Cat.No. W267-E1-6

CVM1-DRM21-V1
C200HW-DRM21-V1

DeviceNet (CompoBus/D)

OPERATION MANUAL

OMRON

CVM1-DRM21-V1
C200HW-DRM21-V1
DeviceNet (CompoBus/D)
Operation Manual

Revised October 2000

Notice:

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

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

⚠ DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ Caution Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

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

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

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

Visual Aids

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

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

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

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DeviceNet is a registered trademark of the Open DeviceNet Vendor Association, Inc.

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

About this Manual:

This manual describes the installation and operation of the DeviceNet (CompoBus/D) network and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the DeviceNet Master and Slave Units. **Be sure to read the precautions provided in the first section.**

Precautions provides precautions for the correct and safe application of the products.

Section 1 provides an overview of the DeviceNet network, including features, specifications, and the system configurations.

Section 2 provides a general overview of the DeviceNet network, including basic operations and basic procedures for starting and running the network.

Section 3 explains the Network configuration and provides the specifications required for setting up the Network.

Section 4 provides Master Unit specifications and describes their components, indicators, switch settings, etc.

Section 5 provides specifications for the Cables and Connectors used in the DeviceNet network.

Section 6 explains the various considerations involved in providing a communications power supply.

Section 7 describes the methods used to mount and wire the components of a DeviceNet network.

Section 8 describes setting up and using remote I/O communications to automatically transfer data between a PC to which a Master Unit is mounted and the Slaves controlled by the Master Unit.

Section 9 describes message communications using FINS commands sent from the ladder diagram program of the PC.

Section 10 provides information on the FINS commands that can be addressed to the CPU Units of CV-series PCs.

Section 11 provides information on the FINS commands that can be addressed to the CPU Units of CS1-series and C200HX/HG/HE PCs.

Section 12 provides information on the FINS commands that can be addressed to the DeviceNet Master Units.

Section 13 describes the software switches used to control DeviceNet operation and the status area used to access DeviceNet status.

Section 14 describes the time required for a complete communications cycle, for an output response to be made to an input, to start the system, and to send a message.

Section 15 describes error processing, periodic maintenance operations, and troubleshooting procedures needed to keep the DeviceNet network operating properly. We recommend reading through the error processing procedures before operation so that operating errors can be identified and corrected more quickly.

The ***Appendices*** provide a list of standard models, the FINS command response codes, a node address settings table, information on multi-vendor applications, and information on current consumptions.

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

PRECAUTIONS

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

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

1 Intended Audience

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

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

2 General Precautions

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

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

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

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

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

3 Safety Precautions

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

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

4 Operating Environment Precautions

Do not operate the control system in the following places.

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

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

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

5 Application Precautions

Observe the following precautions when using a PC System.

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

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

Caution Failure to abide by the following precautions could lead to faulty operation of the PC System or could damage the PC or PC Units. Always heed these precautions.

- Use the Units only with the power supplies and voltages specified in the operation manuals. Other power supplies and voltages may damage the Units.
- Take measures to stabilize the power supply to conform to the rated supply if it is not stable.
- Provide circuit breakers and other safety measures to provide protection against shorts in external wiring.
- Do not apply voltages exceeding the rated input voltage to Input Units. The Input Units may be destroyed.
- Do not apply voltages exceeding the maximum switching capacity to Output Units. The Output Units may be destroyed.
- Always disconnect the LG terminal when performing withstand voltage tests.
- Install all Units according to instructions in the operation manuals. Improper installation may cause faulty operation.
- Provide proper shielding when installing in the following locations:
  - Locations subject to static electricity or other sources of noise.
  - Locations subject to strong electromagnetic fields.
  - Locations subject to possible exposure to radiation.
  - Locations near to power supply lines.

- Be sure to tighten Backplane screws, terminal screws, and cable connector screws securely.
- Do not attempt to take any Units apart, to repair any Units, or to modify any Units in any way.

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

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

6 EC Directives

DeviceNet (CompoBus/D) products that meet EC directives must be installed as follows:

1, 2, 3...

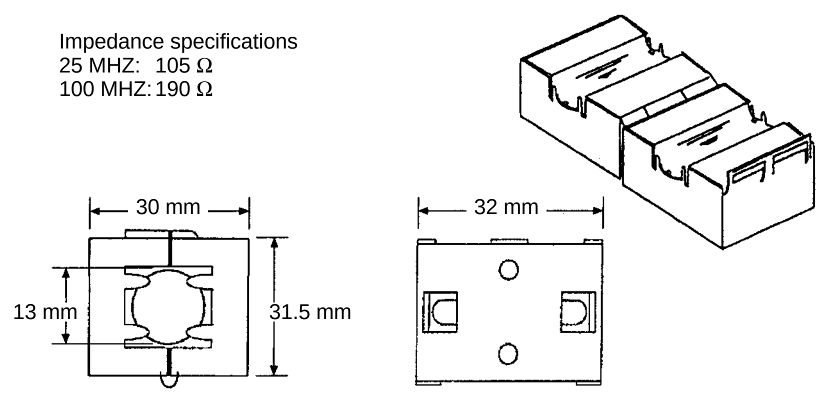
1. DeviceNet Units are designed for installation inside control panels. All DeviceNet Units must be installed within control panels.
2. Used reinforced insulation or double insulation for the DC power supplies used for the communications power supply, internal circuit power supply, and the I/O power supplies.
3. DeviceNet products that meet EC directives also meet the common emission standard (EN50081-2). When DeviceNet products are built into equipment, however, the measure necessary to ensure that the standard is met will vary with the overall configuration of the control panel, the other devices connected to the control panel, and other conditions. You must therefore confirm that EC directives are met for the overall machine or device.

The following examples show means of reducing noise.

1, 2, 3...

1. Noise from the communications cable can be reduced by installing a ferrite core on the communications cable within 10 cm of the DeviceNet (CompoBus/D) Master Unit.

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



2. Wire the control panel with as thick and short electric lines as possible and ground to 100 Ω min.
3. Keep DeviceNet communications cables as short as possible and ground to 100 Ω min.

SECTION 1
Features and System Configuration

This section provides an overview of the DeviceNet (CompoBus/D) network, including features, specifications, and the system configurations.

1-1 Overview of DeviceNet (CompoBus/D)

DeviceNet is a multi-bit, multi-vendor network that combines controls and data on a machine/line-control level and that conforms to DeviceNet open field network specifications.

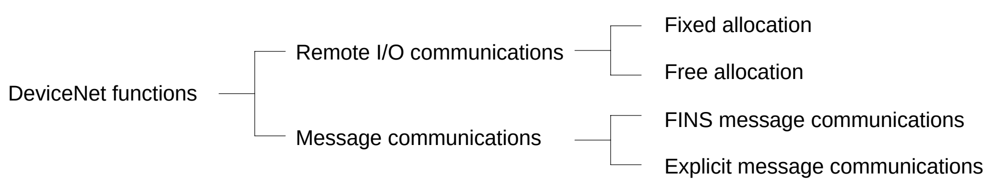
Two types of communications are supported: 1) Remote I/O communications that automatically transfer I/O between Slaves and the CPU Unit without any special programming in the CPU Unit and 2) Message communications that read/write messages, control operation, or perform other functions for Master Units, CPU Units to which a Master Unit is mounted, or Slaves. Message communications are achieved by executing specific instructions (SEND(192), RECV(193), CMND(194), and IOWR) from the program in the CPU Unit.

The following functions are also supported if a Configurator is used.

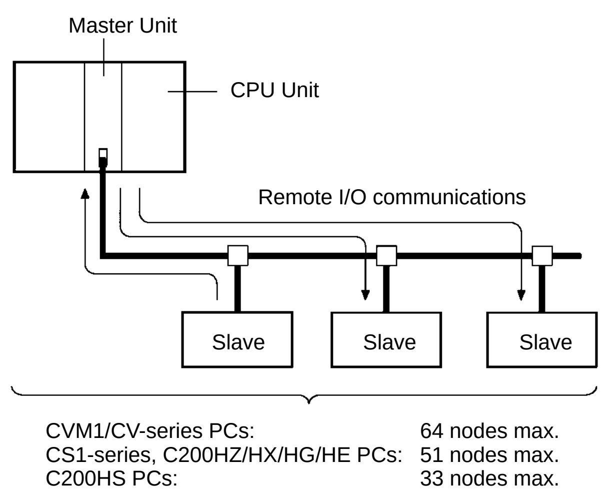
1, 2, 3...

1. I/O area words can be flexibly allocated for remote I/O communications.
2. More than one Master Unit can be mounted under a single PC.
3. More than one Master Unit can be connected in a single network.

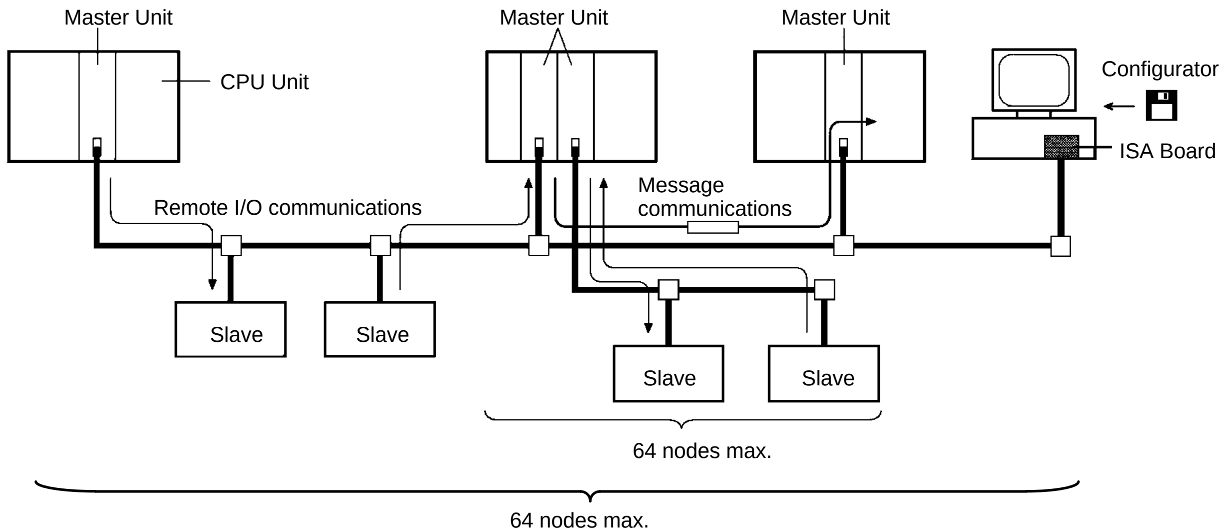
Note The Configurator is a software application running on a personal computer that operates as one node in the DeviceNet network.



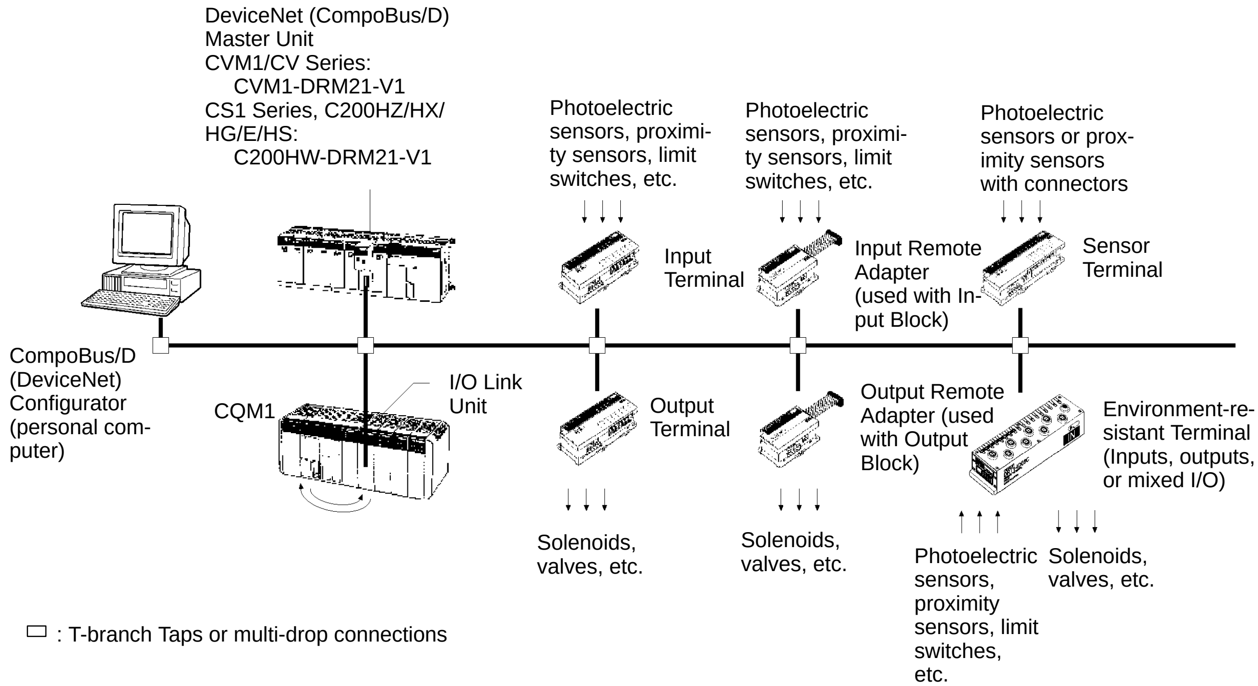
System Configuration without a Configurator

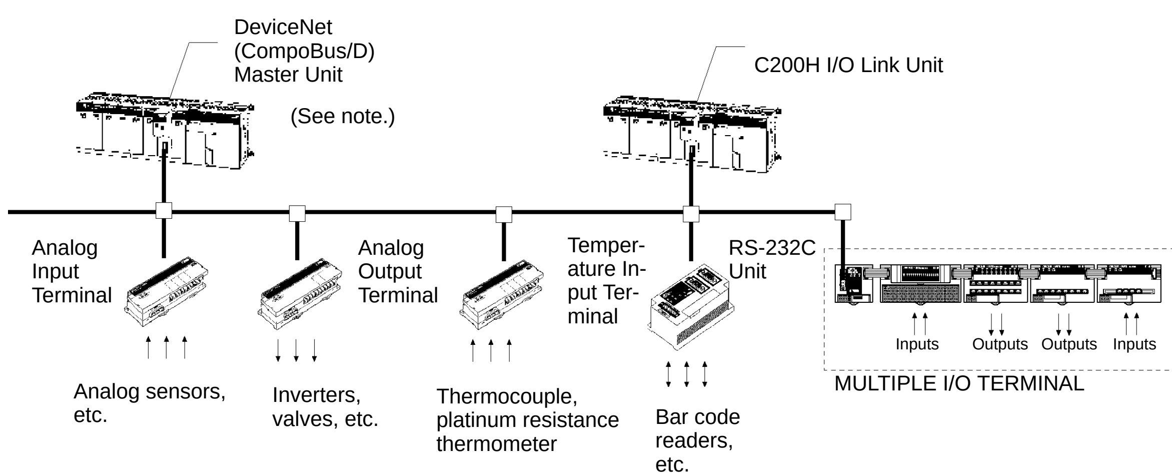


System Configuration with a Configurator



Overall System Configuration





Note A Configurator is required for networks with more than one Master.

Master Features

Master Units

Support remote I/O communications between OMRON PCs (CVM1, CV Series or C200HZ/HX/HG/HE/HS) and Slaves.

Support message communications between OMRON PCs, or between an OMRON PC and Slaves and Masters from other companies.

VME Master Boards

Support remote I/O communications between a VME System and Slaves.

Configurator Features

- Enables free (user-set) allocations to remote I/O.
- Enables multiple Master Units on a single PC.
- Enables multiple Master Units in a single network.

Slave Features

I/O Terminals

- Provide general-purpose I/O via terminal blocks (M3).
- Available in the following models:
  - 8-point transistor-input model
  - 16-point transistor-input model
  - 8-point transistor-output model
  - 16-point transistor-output model

Environment-resistant Terminals

- Improved I/O Terminals that conform to IP66 for spatter-, water-, and oil-resistance.
- Available in the following models:
  - 8-point transistor-input models
  - 8-point transistor-output models
  - 16-point transistor-I/O models (8 inputs and 8 outputs)

Remote Adapters

- Used in combination with G7D and other I/O Blocks to handle relay outputs, power MOS FET Relay outputs, etc.
- Available in 16-point input and 16-point output models.

I/O Link Units

- More than one I/O Link Unit can be mounted to a CQM1 PC.
- Link 16 inputs and 16 outputs between the PC and the Master Unit.

Note A CompoBus/D (DeviceNet) Configurator is required to connect more than one Master to the same Network.

Sensor Terminals

- Accept inputs from photoelectric and proximity sensors with connectors.
- Available in 16-point input and 8-point input/8-point output models.
- Output signals can be used for sensor teaching and external diagnosis.

Analog Input Terminals

- Convert analog inputs to binary.
- Switchable between 2 and 4 input points using the DIP switch.
- Handle inputs of 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, or 4 to 20 mA.

Analog Output Terminals

- Convert binary data to analog outputs.
- Provides outputs of 1 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, or 4 to 20 mA.
- Available in models with a resolution of either 1/6,000 or 1/30,000.

Temperature Input Terminals

- Temperature data is input as binary data for 4 inputs.
- Thermocouple and platinum resistance thermometer inputs are available.

C200H I/O Link Units

- Special I/O Slaves that mount to C200HX/HG/HE PCs and read/write data from the Master Unit to the specified words in the CPU Unit.
- Read and write areas specified for up to 512 bits each (32 words each).
- Any memory area words can be read or written using DeviceNet explicit messages.

RS-232C Units

- Special I/O Slaves that provide two RS-232C ports and control I/O from the Master Units.

MULTIPLE I/O TERMINALs

- Multiple I/O Units can be combined under a Communications Unit and treated as a single Slave.
- Special I/O Units, such as Analog I/O Units, and High-speed Counter Units are also available.

Master Units

Applicable PC	Master Unit model number	Mounting position	Max. No. of Units	
			With Configurator	Without Configurator
CVM1, CV Series	CVM1-DRM21-V1	CPU or Expansion CPU Rack (Classified as CPU Bus Units)	16	1
CS1 Series	C200HW-DRM21-V1	CPU Rack or Expansion I/O Rack (Classified as Special I/O Units)	16	
C200HZ/HX/HG/HE			10 or 16	
C200HS			10	

Slave Units

	Name	I/O points	Model number	Installation	Remarks
Basic Units	Input Terminals (transistor inputs)	8 input points	DRT1-ID08	DIN track or screws	---
		16 input points	DRT1-ID16		---
	Output Terminals (transistor outputs)	8 output points	DRT1-OD08		---
		16 output points	DRT1-OD16		---
	Environment-resistant Terminals (transistor inputs/ outputs)	8 input points	DRT1-ID08C	Screws	Water-resistant. Uses XS2 Sensor I/O Connector to connect I/O and DeviceNet.
		8 output points	DRT1-OD08C		
		8 input/8 output points	DRT1-MD16C		
	Remote Adapters	16 input points	DRT1-ID16X	DIN track or screws	---
		16 output points	DRT1-OD16X		---
	Sensor Terminals	16 input points	DRT1-HD16S		Connected to photoelectric and proximity sensors with connectors
		8 input/8 output points	DRT1-ND16S		
	Temperature Input Terminals	4 input points (4 words)	DRT1-TS04T		Thermocouple inputs
		4 input points (4 words)	DRT1-TS04P		Temperature resistance-thermometer inputs
	CQM1 I/O Link Unit	16 internal input/ 16 internal output points (between CQM1 and Master Unit)	CQM1-DRT21	Assembled with CQM1	Up to 3 or 7 Units mountable to CQM1 (depending on model of CQM1)
Analog Units	Analog Input Terminals	4 input points (4 words) or 2 input points (2 words) (voltages or currents)	DRT1-AD04	DIN track or screws	1 to 5 V, 0 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, or 4 to 20 mA input (switchable) Resolution: 1/6,000
		4 input points (4 words) (voltages or currents)	DRT1-AD04H		1 to 5 V, 0 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, or 4 to 20 mA input (switchable) Resolution: 1/30,000
	Analog Output Terminals	2 output points (2 words)	DRT1-DA02		1 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, or 4 to 20 mA output (switchable) Resolution: 1/6,000
Special I/O Units	C200H I/O Link Unit	512 inputs max. (32 words) 512 outputs max. (32 words)	C200HW-DRT21	Assembled with C200HX/HG/HE	Up to 16 Units mountable to C200HX/HG/HE
	RS-232C Unit	16 inputs (1 word)	DRT1-232C2	DIN track or screws	Two RS-232C ports Explicit messages used for settings and control. RS-232C port status reflected in inputs.

Note For details on Slaves, refer to the *CompoBus (DeviceNet) Slaves Operation Manual* (W347).

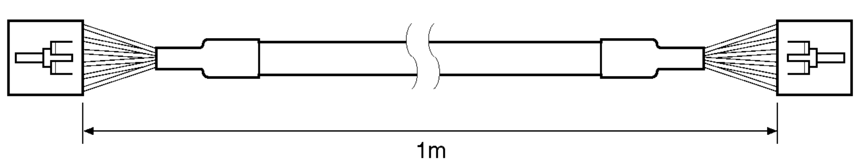
MULTIPLE I/O TERMINAL Units

Unit		I/O points	Words allocated in PC memory		I/O connections	Unit power supply voltage	Installation	Model number	Remarks
			Input	Output					
Communications Unit		None	Status two words	0 words	None	24 VDC (supplied from outside)	DIN track	DRT1-COM	---
Basic I/O Units	Transistor Input Units	16 input points	1 word	0 words	M3 terminal block			GT1-ID16	NPN
								GT1-ID16-1	PNP
		16 input points	1 word	0 words	Connector (made by MOLEX)			GT1-ID16MX	NPN
								GT1-ID16MX-1	PNP
		16 input points	1 word	0 words	Connector (made by FUJITSU)			GT1-ID16ML	NPN
								GT1-ID16ML-1	PNP
		16 input points	1 word	0 words	Connector (D-sub, 25 pin)			GT1-ID16DS	NPN
								GT1-ID16DS-1	PNP
		32 input points	2 words	0 words	High-density connector (made by FUJITSU)			GT1-ID32ML	NPN
								GT1-ID32ML-1	PNP
	Transistor Output Units	16 output points	0 words	1 word	M3 terminal block			GT1-OD16	NPN
								GT1-OD16-1	PNP
		16 output points	0 words	1 word	Connector (made by MOLEX)			GT1-OD16MX	NPN
								GT1-OD16MX-1	PNP
		16 output points	0 words	1 word	Connector (made by FUJITSU)			GT1-OD16ML	NPN
								GT1-OD16ML-1	PNP
		16 output points	0 words	1 word	Connector (D-sub, 25 pin)			GT1-OD16DS	NPN
								GT1-OD16DS-1	PNP
		32 output points	0 words	2 words	High-density connector (made by FUJITSU)			GT1-OD32ML	NPN
								GT1-OD32ML-1	PNP
	Relay Output Units	16 output points (available soon)	0 words	1 word	M3 terminal block			GT1-ROS16	---
		8 output points	0 words	1 word				GT1-ROP08	---

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

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

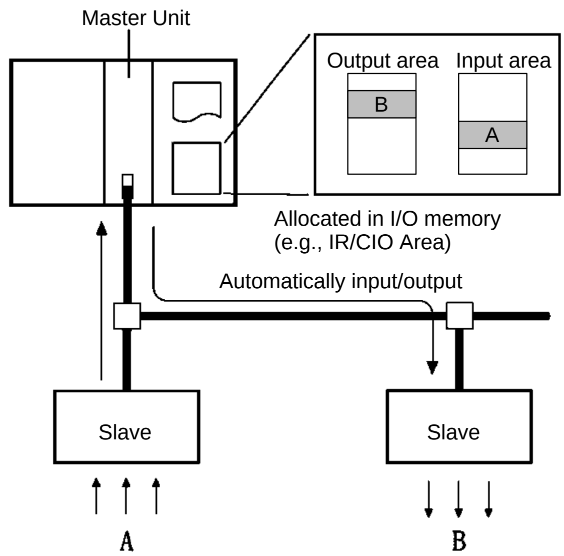
One I/O Unit Connecting Cable (cable length 40 mm) is included with each I/O Unit. One end connector is attached to the Communications Unit. An I/O Unit Connecting Cable with a cable length of 1 m (GCN1-100) is sold separately (see below).



Note For details on MULTIPLE I/O TERMINAL Units, refer to the *CompoBus/D (DeviceNet) MULTIPLE I/O TERMINAL Operation Manual (W348)*.

Features

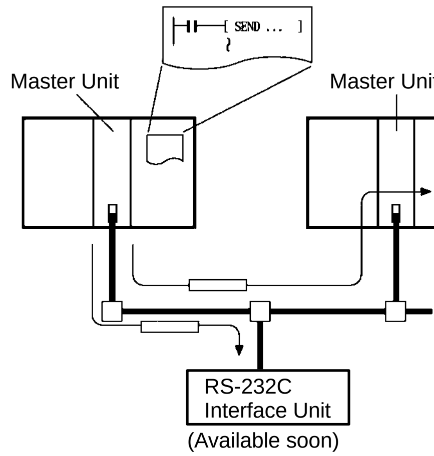
Remote I/O Communications



Note Input and output areas are automatically allocated in fixed areas unless a Configurator is used. A Configurator can be used to freely allocate input blocks 1 and 2, and output blocks 1 and 2, anywhere in I/O memory.

Item	Master Unit model	Without Configurator	With Configurator
Max. No. of Slave nodes per Master	CVM1, CV Series	63 nodes	
	CS1 Series, C200HZ/HX/HG/HE	50 nodes	63 nodes
	C200HS	32 nodes	63 nodes
Max. No. of control points per Master	CVM1, CV Series	2,048 pts (64 input/64 output words)	6,400 pts (100 words x 4 blocks)
	C200HZ/HX/HG/HE	1,600 pts (50 input/50 output words)	Without messages: 4,800 pts With messages: 1,600 pts
	C200HS	1,024 pts (32 input/32 output words)	1,280 pts
Max. No. of I/O points per Slave controllable by Master	CVM1, CV Series	32 input/32 output words	
	CS1 Series C200HZ/HX/HG/HE		
	C200HS		
Remote I/O allocation areas	CVM1, CV Series	Fixed words in IR Area (or CIO area for CS1-series PCs)	Any area
	CS1 Series C200HZ/HX/HG/HE		
	C200HS		

Message Communications



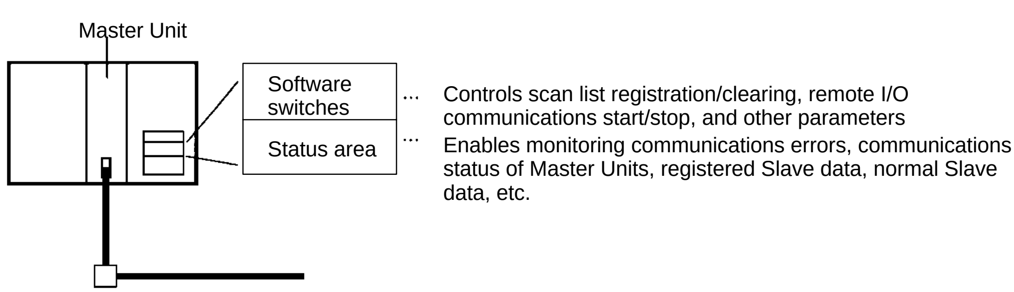
Communications Instructions

Master Unit model	Send	Receive	FINS commands
CVM1, CV Series	SEND(192)	RECV(193)	CMND(194)
CS1 Series, C200HZ/HX/HG/HE	None	None	IOWR
C200HS	---		

Item	Master Unit model	Capacity
Max. No. of nodes per Master Unit for message communications using FINS commands	CVM1, CV Series	8 nodes
	CS1 Series, C200HZ/HX/HG/HE	8 nodes
	C200HS	Not supported
Max. No. of nodes per Master Unit for message communications using explicit messages	CVM1, CV Series	63 nodes
	CS1 Series, C200HZ/HX/HG/HE	63 nodes
	C200HS	Not supported
Max. message length	CVM1, CV Series	SEND(192): 152 bytes RECV(193): 156 bytes CMND(194): 160 bytes (starting with command code)
	CS1 Series, C200HZ/HX/HG/HE	IOWR: 160 bytes (starting with command code)

Communications Software Switches and Communications Status

Words in dedicated areas of the CPU Unit are allocated for DeviceNet communications software switches and status.



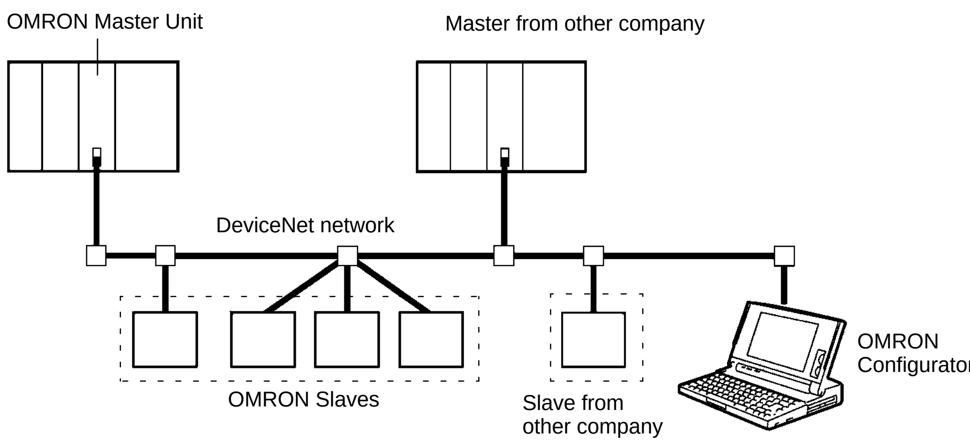
Configurators

Model number	Components	Network connection to personal computer	Applicable personal computers	OS
3G8F5-DRM21	Dedicated ISA Board and Installation Disk	Dedicated ISA Board	IBM AT/PC or compatible	Windows 95 or Windows NT 3.5/4.0
3G8E2-DRM21	Dedicated PCMCIA Card and Installation Disk	Dedicated PCMCIA Card		Windows 95

1-2 DeviceNet Features

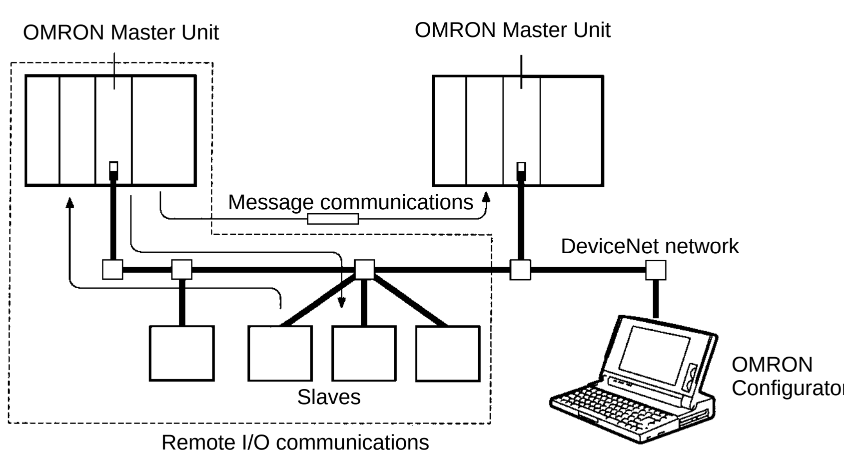
Multi-vendor Network

The DeviceNet conforms to the DeviceNet open field network specification, which means that devices (Masters and Slaves) produced by other manufacturers can also be connected to the Network. A wide range of field-level applications can thus be supported by combining valve devices, sensors, and other devices.



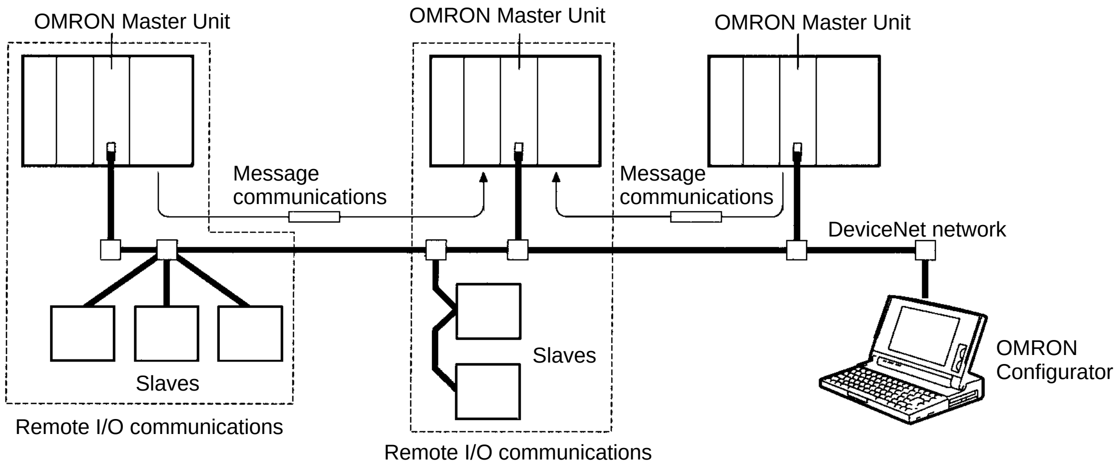
Simultaneous Remote I/O and Message Services

Remote I/O communications to constantly exchange I/O data between the PC and Slaves can be executed simultaneously with message communications, to send/receive Master Unit data as required by the application. A DeviceNet network can thus be installed to flexibly handle applications that require both bit data and message data. Message communications can be achieved either by using OMRON’s FINS commands or by using explicit DeviceNet messages.



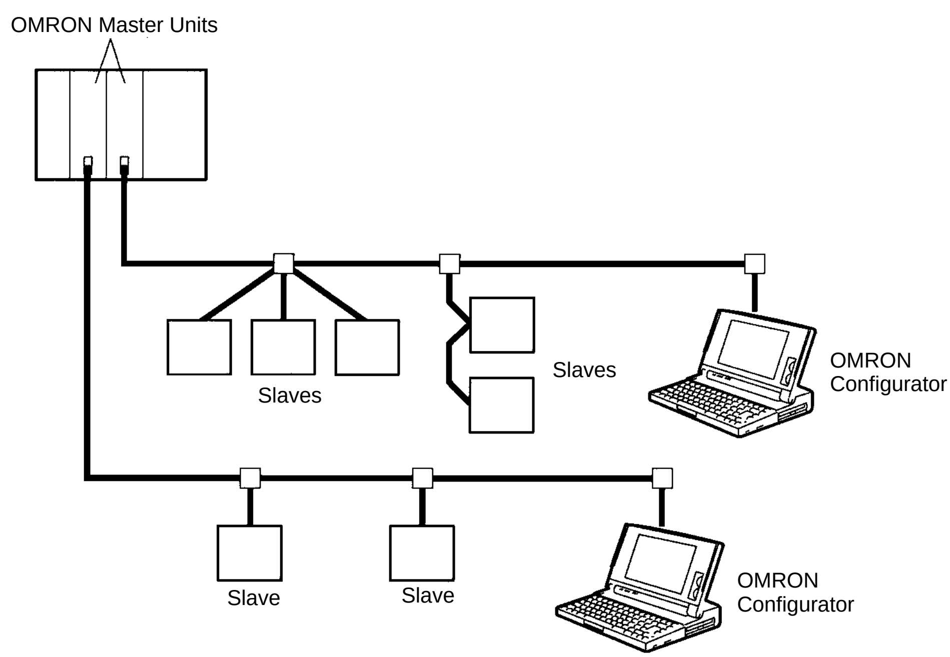
Connect Multiple PCs to the Same Network

A Configurator (sold separately) can be used to enable connection of more than one Master to the Network, allowing message communications between PCs and between multiple groups of PCs and Slaves. This allows the DeviceNet network to be used as a common bus to unify controls while reducing wiring.



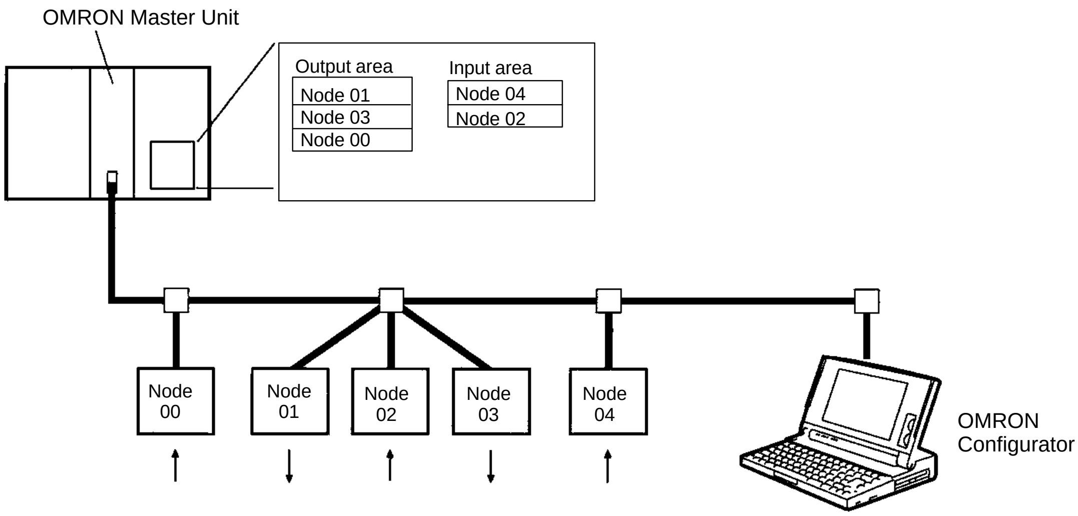
Handles Multi-point Control and Line Expansions with Multi-layer Networks

A Configurator (sold separately) can be used to enable mounting more than one Master Unit to a single PC, allowing control of many more points. This feature can easily handle line expansions and other applications



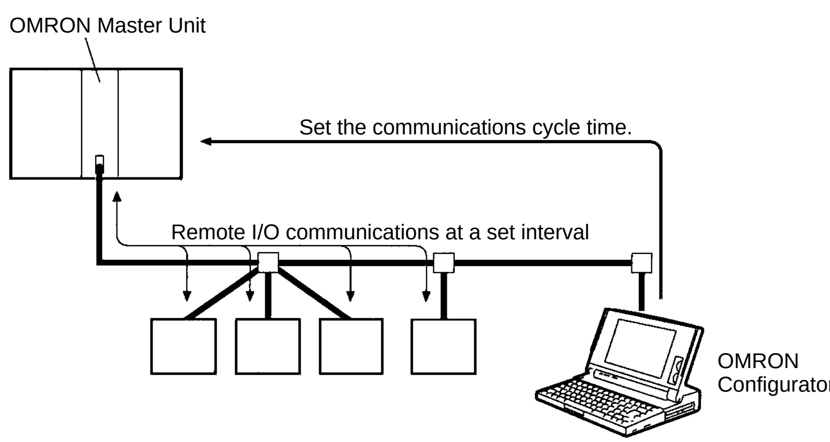
Free Remote I/O Allocation

A Configurator (sold separately) can be used to enable flexible allocation of I/O, i.e., in any area and in any order. This allows I/O allocations that suit the application to simplify programming and enable effective usage of PC memory areas.



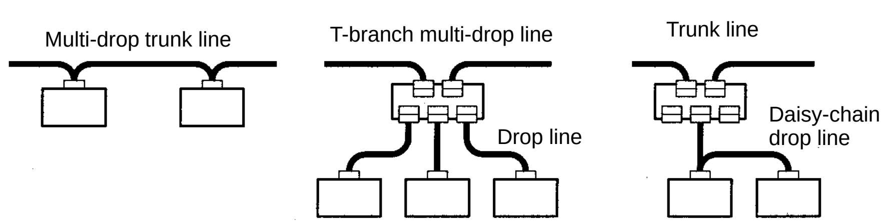
Handle Slaves with Different Response Speeds

A Configurator (sold separately) can be used to set the communications cycle time, enabling usage of Slaves with slow response times.



Easily Expand or Change Lines with Various Connection Methods

Use a multi-drop trunk line, T-branch multi-drop lines, or daisy-chain drop lines. All three connection methods can be combined to flexibly construct a network that meets the needs of the application.



1-3 DeviceNet Master Unit Version Comparison

<table>
<tr><th colspan="2">Item</th><th>Previous version</th><th>V1</th></tr>
<tr><td rowspan="3">DeviceNet (CompoBus/D) Master Unit model number</td><td>C Series</td><td>CVM1-DRM21</td><td>CVM1-DRM21-V1</td></tr>
<tr><td>C200HZ/HX/HG/HE</td><td rowspan="2">C200HW-DRM21</td><td rowspan="2">C200HW-DRM21-V1</td></tr>
<tr><td>C200HS</td></tr>
<tr><td colspan="2">Remote I/O communications</td><td>Fixed allocations only</td><td>Fixed or free allocations</td></tr>
<tr><td colspan="2">Message communications</td><td>Not supported</td><td>Supported</td></tr>
<tr><td colspan="2">Master Units per network</td><td>1 only</td><td>Multiple with Configurator</td></tr>
<tr><td colspan="2">Master Units per PC</td><td>1 only</td><td>Multiple with Configurator</td></tr>
<tr><td colspan="2">Communications parameters</td><td>Fixed</td><td>Settable (communications cycle time)</td></tr>
<tr><td colspan="2">Explicit messages to Slaves from other companies</td><td>Not supported</td><td>Supported</td></tr>
<tr><td colspan="2">Error log in Master Unit</td><td>None</td><td>Supported (readable from Configurator or via FINS commands)</td></tr>
<tr><td colspan="2">Stopping remote I/O communications at startup</td><td>Not supported (always running)</td><td>Supported with Configurator</td></tr>
<tr><td colspan="2">Communications cycle time setting</td><td>Not supported</td><td>Supported with Configurator</td></tr>
<tr><td colspan="2">Communications cycle time PV monitoring</td><td>Not supported</td><td>Supported</td></tr>
</table>

Note The previous versions of DeviceNet (CompoBus/D) Master Units (CVM1-DRM21 and C200HW-DRM21) cannot be used in the same Network as the new versions (CVM1-DRM21-V1 and C200HW-DRM21-V1). They also cannot be mounted to the same PC.

1-4 Communications Specifications

Item		Specification
Communications protocol		DeviceNet
Supported connections (communications)		Master-Slave: Remote I/O and explicit messages Peer-to-peer: FINS commands Both conform to DeviceNet specifications
Connection forms		Combination of multi-drop and T-branch connections (for trunk or drop lines)
Baud rate		500 kbps, 250 kbps, or 125 kbps (switchable)
Communications media		Special 5-wire cables (2 signal lines, 2 power lines, 1 shield line)
Communications distances	500 kbps	Network length: 100 m max. Drop line length: 6 m max. Total drop line length: 39 m max.
	250 kbps	Network length: 250 m max. (see note 1) Drop line length: 6 m max. Total drop line length: 78 m max.
	125 kbps	Network length: 500 m max. (see note 1) Drop line length: 6 m max. Total drop line length: 156 m max.
Communications power supply		24 VDC supplied externally
Max. number of nodes		64 nodes (including Configurator when used)
Max. number of Masters		Without Configurator: 1 With Configurator: 63
Max. number of Slaves		63 Slaves
Communications cycle time (see note 2)		Without Configurator: Calculated from conditions Ex: Input Slaves (16-pt): 16 Output Slaves (16-pt) :16 Cycle time at 500 kbps: 9.7 ms With Configurator: Set between 2 and 500 ms Calculated value takes priority if longer.
Max. communications cycle time with multiple Masters (see note 3)		Calculated from conditions. Ex: Input Slaves (16-pt): 16 Output Slaves (16-pt) :16 Max. cycle time at 500 kbps: 18 ms
Error control checks		CRC error check
Terminating Resistors		Required at both ends of trunk line.

Note
1. Indicates the length when thick cables are used. Reduce the network length to 100 m max. when using thin cables. When using both thick and thin cables together, refer to *Combining Thick and Thin Cables* in *3-2-1 Maximum Network Length*.
2. Indicates the maximum time for remote I/O communications from a Master to a specific Slave until remote I/O communications are conducted again for the same Slave.
3. The communications cycle time when more than one Master is present on a single network.

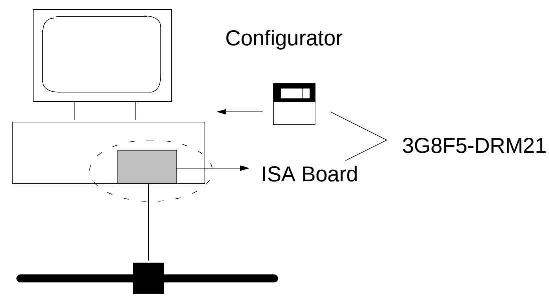
1-5 Outline of Configurator

The Configurator is required to use any of the following functions.

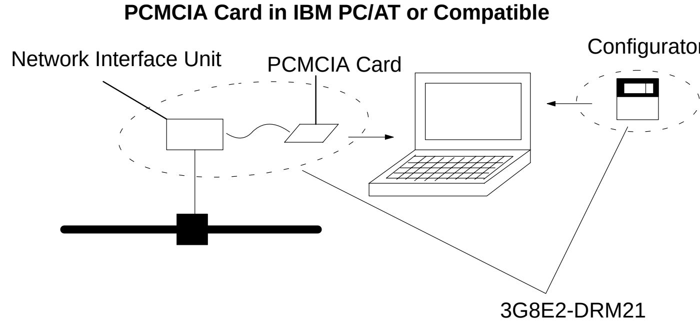
- User-set remote I/O allocations
- More than one Master Unit per PC (i.e., per CPU Unit)
- More than one Master Unit per network
- Setting communications parameters

The Configurator is run on an IBM PC/AT or compatible computer connected to the network as a DeviceNet node. Connection is made either through an ISA Board or PCMCIA Card, as shown in the following diagrams.

ISA Board in IBM PC/AT or Compatible



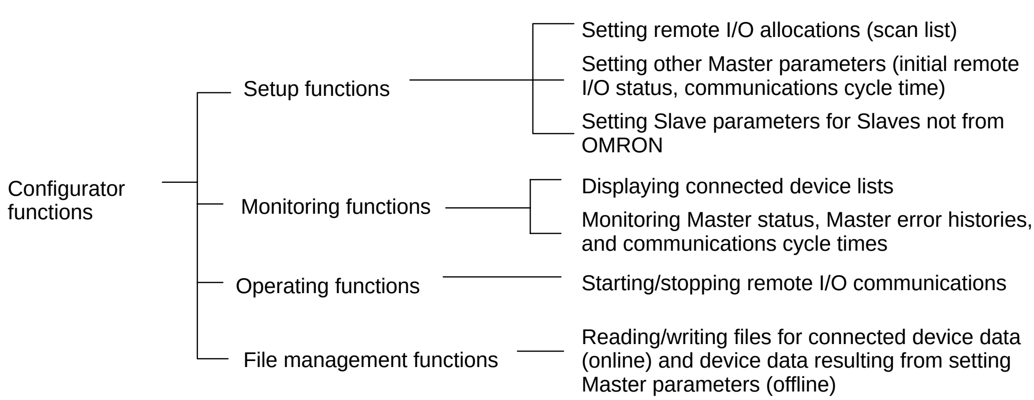
PCMCIA Card in IBM PC/AT or Compatible



Configurators

Model number	Components	Connector to network	Applicable computer	OS
3G8F5-DRM21	Dedicated ISA Board and Configurator Installation Disk	Dedicated ISA Board	IBM PC/AT or compatible	Windows 95 or Windows NT 3.51/4.0
3G8E2-DRM21	Dedicated PCMCIA Card and Configurator Installation Disk	Dedicated PCMCIA Card		Windows 95

The main functions of the Configurator are illustrated below. Refer to the *CompoBus/D Configurator Operation Manual* (W328).



Note

1. Connect only one Configurator to each Network.
2. Do not use a Configurator in locations subjected to excessive noise, particularly when using a PCMCIA Card. Excessive noise will cause the computer to run out of control. (This will not, however, adversely affect the DeviceNet network.)
3. The OMRON Configurator can only be used for OMRON Master Units (CVM1-DRM21-V1, C200HW-DRM21-V1). Do not use the Configurator for other company's Master Units.
4. Scan lists and other Master parameters can be set either manually or by using a wizard.

Configurator Specifications

Item		Specification
Operating environment	Hardware	Computer: IBM PC/AT or compatible CPU: With Windows 95: 66 MHz i486 DX2 min. With Windows NT: 90 MHz Pentium min. Memory: With Windows 95: 12 MB min. (16 MB or more recommended) With Windows NT: 16 MB min. (24 MB or more recommended) Hard disk: 5 MB min. free space
	OS	Windows 95, Windows NT 3.51/4.0 (PCMCIA Cards cannot be used with Windows NT computers)
	DeviceNet interface	ISA Board (included with 3G8F5-DRM21) or PCMCIA Card (included with 3G8E2-DRM21)
Relation to network		Operates as one node on the network and requires one node address
No. connectable to network		One Configurator per network
DeviceNet functions enabled by Configurator		Flexible remote I/O allocations (when usage of scan lists has been enabled) Usage of more than one Master Unit per PC (i.e., per CPU Unit) Usage of more than one Master Unit per network
Main functions	Monitoring	Displaying connected device lists (node address order, remote I/O configurations, etc.) Monitoring Master status (remote I/O operation, errors, etc.) Monitoring Master error histories (up to 20 records of error time stamps, error codes, error types, etc.) Monitoring communications cycle times
	Settings	Setting parameters for OMRON Master Units Setting remote I/O allocations (scan list) Setting initial remote I/O parameters (started/stopped) Setting the communications cycle time
		Setting Slave parameters for Slaves not from OMRON
		Setting node addresses and baud rates
	Operations	Starting/stopping remote I/O communications
	File management	Reading/writing files for connected device data (online) and device data resulting from setting Master parameters (offline)
	Other	Reading/writing EDS files Checking for duplicated I/O allocations in Master parameters Printing Master/Slave parameters
Files that can be written		Master parameter files (parameters for OMRON Master Unit, 1 file per node) Slave parameter files (parameters for Slaves, 1 file per node) Network file (all Master/Slave parameters for Masters/Slaves in the device list, 1 file/network) EDS file (DeviceNet device definition file, 1 file/device type)

SECTION 2
Application Overview

This section provides a general overview of the DeviceNet (CompoBus/D) Network, including basic operations and basic procedures for starting and running the Network.

2-1 List of Application Methods

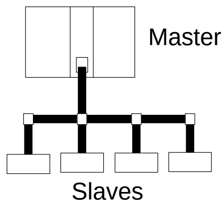
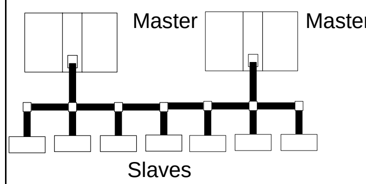
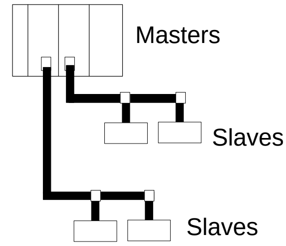
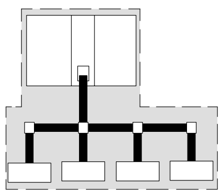
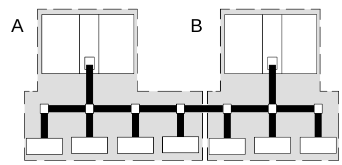
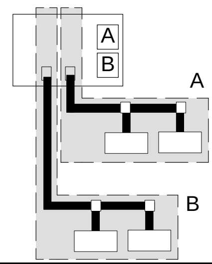
Task		Method	Page
Design	Customizing remote I/O allocations	Allocate I/O using the Configurator.	104
	Easy customization of remote I/O allocations	Allocate I/O using the Master parameter wizard in the Configurator.	See note 2.
	Sending messages between PCs with Master Units	Use communications instructions in the user program.	Sec 9
	Using more than one Master Unit for the same PC	Connect a Configurator to the Network and mount the Master Units to the PC.	104
	Using more than one Master Unit in the same network	Connect a Configurator to the network and connect the Master Units to the Network. (When setting the remote I/O communications settings, you must turn OFF the power supply to the Master Unit (i.e., to the PC) and to the device list with power supplied on to the Slaves.)	104
	Sending explicit DeviceNet messages	Use FINS command code 28 01.	143
Initial startup	Setting node addresses for Master Units	Set the DIP switch on the back of the Master Unit.	37, 42
	Setting the baud rate for Master Units	Set the DIP switch on the back of the Master Unit.	38, 42
	Stopping remote I/O communications for communications errors	Set the DIP switch on the back of the Master Unit.	38, 42
	Holding Slave outputs for communications errors	Set the DIP switch on the output Slave.	See note 1.
	Automatically stopping remote I/O communications at startup	Disable starting remote I/O communications at startup in the Master parameters from the Configurator.	See note 2.
	Branching three drop lines from the same point on the trunk line	Use a T-branch Tap.	14

Task		Method	Page
System operation	Stopping remote I/O communications	Use with the software switches or Configurator.	212
	Enabling the scan list for remote I/O communications when using default allocations	Turn ON bit 0 of the software switches to enable the scan list.	212
	Disabling the scan list for remote I/O communications when using default allocations	Turn ON bit 1 of the software switches to clear the scan list.	212
	Checking whether a scan list was created by the Configurator	Use a Programming Device to monitor scan list registration via Configurator in Master Status Area 2.	215
	Checking whether or not an error history has been generated in a Master Unit	Use a Programming Device to monitor error history generation in Master Status Area 2.	215
	Monitoring error histories in Master Units	Monitor the error histories from the Configurator.	See note 2.
	Monitoring Master Unit status	Monitor the Master status from the Configurator.	See note 2.
	Saving the scan list data for a connected Slave	Save the network configuration under File-Save from the Configurator.	See note 2.
	Checking the current communications cycle time	Use a Programming Device to monitor the current communications cycle time in the status area.	219
	Adjusting the communications cycle time	Set the communications cycle time in the Master parameters from the Configurator.	See note 2.
	Replacing a Master Unit	After replacing the Master Unit, turn ON bit 1 in the software switches to check Slave connection and then turn ON bit 0 in the software switches to enable the scan list.	212, 272

Note
1. Refer to the *CompoBus (DeviceNet) Slaves Operation Manual* or the *CompoBus/D (DeviceNet) MULTIPLE I/O TERMINAL Operation Manual*.
2. Refer to the *CompoBus/D Configurator Operation Manual*.

2-2 System Configurations

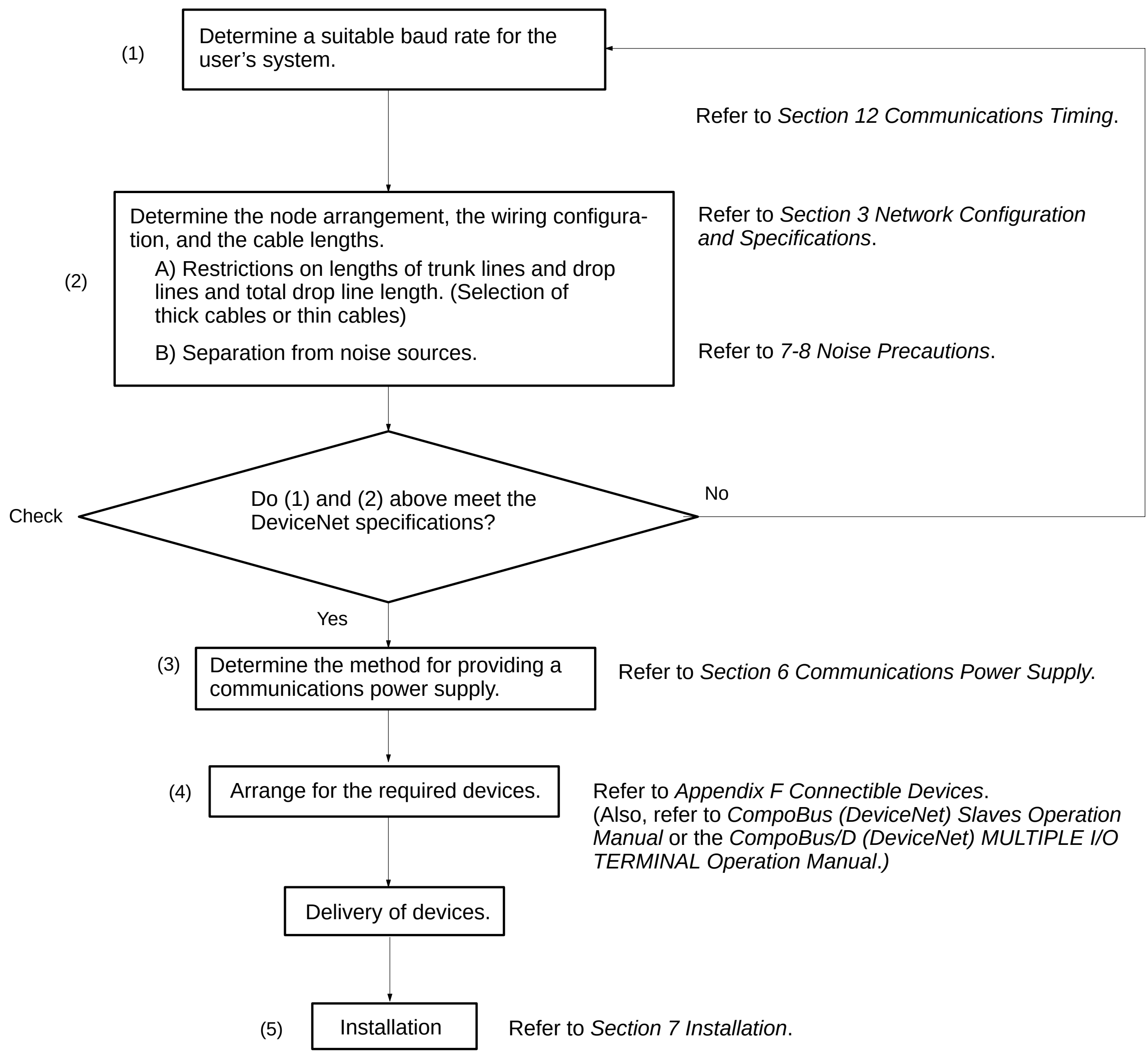
The following patterns can be used in the DeviceNet network configuration.

Pattern type	One Master per network	More than one Masters per network	More than one Master per PC
Form			
Configurator	Not needed if default allocations are used	Required	
Remote I/O Communications			
Default	Yes	No	No
User-set (Configurator required)	Yes 	Yes 	Yes 
Characteristics	Same as previous version.	The communications cycle time will be increased. (The cycle time will be the sum of the individual cycle times that would be required if the network was divided into separate networks with one Master each.)	The cycle time of the PC will be increased.
Precautions	Same as previous version.	Refer to page 25 for precautions on using more than one Master in the same network. Each Slave must belong to only one Master. If there is more than one Master with the scan lists disabled in the same network, communications can stop due to too much traffic on the network (Bus Off).	Do not allocate the same PC memory area words to more than one Master.

2-3 Basic Operating Procedures

2-3-1 Flowchart

The following flowchart outlines the basic flow of operations for setting up the DeviceNet system.



2-3-2 Hardware Preparations

1, 2, 3...

1. Set the initial settings for the Master Unit:

   Unit number ("UNIT No." or "MACHINE No." on front panel switch)
   Node address (back panel DIP switch)
   Baud rate (back panel DIP switch)
   Communications continue/stop setting for communications error (front panel switch)

2. Set the initial settings for the Slaves**:**

   Node address (DIP switch)
   Baud rate (DIP switch)
   Etc.

3. Mount the Master Unit and wire the Network.

   For CVM1 and CV-series PCs, Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack. Only one Master Unit can mounted if a Configurator is not used, but up to 16 Master Units can be mounted if a Configurator is used.

   For C200HX/HG/HE PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 or 16 Master Units can be mounted if a Configurator is used.

   For CS1-series PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 16 Master Units can be mounted if a Configurator is used.

   For C200HS PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 Master Units can be mounted if a Configurator is used.
4. Connect a Programming Device to the PC and turn ON the power supply to the PC.
5. Generate the I/O table.

2-3-3 Setting Up Communications

Remote I/O Communications with One Master Unit in the Network

Using Fixed I/O Allocations

1, 2, 3...

1. Turn ON the power supply to the Slaves and turn ON the communications power supply.
2. Turn ON the power supply to the PC (i.e., to the Master Unit).
3. Switch the PC to PROGRAM mode.
4. Perform the following and go to step 7. if the scan list was disabled at startup.
   a) Confirm that communications are possible with the registered Slaves by monitoring the Registered Slave Data Area.
   b) From a Programming Device connected to the PC, turn ON the Scan List Enable Bit in the software switches (bit 0).

   Remote I/O communications will start with the scan list enabled. You can use the software switches to start and stop remote I/O communications.
5. Perform the following from a Programming Device connected to the PC and go to step 7., if the scan list was disabled at startup and you want to re-register it.
   a) Turn ON the Scan List Clear Bit in the software switches (bit 1).
   b) Confirm that communications are possible with the registered Slaves by monitoring the Registered Slave Data Area.

   Remote I/O communications will start with the scan list enabled. You can use the software switches to start and stop remote I/O communications.

   c) Turn ON the Scan List Enable Bit in the software switches (bit 0).
6. Do nothing if the scan list was enabled at startup and you do not want to change it.

   Remote I/O communications will start with the scan list enabled. You can use the software switches to start and stop remote I/O communications. Go to step 7.
7. Confirm that the MS and NS indicators on all Master Units and Slaves are lit.
8. Switch the PC to RUN mode.

Note The dots on the 7-segment display on the Master Unit can be used to determine if the scan list is enabled or disabled. If both the right and left dots are not lit, the scan list is enabled. If both dots are lit, the scan list is disabled.

Using User-set I/O Allocations

1, 2, 3...

1. Connect a Configurator to the Network.
2. Turn ON the power supply to the Slaves and turn ON the communications power supply.
3. Turn ON the power supply to the PC (i.e., to the Master Unit).
4. Switch the PC to PROGRAM mode.
5. Create the Master parameters with the Configurator.
6. Register the Master parameters in the Master Unit.

   Remote I/O communications will start with the scan list enabled. (Communications will not start at if they have been set to be stopped at startup from the Configurator.) Use the software switches or Configurator to start and stop remote I/O communications.
7. Confirm that the MS and NS indicators on all Master Units and Slaves are lit.
8. Read the Network configuration from the Configurator.
9. Save the Network configuration in a file from the Configurator.
10. Switch the PC to RUN mode.

Remote I/O Communications with More than One Master Unit in the Network

The following procedure can be used only when the scan list is enabled.

1, 2, 3...

1. Connect a Configurator to the network.
2. Turn ON the power supply to all the Slaves.
3. Read the Network configuration from the Configurator.
4. Turn OFF the power supply to all the Slaves.
5. Create the Master parameters for each Master Unit and save the parameters in files.
6. Turn ON the power supply to one PC (i.e., to one of the Master Units).
7. Switch the PC to PROGRAM mode.
8. Read the Network configuration from the Configurator.
9. Read the Master parameter file for the Master Unit that has been turned ON from the Master parameter editing screen.
10. Write the Master parameters.
11. Turn OFF the power supply the PC (i.e., the Master Unit).
12. Repeat the above steps beginning at step 6. for all Master Units.
13. Turn ON the power supply to all Masters and Slaves.

    Remote I/O communications will start with the scan list enabled. (Communications will not start if they have been set to be stopped at startup from the Configurator.) Use the software switches or Configurator to start and stop remote I/O communications.
14. Confirm that the MS and NS indicators on all Master Units and Slaves are lit.
15. Read the Network configuration from the Configurator.
16. Save the Network configuration in a file from the Configurator.
17. Switch the PC to RUN mode.

Note When there are no available node addresses for the Configurator, as is the case when a total of 64 Master Units and Slave Units are used, set up communications based on user-set allocations according to the following procedure.

1, 2, 3...

1. Turn ON the communications power supply.

2. Turn ON the power supply to all the Slaves. (Turn OFF the power supply to all the Masters.)
3. Connect the Configurator to the network using the node address of one of the Masters.
4. Create the Master parameters for each Master Unit and save the parameters in files.
5. Disconnect the Configurator from the network (i.e., go “off-line”).
6. Turn OFF the power supply to all the Slaves.
7. Turn ON the power supply to all the Masters.
8. Connect the Configurator to the network using the node address of one of the Slaves.
9. Read a Master parameter file from the Configurator.
10. Register the Master parameters read in step 9. in the corresponding Master Unit.
11. Repeat steps 9. and 10. for all Master Units.
12. Disconnect the Configurator from the network.
13. Turn ON the power supply to all the Slaves.
14. Start communications.

Setup When Not Using Remote I/O Communications

1, 2, 3...

1. Create an empty scan list
2. Register the scan list in the Master Unit.
3. Confirm that the MS indictor is lit green and that the NS indicator is flashing green on the Master Unit.
4. Switch the PC to RUN mode.

Starting Remote I/O Communications During Operation

1, 2, 3...

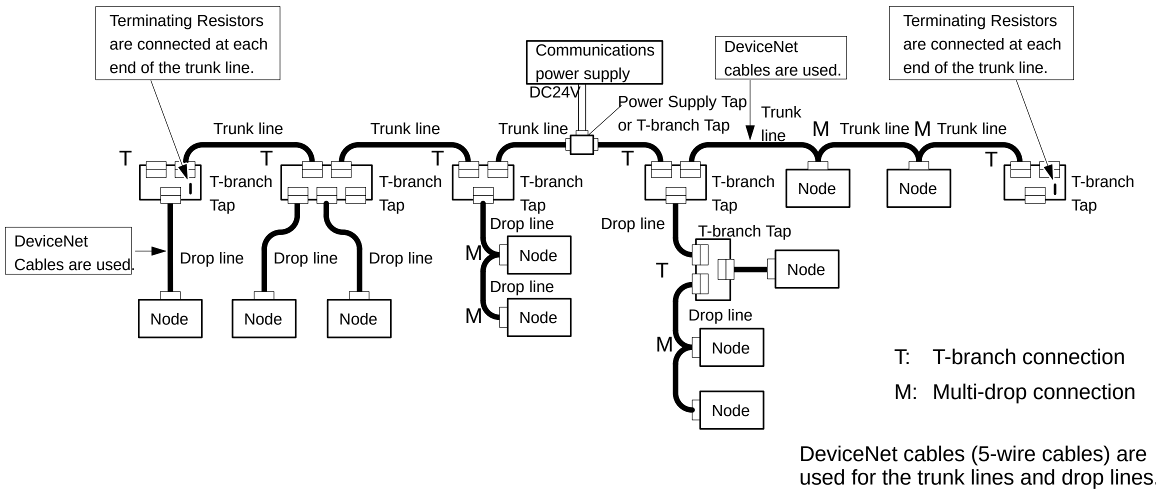
1. Create a scan list.
2. From the Configurator, set remote I/O communications to be stopped at startup.
3. Register the scan list in the Master Unit.
4. Confirm that the MS indictor is lit green and that the NS indicator is flashing green on the Master Unit.
5. Switch the PC to RUN mode.

SECTION 3
Network Configuration and Specifications

This section explains the Network configuration and provides the specifications required for setting up the Network.

3-1 Network Configuration

The following diagram shows the configuration of a DeviceNet (CompoBus/D) network.



3-1-1 Network Components

Nodes

There are two kinds of nodes in a DeviceNet network. The Slaves connect to external I/O and the Master administers the Network and manages the external I/O of the Slaves. The Master and Slaves can be connected at any location in the Network, as shown in the preceding diagram.

Trunk/Drop Lines

The trunk line refers to the cable that has Terminating Resistors on both ends. Cables branching from the trunk line are known as drop lines. The trunk line length does not necessarily coincide with the maximum length of the Network. DeviceNet communications are transmitted through 5-wire cables. The cables come in thick or thin versions.

Connection Methods

Two methods can be used to connect DeviceNet nodes: The T-branch method and the multi-drop method. With the T-branch method, the node is connected to a drop line created with a T-branch Tap. With the multi-drop method, the node is directly connected to the trunk line or the drop line. Secondary branches can be made from a drop line. Both of these connection methods can be used in the same Network, as shown in the example.

Terminating Resistors

Terminating Resistors are connected at each end of the trunk line to reduce signal reflection and stabilize communications. There are two kinds of Terminating Resistors available, one for a T-branch Tap and one for a Terminating-block Terminating Resistor. Use a DeviceNet cable when connecting a Terminating-block Terminating Resistor.

Communications Power Supplies

To use DeviceNet, connect a communications power supply to the communications connector of each node with a 5-wire cable. Basically, a communications power supply, internal circuit power supply, and I/O power supply must be provided separately. Refer to *Section 7 Installation*.

Note
1. Always use DeviceNet cables.
   The newly developed 5-wire cables are now recommended instead of conventional 3-wire cables. The 5-wire cables are more suitable for DeviceNet and easier to use. Refer to *5-1 Cables and Connectors* for details on how to add 5-wire cables to an existing network constructed with 3-wire cables.

2. Connect Terminating Resistors to both ends of the trunk line. When using a Terminating-block Terminating Resistor, use a DeviceNet cable to connect the Terminating Resistor. When connecting the Terminating Resistor, insulate the power supply lines that are not being used with vinyl tape to avoid a short-circuit in the cables.
3. Do not use products other than DeviceNet products (for example, a lightning arrester) in the communications path. If other products are used then this could reduce signal reflection and interfere with normal communications.

3-1-2 Connections

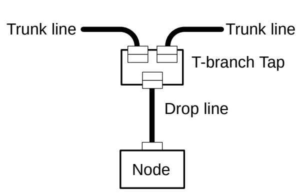
Trunk and Drop Lines

The trunk line is a cable to which Terminating Resistors are connected at the ends. Drop lines are cables that branch from the trunk lines. A special 5-wire cable is used for both the trunk lines and the drop lines.

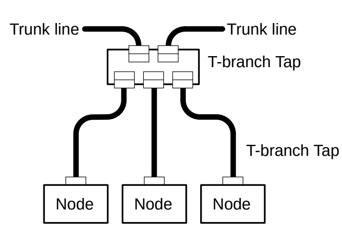
Branching Patterns

Branching Patterns from Trunk Line

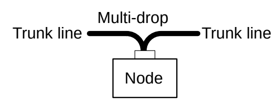
1. One drop line from trunk line



2. Three drop lines (maximum) from trunk line

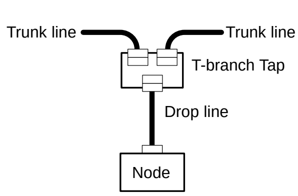


3. Node connected directly to trunk line

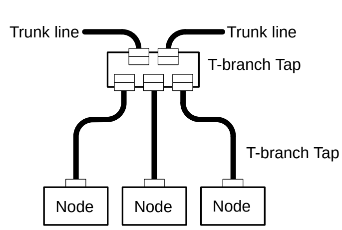


Branching Patterns from Drop Line

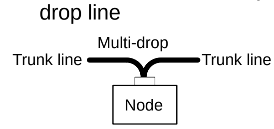
4 One drop line from drop line



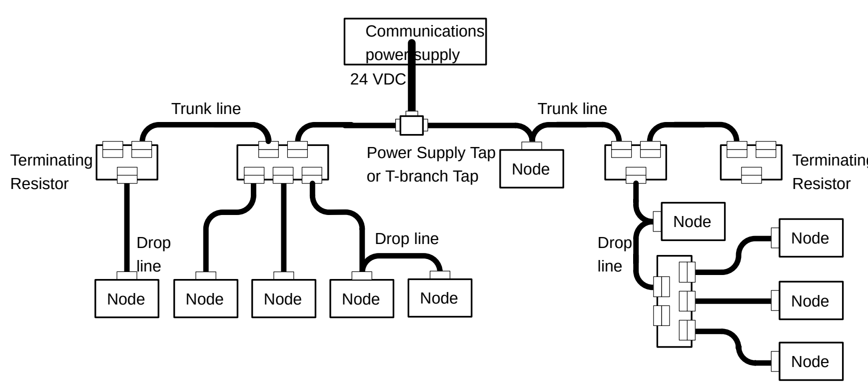
5. Three drop lines (maximum) from drop line



6. Node connected directly to drop line



Various different forms of connection can be used on the same network, as shown in the following diagram. Any number of nodes up to 63 can be connected onto a single drop line.



Note A node can be connected directly to the trunk line with the multi-drop method, but it is easier to connect a node to a drop line.

Note 1. Multi-drop connections with thick cables cannot be used with the connectors supplied with the Unit because the cables are too thick. Use the following connectors for multi-drop connections with thick cables. (For further details, refer to *Section 5 Connectable Devices*.)

XW4B 05C4-T-D (w/o set screw) (made by OMRON)

TMSTB 2.5/5-ST-5.08 AU (w/o set screw) (made by Phoenix Contact)

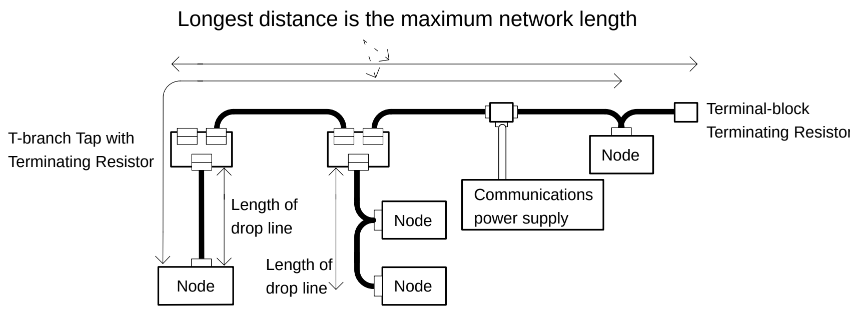
The connector specifications are the same for both cables.
These connectors cannot be used with the Master Unit or CQM1 I/O Link because they may come into contact with the Unit in the adjacent slot. In this case, use a T-branch Tap.

2. When using thick cable, the cable may pull out of the connector depending on the strength of the cable. Follow *7-3 Connecting Communications Cables*, when connecting communications cables.

3-2 Network Configuration Restrictions

3-2-1 Maximum Network Length

The length of the network is longest at either the distance between the two most distant nodes or at the distance between the Terminating Resistors.



There are two types of cables: Thick cables and thin cables. The thick cables are relatively hard and inflexible, but they protect against signal attenuation and can be used for relatively long communications distances. The thin cables are soft and flexible, but they do not protect as well against signal attenuation and are not suited to long communications distances.

The maximum length of a network thus depends on the type of cable that is used, as shown in the following table.

Cable type	Maximum network length
Thick cables (5-wire)	500 m
Thin cables (5-wire)	100 m

Note a) If the length of the network is 100 meters or less, the thin cables can be used for the trunk line. When using thin cables for the trunk line, be sure that communications power supply conditions are met.

b) The length of the network is also restricted by the baud rate used. Even with thick cables, the length of the network will be restricted if the baud rate is set to anything but 125 kbps. Refer to *3-2-4 Baud Rate and Communications Distance*.

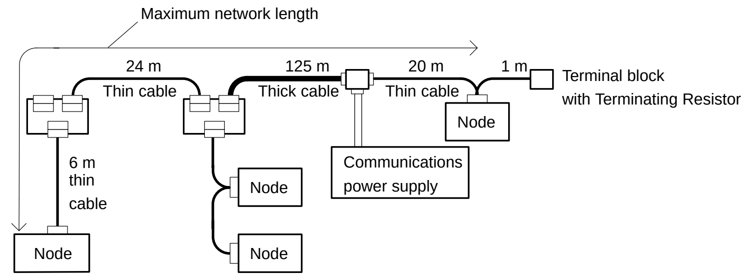
Note **Combining Thick and Thin Cables**

The most distant nodes can also be connected by a combination of thin and thick cables. When these cables are combined, the following conditions must be met and the maximum network length will be shorter than when only thick cables are used. Also, when combining cables, be sure that the maximum current capacity of the cables is not exceeded. Refer to *Section 6 Communications Power Supply.*

Baud rate	Maximum network length
500 kbps	$L_{THICK} + L_{THIN} \leq 100$ m
250 kbps	$L_{THICK} + 2.5 \times L_{THIN} \leq 250$ m
125 kbps	$L_{THICK} + 5 \times L_{THIN} \leq 500$ m

L_{THICK}: Length of the thick cable; L_{THIN}: Length of thin cable

Configuration Example



$L_{THICK} + L_{THIN} = 175 \leq 100$ m	500 kbps	NG
$L_{THICK} + 2.5 \times L_{THIN} = 125 + 2.5 \times 50 = 250 \leq 250$ m	250 kbps	OK
$L_{THICK} + 5 \times L_{THIN} = 125 + 5 \times 50 = 375 \leq 500$ m	125 kbps	OK

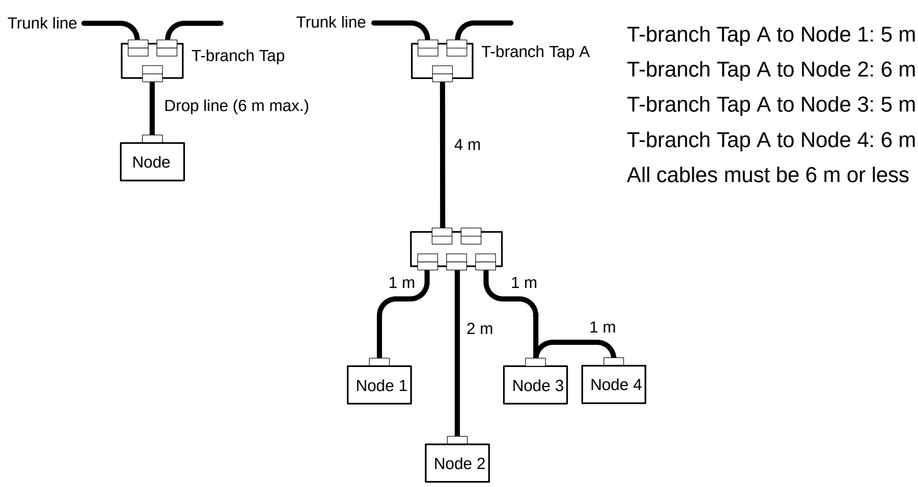
The results of the above formulas indicate that 250 kbps and 125 kbps can be used as the baud rates for this configuration example.

Even when the above conditions are met, however, the current flowing through the cables must not exceed the permissible current capacity. (Refer to *Section 6 Communications Power Supply*.)

3-2-2 Drop Line Lengths

A drop line length is measured from the point in the trunk line where the original branch was made to the end of the branch. The maximum length of a drop line is 6 m. It is possible to make a secondary branch from a drop line.

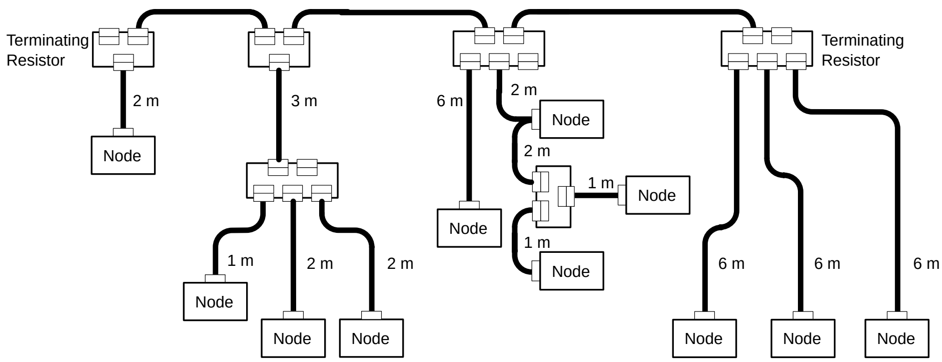
Example



3-2-3 Total Drop Line Length

This is the total sum length of all the drop lines. Even when the length of each individual drop line is 6 m or less, be sure not to exceed the maximum total drop line length. The standard for the total drop line length varies with the baud rate.

Configuration Example



In the configuration example, the length of each drop line is 6 m or less as demanded but the total sum length of all the drop lines is 40 m. Set the baud rate at 250 kbps or 125 kbps because the total maximum length of drop lines at 500 kbps must not exceed 39 m.

3-2-4 Baud Rate and Communications Distance

The communications distance in a DeviceNet network is also restricted by the baud rate, as shown in the following table.

Baud rate	Maximum network length		Drop line length	Total drop line length
	Thick cable	Thin cable		
500 kbps	100 m max.	100 m max.	6 m max.	39 m max.
250 kbps	250 m max.			78 m max.
125 kbps	500 m max.			156 m max.

3-2-5 Locating Terminating Resistors

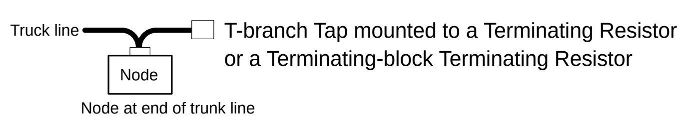
Be sure to connect the Terminating Resistors at both ends of the trunk line to reduce signal reflection and stabilize communications.

When there is a T-branch Tap 6 meters or less from the end of the trunk line (or the node):

> A Terminating Resistor attached to a T-branch Tap can easily be mounted without taking up much space.

When there is not a T-branch Tap 6 meters or less from the end of the trunk line (or the node):

> A Terminating Resistor must be connected before that point. Either a T-branch Tap mounted to a Terminating Resistor or a Terminating-block Terminating Resistor can be used. In this case, be sure to make the cable length 1 m or less from the node to the Terminating Resistor.



SECTION 4
Master Unit Specifications

This section provides Master Unit specifications and describes their components, indicators, switch settings, etc.

4-1 Overall Specifications

<table>
<tr><th colspan="2">PC</th><th>CVM1 and CV Series</th><th>CS1 Series</th><th>C200HX/HG/HE</th><th>C200HS</th></tr>
<tr><td colspan="2">Master model number</td><td>CVM1-DRM21-V1</td><td colspan="3">C200HW-DRM21-V1</td></tr>
<tr><td rowspan="2">Max. No. of Master Units mountable</td><td>With Configurator</td><td colspan="4">1</td></tr>
<tr><td>Without Configurator</td><td>16</td><td>16</td><td>CPU Units with more than 880 I/O points: 16
CPU Units with less than 881 I/O points: 10</td><td>10</td></tr>
<tr><td colspan="2">Master Unit mounting position</td><td>CPU Rack or Expansion CPU Rack (classified as CPU Bus Unit)
Cannot be mounted to Expansion I/O Rack, or to SYSMAC BUS or SYSMAC BUS/2 Slave Racks.</td><td colspan="3">CPU Rack or Expansion CPU Rack (classified as CPU Bus Unit)
Cannot be mounted to Expansion I/O Rack, or to SYSMAC BUS or SYSMAC BUS/2 Slave Racks.</td></tr>
<tr><td rowspan="2">Communications supported</td><td>Remote I/O</td><td colspan="4">Supported</td></tr>
<tr><td>Messages</td><td colspan="3">Supported</td><td>Not supported, but Master Unit will respond to commands addressed to it.</td></tr>
<tr><td rowspan="3">Remote I/O communications</td><td>Max. No. of Slaves per Master Unit</td><td>63</td><td colspan="2">With Configurator: 50
Without Configurator: 63</td><td>With Configurator: 32
Without Configurator: 63</td></tr>
<tr><td>Max. No. of controlled points per Master Unit</td><td>With Configurator: 6,400 pts (100 words x 4 blocks)
Without Configurator: 2,048 pts (64 input/64 output words)</td><td colspan="2">With Configurator:
Without messages: 4,800 pts
With messages: 1,600 pts
Without Configurator: 1,600 pts (50 input/50 output words)</td><td>With Configurator: 1,280 pts
Without Configurator: 1,024 pts (32 input/32 output words)</td></tr>
<tr><td>Max. No. of I/O points per Slave controllable by Master</td><td colspan="4">32 input/32 output words</td></tr>
<tr><td rowspan="2">Message communications</td><td>Max. No. of nodes per Master Unit</td><td>FINS commands: 8
Explicit messages: 63</td><td colspan="2">FINS commands: 8
Explicit messages: 63</td><td>Not supported.</td></tr>
<tr><td>Instructions used</td><td>Data send/receive: SEND(192)/RECV(193)
FINS commands: CMND(194)</td><td colspan="2">Data send/receive: None
FINS commands: IOWR</td><td>Not supported.</td></tr>
<tr><td colspan="2">Software switches</td><td colspan="4">1 word (scan list register/clear, remote I/O communications start/stop, etc.)</td></tr>
<tr><td colspan="2">Status</td><td colspan="4">11 words (status data area, registered Slave data, normal Slave data, current communications cycle time)</td></tr>
</table>

PC	CVM1 and CV Series	CS1 Series	C200HX/HG/HE	C200HS
Settings	Rotary switch: Unit number Back panel DIP switch: Node address Front panel DIP switch: Baud rate, Continue/stop communications for communications errors			
Displays	2-color indicators: Two (Unit status and Network status) 7-segment display: One (Node address and error codes) Dot indicators: Two (Registered scan list enable/disable)			
Voltage of communications power supply	24 VDC ±10% (supplied via special cable)			
Current consumption	Communications power supply: 45 mA max. (from communications connector) Internal I/O power supply: 250 mA at 5 VDC max. (from PC)			
Weight	360 g	250 g		

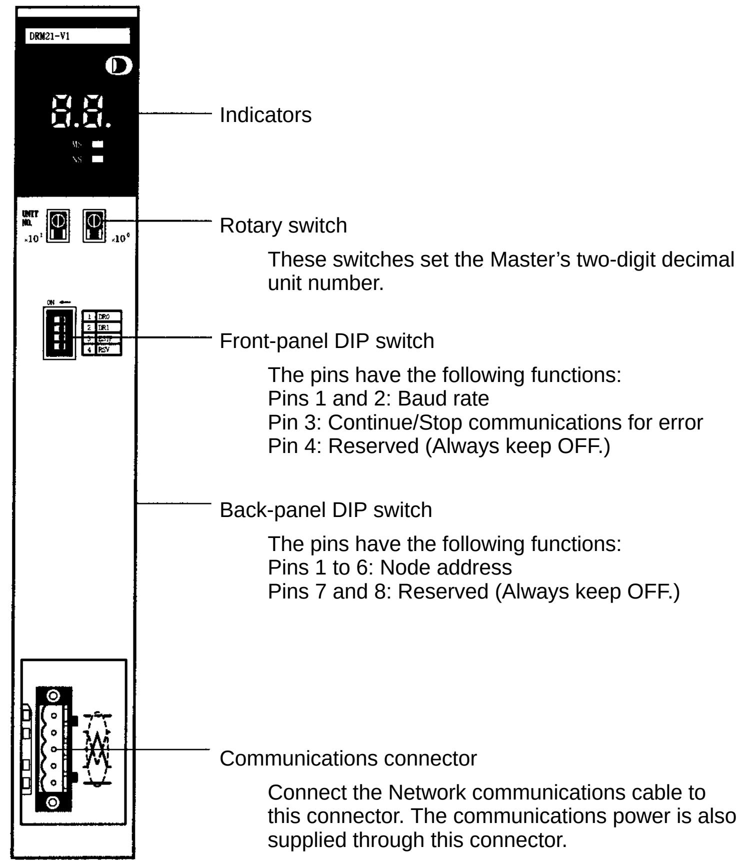
4-2 CVM1 and CV-series PCs

Specifications

Item	Specification
Master Unit model number	CVM1-DRM21-V1
Communications power supply voltage	11 to 25 VDC (Supplied from the communications connector.)
Current consumption	Communications power: 45 mA max. (24 VDC)
	Internal circuits: 250 mA max. (5 VDC) (Supplied from the PC.)
Weight	360 g
General specifications	Conform to CVM1 and CV Series specifications.

Master Unit Components

The following diagram shows the main components of the Master Unit. The functions of these components are described below.



Indicators

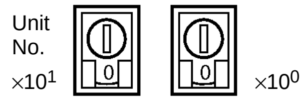
The indicators indicate the status of the Master Unit and Network. When the Network is operating normally, the 7-segment display shows the Master Unit's node address; when an error has occurred, it shows an error code or the faulty node's node address.

The indicators and 7-segment display can be used together to troubleshoot errors. Refer to *15-1 Indicators and Error Processing* for more details.

Indicator	Color	Status	Meaning
MS	Green	ON	The Unit is operating normally.
		Flashing	Switch settings are being read.
	Red	ON	A fatal error (Unit hardware error) has occurred.
		Flashing	A non-fatal error, such as a switch setting error, has occurred.
	---	OFF	The Master Unit's power is OFF, it is resetting, or it is waiting to start initialization.
NS	Green	ON	Normal Network status (Communications connection established.)
		Flashing	The Network is normal, but the communications connection isn't established.
	Red	ON	A fatal communications error has occurred. A node address duplication or Bus Off error was detected. (These errors make communications impossible.)
		Flashing	A non-fatal communications error (a communications error in a Slave) has occurred.
	---	OFF	A Network error has occurred. For example, the Master is the only node in the Network.

Rotary Switches

The Master Unit's two-digit decimal unit number is set with the rotary switches on the front of the Unit. The setting range is 00 to 15.



The left switch sets the 10's digit and the right switch sets the 1's digit. Any unit number from 00 to 15 can be set as long as it hasn't been set on another CPU Bus Unit connected to the PC. Use a small flat-blade screwdriver to turn the rotary switches; be careful not to damage the switch.

Note Always turn OFF the PC before changing the unit number setting.

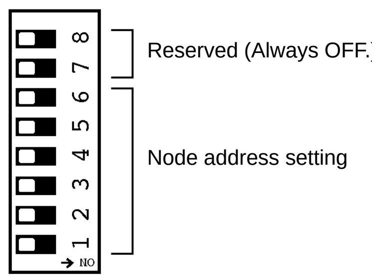
The Master Unit is shipped with the unit number set to 00.

The unit number setting determines which words in the PC's CPU Bus Unit Area are allocated to the Master Unit.

If the same unit number is used for the Master and another CPU Bus Unit, a duplicate number error will occur in the PC and it won't be possible to start up the DeviceNet (CompoBus/D) network.

Rear-panel DIP Switch

The Master Unit's node address setting is made in binary with pins 1 through 6 of the DIP switch on the rear of the Master Unit.



Pins 1 through 6 represent binary digits which are 1 when the pin is ON, 0 when the pin is OFF. Any node address from 0 through 63 can be set as long as it hasn't been set on another node (Slave).
(Refer to *Appendix C Node Address Settings Table* for a complete table of DIP switch settings.)

DIP switch setting						Node address
Pin 6	Pin 5	Pin 4	Pin 3	Pin 2	Pin 1	
0	0	0	0	0	0	0
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
:						:
1	1	1	1	0	0	60
1	1	1	1	0	1	61
1	1	1	1	1	0	62
1	1	1	1	1	1	63

The Master Unit is shipped with the node address set to 0. Since the DIP switch is located on the back of the Master, the Master must be removed from the PC in order to change the node address setting. Be sure to set the node addresses before assembling the Network.

Pins 7 and 8 are reserved for system use. Leave these pins set to OFF (0).

It won't be possible to start up the DeviceNet network if the same node address is used for the Master and another node (node address duplication error).

Note Always turn OFF the PC before changing the DIP switch settings.

Front-panel DIP Switch

The DIP switch on the front of the Master Unit is used to set the baud rate and whether communications will be continued or stopped when a communications error occurs.

The settings of the DIP switch pins are shown in the following table. All pins are set to OFF at the factory.

Pin	Function	Setting
1	Baud rate	See the next table.
2		
3	Continue/stop remote I/O communications for communication errors	OFF: Continue communications ON: Stop communications
4	Reserved	Leave this pin set to OFF.

Pins 1 and 2 are used to set the baud rate as shown in the following table.

Pin 1	Pin 2	Baud rate
OFF	OFF	125 kbps
ON	OFF	250 kbps
OFF	ON	500 kbps
ON	ON	Not allowed. (This setting causes an “incorrect switch setting” error.)

Note Set the same baud rate on all of the nodes (Master and Slaves) in the Network. Any Slaves with baud rates different from the Master's rate won't be able to participate in communications.

Pin 3 is used to set the whether or not communications will stop after a communications error.

Pin 3	Function
OFF	Continue communications.
ON	Stop communications.

If pin 3 is ON, remote I/O communications will be stopped if a transfer error, transmission timeout, or Network power supply error occurs. Remote I/O communications will remain stopped even if the error is cleared until the Clear Communications Error Stoppage Bit is turned ON. (Message communications will continue.) Refer to page 214 for details.

If pin 3 is OFF, remote I/O communications will stop if a transmission timeout or Network power supply error occurs, but will restart automatically when the cause of the error is cleared.

Note
1. Always turn OFF the PC before changing the DIP switch settings.
2. The 7-segment display will show “A0” when remote I/O communications stop.

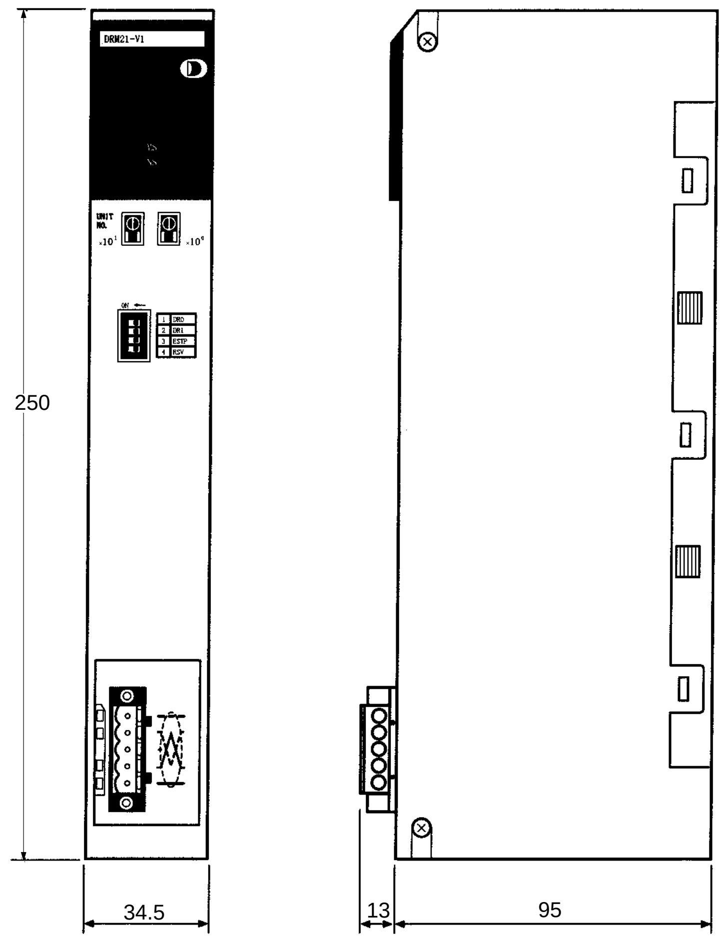
Limitations on Master Unit Mounting

The CVM1/CV-series DeviceNet Master Units are classified as CPU Bus Units. When using a CVM1-BC053/BC103 Backplane, be sure to mount the Unit in a slot that can be used for CPU Bus Units.

Note CVM1/CV-series DeviceNet Master Units can be used at the same time as SYSMAC BUS and SYSMAC BUS/2 Master Units without using a Configurator.

Dimensions

The following diagram shows the dimensions of the CVM1/CV-series Master Unit. Refer to the *CV-series PCs Installation Guide* for the dimensions of the Unit when it is mounted to the Backplane. (All dimensions are in mm.)



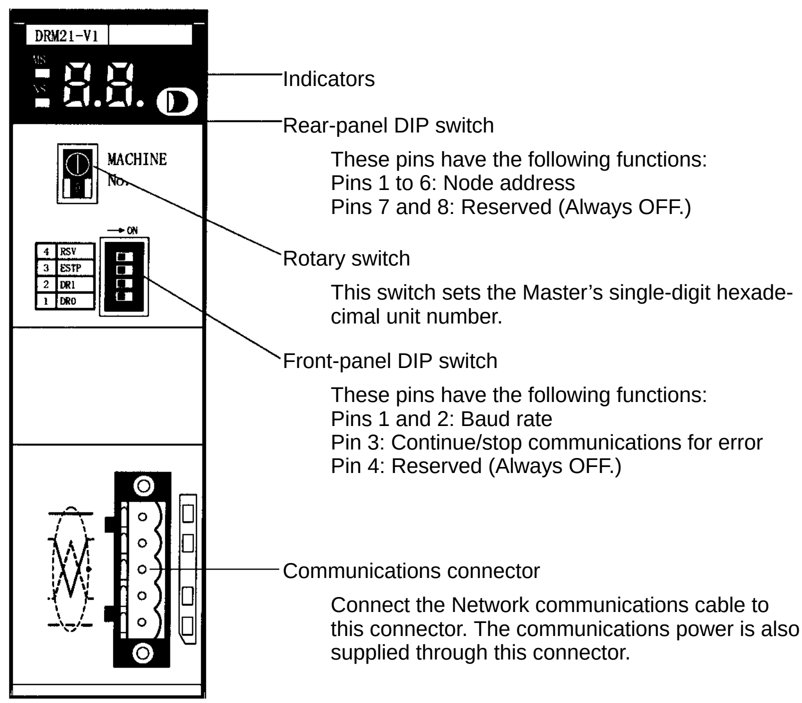
4-3 CS1-series, C200HX, C200HG, C200HE, and C200HS PCs

Specifications

Item	Specification
Master Unit model number	C200HW-DRM21-V1
Communications power supply voltage	11 to 25 VDC (Supplied from the communications connector.)
Current consumption	Communications power: 45 mA max. (24 VDC)
	Internal circuits: 250 mA max. (5 VDC) (Supplied from the PC.)
Weight	250 g
General specifications	Conform to C200HX, C200HG, C200HE, and C200HS specifications.

Master Unit Components

The following diagram shows the main components of the Master Unit. The functions of these components are described below.



__Indicators__

The indicators indicate the status of the Master Unit and Network.

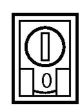
When the Network is operating normally, the 7-segment display shows the Master Unit's node address; when an error has occurred, it shows an error code or the faulty node's node address.

The indicators and 7-segment display can be used together to troubleshoot errors. Refer to *15-1 Indicators and Error Processing* for more details.

Indicator	Color	Status	Meaning
MS	Green	ON	The Unit is operating normally.
		Flashing	Settings are being read.
	Red	ON	A fatal error (hardware error) has occurred.
		Flashing	A non-fatal error, such as a switch setting error, has occurred.
	---	OFF	A hardware error has occurred, the Master Unit's power is OFF, it is resetting, or it is waiting to start initialization.
NS	Green	ON	Normal Network status (Communications connection established.)
		Flashing	The Network is normal, but the communications connection isn't established.
	Red	ON	A fatal communications error has occurred. A node address duplication or Bus Off error was detected. (These errors make communications impossible.)
		Flashing	A non-fatal communications error (a communications error in a Slave) has occurred.
	---	OFF	A Network error has occurred. For example, the Master is the only node in the Network.

Rotary Switch Setting

The Master Unit's one-digit hexadecimal unit number ("MACHINE No.") is set with the rotary switches on the front of the Unit.



The unit number setting range depends on the CPU Unit being used, as shown in the following table.

CPU Unit models	Unit number setting range	Setting method
CS1 Series, C200HX-CPU5□-E/CPU6□-E/CPU8□-E(-Z), C200HG-CPU5□-E/CPU6□-E/CPU8□-E(-Z)	0 to F	Single-digit hexadecimal
C200HX-CPU3□-E/CPU4□-E(-Z), C200HG-CPU3□-E/CPU4□-E(-Z), C200HE, C200HS	0 to 9	

Any unit number in the setting range is allowed as long as it hasn't been set on another Special I/O Unit connected to the PC. Use a small flat-blade screwdriver to turn the rotary switch; be careful not to damage the switch.

Note Always turn OFF the PC before changing the unit number setting.

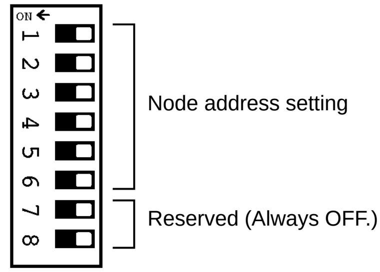
The Master Unit is shipped with the unit number set to 0.

The unit number setting determines which words in the PC's CPU Bus Unit Area are allocated to the Master Unit.

If the same unit number is used for the Master and another Special I/O Unit, an I/O Unit Over error will occur in the PC and it won't be possible to start up the DeviceNet network.

Rear-panel DIP Switch

The Master Unit's node address setting is made in binary with pins 1 through 6 of the DIP switch on the rear of the Master Unit.



Pins 1 through 6 represent binary digits which are 1 when the pin is ON, 0 when the pin is OFF. Any node address from 0 through 63 can be set as long as it hasn't been set on another node (Slave).

(Refer to *Appendix E Node Address Settings Table* for a complete table of DIP switch settings.)

DIP switch setting						Node address
Pin 6	Pin 5	Pin 4	Pin 3	Pin 2	Pin 1	
0	0	0	0	0	0	0
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
:						:
1	1	1	1	0	0	60
1	1	1	1	0	1	61
1	1	1	1	1	0	62
1	1	1	1	1	1	63

The Master Unit is shipped with the node address to 0. Since the DIP switch is located on the back of the Master, the Master must be removed from the PC in order to change the node address setting. Be sure to set the node addresses before assembling the Network.

The Slaves' node addresses can be set from 0 to 49 with C200HX, C200HG, and C200HE PCs or from 0 to 31 with C200HS PCs. The Master's node address can be set from 0 to 63 because it doesn't use any words in the I/O area.

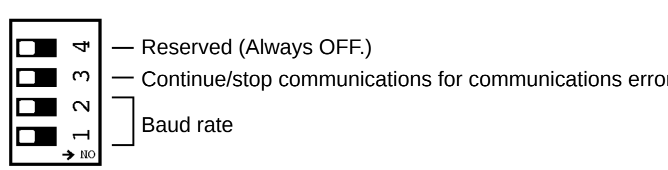
Pins 7 and 8 are reserved for system use. Leave these pins set to OFF (0).

It won't be possible to start up the DeviceNet network if the same node address is used for the Master and another node (node address duplication error).

Note Always turn OFF the PC before changing the DIP switch settings.

Front-panel DIP Switch

The DIP switch on the front of the Master Unit is used to set the communications baud rate and whether communications will be continued or stopped when a communications error occurs.



The settings of the DIP switch pins are shown in the following table. All pins are set to OFF at the factory.

Pin	Function	Setting
1	Baud rate	See the next table.
2		
3	Continue/stop remote I/O communications for communication errors	OFF: Continue communications ON: Stop communications
4	Reserved	Leave this pin set to OFF.

Pins 1 and 2 are used to set the baud rate as shown in the following table.

Pin 1	Pin 2	Baud rate
OFF	OFF	125 kbps
ON	OFF	250 kbps
OFF	ON	500 kbps
ON	ON	Not allowed. (This setting causes an “incorrect switch setting” error.)

Note Set the same baud rate on all of the nodes (Master and Slaves) in the Network. Any Slaves with baud rates different from the Master’s rate won’t be able to participate in communications.

Pin 3 is used to set the whether or not communications will stop after a communications error.

Pin 3	Function
OFF	Continue communications.
ON	Stop communications.

If pin 3 is ON, communications will be stopped if a transfer error, transmission timeout, or Network power supply error occurs. Communications will remain stopped even if the error is cleared until the Clear Communications Error Stoppage Bit is turned ON. Refer to page 214 for details.

If pin 3 is OFF, communications will stop if a transmission timeout or Network power supply error occurs, but will restart automatically when the cause of the error is cleared.

Note Always turn OFF the PC before changing the DIP switch settings.

Memory Overlap with SYSMAC BUS Master Unit (C200HX/HG/HE/HS)

If a Configurator is not used to change the I/O allocations, the data area allocated to DeviceNet Master Units in C200HX, C200HG, C200HE, and C200HS PCs will be the same area as that used by SYSMAC BUS Master Units. A SYSMAC BUS Master and DeviceNet Master Unit cannot be mounted to the same PC unless the I/O allocations for the DeviceNet Master Unit are changed. If the I/O allocations are not changed, the following problems will result:

C200HX, C200HG, and C200HE PCs

An error won’t occur in the PC, but a PC mounting error will occur in the DeviceNet Master Unit and it won’t be possible to use DeviceNet communications.

C200HS PCs

An error won’t occur in the PC or the DeviceNet Master Unit, but both Masters will access the same data area so neither will operate properly.

Note With CVM1 and CV-series PCs, the DeviceNet Master Unit can be used together with SYSMAC BUS and SYSMAC BUS/2 Master Units.

Memory Overlap with Actual I/O (CS1 Series)

With the CS1 Series, the DeviceNet Output Area (CIO 0050 to CIO 0099) is contained inside the I/O Area (CIO 0000 to CIO 0319). For this reason, in systems with a large number of I/O points, where CIO 0050 to CIO 0099 would be allocated to I/O Units, ensure that there is no overlap of area allocation using one of the following methods.

Editing I/O Tables

By editing the I/O tables using the CX-Programmer, it is possible to ensure that actual I/O (for Basic I/O Units) is not allocated to CIO 0050 to CIO 0099.

With automatic allocation (I/O table creation), it is possible that actual I/O is allocated to CIO 0050 to CIO 0099, and so in systems with a large number of I/O points, be sure to edit I/O tables using CX-Programmer. (I/O tables cannot be edited with a Programming Console.)

For details, refer to the *CX-Programmer Operation Manual*.

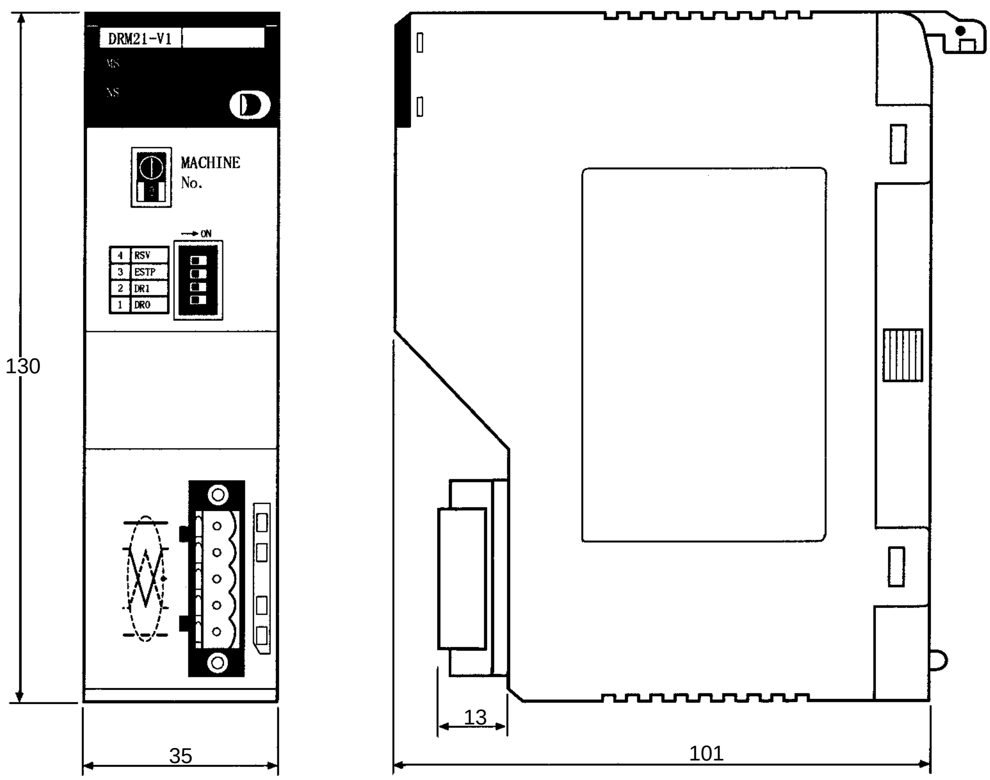
Using the Configurator

By performing user-set allocation using the Configurator, it is possible to change the position of areas used for DeviceNet output. For details, refer to *8-4 User-set Allocations* and the *CompoBus/D Configurator Operation manual* (W328).

Note Attempting to use DeviceNet remote communications I/O functions with the same areas allocated to actual I/O (for Basic I/O Units) and to DeviceNet Slaves may cause I/O Units, the CPU Unit program, or Slaves to malfunction.

Dimensions

The following diagram shows the dimensions of the Master Unit. Refer to the PC's Installation Guide for the dimensions of the Unit when it is mounted to the Backplane. (All dimensions are in mm.)



SECTION 5
Specifications for Connectable Devices

This section provides specifications for the Cables and Connectors used in the DeviceNet network.

5-1 Cables and Connectors

5-1-1 Communications Cables

In the DeviceNet (CompoBus/D) system, special 5-wire cable that conforms to DeviceNet specifications must be used. Cable properties affect DeviceNet communications and non-specified cable cannot be used.

There are two kinds of special cable: Thick cable and thin cable. Select the cable using following the instructions in *Section 2 Application Overview* and *Section 3 Network Configuration and Specifications*.

Contact the following offices for sales and marketing inquiries.

Sales Office for U.S. Markets

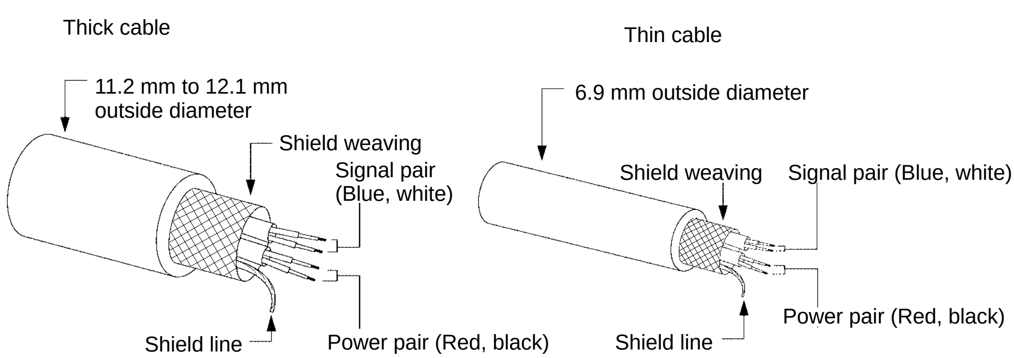
SHOWA ELECTRIC AMERICA INC.
235 Montgomery Street, Suite 1142
San Francisco, CA 94104
Tel No.:+1-415-781-5885
Fax No.:+1-415-781-1561

Sales Office for Asian Markets

SWCC SHOWA (S) PTE, LTD.
65 Chulia Street
#25-05, OCBC Centre
Singapore 049513
Tel No.:+65-5380525
Fax No.:+65-5380565

Liaison Office for European Markets

SHOWA ELECTRIC WIRE&CABLE CO., LTD.
Dusseldorf Office
Am Wehrhahn 33, Wehrhahn Center 40211
Dusseldorf, F.R. Germany
Tel No.:+49-211-350493
Fax No.:+49-211-356651



Showa Electric Cables

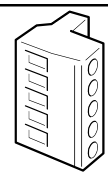
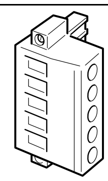
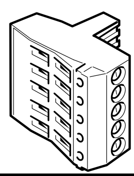
Item	Thick cable		Thin cable	
	Signal wires	**Power wires**	**Signal wires**	**Power wires**
Model number	DCA2-5C10, TDN18 Series		DCA1-5C10, TDN24 Series	
Conductor cross-sectional area	0.86 mm^2	2.17 mm^2	0.20 mm^2	0.38 mm^2
Conductor outer diameter	1.21 mm	1.92 mm	0.60 mm	0.80 mm
Color	Blue, white	Red, black	Blue, white	Red, black
Impedance	120 Ω ±10%	---	120 Ω ±10%	---
Propagation delay	1.36 ns/ft	---	1.36 ns/ft	---
Attenuation factor	500 kHz: 0.25 dB/ft 125 kHz: 0.13 dB/ft	---	500 kHz: 0.50 dB/ft 125 kHz: 0.29 dB/ft	---
Conductor resistance	6.9 Ω/1,000 ft 22.6 Ω/1,000 m	2.7 Ω/1,000 ft 8.9 Ω/1,000 m	28 Ω/1,000 ft 91.9 Ω/1,000 m	17.5 Ω/1,000 ft 57.4 Ω/1,000 m
Maximum current	---	8 A	---	3 A
Finished outer diameter	11.2 to 12.1 mm		6.9 mm	

Allen-Bradley Cables

Item	Thick cable		Thin cable	
	Signal wires	**Power wires**	**Signal wires**	**Power wires**
Model number	1485C-P1-A50		1485C-P1-C150	
Conductor cross-sectional area	0.82 mm^2	1.65 mm^2	0.20 mm^2	0.33 mm^2
Conductor outer diameter	1.17 mm	1.68 mm	0.06 mm	0.79 mm
Color	Blue, white	Red, black	Blue, white	Red, black
Impedance	120 Ω ±10%	---	120 Ω ±10%	---
Propagation delay	1.36 ns/ft	---	1.36 ns/ft	---
Attenuation factor	500 kHz: 0.25 dB/ft 125 kHz: 0.13 dB/ft	---	500 kHz: 0.50 dB/ft 125 kHz: 0.29 dB/ft	---
Conductor resistance	6.9 Ω/1,000 ft 22.6 Ω/1,000 m	3.6 Ω/1,000 ft 11.8 Ω/1,000 m	28 Ω/1,000 ft 91.9 Ω/1,000 m	17.5 Ω/1,000 ft 57.4 Ω/1,000 m
Maximum current	---	8 A	---	3 A
Finished outer diameter	11.2 to 12.1 mm		6.9 mm	

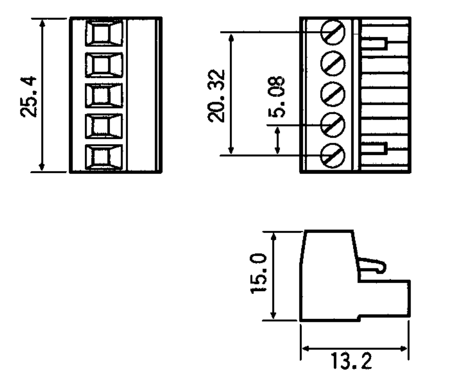
5-1-2 Connectors

When connecting cables to the Unit or a T-branch Tap, use a removable connector. OMRON cables are provided with connectors. Depending on the connector, it may or may not be equipped with connector set screws. Also, there is a multi-drop wiring connector on the market that facilitates multi-drop wiring. The multi-drop wiring connector cannot be used with Master Units (CVM1-DRM21-V1 and C200HW-DRM21-V1), the CQM1 I/O Link Unit (CQM1-DRT21) and T-branch Taps because they may come into contact with the Unit in the adjacent slot.

Name	Appearance	Model	Comments	Manufacturer
COMBICON Plug		MSTB 2.5/5-ST-5.08 AU	For node connection (no connector set screws)	Phoenix Contact K.K.
COMBICON Plug with Screw Flange		MSTBP 2.5/5-STF-5.08 AB AU SO	For node connection and T-branch Tap connection (with connector set screws)	Phoenix Contact K.K.
COMBICON Plug		TMSTBP 2.5/5-ST-5.08 AU	Used to connect a node via a multi-drop connection	Phoenix Contact K.K.

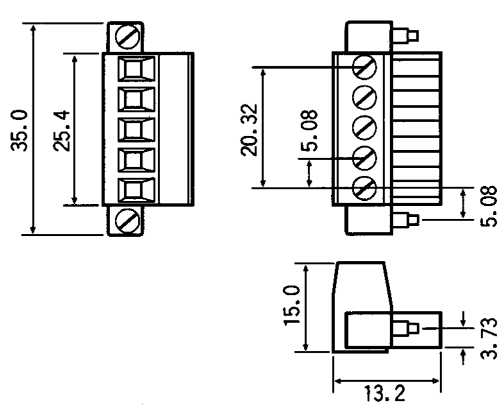
Dimensions

MSTB2.5/5-ST-5.08AU



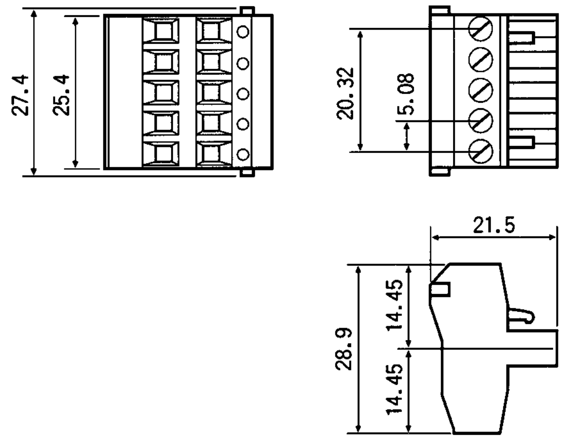
Unit: mm

XW4B-05C1-H1-D



Unit: mm

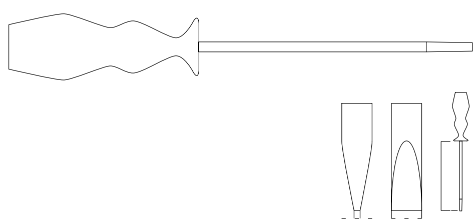
XW4B-05C4-T-D



Unit: mm

5-1-3 Special Connector Screwdriver

Model	Item	Manufacturer
SZF-1	For DeviceNet connectors	Phoenix Contact K.K.



All dimensions are shown in mm.

A	B	C
0.6	3.5	100

5-1-4 T-branch Taps

It is sometimes necessary to connect the Network with a connector attached to a T-branch Tap. There are two kinds of T-branch Taps, one that makes a single branch and another that makes three branches.

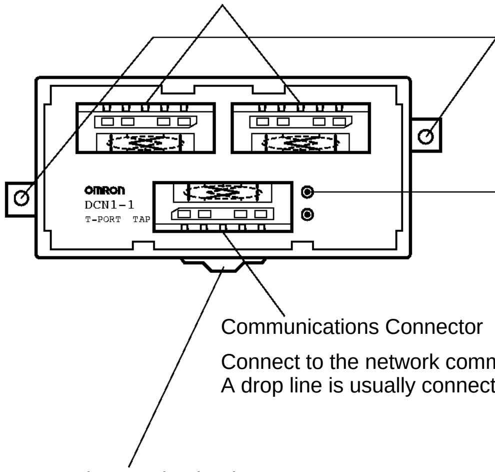
Because the T-branch Tap has a Terminating Resistor socket, a Terminating Resistor can be connected on a trunk line, by installing one of the resistors provided. Also, when the Network is powered by a single power supply and the total current consumption is 5 A or less, a T-branch Tap can be used instead of a Power Supply Tap to connect the communications power supply.

Model	Number of connectors	Comments
DCN1-1C	3 (1 drop line can be connected.)	Three connectors provided. Terminating Resistors can be connected.
DCN1-3C	5 (3 drop lines can be connected.)	Five connectors provided. Terminating Resistors can be connected.

DCN1-1C T-Branch Tap Components

Communications Connector

Connect the network communications cable.
A trunk line is usually connected here.



Mounting screw holes

Used when screwing the Tap to a control panel.

Socket for Terminating Resistor connection

Connect a Terminating Resistor here if the T-branch Tap is installed at the end of the trunk line.

Communications Connector

Connect to the network communications cable.
A drop line is usually connected here.

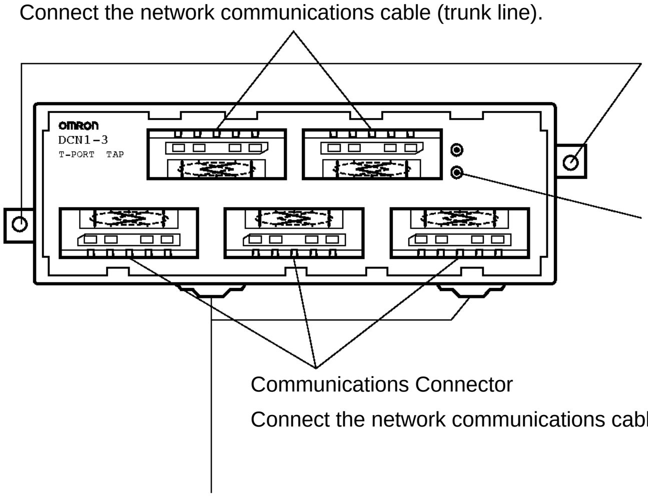
DIN track mounting hooks

Used when mounting the Tap to a DIN track.

DCN1-3C T-Branch Tap Components

Communications Connector

Connect the network communications cable (trunk line).



Mounting screw holes

Used when screwing the Tap to a control panel.

Socket for Terminating Resistor connection

Connect a Terminating Resistor here if the T-branch Tap is installed at the end of a trunk line.

Communications Connector

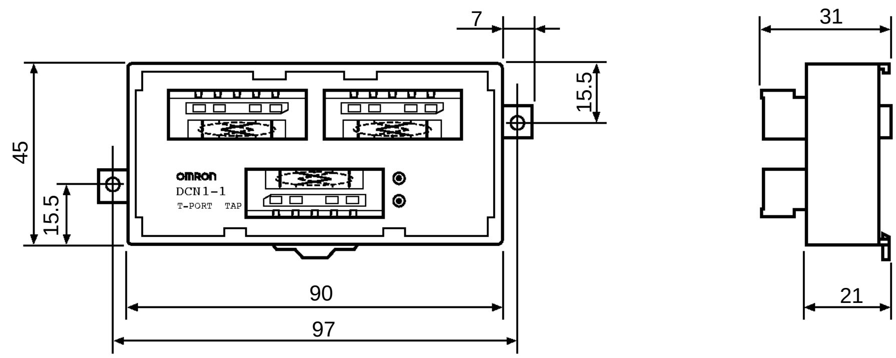
Connect the network communications cable (drop lines).

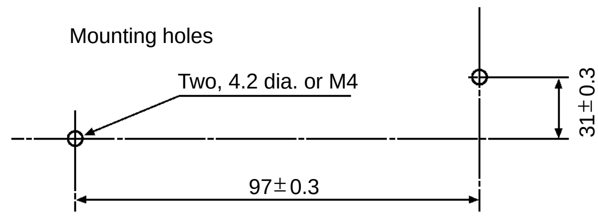
DIN track mounting hooks

Used when mounting the Tap to a DIN track.

DCN1-1C Dimensions

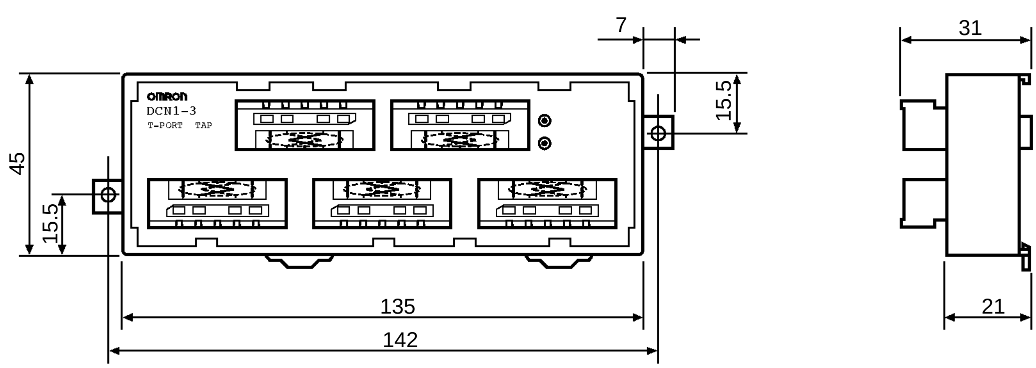
All dimensions are in mm.

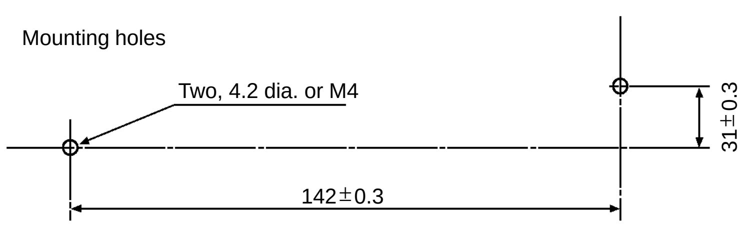




DCN1-3C Dimensions

All dimensions are in mm.

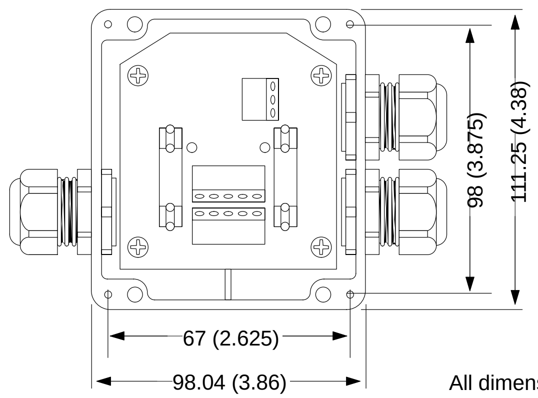




5-1-5 Power Supply Tap

In the DeviceNet system, a communications power supply must be supplied to the Network. When there is one power supply to the Network and the total current consumption is less than 5 A, the communications power supply can be connected by using a general-purpose T-branch Tap instead of a Power Supply Tap. When there is more than one power supply connected to the Network and the total current consumption exceeds 5 A, the communications power supply must be connected with a Power Supply Tap.

Model	Specifications	Manufacture
1485T-P2T5-T5	PowerTap Countercurrent preventive function, ground terminal provided	Allen-Bradley



All dimensions are in mm.

5-1-6 Terminating Resistors

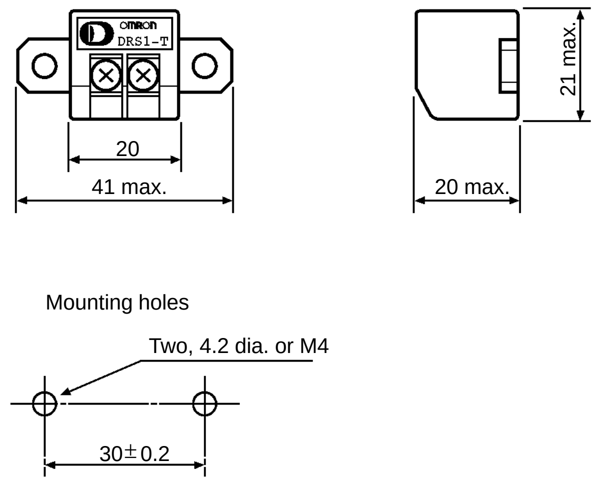
In DeviceNet a Terminating Resistor must be connected to each end of the trunk line. Be sure to connect two Terminating Resistors because the Unit does not have terminal resistors built in.

There are two methods for connecting a Terminating Resistor, one using a special Terminal-block Terminating Resistor and the other installing a resistor on the Terminating Resistor socket of a T-branch Tap. If a resistor is to be installed on a T-branch Tap, be sure to use the Terminating Resistor provided with the T-branch Tap.

Model	Comments
DRS1-T	Terminal-block Terminating Resistor (121 Ω ±1%, 1/4 W)
---	Terminating Resistor provided with T-branch Taps (121 Ω ±1%, 1/4 W)

DRS1-T Terminating Resistor Dimensions

All dimensions are in mm.



Note A Terminating Resistor like the one shown below is included with T-branch Taps.

5-1-7 Communications Power Supply

In the DeviceNet system, a communications power supply must be supplied to the Network that provides an output voltage of 24 VDC ±1% and the AC inputs and DC outputs should be insulated. OMRON S82H-series and S82J-series Power Supply Units are recommended. Select a Power Supply Unit with a permissible current capacity greater than the total power consumption of all nodes to be connected.

Communications Power Supply Specifications

The communications power supply must meet the following specifications.

Item	Specifications
Output voltage	24 VDC ± 1%
Output current	16 A max.
Input fluctuation	0.3% max.
Load fluctuation	0.3% max.
Effect of ambient temperature	0.03% /°C max.
Input voltage	100 to 1,200 V
Input frequency	47 to 450 Hz
Output ripple	250 mV_{p-p}
Output capacity	7,000 µ F max.
Ambient temperature	Operating: 0°C to 60°C Storage: –40°C to 85°C
Max. instantaneous output current	Less than 65 A (peak)
Overvoltage protection	Must be provided.
Overcurrent protection	Must be provided. (max. current: 125%)
Startup time	Must reach 5% of final output voltage within 250 ms.
Startup overshoot	0.2% max.
Insulation	Between output and AC power and between output and chassis ground
Standards	Required: UL Recommended: FCC Class B, CSA, TÜV, and VDE
Ambient humidity	30% to 90% (with no condensation)
Surge current capacity	10% max.

SECTION 6
Communications Power Supply

This section explains the various considerations involved in providing a communications power supply.

6-1 Basic Concept

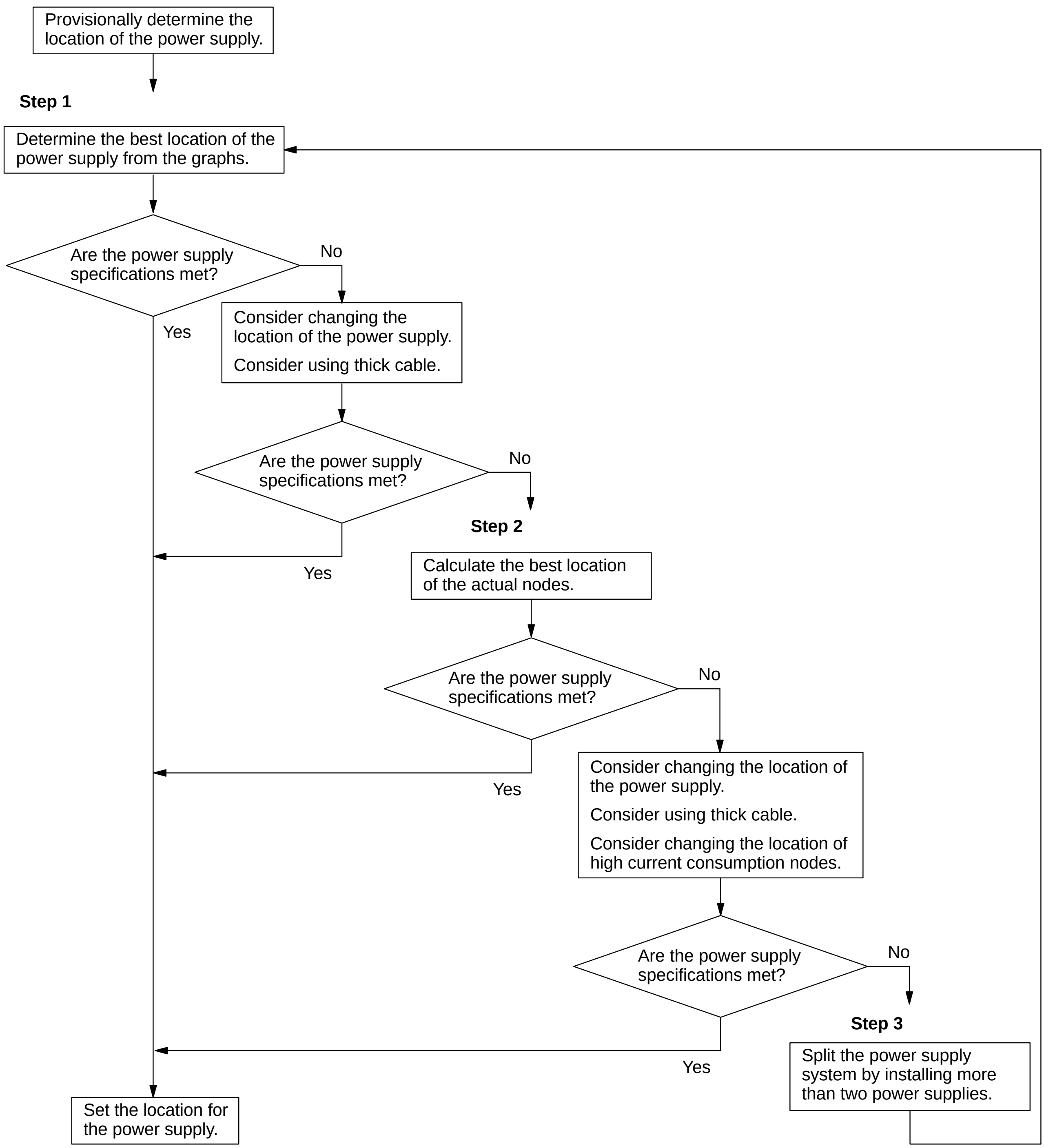
- The communications power supply must be 24 VDC.
- Make sure that the power is supplied from the trunk line.
- When providing power to several nodes from one power supply, if possible try to locate the nodes in both directions from the power supply.
- Provide power through Power Supply Taps. It is, however, possible to use T-branch Taps instead when there is one communications power supply in the system and the total current consumption is less than 5 A.
- The power supply capacity for cables is restricted to 8 A for thick cables and 3 A for thin cables.
- A single network is usually supplied by one power supply. It is, however, possible to have more than one power supply when power supply specifications cannot be met with a single power supply. (See *6-6 Step 3: Splitting the System into Multiple Power Supplies.*)
- Fully consider the power supply capacity allowance in the design.
- If the power supply is switched OFF during the operation of the network, there may be a malfunction in the nodes.
- The current capacity of the drop line varies according to its length. The longer the drop line, the lower its maximum capacity becomes. This is the same whether the cable is thick or thin. Calculate the current capacity passing through the drop line I (the total current consumption at the drop line) using the following formula.

  $I = 4.57/L$ I: Permissible current (A)
  L: Length of the drop line (m)

6-2 Flow Chart

6-2-1 Determining the Communications Power Supply

Use the flow chart below to determine the communications power supply on the trunk line. Satisfy the conditions for each drop line on page 56.



6-3 Locating the Power Supply

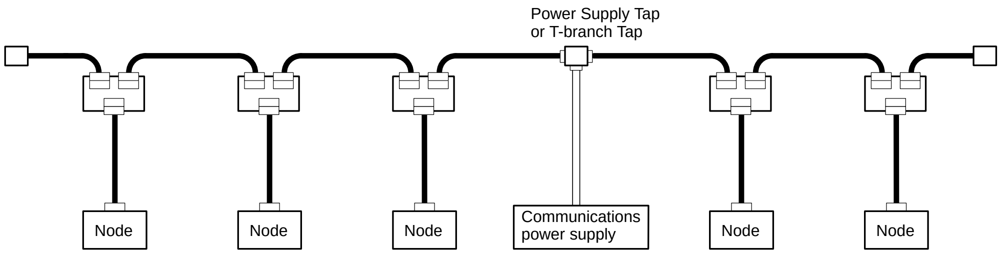
6-3-1 Power Supply Location Patterns

The power supply can be located in the configurations shown below. Basically, select from the configurations 1. and 2.

Consider using configuration 3. when power supply specifications cannot be met by configurations 1. and 2. It is possible to use configuration 4. for a duplex power supply. Refer to sections *6-4* to *6-7* for more details concerning each configuration.

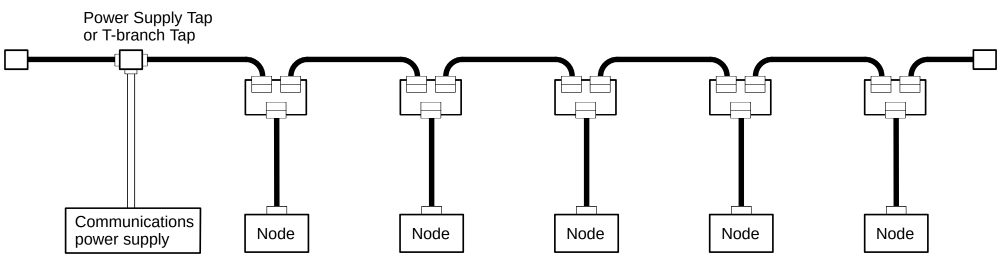
1, 2, 3...

1. **Locating the Nodes on Both Sides of the Power Supply**

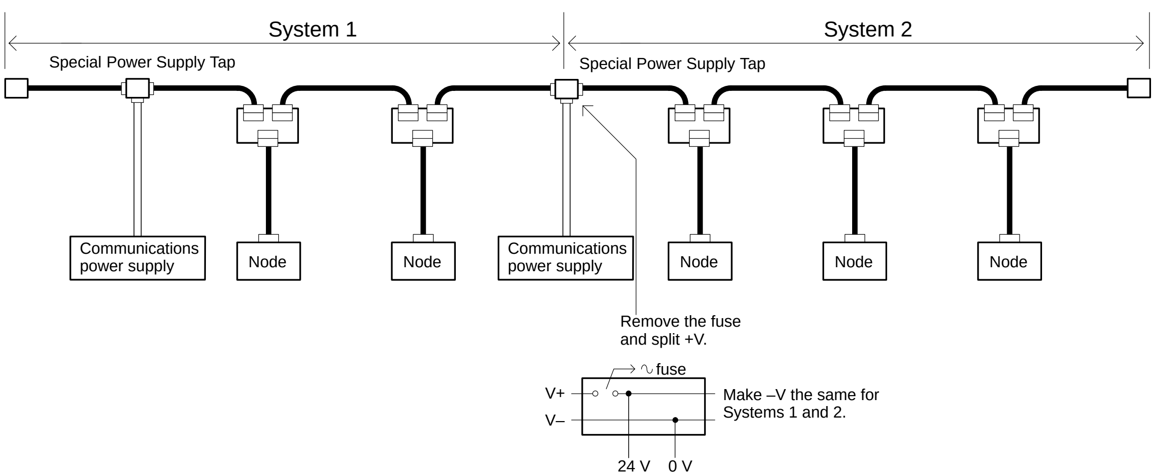


2. **Locating the Nodes on One Side of the Power Supply**

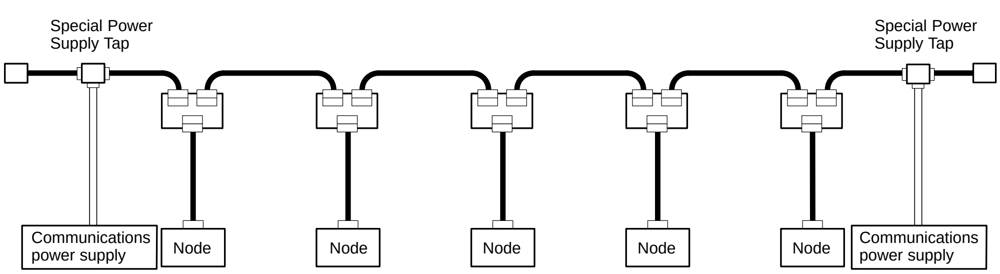
Note Configuration 1. is recommended for a single power supply to several nodes.



3. **Splitting the Power Supply System with Multiple Power Supplies**



4. **Duplex Power Supply with Multiple Power Supplies**



Note If power supply specifications cannot be met with a single power supply when the current capacity of the thick cable exceeds 8 A even after the power supply location is modified, use more than one communications power supply. In configuration 1. the power can be supplied bi-directionally to the trunk line as long as each current capacity is 8 A or less when using thick cable. Accordingly, it is possible to have a configuration with a total maximum current capacity of up to 16 A. Consider changing to thick cable to meet specifications if the current capacity of the thin cable exceeds 3 A when using thin cable for the trunk line.

6-3-2 Setting the Location of the Power Supply

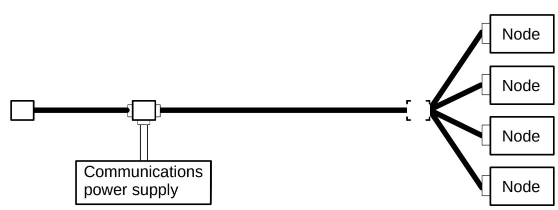
Determine whether or not the current can be supplied normally by finding the current capacity required by each node and the voltage drop in the cables to be used to provide power. Calculate the values below in advance.

- The current capacity required by each node
- The distance between the power supply and each node

6-3-3 Calculating the Location of the Power Supply

There are two methods to find the best location of the communications power supply on the trunk line.

- Simple calculation from a graph
- Calculation by formula (Calculating the voltage drop from resistance and current consumption of the communications cables).
  Each drop line must satisfy the equation on page 56, which represents the relationship between the drop line length and the current capacity for the drop line.
  - From the graph, a hypothetical power supply location can be determined if the conditions calculated in the graph are met by estimating the worst configuration (that has the maximum voltage drop as shown in the diagram below).



  - Even if the power supply specifications cannot be met using the graph, the conditions can be met and a hypothetical power supply location determined by using the formula.

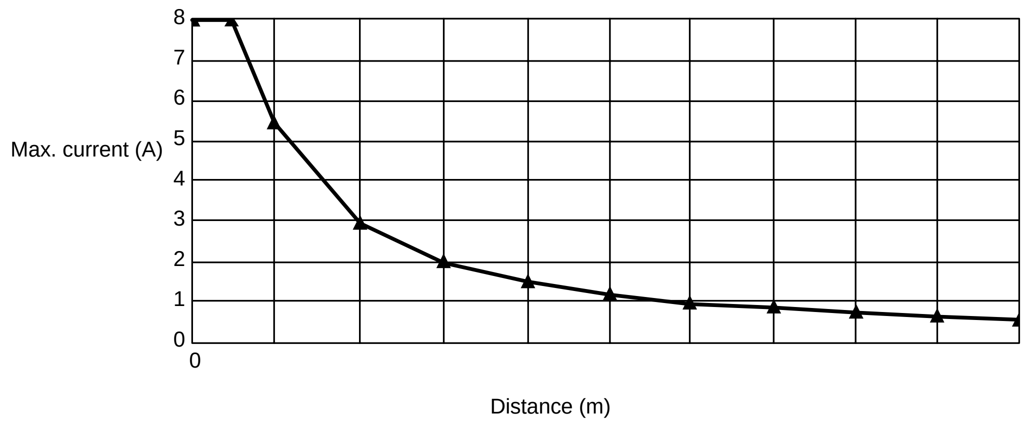
Note When the communications power supply and the internal circuit supply are the same, use the formula to calculate a hypothetical power supply location because it cannot be determined by using the graph.

6-4 Step 1: Determining the Best Location for the Power Supply from a Graph

A voltage drop occurs when a current flows through a communications cable. The longer the communications cable, the greater the voltage drop. The communications power supply at each node must be 11 VDC or more. To ensure this, the relationship is plotted as shown in the graph below to find the maximum current that satisfies the voltage of the communications power supply at different trunk line lengths even if there is a voltage drop due to cable resistance.

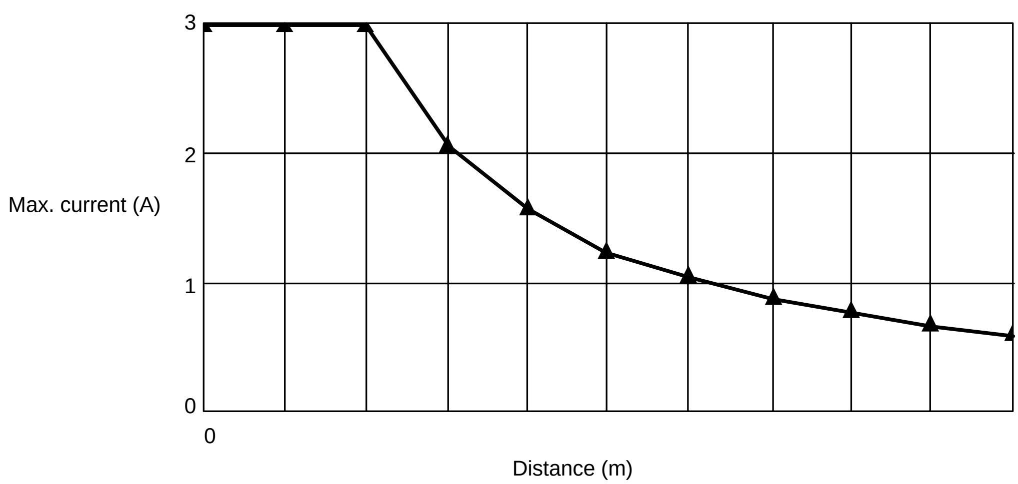
Thick Cable

Distance (m)	0	25	50	100	150	200	250	300	350	400	450	500
Max. current (A)	8.00	8.00	5.42	2.93	2.01	1.53	1.23	1.03	0.89	0.78	0.69	0.63



Thin Cable

Distance (m)	0	10	20	30	40	50	60	70	80	90	100
Max. current (A)	3.00	3.00	3.00	2.06	1.57	1.26	1.06	0.91	0.80	0.71	0.64



6-4-1 Determining the Best Location of the Power Supply from a Graph

Verify the Items 1. to 3. below for each node located in the same direction viewed from the power supply. Therefore, if nodes are located on both sides of the power supply, these items must be verified for all nodes located in each direction.

1, 2, 3...

1. Find A, the total current consumption of all the nodes to which communications power is to be supplied.
2. Using the graph compute B, the maximum current flow in each cable from the power supply to the end of the trunk line according to the types of cables (thick or thin).
3. Compare the values found in steps 1. and 2., above. If the first value (A) is less than the second (B), this shows that power supply specifications are met and power can be supplied to all nodes at any point in the network.

Note Be sure to refer to the correct graph because the maximum current flow is different for thick and thin cables.

6-4-2 Countermeasures

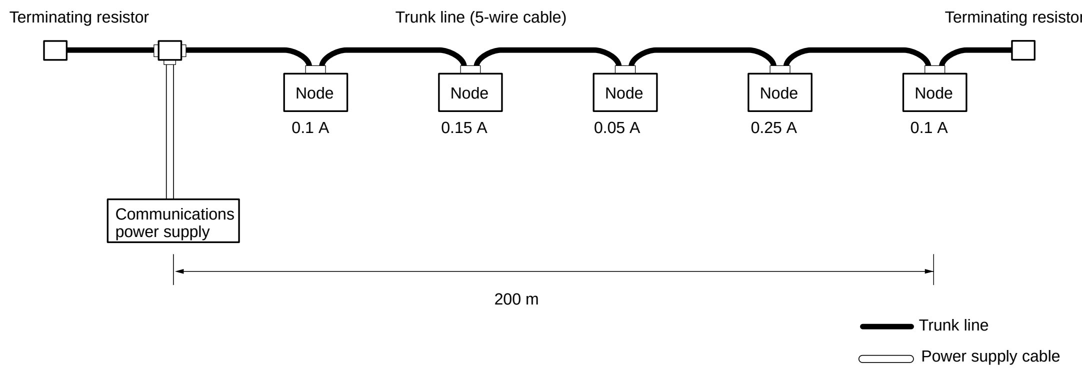
If the second value (B) is less than the first (A), use the following procedure to locate the communications power supply.

- Locate the communications power supply in the center of the network and the nodes to both sides of it.
- If the nodes are already located at both sides of the power supply, move the power supply in the direction that requires the larger current capacity.
- If thin cable is being used, replace it with thick cable.

If, after following the above procedure, B is still less than A, go to Step 2 and determine the actual position of the nodes by the formula calculation method.

Example 1: Communications Power Supply at End of Network

The following example shows a Network that requires power to be supplied for 200 m on thick cable. The power supply is located on the end of the Network. The current consumption for individual nodes is as follows:

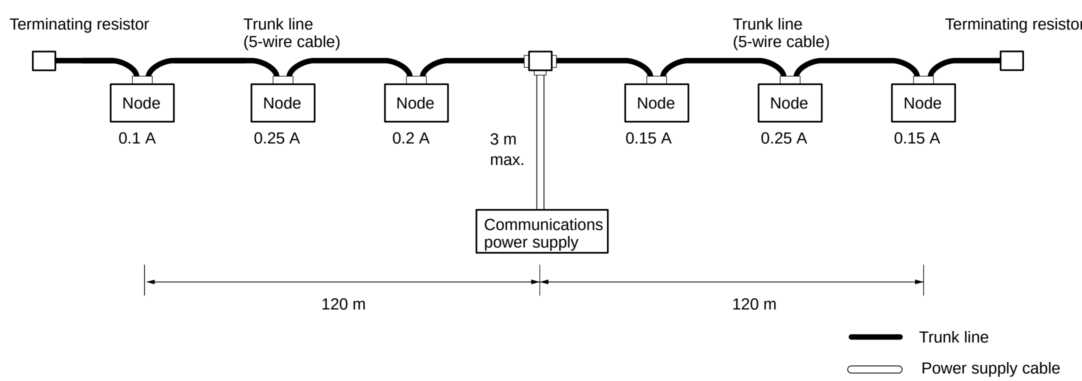


Total power supply length = 200 m
Total current consumption = 0.1 + 0.15 + 0.05 + 0.25 + 0.1 = 0.65 A
Maximum current for thick cable for 200 m (see previous table) = 1.53 A

Because the total current consumption (0.65 A) is less than the maximum current (1.53 A), the power supply can be placed at the end of the network and supply current to all nodes.

Example 2: Communications Power Supply in Center of Network

The following example shows a Network that requires power to be supplied for 240 m on thick cable. The power supply is located in the center of the network. Because the power supply is in the center, the maximum current will flow both to the left and to the right, enabling the supply of at least twice the maximum current as when the power supply is placed on the end of the network. The current consumption for individual nodes is as follows:

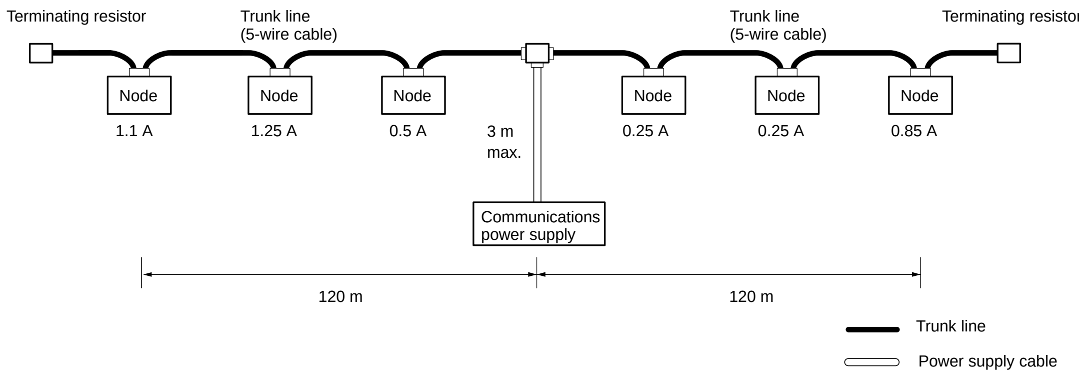


Total power supply length on left = Total power supply length on right = 120 m
Total current consumption on left: 0.1 + 0.25 + 0.2 = 0.55 A
Total current consumption on right: 0.15 + 0.25 + 0.15 = 0.55 A
Maximum current for the left side of the thick cable (see previous table) = approx. 2.5 A
Maximum current for the right side of the thick cable (see previous table) = approx. 2.5 A
(using straight line approximation between 100 to 150 m)

Because the total current flow (0.55 A) is less than the maximum current (approx. 2.5 A) on both the left and the right sides, the power supply can be placed at the center of the network and provide power to all nodes.

Example 3: Uneven Current Consumption on Left and Right

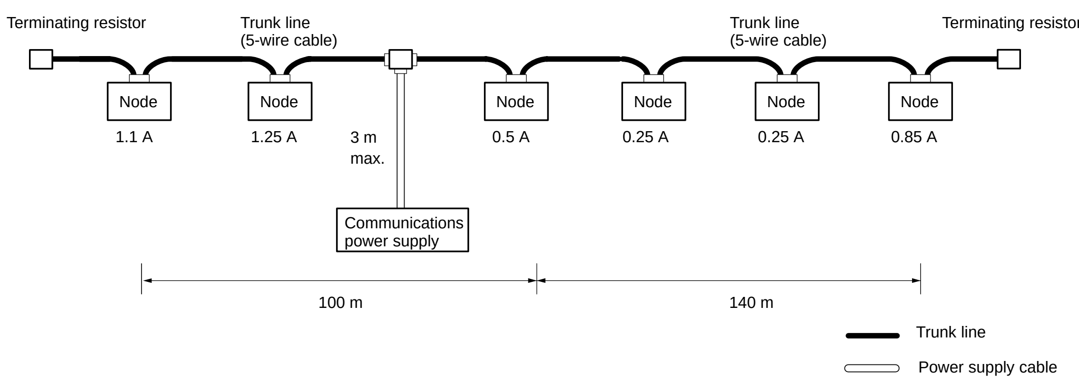
The following example shows a Network that requires power to be supplied for 240 m on thick cable. The power supply must be located off the center of the Network. Because the current consumption is not the same on the left and right sides of the Network, the current flow to one side will be insufficient if the power supply is connected in the very center of the Network. Placing it off center just a little allows power to be supplied to all nodes.



Total power supply length on left = Total power supply length on right = 120 m
Total current consumption on left: 1.1 + 1.25 + 0.5 = 2.85 A
Total current consumption on right: 0.25 + 0.25 + 0.85 = 1.35 A
Maximum current for thick cable for 120 m (see previous table) = approx. 2.5 A (using straight line approximation between 100 to 150 m)

Because the total current flow on the left side (2.85 A) is greater than the maximum current on the left side (2.56 A), the power supply cannot be placed at the center of the network and supply current to all nodes.

This problem can be corrected by moving the communications power supply as shown in the following diagram.



Total power supply length on left = 100 m
Total power supply length on right = 140 m
Total current consumption on left: 1.1 + 1.25 = 2.35 A
Total current consumption on right: 0.5 + 0.25 + 0.25 + 0.85 = 1.85 A
Maximum current for thick cable for 100 m (see previous table) = 2.93 A
Maximum current for thick cable for 140 m (see previous table) = 2.1 A
(using straight line approximation between 100 to 150 m)

Because the total current flow on both the left and right sides is now less than the maximum current, the power supply can be placed as shown in the diagram and supply current to all nodes.

6-5 Step 2: Calculating the Best Location of the Actual Nodes

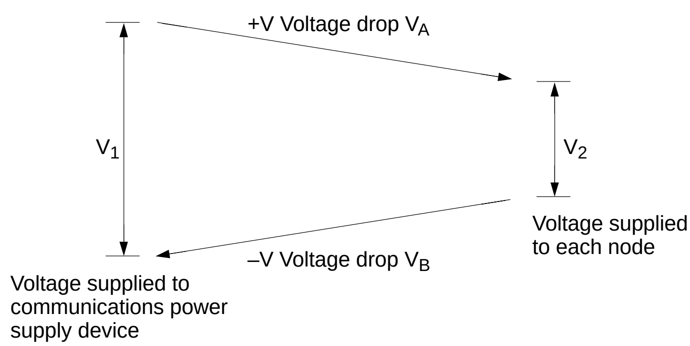
Go to Step 2 if the best location for the power supply cannot be determined from the graphs. The second method calculates the best location for each actual node and does not estimate the worst possible configuration for the power supply.

Basically, in the DeviceNet (CompoBus/D) network the permissible maximum voltage drop within the system can be specified at 5 V for a power supply line (+V or –V), by calculating the specifications for the voltage of the communications power supply (24 VDC) and the input voltage of the communications power supply of each device (11 to 25 VDC).

Of the permissible maximum voltage drop within the system (5 V), the permissible voltage drop in the trunk lines and drop lines are 4.65 V and 0.35 V respectively.

Voltage Drop

In the DeviceNet network the voltage drop at the communications cables, taking the allowance into consideration, is 5 V or less, according to the specifications for the communications power supply device (24 VDC) and communications power supply for each node(11 to 25 VDC).



$V_{1:}$ Voltage supplied to the communications power supply device. Consider the ambient variations of the power supply voltage and take V_1 to be 23 V.

$V_{2:}$ Voltage supplied to each node. Consider the allowance and take V_2 to be 13 V or greater.

$V_{A:}$ Voltage drop at the power supply cables (+V).

$V_{B:}$ Voltage drop at the power supply cables (–V).
In the DeviceNet network V_A and V_B is taken as 5 V or less.

The voltage drop at the communications cables is specified at 5 V for a single power supply line (+V or –V). Of the permissible maximum voltage drop within the system (5 V), the permissible voltage drops in the trunk lines and drop lines are 4.65 V and 0.35 V respectively.

Note Note that when the communications power supply for each node and the internal circuit power supply must be shared, the permissible ambient voltage of the internal circuit is lower than the permissible maximum ambient voltage of the communications power supply. Also, the maximum voltage drop for a single power supply line (+V or –V) must be taken as 1 V. Of the permissible maximum voltage drop for a single power supply line (1 V), the permissible voltage drop in the trunk lines and drop lines are 0.65 V and 0.35 V respectively.

6-5-1 Formulas

Supplying Power Independently for Communications and Internal Circuit

Calculate the distance between the power supply and each node, and the current consumption of each node's communications. (Refer to the current consumption overview in *Appendix F Connectible Devices*.) Try to calculate the best location for each node using the formula below. If the best location for each node can be determined using the formula, the specifications for the power supply to each node can also be met. Do not exceed the maximum current capacity of the cable (Thick cable: 8 A and thin cable: 3 A).

Condition Formula 1 (For the Voltage Drop of the Trunk Line)

□ (Ln x Rc = Nt x 0.005) x In □ 4.65 V

Ln: The distance between the power supply and the nodes (not including the lengths of the drop lines)

Rc: Maximum cable resistance
(Thick cable: 0.015 Ω/m, thin cable: 0.069 Ω/m])

Nt: The number of taps between each node and the power supply

In: The consumption current required for the communications power supply for each node

0.005 Ω = The contact resistance of the taps

Supplying Shared Power for Communications and Internal Circuit

The permissible ambient power supplies of the communications and the internal circuit are as shown below.

Note As a rule the communications power supply and the internal circuit should be kept separate. (Refer to *Section 9 Message Communications*.)

- Permissible ambient voltage of the communications power supply:
  11 to 25 VDC
- Permissible ambient voltage of the internal circuit power supply:
  24 VDC from +10% to –15%

The lowest permissible ambient voltage is 11 VDC for the communications power supply, whereas it is 21 VDC including the allowance for the internal circuit power supply. Due to this difference in lowest permissible ambient voltages, when the internal circuit power is supplied by the communications power supply, the permissible ambient voltage drop at is lower than if the power supplies were separate. When the output voltage ambient fluctuation of the communications power supply has a lower limit of 23 V, the permissible maximum voltage drop of a single power supply line is (23 V – 21 V) /2 = 1 V. Of the permissible maximum voltage drop of a single power supply line (1 V), the permissible maximum voltage drop of trunk lines and drop lines are 0.65 V and 0.35 V respectively.

Calculate the distance between the power supply and each node and the total current consumption of each node in the communications and the internal circuit. (Refer to the current consumption overview in *Appendix F Connectible Devices*.)

Try to calculate the best location for each node using the formula below. If the best location for each node can be determined using the formula, the specifications for the power supply to each node can also be met. Do not exceed the maximum current capacity of the cable (Thick cable: 8 A and thin cable: 3 A).

Condition Formula 2 (For the Voltage Drop of the Trunk Line)

□ [(Ln x Rc = Nt x 0.005) x In] □ 0.65 V

Ln: The distance between the power supply and the nodes (not including the lengths of the drop lines)

Rc: Maximum cable resistance
(Thick cable: 0.015 Ω/m, thin cable: 0.069 Ω/m])

Nt: The number of taps between each node and the power supply

In: The consumption current required for the communications power supply and the internal circuit power supply for each node

0.005 Ω = The contact resistance of the taps

6-5-2 Countermeasures

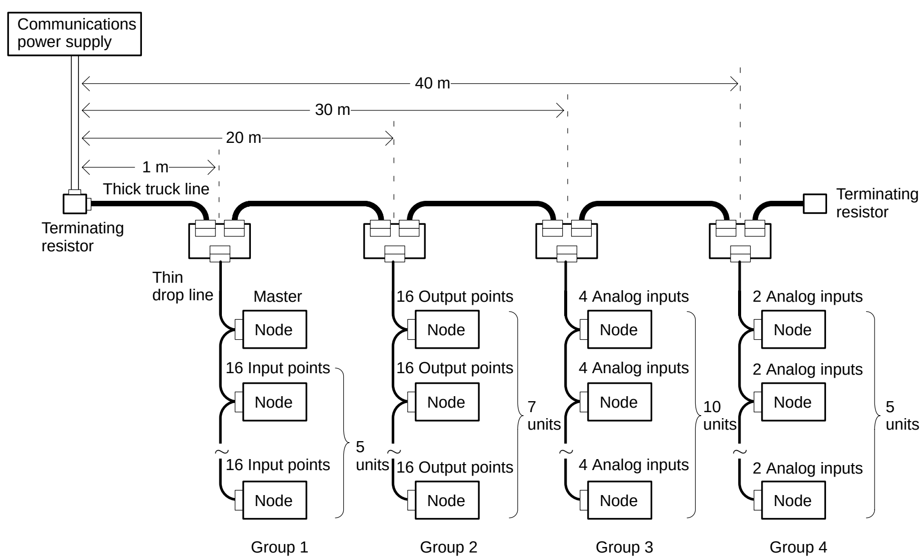
If the best locations cannot be determined using either the first or second formulae, follow the procedure as shown below.

- Locate the communications power supply in the center of the network and the nodes to both sides of it.
- If the nodes are already located at both sides of the power supply, move the power supply in the direction that requires the larger current capacity.
- If thin cable is being used, replace it with thick cable.
- Move the highest current consumption node nearer the power supply.

If the best locations still cannot be determined using the first and second formulae even after carrying out the above procedure, a single power supply will not be sufficient. In that case, proceed to Step 3.

Configuration Example 1

Nodes Concentrated to One Side of the Power Supply (Trunk Line: Thick cable, Drop Lines: Thin cables)



	Group 1	Group 2	Group 3	Group 4
Communications power supply:	45 mA + 30 mA x 5 = 195 mA	30 mA x 7 = 210 mA	30 mA x 10 = 300 mA	30 mA x 5 = 150 mA
Internal circuit power supply:	70 mA x 5 = 350 mA	90 mA x 7 = 630 mA	80 mA x 10 = 800 mA	140 mA x 5 = 700 mA

- Calculate the voltage drop of each group when the network is supplied by the communications power supply only.

  Group 1: (1 x 0.015 + 1 x 0.005) x 0.195 = 0.0039 V

  Group 2: (20 x 0.015 + 2 x 0.005) x 0.21 = 0.0651 V

  Group 3: (30 x 0.015 + 3 x 0.005) x 0.30 = 0.1395 V

  Group 4: (40 x 0.015 + 4 x 0.005) x 0.15 = 0.093 V

  Total voltage drop = 0.0039 + 0.0651 + 0.1395 + 0.093 = 0.3015 V ≤ 4.65 V

  Thus, the best location for the nodes can be determined by using the first formula.

- Calculate the voltage drop of each group when the communications and the internal circuit power supplies are the same.

  Group 1: (1 x 0.015 + 1 x 0.005) x 0.545 = 0.0109 V

  Group 2: (20 x 0.015 + 2 x 0.005) x 0.84 = 0.2604 V

Group 3: (30 x 0.015 + 3 x 0.005) x 1.1 = 0.5115 V

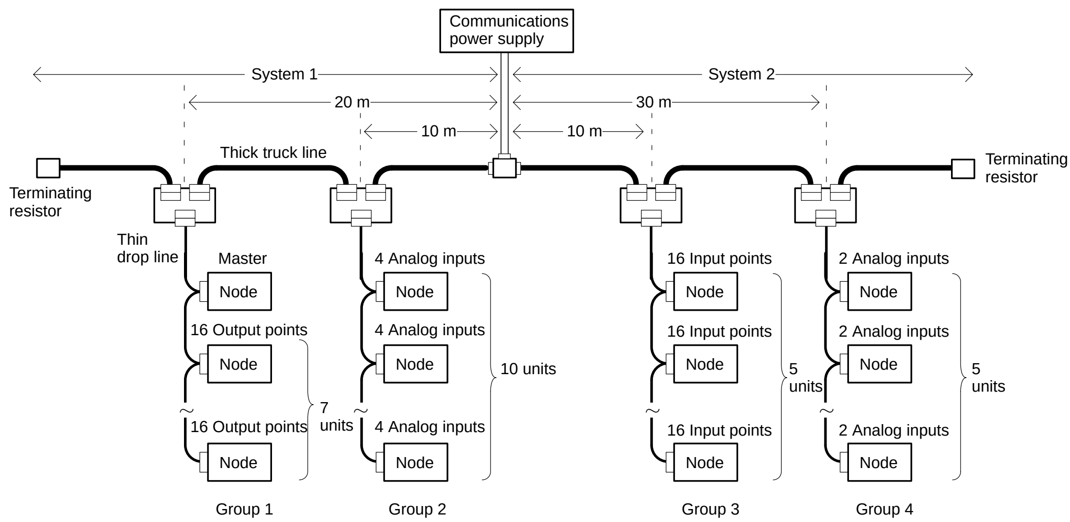
Group 4: (40 x 0.015 + 4 x 0.005) x 0.85 = 0.527 V

Total voltage drop = 0.0109 + 0.2604 + 0.5115 + 0.527 = 1.3098 V ≤ 0.65 V

Thus, the best location for the nodes can be determined by using the second formula.

Configuration Example 2

Nodes Located at Both Sides of the Power Supply (Trunk Line: Thick cable, Drop Lines: Thin cables)



	Group 1	Group 2	Group 3	Group 4
Communications power supply:	45 mA + 30 mA x 7 = 255 mA	30 mA x 10 = 300 mA	30 mA x 5 = 150 mA	30 mA x 5 = 150 mA
Internal circuit power supply:	90 mA x 7 = 630 mA	80 mA x 10 = 800 mA	70 mA x 5 = 350 mA	140 mA x 5 = 700 mA

- Calculate the voltage drop of each group in each system when the network is supplied by the communications power supply only.

System 1

Group 1: (20 x 0.015 + 2 x 0.005) x 0.255 = 0.0791 V

Group 2: (10 x 0.015 + 1 x 0.005) x 0.3 = 0.0465 V

Total voltage drop for System 1 = 0.0791 + 0.0465 = 0.1256 V ≤ 4.65 V

Thus, the best location for the nodes can be determined by using the first formula.

System 2

Group 3: (10 x 0.015 + 1 x 0.005) x 0.15 = 0.0233 V

Group 4: (30 x 0.015 + 2 x 0.005) x 0.15 = 0.069 V

Total voltage drop for System 2 = 0.0233 + 0.069 = 0.0923 V ≤ 4.65 V

Thus, the best location for the nodes can be determined by using the first formula.

- Calculate the voltage drop of each group in each system when the communications and the internal circuit power supplies are the same.

System 1

Group 1: (20 x 0.015 + 2 x 0.005) x 0.885 = 0.2744 V

Group 2: (10 x 0.015 + 1 x 0.005) x 1.1 = 0.1705 V

Total voltage drop for System 1 = 0.2744 + 0.1705 = 0.4449 V ≤ 0.65 V

Thus, the best location for the nodes can be determined by using the second formula.

System 2

Group 3: (10 x 0.015 + 1 x 0.005) x 0.5 = 0.0775 V

Group 4: (30 x 0.015 + 2 x 0.005) x 0.85 = 0.391 V

Total voltage drop for System 2= 0.0775 + 0.391 = 0.4685 V ≤ 0.65 V

Thus, the best location for the nodes can be determined by using the second formula.

6-6 Step 3: Splitting the System into Multiple Power Supplies

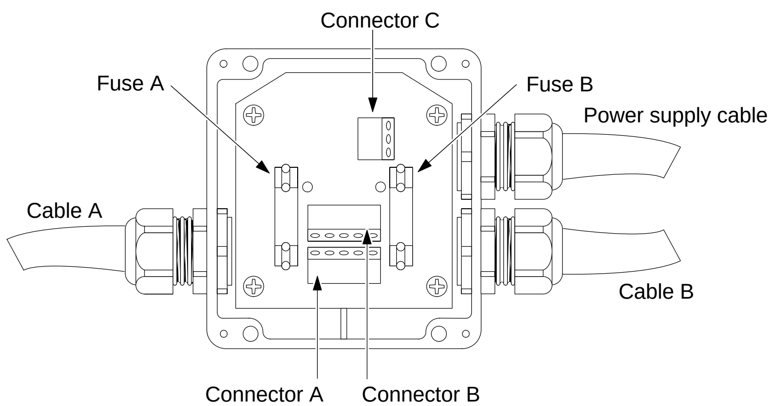
Go to Step 3 if the best location for the nodes cannot be calculated from the formulae. In the third step, there are multiple power supplies and the power supply system is split.

Splitting the Power Supply System

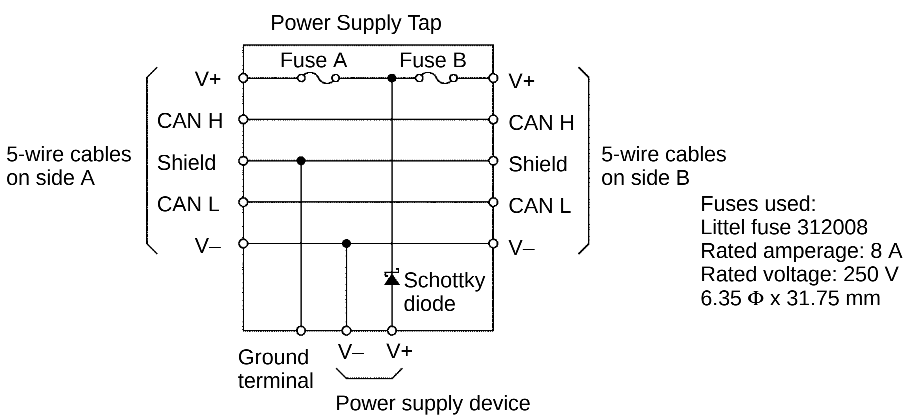
- Be sure to use a Power Supply Tap for each power supply when the network is supplied by two or more power supplies.
- Remove the fuses in the Power Supply Tap to split the power supply system.

Once the power supply system is split, return to Step 1 or 2, and determine the best location of the nodes in each system.

Power Supply Tap Configuration



Internal Circuitry of the Power Supply Tap



Remove fuse A when disconnecting cables on side A, and fuse B when disconnecting cables on side B.

6-7 Dual Power Supply

Power Supply Taps can be used to construct a dual power supply system in the network. Dual power supply differs from parallel operation of power supplies, so the following restrictions apply.

Restrictions

Dual power supply is basically used to ensure backup power supply, not parallel operation of power supplies. Therefore, each power supply to be used must meet the power allocation specifications (must satisfy steps 1 and 2).

6-8 Configuration Design Checklist

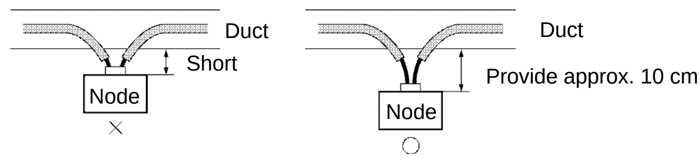
Category	Item	Check	Answer
Specifications	Baud rate	Is system responsiveness fast enough?	Yes, No
	Maximum network length	Is the maximum network length within the specified range for the baud rate?	Yes, No
		Does the maximum network length meet the required cable specifications[for thick cable and thin cable]?	Yes, No
	Drop-line length	Are all drop lines 6 m or shorter?	Yes, No
	Total drop-line length	Is the total length of all the drop lines within the specified range for the baud rate?	Yes, No
	Permissible cable current	Thick cable: Is the current 8 A or less? Thick cable: Is the current 3 A or less?	Yes, No
		Does the current capacity of the drop line satisfy the formula **I** = 4.57/L?	Yes, No
Communications power supply device	Location	Does the location of the power supply meet the required permissible voltage of all the nodes?	Yes, No
	Multiple power supplies	Are special Power Supply Taps being used?	Yes, No

SECTION 7
Installation

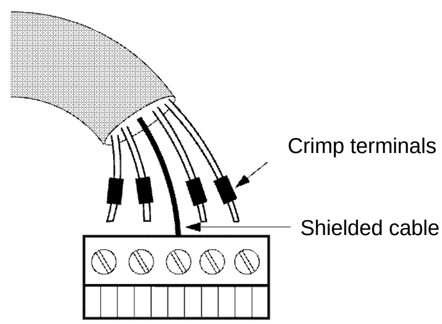
This section describes the methods used to mount and wire the components of a DeviceNet (CompoBus/D) network.

7-1 General Precautions

- Confirm that one Terminating Resistor is attached to each end of the trunk line. The DeviceNet does not have any built-in Terminating Resistors.
- Do not insert arrestors or products other than DeviceNet products in the communications line. Doing so may cause signal reflection or attenuation, disturbing proper communications.
- Provide an appropriate distance between ducts and the Unit so as not to apply any tension to connectors. Applying tension to communications connectors may disconnect them thus causing faulty operation.



- Confirm that communications connectors are securely attached during wiring. Be sure to tighten set screws to an appropriate torque (0.25 to 0.3 N • m). Use the SZF-1 screwdriver for tightening DeviceNet connectors.
- When wiring the connectors, first connect the shielded cable and then securely connect the rest of the cables.
- When wiring, attach crimp terminals to cables and then cover them with vinyl tape or a heat-contraction tube.



7-2 Mounting

A sheet is attached to the Masters and Slaves to prevent pieces of wire from entering the Units. Install and wire the Units with the sheets in place. Stray strands of wire could cause malfunctions.

Be sure to remove the sheet after installation and wiring to facilitate cooling. The Units could overheat and malfunction if the sheets aren't removed.

Do not add or remove nodes to communications cables while the DeviceNet is in operation. Factors such as changes in the positions of terminating resistances caused by cable short-circuits, contact failures, and changes in the node configuration may prevent normal communications.

Note For details on mounting Slaves, refer to the *CompoBus (DeviceNet) Slaves Operation Manual* (W347).

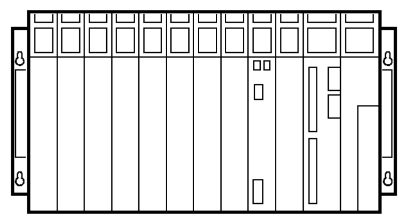
7-2-1 Mounting Master Units

The Master Unit mounts to the PC's Backplane, just like other Units. This section explains only the precautions that should be taken during Master Unit installation. Refer to the PC's Installation Guide for details on mounting Units to the Backplane or installing the PC in a control panel.

CV-series Master Units The Master Unit can be mounted to the CPU Rack or Expansion CPU Rack of any CV-series PC, but there are some limitations on Master Unit mounting.

1, 2, 3...

1. If a Configurator is used, up to 16 Master Units can be mounted to a PC. If a Configurator is not used, only 1 Master Unit can be mounted to a PC.
2. The Master Unit must be secured with screws after being mounted to the Backplane. Tighten to a torque of 1.2 N·m.
3. The DeviceNet Master Unit can’t be mounted in an Expansion I/O Rack, SYSMAC BUS Slave Rack, or SYSMAC BUS/2 Slave Rack.
4. The Master Unit is classified as a CPU Bus Unit. When a CVM1-BC053/BC103 Backplane is being used, the Master Unit must be mounted in one of the slots that support CPU Bus Units. The Master Unit can be mounted in any of these slots as long as its unit number isn’t the same as the unit number of another CPU Bus Unit.
5. The following diagram shows an installed DeviceNet Master Unit. The PC can be installed in a control panel in this condition.



Master Unit

CS1-series, C200HX, C200HG, C200HE, and C200HS Master Units

The Master Unit can be mounted to the CPU Rack or Expansion I/O Rack of any CS1-series, C200HX, C200HG, C200HE, or C200HS PC, but there are some limitations on Master Unit mounting.

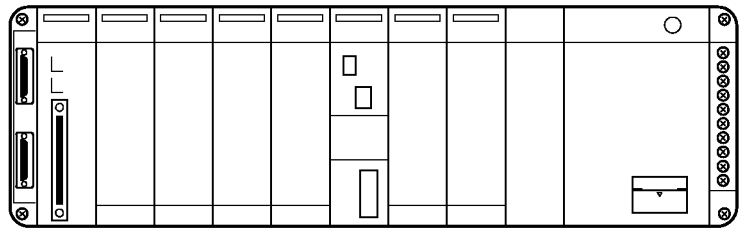
1, 2, 3...

1. If a Configurator is used, up to 10 or 16 Master Units can be mounted to a PC. Refer to the following table for details. If a Configurator is not used, only 1 Master Unit can be connected to a PC.

PC	CPU model number		Max. No. of Master Units
CS1 Series	CS1G-CPU□□ CS1H-CPU□□		16
C200HX, C200HG, or C200HE	More than 880 I/O points	C200HG-CPU53/63(-Z) C200HX-CPU54/64/65/85(-Z)	16
	Less than 881 I/O points	C200HE-CPU11/32/42(-Z) C200HG-CPU33/43(-Z) C200HX-CPU34/44(-Z)	10
C200HS	C200HS-CPU□□ (all models)		10

2. The Master Unit must be secured to the Backplane after mounting.
3. The DeviceNet Master Unit can’t be used simultaneously with a SYSMAC BUS Master Unit.
4. The Master Unit is a Special I/O Unit. It can be mounted in any slot in the Backplane of a CPU Rack or Expansion I/O Rack as long as its unit number isn’t the same as the unit number of another Special I/O Unit.

5. The following diagram shows an installed DeviceNet Master Unit. The PC can be attached to a control panel in this condition.



Master Unit

7-2-2 Mounting T-branch Taps and Terminating Resistors

A T-branch Tap or Terminal-block Terminating Resistor might be required for the Slave. The T-branch Tap can be mounted on DIN track or mounted directly to the control panel with screws, but a Terminal-block Terminating Resistor must be mounted with screws.

When mounting directly to a panel, refer to the diagrams in *5-1 Cables and Connectors* for a template showing the mounting hole placement. Drill the specified holes in the control panel and mount the Slave with M4 screws. Tighten the screws to a torque of 1.2 N・m.

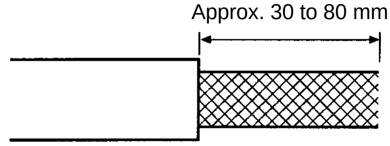
7-3 Connecting Communications Cables

This section explains how to prepare and connect the communications cables to connectors for the DeviceNet network.

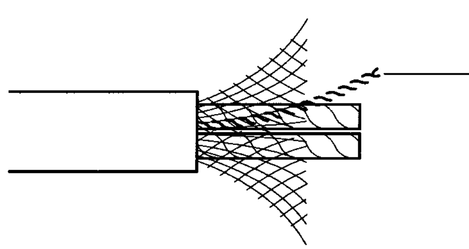
Use the following procedure to prepare and connect the communications cables to the connectors. Although some connectors are equipped with set screw and some are not, the methods used to connect the cables to the connectors are the same.

1, 2, 3...

1. Remove approx. 30 to 80 mm of the cable covering, being careful not to damage the shield weaving underneath. Do not remove more than about 30 mm; removing too much of the covering can result in short circuits.

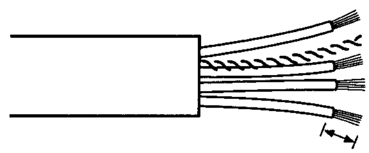


2. Carefully peel back the weaving. You'll find the signal lines, power lines, and the shielding wire. The shielding wire will be loose on the outside of the other lines, but it is harder than the weaving and should be easily identified.

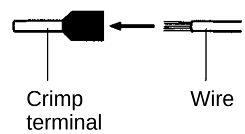


3. Remove the exposed weaving, remove the aluminum tape from the signal and power lines, and strip the covering from the signal and power lines to the

proper length for the crimp terminal connectors. Twist together the wires of each of the signal and power lines.



We recommend the following crimp terminals.
Phoenix Contact K.K., AI-series Crimp Terminals

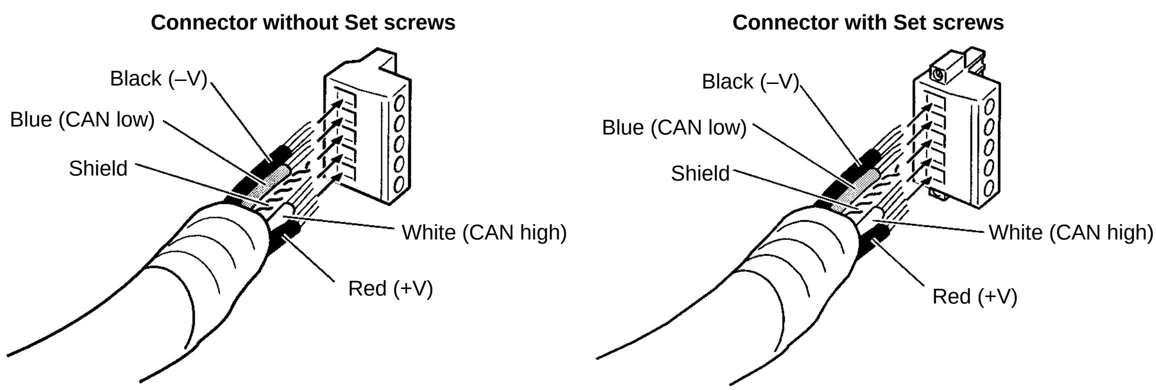


Insert the line into the terminal and then crimp.

The following crimp tool is also available.

Phoenix Contact K.K. Contact., ZA3 Crimp Tool

4. Attach the crimp terminals to the lines and then cover any exposed areas of the cable and lines with electricians tape or heat-shrinking tubes.
5. Orient the connector properly, loosen the line set screws, and then insert the lines in order: Black, blue, shield, white, and then red. The wiring method is the same regardless of whether or not the connector is equipped with set screws.



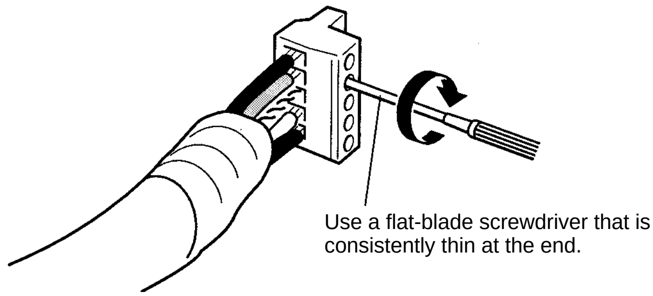
Note Be sure the line set screws are sufficiently loosened before attempting to insert the lines. If these screws are not loose, the lines will enter the gaps in the back of the connector and will not lock properly.

There are colored stickers provided on the Master Unit and Slaves that match the colors of the lines to be inserted. Be sure that the colors match when wiring the connectors. These colors are as follows:

Color	Signal
Black	Power line, negative voltage (–V)
Blue	Communications line, low (CAN low)
---	Shield
White	Communications line, high (CAN high)
Red	Power line, positive voltage (+V)

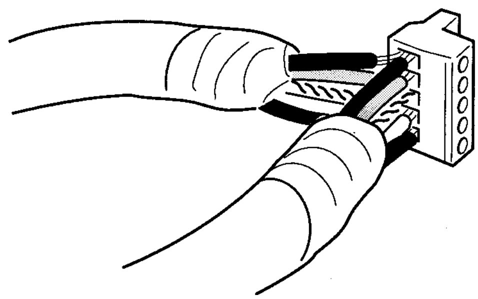
6. Tighten the line set screws for each line in the connector. Tighten the screws to a torque between 0.25 and 0.3 N▯m.

You will not be able to tighten these screws with a normal screwdriver, which narrows to a point at the end. You will need a screwdriver that is consistently thin for the entire length.



Multi-drop Connections with Accessory Connector (Thin Cables Only)

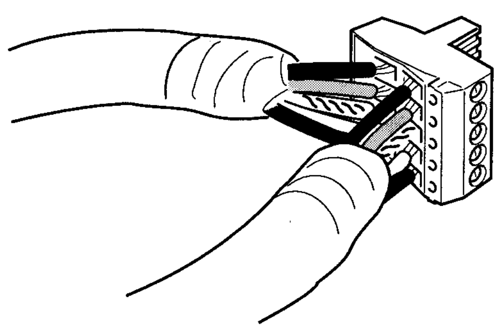
The connectors provided with the Units can be used for a multi-drop connection as long as thin cables are being used, just insert both lines into the same hole in the connector. Be sure to use crimp connectors on both lines. The following illustration shows a multi-drop connection for a connector without set screws.



Multi-drop Connections with Special Connector (Thin or Thick Cables)

A multi-drop wiring connector (sold separately) can be used to wire a multi-drop connector for either thin or thick cables. This multi-drop wiring connector is required to wire a multi-drop connection with thick cables, which are too thick for two lines to fit into the connector provided with the Units.

The multi-drop wiring connector cannot always be used with Master Units or the CQM1 I/O Link Units because it may come into contact with the Units mounted next to the Master Unit or the CQM1 I/O Link Unit. If this happens, use a T-branch Tap to wire the connection.



Note

1. Before connecting the communications cables, turn OFF the power supply to all PCs, Slaves, and communications power supplies.
2. Use crimp terminals for wiring. Connecting bare twisted wires can cause the cables to come OFF, break, or short circuit, most likely resulting in incorrect operation and possibly damage to the Units.
3. Use suitable crimp tools and crimping methods when attaching crimp terminals. Consult the manufacturer of the tools and terminals you are using. Inappropriate tools or methods can result in broken wires.

4. Be extremely careful to wire all signal lines, power lines, and shielding wire correctly.
5. Tighten all set screws firmly. Tighten to a torque of between 0.25 and 0.3 N⋅m.
6. Wire the signal lines, power lines, and shielding wire so that they do not become disconnected during communications.
7. Do not pull on communications cables with excessive force. They may become disconnected or wires may break.
8. Allow leeway so that communications cables do not have to be bent further than natural. The Cables may become disconnected or wires may break if the cables are bent too far.
9. Never place heavy objects on communications cables. They may break.
10. Double-check all wiring before turning ON the power supply.

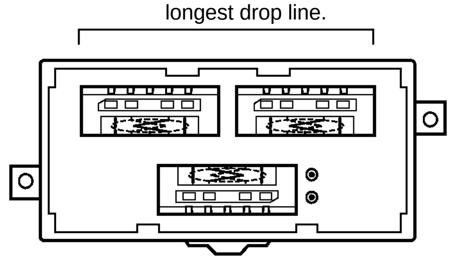
7-4 Connecting Communications Cables to T-branch Taps

This section shows how to connect a communications cable with a connector attached to a T-branch Tap. There are two kinds of T-branch Taps, one makes a single branch and the other makes three branches, but the cable connections are the same for both.

The connectors indicated by asterisks in the following diagrams have the least resistance and these connectors should be used for the trunk line connections. When using a T-branch Tap on a drop line, we recommend connecting the longest drop line to these connectors.

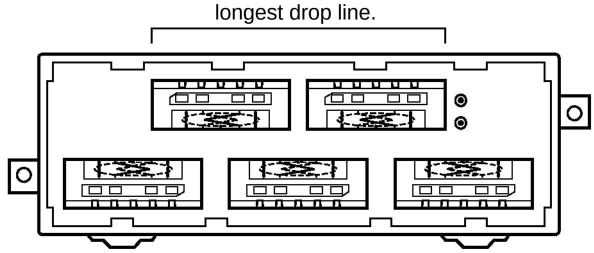
DCN1-1C

* Use for trunk line of longest drop line.

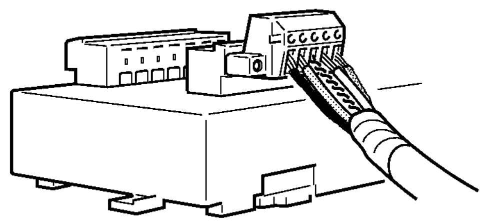


DCN1-3C

* Use for trunk line of longest drop line.



Align the cable connector with the socket on the T-branch Tap as shown in the following diagram and fully insert the connector into the socket. Tighten the set screws to secure the connection. Tighten the screws to a torque of between 0.25 and 0.3 N·m.



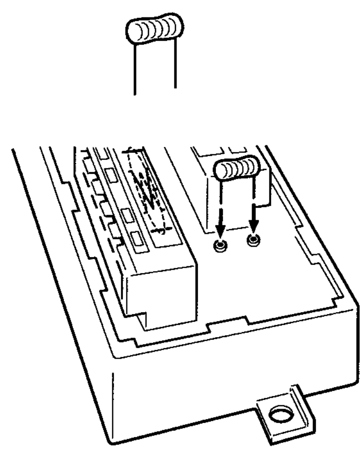
Note To avoid damaging the cable or breaking wires, don’t pull on the cable or bend it too sharply when connecting it to the T-branch Tap. Also, never put heavy objects on top of the cable.

7-5 Connecting Terminating Resistors

Terminating Resistors must be connected at each end of the trunk line. This section shows how to connect the Terminating Resistors.

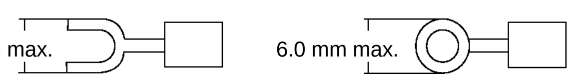
T-branch Tap Terminating Resistor

A terminating resistor is included with the T-branch Tap. Clip the leads on the resistor to about 3 mm and insert it into the T-branch Tap as shown in the following diagram. The resistor can face in either direction.



Terminal-block Terminating Resistor

A terminating resistor is built into the Terminal-block Terminating Resistor. To connect the cable to the Terminating Resistor, attach standard M3 crimp terminals to the signal wires and securely screw the terminals to the Terminal-block Terminating Resistor. Tighten to a torque of between 0.3 and 0.5 N·m.

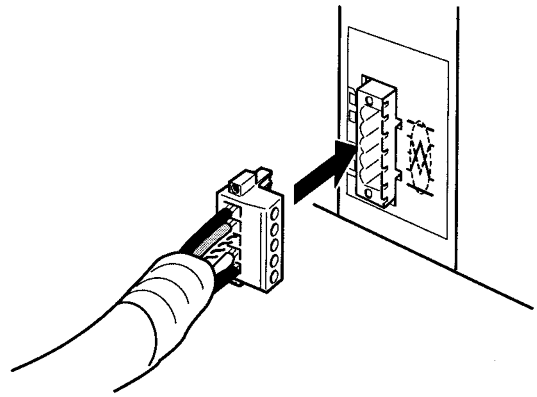


Note To avoid damaging the cable or breaking wires, don’t pull on the cable or bend it too sharply when connecting it to the terminal block. Also, never put heavy objects on top of the cable.

7-6 Connecting Communications Cables to Nodes

This section shows how to connect a communications cable with a connector attached to a Master or Slave.

Align the cable connector with the socket on the node as shown in the following diagram and fully insert the connector into the socket. Tighten the set screws to a torque of between 0.25 and 0.3 N⋅m.



Note

1. The direction of the node's socket varies with different Masters and Slaves. For example, sockets in a CV-series Master and a CS1-series, C200HX, C200HG, C200HE, or C200HS Master face in the opposite direction. Compare the color of the cable wires to the sticker on the node to confirm that the connector is being inserted in the right direction.
2. To avoid damaging the cable or breaking wires, don't pull on the cable or bend it too sharply when connecting it to the terminal block. Also, never put heavy objects on top of the cable.

7-7 Grounding the Network

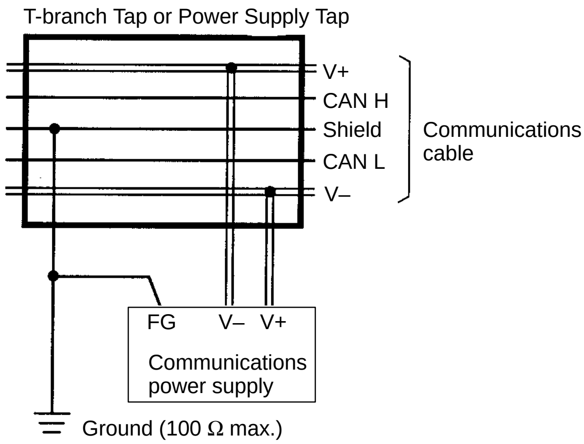
This section shows how to connect a ground wire to the communications cable's shield wire. Connect the ground wire to the communications power supply's FG terminal and ground it to less than 100 Ω.

To prevent ground loops, ground the network at only one location. Also, connect the ground as close as possible to the center of the network.

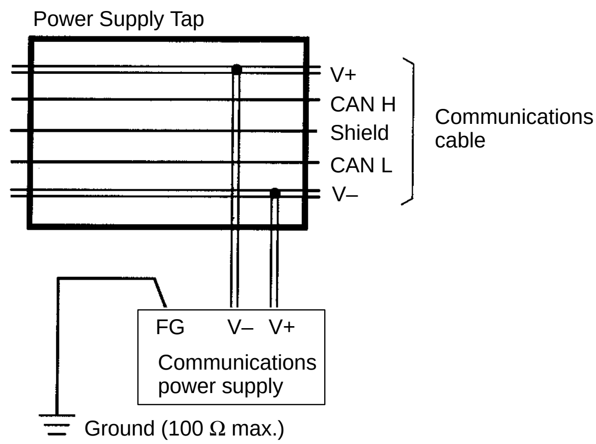
Use a ground line that is separate from ones used for inverters and other drive system devices.

Grounding the Network

The DeviceNet network must be grounded at one location and one location only so that a ground loop is not created. The ground should also be connected as close as possible to the center of the Network. Connect the cable shield to the ground terminal on the communications power supply and then connect to a ground of 100 Ω max., as shown in the following diagrams.



Power supply with cable grounded (one location only)



Power supply without cable grounded

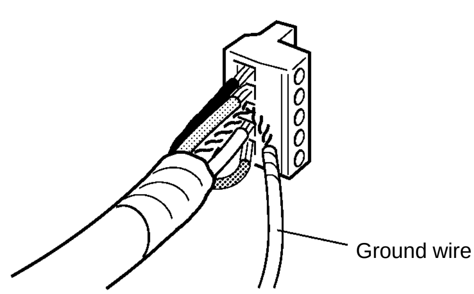
If more than one communications power supply is connected to the same network, ground only the one nearest the center of the network. Do not connect the shield wire at the other power supplies. Always use Power Supply Taps when connecting more than one communications power supply to the same network. (The power supplies are not counted as network nodes.)

Note

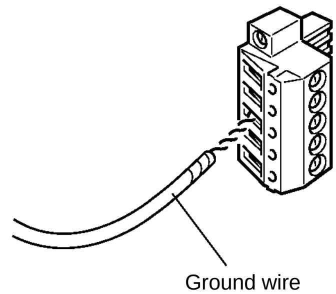
1. Always ground the communications cable shield at one and only one location in the network.
2. Always ground to 100 Ω or less.
3. Always use a separate ground. Never use the same ground as for inverters or other drive system devices.

Grounding from a Connector

The network can be grounded by inserting the ground wire into the same hole as the communications cable's shield wire, as shown in the following diagram.



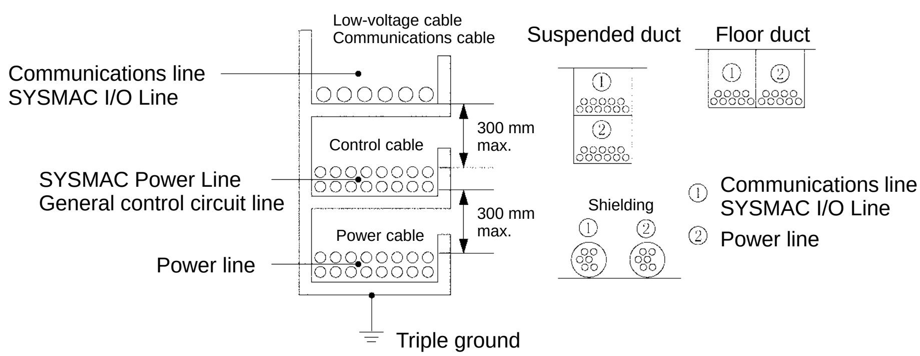
Grounding from a T-branch Tap
The network can be grounded by inserting the ground wire into one of the T-branch Tap connectors, as shown in the following diagram.



7-8 Noise Precautions

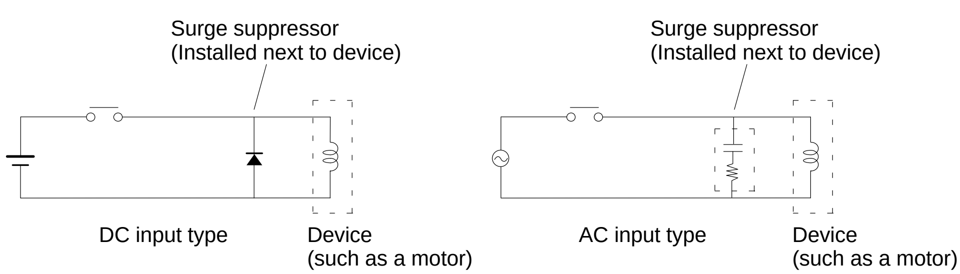
General Precautions

To prevent inductive noise, do not wire the communications line, SYSMAC power lines and power lines near to each other. In particular, be sure to keep the power lines for inverters, motors, regulators, and contactors at least 300 mm away from both the communications lines and the SYSMAC power lines. Also, provide separate conduits or ducts for the communications lines and power lines.

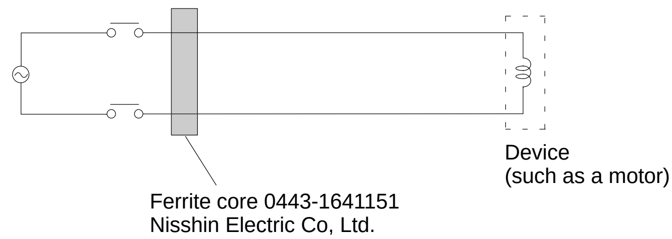


Do not install communications lines and SYSMAC Power Lines onto the control panel on which high-voltage devices are mounted.

Install surge suppressors on devices that generates noise, particularly devices that have an inductive component such as motors, transformers, solenoids, and magnetic coils.



If a surge suppressor does not fit on the device, installing a ferrite core directly next to the device's contactors, such as a contactor may be effective.

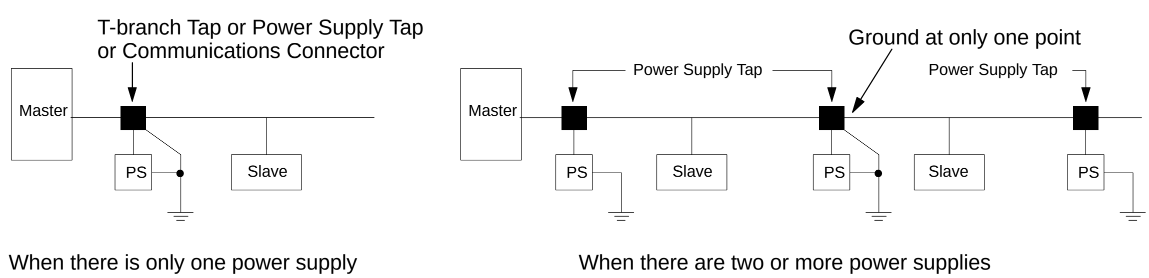


Because noise currents flow through metallic equipment (such as casings), the communications cables should be placed as far away from metallic equipment as possible.

Ground the shielding wire on the communications cable at one point. If the same ground is used for the communications cable and communications power supply, there is a possibility that noise may be transmitted through the ground line to the communications line. In order to avoid this, be sure that the power line ground and the grounds for the communications cables and the communications power supply are located as far from each other as possible.

Insert a line filter on the primary side of the communications power supply.

When there are two or more communications power supplies, the communications power cables can be grounded by simply connecting a single Power Supply Tap near the center of the communications cable. Do not ground shielding wire at more than one place.



7-9 Faulty Operation

When noise is thought to be the cause of a malfunction in the DeviceNet network, the following measures may be effective.

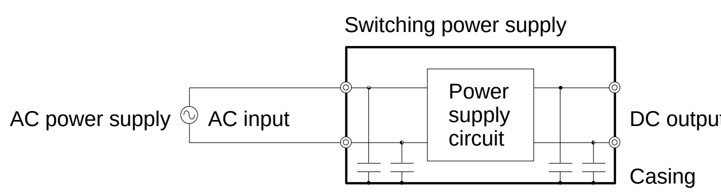
Communications Cable Shielding

Suspend the communications cable shielding wire without grounding it. This will filter the noise that flows from the ground to the communications cable and will filter the noise current that flows in the shielding wire.

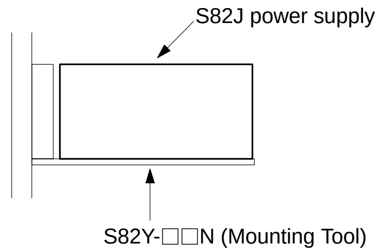
Communications Power Supply

Suspend the communications power supply without grounding it. This will also filter the noise that flows from the communications power supply ground to the communications cable or the noise current that flows in the shielding wire. The switching power supply is usually connected to the case and the capacitor as shown below. The FG terminal must be suspended and the control board for the power supply itself must be insulated.

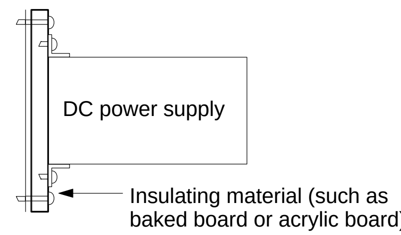
Switching Power Supply Configuration



Suspending the Communications Power Supply



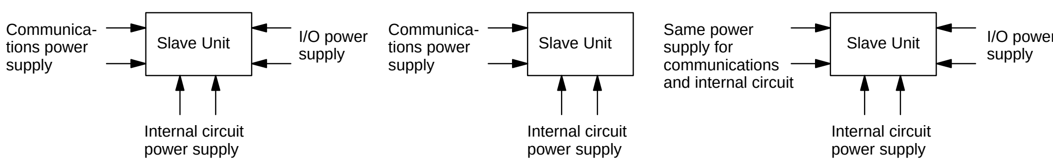
When using S82J power supply



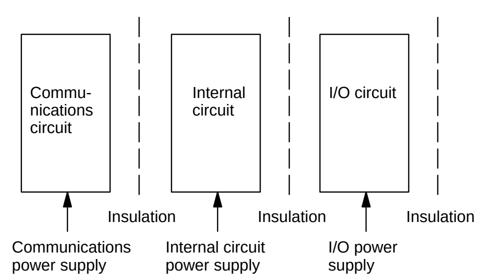
When using other power supplies

7-10 Sharing the Same Power Supply

Slave Units in the DeviceNet network can be classified into three types according to how the power is supplied, as shown below.



Because the power supplies for the communications, internal circuit and I/O are individually insulated as shown below, as a general rule each power supply should be connected separately.

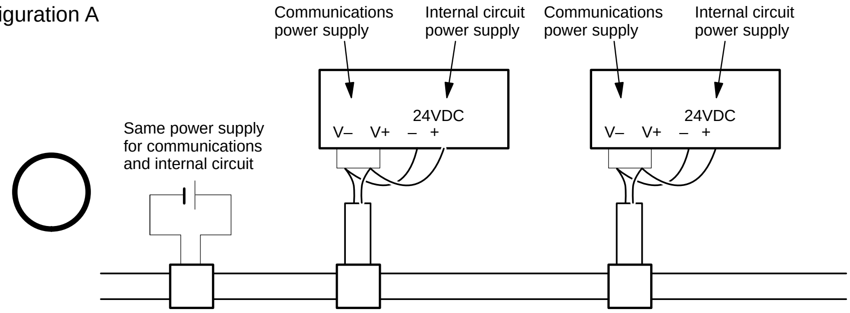


Because of space and cost difficulties involved in preparing individual power supplies, sharing the same power supply may be unavoidable. If this is the case, take the following precautions.

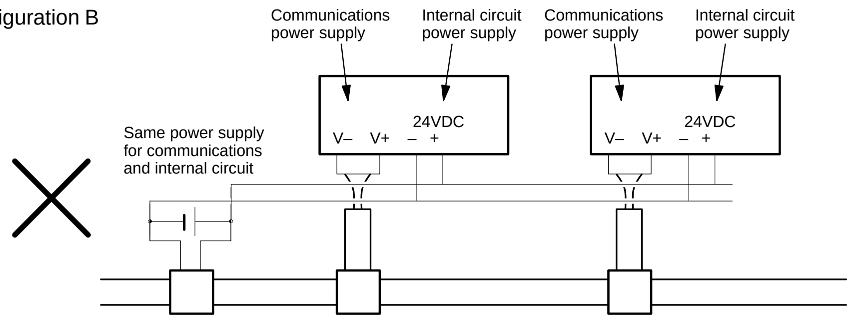
- Be sure to keep the I/O power supply separate.
- When the communications and internal circuit power supply is shared, wiring the network as shown in configuration A is recommended. Do not wire the network as shown in configuration B because it will generate more noise than the network in configuration A.

Note The lower voltage boundary of the internal circuit power supply must be higher than that of the communications power supply. To meet the voltage specifications for the internal circuit power supply, be sure to follow the specifications provided in this manual.

Configuration A



Configuration B



7-11 Operations Checklist

Go through the items in the following checklist before turning ON the Units in the DeviceNet system. All of the checks should be answered “Yes.”

Item		Check	Answer
CV-series Master Units	Switch settings	Has the Master’s unit number been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Has the baud rate (front DIP switch pins 1 and 2) been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Is the baud rate the same on all of the Slaves?	Yes No
		Has the “continue/stop communications for error” setting (front DIP switch pin 3) been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Is pin 4 of the front DIP switch set to OFF?	Yes No
		Has the node address (rear DIP switch pins 1 to 6) been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Is the Master’s node address unique (not allocated to a Slave)?	Yes No
		Are pins 7 and 8 of the rear DIP switch set to OFF?	Yes No
	Protective sheet	Was the protective sheet removed after mounting and wiring?	Yes No

Item		Check	Answer
CS1-series, C200HX, C200HG, C200HE, and C200HS Master Units	Switch settings	Has the Master's unit number been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Has the baud rate (front DIP switch pins 1 and 2) been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Is the baud rate the same on all of the Slaves?	Yes No
		Has the "continue/stop communications for error" setting (front DIP switch pin 3) been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Is pin 4 of the front DIP switch set to OFF?	Yes No
		Has the node address (rear DIP switch pins 1 to 6) been set? (Refer to *Section 4 Master Unit Specifications* for details.)	Yes No
		Is the Master's node address unique (not allocated to a Slave)?	Yes No
		Are pins 7 and 8 of the rear DIP switch set to OFF?	Yes No
	Protective sheet	Was the protective sheet removed after mounting and wiring?	Yes No
Slaves	Switch settings	Has the node address (rear DIP switch pins 1 to 6) been set? (Refer to the relevant explanation in the *CompoBus (DeviceNet) Slaves Operation Manual* (W347) for details.)	Yes No
		Is the Slave's node address unique (not allocated to another Slave)?	Yes No
		Has the baud rate (DIP switch pins 7 and 8) been set? (Refer to the relevant explanation in the *CompoBus (DeviceNet) Slaves Operation Manual* (W347) for details.)	Yes No
		Is the baud rate the same on all of the nodes?	Yes No
		Has the "hold/clear outputs for communications error" setting (DIP switch pin 10) been set on Output Slaves? (Refer to the relevant explanation in the *CompoBus (DeviceNet) Slaves Operation Manual* (W347) for details.)	Yes No
	Protective sheet	Was the protective sheet removed after mounting and wiring?	Yes No
Wiring	Master	Are the connectors and cables to the Master connected correctly?	Yes No
		Are the connectors and cables to the Slaves connected correctly?	Yes No
	Terminating Resistors	Have Terminating Resistors been connected at both ends of the trunk line?	Yes No
		Has a resistance of 121 Ω been used?	
	Max. network length	Is the length of the network within specifications? (Refer to *3-2-1 Maximum Network Length* for details.)	Yes No
	Drop-line length	Are all drop lines 6 m or shorter?	Yes No
		Is the total length of all of the drop lines within specifications? (Refer to *3-2-3 Total Drop Line Length* for details.)	Yes No
	Cables	Does the cable meet the required specifications?	Yes No
		Are the cables separated from any power or high-voltage lines?	Yes No
		Have the cables been handled carefully, without excessive force?	Yes No
Communications power supply	Power supply capacity	Has the power supply requirement been calculated using each node's current consumption? Refer to *7-6 Supplying Communications Power to the Nodes* for details.	Yes No
		Can the power supply handle the inrush current when the system is started?	Yes No
	Ground	Is the network be grounded in only one location? Refer to *7-7 Grounding the Network* for details.	Yes No
		Is the ground connection near the middle of the network?	Yes No
		Is a separate ground line used?	Yes No

SECTION 8
Remote I/O Communications

This section describes setting up and using remote I/O communications to automatically transfer data between a PC to which a Master Unit is mounted and the Slaves controlled by the Master Unit.

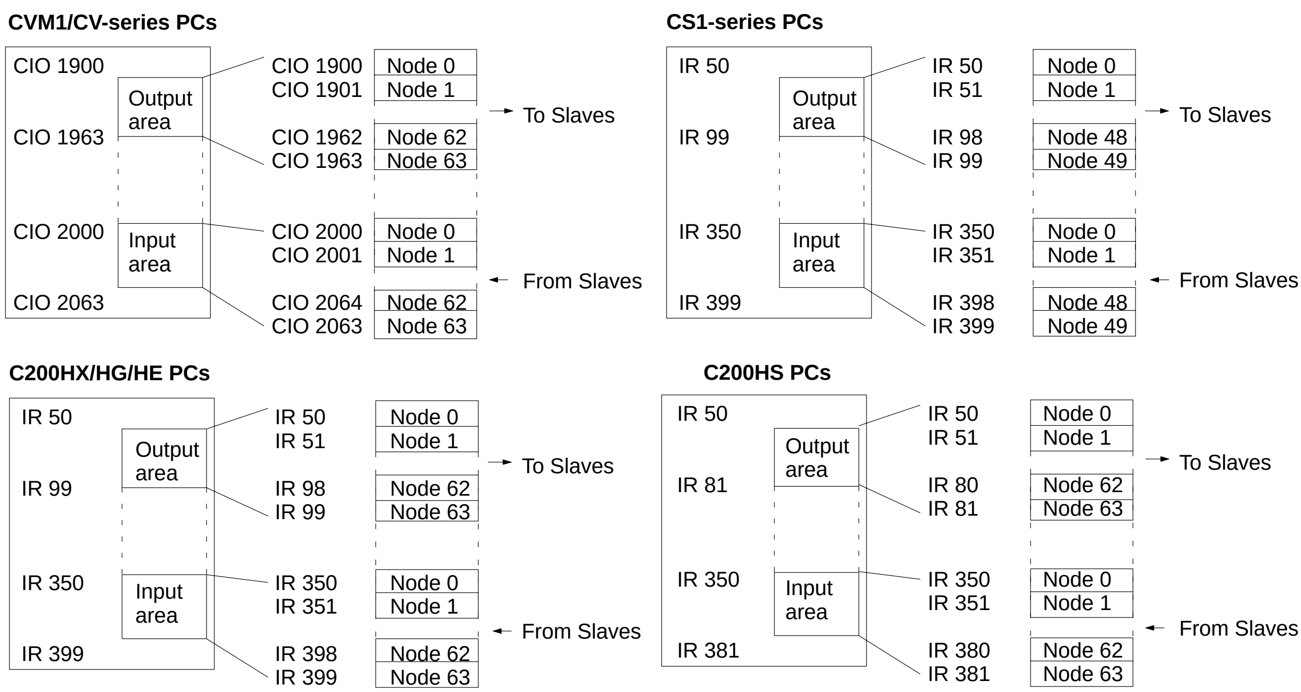
8-1 Overview

The remote I/O communications function enables automatic transfer of I/O data between Slaves and the CPU Unit of the PC to which the Master Unit is mounted without any special programming. To achieve this, each Slave is allocated words in the I/O memory of the CPU Unit. Words are allocated as described next.

Default Allocations

Unless a Configurator is used to change the I/O allocations, words in the CPU Unit are allocated in the order of DeviceNet (CompoBus/D) node addresses starting from node 00. The words are divided into an output area and an input area. The specific words that are allocated depend on the model of PC that is being used.

Each node address is allocated one input and one output word. If a Slave requires more than one input or one output word, then it is assigned more than one node address. If a Slave requires less than one word, it simply uses the rightmost bits in the word allocated to it.

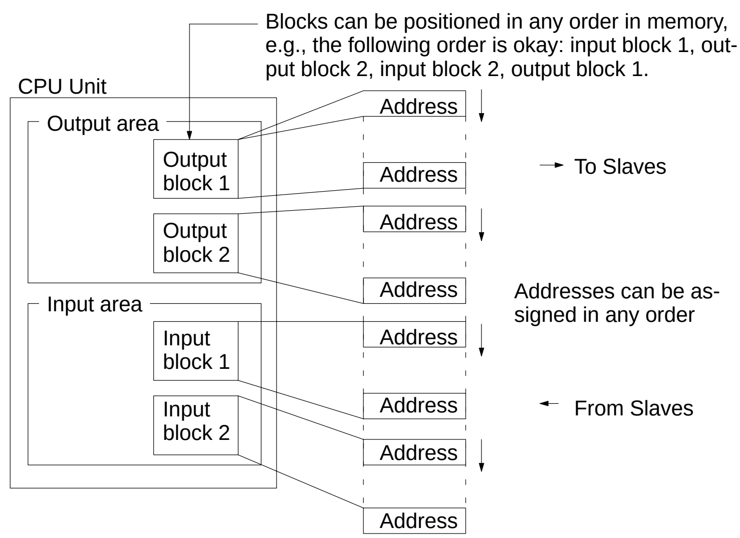


Note With the CS1 Series, the DeviceNet Output Area (CIO 0050 to CIO 0099) is contained inside the I/O Area (CIO 0000 to CIO 0319). For this reason, in systems with a large number of I/O points, edit the I/O table with the CX-programmer so that there is no overlap of area allocation.

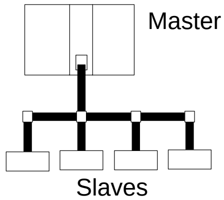
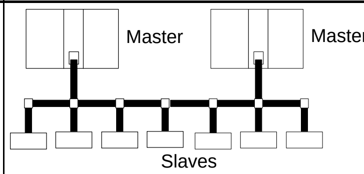
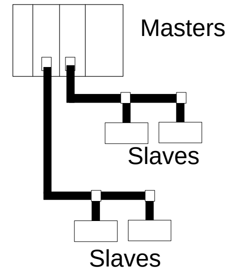
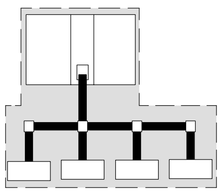
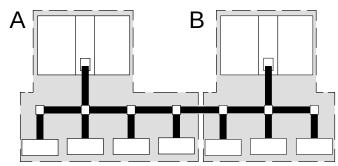
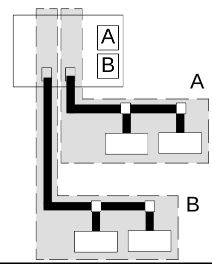
User-set Allocations

A Configurator can be used to allocate blocks 1 and 2 in the output area and input blocks 1 and 2 in the input area in any order to the node addresses.

Each node is allocated at least one byte (leftmost or rightmost). If a Slave requires more than one input or one output word, then it can be allocated more than one input or output word. If a Slave requires less than one word, it simply uses the rightmost bits in the word allocated to it.



Allocation Methods and System Configurations

Configuration	One master per network	More than one master per network	More than one master per PC
Form			
Configurator	Not needed if default allocations are used	Required	
Remote I/O Communications			
Default allocations	Yes	No	No
User-set allocations (Configurator required)	Yes 	Yes 	Yes 
Characteristics	Same as previous version.	The communications cycle time will be increased. (The cycle time will be the sum of the individual cycle times that would be required if the network was divided into separate networks with one master each.)	The cycle time of the PC will be increased.
Precautions	Same as previous version.	Refer to page 104 for precautions on using more than one master in the same network. Each slave must belong to only one master. If there is more than one master with the scan list disabled in the same network, communications can stop due to too much traffic on the network (Bus Off).	Do not allocate the same PC memory area words to more than one master.

Remote I/O Specifications

<table>
<tr><th colspan="2" rowspan="2">PC</th><th colspan="2">CVM1 and CV Series</th><th rowspan="2">CS1 Series</th><th colspan="2">C200HX/HG/HE</th><th rowspan="2">C200HS (all models)</th></tr>
<tr><th>CV500/ CVM1-CPU 01</th><th>All others</th><th>C200HE-CPU 11(-Z)</th><th>All others</th></tr>
<tr><td colspan="2">Master model number</td><td colspan="2">CVM1-DRM21-V1</td><td colspan="4">C200HW-DRM21-V1</td></tr>
<tr><td rowspan="2">Max. No. of slaves per Master Unit</td><td>Without Configurator</td><td colspan="2" rowspan="2">63</td><td colspan="3">50</td><td>32</td></tr>
<tr><td>With Configurator</td><td colspan="3">63</td><td>63</td></tr>
<tr><td rowspan="2">Max. No. of controlled points per Master Unit</td><td>Without Configurator</td><td colspan="2">2,048 pts
(64 input/64 output words)</td><td colspan="3">1,600 pts
(50 input/50 output words)</td><td>1,024 pts
(32 input/32 output words)</td></tr>
<tr><td>With Configurator</td><td colspan="2">6,400 pts
(100 words x 4 blocks)</td><td colspan="3">Without messages:
4,800 pts
With messages:
1,600 pts (See note 1.)</td><td>1,280 pts</td></tr>
<tr><td rowspan="6">Allocation words</td><td>Without Configurator</td><td colspan="2">OUT: CIO 1900 to CIO 1963
IN: CIO 2000 to CIO 2063</td><td>OUT: CIO 0050 to CIO 0099
IN: CIO 0350 to CIO 0399</td><td colspan="2">OUT: IR 50 to IR 99
IN: IR 350 to IR 399</td><td>OUT: IR 50 to IR 81
IN: IR 350 to IR 381</td></tr>
<tr><td rowspan="5">With Configurator</td><td>CIO 0000 to CIO 2427</td><td>CIO 000 to CIO2555</td><td>CIO 0000 to CIO 0235, CIO 0300 to CIO 0511</td><td colspan="3">IR 000 to IR 235, IR 300 to IR 511</td></tr>
<tr><td colspan="2">G008 to G255</td><td>H000 to H099
CIO 1000 to CIO 1063
(See note 2.)</td><td colspan="3">HR 00 to HR 99
LR 00 to LR 63</td></tr>
<tr><td>D00000 to D08191</td><td>D00000 to D24575</td><td>D00000 to D05999</td><td>DM 0000 to DM 4095</td><td>DM 0000 to DM 5999</td><td>DM 0000 to DM 5999</td></tr>
<tr><td colspan="6">Up to two output blocks and two input blocks can be set in the above areas for allocation.</td></tr>
<tr><td colspan="2">Each block can be up to 100 words (including unused areas).</td><td colspan="3">Each block can be up to 100 words (including unused areas).
The total number of words in all four blocks must be 300 words or less (including unused areas).
If message communications are used, the total number of words in all four blocks must be 100 words or less.</td><td>The total number of words in all four blocks must be 80 words or less (including unused areas).</td></tr>
<tr><td rowspan="5">Allocation methods</td><td rowspan="3">Without Configurator</td><td colspan="6">Words in the default allocation areas are allocated in order of node address.</td></tr>
<tr><td colspan="2">1 word per node address for nodes 0 to 63 are allocated from output area CIO 1900 to CIO 1963 and from input area CIO 2000 to CIO 2063.</td><td>1 word per node address for nodes 0 to 49 are allocated from output area CIO 0050 to CIO 0099 and from input area CIO 0350 to CIO 0399.</td><td colspan="2">1 word per node address for nodes 0 to 49 are allocated from output area IR 50 to IR 99 and from input area IR 350 to IR 399.</td><td>1 word per node address for nodes 0 to 31 are allocated from output area IR 50 to IR 81 and from input area IR 350 to IR 381.</td></tr>
<tr><td colspan="6">8-pt Slaves: One word is allocated, but only the rightmost byte is used (1 address).
16-pt Slaves: One word is allocated (1 address).
16-pt+ Slaves: Multiple words are allocated (1 address for each word).</td></tr>
<tr><td rowspan="2">With Configurator</td><td colspan="6">Output blocks 1 and 2 and input blocks 1 and 2 can be set freely within the above areas to any size (as long as the maximum number of words per block or the maximum total number of words is not exceeded). The following restrictions apply.
If a Slave requires more than 8 points (one byte), the leftmost byte of a word (bits 07 to 15) cannot be set as the first byte.
A Slave cannot belong to two Masters.</td></tr>
<tr><td colspan="6">8-pt Slaves: Only the leftmost or rightmost byte is allocated.
16-pt Slaves: One word is allocated.
16-pt+ Slaves: Multiple words are allocated. (If an odd number of bytes is required, the rightmost byte is allocated in the last word.)</td></tr>
<tr><td colspan="2">Remote I/O communications at startup</td><td colspan="6">The initial status of remote I/O communications can be set with a Configurator so that communications are either started or stopped at startup.
Without a Configurator, remote I/O communications will start at startup, but can then be controlled via a software switch.</td></tr>
</table>

PC	CVM1 and CV Series		CS1 Series	C200HX/HG/HE		C200HS (all models)
	CV500/ CVM1-CPU 01	All others		C200HE-CPU 11(-Z)	All others	
Starting/Stopping remote I/O communications	Remote I/O communications can be started and stopped either from a PC Programming Device or from a Configurator.					
Remote I/O communications upon communications errors	A DIP switch on the fount of the Master Unit can be used to set remote I/O communications to stop or continue after communications errors occur.					

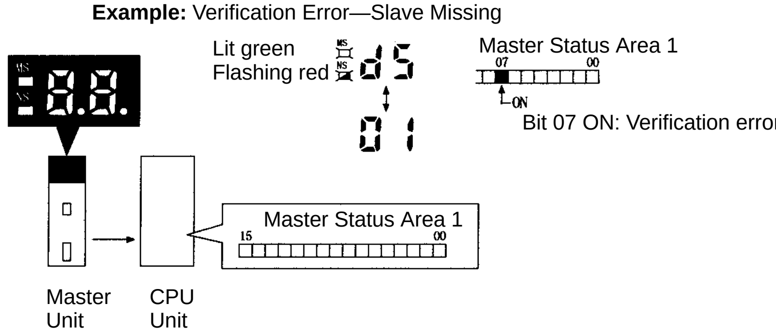
Note
1. With CS1-series and C200HX/HG/HE PCs, only 1,600 points (100 words) can be controlled from a single Master Unit if message communications are used (i.e., if FINS commands are sent or received).
2. If words in the range “LR 00” to “LR 63” are allocated with the Configurator for CS1-series PCs, the corresponding words in the range CIO 1000 to CIO 1063 will actually be allocated.
3. With CS1-series PCs, there are restrictions on the areas that can be allocated by user-set allocation. Be sure to allocate words according to the ranges given in the above table.

Remote I/O Communications Error Indications

There are two ways to obtain information on communications errors that occur in remote I/O communications: 1) Using Master Unit displays, indicators, and Master Status Areas and 2) Using the error history in the Master Unit.

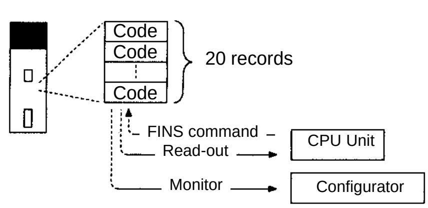
The MS and NS indicators and the 7-segment display on the front panel of the Master Unit can be used together with the Master Status Area 1 inside the CPU Unit to obtain information on a communications error that has occurred. This information can be used as the basis for troubleshooting.

Example: Verification Error—Slave Missing

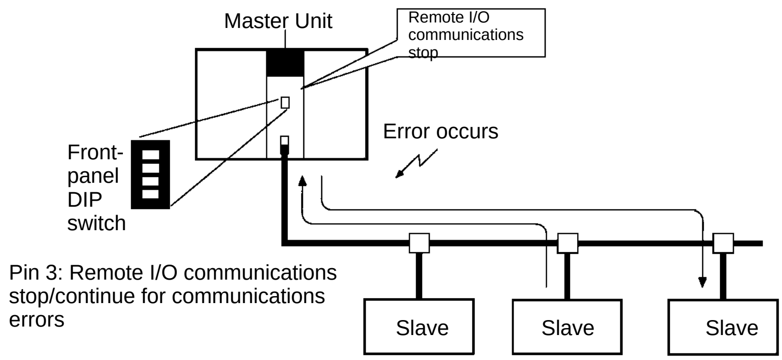


Each time a communications error occurs, an error code is placed in an error record in the error history kept in the RAM of the Master Unit. Up to 20 records can be stored in the error history. For CVM1/CV-series Master Units, the record is also time stamped. (Time stamps are not provided with the other Master Units.)

The error history can be read or cleared from the CPU Unit by sending an FINS command to the Master Unit (ERROR HISTORY READ/CLEAR). The contents of the error history can also be monitored from the Configurator.



A setting on the front-panel DIP switch can be used to control remote I/O communications for communications errors. This pins can be set either to automatically restart communications or to not restart communications after the cause of an error is removed. These errors include the following: Remote I/O communications time-outs, network power supply errors (unstable supply from network), send time-outs (slave missing, other master present, CAN controller error).



Remote I/O Communications Errors

Error		MS/NS indicators	7-segment display	Master status area 1	Error code (hex)	Communications during error
Scan list failure	CPU Unit in PROGRAM mode	MS: No change NS: No change	C0 ↔ Master node address	---	07 08	Stop
	In scan list enable mode		C2 ↔ Master node address			Stop
	Slave missing		C3 ↔ Master node address			Stop
	Setup error		C4 ↔ Master node address			Stop
	During scan list operation		CA ↔ Master nOde address			Stop
Setup error	I/O area overlap	MS: No change NS: Flashing red	d0 ↔ Master node address	Bits 04 and 14 turn ON.	07 02	Stop
	I/O area range violation		d1 ↔ Master node address		07 03	Stop
	Unsupported slave		d2 ↔ Master node address		07 04	Stop
Verification error	Slave missing		d5 ↔ Master node address	Bits 07 and 14 turn ON.	07 05	Stop
	Slave I/O size differs		d6 ↔ Master node address		07 06	Stop
Remote I/O communications time-out			d9 ↔ Master node address	Bits 06 and 14 turn ON.	07 07	Continue
Send error	Network power error	MS: No change NS: Not lit	E0 ↔ Master node address	Bits 05 and 14 turn ON.	07 83	Continue
	Send time-out		E2 ↔ Master node address		07 84	Continue
Configuration error	PC error	MS: Flashing red NS: No change	E4 ↔ Master node address	Bits 03 and 14 turn ON.	07 09	Stop
	Configuration data error		E8 ↔ Master node address		07 01	Stop
Node address duplication		MS: No change NS: Lit red	F0 ↔ Master node address	Bits 01 and 14 turn ON.	07 81	Stop
Bus off detected			F1 ↔ Master node address		07 82	Stop

Error		MS/NS indicators	7-segment display	Master status area 1	Error code (hex)	Communica-tions during error
Illegal switch setting		MS: Flashing red NS: Not lit	F3 ↔ Master node address	Bits 00 and 14 turn ON.	---	Stop
Initialization error with PC			F5 ↔ Master node address	---	00 06	Stop
PC interface error			F6 ↔ Master node address		00 02	Stop
Memory error	EEPROM error	MS: Lit red NS: Not lit	F8 ↔ Master node address	Bits 00 and 14 turn ON.	---	Stop
	RAM error		F9 ↔ Master node address	---	---	Stop
Remote I/O communications stopped		MS: No change NS: No change	A0 ↔ Master node address	Bit 14 turns ON.	---	

8-2 Scan Lists

Contents

Master Units use scan lists to determine normal DeviceNet communications. The scan lists provide the following.

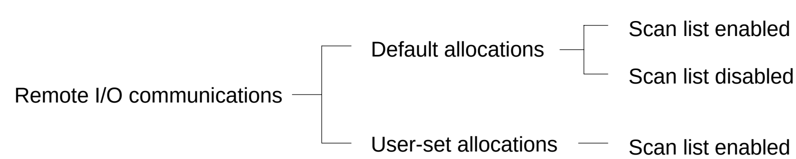
- Slave I/O allocations telling how many I/O points and what node addresses are allocated to each Slave.
- Communications parameters providing the initial remote I/O communications status and the communications cycle time settings.

Scan lists can be either enabled or disabled when the default remote I/O allocations are being used. They must be enabled for user-set allocations.

Creating Scan Lists

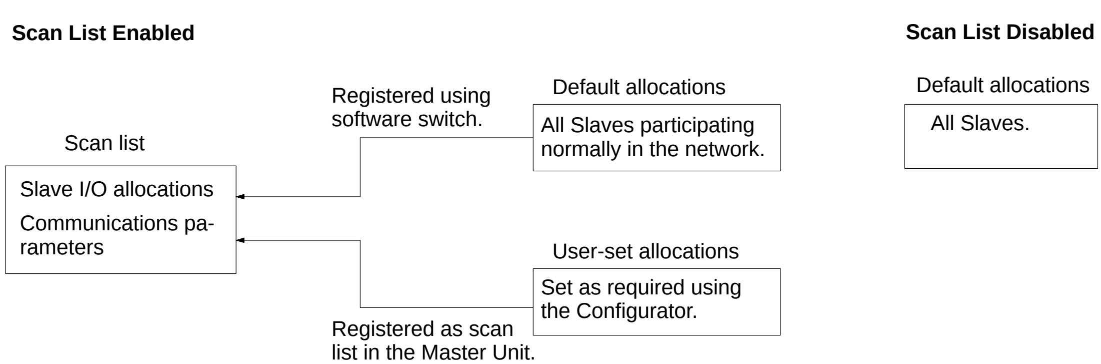
Default Remote I/O Allocations

A scan list can be created by turning ON the Enable Scan List software switch when the PC is in PROGRAM mode, communications are active, and the scan list is disabled. All Slaves that are participating normally in the Network will be registered in the scan list.



User-set Remote I/O Allocations

The user creates the scan list using the Configurator and then registers it in the Master Unit. Settings for all Masters and Slaves participating normally in the network are used as a basis for creating the scan list.



Note The scan lists created with the Configurator will be required again for registration in the Master Unit if the Master Unit is ever set to disable the scan list or if the Master Unit is replaced. Be sure to save any scan lists you create with the Configurator as network files or master parameter files.

Using Scan Lists

Enabling/Disabling a Scan List

To enable a scan list, turn ON the Enable Scan List software switch or use the Configurator. To disable a scan list, turn ON the Clear Scan List software switch.

Note
1. Scan lists cannot be disabled from the Configurator. The scan list will always be enabled when created on the Configurator and registered in a Master Unit.
2. Always enable the scan list during actual system operation. Although operation is possible with the scan list disabled when the default allocations are used, communications will continue even if Slaves fail, creating the possibility of undetected errors in system operation.

Scan List Enabled

When a scan list is enabled, communications are performed according to the scan list stored in the Master Unit's non-volatile memory. Always use this mode for normal operation.

The Master will communicate only with the Slaves registered in the scan list. A verification error will occur if a Slave registered in the scan list doesn't exist in the network or isn't started when I/O communications begin. Even if it is properly connected in the network, a Slave which isn't registered in the scan list will not participate in communications and isn't checked for errors.

Scan List Disabled

When a scan list is disabled, communications are performed without using the scan list. The scan list is disabled when the scan list hasn't been created or it has been cleared. Do not disable the scan list during actual system operation.

All of the Slaves in the network can communicate with the scan list disabled, so Slaves can be added to the network while communications are in progress. Without a scan list, however, there is no way to check for Slaves that have not started or have failed, and errors can thus go undetected. The communications cycle time will be much longer that the computational value when the scan list is disabled.

When a scan list is disabled, operation is possible only by using the default I/O allocations. User-set allocations cannot be used.

Note
1. The scan list is automatically enabled when the Configurator is used to allocate remote I/O. If the software switch is used to clear the scan list, remote I/O communications will operate under the default allocations with the scan list disabled. Always confirm that the system is stopped before disabling the scan list in a Master Unit. This is particularly important if there is more than one Master on the same network. If the scan list is disabled for one of the Masters, normally communications will not be possible.
2. The scan list data in a Master Unit is deleted whenever the scan list is disabled.

8-3 Default Remote I/O Allocation

This section explains how the Slave's I/O points are allocated to words in the PC to which the Master Unit is mounted.

8-3-1 PC Allocation Areas

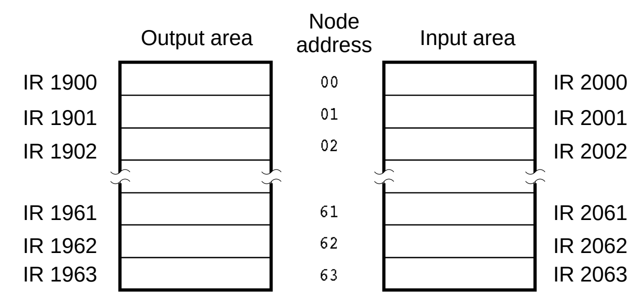
When the default remote I/O allocations are used, words in the memory of the PC are allocated to slave nodes according to node addresses. The words that are allocated are divided into input areas, which show the status of inputs from the Slaves and output areas, which are used to write data to be output to the Slaves.

Words allocated to the node address of the Master Unit aren't used by the Master Unit and can be used by a Slave. The Master's node address, however, must be unique and can't be assigned to both the Master and to a Slave.

When another company's slave is being used, both the input and output areas might be used by the slave even if the slave is just an output slave or input slave. Be sure to check the slave's specifications carefully before using it.

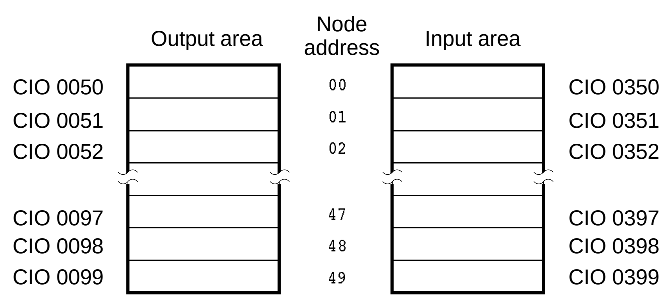
CVM1 and CV-series PCs

The I/O areas consist of an input area (IR 2000 to IR 2063) and output area (IR 1900 to IR 1963). The input and output areas are allocated according to the Slaves' node addresses, as shown in the following diagram.



CS1-series PCs

The DeviceNet Area consists of an input area (CIO 0350 to CIO 0399) and an output area (CIO 0050 to CIO 0099). The input and output areas are allocated according to the Slaves' node addresses, as shown in the following diagram.



With the CS1 Series, the DeviceNet Output Area (CIO 0050 to CIO 0099) is contained inside the I/O Area (CIO 0000 to CIO 0319). For this reason, in systems with a large number of I/O points, where CIO 0050 to CIO 0099 would be allocated to I/O Units, ensure that there is no overlap of area allocation using one of the following methods.

Editing I/O Tables

By editing the I/O tables using the CX-Programmer, it is possible to ensure that actual I/O (for Basic I/O Units) is not allocated to CIO 0050 to CIO 0099.

With automatic allocation (I/O table creation), it is possible that actual I/O is allocated to CIO 0050 to CIO 0099, and so in systems with a large number of I/O points, be sure to edit I/O tables using CX-Programmer. (I/O tables cannot be edited with a Programming Console.)

For details, refer to the *CX-Programmer Operation Manual*.

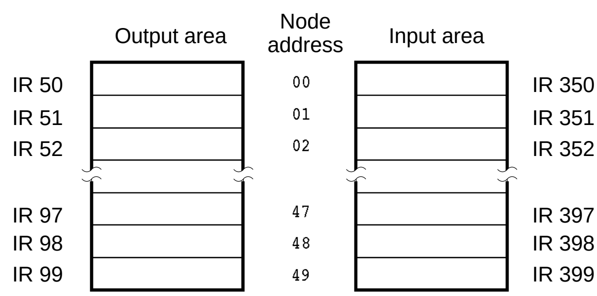
Using the Configurator

By performing user-set allocation using the Configurator, it is possible to change the position of areas used for DeviceNet output. For details, refer to *8-4 User-set Allocations* and the *CompoBus/D Configurator Operation manual* (W328).

Note Attempting to use DeviceNet remote I/O communications functions with the same areas allocated to actual I/O (for Basic I/O Units) and to DeviceNet (CompoBus/D) Slaves may cause I/O Units, the CPU Unit program, or Slaves to malfunction.

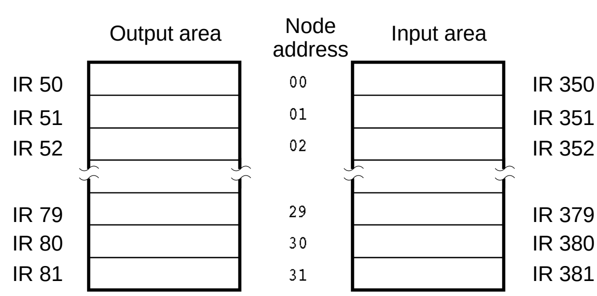
C200HX/HG/HE PCs

The I/O areas consist of an input area (IR 350 to IR 399) and output area (IR 50 to IR 99). The input and output areas are allocated according to the Slaves' node addresses, as shown in the following diagram.



C200HS PCs

The I/O areas consist of an input area (IR 350 to IR 381) and output area (IR 50 to IR 81). The input and output areas are allocated according to the Slaves' node addresses, as shown in the following diagram.



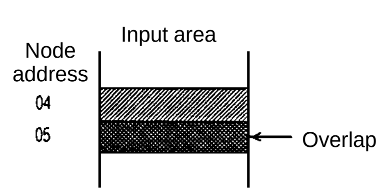
8-3-2 I/O Allocations and Errors

A setup error may occur when the scan list is disabled or a verification error may occur when the scan list is enabled if I/O allocations are not correct.

Setup Error: I/O Area Overlap

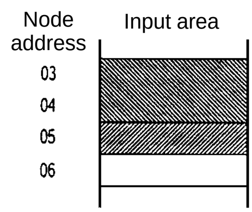
A setup error (I/O Area Overlap) will occur and it won't be possible to start DeviceNet communications if the same word is used by more than one Slave connected to a CVM1/CV-series Master Unit. This error will occur only when the scan list is disabled.

In the following example, the Slave with node address 4 uses two input words but the Slave with node address 5 also uses an input word. This creates an I/O Area Overlap error.

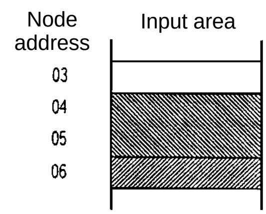


To eliminate the I/O area overlap and clear this error, change the node address setting on one of the Slaves as shown below and restart the Master by turning on the power again or restarting.

Change node address 04 to 03.



Change node address 05 to 06.

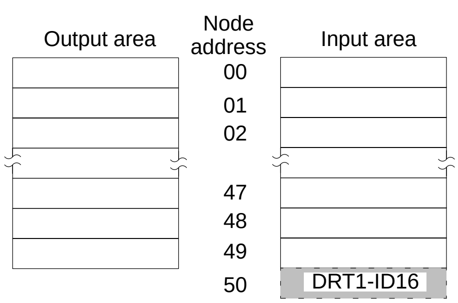


Setup Error: I/O Area Range Violation

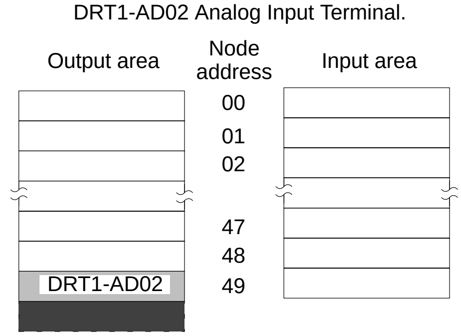
This error will occur only for C200HX/HG/HE PCs.

A setup error (I/O Area Range Violation) will occur and it won't be possible to start DeviceNet communications if the allocations such as those shown in the following examples are used.

Setting Node Addresses Higher than 49
The following illegal allocations will occur if a node address of 50 is set for a DRT1-ID16 Input Terminal.



Going Beyond Area Boundaries
The following illegal allocations will occur if a node address of 49 is set for a DRT1-AD02 Analog Input Terminal.



To eliminate the above problems and clear this error, change the node address setting on the Slave and restart the Master by turning on the power again or restarting.

Verification Error: Slave I/O Size Differs

A verification error (Slave I/O Size Differs) will occur and it won't be possible to start DeviceNet communications if a CVM1/CV-series Master Unit is being used with the scan list enabled and the type of I/O (input or output) or the number of I/O points registered for a Slave in the scan list doesn't match the actual I/O specifications of the Slave that is connected to the Master.

For example, a verification error will occur if the Slave with node address 10 is registered in the scan list as an 8-point Input Slave, but the actual Slave with node address 10 is an Output Slave or has a different number of I/O points.

To eliminate and clear this error, either create the scan list again or replace the Slave with the kind of Slave registered in the scan list.

Note The scan list verification is performed in byte units (8 bits). A verification error will thus not occur if an 1-point Input Slave is used instead of an 8-point Input Slave.

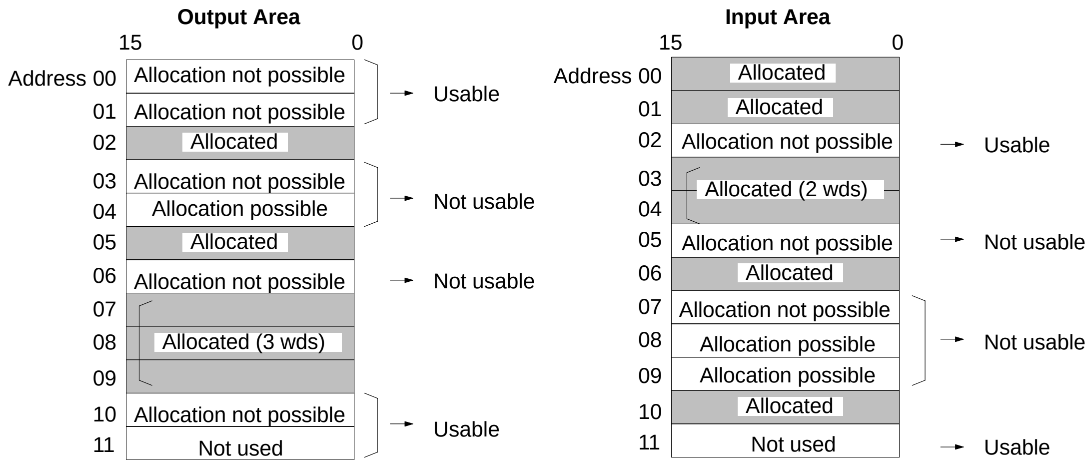
8-3-3 Slave Models and I/O Allocations

The following table shows the default remote I/O allocations for OMRON Slaves.

Outputs	Inputs	Slave name	Model number	Output area	Input area
0 pts	8 pts	Transistor Input Terminal	DRT-ID08	See explanation following table.	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.
		Environment-resistant Terminal	DRT-ID08C		
8 pts	0 pts	Transistor Output Terminal	DRT1-OD08	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.	See explanation following table.
		Environment-resistant Terminal	DRT1-OD08C		
8 pts	8 pts	Sensor Terminal	DRT1-ND16S	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.
		Environment-resistant Terminal	DRT1-MD16C		
0 pts	16 pts	Transistor Input Terminal	DRT1-ID16	See explanation following table.	16 bits allocated.
		Remote Adapter	DRT1-ID16X		
		Sensor Terminal	DRT1-HD16S		
		RS-232C Unit	DRT1-232C2		
16 pts	0 pts	Transistor Output Terminal	DRT1-OD16	16 bits allocated.	See explanation following table.
		Remote Adapter	DRT1-OD16X		
16 pts	16 pts	CQM1 I/O Link Unit	CQM1-DRT21	16 bits allocated.	16 bits allocated.
0 pts	32 pts	Analog Input Terminal (2 inputs)	DRT1-AD04	See explanation following table.	2 words (16 bits each) allocated.
0 pts	64 pts	Analog Input Terminals (4 inputs)	DRT1-AD04	See explanation following table.	4 words (16 bits each) allocated.
			DRT1-AD04H		
		Temperature Input Terminals	DRT1-TS04T		
			DRT1-TS04P		
32 pts	0 pts	Analog Output Terminal (2 outputs)	DRT1-DA02	2 words (16 bits each) allocated.	See explanation following table.
512 pts max.	512 pts max.	C200H I/O Link Unit	C200HW-DRT21	32 words max. (16 bits each) allocated (in 8-bit units)	32 words max. (16 bits each) allocated (in 8-bit units)

For the default allocations, one word each in the input and output areas is allocated to each node address. The words that are allocated are determined by the node address. If a Slave requires more than one input or output word, it is allocated the required number of words. When this happens, the node addresses normally used for the extra words cannot be used, also these node address can be used if the Slaves they are used for are allocated words in the other area (input or output area). Also, any words that are not allocated to a Slave that are between allocated words in the input or output area cannot be used at all, even as work bits.

The Master Units are not allocated any words regardless of the node address setting.



Not usable:	Cannot be used for work bits
Usable:	Can be used as work bits.
Allocation not possible:	Cannot be allocated to any Slave
Allocation possible:	Can be allocated to another Slave

8-3-4 Default Remote I/O Allocation Example

The following example uses a CVM1 or CV-series PC in a network consisting of Slaves with the following I/O points and node address settings:

8 input points → 00	16 output points → 03	48 input points → 06
8 output points → 01	8 mixed I/O points → 04	Master Unit (no points) → 07
16 input points → 02	16 mixed I/O points → 05	32 output points → 08

Node address	Outputs	Inputs		Output area		Input area
00	0 pts	8 pts	CIO 1900	Allocation possible	CIO 2000	Allocation not possible / Allocated
01	8 pts	0 pts	CIO 1901	Allocation not possible / Allocated	CIO 2001	Allocation not possible
02	0 pts	16 pts	CIO 1902	Allocation not possible	CIO 2002	Allocated
03	16 pts	0 pts	CIO 1903	Allocated	CIO 2003	Allocation not possible
04	8 pts	8 pts	CIO 1904	Allocation not possible / Allocated	CIO 2004	Allocation not possible / Allocated
05	16 pts	16 pts	CIO 1905	Allocated	CIO 2005	Allocated
06	0 pts	48 pts	CIO 1906	Allocation not possible	CIO 2006	Allocated
07	Master Unit (see note1)		CIO 1907	Allocation possible	CIO 2007	Allocated
08			CIO 1908	Allocated	CIO 2008	Allocated
09	32 pts	0 pts (see note 2)	CIO 1909	Allocated	CIO 2009	Allocation possible
10	None	None	CIO 1910	Not used	CIO 2010	Not used
11			CIO 1911	Not used	CIO 2011	Not used
63	None	None	CIO 1963	Not used	CIO 2063	Not used

Note

1. The Master Unit is not allocated any words, so any available node address can be used.
2. Slaves can be allocated to the words labeled "Allocation possible" as long as the same words are not allocated to more than one Slave.

8-3-5 Basic Application Procedure

1, 2, 3...

1. Set the initial settings for the Master Unit:

   Unit number ("UNIT No." or "MACHINE No." on front panel switch)
   Node address (back panel DIP switch)
   Baud rate (back panel DIP switch)
   Communications continue/stop setting for communications error (front panel switch)

2. Set the initial settings for the Slaves**:**

   Node address (DIP switch)
   Baud rate (DIP switch)
   Etc.

3. Mount the Master Unit and wire the network.

   For CVM1 and CV-series PCs, Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 16 Master Units can be mounted if a Configurator is used.

   For CS1-series PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 16 Master Units can be mounted if a Configurator is used.

   For C200HX/HG/HE PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 or 16 Master Units can be mounted if a Configurator is used.

   For C200HS PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 or 16 Master Units can be mounted if a Configurator is used.

4. Connect a Programming Device to the PC and turn on the power supply to the PC.
5. Generate the I/O table.
6. Turn on the power supply to the Slaves and turn on the communications power supply.
7. Turn on the power supply to the PC (i.e., to the Master Unit).
8. Switch the PC to PROGRAM mode.
9. Perform the following and go to step 12. if the scan list was disabled at startup.

   a) Confirm that communications are possible with the registered slaves by monitoring the Registered Slave Data Area.
   b) From a Programming Device connected to the PC, turn ON the Scan List Enable Bit in the software switches (bit 0).

   Remote I/O communications will start with the scan list enabled. You can use the software switches to start and stop remote I/O communications.

10. Perform the following from Programming Device connected to the PC and go to step 12. if the scan list was disabled at startup and you want to re-register the the scan list.

   a) Turn ON the Scan List Clear Bit in the software switches (bit 1).
   b) Confirm that communications are possible with the registered slaves by monitoring the Registered Slave Data Area.

   Remote I/O communications will start with the scan list enabled. You can use the software switches to start and stop remote I/O communications.

c) Turn ON the Scan List Enable Bit in the software switches (bit 0).

11. Do nothing if the scan list was enabled at startup and you not want to change the scan list.

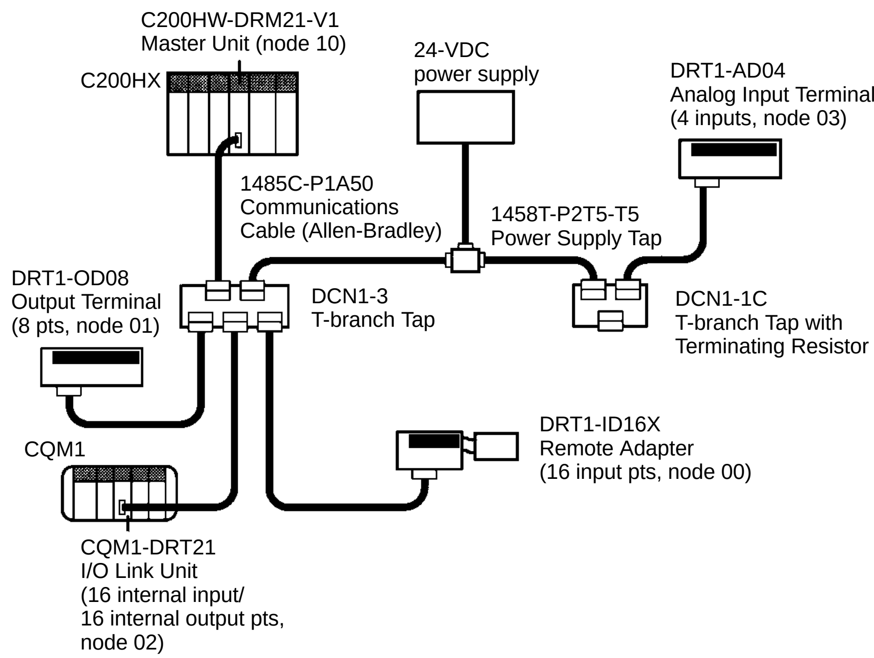
    Remote I/O communications will start with the scan list enabled. You can use the software switches to start and stop remote I/O communications. Go to step 12.

12. Confirm that the MS and NS indicators on all Master Units and Slaves are lit.
13. Switch the PC to RUN mode.

Note The dots on the 7-segment display on the Master Unit can be used to determine if the scan list is enabled or disabled. If both the right and left dots are not lit, the scan list is enabled. If both dots are lit, the scan list is disabled.

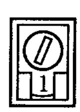
8-3-6 Actual System Allocation Example

The following example provides the procedure for using remote I/O communications with the default remote I/O allocations.



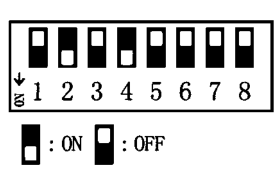
1, 2, 3... 1. Make the initial settings for the Master Unit as follows:

a) Set the unit number. The following example is for unit number 1.



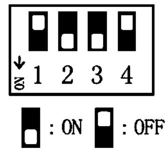
The following words are allocated for the software switches and status areas for a unit number of 1: IR 110 to IR 119 and DM 6034 to DM 6035.

b) Set the node address. The following example is for a node address of 10 (pins 2 and 4 turned ON).

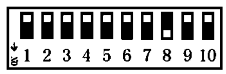
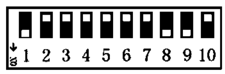
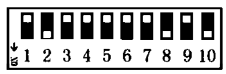
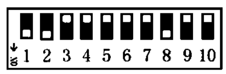


The remote I/O words allocated to the Master Unit are not used.

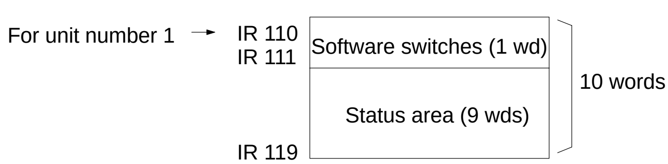
c) Set the baud rate and the communications continue/stop setting for communications errors. The following example show a baud rate of 500 kbps (pin 1 OFF and pin 2 ON) and the setting to stop communications for communications errors (pin 3 ON).



2. Make the initial settings for the Slaves.

Slave	Allocated points		DIP switch settings	Node address (pins 1 to 6)	Baud rate (pins 7 and 8)	Pins 9 and 10
	Inputs	Outputs				
DRT1-ID16X Remote Adapter	16 pts	---		0 (pins 1 to 6 OFF)	500 kbps (pin 7 OFF and pin 8 ON)	Not used (OFF).
DRT1-OD08 Output Terminal	---	8 pts		1 (pin 1 ON)		Pin 9 ON to hold outputs for comm. errors. Pin 10 not used (OFF).
CQM1-DRT21 I/O Link Unit	Internal in the CQM1			2 (pin 2 ON)		Pin 9 not used (OFF). Pin 10 ON to hold outputs for comm. errors.
	16 pts	16 pts				
DRT1-AD04 Analog Input Unit	4 analog input pts	---		3 (pins 1 and 2 ON)		Pin 9 OFF to use 4 inputs. Pin 10 OFF to not use averaging.

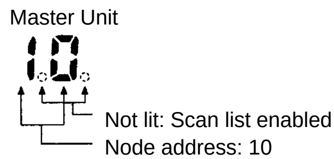
3. Mount and wire the Master Unit.
4. Connect a Programming Device to the PC, turn on the PC, and create the I/O table.
5. Turn off power to the PC (Master Unit).
6. Turn on power to all Slaves and turn on the communications power supply.
7. Turn on power to the PC (Master Unit).
8. Switch the PC to PROGRAM mode.
9. Monitor the Registered Slave Data Area to see if all Slaves are communicating.
10. Turn ON the Enable Scan List software switch, i.e., bit 00 of IR 110. The software switches are in IR 110 because the unit number of the Master Unit is set to 1.



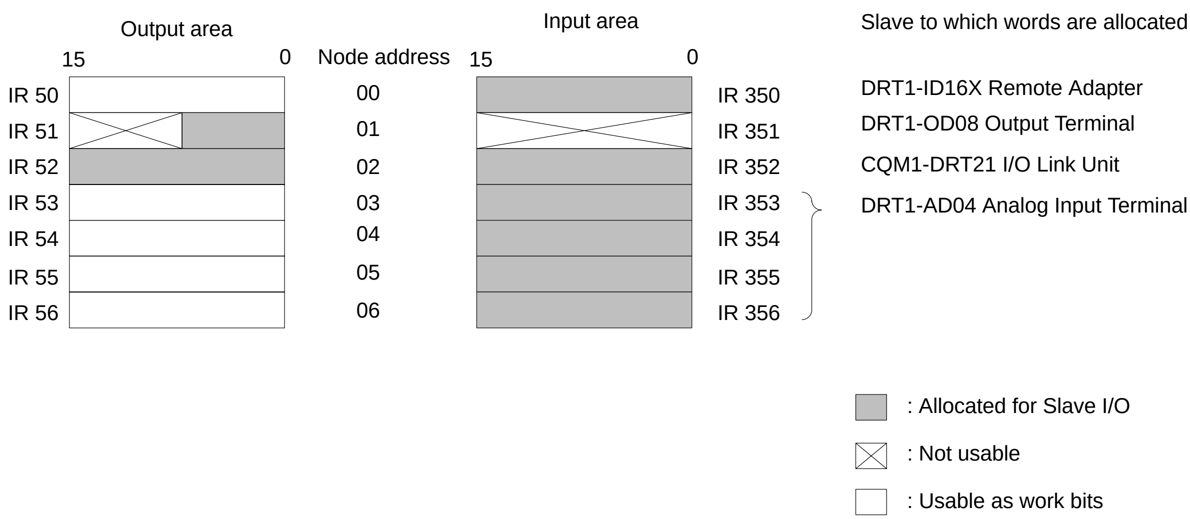
The functions of the software switches are shown in the following table.

Word	Bit	Function
IR 110	00	Enable Scan List
	01	Clear Scan List
	02	Restart for Communications Errors
	03	Start Remote I/O Communications
	04	Stop Remote I/O Communications

11. Confirm that the MS and NS indicators are lit at all nodes and that the 7-segment display on the Master Unit shows a node address of 10 and that the scan list is enabled



Remote I/O words will be allocated to the Slaves as follows and remote I/O communications will start:

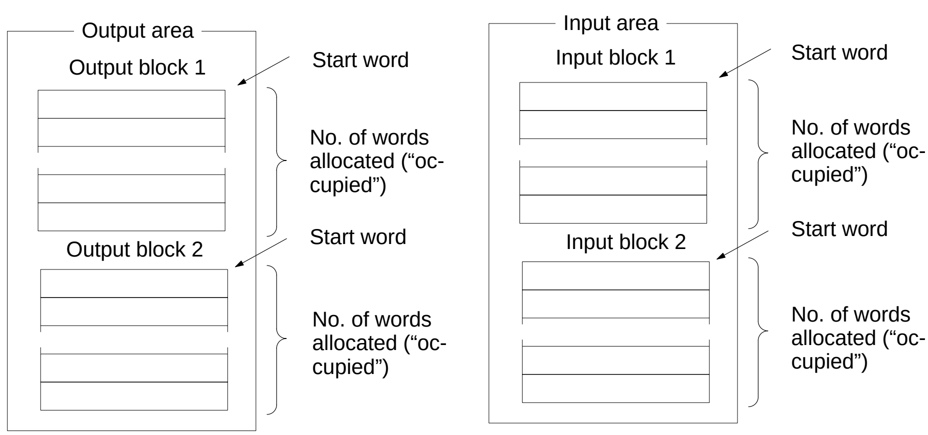


8-4 User-set Allocations

When user-set allocations are used, the remote I/O areas consist of input blocks 1 and 2, which input Slave data to the PC, and output blocks 1 and 2, which output data from the PC to the Slaves. These four blocks can be allocated as desired using the following words. Each block, however, must consist of continuous words within one data area.

PC	**CVM1/CV-series PCs**		**CS1-series PCs**	**C200HX/HG/HE PCs**		**C200HS PCs (all models)**
	CV500/ CVM1-CPU01 -E	**All other models**		**C200HE-CPU11-E**	**All other models**	
Words that can be allocated	CIO 0000 to CIO 2427	CIO 0000 to CIO 2555	CIO 0000 to CIO 0235, CIO 0300 to CIO 0511	IR 000 to IR 235, IR 300 to IR 511		
	G008 to 255		H000 to HR099 CIO 1000 to CIO 1063 (See note.)	HR 00 to HR 99 LR 00 to LR 63		
	D00000 to D08191	D00000 to D24575	D00000 to D05999	DM 0000 to DM 4095	DM 0000 to DM 5999	DM 0000 to DM 5999
Max. No. of words	Each block can be up to 100 words (including unused areas)		Each block can be up to 100 words (including unused areas) The total number of words in all four blocks must be 300 words or less (including unused areas) If message communications are used, the total number of words in all four blocks must be 100 words or less			The total number of words in all four blocks must be 80 words or less (including unused areas)

Note If words in the range "LR 00" to "LR 63" are allocated with the Configurator for CS1-series PCs, the corresponding words in the range CIO 1000 to CIO 1063 will actually be allocated.

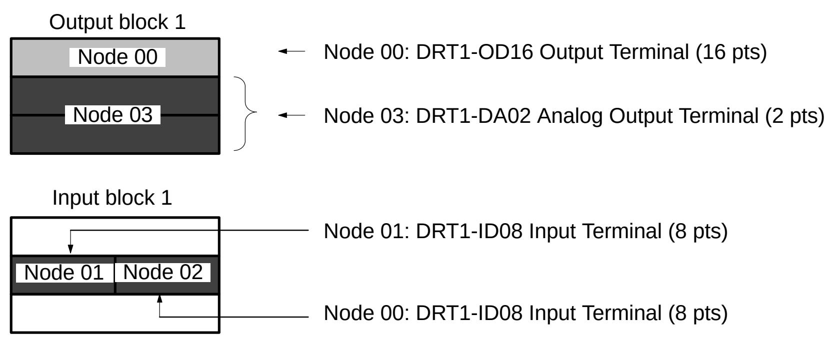


Note
1. When using the Configurator to create Master parameters for a Master Unit mounted to a CS1-series PC, set the PC model to "Other C200HX/HG/HE(-Z) Series".
2. If Master parameters are read from a Master Unit mounted to a CS1-series PC, the PC model will be C200HX-CPU85.
3. With CS1-series PCs, the areas that can be specified when allocating I/O with the Configurator, and the actual areas that are allocated, correspond in the way shown in the following table. There are some areas that cannot be allocated.

Area specified with Configurator	Actual area for CS1-series PC
IR 0 to IR 235	CIO 0000 to CIO 0235
IR 300 to IR 511	CIO 0300 to CIO 0511
HR 00 to HR 99	H000 to H099
DM 0000 to DM 5999	D00000 to D05999

1, 2, 3...

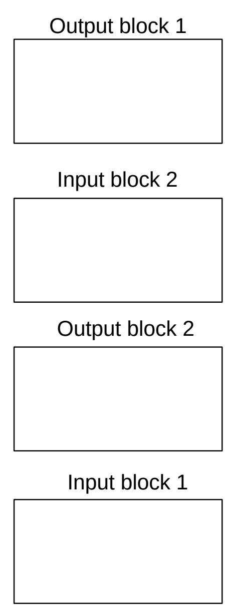
1. Use the Configurator to set the area type, start word, and number of words allocated for each block.
2. Use the Configurator to allocate node addresses within each block, as shown below.



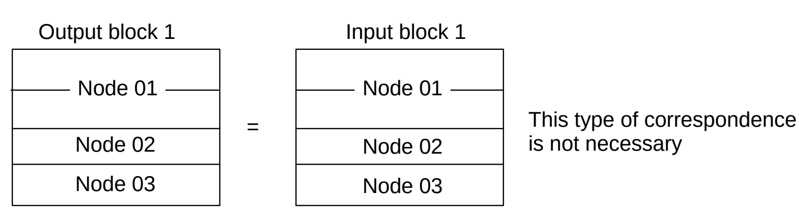
Each node address must be allocated at least one byte (rightmost or leftmost).

Note

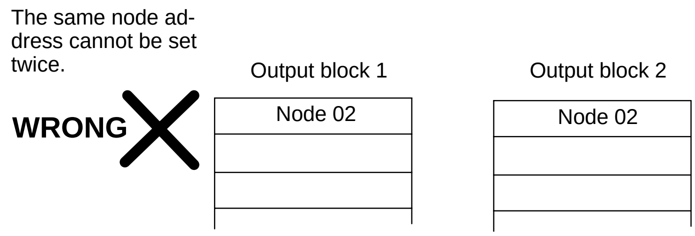
1. Blocks can be in any order in memory.



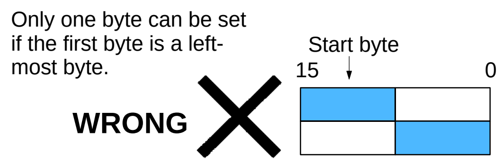
2. Output blocks do not need to match input blocks in terms of node address settings. For example, the following type of correspondence is not necessary.



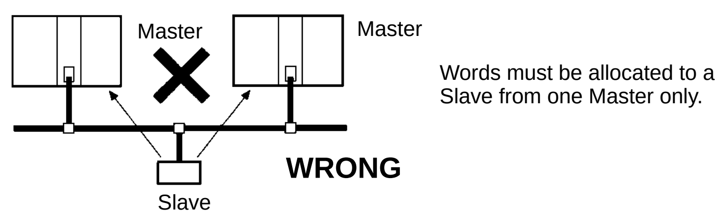
3. Each node address can be set only once in the output blocks and once in the input blocks.



4. I/O can be allocated in either bytes or words, but if the starting byte is a leftmost byte (bits 07 to 15), then only one byte can be set.

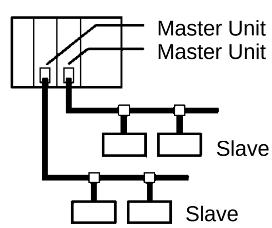


5. The same Slave cannot be allocated words in more than one Master.



   You can use the master parameter file duplication check from the Configurator to check for node address that have been set more than once in the scan list, which shows the I/O allocations that have been made.

6. Always use the Configurator when there is more than one Master and enable the scan lists. A Bus off error can occur if there is more than one Master with the scan list disabled on the same network.
7. User-set allocations can be used to enable mounting more than one Master Unit to the same PC, as shown below.



8. An error will not occur for user-set allocations even if allocated words overlaps with words allocated to other Units. Set allocations carefully; the system will not function properly if used with overlapping setting.

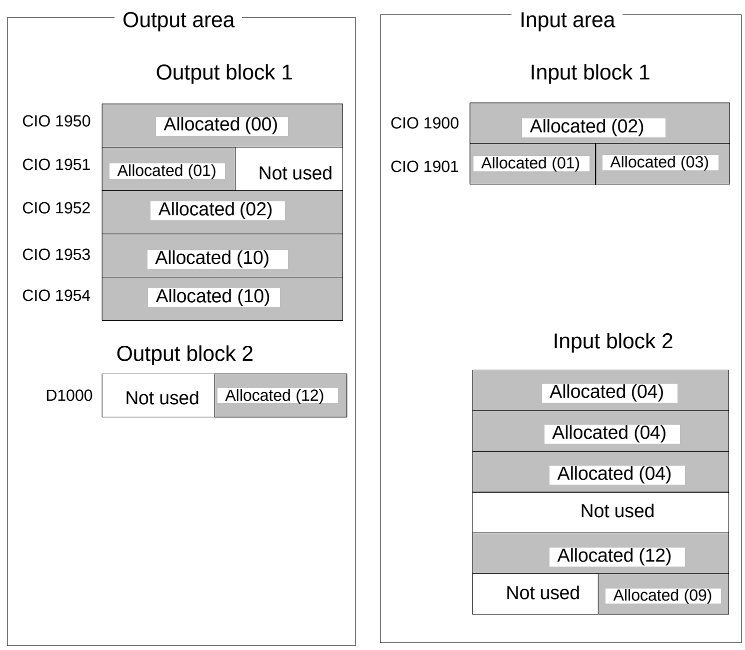
8-4-1 Example of User-set Allocations

The following example uses a CV-series PC in a network consisting of Slaves with the following I/O points and node address settings:

Output Block 1	Output Block 2
16 output points → 00	48 input points → 04
8 I/O points → 01	8 input points → 09
16 I/O points → 02	8 output points, 16 input points → 12
8 input points → 03	
32 output points → 10	

Node address	Outputs	Inputs
00	16 pts	0 pts
01	8 pts	8 pts
02	16 pts	16 pts
03	0 pts	8 pts
10	32 pts	0 pts

Node address	Outputs	Inputs
04	0 pts	48 pts
09	0 pts	8 pts
12	8 pts	16 pts



Setting I/O Allocations on the Configurator

1, 2, 3...

1. Delete the check marks from the “Not Used” setting for each of the blocks: Input blocks 1 and 2 and output blocks 1 and 2.
2. Edit each block and set the area, start word, and number of words allocated for each.
3. Set the start word (or start byte) and the allocation size (number of bytes) for each node address in the current device setup table.

Node address	OUT word	Size	IN word	Size	Exp
00	1950	2			
01	1951H	1	1901H	1	
02	1952	2	1900	2	
03			1901L	1	
04			10	6	
09			15L	1	
10	1953	4			
12	CM1000L	1	14	2	

Output area, block 1
Area: I/O relay
Start word: 1950
No. of words: 5

Output area, block 2
Area: DM Area
Start word: 1000
No. of words: 1

Input area, block 1
Area: I/O relay
Start word: 1900
No. of words: 2

Input area, block 2
Area: I/O relay
Start word: 10
No. of words: 6

I/O relay = IR or CIO Area

8-4-2 Basic Application Procedure

1, 2, 3...

1. Set the initial settings for the Master Unit:

Unit number (“UNIT No.” or “MACHINE No.” on front panel switch)
Node address (back panel DIP switch)
Baud rate (back panel DIP switch)
Communications continue/stop setting for communications error (front panel switch)

2. Set the initial settings for the Slaves:

   Node address (DIP switch)
   Baud rate (DIP switch)
   Etc.

3. Mount the Master Unit and wire the network.

   For CVM1 and CV-series PCs, Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 16 Master Units can be mounted if a Configurator is used.

   For CS1-series PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 16 Master Units can be mounted if a Configurator is used.

   For C200HX/HG/HE PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 or 16 Master Units can be mounted if a Configurator is used.

   For C200HS PCs, Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack. Only one Master Unit can be mounted if a Configurator is not used, but up to 10 or 16 Master Units can be mounted if a Configurator is used.

4. Connect a Programming Device to the PC and turn on the power supply to the PC.
5. Generate the I/O table.
6. Go to step 7. if only one Master Unit is being used and to step 14. if more than one Master Unit is being used in the same Network.
7. Connect a Configurator to the network.
8. Turn on the power supply to all nodes.
9. Switch the PC to PROGRAM mode.
10. Get the device list and create the master parameters with the Configurator.
11. If more than one Master Unit is mounted to the same PC, use the Configurator to check for duplication in the master parameter settings.
12. Register the master parameters in the Master Unit(s).
13. Go to step 28.
14. Connect a Configurator to the network.
15. Turn on the power supply to all the Slaves.
16. Read the network configuration from the Configurator.
17. Turn off the power supply to all the Slaves.
18. Create the master parameters for each Master Unit and save the parameters in files.
19. Turn on the power supply to one PC (i.e., to one of the Master Units).
20. Switch the PC to PROGRAM mode.
21. Read the network configuration from the Configurator.
22. Read the master parameter file for the Master Unit that has been turned on from the master parameter editing screen.
23. Use the Configurator to check for duplication in the master parameter settings.

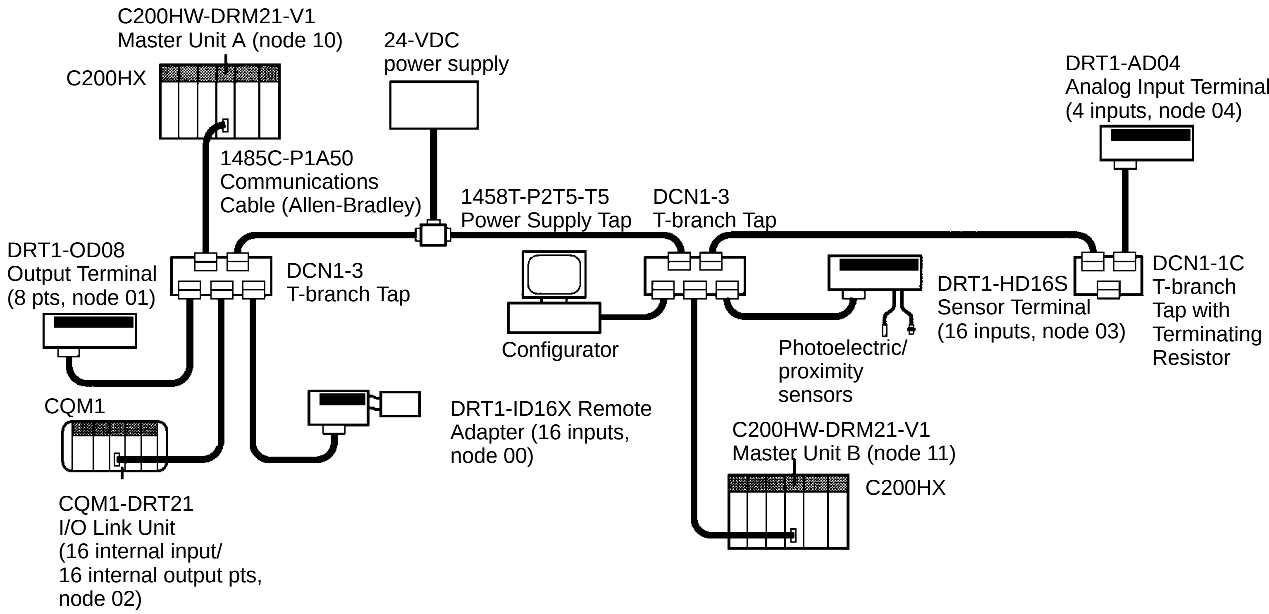
24. Write the master parameters.
25. Turn off the power supply to the PC (i.e., the Master Unit) and the Slaves.
26. Repeat the above steps beginning at step 6. for all Master Units.
27. Turn on the power supply to all Masters and Slaves.
28. Remote I/O communications will start with the scan list enabled. (Communications will not start if they have been set to be stopped at startup from the Configurator.) Use the software switches or Configurator to start and stop remote I/O communications.
29. Confirm that the MS and NS indicators on all Master Units and Slaves are lit.
30. Read the network configuration from the Configurator.
31. Save the network configuration in a file from the Configurator.
32. Switch the PC to RUN mode.

Note When there are no available node addresses for the Configurator, as is the case when a total of 64 Master Units and Slave Units are used, set up communications based on user-set allocations according to the following procedure.

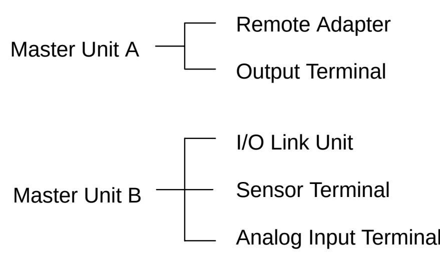
1, 2, 3...
1. Turn ON the communications power supply.
2. Turn ON the power supply to all the Slaves. (Turn OFF the power supply to all the Masters.)
3. Connect the Configurator to the network using the node address of one of the Masters.
4. Create the Master parameters for each Master Unit and save the parameters in files.
5. Disconnect the Configurator from the network (i.e., go “off-line”).
6. Turn OFF the power supply to all the Slaves.
7. Turn ON the power supply to all the Masters.
8. Connect the Configurator to the network using the node address of one of the Slaves.
9. Read a Master parameter file from the Configurator.
10. Register the Master parameters read in step 9. in the corresponding Master Unit.
11. Repeat steps 9. and 10. for all Master Units.
12. Disconnect the Configurator from the network.
13. Turn ON the power supply to all the Slaves.
14. Start communications.

8-4-3 Actual System Allocation Example

The following example provides the procedure for using remote I/O communications with user-set remote I/O allocations.

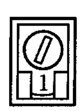


The following remote I/O configuration will be used for the above Network.



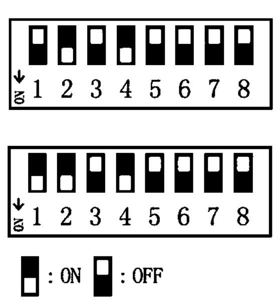
1, 2, 3... 1. Make the initial settings for the Master Units A and B as follows:

a) Set the unit numbers. The following example is for unit number 1 for both Master Units.



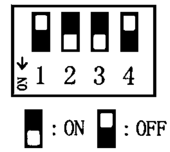
The following words are allocated for the software switches and status areas for a unit number of 1: IR 110 to IR 119 and DM 6034 to DM 6035.

b) Set the node addresses. The following example is for a node address of 10 for Master Unit A (pins 2 and 4 turned ON) and 11 for Master Unit B (pins 1, 2, and 4 turned ON.

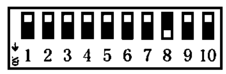
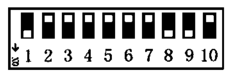
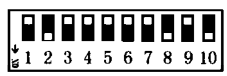
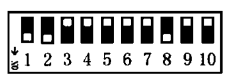
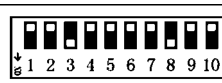


The remote I/O words allocated to the Master Units are not used.

c) Set the baud rates and the communications continue/stop settings for communications errors. The following example shows a baud rate of 500 kbps (pin 1 OFF and pin 2 ON) and the setting to stop communications for communications errors (pin 3 ON).



2. Make the initial settings for the Slaves.

Slave	Allocated points		DIP switch settings	Node address (pins 1 to 6)	Baud rate (pins 7 and 8)	Pins 9 and 10
	Inputs	Outputs				
DRT1-ID16X Remote Adapter	16 pts	---		0 (pins1 to 6 OFF)	500 kbps (pin 7 OFF and pin 8 ON)	Not used (OFF).
DRT1-OD08 Output Terminal	---	8 pts		1 (pin 1 ON)		Pin 9 ON to hold outputs for comm. errors. Pin 10 not used (OFF).
CQM1-DRT21 I/O Link Unit	Internal in the CQM1 16 pts	 16 pts		2 (pin 2 ON)		Pin 9 not used (OFF). Pin 10 ON to hold outputs for comm. errors.
DRT1-HD16S Sensor Terminal	16 pts	---		3 (pins 1 and 2 ON)		Not used (OFF).
DRT1-AD04 Analog Input Unit	4 analog input pts	---		4 (pin 3 ON)		Pin 9 OFF to use 4 inputs. Pin 10 OFF to not use averaging.

3. Mount and wire the Master Units.
4. Connect a Programming Device to the PC, turn on the PC, and create the I/O table.
5. Turn off power to the PCs (Master Units).
6. Connect the Configurator.
7. Turn on power to all Slaves.
8. Place the Configurator online and read the network configuration.
9. Create the master parameters for each Master Unit.
   The input and output areas and the Slave I/O allocations must be set for each Master Unit as shown in the following tables. Use different master parameter file names for the parameters for each master. The master parameter settings will be deleted when the Configurator is ended, so be sure to save the master parameters in files.

Master Unit A

Node address	OUT word	Size	IN word	Size	Exp
00			LR20	2	
01	300L	1			

Output area, block 1		Output area, block 2	Input area, block 1		Input area, block 2
Area:	I/O relay	Area:	Area:	I/O relay	Area:
Start word:	300	Start word:	Start word:	20	Start word:
No. of words:	1	No. of words:	No. of words:	1	No. of words:

Master Unit B

Node address	OUT word	Size	IN word	Size	Exp
02 03 04	DM0100	2	400 401 402	2 2 8	

Output area, block 1		Output area, block 2	Input area, block 1		Input area, block 2
Area:	DM Area	Area:	Area:	I/O relay	Area:
Start word:	100	Start word:	Start word:	4000	Start word:
No. of words:	1	No. of words:	No. of words:	6	No. of words:

I/O relay = IR or CIO Area

10. Turn off power to all Slaves.
11. Turn on power to Master Unit A.
12. Read the network configuration from the Configurator. The device list for Master Unit A will be displayed.
13. Edit the device parameters for Master Unit A with the Configurator by reading the master parameter file created in step 9. and then writing the parameters to Master Unit A.
14. Turn off power to Master Unit A and turn on power to Master Unit B.
15. Repeat steps 12. and 13. for Master Unit B.
16. Turn on power to all Slaves.
17. Read the network configuration from the Configurator.
18. Confirm that all nodes are displayed at the Configurator and that the master parameters for Master Units A and B are set correctly.
19. Save the master parameters in network files.
20. Check the two master parameter files in the network files that have been saved using the Configurator's master parameter file duplication check to be sure that there are no parameter settings that have been duplicated.
21. If there are no duplicated settings in the master parameters, start remote I/O communications for Master Units A and B and confirm that the desired remote I/O communications are performed.
    If there are duplicated settings, correct the remote I/O allocations from the master parameter edit screen, write the corrected parameters to the Master Unit(s) and then repeat the procedure beginning at step 17.

Note Be sure to save the network files. They will be required if a Master Unit is ever set to disable the scan list or if a Master Unit is replaced. (The master parameter files saved in step 9. are not required.)

SECTION 9
Message Communications

This section describes message communications using FINS commands sent from the ladder diagram program of the PC.

9-1 Overview

Message communications enable messages to be set between nodes on a DeviceNet (CompoBus/D) Network when required by system conditions. The messages can be sent between PCs, between an OMRON PC and a master made by another company, or between Slaves. They can be used to send/receive data; read time data, error histories, and other data; or control operation, e.g., by force-setting/resetting bits.

There are two types of messages: FINS messages and explicit messages. Both types of messages are used by placing send/receive instructions in the user program.

FINS Messages

Messages can be exchanged using FINS commands between DeviceNet nodes (Masters and Slaves) that support FINS messages. Both the CVM1-DRM21-V1 and C200HW-DRM21-V1 Master Units support FINS messages.

Explicit Messages

Service requests can be sent to OMRON Special Slaves and DeviceNet devices made by other manufacturers using explicit messages defined for DeviceNet.

Note A specific FINS command (command 28 01) is used to send explicit messages.

Message Support

The following tables outline DeviceNet message support. Of the commands sent and received via the DeviceNet Master Unit, some commands are addressed to the CPU Unit and other commands are addressed to the Master Unit.

Data Send/Receive Commands

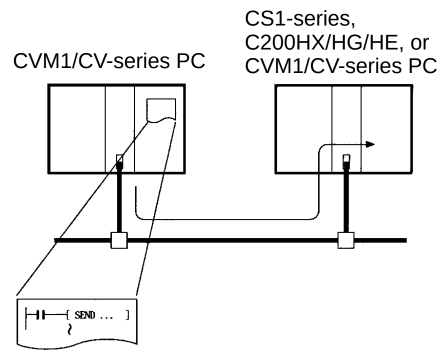
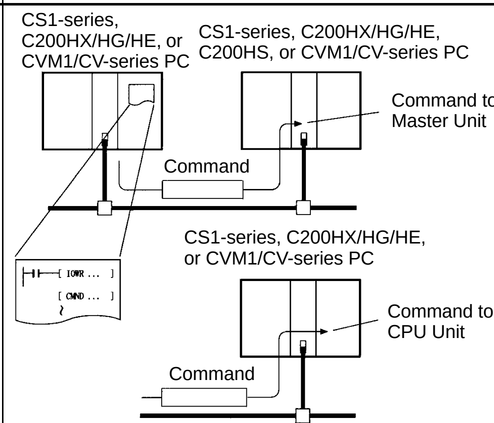
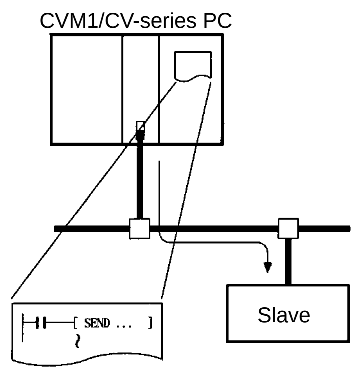
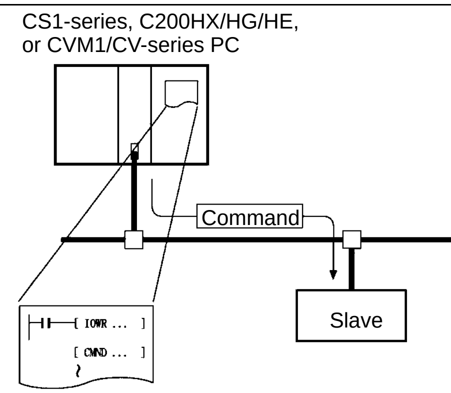
PC sending command	Instruction used	PC receiving command		
		CVM1 and CV Series	C200HX/HG/HE	C200HS
CVM1 and CV Series	SEND(192)/RECEIVE	OK	OK	Not supported
CS1 Series	Not supported			
C200HX/HG/HE	Not supported			
C200HS				

General FINS Commands

PC sending command	Instruction used	PC receiving command		
		CVM1 and CV Series	C200HX/HG/HE	C200HS
CVM1 and CV Series	CMND(194)	OK	OK	Master Unit only (See note.)
CS1 Series	IOWR	OK	OK	Master Unit only (See note.)
C200HX/HG/HE	IOWR	OK	OK	Master Unit only (See note.)
C200HS	Not supported			

Note Only commands addressed to the DeviceNet Master Unit can be sent to C200HS PCs.

Message Communications Overview

Type of message		Data send/receive commands	General FINS commands
PC sending command	**CVM1, CV Series**	**SEND(192)/RECV(193)**	**CMND(194)**
	CS1 Series, C200HX/ HG/HE	**None**	**IOWR**
PC to PC			
PC to OMRON Slave			
Data length (excluding command code)	**CVM1, CV Series**	158 bytes max. (SEND(192): 76 words, RECV(193): 78 words)	158 bytes max.
	CS1 Series, C200HX/ HG/HE	Not supported	158 bytes max.

Note 1. The DeviceNet Master Unit must be registered in the local network routing table of the CVM1 or CV-series PC to execute SEND(192), RECV(193), or CMND(194) instructions from a CVM1 or CV-series PC. The commands will not be sent and cannot be received from other CVM1 or CV-series PCs if the Master Unit is not registered in the routing tables. (Commands can be received from C200HX/HG/HE PCs without the routing table.)

2. The FINS command code can be set to 28 01 to send explicit DeviceNet messages to DeviceNet nodes for OMRON Special Slaves or devices by other manufacturers.

9-1-1 Message Communications Specifications

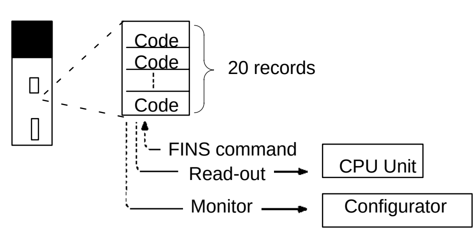
PC		CVM1 and CV Series	CS1 Series, C200HZ/HX/HG/HE	C200HS
Master Unit model number		CVM1-DRM21-V1	C200HW-DRM21-V1	
Max. No. of commu-nications nodes per Master Unit	**FINS messages**	8	8	Not supported.
	Explicit messages	63	63	63
Commu-nications instruc-tions	**Data send/receive**	SEND(192)/RECV(193)	None	Not supported.
	FINS commands	CMND(194)	IOWR	Not supported.
		There are FINS commands addressed to the Master Unit and others addressed to the CPU Unit.		Not supported.
	Explicit DeviceNet messages	CMND(194)	IOWR	Not supported.
		Explicit DeviceNet messages are sent to masters and slaves made by other manufacturers.		Not supported.
Sources:destinations		1:1 (1:N broadcasting is not supported)		Not supported.
Data length (excluding command code)		SEND(192): 76 words max. RECV(193): 78 words max. CMND(194) 158 bytes max.	IOWR: 158 bytes max.	Not supported.
No. of simultaneous instructions		One each for 8 ports (ports 0 to 7)	1 only	Not supported.
Response monitoring time		Default setting: 2 s User setting: 0.1 to 6553.5 s		Not supported.
Retries		0 to 15	0	Not supported.
Message reception	**From CVM1/CV-se-ries PCs**	Supported for data send/receive and FINS commands		Supported only for FINS commands addressed to Master Unit.
	From C200HX/ HG/HE PCs	Supported for FINS commands		

Message Communications Error Indications

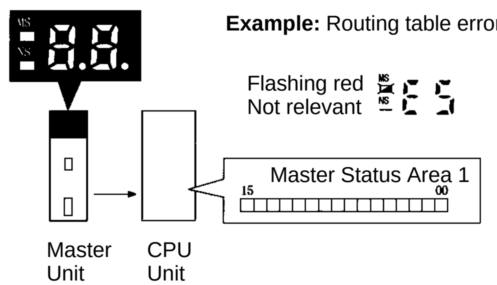
There are two ways to obtain information on communications errors that occur in message communications: 1) Using the error history in the Master Unit and 2) Using Master Unit displays, indicators, and Master Status Areas.

Each time a communications error occurs, and error code is placed in an error record in the error history kept in the RAM of the Master Unit. Up to 20 records can be stored in the error history. For CVM1/CV-series Master Units, the record is also time stamped. (Time stamps are not provided with the other Master Units.)

The error history can be read or cleared from the CPU Unit by sending an FINS command to the Master Unit (Error History Read/Clear). The contents of the error history can also be monitored from the Configurator.



The MS and NS indicators and the 7-segment display on the front panel of the Master Unit can be used together with the Master Status Area 1 inside the CPU Unit to obtain information on a communications error that has occurred. This information can be used as the basis for troubleshooting.



Message Communications Errors

Error		MS/NS indicators	7-segment display	Master status area 1	Error code (hex)
Send error	Network power error	MS: No change NS: Not lit	E0 ↔ Master node address	Bit 05 turns ON.	07 83
	Send time-out		E2 ↔ Master node address		07 84
Configuration error	PC error	MS: Flashing red NS: No change	E4 ↔ Master node address	Bit 03 turns ON.	07 09
	Configuration data error		E8 ↔ Master node address		07 01
	Routing table error		E5 ↔ Master node address		00 0B
Node address duplication		MS: No change NS: Lit red	F0 ↔ Master node address	Bit 01 turns ON.	07 81
Bus Off detected			F1 ↔ Master node address		07 82
Illegal switch setting		MS: Flashing red NS: Not lit	F3 ↔ Master node address	Bit 00 turns ON.	---
Initialization error with PC			F5 ↔ Master node address	---	00 06
PC interface error			F6 ↔ Master node address		00 02
Local node is not part of network; send response message destroyed		MS: No change NS: No change	No change	---	01 01
Send error; send response message destroyed					01 03
Remote node busy; send response message destroyed					01 09
Local node busy; send response message destroyed					01 19
Illegal message received; reception message data destroyed					01 18
Illegal header; send response message destroyed					01 12
Reception buffer full; reception response message destroyed					01 17

Note The send response message or reception response message will be destroyed if any of the following occur:

- If any communications instructions (SEND(192), RECV(193), CMND(194), or IOWR) are executed from the PC at intervals less than the message communications time.
- If messages are received from other nodes at intervals less than the message communications time.

Be sure that the interval between sending messages (i.e., the interval for executing communications instructions from the PC) and the interval for receiving messages at any one node are longer than the message communications time. Refer to *14-2 Message Communications Time* for details on the message communications time.

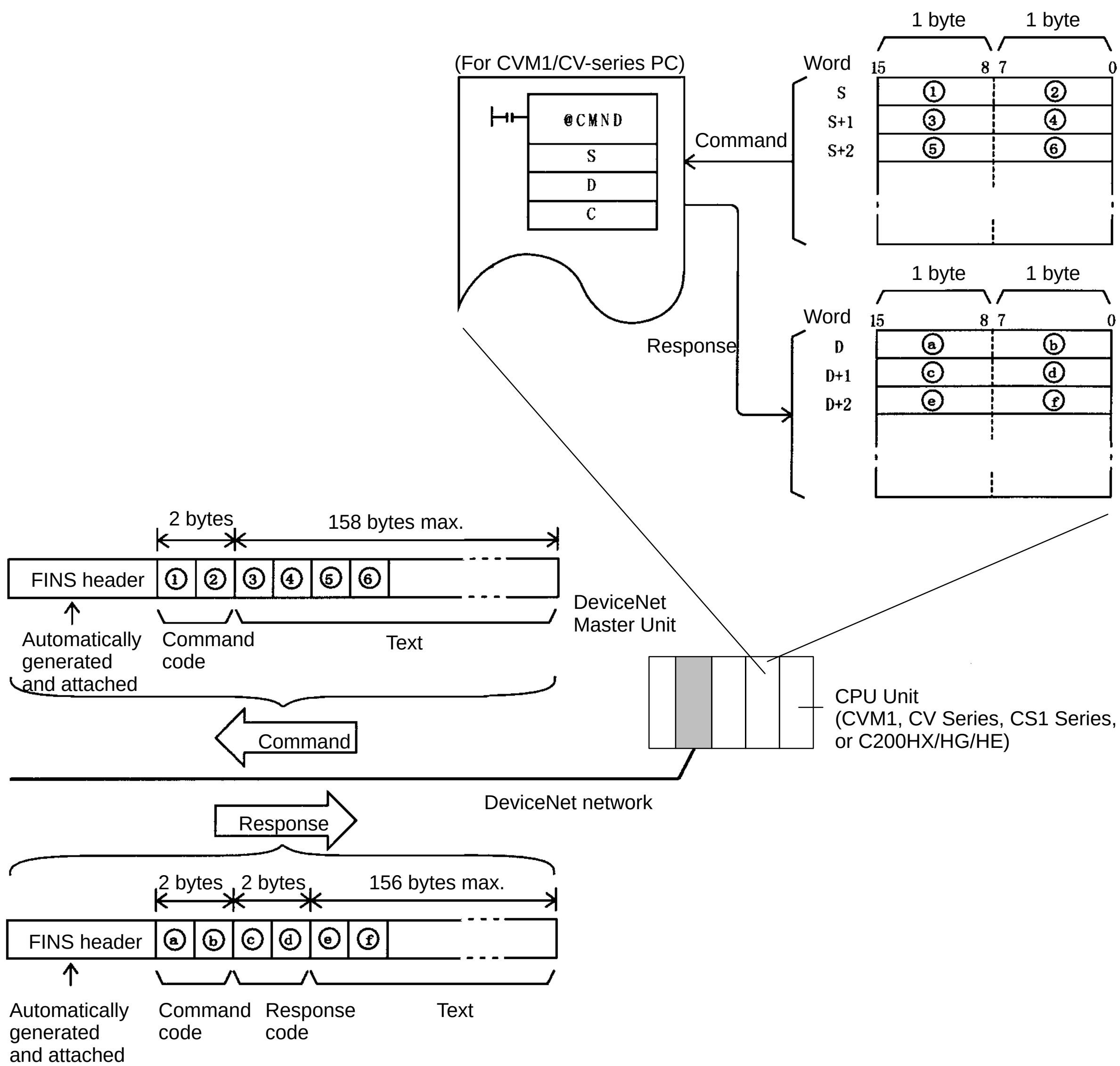
9-2 FINS Commands/Responses

The FINS communication protocol was developed by OMRON for use with factory automation control devices. FINS communications enable reading/writing PC memory and controlling operation without extensive programming in the user program in the PC. FINS communications use an independent system of addresses that does not rely on the addresses used in the DeviceNet Network. This enables communications not only with nodes on the DeviceNet Network, but also with devices and PCs connected via other FA networks, such as the SYSMAC NET and SYSMAC LINK Networks.

Note Although FINS communications enable communications between different networks, they can be used for communications only within one DeviceNet Network.

9-2-1 Sending/Receiving FINS Command/Responses

FINS commands are sent using the CMND(194) instruction for CVM1 and CV-series PCs and the IOWR instructions for CS1-series and C200HX/HG/HE PCs. Sending/receiving FINS commands/responses and the data formats used are illustrated in the following diagram. Unless otherwise specified, all data is hexadecimal.



Command Codes

Command codes are represented by a 2-byte hexadecimal code. FINS commands always begin with a 2-byte command code and any parameters that are required follow the command code.

Response Codes

Response codes are represented by a 2-byte hexadecimal code that indicates the results of command execution. The first byte provides the main response code (MRES), which classifies the results, and the second byte provides the sub-response code (SRES), which provides details on the results.

The main response codes are listed below. Refer to *Appendix B FINS Command Response Codes* for further details on response codes.

Main code	Main code
00: Normal completion	20: Read not possible
01: Local node error	21: Write not possible
02: Destination node error	22: Not executable in current mode
03: Communications controller error	23: No Unit
04: Not executable	24: Start/stop not possible
05: Routing error	25: Unit error
10: Command format error	26: Command error
11: Parameter error	30: Access right error
	40: Abort

9-2-2 Units Supporting FINS Communications

The parameters used for FINS commands depend on the Unit that is processing the command. Command details are provided in other sections for the following Units.

- CVM1 and CV-series CPU Units (See *Section 10.)*
- CS1-series and C200HX/HG/HE CPU Units (See *Section 11.)*
- DeviceNet Master Units (See *Section 12.)*

Note Although CS1-series and C200HX/HG/HE CPU Units cannot directly process FINS commands, the DeviceNet Master Unit will convert the FINS commands into a form that CS1-series and C200HX/HG/HE CPU Units can process. Responses from CS1-series and C200HX/HG/HE CPU Units are also converted into the proper form for FINS communications by the DeviceNet Master Unit and then returned to the source of the command.

9-2-3 FINS Command Lists

Refer to *Sections 10, 11*, and *12* for details on the following commands.

Commands Addressed to CVM1 and CV-series CPU Units

Function	Name	Command code		Page
Manipulating data in data areas and force-setting/resetting bits: CIO Area, DM Area, EM Area, Timer/Counter Area, Transition Area, Step Area	MEMORY AREA READ	01	01	158
	MEMORY AREA WRITE		02	159
	MEMORY AREA FILL		03	160
	MULTIPLE MEMORY AREA READ		04	160
	MEMORY AREA TRANSFER		05	162
	COMPOSITE REGISTRATION READ		10	162
	REGISTER COMPOSITE READ		11	163
Manipulating parameters: PC Setups, I/O tables, routing tables, etc.	PARAMETER AREA READ	02	01	164
	PARAMETER AREA WRITE		02	165
	PARAMETER AREA CLEAR		03	167
Manipulating program areas	PROGRAM AREA PROTECT	03	04	168
	PROGRAM AREA PROTECT CLEAR		05	168
	PROGRAM AREA READ		06	169
	PROGRAM AREA WRITE		07	170
	PROGRAM AREA CLEAR		08	171
Controlling operation	RUN (RUN, DEBUG, MONITOR modes)	04	01	171
	STOP (PROGRAM mode)		02	172
Reading PC model information	CONTROLLER DATA READ	05	01	172
	CONNECTION DATA READ		02	175
Reading PC status	CONTROLLER STATUS READ	06	01	175
	CYCLE TIME READ		20	177

Function	Name	Command code		Page
Manipulating the PC clock	CLOCK READ	07	01	178
	CLOCK WRITE		02	178
Manipulating messages	MESSAGE READ	09	20	179
	MESSAGE CLEAR			179
	FAL/FALS READ			180
Controlling access rights	ACCESS RIGHT ACQUIRE	0C	01	181
	ACCESS RIGHT FORCED ACQUIRE		02	182
	ACCESS RIGHT RELEASE		03	183
Manipulating error data	ERROR CLEAR	21	01	183
	ERROR LOG READ		02	184
	ERROR LOG CLEAR		03	185
Manipulating File Memory	FILE NAME READ	22	01	186
	SINGLE FILE READ		02	187
	SINGLE FILE WRITE		03	188
	MEMORY CARD FORMAT		04	188
	FILE DELETE		05	189
	VOLUME LABEL CREATE/DELETE		06	189
	FILE COPY		07	190
	FILE NAME CHANGE		08	190
	FILE DATA CHECK		09	191
	MEMORY AREA FILE TRANSFER		0A	192
	PARAMETER AREA FILE TRANSFER		0B	193
	PROGRAM AREA FILE TRANSFER		0C	194
Force-setting/resetting bits	FORCED SET/RESET	23	01	195
	FORCED SET/RESET CANCEL		02	196

Commands Addressed to CS1-series and C200HX/HG/HE CPU Units

Function	Name	Command code		Page
Manipulating data in data areas and force-setting/resetting bits: IR Area, DM Area, EM Area, Timer/Counter Area	MEMORY AREA READ	01	01	200
	MEMORY AREA WRITE		02	201
	MULTIPLE MEMORY AREA READ		04	202
	COMPOSITE REGISTRATION READ		10	202
	REGISTER COMPOSITE READ		11	203
Reading PC model information	CONTROLLER DATA READ	05	01	204
Reading PC status	CONTROLLER STATUS READ	06	01	204
Manipulating the PC clock	CLOCK READ	07	01	205

Note Although CS1-series CPU Units support other commands, only the ones listed above can be made via DeviceNet.

Commands Addressed to DeviceNet Master Units

Name	Command code		Page
RESET	04	03	208
CONTROLLER DATA READ	05	01	208
ECHOBACK TEST	08	01	209
ERROR LOG READ	21	02	209
ERROR LOG CLEAR		03	210

Command to Send Explicit DeviceNet Messages

Name	Command code		Page
EXPLICIT MESSAGE SEND	28	01	143

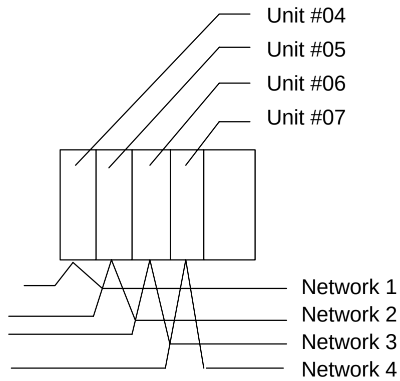
9-3 Message Communications for CVM1 and CV-series PCs

There are two instructions that can be executed to send and receive data from CVM1 and CV-series PCs: SEND(192) and RECV(193). There is another instruction that can be executed to send any FINS command: CMND(194).

Routing Tables

The DeviceNet Master Unit must be registered in the local network table of the CVM1 or CV-series PC to execute SEND(192), RECV(193), or CMND(194) instructions from a CVM1 or CV-series PCs. The commands will not be sent and cannot be received from other CVM1 or CV-series PCs if the Master Unit is not registered in the routing table. (Commands can be received from CS1-series and C200HX/HG/HE PCs without the routing table.)

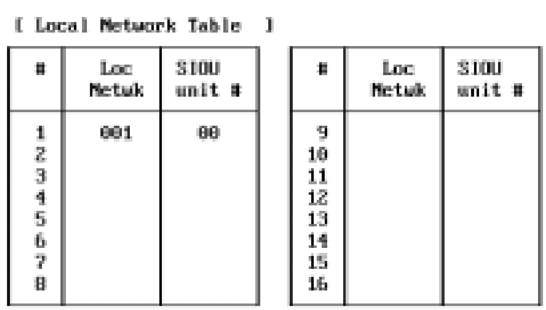
The local network table of the routing tables lists the unit numbers of the Communications Units mounted to the PC and the addresses of the Networks to which each Unit belongs. An example local network table is shown below.



Address of local network	CPU Bus Unit’s unit number
001	04
002	05
003	06
004	07

The unit number of the DeviceNet Master Unit as a CPU Bus Unit is the number set on the rotary switches on the front panel. The network address is the address of the Network to which the CPU Bus Unit is connected.

Routing tables are set from the Support Software using the following display to input the settings.


[Local Network Table]

#	Loc Netwk	SIOU unit #	#	Loc Netwk	SIOU unit #
1	001	00	9		
2			10		
3			11		
4			12		
5			13		
6			14		
7			15		
8			16		

Item	Setting method
Loc Netwk	The network address of each CPU Bus Unit mounted to the PC (1 to 127)
SIOU unit #	The unit number of each CPU Bus Unit mounted to the PC and connecting it to a network (0 to 15)

9-3-1 Data Send/Receive Instructions

NETWORK SEND: SEND(192)

Ladder Symbol

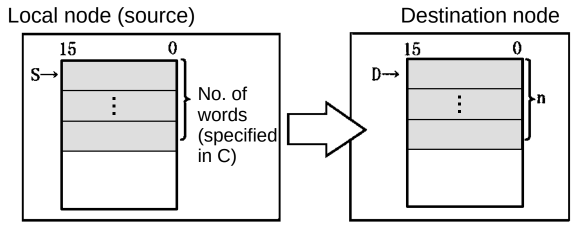
(192)
SEND S D C

Operands

S: 1st source word
D: 1st destination word
C: 1st control word

Variations

j SEND(192)



Description

SEND(192) transfers data beginning at word S in the local PC to addresses beginning at D at the designated node on the designated Network.

The possible values for D depend on the Unit from which the data is being transmitted. If D is in the EM Area, data will be transferred to the current EM bank in the PC to which the data is being transmitted.

The control words, beginning with C, specify the number of words to be sent, the destination node, and other parameters. Some control data parameters depend on the type of Network through which data is being sent.

SEND(192) only starts the transmission. Verify that the transmission has been completed with the Network Status Flags in A502.

Control Data

The control data depends on the destination. The following information is for DeviceNet networks.

Word	Bits 00 to 07	Bits 08 to 15
C	Number of words: 1 to 76 words ($0001 to $004C)	
C+1	Destination network address (0 to 127, i.e., $00 to $7F)[1]	Set to 0.
C+2	Destination unit address[2]	Destination node address[3]
C+3	Bits 00 to 03: No. of retries (0 to 15, i.e., $0 to $F) Bits 04 to 07: Set to 0.	Bits 08 to 11: Transmission port number ($0 to $7) Bit 12 to 14: Set to 0. Bit 15: ON: No response. OFF: Response returned.
C+4	Response monitoring time ($0001 to $FFFF = 0.1 to 6553.5 seconds)[4]	

Note

1. Set the destination network address to $00 when transmitting within the local network. The network of the Unit with the lowest unit number will be selected if the PC belongs to more than one network.
2. Indicates a Unit as shown in the following table.

Unit	Setting
CPU Unit	00
User program in FA computer	01
CPU Bus Unit	$10 to $1F: Unit numbers 0 to 15 $FE: The local Unit

3. Values of $01 to $3F indicate nodes 1 to 63.
4. Designates the length of time that the PC retries transmission when bit 15 of C+3 is OFF and no response is received. The default value is $0000, which indicates 2 seconds.

NETWORK RECEIVE: RECV(193)

Ladder Symbol

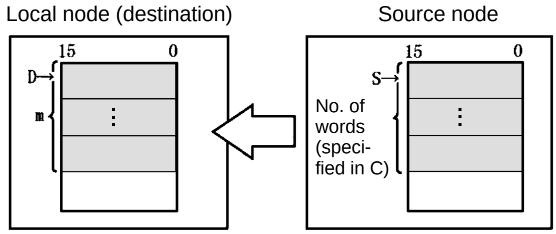
(193)
RECV S D C

Operands

S: 1st source word
D: 1st destination word
C: 1st control word

Variations

j RECV(193)



Description

RECV(193) transfers data beginning at word S from the designated node on the designated Network to addresses beginning at D at the local node.

The possible values for S depend on the Unit being transmitted from.

The control words, beginning with C, specify the number of words to be received, the source node, and other parameters. Some control data parameters depend on the Unit being transmitted from.

Normally a response is required with RECV(193), so set C+3 bit 15 to OFF.

RECV(193) only starts the transmission. Verify that the transmission has been completed with the Network Status Flags in A502.

Control Data

The control data depends on the source node. The following information is for DeviceNet Networks.

Word	Bits 00 to 07	Bits 08 to 15
C	Number of words: 1 to 78, i.e., $0001 to $004E)	
C+1	Source network address (0 to 127, i.e., $00 to $7F)[1]	Set to 0.
C+2	Source unit address[2]	Source node address[3]
C+3	Bits 00 to 03: No. of retries (0 to 15 in hexadecimal, i.e., $0 to $F) Bits 04 to 07: Set to 0.	Bits 08 to 11: Transmission port number ($0 to $7) Bit 12 to 14: Set to 0. Bit 15: ON: No response. OFF: Response returned.
C+4	Response monitoring time ($0001 to $FFFF = 0.1 to 6553.5 seconds)4	

Note

1. Set the source network address to $00 when transmitting within the same network. The network of the Unit with the lowest unit number will be selected if the PC belongs to more than one network.
2. Indicates a Unit as shown in the following table.

Unit	Setting
CPU Unit	00
User program in FA computer	01
CPU Bus Unit	$10 to $1F: Unit numbers 0 to 15 $FE: The local Unit

3. Values of $01 to $3E indicate nodes 1 to 63.
4. Designates the length of time that the PC retries transmission when bit 15 of C+3 is OFF and no response is received. The default value is $0000, which indicates 2 seconds.

9-3-2 Sending FINS Commands

DELIVER COMMAND: CMND(194)

CMND (194) can be used to send FINS commands to read/write I/O memory, read status data, change the operating mode, and perform other functions at other nodes.

Ladder Symbol

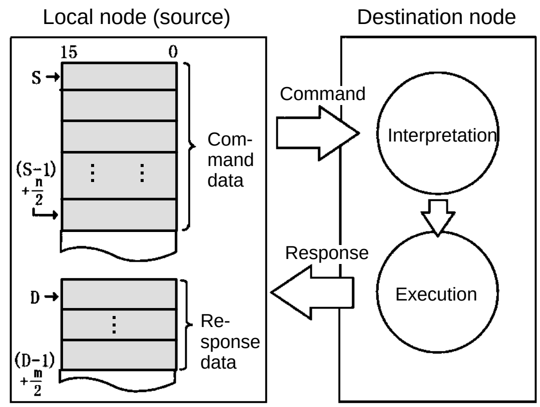
(194)
[CMND S D C]

Operands

S: 1st command word
D: 1st response word
C: 1st control word

Variations

j CMND(194)



Description

CMND(194) transmits the command beginning at word S to the designated Unit at the destination node address in the designated network, and receives the response beginning at word D.

Normally a response is required with CMND(194) and C+3 bit 15 is turned OFF.

Control Data

The control words, beginning with C, specify the number of bytes of control data to be sent, the number of bytes of response data to be received, the destination node, and other parameters. Some control data parameters depend on the destination.

Word	Bits 00 to 07	Bits 08 to 15
C	Number of command bytes to send: 0 to 160 (i.e., $0000 to $00A0)	
C+1	Number of response bytes to receive: 0 to 160 (i.e., $0000 to $00A0)	
C+2	Destination network address (0 to 127, i.e., $00 to $7F)[1]	Set to 0.
C+3	Destination unit FINS address[2]	Destination node address[3]
C+4	Bits 00 to 03: No. of retries (0 to 15, i.e., $0 to $F) Bits 04 to 07: Set to 0.	Bits 08 to 11: Transmission port number ($0 to $7) Bit 12 to 14: Set to 0. Bit 15: ON: No response. OFF: Response returned.
C+5	Response monitoring time ($0001 to $FFFF = 0.1 to 6553.5 seconds)[4]	

Note

1. Set the destination network address to $00 when transmitting within the same network.
2. Indicates a Unit as shown in the following table.

Unit	Setting
CPU Unit	00
User program in FA computer	01
CPU Bus Unit	$10 to $1F: Unit numbers 0 to 15 $FE: The local Unit

3. Values of $01 to $3E indicate nodes 1 to 63.
4. Designates the length of time that the PC retries transmission when bit 15 of C+3 is OFF and no response is received. The default value is $0000, which indicates 2 seconds.

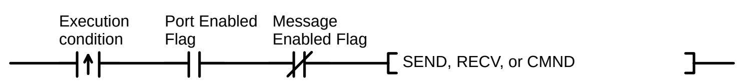
Sending Explicit Messages

Explicit messages can be sent to OMRON Special Slaves and DeviceNet devices made by other manufacturers by setting the FINS command code to 28 01. When this is done, set the response monitoring time in C+5 to at least 0014 hex (2 s). If it is set to less than 2 s, communications may be busy even if the next command is executed after the first one times out.

9-3-3 Using SEND(192), RECV(193), and CMND(194)

SEND(192), RECV(193), and CMND(194) are based on command/response processing. That is, the transmission is not complete until the sending node receives and acknowledges a response from the destination node, unless the response function is disabled in the control word.

If more than one network communications instruction (SEND(192)/RECV(193)/CMND(194)) is used through one port, the following flags must be used to ensure that any previous operation has completed before attempting further communications instructions. The Port Enabled Flag for the communications port and the Message Enabled Flag for the Master Unit are generally programmed as follows:



Communications Flags

Flag	Functions
Port #0 to #7 Enabled Flags (A50200 to A50207)	Enabled Flags A50200 to A50207 are OFF during communications instruction execution for ports #0 to #7, respectively, and turn ON when execution has completed (regardless of whether or not an error has occurred). Do not start a communications instruction for a port unless the corresponding Enabled Flag is ON.
Port #0 to #7 Execution Error Flags (A50208 to A50215)	Execution Error Flags A50208 to A50215 turn OFF following normal completion of a communications instruction (i.e., after reception of response signal) for ports #0 to #7, respectively. These flags turn ON after an unsuccessful communications instruction attempt. Execution Error Flags will maintain status until the next communications instruction. They will turn ON when the next communications instruction is executed even if an error occurred for the last instruction. Error types: Time-out error (command/response time greater than the response monitoring time set in the control words) Transmission data errors
Message Communications Enabled Flag in the Master Unit status area (bit 12 in CIO 1500 + (25 x unit No.))	The Communications Enabled Flag turns OFF when message communications are not possible for the Master Unit due to detection of Bus Off or other errors. This flag is ON when message communications are possible.

Note The behavior of the Message Communications Enabled Flag is different for the CVM1 and CV-series PCs and C200HX/HG/HE PCs.

Communications Flag Operation

The relationship between the the Message Communications Enabled Flag and the NS indicator is shown in the following table.

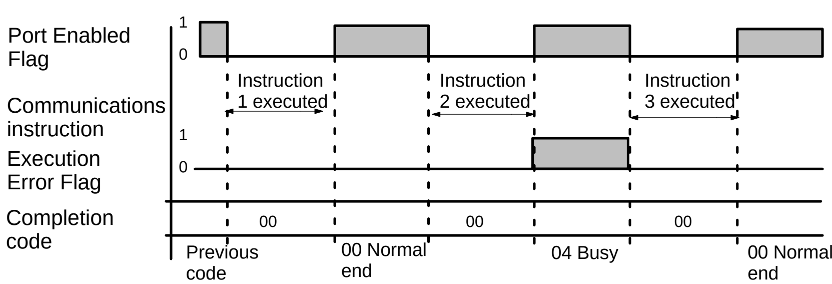
Message Communications Enabled Flag	Network status	NS indicator
ON (1)	Communications connection made (network normal)	Lit green
	Communications connection not made (network normal, but communications not established)	Flashing green
	Non-fatal communications error (error in one or more Slaves)	Flashing red
OFF (0)	Offline or power supply is off (no power supply, resetting, minor failure, or send error)	Not lit
	Fatal communications error	Lit red

Completion Codes

Completion codes are stored in memory as shown in the following table at the completion of execution of communications instructions for each port. The completion codes will be 00 (0000) during execution of the instruction.

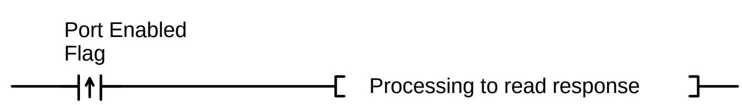
The completion codes are stored as 2 bytes of data (1 word) upon completion of the execution of SEND(192), RECV(193), and CMND(194). These codes are the same as the response codes for FINS commands. The first byte of the completion code is placed in bits 08 to 15 and the second byte is placed in bits 00 to 07.

Words	Functions
Port #0 to #7 Completion Codes (A503 to A510)	A503 to A510 contain the completion codes for the results of communications instruction execution for ports #0 to #7, respectively.



Timing the Reading of Responses

Responses should be read on the rising edge (upward differentiation) of the Port Enabled Flag, as shown in the following diagram.



Send/Receive Data Areas

The following table shows the data areas that can be used with SEND(192) and RECV(193). As indicated, the size of the area depends on the PC that is being used.

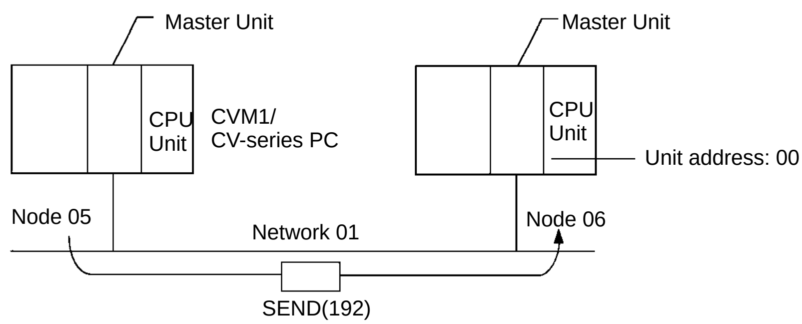
Note Do not cross the boundary of the data areas for the PC you are using.

Data area	CV500/CVM1-CPU01-E1	CV1000/CV2000/CVM1-CPU11/21-E
CIO Area	CIO 0000 to CIO 2555	
CPU Bus Link Area	G000 to C255 (G000 to G007: Read-only)	
Auxiliary Area	A000 to A511 (A256 to A511: Read-only)	
Timer Area	T000 to T511	T0000 to T1023
Counter Area	C000 to C511	C0000 to C1023
DM Area	D0000 to D8191	D00000 to D24575
EM Area	---	E00000 to E32765 (See note)

Note EM Memory must be mounted to the CPU Unit to use the EM Area. There can be up to 8 banks depending on the Memory that is mounted. Refer to the PC's *Installation Guide* for more information.

9-3-4 Programming Examples

Example 1: Sending Data Using SEND(192)



Operation

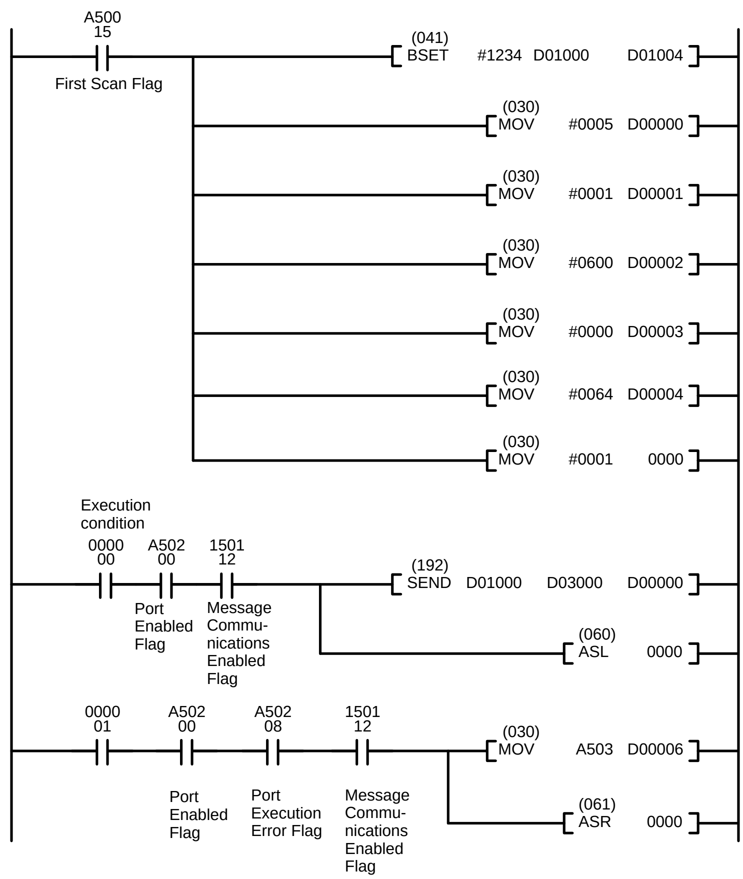
The data from the 5 words D01000 to D01004 from the PC with the Master Unit with node address 05 are sent to D03000 to D03004 in the PC with the Master Unit with node address 06. The completion code is stored in D00006 when execution of SEND(192) has been completed.

Command Details

The following command is used: [SEND(192) S D C]

S = D01000: First source word at local (source) node
D = D03000: First destination word at destination node
C = D00000: First control word; settings are given below (hex).

D00000 = 0005: Number of words to send
D00001 = 0001: Destination network address
D00002 = 0600: Destination node address (06)
Destination unit address (00 = CPU Unit)
D00003 = 0000: Response, communications port 0, no retries
D00004 = 0064: Response monitoring time



Sets 1234 in D01000 to D01004.

Places data into control data words to specify the 5 words to be transmitted to the CPU Unit of node 06 of network 01, through port 0, with response, 0 retries, and a response monitoring time of 10.0 seconds.

Places 0001 into CIO 0000

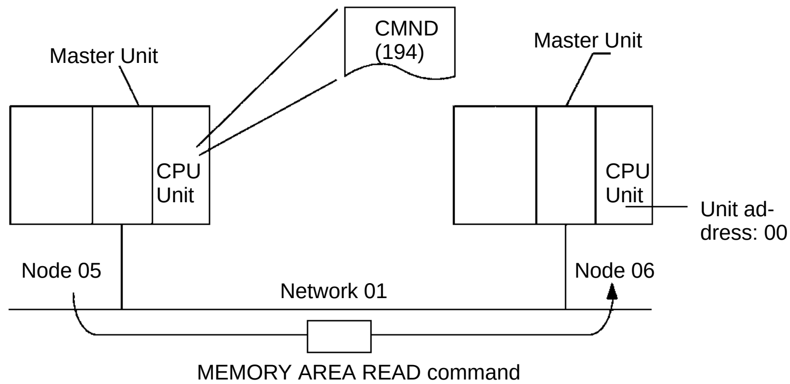
Transfers 5 words of data from D01000 to D01004 from the PC of node 05 to D03000 to D03004 in the PC of node 06.

Shifts the contents of CIO 0000 one bit to the left.

Stores the completion code in A503 to D00006.

Shifts the contents of CIO 0000 one bit to the right to reset CIO 000000.

Example 2: Sending a FINS Command Using CMND(194)



Operation

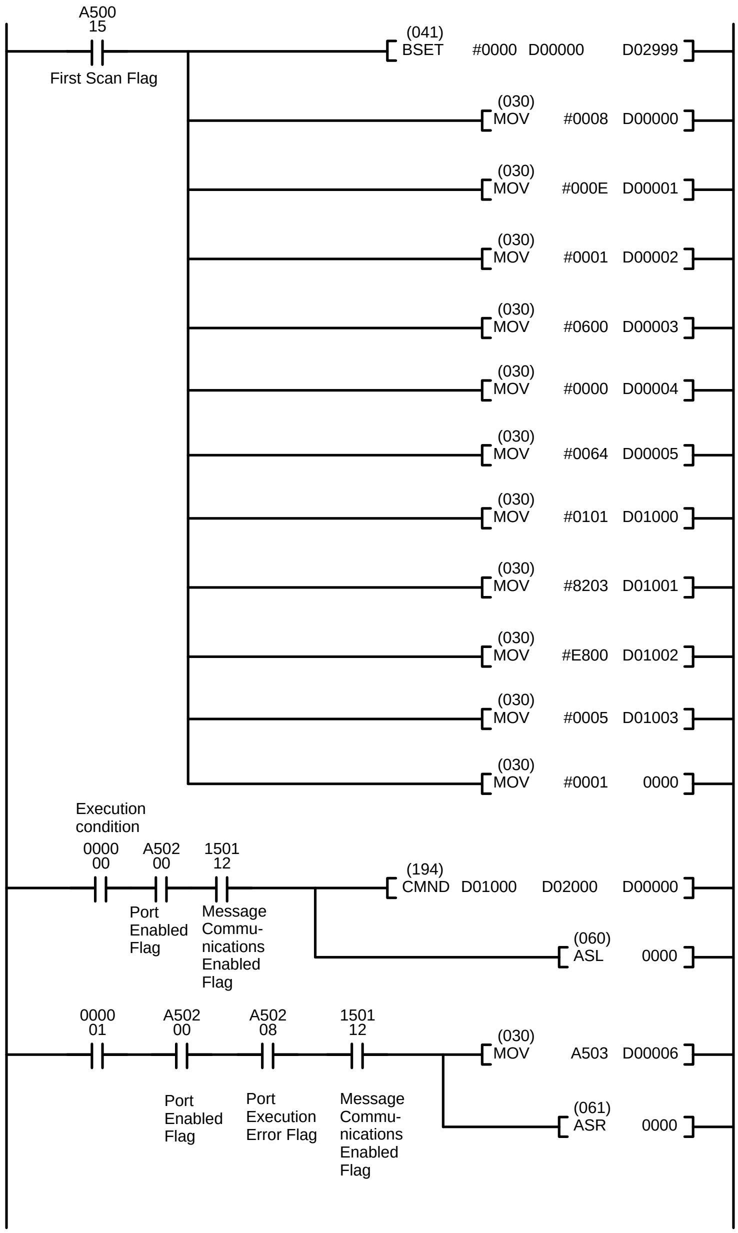
The data in the 5 words D01000 to D01004 are read from the PC with the Master Unit with node address 06 and transferred to the PC of the Master Unit with node address 05 (where CMND(194) is executed). The command data is written starting at DM01000 of the PC with node address 05 and the response data is stored in words beginning with D02000. The completion code is stored in D00006 when execution of CMND(194) has been completed and then the command is executed again.

Command Details

The following command is used: [CMND(194) S D C]

S = D01000: First command word at local node
Settings (hex)
D01000 = 0101: Command Code
D01001 = 8203: Command parameters
D01002 = E800: Command parameters
D01003 = 0005: Command parameters

D = D02000: First response word at local node
C = D00000: First control word
Settings (hex).
D00000 = 0008: Number of command bytes
D00001 = 000E: Number of response bytes
D00002 = 0001: Destination network address
D00003 = 0600: Destination node address (06)
Destination unit address (00 = CPU Unit)
D00004 = 0000: Response, communications port 0, no retries
D00005 = 0064: Response monitoring time



Sets 0000 in D00000 to D02999.

Place data into control data words to specify to read 5 words D01000 to D01004 from the PC of node 06 and network 01 to the PC of node 05.

Place the command data for MEMORY AREA READ into D01000 to D01003.

Places 0001 into CIO 0000

Reads 5 words D01000 to D01004 from the PC of node 06 and network 01 to the PC of node 05 and stored the data beginning at D02000.

Shifts the contents of CIO 0000 one bit to the left.

Stores the completion code in A503 to D00006.

Shifts the contents of CIO 0000 one bit to the right to reset CIO 000000.

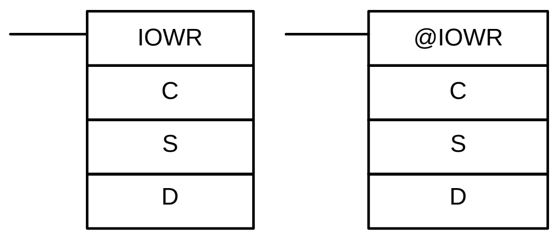
9-4 Message Communications for CS1-series and C200HX/HG/HE PCs

The IOWR instruction is used to send FINS commands for CS1-series and C200HX/HG/HE PCs.

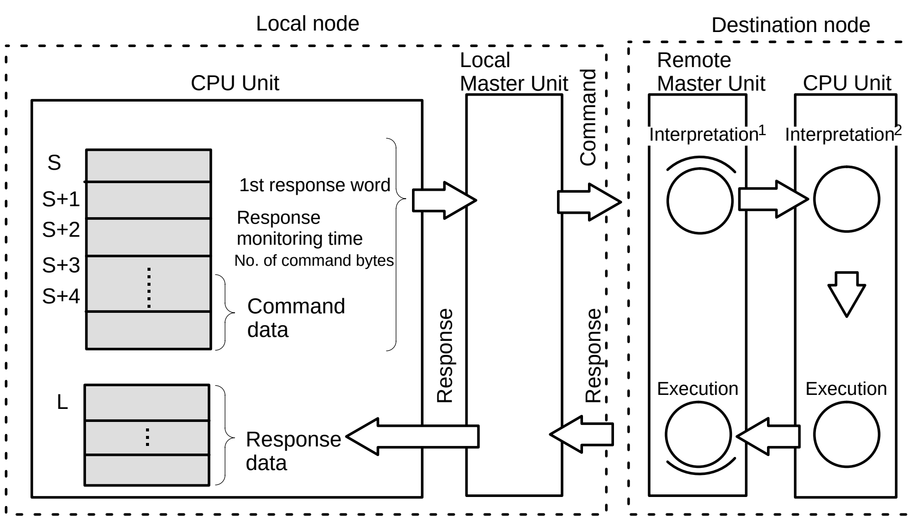
9-4-1 Sending FINS Commands

CS1 Series

Ladder Symbols



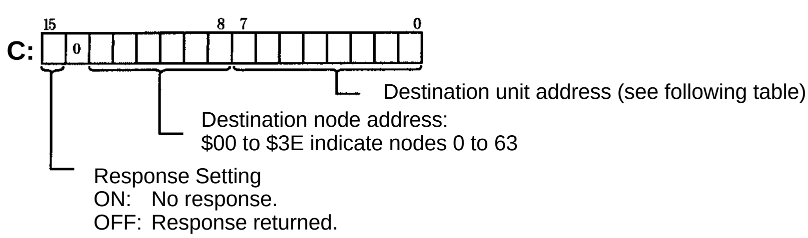
Operands
C: Control code
S: 1st source word
D: Destination information



1: For commands addressed to Master Unit
2: For commands addressed to CPU Unit

Description

IOWR transfers data from the words beginning at S to the specified Special I/O Unit. The control code (C) specified parameters for the instruction as shown in the following illustration.



Destination Unit Address

Unit	Setting
CPU Unit	00
Communications Unit	FE
Special I/O Unit	$10 to $1F: Unit No. + 10

The source words (starting with S) provide execution parameter and the command data as shown in the following table.

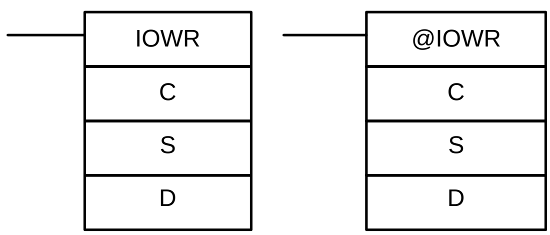
Word	Contents
S	First response word (variable area specification, see *Section 11.*)
S+1	
S+2	Response monitoring time (hex) 0000: 2 s 1000 to 028F: 0.1 to 65.5 s (units of 0.1 s) Above 028F: 65.5 s
S+3	Number of command bytes (hex): 0 to 160
S+4 . . .	Command data beginning with command code

The destination information provides the destination unit number of the Special I/O Unit and the number of words to be written, as shown in the following diagram.

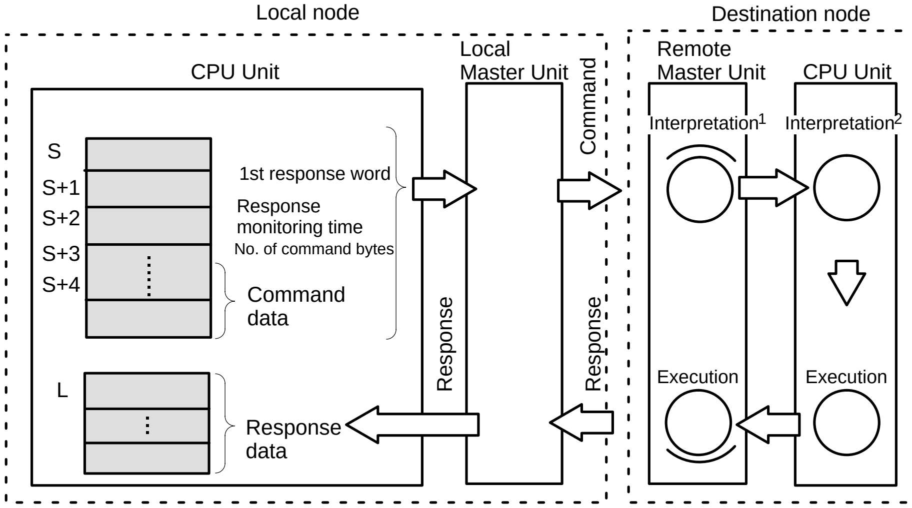
Word	Contents
D	Destination unit number of the Special I/O Unit (0000 to 000F hex)
D+1	Number of words to write (0001 to 0080 hex)

C200HX/HG/HE

Ladder Symbols



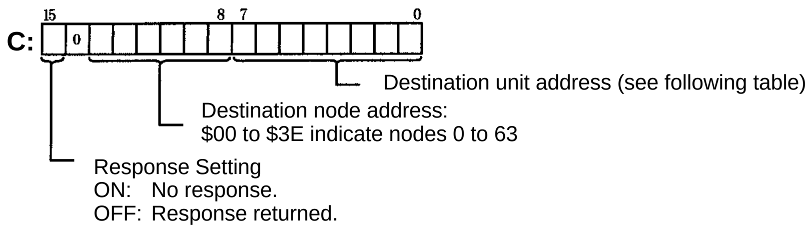
Operands
C: Control code
S: 1st source word
D: Destination information



1: For commands addressed to Master Unit
2: For commands addressed to CPU Unit

Description

IOWR transfers data from the words beginning at S to the specified Special I/O Unit. The control code (C) specified parameters for the instruction as shown in the following illustration.



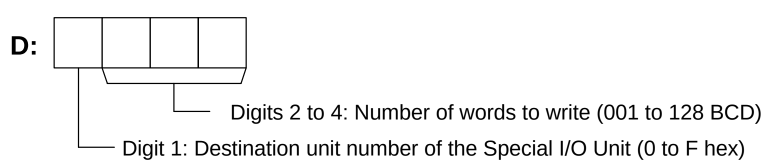
Destination Unit Address

Unit	Setting
CPU Unit	00
Communications Unit	FE
Special I/O Unit	$10 to $1F: Unit No. + 10

The source words (starting with S) provide execution parameter and the command data as shown in the following table.

Word	Contents
S	First response word (variable area specification, see *Section 11.*)
S+1	
S+2	Response monitoring time (hex) 0000: 2 s 1000 to 028F: 0.1 to 65.5 s (units of 0.1 s) Above 028F: 65.5 s
S+3	Number of command bytes (hex): 0 to 160
S+4 . . .	Command data beginning with command code

The destination information provides the destination unit number of the Special I/O Unit and the number of words to be written, as shown in the following diagram.



Data Areas

The following tables shows the data areas that can be used for each parameter of IOWR.

CS1 Series

Area	C	S	D
CIO Area	CIO 0000 to CIO 6143		CIO 0000 to CIO 6142
Work Area	W000 to W511		W000 to W510
Holding Bit Area	H000 to H511		H000 to H510
Auxiliary Bit Area	A000 to A959		A000 to A958
Timer Area	T0000 to T4095		T0000 to T4094
Counter Area	C0000 to C4095		C0000 to C4094
DM Area	D00000 to D32767		D00000 to D32766

Area	C	S	D
EM Area without bank	E00000 to E32767		E00000 to E32766
EM Area with bank	En_00000 to En_32767 (n = 0 to C)		En_00000 to En_32766 (n = 0 to C)
Indirect DM/EM addresses in binary	@ D00000 to @ D32767 @ E00000 to @ E32767 @ En_00000 to @ En_32767 (n = 0 to C)		
Indirect DM/EM addresses in BCD	*D00000 to *D32767 *E00000 to *E32767 *En_00000 to *En_32767 (n = 0 to C)		
Constants	#0000 to #FFFF (binary)	---	D: #0000 to #000F D+1: #0001 to #0080
Data Registers	DR0 to DR15	---	---
Index Registers	---		
Indirect addressing using Index Registers	,IR0 to ,IR15 –2048 to +2047 ,IR0 to –2048 to +2047 ,IR15 DR0 to DR15, IR0 to IR15 ,IR0+(++) to ,IR15+(++) ,–(– –)IR0 to, –(– –)IR15		

C200HX/HG/HE/HS

Area	C	S	D
Internal Relay Area 1	IR 000 to IR 235		
Special Relay Area 1	SR 236 to SR 255		
Special Relay Area 2	SR 256 to SR 299		
Internal Relay Area 2	IR 300 to IR 511		
Holding Relay Area	HR 00 to HR 99		
Auxiliary Relay Area	AR 00 to AR 27		
Link Relay Area	LR 00 to LR 63		
Timer/Counter Area	TC 000 to TC 511		
Data Memory Area	DM 0000 to DM 6599		
Fixed DM Area	DM 6600 to DM 6655		
Extended DM Area	EM 0000 to EM 6143		
Constants	0000 to FFFF	Not usable	0000 to F128

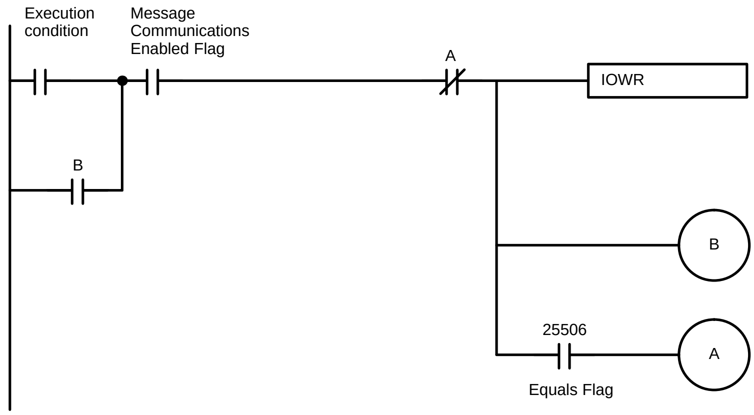
Sending Explicit Messages

Explicit messages can be sent to OMRON Special Slaves and DeviceNet devices made by other manufacturers by setting the FINS command code to 28 01. When this is done, set the response monitoring time in C+5 to at least 0014 hex (2 s). If it is set to less than 2 s, communications may be busy even if the next command is executed after the first one times out.

9-4-2 Using IOWR

The Message Communications Enabled Flag for the Master Unit is used as an execution condition for IOWR. Be sure this Flag is ON before executing IOWR. If this Flag is OFF, an error may occur in the Special I/O Unit.

The Equals Flag is used to execute the instruction again when IOWR execution ends in an error. The status of the Equals Flag can be changed by other instructions; be careful of its location in the program.



Communications Flags

Flag	Address	Functions
Equals Flag	C200HX/HG/HE: SR 25506 CS1 Series: Set by system.	The Equals Flag turns OFF when an error occurs in writing a command from the CPU Unit to the Master Unit. This Flag turns ON after a command has been written normally from the CPU Unit to the Master Unit.
Error Flag	C200HX/HG/HE: SR25503 CS1 Series: Set by system.	The Error Flag is OFF when all operands and the control code are legal. This Flag turns ON when an illegal operand or control code is set or when there is an error in instruction execution, such as the following: The number of words to write in D is not BCD, the node address is not between 1 and 127, the unit address of the local Master Unit is not between 0 and F, the Master Unit is mounted on a Slave Rack, etc.
Message Communications Enabled Flag in the Master Unit status area	C200HX/HG/HE: Bit 12 in IR 101 + (10 x unit No.) CS1 Series: Bit 12 in IR 2001 + (10 x unit No.)	The Communications Enabled Flag turns OFF during messages communications or when message communications are not possible. This Flag is ON when message communications are possible.

Note
1. The behavior of the Message Communications Enabled Flag for CVM1 and CV-series PCs is different to that for CS1-series and C200HX/HG/HE PCs.
2. With CS1-series PCs, there are no memory addresses for the Equals Flag and the Error Flag.

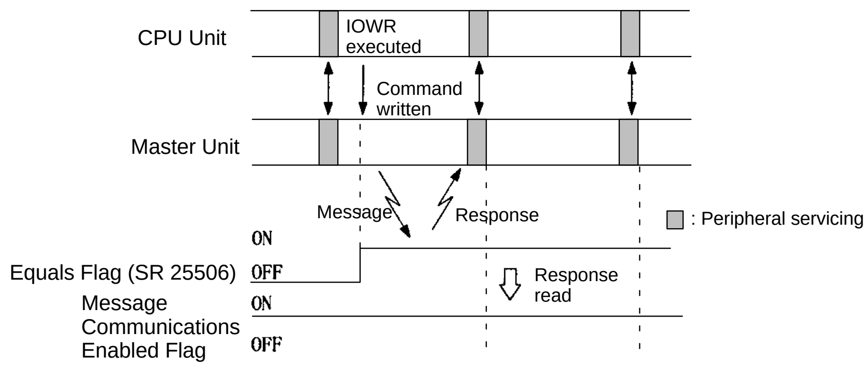
Timing the Reading of Responses

Responses should be read in a cycle after the one in which IOWR is executed and when the Message Communications Enabled Flag turns ON.

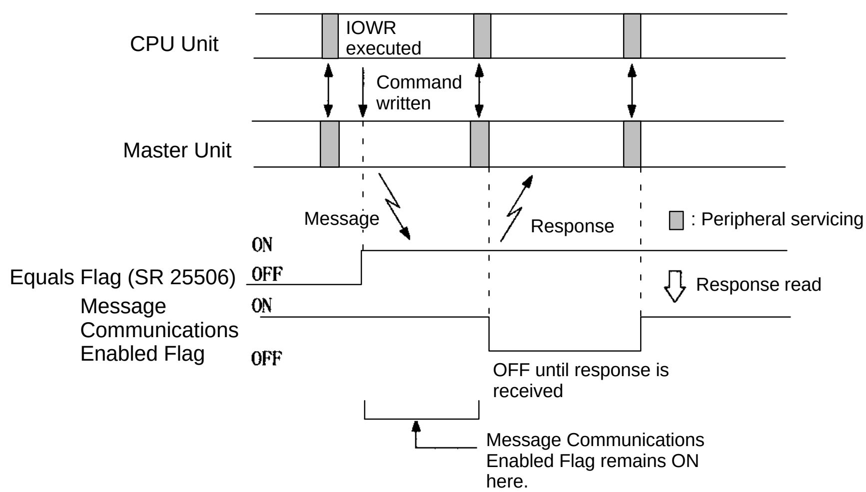
Even if IOWR execution is finished, the status of the Message Communications Enabled Flag will not change until the next peripheral servicing in the CPU Unit. If the response is returned in the same cycle as IOWR execution, the Message Communications Enabled Flag will remain ON. If the response is not received until the next cycle, the Flag will turn OFF during peripheral servicing and then turn ON at the next peripheral servicing after the response is received.

If the Message Communications Enabled Flag is used in the same cycle as the execution condition for reading the response after execution of IOWR, an attempt could be made to read the response even though it has not yet been returned.

Response Received in the Same Cycle

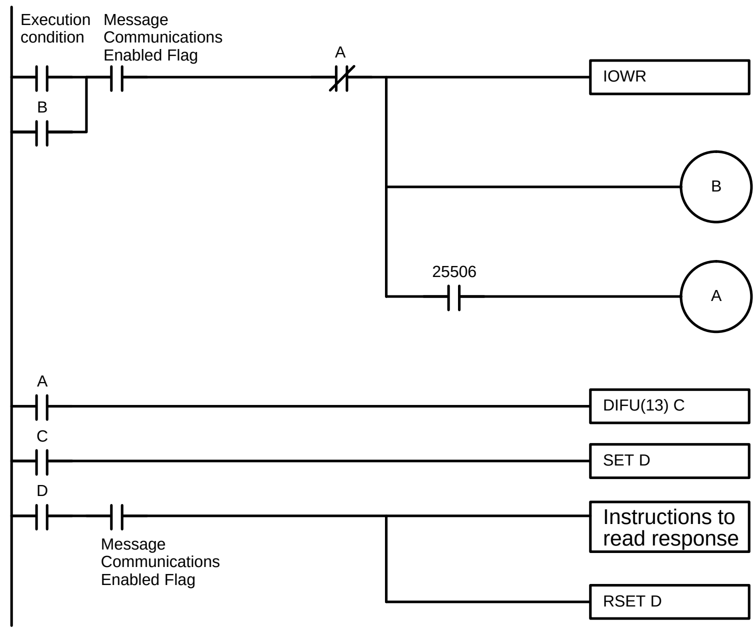


Response Received in the Next Cycle

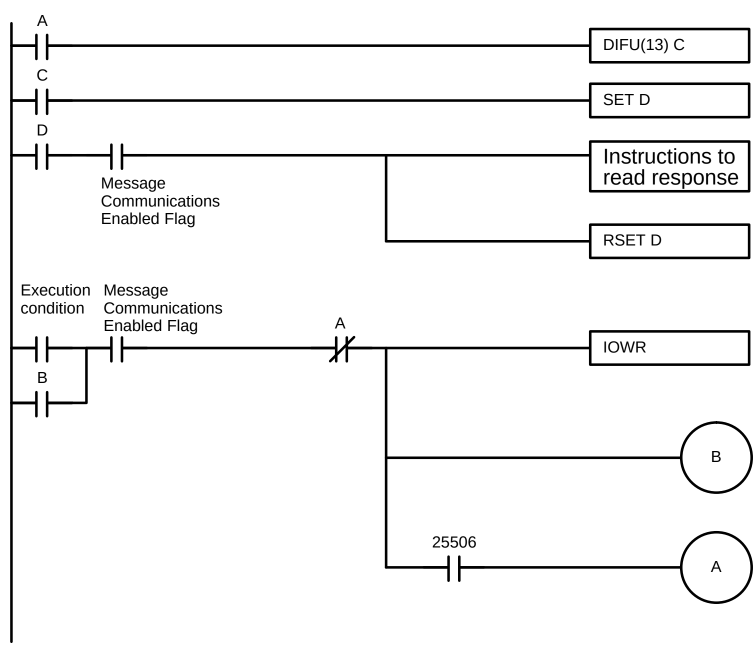


Use the type of programming shown below. The programming shown at the top will not always read the response properly.

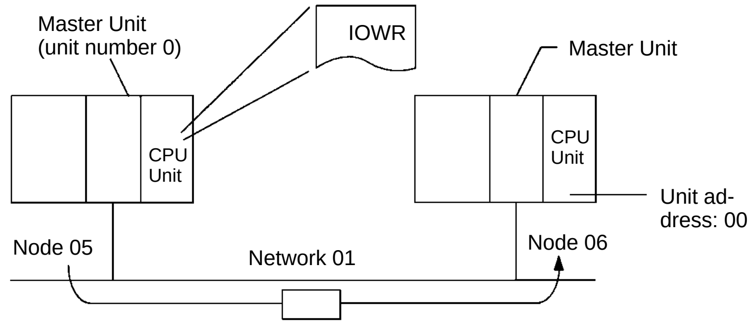
WRONG: Can Improperly Read Response



CORRECT: Properly Reads Response



9-4-3 C200HX/HG/HE Programming Example: Sending a FINS Command



Operation

The data in the 5 words DM 1000 to DM 1004 are read from the PC with the Master Unit with node address 06 and transferred to the PC of the Master Unit with node address 05 (where IOWR is executed). The command data is written starting at DM 1000 of the PC with node address 05 and the response data is stored in words beginning with DM 2000. The completion code is stored in DM 00006 when execution of IOWR has been completed and then the command is executed again.

Command Details

The following command is used: [IOWR C S D]

C = DM 0000: Control word

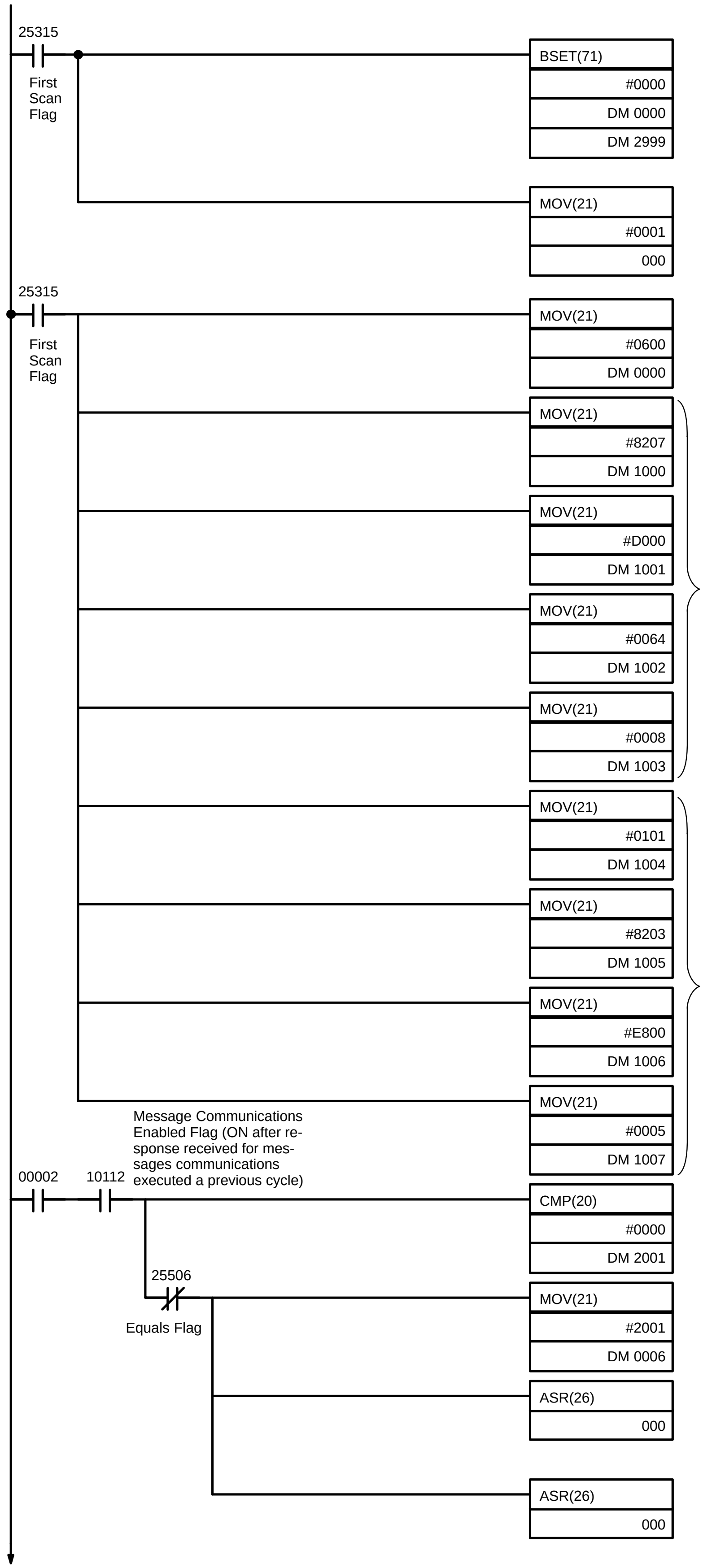
Settings (hex)
DM 0000 = 0600: Response
Destination node address: 06
Destination unit address: 00 (CPU Unit)

S = DM 1000: First source word

Settings (hex)
DM 1000 = 8207: First response word: DM 2000
DM 1001 = D000: Rest of first response word
DM 1002 = 0064: Response monitoring time
DM 1003 = 0008: No. of command bytes
DM 1004 = 0101: Command code
DM 1005 = 8203: Command parameters
DM 1006 = E800: Command parameters
DM 1007 = 0005: Command parameters

D = #0008: Destination information
Destination unit number: 00 (hex)
No. of words to transfer: 08 (BCD)

Assume that IOWR has been allocated a function code, e.g., 18.



Sets 0000 in DM 0000 to DM 2999.

Sets 0001 in IR 000.

Place data into control data word to specify response, destination node address 06, and destination unit address 00.

Place data into source words to specify first response word (DM 2000, using variable area specification), response monitor time (10.0 s), No. of command bytes (8).

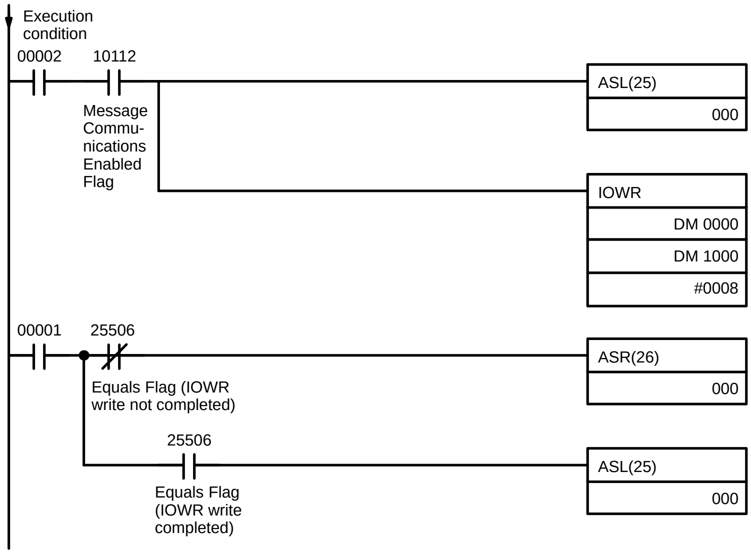
Sets the MEMORY AREA READ command into DM 1004 to DM 1007.

Compares contents of DM 2001 to 0000 after IOWR execution and response reception have been completed the previous cycle.

Places the contents of DM 2001 into DM 0006 if the comparison results is not equals (error).

Shifts the contents of IR 000 one bit right to turn ON IR 00001.

Shifts the contents of IR 000 one bit right to turn ON (reset) IR 00000.



Shifts the contents of IR 0000 one bit to the left to turn ON IR 00001.

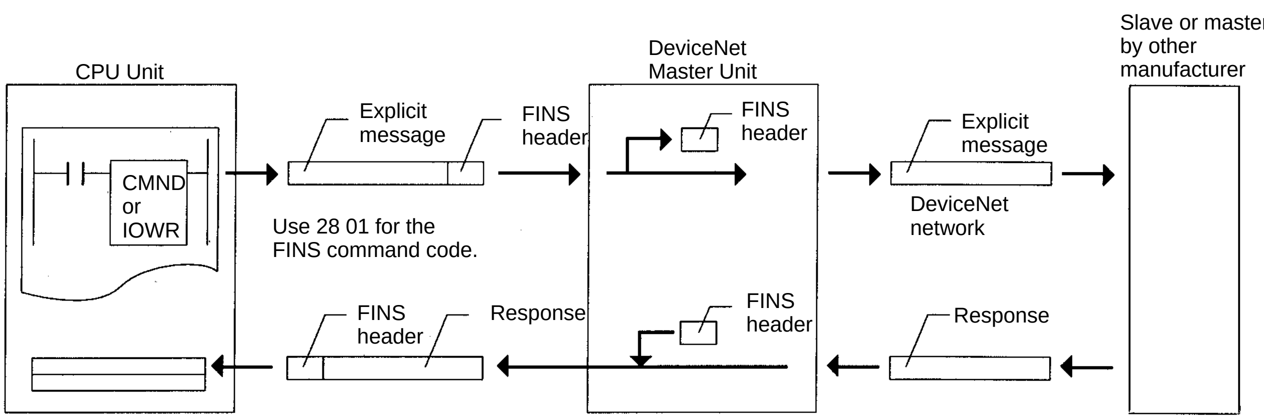
Transfers the 8 words of command data starting from DM 1000 at the CPU Unit to the Master Unit (unit number 0).

If the write for IOWR has been completed, IR 000 is shifted one bit to the right to turn ON (reset) IR 00000.

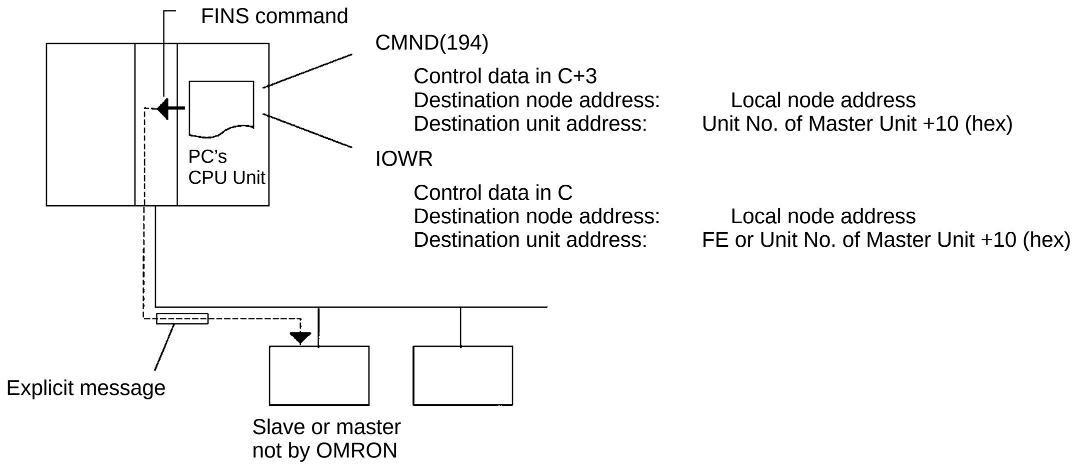
If the write for IOWR has not been completed, IR 000 is shifted one bit to the left to turn ON IR 00002.

9-5 Sending Explicit Messages

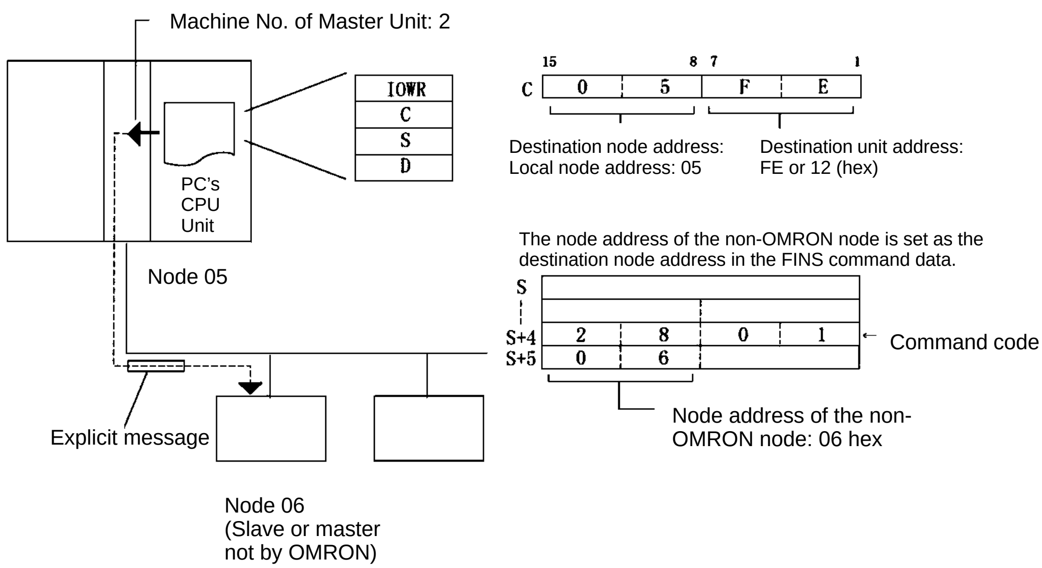
The FINS command code 28 01 can be used to send explicit DeviceNet messages to OMRON Special Slaves and DeviceNet devices made by other manufacturers. The use of explicit messages is illustrated in the following diagram.



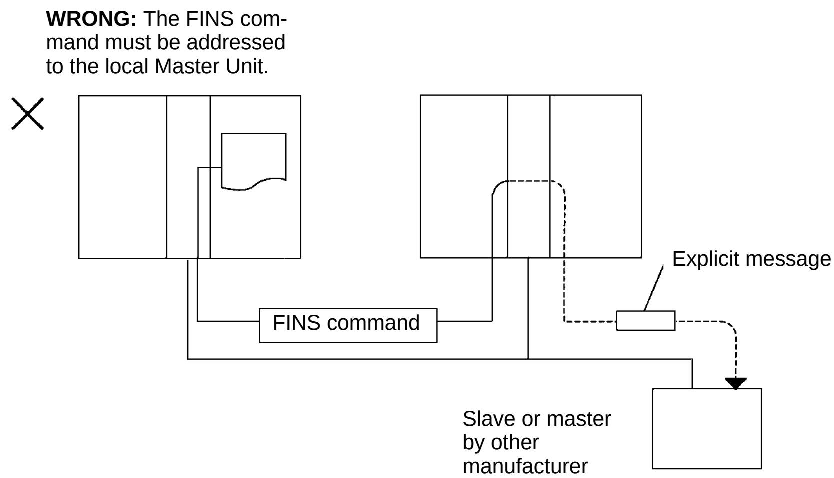
The local Master Unit is specified as the destination in the communications instruction in the PC's user program (not the OMRON Special Slave or DeviceNet device made by another manufacturer), and the node address of the actual destination (i.e., the slave or master made by another manufacturer) is specified in the command data for the explicit message send command.



The following diagram shows an example of actual node address specifications.



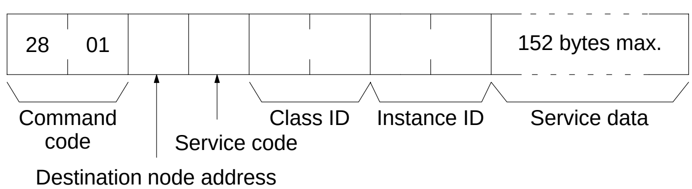
Note Explicit messages are first sent to the the DeviceNet Master Unit, which processes them before sending the actual explicit message to the final destination. You must use the node and unit address of the local Master Unit in the PC user program communications instruction. Addressing them to any other node will result in an error, such as would occur in the following illustration.



9-5-1 FINS Command: EXPLICIT MESSAGE SEND (28 01)

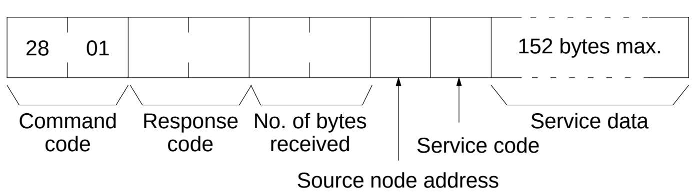
EXPLICIT MESSAGE SEND will send an explicit DeviceNet message to the specified object and receive a response.

Command Block



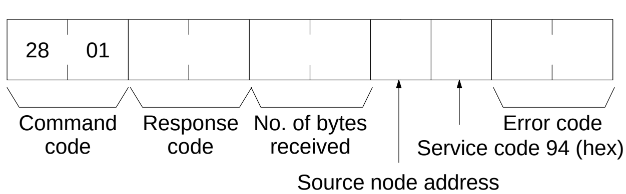
Response Block

Normal Response



Error Responses

The following response is returned if an error occurs for the explicit message.



The following response is returned if the explicit message cannot be sent or times out.

Command code	Response code
28 01	

Parameters

Destination node address (command): The node address of the destination of the explicit message. (The node address of the local Master Unit is specified in the control data for the CMND(194) or IOWR instruction, but the node address of the actual destination is specified here in the FINS command.)

Service code (command, response): A service code defined for DeviceNet. In a normal response, bit 15 of the service code specified in the command will be turned ON and returned. In an error response, 94 hex will always be returned.

Class ID (command): The class ID of the destination of the explicit message.

Instance ID (command): The instance ID of the destination of the explicit message.

Service data (command, response): The data defined for the services codes.

No. of bytes received (response): The number of bytes received from the destination node address (local node).

Destination node address (response): The node address of the OMRON Special I/O Slave Unit or slave manufactured by another company to which the explicit message was sent is returned.

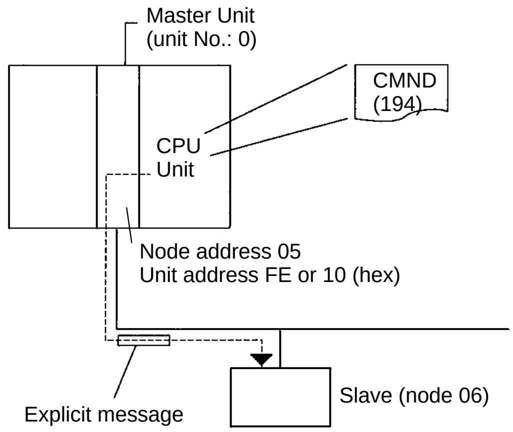
Error code (response): An error code defined by DeviceNet.

Note

1. This command sends a DeviceNet-defined explicit message to an OMRON Special I/O Slave Unit or a Slave manufactured by another company and receives a response.
2. Unlike other FINS commands, this command is addressed to the local Master Unit. The actual destination of the explicit message is given in the command data, as described above.
3. If the DeviceNet Master Unit receives an explicit message, it will automatically return a response.
4. Refer to the DeviceNet Specification for details on parameters for explicit messages.
5. Contact the Open DeviceNet Vendor Association, Inc. (ODVA) at 8222 Wiles Road, Suite 287, Coral Springs, FL 33067 USA (phone: 954-340-5412, fax: 954-340-5413, email: billmoss@ix.netcom.com, Home Page: http://www.odva.org/) to obtain copies of the specification.
6. For details on explicit messages to OMRON Special I/O Slaves, refer to the *CompoBus/D (DeviceNet) Slaves Operation Manual* (W347).

9-5-2 Programming Examples

Example 1: Sending an Explicit Message Using CMND(194)



Operation

The vendor code is read from a slave (OMRON vendor code: 002F hex) using the EXPLICIT MESSAGE SEND command, 28 01. The command data is written starting at DM01000, and the response data is stored starting at D02000. When execution of CMND(194) has been completed, the completion code is stored in D00006 and the instruction is executed again.

Command Details

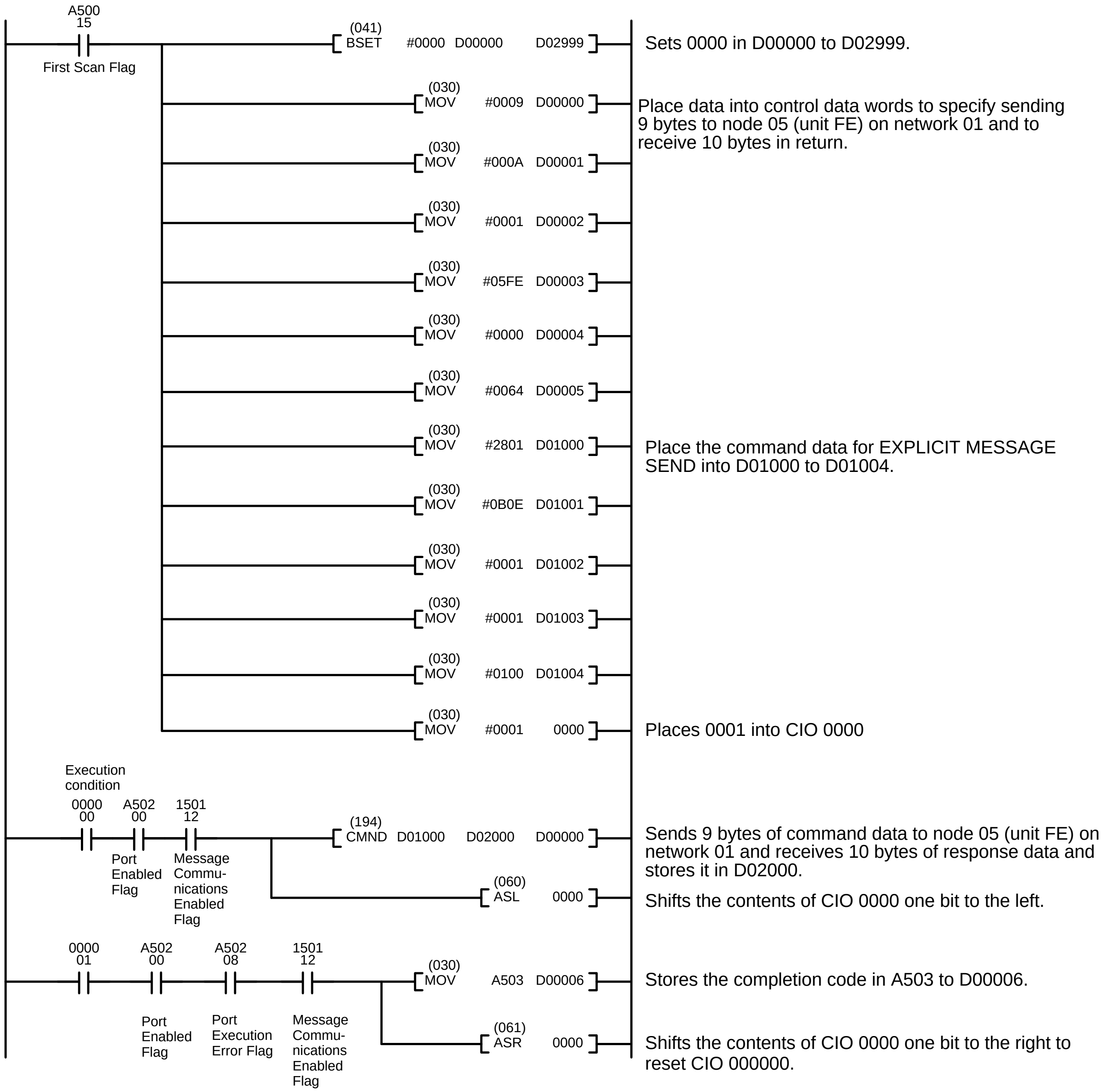
The following command is used: [CMND(194) S D C]

S = D01000: First command word at local node

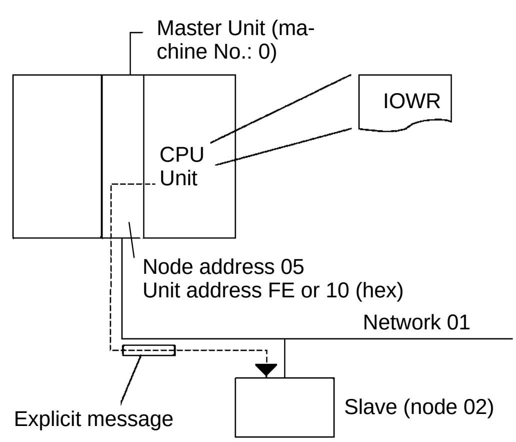
Settings (hex)
D01000 = 2801: Command Code
D01001 = 0B0E: Slave node address: 11
Service code: 0E
D01002 = 0001: Class ID: 0001
D01003 = 0001: Instance ID: 0001
D01004 = 0100: Attribute ID: 01

D = D02000: First response word at local node
C = D00000: First control word

Settings (hex).
D00000 = 0009: Number of command bytes
D00001 = 000A: Number of response bytes
D00002 = 0001: Destination network address: 1
D00003 = 05FE: Destination node address: 05
Destination unit address: FE (or 10)
D00004 = 0000: Response, communications port 0, no retries
D00005 = 0064: Response monitoring time



Example 2: Sending an Explicit Message Using IOWR



Operation

The vendor code is read from a slave (OMRON vendor code: 002F hex) using the EXPLICIT MESSAGE SEND command, 28 01. The command data is written starting at DM 1000, and the response data is stored starting at DM 2000. When execution of CMND(194) has been completed, the completion code is stored in DM 0006 and the instruction is executed again.

Command Details

The following command is used: [IOWR C S D]

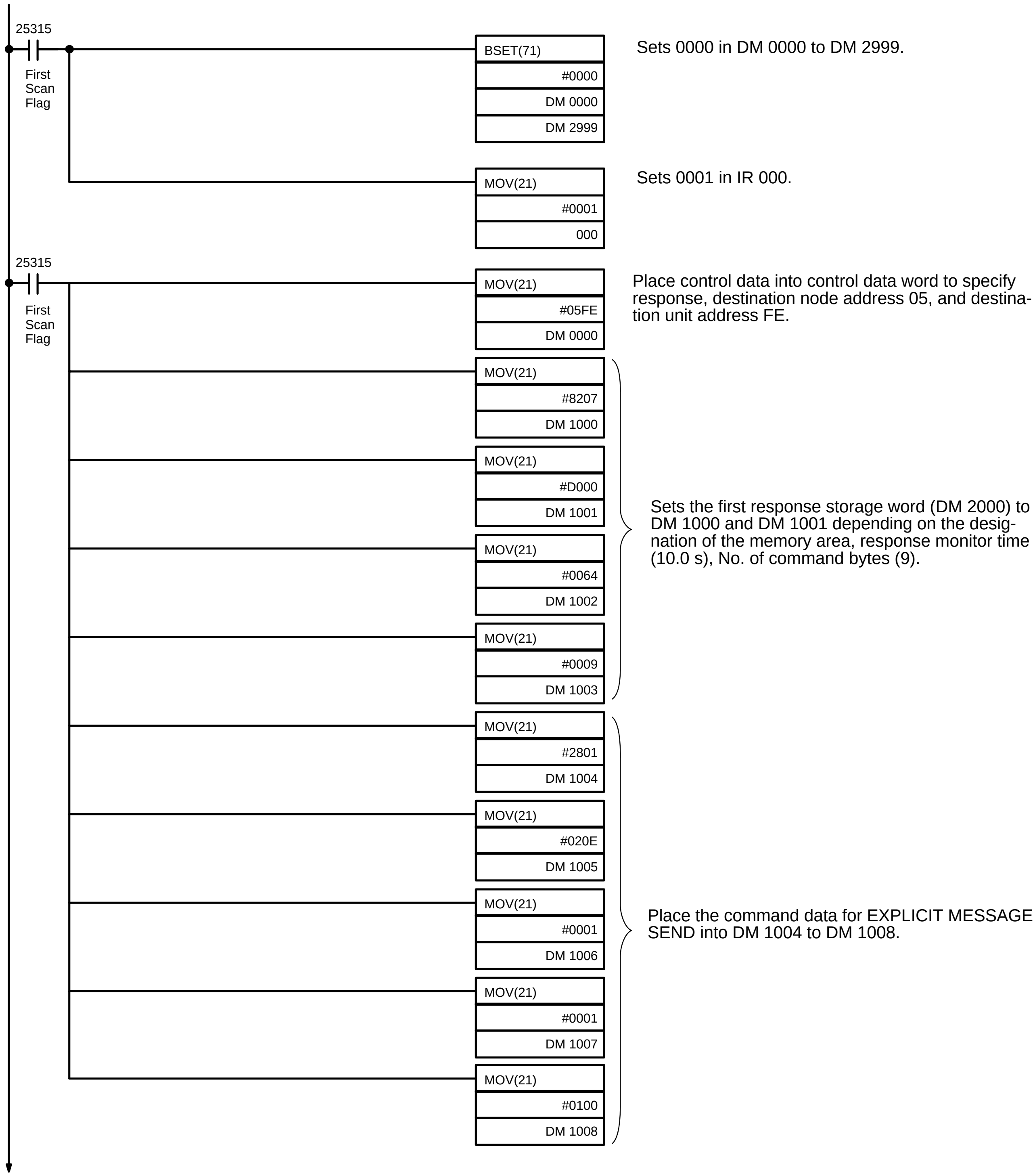
C = DM 0000: Control word

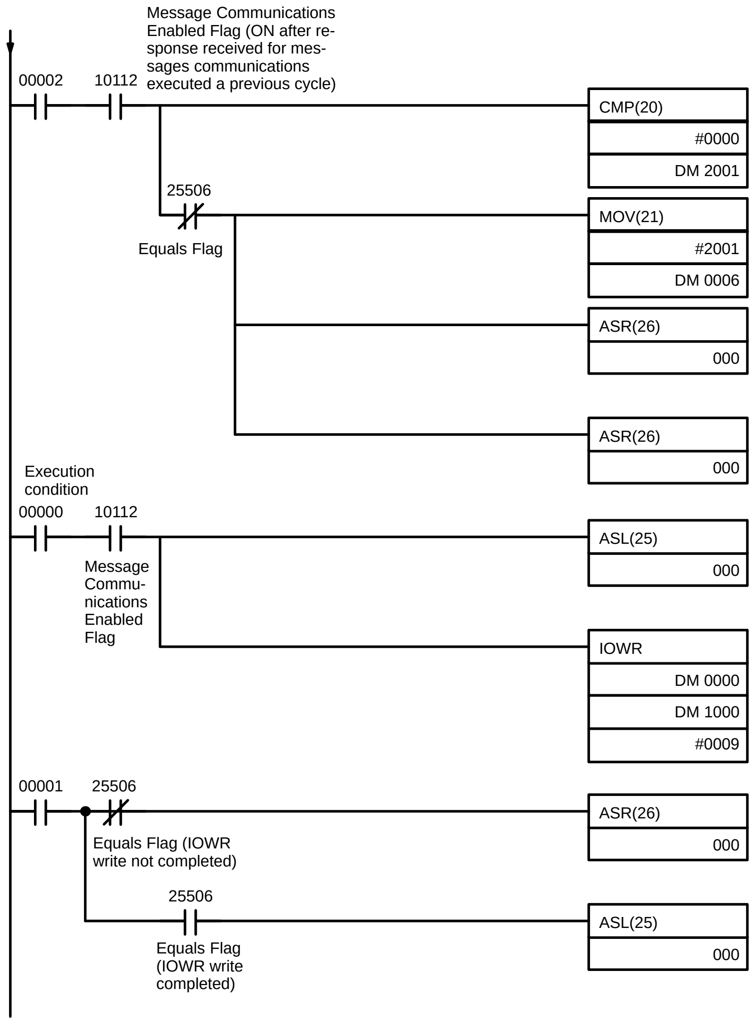
Settings (hex)
DM 0000 = 05FE: Response
Destination node address: 05
Destination unit address: FE (or 10)

S = DM 1000: First source word

Settings (hex)
DM 1000 = 8207: First response word: DM 2000
DM 1001 = D000: Rest of first response word
DM 1002 = 0064: Response monitoring time
DM 1003 = 0009: No. of command bytes
DM 1004 = 2801: Command code
DM 1005 = 020E: Slave node address: 02
Service code: 0E
DM 1006 = 0001: Class ID: 0001
DM 1007 = 0001: Instance ID: 0001
DM 1008 = 0100: Attribute ID: 01

D = #0009: Destination information
Destination unit number: 00 (hex)
No. of words to transfer: 09 (BCD)


25315
First Scan Flag
BSET(71)
#0000
DM 0000
DM 2999
Sets 0000 in DM 0000 to DM 2999.
MOV(21)
#0001
000
Sets 0001 in IR 000.
25315
First Scan Flag
MOV(21)
#05FE
DM 0000
Place control data into control data word to specify response, destination node address 05, and destination unit address FE.
MOV(21)
#8207
DM 1000
MOV(21)
#D000
DM 1001
MOV(21)
#0064
DM 1002
MOV(21)
#0009
DM 1003
Sets the first response storage word (DM 2000) to DM 1000 and DM 1001 depending on the designation of the memory area, response monitor time (10.0 s), No. of command bytes (9).
MOV(21)
#2801
DM 1004
MOV(21)
#020E
DM 1005
MOV(21)
#0001
DM 1006
MOV(21)
#0001
DM 1007
MOV(21)
#0100
DM 1008
Place the command data for EXPLICIT MESSAGE SEND into DM 1004 to DM 1008.



Compares contents of DM 2001 to 0000 after IOWR execution and response reception have been completed the previous cycle.

Places the contents of DM 2001 into DM 0006 if the comparison results is not equals (error).

Shifts the contents of IR 000 one bit right to turn ON IR 00001.

Shifts the contents of IR 000 one bit right to turn ON (reset) IR 00000.

Shifts the contents of IR 0000 one bit to the left to turn ON IR 00001.

Transfers the 9 words of command data starting from DM 1000 at the CPU Unit to the Master Unit (unit number 0).

If the write for IOWR has been completed, IR 000 is shifted one bit to the right to turn ON (reset) IR 00000.

If the write for IOWR has not been completed, IR 000 is shifted one bit to the left to turn ON IR 00002.

SECTION 10
FINS Commands to CVM1 and CV-series CPU Units

This section provides information on the FINS commands that can be addressed to the CPU Units of CVM1 and CV-series PCs.

10-1 Command List

The beginning portions of the command and response blocks up to the command codes and the FCS and terminator have been omitted for simplicity, but must be added for actual transmission if not automatically generated for the transmission method being used.

In the illustrations of command and response blocks in this section, each box represents one byte (i.e., two hexadecimal or BCD digits). Be careful when adding the header, where each box represents one digit (i.e., four bits).

The following table lists the FINS commands supported by CVM1 and CV-series CPU Units and the PC operating modes during which they are enabled.

Name	Command code		PC mode				Page
			RUN	MONITOR	DEBUG	PROGRAM	
MEMORY AREA READ	01	01	Valid	Valid	Valid	Valid	158
MEMORY AREA WRITE		02	Valid	Valid	Valid	Valid	159
MEMORY AREA FILL		03	Valid	Valid	Valid	Valid	160
MULTIPLE MEMORY AREA READ		04	Valid	Valid	Valid	Valid	160
MEMORY AREA TRANSFER		05	Valid	Valid	Valid	Valid	162
COMPOSITE REGISTRATION READ		10	Valid	Valid	Valid	Valid	162
REGISTER COMPOSITE READ		11	Valid	Valid	Valid	Valid	163
PARAMETER AREA READ	02	01	Valid	Valid	Valid	Valid	164
PARAMETER AREA WRITE		02	Valid	Valid	Valid	Valid	165
PARAMETER AREA CLEAR		03	Valid	Valid	Valid	Valid	167
PROGRAM AREA PROTECT	03	04	Valid	Valid	Valid	Valid	168
PROGRAM AREA PROTECT CLEAR		05	Valid	Valid	Valid	Valid	168
PROGRAM AREA READ		06	Valid	Valid	Valid	Valid	169
PROGRAM AREA WRITE		07	Not valid	Valid	Valid	Valid	170
PROGRAM AREA CLEAR		08	Not valid	Not valid	Not valid	Valid	171
RUN	04	01	Valid	Valid	Valid	Valid	171
STOP		02	Valid	Valid	Valid	Valid	172
CONTROLLER DATA READ	05	01	Valid	Valid	Valid	Valid	172
CONNECTION DATA READ		02	Valid	Valid	Valid	Valid	175
CONTROLLER STATUS READ	06	01	Valid	Valid	Valid	Valid	175
CYCLE TIME READ		20	Valid	Valid	Not valid	Not valid	177
CLOCK READ	07	01	Valid	Valid	Valid	Valid	178
CLOCK WRITE		02	Valid	Valid	Valid	Valid	178
MESSAGE READ	09	20	Valid	Valid	Valid	Valid	179
MESSAGE CLEAR			Valid	Valid	Valid	Valid	179
FAL/FALS READ			Valid	Valid	Valid	Valid	180
ACCESS RIGHT ACQUIRE	0C	01	Valid	Valid	Valid	Valid	181
ACCESS RIGHT FORCED ACQUIRE		02	Valid	Valid	Valid	Valid	182
ACCESS RIGHT RELEASE		03	Valid	Valid	Valid	Valid	183
ERROR CLEAR	21	01	Valid	Valid	Valid	Valid	183
ERROR LOG READ		02	Valid	Valid	Valid	Valid	184
ERROR LOG CLEAR		03	Valid	Valid	Valid	Valid	185

Name	Command code		PC mode				Page
			RUN	MONITOR	DEBUG	PROGRAM	
FILE NAME READ	22	01	Valid	Valid	Valid	Valid	186
SINGLE FILE READ		02	Valid	Valid	Valid	Valid	187
SINGLE FILE WRITE		03	Valid	Valid	Valid	Valid	188
MEMORY CARD FORMAT		04	Valid	Valid	Valid	Valid	188
FILE DELETE		05	Valid	Valid	Valid	Valid	189
VOLUME LABEL CREATE/DELETE		06	Valid	Valid	Valid	Valid	189
FILE COPY		07	Valid	Valid	Valid	Valid	190
FILE NAME CHANGE		08	Valid	Valid	Valid	Valid	190
FILE DATA CHECK		09	Valid	Valid	Valid	Valid	191
MEMORY AREA FILE TRANSFER		0A	Valid	Valid	Valid	Valid	192
PARAMETER AREA FILE TRANSFER		0B	Valid	Valid	Valid	Valid	193
PROGRAM AREA FILE TRANSFER		0C	(see note)	Valid	Valid	Valid	194
FORCED SET/RESET	23	01	Not valid	Valid	Valid	Valid	195
FORCED SET/RESET CANCEL		02	Not valid	Valid	Valid	Valid	196

Note When the PC is in RUN mode, data transfers from files to the program area are not possible, but transfers from the program area to files are possible.

10-2 Memory Area Designations

The following table gives the addresses to use when reading or writing PC data. The *Data area address* column gives the normal addresses used in the PC program. The *Address used in communications* column are the addresses used in CV-mode commands and responses. These addresses are combined with the memory area codes to specify PC memory locations. These addresses are not the same as the actual memory addresses of the data.

The *No. of bytes* column specifies the number of bytes to read or write data for that area. The number of bytes varies for the same area depending on the memory area code.

Note The addresses used in communications and the memory area codes are in hexadecimal.

CV500 or CVM1-CPU01-E

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary Areas	Bit status	CIO TR G A	000000 to 25515 TR0 to TR7 G00000 to G25515 A00000 to A51115	000000 to 09FB0F 09FF00 to 09FF07 0A0000 to 0AFF0F 0B0000 to 0CFF0F	00	1
	Bit status (with forced status)	CIO G	000000 to 25515 G00000 to G25515	000000 to 09FB0F 0A0000 to 0AFF0F	40	1
	Word contents	CIO TR G A	0000 to 2555 G000 to G255 A000 to A511	000000 to 09FB00 09FF00 0A0000 to 0AFF00 0B0000 to 0CFF00	80	2
	Word contents (with forced status)	CIO G	0000 to 2555 G000 to G255	000000 to 09FB0F 0A0000 to 0AFF00	C0	4
Timer Area/ Counter Area	Completion Flag status	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03DF00 080000 to 0BDF00	01	1
	Completion Flag status (with forced status)	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03DF00 080000 to 0BDF00	41	1
	PV	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 01FF00 080000 to 0BFF00	81	2

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
DM Area	Word contents	DM	D00000 to D24575	000000 to 1FFF00	82	2
Transition Area (CV500 only)	Flag status	TN	TN0000 to TN1023	000000 to 03FF00	03	1
	Flag status (with forced status)	TN	TN0000 to TN1023	000000 to 03FF00	43	1
Step Area (CV500 only)	Flag status	ST	ST0000 to ST1023	000000 to 03FF00	04	1
	Status	ST	ST0000 to ST1023	000000 to 03FF00	44	1
	Step timer PV	ST	ST0000 to ST1023	000000 to 03FF00	84	2
Forced Status	Bit status	CIO G	000000 to 25515 G00000 to G25515	000000 to 09FB0F 0A0000 to 0AFF0F	05	1
	Word contents	CIO G	0000 to 2555 G000 to G255	000000 to 09FB00 0A0000 to 0AFF00	85	2
Action Area (CV500 only)	Flag status	AC	AC0000 to AC2047	000000 to 07FF00	1B	1
Register Area	Register contents	IR DR	IR0 to IR2 DR0 to DR2	000000 to 000200 000300 to 000500	9C	2
Interrupt area	Scheduled interrupt interval		Not applicable	000200	DD	4

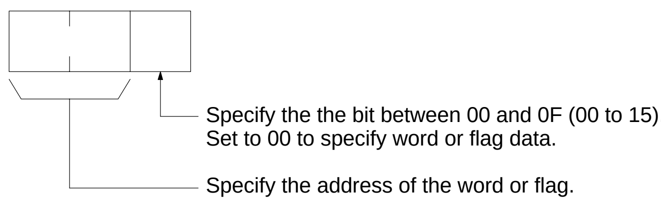
CV1000, CV2000, or CVM1-CPU11-E

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary Areas	Bit status	CIO TR G A	000000 to 255515 TR0 to TR7 G00000 to G25515 A00000 to A51115	000000 to 09FB0F 09FF00 to 09FF07 0A0000 to 0AFF0F 0B0000 to 0CFF0F	00	1
	Bit status (with forced status)	CIO G	000000 to 255515 G00000 to G25515	000000 to 09FB0F 0A0000 to 0AFF0F	40	1
	Word contents	CIO TR G A	0000 to 2555 G000 to G255 A000 to A511	000000 to 09FB00 09FF00 0A0000 to 0AFF00 0B0000 to 0CFF00	80	2
	Word contents (with forced status)	CIO G	0000 to 2555 G000 to G255	000000 to 09FB00 0A0000 to 0AFF00	C0	4
Timer Area/ Counter Area	Completion Flag status	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03FF00 080000 to 0BFF00	01	1
	Completion Flag status (with forced status)	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03FF00 080000 to 0BFF00	41	1
	PV	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03FF00 080000 to 0BFF00	81	2
DM Area	Word contents	DM	D00000 to D24575	000000 to 5FFF00	82	2
Transition Area (CV1000 or CV2000 only)	Flag status	TN	TN0000 to TN1023	000000 to 03FF00	03	1
	Flag status (with forced status)	TN	TN0000 to TN0511	000000 to 03DF00	43	1
Step Area (CV1000 or CV2000 only)	Flag status	ST	ST0000 to ST1023	000000 to 03FF00	04	1
	Status	ST	ST0000 to ST1023	000000 to 03FF00	44	1
	Step timer PV	ST	ST0000 to ST1023	000000 to 03FF00	84	2
Forced Status	Bit status	CIO G	000000 to 255515 G00000 to G25515	000000 to 09FB0F 0A0000 to 0AFF0F	05	1
	Word contents	CIO G	0000 to 2555 G000 to G255	000000 to 09FB00 0A0000 to 0AFF00	85	2
Expansion DM Area (CV1000 or CV2000 only)	Word contents	Banks 0 to 7	E00000 to E32765 to E00000 to E32765	000000 to 7FFD00 to 000000 to 7FFD00	90 to 97	2
		Current bank	E00000 to E32765	000000 to 7FFD00	98	2

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
Action Area (CV1000 or CV2000 only)	Flag status	AC	AC0000 to AC2047	000000 to 1FFF00	1B	1
Register Area	Register contents	IR DR	IR0 to IR2 DR0 to DR2	000000 to 000200 000300 to 000500	9C	2
	Expansion DM current bank no. (CV1000 or CV2000 only)		Not applicable	000600		2
Interrupt area	Scheduled interrupt interval		Not applicable	000200	DD	4

10-2-1 Word/Bit Addresses

Each word/bit address specifies a specific bit or word. The rightmost two digits of the address specify bit 00 to 15 (or 00 if not required), and leftmost four digits specify the word address.



To obtain the corresponding address of the desired word or bit, add the data area word address (hexadecimal) to the first address of the range of addresses used for that data area in communications. For example, the address for word G134 is computed as follows:

First address for CPU Bus Link Area;	0A00
0A00 + 86 (134 in BCD);	0A86

The word address for G134 would thus be 0A8600 (the memory area code would specify this as a word) and the address of bit 12 in C134 would be 0A860C.

10-2-2 Data Configurations

The configuration of the various types of data that can be read or written is shown below. The number of bytes required for each type of data is also given.

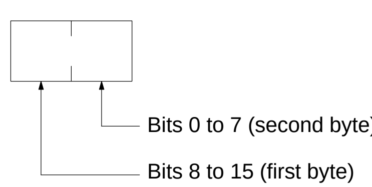
Flag or Bit Status (One Byte)

00: Bit is OFF (0)
01: Bit is ON (1)

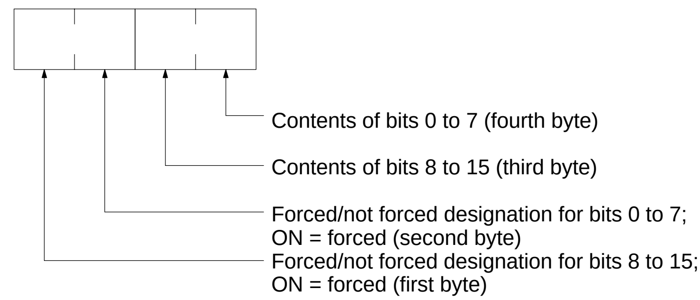
Flag or Bit Status with Forced Status (One Byte)

00: Bit is OFF (0) but not forced.
01: Bit is ON (1) but not forced.
02: Bit has been forced OFF (0).
03: Bit has been forced ON (1).

Word Contents or PV (Two Bytes)



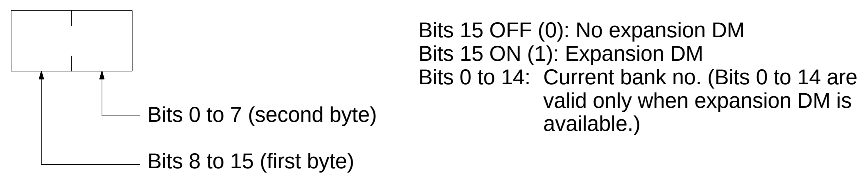
Word Contents or PV with Forced Status (Four Bytes)



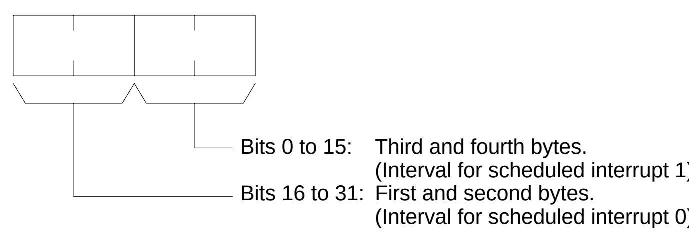
Step Status (One Byte)

00: INACTIVE
01: HALT
02: PAUSE
03: EXECUTE

Current Bank No. of Expansion DM (Two Bytes)

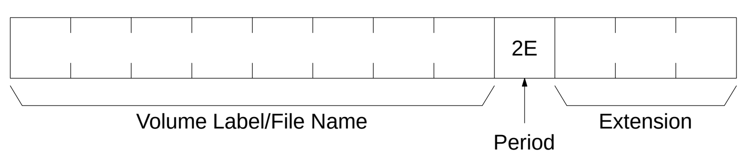


Scheduled Interrupt Interval



10-3 Volume Labels and File Names

Each volume label or file name consists of 12 bytes as follows:



Volume Label/File Name

Each volume label or file name must have eight ASCII characters with or without spaces (ASCII 20). If less than eight letters are used, add spaces to the end of the label/name.

Extension

An extension can be added to each volume label/file name so that the files can be classified. Each extension must have three ASCII characters with or without spaces. If less than three letters are used, add spaces to the end of the extension.

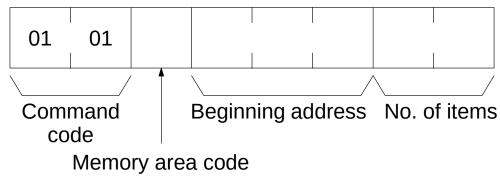
Period

Add a period (ASCII 2E) between the volume label/file name and extension.

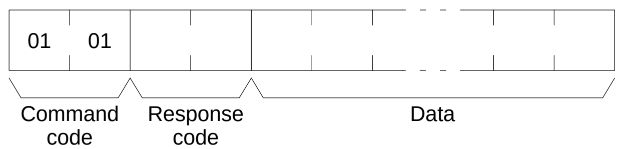
10-4 MEMORY AREA READ

Reads the contents of the specified number of consecutive memory area words starting from the specified word. All words must be in the same memory area (here, all memory areas with the same memory area code are considered as one area).

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Beginning address (command): The address of the first word/bit/flag to read from memory.

No. of items (command): The number of items to be read.

Data (response): The data from the specified words is returned in sequence starting from the beginning address. The required number of bytes in total is calculated as follows:

No. of bytes required by each item x No. of items

Memory Areas
The following data can be read (refer to *10-2 Memory Area Designations* for PC word/bit address designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Bit status	00	1
	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2
DM	Word contents	82	2
Transition	Flag status	03	1
Step	Flag status	04	1
Forced status	Bit status	05	1
	Word contents	85	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2
Action	Flag status	1B	1

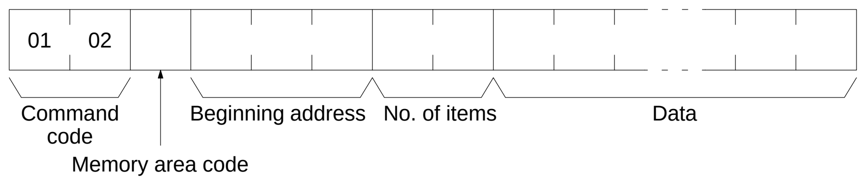
Note Refer to *10-2-2 Data Configurations* for the various data configurations.

10-5 MEMORY AREA WRITE

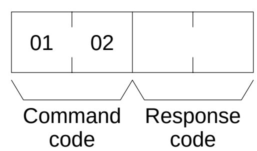
Writes data to the specified number of consecutive words starting from the specified word. All words must be in the same memory area (here, all memory areas with the same memory area code are considered as one area).

Note
1. The MEMORY AREA WRITE command can be executed regardless of the PC's operating mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.
2. When data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

Memory area code (command): The data area to write.

Beginning address (command): The first word/value to write.

No. of items (command): The number of items to be written. If the number of items is set to 0000, nothing will be written and a normal end response code will be returned. Set the number of items to 0001 when writing a step timer PV, register value, or interrupt status.

Data (command): The data to be written. The required number of bytes in total is calculated as follows:

No. of bytes required by each item x No. of items

The following data can be written (refer to *10-2 Memory Area Designations* for the word/bit address designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
Step	Flag ON/OFF	04	1
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2
Register	Register contents	9C	2
	Current bank no. of expansion DM		
Interrupt status	Scheduled interrupt interval	DD	4

Note Refer to *10-2-2 Data Configurations* for the various data configurations.

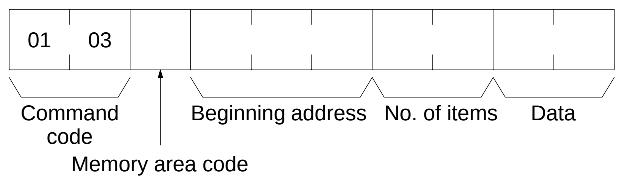
10-6 MEMORY AREA FILL

Writes the same data to the specified number of consecutive memory area words. All words must be in the same memory area (here, all memory areas with the same memory area code are considered as one area).

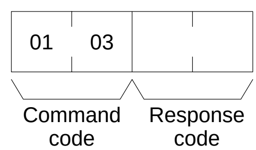
Note 1. The MEMORY AREA FILL command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.

2. When data is written in the Timer/Counter PV Area, the Completion Flag will be turned OFF (0).

Command Block



Response Block



Parameters

Memory area code (command): The data area to write.

Beginning address (command): The first word/values to write.

No. of items (command): The number of items to write. If the number of items is set to 0000, nothing will be written and a normal end response code will be returned.

Data (command): The data to be written to the memory area starting from the Beginning address. The data to be written should consist of two bytes.

The following data can be written (refer to *10-2 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Current bank	98	2

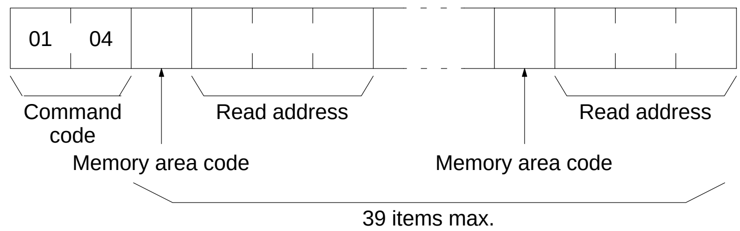
Note Refer to *10-2-2 Data Configurations* for the various data configurations.

10-7 MULTIPLE MEMORY AREA READ

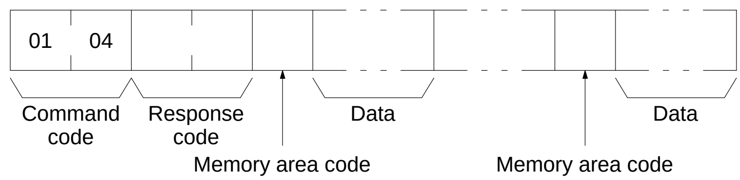
Reads the contents of the specified number of non-consecutive memory area words, starting from the specified word.

Note If there is an error in the command code or a read address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Read address (command): The first word/bit/flag to read.

Data (response): The data in the specified memory area(s) will be returned in sequence starting from the read address.

Memory Areas

The following data can be written (refer to *10-2 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Bit status	00	1
	Bit status (with forced status)	40	1
	Word contents	80	2
	Word contents (with forced status)	C0	4
Timer/Counter	Completion Flag status	01	1
	Completion Flag status (with forced status)	41	1
	PV	81	2
DM	Word contents	82	2
Transition	Flag status	03	1
	Flag status (with forced status)	43	1
Step	Flag status	04	1
	Status	44	1
	Step Timer PV	84	2
Forced Status	Bit status	05	1
	Word contents	85	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2
Action	Flag status	1B	1
Register	Register contents	9C	2
	Expansion DM current bank no.		
Interrupt status	Scheduled interrupt interval	DD	4

Note Refer to *10-2-2 Data Configurations* for the various data configurations.

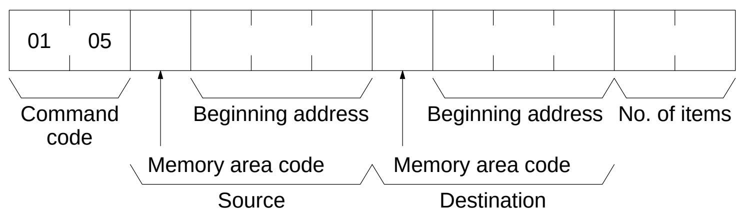
10-8 MEMORY AREA TRANSFER

Copies and transfers the contents of the specified number of consecutive memory area words to the specified memory area. All source words must be in the same area and all designation words must be written to the same area (here, all memory areas with the same memory area code are considered as one area).

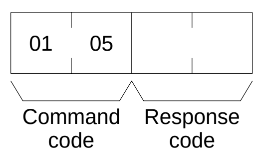
Note 1. The MEMORY AREA TRANSFER command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.

2. When data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

Memory area code (command): The data area to transfer from and the data area to transfer to.

Beginning address (command): The first word/value to transfer from and the first word to transfer to.

No. of items (command): The number of items to transfer (each item consists of two bytes).

The following data can be transferred (refer to *10-2 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2

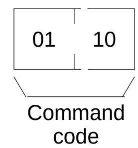
10-9 COMPOSITE REGISTRATION READ

Reads the memory areas according to the addresses specified with the COMPOSITE READ REGISTRATION command (01 11).

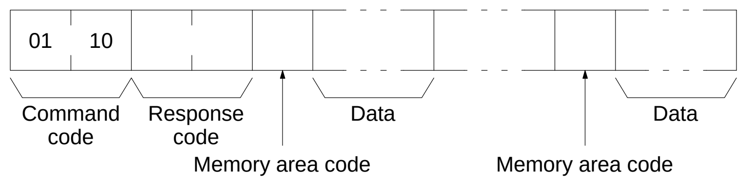
Note 1. Although this command is addressed to the CPU Unit, it is actually processed by the DeviceNet (CompoBus/D) Master Unit. The command will thus result in an error if it is not sent to a CPU Unit through a DeviceNet network.

2. If there is an error in the command code or a read address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (response): The data area to read.

Data (response): The data in the specified with the COMPOSITE READ REGISTRATION command will be returned in sequence. The number of bytes returned for each item depends on the item that is specified.

10-10 REGISTER COMPOSITE READ

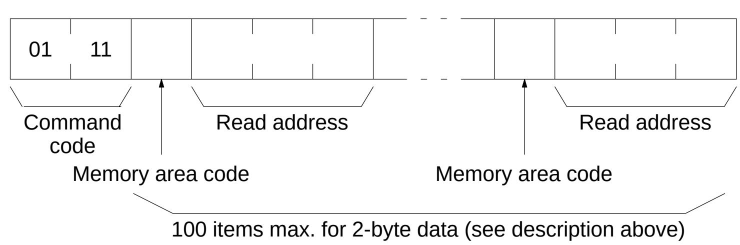
Registers the contents to be read with the COMPOSITE REGISTRATION READ command (01 10). Up to 100 items can be registered for reading for 2-bytes data; up to 50 items for 4-byte data, i.e., up to 200 bytes of data can be read.

The contents registered with this command is effective until the power supply to the PC is turned OFF or until the Master Unit is reset. This enables executing the COMPOSITE REGISTRATION READ command consecutively without having to specify the contents to be read again.

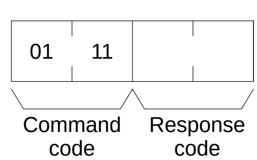
Note

1. Although this command is addressed to the CPU Unit, it is actually processed by the DeviceNet Master Unit. The command will thus result in an error if it is not sent to a CPU Unit through a DeviceNet network.
2. If there is an error in the command code or a read address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Read address (command): The word/bit/flag to read.

Memory Areas

The following data can be written (refer to *10-2 Memory Area Designations* for memory area designations):

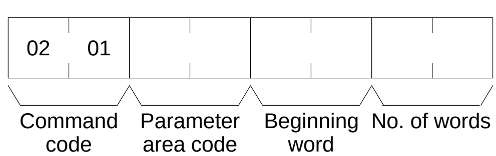
Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Bit status	00	1
	Bit status (with forced status)	40	1
	Word contents	80	2
	Word contents (with forced status)	C0	4
Timer/Counter	Completion Flag status	01	1
	Completion Flag status (with forced status)	41	1
	PV	81	2
DM	Word contents	82	2
Transition	Flag status	03	1
	Flag status (with forced status)	43	1
Step	Flag status	04	1
	Status	44	1
	Step Timer PV	84	2
Forced Status	Bit status	05	1
	Word contents	85	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2
Action	Flag status	1B	1
Register	Register contents	9C	2
	Expansion DM current bank no.		
Interrupt status	Scheduled interrupt interval	DD	4

Note Refer to *10-2-2 Data Configurations* for the various data configurations.

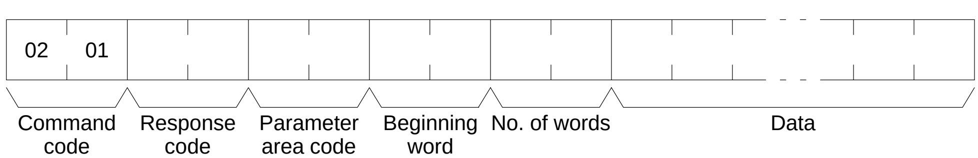
10-11 PARAMETER AREA READ

Reads the contents of the specified number of consecutive parameter area words starting from the specified word. All words in the specified parameter area must be read at the same time to ensure complete data. A maximum of 75 words can be read with each command. To read larger parameter areas, use multiple commands and specify the beginning word and number of words for each.

Command Block



Response Block

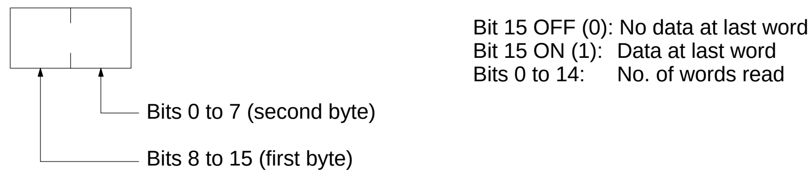


Parameters

Parameter area code (command and response): The parameter area to read.

Beginning word (command and response): The first word to read.

No. of words (command and response): Bits 0 to 14 are used to specify the number of words to be read (each word consists of two bytes). Bit 15 must be OFF (0) in the command block. When the contents in the response block contains the last word of data in the specified parameter area, bit 15 will be ON (1).

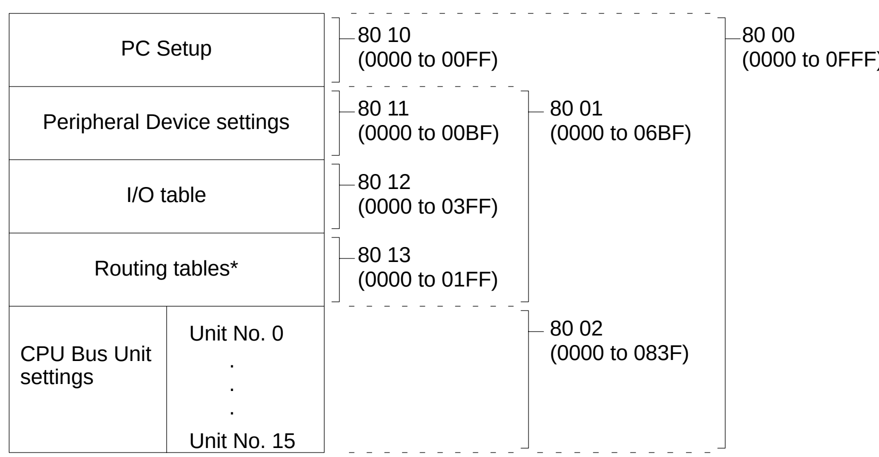


Data (response): The data in the specified parameter area will be returned in sequence starting from the beginning word. The leftmost bits (bits 8 to 15) of each word are read first, followed by the rightmost bits (bits 0 to 7). The required number of bytes in total for each read is calculated as follows:

No. of words x 2 (each word consists of two bytes)

Parameter Areas

There are five parameter areas, each of which has consecutive word addresses beginning from 0000. The following data can be read. The word ranges in parentheses show the possible values for the beginning word.



Note *Although the routing tables have a 512-word area (0000 to 01FF), only a 48-word area (0000 to 002F) of it can be read.

10-12 PARAMETER AREA WRITE

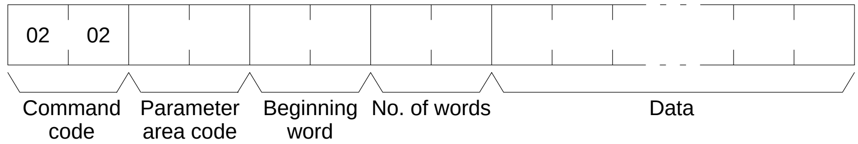
Writes data to the specified number of consecutive parameter area words starting from the specified word. All words in the specified parameter area must be written at the same time to ensure complete data. A maximum of 76 words can be written with each command. To write larger parameter areas, use multiple commands and specify the beginning word for each.

Data can be written to the I/O table only when the PC is in PROGRAM mode.

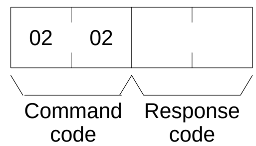
Note
1. The PARAMETER AREA WRITE command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.
2. If any other device has the access right, nothing will be written to the specified parameter area.

3. If memory is write-protected via the key switch on the front panel of the PC, nothing will be written to the specified parameter area.

Command Block



Response Block

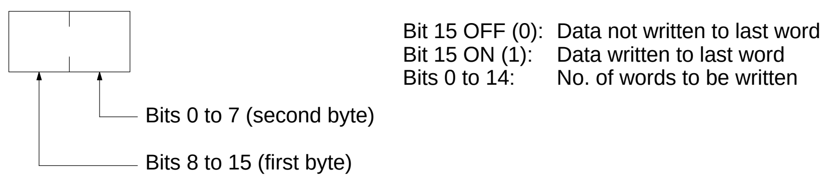


Parameters

Parameter area code (command): The parameter area to write.

Beginning word (command): The first word to write.

No. of words (command): Bits 0 to 14 are used to specify the number of words to be written (each word consists of two bytes). Bit 15 must be ON (1) when data is written to the last word in the specified parameter area or no data will be written. If the number of write words is set to 0000, no words will be written and a normal response code will be returned.

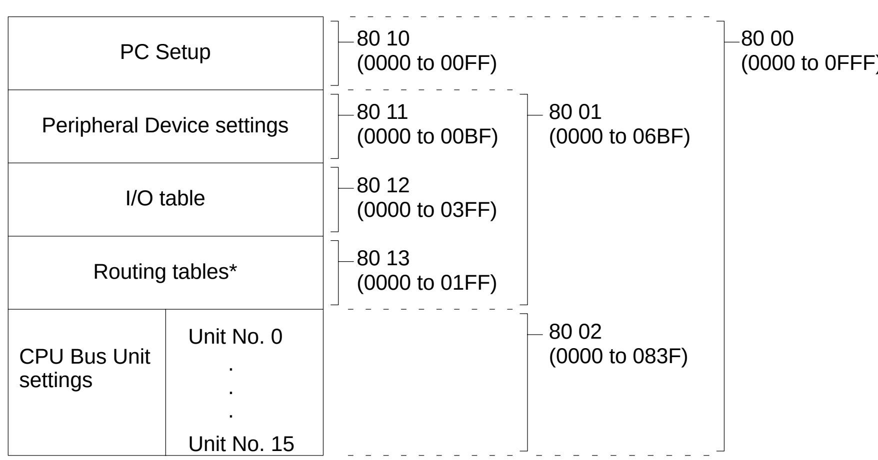


Data (command): The data to be written. The leftmost bits (bits 15 to 8) of each word must be specified first, followed by the rightmost bits (bits 7 to 0). The required number of bytes in total for each write can be calculated as follows:

No. of words x 2 (each word consists of two bytes)

Parameter Areas

There are five parameter areas, each of which has consecutive word addresses beginning from 0000. The following data can be read. The word ranges in parentheses show the possible values for the beginning word.



Note *Only a 48-word area (0000 to 002F) of the routing tables is available. The data must be written to the 48-word area in sequence beginning from 0000 or an error will result as the PC automatically does a format check in order to prevent routing errors.

10-13 PARAMETER AREA CLEAR

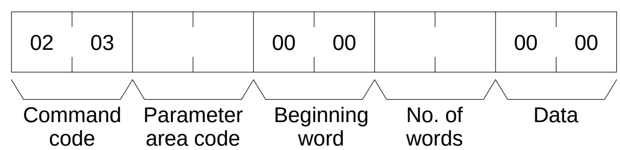
Writes all zeros to the specified number of consecutive parameter area words to clear the previous data. The I/O table can be cleared only when the PC is in PROGRAM mode.

Always clear the entire range of the specified parameter area.

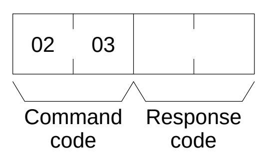
Note

1. The PARAMETER AREA CLEAR command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.
2. If any other device holds the access right, nothing can be written to the specified parameter area.
3. If memory is write-protected via the key switch on the front panel of the PC, nothing can be written to the specified parameter area.

Command Block



Response Block



Parameters

Parameter area code (command): The parameter area to clear.

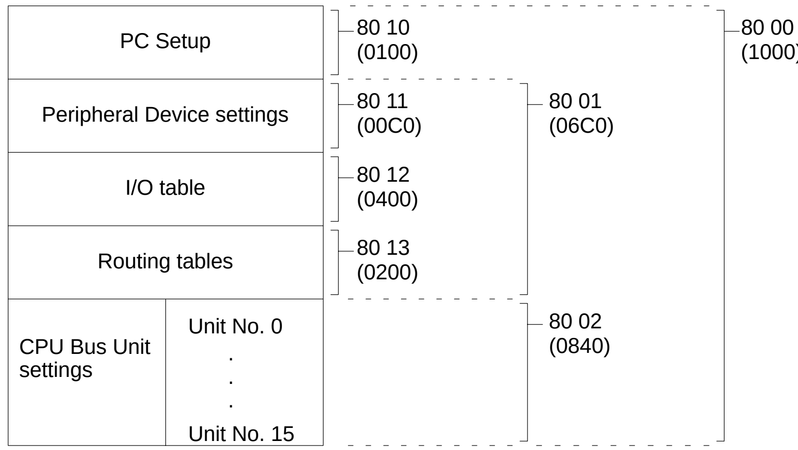
Beginning word (command): Fixed at 0000.

No. of words (command): The number of words to clear (see diagram below).

Data (command): Set to 0000. The number of word addresses where the data (0000) should be written is specified by the number of words in the command block.

Parameters Areas

The available parameter areas and the number of words in each are as shown below. The number of words in the parentheses is specified as the number of words to clear.

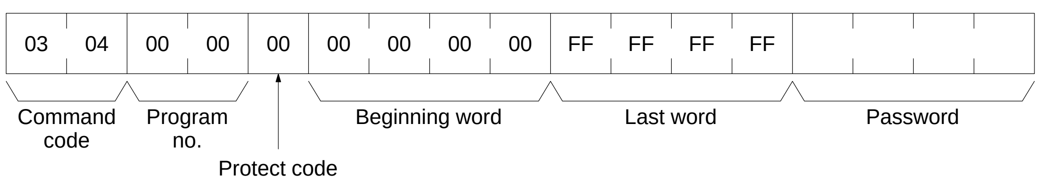


10-14 PROGRAM AREA PROTECT

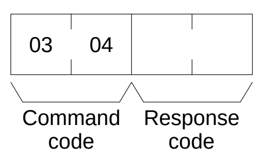
Protects the program by making it read-only.

Note 1. The program cannot be protected if any other device holds the access right.
2. If memory is write-protected via the key switch on the front panel of the PC, the PROGRAM AREA PROTECT command will not be effective.

Command Block



Response Block



Parameters

The command will be executed normally even if the beginning word and last word are set to values other than those shown below.

Program no. (command): Set to 0000.

Protect code (command): Set to 00.

Beginning word (command): Set to 00000000

Last word (command): Set to FFFFFFFF

Password (command): Set any four ASCII characters. The password is used with the PROGRAM AREA PROTECT CLEAR command (refer to *10-15 PROGRAM AREA PROTECT CLEAR*).

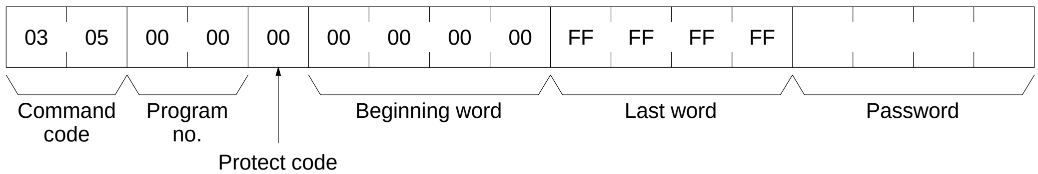
10-15 PROGRAM AREA PROTECT CLEAR

Restores write and read access rights so that data can be written to and read from the program area.

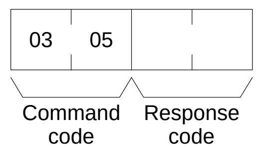
Note 1. Protection cannot be cleared if any other device holds the access right.

2. If memory is write-protected via the key switch on the front panel of the PC, the PROGRAM AREA PROTECT CLEAR command is not effective.
3. If you forget the password, you will not be able to clear program protection without using PROGRAM AREA CLEAR to delete the entire program area. Executing PROGRAM AREA CLEAR will release program protection.

Command Block



Response Block



Parameters

The command will be executed normally even if the beginning word and last word are set to values other than those shown below.

Program no. (command): Set to 0000.

Protect code (command): Set to 00.

Beginning word (command): Set to 00000000

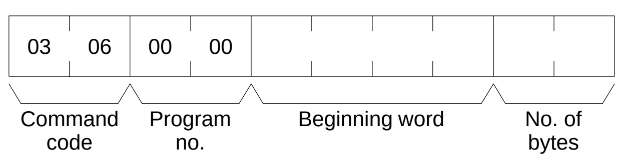
Last word (command): Set to FFFFFFFF

Password (command): The password that was set in the PROGRAM AREA PROTECT command.

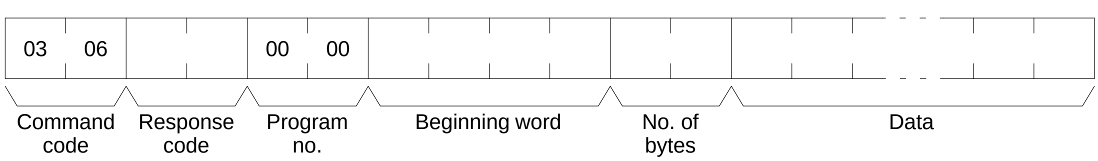
10-16 PROGRAM AREA READ

Reads the contents of the specified number of consecutive program area words starting from the specified word. A maximum of 148bytes can be read with each command. To read larger amounts of data, use multiple commands and specify the beginning word and number of words for each.

Command Block



Response Block

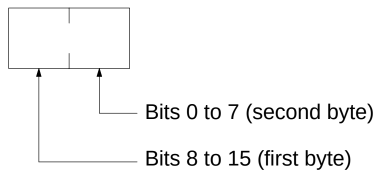


Parameters

Program no. (command and response): Set to 0000.

Beginning word (command and response): Set between 00000E00 and 0000FFFE for the CV500 or CVM1-CPU01 and between 00000E00 and 0001FFFE for the CV1000/CV2000 or the CVM1-CPU11/21. The beginning word must be an even number.

No. of bytes (command and response): The number of bytes in an even number (148 or smaller). Bit 15 must be OFF (0) in the command block. Bit 15 will be ON (1) in the response block when the last word data of the program area is returned.



Bit 15 OFF (0): Without last word data
Bit 15 ON (1): With last word data
Bits 0 to 14: No. of bytes read

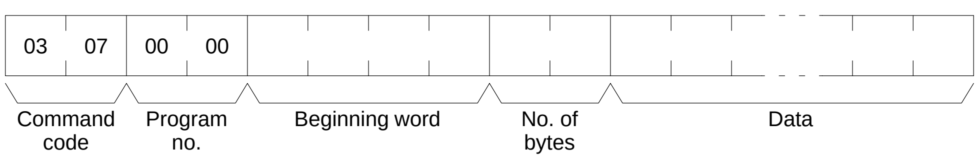
Data (response): The data in the specified program area will be returned in sequence starting from the beginning word.

10-17 PROGRAM AREA WRITE

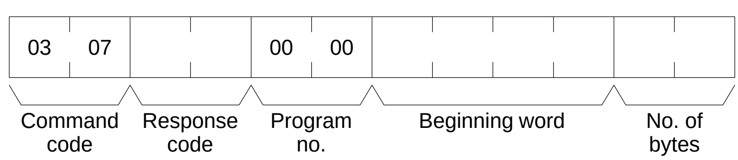
Writes data to the specified number of consecutive program area words starting from the specified word. A maximum of 150 bytes can be written with each command. To write larger amounts of data, use multiple commands and specify the beginning word and number of words for each.

Note
1. If memory is write-protected via the key switch on the PC's front panel or by the PROGRAM AREA PROTECT command (refer to *10-14 PROGRAM AREA PROTECT*), nothing will be written to the program area.
2. The PROGRAM AREA WRITE command can be executed as long as the PC is not in RUN mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in MONITOR or DEBUG mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.

Command Block



Response Block

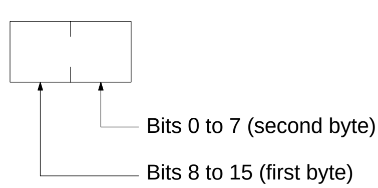


Parameters

Program no. (command and response): Set to 0000.

Beginning word (command and response): Set between 00000E00 and 0000FFFE for the CV500 or CVM1-CPU01 and between 00000E00 and 0001FFFE for the CV1000/CV2000 or the CVM1-CPU11/21. The beginning word must be an even number.

No. of bytes (command and response): The number of bytes in an even number (150 or smaller). Bit 15 must be ON (1) when data is written to the last word in the specified parameter area or no data will be written.



Bit 15 OFF (0): Data not written to last word
Bit 15 ON (1): Data written to last word
Bits 0 to 14: No. of bytes written

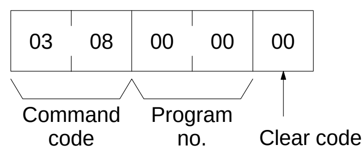
Data (command): The data to be written.

10-18 PROGRAM AREA CLEAR

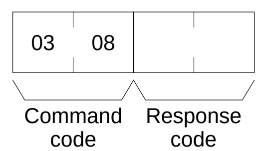
Clears the contents of the program area.

Note
1. If memory is write-protected via the key switch on the front panel of the PC, the PROGRAM AREA CLEAR command is not effective.
2. The PROGRAM AREA CLEAR command will clear the program area even if memory is write-protected by the PROGRAM AREA PROTECT command (refer to *10-14 PROGRAM AREA PROTECT*). Executing PROGRAM AREA CLEAR will release program protection.
3. If any other device holds the access right, the PROGRAM AREA CLEAR command is not effective.

Command Block



Response Block



Parameters

Program no. (command): Set to 0000.

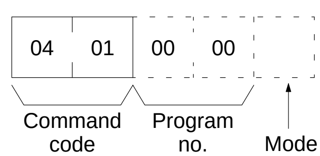
Clear code (command): Set to 00.

10-19 RUN

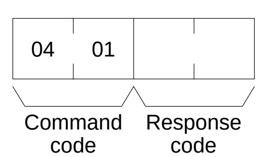
Changes the PC to DEBUG, MONITOR, or RUN mode, enabling the PC to execute its program.

Note If any other device holds the access right, the PC mode will not be changed.

Command Block



Response Block



Parameters

Program no. (command): Set to 0000.

Mode (command): As follows:

0001: DEBUG mode

0002: MONITOR mode

0004: RUN mode

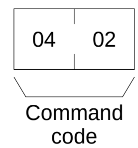
Note If the mode is not specified, the PC will go to MONITOR mode.

10-20 STOP

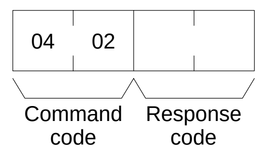
Changes the PC to PROGRAM mode, stopping program execution.

Note If any other device holds the access right, nothing will be executed.

Command Block



Response Block

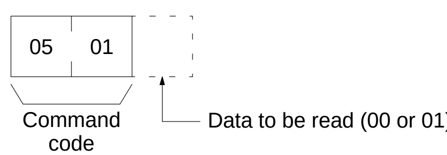


10-21 CONTROLLER DATA READ

Reads the following data:

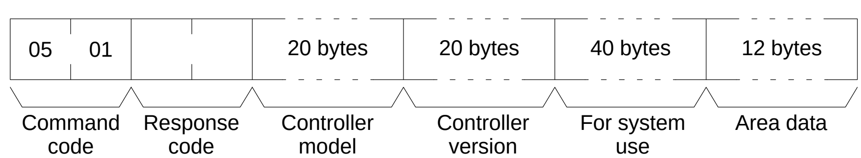
- Controller model and version
- Area data
- CPU Bus Unit configuration
- Remote I/O data
- PC status

Command Block

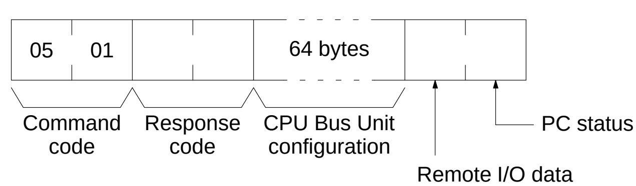


Response Block

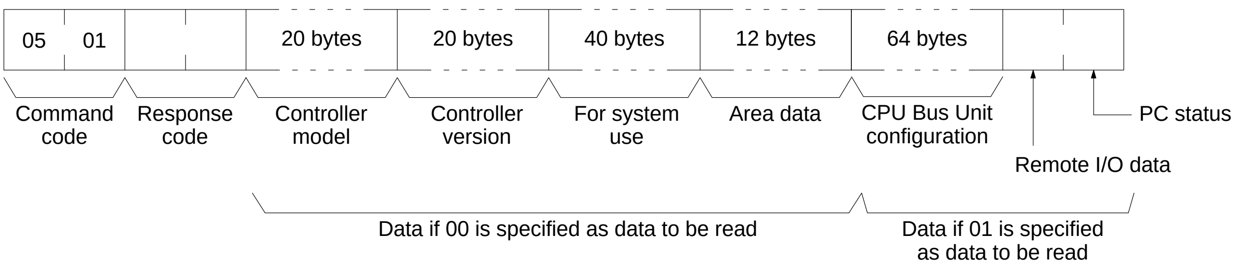
The format is as follows if 00 is specified as the data to be read:



The format is as follows if 01 is specified as the data to be read:



The format is as follows when the data to be read is omitted.



Parameters

Data (command): Specify as follows to read the desired data:

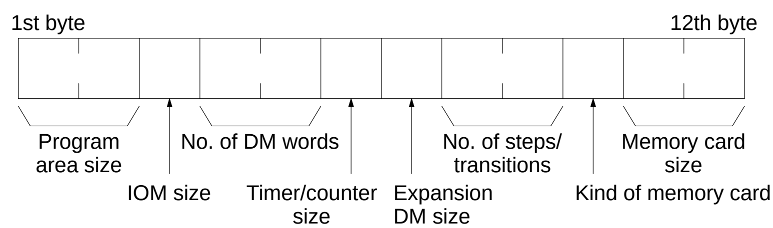
Value	00	01	Omitted
Data to be read	Controller model Controller version Area data	CPU Bus Unit configuration Remote I/O data PC status	Controller model Controller version Area data CPU Bus Unit configuration Remote I/O data PC status

Note If no data is specified, all data will be read consecutively

Controller model and Controller version (response): Both are read in ASCII codes (20 bytes (i.e. 20 ASCII characters) max. each)

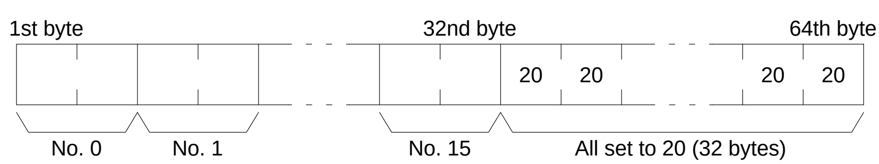
For system use (response): Reserved for system use.

Area data (response): As follows:

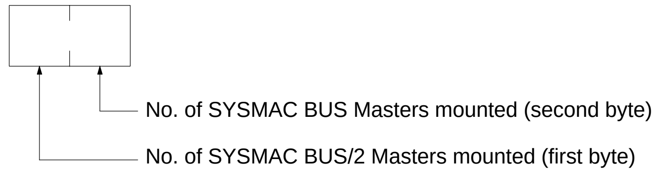


Item	Meaning	Unit
Program area size	The size of PC Setup and program area	K words (1K words = 1,024 words)
IOM size	The size of the area in which bit/word commands can be used.	K bytes (1K bytes = 1,024 bytes)
No. of DM words	Total words in the DM area	K words
Timer/counter size	Maximum no. of timers/counters available	Timers/Counters
Expansion DM size	Banks in the expansion DM area	Banks (1 bank = 32,766 words)
No. of steps/transitions	Maximum no. of steps/transitions available	Steps/transitions
Kind of memory card	00: No memory card 01: SPRAM 02: EPROM 03: EEPROM	---
Memory card size	Size of the memory card	K byte (1 word = 2 bytes)

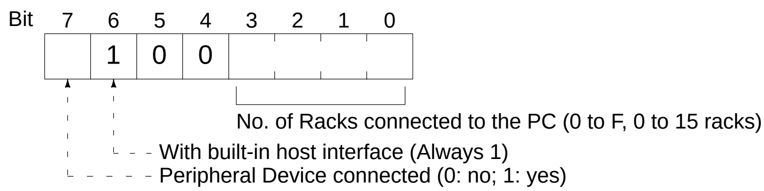
CPU Bus Unit configuration (response): Each CPU Bus Unit has a code assigned to it consisting of two ASCII characters (two bytes). These codes are given in the numerical order according to the unit number of the CPU Bus Units (unit 0 to 15).



Remote I/O data (response): The number of remote I/O systems (SYSMAC BUS and SYSMAC BUS/2) is returned in two bytes as follows:



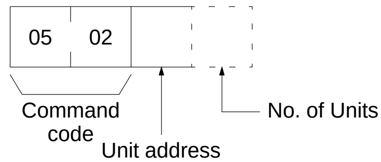
PC status (response): The following single byte (8 bits) is returned:



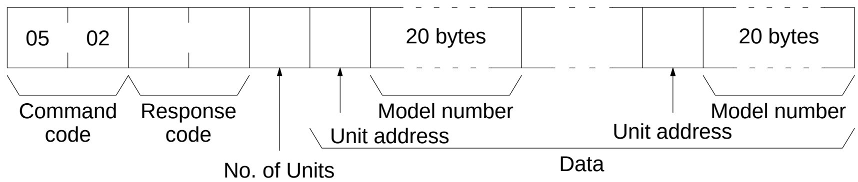
10-22 CONNECTION DATA READ

Reads the model number of the specified Units.

Command Block



Response Block



Parameters

Unit address (command and response): The unit address of the first Unit whose model number is to be read. If the specified Unit does not exist, the CONTROLLER DATA READ command is executed from the next Unit. Specify the following for the unit address.

CPU: 00
CPU Bus Unit: 10_{16} + unit number in hexadecimal

No. of Data Units (command): The number of data units for which the model number is to be read. A number between 01 and 19 (hexadecimal) can be specified. If the number of data units is not specified, 19 (25 data units) will be used.

No. of Units (response): The number of Units for which a model number is being returned. If bit 7 is ON (1), the model number of the last Unit is being returned.

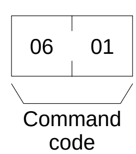
Unit address and model number (response): The unit address and model number. The model number is provided in up to 20 ASCII characters.

10-23 CONTROLLER STATUS READ

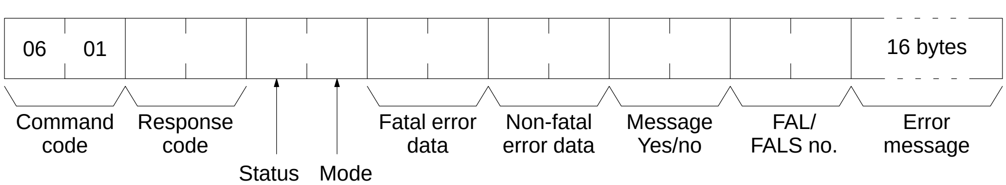
Reads the status of the Controller.

Note To read the error log, read the appropriate Auxiliary Area words or execute the ERROR LOG READ command (refer to *10-34 ERROR LOG READ*).

Command Block



Response Block



Parameters

Status (response): The operating status of the PC as follows:

00: Stop (program not being executed)

01: Run (program being executed)

80: CPU on standby (the start switch is OFF or the CPU is waiting for a signal from a device such as a SYSMAC BUS/2 Remote I/O Slave Unit).

Mode (response): One of the following PC modes:

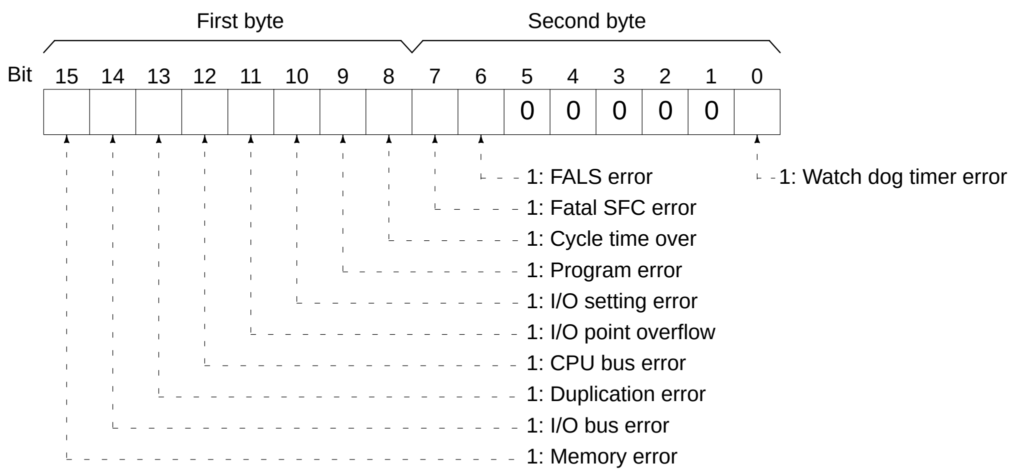
00: PROGRAM

01: DEBUG

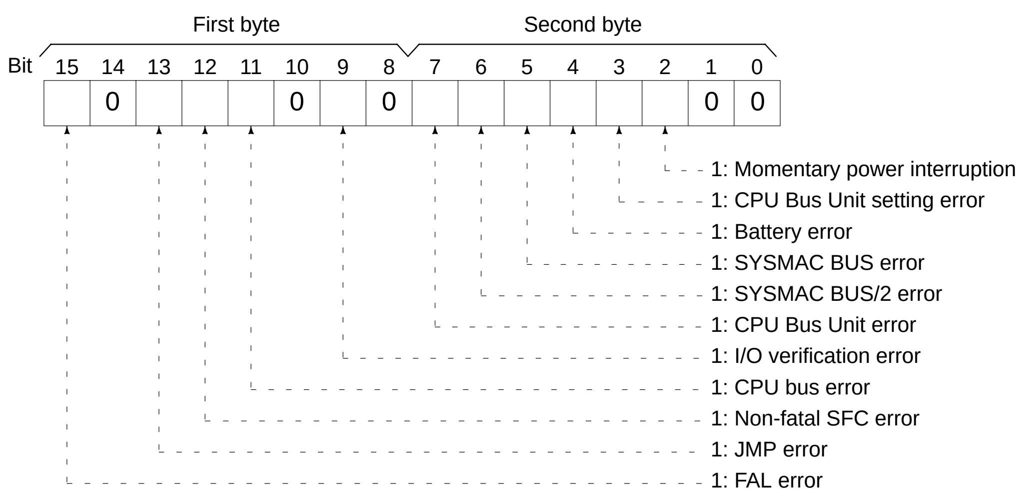
02: MONITOR

04: RUN

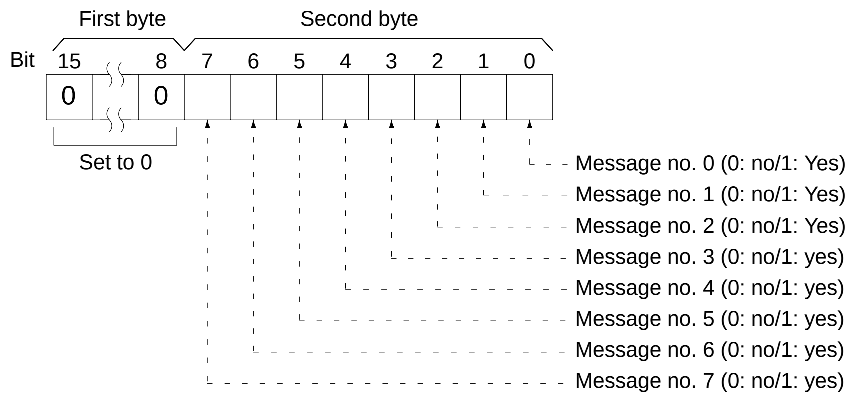
Fatal error data (response): The contents of PC fatal error information (for details refer to the *CV-series PC Operation Manual: Ladder Diagrams*):



Non-fatal error data (response): The contents of PC non-fatal error information (for details refer to the *CV-series PC Operation Manual: Ladder Diagrams*):



Message yes/no (response): If MSG(195) has been executed, the bit corresponding to the message number will be ON (1) as shown below. To read the messages generated by MSG(195), execute the MESSAGE READ command (refer to *10-27 MESSAGE READ*).



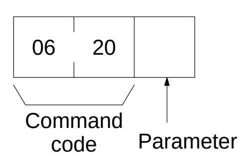
FAL/FALS no. (response): The highest priority FAL or FALS error. The actual value returned will be 4100 plus the FAL/FALS number; for details refer to the *CV-series PC Operation Manual: Ladder Diagrams*). If no FAL or FALS error has occurred, 0000 will be returned.

Error message (response): The error message of the present FAL/FALS number. If there is no error, 16 spaces (ASCII 20) will be returned.

10-24 CYCLE TIME READ

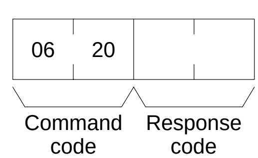
Initializes the PC's cycle time history or reads the average, max., and min. cycle time.

Command Block

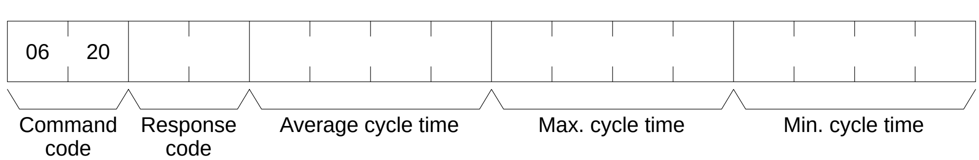


Response Block

The response format is as follows when the parameter is 00 (when initializing):



The response format is as follows when the parameter is 01 (when reading):



Parameters

Parameter code (command): As follows:

00: Initializes the cycle time.

01: Reads the average, maximum, and minimum cycle time.

Average cycle time, max. cycle time, min. cycle time (response): Each value is expressed in 8-digit BCD in 0.1-ms increments. For example, if 00 00 06 50 is returned, the cycle time is 65 ms.

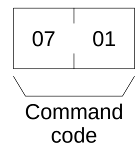
The average cycle time is obtained as follows:

Average cycle time = (max. cycle time + min. cycle time)/2

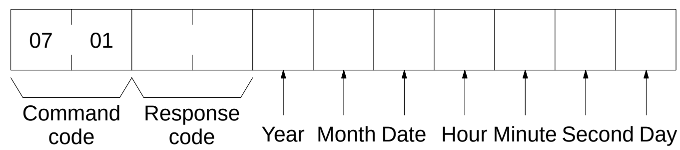
10-25 CLOCK READ

Reads the clock.

Command Block



Response Block



Parameters

Year, month, date, hour, minute, second, day (response): Each value is expressed in BCD.

Year: The rightmost two digits of the year.

Hour: 00 to 23.

Day: As follows:

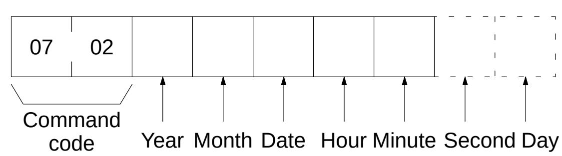
Value	00	01	02	03	04	05	06
Day	Sun	Mon	Tues	Wed	Thur	Fri	Sat

10-26 CLOCK WRITE

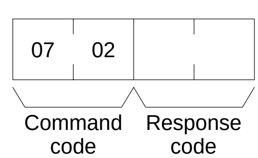
Sets the clock.

Note
1. The PC automatically checks the range of the specified data. If any portion of the data is incorrect, the clock will not be set.
2. If any other device holds the access right, the clock will not be set.

Command Block



Response Block



Parameters

Year, month, date, hour, minute, second, day (command): Each specified value is expressed in BCD.

Year: The rightmost two digits of the year.

Hour: Specify 00 to 23.

Day: As follows:

Value	00	01	02	03	04	05	06
Day	Sun	Mon	Tues	Wed	Thur	Fri	Sat

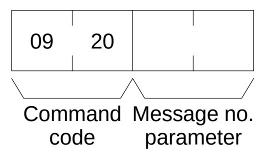
Note 1. If the second or day are not specified, 00 will be set as the second and the previous value will be kept for the day.
2. The PC does not check the day from the date. This means that no error will occur even if the date and day do not agree.

10-27 MESSAGE READ

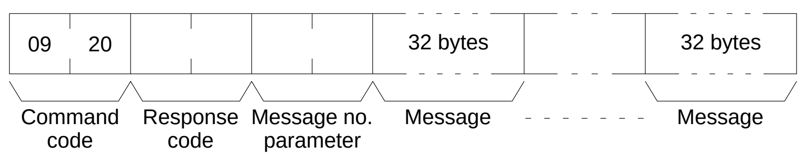
Reads messages generated by MSG(195).

Note The MESSAGE READ, MESSAGE CLEAR (refer to *10-28 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *10-29 FAL/FALS READ*) share the same command code. They are distinguished by bits 14 and 15 of the two-byte parameter following the command code. To read MSG(195) messages, bits 14 and 15 must be OFF (0).

Command Block

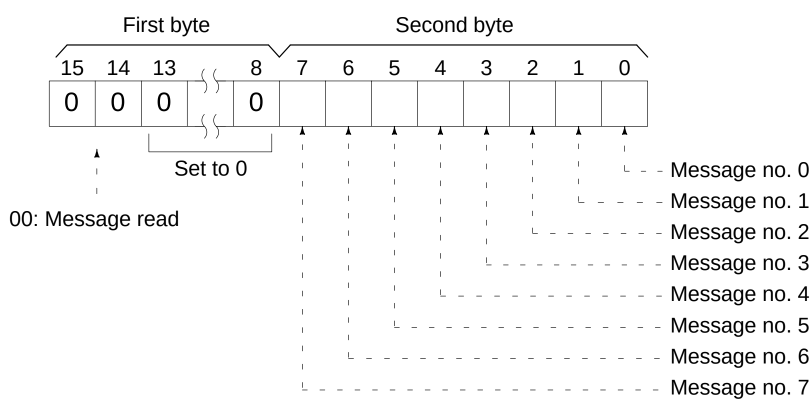


Response Block



Parameters

Message no. parameter (command and response): In the command block, turn ON (1) the bits of the messages to be read. In the response block, the bits of the messages being returned will be ON (1). If no bits are turned ON in the command block, all bits will be OFF (0) in the response block and no further data will be returned.



Message (response): Each message is read in the numerical order according to the message number. Each message consists of 32 ASCII characters (32 bytes). The total number of bytes of the messages is calculated as follows:

The number of messages * 32 bytes

If no message has been registered for a message number that has been requested, 32 spaces (ASCII 20) will be returned.

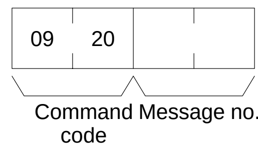
10-28 MESSAGE CLEAR

Clears messages generated with MSG(195).

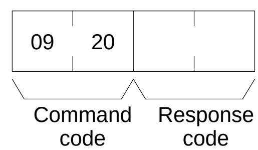
Note 1. The MESSAGE READ, MESSAGE CLEAR (refer to *10-27 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *10-29 FAL/FALS READ*) share the same command code. They are distinguished by bits 14 and 15 of the two-byte parameter following the command code. To clear messages, bit 14 must be ON (0) and bit 15 must be OFF (0).

2. If any other device holds the access right, messages will not be cleared.

Command Block

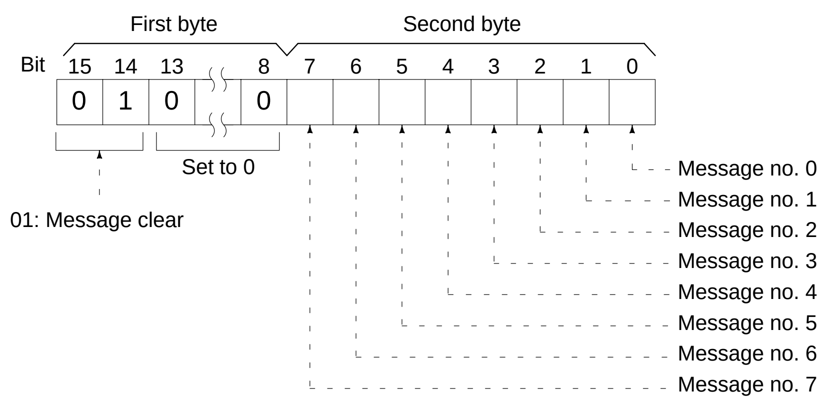


Response Block



Parameters

Message no. (command): Turn ON the bits of the messages to be cleared.

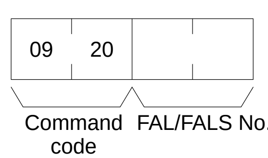


10-29 FAL/FALS READ

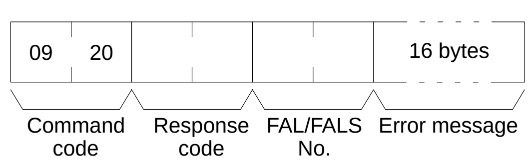
Reads FAL/FALS messages.

Note The MESSAGE READ (refer to *10-27 MESSAGE READ)*, MESSAGE CLEAR (refer to *10-28 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *10-29 FAL/FALS READ*) share the same command code. They are distinguished by bits 14 and 15 of the two-byte parameter after the command code. To read FAL/FALS messages, bit 14 must be OFF (0) and bit 15 must be ON (1).

Command Block

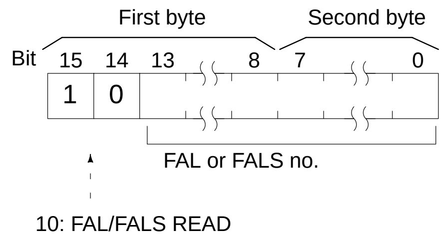


Response Block



Parameters

FAL/FALS no. (command and response): In the command block, specify in hexadecimal in bits 0 to 13 the FAL or FALS number to be read as shown below. In the response block, the FAL or FALS number is returned.



Error message (response): The error message specified in the FAL(006) or FALS(007) instruction. If there is no error, 16 spaces (ASCII 20) will be returned.

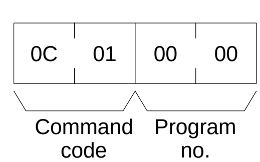
10-30 ACCESS RIGHT ACQUIRE

Acquires the access right as long as no other device holds it. Execute the ACCESS RIGHT ACQUIRE command when you need to execute commands continuously without being interrupted by other devices. As soon as the execution of the commands has been completed, execute the ACCESS RIGHT RELEASE command to release the access right (refer to *10-32 ACCESS RIGHT RELEASE*). If another devices holds the access right, the device will be identified in the response.

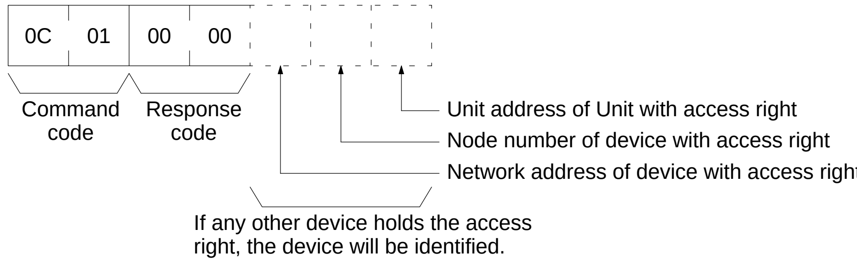
Note
1. If any other device has the access right, the access right cannot be acquired with this command; use the ACCESS RIGHT FORCED ACQUIRE command (refer to *10-31 ACCESS RIGHT FORCED ACQUIRE*).
2. The following commands cannot be executed by other devices if the host computer holds the access right. Do not restrict the access right unless necessary.

   PARAMETER AREA WRITE (02 02)
   PARAMETER AREA CLEAR (02 03)
   PROGRAM AREA PROTECT (03 04)
   PROGRAM AREA CLEAR (03 05)
   PROGRAM AREA WRITE (03 07)
   PROGRAM AREA PROTECT CLEAR (03 08)
   RUN (04 01)
   STOP (04 02)
   CLOCK WRITE (07 02)
   MESSAGE CLEAR (09 20)
   ACCESS RIGHT ACQUIRE (0C 01)
   ERROR CLEAR (21 01)
   ERROR LOG CLEAR (21 03)
   PARAMETER AREA FILE TRANSFER (22 0B)
   PROGRAM AREA FILE TRANSFER (22 0C)
   FORCED SET/RESET (23 01)
   FORCED SET/RESET CANCEL (23 02)

Command Block



Response Block



Parameters

Program no. (command): Set to 0000.

10-31 ACCESS RIGHT FORCED ACQUIRE

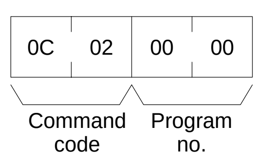
Acquires the access right even if another device already holds it.

Note

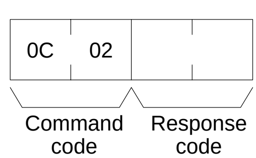
1. Even if any other device has the access right, the access right can be acquired with this command and a normal response code will be returned.
2. The following commands cannot be executed by other devices if the host computer holds the access right. Do not restrict the access right unless necessary.

   PARAMETER AREA WRITE (02 02)
   PARAMETER AREA CLEAR (02 03)
   PROGRAM AREA PROTECT (03 04)
   PROGRAM AREA CLEAR (03 05)
   PROGRAM AREA WRITE (03 07)
   PROGRAM AREA PROTECT CLEAR (03 08)
   RUN (04 01)
   STOP (04 02)
   CLOCK WRITE (07 02)
   MESSAGE CLEAR (09 20)
   ACCESS RIGHT ACQUIRE (0C 01)
   ERROR CLEAR (21 01)
   ERROR LOG CLEAR (21 03)
   PARAMETER AREA FILE TRANSFER (22 0B)
   PROGRAM AREA FILE TRANSFER (22 0C)
   FORCED SET/RESET (23 01)
   FORCED SET/RESET CANCEL (23 02)
3. When the ACCESS RIGHT FORCED ACQUIRE command is executed while any other device has the access right, the access right of the other device will be canceled. If possible, wait until the other device completes the present operation, and then execute the ACCESS RIGHT ACQUIRE command (refer to *10-30 ACCESS RIGHT ACQUIRE*).
4. The device that has lost the access right is not notified.

Command Block



Response Block



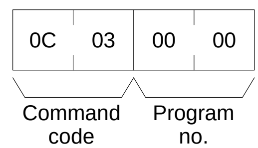
Parameters

Program no. (command): Set to 0000.

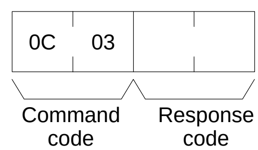
10-32 ACCESS RIGHT RELEASE

Releases the access right regardless of what device holds it. A normal response code will returned even when another device held the access right or when no device held the access right.

Command Block



Response Block



Parameters

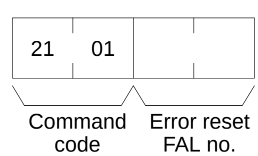
Program no. (command): Set to 0000.

10-33 ERROR CLEAR

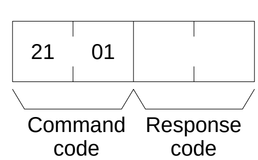
Clears errors or error messages from the PC. A normal response will be returned even if the error has not occurred.

Note The cause of the error must be removed before executing the ERROR CLEAR command or the same error will occur again after the ERROR CLEAR command is executed.

Command Block



Response Block



Parameters

Error reset FAL no. (command): The code of the error to be reset.

The following codes can be used regardless of the PC’s mode:

Error code	Meaning
FFFE	Present error cleared. Resets the highest priority error.
0002	Momentary power interruption error. This error occurs when the CPU power has been interrupted.
00A0 to 00A7	SYSMAC BUS error
00B0 to 00B3	SYSMAC BUS/2 error
00E7	I/O verification error. This error occurs if the I/O table differs from the actual I/O points in the System.
00F4	Non-fatal SFC error. This error occurs when there is an error while the PC is executing an SFC program.
00F7	Battery error
00F8	Indirect DM error. This error occurs when a mistake has occurred in indirectly addressing the DM Area.
00F9	JMP error. This error occurs when a jump has been specified without a destination.
0200 to 0215	CPU Bus Unit error (the rightmost two digits are the unit number in BCD of the Unit that has the error). This error occurs if there is a parity error at the time of data transfer between the CPU Bus Unit and CPU or if the CPU Bus Unit has a watchdog timer error.
0400 to 0415	CPU Bus Unit setting error (the rightmost two digits are the unit number in BCD of the Unit that has the error).
4101 to 42FF	FAL(006) executed in the user program.

The following codes can be used only when the PC is in PROGRAM mode:

Error code	Meaning
FFFF	All errors cleared.
809F	Cycle time too long
80C0 to 80C7	I/O bus error. This error occurs when there is an error in an I/O bus check or a Unit has been removed or added when power is turned on to the PC.
80E0	I/O setting error. This error occurs if the I/O table differs from actual I/O points in the System.
80E1	I/O points overflow
80E9	Duplication error. This error occurs if the same unit number is assigned more than one Unit or the same word is allocated more than once.
80F0	Program error. This error occurs if a program that exceeds memory capacity is executed.
80F1	Memory error. This error occurs if an error is found in the PC’s memory, memory card, or PC Setup during an memory error check.
80F3	Fatal SFC error. This error occurs if an SFC syntax error has been discovered and the program will not execute.
80FF	System error. This error occurs if the CPU has a watchdog timer error.
8100 to 8115	CPU bus error. The rightmost two digits are the unit number in BCD of the CPU Bus Unit that has the error. This error occurs if an error is discovered during a CPU bus check.
C101 to C2FF	FALS(007) executed.

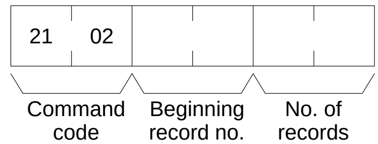
10-34 ERROR LOG READ

Reads the PC’s error log.

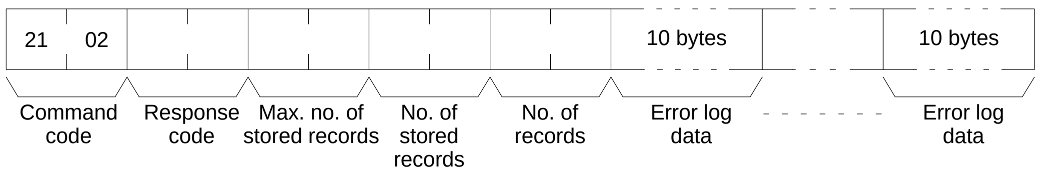
Note 1. When the PC does not have the specified number of records, all the records that have been stored in the PC will be read and an address range overflow error will result.

2. If the data is too large and exceeds the permissible length of the response block, the part in excess will not be read and a response length overflow error will result.

Command Block



Response Block



Parameters

Beginning record no. (command): The first record to be read (the first record number is 0000).

Max. no. of stored records (response): The maximum number of records that can be recorded.

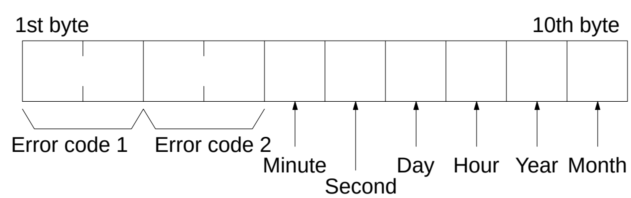
No. of stored records (response): The number of records that have been recorded.

No. of records (command and response): The number of records to read. With the DeviceNet network, up to 15 records can be read at the same time.

Error log data (response): The specified error log records will be returned in sequence starting from the beginning record number. The total number of bytes required is calculated as follows:

No. of records x 10 bytes

The configuration of each error record is as follows:



Error code 1, 2: Refer to page 184 for error code 1 and to the relevant operation manual or installation guide for error code 2.

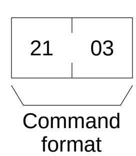
Each data includes the second, minute, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

10-35 ERROR LOG CLEAR

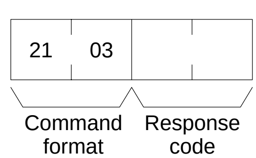
Clears all error log records.

Note This command cannot be executed if any other device has the access right.

Command Block



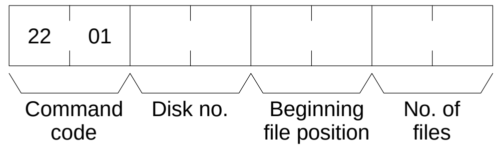
Response Block



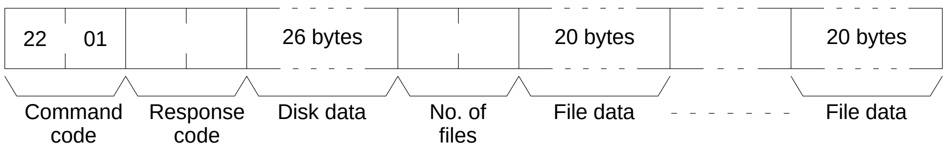
10-36 FILE NAME READ

Reads out data on the specified number of files stored in the file device connected to the PC.

Command Block



Response Block



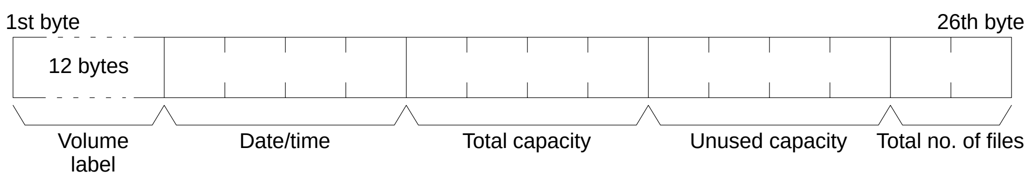
Parameters

Disk no. (command): Set to 0000 for the file device (memory card).

Beginning file position (command): The first file to be read (the first file number is 0000).

No. of files (command): The number of files to be read between 0001 and 0019.

Disk data (response): The data from the file device, the configuration of which is as follows:



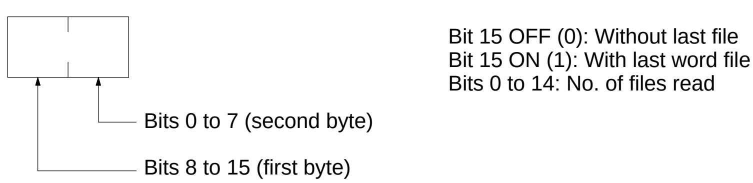
Volume Label
The volume label registered with the file device (refer to *10-3 Volume Labels and File Names* for the configuration of the volume label). If no volume label has been registered, 20 spaces (ASCII 20) will be returned.

Date/Time
The date and time that the volume label was created (see next page).

Total Capacity and Open Capacity
The total capacity of the file device and the number of bytes still available (hexadecimal).

Total No. of Files
The number of files recorded in the file device.

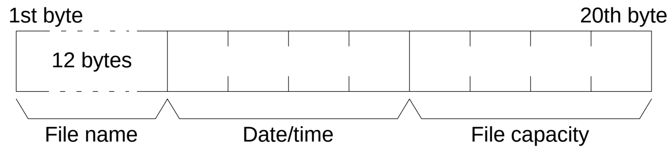
No. of files (response): The number of files that have been read. Bit 15 is ON (1) if the last file is included.



File data (response): Each file data consists of 20 bytes. The specified files will be transmitted in sequence starting from the first file. The total number of bytes required is calculated as follows:

No. of read files x 20 bytes

The configuration for each file data is as follows:



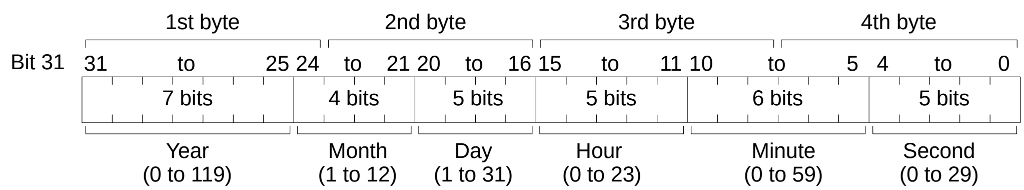
File Name
The name of the file (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

Date/Time
The date and time that the file was created (see below).

File Capacity
The capacity (bytes) of the file.

Date/Time

The configuration of the clock data (four bytes or 32 bits) is as follows:



All data values are in BCD.

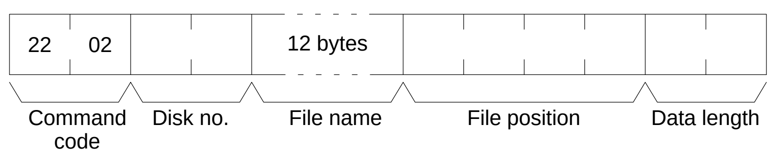
Year: Add 1980.

Second: Multiply by two.

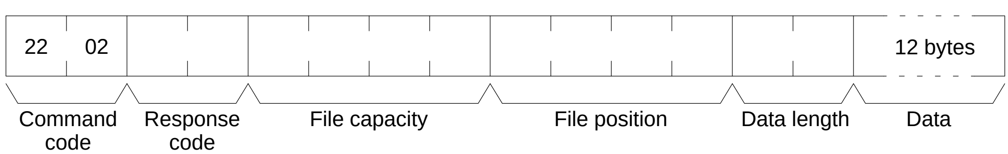
10-37 SINGLE FILE READ

Reads the contents of a file stored in the file device connected to the PC.

Command Block



Response Block



Parameters

Disk no. (command): Set to 0000 for the file device (memory card).

Beginning file name (command): The name of the file to be read (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

File position (command and response): The number of bytes from the start of the file from which to start reading (files start at 00000000).

Data length (command and response): The number of bytes of data to read.

File capacity (response): The capacity (bytes) of the file that was read.

Note If the SINGLE FILE READ command is executed for a file with a file capacity of 0 bytes, the data length will be returned as 0000 and no data will be read.

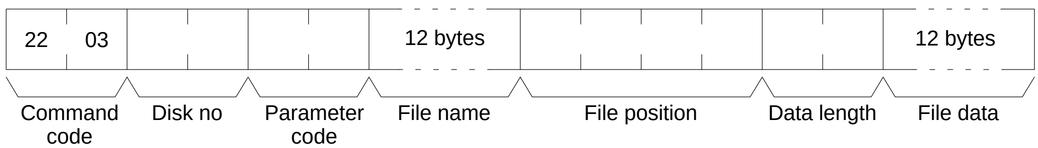
Data (response): The specified data in sequence starting from the specified byte.

10-38 SINGLE FILE WRITE

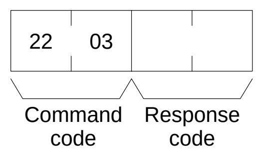
Writes a new file to the file device connected to the PC or appends/overwrites an existing file stored in the file device. Designation can be made to protect existing files if an attempt is made to create a new file of the same name as an existing file. When a new file is written or an existing file is modified, the file will record the clock data of the PC as the date of the file.

Note Writing a new file or modifying an existing file must be done within the capacity of the file device or the SINGLE FILE WRITE command cannot be executed.

Command Block



Response Block



Parameters

Disk no. (command): Set to 0000 for the file device (memory card).

Parameter code (command): As follows:

0000: Writes a new file. If a file with the same name already exists, the new file will not be created.

0001: Writes a new file. If a file with the same name already exists, it will be overwritten

0002: Add data to an existing file.

0003: Overwrite an existing file.

File name (command): The name of the file to be written (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

File position (command): The number of bytes from the start of the file from which to start writing (files start at 00000000). To create a new file or add data to an existing file, specify 00000000 as the file position.

Data length (command and response): The number of bytes to be written.

Note A new file with a file capacity of 0 (no data) will be created if SINGLE FILE WRITE is executed with 0000 as the data length.

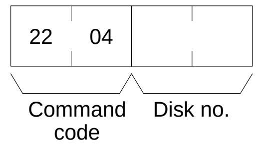
File data (response): The data to be written to the file.

10-39 MEMORY CARD FORMAT

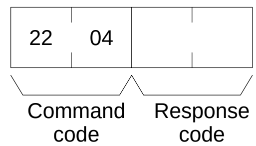
Formats a memory card. Always execute the MEMORY CARD FORMAT before using a new memory card as a file device.

Note If the MEMORY CARD FORMAT command is executed, all data will be cleared from the memory card. Be sure that it is okay to delete the data before executing this command.

Command Block



Response Block



Parameters

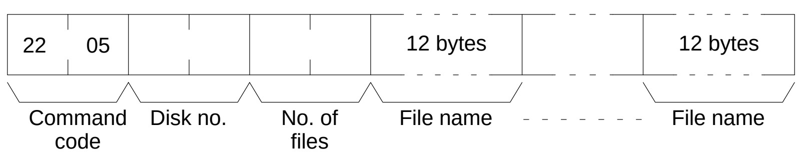
Disk no. (command): Set to 0000 for the file device (memory card).

10-40 FILE DELETE

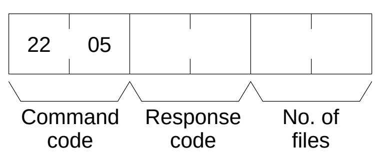
Deletes files stored by the file device connected to the PC.

Note
1. The specified files will be deleted in sequence. If non-existing file names have been specified, the PC will ignore them and the operation will continue.
2. If the specified number of files and the number of file names do not coincide, no files will be deleted.

Command Block



Response Block



Parameters

Disk no. (command): Set to 0000 for the file device (memory card).

No. of files (command): The number of files to be deleted.

File name (command): The names of the files to be deleted (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

No. of files (response): The number of files that have been deleted.

10-41 VOLUME LABEL CREATE/DELETE

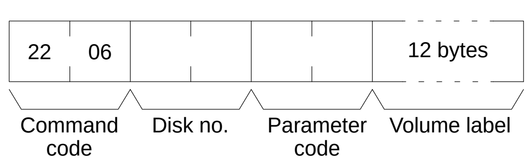
Creates a volume label on the file device connected to the PC or deletes an existing volume label from the file device.

Only one volume label can be created for a single memory card.

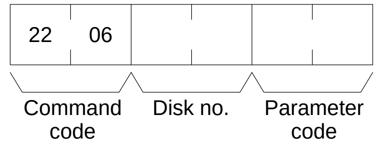
When a volume label is generated, the clock data of the PC will be recorded as the date of the volume label.

Command Block

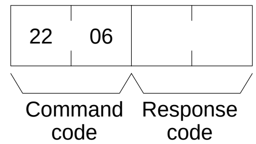
The command format for creating a volume label is as follows:



The command format for deleting a volume label is as follows:



Response Block



Parameters

Disk no. (command): Set to 0000 for the file device (memory card).

Parameter code (command and response): As follows:

0000: Creates a new volume label. If a label already exists, nothing will be executed.

0001: Creates a volume label. If a label already exists, it will be overwritten.

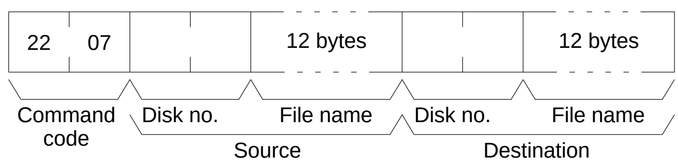
0002: Deletes an existing volume label.

Volume label (command): The volume label to be written (refer to *10-3 Volume Labels and File Names* for the configuration of the volume label).

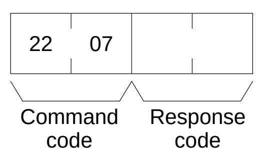
10-42 FILE COPY

Copies a file from one file device to another file device connected to the same PC.

Command Block



Response Block



Parameters

Disk no. (command): Set to 0000 for the file devices (memory cards).

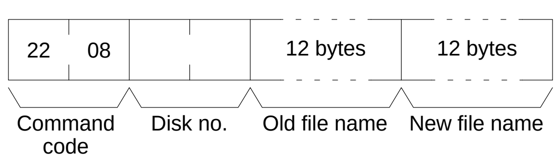
File name (command): The file to be copied and a new name for the copied file (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

Note
1. The file will not be copied if an existing file name is given.
2. The copied file is given the same date as the original file.

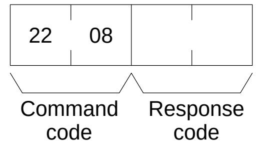
10-43 FILE NAME CHANGE

Changes a file name.

Command Block



Response Block



Parameters

Disk no. (command): Set to 0000 for the file device (memory cards).

Old and new file names (command): The original file name and a new name for the file (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

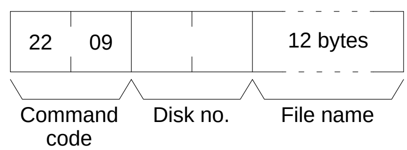
Note

1. The file name will not be changed if an existing file name is given for the new file.
2. The new file is given the same date as the original file.

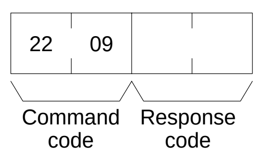
10-44 FILE DATA CHECK

Does a data check on a file stored in the extended memory (file device) connected to the PC by confirming the checksum at the beginning of the file.

Command Block



Response Block



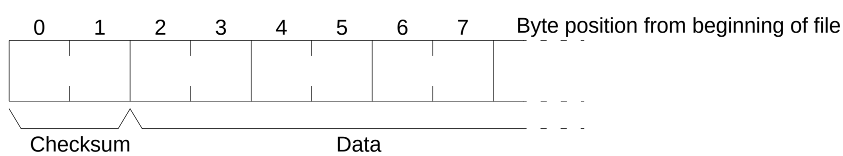
Parameters

Disk no. (command): Set to 0000 for the file device (memory cards).

File name (command): The file to be checked (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

File Data Check

The configuration of a file stored in the file device is as follows:



Checksum

The first two bytes of a file are called the checksum, which is the rightmost two bytes resulting from adding all data words (two bytes each). If the number of all bytes is odd, a byte of 00 is added to it so that the number of the number of bytes is even.

Example

- **Data:** 13 3A E4 F3 CC 0B 3C 5F A2
- **Words:** 133A E4F3 CC0B 3C5F A200
- **Total:** 133A + E4F3 + CC0B + 3C5F + A200 = 2A297
- **Checksum:** A2 97

Data

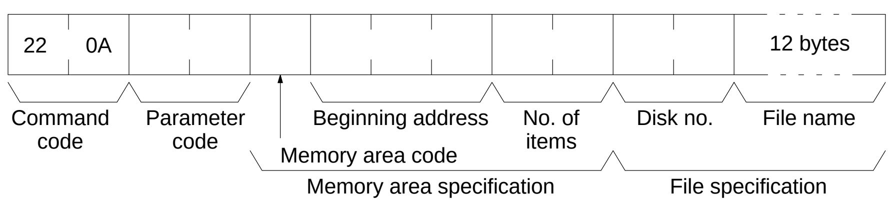
"File data" refers to the data in a file that a file device stores. A file data check is done with the checksum. To complete a file data check, the data words starting from the third byte are added and the result is compared with the checksum. If these values are the same, the file is assumed to contain no errors; if the values differ, a parity/sum check error will result. A file with a capacity of two bytes has a checksum of 0000.

10-45 MEMORY AREA FILE TRANSFER

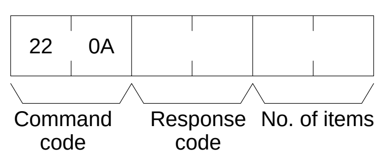
Transfers or compares data between the PC memory areas and the file device connected to the PC. The clock data of the PC upon completion of the MEMORY AREA FILE TRANSFER command will be recorded as the date of the file that has been transferred.

Note
1. The checksum is stored at the front (bytes 0 and 1) of the file. Thus file transfer or comparison is effective from the next byte after the checksum.
2. The MEMORY AREA FILE TRANSFER command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.
3. If data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

Parameter code (command): As follows:

0000: Data transfer from the PC memory area to the file device.

0001: Data transfer from the file device to the PC memory area.

0002: Data compared.

Memory area code (command): The memory area to be used for data transfer or comparison.

Beginning address (command): The first word/value in the memory area to be transferred or compared.

No. of items (command and response): In the command block, the number of items to be transferred or compared. In the response block, the number of items transferred or compared.

Disk no. (command): Set to 0000 for the file device (memory cards).

File name (command): The file to be transferred or compared (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

Memory Areas

The following data can be used for transfer or comparison (refer to *10-2 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2

Note Refer to *10-2-2 Data Configurations* for the various data configurations.

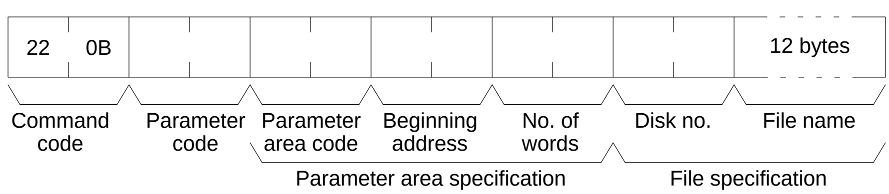
10-46 PARAMETER AREA FILE TRANSFER

Compares or transfers data between the PC's parameter area and the file device connected to the PC. The clock data of the PC upon completion of the PARAMETER AREA FILE TRANSFER command will be recorded as the date of the file that has been transferred.

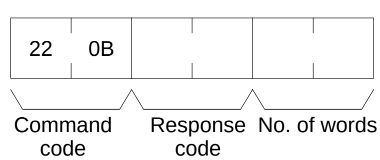
A file can be transferred to the I/O table only when the PC is in PROGRAM mode.

Note
1. The checksum is stored at the front (bytes 0 and 1) of the file. Thus file transfer or comparison is effective from the next byte after the checksum.
2. The PARAMETER AREA FILE TRANSFER command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *10-23 CONTROLLER STATUS READ*) to read the PC's mode.
3. This command cannot be executed if any other device holds the access right or when memory is write-protected via the key switch on the front panel of the PC.

Command Block



Response Block



Parameters

Parameter code (command): As follows:

0000: Data transfer from the PC's parameter area to the file device.

0001: Data transfer from the file device to the PC's parameter area.

0002: Data compared.

Parameter area code (command): The parameter area to be used for data transfer or comparison.

Beginning address (command): The first word in the parameter area to be transferred or compared. Each parameter area has consecutive word addresses beginning at 0000.

No. of words (command and response): In the command block, the number of data words to be transferred or compared. In the response block, the number of words transferred or compared

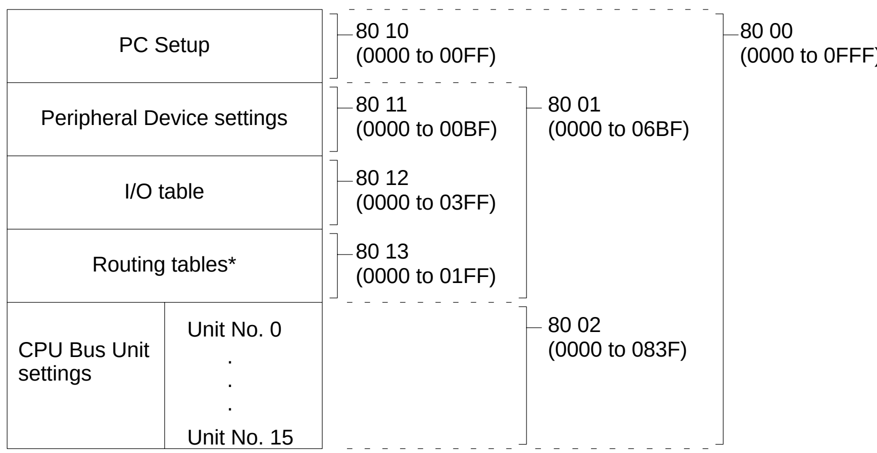
Note If 0000 is specified as the number of items, no data will be transferred or compared and a normal response code will be returned.

Disk no. (command): Set to 0000 for the file device (memory cards).

File name (command): The file to be transferred or compared (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

Parameter Areas

The following shows the parameter areas and the words that can be specified. The word ranges in parentheses show the possible values for the beginning word.



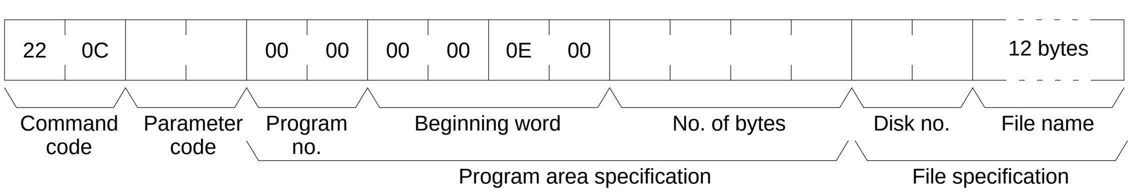
Note *Although the routing tables have a 512-word area (0000 to 01FF), only a 48-word area (0000 to 003F) of it can be read/written.

10-47 PROGRAM AREA FILE TRANSFER

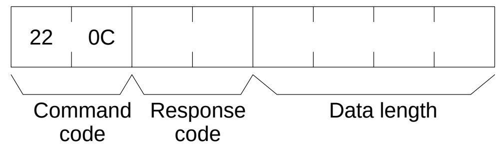
Compares or transfers data between the PC's program area and the file device connected to the PC. The clock data of the PC upon completion of the PROGRAM AREA FILE TRANSFER command will be recorded as the date of the file that has been transferred.

Note
1. The checksum is stored at the front (bytes 0 and 1) of the file. Thus file transfer or comparison is effective from the next byte after the checksum.
2. This command cannot be executed when the access right is held by any other device or when the PC is write-protected by the key switch on the front panel.
3. The PROGRAM AREA FILE TRANSFER command cannot be executed when the PC is in the RUN mode.

Command Block



Response Block



Parameters

Parameter code (command): As follows:

0000: Data transferred from the program area to the file device.

0001: Data transferred from the file device to the program area.

0002: Data compared.

Program no. and beginning word (command): As follows:

0000: Program no.

00000E00: Beginning word

No. of bytes (command): The number of data bytes to be transferred or compared as follows:

0000F1FE: CV500 or CVM1-CPU01-V☐

0001F1FE: CV1000/CV2000 or CVM1-CPU11/21-V☐

Note If 00000000 is specified as the number of transfer data bytes, no file transfer or comparison will be performed and a normal response code will be returned.

Disk no. (command): Set to 0000 for the file device (memory card).

File name (command): The file to be transferred or compared (refer to *10-3 Volume Labels and File Names* for the configuration of the file name).

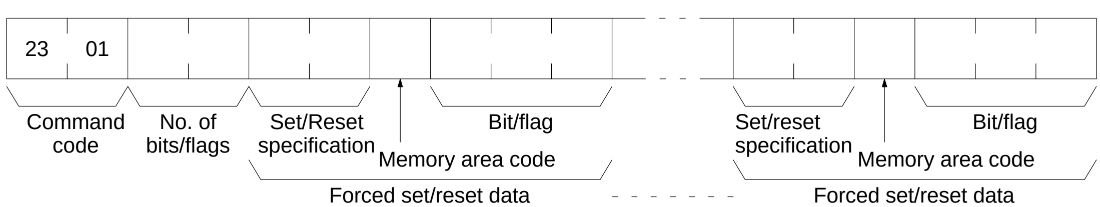
Data length (response): The number of bytes that have been transferred or compared.

10-48 FORCED SET/RESET

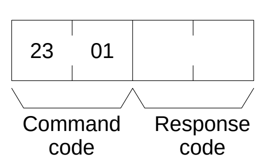
Force-sets (ON) or force-resets (OFF) bits/flags or releases force-set status. Bits/flags that are forced ON or OFF will remain ON or OFF and cannot be written to until the forced status is released.

Note This command cannot be used to release the status of Completion Flags for timers or counters. Use the FORCE SET/RESET CANCEL command (refer to *10-49 FORCE SET/RESET CANCEL*).

Command Block



Response Block



Parameters

No. of bits/flags (command): The number of bits/flags to be controlled.

Set/Reset specification (command): The action to be taken for each bit/flag

Value	Name
0000	Force-reset (OFF)
0001	Force-set (ON)
8000	Forced status released and bit turned OFF (0)
8001	Forced status released and bit turned ON (1)
FFFF	Forced status released

Memory area code (command): The memory area of the bit or flag to be controlled.

Bit/Flag (command): The bit or flag to be controlled.

Memory Areas
The bits (flags) in the following memory areas can be forced set/reset or released (refer to *10-2 Memory Area Designations* for memory area designations):

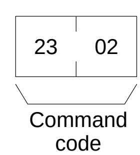
Memory area	Data	Memory area code
CIO, TR, and CPU Bus Link (see note)	Bits status	00
Timer/Counter	Completion Flag status	01
Transition	Flag status	03

Note FORCED SET/RESET cannot be used for the Auxiliary Area.

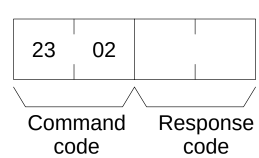
10-49 FORCED SET/RESET CANCEL

Cancels all bits (flags) that have been forced ON or forced OFF.

Command Block



Response Block



Note The bits (flags) in the following memory areas can be forced set or forced reset, and cancelled.

Memory area	Data	Memory code
CIO, TR, CPU Bus Link, and Auxiliary	Bits status	00
Timer/Counter	Completion Flag status	01
Transition	Flag status	03

SECTION 11
FINS Commands to CS1-series and C200HX/HG/HE CPU Units

This section provides information on the FINS commands that can be addressed to the CPU Units of CS1-series and C200HX/HG/HE PCs.

11-1 Command List

The beginning portions of the command and response block up to the command codes and the FCS and terminator have been omitted for simplicity, but must be added for actual transmission if not automatically generated for the transmission method being used.

In the illustrations of command and response blocks in this section, each box represents one byte (i.e., two hexadecimal or BCD digits). Be careful when adding the header, where each box represents one digit (i.e., four bits).

The following table lists the FINS commands supported by C200HX/HG/HE CPU Units and the PC operating modes during which they are enabled.

Command code		Name	PC mode			Page
			RUN	MONITOR	PROGRAM	
01	01	MEMORY AREA READ	Valid	Valid	Valid	200
	02	MEMORY AREA WRITE	Valid	Valid	Valid	201
	04	MULTIPLE MEMORY AREA READ	Valid	Valid	Valid	202
	10	COMPOSITE REGISTRATION READ	Valid	Valid	Valid	202
	11	REGISTER COMPOSITE READ	Valid	Valid	Valid	203
05	01	CONTROLLER DATA READ	Valid	Valid	Valid	204
06	01	CONTROLLER STATUS READ	Valid	Valid	Valid	204
07	01	CLOCK READ	Valid	Valid	Valid	205

Note Although CS1-series CPU Units support other commands, only the ones listed above can be made via DeviceNet (CompoBus/D).

11-2 Memory Area Designations

The following table gives the addresses to use when reading or writing PC data. The *Data area address* column gives the normal addresses used in the PC program. The *Address used in communications* column are the addresses used in CV-mode commands and responses. These addresses are combined with the memory area codes to specify PC memory locations. These addresses are not the same as the actual memory addresses of the data.

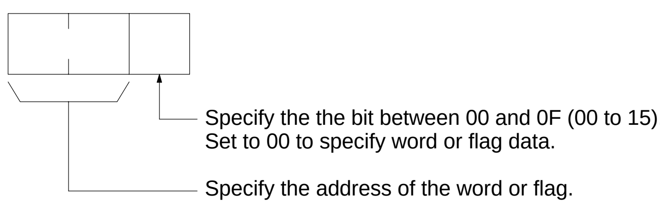
The *No. of bytes* column specifies the number of bytes to read or write data for that area. The number of bytes varies for the same area depending on the memory area code. Actual data area sizes vary with the PC being used. Refer to your PC's operation manual for specific limits.

Memory area	Data	Data area address	Address used in communications		Memory area code	No. of bytes
			1st and 2nd bytes	3rd byte		
CIO area	Bit status	00000 to 51115	0000 to 01FF	00 to 0F	00	1
	Word contents	000 to 511		00 to 00	80	2
LR area	Bit status	LR 0000 to LR 6315	03E8 to 0427	00 to 0F	00	1
	Word contents	LR 00 to LR 63		00 to 00	80	2
HR area	Bit status	HR 0000 to HR 9915	0428 to 048B	00 to 0F	00	1
	Word contents	HR 00 to HR 99		00 to 00	80	2
AR area	Bit status	AR 0000 to AR 2715	048C to 04A7	00 to 0F	00	1
	Word contents	AR 000 to AR 27		00 to 00	80	2
Timer Area/ Counter Area	Completion Flag status	TIM 000 to TIM 511 CNT 000 to CNT 511	0000 to 01FF	00 to 00	01	1
	PV	TIM 000 to TIM 511 CNT 000 to CNT 511		00 to 00	81	2
DM Area	Word contents	DM 0000 to DM 9999	0000 to 270F	00 to 00	82	2
EM Area	Word contents	EM 0000 to EM 6144	0000 to 17FF	00 to 00	90 to 92, 98, A8 to AF (see note)	2

Note EM Area bank designations:
90 to 97: Banks 0 to 7
98: Current bank
A8 to AF: Banks 8 to 15

11-2-1 Word/Bit Addresses

Each word/bit address specifies a specific bit or word. The rightmost two digits of the address specify bit 00 to 15 (or 00 if not required), and leftmost four digits specify the word address.

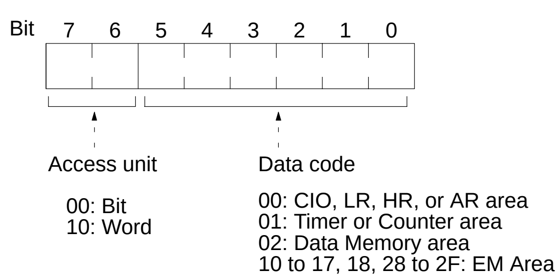


To obtain the corresponding address of the desired word or bit, add the data area word address (hexadecimal) to the first address of the range of addresses used for that data area in communications. For example, the address for word AR 13 is computed as follows:

First address for AR Area; 048C
048C + 0D (13 in BCD); 0499

The word address for AR 13 would be 049900 (the memory area code would specify this as a word) and the address of bit 12 in AR 13 would be 04990C.

The unit of access (bit or word) and the data code are specified as shown in the following illustration.



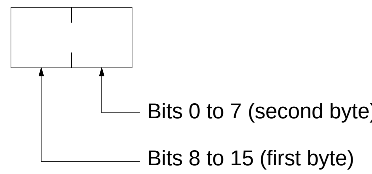
11-2-2 Data Configuration

The configuration of the various types of data that can be read or written is shown below. The number of bytes required for each type of data is also given.

Flag or Bit Status (One Byte)

00: Bit is OFF (0)
01: Bit is ON (1)

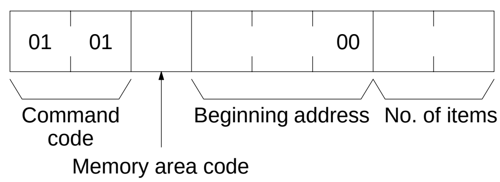
Word Contents or PV (Two Bytes)



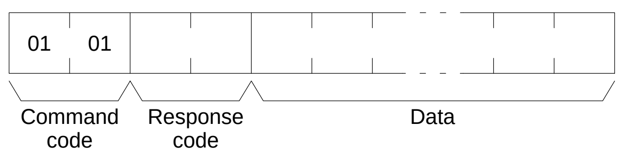
11-3 MEMORY AREA READ

Reads the contents of the specified number of consecutive memory area words starting from the specified word. All words must be in the same memory area (here, all memory areas with the same memory area code are considered as one area).

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Beginning address (command): The address of the first word/bit/flag to read from memory. Specify 00 for the 3rd byte.

No. of items (command): The number of items to be read. Specify 0000 to 03E7 (0 to 999 decimal). The command can complete normally even if zero items are specified. When reading through a DeviceNet network, however, the total number of bytes in one read must be 156 or less. Adjust the number of items according to the number of bytes required per item so that the total number of bytes being read does not exceed 156.

Data (response): The data from the specified words is returned in sequence starting from the beginning address. PVs for timers and counters are returned as BCD. The required number of bytes in total is calculated as follows:

No. of bytes required by each item x No. of items

Memory Areas

The following area can be read (refer to *11-2 Memory Area Designations* for PC word/bit address designations):

Memory area	Data	Memory area code	No. of bytes
CIO, LR, HR, or AR area	Word contents	80	2
Timer/Counter	Completion Flag status	01	1

Memory area	Data	Memory area code	No. of bytes
	PV	81	2
DM	Word contents	82	2
EM	Word contents	90 to 97, 98, A8 to AF	2

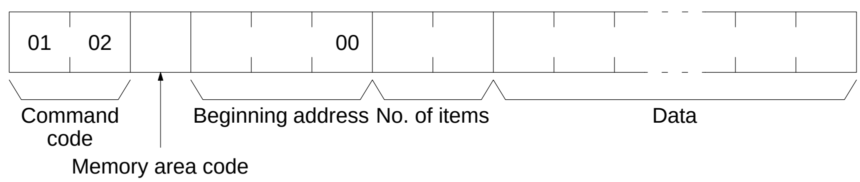
Note Refer to *11-2-2 Data Configurations* for the various data configurations.

11-4 MEMORY AREA WRITE

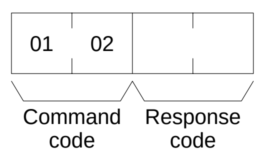
Writes data to the specified number of consecutive words starting from the specified word. All words must be in the same memory area (here, all memory areas with the the same memory area code are considered as one area).

Note When data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

Memory area code (command): The data area to write.

Beginning address (command): The first word/value to write. Specify 00 for the 3rd byte.

No. of items (command): The number of items to be written. Specify 0000 to 03E5 (0 to 997 decimal). The command can complete normally even if zero items are specified. When writing through a DeviceNet network, however, the total number of bytes in one write must be 152 or less. Adjust the number of items according to the number of bytes required per item so that the total number of bytes being written does not exceed 152.

Data (command): The data to be written. PVs for timers and counters are written as BCD. The required number of bytes in total is calculated as follows:

2 bytes x No. of items

The following data can be written (refer to *11-2 Memory Area Designations* for the word/bit address designations):

Memory area	Data	Memory area code	No. of bytes
CIO, LR, HR, or AR area	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
EM	Word contents	90 to 97, 98, A8 to AF	2

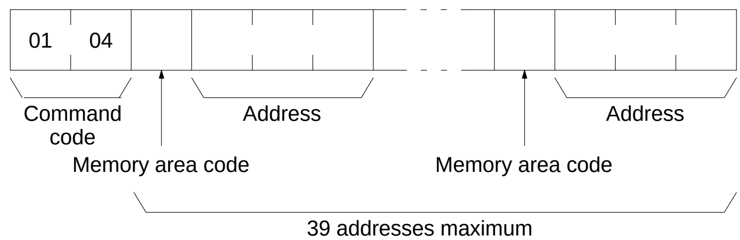
Note Refer to *11-2-2 Data Configurations* for the various data configurations.

11-5 MULTIPLE MEMORY AREA READ

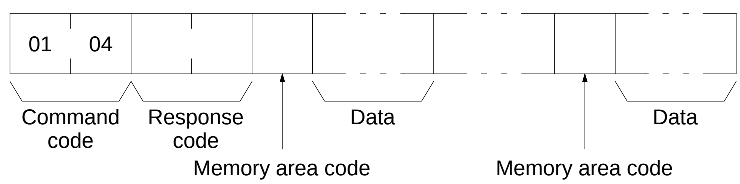
Reads the contents of the specified number of non-consecutive memory area words, starting from the specified word.

Note If there is an error in the command code or an address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Address (command): The word/bit/flag to read. The content of up to 39 address can be read.

Data (response): The data in the specified memory area(s) will be returned in sequence starting from the beginning address.

Memory Areas

The following data can be written (refer to *11-2 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, LR, HR, or AR area	Bit status	00	1
	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2
DM	Word contents	82	2
EM	Word contents	90 to 97, 98, A8 to AF	2

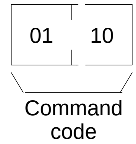
Note Refer to *11-2-2 Data Configurations* for the various data configurations.

11-6 COMPOSITE REGISTRATION READ

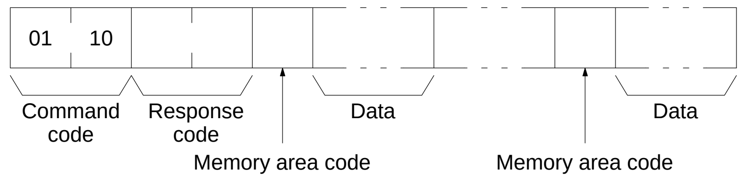
Reads the memory areas according to the addresses specified with the COMPOSITE READ REGISTRATION command (01 11).

Note
1. Although this command is addressed to the CPU Unit, it is actually processed by the DeviceNet Master Unit. The command will thus result in an error if it is not sent to a CPU Unit through a DeviceNet network.
2. If there is an error in the command code or a read address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (response): The data area to read.

Data (response): The data in the specified with the COMPOSITE READ REGISTRATION command will be returned in sequence. The number of bytes returned for each item depends on the item that is specified.

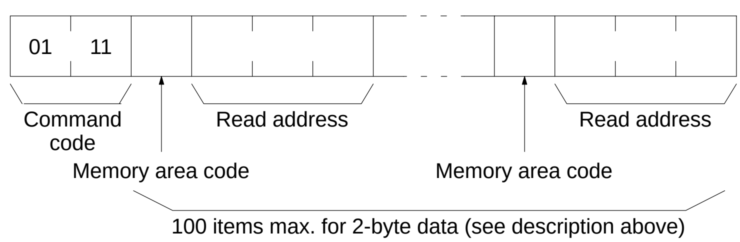
11-7 REGISTER COMPOSITE READ

Registers the contents to be read with the COMPOSITE REGISTRATION READ command (01 10). Up to 100 items can be registered for reading for 2-bytes data; up to 50 items for 4-byte data, i.e., up to 200 bytes of data can be read.

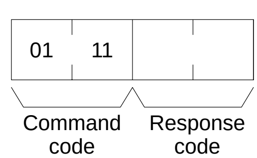
The contents registered with this command is effective until the power supply to the PC is turned OFF or until the Master Unit is reset. This enables executing the COMPOSITE REGISTRATION READ command consecutively without having to specify the contents to be read again.

Note
1. Although this command is addressed to the CPU Unit, it is actually processed by the DeviceNet Master Unit. The command will thus result in an error if it is not sent to a CPU Unit through a DeviceNet network.
2. If there is an error in the command code or a read address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Read address (command): The word/bit/flag to read.

Memory Areas

The following data can be written (refer to *11-2 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Bit status	00	1
	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2
DM	Word contents	82	2
EM	Word contents, specified bank	90 to 97, 98, A8 to AF	2

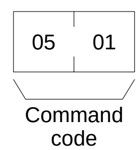
Note Refer to *10-2-2 Data Configurations* for the various data configurations.

11-8 CONTROLLER DATA READ

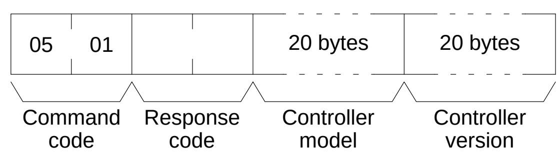
Reads the following data:

• Controller model and version

Command Block



Response Block



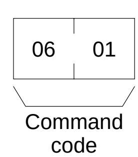
Parameters

Controller model and Controller version (response): Both are returned in ASCII (20 bytes (i.e., 20 ASCII characters) max. each). The version of MPU1 is returned first followed by the version of MPU2. If the model or version information does not require 20 bytes, the remainder of the 20 bytes will be filled with spaces (ASCII 20).

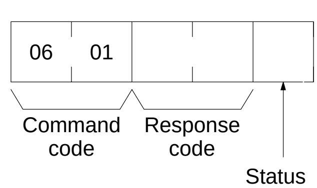
11-9 CONTROLLER STATUS READ

Reads the status of the Controller.

Command Block



Response Block



Parameters

Status (response): The operating status of the PC as follows:

00: Stop (program not being executed)

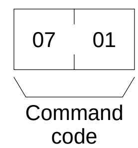
01: Run (program being executed)

80: CPU on standby

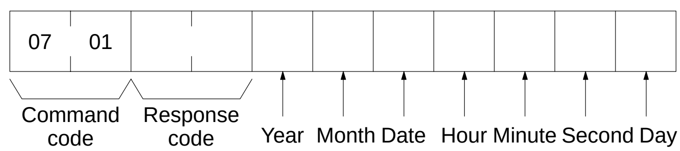
11-10 CLOCK READ

Reads the clock. This command is valid for the C200H only.

Command Block



Response Block



Parameters

Year, month, date, hour, minute, second, day (response): Each value is expressed in BCD.

Year: The rightmost two digits of the year.

Hour: 00 to 23.

Day: As follows:

Value	**00**	**01**	**02**	**03**	**04**	**05**	**06**
Day	Sun	Mon	Tues	Wed	Thur	Fri	Sat

SECTION 12
FINS Commands to Master Units

This section provides information on the FINS commands that can be addressed to the DeviceNet (CompoBus/D) Master Units.

12-1 Command List

The beginning portions of the command and response block up to the command codes and the FCS and terminator have been omitted for simplicity, but must be added for actual transmission if not automatically generated for the transmission method being used.

In the illustrations of command and response blocks in this section, each box represents one byte (i.e., two hexadecimal or BCD digits). Be careful when adding the header, where each box represents one digit (i.e., four bits).

The following table lists the FINS commands supported by the DeviceNet Units.

Command code		Name	Page
04	03	RESET	208
05	01	CONTROLLER DATA READ	208
08	01	LOOP BACK TEST	209
21	02	ERROR LOG READ	209
	03	ERROR LOG CLEAR	210

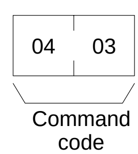
12-2 RESET

Resets the DeviceNet Master Unit.

1, 2, 3...

1. No response will be returned for this command.
2. Communications errors may occur for Slaves or timeouts may occur for remote nodes with which message communications are in progress when the Master Unit is reset, but normal communications will be possible again as soon as the Master Unit restarts.

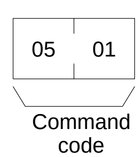
Command Block



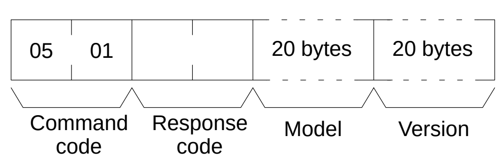
12-3 CONTROLLER DATA READ

Reads the model and version of the DeviceNet Master Unit.

Command Block



Response Block



Parameters

Model and Version (response): Both are read in ASCII (20 bytes (i.e. 20 ASCII characters) max. each). If the model or version information does not require 20 bytes, the remainder of the 20 bytes will be filled with spaces (ASCII 20).

The Master Unit version will be “0200” for all PCs. The following model data will be returned.

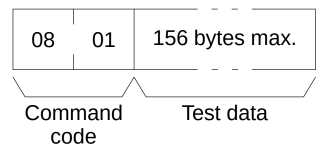
CVM1 and CV-series PCs:	CVM1-DRM21-V1
CS1-series and C200HX/HG/HE/HS PCs:	C200HW-DRM21-V1

12-4 ECHOBACK TEST

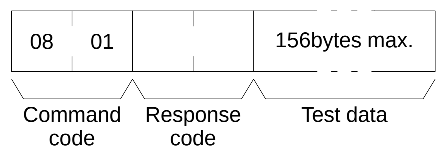
Executes an echo test between the local node and a destination node.

Note
1. The destination node is designated in the control data of the CMND(194) instruction.
2. The unit address must designate a DeviceNet Master Unit.

Command Block



Response Block



Parameters

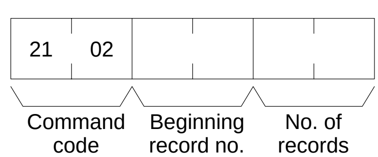
Test data (command and response): In the command block, designate the data to be transmitted to the destination node. The designated data consists of 156 bytes maximum (binary data). In the response block, the test data from the command block will be returned as it is. If the test data in the response block is different from that in the command block, an error has occurred.

12-5 ERROR LOG READ

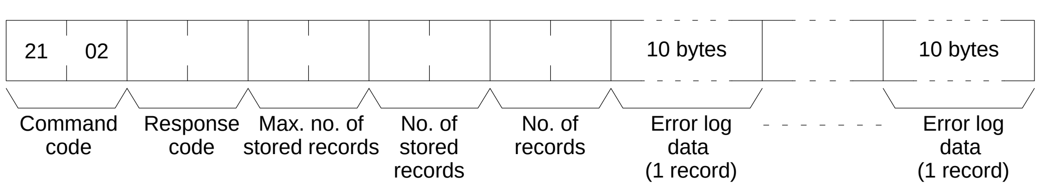
Reads the specified number of records from the error history file beginning with the specified record.

Note
1. If the number of records that you designate in the command block exceeds the actual number of stored records, all the stored records will be returned and no error will occur. If there are no records in the error history, a response code of 1103 will be returned (address range specification error) and no records will be returned.
2. The error history in the Master Unit is cleared when power to the PC is turned off or the Master Unit is reset. Be sure to save the error history in the DM area if you want to maintain the data.

Command Block



Response Block



Parameters

Beginning record no. (command): Designates the beginning record number in a range of 0000 to 0013 (0 to 19 in decimal) (the first record is 0000).

No. of records (command and response): Designates the number of records to be read in a range of 0001 to 0014 (1 to 20 in decimal). If more than 20 records is specified, all records through the last one will be returned along with a 110B error response code (response too long).

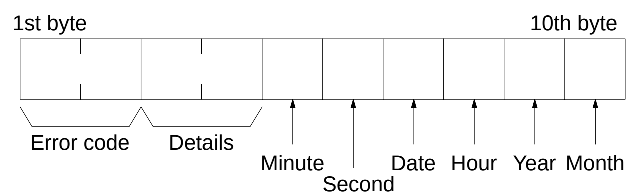
Max. no. of stored records (response): The maximum number of stored records varies with the kind of Unit. The DeviceNet Master Unit can store 20 records maximum.

No. of stored records (response): The number of records that have been recorded.

Error log data (response): The specified error log records will be returned in sequence starting from the beginning record number. The total number of bytes required is calculated as follows:

No. of records x 10 bytes

The configuration of each error record is as follows:



- Error Code and Details
  The error code and details vary with the kind of Unit.
- Minute, Second, Date, Hour, Year, and Month
  Each record includes the second, minute, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

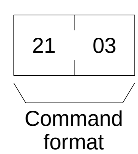
Note The time stamp is returned only for CVM1 and CV-series PCs. All bytes will be all zeros for other PCs. If the time of the error is required, use the clock function (CS1 Series: A351 to A354; C200HX/HG/HE/HS: AR 18 to AR 20).

12-6 ERROR LOG CLEAR

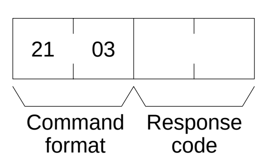
Clears all error log records to all zeros.

Note This command cannot be executed if any other device has the access right.

Command Block



Response Block



SECTION 13
Software Switches and Status Area

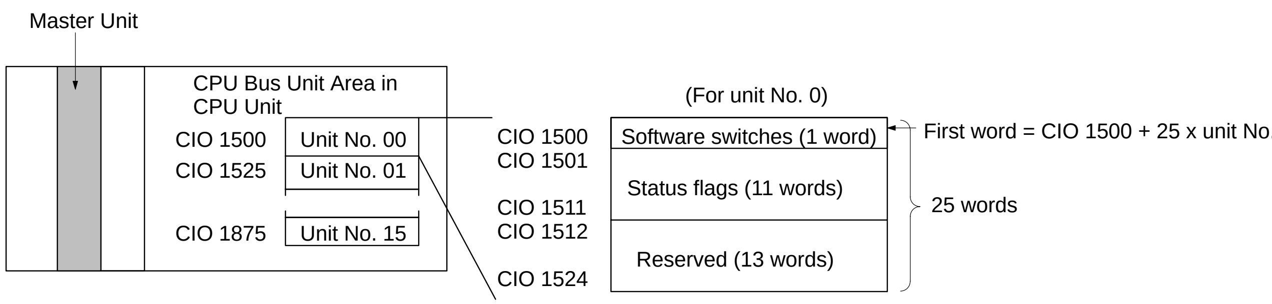
This section describes the software switches used to control DeviceNet operation and the status area used to access DeviceNet status.

13-1 Software Switch/Status Area

The software switch/status flag area contains the software switches required to control the network and the status flags that indicate the status of the network and Slaves. In CVM1 and CV-series PCs, the statuses of software switches and status flags are stored in the CPU Bus Unit Area, and in CS1-series and C200HX/HG/HE/HS PCs, they are stored in the Special I/O Unit Area.

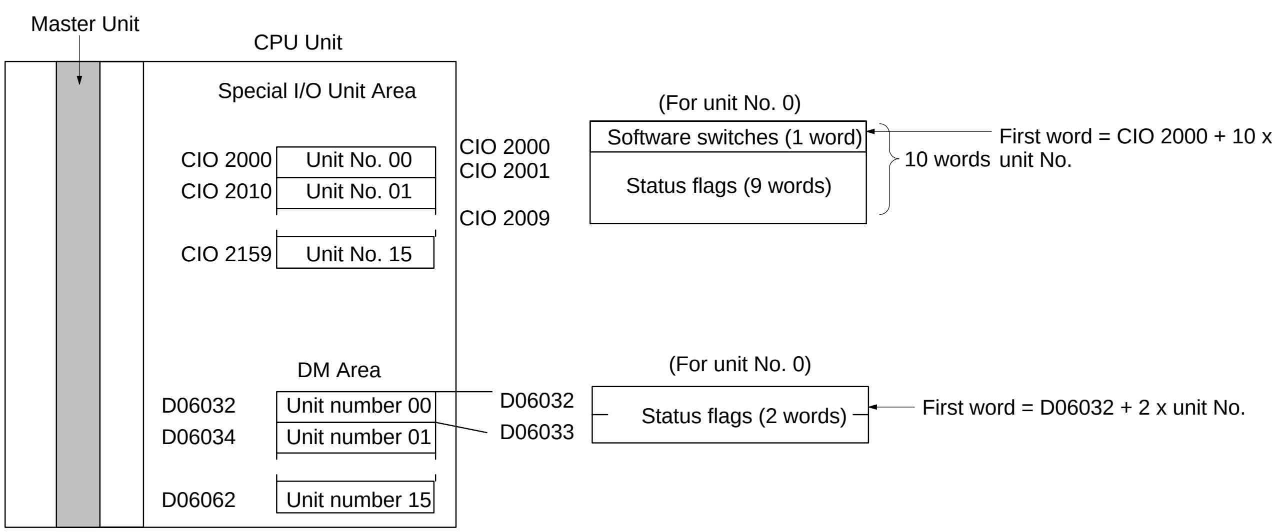
CVM1 and CV-series PCs

The CPU Bus Unit Area is divided into sixteen 25-word groups. These groups are allocated to the CPU Bus Units according to their unit number settings, as shown in the following diagram.



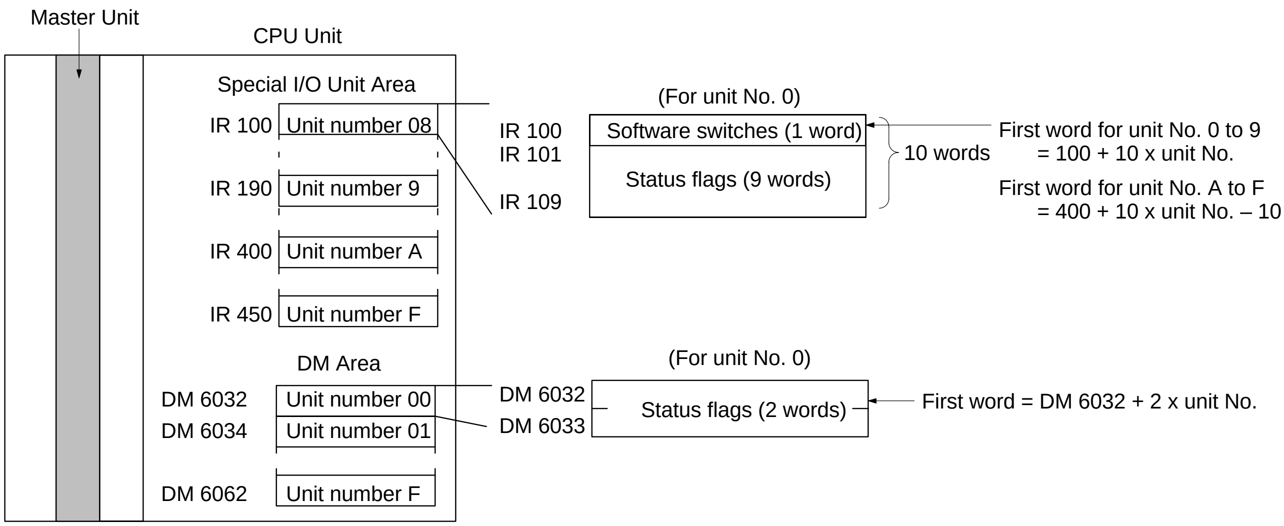
CS1-series PCs

The Special I/O Unit Area is divided into sixteen 10-word groups. These groups are allocated to the Special I/O Units according to their unit number settings, as shown in the following diagram.



C200HX, C200HG, C200HE, and C200HS PCs

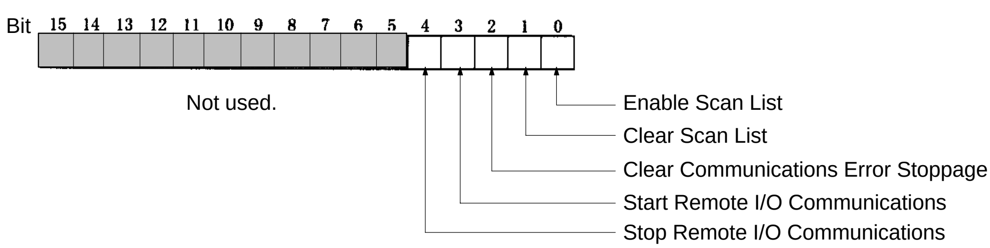
The Special I/O Unit Area is divided into sixteen 10-word groups. These groups are allocated to the Special I/O Units according to their unit number settings, as shown in the following diagram.



13-2 Software Switches

The software switches are used to control the scan list and restart communications that have been stopped due to communications errors. The scan list is a list which contains data on the nodes participating in DeviceNet (CompoBus/D) communications, such as the node addresses and I/O points for each node; it is stored in the Master Unit's non-volatile memory. Refer to *8-2 Scan List* for more details.

The following diagram shows the locations of the software switches.



Name	CVM1 and CV-series PCs	CS1-series PCs	C200HX/HG/HE/HS	Bit	Function
Enable Scan List	CIO 1500 + 25 x unit No.	CIO 2000 + 10 x unit No.	Unit No. 0 to 9: IR 100+10 x unit No. Unit No. A to F: IR 400+10 x unit No.–10	00	Turn from OFF to ON when operating with the scan list disabled to register the Slaves currently participating in communications in the scan list and restart remote I/O communications with the scan list enabled. The PC must be in PROGRAM mode.
Clear Scan List				01	Turn from OFF to ON to clear the scan list restart communications with the scan list disabled. The PC must be in PROGRAM mode.
Clear Communications Error Stoppage				02	Turn from OFF to ON when the Master Unit's DIP switch has been set to stop communications when a communications error occurs to restart communications after communications errors.
Start Remote I/O Communications				03	Turn from OFF to ON to start remote I/O communications.
Stop Remote I/O Communications				04	Turn from OFF to ON to stop remote I/O communications.

Enable Scan List

When the Enable Scan List software switch is turned from OFF to ON, the Slaves that are currently participating in communications are registered in the scan list and the scan list is stored in the Master Unit's non-volatile memory. After the scan list is created, communications are started with the scan list enabled.

The Enable Scan List software switch is effective only when the PC is in PROGRAM mode and communications are being performed with the scan list disabled. If this bit is turned ON while the Master Unit is already operating with the scan list enabled, the operation won't be performed and an error will occur.

The result of the operation is indicated in the status flags, as follows:

Normal completion: The Scan List Operation Completed Flag goes ON.
Error completion: The Scan List Operation Error Flag goes ON.

After creating the scan list, check which of these flags is ON and then turn OFF the Enable Scan List software switch.

Clear Scan List

When the Clear Scan List software switch is turned from OFF to ON, the scan list being used will be cleared and communications will be started with the scan list disabled.

The result of the operation is indicated in the status flags, as follows:

Normal completion: The Scan List Operation Completed Flag goes ON.
Error completion: The Scan List Operation Error Flag goes ON.

After clearing the scan list, check which of these flags is ON and then turn OFF the Clear Scan List software switch.

The Clear Scan List software switch is effective only when the PC is in PROGRAM mode and communications are being performed with the scan list enabled. The status of this bit is ignored when the Master Unit is already operating with the scan list disabled.

Clear Communications Error Stoppage

When the Master Unit's DIP switch has been set to stop communications when a communications error occurs, the Clear Communications Error Stoppage software switch can be turned from OFF to ON to restart communications after a communications error. Be sure to correct the cause of the error before restarting communications because the error will recur immediately if the cause isn't corrected.

The Clear Communications Error Stoppage software switch is effective only when communications have been stopped due to an error. (The status of this bit is ignored otherwise.)

The Communications Stoppage Cleared Flag will go ON when this operation is completed. Check that this flag is ON and then turn OFF the Clear Communications Error Stoppage software switch.

Start Remote I/O Communications

The Start Remote I/O Communications software switch can be turned from OFF to ON to start remote I/O communications. If remote I/O communications are already started, this switch will have no effect.

The Remote I/O Communications Operating Flag will turn ON when remote I/O communications have started. Check that this flag is ON and then turn OFF the Start Remote I/O Communications software switch.

Stop Remote I/O Communications

The Stop Remote I/O Communications software switch can be turned from OFF to ON to stop remote I/O communications. If remote I/O communications are already stopped, this switch will have no effect.

The Remote I/O Communications Operating Flag will turn OFF when remote I/O communications have stopped. Check that this flag is OFF and then turn OFF the Stop Remote I/O Communications software switch.

13-3 Status Area

The status flags indicate the status of the Master Unit and the Network. These flags occupy the 11 words after the word allocated to the software switches (except the last two words are allocated in the DM area for C200HX/HG/HE/HS PCs). The 11 words are divided into five areas, as shown in the following diagram.

CVM1 and CV-series PCs

	CIO Area
First word + 1	Master status area 1 (1 word)
First word + 2	Registered Slaves data (4 words)
First word + 6	Normal Slaves data (4 words)
First word + 10	Master status area 2 (1 word)
First word + 11	Current communications cycle time (1 word)

CS1-series and C200HX/HG/HE/HS PCs

	IR Area
First word + 1	Master status area 1 (1 word)
First word + 2	Registered Slaves data (4 words)
First word + 6	Normal Slaves data (4 words)

	DM Area
First word + 1	Master status area 2 (1 word)
First word + 1	Current communications cycle time (1 word)

Master Status Area 1

This word contains flags that show the operating status of the network, the results of software switch operations, and current error data.

Registered Slaves Data

When the Master is operating with the scan list enabled, these flags indicate the Slaves that are registered in the scan list. When the Master is operating with the scan list disabled, these flags indicate the Slaves that have participated in communications even one time. Each bit is allocated to one Slave. When the Enable Scan List software switch is turn ON to create the scan list, the Slave for which bits are ON in the Registered Slave Data will be registered in the scan list.

Normal Slaves Data

These flags indicate which Slaves are communicating normally. Each bit is allocated to one Slave.

Master Status Area 2

This word contains status data on the error history and Configurator scan lists.

Current Communications Cycle Time

This word contains the current communications cycle time.

13-3-1 Master Status Area 1

The following diagram shows the structure of Master Status Area 1.

CVM1 and CV-series PCs

CIO 1501 + 25 x unit No.

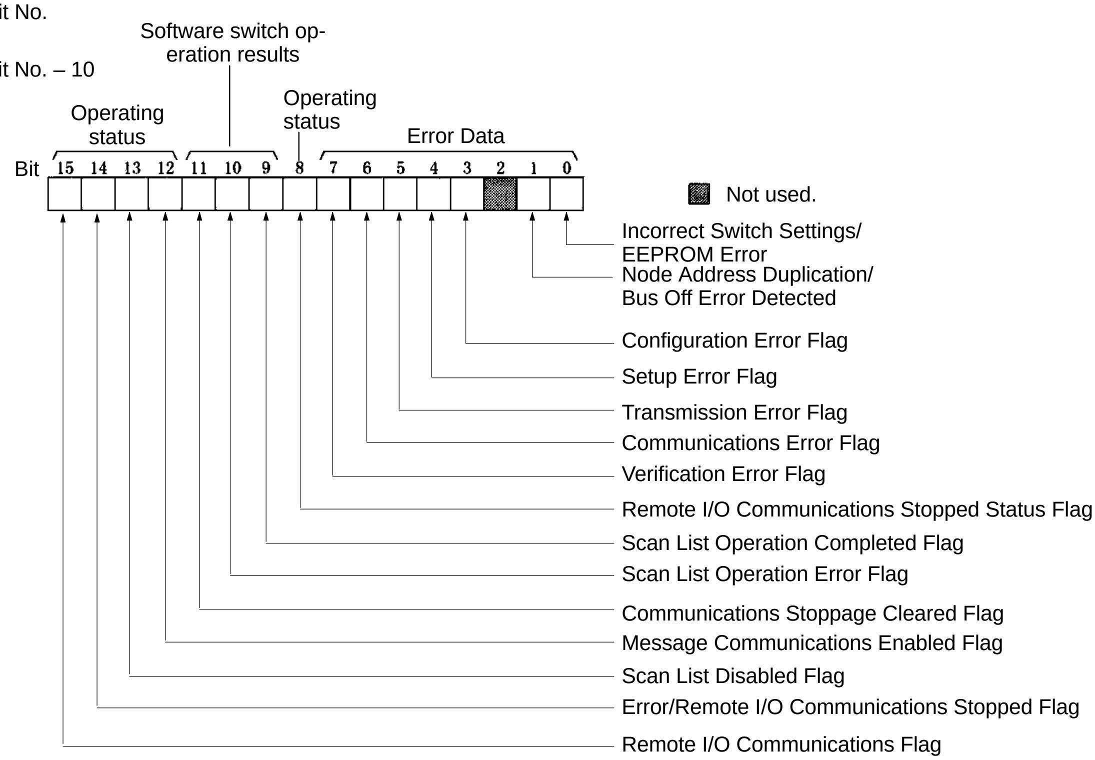
CS1-series PCs

CIO 2001 + 10 x unit No.

C200HX/HG/HE/HS PCs

Unit No. 0 to 9:
IR 101 + 10 x unit No.

Unit No. A to F:
IR 401 + 10 x unit No. – 10



Incorrect Switch Setting/EEPROM Error Flag (Bit 00)

This flag is turned ON (1) when there is an incorrect switch setting or an error in EEPROM.

The incorrect switch setting error occurs when an invalid setting has been made for the Master Unit's baud rate. (Pins 1 and 2 of the front DIP switch are both ON.) An EEPROM error occurs when an error is detected in the initialization check as the scan list or other data is written to EEPROM.

The Error/Remote I/O Communications Stopped Flag (bit 14) will turn ON whenever this flag turns ON.

Node Address Duplication/Bus Off Error Detected Flag (Bit 01)

This flag is turned ON (1) when the same node address is set for more than one

Unit or a Bus Off error is detected. A Bus Off error occurs when an unacceptably high error rate is detected through the communications cable.

The Error/Remote I/O Communications Stopped Flag (bit 14) will turn ON whenever this flag turns ON.

Configuration Error Flag (Bit 03)

This flag is turned ON (1) when a configuration error occurs. A configuration error will occur in the following cases:

- A data error occurred in the configuration data for the scan list or other data. (Configuration data error)
- A PC mounting error occurred for a C200HX, C200HG, C200HE, or C200HS PC.
- A routing table error occurred for a CVM1 or CV-series PC.

The Error/Remote I/O Communications Stopped Flag (bit 14) will turn ON whenever this flag turns ON.

Setup Error Flag (Bit 04)

This flag is turned ON (1) when a setup error occurs. A setup error will occur in the following cases:

- The same remote I/O words are allocated to more than one Slave. (I/O area overlap)
- The I/O area range has been exceeded. (I/O area range over)
- A Slave that is not supported has been mounted.

The Error/Remote I/O Communications Stopped Flag (bit 14) will turn ON whenever this flag turns ON.

Transmission Error Flag (Bit 05)

This flag is turned ON (1) when a transmission error occurs. A transmission error will occur in the following cases:

- The communications power supply to the Master Unit isn't ON. (Network power supply error)
- There is no response from a Slave because it has been removed, the baud rates don't match, or some other reason. (Transmission timeout)

The Error/Remote I/O Communications Stopped Flag (bit 14) will turn ON whenever this flag turns ON.

If the Communications Continue/Stop for Communications Error setting on the front-panel DIP switch is set to stop communications, then communications will stop and remained stopped when the Transmission Error Flag turns ON (message communications will not stop).

Communications Error Flag (Bit 06)

This flag is turned ON (1) when a communications error occurs. A communications error will occur when there is no response from one of the Slaves that are participating in communications.

The Error/Remote I/O Communications Stopped Flag (bit 14) will turn ON whenever this flag turns ON.

If the Communications Continue/Stop for Communications Error setting on the front-panel DIP switch is set to stop communications, then communications will stop and remained stopped when the Transmission Error Flag turns ON (message communications will not stop).

Verification Error Flag (Bit 07)

This flag is turned ON (1) when a verification error occurs. An verification error will occur in the following cases:

- A non-existent Slave is registered in the scan list. (Non-existent Slave)
- One of the Slave's I/O parameters don't match the I/O parameters registered in the scan list. (Slave Unit I/O size differs)

The Error/Remote I/O Communications Stopped Flag (bit 14) will turn ON whenever this flag turns ON.

Remote I/O Communications Stopped Status Flag (Bit 08)

This flag is turned ON (1) when remote I/O communications are stopped for an error. It will be turned OFF (0) when remote I/O communications are operating normally or when they have been stopped for an error which has already been cleared but the Communications Continue/Stop for Communications setting has been set to stop communications. This flag thus indicates the status of remote I/O communications in terms of the settings of the software switches and settings from the Configurator.

Scan List Operation Completed Flag (Bit 09)

This flag is turned ON (1) after the scan list is enabled or cleared; it will be OFF (0) while these operations are being executed and will remain OFF if an error occurs during execution.

This flag is turned OFF when the Enable Scan List software switch or Clear Scan List software switch is turned OFF after execution of the corresponding operation. Be sure this flag or the next flag is ON before turning OFF the Enable Scan List software switch or Clear Scan List software switch.

Scan List Operation Error Flag (Bit 10)

This flag is turned ON (1) when the create scan list or clear scan list operation couldn't be executed; it will be OFF (0) while these operations are being executed and will remain OFF if the operation is executed normally.

This flag is turned OFF when the Enable Scan List software switch or Clear Scan List software switch is turned OFF after execution of the corresponding operation. Be sure this flag or the previous flag is ON before turning OFF the Enable Scan List software switch or Clear Scan List software switch.

Communications Stoppage Cleared Flag (Bit 11)

This flag is turned ON (1) when communications are successfully restarted after being stopped due to a communications error. Be sure this flag is ON before turning OFF the Clear Communications Error Stoppage software switch.

Message Communications Enabled Flag (Bit 12)

For CVM1 and CV-series PCs, this flag will be ON (1) when messages communications are possible; it will be OFF (0) when message communications are not possible due to a Bus Off or other error.

For C200HX/HG/HE/HS PCs, this flag will be ON (1) when messages communications to the Master Unit or other nodes are possible; it will be OFF (0) when message communications are in progress to the Master Unit or other nodes (until a response is returned) or when message communications are not possible.

Note

1. The Message Communications Enabled Flag should be used as an execution condition for message communications for all PCs.
2. The status of the Message Communications Enabled Flag will not change until the next time peripheral servicing is performed, i.e., not until at least the next scan after a message is sent.

Scan List Disabled Flag (Bit 13)

This flag will be ON (1) when the Master Unit is operating with the scan list disabled and OFF when operating with the scan list enabled. The dots in the Master Unit's 7-segment display will be lit when the scan list is disabled.

Error/Communications Stopped Flag (Bit 14)

This flag is turned ON (1) when any of the bits 00 to 06 in Master Status Area 1 are ON. It can be used as an execution condition for processing errors.

This flag will remain ON if communications were stopped due to a communications error, network power supply error, or transmission timeout error but remained stopped even though the cause of the error has been cleared.

Remote I/O Communications Flag (Bit 15)

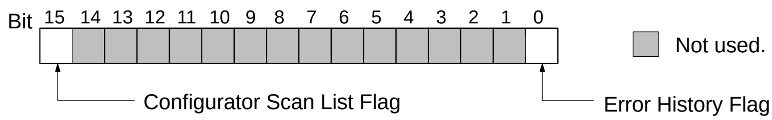
This flag is turned ON (1) when remote I/O communications are being executed.

It can be used as an execution condition for processing errors. Refer to *14-1-4 System Startup Time* for details.

13-3-2 Master Status Area 2

The following diagram shows the structure of Master Status Area 2.

CVM1 and CV-series PCs
CIO 1510 + 25 x unit No.
CS1-series PCs
D06032 + 2 x unit No.
C200HX/HG/HE/HS PCs
DM 6032 + 2 x unit No.



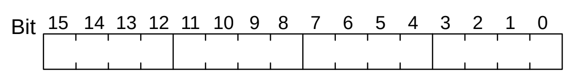
Error History Flag (Bit 00)
This flag is turned ON (1) when there is an error history recorded in the Master Unit and OFF when there is no error history. The error history will be cleared when the Master Unit is reset, power is turned off, or an error history clear operation is performed.

Configurator Scan List Flag (Bit 15)
This flag is turned ON (1) when a user-set scan list has been registered in the Master Unit from the Configurator and operation is taking place with the scan list enabled. It is OFF when operating with the scan list disabled or when a default scan list has been registered using the software switch and operation is taking place with the scan list enabled.

13-3-3 Current Communications Cycle Time

The following diagram shows the structure of Current Communications Cycle Time in memory.

CVM1 and CV-series PCs
CIO 1511 + 25 x unit No.
CS1-series PCs
D06033 + 2 x unit No.
C200HX/HG/HE/HS PCs
DM 6033 + 2 x unit No.



The current communications cycle time is stored in the above word as 4-digit BCD in ms. The value is truncated at the decimal point. The value is refreshed each PC execution cycle for CS1-series and C200HX/HG/HE/HS PCs and each peripheral servicing time for CVM1 and CV-series PCs.

13-3-4 Registered Slave Data

The bits in the Registered Slave Data Area correspond to the Slaves' node addresses, as shown in the following diagram.

First Words
CVM1 and CV-series PCs
CIO 1502 + 25 x unit No.
CS1-series PCs
CIO 2002 + 10 x unit No.
C200HX/HG/HE/HS PCs
Unit No. 0 to 9:
IR 102 + 10 x unit No.
Unit No. A to F:
IR 402 + 10 x (unit No. – 10)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
First word + 2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
First word + 3	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
First word + 4	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
First word + 5	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

When the Master is operating with the scan list enabled, the flags of Slaves registered in the scan list will be ON.

When the Master is operating with the scan list disabled, the flags of Slaves will be ON if the Master established a connection (communications) with the Slaves even one time.

If the default scan list is enabled using the software switch, any Slave whose bit is ON will be in the scan list.

13-3-5 Normal Slave Data

The bits in the Normal Slave Data Area correspond to the Slaves' node addresses, as shown in the following diagram.

First Words

CVM1 and CV-series PCs

CIO 1506 + 25 x unit No.

CS1-series PCs

CIO 2006 + 10 x unit No.

C200HX/HG/HE/HS PCs

Unit No. 0 to 9:
IR 106 + 10 x unit No.

Unit No. A to F:
IR 406 + 10 x (unit No. – 10)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
First word + 6	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
First word + 7	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
First word + 8	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
First word + 9	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

A Slave's corresponding flag will be ON if the Master has established normal communications with the Slave. The corresponding flag will be turned OFF if a setup error, communications error, or verification error occurs with the Slave.

If a transmission timeout error or network power supply error occurs, these flags will retain the status they had just before the error occurred.

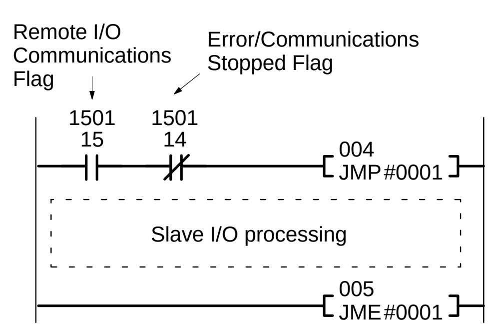
All bits will be OFF if remote I/O communications have not been started at all since the Master Unit was started.

If remote I/O communications are stopped after they were started, these flags will retain the status they had just before communications were stopped.

13-3-6 Using the Status Area in Programming

Remote I/O Communications

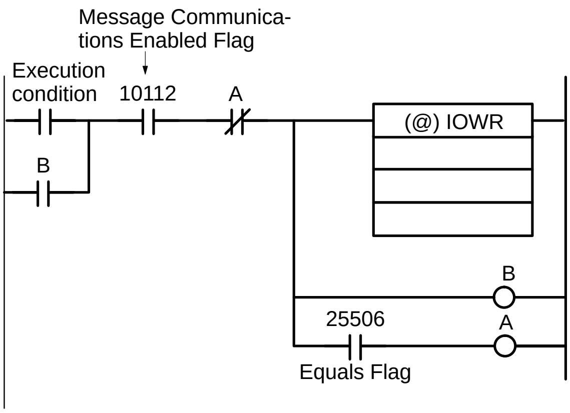
The following type of programming can be used to execute Slave I/O processing if an error occurs or if the Error/Communications Stopped Flag (bit 14) turns ON during remote I/O communications (i.e., when the Remote I/O Communications Flag is ON). The following example is for CVM1 and CV-series PCs.



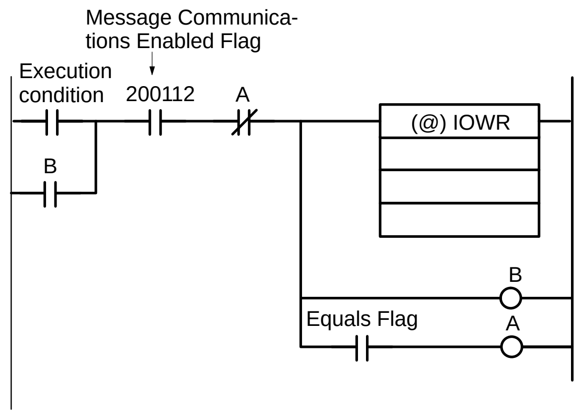
Message Communications

The following type of programming can be used to execute message communications when the Message Communications Enabled Flag is ON and the IOWR Write Normal Flag (Equals Flag) are ON.

Example 1: C200HX/HG/HE, Unit No. 0



Example 2: CS1 Series, Unit No. 0



Note Be sure to use the Message Communications Enabled Flag as an input condition.

SECTION 14
Communications Timing

This section describes the time required for a complete communications cycle, for an output response to be made to an input, to start the system, and to send a message.

14-1 Remote I/O Communications Characteristics

This section describes the characteristics of DeviceNet (CompoBus/D) communications when OMRON Master and Slave Units are being used. Use this section for reference when planning operations that require precise I/O timing.

The equations provided here are valid under the following conditions:

1, 2, 3...
1. The Master Unit is operating with the scan list enabled.
2. All of the required Slaves are participating in communications.
3. No errors are being indicated at the Master Unit
4. Messages aren't being produced in the Network (from another company's configurator, for example).

Note The values provided by these equations may not be accurate if another company's Master or Slave is being used in the Network.

14-1-1 Communications Cycle Time and Refresh Time

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

Communications Cycle Time

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

The communications cycle time depends on the number of Masters in the Network and on whether or not message communications are being performed. The following explanation is for a network with one Master. For networks with several Masters, refer to *More than One Master in Network* on page 232.

Use the equations shown below to calculate the communications cycle time (T_{RM}) for a network with one Master. Note that if the result of this calculation is less than 2 ms, the actual communications cycle time will be 2 ms.

T_{RM} = Σ (Communications time per Slave)
+ High-density Unit processing time
+ Explicit message processing time
+ $10 \times N + 1.0$ [ms]

<u>Communications Time Per Slave:</u>
This is the communications time required for a single Slave (refer to page 224).
"Σ (Communications time per Slave)" represents the total of the "Communications time per Slave" for all the Slaves in the network.

<u>High-density Unit Processing Time:</u>
3.5 [ms]
This is added if there are any Slaves in the network that use at least 8 bytes for input, output, or both.

<u>Explicit Message Processing Time:</u>
$0.11 \times T_B + 0.6$ [ms]
Only added when explicit communications are performed.
T_B = The baud rate factor
(500 kbps: $T_B = 2$; 250 kbps: $T_B = 4$; 125 kbps: $T_B = 8$)

N: Number of Slaves

Communications Time/Slave

The communications time per Slave is the communications time required for a single Slave. The communications time per Slave is used to calculate the minimum I/O response time.

The following equations show the communications time/Slave (T_{RT}) for each kind of Slave Unit.

Output Slaves with Less Than 8 Bytes of Output

$T_{RT} = 0.016 \times T_B \times S_{OUT1} + 0.11 \times T_B + 0.07$ [ms]

S_{OUT1} : The number of Output Slave output words
T_B : The baud rate factor
(500 kbps: $T_B = 2$; 250 kbps: $T_B = 4$; 125 kbps: $T_B = 8$)

Input Slaves with Less Than 8 Bytes of Input

$T_{RT} = 0.016 \times T_B \times S_{IN1} + 0.06 \times T_B + 0.05$ [ms]

S_{IN1} : The number of Input Slave input words
T_B : The baud rate factor
(500 kbps: $T_B = 2$; 250 kbps: $T_B = 4$; 125 kbps: $T_B = 8$)

Mixed I/O Slaves with Less Than 8 Bytes of Input or Output

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

S_{OUT2} : The number of Mixed I/O Slave output words
S_{IN2} : The number of Mixed I/O Slave input words
T_B : The baud rate factor
(500 kbps: $T_B = 2$; 250 kbps: $T_B = 4$; 125 kbps: $T_B = 8$)

Slaves with More Than 8 Bytes of Input or Output

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

T_{OH} : Protocol overhead
$T_{BYTE\text{-}IN}$: The input byte transmission time
B_{IN} : The number of input words
$T_{BYTE\text{-}OUT}$: The output byte transmission time
B_{OUT} : The number of output words

Baud rate	T_{OH}	$T_{BYTE\text{-}IN}$	$T_{BYTE\text{-}OUT}$
500 kbps	0.306 ms	0.040 ms	0.036 ms
250 kbps	0.542 ms	0.073 ms	0.069 ms
125 kbps	1.014 ms	0.139 ms	0.135 ms

For Input Slaves take B_{OUT} to be 0, and for Output Slaves take B_{IN} to be 0.

Refresh Time

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

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

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

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

Master Unit for CS1-series, C200HX, C200HG, C200HE, and C200HS PCs (C200HW-DRM21)

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

PC	DeviceNet Unit I/O refreshing time (ms)
CS1 Series, C200HX, C200HG, and C200HE	$1.72 + 0.022 \times$ the number of words refreshed
C200HS	$2.27 + 0.077 \times$ the number of words refreshed

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

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

14-1-2 I/O Response Time

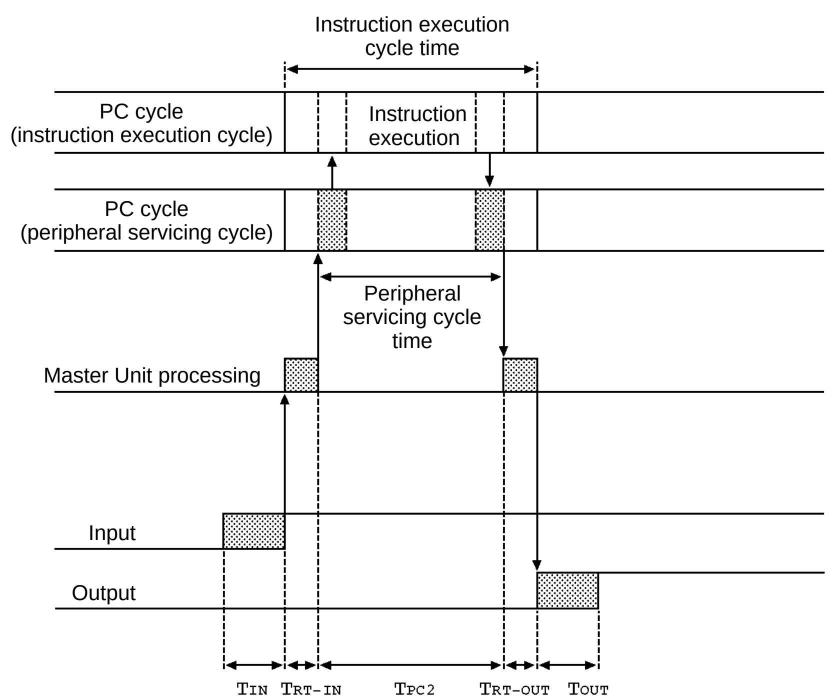
The I/O response time is the time it takes from the reception of an input signal at an Input Slave to the output of the corresponding output signal at an Output Slave.

CVM1 and CV-series PCs (Asynchronous Mode)

The following timecharts show the minimum and maximum I/O response times of the DeviceNet network for a CVM1 or CV-series PC operating in asynchronous mode.

Minimum I/O Response Time

The minimum I/O response time occurs when the DeviceNet Master Unit refreshing is executed just after the input signal is received by the Master and instruction execution is completed within one peripheral servicing cycle.



T_{IN}: The Input Slave's ON (OFF) delay
T_{OUT}: The Output Slave's ON (OFF) delay
$T_{RT\text{-}IN}$: Input Slave's communications time/Slave (See page 224.)
$T_{RT\text{-}OUT}$: Output Slave's communications time/Slave (See page 224.)
T_{PC2}: The PC's peripheral servicing cycle time

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

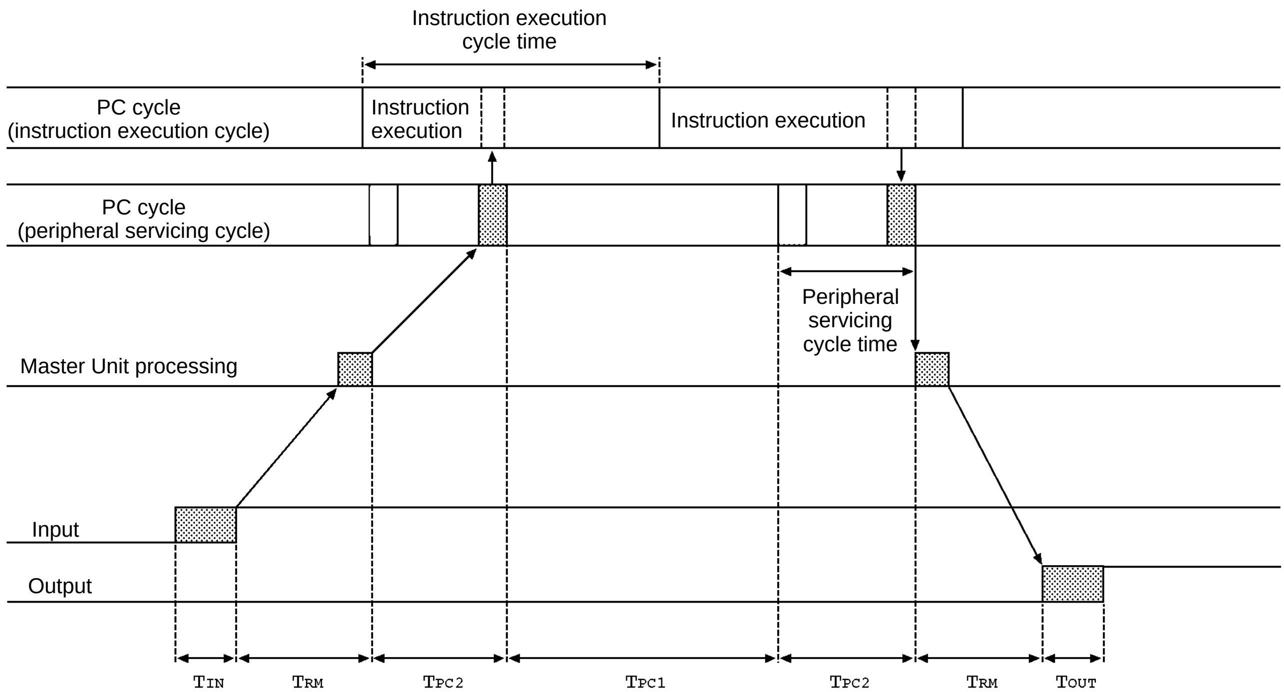
$$T_{MIN} = T_{IN} + T_{RT\text{-}IN} + T_{PC2} + T_{OUT} + T_{RT\text{-}OUT}$$

Note

1. Refer to the *CompoBus/D (DeviceNet) Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 225 and to the PC's Operation Manual for details on the PC's peripheral servicing cycle time.

Maximum I/O Response Time

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



T_{IN}: The Input Slave's ON (OFF) delay
T_{OUT}: The Output Slave's ON (OFF) delay
T_{RM}: Master Unit's communications cycle time (See page 224.)
T_{PC1}: The PC's instruction execution cycle time
T_{PC2}: The PC's peripheral servicing cycle time

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

$$T_{MAX} = T_{IN} + 2 \times T_{RM} + T_{PC1} + 2 \times T_{PC2} + T_{OUT}$$

Note

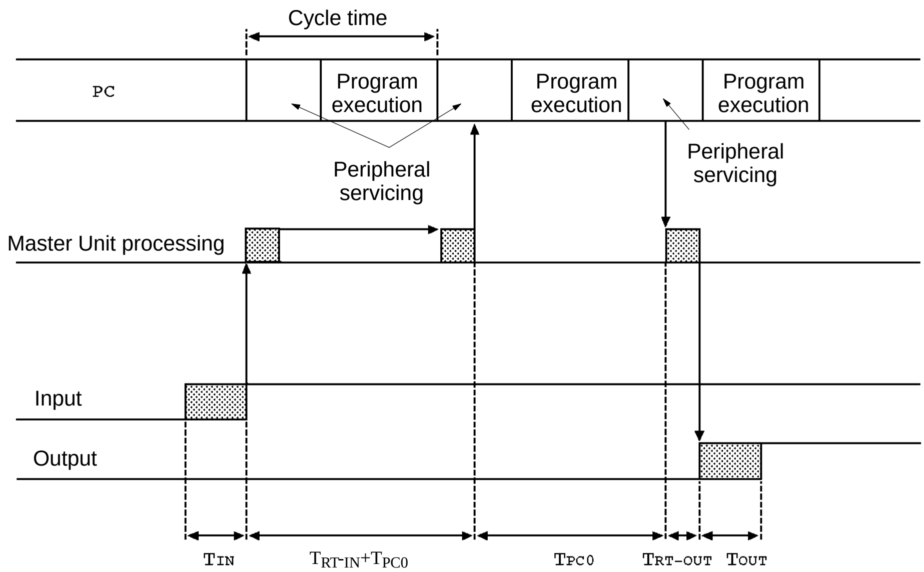
1. Refer to the *CompoBus/D (DeviceNet) Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 225 and to the PC's Operation Manual for details on the PC's peripheral servicing cycle time.

CVM1 and CV-series PCs (Synchronous Mode)

The following timecharts show the minimum and maximum I/O response times of the DeviceNet network for a CVM1 or CV-series PC operating in synchronous mode.

Minimum I/O Response Time

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



T_{IN}: The Input Slave's ON (OFF) delay
T_{OUT}: The Output Slave's ON (OFF) delay
$T_{RT\text{-}IN}$: Input Slave's communications time/Slave (See page 224.)
$T_{RT\text{-}OUT}$: Output Slave's communications time/Slave (See page 224.)
T_{PC0}: The PC's cycle time (program execution + peripheral servicing)

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

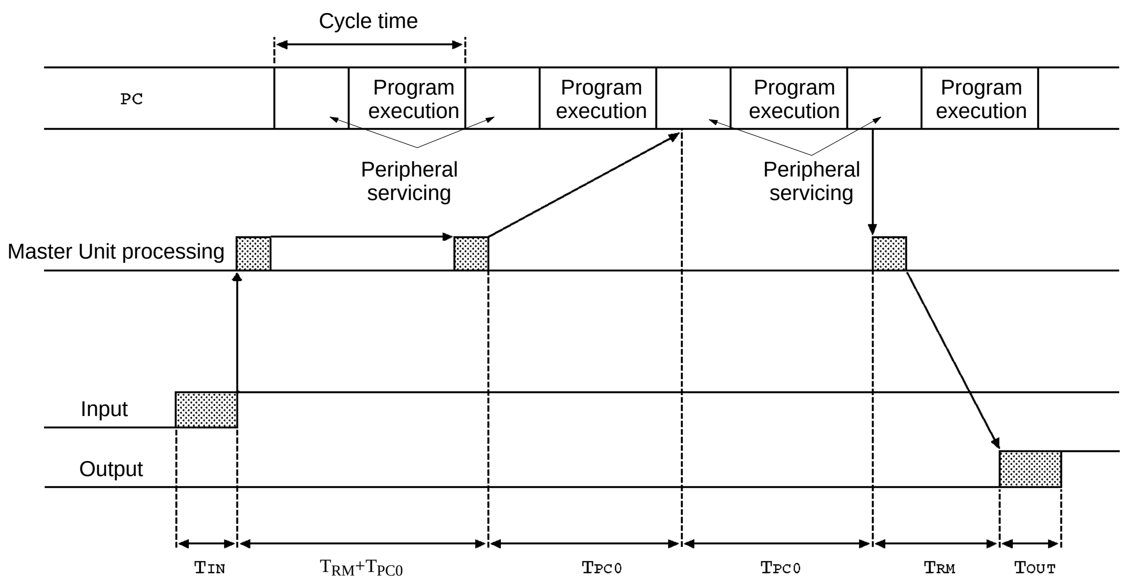
$$T_{MIN} = T_{IN} + T_{RT\text{-}IN} + 2 \times T_{PC0} + T_{RT\text{-}OUT} + T_{OUT}$$

Note

1. Refer to the *CompoBus/D (DeviceNet) Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 225 and to the PC's Operation Manual for details on the PC's cycle time.

Maximum I/O Response Time

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



T_{IN}: The Input Slave's ON (OFF) delay
T_{OUT}: The Output Slave's ON (OFF) delay
T_{RM}: Master Unit's communications cycle time (See page 224.)
T_{PC0}: The PC's cycle time (program execution + peripheral servicing)

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

$$T_{MAX} = T_{IN} + 2 \times T_{RM} + 3 \times T_{PC0} + T_{OUT}$$

Note

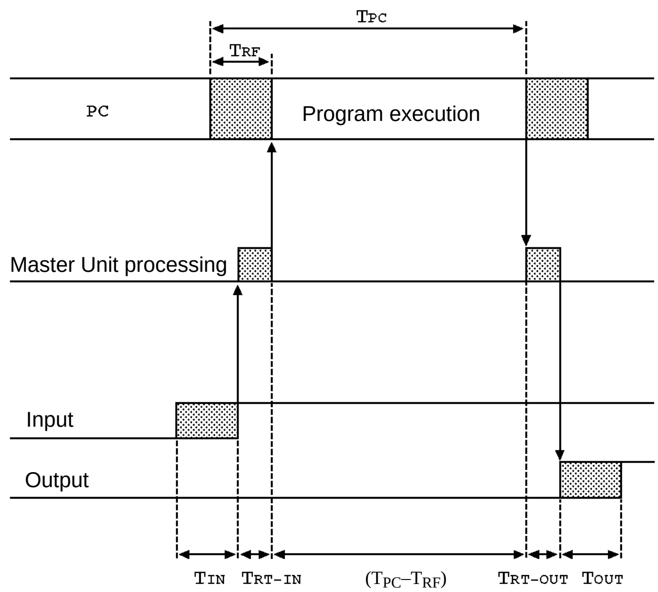
1. Refer to the *CompoBus/D (DeviceNet) Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 225 and to the PC's Operation Manual for details on the PC's peripheral servicing cycle time.

CS1-series, C200HX, C200HG, C200HE, and C200HS PCs

The following timecharts show the minimum and maximum I/O response times of the DeviceNet network with a C200HX, C200HG, C200HE, or C200HS PC.

Minimum I/O Response Time

The minimum I/O response time occurs when the Slave's I/O refreshing is executed just after the input signal is received by the Master Unit and the output signal is output at the beginning of the next I/O refresh cycle.



T_{IN}: The Input Slave's ON (OFF) delay
T_{OUT}: The Output Slave's ON (OFF) delay
T_{RT-IN}: Input Slave's communications time/Slave (See page 224.)
T_{RT-OUT}: Output Slave's communications time/Slave (See page 224.)
T_{PC}: The PC's cycle time
T_{RF}: The PC's DeviceNet Unit refresh time (See page 225.)

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

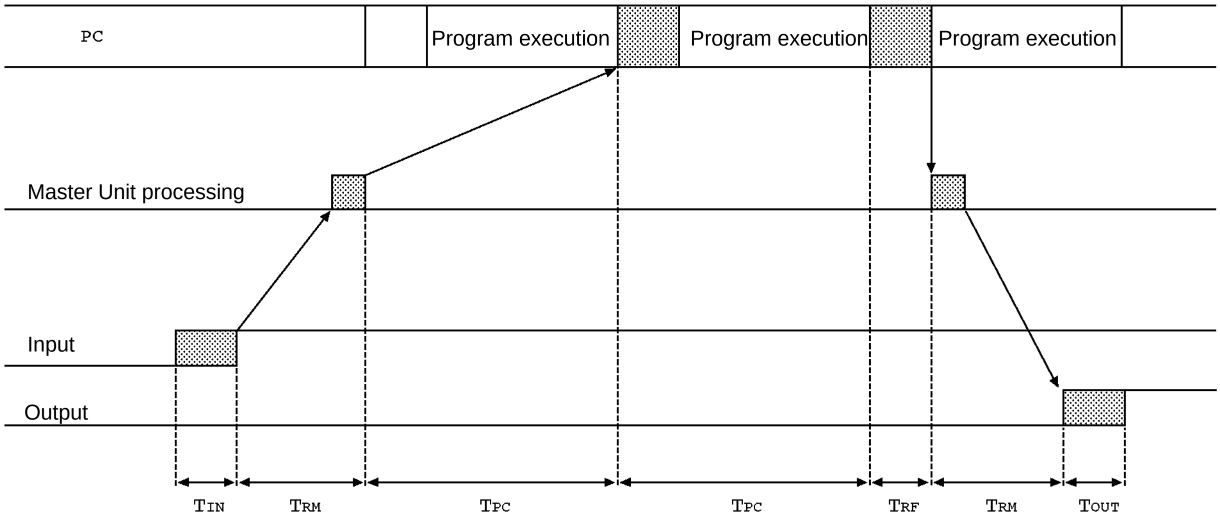
$$T_{MIN} = T_{IN} + T_{RT-IN} + (T_{PC} – T_{RF}) + T_{RT-OUT} + T_{OUT}$$

Note

1. Refer to the *CompoBus/D (DeviceNet) Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 225 and to the PC's Operation Manual for details on the PC's cycle time.

Maximum I/O Response Time

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



T_{IN}: The Input Slave's ON (OFF) delay
T_{OUT}: The Output Slave's ON (OFF) delay
T_{RM}: The communications cycle time for the total Network (See page 224.)
T_{PC}: The PC's cycle time
T_{RF}: The PC's DeviceNet Unit refresh time (See page 225.)

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

$$T_{MAX} = T_{IN} + 2 \times T_{RM} + 2 \times T_{PC} + T_{RF} + T_{OUT}$$

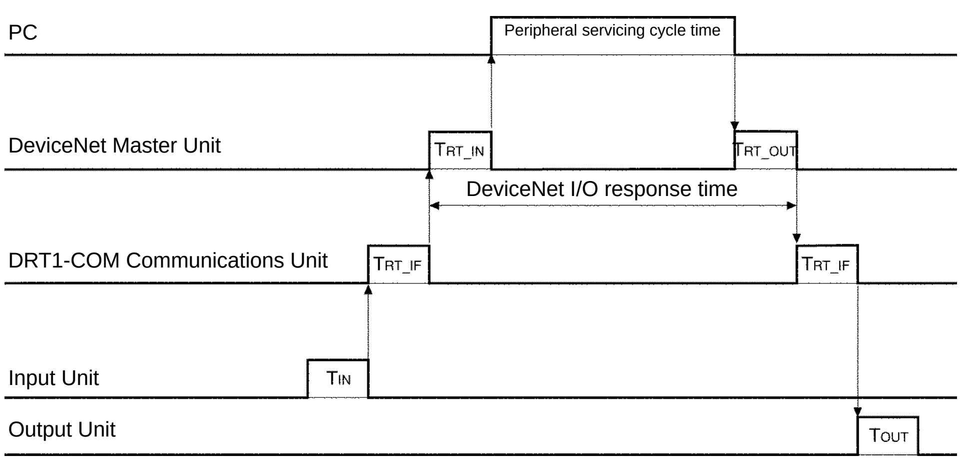
Note

1. Refer to the *CompoBus/D (DeviceNet) Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 225 and to the PC's Operation Manual for details on the PC's cycle time.

MULTIPLE I/O TERMINAL

Minimum I/O Response Time

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



T_{IN}: Input Unit ON (OFF) delay time
T_{OUT}: Output Unit ON (OFF) delay time
$T_{RT\text{-}IF}$: I/O Unit interface communications time (1.5 ms)
$T_{RT\text{-}IN}$: Input Slave's communications time/Slave (See page 224.)

$T_{RT\text{-}OUT}$: Output Slave's communications time/Slave (See page 224.)
(With the MULTIPLE I/O TERMINAL, $T_{RT\text{-}IN}$ and $T_{RT\text{-}OUT}$ will be the equal to the communications time for one Slave.)

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

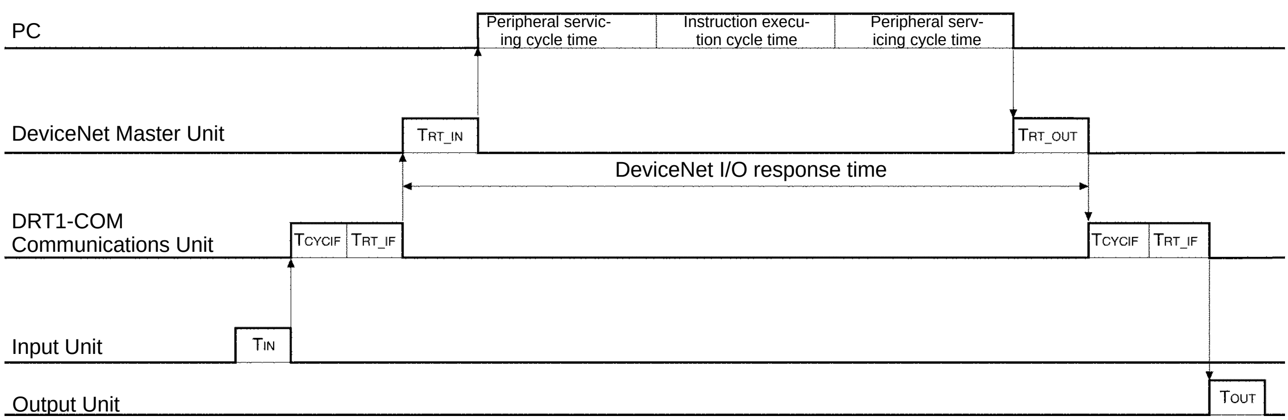
$$T_{MIN} = T_{IN} + T_{RT\text{-}IF} + (\text{DeviceNet I/O response time}) + T_{RT\text{-}IF} + T_{OUT}$$

Note

1. For details on the Input Unit input delay time and the Output Unit output delay time, see information on the I/O Units in *DeviceNet (CompoBus/D) MULTIPLE I/O TERMINAL Operation Manual* (W348); for details on the DeviceNet I/O response times, see the explanation of the remote I/O communications performance.
2. Refer to the PC's Operation Manual for details on the PC's cycle time.

Maximum I/O Response Time

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



T_{IN}: Input Unit ON (OFF) delay time
T_{OUT}: Output Unit ON (OFF) delay time
T_{CYCIF}: I/O Unit interface cycle time
$T_{RT\text{-}IF}$: I/O Unit interface communications time (1.5 ms)
T_{RM}: The communications cycle time for the total Network (See page 224.)

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

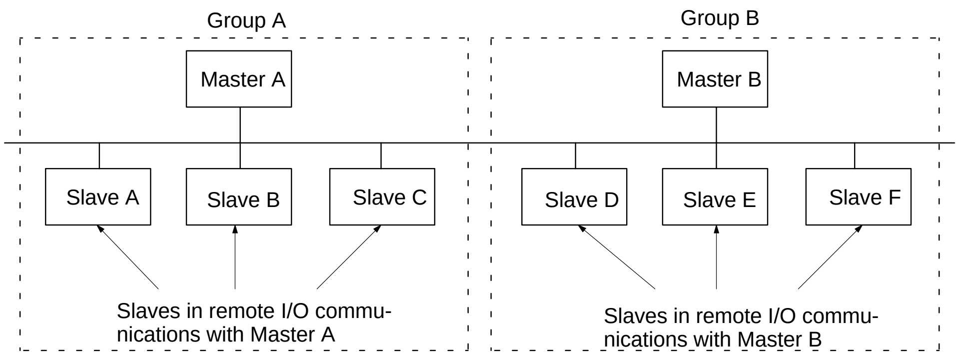
$$T_{MAX} = T_{IN} + T_{RT\text{-}IF} \times 2 + (\text{DeviceNet I/O response time}) + T_{RT\text{-}IF} \times 2 + T_{OUT}$$

Note For details on the Input Unit input delay time, the Output Unit output delay time and the I/O Unit interface cycle time, see information on the I/O Units and on communications timing in *DeviceNet (CompoBus/D) MULTIPLE I/O TERMINAL Operation Manual* (W348). For details on the DeviceNet I/O response times, see the explanation of the remote I/O communications performance.

14-1-3 More than One Master in Network

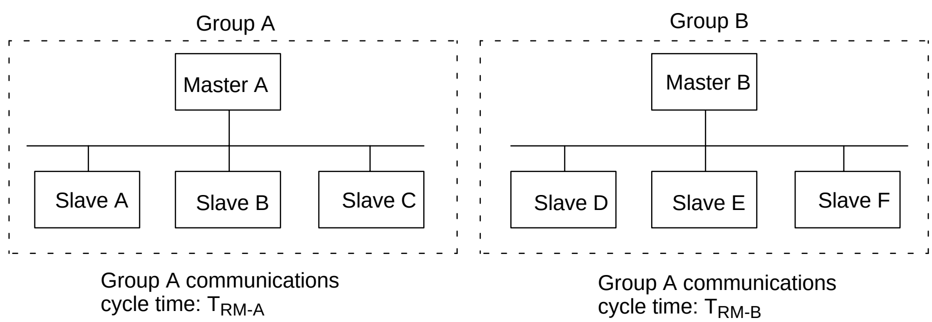
The following equation shows the remote I/O communications cycle time (T_{RM}) when there is more than one Master in the Network and message communications are not being performed. An example for two Master Unit is used.

First, the Network is divided into two groups: Master A and the Slaves in remote I/O communications with it and Master B and the Slaves in remote I/O communications with it.



Note Although in the above diagram the Slaves are separated into two groups for convenience, the actual physical positions in the Network are irrelevant.

Next, we can refer to the previous equations and calculate the communications cycle time for each group as if they were separate Networks.



In Networks with two Masters, the communications cycle time for the entire Network will be the sum of the communications cycle times for the groups.

$$T_{RM} = T_{RM-A} + T_{RM-B}$$

Although this example shows only two Masters in the Network, the total communications cycle time for any Network can be calculated by dividing it into groups and adding the communications cycle times of all groups.

14-1-4 System Startup Time

This section describes the system startup time for a Network operating with the scan list enabled. The system startup time is the delay from the time that the Master Unit is turned ON until remote I/O communications begin. Here, we assume that the scan list is enabled and that remote I/O communications are set to start automatically at startup.

System Startup Times The following table shows the system startup times for two cases. In the first case, the Master Unit starts up just after all of the Slaves' power supplies are turned ON. In the second case, the Master Unit is restarted while communications are in progress.

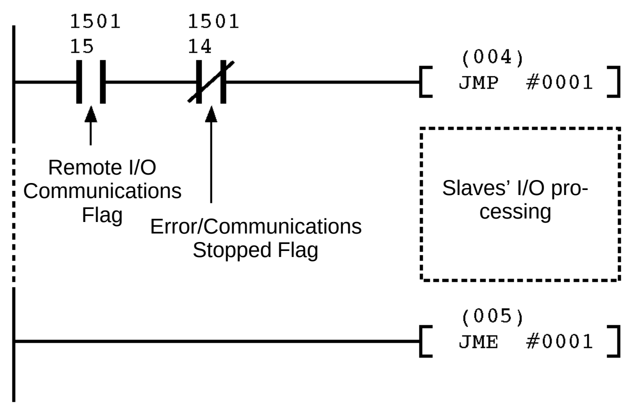
Case	Slave's indicator status	System startup time
The Master is started just after Slave startup.	The NS indicator is OFF or flashing green.	6 seconds
Just the Master is restarted.	The NS indicator is flashes red while the Master is OFF.	8 seconds
Just the Slaves are restarted.	---	10 seconds

Program Example

As shown in the preceding table, it takes time for DeviceNet communications to start up. This programming uses flags in the Master status area to prevents the Slaves' I/O processing from being performed until remote I/O communications start up.

Note Refer to *3 Status Area* for details on Master Status Area 1.

This programming is for a CVM1 or CV-series PC and a Master Unit with a unit number of 00.



14-2 Message Communications Time

The message communications time is the time required from the time a Master Unit starts to send a message over the Network to another node until the Master Unit completes sending the message (data for SEND(192)/RECV(193) and FINS commands for CMND(194)/IOWR).

If the CPU Unit attempts to send another message or receives a message from another node within the message communications time, the second message or the message being received from another node may be destroyed. Never execute a second communications instruction before the message communications time has elapsed and never send messages to any one node at intervals less than the message communications time.

Note

1. If send or receive messages are destroyed, error records will be placed in the error history of the Master Unit. If an error occurs, read the error history using the FINS command or monitor the error history from the Configurator.
2. The following equations can be used to find the approximate message communications time, but this is a typical time, not the maximum time. The message communications time will vary depending on the frequency of message communications, the load on the remote node, the communications cycle time, and other factors. For any one Master Unit, the message communications time can be greatly increased due to heavy loads and the user program must be written to allow for this.

The following equation can be used to compute the approximate message communications time.

Message communications time =
Communications cycle time x ((No. of message bytes + 15) $\div$ 6 + 1)

No. of message bytes: No. of data bytes following the FINS command code

The communications cycle time depends on whether or not remote I/O communications are being used.

Message Communications Only (No Remote I/O Communications)
The following equation can be used to compute the message communications time when remote I/O communications are not being used.

Communications cycle time =
$2 \text{ (see note)} + 0.11 \times T_B + 0.6$ [ms]

T_B : The baud rate factor
(500 kbps: $T_B = 2$; 250 kbps: $T_B = 4$; 125 kbps: $T_B = 8$)

Note The communications cycle time will be 2 ms even if remote I/O communications are not being used.

Remote I/O and Message Communications

Performing message communications in addition to remote I/O communications will increase the message communications time.

Communications cycle time=
Communications cycle time for remote I/O communications only
$+ 0.11 \times T_B + 0.6$ [ms]

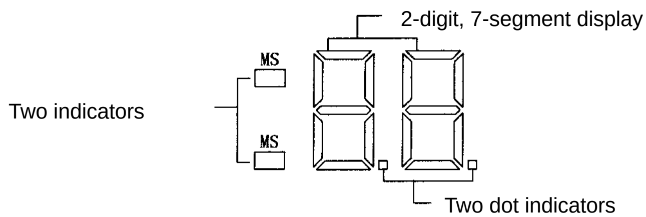
T_B : The baud rate factor
(500 kbps: $T_B = 2$; 250 kbps: $T_B = 4$; 125 kbps: $T_B = 8$)

SECTION 15
Troubleshooting and Maintenance

This section describes error processing, periodic maintenance operations, and troubleshooting procedures needed to keep the DeviceNet (CompoBus/D) network operating properly. We recommend reading through the error processing procedures before operation so that operating errors can be identified and corrected more quickly.

15-1 Indicators and Error Processing

DeviceNet Master Units have an MS (Module Status) indicator that indicates the status of the node itself and an NS (Network Status) indicator that indicates the status of the Network. The Master Units also have a 2-digit, 7-segment display and two dot indicators. These indicators and display show when an error has occurred and what type of error it is.



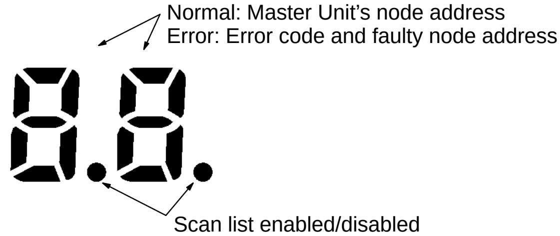
15-1-1 MS and NS Indicators

The MS and NS indicators can be green or red and they can be OFF, flashing, or ON. The following table shows the meaning of these indicator conditions.

Indicator	Color	Status	Meaning
MS	Green	ON	Normal operating status: Communications are being performed normally.
		Flashing	Reading switch settings.
	Red	ON	A non-recoverable, fatal error has occurred: Watchdog timer error, memory error, or system error. The Unit will need replaced.
		Flashing	A recoverable error has occurred: Configuration error, switch setting error, PC initialization error, PC interface error, or routing table error. Correct the error and reset the Unit.
	---	OFF	Power isn't being supplied or the Unit is being reset.
NS	Green	ON	The Unit is online with the network and a communications connection is currently established. Either remote I/O communications are active with the scan list enabled or message communications are in progress.
		Flashing	The Unit is online with the network, but a communications connection has not yet been established. Either the scan list is being read, or both remote I/O communications and message communications are stopped.
	Red	ON	A fatal communications error has occurred. Network communications are not possible. Check for a node address duplication or Bus Off error.
		Flashing	A non-fatal error has occurred: Communications error, setup error, or verification error.
	---	OFF	The Unit is not online with the network. There is no network power supply error, the Unit is being reset, a minor failure, or a send error has occurred.

15-1-2 Seven-Segment Display

In addition to the MS and NS indicators, Master Units have a 2-digit, 7-segment display that normally indicates the Master's node address. When an error occurs, the display will alternate between the error code and the node address of the faulty Slave.



Dot Indicators

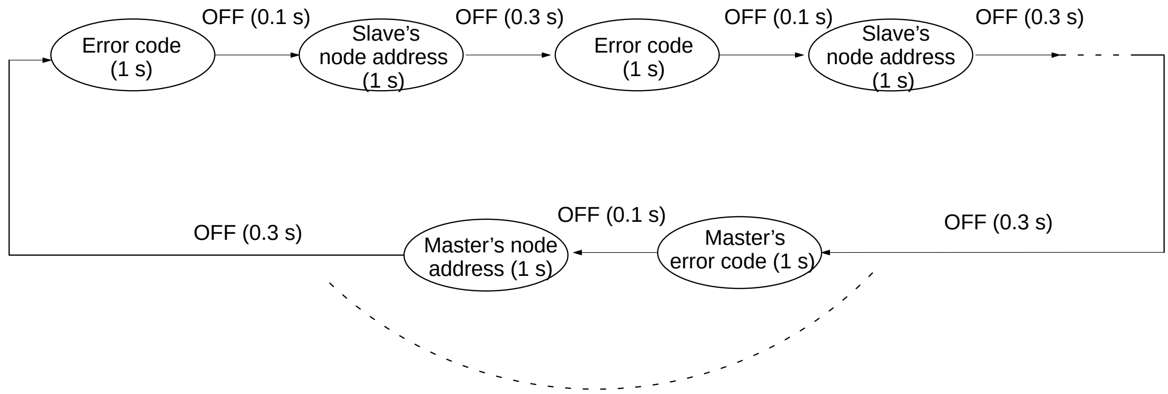
The dots at the lower-right corner of each digit show whether the scan list is enabled or disabled for DeviceNet remote I/O communications. The dots are ON when the scan list is disabled and OFF when the scan list is enabled.

Seven-segment Display

The 7-segment digits themselves show the Master's node address during normal operation, but indicate the error code and faulty Slave node address when an error occurs. The following table outlines the operation of the display.

Status		Display	
Remote I/O communications active and normal		Master Unit's node address (00 to 63)	Lit
From power ON to start of remote I/O communications	Remote I/O communications automatically started at startup		Flashing
	Remote I/O communications stopped at startup		Flashing until end of node address duplication check
At startup of remote I/O communications			Flashing until remote I/O communications start
Error	Watchdog timer	No lit	
	Memory or system error	Error code only	Lit
	Other errors	Error code and error node address alternate (see diagram below)	
Scan list	Reading	"- -"	Flashing
	Registered		

The following diagram illustrates the alternating display of the error code and error node address.



There is no priority in the error codes; all errors that have occurred will be displayed in order. All error codes begin with letters, so they can be distinguished from node addresses immediately.

15-1-3 Identifying Errors from the Indicators

The indicators can be used to identify the cause of an error.

Normal Indications

The following table shows the status of the MS and NS indicators and the 7-segment display during normal operation.

Display/Indicator status			Network/Unit status	Comments
MS	**NS**	**7-segment**		
ON (green)	ON (green)	Master Unit's node address	Remote I/O or message communications in progress.	This is the normal display when remote I/O and/or message communications are active.
ON (green)	Flashing (green)	Master Unit's node address	Remote I/O communications stopped and message connection not established.	"Connection not established" indicates that the local node has not sent a message to another node and that a message has not been received from another node.
No change	Flashing (green)	Master Unit's node address (flashing)	Remote I/O communications are being initialized between the Master Unit and Slaves.	---
OFF	OFF	OFF	Waiting for initialization with PC.	Reset the Master Unit if this status continues for an extended period of time. If operation still is not possible, replace the CPU Unit and/or Master Unit.
Flashing (green)	OFF	Master Unit's node address	Waiting for end of node address duplication check.	The following causes should be considered if this status continues for too long Unit numbers A to F have been used for a C200HS PC. The same Unit number has been used for more than one C200HS PC. Unit numbers A to F have been used for a C200HX/HG/HE PC that supports less than 881 I/O points. The Master Unit is not registered in the I/O table for a C200HX/HG/HE PC. Reset the Master Unit if none of the above are problems. If operation still is not possible, replace the CPU Unit and/or Master Unit.
No change	No change	- - (flashing)	Saving scan list in EEPROM or clearing scan list.	---

Errors Occurring in the Master Unit

The following table lists probable causes and remedies for errors that occur in the Master Unit. In the 7-segment display column, Mnn represents the Master's node address and Snn represents a Slave's node address. "---" indicates that the status of the indicator will not change from its previous condition.

Display/Indicator status			Error	Probable cause and remedy
7-segment	MS	NS		
OFF	OFF	OFF	PC Watchdog Timer Error	Either a watchdog timer error occurred in the PC or power isn't being supplied to the PC properly. Master Unit operation will stop. Refer to the PC's Operation Manual for details.
OFF	OFF or ON (red)	OFF	Watchdog Timer Error	A watchdog timer error occurred in the Master Unit and Master Unit operation will stop. Replace the Master Unit. The MS indicator will be OFF in C200HW-DRM21-V1, ON (red) in the CVM1-DRM21-V1.
A0 ⇔ Mnn	---	---	Communications stopped due to an error	The Master has been set to stop communications in the event of a communications error and communications have been stopped due to a communications error, send timeout, or network power supply error. Remote I/O communications will stop but message communications will continue. Bits 06 and 15, or bits 05 and 14, will be ON in Master Status Area 1. Remove the cause of any communications error (error d9), network power supply errors (error E0), and send timeouts (error E2) and then restart remote I/O communications using the software switch to cancel stoppage of communications.
C0 ⇔ Mnn	---	---	Scan list operation couldn't be performed.	The scan list couldn't be created or cleared because the PC wasn't in PROGRAM mode. Switch the PC to PROGRAM mode and try the operation again.
C2 ⇔ Mnn				The scan list couldn't be created because the Master was already operating with the scan list enabled. Use the Clear Scan List BIt to switch the Master to scan list disabled mode and try the operation again.
C3 ⇔ Mnn				The scan list couldn't be created or cleared because one of the Slaves that should be registered didn't exist. Check the Slaves' connections and recognition by the Master and try the operation again.
C4 ⇔ Mnn				The scan list couldn't be created because a configuration error occurred. Eliminate the cause of the configuration error, restart the Master, and try the operation again.
CA ⇔ Mnn				The scan list couldn't be created or cleared because a scan list operation was already being performed. Verify that the previous scan list operation has been completed and try the operation again.
d0 ⇔ Snn	ON (green)	Flashing (red)	Setup error: I/O area overlap	There is an overlap in the Slaves' I/O words. The Master Unit will attempt to reconnect to the Slaves with the error. Bits 04 and 14 will be ON in Master Status Area 1. Correct the Slave node address.
d1 ⇔ Snn	ON (green)	Flashing (red)	Setup error: I/O area range exceeded	The range of the Slaves' I/O area was exceeded. The Master Unit will attempt to reconnect to the Slaves with the error. Bits 04 and 14 will be ON in Master Status Area 1. Correct the Slave node address.

Display/Indicator status			Error	Probable cause and remedy
7-segment	**MS**	**NS**		
d2 ⇔ Snn	ON (green)	Flashing (red)	Setup error: Slave not supported	The number of I/O points/Slave has exceeded 64 bytes. The Master Unit will attempt to reconnect to the Slaves with the error. Bits 04 and 14 will be ON in Master Status Area 1. Correct the Slave node address.
d5 ⇔ Snn	ON (green)	Flashing (red)	Verification error: Slave doesn’t exist	A Slave registered in the scan list doesn’t exist in the network. The Master Unit will attempt to reconnect to the Slaves with the error. Bits 07 and 14 will be ON in Master Status Area 1. Check the Master/Slave baud rates, for loose or broken cables, for noise, cable lengths, and Terminating Resistors.
d6 ⇔ Snn	ON (green)	Flashing (red)	Verification error: Slave I/O size differs	The I/O size of a Slave registered in the scan list doesn’t match the actual Slave in the network. The Master Unit will attempt to reconnect to the Slaves with the error. Bits 07 and 14 will be ON in Master Status Area 1. Check the Slave and create the scan list again.
d9 ⇔ Snn	ON (green)	Flashing (red)	Communications error: Remote I/O communications timeout	A response from a Slave timed out 6 times or a fragmentation occurred 3 time. The Master Unit will attempt to reconnect to the Slaves with the error. Bits 07 and 14 will be ON in Master Status Area 1. Check the Master/Slave baud rates, for loose or broken cables, for noise, cable lengths, and Terminating Resistors.
E0 ⇔ Mnn	ON (green)	OFF	Send error: Network power supply error	The communications power supply isn’t being supplied from the communications connector. The Master Unit will be waiting for power supply. Bits 05 and 14 will be ON in Master Status Area 1. Check the power supply and connecting cables.
E2 ⇔ Mnn	ON (green)	OFF	Send error: Send timeout	A transmission couldn’t be completed successfully for one of the following reasons: • There are no Slaves in the network. • There is another Master in the Network. • There is an error in the CAN controller. The Master Unit will retry. Bits 05 and 14 will be ON in Master Status Area 1. Check the Master/Slave baud rates, for loose or broken cables, for noise, cable lengths, and Terminating Resistors.

Display/Indicator status			Error	Probable cause and remedy
7-segment	MS	NS		
E4 ⇔ Mnn	Flashing (red)	---	PC mounting error (for V1 Master Units only; see note 1 at end of table)	C200HX/HG/HE PCs: Either the Master Unit is mounted to a Slave Rack or two Master Units are mounted without using a Configurator to enable them. CVM1 and CV-series PCs: Two Master Units are mounted without using a Configurator to enable them. Operation will continue from where remote I/O communications stopped (including I/O refresh). Bits 03 and 14 will be ON in Master Status Area 1. Create a scan list using the configurator. (V1 Master Units: When a PC mounting error occurs, remote I/O communications will stop, but messages communications and software switch/status area refreshes will continue. A PC mounting error will always occur the first time PC power is turned ON with more than one Master Unit, but the error can be eliminated by registering proper parameters in all Master Units.)
E5 ⇔ Mnn	Flashing (red)	---	Routing table error	The Master Unit is not properly registered in the local network table. Master Unit operation will continue without the routing tables. Bits 05 and 14 will be ON in Master Status Area 1. Correct the routing tables in the CPU Unit and restart the Master Unit.
E8 ⇔ Mnn	Flashing (red)	---	Configuration data error	There is a data error in the configuration data (i.e., the scan list and Master parameters) in the Master Unit. Check the network configuration and create the scan list again. Master Unit operation will continue with the scan list disabled and with the default Master parameters (see note 2 at end of table). Check the network configuration and correct the scan list and network parameters from the Configurator, or use the software switch to reset the scan list. (For V0 Master Units (without “V1” suffix in model number), operation will continue with the scan list disabled. For V1 Master Units, remote I/O communications will stop and only the software switches and status area will be refreshed.)
F0 ⇔ Mnn	ON (green)	ON (red)	Node address duplication	The Master Unit’s node address has been set on another node. Master Unit operation will stop. Bits 01 and 14 will be ON in Master Status Area 1. Change the node address settings to eliminate the duplication and restart the Master.
F1 ⇔ Mnn	ON (green)	OFF	Bus Off error detected	A Bus Off status was detected. (Communications were stopped because of the occurrence of a number of data errors.) Master Unit operation will stop. Bits 01 and 14 will be ON in Master Status Area 1. Check the Master/Slave baud rates, for loose or broken cables, for noise, cable lengths, and Terminating Resistors.
F3 ⇔ Mnn	Flashing (green)	OFF	Incorrect switch settings	A mistake has been made in the DIP switch settings. Master Unit operation will stop. Bits 00 and 14 will be ON in Master Status Area 1. Check the settings and restart the Master Unit.

Display/Indicator status			Error	Probable cause and remedy
7-segment	MS	NS		
F4 ⇔ Mnn	Flashing (green)	OFF	Configuration error: PC mounting error (V0 Master Units only)	One of the following errors has occurred when using a C200HW-DRM21-V1 Master: • A SYSMAC BUS Master is connected too. • Two or more Master Units are connected. Master Unit operation will stop. Change the configuration and restart the PC.
F5 ⇔ Mnn	Flashing (green)	OFF	Initialization error with PC	An error occurred during initialization with the PC. Master Unit operation will stop. Check the following items and restart the PC. • I/O table in CPU Unit. • Error log in CPU Unit. • Unit number of Master Unit.
F6 ⇔ Mnn	Flashing (red)	OFF	PC interface error	An error occurred in communications with the PC. Master Unit operation will stop. Check the following items and restart the PC. CVM1 and CV-series PCs • CPU Unit status. • IOSP instruction programming methods • CPU Bus Unit servicing setting (A015) C200HX/HG/HE/HS PCs • CPU Unit status • Noise interference If the problem cannot be fixed, replace the CPU Unit or Master Unit.
F8 ⇔ Mnn	ON (red)	OFF	Memory error: EEPROM error	Master parameters can’t be read or written to EEPROM. Master Unit operation will stop. Bits 00 and 14 will be ON in Master Status Area 1. Replace the Master Unit.
F9 ⇔ Mnn	ON (red)	OFF	Memory error: RAM error	An error occurred during the RAM check in initialization. Master Unit operation will stop. Replace the Master Unit.

Note

1. With the V0 (original) version of the Master Unit, Master Unit operation would stop with an F4 error code displayed for a PC mounting error. With V1 Master Units, remote I/O communications will stop for PC mounting errors, but Master Unit operation will continue and message communications will be possible. In this case, remote I/O will not be refreshed between the PC and the Master Unit, but software switches and the status area will be refreshed.
2. With the V0 (original) version of the Master Unit, remote I/O communications would continue with the scan list disabled for configuration errors (E8). With V1 Master Units, remote I/O communications will not continue (i.e., I/O will not be refreshed between the PC and the Master Unit) and only software switches and the status area will be refreshed.

Errors Occurring in the Slave Unit

The following table lists probable causes and remedies for errors that occur in the Slave Unit.

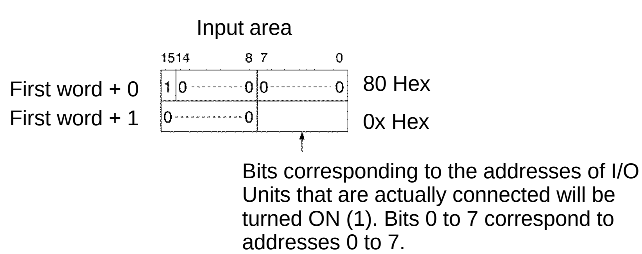
Display/Indicator status		Network status	Probable cause and remedy
MS	NS		
ON (green)	ON (green)	Remote I/O or message communications in progress (normal status)	Remote I/O communications and/or message communications are active on the Network.
ON (green)	OFF	Checking for node address duplication	Checking whether the Unit's node address has been set on another node.
ON (green)	Flashing (green)	Waiting for connection	The Unit is waiting for a connection from the Master Unit.
ON (red)	OFF	Watchdog timer error	A watchdog timer error occurred in the Unit. Replace the Unit.
Flashing (red)	OFF	Incorrect switch settings	A mistake has been made in the switch settings. Check the settings and restart the Slave.
ON (green)	ON (red)	Node address duplication	The Slave Unit's node address has been set on another node. Change the settings to eliminate the duplication and restart the Slave.
ON (green)	ON (red)	Bus Off error detected	The communications controller detected a Bus Off status and communications have been stopped. Check the following and restart the Slave: Master/Slave baud rates, for loose or broken cables, for noise, cable lengths, and Terminating Resistors.
ON (green)	Flashing (red)	Communications timeout	The connection with the Master Unit timed out. Check the following and restart the Slave: Master/Slave baud rates, for loose or broken cables, for noise, cable lengths, and Terminating Resistors.

15-1-4 Normal MULTIPLE I/O TERMINAL Status

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

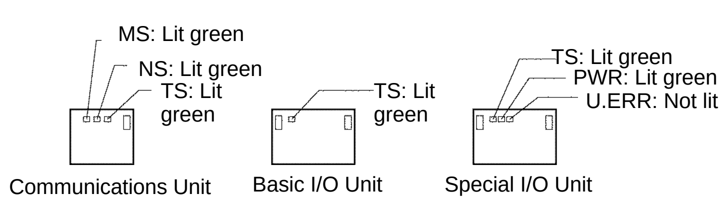
I/O Unit Interface Status

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



Unit Indicators

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

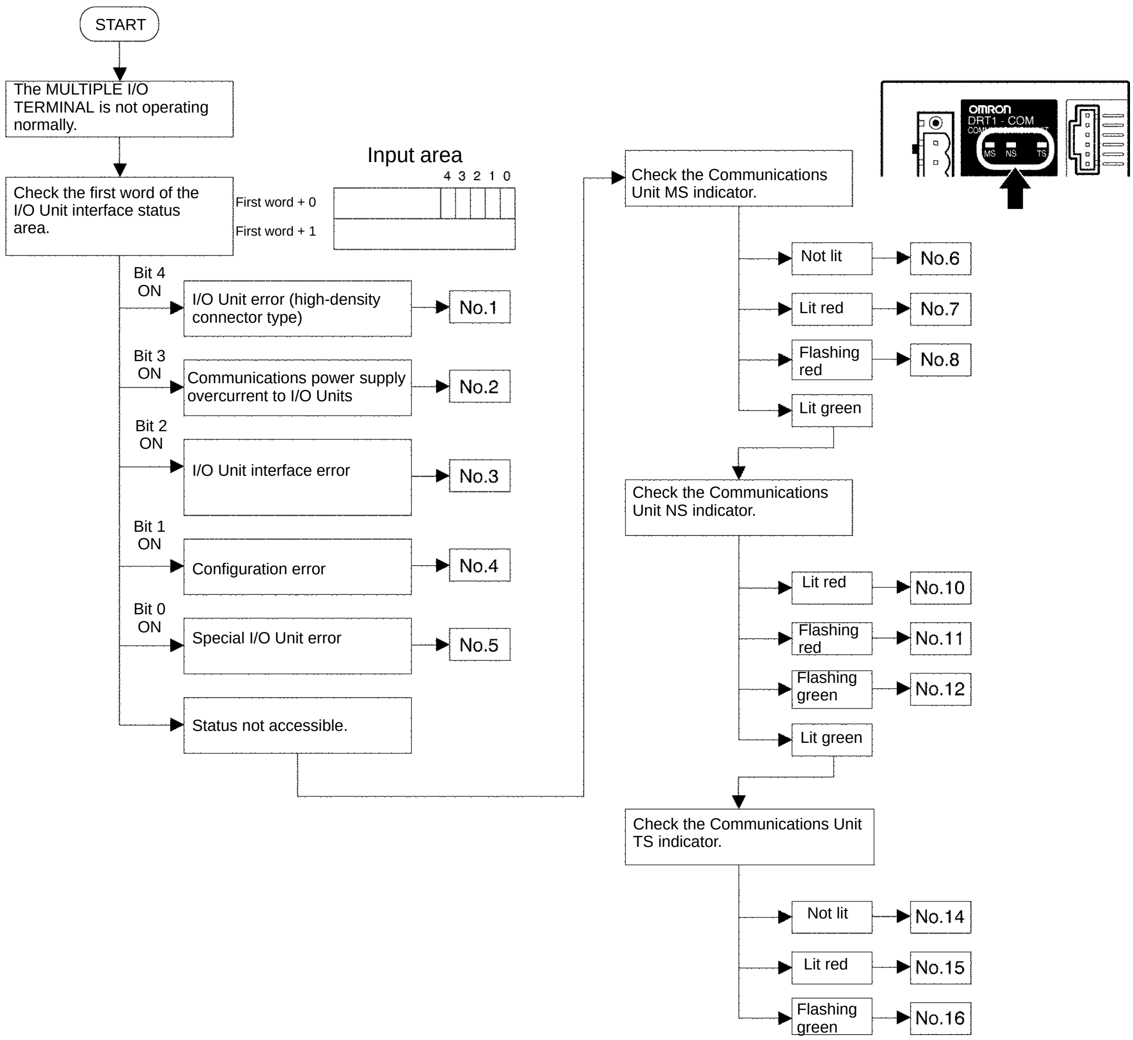


15-1-5 MULTIPLE I/O TERMINAL Troubleshooting

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

Check Flowchart

When an error occurs in a MULTIPLE I/O TERMINAL, use the following flowchart to find the cause of the error, determine its location, and take the appropriate action. The numbers correspond to the numbers in the tables beginning on page 247.



Status Area Error Processing

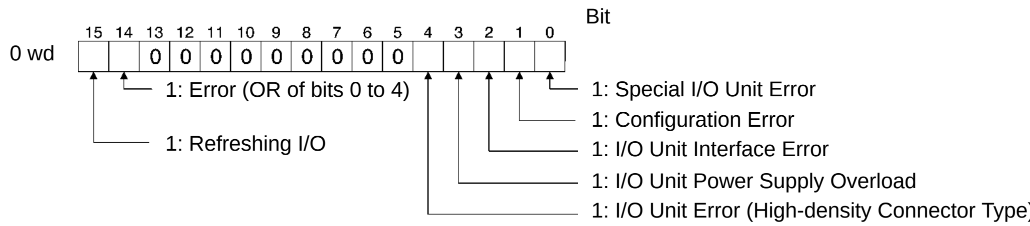
A MULTIPLE I/O TERMINAL status area is available in the first two words of the MULTIPLE I/O TERMINAL input area in the Master. The contents and causes of errors can be found by checking this area.

Status Area Configuration

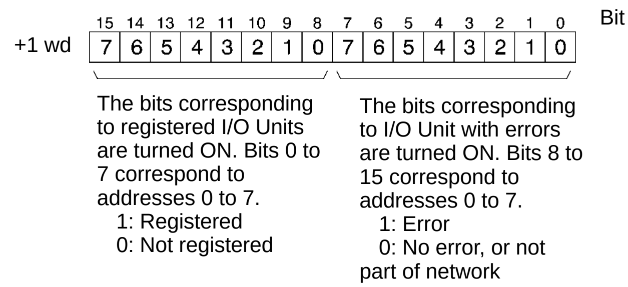
The status area is configured as shown in the following diagram.

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

I/O Unit Connection Information



Error and Registered I/O Unit Addresses



Probable Causes of Errors and Countermeasures

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

No.	Error content	Probable cause	Countermeasure
1	I/O Unit error (high-density connector type)	A hardware error has occurred in an I/O Unit.	Replace the I/O Unit in which the hardware error has occurred.
2	Communications power supply overcurrent to an I/O Unit	The power supply to the I/O Unit interface has shorted.	Check that the I/O Unit communications cable has not shorted.
		The current consumption of the I/O Unit interface exceeds 0.4 A.	Check that the total current consumption of the communications power supply for the I/O Units does not exceed 0.4 A.
			After taking the above measures, restart the Communications Unit. If the problem persists, replace the Communications Unit.
3	I/O Unit interface error	The end connector is not connected.	After turning OFF the power supply to the Communications Unit and all I/O Units, attach the end connector to the I/O Unit interface connector 2 on the terminal I/O Unit.
		The I/O Unit Connecting Cable is broken.	Replace the broken cable.
		There is a lot of noise.	Remove the source of the noise.
		Too many I/O Units are connected.	Connect no more than 8 I/O Units for each Communications Unit.
			After taking the above measures, restart the Communications Unit. If the problem persists, replace the Communications Unit.
4	Configuration error	The I/O Unit configuration was changed while the Communications Unit was turned ON.	After turning OFF the power supply to the Communications Unit and all I/O Units, return to the correct I/O Unit configuration, and restart the Communications Unit. If the problem persists, replace the Communications Unit.
5	Special I/O Unit error	A specific error, such as no operating power supply, has occurred in a Special I/O Unit.	Check the operating power supply, and provide the correct power supply. If the problem persists, replace the Special I/O Unit in which the error occurred.

Troubleshooting via Indicators

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

Indicator Meanings

Unit	Indicator name	Meaning
Communications Unit	NS	Displays the DeviceNet communications status.
	MS	Displays the Communications Unit status.
	TS	Displays the I/O Unit interface status.
Basic I/O Unit	TS	Displays the I/O Unit interface status.
Special I/O Unit	TS	Displays the I/O Unit interface status.
	U.ERR	Displays the Special I/O Unit status.
	PWR	Displays the operating power supply status.

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

Causes and Remedies for Communications Unit MS Indicator Errors

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

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

Causes and Remedies for Communications Unit NS indicator Errors

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

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

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

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

No.	TS indicator status		Cause	Remedy
	Communications Unit	I/O Units		
14	OFF	All I/O Unit TS indicators are not lit.	The power supply to the I/O Unit interface has shorted. The current consumption of the I/O Unit interface exceeds 0.4 A.	Check that the I/O Unit communications cable has not shorted. Check that the total current consumption of the communications power supply for the I/O Unit does not exceed 0.4 A. After taking the above measures, restart the Communications Unit.
			The cable between the Communications Unit and the first I/O Unit is disconnected.	After turning OFF the power supply to the Communications Unit and all I/O Units, correctly connect the cable.
15	ON (red) (I/O Unit interface error)	The TS indicators on the Units closer to the Communications Unit are flashing green and the indicators on the rest of the Units are lit red.	The cable is broken at the Unit where the TS indicator display changes.	After turning OFF the power supply to the Communications Unit and all I/O Units, replace the broken cable.
		All I/O Unit TS indicators are lit red.	The cable between the Communications Unit and the first I/O Unit is broken.	
			There is a lot of noise.	Remove the source of the noise.
		All I/O Unit TS indicators are lit green.	The end connector is not connected.	After turning OFF the power supply to the Communications Unit and all I/O Units, attach the end connector to the I/O Unit interface connector 2 of the terminal I/O Unit.
			The cable connected to the Remote Terminal Unit I/O interface connector 1 is broken.	After turning OFF the power supply to the Communications Unit and all I/O Units, perform a continuity test on the cable, and replace the broken cable.
		The TS indicators on the Units closer to the Communications Unit are flashing green and the indicators on the rest of the Units are not lit.	The I/O Unit configuration changed after the Unit where the TS indicator display changed.	After turning OFF the power supply to the Communications Unit and all I/O Units, return to the correct I/O Unit configuration, and restart the Communications Unit.
			At the last Unit where the green light is flashing, one of the cables is broken.	After turning OFF the power supply to the Communications Unit and all I/O Units, check the connection status of the cable. If the problem persists, replace the cable after turning OFF the power supply to the Communications Unit and all I/O Units.
			I/O Unit interface connector 2 are connected at the Unit where the TS indicator display changed.	After turning OFF the power supply to the Communications Unit and all I/O Units, correctly reconnect the cable.
16	Flashing (green) (Special I/O Unit error)	There is a Special I/O Unit with the TS and U.ERR indicators lit red.	A specific error, such no operating power supply, has occurred in a Special I/O Unit.	Check the operating power supply, and provide the correct power supply. If the problem persists, replace the Special I/O Unit in which the error occurred.

15-2 Error History

Up to 20 records of errors can be set in an error history (error log) in the DeviceNet Master Unit. The error log can be read, cleared, and monitored using FINS commands or a Configurator, as described following.

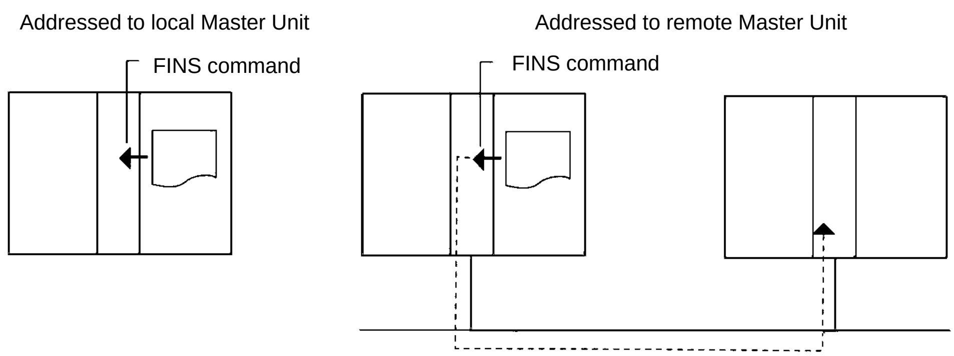
Note The contents of the error history is cleared when power is turned OFF or when the Master Unit is reset.

FINS Commands

The following FINS commands can be sent from a CPU Unit to the Master Unit to read and clear the error history.

- ERROR HISTORY READ, command code 21 02
- ERROR HISTORY CLEAR, command code 21 03

The data that was read can be stored in the DM area of the PC.

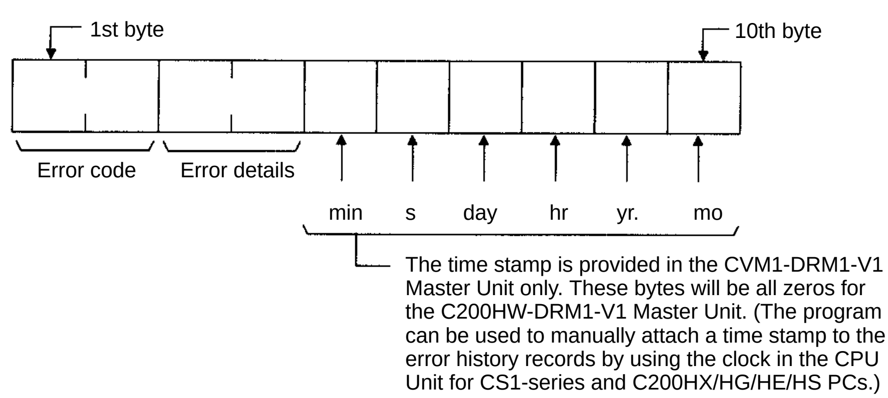


Configurator

The Master error history read operation can be used from the Configurator to monitor the error history. With the Configurator, the error history can only be monitored and the data cannot be saved.

15-2-1 Error History Data

Each record in the error history consists of 10 bytes in the configuration shown in the following diagram. Up to 20 records can be stored in the DeviceNet Master Unit. If more than 20 errors occur, the newest records are stored and the oldest ones are deleted.



Note The time stamp is not provided for any error that occurs during initialization with the PC.

15-2-2 Error Codes

The error codes used in the error history are described in the following table. The error codes cover errors such as destroyed responses for messages communications, which are not displayed on the front-panel indicators.

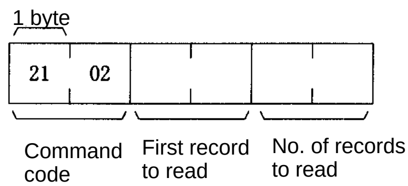
Error code (hex)	Error details		Error		Meaning	7-segment display
0002	Code from 7-segment display on Master Unit	Error node address	PC interface error		Error occurred in PC interface.	F6
0006			Initialization error with PC		Error occurred in initialization with PC.	F5
000B			Routing table error		Error in routing table data.	E5
0101	Destination node address	Frame discriminator (automatically set by system when FINS command is set)	Send response message destroyed	Not in network	The local node is not in network; attempted to send response message, but message was destroyed.	---
0103				Local node not participating	Send error occurred; attempted to send response message, but message was destroyed.	---
0109				Remote node busy	Remote mode was busy; attempted to send response message, but message was destroyed.	---
0112				Illegal header	An illegal header was detected; attempted to send response message, but message was destroyed.	---
0117	Source node address		Receive response message destroyed	Reception buffer full	The internal reception buffer in the local node was full; attempted to receive response message, but message was destroyed.	---
0118				Illegal message	An illegal message was received and destroyed.	---
0119	Destination node address		Send response message destroyed	Local node busy	Local mode was busy; attempted to send response message, but message was destroyed.	---
0701	Code from 7-segment display on Master Unit	Error node address	Configuration error		A configuration data error occurred.	E8
0702			I/O area overlap		Words in the Slave I/O areas are overlapping.	d0
0703			I/O area range exceeded		An I/O area is outside the valid areas.	d1
0704			Unsupported Slave		An unsupported Slave is connected.	d2
0705			Verification error: Slave missing		A Slave registered in the scan list is not connected to the network.	d5
0706			Verification error: Slave I/O size differs		The I/O capacity of a Slave does not agree with the information in the scan list.	d5
0707			Communications error		An error occurred in remote I/O communications.	d9
0708			Scan list operation failed		It was not possible to perform a scan list operation.	C0 to C5
0709			PC mounting error		A PC mounting error has occurred.	E4
0781			Node address duplication		The same node address is allocated to two nodes.	F0
0782			Bus Off detected		A Bus Off status was detected.	F1
0783			No communications power supply		The communications power is not being supplied.	E0
0784			Send timeout		A send timeout occurred.	E2

Note When monitoring the error history from the Configurator, the information in the "Meaning" column is also displayed.

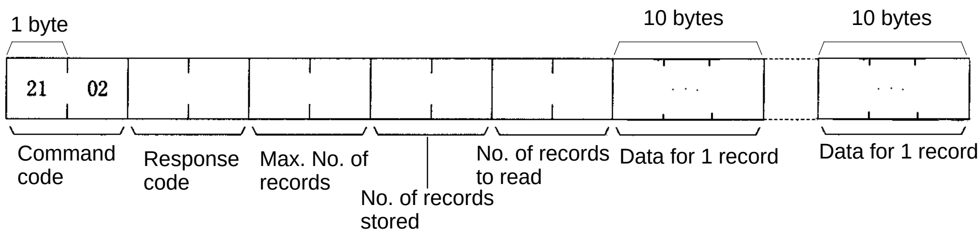
15-2-3 FINS Commands for Error Histories

ERROR HISTORY READ

Command Block

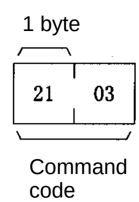


Response Block

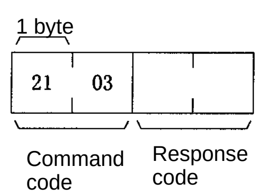


ERROR HISTORY CLEAR

Command Block



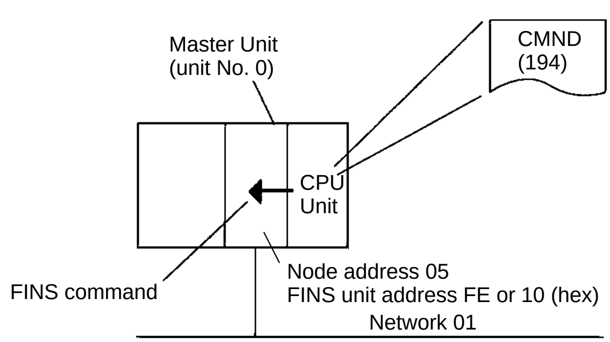
Response Block



15-2-4 Programming Examples

This section describes how to read the error history data from the Master Unit and store it in the DM area of the PC. Examples are given for both CVM1/CV-series PCs and C200HX/HG/HE PCs.

CVM1 and CV-series PCs: Using CMND(194)



The program reads 20 records of error history data from the Master Unit, stores the data, and then clears the error history. This process is repeatedly executed. The ERROR HISTORY READ (21 02) and ERROR HISTORY CLEAR (21 03) commands are used.

The ERROR HISTORY READ command is stored in memory starting from D01000 and the ERROR HISTORY CLEAR command is stored starting from D01003. The responses for both commands are stored starting at D02000. The error records starting at D02005 are moved one record at a time (10 bytes or 5 words) starting at D00098 using indirect addressing. When 20 records have been read out, they are moved to D00100 to D00199. When a total of 20 records have been stored in memory, the previous records are overwritten starting at D00100. (Because the data is in the DM area, it will be preserved even if power is turned OFF.)

If the ERROR HISTORY READ command ends in an error, the response code is stored in D00006. If there are not 20 records in the Master Unit when ERROR HISTORY READ is executed, a 11 04 response code will be returned. In this case, the response code is not treated as an error and normal processing continues.

Command Details

The following commands are used: [CMND(194) S D C]

Reading the Error History

S = D01000: First command word at local node
Settings (hex)
D01000 = 2102: Command Code
D01001 = 0000: Command parameters
D01002 = 0014: Command parameters to read 20 records

D = D02000: First response word at local node
C = D00000: First control word
Settings (hex).

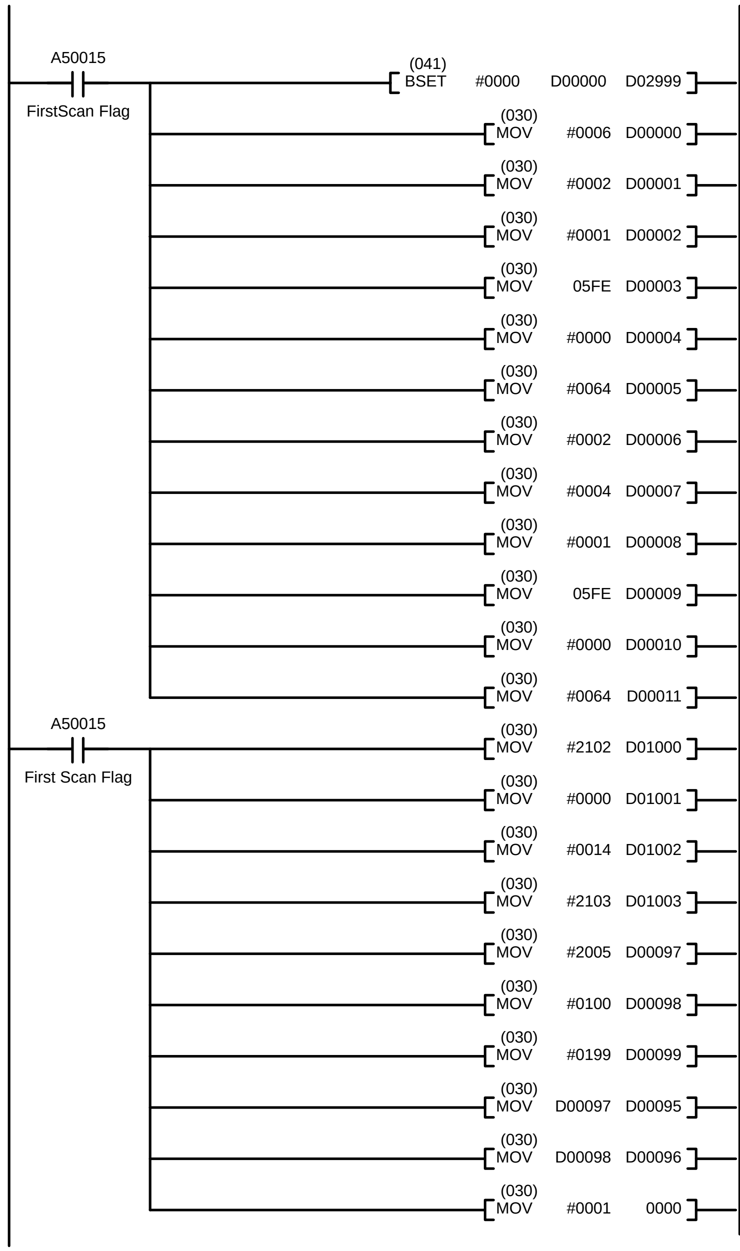
D00000 = 0006: Number of command bytes
D00001 = 00D2: Number of response bytes
D00002 = 0001: Destination network address (01)
D00003 = 05FE: Destination node address (05)
Destination FINS unit address (FE = Master Unit)
D00004 = 0000: Response, communications port 0, no retries
D00005 = 0064: Response monitoring time

Clearing the Error History

S = D01003: First command word at local node
Settings (hex)
D010003= 2103: Command Code

D = D02000: First response word at local node
C = D00006: First control word
Settings (hex).

D00006 = 0002: Number of command bytes
D00007= 0004: Number of response bytes
D00008 = 0001: Destination network address (01)
D00009 = 05FE: Destination node address (05)
Destination FINS unit address (FE = Master Unit)
D00010= 0000: Response, communications port 0, no retries
D00011= 0064: Response monitoring time



Sets 0000 in D00000 to D02999.

Place data into control data words to specify reading 20 records from the error history from the Master Unit at node 05 of network 01.

Place data into control data words to specify clearing the error history from the Master Unit at node 05 of network 01.

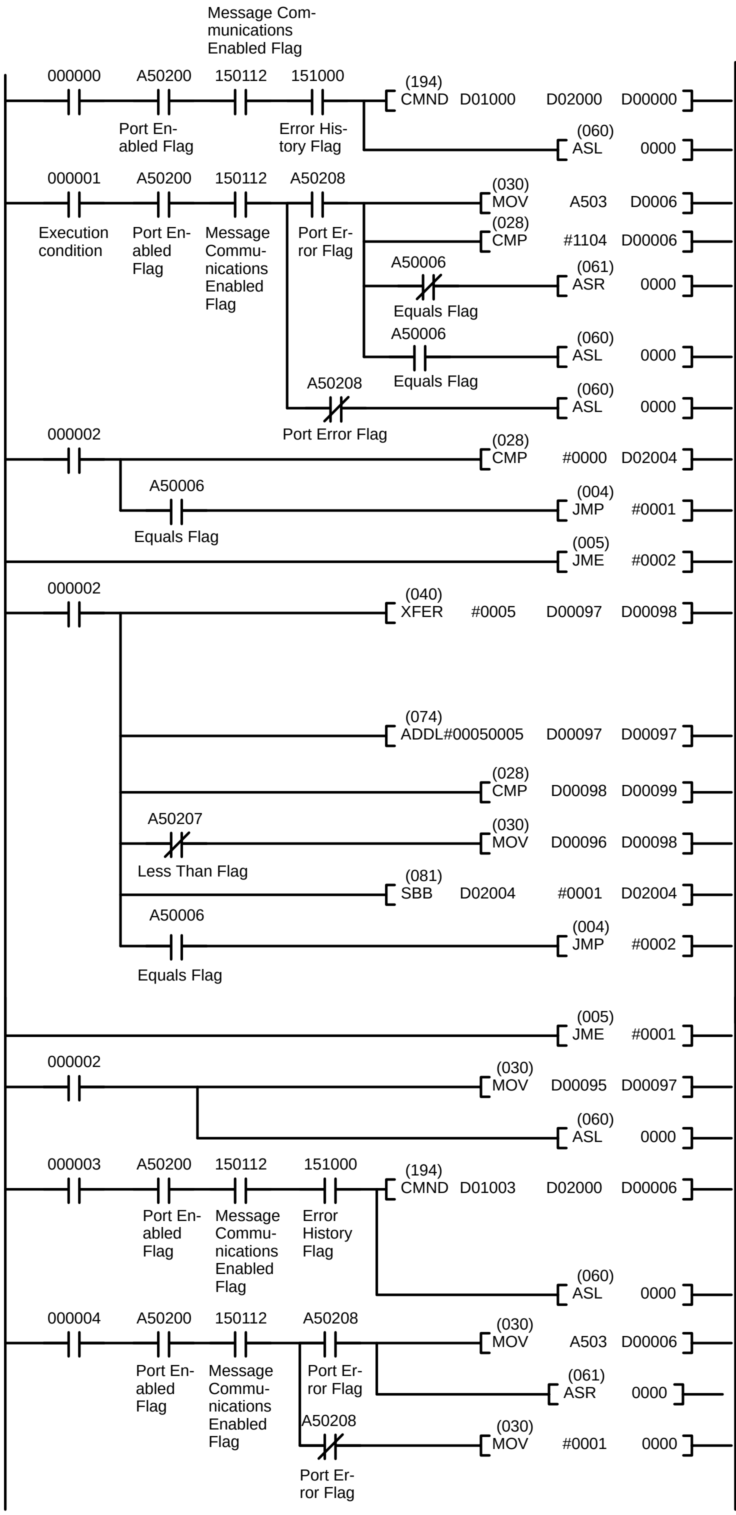
Place the command data for ERROR HISTORY READ into D01000 to D01002.

Places the command data for ERROR HISTORY CLEAR into D01003.

Place 2005, 0100, and 0199 into D00097, D00098, and D00099 to use D02005, D00100, and D00199 as the initial addresses for indirectly addressing storing the response code, the first error history data word, and the last error history data word, respectively.

Transfer the contents of D00097 and D00098 to D00095 and D00096.

Sets the contents of CIO 0000 to 0001.



Reads 20 records from node 05 in network 01 and stores the data beginning at D02000. Control data is specified starting at D00000.

Shifts 0000 one bit to the left to turn ON CIO 000001.

Stores the completion code in A503 to D00006, compares it with 1104 and then turns ON CIO 000000 by shifting CIO 0000 one bit to the right to retry the command or turns ON CIO 000002 by shifting CIO 0000 one bit to the left.

Shifts the contents of CIO 0000 one bit to the left to turn ON CIO 000002.

Compares the contents of D02004 to 1104 jumps according to the results, i.e., to JME #0001 if the Equals Flag is ON.

Uses indirect addressing with D00097 and D00098 to store 5 words of data in consecutive words (removing the error history data from the response data).

Adds the contents of D00097 to 00050005 and stores the results in D00097 and D00098.

Compares the contents of D00098 and D00099 and moves the contents of D00096 to D00098 if the results is “less than.”

Subtracts 0001 from the contents of D02004.

Jumps to JME #0002 if contents of D02004 is 0000.

Moves the contents of D00095 to D00097.

Shifts 0000 one bit to the left to turn ON CIO 000003.

Clears the error history from node 05 in network 01 and stores the response data beginning at D02000. Control data is specified starting at D00006.

Shifts the contents of CIO 0000 one bit to the left.

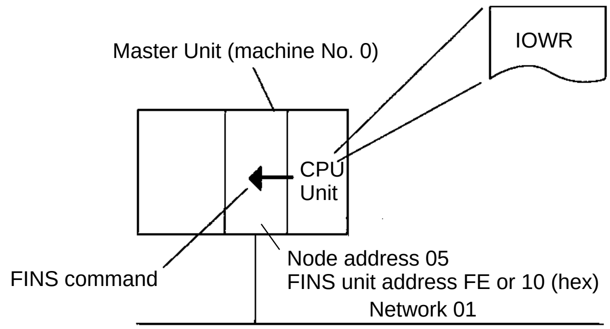
Stores the completion code in D00006

Shifts 0000 one bit to the right to turn ON CIO 000003 to retry the command.

Sets 0001 to CIO 0000 to read the contents of the data history again.

C200HX/HG/HE PCs: Using IOWR

The following explanation also applies to CS1-series PCs. Note, however, that I/O memory addresses and specification methods for the 3rd operand of IOWR instructions are different.



The program reads 20 records of error history data from the Master Unit, stores the data, and then clears the error history. This process is repeatedly executed. The ERROR HISTORY READ (21 02) and ERROR HISTORY CLEAR (21 03) commands are used.

The ERROR HISTORY READ command is stored in memory starting from DM 1000 and the ERROR HISTORY CLEAR command is stored starting from DM 1010. The responses for both commands are stored starting at DM 2000. The error records starting at DM 2005 are moved one record at a time (10 bytes or 5 words) starting at DM 0098 using indirect addressing. When 20 records have been read out, they are moved to DM 0100 to DM 0199. When a total of 20 records have been stored in memory, the previous records are overwritten starting at DM 0100. (Because the data is in the DM area, it will be preserved even if power is turned OFF.)

Time stamps are not provided in the error history data for the C200HW-DRM21-V1 Master Unit. Thus, each time 5 words are read out, the time data from the CPU Unit is used to overwrite the time data from the error history (which is all zeros when read out).

If the ERROR HISTORY READ command ends in an error, the response code is stored in DM 0006. If there are not 20 records in the Master Unit when ERROR HISTORY READ is executed, a 11 04 response code will be returned. In this case, the response code is not treated as an error and normal processing continues.

Command Details

The following command is used: [IOWR C S D]

Reading the Error History

C = DM 0000: Control word

Settings (hex)

DM 0000 = 05FE: Response
Destination node address: 05
Destination FINS unit address: FE (Master Unit)

S = DM 1000: First source word

Settings (hex)

DM 1000 = 8207:	First response word: DM 2000
DM 1001 = D000:	Rest of first response word
DM 1002 = 0064:	Response monitoring time
DM 1003 = 0006:	No. of command bytes
DM 1004 = 2102:	Command code
DM 1005 = 0000:	Command parameters
DM 1006 = 0014:	Command parameters to read 20 records

D = #0007: Destination information

Destination machine number: 00 (hex)

No. of words to transfer: 07 (BCD)

Clearing the Error History

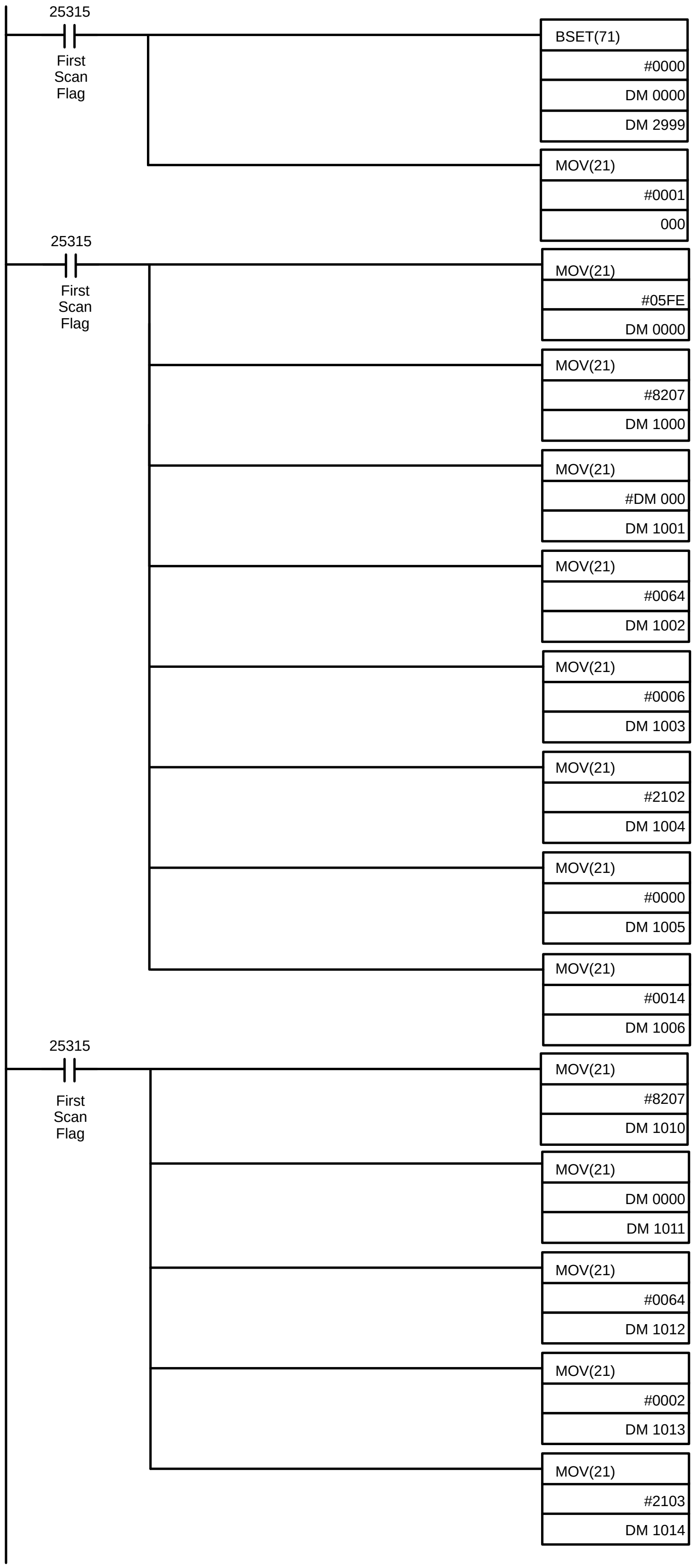
C = DM 0000: Control word

Settings (hex)
DM 0000 = 05FE: Response
Destination node address: 05
Destination FINS unit address: FE (Master Unit)

S = DM 1010: First source word

Settings (hex)
DM 1010 = 8207: First response word: DM 2000
DM 1011 = D000: Rest of first response word
DM 1012 = 0064: Response monitoring time
DM 1013 = 0002: No. of command bytes
DM 1014 = 2103: Command code

D = #0005: Destination information
Destination machine number: 00 (hex)
No. of words to transfer: 05 (BCD)



Sets 0000 in DM 0000 to DM 2999.

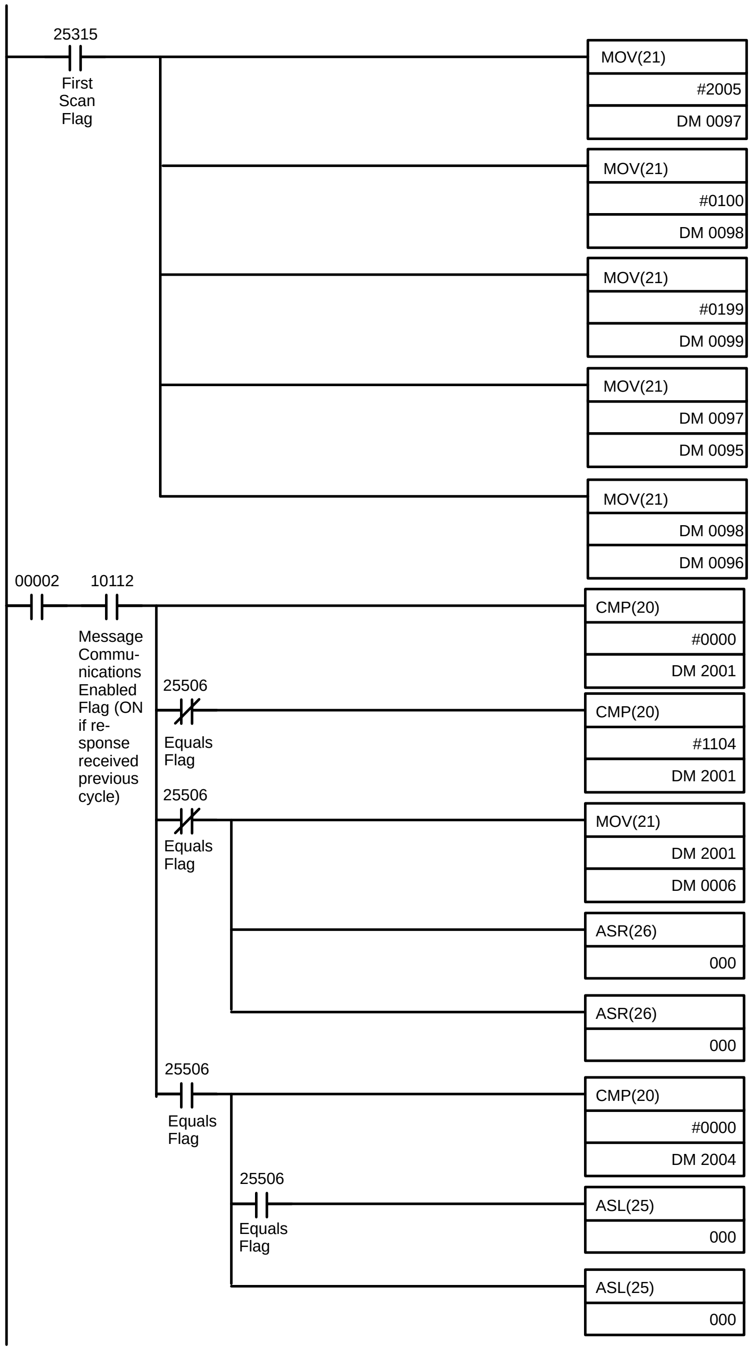
Sets the contents of IR 000 to 0001.

Place data into control data words to specify reading 20 records from the error history from the Master Unit at node 05 of network 01.

Place the command data for ERROR HISTORY READ into DM 1004 to DM 1006.

Place data into control data words to specify clearing the error history from the Master Unit at node 05 of network 01.

Places the command data for ERROR HISTORY CLEAR into DM 1013 and DM 1014.



Place 2005, 0100, and 0199 into DM 0097, DM 0098, and DM 0099 to use DM 2005, DM 0100, and DM 0199 as the initial addresses for indirectly addressing storing the response code, the first error history data word, and the last error history data word, respectively.

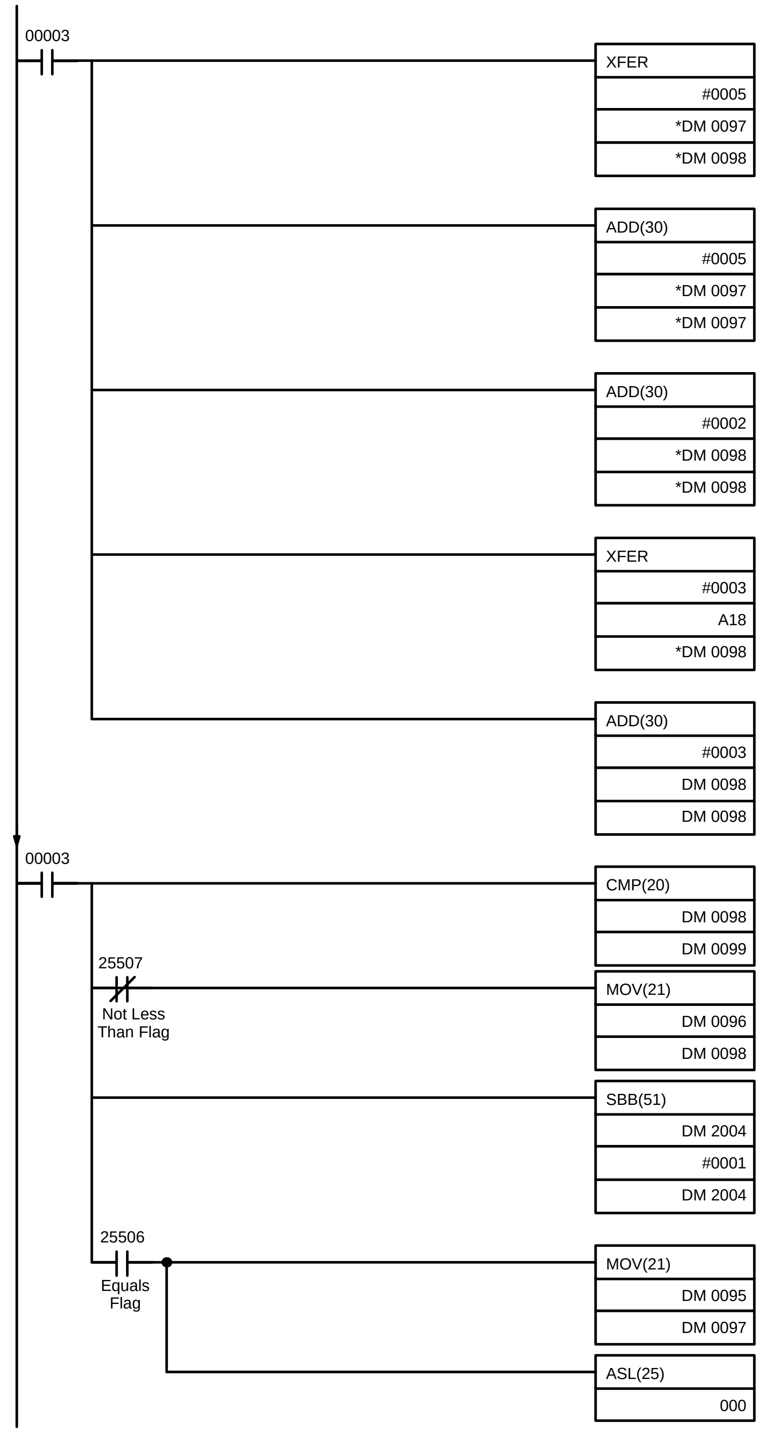
Transfer the contents of DM 0097 and DM 0098 to DM 0095 and DM 0096.

Compares the contents of DM 2001 to 0000 each cycle if the IOWR instruction execution and message communications (reception of the response) have been completed.

If an error response is returned, compares the contents of DM 2001 to the error code 1104.

If the error code is not 1104 (i.e., if the error is not insufficient records), then the contents of DM 2001 is moved to DM 0006 and the contents of IR 000 are shifted to the right twice to torn ON IR 00000 and then IR 00001 to retry the command.

Compares the contents of DM 2004 (number of records read) to 0000 if the command ended normally. The contents of IR 000 are then shifted to the left once to indicate that records were read and twice to indicate that no records were read.



Uses indirect addressing with DM 0097 and DM 0098 to store 5 words of data in consecutive words (removing the error history data from the response data).

Adds 0005 to the contents of DM 0097 to move to the next 5 words.

Adds 0002 to the contents of DM 0098 to change to the address to the next word after the error code and error details.

Uses indirect addressing with DM 0098 to store the time stamp from the CPU Unit's clock in AR 18 to AR 20.

Shifts the contents of IR 000 one bit to the left.

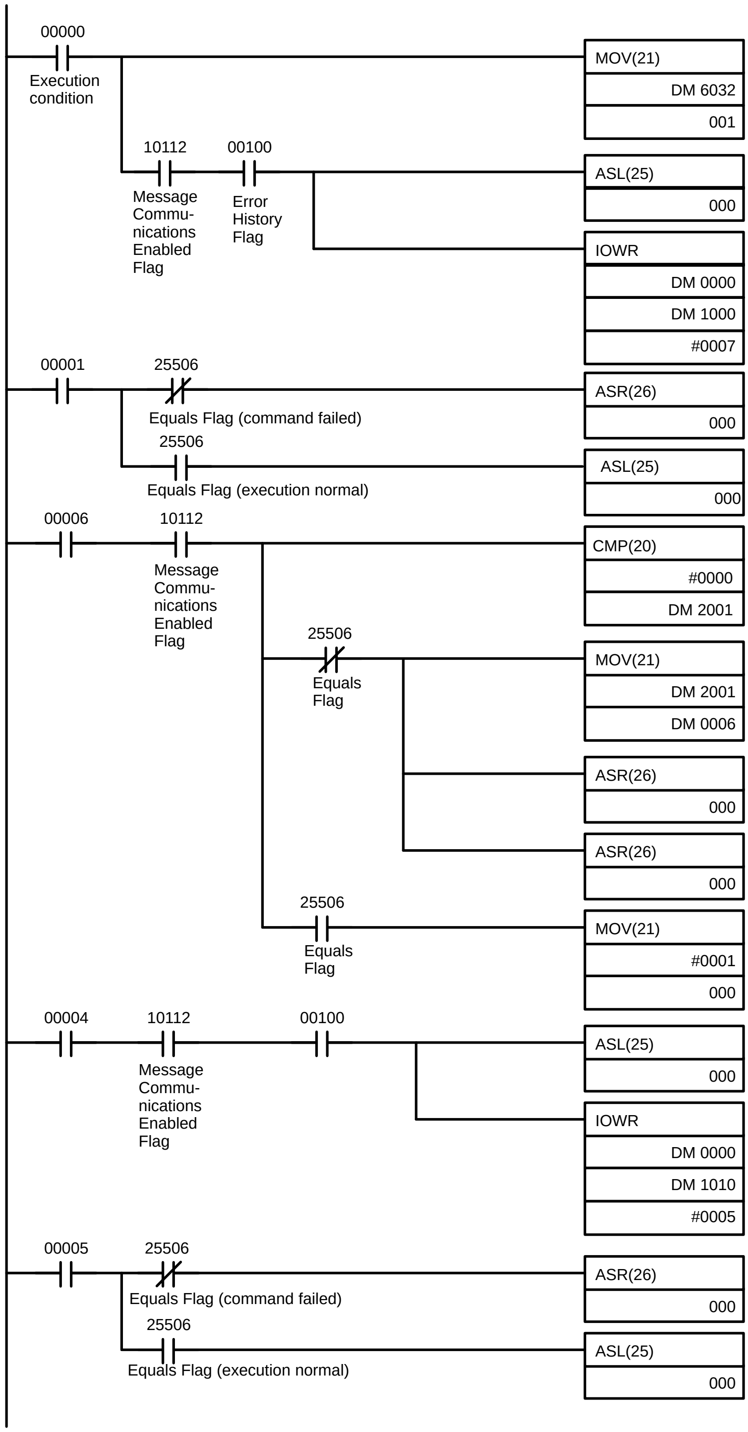
Adds 0003 to the contents of DM 0098 to change to the address to the next word after the time stamp.

Compares the contents of DM 0098 an DM 0099.

Moves the contents of DM 0096 to DM 0098.

Subtracts 0001 from the contents of DM 2004.

Moves the contents of DM 0095 to DM 0097 and shifts the contents of IR 000 one bit to the left to turn ON IR 00004 (to turn ON the execution condition for clearing the error history).



Moves the contents of DM 6032 (Master Status Area 2 for Unit 00) to IR 001.

Shifts the contents of IR 000 one bit to the left to turn ON IR 000001.

Transfers seven words of command data from DM 1010 at the local node to the Master Unit (Unit #0).

Shifts the contents of IR 000 one bit to the right to turn ON IR 000000 and retry the read command, or shifts the contents of IR 000 one bit to the left to turn ON IR 000002.

Compares the contents of DM 2001 to 0000.

Moves the contents of DM 2001 to DM 0006.

Shifts the contents of IR 000 one bit to the right to turn ON IR 000005 and then shifts it one more bit to turn ON IR 000004 to retry the clear command.

Places 0001 into IR 000 to repeat processing from the error history read.

Shifts the contents of IR 000 one bit to the left to turn ON IR 000005.

Transfers five words of command data from DM 1010 at the local node to the Master Unit (Unit #0).

Shifts the contents of IR 000 one bit to the right to turn ON IR 000004 to retry the clear command or shifts the contents of IR 000 one bit to the left to turn ON IR 000006.

15-3 Troubleshooting

15-3-1 Master Unit Troubleshooting

The indicators of a Master Unit connected to a C200HX, C200HG, C200HE, or C200HS PC will indicate when an error has occurred. Check the Master Unit's indicators and perform the error processing described in the following table.

When an error occurs in a Slave, the Slave can be identified from the status of the Master's indicators or from the status flags in the PC's Special I/O Unit area.

PC Error (CVM1-DRM21-V1)

Use the following table to troubleshoot errors in a PC that has a CVM1-DRM21-V1 Master Unit installed. Refer to the *CV-series PCs Operation Manual: Ladder Diagrams* for more details.

Error	Probable cause
An I/O verification error occurred.	• Make sure that the Unit is connected properly. • Check the I/O table with the I/O Table Verification operation and correct it if necessary. After correcting it, perform the I/O Table Create operation.
A CPU Bus Unit setting error occurred.	• Make sure that the Master's unit number setting is correct. The acceptable unit number range is 00 to 15. • Check the I/O table with the I/O Table Verification operation and correct it if necessary. After correcting it, perform the I/O Table Create operation.
A CPU Bus Unit error occurred.	• Make sure that the Unit is connected properly. • Restart the Unit. Replace the Unit if it doesn't restart.
A CPU Bus error occurred.	• Make sure that the Unit is connected properly.

PC Error (C200HW-DRM21-V1)

Use the following table to troubleshoot errors in a PC that has a C200HW-DRM21-V1 Master Unit installed. Refer to the *CS1 Series Operation Manual, C200HX, C200HG, and C200HE Operation Manual* or *C200HS Operation Manual* for more details.

Error	Probable cause
An I/O verification error occurred.	• Check the I/O table with the I/O Table Verification operation and correct it if necessary. After correcting it, perform the I/O Table Create operation.
An I/O set error occurred.	• Check the I/O table with the I/O Table Verification operation and correct it if necessary. After correcting it, perform the I/O Table Create operation.
An I/O unit over error occurred.	• Make sure that the Master's unit number setting is correct. The acceptable unit number ranges are as follows. CS1G-CPU□□ 0 to F CS1H-CPU□□ 0 to F C200HX-CPU3□-E/CPU4□-E: 0 to 9 C200HX-CPU5□-E/CPU6□-E: 0 to F C200HG-CPU3□-E/CPU4□-E: 0 to 9 C200HG-CPU5□-E/CPU6□-E: 0 to F C200HE-CPU11-E/CPU32-E/CPU42-E: 0 to 9 C200HS-CPU□□-E: 0 to 9 • Make sure that the Slave's unit number hasn't been set on any other Special I/O Units.
A Special I/O Unit error occurred.	• Make sure that the Unit is connected properly. • Check to see if the IOWR instruction was executed with the Message Communications Enabled Flag turned ON. • Restart the Unit. Replace the Unit if it doesn't restart.
An I/O Bus error occurred.	• Make sure that the Unit is connected properly.

No I/O Data Communications

Use the following table to troubleshoot the network when I/O data communications won't start. (The I/O Data Communications Flag remains OFF.)

Error	Probable cause
All of the Master's indicators are OFF.	• Check whether power is being supplied to the PC. • Check whether the Master Unit is mounted in the Backplane correctly. • When a watchdog timer (WDT) error has occurred in the PC, follow the procedures described in the PC's manual to correct the problem. • All of the indicators will be OFF when a Special I/O Unit error has occurred with the C200HW-DRM21-V1. Restart the Unit. Replace the Unit if it doesn't restart.
The Master's MS indicator is ON and green, but the NS indicator remains OFF. (The NS indicator normally goes ON 2 s after the MS indicator.)	• If the Master's 7-segment display is displaying an error code, refer to the tables in *15-1-3 Identifying Errors from the Indicators*. • Make sure that the C200HW-DRM21-V1 Master's unit number setting is correct. The acceptable unit number ranges are as follows. CS1G-CPU☐☐ 0 to F CS1H-CPU☐☐ 0 to F C200HX-CPU3☐-E/CPU4☐-E: 0 to 9 C200HX-CPU5☐-E/CPU6☐-E: 0 to F C200HG-CPU3☐-E/CPU4☐-E: 0 to 9 C200HG-CPU5☐-E/CPU6☐-E: 0 to F C200HE-CPU11-E/CPU32-E/CPU42-E: 0 to 9 C200HS-CPU☐☐-E: 0 to 9 • Make sure that the Slave's unit number hasn't been set on any other Special I/O Units. • With a C200HW-DRM21-V1 Master, check the I/O table with the I/O Table Verification operation and correct it if necessary. After correcting it, perform the I/O Table Create operation. Restart the Unit. Replace the Unit if it doesn't restart.
The Master's MS indicator is ON and green, but the NS indicator continues to flash green. (The NS indicator normally goes ON 2 s after the MS indicator.)	• If the Master's 7-segment display is displaying an error code, refer to the tables in *15-1-3 Identifying Errors from the Indicators*. • Restart the Unit. Replace the Unit if it doesn't restart.
The Master's MS and NS indicators are ON and green, but the 7-segment display continues to flash the Master's node address. (The node address normally stops flashing within 8 s after the NS lights.)	• Check that the Master's baud rate matches the baud rates set on all of the Slaves. If they don't match, set all of the baud rates to the same value. • Make sure that there are121-Ω terminators connected at both ends of the trunk line. Connect 121-Ω terminators if the wrong resistance is being used. • Check whether all of the Slaves' settings are correct. See *7-11 Operations Checklist* for details. • Check whether the communications cables are wired correctly. See *7-11 Operations Checklist* for details. • Check whether the power supply is set correctly. See *7-11 Operations Checklist* for details. • Check for broken wires in the communications and power supply cables attached to the connectors. • Check whether the Slaves are operating properly. When an OMRON Slave is being used, refer to the troubleshooting tables in *15-3-2 Slave Unit Troubleshooting*. If another company's Slave is being used, refer to that Slave's user's manual.

I/O Link Problems

Use the following table to troubleshoot I/O Link problems.

Error	Probable cause
The I/O isn't simultaneous.	Observe the following points when writing application programs: • The simultaneity of node-units of data is ensured between the PC and Master Unit. • In OMRON Slaves, the simultaneity of word-units of data is ensured. • If another company's Slave is being used, refer to that Slave's user's manual for details.
At startup, OFF outputs are output from the Slaves.	When the Master is operating with the scan list disabled and the PC is set to maintain the status of I/O area bits, those held output points will be output from the Output Slaves at startup. Be sure to perform the Create Scan List operation and operate the Master with the scan list enabled. Refer to the PC's Operation Manual for details on the IOM Hold Bit (CS1 Series, CVM1, and CV Series) or I/O Status Hold Bit (C200H☐).

Communications Error Setting Problems

Use the following table to correct problems with the "Continue/Stop Communications for Error" DIP switch setting.

Error	Probable cause
Communications are stopped even though there is no communications error.	When the DIP switch's "Continue/Stop Communications for Error" pin is ON, communications will be stopped if a communications error, transmission timeout, or network power supply error occurs. While communications are stopped, the 7-segment displays will alternately display error code A0 and the error code of the communications error that caused the stoppage. After a network power supply error or transmission timeout is corrected, the indicators will show just the communications stoppage code (A0).
Communications are stopped by the DIP switch setting, but don't resume after toggling the Clear Communications Error Stoppage Bit.	When communications can't be restarted with Slaves that were communicating normally before the stoppage, stop the communications again. Check that the Slave has started up and perform the "clear communications error stoppage" operation. It may be necessary to perform the operation twice if the network contains another company's Slave that takes a long time to join the network.

Scan List Problems

Use the following table to troubleshoot scan list problems.

Error	Probable cause
A scan list couldn't be created by the "create scan list" operation. A scan list couldn't be cleared by the "clear scan list" operation.	Neither the create scan list nor clear scan list operations can be performed until the I/O Data Communications flag goes ON. (There is a delay after the power is first turned ON and after the scan list clear operation is executed.) Make sure that the I/O Data Communications flag is ON before attempting to execute the create scan list or clear scan list operations.
The "create scan list" or "clear scan list" operation was executed, but the Master's 7-segment displays still display "- -". (The "- -" display usually lasts for 1 s after the "create scan list" operation or 0.1 s after the "clear scan list" operation.)	Restart the Master Unit, execute the clear scan list operation, and then the create scan list operation if necessary. Replace the Master Unit if this doesn't correct the problem.

15-3-2 Slave Unit Troubleshooting

Red Indicator (ON or Flashing)

Use the following table to troubleshoot problems in a Slave that has a red indicator that is ON or flashing.

Error	Probable cause
The MS indicator is a constant red.	The Slave Unit is faulty. Replace the Unit.
The MS indicator is flashing red.	• Check that the Slave's baud rate setting is correct. The setting must be 125 kbps, 250 kbps, or 500 kbps. Restart the Unit after changing the baud rate. • Replace the Unit if the MS indicator continues to flash red even though the baud rate setting is correct.
After the MS indicator turns green, the NS indicator doesn't flash green - it turns red immediately.	Restart the faulty Slave Unit after checking the following points. • Make sure that the Master and Slaves baud rate settings all match. If they don't match, set all of the baud rates to the same value. • Check for a node address duplication. If necessary change the node address settings so that each node has a unique number. • See the troubleshooting steps below under the error heading: "The NS indicator lights green but turns red after a short time." • Check whether all of the Slaves' settings are correct. See *7-11 Operations Checklist* for details. • If a particular Slave's NS indicator is always red, replace that Slave.
The NS indicator lights green but turns red after a short time **or** The NS indicator lights green but starts flashing red after a short time.	Restart the faulty Slave Unit after checking the following points. • Make sure that there are121-Ω terminators connected at both ends of the trunk line. Connect 121-Ω terminators if the wrong resistance is being used. • Check whether all of the Slaves' settings are correct. See *7-11 Operations Checklist* for details. • Check whether the communications cables are wired correctly. See *7-11 Operations Checklist* for details. • Check whether the power supply is set correctly. See *7-11 Operations Checklist* for details. • Check all the nodes for broken wires in the communications and power supply cables attached to the connectors. • Check whether power is correctly supplied to the network. • If there is nearby equipment that generates electrical noise, take steps to shield the Master, Slaves, and communications cables from the noise. • If an error has occurred with OMRON's Master Unit, refer to *15-1 Indicators and Error Processing* or *15-3-1 Master Unit Troubleshooting*. If an error has occurred in a Master Unit supplied by another maker, refer to the relevant user's manual. • If a particular Slave's NS indicator is always red, replace that Slave.

Trouble Adding a Slave to the Network

Use the following table to troubleshoot problems in adding a Slave to the network.

Error	Probable cause
The NS indicator remains OFF.	• Check if the baud rate of the Master Unit coincides with that of the Slave Unit. If the baud rates are different, correct the baud rate of the Slave Unit. • Check that the Slave's connector is connected correctly. • Check whether the communications power supply is supplying 24 VDC. • Make sure that the Master is operating properly. When using an OMRON Master, refer to the troubleshooting tables in *15-1-3 Identifying Errors from the Indicators* or *15-3-1 Master Unit Troubleshooting*. When using another company's Master Unit, refer to that Master's user's manual. • Check whether the communications cables are wired correctly. See *7-11 Operations Checklist* for details. • Check whether the power supply is set correctly. See *7-11 Operations Checklist* for details. • Check for broken wires in the communications and power supply cables attached to the connectors.
The NS indicator continues to flash green.	• Make sure that the Master is operating properly. When using an OMRON Master, refer to the troubleshooting tables in *15-1-3 Identifying Errors from the Indicators* or *15-3-1 Master Unit Troubleshooting*. When using another company's Master Unit, refer to that Master's user's manual. • Check whether the Slave is registered in the Master's scan list. If an OMRON Master Unit is being used, a new Slave can't be added to the network if the Master is operating with the scan list enabled. First perform the clear scan list operation, check that the Slave has joined the network, and then perform the create scan list operation. If another company's Master Unit is being used, refer to that Master's user's manual for details on adding a new Slave to its scan list.

Error	Probable cause
The NS indicator alternates between being green and flashing green, or alternates between flashing red and flashing green.	• When using an OMRON Master, check the following items and perform the necessary error processing steps. → Register the scan list again. (After performing the clear scan list operation, check that the Slave has joined the network and perform the create scan list operation.) → Make sure that the Slave's allocated I/O area doesn't overlap with that of another Slave. If there is an overlap, change the Slave's node address to eliminate it. → Make sure that the allocated I/O area doesn't exceed the allowed range shown below: C200HW-DRM21-V1 Output: IR 050 to IR 099 Input: IR 350 to IR 399 If the I/O area exceeds this range, change the Slave's node address to correct the problem. • When using another company's Master Unit, check that the I/O size registered in the Master's scan list matches the actual I/O size of the Slave. The I/O size is recorded in the following attributes of the connection object: Interface 2 (Polled I/O Connection) Produced Connection size (Input size) Consumed Connection size (Output size) and: Interface 3 (Bit strobed I/O Connection) Produced Connection size (Input size) See *Appendix C Multi-vendor Usage* for details and record the correct value in the Master's scan list. Refer to the Master's manual for details on registering the values.

15-3-3 Analog Input Unit Troubleshooting

DRT1-AD04

Error	Probable cause
The AD converted data is FFFF.	The Analog Input Terminal's open-circuit detection function is activated when the input range is set to 1 to 5 V and the voltage drops below 0.8 V or the input range is set to 4 to 20 mA and the current drops below 3.2 mA. The converted data is set to FFFF when the open-circuit detection function is activated. Check the Analog input's cables for broken wires or incorrect wiring. When the input signal rises above 0.8 V or 3.2 mA, the converted data will automatically return to its normal range.

DRT1-AD04H

Error	Probable cause
The AD converted data is 7FFF when the disconnection indicator is lit.	The Analog Input Terminal's open-circuit detection function is activated when the input range is set to 1 to 5 V and the voltage drops below 0.8 V or the input range is set to 4 to 20 mA and the current drops below 3.2 mA. The converted data is set to FFFF when the open-circuit detection function is activated. The disconnection indicator will be lit at the same time. Check the Analog input's cables for broken wires or incorrect wiring. When the input signal rises above 0.8 V or 3.2 mA, the converted data will automatically return to its normal range. The disconnection indicator will go out at the same time.

15-3-4 Temperature Input Terminal Troubleshooting

Use the following table to troubleshoot problems in the Temperature Input Terminal.

Error	Probable cause
The temperature data is 7FFF when the disconnection indicator is lit.	Check the temperature sensor cables for broken wires or incorrect wiring. Check that input cables are wired properly. Check that the cold junction compensator is connected properly (applicable to the DRT1-TS04T only).

15-3-5 C200H I/O Link Unit Troubleshooting

When an error occurs in the C200H I/O Link Unit and the error code is displayed by the 7-segment display, use the following table to troubleshoot the problem. If the error code is not shown on the 7-segment display, use the table under the heading *Identifying Errors from Symptoms* to troubleshoot the problem.

Identifying Errors from Seven-segment Display

Display	Probable cause	Possible remedy
C0	Attempt was made to set the Link Area when the PC is not in PROGRAM mode.	1. Turn OFF bit 00 of the software switches. 2. Switch the PC's operating mode to PROGRAM mode. 3. Turn ON bit 00 of the software switches again.
C3	Invalid setting values in Link Area.	1. Turn OFF bit 00 of the software switches. 2. Check the area settings, address settings, and size settings, and correct if necessary. 3. Turn ON bit 00 of the software switches again.
D9	Timeout error in communications with Master Unit. • The Master Unit is not operating. • The cables are not connected properly. • A source of noise is close to the Master Unit.	1. Check the status of the Master Unit. 2. Check that the DeviceNet communications cables are connected properly and that noise preventative measures have been taken. 3. If the error is not cleared after taking the above steps, restart the Unit.
E0	The Network's communications power is not being supplied normally.	Check the Network's power supply and wiring, and restart the Unit.
E4	The Unit's Read/Write Area is set to default settings with other Communications Units connected.	1. Check that the area address settings for the SYSMAC BUS Masters, DeviceNet Masters, and DeviceNet Slaves are not overlapping. 2. Set the Read/Write Area settings using bit 00 of the software switches. (If the settings are overlapping intentionally, the Unit will operate according to the Read/Write Area settings after setting this bit.) 3. Restart the Unit.
E6	The CPU Unit is mounted to a C200H or C200HS PC.	Remount the CPU Unit to a C200HE, C200HG, or C200HX PC, and restart the PC.
E8	Internal non-volatile memory data error	1. Set the Read/Write Area settings using bit 00 of the software switches. 2. Restart the Unit. 3. If the error is not cleared, replace the Unit.
F0	Duplicate node address error	Reset the node address to a number that is not used by another Unit, and restart the Unit.
F1	Bus Off error	1. Check that the DeviceNet communications cables are wired connected, and that noise preventative measures have been taken. 2. Restart the Unit.
	Master Unit baud rate setting error	Make sure that the baud rate settings match and restart the Unit.

Display	Probable cause	Possible remedy
F3	Front/rear-panel DIP switch setting error • Pin 4 of front-panel DIP switch is ON. • Pins 1 and 2 of front-panel DIP switch are ON. • Pin 7 or 8 on rear-panel DIP switch is ON.	• Make sure pin 4 on the front panel, and pins 7 and 8 on the rear panel are turned OFF. • Turn ON or OFF pins 1 and 2 according to the correct baud rate setting.
F6	CPU Unit interface error from noise	Remove cause of noise and restart the Unit. If the error is not cleared, replace the C200H I/O Link Unit or the CPU Unit.
F9	Hardware error	1. Restart the Unit 2. If the error is not cleared, replace the Unit.

Identifying Errors from Symptoms

Symptom	Probable Cause	Possible remedy
The power is ON, but the Slave Unit's indicators are all OFF.	CPU Unit error caused by noise interference.	Restart the Unit.
The Read/Write Area's settings have been set, but data is not being refreshed according to the settings.	The settings have not been validated.	1. Turn ON bit 00 of the software switches. 2. Reset the Unit.
	The Unit has not been reset.	Restart the PC or turn ON and OFF the bit corresponding to the unit number in word AR 01.
After setting the areas and operating the Unit, the data in the output area frequently appears as unexpected values.	The area settings are overlapping with those of other Communications Units.	Check the area settings of other Communications Units, and correct settings so that data is not written to an area already being used by another Unit.
When reading the Slave's DM Area from the Master, unstable values are returned and the data is unreadable.	Attempt was made to access of words from DM 4096 onwards in the C200HE-CPU11 CPU Unit.	Access the correct words only.
The Explicit Connection Established Flag is ON in the C200H I/O Link Unit's status words, but Unit is not receiving an explicit message from the Master.	The Network cables are disconnected, or the Master Unit's power supply is OFF. (OMRON Master Units do not have timeouts when explicit message communications are used, so the Explicit Connection Established Flag will not turn OFF even if communications are stopped).	Restart the Master Unit, or connect the cables correctly. (Timeouts cannot be set for OMRON Master Units using explicit message communications.)

15-3-6 RS-232C Unit Troubleshooting

Symptom	Probable cause	Possible remedy
The RS-232C Unit's ERR indicator is lit.	The RS-232C Unit is damaged.	Replace the RS-232C Unit.
RS-232C port communications error (the Unit's RD and SD indicators are not lit).	The wiring is incorrect, or the cables are not connected properly.	Check the wiring with the RS-232C Unit and correct it if necessary.
	The RS-232C port's parameters do not match those of the RS-232C Unit.	Reset the RS-232C port's parameters to match the parameters of the RS-232C Unit.
Parameter Error Flag (bit 01 or 09) in communications status word is ON.	The parameters are set incorrectly.	Reset the parameters correctly using the PARAMETER SET command, then execute the RS-232C PORT RESET command or restart the RS-232C Unit.
Parity Error Flag (bit 04 or 12) in communications status word is ON.	The parity setting does not match the setting in the RS-232C Unit.	Reset the RS-232C port's parity setting to match the parity of the RS-232C Unit.
Overrun Error Flag (bit 05 or 13) in communications status word is ON.	The baud rate does not match the setting in the RS-232C Unit.	Reset the RS-232C port's baud rate to match the baud rate of the RS-232C Unit.
Framing Error Flag (bit 06 or 14) in communications status word is ON.	The character block settings (data length, parity, and stop bits) do not match those in the RS-232C Unit.	Reset the RS-232C port's character block (data length, parity, and stop bits) to match the character block of the RS-232C Unit.
Receive Buffer Error Flag (bit 07 or 15) in communications status word is ON.	The receive buffer has overflowed.	The receive buffer for each of the RS-232C Unit's ports is 1,024 bytes. Increase the reading frequency so that the receive buffer does not overflow. If the receive buffer has overflown, execute the RS-232C PORT RESET command or restart the RS-232C Unit.

15-4 Maintenance

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

15-4-1 Cleaning

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

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

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

15-4-2 Inspection

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

Inspection Equipment

Prepare the following equipment before inspecting the system.

Required Equipment

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

Equipment that could be needed

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

Inspection Procedure

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

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

The following table shows the acceptable temperature and humidity ranges for DeviceNet Units.

Unit	Acceptable temperature	Acceptable humidity*
Master Unit	0°C to 55°C	10% to 90%
I/O Link Unit		
Transistor Remote Terminal	0°C to 55°C	35% to 85%
Environment-resistant Unit	–10°C to +55°C	25% to 85%
Remote Adapter	0°C to 55°C	35% to 85%
Sensor Terminal	0°C to 55°C	35% to 85%
Analog Input Terminal		
Analog Output Terminal		
Temperature Input Terminal		
C200H I/O Link Unit	0°C to 55°C	10% to 90%
RS-232C Unit	–10°C to +55°C	25% to 85%
MULTIPLE I/O TERMINAL (Communications Unit, I/O Units)	–10°C to +55°C	25% to 85%

Note Acceptable humidity range with no condensation or icing.

15-4-3 Replacing Nodes

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

Precautions

Observe the following precautions when replacing a faulty Unit.

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

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

Settings after Replacing Nodes

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

Settings after Replacing Master Units

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

Default Remote I/O Allocations

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

User-set Remote I/O Allocations

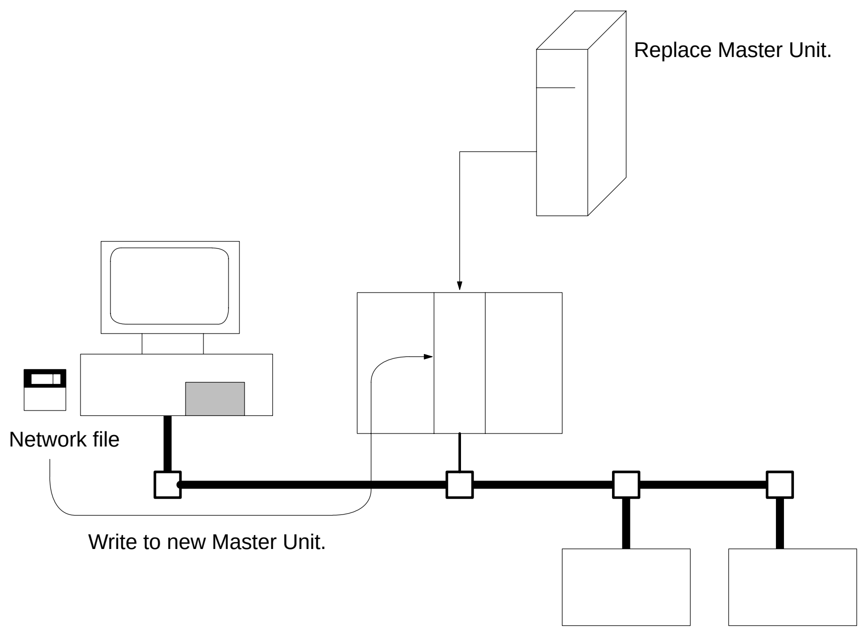
Perform one of the following procedures.

Using a Network File

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

1, 2, 3...

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



Recreating the Allocations from the Configurator

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

1, 2, 3...

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

Note

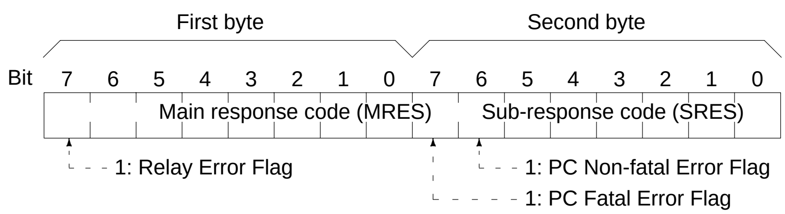
1. You should always save the network file to a disk when using user-set remote I/O allocations so that the scan list and other parameters are available should you need to replace a Master Unit.
2. Whenever using a new CPU Unit, be sure that all data in the DM Area, HR Area, and other memory areas is transferred to the new CPU Unit before starting operation.

Appendix A
FINS Command Response Codes

This section describes the response codes returned with responses to FINS commands. Response codes can be used to confirm normal completion of command execution or to troubleshoot problems when commands fail. Refer to the operation manuals for specific Units or Systems for further troubleshooting information.

Configuration

Response codes for FINS commands consist of two bytes that indicate the result of executing a command. The structure of the response codes is shown in the following diagram.



The main response code (MRES) in the first byte classifies the response and the sub-response code (SRES) in the second byte indicates details under the MRES classification.

If bit 7 of the first byte is ON, a network relay error has occurred. Refer to *Network Relay Errors* in this appendix for details on troubleshooting the error.

If bit 6 or 7 of the second byte is ON, an error has occurred in the PC or computer returning the response. Refer to the operation manual for the device returning the response for details when troubleshooting the error.

Response Codes and Troubleshooting

The table below lists response codes (main and sub-codes) returned after execution of the FINS commands, the probable cause of errors, and recommended remedies.

Upon receipt of some commands, the destination node will issue a request to another node; the other node is referred to as the third node.

Main code	Sub-code	Probable cause	Check point	Remedy
00: Normal completion	00	---	---	---
	01	Service was interrupted	---	Check the contents of the destination transmission area of third node.
			Data link status	Check the data link status.
01: Local node error	01	Local node not part of Network	Local node status in network	Add to Network.
	02	Token time-out, node address too large	Max. node address	Set the local node's node address below the maximum node address.
	03	Transmission failed: Node missing, send buffer insufficient, other problem	---	Check communications with internode echo test. If the test fails, check network.
	04	Maximum number of frames exceeded	Number of frames that can be sent	Either check the execution of events in the network and reduce the number of events occurring in one cycle, or increase the maximum number of frames.
	05	Node address setting error (range)	Node address	Make sure the node address is within specified range and that there are no duplicate node addresses.
	06	Node address duplication error	Node address	Make sure that there are no duplicate node addresses.

Main code	Sub-code	Probable cause	Check point	Remedy
02: Destination node error	01	Destination node not part of Network	INS indicator of relevant Unit	Add to Network.
	02	No node with the specified node address	Control data in instruction	Check the destination node’s node address.
	03	Third node not part of Network	Control data in instruction	Check the third node’s node address.
		Broadcasting was specified.	Command data	Check the control data and specify only one node as the third node.
	04	Busy error, destination node busy	---	Increase the number of transmit retry attempts or re-evaluate the system so that the destination node is not so busy receiving data.
	05	Response time-out, message packet was corrupted by noise	---	Increase the number of transmit retry attempts.
		Response time-out, response watchdog timer interval too short	Control data in instruction	Increase the value for the response monitoring time in the control data.
		Frame lost in transmission	Error history	Check the error history and correct the process.
03: Communications controller error	01	Error occurred in the communications controller, Unit indicator is lit	Unit/Board indicators	Take corrective action, referring to the manual for the relevant Unit or Board.
	02	CPU error occurred in the PC at the destination node	CPU Unit indicators at remote PC’	Clear the error in the CPU (refer to the PC’s operation manuals)
	03	A controller error has prevented a normal response from being returned.	Board indicators	Check network communications status and reset the controller board. If the error still exists, replace the controller board.
	04	Node address setting error	Unit number	Make sure the node address is within specified range and that there are no duplicate node addresses.
04: Not executable	01	An undefined command has been used.	Command code	Check the command code and be sure that the Unit supports it.
	02	Cannot process command because the specified unit model or version is wrong.	Unit model/version	Check the unit model and version.
05: Routing error	00	Routing error in control data or routing tables.	Control data in instruction or routing tables	Be sure the Unit is listed in the routing tables for CVM1 and CV-series PCs, address only within the local network, check the node address setting of the remote node, use “00” for the network address for C200HX/HG/HE PCs.
	01	Destination node address is not set in the routing table.	Entry for destination node in routing tables	Set the destination node address in the routing tables.
	02	Routing tables aren’t registered.	Routing tables	Set the source nodes, destination nodes, and relay nodes in the routing tables.
	03	Routing table error	Routing tables	Set the routing tables correctly.
	04	The maximum number of relay nodes (2) was exceeded in the command.	Network configuration	Redesign the network or reconsider the routing tables to reduce the number of relay nodes in the command.

Main code	Sub-code	Probable cause	Check point	Remedy
10: Command format error	01	The command is longer than the max. permissible length.	Command data	Check the command format of the command and set it correctly.
	02	The command is shorter than min. permissible length.	Command data	Check the command format of the command and set it correctly.
	03	The designated number of data items differs from the actual number.	Command data	Check the number of items and the data, and make sure that they agree.
	04	An incorrect command format has been used.	Command data	Check the command format of the command and set it correctly.
	05	Header error: the node address of the remote node is not between 00 and 63.	Routing tables	Check the node address of the remote node.
11: Parameter error	01	A correct memory area code has not been used or Expansion Data Memory is not available.	Memory area code in command data	Check the command's memory area code and set the appropriate code.
	02	The access size specified in the command is wrong, or the first address is an odd number.	Access size in command data	Set the correct access size for the command.
	03	The first address is in an inaccessible area.	First address in command data	Set a first address that is in an accessible area.
	04	The end of specified word range exceeds the acceptable range.	First address and number of items in command data	Check the acceptable limits of the data area and set the word range within the limits.
			Data link tables	Check the data link tables to be sure the limit to link words has not been exceeded.
	06	A non-existent program no. has been specified.	Program number in command data	Check the program number and be sure that it is set correctly.
	09	The sizes of data items in the command block are wrong.	Command data	Check the command data and be sure that the sixes of the data items are correct.
			Data link tables	Check the data link tables to be sure all nodes in the refresh parameters are in the common link parameters.
	0A	The IOM break function cannot be executed because it is already being executed.	IOM break function in CPU Unit	Either abort the current IOM break function processing, or wait until it is completed and execute the command.
			Data link tables	Check the data link tables for duplicate node addresses.
	0B	The response block is longer than the max. permissible length.	Number of items set in command data	Check the command format and set the number of items correctly.
	0C	An incorrect parameter code has been specified.	Parameters in command data	Check the command data and reenter it correctly.
			Data link table file	Check the data link table file for corruption.

Main code	Sub-code	Probable cause	Check point	Remedy
20: Read not possible	02	The data is protected.	---	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command.
		An attempt was made to download a file that is being uploaded.	File name	Check the file name and either interrupt servicing or wait for servicing to complete before re-executing the command.
	03	The registered table does not exist or is incorrect.	Relevant table	Set or reset the registered table.
		Too many files open.	Number of files open	Close open files and re-execute the command.
	04	The corresponding search data does not exist.	---	---
	05	A non-existing program no. has been specified.	Program number in command data	Check the program number and be sure that it is set correctly.
	06	A non-existing file has been specified.	File name and device	Check whether the correct file name was used.
	07	A verification error has occurred.	Contents of memory that was compared	Check whether the memory contents are correct and replace if incorrect.
			---	Check the contents of the file. A read error may have occurred.
21: Write not possible	01	The specified area is read-only or is write-protected.	---	If the specified area is read-only, the write cannot be performed. If it is write-protected, turn off the write-protect switch and execute the instruction again.
	02	The data is protected.	---	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command.
		An attempt was made to simultaneously download and upload a file.	File name	Check the file name and either interrupt servicing or wait for servicing to complete before re-executing the command.
		The data link tables cannot be written manual because they are set for automatic generation.	PC Setup	Change the PC Setup to manual data link table generation.
	03	The number of files exceeds the maximum permissible.	Number of files in the file device	Write the file(s) again after erasing unneeded files, or use different disk or Memory Card that has free space.
		Too many files open.	Number of files open	Close open files and re-execute the command.
	05	A non-existing program no. has been specified.	Program number in the command data	Check the program number and be sure that it is set correctly.
	06	A non-existent file has been specified.	File name	---
	07	The specified file already exists.	File name	Change the name of the file and execute the instruction again.
	08	Data cannot be changed.	The contents of memory to be changed.	Check the contents of the memory area being written to.

Main code	Sub-code	Probable cause	Check point	Remedy
22: Not executable in current mode	01	The mode is wrong (executing).	---	Check the operating mode.
		Data links are active.	Data link status	Check the data link status before execution.
	02	The mode is wrong (stopped).	---	Check the operating mode.
		Data links are active.	Data link status	Check the data link status before execution.
	03	The PC is in the PROGRAM mode.	---	Check the PC's mode.
	04	The PC is in the DEBUG mode.	---	Check the PC's mode.
	05	The PC is in the MONITOR mode.	---	Check the PC's mode.
	06	The PC is in the RUN mode.	---	Check the PC's mode.
	07	The specified node is not the polling node.	---	Check which node is the polling node.
	08	The mode is wrong and the step cannot be executed.	---	Check whether the step has active status or not.
	11	Unit busy: Attempt made to send message to 9th node.	Message communications	Check the number of message communications nodes for each Master Unit.
23: No Unit	01	A file device does not exist where specified.	Configuration of Unit	Mount the Memory Card or disk
	02	The specified memory does not exist.	---	Check the specifications of the installed file memory.
	03	No clock exists.	---	Check the model number.
24: Start/stop not possible	01	The data link tables either haven't been created or are incorrect.	Data link tables	Set the data link tables correctly.

Main code	Sub-code	Probable cause	Check point	Remedy
25: Unit error	02	Parity/checksum error occurred because of incorrect data.	Contents of memory being processed	Transfer correct data into memory.
	03	I/O setting error (The registered I/O configuration differs from the actual.)	I/O Unit configuration	Either change the actual configuration to match the registered one, or generate the I/O tables again.
	04	Too many I/O points	I/O points registered in I/O tables	Redesign the system to remain within permissible limits.
	05	CPU bus error (An error occurred during data transfer between the CPU and a CPU Bus Unit.)	CPU bus line	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	06	I/O duplication error (A rack number, unit number, or I/O word allocation has been duplicated.)	Rack numbers, unit numbers, and I/O addresses in PC Setup	Check the system's settings and eliminate any duplication.
	07	I/O bus error (An error occurred during data transfer between the CPU and an I/O Unit.)	I/O bus line	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	09	SYSMAC BUS/2 error (An error occurred during SYSMAC BUS/2 data transfer.)	SYSMAC BUS/2 transmission path	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	0A	Special I/O Unit error (An error occurred during CPU Bus Unit data transfer.)	CPU Bus Unit transmission path	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	0D	Duplication in SYSMAC BUS word allocation.	Word settings	Check and regenerate the I/O table.
	0F	A memory error has occurred in internal memory, in the Memory Card, or in Expansion DM during the error check.	Contents of memory being processed	If the error occurred in internal memory or the EM Unit, correct the data in the command an execute it again. If the error occurred in a Memory Card or EM used for file memory, the file data has been corrupted. Execute the MEMORY CARD FORMAT command. If the above remedies do not eliminate the error, replace the faulty memory.
	10	Terminator not connected in SYSMAC BUS System.	---	Connect the terminator correctly.

Main code	Sub-code	Probable cause	Check point	Remedy
26: Command error	01	The specified area is not protected. This response code will be returned if an attempt is made to clear protection on an area that is not protected.	Program area command protection	The program area is not protected, so it isn't necessary to clear protection.
	02	An incorrect password has been specified.	---	Specify a password that is registered.
	04	The specified area is protected.	---	Execute the command again after the PROGRAM AREA PROTECT CLEAR command.
		To many commands at destination.	Number of commands being executed	The destination has received more than 5 commands. Either interrupt servicing or wait for servicing to complete before re-executing the command.
	05	The service is being executed.	---	Execute the command again after the service has been completed or aborted.
	06	The service is not being executed.	---	Execute the service if necessary.
	07	Service cannot be executed from local node because the local node is not part of the data link.	LNK indicator on Unit/Board	Execute the service from a node that is part of the data link.
		A buffer error has prevented returning a normal response.	---	Reset the board. If the error persists, replace the board.
	08	Service cannot be executed because necessary settings haven't been made.	Settings before execution	Make the necessary settings.
	09	Service cannot be executed because necessary settings haven't been made in the command data.	Command data	Check the command format of and make the necessary settings.
	0A	The specified action or transition number has already been registered.	Action and transition numbers in program in program area	Execute the command again using an action or transition number that hasn't been registered.
	0B	Cannot clear error because the cause of the error still exists.	Cause of error	Eliminate the cause of the error and execute the ERROR CLEAR command.
30: Access right error	01	The access right is held by another device.	---	Execute the command again after the access right has been released. (The command can be executed after the ACCESS RIGHT FORCED ACQUIRE or ACCESS RIGHT RELEASE command is completed. Releasing the access right might affect processes in progress at the node that held the access right.)
	05	No object	---	---
40: Abort	01	Command was aborted with ABORT command.	---	---

Appendix B
Node Address Settings Table

Each Slave's node address is set in binary with pins 1 through 6 of the Slave's DIP switch. There are some differences in the location and orientation of the DIP switches, but the node address is always set in binary.
(0: OFF, 1: ON)

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

DIP switch setting						Node address
Pin 1	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	
0	0	0	0	0	1	32
1	0	0	0	0	1	33
0	1	0	0	0	1	34
1	1	0	0	0	1	35
0	0	1	0	0	1	36
1	0	1	0	0	1	37
0	1	1	0	0	1	38
1	1	1	0	0	1	39
0	0	0	1	0	1	40
1	0	0	1	0	1	41
0	1	0	1	0	1	42
1	1	0	1	0	1	43
0	0	1	1	0	1	44
1	0	1	1	0	1	45
0	1	1	1	0	1	46
1	1	1	1	0	1	47
0	0	0	0	1	1	48
1	0	0	0	1	1	49
0	1	0	0	1	1	50
1	1	0	0	1	1	51
0	0	1	0	1	1	52
1	0	1	0	1	1	53
0	1	1	0	1	1	54
1	1	1	0	1	1	55
0	0	0	1	1	1	56
1	0	0	1	1	1	57
0	1	0	1	1	1	58
1	1	0	1	1	1	59
0	0	1	1	1	1	60
1	0	1	1	1	1	61
0	1	1	1	1	1	62
1	1	1	1	1	1	63

Appendix C
Multi-vendor Applications

This appendix provides precautions and reference material needed when using DeviceNet (CompoBus/D) Units as DeviceNet components in a multi-vendor environment.

Overview

Connecting another Company's Slaves to an OMRON Master

Refer to the Slave's manual when connecting another company's Slave to an OMRON Master Unit.

If a Slave has an EDS file, it can be installed in OMRON's Configurator to enable handling it just like an OMRON Slave. (OMRON's Configurator already has installed all of the Slave EDS files currently registered with the ODVA.)

In particular, be sure to determine the number of words in the OMRON Master Unit that the Slave requires for input and output.

For Connection Object Interface 2 (Polled I/O Connection), the number of I/O words allocated in the OMRON Master can be found from the "Produced Connection Size" and "Consumed Connection Size" as shown below. Up to 32 words can be allocated to inputs and another 32 words to outputs.

Produced Connection Size
This is the amount of memory (usually in bytes) allocated as input.

Consumed Connection Size
This is the amount of memory (usually in bytes) allocated as output.

If the connection size is an even number of bytes, the number of allocated words is: (bytes ÷ 2).

If the connection size is an odd number of bytes, the number of allocated words is: [(bytes +1) ÷ 2)].

For Connection Object Interface 3 (Bit Strobed I/O Connection), the number of input words allocated in the OMRON Master can be found from the "Produced Connection Size" as shown below.

Produced Connection Size
This is the amount of memory (usually in bytes) allocated as input.

If the connection size is an even number of bytes, the number of allocated words is: (bytes ÷ 2).

If the connection size is an odd number of bytes, the number of allocated words is: [(bytes +1) ÷ 2)].

Connecting an OMRON Slave to another Company's Configurator

When another company's configurator (a device that makes environment settings on DeviceNet Masters and Slaves) is connected, it will be able to read settings from OMRON Masters and Slaves but not change them.

When another company's configurator is being used, we recommend creating an OMRON Slave EDS file (a file that contains each Slave's parameters and operating information). Refer to the DeviceNet protocol tables later in this appendix as well as the Configurator's manual for details on creating an EDS file.

Master Unit Device Profile

General data	Compatible DeviceNet Specifications	Volume I - Release 1.2 Volume II - Release 1.1	
	Vendor name	OMRON Corporation	Vendor ID = 47
	Device profile name	Communication Adapter	Profile number = 12
	Manufacturer catalog number	Manual number (W267)	
	Manufacturer revision	1.0	
Physical conformance data	Network current consumption	24 VDC, 45 mA max.	
	Connector type	Open plug	
	Physical insulation	Yes	
	Supported indicators	Module, Network	
	MAC ID setting	DIP switch	
	Default MAC ID	0	
	Baud rate setting	DIP switch	
	Supported baud rates	125 kbps, 250 kbps, and 500 kbps	
Communications data	Predefined Master/Slave connection set	Group 2 client Group 2 only client	
	Dynamic connection support (UCMM)	Yes	
	Explicit message fragmentation support	Yes	

Object Mounting

Identity Object (0x01)

Object class	Attribute	Not supported
	Service	Not supported

Item		ID content	Get (read)	Set (write)	Value
Object instance	Attribute	1 Vendor	Yes	No	47
		2 Product type	Yes	No	12
		3 Product code	Yes	No	(See table below.)
		4 Revision	Yes	No	1.2
		5 Status (bits supported)	Yes	No	---
		6 Serial number	Yes	No	Unique for each Unit
		7 Product name	Yes	No	(See table below.)
		8 State	No	No	---

Model	Product code	Product name
CVM1-DRM21-V1	0	CVM1-DRM21-V1
C200HW-DRM21-V1	1	C200HW-DRM21-V1

Message Router Object (0x02)

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

DeviceNet Object (0x03)

Object class	Attribute	Not supported
	Service	Not supported

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

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

Connection Object (0x05)

Object class	Attribute	Not supported
	Service	Not supported
	Max. number of active connections	256

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

Communications	Instance type
Explicit messaging	00 hexadecimal
I/O	01 hexadecimal

Connection	Transport class trigger
Poll client	22 hexadecimal
Strobe client	22 hexadecimal
Explicit client	23 hexadecimal
Explicit server	83 hexadecimal

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

Appendix D
Connectable Devices and Device Current Consumptions

Devices

Master Units

Model	Specifications	Manufacturer
CVM1-DRM21-V1	For CVM1 and CV-series PCs	OMRON
C200HW-DRM21-V1	For CS1-series, C200HX/HG/HE, C200HS PCs	OMRON
3G8B3-DRM21	VME board	OMRON

Configurators

Model	Specifications	Manufacturer
3G8F5-DRM21	For ISA board	OMRON
3G8E2-DRM21	For PCMCIA board	OMRON

Slave Units

Basic I/O Slave Units

Model	Specifications	Manufacturer
CQM1-DRT21	I/O Link Unit suitable for CQM1-series board 16 inputs and 16 outputs	OMRON
DRT1-ID08	Remote I/O Terminal 8 transistor inputs (NPN)	OMRON
DRT1-ID08-1	Remote I/O Terminal 8 transistor inputs (PNP)	OMRON
DRT1-ID16	Remote I/O Terminal 16 transistor inputs (NPN)	OMRON
DRT1-ID16-1	Remote I/O Terminal 16 transistor inputs (PNP)	OMRON
DRT1-OD08	Remote I/O Terminal 8 transistor outputs (NPN)	OMRON
DRT1-OD08-1	Remote I/O Terminal 8 transistor outputs (PNP)	OMRON
DRT1-OD16	Remote I/O Terminal 16 transistor outputs (NPN)	OMRON
DRT1-OD16-1	Remote I/O Terminal 16 transistor outputs (PNP)	OMRON
DRT1-ID08C	Environment-resistant Terminal 8 transistor inputs, 8 transistor outputs (NPN) Conforms to IEC IP66	OMRON
DRT1-OD08C	Environment-resistant Terminal 8 transistor outputs (NPN) Conforms to IEC IP66	OMRON
DRT1-MD16C	Environment-resistant Terminal 8 transistor outputs (NPN) Conforms to IEC IP66	OMRON

Model	Specifications	Manufacturer
DRT1-ID16X	Remote Adapter 16 transistor inputs (NPN)	OMRON
DRT1-ID16X-1	Remote Adapter 16 transistor inputs (PNP)	OMRON
DRT1-OD16X	Remote Adapter 16 transistor outputs (NPN)	OMRON
DRT1-OD16X-1	Remote Adapter 16 transistor outputs (PNP)	OMRON
DRT1-HD16S	Sensor Terminal 8 sensor inputs (NPN) 2 inputs per sensor	OMRON
DRT1-ND16S	Sensor Terminal 8 sensor inputs (NPN) 1 input and 1 output per sensor	OMRON
DRT1-AD04	Analog Input Terminal 4 analog inputs (allocated 4 words) or 2 analog inputs (allocated 2 words) (Switchable)	OMRON
DRT1-DA02	Analog Output Terminal 2 analog outputs (allocated 2 words)	OMRON
DRT1-TS04T	Temperature Input Terminal Thermocouple input 4 inputs (allocated 4 words)	OMRON
DRT1-TS04P	Temperature Input Terminal Temperature-resistance thermometer input 4 inputs (allocated 4 words)	OMRON

Special I/O Slave Units

Model	Specifications	Manufacturer
C200HW-DRT21	I/O Link Unit for C200HE, C200HG, C200HX PCs (User-set allocations possible) 512 inputs max., 512 outputs max. Read/Write area can be user-set using explicit DeviceNet messages.	OMRON
DRT1-232C2	RS-232C Unit with 2 RS-232C ports 16 inputs (communications status) RS-232C ports' parameters can be set, and data can be transmitted to and from external devices using explicit DeviceNet messages.	OMRON

MULTIPLE I/O TERMINAL Units

Model	Specifications	Manufacturer
DRT1-COM	Communications Unit Two input words (status)	OMRON
GT1-ID16	Transistor Input Unit (terminal block) 16 transistor inputs (NPN)	OMRON
GT1-ID16-1	Transistor Input Unit (terminal block) 16 transistor inputs (PNP)	OMRON
GT1-ID16MX	Transistor Input Unit (MOLEX connector) 16 transistor inputs (NPN)	OMRON
GT1-ID16MX-1	Transistor Input Unit (MOLEX connector) 16 transistor inputs (PNP)	OMRON
GT1-ID16ML	Transistor Input Unit (FUJITSU connector) 16 transistor inputs (NPN)	OMRON

Model	Specifications	Manufacturer
GT1-ID16ML-1	Transistor Input Unit (FUJITSU connector) 16 transistor inputs (PNP)	OMRON
GT1-ID16DS	Transistor Input Unit (D-sub, 25-pin connector) 16 transistor inputs (NPN)	OMRON
GT1-ID16DS-1	Transistor Input Unit (D-sub, 25-pin connector) 16 transistor inputs (PNP)	OMRON
GT1-ID32ML	Transistor Input Unit (FUJITSU high-density connector) 32 transistor inputs (NPN)	OMRON
GT1-ID32ML-1	Transistor Input Unit (FUJITSU high-density connector) 32 transistor inputs (PNP)	OMRON
GT1-OD16	Transistor Output Unit (terminal block) 16 transistor outputs (NPN)	OMRON
GT1-OD16-1	Transistor Output Unit (terminal block) 16 transistor outputs (PNP)	OMRON
GT1-OD16MX	Transistor Output Unit (MOLEX connector) 16 transistor outputs (NPN)	OMRON
GT1-OD16MX-1	Transistor Output Unit (MOLEX connector) 16 transistor outputs (PNP)	OMRON
GT1-OD16ML	Transistor Output Unit (FUJITSU connector) 16 transistor outputs (NPN)	OMRON
GT1-OD16ML-1	Transistor Output Unit (FUJITSU connector) 16 transistor outputs (PNP)	OMRON
GT1-OD16DS (available soon)	Transistor Output Unit (D-sub, 25-pin connector) 16 transistor outputs (NPN)	OMRON
GT1-OD16DS-1	Transistor Output Unit (D-sub, 25-pin connector) 16 transistor outputs (PNP)	OMRON
GT1-OD32ML	Transistor Output Unit (FUJITSU high-density connector) 32 transistor outputs (NPN)	OMRON
GT1-OD32ML-1	Transistor Output Unit (FUJITSU high-density connector) 32 transistor outputs (PNP)	OMRON
GT1-ROP08	Relay Output Unit (power relays) 8 relay outputs (allocated 1 word)	OMRON
GT1-ROS16	Relay Output Unit (miniature relays) 16 relay outputs	OMRON
GT1-AD04	Analog Input Unit (terminal block) 4 inputs (allocated 4 words)	OMRON
GT1-AD08MX	Analog Input Unit (MOLEX connector) 8 inputs (allocated 8 words) or 4 inputs (allocated 4 words) (Select using the DIP switch.)	OMRON
GT1-DA04	Analog Output Unit (terminal block) 4 outputs (allocated 4 words)	OMRON
GT1-DA04MX	Analog Output Unit (MOLEX connector) 4 outputs (allocated 4 words)	OMRON
GT1-CT01	Counter Unit 1 encoder input (A, B, Z) 1 external input, 2 external outputs (allocated 3 words for input and 3 words for output)	OMRON

Communications Cables

Model	Specifications	Manufacturer
DCA2-5C10	Thick cable: 5 wires, 100 m	OMRON
DCA1-5C10	Thin cable: 5 wires, 100 m	OMRON
TDN18-10G	Thick cable: 5 wires, 10 m	Showa Electric
TDN18-30G	Thick cable: 5 wires, 30 m	Showa Electric
TDN18-50G	Thick cable: 5 wires, 50 m	Showa Electric
TDN18-100G	Thick cable: 5 wires, 100 m	Showa Electric
TDN18-300G	Thick cable: 5 wires, 300 m	Showa Electric
TDN18-500G	Thick cable: 5 wires, 500 m	Showa Electric
TDN24-10G	Thin cable: 5 wires, 10 m	Showa Electric
TDN24-30G	Thin cable: 5 wires, 30 m	Showa Electric
TDN24-50G	Thin cable: 5 wires, 50 m	Showa Electric
TDN24-100G	Thin cable: 5 wires, 100 m	Showa Electric
TDN24-300G	Thin cable: 5 wires, 300 m	Showa Electric
TDN24-500G	Thin cable: 5 wires, 500 m	Showa Electric
1485C-P1-A50	Thick cable: 5 wires, 50 m	Allen-Bradley
1485C-P1-C150	Thin cable: 5 wires, 150 m	Allen-Bradley

Connectors

Model	Specifications	Manufacturer
MSTB2.5/5-ST-5.08AU	For node connection Without connector set screws (Attach to DRT1 Series)	Phoenix Contact K.K.
MSTBP 2.5/5-STF-5.08 AB AU SO	For T-branch Tap and node connection With connector set screws (Attach to CVM1-DRM21-V1, C200HW-DRM21-V1, CQM1-DRT21-DCN1)	Phoenix Contact K.K.
TMSTBP 2.5/5-ST-5.08 AU	For node connection (Multi-drop wiring) Without connector set screws	Phoenix Contact K.K.

Connector Screwdriver

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

Terminating Resistors

Model	Specifications	Manufacturer
DRS1-T	Terminal-block Terminating Resistor, 121 Ω	OMRON

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

T-branch Tap

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

Power Supply Tap

Model	Specifications	Manufacturer
1485T-P2T5-T5	Required when connecting more than one power supply. Ground terminal provided.	Allen-Bradley

Cable Connectors for Sensor Terminals

Model	Specifications	Manufacturer
XS8A-0441	Connector marking: XS8-1 Applicable cable wire size: 0.3 to 0.5 mm^2	OMRON
XS8A-0442	Connector marking: XS8-2 Applicable cable wire size: 0.14 to 0.2 mm^2	OMRON

Connectors for Environment-resistant Terminals

I/O Connectors

Model	Description	Manufacturer
XS2G-D4□□	Assembled male connector plug (Crimped or soldered)	OMRON
XS2H-D421-□□□	Cable with connector plug at one end (Male plug-to-cable core wires)	
XS2W-D42□-□□□	Cable with connector plug at both ends (Male plug-to-female plug)	

External Power Supply Connectors

Model	Description	Manufacturer
XS2C-D4□□	Assembled female connector plug (Crimped or soldered)	OMRON
XS2F-D42□-□80-A	Cable with connector plug at one end (Female plug-to-cable core wires)	

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

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

Applicable Connectors for MULTIPLE I/O TERMINAL Units

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

Connector Cables for MULTIPLE I/O TERMINAL Units

Model	Unit connected	Manufacturer
G79-□□□C	GT1-ID16ML ↓ I/O Block (G7TC-I□16)	OMRON
	GT1-OD16ML ↓ I/O Block (G7TC-OC16, G7OD-SOC16, G7OD-FOM16, G7OA-ZOC16-3, M7F)	
	GT1-OD16ML-1 ↓ I/O Block (G7TC-OC16-1, G7OD-SOC16-1, G7OD-FOM16-1, G7OA-ZOC16-4, M7F)	
G79-I□C-□	GT1-ID32ML ↓ I/O Block (G7TC-I□16)	
G79-O□C-□	GT1-OD32ML ↓ I/O Block (G7TC-OC16, G7TC-OC08, G70D-SOC16, G7OD-FOM16, G70A-ZOC16-3, M7F)	
XW2Z-□□□A	GT1-ID16ML(-1), GT1-OD32ML(-1) ↓ Connector-Terminal Block Conversion Unit (XW2B-20G4, XW2B-20G5)	
XW2Z-□□□B	GT1-ID32ML(-1), GT1-OD32ML(-1) ↓ Connector-Terminal Block Conversion Unit (XW2B-40G4, XW2B-40G5)	

Recommended Power Supplies for MULTIPLE I/O TERMINAL Units

Model	Specification	Manufacturer
S82K-05024	100 to 120/200 to 240 V, 50 W	OMRON
S82K-10024	100 to 120/200 to 240 V, 100 W	
S82J-5524	100 to 120 V, 50 W	
S82J-5024	100 to 120 V, 100 W	
S82J-6524	200 to 240 V, 50 W	
S82J-6024	200 to 240 V, 100 W	

Current Consumption Overview

Model	Internal current consumption	Communications current consumption
DRT1-ID08	50 mA max.	30 mA max.
DRT1-ID08-1	50 mA max.	30 mA max.
DRT1-ID16	50 mA max.	30 mA max.
DRT1-ID16-1	50 mA max.	30 mA max.
DRT1-OD08	50 mA max.	30 mA max.
DRT1-OD08-1	50 mA max.	30 mA max.
DRT1-OD16	50 mA max.	30 mA max.
DRT1-OD16-1	50 mA max.	30 mA max.
DRT1-ID08C	35 mA max.	30 mA max.
DRT1-OD08C	45 mA max.	30 mA max.
DRT1-MD16C	35 mA max.	30 mA max.
DRT1-ID16X	70 mA max.	30 mA max.
DRT1-ID16X-1	70 mA max.	30 mA max.
DRT1-OD16X	50 mA max.	30 mA max.
DRT1-OD16X-1	70 mA max.	30 mA max.
DRT1-HD16S	60 mA max.	40 mA max.
DRT1-ND16S	60 mA max.	40 mA max.
DRT1-AD04	80 mA max.	30 mA max.
DRT1-AD04H	130 mA max.	30 mA max.
DRT1-DA02	140 mA max.	30 mA max.
DRT1-TS04T	130 mA max.	30 mA max.
DRT1-TS04P	130 mA max.	30 mA max.
CQM1-DRT21	80 mA max. (5 VDC supplied from the Backplane)	40 mA max.
C200HW-DRT21	250 mA max. (5 VDC supplied from the Backplane)	45 mA max.
DRT1-232C2	100 mA max.	50 mA max.

MULTIPLE I/O TERMINAL Units

Model	I/O Unit interface current consumption	Internal power supply and I/O power supply
GT1-ID16 (-1)	35 mA max.	---
GT1-ID16MX (-1)	35 mA max.	---
GT1-ID16ML (-1)	35 mA max.	---
GT1-ID16DS (-1)	35 mA max.	---
GT1-ID32ML (-1)	55 mA max.	---
GT1-OD16 (-1)	35 mA max.	9 mA max.
GT1-OD16MX (-1)	35 mA max.	9 mA max.
GT1-OD16ML (-1)	35 mA max.	9 mA max.
GT1-OD16DS (-1)	35 mA max.	9 mA max.
GT1-OD32ML (-1)	65 mA max.	11 mA max.
GT1-ROP08	40 mA max.	350 mA max. (Inrush current: 30 A max.)
GT1-ROS16	50 mA max.	250 mA max. (Inrush current: 30 A max.)
GT1-AD04	50 mA max.	Internal power supply: 100 mA (Inrush current: 30 A max.)
GT1-AD08MX	50 mA max.	Internal power supply: 100 mA (Inrush current: 30 A max.)
GT1-DA04	50 mA max.	Internal power supply: 100 mA (Inrush current: 30 A max.)
GT1-DA04MX	50 mA max.	Internal power supply: 100 mA (Inrush current: 30 A max.)
GT1-CT01	90 mA max.	9 mA max.

Glossary

Busoff A Busoff error occurs when there is an unacceptably high error rate on the communications bus. This error is detected when the internal error counter exceeds a specified value. (The error counter is cleared whenever the Master Unit is started or reset.)

CAN Controller Area Network. A communications protocol for a LAN developed for mounting in automobiles. The DeviceNet uses CAN technology.

configurator A device used to make system settings, read IDs, read/write parameters, read the network configuration, etc. OMRON provides a CompoBus/D (DeviceNet) Configurator for OMRON Master Units.

consumed connection size The size in bytes of the data received through a connection.

ODVA Open DeviceNet Vendor Association. A non-profit vendor association responsible for spreading DeviceNet.

produced connection size The size in bytes of the data sent through a connection.

connection A logical communications channel created to communicate between two nodes. Connections are established and maintained between masters and slaves.

device profile A description of the structure and behavior of a device giving the minimum data configurations and operations that the device must support. Device profiles enable common device models, and are also called device models. Device profiles are being studied for sensors, valves, displays, encoders, and other devices.

master A node that controls the collection and distribution of data. With the DeviceNet, the predefined master/slave connection set defines the functions provided by all masters.

slave A node that provides data in response to requests from masters. With the DeviceNet, the predefined master/slave connection set defines the functions provided by all slaves.

Index

R

S

T–V

Revision History

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

Cat. No. W267-E1-6

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
1	August 1996	Original production
2	June 1997	Complete revision to include V1 Master Units.
3	December 1997	The manual was revised to include new information on network configuration and wiring, and Temperature Input Terminals. **Section 3:** Added to include information on network configuration and specifications. **Page 72:** Changes to table. **Pages 72 to 84:** Additions made to include DRT1-AD04H. **Pages 91 to 97:** Information added on Temperature Input Terminals. **Section 6:** Added to include information on the communications power supply. **Section 7:** Extensively revised to include information on wiring the network. **Page 267:** Information changed in table. **Appendix F:** Added to provide information on connectable devices and current consumption.
4	April 1998	The manual was revised to correct errors and include new information on multiple I/O terminals. **Page 6:** Table added to include information on MULTIPLE I/O TERMINAL. **Page 34:** Information on MULTIPLE I/O TERMINAL added. **Pages 46, 51, 56, 60, 65, 72, 84, 91:** Specifications corrected. **Pages 47, 53, 58, 62, 67, 68, 76:** “Insulated” corrected to “isolated.” **Pages 50, 56, 60, 64, 71, 84, 91, 98:** Note on opening the cover removed. **Page 92:** Note on converted data removed. **Section 5-3:** Added to include information on MULTIPLE I/O TERMINAL. **Section 7-12:** Added to include information on installation and connection of MULTIPLE I/O TERMINAL **Pages 350 to 352:** Information on MULTIPLE I/O TERMINAL response times and communications cycle times added. **Pages 363 to 368:** Error processing information for MULTIPLE I/O TERMINAL added. **Page 407:** Communications Unit device profile added. **Page 418:** Connectable device information updated to include MULTIPLE I/O TERMINAL.
5	May 2000	Changes were made throughout the manual to correct errors and include new information on CS1-series PCs, Basic and Special I/O Units, MULTIPLE I/O TERMINAL Units, and Environment-resistant Terminals. “CompoBus/D” was changed to “DeviceNet” and “CV-series” was amended to “CVM1 and CV-series” throughout the manual. **Pages 2, 7, 8, 22, 32, 37, 40, 185, 193, 208, 211, 212, 216, 220, 224, 227, 234-236, 239-242, 252-254, 313, 325, 328-335, 340, 345, 355, 356, 365, 371, 377-379:** Information on CS1-series PCs added. **Pages 3-6:** Major changes to model information. **Pages 7, 15, 19, 341-347:** Notes changed/added. **Page 13:** Correction made to information on communications cycle time. **Pages 21, 27:** Information on reference sources added/changed. **Pages 23, 228:** Information on communications setup added. **Sections 5-1 to 5-3:** Removed. **Sections 5-4-8 to 5-4-12:** Removed. **Page 181:** Information on dual power supply changed. **Page 184:** Torque data changed. Information on mounting added. **Section 7-2-2:** Removed. **Pages 187, 219, 226:** Changes to graphics. **Pages 190-192:** Torque data changed. **Sections 7-11, 7-12:** Removed. **Pages 204, 218, 384, 400, 401:** Changes made to tables. **Pages 234, 246, 253, 259, 260:** Information on explicit messages added. **Page 326:** Information on error log data added. **Pages 338-339:** Changes made to information on communications cycle time. Information for networks with more than one Master moved to page 347. **Pages 346-349:** Equations changed/added. **Section 14-1-3:** Removed. **Page 382:** Information on troubleshooting for Analog I/O Units, Temperature Input Terminals, the C200H I/O Link Unit, and the RS-232C Unit added. **Page 399:** Change to introduction. Information on connection to other company’s Masters removed. **Pages 402-408:** Removed. **Appendix E:** Removed. **Appendix F:** New model information added.
6	October 2000	Reprinted due to error.