

**DRT1-COM**  
**GT1 Series**

**DeviceNet**  
**MULTIPLE I/O TERMINAL**

**OPERATION MANUAL**

**OMRON**

**DRT1-COM**  
**GT1 Series**  
**DeviceNet**  
**MULTIPLE I/O TERMINAL**  
**Operation Manual**


*Revised May 2003*





## 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 operation of the DeviceNet MULTIPLE I/O TERMINAL and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to operate the MULTIPLE I/O TERMINAL.

**Section 1** provides an overview of the MULTIPLE I/O TERMINAL, including its features and functions.

**Section 2** provides the basic procedure for operation and includes an actual example.

**Section 3** provides some examples of programs used with the Counter Unit.

**Section 4** provides the basic specifications for the I/O Units including Communications Units, Transistor Input and Output Units, and Relay Output Units.

**Section 5** provides the specifications for Special I/O Units, including the Analog Input Unit, the Analog Output Unit, the Temperature Input Unit, and the Counter Unit. Setting procedures for a Configurator are also provided.

**Section 6** provides characteristics for communications in the DeviceNet Unit and describes how to calculate the times required for communications between Units.

**Section 7** provides procedures for dealing with errors as well as basic maintenance procedures.

The **Appendices** provide Slave device profiles and lists 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

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.

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.

 **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 abovementioned 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 noise.
  - 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  $\Omega$  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., Power Supply Unit, 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.
- Always disconnect the LG terminal when performing withstand voltage tests.
- 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 track, 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 use 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 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.

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

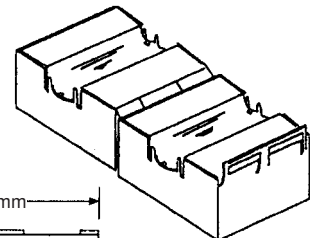
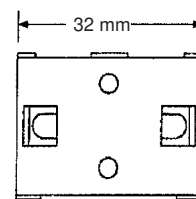
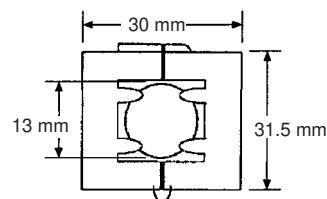
- 1,2,3...**
1. MULTIPLE I/O TERMINAL products are designed for installation inside control panels. All MULTIPLE I/O TERMINAL products must be installed within control panels.
  2. Used reinforced insulation or double insulation for the DC power supplies used for the communications power supply, internal 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.
  4. MULTIPLE I/O TERMINAL products that meet EC Directives have configurations with less than 30 m of I/O wiring, and less than 10 m of power supply wiring.

The following examples show means of reducing noise.

- 1,2,3...**
1. Noise from the communications cable can be reduced by installing a ferrite core on the communications cable within 10 cm of the DeviceNet Master Unit.

**Ferrite Core (Data Line Filter): LF130B (Manufactured by Easy Magnet Co.)**

Impedance specifications  
 25 MHZ: 105  $\Omega$   
 100 MHZ: 190  $\Omega$



2. Wire the control panel with cables as thick and short as possible and ground to 100  $\Omega$  min.

3. Keep DeviceNet communications cables as short as possible and ground to 100  $\Omega$  min.

# SECTION 1

## MULTIPLE I/O TERMINAL

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

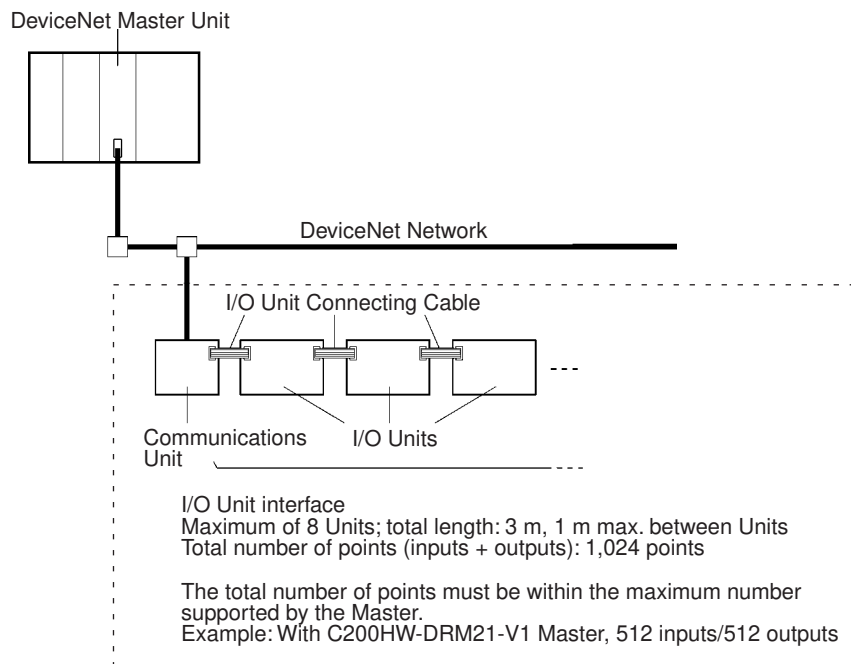
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# 1-1 MULTIPLE I/O TERMINAL

## 1-1-1 Overview

A MULTIPLE I/O TERMINAL is a building-block DeviceNet Slave that consists of a Communications Unit that interfaces one or more I/O Units. The I/O Unit interface supports up to 8 I/O Units and a total of up to 1,024 I/O points. I/O Units are connected using simple snap-on 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.

## 1-1-2 System Configuration



### 1-1-3 Features

<b>Simple Connections</b>	The Communications Unit and the I/O Units are separate, and the Communications Unit and the I/O Units are connected by an I/O Unit interface. I/O can be expanded simply by connecting additional I/O Units to the I/O Unit interface.
<b>Automatic Recognition of I/O Units</b>	When the power to the Communications Unit is turned ON, the models of the I/O Units on the I/O Unit interface are automatically recognized, and the number of remote I/O communications points with the DeviceNet Master Unit is automatically determined. This enables I/O to be increased or decreased simply by connecting or disconnecting I/O Units.
<b>Status Notification</b>	Status information about the I/O Unit interface can be transmitted as inputs to the DeviceNet Master Unit (two words).
<b>Many Types of I/O Unit</b>	The following I/O Units are available. <ul style="list-style-type: none"><li>• 16- or 32-point Transistor Input Units (terminal block, connector, 25-pin D-sub connector, or high-density connector)</li><li>• 16- or 32-point Transistor Output Units (terminal block, connector, 25-pin D-sub connector, or high-density connector)</li><li>• 8-point/16-point Relay Output Unit (16-point Unit)</li><li>• 4- or 8-point Analog Input Unit (terminal block or connector)</li><li>• 4-point Analog Output Unit (terminal block or connector)</li><li>• 1-point Pulse Input Unit (high-speed counter)</li><li>• 4-point Temperature Input Unit</li></ul>
<b>An I/O-intensive System Can be Built at Low Cost</b>	Compared with fixed I/O Terminals, a high cost-performance ratio can be achieved if I/O Units are used.
<b>Range Setting by Configurator</b>	The input and output ranges for the Analog Input, Analog Output, and Temperature Input Units can be set for each point using the Configurator (with version 1.11 or later). Using DIP switches, ranges can be set in 2-point units for the Analog Input and Analog Output Units, and in 4-point units for the Temperature Input Unit.

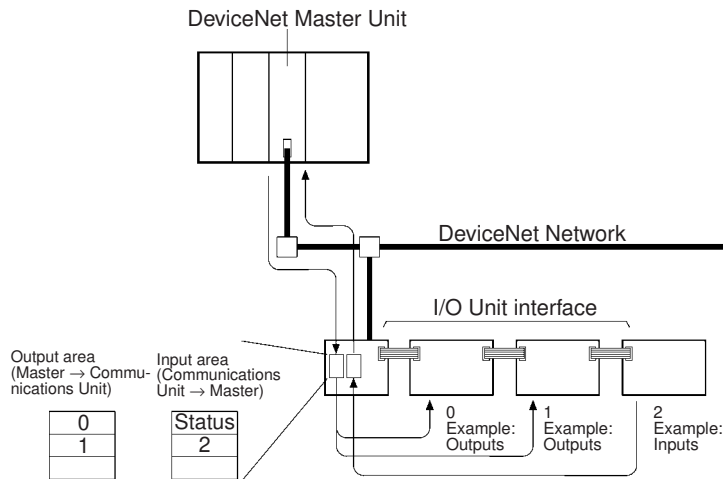


### 1-1-4 Communications Units and I/O Units

**Communications Unit**

The Communications Unit interfaces the I/O Units to the DeviceNet.

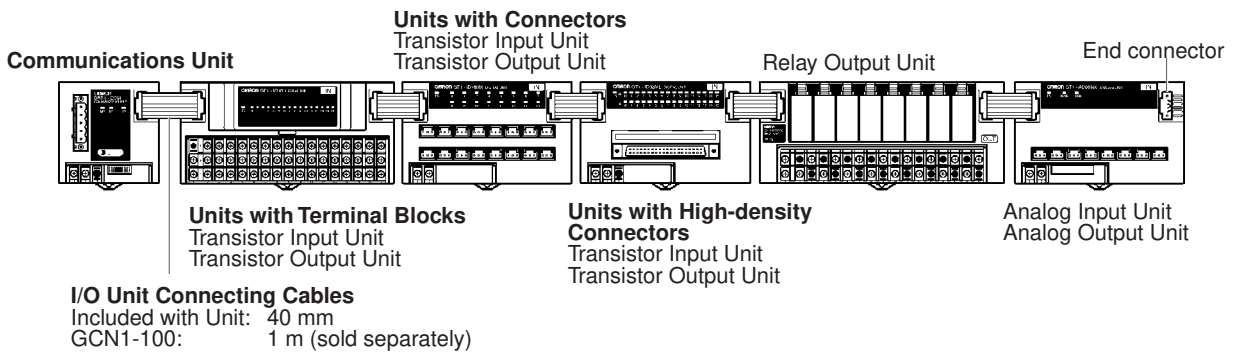
- It controls the I/O Units in response to I/O refresh requests from the DeviceNet Master.
- It automatically recognizes the configuration of the I/O Units when the I/O Unit interface is initialized.
- It notifies the connection status or the status information for the I/O Units to the DeviceNet Master Unit.
- It provides a DIP switch to set the node number and baud rate of the MULTIPLE I/O TERMINAL as a DeviceNet 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 Communications 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.
- The connection order of I/O Units is flexible.



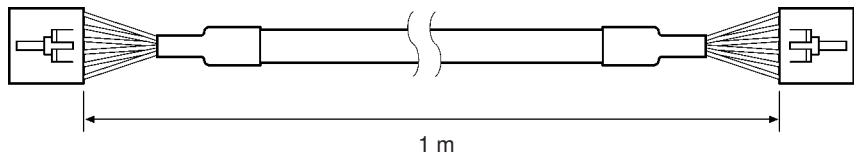
1-1-5 List of Models

Unit		I/O points	Words allocated in PC memory		I/O connections	Unit power supply voltage	Installation	Model number	Remarks
			Input	Output					
Communications Unit		None	Status two words	0 words	None	24 VDC (supplied from outside)	DIN track	DRT1-COM	---
Basic I/O Units	Transistor Input Units	16 inputs	1 word	0 words	M3 terminal block			24 VDC (supplied from outside)	DIN track
						GT1-ID16-1	PNP		
		16 inputs	1 word	0 words	Connectors (made by MOLEX)	GT1-ID16MX	NPN		
						GT1-ID16MX-1	PNP		
		16 inputs	1 word	0 words	Connectors (made by FUJITSU)	GT1-ID16ML	NPN		
					GT1-ID16ML-1	PNP			
					GT1-ID16ML-1	PNP			
	16 inputs	1 word	0 words	Connectors (25-pin D-sub connectors)	GT1-ID16DS	NPN			
					GT1-ID16DS-1	PNP			
					GT1-ID16DS-1	PNP			
	32 inputs	2 words	0 words	High-density connector (made by FUJITSU)	GT1-ID32ML	NPN			
					GT1-ID32ML-1	PNP			
	Transistor Output Units	16 outputs	0 words	1 word	M3 terminal block	GT1-OD16	NPN		
						GT1-OD16-1	PNP		
16 outputs		0 words	1 word	Connectors (made by MOLEX)	GT1-OD16MX	NPN			
					GT1-OD16MX-1	PNP			
16 outputs		0 words	1 word	Connectors (made by FUJITSU)	GT1-OD16ML	NPN			
				GT1-OD16ML-1	PNP				
				GT1-OD16ML-1	PNP				
16 outputs	0 words	1 word	Connectors (25-pin D-sub connectors)	GT1-OD16DS	NPN				
				GT1-OD16DS-1	PNP				
				GT1-OD16DS-1	PNP				
32 outputs	0 words	2 words	High-density connector (made by FUJITSU)	GT1-OD32ML	NPN				
				GT1-OD32ML-1	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	Unit power supply voltage	Installation	Model number	Remarks	
			Input	Output						
Special I/O Units (See note.)	Analog Input Units	4 inputs	4 words	0 word	M3 terminal block	24 VDC (supplied from outside)	DIN track	GT1-AD04 (See note 2.)	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	
		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 (See note 2.)		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		
	Temperature Input Units	4 inputs	4 words (8 words depending on mode)	0 words	M3 terminal block			GT1-TS04T		Inputs: R, S, K, J, T, B, L
								GT1-TS04P		
	Counter Unit	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, Temperature Input 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 Communications Unit, and a 40-mm I/O Unit Connecting Cable is included with each I/O Unit. A 1-m I/O Unit Connecting Cable (GCN1-100) is also available.



**Applicable Connectors**

The applicable connectors are shown in the following table.

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

**Note** Refer to page 219, *High-density Connector Cables for MULTIPLE I/O TERMINALS* for details.

## 1-2 Functions

### 1-2-1 I/O Unit Interface Specifications

Item		Specification
Communications method		Special protocol
Number of I/O Units		8 Units max.
Maximum number of points		Total inputs/outputs: 1,024 points (bits)
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 Communications Unit to the I/O Unit (0.4 A max.)
Relationship to DeviceNet		After the I/O Unit interface is established, DeviceNet communications continue normally, even if an error occurs on the I/O Unit interface.
Addresses		Automatically recognized when the power to the Communications Unit is turned ON.
I/O configuration		Automatically recognized when the power to the Communications 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 Units, Analog Output Units, Temperature Input 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 Communications Unit exceeds 0.4 A.
Error detection		Frame error check; CRC-CCITT check

**I/O Interface Current Consumption**

Make sure that the power supply from the Communications Unit to the I/O Units is less than the total rated output current (400 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-TS04T	50 mA max.
GT1-TS04P	50 mA max.
GT1-CT01	90 mA max.

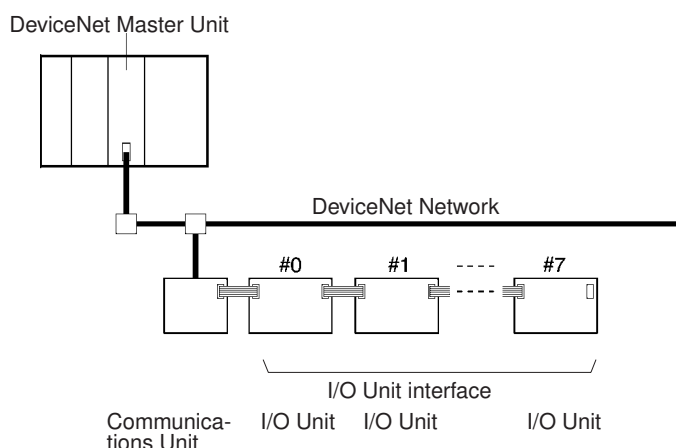
**Calculation Example**

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

$$\begin{aligned}
 &(\text{GT1-ID32ML current consumption}) \times 5 \text{ Units} \\
 &+ (\text{GT1-OD16 current consumption}) \times 3 \text{ Units} \\
 &= 55 \text{ mA} \times 5 + 35 \text{ mA} \times 3 = 380 \text{ mA} \leq 400 \text{ mA}
 \end{aligned}$$

**I/O Unit Interface Addresses**

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

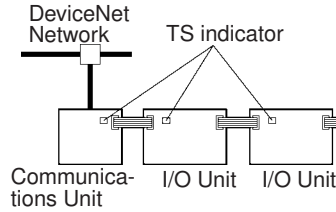


**Checking the I/O Unit Interface Status**

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

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

**Indicators**

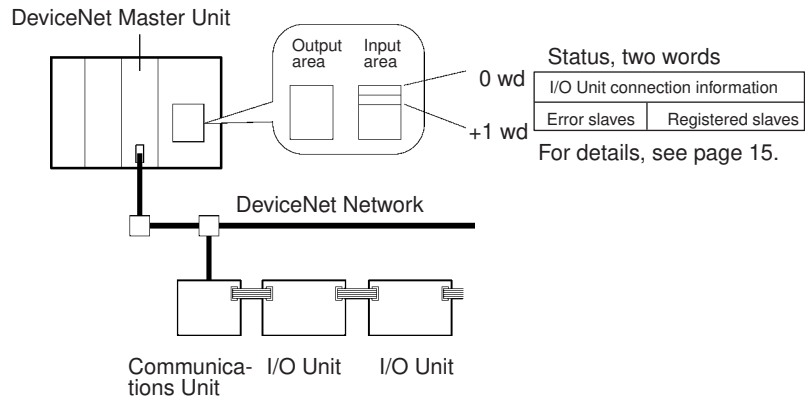


Unit	Normal	Error
Communications Unit	TS Indicator: Lit green	TS indicator I/O Unit interface error: Lit red Special I/O Unit error: Flashing green Maximum power supply overload to I/O Units: Not lit
I/O Units	TS indicator: Lit green U.ERR indicator: Not lit PWR indicator: Lit green	TS indicator I/O Unit interface error: Lit red U.ERR indicator Special I/O Unit error: Lit red PWR indicator No internal power supply: Not lit

For details, refer to page 199, *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 via the DeviceNet.

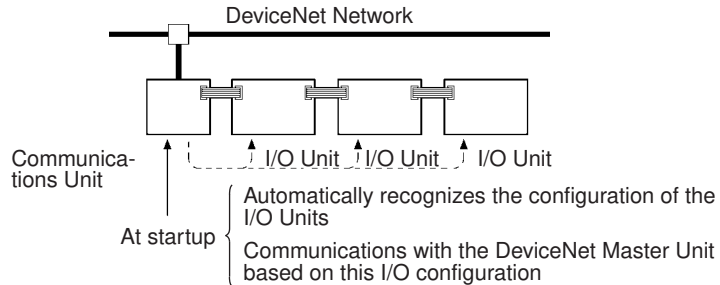


**1-2-2 Exchanging Data**

**Initialization**

When the Communications 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 Communications Unit. These processes are performed each time the power is turned ON.

Remote I/O communications with the DeviceNet Master Unit are carried out by a MULTIPLE I/O TERMINAL based on the registered configuration. When the power to the Communications Unit is turned ON, the bits allocated to the I/O Units can be used to check the status (bits 0 to 7 of the first word) of the Communications Unit.



- Note**
1. If the configuration of the I/O Units is to be changed, a number of precautions must be noted. For details, see *1-2-5 I/O Configuration Changes*.
  2. For details of data exchange timing, see *6-1-1 I/O Response Time*.

**Error Processing**

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

**1-2-3 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 *DeviceNet Operation Manual (W267)*.

**Fixed Allocation**

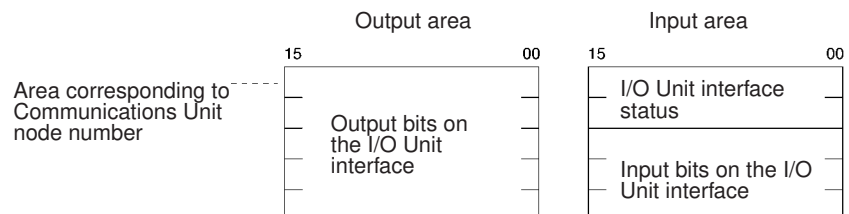
The output area and input area corresponding to the Communications Unit node number for a MULTIPLE I/O TERMINAL are as shown in the following diagram.

**Output Area**

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

**Input Area**

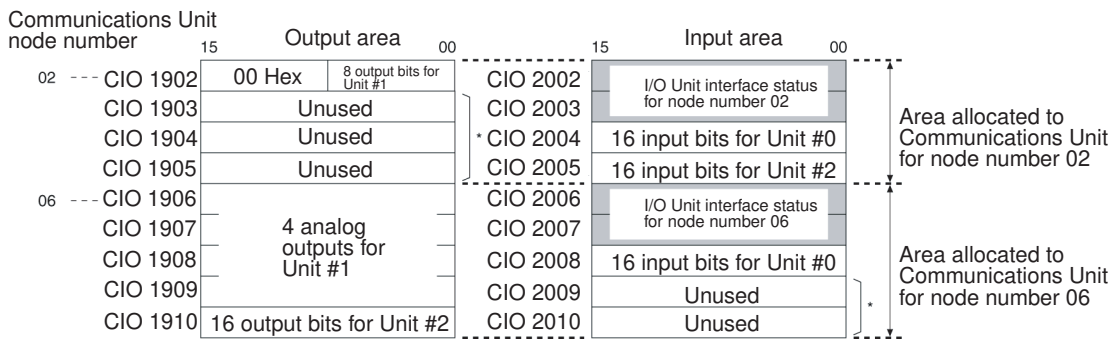
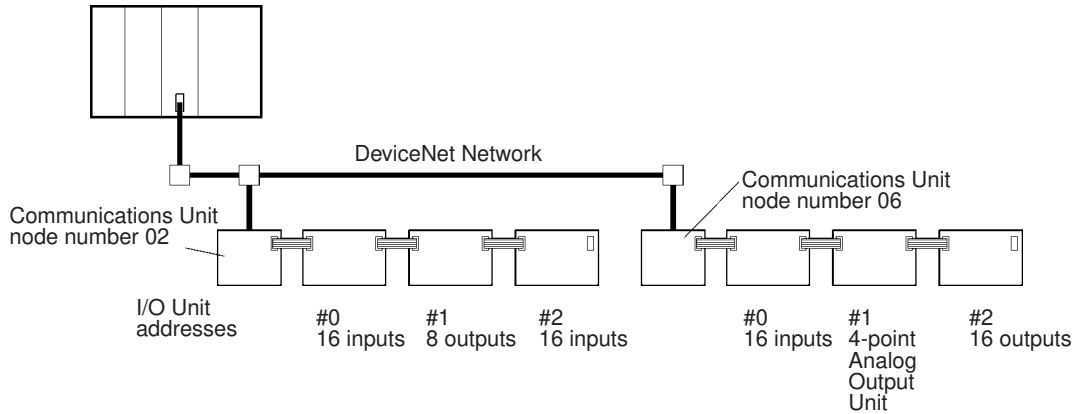
The input area contains the Communications Unit status (two words), and input bits in the order that I/O Units are connected on the I/O Unit interface.



The input and output bits for the I/O Unit interface are allocated in the DeviceNet input and output areas in 16-point (one word) increments. With 8-point I/O Units, these bits are allocated using the rightmost byte (bits 0 to 7), and the leftmost byte (bits 8 to 15) will be 00 Hex.

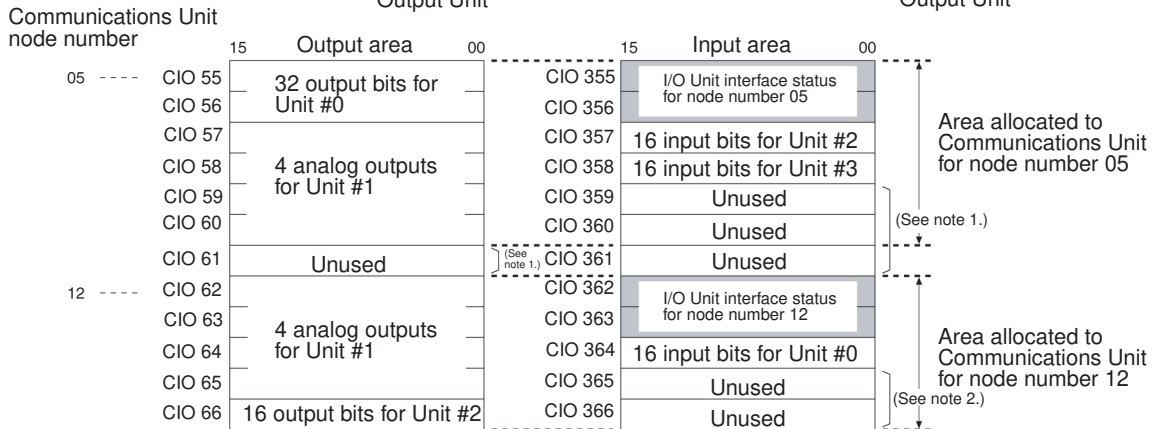
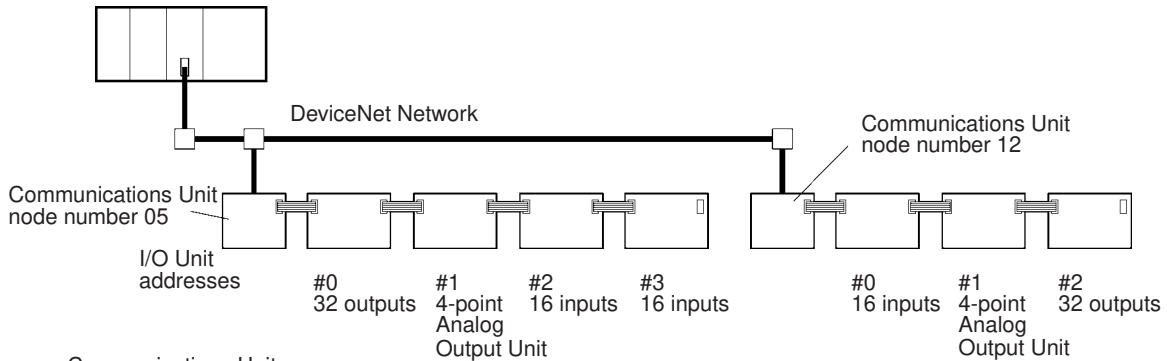


**Example: CVM1/CV Series**



The unused words can be used as work bits.

**Example: C200HX/HG/HE**



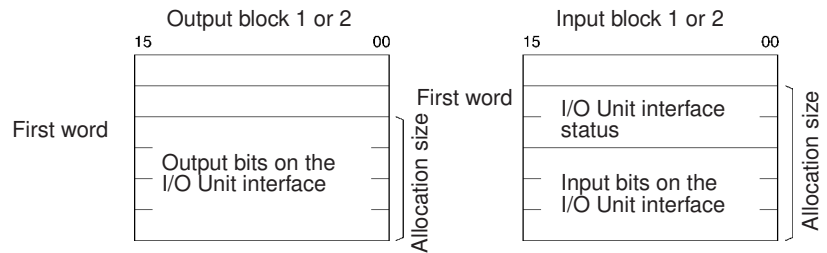
- Note 1.** The unused words between I/O areas that are used cannot be used as work bits.
- 2.** The unused words (not between I/O areas that are used) can be used as work bits.

**User-set Allocation**

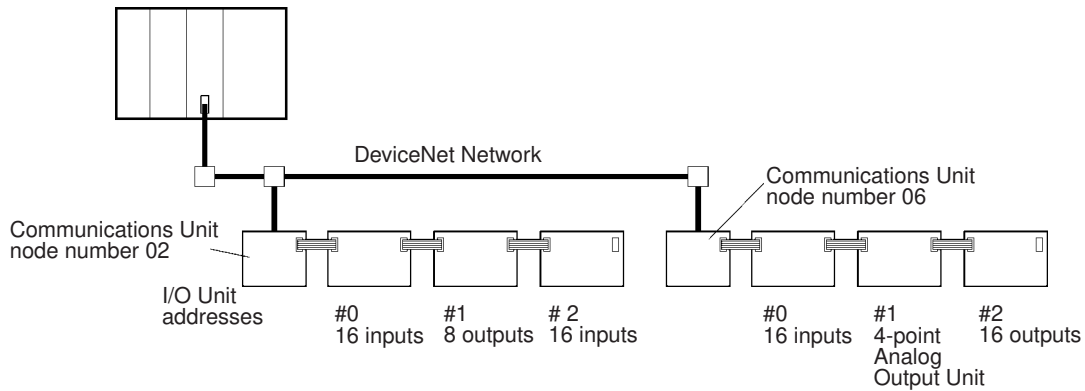
The Configurator can be used to set the Communications Unit node number, first word, and number of bytes to allocate (allocation size) for input block 1 and 2 and for output block 1 and 2, as shown in the following diagram.

Output block 1 or 2: Output bits in the order I/O Units are connected on the I/O Unit interface

Input block 1 or 2: I/O Unit interface status (two words), and input bits in the order I/O Units are connected on the I/O Unit interface



**Example: CVM1/CV Series**

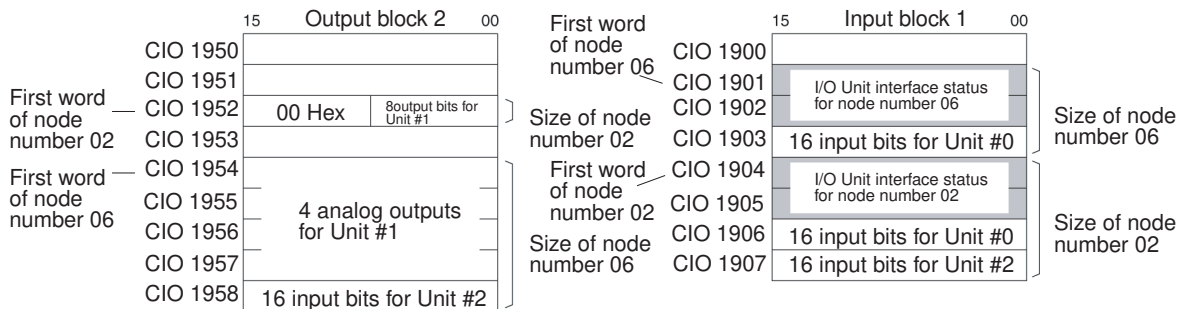


Allocation settings for node number 02  
 First word: CIO 1952  
 Allocation size: 2 bytes (1 word)

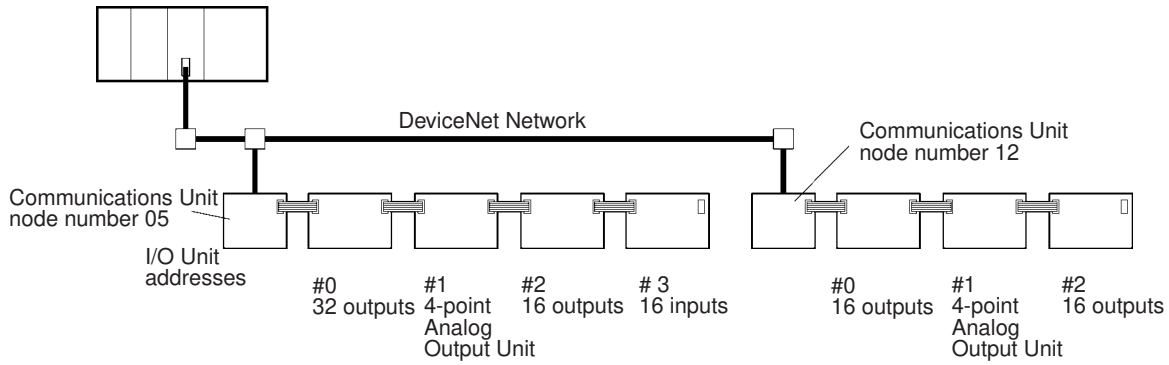
Allocation settings for node number 06  
 First word: CIO 1904  
 Allocation size: 8 bytes (4 words)

Allocation settings for node number 06  
 First word: CIO 1954  
 Allocation size: 10 bytes (5 words)

Allocation settings for node number 02  
 First word: CIO 1901  
 Allocation size: 6 bytes (3 words)



**Example: C200HX/HG/HE Series**

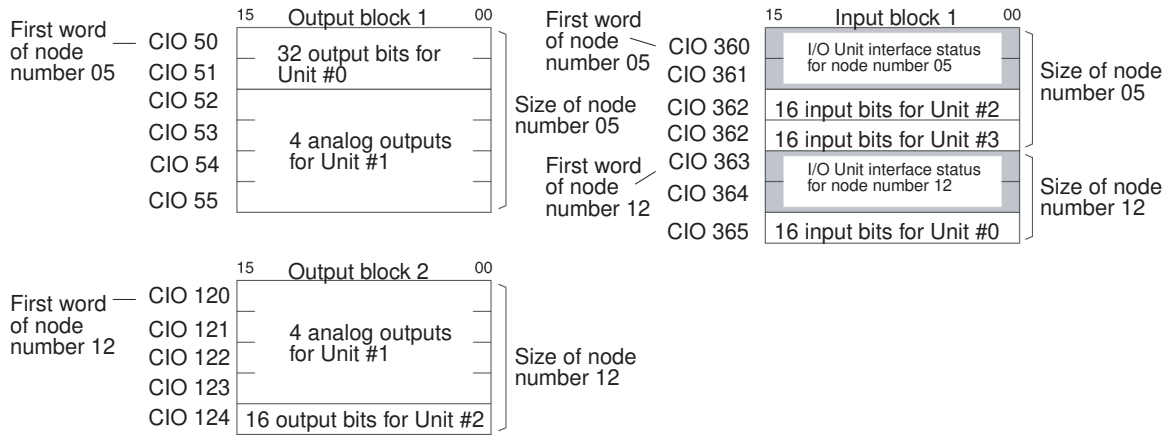


Allocation settings for node number 05  
 First word: CIO 50  
 Allocation size: 12 bytes (6 words)

Allocation settings for node number 05  
 First word: CIO 360  
 Allocation size: 3 bytes (4 words)

Allocation settings for node number 12  
 First word: CIO 120  
 Allocation size: 10 bytes (5 words)

Allocation settings for node number 12  
 First word: CIO 363  
 Allocation size: 8 bytes (3 words)



**Allocation Precautions**

Note the following precautions when starting the DeviceNet Network.

**Limits on the Total Number of Input and Output Points for a Master Unit**

A maximum of 1,024 inputs and outputs can be controlled by one Communications Unit (DRT1-COM). The number of I/O points for each node, however, depends on the Master Unit. For example, with the CV-series Master Unit (CVM1-DRM21-V1) or the C200HX/HG/HE and C200HS Master Unit (C200HW-DRM21-V1), up to 512 inputs and up to 512 outputs can be used at each node. Therefore, connect I/O Units within a range that does not exceed the number of I/O points for each Master Unit node. The following table shows the I/O size of each Unit.

Unit model	Number of inputs	Number of outputs
DRT1-COM	32 points	0 point
GT1-ID16(-1), GT1-ID16MX(-1), GT1-ID16ML(-1)*, GT1-ID16DS(-1)*	16 points	0 point
GT1-OD16(-1), GT1-OD16MX(-1), GT1-OD16ML(-1)*, GT1-OD16DS(-1)*, GT1-ROS16, GT1-ROP08	0 points	16 points
GT1-ID32ML(-1)	32 points	0 point
GT1-OD32ML(-1)	0 points	32 points
GT1-AD04*	64 points	0 points
GT1-AD08MX (With 8-input mode)	128 points	0 points
GT1-AD08MX (With 4-input mode)	64 points	0 points
GT1-DA04*, GT1-DA04MX	0 points	64 points
GT1-TS04T, GT1-TS04P (With Normal Mode)	64 points	0 points
GT1-TS04T, GT1-TS04P (With 2-decimal-place Mode)	128 points	0 points
GT1-CT01	48 points	48 points

The GT1-ROP08 (Relay Output Unit with Power Relay) has 8 actual outputs but, as a MULTIPLE I/O TERMINAL, the number of outputs allocated to the Master Unit is 16.

**Calculation Example**

When one GT1-DA04MX Analog Output Unit and three GT1-AD08 Analog Input Units are used, the total number of input points and output points is calculated as follows:

Total Number of Input Points:

$$\begin{aligned} & \text{Communications Unit (Status) + Analog Input Units} \times 3 \\ & = 32 \text{ points} + 128 \text{ points} \times 3 = 416 \text{ points} \end{aligned}$$

Total Number of Output Points:

$$\begin{aligned} & \text{Analog Output Units} \times 1 \\ & = 64 \text{ points} \end{aligned}$$

**Reference**

For information on dealing with other problems concerning the MULTIPLE I/O TERMINAL, refer to *SECTION 7 Troubleshooting and Maintenance*. For information on problems concerning the DeviceNet, refer to *DeviceNet Operation Manual (W267)*.

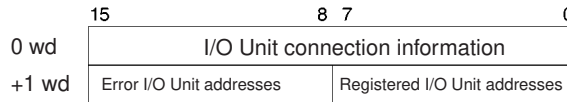
**1-2-4 I/O Unit Interface Status**

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

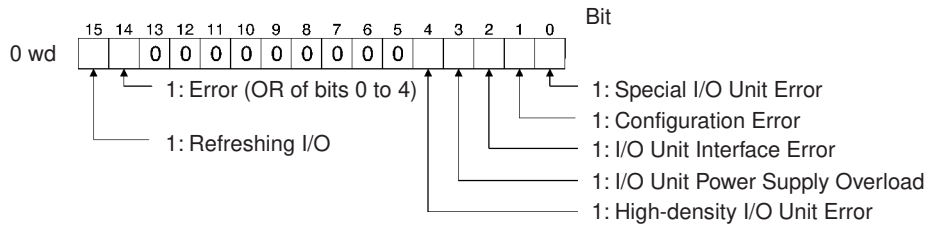
- I/O Unit connection information (I/O Unit interface status)
- Registered I/O Unit addresses

• Error I/O Unit addresses

As shown in the following diagram, the status consists of two words. The first two words of the Communications 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.

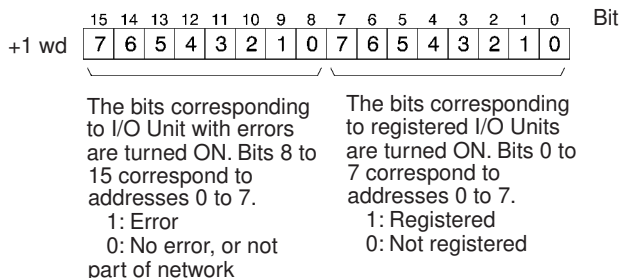


I/O Unit Connection Information



Bit	Flag name	Meaning	Content
15	Refreshing I/O	Refreshing I/O	1: Communications between the Communications 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	High-density I/O Unit Error	A high-density 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 when the Communications Unit was started.	1: I/O configuration change during 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

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



**1-2-5 I/O Configuration Changes**

The I/O Unit interface automatically recognizes the I/O Unit configuration each time the Communications Unit is started up, and stores this as the normal configuration.

- Note**
1. If the I/O Unit configuration is changed while the Communications Unit is turned ON, a configuration error will occur. Do not change the I/O Unit configuration while power is being supplied to the Communications 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 DeviceNet 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 Unit configuration is changed, perform the following operations, according to the DeviceNet area allocation method. For details about I/O allocation, refer to *DeviceNet Operation Manual (W267)*.

**Default Allocations**

Because the allocation size of the Communications Unit changes together with changes to the I/O Unit configuration, a verification error will occur on DeviceNet if the scan list is enabled, as follows:

- Master Unit 7-segment display will show d6, Slave I/O size mismatch.
- Master status bits 14 and 7 will turn ON.

Perform the following operations, according to the status of the input/output areas.

**Allocation Areas Do Not Overlap with Other Slaves**

Remote I/O communications will be performed unchanged with the new configuration. Check the Verification Error Bit and, if required, perform processing to disable the allocated words in the CPU Unit. Also check the number of points for the changed I/O Unit and its allocation area on the I/O Unit interface, and re-register the scan list (first set the Scan List Enable software switch to OFF, and then set it to ON after checking the I/O size).

**Allocation Areas Overlap with Other Slaves**

In this case, I/O area duplication will also occur on the DeviceNet, as follows:

- Master Unit 7-segment display will show d0, I/O area duplication.
- Master status bits 14 and 4 will turn ON.

Check the Verification Error Bit, and perform processing to disable the allocated words in the CPU Unit. Also change the Slave node number so that the allocation area does not overlap with any other, and re-register the scan list (first set the Scan List Enable software switch to OFF, and then set it to ON after checking the I/O size).

- Note** If the scan list is disabled, there will be no changes made in the DeviceNet Master Unit, even if the Communications Unit input/output sizes change. Be sure to use the Scan List Enable Mode for normal operations.

**User-set Allocations**

The sizes of the allocated areas for the Communications Unit will change with changes to the I/O Unit configuration, causing a Verification Error to occur on DeviceNet if the scan list is enabled, as follows:

- Master Unit 7-segment display will show d6, a Slave I/O size mismatch.
- Master status bits 14 and 7 will turn ON.

Perform the following operations, according to the status of the input/output areas.

**Allocation Areas Do Not Overlap with Other Slaves**

Remote I/O communications will be performed unchanged with the new configuration data. Check the Verification Error Bit and, if required, perform processing to disable the allocated words in the CPU Unit. Also, perform change the allocations using the Configurator.

**Allocation Areas Not Overlap with Other Slaves**

In this case, I/O area duplication will also occur on the DeviceNet, as follows:

- Master Unit 7-segment display will show d0, I/O area duplication.
- Master status bits 14 and 4 will turn ON.

Check the Verification Error Bit, and perform processing to disable the allocated words in the CPU Unit. Also, perform change allocations using the Configurator.

## **SECTION 2**

# **Hardware Setup and Operational Check**

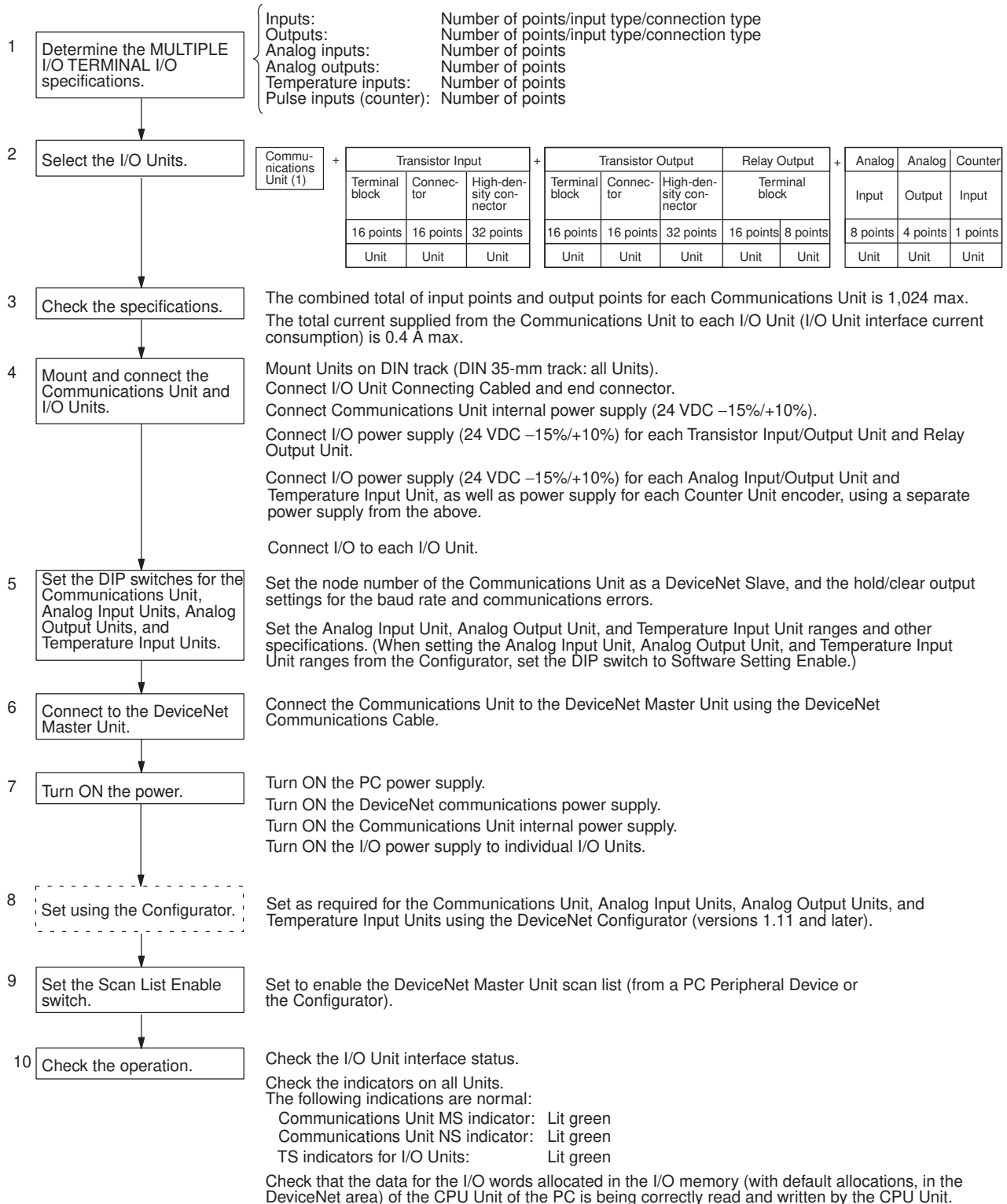
This section provides the basic procedure for operation and includes an actual example.

2-1	Basic Procedure .....	20
2-2	Specific Example .....	21



## 2-1 Basic Procedure

The basic operating procedure is shown below. For details about settings and connections, refer to *DeviceNet Operation Manual (W267)*. For explanations about Slave Units, refer to *SECTION 4 Basic I/O Unit Specifications* and *SECTION 5 Special I/O Unit Specifications*.



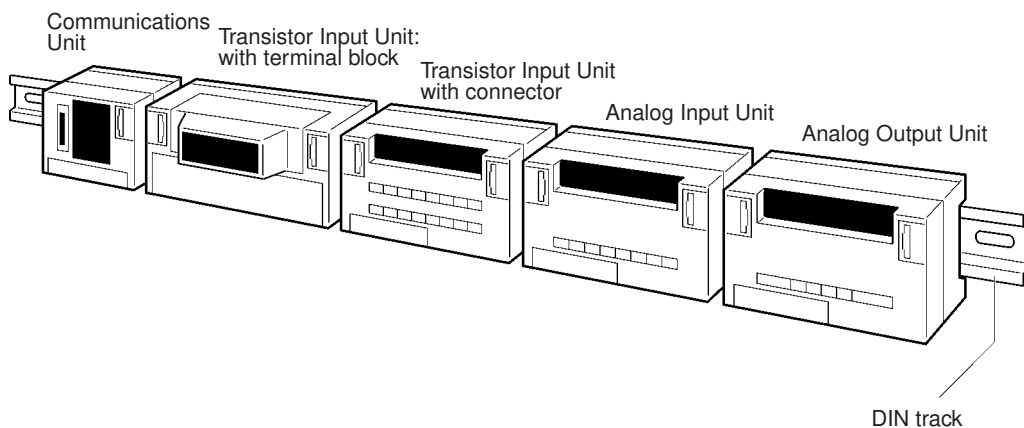
## 2-2 Specific Example

- 1,2,3...**
- Determine the MULTIPLE I/O TERMINAL I/O specifications.  
Each Communications Unit for the MULTIPLE I/O TERMINAL can be connected to a combined total of 1,024 input and output points (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 points
    - Outputs: 16 points
    - Analog Input: 8 inputs (8 words)
    - Analog Output: 4 outputs (4 words)
  - Select the I/O Units.
    - DRT1-COM Communications Unit: 1 Unit
    - GT1-ID16 Transistor Input Unit, 16 points with terminal block: 1 Unit
    - GT1-OD16MX Transistor Output Unit, 16 points with connector: 1 Unit
    - GT1-AD08MX Analog Input Unit, 8 inputs: 1 Unit
    - GT1-DA04MX Analog Output Unit: 4 outputs: 1 Unit
  - Check the specifications.
    - Check that the total number of input and output points (words) is less than 1,024 (64). In this example, the number of points is calculated as follows:  
Inputs (16 points) + Outputs (16 points) + Analog Input (8 words x 16 points) + Analog Output (4 words x 16 points)  
= 224 points

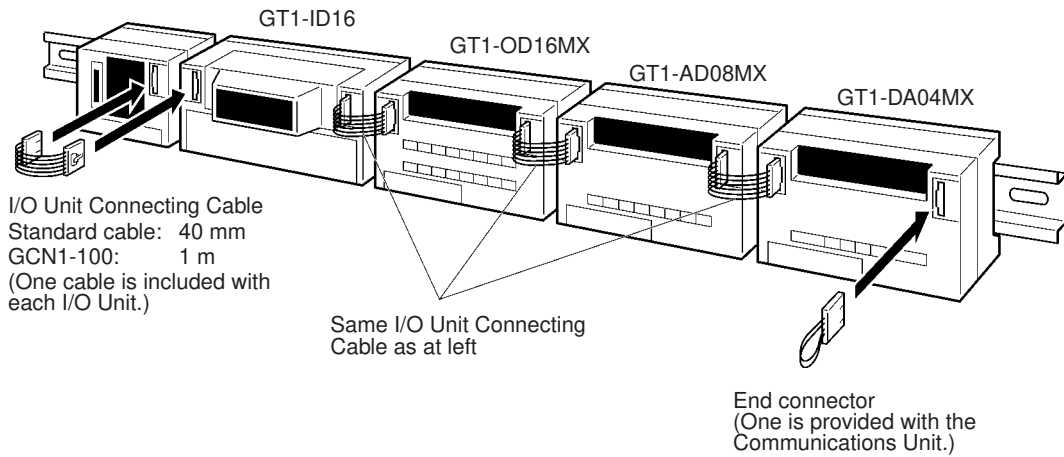
**Note** There are DeviceNet Master Units that have restrictions on the number of input and output points per Slave Unit. Make sure that the number of input and output points does not exceed the limit for the Master Unit. (For example, the C200HW-DRM21-V1 has an upper limit of 512 for both input and output points.) The maximum number of input and output points for the Master Unit, includes the 2 words allocated to the I/O Unit interface status. When calculating the total number of input and output points, be sure to include this (32 points) in the calculation.

    - Check that the total I/O Unit interface current consumption is less than 0.4 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
  - Mount and connect the Communications Unit and I/O Units.

### • Mounting on the DIN Track

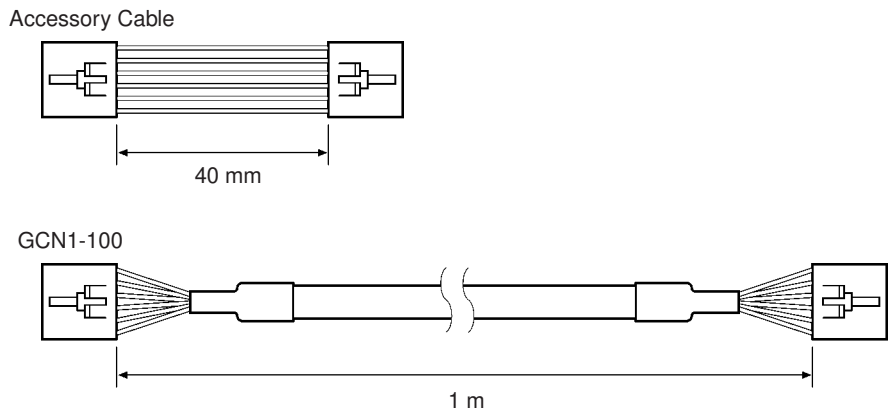


• Connecting I/O Unit Connecting Cable

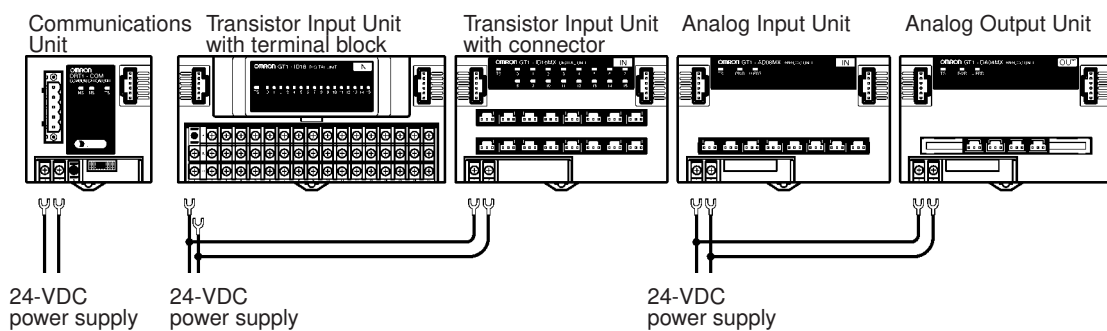


To connect each pair of Units, connect I/O Unit interface communications connector 2 on the Unit closer to the Communications Unit to I/O Unit interface communications connector 1 on the Unit closer to the end Unit.

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



• Connecting Communications Unit and I/O Unit Power



Note Be sure to separate the communications power supply, the internal power supply for the Communications 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 Communications Unit internal power supply, can be obtained using the following formula:

Communications Unit internal power supply current  
= Communications 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 Communications 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.

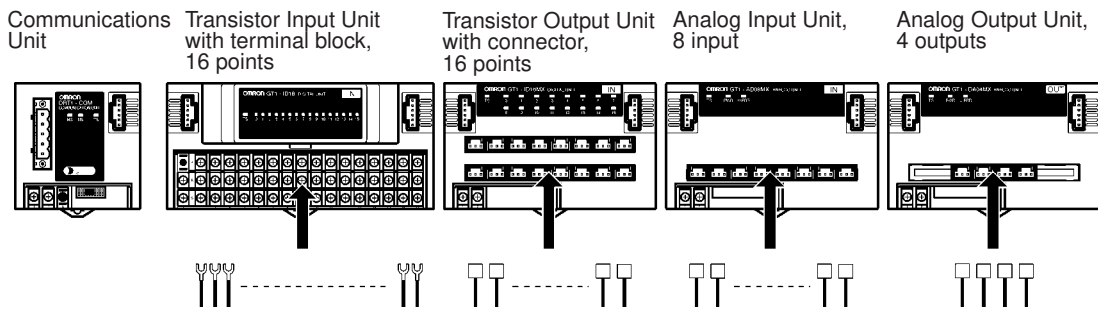
The following OMRON products are recommended for the 24-VDC power supply:

- 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

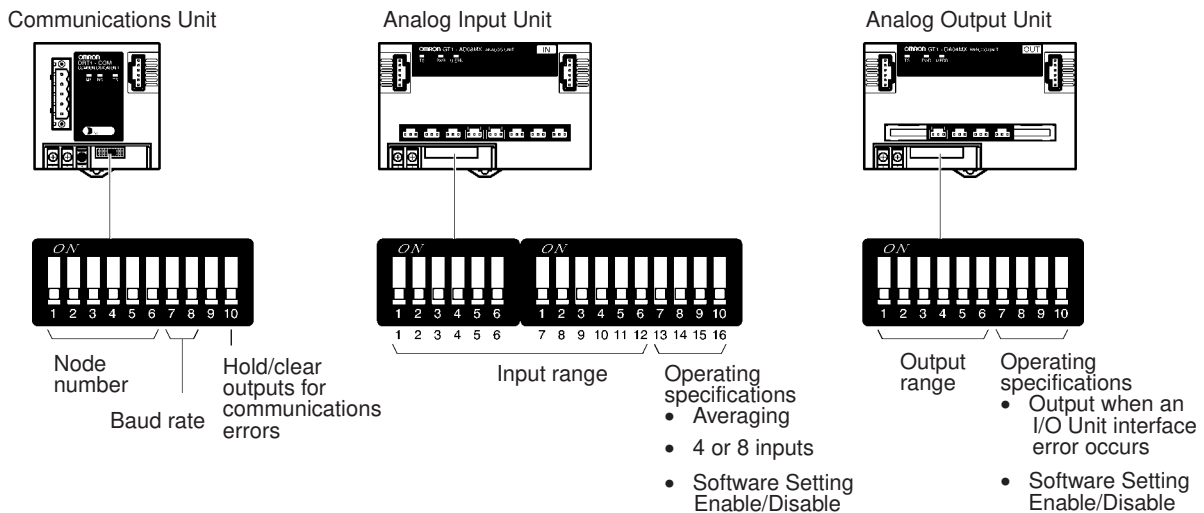
For details of the I/O Unit interface current consumption for the Units, refer to page 9, *I/O Interface Current Consumption*.

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 41).

• Connecting I/O Units to I/O

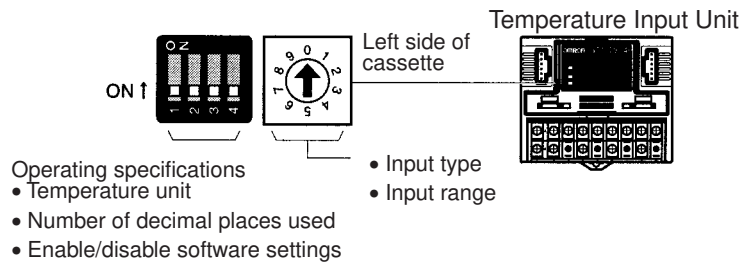


5. Set the DIP switches for the Communications Unit, Analog Input Unit, and Analog Output Unit.

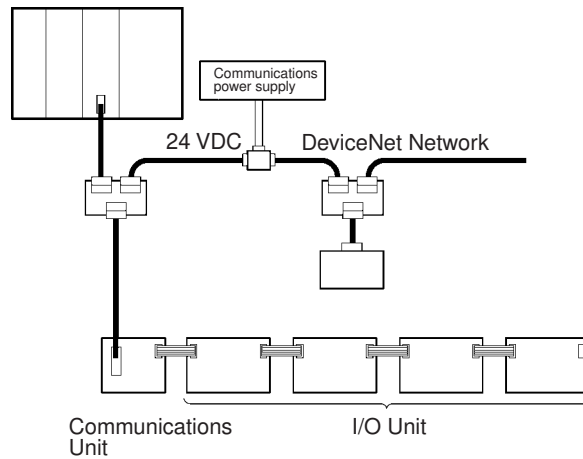


Note a) If a DeviceNet Configurator (versions 1.11 and later) is used, the input range for Analog Input Units, the output range for Analog Output Units, and I/O Unit interface error output (high-clear output/low-clear output) can be set via the network. When setting from the Configurator, use the DIP switch to set the Software Setting Enable/Disable setting to Enable. For details, refer to 5-1 *Analog Input Units* and 5-2 *Analog Output Units*.

- b) You must also use the DIP switch and the Configurator to set the Temperature Input Unit. For details, refer to 5-3 *GT1-TS04T and GT1-TS04P Temperature Input Units*.



6. Connect to the DeviceNet Master Unit.



7. Turn ON the power.  
 8. Set using the Configurator.

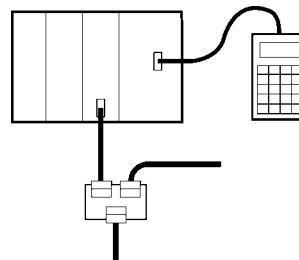
Using version 1.11 or later versions of the DeviceNet Configurator, it is possible, via the network, to set the following:

- Input range for Analog Input Units.
- Output range for Analog Output Units.
- I/O Unit interface error output (low-clear output/high-clear output) for Analog Output Units.

Note a) When using a DIP switch, the input and output ranges for the Analog Input and Output Units can be set in 2-point units, whereas with a Configurator, a setting can be made for each point.

b) You can set the Temperature Input Unit input range as well as the I/O Unit settings using the Configurator. For details, refer to 5-3-2 *Settings Using the Configurator*.

9. Create the scan list.

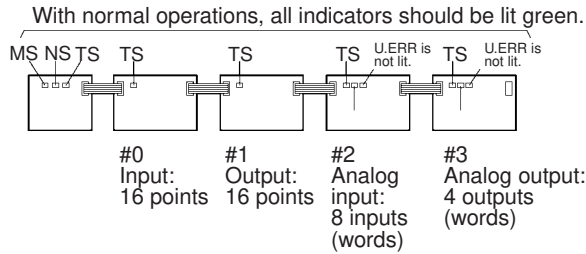


Set the Scan List Enable switch (PC software switch) to ON. For example, for a DeviceNet Master Unit with unit address 0 installed in a C200HX/HG/

HE(-Z) PC, turn ON IR 10000. For details of the DeviceNet startup procedure, refer to the *DeviceNet Operation Manual (W267)*.

10. Check the operation.

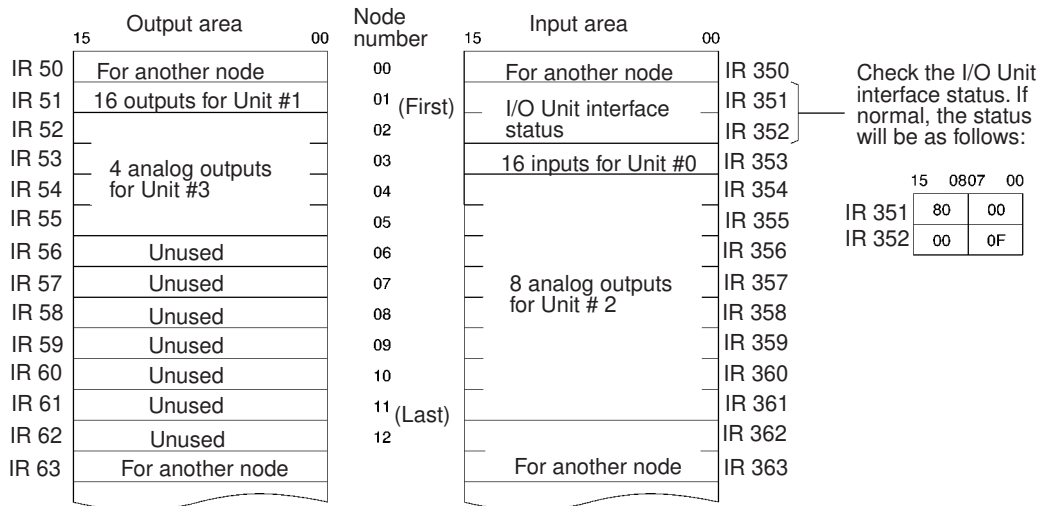
• **Checking Indicators**



• **Checking the I/O Unit Interface Status**

**Example:**

The following allocations will be used for status when the default allocations are used for a Communications Unit with node number 01 connected to a C200HX/HG/HE(-Z) DeviceNet Master Unit with unit address 0.



- 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).
- The input/output areas are allocated in the words corresponding to node numbers 01 to 11.

## SECTION 3

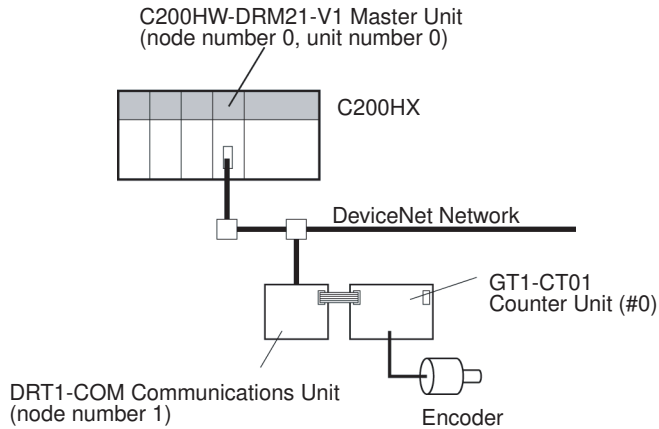
### Sample Programs

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

3-1	Examples of Counter Unit Operation . . . . .	28
3-1-1	Counter Unit Word Allocation for Functions . . . . .	28
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### 3-1 Examples of Counter Unit Operation

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



#### 3-1-1 Counter Unit Word Allocation for Functions

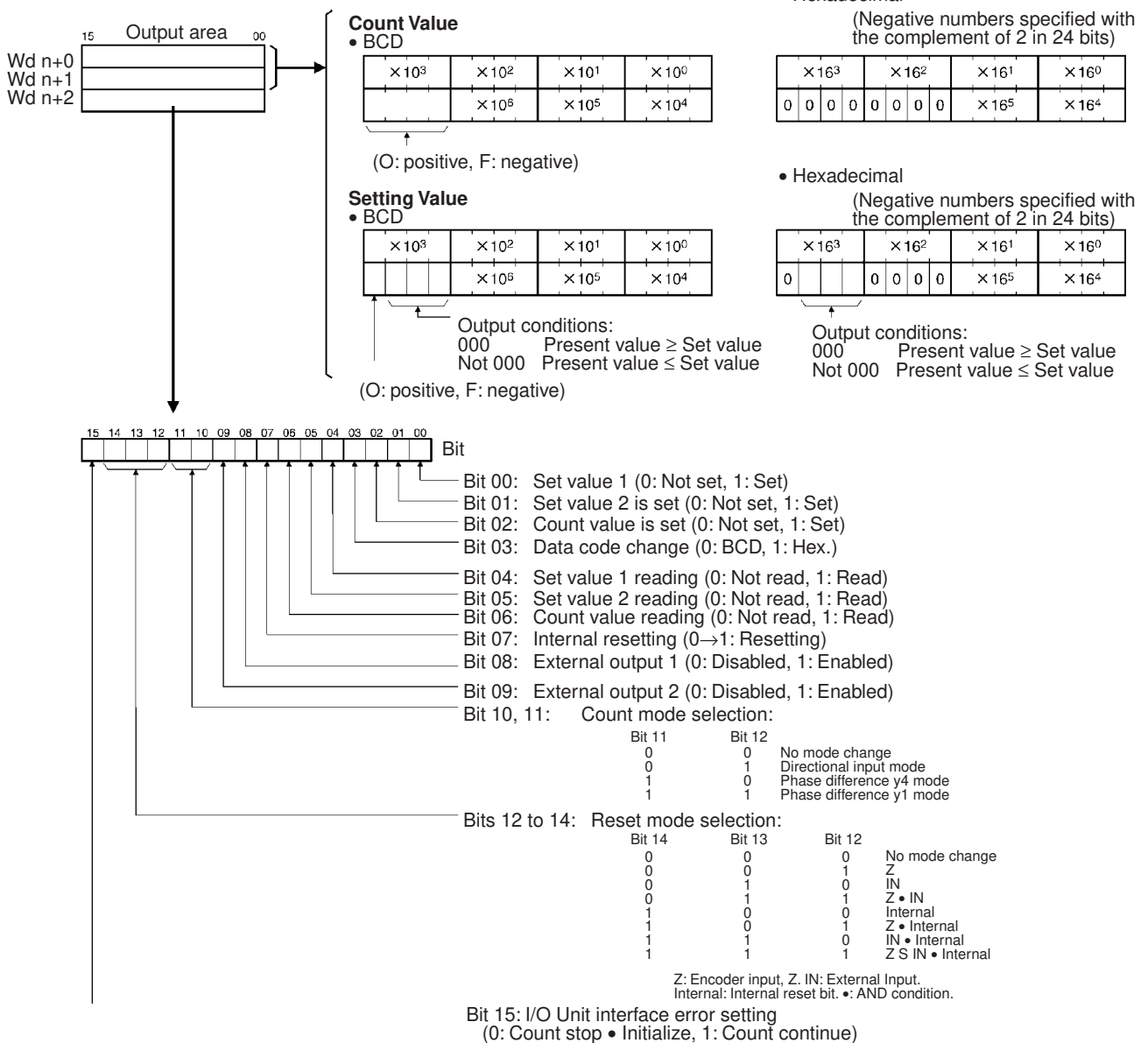
Setting and control for the Counter Unit is executed by writing to the allocated area in the output area of the Master, and status check and monitoring is executed by reading the allocated area in the input area of the Master. The allocated area for the Counter Unit, with the system configuration shown above, is given below (this example is for fixed allocation). For details about area allocation for a MULTIPLE I/O TERMINAL (Communications Unit) on a DeviceNet Master, refer to the *DeviceNet Operation Manual (W267)*. For details about area allocation for a Counter Unit in the area used by a MULTIPLE I/O TERMINAL, refer to *1-2-3 Allocating I/O*.

Communications node number	15	Output area	00	15	Input area	00
01	CIO 51	Counter Unit #0 (For setting and writing in)		CIO 351	I/O Unit interface status for node number 01	
	CIO 52			CIO 352		
	CIO 53			CIO 353	Counter Unit #0 (For status check and reading)	
	CIO 54		Unused	CIO 354		
	CIO 55	Unused	CIO 355			

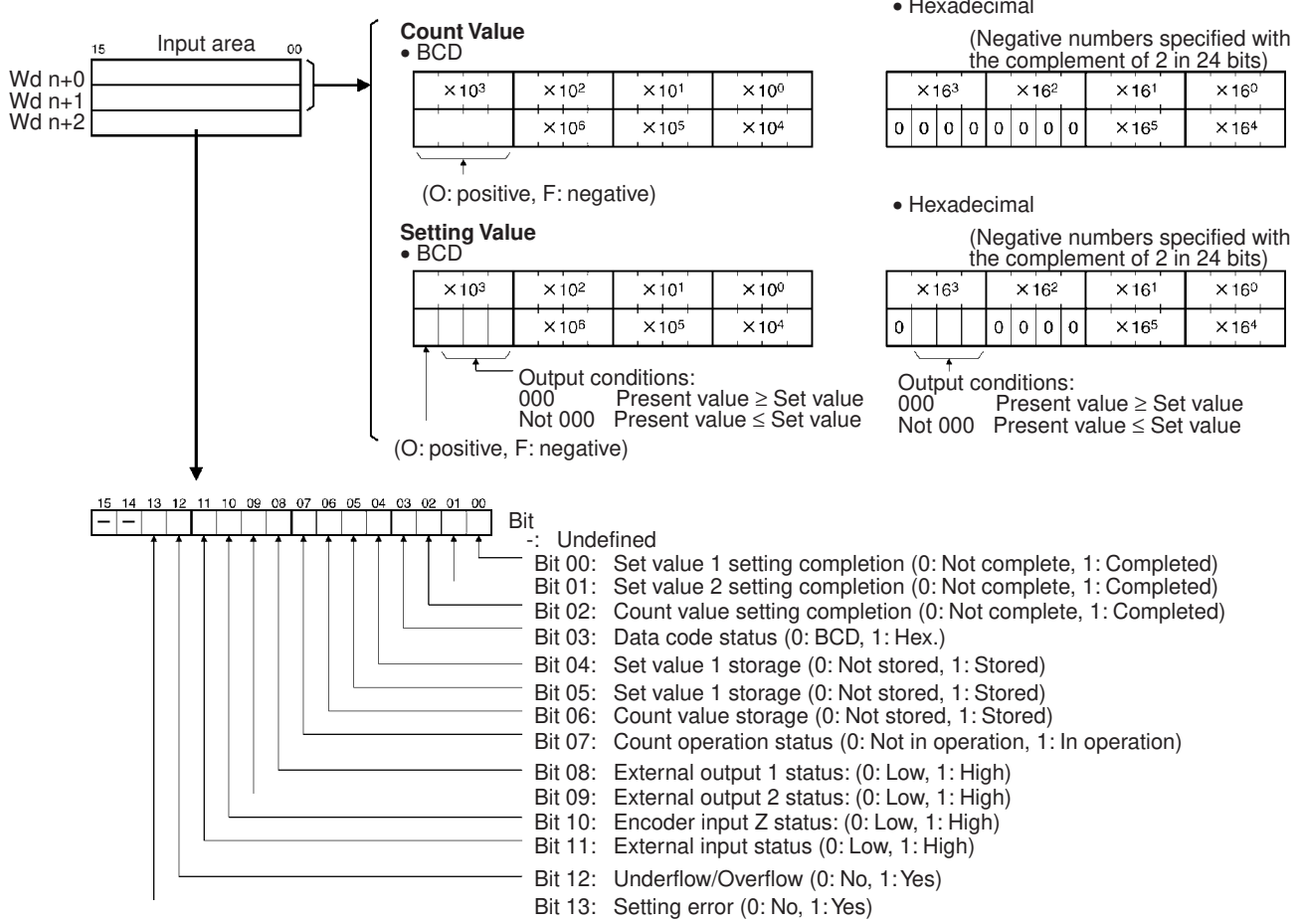
Functions are allocated to the words as shown below. This is only a basic list. For details, refer to *5-4 GT1-CT01 Counter Unit*.



Output Area



Input Area



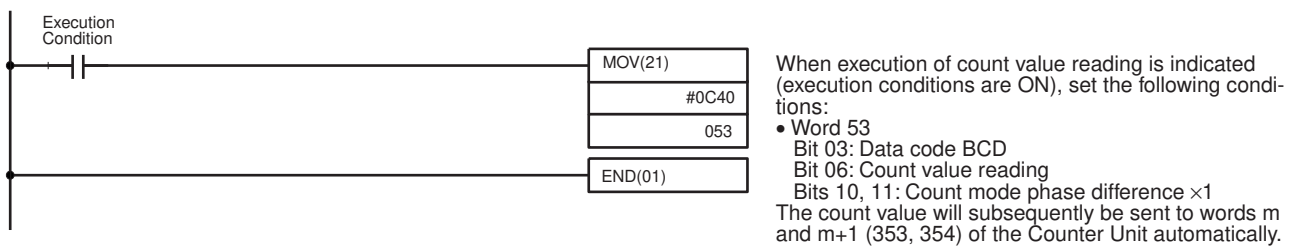
### 3-1-2 Present Count Value Reading

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 5-4 GT1-CT01 Counter Unit.

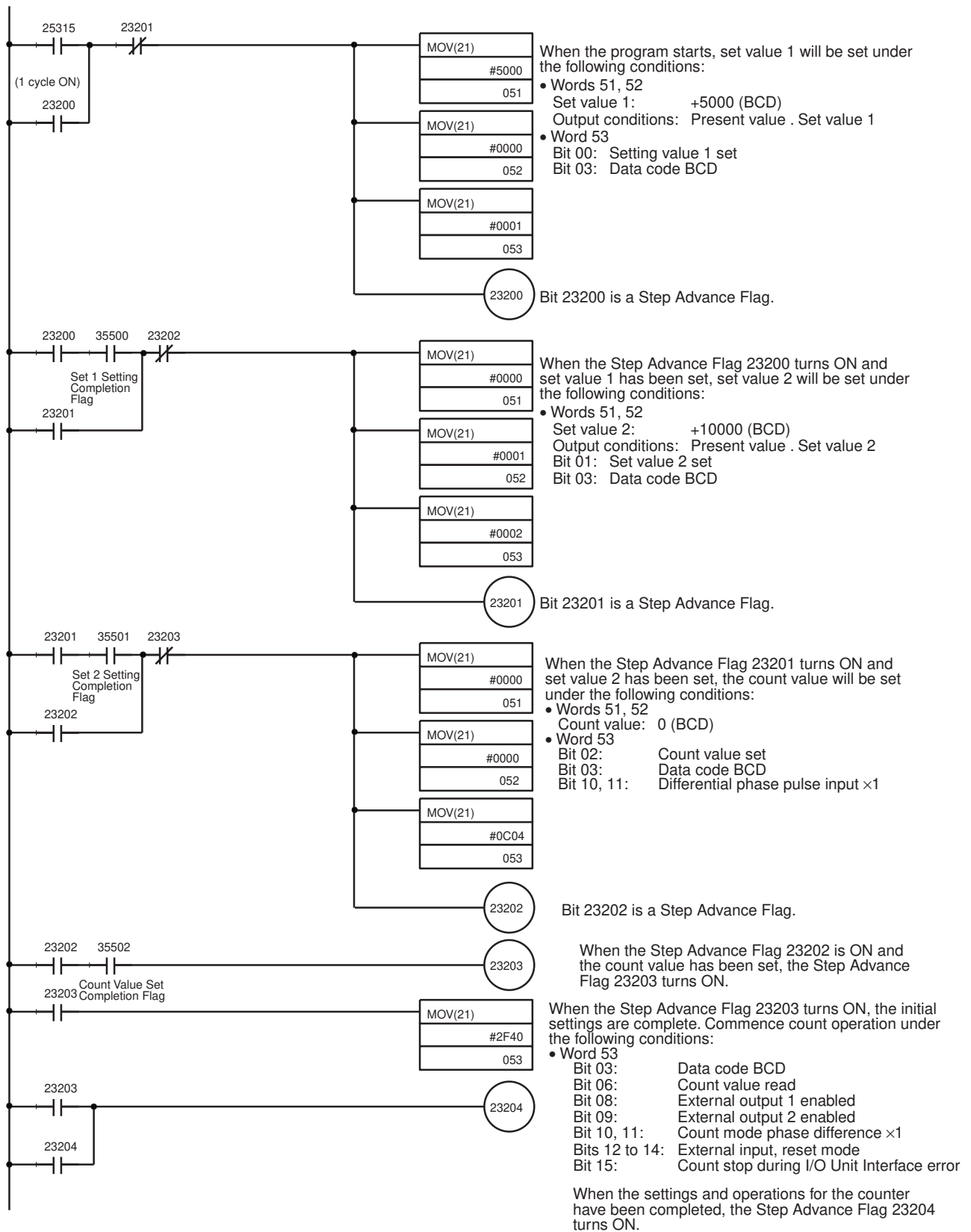
- Note**
1. To execute counting, it is necessary to set the count mode. If the count mode is changed during count operation, however, the count value will be cleared to 0.
  2. Setting and reading will not be executed if a bit with a higher priority is ON. As shown in the following example, therefore,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



### 3-1-3 Counter Setting and Execution

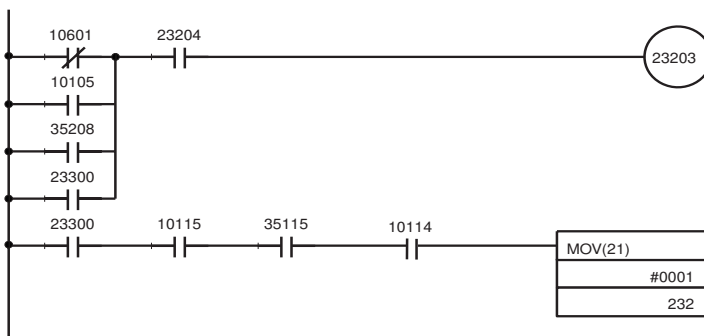
When the program is executed, the necessary settings for the Counter Unit will be made, and count operation will start. During count operation, external outputs 1 and 2 of the Counter Unit will automatically switch ON or OFF, according to the count value.

- 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.



### 3-1-4 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, 3-1-3 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 *DeviceNet Operation Manual (W267)*.



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 Communications Unit Bit (node number 01 = 10601) for the Master Unit normal Slave information area is OFF (error).
- Bit 5 (10105) of the Master Status Area 1 is ON (transmission error in the DeviceNet).
- 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 (Device Net remote I/O communications are operating).
- Bit 14 (10114) of the Master Status Area 1 is OFF (Error/Communications Stopped Flag).
- 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 4

# Basic I/O Unit Specifications

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

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## 4-1 Communications Unit

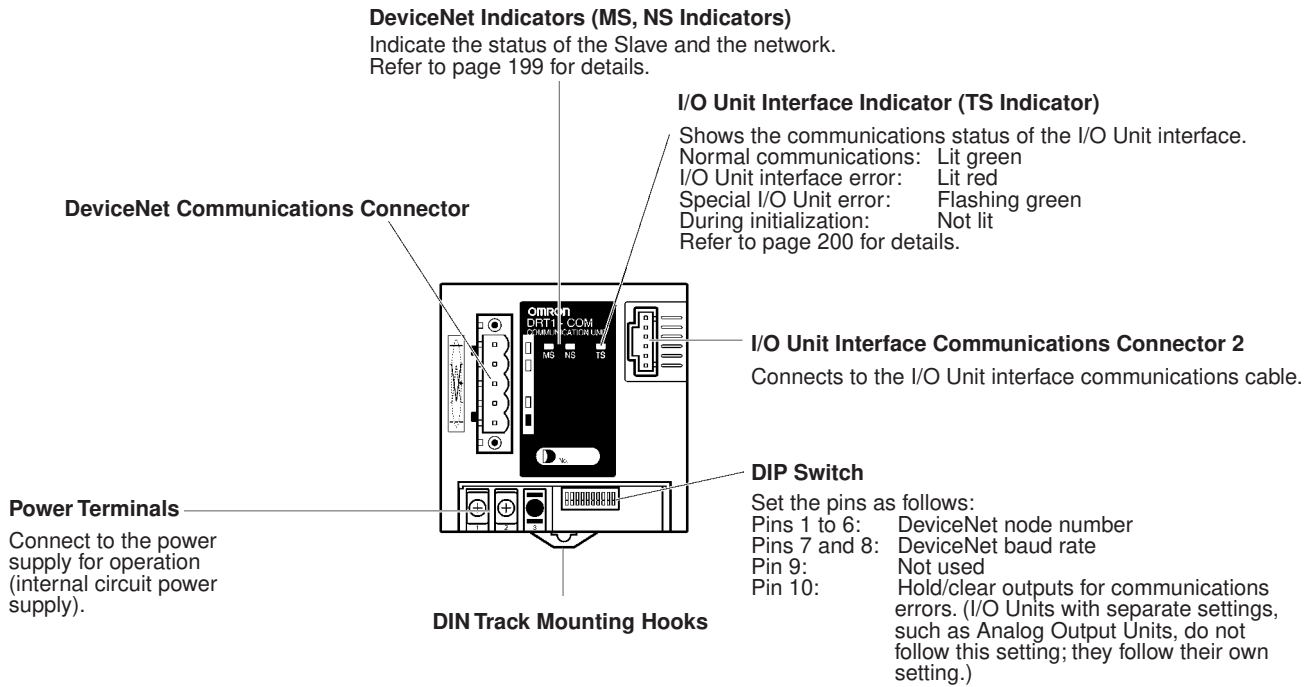
The Communications Unit connects the MULTIPLE I/O TERMINAL to the DeviceNet Network. Connections for a maximum of eight I/O Units can be made with one Communications Unit.

### Specifications

Item		Specification
Model		DRT1-COM
DeviceNet communications power supply	Voltage range	11 to 25 VDC (supplied from the DeviceNet communications connector)
	Unit current consumption	30 mA max.
Internal power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $+10\%/ -15\%$ )
	Unit current consumption	110 mA 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 Communications Unit can be obtained using the following formula: Communications Unit internal power supply current = Communications 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) and outputs (OUT): 1,024 points max.
	Rated output current	0.4 A max.
	Overcurrent protection function	105% of rated current or higher. When an overcurrent occurs, the power supply to the I/O Units will remain OFF until the power supply is turned ON again.
Noise immunity		$\pm 2000$ V (IEC1000-4-4 via fast transient noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup>
Shock resistance		200 m/s <sup>2</sup>
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
Mounting		DIN 35-mm track
Weight		Approx. 135 g
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2

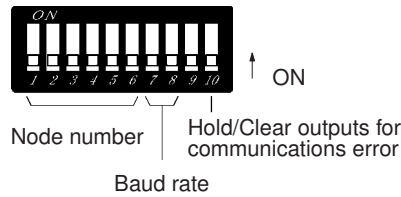
This product has been tested in the test laboratory of a third party authorized by ODVA and has been approved as conforming to ODVA Conformance Software Ver. 2.0-1.00.

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
1 through 6	Node number	Refer to page 38, <i>Node Number Settings</i> and <i>Baud Rate Settings</i> for details.
7 and 8	Baud rate	
9	Reserved for system use.	Always OFF.
10	Hold/Clear outputs for communications error	OFF: Clear All output data will be cleared to 0 when a communications error occurs.  ON: Hold All output data will be retained when a communications error occurs. (See note 1.)

- Note**
1. I/O Units with individual settings, such as Analog Output Units, do not follow this setting; they follow their own setting.
  2. Always turn OFF the power supplies (including the communications power supply) before changing any settings.



**Node Number Settings**

The setting range for the Communications Unit node numbers varies according to the PC, as shown in the following table.

Master PC	CV Series	C200HX/HG/HE(-Z)	C200HS
Setting range (decimal)	0 to 63	0 to 49 (without Configurator) 0 to 63 (with Configurator)	0 to 31 (without Configurator) 0 to 63 (with Configurator)

Node numbers vary according to the settings of pins 1 to 6, as shown in the following table. Node numbers can be set to any value within the range, as long as they do not coincide with other nodes (Master, Slave) or node numbers in the same network.

Pin						Node number
6	5	4	3	2	1	
OFF	OFF	OFF	OFF	OFF	OFF	0 (factory-set)
OFF	OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	OFF	ON	OFF	2
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
ON	ON	ON	ON	OFF	ON	61
ON	ON	ON	ON	ON	OFF	62
ON	ON	ON	ON	ON	ON	63

- Note**
1. For details about node numbers and I/O allocation, refer to *DeviceNet Operation Manual (W267)*.
  2. If node numbers coincide with other nodes, overlapping will occur and communications will not be possible.

**Baud Rate Settings**

The baud rate can be set using pins 7 and 8, according to the following table.

Pin		Baud rate
1	2	
7	8	
OFF	OFF	125 kbps (factory-set)
ON	OFF	250 kbps
OFF	ON	500 kbps
ON	ON	Setting not possible

- Note**
1. Be sure to turn OFF the power supply to Slaves (including communications power supply) when making the setting.
  2. Set the same baud rate for all the nodes (Master, Slaves) on the network. Not only can Slaves with a different baud rate to the Master not take part in communications, they can also cause communications errors for communications between correctly set nodes.

**Mounting**

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

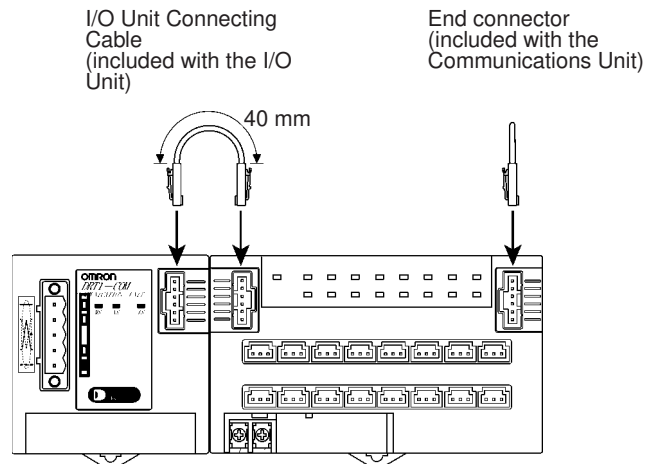
**I/O Unit Interface Connectors**

The I/O Unit interface connectors provide I/O Unit interface and allow power to be supplied to the I/O Units.

A feedback cable must be connected to the right-side connector on the end 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 attached to the Communications Unit. An I/O Unit Connecting Cable with a cable length of 1 m (GCN1-100) is sold separately.

As shown in the following diagram, connect the I/O Unit interface connector 2 on the Communication Unit to the I/O Unit interface connector 1 on the I/O Unit.

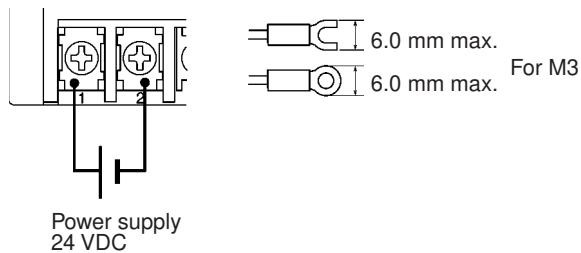


Connect the I/O Units in order, in the way shown in the above diagram. A maximum of 8 Units can be connected.

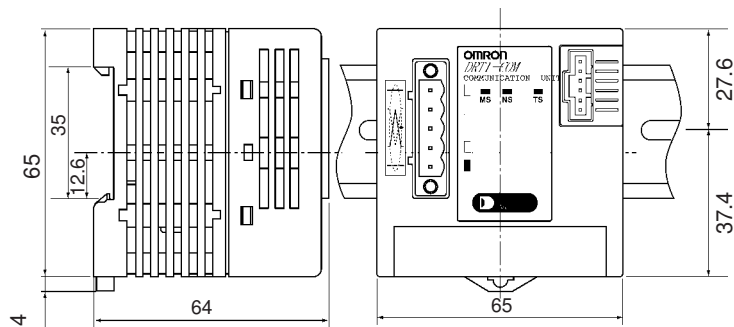
Be sure to connect the end connector to the I/O Unit interface connector 2 of the last I/O Unit.

**Wiring**

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



**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.

## 4-2 Specifications Common to All 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		$\pm 2000$ V (IEC61000-4-4 via fast transient noise simulator)
Vibration resistance		Relay output unit: 10 to 55 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup> Others: 10 to 150 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup>
Shock resistance		200 m/s <sup>2</sup>
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
Mounting		DIN 35-mm track
Safety standards		UL508, CSA22.2
EMC directives		EN50081-2, EN50082-2

### 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	Typical: 5 mA at 24 VDC, minimum 3 mA at 17 VDC.
Input impedance	4.4 k $\Omega$
ON delay time	1.5 ms max.
OFF delay time	1.5 ms max.
Insulation resistance	20 M $\Omega$ 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 M $\Omega$ 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
GT1-ID16(-1)	35 mA max.	---	Approx. 330 g
GT1-ID16MX(-1)	35 mA max.	---	Approx. 175 g
GT1-ID16ML(-1)	35 mA max.	---	Approx. 120 g
GT1-ID16DS(-1)	35 mA max.	---	Approx. 125 g
GT1-ID32ML(-1)	55 mA max.	---	Approx. 195 g
GT1-OD16(-1)	35 mA max.	9 mA max.	Approx. 330 g
GT1-OD16MX(-1)	35 mA max.	9 mA max.	Approx. 150 g
GT1-OD16ML(-1)	35 mA max.	9 mA max.	Approx. 90 g
GT1-OD16DS(-1)	35 mA max.	9 mA max.	Approx. 95 g
GT1-OD32ML(-1)	65 mA max.	11 mA max.	Approx. 165 g
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 20 A max.)	Approx. 220 g
GT1-AD08MX	50 mA max.	100 mA max. (inrush current 30 A max.)	Approx. 180 g
GT1-DA04	50 mA max.	150 mA max. (inrush current 20 A max.)	Approx. 230 g
GT1-DA04MX	50 mA max.	100 mA max. (inrush current 30 A max.)	Approx. 180 g
GT-TS04T	50 mA max.	80 mA max. (inrush current 10 A max.)	Approx. 210 g
GT-TS04P	50 mA max.	80 mA max. (inrush current 10 A max.)	Approx. 210 g
GT1-CT01	90 mA max.	9 mA max.	Approx. 250 g

### 4-2-1 Precautions for Connecting a DC 2-wire Sensor

Check that the following conditions have been satisfied when using a DC 2-wire sensor with a Transistor Input Unit. Failure to meet these conditions may result in operating errors.

#### **Transistor Input Unit ON Voltage and Sensor Residual Voltage**

$$V_{ON} \leq V_{CC} - V_R$$

$V_{CC}$ : I/O supply voltage

(Supply voltage range is 20.4 to 26.4 V, but is calculated at 20.4 V as the worst-case scenario.)

$V_{ON}$ : ON voltage for the Transistor Input Unit  
(15 V with a MULTIPLE I/O TERMINAL)

$V_R$ : Sensor output residual voltage

The above formula can sometimes be satisfied by adjusting the I/O supply voltage ( $V_{CC}$ ) to 26.4 V.

#### **Transistor Input Unit ON Current and Sensor Control Output (Load Current)**

$$I_{OUT (min.)} \leq I_{ON} \leq I_{OUT (max.)}$$

$I_{OUT}$ : Sensor control output (load current)

$I_{ON}$ : ON current of the Transistor Input Unit

$I_{ON}$  can be determined as follows:

$$I_{ON} = (V_{CC} - V_R - V_F) / R_{IN}$$

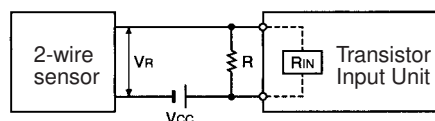
$V_F$ : The Transistor Input Unit's internal residual voltage  
(1.5 V with a MULTIPLE I/O TERMINAL)

$R_{IN}$ : The Transistor Input Unit's input impedance  
(4.4 k $\Omega$  with a MULTIPLE I/O TERMINAL).

When  $I_{ON}$  is smaller than  $I_{OUT (min.)}$ , connect a bleeder resistor R. The bleeder resistor constant can be determined as follows:

$$R \leq (V_{CC} - V_R) / (I_{OUT (min.)} - I_{ON})$$

$$\text{Power } W \geq (V_{CC} - V_R)^2 / R \times 4 \text{ [tolerance]}$$



#### **Transistor Input Unit OFF Current and Sensor Leakage Current**

$$I_{OFF} \geq I_{LEAK}$$

$I_{OFF}$ : OFF current of the Transistor Input Unit  
(1.0 mA with a MULTIPLE I/O TERMINAL).

$I_{LEAK}$ : Sensor leakage current.

If the sensor leakage current is greater than the OFF current of the Transistor Input Unit, connect a bleeder resistor R. The bleeder resistor constant can be determined as follows:

$$R \leq (I_{OFF} \times R_{IN} + V_F) / (I_{LEAK} - I_{OFF})$$

$$\text{Power } W \geq (V_{CC} - V_R)^2 / R \times 4 \text{ [tolerance]}$$

**4-2-2 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:

<b>Indicator</b>	<b>Color</b>	<b>State</b>	<b>Meaning</b>
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 Communications Units, differ from those for I/O Units. For details, refer to page 200.

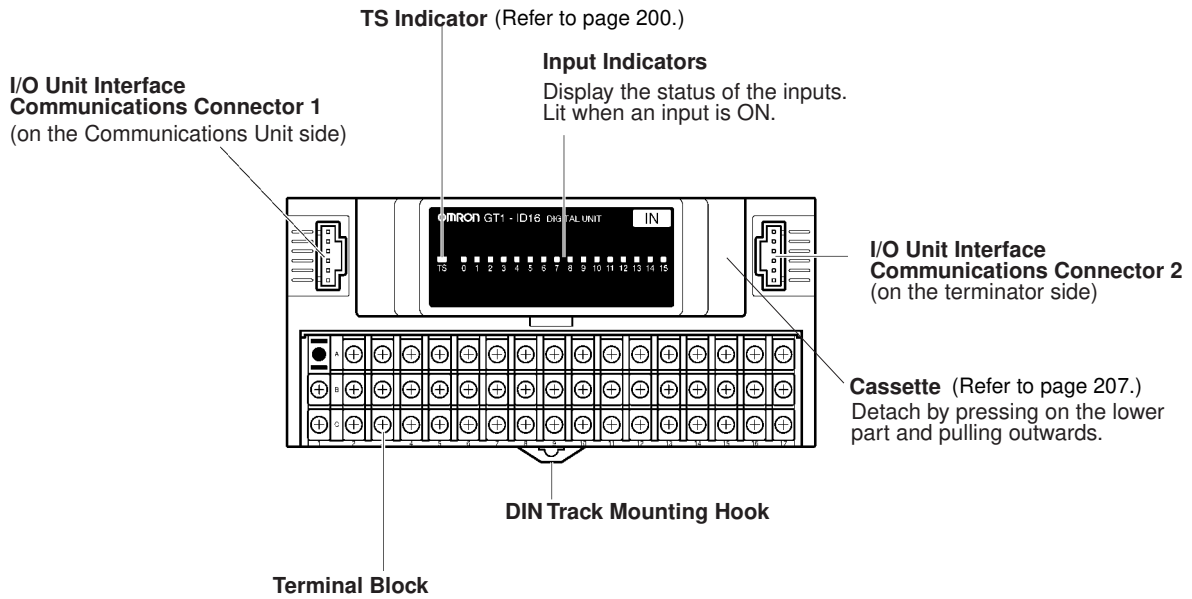
## 4-3 Transistor Input Units

### 4-3-1 GT1-ID16 Transistor Input Unit with Terminal Block (NPN)

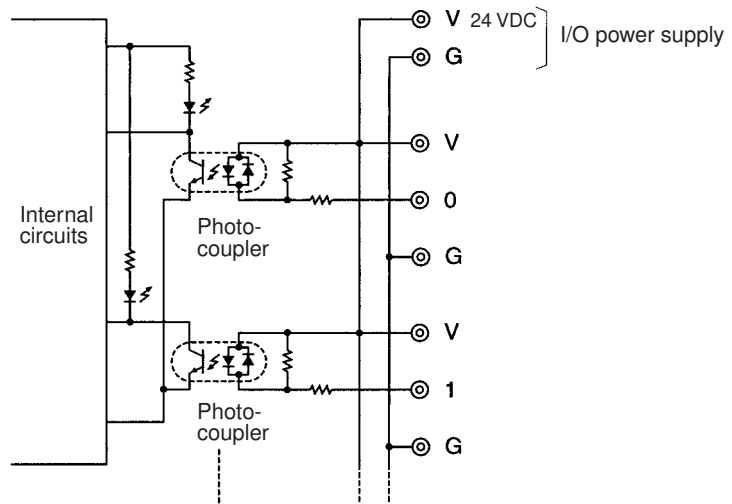
#### Input Specifications

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

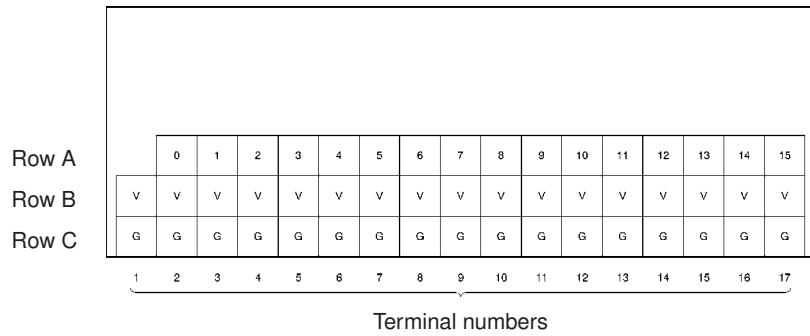
#### Components



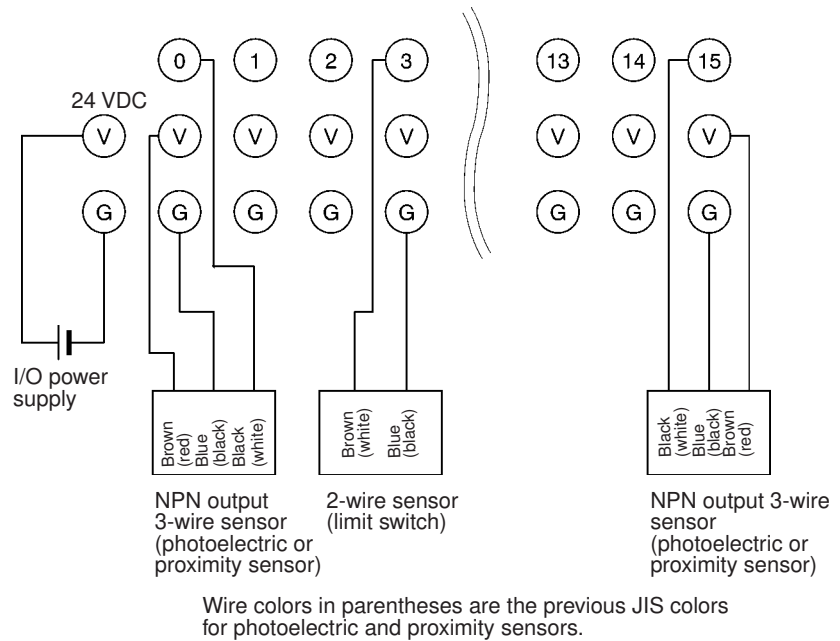
#### Internal Circuits



Terminal Arrangement

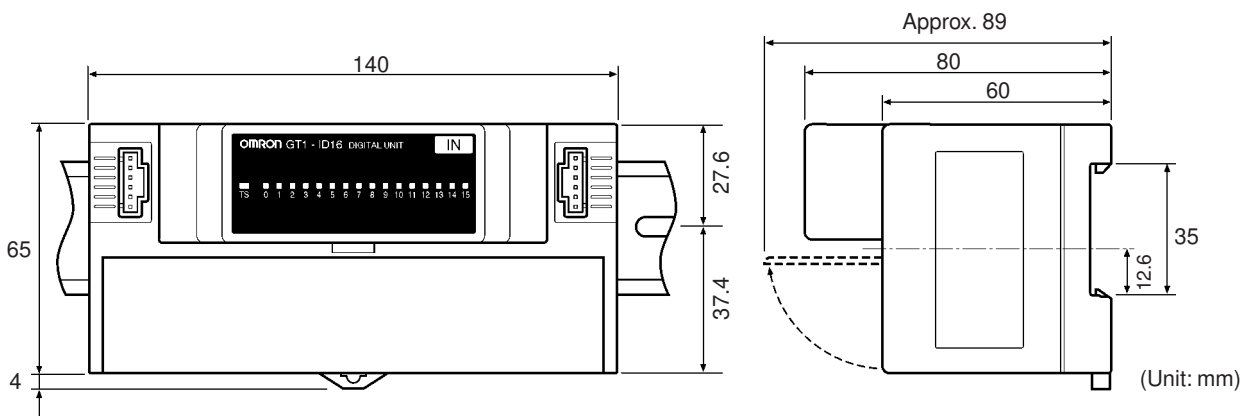


Wiring



**Note** V terminals and G terminals are internally connected. When the I/O power is being supplied, the power can be supplied to the input devices from the V terminals and G terminals. Current supplied in this way, however, must be less than 1 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.

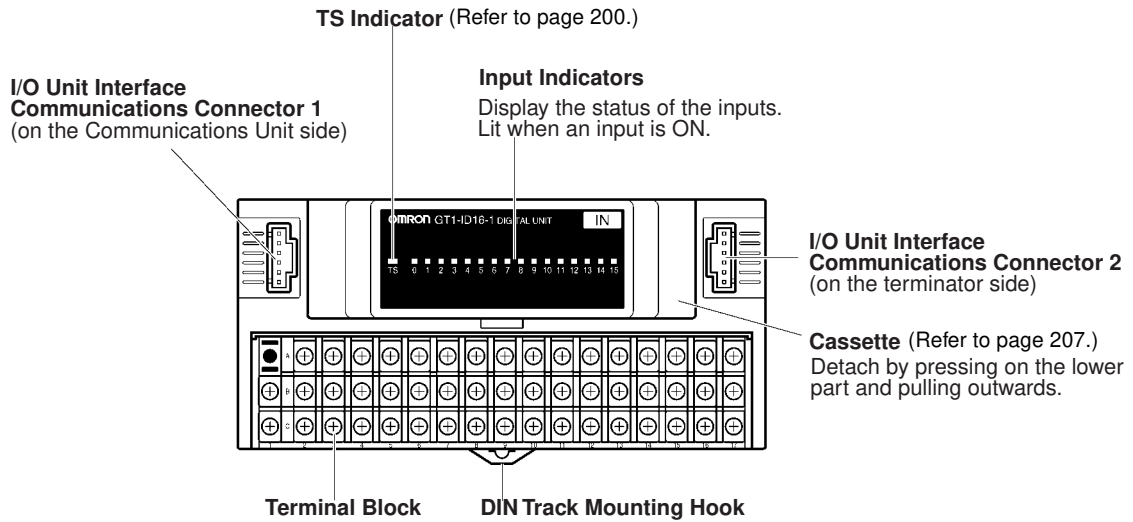


### 4-3-2 GT1-ID16-1 Transistor Input Unit with Terminal Block (PNP)

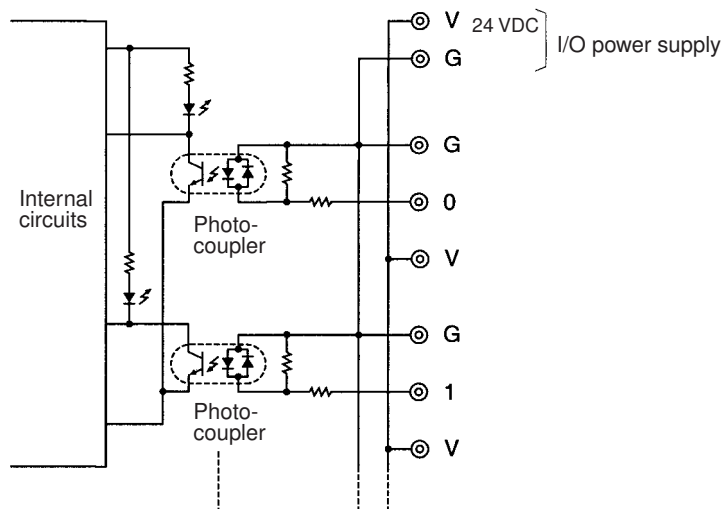
#### Input Specifications

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

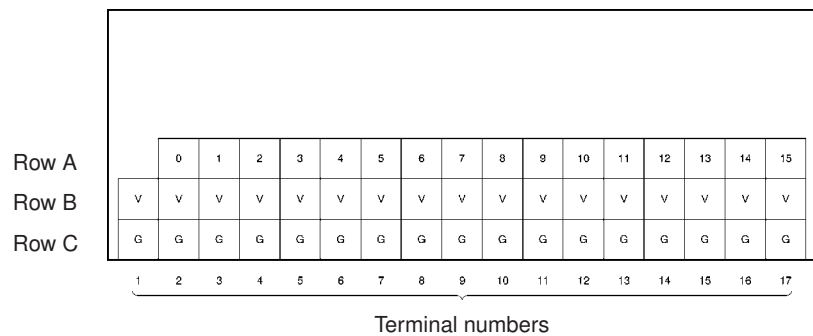
#### Components



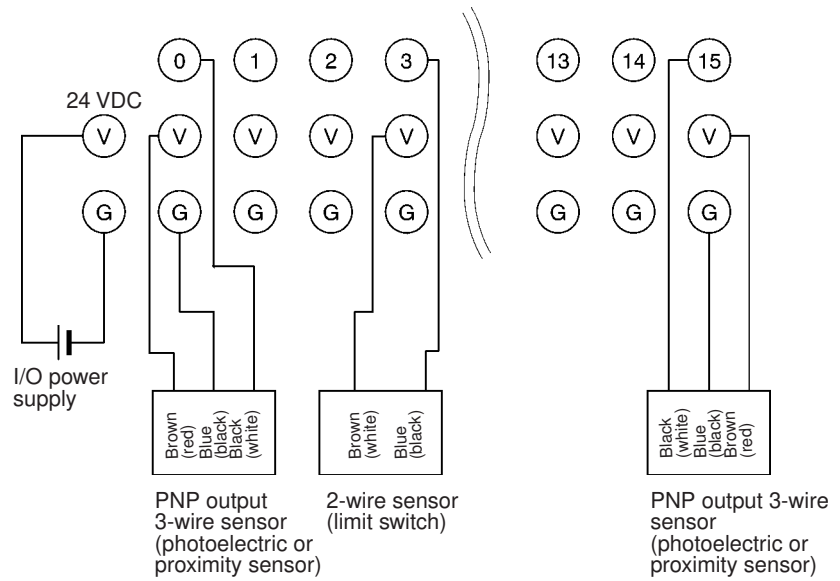
#### Internal Circuits



#### Terminal Arrangement



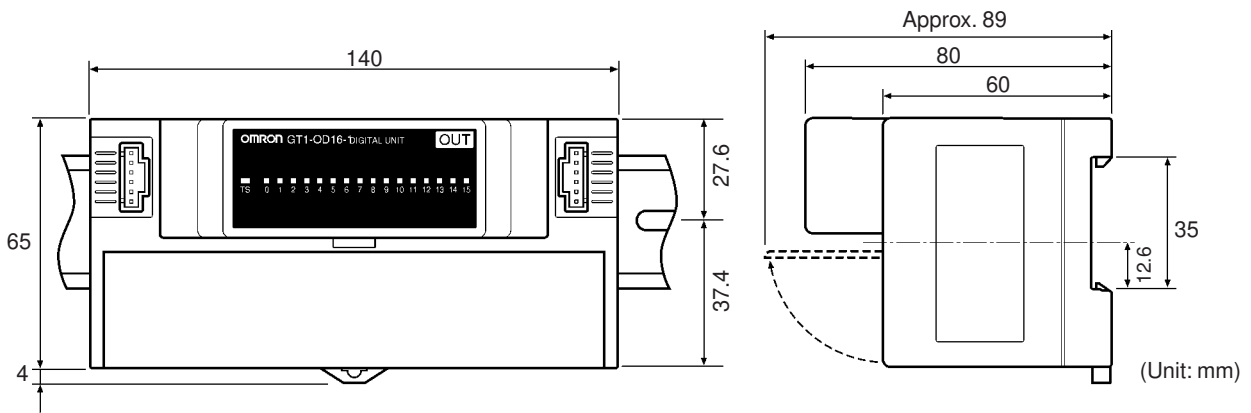
Wiring



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

**Note** V terminals and G terminals are internally connected. 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.

Dimensions



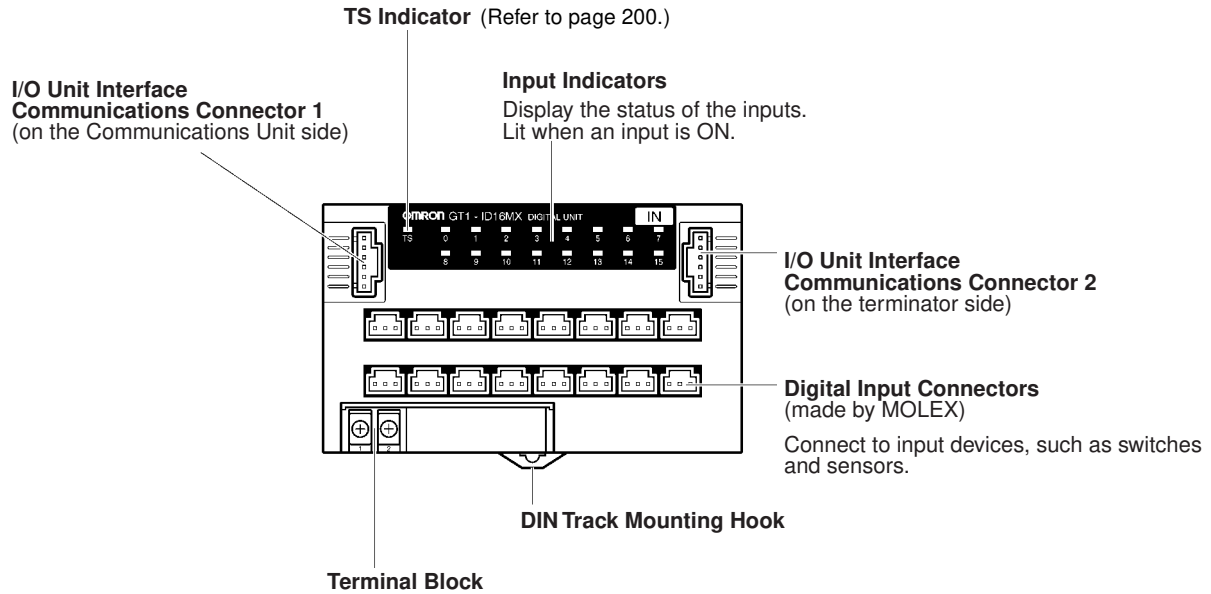
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-3-3 GT1-ID16MX Transistor Input Unit with Connector (NPN)

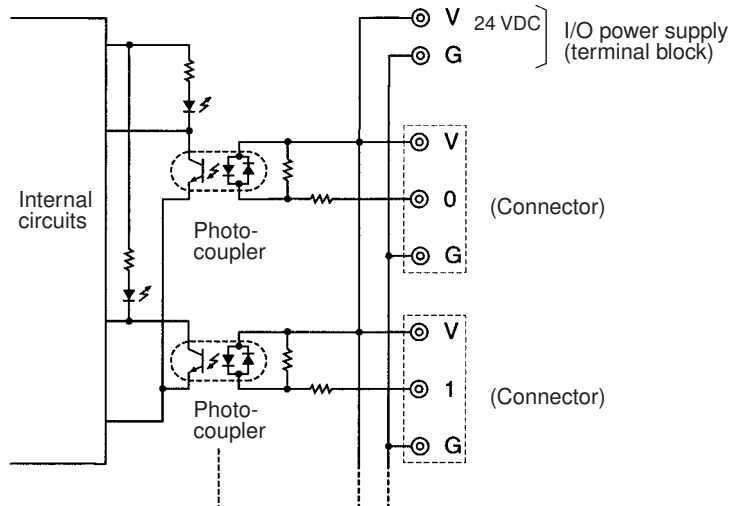
#### Input Specifications

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

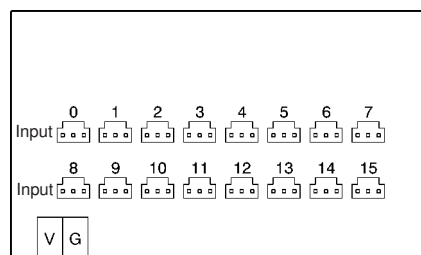
#### Components



#### Internal Circuits

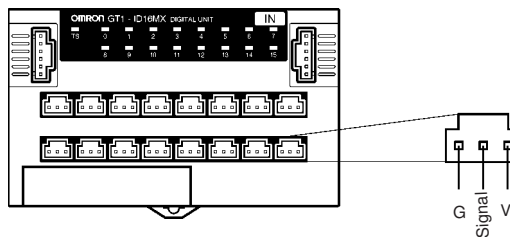


#### Terminal Arrangement



**Connector Pin Arrangement**

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



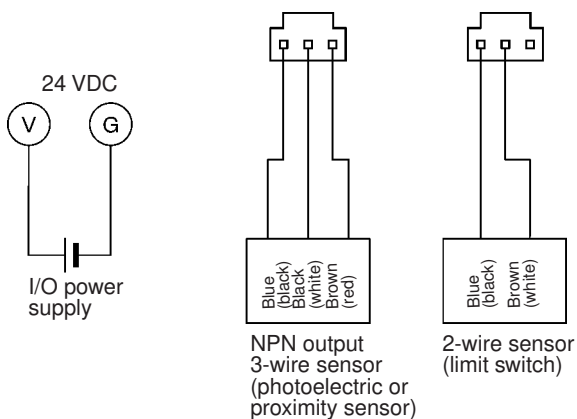
**Wiring**

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

**Applicable Connectors**

Manufacturer	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

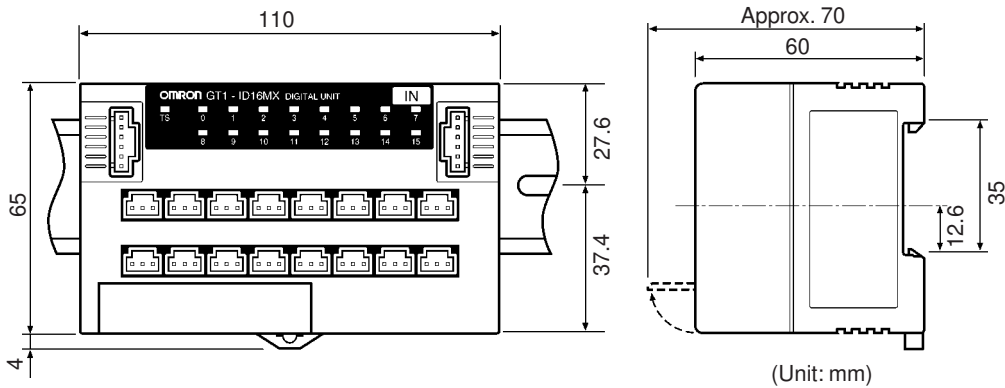
**Wiring Example**



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



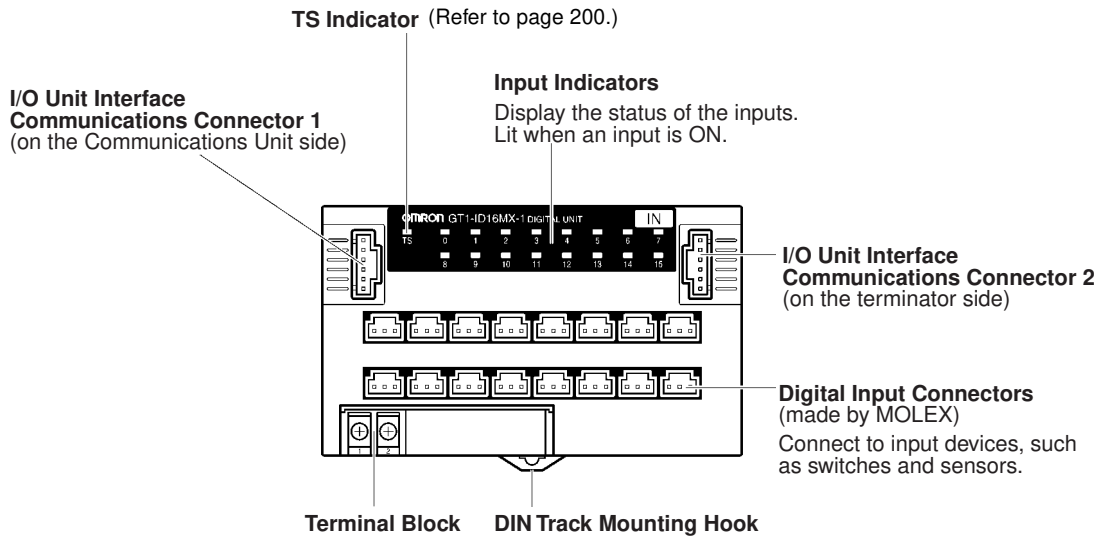
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

4-3-4 GT1-ID16MX-1 Transistor Input Unit with Connector (PNP)

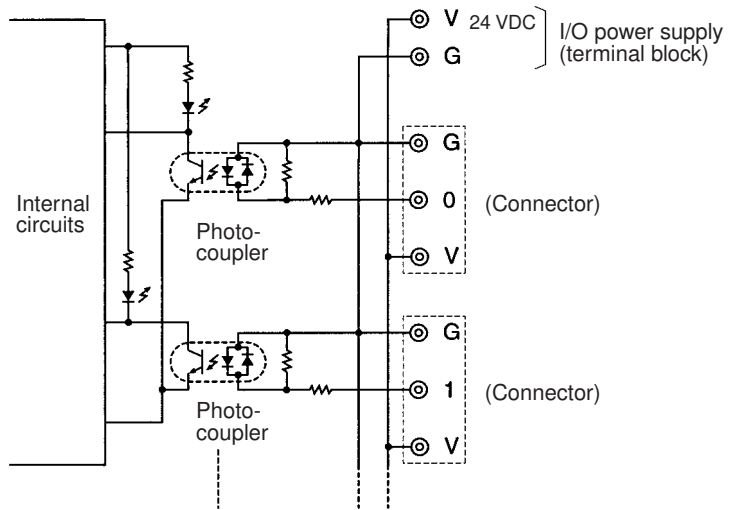
Input Specifications

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

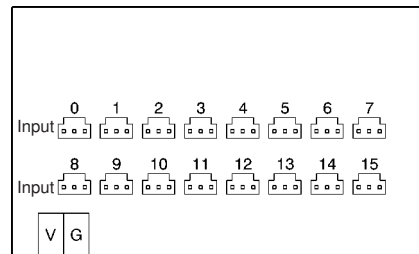
Components



Internal Circuits

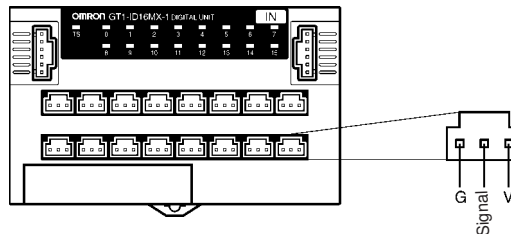


Terminal Arrangement



Connector Pin Arrangement

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



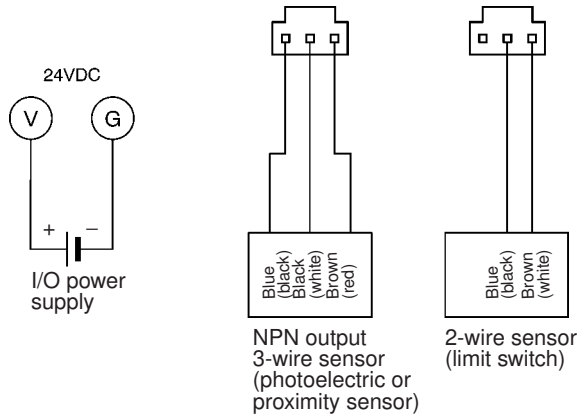
Wiring

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

Applicable Connectors

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

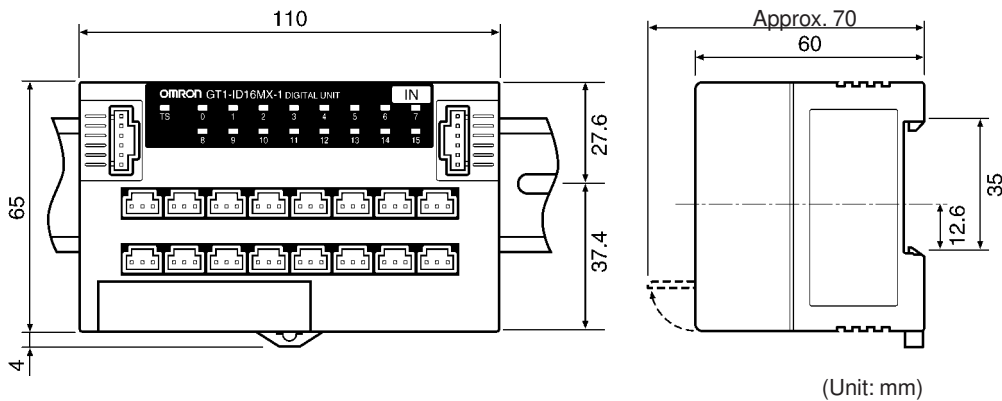
Wiring Examples



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



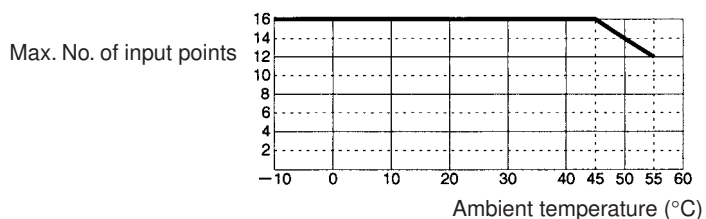
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

4-3-5 GT1-ID16ML Transistor Input Unit with Connector (NPN)

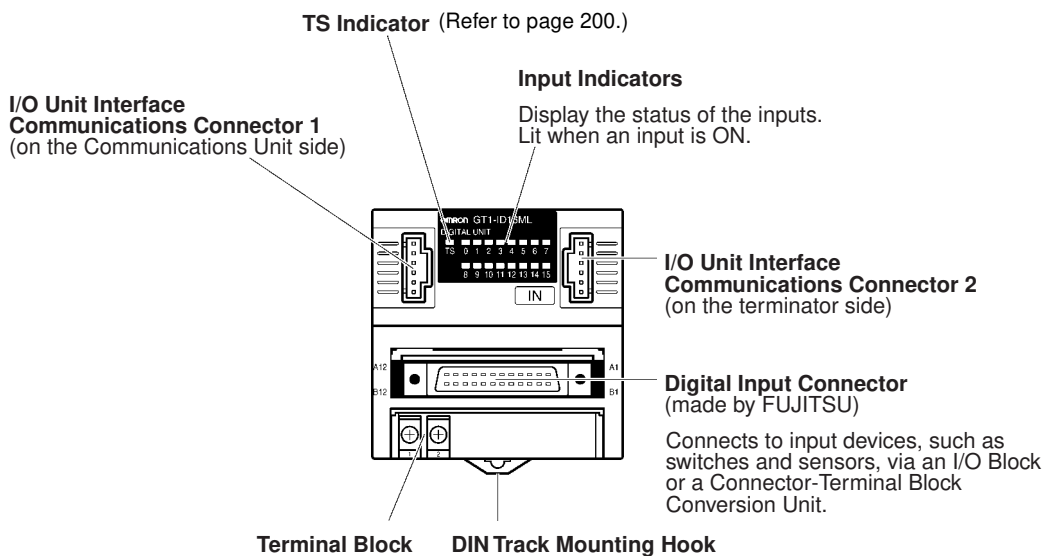
Input Specifications

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

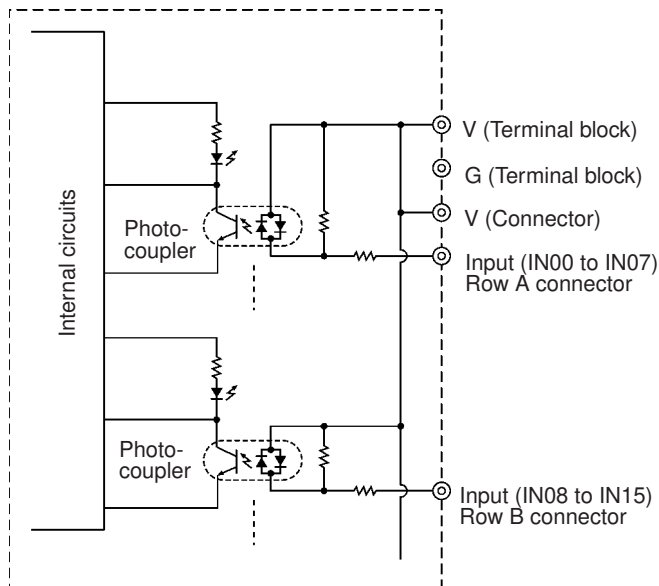
**Note** The number of input points that can be ON simultaneously depends on the ambient temperature, as shown below.



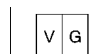
Components



Internal Circuits

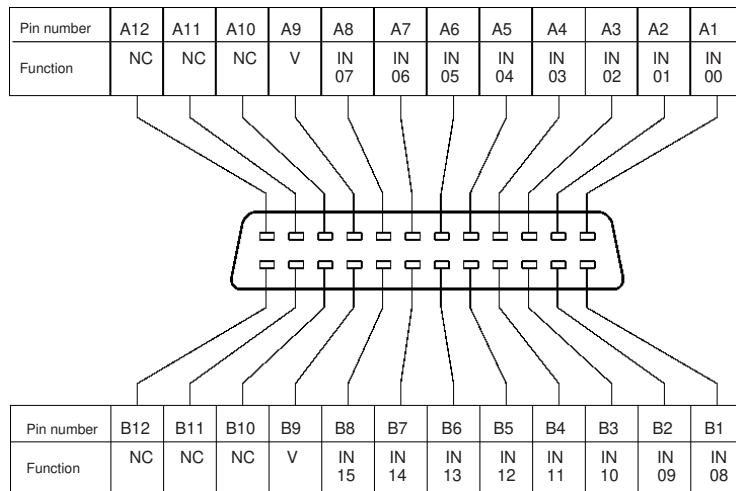


Terminal Arrangement





Connector Pin Arrangement



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

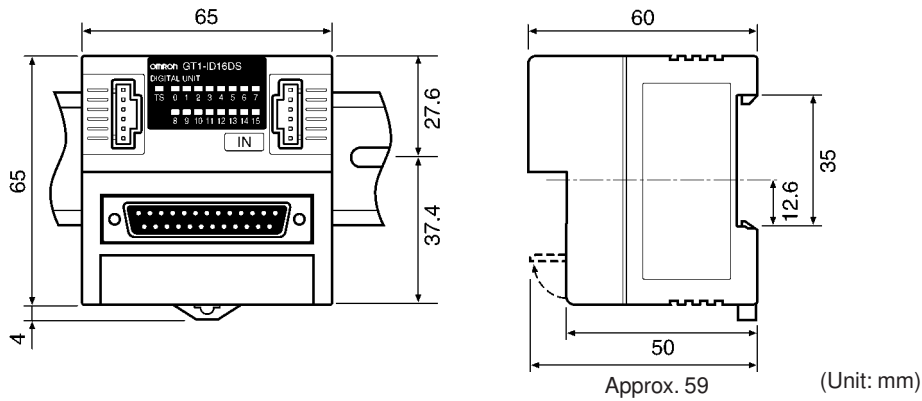
Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

**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

Dimensions



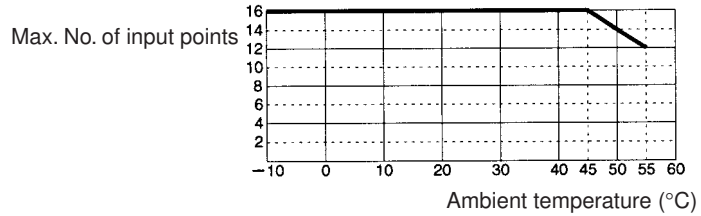
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

4-3-6 GT1-ID16ML-1 Transistor Input Unit with Connector (PNP)

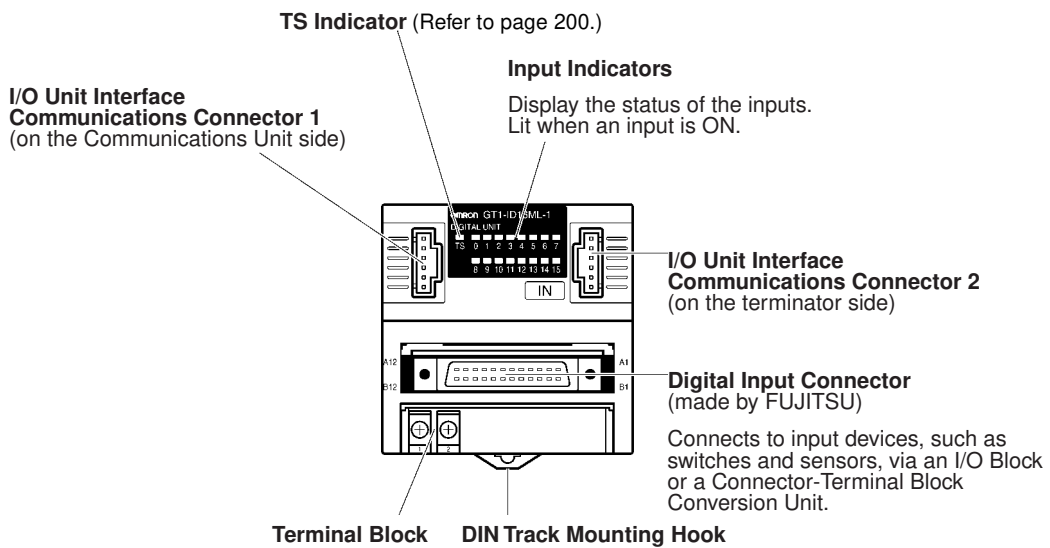
Input Specifications

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

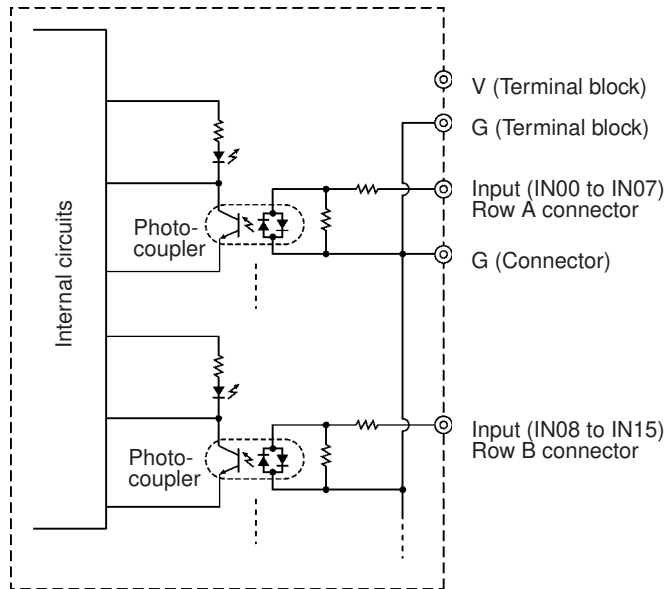
**Note** The number of input points that can be ON simultaneously depends on the ambient temperature, as shown below.



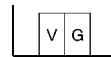
Components



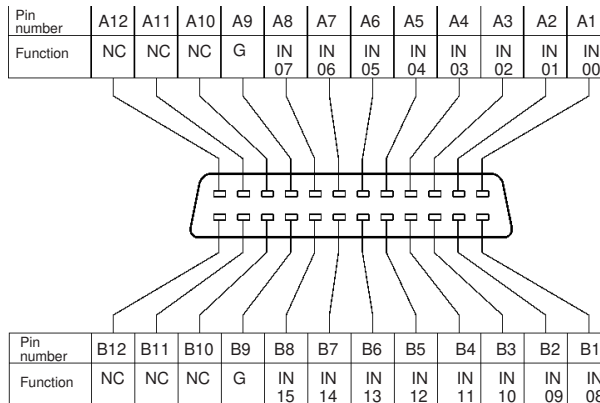
Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



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

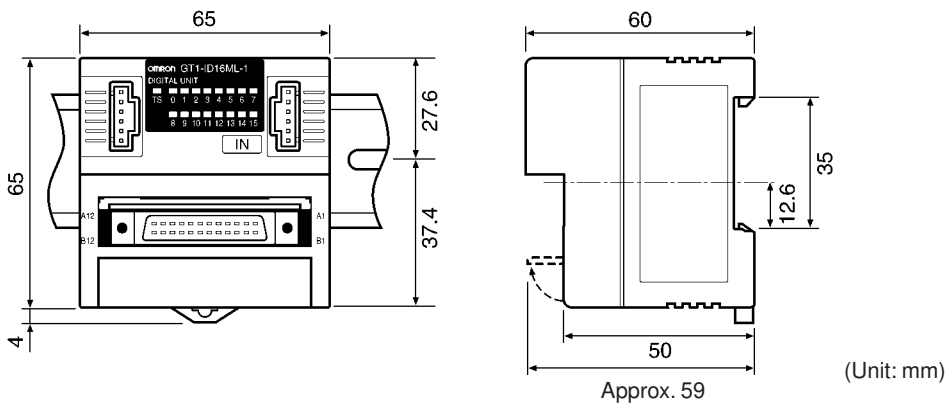
Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

**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

**Dimensions**



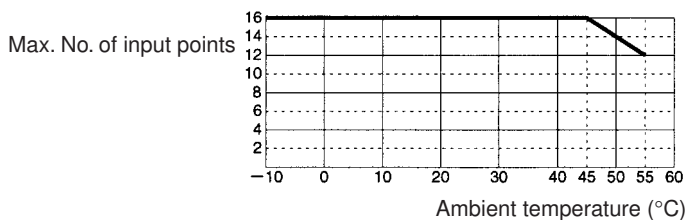
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

**4-3-7 GT1-ID16DS Transistor Input Unit with Connector (NPN)**

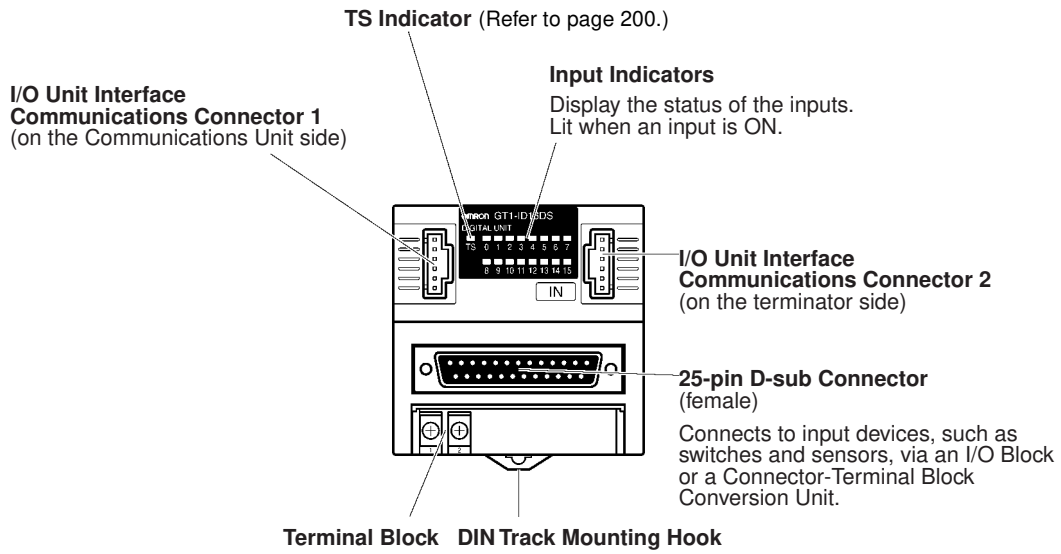
**Input Specifications**

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

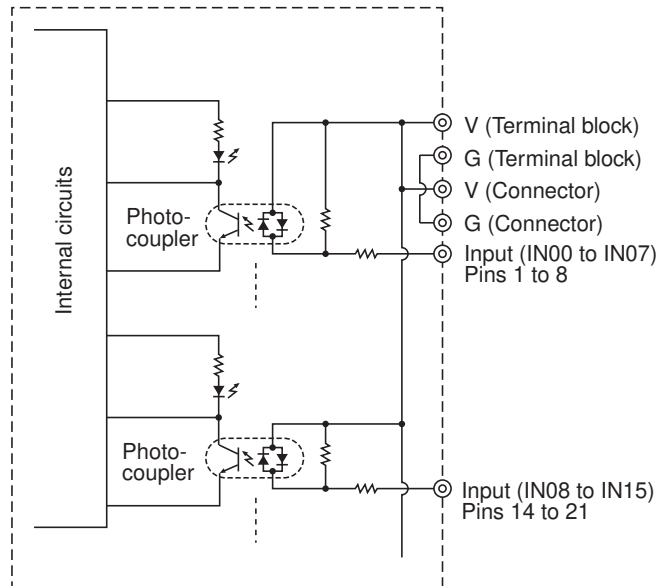
**Note** The number of input points that can be ON simultaneously depends on the ambient temperature, as shown below.



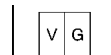
Components



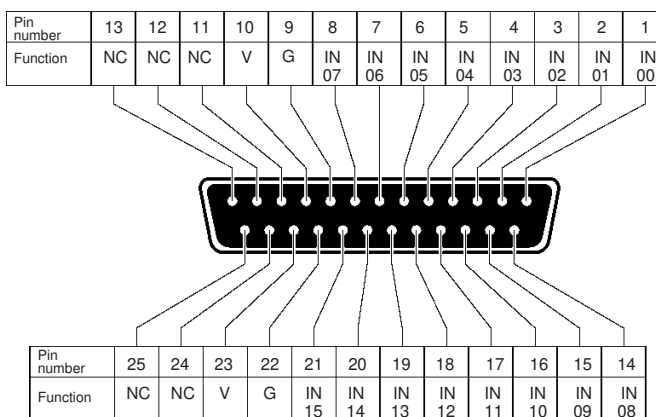
Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



Wiring

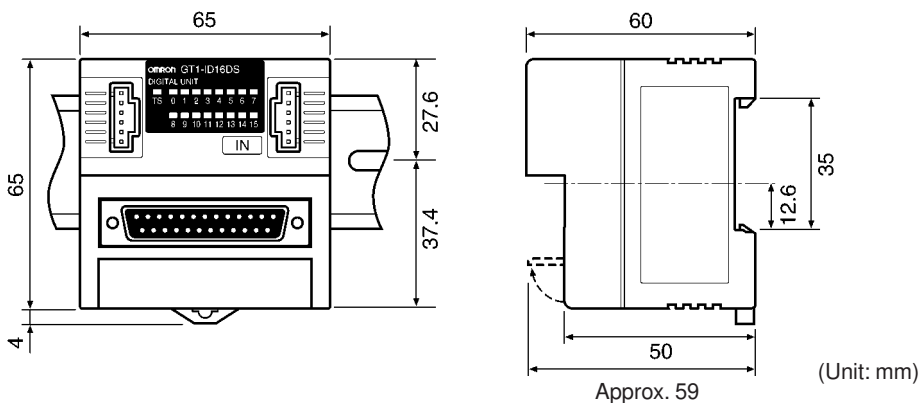
Attach a 25-pin D-sub connector to the Transistor Input Unit and connect it to the external devices.

Applicable Connectors

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

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

Dimensions



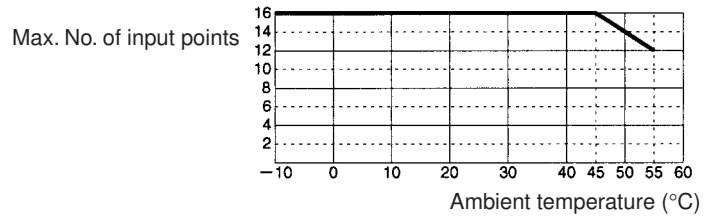
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-3-8 GT1-ID16DS-1 Transistor Input Unit with Connector (PNP)

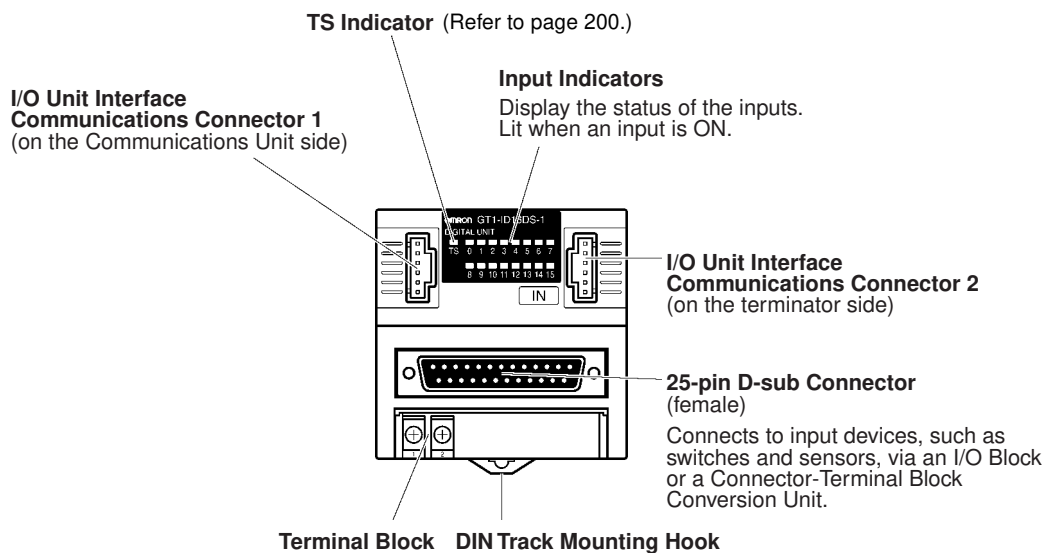
#### Input Specifications

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

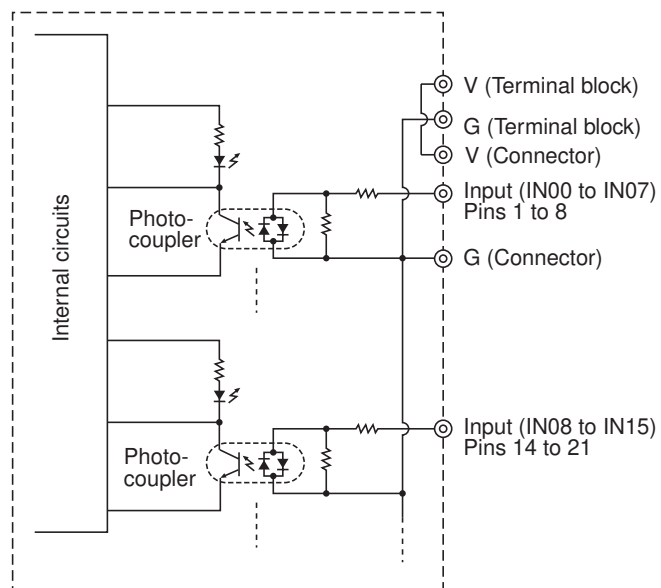
Note The number of input points that can be ON simultaneously depends on the ambient temperature, as shown below.



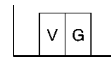
#### Components



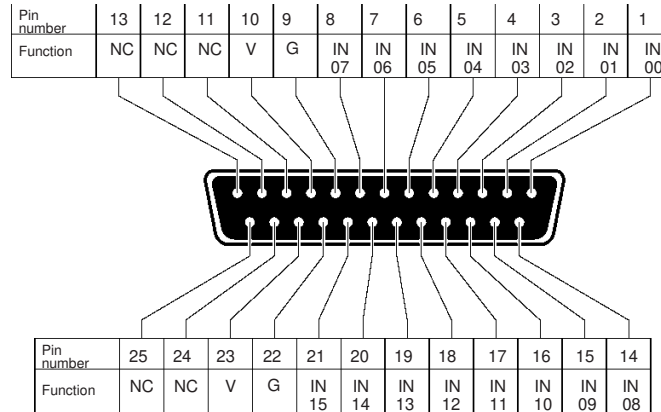
#### Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



Wiring

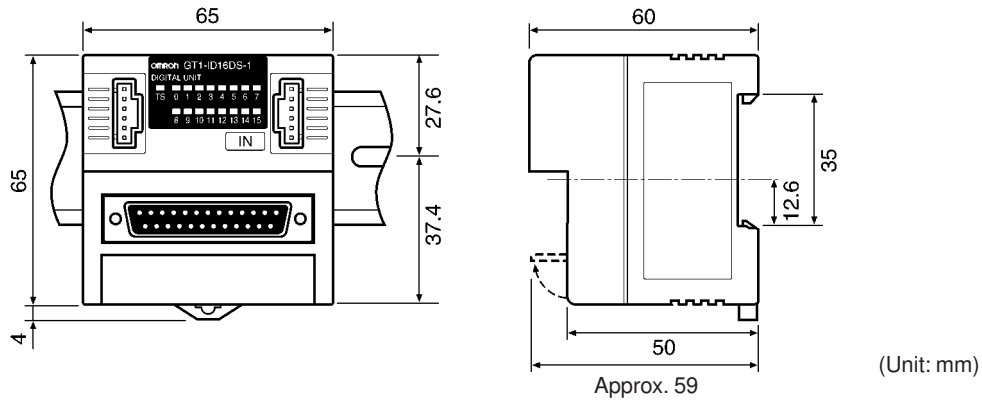
Attach a 25-pin D-sub connector to the Transistor Input Unit and connect it to the external devices.

Applicable Connectors

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

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

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.

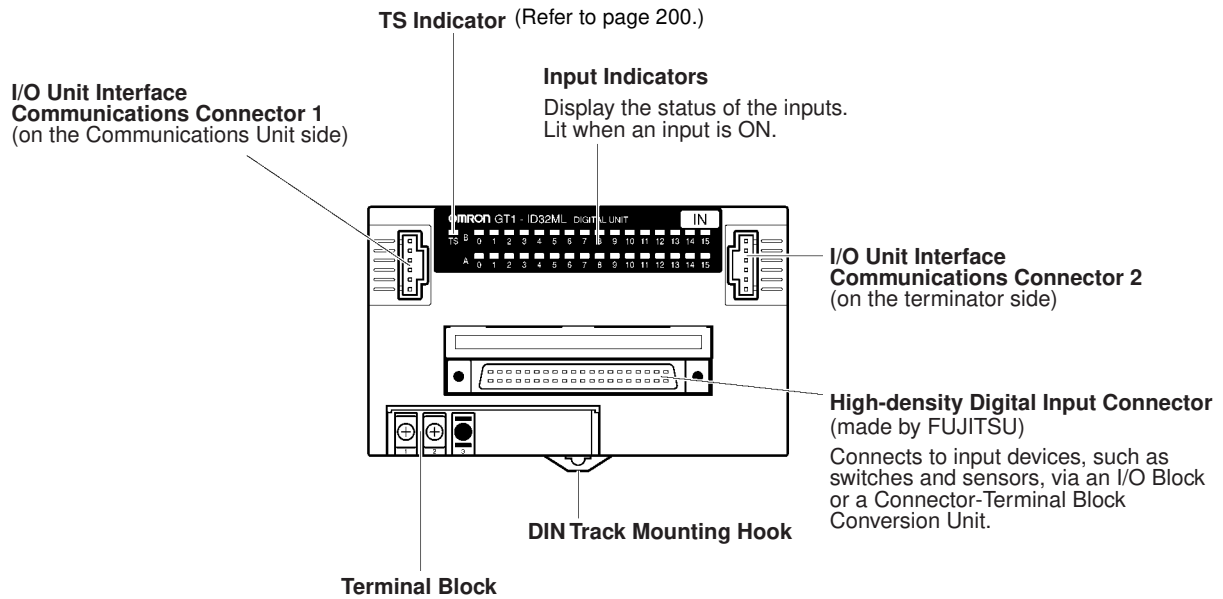


### 4-3-9 GT1-ID32ML Transistor Input Unit with High-density Connector (NPN)

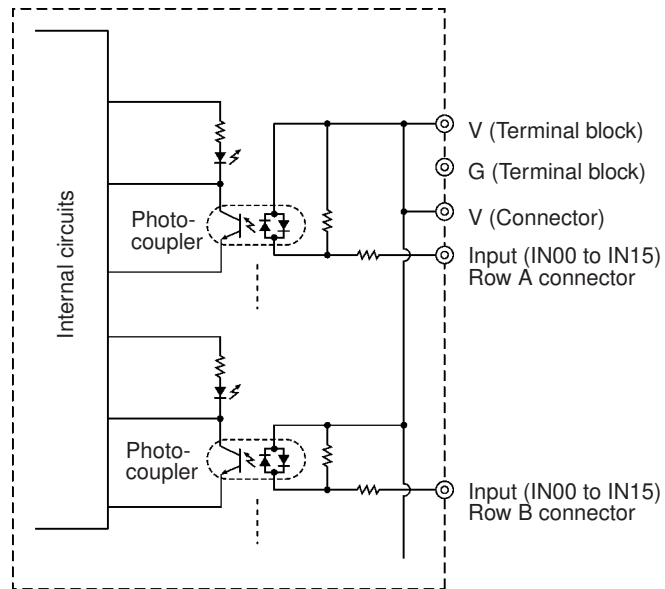
#### Input Specifications

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

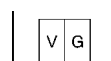
#### Components



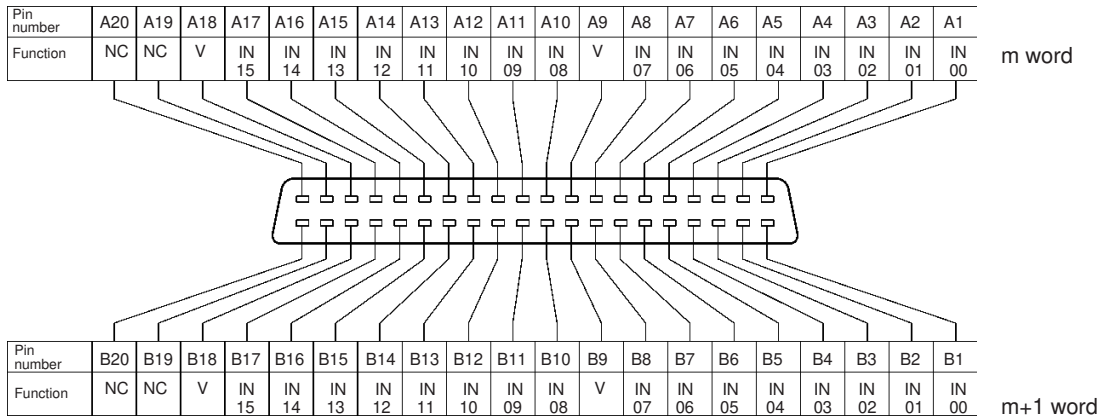
#### Internal Circuits



#### Terminal Arrangement



Connector Pin Arrangement



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 on 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

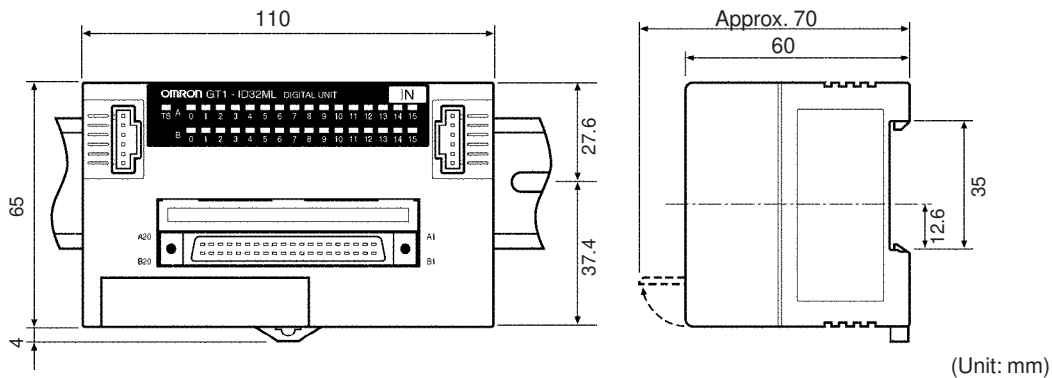
**Cables with Connectors**

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



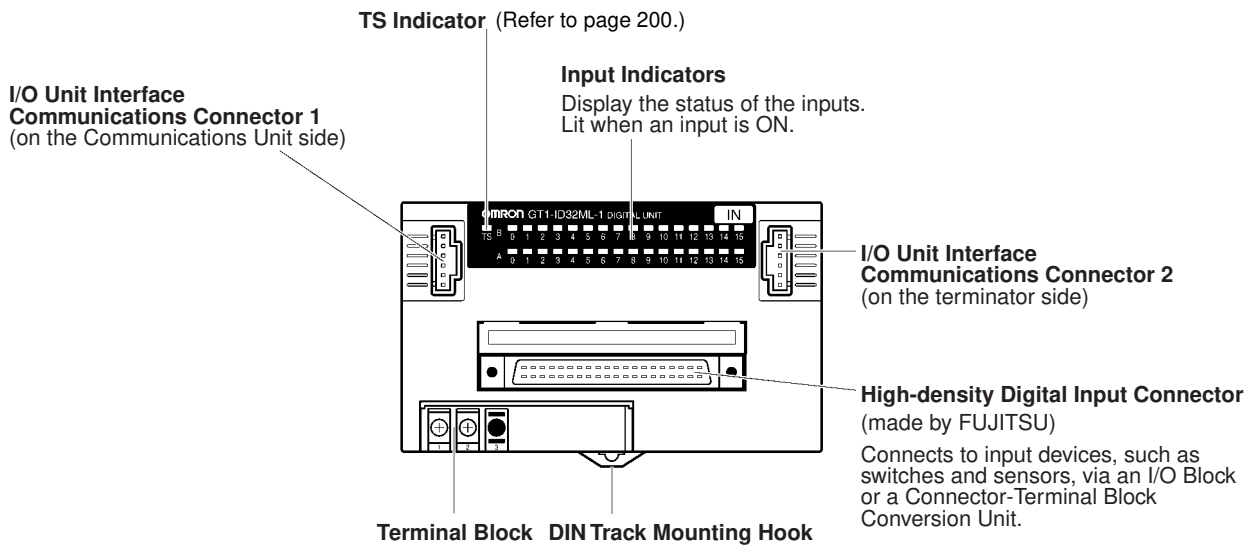
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-3-10 GT1-ID32ML-1 Transistor Input Unit with High-density Connector (PNP)

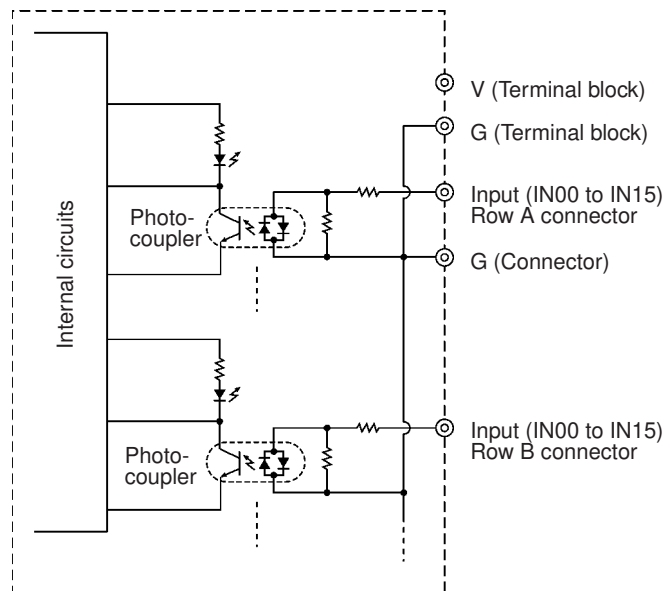
#### Input Specifications

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

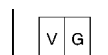
#### Components



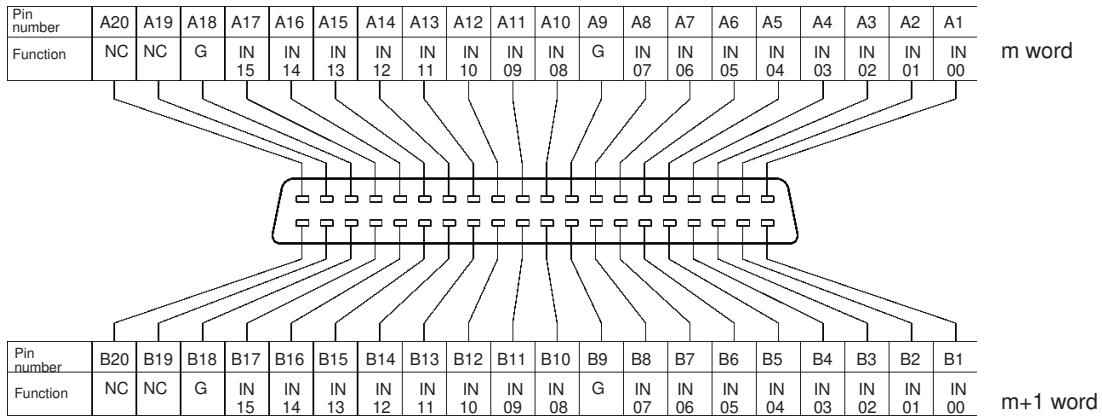
#### Internal Circuits



#### Terminal Arrangement



Connector Pin Arrangement



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 on 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

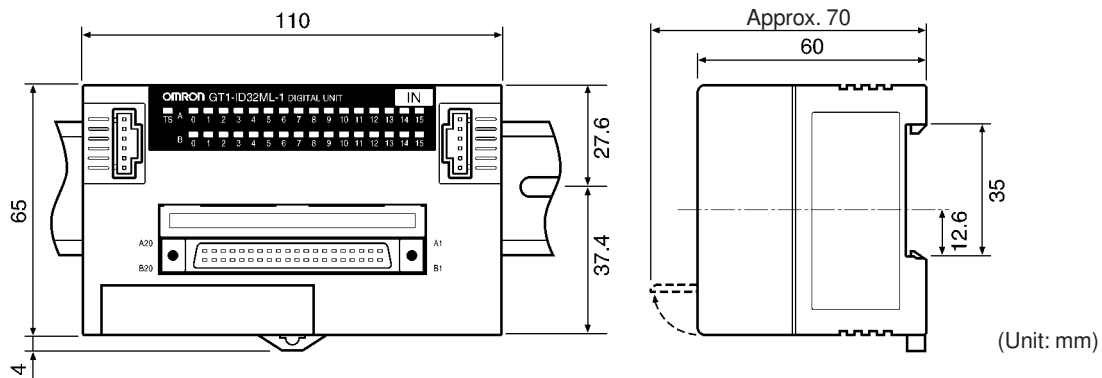
Cables with Connectors

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



**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.

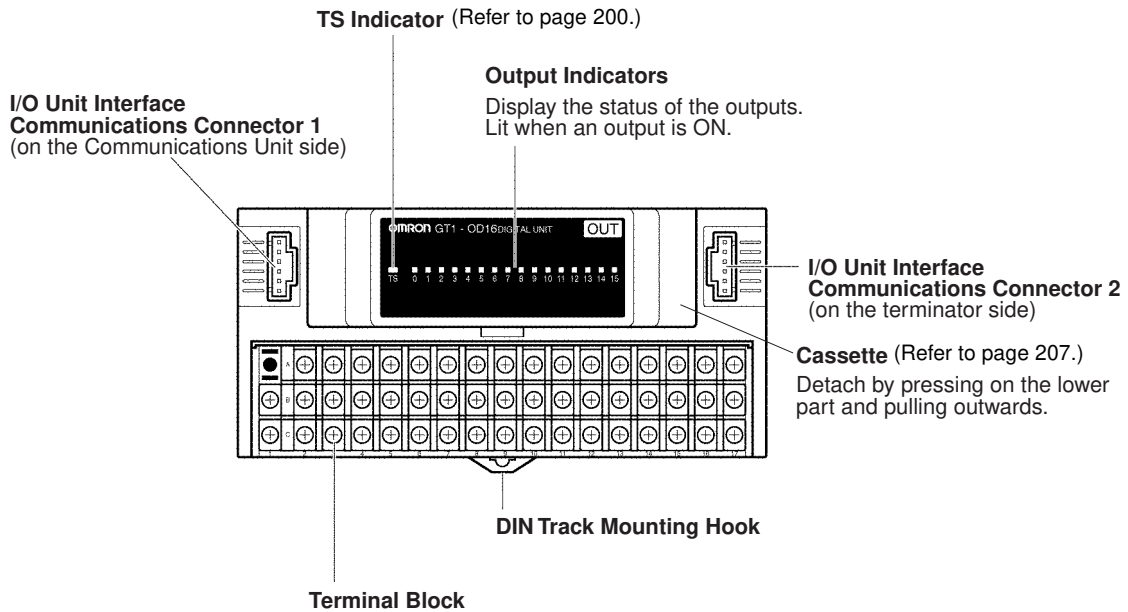
## 4-4 Transistor Output Units

### 4-4-1 GT1-OD16 Transistor Output Unit with Terminal Block (NPN)

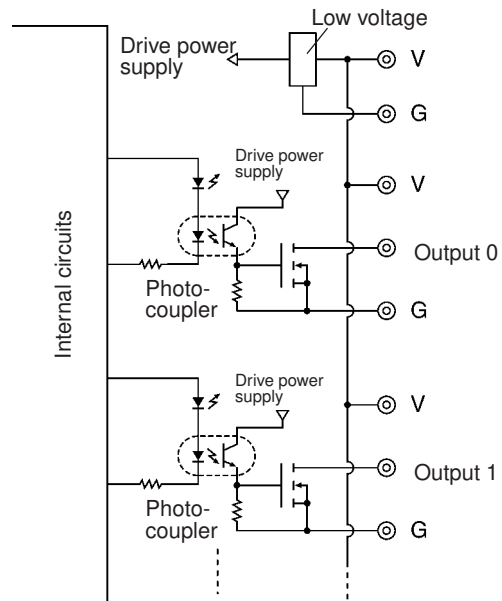
#### Output Specifications

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

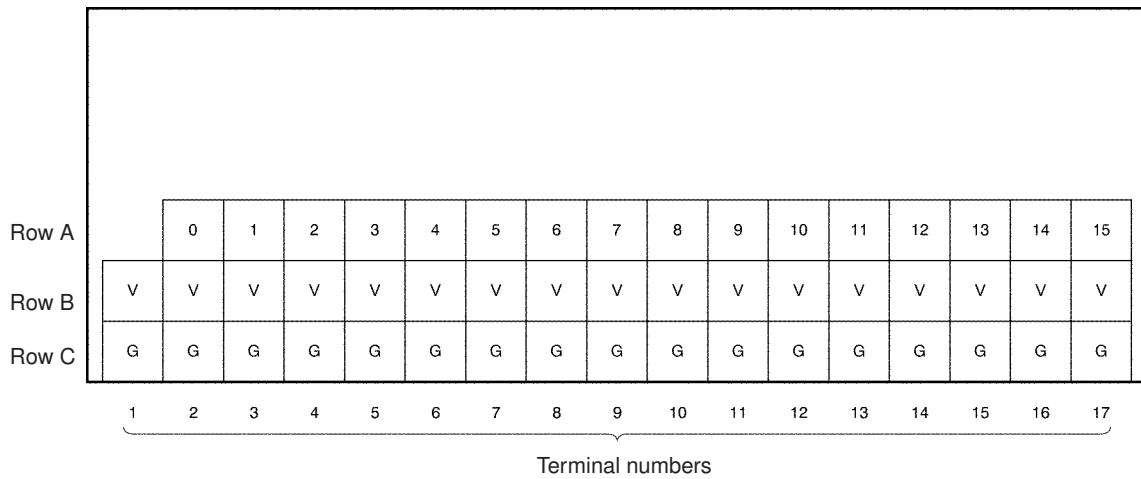
#### Components



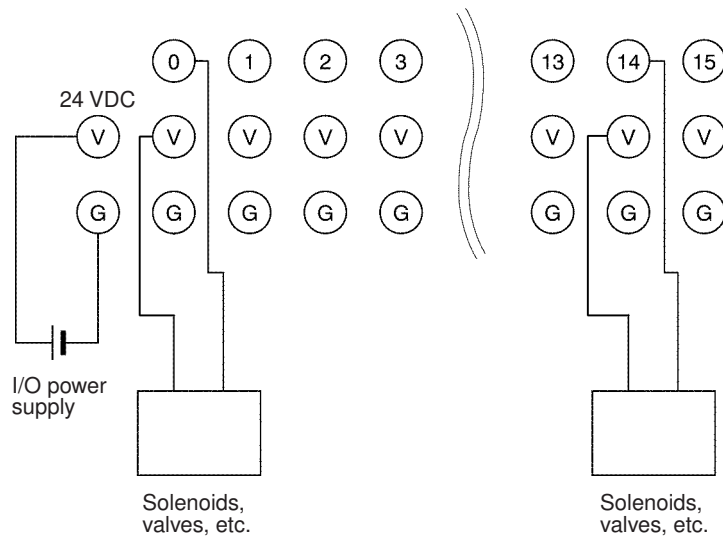
#### Internal Circuits



Terminal Arrangement

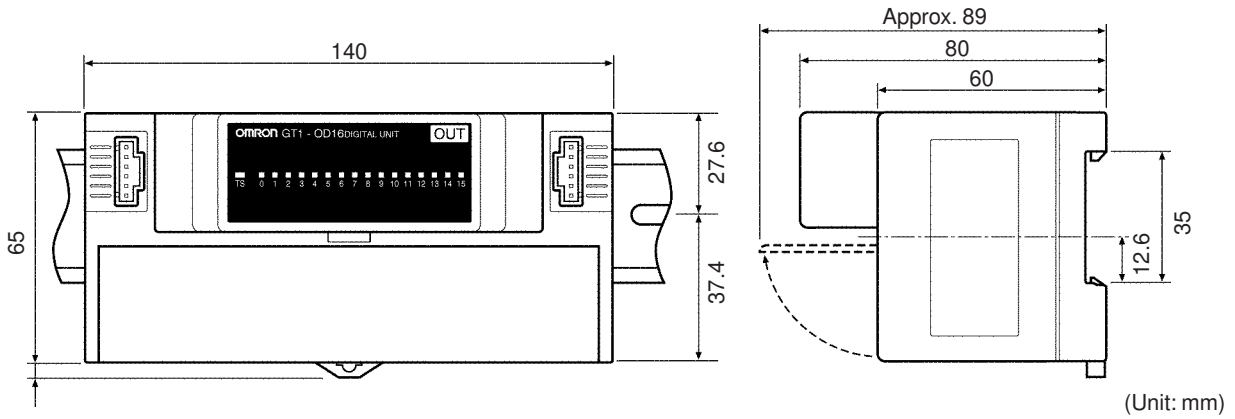


Wiring



**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



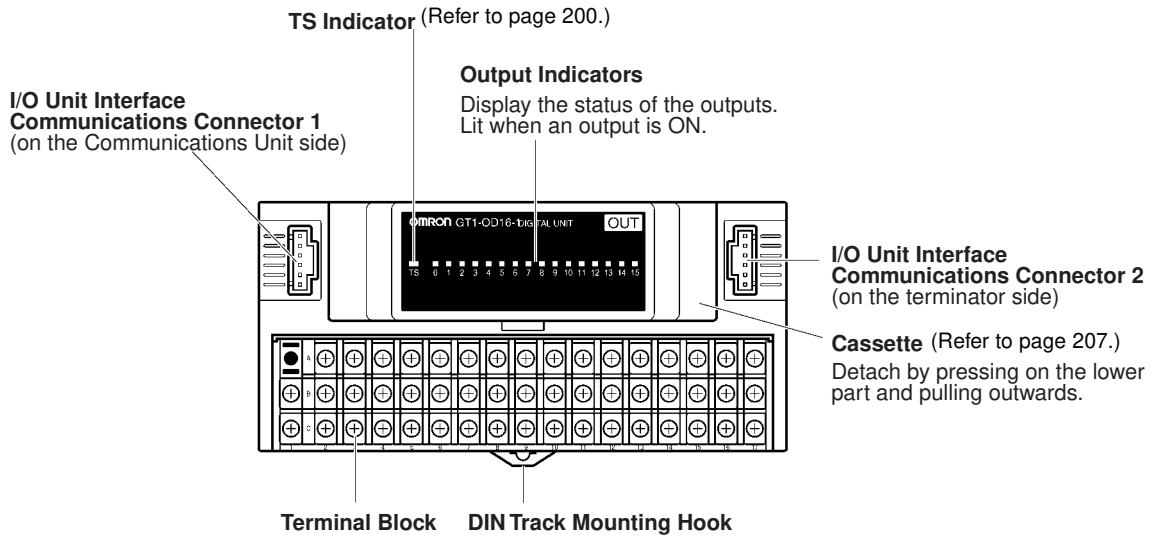
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

4-4-2 GT1-OD16-1 Transistor Output Unit with Terminal Block (PNP)

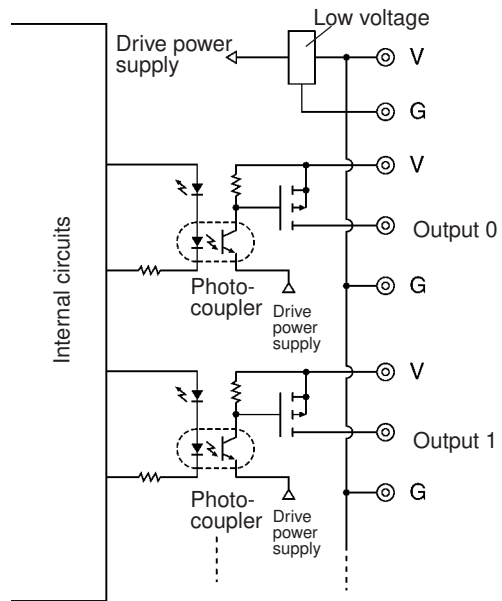
Output Specifications

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

Components



Internal Circuits



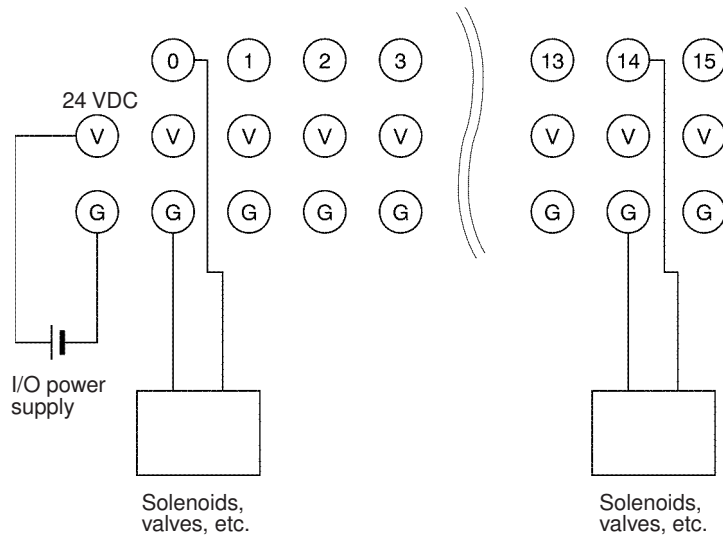
Terminal Arrangement

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
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Terminal numbers

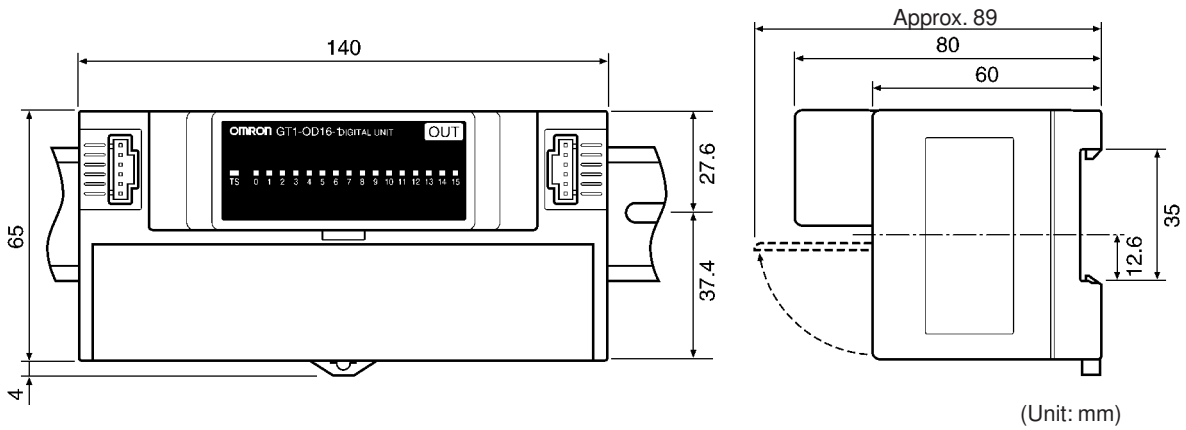


Wiring



**Note** V terminals and G terminals are 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



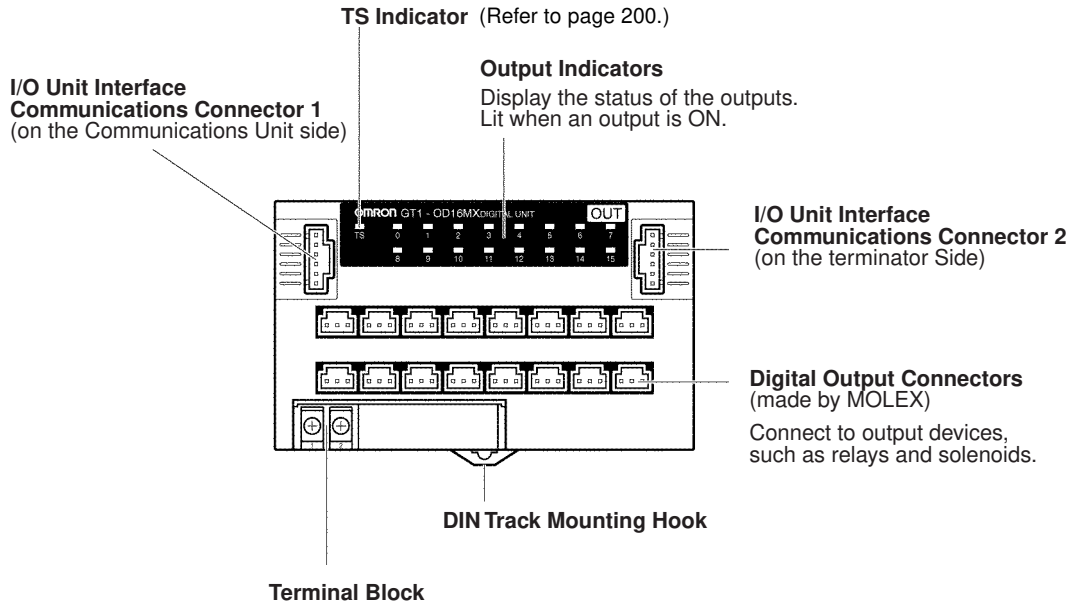
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-4-3 GT1-OD16MX Transistor Output Unit with Connector (NPN)

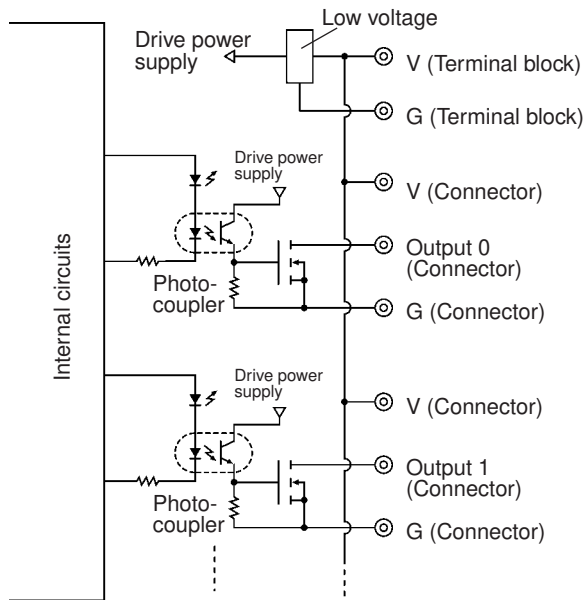
#### Output Specifications

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

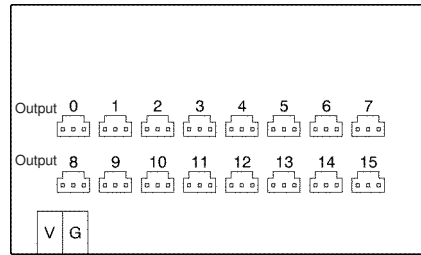
#### Components



#### Internal Circuits

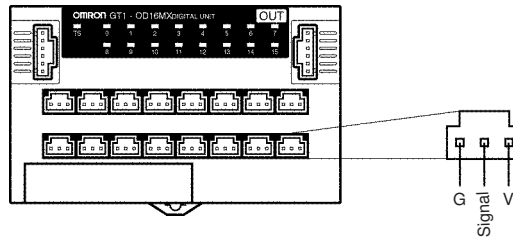


Terminal Arrangement



Connector Pin Arrangement

The following diagram shows the pin arrangement for the connector.



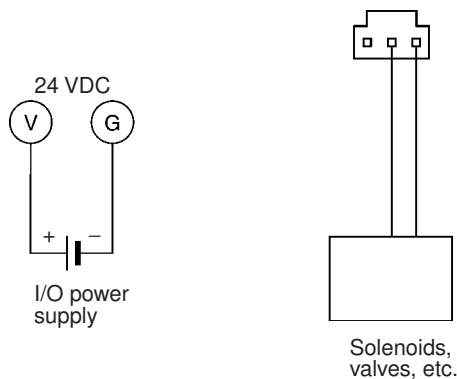
Wiring

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

Applicable Connectors

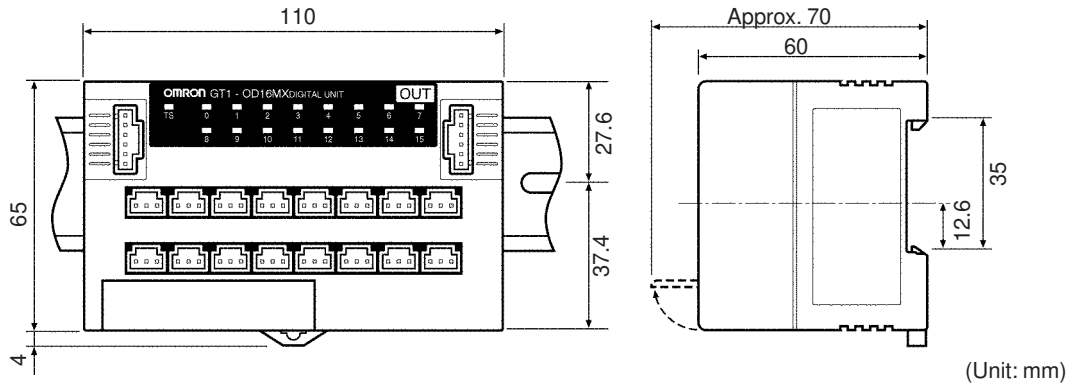
Manufacturer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
		Crimp	Housing	50-57-9403
	Crimp	Reeled contacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
		Loose contacts	16-02-0096	For AWG#24 to 30
			16-02-0102	For AWG#22 to 24
	Crimping tool		570-36-5000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

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



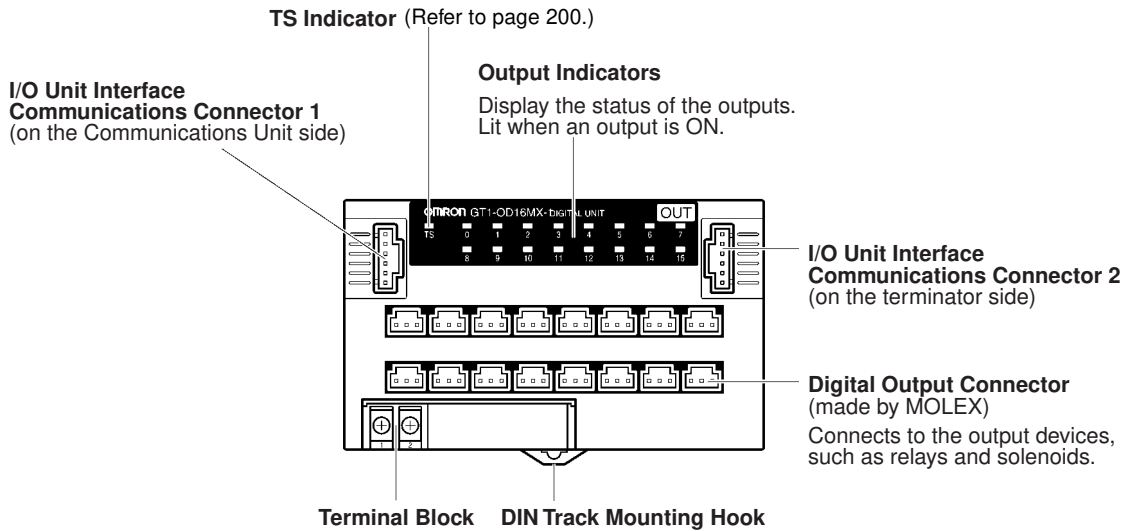
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

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

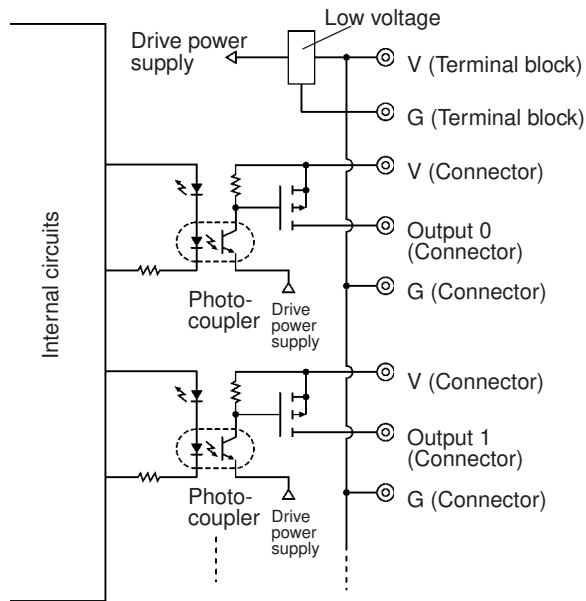
Output Specifications

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

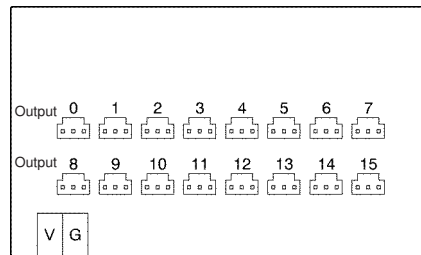
Components



Internal Circuits

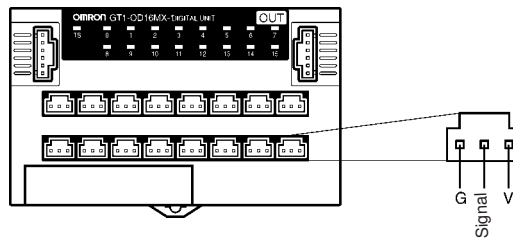


Terminal Arrangement



Connector Pin Arrangement

The following diagram shows the pin arrangement for the connector.



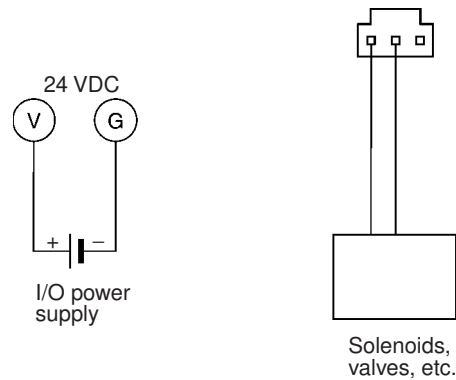
Wiring

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

Applicable Connectors

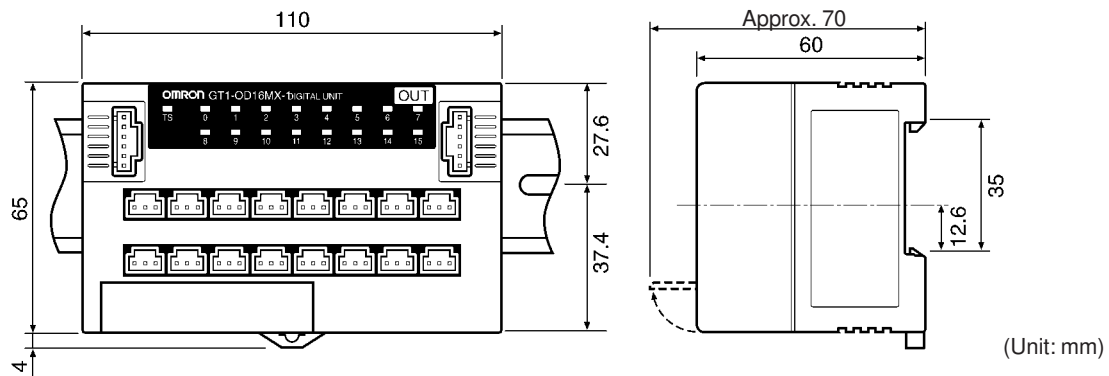
Manufacturer	Connector	Model number	Remarks	
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
		Crimp	Housing	50-57-9403
	Loose contacts	Reeled contacts	16-02-0069	For AWG#24 to 30
			16-02-0086	For AWG#22 to 24
			16-02-0096	For AWG#24 to 30
	Crimping tool		16-02-0102	For AWG#22 to 24
			570-36-5000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



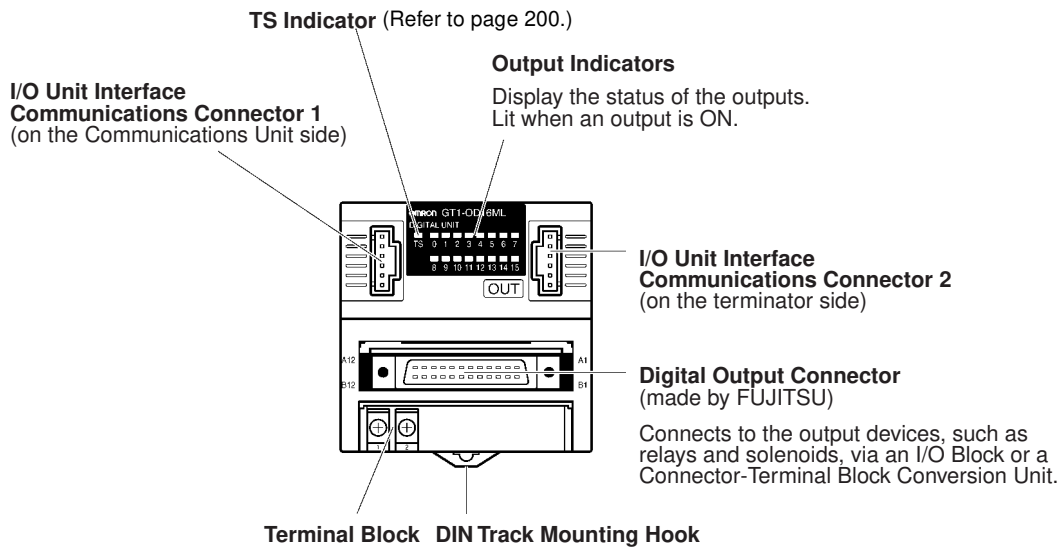
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-4-5 GT1-OD16ML Transistor Output Unit with Connector (NPN)

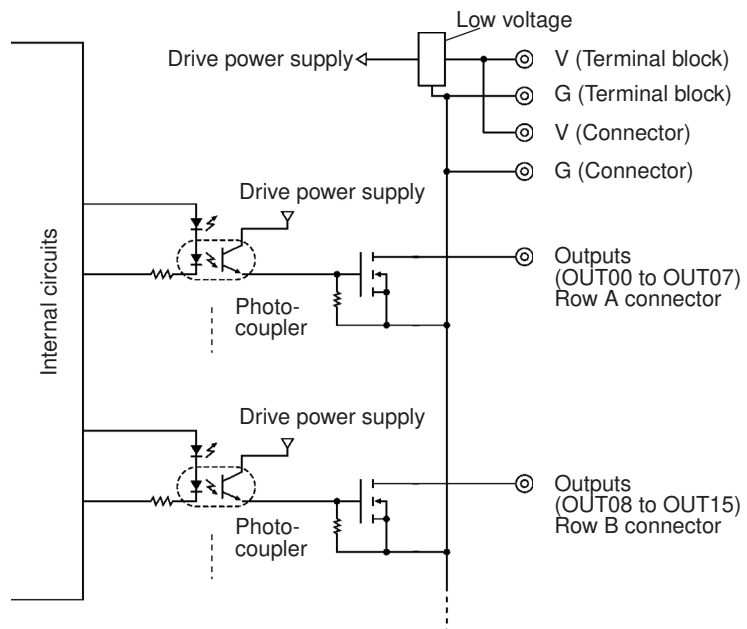
#### Output Specifications

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

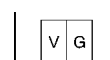
#### Components



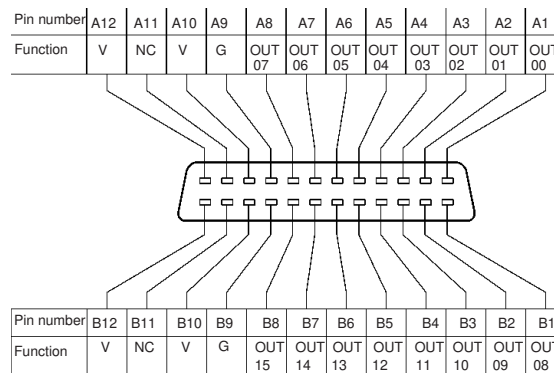
#### Internal Circuits



#### Terminal Arrangement



Connector Pin Arrangement



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

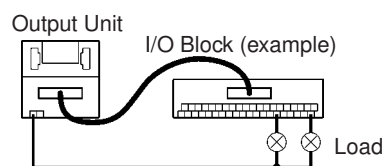
Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

**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.

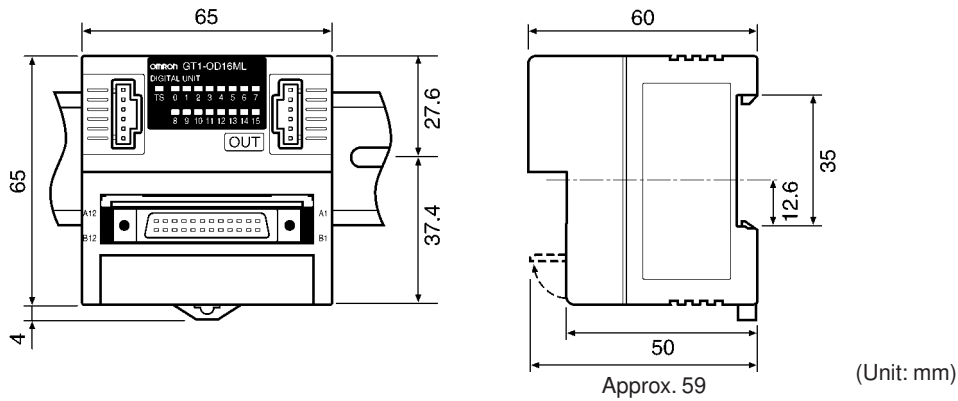
Manufacturer	Model number	Corresponding device
OMRON	XW2Z-□□□A	Connector-Terminal Block Conversion Unit XW2B-20G4 XW2B-20G5
	G79-□□□C	I/O Block G7TC-OC16 G70D-SOC16 G70D-FOM16 G70A-ZOC16-3 M7F

**Note** V terminals and G terminals are 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



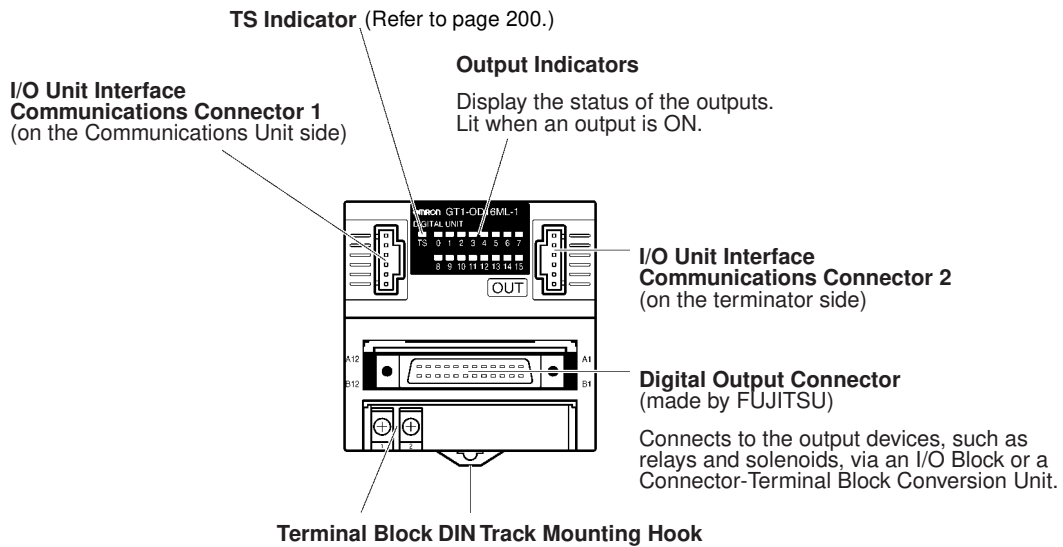
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

4-4-6 GT1-OD16ML-1 Transistor Output Unit with Connector (PNP)

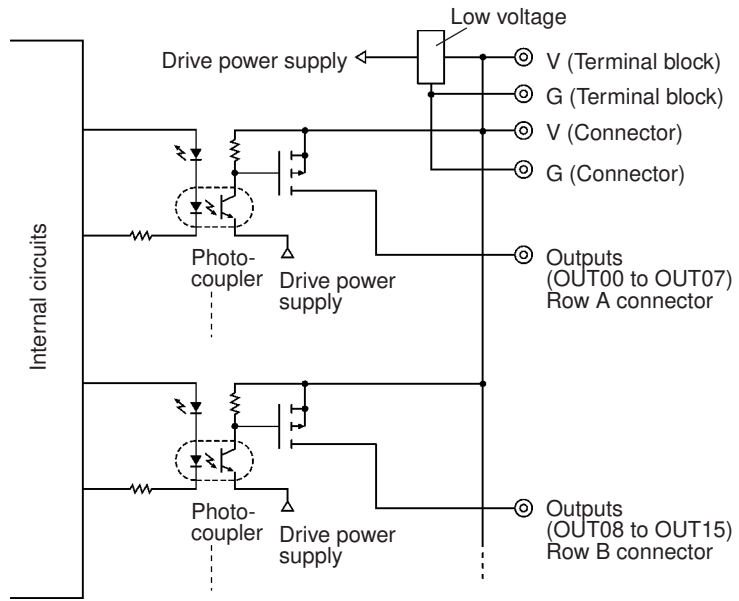
Output Specifications

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

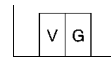
Components



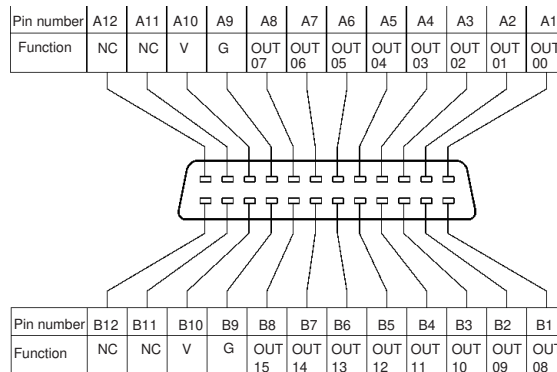
Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



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

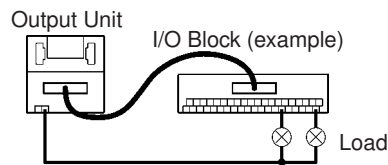
Manufacturer	Model number	Remarks
FUJITSU	FCN361J024-AU	Soldered
	FCN363J024-AU	Crimp
	FCN367J024-AU/F	Pressure-welded

**Connector Cables**

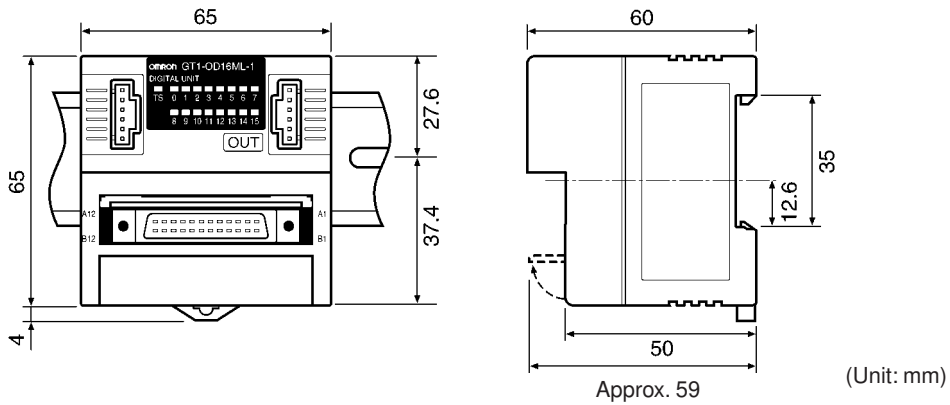
When a Transistor Output Unit (connector) is to be connected to an OMRON I/O Block or a Connector-Terminal Block Conversion Unit, use the cables (sold separately) listed in the following table.

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**



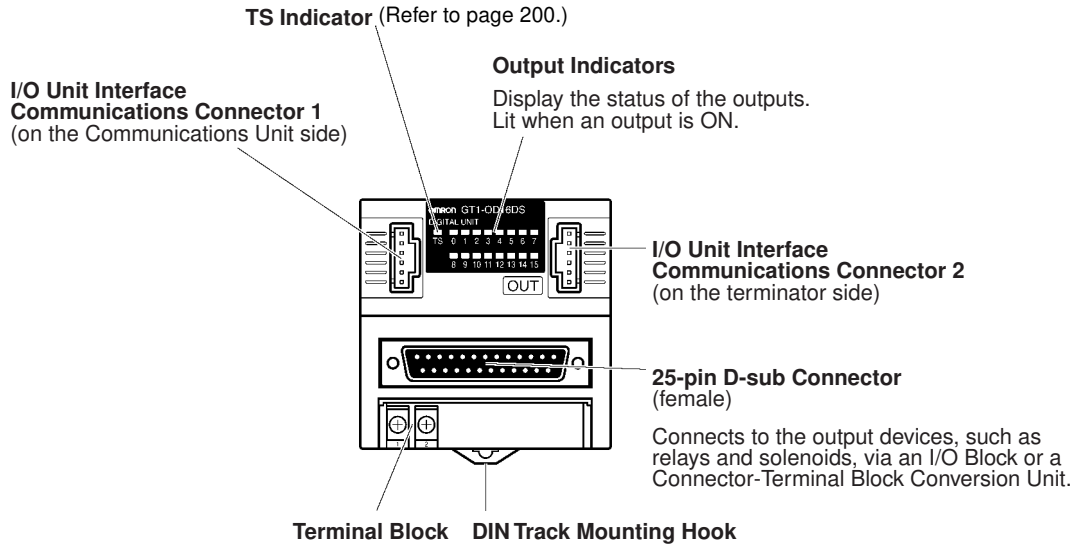
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-4-7 GT1-OD16DS Transistor Output Unit with Connector (NPN)

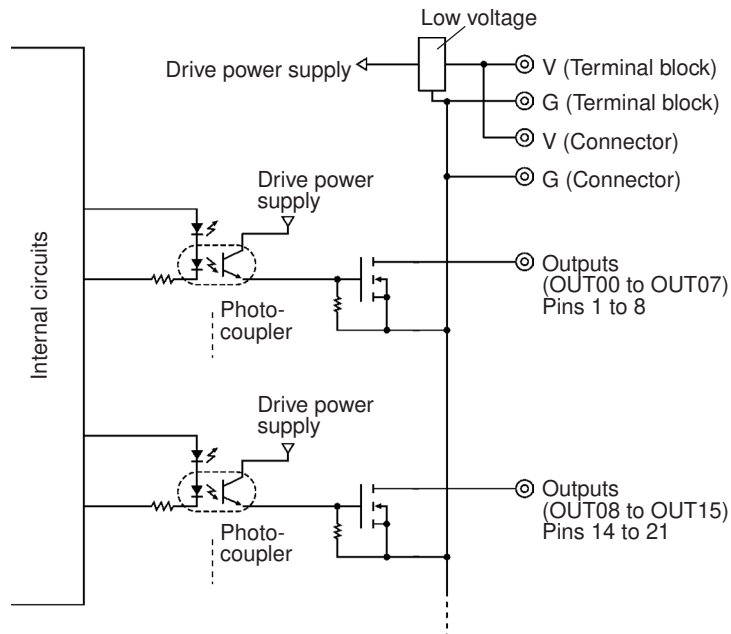
Output Specifications

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

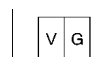
Components



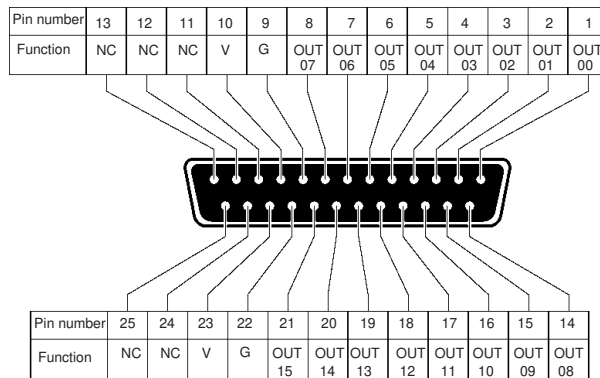
Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



Wiring

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

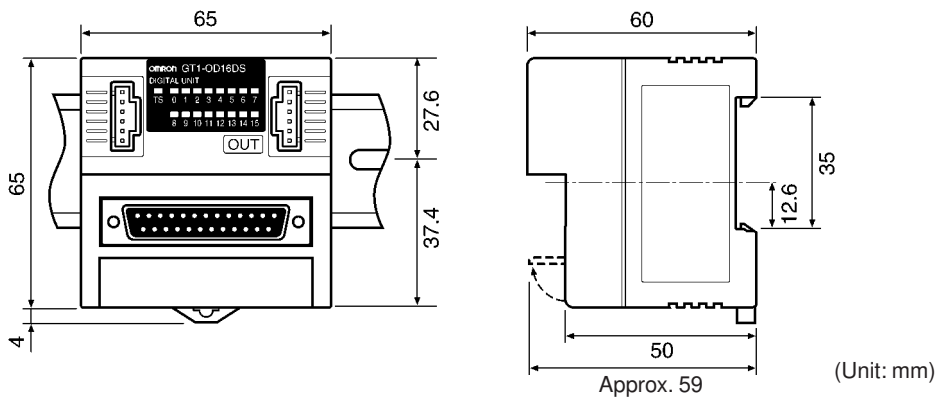
**Applicable Connectors**

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



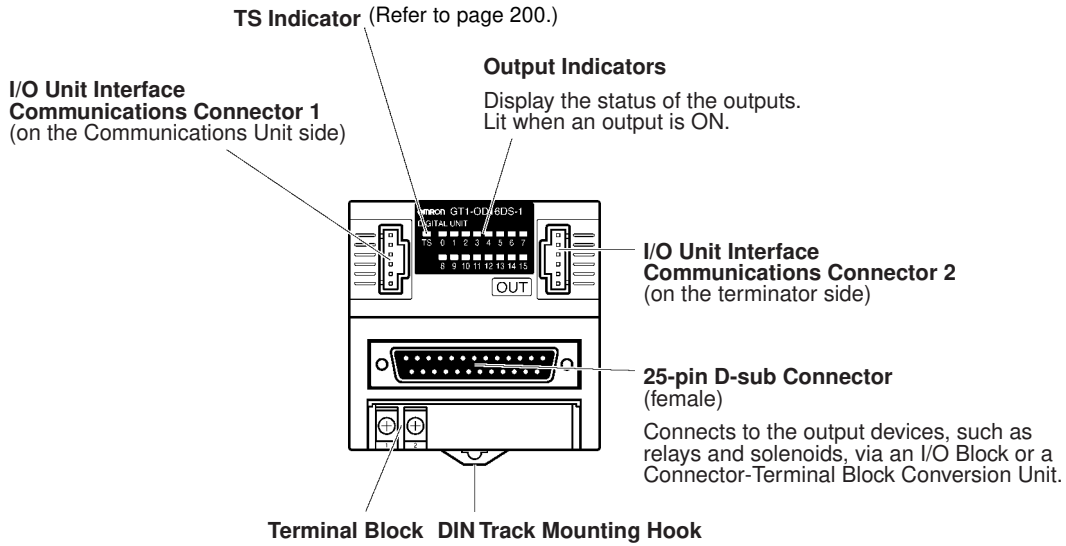
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-4-8 GT1-OD16DS-1 Transistor Output Unit with Connector (PNP)

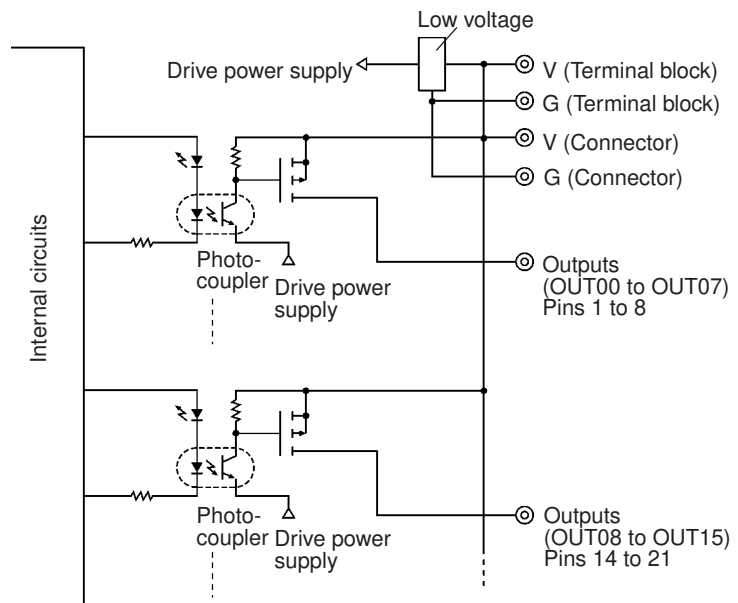
Output Specifications

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

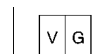
Components



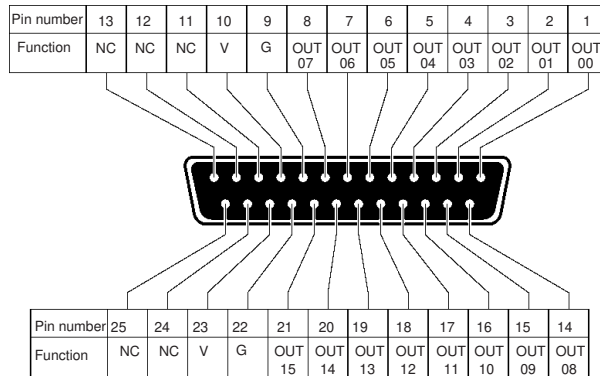
Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



Wiring

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

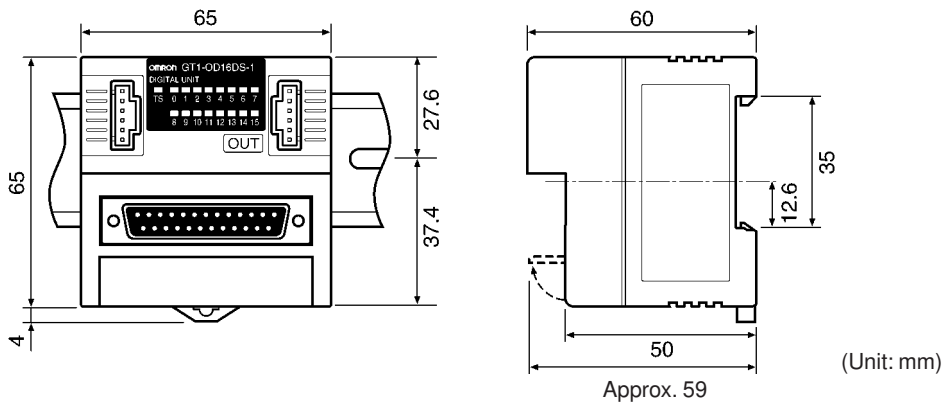
**Applicable Connectors**

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



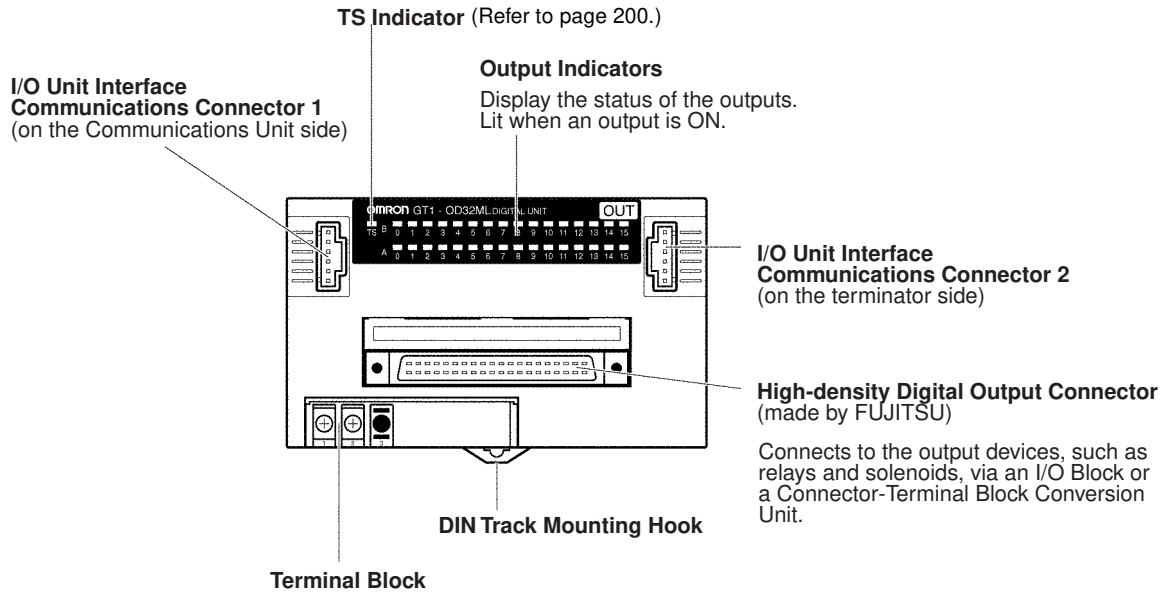
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

### 4-4-9 GT1-OD32ML Transistor Output Unit with High-density Connector (NPN)

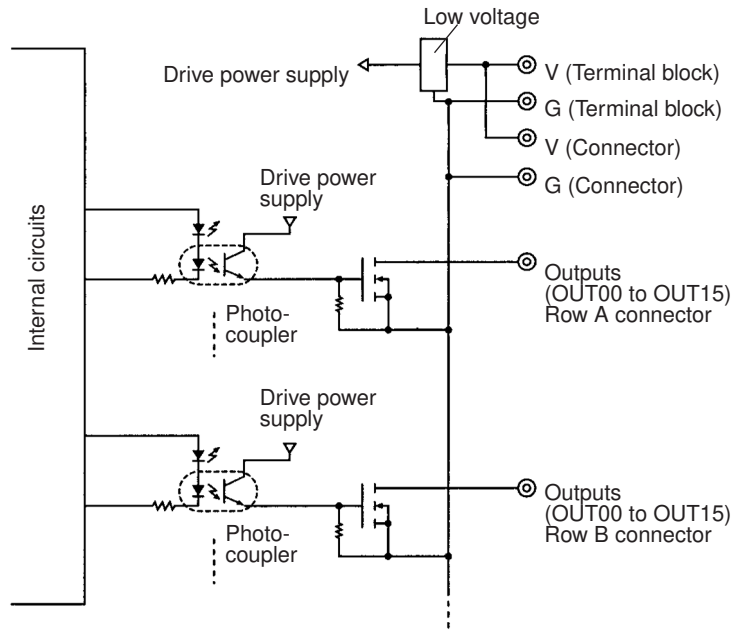
Output Specifications

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

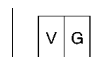
Components



Internal Circuits

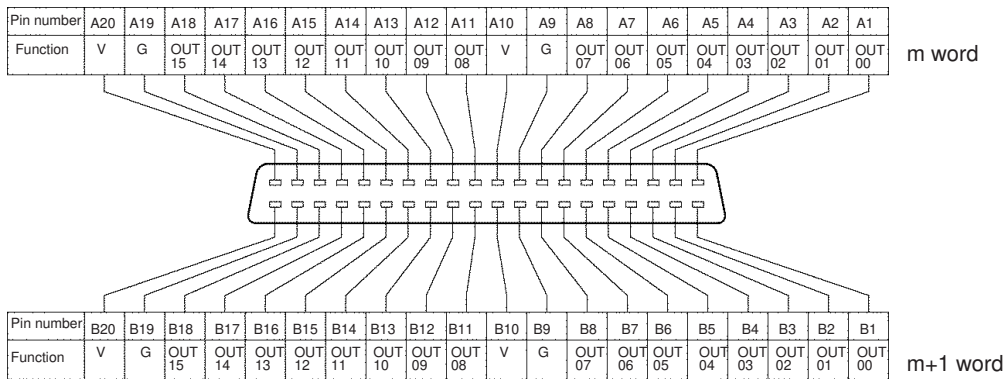


Terminal Arrangement





Connector Pin Arrangement



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

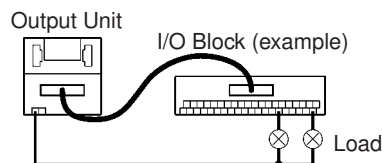
Manufacturer	Model number	Remarks
FUJITSU	FCN361J040-AU	Soldered
	FCN363J040-AU	Crimp
	FCN367J040-AU/F	Pressure-welded

**Connector Cables**

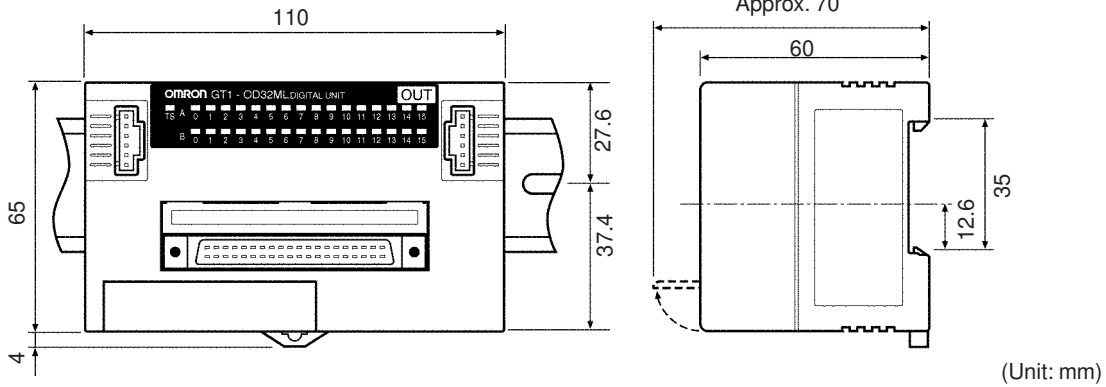
When a Transistor Output Unit (high-density connector) is to be connected to an OMRON I/O Block or a Connector-Terminal Block Conversion Unit, use the cables (sold separately) listed in the following table.

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



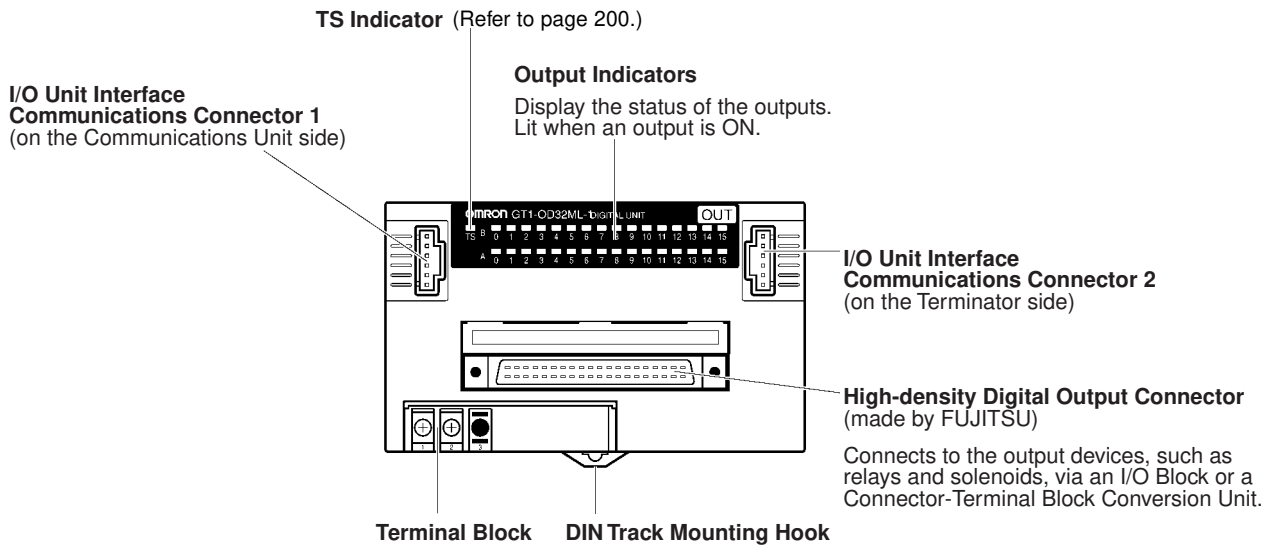
**Note** The vertical center of the Unit is 4.9 mm lower than the center of the DIN track. The Unit therefore extends downward 41.4 mm (including the mounting hook) from the DIN track center.

**4-4-10 GT1-OD32ML-1 Transistor Output Unit with High-density Connector (PNP)**

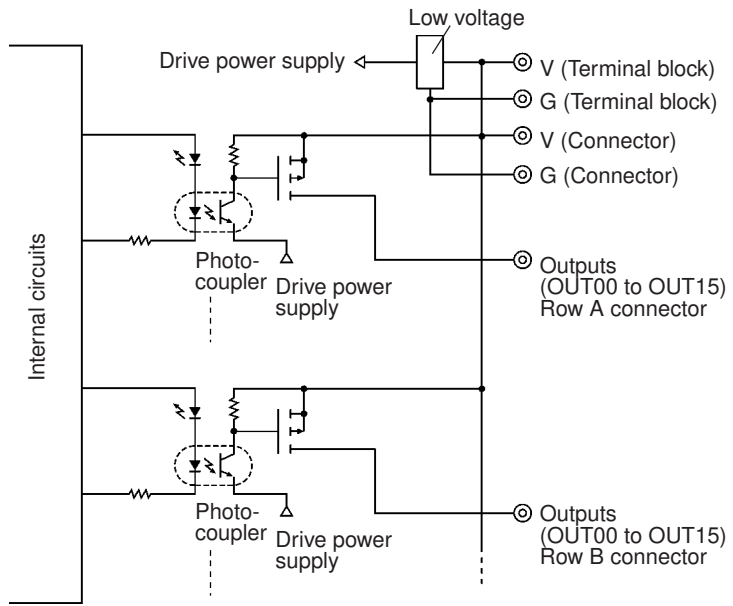
Output Specifications

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

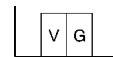
Components



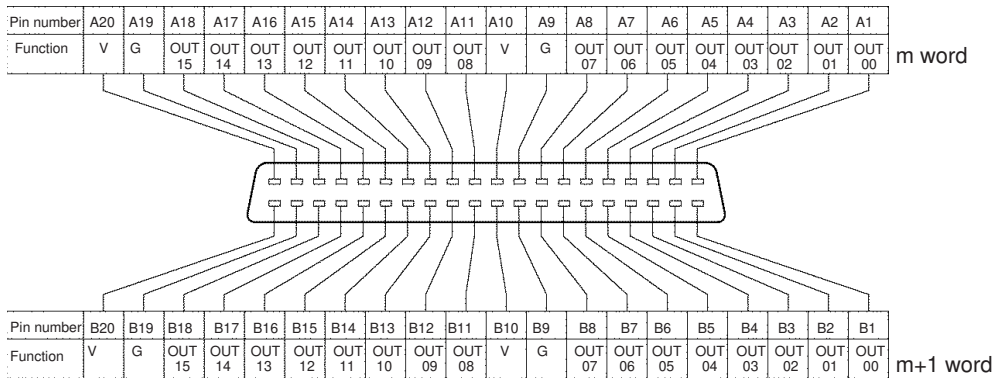
Internal Circuits



Terminal Arrangement



Connector Pin Arrangement



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

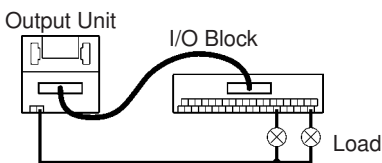
Manufacturer	Model number	Remarks
FUJITSU	FCN361J040-AU	Soldered
	FCN363J040-AU	Crimp
	FCN367J040-AU/F	Pressure-welded

**Connector Cables**

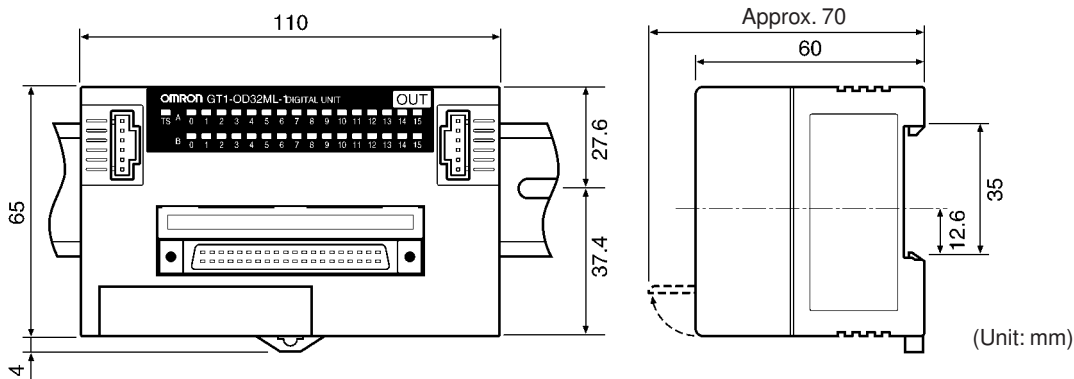
When a Transistor Output Unit (high-density connector) is to be connected to an OMRON I/O Block or a Connector-Terminal Block Conversion Unit, use the cables (sold separately) listed in the following table.

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.

## 4-5 Relay Output Units

### 4-5-1 GT1-ROP08 Relay Output Unit with Power Relay

#### Output Specifications

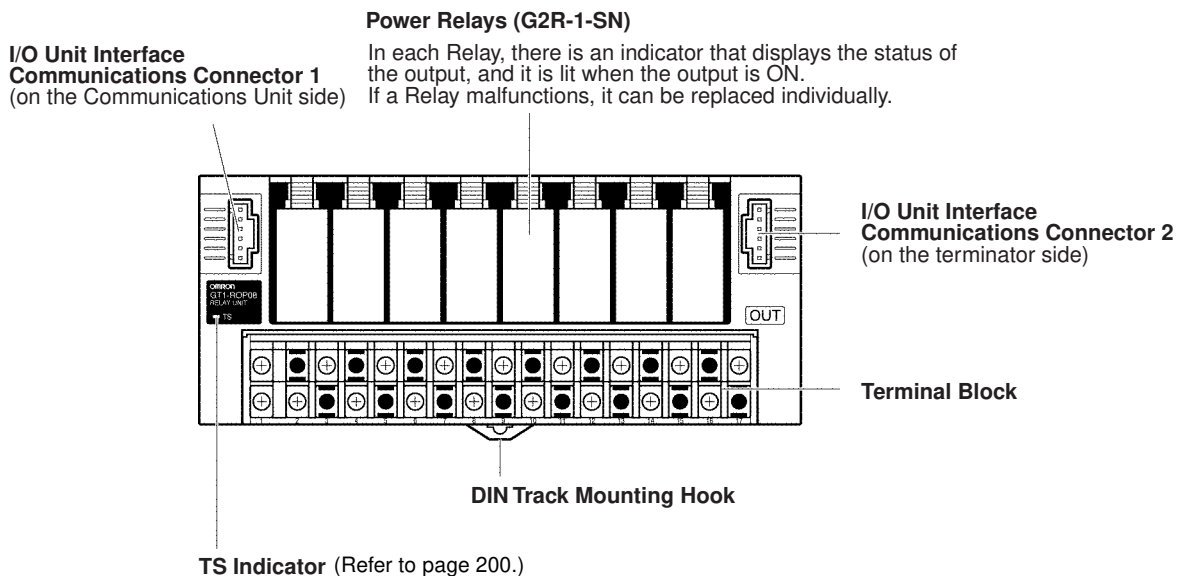
Item	Specifications
Number of outputs	8 points
Relay	Power Relay (G2R-1-SN)
Rated load (resistive load)	5 A at 250 VAC/5 A at 30 VDC
Rated thermal current	5 A
Maximum switching voltage	250 VAC/125 VDC
Maximum switching current	5 A
Minimum permissible load	100 mA at 5 VDC (P level reference value)
Insulation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

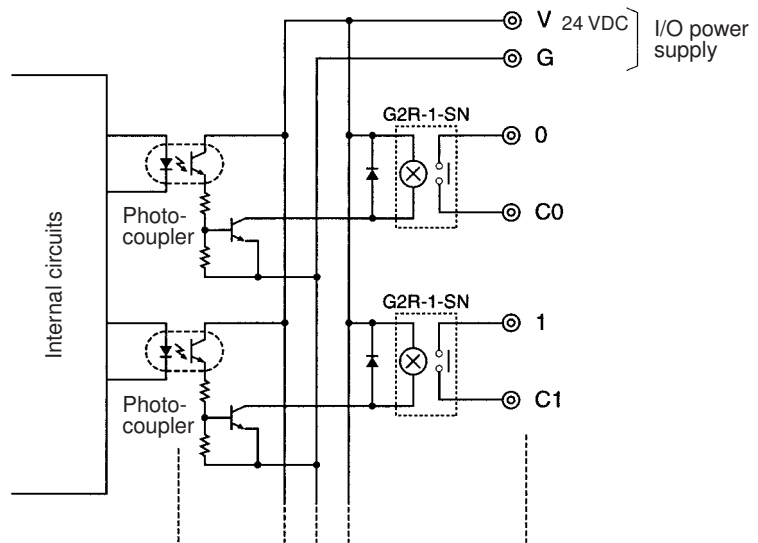
Item	Number of operations	Notes
Mechanical life expectancy	20,000,000 operations min.	Switching frequency: 18,000 times/hour (At ambient temperature 23°C with rated load)
Electrical life expectancy	100,000 operations min.	Switching frequency: 1,800 times/hour (At ambient temperature 23°C with rated load)

#### Components

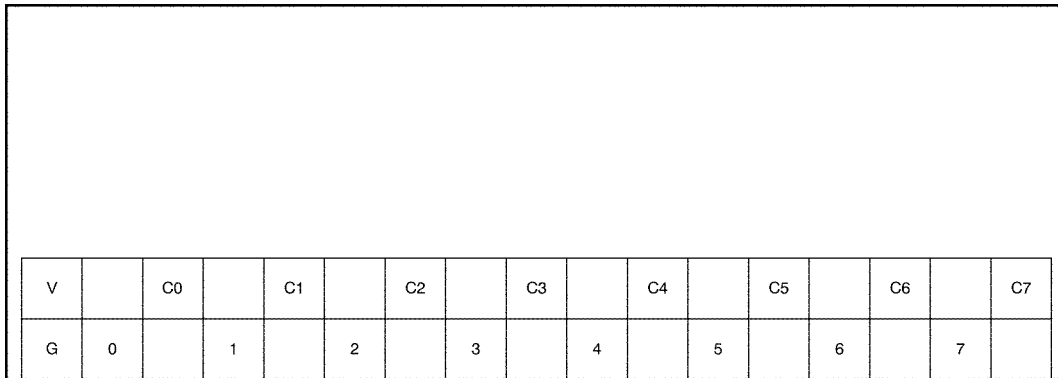


**Note** For details on how to replace Relays, refer to page 206.

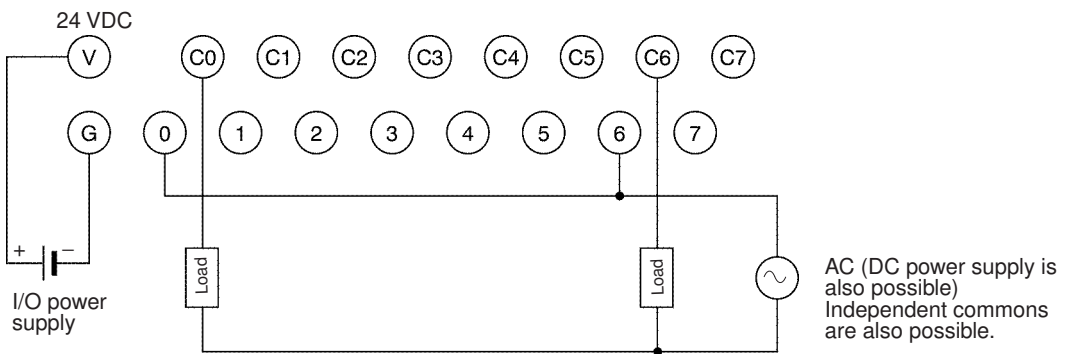
Internal Circuits



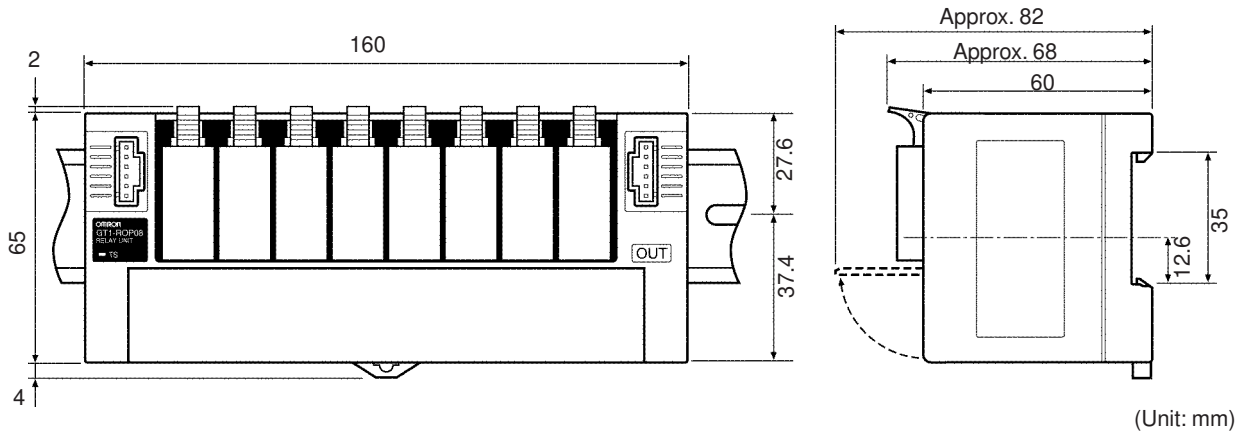
Terminal Arrangement



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.

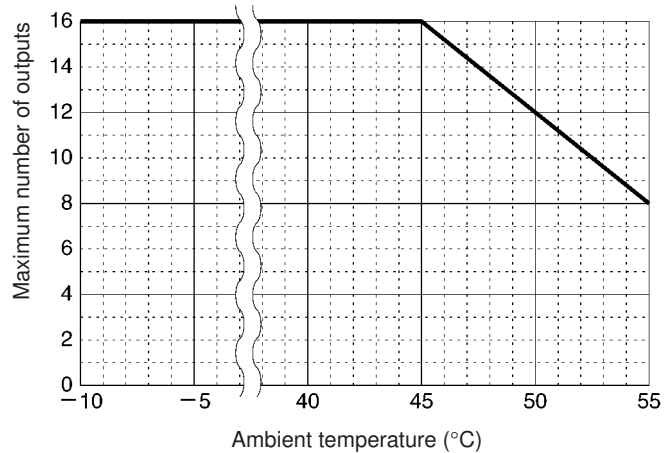
4-5-2 GT1-ROS16 Relay Output Unit with Miniature Relay

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

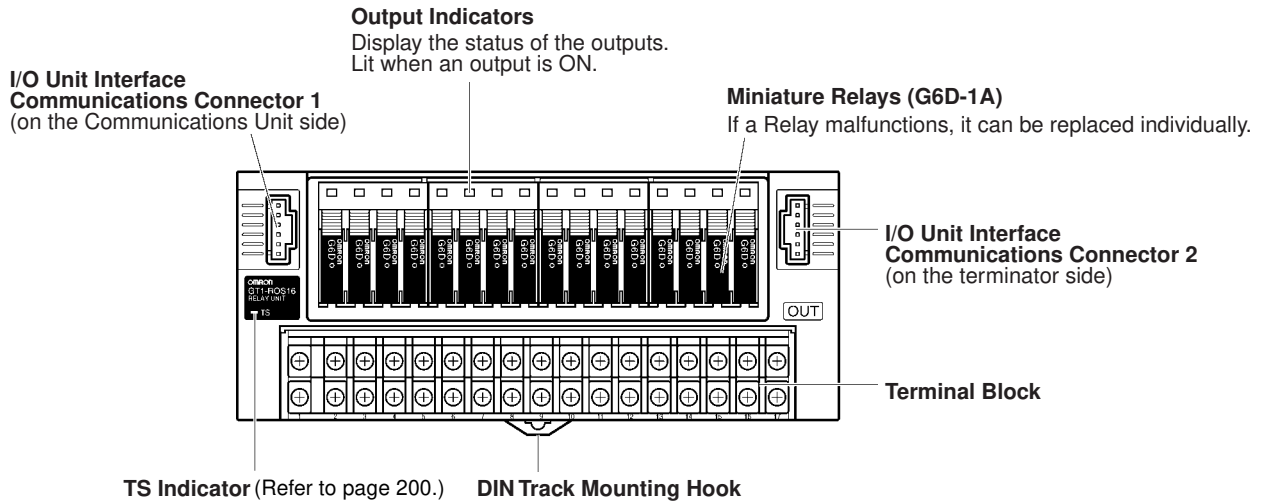
For details about the Relay characteristics, refer to G6D-1A in the *PCB Relays Catalog (X033)*. The following table shows how the number of outputs that can be ON simultaneously varies with the ambient temperature.



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

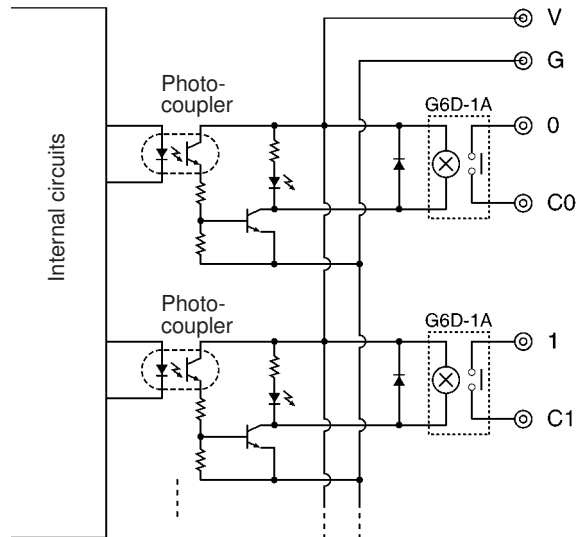
Item	Number of operations	Notes
Mechanical life expectancy	20,000,000 operations min.	Switching frequency: 18,000 times/hour (At ambient temperature 23°C with rated load)
Electrical life expectancy	100,000 operations min.	Switching frequency: 1,800 times/hour (At ambient temperature 23°C with rated load)

**Components**



**Note** For details on how to replace Relays, refer to page 206.

**Internal Circuits**

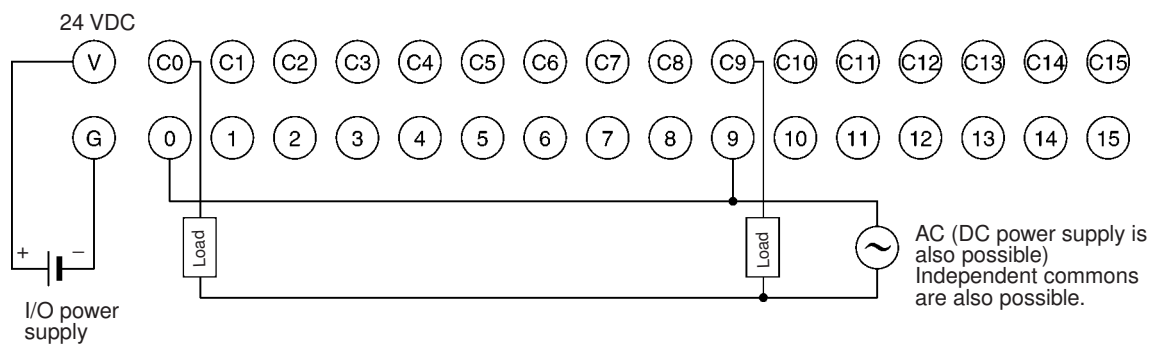




Terminal Arrangement

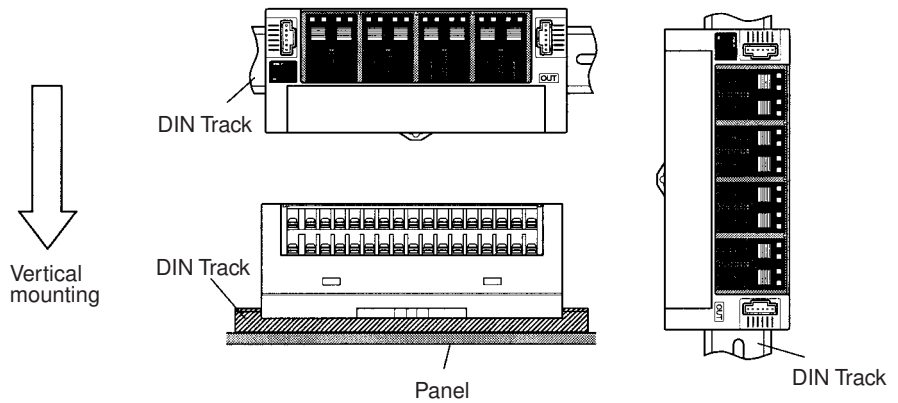
V	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
G	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Wiring

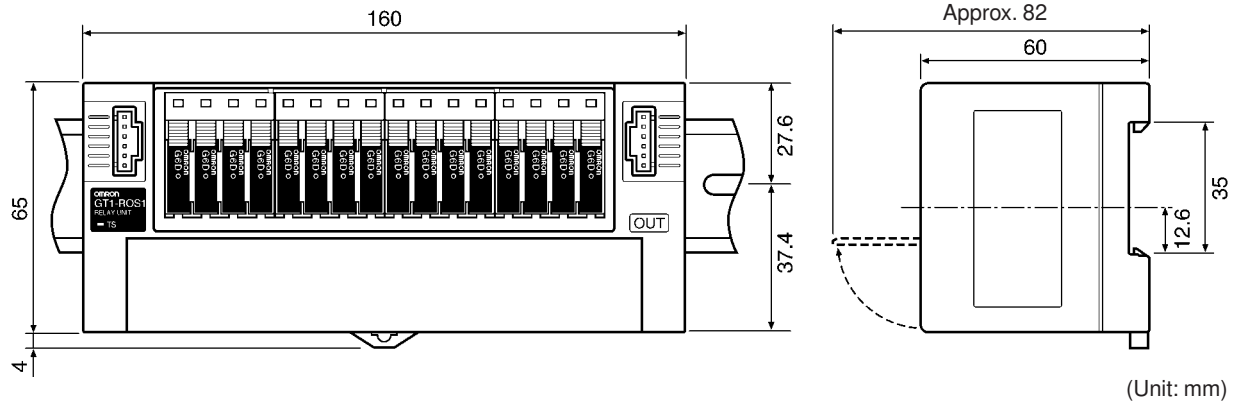


Mounting

Be sure to mount the Unit in one of the directions shown in the following diagram. If the Unit is not mounted correctly, there is a risk that the service life will be reduced.



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 5 Special I/O Unit Specifications

This section provides the specifications for Special I/O Units, including the Analog Input Unit, the Analog Output Unit, the Temperature Input Unit, and the Counter Unit. Setting procedures for a Configurator are also provided.

5-1	Analog Input Units . . . . .	98
5-1-1	GT1-AD04 . . . . .	98
5-1-2	GT1-AD08MX . . . . .	106
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## 5-1 Analog Input Units

### 5-1-1 GT1-AD04

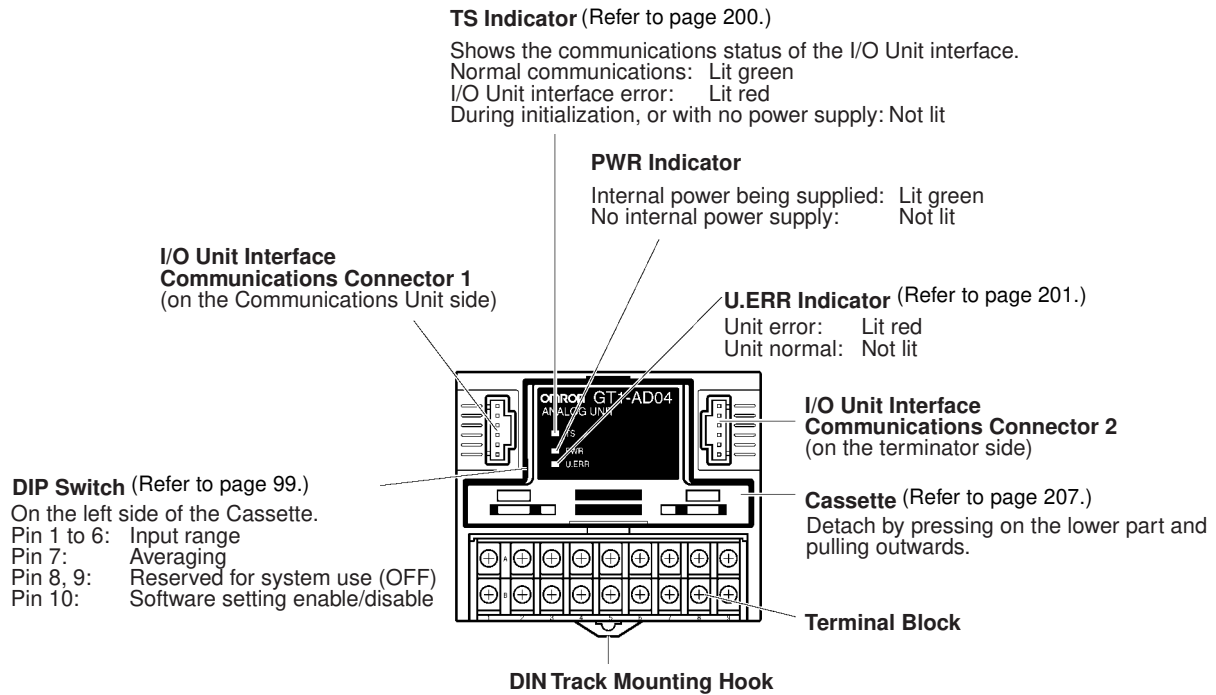
#### General Specifications

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 20 A max., pulse width 1 ms max.)
Current consumption (I/O Unit interface)		50 mA max.
Noise immunity		$\pm 2000$ V (IEC61000-4-4 via fast transient noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup>
Shock resistance		200 m/s <sup>2</sup>
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
Weight		Approx. 220 g

#### Characteristics

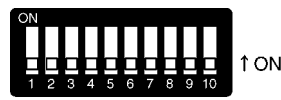
Item	Specification	
	Voltage inputs	Current inputs
Input signal range	0 to 5 V, 1 to 5 V, 0 to 10 V, or -10 to 10 V	0 to 20 mA or 4 to 20 mA
Max. signal input	$\pm 15$ V	$\pm 30$ mA
Input impedance	1 M $\Omega$ min.	Approx. 250 $\Omega$
Resolution	1/6000 (FS)	
Accuracy	25°C	$\pm 0.3\%$ FS
	-10°C to 55°C	$\pm 0.6\%$ 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.



- Input range Operation specifications
- Averaging
  - Software setting enable/disable

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 page 103)	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 using the Configurator is enabled. (see note 1)

- Note**
1. When setting the input range using a DeviceNet Configurator, use version 1.11 or later. (If pin 10 is ON, and a setting is made using the Configurator, the input ranges will all be 0 to 5 V.)
  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.

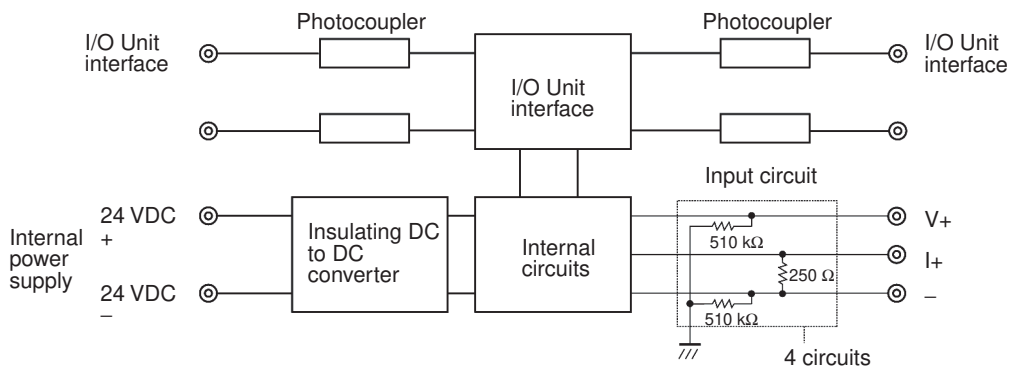
**Input Range Settings**

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

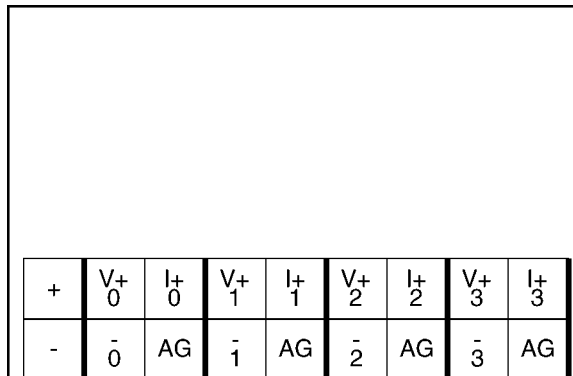
Pin 1	Pin 2	Pin 3	Input range for inputs 0 and 1
Pin 4	Pin 5	Pin 6	Input range for inputs 2 and 3
OFF	OFF	OFF	0 to 5 V
ON	OFF	OFF	1 to 5 V
OFF	ON	OFF	0 to 10 V
ON	ON	OFF	-10 to 10 V
OFF	OFF	ON	4 to 20 mA
ON	OFF	ON	0 to 20 mA
Other than the above			Cannot be set

**Note** If input range setting is performed using the Configurator (version 1.11 or later), it is possible to make the setting for each point.

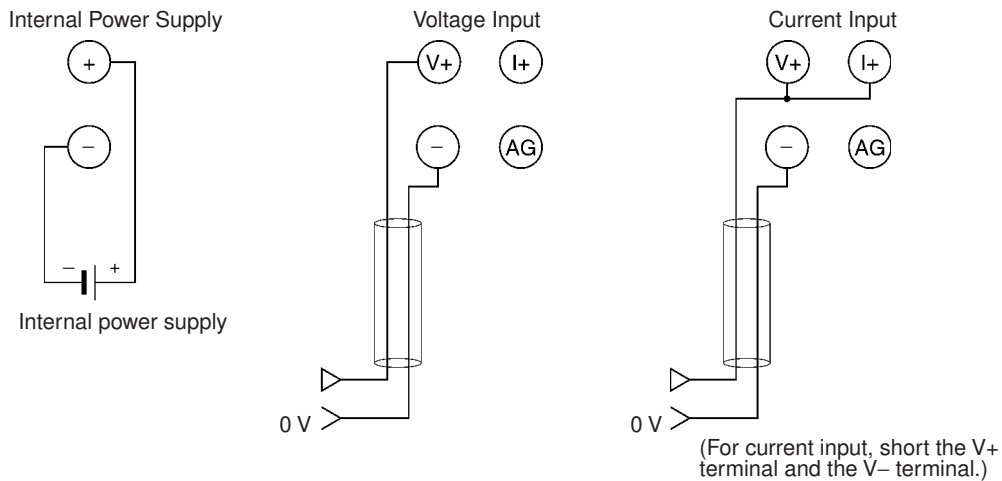
**Internal Circuits**



**Terminal Arrangement**



Wiring

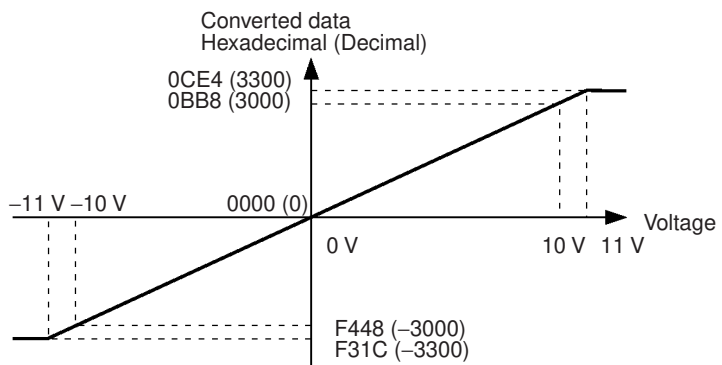


Input Ranges and Converted Data

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.

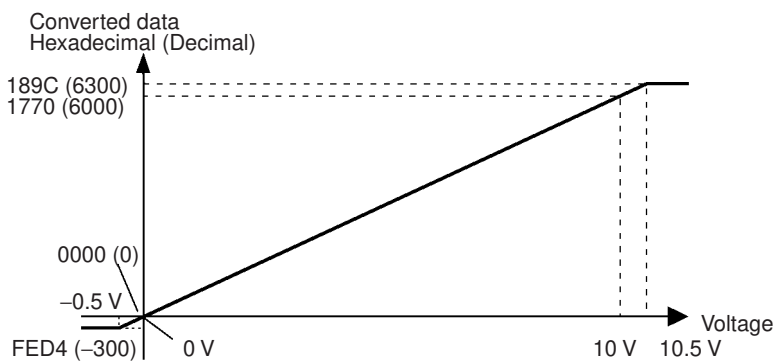
**-10 to 10 V**

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).



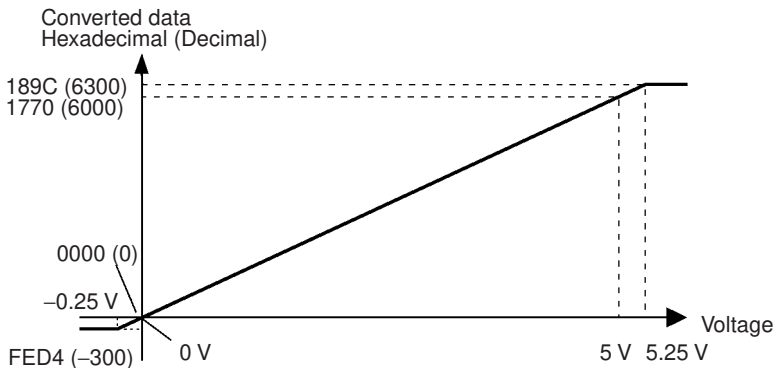
**0 to 10 V**

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).



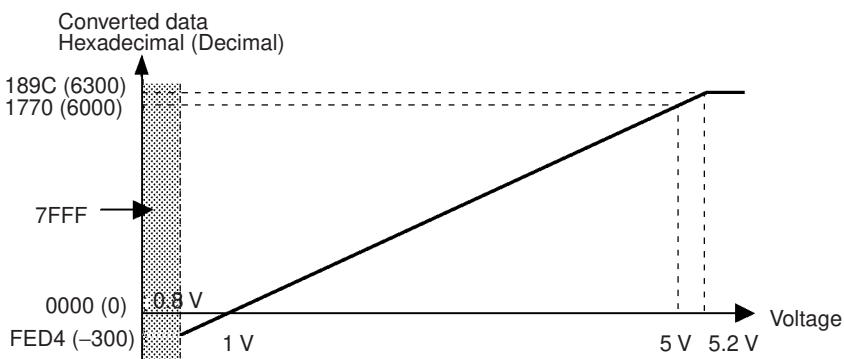
**0 to 5 V**

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).



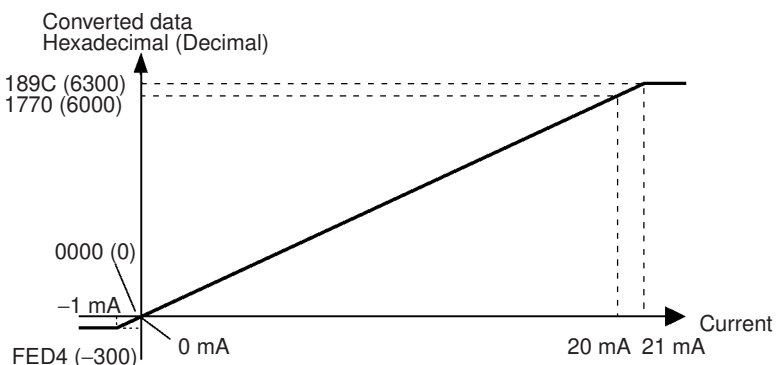
**1 to 5 V**

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**

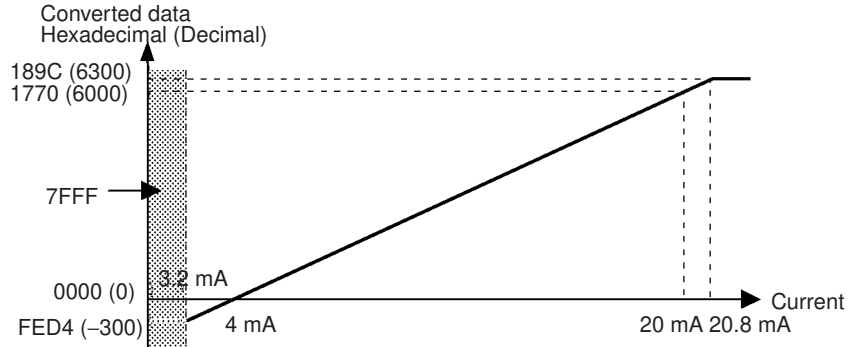
The 0- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 mA (0000 Hex).





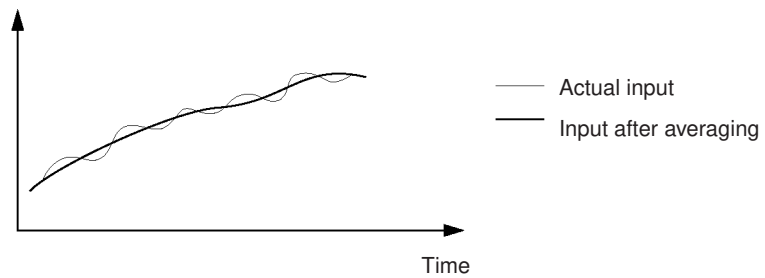
**4 to 20 mA**

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.

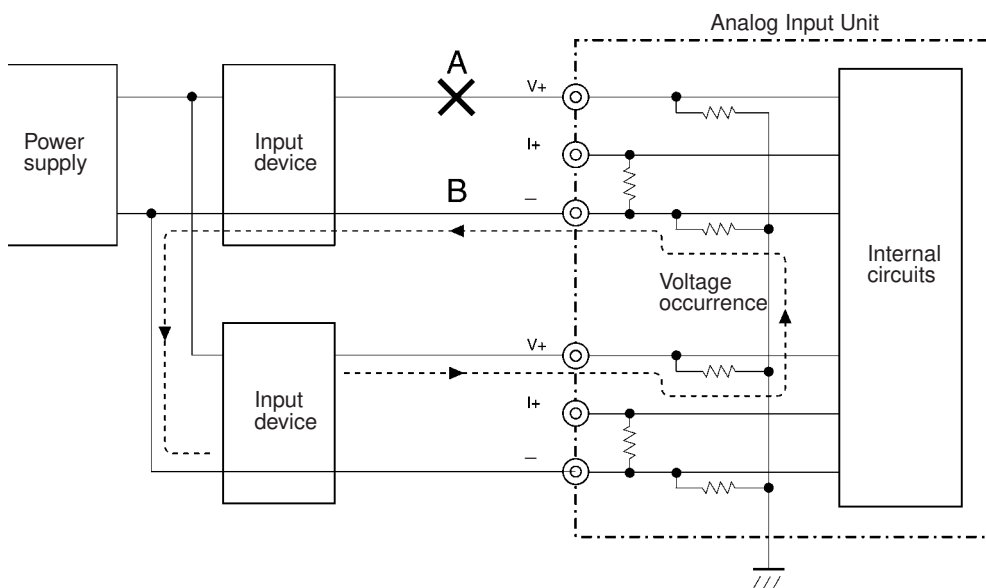
**Open-circuit Detection Function**

The open-circuit detection function is activated when the input range is set to 1 to 5 V and the voltage drops below 0.8 V, or when the input range is set to 4 to 20 mA and the current drops below 3.2 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**

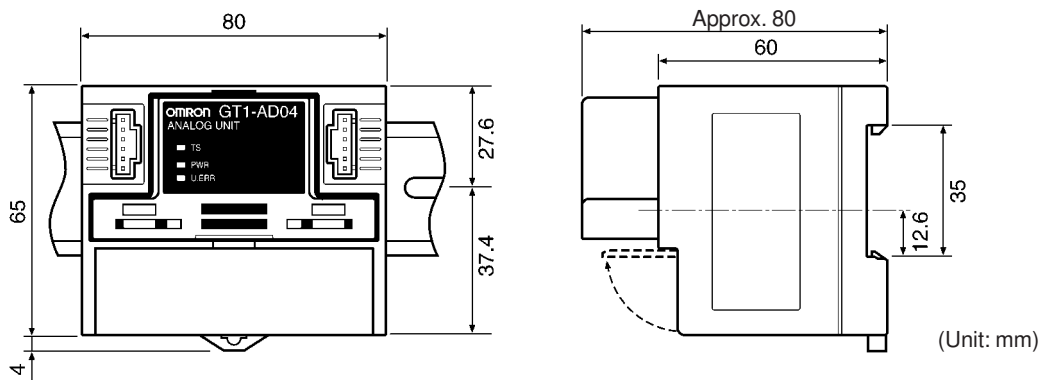
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit
First word	Input 0 converted data																
First word + 1	Input 1 converted data																
First word + 2	Input 2 converted data																
First word + 3	Input 3 converted data																

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.

## 5-1-2 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 <sup>+10%</sup> / <sub>-15%</sub> )
	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		±2000 V (IEC61000-4-4 via fast transient noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup>
Shock resistance		200 m/s <sup>2</sup>
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
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 200.)

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**

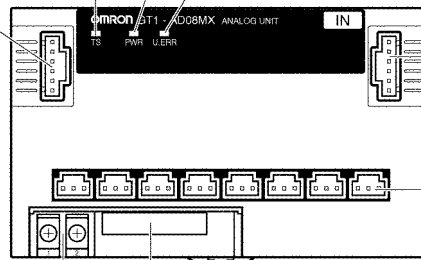
Internal power being supplied: Lit green  
 No internal power supply: Not lit

**U.ERR Indicator** (Refer to page 201.)

Unit error: Lit red  
 Unit normal: Not lit

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

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



**Analog Input Connectors**  
 (made by MOLEX)  
 Connect to analog input devices.

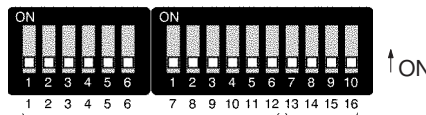
**DIP Switch** (Refer to page 107.)

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

**Internal Power Supply Terminals**

DIP Switch Settings

The following diagram shows the functions of the DIP switch.



Input range

Operation specifications

- Averaging
- Switching between 4 and 8 inputs.
- Software setting enable/disable

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 (refer to page 111)	OFF	No averaging is performed. (factory-set)
		ON	Averaging is performed.
14	8-point/4 inputs switching (refer to page 111)	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 using the Configurator (see note) is enabled.

**Note** When setting the input range using a DeviceNet Configurator, use version 1.11 or later. (If pin 16 is ON, and a setting is made using the Configurator, the input ranges will all be 0 to 5 V.)

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

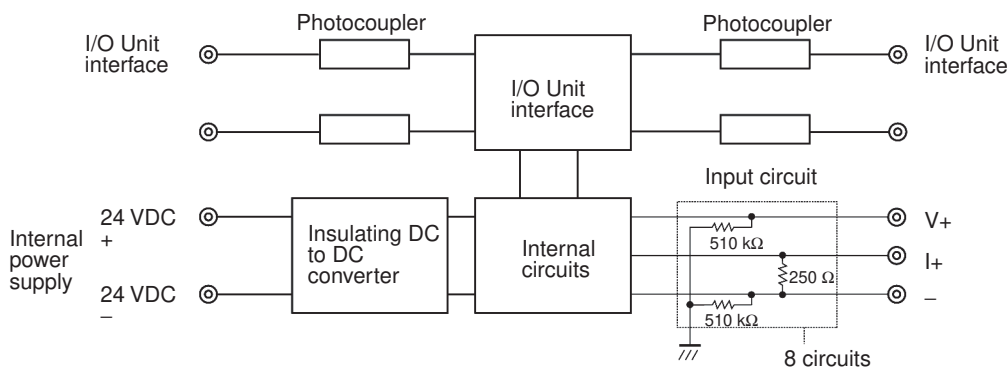
**Input Range Settings**

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

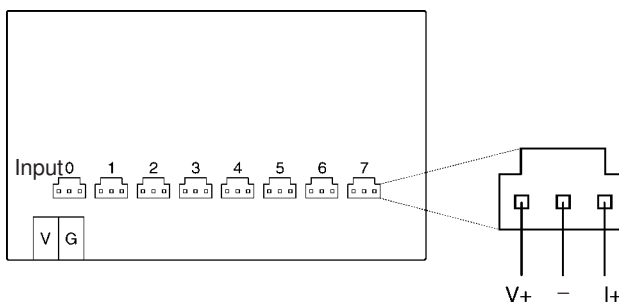
**Note** If input range setting is performed using the Configurator (version 1.11 or later), it is possible to make the setting for each point.

**Internal Circuits**



**Terminal/Connector Pin Arrangement**

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

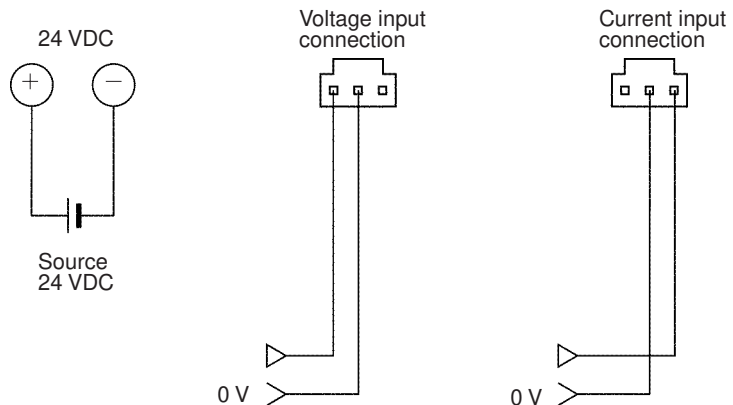


**Wiring**

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**

Manufacturer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
		Crimp	Housing	50-57-9403
	Crimp	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

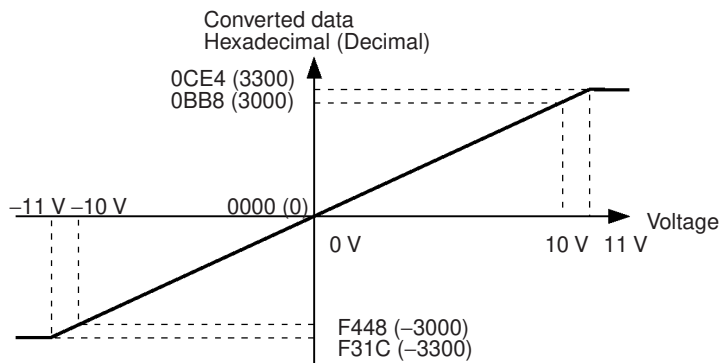


**Input Ranges and Converted Data**

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**

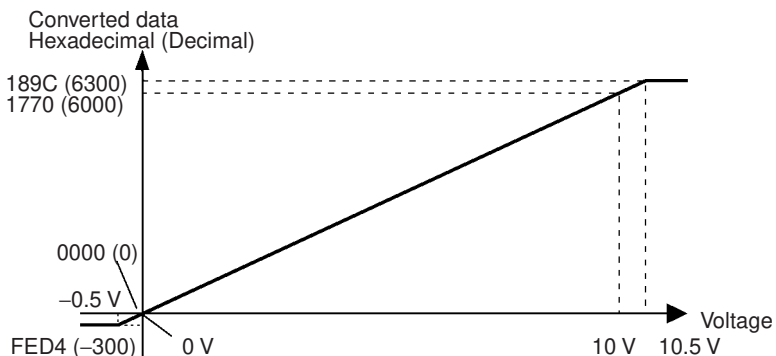
The -10- to 10-V range corresponds to the hexadecimal values F448 to 0BB8 (-3000 to 3000). The entire data range is F31C to 0CE4 (-3300 to 3300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 V (0000 Hex).



**0 to 10 V**

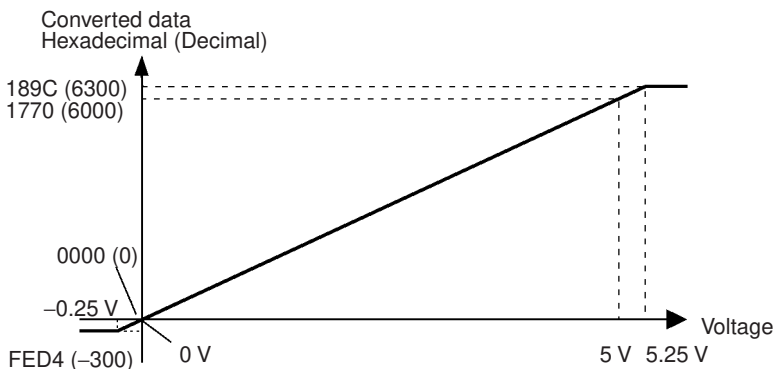
The 0- to 10-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative

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).



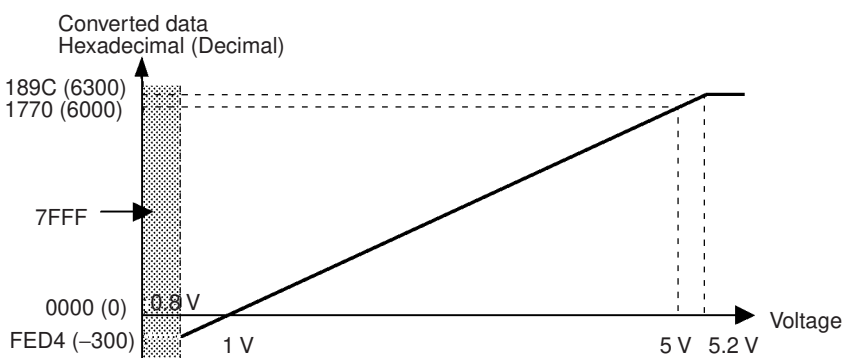
**0 to 5 V**

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**

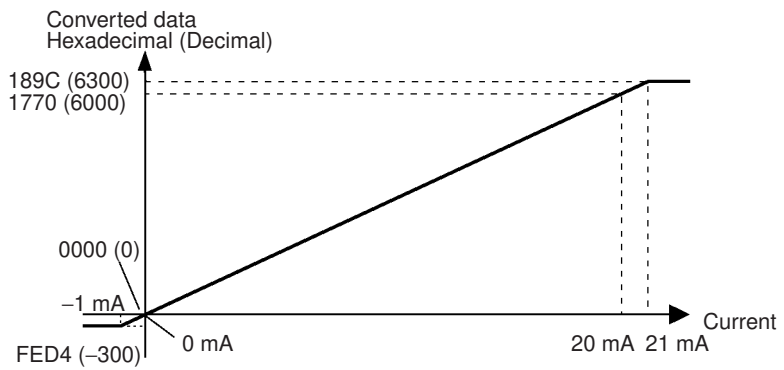
The 1- to 5-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). If the input voltage falls below 0.8 V, the open-circuit detection function will activate and the converted data will be set to 7FFF.



**0 to 20 mA**

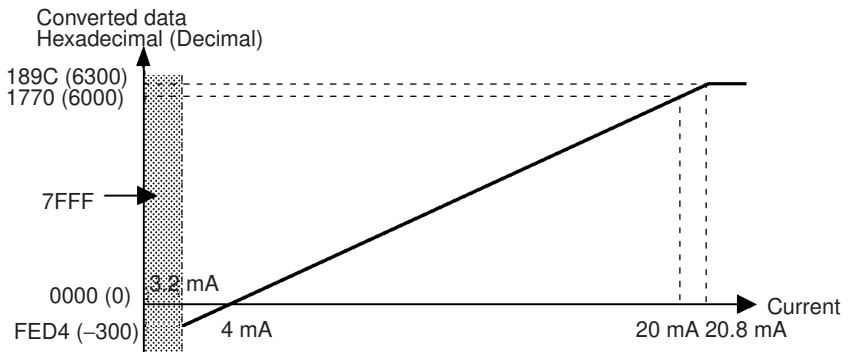
The 0- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative voltage is expressed as a two's complement (16 bits). If the line is disconnected, the data will be the same as an input of 0 mA (0000 Hex).





**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.



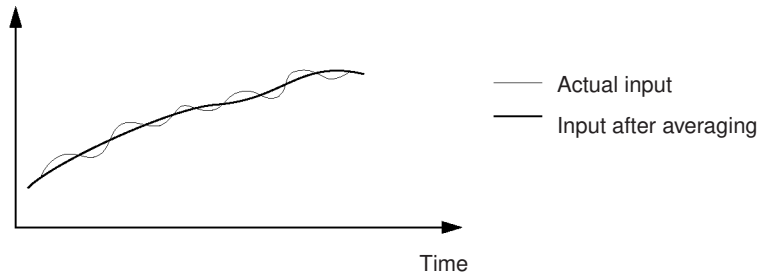
**Number of Inputs**

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**

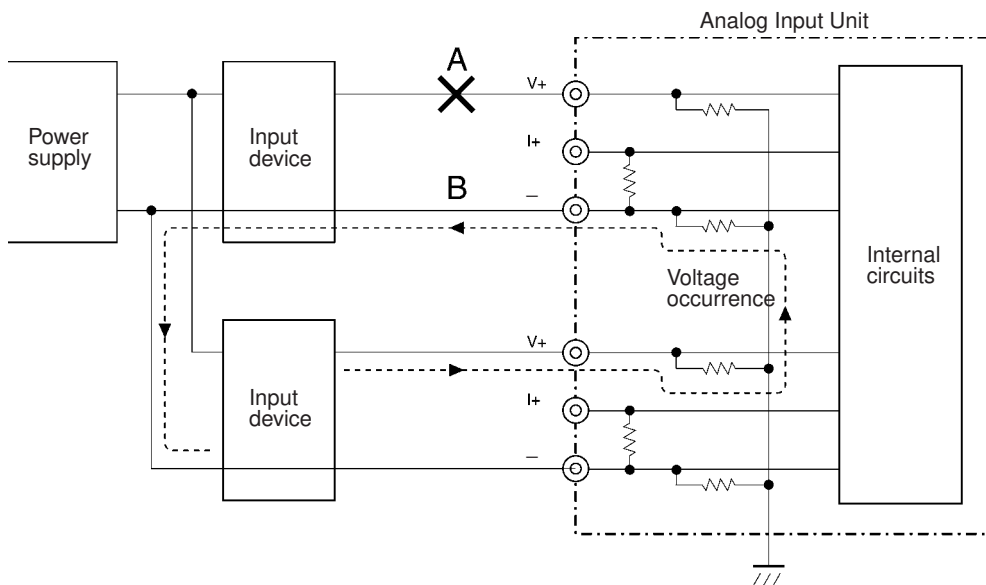
The open-circuit detection function is activated when the input range is set to 1 to 5 V and the voltage drops below 0.8 V, or when the input range is set to 4

to 20 mA and the current drops below 3.2 mA. When the opencircuit 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

	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

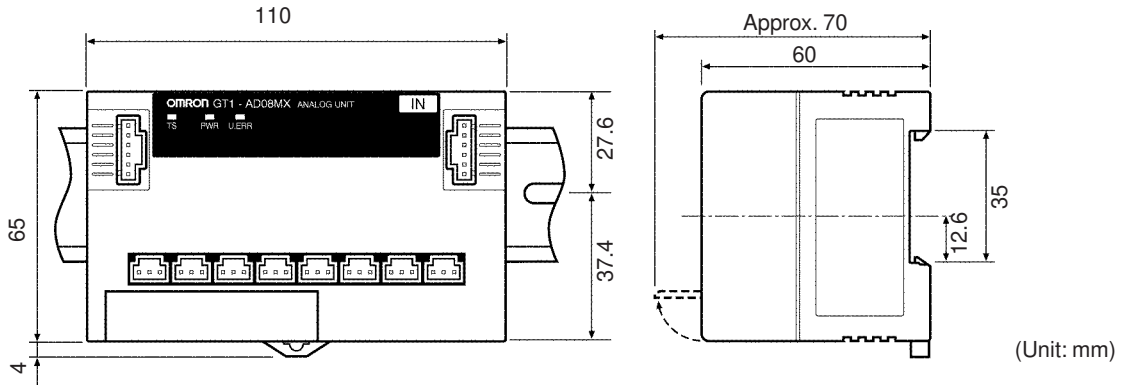
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
First word	Input 0 converted data															
First word + 1	Input 1 converted data															
First word + 2	Input 2 converted data															
First word + 3	Input 3 converted data															

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**



**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.

### 5-1-3 Settings Using the Configurator

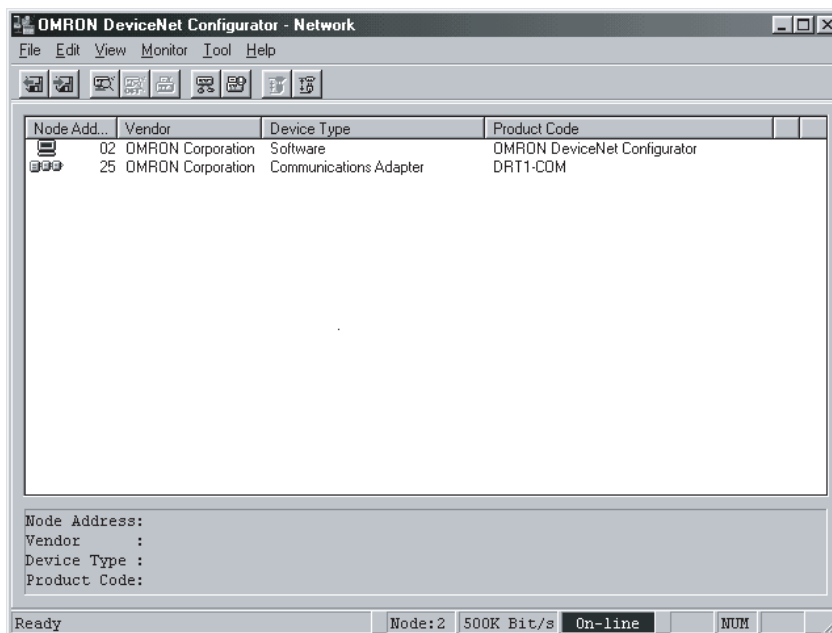
The input range for the Analog Input Unit can be set using version 1.11 or later of the DeviceNet Configurator (referred to as the Configurator below). Using Ver. 1.20 or later, you can also adjust or clear the offset and gain settings.

#### Input Range Settings

Use the following procedure to set the input range. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

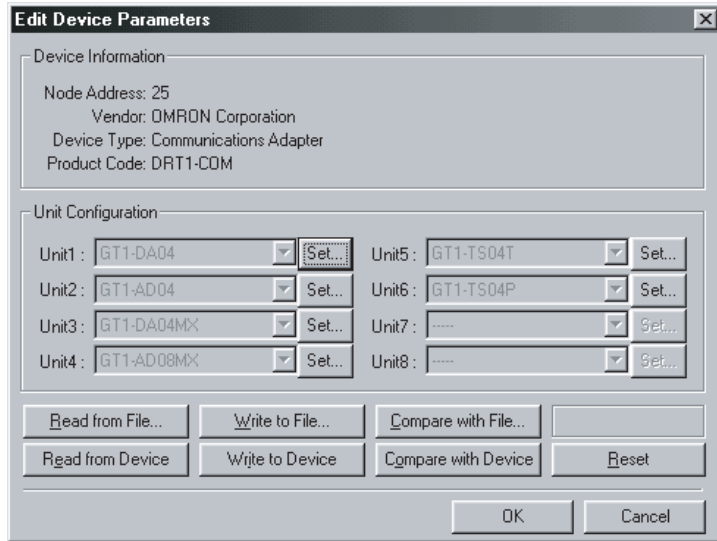
Note The input range can be set for each point using the Configurator. Ranges can be set in 2-point units by setting DIP switches.

- 1,2,3...**
1. Using the DIP switch for the Analog Input Unit, make the Software Setting Enable/Disable setting to enable by making the following pin settings:  
GT1-AD04: Set pin 10 to ON.  
GT1-AD08MX: Set pin 16 to ON.
  2. Turn ON the power supply for all the Units of the MULTIPLE I/O TERMINAL, including the Analog Unit and the Communications Unit.
  3. Connect the Configurator to the DeviceNet network, making it online.
  4. On the device list for the Configurator, double-click the Communications Unit to which the Analog Input Unit is connected.



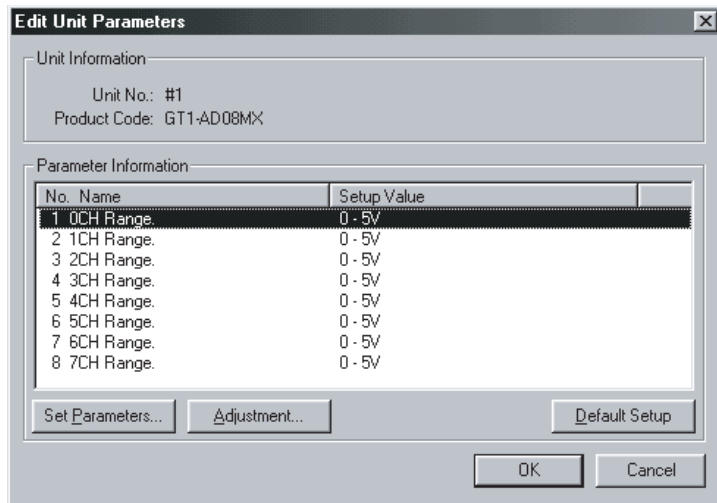
The Edit Device Parameters window for the Communications Unit that is double-clicked, will be displayed.

- Click **Set** on the right of the Analog Input Unit to be set. **Unit 1 to Unit 8** correspond to I/O Units #0 to #7.



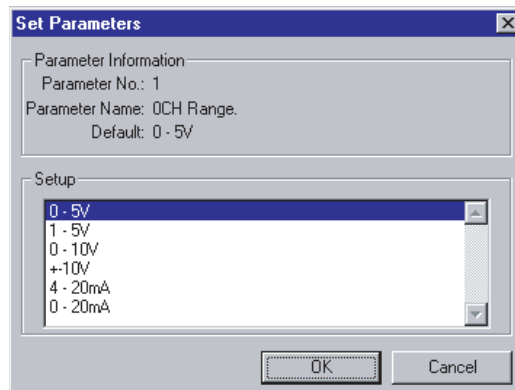
The Edit Unit Parameters window for the Analog Input Unit will be displayed.

- Double-click the line for the input range to be changed, or alternatively, click **Set Parameters** once with the line selected.

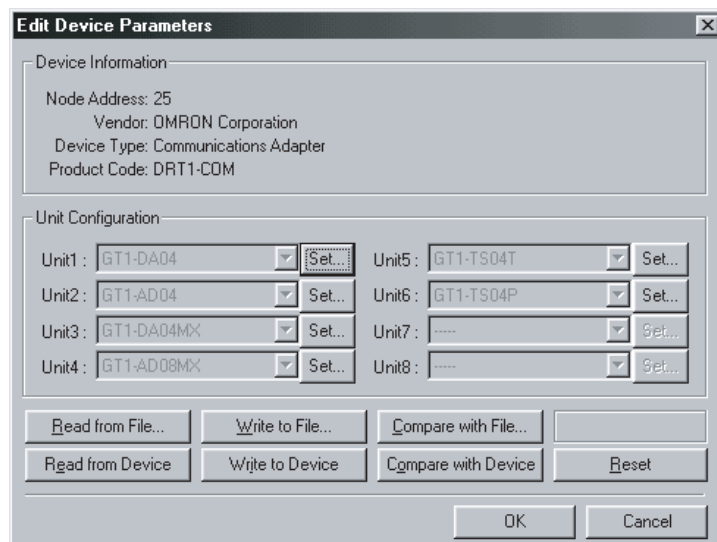


The Parameter Setting window will be displayed.

- Select the desired input range and click **OK**.

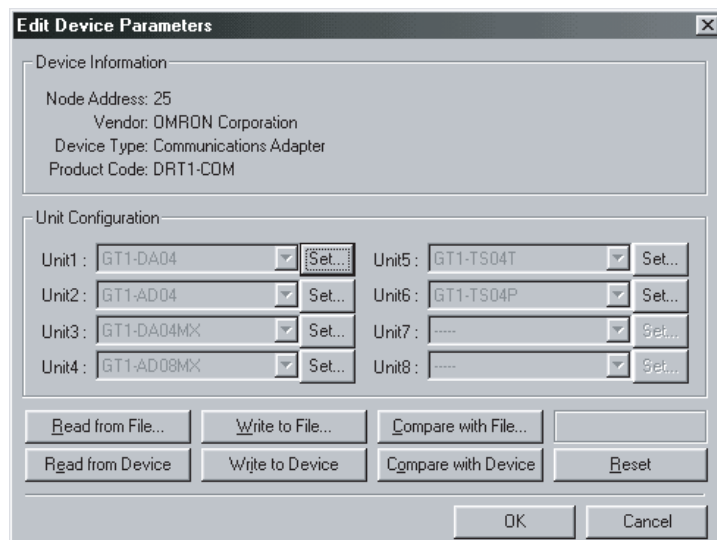


- The input range will be set and the window for step 6 will appear again.
8. To change other input ranges, repeat steps 6 and 7.
  9. When all the required input ranges have been changed, click **OK** in the Edit Unit Parameters window of the Analog Input Unit. The Edit Device Parameters window for the Communications Unit will appear again.
  10. To make the settings for other I/O Units, repeat steps 5 to 9.
  11. From the Edit Device Parameters window of the Communications Unit, click **Write to Device**.



The specified input range will be set for the Analog Input Unit. At this stage, however, the setting is not enabled.

12. From the Edit Device Parameters window of the Communications Unit, click **Reset**.



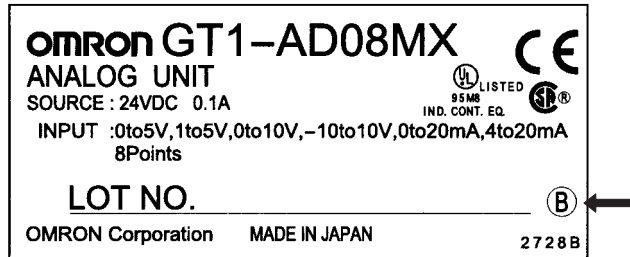
The Communications Unit and all the I/O Units connected to the Communications Unit will be reset, and the specified parameters (for example, for input range) will be enabled.

**Note** Even if **Reset** is not clicked and the power supply for the Communications Unit is turned OFF and ON again, the settings will be enabled.

**Adjusting Offset and Gain**

Use the following procedure to adjust the offset and gain settings. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

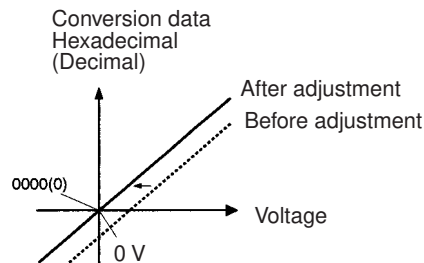
- Note**
1. The offset and gain can be adjusted only with a Configurator Ver. 1.20 or later.
  2. With the earlier model GT1-AD08MX Analog Input Unit, the offset and gain cannot be adjusted, even with a Configurator Ver. 1.20 or later. Check the label on the front on the Unit for whether the offset and gain can be adjusted. Offset and gain can be adjusted only if the letter B appears on the label as shown below.



**Offset Adjustment**

Offset adjustment is used to adjust inputs so that when the value corresponding to 0% in the input range is input, it is converted accurately to 0%. Offset adjustment is used when input voltage and input current differ from the actual value of 0% due to the features of the Unit or the method of connection being used.

E.g.: Input range is 0 to 10 V



The possible range of offset adjustment depends on the input range. Refer to the following table.

Input range	Input corresponding to 0%	Adjustment range
0 to 10 V	0 V	-0.5 to 0.5 V
-10 to 10 V	-10 V	-11.0 to -9.0 V
1 to 5 V	1 V	0.8 to 1.2 V
0 to 5 V	0 V	-0.25 to 0.25 V
4 to 20 mA	4 mA	3.2 to 4.8 mA
0 to 20 mA	0 mA	-1.0 to 1.0 mA

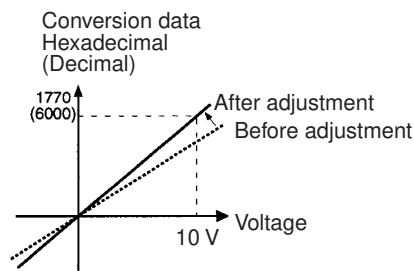
If the input corresponding to 0% is outside the range of possible adjustments shown in the above table, check the connection to the input device.

**Gain Adjustment**

Gain adjustment is used to adjust the rate of fluctuation of input conversion values so that when the value corresponding to 100% in the input range is input, it is converted accurately to 100%. Gain adjustment is used when the greater the input voltage and input current, the greater the difference from the

actual value due to the features of the Unit or the method of connection being used.

E.g.: Input range is 0 to 10 V



The possible range of gain adjustment depends on the input range. Refer to the following table.

Input range	Input corresponding to 100%	Adjustment range
0 to 10 V	10 V	9.5 to 10.5 V
-10 to 10 V	10 V	9.0 to 11.0 V
1 to 5 V	5 V	4.8 to 5.2 V
0 to 5 V	5 V	4.75 to 5.25 V
4 to 20 mA	20 mA	19.2 to 20.8 mA
0 to 20 mA	20 mA	19.0 to 21.0 mA

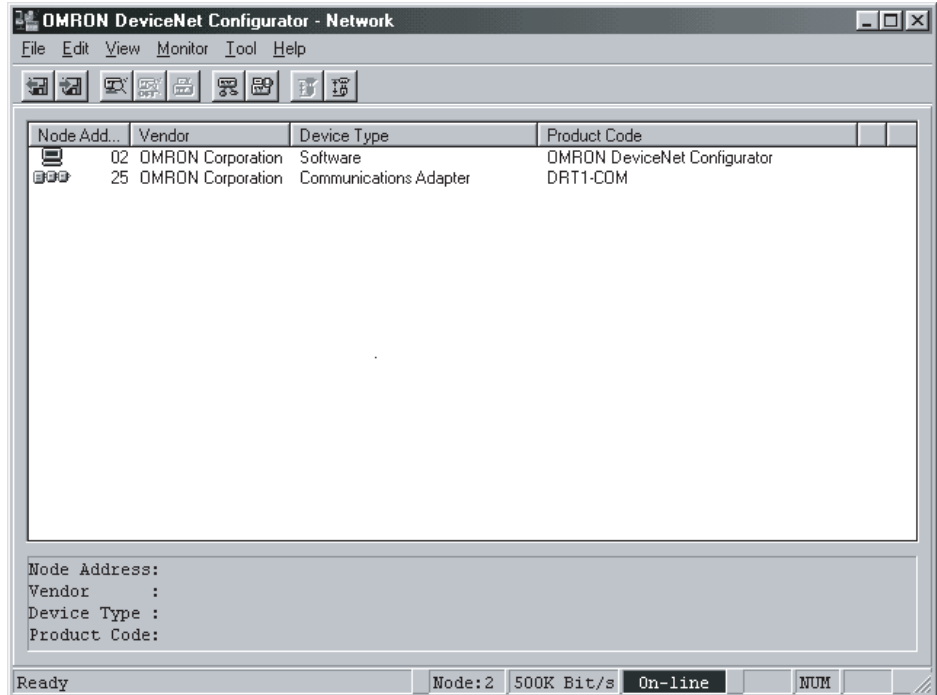
If the input corresponding to 100% is outside the range of possible adjustments shown in the above table, check the connection to the input device.

**Adjustment Procedure**

- 1,2,3...**
1. Connect the input device to the Analog Input Unit that is to be adjusted.
  2. Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including Analog Input Unit to be adjusted and the Communications Unit.
  3. Connect the Configurator to the DeviceNet network and go online.

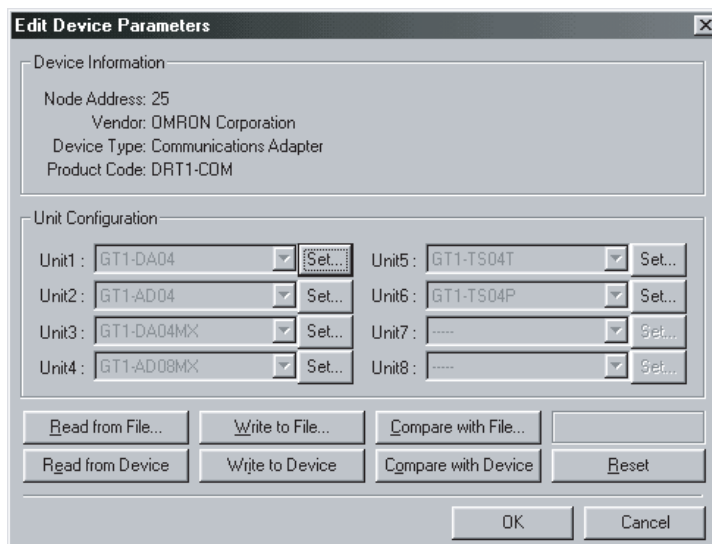


- On the device list for the Configurator, double-click the Communications Unit to which the Analog Input Unit is connected.



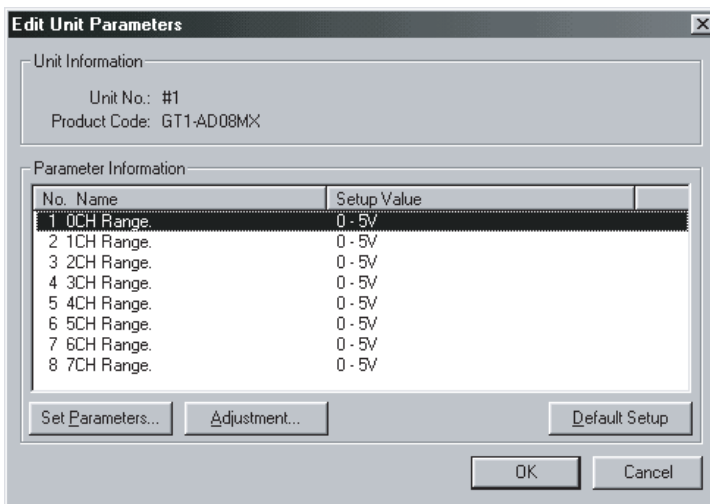
The Edit Device Parameters Window for the selected Communications Unit will be displayed.

- Click **Set** on the right of the Analog Input Unit to be set. **Unit 1** to **Unit 8** correspond to I/O Units #0 to #7.



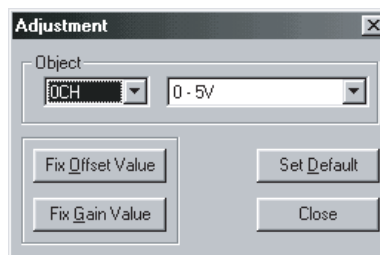
The Edit Unit Parameters Window for the Analog Input Unit will be displayed.

- Click **Adjustment**.

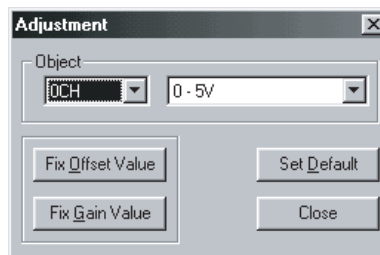


The Unit Adjustment Window will be displayed.

- Click the Down Arrow and select the input words and the input range to be adjusted.



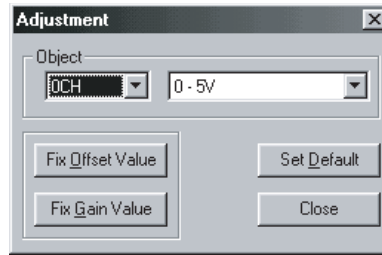
- Apply the input voltage or input current corresponding to 0% to the input terminal on the Analog Input Unit.
- Click **Fix Offset Value** when the appropriate input voltage or input current has been applied according to step 8.



The offset will be set so that the input voltage or input current are converted to a value of 0%, and the value of the offset will be stored in the EEPROM in the Analog Input Unit. Reset the Unit to enable the new setting.

- Apply the input voltage or input current corresponding to 100% to the input terminal on the Analog Input Unit.

- Click **Fix Gain Value** when the appropriate input voltage or input current has been applied according to step 10.



The gain will be adjusted so that the input voltage or input current will be converted to a value of 100%, and the value of the gain will be stored in the EEPROM in the Analog Input Unit. Reset the Unit to enable the new setting.

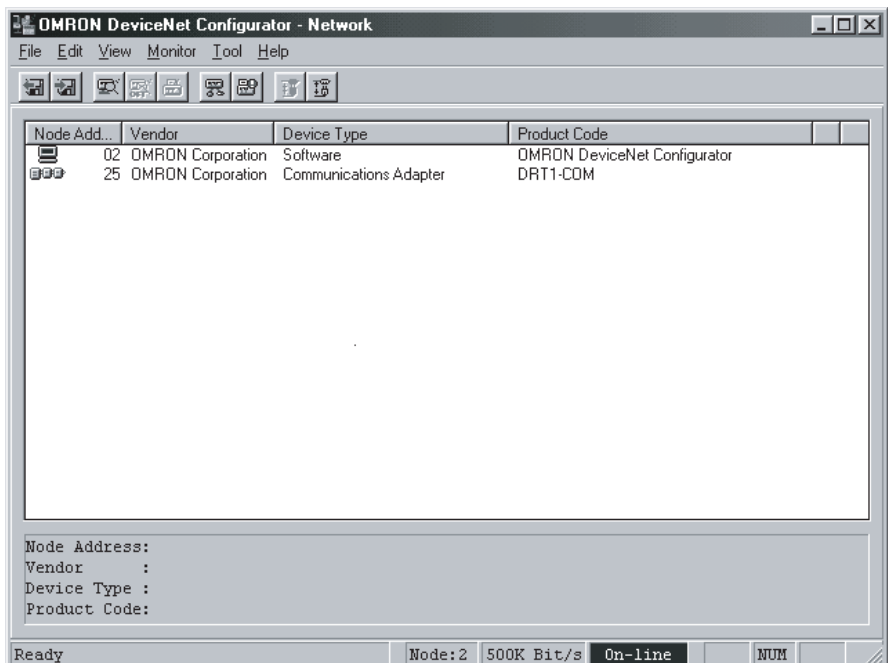
- Repeat steps 7 to 11 to adjust other inputs as necessary.
- When you have completed all the adjustments, click **Close**. A message asking if you want to reset will appear. Click **Yes**. The Communications Unit and all I/O Units connected to it will be reset, and the new settings will be enabled.

**Clearing Offset and Gain Settings**

All offset and gain settings in the Analog Input Unit can be cleared at once. Use the following procedure to clear the offset and gain settings stored in the EEPROM in the Analog Input Unit. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

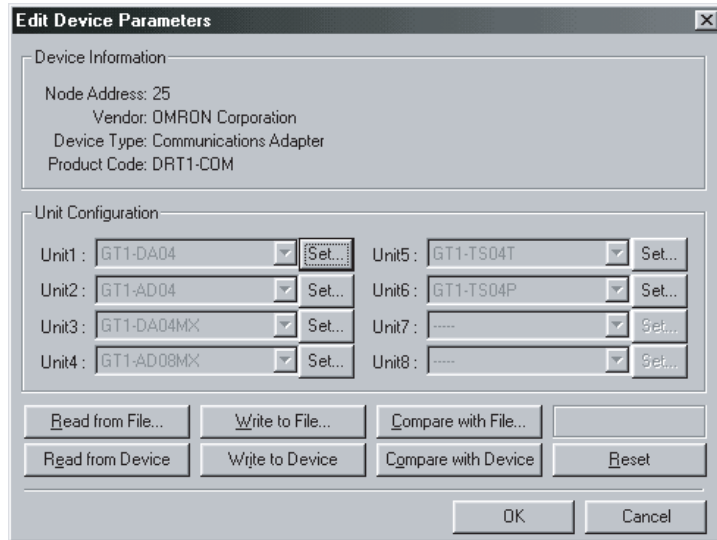
**Note** The offset and gain can be adjusted only with a Configurator Ver. 1.20 or later.

- 1,2,3... Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including Communications Unit and the Analog Input Unit that is to be cleared.
- Connect the Configurator to the DeviceNet network and go online.
- On the device list for the Configurator, double-click the Communications Unit to which the Analog Input Unit is connected.



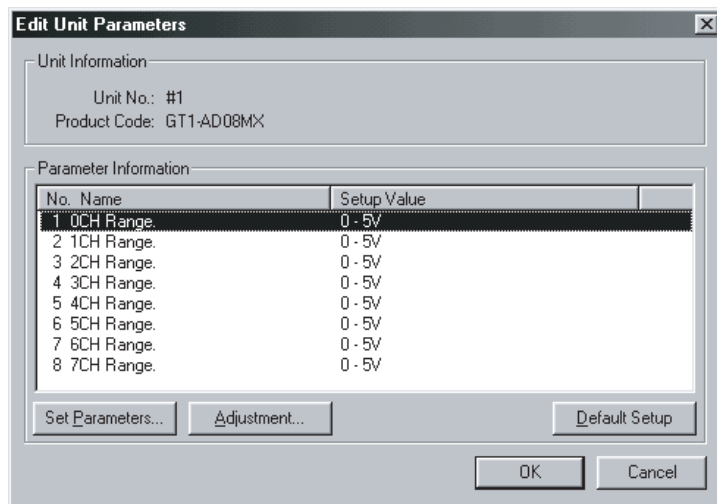
The Edit Device Parameters Window for the selected Communications Unit will be displayed.

- Click **Set** on the right of the Analog Input Unit to be set. **Unit 1** to **Unit 8** correspond to I/O Units #0 to #7.



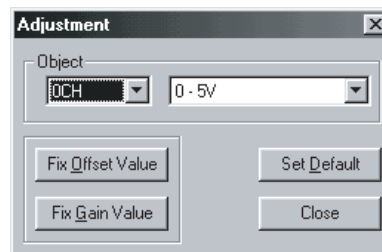
The Edit Unit Parameters Window for the Analog Input Unit will be displayed.

- Click **Adjustment**.



The Unit Adjustment Window will be displayed.

- Click **Set Default**.



7. A message asking you to confirm will appear. Click **Yes**.



The offset and gain settings stored in the EEPROM in the Analog Input Unit will be reset to the default values. Reset the Unit to enable the default settings.

8. After clearing the settings, click **Close**. A message asking if you want to reset will appear. Click **Yes**. The Communications Unit and all I/O Units connected to it will be reset, and the default settings will be enabled.

## 5-2 Analog Output Units

### 5-2-1 GT1-DA04

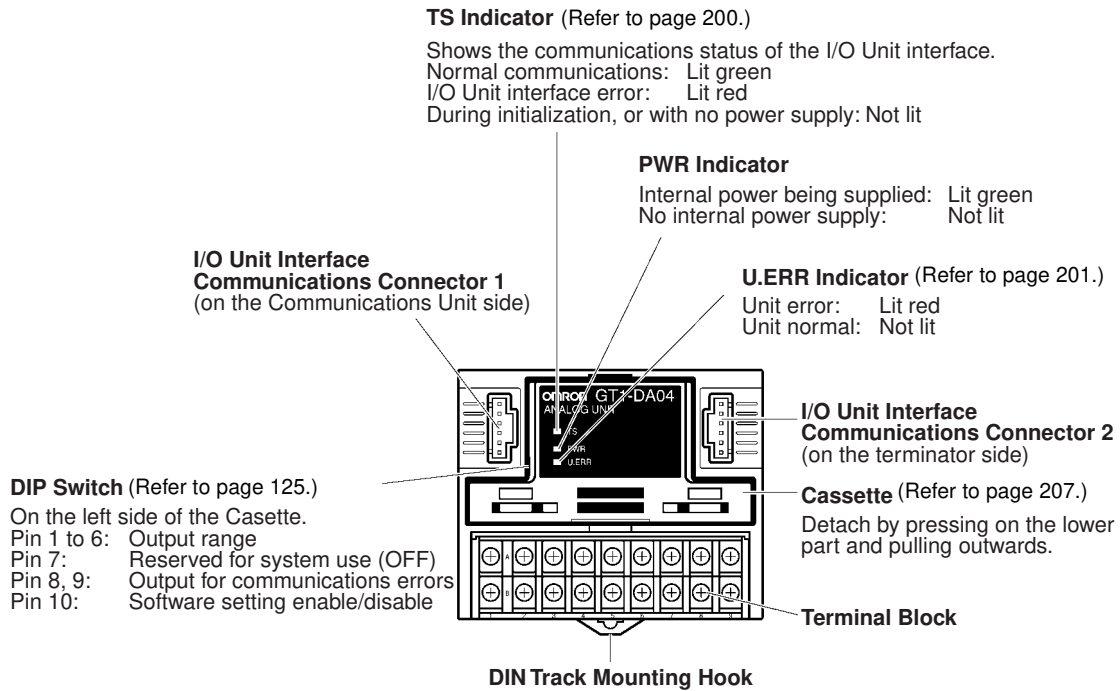
#### General Specifications

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)	150 mA max. (inrush current 20 A max., pulse width 1 ms max.)
Current consumption (I/O Unit interface)		50 mA max.
Noise immunity		$\pm 2000$ V (IEC61000-4-4 via fast transient noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup>
Shock resistance		200 m/s <sup>2</sup>
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
Weight		Approx. 230 g

#### Characteristics

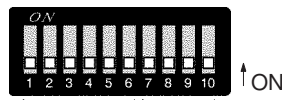
Item	Specification	
	Voltage outputs	Current outputs
Output signal range	0 to 5 V, 1 to 5 V, 0 to 10 V, or -10 to 10 V	4 to 20 mA
Allowable external output load resistance	5 K $\Omega$ min.	600 $\Omega$ min.
External output impedance	0.5 $\Omega$ max.	---
Resolution	1/6000 (full scale)	
Accuracy	25°C	$\pm 0.4\%$ FS
	-10°C to 55°C	$\pm 0.8\%$ 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.



- Output range      Operating specifications
- Output for communications errors
  - Software setting enable/disable

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	Output for communications errors (See below.)	8      9	Output
		OFF   OFF	Clear to minimum (See below.)
		OFF   ON	Clear to maximum (See below.)
		ON    OFF	Clear to 0 V (for -10 to 10 V) Clear to minimum (other than the above)
		ON    ON	Hold
10	Software setting enable/disable	OFF	Set the output range and output for communications errors with pins 1 to 9. (factory-set)
		ON	Output range setting (See note.) and output setting for communications errors can be set using the Configurator.

- Note**
1. When setting the output range or output for communications errors using a DeviceNet Configurator, use version 1.11 or later. (If pin 10 is ON, and a setting is made using the Configurator, the output ranges will all be 0 to 5 V and the output for communications errors setting will be set to clear to minimum.)
  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 Communications 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

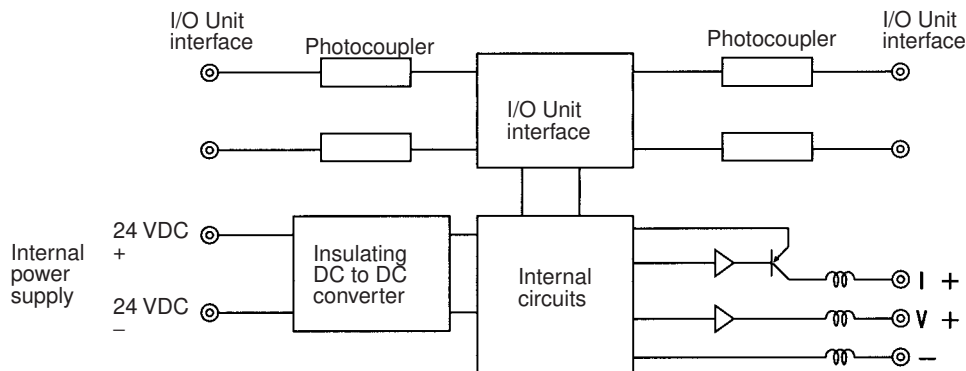
- Note** If output range setting is performed using the Configurator (version 1.11 or later), it is possible to make the setting for each point.

**Output Setting for Communications Errors**

When clear to minimum, clear to maximum, or clear to 0 V is set using DIP switch pins 8 and 9 and a communications error occurs, the outputs shown in the following table will be produced according to the output range.

Output signal range	Clear to minimum	Clear to maximum	Clear to 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**

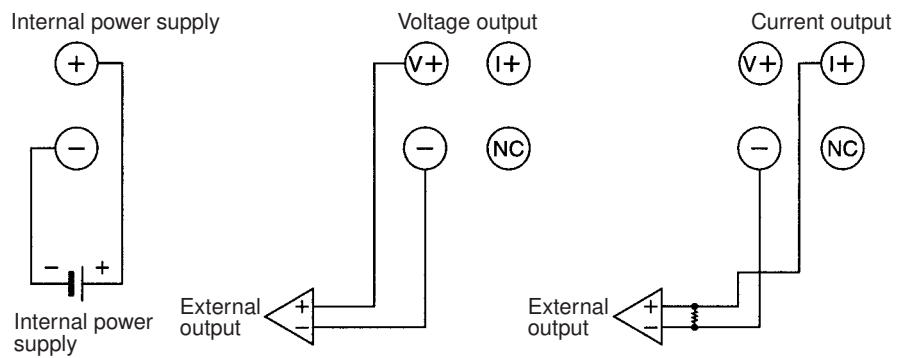




Terminal Arrangement

+	V <sub>0</sub> <sup>+</sup>	I <sub>0</sub> <sup>+</sup>	V <sub>1</sub> <sup>+</sup>	I <sub>1</sub> <sup>+</sup>	V <sub>2</sub> <sup>+</sup>	I <sub>2</sub> <sup>+</sup>	V <sub>3</sub> <sup>+</sup>	I <sub>3</sub> <sup>+</sup>
-	$\bar{0}$	NC	$\bar{1}$	NC	$\bar{2}$	NC	$\bar{3}$	NC

Wiring

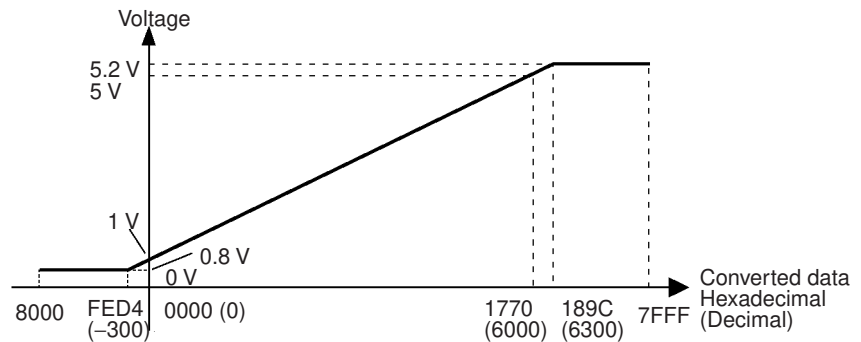


Output Ranges and Converted Data

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.

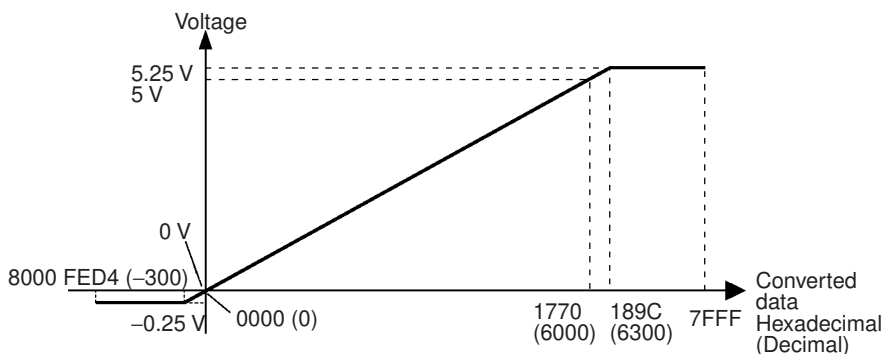
**1 to 5 V**

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.



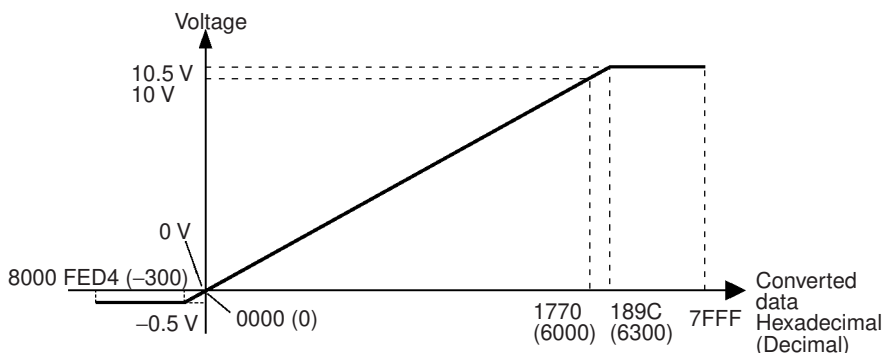
**0 to 5 V**

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.



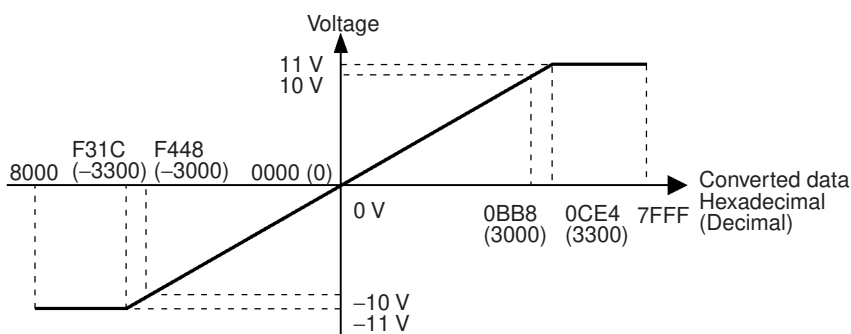
**0 to 10 V**

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.



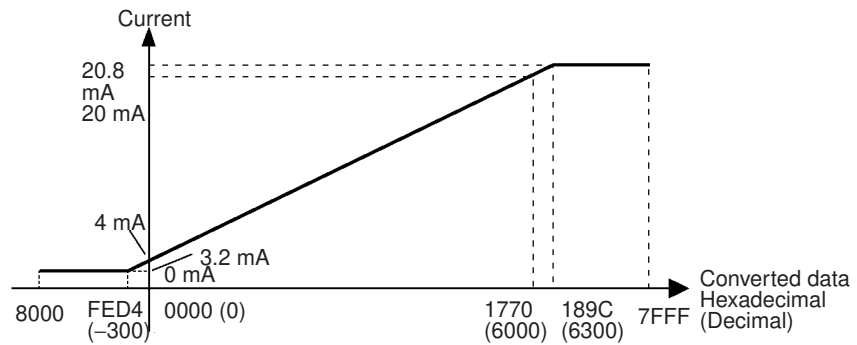
**-10 to 10 V**

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 DeviceNet or I/O Unit interface communications. The following settings are possible:

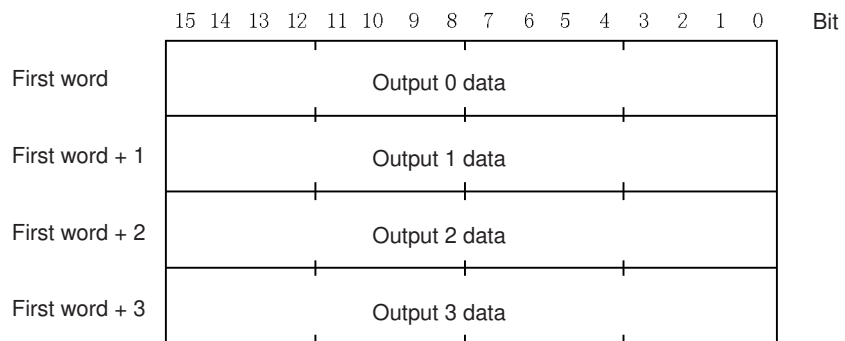
- Hold (maintain previous output status)
- Clear to minimum (clear to the lower limit of the output signal range)
- Clear to maximum (clear to the upper limit of the output signal range)
- Clear to 0 V (for -10 to 10 V only)

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

Output signal range	Clear to minimum	Clear to maximum	Clear to 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.

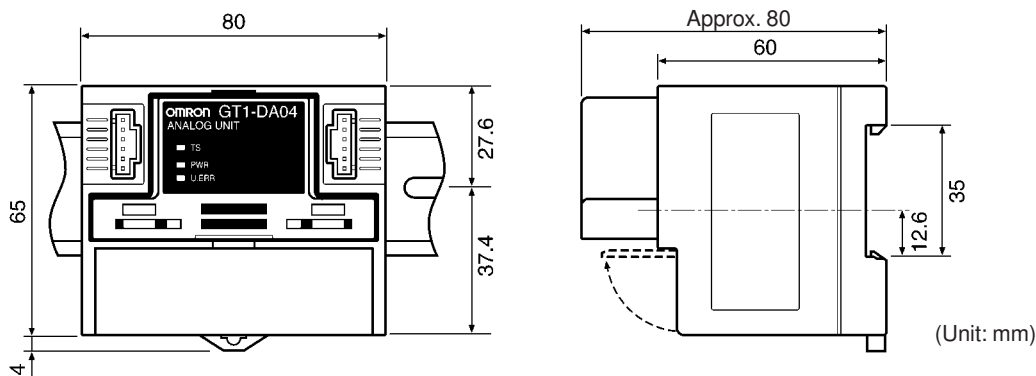


When a negative voltage is to be output, specify the conversion data as the two's complement. To obtain a two's complement from an absolute value, the NEG instruction is useful.

**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.

5-2-2 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		$\pm 2000$ V (IEC61000-4-4 via fast transient noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup>
Shock resistance		200 m/s <sup>2</sup>
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
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 200.)

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

**U.ERR Indicator** (Refer to page 201.)

Unit error: Lit red

Unit normal: Not lit

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

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

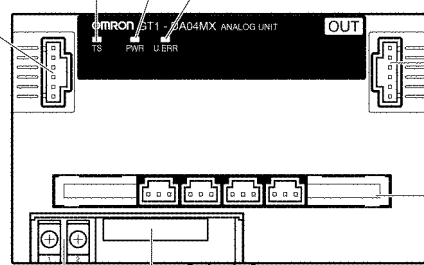
**Analog Output Connectors**  
(made by MOLEX)  
Connect to an analog output devices.

**DIP Switch**  
(Refer to page 132.)

- Pin 1 to 6: Output range
- Pin 7: Reserved for system use (OFF)
- Pin 8, 9: Output for communications errors
- Pin 10: Software setting enable/disable

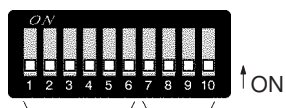
**Internal Power Supply Terminals**

**DIN Track Mounting Hook**



**DIP Switch Settings**

The following diagram shows the functions of the DIP switch.



Output range      Operating specifications  
 Output for communications errors  
 Software setting enable/disable

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	Output for communications errors (See below.)	8      9	Output
		OFF   OFF	Clear to minimum (See below.)
		OFF   ON	Clear to maximum (See below.)
		ON    OFF	Clear to 0 V (for -10 to 10 V) Clear to minimum (other than the above)
		ON    ON	Hold
10	Software setting enable/disable	OFF	Set the output range, and output for communications errors, with pins 1 to 9. (factory-set)
		ON	Output range setting (See note.) and output setting for communications errors can be set using the Configurator.

- Note**
1. When setting the output range or output for communications errors using a DeviceNet Configurator, use version 1.11 or later. (If pin 10 is ON, and a setting is made using the Configurator, the output ranges will all be 0 to 5 V and the output for communications errors setting will be set to clear to minimum.)
  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 Communications 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.

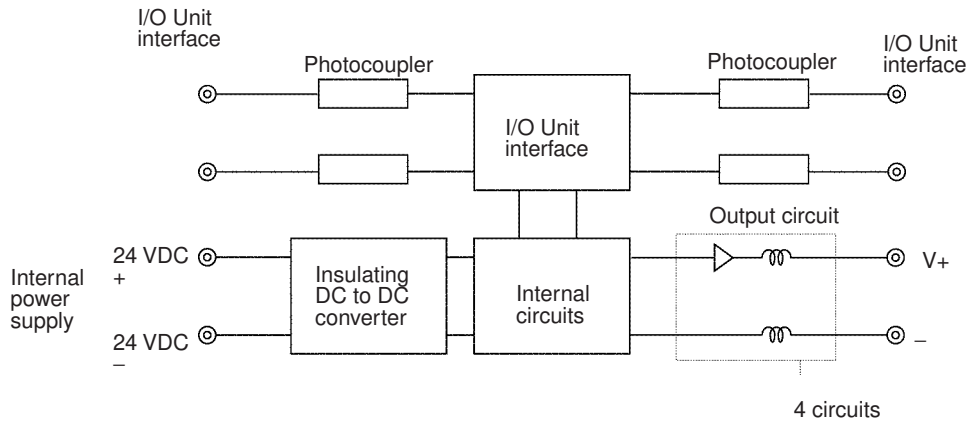
Pin 1	Pin 2	Pin 3	Output range settings for outputs 0 and 1
Pin 4	Pin 5	Pin 6	Output range settings for outputs 2 and 3
OFF	OFF	OFF	0 to 5 V (factory-set)
ON	OFF	OFF	1 to 5 V
OFF	ON	OFF	0 to 10 V
ON	ON	OFF	-10 to 10 V
Other than the above			Cannot be set

**output for communications errors**

When clear to minimum, clear to maximum, or clear to 0 V 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.

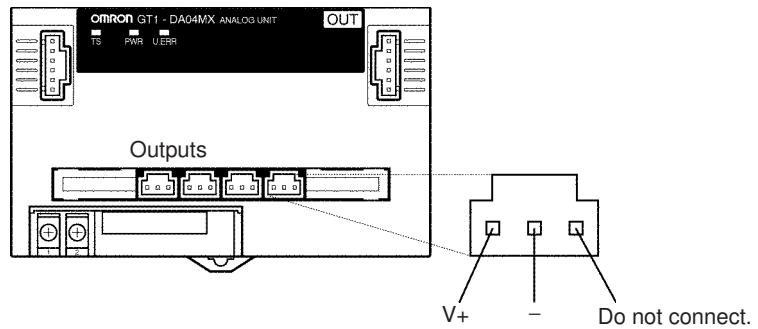
Output signal range	Clear to minimum	Clear to maximum	Clear to 0 V
0 to 5 V	-0.25 V	5.25 V	-0.25 V
1 to 5 V	0.8 V	5.2 V	0.8 V
0 to 10 V	-0.5 V	10.5 V	-0.5 V
-10 to 10 V	-11 V	11 V	0 V

**Internal Circuits**



**Terminal/Connector Pin Arrangement**

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

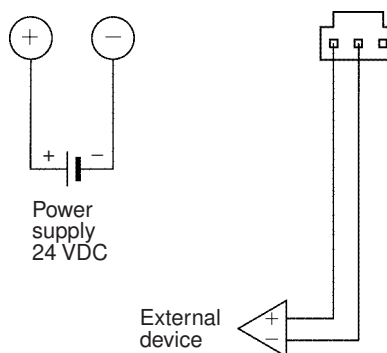


**Wiring**

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

**Applicable Connectors**

Manufacturer	Connector		Model number	Remarks
MOLEX	Pressure-welded	Housing	521-09-0390	For AWG#24
		Crimp	Housing	50-57-9403
	Crimp	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	

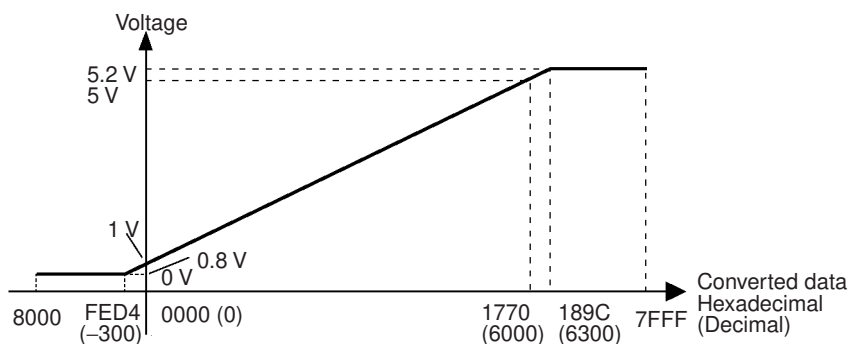


**Output Ranges and Converted Data**

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**

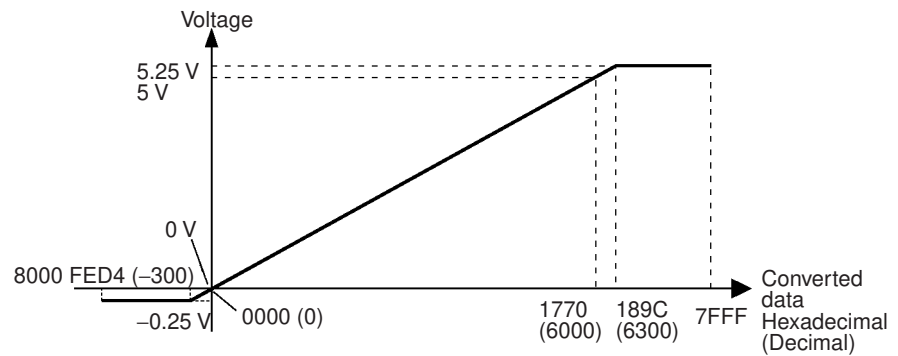
The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 1 to 5 V. The entire output range is 0.8 to 5.2 V.





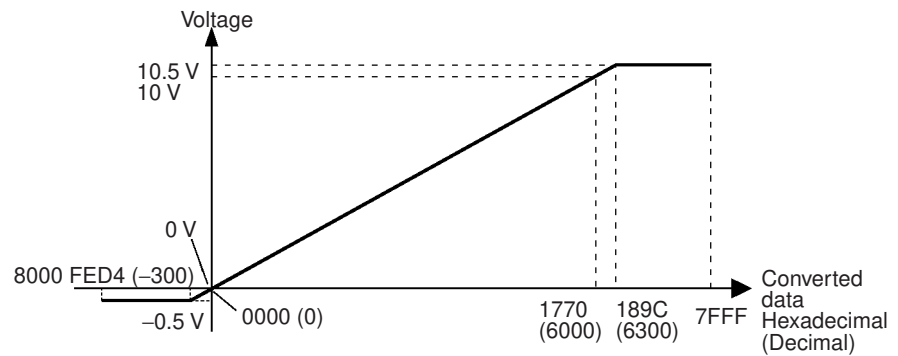
**0 to 5 V**

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.



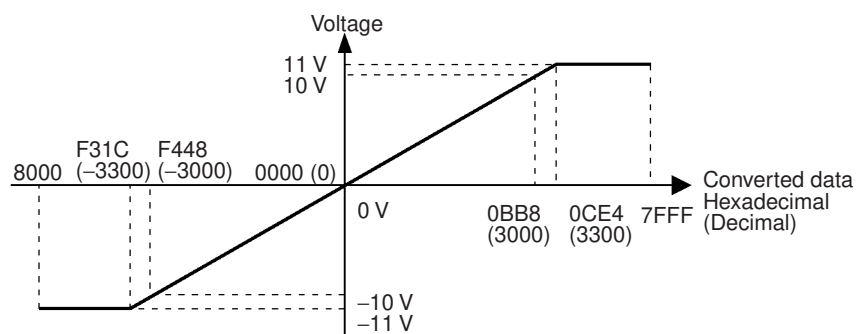
**0 to 10 V**

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 DeviceNet or I/O Unit interface communications.

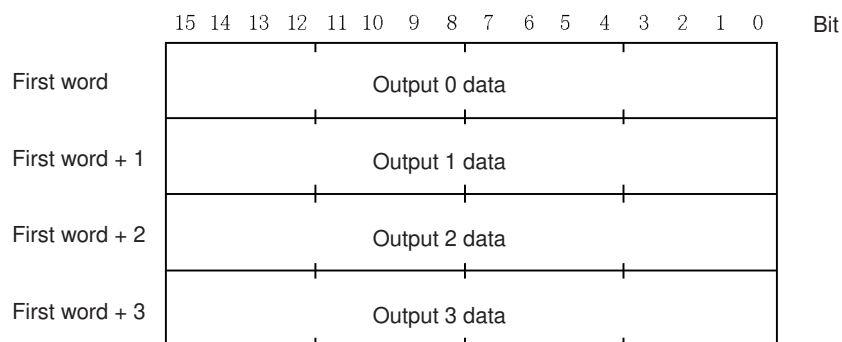
Settings		Output status after communications error
Pin 8	Pin 9	
OFF	OFF	Clear to minimum (Clear to the lower limit of the output signal range.)
OFF	ON	Clear to maximum (Clear to the upper limit of the output signal range.)
ON	OFF	Clear to 0 V (for -10 to 10 V only) Clear to minimum (other than the above)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

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

Output signal range	Clear to minimum	Clear to maximum	Clear to 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.

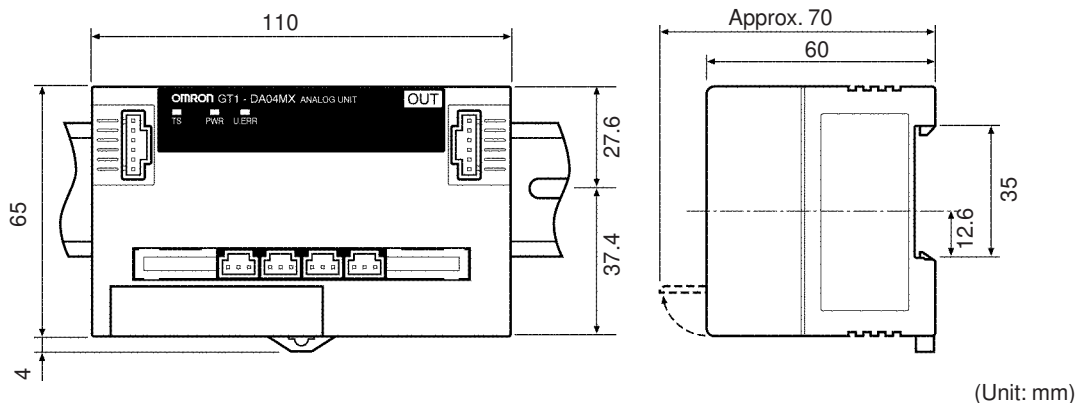


When a negative voltage is to be output, specify the conversion data as the two's complement. To obtain a two's complement from an absolute value, the NEG instruction is useful.

**Conversion Time**

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

**Dimensions**



**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.

### 5-2-3 Settings Using the Configurator

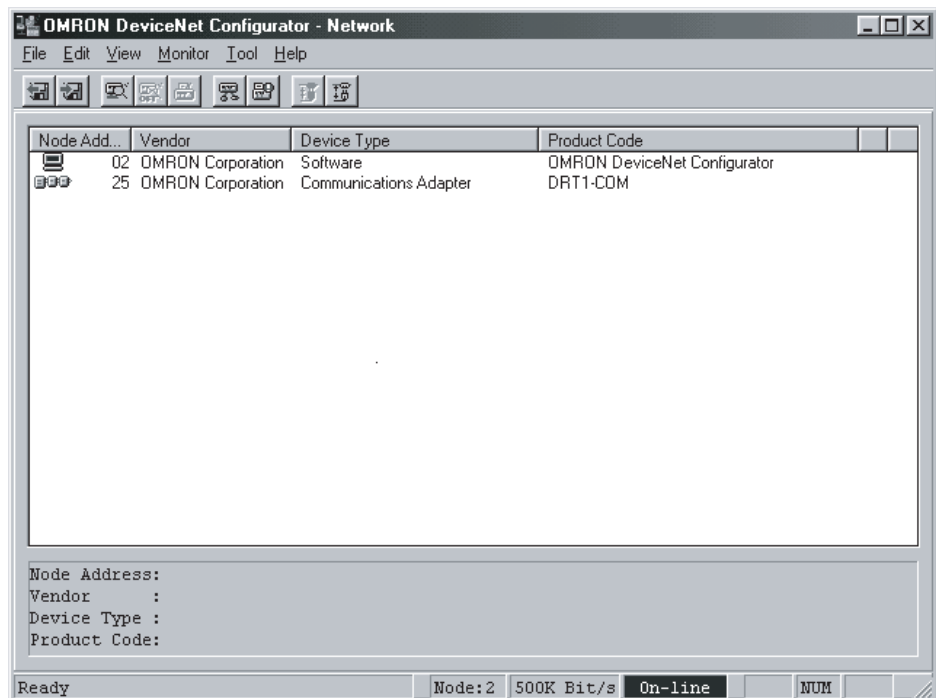
The output range and the output for communications errors for the Analog Output Unit can be set using version 1.11 or later of the DeviceNet Configurator (referred to as the Configurator below). Using Ver. 1.20 or later, you can also adjust or clear the offset and gain settings.

#### Setting the Output Range and Output for Communications Errors

Use the following procedure to set the output range. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

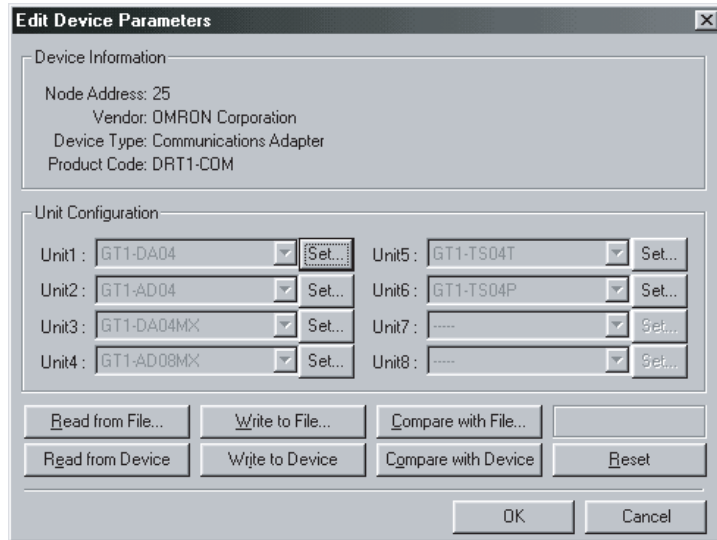
Note The output range can be set for each point using the Configurator. Ranges can be set in 2-point units using DIP switches.

- 1,2,3... 1. Set pin 10 of the DIP switch for the Analog Output Unit to ON to set the Software Setting Enable/Disable setting to enable.
2. Turn the power supply ON for all the Units of the MULTIPLE I/O TERMINAL, including the Analog Unit and the Communications Unit.
3. Connect the Configurator to the DeviceNet network, making it online.
4. On the device list for the Configurator, double-click the Communications Unit to which the Analog Output Unit is connected.



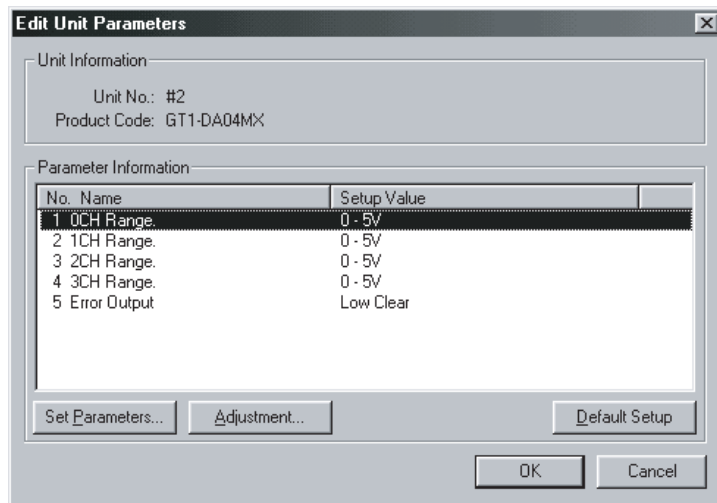
The Edit Device Parameters window for the Communications Unit that is double-clicked, will be displayed.

- Click **Set** on the right of the Analog Output Unit to be set. **Unit 1 to Unit 8** correspond to I/O Units #0 to #7.



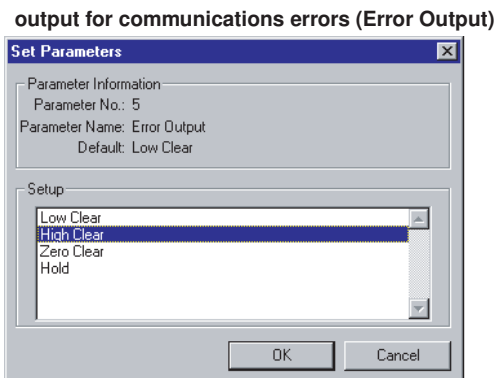
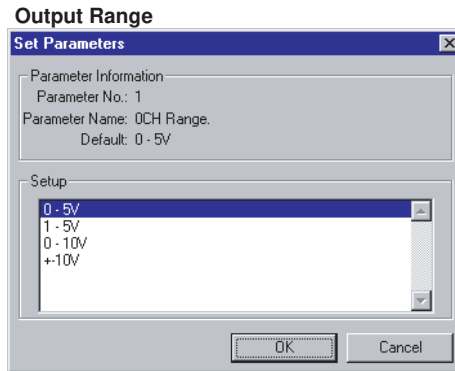
The Edit Unit Parameters window for the Analog Output Unit will be displayed.

- Double-click the line for the setting to be changed, or alternatively, click **Set Parameters** once with the line selected.

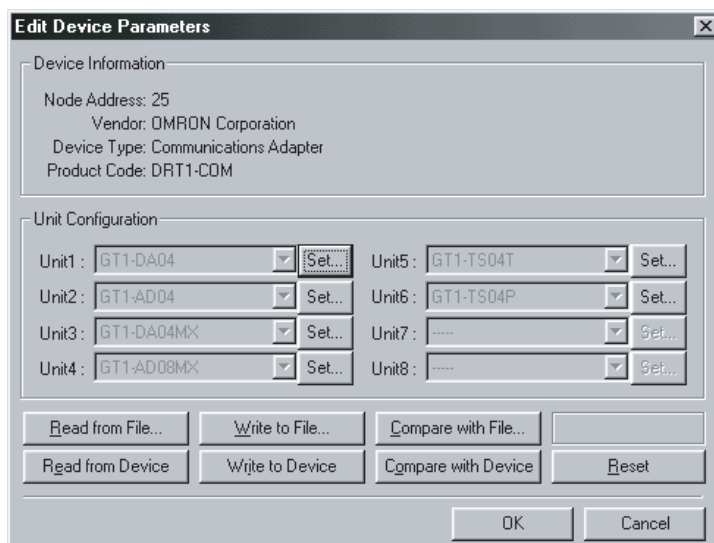


The Parameter Setting window will be displayed.

7. Select the new setting and click **OK**.

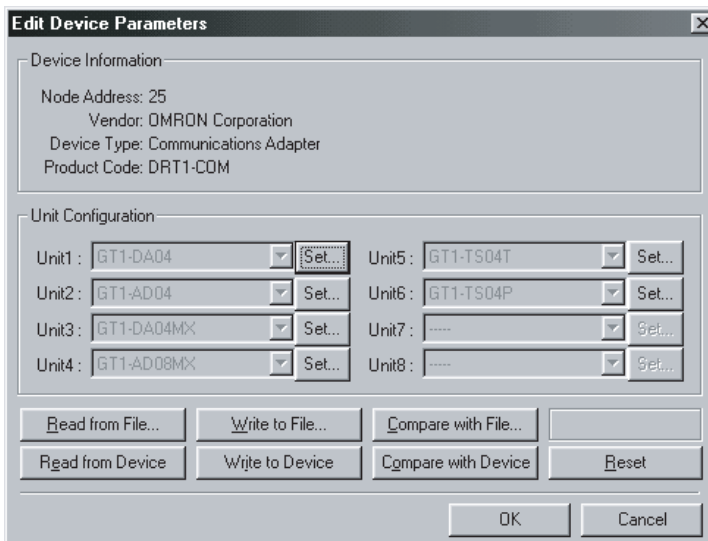


- The output range will be set and the window for step 6 will appear again.
8. To change other output ranges, repeat steps 6 and 7.
  9. When all the required output ranges have been changed, click **OK** in the Edit Unit Parameters window of the Analog Output Unit. The Edit Device Parameters window for the Communications Unit will appear again.
  10. To make the settings for other I/O Units, repeat steps 5 to 9.
  11. From the Edit Device Parameters window of the Communications Unit, click **Write to Device**.



The specified output range and output for communications errors will be set for the Analog Output Unit. At this stage, however, the setting is not enabled.

- From the Edit Device Parameters window of the Communications Unit, click **Reset**.



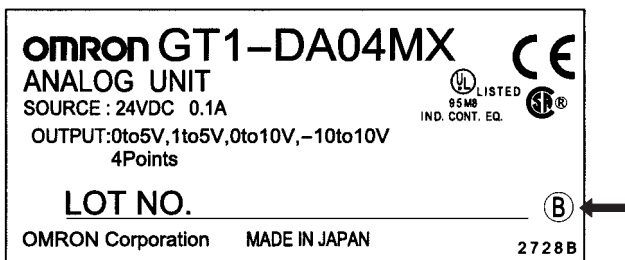
The Communications Unit and all the I/O Units connected to the Communications Unit will be reset, and the specified parameters (for example, for output range) will be enabled.

Note Even if **Reset** is not clicked and the power supply for the Communications Unit is switched OFF and ON again, the settings will be enabled.

**Adjusting Offset and Gain**

Use the following procedure to adjust the offset and gain settings. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

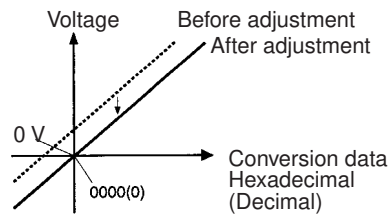
- Note**
- The offset and gain can be adjusted only with a Configurator Ver. 1.20 or later.
  - With the earlier model GT1-DA04MX Analog Output Unit, the offset and gain cannot be adjusted, even with a Configurator Ver. 1.20 or later. Check the label on the front on the Unit for whether the offset and gain can be adjusted. Offset and gain can be adjusted only if the letter B appears on the label as shown below.



**Offset Adjustment**

Offset adjustment is used to adjust outputs so that when the value corresponding to 0% in the output range is written, it is converted accurately to output 0%. Offset adjustment is used when output voltage and output current differ from the actual value of 0% due to the features of the Unit or the method of connection being used.

E.g.: Output range is 0 to 10 V



The possible range of offset adjustments depends on the output range. Refer to the following table.

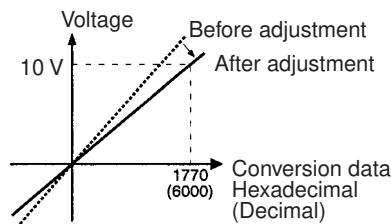
Output range	Data corresponding to 0%	Output corresponding to 0%	Adjustment range
0 to 10 V	0000 Hex (0)	0 V	-0.5 to 0.5 V
-10 to 10 V	F448 Hex (-3000)	-10 V	-11.0 to -9.0 V
1 to 5 V	0000 Hex (0)	1 V	0.8 to 1.2 V
0 to 5 V	0000 Hex (0)	0 V	-0.25 to 0.25 V
4 to 20 mA (See note.)	0000 Hex (0)	4 mA	3.2 to 4.8 mA

Note An output range of 4 to 20 mA is possible only with the GT1-DA04. If the output corresponding to 0% is outside the range of possible adjustments shown in the above table, check the connection to the output device.

**Gain Adjustment**

Gain adjustment is used to adjust the rate of fluctuation of output conversion values so that when the value corresponding to 100% in the output range is written, it is converted accurately to output 100%. Gain adjustment is used when the greater the output voltage and output current, the greater the difference from the actual value due to the features of the Unit or the method of connection being used.

E.g.: Input range is 0 to 10 V



The possible range of gain adjustments depends on the output range. Refer to the following table.

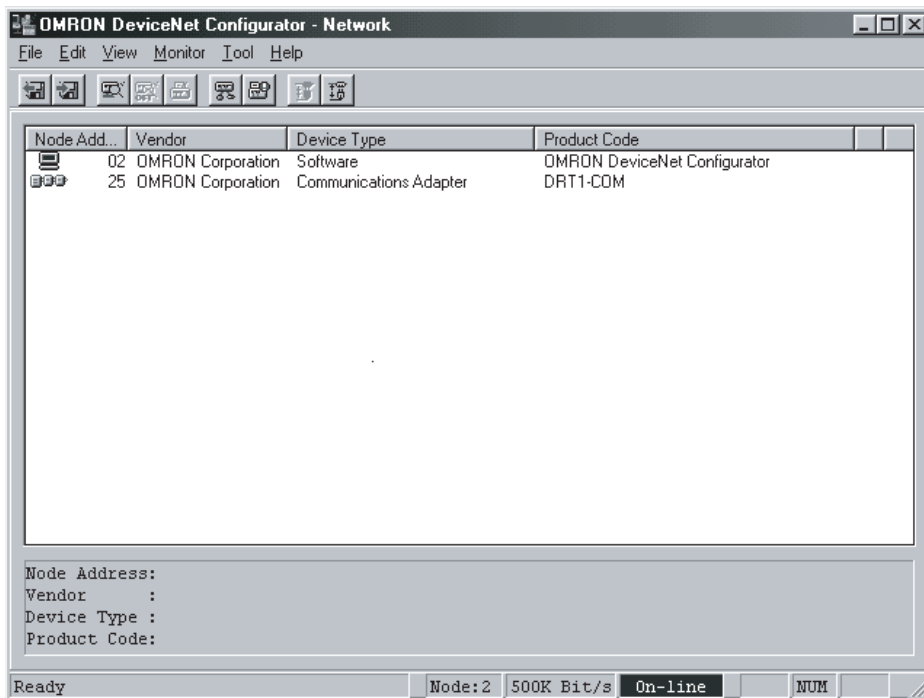
Output range	Data corresponding to 100%	Output corresponding to 100%	Adjustment range
0 to 10 V	1770 Hex (6000)	10 V	9.5 to 10.5 V
-10 to 10 V	0BB8 Hex (3000)	10 V	9.0 to 11.0 V
1 to 5 V	1770 Hex (6000)	5 V	4.8 to 5.2 V
0 to 5 V	1770 Hex (6000)	5 V	4.75 to 5.25 V
4 to 20 mA (See note.)	1770 Hex (6000)	20 mA	19.2 to 20.8 mA

Note An output range of 4 to 20 mA is possible with only the GT1-DA04.

If the output corresponding to 100% is outside the range of possible adjustments shown in the above table, review the connection to the output device.

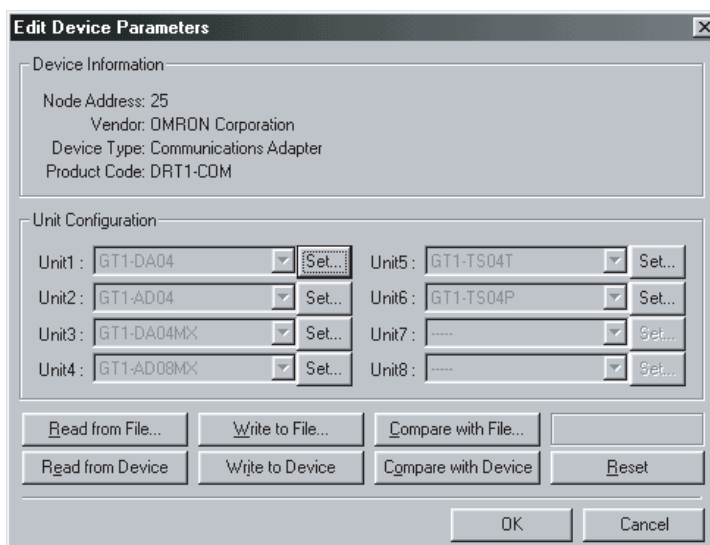
**Adjustment Procedure**

- 1,2,3...
1. Connect the output device to the Analog Output Unit that is to be adjusted.
  2. Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including Analog Output Unit to be adjusted and the Communications Unit.
  3. Connect the Configurator to the DeviceNet network and go online.
  4. On the device list for the Configurator, the double-click Communications Unit to which the Analog Output Unit is connected.



The Edit Device Parameters Window for the selected Communications Unit will be displayed.

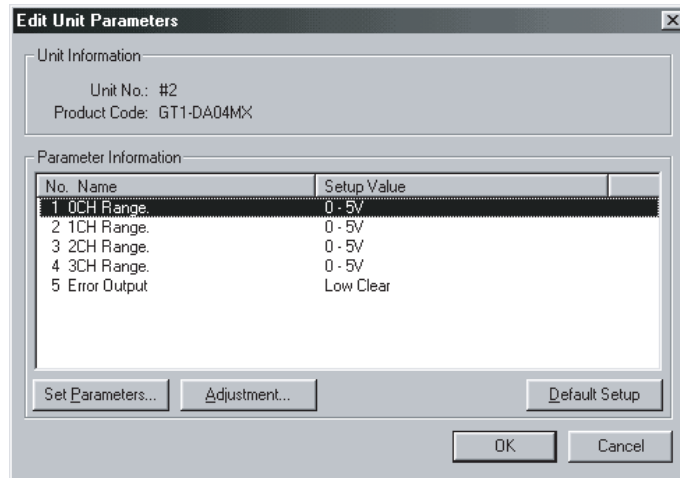
5. Click **Set** on the right of the Analog Output Unit to be set. **Unit 1** to **Unit 8** correspond to I/O Units #0 to #7.





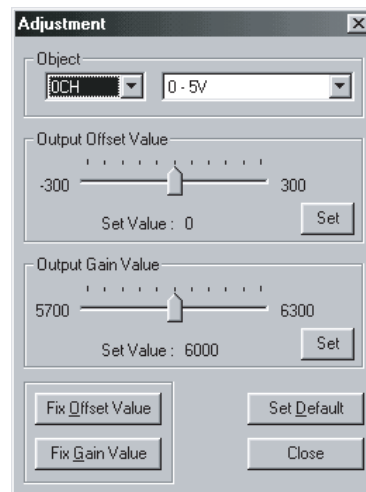
The Edit Unit Parameters Window for the Analog Output Unit will be displayed.

6. Click **Adjustment**.

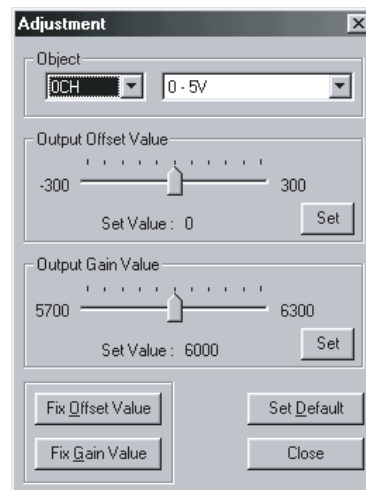


The Unit Adjustment Window will be displayed.

7. Click the Down Arrow and select the output words and the output range to be adjusted.

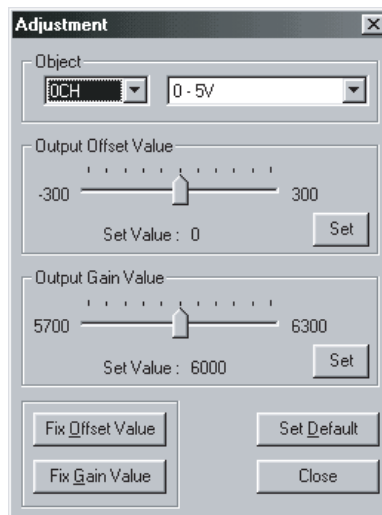


8. Drag the Offset Output Slide Bar to adjust the value, and then click **Set**.



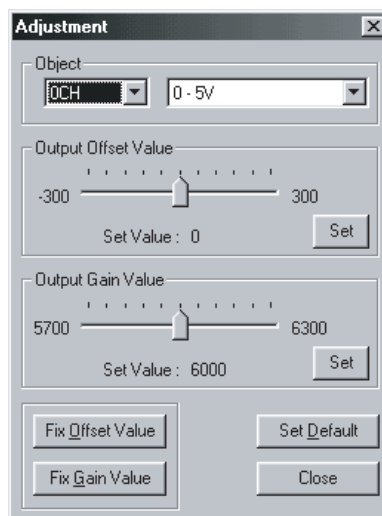
The voltage output or current output will be output on the output terminal on the Analog Output Unit designated in step 7. Adjust the slider bar until the output is correct for 0%.

9. Click **Fix Offset Value** when the voltage output or current output is correct for 0%.



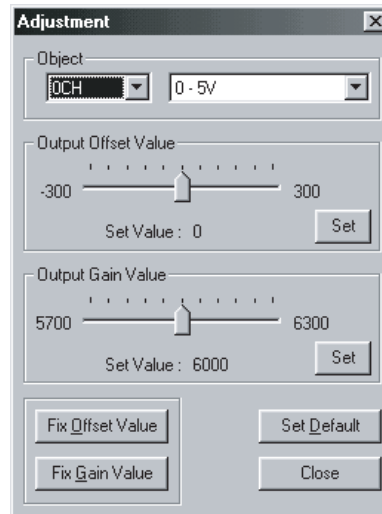
The offset value set using the slider bar will be stored in the EEPROM in the Analog Output Unit. Reset the Unit to enable the new setting.

10. Drag the Gain Output Slider Bar to adjust the value, then click **Set**.



The voltage output or current output will be output on the output terminal on the Analog Output Unit designated in step 7. Adjust the slider bar until the output is correct for 100%.

11. Click **Fix Gain Value** when the voltage output or current output is correct for 100%.



The gain value set using the slider bar will be stored in the EEPROM in the Analog Output Unit. Reset the Unit to enable the new setting.

12. Repeat steps 7 to 11 to adjust other outputs as necessary.
13. When you have completed all the adjustments, click **Close**. A message asking if you want to reset will appear. Click **Yes**. The Communications Unit and all I/O Units connected to it will be reset, and the new settings will be enabled.

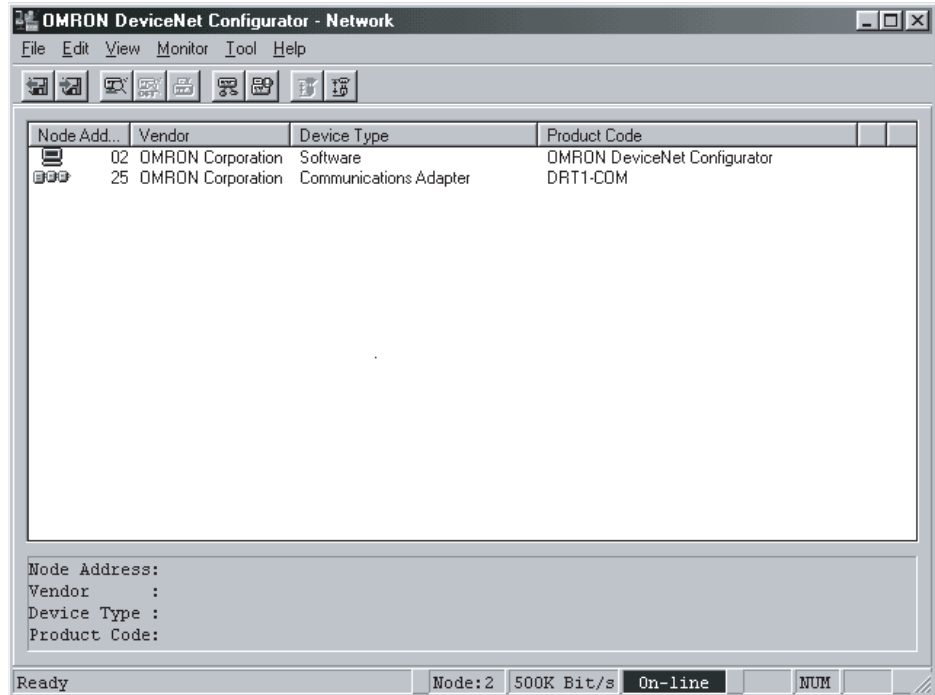
### Clearing Offset and Gain Settings

All offset and gain settings in the Analog Output Unit can be cleared at once. Use the following procedure to clear the offset and gain settings stored in the EEPROM in the Analog Output Unit. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

**Note** The offset and gain can be adjusted only with a Configurator Ver. 1.20 or later.

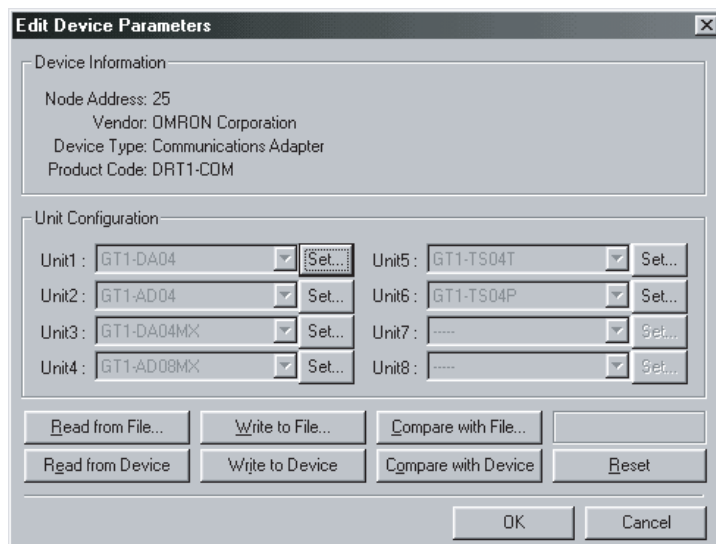
- 1,2,3...** 1. Turn ON the power supply for all the Units of the MULTIPLE I/O TERMINAL, including the Communications Unit and the Analog Output Unit to be cleared.
2. Connect the Configurator to the DeviceNet network and go online.

- On the device list for the Configurator, double-click the Communications Unit to which the Analog Output Unit is connected.



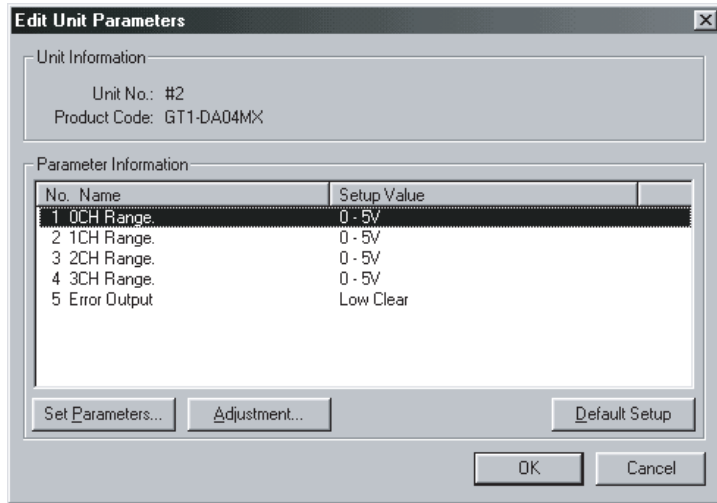
The Edit Device Parameters Window for the selected Communications Unit will be displayed.

- Click **Set** on the right of the Analog Output Unit to be cleared. **Unit 1 to Unit 8** correspond to I/O Units #0 to #7.



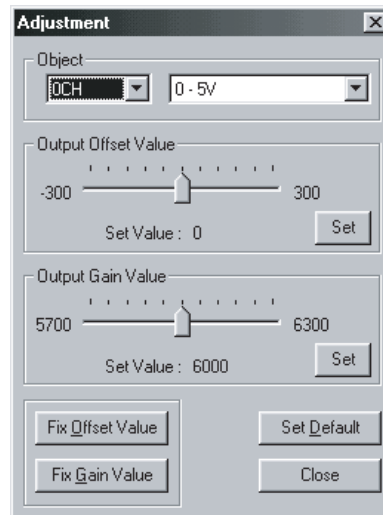
The Edit Unit Parameters Window for the Analog Output Unit will be displayed.

- Click **Adjustment**.



The Unit Adjustment Window will be displayed.

- Click **Set Default**.



- A message asking you to confirm will appear. Click **Yes**.



The offset and gain settings stored in the EEPROM in the Analog Output Unit will be reset to the default values. Reset the Unit to enable the default settings.

- After clearing the adjustment settings, click **Close**. A message asking if you want to reset will appear. Click **Yes**. The Communications Unit and all I/O Units connected to it will be reset, and the default settings will be enabled.

## 5-3 GT1-TS04T and GT1-TS04P Temperature Input Units

### 5-3-1 Specifications

#### General Specifications

Item		Specification
I/O connections		M3 terminal block
Number of inputs		4 points (Allocated 4 words or 8 words in the master. The number of allocated words can be set using the DIP switch.)
Internal power supply	Voltage range	20.4 to 26.4 VDC (−15 to 10% at 24 VDC)
	Current consumption in Unit (inrush current)	80 mA max. (Inrush current 10 A max., pulse width 1 ms max.)
Current consumption (I/O Unit interface)		50 mA max.
Noise immunity		±2000 V (IEC61000-4-4 via fast transient noise simulator)
Vibration resistance		10 to 150 Hz, 0.7-mm double amplitude or 50 m/s <sup>2</sup>
Shock resistance		150 m/s <sup>2</sup>
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
Weight		Approx. 210 g

#### Characteristics

Item	Specification	
	GT1-TS04T	GT1-TS04P
Model	GT1-TS04T	GT1-TS04P
Input type	R, S, K, J, T, B, L: Switching possible	Pt100, JPt100: Switching possible
Accuracy	(The larger of ±0.3% of the displayed value or ±1°C. See note.) ±1 digit max.	When the range is −200.0 to 650.0: (The larger of ±0.3% of the indicated value or 0.8°C) ±1 digit max.  When the range is −200.0 to 200.0: (The larger of ±0.3% of the indicated value or 0.5°C) ±1 digit max.
Conversion cycle	250 ms / 4 points	
Temperature conversion data	Binary data (4-digit Hex.)	
Isolation method	Photocoupler isolation between inputs and communications lines Photocoupler isolation between each temperature input signal	

Note K or T below −100°C: ±2°C ±1 digit max.

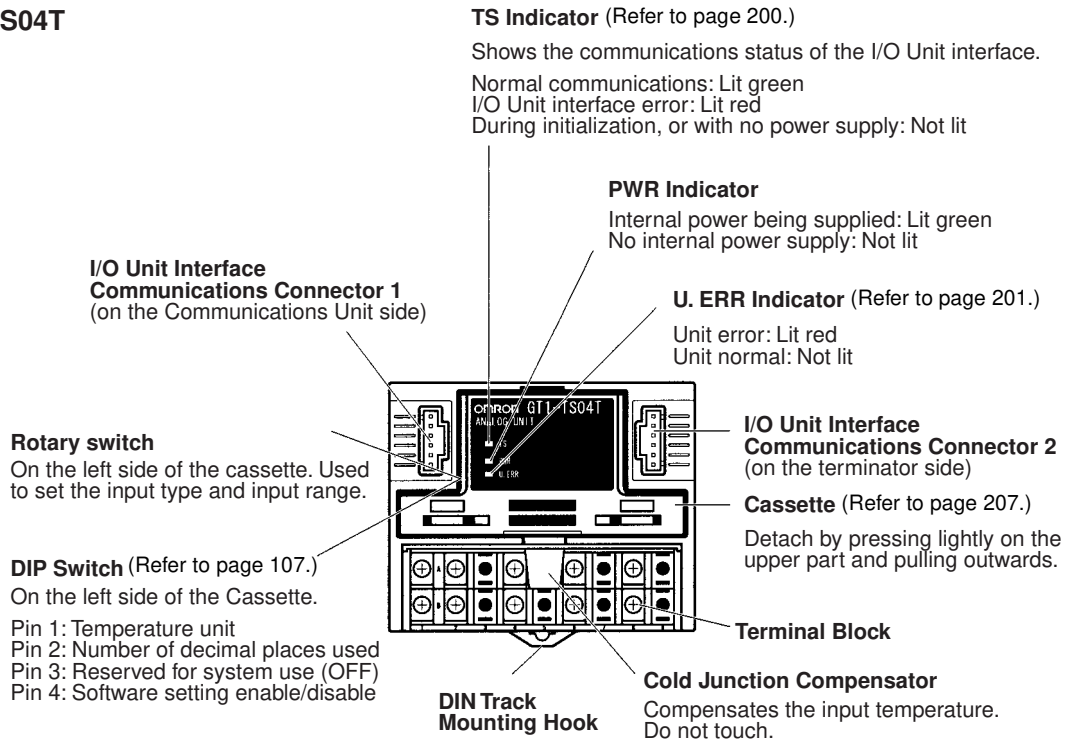
L: ±2°C ±1 digit max.

R or S below 200°C: ±3°C ±1 digit max.

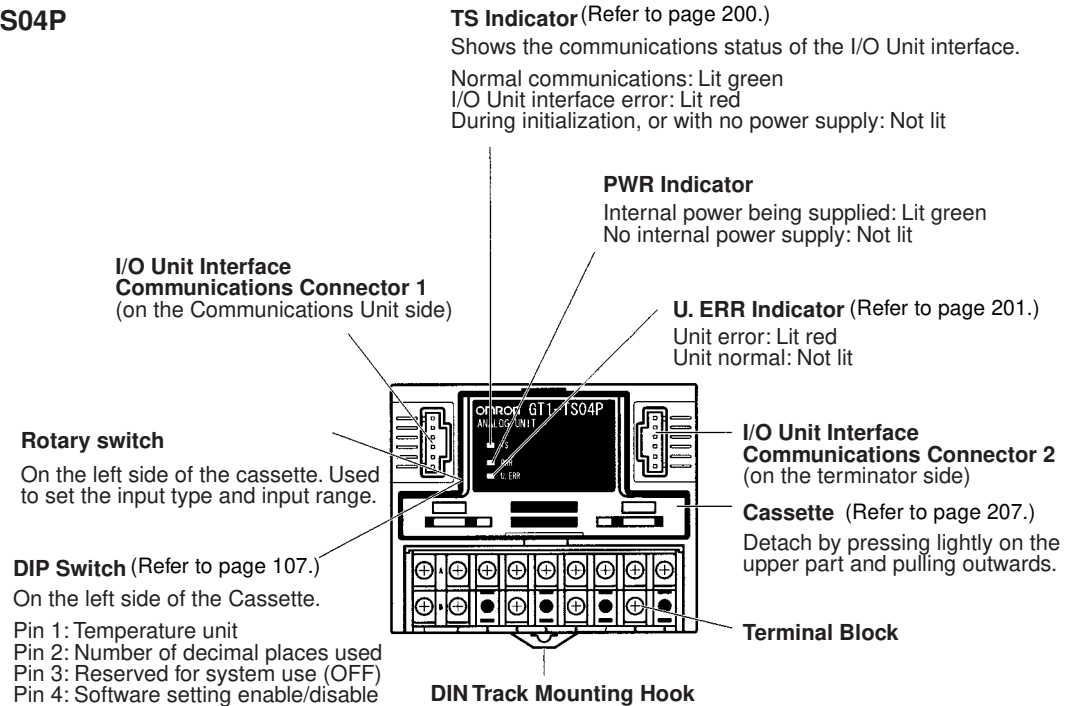
B below 400°C: No standard set

Components

GT1-TS04T

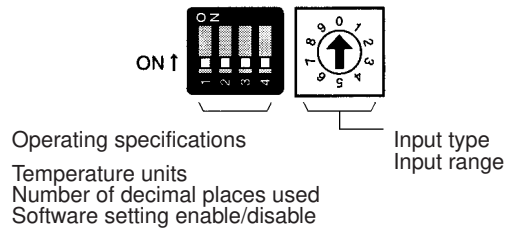


GT1-TS04P



**DIP Switch and Rotary Switch Settings**

The DIP switch and rotary switch are located on the left side of the cassette on the Temperature Input Units (GT1-TS04T/TS04P). Remove the cassette from the Unit to set the DIP switch and rotary switch.



**Note** Before detaching or attaching the Cassette or making DIP switch or rotary switch settings, be sure that the power supply to the I/O Unit (including power supply to I/O Unit interface) is OFF.

**Operating Specification Settings**

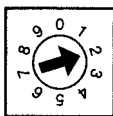
DIP switch	Function	Setting	Setting contents
1	Temperature unit	OFF	°C (factory-set)
		ON	°F
2	Number of decimal places used (refer to <i>Converted Data</i> on page 153)	OFF	Normal Mode (0 or 1 digit after the decimal point, depending on the input) (factory-set)
		ON	2-decimal-place Mode
3	Reserved for system use	OFF	Must be set to OFF (factory-set).
4	Software setting enable/disable	OFF	Set the input range using the rotary switch (factory-set).
		ON	Set the input range using the Configurator. (See note.)

- Note**
- When setting the input range using a DeviceNet Configurator, use version 1.20 or later. If pin 4 is ON, and the Configurator is not used to make the settings, all input ranges will be set to K (–200 to 1300°C) or Pt100 (–200 to 650°C).
  - If input ranges are set using the Configurator (version 1.20 or later), it is possible to make different settings for each point.

**Input Type and Input Range Settings**

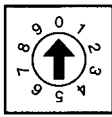
The following input types and input ranges are determined by the number set on the rotary switch. The input type and input range made using the rotary switch are the same for all 4 input points.

**GT1-TS04T**



Number	Input type	Range (°C)	Range (°F)
0	R	0 to 1700	0 to 3000
1	S	0 to 1700	0 to 3000
2 (factory-set)	K	–200 to 1300	–300 to 2300
3	K	0.0 to 500.0	0.0 to 900.0
4	J	–100 to 850	–100 to 1500
5	J	0.0 to 400.0	0.0 to 750.0
6	T	–200.0 to 400.0	–300.0 to 700.0
7	L	–100 to 850	–100 to 1500
8	L	0.0 to 400.0	0.0 to 750.0
9	B	100 to 1800	300 to 3200



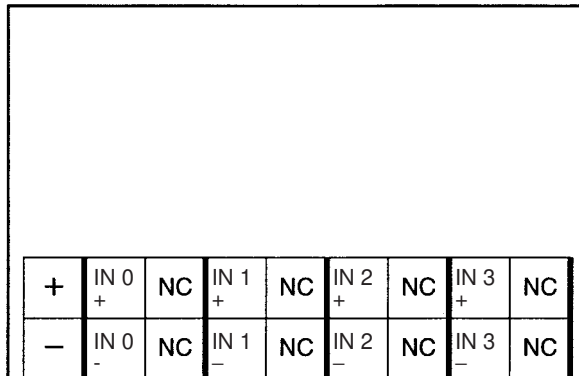


**GT1TS04P**

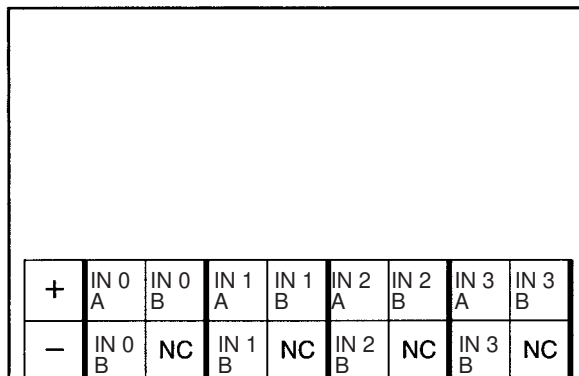
Number	Input type	Range (°C)	Range (°F)
0 (factory-set)	Pt100	-200.0 to 650.0	-300.0 to 1200.0
1	JPt100	-200.0 to 650.0	-300.0 to 1200.0
2	Pt100	-200.0 to 200.0	-300.0 to 380.0
3	JPt100	-200.0 to 200.0	-300.0 to 380.0
4 to 9	Cannot be set		

**Terminal Arrangement**

**GT1-TS04T**

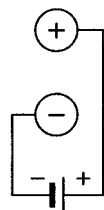


**GT1-TS04P**



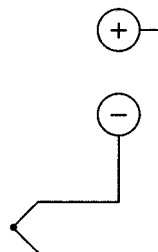
**Wiring**

Internal Power Supply

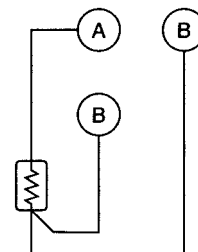


Internal power supply

GT1-TS04T  
Thermocouple  
input



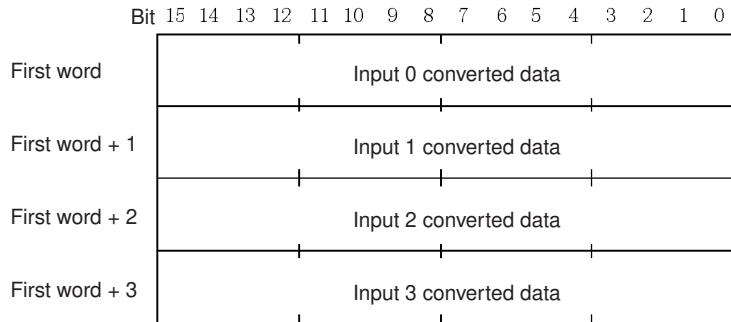
GT1-TS04P  
Platinum resistance  
thermometer input



Converted Data

**Normal Mode**

The input temperature data is converted into 4-digit hexadecimal (binary) data and stored in one of the four words in the Master allocated to temperature input as shown below.

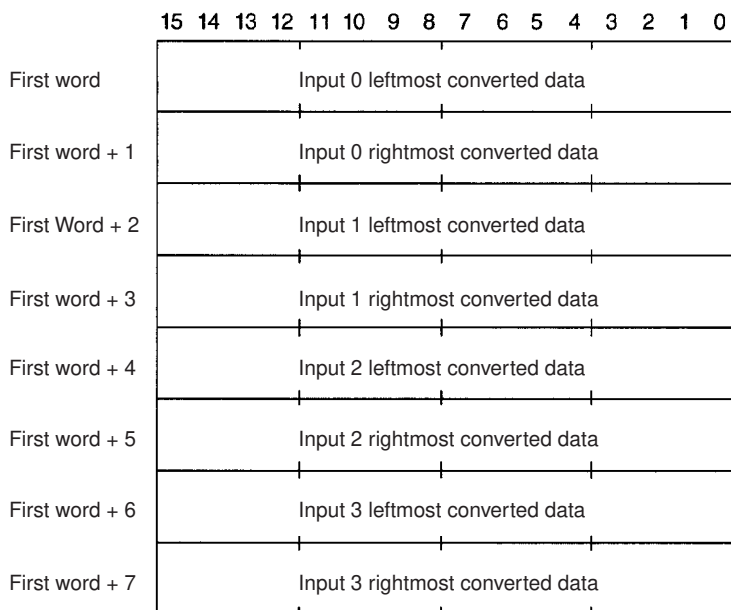


If the converted data is a negative number, it is stored as a two's complement. Data for range codes that include one digit after the decimal point are stored without the decimal point, i.e., 10 times the actual value is stored. Some examples are provided in the following table.

	Input	Data conversion examples
Unit: 1°	K (0.0 to 500.0°C), J (0.0 to 400.0°C), T and L (0.0 to 400.0°C), Pt100, JPt100	850° → 0352 Hex -200° → FF38 Hex
Unit: 0.1°	R, S, K (-200 to 1300°C), J (-100 to 850°C), L (-100 to 850°C), B	×10 500.0° → 5000 → 1388 Hex -20.0° → -200 → FF38 Hex -200.0° → -2000 → F830 Hex

**Two-decimal-point Mode**

The input temperature data for all input types and input ranges is sent to the Master as a value with 2 digits after the decimal point. The value of the temperature data is multiplied by 100 and converted to 8-digit hexadecimal digital (double-precision binary) data. If the converted data is a negative number, it is expressed as a two's complement. The four input points are allocated eight words in the Master as shown below.



Example: 850.00°C x 100 = 85000; Converted to binary = 00014C08 Hex. Thus, leftmost data: 4C08 Hex., and rightmost data: 0001 Hex.

-200.00°C x 100 = -20000; Converted to binary = FFFFB1E0 Hex.  
 Thus, leftmost data: B1E0 Hex., and rightmost data: FFFF Hex.

**Note** In 2-decimal-place Mode, temperature data as far as two digits after the decimal point is converted to binary data, but the actual resolution is not 0.01°C (°F). For this reason, there may be skipping and inaccuracies in the first and second digits after the decimal point (0.1 and 0.01). Treat any resolution above that specified for the normal data format as reference data.

**Data Range and Open-circuit Detection Function**

The range of data that can be converted depends on the number set using the rotary switch, as follows:

**GT1-TS04T**

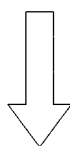
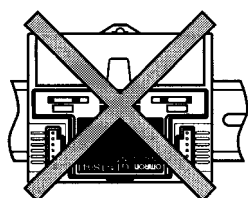
Number	Input range	Range (°C)	Range (°F)
0	R	-20 to 1720	-20 to 3020
1	S	-20 to 1720	-20 to 3020
2 (factory-set)	K	-220 to 1320	-320 to 2320
3	K	-20.0 to 520.0	-20.0 to 920
4	J	-120 to 870	-120 to 1520
5	J	-20.0 to 420.0	-20.0 to 770.0
6	T	-220.0 to 420.0	-320.0 to 720.0
7	L	-120 to 870	-120 to 1520
8	L	-20.0 to 420.0	-20.0 to 770.0
9	B	80 to 1820	280 to 3220

**GT1-TS04P**

Number	Input range	Range (°C)	Range (°F)
0 (factory-set)	Pt100	-220.0 to 670.0	-320.0 to 1220.0
1	JPt100	-220.0 to 670.0	-320.0 to 1220.0
2	Pt100	-220.0 to 220.0	-320.0 to 400.0
3	JPt100	-220.0 to 220.0	-320.0 to 400.0
4 to 9	Cannot be set		

If the input temperature exceeds the possible conversion range, the converted data will be fixed at the upper or lower limit. If the input temperature falls outside the range of possible conversions by more than a specific value, the input wiring will be assumed to be open, the open-circuit detection function will be triggered, and the converted data will be 7FFF Hex. The open-circuit detection function will also be triggered if there is an error in the cold junction compensator. Once the conversion data returns to within the possible range, the open-circuit detection function will be automatically be cleared, and normal conversion data restored.

**Mounting**

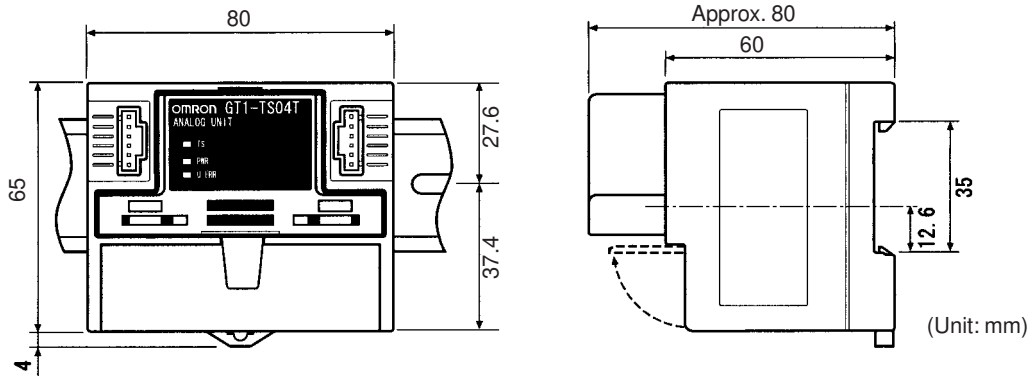


Vertical mounting

Do not mount the GT1-TS04T as shown on the left. If the Unit is mounted in this orientation, it may not provide the required accuracy.

**Dimensions**

The illustration below shows the GT1-TS04T. The dimensions for the GT1-TS04P are the same.



**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.

**5-3-2 Settings Using the Configurator**

Use Ver. 1.20 or later of the DeviceNet Configurator (referred to as the Configurator below) to make the following settings and adjustments.

- Setting the input range (page 154)
- Calibrating the Temperature Input Unit (GT1-TS04T: page 158; GT1-TS04P: page 162)
- Checking accuracy (page 165)
- Clearing calibrated data (page 169)

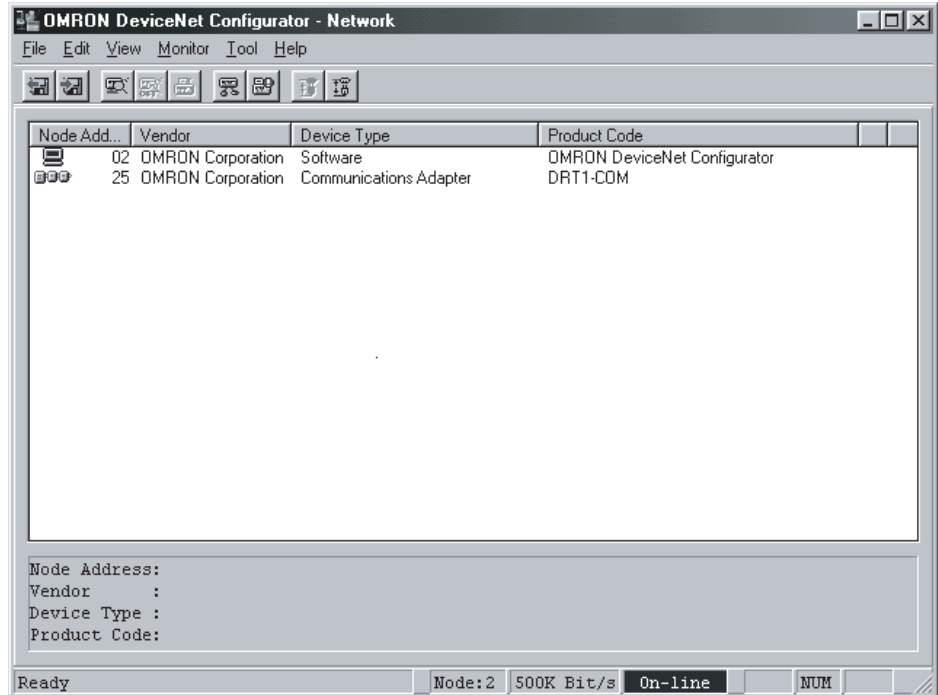
**Input Range Setting**

Use the following procedure to set the input range. the DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

**Note** The input range can be set for each point using the Configurator. Ranges can be set in 4-point units by setting DIP switches.

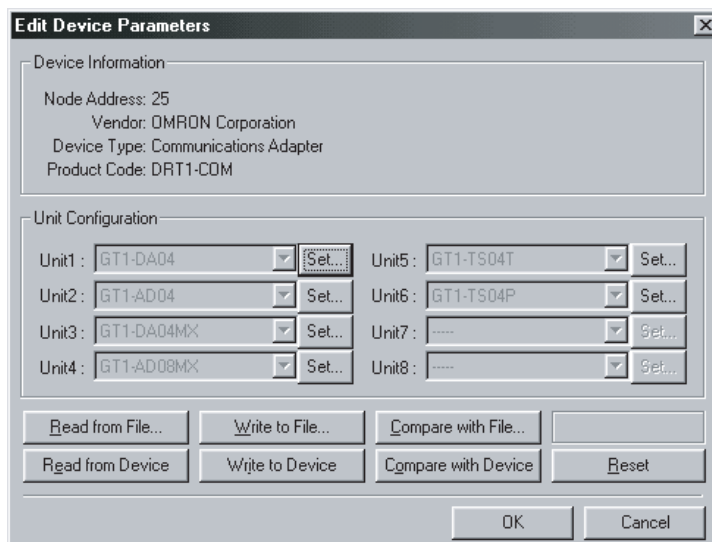
- 1,2,3...**
1. Turn ON pin 4 on the DIP switch to enable software settings.
  2. Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including the Temperature Input Unit to be set and the Communications Unit.
  3. Connect the Configurator to the DeviceNet network and go online.

- On the device list for the Configurator, double-click the Communications Unit to which the Temperature Input Unit is connected.



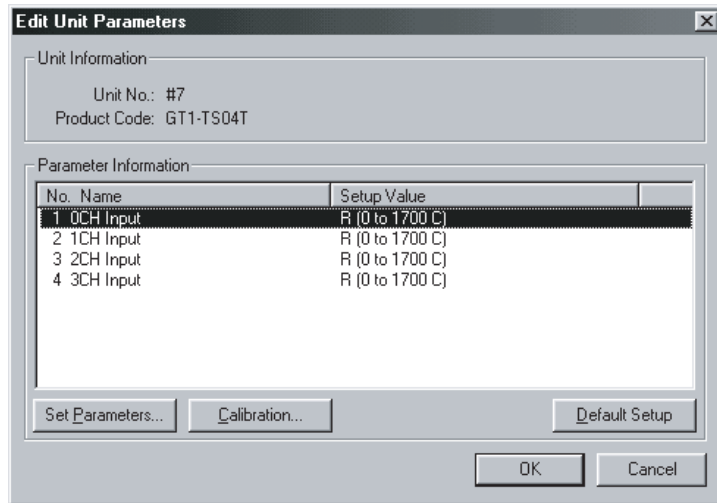
The Edit Device Parameters Window for the selected Communications Unit will be displayed.

- Click **Set** on the right of the Temperature Input Unit to be set. **Unit 1 to Unit 8** correspond to I/O Units #0 to #7.



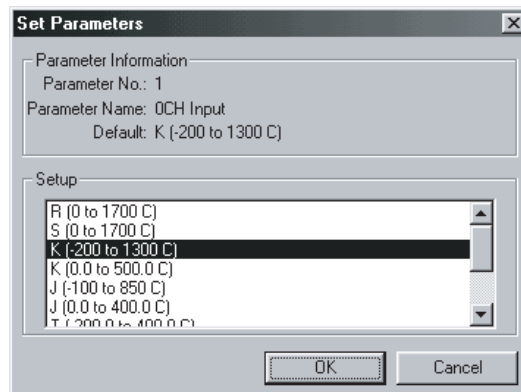
The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

- Double-click the line for the input range to be changed or, alternatively, click **Set Parameters** once with the line selected.



The Parameter Setting Window will be displayed.

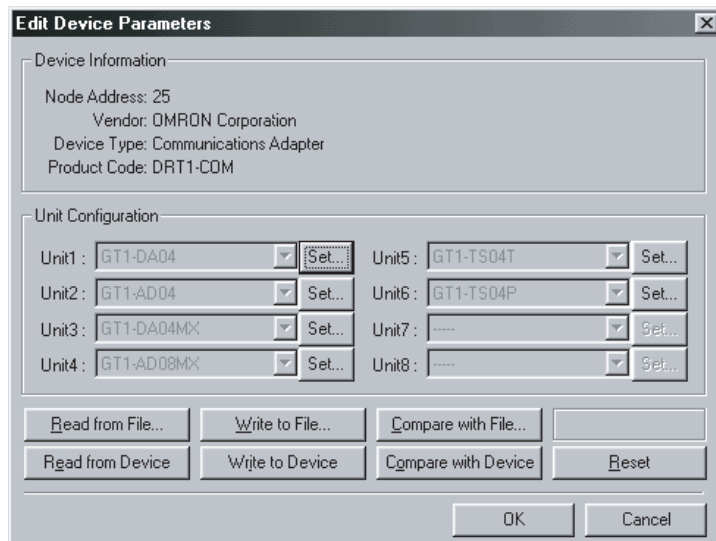
- Select the desired input range and click **OK**.



The input range will be set and the window for step 6 will appear again.

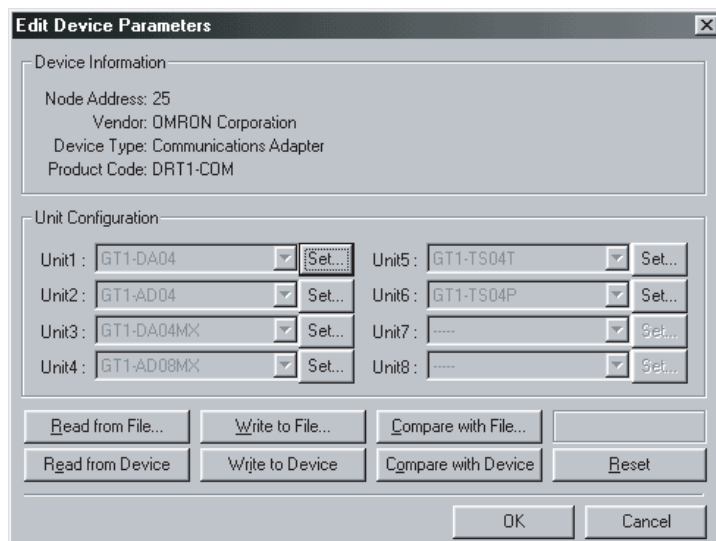
- To change other input ranges, repeat steps 6 and 7.
- When all the required input ranges have been set, click **OK** in the Edit Unit Parameters Window for the Temperature Input Unit. The Edit Device Parameters Window for the Communications Unit will appear again.
- To make the settings for other I/O Units, repeat steps 5 to 9.

- From the Edit Device Parameters Window for the Communications Unit, click **Write to Device**.



The specified input ranges will be set in the Temperature Input Unit. At this stage, however, the settings are not enabled.

- From the Edit Device Parameters Window for the Communications Unit, click **Reset**.



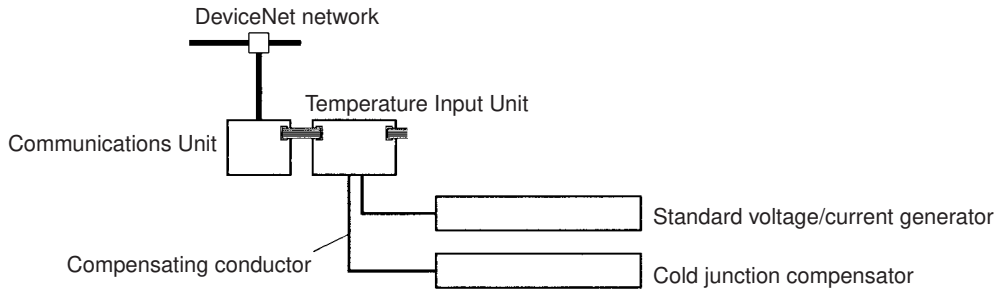
The Communications Unit and all the I/O Units connected to the Communications Unit will be reset, and the specified parameters (for example, for input ranges) will be enabled.

**Note** The settings will be enabled when the power supply to the Communications Unit is turned OFF and ON again even if **Reset** is not clicked at this time.

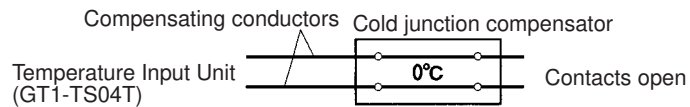
**Calibrating the GT1-TS04T** Use the following procedure to calibrate the GT1-TS04T. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

**Note** The Temperature Input Unit is correctly calibrated before being shipped from the factory, and calibration is not necessary for normal operation. Calibrate the Unit only if absolutely necessary. OMRON is not responsible for the results of any user-set calibrations. If the manual calibrations fail, clear the calibration to restore the Unit to the default settings.

- 1,2,3...** 1. Connect the external devices to the Temperature Input Unit that is to be calibrated.



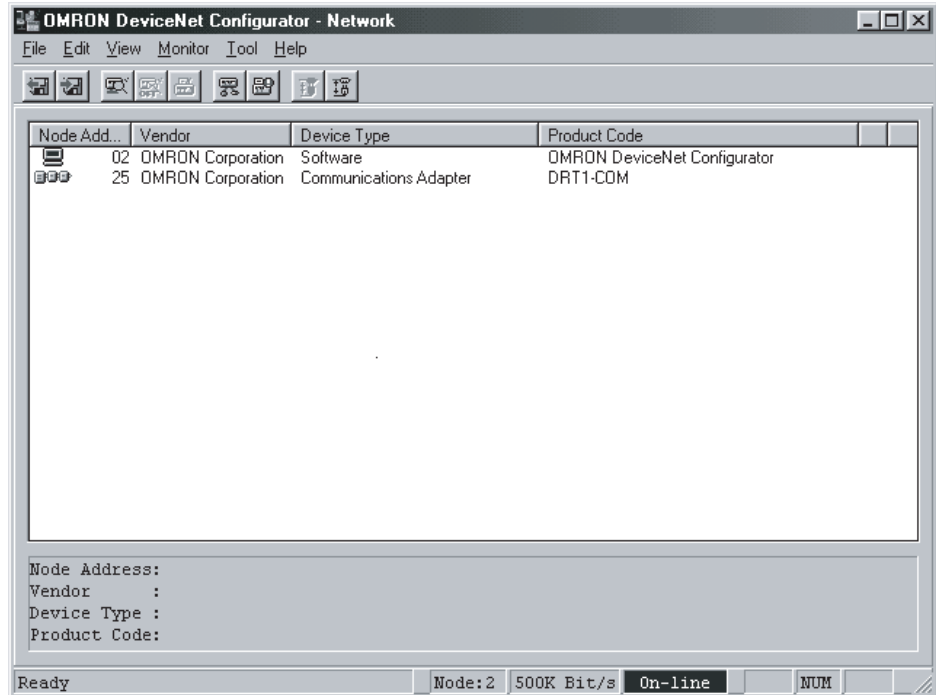
Use a calibrated thermocouple in a cold junction compensator and a compensating conductor. If using an R, S, or B thermocouple, a K thermocouple can be used instead. Set the cold junction compensator to 0°C, but disable the setting (i.e., keep the contact open) until the bias compensation described in step 10 is completed. Do not touch the Temperature Input Terminal or the compensating conductors.



2. Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including the Temperature Input Unit to be calibrated and the Communications Unit. Wait approximately 30 minutes until the internal temperature of the Temperature Input Unit has stabilized.
3. Connect the Configurator to the DeviceNet network and go online.

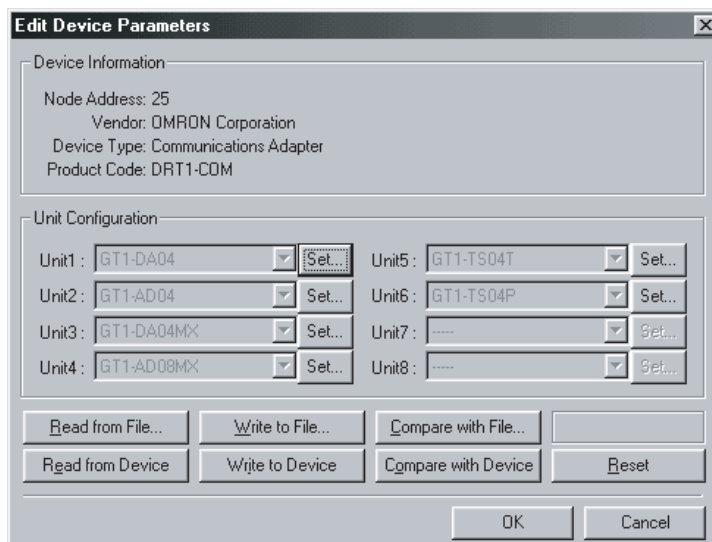


- On the device list for the Configurator, double-click the Communications Unit to which the Temperature Input Unit is connected.



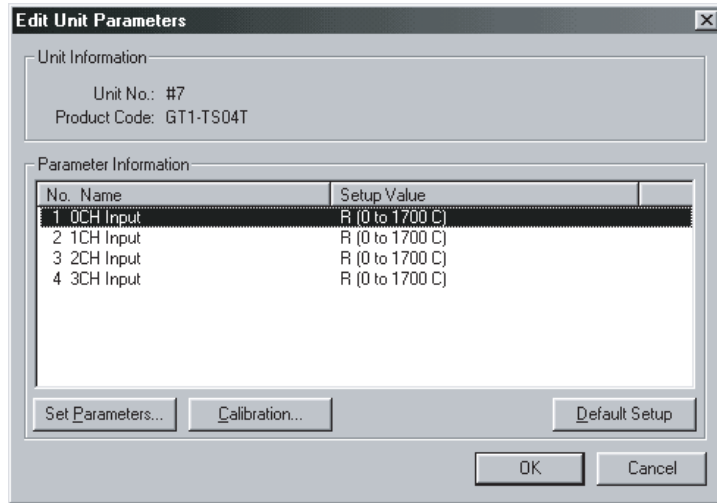
The Edit Device Parameters Window for the selected Communications Unit will be displayed.

- Click **Set** on the right of the Temperature Input Unit to be set. **Unit 1 to Unit 8** correspond to I/O Units #0 to #7.



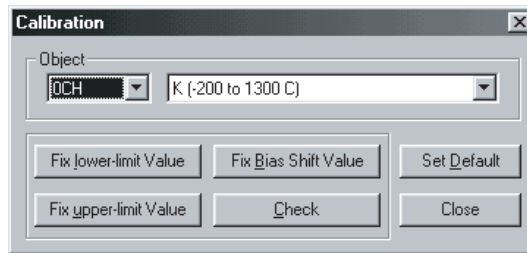
The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

- Click **Calibration**.

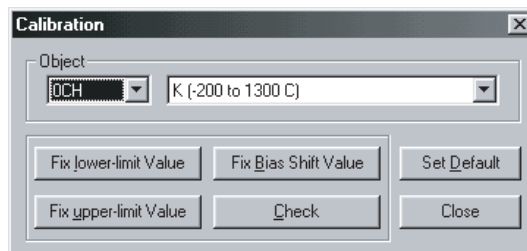


The Calibrate Unit Window will be displayed. At this time, the GT1-TS04T will enter Calibration Mode. While in Calibration Mode, temperature data sent to the Master will be 7FFF Hex. (7FFFFFFF Hex if in 2-decimal-place Mode). Exit the Calibration Mode by resetting the MULTIPLE I/O TERMINAL, or by turning the power OFF and ON again, to return to normal operating conditions.

- Click the Down Arrow and select the input words, the input type, and the input range to be calibrated.



- Calibrate the lower limit. Apply 0 mV to the input terminal (as selected in step 7) on the Temperature Input Unit from the standard voltage/current generator. Wait approximately 1 minute for the input to stabilize, then click **Fix lower-limit Value**.



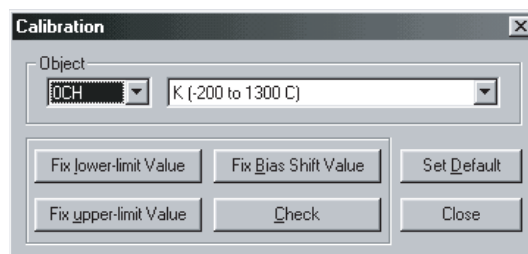
The calibrated lower limit will be stored in the EEPROM in the Temperature Input Unit.

- Calibrate the upper limit. Apply the voltage corresponding to the input type and input range as shown in the following table to the input terminal (as se-

lected in step 7) on the Temperature Input Unit from the standard voltage/current generator.

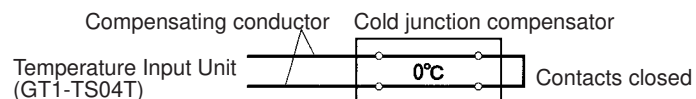
Input type	Range (°C)	Range (°F)	Input voltage
R	0 to 1700	0 to 3000	20 mV
S	0 to 1700	0 to 3000	20 mV
K	-200 to 1300	-300 to 2300	50 mV
K	0.0 to 500.0	0.0 to 900.0	20 mV
J	-100 to 850	-100 to 1500	50 mV
J	0.0 to 400.0	0.0 to 750.0	20 mV
T	-200.0 to 400.0	-300.0 to 700.0	20 mV
L	-100 to 850	-100 to 1500	50 mV
L	0.0 to 400.0	0.0 to 750.0	20 mV
B	100 to 1800	300 to 3200	20 mV

Wait approximately 1 minute for the input to stabilize, then click **Fix upper-limit Value**.

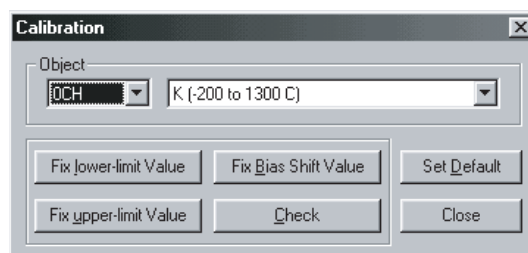


The calibrated upper limit will be stored in the EEPROM in the Temperature Input Unit.

- Compensate for bias. Turn OFF the standard voltage/current generator, and enable the cold junction compensator (close the contacts) as shown below. Check that the cold junction compensator is functioning at 0°C.



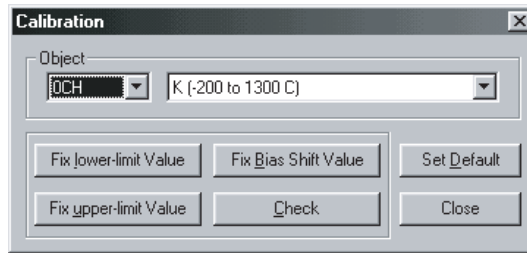
With sensors R, S, and B, the margin of error at close to 0°C is great, so set the input type to a K thermocouple to compensate. Wait approximately 40 minutes for the temperature to stabilize, then click **Fix Bias Shift Value**.



The bias compensation will be stored in the EEPROM in the Temperature Input Unit.

- Repeat steps 7 to 10 to adjust other inputs as necessary.

- When you have completed all the adjustments, click **Close**.



A message asking if you want to reset will appear. Click **Yes**. The Communications Unit and all I/O Units connected to it will be reset, and the Unit will return to normal operating mode from Calibration Mode. The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

**Note** When calibrating the Temperature Input Unit, the calibration data will be stored in the Temperature Input Unit and enabled when it is set.

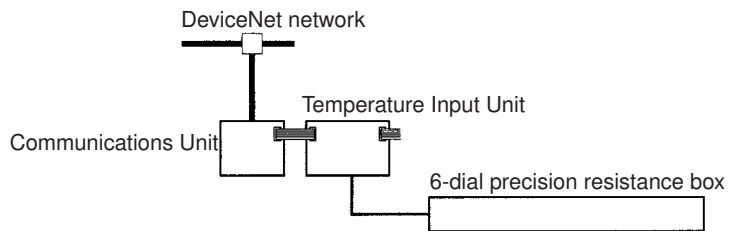
**Calibrating the GT1-TS04P**

Use the following procedure to calibrate the GT1-TS04P. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

**Note** The Temperature Input Unit is correctly calibrated before being shipped from the factory, and calibration is not necessary for normal operation. Calibrate the Unit only if absolutely necessary. OMRON is not responsible for the results of any user-set calibrations. If the manual calibrations fail, clear the calibration to restore the Unit to the default settings.

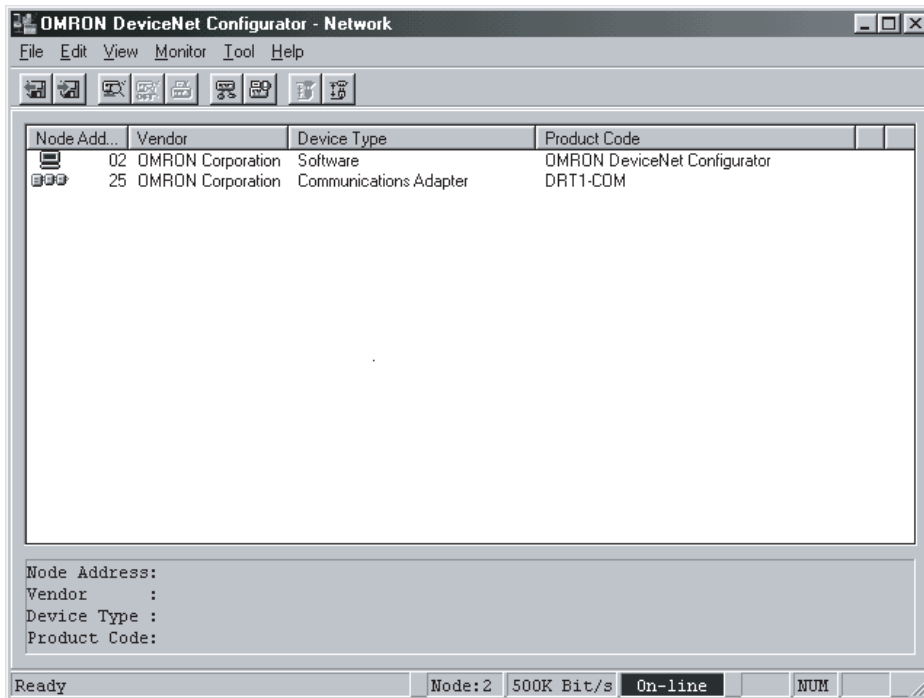
**1,2,3...**

- Connect a 6-dial precision resistance box to the Temperature Input Unit that is to be calibrated.



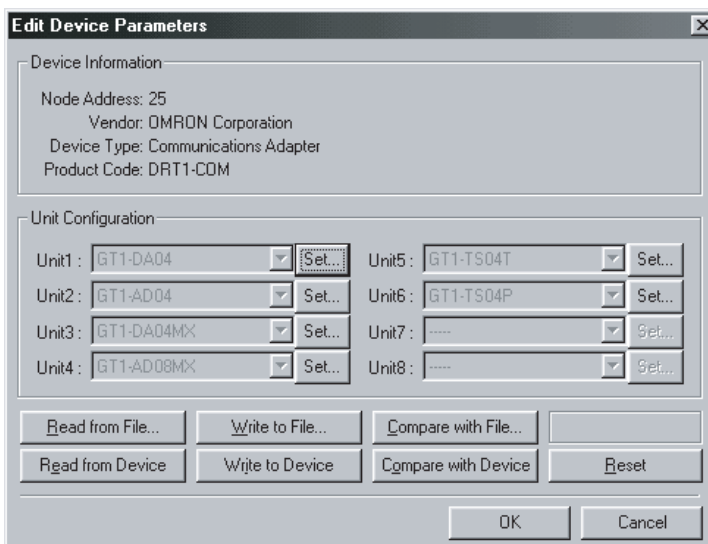
- Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including the Temperature Input Unit to be calibrated and the Communications Unit. Wait approximately 30 minutes until the internal temperature of the Temperature Input Unit has stabilized.
- Connect the Configurator to the DeviceNet network and go online.

- On the device list for the Configurator, double-click the Communications Unit to which the Temperature Input Unit is connected.



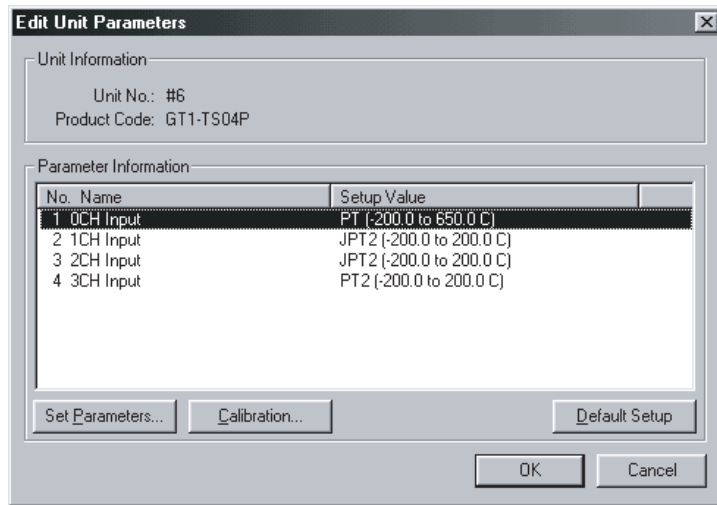
The Edit Device Parameters Window for the selected Communications Unit will be displayed.

- Click **Set** on the right of the Temperature Input Unit to be set. **Unit 1 to Unit 8** correspond to I/O Units #0 to #7.



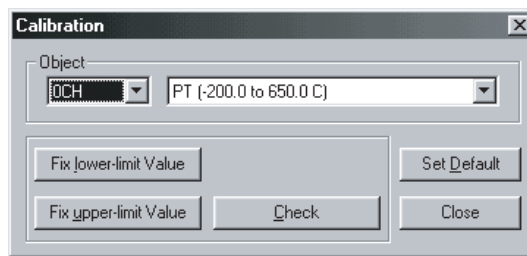
The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

- Click **Calibration**.

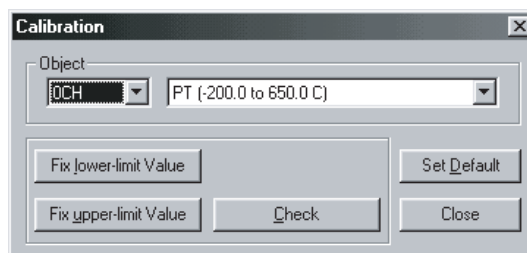


The Calibrate Unit Window will be displayed. At this time, the GT1-TS04P will enter Calibration Mode. While in Calibration Mode, temperature data sent to the Master will be 7FFF Hex. (7FFFFFFF Hex if in 2-decimal-place Mode). Exit the Calibration Mode by resetting the MULTIPLE I/O TERMINAL, or by turning the power OFF and ON again, to return to normal operating conditions.

- Click the Down Arrow to select the input words, the input type, and the input range to be calibrated.



- Calibrate the lower limit. Apply 18 Ω to the input terminal (as selected in step 7) on the Temperature Input Unit from the 6-dial precision resistance box. Wait approximately 1 minute for the input to stabilize, then click **Fix lower-limit Value**.

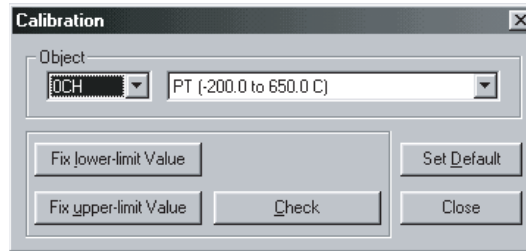


The calibrated lower limit will be stored in the EEPROM in the Temperature Input Unit.

- Calibrate the upper limit. Apply the resistance corresponding to the input type and input range as shown in the following table to the input terminal (as selected in step 7) on the Temperature Input Unit from the 6-dial precision resistance box.

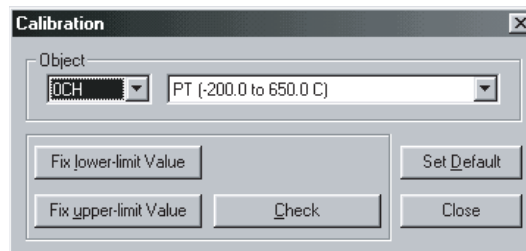
Input type	Range (°C)	Range (°F)	Input resistance
Pt100	-200.0 to 650.0	-300.0 to 1200.0	330 Ω
JPt100	-200.0 to 650.0	-300.0 to 1200.0	330 Ω
Pt100	-200.0 to 200.0	-300.0 to 380.0	180 Ω
JPt100	-200.0 to 200.0	-300.0 to 380.0	180 Ω

Wait approximately 1 minute for the input to stabilize, then click **Fix upper-limit Value**.



The calibrated upper limit will be stored in the EEPROM in the Temperature Input Unit.

10. Repeat steps 7 to 9 to adjust other inputs as necessary.
11. When you have completed all the adjustments, click **Close**. A message asking if you want to reset will appear. Click **Yes**. The Communications Unit and all I/O Units connected to it will be reset, and the Unit will return to normal operating mode from Calibration Mode.



The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

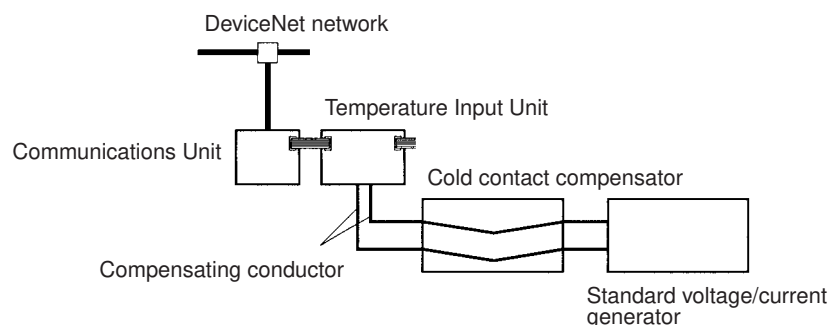
Note When calibrating the Temperature Input Unit, the calibration data will be stored in the Temperature Input Unit and enabled when it is set.

**Checking Accuracy**

Be sure to check accuracy after enabling the calibration. During the accuracy check, be sure to check the lower limit, median value, and upper limit. Use the following procedure to check the accuracy. the DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

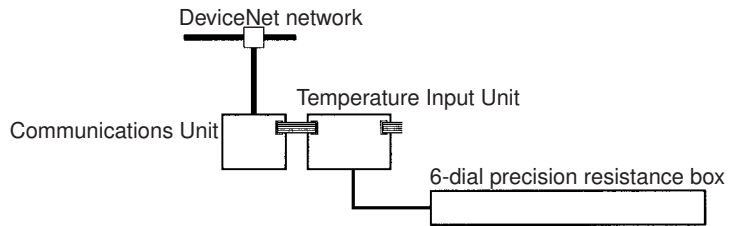
1. Connect the external devices to the Temperature Input Unit to be checked, as shown below.

**GT1-TS04T**

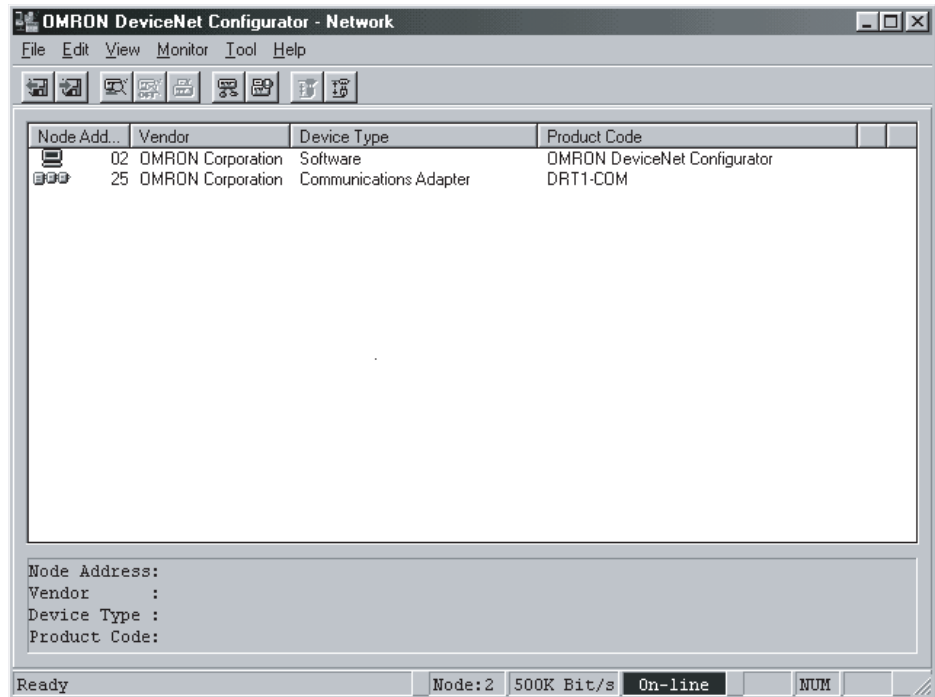


Use a calibrated thermocouple in the cold junction compensator and a compensating conductor, and set the cold junction compensator to 0°C.

**GT1-TS04P**



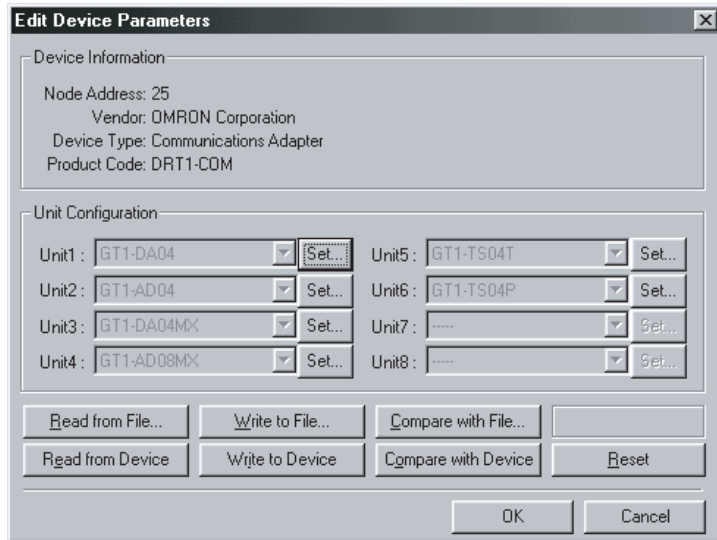
2. Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including the Temperature Input Unit to be checked and the Communications Unit. Wait approximately 30 minutes until the internal temperature of the Temperature Input Unit has stabilized.
3. Connect the Configurator to the DeviceNet network and go online.
4. On the device list for the Configurator, double-click the Communications Unit to which the Temperature Input Unit is connected.



The Edit Device Parameters Window for the selected Communications Unit will be displayed.

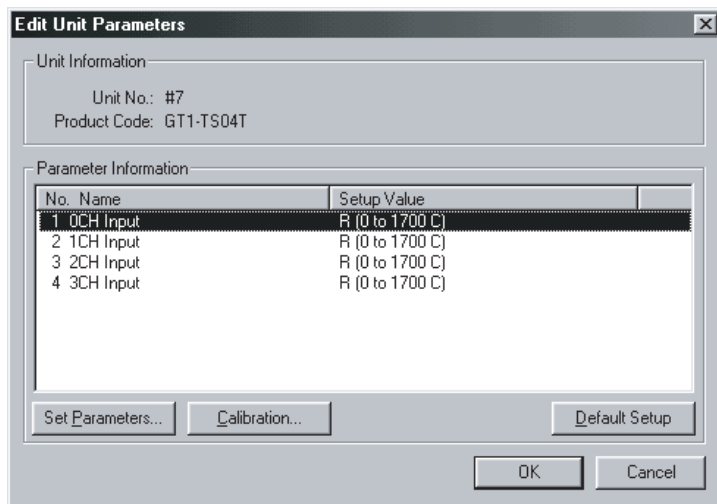


- Click **Set** on the right of the Temperature Input Unit to be set. **Unit 1 to Unit 8** correspond to I/O Units #0 to #7.



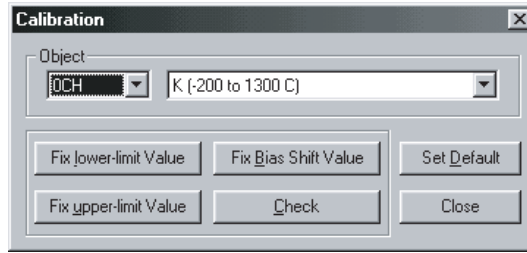
The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

- Click **Calibration**.

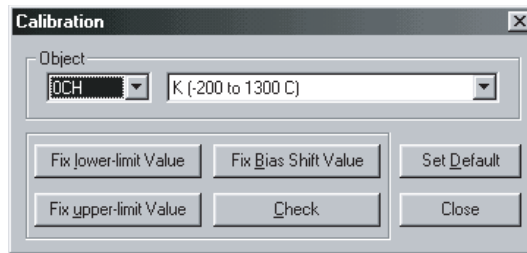


The Calibrate Unit Window will be displayed. At this time, the Temperature Input Unit will enter Calibration Mode. While in Calibration Mode, temperature data sent to the Master will be 7FFF Hex. (7FFFFFFF Hex if in 2-decimal-place Mode). Exit the Calibration Mode by resetting the MULTIPLE I/O TERMINAL, or by turning the power OFF and ON again, to return to normal operating conditions.

7. Click the Down Arrow to select the input words, the input type, and the input range to be checked.



8. Click **Check**.



The Check Unit Window will be displayed.

9. Check the lower limit as follows:
  - GT1-TS04T

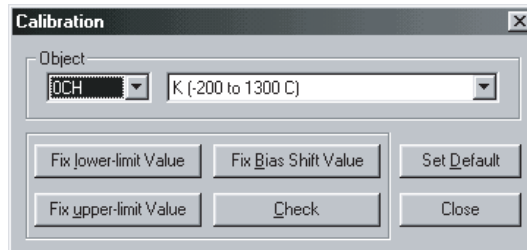
Check that the cold contact compensator is operating at 0°C, then apply a voltage equivalent to the lower limit of the conversion range to the input terminal (as selected in step 7) on the Temperature Input Unit from the standard voltage/current generator.

- GT1-TS04P

Apply a resistance equivalent to the lower limit of the conversion range to the input terminal (as selected in step 7) on the Temperature Input Unit from the 6-dial precision resistance box.

Check that the temperature data equivalent to the voltage or resistance input is correctly displayed as the Current Value.

10. Repeat step 9 for the median value and the upper limit.
11. To continue checking other inputs, click **Close** to return to the Edit Unit Window, and then repeat steps 7 to 10.
12. When you have completed all the checks, click **Close**.



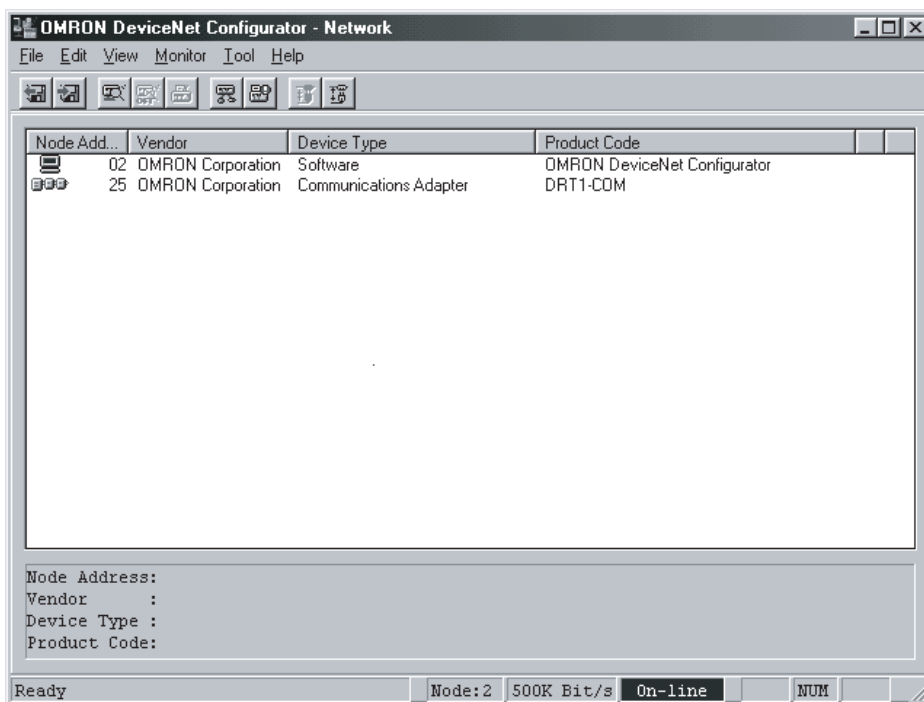
A message asking if you want to reset will appear. Click **Yes**. The Communications Unit and all I/O Units connected to it will be reset, and the Unit will return to normal operating mode from Calibration Mode. The Edit Unit Parameters Window for the Temperature Input Unit.

**Clearing Calibration**

If the calibrations fail, clear the calibration data stored in the EEPROM in the Temperature Input Unit, and restore the Unit to the default values. All the calibration data stored in the Temperature Input Unit will be cleared simultaneously.

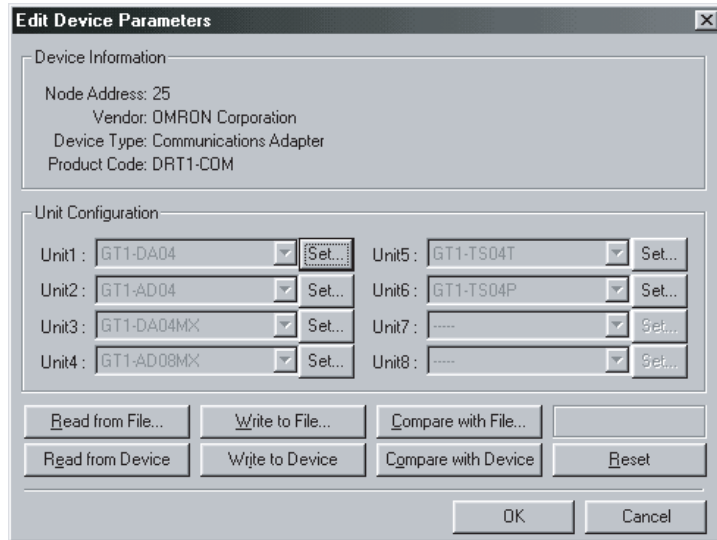
Use the following procedure to clear the data. The DeviceNet and the MULTIPLE I/O TERMINAL must be connected first.

- 1,2,3...**
1. Turn ON the power supply to all the Units of the MULTIPLE I/O TERMINAL, including the Communications Unit and the Temperature Input Unit whose calibration data is to be cleared.
  2. Connect the Configurator to the DeviceNet network and go online.
  3. On the device list for the Configurator, double-click the Communications Unit to which the Temperature Input Unit is connected.



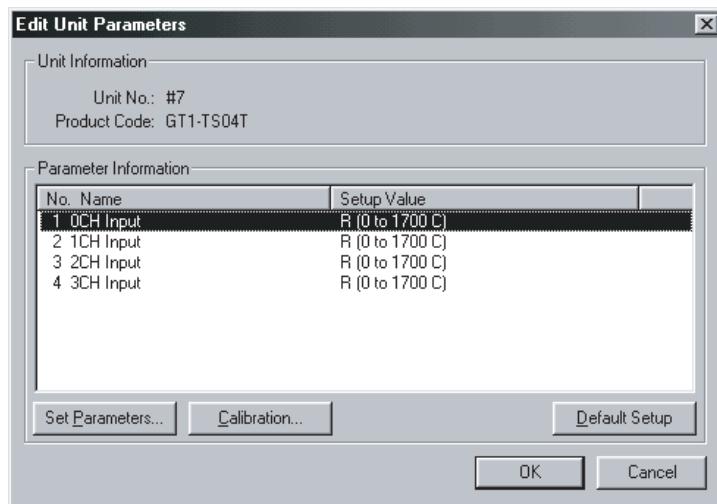
The Edit Device Parameters Window for the selected Communications Unit will be displayed.

- Click **Set** on the right of the Temperature Input Unit to be cleared. **Unit 1** to **Unit 8** correspond to I/O Units #0 to #7.



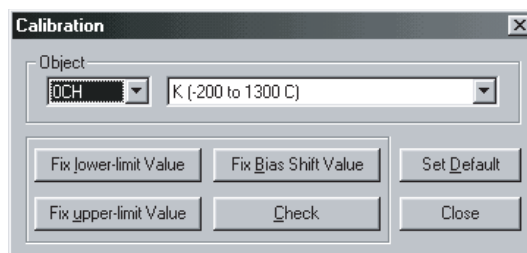
The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

- Click **Calibration**.



The Calibrate Unit Window will be displayed. At this time, the Temperature Input Unit will enter Calibration Mode. While in Calibration Mode, temperature data sent to the Master will be 7FFF Hex. (7FFFFFFF Hex if in 2-decimal-place Mode). Exit the Calibration Mode by resetting the MULTIPLE I/O TERMINAL, or by turning the power OFF and ON again, to return to normal operating conditions.

- Click **Set Default**.

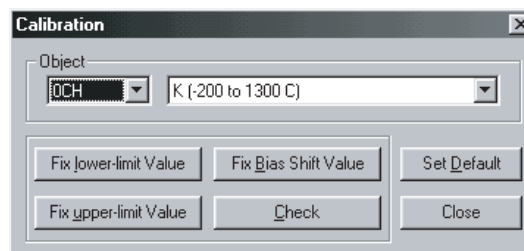


7. A message asking you to confirm will appear. Click **Yes**.



The calibration data stored in the EEPROM in the Temperature Input Unit will be cleared.

8. When you have finished clearing the calibration data, click **Close**. The Communications Unit and all I/O Units connected to it will be reset, and the Unit will return to normal operating mode from Calibration Mode.



The Edit Unit Parameters Window for the Temperature Input Unit will be displayed.

**Note** When clearing the calibration data stored in the Temperature Input Unit, the data will be cleared and the default settings enabled at the same time.

## 5-4 GT1-CT01 Counter Unit

### General Specifications

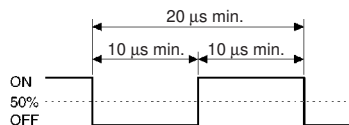
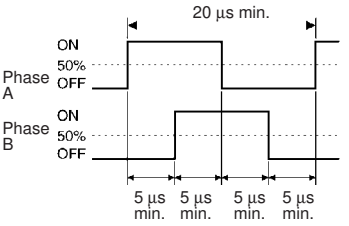
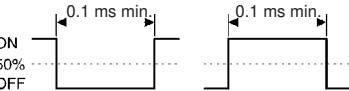
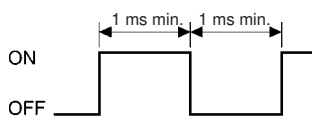
Item		Specification
I/O connections		Terminal block (M3)
Number of I/O		Encoder input: 1 point (A, B, Z) External input: 1 point (IN) External output: 2 points (OUT 1, OUT 2) (Allocated 3 input words and 3 output words on the Master)
Internal power supply	Voltage range	20.4 to 26.4 VDC (24 VDC $+10\%/_{-15\%}$ )
	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		$\pm 2000$ V (IEC61000-4-4 via fast transient noise simulator)
Vibration resistance		10 to 150 Hz, 1.0-mm double amplitude or 70 m/s <sup>2</sup>
Shock resistance		200 m/s <sup>2</sup>
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
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 ( $\times 1, \times 4$ ) 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 OMRON Encoders E6B2-CWZ6C and E6H-CWZ6C are recommended.

**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	
Number of circuits	1 count input point	1 point
Minimum response pulse	<p>Encoder Inputs A and B</p> <p>Waveform</p> <p>Input rising time/falling time: 3 ms max. at 50 kHz with pulses with a duty factor of 50%</p>  <p>Relationship between A and B phases with offset phase input</p>  <p>Encoder Input Z</p> 	

**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**

**TS Indicator** (Refer to page 200.)

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

**U.ERR Indicator** (Refer to page 201.)

Unit error: Lit red  
 Unit normal: Not lit

**A, B Indicator**

Lit when the encoder input is ON.

**IN Indicator**

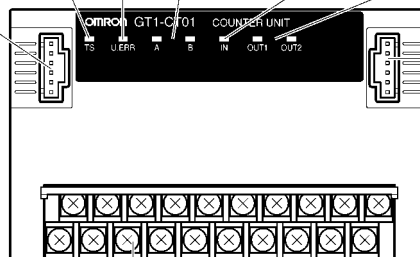
Lit when the external input is ON.

**OUT1, OUT2 Indicator**

Lit when external output is ON.

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

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

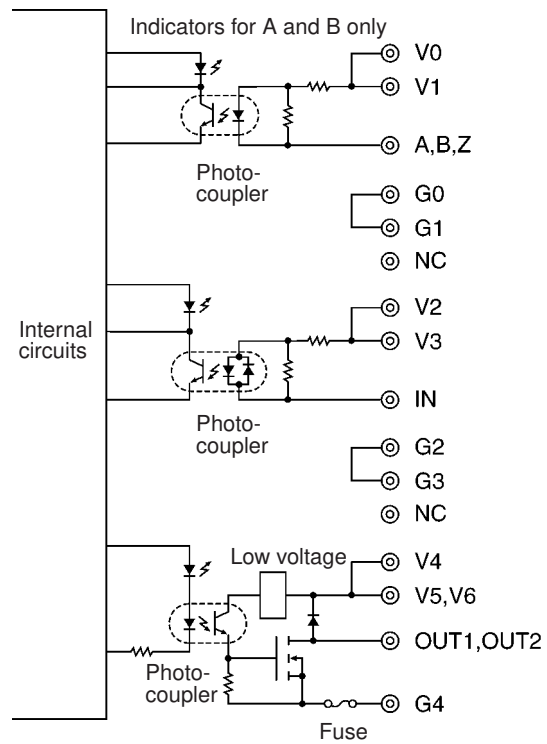


**Terminal Block**    **DIN Track Mounting Hook**

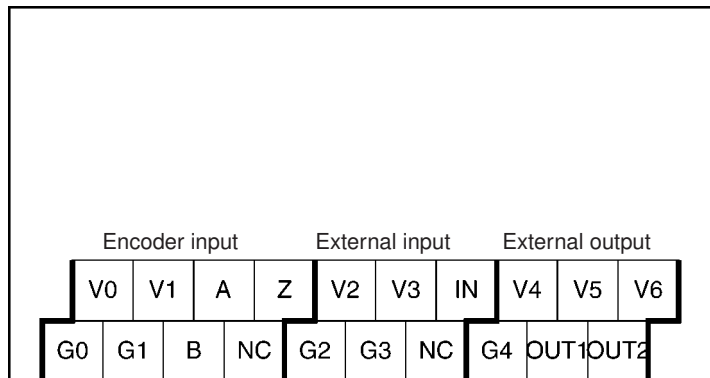
**Note** Setting for the Counter Unit is carried out in a PC word (output area allocated to the Counter Unit).



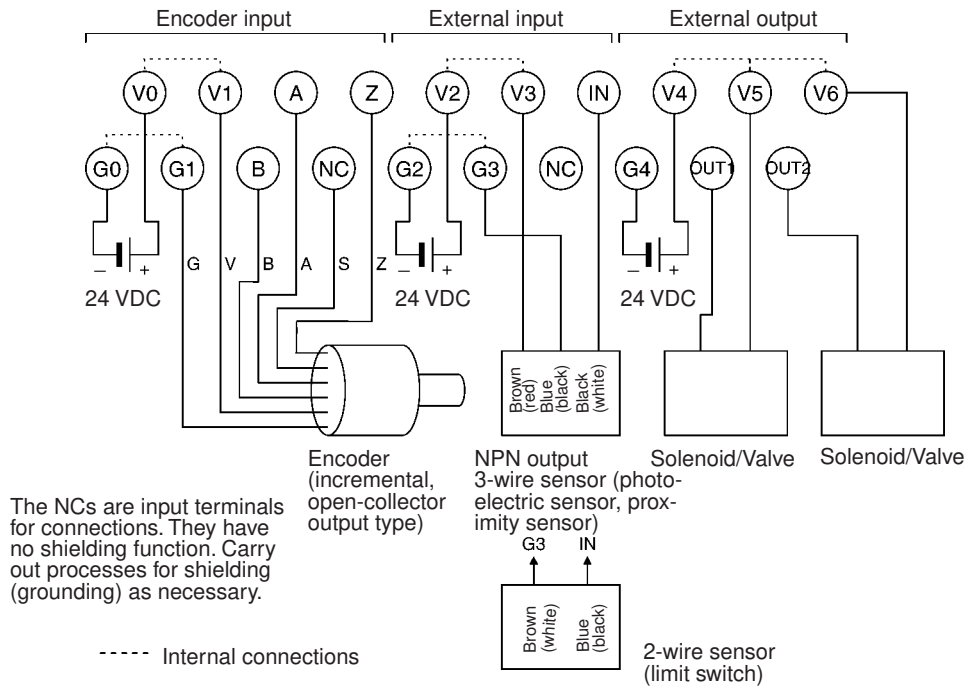
Internal Circuits



Terminal Arrangement



Wiring



- Note**
1. Do not use the same power supply for the encoder as that used for other I/O Units or communications.
  2. Wire colors in parentheses are the previous JIS colors for photoelectric and proximity sensors.

**Count Mode**

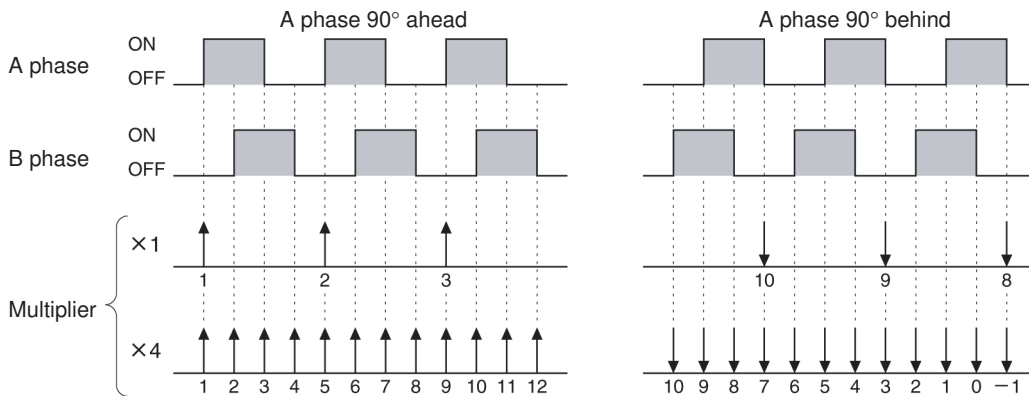
The following count modes can be used with the Counter Unit.

**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

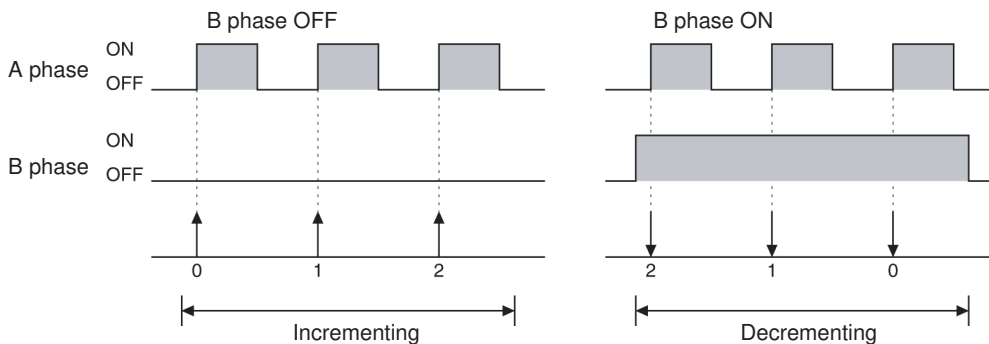


**Note** When using differential phase pulse input at a multiple function setting of ×4, the count number for each revolution of the encoder will be 4 times the resolution of the encoder. Use an encoder that is compatible with the counting range.

**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 179, *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 182, *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  $\leq$  Set value: When the count value is less than or equal to the set value, the external output will be ON.

Present value  $\geq$  Set value: When the count value is greater than or equal to the set value, the external output will be ON.

**External Output Enable/Disable:**

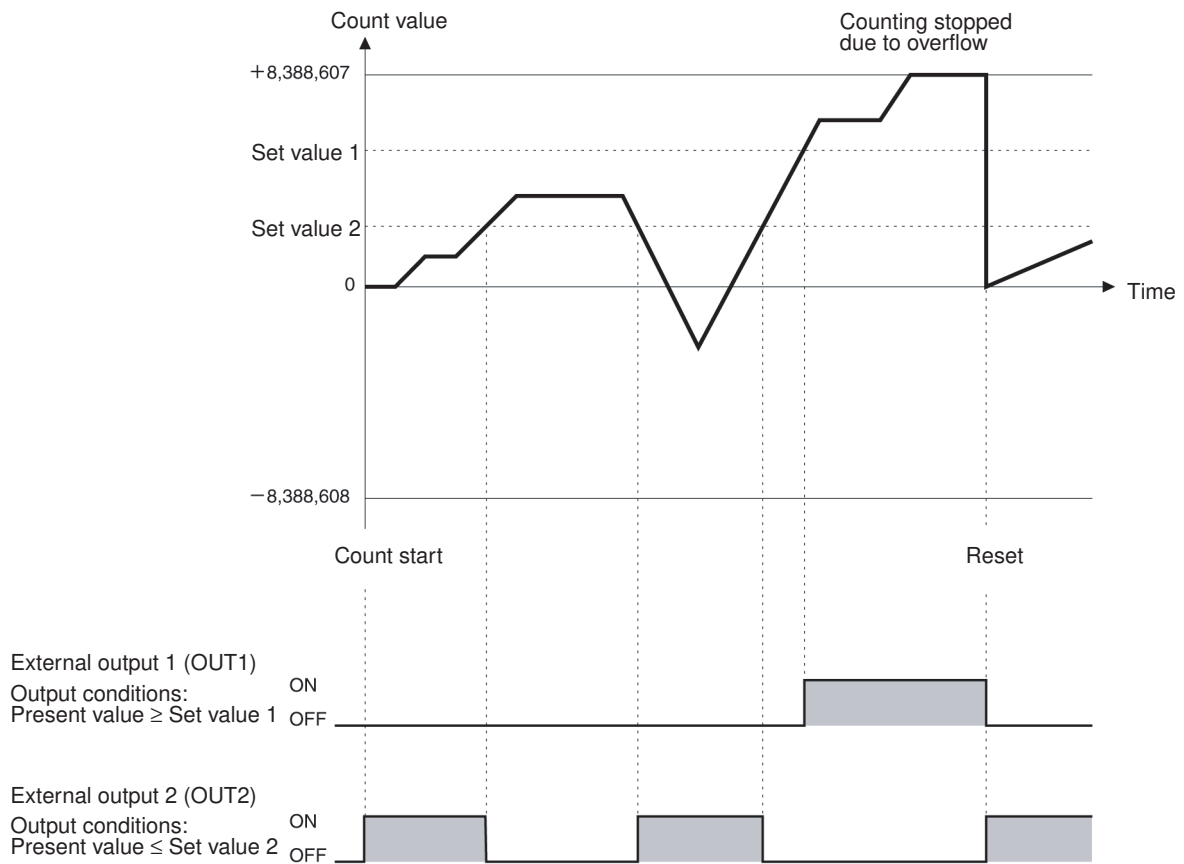
Actual external output will only be made when the External Output Enable Bits (bits 08 and 09 in word  $n+2$  of the output area) are ON. If the External Output Enable Bits are OFF, external output will remain OFF, even if the output conditions are satisfied.

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**

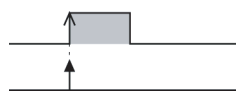
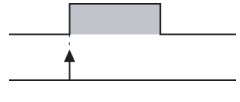
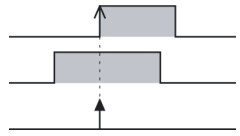
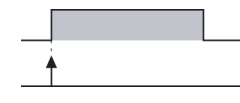
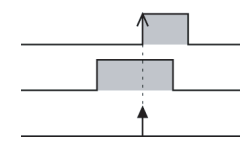
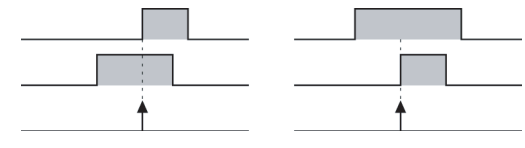
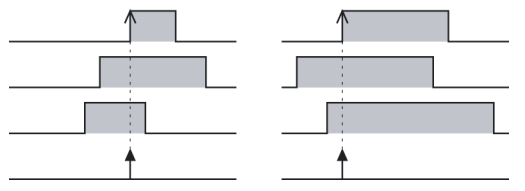
Count value setting refers to the procedure required to change the present value of the count as required, whereas count value reset refers to the process required to reset the present count value to 0.

**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

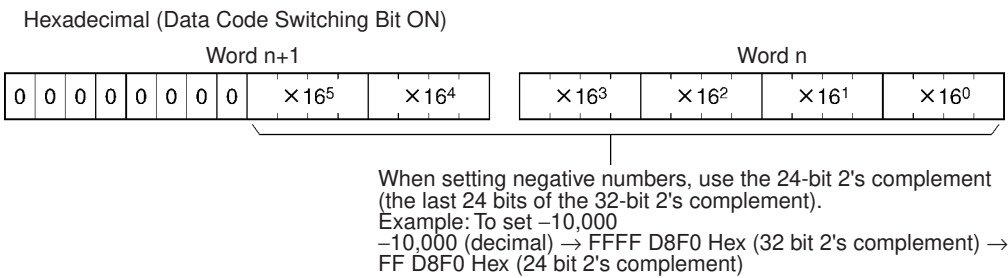
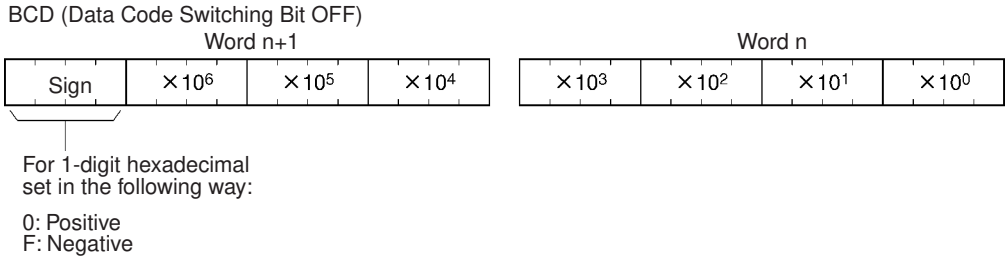
- Note**
1. Setting of the reset mode is performed in bits 12 to 14 in word n+2 of the output area.
  2. The Counter Unit will execute reset with the first count following the fulfillment of the reset conditions.
  3. Encoder input Z is only effective for the rising edge. When using the encoder input 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.



**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.

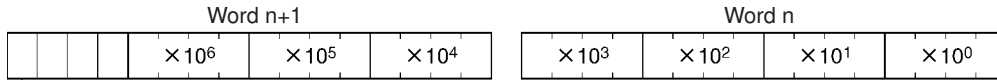
**Setting of Set Values 1 and 2**

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).

- 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)



Set the output conditions 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)

Set the sign with 1 bit.

0: Positive  
 1: Negative

Hexadecimal (Data Code Switching Bit ON)



Set the output conditions 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)

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 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**
- For details about allocation in the allocation area in the Master, refer to the *DeviceNet Operation Manual (W267)*.
  - 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

Word	Bit	Function																																																																						
Wd n	00 to 15	<p><b>Setting Count Value</b></p> <p>At the rising edge of the Count Value Setting Bit (word n+2, bit 2) starts, the value is read and set.</p> <p>BCD (Data Code Switching Bit OFF)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Word n+1</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;">Sign</td> <td style="width: 10%;"><math>\times 10^6</math></td> <td style="width: 10%;"><math>\times 10^5</math></td> <td style="width: 10%;"><math>\times 10^4</math></td> </tr> </table> </div> <div style="text-align: center;"> <p>Word n</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;"><math>\times 10^3</math></td> <td style="width: 10%;"><math>\times 10^2</math></td> <td style="width: 10%;"><math>\times 10^1</math></td> <td style="width: 10%;"><math>\times 10^0</math></td> </tr> </table> </div> </div> <p>Set the sign in 1-digit hexadecimal. 0: Positive 1: Negative</p> <p>Hexadecimal (Data Code Switching Bit ON)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Word n+1</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td> <td style="width: 10%;"><math>\times 16^5</math></td> <td style="width: 10%;"><math>\times 16^4</math></td> </tr> </table> </div> <div style="text-align: center;"> <p>Word n</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;"><math>\times 16^3</math></td> <td style="width: 10%;"><math>\times 16^2</math></td> <td style="width: 10%;"><math>\times 16^1</math></td> <td style="width: 10%;"><math>\times 16^0</math></td> </tr> </table> </div> </div> <p>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)</p> <p><b>Setting Set Values</b></p> <p>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.</p> <p>BCD (Data Code Switching Bit OFF)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Word n+1</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;"></td><td style="width: 10%;"></td><td style="width: 10%;"></td> <td style="width: 10%;"><math>\times 10^6</math></td> <td style="width: 10%;"><math>\times 10^5</math></td> <td style="width: 10%;"><math>\times 10^4</math></td> </tr> </table> </div> <div style="text-align: center;"> <p>Word n</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;"><math>\times 10^3</math></td> <td style="width: 10%;"><math>\times 10^2</math></td> <td style="width: 10%;"><math>\times 10^1</math></td> <td style="width: 10%;"><math>\times 10^0</math></td> </tr> </table> </div> </div> <p>Set the output conditions 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)</p> <p>Set the sign with 1 bit. 0: Positive 1: Negative</p> <p>Hexadecimal (Data Code Switching Bit ON)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Word n+1</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;">0</td><td style="width: 10%;"></td><td style="width: 10%;"></td><td style="width: 10%;"></td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td> <td style="width: 10%;"><math>\times 16^5</math></td> <td style="width: 10%;"><math>\times 16^4</math></td> </tr> </table> </div> <div style="text-align: center;"> <p>Word n</p> <table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;"><math>\times 16^3</math></td> <td style="width: 10%;"><math>\times 16^2</math></td> <td style="width: 10%;"><math>\times 16^1</math></td> <td style="width: 10%;"><math>\times 16^0</math></td> </tr> </table> </div> </div> <p>When setting negative numbers, use the 24-bit 2's complement (the last 24 bits of the 32-bit 2's complement). 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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	Count Mode Selection Bits	The count mode is set in the following way. <table border="1"> <thead> <tr> <th>Bit 11</th> <th>Bit 10</th> <th>Count mode</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>No mode change</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>Pulse and direction input mode</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>Differential phase pulse input (×4)</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>Differential phase pulse input (×1)</td> </tr> </tbody> </table>	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 (×1)																				
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11	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	Reset Mode Setting Bits	The reset mode is set in the following way. <table border="1"> <thead> <tr> <th>Bit 14</th> <th>Bit 13</th> <th>Bit 12</th> <th>Reset mode</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>No mode change</td> </tr> <tr> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>Encoder input Z</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>External input</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>ON</td> <td>Encoder input Z and external input</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>Internal reset bit</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>ON</td> <td>Encoder input Z and internal reset bit</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>OFF</td> <td>External input and internal reset bit</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>ON</td> <td>Encoder input Z, external input, and internal reset bit</td> </tr> </tbody> </table>	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
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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. <b>Note:</b> In the event of I/O Unit interface error, the Communications 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**

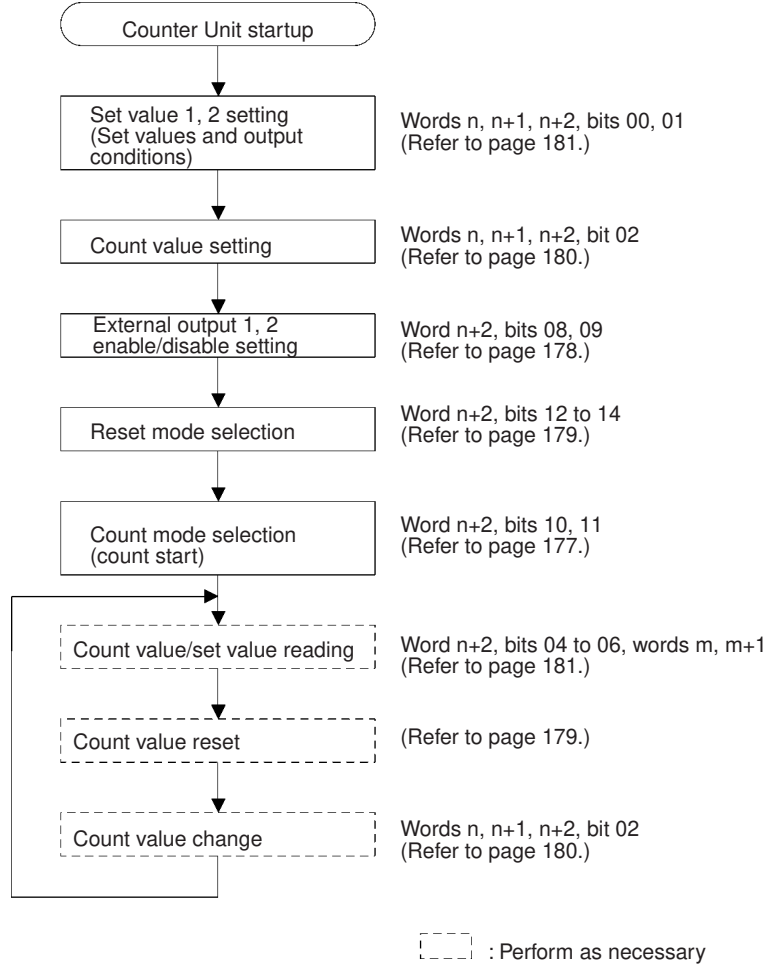
Word	Bit	Function																																																																							
Wd m	00 to 15	<p><b>Reading Count Value</b></p> <p>While the Count Value Reading Bit (word n+2, bit 06) is ON, the value will be constantly read and stored BCD (Data Code Switching Bit OFF)</p> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px;"> <p style="text-align: center;">Word n+1</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 10%;">Sign</td> <td style="width: 15%;">× 10<sup>6</sup></td> <td style="width: 15%;">× 10<sup>5</sup></td> <td style="width: 15%;">× 10<sup>4</sup></td> </tr> </table> </div> <div style="border: 1px solid black; padding: 2px;"> <p style="text-align: center;">Word n</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;">× 10<sup>3</sup></td> <td style="width: 15%;">× 10<sup>2</sup></td> <td style="width: 15%;">× 10<sup>1</sup></td> <td style="width: 15%;">× 10<sup>0</sup></td> </tr> </table> </div> </div> <p>The sign will be stored in 1-digit hexadecimal.                      0: Positive                      1: Negative</p> <p>Hexadecimal (Data Code Switching Bit ON)</p> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px;"> <p style="text-align: center;">Word n+1</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td> <td style="width: 15%;">× 16<sup>5</sup></td> <td style="width: 15%;">× 16<sup>4</sup></td> </tr> </table> </div> <div style="border: 1px solid black; padding: 2px;"> <p style="text-align: center;">Word n</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;">× 16<sup>3</sup></td> <td style="width: 15%;">× 16<sup>2</sup></td> <td style="width: 15%;">× 16<sup>1</sup></td> <td style="width: 15%;">× 16<sup>0</sup></td> </tr> </table> </div> </div> <p>Negative numbers will be stored using the 24-bit 2's complement (the last 24 bits of the 32-bit 2's complement).                      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Value (decimal)	BCD (sign + 7 digits)	Hexadecimal (6 digits)																																																																							
-8,388,608	F838 8608	80 0000																																																																							
to	to	to																																																																							
-1	F000 0001	FF FFFF																																																																							
0	0000 0000	00 0000																																																																							
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to	to	to																																																																							
8,388,607	0838 8607	7F FFFF																																																																							
Wd m+1	00 to 15	<p>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)</p> <p>The sign will be stored with 1 bit.                      0: Positive                      1: Negative</p> <p>Hexadecimal (Data Code Switching Bit ON)</p> <div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px;"> <p style="text-align: center;">Word n+1</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 10%;">0</td><td style="width: 10%;"> </td><td style="width: 10%;"> </td><td style="width: 10%;"> </td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td><td style="width: 10%;">0</td> <td style="width: 15%;">× 16<sup>5</sup></td> <td style="width: 15%;">× 16<sup>4</sup></td> </tr> </table> </div> <div style="border: 1px solid black; padding: 2px;"> <p style="text-align: center;">Word n</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;">× 16<sup>3</sup></td> <td style="width: 15%;">× 16<sup>2</sup></td> <td style="width: 15%;">× 16<sup>1</sup></td> <td style="width: 15%;">× 16<sup>0</sup></td> </tr> </table> </div> </div> <p>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)</p> <p>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)</p>	0				0	0	0	0	× 16 <sup>5</sup>	× 16 <sup>4</sup>	× 16 <sup>3</sup>	× 16 <sup>2</sup>	× 16 <sup>1</sup>	× 16 <sup>0</sup>																																																									
0				0	0	0	0	× 16 <sup>5</sup>	× 16 <sup>4</sup>																																																																
× 16 <sup>3</sup>	× 16 <sup>2</sup>	× 16 <sup>1</sup>	× 16 <sup>0</sup>																																																																						

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			

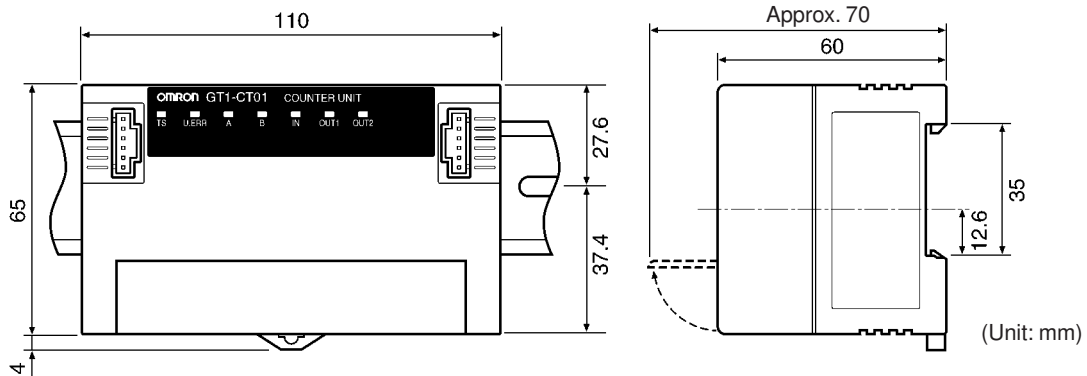
**Procedure Example**

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 182, *Word Functions* or *3-1 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 6

## Communications Timing

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

- 6-1 Remote I/O Communications Characteristics ..... 190
  - 6-1-1 I/O Response Time..... 190
  - 6-1-2 Communications Cycle Time and Refresh Time..... 191
  - 6-1-3 I/O Unit Interface Cycle Time ..... 193

## 6-1 Remote I/O Communications Characteristics

This section describes the characteristics of DeviceNet 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 operating with the scan list enabled.
  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 (from another company's configurator, for example).

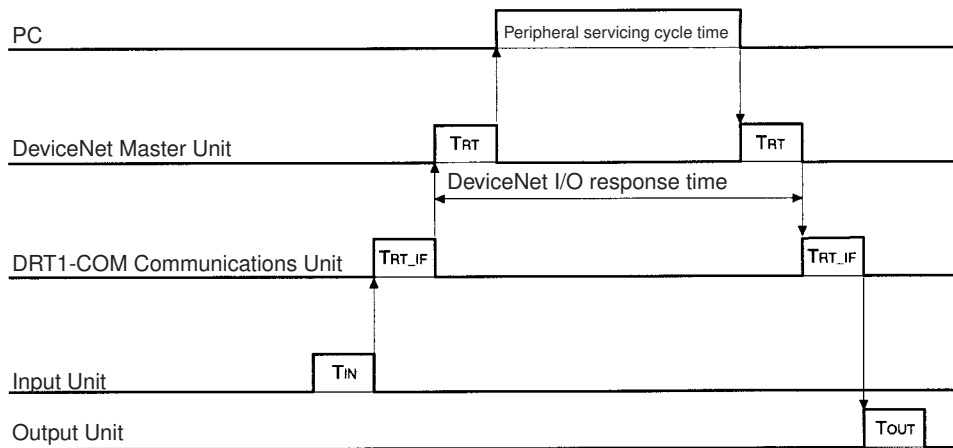
- Note**
1. The values provided by these equations may not be accurate if another company's Master or Slave is being used in the Network.
  2. This manual only refers to parts related to the MULTIPLE I/O TERMINAL. For details about the Master Unit or the entire DeviceNet, refer to the *DeviceNet Operation Manual (W267)*, and for details about Slaves other than the MULTIPLE I/O TERMINAL, refer to the *DeviceNet Slaves Operation Manual (W347)*.

### 6-1-1 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
- $T_{RT-IF}$ : I/O Unit interface communications time (1.5 ms)
- $T_{RT}$ : Communications time for 1 Slave (refer to page 192)

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

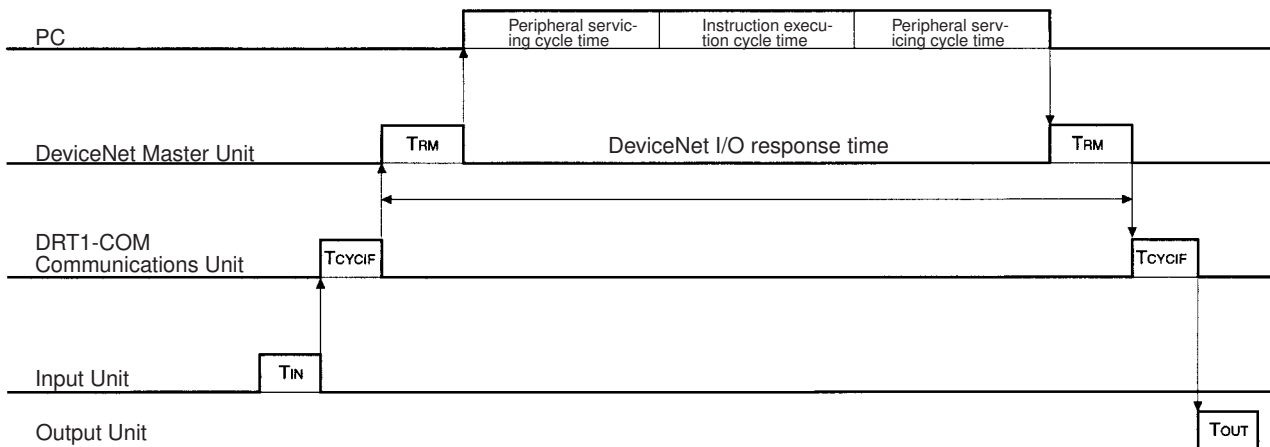
$$T_{MIN} = T_{IN} + T_{RT-IF} + (\text{DeviceNet I/O response time}) + T_{RT-IF} + T_{OUT}$$

**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 *1-1 MULTIPLE I/O TERMINAL*; for details on the DeviceNet I/O response times, see the explanation of the remote I/O communications performance.

**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<sub>IN</sub>: Input I/O Unit ON (OFF) delay time
- T<sub>OUT</sub>: Output I/O Unit ON (OFF) delay time
- T<sub>CYCIF</sub>: I/O Unit interface cycle time (see 6-1-3 I/O Unit Interface Cycle Time)
- T<sub>RM</sub>: Communications cycle time for the whole network

The maximum I/O response time (T<sub>MAX</sub>) is the total of the following terms:

$$T_{MAX} = T_{IN} + T_{CYCIF} \times 2 + (\text{DeviceNet I/O response time}) + T_{OUT}$$

**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 1-1 MULTIPLE I/O TERMINAL; for details on the I/O Unit interface cycle time, refer to 6-1-3 I/O Unit Interface Cycle Time; for details on the DeviceNet I/O response times, see the explanation of the remote I/O communications performance.

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

**6-1-2 Communications Cycle Time and Refresh Time**

This section explains the communications cycle time, communications time/Slave, and refresh time.

**Communications Cycle Time**

The communications 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 communications cycle time is used to calculate the maximum I/O response time.

The communications cycle time depends on the number of Masters on the Network and on whether or not message communications are being performed. The explanation given here applies to use with 1 Master. For use with several Masters, refer to the explanation on remote I/O communications characteristics in *DeviceNet Operation Manual (W267)*.

The following equations show the communications cycle time (T<sub>RM</sub>) when there is only 1 Master in the Network.

$$T_{RM} = \Sigma (\text{communications time per Slave: } T_{RT})$$

- +multiple Units processing time
- +Explicit message processing time
- +0.01 × N + 1.0 (ms)



- For details about the communications time required for 1 Slave refer to page 192. For the MULTIPLE I/O TERMINAL, it equals the communications time required for 1 Slave Unit of the Communications Unit.  $\Sigma$  (communications time per Slave) is the total of the communications times for all the Slaves in the network.
- Multiple Units processing time = 3.5 (ms). It is to be added only if there is a Slave where the input or output exceeds 8 bytes.
- Explicit message processing time =  $0.11 \times T_B + 0.6$  (ms). It is to be added only when explicit message communications are executed.  $T_B$  is a fixed value (At 500 kbps = 2, 125 kbps = 4, 125 kbps = 8).
- N = Number of Slaves

**Communications Time per Slave**

The communications time per Slave is the communications time required for a single Slave. The formula for calculating the communications time per Slave ( $T_{RT}$ ) for different types of Slave is shown below. For the MULTIPLE I/O TERMINAL, it will be the communications time per Slave of the Communications Unit. With the MULTIPLE I/O TERMINAL, 2 input words (4 bytes) are used for notifying the status of I/O Unit interfaces. This must be included as the number of bytes when making calculations.

**Output Slave with 8 Bytes of Output or Less**

$$T_{RT} = 0.016 \times T_B \times S_{OUT1} + 0.11 \times T_B + 0.07 \text{ (ms)}$$

$S_{OUT1}$ : Number of output words for the Output Slave

$T_B$ : At 500 kbps = 2, 250 kbps = 4, 125 kbps = 8

**Input Slave with 8 Bytes of Input or Less**

$$T_{RT} = 0.016 \times T_B \times S_{IN1} + 0.06 \times T_B + 0.05 \text{ (ms)}$$

$S_{IN1}$ : Number of input words for the Input Slave

$T_B$ : At 500 kbps = 2, 250 kbps = 4, 125 kbps = 8

**Mixed I/O Slave with 8 Bytes of Both Input and Output or Less**

$$T_{RT} = 0.016 \times T_B \times (S_{OUT2} + S_{IN2}) + 0.11 \times T_B + 0.07 \text{ (ms)}$$

$S_{OUT2}$ : Number of output words for the Mixed I/O Slave

$S_{IN2}$ : Number of input words for the Mixed I/O Slave

$T_B$ : At 500 kbps = 2, 250 kbps = 4, 125 kbps = 8

**Slave with more than 8 Bytes of Input or Output (or Both)**

$$T_{RT} = T_{OH} + T_{BYTE-IN} \times B_{IN} + T_{BYTE-OUT} \times B_{OUT} \text{ (ms)}$$

$T_{OH}$ : Protocol overhead

$T_{BYTE-IN}$ : Input byte transmission time

$B_{IN}$ : Number of input bytes

$T_{BYTE-OUT}$ : Output byte transmission time

$B_{OUT}$ : Number of output bytes

Communication speed	$T_{CH}$	$T_{BYTE-IN}$	$T_{BYTE-OUT}$
500 kbps	0.306 ms	0.040 ms	0.036 ms
250 kbps	0.542 ms	0.073 ms	0.069 ms
125 kbps	1.014 ms	0.139 ms	0.135 ms

If there are no Output Slaves, use 0 as the value of  $B_{OUT}$ . If there are no input Slaves, use 0 as the value of  $B_{IN}$ .

**Refresh Time**

The refresh time is the time required for I/O data to be exchanged between the PC's CPU and the DeviceNet Master Unit. The PC's cycle time is increased when a Master Unit is mounted, as shown below.

**Note** Refer to the PC's Operation Manual for more details on the refresh time and the PC's cycle time.

**Master Unit for CV-series PCs (CVM1-DRM21)**

The PC's cycle time is increased by 1.1 ms. This is the extra time required for CPU Bus Unit servicing (DeviceNet Master Unit refreshing).

**Master Unit for C200HX, C200HG, C200HE, and C200HS PCs (C200HW-DRM21)**

The PC's cycle time is increased by the amount shown below. The extra time is required for I/O refreshing.

PC	DeviceNet Unit I/O refreshing time (ms)
C200HX, C200HG, and C200HE	$1.72 + 0.022 \times \text{the number of words refreshed}$
C200HS	$2.27 + 0.077 \times \text{the number of words refreshed}$

The number of words refreshed is the total number of words in the I/O area that are used by the Slaves, including any unused words between words actually used by the Slaves. For example, if there are only two Input Slaves with node numbers 1 and 5, the 5 input words for nodes 1 through 5 would be refreshed even though the input words for nodes 2, 3, and 4 are unused.

If message communications are being performed, just add the number of words used in message communications to the above number of words for whenever messages are being processed.

**6-1-3 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 can be calculated using the following formula:

$$T_{CYCIF} = 1.5 \times \text{MOD} \text{ [ms]}$$

MOD: Number of I/O data frames

If the total numbers of input bits and output bits are both 128 or less: MOD = 1

If the either the total number of input bits or the total number of output bits is more than 128: MOD = 2

**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:

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

MOD: Number of I/O data frames

If there is no ordinary I/O Unit: MOD = 0

If the total numbers of input bits and output bits are both 128 or less: MOD = 1

If the either the total number of input bits or the total number of output bits is more than 128: MOD = 2

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

# SECTION 7

## Troubleshooting and Maintenance

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

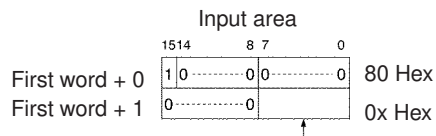
7-1	Normal Indication.....	196
7-2	Troubleshooting .....	197
7-3	Maintenance.....	204
7-3-1	Cleaning.....	204
7-3-2	Inspection.....	204
7-3-3	Replacing Units .....	205

## 7-1 Normal Indication

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

### I/O Unit Interface Status

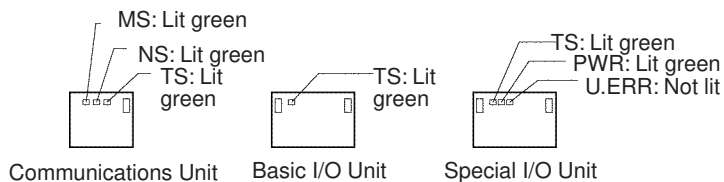
During normal operation, the status of the I/O Unit interface is set in the first two words of the MULTIPLE I/O TERMINAL input area as shown in the following diagram.



Bits corresponding to the addresses of I/O Units that are actually connected will be turned ON (1). Bits 0 to 7 correspond to addresses 0 to 7.

### Unit Indicators

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

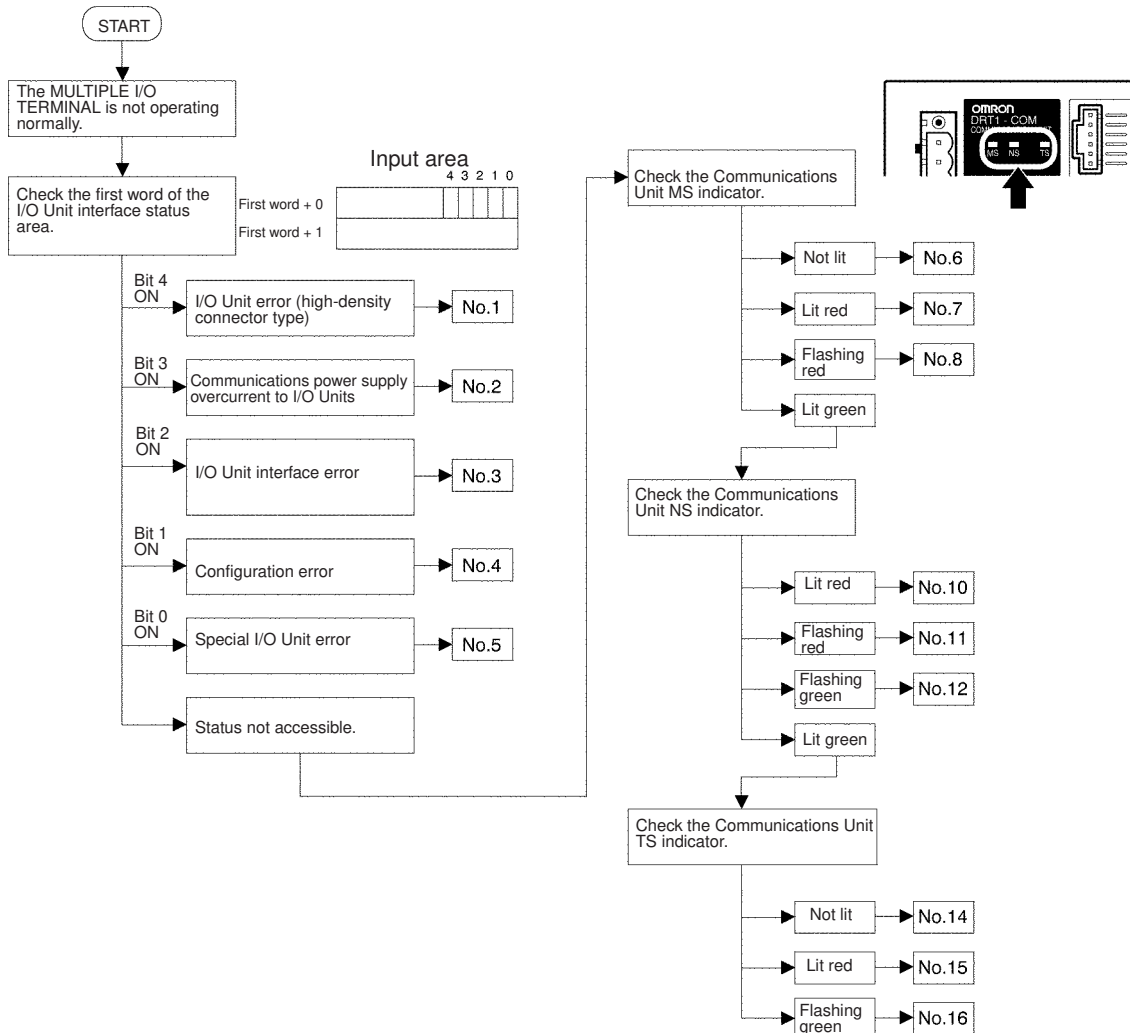


## 7-2 Troubleshooting

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 198.

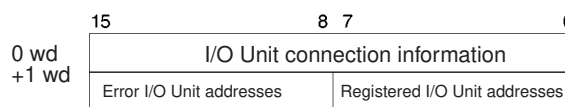


### Status Area Error Processing

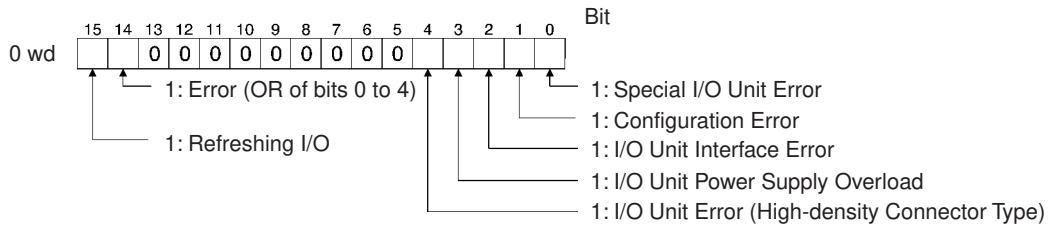
A MULTIPLE I/O TERMINAL status area is available in the first two words of the MULTIPLE I/O TERMINAL input area in the Master. The contents and causes of errors can be found by checking this area.

#### Status Area Configuration

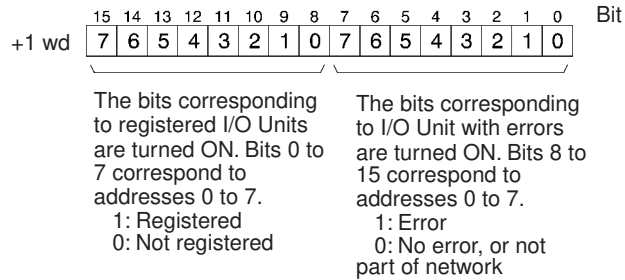
The status area is configured as shown in the following diagram.



**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)	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	The power supply to the I/O Unit interface has shorted. The current consumption of the I/O Unit interface exceeds 0.4 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 Units does not exceed 0.4 A. After taking the above measures, restart the Communications Unit. If the problem persists, replace the Communications Unit.
3	I/O Unit interface error	The end connector is not connected.  The I/O Unit Connecting Cable is broken.  There is a lot of noise.  Too many I/O Units are connected.	After turning OFF the power supply to the Communications Unit and all I/O Units, attach the end connector to the I/O Unit interface connector 2 on the terminal I/O Unit.  Replace the broken cable.  Remove the source of the noise.  Connect no more than 8 I/O Units for each Communications Unit. After taking the above measures, restart the Communications Unit. If the problem persists, replace the Communications Unit.
4	Configuration error	The I/O Unit configuration was changed while the Communications Unit was turned ON.	After turning OFF the power supply to the Communications Unit and all I/O Units, return to the correct I/O Unit configuration, and restart the Communications Unit. If the problem persists, replace the Communications Unit.
5	Special I/O Unit error	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
Communications Unit	NS	Displays the DeviceNet communications status.
	MS	Displays the Communications 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 Communications Unit MS Indicator Errors**

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

No.	Communications Unit MS indicator status	Cause	Remedy
6	OFF 	The power is not being supplied.	Check the operating power supply, and provide the correct power supply. If the problem persists, replace the Communications Unit.
7	ON (red) 	A hardware error has occurred in the Communications Unit.	Restart the Communications Unit. If the problem persists, replace the Communications Unit.
8	Flashing (red) 	The DIP switch setting of the Communications Unit is incorrect.	After checking the DIP switch setting (baud rate setting pins 7, 8, or 9) and resetting it correctly, restart the Communications Unit. If the problem persists, replace the Communications Unit.
9	ON (green) 	No error	Proceed to the next item, <i>Causes and Remedies for Communications Unit NS indicator Errors</i> .


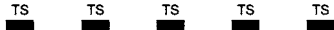
**Causes and Remedies for Communications Unit NS Indicator Errors**

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


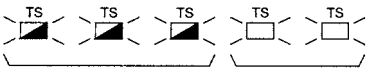
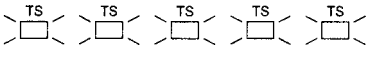
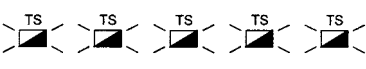
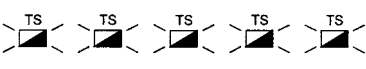
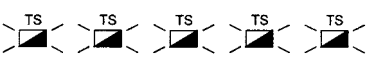

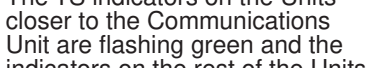

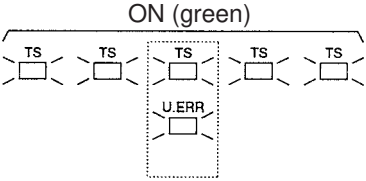
No.	Communications Unit NS indicator status	Cause	Remedy
10	ON (red) 	The Unit is in Bus Off status.  A Slave already exits with the same node number as the Communications Unit.  The baud rate does not match that of the Master Unit.	Check the connection status of the DeviceNet communications cable or the noise status.  Reset the node number so that it is not duplicated.  Reset with the same baud rate as that of the Master Unit.  After taking the above measures, restart the Communications Unit. If the problem persists, replace the Communications Unit.
11	Flashing (red) 	A timeout occurred in communications with the Master Unit.	Check the status of the Master Unit.  Check the connection status of the DeviceNet communications cable or the noise status.  After taking the above measures, restart the Communications Unit. If the problem persists, replace the Communications Unit.
12	Flashing (green) 	The Master Unit has not been started correctly.	Check that the Master Unit has started normally.
		There is a configuration error in the Master Unit I/O area.	Check that the number of I/O points for the Master Unit I/O area and the Communications Unit match.
13	ON (green) 	No error	Proceed to the next item, <i>Causes and Remedies for Communications Unit and I/O Unit TS Indicator Errors</i> .

**Causes and Remedies for Communications Unit and I/O Unit TS Indicator Errors**

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

No.	TS indicator status		Cause	Remedy
	Communications Unit	I/O Units		
14	 OFF	 All I/O Unit TS indicators are not lit.	The power supply to the I/O Unit interface has shorted.  The current consumption of the I/O Unit interface exceeds 0.4 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 0.4 A.  After taking the above measures, restart the Communications Unit.
			The cable between the Communications Unit and the first I/O Unit is disconnected.	After turning OFF the power supply to the Communications Unit and all I/O Units, correctly connect the cable.



No.	TS indicator status		Cause	Remedy	
	Communi-cations Unit	I/O Units			
15	 <p>ON (red) (I/O Unit interface error)</p>	 <p>Flashing (green)      ON (red)</p> <p>The TS indicators on the Units closer to the Communications Unit are flashing green and the indicators on the rest of the Units are lit red.</p>	The cable is broken at the Unit where the TS indicator display changes.	<p>After turning OFF the power supply to the Communications Unit and all I/O Units, replace the broken cable.</p>	
		 <p>All I/O Unit TS indicators are lit red.</p>	The cable between the Communications Unit and the first I/O Unit is broken.		
		 <p>All I/O Unit TS indicators are lit green.</p>	There is a lot of noise.		Remove the source of the noise.
		 <p>All I/O Unit TS indicators are lit green.</p>	The end connector is not connected.		After turning OFF the power supply to the Communications Unit and all I/O Units, attach the end connector to the I/O Unit interface connector 2 of the terminal I/O Unit.
		 <p>All I/O Unit TS indicators are lit green.</p>	The cable connected to the Remote Terminal Unit I/O Unit interface connector 1 is broken.		After turning OFF the power supply to the Communications Unit and all I/O Units, perform a continuity test on the cable, and replace the broken cable.
		 <p>Flashing (green)      OFF</p> <p>The TS indicators on the Units closer to the Communications Unit are flashing green and the indicators on the rest of the Units are not lit.</p>	The I/O Unit configuration changed after the Unit where the TS indicator display changed.		After turning OFF the power supply to the Communications Unit and all I/O Units, return to the correct I/O Unit configuration, and restart the Communications Unit.
		 <p>At the last Unit where the green light is flashing, one of the cables is broken.</p>			After turning OFF the power supply to the Communications 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 Communications 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 Communications Unit and all I/O Units, correctly reconnect the cable.		
16	 <p>Flashing (green) (Special I/O Unit error)</p>	 <p>ON (green)</p> <p>There is a Special I/O Unit with the TS and U.ERR indicators lit red.</p>	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.	

**Causes and Remedies for Other Types of Errors**

Error	Probable cause
After the MS indicator turns green, the NS indicator doesn't flash green - it turns red immediately.	Restart the faulty Slave Unit after checking the following points. <ul style="list-style-type: none"> <li>• Make sure that the Master and Slaves baud rate settings all match. If they don't match, set all of the baud rates to the same value.</li> <li>• Check for a node number duplication. If necessary change the node number settings so that each node has a unique number.</li> <li>• See the troubleshooting steps below under the error heading: "The NS indicator lights green but turns red after a short time."</li> <li>• If a particular Slave's NS indicator is always red, replace that Slave.</li> </ul>
The NS indicator lights green but turns red after a short time <b>or</b> The NS indicator lights green but starts flashing red after a short time.	Restart the faulty Slave Unit after checking the following points. <ul style="list-style-type: none"> <li>• Make sure that there are 121-Ω terminators connected at both ends of the trunk line. Connect 121-Ω terminators if the wrong resistance is being used.</li> <li>• Check whether all of the Slaves' settings are correct.</li> <li>• Check whether the communications cables are wired correctly.</li> <li>• Check whether the power supply is set correctly.</li> <li>• Check all the nodes for broken wires in the communications and power supply cables attached to the connectors.</li> <li>• Check whether power is correctly supplied to the network.</li> <li>• If there is nearby equipment that generates electrical noise, take steps to shield the Master, Slaves, and communications cables from the noise.</li> <li>• If an error has occurred with OMRON's Master Unit, refer to the <i>DeviceNet Operation Manual (W267)</i>. If an error has occurred in a Master Unit supplied by another maker, refer to the relevant user's manual.</li> <li>• If a particular Slave's NS indicator is always red, replace that Slave.</li> </ul>

**Trouble Adding a Slave to the Network**

Error	Probable cause
The NS indicator remains OFF.	<ul style="list-style-type: none"> <li>• Check if the baud rate of the Master Unit coincides with that of the Slave Unit. If the baud rates are different, correct the baud rate of the Slave Unit.</li> <li>• Check that the Slave's connector is connected correctly.</li> <li>• Check whether the communications power supply is supplying 24 VDC.</li> <li>• Make sure that the Master is operating properly.                      When using an OMRON Master, refer to the <i>DeviceNet Operation Manual (W267)</i>.                      When using another company's Master Unit, refer to that Master's user's manual.</li> <li>• Check whether the communications cables are wired correctly.</li> <li>• Check whether the power supply is set correctly.</li> <li>• Check for broken wires in the communications and power supply cables attached to the connectors.</li> </ul>

<b>Error</b>	<b>Probable cause</b>
<p>The NS indicator continues to flash green.</p>	<ul style="list-style-type: none"> <li>• Make sure that the Master is operating properly. When using an OMRON Master, refer to the <i>DeviceNet Operation Manual (W267)</i>. When using another company’s Master Unit, refer to that Master’s user’s manual.</li> <li>• Check whether the Slave is registered in the Master’s scan list. If an OMRON Master Unit is being used, a new Slave cannot be added to the network if the Master is operating with the scan list enabled. First perform the clear scan list operation, check that the Slave has joined the network, and then perform the create scan list operation. If another company’s Master Unit is being used, refer to that Master’s user’s manual for details on adding a new Slave to its scan list.</li> </ul>
<p>The NS indicator alternates between being green and flashing green, or alternates between flashing red and flashing green.</p>	<ul style="list-style-type: none"> <li>• When using an OMRON Master, check the following items and perform the necessary error processing steps.               <ul style="list-style-type: none"> <li>→ Register the scan list again. (After performing the clear scan list operation, check that the Slave has joined the network and perform the create scan list operation.)</li> <li>→ Make sure that the Slave’s allocated I/O area doesn’t overlap with that of another Slave. If there is an overlap, change the Slave’s node number to eliminate it.</li> <li>→ Make sure that the allocated I/O area doesn’t exceed the allowed range shown below:                      C200HW-DRM21-V1   Output:   IR 050 to IR 099                    Input:    IR 350 to IR 399                  If the I/O area exceeds this range, change the Slave’s node number to correct the problem.</li> </ul> </li> <li>• When using another company’s Master Unit, check that the I/O size registered in the Master’s scan list matches the actual I/O size of the Slave. The I/O size is recorded in the following attributes of the connection object:               <ul style="list-style-type: none"> <li>Interface 2 (Polled I/O Connection)     Produced Connection size (Input size)     Consumed Connection size (Output size)</li> </ul>               and:               <ul style="list-style-type: none"> <li>Interface 3 (Bit strobed I/O Connection)     Produced Connection size (Input size)</li> </ul> </li> </ul> <p>See <i>Appendix C Multi-vendor Usage</i> for details and record the correct value in the Master’s scan list. Refer to the Master’s manual for details on registering the values.</p>

## 7-3 Maintenance

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

### 7-3-1 Cleaning

Clean the DeviceNet 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.

### 7-3-2 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 DeviceNet Units.

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

### 7-3-3 Replacing Units

The DeviceNet 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. Also, if using a Configurator to set the Analog Input Unit, Analog Output Unit, or Temperature Input Unit, be sure to set them to the same settings as before.

#### Settings after Replacing Master Units

The scan list (network file) must be registered after replacing a Master Unit. Use the following procedures.

##### **Default Remote I/O Allocations**

Turn ON power to all Slaves and then turn ON the Scan List Enable software switch (bit 00). The scan list will be registered.

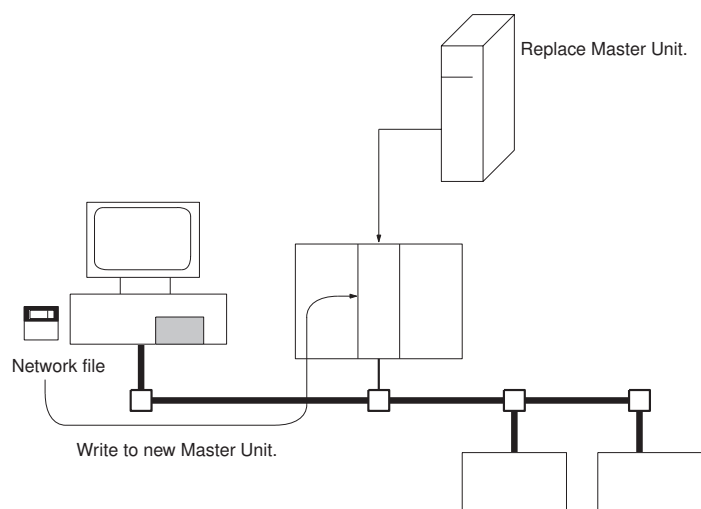
##### **User-set Remote I/O Allocations**

Perform one of the following procedures.

##### **Using a Network File**

The following procedure can be used to write the scan list to the Master Unit from a network file saved on a disk.

- 1,2,3...**
1. Turn ON power to the Master Unit and the Configurator.
  2. Place the Configurator online and read the network file that was previously saved.
  3. Use the device parameter editing operation, specify the Master Unit that has been replaced, and write the scan list in the network file to the Master Unit.



### Recreating the Allocations from the Configurator

The following procedure can be used to recreate user-set allocations and write them to the Master Unit.

- 1,2,3...**
1. Turn ON power to the Master Unit, Slaves, and Configurator.
  2. Place the Configurator online and create the device list.
  3. Specify the Master Unit, register Slaves using the device parameter editing operation, and allocate I/O.
  4. Write the scan list to the Master Unit.

**Note** You should always save the network file to a disk when using user-set remote I/O allocations so that the scan list and other parameters are available should you need to replace a Master 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

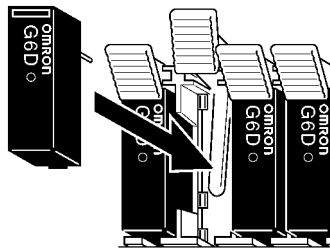
Use the following procedure to replace Relays. Here, the GT1-ROS16 is used as an example. The same general procedure applies to the GT1-ROP08.

**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.

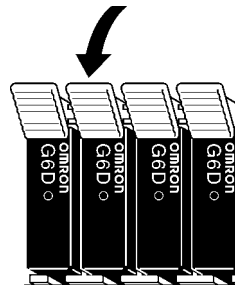
- 1,2,3...**
1. Push the lever for the Relay to be replaced and remove the Relay. The Relays are arranged in order, with the corresponding contact numbers increasing from left to right. Push the lever gently so that the detached Relay does not spring out suddenly.



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.



- 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

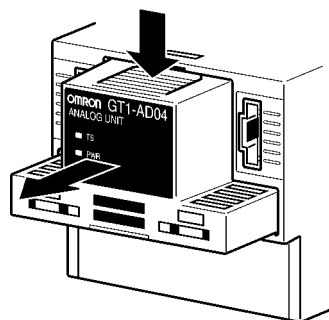
With the following Units, a malfunctioning Cassette can be replaced.

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
Temperature Input Unit:	GT1-TS04T, GT1-TS04P

- Note**
- 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.
  - 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...** For the Analog Input and Output Units, as well as the Temperature Input Unit, 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.



- 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

## Slave Device Profiles

Refer to the Slave specifications and Device profiles in this manual when connecting an OMRON Slave Unit to another company's Master.

### DRT1-COM Communications Unit Device Profile

General data	Compatible DeviceNet Specifications	Volume I - Release 1.3 Volume II - Release 1.3	
	Vendor name	OMRON Corporation	Vendor ID = 47
	Device type name	Slaves: Communication adapter	Device type number = 12
	Manufacturer catalog number	Manual number (W267)	
	Manufacturer revision	1.0	
Physical conformance data	Network current consumption	24 VDC at 30 mA max.	
	Connector type	Open plug	
	Physical insulation	Yes	
	Supported indicators	Module, Network	
	MAC ID setting	DIP switch	
	Default MAC ID	0	
	Baud rate setting	DIP switch	
	Supported baud rates	125 kbps, 250 kbps, and 500 kbps	
Communications data	Predefined Master/Slave connection set	Group 2 only server	
	Dynamic connection support (UCMM)	No	
	Explicit message fragmentation support	Yes	

### Object Mounting

#### Identity Object (0x01)

Object class	Attribute	Not supported
	Service	Not supported

Item		ID content	Get (read)	Set (write)	Value
Object instance	Attribute	1 Vendor	Yes	No	47
		2 Product type	Yes	No	12
		3 Product code	Yes	No	306
		4 Revision	Yes	No	1.3
		5 Status (bits supported)	Yes	No	Bit 0 only
		6 Serial number	Yes	No	Unique for each Unit
		7 Product name	Yes	No	DRT1-COM
		8 State	No	No	---

Item		DeviceNet service	Parameter option
Object instance	Service	05 Reset	No
		0E Get_Attribute_Single	No



**Message Router Object (0x02)**

Object class	Attribute	Not supported
	Service	Not supported
Object instance	Attribute	Not supported
	Service	Not supported
Vendor specification addition		No

**DeviceNet Object (0x03)**

Object class	Attribute	Not supported
	Service	Not supported

Item	ID content	Get (read)	Set (write)	Value	
Object instance	Attribute	1 MAC ID	Yes	No	---
		2 Baud rate	Yes	No	---
		3 BOI	Yes	No	00 Hex
		4 Bus Off counter	Yes	No	---
		5 Allocation information	Yes	No	---
		6 MAC ID switch changed	No	No	---
		7 Baud rate switch changed	No	No	---
		8 MAC ID switch value	No	No	---
		9 Baud rate switch value	---	---	---

Item	DeviceNet service	Parameter option	
Object instance	Service	0E Get_Attribute_Single	No
		4B Allocate_Master/Slave_Connection_Set	No
		4C Release_Master/Slave_Connection_Set	No

**Connection Object (0x05)**

Object class	Attribute	Not supported
	Service	Not supported
	Max. number of active connections	1

Item	Section	Information	Max. number of instances
Object instance 1	Instance type	Explicit Message	1
	Production trigger	Cyclic	---
	Transport type	Server	---
	Transport class	3	---

Item	ID content	Get (read)	Set (write)	Value	
Object instance 1	Attribute	1 State	Yes	No	---
		2 Instance type	Yes	No	0000 Hex
		3 Transport class trigger	Yes	No	8300 Hex
		4 Produced connection ID	Yes	No	---
		5 Consumed connection ID	Yes	No	---
		6 Initial comm. characteristics	Yes	No	2100 Hex
		7 Produced connection size	Yes	No	FF00 Hex
		8 Consumed connection size	Yes	No	FF00 Hex
		9 Expected packet rate	Yes	Yes	---
		12 Watchdog time-out action	Yes	No	0100 Hex
		13 Produced connection path length	Yes	No	0000 Hex
		14 Produced connection path	Yes	No	---
		15 Consumed connection path length	Yes	No	0000 Hex
		16 Consumed connection path	Yes	No	---
17 Production inhibit time	Yes	No	0000 Hex		

Item	DeviceNet service	Parameter option	
Object instance 1	Service	05 Reset	No
		0E Get_Attribute_Single	No
		10 Set_Attribute_Single	No

Item	Section	Information	Max. number of instances
Object instance 2	Instance type	Polled I/O	1
	Production trigger	Cyclic	---
	Transport type	Server	---
	Transport class	2	---

Item		ID content	Get (read)	Set (write)	Value
Object instance 2	Attribute	1 State	Yes	No	---
		2 Instance type	Yes	No	0100 Hex
		3 Transport class trigger	Yes	No	8200 Hex
		4 Produced connection ID	Yes	No	---
		5 Consumed connection ID	Yes	No	---
		6 Initial comm. characteristics	Yes	No	0100 Hex
		7 Produced connection size	Yes	No	See note.
		8 Consumed connection size	Yes	No	See note.
		9 Expected packet rate	Yes	Yes	---
		12 Watchdog time-out action	Yes	No	0000 Hex
		13 Produced connection path length	Yes	No	0000 Hex
		14 Produced connection path	Yes	No	No
		15 Consumed connection path length	Yes	No	0000 Hex
		16 Consumed connection path	Yes	No	No
17 Production inhibit time	Yes	No	0000 Hex		

Item		DeviceNet service	Parameter option
Object instance 2	Service	0E Get_Attribute_Single	No
		10 Set_Attribute_Single	No

**Note** The values for produced connection size and consumed connection size will be the respective totals for all the I/O Units connected to the Communications Unit. The following table lists the values for each I/O Unit.

Model	Produced connection size	Consumed connection size
DRT1-COM	0400 Hex	0000 Hex
GT1-ID16(-1)	0200 Hex	0000 Hex
GT1-ID16MX(-1)	0200 Hex	0000 Hex
GT1-ID16ML(-1)	0200 Hex	0000 Hex
GT1-ID16DS(-1)	0200 Hex	0000 Hex
GT1-ID32ML(-1)	0400 Hex	0000 Hex
GT1-OD16(-1)	0000 Hex	0200 Hex
GT1-OD16MX(-1)	0000 Hex	0200 Hex
GT1-OD16ML(-1)	0000 Hex	0200 Hex
GT1-OD16DS(-1)	0000 Hex	0200 Hex
GT1-OD32ML(-1)	0000 Hex	0400 Hex
GT1-ROS16	0000 Hex	0200 Hex
GT1-ROP08	0000 Hex	0200 Hex
GT1-AD04	0800 Hex	0000 Hex
GT1-AD08MX (set for 4 inputs)	0800 Hex	0000 Hex
GT1-AD08MX (set for 8 inputs)	1000 Hex	0000 Hex
GT1-DA04	0000 Hex	0800 Hex
GT1-DA04MX	0000 Hex	0800 Hex
GT1-TS04T/P (Normal Mode)	0800 Hex	0000 Hex
GT1-TS04T/P (2-decimal-place Mode)	1000 Hex	0000 Hex
GT1-CT01	0600 Hex	0600 Hex

Item	Section	Information	Max. number of instances
Object instance 3	Instance type	Bit strobed I/O	1
	Production trigger	Cyclic	---
	Transport type	Server	---
	Transport class	2	---

Item	ID content	Get (read)	Set (write)	Value	
Object instance 3	Attribute	1 State	Yes	No	---
		2 Instance type	Yes	No	0100 Hex
		3 Transport class trigger	Yes	No	8200 Hex
		4 Produced connection ID	Yes	No	---
		5 Consumed connection ID	Yes	No	---
		6 Initial comm. characteristics	Yes	No	0100 Hex
		7 Produced connection size	Yes	No	See note.
		8 Consumed connection size	Yes	No	0800 Hex
		9 Expected packet rate	Yes	Yes	---
		12 Watchdog time-out action	Yes	No	0000 Hex
		13 Produced connection path length	Yes	No	0000 Hex
		14 Produced connection path	Yes	No	No
		15 Consumed connection path length	Yes	No	0000 Hex
		16 Consumed connection path	Yes	No	No
		17 Production inhibit time	Yes	No	0000 Hex

Item	DeviceNet service	Parameter option
Object instance 3	Service	
	0E Get_Attribute_Single	No
	10 Set_Attribute_Single	No

**Note** The values for produced connection size and consumed connection size will be the respective totals for all the I/O Units connected to the Communications Unit. The following table lists the values for each I/O Unit. Only the following Units are applicable because the Bit Strobed I/O is valid only when OUT is 0 bytes and IN is 8 bytes or less.

Model	Produced connection size
DRT1-COM	0400 Hex
GT1-ID16(-1)	0200 Hex
GT1-ID16MX(-1)	0200 Hex
GT1-ID16ML(-1)	0200 Hex
GT1-ID16DS(-1)	0200 Hex
GT1-ID32ML(-1)	0400 Hex
GT1-AD04	0800 Hex
GT1-AD08MX (set for 4 inputs)	0800 Hex
GT1-AD08MX (set for 8 inputs)	1000 Hex
GT1-TS04T/P (Normal Mode)	0800 Hex
GT1-TS04T/P (2-decimal-place Mode)	1000 Hex

# Appendix B

## Connectable Devices

### Devices

#### MULTIPLE I/O TERMINAL Units

Model	Specifications	Manufacturer
DRT1-COM	Communications 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-TS04T	Temperature Input Unit 4 inputs (allocated 4 or 8 words) (Select using the DIP switch.) Input types: R, S, K, J, T, B, L	OMRON
GT1-TS04P	Temperature Input Unit 4 inputs (allocated 4 or 8 words) (Select using the DIP switch.) Input types: Pt100, JPt100	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

## Communications Cables

Model	Specifications	Manufacturer
DCA2-5C10	Thick cable: 5 wires, 100 m	OMRON
DCA1-5C10	Thin cable: 5 wires, 100 m	OMRON
DVN18-10G	Thick cable: 5 wires, 10 m	Nihon Wire & Cable
DVN18-30G	Thick cable: 5 wires, 30 m	Nihon Wire & Cable
DVN18-50G	Thick cable: 5 wires, 50 m	Nihon Wire & Cable
DVN18-100G	Thick cable: 5 wires, 100 m	Nihon Wire & Cable
DVN18-300G	Thick cable: 5 wires, 300 m	Nihon Wire & Cable
DVN18-500G	Thick cable: 5 wires, 500 m	Nihon Wire & Cable
DVN24-10G	Thin cable: 5 wires, 10 m	Nihon Wire & Cable
DVN24-30G	Thin cable: 5 wires, 30 m	Nihon Wire & Cable
DVN24-50G	Thin cable: 5 wires, 50 m	Nihon Wire & Cable
DVN24-100G	Thin cable: 5 wires, 100 m	Nihon Wire & Cable
DVN24-300G	Thin cable: 5 wires, 300 m	Nihon Wire & Cable
DVN24-500G	Thin cable: 5 wires, 500 m	Nihon Wire & Cable
1485C-P1-A50	Thick cable: 5 wires, 50 m	Allen-Bradley (See note.)
1485C-P1-C150	Thin cable: 5 wires, 150 m	Allen-Bradley (See note.)

**Note** 1. The cables made by Nihon Wire & Cable Company Ltd. are sold through the OMRON 24 Service Co., Ltd. The product specifications are identical to the OMRON cable specifications.

2. The cables made by Allen-Bradley are stiffer than the cables made by OMRON and Nihon Wire & Cable Company Ltd., so do not bend the Allen-Bradley cables as much as the others.

## Connectors

Model	Specifications	Manufacturer
MSTB2.5/5-ST-5.08AU	For node connection Without connector set screws (Attach to DRT1-ID08(-1), -ID16(-1), -OD08(-1), -OD16(-1), -ID16X(-1), -OD16X(-1), -HD16S, -ND16S, -AD04, -AD04H, -DA02, -TS04T, -TS04P)	Phoenix Contact K.K. Reference No: 1752399

## Connector Screwdriver

Model	Specifications	Manufacturer
SZF-1	Special screwdriver for DeviceNet connectors	Phoenix Contact K.K.

## Terminating Resistors

Model	Specifications	Manufacturer
DRS1-T	Terminal-block Terminating Resistor, 121 $\Omega$	OMRON

**Note** Also can be used as Terminating Resistor with T-branch Tap.

## T-branch Tap

Model	Specifications	Manufacturer
DCN1-1C	3 connectors provided (When used on trunk line, 1 drop line can be connected.) Terminating Resistor can be connected.	OMRON
DCN1-3C	5 connectors provided (When used on trunk line, 3 drop lines can be connected.) Terminating Resistor can be connected.	OMRON

## Power Supply Tap

Model	Specifications	Manufacturer
DCN1-1P	Power supply 1-branch tap with 2 connectors (provided)	OMRON
1485T-P2T5-T5	Required when connecting more than one power supply. Countercurrent flow prevention, ground terminal provided	Allen-Bradley

## 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 Communications 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 con- tacts	For AWG#24 to 30
16-02-0086				For AWG#22 to 24
16-02-0096			Loose con- tacts	For AWG#24 to 30
16-02-0102				For AWG#22 to 24
570-36-5000			Crimping tool	
11-01-0209				For AWG#24 to 30
XW2S-2513	Recom- mended 25-pin D- sub con- nector 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 max. (inrush current: 20 A max.)
GT1-AD08MX	50 mA max.	Internal power supply: 100 mA max. (inrush current: 30 A max.)
GT1-DA04	50 mA max.	Internal power supply: 150 mA max. (inrush current: 20 A max.)
GT1-DA04MX	50 mA max.	Internal power supply: 100 mA max. (inrush current: 30 A max.)
GT1-TS04T	50 mA max.	Internal power supply: 80 mA max. (inrush current: 10 A max.)
GT1-TS04P	50 mA max.	Internal power supply: 80 mA max. (inrush current: 10 A max.)
GT1-CT01	90 mA max.	9 mA max.

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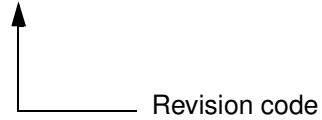
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## Revision History

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

Cat. No. W348-E1-05



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

Revision code	Date	Revised content
1	December 1998	Original production
2	January 2000	<p>Changed “CompoBus/D” to “DeviceNet” in most of the manual.</p> <p>Notes on relationship of ambient temperature and maximum number of simultaneously ON points added to section 4.</p> <p>Configurator graphics changed.</p> <p><b>Page xv:</b> Information on Low-voltage Directive removed.</p> <p><b>Page 3, 5, 7, 20, 24, 132, 165, 167, 176:</b> Information added on Temperature Input Unit.</p> <p><b>Page 36, 44, 96, 104, 115, 121, 132:</b> Noise immunity specification changed and three specifications removed.</p> <p><b>Page 44:</b> Input impedance added.</p> <p><b>Page 45:</b> Units added to current consumption table and precautions on 2-wire DC sensors added.</p> <p><b>Page 46, 48, 54, 56, 58, 60:</b> Maximum number of simultaneously ON points changed.</p> <p><b>Page 46, 48, 50, 52, 90:</b> Internal circuits diagram changed.</p> <p><b>Page 35, 54, 56, 58, 60, 75, 77, 80, 82:</b> “Available soon” note removed.</p> <p><b>Page 96, 115:</b> Current consumption specification changed.</p> <p><b>Page 102:</b> Voltage and current specification changed for open-circuit detection.</p> <p><b>Page 111:</b> Converted data graphic added for 4 points and conversion time changed.</p> <p><b>Page 115, 132:</b> Section added on offset and gain adjustments.</p> <p><b>Page 116, 123:</b> Pins 8, 9, and 10 changed.</p> <p><b>Page 120:</b> Description of output status for communications error changed.</p> <p><b>Page 118:</b> Wiring diagram changed.</p> <p><b>Page 151:</b> I/O response time graphics changed.</p> <p><b>Page 151:</b> Formula changed.</p> <p><b>Page 165:</b> Information added on Configurator.</p> <p><b>Page 177:</b> Power Supply Tap added to table.</p> <p><b>Page 179:</b> Power supply specifications changed in table.</p>
3	October 2000	Reprinted due to error.

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### *Revision History*

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<b>Revision code</b>	<b>Date</b>	<b>Revised content</b>
04	April 2002	<b>Page xiii:</b> Minor addition made to warning information. <b>Page xv:</b> Paragraph added to first list. <b>Page 12:</b> Several changes made to second diagram. <b>Page 15:</b> Text added after table. <b>Pages 62, 64:</b> Minor change made in first table. <b>Pages 76, 81, 85:</b> Minor changes made to internal circuit diagrams. <b>Page 216:</b> Several changes made to second and third tables.
05	May 2003	<b>Page 32:</b> "#0004" corrected to "#0C04" in ladder diagram . Information on word 53 bits 10 and 11 added. <b>Page 33:</b> Bit 10114 added to ladder diagram . <b>Page 184:</b> "x4" corrected to "x1" for differential phase pulse input when bit 10 and 11 are both ON.

**OMRON CORPORATION**

FA Systems Division H.Q.  
66 Matsumoto  
Mishima-city, Shizuoka 411-8511  
Japan  
Tel: (81)55-977-9181/Fax: (81)55-977-9045

**Regional Headquarters**

**OMRON EUROPE B.V.**

Wegalaan 67-69, NL-2132 JD Hoofddorp  
The Netherlands  
Tel: (31)2356-81-300/Fax: (31)2356-81-388

**OMRON ELECTRONICS LLC**

1 East Commerce Drive, Schaumburg, IL 60173  
U.S.A.  
Tel: (1)847-843-7900/Fax: (1)847-843-8568

**OMRON ASIA PACIFIC PTE. LTD.**

83 Clemenceau Avenue,  
#11-01, UE Square,  
Singapore 239920  
Tel: (65)6835-3011/Fax: (65)6835-2711

# OMRON

**Authorized Distributor:**



**Cat. No. W348-E1-05**

**DRT1-COM/GT1 Series DeviceNet MULTIPLE I/O TERMINAL**

**OPERATION MANUAL**

**OMRON**