Cat. No. W457-E1-03

CRT1 Series

CompoNet Slave Units and Repeater Unit

OPERATION MANUAL

OMRON

CRT1 Series
CompoNet Slave Units
and Repeater Unit

Operation Manual

Revised October 2007

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. Additionally, there may be severe property damage.

⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

⚠ 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 “PLC” means Programmable Controller. “PC” is used, however, in some Programming Device displays to mean Programmable Controller.

Visual Aids

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

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

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

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About this Manual:

This manual describes the installation and operation of the CompoNet CRT1-ID16(-1)/OD16(-1), CRT1-ROS16, CRT1-ID16TA(-1)/OD16TA(-1)/MD16TA(-1), CRT1B-ID/OD/MD□□□(-1), and CRT1-AD04/DA02 Slave Units, and the CRS1-RPT01 Repeater Unit and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install or operate a CompoNet Slave Unit or Repeater Unit. Be sure to read the precautions provided in the following section. Also be sure to read the *CompoNet Master Unit Operation Manual* (see following table) together with this manual.

Precautions provides general precautions for using the CompoNet Slave Units, Repeater Units, Programmable Controller, and related devices.

Section 1 introduces the CompoNet Slave Units and the various models that are available.

Section 2 describes the configurations of CompoNet Networks.

Section 3 describes how to install and wire a CompoNet Network.

Section 4 provides the basic specifications of the Slave Units.

Section 5 describes the Digital I/O Slave Units.

Section 6 describes the Analog I/O Slave Units.

Section 7 describes the Expansion Units.

Section 8 describes the Bit Slave Units.

Section 9 describes the Repeater Unit.

Section 10 individually describes the functions provided by CompoNet Slave Unit. The functions are divided into those supported by all CompoNet Slave Units and those supported only by specific CompoNet Slave Units.

Section 11 provides troubleshooting information that can be used in the event a problem occurs in CompoNet Slave Unit operation. It also provides information on maintenance that should be performed to ensure optimum application of the CompoNet Slave Units.

The ***Appendices*** provide specialized information, including information on CompoNet explicit messages, object mounting, connectable devices, current consumption, and precautions for connecting two-wire DC sensors.

⚠ 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.

Related Manuals:

Cat. No.	Models	Name	Description
W457 (this manual)	CRT1 Series	CompoNet Slave Units and Repeater Unit Operation Manual	Provides the specifications of CompoNet Slave Units and Repeater Unit.
W456	CS1W-CRM21 and CJ1W-CRM21	CS/CJ-series CompoNet Master Units Operation Manual	Provides an overview of CompoNet Networks, communications specifications, wring methods, and CompoNet Master Unit functions.
W342	CS1G/H-CPU□□H CS1G/H-CPU□□-EV1 CS1D-CPU□□H CS1D-CPU□□S CS1W-SCB□□-V1 CS1W-SCU□□-V1 CJ1G/H-CPU□□H CJ1G-CPU□□P CJ1G-CPU□□ CJ1M-CPU□□ CJ1W-SCU□□-V1 CP1H-X□□□□-□ CP1H-XA□□□□-□ CP1H-Y□□□□-□ NSJ□-□□□□(B)-G5D NSJ□-□□□□(B)-M3D	SYSMAC CS/CJ/CP Series SYSMAC One NSJ Series Communications Commands Reference Manual	Describes the communications commands used with CS-series, CJ-series, and CP-series PLCs and NSJ Controllers.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

PRECAUTIONS

This section provides general precautions for using the CompoNet CRT1-ID16(-1)/OD16(-1), CRT1-ROS16, CRT1-ID16TA(-1)/OD16TA(-1)/MD16TA(-1), CRT1B-ID/OD/MD□□□(-1), and CRT1-AD04/DA02 Slave Units, and the CRS1-RPT01 Repeater Unit.

The information contained in this section is important for the safe and reliable application of the CompoNet Slave Units and Repeater Unit. You must read this section and understand the information contained before attempting to set up or operate a CompoNet Network using CompoNet Slave Units or Repeater Units.

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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 the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.
Be sure this manual is delivered to the persons actually using the CompoNet Slave Units and Repeater Units.

⚠WARNING It is extremely important that a PLC and all PLC 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 PLC System to the above-mentioned applications.

3 Safety Precautions

⚠WARNING Do not attempt to take any Unit apart and do not touch the interior of any Unit while the power is being supplied. Also, do not turn ON the power supply while the cover is open. Doing any of these may result in electric shock.

⚠ WARNING Provide safety measures in external circuits (i.e., not in the Slave Units), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another external factor affecting the PLC operation. ("PLC" includes CPU Units, other Units mounted in the PLC, and Remote I/O Terminals.) Not doing so may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
- The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.
- The PLC outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-VDC output (service power supply) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

⚠ WARNING The CPU Unit refreshes I/O even when the program is stopped (i.e., even in PROGRAM mode). Confirm safety thoroughly in advance before changing the status of any part of memory allocated to I/O Units, Special I/O Units, or CPU Bus Units. Any changes to the data allocated to any Unit may result in unexpected operation of the loads connected to the Unit. Any of the following operation may result in changes to memory status.

- Transferring I/O memory data to the CPU Unit from a Programming Device.
- Changing present values in memory from a Programming Device.
- Force-setting/-resetting bits from a Programming Device.
- Transferring I/O memory files from a Memory Card or EM file memory to the CPU Unit.
- Transferring I/O memory from a host computer or from another PLC on a network.

4 Operating Environment Precautions

⚠ Caution Do not operate the control system in the following locations:

- 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 exposure to water, oil, or chemicals (including acids).
- Locations subject to shock or vibration.

⚠ **Caution** 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 PLC 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 PLC System. Make 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 a CompoNet Network.

- When transporting the Unit, use special packing boxes and protect it from being exposed to excessive vibration or impact during transportation.
- Do not drop any Unit or subject any Unit to excessive shock or vibration. Otherwise, Unit failure or malfunction may occur.
- Mount the Units securely using either DIN Track or screws.
- Make sure that all Slave Unit mounting screws and cable connector screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
- Make sure that the terminal blocks, communications cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- When installing the Units, ground to 100 Ω min.
- Wire all connections correctly according to instructions in the manual.
- Always separate Special Flat Cables (Standard and Sheathed) for different CompoNet systems by at least 5 mm to prevent unstable operation due to interference. Do not bundle Special Flat Cables.
- Do not extend connection distances or the number of connected nodes beyond the ranges given in the specifications.
- Do not allow foreign matter to enter the Units when wiring and installing the Units.
- Use the correct wiring materials to wire the Units.
- Always use the specified communications cables and connectors.
- Confirm the polarity of all terminals before wiring them.
- Make sure that all terminal block screws are tightened to the torque specified in this manuals. Incorrect tightening torque may result in fire, malfunction, or failure.

- Do not bend cables past their natural bending radius or pull on cables.
- Observe the following precautions when wiring the communications cable.
    - Separate the communications cables from the power lines or high-tension lines.
    - Do not bend the communications cables past their natural bending radius.
    - Do not pull on the communications cables.
    - Do not place heavy objects on top of the communications cables.
    - Always lay communications cable inside ducts.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
- Confirm voltage specifications when wiring communications, the power supply, and I/O crossovers. Incorrect wiring may result in malfunction.
- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.
- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltages may result in burning.
- After replacing Units, resume operation only after transferring to the new CPU Unit and/or Special I/O Units the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in unexpected operation.
- Check all wiring and switch settings to be sure they are correct.
- Always turn OFF the power supply to the PLC and Slave Units before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
    - Removing or attaching terminal blocks to Slave Units and Expansion Units
    - Connecting or removing terminal blocks
    - Replacing parts
    - Connecting cables or wiring the system.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
    - Changing the operating mode of the PLC
    - Force-setting/force-resetting any bit in memory
    - Changing the present value of any word or any set value in memory from the user program

- Touch a grounded piece of metal to discharge static electricity from your body before touching any Unit.
- When replacing relays or other parts, be sure to confirm that the ratings of the new part are correct. Not doing so may result in malfunction or burning.
- Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

6 Conformance to EC Directives

6-1 Applicable Directives

- EMC Directives
- Low Voltage Directive

6-2 Concepts

EMC Directives

The OMRON products described in this manual are designed so that they individually comply with the related EMC Directives 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 Directives (see note). Whether the products conform to the standards in the system used by the customer, however, cannot be checked by OMRON and 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.

Note Applicable EMC (Electromagnetic Compatibility) standards are as follows:

EMS (Electromagnetic Susceptibility): EN 61131-2 and EN 61000-6-2
EMI (Electromagnetic Interference): EN 61131-2 and EN 61000-6-4
(Radiated emission: 10-m regulations)

Low Voltage Directive

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

Applicable standard: EN 61131-2

6-3 Conformance to EC Directives

The OMRON products described in this manual comply with the related EMC Directives. To ensure that the machine or device in which the products are used complies with EC Directives, the products must be installed as follows:

1,2,3...

1. The products must be installed within a control panel.
2. A DC power supply with reinforced insulation or double insulation that can maintain a stable output even if the input is interrupted for 10 ms must be used for communications power, internal power, and I/O power.
   The OMRON S82J-series Power Supply is recommended. (See note.)

3. Products complying with EC Directives also conform to the Emission Standards (EN 61131-2 and EN 61000-6-4). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment complies with EC Directives.
4. Conformance with the EC Directives was confirmed with a system configuration using I/O wiring lengths of less than 30 m.

   Note Conformance with the EMC Directive was confirmed when using the recommended power supply.

SECTION 1
Features and Slave Units

This section introduces the CompoNet Slave Units and the various models that are available.

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1-1 Features of CompoNet Slave Units

1-1-1 Overview

CompoNet Slave Units do not simply input and output ON/OFF signals, they can also collect a variety of information that can improve equipment operating rates.

They can also be used to build maintenance systems separate from control systems. Coexisting control and maintenance systems can contribute to reducing equipment startup time, recovery time after problems, and preventative maintenance of equipment.

■ **Control System:**

For remote I/O communications with the PLC, I/O is allocated for each node address by default. In addition, Slave Unit status information other than I/O is allocated in an input area in the Master Unit. The allocation can be set using the CompoNet Support Software or explicit messages.

■ **Maintenance System:**

Slave Units can store several kinds of equipment data. This data can be read from or written to the Slave Unit's memory using the CompoNet Support Software or by sending explicit messages from the Master Unit (PLC) to the Slave Unit.

1-1-2 Features of CompoNet Slave Units

CompoNet Slave Units have the following features.

Main Features

The functions that can be used depend on the type of Slave Unit. For details, refer to *1-1-3 CompoNet Slave Unit Functions*.

Operation Time Monitor

The Slave Unit can quickly measure the ON/OFF timing of input and output contacts without relying on the ladder program. Contact types (IN - OUT, OUT - IN, IN - IN, OUT - OUT) and trigger patterns (ON → OFF, OFF → ON, ON → ON, OFF → OFF) can be freely combined for measurement. A time can be set in the Slave Unit memory to enable notification of the status when the measured time exceeds the set time.
This data can be set or read by using the CompoNet Support Software.

Contact Operation Monitor

The number of times each input contact or output contact is turned ON can be counted at a sampling frequency of 50 Hz maximum and stored. A value can also be set in the Slave Unit to enable notification of the status if the number of contact operations reaches the set value.
This data can be set or read by using the CompoNet Support Software.

Note The contact operation monitor and the total ON time monitor cannot both be used for the same contact at the same time.

Total ON Time Monitor

The total ON time of sensors, relays, and other devices are stored in the Slave Unit memory. A value can also be set in the Slave Unit to enable notification of the status if the total time reaches the set value.
These values can be set or read by using the CompoNet Support Software.

Note The total ON time monitor and the contact operation monitor cannot be used at the same time for the same contact.

Automatic Baud Rate Detection

The baud rate is automatically set to the same baud rate as the Master Unit; therefore, there is no need to set the baud rate of the Slave Units.

Unit Conduction Time Monitor

The total ON time of the Slave Unit's internal circuit power supply can be stored. This value can be read using the CompoNet Support Software or explicit messages. A value can also be set in the Slave Unit to enable obtaining notification of the status if the total time reaches a set monitor value.
This data can be read or written by using the CompoNet Support Software.

Naming Units

The user can set any name for each Unit as a comment. The names are stored in Slave Unit memory.
This data can be read or written by using the CompoNet Support Software.

Naming Connected Devices

Any name can be set for each I/O contact (e.g., sensor or valve) connected to a Slave Unit. The names are stored in Slave Unit memory.
This data can be read or written by using the CompoNet Support Software.

Network Power Voltage Monitoring

The network power supply voltage (present, maximum, and minimum values) can be stored in the Slave Unit memory. A monitor voltage can also be set in the Slave Unit to enable notification of the status if the voltage drops to the preset value.
These values can be set or read by using the CompoNet Support Software.

I/O Power Status Monitor

The I/O power status monitor function checks if the I/O power is ON or not, and provides notification in a status area. This data can be checked by using the CompoNet Support Software.

Communications Error History Monitor

The previous four error records (communications error codes and the power voltage when the error occurred) can be held in the Slave Unit memory and can be read by using the CompoNet Support Software.

Input Filters

The Slave Units can eliminate data omissions by noise or switch chattering by reading input values multiple times during the set time. An ON delay or OFF delay can also be implemented by using this function.
These settings are made by using the CompoNet Support Software.

Communications Error Output Setting

The output value when a communications error occurs can be set for each bit or word of an Output Unit.
These settings are made by using the CompoNet Support Software.

Preventing Malfunctions Caused by Inrush Current at Startup

This function holds inputs from when the power is turned ON until the Unit stabilizes, i.e., inputs are not received while the I/O power is OFF and for 100 ms after the I/O power is turned ON. This contributes to eliminating input errors caused by inrush current when the I/O power is turned ON.
These settings are made by using the CompoNet Support Software.

Sensor Power Short-circuit Detection

The I/O power current is monitored. If an excessive current is detected, it is assumed that a sensor power short-circuit has occurred and the sensor power output is turned OFF forcibly. The status can be checked by using the LED indicators on the Slave Unit or by using the CompoNet Support Software.

External Load Short-circuit Detection

The output load current is monitored. If an excessive current is detected, it is assumed that an external load short-circuit has occurred and the output is turned OFF forcibly to prevent damage to the Unit's output circuit. The status can be checked by using the LED indicators on the Slave Unit or by using the CompoNet Support Software.

Removable Terminal Block

The terminal block can be removed.

Expansion Using Expansion Units

One Expansion Unit can be added to a Digital I/O Slave (with 2-tier terminal block and relay outputs). This extends the range of possible system configurations by making it possible to expand to a variety of I/O combinations, e.g., 16 inputs and 8 outputs or 24 inputs (16 inputs + 8 inputs).

Scaling

Converted data can be scaled to any value by the user. Ladder program calculations for the Master Unit are not required if the scaling function is used with the Slave Unit. The offset compensation function can also be used to offset scaled values.
These settings are made by using the CompoNet Support Software.

Last Maintenance Date (Maintenance Function)

The date that maintenance was performed can be written in the Slave Unit by using the CompoNet Support Software.

Cumulative Counter

The cumulative counter function calculates the integral time for input (or output) analog values and reads the cumulative value. Monitor values can be set in Units. If the cumulative counter value exceeds the set monitor value, the Cumulative Counter Monitor Flag in general status turns ON.
These values can be set and read by using the CompoNet Support Software.

Moving Average

Analog Input Units can calculate the average of the last 8 inputs (moving average) and use it as the converted digital data. Smooth input values can be obtained by averaging the inputs if there are small fluctuations in the input.
These settings can be made by using the CompoNet Support Software.

Setting the Number of AD Conversion Points

The conversion cycle is 4 ms max. when using all 4 analog inputs. The AD conversion cycle can be made faster if fewer AD conversion points are used.

Rate of Change Calculations

The rate of change calculation function can find the rate of change for the set data sampling cycle for the values input to the Analog Input Unit.
These settings can be made by using the CompoNet Support Software.

Comparator

The inputs to Analog Input Units or calculated data can be compared with alarm settings (upper upper limit, upper limit, lower limit, and lower lower limit) and the result stored in the Analog Status Flags. The Normal Flag (pass signal) turns ON for values outside the set range.
These settings can be made by using the CompoNet Support Software.

Peak/Bottom Hold

The peak/bottom hold function holds the maximum (peak) or the minimum (bottom) value input to the Analog Input Unit. The maximum (peak) and minimum (bottom) value can be compared with an alarm set value and used as status data to turn ON alarm flags (comparator function).
These settings can be made by using the CompoNet Support Software.

Top/Valley Hold

The top/valley hold function holds the top or valley value input to the Analog Input Unit. The Top/Valley Detection Timing Flag can be used to check when top and valley values were detected. The top and valley values can be compared with an alarm set value and used as status data to turn ON alarm flags (comparator function).
These settings can be made by using the CompoNet Support Software.

Disconnected Line Detection

With Analog Input Units, the Disconnected Line Detection Flag for each channel can be used in the Master Unit to check whether the analog input lines (for voltage inputs or current inputs) are disconnected for channels enabled for analog inputs under the setting of the number of AD conversion points.
This function is supported only when the input range is 1 to 5 V or 4 to 20 mA.

User Adjustment

The user adjustment function can be used to compensate offsets in input (or output) values that occur due to the features of or connection method used for input or output devices to adjust the input (or output). The conversion line is adjusted at two points: 0% and 100%.
The adjustments can be made by using the CompoNet Support Software.

Other Features

Rotary Switch Setting of Node Addresses

Node addresses can now be set much more easily using rotary switches.

Bit-level Distribution (Bit Slaves)

Units are available with 2 inputs, 2 outputs, 4 inputs, 2 inputs/2 outputs. This enables bit-level distribution with Slave Units. At the same time, unused Slave Unit I/O can be suppressed.

IP54 Dust-tight, Splash-proof Units (Bit Slaves)

The CRT1B-□D□□SP(-1) Units conform to the IEC IP54 dust-tight, splash-proof degree of protection (see note).

Note For protection against humans and solid foreign objects, IP54 requires that dust will not penetrate inside the device to a degree that would affecting operation. For protection against water ingress, water splashing from any direction must have no adverse effect.

Flat Cable Connected as a Standard Feature (Bit Slaves)

Bit Slave Units are sold with Standard or Sheathed Flat Cable already connected. Bit Slaves cannot be used, however, at a baud rate of 4 Mbit/s (no branch lines).

No I/O Power Supply Wiring Required (Bit Slaves)

The current consumption for external I/O (sensors or actuators) power supply connected to Bit Slaves using sensor connectors (e-CON) or clamp terminals is supplied through the Flat Cable. No separate wiring is required for I/O power supply.

Industry Standard Sensor Connectors (e-CON) (CRT1-□D16S(-1)/CRT1B-□D02S(-1)/CRT1B-□D0□SP(-1))

No special tools are required for connections because industry standard sensor connectors (e-CON) are used. Electrical cables do not need to be stripped and are simply inserted with pliers. When using e-CON Connectors, there is no need to prepare special tools for wiring, and connectors from different makers can be used interchangeably.

Units with Clamp Terminal Blocks (CRT1-□D16SL(-1)/CRT1B-MD04SLP(-1))

There is no need to tighten the screws because these Units use screw-less clamp terminal blocks. Connections are made simply by inserting the pin terminals. Wiring can be completed in one step.

1-1-3 CompoNet Slave Unit Functions

Yes: Supported, ---: Not supported

<table>
<tr><th rowspan="4">Unit
Function</th><th colspan="6">Digital I/O Slave Units</th></tr>
<tr><th colspan="3">2-tier Terminal block</th><th colspan="3">3-tier Terminal Block</th></tr>
<tr><th colspan="2">CRT1-□D16(-1)</th><th>CRT1-ROS16</th><th colspan="3">CRT1-□D16TA(-1)</th></tr>
<tr><th>Input Units</th><th>Output Units</th><th>Output Units</th><th>Input Units</th><th>Output Units</th><th>Input/ Output Units</th></tr>
<tr><td>Operation Time Monitor</td><td colspan="6">Yes</td></tr>
<tr><td>Contact Operation Monitor</td><td colspan="6">Yes</td></tr>
<tr><td>Total ON Time Monitor</td><td colspan="6">Yes</td></tr>
<tr><td>Automatic Baud Rate Detection</td><td colspan="6">Yes</td></tr>
<tr><td>Unit Conduction Time Monitor</td><td colspan="6">Yes</td></tr>
<tr><td>Naming Units</td><td colspan="6">Yes</td></tr>
<tr><td>Naming Connected Devices</td><td colspan="6">Yes</td></tr>
<tr><td>Network Power Voltage Monitor</td><td colspan="6">Yes</td></tr>
<tr><td>I/O Power Status Monitor</td><td colspan="2">Yes</td><td>---</td><td colspan="3">Yes</td></tr>
<tr><td>Communications Error History Monitor</td><td colspan="6">Yes</td></tr>
<tr><td>Input Filter</td><td>Yes</td><td>---</td><td>---</td><td>Yes</td><td>---</td><td>Yes</td></tr>
<tr><td>Communications Error Output</td><td>---</td><td>Yes</td><td>Yes</td><td>---</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Preventing Malfunctions Caused by Inrush Current at I/O Startup</td><td>Yes</td><td>---</td><td>---</td><td>Yes</td><td>---</td><td>Yes</td></tr>
<tr><td>Sensor Power Short-circuit Detection</td><td colspan="6">---</td></tr>
<tr><td>External Load Short-circuit Detection</td><td colspan="6">---</td></tr>
<tr><td>Removable Terminal Block Structure</td><td colspan="6">Yes</td></tr>
<tr><td>Expansion Using Expansion Units</td><td colspan="2">Yes</td><td>Yes</td><td colspan="3">---</td></tr>
<tr><td>Scaling</td><td colspan="6">---</td></tr>
<tr><td>Last Maintenance Date</td><td colspan="6">Yes</td></tr>
<tr><td>Cumulative Counter</td><td colspan="6">---</td></tr>
<tr><td>Moving Average</td><td colspan="6">---</td></tr>
<tr><td>Setting the Number of AD Conversion Points</td><td colspan="6">---</td></tr>
<tr><td>Rate of Change</td><td colspan="6">---</td></tr>
<tr><td>Comparator</td><td colspan="6">---</td></tr>
<tr><td>Peak/Bottom Hold</td><td colspan="6">---</td></tr>
<tr><td>Top/Valley Hold</td><td colspan="6">---</td></tr>
<tr><td>Disconnected Line Detection</td><td colspan="6">---</td></tr>
<tr><td>User Adjustment</td><td colspan="6">---</td></tr>
</table>

Yes: Supported, ---: Not supported

<table>
<tr><th rowspan="4">Unit
Function</th><th colspan="5">Digital I/O Slave Units</th></tr>
<tr><th colspan="3">Units with Connectors</th><th colspan="2">Units with Clamp Terminal Blocks</th></tr>
<tr><th colspan="3">CRT1-□D16S(-1)</th><th colspan="2">CRT1-□D16SL(-1)</th></tr>
<tr><th>Input Units</th><th>Output Units</th><th>Input/Output Units</th><th>Input Units</th><th>Output Units</th></tr>
<tr><td>Operation Time Monitor</td><td colspan="5">Yes</td></tr>
<tr><td>Contact Operation Monitor</td><td colspan="5">Yes</td></tr>
<tr><td>Total ON Time Monitor</td><td colspan="5">Yes</td></tr>
<tr><td>Automatic Baud Rate Detection</td><td colspan="5">Yes</td></tr>
<tr><td>Unit Conduction Time Monitor</td><td colspan="5">Yes</td></tr>
<tr><td>Naming Units</td><td colspan="5">Yes</td></tr>
<tr><td>Naming Connected Devices</td><td colspan="5">Yes</td></tr>
<tr><td>Network Power Voltage Monitor</td><td colspan="5">Yes</td></tr>
<tr><td>I/O Power Status Monitor</td><td>---</td><td>Yes</td><td>Yes</td><td colspan="2">Yes</td></tr>
<tr><td>Communications Error History Monitor</td><td colspan="5">Yes</td></tr>
<tr><td>Input Filter</td><td>Yes</td><td>---</td><td>Yes</td><td>Yes</td><td>---</td></tr>
<tr><td>Communications Error Output</td><td>---</td><td>Yes</td><td>Yes</td><td>---</td><td>Yes</td></tr>
<tr><td>Preventing Malfunctions Caused by Inrush Current at I/O Startup</td><td>Yes</td><td>---</td><td>Yes</td><td>Yes</td><td>---</td></tr>
<tr><td>Sensor Power Short-circuit Detection</td><td colspan="5">---</td></tr>
<tr><td>External Load Short-circuit Detection</td><td colspan="5">---</td></tr>
<tr><td>Removable Terminal Block Structure</td><td colspan="3">---</td><td colspan="2">Yes</td></tr>
<tr><td>Expansion Using Expansion Units</td><td colspan="5">---</td></tr>
<tr><td>Scaling</td><td colspan="5">---</td></tr>
<tr><td>Last Maintenance Date</td><td colspan="5">Yes</td></tr>
<tr><td>Cumulative Counter</td><td colspan="5">---</td></tr>
<tr><td>Moving Average</td><td colspan="5">---</td></tr>
<tr><td>Setting the Number of AD Conversion Points</td><td colspan="5">---</td></tr>
<tr><td>Rate of Change</td><td colspan="5">---</td></tr>
<tr><td>Comparator</td><td colspan="5">---</td></tr>
<tr><td>Peak/Bottom Hold</td><td colspan="5">---</td></tr>
<tr><td>Top/Valley Hold</td><td colspan="5">---</td></tr>
<tr><td>Disconnected Line Detection</td><td colspan="5">---</td></tr>
<tr><td>User Adjustment</td><td colspan="5">---</td></tr>
</table>

Yes: Supported, ---: Not supported

Unit	Analog I/O Slave Units		Bit Slave Units					Repeater Units
	CRT1-AD04 CRT1-DA02		CRT1B-□D02S (-1)		CRT1B-□D0□SP(-1) CRT1B-MD04SLP(-1)			CRS1-RPT01
Function	**Input Units**	**Output Units**	**Input Units**	**Output Units**	**Input Units**	**Output Units**	**Input/ Output Units**	
Operation Time Monitor	---		Yes					---
Contact Operation Monitor	---		Yes					---
Total ON Time Monitor	---		Yes					---
Automatic Baud Rate Detection	Yes		Yes					Yes
Unit Conduction Time Monitor	Yes		Yes					Yes
Naming Units	Yes		Yes					Yes
Naming Connected Devices	Yes		Yes					---
Network Power Voltage Monitor	Yes		Yes					Yes
I/O Power Status Monitor	---		---					---
Communications Error History Monitor	Yes		Yes					Yes
Input Filter	---		Yes	---	Yes	---	Yes	---
Communications Error Output	---	Yes	---	Yes	---	Yes	Yes	---
Preventing Malfunctions Caused by Inrush Current at I/O Startup	---		Yes	---	Yes	---	Yes	---
Sensor Power Short-circuit Detection	---		Yes	---	Yes	---	Yes	---
External Load Short-circuit Detection	---		---	Yes	---	Yes	Yes	---
Removable Terminal Block Structure	Yes		---					---
Expansion Using Expansion Units	---		---					---
Scaling	Yes		---					---
Last Maintenance Date	Yes		Yes					Yes
Cumulative Counter	Yes		---					---
Moving Average	Yes	---	---					---
Setting the Number of AD Conversion Points	Yes	---	---					---
Rate of Change	Yes	---	---					---
Comparator	Yes	---	---					---
Peak/Bottom Hold	Yes	---	---					---
Top/Valley Hold	Yes	---	---					---
Disconnected Line Detection	Yes	---	---					---
User Adjustment	Yes		---					---

Note The Contact Operation Monitor and the Total ON Time Monitor cannot be used at the same time for the same contact.

1-2 Slave Unit Models

CompoNet Slave Units can be classified into the following groups.

Word Slave Units

Word Slave Units are Slave Units that are allocated units of 16 bits (i.e., 1 word) in I/O memory of the CPU Unit.

Digital I/O Slave Units:	Slave Units with digital I/O
Analog I/O Slave Units:	Slave Units with analog I/O
Expansion Units:	Units that can be used to expand the number of I/O points for Digital I/O Slave Units (with 2-tier terminal blocks or relay outputs).

IP20 and IP54 Bit Slave Units

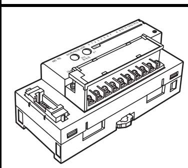
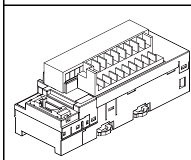
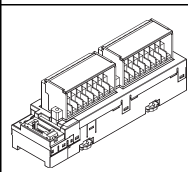
Bit Slave Units are Slave Units that are allocated units of 2 bits in I/O memory of the CPU Unit. Bit Slave Units provide 2 or 4 digital contact I/O points and have Standard or Sheathed Flat Cable already connected.

Repeater Units

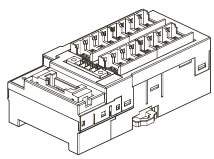
Units that can be used to expand the network by extending trunk lines or branching.

1-2-1 Word Slave Units

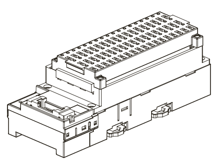
Digital I/O Slave Units

Type	Appearance	I/O capacity	Model	Features
Digital I/O Slave Units with 2-tier Terminal Block		16 inputs (NPN)	CRT1-ID16	• Terminal blocks can be attached/ removed from the Unit. • Expansion Units can be added.
		16 inputs (PNP)	CRT1-ID16-1	
		16 outputs (NPN)	CRT1-OD16	
		16 outputs (PNP)	CRT1-OD16-1	
		16 outputs (relay outputs)	CRT1-ROS16	
		16 outputs (SSR outputs)	CRT1-ROF16	
Digital I/O Slave Units with 3-tier Terminal Block		16 inputs (NPN)	CRT1-ID16TA	• Terminal blocks can be attached/ removed from the Unit. • Expansion Units cannot be added.
		16 inputs (PNP)	CRT1-ID16TA-1	
		16 outputs (NPN)	CRT1-OD16TA	
		16 outputs (PNP)	CRT1-OD16TA-1	
		8 inputs/8 outputs (NPN)	CRT1-MD16TA	
		8 inputs/8 outputs (PNP)	CRT1-MD16TA-1	

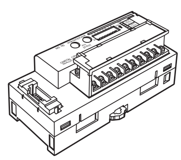
Units with Connectors

Type	Appearance	I/O capacity	Model	Features
Units with Connectors		16 inputs (NPN)	CRT1-ID16S	• Equipped with industry standard sensor connectors (e-CON). • Expansion Units cannot be added.
		16 inputs (PNP)	CRT1-ID16S-1	
		16 outputs (NPN)	CRT1-OD16S	
		16 outputs (PNP)	CRT1-OD16S-1	
		8 inputs and 8 outputs (NPN)	CRT1-MD16S	
		8 inputs and 8 outputs (PNP)	CRT1-MD16S-1	

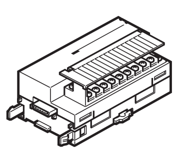
Units with Clamp Terminal Blocks

Type	Appearance	I/O capacity	Model	Features
Units with Screw-less Clamp Terminal Blocks		16 inputs (NPN)	CRT1-ID16SL	• Equipped with screw-less clamp terminals. • Expansion Units cannot be added.
		16 inputs (PNP)	CRT1-ID16SL-1	
		16 outputs (NPN)	CRT1-OD16SL	
		16 outputs (PNP)	CRT1-OD16SL-1	

Analog I/O Slave Units

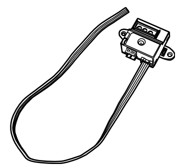
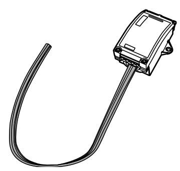
Type	Appearance	I/O capacity	Model	Features
Analog Input Units		4 inputs	CRT1-AD04	I/O range: 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V, 0 to 20 mA, 4 to 20 mA
Analog Output Units		2 outputs	CRT1-DA02	

Expansion Units

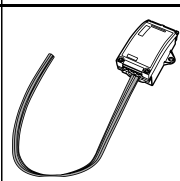
Appearance	I/O capacity	Model	Features
	8 inputs (NPN)	XWT-ID08	• Expansion Units are used to add points to Digital I/O Slave Units (with 2-tier terminal blocks or relay outputs). • One Expansion Unit can be added to one Slave Unit.
	8 inputs (PNP)	XWT-ID08-1	
	8 outputs (NPN)	XWT-OD08	
	8 outputs (PNP)	XWT-OD08-1	
	16 inputs (NPN)	XWT-ID16	
	16 inputs (PNP)	XWT-ID16-1	
	16 outputs (NPN)	XWT-OD16	
	16 outputs (PNP)	XWT-OD16-1	

1-2-2 Bit Slave Units

Slaves with Connectors

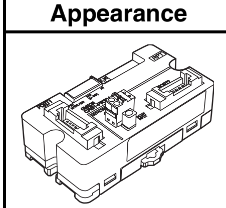
Degree of protection	Appearance	I/O capacity	Model	Features
IP20 indoor enclosure		2 inputs (NPN)	CRT1B-ID02S	• Standard Flat Cable connected as standard feature. • Industrial standard connectors (e-CON)
		2 inputs (PNP)	CRT1B-ID02S-1	
		2 outputs (NPN)	CRT1B-OD02S	
		2 outputs (PNP)	CRT1B-OD02S-1	
IP54 dust-tight/ splash-proof		2 inputs (NPN)	CRT1B-ID02SP	• Sheathed Flat Cable connected as standard feature • Industrial standard connectors (e-CON)
		2 inputs (PNP)	CRT1B-ID02SP-1	
		2 outputs (NPN)	CRT1B-OD02SP	
		2 outputs (PNP)	CRT1B-OD02SP-1	
		4 inputs (NPN)	CRT1B-ID04SP	
		4 inputs (PNP)	CRT1B-ID04SP-1	

Slaves with Clamp Terminal Blocks

Degree of protection	Appearance	I/O capacity	Model	Features
IP54 dust-tight/ splash-proof		2 inputs/2 outputs (NPN)	CRT1B-MD04SLP	• Sheathed Flat Cable connected as standard feature • Screw-less clamp terminal block
		2 inputs/2 outputs (PNP)	CRT1B-MD04SLP-1	

Note Bit Slaves have Standard or Sheathed Flat Cable connected as standard feature. They cannot be at a baud rate of 4 Mbit/s, for which branch lines are not supported.

1-2-3 Repeater Units

Appearance	Specification	Model	Features
	Two communications connectors (Upstream port and downstream port) One downstream port power supply connector Up to 64 Units can be connected for each Master Unit.	CRS1-RPT01	• For trunk line-branch line formations, sub-trunk lines can be connected under a Repeater Unit just like they can be under the Master Unit. • For unrestricted branching formations, there are no restrictions on the connections. • Repeater Units enable branching the trunk line, adding more nodes, increasing the connection distance, and changing the type of cable upstream and downstream of the Repeater Unit.

1-2-4 Slave Unit Installation and Connection

Installing Slave Units

Refer to the following table for the installation and wiring methods for the Slave Units.

Slave Unit Installation and Wiring Methods

Name			Model	Slave Unit installation	I/O connection method	Internal power	External power
Digital I/O Slave Units	With 2-tier Terminal Block		CRT1-ID16(-1)	DIN Track	Terminal block with M3 screws	Supplied along with communica-tions power	An external I/O power supply is required for con-nected devices.
			CRT1-OD16(-1)				
			CRT1-ROS16				
			CRT1-ROF16				
	With 3-tier Terminal Block		CRT1-ID16TA(-1)				
			CRT1-OD16TA(-1)				
			CRT1-MD16TA(-1)				
	With Connector		CRT1-ID16S(-1)		Industry stan-dard sensor con-nectors (e-CON).		Shared with com-munications power supply. (See note.)
			CRT1-OD16S(-1)				I/O power must be supplied externally for connected devices.
			CRT1-MD16S(-1)				Shared with com-munications power supply only for inputs. (See note.)
	With Clamp Ter-minal Block		CRT1-ID16SL(-1)		Screw-less clamp terminal block		I/O power must be supplied externally for connected devices.
			CRT1-OD16SL(-1)				
Analog I/O Slave Units			CRT1-AD04		Terminal block with M3 screws		---
			CRT1-DA02				
Digital I/O Slave Units Expansion Units			XWT-ID08(-1)				Refer to the follow-ing section.
			XWT-OD08(-1)				
			XWT-ID16(-1)				
			XWT-OD16(-1)				
Bit Slave Units	With Connec-tors	IP20	CRT1B-ID02S(-1)	M4 screw installation	Industrial stan-dard sensor con-nector (e-CON)		Supplied along with communications power (See note.)
			CRT1B-OD02S(-1)				
		IP54	CRT1B-ID02SP(-1)				
			CRT1B-OD02SP(-1)				
			CRT1B-ID04SP(-1)				
	With Clamp Terminal Blocks	IP54	CRT1B-MD04SLP(-1)		Screw-less clamp terminal block		
Repeater Units			CRS1-RPT01	DIN Track or M4 screw installation	---		Communications power for the down-stream line must be supplied from the communications power supply con-nector.

Note For Bit Slave Units, the external I/O (sensor and actuator) power is also provided through the Flat Cable from the communications power supply connected to the Master Unit or the Repeater Unit. When calculating the output current of the communications power supply, always include the external I/O current consumption for Bit Slave Units.

Supplying I/O Power to Expansion Units

Supply I/O power to Expansion Slave Units according to the following table.

Combination	I/O power supply to Expansion Slave Unit
Digital Input Slave Unit with Expansion Input Unit Example: CRT1-ID16 + XWT-ID16 (or XWT-ID08)	Not required (The Expansion Unit uses the same I/O power supply as the Digital I/O Slave Unit.)
Digital Input Slave Unit with Expansion Output Unit Example: CRT1-ID16 + XWT-OD16 (or XWT-OD08)	Required (I/O power must be supplied to both Units.)
Digital Output Slave Unit with Expansion Input Unit Example: CRT1-OD16 + XWT-ID16 (or XWT-ID08)	Required (I/O power must be supplied to both Units.)
Digital Output Slave Unit with Expansion Output Unit Example: CRT1-OD16 + XWT-OD16 (or XWT-OD08)	Required (I/O power must be supplied to both Units.)

SECTION 2
Wiring Configurations

This section describes the configurations of CompoNet Networks.

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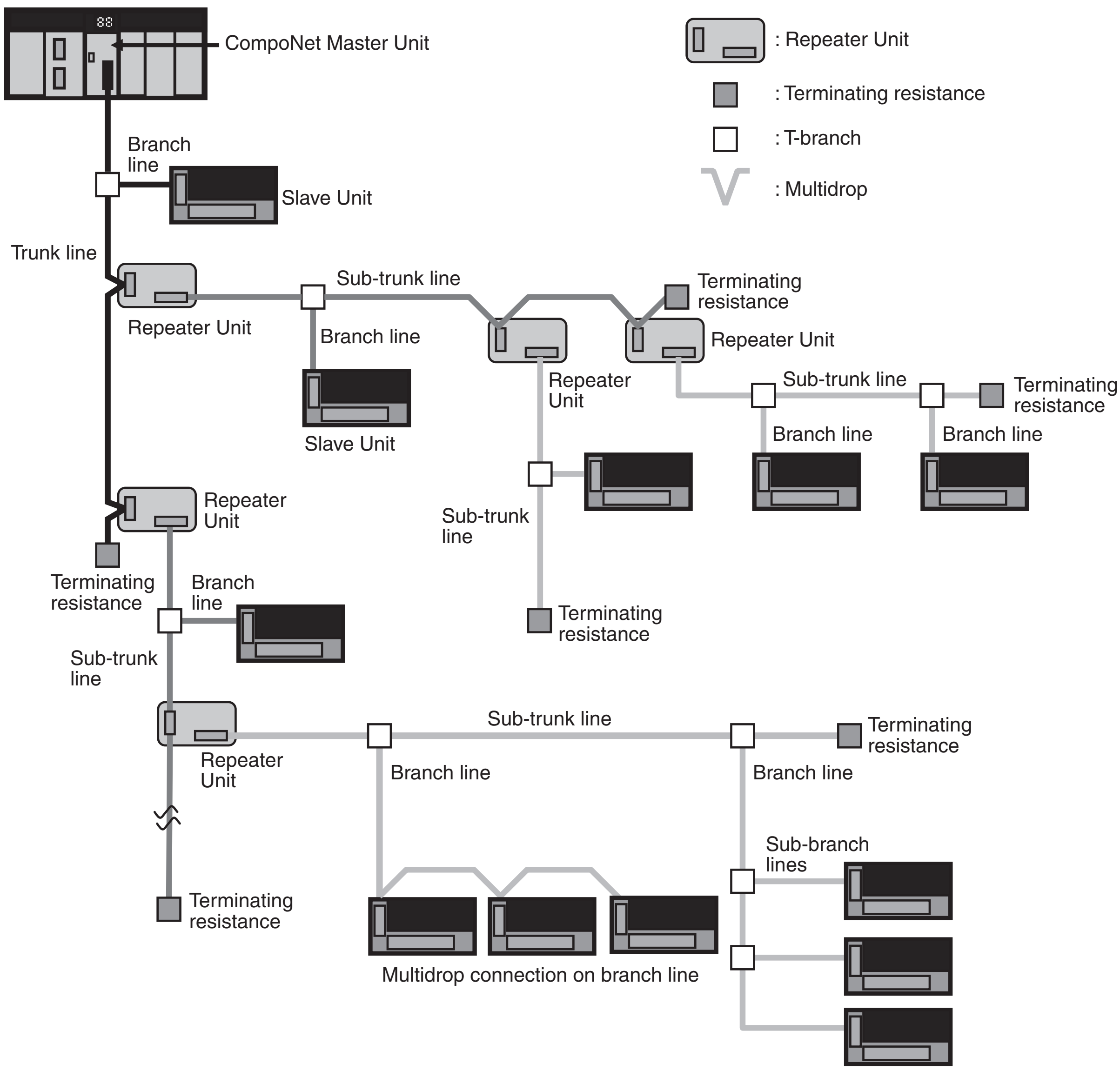
2-4-2 Flat Cable 27

2-1 CompoNet Networks

2-1-1 Overall System Configuration and Elements

A CompoNet Network is a remote I/O system that consists of the following elements.

System Configuration Example



Communications Cables

CompoNet Networks use round cable I (commercially available VCTF 2-conductor cable), Flat Cable I (DCA4-4F10 Standard Flat Cable), and Flat Cable II (DCA5-4F10 Sheathed Flat Cable) for Communications Cables.

Master Unit

The Master Unit manages the CompoNet Network and transfers I/O data between the PLC and the Slave Units.

There is only one Master Unit per network. The Master Unit must be connected to the trunk line.

Slave Units

Some Slave Units receive output data from the Master Unit across the CompoNet Network and output it. Other Slave Units send data that has been input across the network to the Master Unit. There are two types of Slave Unit according to the I/O capacity of the Slave Unit.

- Word Slave Units: Word Slave Units are allocated units of 16 bits (i.e., 16 I/O points) in the I/O memory of the CPU Unit.
- Bit Slave Units: Bit Slave Units are allocated units of 2 bits (i.e., 2 I/O points) in the I/O memory of the CPU Unit.

There are also two types of Bit Slave Unit according to differences in their environment resistance: IP20 Slave Units and IP54 Slave Units. In addition, there are two types of Flat Cable according to the environment resistance: Standard Flat Cable and Sheathed Flat Cable.

Repeater Unit

Using Repeater Units enables expanding network connections as follows:

- Extending the Communications Cable
- Increasing the number of nodes (Units)
- Creating long-distance T-branches from the trunk line and sub-trunk lines (See note.)
- Converting between different types of cable (round cable I, Flat Cable I, and Flat Cable II)

A sub-trunk line downstream from a Repeater Unit can be connected with the same communications specifications (i.e., distances and number of Slave Units) as the trunk line.

Up to 64 Repeater Units can be connected per network (i.e., per Master Unit). When Repeater Units are connected in series from the Master Unit, up to two layers can be created.

Note The physical layer is not connected across a Repeater Unit. The connection is thus different from a branch connection, which branches the same physical layer.

Terminating Resistance

With a CompoNet Network, the Master Unit is located at one end of the trunk line and terminating resistance is connected to the other end of the trunk line. If Repeater Units are used, each Repeater Unit is treated like a Master Unit, i.e., terminating resistance is connected to the most remote end of the sub-trunk line downstream from the Repeater Unit.

Note Terminating resistance reduces signal bouncing to stabilize communications and must always be connected to the most remote end of the network lines below the Master Unit and each Repeater Unit. Always connect terminating resistance to ensure the quality of the transmission path.

Trunk Lines and Branch Lines

The trunk lines and branch lines in a CompoNet Network are defined as follows:

- Trunk line: The transmission path between the Master Unit and the terminating resistance.
- Sub-trunk line: The transmission path between the Repeater Unit and the terminating resistance (when a Repeater Unit is used)
- Branch line: The transmission path created using a T-branch from the trunk line or sub-trunk line.
- Sub-branch line: The transmission path created using a T-branch from a branch line. (T-branching is not possible from sub-branch lines.)

Note Due to differences in functionality, the same type of cable must be used between the trunk line and a branch line, a sub-trunk line and branch line, and a branch line and sub-branch line. Different types of cable can be used between the trunk line and a sub-trunk line.

Branches

There are two ways to create branch lines.

1) T-branch Connections

- T-branch connections using Flat Connectors (when Flat Cable is used)
- T-branch connections using commercially available relay terminals (when round cable is used)

2) Multidrop Connections

- Multidrop connections using Open Type Connectors (when round cable is used)
- Multidrop connections using Flat Connectors and Multidrop Connectors (when Flat Cable is used)

Note Flat Connectors can also be used to extend the Communications Cable.

Communications Power Supply

This is the power supply for communications and internal operations for each Unit.

A commercially available 24-VDC power supply is used to power communications and internal operations for each Unit.

One communications power supply can be connected for each trunk line and sub-trunk line. Communications power is supplied to the trunk line from the Master Unit and to a sub-trunk line from the Repeater Unit.

One power supply cannot be used to supply communications power to more than one line (i.e., to the trunk line and sub-trunk line or to two sub-trunk lines).

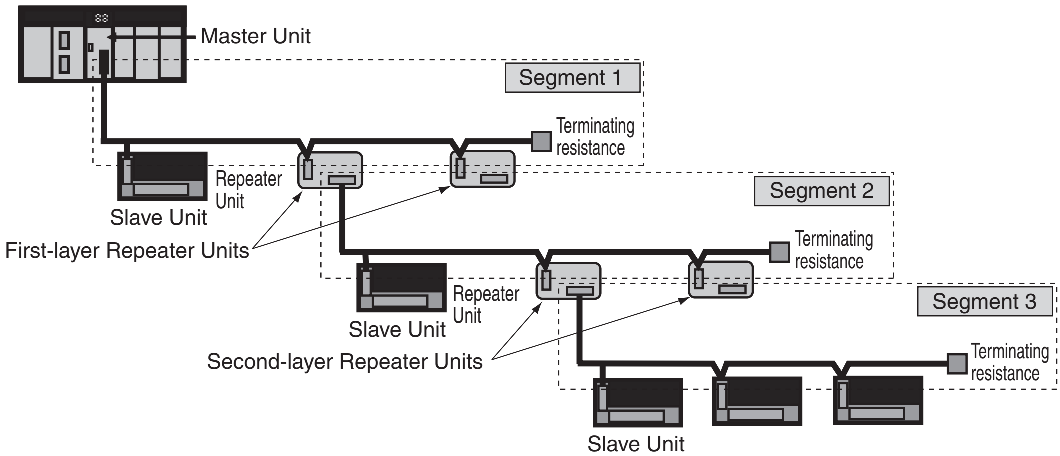
I/O Power Supply

A commercially available 24-VDC power supply is used to power the I/O operations of the external I/O device connected to each Unit.
It is connected to the I/O power supply terminal of each Unit.

2-1-2 Segments

Segment Layers

When Repeater Units are used, the CompoNet Network is divided into segments by the Repeater Units. Each segment is connected to the network, but is isolated electrically. Three layers of these isolated segments can be configured, called segments 1, 2, and 3, counted in order from the Master Unit. Repeater Units can be used to add a maximum of two extra segment layers. Including Repeater Units connected using multidrop connections, a maximum of 64 Repeater Units can be connected in a single network (i.e., to a single Master Unit).



Number of Units Per Segment

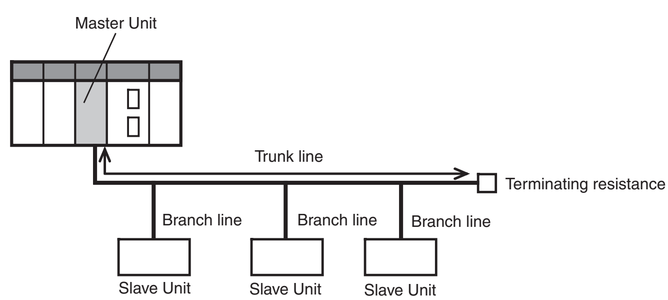
A maximum of 32 Slave Units and Repeater Units can be connected in the one segment.

2-2 Wiring Formations

There are two possible wiring formations for a CompoNet Network.

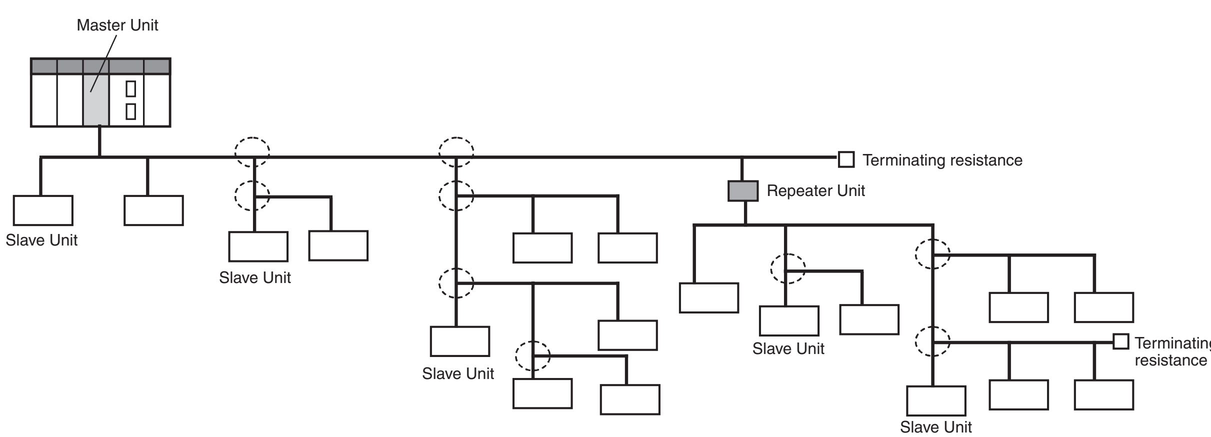
Trunk Line-Branch Line Formation

With this wiring formation, the trunk line is differentiated from branch lines and there are restrictions on the number of branches and the number of connections.



Unrestricted Wiring Formation

With this wiring formation, there is no distinction between the trunk line and branch lines. There are no wiring restrictions as long as the total cable length does not exceed 200 m. There is also no limit in the number of branches.



The formation to be used is determined automatically by the type of cable to used and the required baud rate.

Cable type	Baud rate			
	4 Mbits/s	3 Mbits/s	1.5 Mbits/s	93.75 kbits/s
Round cable	❍ (See note.)	❍	❍	❍
Flat Cable	❍ (See note.)	❍	❍	◇

❍: Trunk line - branch line wiring formation
◇: Unrestricted wiring formation

Note Lines cannot be branched from the trunk line when the baud rate is 4 Mbit/s. (Only multidrop connections can be used for branching from the trunk line or sub-trunk lines.)

The following table shows the conditions and restrictions for each formation.

Item	Wiring formation	
	Trunk line-branch line formation	Unrestricted wiring formation
Master Unit location	End of network	Anywhere in network (not necessarily at the end)
Maximum number of Slave Units connected to any one branch line	1 or 3 depending on the cable type and baud rate	No restrictions
Terminating resistance location	On the opposite ends of the trunk line and all sub-trunk lines from the Master Unit and each Repeater Unit	On the most remote ends from the Master Unit and each Repeater Unit

2-3 Communications Cable

2-3-1 Cables That Can Be Used

The following three types of cable can be used in a CompoNet network.

Round cable I (commercially available VCTF 2-conductor cable)

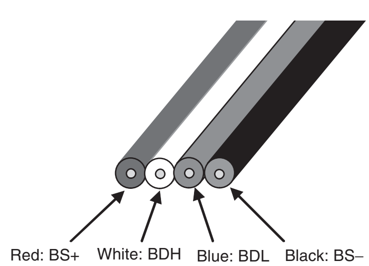
600-V vinyl-insulated cab-tyre cable

JIS C 3306

Nominal cross-sectional area: 0.75 mm^2 (signal lines × 2)

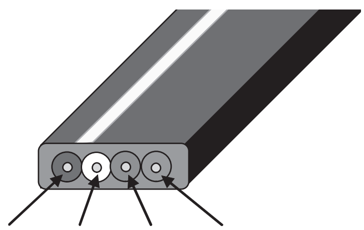
Conductor resistance: 25.1 Ω/km max. (20°C)

Flat Cable I (DCA4-4F10 Standard Flat Cable, 4 conductors)



Conduc-tor No.	Insulation color	Application	Nominal cross-sec-tion	Conductor resistance (Ω/km)	Dielectric strength (V)	Insulation resistance (MΩ)	Allowable current (A)
1	Red	BS+ (communica-tions power supply positive side)	0.75 mm^2 (AWG19)	25.0 max.	2000	20 min.	5 max.
2	White	BDH (signal high)	0.5 mm^2 (AWG21)	37.5 max.			---
3	Blue	BDL (signal low)	0.5 mm^2 (AWG21)	37.5 max.			---
4	Black	BS– (communica-tions power supply negative side)	0.75 mm^2 (AWG19)	25.0 max.			5 max.

Flat Cable II (DCA5-4F10 Sheathed Flat Cable, 4 conductors)



Conduc-tor No.	Insulation color	Application	Nominal cross-sec-tion	Conductor resistance (Ω/km)	Dielectric strength (V)	Insulation resistance (MΩ)	Allowable current (A)
1	Red	BS+ (communica-tions power supply positive side)	0.75 mm^2 (AWG19)	25.0 max.	2000	20 min.	5 max.
2	White	BDH (signal high)	0.5 mm^2 (AWG21)	37.5 max.			---
3	Blue	BDL (signal low)	0.5 mm^2 (AWG21)	37.5 max.			---
4	Black	BS– (communica-tions power supply negative side)	0.75 mm^2 (AWG19)	25.0 max.			5 max.

Note (1) Do not use any cables other than those given above.

(2) The characteristics of each conductor in Flat Cable I and Flat Cable II have been adjusted to the application. Check the line insulator colors and use each line only for the application given in the above table.

2-3-2 Criteria for Selecting Cable

Selecting Cable Types

Select the cable type using the following items as conditions.

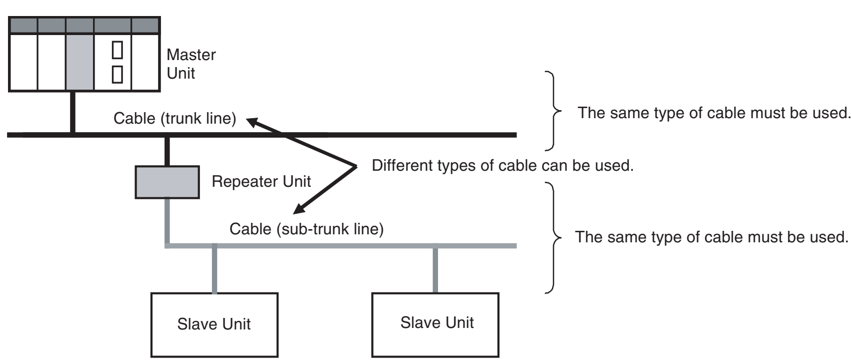
Item			Cable type		
			Round cable I	**Flat Cable I**	**Flat Cable II**
Application			• When using commercially available cable is desirable. • To provide communications power separately.	• To supply communications power to all Slave Units with the communications cable.	• To supply communications power to all Slave Units with the communications cable. • Applications in environments that required IP54 compliance (drip-proof, splash-proof).
Slave Unit connections	Word Slave Units		Supported		
	Bit Slave Units	IP20 Bit Slave Units	Not supported. (See note.)	Supported	Not supported.
		IP54 Bit Slave Units		Not supported.	Supported
Wiring method for communications power supply			Wired separately from the Communications Cable.	Supplied via Communications Cable. (Power is supplied from the Master Unit and Repeater Units.)	
Master Unit location			End of trunk line	Baud rate other than 93.75 kbits/s: End of trunk line 93.75 kbits/s: Anywhere in network	

Note Bit Slaves come with a Flat Cable already connected. If this cable is removed, the Unit cannot be connected.

Using Different Cable Types

The same type of cable must be used for all lines downstream from the Master Unit (i.e., the trunk line and branch lines, sub-trunk lines and their branch lines, and branch lines and sub-branch lines must use the same type of cable).

When Repeater Units are used, however, different cables can be used for the trunk line and sub-trunk lines, and for sub-trunk lines and sub-trunk lines, above and below a Repeater Unit.



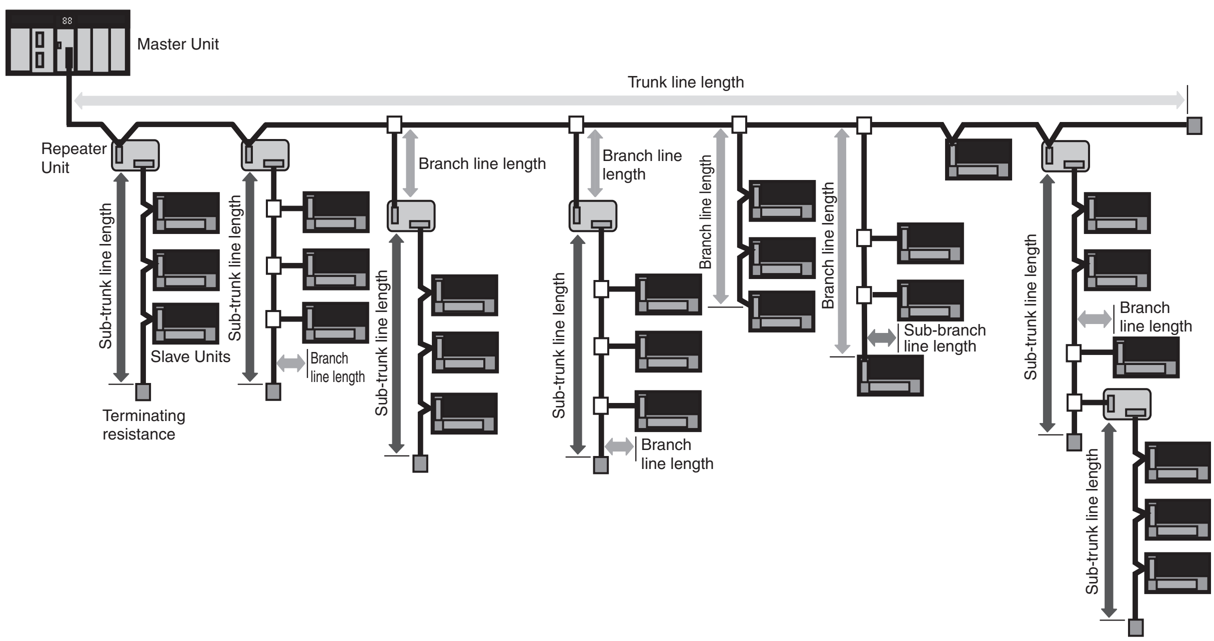
Note Flat Cable I (Standard) and Flat Cable II (Sheathed) are treated as different types of cable.

Restrictions in Distance between Cables of Multiple CompoNet Systems

When using more than one CompoNet System with Flat Cable (sheathed or unsheathed), operation may be unstable due to interference. To prevent this, the Flat Cables for the different CompoNet Systems must be separated from each other by at least 5 mm.

2-3-3 Maximum Distance and Number of Connected Units for Types of Communications Cables

The maximum lengths for each cable are shown below, along with the maximum number of Slave Units that can be connected.
Do not exceed these limits.



Baud Rate of 4 Mbit/s (No Branch Lines, See note.)

Item	Round cable	Flat Cable
Length per trunk line or sub-trunk line (maximum length with two Repeater Units)	30 m (90 m)	30 m (90 m)
Branch line length	Lines cannot be branched from the trunk line. (Only multidrop connections are possible from the trunk line or sub-trunk lines.)	
Total branch line length		
Restrictions on branch line locations		
Number of Slave Units (including Repeater Units) per trunk line or sub-trunk line	32	32

Note Bit Slave Units come with Flat Cable and cannot be connected. The network must consist of only Word Slave Units and multidrop connections. (Use DCN4-MD4 Multidrop Connectors for Flat Cable.)

Baud Rate of 3 Mbit/s

Item	Round cable	Flat Cable
Length per trunk line or sub-trunk line (maximum length with two Repeater Units)	30 m (90 m)	30 m (90 m)
Branch line length	0.5 m	0.5 m
Total branch line length	8 m	8 m
Restrictions on branch line locations	3/m	3/m
Number of Units per branch (See note 1.)	1	1
Maximum sub-branch line length	Not supported.	Not supported.

Item	Round cable	Flat Cable
Total sub-branch line length	Not supported.	Not supported.
Number of Slave Units (including Repeater Units) per trunk line or sub-trunk line	32	32

Baud Rate of 1.5 Mbit/s

Item	Round cable		Flat Cable
	Without branching	With branching	
Length per trunk line or sub-trunk line (maximum length with two Repeater Units)	100 m (300m)	30 m (90m)	30 m (90 m)
Branch line length	Not supported. (See note 2.)	2.5 m	2.5 m
Total branch line length	Not supported. (See note 2.)	25 m	25 m
Restrictions on branch line locations	---	3/m	3/m
Number of Units per branch (See note 1.)		3	3
Maximum sub-branch line length		Not supported.	0.1 m (See note 3.)
Total sub-branch line length		Not supported.	2 m (See note 3.)
Number of Slave Units (including Repeater Units) per trunk line or sub-trunk line	32	32	32

Note (1) The number of Units per branch is the maximum number of Slave Units or Repeater Units that can be connected to one branch using multidrop or T-branch connections (sub-branch lines).

(2) Lines cannot be branched from the trunk line. (Only multidrop connections are possible from the trunk line or sub-trunk lines.)

(3) Sub-branch lines can be branched from branch lines.

Baud Rate of 93.75 kbit/s

Item	Round cable	Flat Cable
Length per trunk line or sub-trunk line (maximum length with two Repeater Units)	500 m (1,500 m)	Unrestricted wiring is enabled for a total length of 200 m.
Branch line length	6 m	
Total branch line length	120 m	
Restrictions on branch line locations	3/m	
Number of Units per branch (See note.)	1	
Maximum sub-branch line length	---	
Total sub-branch line length	---	
Number of Slave Units (including Repeater Units) per trunk line or sub-trunk line	32	32

Note The number of Units per branch is the maximum number of Slave Units or Repeater Units that can be connected to one branch using multidrop or T-branch connections (sub-branch lines).

2-4 Communications Cable Wiring Examples

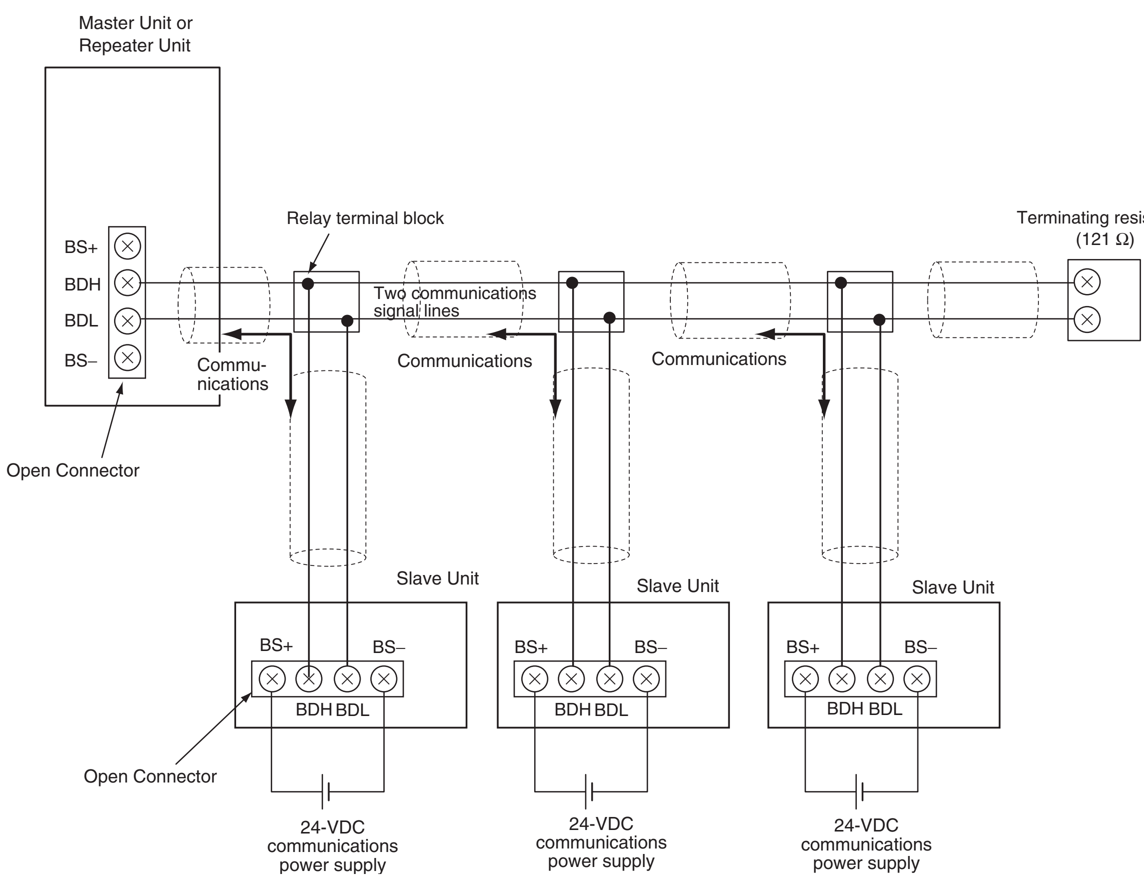
The following wiring is required in a CompoNet Network.

- Two communications signal lines (communications data): BDH (communications data high) and BDL (communications data low)
- Two communications power supply lines (power for communications and internal Slave Unit circuits): BS+ (communications power supply plus side) and BS− (communications power supply minus side)

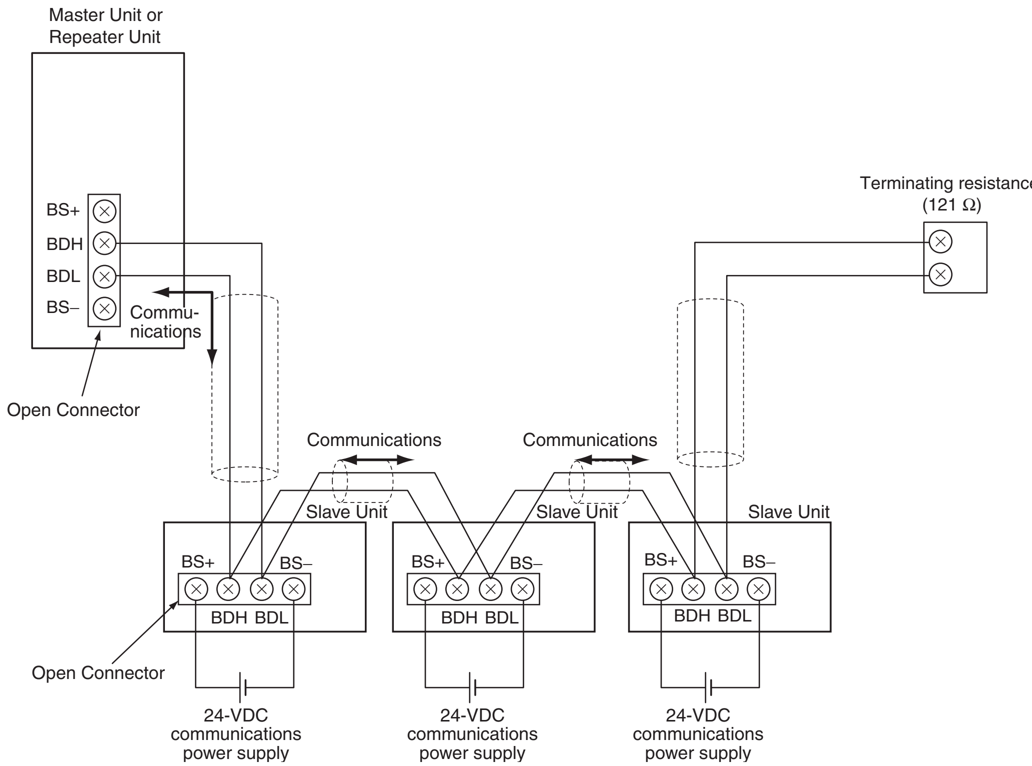
The wiring method depends on the type of cable that is used.

2-4-1 Round Cable

- Connect the two communications signal lines in parallel between the Master Unit or Repeater Unit and multiple Slave Units.
- Use Open Type Connectors (DCN4-TB4, for connecting Units) to connect Communications Cables to Master Units, Repeater Units, and Slave Units.
- To supply the communications power (24 VDC), connect the two communications power supply lines to each Slave Unit separately from the Communications Cables.
- Power is not supplied to the Master Unit or Repeater Units.
- Terminating resistance (DRS1-T) must be connected at the end of the network.

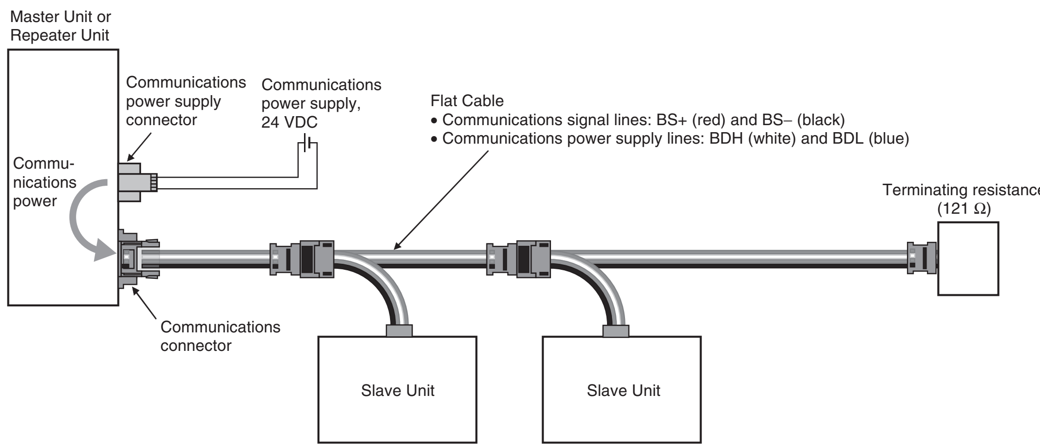


Slave Units can also be connected in parallel using multidrop connections.

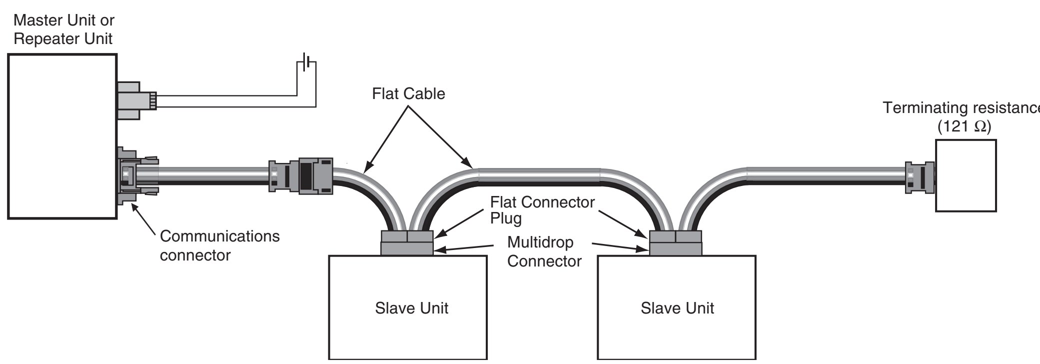


2-4-2 Flat Cable

- The two communications signal lines and the two communications power supply lines are connected to the Master Unit, Repeater Units, and Slave Units using Flat Cable.
- Connect the communications power supply (24 VDC) to the communications power supply connector for the Master Unit or Repeater Unit.
- Terminating resistance (DCN4-TM4 or DCN5-TM4) must be connected at the end of the network.



Slave Units can also be connected in parallel by using multidrop connections. A DCN4-MD4 Multidrop Connector is required for this.



SECTION 3
Installation and Wiring

This section describes how to install and wire a CompoNet Network.

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3-1 Installing Slave Units

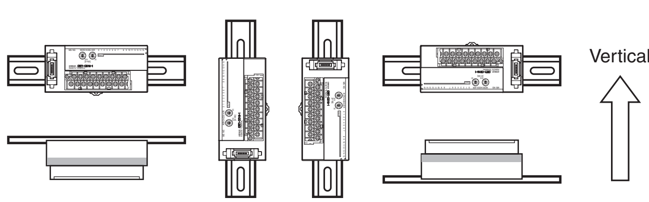
3-1-1 Installation Method

The installation method for Slave Units and Repeater Units depends on the model.

Name			Model	Installation method
Digital I/O Slave Units	With 2-tier Terminal Block		CRT1-ID16(-1)	DIN Track
			CRT1-OD16(-1)	
			CRT1-ROS16	
			CRT1-ROF16	
	With 3-tier Terminal Block		CRT1-ID16TA(-1)	
			CRT1-OD16TA(-1)	
			CRT1-MD16TA(-1)	
	With Connector		CRT1-ID16S(-1)	
			CRT1-OD16S(-1)	
			CRT1-MD16S(-1)	
	With Clamp Terminal Block		CRT1-ID16SL(-1)	
			CRT1-OD16SL(-1)	
Analog I/O Slave Units			CRT1-AD04	
			CRT1-DA02	
Expansion Units			XWT-ID08(-1)	
			XWT-OD08(-1)	
			XWT-ID16(-1)	
			XWT-OD16(-1)	
Bit Slave Units	With Connector	IP20	CRT1B-ID02S(-1)	Screw installation (M4)
			CRT1B-OD02S(-1)	
		IP54	CRT1B-ID02SP(-1)	
			CRT1B-OD02SP(-1)	
			CRT1B-ID04SP(-1)	
	With Clamp Terminal Block	IP54	CRT1B-MD04SLP(-1)	
Repeater Unit			CRS1-RPT01	DIN Track or screw installation (M4)

3-1-2 Installation Orientation

There are no restrictions in the orientation unless otherwise specified in the instructions for the Unit. Installation is possible in any of the following six orientations.



3-1-3 Mounting to a DIN Track

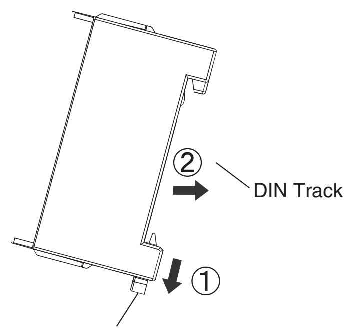
Materials Required for Installation

Name	Model	Remarks
35-mm DIN Track	PFP-50N	Length: 50 cm
	PFP-100N	Length: 100 cm
	PFP-100N2	Length: 100 cm
End Plate	PFP-M	Two End Plates are required for each Slave Unit and each Repeater Unit.

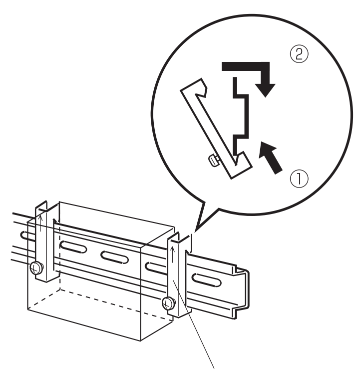
Installation Orientation

1,2,3...

1. Hook the slot on the back of the Unit into the top of the DIN Track. Pull down the DIN Track mounting pin and insert the Unit.



2. Hook the bottom of the End Plate on the DIN Track first, and then the top. Attach an End Plate on each side of the Unit, and tighten the screws to secure them.
   Check to make sure that the Unit is firmly secured.

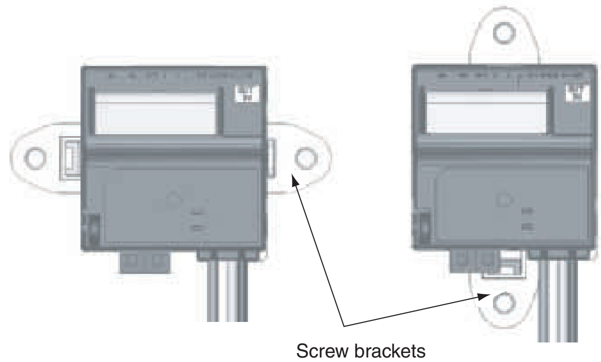


3-1-4 Mounting with Screws

Refer to the dimensions for the particular Unit and prepare the mounting holes in the panel. Tighten the M4 screws to a torque of 0.9 N·m, and check to be sure that the Unit is securely mounted.

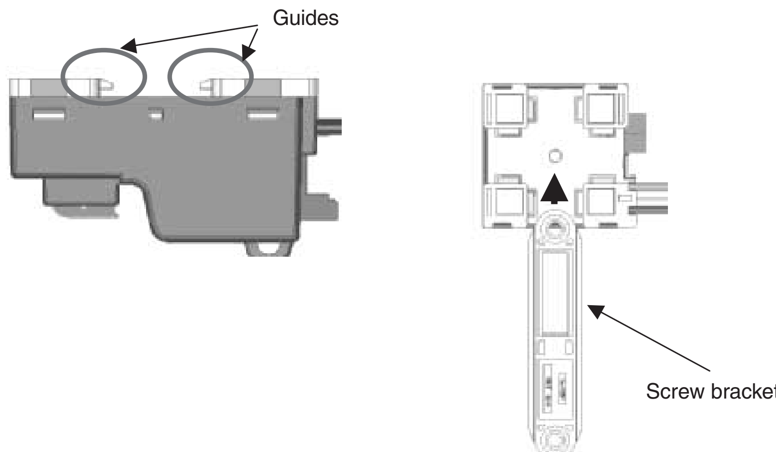
Installing IP20 Bit Slave Units

The IP20 Bit Slave Units, the CRT1B-ID02S(-1), and CRT1B-OD02S(-1) are installed using the enclosed screw bracket along with screw holes in one of the two orientations shown below.

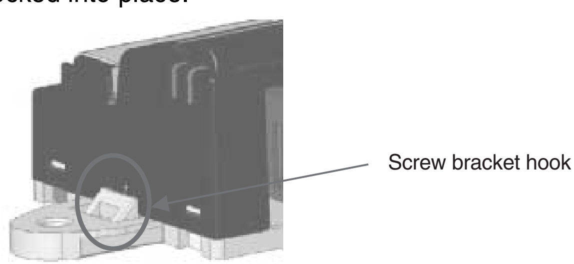


Use the following procedure to mount the screw bracket.

1,2,3... 1. Insert the screw bracket into the back of the Bit Slave Unit along the guides.



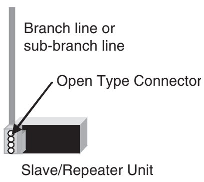
2. Press the screw bracket in until the hooks on the bracket are completely locked into place.

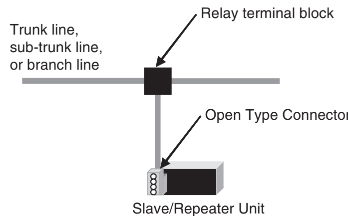
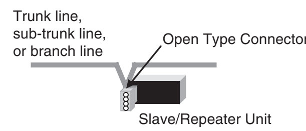


3-2 Connecting Cables

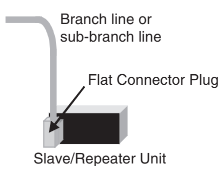
In a CompoNet Network, Units can be connected and cables can be branched and extended by using Communications Cable and mounting connectors to Units.
The methods for connecting Communications Cables and Units and for branching depend on the cable type and branching formation used.
The differences are shown in the following table.

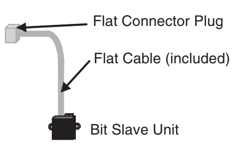
3-2-1 Round Cable

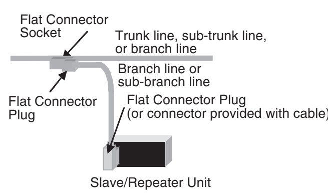
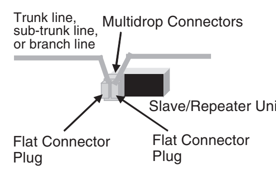
<table>
<tr><th rowspan="2">Slave Unit/Repeater Unit connections</th><th colspan="2">Cable branches</th></tr>
<tr><th>T-branch connections</th><th>Multidrop connections</th></tr>
<tr>
<td>Open Type Connector


Note Open Type Connectors cannot be used for Bit Slaves.</td>
<td>Commercially available relay terminal block

</td>
<td>Open Type Connector

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

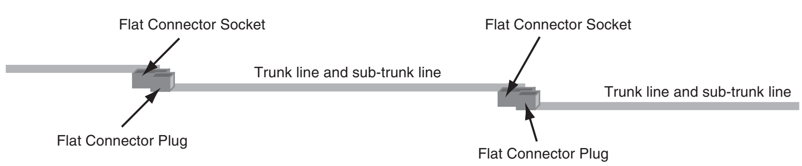
3-2-2 Flat Cable

<table>
<tr><th rowspan="2">Slave Unit/Repeater Unit connections</th><th colspan="2">Cable branches</th></tr>
<tr><th>T-branch connections</th><th>Multidrop connections</th></tr>
<tr>
<td>Flat Connector Plug
• Word Slaves and Repeater Units


• Bit Slaves


Note Bit Slave Units come with Flat Cable already connected.</td>
<td>Flat Connector Socket + Flat Connector Plug

</td>
<td>Multidrop Connector


Note Multidrop connections using Multidrop Connectors are not possible using Flat Cable II (Sheathed).</td>
</tr>
</table>

<table>
<tr><th>Cable Extension</th></tr>
<tr><td>Flat Connector Socket + Flat Connector Plug

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

3-3 Preparing Flat Connectors

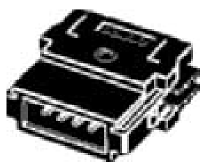
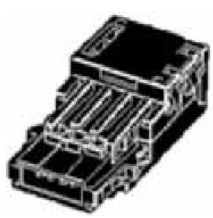
In order to connect Flat Cable (Standard or Sheathed) to Units, and for branching the wiring, Flat Connectors must be prepared and attached to the Flat Cables. The procedure is described below.

Note (1) Flat Connectors cannot be reused once they have been attached. Perform the procedure with care.

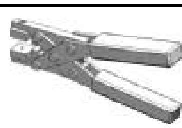
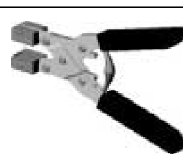
(2) Always hold on to the Flat Connector when connecting or disconnecting it.

(3) When connecting a Flat Connector, press it all the way in and then pull on it to be sure it is locked into place.

Connectors Used

Name	Appearance	Model	Application
Flat Connector Socket		DCN4-TR4	Used as a set with the DCN4-BR4 Flat Connector Plug in the following applications: • Extending the trunk line or sub-trunk lines. • T-branching branch lines from the trunk line or sub-trunk lines. • T-branching sub-branch lines from a branch line.
			Used independently when connecting a DCN4-TM4 Terminating Resistor to the end of the trunk line or a sub-trunk line.
Flat Connector Plug		DCN4-BR4	Used as a set with the DCN4-TR4 Flat Connector Socket in the following applications: • Extending the trunk line or sub-trunk lines. • T-branching branch lines from the trunk line or sub-trunk lines. • T-branching sub-branch lines from a branch line.
			Used independently in the following applications: • Connecting Communications Cable to a Unit. • Connecting Communications Cable to a DCN4-MD4 Multidrop Connector (when a multidrop connection is used).
Flat Connector Socket		DCN5-TR4	Used as a set with the DCN5-BR4 Flat Connector Plug in the following applications: • Extending the trunk line or sub-trunk lines. • T-branching branch lines from the trunk line or sub-trunk lines. • T-branching sub-branch lines from a branch line.
			Used independently when connecting a DCN5-TM4 Terminating Resistor to the end of the trunk line or a sub-trunk line.
Flat Connector Plug		DCN5-BR4	Used as a set with the DCN5-TR4 Flat Connector Socket in the following applications: • Extending the trunk line or sub-trunk lines • T-branching branch lines from the trunk line or sub-trunk lines • T-branching sub-branch lines from a branch line
			Used independently to connect Communications Cable to a Unit.

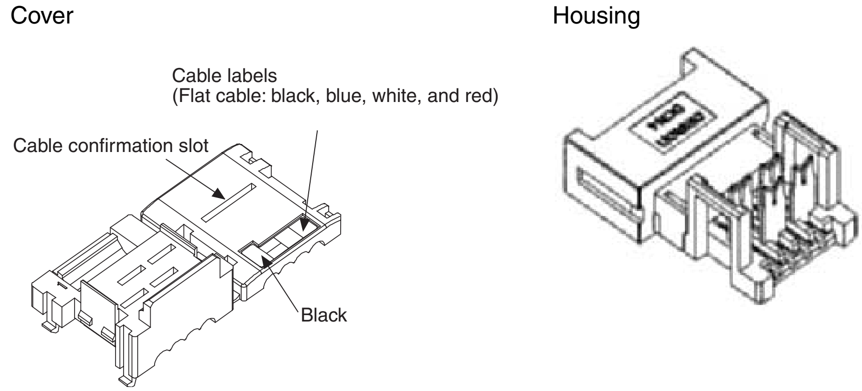
Tools Required

Name	Appearance	Model	Application
Pliers		DWT-A01	Crimping tool for DCN4-TR4 Flat Connector Socket or DCN4-BR4 Flat Connector Plug
Pliers		DWT-A02	Crimping tool for DCN5-TR4 Flat Connector Socket or DCN5-BR4 Flat Connector Plug

3-3-1 Flat Cable I (Standard)

Preparing DCN4-TR4 Flat Connector Sockets

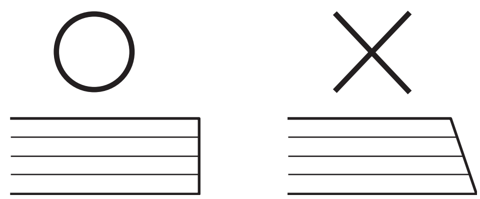
Component Names



■ **Cutting the Cable (when Extending Cable or Connecting Terminating Resistance)**

Cut the cable perpendicular to the length.

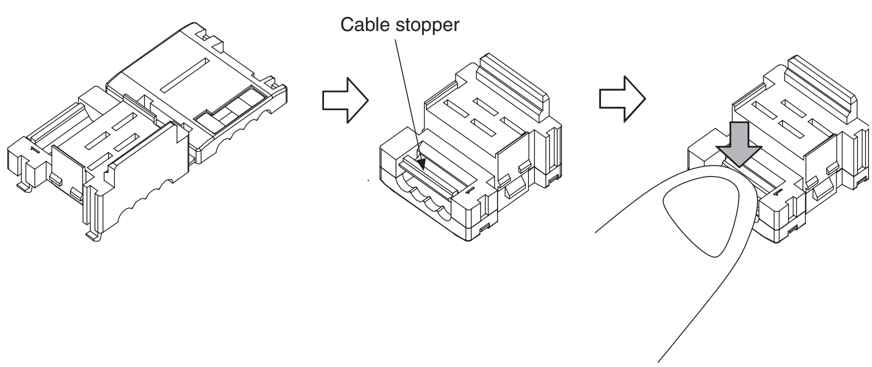
To prevent short-circuits, cut the cable with a sharp blade, such as wire cutters, and be sure that there are no whiskers on the wires.



■ **Setting the Cable Stopper (when Extending Cable or Connecting Terminating Resistance)**

A stopper must be set in advance when extending a line or connecting terminating resistance.

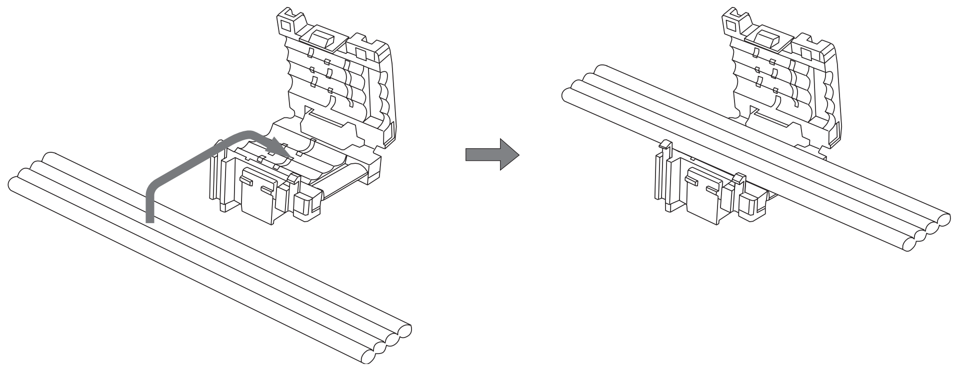
Close the cover, secure the hooks, and then press down on the cable stopper until it clicks into place.



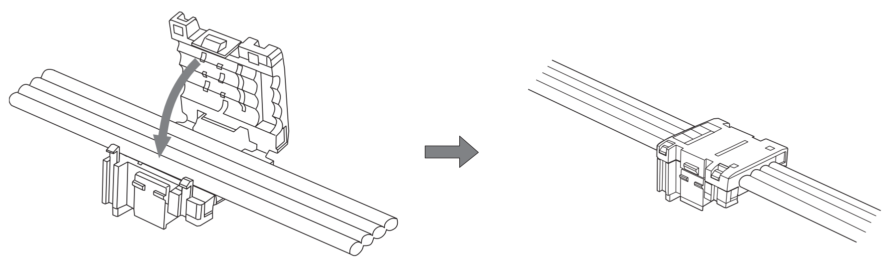
■ Attaching the Cable

■ T-branch Connections

1,2,3... 1. Align the cable labels and cable colors and insert the cable into the cover.

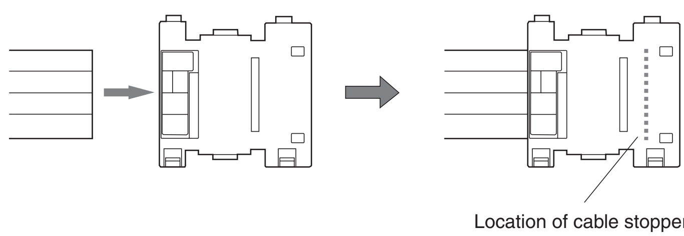


2. Hold the cable and secure it with the hooks.



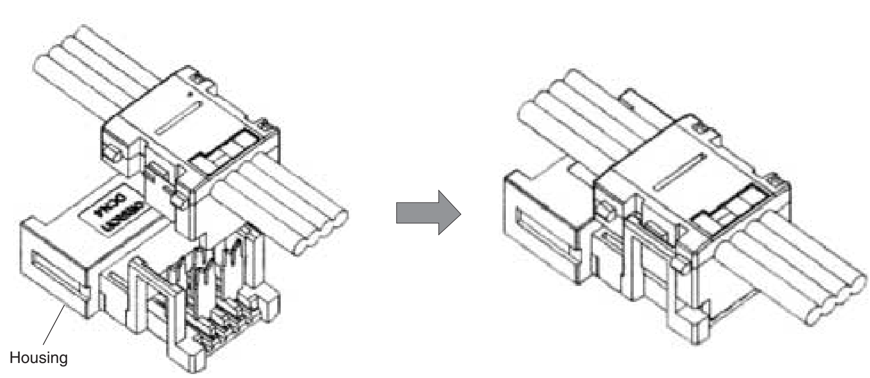
■ Line Extensions and Terminating Resistance

Insert the cable end all the way into a cover with the cable stopper already set.



■ Attaching the Housing

Confirm that the cable labels and cable colors match and then temporarily secure the housing to the cover.



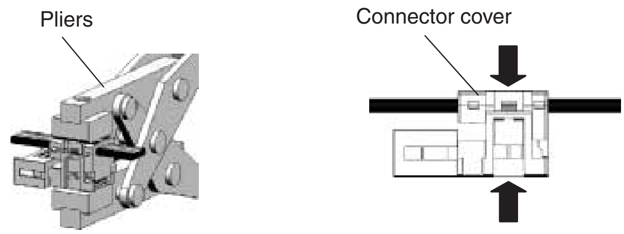
Note The housing cannot be removed from the cover once it has been attached. The connector may be damaged if the housing is forcefully removed.

■ Pressure-welding the Connector

The connector is pressure-welded using the DWT-A01 Pliers.

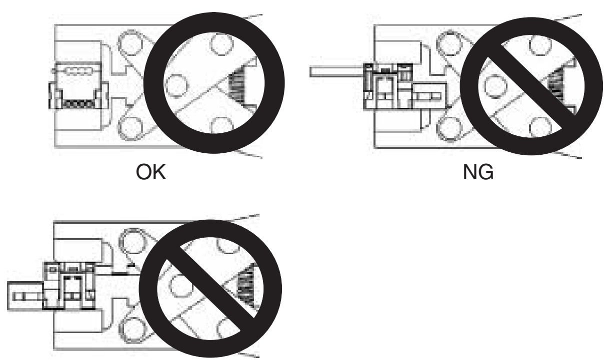
1,2,3...

1. As shown below, align the center (see arrows) of the connector cover with the center of the pressure-welding block on the Pliers.



2. Squeeze firmly on the Pliers until the lock on the connector clicks into place.

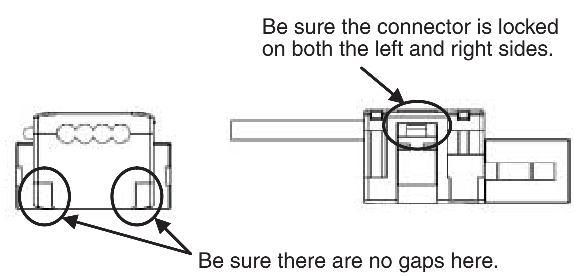
Note
(1) Do not pressure-weld the connector cover at the edges.
(2) Do not pressure-weld the connector cover at the back of the pressure-welding block.
(3) Set the connector in the correct orientation.



OK NG

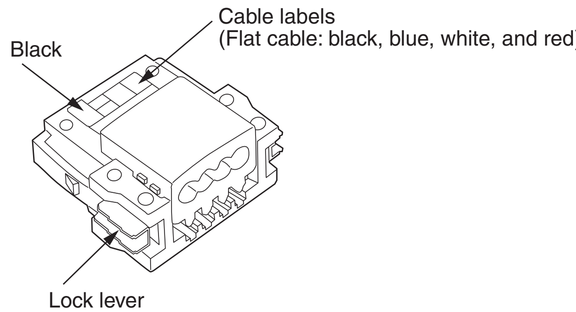
NG

3. After attaching the cable, confirm that it is properly pressure-welded as shown below.



Preparing DCN4-BR4 Flat Connector Plugs

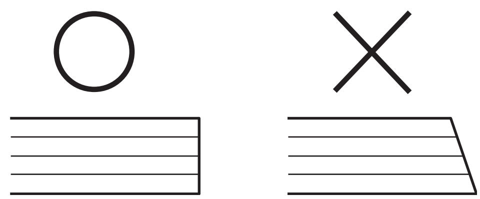
Component Names



■ **Cutting the Cable**

Cut the cable perpendicular to the length.

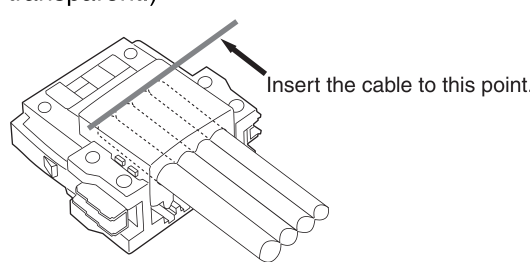
To prevent short-circuits, cut the cable with a sharp blade, such as wire cutters, and be sure that there are no whiskers on the wires.



■ **Attaching the Cable**

Align the cable labels and cable colors and insert the cable.

Confirm that the cable is inserted all the way to the back. (The cover is semi-transparent.)

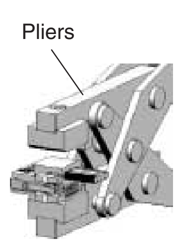


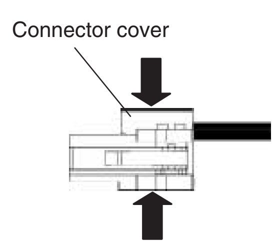
■ **Pressure-welding the Connector**

The connector is pressure-welded by using the DWT-A01 Pliers.

1,2,3...

1. As shown below, align the center (see arrows) of the connector cover with the center of the pressure-welding block on the DWT-A01 Pliers.



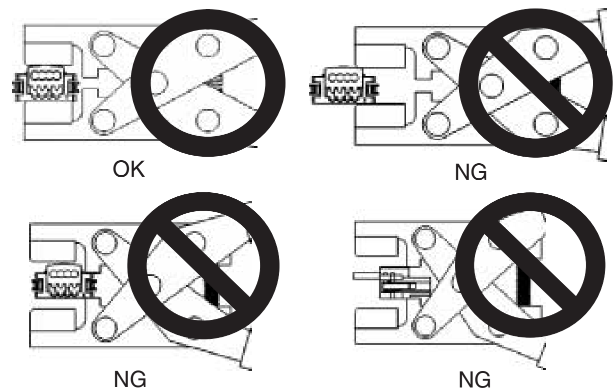


2. Squeeze firmly on the Pliers until the lock on the connector clicks into place.

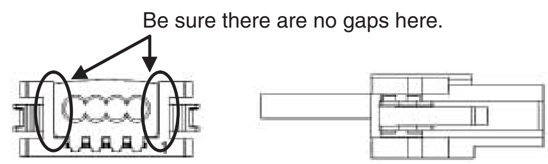
Note (1) Do not pressure-weld the connector cover at the edges.

(2) Do not pressure-weld the connector cover at the back of the pressure-welding block.

(3) Set the connector in the correct orientation.



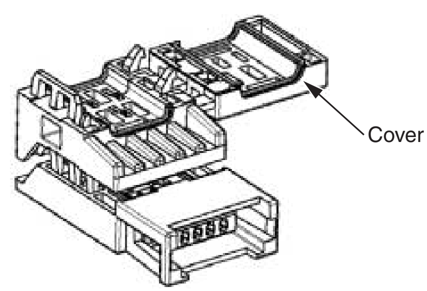
3. After attaching the cable, confirm that it is properly pressure-welded as shown below.



3-3-2 Flat Cable II (Sheathed)

Preparing DCN5-TR4 Flat Connector Sockets

Component Names



■ **Cutting the Cable**

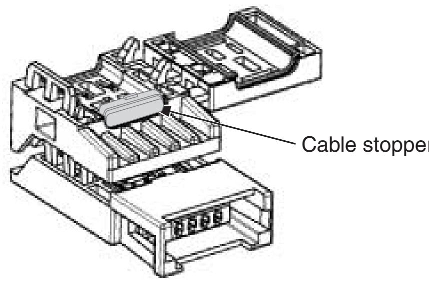
Cut the cable perpendicular to the length.

To prevent short-circuits, cut the cable with a sharp blade, such as wire cutters, and be sure that there are no whiskers on the wires.

■ **Setting the Cable Stopper (when Extending Cable or Connecting Terminating Resistance)**

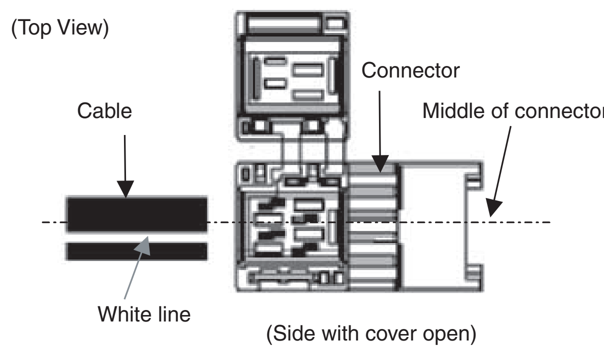
A stopper must be set in advance when extending a line or connecting terminating resistance.

Set the cable into the cover and position it so that the cable end strikes the cable stopper.

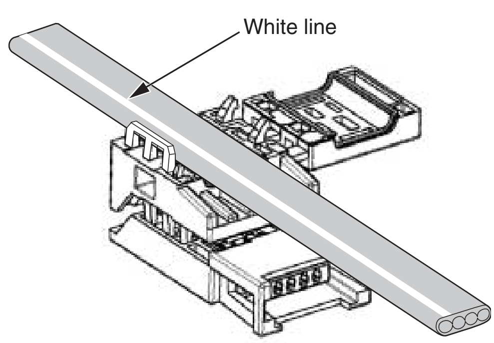


■ Attaching the Cable

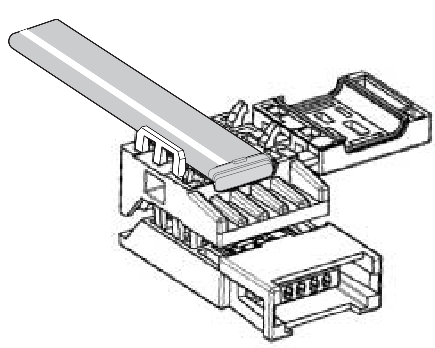
1,2,3... 1. As shown in the diagram below, place the cable so that the white line is in the direction of the side with the open cover, with the white line on the cable facing upward.



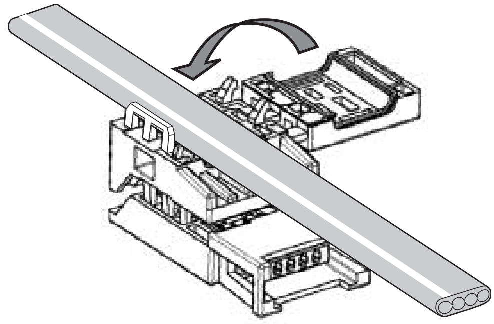
T-branch Connections



Line Extensions and Terminating Resistance Connections



2. Hold the cable so that it does not move and close the cover.



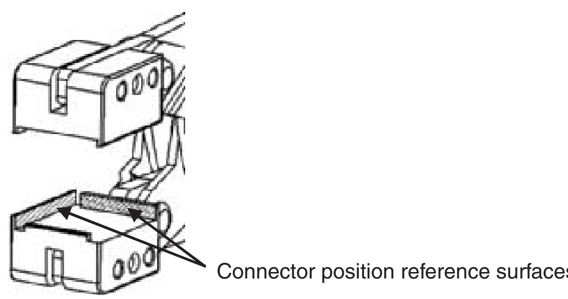
Note When extending the cable or connecting terminating resistance, make sure that the end of the cable is inserted all the way to the cable stopper so that it will not be pulled out.

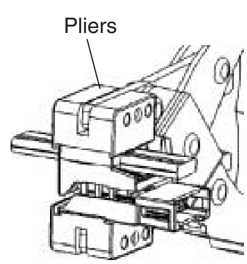
■ Pressure-welding the Connector

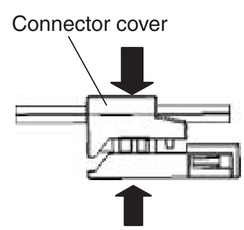
Use the DWT-A02 Pliers to pressure-weld the connector.

1,2,3...

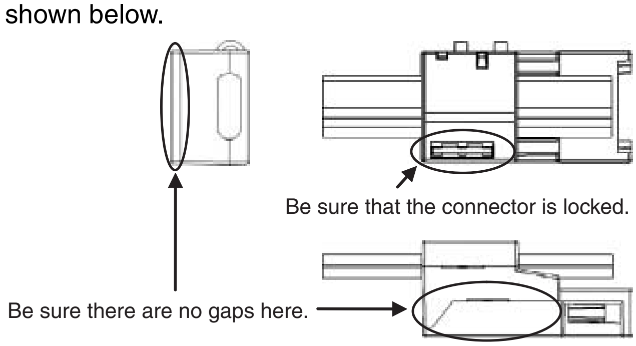
1. Set the connector on the pressure-welding block of the crimping tool. As shown below, align the center (see arrows) of the connector cover with the center of the pressure-welding block on the Pliers.





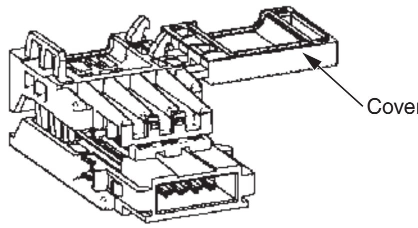


2. Squeeze firmly on the Pliers until the lock on the connector clicks into place.
3. After attaching the cable, confirm that it is properly pressure-welded as shown below.



Preparing DCN5-BR4 Flat Connector Plugs

Component Names



■ **Cutting the Cable**

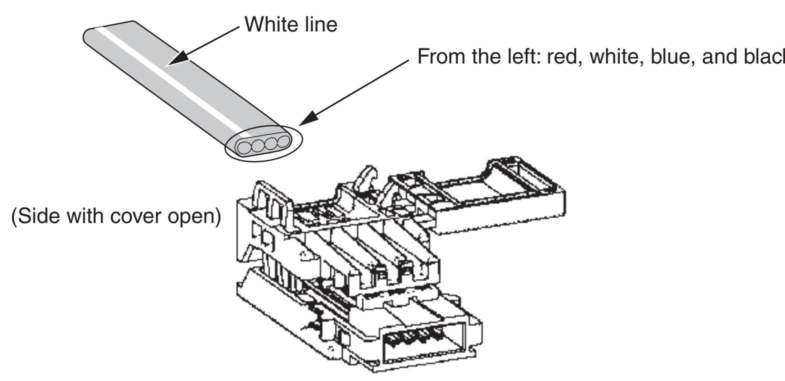
Cut the cable perpendicular to the length.

To prevent short-circuits, cut the cable with a sharp blade, such as wire cutters, and be sure that there are no whiskers on the wires.

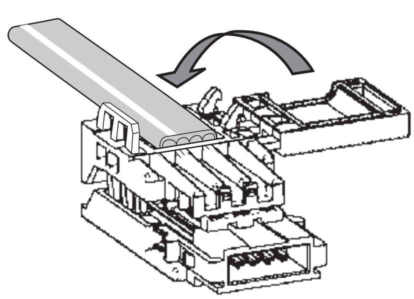
■ **Attaching the Cable**

1,2,3...

1. As shown in the diagram below, place the cable so that the white line is in the direction of the side with the open cover, with the white line on the cable facing upward.



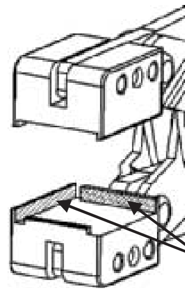
2. Hold the cable so that it does not move and close the cover.

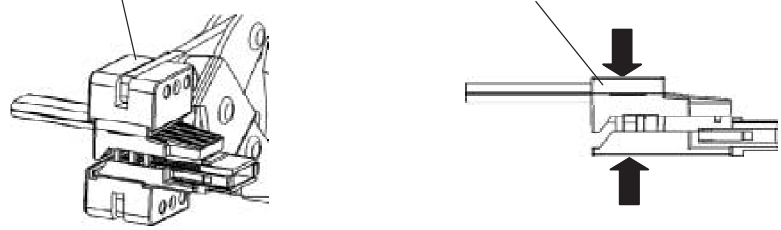


■ **Pressure-welding the Connector**

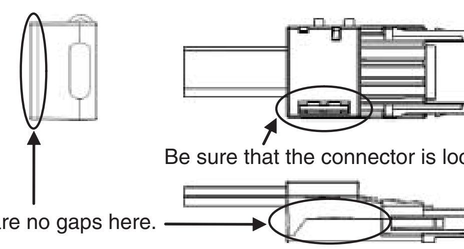
Use the DWT-A02 Pliers to pressure-weld the connector.

1,2,3... 1. As shown below, align the center (see arrows) of the connector cover with the center of the pressure-welding block on the Pliers.





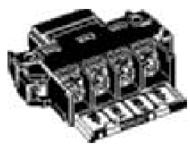
2. Squeeze firmly on the Pliers until the lock on the connector clicks into place.
3. After attaching the cable, confirm that it is properly pressure-welded as shown below.

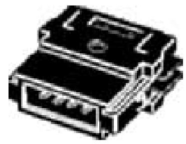
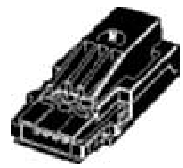


3-4 Connecting Cables and Terminating Resistance

This section describes how to connect Flat Cable (Standard or Sheathed) or round cable to Slave Units, Repeater Units, and Terminating Resistors, and how to extend or branch the cables.

Peripheral Devices Used

Name	Appearance	Model	Application
Open Type Connector (for connecting Units)		DCN4-TB4	Converts the Unit's communications connector into a screw terminal block to enable connecting round cable to a Slave Unit or Repeater Unit.
Relay terminal block	---	Commercially available	Used for T-branching round cables.
Multidrop Connector		DCN4-MD4	Used to connect Slave Units or Repeater Units to trunk lines, sub-trunk lines, or branch lines by using multidrop connections.

Name	Appearance	Model	Application
Terminating Resistor		DCN4-TM4	This is a Connector-type Terminating Resistor for Flat Cable I. It is connected to a DCN4-TR4 Flat Connector Socket at the end of a trunk line or sub-trunk line.
Terminating Resistor		DCN5-TM4	This is a Connector-type Terminating Resistor for Flat Cable II. It is connected to a DCN5-TR4 Flat Connector Socket at the end of a trunk line or sub-trunk line.
Terminating Resistor		DRS1-T	This is a Terminal Block-type Terminating Resistor for round cable. It is connected to the end of a trunk line or sub-trunk line round cable.

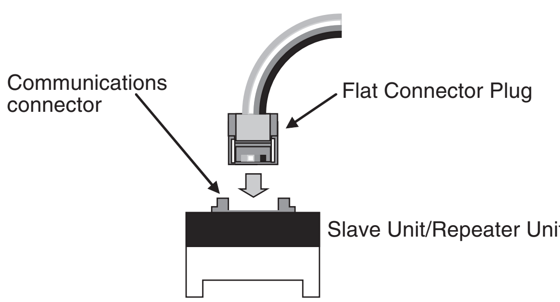
Terminal Resistor Specifications

Type	Connector		Terminal block
Model	DCN4-TM4	DCN5-TM4	DRS1-T
Resistance	121 Ω	121 Ω	121 Ω
Rated power	1/4 W	1/4 W	1/4 W
Accuracy	1% max.	1% max.	---
Capacity between power supply lines	0.01 µF	0.01 µF	---

3-4-1 Connecting Communications Cable to Slave Units and Repeater Units

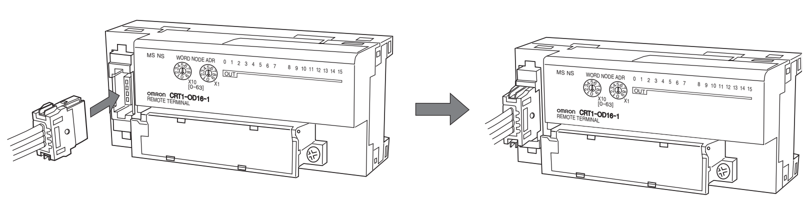
Connecting Flat Cable I

A DCN4-BR4 Flat Connector Plug attached to a Communications Cable is connected to the communications connector of a Slave Unit or Repeater Unit.



Installation Method

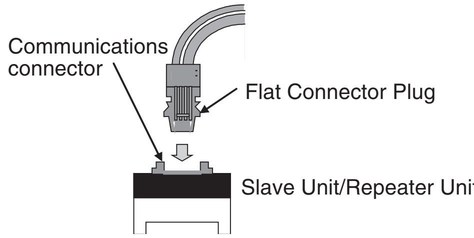
Be sure the face of the Connector on which line colors are indicated (red, white, black, and blue) is facing to the left and press in the Connector until it clicks into place.



Note To remove a Connector once it has been attached, press in on the catches on both sides of the Connector and pull it out.

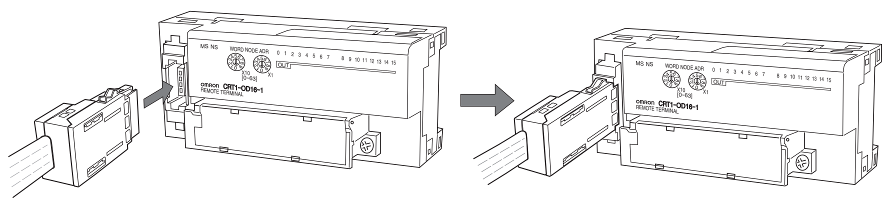
Connecting Flat Cable II

A DCN5-BR4 Flat Connector Plug attached to a Communications Cable is connected to the communications connector of a Slave Unit or Repeater Unit.



Installation Method

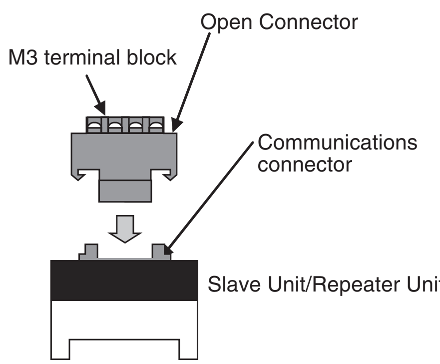
Orient the Connector so that the white line on the cable is facing to the left and press in the Connector until it clicks into place.



Note To remove a Connector once it has been attached, press in on the catches on both sides of the Connector and pull it out.

Connecting Round Cable

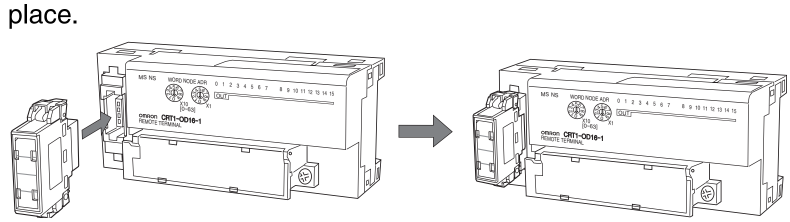
The DCN4-TB4 Open Type Connector is used to convert the communications connector on the Slave Unit or Repeater Unit to a terminal block (M3) for connecting the cable wires.



Installation Method

1,2,3...

1. Attach the Open Type Connector to the communications connector of the Slave Unit or Repeater Unit.
   Orient the Open Type Connector so that the side with the open terminals is facing to the left and press in the Open Type Connector until it clicks into place.



Note To remove the Open Type Connector once it has been attached, firmly press in on the catches on both sides and pull out the Open Type Connector.

2. Open the Open Type Connector's terminal cover and connect the cable wires to BDH (communications data high) and BDL (communications data low) in the terminal block.

Note Before connecting the cable wires to the terminal block, first attach the M3 crimp terminals shown below to the wires.

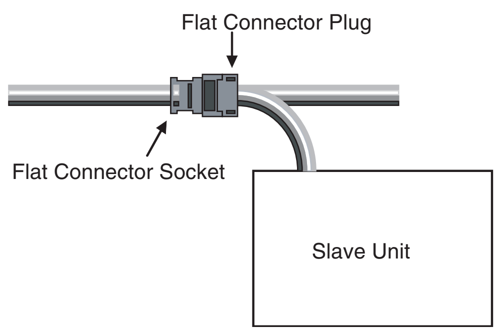
3-4-2 Branching Communications Cables

There are two methods that can be used to branch the trunk line, sub-trunk lines, and branch lines: T-branches and multidrop connections.

T-branches

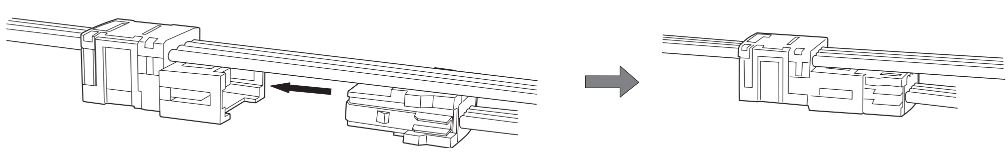
Using Flat Cable I

Attach a DCN4-BR4 Flat Connector Plug to the DCN4-TR4 Flat Connector Socket connected to Communications Cable.



■ **Installation Method**

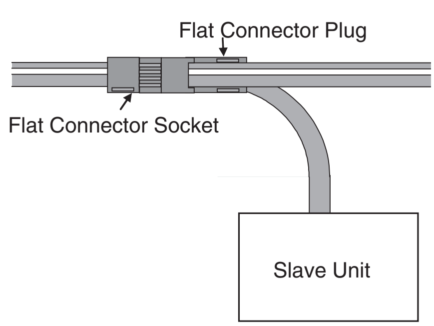
Be sure the surface of the Flat Connector Plug on which line colors are indicated (red, white, black, and blue) is facing downward and press in the Connector until it clicks into place.



Note To remove a Connector once it has been attached, press in on the catches on both sides of the Connector and pull it out.

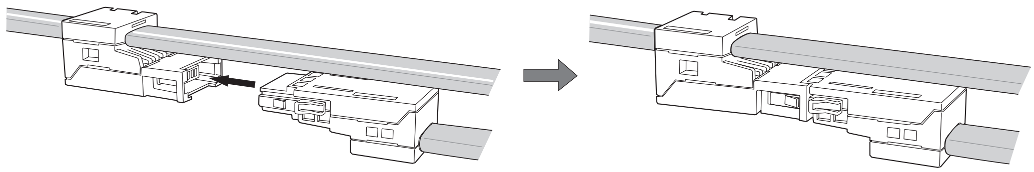
Using Flat Cable II

Attach a DCN5-BR4 Flat Connector Plug to the DCN5-TR4 Flat Connector Socket connected to Communications Cable.



■ Installation Method

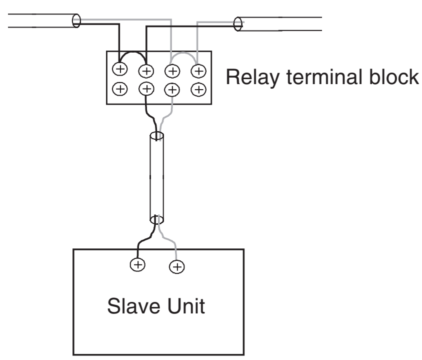
Place the Flat Connector Plug so that the white line on the cable is facing downward and press in the Connector until it clicks into place.



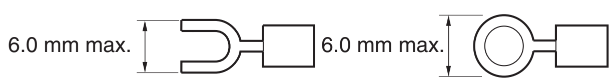
Note To remove a Connector once it has been attached, press in firmly on the catches on both sides of the front of the Connector and pull it out.

Using Round Cable

Connect the cable wires by using a commercially available relay terminal block.



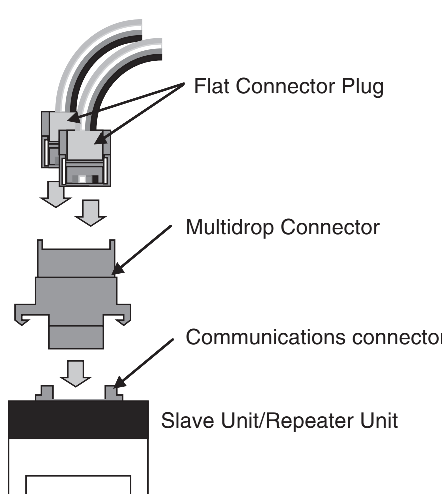
Note Before connecting the cable wires to the terminal block, first attach the M3 crimp terminals shown below to the wires.



Multidrop Connections

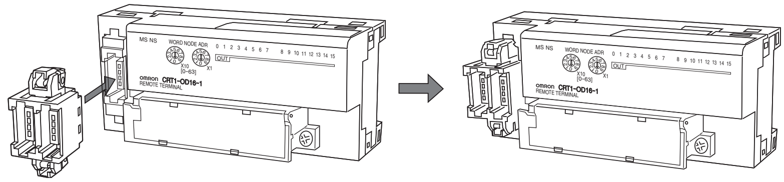
Using Flat Cable I

Attach a DCN4-MD4 Multidrop Connector to the communications connector of the Slave Unit or Repeater Unit, and then attach two DCN4-BR4 Flat Connector Plugs that are already connected to Communications Cables.

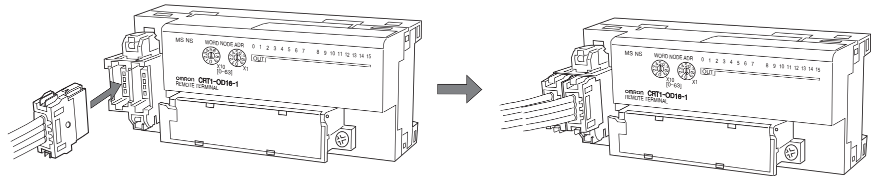


■ Installation Method

1,2,3... 1. Place the Multidrop Connector so that the surface with the printed number is facing to the left and press in the Connector until it clicks into place.



2. Be sure the surfaces of the two Flat Connector Plugs on which line colors are indicated (red, white, black, and blue) are facing to the left and press in the Connectors until they click into place.



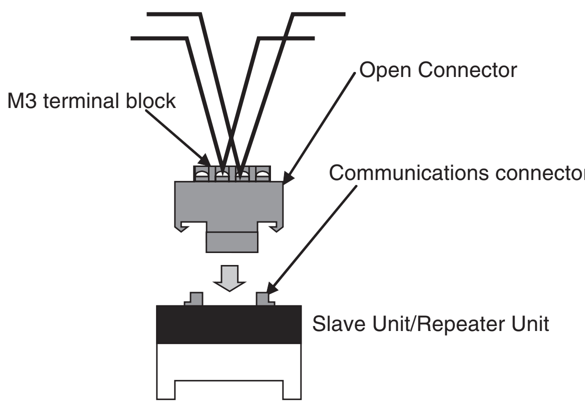
Note To remove a Connector once it has been attached, press in on the catches on both sides of the Connector and pull it out.

Using Flat Cable II

Branching is not possible using multidrop connections.

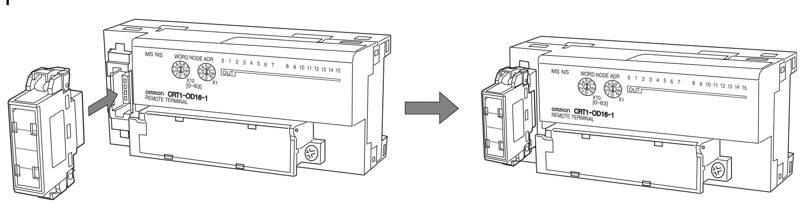
Using Round Cable

The DCN4-TB4 Open Type Connector is used to convert the communications connector on the Slave Unit or Repeater Unit to a terminal block (M3) for connecting the cable wires.



■ Connection Method

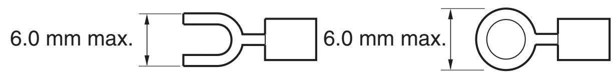
1,2,3... 1. Orient the Open Type Connector so that surface with the open terminals is facing to the left and press in the Open Type Connector until it clicks into place.



Note To remove a Connector once it has been attached, press in firmly on the catches on both sides of the Connector and pull it out.

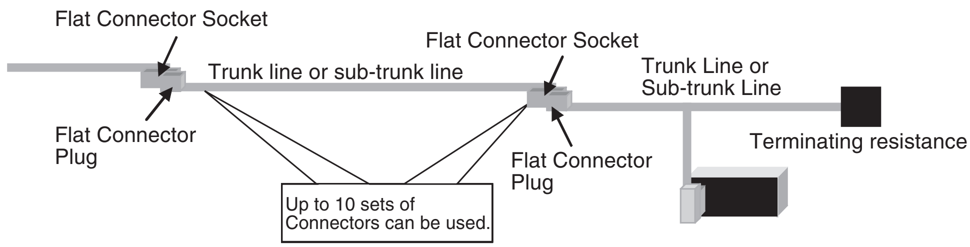
2. Open the Open Type Connector's terminal cover and connect the cable wires to BDH (communications data high) and BDL (communications data low) in the terminal block.

Note Before connecting the cable wires to the terminal block, first attach the M3 crimp terminals shown below to the wires.



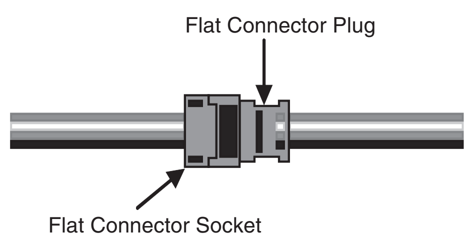
3-4-3 Extending Communications Cables

The cable length for the trunk line, sub-trunk lines, branch lines, and sub-branch lines can be extended by up to 10 levels by using Flat Connectors. The maximum extendable length, however, is the maximum trunk line length. (Refer to *2-3-3 Maximum Distance and Number of Connected Units for Types of Communications Cables*.)



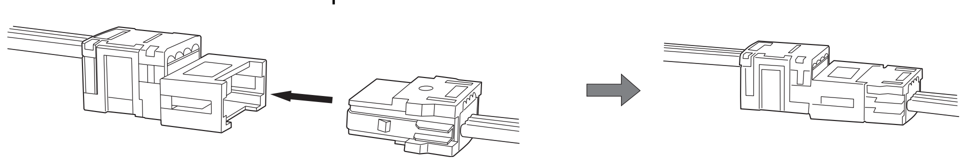
Flat Cable I

Attach a DCN4-BR4 Flat Connector Plug to a DCN4-TR4 Flat Connector Socket connected to Communications Cable.



Installation Method

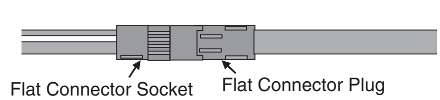
Be sure the surface of the Flat Connector Plug on which line colors are indicated (red, white, black, and blue) is facing downward and press in the Connector until it clicks into place.



Note To remove a Connector once it has been attached, press in on the catches on both sides of the Connector and pull it out.

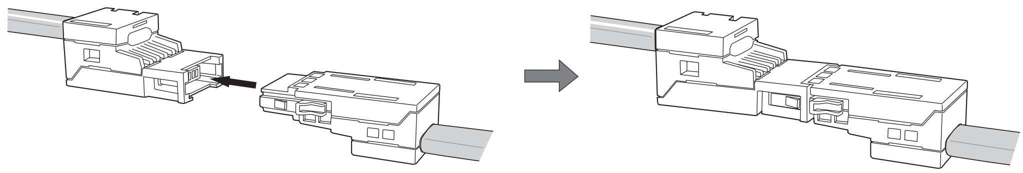
Flat Cable II

Attach a DCN5-BR4 Flat Connector Plug to a DCN5-TR4 Flat Connector Socket connected to Communications Cable.



Installation Method

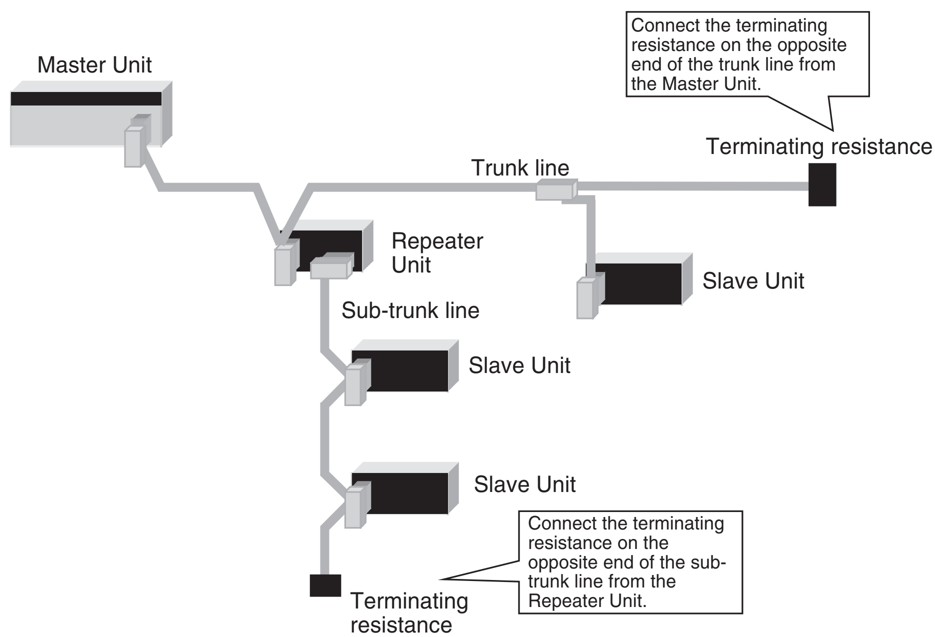
Orient the Flat Connector Plug so that the white line on the cable is facing downward and press in the Connector until it clicks into place.



Note To remove a Connector once it has been attached, press in firmly on the catches on both sides of the Connector and pull it out.

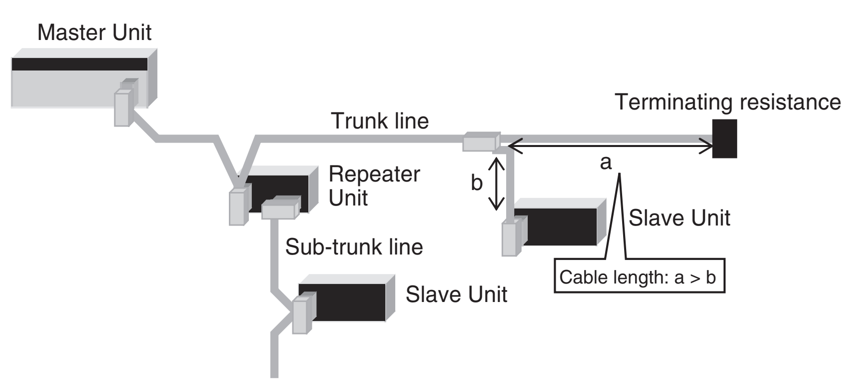
3-4-4 Connection Locations for Terminating Resistance

Terminating resistance must always be connected to the trunk line and each sub-trunk line on the opposite end from the Master Unit or Repeater Unit.



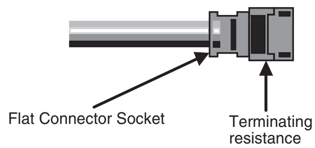
Note (1) Do not connect terminating resistance at the same end of the cable as the Master Unit or Repeater Unit.

(2) When the cable is branched at the locations shown in the figure below, connect the terminating resistance at the end of the line so that the length of a is greater than b.



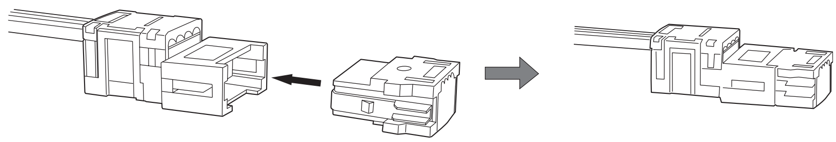
Flat Cable I

Attach a DCN5-TM4 Terminating Resistor to the DCN5-TR4 Flat Connector Socket connected to Communications Cable.



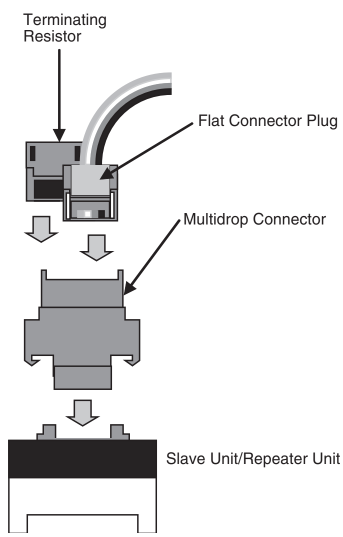
Installation Method

Push in the Terminating Resistor until it clicks into place.



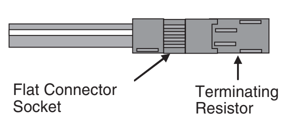
Note To remove a Terminating Resistor once it has been connected, press in on the catches on both sides and pull it out.

When using a multidrop connection for branching a Slave Unit or Repeater Unit, the Terminating Resistor can be directly connected to the Multidrop Connector that is connected to the Unit. (This is only possible when Flat Cable I is used.)



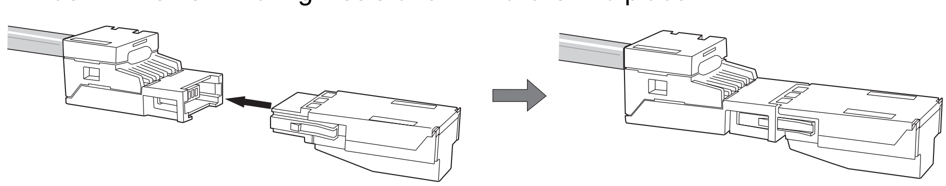
Flat Cable II

Attach a DCN5-TM4 Terminating Resistor to the DCN5-TR4 Flat Connector Socket connected to Communications Cable.



Installation Method

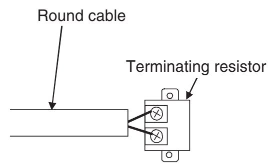
Push in the Terminating Resistor until it clicks into place.



Note To remove a Terminating Resistor once it has been connected, press in on the catches on both sides and pull it out.

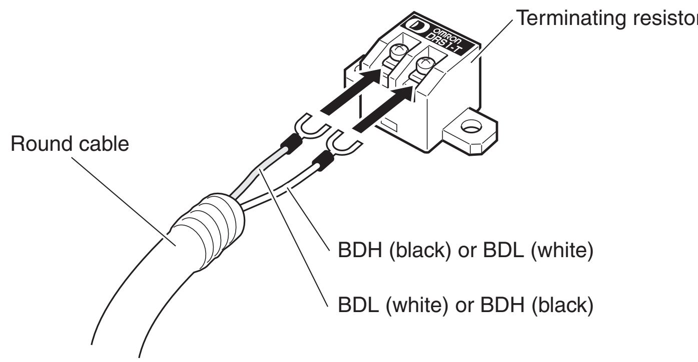
Round Cable

Connect the cable wires to a DRS1-T Terminating Resistor.

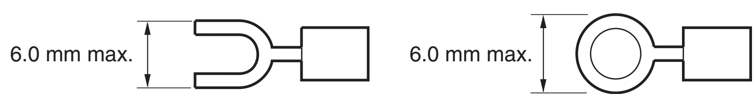


Connection Method

Connect the cable wires to the Terminating Resistor and tighten the screws. The Terminating Resistor has no polarity, so either wire can be connected to either terminal regardless of the color.



Note Before connecting the cable wires to the Terminating Resistor, first attach the M3 crimp terminals shown below to the wires.



3-5 Power Supply Wiring

The following power supplies are required to operate the CompoNet Network.

- Communications power supply: Used for communications with individual Units and for internal circuit operations of Units.
- I/O power supply: Used for I/O operations for Units with external I/O.

The method for supplying communications power and I/O power depends on the types of cable and Slave Unit that are used. The differences are shown in the following table.

Slave Unit classification according to power supply method	Cable type	Communications power supply	I/O power supply
Multi-power supply	Flat Cable	Supplied through the Communications Cable by supplying power to the Master Unit.	Supplied to individual Units separately from the communications power supply.
	Round cable	Supplied to Units individually.	
Network power supply	Flat Cable	The communications power supply and the I/O power supply are provided together through Communications Cable.	
	Round cable	Cannot be used.	

Multi-power Supply Slave Units

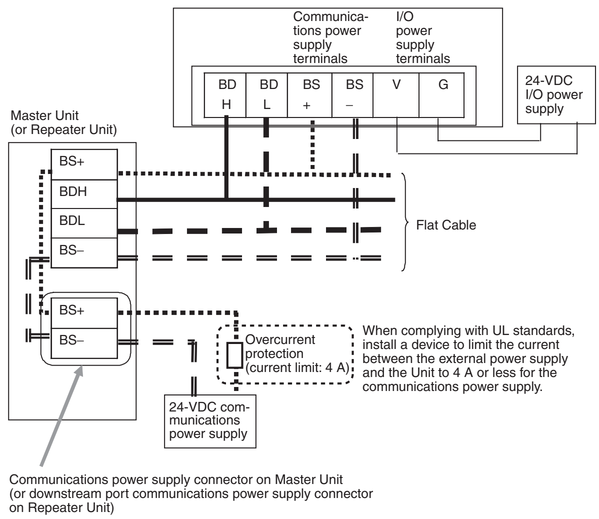
Using Flat Cable

- Communications Power Supply

  Supply communications power to the Master Unit's communications power supply connector (or to the downstream port communications power supply connectors on Repeater Units.)

- I/O Power Supply

  Supply I/O power to the I/O power supply terminals of individual Units, separate from the communications power supply.



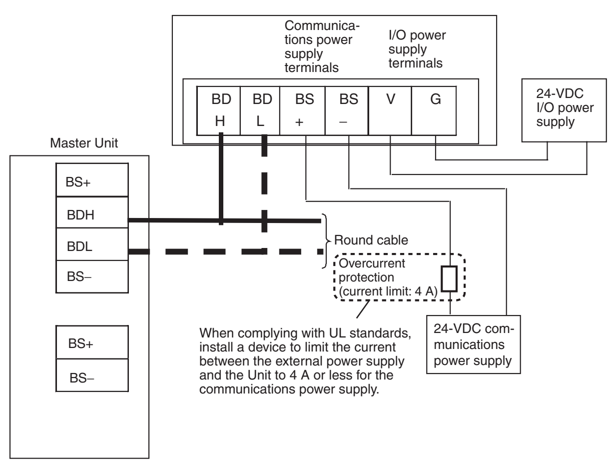
Using Round Cable

- Communications Power Supply

  Supply power to the power supply terminals of the communications connectors of individual Units (or to the PORT1 connector for Repeater Units).

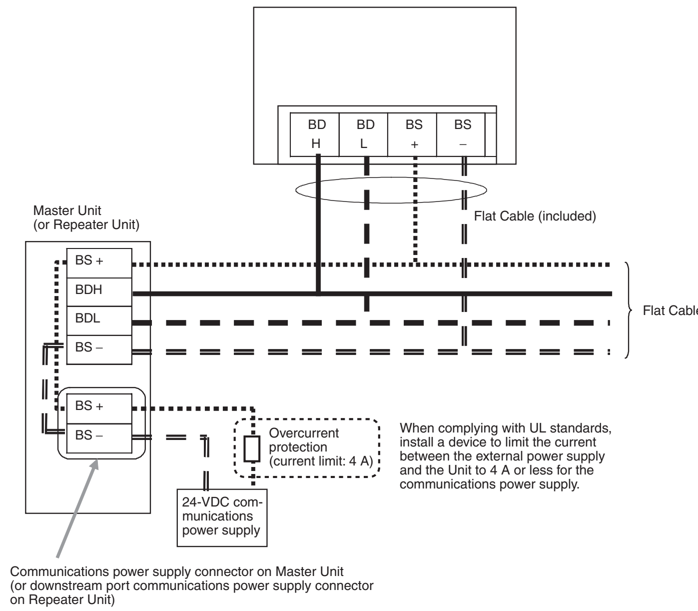
- I/O Power Supply

  Supply I/O power to the I/O power supply terminals of individual Units, separate from the communications power supply. To prevent noise, be sure to use separate power supplies for I/O and communications.



Network Power Supply Slave Units

These Units use the same set of power supply terminals for both communications and I/O power, so there is no need to provide separate power supplies. (Bit Slave Units are sold with a Flat Cable already attached.) The common communications and I/O power supply is provided to the Master Unit's communications power supply connector (or to the downstream port communications power supply connectors on Repeater Units).



3-5-1 Power Supply Specifications

Use a communications power supply that meets the following specifications.

Item	Specification
Output voltage	24 VDC ±10%
Output ripple	600 mVp-p
Output current	Use a power supply that equals or exceeds the following total current consumption: • The current consumption of all Word Slave Units and Repeater Units • The current consumption of all Bit Slave Units and the current consumption of their external I/O
Insulation	Between output and AC power and between output and chassis ground

We recommend an OMRON S82-series Power Supply for the communications power supply for CompoNet Slave Units.

Note For network power supply Slave Units, the external I/O power supply is also provided through the Flat Cable from the communications power supply connected to the Master Unit or the Repeater Unit.
When calculating the output current of the communications power supply, always include the external I/O current consumption and actual load current for network power supply Slave Units.
For example, the power supply current consumption for Bit Slave Unit is expressed by the following formula.

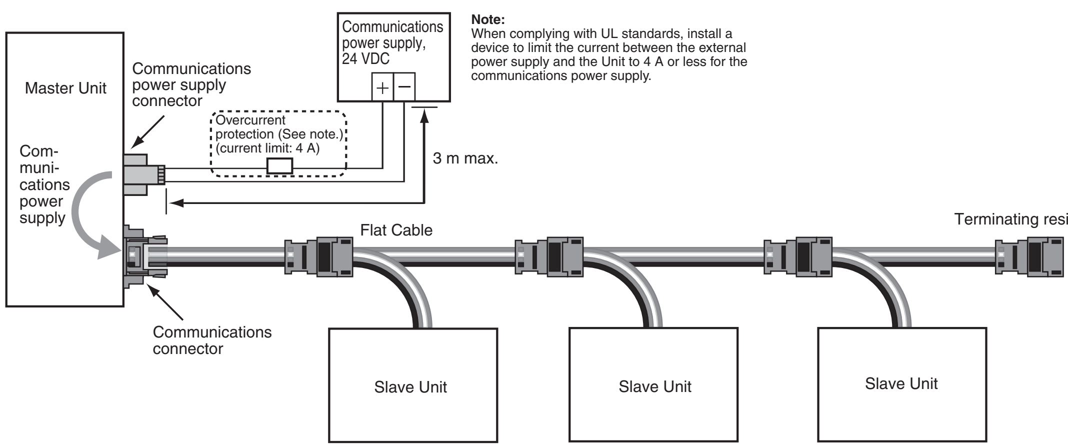
- Input Bit Slave Units:
  Communications power supply current consumption = Bit Slave Unit communications current consumption + (Bit Slave Unit input current × number of inputs used) + (sensor current consumption × number of sensors used)
- Output Bit Slave Units:
  Communications power supply current consumption = Bit Slave Unit communications current consumption + (actual load current × number of actuators used)
- I/O Bit Slave Units:
  Communications power supply current consumption = Bit Slave Unit communications current consumption + (Bit Slave Unit input current × number of inputs used) + (sensor current consumption × number of sensors used) + (actual load current × number of actuators used)

For details on current consumption for each Unit, refer to *Appendix D Current Consumption Summary*.

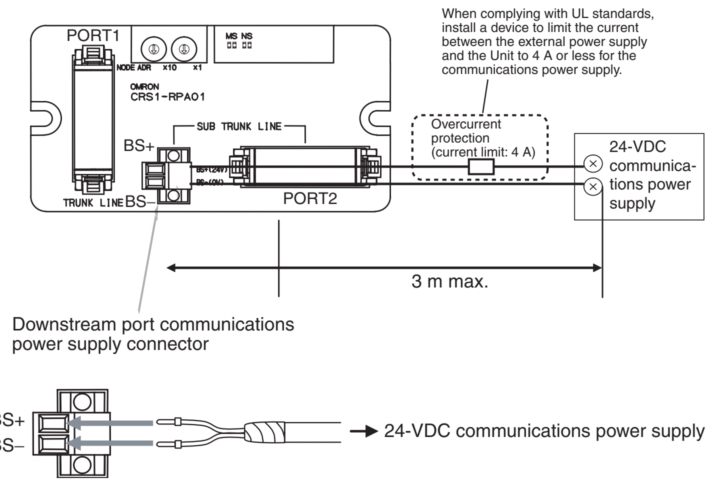
3-5-2 Connection Locations for Communications Power Supply

Flat Cable

Connect a 24-VDC power supply to the Master Unit's communications power supply connector (BS+ and BS−). This provides communications power to each Slave Unit and Repeater Unit connected by Flat Cable. Connect only one communications power supply for the trunk line. The cable between the communications power supply and the communications power supply connector must be no longer than 3 m.



When Repeater Units are used, communications power to sub-trunk lines is supplied by the downstream port communications power supply connectors (BS+ and BS−) of the Repeater Units. The cable between the communications power supply and the communications power supply connector must be no longer than 3 m.



Recommended Ferrules

The following ferrules are recommended for the communications power supply cable.

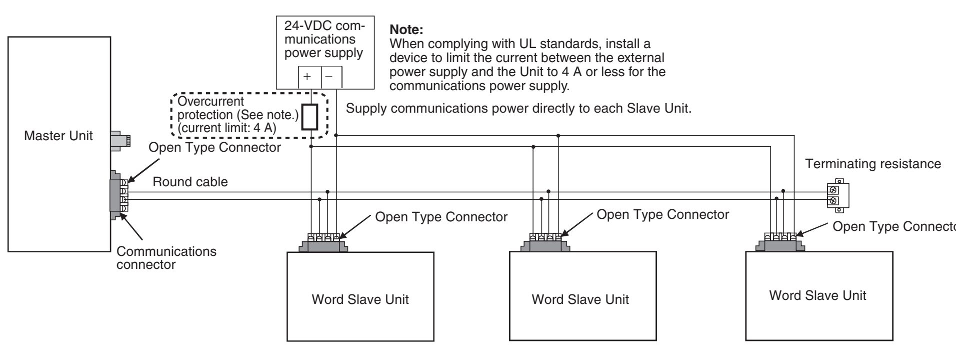
Product number	Applicable power cable size	Crimping tool	Manufacturer
AI0,5-10 WH	0.5 mm (AWG20)	CRIMPFOX UD6 (Product No. 1204436) or CRIMPTFOX ZA3 series	Phoenix Contact
H0.5/16 orange	0.5 mm (AWG20)	Crimper PZ1.5 (Product No. 900599)	Weidmuller

The following screwdriver is recommended for use when removing ferrules.

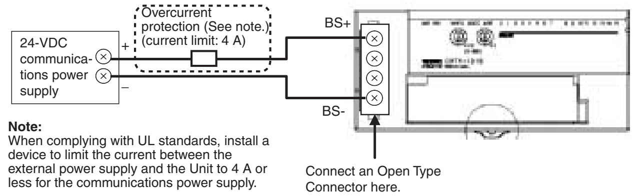
Product number	Manufacturer
XW4Z-00C	OMRON

Round Cable

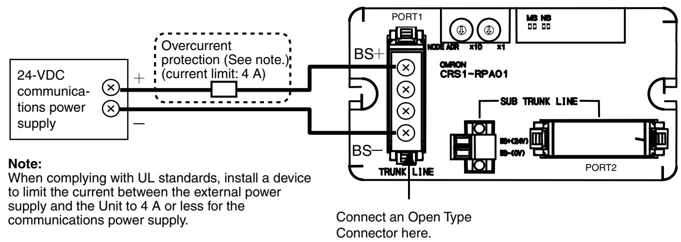
A 24-VDC power supply is connected individually to each Slave Unit. Power does not need to be supplied to the Master Unit.



Before connecting the power supply, first connect a DCN4-TB4 Open Type Connector to the communications connector to convert it to a screw terminal block.



When using a Repeater Unit, supply power through the BS+ and BS– terminals of the Repeater Unit's PORT1 connector.



3-5-3 Connecting the I/O Power Supply

Provide a 24-VDC I/O power supply to the I/O terminals of all Slave Units (multi-power supply models). For details on connections, refer to *3-6 Connecting External I/O for Slave Units*.

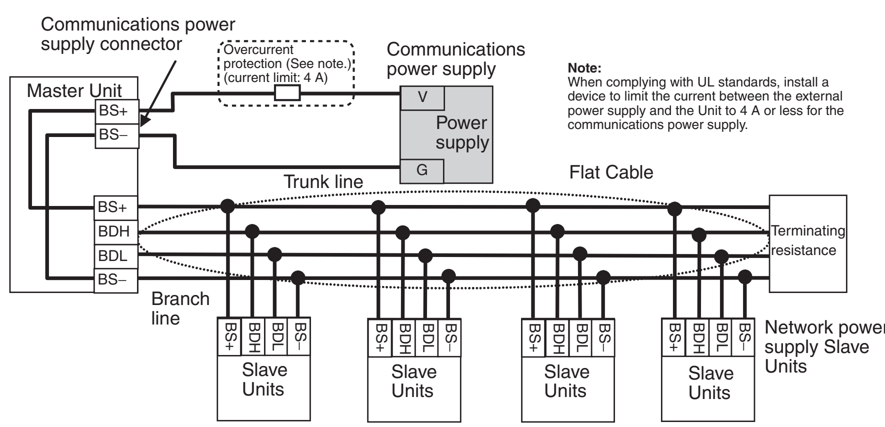
3-5-4 Connecting the Communications and I/O Power Supplies

Using Flat Cable

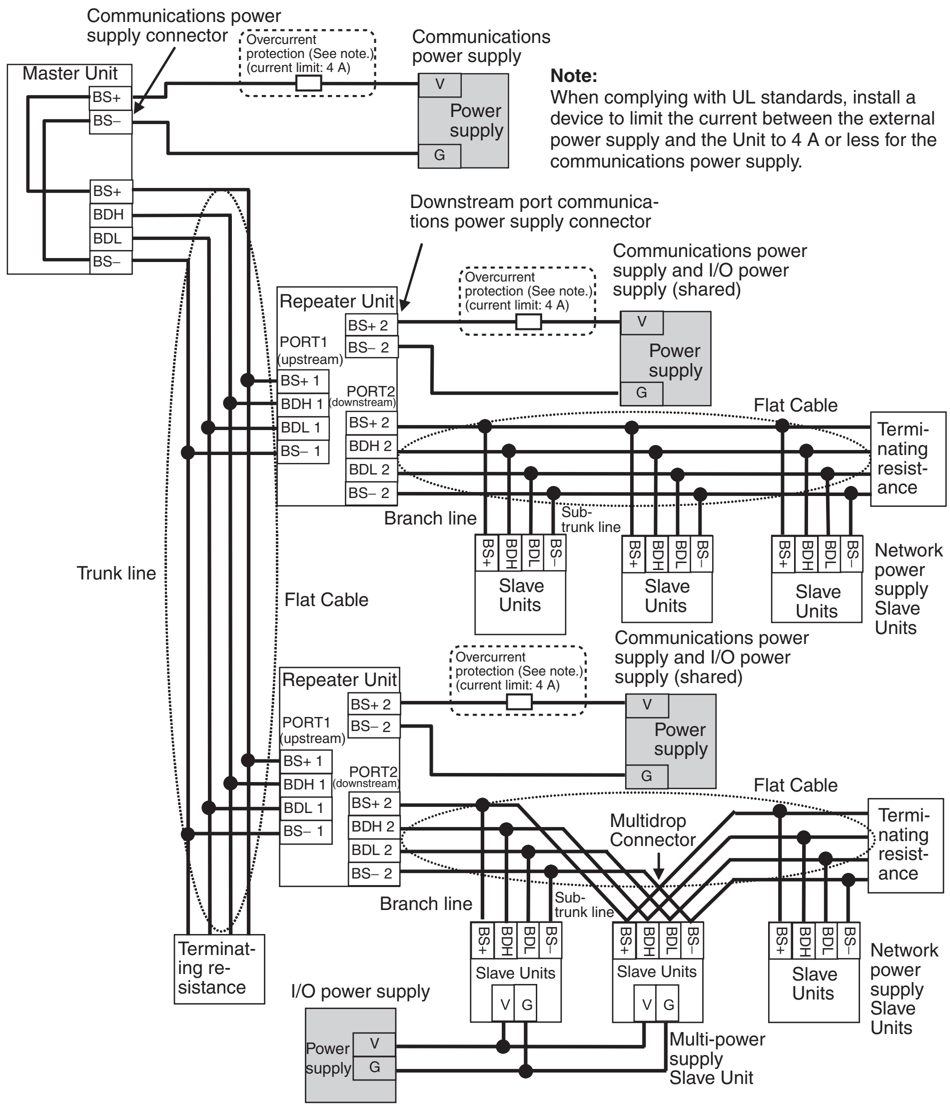
When Flat Cable is used, the Slave Unit communications power is supplied through the Flat Cable. There is no special wiring required to provide the communications power supply to individual Slave Units. The same communications power supply is shared for the entire trunk line or sub-trunk line.

For Slave Units requiring an I/O power supply (i.e., multi-power supply Slave Units), however, I/O power must be supplied separately.

Not Using Repeater Unit



Using Repeater Units



Note (1) Do not supply communications power from more than one location for the trunk line or for any one sub-trunk line. The quality of communications will decrease and normal communications may not be possible.

(2) Do not supply communications power to the trunk line and a sub-trunk line or to two sub-trunk lines from the same power supply. Also do not supply communications power to two or more CompoNet systems from the same power supply. The quality of communications will decrease and normal remote I/O communications may not be possible.

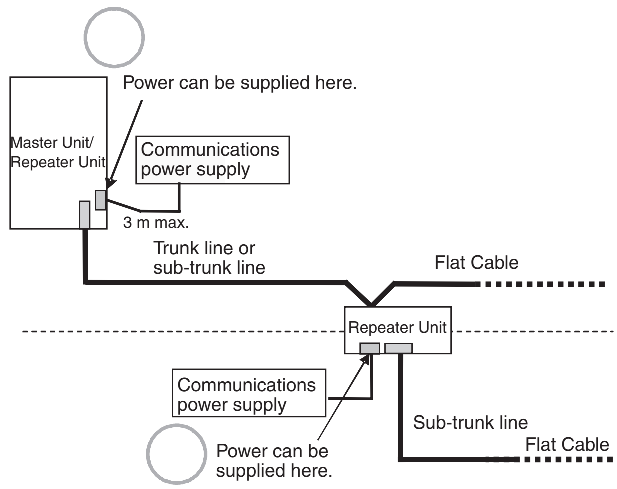
(3) The I/O power supply to multi-power supply Slave Units may be a source of noise depending on the connected devices. Even when supplying the communications power supply together to all Slave Units, use a separate I/O power supply so that noise does not affect the network.

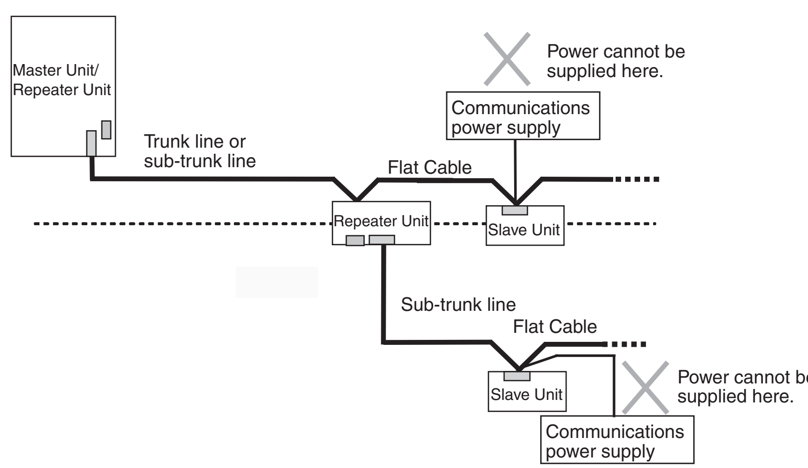
Restrictions

The following restrictions apply when supplying communications power through Flat Cable.

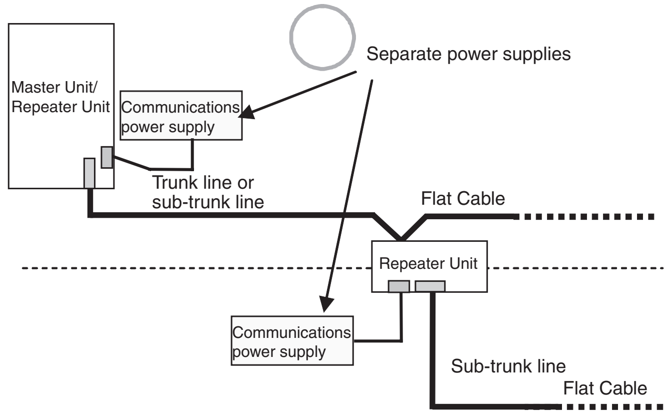
- The communications power supply can be connected at only one location for the trunk line and one location each for the sub-trunk lines.

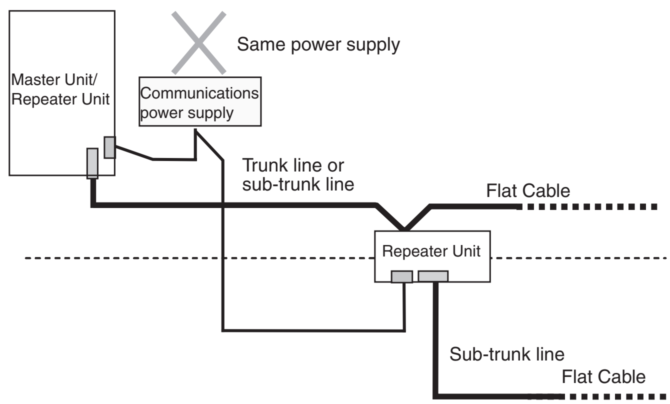
• Communications power to the trunk line can be supplied only through the communications power supply connector on the Master Unit. Communications power to a sub-trunk line can be supplied only through the downstream port communications power supply connector on the Repeater Unit. Communications power cannot be supplied at any other location.





- Use separate power supplies for the Master Unit trunk line and for each sub-trunk line (i.e., for the trunk line or sub-trunk line upstream from a Repeater Unit and the sub-trunk line downstream from a Repeater Unit).





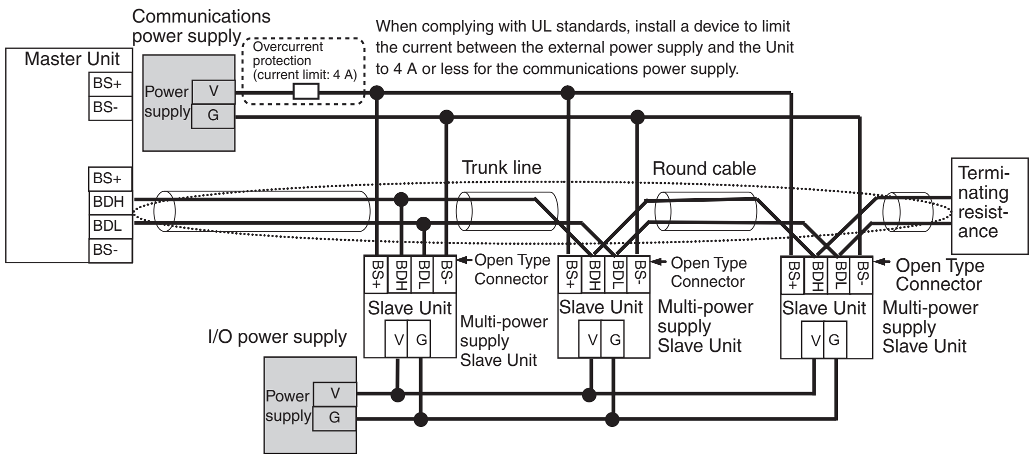
Transmission quality will not be maintained and communications errors may occur if this restriction is not observed.

Round Cable

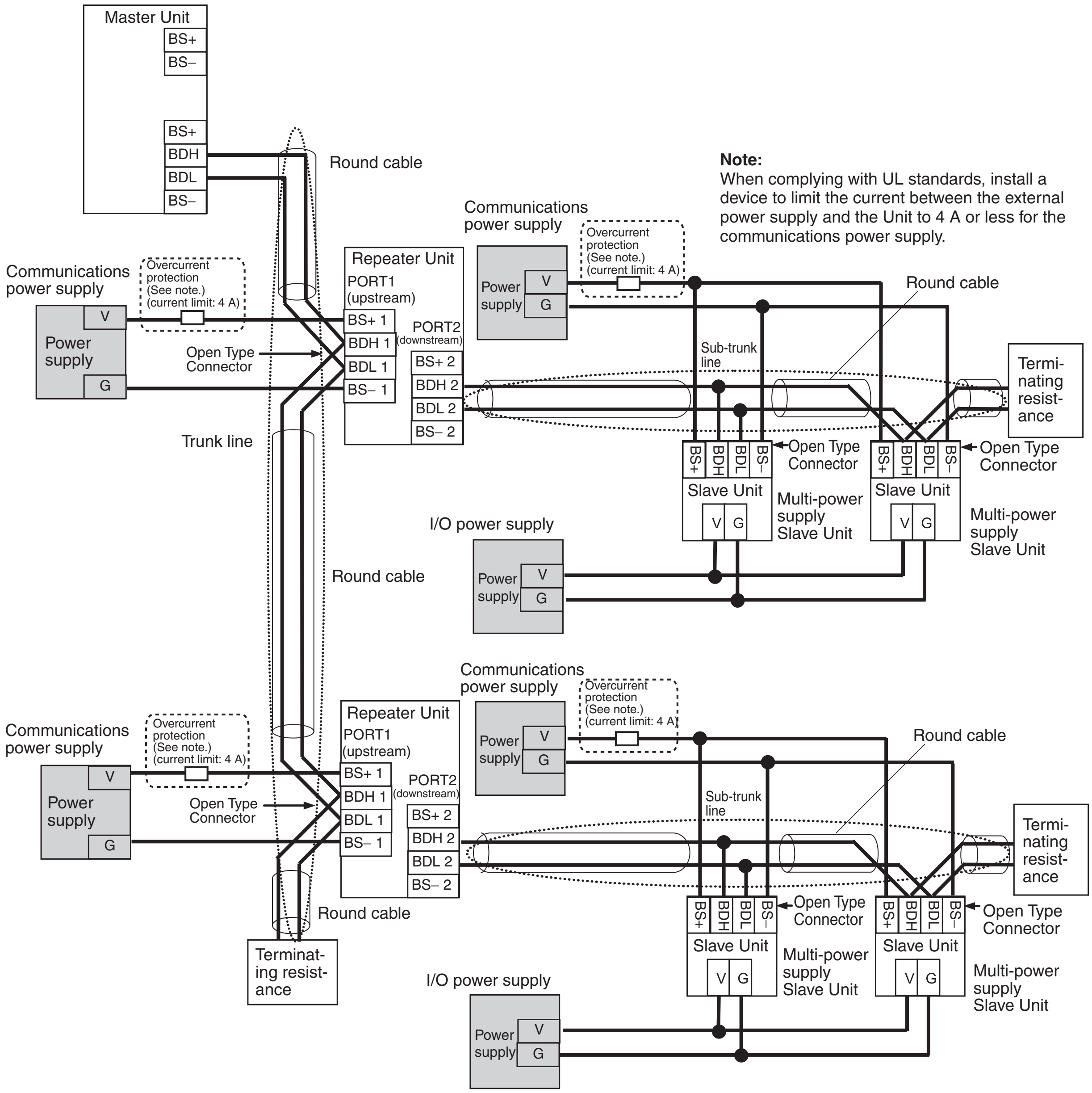
When round cable is used, the communications power cannot be supplied through the communications cable. The communications power must be supplied to each Slave Unit and Repeater Unit through separate lines. For Slave Units that require power for I/O (i.e., multi-power supply Slave Units), the I/O power must also be supplied separately.

There is no need to provide an external communications power supply for the Master Unit.

Not Using a Repeater Unit



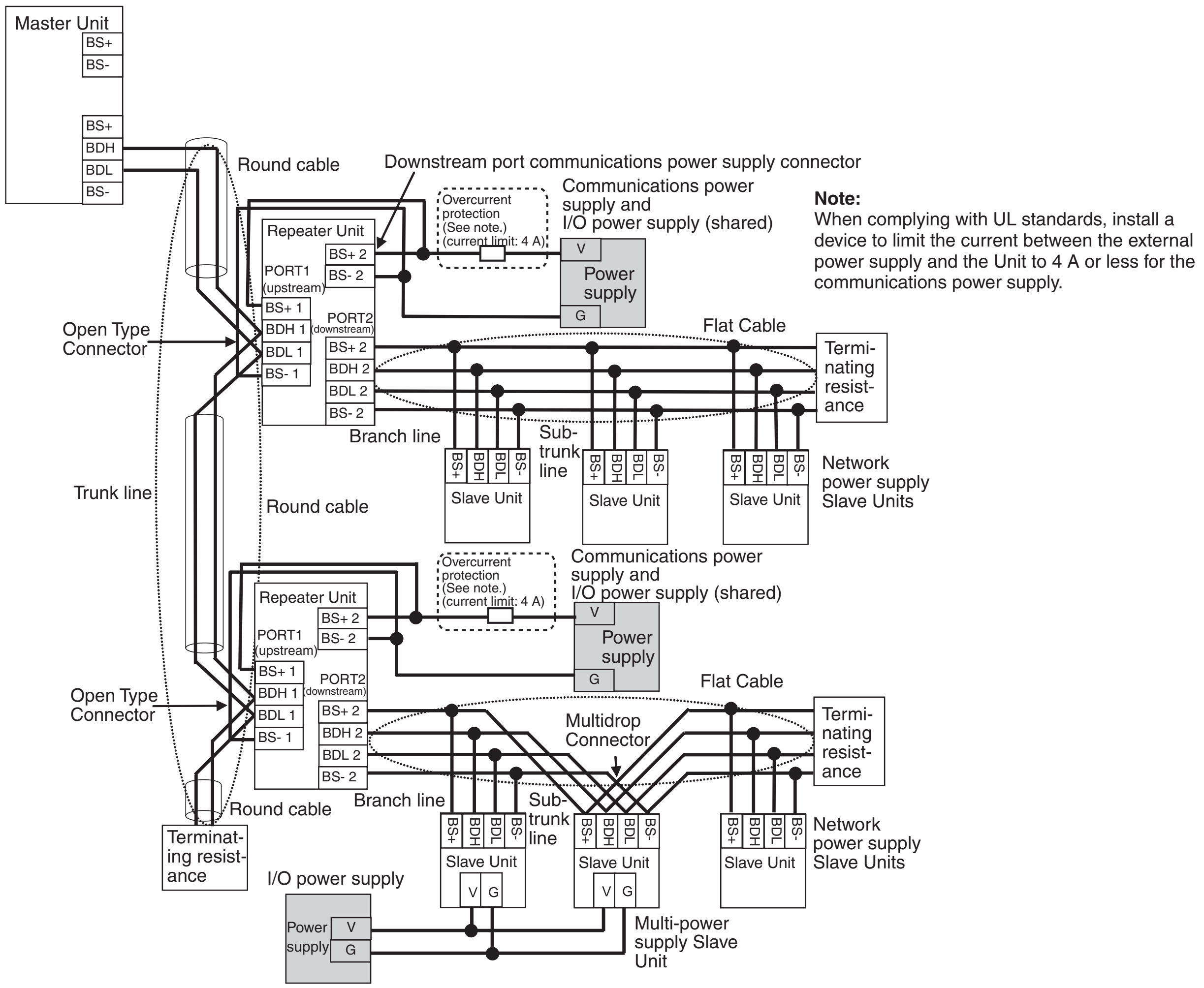
Using Repeater Units



Note The I/O power supply to multi-power supply Slave Units may be a source of noise depending on the connected devices. Even when supplying the communications power supply together to all Slave Units, use a separate I/O power supply so that noise does not affect the network.

Using Flat Cable and Round Cable Together

One or more Repeater Units can be used in a CompoNet Network to use both round cable and Flat Cable under the same Master Unit.



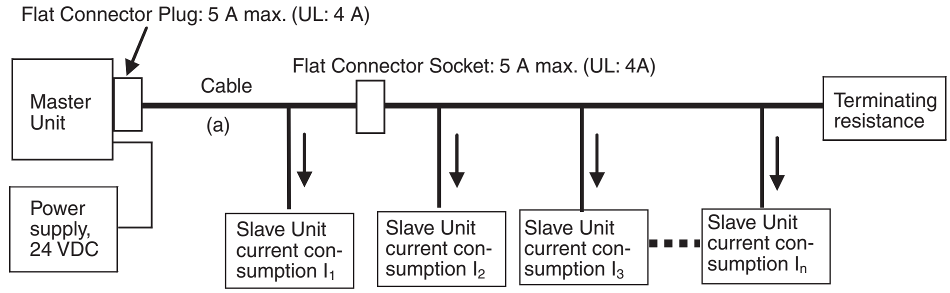
Note The I/O power supply to multi-power supply Slave Units may be a source of noise depending on the connected devices. Even when supplying the communications power supply together to all Slave Units, use a separate I/O power supply so that noise does not affect the network.

3-5-5 Precautions when Supplying Communications Power

When supplying communications power and I/O power, the allowable currents of cables and connections, the voltage drop, and the capacity and location of power supplies must be considered.

Allowable Current Restrictions

Do not allow the total current consumption of all Slave Units to exceed the allowable current of the communications cables and connectors. Exceeding the allowable current may result in heating or burnout of the cables or connectors.



The allowable currents for cables and connectors are given below.

Allowable Currents for Cables

Select the communications cable so that the total current consumption of all Slave Units does not exceed the allowable current of the cable.

Cable allowable current $\geq I_1 + I_2 + I_3 + \cdots I_n$
(For the allowable cable current for "a" in the above diagram)

Allowable Currents for Connectors

There are limits to the allowable current for the communications power supply connectors on the Master Unit and Repeater Units, Flat Connector Sockets, and Flat Connector Plugs. Do not allow the current flow where these connectors are used to exceed the allowable current.

Name	Model	Allowable current
Communications power supply connectors on CS/CJ-Master Units	CS1W-CRM21	5 A (UL: 4 A)
	CJ1W-CRM21	
Communications power supply connector on Repeater Unit	CRS1-RPT01	
Flat Connector Sockets	DCN4-TR4	
	DCN5-TR4	
Flat Connector Plugs	DCN4-BR4	
	DCN5-BR4	
Multidrop Connector	DCN4-MD4	

Voltage Drop

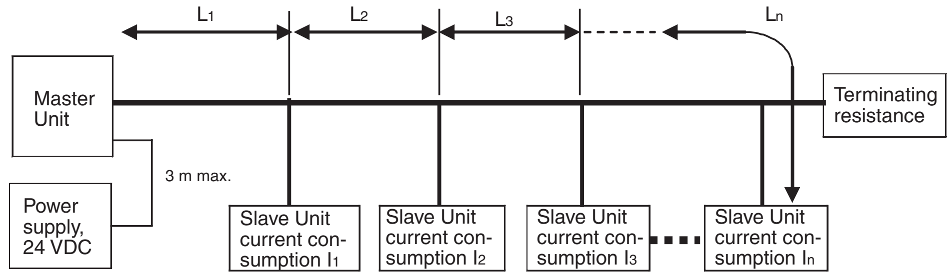
Cable Voltage Drop

The voltage drop must be considered so that the power supply voltage at the Slave Unit that is the farthest from the power supply will still be within the allowable power supply range.

The voltage drop is expressed by the following formula.

Voltage drop (V) = Current (A) $\times$ Cable conductor resistance (Ω/m) $\times$ Cable length (m) $\times$ 2

If the voltage drop is too large and power cannot be supplied to the farthest Slave Unit within the allowable range, add a Repeater Unit and supply power from the Repeater Unit.



■ **Calculation Example**

The allowable power supply voltage range for Slave Units is 14 to 26.4 VDC. If a 24-VDC power supply is used, the allowable voltage drop is 10 V.

The extended length of cable that can be used is expressed by the following formula:

$$10\ (V) \geq \{(I_1 + I_2 + I_3 + \ldots + I_n) \times R_1 \times L_1 \times 2\} + \{(I_2 + I_3 + \ldots + In) \times R_2 \times L_2 \times 2\} + \{(I_3 + \ldots + I_n) \times R_3 \times L_3 \times 2\} + \ldots + \{I_n \times R_n \times L_n \times 2\}$$

To provide leeway when selecting the cable, use the following formula.

$$10(V) \geq \{(I_1 + I_2 + I_3 + \ldots + I_n) \times R \times L \times 2\}$$

R = Cable conductor resistance = 0.025 Ω/m for Flat Cable

Therefore the length that the cable can be extended is as follows:

$$L\ (m) \leq 200 \div (I_1 + I_2 + I_3 + \ldots + I_n) \ldots \text{For Flat Cable}$$

3-5-6 Precautions when Providing the I/O Power Supply

When installing a system, the supply methods for communications power and I/O power must be considered. Not only hardware, such as selecting the power supplies and cables based on allowable currents and voltage drop, be considered, but also system operation for power supply errors, costs, and other software issues must be considered when studying power supply methods.

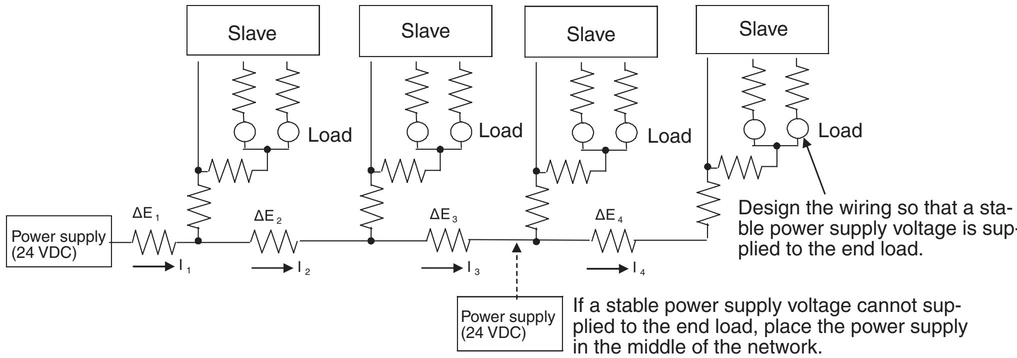
Supplying I/O Power from One Source

When supplying I/O power to the entire system from one source, the power consumed by each device and all the loads must be considered. Select the cables so that the power supply voltage for the last Slave Unit and load will be within the allowable range.

Also, give proper consideration to the power supply capacity and be sure the total line current is within the allowable current range of the cable.

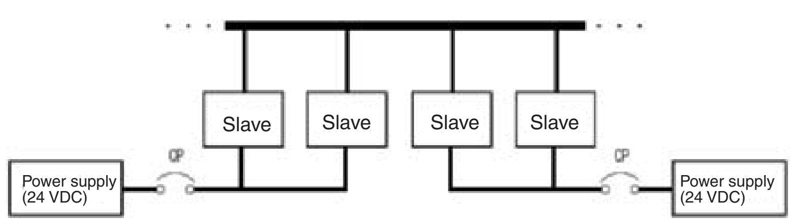
The following measures can be considered to keep the voltage drop within the allowable range when supplying power from one power supply.

- Increase the thickness of the power supply cables.
- Increase the output voltage of the power supply.
- Shorten the wiring.
- Locate the power supply in the middle of the network.



Supplying I/O Power from Multiple Sources

Supplying I/O power from multiple power supplies instead of from one power supply enables reducing the line current, reducing the voltage drop, and decreasing the size of the cable. Using multiple power supplies should also be considered to increase system safety when power supply errors occur.



3-5-7 Other Precautions

Power Supply Errors

The location of power supplies and the grouping of Slave Units should be considered based on whether the overall system is to be stopped when a power supply error occurs.

If it is necessary to prevent the overall system from stopping to ensure system safety, consider placing power supplies in more than one location and consider the way Slave Units should be grouped when supplying power.

Cost Considerations

Also consider the power supply methods in light of the total cost, including the following items:

The capacity and number of power supplies, Cable thickness (allowable current) and length (voltage drop), System safety, and Wiring work.

3-6 Connecting External I/O for Slave Units

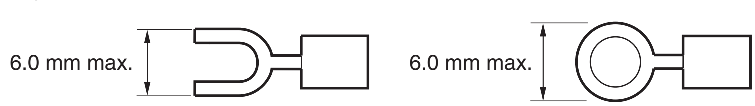
This section describes how to connect external devices, such as sensors, to the I/O terminals of Slave Units. The connection method varies depending on the type of Slave Unit that is used. The following table shows the differences in external I/O connection methods according to the Slave Unit.

Name			Model	Installation method
Digital I/O Slave Units	With 2-tier Terminal Block		CRT1-ID16(-1)	Screw terminal block (M3)
			CRT1-OD16(-1)	
			CRT1-ROS16	
			CRT1-ROF16	
	With 3-tier Terminal Block		CRT1-ID16TA(-1)	
			CRT1-OD16TA(-1)	
			CRT1-MD16TA(-1)	
	With Connector		CRT1-ID16S(-1)	Sensor connector (e-CON)
			CRT1-OD16S(-1)	
			CRT1-MD16S(-1)	
	With Clamp Terminal Block		CRT1-ID16SL(-1)	Screw-less clamp terminal block
			CRT1-OD16SL(-1)	
Analog I/O Slave Units			CRT1-AD04	Screw terminal block (M3)
			CRT1-DA02	
Expansion Units			XWT-ID08(-1)	
			XWT-OD08(-1)	
			XWT-ID16(-1)	
			XWT-OD16(-1)	
Bit Slaves	With Connector	IP20	CRT1B-ID02S(-1)	Sensor connector (e-CON)
			CRT1B-OD02S(-1)	
		IP54	CRT1B-ID02SP(-1)	
			CRT1B-OD02SP(-1)	
			CRT1B-ID04SP(-1)	
	With Clamp Terminal Block	IP54	CRT1B-MD04SLP(-1)	Screw-less clamp terminal block

3-6-1 Connecting to a Screw Terminal Block

For Slave Units with screw terminal blocks, attach the following M3 crimp terminals to signal lines and then connect them to the terminal block.

Tighten the terminal block screws to a torque of 0.5 N·m.



3-6-2 Connecting to Sensor Connectors

For Slave Units with industry standard sensor connectors (e-CON), a special cable connector must be attached to an external device cable. Follow the procedure below to attach the connector to the cable.

■ Checking the Cable Connector and Cable Wire Size

The wire size and sheath diameter of applicable cables depend on the type of cable connector. Use the following table to check that the cable connector and external device cable wire size and sheath diameter are compatible.

Tyco Electronics Connectors

Model	Housing color	Applicable wire range	
3-1473562-4	Orange	sheath outer diameter: 0.9 to 1.0 mm	Cross-sectional area: 0.08 to 0.5 mm^2
1-1473562-4	Red	sheath outer diameter: 0.9 to 1.0 mm	
1473562-4	Yellow	sheath outer diameter: 1.0 to 1.15 mm	
2-1473562-4	Blue	sheath outer diameter: 1.15 to 1.35 mm	
4-1473562-4	Green	sheath outer diameter: 1.35 to 1.60 mm	

Sumitomo 3M Connectors

Model	Housing color	Applicable wire range
37104-3101-000FL	Red	AWG26 (0.14 mm^2) to AWG24 (0.2 mm^2), sheath outer diameter: 0.8 to 1.0 mm
37104-3122-000FL	Yellow	AWG26 (0.14 mm^2) to AWG24 (0.2 mm^2), sheath outer diameter: 1.0 to 1.2 mm
37104-3163-000FL	Orange	AWG26 (0.14 mm^2) to AWG24 (0.2 mm^2), sheath outer diameter: 1.2 to 1.6 mm
37104-2124-000FL	Green	AWG22 (0.3 mm^2) to AWG20 (0.5 mm^2), sheath outer diameter: 1.0 to 1.2 mm
37104-2165-000FL	Blue	AWG22 (0.3 mm^2) to AWG20 (0.5 mm^2), sheath outer diameter: 1.2 to 1.6 mm
37104-2206-000FL	Gray	AWG22 (0.3 mm^2) to AWG20 (0.5 mm^2), sheath outer diameter: 1.6 to 2.0 mm

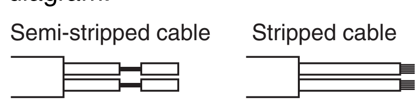
OMRON Connectors

Model	Specification	Applicable wire range
XN2A-1430	Spring clamp type	AWG28 (0.08 mm^2) to AWG20 (0.5 mm^2), sheath outer diameter: 1.5 mm max.

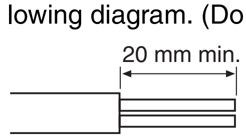
■ Preparing External Device Cables

Using Tyco Electronics or Sumitomo 3M Connectors

The sensor and other external device cables for connector output with transistors are normally either semi-stripped or stripped, as shown in the following diagram.

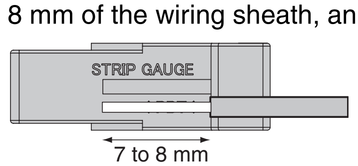


When the cables are prepared this way, a cable connector cannot be attached, so first cut the end and remove the cable sheath as shown in the following diagram. (Do not strip the sheaths of the core wires.)



Using OMRON Connectors

Align the cable with the strip gauge on the side of the connector. Remove 7 to 8 mm of the wiring sheath, and twist the exposed wires several times.



■ Inserting Cable Wires into the Cable Connector

Insert the cable wires of the external device into the cable connector, and connect each wire so that the terminal number on the connector cover matches the wire color as shown in the following table.

	Using CRT1-ID16S, CRT1-MD16S, CRT1B-ID02S, CRT1B-ID02SP, CRT1B-ID04SP		**Using CRT1-ID16S-1, CRT1-MD16S-1, CRT1B-ID02S-1, CRT1B-ID02SP-1, CRT1B-ID04SLP-1**	
Terminal number	3-wire sensor (without self-diagnostic output)	2-wire sensor (without self-diagnostic output)	3-wire sensor (without self-diagnostic output)	2-wire sensor (without self-diagnostic output)
1	Brown (red)	---	Brown (red)	Brown (white)
2	---	---	---	---
3	Blue (black)	Blue (black)	Blue (black)	---
4	Black (white)	Brown (white)	Black (white)	Blue (black)

Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

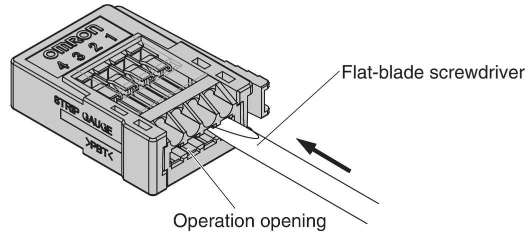
Using Tyco Electronics or Sumitomo 3M Connectors

1,2,3... 1. Confirm that the terminal number matches the wire color, and insert each wire all the way into the opening on the cable connector cover.

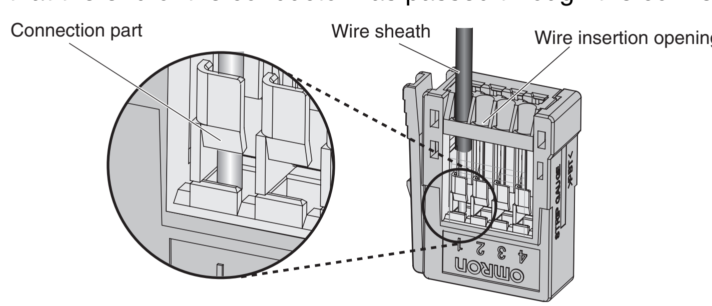
2. Use a tool, such as a pliers, to push the cover straight in so that it is parallel with the body.

Using OMRON Connectors

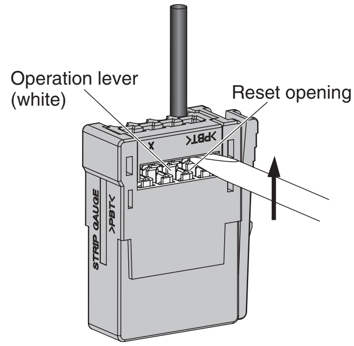
1,2,3... 1. Use a flat-blade screwdriver to push the operation lever inside the connector's operation opening until it locks, as shown in the following diagram.



2. Insert the line all the way to the back of the wire insertion opening. Check that the sheath of the line is inserted into the wire insertion opening, and that the end of the conductor has passed through the connection part.



3. Insert a flat-blade screwdriver into the reset opening and pull back the lever lightly. A click will be heard and the operation lever will return to its normal position.



4. Lightly pull on the lines to confirm that they are connected properly.

Note To remove a wire, push in the operation lever, check that the operation lever has locked, and then pull out the wire. After removing the wire, always return the operation lever to its normal position.

3-6-3 Connecting to Screw-less Clamp Terminal Blocks

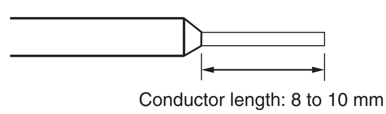
For Slave Units with screw-less clamp terminal blocks, the terminal blocks can be easily wired by inserting pin terminals. Follow the procedure below to connect the external device cable to a screw-less clamp terminal block.

■ Applicable Pin Terminals

When wiring an external device cable to a screw-less clamp terminal block, special pin terminals must be placed on the cable wires. The applicable pin terminals are listed in the following table.

Name	Applicable wire size	Crimp tool	Manufacturer
H0.5/14 orange	0.5 mm^2/AWG20	PZ6 roto	Weidmuller Co. Ltd.
H0.75/14 white	0.75 mm^2/AWG18		
H1.5/14 red	1.5 mm^2/AWG16		

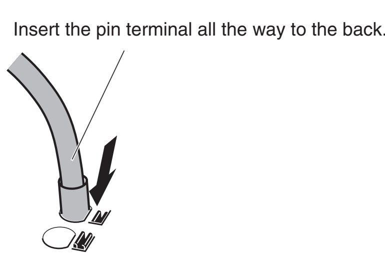
The pin terminal conductor should be about 8 to 10 mm in length.



■ Wiring to the Screw-less Clamp Terminal Block

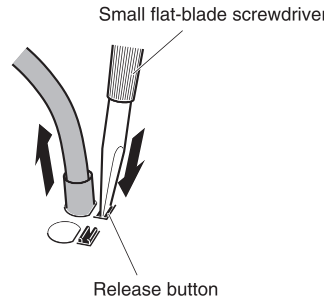
Inserting Pin Terminals

Insert the pin terminal all the way to the back of the terminal hole.



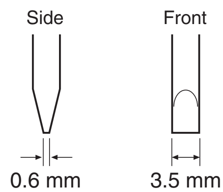
Removing Pin Terminals

Press down the release button next to the terminal hole with a small flat-blade screwdriver and pull out the pin terminal while the release button is down.



The following screwdriver is recommended for removing pin terminals.

Model	Manufacturer
SD0.6 × 3.5 × 100 Flat-blade Screwdriver	Weidmuller Co. Ltd.

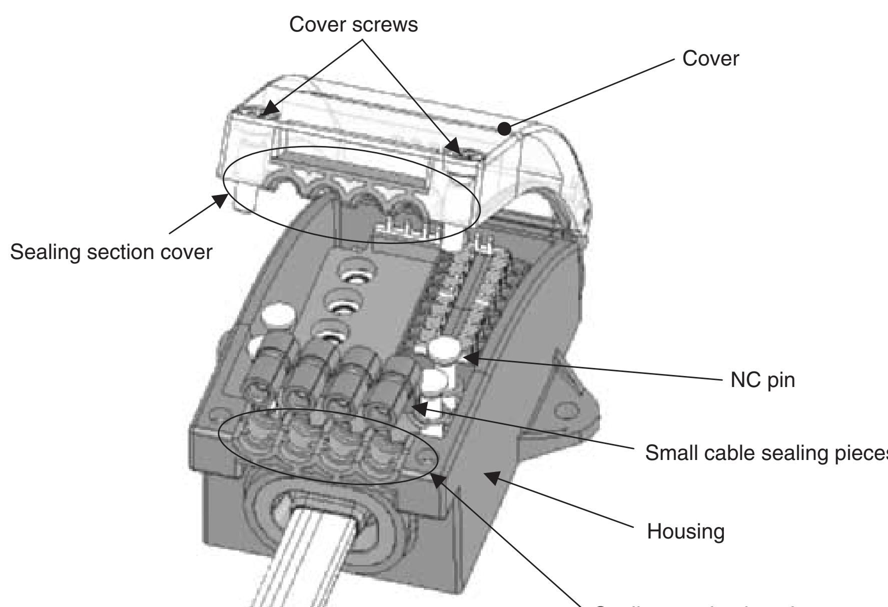


Note Press the release button with a force of 30 N or less. Applying excessive force may damage the clamp terminal block.

3-6-4 Connecting External I/O to IP54 Bit Slave Units

This section describes connecting external I/O to IP54 Slave Units.

Components



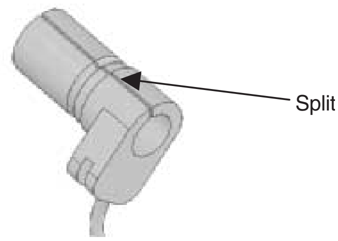
External I/O is connected to the clamp terminal block or industry standard sensor connectors (e-CON) inside the housing. Connected external I/O cables are passed through the sealing.

The cables are held between the sealing section cover and sealing section housing to ensure resistance to splashing.

For cables with smaller outer diameters, the sealing pieces can be used to ensure splash resistance.

Applicable Cables

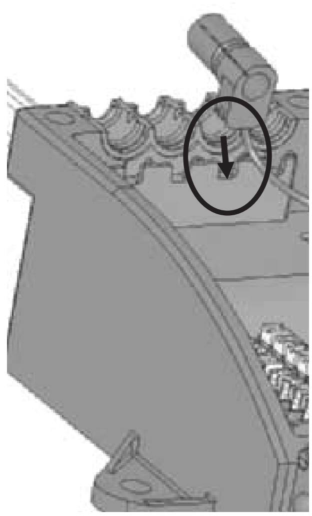
The range of outer diameters of cables that can be connected is 2.2 to 6.3 mm. When the diameter is within the range of 2.2 to less than 3.6 mm, then the sealing section for small-diameter cables must be attached.



Installation Method

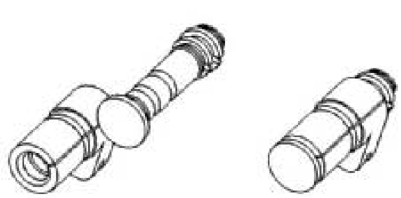
1,2,3...

1. Expand the split in the sealing piece and insert the cable.
2. Place the groove on the sealing pieces onto the inside of the housing to secure it. (See following diagram.)



Handling Unconnected Terminals

For terminals that are not connected, insert an NC pin into the small cable sealing piece as shown in the following diagram. Then secure the sealing piece onto the housing as described above.



Tightening the Cover

Finally, close the cover and tighten the cover screws.

The tightening torque is 0.8 to 1.0 N·m.

SECTION 4
Basic Specifications of Slave Units

This section provides the basic specifications of the Slave Units.

4-1 Basic Specifications of Slave Units 74

4-1-1 Communications Specifications 74

4-1-2 Performance Specifications 75

4-1-3 Communications Indicators 75

4-1 Basic Specifications of Slave Units

This section gives the specifications that are the same for all Slave Units. For specifications that vary with the Slave Unit, refer to the section for each Slave Unit.

4-1-1 Communications Specifications

Item	Specification
Communications protocol	CompoNet Network protocol
Types of communications	Remote I/O communications (programless, constant sharing of data with Slave Units) and message communications (explicit message communications as required with Slave Units and FINS message communications as required with PLCs)
Baud rate	4 Mbits/s, 3 Mbits/s, 1.5 Mbits/s, 93.75 kbits/s
Modulation	Base-band
Coding	Manchester code
Error control	Manchester code rules, CRC
Communications media	The following media can be used. • Round cable I (JIS C 3306, VCTF 2-conductor) • Flat Cable I (DCA4-4F10 Standard Flat Cable) • Flat Cable II (DCA5-4F10 Sheathed Flat Cable) **Note** Round cable I, Flat Cable I, and Flat Cable II are all different types of cable. To use more than one type of cable at a time, Repeater Units must be used to separate them on trunk lines and sub-trunk lines.
Communications distance and wiring	Refer to *1-2-1 Cable Types, Baud Rates, and Maximum Distances* in the *Master Unit Operation Manual*.
Connectable Master Units	CompoNet Master Units
Connectable Slave Units	CompoNet Slave Units
Maximum I/O capacity	Word Slave Units: 1,024 inputs and 1,024 outputs (2,048 I/O points total) Bit Slave Units: 256 inputs and 256 outputs (512 I/O points total)
Maximum number of nodes	Word Slave Units: 64 input nodes and 64 output nodes Bit Slave Units: 128 input nodes and 128 output nodes Repeater Units: 64 nodes
Bits allocated per node address	Word Slave Units: 16 bits Bit Slave Units: 2 bits
Maximum number of nodes per trunk line or sub-trunk line	32 nodes (including Repeater Units)
Applicable node addresses	Word Slave Units: IN0 to IN63 and OUT0 to OUT63 Bit Slave Units: IN0 to IN127 and OUT0 to OUT127 Repeater Units: 0 to 63
Repeater Unit application conditions	Up to 64 Repeater Units can be connected per network. When Repeater Units are connected in series from the Master Unit, up to 2 extra segment layers can be created (i.e., up to 2 Repeater Units are allowed between a Slave Unit and the Master Unit).
Signal lines	Two lines: BDH (communications data high) and BDL (communications data low)
Power lines	Two lines: BS+ and BS– (power for communications and internal Slave Unit circuits) • Power is supplied from the Master Unit or Repeater Units.
Connection forms	Flat Cable at baud rate of 93.75 kbits/s: No restrictions Other cables or baud rates: Trunk line and branch lines
	Connections for Slave Units and Repeater Units: T-branch or multidrop connections

4-1-2 Performance Specifications

Item	Specification
Communications power supply voltage	14 to 26.4 VDC
I/O power supply voltage	20.4 to 26.4 VDC (24 VDC –15%/+10%)
Noise immunity	Conforms to IEC 61000-4-4 2kV (power line)
Vibration resistance	10 to 60 Hz with double-amplitude of 0.7 mm, 60 to 150 Hz and 50 m/s^2 in X, Y, and Z directions for 80 min each
Shock resistance	150 m/s^2 (3 times each in 6 directions on 3 axes)
Dielectric strength	500 VAC (between isolated circuits)
Insulation resistance	20 MΩ min. (between isolated circuits)
Ambient operating temperature	–10 to 55°C
Ambient operating humidity	25% to 85% (with no condensation)
Ambient operating atmosphere	No corrosive gases
Storage temperature	–25 to 65°C
Storage humidity	25% to 85% (with no condensation)
Terminal block screw tightening torque (See note.)	M3 wiring screws: 0.5 N·m M3 mounting screws: 0.5 N·m
Installation	Mounted on 35-mm DIN Track or secured with M4 screws (depending on model)

Note Applicable only to Slaves to which screw terminal blocks are mounted.

Some of the specifications are different for the CRT1-ROS16 (with relay outputs) and the CRT1-ROF16 (with SSR outputs). For details, refer to *5-3-3 Sixteen-point Output Units (2-tier Terminal Block with Relay Outputs)* and *5-3-4 Sixteen-point Output Units (2-tier Terminal Block with SSR Outputs)*.

4-1-3 Communications Indicators

The communications indicators have the following meanings.

MS (Module Status): Indicates the status of the node with a two-color LED (green/red).

NS (Network Status): Indicates the status of communications with a two-color LED (green/red).

Name	Indicator status	Node/communications status	Meaning
MS	Lit green.	Normal status	The Unit is operating normally.
	Lit red.	Fatal error	A hardware error has occurred in the Unit. The watchdog timer has timed-out.
	Flashing red.	Non-fatal error	There is an error in the switch settings. An EEPROM checksum error has occurred.
	Not lit.	Power OFF/Startup	The power supply is OFF, the Unit is being reset, or the Unit is being initialized.
NS	Lit green.	Online and participating	Normal communications are in progress and the node is participating in the network.
	Flashing green.	Online but not participating	Normal communications are in progress but the node is not yet participating in the network.
	Lit red.	Fatal communications error	The address is set out of range. The same address has been set for more than one node.
	Flashing red.	Non-fatal communications error	Polling has timed out. The network has timed out.
	Not lit.	Power OFF/Baud rate not yet detected.	The power supply is OFF or the baud rate has not been detected.

Note When flashing, indicators are lit for 0.5 s and not lit for 0.5 s.

SECTION 5
Digital I/O Slave Units

This section describes the Digital I/O Slave Units.

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5-2	Allocating I/O Data		79
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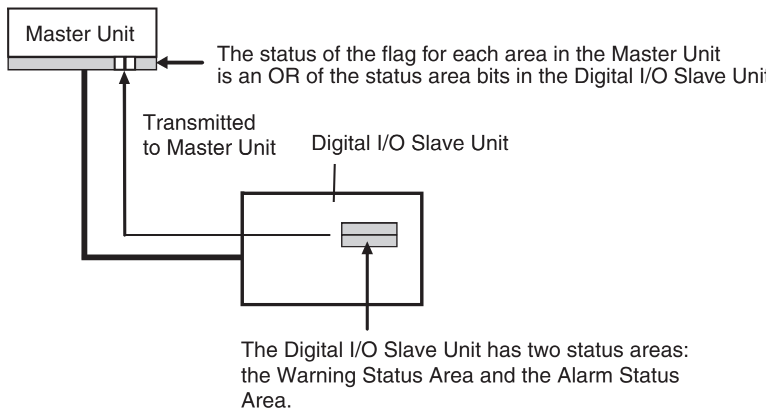
5-1 Status Areas

A Digital I/O Slave Unit has two internal status areas: the Warning Status Area and the Alarm Status Area. The status flags in these areas are turned ON and OFF based on the threshold values set by the user for each function in that Unit.
For each area, a corresponding status flag in the Master Unit will be turned ON if any flag in the status area in the Digital I/O Slave Unit turns ON. Bit 12 in the Master Unit corresponds to the Warning Status Area and bit 13 corresponds to the Alarm Status Area.

The Digital I/O Slave Unit's status area information can be read by using the CompoNet Support Software or explicit messages.



Warning Status Area

The Digital I/O Slave Unit's Warning Status Area contains the following 16 bits. These bits indicate minor errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	Reserved	---
2	Network Power Voltage Drop Flag OFF: Normal ON: Error (Voltage dropped below threshold.)	Monitors the voltage set as the threshold for the network power voltage monitor function.
3	Unit Maintenance Flag OFF: Normal ON: Error (Threshold exceeded.)	Monitors the power ON time warning value set as the threshold for the Unit Conduction Time Monitor function.
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Operation Time Monitor Flag OFF: Normal ON: Error (Threshold exceeded.)	Turns ON when the threshold set for the operation time monitor function is exceeded.
9	Connected Device Maintenance Flag OFF: Normal ON: Error (Threshold exceeded.)	Turns ON when the threshold set for the contact operation monitor function or the total ON time monitor function is exceeded.
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---

Bit	Content	Description
14	Reserved	---
15	Reserved	---

Alarm Status Area

The Digital I/O Slave Unit's Alarm Status Area contains the following 16 bits. These bits indicate serious errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	EEPROM Data Error Flag OFF: Normal ON: Error occurred	Turns ON when there is an error in the EEPROM data.
2	Reserved	---
3	Reserved	---
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	I/O Power Supply Status Flag 1 OFF: I/O power is ON ON: I/O power is not ON.	Turns ON when I/O power is not being supplied.
9	I/O Power Supply Status Flag 2 OFF: I/O power is ON ON: I/O power is not ON.	Turns ON when I/O power is not being supplied to the Expansion Unit.
10	Reserved	---
11	Reserved	---
12	Operation Time Configuration Flag OFF: Normal ON: Error	Turns ON when a threshold value is set for the operation time monitor function between a Digital I/O Slave Unit and Expansion Unit if an Expansion Unit is not connected.
13	Reserved	---
14	Reserved	---
15	Reserved	---

5-2 Allocating I/O Data

Input and output areas in I/O memory in the Master Unit are allocated to the I/O data of Word Slave Units in a CompoNet Network. Node address areas are allocated in order of node addresses for Slave Units of the same type. In a CompoNet Network, Units are allocated node address areas of the size required for each Unit, based on the node address set for the Unit.

5-2-1 Data Allocation for Word Slave Units

Word Slave Units are allocated node address areas in units of 16 points (one word).

- Units with 16 inputs or outputs are allocated one word (the node address set for the Unit).
- Units with 16 I/O points (8 inputs and 8 outputs) are allocated two words (the node address set for the Unit). The data is allocated to the lower bytes of the words, and the upper bytes remain unused.

Sixteen-point Input Unit

Input Area

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

Sixteen-point Output Unit

Output Area

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

Sixteen-point I/O Unit

Output Area

Not used.	7	6	5	4	3	2	1	0

Input Area

Not used.	7	6	5	4	3	2	1	0

5-2-2 Data Allocation for Word Slave Units with Expansion Units

When an Expansion Unit is used, memory is allocated in the same way as it would be allocated to a Word Slave Unit that includes the input and output data of the Expansion Unit.

Sixteen-point Input Unit + Sixteen-point Expansion Input Unit

Two node address areas are allocated: Node address m in the Input Area and node address m+1 in the Input Area.

Input Area

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

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

Sixteen-point Input Unit + Eight-point Expansion Input Unit

Two node address areas are allocated: Node address m in the Input Area and node address m+1 in the Input Area.

Input Area

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

Not used.	23	22	21	20	19	18	17	16

Sixteen-point Input Unit + Sixteen-point Expansion Output Unit

Two node address areas are allocated: Node address m in the Input Area and node address m in the Output Area.

Output Area

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

Input Area

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

Sixteen-point Input Unit + Eight-point Expansion Output Unit

Two node address areas are allocated: Node address m in the Input Area and node address m in the Output Area.

Output Area

Not Used.								7	6	5	4	3	2	1	0

Input Area

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

Sixteen-point Output Unit + Sixteen-point Expansion Output Unit

Two node address areas are allocated: Node address m in the Output Area and node address m+1 in the Output Area.

Output Area

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16

Sixteen-point Output Unit + Eight-point Expansion Output Unit

Two node address areas are allocated: Node address m in the Output Area and node address m+1 in the Output Area.

Output Area

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Not Used.								23	22	21	20	19	18	17	16

Sixteen-point Output Unit + Sixteen-point Expansion Input Unit

Two node address areas are allocated: Node address m in the Output Area and node address m in the Input Area.

Output Area

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

Input Area

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

Sixteen-point Output Unit + Eight-point Expansion Input Unit

Two node address areas are allocated: Node address m in the Output Area and node address m in the Input Area.

Output Area

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

Input Area

Not Used.								7	6	5	4	3	2	1	0

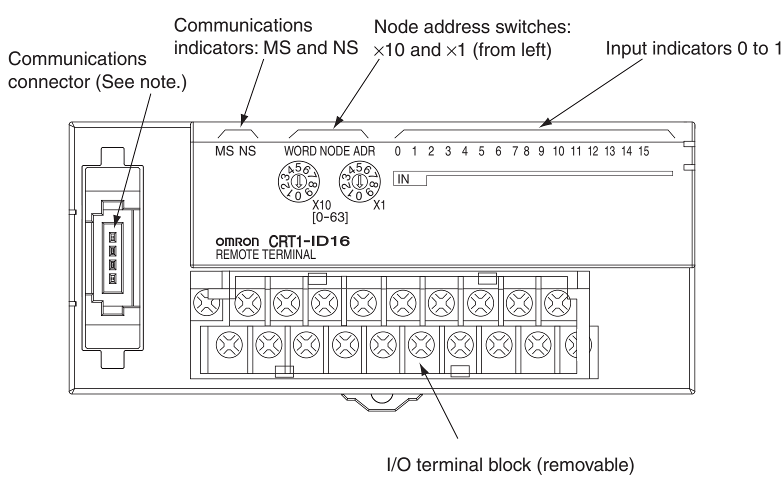
5-3 Units with Screw Terminal Blocks

5-3-1 Sixteen-point Input Units (2-tier Terminal Block)

Input Section Specifications

Item	Specification	
Model	CRT1-ID16	CRT1-ID16-1
I/O capacity	16 inputs	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 17 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 inputs/common	
Isolation method	Photocoupler	
Input indicator	LED (yellow)	
Installation	DIN Track	
Power supply type	Multi-power supply	
Communications power supply current consumption	55 mA max. for 24-VDC power supply voltage 85 mA max. for 14-VDC power supply voltage	
Weight	141 g max.	

Component Names and Functions (Same for CRT1-ID16 and CRT1-ID16-1)



Note A Flat Connector Plug or DCN4-TB4 Open Type Connector can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

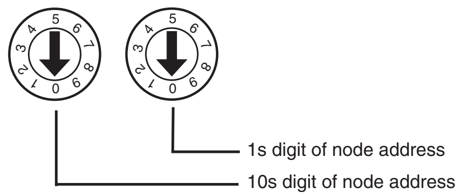
The meanings of the input indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.

Setting the Node Address

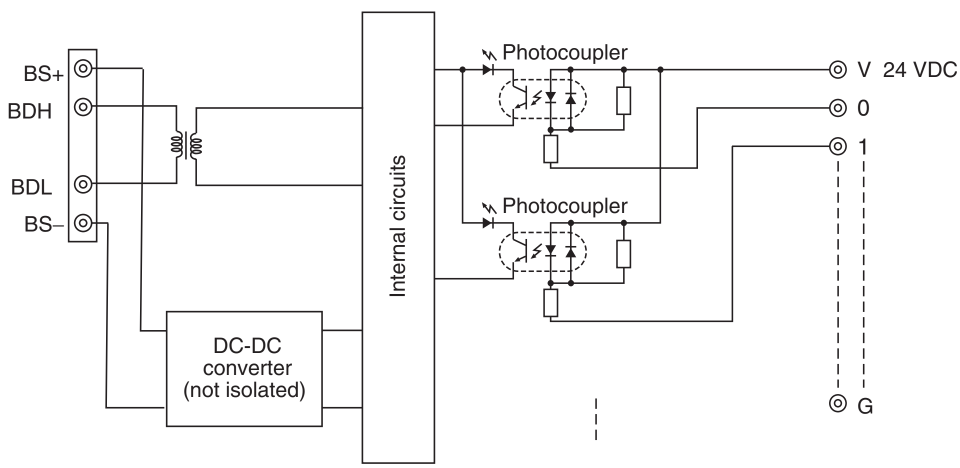
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

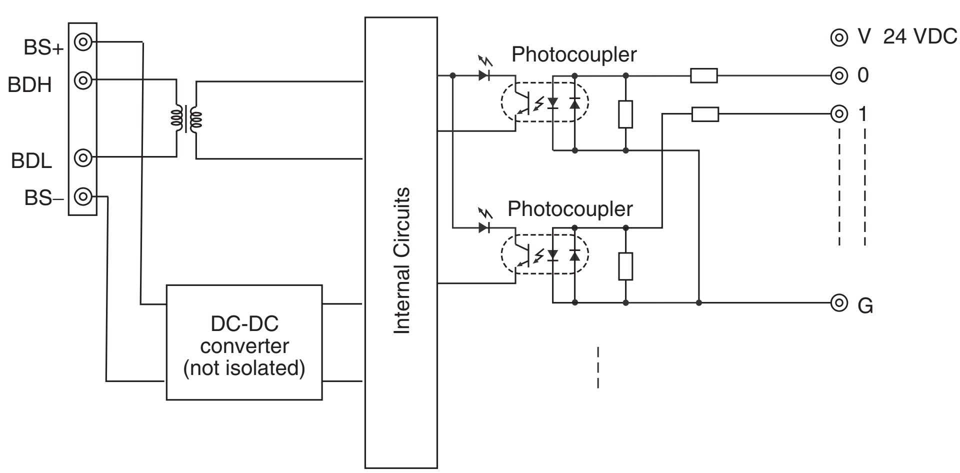


Internal Circuits

CRT1-ID16 (NPN)

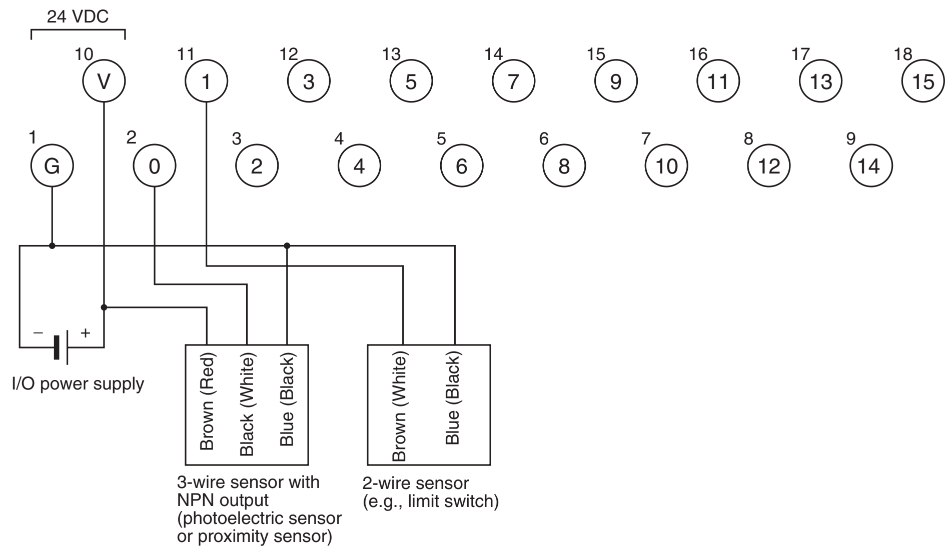


CRT1-ID16-1 (PNP)

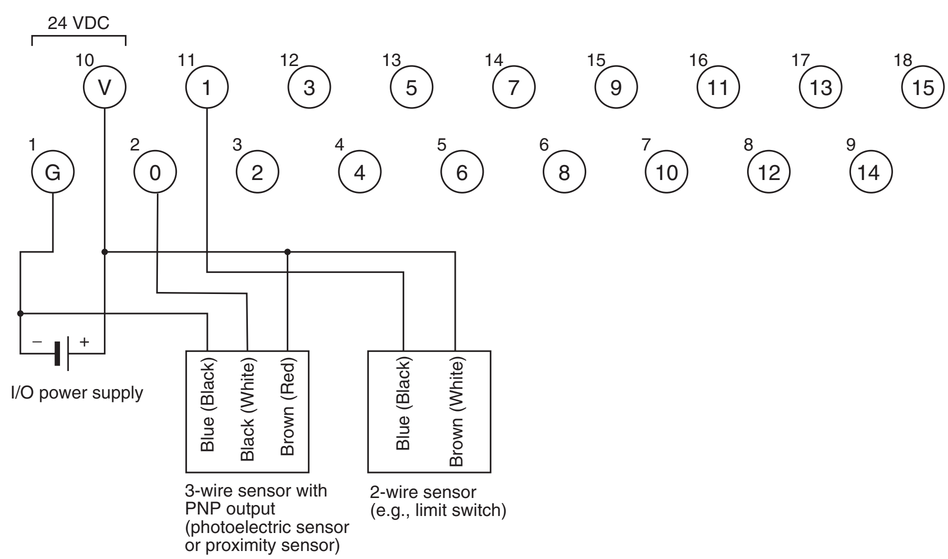


Wiring

CRT1-ID16 (NPN)



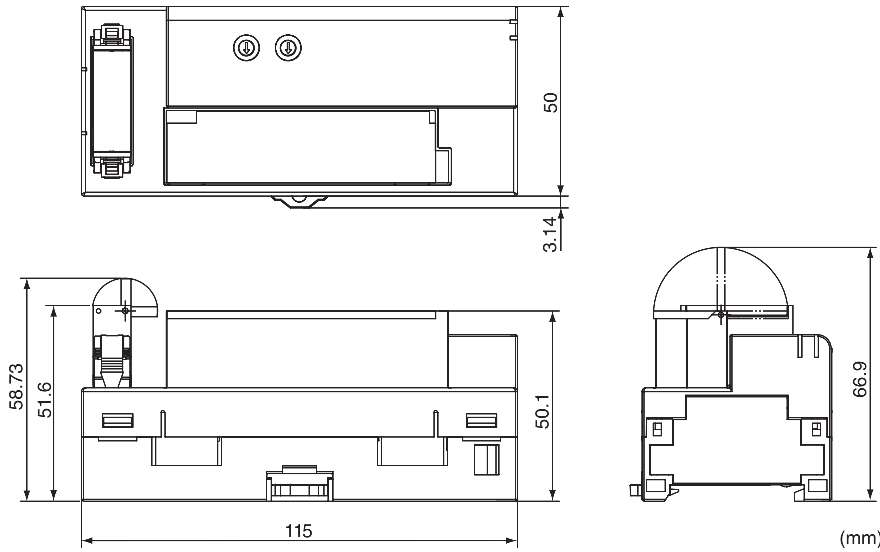
CRT1-ID16-1 (PNP)



Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

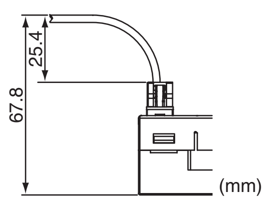
Dimensions (Same for CRT1-ID16 and CRT1-ID16-1)

When a DCN4-TB4 Open Type Connector Is Mounted

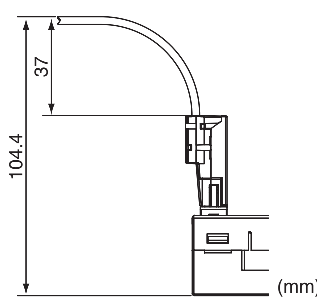


Communications Connector Dimensions Including the Connector and Cable

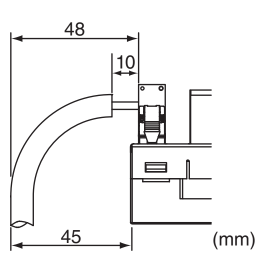
■ When a DCN4-BR4 Standard Flat Connector Plug Is Mounted



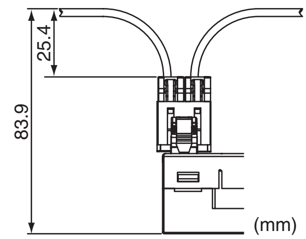
■ When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted



■ When a DCN4-TB4 Open Type Connector Is Mounted



■ **When a DCN4-MD4 Multidrop Connector Is Mounted**

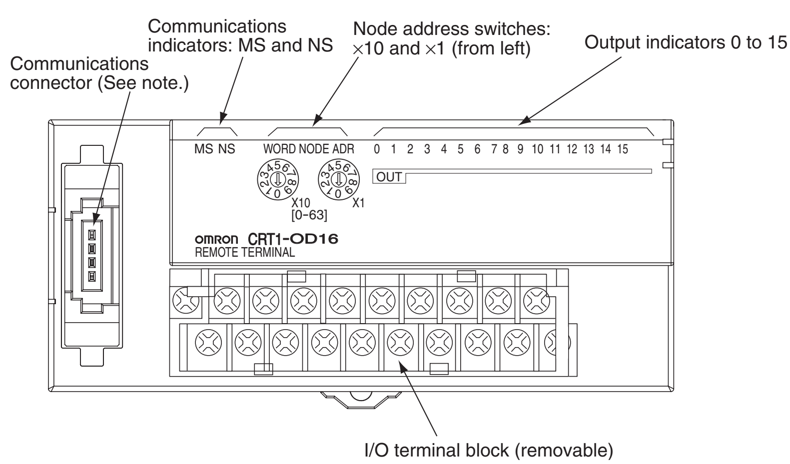


5-3-2 Sixteen-point Output Units (2-tier Terminal Block with Transistor Outputs)

Output Section Specifications

Item	Specification	
Model	CRT1-OD16	CRT1-OD16-1
I/O capacity	16 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.5 A/output, 4 A/common	
Residual voltage	1.2 V max.(0.5 A DC, between each output terminal and the G terminal)	1.2 V max.(0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 outputs/common	
Isolation method	Photocoupler	
Output indicators	LED (yellow)	
Installation	DIN Track	
Power supply type	Multi-power supply	
Communications power supply current consumption	55 mA max. for 24-VDC power supply voltage 85 mA max. for 14-VDC power supply voltage	
Output handling for communications errors	Select either hold or clear from CompoNet Support Software.	
Weight	141 g max.	

Component Names and Functions (Same for CRT1-OD16 and CRT1-OD16-1)



Note A Flat Connector Plug or DCN4-TB4 Open Type Connector can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

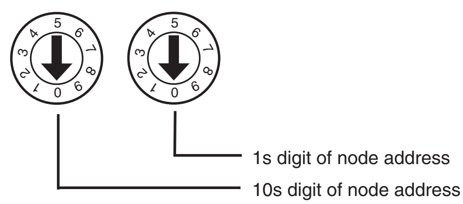
The meanings of the output indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

Setting the Node Address

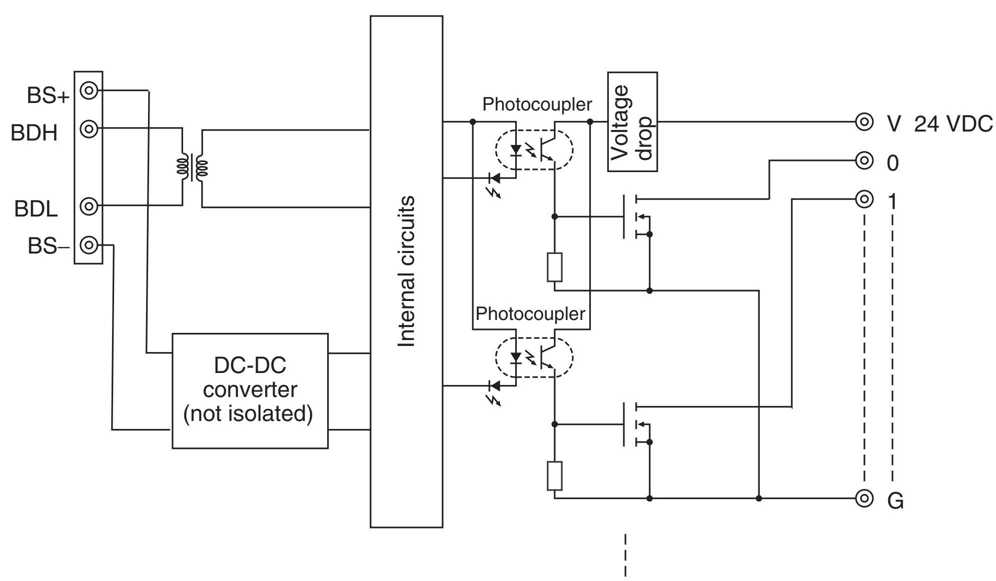
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

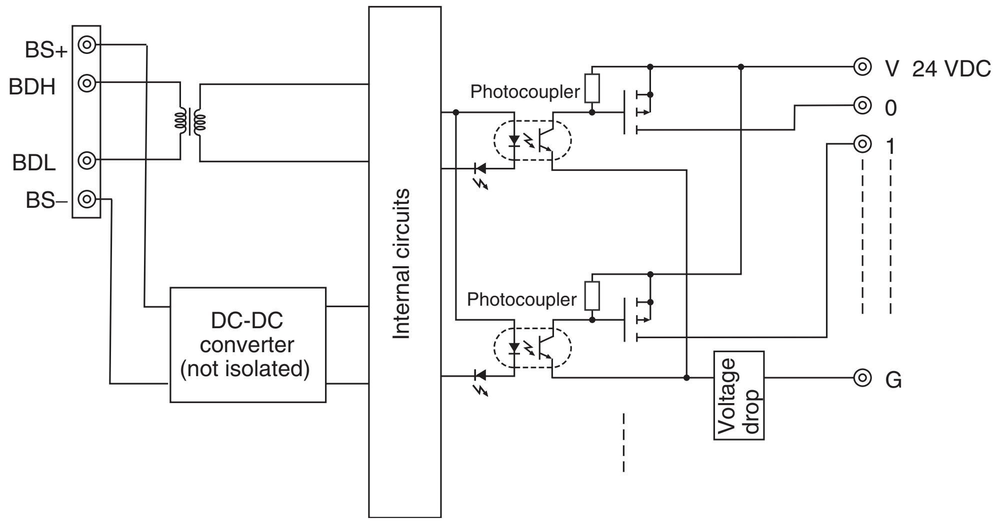


Internal Circuits

CRT1-OD16 (NPN)

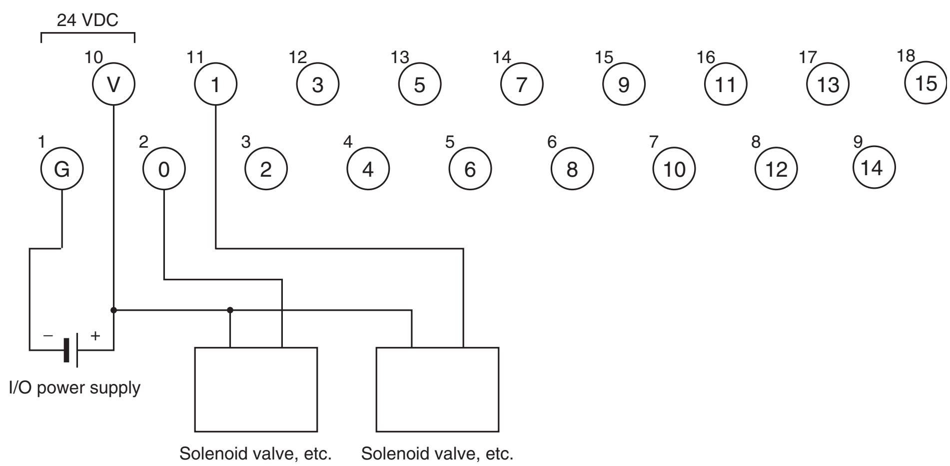


CRT1-OD16-1 (PNP)

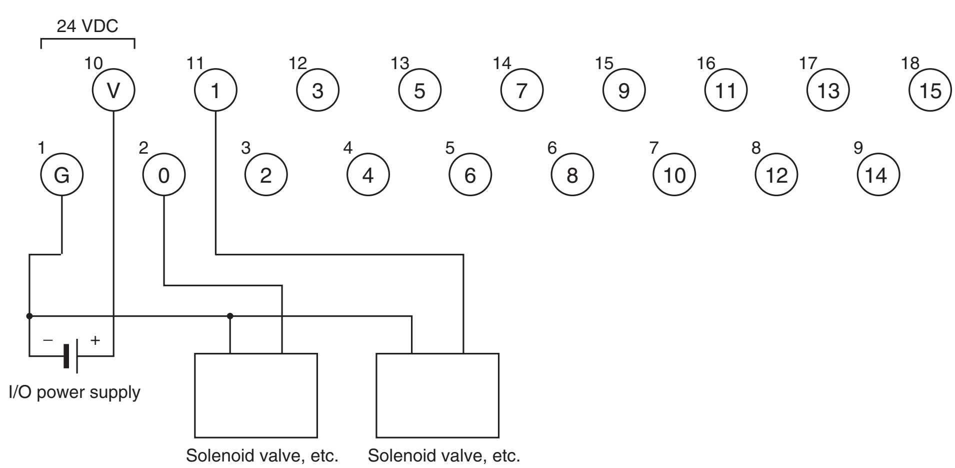


Wiring

CRT1-OD16 (NPN)



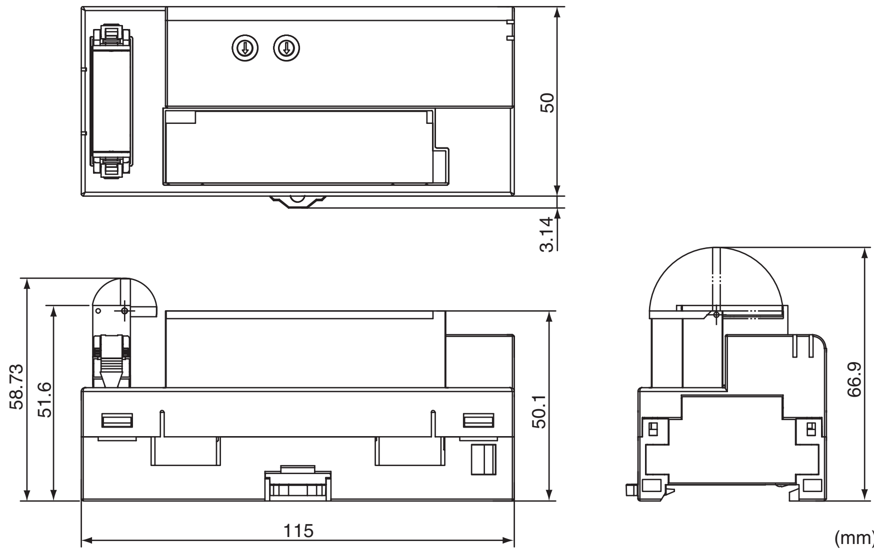
CRT1-OD16-1 (PNP)



Note When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

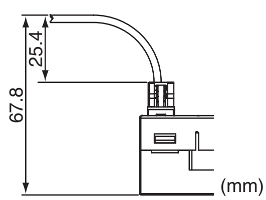
Dimensions (Same for CRT1-OD16 and CRT1-OD16-1)

When a DCN4-TB4 Open Type Connector Is Mounted

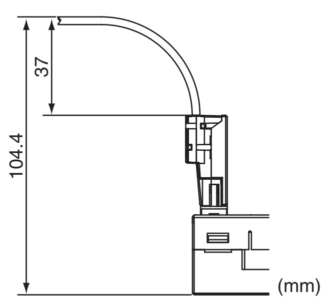


Communications Cable Dimensions when Connector and Cable Are Connected

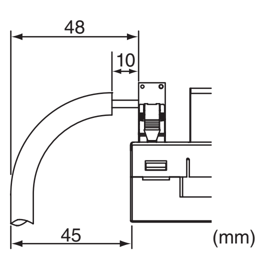
■ **When a DCN4-BR4 Standard Flat Connector Plug Is Mounted**



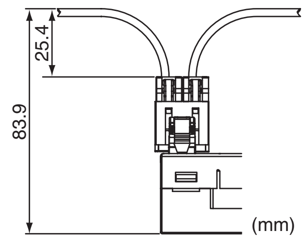
■ **When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted**



■ **When a DCN4-TB4 Open Type Connector Is Mounted**



■ When a DCN4-MD4 Multidrop Connector Is Mounted



5-3-3 Sixteen-point Output Units (2-tier Terminal Block with Relay Outputs)

Common Specifications

Item	Specification
Communications power supply voltage	14 to 26.4 VDC
Noise immunity	Conforms to IEC 61000-4-4 2 kV (power line)
Vibration resistance	10 to 55 Hz with double-amplitude of 0.7 mm
Shock resistance	100 m/s^2 (3 times in 6 directions on 3 axes)
Dielectric strength	500 VAC (between isolated circuits)
Insulation resistance	20 MΩ min. (between isolated circuits)
Ambient operating temperature	–10 to 55°C
Ambient operating humidity	25% to 85% (with no condensation)
Ambient operating atmosphere	No corrosive gases
Storage temperature	–25 to 65°C
Storage humidity	25% to 85% (with no condensation)
Terminal block screws tightening torque	M3 wiring screws: 0.5 N·m M3 mounting screws: 0.5 N·m

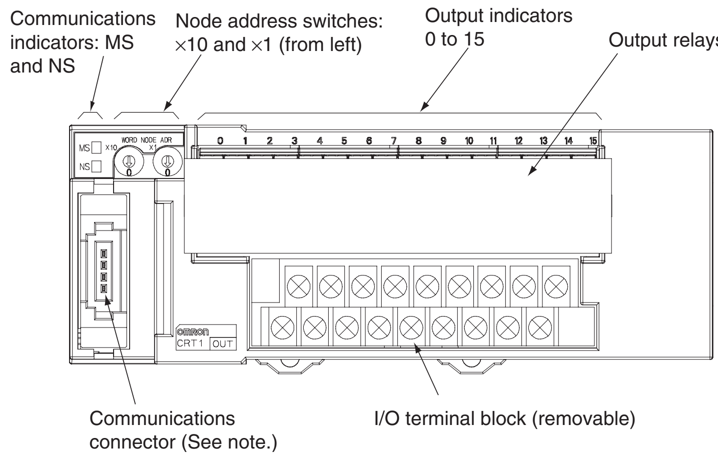
Relay Output Section Specifications (per Output)

Item	Specification
Model	CRT1-ROS16
I/O capacity	16 outputs
Mounted Relays	DRTA-NY5W-K (5 VDC)
Rated load	Resistive load 250 VAC, 2 A, common: 8 A 30 VDC, 2 A, common: 8 A
Rated ON current	3 A
Maximum contact voltage	250 VAC, 125 VDC
Maximum contact current	3 A
Maximum switching capacity	750 VA AC, 90 W DC
Minimum applicable load (reference value)	5 VDC, 1 mA
Mechanical service life	20,000,000 operations min.
Electrical service life	100,000 operations min.
Installation method	DIN Track
Communications power supply current consumption	155 mA max. for 24-VDC power supply voltage 255 mA max. for 14-VDC power supply voltage
Output hold for communications errors	Hold or clear can be selected. (CompoNet Support Software)
Weight	260 g max.

Note (1) When 2 to 3 A (8 to 10 A per common) is flowing, either do not turn ON more than 4 at the same time or operate at an ambient temperature of 45°C or less. There are no restrictions if 2 A or less is flowing (8 A or less per common).

(2) The rated current is the value for assuring normal operation, and not for assuring durability of the relays. The relay service life depends greatly on factors such as the operating temperature, the type of load, and switching conditions. The actual equipment must be checked under actual operating conditions.

Component Names and Functions



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

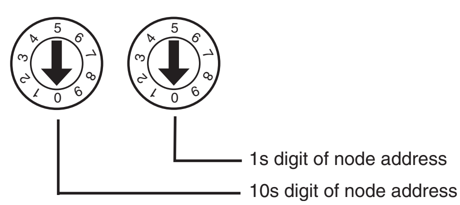
The meanings of the output indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

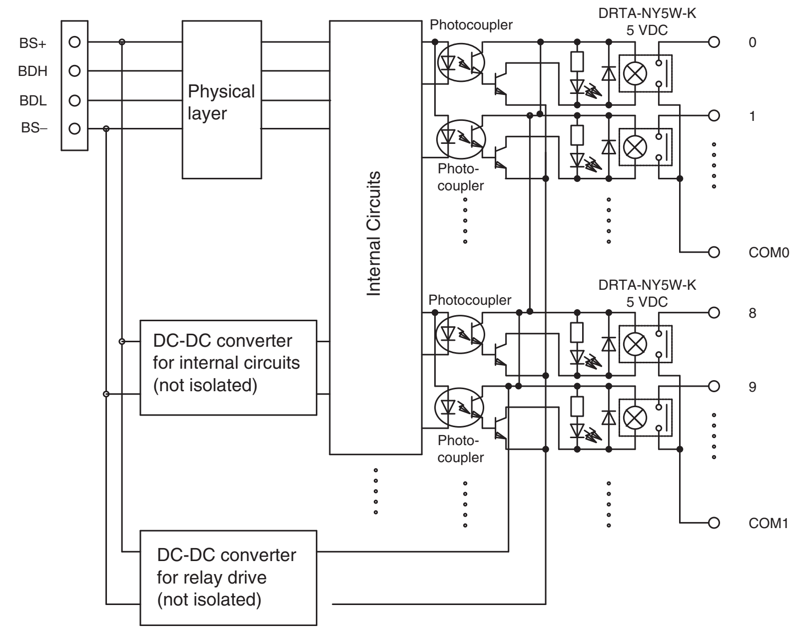
Setting the Node Address

The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

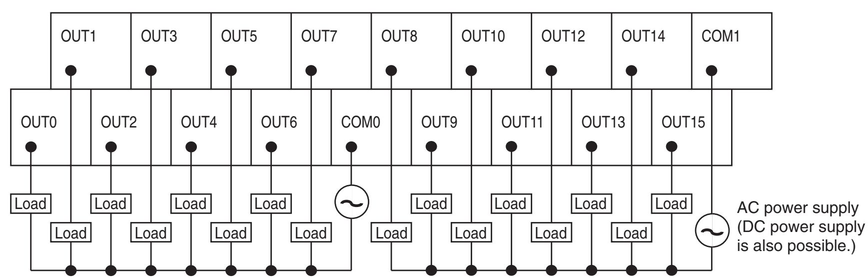
The setting on the rotary switches is read when power is turned ON.



Internal Circuits

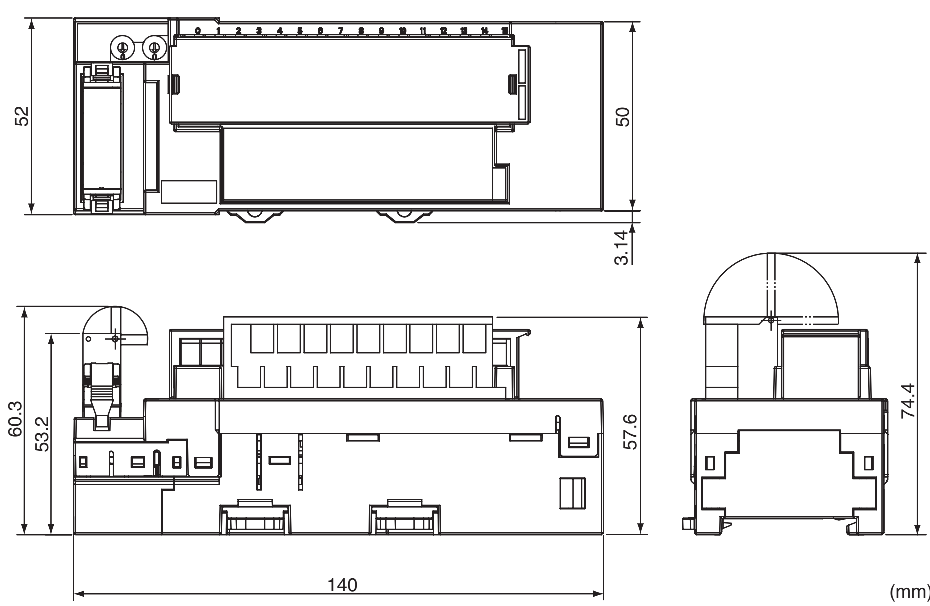


Wiring



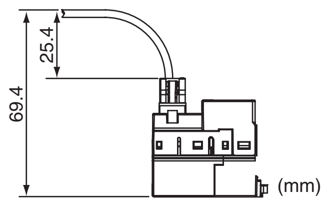
Dimensions

When a DCN4-TB4 Open Type Connector Is Mounted

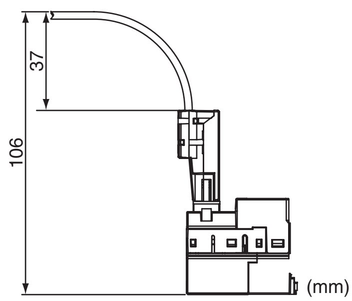


Communications Cable Dimensions when Connector and Cable Are Connected

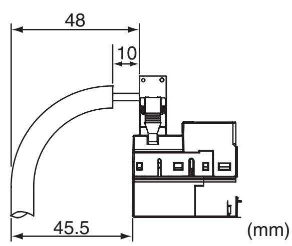
■ When a DCN4-BR4 Standard Flat Connector Plug Is Mounted



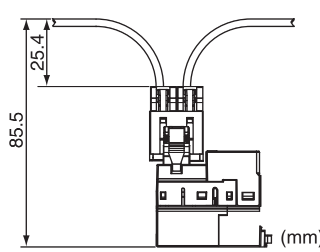
■ When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted



■ When a DCN4-TB4 Open Type Connector Is Mounted

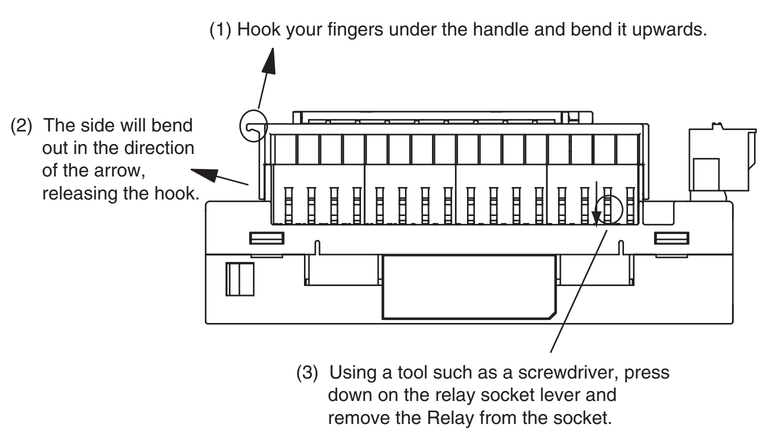


■ When a DCN4-MD4 Multidrop Connector Is Mounted



Replacing Relays

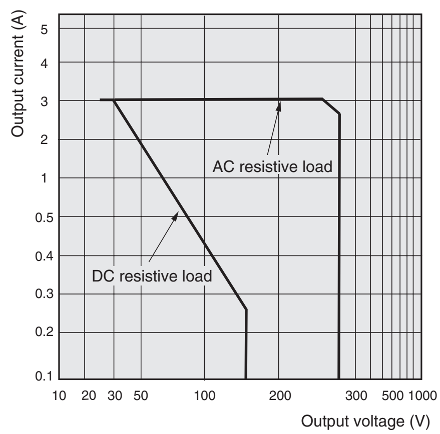
To replace output relays, first remove the cover using the following procedure.



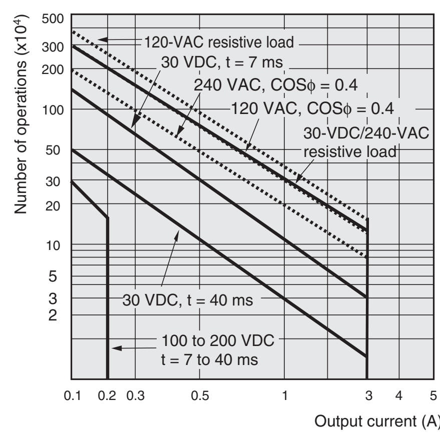
Reference Data

The following reference data shows actual measured data from sampling in a production line. There is some variation in relay characteristics, so use this data for reference only.

Maximum Switching Capacity



Durability Curve



5-3-4 Sixteen-point Output Units (2-tier Terminal Block with SSR Outputs)

Common Specifications

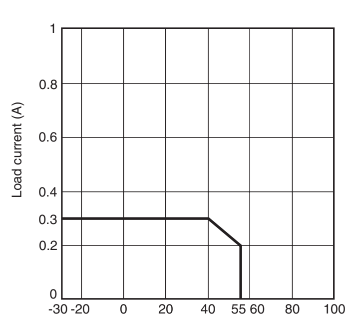
Item	Specification
Communications power supply voltage	14 to 26.4 VDC
Noise immunity	Conforms to IEC 61000-4-4 2 kV (power line)
Vibration resistance	10 to 60 Hz with double-amplitude of 0.7 mm, 60 to 150 Hz and 50 m/s^2 in X, Y, and Z directions for 80 min each
Shock resistance	150 m/s^2 (3 times in 6 directions on 3 axes)
Dielectric strength	500 VAC (between isolated circuits)
Insulation resistance	20 MΩ min. (between isolated circuits)
Ambient operating temperature	–10 to 55°C
Ambient operating humidity	25% to 85% (with no condensation)
Ambient operating atmosphere	No corrosive gases
Storage temperature	–25 to 65°C
Storage humidity	25% to 85% (with no condensation)
Terminal block screws tightening torque	M3 wiring screws: 0.5 N·m M3 mounting screws: 0.5 N·m

SSR Output Section Specifications (per Output)

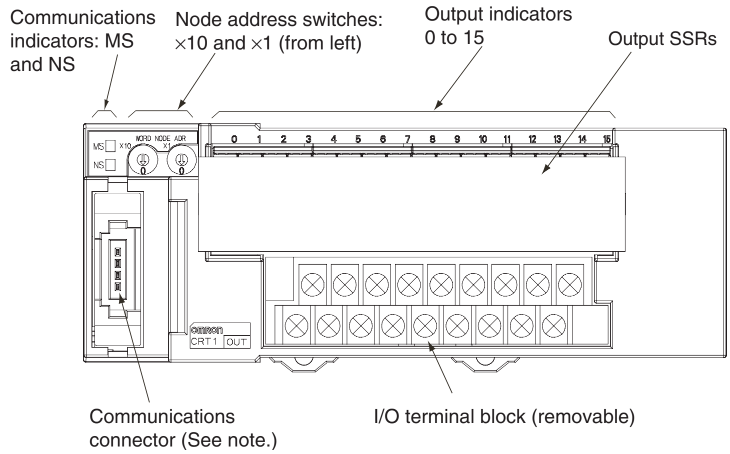
Item	Specification
Model	CRT1-ROF16
I/O capacity	16 outputs
Load voltage	24 to 265 VAC
Load current	0.3 A (See note.)
Inrush current resistivity	50 A (60 Hz)
Installation method	DIN Track
Communications power supply current consumption	85 mA max. for 24-VDC power supply voltage 130 mA max. for 14-VDC power supply voltage
Output hold for communications errors	Hold or clear can be selected. (CompoNet Support Software)
Weight	250 g max.

Note The SSRs cannot be replaced.

Load Current Vs. Ambient Temperature Characteristics



Component Names and Functions



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

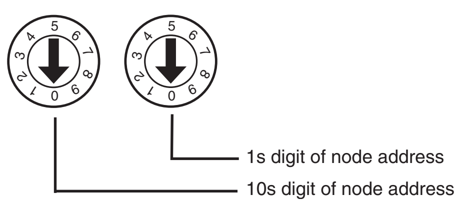
The meanings of the output indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

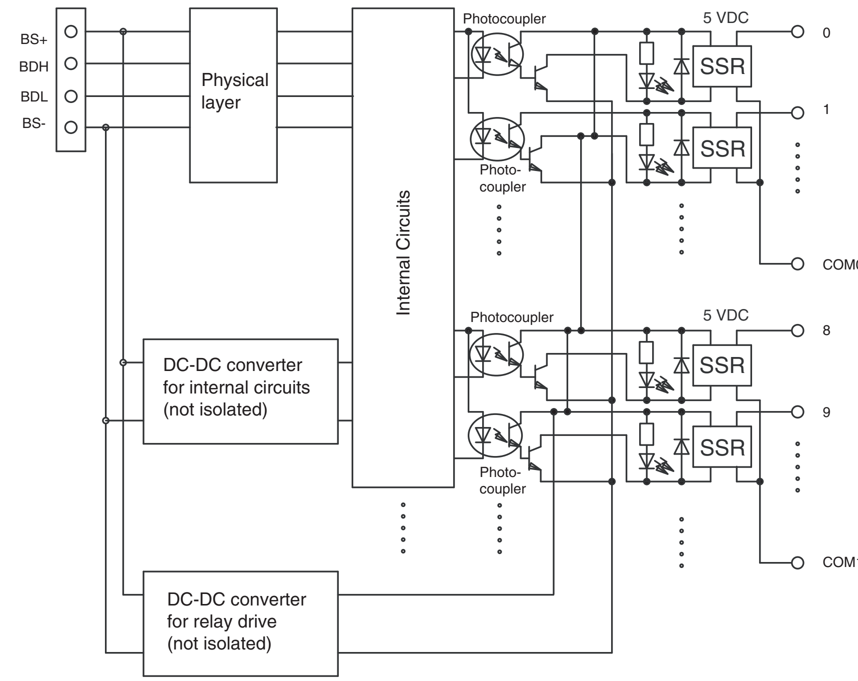
Setting the Node Address

The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

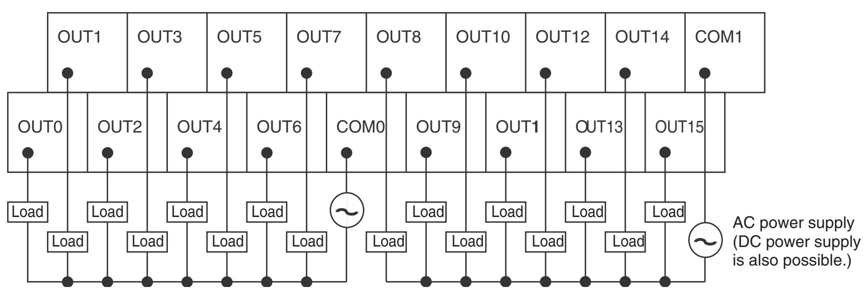
The setting on the rotary switches is read when power is turned ON.



Internal Circuits

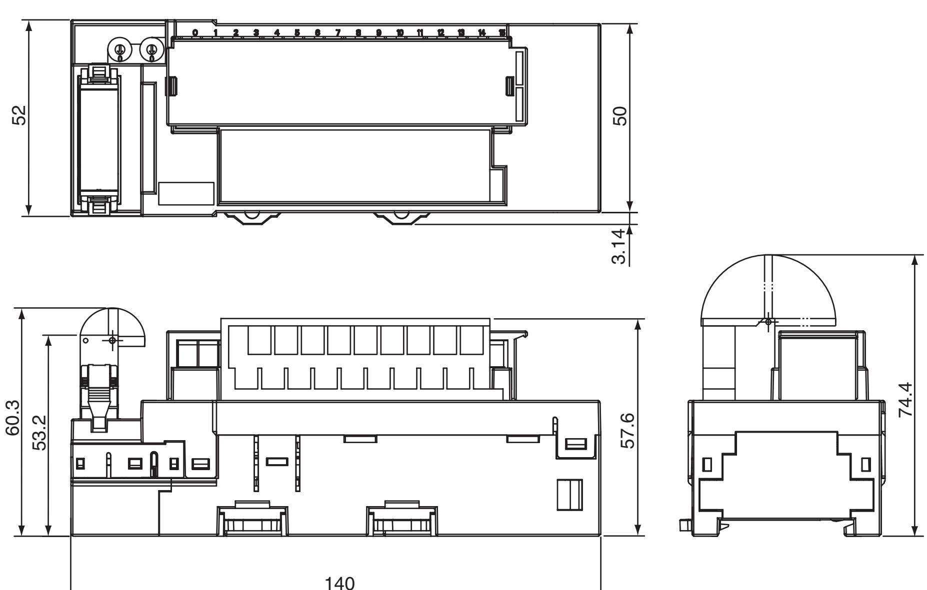


Wiring



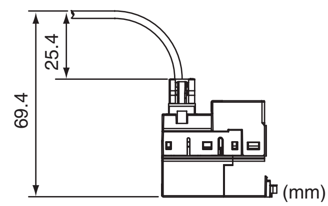
Dimensions

When a DCN4-TB4 Open Type Connector Is Mounted

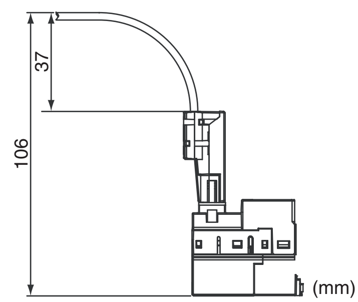


Communications Cable Dimensions when Connector and Cable Are Connected

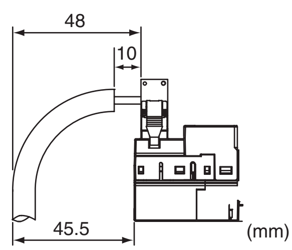
■ When a DCN4-BR4 Standard Flat Connector Plug Is Mounted



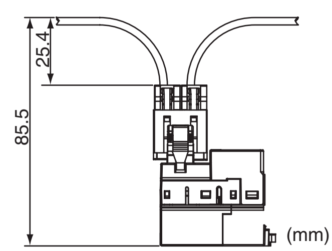
■ When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted



■ When a DCN4-TB4 Open Type Connector Is Mounted



■ When a DCN4-MD4 Multidrop Connector Is Mounted

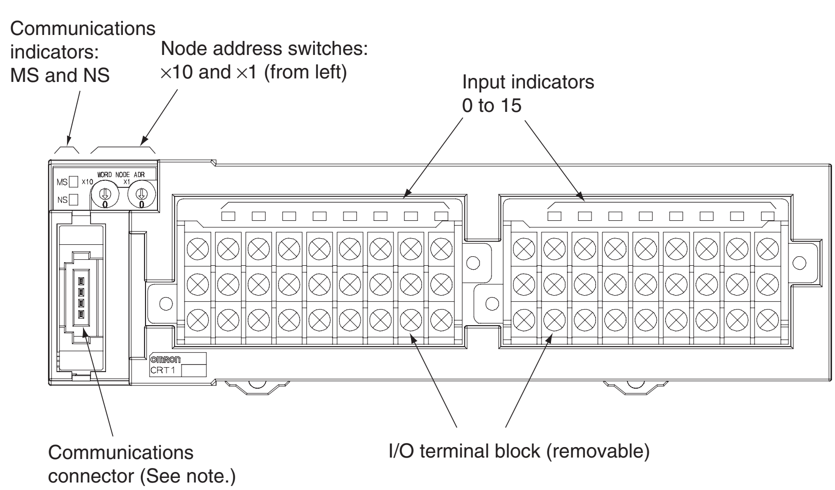


5-3-5 Sixteen-point Input Units (3-tier Terminal Block)

Input Section Specifications

Item	Specification	
Model	CRT1-ID16TA	CRT1-ID16TA-1
I/O capacity	16 inputs	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 17 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 inputs/common	
Isolation method	Photocoupler	
Input indicator	LED (yellow)	
Installation	DIN Track	
Power supply type	Multi-power supply	
Communications power supply current consumption	40 mA max. for 24-VDC power supply voltage 55 mA max. for 14-VDC power supply voltage	37 mA max. for 24-VDC power supply voltage 55 mA max. for 14-VDC power supply voltage
I/O power supply current consumption	3.6 mA max. for 24-VDC power supply voltage	3.5 mA max. for 24-VDC power supply voltage
Weight	330 g max.	

Component Names and Functions (Same for CRT1-ID16TA/CRT1-ID16TA-1)



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

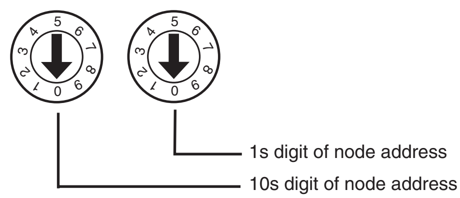
The meanings of the input indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.

Setting the Node Address

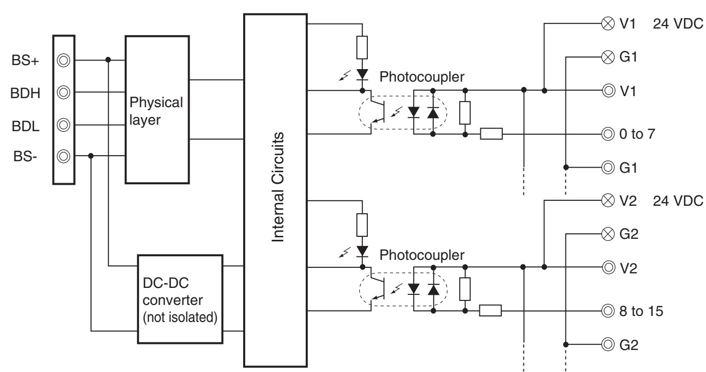
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

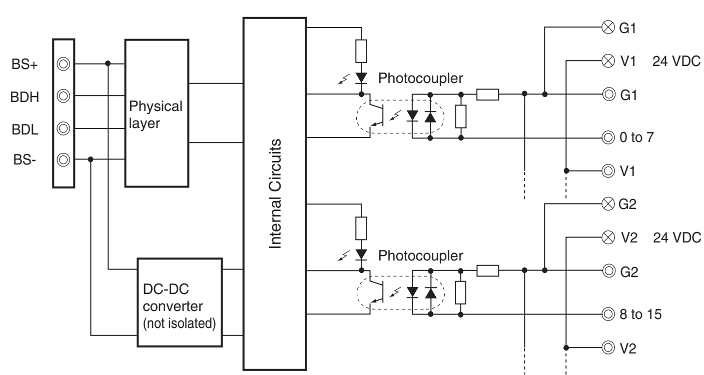


Internal Circuits

CRT1-ID16TA (NPN)

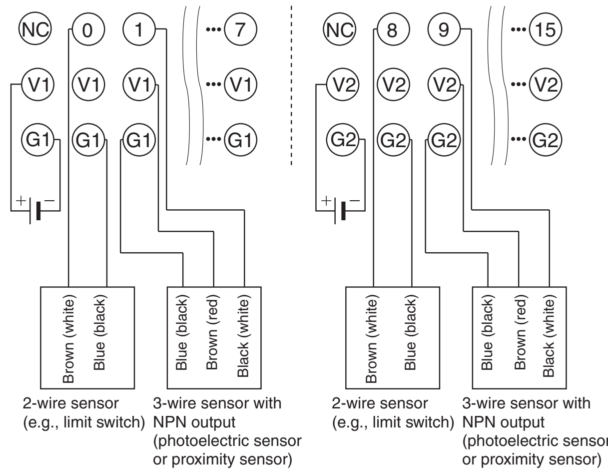


CRT1-ID16TA-1 (PNP)

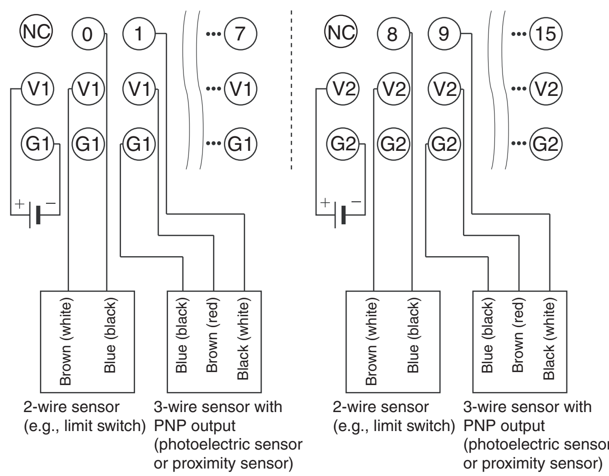


Wiring

CRT1-ID16TA (NPN)



CRT1-ID16TA-1 (PNP)



Note

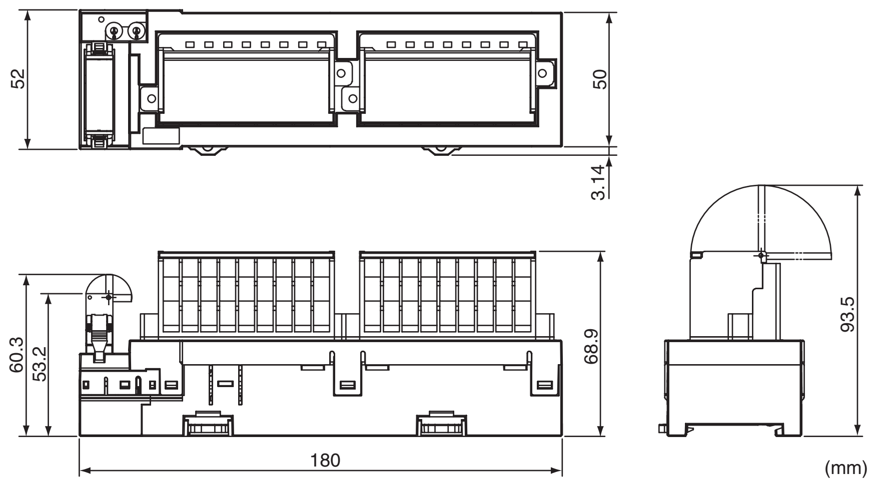
(1) The V1 and V2 terminals and the G1 and G2 terminals of the I/O power supply are not connected internally. Supply power separately for V1-G1 and V2-G2.

(2) Do not wire NC terminals.

(3) Wire colors have been changed according to the revised JIS standards for photoelectric and proximity sensors. The previous colors are shown in parentheses.

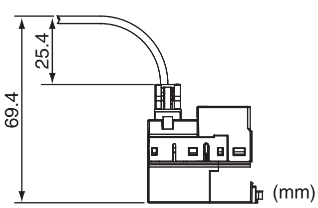
Dimensions (Same for CRT1-ID16TA/CRT1-ID16TA-1)

When a DCN4-TB4 Open Type Connector Is Mounted

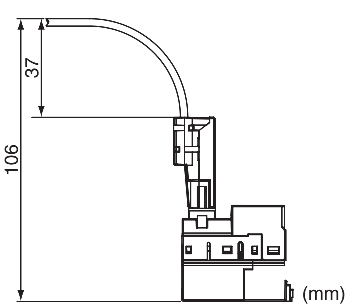


Communications Cable Dimensions when Connector and Cable Are Connected

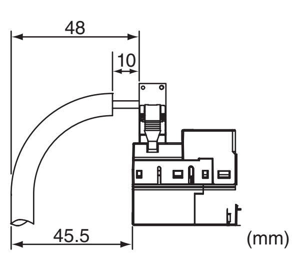
■ **When a DCN4-BR4 Standard Flat Connector Plug Is Mounted**



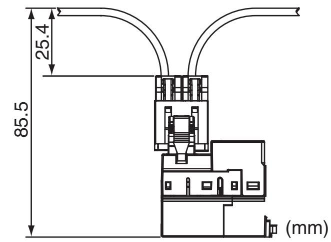
■ **When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted**



■ **When a DCN4-TB4 Open Type Connector Is Mounted**



■ **When a DCN4-MD4 Multidrop Connector Is Mounted**

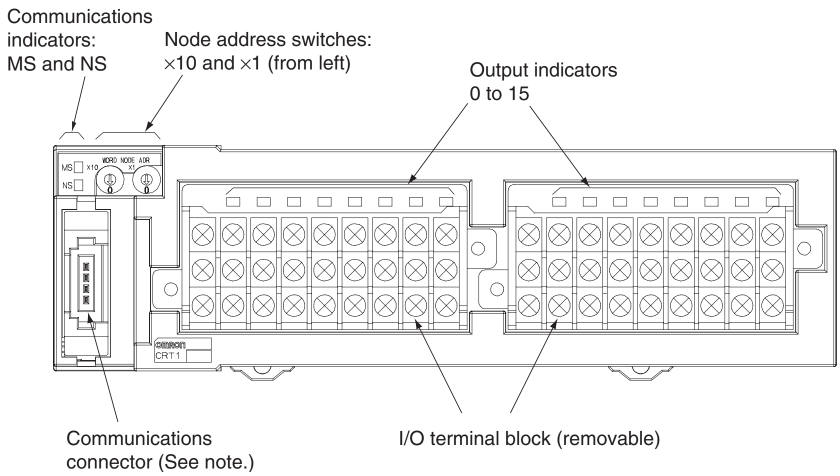


5-3-6 Sixteen-point Output Units (3-tier Terminal Block)

Output Section Specifications

Item	Specification	
Model	CRT1-OD16TA	CRT1-OD16TA-1
I/O capacity	16 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.5 A/output, 2 A/common	
Residual voltage	1.2 V max.(0.5 A DC, between each output terminal and the G terminal)	1.2 V max.(0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 outputs/common	
Isolation method	Photocoupler	
Output indicators	LED (yellow)	
Installation	DIN Track	
Power supply type	Multi-power supply	
Communications power supply current consumption	45 mA max. for 24-VDC power supply voltage 65 mA max. for 14-VDC power supply voltage	
I/O power supply current consumption	12 mA max. for 24-VDC power supply voltage	
Output handling for communications errors	Select either hold or clear from CompoNet Support Software.	
Weight	330 g max.	

Component Names and Functions (Same for CRT1-OD16TA/CRT1-OD16TA-1)



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

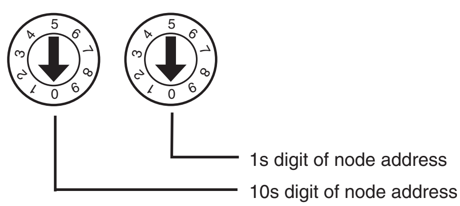
The meanings of the output indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

Setting the Node Address

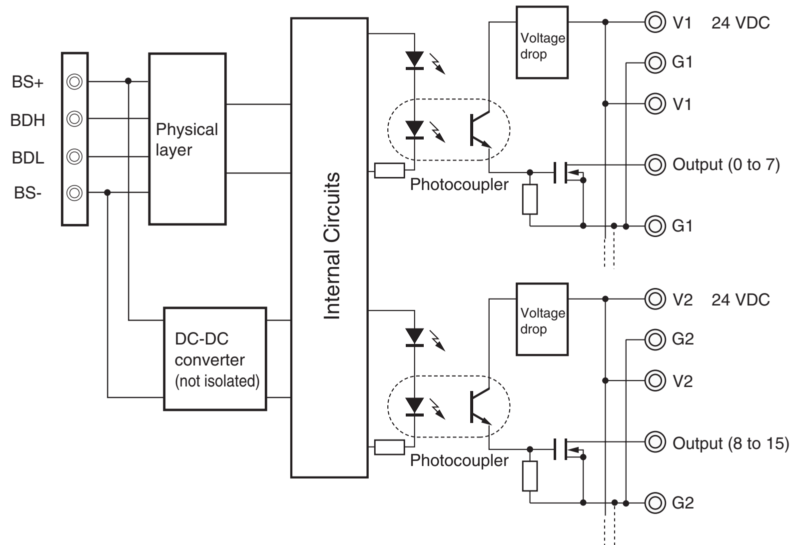
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

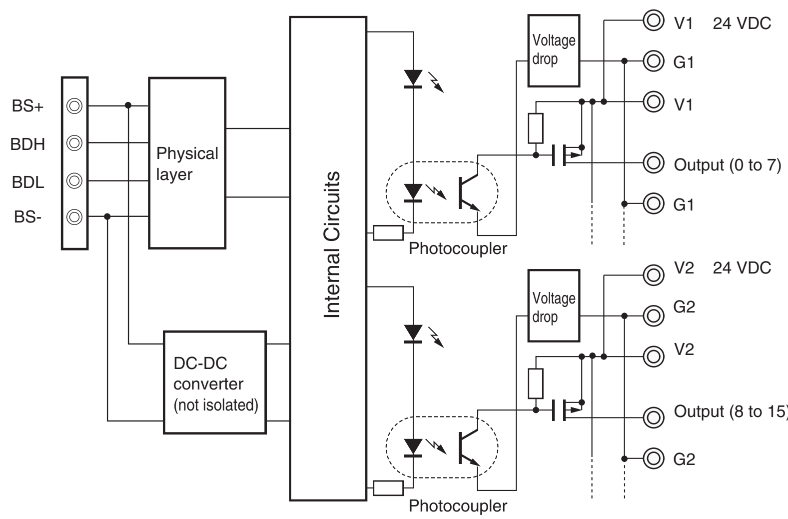


Internal Circuits

CRT1-OD16TA (NPN)

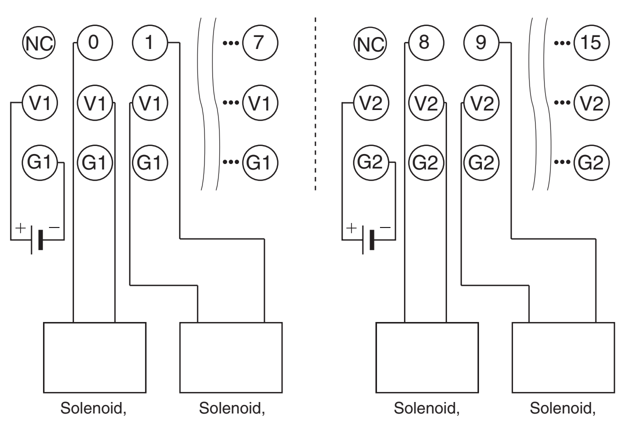


CRT1-OD16TA-1 (PNP)

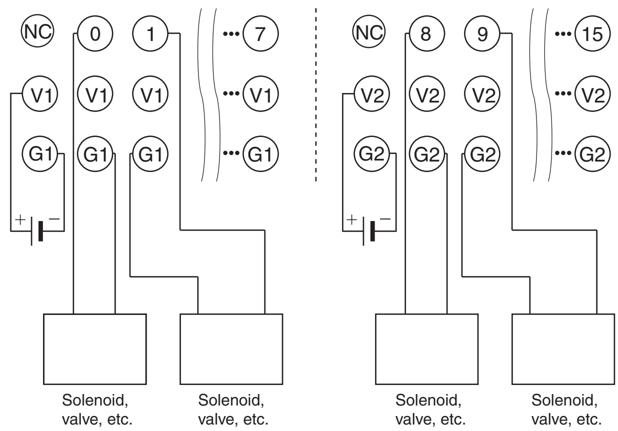


Wiring

CRT1-OD16TA (NPN)



CRT1-OD16TA-1 (PNP)



Note

(1) The V1 and V2 terminals and the G1 and G2 terminals of the I/O power supply are not connected internally. Supply power separately for V1-G1 and V2-G2.

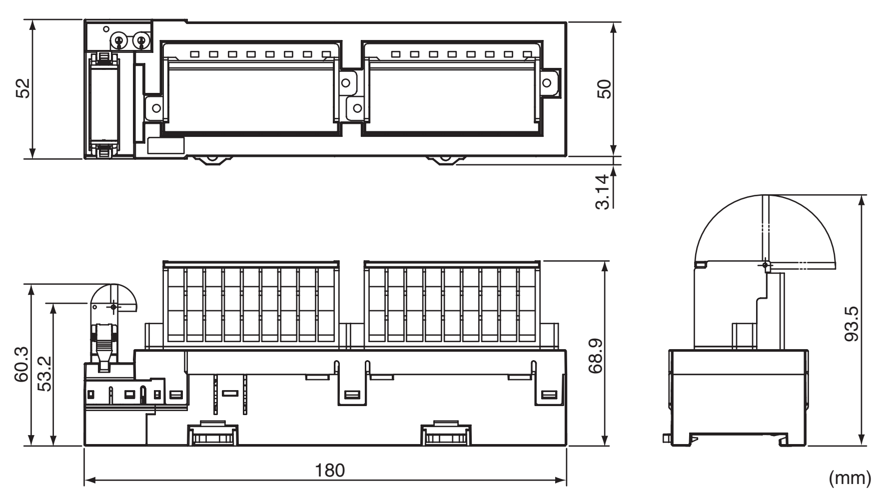
(2) Use a maximum current of 500 mA for each V1, V2, G1, and G2 terminal aside from the I/O power supply terminals.

(3) When using an inductive load, such as a solenoid valve, either use a built-in diode to absorb the counterelectromotive force or install an external diode.

(4) Do not wire NC terminals.

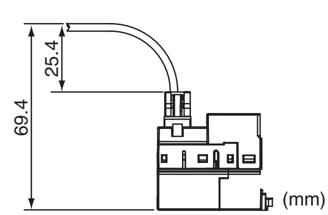
Dimensions (Same for CRT1-OD16TA/CRT1-OD16TA-1)

When a DCN4-TB4 Open Type Connector Is Mounted

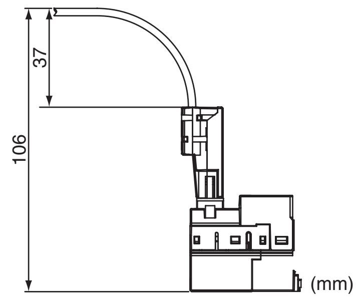


Communications Cable Dimensions when Connector and Cable Are Connected

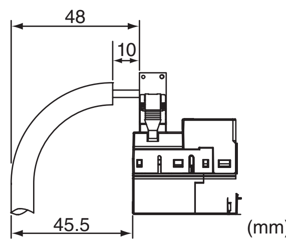
■ **When a DCN4-BR4 Standard Flat Connector Plug Is Mounted**



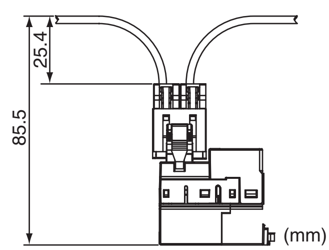
■ When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted



■ When a DCN4-TB4 Open Type Connector Is Mounted



■ When a DCN4-MD4 Multidrop Connector Is Mounted



5-3-7 Eight-point Input and 8-point Output Units (3-tier Terminal Block)

Common Specifications

Item	Specification
Installation	DIN Track
Communications power supply current consumption	40 mA max. for 24-VDC power supply voltage 60 mA max. for 14-VDC power supply voltage
Weight	330 g max.

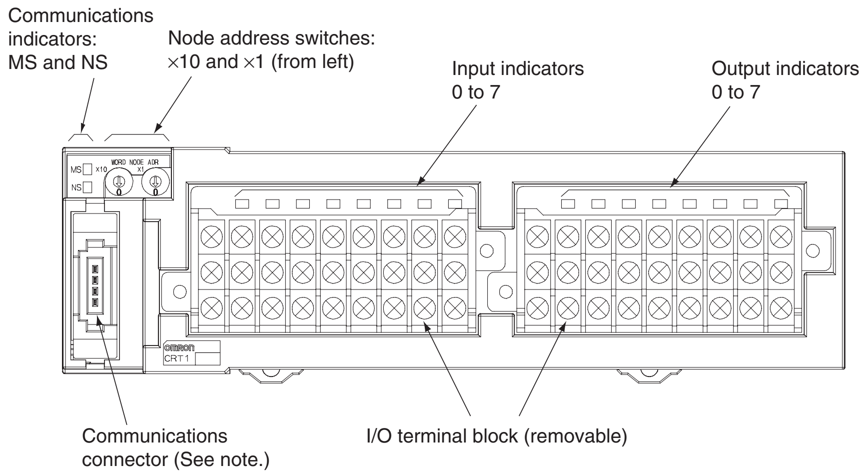
Input Section Specifications

Item	Specification	
Model	CRT1-MD16TA	CRT1-MD16TA-1
I/O capacity	8 inputs	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 17 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 inputs/common	
Isolation method	Photocoupler	
Input indicator	LED (yellow)	
Power supply type	Multi-power supply	
I/O power supply current consumption	3.5 mA max. for 24-VDC power supply voltage	

Output Section Specifications

Item	Specification	
Model	CRT1-MD16TA	CRT1-MD16TA-1
I/O capacity	8 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.5 A/output, 2A/common	
Residual voltage	1.2 V max.(0.5 A DC, between each output terminal and the G terminal)	1.2 V max.(0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 outputs/common	
Isolation method	Photocoupler	
Output indicators	LED (yellow)	
I/O power supply current consumption	12 mA max. for 24-VDC power supply voltage	
Output handling for communications errors	Select either hold or clear from CompoNet Support Software.	

Component Names and Functions (Same for CRT1-MD16TA/CRT1-MD16TA-1)



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

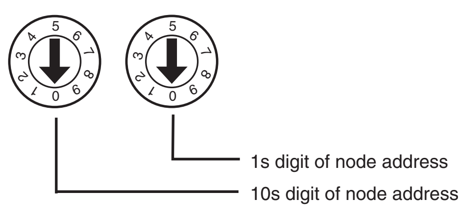
The meanings of the I/O indicators are given in the following table.

Name	LED status	I/O status	Meaning
IN0 to IN7 OUT0 to OUT7	Lit yellow.	Input or output ON	The input or output is ON.
	Not lit.	Input or output OFF	The input or output is OFF.

Setting the Node Address

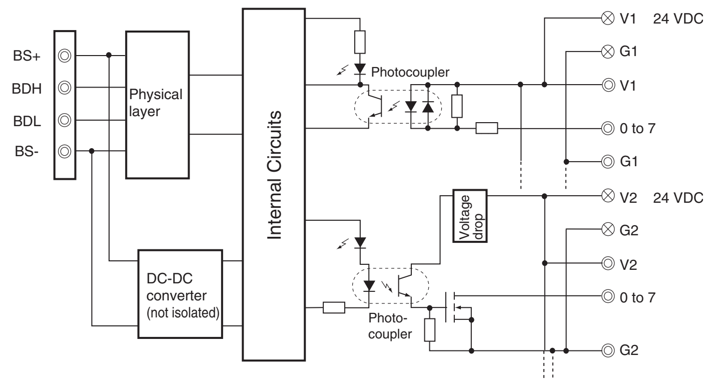
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

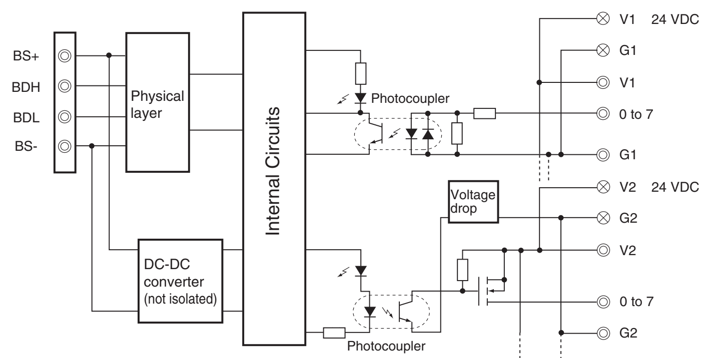


Internal Circuits

CRT1-MD16TA (NPN)

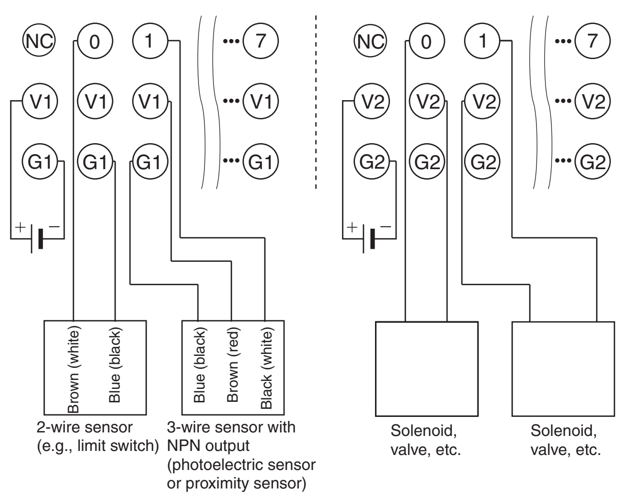


CRT1-MD16TA-1 (PNP)

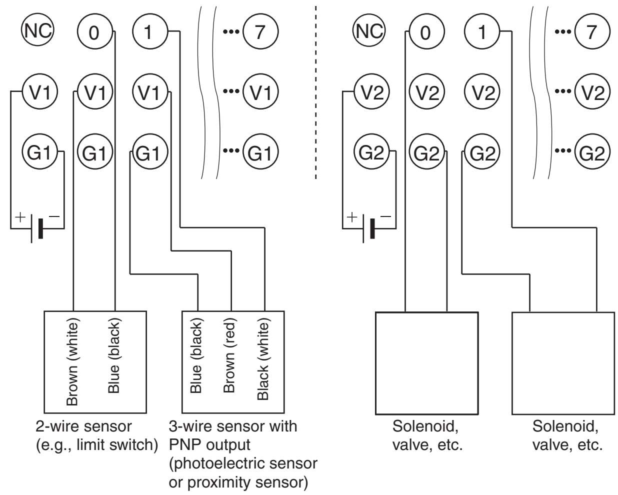


Wiring

CRT1-MD16TA (NPN)



CRT1-MD16TA-1 (PNP)



Note

(1) The V1 and V2 terminals and the G1 and G2 terminals of the I/O power supply are not connected internally. Supply power separately for V1-G1 and V2-G2.

(2) Use a maximum current of 500 mA for each V1, V2, G1, and G2 terminal aside from the I/O power supply terminals on the output side.
Supply power separately for V1-G1 and V2-G2.

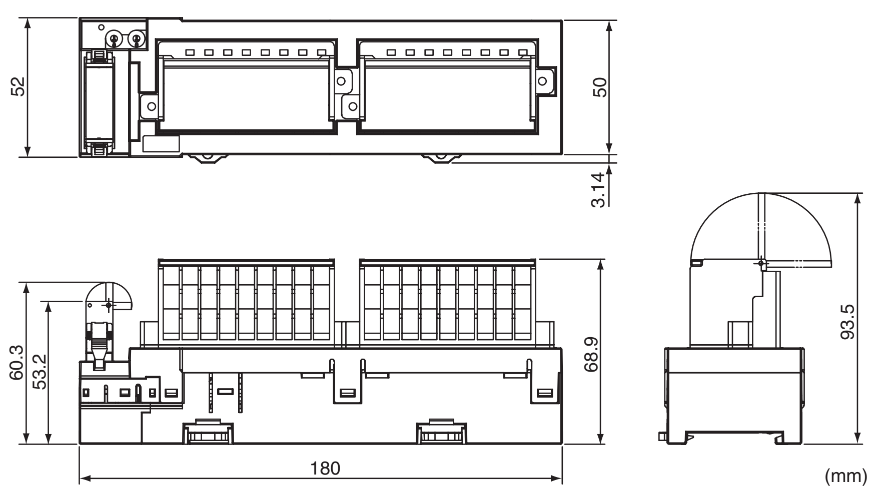
(3) When using an inductive load, such as a solenoid valve, either use a built-in diode to absorb the counterelectromotive force or install an external diode.

(4) Do not wire NC terminals.

(5) Wire colors have been changed according to the revised JIS standards for photoelectric and proximity sensors. The previous colors are shown in parentheses.

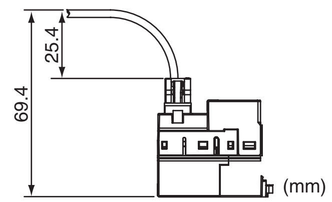
Dimensions (Same for CRT1-MD16TA/CRT1-MD16TA-1)

When a DCN4-TB4 Open Type Connector Is Mounted

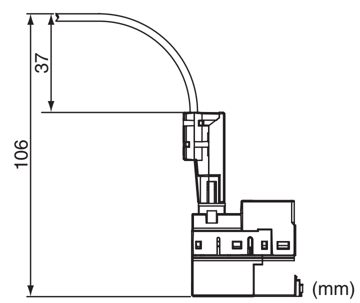


Communications Cable Dimensions when Connector and Cable Are Connected

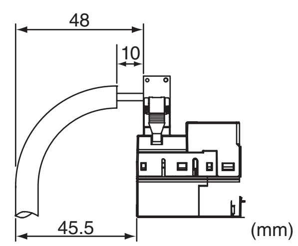
■ When a DCN4-BR4 Standard Flat Connector Plug Is Mounted



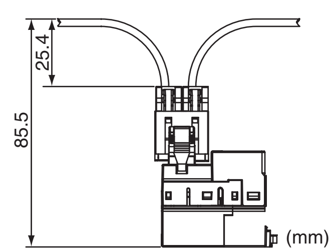
■ When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted



■ When a DCN4-TB4 Open Type Connector Is Mounted



■ When a DCN4-MD4 Multidrop Connector Is Mounted



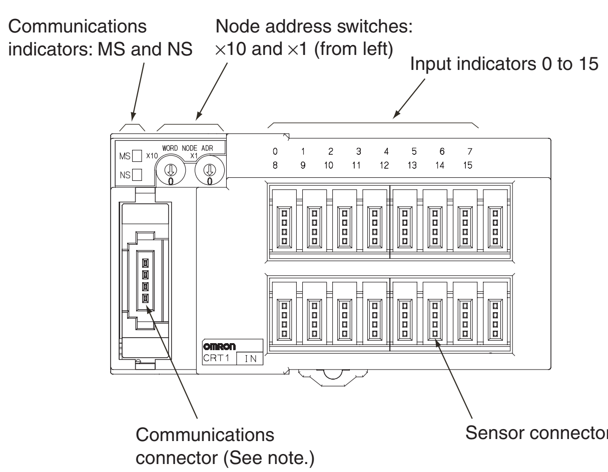
5-4 Units with Connectors

5-4-1 Sixteen-point Input Units

Input Section Specifications

Item	Specification	
Model	CRT1-ID16S	CRT1-ID16S-1
I/O capacity	16 inputs	
Internal I/O common	NPN	PNP
ON voltage	10.5 VDC min. (between each input terminal and the V terminal)	10.5 VDC min. (between each input terminal and the G terminal)
OFF current	1 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 11 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 inputs/common	
Isolation method	Photocoupler	
Input indicator	LED (yellow)	
Installation	DIN Track	
Power supply type	Network power supply	
Power short-circuit protection	Operates at 50 mA/pt. min.	
Current supplied to input devices	50 mA/input	
Communications power supply current consumption	110 mA max. for 24-VDC power supply voltage 125 mA max. for 14-VDC power supply voltage	110 mA max. for 24-VDC power supply voltage 120 mA max. for 14-VDC power supply voltage
Weight	110 g max.	

Component Names and Functions (Same for CRT1-ID16S and CRT1-ID16S-1)



Note A Flat Connector Plug or DCN4-TB4 Open Type Connector can be connected to the communications connector.

Indicator Section

Communications Indicators Refer to *4-1-3 Communications Indicators*.

I/O Indicators

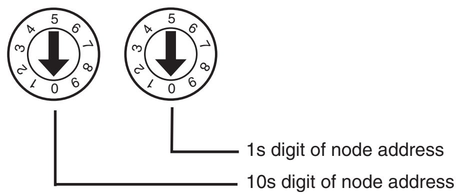
The meanings of the input indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.

Setting the Node Address

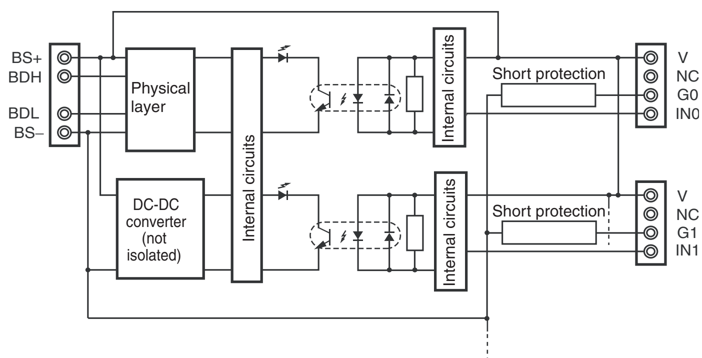
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

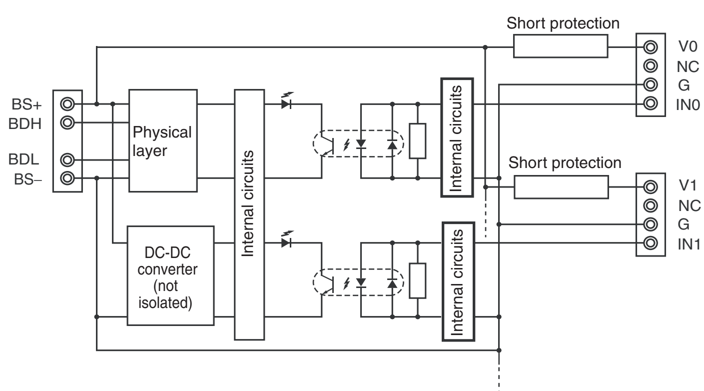


Internal Circuits

CRT1-ID16S (NPN)

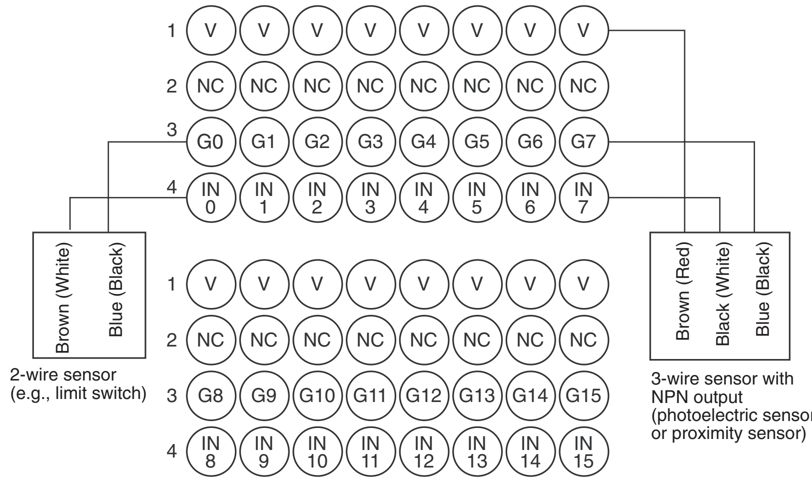


CRT1-ID16S-1 (PNP)

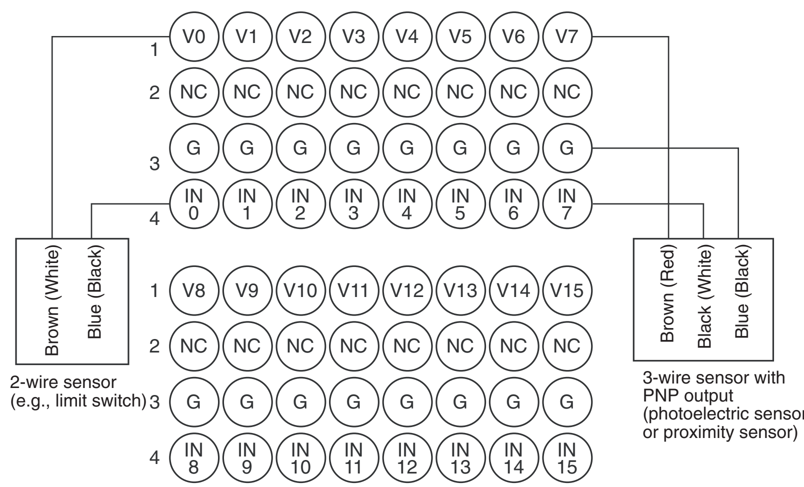


Wiring

CRT1-ID16S (NPN)



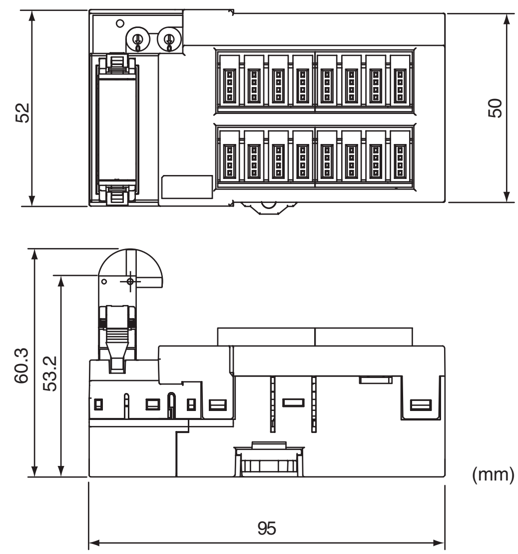
CRT1-ID16S-1 (PNP)



Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

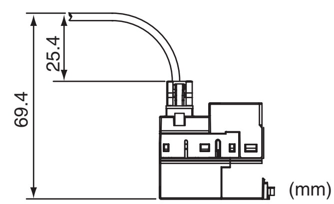
Dimensions (Same for CRT1-ID16S and CRT1-ID16S-1)

When a DCN4-TB4 Open Type Connector Is Mounted

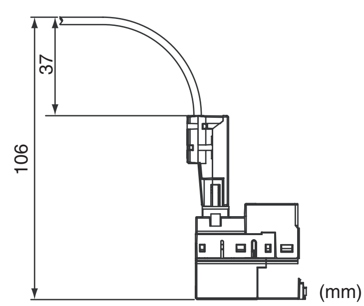


Communications Connector Dimensions Including the Connector and Cable

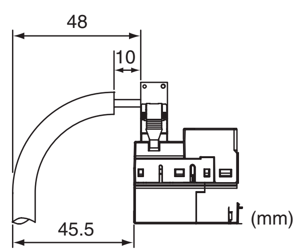
■ When a DCN4-BR4 Standard Flat Connector Plug Is Mounted



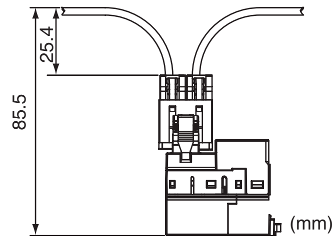
■ When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted



■ When a DCN4-TB4 Open Type Connector Is Mounted



■ When a DCN4-MD4 Multidrop Connector Is Mounted

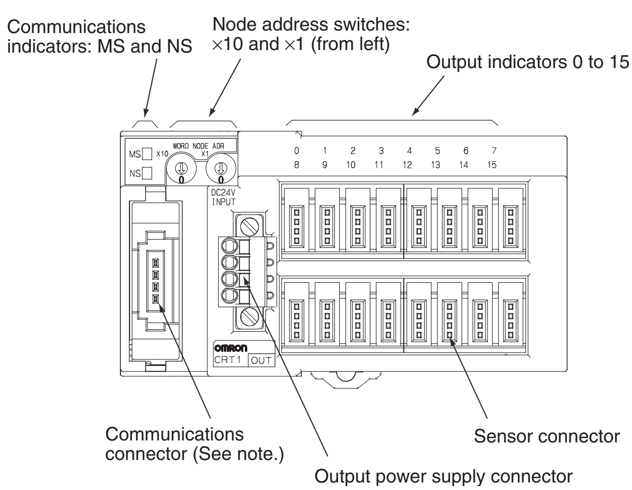


5-4-2 Sixteen-point Output Units

Output Section Specifications

Item	Specification	
Model	CRT1-OD16S	CRT1-OD16S-1
I/O capacity	16 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.5 A/output, 4 A/common	
Residual voltage	1.2 V max.(0.5 A DC, between each output terminal and the G terminal)	1.2 V max.(0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 outputs/common	
Isolation method	Photocoupler	
Output indicators	LED (yellow)	
Installation	DIN Track	
Power supply type	Multi-power supply	
Current supplied to output devices	100 mA/output	
Communications power supply current consumption	38 mA max. for 24-VDC power supply voltage 60 mA max. for 14-VDC power supply voltage	39 mA max. for 24-VDC power supply voltage 60 mA max. for 14-VDC power supply voltage
I/O power supply current consumption	20 mA max. for 24-VDC power supply voltage	20 mA max. for 24-VDC power supply voltage
Output handling for communications errors	Select either hold or clear from CompoNet Support Software.	
Weight	110 g max.	

Component Names and Functions (Same for CRT1-OD16S and CRT1-OD16S-1)



Note A Flat Connector Plug or DCN4-TB4 Open Type Connector can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

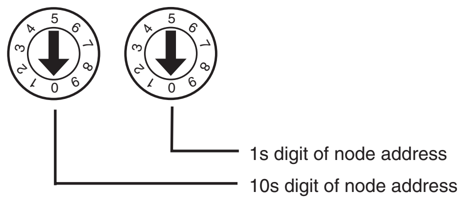
The meanings of the output indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

Setting the Node Address

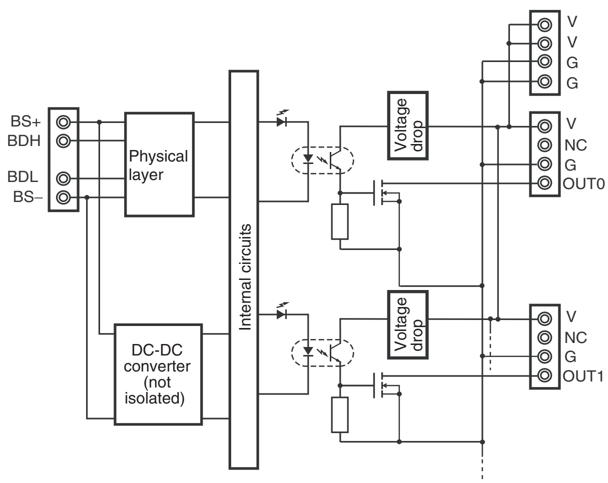
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

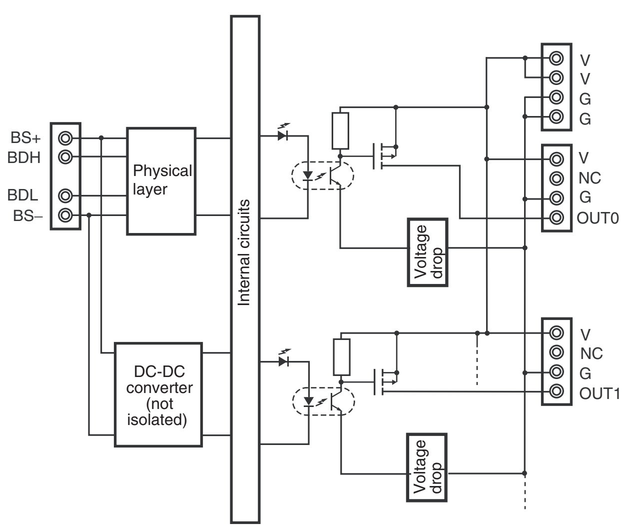


Internal Circuits

CRT1-OD16S (NPN)

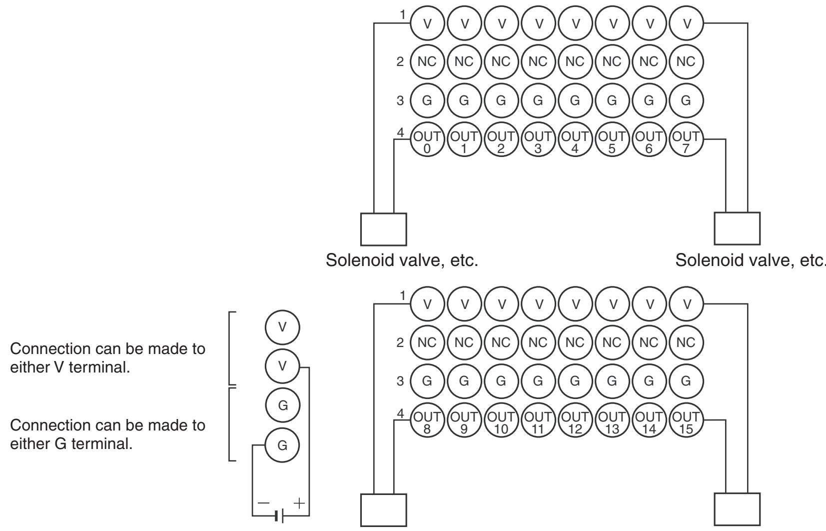


CRT1-OD16S-1 (PNP)

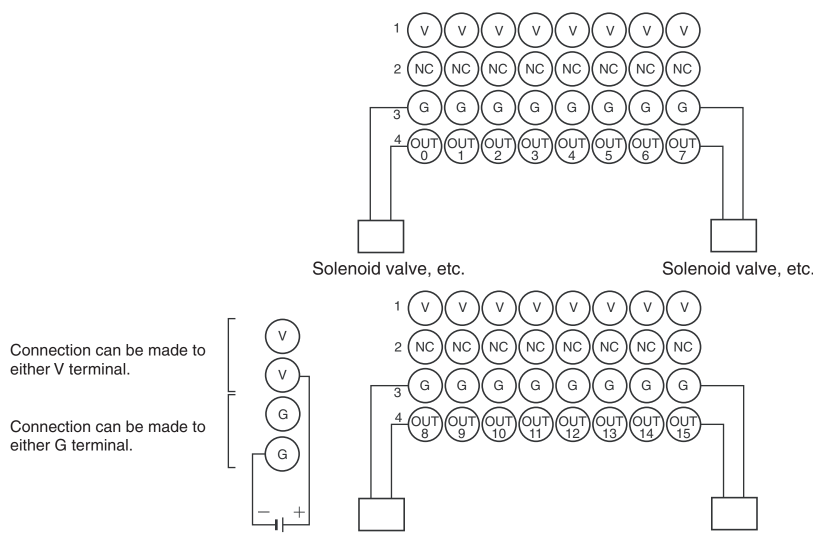


Wiring

CRT1-OD16S (NPN)



CRT1-OD16S-1 (PNP)



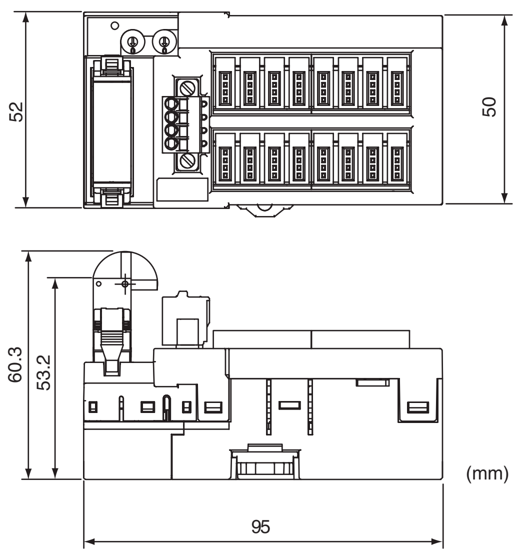
Note

(1) When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

(2) Two V terminals and two G terminals are provided for use as I/O power supply terminals. One set of terminals is used for the power supply for the Unit, and the other set is used for the supply power to the next Unit. Use a maximum current of 4 A per terminal.

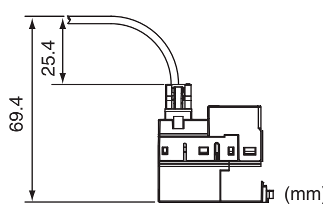
Dimensions (Same for CRT1-OD16S and CRT1-OD16S-1)

When a DCN4-TB4 Open Type Connector Is Mounted

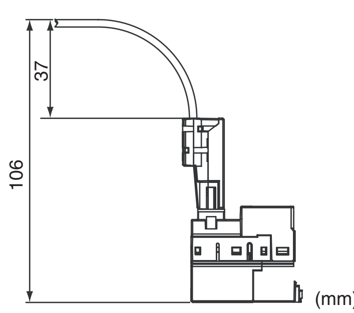


Communications Connector Dimensions Including the Connector and Cable

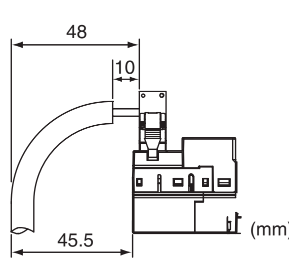
■ **When a DCN4-BR4 Standard Flat Connector Plug Is Mounted**



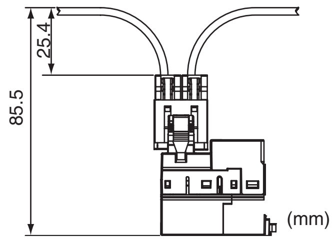
■ **When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted**



■ **When a DCN4-TB4 Open Type Connector Is Mounted**



■ **When a DCN4-MD4 Multidrop Connector Is Mounted**



5-4-3 Eight-point Input and 8-point Output Units

Common Specifications

Item	Specification	
Installation	DIN Track	
Communications power supply current consumption	75 mA max. for 24-VDC power supply voltage 95 mA max. for 14-VDC power supply voltage	75 mA max. for 24-VDC power supply voltage 95 mA max. for 14-VDC power supply voltage
Weight	120 g max.	

Input Section Specifications

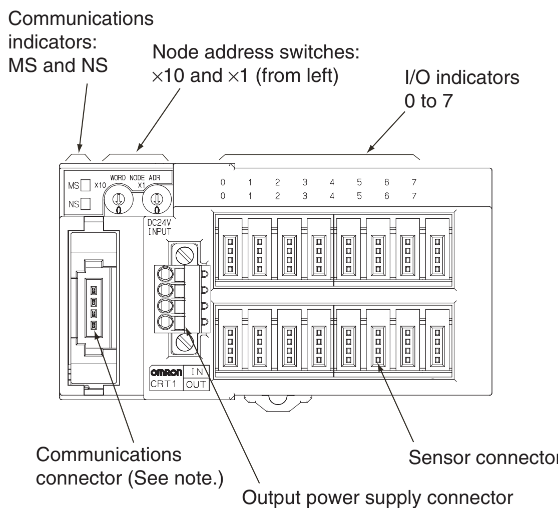
Item	Specification	
Model	CRT1-MD16S	CRT1-MD16S-1
I/O capacity	8 inputs	
Internal I/O common	NPN	PNP
ON voltage	10.5 VDC min. (between each input terminal and the V terminal)	10.5 VDC min. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 11 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 inputs/common	
Isolation method	Photocoupler	
Input indicator	LED (yellow)	
Power supply type	Network power supply	
Power short-circuit protection	Operates at 50 mA/pt. min.	
Current supplied to input devices	50 mA/input	

Output Section Specifications

Item	Specification	
Model	CRT1-MD16S	CRT1-MD16S-1
I/O capacity	8 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.5 A/output, 2 A/common	
Residual voltage	1.2 V max.(0.5 A DC, between each output terminal and the G terminal)	1.2 V max.(0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 outputs/common	

Item	Specification
Isolation method	Photocoupler
Output indicators	LED (yellow)
Power supply type	Multi-power supply
Current supplied to output devices	100 mA/output
I/O power supply current consumption	12 mA max. for 24-VDC power supply voltage
Output handling for communications errors	Select either hold or clear from CompoNet Support Software.

Component Names and Functions (Same for CRT1-MD16S/CRT1-MD16S-1)



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

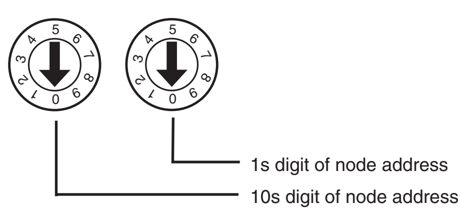
The meanings of the I/O indicators are given in the following table.

Name	LED status	I/O status	Meaning
IN0 to IN7 OUT0 to OUT7	Lit yellow.	Input or output ON	The input or output is ON.
	Not lit.	Input or output OFF	The input or output is OFF.

Setting the Node Address

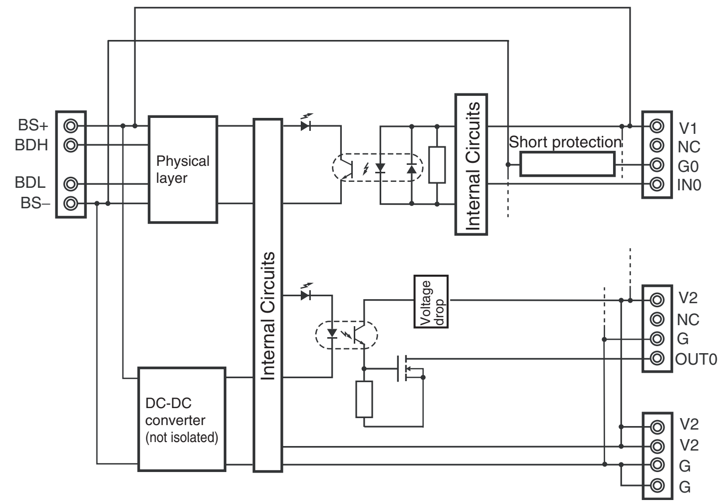
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

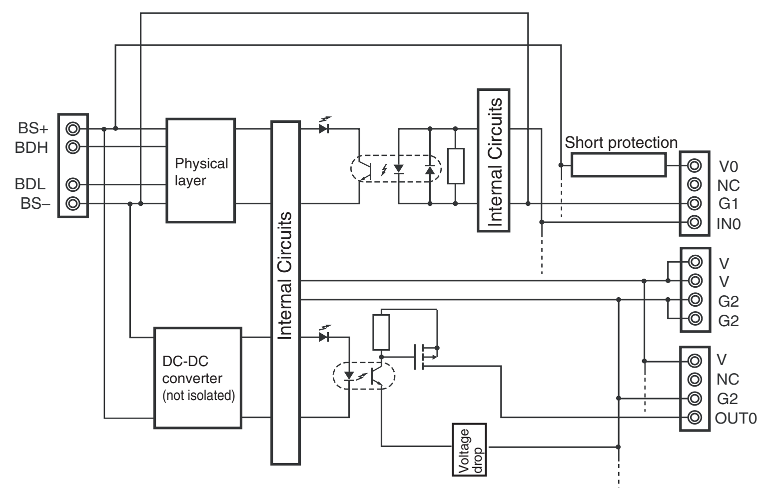


Internal Circuits

CRT1-MD16S (NPN)

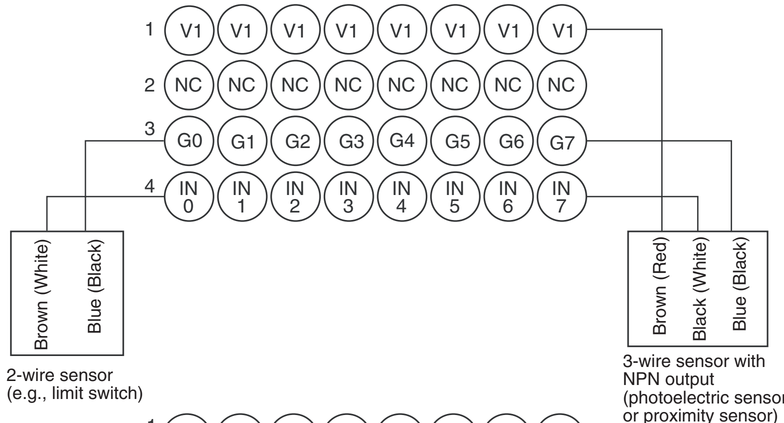


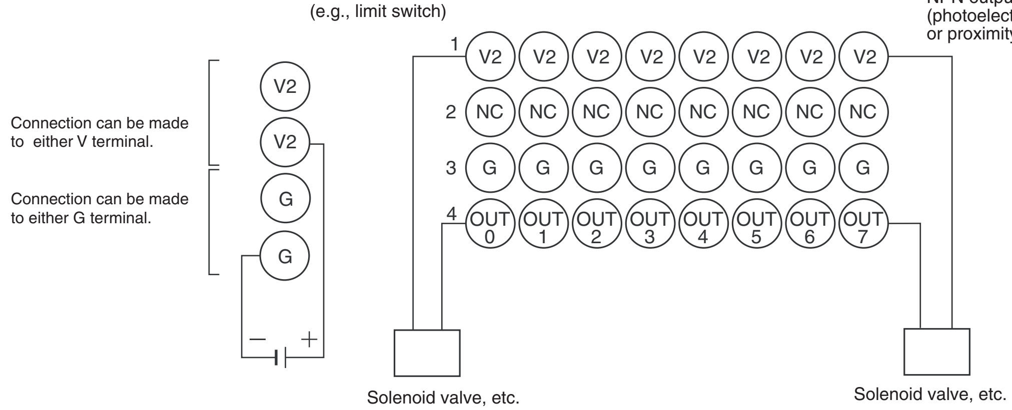
CRT1-MD16S-1 (PNP)



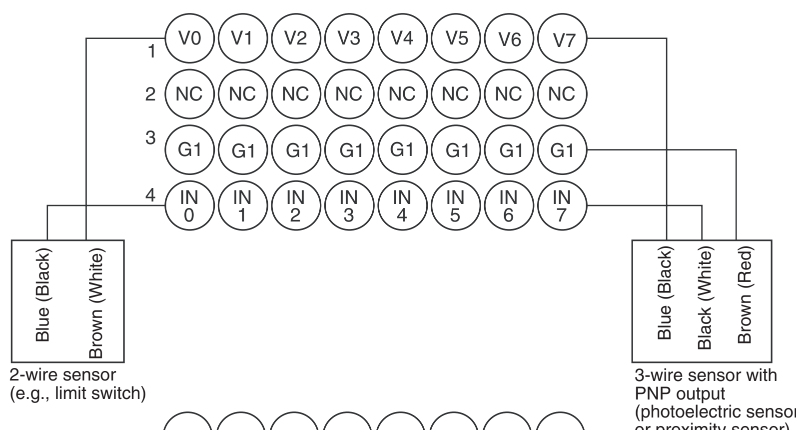
Wiring

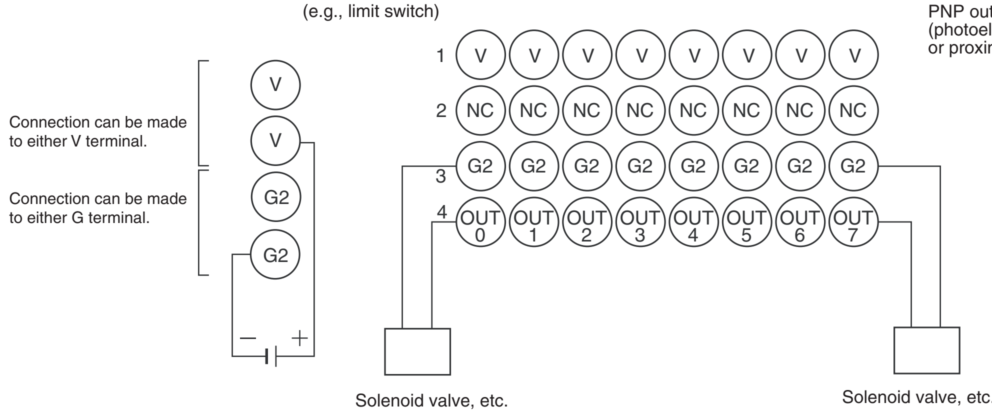
CRT1-MD16S (NPN)





CRT1-MD16S-1 (PNP)





Note

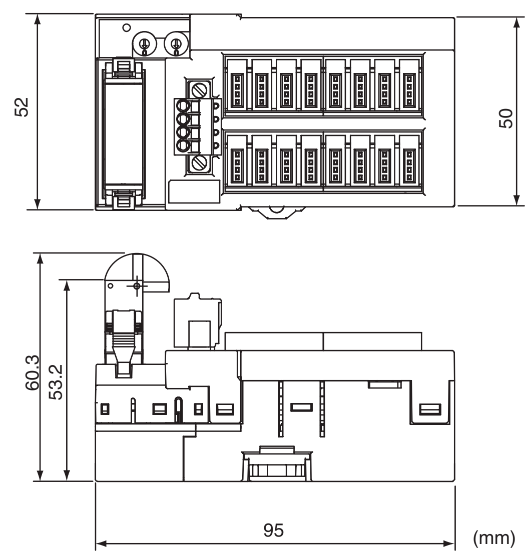
(1) When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

(2) Two V terminals and two G terminals are provided for use as I/O power supply terminals. One set of terminals is used for the power supply for the Unit, and the other set is used for the supply power to the next Unit. Use a maximum current of 4 A per terminal.

(3) Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

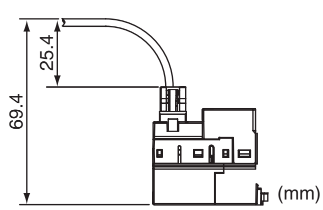
Dimensions (Same for CRT1-MD16S/CRT1-MD16S-1)

When a DCN4-TB4 Open Type Connector Is Mounted

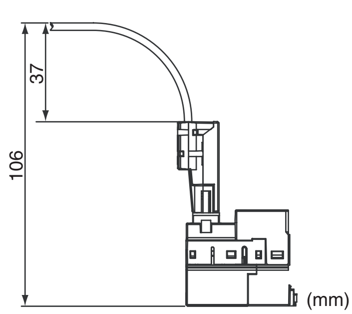


Communications Cable Dimensions when Connector and Cable Are Connected

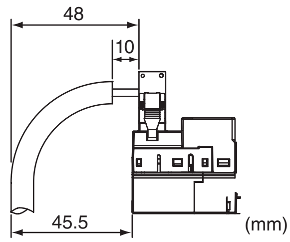
■ When a DCN4-BR4 Standard Flat Connector Plug Is Mounted



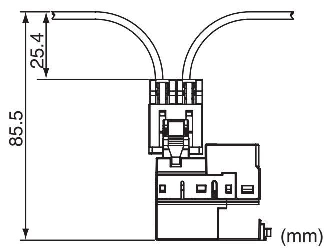
■ When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted



■ **When a DCN4-TB4 Open Type Connector Is Mounted**



■ **When a DCN4-MD4 Multidrop Connector Is Mounted**



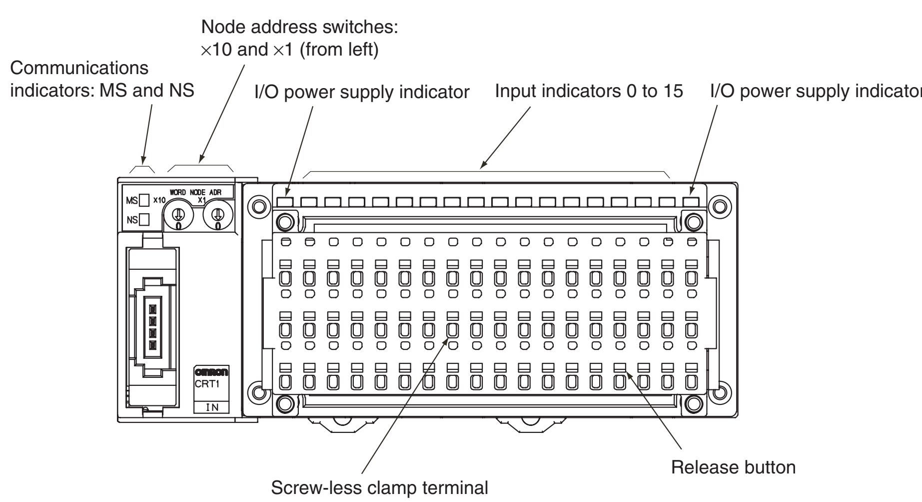
5-5 Units with Clamp Terminal Blocks

5-5-1 Sixteen-point Input Units

Input Section Specifications

Item	Specification	
Model	CRT1-ID16SL	CRT1-ID16SL-1
I/O capacity	16 inputs	
Internal I/O common	NPN	PNP
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 17 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 inputs/common	
Isolation method	Photocoupler	
Input indicator	LED (yellow)	
Installation	DIN Track	
Power supply type	Multi-power supply	
Current supplied to input devices	100 mA/input	
Communications power supply current consumption	34 mA max. for 24-VDC power supply voltage 55 mA max. for 14-VDC power supply voltage	34 mA max. for 24-VDC power supply voltage 55 mA max. for 14-VDC power supply voltage
I/O power supply current consumption	13 mA max. for 24-VDC power supply voltage	13 mA max. for 24-VDC power supply voltage
Weight	250 g max.	

Component Names and Functions (Same for CRT1-ID16SL and CRT1-ID16SL-1)



Note A Flat Connector Plug or DCN4-TB4 Open Type Connector can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

The meanings of the input indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.

I/O Power Supply Indicators

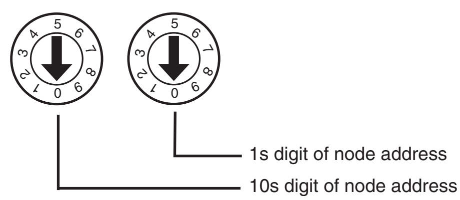
The meanings of the I/O power supply indicators are given in the following table.

Name	LED status	I/O status	Meaning
I/O	Lit green.	I/O power supply ON	The I/O power supply is ON.
	Not lit.	I/O power supply OFF	The I/O power supply is OFF.

Setting the Node Address

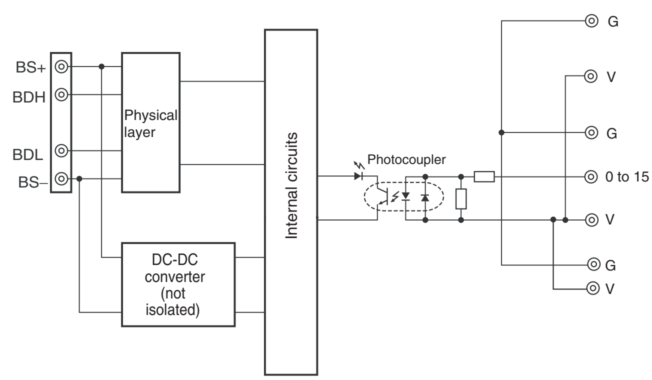
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

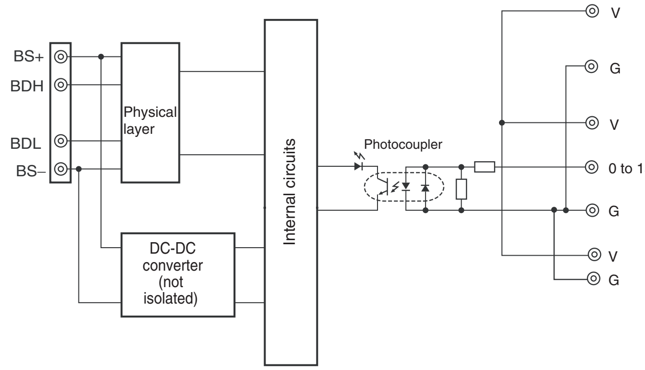


Internal Circuits

CRT1-ID16SL (NPN)

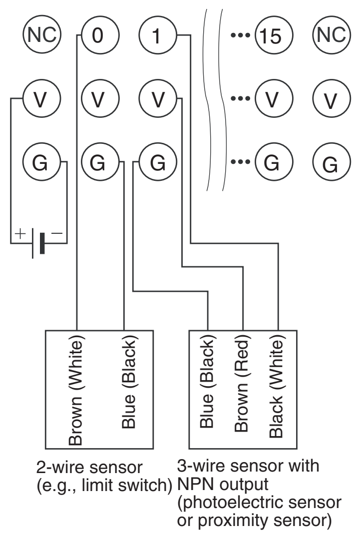


CRT1-ID16SL-1 (PNP)

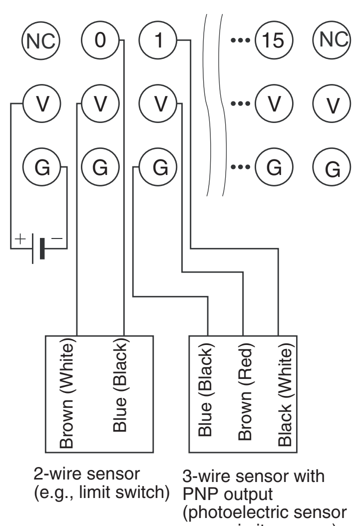


Wiring

CRT1-ID16SL (NPN)



CRT1-ID16SL-1 (PNP)



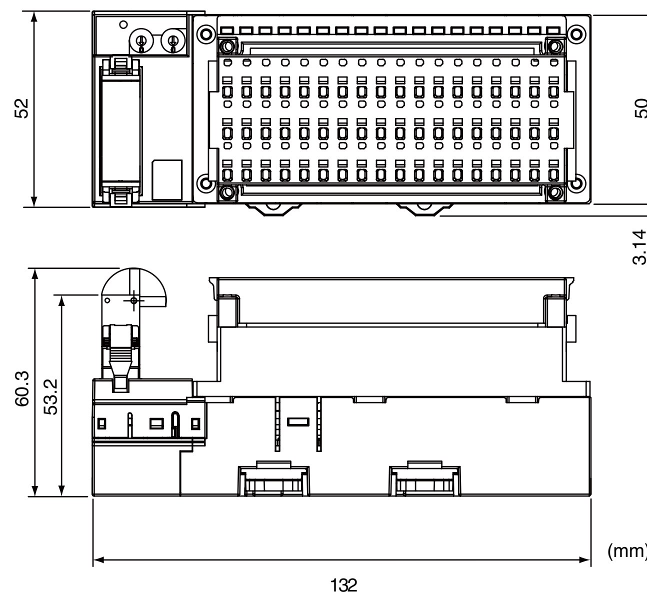
Note

(1) Do not wire NC terminals.

(2) Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

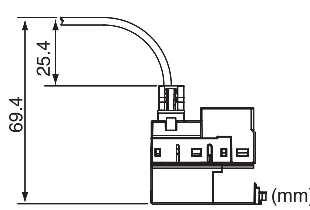
Dimensions (Same for CRT1-ID16SL and CRT1-ID16SL-1)

When a DCN4-TB4 Open Type Connector Is Mounted

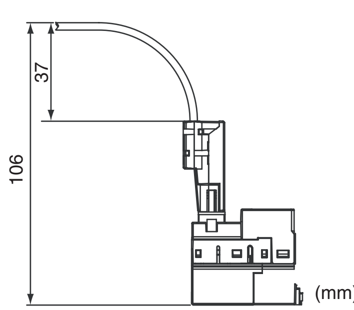


Communications Connector Dimensions Including the Connector and Cable

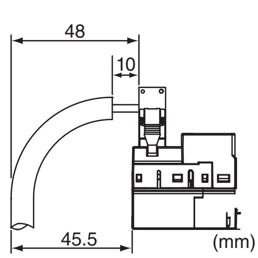
■ **When a DCN4-BR4 Standard Flat Connector Plug Is Mounted**



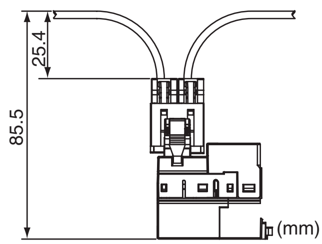
■ **When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted**



■ **When a DCN4-TB4 Open Type Connector Is Mounted**



■ When a DCN4-MD4 Multidrop Connector Is Mounted

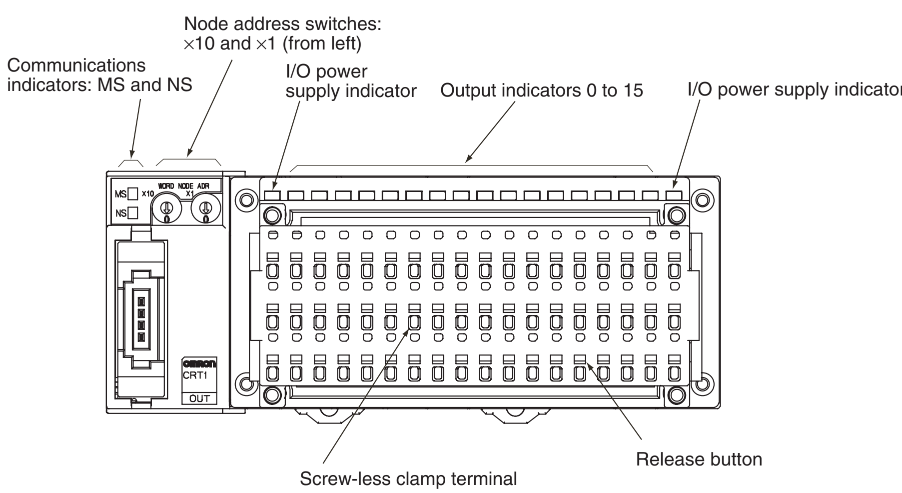


5-5-2 Sixteen-point Output Units

Output Section Specifications

Item	Specification	
Model	CRT1-OD16SL	CRT1-OD16SL-1
I/O capacity	16 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.5 A/output, 4 A/common	
Residual voltage	1.2 V max.(0.5 A DC, between each output terminal and the G terminal)	1.2 V max.(0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 outputs/common	
Isolation method	Photocoupler	
Output indicators	LED (yellow)	
Installation	DIN Track	
Power supply type	Multi-power supply	
Current supplied to output devices	100 mA/output	
Communications power supply current consumption	37 mA max. for 24-VDC power supply voltage 60 mA max. for 14-VDC power supply voltage	
I/O power supply current consumption	29 mA max. for 24-VDC power supply voltage	30 mA max. for 24-VDC power supply voltage
Output handling for communications errors	Select either hold or clear from CompoNet Support Software.	
Weight	250 g max.	

Component Names and Functions (Same for CRT1-OD16SL and CRT1-OD16SL-1)



Note A Flat Connector Plug or DCN4-TB4 Open Type Connector can be connected to the communications connector.

Indicator Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

The meanings of the output indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

I/O Power Supply Indicators

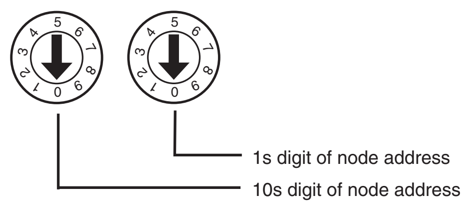
The meanings of the I/O power supply indicators are given in the following table.

Name	LED status	I/O status	Meaning
I/O	Lit green.	I/O power supply ON	The I/O power supply is ON.
	Not lit.	I/O power supply OFF	The I/O power supply is OFF.

Setting the Node Address

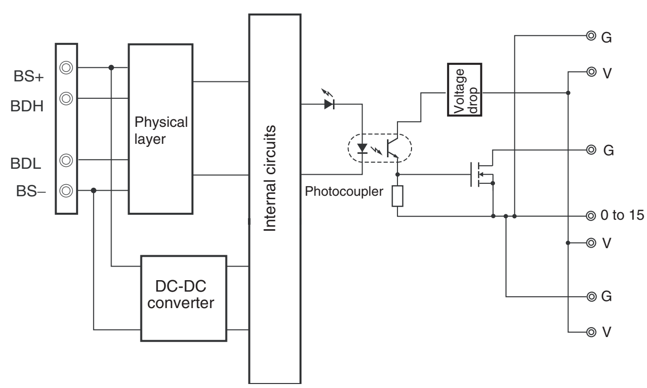
The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.

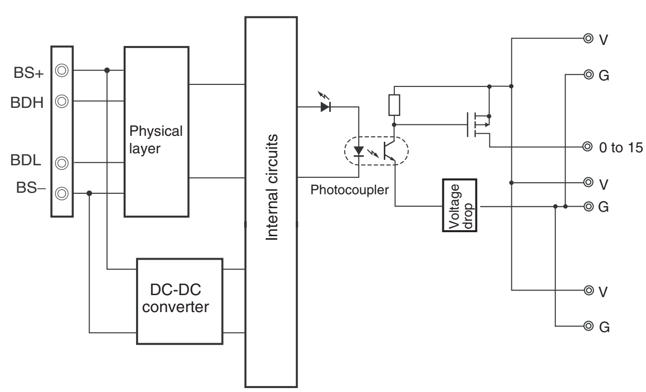


Internal Circuits

CRT1-OD16SL (NPN)

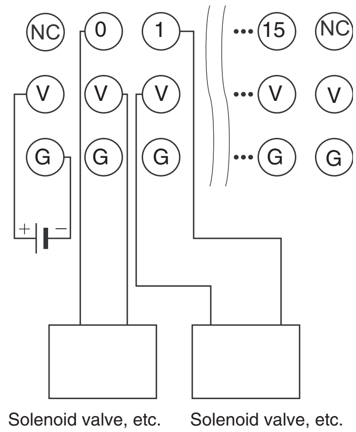


CRT1-OD16SL-1 (PNP)

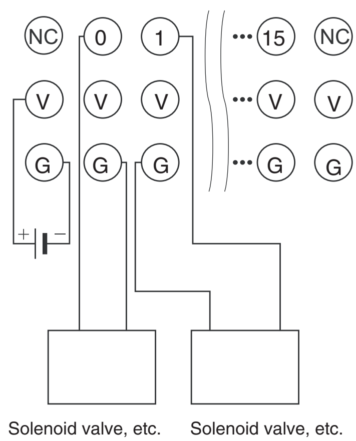


Wiring

CRT1-OD16SL (NPN)



CRT1-OD16SL-1 (PNP)



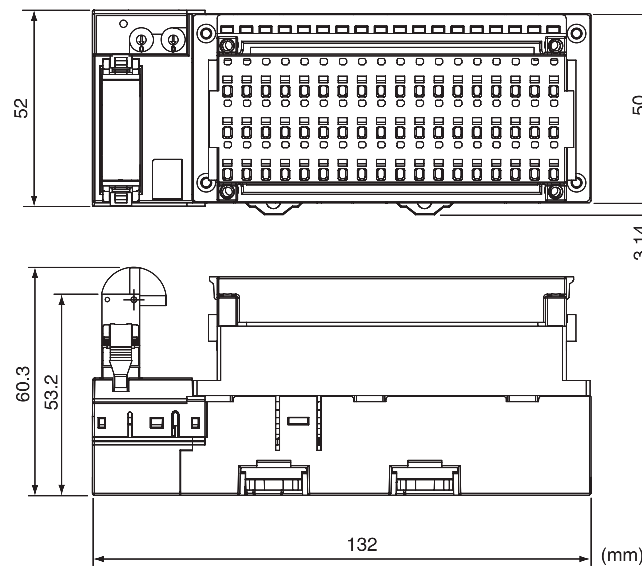
Note

(1) When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

(2) Do not wire NC terminals.

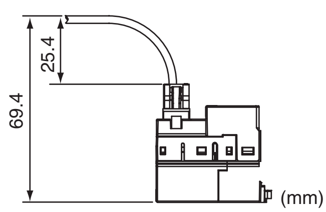
Dimensions (Same for CRT1-OD16SL and CRT1-OD16SL-1)

When a DCN4-TB4 Open Type Connector Is Mounted

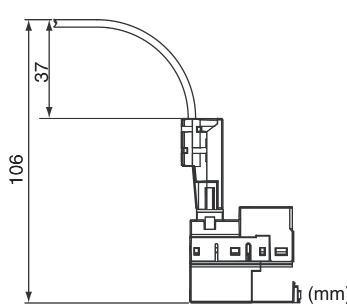


Communications Cable Dimensions when Connector and Cable Are Connected

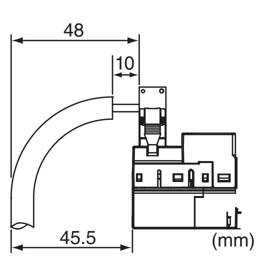
■ **When a DCN4-BR4 Standard Flat Connector Plug Is Mounted**



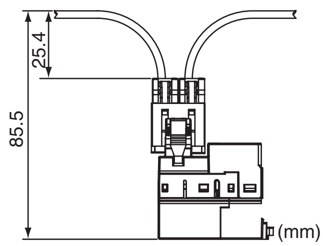
■ **When a DCN5-BR4 Sheathed Flat Connector Plug Is Mounted**



■ **When a DCN4-TB4 Open Type Connector Is Mounted**



■ **When a DCN4-MD4 Multidrop Connector Is Mounted**



SECTION 6
Analog I/O Slave Units

This section describes the Analog I/O Slave Units.

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6-1 Overview of Analog I/O Slave Units

This section provides an overview of Analog I/O Slave Units, including details on functions and setting methods for each Unit.

6-1-1 Analog I/O Slave Units

Analog I/O Slave Units can use a variety of functions, such as scaling and peak/bottom hold functions. Analog Input Units can also internally perform math on analog input values, which previously required ladder programming at the host PLC.

Analog data can be selected from the six values obtained from math operations and allocated as I/O in the Master Unit in combination with Generic Status Flags or other status information. The CompoNet Support Software can be used to easily allocate status information, monitor and set unique Analog I/O Slave Unit functions, and monitor operation.

6-1-2 List of Data Processing Functions

The following tables list the data processing functions that can be used with Analog I/O Slave Units. Refer to *6-4 Analog Input Slave Units* and *6-5 Analog Output Slave Units* for details on functions and setting methods.

CRT1-AD04 Analog Input Slave Unit

Function	Details
Moving average	Calculates the average of the past eight analog input values, and produces a stable input value even when the input value is unsteady.
Setting the number of AD conversion points	By reducing the number of input conversion points, the conversion cycle speed can be increased. For details, refer to *6-4-3 Calculating the Conversion Cycle.*
Scaling	Performs scaling. Scaling allows conversion of values between 0 and 6,000 into values using the industry unit required by the user. It reduces the number of operations requiring ladder programming in the CPU Unit. Scaling also supports an offset function for compensating for mounting errors in sensors and other devices.
Peak/bottom hold	Holds the maximum and minimum analog input values.
Top/valley hold	Holds the top and valley values for analog input values.
Rate of change	Calculates the rate of change for analog input values.
Comparator	Compares the analog input value or an analog value after math processing (value for peak, bottom, top, valley, rate of change) with the four set values HH, H, L, and LL, and indicates the result with the Analog Status Flags.
Disconnected line detection	Detects disconnections of analog inputs. (Valid only for the input ranges 4 to 20 mA and 1 to 5 V)
User adjustment	Adjusts the input when an offset occurs in the input voltage or current.
Cumulative counter	Calculates an approximation to the integral of analog input values over time.

CRT2-DA02 Analog Output Slave Units

Function	Details
Scaling	Performs scaling. Scaling allows conversion of values between 0 and 6,000 into values using the industry unit required by the user. It reduces the number of operations required in ladder programming in the Master Unit.
User adjustment	Adjusts the output when an offset occurs in the output voltage or current.
Cumulative counter (maintenance function)	Calculates an approximation to the integral of analog output values over time.
Communications error output setting	Sets the value output when a communications error occurs for each output.

6-1-3 Data Processing Flowcharts for Analog Input Slave Units

Analog Input Value

The following math operations can be performed on the external analog input value. The values obtained after processing (analog input values) can be allocated as I/O in the Master Unit.

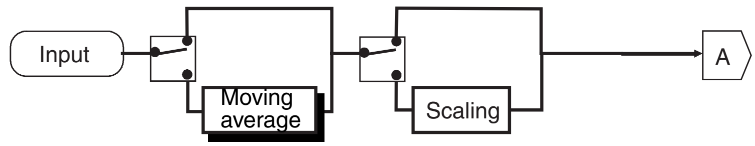
- Scaling to desired industry unit
- Moving average processing

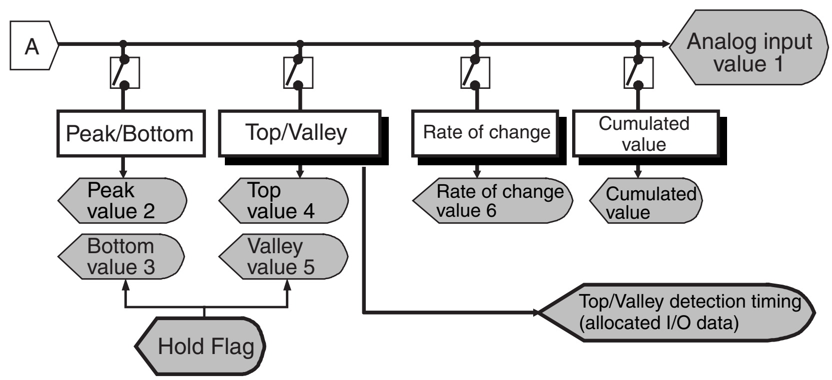
Other Operation Results

After moving average and scaling processing, the analog input value can be processed using the following operations. The values after processing are called peak value, bottom value, top value, valley value, rate of change, and cumulated value.

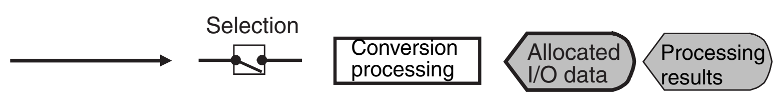
- Peak/hold operation
- Top/valley operation
- Rate of change operation
- Cumulative operation (maintenance function)

Analog processing is performed according to the following flowchart.





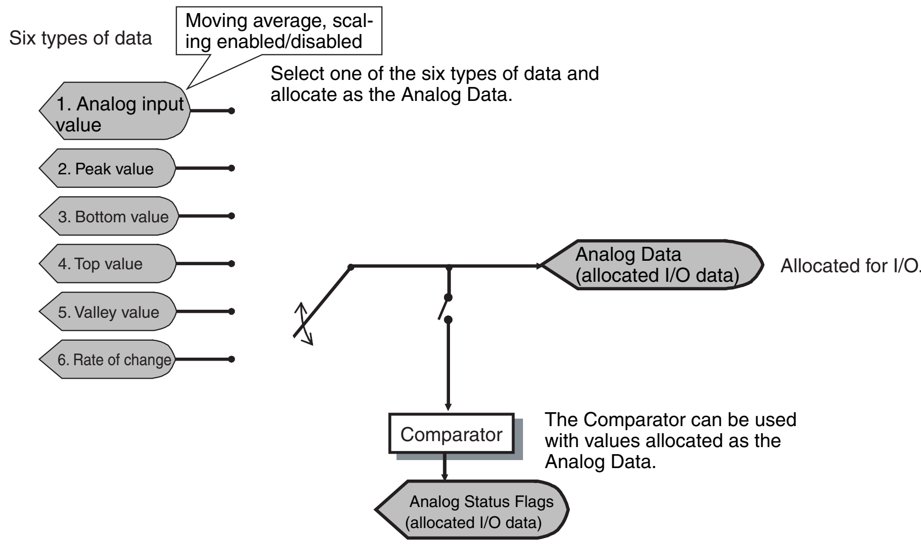
Data Flow



6-1-4 Selecting Data for Analog Input Slave Units

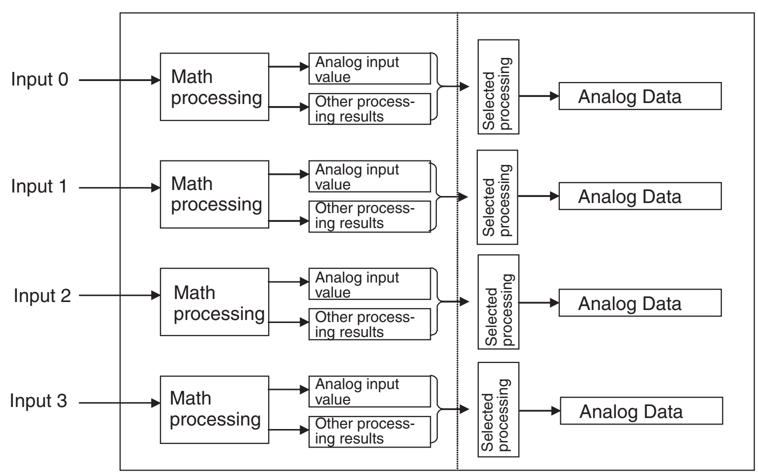
After performing math operations, select one out of the six resulting values to allocate in the Master Unit, from the analog input value, peak value, bottom value, top value, valley value, and rate of change. The selected data is referred to as “analog data” and can be allocated in the Master Unit individually or in combination with Status Flags. The data is selected using the CompoNet Support Software. For Analog Data comparator operations with four alarm set values can be performed (comparator function).

Flow of Data in Analog Input Slave Units



Note By default, the input analog value is allocated for I/O without modification.

For Inputs 0 to 3, the Analog Data can be separately selected, as shown in the following diagram.



6-1-5 I/O Data

Analog Input Slave Units (CRT1-AD04)

Analog Input Slave Units support the following four types of input data, and one type of output data. The required data can be allocated for I/O.

Input Data

I/O data	Details
Analog Data (8 input bytes)	• Used to monitor analog data. • Select one type of data from the analog input value, peak value, bottom value, top value, valley value, and rate of change. (Default allocation: Analog input value) **Note** Values allocated to analog data can be used with the comparator.
Top/Valley Detection Timing Flags (2 input bytes)	Top/Valley Detection Timing Flags are allocated in one word. These flags are used to time reading the values held as the top and valley values when both the top and valley values are allocated at the same time.

I/O data	Details
Analog Status Flags (4 input bytes)	Used to allocate the bits for the Comparator Result Flag, Top/Valley Detection Timing Flag, and Disconnected Line Detection Flag. The function of each bit is as follows: • Comparator Result Flags Allow control of the judgement results only, without allocating analog values. • Top/Valley Detection Timing Flags Used to time reading the values held as the top and valley values when both the top and value values are allocated at the same time. • Disconnected Line Detection Flags Disconnections can be detected even when the analog values are not allocated.
Analog Data + Top/Valley Detection Timing Flags (10 input bytes)	The Top/Valley Detection Timing Flags (2 bytes) are allocated following the Analog Data (8 bytes).

Output Data

I/O data	Details
Hold Flags (2 output bytes)	Used with each of the hold functions (peak, bottom, top, and valley) to control the execution timing of hold functions from the Master Unit.

Analog Output Slave Units (CRT1-DA02)

Analog Output Slave Units support one type of output data.

Output Data

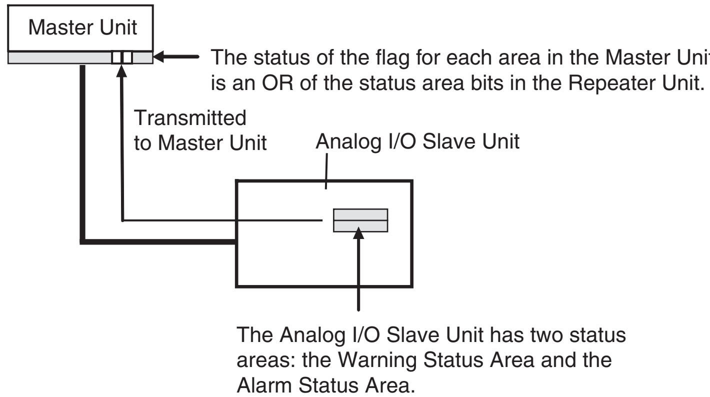
Data Type	Details
Output data (4 output bytes)	Used to allocate two words of analog output data.

6-2 Status Areas

An Analog I/O Slave Unit has two status areas: the Warning Status Area and the Alarm Status Area. The status flags in these areas are turned ON and OFF based on the threshold/monitor values set for each function in that Unit.

For each area, a corresponding status flag in the Master Unit will be turned ON if any flag in the status area in the Analog I/O Slave Unit turns ON. Bit 12 in the Master Unit corresponds to the Warning Status Area and bit 13 corresponds to the Alarm Status Area.

The Analog I/O Slave Unit's status area information can be read by using the CompoNet Support Software or explicit messages.



CRT1-AD04 Analog Input Unit

Warning Status Area

The Analog Input Slave Unit's Warning Status Area contains the following 16 bits. These bits indicate minor errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	Reserved	---
2	Network Power Voltage Drop Flag OFF: Normal ON: Error (Voltage dropped below threshold.)	Turns ON when the voltages drops below the voltage set for the network power voltage monitor function.
3	Unit Maintenance Flag OFF: Normal ON: Error (Threshold exceeded.)	Turns ON when the threshold set for the Unit Conduction Time Monitor function is exceeded.
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Analog Range Exceeded Flag OFF: Within range (below set monitor value) ON: Out-of-range (exceeded set monitor value)	Turns ON when the analog data exceeds the displayable range or when the monitor value set for the comparator function is exceeded.
9	Cumulated Counter Exceeded Flag OFF: Within range (below set monitor value) ON: Out-of-range (exceeded set monitor value)	Turns ON when cumulated value exceeds the set monitor value.
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

Alarm Status Area

The Analog Input Slave Unit's Alarm Status Area contains the following 16 bits. These bits indicate serious errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	EEPROM Data Error Flag OFF: Normal ON: Error	Turns ON then there is an error in the EEPROM data.
2	Reserved	---
3	Reserved	---
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Disconnected Line Detection Flag OFF: Normal ON: Disconnected line detected	Turns ON then the line is disconnected, including wiring mistakes and connected device failure.
9	Analog Hardware Error Flag OFF: Normal ON: Error	Turns ON when there is an error in the analog circuits in the Unit.
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

CRT1-DA02 Analog Output Units

Warning Status Area

The Analog Output Slave Unit's Warning Status Area contains the following 16 bits. These bits indicate minor errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	Reserved	---
2	Network Power Voltage Drop Flag OFF: Normal ON: Error (Voltage dropped below threshold.)	Monitors the voltage set for the network power voltage monitor function.
3	Unit Maintenance Flag OFF: Normal ON: Error (Threshold exceeded.)	Monitors the power ON time warning value set for the Unit Conduction Time Monitor function.
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Error Output Flag OFF: Normal ON: Output is incorrect	Turns ON when the value set for the communications error output function is being output.
9	Cumulated Counter Exceeded Flag OFF: Within range (below set monitor value) ON: Out-of-range (exceeded set monitor value)	Turns ON when cumulated value exceeds the set monitor value.

Bit	Content	Description
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

Alarm Status Area

The Analog Output Slave Unit's Alarm Status Area contains the following 16 bits. These bits indicate serious errors in the Unit.

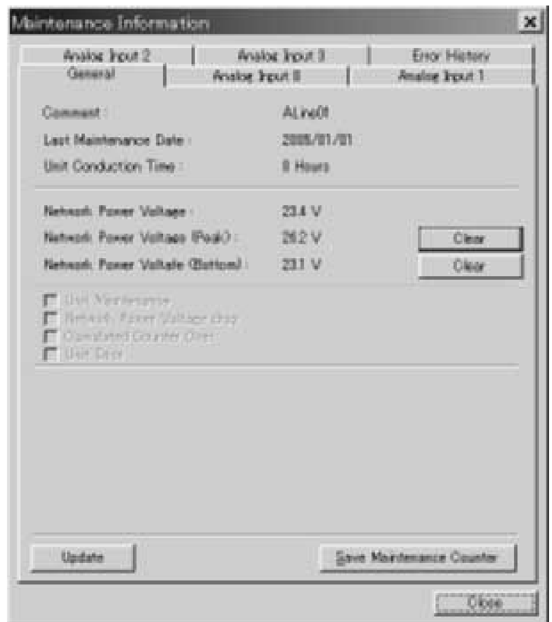
Bit	Content	Description
0	Reserved	---
1	EEPROM Data Error Flag OFF: Normal ON: Error	Turns ON then there is an error in the EEPROM data.
2	Reserved	---
3	Reserved	---
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Reserved	---
9	Analog Hardware Error Flag OFF: Normal ON: Error	Turns ON when there is an error in the analog circuits in the Unit.
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

6-3 Maintenance Information Window

This section describes the Maintenance Information Window, which can be used to monitor the status of Analog I/O Slave Units. The Monitor Device Window can be used to check the same Slave status information. Refer to the Maintenance Information Window in this section for examples.

6-3-1 Checking Maintenance Information

Maintenance information can be checked in either of two ways: 1) Right-click the Main Window in the CompoNet Support Software to display the popup menu and select ***Maintenance Information***, or 2) Open the Maintenance Mode Window and double-click the desired Unit's icon to display the Maintenance Information Window.



Item	Description
Comment	Displays up to 32 characters of text set as the Unit name.
Last Maintenance Date	Displays the last maintenance date that was set.
Unit Conduction Time	Displays the total time that the Unit has been ON (cumulative power ON time).
Present Value (Not displayed in dialog box.)	The present analog values are displayed: Peak, bottom, top, valley, rate of change, cumulative counter, maximum, and minimum. Displays data obtained from the analog value. Refer to the descriptions of individual functions for setting methods.
Network Power Voltage	Displays the present value of the network power supply voltage.
Network Power Voltage (Peak)	Displays the maximum power supply voltage up to the present time.
Network Power Voltage (Bottom)	Displays the minimum power supply voltage up to the present time.
Update Button	Click this Button to update the Maintenance information.
Save Maintenance Counter Button	This button saves the Maintenance Counter value in the Unit. If this function is used, the previous value will be retained when the power supply is turned OFF and ON again.

Note Always update the information when the parameters have been edited or set.

Status Check Boxes

The flags (check boxes) shown in the following table will be turned ON when the corresponding error occurs.

Item	Description
Unit Maintenance	ON when the total Unit ON time exceeds the set value.
Network Power Voltage drop	ON when the network power supply voltage falls below the set value.
Cumulated Counter Over	ON when any one of the input's cumulative counter values exceeds the set value.
Unit Error	ON when a Unit Error has occurred in an Analog Unit.
Threshold Cumulated Counter Over	ON when the cumulative counter value exceeds the set value.
Cumulated Counter Overflow	ON when there is an overflow in the cumulative counter value.
Cumulated Counter Underflow	ON when there is an underflow in the cumulative counter value.

CRT1-AD04 Analog Input Units Only

Item	Description
Over Range/Under Range	ON when the analog data is above or below the displayable range.
Alarm Over/Warning Over	ON when the analog data is above or below the monitoring set values set in the comparator function.
Broken wire	ON when a wire is broken or disconnected. (Used only when the input range is 1 to 5 V or 4 to 20 mA.)

Error History Window

Item	Description
Content	Displays the contents of the communications errors that have occurred.
Network Power Voltage	Displays the power supply voltage being supplied when the error occurred.
Unit Conduction Time	Displays the total time that the network power supply had been ON when the error occurred.

6-4 Analog Input Slave Units

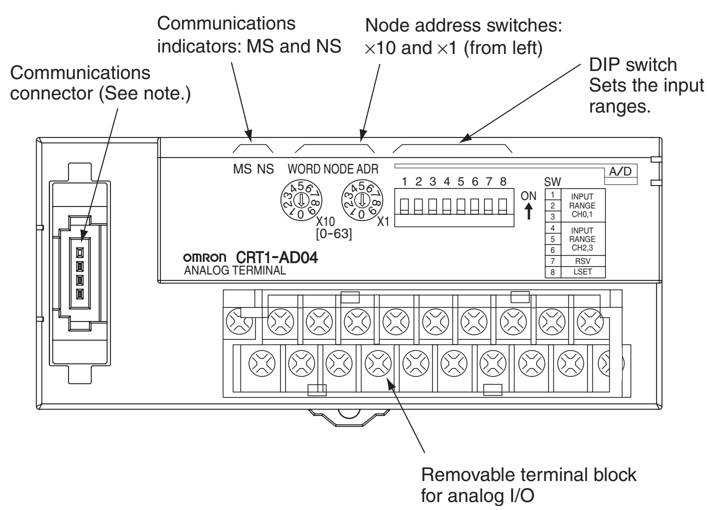
6-4-1 Four-point Analog Input Slave Unit

General Specifications

Item		Specification	
		Voltage input	Current input
Model		CRT1-AD04	
Input signal ranges		0 to 5 V 1 to 5 V 0 to 10 V –10 to 10 V	0 to 20 mA 4 to 20 mA
Maximum signal input		±15 V	±30 mA
Input impedance		1 M Ω min.	Approx. 250 Ω
Resolution		1/6,000 (full scale)	
Overall accuracy	25°C	±0.3% FS	±0.4% FS (See note.)
	–10 to 55°C	±0.6% FS	±0.8% FS (See note.)
Analog conversion cycle		4 ms max./ 4 points	
AD conversion data		–10 to 10 V range: F448 to 0BB8 hex full scale (–3,000 to 3,000) Other ranges: 0000 to 1770 hex full scale (0 to 6,000) AD conversion range: ±5% FS of the above data ranges.	
Isolation method		Photocoupler isolation (between input and communications lines) No isolation between input signal wires	
Mounting		DIN Track mounting	
Power supply type		Multi-power supply	
Communications power current consumption		110 mA max. for 24-VDC power supply 175 mA max. for 14-VDC power supply	
Weight		153 g	

Note In the 0 to 20 mA mode, accuracy may be lost below 0.2 mA.

Component Names and Functions



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

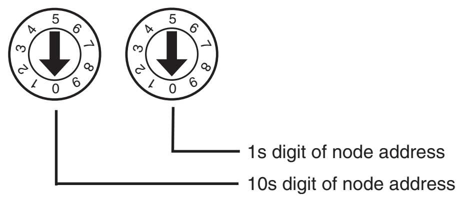
Refer to *4-1-3 Communications Indicators*.

Switch Settings

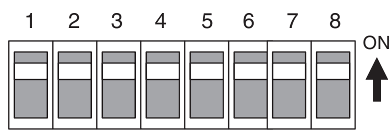
Setting the Node Address

The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (Set to between 0 and 63.)

The setting on the rotary switches is read when power is turned ON.



Setting the Input Ranges



Pin No.	Setting	Specification
1	Input Slave Unit: Input range setting for Inputs 0 and 1. (The same range is used for both inputs.)	Default setting: All pins OFF
2		
3		
4	Input Slave Unit: Input range setting for Inputs 2 and 3. (The same range is used for both inputs.)	Default setting: All pins OFF
5		
6		
7	Always OFF.	Always set this pin to OFF. Malfunctions may occur if it is set to ON.
8	Range setting method	OFF: Use CompoNet Support Software. ON: Use DIP switch.

Note

(1) Always use the default setting (OFF) for pin 7.

(2) Always set pin 8 to ON if the DIP switch is used to set the ranges. If this pin is OFF, the DIP switch settings will not be enabled.

(3) The DIP switch settings are read when the power is turned ON.

■ Inputs 0 and 1 (Shared Setting)

Input range	Pin 1	Pin 2	Pin 3
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
–10 to 10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF	ON
0 to 20 mA	ON	OFF	ON

■ Inputs 2 and 3 (Shared Setting)

Input range	Pin 4	Pin 5	Pin 6
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
–10 to 10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF	ON
0 to 20 mA	ON	OFF	ON

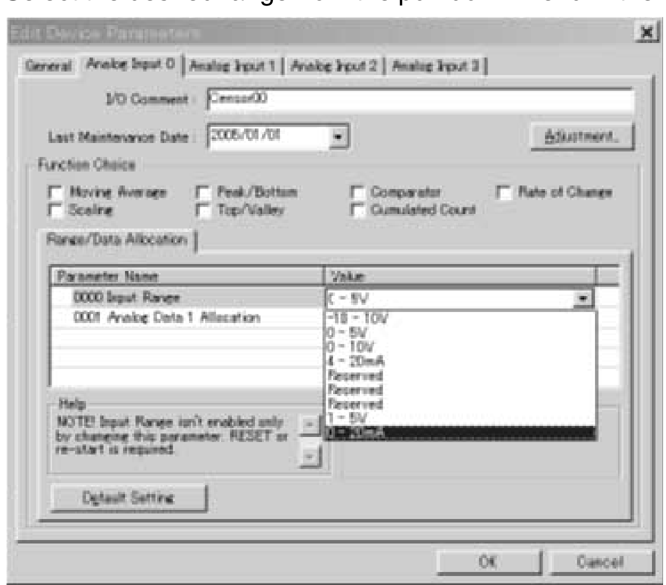
Note When the DIP switch is used to set the input ranges (pin 8 ON), the input signal ranges must always be the same for Inputs 0 and 1 and for Inputs 2 and 3. If it is necessary to set separate input signal ranges for Inputs 0 to 3, use the CompoNet Support Software rather than the DIP switch to make the settings.

Setting the Input Range from the CompoNet Support Software

Use the following procedure to set the input range for each input using the CompoNet Support Software.

1,2,3...

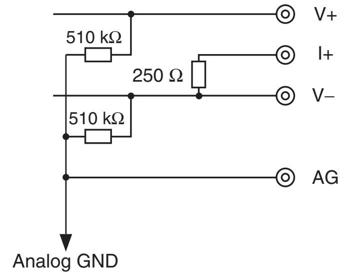
1. Double-click the icon of the Slave to be set in the Main Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus)
2. Select the Tab Page for the input where the range is to be changed.
3. Select the desired range from the pull-down menu in the *Input Range* field.



4. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.

5. Click the **OK** Button and exit the window.

Internal Circuits

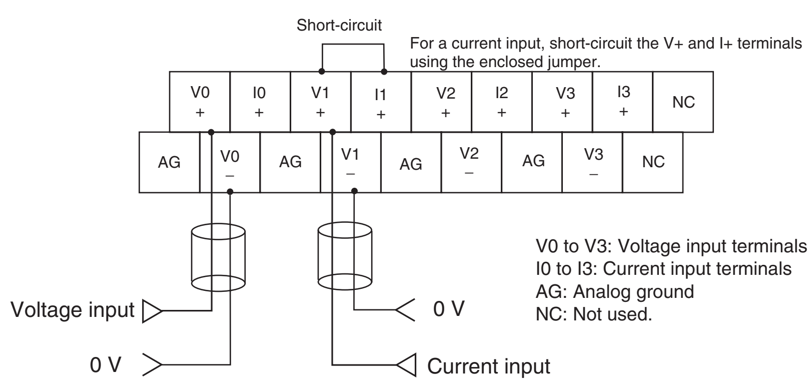


Terminal Arrangements

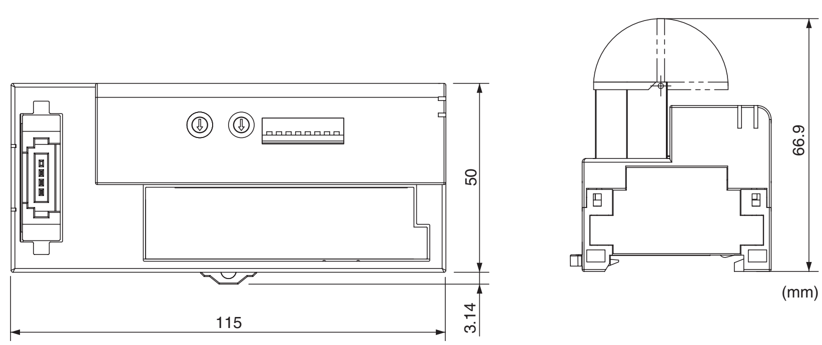
Communications Connector

BS+	Communications power supply +
BDH	Communications data high
BDL	Communications data low
BS–	Communications power supply –

Analog I/O Terminal Block



Dimensions

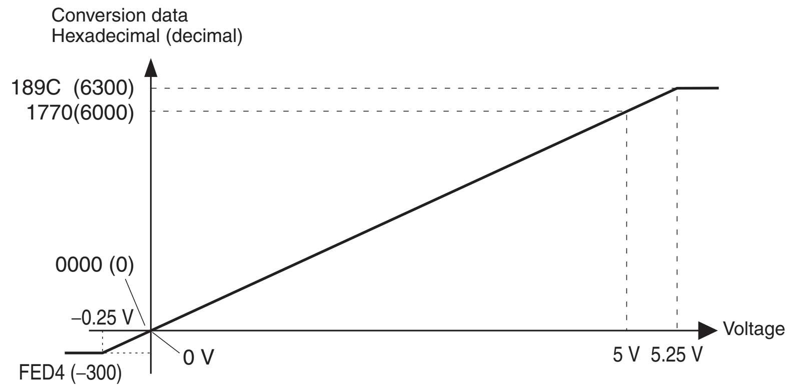


Input Range and Conversion Data

The analog data that is input can be converted to digital data according to the input range, as described here. If the input exceeds the input range, the AD conversion data will be fixed at the upper or low limit.

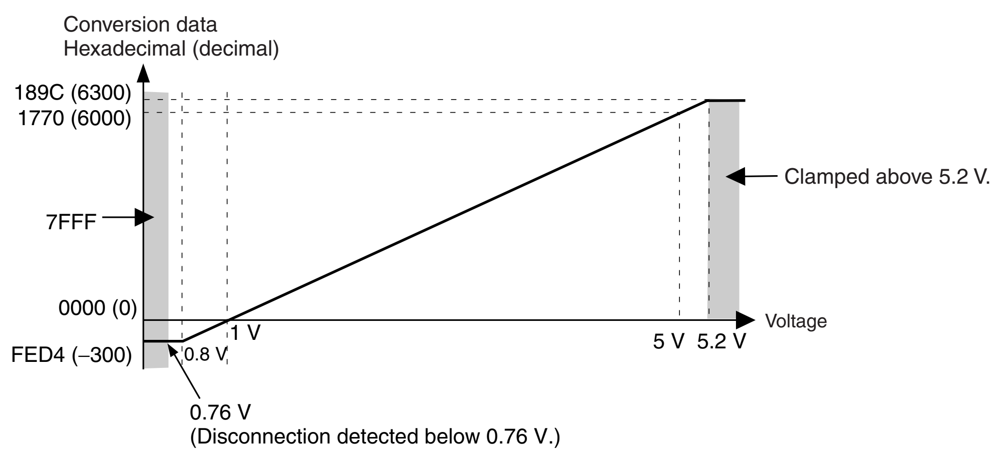
■ Input Range: 0 to 5 V

The voltage range 0 to 5 V corresponds to 0000 to 1770 hex (0 to 6,000). The convertible data range is FED4 to 189C hex (–300 to 6,300). Negative voltages are expressed as two's complements (16 bits). When a disconnection occurs, the data equivalent to 0 V input will be used (0000 hex).



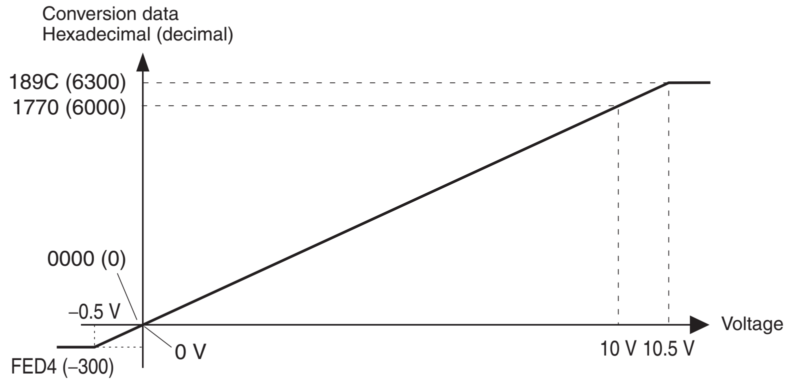
■ Input Range:1 to 5 V

The voltage range 1 to 5 V corresponds to 0000 to 1770 hex (0 to 6,000). The convertible data range is FED4 to 189C hex (–300 to 6,300). If the input voltage falls below the input range (input voltage less than 0.76 V), a disconnection is detected and the data is set to 7FFF hex.



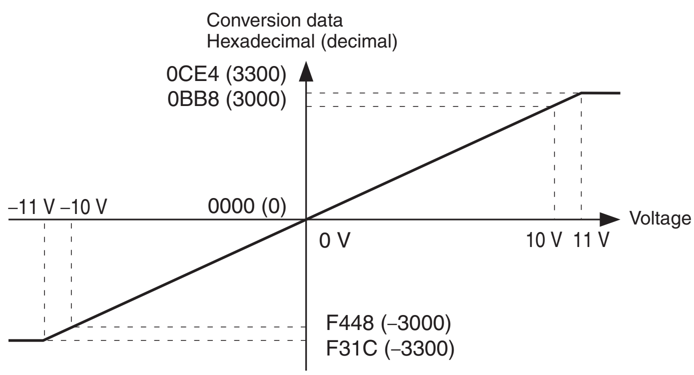
■ Input Range: 0 to 10 V

The voltage range 0 to 10 V corresponds to 0000 to 1770 hex (0 to 6,000). The convertible data range is FED4 to 189C hex (–300 to 6,300). Negative voltages are expressed as two's complements (16 bits). When a disconnection occurs, the data equivalent to 0 V input will be used (0000 hex).



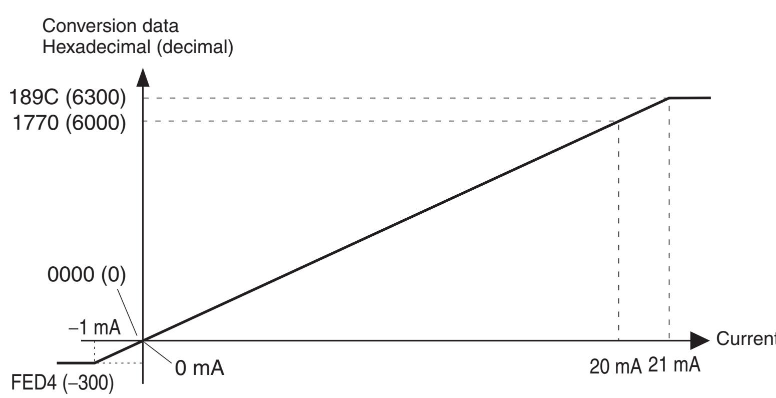
■ Input Range: –10 to 10 V

The voltage range –10 to 10 V corresponds to F448 to 0BB8 hex (–3,000 to 3,000). The convertible data range is F31C to 0CE4 hex (–3,300 to 3,300). Negative voltages are expressed as two's complements (16 bits). When a disconnection occurs, the data equivalent to 0 V input will be used (0000 hex).



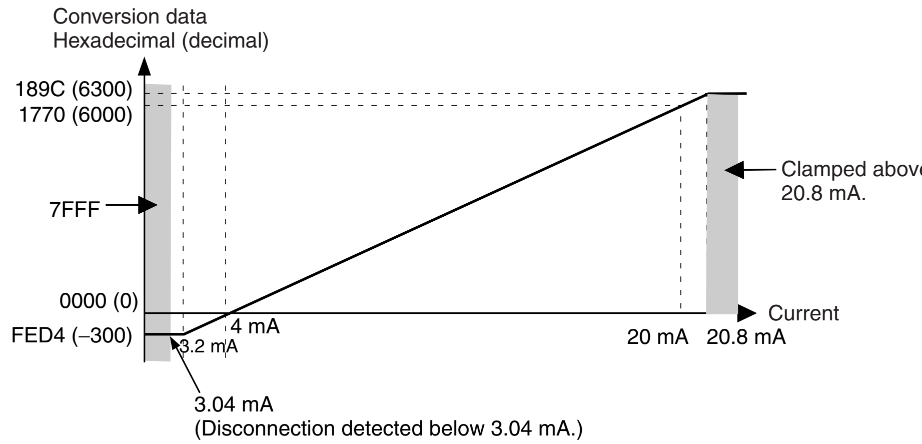
■ Input Range: 0 to 20 mA

The current range 0 to 20 mA corresponds to 0000 to 1770 hex (0 to 6,000). The convertible data range is FED4 to 189C hex (–300 to 6,300). Negative currents are expressed as two's complements (16 bits). When a disconnection occurs, the data equivalent to 0 mA input will be used (0000 hex).



■ Input Range: 4 to 20 mA

The current range 4 to 20 mA corresponds to 0000 to 1770 hex (0 to 6,000). The convertible data range is FED4 to 189C hex (–300 to 6,300). If the input current is below the input range (input current less than 3.04 mA), a disconnection is detected and the data is set to 7FFF hex.



AD Conversion Data

Negative AD conversion data is expressed as two's complements. The NEG instruction (two's complement conversion) can be used to obtain the absolute value of the two's complement.

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

Conversion Speed

The AD conversion data for 4 input points is refreshed every 3.82 ms max., although the conversion speed will vary depending on the functions and number of AD conversion points being used. Refer to *6-4-3 Calculating the Conversion Cycle* for details.

6-4-2 I/O Data Allocation Methods

Allocating I/O Data

Use one of the following methods to select the data for allocating in the Master Unit for remote I/O communications.

■ Default I/O Data

When using the Analog Input Slave Unit's default settings, only the analog input values are selected as the I/O data and allocated in the four words (eight bytes) of the Master Unit's input Area, as shown in the following diagram.

15 0
Analog input value for Input 0
Analog input value for Input 1
Analog input value for Input 2
Analog input value for Input 3

■ Allocating I/O Data Using the CompoNet Support Software

The analog data can be combined with other data, such as the Status Flags, and allocated in the Master Unit. Select the required data from the CompoNet Support Software drop-down menu.

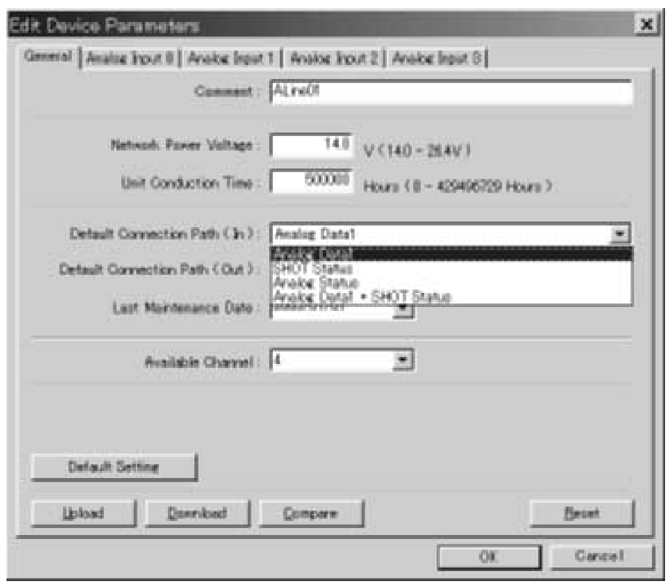
Example: Allocating Analog Data + Top/Valley Detection Timing Flags in the Master Unit.

15 8	7 0
Analog Data 1 for Input 0	
Analog Data 1 for Input 1	
Analog Data 1 for Input 2	
Analog Data 1 for Input 3	
Top Detection Timing Flag	**Valley Detection Timing Flag**

Setting Using the CompoNet Support Software

1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window to open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Click the **General** Tab and select the desired I/O data (pattern) from the pull-down menu under the *Default Connection Path (In)* field. In the following example, Analog Data1 is selected.



3. Click the **Download** Button and then click the **Reset** Button to reset the Unit.
4. Click the **OK** Button and exit the window.

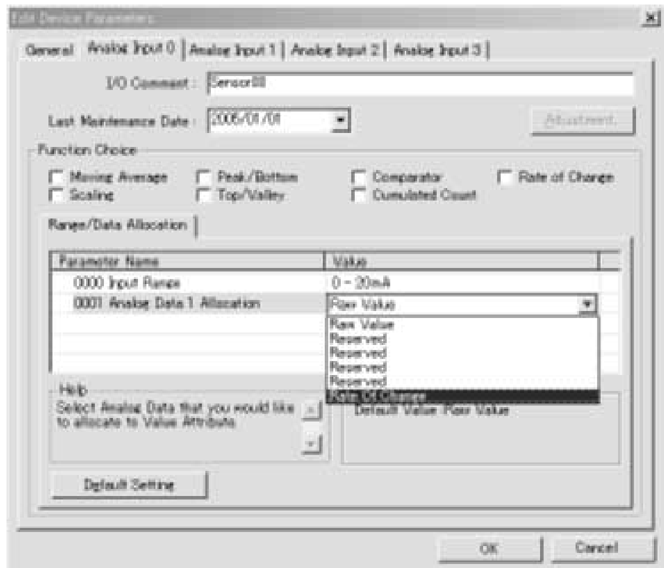
Specifying the Analog Data

One of the following six processed values can be selected as the analog data: Analog Input Value (raw value), Peak, Bottom, Top, Valley, and Rate of Change. These values can be selected alone or in combination with the Status Flags.

Setting Using the CompoNet Support Software

1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window to open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the tab page for the analog input that is to be set, and select the value to be allocated from the drop-down list for the *Analog Data 1 Allocation.*



3. Return to the General Tab Page, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
4. Click the **OK** Button and exit the window.

I/O Data

Analog Data

Analog Data is used to monitor analog values. Analog input value is allocated as the default setting, but any one of analog input value, peak value, bottom value, top value, valley value or rate of change can be selected as allocation data.

Note The comparator function can be used for the data allocated in Analog Data.

The data format used for allocating data in the Master Unit is shown below. Data is allocated as two's complements (8 bytes = 4 words).

15 **0**

Analog Data 1 for Input 0
Analog Data 1 for Input 1
Analog Data 1 for Input 2
Analog Data 1 for Input 3

Top/Valley Detection Timing Flags (Shot Status)

These flags turn ON for the one-shot time when detecting the top or valley for the top/valley hold function.

These flags are used to time reading the values held as the top and valley values at the Master Unit. The following data format is used when these flags are allocated in the Master Unit (2 bytes = 1 word).

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	0	0	0	0	V_ST3	V_ST2	V_ST1	V_ST0
+1	0	0	0	0	T_ST3	T_ST2	T_ST1	T_ST0

The details of each byte are shown in the following table.

Byte	Abbreviation	Name	Details
+0	V_STx	Valley Detection Timing Flag	Turns ON when a valley is detected by the valley hold function and then turns OFF after the one-shot time has elapsed.
+1	T_STx	Top Detection Timing Flag	Turns ON when a top is detected by the top hold function and then turns OFF after the one-shot time has elapsed.

Note The one-shot time can be changed. For details, refer to the one-shot time settings for the top/valley hold function.

Analog Status Flags

The Analog Status Flags include allocations for the Comparator Result Flag, the Top/Valley Detection Timing Flags, and the Disconnected Line Detection Flags. These flags are used for detection and monitoring.

The data format used for each byte when these flags are allocated in the Master Unit is shown below (4 bytes = 2 words).

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
+0	BW0	T_ST0	V_ST0	HH0	H0	PS0	L0	LL0	Input 0
+1	BW1	T_ST1	V_ST1	HH1	H1	PS1	L1	LL1	Input 1
+2	BW2	T_ST2	V_ST2	HH2	H2	PS2	L2	LL2	Input 2
+3	BW3	T_ST3	V_ST3	HH3	H3	PS3	L3	LL3	Input 3

The details for each bit are shown in the following table.

Bit	Abbrevi-ation	Name		Details
0	LLx	Compara-tor result	Low Low Limit Alarm Flag	Turns ON when the value of data allocated in Analog Data drops below the Low Low Limit alarm setting.
1	Lx		Low Limit Alarm Flag	Turns ON when the value of data allocated in Analog Data drops below the Low Limit alarm setting.
2	PSx		Normal Flag (pass signal)	Turns ON when none of the alarms (High High Limit, High Limit, Low Low Limit, and Low Limit) have been output.
3	Hx		High Limit Alarm Flag	Turns ON when the value of data allocated in Analog Data exceeds the High Limit alarm setting.
4	HHx		High High Limit Alarm Flag	Turns ON when the value of data allocated in Analog Data exceeds the High High Limit alarm setting.
5	V_STx	Top/val-ley detec-tion timing	Valley Detec-tion Timing Flag	Used with the valley hold func-tion. Turns ON when a valley is detected, and turns OFF after the one-shot time has lapsed.
6	T_STx		Top Detection Timing Flag	Used with the top hold function. Turns ON when a top is detected, and turns OFF after the one-shot time has lapsed.
7	BWx	Disconnected Line Detec-tion Flag		Turns ON when a disconnection is detected.

Analog Data + Top/Valley Detection Timing Flags (Analog Data + Shot Status)

This data pattern consists of Analog Data followed by the Top/Valley Detection Timing Flags and is allocated in the Master Unit using the following data format (10 bytes = 5 words).

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	Analog Data 1 for Input 0							
+1								
+2	Analog Data 1 for Input 1							
+3								
+4	Analog Data 1 for Input 2							
+5								
+6	Analog Data 1 for Input 3							
+7								
+8	0	0	0	0	V_ST3	V_ST2	V_ST1	V_ST0
+9	0	0	0	0	T_ST3	T_ST2	T_ST1	T_ST0

Hold Flags (Output)

Hold Flags are used with the peak/bottom hold and top/valley hold functions. The Hold Flags are used to control the hold execution timing from the Master Unit and are allocated in the Master Unit using the following data format (2 bytes).

Note A delay may occur between when the Master Unit's power is turned ON until notification of the Hold Flag status is sent to the Slave.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	0	0	0	0	HD3	HD2	HD1	HD0
+1	0	0	0	0	0	0	0	0

The details for each bit are shown in the following table.

Bit	Abbreviation	Name	Details
0	**HD0**	Hold Flag for Input 0	The hold function is performed for Analog Input 0 while this flag is ON. The hold function stops and the last value is held when the flag goes OFF.
1	**HD1**	Hold Flag for Input 1	The hold function is performed for Analog Input 1 while this flag is ON. The hold function stops and the last value is held when the flag goes OFF.
2	**HD2**	Hold Flag for Input 2	The hold function is performed for Analog Input 2 while this flag is ON. The hold function stops and the last value is held when the flag goes OFF.
3	**HD3**	Hold Flag for Input 3	The hold function is performed for Analog Input 3 while this flag is ON. The hold function stops and the last value is held when the flag goes OFF.

6-4-3 Calculating the Conversion Cycle

The conversion cycle speed can be improved by setting the number of AD conversion points, but will vary with the use of the math operations. Use the following table and formula to calculate the conversion cycle time.

Formula

AD conversion cycle time = AD base conversion time +Σ (Additional time for each function)

AD base conversion time: Cycle time when the math operation is not used at all. The value for each conversion point from 1 to 4 is different.

Additional time for each function: The additional time that is required when math operations are used.

The following table shows the AD base conversion times (unit: ms).

Time	1 point	2 points	3 points	4 points
Max	1.66	2.42	3.21	3.82
Min	0.68	0.81	1.47	2.03
Average	0.88	1.60	2.32	3.07

Note The CompoNet communications cycle is 4 ms.

The following table shows the additional time required for each function (unit: ms).

Math operation	Additional time for each point
Moving average	0.045
Scaling	0.055
Peak/bottom hold	0.025
Top/valley hold	0.070
Comparator	0.065
Rate of change	0.030
Cumulative counter	0.035

Calculation Example

When using three points, and applying scaling to the first and second inputs, and the cumulative counter to the third input, the maximum AD conversion cycle time can be obtained by using the following formula.

Formula: 3.21 + (0.055 × 2) + 0.035 = 3.355 ms

6-5 Analog Output Slave Units

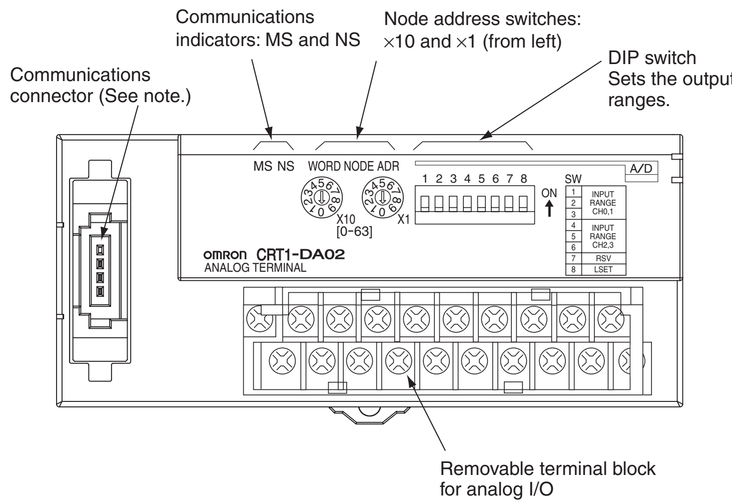
6-5-1 Two-point Analog Output Slave Unit

General Specifications

Item		Specification	
		Voltage output	Current output
Model		CRT1-DA02	
Output signal ranges		0 to 5 V 1 to 5 V 0 to 10 V –10 to 10 V	0 to 20 mA 4 to 20 mA
External output allowable load resistance		1 kΩ min.	600 Ω max.
Resolution		1/6,000 (full scale)	
Overall accuracy	25°C	±0.4% FS	±0.4% FS (See note.)
	–10 to 55°C	±0.8% FS	±0.8% FS (See note.)
Conversion time		2 ms/ 2 points	
DA conversion data		–10 to 10 V range: F448 to 0BB8 hex full scale (–3,000 to 3,000) Other ranges: 0000 to 1770 hex full scale (0 to 6,000) DA conversion range: ±5% FS of the above data ranges.	
Isolation method		Photocoupler isolation (between output and communications lines) No isolation between output signal wires.	
Mounting		DIN Track mounting	
Power supply type		Multi-power supply	
Communications power current consumption		125 mA max. for 24-VDC power supply 205 mA max. for 14-VDC power supply	
Weight		155 g	

Note The specified accuracy does not apply below 0.2 mA when using the 0 to 20 mA range.

Component Names and Functions



Note A Flat Connector Plug or DCN4-TB4 Open Type Connector can be connected to the communications connector.

Indicator Section

Communications Indicators

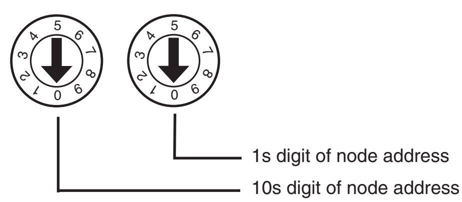
Refer to *4-1-3 Communications Indicators*.

Switch Settings

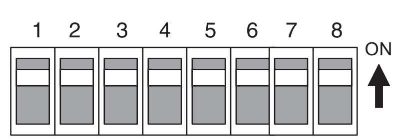
Setting the Node Address

The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (Set to between 0 and 63.)

The setting on the rotary switches is read when power is turned ON.



Setting the Output Ranges



Each pin is set according to the following table.

Pin No.	Setting	Specification
1	Sets output range for Output 0	Default setting: All pins OFF
2		
3		
4	Sets output range for Output 1	Default setting: All pins OFF
5		
6		

Pin No.	Setting	Specification
7	Always OFF.	Always set this pin to OFF. Unexpected operation may result if it is turned ON.
8	Range setting method	OFF: Use CompoNet Support Software. ON: Use DIP switch.

Note (1) Always use the default setting (OFF) for pin 7.

(2) Always set pin 8 to ON if the DIP switch is used to set the range. If this pin is OFF, the DIP switch settings will not be enabled.

(3) The DIP switch settings are read when the power is turned ON.

■ Output 0 Range

Signal range	Pin 1	Pin 2	Pin 3
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
–10 to 10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF	ON
0 to 20 mA	ON	OFF	ON

■ Output 1 Range

Signal range	Pin 4	Pin 5	Pin 6
0 to 5 V	OFF	OFF	OFF
1 to 5 V	ON	OFF	OFF
0 to 10 V	OFF	ON	OFF
–10 to 10 V	ON	ON	OFF
4 to 20 mA	OFF	OFF	ON
0 to 20 mA	ON	OFF	ON

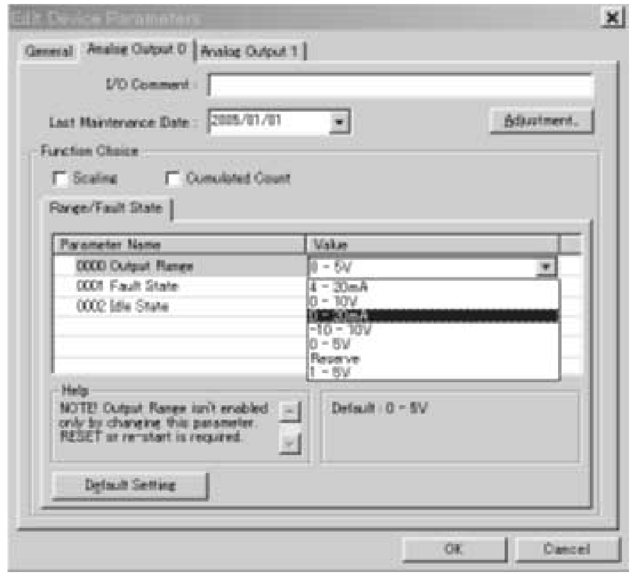
Setting Using the CompoNet Support Software

Use the following procedure to set the output range for each output using the CompoNet Support Software.

1,2,3...

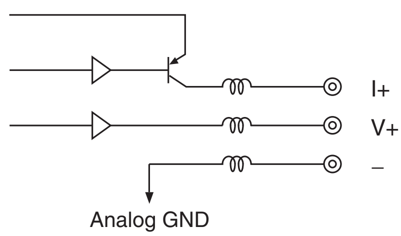
1. Double-click the icon of the Slave to be set in the Main Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the Tab Page for the output where the range is to be changed.

3. Click the *Output Range* field, and select the desired range.



4. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
5. Click the **OK** Button and exit the window.

Internal Circuits



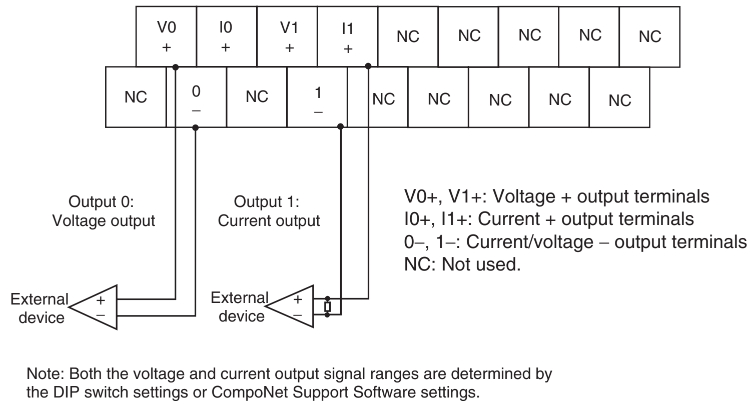
The negative terminals for output 0 and output 1 are connected internally.

Wiring

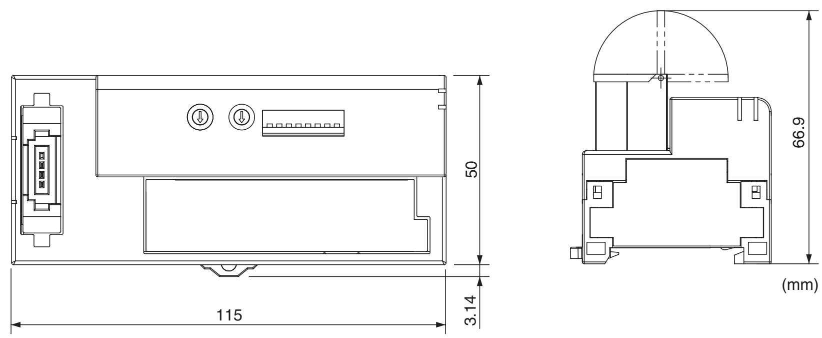
Communications Connector

BS+	Communications power supply +
BDH	Communications data high
BDL	Communications data low
BS–	Communications power supply –

Analog I/O Terminal Block



Dimensions

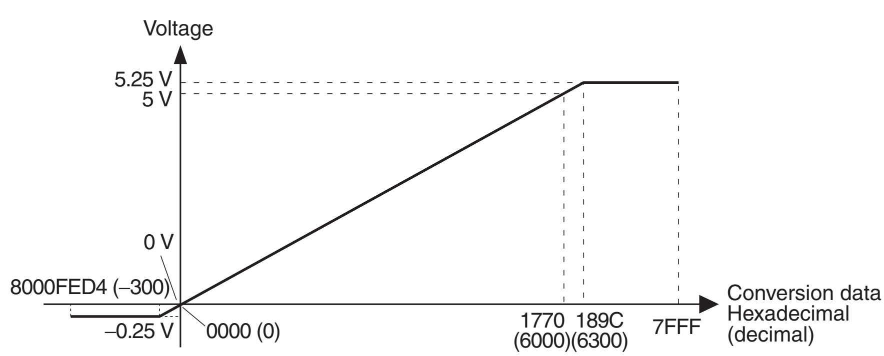


Output Range and Conversion Data

The digital data that is output is converted to analog data according to the output range used, as shown below. When the value exceeds the output range, the DA conversion data is fixed at the High Limit or Low Limit set value.

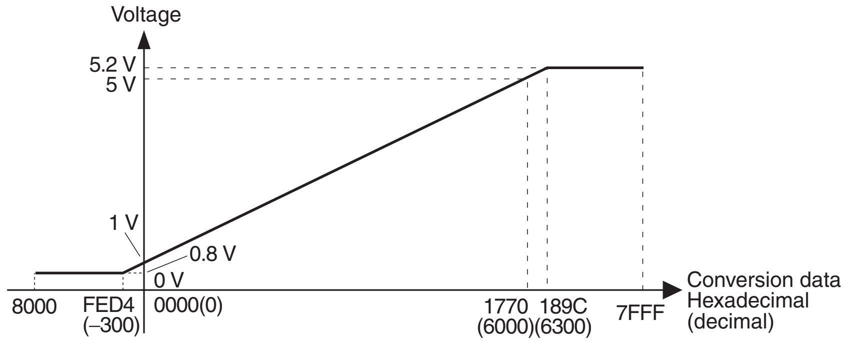
Output Range: 0 to 5 V

The values 0000 to 1770 hex (0 to 6,000) correspond to the voltage range 0 to 5 V. The output range is –0.25 to 5.25 V.



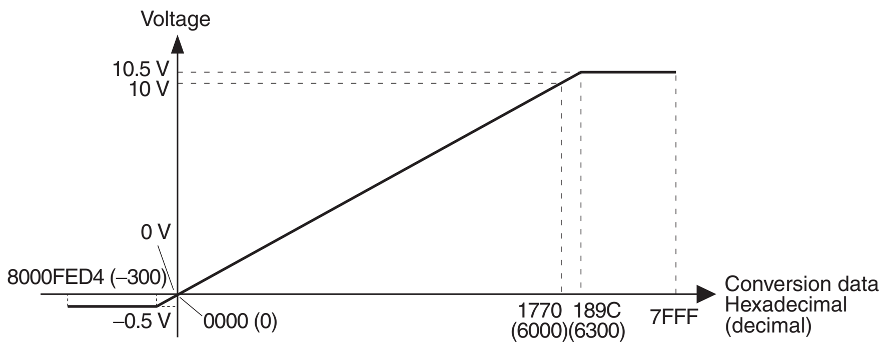
Output Range: 1 to 5 V

The values 0000 to 1770 hex (0 to 6,000) correspond to the voltage range 1 to 5 V. The output range is 0.8 to 5.2 V.



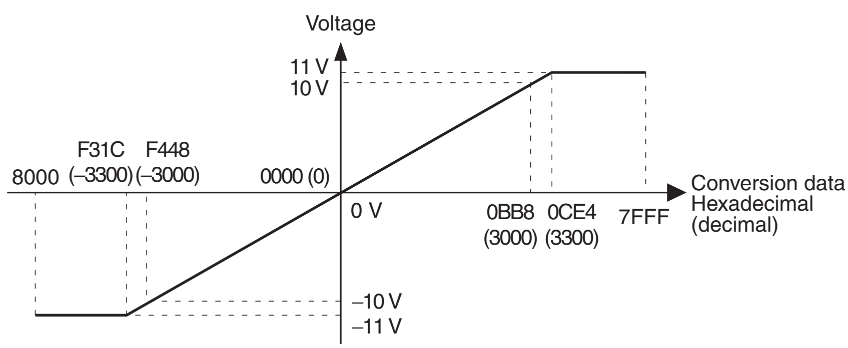
Output Range: 0 to 10 V

The values 0000 to 1770 hex (0 to 6,000) correspond to the voltage range 0 to 10 V. The output range is –0.5 to 10.5 V.



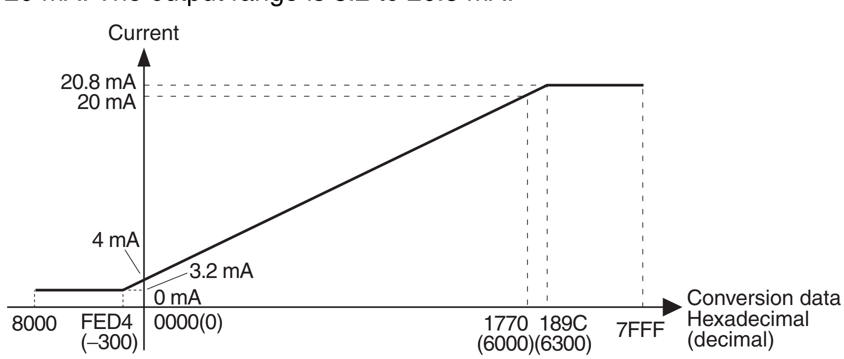
Output Range: –10 to 10 V

The values F448 to 0BB8 hex (–3,000 to 3,000) correspond to the voltage range –10 to 10 V. The output range is –11 to 11 V. Negative voltages are specified as two's complements (16 bits).



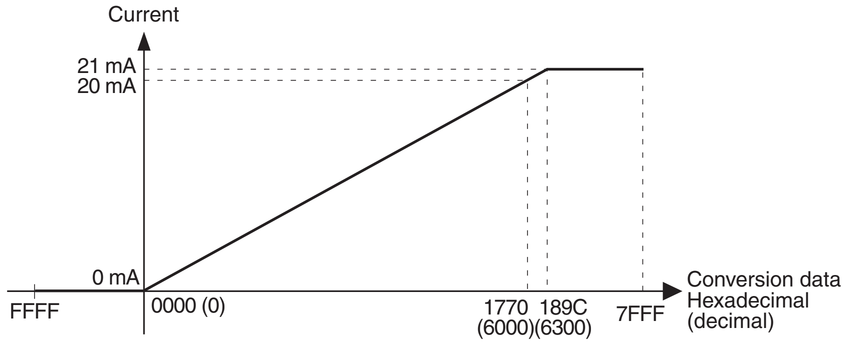
Output Range: 4 to 20 mA

The values 0000 to 1770 hex (0 to 6,000) correspond to the current range 4 to 20 mA. The output range is 3.2 to 20.8 mA.



Output Range: 0 to 20 mA

The values 0000 to 1770 hex (0 to 6,000) correspond to the current range 0 to 20 mA. The output range is 0 to 21 mA.



DA Conversion Data

DA conversion data is output from the Master Unit as shown in the following diagram.

Bit	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Word +0	Output 0 DA conversion data
Word +1	Output 1 DA conversion data

When outputting negative voltages, specify the DA conversion data as two's complements. The NEG instruction can be used to obtain two's complements from absolute values. If SW7 is used, the DA conversion data is specified as signed binary.

Note Pulses may be output if the power supply to the Analog Output Unit is turned ON and OFF excessively. When controlling an output device like an inverter, be sure the output device is OFF before turning the power supply to the Analog Output Unit ON or OFF.

6-5-2 I/O Data Types and Allocation Methods

I/O Data Allocated in the Master Unit

The Analog Output Unit has only one type of output data. The output data is allocated by default, so there is no need to change the setting. Two words (4 bytes) of output data is allocated. The data is output as two's complements.

15 8 7 0
Analog output value for Output 0
Analog output value for Output 1

SECTION 7
Expansion Units

This section describes the Expansion Units.

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7-2 Expansion Unit Specifications 171

7-2-1 Eight-point Input Units 171

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7-1 Expansion Units

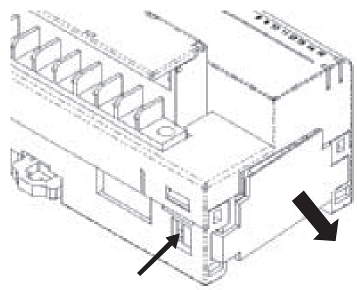
One Expansion Unit can be combined with one Digital I/O Slave Unit (CRT1-ID16(-1), CRT1-OD16(-1), CRT1-ROS16, or CRT1-ROF16). The following Expansion Units are available. They can be combined in various ways for flexible I/O capacity expansion.

Model	I/O points	Input capacity	Output capacity
XWT-ID08	8 DC inputs (NPN)	8	0
XWT-ID08-1	8 DC inputs (PNP)	8	0
XWT-OD08	8 transistor outputs (NPN)	0	8
XWT-OD08-1	8 transistor outputs (PNP)	0	8
XWT-ID16	16 DC inputs (NPN)	16	0
XWT-ID16-1	16 DC inputs (PNP)	16	0
XWT-OD16	16 transistor outputs (NPN)	0	16
XWT-OD16-1	16 transistor outputs (PNP)	0	16

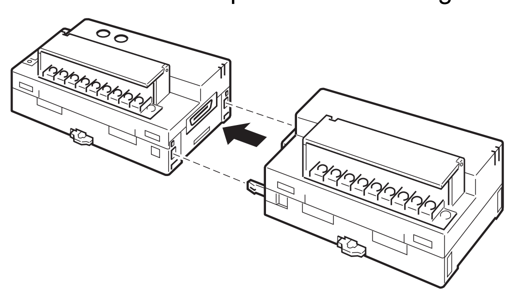
Installing Expansion Units

1,2,3...

1. Remove the cover from the right side of the Digital I/O Slave Unit.



2. Align the connector on the Expansion Unit with the connector on the Digital I/O Slave Unit and press the Units together.



3. Press the Expansion Unit and Digital I/O Slave Unit together until they click into place with the connectors properly mated.

I/O Power Supply

If an Expansion Input Unit is connected to a Digital Input Slave Unit, then I/O power must be supplied only to the Digital I/O Slave Unit. If any other combination of Units is used, I/O power must be supplied to both the Digital I/O Slave Unit and Expansion Unit. This includes connecting an Expansion Input Unit to a Digital Output Slave Unit, an Expansion Output Unit to a Digital Input Slave Unit, or an Expansion Output Unit to a Digital Output Slave Unit.

Refer to the following table and write the I/O power correctly when connecting an Expansion Unit.

Combination	I/O power supply to Expansion Slave Unit
Digital Input Slave Unit with Expansion Input Unit Example: CRT1-ID16 + XWT-ID16	Not required. (The Expansion Unit uses the same I/O power supply as the Digital I/O Slave Unit.)
Digital Input Slave Unit with Expansion Output Unit Example: CRT1-ID16 + XWT-OD16	Required (I/O power must be supplied to both Units.)
Digital Output Slave Unit with Expansion Input Unit Example: CRT1-OD16 + XWT-ID16	Required (I/O power must be supplied to both Units.)
Digital Output Slave Unit with Expansion Output Unit Example: CRT1-OD16 + XWT-OD16	Required (I/O power must be supplied to both Units.)

Note Do not connect Expansion Units while the power supply is ON.

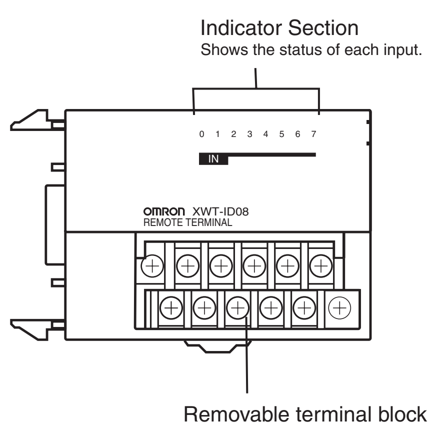
7-2 Expansion Unit Specifications

7-2-1 Eight-point Input Units

Input Section Specifications

Item	Specification	
Model	XWT-ID08	XWT-ID08-1
Internal I/O common	NPN	PNP
I/O capacity	8 inputs	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 17 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 inputs/common	

Component Names and Functions (Same for XWT-ID08 and XWT-ID08-1)



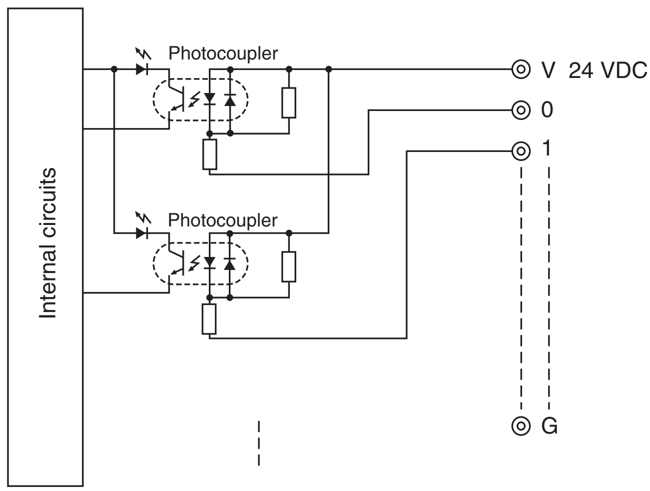
Operation Indicators

The meanings of the input indicators are given in the following table.

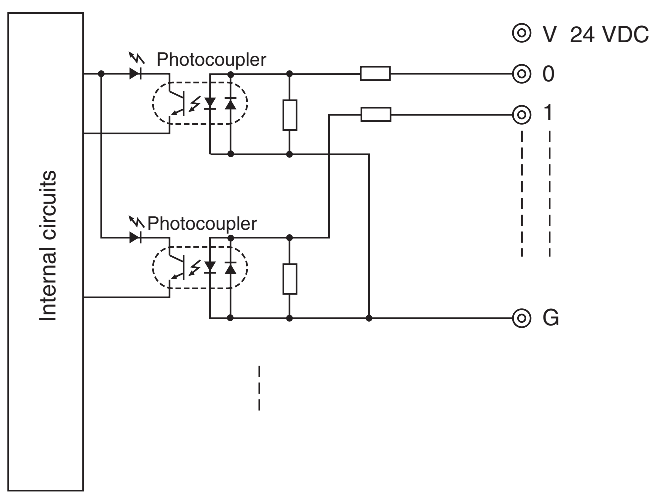
Name	LED status	I/O status	Meaning
0 to 7	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.

Internal Circuits

XWT-ID08 (NPN)

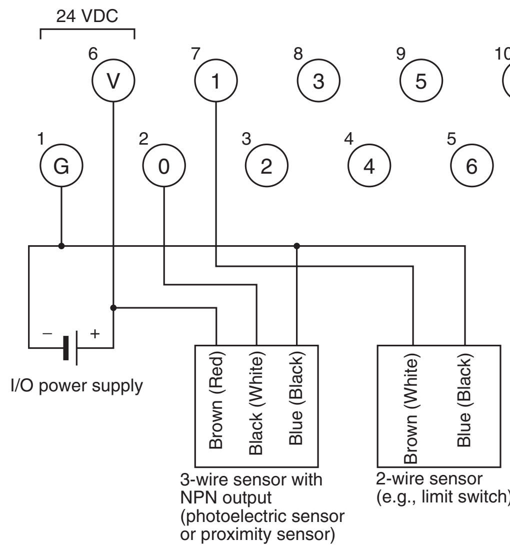


XWT-ID08-1 (PNP)

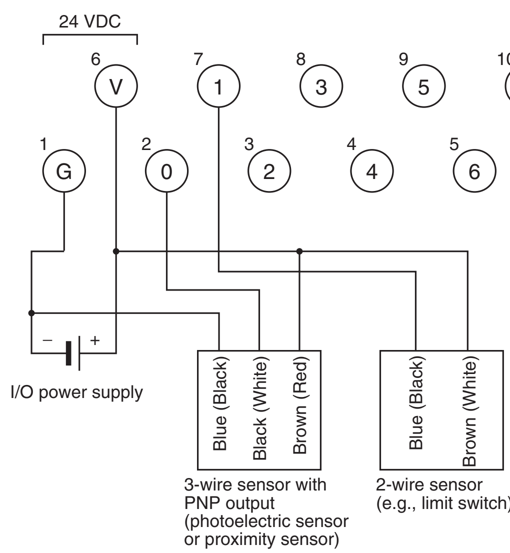


Wiring

XWT-ID08 (NPN)

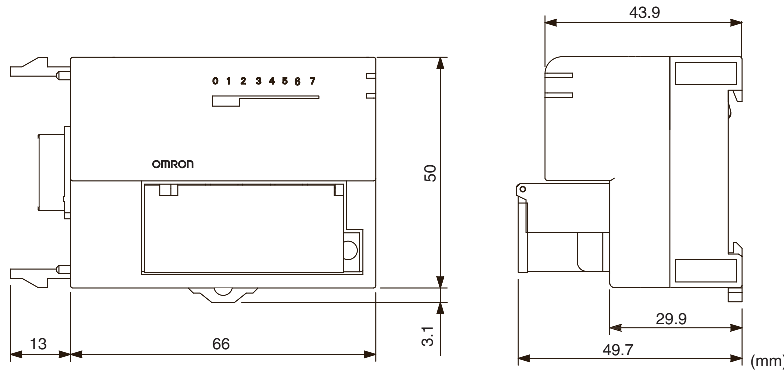


XWT-ID08-1 (PNP)



Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

Dimensions (Same for XWT-ID08 and XWT-ID08-1)

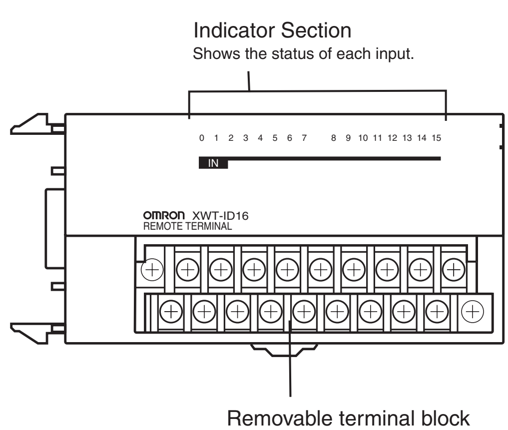


7-2-2 Sixteen-point Input Units

Input Section Specifications

Item	Specification	
Model	XWT-ID16	XWT-ID16-1
Internal I/O common	NPN	PNP
I/O capacity	16 inputs	
ON voltage	15 VDC min. (between each input terminal and the V terminal)	15 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max.(between each input terminal and the V terminal)	5 VDC max.(between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	At 24 VDC: 6.0 mA max./input At 17 VDC: 3.0 mA max./input	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 inputs/common	

Component Names and Functions (Same for XWT-ID16 and XWT-ID16-1)



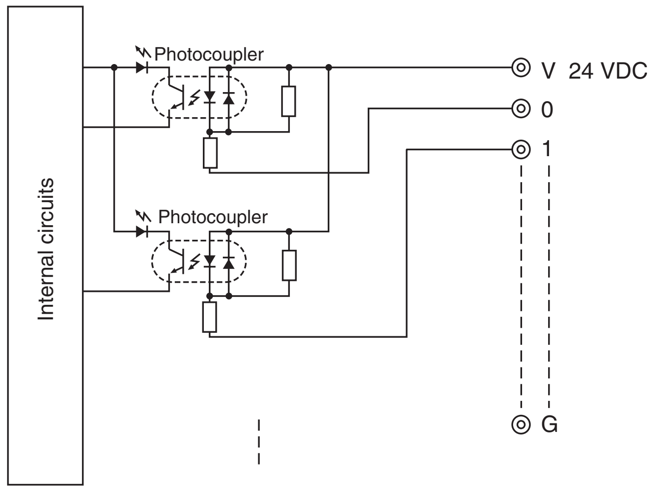
Operation Indicators

The meanings of the input indicators are given in the following table.

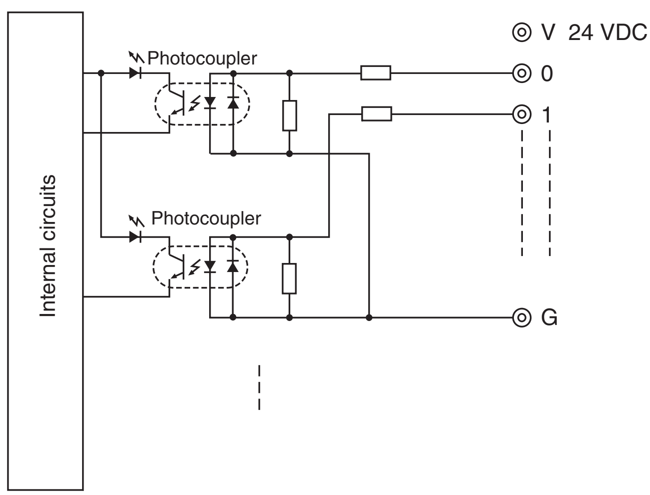
Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.

Internal Circuits

XWT-ID16 (NPN)

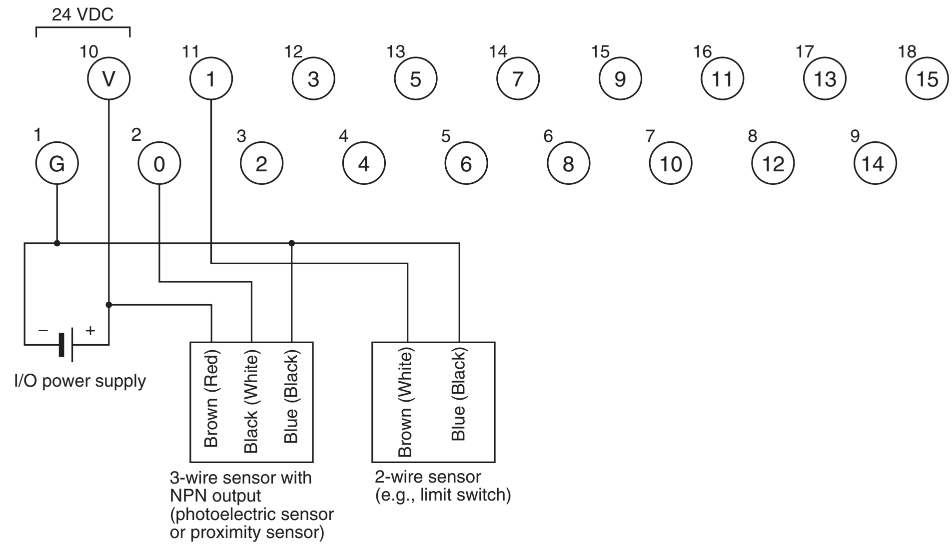


XWT-ID16-1 (PNP)

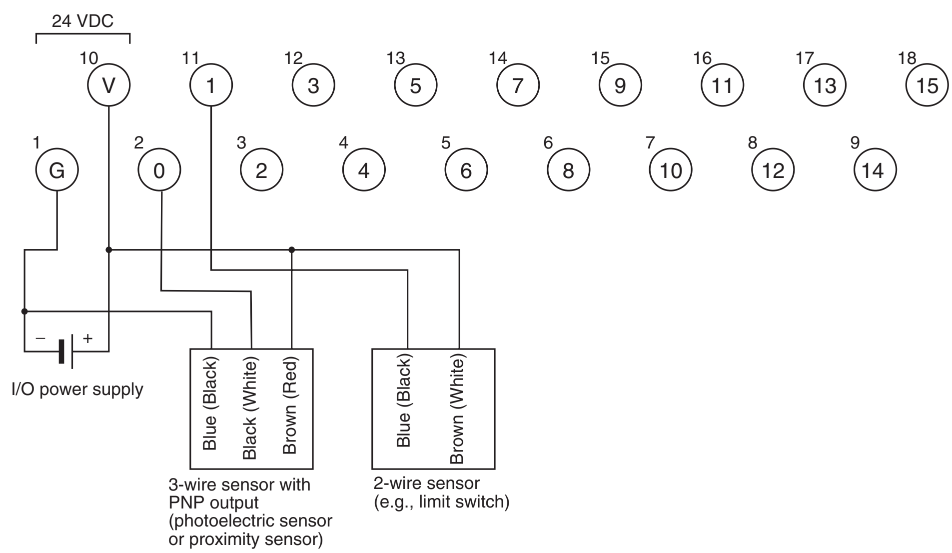


Wiring

XWT-ID16 (NPN)

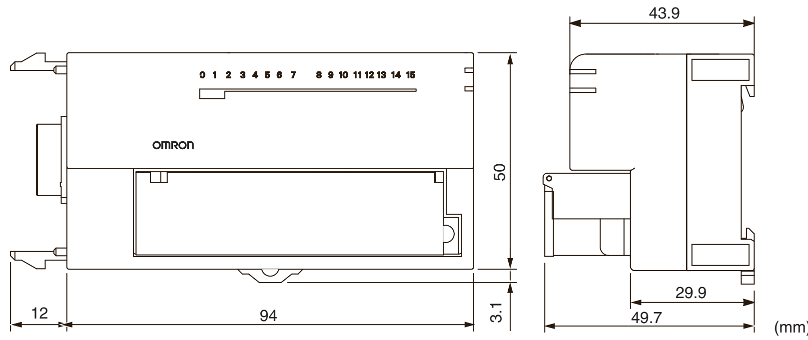


XWT-ID16-1 (PNP)



Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

Dimensions (Same for XWT-ID16 and XWT-ID16-1)

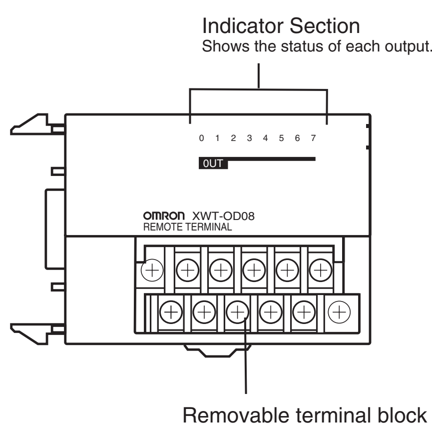


7-2-3 Eight-point Output Units

Output Section Specifications

Item	Specification	
Model	XWT-OD08	XWT-OD08-1
Internal I/O common	NPN	PNP
I/O capacity	8 outputs	
Rated output current	0.5 A/output, 2.0 A/common	
Residual voltage	1.2 V max.(0.5 A DC, between each output terminal and the G terminal)	1.2 V max.(0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	0.1 mA max.
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	8 outputs/common	

Component Names and Functions (Same for XWT-OD08 and XWT-OD08-1)



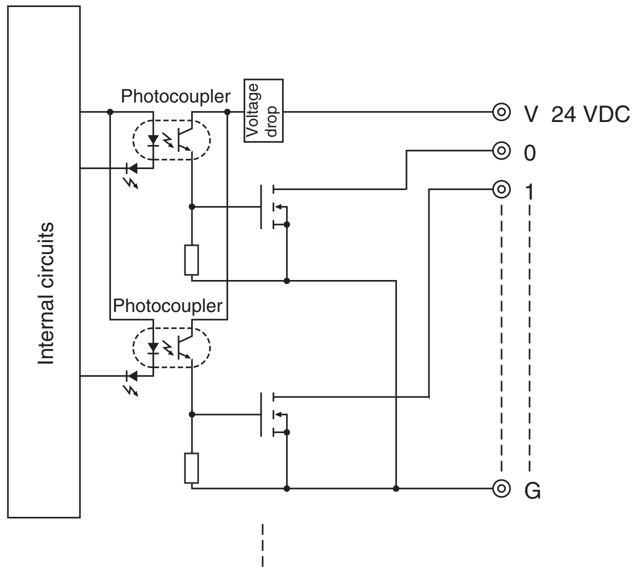
Operation Indicators

The meanings of the output indicators are given in the following table.

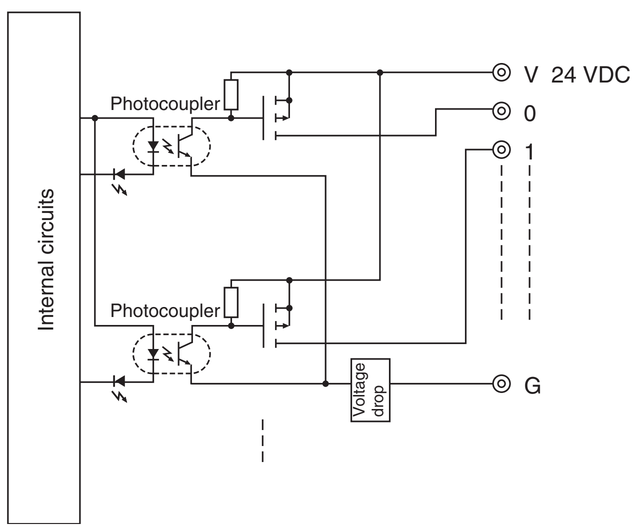
Name	LED status	I/O status	Meaning
0 to 7	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

Internal Circuits

XWT-OD08 (NPN)

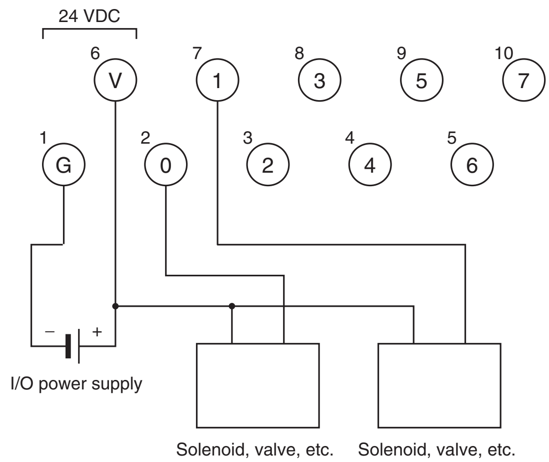


XWT-OD08-1 (PNP)

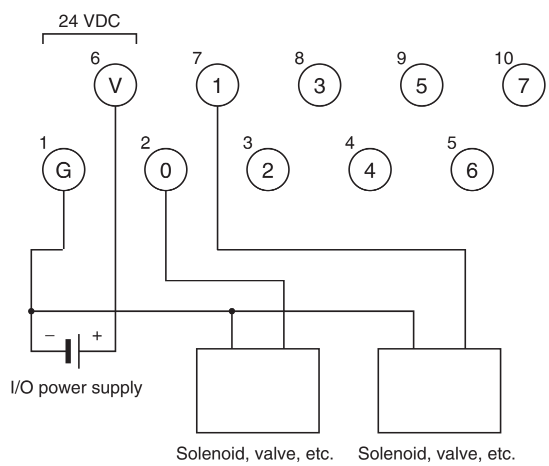


Wiring

XWT-OD08 (NPN)

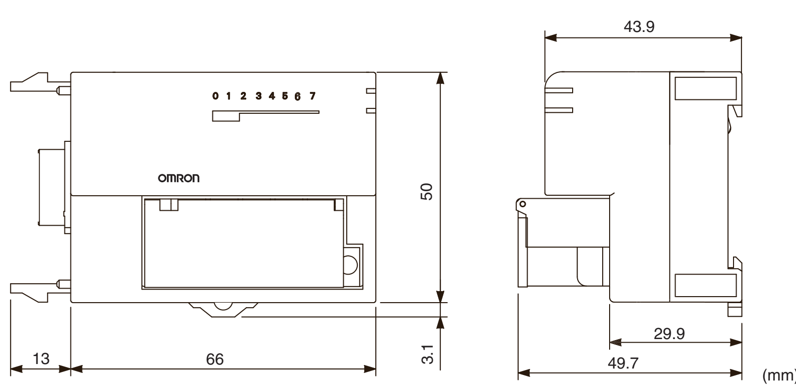


XWT-OD08-1 (PNP)



Note When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

Dimensions (Same for XWT-OD08 and XWT-OD08-1)

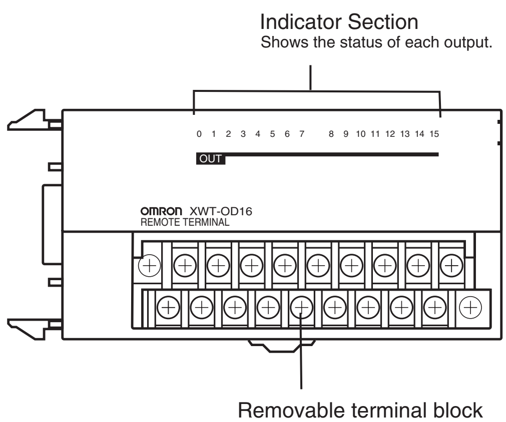


7-2-4 Sixteen-point Output Units

Output Section Specifications

Item	Specification	
Model	XWT-OD16	XWT-OD16-1
Internal I/O common	NPN	PNP
I/O capacity	16 outputs	
Rated output current	0.5 A/output, 4.0 A/common	
Residual voltage	1.2 V max. (0.5 A DC, between each output terminal and the G terminal)	1.2 V max. (0.5 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	0.1 mA max.
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	16 outputs/common	

Component Names and Functions (Same for XWT-OD16 and XWT-OD16-1)



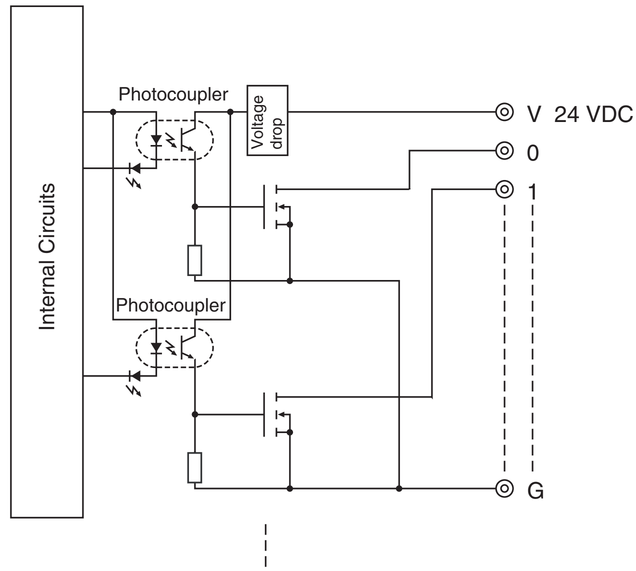
Operation Indicators

The meanings of the output indicators are given in the following table.

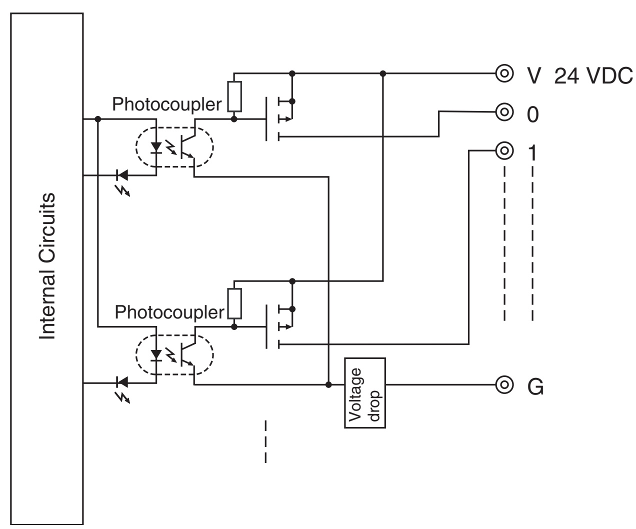
Name	LED status	I/O status	Meaning
0 to 15	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.

Internal Circuits

XWT-OD16 (NPN)

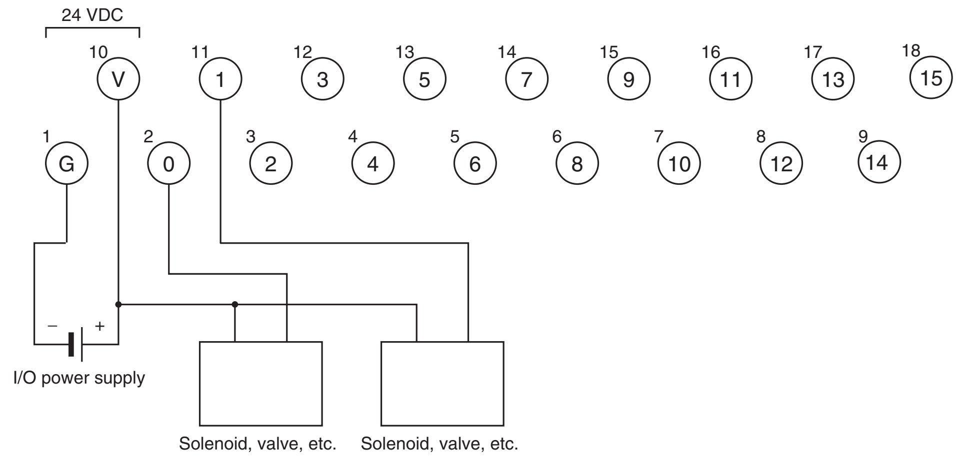


XWT-OD16-1 (PNP)

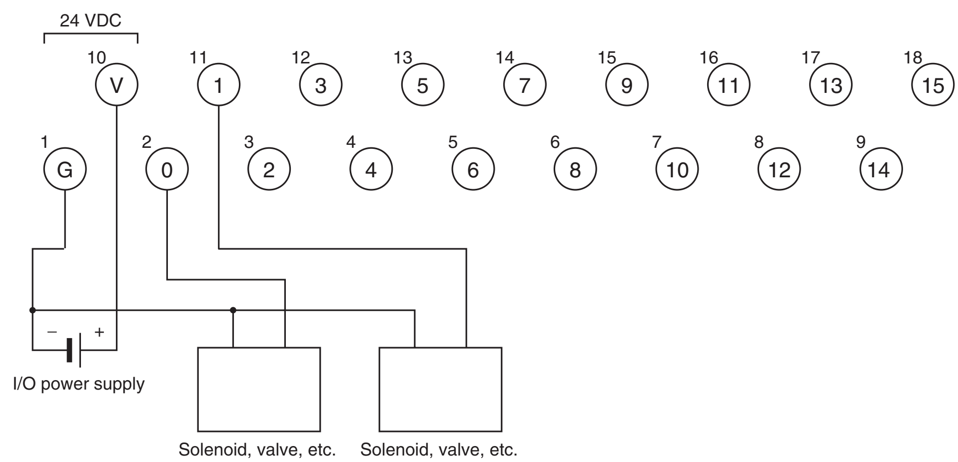


Wiring

XWT-OD16 (NPN)

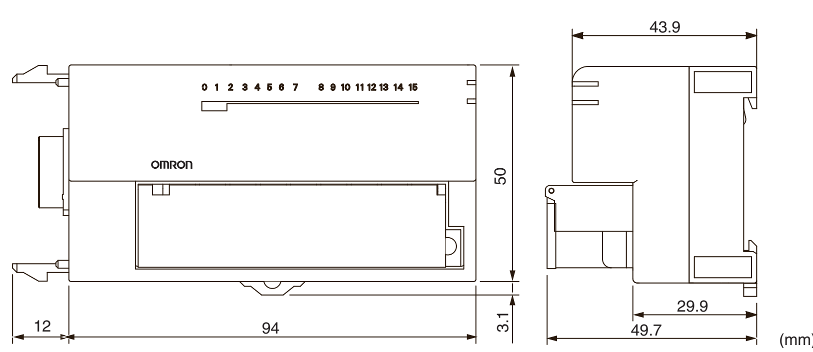


XWT-OD16-1 (PNP)



Note When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

Dimensions (Same for XWT-OD16 and XWT-OD16-1)



SECTION 8
Bit Slave Units

This section describes the Bit Slave Units.

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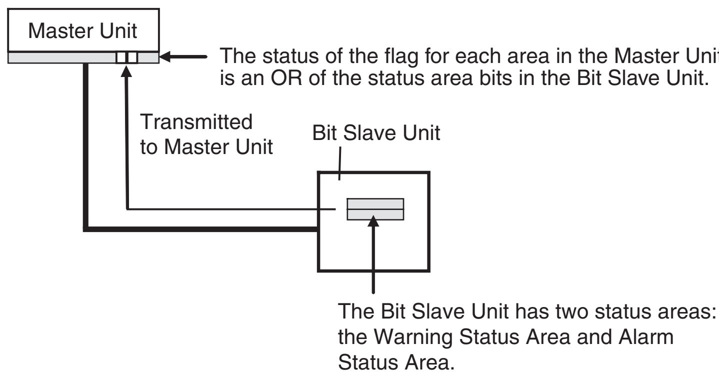
8-1 Status Areas

A Bit Slave Unit has two status areas: the Warning Status Area and the Alarm Status Area. The status flags in these areas are turned ON and OFF based on the threshold values set by the user for each function in that Unit. For each area, a corresponding status flag in the Master Unit will be turned ON if any flag in the status area in the Bit Slave Unit turns ON. Bit 12 in the Master Unit corresponds to the Warning Status Area and bit 13 corresponds to the Alarm Status Area.

The Bit Slave Unit's status area information can be read by using the CompoNet Support Software or explicit messages.



Warning Status Area

The Bit Slave Unit's Warning Status Area contains the following 16 bits. These bits indicate minor errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	Reserved	---
2	Network Power Voltage Drop Flag OFF: Normal ON: Error (Voltage dropped below threshold.)	Monitors the voltage set as the threshold for the network power voltage monitor function.
3	Unit Maintenance Flag OFF: Normal ON: Error (Threshold exceeded.)	Monitors the power ON time warning value set as the threshold for the Unit Conduction Time Monitor function.
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Operation Time Monitor Flag OFF: Normal ON: Error (Threshold exceeded.)	Turns ON when the threshold set for the operation time monitor function is exceeded.
9	Connected Device Maintenance Flag OFF: Normal ON: Error (Threshold exceeded.)	Turns ON when the threshold set for the contact operation monitor function or the total ON time monitor function is exceeded.
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

Alarm Status Area

The Bit Slave Unit's Alarm Status Area contains the following 16 bits. These bits indicate serious errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	EEPROM Data Error Flag OFF: Normal ON: Error occurred	Turns ON when there is an error in the EEPROM data.
2	Reserved	---
3	Reserved	---
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Reserved	---
9	Reserved	---
10	Sensor Power Short-circuit Detection Flag OFF: Normal ON: Short-circuit	Turns ON when there is a short in the power supply connection to the connected devices, including wiring mistakes and connected device failure.
11	External Load Short-circuit Detection Flag OFF: Normal ON: Short-circuit	Turns ON when there is a short in the external load connection, including wiring mistakes and connected device failure.
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

8-2 Allocating I/O Data

Bit Slave Units are allocated node address areas in units of two points (two bits).

- Input Units and Output Units

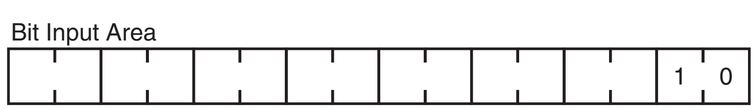
  Units with two points are allocated two bits (the node address set for the Unit).

  Units with four points are allocated four bits (the node address set for the Unit and the next node address area).

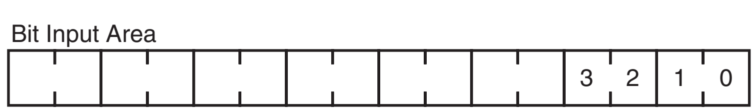
- I/O Units

  Units are allocated two words (the input and output node address areas).

Two-point Input Units

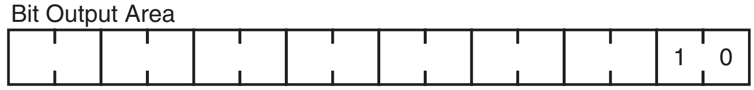


Four-point Input Units



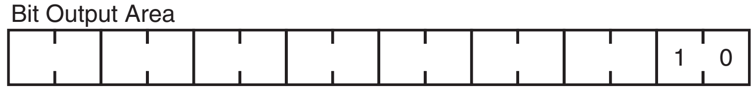
Two-point Output Units

Bit Output Area

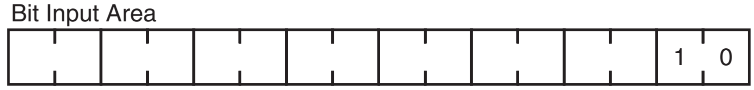


Four-point I/O Units

Bit Output Area



Bit Input Area



Bit Slave Units are allocated node address areas in order without leaving any bits unused in the middle. For example, eight, two-point Slave Units are allocated one word. Likewise, four, two-point Slave Units and two, four-point Slave Units are also allocated one word.

8-3 Industry Standard Sensor Connectors

8-3-1 Two-point Input Units (IP20)

Input Section Specifications

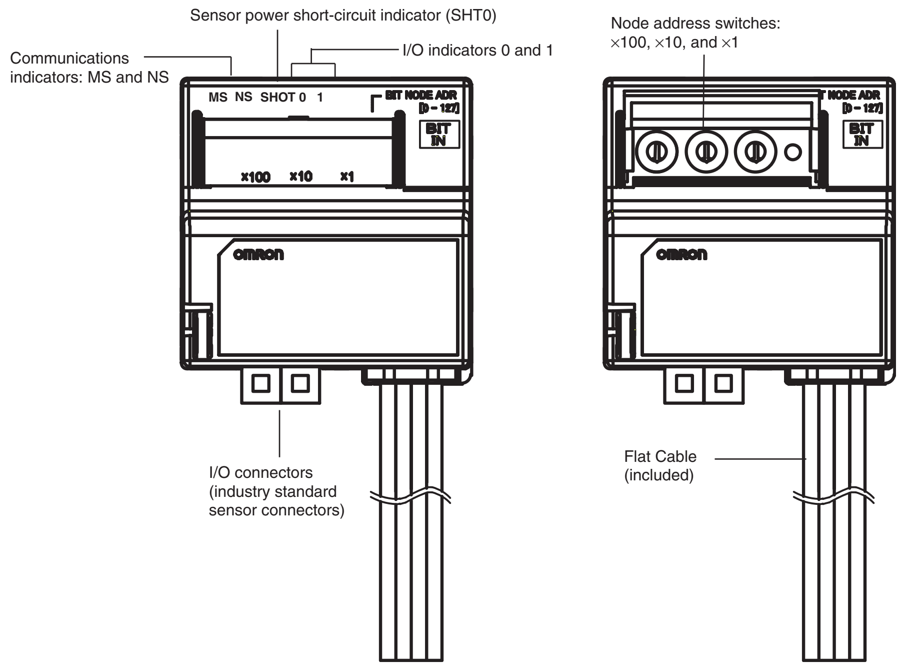
Item	Specification	
Model	CRT1B-ID02S	CRT1B-ID02S-1
I/O capacity	2 inputs	
Internal I/O common	NPN	PNP
ON voltage	10.5 VDC min. (between each input terminal and the V terminal)	10.5 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	3.0 mA max./input (at 10.5 VDC)	
Sensor power supply voltage	Communications power supply voltage + 0 V (max.) Communications power supply voltage – 1 V (min.)	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	2 inputs/common	
Sensor power short-circuit detection	Detected.	
Isolation method	No isolation	
Input indicators	LEDs (yellow)	
Degree of protection	IEC standard IP20	
Installation	Screw installation (M4)	
Power supply type	Network power supply	
Communications power supply current consumption (See note.)	65 mA max. for 24-VDC power supply voltage 80 mA max. for 14-VDC power supply voltage	45 mA max. for 24-VDC power supply voltage 65 mA max. for 14-VDC power supply voltage
Weight	70 g max.	

Note The current consumption is for Bit Slave Unit communications current when all inputs are OFF, i.e., it does not include input device current consumption. The communications power supply is also used for the I/O power supply for sensors. Be sure to consider the sensor current consumption and the number of sensors connected in addition to the communications power.

The power supply current consumption is expressed by the following formula.

Communications power supply current consumption = Bit Slave Unit communications current consumption + (Bit Slave Unit input current × number of inputs used) + (sensor current consumption × number of sensors used)

Component Names and Functions (Same for CRT1B-ID02S and CRT1B-ID02S-1)



Display Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

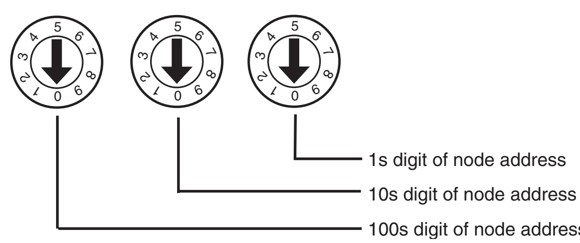
The meanings of the input and status indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 1	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.
SHT0	Lit red.	Sensor power short-circuit	The sensor power supply is short-circuited.

Setting the Node Address

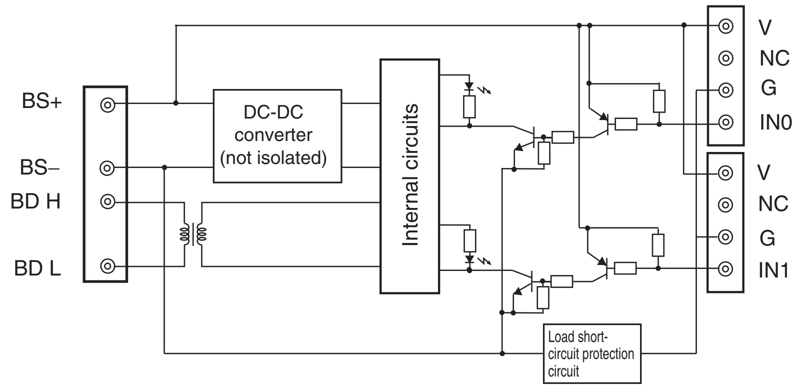
The node address is set as a decimal number between 0 and 127 with the 100s digit set on the left rotary switch, the 10s digit set on the middle rotary switch, and the 1s digit set on the right rotary switch.

The setting on the rotary switches is read when power is turned ON.

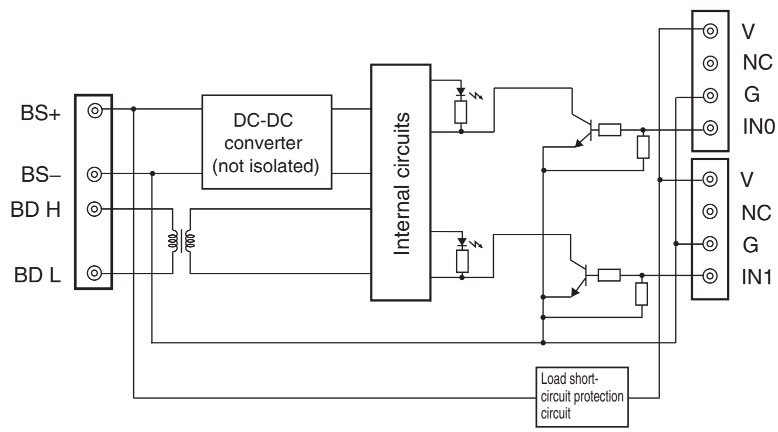


Internal Circuits

CRT1B-ID02S (NPN)



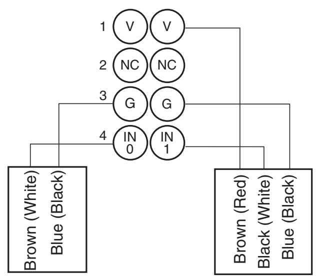
CRT1B-ID02S-1 (PNP)



Wiring

The I/O connector section uses industry standard sensor connectors (e-CON). Pin arrangements and signals are shown below.

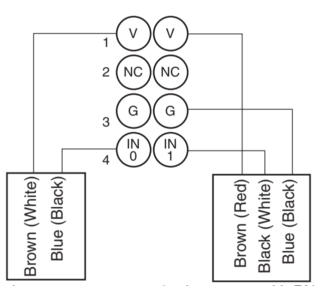
CRT1B-ID02S (NPN)



2-wire sensor
(e.g., limit switch)

3-wire sensor with NPN output
(photoelectric sensor or
proximity sensor)

CRT1B-ID02S-1 (PNP)

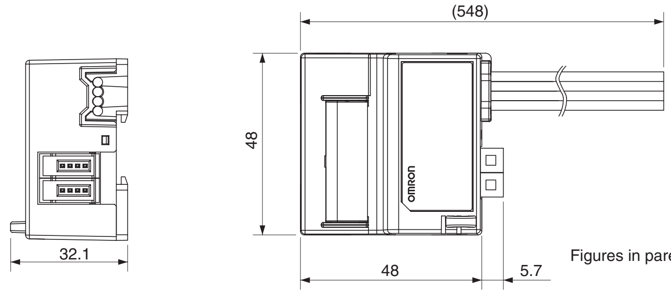


2-wire sensor
(e.g., limit switch)

3-wire sensor with PNP output
(photoelectric sensor or
proximity sensor)

Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

Dimensions (Same for CRT1B-ID02S and CRT1B-ID02S-1)



Figures in parentheses are reference dimensions.
(Unit: mm)

8-3-2 Two-point Output Units (IP20)

Output Section Specifications

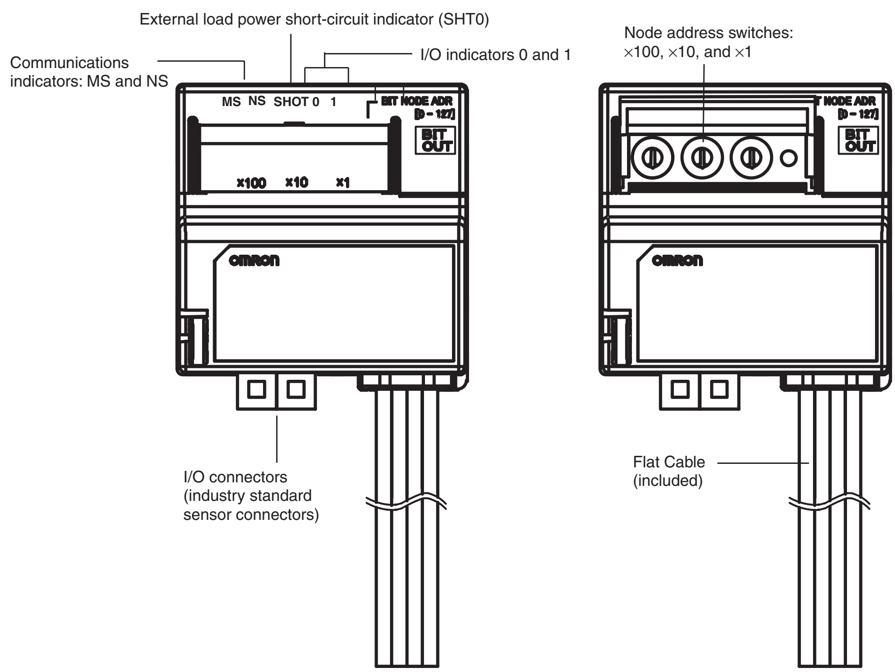
Item	Specification	
Model	CRT1B-OD02S	CRT1B-OD02S-1
I/O capacity	2 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.2 A/output	
Load power supply voltage	Communications power supply voltage + 0 V (max.) Communications power supply voltage – 1.2 V (min.)	
Residual voltage	1.2 V max. (0.2 A DC, between each output terminal and the G terminal)	1.2 V max. (0.2 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	2 outputs/common	
External load power short-circuit detection	Detected	
Isolation method	No isolation	
Output indicators	LEDs (yellow)	
Degree of protection	IEC standard IP20	
Installation	Screw installation (M4)	
Power supply type	Network power supply	
Communications power supply current consumption (See note.)	55 mA max. for 24-VDC power supply voltage 75 mA max. for 14-VDC power supply voltage	55 mA max. for 24-VDC power supply voltage 70 mA max. for 14-VDC power supply voltage
Weight	59 g max.	

Note The current consumption is for Bit Slave Unit communications current when all outputs are OFF, i.e., it does not include the output device load current consumption. The communications power supply is also used for the I/O power supply for actuators. Be sure to consider the actuator load current consumption and the number of sensors connected in addition to the communications power.

The power supply current consumption is expressed by the following formula.

Communications power supply current consumption = Bit Slave Unit communications current consumption + (actual load current × number of actuators used)

Component Names and Functions (Same for CRT1B-OD20S and CRT1B-OD20S-1)



Display Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

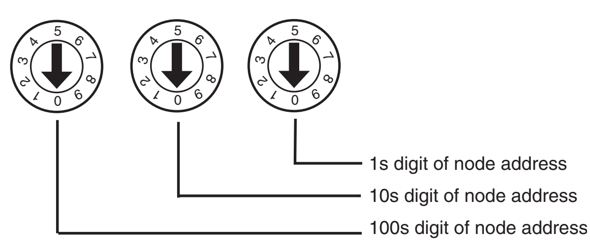
The meanings of the output and status indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 1	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.
SHT0	Lit red.	Load power short-circuit detection	The load power supply is short-circuited.

Setting the Node Address

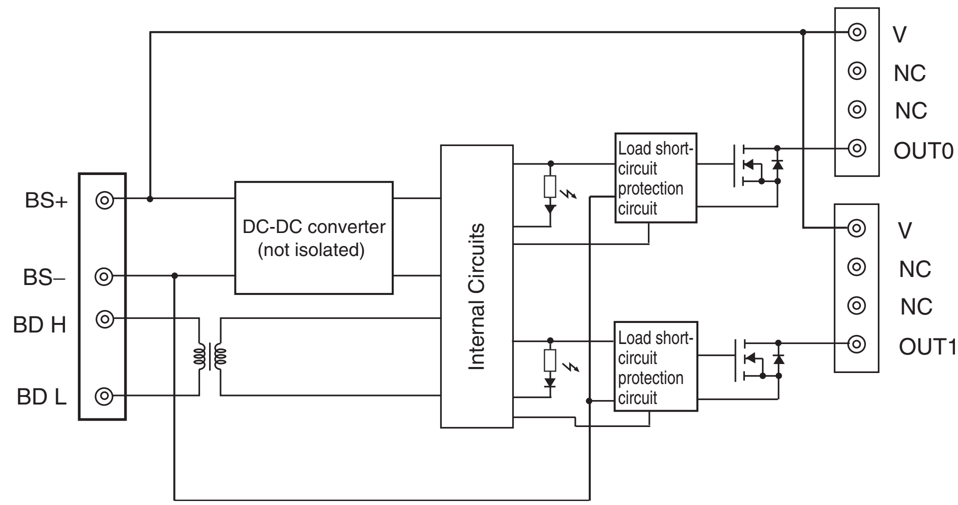
The node address is set as a decimal number between 0 and 127 with the 100s digit set on the left rotary switch, the 10s digit set on the middle rotary switch, and the 1s digit set on the right rotary switch.

The setting on the rotary switches is read when power is turned ON.

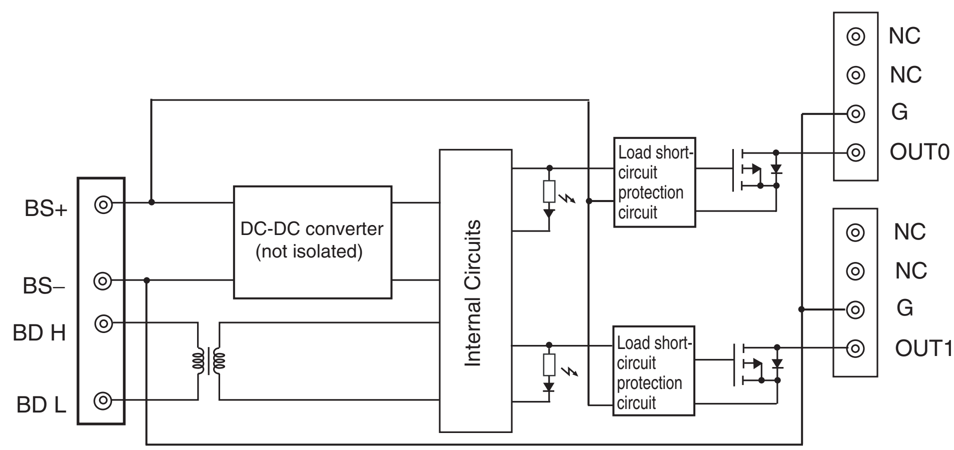


Internal Circuits

CRT1B-OD02S (NPN)



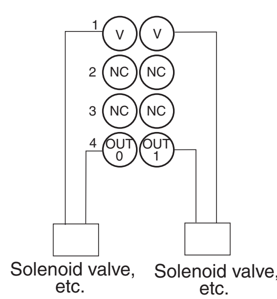
CRT1B-OD02S-1 (PNP)



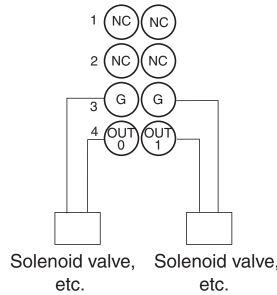
Wiring

The I/O connector section uses industry standard sensor connectors (e-CON). Pin arrangements and signals are shown below.

CRT1B-OD02S (NPN)

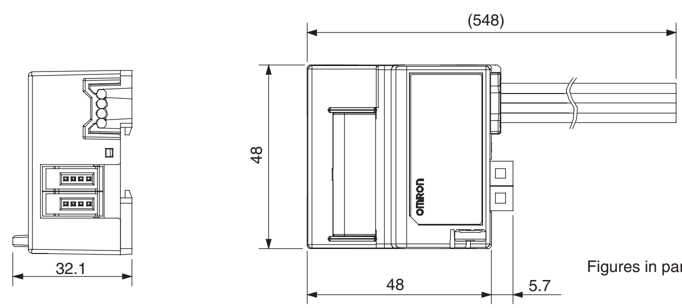


CRT1B-OD02S-1 (PNP)



Note When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

Dimensions (Same for CRT1B-OD02S and CRT1B-OD02S-1)



8-3-3 Two-point Input Units (IP54)

Input Section Specifications

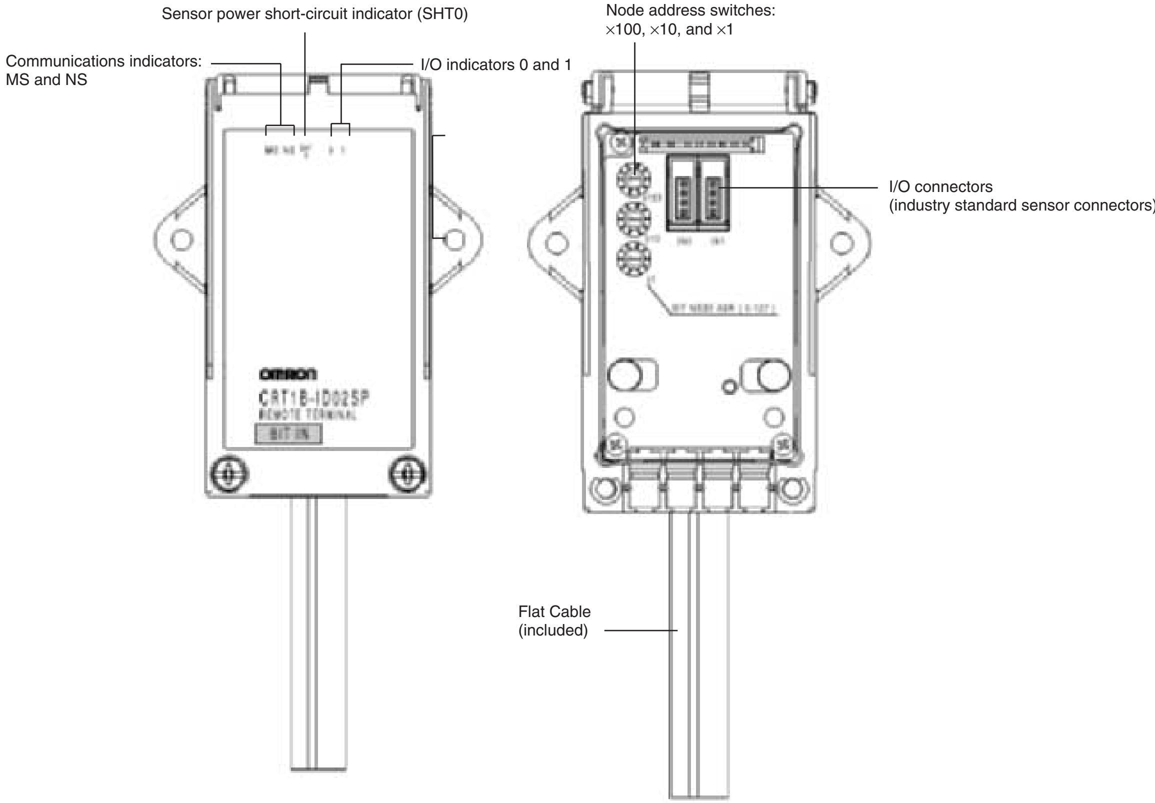
Item	Specification	
Model	CRT1B-ID02SP	CRT1B-ID02SP-1
I/O capacity	2 inputs	
Internal I/O common	NPN	PNP
ON voltage	10.5 VDC min. (between each input terminal and the V terminal)	10.5 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	3.0 mA max./input (at 10.5 VDC)	
Sensor power supply voltage	Communications power supply voltage + 0 V (max.) Communications power supply voltage – 1 V (min.)	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	2 inputs/common	
Sensor power short-circuit detection	Detected	
Isolation method	No isolation	
Input indicators	LEDs (yellow)	
Degree of protection	IEC standard IP54	
Installation	Screw installation (M4)	
Power supply type	Network power supply	
Communications power supply current consumption (See note.)	65 mA max. for 24-VDC power supply voltage 80 mA max. for 14-VDC power supply voltage	
Weight	184 g max.	

Note The current consumption is for Bit Slave Unit communications current when all inputs are OFF, i.e., it does not include input device current consumption. The communications power supply is also used for the I/O power supply for sensors. Be sure to consider the sensor current consumption and the number of sensors connected in addition to the communications power.

The power supply current consumption is expressed by the following formula.

Communications power supply current consumption = Bit Slave Unit communications current consumption + (Bit Slave Unit input current × number of inputs used) + (sensor current consumption × number of sensors used)

Component Names and Functions (Same for CRT1B-ID02SP and CRT1B-ID02SP-1)



Display Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

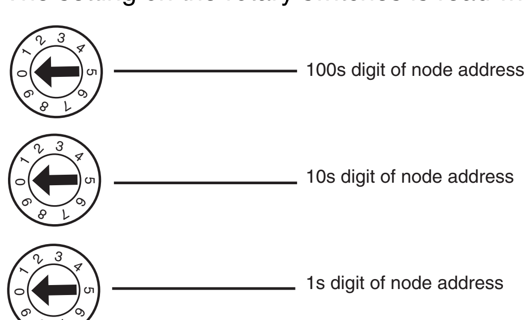
The meanings of the input and status indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 1	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.
SHT0	Lit red.	Sensor power short-circuit	The sensor power supply is short-circuited.

Setting the Node Address

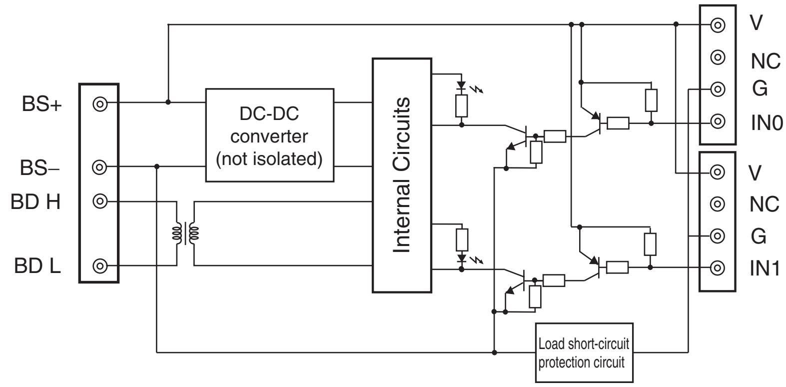
The node address is set as a decimal number between 0 and 127 with the 100s digit set on the top rotary switch, the 10s digit set on the middle rotary switch, and the 1s digit set on the bottom rotary switch.

The setting on the rotary switches is read when power is turned ON.

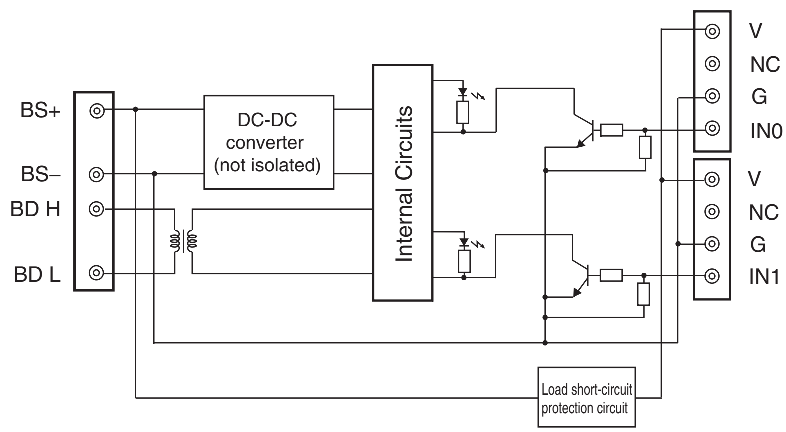


Internal Circuits

CRT1B-ID02SP (NPN)



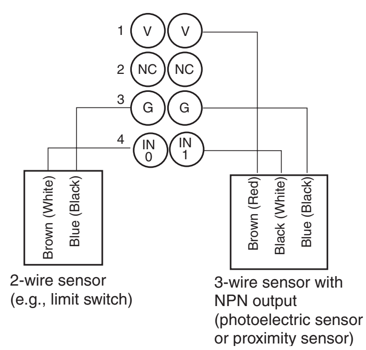
CRT1B-ID02SP-1 (PNP)



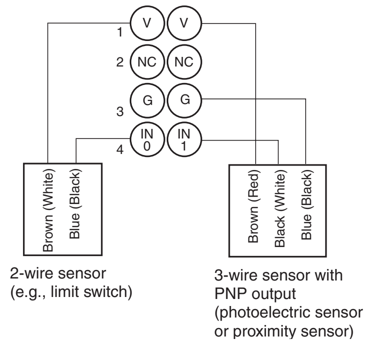
Wiring

The I/O connector section uses industry standard sensor connectors (e-CON). Pin arrangements and signals are shown below.

CRT1B-ID02SP (NPN)

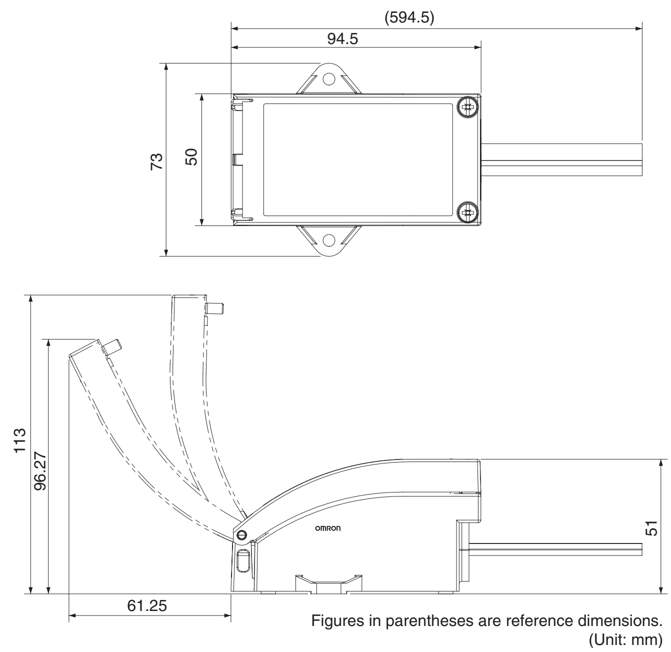


CRT1B-ID02SP-1 (PNP)



Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

Dimensions (Same for CRT1B-ID02SP and CRT1B-ID02SP-1)



8-3-4 Two-point Output Units (IP54)

Output Section Specifications

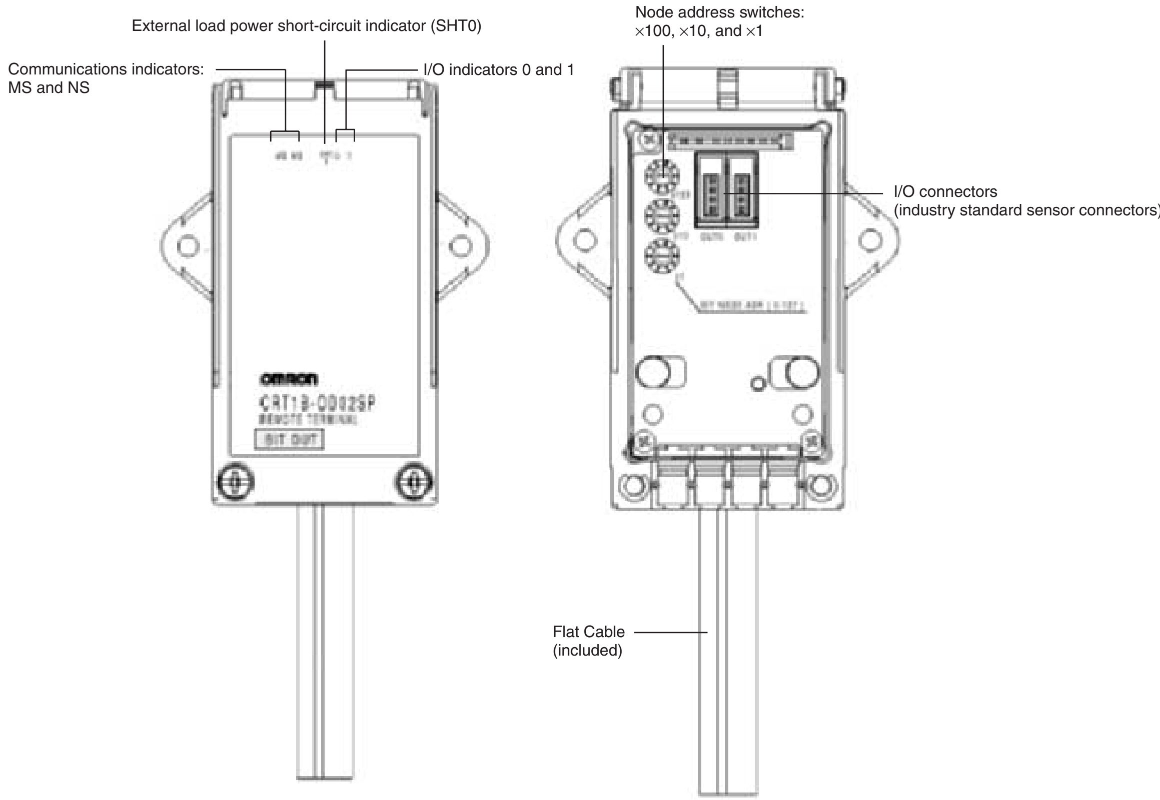
Item	Specification	
Model	CRT1B-OD02SP	CRT1B-OD02SP-1
I/O capacity	2 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.2 A/output	
Load power supply voltage	Communications power supply voltage + 0 V (max.) Communications power supply voltage – 1.2 V (min.)	
Residual voltage	1.2 V max. (0.2 A DC, between each output terminal and the G terminal)	1.2 V max. (0.2 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	2 outputs/common	
External load power short-circuit detection	Detected	
Isolation method	No isolation	
Output indicators	LEDs (yellow)	
Degree of protection	IEC standard IP54	
Installation	Screw installation (M4)	
Power supply type	Network power supply	
Communications power supply current consumption (See note.)	50 mA max. for 24-VDC power supply voltage 75 mA max. for 14-VDC power supply voltage	
Weight	169 g max.	

Note The current consumption is for Bit Slave Unit communications current when all outputs are OFF, i.e., it does not include the output device load current consumption. The communications power supply is also used for the I/O power supply for actuators. Be sure to consider the actuator load current consumption and the number of sensors connected in addition to the communications power.

The power supply current consumption is expressed by the following formula.

Communications power supply current consumption = Bit Slave Unit communications current consumption + (actual load current × number of actuators used)

Component Names and Functions (Same for CRT1B-OD02SP and CRT1B-OD02SP-1)



Display Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

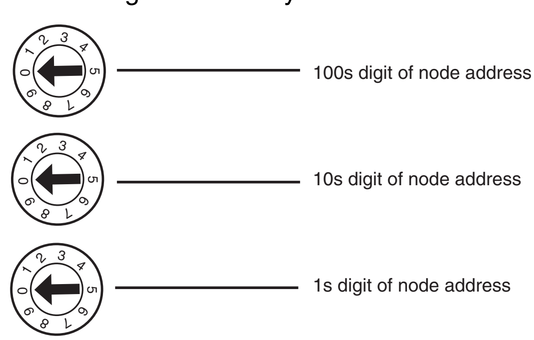
The meanings of the output and status indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 1	Lit yellow.	Output ON	The output is ON.
	Not lit.	Output OFF	The output is OFF.
SHT0	Lit red.	Load power short-circuit detection	The load power supply is short-circuited.

Setting the Node Address

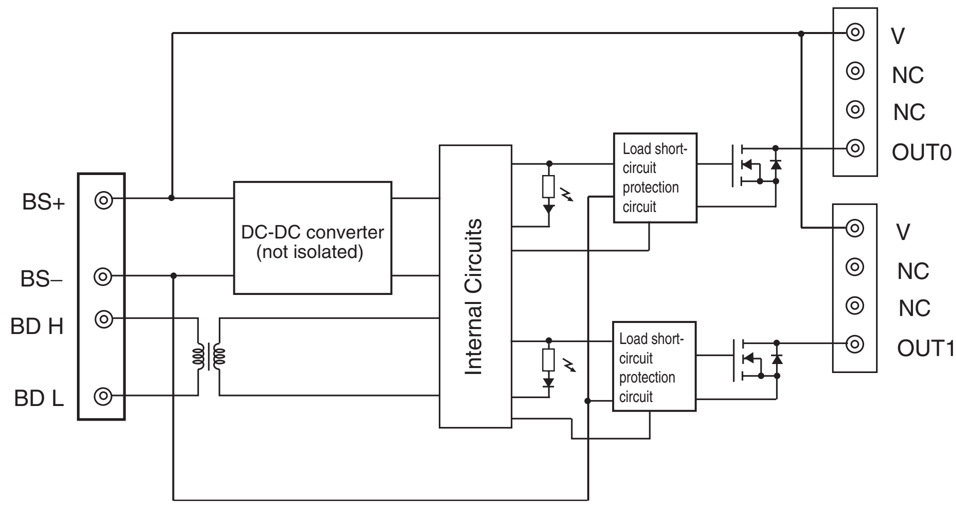
The node address is set as a decimal number between 0 and 127 with the 100s digit set on the top rotary switch, the 10s digit set on the middle rotary switch, and the 1s digit set on the bottom rotary switch.

The setting on the rotary switches is read when power is turned ON.

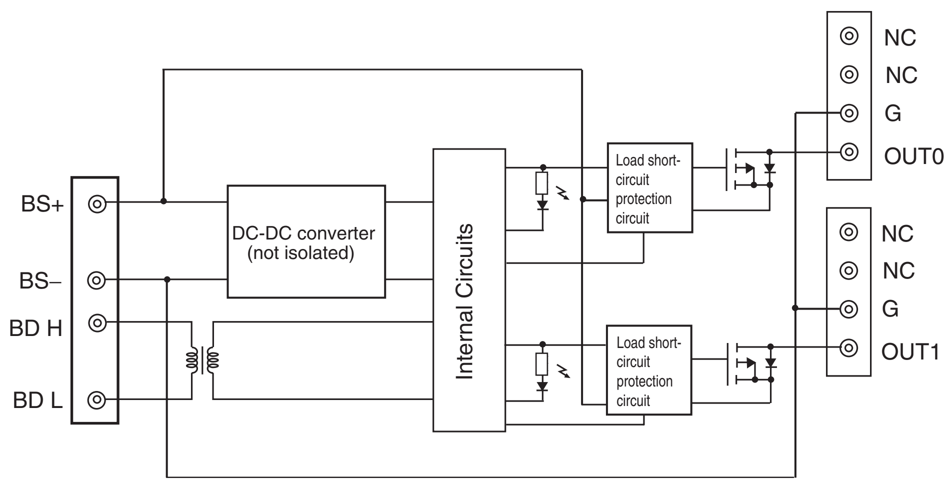


Internal Circuits

CRT1B-OD02SP (NPN)



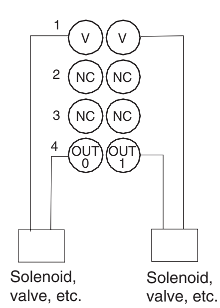
CRT1B-OD02SP-1 (PNP)



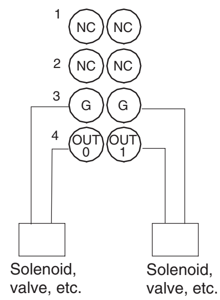
Wiring

The I/O connector section uses industry standard sensor connectors (e-CON). Pin arrangements and signals are shown below.

CRT1B-OD02SP (NPN)

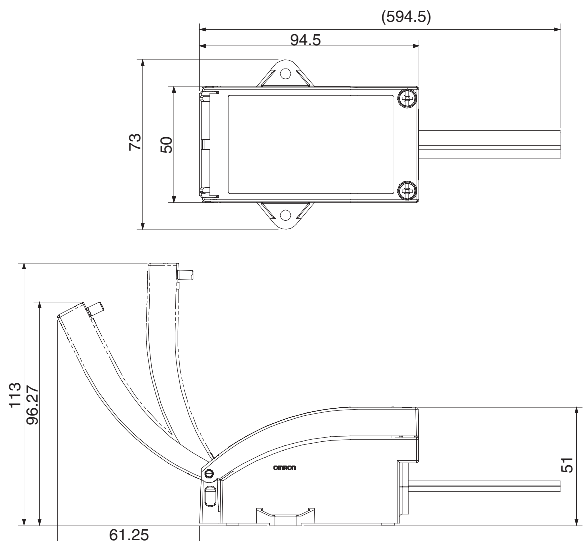


CRT1B-OD02SP-1 (PNP)



Note When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

Dimensions (Same for CRT1B-OD02SP and CRT1B-OD02SP-1)



Figures in parentheses are reference dimensions.
(Unit: mm)

8-3-5 Four-point Input Units (IP54)

Input Section Specifications

Item	Specification	
Model	CRT1B-ID04SP	CRT1B-ID04SP-1
I/O capacity	4 inputs	
Internal I/O common	NPN	PNP
ON voltage	10.5 VDC min. (between each input terminal and the V terminal)	10.5 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1.0 mA max.	
Input current	3.0 mA max./input (at 10.5 VDC)	
Sensor power supply voltage	Communications power supply voltage + 0 V (max.) Communications power supply voltage – 1 V (min.)	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	4 inputs/common	

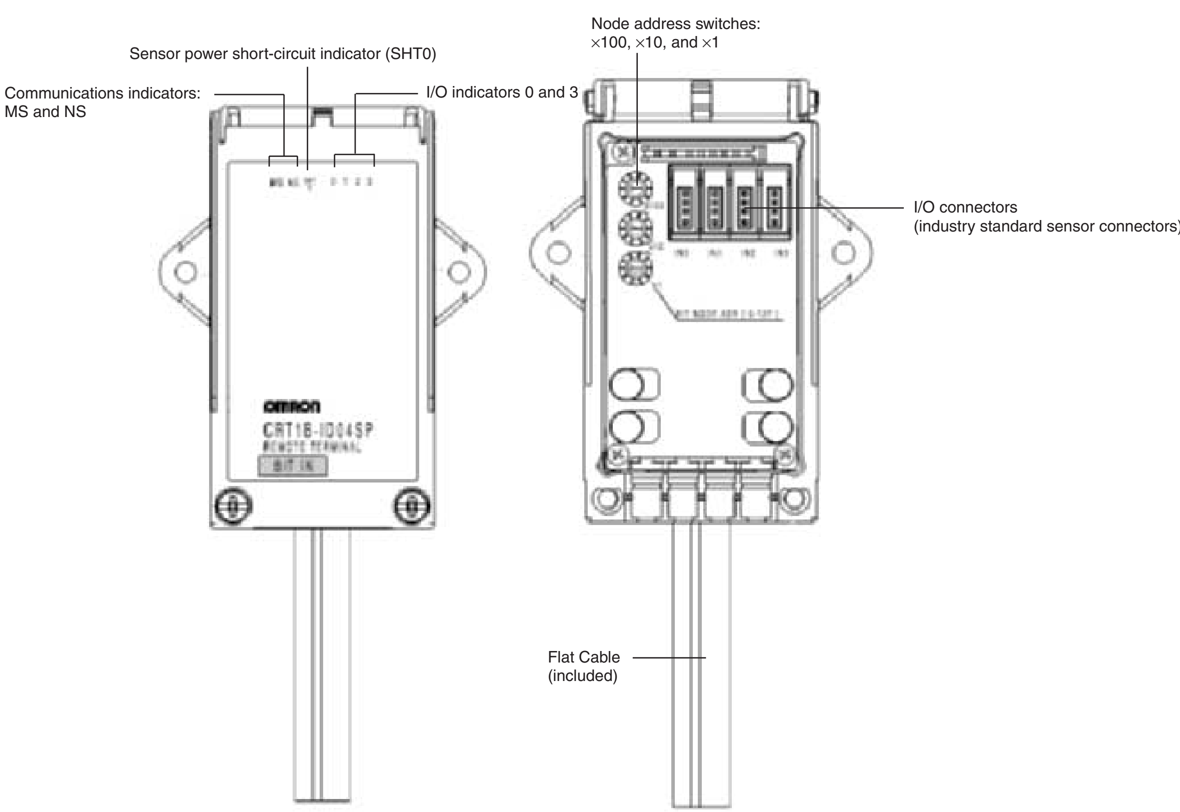
Item	Specification
Sensor power short-circuit detection	Detected
Isolation method	No isolation
Input indicators	LEDs (yellow)
Degree of protection	IEC standard IP54
Installation	Screw installation (M4)
Power supply type	Network power supply
Communications power supply current consumption (See note.)	85 mA max. for 24-VDC power supply voltage 90 mA max. for 14-VDC power supply voltage
Weight	188 g

Note The current consumption is for Bit Slave Unit communications current when all inputs are OFF, i.e., it does not include input device current consumption. The communications power supply is also used for the I/O power supply for sensors. Be sure to consider the sensor current consumption and the number of sensors connected in addition to the communications power.

The power supply current consumption is expressed by the following formula.

Communications power supply current consumption = Bit Slave Unit communications current consumption + (Bit Slave Unit input current × number of inputs used) + (sensor current consumption × number of sensors used)

Component Names and Functions (Same for CRT1B-ID04SP/CRT1B-ID04SP-1)



Display Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

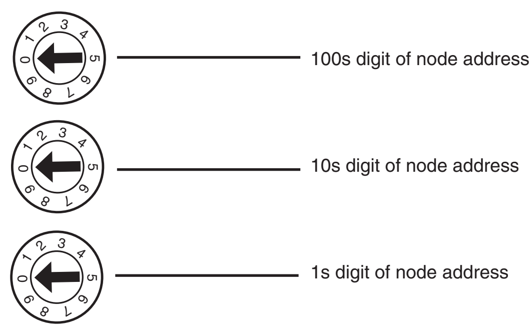
The meanings of the input and status indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 3	Lit yellow.	Input ON	The input is ON.
	Not lit.	Input OFF	The input is OFF.
SHT0	Lit red.	Sensor power short-circuit	The sensor power supply is short-circuited.

Setting the Node Address

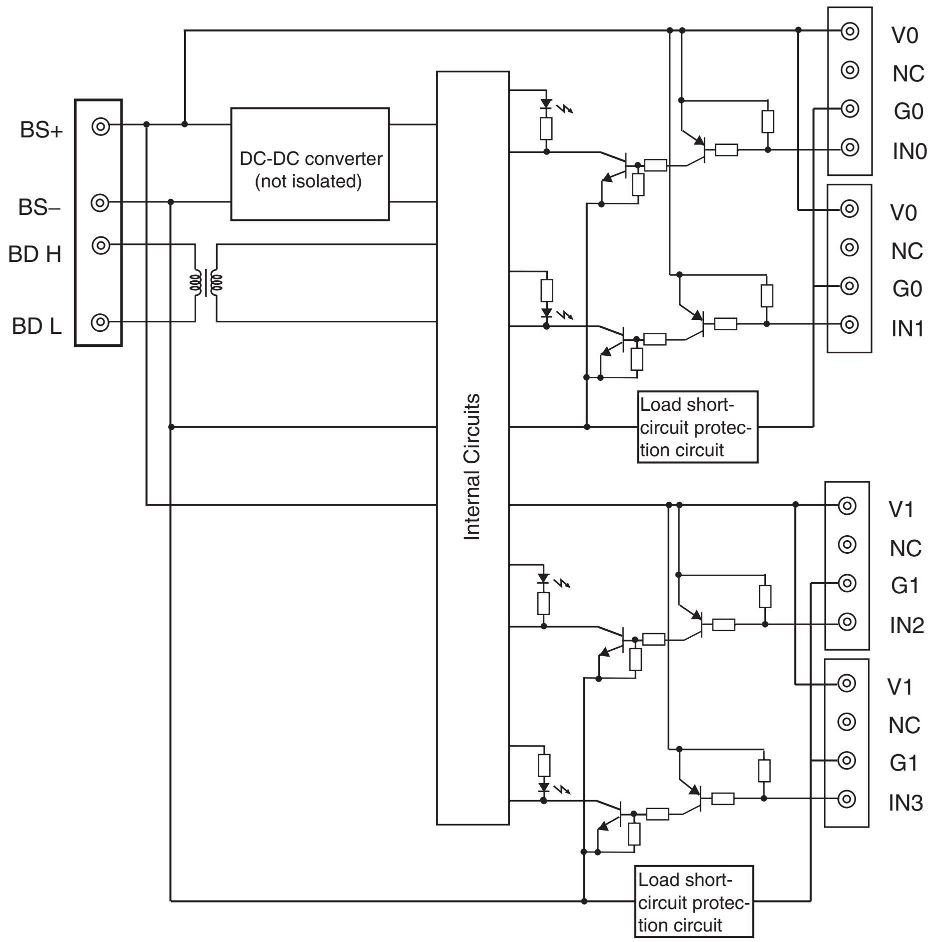
The node address is set as a decimal number between 0 and 127 with the 100s digit set on the top rotary switch, the 10s digit set on the middle rotary switch, and the 1s digit set on the bottom rotary switch.

The setting on the rotary switches is read when power is turned ON.

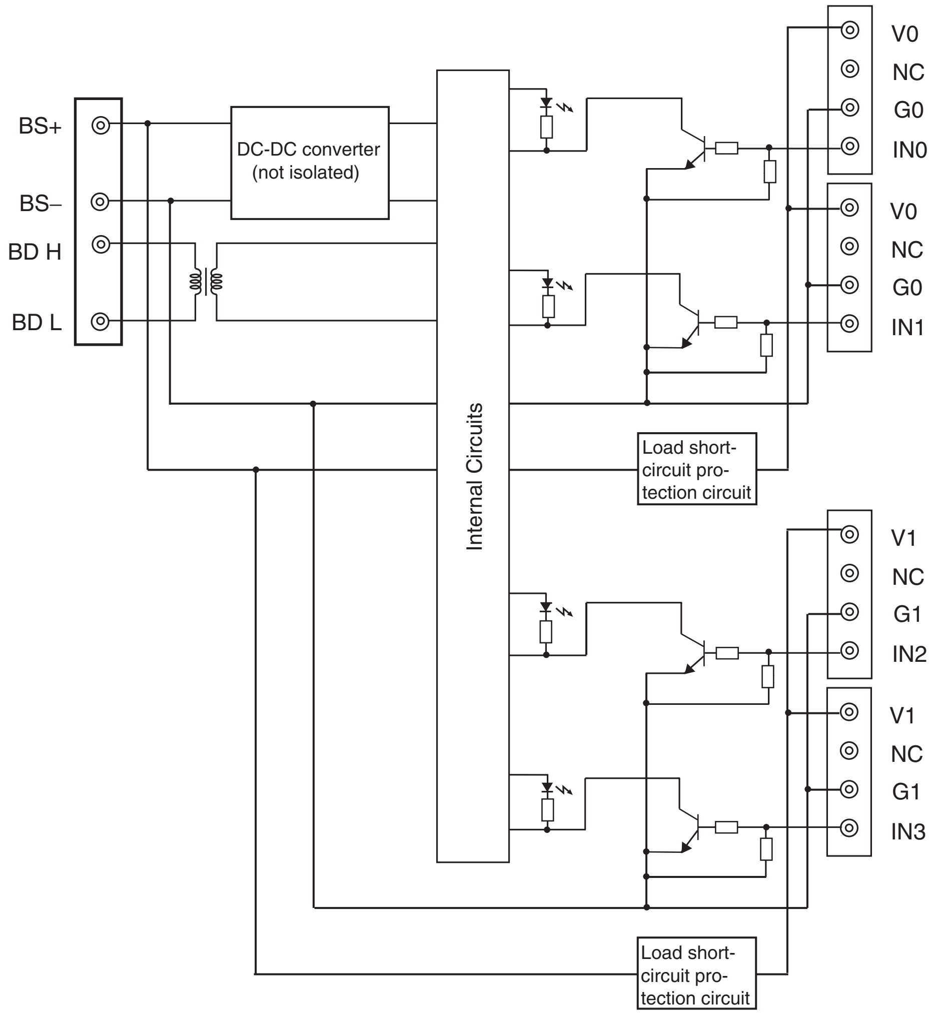


Internal Circuits

CRT1B-ID04SP (NPN)



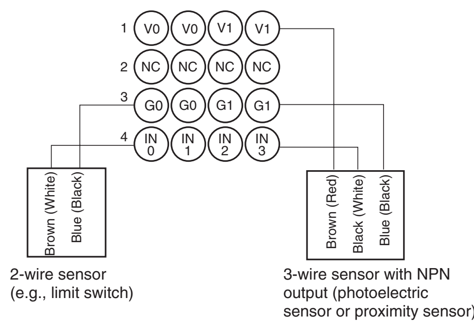
CRT1B-ID04SP-1 (PNP)



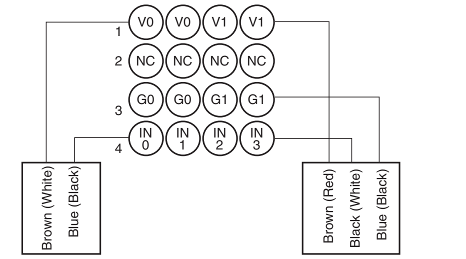
Wiring

The I/O connector section uses industry standard sensor connectors (e-CON). Pin arrangements and signals are shown below.

CRT1B-ID04SP (NPN)

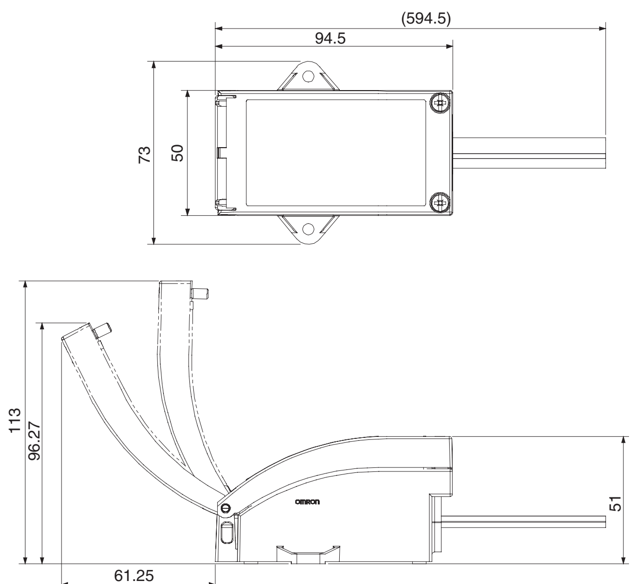


CRT1B-ID04SP-1 (PNP)



Note Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

Dimensions (Same for CRT1B-ID04SP and CRT1B-ID04SP-1)



Figures in parentheses are reference dimensions.
(Unit: mm)

8-4 Clamp Terminal Blocks

8-4-1 Two-point Input/Two-point Output Units (IP54)

Input Section Specifications

Item	Specification	
Model	CRT1B-MD04SLP	CRT1B-MD04SLP-1
I/O capacity	2 inputs	
Internal I/O common line	NPN	PNP
ON voltage	10.5 VDC min. (between each input terminal and the V terminal)	10.5 VDC min. (between each input terminal and the G terminal)
OFF voltage	5 VDC max. (between each input terminal and the V terminal)	5 VDC max. (between each input terminal and the G terminal)
OFF current	1 mA max.	
Input current	3.0 mA max./input (at 10.5 VDC)	
Sensor power supply voltage	Communications power supply voltage + 0 V (max.) Communications power supply voltage – 1 V (min.)	
ON delay	1.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	2 inputs/common	
Sensor power short-circuit detection	Detected	
Isolation method	No isolation	
Input indicators	LEDs (yellow)	
Degree of protection	IEC standard IP54	
Installation	Screw installation (M4)	
Power supply type	Network power supply	
Communications power supply current consumption (See note.)	80 mA max. for 24-VDC power supply voltage 90 mA max. for 14-VDC power supply voltage	75 mA max. for 24-VDC power supply voltage 85 mA max. for 14-VDC power supply voltage
Weight	191 g max.	191 g max.

Note The current consumption is for Bit Slave Unit communications current when all inputs and outputs are OFF, i.e., it does not include input device current consumption or output load current consumption. The communications power supply is also used for the I/O power supply for sensors and actuators. Be sure to consider the sensor and actuator current consumption and the number of sensors and actuators connected.

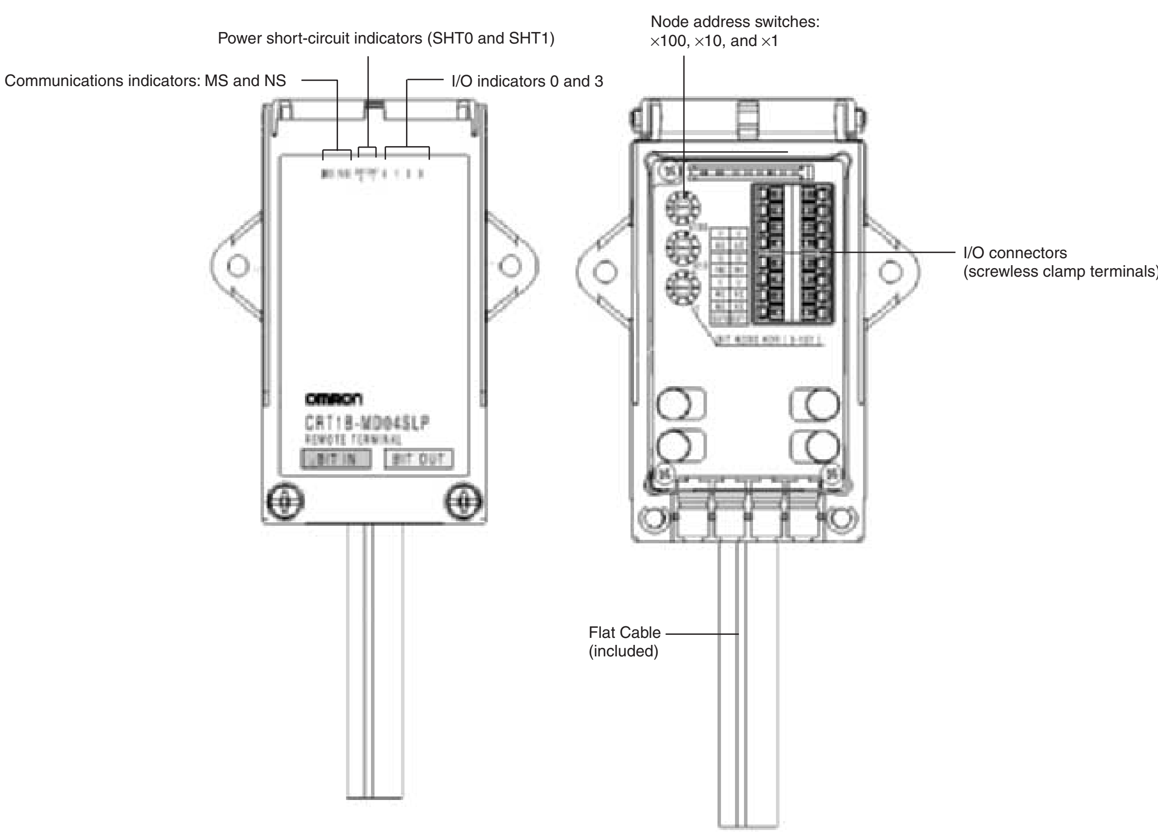
The power supply current consumption is expressed by the following formula.

Communications power supply current consumption = Bit Slave Unit communications current consumption + (Bit Slave Unit input current × number of inputs used) + (sensor current consumption × number of sensors used) + (actual load current x number of actuators used)

Output Section Specifications

Item	Specification	
Model	CRT1B-MD04SLP	CRT1B-MD04SLP-1
I/O capacity	2 outputs	
Internal I/O common	NPN	PNP
Rated output current	0.2 A/output	
Load power supply voltage	Communications power supply voltage + 0 V (max.) Communications power supply voltage – 1.2 V (min.)	
Residual voltage	1.2 V max.(0.2 A DC, between each output terminal and the G terminal)	1.2 V max.(0.2 A DC, between each output terminal and the V terminal)
Leakage current	0.1 mA max.	
ON delay	0.5 ms max.	
OFF delay	1.5 ms max.	
Number of circuits per common	2 outputs/common	
External load power short-circuit detection	Detected	
Isolation method	No isolation	
Input indicators	LEDs (yellow)	

Component Names and Functions (Same for CRT1B-MD04SLP/CRT1B-MD04SLP-1)



Display Section

Communications Indicators

Refer to *4-1-3 Communications Indicators*.

I/O Indicators

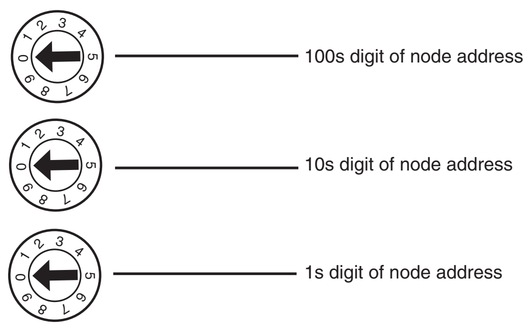
The meanings of the I/O and status indicators are given in the following table.

Name	LED status	I/O status	Meaning
0 to 3	Lit yellow.	Input/output ON	The input/output is ON.
	Not lit.	Input/output OFF	The input/output is OFF.
SHT0	Lit red.	Sensor power short-circuit	The sensor power supply is short-circuited.
SHT1	Lit red.	Load power short-circuit detection	The load power supply is short-circuited.

Setting the Node Address

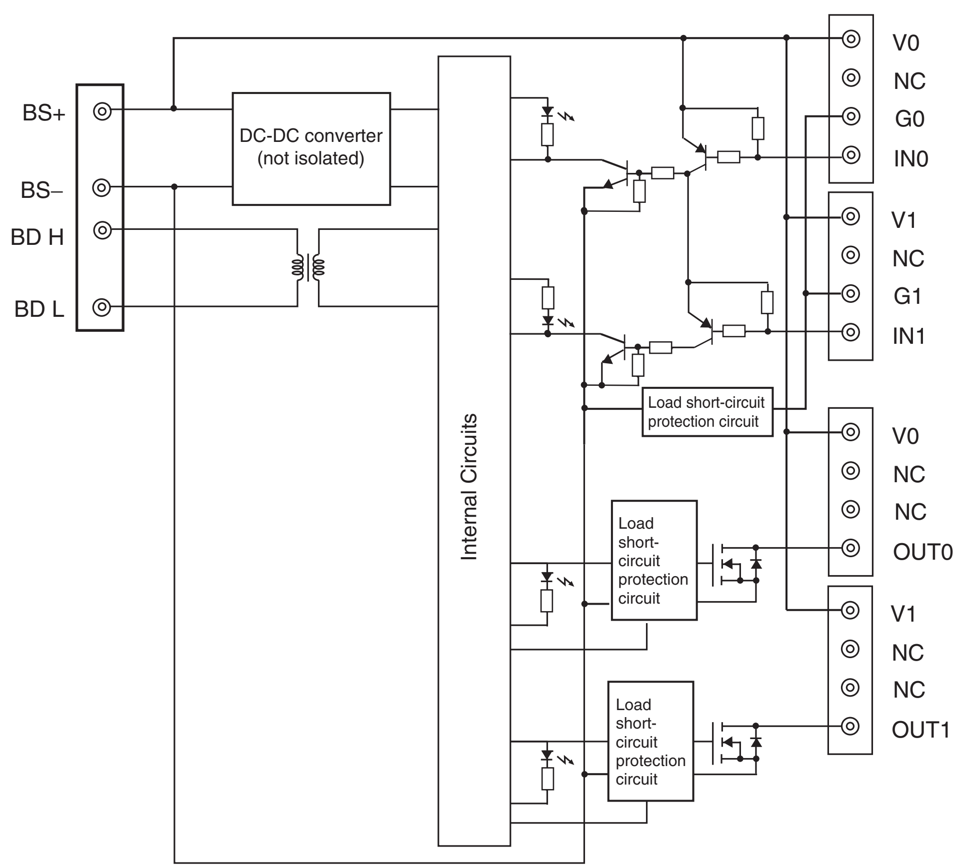
The node address is set as a decimal number between 0 and 127 with the 100s digit set on the top rotary switch, the 10s digit set on the middle rotary switch, and the 1s digit set on the bottom rotary switch.

The setting on the rotary switches is read when power is turned ON.

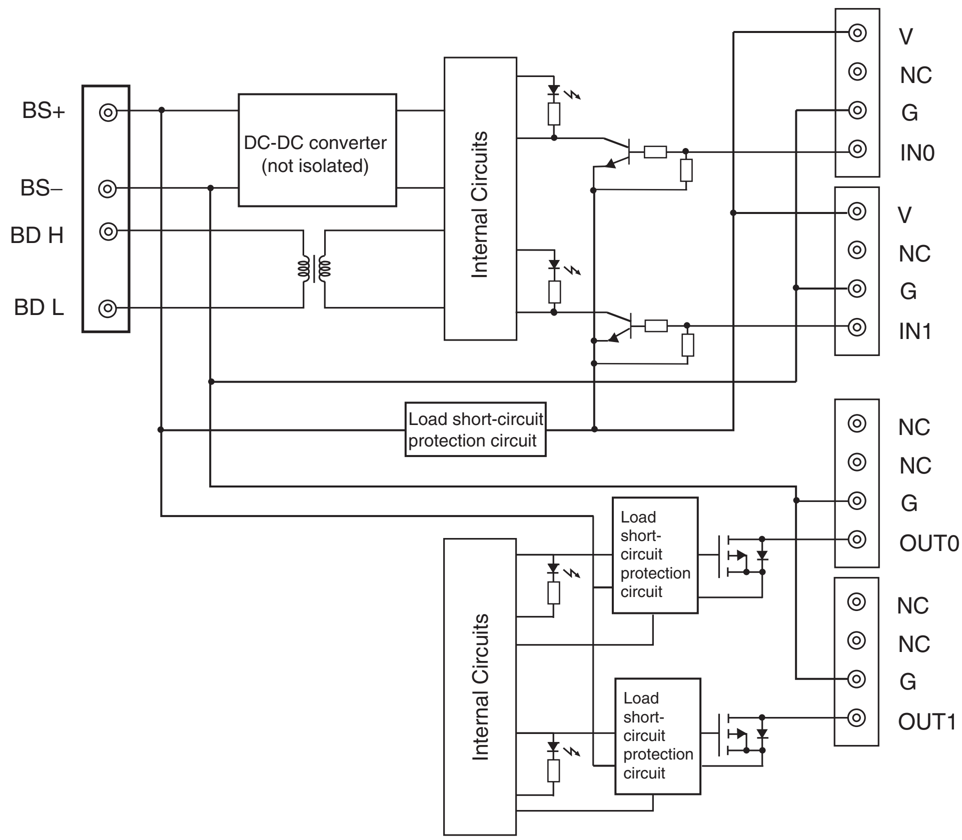


Internal Circuits

CRT1B-MD04SLP (NPN)



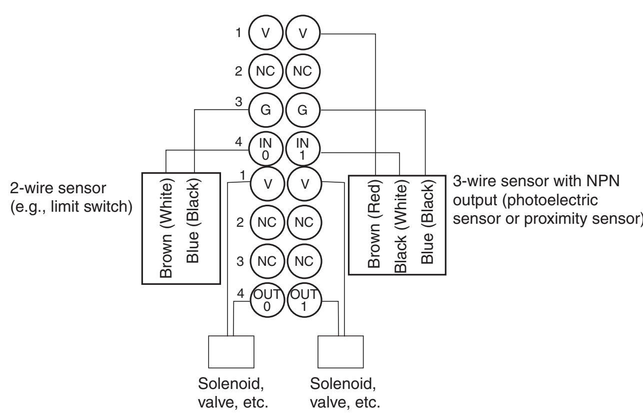
CRT1B-MD04SLP-1 (PNP)



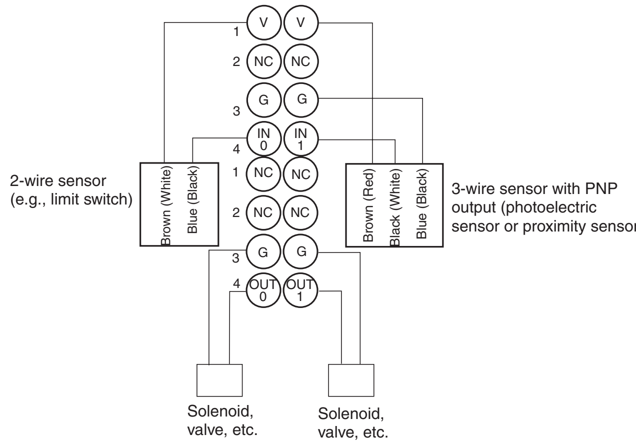
Wiring

The I/O connector section uses a screw-less clamp terminal block. Pin arrangements and signals are shown below.

CRT1B-MD04SLP (NPN)



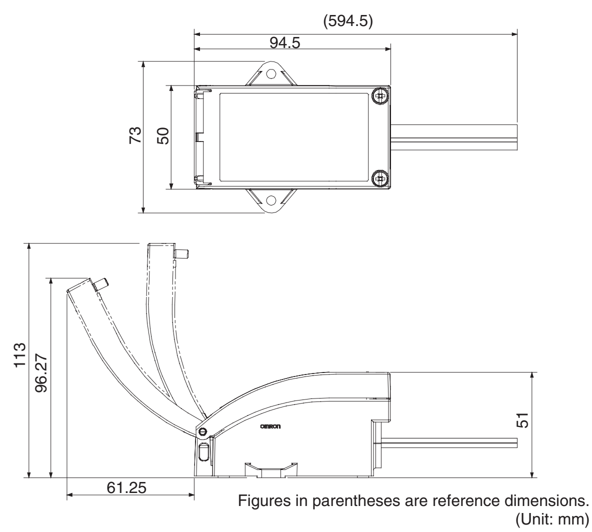
CRT1B-MD04SLP-1 (PNP)



Note (1) When using an inductive load (such as a solenoid valve), either use a built-in diode for absorbing the counterelectromotive force or install an external diode.

(2) Wire colors have been changed according to revisions in the JIS standards for photoelectric and proximity sensors. The colors in parentheses are the wire colors prior to the revisions.

Dimensions (Same for CRT1B-MD04SLP and CRT1B-MD04SLP-1)



SECTION 9
Repeater Units

This section describes the Repeater Unit.

9-1 Status Areas. 214

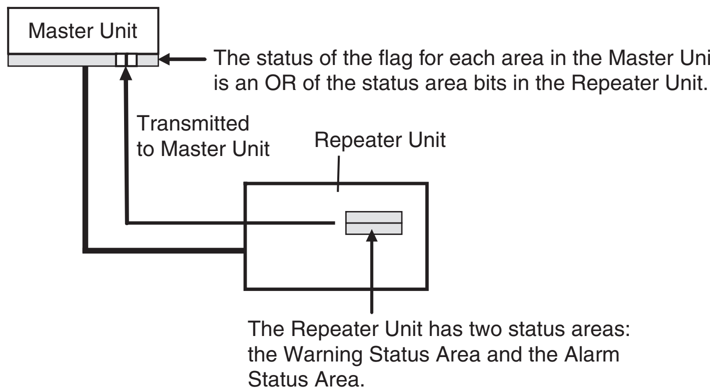
9-2 Repeater Unit 216

9-2-1 Repeater Unit 216

9-1 Status Areas

An Repeater Unit has two status areas: the Warning Status Area and the Alarm Status Area. The status flags in these areas are turned ON and OFF based on the threshold/monitor values set for each function in that Unit. For each area, a corresponding status flag in the Master Unit will be turned ON if any flag in the status area in the Repeater Unit turns ON. Bit 12 in the Master Unit corresponds to the Warning Status Area and bit 13 corresponds to the Alarm Status Area.

The Repeater Unit's status area information can be read by using the CompoNet Support Software or explicit messages.



Warning Status Area

The Repeater Unit's Warning Status Area contains the following 16 bits. These bits indicate minor errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	Reserved	---
2	Network Power Voltage Drop Flag OFF: Normal ON: Error (Voltage dropped below threshold.)	Turns ON when the voltages drops below the voltage set for the network power voltage monitor function.
3	Unit Maintenance Flag OFF: Normal ON: Error (Threshold exceeded.)	Turns ON when the threshold set for the Unit Conduction Time Monitor function is exceeded.
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Reserved	---
9	Reserved	---
10	Downstream Network Voltage Flag OFF: Normal ON: Error (Power OFF.)	Turns ON when the power supply to the downstream network is OFF.
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

Alarm Status Area

The Repeater Unit's Alarm Status Area contains the following 16 bits. These bits indicate serious errors in the Unit.

Bit	Content	Description
0	Reserved	---
1	EEPROM Data Error Flag OFF: Normal ON: Error	Turns ON when there is an error in the EEPROM data.
2	Reserved	---
3	Reserved	---
4	Reserved	---
5	Reserved	---
6	Reserved	---
7	Reserved	---
8	Reserved	---
9	Reserved	---
10	Reserved	---
11	Reserved	---
12	Reserved	---
13	Reserved	---
14	Reserved	---
15	Reserved	---

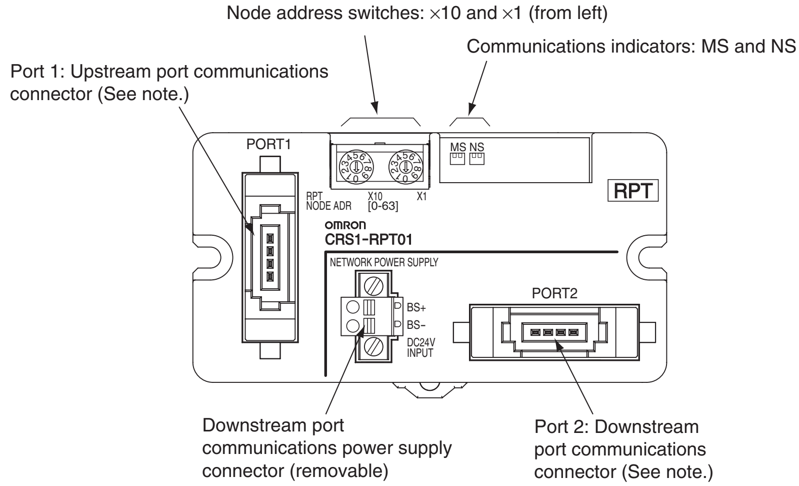
9-2 Repeater Unit

9-2-1 Repeater Unit

Specifications

Item	Specification
Model	CRS1-RPT01
Communications ports	Upstream port (port 1):Ttrunk line or sub-trunk line Downstream port (port 2): Sub-trunk line (Can be wired with the same communications specifications as the Master Unit.) Different types of communications cable can be connected to the upstream and downstream ports.
Maximum number of layers	Up to two extra segment layers can be created from the Master Unit
Number of nodes per network (per Master Unit)	64 nodes
Number of nodes per trunk line or sub-trunk line	32 nodes
Communications power supply connector	One downstream communications port power supply connector **Note** Communications power for the Repeater Unit is supplied from the BS+ and BS– terminals on the upstream port communications connector (PORT1).
Communications power supply connector allowable current capacity	5 A max. (UL: 4A)
Noise immunity	Conforms to IEC 61000-4-4 2kV (power line)
Vibration resistance	10 to 150 Hz with double-amplitude of 0.7 mm or 50 m/s^2
Shock resistance	150 m/s^2
Dielectric strength	500 VAC (between isolated circuits)
Insulation resistance	20 MΩ min. (between isolated circuits)
Ambient operating temperature	–10 to 55°C
Ambient operating humidity	25% to 85% (with no condensation)
Ambient operating atmosphere	No corrosive gases
Storage temperature	–25 to 65°C
Storage humidity	25% to 85% (with no condensation)
Installation	DIN Track or M4 screws
Weight	73 g
Communications power supply voltage	14 to 26.4 VDC
Communications power supply current consumption	95 mA max.

Component Names and Functions



Note A Flat Connector Plug or Open Type Connector (DCN4-TB4) can be connected to the communications connector.

Indicator Section

Communications Indicators

The communications indicators have the following meanings.

MS (Module Status): Indicates the status of the node with a two-color LED (green/red).

NS (Network Status): Indicates the status of communications with a two-color LED (green/red).

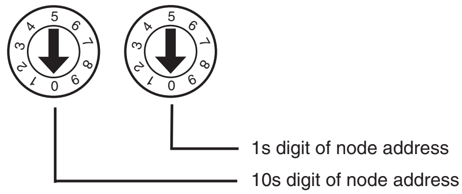
Name	Indicator status	Status	Meaning
MS	Lit green.	Normal status	The Unit is operating normally.
	Flashing green.	---	---
	Lit red.	Fatal error	A hardware error has occurred in the Unit. The watchdog timer has timed-out.
	Flashing red.	Non-fatal error	There is an error in the settings. An EEPROM checksum error has occurred.
	Not lit.	Power OFF/Startup	The power supply is OFF, the Unit is being reset, or the Unit is being initialized.
NS	Lit green.	Online and participating	Normal communications are in progress and the node is participating in the network.
	Flashing green.	Online but not participating	Normal communications are in progress but the node is not yet participating in the network.
	Lit red.	Fatal communications error	The address is set out of range or the same address has been set for more than one node.
	Flashing red.	Non-fatal communications error	Polling has timed out. The network has timed out.
	Not lit.	Power OFF/Baud rate not yet detected.	The power supply is OFF or the baud rate has not been detected.

Note When flashing, indicators are lit for 0.5 s and not lit for 0.5 s.

Setting the Node Address

The node address is set as a decimal number with the 10s digit set on the left rotary switch and the 1s digit set on the right rotary switch. (The maximum node address is 63.)

The setting on the rotary switches is read when power is turned ON.



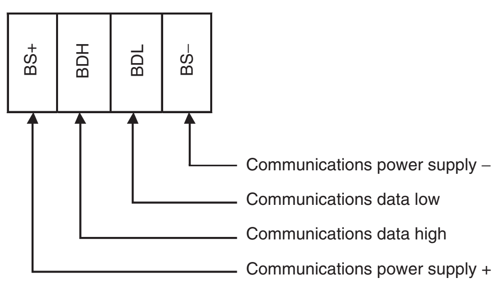
Terminal Arrangement

Upstream Port Communications Connector (Port 1)

BS+	Communications power supply +
BDH	Communications data high
BDL	Communications data low
BS–	Communications power supply –

Note The BS+ and BS– terminals are the communications power for the Repeater Unit.

Downstream Port Communications Connector (Port 2)



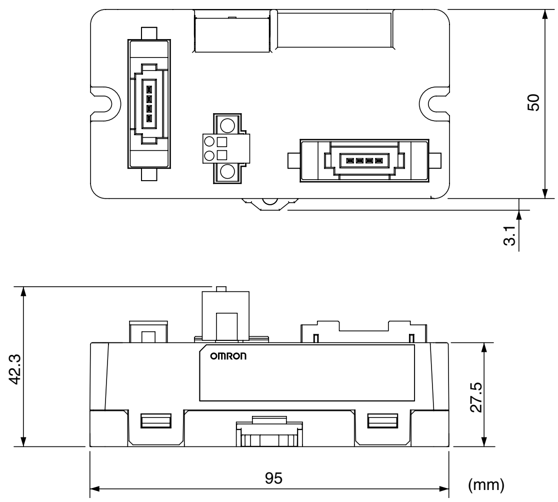
Downstream Port Communications Power Supply Connector

This connector supplies communications power to Slave Units and Repeater Units connected to the downstream communications connector.

BS+	Communications power supply +
BS–	Communications power supply –

Note Communications power for the Repeater Unit is supplied from the BS+ and BS– terminals on the upstream port communications connector (port 1).

Dimensions



SECTION 10
Smart Functions

This section individually describes the functions provided by CompoNet Slave Unit. The functions are divided into those supported by all CompoNet Slave Units and those supported only by specific CompoNet Slave Units.

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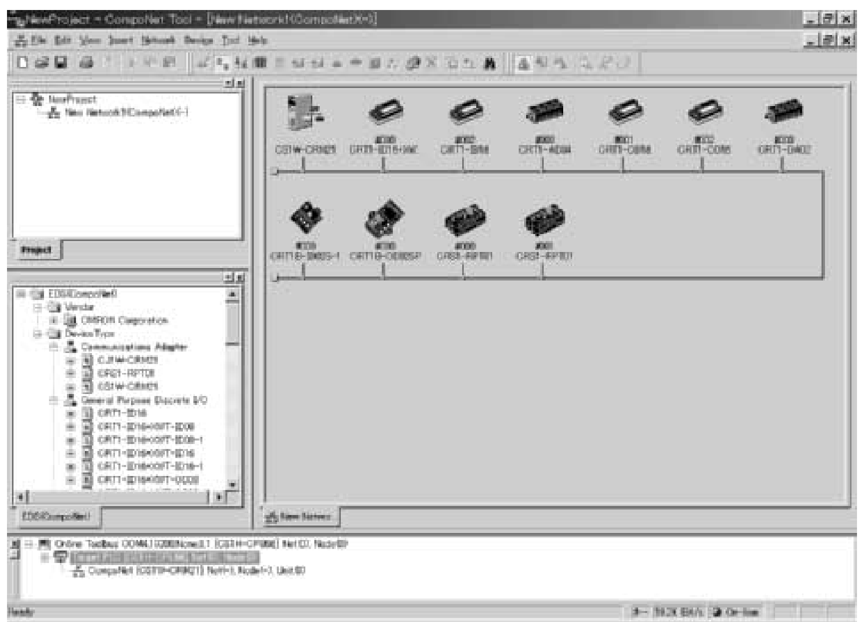
10-1 CompoNet Support Software Windows

There are two main network display windows in the CompoNet Support Software: the Standard Window and the Maintenance Mode Window. These windows can be easily switched between by clicking the icon or selecting ***View*** - ***Large Icons (maintenance mode)***.

10-1-1 Standard Window

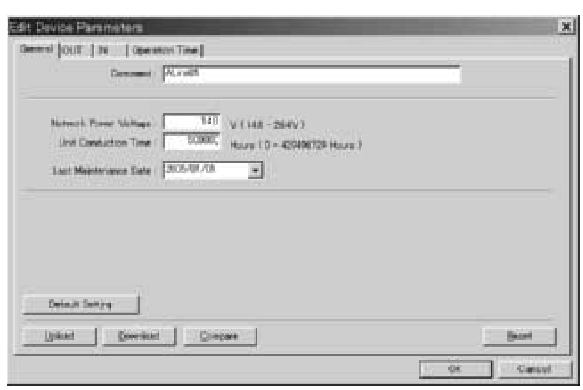
The Standard Window has a white background and is displayed when the CompoNet Support Software is started. Normally, parameters and other settings are made in this window. The devices parameters for any Slave Unit can be set or edited simply by double-clicking on the Slave Unit in the Standard Window. Refer to *10-2 Functions Common to All Slave Units* for details on how to set and edit functions for each Slave Unit. Also refer to the settings methods provided for each Slave Unit.

Standard Window



Edit Device Parameters Windows

The Edit Device Parameters Windows are used to set and edit functions. Double-click any Slave Unit, or right-click the Slave Unit and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window.



10-1-2 Maintenance Mode Window

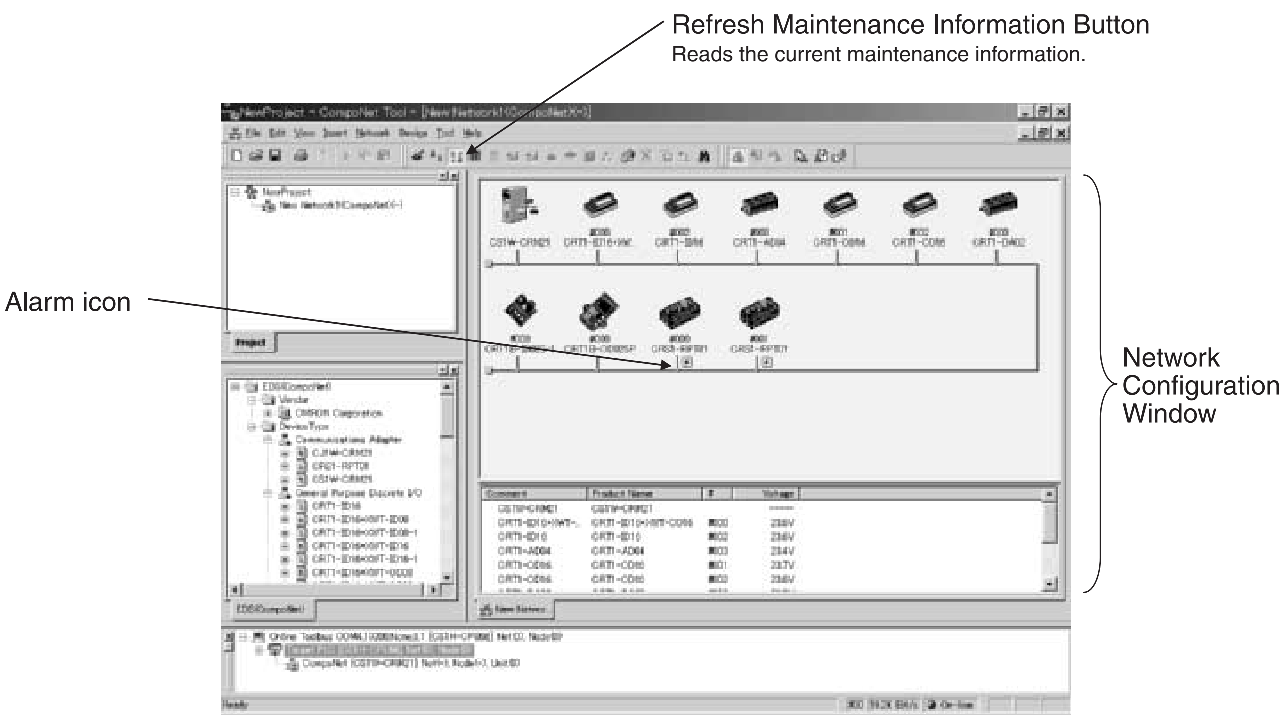
The Maintenance Mode Window is different from the Standard Window because it enables easily monitoring CompoNet Slave Unit data. The Maintenance Mode and Standard Windows can be easily switched between by clicking the icon or selecting ***View*** - ***Large Icons (maintenance mode)***. The background of the Maintenance Mode Window is light blue.

CompoNet Slave Unit data is displayed using the Maintenance Information Window in the Maintenance Mode Window. Open this window to access the status of CompoNet Slave Units.

If an error has been detected in the settings for a Slave Unit, the Network Configuration Window will display a yellow alarm icon that provides information about the error beside the Slave Unit icon. In this way, the Maintenance Mode Window shows the status of each device, the maintenance date, and the location of errors.

Note The Maintenance Mode Window displays data that is uploaded with the network. The data is not constantly updated through communications. To obtain the latest CompoNet Slave Unit status, click the Refresh Button in the Maintenance Mode Window to read the data from the network. Alternatively, use the Device Monitor Window, which is constantly being refreshed with the latest CompoNet Slave Unit status.

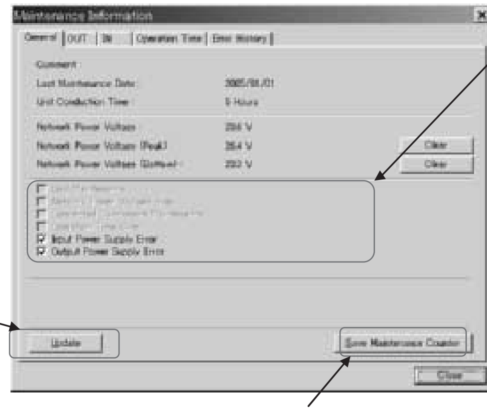
Maintenance Mode Window



Maintenance Information Window

Double-click any CompoNet Slave Unit icon with an alarm icon beside it to display the Maintenance Information Window for that Slave Unit.

Maintenance information
Displays the generated maintenance information.

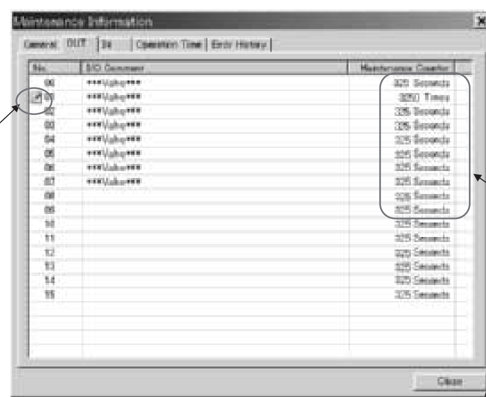


Refreshes the current Slave Unit maintenance information.

The maintenance counter value can be saved to flash memory in the Slave Unit.
Normally, the number of contact operations is saved every 12 minutes, which means that the number of operations saved may not be completely accurate, depending on when the power is turned OFF.

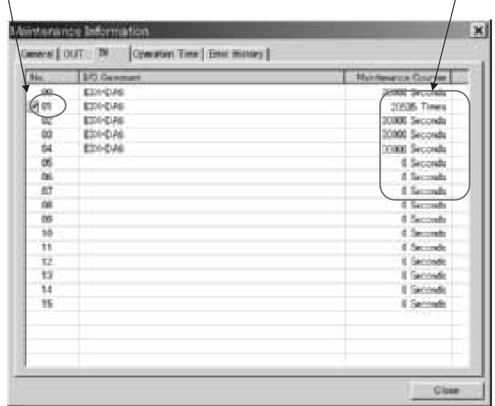
■ OUT and IN Tab Pages

More detailed maintenance information can be found on the OUT and IN Tab Pages.



Nodes that require maintenance can be seen in a glance because an alarm icon is displayed for nodes that exceed monitor values.

The maintenance counter value that was read is displayed.

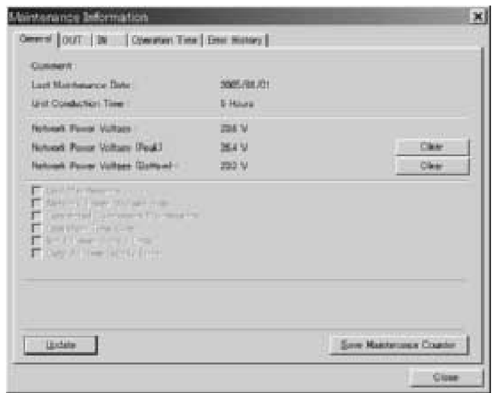


10-1-3 Device Monitor Window

The Device Monitor Window is designed to easily monitor CompoNet Slave Unit data. The displayed data is the same as the Maintenance Mode Window. The Device Monitor Window differs from the Maintenance Mode Window, however, because the data is refreshed online. The data is constantly refreshed by explicit messages between Slave Units and the CompoNet Support Software. Use this Device Monitor Window, therefore, to check the latest CompoNet Slave Unit data.

Right-click in the window and select ***Monitor*** when the CompoNet Support Software is online to display the Device Monitor Window.

Device Monitor Window



Note Slave Units and the CompoNet Support Software are constantly exchanging large amounts of the latest data for the Device Monitor Function. This means that each refresh may take a long time if the CompoNet Support Software is connected through a peripheral bus, depending on the Slave Units.

10-2 Functions Common to All Slave Units

This section describes the functions common to all CompoNet Slave Units and the procedures for using these functions.

10-2-1 Automatic Baud Rate Detection

Description

The CompoNet Slave Units are automatically set to the same baud rate as the Master Unit. It is not necessary to set the baud rate separately for any Slave Unit.

The baud rate is set when communications is established with the Master Unit after the power is turned ON. The baud rate setting is stored in memory until the power is turned ON again or until the Master Unit baud rate setting is changed.

10-2-2 Hold/Clear Outputs

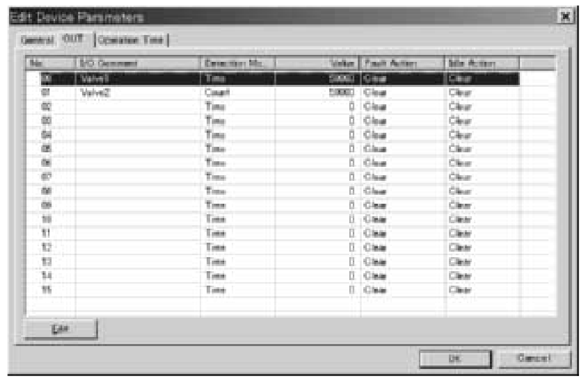
Description

Output Units can be set to hold or clear outputs when an error occurs.

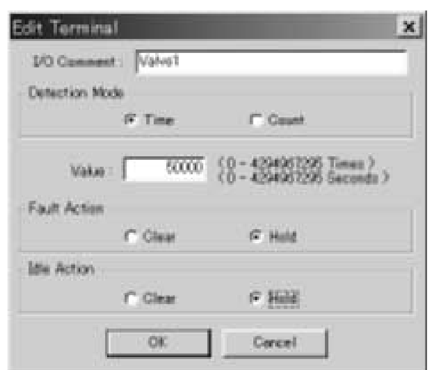
Procedure Using CompoNet Support Software

1,2,3... 1. Double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window.

2. Click the **OUT** Tab.



3. Double-click the terminal to be set. The following window will be displayed. Select either ***Clear*** or ***Hold*** to clear or hold outputs when a communications error or idle action occurs.



Fault Action

Clear	Clears all output data from the Master Unit to 0 when a communications error occurs.
Hold	Holds all output data from the Master Unit at its current status when a communications error occurs.

A communications error occurs when communications with the Master Unit are interrupted.

Idle Action

Clear	Clears all output data from the Master Unit to 0 when idle action occurs.
Hold	Holds all output data from the Master Unit at its current status when idle action occurs.

Idle action is the status that results when an idle output specification is received from the Master Unit. An idle output is specified when a CPU Unit monitoring error occurs in a CS/CJ-series Master Unit.

4. Confirm that the setting is shown in the Edit Device Parameters Window. Click the **General** Tab, click the **Download** Button, and then click the **Reset** Button.
5. Click the **OK** Button.

10-2-3 Network Power Voltage Monitor

Description

The Network Power Voltage Monitor function stores the present value, minimum value, and maximum value of the network power voltage in the Slave Unit memory. If a monitor voltage is set using the CompoNet Support Software, the monitor voltage is stored in the Slave Unit memory. (The default is 14 V.) If the voltage drops below the monitor voltage, a flag in a status area in the Slave Unit will turn ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages.

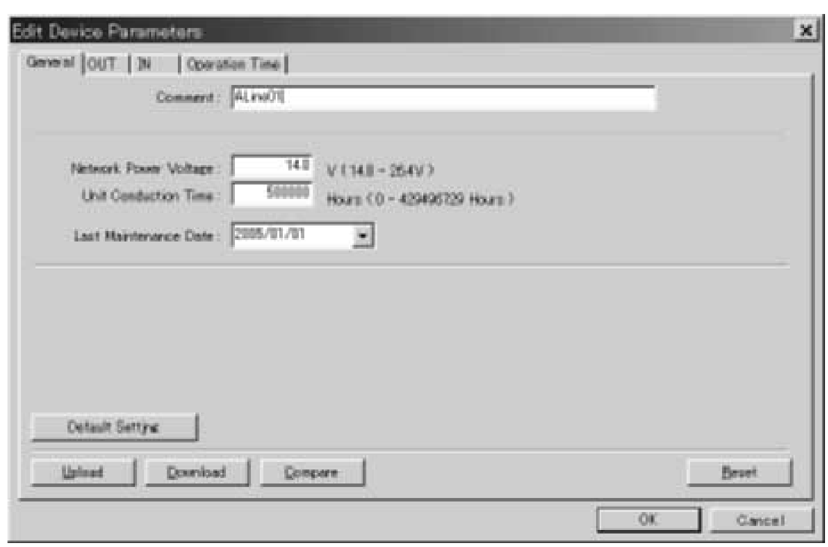
Note (1) The minimum communications power voltage for the CompoNet network itself is 14 V, so if the network power voltage drops below 14 V, it may not be possible to read a measurement value using the CompoNet Support Software.

(2) The maximum and minimum values of the network power voltage are cleared when the network power is turned OFF.

Settings Using the CompoNet Support Software

1,2,3...

1. Turn ON the power to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window.
   In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.
3. Click the **General** Tab.



4. Enter the desired value in the Network Power Voltage Monitor Value field. (The default is 14 V.)
5. Click the **Download** Button, and then click the **OK** Button.

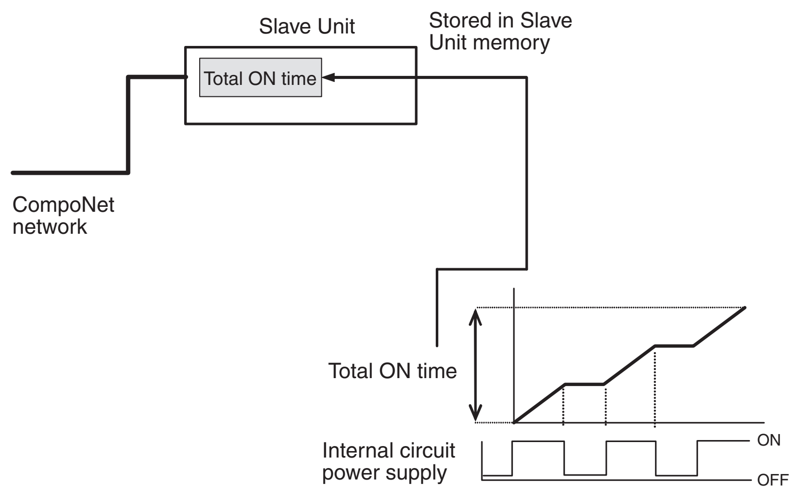
10-2-4 Unit Conduction Time Monitor

Description

The cumulative time that power is ON to the Slave Unit's internal circuits can be stored in the Slave Unit memory. (This data can be read using the CompoNet Support Software or using explicit messages.)

The monitor value is also stored in the Slave Unit memory so once the total time reaches the monitor value, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages.

- Measurement time: 0 to 429,496,729.5 h (Stored data: 0000 0000 to FFFF FFFF hex)
- Measurement unit: 0.1 h
- Storage unit: 0.2 h



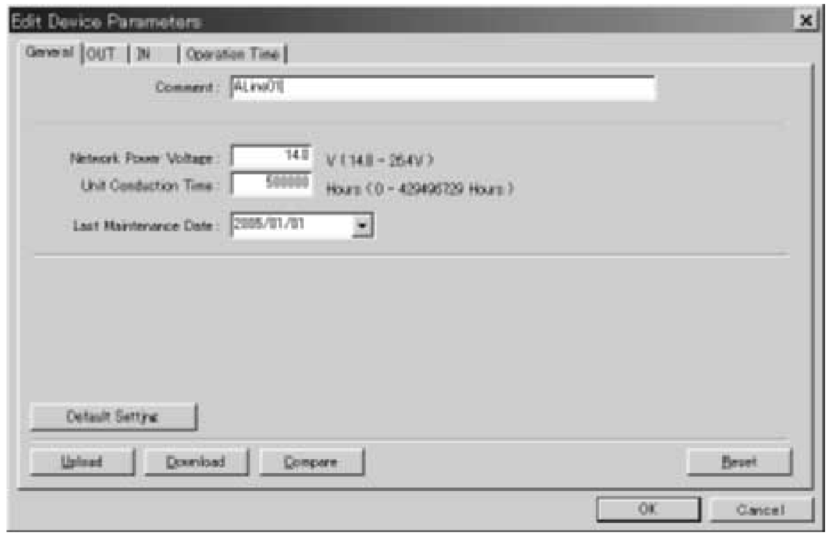
Note The Unit Conduction Time Monitor Function adds up the time the CompoNet Slave Unit network power supply is ON. The time when the power is OFF is not included.

Settings Using the CompoNet Support Software

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window. In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.

3. Click the **General** Tab.

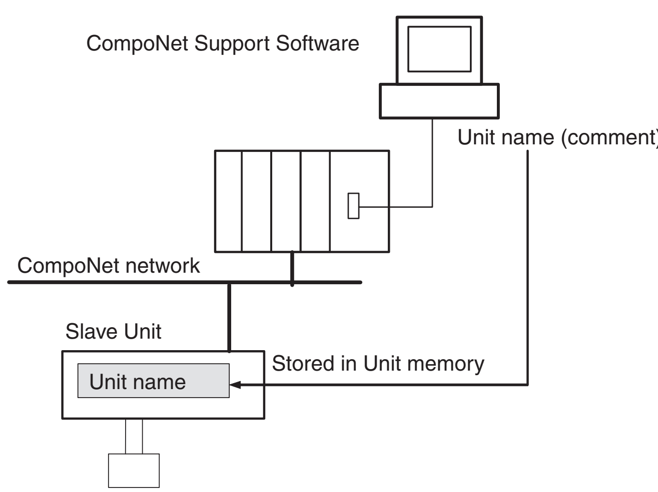


4. Enter the desired value in the Unit Conduction Time Monitor Value field.
5. Click the **Download** Button, and then click the **OK** Button.

10-2-5 Naming Units

Description

The user can set any name for each Unit (up to 32 characters) as a comment. The name is stored in the Slave Unit memory. The CompoNet Support Software or explicit messages can be used to read/write the name (i.e., the comment).

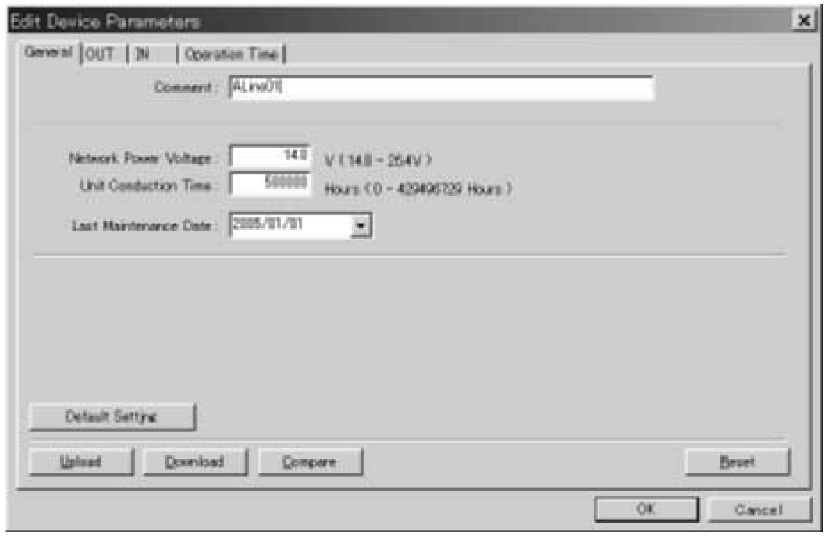


Settings Using the CompoNet Support Software

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window.
   In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.

3. Click the **General** Tab.

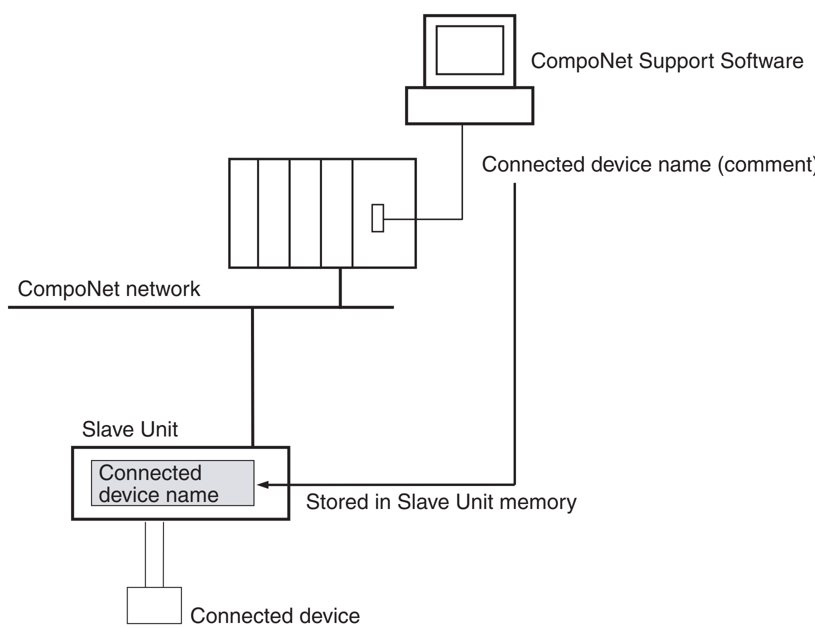


4. Enter the desired name in the *Comment* Field.
5. Click the **Download** Button, and then click the **Reset** Button to reset the Unit.
6. Click the **OK** Button.

10-2-6 Naming Connected Devices

Description

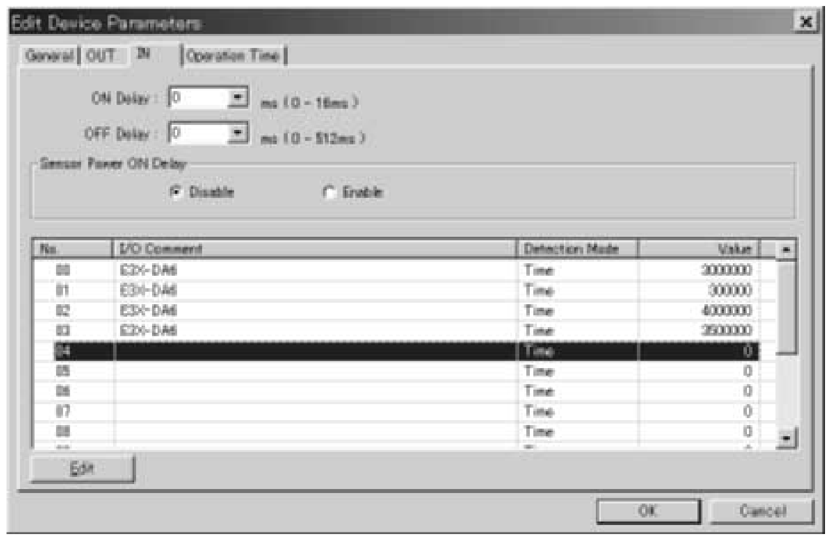
The user can set any name for each I/O contact in the Unit (up to 32 characters). These names are stored in the Slave Unit memory. Connected devices can be checked for each I/O contact, which is useful for remote maintenance and other applications where, for example, devices with errors need to be identified. The CompoNet Support Software or explicit messages can be used to read/write the name (i.e., comment).



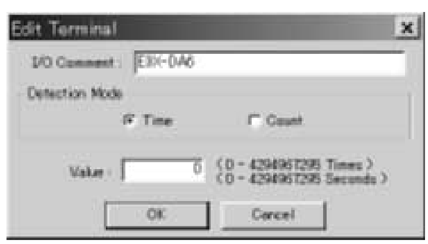
Settings Using the CompoNet Support Software

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window. In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.
3. Click the **IN** or **OUT** Tab. The IN Tab Page is shown in the following example.



4. Double-click in the *I/O Comment* Column for the connected device for which a comment is to be added. The following window will be displayed. Enter the desired name and click the **OK** Button.



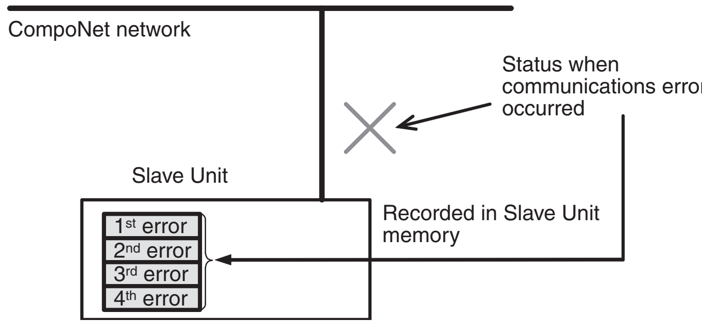
5. Click the **General** Tab, click the **Download** Button, and then click the **OK** Button.

10-2-7 Communications Error History Monitor

Description

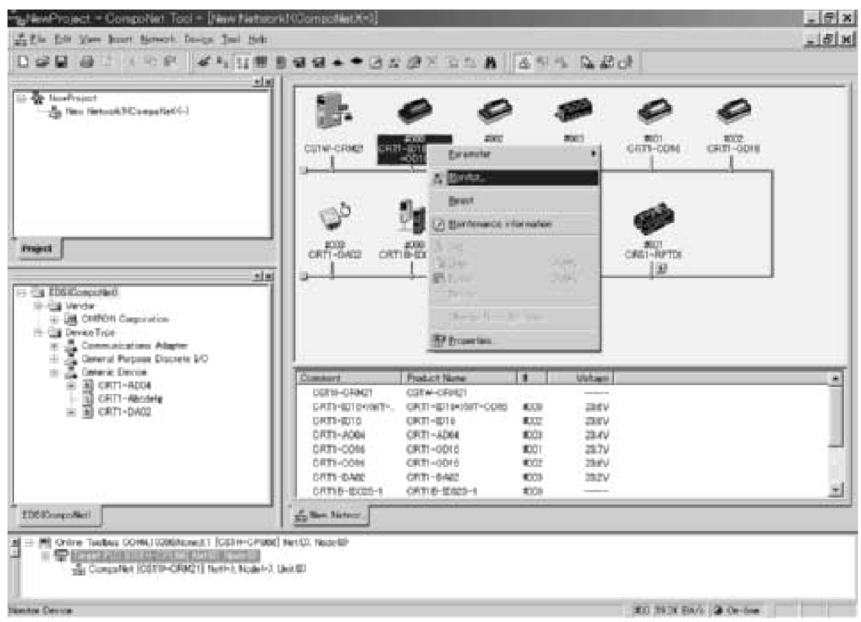
The previous four error history records (communications error codes and the power voltage when the error occurred) can be stored in the Slave Unit memory.

The communications error history can be read using the CompoNet Support Software.

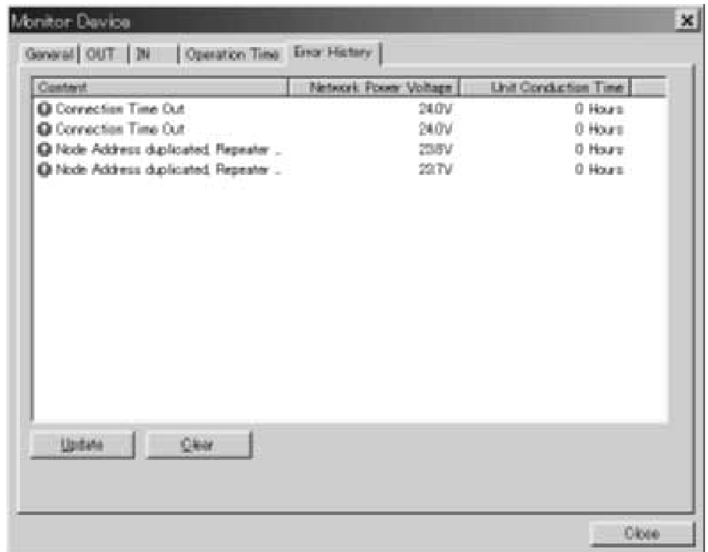


Checking Using the CompoNet Support Software

1,2,3...
1. Turn ON the power supply to the CompoNet Slave Unit.
2. Right-click the icon for the desired CompoNet Slave Unit in the Network Configuration Window and select ***Monitor***.



3. Click the **Error History** Tab in the Device Monitor Window. The communications error history showing the previous 4 errors will be displayed, as shown below. To display the latest error history, click the **Update** Button. To reset the whole error history, click the **Clear** Button.



Note The error history can also be checked by double-clicking the Slave Unit icon in the Maintenance Mode Window and then clicking the Error History Tab in the Maintenance Information Window.

10-2-8 Last Maintenance Date

Description

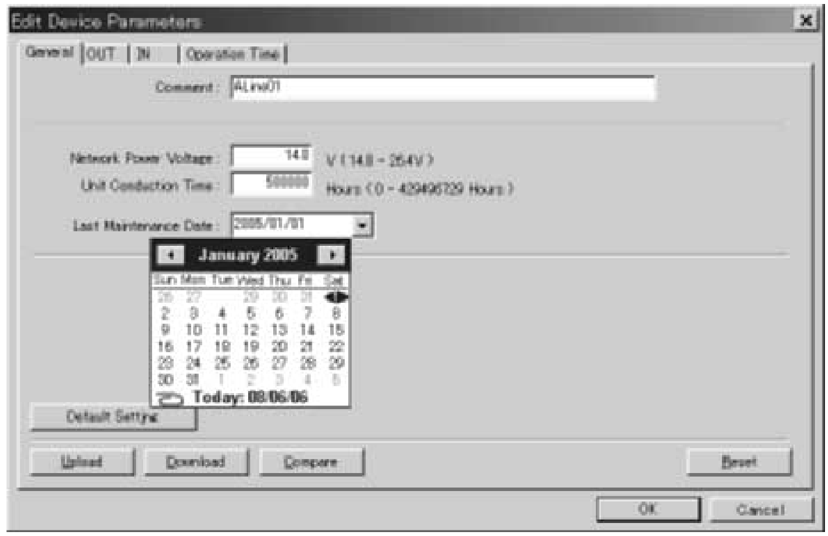
This function can be used to write the date maintenance was last performed in the Slave Unit memory. This makes it easier to decide when maintenance should be performed next. This maintenance date can be written using the CompoNet Support Software.

Settings Using the CompoNet Support Software

1,2,3...

1. Double-click the icon for the target CompoNet Slave Unit in the Standard Window to open the Edit Device Parameters Window. (Right-click in the Maintenance Mode Window and select ***Parameters*** - ***Edit***.)

2. Click the **General** Tab and select a date from the pull-down list for the *Last Maintenance Date* Field. (Select ***Today*** from the bottom of the list to select today's date.)



3. Click the **Download** Button, and then click the **OK** Button.

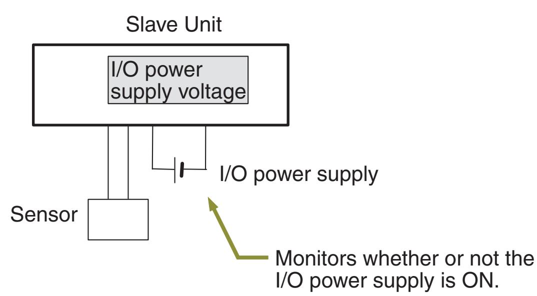
10-3 Word Slave Unit and Bit Slave Unit Functions

10-3-1 I/O Power Status Monitor (Digital I/O Slave Units Only)

Description

The I/O power status monitor function can be used to detect whether the I/O power is ON.

When the I/O power is turned OFF, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages.



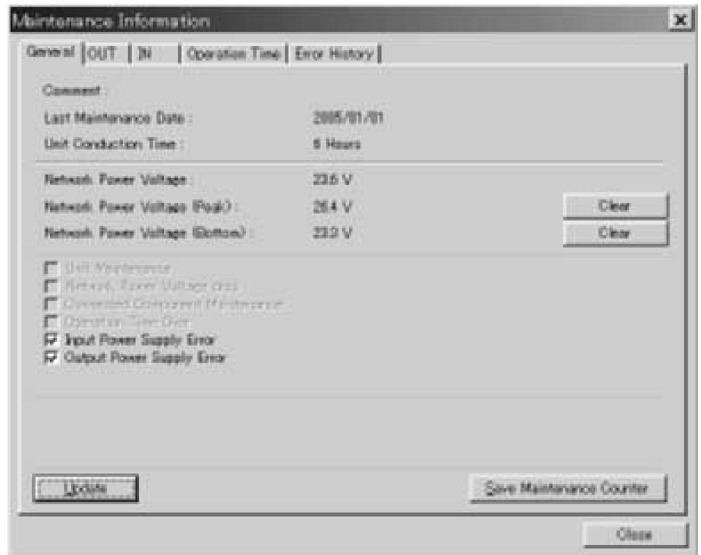
Note A detection voltage cannot be set for the I/O power supply.

Checking Using the CompoNet Support Software

The procedure for checking using the CompoNet Support Software is outlined below.

1,2,3... 1. Turn ON the power supply to the CompoNet Slave Unit.

2. In the Maintenance Mode Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window to display the Maintenance Information Window. If ***Input Power Supply Error*** and ***Output Power Supply Error*** are selected, it means that the I/O power is not ON.



10-3-2 Input Filter (Input Units Only)

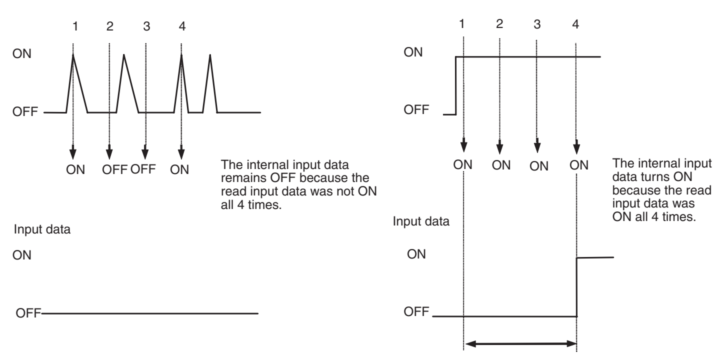
Description

An input value can be read more than once during a set time interval and the input value can be set to be enabled only when all the read values are the same. This function operates for all input points in one Slave Unit.

ON Response Time

When the input data turns ON, the input data is read 4 times at a set interval (1/4 of the ON response time setting) and the internal input data turns ON only when all four values are ON. The ON timing is delayed by the value of the ON response time.

This function can also be used to implement an ON delay (i.e., by utilizing the delay caused by the ON response time when the input filter is enabled).

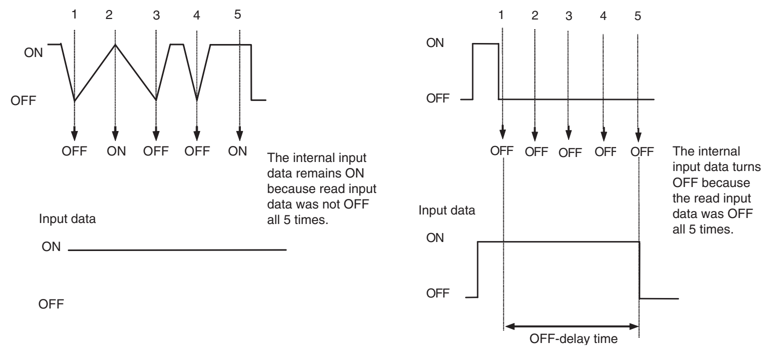


OFF Response Time

When the input data turns OFF, the input data is read 5 times at a set interval (1/5 of the OFF response time setting) and the internal input data turns OFF only when all values are OFF. The OFF timing is delayed by the value of the OFF response time.

This function can also be used to implement an OFF delay.

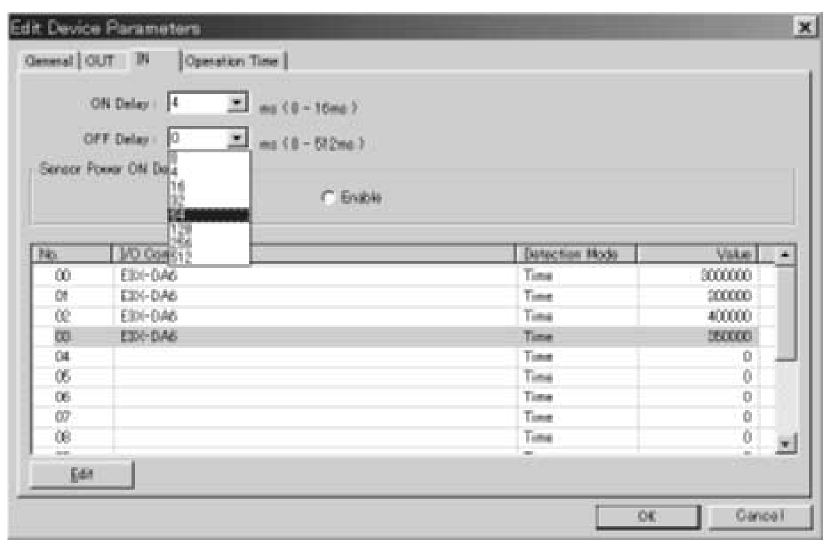
To enable reading pulses shorter than the communications cycle time, set the OFF response time to a value longer than the communications cycle time. (The input may remain ON if the input pulse interval is too short.)



Settings Using the CompoNet Support Software

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window.
   In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.
3. Click the **IN** Tab.
   Select the *ON Response Time* and *OFF Response Time* from the pull-down lists.

4. Click the **General** Tab, click the **Download** Button, and then click the **Reset** Button.
5. Click the **OK** Button.

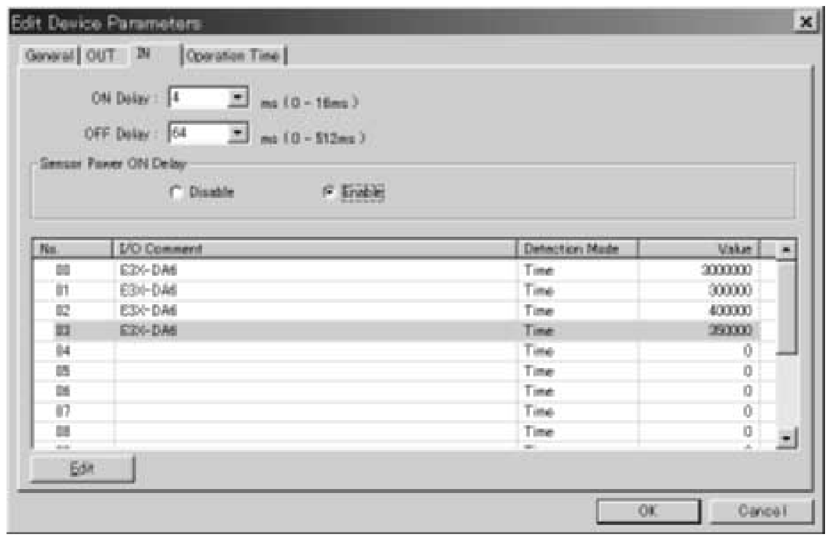
10-3-3 Error Prevention for Surge Current at Startup (Input Units Only)

Description

This function can be used to prevent reading inputs while the I/O power is OFF and for 100 ms after the I/O power is turned ON (i.e., until the Slave Unit stabilizes). It helps avoid input errors caused by inrush current from connected devices when the I/O power supply is turned ON.

Settings Using the CompoNet Support Software

1,2,3...
1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window. In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.
3. Click the IN Tab.
   Select the *Enable Option in the Sensor Power ON Delay* Area.



4. Click the **General** Tab, click the **Download** Button, and then click the **Reset** Button.
5. Click the **OK** Button.

10-3-4 Contact Operation Monitor

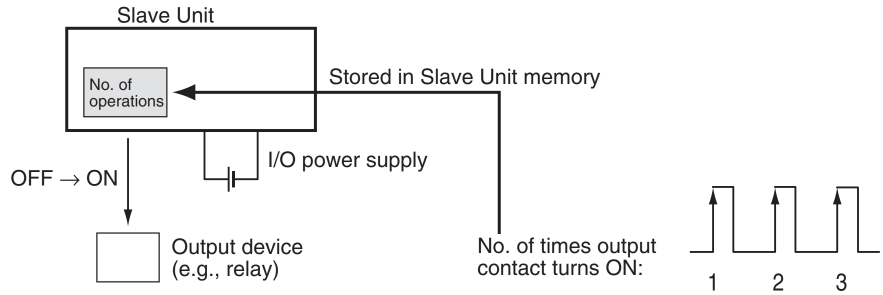
Description

The number of times each input contact or output contact is turned ON can be counted (resolution: 50 Hz max.) and stored in Slave Unit memory. (This data can be read using the CompoNet Support Software or using explicit messages.)

A monitor value can also be stored in the Slave Unit memory so once the number of contact operations reaches the monitor value, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages.

- No. of times measured: 0 to 4,294,967,295 (Stored data: 0000 0000 to FFFF FFFF hex)

- Measurement unit: No. of operations



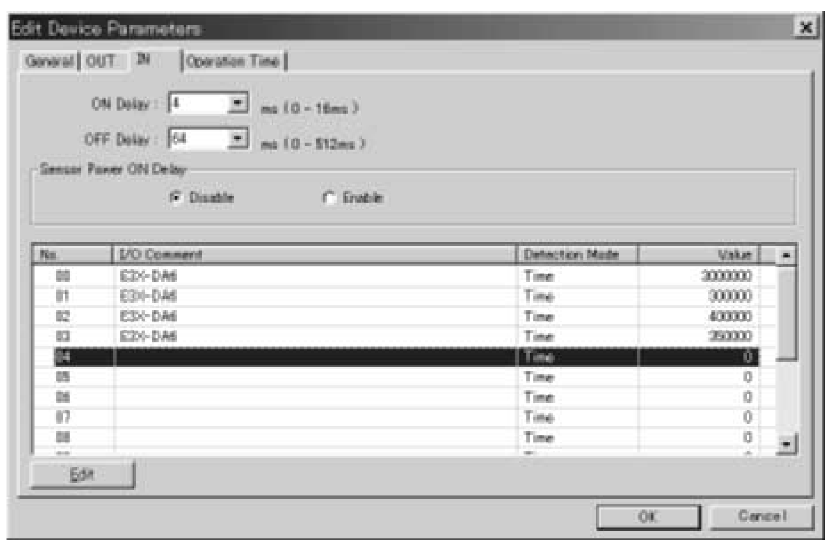
Note (1) The contact operation monitor and the total ON time monitor cannot both be used for the same contact at the same time. Select only one of these functions under the *Operation Monitor Mode*.

(2) This function does not operate if the I/O power is not turned ON.

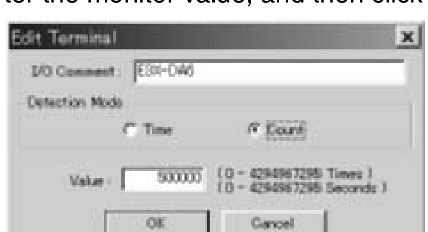
Settings Using the CompoNet Support Software

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window. In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.
3. Click the **IN** Tab.



4. Double-click the I/O comment of the input to be set. The following window will be displayed. Select the *Count* option in the *Detection Mode* Area, enter the monitor value, and then click the **OK** Button.



5. Check that the set monitor value appears in the Edit Device Parameters Window, click the **General** Tab, and then click the **Download** Button.
6. Click the **OK** Button.

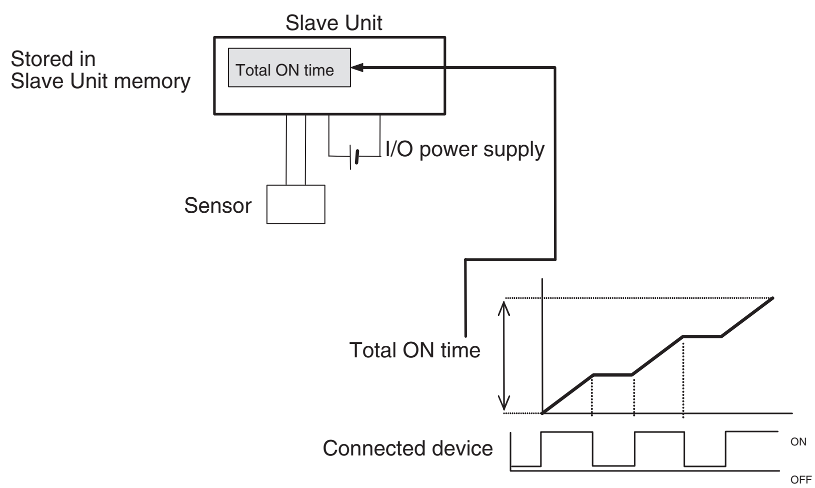
10-3-5 Total ON Time Monitor

Description

This function totals the time that each input and output contact is ON (unit: s) and stores this total time in the Slave Unit memory. (This data can be read using the CompoNet Support Software or using explicit messages.)

A monitor value can also be stored in the Slave Unit memory so once the set total time has been reached, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages.

- Measurement time: 0 to 4,294,967,295 s (Stored data: 0000 0000 to FFFF FFFF Hex)
- Measurement unit: s



Note

(1) The total ON time monitor and the contact operation monitor cannot both be used for the same contact at the same time. Select only one of these functions under the *Operation Monitor Mode*.

(2) This function does not operate if the I/O power is not turned ON.

(3) The Total ON Time Monitor Function checks at 1 second intervals whether or not the connected device is turned ON.
Keep this in mind when measuring total ON times for inputs of less than 1 s.

■ Measuring an ON Time of 0.5 s

As shown in *Figure A*, the actual ON time is 1.5 s (3 × 0.5 s) but the total ON time is measured only as 1 s because the input is ON only once when a measurement is taken.

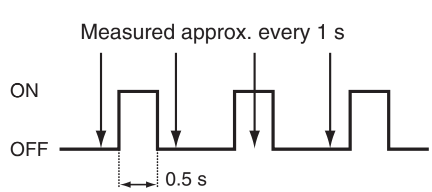


Figure A

In *Figure B*, the actual ON time is 1.5 s (3 × 0.5 s) but the total ON time is measured as 2 s because the input is ON twice when a measurement is taken.

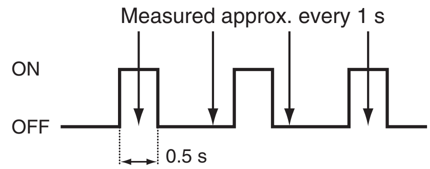


Figure B

■ Measuring an ON Time of 1.5 s

In *Figure C*, the actual ON time is 3 s (2 × 1.5 s) but the total ON time is measured as 4 s because the input is ON 4 times when a measurement is taken.

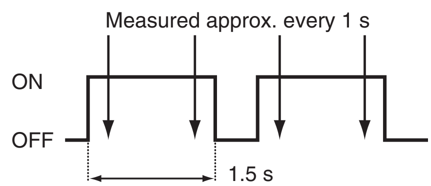
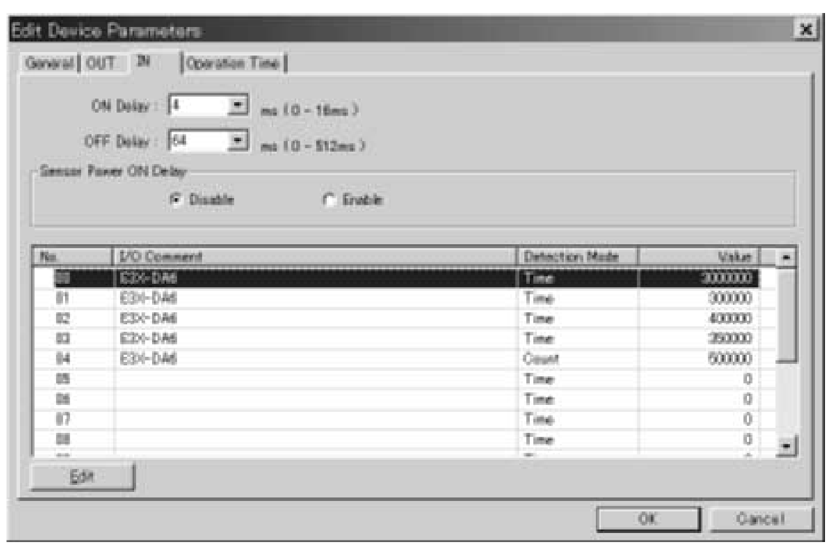


Figure C

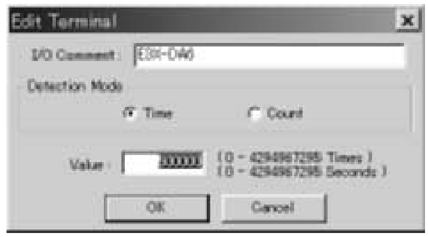
Settings Using the CompoNet Support Software

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window. In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.
3. Click the **IN** Tab.



4. Double-click the I/O comment of the input to be set. The following window will be displayed. Select the *Total ON Time* option in the Detection Mode Area, enter the monitor value, and then click the **OK** Button.



5. Check that the set monitor value appears in the Edit Device Parameters Window, click the **General** Tab, and then click the **Download** Button.
6. Click the **OK** Button.

10-3-6 Operation Time Monitor

Description

This function can be used to measure the contact I/O timing (ON/OFF) in the Slave Unit (measurement unit: ms) and store the measurement in the Slave Unit memory. (This data can be read using the CompoNet Support Software or using explicit messages.)

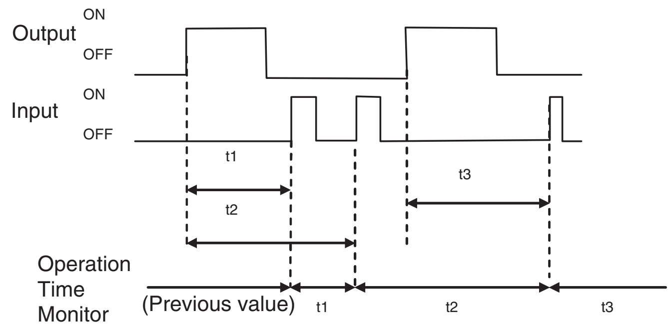
The operation time of various combinations of contacts can be monitoring in the Slave Unit (e.g., input-output, output-input, input-input, and output-output).

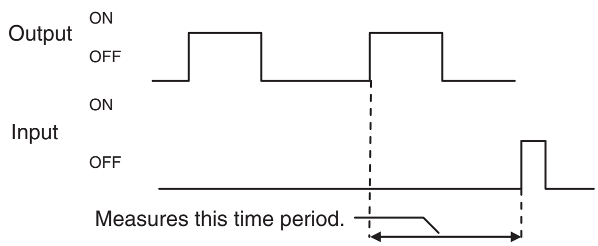
In addition, the trigger edge pattern can be set to ON→OFF, ON→ON, OFF→OFF, or OFF→ON. Any input number and output number combination can also be set. (The number of contact points that can be set depends on the Unit.)

This function allows high-precision measurement of the operation time without being affected by the communications cycle. A monitor value can also be stored in the Slave Unit memory so once the set monitor time has been exceeded, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages.

- The operation time is stored when the time from the output turning ON to the input turning ON is measured. The operation time continues to be measured internally until the next time the output turns ON, and the measurement value is refreshed if the input turns ON again before the next time the output turns ON. For cylinders and other applications with reciprocating operation that receive inputs during the operating time, the measurement taken during operation (outward motion) may be refreshed

during the release (return motion).
Alternatively, if the output turns ON twice before the input turns ON, the time measured is from when the second time the output turns ON to when the input turns ON.





Note (1) If the same contact is used for the start and end of measurement and the same trigger edge pattern is used for both, the measured time will always be 0 ms.

(2) If monitor settings are changed while this function is being used, the accuracy of subsequent monitoring operations cannot be guaranteed. Correct monitoring operations will begin again from the point of the next start trigger.

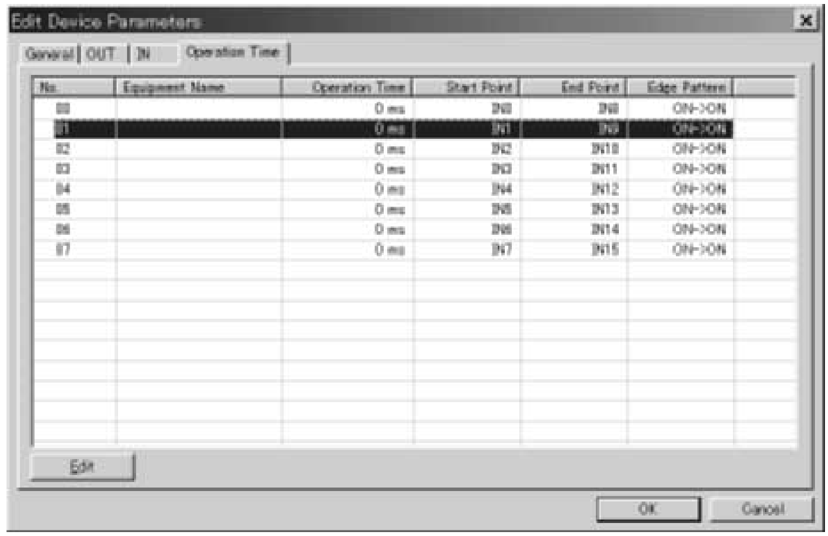
(3) If the measurement start trigger is input and the monitoring set value expires, the flag in the internal Unit Status Area turns ON even if the measurement end trigger has not been input. The Unit's operation time monitor value will retain the previous measurement value until the measurement end trigger is input.

Settings Using the CompoNet Support Software

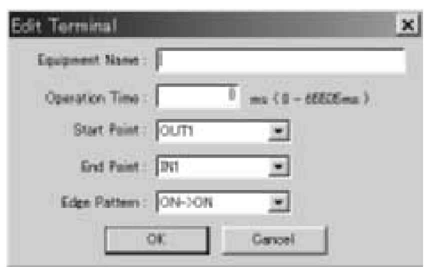
1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. In the Standard Window, double-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window, or right-click the icon and select ***Parameters*** - ***Edit***, to display the Edit Device Parameters Window.
In the Maintenance Mode Window, right-click the icon for the CompoNet Slave Unit to be set in the Network Configuration Window and select ***Parameters*** - ***Edit*** to display the Edit Device Parameters Window.

3. Click the **Operation Time** Tab.



4. Double-click the target device under *Equipment Name*. The following window will be displayed.
   Enter the desired value in the *Operation Time* Field and select the points to be monitored from the pull-down lists of the *Start Point* and *End Point* Fields. Then select the ON edge or OFF edge monitoring in the *Edge Pattern* Field. Click the **OK** Button.



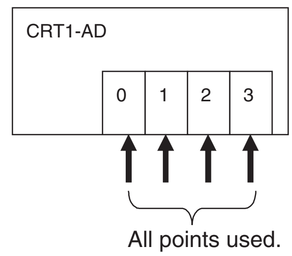
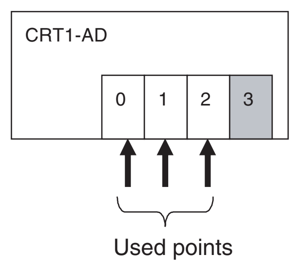
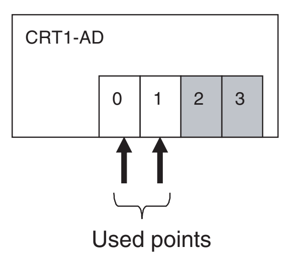
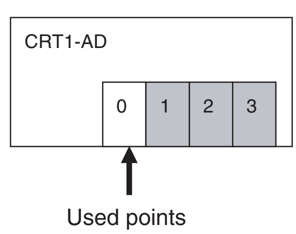
5. Check that the operation time monitor setting appears in the Edit Device Parameters Window.
   Click the **General** Tab, click the **Download** Button, and then click the **Reset** Button.
6. Click the **OK** Button.

10-4 Analog I/O Slave Unit Functions

10-4-1 Analog Input Unit Functions

Setting the Number of AD Conversion Points

Normally, when using a four-point Input Unit, the values for the four inputs are converted in sequence. The setting can be changed, however, so that unused inputs are not converted. By reducing the number of conversion points, the conversion cycle speed is increased. For details on conversion cycle time, refer to *6-4-3 Calculating the Conversion Cycle.*

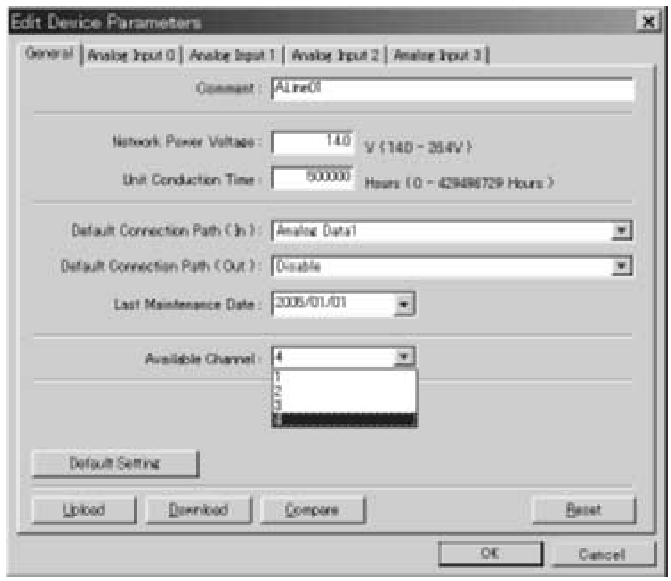
Conversion points	Details
4 points (default)	Converting Inputs 0 to 3. 
3 points	Converting Inputs 0 to 2. 
2 points	Converting Inputs 0 and 1. 
1 point	Converting Input 0 only. 

Note Four points of input analog data are used regardless of the setting of the number of AD conversion points.

Setting Using the CompoNet Support Software

1,2,3...

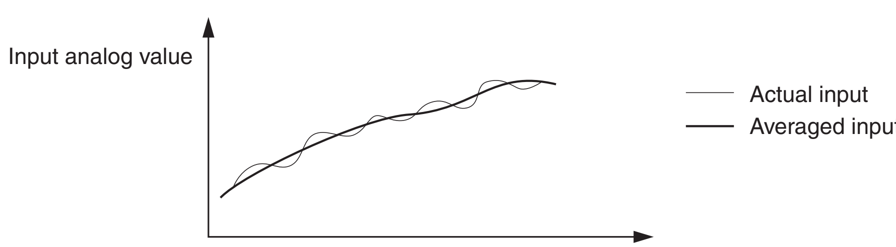
1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Click the **General** Tab and select the number of conversion points from the pull-down menu under the *Available Channel* field. In the following example, all four points are selected for conversion.



3. Click the **Download** Button, and then click the **Reset** Button to reset the Unit.
4. Click the **OK** Button and exit the window.

Moving Average Processing

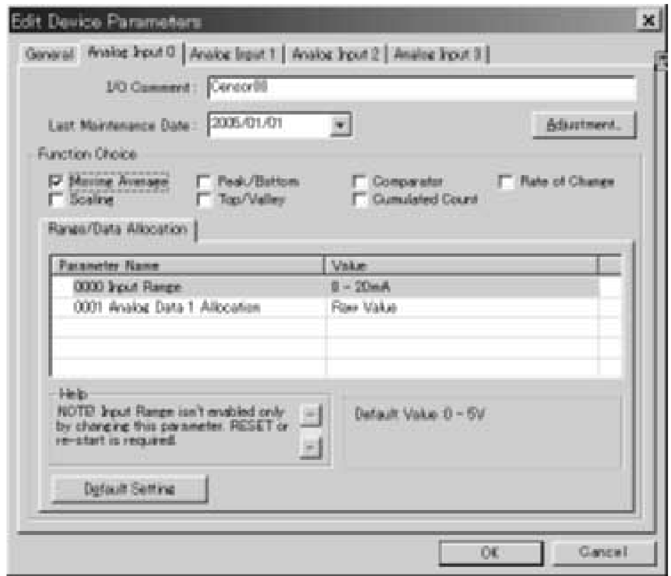
This function calculates the average value (moving average) of the previous eight inputs, and uses the resulting value as conversion data. When the input value fluctuates frequently, averaging can be used to produce a stable input value, as shown in the following diagram.



Setting Using the CompoNet Support Software

1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the Tab Page for the input where moving average processing is to be performed, and select ***Moving Average*** under the *Function Choice* heading.



3. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
4. Click the **OK** Button and exit the window.

Scaling

The default setting is used to perform AD conversion of analog input values, scaling them to a count between 0 and 6,000. Scaling can be used to change scaled values that correspond to the input signal range into other values required by the user (industry unit values). Scaling also eliminates the need for ladder programming in the Master Unit to perform math operations. The following two methods of input scaling can be used.

Default Scaling

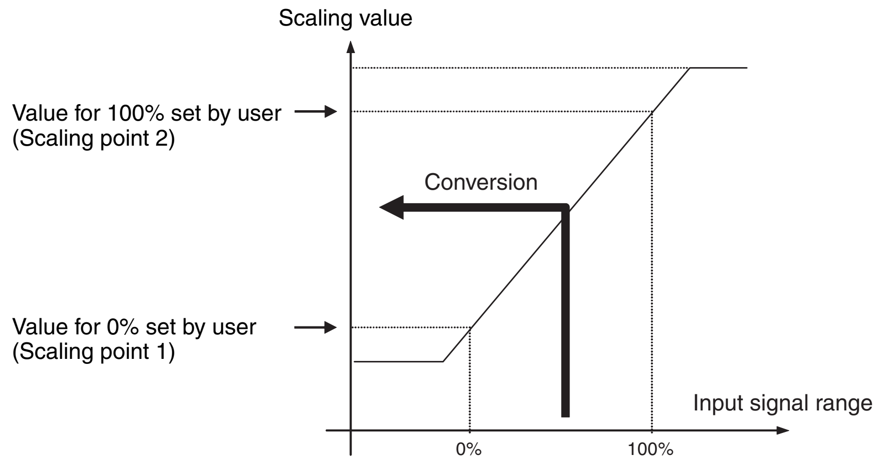
Analog input values (count values) are converted to the original voltage and current values. The units used are mV or µA. When default scaling is selected, scaling is performed according to the range used, as shown in the following table.

Input range	0 to 5 V	0 to 10 V	1 to 5 V	–10 to 10 V (CRT1-AD04 only)	0 to 20 mA	4 to 20 mA
100%	5,000 mV	10,000 mV	5,000 mV	10,000 mV	20,000 µA	20,000 µA
0%	0000 mV	0000 mV	1,000 mV	–10,000 mV	0000 µA	4,000 µA
Discon-nected line	0000 hex	0000 hex	7FFF hex	0000 hex	0000 hex	7FFF hex

User Scaling

Analog input values (count values) are scaled to user-defined values. The conversion values for 100% and 0% are set using the CompoNet Support Software.

Input range	0 to 5 V	0 to 10 V	1 to 5 V	–10 to 10 V (CRT1-AD04 only)	0 to 20 mA	4 to 20 mA
100%	Set using CompoNet Support Software (–28,000 to 28,000)					
0%	Set using CompoNet Support Software (–28,000 to 28,000)					
Discon-nected line	0000 hex	0000 hex	7FFF hex	0000 hex	0000 hex	7FFF hex

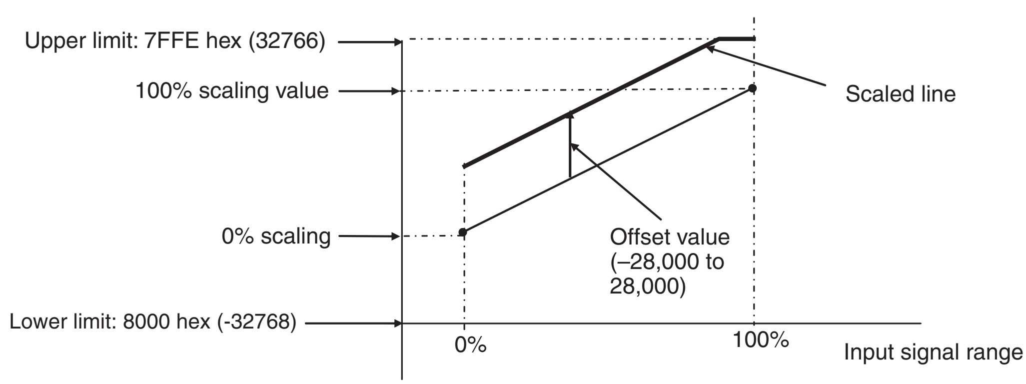


Note Reverse scaling, where the 0% scaling value is higher than the 100% scaling value, is also supported.

Offset Compensation

Scaling analog input values of linear sensors to distances produces mounting error in the sensor. Offset compensation compensates for error that occurs during scaling. The offset amount is added to the scaled line before processing, as shown in the following diagram. The offset (error) value can be input between –28,000 to 28,000, but make sure that underflow or overflow does not occur. The High Limit is 7FFE hex and the Low Limit is 8000 hex.

Note The offset value can be set even when using default scaling.

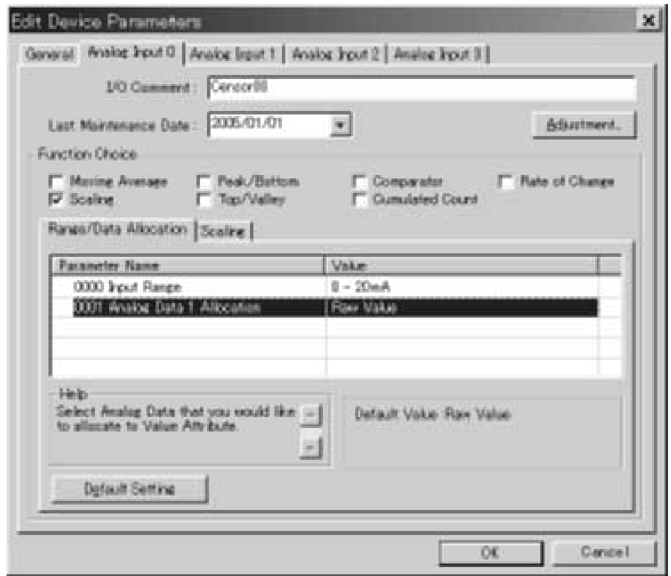


Setting Using the CompoNet Support Software

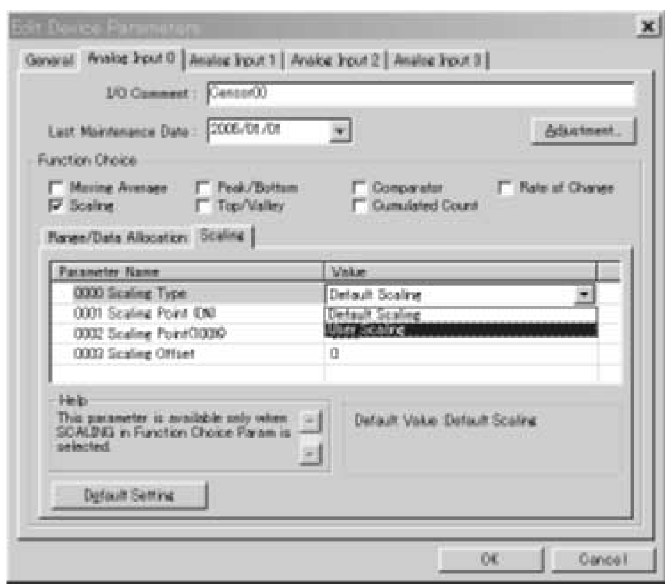
1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)

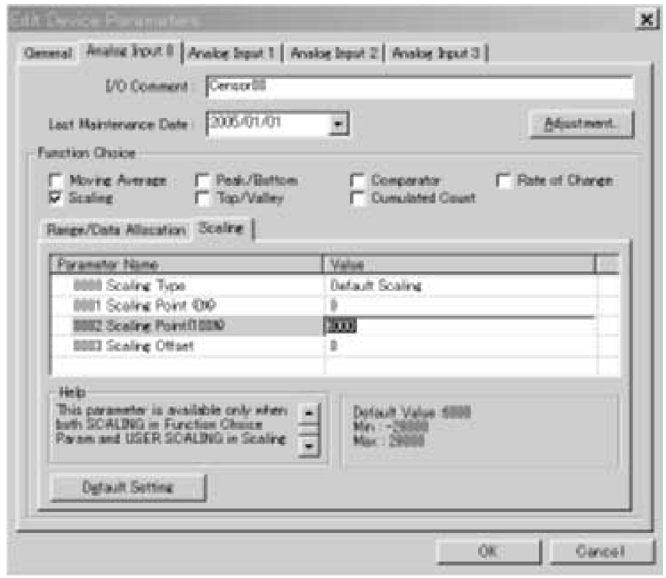
2. Select the Tab Page for the input where scaling is to be performed, and select ***Scaling*** under the *Function Choice* heading.



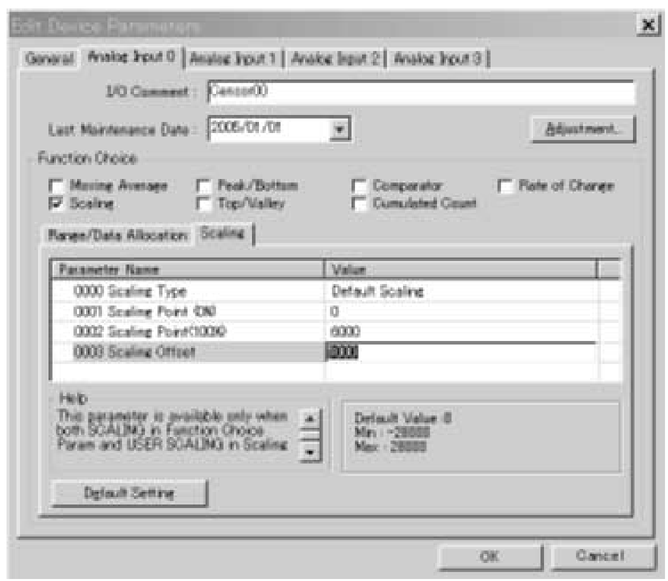
3. Click the **Scaling** Tab, and select either ***Default Scaling*** or ***User Scaling***. *User Scaling* is selected in the following example.



4. For user scaling, set the 0% value in the *Scaling point (0%)* field, and set the 100% value in the *Scaling point (100%)* field.



5. For offset compensation, set the offset value in the *Scaling Offset field*. Either *Default Scaling* or *User Scaling* can be set in the *Scaling Type* field.

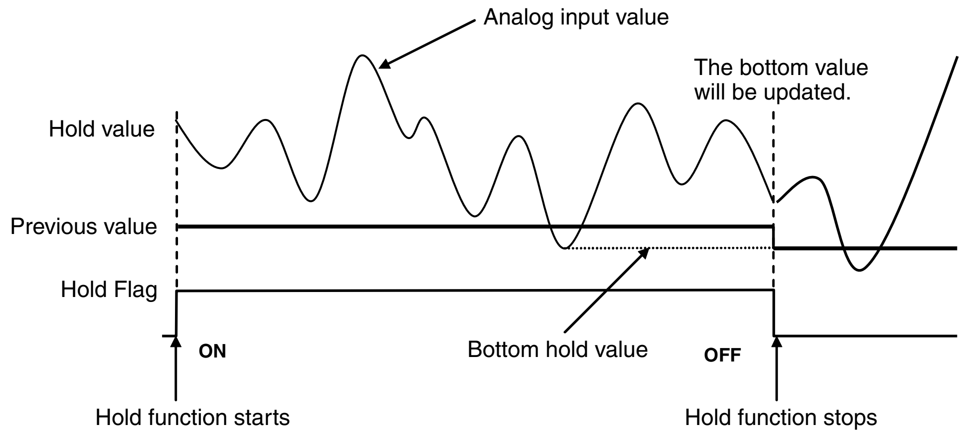


6. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
7. Click the **OK** Button and exit the window.

Peak/Bottom Hold

Peak/bottom hold is used to hold the maximum (peak) value or minimum (bottom) value of the analog input value. When the Hold Flag (output) allocated in the OUT Area turns ON, the hold function starts, searching for the peak or bottom value until the Hold Flag turns OFF. (The peak/bottom value is refreshed when the Hold Flag turns OFF.) The comparator function can be used to compare the peak or bottom values allocated as analog data. (Refer to details on the comparator function.)

■ **Example of Bottom Hold**

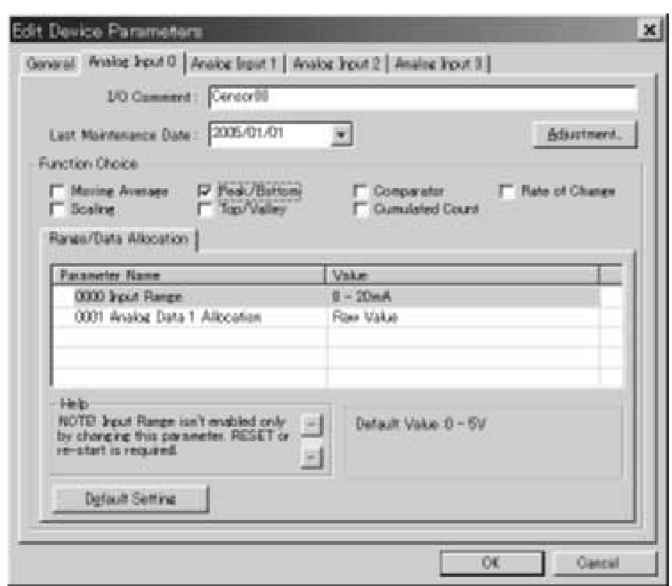


Note A delay in network transmission time will occur from the time the Hold Flag turns ON (or OFF) in the Master Unit's ladder program until notification of the flag's status is actually sent to the Slave. Therefore, even when the Hold Flag is ON, the first analog data transmitted to the Master Unit when the CPU Unit power is turned ON may be the data from when the Hold Flag was OFF. To collect peak/bottom hold data using the Hold Flag at the Master Unit, configure a ladder program that considers the transmission delay when the Hold Flag is turned ON, then enables the peak/bottom hold values after a fixed time interval.

Setting Using the CompoNet Support Software

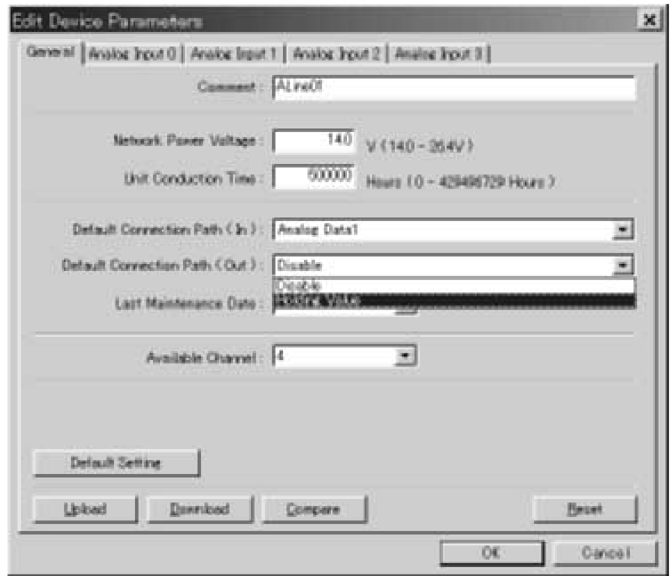
1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the Tab Page for the input where peak/bottom hold is to be set, and select ***Peak/Bottom Hold*** under the *Function Choice* heading.



3. To allocate the Hold Flags (output) in the default connection path, click the **General** Tab and select ***Holding Value*** from the pull-down menu in the *De-*

fault Connection Path (Out) field.



4. Click the **Download** Button and then click the **Reset** Button to reset the Unit.
5. Click the **OK** Button and exit the window.

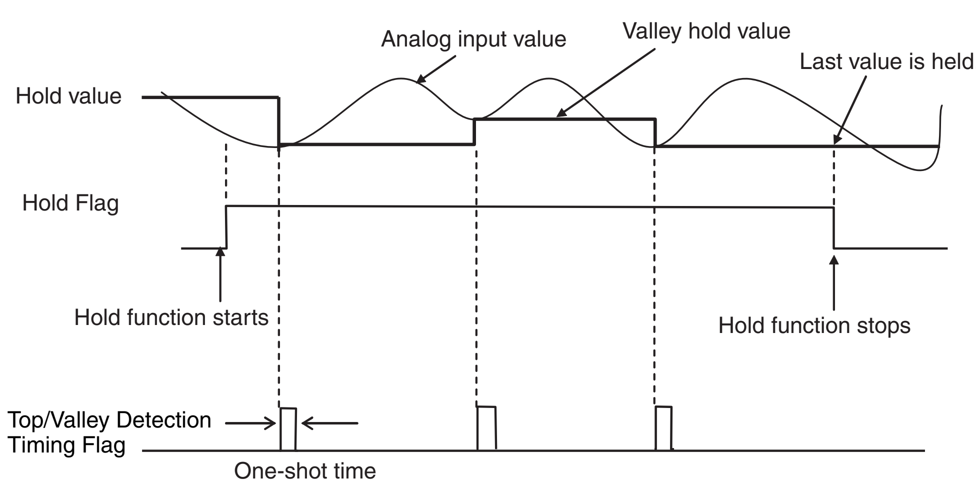
Top/Valley Hold

Top/valley hold is used to hold the top and valley values of the analog input value.

Analog values that fluctuate more than twice the hysteresis value are monitored, and the top or valley values are held. The top or valley value is allocated along with the Top/Valley Detection Timing Flags, which can be used to check the hold timing.

When the Hold Flag (output) allocated in the OUT Area turns ON, the hold function starts, refreshing the top or valley value until the Hold Flag turns OFF. (The last value is held when the Hold Flag turns OFF, but the next time the Hold Flag turns ON, the hold value is initialized as soon as a top or valley occurs.) The comparator can be used to compare the top or valley value allocated as analog data. (Refer to details on the comparator function.)

■ Example of Valley Hold



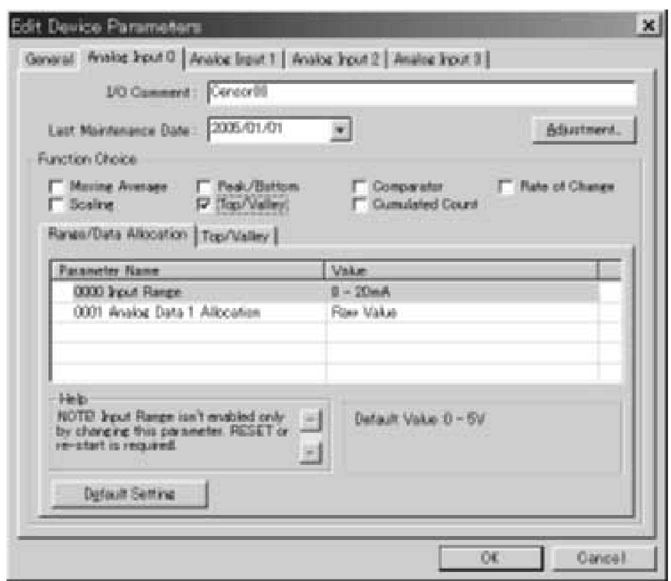
Note 1. A delay in network transmission time will occur from the time the Hold Flag turns ON (or OFF) in the Master Unit's ladder program until notification of the flag's status is actually sent to the Slave. Therefore, even when the Hold Flag is ON, the first analog data transmitted to the Master Unit when the CPU Unit power is turned ON may be the data from when the Hold Flag was OFF. To collect top/valley hold data using the Hold Flag at the Master Unit, configure a ladder program which considers the transmission delay time when the Hold Flag is turned ON, then enables the top/valley hold values after a fixed time interval.

2. The time that the Top/Valley Detection Timing Flags are ON can be adjusted by setting the one-shot time. Use the CompoNet Support Software to set the one-shot time (the setting range is 1 to 65535 ms).
3. If the Hold Flag turns OFF during the time the Top/Valley Detection Timing Flag is set to be ON, both flags will turn OFF simultaneously.

Setting Using the CompoNet Support Software

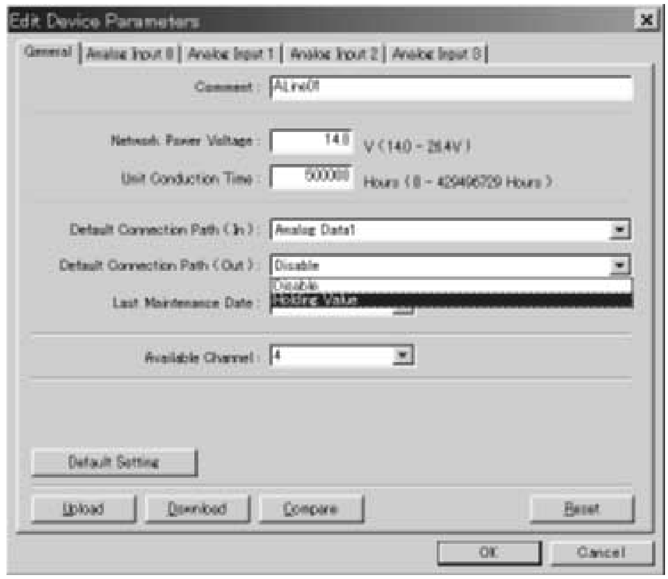
1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the Tab Page for the input where top/valley hold is to be set, and select ***Top/Valley Hold*** under the *Function Choice* heading.



3. To allocate the Hold Flag (output) in the default connection path, click the **General** Tab, and select ***Holding Value*** from the pull-down menu in the

Default Connection Path (Out) field.

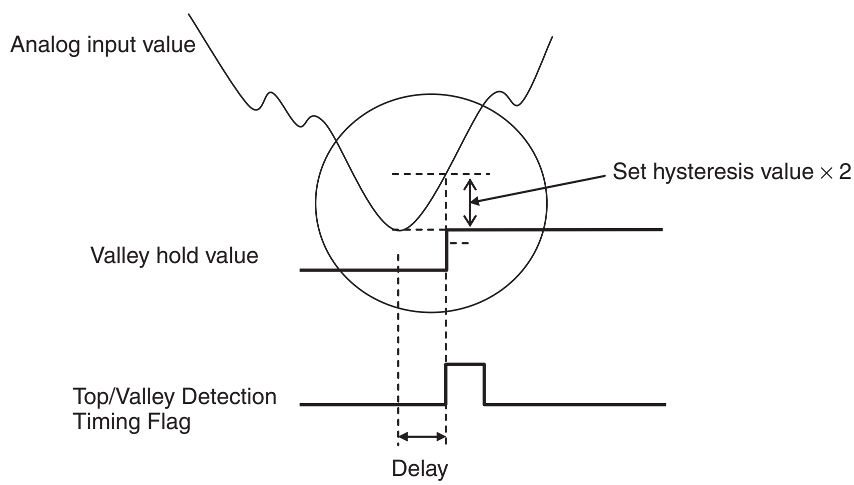


4. Click the **Download** Button, and then click the **Reset** Button to reset the Unit.

Hysteresis Setting

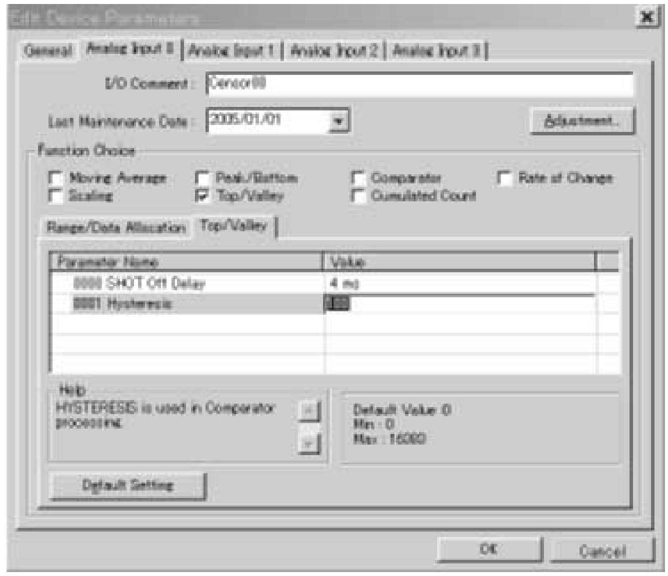
The hysteresis value can be set using the CompoNet Support Software to prevent detection of top or valley values that occur due to minor fluctuations in the analog input value. This will cause the start of data holding to be delayed after the actual top or valley value occurs, as shown in the following diagram.

■ Timing for Setting Data



■ Setting Hysteresis Using the CompoNet Support Software

1,2,3... 1. Input the value for hysteresis in the *Hysteresis* field in the **Top/Valley** Tab under the *Function Choice* heading.

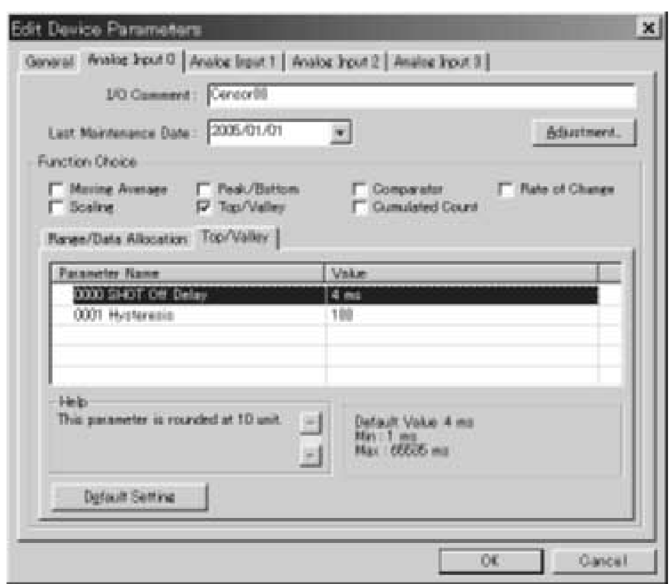


2. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
3. Click the **OK** Button and exit the window.

Note The hysteresis value set for the top/valley hold function is also used by the comparator function.

One-shot Time Setting

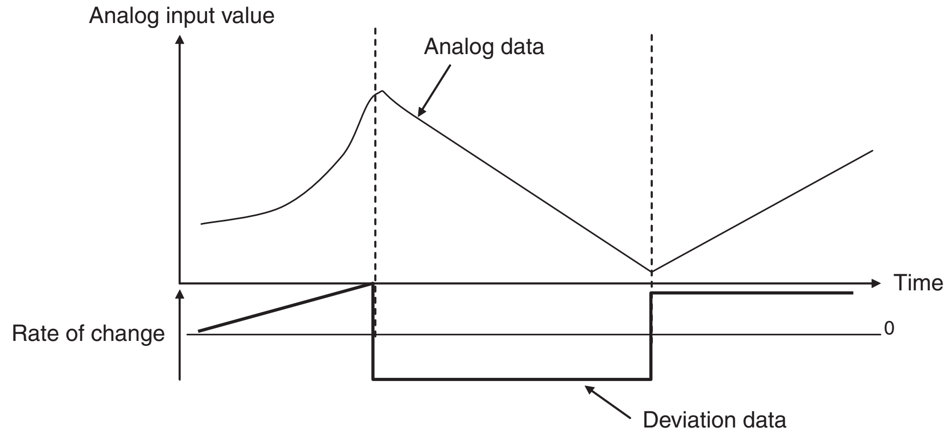
1,2,3... 1. Input the desired value in the *SHOT Off Delay* field of the **Top/Valley** Tab under the *Function Choice* heading.



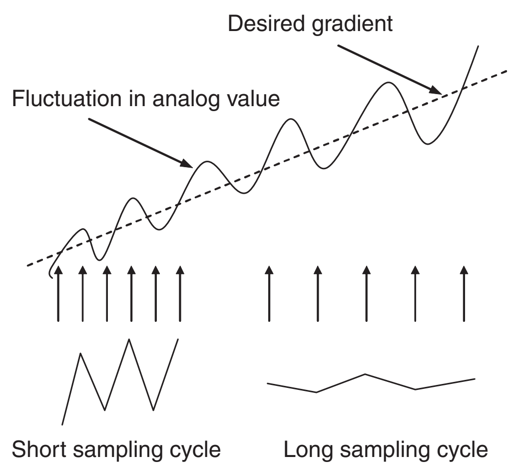
2. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
3. Click the **OK** Button and exit the window.

Rate of Change Calculation

The rate of change can be obtained for each sampling cycle set for the analog input data. This function calculates the difference between each set sampling cycle and value obtained in the previous cycle. The default setting for the sampling cycle is 100 ms and the sampling cycle setting range is 10 to 65,530 ms (in units of 10 ms).



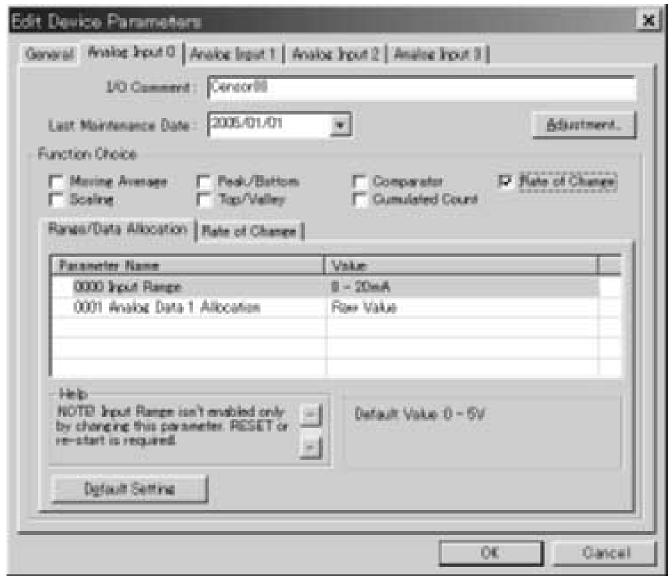
Note If the sampling cycle is set to a small value, the rate of change will be sensitive to small changes. If the analog data is subject to minute fluctuations, and the sampling cycle is shorter than the cycle of fluctuation, the fluctuation will be regarded as the rate of change. To prevent this occurring, use moving average processing, which will set a longer sampling cycle.



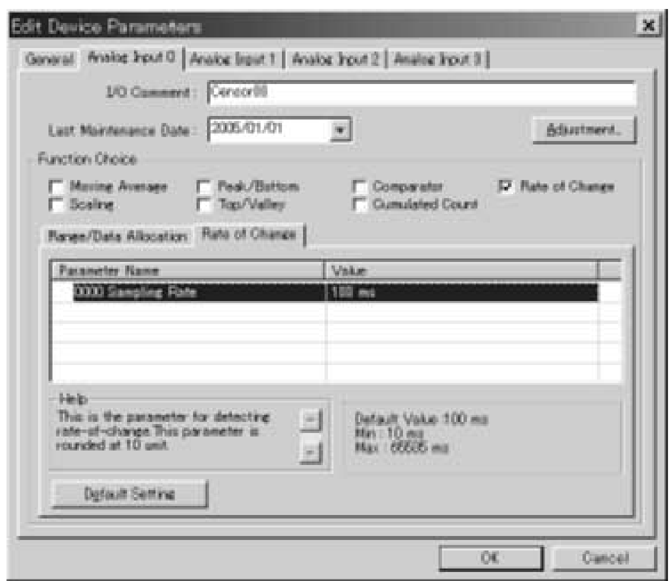
Setting Using the CompoNet Support Software

1,2,3... 1. Double-click the icon of the Analog I/O Slave Unit to be set in the Main Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)

2. Select the Tab Page for the input where rate of change is to be set, and select ***Rate of Change*** under the *Function Choice* heading.



3. To set the sampling cycle, click the **Rate of Change** Tab and input the desired value for the sampling cycle in the *Sampling Rate* field.

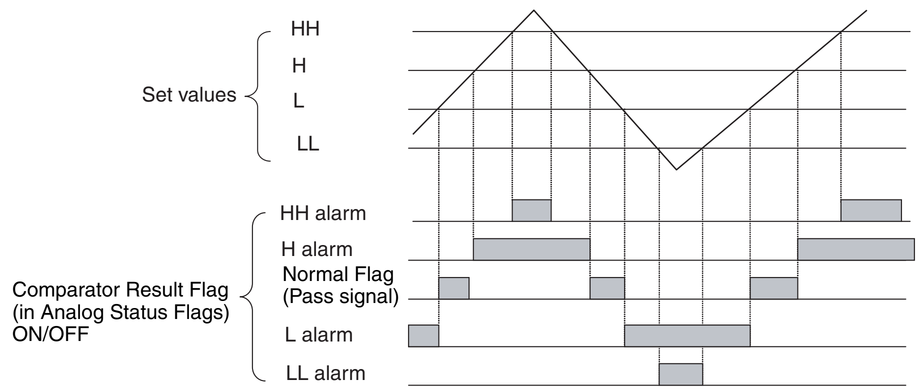


4. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
5. Click the **OK** Button and exit the window.

Comparator

When the High High Limit, High Limit, Low Low Limit, and Low Limit are set in the Slave, a flag will turn ON when a value exceeds the setting range. The four set values are High High Limit (HH), High Limit (H), Low Low Limit (LL), and Low Limit (L), and the values are compared with those in Analog Data. When each of these values is exceeded, the Comparator Result Flag in the area for Analog Status Flags turns ON. If an alarm does not occur, the Normal

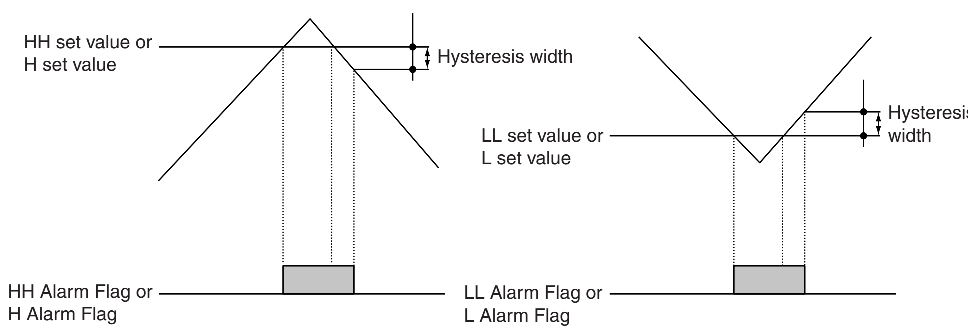
Flag (pass signal) turns ON.



Note When the analog input value changes faster than the conversion cycle, the High Limit alarm may turn ON without the Normal Flag (pass signal) turning ON for the Low Limit alarm. Configure ladder programs to prevent this occurring.

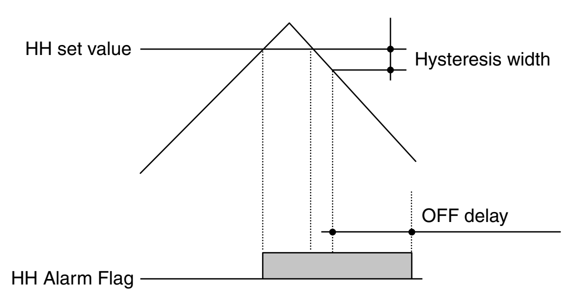
Setting Hysteresis

The Comparator Result Flag turns OFF when the value is lower than the hysteresis width (H or HH alarm occurs) or exceeds it (L or LL alarm occurs), as shown in the following diagram. If the analog value fluctuates around the threshold, and the flag repeatedly turns ON or OFF, setting hysteresis will stabilize the flag operation.



OFF Delay

The time until the Comparator Result Flag turns OFF can be extended. For example, even if the Flag is ON momentarily, the OFF delay can be set so that the Master Unit can receive notification of the Flag's status.

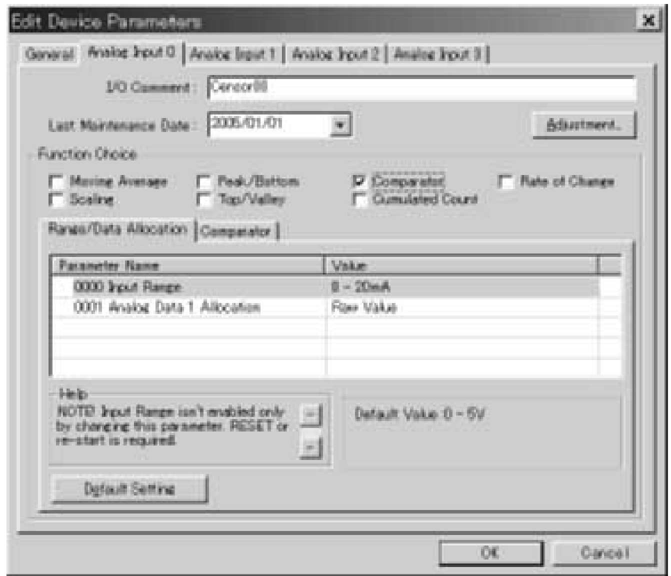


Setting Using the CompoNet Support Software

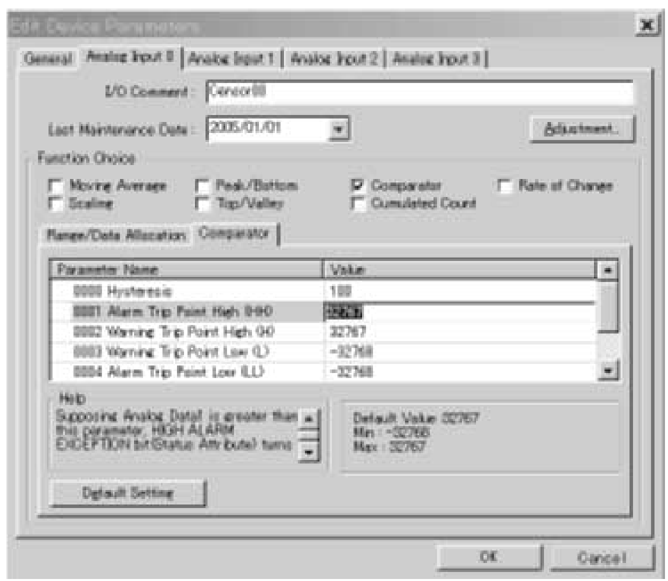
1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Main Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)

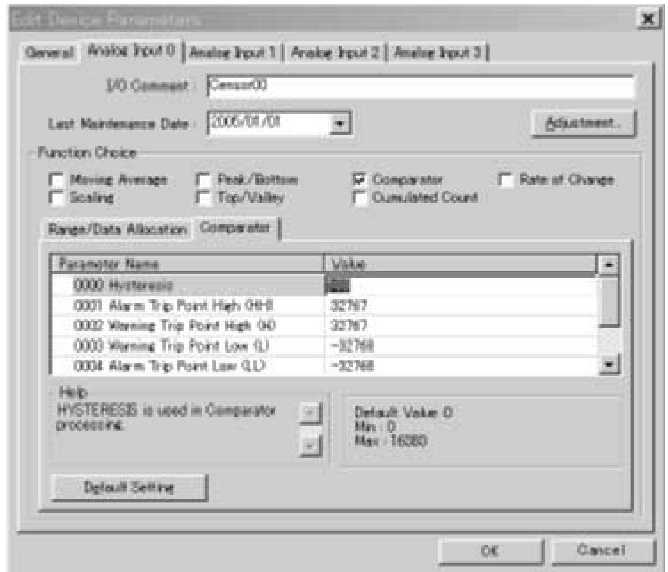
2. Select the Tab Page for the input where the comparator function is to be set, and select ***Comparator*** under the *Function Choice* heading.



3. Click the **Comparator** Tab and set each of the alarm values. The example here shows the setting for *Alarm Trip Point High* (HH limit set value).

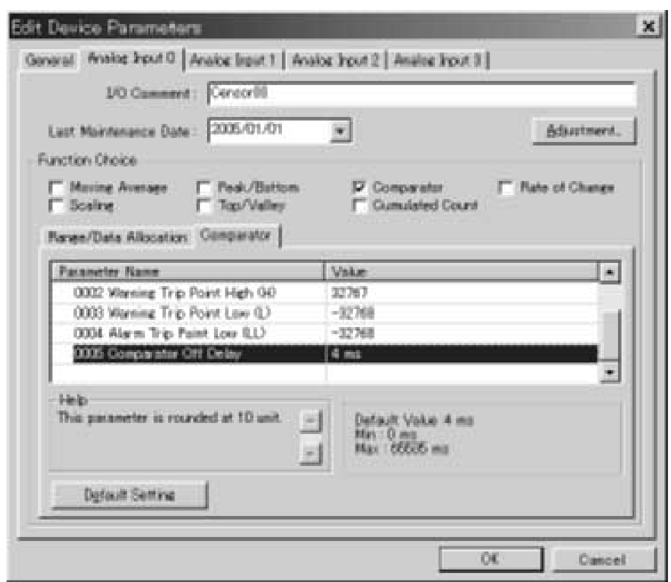


4. To set the hysteresis value, input the desired value in the *Hysteresis* field.



Note The hysteresis value set for the comparator function is also used by the top/valley hold function.

5. To set the OFF delay function, input the desired value in the *Comparator Off Delay* field.



6. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
7. Click the **OK** Button and exit the window.

Disconnected Line Detection

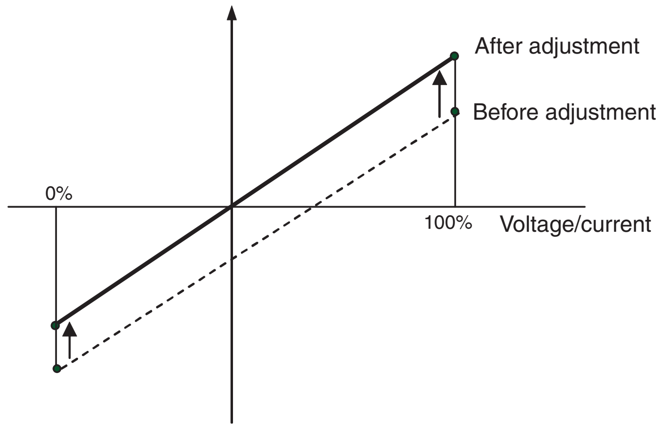
When a disconnection occurs in an analog input line (voltage input or current input), the Disconnected Line Detection Flag turns ON for each input that is valid in the number of AD conversion points. The Disconnected Line Detection Flags are included in the Analog Status Flags.

When Disconnected Line Detection is enabled, the value of AD conversion data is set to 7FFF hex. When the input returns to a value within the range that can be converted, the Disconnected Line Detection function will automatically be turned OFF, and normal data conversion will occur.

Disconnected Line detection is supported for input ranges of 1 to 5 V or 4 to 20 mA only. With the 1 to 5 V input range, an disconnected line condition is detected when the input voltage is below 0.76 V (less than 6%). With the 4 to 20 mA input range, an disconnected line condition is detected when the input current is below 3.04 mA.

User Adjustment

Depending on factors such as the characteristics and connection methods of the input device, the input can be adjusted to compensate for error in the input voltage or current. The following diagram shows when compensation is applied to the conversion line at the two points for 0% and 100%.



The following table shows the input ranges that support user adjustment.

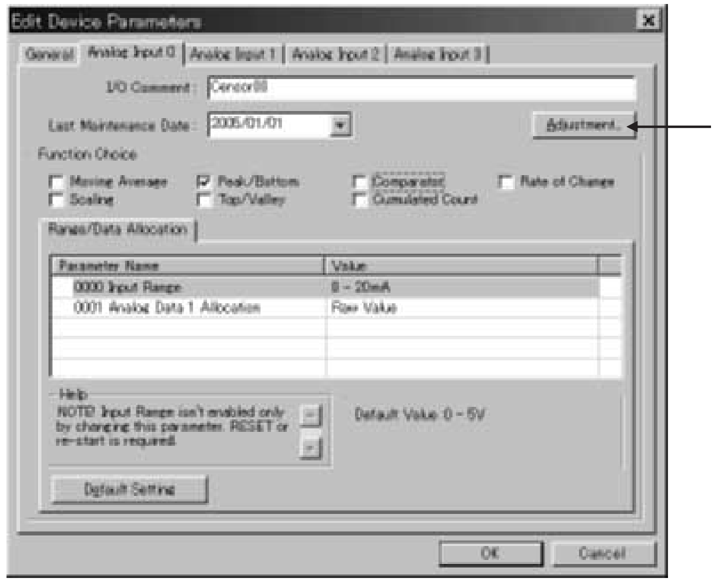
Input range	Low Limit	High Limit
0 to 5 V	–0.25 to 0.25 V	4.75 to 5.25 V
1 to 5 V	0.8 to 1.2 V	4.8 to 5.2 V
0 to 10 V	–0.5 to 0.5 V	9.5 to 10.5 V
–10 to 10 V	–11 to –9.0 V	9.0 to 11 V
4 to 20 mA	3.2 to 4.8 mA	19.2 to 20.8 mA
0 to 20 mA	–1.0 to 1.0 mA	19 to 21 mA

Setting Using the CompoNet Support Software

1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)

2. Select the Tab Page for the input to be adjusted, and click the **Adjustment** Button. (At the same time set the input range again.)



3. Input the voltage (or current) transmitted from the connected device to the Unit's input terminal that is equivalent to the 100% value.
4. Click the **Fix upper adjusting value** Button, and input the adjusted value.

5. Input the voltage (or current) transmitted from the connected device to the Unit's input terminal that is equivalent to the 0% value.
6. Click the **Fix lower adjusting value** Button, and input the adjusted value.

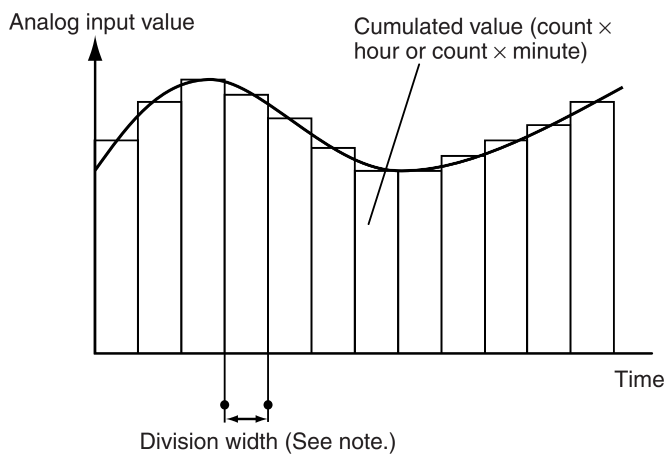
7. To return an adjusted value to the default setting, click the **Default Setting** Button.
8. Close the Adjustment Window, return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.

9. Click the **OK** Button and exit the window.

Cumulative Counter

The cumulative counter calculates an approximation to the integral of analog input values over time. The cumulated value can be calculated in “count hours” (by selecting “hours”) or “count minutes” (by selecting “minutes”). The count value is the analog input value in the industry unit obtained after scaling. For example, 100.0 count hours indicates a value equivalent to an analog input value of 100 counts continuing for one hour. The counter range for a four-byte area (two words) for count hours or count minutes is –214,748,364.8 to +214,748,364.7. Data is displayed on the CompoNet Support Software in units of 0.1 hour or minute.

Monitor values can also be set in the Unit. When the cumulated count value exceeds the set monitor value, the Cumulative Counter Flag in the area for Generic Status Flags turns ON.



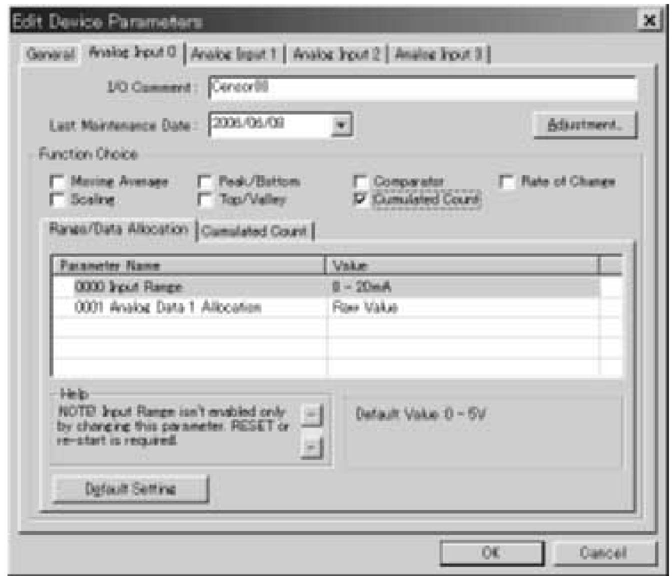
Note The following table shows the divisions for the cumulative counter.

Unit	Divisions
Hour	3.6 s (1/1,000 hour)
Minute	60 ms (1/1,000 minute)

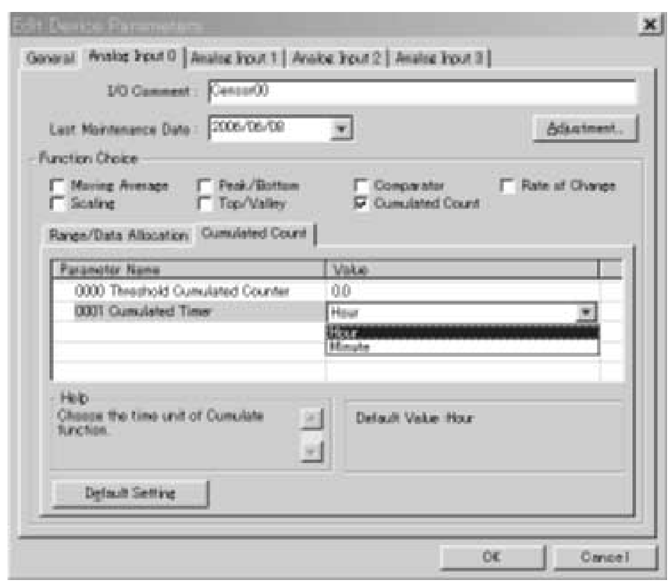
Setting Using the CompoNet Support Software

1,2,3... 1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)

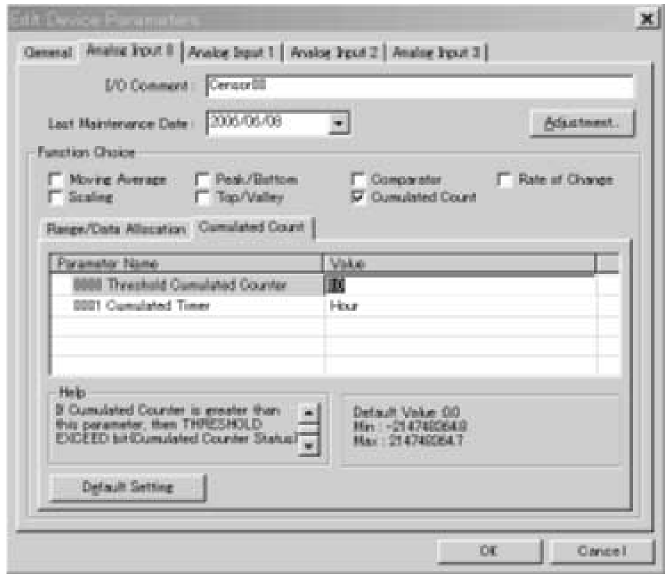
2. Select the Tab Page for the input where the cumulative counter is to be set, and select ***Cumulated Count*** under the *Function Choice* heading.



3. To set the counter unit, click the **Cumulated Count** Tab and select ***Hour*** or ***Minute*** from the pull-down menu in the *Cumulated Timer* field.



4. To set the monitor value, click the **Cumulated Count** Tab, and input the desired value in the *Threshold Cumulated Counter* field.



5. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
6. Click the **OK** Button and exit the window.

Last Maintenance Date

The last maintenance date can be set in the Unit separately for the Unit and the connected devices. It enables the user to easily determine the next maintenance date. The date can be set using the CompoNet Support Software.

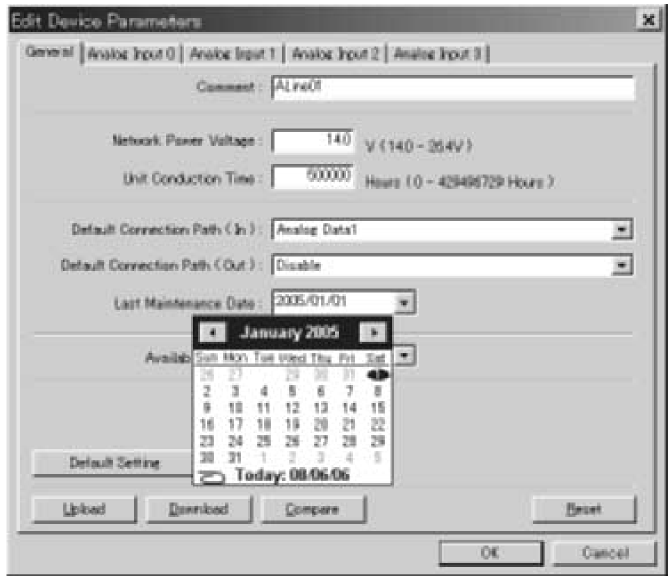
Setting Using the CompoNet Support Software

■ Setting the Last Maintenance Date of the Unit

1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Click the **General** Tab, and select the applicable date from the pull-down menu in the *Last Maintenance Date* field. (To enter the current date, select

Today, which is at the bottom of the pull-down menu.)

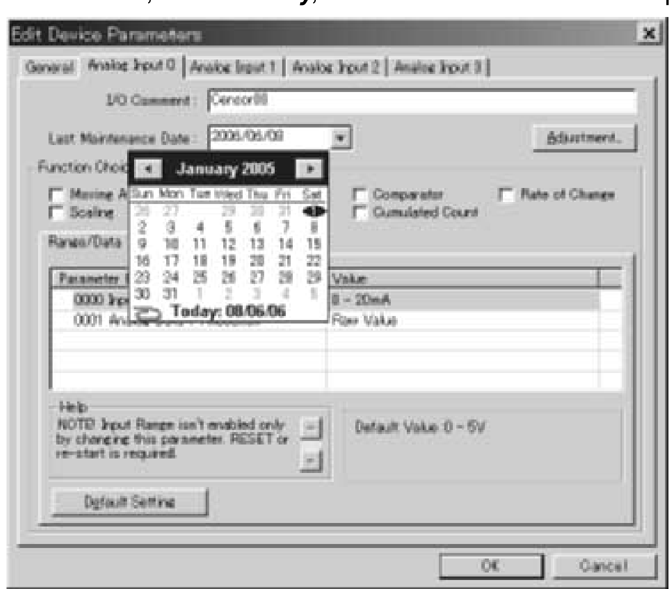


3. Click the **Download** Button, and then click the **Reset** Button to reset the Unit.
4. Click the **OK** Button and exit the window.

■ Setting the Last Maintenance Date of the Connected Device

1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Click the Tab Page for the input that is connected to a connecting device requiring the last maintenance date to be set. Select the applicable date from the pull-down menu in the *Last Maintenance Date* field. (To enter the current date, select ***Today***, which is at the bottom of the pull-down menu.)



3. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
4. Click the **OK** Button and exit the window.

10-4-2 Analog Output Unit Functions

Scaling

The default setting is used to perform DA conversion, converting analog output values that have been scaled to a count of 0 to 6,000 into corresponding digital values in the output signal range. Scaling can be used to change scaled values that correspond to the output signal range into other values required by the user (industry unit values). Scaling also eliminates the need for ladder programming in the Master Unit to perform math operations. The following two methods of scaling can be used.

Default Scaling

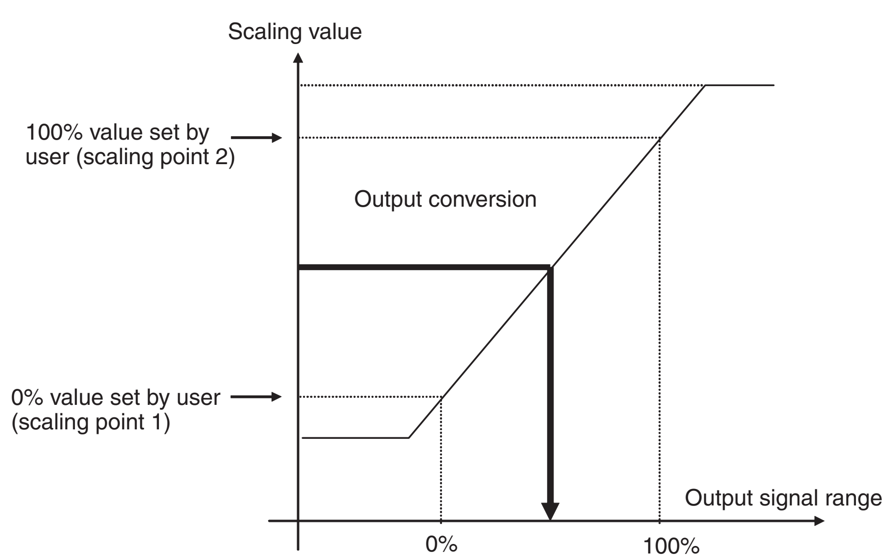
Default scaling converts analog output values into voltage or current values. The units used are mV or µA. When default scaling is selected, scaling is performed according to the output range, as shown in the following table.

Output range	0 to 5 V	0 to 10 V	1 to 5 V	–10 to 10 V	0 to 20 mA	4 to 20 mA
100%	5,000 mV	10,000 mV	5,000 mV	10,000 mV	20,000 µA	20,000 µA
0%	0000 mV	0000 mV	1,000 mV	–10,000 mV	0000 µA	4,000 µA
Discon-nected line	---	---	7FFF hex	---	---	7FFF hex

User Scaling

User scaling allows analog output values to be scaled to user-defined values. The conversion values for 100% and 0% are set using the CompoNet Support Software.

Input range	0 to 5 V	0 to 10 V	1 to 5 V	–10 to 10 V	0 to 20 mA	4 to 20 mA
100%	Set using CompoNet Support Software (–28,000 to 28,000)					
0%	Set using CompoNet Support Software (–28,000 to 28,000)					
Discon-nected line	---	---	7FFF hex	---	---	7FFF hex

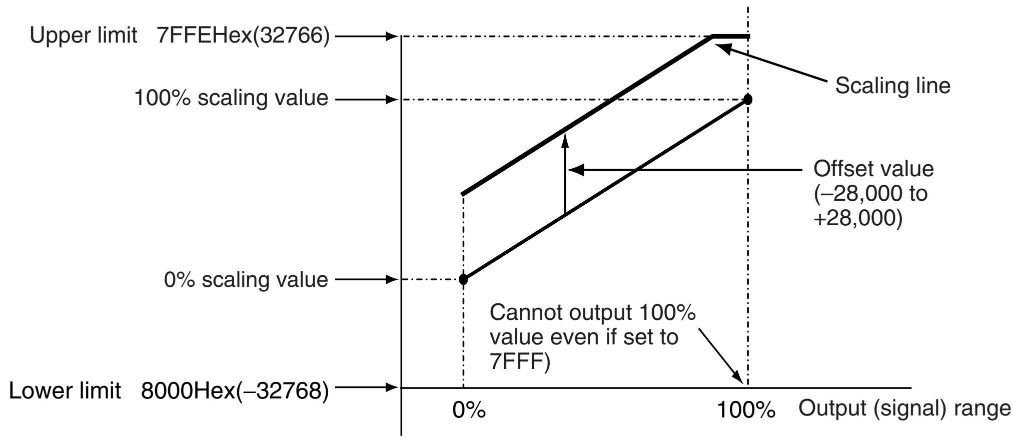


Note Reverse scaling, where the 0% scaling value is higher than the 100% scaling value, is also supported.

Offset Compensation

Offset compensation is used to compensate for error that occurs during scaling. The offset amount is added to the scaled line before processing, as shown in the following diagram. The offset (error) value can be input between –28,000 and 28,000, but if underflow or overflow occurs in the scaled line, the 100% or 0% output will not be possible. The High Limit is 7FFE hex and the Low Limit is 8000 hex.

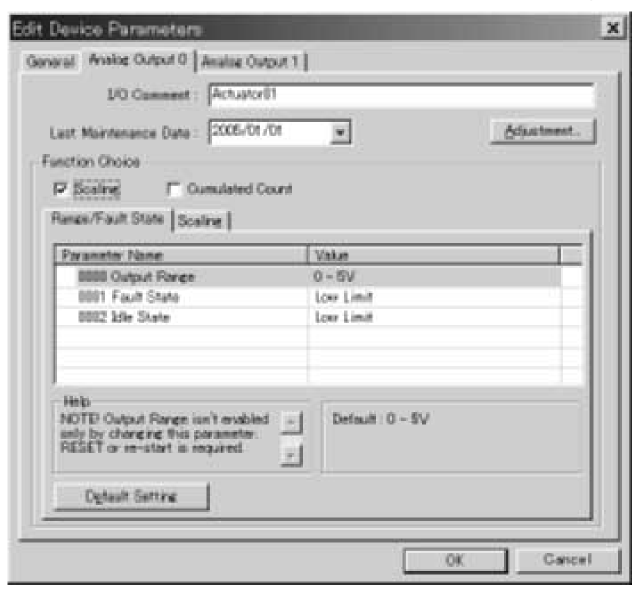
Note The offset value can be set even when using default scaling.



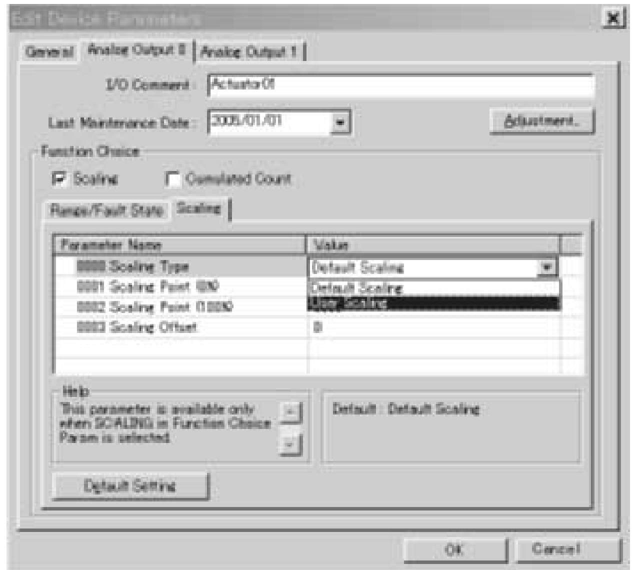
Setting Using the CompoNet Support Software

1,2,3...

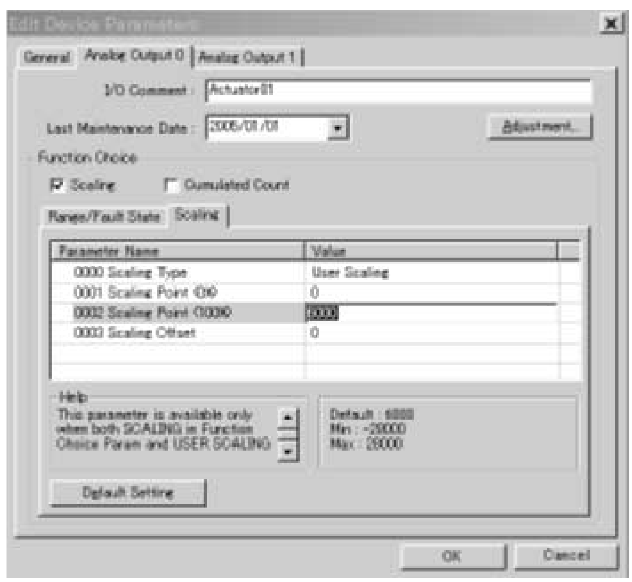
1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the Tab Page for the output where scaling is to be performed, and select ***Scaling*** under the *Function Choice* heading.



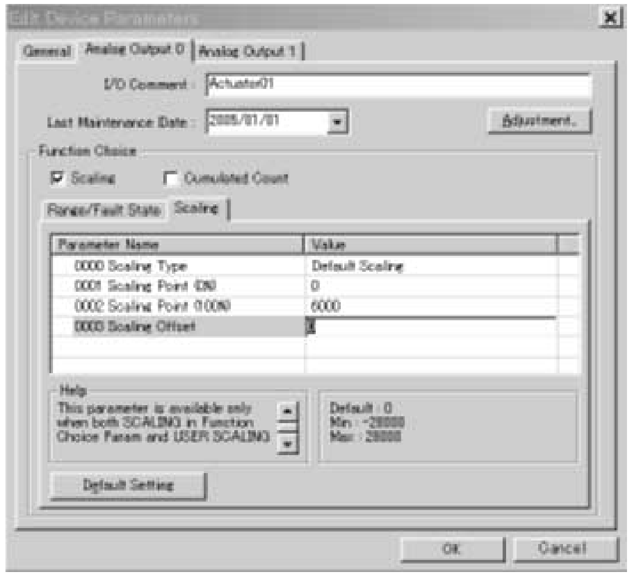
3. To select the scaling type, click the **Scaling** Tab, and select either ***Default Scaling*** or ***User Scaling***. The following example shows when *User Scaling* is selected.



4. For user scaling, set the 0% value in the *Scaling point (0%)* field, and set the 100% value in the *Scaling point (100%)* field.



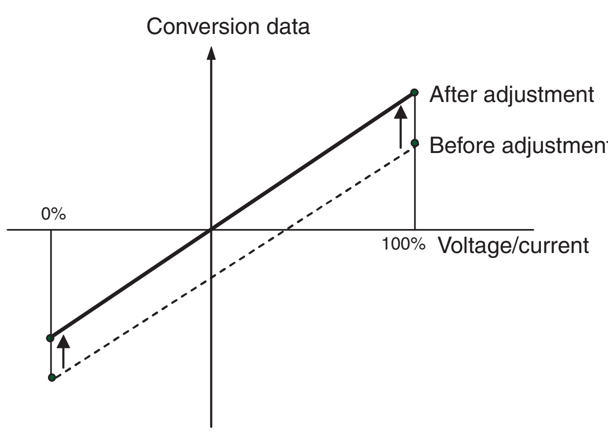
5. For offset compensation, set the offset value in the *Scaling Offset* field. Also select either ***Default Scaling*** or ***User Scaling*** in the *Scaling Type* field.



6. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
7. Click the **OK** Button and exit the window.

User Adjustment

Depending on factors such as the characteristics and connection methods of the output device, the output can be adjusted to compensate for error in the final output. The following diagram shows when compensation is applied to the conversion line at the two points for 0% and 100%.



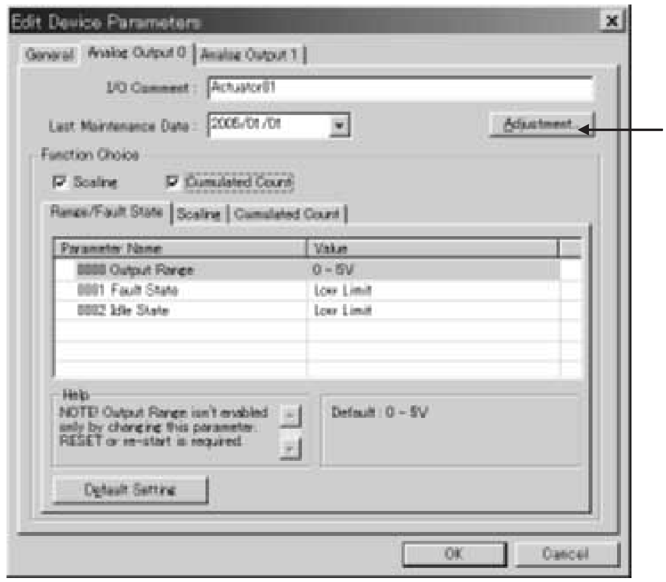
The ranges supported for adjustment (–5% to +5%) are shown in the following table. If adjustment cannot be performed within the following ranges, check the method being used to connect the output device.

Output range	Low Limit	High Limit
0 to 5 V	–0.25 to 0.25 V	4.75 to 5.25 V
1 to 5 V	0.8 to 1.2 V	4.8 to 5.2 V
0 to 10 V	–0.5 to 0.5 V	9.5 to 10.5 V
–10 to 10 V	–11 to –9.0 V	9.0 to 11 V
4 to 20 mA	3.2 to 4.8 mA	19.2 to 20.8 mA
0 to 20 mA	0.2 to 1.0 mA	19 to 21 mA

Setting Using the CompoNet Support Software

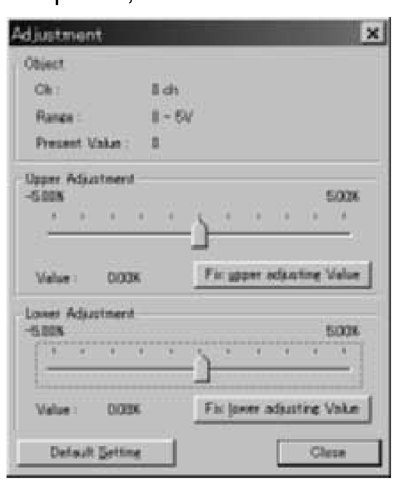
1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the Tab Page for the output to be adjusted, and click the **Adjustment** Button. (At the same time set the output range again.)



Adjusting the Low Limit

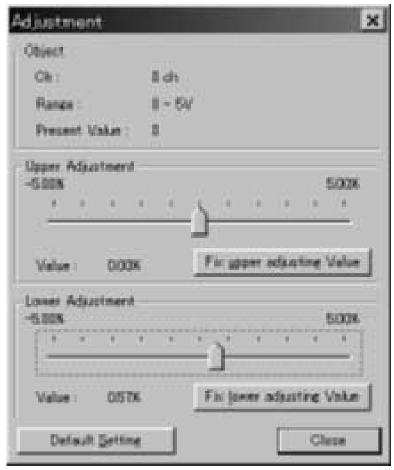
3. Output the value that is equivalent to 0% from the Master Unit. Always perform adjustment with the 0% value.
4. Adjust the analog value that is output from the terminal using the Low Limit slide bar, as shown in the following window. Repeat adjustments until the correct 0% value is output from the output device. After compensation is completed, click the **Fix lower adjusting value** Button.



5. To return to the default settings, click the **Default Setting** Button.
6. Close the Adjustment Window, return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
7. Click the **OK** Button and exit the window.

Adjusting the High Limit

8. Output the value from the Master Unit that is equivalent to the Output Unit's maximum (100%) value. Adjustment using the 100% value is highly recommended, but can be performed using a lower value.
9. Adjust the analog value that is output from the terminal using the High Limit slide bar, as shown in the following window. Repeat adjustments until the correct 100% value is output from the output device. After compensation is completed, click the **Fix upper adjusting value** Button.

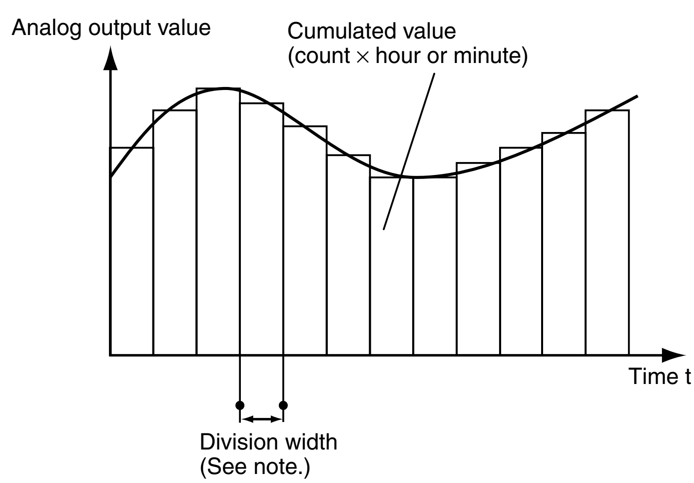


Note If the High Limit adjustment is not performed for the 100% value, a discrepancy will occur when the Low Limit is adjusted, so always adjust the Low Limit of Output Slave Units before adjusting the High Limit.

Cumulative Counter

The cumulative counter calculates an approximation to the integral of analog output values over time. The cumulated value can be calculated in “count hours” (by selecting “hours”) or “count minutes” (by selecting “minutes”). The count value is the analog output value in the industry unit obtained after scaling. For example, 100.0 count hours indicates a value equivalent to an analog output value of 100 counts continuing for one hour. The counter range for a two-word area (four bytes) for count hours or count minutes is –214,748,364.8 to 214,748,364.7. Data is displayed on the CompoNet Support Software in units of 0.1 hours or minutes.

Monitor values can also be set in the Unit. When the cumulated count value exceeds the set monitor value, the Cumulative Counter Flag in the area for Generic Status Flags turns ON.

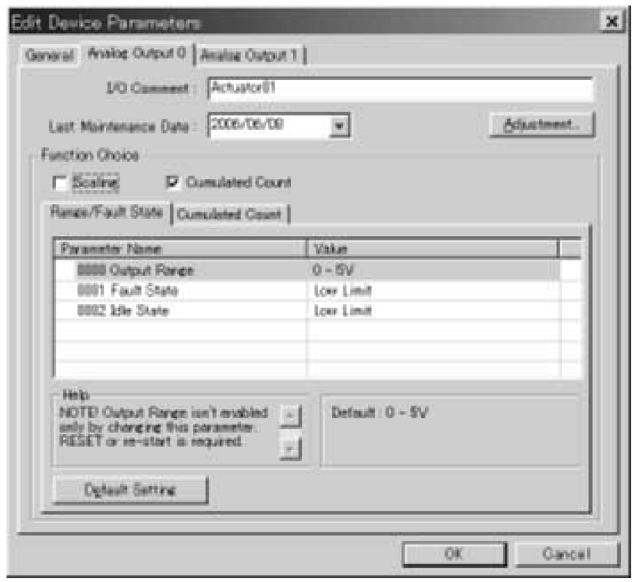


Note The following table shows the divisions for the cumulative counter.

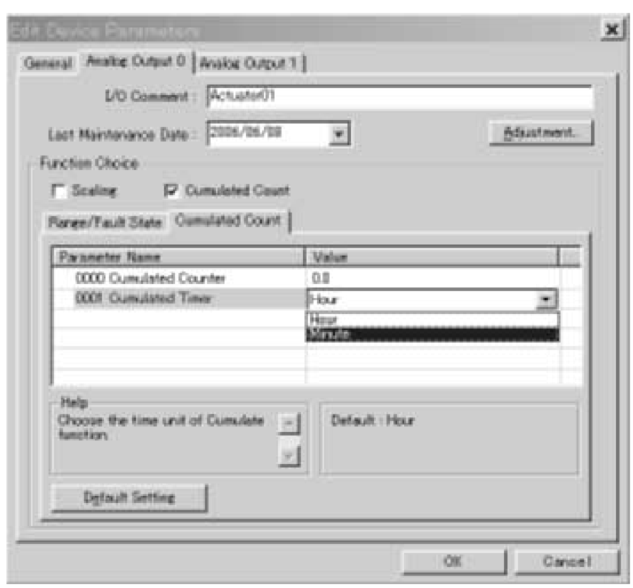
Unit	Divisions
Hour	3.6 s (1/1,000 hour)
Minute	60 ms (1/1,000 minute)

Setting Using the CompoNet Support Software

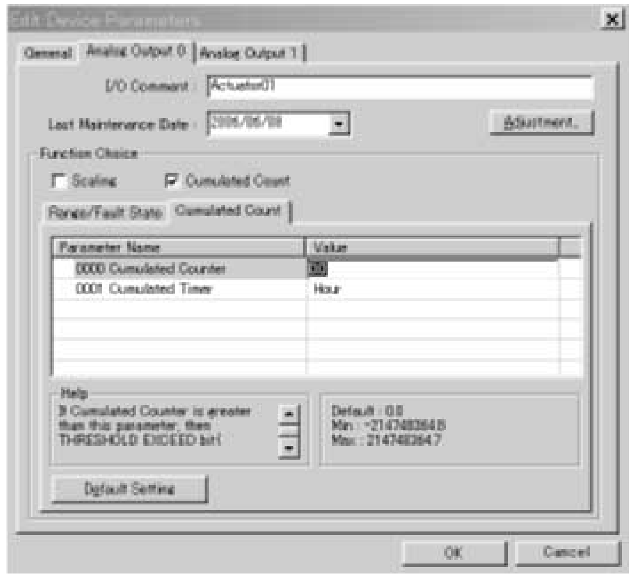
1,2,3...
1. Double-click the icon of the Analog I/O Slave Unit to be set in the Main Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)
2. Select the tab page for the output where the cumulated counter is to be set, and select *Cumulated Count* under the *Function Choice* heading.



3. To set the counter unit, click the **Cumulated Count** Tab and select ***Hour*** or ***Minute*** from the pull-down menu in the *Cumulated Timer* field.



4. To set the monitor value, click the **Cumulated Count** Tab, and input the desired value in the *Threshold Cumulated Counter* field.



5. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
6. Click the **OK** Button and exit the window.

Setting Output Value for Errors

The value that is output when communications errors (time-out and BusOff errors) occur can be set for each output. The four output settings are set using the CompoNet Support Software.

Setting Patterns

Low limit	Outputs the values in the following table according to the output range.
High limit	Outputs the values in the following table according to the output range.
Hold last state	Holds and outputs the value from immediately before the error occurred.
Zero count	Outputs the value when 0 is written from the Host. This setting will be affected by scaling settings that are used.

Output Ranges and Values

Output range	Low limit	High limit	Hold last state
0 to 5 V	–0.25 V	5.25 V	Holds value.
1 to 5 V	0.8 V	5.2 V	Holds value.
0 to 10 V	–0.5 V	10.5 V	Holds value.
–10 to 10 V	–11 V	11 V	Holds value.
4 to 20 mA	3.2 mA	20.8 mA	Holds value.
0 to 20 mA	0 mA	21 mA	Holds value.

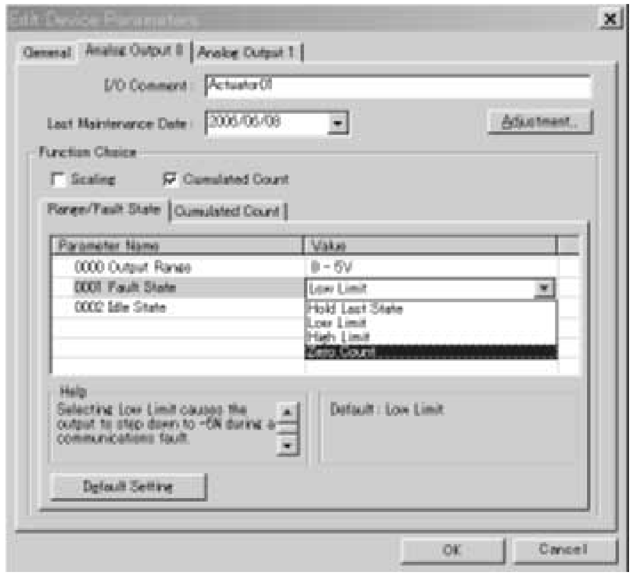
Note When a node address has been used more than once or a Unit error has occurred, the current output will be 0 mA and the voltage output will be 0 V, regardless of the setting.

Setting Using the CompoNet Support Software

1,2,3...

1. Double-click the icon of the Analog I/O Slave Unit to be set in the Network Configuration Window and open the Edit Device Parameters Window. (Alternatively, right-click the Slave Unit icon and select ***Parameters - Edit*** from the menus.)

2. Select the Tab Page for the output where the communications error output value is to be set, and select the desired item from the pull-down menu in the *Fault State* field.



3. Return to the **General** Tab, click the **Download** Button, and then click the **Reset** Button to reset the Unit.
4. Click the **OK** Button and exit the window.

10-5 Functions Unique to Bit Slave Units

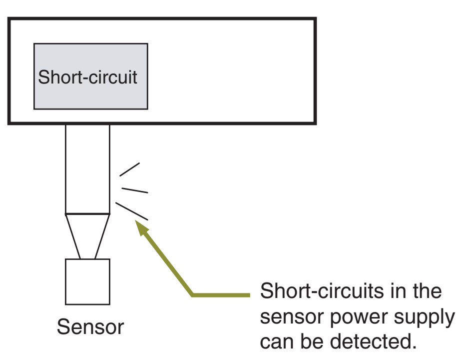
10-5-1 Sensor Power Short-circuit Detection (Input)

Description

This function monitors the sensor power supply current. If the current is 80 mA or higher per input contact, a sensor power short-circuit is detected.

The I/O power for the Slave Unit turns OFF if a short-circuit is detected for even just one of the contacts being used.

The Slave Unit SHT0 indicator can be used to check whether a sensor power short-circuit has been detected. When a sensor power short-circuit is detected, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages. When the cause of the short-circuit is removed, the Slave Unit is automatically reset, and the power output to the connector that had the short-circuit is turned ON again.



Note Use a power supply rated 100 W or higher as the communications power supply. A short-circuit is detected if a current of 80 mA or more flows two inputs in the Unit's sensor power output. The communications power supply may be temporarily cut if a short-circuit occurs. The Slave Unit is automatically restored after the cause of the short-circuit has been removed but external circuits must also be created to ensure safe system operation while the power is disconnected. Use the following formulas as a guide for calculating the sensor current consumption.

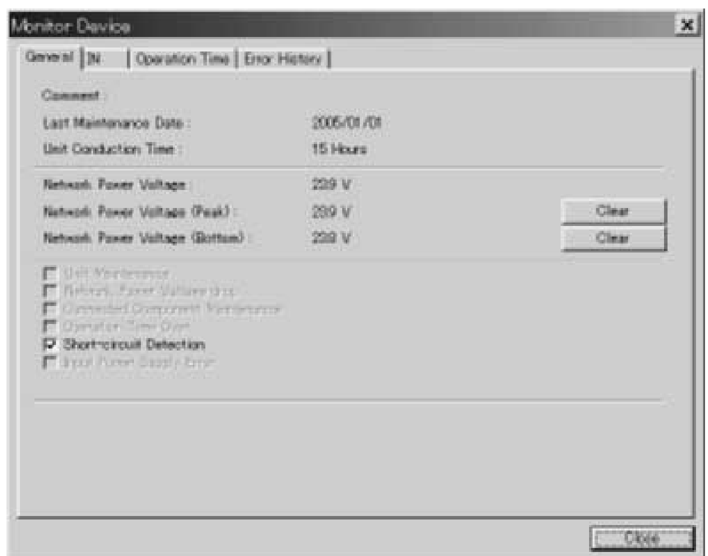
- Total network current = Total Sensor Unit current consumption + total sensor current consumption
- Communications power capacity used ≥ {total network current + (short-circuit detection current = 80 mA)} × (CompoNet network voltage)

Checking Using the CompoNet Support Software

The procedure for checking using the CompoNet Support Software is outlined below.

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. Right-click the icon for the desired CompoNet Slave Unit in the Network Configuration Window and select ***Monitor***.
   Make sure the Short-circuit Detection option is selected.



10-5-2 External Load Short-circuit Detection (Output)

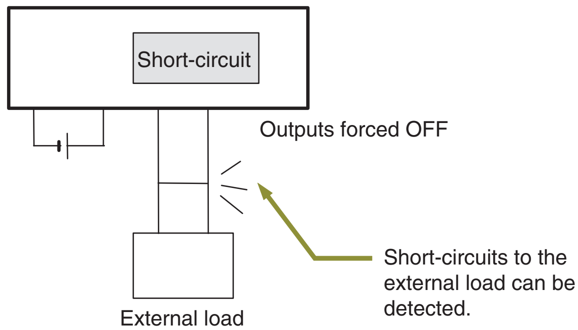
Description

This function monitors the load current for the output section and detects an external load short-circuit if the current per contact (or common) exceeds a specific value. When an external load short-circuit is detected, all Unit outputs are turned OFF to prevent damage to the Unit's output circuits.

The I/O power for the Unit turns OFF if a short-circuit is detected for even just one of the contacts being used.

The Slave Unit's SHT0 or SHT1 indicators can be used to check whether an external load short-circuit has been detected. When an external load short-circuit is detected, a flag in a status area in the Slave Unit turns ON to notify the Master Unit. The notification details can be read using the CompoNet Support Software or using explicit messages.

When the cause of the short-circuit is removed, the Slave Unit is automatically reset, and the power output to the connector for which the short-circuit was detected is turned ON again.

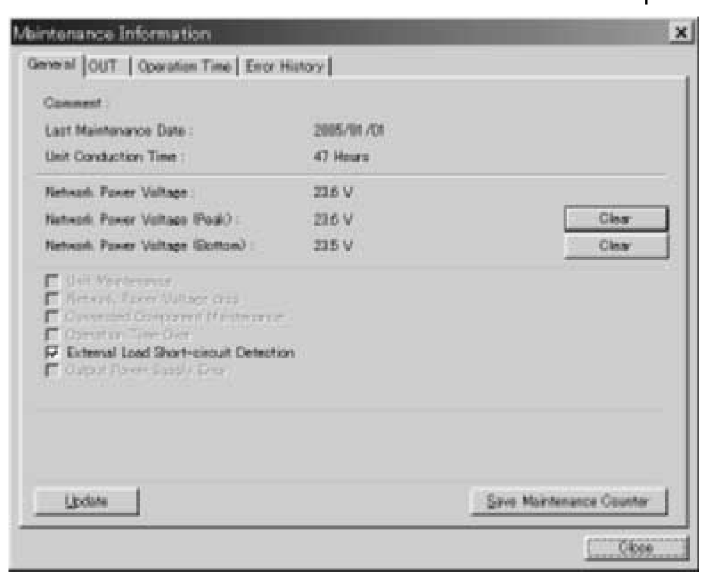


Note The OMRON S8□□ Power Supply Unit is recommended as the I/O power supply. Load short-circuits may not be detected for power supplies with an inverted L overcurrent protection characteristic. If using a power supply with an inverted L overcurrent protection characteristic, use one rated for 100 W or higher.

Checking Using the CompoNet Support Software

1,2,3...

1. Turn ON the power supply to the CompoNet Slave Unit.
2. Right-click the icon for the target CompoNet Slave Unit in the Network Configuration Window and select ***Monitor***.
   Make sure the External Local Short-circuit Detection option is selected.



SECTION 11
Troubleshooting and Maintenance

This section provides troubleshooting information that can be used in the event a problem occurs in CompoNet Slave Unit operation. It also provides information on maintenance that should be performed to ensure optimum application of the CompoNet Slave Units.

11-1 Indicator Meanings and Troubleshooting 278
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11-1 Indicator Meanings and Troubleshooting

MS and NS indicators	Meaning		Remarks
MS Lit green NS Lit green	Remote I/O communications or message communications are in progress.	Remote I/O communications are being executed.	Either remote I/O communications, message communications, or both are being executed. Status is normal.
MS Lit green NS Not lit	Synchronizing speed.	Waiting for connection with Master Unit.	If only certain Slave Units show this status, check that the baud rate is the same and then restart the Slave Units.
MS Lit green NS Flashing green	Waiting for a connection.	Waiting for a connection with the Master Unit to be established.	
MS Lit red NS Not lit	Watchdog timer error	A watchdog timer error has occurred in the Slave Unit.	Replace the Slave Unit. Alternatively, check the Expansion Unit connection.
MS Flashing red NS Not lit	Illegal switch setting	A DIP switch or other switch setting is illegal.	Check the switch settings then restart the Slave Units.
	EEPROM checksum error	EEPROM data error	Use the CompoNet Support Software to restore the default data.
MS Lit green NS Lit red	Configuration error	• A node address has been set out of range. • The same node address has been used more than once. • Repeater Unit configuration error	Check that the node address is set within the allowable range and that it is used only once. Check the Repeater Unit configuration and then restart the Slave Units.
MS Lit green NS Flashing red	Communications timeout	---	Check the following items then restart the Slave Units: Is the baud rate the same for the Master Unit and Slave Units? Is the cable length (trunk line/branch lines) OK? Is the cable disconnected or loose? Is there terminating resistance on both ends of the trunk line? Is there too much noise?

11-2 Troubleshooting

11-2-1 Troubleshooting for Errors Shown by Indicators

Indicators Are Lit or Flashing Red

Problem	Cause and possible corrections
MS indicator is lit red.	• The Slave Unit is malfunctioning. Replace the Slave Unit. • The Expansion Unit is disconnected. Check the Expansion Unit connection.
MS indicator is flashing red.	• The DIP switch or other setting is illegal. Check the switch settings then restart the Slave Unit. • There is an error in the Slave Unit's EEPROM memory data. Double-click the icon for the Slave Unit in the CompoNet Support Software. The Edit Device Parameters Window will open. Click the **Default Setting** Button and then click the **Reset** Button. Replace the Slave Unit if the MS indicator keeps flashing red even after the data has been returned to the default settings.
The NS indicator lights red without flashing green after the MS indicator lights green.	Check the following items, and then restart the Slave Unit with the error: • The node address has been set out of range or duplicated, or a Repeater Unit configuration error has occurred. Check all node addresses and check the Repeater Unit configuration and change the settings if required. • Refer to the next item "The NS indicator lights green momentarily and then changes to red". • Replace the Slave Unit if its NS indicator is always lit red.
The NS indicator lights green momentarily and then changes to red. The NS indicator lights green momentarily and then changes to flashing red.	Check the following items then restart the Slave Unit with the error: • Check that terminating resistance (121 Ω) is connected to both ends of the network's trunk line. If the correct terminating resistance is not set, connect terminating resistance of 121 Ω. • Check that all Slave Units are set correctly. • Check that the communications cable is wired correctly. • Check that the power supply cable and power supply are wired correctly and that the settings are correct. • Check connector wiring for all nodes to make sure that the communications cable and power supply cables are not disconnected. • Check that the communications power is supplied correctly. • If there are devices in the vicinity that generate noise, implement noise countermeasures for the Master Unit and Slave Units and the communications cable. • If using an OMRON Master Unit, refer to the manual for that Master Unit if an error has occurred in the Master Unit. If using a Master from another manufacturer, refer to the user's manual for that product if an error has occurred in the Master. • Replace the Slave Unit if its NS indicator is always lit red.

Cannot Participate in Network

Problem	Cause and possible corrections
NS indicator remains not lit and status does not change.	• Check that all Slave Unit connectors are connected correctly. • Check that the Master Unit is operating correctly. If using an OMRON Master Unit, check the Master Unit mode and the Slave Unit node addresses. • If using a Master from another manufacturer, refer to the user's manual for that Master. • Check that the communications cable is wired correctly. • Check that the power supply cable and power supply are wired correctly and that the settings are correct. • Check connector wiring to make sure that the communications cable and power supply cables are not disconnected.

Problem	Cause and possible corrections
NS indicator remains lit green and status does not change.	• Check that the Master Unit is operating correctly. Refer to the manual for the Master Unit. • Check that the Slave Unit is registered in the Master Unit registration table.
The NS indicator alternates between flashing green and being lit green. Alternatively, the NS indicator alternates between flashing red and flashing green.	Check the following items and take corrective measures based on the Master Unit indicator display. • Re-register the registration table. • Check that the Slave Unit I/O area is not duplicated with the I/O area of another Slave Unit. If the I/O area is duplicated, change the node address so that it is no longer duplicated. • Check that the Slave Unit I/O area is not outside the area permitted by the Master Unit. Change the node address if the I/O area is outside the permitted area.

11-2-2 Troubleshooting by Slave Unit Type

Model	Problem	Cause	Possible correction
All Slave Units	The MS and NS indicators are not lit green.	Refer to *4-1-3 Communications Indicators.*	---
	The Network Power Voltage Drop Flag does not turn ON even if the network power supply voltage drops.	The monitor value for the network power supply voltage is set too low. **Note** The default setting is 14 V or less.	Increase the network power voltage monitor value.
	The Network Power Voltage Drop Status is ON even though the network power supply voltage should be appropriate.	The monitor value for the network power supply voltage is set too high.	Decrease the network power voltage monitor value.
	Cannot set the network power voltage monitor value.	The attempted setting is outside the setting range (14 to 26.4 V).	Set the voltage inside the 14 to 26.4-V range.
	Cannot set the connected device or Unit name.	The name (comment) exceeds 32 characters.	Set a name within 32 characters.
	The status for Unit Maintenance Date and Connected Device Maintenance Date do not turn ON.	The status flag will be OFF regardless if the monitor value is set to 0 (function not executed).	Set the monitor value to a value other than 0.
	When the Unit power was turned ON again, the following values did not change to the values from immediately after the power was turned OFF. Word Slave Units: Unit Conduction Time and Maintenance Counter	The Maintenance Counter value is stored in internal EEPROM memory once every 12 minutes while the power is ON. Execute ***Save Maintenance Counter*** to save the value. If the power is turned OFF without executing saving the maintenance counter, the value saved previously (from up to 12 minutes earlier) will be read.	Execute ***Save Maintenance Counter*** in the Maintenance Information Window of the CompoNet Support Software before turning OFF the power.
All models other than Analog I/O Slave Units	The Maintenance Counter returned to 0.	• The Maintenance Counter will return to 0 if the Unit is reset. • The Maintenance Counter will always return to 0 when the setting is switched between the Total ON Time Monitor Function and the Contact Operation Monitor Function.	---
	Some functions do not change even after parameters have been edited or set.	The functions that have been changed are enabled only after the power is cycled.	Cycle the power or reset the CompoNet Support Software.
	The Maintenance Counter is not counting even though outputs are turned ON.	The I/O power supply is OFF.	Check that the I/O power supply is turned ON.

Model	Problem	Cause	Possible correction
Slave Units to which Expansion Units can be mounted **CRT1-ID16 (-1)** **CRT1-OD16 (-1)** **CRT1-ROS16** **CRT1-ROF16**	I/O communications stopped after mounting or removing an Expansion Unit and turning ON the power.	The number of I/O points increase or decrease when Expansion Units are mounted or removed. The number of I/O points may not match the I/O table registered in the Master Unit.	Change the Master Unit I/O table settings.
	The MS indicator is lit red after mounting or removing an Expansion Unit online.	Expansion Units cannot be mounted or removed online.	Turn OFF the power before mounting or removing Expansion Units.
Slave Units with Operation Time Monitor Function **CRT1-ID16 (-1) (See note.)** **CRT1-OD16 (-1) (See note.)** **CRT1-ROS16 (See note.)** **CRT1-ROF16 (See note.)** **CRT1-ID16TA (-1)** **CRT1-OD16TA (-1)** **CRT1-MD16TA (-1)** **CRT1-ID16S (-1)** **CRT1-OD16S (-1)** **CRT1-MD16S (-1)** **CRT1-ID16SL (-1)** **CRT1-OD16SL (-1)** **CRT1B-ID02S (-1)** **CRT1B-OD02S (-1)** **CRT1B-ID02SP (-1)** **CRT1B-OD02SP (-1)** **CRT1B-ID04SP (-1)** **CRT1B-MD04SLP (-1)** **Note** An Expansion Unit is mounted enabling use as an I/O Unit.	The Operation Time Monitor does not show the expected values.	• If the input filter is set, there is a delay with the ON or OFF time. • The operation time ON or OFF edge selection may not be on the intended setting. • The selected operation time combination is not supported. If the operation time monitor does not show the expected values, the settings may be different from the intended settings. The accuracy is ±6 ms.	• Use the Operation Time Monitor function considering the filter setting or set the filter constant to 0 ms. • Check the operation time combination set for Slave Units for which the operation time edge can be set.
	The status flag for the Operation Time Monitor value has been turns ON and OFF.	The Operation Time Flag is refreshed each measurement cycle, when the operation time is compared with the monitor value. If the Operation Time Flag turns ON for one cycle it will turn OFF when refreshed if the operation time has dropped below the monitor value. There is another flag that holds the contents of monitor value exceeded flags.	---
Slave Units with outputs **CRT1-OD16 (-1)** **CRT1-ROS16** **CRT1-ROF16** **CRT1-OD16TA (-1)** **CRT1-MD16TA (-1)** **CRT1-OD16S (-1)** **CRT1-MD16S (-1)** **CRT1-OD16SL (-1)** **CRT1B-OD02S (-1)** **CRT1B-OD02SP (-1)** **CRT1B-MD04SLP (-1)**	Cannot hold outputs when communication errors occur.	The Unit is set to clear outputs for communications errors.	Change the setting to hold outputs for communications errors.
	Cannot clear outputs when communication errors occur.	The Unit is set to hold outputs for communications errors.	Change the setting to clear outputs for communications errors.

Model	Problem	Cause	Possible correction
Slave Units with inputs **CRT1-ID16 (-1)** **CRT1-ID16TA (-1)** **CRT1-MD16TA (-1)** **CRT1-ID16S (-1)** **CRT1-MD16S (-1)** **CRT1-ID16SL (-1)** **CRT1B-ID02S (-1)** **CRT1B-ID02SP (-1)** **CRT1B-MD04SLP (-1)**	There is a delay with the ON and OFF timing for input values.	An input filter may be set.	Set the input filter value to 0. Alternatively, change the input filter to an appropriate value.
Slave Units with External Load Short-circuit Detection Function **CRT1B-OD02S (-1)** **CRT1B-OD02SP (-1)** **CRT1B-MD04SLP (-1)**	The short-circuit detection status does not turn OFF after an external load short-circuit has been detected, even though the error has been fixed.	The status will not turn OFF until the power for the node where the error was detected is reset.	Cycle the communications power after fixing the error.
All Analog I/O Slave Units	The status does not turn ON even if the monitor value is exceeded.	The required Analog Smart Function is not enabled. The status will be OFF regardless if the monitor value is set to 0.	Enable the required function. Set the monitor value setting to a value other than 0. Check the decimal point position then set the monitor value again.
	• The expected analog input value is not received or the expected analog output is not output after changing the input type, display mode, or unit. • The Unit does not operate as expected after changing the allocated I/O data or a function enable bit.	• The changes will not be enabled until the power is cycled or the CompoNet Software Support is used to reset the Unit.	• Cycle the power or reset the CompoNet Support Software.
	• The analog data values are different from expected or the analog data error is too large. • A disconnection is detected even though it is not disconnected.	• The I/O data function allocations are not correct. • The scaling function is operating. • The connected Sensor is different from the set input type. • The user adjustment error is too large.	• Check again that the analog data type to be set is correctly allocated for the I/O data. • If using the Scaling function, check again that the scaling value is correct. • Remove the Scaling function if it has been allocated by mistake. • Check the input type again. • Execute user adjustment again.
	Cannot set using external switches.	• SW8 is turned OFF (default).	• Turn ON SW 8.
	User adjustment is not accepted.	• Attempted to calibrate with inputs outside the setting range.	• Calibrate again with the correct input voltage (current). • Change the adjustment system if necessary.

Model	Problem	Cause	Possible correction
Analog I/O Slave Units (Inputs) **CRT1-AD04**	The disconnection display does not clear.	• The Sensor is disconnected.	• Restore the Sensor connection. • Check the connected Sensor and input type again.
	No disconnection display.	• Disconnection is not displayed for ranges other than 1 to 5 V and 4 to 20 mA.	---
	The conversion cycle is too long.	• The setting of the number of AD conversion points is on the maximum (4 points). • The processing time gets longer each time a function is added.	• Reduce the number of points if some inputs are unnecessary and execute conversion again. • Delete any unused functions and execute conversion again.
Analog I/O Slave Units (Outputs) **CRT1-DA02**	The expected value is not held when communications errors occur.	• The output value that is set for communications errors is incorrect.	• Check the output setting for communications errors.

11-3 Device Maintenance

This section describes everyday device maintenance, in particular cleaning methods, inspection methods, and how to replace Units.

11-3-1 Cleaning

Perform the following cleaning regularly to ensure the network is kept in the best condition possible.

- Wipe the network over with a soft, dry cloth when doing daily cleaning.
- If dirt remains even after wiping with a soft, dry cloth, wipe over with a cloth that has been wet with a sufficiently diluted detergent (2%) and wrung dry.
- Units will become stained if items such as rubber or vinyl products or tape are left on the Unit for long periods. Remove such items during regular cleaning.

Note Never use benzine, thinners, or other volatile solvents, or chemical cloths. The Unit coating may change if these products are used.

11-3-2 Inspections

Always perform periodic inspections to ensure the network is kept in the best possible condition.

Periodic inspections should occur every 6 months to a year. Periodic inspections should occur more frequently, however, for Units in environments subject to high temperatures, high humidity, or a lot of dust.

Materials Required for Inspections

The following materials are required to perform periodic inspections.

Materials Used Regularly

Phillips screwdrivers and flat-blade screwdrivers

Screwdrivers for communications connectors

Testers (or digital voltmeters)

Industrial alcohol and pure cotton cloth

Materials Sometimes Required

Synchroscope

Pen oscilloscope

Thermometer and hygrometer

Inspection Items

Periodically inspect the following items to ensure that they do not deviate from the criteria. If the items deviate from the criteria, adjust the environment so the criteria are met or adjust the Unit itself.

Inspection item	Inspection details	Criteria	Inspection method
Environment	Are the ambient and in-panel temperatures appropriate?	Refer to the specifications for each Slave Unit.	Thermometer
	Is the ambient and in-panel humidity appropriate?	Refer to the specifications for each Slave Unit.	Hygrometer
	Has dust collected?	No dust	Visual inspection

Inspection item	Inspection details	Criteria	Inspection method
Installation	Has the Unit been secured?	No looseness	Phillips screwdriver
	Are the communications cable connectors inserted properly?	No looseness	Phillips screwdriver
	Are the external wiring screws loose?	No looseness	Phillips screwdriver
	Are the connection cables damaged?	No visible damage	Visual inspection

11-3-3 Handling when Replacing Units

Networks are constructed from a Master Unit and Slave Units. If a Unit is malfunctioning, the entire network will be affected. The malfunctioning Unit must be replaced quickly. To restore network functions as quickly as possible, it is recommended that spare Units are kept on hand ready to replace malfunctioning Units immediately.

Precautions When Replacing Units

Heed the following precautions when replacing nodes after periodic inspection has revealed a problem.

Check that the new Unit does have errors after replacement.

If returning malfunctioning devices for repair, attach a detailed description of the malfunction to the device and send the device to the OMRON representative listed at the end of this manual or to your OMRON representative.

If contacts are defective, wipe them with a clean pure cotton cloth that has been soaked in industrial alcohol.

Settings after Unit Replacement

After replacing a Unit, make the switch and other settings the same as before the Unit was replaced.

Appendix A
CompoNet Explicit Messages

CompoNet explicit messages sent from the CompoNet Master Unit to a CompoNet Slave Unit can be used to read or write any parameter of the specified Slave Unit.

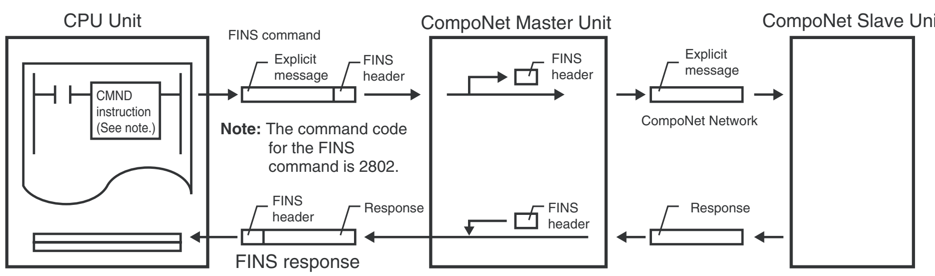
The CompoNet Slave Units process the commands sent from the Master Unit and then return responses.

Sending Explicit Messages by FINS Commands

FINS commands are used to send CompoNet explicit messages from a CS/CJ-series CompoNet Master Unit. For details on FINS commands, refer to the *SYSMAC CS/CJ/CP-series and SYSMAC One NSJ-series Communications Commands Reference Manual* (Cat. No. W342).

Message Flow

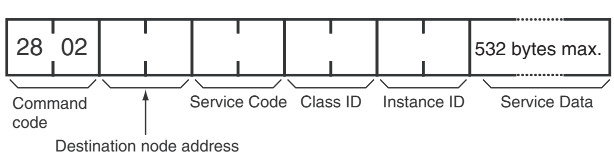
FINS commands are sent by using the CX-Programmer's CMND instruction. When a FINS command is sent from the CPU Unit to the CompoNet Master Unit, the CompoNet Master Unit converts the FINS command to a CompoNet explicit message and sends it to a CompoNet Slave Unit. The response from the Slave Unit is then converted by the Master Unit from a CompoNet explicit message to a FINS response and sent back to the CPU Unit.



FINS Format

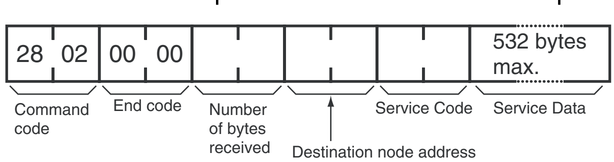
The FINS command code of 2802 hex is used to send CompoNet explicit messages.

Command Format

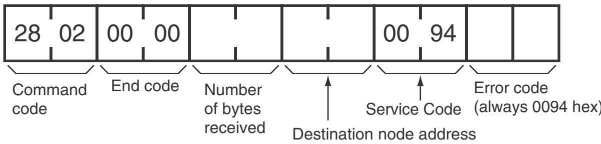


Response Format

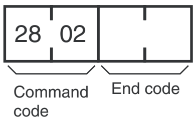
• When a Normal Response Is Returned for a CompoNet Explicit Message



• When an Error Response Is Returned for a CompoNet Explicit Message (CompoNet Explicit Message Communications Error)



- When a CompoNet Explicit Message Transmission Failure or Timeout Occurs (FINS Communications Error)



Description of Parameters

Destination Node Address (Command)

Specifies the Slave Unit destination node address for the explicit message.

Input Units	Output Units	I/O Units
10xx Hex	20xx Hex	30xx Hex

The Slave Unit's node address (hex) is entered in xx.

Service Code (Command, Response)

In a command this parameter specifies the service code defined by the CompoNet Network. For details, refer to the following table. In a normal response, a value is returned with the leftmost bit turned ON for the service code specified by the command. In an error response, 0094 hex is returned to indicate an error.

Service Codes

Service	Read	Write	Reset	Save
Command	0E Hex	10 Hex	05 Hex	16 Hex
Normal response	8E Hex	90 Hex	85 Hex	96 Hex

Class ID (Response)

Specifies the class ID for the explicit message.

Instance ID (Command)

Specifies the instance ID for the explicit message.

Service Data (Command, Response)

In a command, the data defined for the service code is specified for this parameter. In a response, the reception data defined for the service code is returned.

Number of Bytes Received (Response)

The number of bytes received in the data from the destination node address onwards is returned.

Destination Node Address (Response)

The node address of the remote Slave Unit (the source of the response) is returned.

Error Code (Response)

The error code defined by the CompoNet Network is returned. For details, refer to the list of error codes in the following table.

List of Error Codes

Response code	Error name	Cause
08FF	Service not supported	The Service code is incorrect.
09FF	Invalid attribute value	The specified Attribute value is not supported. The data written was outside valid range.

Response code	Error name	Cause
16FF	Object does not exist	The specified Instance ID is not supported.
15FF	Too much data	The data is larger than the specified size.
13FF	Not enough data	The data is smaller than the specified size.
0CFF	Object state conflict	The specified command cannot be executed due to an internal error.
20FF	Invalid parameter	The specified operation command data is not supported.
0EFF	Attribute not settable	An Attribute ID supported only for reading has been executed for a write service code.
10FF	Device state conflict	The specified command cannot be executed due to an internal error.
14FF	Attribute not supported	The specified Attribute is not supported.
19FF	Store operation failure	The data cannot be stored in memory.

End Code

The FINS communications end code is returned. For details, refer to the *SYSMAC CS/CJ/CP-series and SYSMAC One NSJ-series Communications Commands Reference Manual* (Cat. No. W342).

Explicit Messages Common to All Slave Units

Setting and Monitoring the Unit Conduction Time

Explicit message	Read/ write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Unit Maintenance Set Value	Read	Reads the set value for Unit Conduction Time (unit: 0.1 hr)	0E hex	95 hex	01 hex	73 hex	---	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)
	Write	Writes the set value for Unit Conduction Time (unit: 0.1 hr)	10 hex	95 hex	01 hex	73 hex	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)	---
Unit Maintenance Present Value	Read	Reads the present value for Unit Conduction Time (unit: 0.1 hr)	0E hex	95 hex	01 hex	71 hex	---	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)
Unit Maintenance Flag	Read	Reads the monitor status of Unit Conduction Time	0E hex	95 hex	01 hex	72 hex	---	1 byte 00 hex: Within range 01 hex: Out of range (over the monitor value)

Reading Warning Status and Alarm Status

Explicit message	Read/ write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Warning Status Read	Read	Reads the Slave Unit's warning status area.	0E hex	95 hex	01 hex	C5 hex	---	2 bytes
Alarm Status Read	Read	Reads the Slave Unit's alarm status area.	0E hex	95 hex	01 hex	C6 hex	---	2 bytes

Note For information on individual bits in the status areas of a Slave Unit, refer to the *Status Areas* section for the Slave Unit.

Explicit Messages for Digital I/O Slave Units

Setting and Monitoring Inputs

Explicit message	Read/ write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Terminal Maintenance Information Monitor Mode	Read	Reads the monitor mode for maintenance information of the input (No. 1 to 32) specified by the Instance ID.	0E hex	08 hex	01 to 20 hex	65 hex	---	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode
	Write	Writes the monitor mode for maintenance information of the input (No. 1 to 32) specified by the Instance ID.	10 hex	08 hex	01 to 20 hex	65 hex	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode	---
Set Value for Input Total ON Time or Contact Operation Counter	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the input (No. 1 to 32) specified by the Instance ID.	0E hex	08 hex	01 to 20 hex	68 hex	---	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)
	Write	Writes the set value for the total ON time (unit: s) or number of contact operations (unit: operations) of the input (No. 1 to 32) specified by the Instance ID.	10 hex	08 hex	01 to 20 hex	68 hex	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)	---
Input Total ON Time or Contact Operation Counter Read	Read	Reads the total ON time (unit: s) or number of contact operations (unit: operations) for the input (No. 1 to 32) specified by the Instance ID.	0E hex	08 hex	01 to 20 hex	66 hex	---	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)
Input Total ON Time or Contact Operation Counter Reset	Reset	Resets the total ON time (unit: s) or number of contact operations (unit: operations) for the input (No. 1 to 32) specified by the Instance ID.	05 hex	08 hex	01 to 20 hex	66 hex	---	---
Monitor Status for Input Total ON Time or Contact Operation Counter Read	Read	Reads the monitor status for total ON time or number of contact operations for the input (No. 1 to 32) specified by the Instance ID.	0E hex	08 hex	01 to 20 hex	67 hex	---	1 byte 00 hex: Within range 01 hex: Out of range (over the monitor value)

Setting and Monitoring the Outputs

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Terminal Maintenance Information Monitor Mode	Read	Reads the monitor mode for maintenance information of the output (No. 1 to 32) specified by the Instance ID.	0E hex	09 hex	01 to 20 hex	65 hex	---	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode
	Write	Writes the monitor mode for maintenance information of the output (No. 1 to 32) specified by the Instance ID.	10 hex	09 hex	01 to 20 hex	65 hex	1 byte 00 hex: Total ON time mode 01 hex: Contact operation counter mode	---
Set Value for Output Total ON Time or Contact Operation Counter	Read	Reads the set value for the total ON time (unit: s) or number of contact operations (unit: operation) for the output (No. 1 to 32) specified by the Instance ID.	0E hex	09 hex	01 to 20 hex	68 hex	---	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)
	Write	Writes the set value for the total ON time (unit: s) or number of contact operations (unit: operation) for the output (No. 1 to 32) specified by the Instance ID.	10 hex	09 hex	01 to 20 hex	68 hex	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)	---
Output Total ON Time or Contact Operation Counter Read	Read	Reads the total ON time (unit: s) or number of contact operations (unit: operation) for the output (No. 1 to 32) specified by the Instance ID.	0E hex	09 hex	01 to 20 hex	66 hex	---	4 bytes 00000000 to FFFFFFFF hex (0 to 4294967295)
Reset for Output Total ON Time or Contact Operation Counter Reset	Reset	Resets the total ON time (unit: s) or number of contact operations (unit: operation) for the output (No. 1 to 32) specified by the Instance ID to 0.	05 hex	09 hex	01 to 20 hex	66 hex	---	---
Monitor Status for Output Total ON Time or Contact Operation Counter Read	Read	Reads the monitor status for total ON time or contact operation counter for the output (No. 1 to 32) specified by the Instance ID.	0E hex	09 hex	01 to 20 hex	67 hex	---	1 byte 00 hex: Within range 01 hex: Out of range (over the monitor value)

Setting and Monitoring Operation Time

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Operation Time Monitor Status Read	Read	Reads the monitor status for the time (unit: ms) from the start point trigger until the end point trigger specified by the Instance ID (No. 1 to 8).	0E hex	97 hex	01 to 08 hex	66 hex	---	1 byte 00 hex: Threshold not passed 01 hex: Threshold passed
Operation Time Monitor Setting	Read	Reads the setting for the time (unit: ms) from the start point trigger until the end point trigger specified by the Instance ID (No. 1 to 8).	0E hex	97 hex	01 to 08 hex	67 hex	---	2 bytes (See note.)
	Write	Writes the setting for the time (unit: ms) from the start point trigger until the end point trigger specified by the Instance ID (No. 1 to 8).	10 hex	97 hex	01 to 08 hex	67 hex	---	2 bytes (See note.)
Operation Time Monitor Peak Value Read	Read	Reads the peak value for the time (unit: ms) from the start point trigger until the end point trigger specified by the Instance ID (No. 1 to 8).	0E hex	97 hex	01 to 08 hex	68 hex	---	2 bytes 0000 to FFFF hex (0 to 65535)
Operation Time Monitor Peak Value Reset	Reset	Resets to the present value the peak value for the time (unit: ms) from the start point trigger until the end point trigger specified by the Instance ID (No. 1 to 8)	05 hex	97 hex	01 to 08 hex	68 hex	---	---
Operation Time Monitor History	Read	Reads the monitor history for the time (unit: ms) from the start point trigger until the end point trigger specified by the Instance ID (No. 1 to 8).	0E hex	97 hex	01 to 08 hex	6D hex	---	1 byte 00 hex: Value not exceeded 01 hex: Value exceeded
Operation Time Monitor History Reset	Reset	Resets the monitor history for the time (unit: ms) from the start point trigger until the end point trigger specified by the Instance ID (No. 1 to 8) to 0.	05 hex	97 hex	01 to 08 hex	6D hex	---	---

Note Refer to the note on page 303.

Setting Hold/Clear for Communications Errors for Outputs

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Setting for Output Status (Hold or Clear) after Communications Error	Read	Reads whether hold or clear is set as the output status after a communications error for an output (No. 1 to 32) specified by the Instance ID. The setting can be read for a specified number of points.	0E hex	09 hex	01 to 20 hex	05 hex	---	1 byte 00 hex: Clear 01 hex: Hold
Setting for Output Status (Hold or Clear) after Communications Error	Write	Sets whether hold or clear is set as the output status after a communications error for an output (No. 1 to 32) specified by the Instance ID. The setting can be set for a specified number of points.	10 hex	09 hex	01 to 20 hex	05 hex	1 byte 00 hex: Clear 01 hex: Hold	---

Note The default setting is for all outputs to be cleared (0).

Writing Maintenance Information

Explicit message	Read/ write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Maintenance Counter Save	Save	Stores the maintenance counter in the Slave Unit's memory.	16 hex	95 hex	01 hex	75 hex	---	---

Reading Operation Time Monitor and Total ON Time/Contact Operation Counter for All Slave Units at Once

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Monitor Status for Operation Time Monitor for All Slave Units Read at Once	Read	Reads the monitor status for total operation time monitor for all Slave Units.	0E hex	95 hex	01 hex	7E hex	---	+00: Response size +01: 02 hex (fixed) +02: Response area 1 +03: Response area 2 (See note 1.)
Monitor Status for Total ON Time or Contact Operation Counter for All Slave Units Read at Once	Read	Reads the monitor status for total ON time or contact operation counter for all Slave Units.	0E hex	95 hex	01 hex	7F hex	---	+00: Response size +01: 08 hex (fixed) +02: Response area 1 +03: Response area 2 +04: Response area 3 +05: Response area 4 +06: Response area 5 +07: Response area 6 +08: Response area 7 +09: Response area 8 (See note 2.)

Note (1) The Attribute (7E hex) is bit 6 of the Generic Status and so the size is fixed at 4 bytes and has the following format.

+00	Size, 0002	Fixed
+01		
+02	IN+OUT combined, terminals 0 to 7	The bit turns ON when the set value is exceeded.
+03	Not used.	

Note
- Depending on the Unit size, not all bits are used.
- 14FF is returned for all Units except mixed I/O Units.

(2) The Attribute (7F hex) is bit 7 of the Generic Status and so the size is fixed at 6 bytes and has the following format.

Offset (byte)	Up to 32 inputs	Up to 16 inputs	Up to 32 inputs	Inputs and outputs
+00	4			
+01	No. of data items (UNIT)			
+02	IN Area, terminals 0 to 7	Not used.	OUT Area, terminals 0 to 7	IN Area, terminals 0 to 7
+03	IN Area, terminals 8 to 15		OUT Area, terminals 8 to 15	IN Area, terminals 8 to 15
+04	IN Area, terminals 16 to 23	OUT Area, terminals 0 to 7	OUT Area, terminals 16 to 23	OUT Area, terminals 0 to 7
+05	IN Area, terminals 24 to 31	OUT Area, terminals 8 to 15	OUT Area, terminals 24 to 31	OUT Area, terminals 8 to 15

Note Depending on the Unit size, not all bits are used.

Explicit Messages for Analog I/O Slave Units

Reading DIP Switch Settings

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
DIP Switch Status Read	Read	Reads the status of the Input/Output Terminals DIP switch.	0E hex	94 hex	01 hex	68 hex	---	1 byte

Setting and Reading for Analog Input Units

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Analog Data 1 Value	Read	Reads the value for Analog Data 1.	0E hex	0A hex	01 to 04 hex	03 hex	---	2 bytes
Analog Data 2 Value	Read	Reads the value for Analog Data 2.	0E hex	0A hex	01 to 04 hex	65 hex	---	2 bytes
Setting the Number of AD Conversion Points	Write/ Read	Sets the number of AD conversion points.	Write: 10 hex Read: 0E hex	0A hex	00 hex	64 hex	2 bytes	1 byte
Input Range Setting	Write/ Read	Sets the input range. –10 to 10 V: 0 0 to 5 V: 1 0 to 10 V: 2 4 to 20 mA: 3 1 to 5 V: 7 0 to 20 mA: 8	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	07 hex	1 byte	1 byte
Analog Status Flag Read	Read	Reads the status of the Analog Status Flags. LL = 0; L = 1; Pass signal = 2; H = 3; HH = 4; Valley shot = 5; Top shot = 6; Disconnected line detection = 7	0E hex	0A hex	01 to 04 hex	66 hex	---	1 byte
Analog Data 1 Allocation Selection	Write/ Read	Selects the data allocated to Analog Data 1. Analog input value: 0; Peak value: 1; Bottom value: 2; Top value: 3; Valley value: 4; Rate of change value: 5	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	68 hex	1 byte	1 byte
Analog Data 2 Allocation Selection	Write/ Read	Selects the data allocated to Analog Data 2. Analog input value: 0; Peak value: 1; Bottom value: 2; Top value: 3; Valley value: 4; Rate of change value: 5	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	69 hex	1 byte	1 byte

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Function Setting	Write/ Read	Sets each function. Bit status: ON: Enabled, OFF: Disabled Moving average: 0; Scaling: 1; Peak/bottom hold: 2; Top/valley hold: 3; Comparator: 4; Cumulative counter: 5; Rate of change: 6	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	6E hex	1 byte	1 byte
Scaling Type Setting	Write/ Read	Default scaling: 0: User scaling: 1	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	6F hex	1 byte	1 byte
Scaling Point 1 Setting	Write/ Read	Sets an analog value as the 0% value for user scaling.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	70 hex	2 bytes (–28000 to 28000)	2 bytes (–28000 to 28000)
Scaling Point 2 Setting	Write/ Read	Sets an analog value as the 100% value for user scaling.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	71 hex	2 bytes (–28000 to 28000)	2 bytes (–28000 to 28000)
Offset Compensation after Scaling	Write/ Read	Compensates for scaling errors with an offset value.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	72 hex	2 bytes (–28000 to 28000)	2 bytes (–28000 to 28000)
Maximum Value Read	Read/ Reset	Reads the maximum value after power is turned ON.	Read: 0E hex Reset: 35 hex	0A hex	01 to 04 hex	73 hex	---	2 bytes
Minimum Value Read	Read/ Reset	Reads the minimum value after power is turned ON.	Read: 0E hex Reset: 35 hex	0A hex	01 to 04 hex	74 hex	---	2 bytes
Peak Value Read	Read	The peak value is held while the hold function is enabled. The held value is read by this message.	0E hex	0A hex	01 to 04 hex	75 hex	---	2 bytes
Bottom Value Read	Read	The bottom value is held while the hold function is enabled. The held value is read by this message.	0E hex	0A hex	01 to 04 hex	76 hex	---	2 bytes
Top Value Read	Read	The top value is held while the hold function is enabled. The held value is read by this message.	0E hex	0A hex	01 to 04 hex	77 hex	---	2 bytes
Top Detection Timing Flag Read	Read	Reads the timing for detecting top values.	0E hex	0A hex	01 to 04 hex	78 hex	---	1 byte
Valley Value Read	Read	The valley value is held and read.	0E hex	0A hex	01 to 04 hex	79 hex	---	2 bytes

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Valley Detection Timing Flag Read	Read	Reads the timing for detecting valley values.	0E hex	0A hex	01 to 04 hex	7A hex	---	1 byte
HH Value Setting	Write/ Read	Sets the HH value.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	7D hex	2 bytes (–32768 to 32767)	2 bytes (–32768 to 32767)
LL Value Setting	Write/ Read	Sets the LL value.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	7E hex	2 bytes (–32768 to 32767)	2 bytes (–32768 to 32767)
H Value Setting	Write/ Read	Sets the H value.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	7F hex	2 bytes (–32768 to 32767)	2 bytes (–32768 to 32767)
L Value Setting	Write/ Read	Sets the L value.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	80 hex	2 bytes (–32768 to 32767)	2 bytes (–32768 to 32767)
Scaled Analog Input Value Read	Read	Reads analog input values for which have only been scaled.	0E hex	0A hex	01 to 04 hex	8D hex	---	2 bytes
Rate of Change Value Read	Read	Reads the rate of change for each sampling cycle.	0E hex	0A hex	01 to 04 hex	8E hex	---	2 bytes
Sampling Cycle Setting	Write/ Read	Sets the sampling cycle for obtaining the rate of change based on the previous value.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	90 hex	2 bytes (10 to 65535)	2 bytes (10 to 65535)
Cumulated Value Read	Read/ Reset	Reads the cumulated analog input value.	Read: 0E hex Reset: 35 hex	0A hex	01 to 04 hex	91 hex	---	4 bytes (–214748364.8 to 214748364.8)
Cumulative Counter Flag Read	Read	Reads the cumulative count status in the Cumulative Counter Flag in the area for Generic Status Flags. 0: Counter overflow 1: Counter underflow 7: Set value overflow	Read: 0E hex	0A hex	01 to 04 hex	92 hex	---	1 byte
Cumulative Counter Monitor Value Setting	Write/ Read	Writes/reads the set monitor value for the cumulative counter.	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	93 hex	4 bytes	4 bytes
Cumulative Counter Unit Setting	Write/ Read	Sets the unit for the cumulative counter. 0: Hour (count hours); 1: Minute (count minutes)	Write: 10 hex Read: 0E hex	0A hex	01 to 04 hex	94 hex	1 byte	1 byte

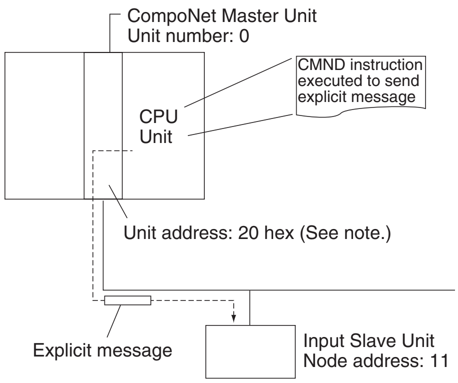
Setting and Reading for Analog Output Units

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Analog Output Value Read	Read	Reads analog output values.	0E hex	0B hex	01 to 02 hex	03 hex	---	2 bytes
Output Range Setting	Write/ Read	Sets the output range. 4 to 20 mA: 0; 0 to 10 V: 1; 0 to 20 mA: 2; –10 to 10 V: 3; 0 to 5 V: 4; 1 to 5 V: 6	0E hex	0B hex	01 to 02 hex	07 hex	---	1 byte
Communications Error Output Setting	Write/ Read	Sets the communications error output value for each output. 0: Hold last state 1: Low limit 2: High limit 3: Zero count	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	09 hex	1 byte	1 byte
Function Setting	Write/ Read	Sets the function. Scaling: 0; Cumulative counter: 1	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	6E hex	1 byte	1 byte
Scaling Type Setting	Write/ Read	Default scaling: 0: User scaling: 1	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	6F hex	1 byte	---
Scaling Point 1 Setting	Write/ Read	Sets a conversion value as the 0% value for user scaling.	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	70 hex	2 bytes (–28000 to 28000)	2 bytes (–28000 to 28000)
Scaling Point 2 Setting	Write/ Read	Sets a conversion value as the 100% value for user scaling.	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	71 hex	2 bytes (–28000 to 28000)	2 bytes (–28000 to 28000)
Offset Compensation after Scaling	Write/ Read	Compensates for scaling errors with an offset value.	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	72 hex	2 bytes (–28000 to 28000)	2 bytes (–28000 to 28000)
Cumulated Value Read	Read/ Reset	Reads the cumulated analog output value.	Read: 0E hex Reset: 35 hex	0B hex	01 to 02 hex	91 hex	---	4 bytes (–214748364.8 to 214748364.8)
Cumulative Counter Flag Read	Read	Reads the cumulative count status in the Cumulative Counter Flag in the area for Generic Status Flags. 0: Counter overflow 1: Counter underflow 7: Set value overflow	Read: 0E hex	0B hex	01 to 02 hex	92 hex	---	1 byte

Explicit message	Read /write	Function	Command					Response
			Service code	Class ID	Instance ID	Command data		Service data
						Attribute ID	Data	
Cumulative Counter Monitor Value Setting	Write/ Read	Writes/reads the set monitor value for the cumulative counter.	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	93 hex	4 bytes	4 bytes
Cumulative Counter Unit Setting	Write/ Read	Sets the unit for the cumulative counter. 0: Hour (count hours); 1: Minute (count minutes)	Write: 10 hex Read: 0E hex	0B hex	01 to 02 hex	94 hex	1 byte	---

Example of Using Explicit Messages

Example of Sending an Explicit Message with the CMND Instruction



Note: The CompoNet Master Unit (or Special I/O Unit) unit address is the unit number + 20 hex.

Operation

The unit maintenance PV (class ID: 95 hex, instance ID: 01 hex, attribute ID: 71 hex) is read from the Slave Unit.

The command data is read by using the EXPLICIT MESSAGE SEND command (28 02).

The command data is written in words starting from D01000 in the CPU Unit and the response data is stored in words starting from D02000.

Command Details

[CMND S D C]

Contents of S

Address	Contents (hex)	Meaning
D01000	28 02	Command code
D01001	10 0B	Destination node address (Input Slave Unit: node address 11)
D01002	00 0E	Service code: 0E hex
D01003	00 95	Class ID: 0095 hex
D01004	00 01	Instance ID: 0001 hex
D01005	71 00	Attribute ID: 71 hex (The rightmost 00 hex is not read because the number of bytes of command data is set to 11 bytes.)

D: First Response Storage Word

Contents of C

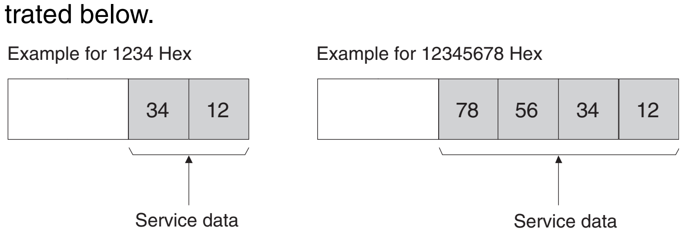
Address	Contents (hex)	Meaning
D00000	00 0B	Number of bytes of command data: 11 bytes
D00001	00 0E	Number of bytes of response data: 14 bytes
D00002	00 00	Destination Master Unit network address: 0
D00003	00 20	Destination Master Unit node address: 0 Destination Master Unit unit address: 20 hex
D00004	00 00	Response required Communications port number: 0 Number of retries: 0
D00005	00 64	Response monitoring time

Response

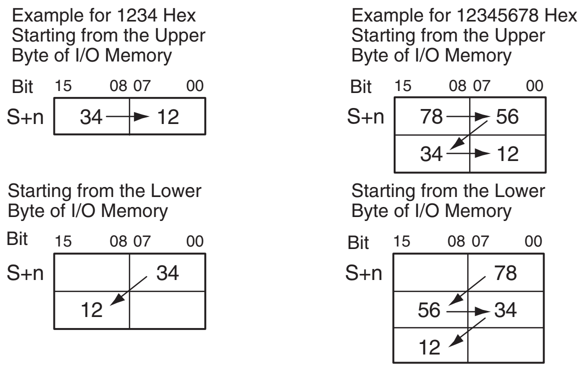
Contents of D

Address	Contents (hex)	Meaning
D02000	28 02	---
D02001	00 00	---
D02002	00 08	---
D02003	10 0B	Destination node address: 11 (0B hex)
D02004	00 8E	Normal completion: 8E hex
D02005	2F 07	The Unit maintenance PV (0000072F hex) is stored in order from leftmost to rightmost. (See note.)
D02006	00 00	---

Note (1) The service data is stored for the command format with the lower byte stored first followed by the upper byte for word (2-byte) or double-word (4-byte) data. For example, with word data, 1234 hex would be specified by setting 34 hex first followed by 12 hex. With double-word data, 12345678 hex would be specified by setting 78 hex first followed by 56 hex, 34 hex, and then 12 hex. This is illustrated below.



Data is thus set in I/O memory starting from the address specified for operand S of the CMND instruction as follows:



(2) The service data is stored in the same way for the response format, i.e., when word (2-byte) or double-word (4-byte) data is received, the lower byte is stored first.

Appendix B
Object Mounting

Identity Object (0x01)

Object class	**Attribute**	Not supported
	Service	Not supported

Object instance	**Attribute**	**ID**	**Contents**	**Get (read)**	**Set (write)**	**Value**
		1	Vendor	Yes	No	47
		2	Device type	Yes	No	See note.
		3	Product code	Yes	No	See note.
		4	Revision	Yes	No	1.1
		5	Status (bits supported)	Yes	No	Bit 0 only
		6	Serial number	Yes	No	Unique for each Unit
		7	Product name	Yes	No	See note.
		8	State	No	No	
	Service	**Code**	**Description**	**Parameter option**		
		05	Reset	No		
		0E	Get_Attribute_Single	No		

Note The product code and product name depend on the type of Slave Unit being used, as shown in the following table.

Model		**Device type**	**Product code**	**Product name**
Basic Unit	**Expansion Unit**			
CRT1-ID16	None	07 hex	1327	CRT1-ID16
	XWT-ID08	07 hex	1328	CRT1-ID16
	XWT-ID16	07 hex	1329	CRT1-ID16
	XWT-OD08	07 hex	1330	CRT1-ID16
	XWT-OD16	07 hex	1331	CRT1-ID16
	XWT-ID08-1	07 hex	1332	CRT1-ID16
	XWT-ID16-1	07 hex	1333	CRT1-ID16
	XWT-OD08-1	07 hex	1334	CRT1-ID16
	XWT-OD16-1	07 hex	1335	CRT1-ID16
CRT1-ID16-1	None	07 hex	1345	CRT1-ID16-1
	XWT-ID08	07 hex	1346	CRT1-ID16-1
	XWT-ID16	07 hex	1347	CRT1-ID16-1
	XWT-OD08	07 hex	1348	CRT1-ID16-1
	XWT-OD16	07 hex	1349	CRT1-ID16-1
	XWT-ID08-1	07 hex	1350	CRT1-ID16-1
	XWT-ID16-1	07 hex	1351	CRT1-ID16-1
	XWT-OD08-1	07 hex	1352	CRT1-ID16-1
	XWT-OD16-1	07 hex	1353	CRT1-ID16-1

Model		Device type	Product code	Product name
Basic Unit	Expansion Unit			
CRT1-OD16	None	07 hex	1336	CRT1-OD16
	XWT-ID08	07 hex	1337	CRT1-OD16
	XWT-ID16	07 hex	1338	CRT1-OD16
	XWT-OD08	07 hex	1339	CRT1-OD16
	XWT-OD16	07 hex	1340	CRT1-OD16
	XWT-ID08-1	07 hex	1341	CRT1-OD16
	XWT-ID16-1	07 hex	1342	CRT1-OD16
	XWT-OD08-1	07 hex	1343	CRT1-OD16
	XWT-OD16-1	07 hex	1344	CRT1-OD16
CRT1-OD16-1	None	07 hex	1354	CRT1-OD16-1
	XWT-ID08	07 hex	1355	CRT1-OD16-1
	XWT-ID16	07 hex	1356	CRT1-OD16-1
	XWT-OD08	07 hex	1357	CRT1-OD16-1
	XWT-OD16	07 hex	1358	CRT1-OD16-1
	XWT-ID08-1	07 hex	1359	CRT1-OD16-1
	XWT-ID16-1	07 hex	1360	CRT1-OD16-1
	XWT-OD08-1	07 hex	1361	CRT1-OD16-1
	XWT-OD16-1	07 hex	1362	CRT1-OD16-1
CRT1-ROS16	None	07 hex	1511	CRT1-ROS16
	XWT-ID08	07 hex	1512	CRT1-ROS16
	XWT-ID16	07 hex	1513	CRT1-ROS16
	XWT-OD08	07 hex	1514	CRT1-ROS16
	XWT-OD16	07 hex	1515	CRT1-ROS16
	XWT-ID08-1	07 hex	1516	CRT1-ROS16
	XWT-ID16-1	07 hex	1517	CRT1-ROS16
	XWT-OD08-1	07 hex	1518	CRT1-ROS16
	XWT-OD16-1	07 hex	1519	CRT1-ROS16
CRT1-ROF16	None	07 hex	1520	CRT1-ROF16
	XWT-ID08	07 hex	1521	CRT1-ROF16
	XWT-ID16	07 hex	1522	CRT1-ROF16
	XWT-OD08	07 hex	1523	CRT1-ROF16
	XWT-OD16	07 hex	1524	CRT1-ROF16
	XWT-ID08-1	07 hex	1525	CRT1-ROF16
	XWT-ID16-1	07 hex	1526	CRT1-ROF16
	XWT-OD08-1	07 hex	1527	CRT1-ROF16
	XWT-OD16-1	07 hex	1528	CRT1-ROF16
CRT1-ID16TA	---	07 hex	1529	CRT1-ID16TA
CRT1-ID16TA-1		07 hex	1530	CRT1-ID16TA-1
CRT1-OD16TA		07 hex	1531	CRT1-OD16TA
CRT1-OD16TA-1		07 hex	1532	CRT1-OD16TA-1
CRT1-MD16TA		07 hex	1533	CRT1-MD16TA
CRT1-MD16TA-1		07 hex	1534	CRT1-MD16TA-1

Model		Device type	Product code	Product name
Basic Unit	Expansion Unit			
CRT1-ID16S	---	07 hex	1535	CRT1-ID16S
DRT1-ID16S-1		07 hex	1536	DRT1-ID16S-1
CRT1-OD16S		07 hex	1537	CRT1-OD16S
CRT1-OD16S-1		07 hex	1538	CRT1-OD16S-1
CRT1-MD16S		07 hex	1539	CRT1-MD16S
CRT1-MD16S-1		07 hex	1540	CRT1-MD16S-1
CRT1-ID16SL		07 hex	1541	CRT1-ID16SL
CRT1-ID16SL-1		07 hex	1542	CRT1-ID16SL-1
CRT1-OD16SL		07 hex	1543	CRT1-OD16SL
CRT1-OD16SL-1		07 hex	1544	CRT1-OD16SL-1
CRT1B-ID02S		07 hex	1364	CRT1B-ID02S
CRT1B-ID02S-1		07 hex	1365	CRT1B-ID02S-1
CRT1B-OD02S		07 hex	1366	CRT1B-OD02S
CRT1B-OD02S-1		07 hex	1367	CRT1B-OD02S-1
CRT1B-ID02SP		07 hex	1368	CRT1B-ID02SP
CRT1B-ID02SP-1		07 hex	1369	CRT1B-ID02SP-1
CRT1B-OD02SP		07 hex	1370	CRT1B-OD02SP
CRT1B-OD02SP-1		07 hex	1371	CRT1B-OD02SP-1
CRT1B-ID04SP		07 hex	1372	CRT1B-ID04SP
CRT1B-ID04SP-1		07 hex	1373	CRT1B-ID04SP-1
CRT1B-MD04SLP		07 hex	1374	CRT1B-MD04SLP
CRT1B-MD04SLP-1		07 hex	1375	CRT1B-MD04SLP-1
CRT1-AD04		00 hex	65	CRT1-AD04
CRT1-DA02		00 hex	66	CRT1-DA02
CRS1-RPT01		26 hex	1363	CRT1-RPT01

Message Router Object (0x02)

Object class	**Attribute**	Not supported
	Service	Not supported
Object instance	**Attribute**	Not supported
	Service	Not supported
Vendor specification addition		None

Assembly Object (0x04)

Object class	**Attribute**	Not supported
	Service	Not supported

Object instance	Attribute	ID	Contents	Get	Set	Value
		1	Number of members in list	No	No	
		2	Member list	No	No	
		3	Data	Yes	No	
	Service	**Code**	**Description**	**Parameter option**		
		0E	Get_Attribute_Single	None		

The assembly instances for CompoNet Slave Units are given below.

Digital Input Slave Units

Instance number	Type	Bit allocation								Supported model
Assembly instance 2 2 inputs	Input	---	---	---	---	---	---	1	0	CRT1B-ID02S(-1) CRT1B-ID02SP(-1) CRT1B-MD04SLP(-1)
Assembly instance 3 4 inputs	Input	---	---	---	---	3	2	1	0	CRT1B-ID04SP(-1)
Assembly instance 4 8 inputs	Input	7	6	5	4	3	2	1	0	CRT1-OD16(-1) + XWT-ID08(-1) CRT1-ROS16 + XWT-ID08(-1) CRT1-ROF16 + XWT-ID08(-1) CRT1-MD16TA(-1) CRT1-MD16S(-1)
Assembly instance 5 16 inputs	Input	7	6	5	4	3	2	1	0	CRT1-ID16(-1)
		15	14	13	12	11	10	9	8	CRT1-ID16(-1) + XWT-OD08(-1) CRT1-ID16(-1) + XWT-OD16(-1) CRT1-OD16(-1) + XWT-ID16(-1) CRT1-ROS16 + XWT-ID16(-1) CRT1-ROF16 + XWT-ID16(-1) CRT1-ID16TA(-1) CRT1-ID16S(-1) CRT1-ID16SL(-1)
Assembly instance 6 32 inputs	Input	7	6	5	4	3	2	1	0	CRT1-ID16(-1) + XWT-ID16(-1)
		15	14	13	12	11	10	9	8	
		23	22	21	20	19	18	17	16	
		31	30	29	28	27	26	25	24	
Assembly instance 7 24 inputs	Input	7	6	5	4	3	2	1	0	CRT1-ID16(-1) + XWT-ID08(-1)
		15	14	13	12	11	10	9	8	
		23	22	21	20	19	18	17	16	

Digital Output Slave Units

Instance number	Type	Bit allocation								Supported model
Assembly instance 32 2 outputs	Output	---	---	---	---	---	---	1	0	CRT1B-OD02S(-1) CRT1B-OD02SP(-1) CRT1B-MD04SLP(-1)
Assembly instance 34 8 outputs	Output	7	6	5	4	3	2	1	0	CRT1-ID16(-1) + XWT-OD08(-1) CRT1-MD16TA(-1) CRT1-MD16S(-1)
Assembly instance 35 16 outputs	Output	7	6	5	4	3	2	1	0	CRT1-ID16(-1) + XWT-OD16(-1)
		15	14	13	12	11	10	9	8	CRT1-OD16(-1) CRT1-OD16(-1) + XWT-ID08(-1) CRT1-OD16(-1) + XWT-ID16(-1) CRT1-ROS16 CRT1-ROS16 + XWT-ID08(-1) CRT1-ROS16 + XWT-ID16(-1) CRT1-ROF16 CRT1-ROF16 + XWT-ID08(-1) CRT1-ROF16 + XWT-ID16(-1) CRT1-OD16TA(-1) CRT1-OD16S(-1) CRT1-OD16SL(-1)

Instance number	Type	Bit allocation								Supported model
Assembly instance 36 32 outputs	Output	7	6	5	4	3	2	1	0	CRT1-OD16(-1) + XWT-OD16(-1) CRT1-ROS16 + XWT-OD16(-1) CRT1-ROF16 + XWT-OD16(-1)
		15	14	13	12	11	10	9	8	
		23	22	21	20	19	18	17	16	
		31	30	29	28	27	26	25	24	
Assembly instance 37 24 outputs	Output	7	6	5	4	3	2	1	0	CRT1-OD16(-1) + XWT-OD08(-1) CRT1-ROS16 + XWT-OD08(-1) CRT1-ROF16 + XWT-OD08(-1)
		15	14	13	12	11	10	9	8	
		23	22	21	20	19	18	17	16	

Analog Input Slave Units

Instance number	Byte	Bit allocation								Supported model
Instance 104 Analog Data (input)	+0	Input 0, Analog Data 1								CRT1-AD04
	+1									
	+2	Input 1, Analog Data 1								
	+3									
	+4	Input 2, Analog Data 1								
	+5									
	+6	Input 3, Analog Data 1								
	+7									
Instance 122 Top/Valley Detection Timing Flags	+1	0	0	0	0	T_ST3	T_ST2	T_ST1	T_ST0	CRT1-AD04
Instance 134 Analog Status Flags	+0	BW0	T_ST0	V_ST0	HH0	H0	PS0	L0	LL0	CRT1-AD04
	+1	BW1	T_ST1	V_ST1	HH1	H1	PS1	L1	LL1	
	+2	BW2	T_ST2	V_ST2	HH2	H2	PS2	L2	LL2	
	+3	BW3	T_ST3	V_ST3	HH3	H3	PS3	L3	LL3	
	+0	BW1	T_ST1	V_ST1	HH1	H1	PS1	L1	LL1	
	+1	BW2	T_ST2	V_ST2	HH2	H2	PS2	L2	LL2	
	+2	BW3	T_ST3	V_ST3	HH3	H3	PS3	L3	LL3	
	+3	0	0	MRF	CCW	RHW	NPW	0	0	
Instance 174 Analog Data 1 + Top/ Valley Detection Tim- ing Flags	+0	Input 0, Analog Data 1								CRT1-AD04
	+1									
	+2	Input 1, Analog Data 1								
	+3									
	+4	Input 2, Analog Data 1								
	+5									
	+6	Input 3, Analog Data 1								
	+7									
	+8	0	0	0	0	V_ST3	V_ST2	V_ST1	V_ST0	
	+9	0	0	0	0	T_ST3	T_ST2	T_ST1	T_ST0	

Analog Output Slave Units

Instance number	Byte	Bit allocation								Supported model
Instance 190 Hold Flags	+0	---	---	---	---	HD3	HD1	HD1	HD0	CRT1-AD04
Instance 192 Analog output data	+0	Input 0, Analog Data								CRT1-DA02
	+1									
	+2	Input 1, Analog Data								
	+3									

Connection Object (0x05)

Object class	**Attribute**	Not supported
	Service	Not supported
	Maximum number of active connections	1

Object instance 1	**Section**	**Information**		**Maximum number of instances**		
	Instance type	Polled I/O		1		
	Production trigger	Cyclic		---		
	Transport type	Server				
	Transport class	2				
	Attribute	**ID**	**Contents**	**Get (read)**	**Set (write)**	**Value**
		1	State	Yes	No	
		2	Instance type	Yes	No	01 (hexadecimal)
		3	Transport class trigger	Yes	No	82H (Input and Mixed I/O Slave Units) 80H (Output Slave Units and Repeater Units)
		4	Produced connection ID	Yes	No	---
		5	Consumed connection ID	Yes	No	---
		6	Initial comm. characteristics	Yes	No	01 (hexadecimal)
		7	Produced connection size	Yes	No	See note.
		8	Consumed connection size	Yes	No	See note.
		9	Expected packet rate	Yes	Yes	---
		12	Watchdog timeout action	Yes	No	00 (hexadecimal)
		13	Produced connection path length	Yes	No	See note.
		14	Produced connection path	Yes	No	See note.
		15	Consumed connection path length	Yes	No	See note.
		16	Consumed connection path	Yes	No	See note.
		17	Production inhibit time	Yes	No	0000 (hexadecimal)
	Service	**Code**	**Description**	**Parameter option**		
		05	Reset	None		
		0E	Get_Attribute_Single	None		
		10	Set_Attribute_Single	None		

Note The data depends on the type of Slave Unit being used, as shown in the following table.

Model: Basic Unit	Model: Expansion Unit	Name	Produced connection size	Produced connection path length	Produced connection path	Consumed connection size	Consumed connection path length	Consumed connection path
CRT1B-ID02S (-1)		Input Data	0001	0006	20_04_24_ 02_30_03	---	0000	---
CRT1B-OD02S (-1)		Output Data	---	0000	---	0001	0006	20_04_24_ 02_30_03
CRT1B-ID02SP (-1)		Input Data	0001	0006	20_04_24_ 02_30_03	---	0000	---
CRT1B-OD02SP (-1)		Output Data	---	0000	---	0001	0006	20_04_24_ 02_30_03
CRT1B-ID04SP (-1)		Input Data	0001	0006	20_04_24_ 03_30_03	---	0000	---
CRT1B-MD04SLP (-1)		Input Data	0001	0006	20_04_24_ 02_30_03	---	0000	---
		Output Data	---	0000	---	0001	0006	20_04_24_ 02_30_03
CRT1-ID16 (-1)	NA	Input Data	0002	0006	20_04_24_ 05_30_03	---	0000	---
	XWT-ID08 (-1)	Input Data	0003	0006	20_04_24_ 07_30_03	---	0000	---
	XWT-ID16 (-1)	Input Data	0004	0006	20_04_24_ 06_30_03	---	0000	---
	XWT-OD08 (-1)	Input Data	0002	0006	20_04_24_ 05_30_03	---	0000	---
		Output Data	---	0000	---	0001	0006	20_04_24_ 22_30_03
	XWT-OD16 (-1)	Input Data	0002	0006	20_04_24_ 05_30_03	---	0000	---
		Output Data	---	0000	---	0002	0006	20_04_24_ 23_30_03
CRT1-OD16 (-1)	NA	Output Data	---	0000	---	0002	0006	20_04_24_ 23_30_03
	XWT-ID08 (-1)	Output Data		0000	---	0002	0006	20_04_24_ 23_30_03
		Input Data	0001	0006	20_04_24_ 04_30_03	---	0000	---
	XWT-ID16 (-1)	Output Data	---	0000	---	0002	0006	20_04_24_ 23_30_03
		Input Data	0002	0006	20_04_24_ 05_30_03	---	0000	---
	XWT-OD08 (-1)	Output Data	---	0000	---	0003	0006	20_04_24_ 25_30_03
	XWT-OD16 (-1)	Output Data	---	0000	---	0004	0006	20_04_24_ 24_30_03

Model		Name	Produced connection size	Produced connection path length	Produced connection path	Consumed connection size	Consumed connection path length	Consumed connection path
Basic Unit	**Expansion Unit**							
CRT1-ROS16	NA	Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
	XWT-ID08 (-1)	Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
		Input Data	0001	0006	20_04_24_04_30_03	---	0000	---
	XWT-ID16 (-1)	Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
		Input Data	0002	0006	20_04_24_05_30_03	---	0000	---
	XWT-OD08 (-1)	Output Data	---	0000	---	0003	0006	20_04_24_25_30_03
	XWT-OD16 (-1)	Output Data	---	0000	---	0004	0006	20_04_24_24_30_03
CRT1-ROF16	NA	Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
	XWT-ID08 (-1)	Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
		Input Data	0001	0006	20_04_24_04_30_03	---	0000	---
	XWT-ID16 (-1)	Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
		Input Data	0002	0006	20_04_24_05_30_03	---	0000	---
	XWT-OD08 (-1)	Output Data	---	0000	---	0003	0006	20_04_24_25_30_03
	XWT-OD16 (-1)	Output Data	---	0000	---	0004	0006	20_04_24_24_30_03
CRT1-ID16TA(-1)		Input Data	0002	0006	20_04_24_05_30_03	---	0000	---
CRT1-OD16TA(-1)		Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
CRT1-MD16TA(-1)		Input Data	0001	0006	20_04_24_04_30_03	---	0000	---
		Output Data	---	0000	---	0001	0006	20_04_24_22_30_03
CRT1-ID16S(-1)		Input Data	0002	0006	20_04_24_05_30_03	---	0000	---
CRT1-OD16S(-1)		Output Data	---	0000	---	0002	0006	20_04_24_23_30_03
CRT1-MD16S(-1)		Input Data	0001	0006	20_04_24_04_30_03	---	0000	---
		Output Data	---	0000	---	0001	0006	20_04_24_22_30_03
CRT1-ID16SL(-1)		Input Data	0002	0006	20_04_24_05_30_03	---	0000	---
CRT1-OD16SL(-1)		Output Data	---	0000	---	0002	0006	20_04_24_23_30_03

Model		Name	Produced connection size	Produced connection path length	Produced connection path	Consumed connection size	Consumed connection path length	Consumed connection path
Basic Unit	Expansion Unit							
CRT1-AD04		Analog Data 1	0008	0006	20_04_24_68_30_03	0000	0000	---
		Generic Status	0001	0006	20_04_24_79_30_03	0000	0000	---
		Top and Valley shot	0002	0006	20_04_24_7A_30_03	0000	0000	---
		Analog Status	0004	0006	20_04_24_86_30_03	0000	0000	---
		Top and Valley shot + Generic status	0003	0006	20_04_24_97_30_03	0000	0000	---
		Analog Status + Generic status	0005	0006	20_04_24_A4_30_03	0000	0000	---
		Analog data 1 + Top and valley shot	000A	0006	20_04_24_AE_30_03	0000H	0000	---
		Analog data + Top and valley shot + generic status	000B	0006	20_04_24_B8_30_03	0000	0000	---
		Hold control	0000	0000	---	0001	0006	20_04_24_BE_30_03
CRT1-DA02		Generic Status	0001	0006	20_04_24_79_30_03	---	---	---
		Analog Data	---	---	---	0004	0006	20_04_24_C0_30_03

Appendix C
Connectable Devices

Digital I/O Slave Units and Expansion Units

Model	Specification	Manufacturer
CRT1-ID16	CompoNet Slave Unit with 16 DC inputs (NPN)	OMRON
CRT1-ID16-1	CompoNet Slave Unit with 16 DC inputs (PNP)	OMRON
CRT1-OD16	CompoNet Slave Unit with 16 transistor outputs (NPN)	OMRON
CRT1-OD16-1	CompoNet Slave Unit with 16 transistor outputs (PNP)	OMRON
CRT1-ROS16	CompoNet Slave Unit with 16 relay outputs (relay outputs)	OMRON
CRT1-ROF16	CompoNet Slave Unit with 16 SSR outputs (SSR outputs)	OMRON
CRT1-ID16TA	CompoNet Slave Unit with 16 DC inputs (NPN)	OMRON
CRT1-ID16TA-1	CompoNet Slave Unit with 16 DC inputs (PNP)	OMRON
CRT1-OD16TA	CompoNet Slave Unit with 16 transistor outputs (NPN)	OMRON
CRT1-OD16TA-1	CompoNet Slave Unit with 16 transistor outputs (PNP)	OMRON
CRT1-MD16TA	CompoNet Slave Unit with 8 inputs and 8 outputs (NPN)	OMRON
CRT1-MD16TA-1	CompoNet Slave Unit with 8 inputs and 8 outputs (PNP)	OMRON
CRT1-ID16S	CompoNet Slave Unit with 16 DC inputs (NPN)	OMRON
CRT1-ID16S-1	CompoNet Slave Unit with 16 DC inputs (PNP)	OMRON
CRT1-OD16S	CompoNet Slave Unit with 16 transistor outputs (NPN)	OMRON
CRT1-OD16S-1	CompoNet Slave Unit with 16 transistor outputs (PNP)	OMRON
CRT1-MD16S	CompoNet Slave Unit with 8 inputs and 8 outputs (NPN)	OMRON
CRT1-MD16S-1	CompoNet Slave Unit with 8 inputs and 8 outputs (PNP)	OMRON
CRT1-ID16SL	CompoNet Slave Unit with 16 DC inputs (NPN)	OMRON
CRT1-ID16SL-1	CompoNet Slave Unit with 16 DC inputs (PNP)	OMRON
CRT1-OD16SL	CompoNet Slave Unit with 16 transistor outputs (NPN)	OMRON
CRT1-OD16SL-1	CompoNet Slave Unit with 16 transistor outputs (PNP)	OMRON
XWT-ID16	Expansion Unit with 16 DC inputs (NPN)	OMRON
XWT-ID16-1	Expansion Unit with 16 DC inputs (PNP)	OMRON
XWT-OD16	Expansion Unit with 16 transistor outputs (NPN)	OMRON
XWT-OD16-1	Expansion Unit with 16 transistor outputs (PNP)	OMRON
XWT-ID08	Expansion Unit with 8 DC inputs (NPN)	OMRON
XWT-ID08-1	Expansion Unit with 8 DC inputs (PNP)	OMRON
XWT-OD08	Expansion Unit with 8 transistor outputs (NPN)	OMRON
XWT-OD08-1	Expansion Unit with 8 transistor outputs (PNP)	OMRON

Analog I/O Slave Units

Model	Specification	Manufacturer
CRT1-AD04	Analog Input Slave Unit with 4 analog data inputs (4 words)	OMRON
CRT1-DA02	Analog Output Slave Unit with 2 analog data inputs (2 words)	OMRON

Bit Slave Units

Model	Specification	Manufacturer
CRT1B-ID02S	CompoNet Slave Unit with IP20 protection and 2 DC inputs (NPN)	OMRON
CRT1B-ID02S-1	CompoNet Slave Unit with IP20 protection and 2 DC inputs (PNP)	OMRON

CRT1B-OD02S	CompoNet Slave Unit with IP20 protection and 2 transistor inputs (NPN)	OMRON
CRT1B-OD02S-1	CompoNet Slave Unit with IP20 protection and 2 transistor inputs (PNP)	OMRON
CRT1B-ID02SP	CompoNet Slave Unit with IP54 protection and 2 DC inputs (NPN)	OMRON
CRT1B-ID02SP-1	CompoNet Slave Unit with IP54 protection and 2 DC inputs (PNP)	OMRON
CRT1B-OD02SP	CompoNet Slave Unit with IP54 protection and 2 transistor inputs (NPN)	OMRON
CRT1B-OD02SP-1	CompoNet Slave Unit with IP54 protection and 2 transistor inputs (PNP)	OMRON
CRT1B-ID04SP	CompoNet Slave Unit with IP54 protection and 4 DC inputs (NPN)	OMRON
CRT1B-ID04SP-1	CompoNet Slave Unit with IP54 protection and 4 DC inputs (PNP)	OMRON
CRT1B-MD04SLP	CompoNet Slave Unit with IP54 protection and 2 DC inputs (NPN) and 2 transistor outputs (NPN)	OMRON
CRT1B-MD04SLP-1	CompoNet Slave Unit with IP54 protection and 2 DC inputs (PNP) and 2 transistor outputs (PNP)	OMRON

Repeater Unit

Model	Specification	Manufacturer
CRS1-RPT01	2 communications connectors (upstream and downstream ports) 1 upstream port communications power supply connector Up to 64 Repeater Units can be connected for 1 Master Unit.	OMRON

Communications Cables

Model	Specification	Manufacturer
---	Round cable I (VCTF 2-conductor cable) JIS C 3306, nominal cross-section of conductor: 0.75 mm^2, finished cable diameter: 2.3 mm	---
DCA4-4F10	Flat Cable I (Standard Flat Cable, 4 conductors, UL certified) Length: 100 m, conductor cross-sections: 0.75 mm^2 $\times$ 2, 0.5 mm^2 $\times$ 2	OMRON
DAC5-4F10	Flat Cable II (Sheathed Flat Cable, 4 conductors, UL certified) Length: 100 m, conductor cross-sections: 0.75 mm^2 $\times$ 2, 0.5 mm^2 $\times$ 2, degree of protection: IP54s	OMRON

Connectors

Model	Specification	Manufacturer
DCN4-TR4	Flat Connector Socket for Flat Cable I (Standard)	OMRON
DCN5-TR4	Flat Connector Socket for Flat Cable II (Sheathed)	
DCN4-BR4	Flat Connector Plug for Flat Cable I (Standard)	
DCN5-BR4	Flat Connector Plug for Flat Cable II (Sheathed)	
DCN4-MD4	Multidrop Connector (for multidrop connections)	
DCN4-TB4	Open Type Connector (for connecting Units) Used to convert the communications connector on a Master Unit, Slave Unit, or Repeater Unit to a terminal block. The terminal block size is M3.	OMRON

Terminating Resistors

Model	Specification	Manufacturer
DRS1-T	Terminal Block-type Terminating Resistor for Round Cable, 121 Ω	OMRON
DCN4-TM4	Connector-type Terminating Resistor for Flat Cable I, 121 Ω	
DCN5-TM4	Connector-type Terminating Resistor for Flat Cable II, 121 Ω	

Appendix D
Current Consumption Summary

Digital I/O Slave Units

Model	Communications current consumption
CRT1-ID16	55 mA max. (for 24 V) 85 mA max. (for 14 V)
CRT1-ID16-1	55 mA max. (for 24 V) 85 mA max. (for 14 V)
CRT1-OD16	55 mA max. (for 24 V) 85 mA max. (for 14 V)
CRT1-OD16-1	55 mA max. (for 24 V) 85 mA max. (for 14 V)
CRT1-ROS16	155 mA max. (for 24 V) 255 mA max. (for 14 V)
CRT1-ROF16	85 mA max. (for 24 V) 130 mA max. (for 14 V)
CRT1-ID16TA	40 mA max. (for 24 V) 55 mA max. (for 14 V)
CRT1-ID16TA-1	37 mA max. (for 24 V) 55 mA max. (for 14 V)
CRT1-OD16TA	45 mA max. (for 24 V) 65 mA max. (for 14 V)
CRT1-OD16TA-1	45 mA max. (for 24 V) 65 mA max. (for 14 V)
CRT1-MD16TA	40 mA max. (for 24 V) 60 mA max. (for 14 V)
CRT1-MD16TA-1	40 mA max. (for 24 V) 60 mA max. (for 14 V)
CRT1-ID16S	110 mA max. (for 24 V) 125 mA max. (for 14 V)
CRT1-ID16S-1	110 mA max. (for 24 V) 120 mA max. (for 14 V)
CRT1-OD16S	38 mA max. (for 24 V) 60 mA max. (for 14 V)
CRT1-OD16S-1	39 mA max. (for 24 V) 60 mA max. (for 14 V)
CRT1-MD16S	75 mA max. (for 24 V) 95 mA max. (for 14 V)
CRT1-MD16S-1	75 mA max. (for 24 V) 95 mA max. (for 14 V)
CRT1-ID16SL	34 mA max. (for 24 V) 55 mA max. (for 14 V)
CRT1-ID16SL-1	34 mA max. (for 24 V) 55 mA max. (for 14 V)
CRT1-OD16SL	37 mA max. (for 24 V) 60 mA max. (for 14 V)

Model	Communications current consumption
CRT1-OD16SL-1	37 mA max. (for 24 V) 60 mA max. (for 14 V)
XWT-ID08 (See note.)	5 mA max.
XWT-ID08-1 (See note.)	5 mA max.
XWT-OD08 (See note.)	5 mA max.
XWT-OD08-1 (See note.)	5 mA max.
XWT-ID16 (See note.)	10 mA max.
XWT-ID16-1 (See note.)	10 mA max.
XWT-OD16 (See note.)	10 mA max.
XWT-OD16-1 (See note.)	10 mA max.

Note The communications current consumption indicated for Expansion Units is the additional current consumed when the Expansion Unit is connected to a Basic Unit.
For example, the current consumption for a combination of a CRT1-ID16 Basic Unit and an XWT-OD16 Expansion Unit is 80 + 10 = 90 mA.

Analog I/O Slave Units

Model	Communications current consumption
CRT1-AD04	110 mA max. (for 24 V) 175 mA max. (for 14 V)
CRT1-DA02	125 mA max. (for 24 V) 205 mA max. (for 14 V)

Bit Slave Units

Model	Communications current consumption
CRT1B-ID02S	65 mA max. (for 24 V) 80 mA max. (for 14 V)
CRT1B-ID02S-1	45 mA max. (for 24 V) 65 mA max. (for 14 V)
CRT1B-OD02S	55 mA max. (for 24 V) 75 mA max. (for 14 V)
CRT1B-OD02S-1	55 mA max. (for 24 V) 70 mA max. (for 14 V)
CRT1B-ID02SP	65 mA max. (for 24 V) 80 mA max. (for 14 V)
CRT1B-ID02SP-1	65 mA max. (for 24 V) 80 mA max. (for 14 V)
CRT1B-OD02SP	50 mA max. (for 24 V) 75 mA max. (for 14 V)
CRT1B-OD02SP-1	50 mA max. (for 24 V) 75 mA max. (for 14 V)
CRT1B-ID04SP	85 mA max. (for 24 V) 90 mA max. (for 14 V)
CRT1B-ID04SP-1	85 mA max. (for 24 V) 90 mA max. (for 14 V)
CRT1B-MD04SLP	80 mA max. (for 24 V) 90 mA max. (for 14 V)
CRT1B-MD04SLP-1	75 mA max. (for 24 V) 85 mA max. (for 14 V)

Repeater Unit

Model	Communications current consumption
CRS1-RPT01	95 mA max.

Appendix E

Precautions with Connecting Two-wire DC Sensors

When using a two-wire sensor with a Slave Unit with DC inputs, check that the following conditions have been met. Failure to meet these conditions may result in operating errors.

Relation between ON Voltage of Slave Unit with DC Inputs and Sensor Residual Voltage

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

V_{CC}: I/O power supply voltage (The allowable power supply voltage range is 20.4 to 26.4 V, so 20.4 V will be used here to allow for the worst possible conditions.)

V_{ON}: ON voltage for a Slave Unit with DC Inputs

V_R: Sensor's output residual voltage

It is sometimes possible to satisfy the above equation by adjusting the I/O power supply voltage (V_{CC}) to 26.4 V.

Relation between ON Current of Slave Unit with DC Inputs 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 Input Slave Unit with DC inputs

I_{ON} is calculated as follows:

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

V_F: Internal residual voltage of a Slave Unit with DC Inputs

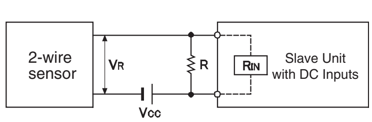
R_{IN}: Input impedance of a Slave Unit with DC Inputs

When I_{ON} is smaller than I_{OUT} (min), connect a bleeder resistor R.

The bleeder resistor constant can be calculated using the following equation.

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

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



Relation between OFF Current of Slave Unit with DC Inputs and Sensor Leakage Current

$I_{OFF} \geq I_{leak}$

I_{OUT}: OFF current of a Slave Unit with DC Inputs

I_{leak}: Sensor's leakage current

Connect a bleeder resistor if the Sensor's leakage current is greater than the OFF current of a Slave Unit with DC Inputs.

The bleeder resistor constant can be calculated using the following equation.

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

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

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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. W457-E1-03

Revision code

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
01	September 2006	Original production
02	July 2007	Additions to include Digital I/O Slave Units (16-point Input Unit with 3-tier terminal block, 16-point Output Unit with 3-tier terminal block, 8-point Input/8-point Output Unit with 3-tier terminal block, and 16-point Output Unit with relay outputs). Connector names were also changed globally.
03	October 2007	Information was added on the following. Digital I/O Slave Units: 16-input Units (Connector Model and Clamp Model), 16-output Unit (2-tier Terminal Block Model with SSR Outputs, Connector Model, and Clamp Model) 8-input and 8-output Units (Connector Model)