td>−8,388,608
to
−1
0
1
to
8,388,607</td><td>F838 8608
to
F000 0001
0000 0000
0000 0001
to
0838 8607</td><td>80 0000
to
FF FFFF
00 0000
00 0001
to
7F FFFF</td></tr>
</table>

</td></tr>
<tr><td>Wd n+1</td><td>00 to 15</td></tr>
</table>

Word	Bit	Name	Function
Wd n+2	00	Set Value 1 Setting Bit	At the rising edge of this bit, the Counter Unit reads the value from words n and n+1, and sets it as set value 1. Before turning this bit OFF, check that bit 00 in word m+2 (Set Value 1 Setting Completion Flag) is ON.
	01	Set Value 2 Setting Bit	At the rising edge of this bit, the Counter Unit reads the value from words n and n+1, and sets it as set value 2. Before turning this bit OFF, check that bit 01 in word m+2 (Set Value 2 Setting Completion Flag) is ON.
	02	Count Value Setting Bit	At the rising edge of this bit, the Counter Unit reads the value from words n and n+1, and changes the count value (present value). Before turning this bit OFF, check that bit 02 in word m+2 (Count Value Setting Completion Flag) is ON.
	03	Data Code Switching Bit	This bit determines whether the setting and reading of the count value or the set values is performed in BCD or hexadecimal. OFF: BCD ON: Hexadecimal
	04	Set Value 1 Reading Bit	While this bit is ON, the Counter Unit reads the normal value of set value 1 and the output conditions and stores them in words m and m+1.
	05	Set Value 2 Reading Bit	While this bit is ON, the Counter Unit reads the normal value of set value 2 and the output conditions and stores them in words m and m+1.
	06	Count Value Reading Bit	While this bit is ON, the Counter Unit reads the normal value of the count value and stores it in words m and m+1.
	07	Internal Resetting Bit	When used for count value resetting, the rising edge of this bit becomes the condition for resetting (only enabled for rising edge).
	08	External Output 1 Enable Bit	This bit determines whether external output 1 comes ON when the output conditions for the count value and set value 1 are fulfilled. OFF: No output (regardless of comparison result, external output 1 will always be OFF) ON: Output (when the output conditions are fulfilled, external output 1 will turn ON)
	09	External Output 2 Enable Bit	This bit determines whether external output 2 comes ON when the output conditions for the count value and set value 2 are fulfilled. OFF: No output (regardless of comparison result, external output 2 will always be OFF) ON: Output (when the output conditions are fulfilled, external output 2 will turn ON)
	10 11	Count Mode Selection Bits	The count mode is set in the following way. Bit 11 / Bit 10 / Count mode OFF OFF No mode change OFF ON Pulse and direction input mode ON OFF Differential phase pulse input (×4) ON ON Differential phase pulse input (×4) Between the Counter Unit startup and count mode setting, count operations will not begin. If the count mode has already been set when the Counter Unit is started up, however, count operations will start in the count mode set. If the count mode is changed during count operations, the present value will be cleared to 0 before counting starts in the new mode.
	12 13 14	Reset Mode Setting Bits	The reset mode is set in the following way. Bit 14 / Bit 13 / Bit 12 / Reset mode OFF OFF OFF No mode change OFF OFF ON Encoder input Z OFF ON OFF External input OFF ON ON Encoder input Z and external input ON OFF OFF Internal reset bit ON OFF ON Encoder input Z and internal reset bit ON ON OFF External input and internal reset bit ON ON ON Encoder input Z , external input, and internal reset bit
	15	I/O Unit Interface Error Setting Bit	Counter Unit operations in the event of I/O Unit interface error (see note) are set in the following way. OFF: Count operations will be stopped, and the present value and set values 1 and 2 will be cleared to 0. External outputs 1 and 2 will be turned OFF. ON: Count operations will continue. **Note:** In the event of I/O Unit interface error, the Communication Unit and all the I/O Units must be restarted.

Note A priority exists for setting and reading commands. If a bit with a higher priority always comes first, other settings and readings will not be made, even if they have been specified. In order of decreasing priority:
1. Count value setting → 2. Set value 2 setting → 3. Set value 1 setting → 4. Count value reading → 5. Set value 2 reading → 6. Set value 1 reading

Input Word Functions

Word	Bit	Function
Wd m	00 to 15	**Reading Count Value** While the Count Value Reading Bit (word n+2, bit 06) is ON, the value will be constantly read and stored
Wd m+1	00 to 15	**Reading Set Values** While the Set Value 1 Reading Bit (word n+2, bit 04) or the Set Value 2 Reading Bit (word n+2, bit 05) is ON, the values and the output conditions will constantly be read and stored.

Reading Count Value

While the Count Value Reading Bit (word n+2, bit 06) is ON, the value will be constantly read and stored

BCD (Data Code Switching Bit OFF)

Word n+1				Word n			
Sign	×10⁶	×10⁵	×10⁴	×10³	×10²	×10¹	×10⁰

The sign will be stored in 1-digit hexadecimal.
0: Positive
1: Negative

Hexadecimal (Data Code Switching Bit ON)

Word n+1										Word n			
0	0	0	0	0	0	0	0	×16⁵	×16⁴	×16³	×16²	×16¹	×16⁰

Negative numbers will be stored using the 24-bit 2's complement
(the last 24 bits of the 32-bit 2's complement).
Example:For –10,000
–10,000 (decimal) → FFFF D8F0 Hex (32-bit 2's complement) →
FF D8F0 Hex (24-bit 2's complement)

Reading Set Values

While the Set Value 1 Reading Bit (word n+2, bit 04) or the Set Value 2 Reading Bit (word n+2, bit 05) is ON, the values and the output conditions will constantly be read and stored.

BCD (Data Code Switching Bit OFF)

Word n+1								Word n			
				×10⁶	×10⁵	×10⁴	×10³	×10²	×10¹	×10⁰

The output conditions will be stored with 3 bits.
000: Present value ≥ Set value → Output ON
Not 000: Present value ≤ Set value → Output ON
(Whether output is actually made depends on the settings of the External Output Enable Bits, word n+2 bits 08, 09)

The sign will be stored with 1 bit.
0: Positive
1: Negative

Hexadecimal (Data Code Switching Bit ON)

Word n+1										Word n			
0				0	0	0	0	×16⁵	×16⁴	×16³	×16²	×16¹	×16⁰

Negative numbers will be stored using the 24-bit 2's complement
(the last 24 bits of the 32-bit 2's complement).
Example:For –10,000
–10,000 (decimal) → FFFF D8F0 Hex (32-bit 2's complement) →
FF D8F0 Hex (24-bit 2's complement)

The output conditions will be stored with 3 bits.
000: Present value ≥ Set value → Output ON
Not 000: Present value ≤ Set value → Output ON
(Whether output is actually made depends on the settings of the External Output Enable Bits, word n+2 bits 08, 09)

Setting Range

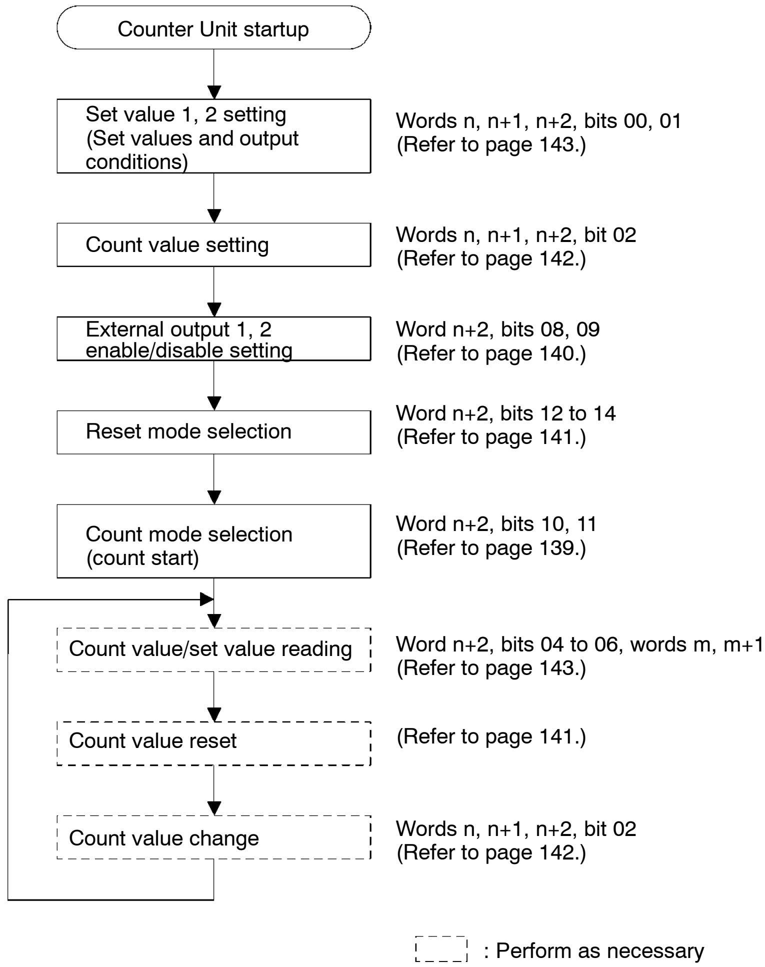
Value (decimal)	BCD (sign + 7 digits)	Hexadecimal (6 digits)
–8,388,608 to –1	F838 8608 to F000 0001	80 0000 to FF FFFF
0	0000 0000	00 0000
1 to 8,388,607	0000 0001 to 0838 8607	00 0001 to 7F FFFF

Word	Bit	Name	Function
Wd m+2	00	Set Value 1 Setting Completion Flag	When setting for set value 1 has been completed, even if an error has occurred, this flag will turn ON. This flag will turn OFF if bit 00 in word n+2 (Set Value 1 Setting Bit) turns OFF, or if a command is executed for a bit with a higher priority. Use bit 13 in word m+2, to check whether the setting was completed under normal or error status.
	01	Set Value 2 Setting Completion Flag	When setting for set value 2 has been completed, even if an error has occurred, this flag will turn ON. This flag will turn OFF if bit 01 in word n+2 (Set Value 2 Setting Bit) turns OFF, or if a command is executed for a bit with a higher priority. Use bit 13 in word m+2, to check whether the setting was completed under normal or error status.
	02	Count Value Setting Completion Flag	When setting for the count value has been completed, even if an error has occurred, this flag will turn ON. This flag will turn OFF if bit 02 in word n+2 (Count Value Setting Bit) turns OFF. Use bit 13 in word m+2, to check whether the setting was completed under normal or error status.
	03	Data Code Status Flag	This flag shows whether the data stored in words m and m+1 is displayed in BCD or hexadecimal. OFF: BCD ON: Hexadecimal
	04	Set Value 1 Stored Flag	This flag will turn ON if the data stored in words m and m+1 is set value 1. This flag will turn OFF if bit 04 in word n+2 (Set Value 1 Reading Bit) turns OFF, or if a command is executed for a bit with a higher priority.
	05	Set Value 2 Stored Flag	This flag will turn ON if the data stored in words m and m+1 is set value 2. This flag will turn OFF if bit 05 in word n+2 (Set Value 2 Reading Bit) turns OFF, or if a command is executed for a bit with a higher priority.
	06	Count Value Stored Flag	This flag will turn ON if the data stored in words m and m+1 is the count value. This flag will turn OFF if bit 06 in word n+2 (Count Value Reading Bit) turns OFF, or if a command is executed for a bit with a higher priority.
	07	Count Operating Flag	This flag shows the status of count operation. OFF: Stopped ON: In operation
	08	External Output 1 Status Flag	This flag shows the status of external output 1. OFF: Low (OFF) ON: High (ON) This flag will always be OFF, when the External Output 1 Enable Bit (word n+2, bit 08) is OFF.
	09	External Output 2 Status Flag	This flag shows the status of external output 2. OFF: Low (OFF) ON: High (ON) This flag will always be OFF, when the External Output 2 Enable Bit (word n+2, bit 09) is OFF.
	10	Encoder Input Z Status Flag	This flag shows the status of encoder input Z. OFF: Low (OFF) ON: High (ON)
	11	External Input Status Flag	This flag shows the status of external input. OFF: Low (OFF) ON: High (ON)
	12	Underflow/ Overflow Flag	This flag will turn ON if the count value registers underflow or overflow. Count operation will stop with the count value at either the lower or upper limit. To restart count operation, execute counter value setting or resetting. This flag will turn OFF when counting restarts.
	13	Setting Error Flag	This flag will turn ON if setting for the count value or set values is completed under error status. This may occur if a value is outside the specified range, or there is an irregularity in the value format. This flag will turn OFF when the set values or the count value are set correctly.
	14	Reserved for system	(Do not set)
	15		

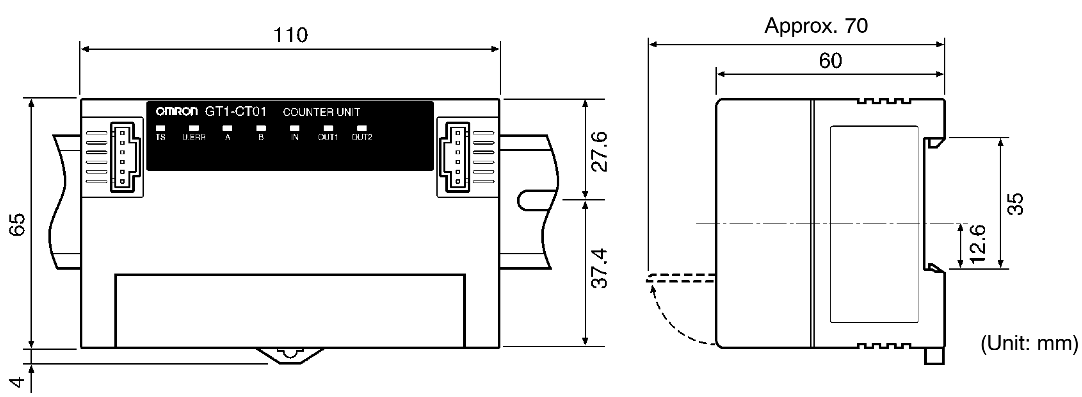
Procedure Example

This section provides a procedure example starting from the settings of the Counter Unit up to the outputting of comparison results.

This example only provides the basic procedure. For details about actual setting and programming, refer to page 144, *Word Functions* or *5-1 Examples of Counter Unit Operation*.



Dimensions



Note The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

SECTION 8
Communications Timing

This section provides characteristics for communications in the PROFIBUS-DP Unit and describes how to calculate the times required for communications between Units.

8-1 Remote I/O Communications Characteristics 152

8-1-1 I/O Response Time 152

8-1-2 Communications Cycle Time and Refresh Time 153

8-1-3 I/O Unit Interface Cycle Time 153

8-1-4 Asynchronus / synchronous mode 154

8-1 Remote I/O Communications Characteristics

This section describes the characteristics of PROFIBUS-DP communications when OMRON Master and Slave Units are being used. Use this section for reference when planning operations that require precise I/O timing.

The equations provided here are valid under the following conditions:

1, 2, 3...
1. The Master Unit is configured properly.
2. All of the required Slaves are participating in communications.
3. No errors are being indicated at the Master Unit
4. Messages are not being produced in the Network.

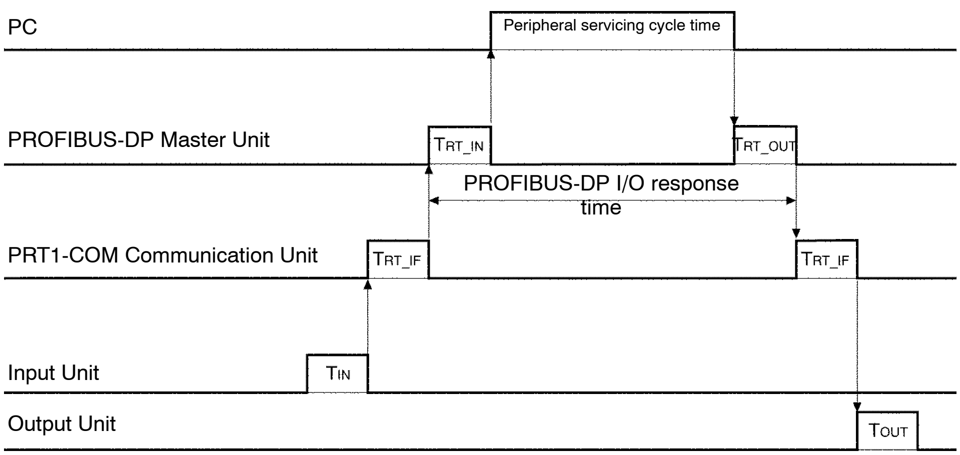
Note
1. The values provided by these equations may not be accurate if another company's Master or Slave is being used in the Network.
2. This manual only refers to parts related to the MULTIPLE I/O TERMINAL.

8-1-1 I/O Response Time

The I/O response time is the time it takes from the reception of an input signal at an Input Slave (MULTIPLE I/O TERMINAL Input I/O Unit) to the output of the corresponding output signal at an Output Slave (MULTIPLE I/O TERMINAL Output I/O Unit).

Minimum I/O Response Time

The minimum I/O response times are the I/O response times shown in the following diagram.



T_{IN}: Input I/O Unit ON (OFF) delay time
T_{OUT}: Output I/O Unit ON (OFF) delay time
$T_{RT\text{-}IF}$: I/O Unit interface communications time (1.5 ms)
$T_{RT\text{-}IN}$: Communications time for 1 Input Slave
$T_{RT\text{-}OUT}$: Communications time for 1 Output Slave
(With the MULTIPLE I/O TERMINAL, $T_{RT\text{-}IN}$ and $T_{RT\text{-}OUT}$ will be the communications time per Slave.)

The minimum I/O response time (T_{MIN}) is the total of the following terms:

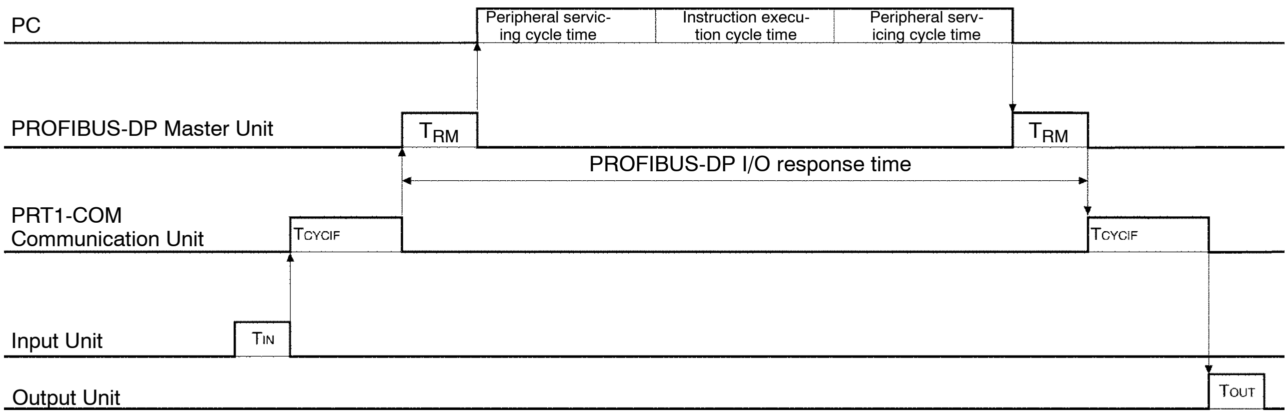
$$T_{MIN} = T_{IN} + T_{RT\text{-}IF} + (\text{PROFIBUS-DP I/O response time}) + T_{RT\text{-}IF} + T_{OUT}$$

Note For details on the Input I/O Unit input delay time and the Output I/O Unit output delay time, see information on the I/O Units in 6-1 Common Specifications for Basic I/O Units.

Note Refer to the PC's Operation Manual for details on the PC's cycle time.

Maximum I/O Response Time

The maximum I/O response time occurs with the I/O timing shown in the following diagram.



T_{IN}: Input I/O Unit ON (OFF) delay time
T_{OUT}: Output I/O Unit ON (OFF) delay time
T_{CYCIF}: I/O Unit interface cycle time (see *8-1-3 I/O Unit Interface Cycle Time*)
T_{RM}: PROFIBUS-DP cycle time for the whole network

The maximum I/O response time (T_{MAX}) is the total of the following terms:

$$T_{MAX} = T_{IN} + T_{CYCIF} + \text{(PROFIBUS-DP I/O response time)} + T_{CYCIF} + T_{OUT}$$

Note For details on the Input I/O Unit input delay time and the Output I/O Unit output delay time, refer to information on the I/O Units in *6-1 Common Specifications for Basic I/O Units.*

Note Refer to the PC's Operation Manual for details on the PC's cycle time.

8-1-2 PROFIBUS-DP Cycle Time

PROFIBUS-DP Cycle Time

The PROFIBUS-DP cycle time is the time from the completion of a Slave's remote I/O communications processing until remote I/O communications with the same Slave are processed again. The PROFIBUS-DP cycle time is used to calculate the maximum I/O response time.

The PROFIBUS-DP cycle time depends on the number of masters and total number of slaves in the network. For calculating the PROFIBUS-DP cycle time refer to PROFIBUS-DP Master Unit Operation Manual (W349).

The time required to exchange data between the master unit and the PLC CPU can also be found in this manual.

8-1-3 I/O Unit Interface Cycle Time

The I/O Unit interface cycle time is the time interval between the I/O processing of I/O Units in a MULTIPLE I/O TERMINAL and the next I/O processing for those I/O Units.

Without a Special I/O Unit

If there is not a Special I/O Unit, the I/O Unit interface cycle time is:

$$T_{RT\text{-}IF} = 1.5 \text{ [ms]}$$

With a Special I/O Unit

More frames are required with a Special I/O Unit. There will be one additional special I/O data frame per Special I/O Unit and one additional frame for checking the status of all the Special I/O Units. Therefore, the I/O Unit interface cycle time with a Special I/O Unit can be calculated using the following formula:

$$T_{CYCIF} = 1.5 \times (MOD + N + 1) \text{ [ms]}$$

MOD: Number of I/O data frames
If there is no basic I/O Unit: MOD = 0
If there are basic I/O Units: MOD = 1

N: Number of Special I/O Units (1 to 8)

8-1-4 Asynchronous / synchronous mode

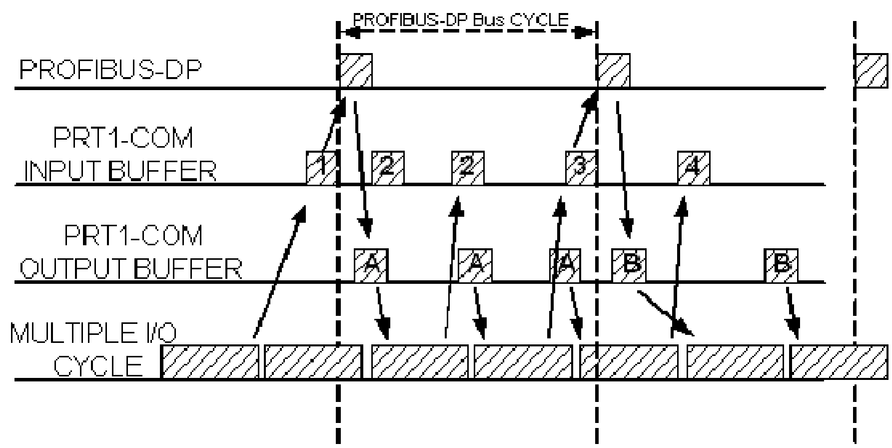
The communication unit (PRT1-COM) can be programmed in either asynchronous or synchronous mode.

For optimal performance use asynchronous mode. Use synchronous mode only when:

$^1/_2$ * PROFIBUS-DP Cycle time $\leq$ MULTIPLE I/O Bus cycle time $\leq$ PROFIBUS-DP Cycle time

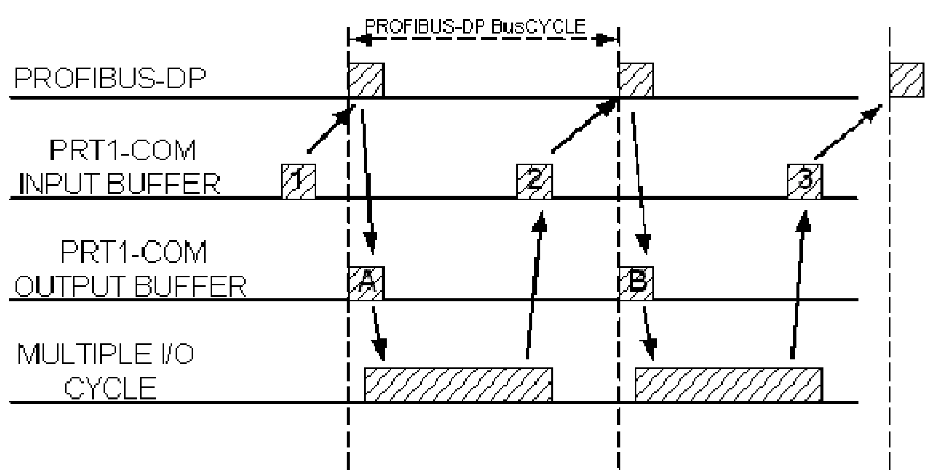
Both modes are explained with a timing diagram.

The following timing diagram shows an asynchronous transfer.



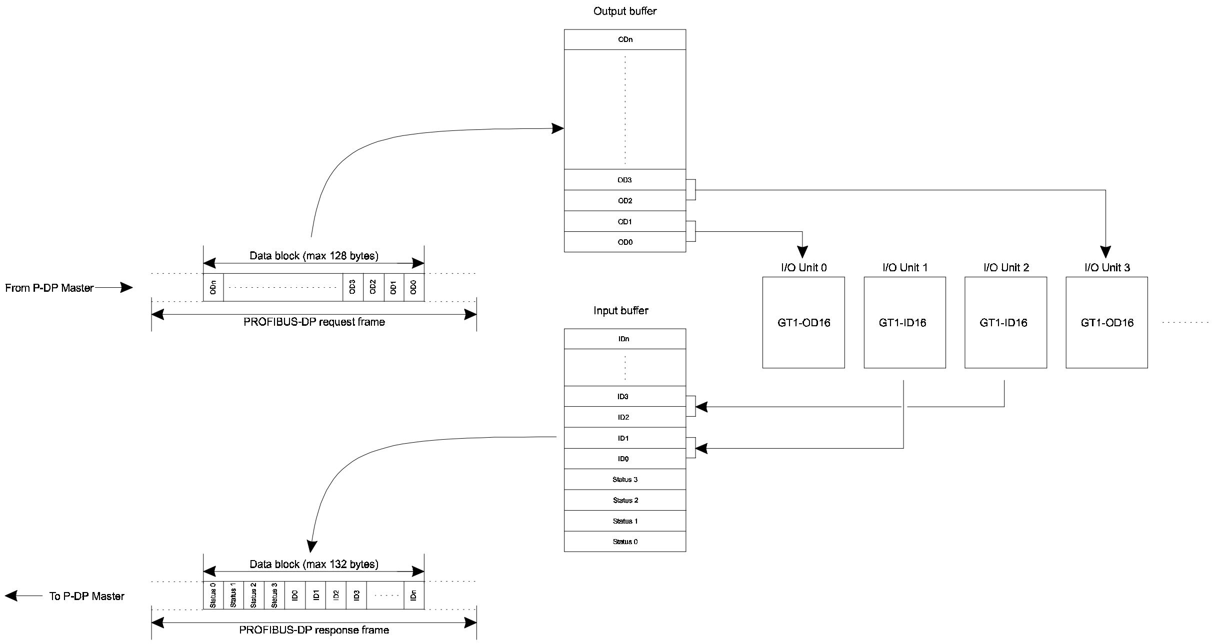
In this example, input data-3, rather than input data-2 is send with the next PROFIBUS-DP data exchange cycle.

The following timing diagram shows a synchronous transfer.



For calculating MULTIPLE I/O Unit cycle time, see section 8-1-3.

The actual transfer of data between PROFIBUS-DP, the PRT1-COM buffers and the MULTIPLE I/O Units is shown here.



SECTION 9
Troubleshooting and Maintenance

This section provides procedures for dealing with errors as well as basic maintenance procedures.

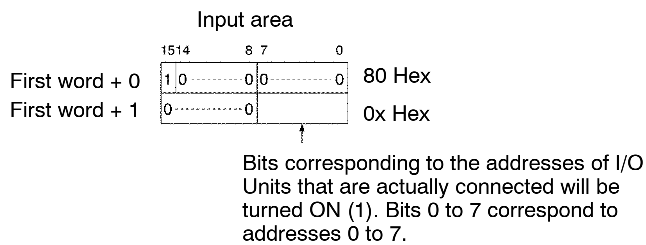
9-1 Normal Indication 158
9-2 Troubleshooting 159
9-3 Maintenance 164
9-3-1 Cleaning 164
9-3-2 Inspection 164
9-3-3 Replacing Units 165

9-1 Normal Indication

When a MULTIPLE I/O TERMINAL is operating normally, the status will be as follows:

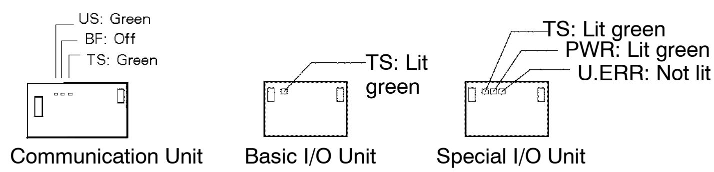
I/O Unit Interface Status

During normal operation, the status of the I/O Unit interface is set in the first two words of the MULTIPLE I/O TERMINAL input area as shown in the following diagram.



Unit Indicators

During normal operation, the front-panel indicators of each Unit will be as shown in the following diagram.

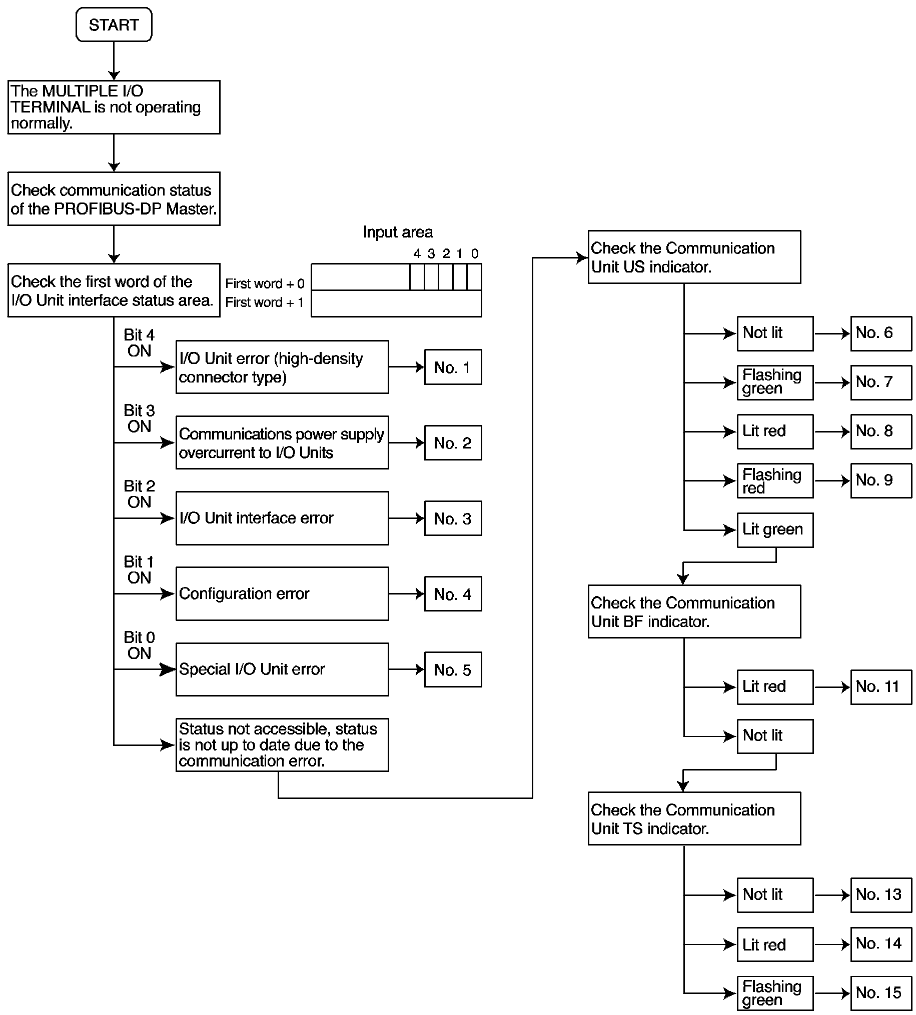


9-2 Troubleshooting

This section explains the causes of errors, how to determine their locations, and the actions to be taken when errors occur in a MULTIPLE I/O TERMINAL.

Check Flowchart

When an error occurs in a MULTIPLE I/O TERMINAL, use the following flowchart to find the cause of the error, determine its location, and take the appropriate action. The numbers correspond to the numbers in the tables beginning on page 160.



Status Area Error Processing

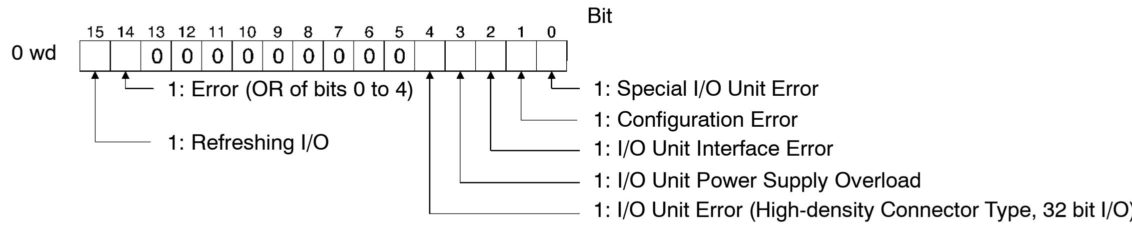
A MULTIPLE I/O TERMINAL status area is available in the first two words of the MULTIPLE I/O TERMINAL input area in the Master. The contents and causes of errors can be found by checking this area.

Status Area Configuration

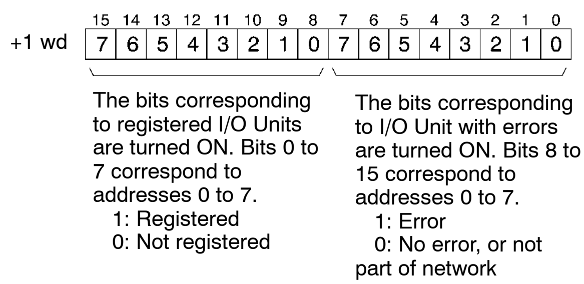
The status area is configured as shown in the following diagram.

	15 … 8	7 … 0
0 wd	I/O Unit connection information	
+1 wd	Error I/O Unit addresses	Registered I/O Unit addresses

I/O Unit Connection Information



Error and Registered I/O Unit Addresses



Probable Causes of Errors and Countermeasures

Use the status area to determine the error content and the I/O Unit address where the error occurred, and then take action according to the following table.

No.	Error content	Probable cause	Countermeasure
1	I/O Unit error (high-density connector type) (TS led = red on)	A hardware error has occurred in an I/O Unit.	Replace the I/O Unit in which the hardware error has occurred.
2	Communications power supply overcurrent to an I/O Unit (TS led = off)	The power supply to the I/O Unit interface has shorted.	Check that the I/O Units and their communication cables have not shorted.
		The current consumption of the I/O Unit interface exceeds 0.3 A.	Check that the total current consumption of the communications power supply for the I/O Units does not exceed 0.3 A.
			After taking the above measures, restart the Communication Unit. If the problem persists, replace the Communication Unit.
3	I/O Unit interface error (TS led = red on)	The end connector is not connected.	After turning OFF the power supply to the Communication Unit and all I/O Units, attach the end connector to the I/O Unit interface connector 2 on the terminal I/O Unit.
		The I/O Unit Connecting Cable is broken.	Replace the broken cable.
		There is a lot of noise.	Remove the source of the noise.
		Too many I/O Units are connected. (US led = flashing green)	Connect no more than 8 I/O Units for each Communication Unit.
			After taking the above measures, restart the Communication Unit. If the problem persists, replace the Communication Unit.
4	Configuration error (TS led = red on)	The I/O Unit configuration was changed while the Communication Unit was turned ON.	After turning OFF the power supply to the Communication Unit and all I/O Units, return to the correct I/O Unit configuration, and restart the Communication Unit. If the problem persists, replace the Communication Unit.
5	Special I/O Unit error (TS led = flashing green)	A specific error, such as no operating power supply, has occurred in a Special I/O Unit.	Check the operating power supply, and provide the correct power supply. If the problem persists, replace the Special I/O Unit in which the error occurred.

Troubleshooting via Indicators

There are indicators that display the Unit status of each MULTIPLE I/O TERMINAL Unit. The contents and causes of errors can be found by checking these indicators.

Indicator Meanings

Unit	Indicator name	Meaning
Communication Unit	BF	Displays the BUS communications status.
	US	Displays the Communication Unit status.
	TS	Displays the I/O Unit interface status.
Basic I/O Unit	TS	Displays the I/O Unit interface status.
Special I/O Unit	TS	Displays the I/O Unit interface status.
	U.ERR	Displays the Special I/O Unit status.
	PWR	Displays the operating power supply status.

In addition to the above indicators, some Units also have indicators that display the I/O status.

Causes and Remedies for Communication Unit US Indicator Errors

First use the Communication Unit US indicator to check the status of the Communication Unit, and then take action according to the following table.

No.	Communication Unit US indicator status	Cause	Remedy
6	OFF US	The power is not being supplied.	Check the operating power supply, and provide the correct power supply. If the problem persists, replace the Communication Unit.
7	Flashing (green) US	Initialisation failure of Communication Unit.	Check other led indicators for failure cause.
8	ON (red) US	A hardware error has occurred in the Communication Unit.	Restart the Communication Unit. If the problem persists, replace the Communication Unit.
9	Flashing (red) US	Special I/O Units have been parameterized.	Restart the Communication Unit. If the problem persists, replace the Communication Unit.
10	ON (green) US	No error	Proceed to the next item, *Causes and Remedies for Communication Unit BF indicator Errors*.

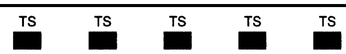
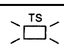
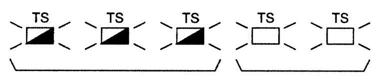
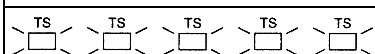
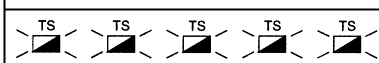
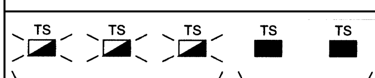
Causes and Remedies for Communication Unit BF indicator Errors

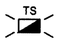
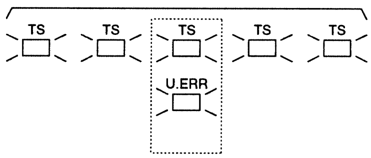
Next use the BF indicator to check the status of the Communication Unit, and then take action in according to the following table.

No.	Communication Unit BF indicator status	Cause	Remedy
11	ON (red) BF	The Unit is in Bus Off status.	Check the connection status of the PROFIBUS-DP communications cable or the noise status.
		A Slave already exits with the same node number as the Communication Unit.	Reset the node number so that it is not duplicated.
		Communication Unit not properly configured.	Re-configure the PROFIBUS-DP Unit.
			After taking the above measures, restart the Communication Unit. If the problem persists, replace the Communication Unit.
12	OFF BF	No error	Proceed to the next item, *Causes and Remedies for Communication Unit and I/O Unit TS Indicator Errors*.

Causes and Remedies for Communication Unit and I/O Unit TS Indicator Errors

If there is no error after the US indicator and BF indicator have been checked, use the TS indicator of each Unit to check the status of the Communication Unit and each I/O Unit, and then take action in according to the following table.

No.	TS indicator status: Communication Unit	TS indicator status: I/O Units	Cause	Remedy
13	 OFF	 All I/O Unit TS indicators are not lit.	The power supply to the I/O Unit interface has shorted or disconnected. The current consumption of the I/O Unit interface exceeds 0.3 A.	Check that the I/O Unit communications cable has not shorted. Check that the total current consumption of the communications power supply for the I/O Unit does not exceed 0.3 A. After taking the above measures, restart the Communication Unit.
14	 ON (red) (I/O Unit interface error)	 The TS indicators on the Units closer to the Communication Unit are flashing green and the indicators on the rest of the Units are lit red.	The cable is broken at the Unit where the TS indicator display changes. (The upline is broken.)	After turning OFF the power supply to the Communication Unit and all I/O Units, replace the broken cable.
		 All I/O Unit TS indicators are lit red.	The cable between the Communication Unit and the first I/O Unit is broken. (Upline)	
			There is a lot of noise.	Remove the source of the noise.
		 All I/O Unit TS indicators are lit green.	The end connector is not connected.	After turning OFF the power supply to the Communication Unit and all I/O Units, attach the end connector to the I/O Unit interface connector 2 of the terminal I/O Unit.
			The cable connected to the Remote Terminal Unit I/O interface connector 1 is broken.	After turning OFF the power supply to the Communication Unit and all I/O Units, perform a continuity test on the cable, and replace the broken cable.
		 The TS indicators on the Units closer to the Communication Unit are flashing green and the indicators on the rest of the Units are not lit.	The I/O Unit configuration changed after the Unit where the TS indicator display changed.	After turning OFF the power supply to the Communication Unit and all I/O Units, return to the correct I/O Unit configuration, and restart the Communication Unit.
			At the last Unit where the green light is flashing, one of the cables is broken. (The downline is broken.)	After turning OFF the power supply to the Communication Unit and all I/O Units, check the connection status of the cable. If the problem persists, replace the cable after turning OFF the power supply to the Communication Unit and all I/O Units.
			I/O Unit interface connector 2 are connected at the Unit where the TS indicator display changed.	After turning OFF the power supply to the Communication Unit and all I/O Units, correctly reconnect the cable.

No.	TS indicator status		Cause	Remedy
	Commu-nication Unit	I/O Units		
15	 Flashing (green) (Special I/O Unit error)	ON (green)  There is a Special I/O Unit with the TS and U.ERR indicators lit red.	A specific error, such as no operating power supply, has occurred in a Special I/O Unit.	Check the operating power supply, and provide the correct power supply. If the problem persists, replace the Special I/O Unit in which the error occurred.

9-3 Maintenance

This section describes the routine cleaning and inspection recommended as regular maintenance.

9-3-1 Cleaning

Clean the PROFIBUS-DP Units regularly as described below in order to keep it in its optimal operating condition.

- Wipe the Unit with a dry, soft cloth for regular cleaning.
- When a spot can't be removed with a dry cloth, dampen the cloth with a neutral cleanser, wring out the cloth, and wipe the Unit.
- A smudge may remain on the Unit from gum, vinyl, or tape that was left on for a long time. Remove the smudge when cleaning.

⚠ Caution Never use volatile solvents such as paint thinner or benzene or chemical wipes. These substances could damage the surface of the Unit.

9-3-2 Inspection

Be sure to inspect the system periodically to keep it in its optimal operating condition. In general, inspect the system once every 6 to 12 months, but inspect more frequently if the system is used with high temperature or humidity or under dirty/dusty conditions.

Inspection Equipment

Prepare the following equipment before inspecting the system.

Required Equipment
Have a standard and phillips-head screwdriver, multimeter, alcohol, and a clean cloth.

Equipment that could be needed
Depending on the system conditions, a synchroscope, oscilloscope, thermometer, or hygrometer (to measure humidity) might be needed.

Inspection Procedure

Check the items in the following table and correct any items that are below standard.

Item		Standard	Equipment
Environmental conditions	Ambient and cabinet temperature	See below.	Thermometer
	Ambient and cabinet humidity	See below.	Hygrometer
	Dust/dirt accumulation	None	---
Installation	Are the Units installed securely?	No looseness	---
	Are the communications connectors fully inserted?	No looseness	---
	Are the external wiring screws tight?	No looseness	---
	Are the connecting cables undamaged?	No damage	---

The following table shows the acceptable temperature and humidity ranges for PROFIBUS-DP Units.

Unit	Acceptable temperature	Acceptable humidity*
Master Unit	0°C to 55°C	10% to 90%
MULTIPLE I/O TERMINAL (Communication Unit, I/O Units)	−10°C to 55°C	25% to 85%

9-3-3 Replacing Units

The PROFIBUS-DP Master Unit and Slave Units make up the network. The entire network is affected when a Unit is faulty, so a faulty Unit must be repaired or replaced quickly. We recommend having spare Units available to restore network operation as quickly as possible.

Precautions

Observe the following precautions when replacing a faulty Unit.

- After replacement make sure that there are no errors with the new Unit.
- When a Unit is being returned for repair, attach a sheet of paper detailing the problem and return the Unit to your OMRON dealer.
- If there is a faulty contact, try wiping the contact with a clean, lint-free cloth dampened with alcohol.

Note To prevent electric shock when replacing a Unit, be sure to turn OFF the power supplies to all of the nodes (Master and Slaves) before removing the faulty Unit.

Resetting after Replacing Units

After replacing a Unit, set the new Unit's switches to the same settings that were on the old Unit.

Replacing Relays for the Relay Output Unit

With the Relay Output Unit (GT1-ROP08, GT1-ROS16), malfunctioning Relays can be replaced.

The following Relays can be replaced:

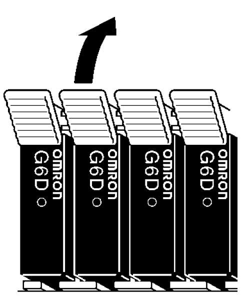
GT1-ROP08: G2R-1-SN Power Relay
GT1-ROS16: G6D-1A Miniature Relay

Use the following procedure to replace Relays. Here, the GT1-ROS16 is used as an example. The same general procedure applies to the GT1-ROP08.

Note Check that the internal power supply for the Relay Output Unit, and the power supplies for the I/O and I/O Interface Units are all OFF before performing Relay replacement.

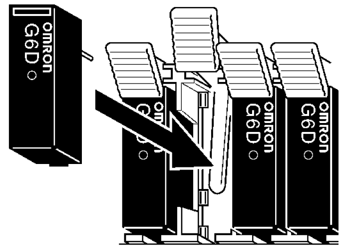
1, 2, 3...

1. Push the lever for the Relay to be replaced and remove the Relay. The Relays are arranged in order, with the corresponding contact numbers increasing from left to right. Push the lever gently so that the detached Relay does not spring out suddenly.

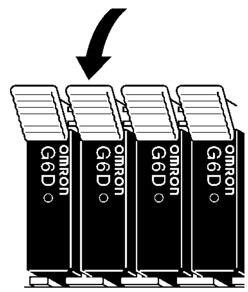


2. Insert the new Relay, pushing it into the slot as far as possible. Check the positioning of the pin in the Relay with respect to the Relay Output Unit, and be careful to replace the Relay with the correct orientation. When replacing the Relay, try to keep it as parallel as possible to the plane of the Unit. When inserting the Relay, push it gently and check whether the Relay is inside the slot. If the Relay does not enter the slot properly when pushed gently, it means that the pin is not aligned properly. In this case, remove the Relay

and start again. If the pin appears to have entered the slot properly, push the Relay into the slot as far as it will go.



3. When the Relay has been pushed inside as far as it will go, raise the lever so that it is covering the top of the Relay.



Replacing the Cassette

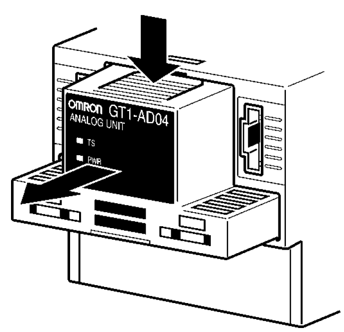
With the following Units, a malfunctioning Cassette can be replaced.

Transistor Input Units (with terminal block):	GT1-ID16, GT1-ID16-1
Transistor Output Units (with terminal block):	GT1-OD16, GT1-OD16-1
Analog Input Unit (with terminal block):	GT1-AD04
Analog Output Unit (with terminal block):	GT1-DA04

Note
1. Check that the internal power supply for the I/O Unit and the power supplies for the I/O and I/O Interface Units are all OFF before performing Cassette replacement.
2. Other I/O Units are not designed to house a Cassette. In order to avoid trying to attach a Cassette to an incompatible Unit, check the I/O Unit first.

Use the following procedure to replace the Cassette. The GT1-AD04 is used as an example. The same general procedure applies to other Units.

1, 2, 3...
1. For the Analog Input and Output Units, with the top part of the Cassette pressed down, pull the Cassette outwards (see diagram below). For the Transistor Input and Output Units, with the bottom part of the Cassette pressed up, pull the Cassette outwards.



2. Insert the new Cassette as far as possible into the space, taking care about its orientation. After doing so, try to gently pull the Cassette outwards to check whether it is secure.

Appendix A
GSD file for PRT1-COM

```
;***************************************************************************
;**                                                                       **
;**      OMRON Europe B.V.                                                **
;**                                                                       **
;**      European Headquarters                                            **
;**      Wegalaan 67-69                                                   **
;**      NL-2132 JD  Hoofddorp                                            **
;**      The Netherlands                                                  **
;**                                                                       **
;**      European Technical Centre                                        **
;**      Zilverenberg 2                                                   **
;**      NL-5234 GM 's-Hertogenbosch                                      **
;**      The Netherlands                                                  **
;**                                                                       **
;***************************************************************************
;**                                                                       **
;**      Device DataBase File for PRT1-COM Multiple I/O slave             **
;**                                                                       **
;**      Filename:  OC_047D.GSD                                           **
;**      Version :  1.1                                                   **
;**      Date    :  October 5, 1999                                       **
;**                                                                       **
;**      (C) Copyright OMRON Corporation 1998, 1999                       **
;**          All Right Reserved                                           **
;**                                                                       **
;***************************************************************************
;**                                                                       **
;**   Important notice:                                                   **
;**   =================                                                   **
;**   - Any modification of parameters in this file may lead to undefined **
;**     behavior of the PROFIBUS-DP system.                               **
;**   - When selecting the modules for the application, the System status **
;**     module MUST be selected first.                                    **
;**   - Select the I/O modules in the order of (physical) attachment to the **
;**     PRT1-COM unit                                                     **
;**                                                                       **
;**                                                                       **
;***************************************************************************


; General information ******************************************************/
                                        ;
#Profibus_DP                            ;
GSD_Revision        = 1                 ; GSD file revision 1.0.
                                        ;
Vendor_Name         = "OMRON Corporation" ; Vendor name string.
Model_Name          = "PRT1-COM"        ; Model type string.
Ident_Number        = 0x047D            ; PNO Identification number.
                                        ;
FMS_supp            = 0                 ; Profibus-FMS not supported.
Protocol_Ident      = 0                 ; Profibus-DP supported.
Station_Type        = 0                 ; Station = DP-Slave.
```

```
Slave_Family        = 3                          ; Slave family = 3 (I/O).
                                                 ;
Revision            = ”V1.1”                     ; Device revision 1.1.
Hardware_Release    = ”V1.0”                     ; Hardware revision 1.0.
Software_Release    = ”V1.1”                     ; Software revision 1.1.
                                                 ;
                                                 ;
; Specific implementation information *****************************************/
                                                 ;
Implementation_type = ”SPC3”                     ; Siemens SPC3 ASIC used.
Redundancy          = 0                          ; Redundancy NOT supported.
Repeater_Ctrl_Sig   = 2                          ; Supported, TTL level
24V_Pins            = 0                          ; No external 24 Volt input.
                                                 ;
Set_Slave_Add_supp  = 0                          ; Station address is set
                                                 ; through hardware address
                                                 ; selectors.
; Media access information ****************************************************/
                                                 ; Automatic baud rate select
Auto_Baud_supp      = 1                          ; (SPC3 specific feature).
                                                 ; Supported baud rates:
9.6_supp            = 1                          ; 9600 Baud
19.2_supp           = 1                          ; 19.2 kBaud
93.75_supp          = 1                          ; 93.75 kBaud
187.5_supp          = 1                          ; 187.5 kBaud
500_supp            = 1                          ; 500 kBaud
1.5M_supp           = 1                          ; 1.5 MBaud
3M_supp             = 1                          ; 3 MBaud
6M_supp             = 1                          ; 6 MBaud
12M_supp            = 1                          ; 12 MBaud
                                                 ; Max. response times:
MaxTsdr_9.6         = 60                         ; 60 Tbit = 6.25 msec.
MaxTsdr_19.2        = 60                         ; 60 Tbit = 3.125 msec.
MaxTsdr_93.75       = 60                         ; 60 Tbit = 640 usec.
MaxTsdr_187.5       = 60                         ; 60 Tbit = 320 usec.
MaxTsdr_500         = 100                        ; 100 Tbit = 200 usec.
MaxTsdr_1.5M        = 150                        ; 150 Tbit = 100 usec.
MaxTsdr_3M          = 250                        ; 250 Tbit = 83 usec.
MaxTsdr_6M          = 450                        ; 450 Tbit = 75 usec.
MaxTsdr_12M         = 800                        ; 800 Tbit = 67 usec.
                                                 ;
Min_Slave_Intervall = 10                         ; Minimum slave interval =
                                                 ; 1 msec.
                                                 ;
; DP-slave information ********************************************************/
                                                 ;
Freeze_Mode_supp    = 1                          ; Freeze mode supported.
Sync_Mode_supp      = 1                          ; Sync mode supported.
Fail_Safe           = 1                          ; Fail safe supported.
                                                 ;
Modular_Station     = 1                          ; Modular station.
Max_Module          = 9                          ; Maximum # of modules: 9.
FixPresetModules    = 1                          ; Enable fixed modules preset.
                                                 ; (Siemens Configurators).
Max_Input_Len       = 132                        ; Maximum # of input bytes.
Max_Output_Len      = 128                        ; Maximum # of output bytes.
```

```
Max_Data_Len        = 260                          ; Maximum # of data bytes.
                                                   ;
Max_Diag_Data_Len   = 6                            ; Maximum diagnostic length.
                                                   ;
                                                   ;
; User parameter message definition ******************************************/
                                                   ; Preset parameterization
User_Prm_Data_Len   = 3                            ; message length and default
                                                   ; message.
User_Prm_Data       = 0x40,\                       ; Mandatory additional user
                      0x00,\                       ; parameters.
                      0x00                         ;
                                                   ;
                                                   ;
; Module definition list *****************************************************/
                                                   ; MANDATORY first selection:
Module = ”System status (MANDATORY)” 0x93          ; System status bytes (4)
Preset = 1                                         ; Pre-select this module
EndModule                                          ; (Siemens Configurators).
                                                   ; Digital Inputs:
Module = ”GT1-ID16: 16 Digital Inputs” 0x91        ; 16 Digital Inputs.
EndModule                                          ;
Module = ”GT1-ID32: 32 Digital Inputs” 0x93        ; 32 Digital Inputs.
EndModule                                          ;
                                                   ; Digital Outputs:
Module = ”GT1-OD16: 16 Digital Outputs” 0xA1       ; 16 Digital Outputs.
EndModule                                          ;
Module = ”GT1-OD32: 32 Digital Outputs” 0xA3       ; 32 Digital Outputs.
EndModule                                          ;
                                                   ; Relay Outputs:
Module = ”GT1-ROP08: 8 Relay Outputs” 0xA0         ; 8 Relay Outputs.
EndModule                                          ;
Module = ”GT1-ROS16: 16 Relay Outputs” 0xA1        ; 16 Relay Outputs.
EndModule                                          ;
                                                   ; Temperature sensor I/O:
Module = ”GT1-TS04: 4 Temperature Inputs” 0x97     ; 4 Temperature Inputs.
EndModule                                          ;
                                                   ; Analog Inputs:
Module = ”GT1-AD04: 4 Analog Inputs” 0x97          ; 4 Analog Inputs.
EndModule                                          ;
Module = ”GT1-AD08: 8 Analog Inputs” 0x9F          ; 8 Analog Inputs.
EndModule                                          ;
                                                   ; Analog Outputs:
Module = ”GT1-DA04: 4 Analog Outputs” 0xA7         ; 4 Analog Outputs.
EndModule                                          ;
                                                   ; Counters:
Module = ”GT1-CT01: High Speed Counter” 0xB5       ; High speed counter.
EndModule                                          ;
                                                   ;
                                                   ;
; End of GSD file ************************************************************/
```

Appendix B
Connectible Devices

Devices

MULTIPLE I/O TERMINAL Units

Model	Specifications	Manufacturer
PRT1-COM	Communication Unit Two input words (status)	OMRON
GT1-ID16	Transistor Input Unit (terminal block) 16 transistor inputs (for NPN outputs)	OMRON
GT1-ID16-1	Transistor Input Unit (terminal block) 16 transistor inputs (for PNP outputs)	OMRON
GT1-ID16MX	Transistor Input Unit (Molex connector) 16 transistor inputs (for NPN outputs)	OMRON
GT1-ID16MX-1	Transistor Input Unit (Molex connector) 16 transistor inputs (for PNP outputs)	OMRON
GT1-ID16ML	Transistor Input Unit (Fujitsu connector) 16 transistor inputs (for NPN outputs)	OMRON
GT1-ID16ML-1	Transistor Input Unit (Fujitsu connector) 16 transistor inputs (for PNP outputs)	OMRON
GT1-ID16DS	Transistor Input Unit (25-pin D-sub connector) 16 transistor inputs (for NPN outputs)	OMRON
GT1-ID16DS-1	Transistor Input Unit (25-pin D-sub connector) 16 transistor inputs (for PNP outputs)	OMRON
GT1-ID32ML	Transistor Input Unit (Fujitsu high-density connector) 32 transistor inputs (for NPN outputs)	OMRON
GT1-ID32ML-1	Transistor Input Unit (Fujitsu high-density connector) 32 transistor inputs (for PNP outputs)	OMRON
GT1-OD16	Transistor Output Unit (terminal block) 16 transistor outputs (for NPN outputs)	OMRON
GT1-OD16-1	Transistor Output Unit (terminal block) 16 transistor outputs (for PNP outputs)	OMRON
GT1-OD16MX	Transistor Output Unit (Molex connector) 16 transistor outputs (for NPN outputs)	OMRON
GT1-OD16MX-1	Transistor Output Unit (Molex connector) 16 transistor outputs (for PNP outputs)	OMRON
GT1-OD16ML	Transistor Output Unit (Fujitsu connector) 16 transistor outputs (for NPN outputs)	OMRON
GT1-OD16ML-1	Transistor Output Unit (Fujitsu connector) 16 transistor outputs (for PNP outputs)	OMRON
GT1-OD16DS	Transistor Output Unit (25-pin D-sub connector) 16 transistor outputs (for NPN outputs)	OMRON
GT1-OD16DS-1	Transistor Output Unit (25-pin D-sub connector) 16 transistor outputs (for PNP outputs)	OMRON
GT1-OD32ML	Transistor Output Unit (Fujitsu high-density connector) 32 transistor outputs (for NPN outputs)	OMRON
GT1-OD32ML-1	Transistor Output Unit (high-density connector) 32 transistor outputs (for PNP outputs)	OMRON
GT1-ROP08	Relay Output Unit (power relays) 8 relay outputs (allocated 1 word)	OMRON

Model	Specifications	Manufacturer
GT1-ROS16	Relay Output Unit (miniature relays) 16 relay outputs	OMRON
GT1-AD04	Analog Input Unit (terminal block) 4 inputs (allocated 4 words)	OMRON
GT1-AD08MX	Analog Input Unit (Molex connector) 8 inputs (allocated 8 words) or 4 inputs (allocated 4 words) (Select using the DIP switch.)	OMRON
GT1-DA04	Analog Output Unit (terminal block) 8 outputs (allocated 4 words)	OMRON
GT1-DA04MX	Analog Output Unit (Molex connector) 4 outputs (allocated 4 words)	OMRON
GT1-CT01	Counter Unit (terminal block) 1 encoder input (Encoder A, B, Z) 1 external input, 2 external outputs (input 3 words/output 3 words allocated)	OMRON

I/O Unit Connecting Cables for MULTIPLE I/O TERMINAL Units

Model	Specifications	Manufacturer
(Provided with I/O Units)	Cable length: 40 mm	OMRON
(Provided with Communication Unit)	End connector	
GCN1-100	Cable length: 1 m	

Applicable Connectors for MULTIPLE I/O TERMINAL Units

Model number	Type			Remarks
521-09-390	Connector made by MOLEX	Pressure-welded	Housing	For AWG#24
50-57-9403		Crimp	Housing	
16-02-0069			Reeled contacts	For AWG#24 to 30
16-02-0086				For AWG#22 to 24
16-02-0096			Loose contacts	For AWG#24 to 30
16-02-0102				For AWG#22 to 24
570-36-5000			Crimping tool	For AWG#22 to 26
11-01-0209				For AWG#24 to 30
XW2S-2513	Recommended 25-pin D-sub connector made by OMRON	Hood		
XW2A-2501		Plug		

High-density Connector Cables for MULTIPLE I/O TERMINAL Units

Model	Unit connected	Manufacturer
G79-□□□C	GT1-ID16ML ↕ I/O Block (G7TC-I□16)	OMRON
	GT1-OD16ML ↕ I/O Block (G7TC-OC16, G70D-SOC16, G70D-FOM16, G70A-ZOC16-3, M7F)	
	GT1-OD16ML-1 ↕ I/O Block (G7TC-OC16-1, G70D-SOC16-1, G70D-FOM16-1, G70A-ZOC16-4, M7F)	
G79-I□C-□	GT1-ID32ML ↕ I/O Block (G7TC-I□16)	
G79-O□C-□	GT1-OD32ML ↕ I/O Block (G7TC-OC16, G7TC-OC08 G70D-SOC16, G70A-ZOC16-3, G7A-FOM16, M7F)	
	GT1-OD32ML-1 ↕ I/O Block (G7TC-OC16-1, G70D-SOC16-1, G70D-FOM16-1, G70A-ZOC16-4)	
XW2Z-□□□A	GT1-ID16ML(-1), GT1-OD16ML(-1) ↕ Connector–Terminal Block Conversion Unit (XW2B-20G4, XW2B-20G5)	
XW2Z-□□□B	GT1-ID32ML(-1), GT1-OD32ML(-1) ↕ Connector–Terminal Block Conversion Unit (XW2B-40G4, XW2B-40G5)	

Recommended Power Supplies for MULTIPLE I/O TERMINAL Units

Model	Specification	Manufacturer
S82K-05024	100 to 120/200 to 240 V, 50 W	OMRON
S82K-10024	100 to 120/200 to 240 V, 100 W	
S82J-5524	100 to 120 V, 50 W	
S82J-5024	100 to 120 V, 100 W	

MULTIPLE I/O TERMINAL Units

Model	I/O Unit interface current consumption	Internal power supply and I/O power supply
GT1-ID16(-1)	35 mA max.	---
GT1-ID16MX(-1)	35 mA max.	---
GT1-ID16ML(-1)	35 mA max.	---
GT1-ID16DS(-1)	35 mA max.	---
GT1-ID32ML(-1)	55 mA max.	---
GT1-OD16(-1)	35 mA max.	9 mA max.
GT1-OD16MX(-1)	35 mA max.	9 mA max.
GT1-OD16MIL-1)	35 mA max.	9 mA max.
GT1-OD16DS(-1)	35 mA max.	9 mA max.
GT1-OD32ML(-1)	65 mA max.	11 mA max.
GT1-ROS16	35 mA max.	250 mA max. (inrush current: 30 A max.)
GT1-ROP08	40 mA max.	350 mA max. (inrush current: 30 A max.)
GT1-AD04	50 mA max.	Internal power supply: 100 mA (inrush current: 30 A max.)
GT1-AD08MX	50 mA max.	Internal power supply: 100 mA (inrush current: 30 A max.)
GT1-DA04	50 mA max.	Internal power supply: 100 mA (inrush current: 30 A max.)
GT1-DA04MX	50 mA max.	Internal power supply: 100 mA (inrush current: 30 A max.)
GT1-CT01	90 mA max.	9 mA max.

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Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. W900-E2-1

Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

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1	December 1999	Original production

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