Cat. No. W379-E1-03

CVM1-DRM21-V1
C200HW-DRM21-V1

DeviceNet Master Units

OPERATION MANUAL

OMRON

CVM1-DRM21-V1
C200HW-DRM21-V1

DeviceNet Master Units

Operation Manual

Revised August 2010

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

Visual Aids

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

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

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

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About this Manual:

This manual describes the installation and operation of the CVM1-DRM21-V1 and C200HW-DRM21-V1 DeviceNet Master Units 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.**

The following manuals are also cover information related to DeviceNet applications. Use the *DeviceNet Operation Manual* together with other required manuals.

Manual	Contents	Cat. No.
DeviceNet Operation Manual	Describes the configuration and construction of a DeviceNet network, including installation procedures and specifications for cables, connectors, and other connection devices, as well as information on the communications power supply.	W267
DeviceNet Master Units Operation Manual (this manual)	Describes the models, specifications, functions, and application methods of C200HX/HG/HE, CVM1, and CV-series DeviceNet Master Units.	W379
CS1 Series DeviceNet Unit Operation Manual	Describes the models, specifications, functions, and application methods of the CS1-series DeviceNet Unit.	W380
DeviceNet Slaves Operation Manual	Describes the models, specifications, functions, and application methods of DeviceNet Slaves.	W347
DeviceNet Configurator Operation Manual (Ver. 2)	Describes the operation of the DeviceNet Configurator to allocate remote I/O areas according to application needs, as well as procedures to set up a DeviceNet network with more than one master.	W382
DeviceNet MULTIPLE I/O TERMINAL Operation Manual	Describes the models, specifications, functions, and application methods of the DeviceNet MULTIPLE I/O TERMINALs.	W348

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 explains the main components of the Master Units and the installation procedures.

Section 3 describes how to allocate I/O for remote I/O communications.

Section 4 describes message communications using FINS commands sent from the ladder diagram program of the PLC.

Section 5 describes the software switches used to control DeviceNet operation and the status area used to access DeviceNet status.

Section 6 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 7 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.

Section 8 provides information on the FINS commands that can be addressed to the CPU Units of CVM1 and CV-series PLCs.

⚠ 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.

Section 9 provides information on the FINS commands that can be addressed to the CPU Units of CS-series and C200HX/HG/HE PLCs.

Section 10 provides information on the FINS commands that can be addressed to the DeviceNet Master Units.

The ***Appendices*** provide a list of the FINS command response codes, a node address settings table, information on multi-vendor applications, and information on the Master Unit's device profile.

Read and Understand this Manual

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

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WARRANTY
OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

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

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

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

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

Disclaimers

CHANGE IN SPECIFICATIONS

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

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

DIMENSIONS AND WEIGHTS

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

PERFORMANCE DATA

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

ERRORS AND OMISSIONS

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

PRECAUTIONS

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

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

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1 Intended Audience

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

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

2 General Precautions

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

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

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

This manual provides information for programming and operating OMRON PLC 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 PLC System and all PLC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PLC System to the 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** Provide safety measures in external circuits (i.e., not in the Programmable Controller), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another external factor affecting the PLC operation. Not doing so may result in serious accidents.

⚠ **WARNING** Input only the specified range of voltage or current to a Unit. A current or voltage exceeding the specified range may cause malfunction or fire.

⚠ **WARNING** Provide safety measures in external circuits (i.e., not in the Programmable Controller), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another external factor affecting the PLC operation. Not doing so may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

- The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. Unexpected operation, however, may still occur for errors in the I/O control section, errors in I/O memory, and other errors that cannot be detected by the self-diagnosis function. As a countermeasure for all such errors, external safety measures must be provided to ensure safety in the system.
- The PLC outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-V DC output (service power supply to the PLC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

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

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

4 Operating Environment Precautions

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 PLC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PLC System. 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 PLC 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 PLC System before attempting any of the following. Performing any of the following with the power supply turned on may lead to electrical shock:
  - Mounting or removing any Units (e.g., Power Supply Units, 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 PLC System or could damage the PLC or PLC 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 PLC System to ensure safety.
- Always follow electrical specifications for terminal polarity, communications path wiring, power supply wiring, and I/O jumpers. Incorrect wiring can cause failures.
- Although the Environment-resistive Slaves have IP66 or IP67 degree of protection, do not use them in applications where the Slave is always submerged in water.

6 EC Directives

DeviceNet products conform to EMS and low-voltage level directives as follows:

EMC Directives

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

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

Low-voltage Level Directives

Always ensure that devices operating at voltages of 50 to 1,000 V AC and 75 to 1,500 V DC meet the necessary safety standard for the PLC (EN61131-2).

DeviceNet products that comply with 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. Use 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 comply with EC Directives also conform to the Common Emission Standard (EN50081-2). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment complies with EC Directives.
4. DeviceNet products that comply with EC Directives have configurations with less than 30 m of I/O wiring, and less than 10 m of power supply wiring.

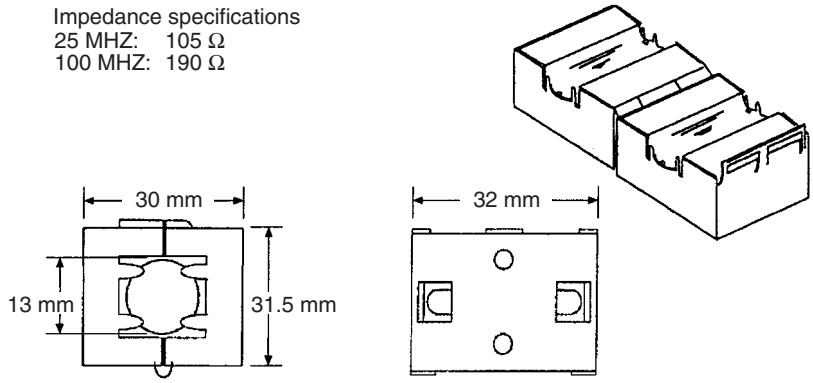
The following examples shows how to reduce noise.

1,2,3...

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

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

   Impedance specifications
   25 MHZ: 105 Ω
   100 MHZ: 190 Ω



2. Wire the control panel with as thick and short cables 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 network, including features, specifications, and the system configurations.

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1-1 Overview of DeviceNet

1-1-1 Introduction

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.

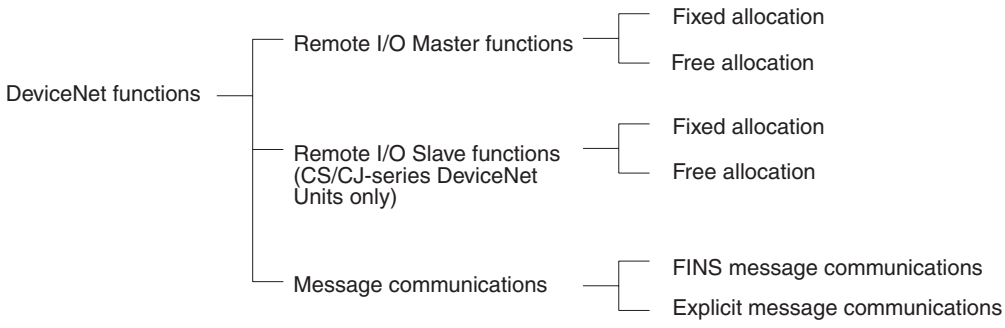
The CS/CJ-series DeviceNet Units are equipped with a Remote I/O Slave function, which can be used to automatically exchange I/O with other Masters (CPU Units).

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

1,2,3...

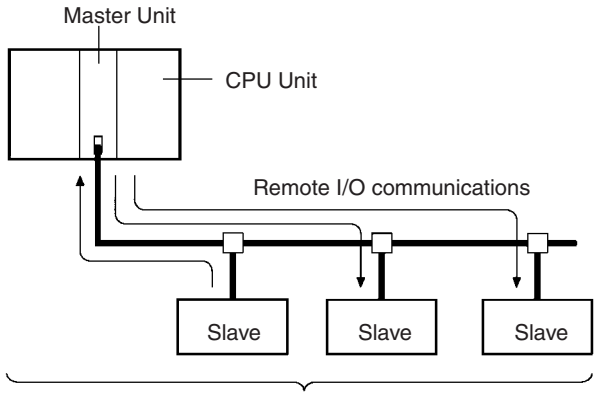
1. I/O area words can be flexibly allocated for remote I/O communications.
2. More than one Master Unit can be mounted under a single PLC.
3. More than one Master Unit can be connected in a single network.

Note The Configurator is a software application running on a personal computer that operates as one node in the DeviceNet network. (When a CS/CJ-series DeviceNet Unit is being used, the Configurator can be connected as a node or a Programming Device.)



Note The Remote I/O Slave functions supported by CS/CJ-series DeviceNet Units are not the only difference between the CS/CJ-series DeviceNet Units and the CVM1/CV-series, C200HX/HG/HE, and C200HS DeviceNet Master Units.
Although this section (*1-1 Overview of DeviceNet*) includes the CS/CJ-series DeviceNet Units, this Manual focuses on the operations of the CVM1/CV-series, C200HX/HG/HE, and C200HS DeviceNet Master Units. Refer to the *CS/CJ Series DeviceNet Units Operation Manual* (W380) for details on the special features of the CS/CJ-series DeviceNet Units.

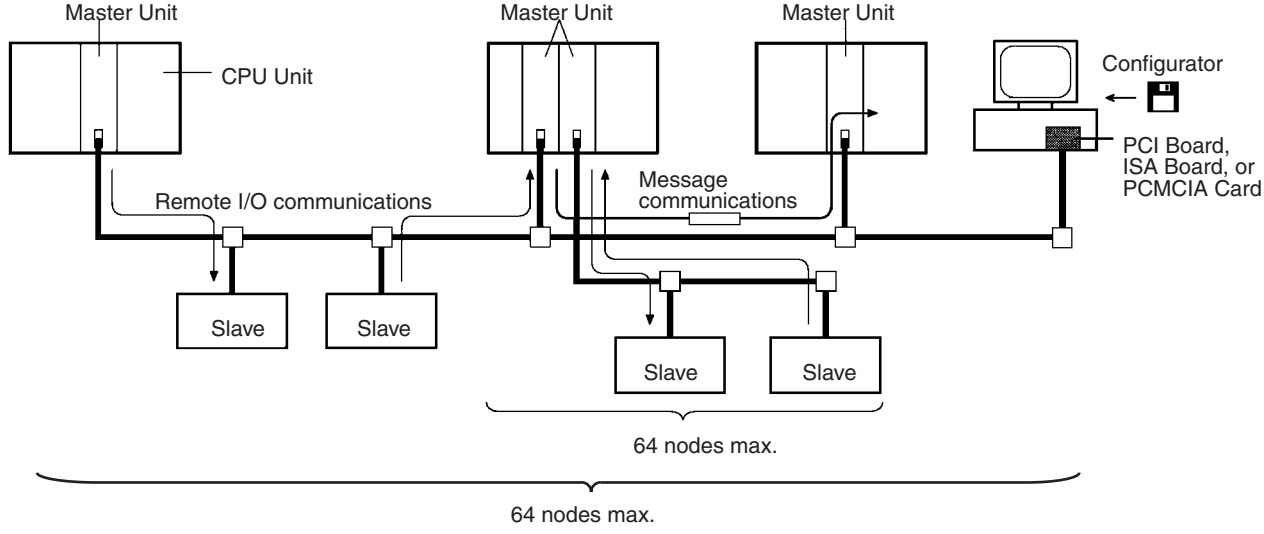
System Configuration without a Configurator



CVM1/CV-series, CS/CJ-series PLCs: 64 nodes max.
C200HZ/HX/HG/HE PLCs: 51 nodes max.
C200HS PLCs: 33 nodes max.

Note When a C200HX/HG/HE Master Unit is being used in a CS-series PLC, the maximum number of nodes is 51 nodes.
If all of the Master Units are CS/CJ-series DeviceNet Units, more than one Master Unit can be connected even without a Configurator. (The Configurator is required if another model of DeviceNet Master Unit is included in the system. An example of this kind of system configuration is shown in the following diagram.)

System Configuration with a Configurator

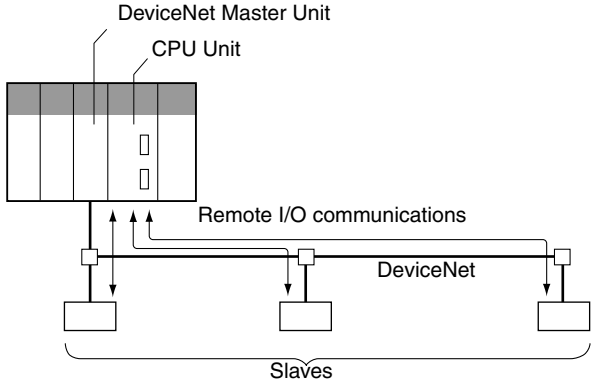


1-1-2 Master Unit Models

Applicable PC	Master Unit model number	Mounting position	Master/Slave functions	Max. number of Units	
				With Configurator	Without Configurator
CS Series	CS1W-DRM21(-V1)	CPU Rack or Expansion I/O Rack (Classified as CPU Bus Units)	Master and Slave functions	16	
CJ Series	CJ1W-DRM21				
CVM1, CV Series	CVM1-DRM21-V1	CPU or Expansion CPU Rack (Classified as CPU Bus Units)	Master function only	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	

1-1-3 DeviceNet Functions of OMRON Master Units

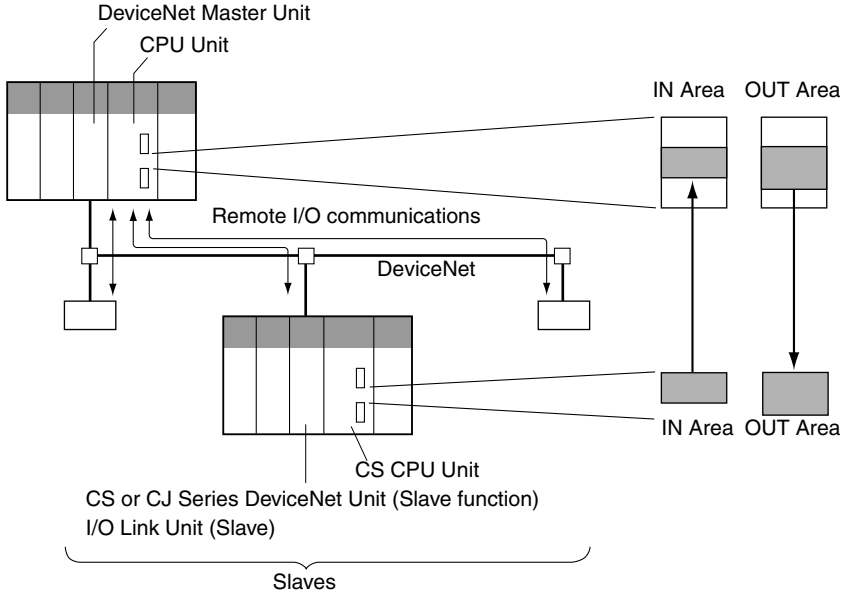
Remote I/O Master Function



Item	Master	Model	Without Configurator	With Configurator
Max. No. of Slave nodes per Master	CS Series	CS1W-DRM21(-V1)	63 nodes	
	CJ Series	CJ1W-DRM21	63 nodes	
	CVM1, CV Series	CVM1-DRM21-V1	63 nodes	
	CS Series, C200HX/HG/HE	C200HW-DRM21-V1	50 nodes	63 nodes
	C200HS		32 nodes	63 nodes
Max. No. of control points per Master	CS Series	CS1W-DRM21(-V1)	2,048 pts (64 input /64 output words) or 16,000 pts (500 input/500 output words)	32,000 pts (500 words x 4 blocks)
	CJ Series	CJ1W-DRM21		
	CVM1, CV Series	CVM2-DRM21-V1	2,048 pts (64 input/ 64 output words)	6,400 (100 words x 4 blocks
	CS Series, C200HX/HG/HE	C200HW-DRM21-V1	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

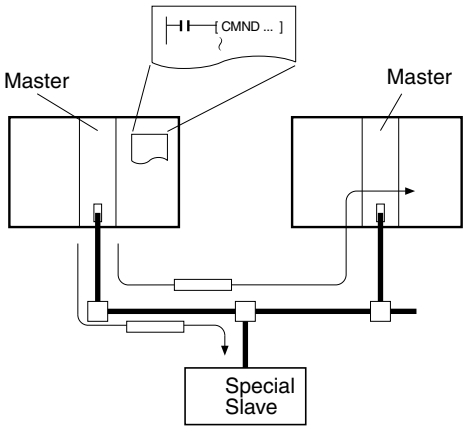
Item	Master	Model	Without Configurator	With Configurator
Max. No. of I/O points per Slave controllable by Master	CS Series	CS1W-DRM21(-V1)	100 input words x 2/100 output words x 1	
	CJ Series	CJ1W-DRM21		
	CVM1, CV Series	CVM1-DRM21-V1	32 input/32 output words	
	CS Series, C200HX/ HG/HE	C200HW-DRM21-V1		
	C200HS			
Remote I/O allocation areas	CS Series	CS1W-DRM21(-V1)	CS/CJ DeviceNet words in CIO Area, and user-allocated words in CIO Area, DM Area, and other areas.	User-allocated words in CIO Area, DM Area, and other areas.
	CJ Series	CJ1W-DRM21		
	CVM1, CV Series	CVM1-DRM21-V1	DeviceNet Area (including dedicated words/ bits)	User-allocated words in CIO Area, DM Area, and other areas.
	CS Series, C200HX/ HG/HE	C200HW-DRM21-V1		
	C200HS			

Remote I/O Slave Function



Item	CPU Unit to which a Slave is mounted	Unit Model	Without the Configurator	With the Configurator
Max. No. of I/O pts per Slave	CS Series	CS1W-DRM21(-V1)	32 pts (1 input/ 1 output word) or 3,200 pts (100 input/100 output words)	4,800 pts (100 input words x 2/100 output words x 1)
	CJ Series	CJ1W-DRM21		
	CS Series, C200HX/ HG/HE	C200HW-DRT21	1,024 pts (32 input/32 output words)	
	CQM1H CQM1 Series	CQM1-DRT21	32 pts (1 input/1 output word)	
Allocation areas in the CPU Unit to which this Slave is mounted	CS Series	CS1W-DRM21(-V1)	CIO, WR, DM, EM, HR	
	CJ Series	CJ1W-DRM21		
	CS Series, C200HX/ HG/HE	C200HW-DRM21	CIO, DM, EM, AR, LR, T/C	
	CQM1H CQM1 Series	CQM1-DRT21	CIO	

Message Communications Function



Item	Master	Unit model	Send	Receive	FINS commands
Communications Instructions	CS Series	CS1W-DRM21(-V1)	SEND(192)	RECV(193)	CMND(194)
	CJ Series	CJ1W-DRM21	SEND(192)	RECV(193)	CMND(194)
	CVM1, CV Series	DVM1-DRM21-V1	SEND(192)	RECV(193)	CMND(194)
	CS Series, C200HX/HG/HE	C200HW-DRM21-V1	None	None	IOWR
	C200HS		---		

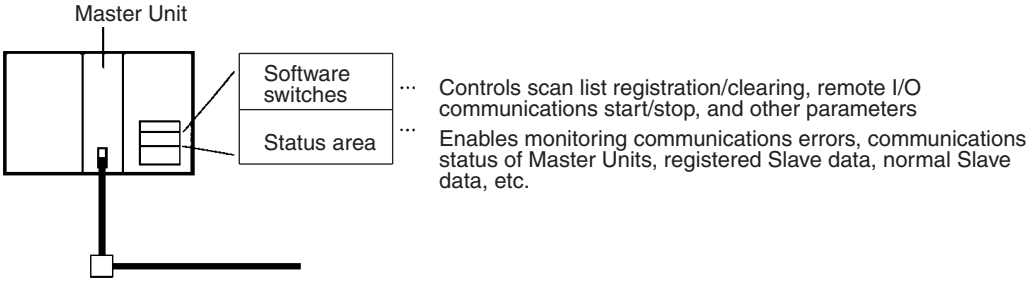
Item	Master model	Model	Capacity
Max. No. of nodes per Master for message communications using FINS commands	CS Series	CS1W-DRM21(-V1)	63 nodes
	CJ Series	CJ1W-DRM21	
	CVM1, CV Series	CVM1-DRM21-V1	8 nodes
	CS Series, C200HX/HG/HE	C200HW-DRM21-V1	8 nodes
	C200HS		Not supported
Max. No. of nodes per Master for message communications using explicit messages	CS Series	CS1W-DRM21(-V1)	63 nodes
	CJ Series	CJ1W-DRM21	
	CVM1, CV Series	CVM1-DRM21-V1	63 nodes
	CS Series, C200HX/HG/HE	C200HW-DRM21-V1	63 nodes
	C200HS		Not supported
Max. message length	CS Series	CS1W-DRM21(-V1)	SEND(192): 267 words RECV(193): 269 words CMND(194): 542 bytes (starting with command code)
	CJ Series	CJ1W-DRM21	
	CVM1, CV Series	CVM1-DRM21-V1	SEND(192): 76 words RECV(193): 78 words CMND(194): 160 bytes (starting with command code)
	CS Series, C200HX/HG/HE	C200HW-DRM21-V1	IOWR(223): 160 bytes (starting with command code)

Note PLCs equipped with a C200HW-DRM21-V1 DeviceNet Master (for C200HX/HG/HE or C200HS PLCs) or a CVM1-DRM21-V1 DeviceNet Master (for CVM1/CV-series PLCs) can communicate with each other through FINS message communications.
Furthermore, PLCs equipped with a CS1W-DRM21(-V1) or a CJ1W-DRM21-V1 DeviceNet Unit (for CS/CJ-series PLCs) can also communicate with each other through FINS message communications.

The FINS message format used in the C200HW-DRM21-V1 and CVM1-DRM21-V1 DeviceNet Master Units is different from the FINS message format used in the CS1W-DRM21-V1 and CJ1W-DRM21-V1 DeviceNet Units, so a PLC equipped with one of the DeviceNet Master Units cannot transmit FINS messages to a PLC equipped with one of the DeviceNet Units. (The two groups of PLCs can communicate with explicit message communications.)

Communications Software Switches and Communications Status

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



1-1-4 Types of Slaves

The following classifications are used for DeviceNet Slaves.

For details on DRT1-series Slaves, including General-purpose Slaves, Environment-resistive Slaves, and Special Slaves, refer to the *DeviceNet DRT1 Series Slave Operation Manual* (W347). For details on DRT2-series Slaves, including General-purpose Slaves, Environment-resistive Slaves, and Special Slaves, refer to the *DeviceNet DRT2 Series Slave Operation Manual* (W404).

Refer to the *DeviceNet MULTIPLE I/O TERMINAL Operation Manual* (W348) for more details on the MULTIPLE I/O TERMINAL Slaves.

General-purpose Slaves Slaves with I/O functions for 32 or fewer inputs and 32 or fewer outputs.

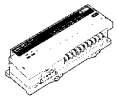
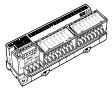
Environment-resistive Slaves Slave with I/O functions for I/O that uses a round, waterproof connector connected to a communications cable.

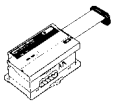
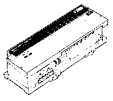
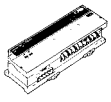
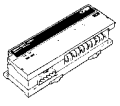
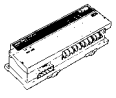
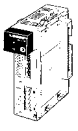
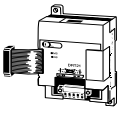
Special Slaves Slaves with more than 32 inputs or 32 outputs or Slaves with functions other than I/O.

MULTIPLE I/O TERMINALs These are high-density I/O Block Slaves.

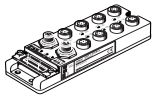
● DRT1 Slaves

General-purpose Slaves

Name	Appearance	I/O points	Model number	Communications cable	Remarks
Remote I/O Terminals with Transistors		8 input points (NPN)	DRT1-ID08	Normal square connectors	---
		8 input points (PNP)	DRT1-ID08-1		
		16 input points (NPN)	DRT1-ID16		
		16 input points (PNP)	DRT1-ID16-1		
		8 output points (NPN)	DRT1-OD08		
		8 output points (PNP)	DRT1-OD08-1		
		16 output points (NPN)	DRT1-OD16		
		16 output points (PNP)	DRT1-OD16-1		
		8 input points+8 output points (NPN)	DRT1-MD16		
Remote I/O Terminals with Transistors and 3-tier Terminal Block		16 input points (NPN)	DRT1-ID16T		Simple wiring (not necessary to tighten multiple wires together and wiring locations are easy to understand) The DRT1-□D16TA(-1) does not need a separate power supply for internal circuits (uses the communications power supply).
		16 input points (PNP)	DRT1-ID16T-1		
		16 input points (NPN)	DRT1-ID16TA		
		16 input points (PNP)	DRT1-ID16TA-1		
		16 output points (NPN)	DRT1-OD16T		
		16 output points (PNP)	DRT1-OD16T-1		
		16 output points (NPN)	DRT1-OD16TA		
		16 output points (PNP)	DRT1-OD16TA-1		
		8 input points+8 output points (NPN)	DRT1-MD16T		
		8 input points+8 output points (PNP)	DRT1-MD16T-1		
		8 input points+8 output points (NPN)	DRT1-MD16TA		
		8 input points+8 output points (PNP)	DRT1-MD16TA-1		

Name	Appearance	I/O points	Model number	Communications cable	Remarks
Remote I/O Terminals with Transistors and Connectors		32 input points (NPN)	DRT1-ID32ML	Normal square connectors	Compact (35 x 60 x 80 mm (W x D x H)) Connects to a Relay Terminal through a MIL cable. Does not need a separate power supply for internal circuits (uses the communications power supply).
		32 input points (PNP)	DRT1-ID32ML-1		
		32 output points (NPN)	DRT1-OD32ML		
		32 output points (PNP)	DRT1-OD32ML-1		
		16 input points+16 output points (NPN)	DRT1-MD32ML		
		16 input points+16 output points (PNP)	DRT1-MD32ML-1		
Remote Adapters		16 input points (NPN)	DRT1-ID16X		Compact (85 x 50 x 40 mm W x D x H) Connects to a G70D Relay terminal and can be used for a relay output or a power MOSFET relay output.
		16 input points (PNP)	DRT1-ID16X-1		
		16 output points (NPN)	DRT1-OD16X		
		16 output points (PNP)	DRT1-OD16X-1		
Sensor Terminals		16 input points (NPN)	DRT1-HD16S		Connected to photoelectric and proximity sensors with connectors
		8 input/8 output points (PNP)	DRT1-ND16S		
Temperature Input Terminals		4 thermocouple input points (4 words)	DRT1-TS04T		Thermocouple inputs Temperature resistance thermometer inputs
		4 temperature resistance thermometer input points (4 words)	DRT1-TS04P		
Analog Input Terminals		4 input points (4 words) or 2 input points (2 words)	DRT1-AD04		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)	DRT1-AD04H		1 to 5 V, 0 to 5 V, 0 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
CQM1 I/O Link Unit		16 internal inputs/ 16 internal outputs (between CQM1 and Master)	CQM1-DRT21		Remote I/O communications between PCs
CPM2A/ CPM1A I/O Link Unit		32 internal inputs/ 32 internal outputs (between CPM2A/ CPM1A and Master)	CPM1A-DRT21		Remote I/O communications between PCs

Waterproof and Environment-resistive Slaves

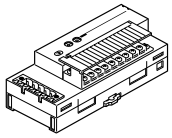
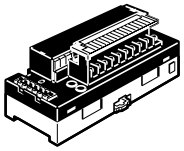
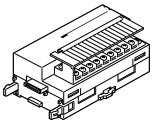
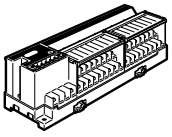
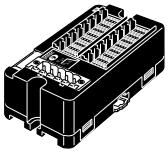
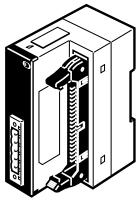
Name	Appearance	I/O points	Model number	Communications cable	Remarks
Waterproof Terminals		4 input points (NPN)	DRT1-ID04CL	Round connectors	Dust and drip-proof structure for environmental resistance (IP 67) XS2 Series connector system eliminates the need for tools for sensor, valve or other connections.
		4 input points (PNP)	DRT1-ID04CL-1		
		8 input points (NPN)	DRT1-ID08CL		
		8 input points (PNP)	DRT1-ID08CL-1		
		4 output points (NPN)	DRT1-OD04CL		
		4 output points (PNP)	DRT1-OD04CL-1		
		8 output points (NPN)	DRT1-OD08CL		
		8 output points (PNP)	DRT1-OD08CL-1		
Environment-resistive Terminals		8 input points (NPN)	DRT1-ID08C		Spatter, dust and drip-proof structure for environmental resistance (IP 66) XS2 Series connector system eliminates the need for tools for sensor, valve or other connections.
		8 output points (NPN)	DRT1-OD08C		
		16 input points (NPN)	DRT1-HD16C		
		16 input points (PNP)	DRT1-HD16C-1		
		16 output points (NPN)	DRt1-WD16C		
		16 output points (PNP)	DRT1-WD16C-1		
		8 input points+8 output points (NPN)	DRT1-MD16C		
		8 input points+8 output points (PNP)	DRT1-MD16C-1		
B7AC Interface Terminal		10 input points x 3	DRT1-B7AC		Splits 1 B7AC Unit into 3 branches. XS2 Series connector system eliminates the need for tools. Spatter, dust and drip-proof structure for environmental resistance (IP 66)

Special Slaves

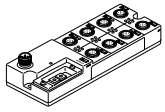
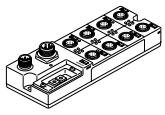
Name	Appearance	I/O points	Model number	Communications cable	Remarks
Programmable Slaves		512 inputs max. (32 words) 512 outputs max. (32 words)	CPM2C-S100C-DRT CPM2C-S110C-DRT	Normal square connectors	Controller that enables communications with CompoBus/S Master. Enables message communications using explicit messages.
C200H I/O Link Unit		512 inputs max. (32 words) 512 outputs max. (32 words)	C200HW-DRT21		Supports remote I/O and message communications between PCs. Max. I/O area: 512 input points and 512 output points Any I/O words can be allocated.
RS-232C Unit		16 inputs (1 word)	DRT1-232C2		Two RS-232C ports mounted Data sent and received by explicit message (151 bytes max.) Executes settings and control through explicit messages. Reflects RS-232C port status in the input.

● DRT2 Slaves

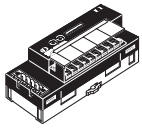
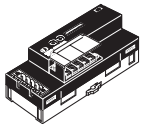
General-purpose Slaves

Name	Appearance	I/O points	Model number	Remarks
Remote I/O Terminals with Transistors		16 input points (NPN)	DRT2-ID16	Terminal block mounted/ removed using screws.
		16 input points (PNP)	DRT2-ID16-1	
		16 output points (NPN)	DRT2-OD16	
		16 output points (PNP)	DRT2-OD16-1	
Remote I/O Terminal with Relay Outputs		16 output points	DRT2-ROS16	Relay outputs
Remote I/O Terminal Expansion Units with Transistors		16 input points (NPN)	XWT-ID16	Expansion Unit for increasing inputs or outputs of the Basic Unit.
		16 input points (PNP)	XWT-ID16-1	
		16 output points (NPN)	XWT-OD16	
		16 output points (PNP)	XWT-OD16-1	
		8 input points (NPN)	XWT-ID08	
		8 input points (PNP)	XWT-ID08-1	
		8 output points (NPN)	XWT-OD08	
		8 output points (PNP)	XWT-OD08-1	
Remote I/O Terminals with 3-tier Terminal Blocks and Transistors		16 input points (NPN)	DRT2-ID16TA	Wiring locations easy to find (wiring to the same terminal not required). Cannot be expanded with an Expansion Unit.
		16 input points (PNP)	DRT2-ID16TA-1	
		16 output points (NPN)	DRT2-OD16TA	
		16 output points (PNP)	DRT2-OD16TA-1	
		8 input points/8 output points (NPN)	DRT2-MD16TA	
		8 input points/8 output points (PNP)	DRT2-MD16TA-1	
Sensor Connector Terminals with Transistors		16 input points (NPN)	DRT2-ID16S	Use industry standard Sensor connectors.
		16 input points (PNP)	DRT2-ID16S-1	
MIL Connector Terminals with Transistors		32 input points (NPN)	DRT2-ID32ML	Connects to relay terminal using MIL cable.
		32 input points (PNP)	DRT2-ID32ML-1	
		32 output points (NPN)	DRT2-OD32ML	
		32 output points (PNP)	DRT2-OD32ML-1	
		16 input points/16 output points (NPN)	DRT2-MD32ML	
		16 input points/16 output points (PNP)	DRT2-MD32ML-1	

Environment-resistive Slaves

Name	Appearance	I/O points	Model number	Remarks
Environment-resistive Terminals		8 input points (NPN)	DRT2-ID08C	Waterproof, oil-proof, and spatter-proof construction (IP67).
		8 input points (PNP)	DRT2-ID08C-1	
		16 input points (NPN)	DRT2-HD16C	
		16 input points (PNP)	DRT2-HD16C-1	
		8 output points (NPN)	DRT2-OD08C	
		8 output points (PNP)	DRT2-OD08C-1	

Analog Slaves

Name	Appearance	I/O points	Model number	Remarks
Analog Terminals		4 input points (0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V, 0 to 20 mA, 4 to 20 mA)	DRT2-AD04	Terminal block mounted/ removed using screws.
		2 output points (0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V, 0 to 20 mA, 4 to 20 mA)	DRT2-DA02	

MULTIPLE I/O TERMINAL Units

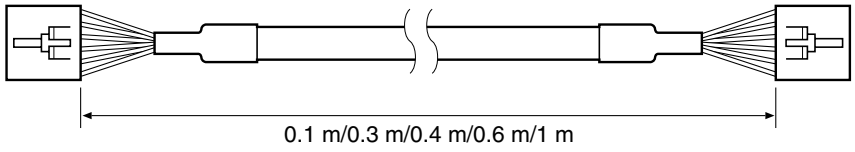
Unit		I/O points	Words allocated in PC memory		I/O connections	Unit power supply voltage	Installation	Model number	Remarks
			Input	Output					
Communications Unit		None	Two status words	0 words	None	24 V DC (supplied from outside)	DIN track	DRT1-COM	---
Basic I/O Units	Transistor Input Units	16 input 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-OD31ML-1	PNP
	Relay Output Units	8 output points	0 words	1 word	M3 terminal block			GT1-ROP08	---
		16 output points	0 words	1 word	M3 terminal block			GT1-ROS16	---

Unit		I/O points	Words allocated in PC memory		I/O connections	Unit power supply voltage	Installation	Model number	Remarks
			Input	Output					
Special I/O Units (See note.)	Analog Input Units	4 inputs	4 words	0 words	M3 terminal block	24 V DC (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 words	Connector (made by MOLEX)			GT1-AD08MX	
	Analog Output Units	4 outputs	0 words	4 words	M3 terminal block			GT1-DA04	Outputs: 4 to 20 mA, 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V
		4 outputs	0 words	4 words	Connector (made by MOLEX)			GT1-DA04MX	Outputs: 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to 10 V
	Temperature Input Unit	4 inputs	4 or 8 words (varies with data format)	0 words	M3 terminal block			GT1-TS04T	Sensor types: R, S, K, J, T, B, L
								GT1-TS04P	Sensor types: Pt100, JPt100
	Counter Unit	1 input	3 words	3 words	M3 terminal block			GT1-CT01	1 external input 2 external outputs

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

I/O Unit Connecting Cables with a cable lengths of 0.1, 0.3, 0.4, 0.6, and 1 m (GCN1-010/030/040/060/100) are sold separately (see below).



1-1-5 DeviceNet Configurator

The Configurator is a software configuration tool for the DeviceNet network. The Configurator can be used to set parameters (the scan list) and monitor operation in OMRON Master Units. The Configurator can also be used to set parameters in OMRON and other companies' Slaves.

Product name	Model	Components	Network connection to computer	Applicable computer	OS
DeviceNet Configurator (Ver. 2)	WS02-CFDC1-J	Installation disk (CD-ROM)	Any of the following: • Through an Ethernet Unit • Serial connection • PCMCIA Card • ISA Board (See the table below.)	IBM PC/AT or compatible	Windows 95, 98, Me, NT4.0, or 2000

Note The following Boards and Cards can be used.

Model	Components	Applicable computer	OS
3G8F7-DRM21	Dedicated PCI Board (Configurator not included.)	IBM PC/AT or compatible	Windows 95, 98, Me, NT 4.0, or 2000
3G8F5-DRM21	Dedicated ISA Board with DeviceNet Configurator		Windows 95, 98, or NT4.0
3G8E2-DRM21	Dedicated PCMCIA Card with DeviceNet Configurator		Windows 95 or 98

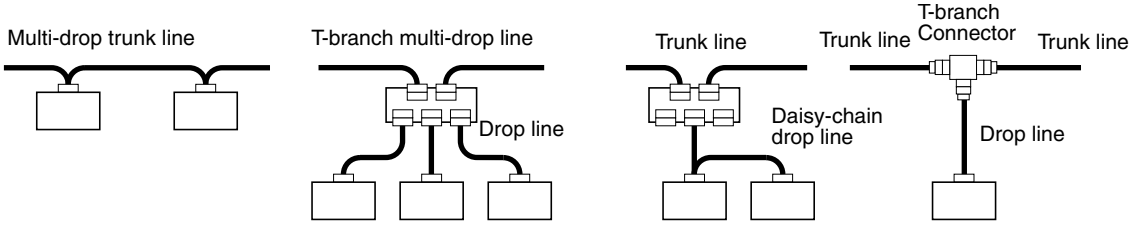
1-2 DeviceNet Network Features

DeviceNet is an open field network that can easily connect a variety of control devices such as PCs, personal computers, sensors, and actuators.

The DeviceNet network not only reduces wiring and maintenance costs because it requires less wiring, it also allows DeviceNet-compatible devices from different manufacturers to be connected. There is a wide selection of DeviceNet-compatible devices available, so a more economical system can be constructed.

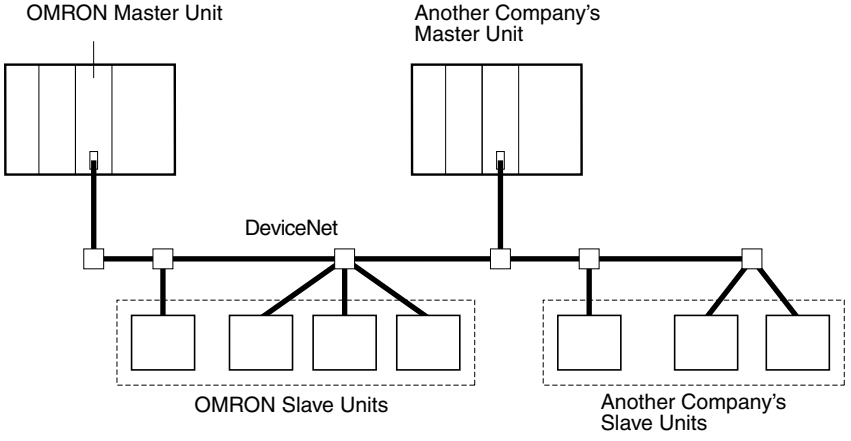
1-2-1 Reduced Wiring

Use special cable to wire connections such as multi-drop trunk lines and T-branch multi-drop lines. These connection methods can help reduce onsite wiring costs and maintenance costs.



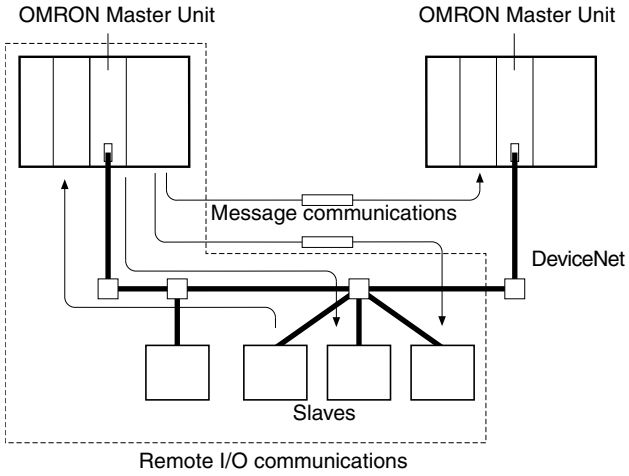
1-2-2 Multi-vendor Networks

The DeviceNet communications specifications are open and standardized, so a DeviceNet-compatible device from any manufacturer can be connected. DeviceNet can be used in a variety of field-level applications by combining devices such as valves and sensors.



1-2-3 Remote I/O Communications and Message Communications

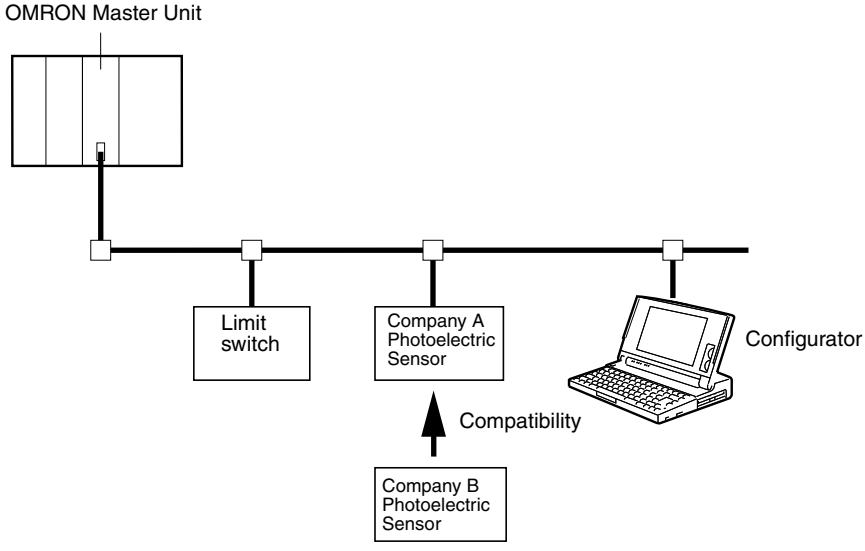
DeviceNet supports message communications as well as remote I/O communications. Message communications can be used to make device settings and monitor operation.



1-2-4 Device Profiles

Since device profiles are defined in DeviceNet, devices are compatible and replaceable even in a multi-vendor environment.

It is possible to set each device's parameters and monitor operation easily from the Configurator based on the device's profile data.



1-3 DeviceNet Master Unit Version Comparison

Item		Previous version	V1
DeviceNet Master Unit model number	C Series	CVM1-DRM21	CVM1-DRM21-V1
	CS Series	C200HW-DRM21	C200HW-DRM21-V1
	C200HZ/HX/HG/HE		
	C200HS		
Remote I/O communications		Fixed allocations only	Fixed or free allocations (See note 1.)
Message communications		Not supported	Supported
Master Units per network		1 only	Multiple with Configurator (See note 1.)
Master Units per PLC		1 only	Multiple with Configurator (See note 1.)
Communications parameters		Fixed	Can be set (communications cycle time) (See note 1.)
Explicit messages to Slaves from other companies		Not supported	Supported
Error log in Master Unit		None	Supported (readable from Configurator or via FINS commands)
Stopping remote I/O communications at startup		Not supported (always running)	Supported with Configurator (See note 1.)
Communications cycle time setting		Not supported	Supported with Configurator (See note 1.)
Communications cycle time PV monitoring		Not supported	Supported

Note

1. Configurator required.
2. The previous versions of DeviceNet 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 PLC.
3. Refer to the *CS/CJ Series DeviceNet Units Operation Manual* (W380) for details on the differences of the CS/CJ-series DeviceNet Units.

1-4 Specifications

1-4-1 DeviceNet Master Units

Standard Models

Applicable PLCs	Unit type	Communications supported	Model number
CVM1/CV-series	CPU Bus Unit	Remote I/O communications, Master (fixed or free allocation) Message communications	CVM1-DRM21-V1
C200HS, C200HX/HG/HE	Special I/O Unit		C200HW-DRM21-V1

General Specifications The general specifications conform to the CPU Unit's specifications.

Functions and Characteristics

Item		Specification			
		CVM1 and CV Series (All models)	**CS Series (All models)**	**C200HX/HG/HE (All models)**	**C200HS (All models)**
Master model number		CVM1-DRM21-V1	C200HW-DRM21-V1		
Unit type		CPU Bus Unit	Special I/O Unit		
Unit number setting range		0 to F	0 to F	0 to F (0 to 9 when using a C200HX/HG-CPU3□/4□(-Z))	0 to 9
Master Unit mounting position		CPU Rack or Expansion CPU Rack (Cannot be mounted to an Expansion I/O Rack or Remote I/O Slave Rack.)	CPU Rack or Expansion I/O Rack (Cannot be mounted to a Remote I/O Slave Rack)		
Max. number of Master Units mountable	**Fixed allocation (Without Configurator)**	1 Master Unit max.			
	Free allocation (With Configurator)	16 Master Units max.	16 Master Units max.	16 Master Units max. (10 Master Units max. when using a C200HX/HG-CPU3□/4□ (-Z))	10 Master Units max.
Max. number of Units in network		64 Units max.			
Data areas allocated in CPU Unit	**Remote I/O communications area**	Fixed allocation (Without Configurator): Fixed regions within the data areas Free allocation (Using Configurator): Any part of the I/O memory area (Set with the Configurator.)			
	CPU Bus Unit area or Special I/O Unit area	25 words/Unit in the CPU Bus Unit area (allocated by unit number)	10 words/Unit in the Special I/O Unit area (allocated by unit number)		
		1 word for software switches (control bits) and 11 words for the status area	1 word for software switches (control bits) and 9 words for the status area		
	DM area	Generally not used.	2 words/Unit		
			2 words for the status area		
Supported connections (Communications functions)		Remote I/O communications function (Master): Master/Slave connection (Poll/Bit-strobe) Explicit messaging communications function, FINS messaging communications function, Explicit connection Both communications functions conform to standard DeviceNet protocol.			
		Supported			Not supported, but Master Unit will respond to commands addressed to it.

Item		Specification			
		CVM1 and CV Series (All models)	**CS Series (All models)**	**C200HX/HG/HE (All models)**	**C200HS (All models)**
Remote I/O communications Master function	**Slave allocation Fixed allocation (Without Configurator)**	OUT: CIO 1900 to CIO 1963 IN: CIO 2000 to CIO 2063	OUT: CIO 0050 to CIO 0099 IN: CIO 0350 to CIO 0399	OUT: IR 50 to IR 99 IN: IR 350 to IR 399	OUT: IR 50 to IR 81 IN: IR 350 to IR 381
	Slave allocation Free allocation (With Configurator)	Use the Configurator to set the number of words (1/2 Input and 1/2 Output) being allocated to each Slave, the data area, and the leading address in the data area.			
		Allocate blocks starting at any address in the CIO area, CPU Bus Link area, or DM area.	Allocate blocks starting at any address in the CIO/IR area, HR area, LR area (see note 1), or DM area.		
		Max. block size: 100 words	The max. block size is 100 words, but the total for all 4 blocks is limited to 300 words max. (When message communications are being used, the total for all 4 blocks is limited to 100 words max.)		The total for all 4 blocks is limited to 80 words max.
	Max. No. of Slaves per Master Unit	63	Without Configurator:63 With Configurator:50		Without Configurator: 63 With Configurator: 32
	Max. No. of controlled points per Master Unit	Without Configurator: 2,048 pts (64 input/64 output words) With Configurator: 6,400 pts (100 words x 4 blocks)	Without Configurator: 1,600 pts (50 input/50 output words) With Configurator: Without messages: 4,800 pts With messages: 1,600 pts		Without Configurator: 1,024 pts (32 input/32 output words) With Configurator: 1,280 pts
	Max. No. of I/O points per Slave controllable by Master	1,024 pts (32 input/32 output words)			
Factory default settings		Scan list: Disabled Master functions: Enabled Remote I/O communications: Start			
Data stored in Master Unit's non-volatile memory (EEPROM)		The following settings are stored: Master scan list (The same data is also stored in the network configuration file set with the Configurator.)			
Connection used		Connection method cannot be set (The Poll/Bit-strobe connection is used.)			
Communications cycle time (See note 2.)		Without Configurator: The communications cycle time is calculated from the network conditions. For example, the communications cycle time will be 9.7 ms if there are 16 Input Slaves (16 inputs each), 16 Output Slaves (16 outputs each), and a baud rate of 500 kbps. With Configurator: The communications cycle time can be set to a fixed value between 2 and 500 ms, although the calculated value (based on network conditions) takes precedence if the calculated value > the fixed value.			
Max. communications cycle time for multiple Masters (See note 3.)		The communications cycle time is calculated from the network conditions. For example, the communications cycle time will be 18 ms if there are 16 Input Slaves (16 inputs each), 16 Output Slaves (16 outputs each), and a baud rate of 500 kbps.			

Item		Specification			
		CVM1 and CV Series (All models)	**CS Series (All models)**	**C200HX/HG/HE (All models)**	**C200HS (All models)**
Message communications	**Max. No. of nodes per Master Unit**	FINS commands:8 Explicit messages:63	FINS commands:8 Explicit messages:63		FINS commands: Not supported. Explicit messages:63
	Instructions used	Data send/receive: SEND(192)/ RECV(193) FINS commands: CMND(194)	Data send/receive: Send not supported. Reception is supported. FINS commands: IOWR		Data send/receive: Not supported. FINS commands: Send not supported. Master Units can receive.
	Sending/Receiving FINS commands through serial connection	Not supported. (The serial connection is not supported.)			
	Inter-network communications	Not supported.			
Other functions	**Remote programming/monitoring**	Not supported. (Monitoring is possible through the Configurator.)			
	Configurator operations through serial connection	Not supported.			
	Memory Card backup function	Not supported.			
	Master Unit error log function	Supported. (Can be read by the Configurator or a FINS command.)			
	Communications cycle time setting	Can be set with the Configurator.			
	Message monitoring timer	Cannot be set.			
	COS/Cyclic heartbeat timer value setting	Cannot be set.			
	Device information check function	None			
Configurator (version 2.□) connection method		A direct DeviceNet connection is required through a special Board or Card.			
Settings		Rotary switches: Unit number setting (2 decimal switches) Back panel DIP switch: Node address Front panel DIP switch: Baud rate, Continue/stop communications for communications errors			
Displays		2-color LED indicators: Two (Indicate the Unit/Module status and Network status.) 7-segment LED display: One (Indicates the Master Unit's node address, error code, and node address where error occurred.) Dot indicators: Two (Indicate whether the registered scan list is enabled or disabled.)			
Front panel connections		One communications connector (with CAN H and CAN L communications data connections, V+ and V– power supply connections, and shield connection)			
Voltage of communications power supply		11 to 25 V DC (supplied through communications connector)			

Item	Specification			
	CVM1 and CV Series (All models)	**CS Series (All models)**	**C200HX/HG/HE (All models)**	**C200HS (All models)**
Effect on the CPU Unit's cycle time	1.1 ms	1.72 + 0.022 × Number of words (ms)		2.27 + 0.077 × Number of words (ms)
Current consumption	Communications power supply: 45 mA at 24 V DC max. (from communications connector) Internal circuit power supply: 250 mA at 5 V DC max. (from PLC)			
Dimensions	34.5 × 250 × 95 mm (W×H×D)	35 × 130 × 101 mm (W×H×D)		
Weight (See note 4.)	360 g	250 g		

Note

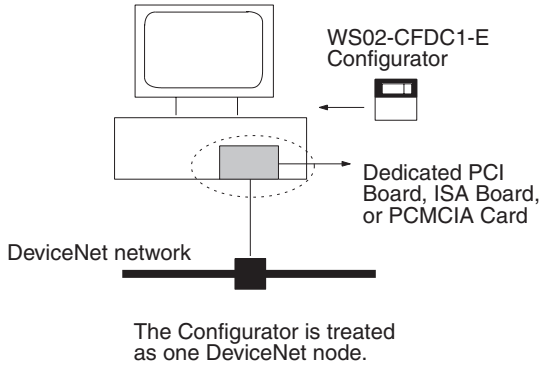
1. With CS-series PLCs, the words allocated to LR 00 through LR 63 with the Configurator are actually allocated to PLC words CIO 1000 to CIO 1063.
2. The communications cycle time is the maximum time from the point that the Master executes remote I/O communications with a particular Slave until it executes remote I/O communications again with the same Slave.
3. This is the maximum communications cycle time when there are two or more Masters in the same network. (The Configurator is required to set up this network configuration if the Master Units are for CVM1/CV-series, C200HX/HG/HE, or C200HS PLCs.)
4. The weight does not include the connectors provided with the Unit.

1-5 Overview of Configurator Usage

When the Configurator is used, the I/O words used for remote I/O communications can be allocated freely and nodes can be set in any order. The Configurator also allows more than one Master Unit to be connected to a CPU Unit or network. The Configurator has a user-friendly graphical interface, so devices (Masters and Slaves) can be registered and I/O words can be allocated simply by dragging and dropping icons.

The Configurator can be connected to the DeviceNet network with the following methods. (The serial connection is not supported by the Master Units for CVM1/CV-series, C200HX/HG/HE, or C200HS PLCs.)

Dedicated Board/Card in IBM PC/AT or Compatible



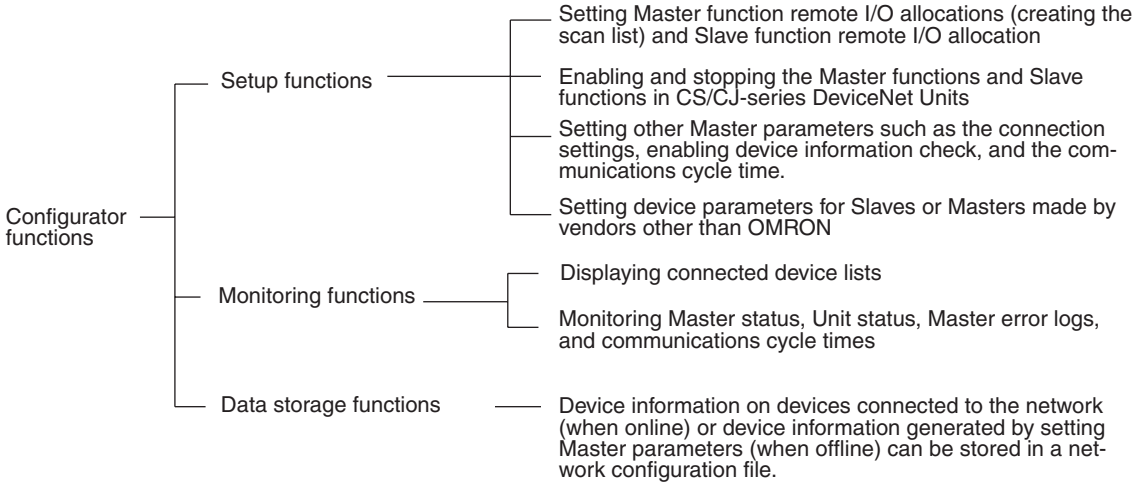
Standard Models

Model number	Components	Connection to network computer	Applicable computer	OS
WS02-CFDC1-E	Configurator Installation Disk (CD–ROM)	Through one of the following: Dedicated PCI Card Dedicated PCMCIA Card Dedicated ISA Card (See next table.)	IBM PC/AT or compatible	Windows 95, 98, Me, 2000, or NT 4.0

The following table lists the Dedicated Boards and Cards.

Model number	Components	Applicable computer	OS
3G8F7-DRM21	Dedicated PCI Board and Installation Disk with DeviceNet scanner software	IBM PC/AT or compatible	Windows 95, 98, Me, NT 4.0, or 2000
3G8F5-DRM21	Dedicated ISA Board and Installation Disk with Configurator	IBM PC/AT or compatible	Windows 95, 98, or NT 4.0
3G8E2-DRM21	Dedicated PCMCIA Card and Installation Disk with Configurator	IBM PC/AT or compatible	Windows 95 or 98

The main functions of the Configurator are illustrated below. For more details, refer to the *Configurator Operation Manual* (W382).



Note

1. Master device parameters, such as scan lists, can be generated either by using the Parameter Wizard, or by using the parameter editing operation to set all of the items.
2. Connect only one Configurator to each Network.
3. Do not use a Configurator in locations subject to excessive noise, particularly when using a PCMCIA Card. Excessive noise could cause the computer to malfunction. (Even if the computer malfunctions, the DeviceNet network itself will not be adversely affected.)
4. The OMRON Configurator can only be used with the following OMRON Master Units: CS1W-DRM21, CJ1W-DRM21, CVM1-DRM21-V1, C200HW-DRM21-V1. Do not use the Configurator for other company's Master Units.

DeviceNet Configurator (Version 2.□) Specifications

Item		Specification	
Operating environment	Hardware	Computer: IBM PC/AT or compatible CPU: 166 MHz Pentium min. Memory: 32 MB min. Hard disk: 15 MB min. free space	
	OS	Windows 95, 98, Me, NT 4.0, or 2000 (Some of these Operating Systems are not compatible with the ISA Board and PCMCIA Card.) Windows 95, 98, Me, NT 4.0, or 2000 (Some of these Operating Systems are not compatible with the ISA Board and PCMCIA Card.)	
Network connection methods		Using a Dedicated Board or Card	3G8F7-DRM21: Dedicated PCI Board 3G8F5-DRM21: Dedicated ISA Board 3G8E2-DRM21: Dedicated PCMCIA Card
		Serial connection (Connecting to the DeviceNet network through a serial connection)	Connect to the DeviceNet network from the computer's COM port by connecting to one of the following serial communications ports (peripheral bus or host link) on a CS/CJ-series PLC: The CPU Unit's peripheral port The CPU Unit's RS-232C port The RS-232C port of a Serial Communications Board or Unit
		Ethernet connection (Connecting to the DeviceNet network through an Ethernet connection)	Connect to the DeviceNet network from the computer's Ethernet port by connecting to an Ethernet Unit in a CS/CJ-series PLC. **Note:** A CS/CJ-series Ethernet Unit (CS1W-ETN□□ or CJ1W-ETN□□) and CS/CJ-series DeviceNet Unit (CS1W-DRM21 or CJ1W-DRM21) are required to connect to the DeviceNet network through Ethernet.
Node addresses	Using a Dedicated Board or Card	The Board or Card occupies one node address.	
	Using a serial connection	A node address is not occupied.	
Number connectable to network		One Configurator per network	
Compatible DeviceNet Masters		OMRON Master Units: CS1W-DRM21, CJ1W-DRM21, CVM1-DRM21-V1, C200HW-DRM21-V1, 3G8F7-DRM21 **Note:** The Master Unit's device parameters can be output in file format for an Open Network Controller or NetXServer for DeviceNet.	

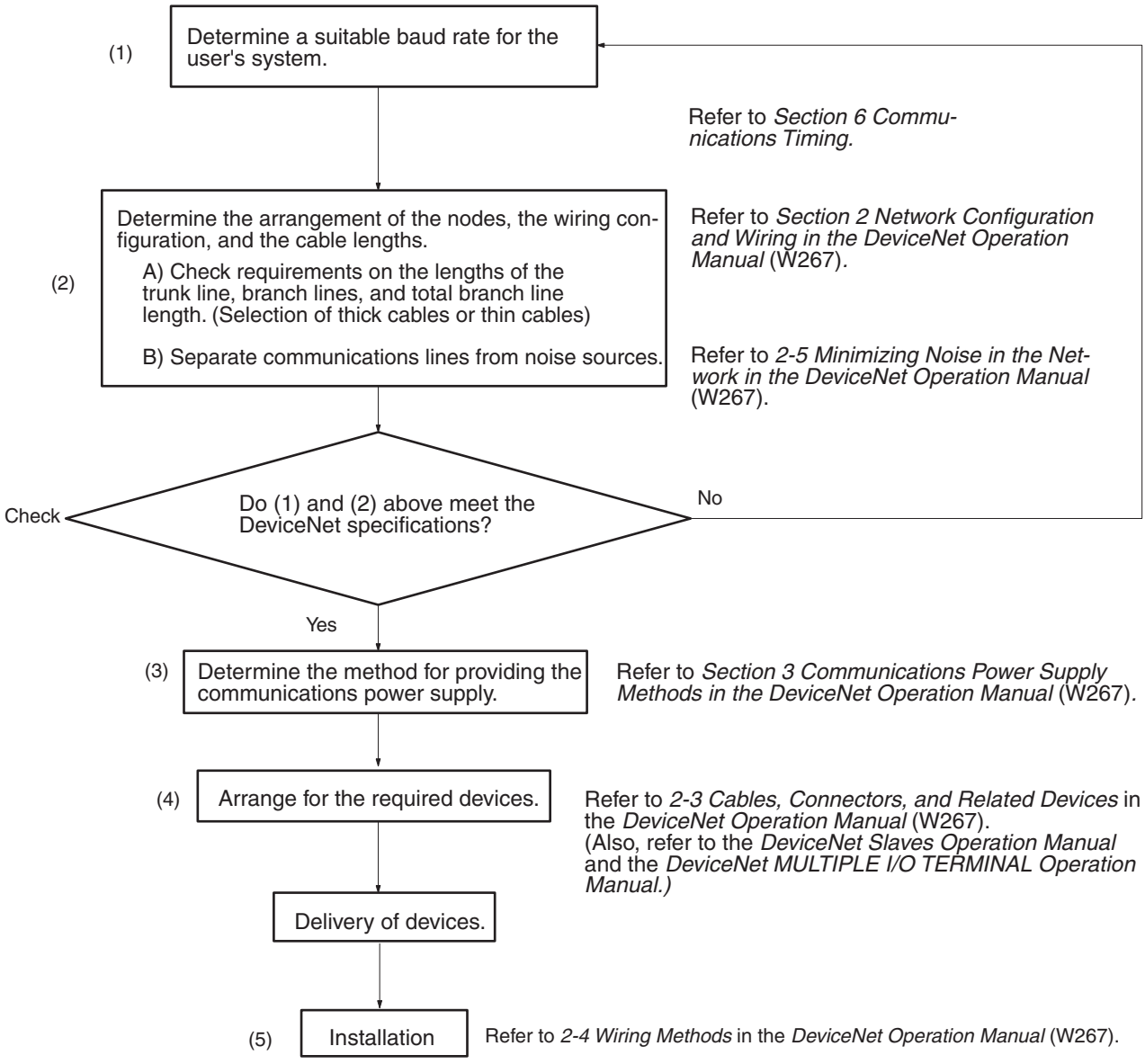
Item		Specification
Main functions	Settings	Setting parameters for OMRON Master Units (the Master's device parameters): Freely allocate remote I/O as a Master. (Create the scan list. Nodes can be set in any order and separate output and input blocks can be created. See note below.) Freely allocate remote I/O as a Slave. Set the connection to be used for remote I/O communications as a Master. Set the connection to be used for remote I/O communications as a Slave. Set whether to check device information during remote I/O communications (Specify whether to check the Slave's header, device type, and product code.) Set the message monitoring timer list for Explicit messaging. Set the COS/Cyclic heartbeat timer value. Set the communications cycle time. **Note 1.** There is a Device parameter creation wizard provided to simplify parameter settings. **Note 2.** The free remote I/O allocation function can prevent overlapping I/O allocations even when the node address order is changed or several Master Units are installed in the same PLC.
		Set the Slave's parameters (including other companies' Slaves.)
		Set each node's node address/baud rate.
		Set I/O comments (in the Slave's I/O data.)
	Monitoring	List the device information (such as node address order and remote I/O configuration order) of devices connected to the network. Monitor status of OMRON Master. Monitor error log in OMRON Master. (Error log entries contain the error time stamp, error code, and error details.) Monitor Slave's status and parameters.
	Data storage	Store the device information of devices connected to the network in a network configuration file. Store an individual device's device information in a device parameters file.
	Settings	Setting Slave parameters for Slaves not from OMRON
		Setting node addresses and baud rates
	Data storage	Starting/stopping remote I/O communications
	File export	Export the network configuration list (contents of a detailed display) in CSV format. Export I/O comments in CSV format. Export the OMRON Master Unit's device parameters to a DRM_UNIT (virtual Unit) file for an Open Network Controller. Export the OMRON Master Unit's device parameters to a file for a NetXServer for DeviceNet.
	Other	Read and write EDS files. Print Master and Slave device parameters. Use Explicit messaging to read or set parameters.

Note With DeviceNet Configurator (Version 2.□), EDS files are required to construct the DeviceNet network and set Masters/Slaves. When another company's Slave is being set, obtain a copy of the EDS file.

1-6 Basic Operating Procedures

1-6-1 DeviceNet Network Setup Flowchart

The following flowchart outlines the basic flow of operations for setting up the DeviceNet system. Refer to the *DeviceNet Operation Manual* (W267) for detailed procedures on planning and wiring the network.



1-6-2 Hardware Preparations

1,2,3...

1. Make initial Master Unit settings.
   - Unit number (“UNIT No.” or “MACHINE No.” on front panel switch)
   - Node address (back panel DIP switch, pins 1 to 6)
   - Baud rate (front panel DIP switch, pins 1 and 2)
   - Continue/stop communications for communications error (front panel DIP switch, pin 3)
2. Make initial Slave Unit settings.
   - Node address (DIP switch, pins 1 to 6)
   - Baud rate (DIP switch, pins 7 and 8)
   - Other required settings
3. Mount the Master Unit and wire the network.

   CVM1 and CV–series PLCs
   Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 16 Master Units can be mounted.

   C200HX/HG/HE PLCs
   Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 10 or 16 Master Units can be mounted.

   CS-series PLCs
   Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 16 Master Units can be mounted.

   C200HS PLCs
   Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 10 Master Units can be mounted.
4. Connect a Programming Device to the PLC and turn ON the power supply to the PLC.
5. Generate the I/O table.

1-6-3 Setting Up Communications

Procedure when Using Remote I/O Communications

Fixed I/O Allocations

1,2,3...

1. Turn ON the communications power supply.
2. Turn ON the power supply to the Slaves.
3. Turn ON the power supply to the PLC (i.e., to the Master Unit).
4. Switch the PLC to PROGRAM mode.
5. This step depends on the handling of the scan list:
   a) If the scan list is disabled at startup, proceed to step page 28

b) If the scan list is enabled at startup and will be registered again, proceed to step page 28

c) If the scan list is enabled at startup and will not be changed, proceed to step page 28

Note: The status of the dots in the Master Unit's 7-segment LED display indicate whether the scan list is enabled or disabled.
(The scan list is enabled if neither the left nor right dots are lit.
The scan list is disabled if both the left and right dots are lit.)

6. Perform the following operations and proceed to step page 28
   a) Check the Registered Slave Data Area and confirm that communications are possible with the registered Slaves.
   b) From a Programming Device connected to the PLC, turn ON the Scan List Enable Bit in the software switches (bit 0).
7. Perform the following operations from a Programming Device connected to the PLC and proceed to step page 28
   a) Turn ON the Scan List Clear Bit in the software switches (bit 1).
   b) Check the Registered Slave Data Area and confirm that communications are possible with the registered Slaves.
   c) Turn ON the Scan List Enable Bit in the software switches (bit 0).
8. 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.
9. Confirm that the MS and NS indicators on the Master Unit and all Slaves are lit green.
10. Switch the PLC to RUN mode.

Note Always operate the network with the scan list enabled.

User-set (Free) I/O Allocations

1,2,3...

1. Create a Network configuration with the Configurator offline.
2. Edit the Master and Slave device parameters with the Configurator.
3. Save the Network configuration file with the Configurator.
4. Connect the Configurator.
5. Turn ON the communications power supply.
6. Switch the Configurator online.
7. Read the saved Network configuration file with the Configurator.
8. Turn ON the power supply to all of the Slaves.
9. Turn ON the power supply to all of the Masters (i.e., to the PLC).
10. Switch the PLC to PROGRAM mode.
11. Download the network configuration (including the device parameters of all nodes.)
12. Switch the Configurator offline.
13. Turn ON the power supplies to all of the Slaves.
14. 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.
15. Confirm that the MS and NS indicators on the Master Unit and all Slaves are lit green.
16. Switch the PLC to RUN mode.

Note When there are 64 Master Units and Slave Units being used, set up communications based on user-set allocations according to the following procedure.

a) Turn ON the power supply to the Masters and turn OFF the power supply to all Slaves.
b) Switch the Configurator online using any one of the Slave's node addresses.
c) Use the Configurator to download the device parameters of only the Master Units.
d) Switch the Configurator offline.
e) Turn OFF the power supply to the Masters and turn ON the power supply to all of the Slaves. (See note.)
f) Switch the Configurator online using any one of the Master's node addresses. (See note.)
g) Download the network configuration. There will be a warning issued because the Masters' power supply is OFF, but this is normal. (See note.)
h) Switch the Configurator offline. (See note.)
i) Turn ON the power supplies to the Masters. (See note.)

Note: Steps 5 through 9 are not necessary if none of the Slaves have device parameters.

Procedure when Not Using Remote I/O Communications

Disabling Remote I/O Communications

1,2,3...

1. Create an empty scan list.
2. Download the scan list to the Master Unit.
3. Confirm that the MS indicator is lit and the NS indicator is flashing on the Master Unit.
4. Switch the PLC 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. Download the scan list to the Master Unit.
4. Confirm that the MS indicator is lit and the NS indicator is flashing on the Master Unit.
5. Switch the PLC to RUN mode.

1-6-4 Startup Procedure

1,2,3...

1. Turn ON the communications power supply.
2. Turn ON the Slave's power supply.
3. Turn ON the PLC's power supply, i.e., the Master Unit's power supply.
4. Operate the system.

Note It is also acceptable to turn ON the communications power supply and Slave's power supply at the same time, the Slave's power supply and PLC's power supply at the same time, or all three power supplies at the same time.

- Slaves may not be recognized if the communications power supply is turned ON after the Slave power supply.
- Always operate the network with the scan list enabled in the Master Unit. When the scan list is enabled, the user can check whether Slaves are participating in the network from the PLC and verify that the DeviceNet network is communicating normally.

1-7 Operations Listed by Category

Desired operation		Method	Page
Design	Customized remote I/O allocation	Allocate I/O using the Configurator.	64
	User–friendly customization of remote I/O allocations	Allocate I/O using the Master parameter wizard in the Configurator.	See note 2.
	Sending messages between PLCs with Master Units	Use communications instructions in the user program.	Sec 4
	Using more than one Master Unit in the same PLC	Connect a Configurator to the Network and mount the Master Units to the PLC.	64
	Using more than one Master Unit in the same network (in different PLCs)	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 PLCs) and create a device list while power is ON to the Slaves only.)	64
	Sending explicit DeviceNet messages	Use FINS command code 28 01.	113
Initial startup	Setting node addresses for Master Units	Set the DIP switch on the back of the Master Unit.	35, 39
	Setting the baud rate for Master Units	Set the DIP switch on the front of the Master Unit.	36, 39
	Stopping remote I/O communications for communications errors	Set the DIP switch on the front of the Master Unit.	36, 39
	Maintaining the Slave's outputs for communications errors	Set the DIP switch on the output Slave.	See note 1.
	Preventing remote I/O communications from starting automatically at startup	Use the Configurator to disable the starting of remote I/O communications at startup in the Master parameters	See note 2.
	Branching three drop lines from the same point on the trunk line	Use a T-branch Tap.	See note 3.
System operation	Stopping remote I/O communications	Stop with the software switch or Configurator.	122
	Enabling the scan list for remote I/O communications when using fixed (default) I/O allocations	Turn ON bit 0 of the software switches to enable the scan list.	122
	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.	122
	Checking whether a scan list was created by the Configurator	Use a Programming Device to monitor the status of the flag indicating that the scan list was registered from the Configurator in Master Status Area 2.	125
	Checking whether or not an error log has been generated in a Master Unit	Use a Programming Device to check the flag for error logs in Master Status Area 2.	125
	Monitoring error logs in Master Units	Monitor the error logs from the Configurator.	See note 2.
	Monitoring Master Unit status	Monitor the Master status from the Configurator.	See note 2.
	Saving a connected Slave's scan list data	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.	130
	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, check Slave connections, and turn ON bit 0 in the software switches to enable the scan list.	122, 170

Note
1. Refer to the *DeviceNet Slaves Operation Manual* or the *DeviceNet MULTIPLE I/O TERMINAL Operation Manual*.
2. Refer to the *Configurator Operation Manual*.
3. Refer to the *DeviceNet Operation Manual* (W267).

SECTION 2
Master Unit Components and Installation

This section explains the main components of the Master Units and the installation procedures.

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2-1-2 Switch Settings. 35
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2-3-1 Mounting the Master Units 43
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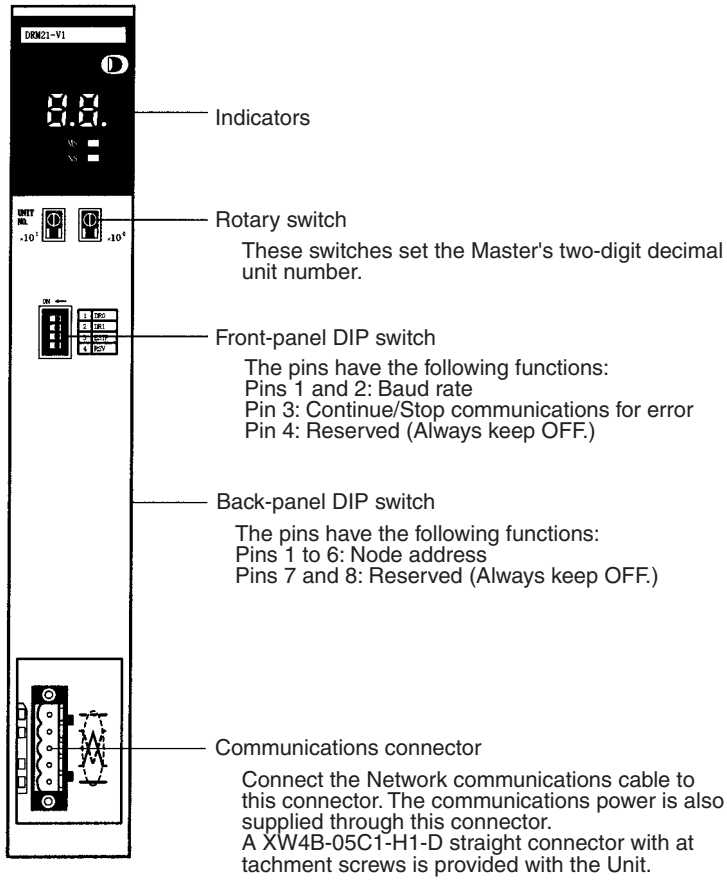
2-1 Master Unit for CVM1 and CV-series PLCs

2-1-1 Component Names and Functions



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 and the faulty node's node address.

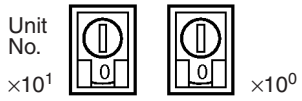
The indicators and 7-segment display can be used together to troubleshoot errors. Refer to *7-1 Indicators and Error Processing* for more details.

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	The Unit is offline or the power is OFF. For example, the Master is the only node in the Network.

2-1-2 Switch Settings

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 PLC. Use a small flat-blade screwdriver to turn the rotary switches; be careful not to damage the switch.

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

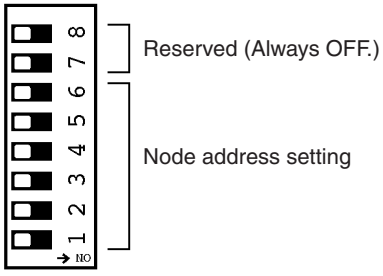
The Master Unit is shipped with the unit number set to 00.

The unit number setting determines which words in the PLC'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 PLC and communications will not start.

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 PLC in order to change the node address setting. Be sure to set the node addresses before assembling the Network.

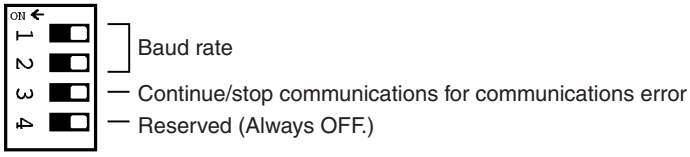
Pins 7 and 8 are reserved for system use. Leave these pins set to OFF (0).

Communications will not start if the same node address is used for the Master and another node (node address duplication error).

Note Always turn OFF the PLC 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 continue or stop 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 and may cause communications errors in the other nodes that are set correctly.

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 125 for more 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 PLC before changing the DIP switch settings.
2. The 7-segment display will show “A0” when remote I/O communications stop.

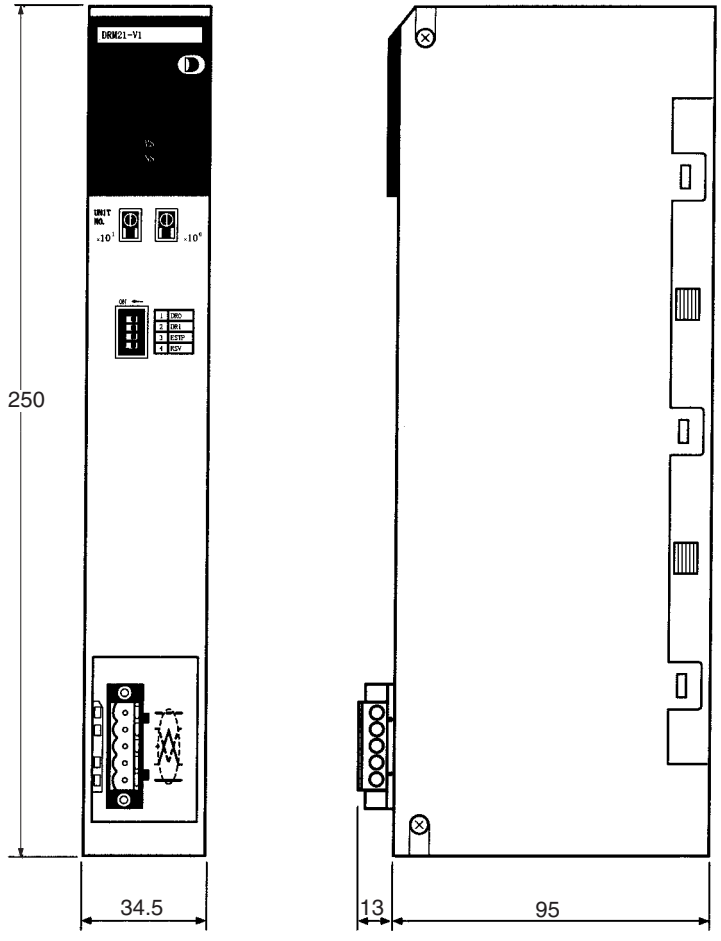
2-1-3 Master Unit Mounting Restrictions

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 even when the Configurator is not being used.

2-1-4 Dimensions

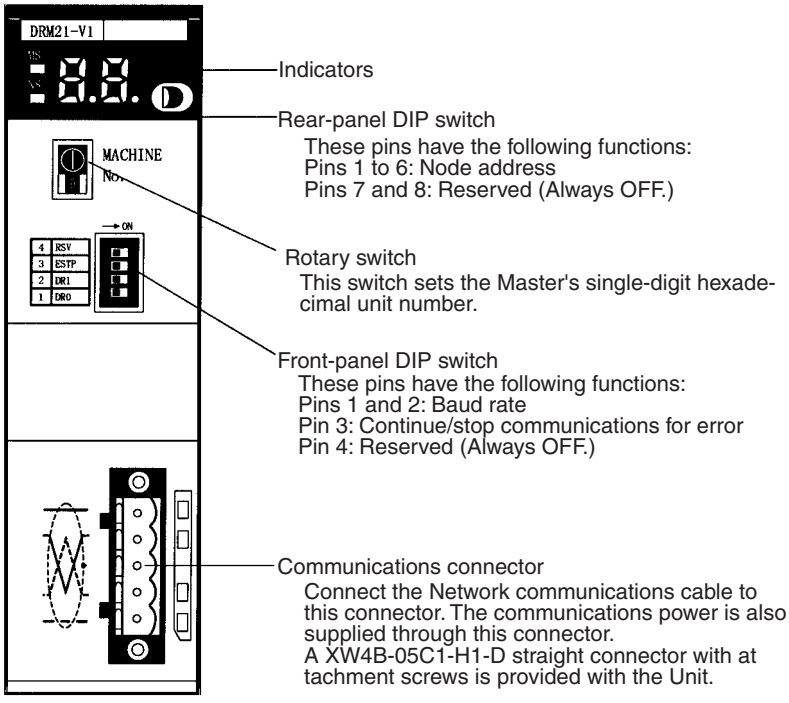
The following diagram shows the dimensions of the CVM1/CV-series Master Unit. Refer to the *CV-series PLCs Installation Guide* for the dimensions of the Unit when it is mounted to the Backplane. (All dimensions are in mm.)



2-2 Master Units for C200HX/HG/HE and C200HS PLCs

2-2-1 Component Names and Functions

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 *7-1 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	The Unit is offline or the power is OFF. For example, the Master is the only node in the Network.

2-2-2 Switch Settings

Rotary Switch Setting

The Master Unit's one-digit hexadecimal unit number ("MACHINE No.") is set with the rotary switch 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
CS 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 PLC. Use a small flat-blade screwdriver to turn the rotary switch; be careful not to damage the switch.

When a C200HW-DRT21 I/O Link Unit is being used at the same time, set I/O Link Unit's unit number higher than the Master Unit's unit number. Refer to *page 41 Master Unit Mounting/Usage Restrictions* for more details.

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

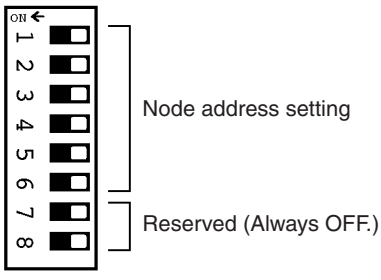
The Master Unit is shipped with the unit number set to 0.

The unit number setting determines which words in the PLC's data 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 PLC 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 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

DIP switch setting						Node address
Pin 6	Pin 5	Pin 4	Pin 3	Pin 2	Pin 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 PLC 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/HG/HE PLCs or from 0 to 31 with C200HS PLCs. The Master's node address can be set from 0 to 63 because it doesn't use any words in the I/O area.

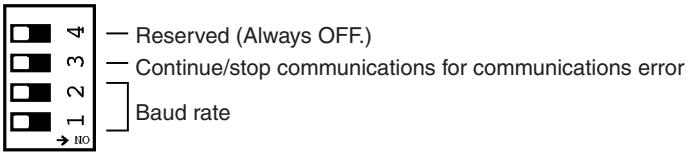
Pins 7 and 8 are reserved for system use. Leave these pins set to OFF (0).

Communications will not start up if the same node address is used for the Master and another node (node address duplication error).

Note Always turn OFF the PLC 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 continue or stop 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 and may cause communications errors in the other nodes that are set correctly.

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 125 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

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

2-2-3 Master Unit Mounting/Usage Restrictions

Mounting another Communications Unit in a CS-series, C200HX/HG/HE, or C200HS PLC

When the following combinations of Units are used in a CS-series, C200HX/HG/HE, or C200HS PLC and fixed (default) I/O allocations are being used, the allocated I/O areas will overlap and the Units will not operate properly. In these cases, the Configurator must be used to set the I/O area allocations manually.

1,2,3...

1. Two or more Master Units are being mounted to the same PLC
2. A Master Unit and SYSMAC BUS Master Unit are being mounted to the same PLC
3. A Master Unit and C200HW-DRT21 I/O Link Unit are being mounted to the same PLC

When a C200HW-DRT21 I/O Link Unit is being mounted in the same PLC, set the I/O Link Unit’s unit number higher than the Master Unit’s unit number and change the I/O Link Unit’s allocation with a Programming Console or Configurator.

The Units will not operate properly if you attempt to operate the system with fixed I/O allocations. The effects depend on the PLC model being used, as follows:

- CS-series and C200HX/HG/HE PLCs
  An error won’t occur in the PLC, but a PLC mounting error will occur in the DeviceNet Master Unit and it won’t be possible to use DeviceNet communications.
- C200HS PLC
  An error won’t occur in the PLC or the DeviceNet Master Unit, but both Masters will access the same data area so neither will operate properly.

Master Unit I/O Allocation overlapping with Actual I/O in CS-series PLC

With the CS-series PLC’s, 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

Use the CX-Programmer to edit the I/O tables so that the actual I/O (in Basic I/O Units) is not allocated to CIO 0050 to CIO 0099.

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

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

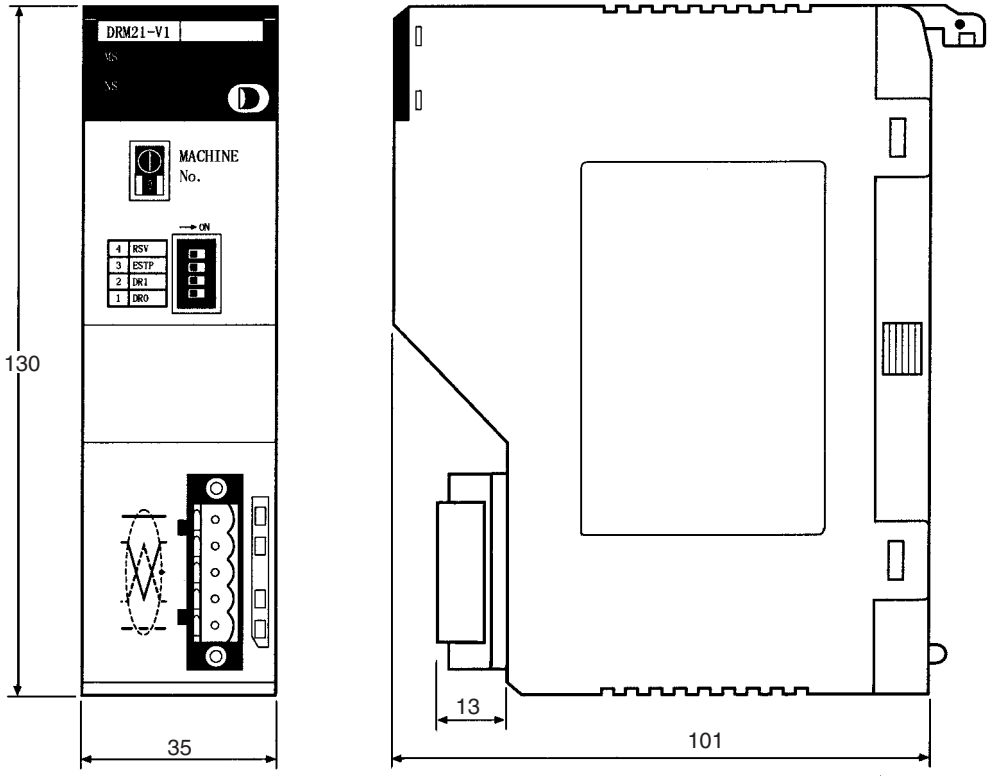
Using the Configurator

Use the Configurator to set the I/O allocation manually and change the position of areas used for DeviceNet output. For details, refer to *3-4 User-set Allocations* and the *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 malfunctions in the I/O Units, the CPU Unit program, or Slaves.

Dimensions

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



2-3 Mounting DeviceNet Master Units

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 allow proper 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 network is operating. 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 *DeviceNet Slaves Operation Manual* (W347).

2-3-1 Mounting the Master Units

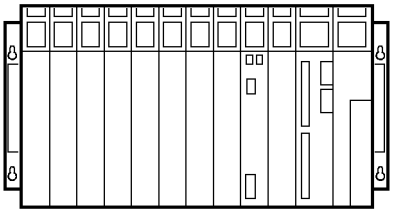
The Master Unit mounts to the PLC's Backplane, just like other Units. This section explains only the precautions that should be taken during Master Unit installation. Refer to the PLC's Installation Guide for details on mounting Units to the Backplane or installing the PLC in a control panel.

CV-series Master Units

The Master Unit can be mounted to the CPU Rack or Expansion CPU Rack of any CV-series PLC, 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 PLC. If a Configurator is not used, only 1 Master Unit can be mounted to a PLC.
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 PLC can be installed in a control panel in this condition.



Master Unit

C200HX/HG/HE and C200HS Master Units

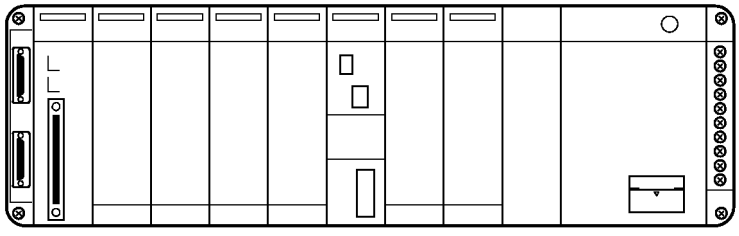
The Master Unit can be mounted to the CPU Rack or Expansion I/O Rack of any CS-series, C200HX, C200HG, C200HE, or C200HS PLC, but there are some limitations on Master Unit mounting.

1,2,3...

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

PLC	CPU model number		Max. No. of Master Units
CS 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 PLC can be attached to a control panel in this condition.



Master Unit

2-3-2 Mounting T-branch Taps and Terminating Resistors

A T-branch Tap or Terminal-block Terminating Resistor might be required to connect 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 *Appendix B Dimensions of Connectable Devices* in the *DeviceNet Operation Manual* (W267) for templates showing the mounting hole placement. Drill the specified holes in the control panel and mount the device with M4 screws. Tighten the screws to a torque of 1.2 N·m.

When mounting to DIN Track, mount the device to a 35-mm DIN Track (50-cm PFP-50N, 100-cm PFP-100N, or 100-cm PFP-100N2) just like a Slave Unit and secure the device with PFP-M End Plates.

SECTION 3
Remote I/O Communications

This section describes how to allocate I/O for remote I/O communications.

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3-1 Overview of the Remote I/O Functions

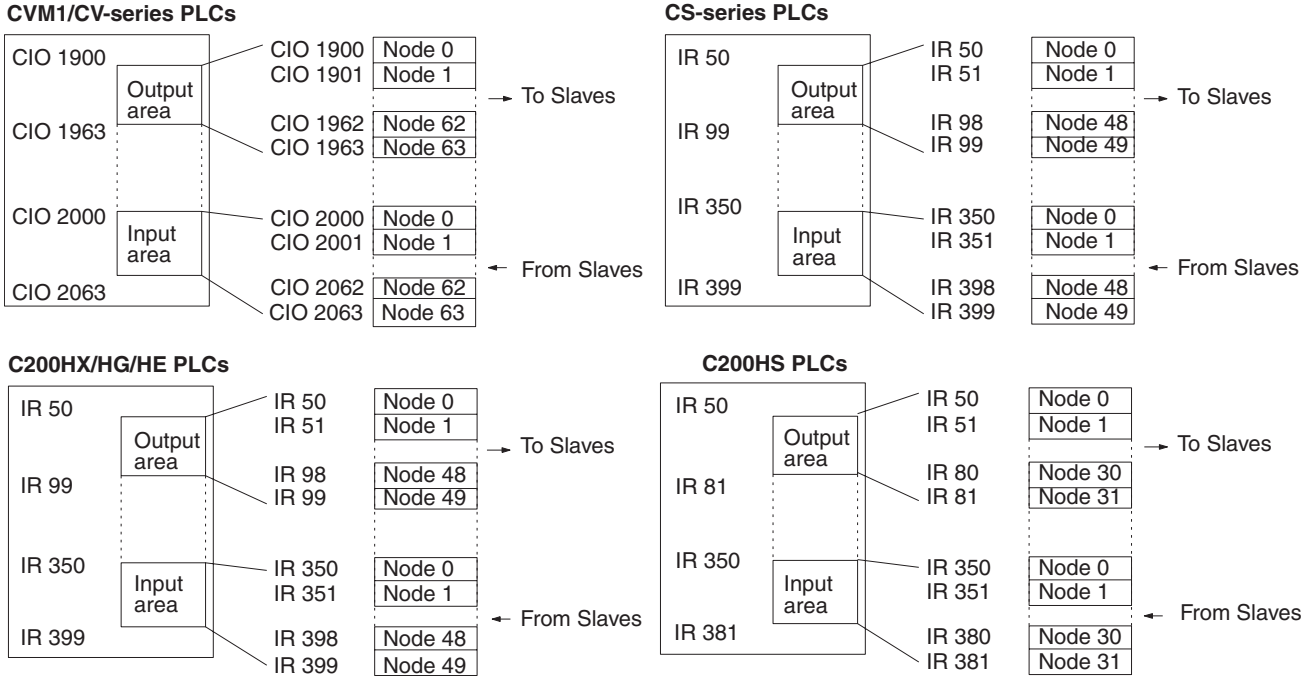
3-1-1 Introduction

The remote I/O communications function automatically exchanges I/O data between Slaves and the CPU Unit of the PLC 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. Default (fixed) word allocations can be used or the allocated words can be specified (user-set) with a Configurator.

Default Allocations (Configurator not Required)

The default input and output words are allocated to the nodes based on their node address settings, as shown in the following diagrams. Words are allocated to node addresses starting from node address 00.

Each node address is allocated one input and one output word. If a Slave requires more than one input or one output word, then the Slave occupies the input/output words for 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.



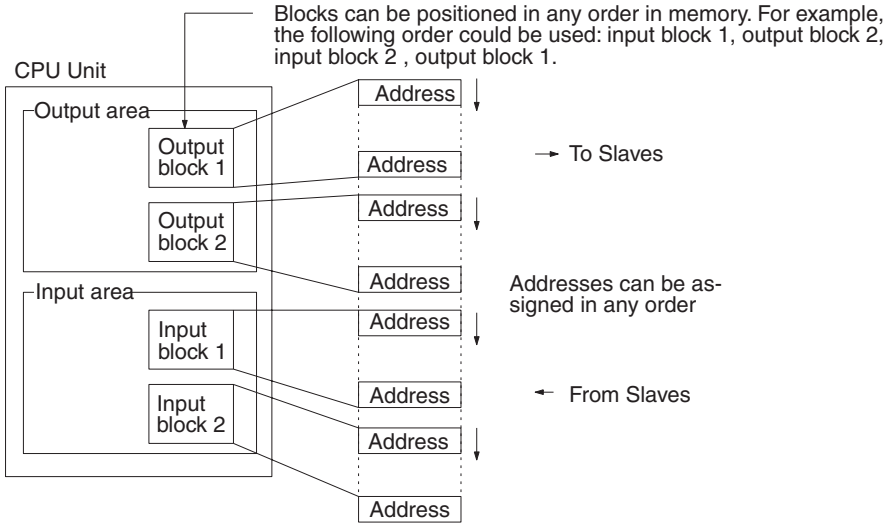
Note With the CS1 Series, the DeviceNet Output Area (CIO 0050 to CIO 0099) is contained inside the I/O Area (CIO 0000 to CIO 0319). For this reason, in systems with a large number of I/O points, edit the I/O table with the CX-programmer so that no actual I/O points (in Basic I/O Units) are allocated to the words between CIO 0050 and CIO 0099.

User-set Allocations (Configurator Required)

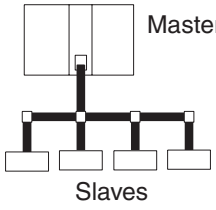
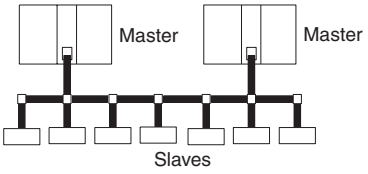
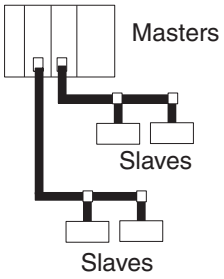
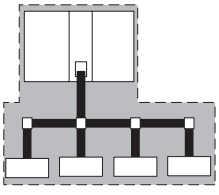
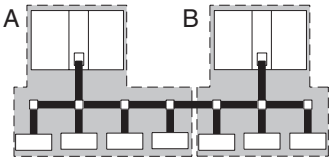
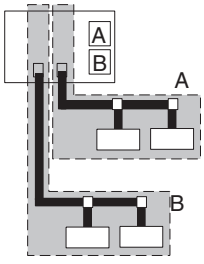
A Configurator can be used to allocate up to two output area blocks (1 and 2) and two input area blocks (1 and 2), for a total of four blocks. The blocks can be arranged in any order and the Slaves can be allocated words in these blocks in any order.

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 in a network	More than one Master in a network	More than one Master in a PLC
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 

Configuration	One Master in a network	More than one Master in a network	More than one Master in a PLC
Characteristics	Same as previous version.	The communications cycle time will be increased. (The communications cycle time will be the sum of the individual communications cycle times if the network was divided into separate networks (A and B in this case) with one Master each.)	The cycle time of the PLC will be increased.
Precautions	Same as previous version.	Refer to page 64 for precautions on using more than one Master in a network. Each Slave must belong to only one Master. If there is more than one Master in the network with its scan list disabled, communications may stop due to too much traffic on the network (Bus Off).	Do not allocate the same PLC memory area words to two Masters.

Remote I/O Specifications

<table>
<tr><th colspan="2" rowspan="2">PLC</th><th colspan="2">CVM1 and CV Series</th><th rowspan="2">CS Series</th><th colspan="2">C200HX/HG/HE</th><th rowspan="2">C200HS (all models)</th></tr>
<tr><th>CV500/ CVM1-CPU01 (-V□)</th><th>All others</th><th>C200HE-CPU11(-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
(total in all 4 blocks)</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>
</table>

<table>
<tr><th colspan="2" rowspan="2">PLC</th><th colspan="2">CVM1 and CV Series</th><th rowspan="2">CS Series</th><th colspan="2">C200HX/HG/HE</th><th rowspan="2">C200HS (all models)</th></tr>
<tr><th>CV500/ CVM1-CPU01 (-V□)</th><th>All others</th><th>C200HE-CPU11(-Z)</th><th>All others</th></tr>
<tr><td rowspan="5">Allocation methods</td><td rowspan="3">Without Configurator</td><td colspan="7">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="7">8-pt Slaves: One word is allocated, but only the rightmost byte is used (occupies 1 address).
16-pt Slaves: One word is allocated (occupies 1 address).
16-pt+ Slaves: Multiple words are allocated (occupies 1 address for each word).</td></tr>
<tr><td rowspan="2">With Configurator</td><td colspan="7">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="7">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="7">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>
<tr><td colspan="2">Starting/Stopping remote I/O communications</td><td colspan="7">Remote I/O communications can be started and stopped either from a PLC Programming Device or from a Configurator.</td></tr>
<tr><td colspan="2">Remote I/O communications upon communications errors</td><td colspan="7">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.</td></tr>
</table>

Note

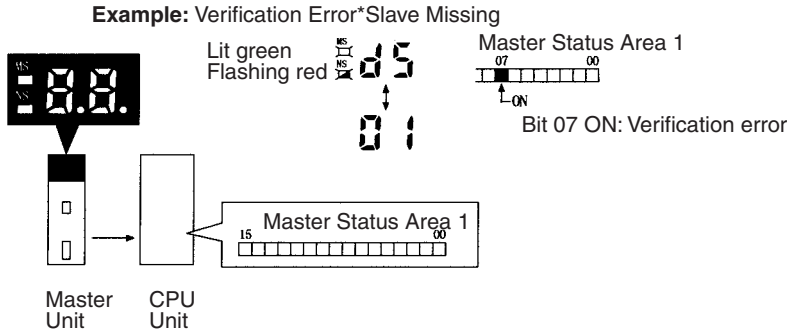
1. With CS-series and C200HX/HG/HE PLCs, only 1,600 points (100 words) can be controlled from a single Master Unit if message communications are used (i.e., if FINS commands are sent or received).
2. If words in the range “LR 00” to “LR 63” are allocated with the Configurator for CS-series PLCs, the corresponding words in the range CIO 1000 to CIO 1063 will actually be allocated.
3. With CS-series PLCs, 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 log in the Master Unit.

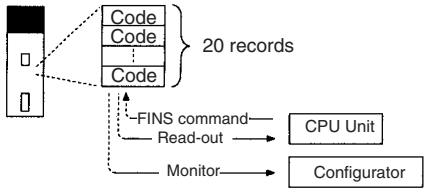
1,2,3...

1. 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. Use this information for troubleshooting.

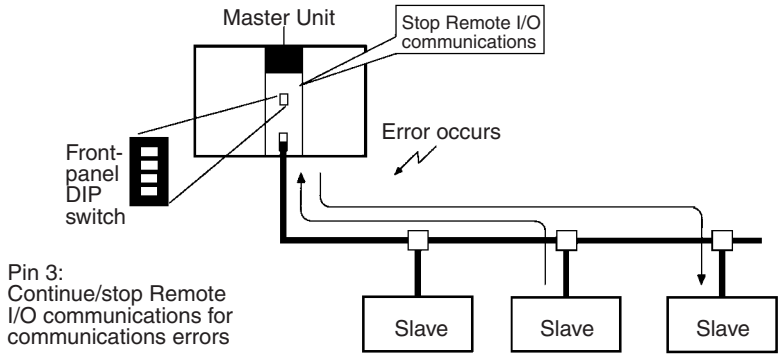


2. Each time a communications error occurs, an error code is placed in an error record in the error log kept in the RAM of the Master Unit. Up to 20 records can be stored in the error log. For CVM1/CV-series Master Units, the record is also time stamped. (Time stamps are not provided with the C200HX/HG/HE and C200HS Master Units.)

   The error log can be read or cleared from the CPU Unit by sending an FINS command to the Master Unit (ERROR LOG READ/CLEAR). The contents of the error log 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)	Stop Remote I/O communications for communications error
Scan list failure	CPU Unit in PROGRAM mode	MS: No change NS: No change	C0 ↔ Master node address	---	07 08	---
	Scan list enabled		C2 ↔ Master node address			---
	Slave missing		C3 ↔ Master node address			---
	Setup error		C4 ↔ Master node address			---
	Scan list operation in progress		CA ↔ Master nOde address			---
Setup error	I/O area overlap	MS: No change NS: Flashing red	d0 ↔ Master node address	Bits 04 and 14 turn ON.	07 02	---
	I/O area range violation		d1 ↔ Master node address		07 03	---
	Unsupported slave		d2 ↔ Master node address		07 04	---
Verification error	Slave missing		d5 ↔ Master node address	Bits 07 and 14 turn ON.	07 05	---
	Slave I/O size mismatch		d6 ↔ Master node address		07 06	---
Remote I/O communications time-out			d9 ↔ Master node address	Bits 06 and 14 turn ON.	07 07	Yes (See note.)
Send error	Network power supply error	MS: No change NS: Not lit	E0 ↔ Master node address	Bits 05 and 14 turn ON.	07 83	Yes (See note.)
	Send time-out		E2 ↔ Master node address		07 84	Yes (See note.)
Configuration error	PLC error	MS: Flashing red NS: No change	E4 ↔ Master node address	Bits 03 and 14 turn ON.	07 09	---
	Configuration data error		E8 ↔ Master node address		07 01	---
Node address duplication		MS: No change NS: Lit red	F0 ↔ Master node address	Bits 01 and 14 turn 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	Bits 00 and 14 turn ON.	---	---
Initialization error with PLC			F5 ↔ Master node address	---	00 06	---
PLC interface error			F6 ↔ Master node address		00 02	---
Memory error	EEPROM error	MS: Lit red NS: Not lit	F8 ↔ Master node address	Bits 00 and 14 turn ON.	---	---
	RAM error		F9 ↔ Master node address	---	---	---
Remote I/O communications stopped		MS: No change NS: No change	A0 ↔ Master node address	Bits 06 and 14 turn ON or Bits 05 and 14 turn ON	---	See note.

Note The Master will go into “remote I/O communications stopped” status (code A0) if pin 3 of the front–panel DIP switch is set to “stop remote I/O communi-

cations for a communications error" and a remote I/O communications time-out or send error occurs.

3-2 Scan Lists

Contents

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

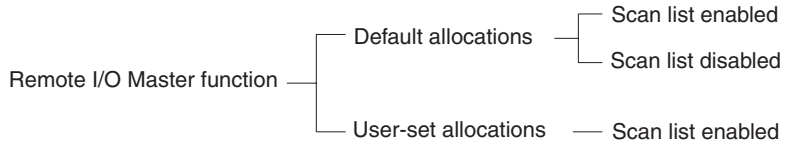
- Slave I/O allocation information that shows the number of I/O points and node addresses allocated to each Slave.
- Communications parameters providing the initial remote I/O communications status and the communications cycle time settings.

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

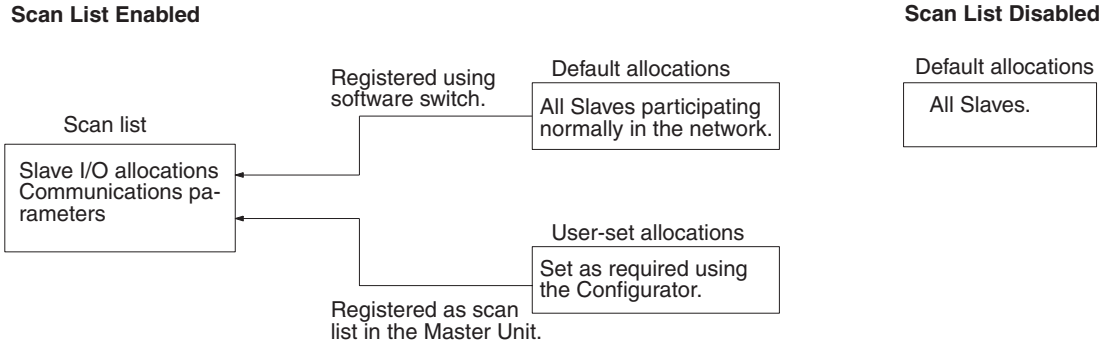
Default Remote I/O Allocations

A scan list can be created by turning ON the Enable Scan List software switch when the PLC 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. Create the scan list based on the device information of all Masters and Slaves participating normally in the network.



Note The scan lists created with the Configurator will be needed 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 do not start due to some problem, so the system may not operate properly.

Scan List Enabled

When a scan list is enabled, the Master will communicate only with the Slaves registered in the scan list. The scan list enabled mode can be used with default allocations or user-set allocations.

If a Slave registered in the scan list doesn't exist in the network or isn't started when I/O communications begin, a verification error will occur and status area bit 7 will be turned ON.

Scan List Disabled

Do not operate the system with the scan list disabled. Disable the scan list only when the scan list must be cleared temporarily, e.g., when the Master Unit is being replaced, the connected Slaves are changed, or node addresses are changed.

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. Furthermore, the communications cycle time will be much longer than the calculated 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, normal communications will not be possible.
2. The scan list data in a Master Unit is deleted whenever the scan list is disabled.

3-3 Default Remote I/O Allocation

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

3-3-1 PLC Allocation Areas

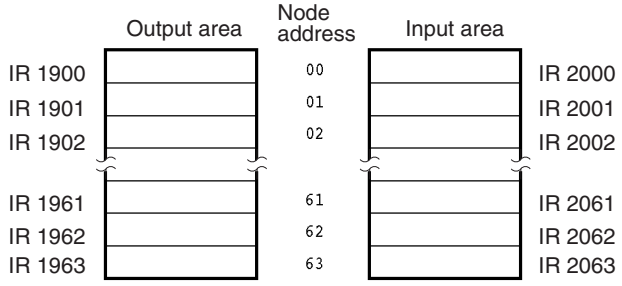
The default I/O allocations depend on the node addresses of the Units and the model of PLC being used. The words that are allocated are divided into input areas, which show the status of inputs from the Slaves and output areas, which are used to write data to be output to the Slaves.

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.

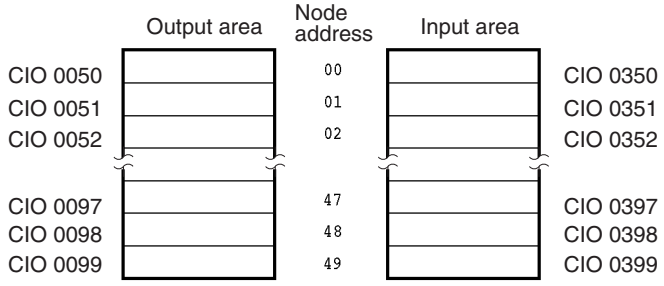
CVM1 and CV-series PLCs

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.



CS-series PLCs

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 CS Series, the default DeviceNet Output Area (CIO 0050 to CIO 0099) is within 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 I/O 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 the CX-Programmer. (I/O tables cannot be edited with a Programming Console.)

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

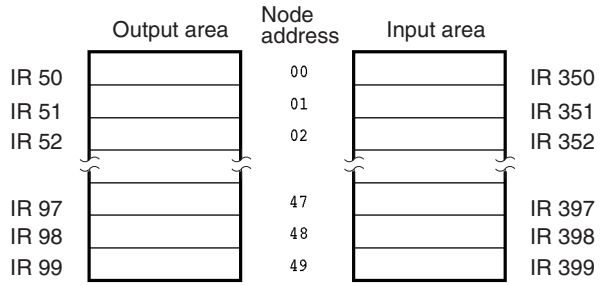
Using the Configurator

The DeviceNet output area can be changed by setting the I/O allocation (user-set allocation) with the Configurator. For details, refer to *page 64 User-set Allocations* and the *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 malfunctions in the I/O Units, the CPU Unit program, or Slaves.

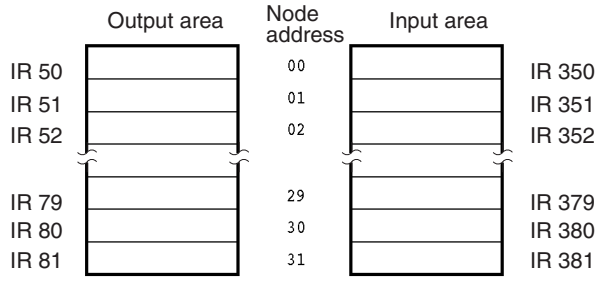
C200HX/HG/HE PLCs

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 PLCs

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.



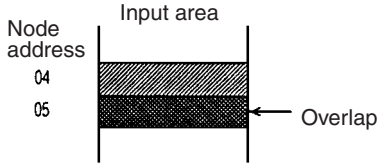
3-3-2 I/O Allocation and Errors

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

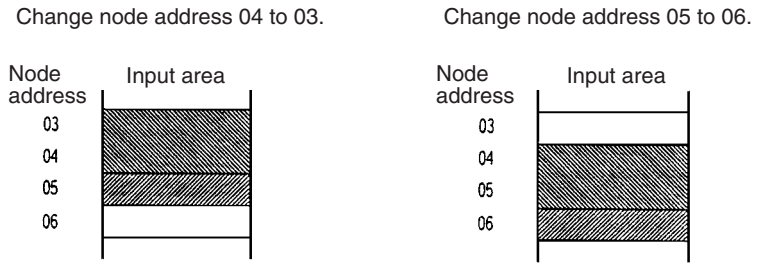
Setup Error: I/O Area Overlap

A setup error (I/O Area Overlap) will occur and it won't be possible to start DeviceNet communications if the same word is allocated to more than one Slave. 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.



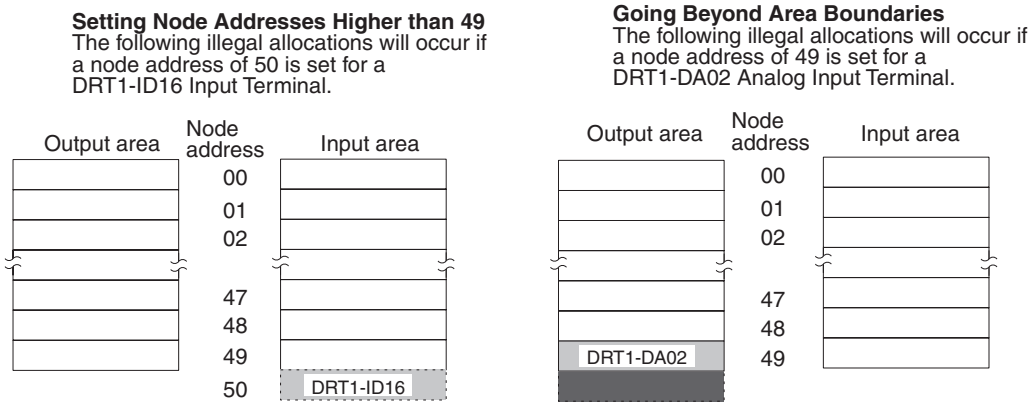
To eliminate the I/O area overlap and clear this error, change the node address setting on one of the Slaves as shown below and restart the Master by turning the power OFF and ON again or restarting.



Setup Error: I/O Area Range Violation

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

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.



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

Verification Error: Slave I/O Size Mismatch

A verification error (Slave I/O Size Mismatch) will occur and it won't be possible to start DeviceNet communications if the scan list is 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 input 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 a 1-point Input Slave is used instead of an 8-point Input Slave.

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

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

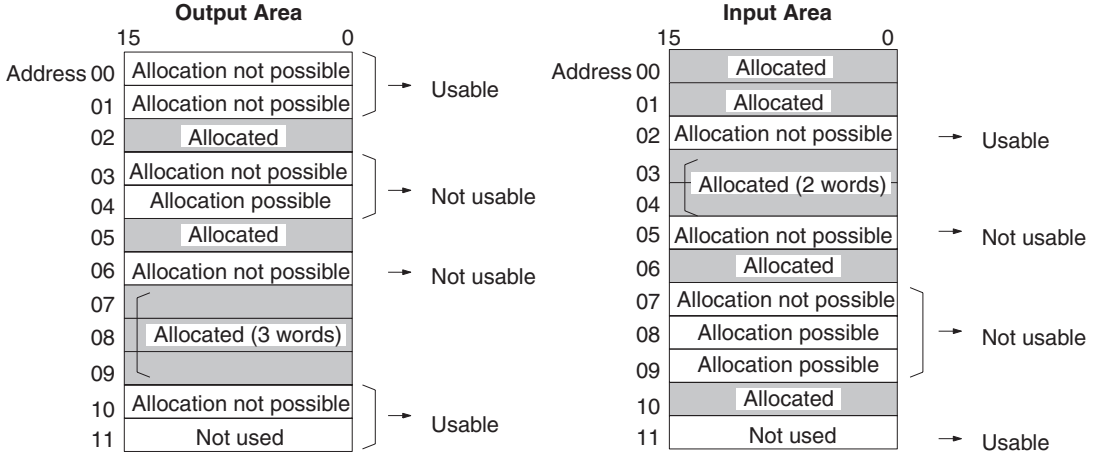
Required I/O		Slave name	Model number	Output area	Input area
Outputs	Inputs				
0 pts	4 pts	Waterproof Terminal	DRT1-ID04CL(-1)	See explanation following table.	Rightmost 4 bits allocated Leftmost 12 bits cannot be used.
0 pts	8 pts	Transistor Input Terminal	DRT1-ID08(-1)	See explanation following table.	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.
		Waterproof Terminal	DRT1-ID08CL(-1)		
		Environment-resistant Terminal	DRT1-ID08C		
4 pts	0 pts	Waterproof Terminal	DRT1-OD04CL(-1)	Rightmost 4 bits allocated Leftmost 12 bits cannot be used.	See explanation following table.
8 pts	0 pts	Transistor Output Terminal	DRT1-OD08(-1)	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.	See explanation following table.
		Waterproof Terminal	DRT-OD08CL(-1)		
		Environment-resistant Terminal	DRT1-OD08C		
8 pts	8 pts	I/O Terminal	DRT1-MD16(-1)	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.	Rightmost 8 bits allocated Leftmost 8 bits cannot be used.
		I/O Terminal (Three–level Terminal Block)	DRT1-MD16T(-1)		
			DRT1-MD16TA(-1)		
		Sensor Terminal	DRT1-ND16S		
		Environment-resistant Terminal	DRT1-MD16C(-1)		
0 pts	16 pts	Transistor Input Terminal	DRT1-ID16(-1)	See explanation following table.	16 bits allocated.
		Transistor Input Terminal (Three–level Terminal Block)	DRT1-ID16T(-1)		
			DRT1-ID16TA(-1)		
		Remote Adapter	DRT1-ID16X(-1)		
		Sensor Terminal	DRT1-HD16S		
		Environment-resistant Terminal	DRT1-HD16C(-1)		
		RS-232C Unit	DRT1-232C2		
16 pts	0 pts	Transistor Output Terminal	DRT1-OD16(-1)	16 bits allocated.	See explanation following table.
		Transistor Input Terminal (Three–level Terminal Block)	DRT1-OD16T(-1)		
			DRT1-OD16TA(-1)		
		Remote Adapter	DRT1-OD16X(-1)		
		Environment-resistant Terminal	DRT1-WD16C(-1)		
16 pts	16 pts	I/O Terminal (Connector)	DRT1-MD32ML(-1)	16 bits allocated.	16 bits allocated.
		CQM1 I/O Link Unit	CQM1-DRT21		

Required I/O		Slave name	Model number	Output area	Input area
Outputs	Inputs				
0 pts	32 pts	I/O Terminal (Connector)	DRT1-MD32ML(-1)	See explanation following table.	2 words (16 bits each) allocated.
		Analog Input Terminal (2 inputs)	DRT1-AD04		
		B7AC Interface Terminal	DRT1–B7AC		
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	Transistor Output Terminal (Connector)	DRT1-OD32ML(-1)	4 words (16 bits each) allocated.	See explanation following table.
		Analog Output Terminal (2 outputs)	DRT1-DA02	2 words (16 bits each) allocated.	See explanation following table.
32 pts	32 pts	CPM1A/CPM2A I/O Link Unit	CPM1A-DRT21	2 words (16 bits each) allocated.	2 words (16 bits each) allocated.
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)
		Programmable Slaves	CPM2C-S100C-DRT		
			CPM2C-S110C-DRT		

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. Do not assign the next node address to another Slave if the Slave requiring two or more words will use the words normally allocated to that node address.

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 in the input and output areas 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

Note DRT2-series Smart Slaves have data stored internally, so when allocating I/O, the user must specify which data is allocated for remote I/O communications with the Master Unit. Refer to *3-5 DeviceNet Remote I/O Communications* for details.

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

The following example uses a CVM1 or CV-series PLC 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.

3-3-5 Basic Application Procedure

1,2,3...

1. Make initial Master Unit settings.
   - Unit number (“UNIT No.” or “MACHINE No.” on front panel switch)
   - Node address (back panel DIP switch, pins 1 to 6)
   - Baud rate (front panel DIP switch, pins 1 and 2)
   - Continue/stop communications for communications error (front panel DIP switch, pin 3)
2. Make initial Slave Unit settings.
   - Node address (DIP switch, pins 1 to 6)
   - Baud rate (DIP switch, pins 7 and 8)
   - Other required settings

3. Mount the Master Unit and wire the network.

   CVM1 and CV-series PLCs
   Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 16 Master Units can be mounted.

   C200HX/HG/HE PLCs
   Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 10 or 16 Master Units can be mounted.

   CS-series PLCs
   Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 16 Master Units can be mounted.

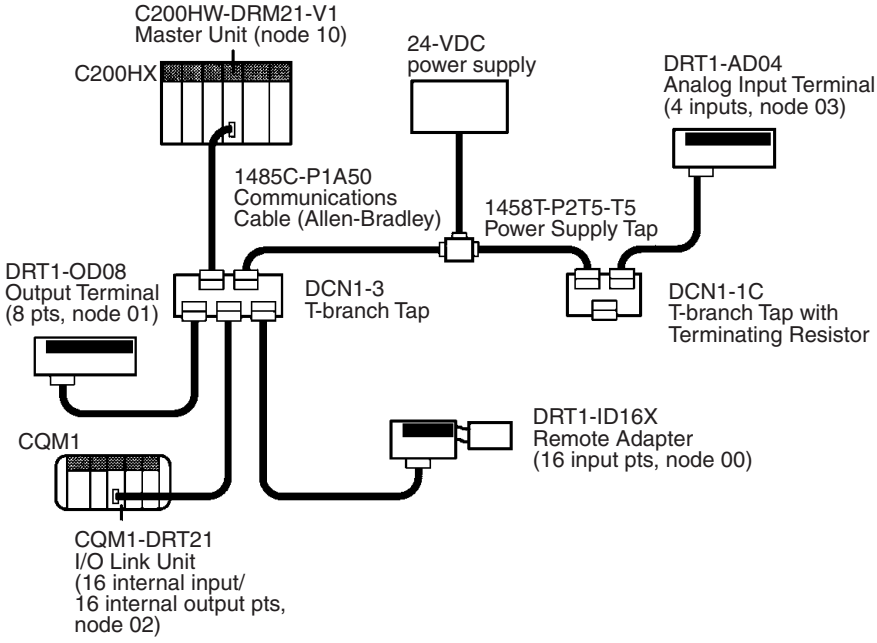
   C200HS PLCs
   Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.
   - Without Configurator: Only one Master Unit can mounted.
   - With Configurator: Up to 10 Master Units can be mounted.
4. Connect a Programming Device to the PLC and turn ON the power supply to the PLC.
5. Generate the I/O table.
6. Turn ON the Slaves' power supply and the communications power supply.
7. Turn ON the power supply to the PLC (i.e., to the Master Unit).
8. Switch the PLC to PROGRAM mode.
9. This step depends on the handling of the scan list:
   a) If the scan list is disabled at startup, proceed to step 6.
   b) If the scan list is enabled at startup and will be registered again, proceed to step 7.
   c) If the scan list is enabled at startup and will not be changed, proceed to step 8.

   Note: The status of the dots in the Master Unit's 7-segment LED display indicate whether the scan list is enabled or disabled.
   (The scan list is enabled if neither the left nor right dots are lit.
   The scan list is disabled if both the left and right dots are lit.)
10. Perform the following operations and proceed to step 8.
    a) Check the Registered Slave Data Area and confirm that communications are possible with the registered Slaves.
    b) From a Programming Device connected to the PLC, turn ON the Scan List Enable Bit in the software switches (bit 0).
11. Perform the following operations from a Programming Device connected to the PLC and proceed to step 8.
    a) Turn ON the Scan List Clear Bit in the software switches (bit 1).
    b) Check the Registered Slave Data Area and confirm that communications are possible with the registered Slaves.
    c) Turn ON the Scan List Enable Bit in the software switches (bit 0).

12. 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.
13. Confirm that the MS and NS indicators on the Master Unit and all Slaves are lit green.
14. Switch the PLC to RUN mode.

3-3-6 Actual System Allocation Example

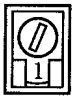
The following example application uses remote I/O communications with the default I/O allocations.



Procedure

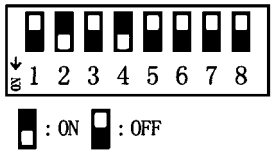
1,2,3... 1. Make the initial settings for the Master Unit as follows:

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



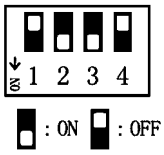
The following words are allocated for the software switches and status areas for a unit number of 1: IR 110 to IR 119 and DM 6034 to DM 6035.

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

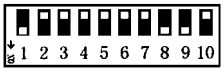
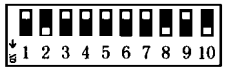
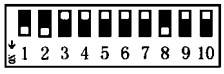


The remote I/O words allocated to the Master Unit are not used.

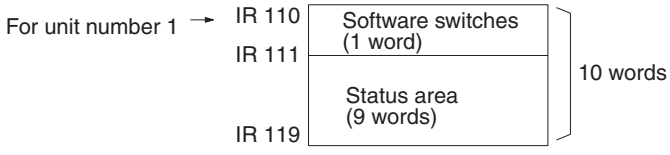
c) Set the baud rate and the “continue/stop communications for communications errors” setting. The following example shows a baud rate of 500 kbps (pin 1 OFF and pin 2 ON) and pin 3 set to stop communications for communications errors (pin 3 ON).



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 maintain outputs for communications 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 maintain outputs for communications 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.

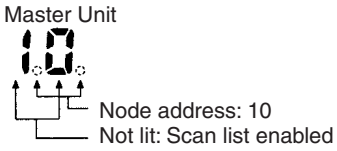
3. Mount and wire the Master Unit.
4. Connect a Programming Device to the PLC, turn ON the PLC, and create the I/O table.
5. Turn OFF power to the PLC (Master Unit).
6. Turn ON power to all Slaves and turn ON the communications power supply.
7. Turn ON power to the PLC (Master Unit).
8. Switch the PLC 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.



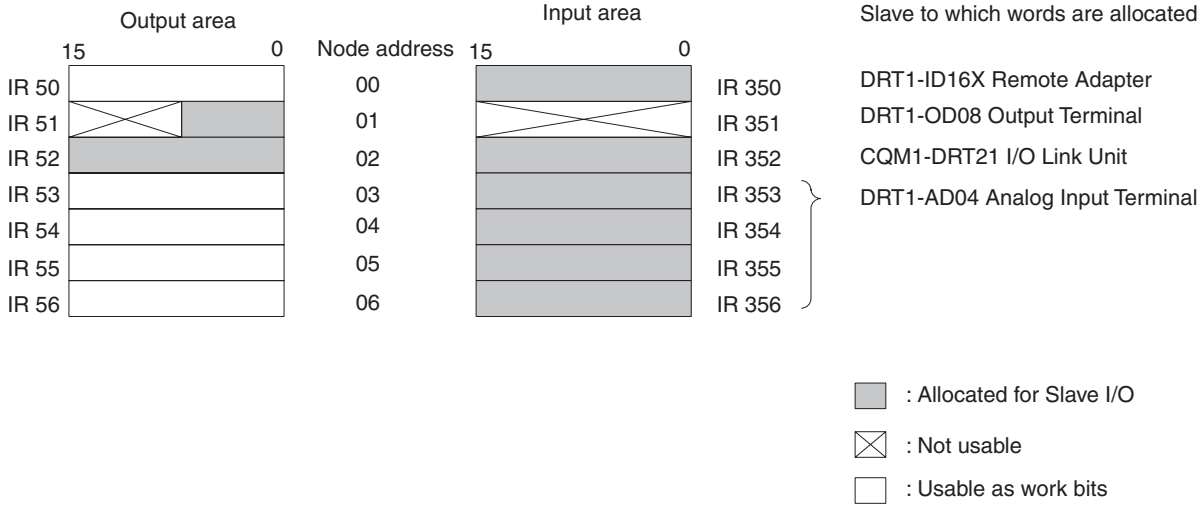
The functions of the software switches are shown in the following table.

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:



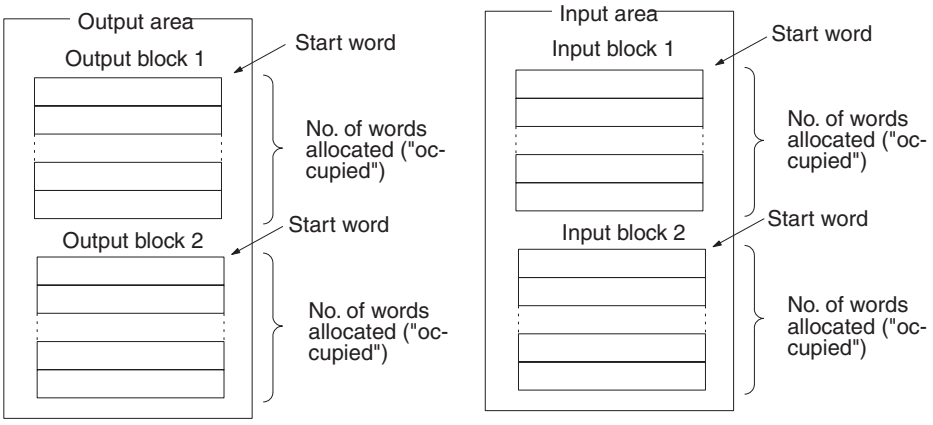
3-4 User-set Allocations

3-4-1 Allocation Method

The remote I/O areas are composed of four blocks: input blocks 1 and 2, which input Slave data to the PLC, and output blocks 1 and 2, which output data from the PLC to the Slaves. These four blocks can be allocated in any order using the following data area regions. Each block must consist of continuous words within one data area.

PLC	CVM1/CV-series PLCs		CS-series PLCs	C200HX/HG/HE PLCs		C200HS PLCs (all models)
	CV500/ CVM1-CPU01(-V□)	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 CS-series PLCs, the corresponding words in the range CIO 1000 to CIO 1063 will actually be allocated.



Note

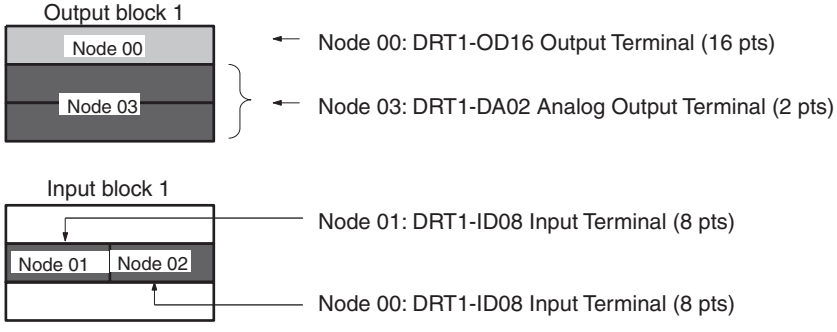
1. When using the Configurator to create Master parameters for a C200HX/HG/HE or C200HS Master Unit mounted to a CS-series PLC, set the PLC model to “Other C200HX/HG/HE(-Z) Series”.
2. The following table shows the data areas listed in the Configurator and the corresponding data areas in the CS-series PLC when a C200HX/HG/HE or C200HS Master Unit is mounted to a CS-series PLC and I/O is being allocated with the Configurator. Only parts of the data areas in the CS-series PLC can be used.

Area specified with Configurator	Actual area for CS-series PLC
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
LR 00 to LR 63	CIO 1000 to CIO 1063
DM 0000 to DM 5999	D00000 to D05999

Procedure

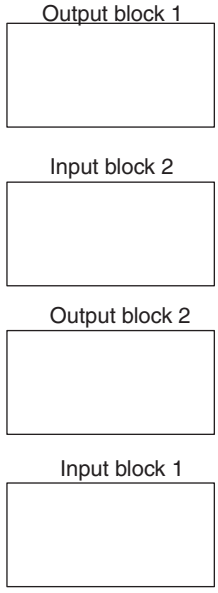
1,2,3...

1. Use the Configurator to set the data area, starting word, and number of words that are being allocated for each block.
2. Use the Configurator to allocate node addresses within each block, as shown below.

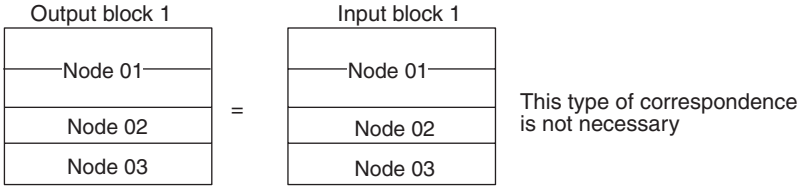


Each node address must be allocated at least one byte (rightmost or leftmost).

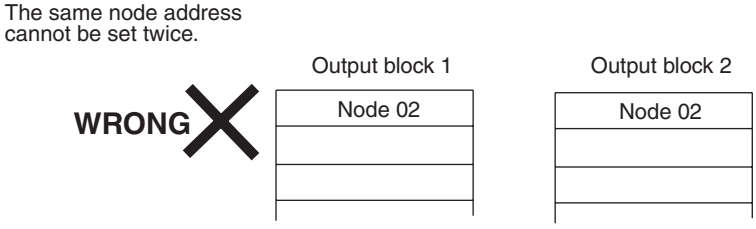
Note 1. Blocks can be allocated in any order, as shown in the following example.



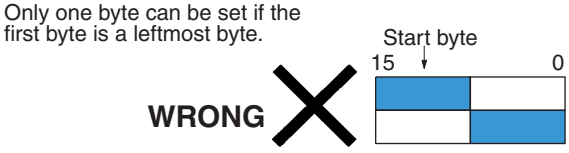
2. Output blocks do not need to match input blocks in terms of node address settings. For example, the following type of correspondence is not necessary.



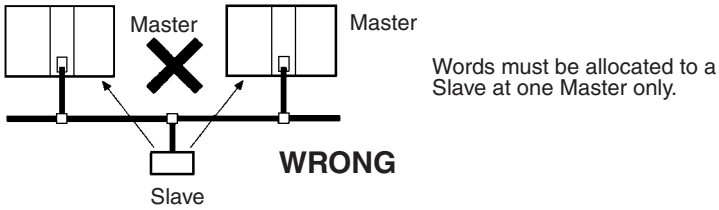
3. Each node address can be set only once in the output blocks and once in the input blocks.



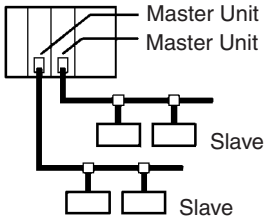
4. I/O can be allocated in either bytes or words, but if the starting byte is a leftmost byte (bits 07 to 15), then only one byte can be set.



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



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. If user-set allocations are used, more than one Master Unit can be mounted to the same PLC, as shown below.



3-4-2 Example of User-set Allocations

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

Output Block 1 and Input Block 1

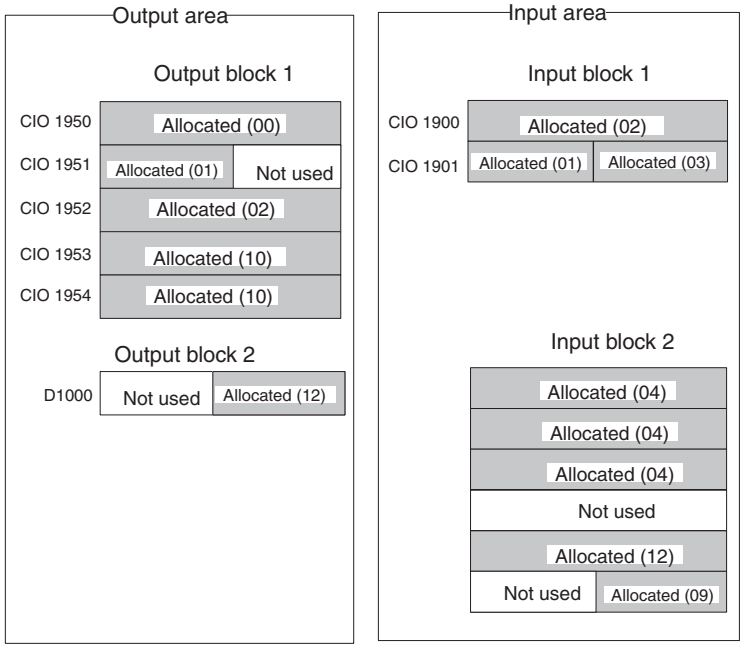
16 output points → 00
8 I/O points → 01
16 I/O points → 02
8 input points → 03
32 output points → 10

Output Block 2 and Input Block 2

48 input points → 04
8 input points → 09
8 output points, 16 input points → 12

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 with the Configurator

1,2,3...

1. If there are Slaves with Output and Input sizes different from the default settings, edit the I/O information for those Slaves and set the correct I/O sizes (number of bytes).
2. Double-click the Master Unit's icon to display its Edit Device Parameters Window.
3. Display the *General* Tab and move all of the Slaves that are being registered from the *Unregistered Device List* to the *Registered Device List*.
   When the allocations are complicated, we recommend deleting the check mark from the *Perform Automatic Allocation during Registration* Box.
4. Display the *I/O Allocation (OUT)* Tab or *I/O Allocation (IN)* Tab and make the settings for Output Blocks 1/2 and Input Blocks 1/2.
   Click a block's **Change Memory** Button to set that block's data area, starting word, and number of words.

Output area, block 1		Output area, block 2		Input area, block 1		Input area, block 2	
Area:	I/O relay	Area:	DM Area	Area:	I/O relay	Area:	I/O relay
Start word:	1950	Start word:	1000	Start word:	1900	Start word:	10
No. of words:	5	No. of words:	1	No. of words:	2	No. of words:	6

I/O relay = IR or CIO Area

5. Display the *I/O Allocation (OUT)* Tab or *I/O Allocations (IN)* Tab and allocate memory to the Slaves.
   A Slave's *Allocation Setting* Window can be displayed by double–clicking the Slave in the list. It is also possible to drag and drop the Slave from the list to the desired location in an input block or output block.

Output area, block 1

1950:Bit00	#00
1950:Bit08	#00
1951:Bit00	
1951:Bit08	#01
1952:Bit00	#02
1952:Bit08	#02
1953:Bit00	#10
1953:Bit08	#10
1954:Bit00	#10
1954:Bit08	#10

Output area, block 2

D1000:Bit00	#12
D1000:Bit08	

Input area, block 1

1900:Bit00	#02
1900:Bit08	#02
1901:Bit00	#03
1901:Bit08	#01

Input area, block 2

0010:Bit00	#04
0010:Bit08	#04
0011:Bit00	#04
0011:Bit08	#04
0012:Bit00	#04
0012:Bit08	#04
0013:Bit00	
0013:Bit08	
0014:Bit00	#12
0014:Bit08	#12
0015:Bit00	#09
0015:Bit08	

3-4-3 Basic Application Procedure

1,2,3...

1. Make initial Master Unit settings.
   - Unit number ("UNIT No." or "MACHINE No." on front panel switch)
   - Node address (back panel DIP switch, pins 1 to 6)
   - Baud rate (front panel DIP switch, pins 1 and 2)
   - Continue/stop communications for communications error (front panel DIP switch, pin 3)
2. Make initial Slave Unit settings.
   - Node address (DIP switch, pins 1 to 6)
   - Baud rate (DIP switch, pins 7 and 8)
   - Other required settings
3. Mount the Master Unit and wire the network.

CVM1 and CV–series PLCs
Master Units are treated as CPU Bus Units and can be mounted to the CPU Rack or Expansion CPU Rack.

- Without Configurator: Only one Master Unit can mounted.
- With Configurator: Up to 16 Master Units can be mounted.

C200HX/HG/HE PLCs
Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.

- Without Configurator: Only one Master Unit can mounted.
- With Configurator: Up to 10 or 16 Master Units can be mounted.

CS1-series PLCs
Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.

- Without Configurator: Only one Master Unit can mounted.
- With Configurator: Up to 16 Master Units can be mounted.

C200HS PLCs
Masters are treated as Special I/O Units and can be mounted to the CPU Rack or Expansion I/O Rack.

- Without Configurator: Only one Master Unit can mounted.
- With Configurator: Up to 10 Master Units can be mounted.

4. Connect a Programming Device to the PLC and turn ON the power supply to the PLC.
5. Generate the I/O table.
6. Create a Network configuration with the Configurator offline.
7. Edit the Master and Slave device parameters with the Configurator.
8. Save the Network configuration file with the Configurator.
9. Connect the Configurator.
10. Turn ON the communications power supply.
11. Switch the Configurator online.
12. Read the saved Network configuration file with the Configurator.
13. Turn ON the power supply to all of the Slaves.
14. Turn ON the power supply to all of the Masters (i.e., to the PLC).
15. Switch the PLC to PROGRAM mode.
16. Download the network configuration (including the device parameters of all nodes.)
17. Switch the Configurator offline.
18. Turn ON the power supplies to all of the Slaves.
19. 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.
20. Upload the network configuration.
21. Confirm that Master Unit's Master parameters have been set correctly.
22. Save the data as a network configuration file.
23. Confirm that the MS and NS indicators on the Master Unit and all Slaves are lit green.

24. Switch the PLC to RUN mode.

Note When there are 64 Master Units and Slave Units being used, set up communications based on user-set allocations according to the following procedure.

a) Turn ON the power supply to the Masters and turn OFF the power supply to all Slaves.

b) Switch the Configurator online using any one of the Slave's node addresses.

c) Use the Configurator to download the device parameters of only the Master Units.

d) Switch the Configurator offline.

e) Turn OFF the power supply to the Masters and turn ON the power supply to all of the Slaves. (See note.)

f) Switch the Configurator online using any one of the Master's node addresses. (See note.)

g) Download the network configuration. There will be a warning issued because the Masters' power supply is OFF, but this is normal. (See note.)

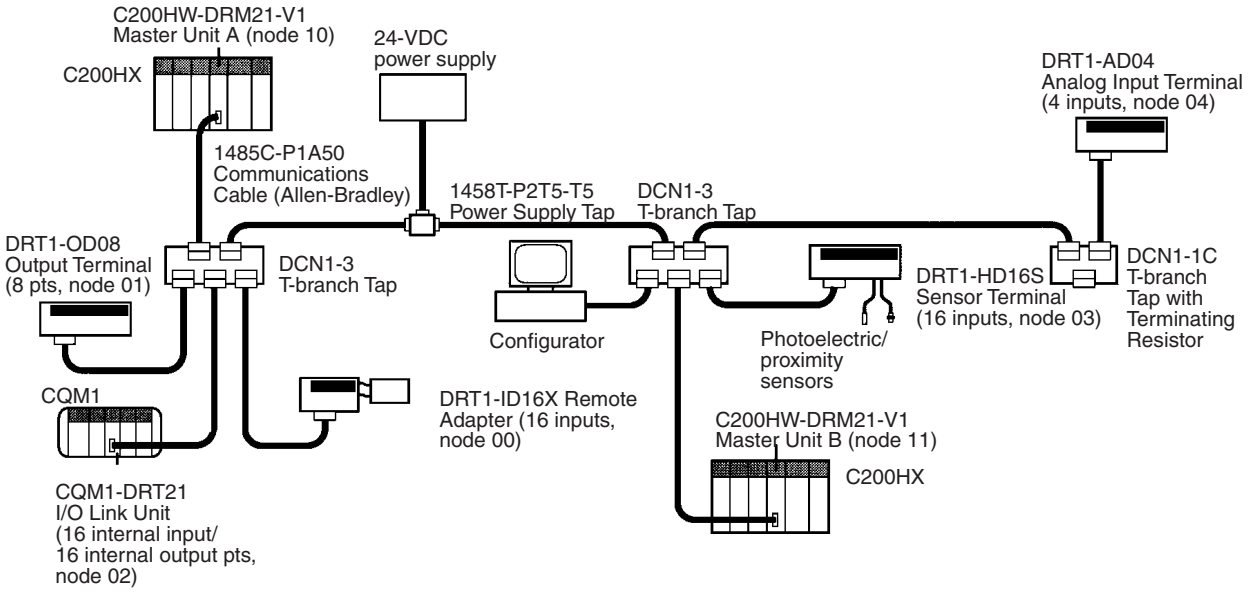
h) Switch the Configurator offline. (See note.)

i) Turn ON the power supplies to the Masters. (See note.)

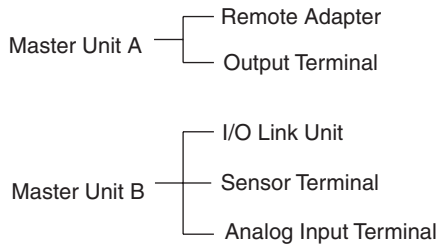
Note: Steps 5 through 9 are not necessary if none of the Slaves have device parameters.

3-4-4 Actual System Allocation Example

The following example network uses remote I/O communications and requires user-set remote I/O allocations.



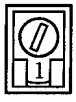
The following remote I/O configuration will be used for the above Network.



Procedure

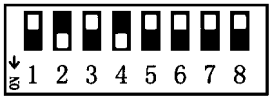
1,2,3... 1. Make the initial settings for the Master Units A and B as follows:

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

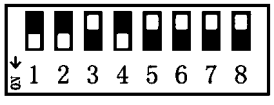


The following words are allocated for the software switches and status areas for a unit number of 1: IR 110 to IR 119 and DM 6034 to DM 6035.

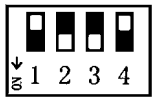
b) Set the node addresses. The following example is for a node address of 10 for Master Unit A (pins 2 and 4 turned ON) and 11 for Master Unit B (pins 1, 2, and 4 turned ON.



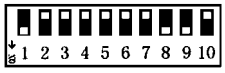
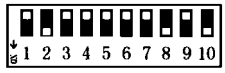
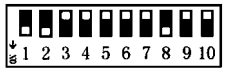
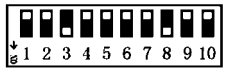
The remote I/O words allocated to the Master Units are not used.



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 pin 3 set 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			2 (pin 2 ON)		Pin 9 not used (OFF). Pin 10 ON to hold outputs for comm. errors.
	16 pts	16 pts				
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 PLC, turn ON the PLC, and create the I/O table. Turn OFF the PLC after creating the I/O table.
5. Use the Configurator to create the network configuration and Master parameters in advance and store the data in a network configuration file.
   a) Settings for Master Unit A

Output area, block 1		Output area, block 2	Input area, block 1		Input area, block 2
Area:	I/O relay	Area:	Area:	Link 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:

Output area, block 1

IR 300:Bit00	#01
IR 300:Bit08	

Input area, block 1

LR20:Bit00	#00
LR20:Bit08	#00

Note: I/O is not allocated to Output Block 2 or Input Block 2.

   b) Settings for Master Unit B

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:	400	Start word:
No. of words:	1	No. of words:	No. of words:	6	No. of words:

Output area, block 1

DM0100:Bit00	#02
DM0100:Bit08	#02

Input area, block 1

IR 400:Bit00	#02
IR 400:Bit08	#02
IR 401:Bit00	#03
IR 401:Bit08	#03
IR 402:Bit00	#04
IR 402:Bit08	#04
IR 403:Bit00	#04
IR 403:Bit08	#04
IR 404:Bit00	#04
IR 404:Bit08	#04
IR 405:Bit00	#04
IR 405:Bit08	#04

Note: I/O is not allocated to Output Block 2 or Input Block 2.

6. Turn ON the communications power supply.
7. Turn OFF all of the Slaves' power supplies.
8. Connect the Configurator.
9. Place the Configurator online and read the network configuration file that was created in step page 72
10. Verify the network configuration and confirm that there are no differences.
11. Turn ON the power to PLC A (Master Unit A) and PLC B (Master Unit B).
12. Switch PLC A and PLC B to PROGRAM mode.
13. Download the network configuration. (Write device parameters to all devices.)

    There will be an error generated because the Slaves' power supply is OFF, but this is normal.

Note

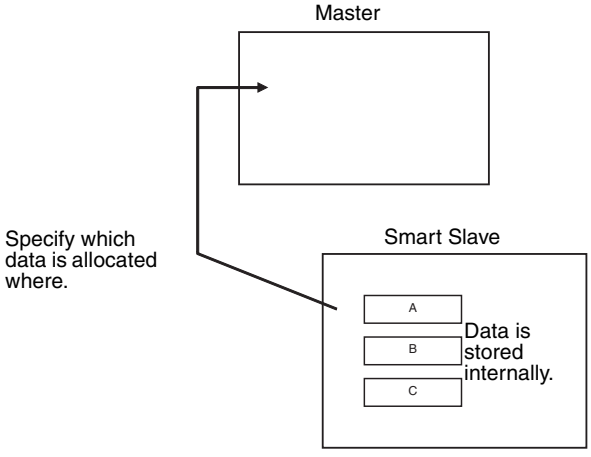
1. Always save the network configuration file if a Master Unit was switched to scan list disabled mode or a Unit was replaced.
2. If there are any Slaves in the network that have device parameters, it may be necessary to edit those device parameters and download (write) them after the Slave's power is turned ON.

3-5 DeviceNet Remote I/O Communications

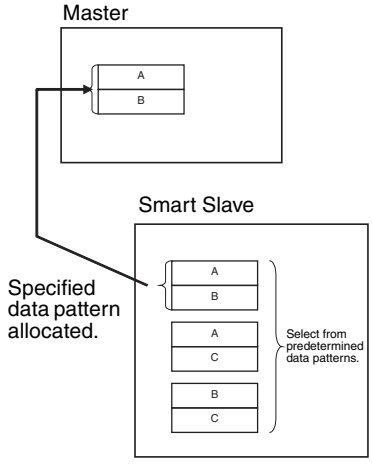
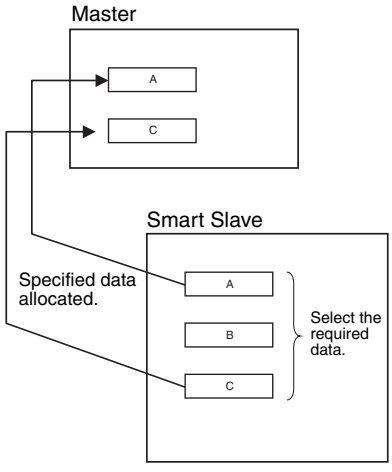
This section describes how DRT2-slave data can be allocated for remote I/O communications with the Master Unit.

3-5-1 Overview of Remote I/O Allocations for Smart Slaves

Unlike the DRT1-series Slaves, the DRT2-series Smart Slaves store data internally. When necessary, the user can specify which data is allocated for remote I/O communications with the Master Unit. (Allocation is not required, however, for the default I/O data.)



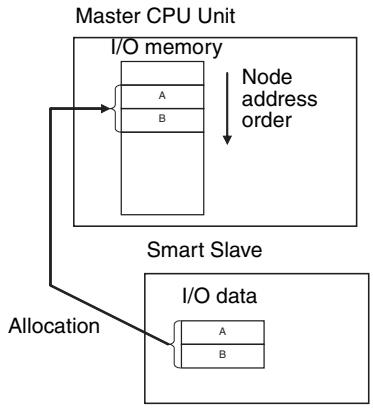
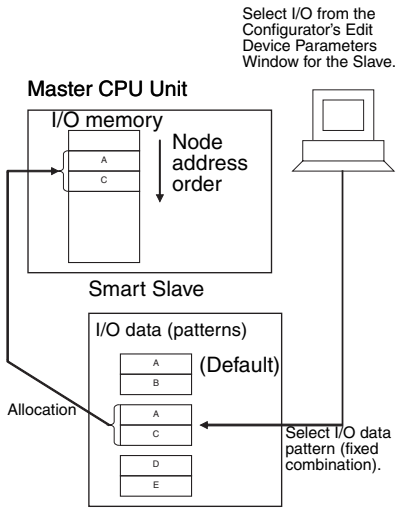
- Data can be specified in either of the two ways described below.

• Select a data pattern (fixed combination) using the Slave's default connection path setting.	• Select individual data as desired using the Master's connection setting.
	
Either fixed allocation or user allocation is possible.	Only possible with user allocation and if the Master Unit is a CS/CJ-series DeviceNet Unit.

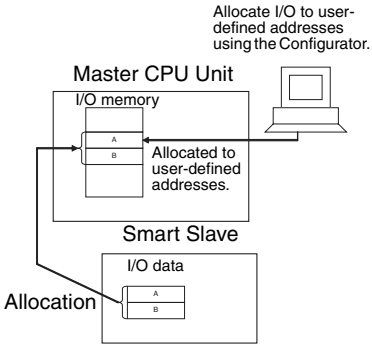
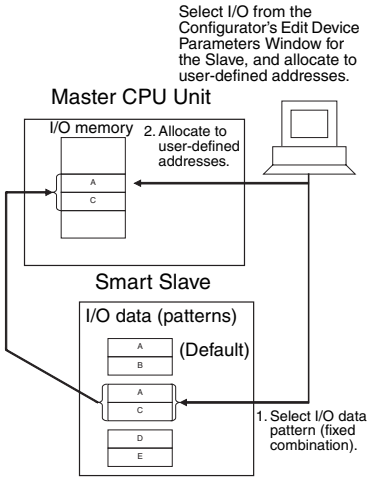
Smart Slave I/O Allocation Methods

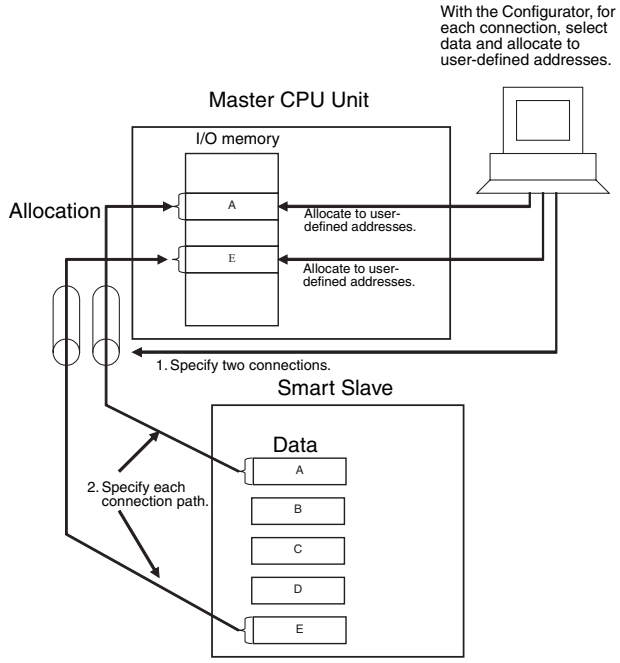
Smart Slave data can be allocated to the Master Unit for remote I/O communications in any of the ways described below.

Fixed Allocation

Type	Allocating default I/O data	Allocating selected I/O data (patterns)
Description	I/O data is allocated to fixed addresses in the Master Unit in order of node address.	Selected I/O data (pattern) is allocated to fixed addresses in the Master Unit.
Method	Configurator not used.	Configurator used to select I/O data (pattern).
Configuration		
Setting method with Configurator	None	In the Slave's Edit Device Parameters Window, select the data in the Slave from the pull-down menu for the Slave's default connection path, and execute download.

User Allocation

Type	Allocating default I/O data	Allocating selected I/O data (patterns)
Description	I/O data is allocated to user-defined addresses in the Master Unit.	Selected I/O data (pattern) is allocated to user-defined addresses in the Master Unit.
Method	Configurator used to allocate user-defined addresses.	1. Configurator used to select I/O data (pattern). 2. Selected data allocated to user-defined memory addresses.
Configuration		
Setting method with Configurator	In the Master's Edit Device Parameters Window, allocate Slave I/O.	1. In the Slave's Edit Device Parameters Window, select the data in the Slave from pull-down menu for the Slave's default connection path, and execute download. 2. In the Master's Edit Device Parameters Window, allocate Slave I/O.

Type	Selecting I/O data and allocating to user-defined addresses
Description	Select up to two types of I/O data, and allocate to user-defined addresses in the Master Unit.
Method	1. Select up to two types of I/O data using the Configurator. 2. Allocate the selected I/O data to user-defined addresses in the Master Unit.
Configuration	 **Note:** Up to two connections can be specified from CS/CJ-series Master Units.
Setting method with Configurator	1. In the Master's Edit Device Parameters Window, select the Smart Slave to be set, and specify the connection in the Advanced Setting Window. Select the I/O data (pattern) in the connection path setting. 2. In the Master's Edit Device Parameters Window, allocate Slave I/O.

Note The above method can be used only if the Master Unit is a CS/CJ-series DeviceNet Unit. When using a CVM1/CV-series DeviceNet Master Unit, a C200HX/HG/HE/HS DeviceNet Master Unit, or another company's Master Unit, select the I/O data from the pull-down menu for the default connection path in the Slave's Edit Device Parameters Window.

3-5-2 I/O Allocations for Smart Slaves

General-purpose Slaves and Environment-resistive Slaves

DRT2-slave data can be allocated for remote I/O communications with the Master Unit using any of the following methods.

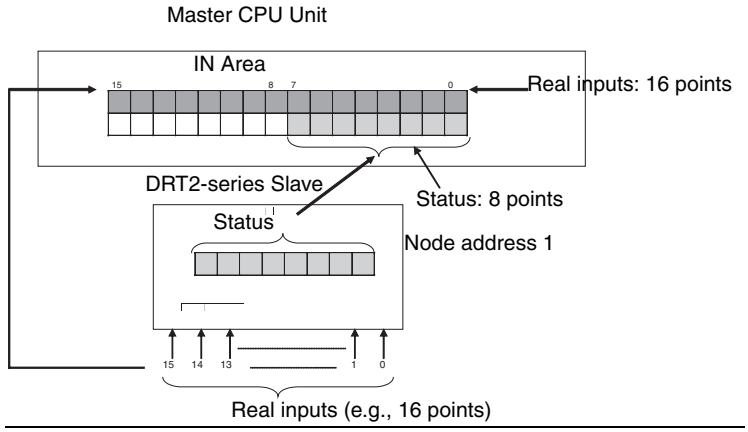
1,2,3...

1. Allocating only real I/O data (default)
2. Allocating real I/O data and Generic Status Flags together
3. Allocating real I/O data and Generic Status Flags independently

   Method 2 can be performed by selecting the I/O data and flags from the pull-down menu for the Slave's default connection path using the Configurator.

Method 3 can be performed by allocating real I/O data and Generic Status Flags independently in the Master's connection path using the Configurator. (This method can be used only with CS/CJ-series Master Units.)

■ **Example of Allocation Using Method 2**



The Generic Status Flags are as follows:

Bit	Contents	
0	Basic Unit's I/O Power Status Bit 0: I/O power supply ON 1: I/O power supply OFF	See note 1.
1	Expansion Unit's I/O Power Status Bit 0: I/O power supply ON 1: I/O power supply OFF	
2	Network Power Voltage Drops Bit 0: Normal (Higher than set monitor value) 1: Error (Same as or lower than set monitor value)	
3	Unit Maintenance Bit 0: Within range (Lower than set monitor value) 1: Out of range (Same as or higher than set monitor value)	
4	Sensor Disconnected Bit (Environment-resistive Input Terminals only) 0: Connected (all inputs connected) 1: Disconnected (one or more input is not connected)	
5	Short-circuited Bit (Sensor Connector Terminals and Environment-resistive Input Terminals Only) 0: Normal I/O (all I/O points normal) 1: Short-circuited I/O (one or more I/O point is short-circuited)	
6	Operation Time Over Bit 0: Within range (all output-to-input sets are lower than set monitor value) 1: Out of range (one or more output-to-input set is same as or higher than set monitor value)	See note 2.
7	Connected Component Maintenance Bit 0: Within range (all I/O points are lower than set monitor value) 1: Out of range (one or more I/O point is same as or higher than set monitor value)	

Note

1. Bits 00 and 01 (I/O power supply voltage statuses 1 and 2, respectively) indicate the status of the system power supply, as follows:

Bit	Name	System configuration			
		Basic Unit only (Expansion Unit not used)	**Basic Unit Input Terminal and Expansion Unit Input Terminal**	**Basic Unit Output or Input Terminal and Expansion Unit Output Terminal**	**Basic Unit Output Terminal and Expansion Unit Input Terminal**
0	Basic Unit's I/O Power Status Flag	Basic Unit I/O power supply		Basic Unit I/O power supply	Basic Unit output power supply
1	Expansion Unit's I/O Power Status Flag	--- (Not used.)		Expansion Unit output power supply	Expansion Unit input power supply

2. The Operation Time Over Bit functions only for Slaves with both inputs and outputs. It does not function for Slaves with only IN or OUT Areas.

Allocating Only Real I/O Data (Default)

Example 1: Using 16 inputs.

IN Area

	15 … 0
Address header	Allocated 16 inputs.

Example 2: Using 16 outputs.

OUT Area

	15 … 0
Address header	Allocated 16 outputs.

Example 3: Using 16 inputs and 8 inputs (Expansion Unit).

IN Area

	15 … 0	
Address header	Allocated 16 inputs.	
Address header + 1		Allocated 8 inputs.

Example 4: Using 16 outputs and 8 inputs (Expansion Unit).

OUT Area

	15 … 0
Address header	Allocated 16 outputs.

IN Area

	7 … 0
Address header	Allocated 8 inputs.

Allocating Real I/O Data and Generic Status Flags Together

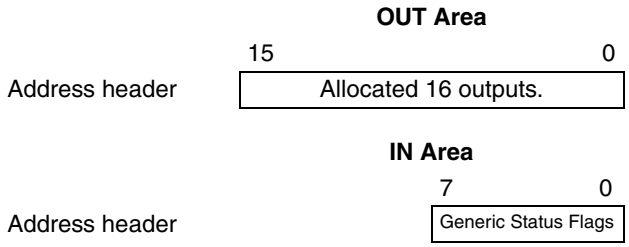
The Generic Status Flags are for providing notification of the status of the Smart Slave to the host. They are allocated to the Master Unit's IN Area and consist of 8 bits.

Example 1: Using 16 inputs.

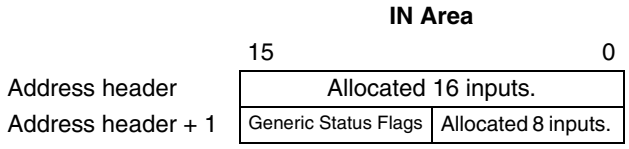
IN Area

	15 … 0	
Address header	Allocated 16 inputs.	
Address header + 1		Generic Status Flags

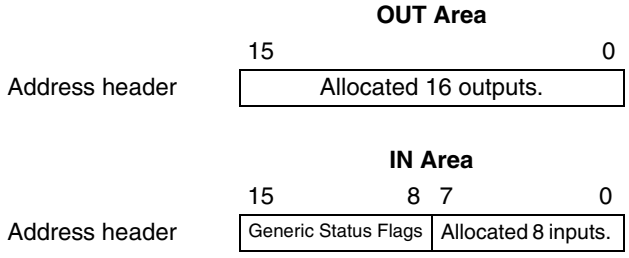
Example 2: Using 16 outputs.



Example 3: Using 16 inputs and 8 inputs (Expansion Unit).

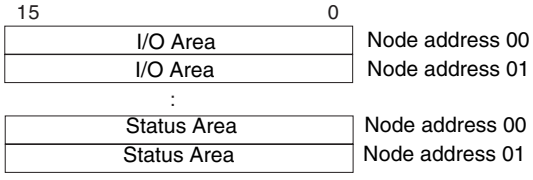


Example 4: Using 16 outputs and 8 inputs (Expansion Unit).



Allocating Real I/O Data and Generic Status Flags Individually

Instead of allocating real I/O and Generic Status Flags together, they can be allocated individually. This is only possible, however, if the Master Unit is a CS/CJ-series DeviceNet Unit and the Configurator is used.



Analog Slaves

Data that is allocated for remote I/O communications can be selected using any of the following methods.

1,2,3...

1. Allocating only analog values (default I/O data)
2. Allocating a fixed I/O data pattern
3. Allocating user-defined I/O data

With methods 2 and 3, the Configurator is used to specify the I/O data that is to be allocated. An outline of the methods used is given below.

Allocating Fixed I/O Data Patterns

There are eleven fixed I/O data patterns. The Configurator is used to select the desired I/O data pattern from the pull-down menu for the Slave's default connection path in the Edit Device Parameters Window.

Allocating User-defined I/O Data

Using the Configurator, the desired combination of I/O data can be allocated for the Master Unit connection. The desired connection is selected from the Master's Edit Device Parameters Window. Up to two of the eleven I/O data patterns can be selected for the connection paths of the connection.

Note If analog data is allocated to a COS connection, a frame will be sent to the host each analog conversion cycle. This will cause frames to be sent fre-

quently, increasing network traffic and possibly affecting the communications cycle time.

■ I/O Data for Analog Input Terminal (DRT2-AD04)

Data (patterns)
Analog Data 1 (8 input bytes) (default)
Analog Data 2 (8 input bytes)
Generic Status Flags (1 input byte)
Top/Valley Detection Timing Flags (2 input bytes)
Analog Status Flags (4 input bytes)
Analog Data 1 + Analog Data 2 (8 input bytes)
Top/Valley Detection Timing Flags + Generic Status Flags (3 input bytes)
Analog Status Flags + Generic Status Flags (10 input bytes)
Analog Data 1 + Top/Valley Detection Timing Flags (6 input bytes)
Analog Data 1 + Top/Valley Detection Timing Flags + Generic Status Flags (11 input bytes)
Hold Flags (1 output byte)

SECTION 4
Message Communications

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

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4-1 Overview

The message communications functions allow messages to be sent between nodes on a DeviceNet Network when required by system conditions. The messages can be sent between PLCs, between an OMRON PLC 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 executing 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.

Explicit Messages

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

Note A specific FINS command (command 2801) is used to send explicit messages.

Message Support

The following tables outline DeviceNet message support. Among the commands sent and received via the DeviceNet Master Unit, some commands are addressed to the CPU Unit (CVM1/CV-series, CS-series, or C200HX/HG/HE) and other commands are addressed to the DeviceNet Master Unit itself.

Data Send/Receive Commands

PLC sending command	Instruction used	PLC receiving command		
		CVM1 or CV-series	CS-series or C200HX/HG/HE	C200HS
CVM1 and CV-series	SEND(192) and RECV(193)	OK	OK	Not supported
CS-series	Not supported			
C200HX/HG/HE	Not supported			
C200HS				

General FINS Commands

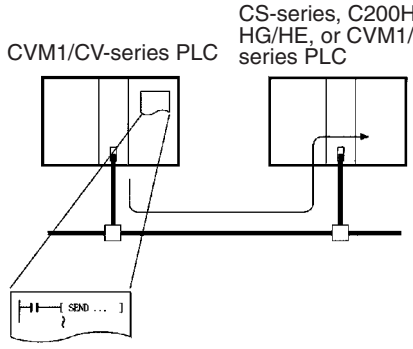
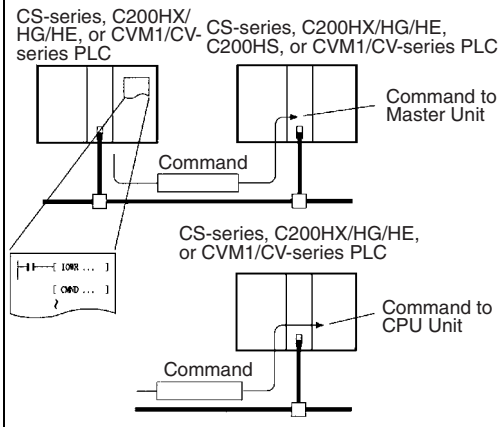
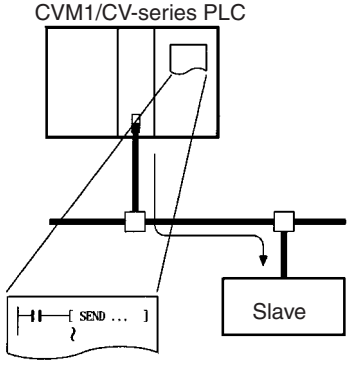
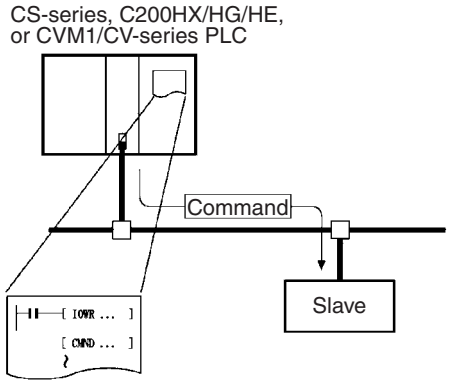
PLC sending command	Instruction used	PLC receiving command		
		CVM1 or CV-series	CS-series or C200HX/HG/HE	C200HS
CVM1 and CV-series	CMND(194)	OK	OK	Master Unit only (See note 1.)
CS-series	IOWR	OK	OK	Master Unit only (See note 1.)
C200HX/HG/HE	IOWR	OK	OK	Master Unit only (See note 1.)
C200HS	Not supported			

Note

1. With C200HS PLCs, only commands addressed to the DeviceNet Master Unit can be received.
2. In these tables, the “CS-series” refers to a CS-series PLC with a C200HX/HG/HE or C200HS DeviceNet Master Unit mounted. Refer to the *CS/CJ*

Series DeviceNet Units Operation Manual (W380) for details when mounting a CS-series DeviceNet Unit to a CS-series PLC.

Message Communications Overview

Type of message		Data send/receive commands	General FINS commands
PLC sending command	**CVM1, CV-series**	**SEND(192)/RECV(193)**	**CMND(194)**
	CS-series, C200HX/ HG/HE	**None**	**IOWR**
PLC to PLC			
PLC to OMRON Slave			
Data length (excluding command code) See note 3.	CVM1, CV-series	158 bytes max. (SEND(192): 76 words, RECV(193): 78 words)	158 bytes max.
	CS-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 PLC to execute SEND(192), RECV(193), or CMND(194) instructions from a CVM1 or CV-series PLC. The commands will not be sent and cannot be received from other CVM1 or CV-series PLCs if the Master Unit is not registered in the routing tables. (Commands can be received from CS-series or C200HX/HG/HE PLCs 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.
3. The Data length maximums shown in the table are recommended values. The data length can actually be as long as the max. values shown below, but busy responses are likely to occur if the recommended values are exceeded.

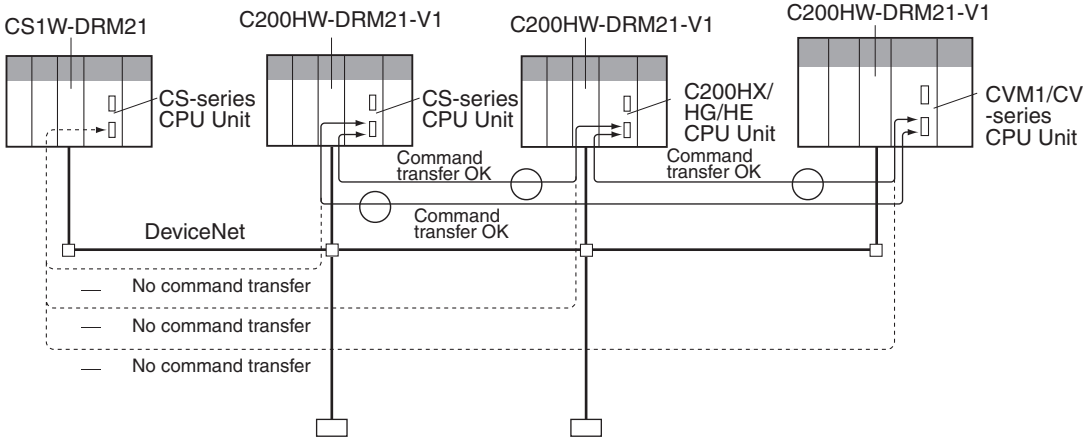
- CVM1/CV-series: 450 bytes max. (SEND: 222 words; RECV: 224 words)
- CS-series and C200HX/HG/HE: 248 bytes max.

Message Communications with CS/CJ-series DeviceNet Units (CS1W-DRM21 and CJ1W-DRM21)

FINS message communications are not supported between a PLC with a CS/CJ-series DeviceNet Unit (CS1W-DRM21 or CJ1W-DRM21) and a PLC with a C200HW-DRM21-V1 or CVM1-DRM21-V1 DeviceNet Master Unit. Although FINS message communications cannot be used, Explicit messages can be transferred between a DeviceNet Units (CS1W-DRM21 or CJ1W-DRM21) and DeviceNet Master Unit (C200HW-DRM21-V1 or CVM1-DRM21-V1).

The following table shows the combinations of PLCs that support FINS message communications.

PLC sending command	Mounted DeviceNet Unit	FINS message communications		PLC receiving command			
				CS-series or CJ-series	CS-series	C200HX/ HG/HE	CVM1 or CV-series
		Instructions that send commands for data transfers	Instructions that send any FINS command	CS1W-DRM21 or CJ1W-DRM21	C200HW-DRM21-V1	C200HW-DRM21-V1	CVM1-DRM21-V1
CS-series or CJ-series	CS1W-DRM21 or CJ1W-DRM21	SEND and RECV	CMND	OK	Not supported.	Not supported.	Not supported.
CS-series	C200HW-DRM21-V1	Not supported.	IOWR	Not supported.	OK	OK	OK
C200HX/HG/HE	C200HW-DRM21-V1	Not supported.	IOWR	Not supported.	OK	OK	OK
CVM1 or CV-series	CVM1-DRM21-V1	SEND(192) and RECV(193)	CMND(194)	Not supported.	OK	OK	OK



Note The C200HW-DRM21-V1 DeviceNet Master Unit (for C200HX/HG/HE and C200HS PLCs) and CVM1-DRM21-V1 DeviceNet Master Unit (for CVM1 and CV-series PLCs) use a proprietary OMRON protocol for FINS message communications. In contrast, the CS1W-DRM21 and CJ1W-DRM21 DeviceNet Units (for CS-series and CJ-series PLCs) use Explicit messaging for FINS communications, which is the standard messaging protocol in DeviceNet. The C200HW-DRM21-V1 and CVM1-DRM21-V1 DeviceNet Master Units cannot communicate with the CS1W-DRM21 and CJ1W-DRM21 DeviceNet Units through FINS messaging because of these different FINS messaging protocols.

4-1-1 Message Communications Specifications

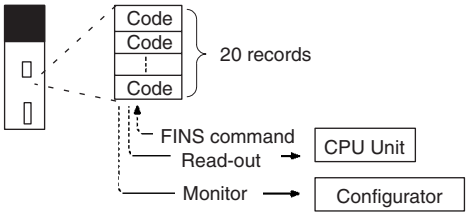
PLC		CVM1 and CV-series	CS-series, C200HZ/HX/HG/HE	C200HS
Master Unit model number		CVM1-DRM21-V1	C200HW-DRM21-V1	
Max. No. of communications nodes per Master Unit	**FINS messages**	8	8	Not supported.
	Explicit messages	63	63	63
Communications instructions	**Data send/receive**	SEND(192)/RECV(193)	None	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-series PLCs**	Supported for data send/receive and FINS commands		Supported only for FINS commands addressed to Master Unit.
	From C200HX/HG/HE PLCs	Supported for FINS commands		

Message Communications Error Indications

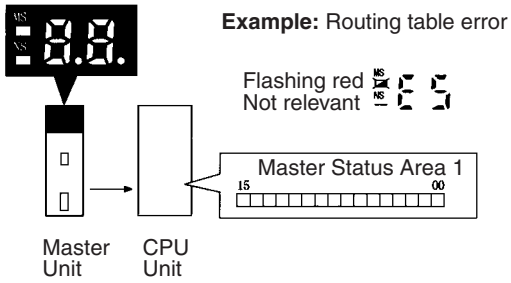
There are two ways to obtain information on communications errors that occur in message communications: 1) Using the error log in the Master Unit and 2) Using Master Unit displays, indicators, and Master Status Areas.

Each time a communications error occurs, and error code is placed in an error record in the error log kept in the RAM of the Master Unit. Up to 20 records can be stored in the error log. For CVM1/CV-series Master Units, the record is also time stamped. (Time stamps are not provided by the Master Units for C200HX/HG/HE and C200HS PLCs.)

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



The MS and NS indicators and the 7segment 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	PLC 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 PLC			F5 ↔ Master node address	---	00 06
PLC 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 In message communications, the send response message or reception response message may be lost if either of the following occur:

- If any communications instructions (SEND(192), RECV(193), CMND(194), or IOWR) are executed from the PLC 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 PLC) and the interval for receiving messages at any one node are longer than the message communications

time. Refer to *6-2 Message Communications Time* for details on the message communications time.

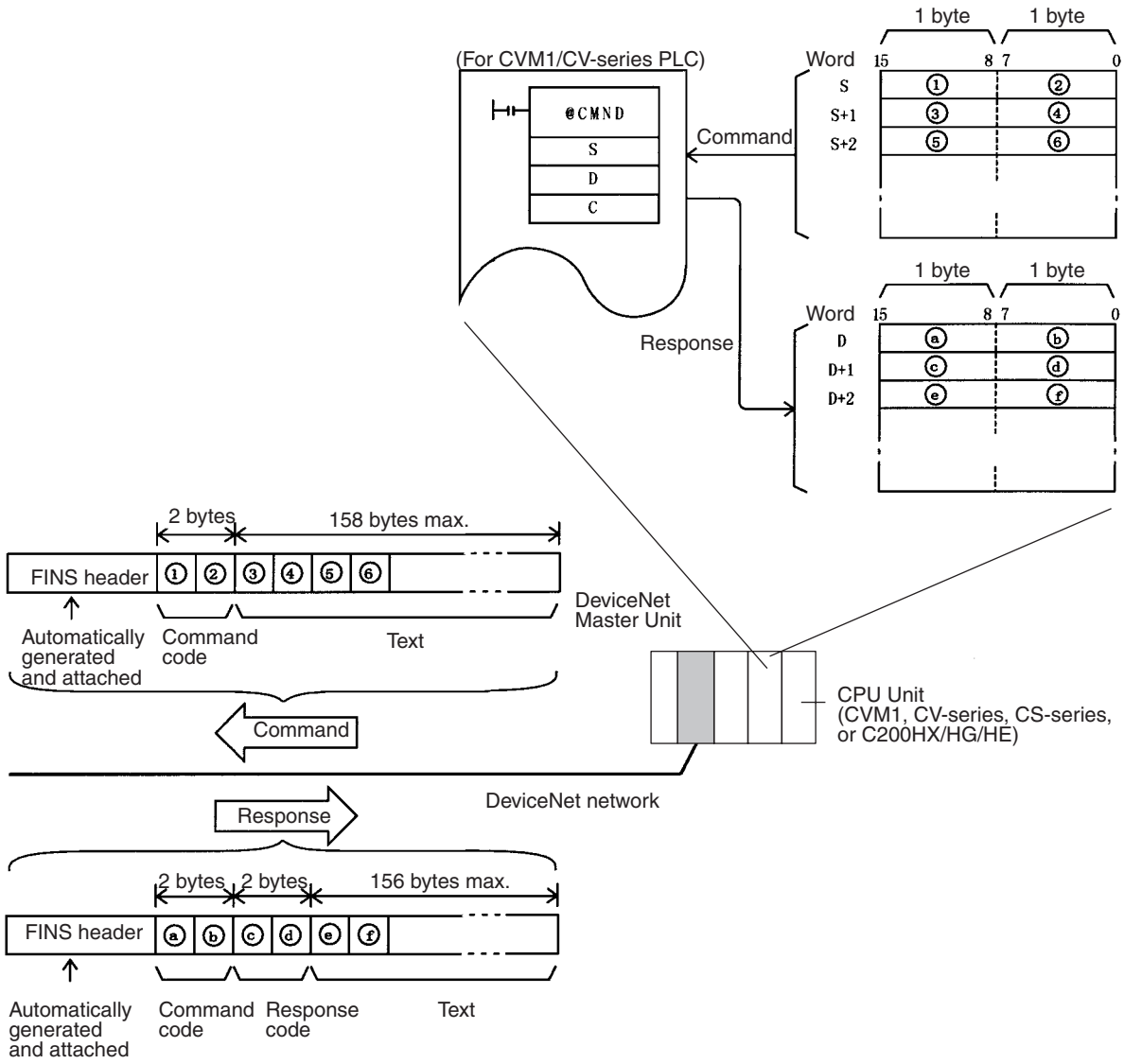
4-2 FINS Commands/Responses

The FINS communication protocol was developed by OMRON for use with factory automation control devices. FINS communications enable reading/writing PLC memory and controlling operation without extensive programming in the user program in the PLC. 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 PLCs connected via other FA networks, such as the SYSMAC NET and SYSMAC LINK Networks.

Note Although the FINS communications service is a protocol that can communications between different kinds of networks, the C200HW-DRM21-V1 DeviceNet Master Unit (for C200HX/HG/HE and C200HS PLCs) and CVM1-DRM21-V1 DeviceNet Master Unit (for CVM1 and CV-series PLCs) support FINS communications within one DeviceNet Network only.

4-2-1 Sending/Receiving FINS Command/Responses

FINS commands are sent using the CMND(194) instruction for CVM1 and CV-series PLCs and the IOWR instructions for CS-series and C200HX/HG/HE PLCs. 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

Main code	Main code
11: Parameter error	30: Access right error
	40: Abort

4-2-2 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 8.)*
- CS-series and C200HX/HG/HE CPU Units (See *Section 9.)*
- DeviceNet Master Units (See *Section 10.)*

Note Although C200HX/HG/HE CPU Units cannot directly process FINS commands, the DeviceNet Master Unit will convert the FINS commands into a form that C200HX/HG/HE CPU Units can process. Responses from 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.

When a C200HW-DRM21-V1 DeviceNet Master Unit is mounted in a CS-series PLC, the FINS commands cannot be exchanged through the C200H bus so the DeviceNet Master Unit converts the command format in the same way.

4-2-3 FINS Command Lists

Refer to *Sections 8, 9*, and *10* 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	180
	MEMORY AREA WRITE		02	181
	MEMORY AREA FILL		03	182
	MULTIPLE MEMORY AREA READ		04	183
	MEMORY AREA TRANSFER		05	184
	COMPOSITE REGISTRATION READ		10	185
	REGISTER COMPOSITE READ		11	186
Manipulating parameters: PC Setup, I/O tables, routing tables, etc.	PARAMETER AREA READ	02	01	187
	PARAMETER AREA WRITE		02	189
	PARAMETER AREA CLEAR		03	190
Manipulating program areas	PROGRAM AREA PROTECT	03	04	191
	PROGRAM AREA PROTECT CLEAR		05	192
	PROGRAM AREA READ		06	192
	PROGRAM AREA WRITE		07	193
	PROGRAM AREA CLEAR		08	194
Controlling operation	RUN (RUN, DEBUG, MONITOR modes)	04	01	194
	STOP (PROGRAM mode)		02	195
Reading PLC model information	CONTROLLER DATA READ	05	01	195
	CONNECTION DATA READ		02	198
Reading PLC status	CONTROLLER STATUS READ	06	01	199
	CYCLE TIME READ		20	200
Manipulating the PLC clock	CLOCK READ	07	01	201
	CLOCK WRITE		02	202
Manipulating messages	MESSAGE READ	09	20	202
	MESSAGE CLEAR			203
	FAL/FALS READ			204
Controlling access rights	ACCESS RIGHT ACQUIRE	0C	01	205
	ACCESS RIGHT FORCED ACQUIRE		02	206
	ACCESS RIGHT RELEASE		03	206
Manipulating error data	ERROR CLEAR	21	01	207
	ERROR LOG READ		02	208
	ERROR LOG CLEAR		03	209
Manipulating File Memory	FILE NAME READ	22	01	209
	SINGLE FILE READ		02	211
	SINGLE FILE WRITE		03	211
	MEMORY CARD FORMAT		04	212
	FILE DELETE		05	213
	VOLUME LABEL CREATE/DELETE		06	213
	FILE COPY		07	214
	FILE NAME CHANGE		08	214
	FILE DATA CHECK		09	215
	MEMORY AREA FILE TRANSFER		0A	216
	PARAMETER AREA FILE TRANSFER		0B	217
	PROGRAM AREA FILE TRANSFER		0C	218
Force-setting/resetting bits	FORCED SET/RESET	23	01	219
	FORCED SET/RESET CANCEL		02	220

Commands Addressed to CS-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	226
	MEMORY AREA WRITE		02	227
	MULTIPLE MEMORY AREA READ		04	228
	COMPOSITE REGISTRATION READ		10	229
	REGISTER COMPOSITE READ		11	229
Reading PLC model information	CONTROLLER DATA READ	05	01	230
Reading PLC status	CONTROLLER STATUS READ	06	01	231
Manipulating the PLC clock	CLOCK READ	07	01	231

Note Although CS-series CPU Units support other commands, only the ones listed above can be sent through a C200HW-DRM21-V1 DeviceNet Master Unit.

Commands Addressed to CVM1-DRM21-V1 and C200HW-DRM21-V1 DeviceNet Master Units

Name	Command code		Page
RESET	04	03	234
CONTROLLER DATA READ	05	01	234
ECHOBACK TEST	08	01	235
ERROR LOG READ	21	02	235
ERROR LOG CLEAR		03	237

Command to Send Explicit DeviceNet Messages

Name	Command code		Page
EXPLICIT MESSAGE SEND	28	01	113

4-3 Message Communications for CVM1 and CV-series PLCs

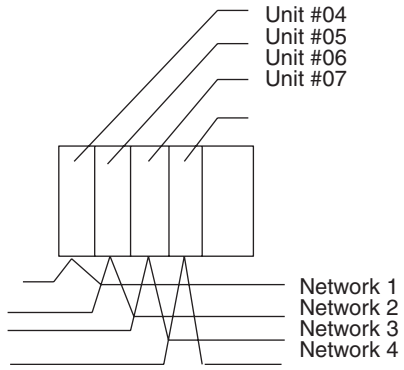
4-3-1 Instructions for Message Communications

There are two instructions that can be executed to send and receive data from CVM1 and CV-series PLCs: 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 PLC to execute SEND(192), RECV(193), or CMND(194) instructions from a CVM1 or CV-series PLCs. The commands will not be sent and cannot be received from other CVM1 or CV-series PLCs if the Master Unit is not registered in the routing table. (Commands can be received from CS-series and C200HX/HG/HE PLCs without the routing table.)

The local network table of the routing tables lists the unit numbers of the Communications Units mounted to the PLC 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 PLC (1 to 127)
SIOU unit #	The unit number of each CPU Bus Unit mounted to the PLC and connecting it to a network (0 to 15)

4-3-2 Data Send/Receive Instructions

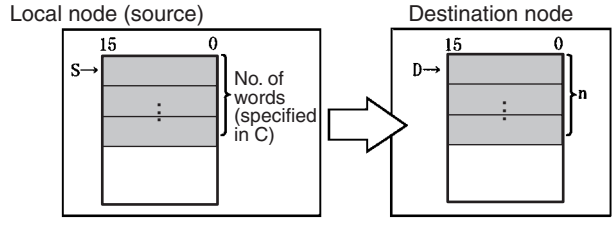
NETWORK SEND: SEND(192)

Ladder Symbol

(192)
SEND S D C

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

Variations
↑ SEND(192)



Description

SEND(192) transfers data beginning at word S in the local PLC 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 PLC 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]	

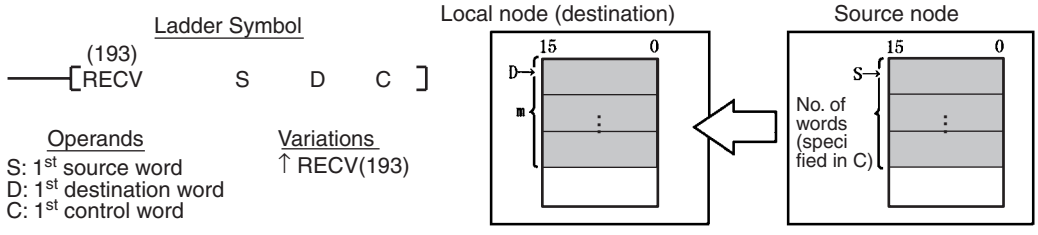
Note

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 PLC 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 PLC 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)



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 PLC 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 PLC retries transmission when bit 15 of C+3 is OFF and no response is received. The default value is $0000, which indicates 2 seconds.

4-3-3 Sending FINS Commands

DELIVER COMMAND: CMND(194)

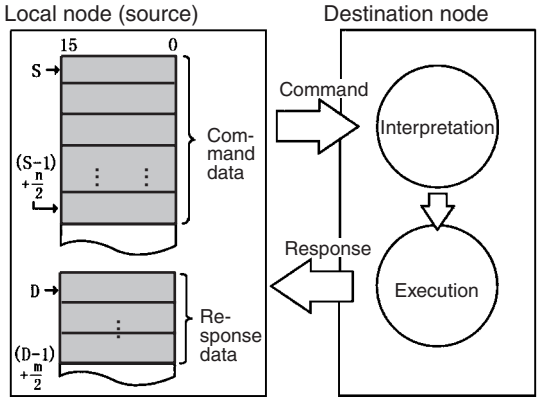
CMND (194) can be used to send FINS commands to read/write I/O memory, read status data, change the operating mode, and perform other functions at other nodes.

Ladder Symbol

(194)
CMND S D C

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

Variations
↑ 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 PLC 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

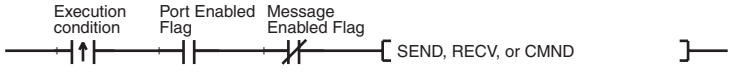
Explicit messages can be sent to OMRON Special Slaves and DeviceNet devices made by other manufacturers by setting the FINS command code to

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.

4-3-4 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/CV-series PLCs than it is for CS-series and C200HX/HG/HE PLCs.

Communications Flag Operation

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

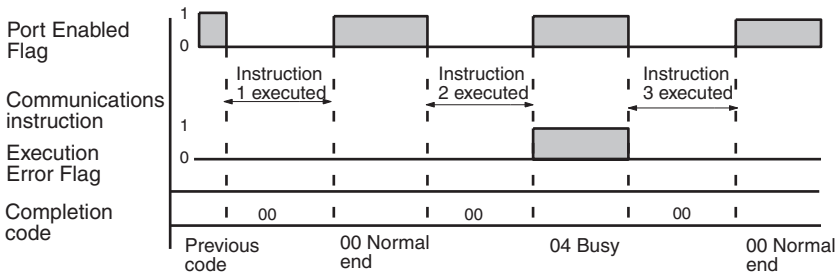
Message Communications Enabled Flag	Network status	NS indicator
ON (1)	Communications connection made (network normal)	Lit green
	Communications connection not made (network normal, but communications not established)	Flashing green
	Non-fatal communications error (error in one or more Slaves)	Flashing 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 PLC that is being used.

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

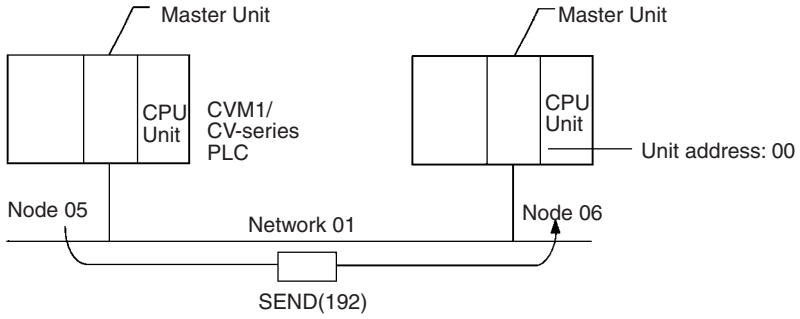
Data area	CV500/CVM1-CPU01-E1	CV1000/CV2000/CVM1-CPU11/21-E
CIO Area	CIO 0000 to CIO 2555	
CPU Bus Link Area	G000 to C255 (G000 to G007: Read-only)	
Auxiliary Area	A000 to A511 (A256 to A511: Read-only)	

Data area	CV500/CVM1-CPU01-E1	CV1000/CV2000/CVM1-CPU11/21-E
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 PLC's *Installation Guide* for more information.

4-3-5 Programming Examples

Example 1: Sending Data Using SEND(192)



Operation

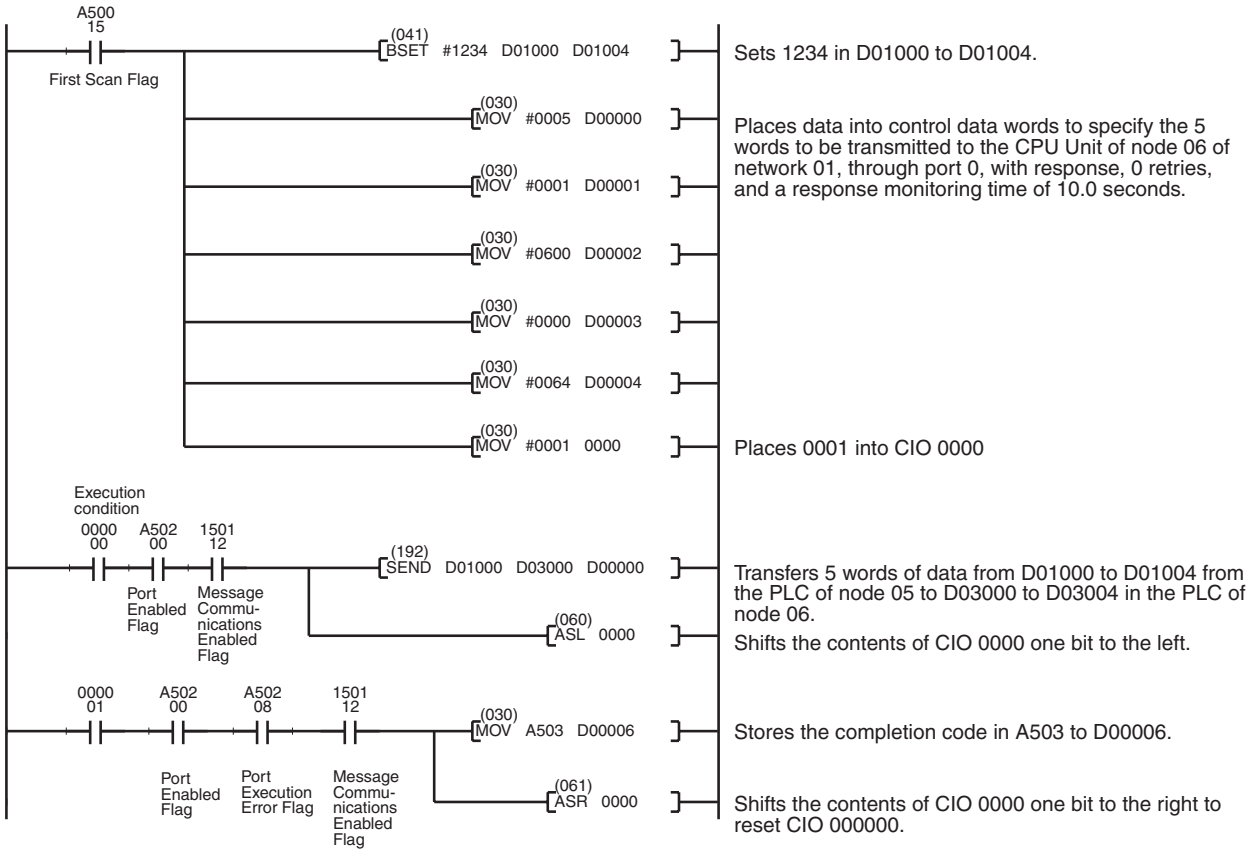
The data from the 5 words D01000 to D01004 from the PLC with the Master Unit with node address 05 are sent to D03000 to D03004 in the PLC with the Master Unit with node address 06. The completion code is stored in D00006 when execution of SEND(192) has been completed.

Command Details

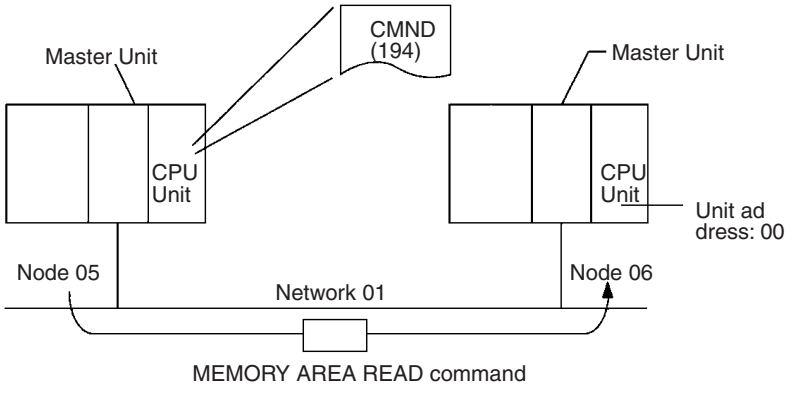
The following command is used: [SEND(192)SDC]

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



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



Operation

The data in the 5 words D01000 to D01004 are read from the PLC with the Master Unit with node address 06 and transferred to the PLC of the Master Unit with node address 05 (where CMND(194) is executed). The command data is written starting at DM01000 of the PLC 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

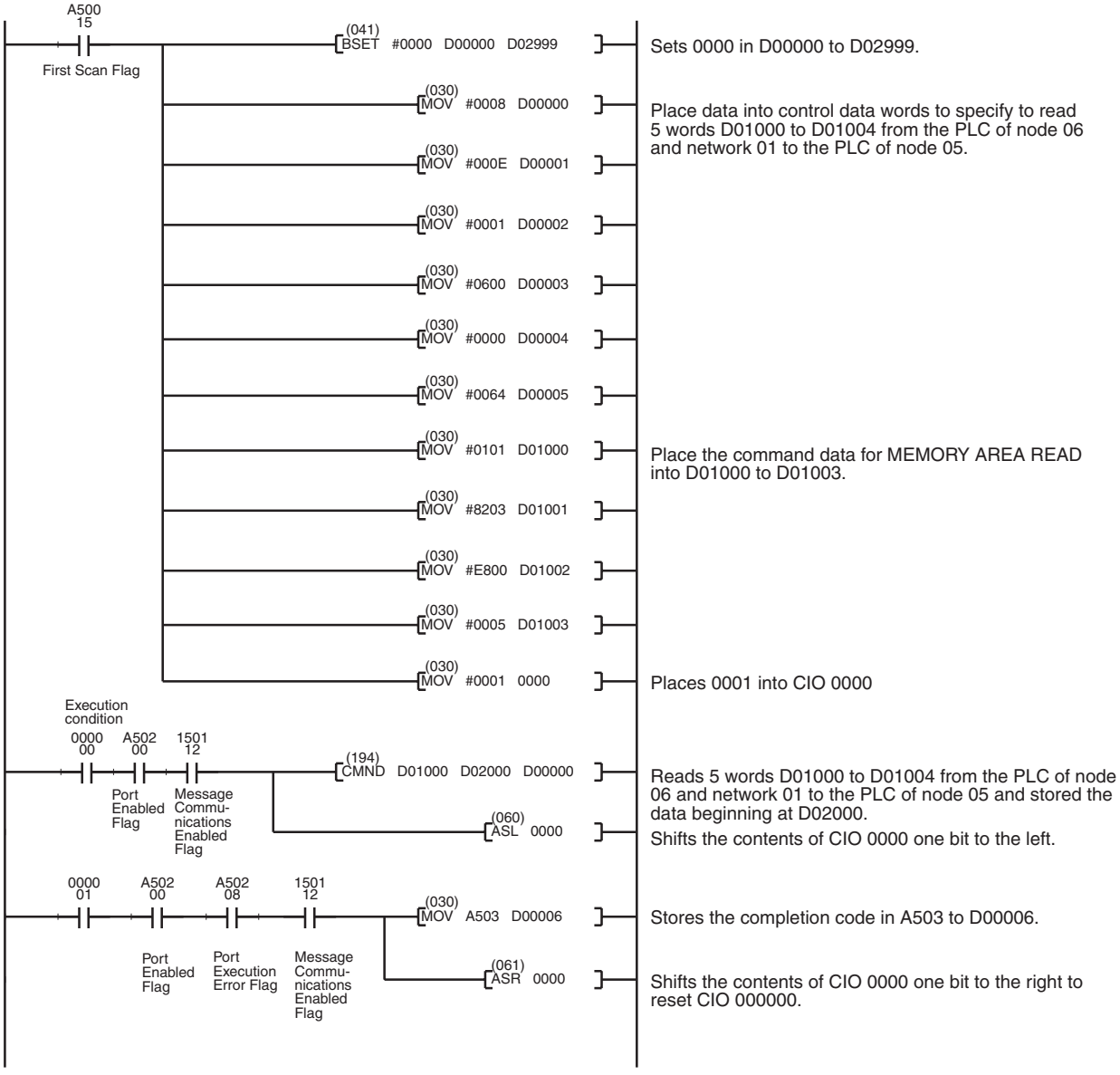
The following command is used: [CMND(194)S D C]

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



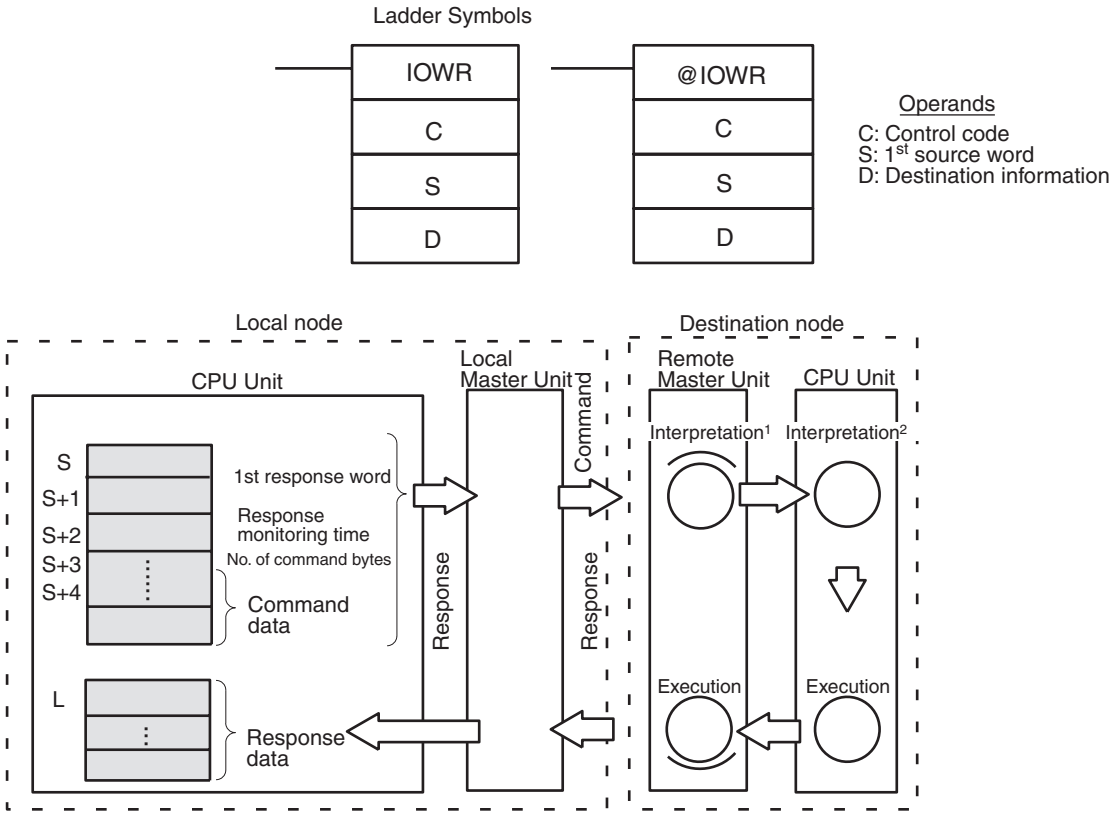
4-4 Message Communications for CS-series and C200HX/HG/HE PLCs

4-4-1 Instructions for Message Communications

Use the IOWR instruction to send any FINS commands from a CS-series or C200HX/HG/HE PLC equipped with a C200HW-DRM21-V1 DeviceNet Master Unit.

4-4-2 Sending FINS Commands

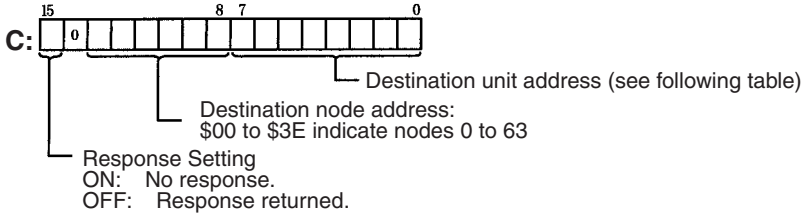
CS Series



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.

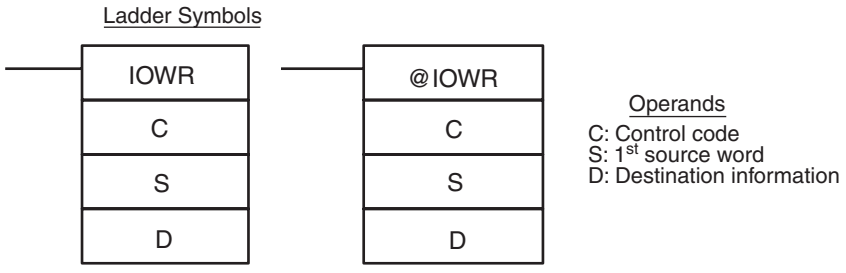
Word	Contents
S	First response word (variable area specification, see *Section 9.*)
S+1	
S+2	Response monitoring time (hex) 0000:2 s 0001 to 028F:0.1 to 65.5 s (units of 0.1 s) Above 028F:65.5 s
S+3	Number of command bytes (hex): 0 to 160
S+4 . . .	Command data beginning with command code

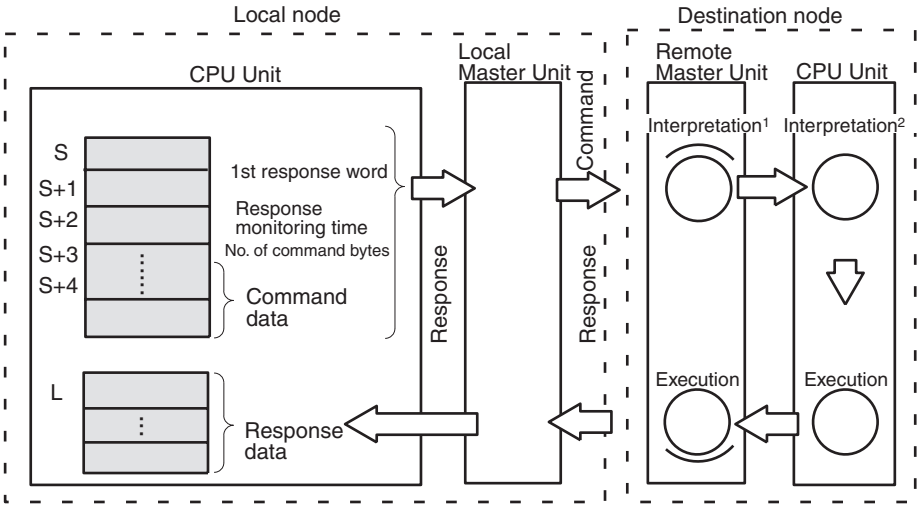
The destination information provides the destination unit number of the Special I/O Unit and the number of words to be written, as shown in the following diagram.

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)

Note Not all data area words can be specified for the first response word in S and S+1. Refer to *SECTION 9 FINS Commands to CS-series and C200HX/HG/HE CPU Units* for details on the restrictions.

C200HX/HG/HE

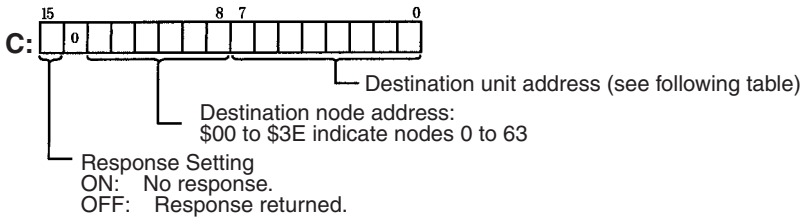




1: For commands addressed to Master Unit
2: For commands addressed to CPU Unit

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.



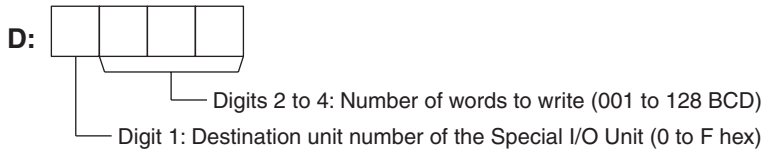
Destination Unit Address

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 9.*)
S+1	
S+2	Response monitoring time (hex) 0000:2 s 0001 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.



Note Not all data area words can be specified for the first response word in S and S+1. Refer to *SECTION 9 FINS Commands to CS-series and C200HX/HG/HE CPU Units* for details on the restrictions.
If the data area is specified incorrectly, a Special Unit Error will occur and remote I/O communications will stop.

Data Areas

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

CS 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
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		
DM Area	DM 0000 to DM 6143		
Fixed DM Area	DM 6144 to DM 6655		
Indirect DM addresses	*DM 0000 to *DM 6655		
Constants	0000 to FFFF	Not usable	0000 to F128

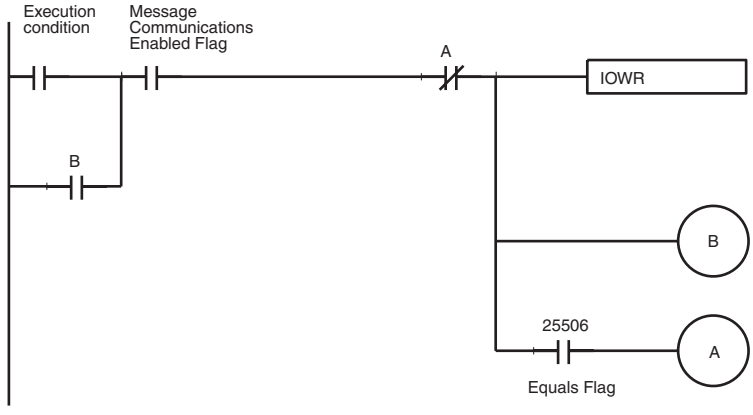
Sending Explicit Messages

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.

4-4-3 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	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: SR 25503	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.) CS Series: Bit 12 in CIO 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 PLCs is different to that for CS-series and C200HX/HG/HE PLCs.
2. With CS-series PLCs, there are no memory addresses for the Equals Flag and the Error Flag.

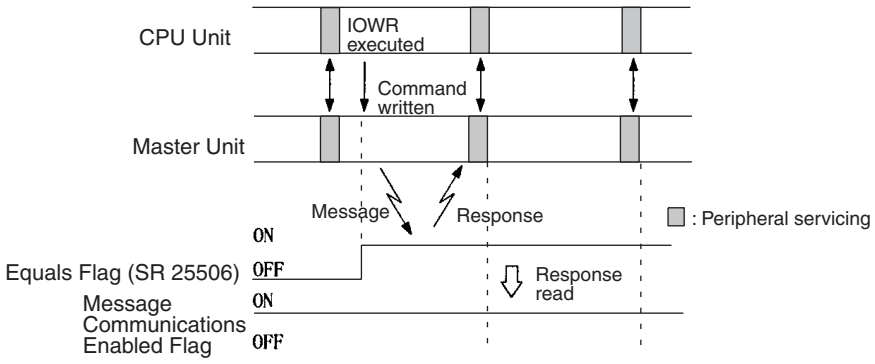
Timing the Reading of Responses

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

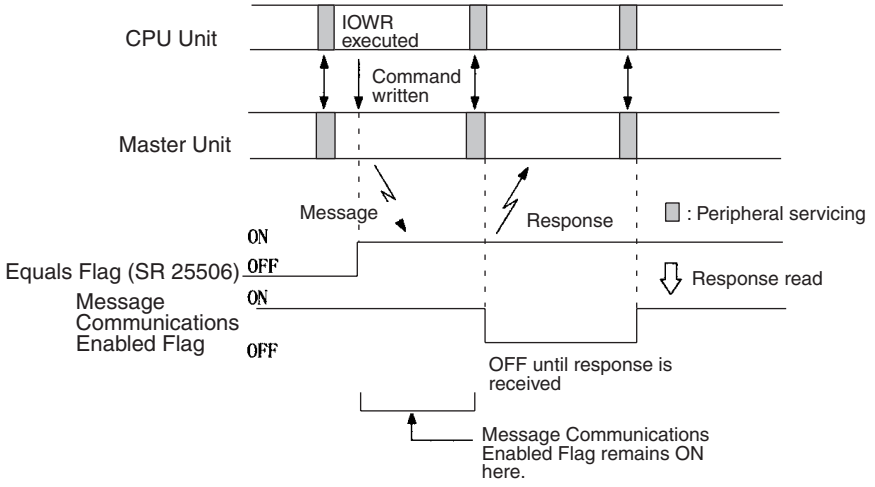
Even if IOWR execution is finished, the status of the Message Communications Enabled Flag will not change until the next peripheral servicing in the CPU Unit. If the response is returned in the same cycle as IOWR execution, the Message Communications Enabled Flag will remain ON. If the response is not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

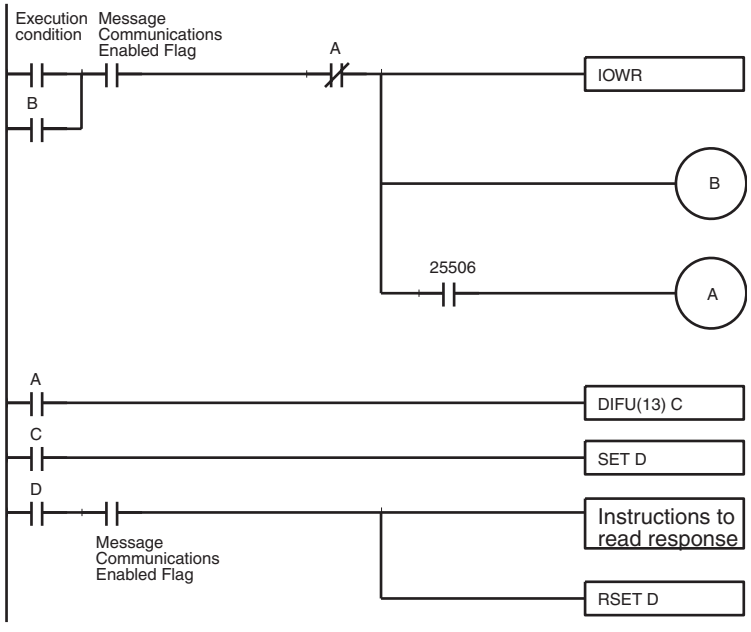


Response Received in the Next Cycle

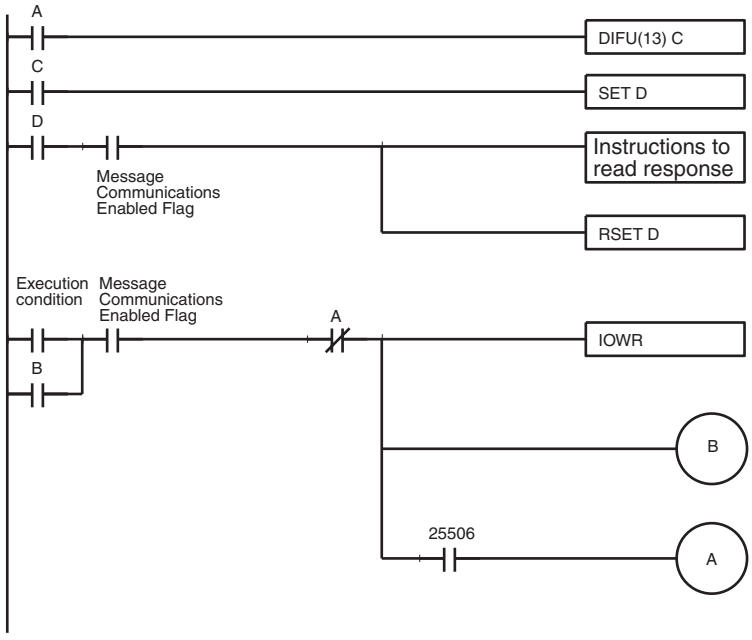


Use the type of programming shown below. The programming shown at the top will not always read the response properly.

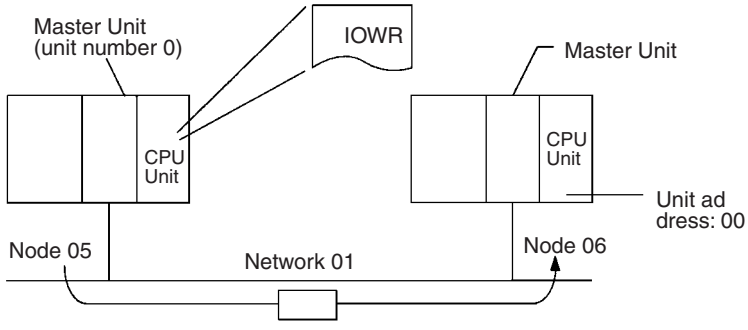
WRONG: Can Improperly Read Response



CORRECT: Properly Reads Response



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



MEMORY AREA READ command

Operation

The data in the 5 words DM 1000 to DM 1004 are read from the PLC with the Master Unit with node address 06 and transferred to the PLC of the Master Unit with node address 05 (where IOWR is executed). The command data is written starting at DM 1000 of the PLC 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)

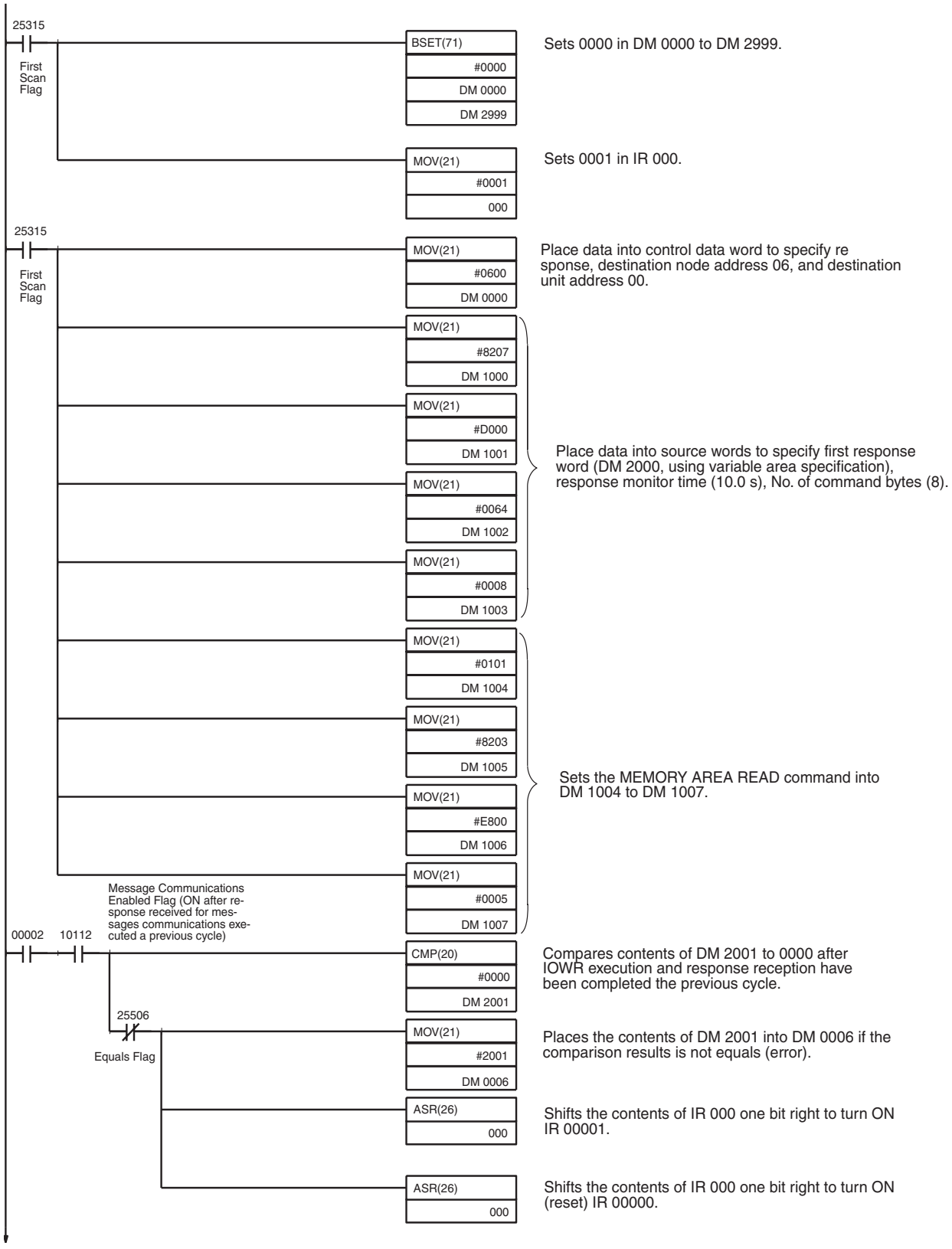
S = DM 1000:First source word

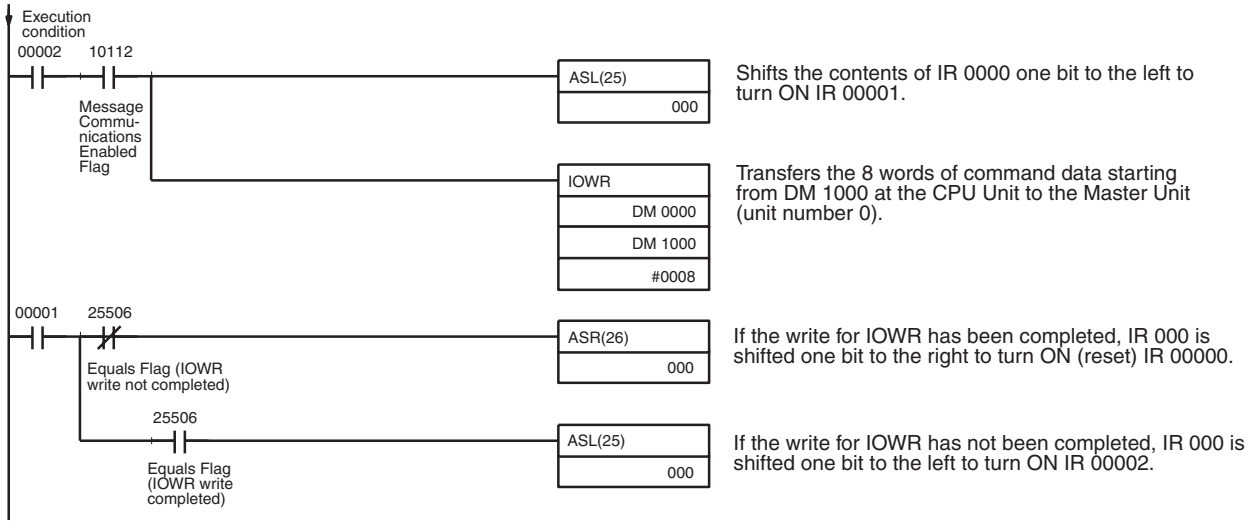
Settings (hex)
DM 1000 = 8207:First response word: DM 2000

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)

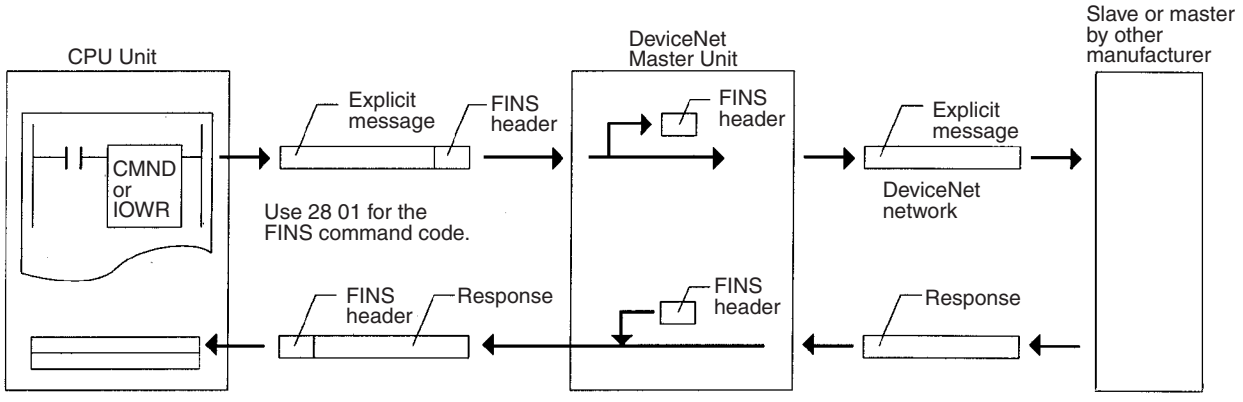
Assume that IOWR has been allocated a function code, e.g., 18.


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)
#0600
DM 0000
Place data into control data word to specify re sponse, destination node address 06, and destination unit address 00.
MOV(21)
#8207
DM 1000
MOV(21)
#D000
DM 1001
MOV(21)
#0064
DM 1002
MOV(21)
#0008
DM 1003
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).
MOV(21)
#0101
DM 1004
MOV(21)
#8203
DM 1005
MOV(21)
#E800
DM 1006
MOV(21)
#0005
DM 1007
Sets the MEMORY AREA READ command into DM 1004 to DM 1007.
Message Communications Enabled Flag (ON after re- sponse received for mes- sages communications exe- cuted a previous cycle)
00002
10112
CMP(20)
#0000
DM 2001
Compares contents of DM 2001 to 0000 after IOWR execution and response reception have been completed the previous cycle.
25506
Equals Flag
MOV(21)
#2001
DM 0006
Places the contents of DM 2001 into DM 0006 if the comparison results is not equals (error).
ASR(26)
000
Shifts the contents of IR 000 one bit right to turn ON IR 00001.
ASR(26)
000
Shifts the contents of IR 000 one bit right to turn ON (reset) IR 00000.

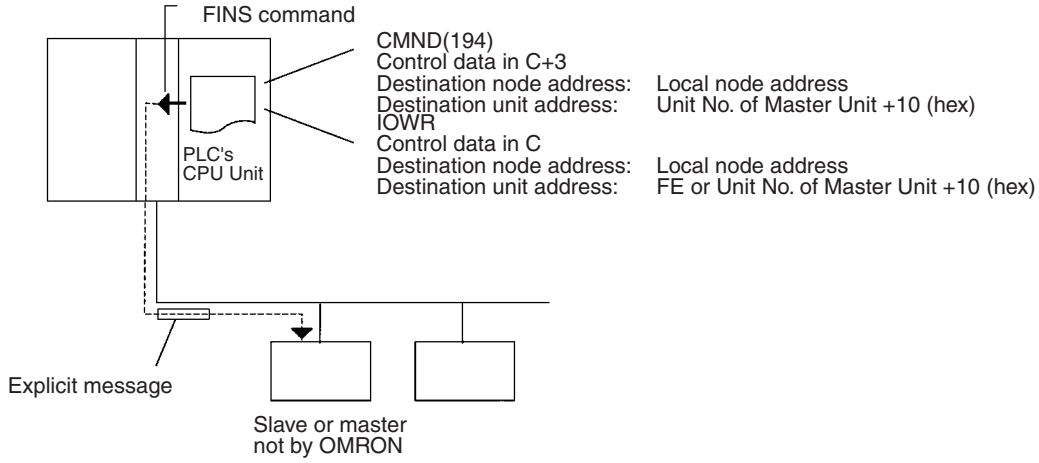


4-5 Sending Explicit Messages

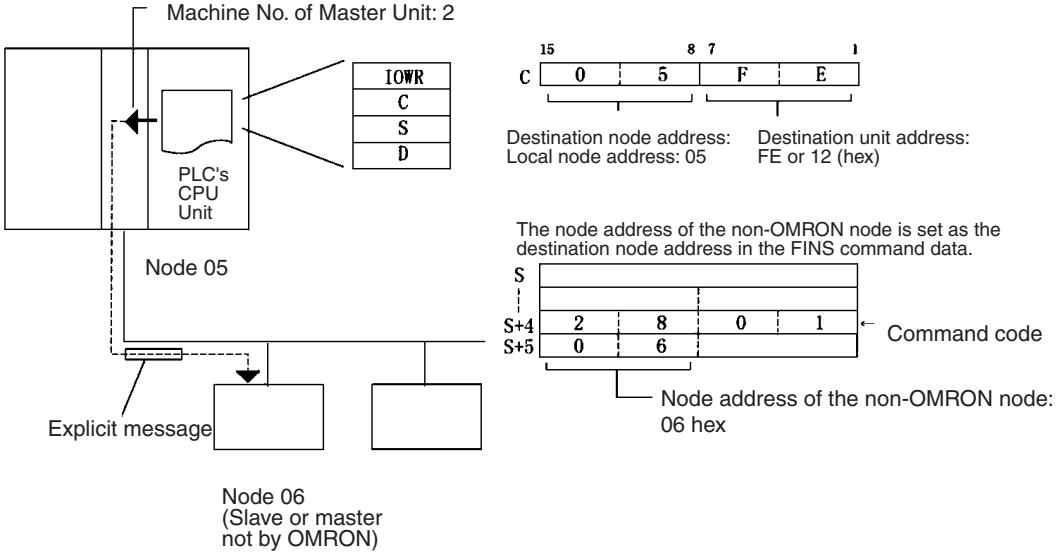
The FINS command code 28 01 can be used to send explicit DeviceNet messages to OMRON Special Slaves and DeviceNet devices made by other manufacturers. The use of explicit messages is illustrated in the following diagram.



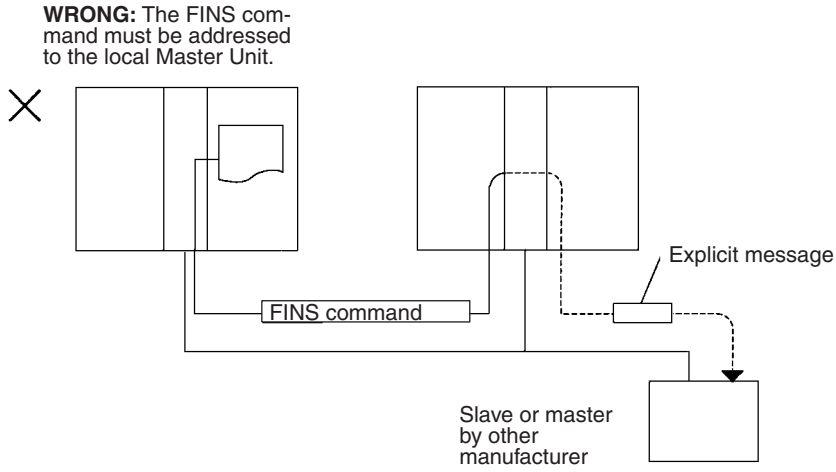
The local Master Unit is specified as the destination in the communications instruction in the PLC's user program (not the OMRON Special Slave or DeviceNet device made by another manufacturer), and the node address of the actual destination (i.e., the slave or master made by another manufacturer) is specified in the command data for the explicit message send command.



The following diagram shows an example of actual node address specifications.



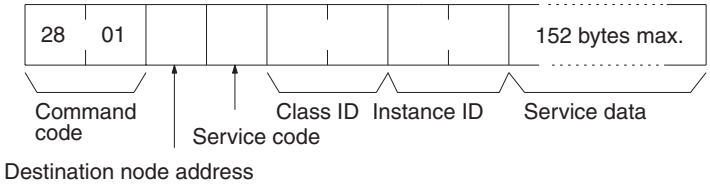
Note Explicit messages are first sent to the DeviceNet Master Unit, which processes them before sending the actual explicit message to the final destination. You must use the node and unit address of the local Master Unit in the PLC user program communications instruction. Addressing them to any other node will result in an error, such as would occur in the following illustration.



4-5-1 FINS Command: EXPLICIT MESSAGE SEND (28 01)

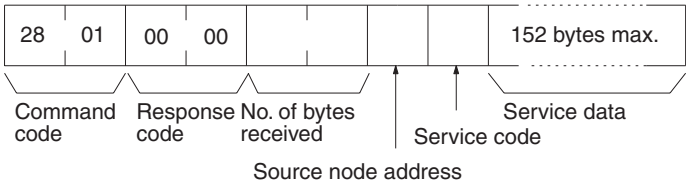
EXPLICIT MESSAGE SEND will send an explicit DeviceNet message to the specified object and receive a response.

Command Block



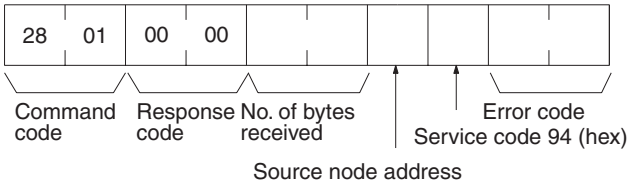
Response Block

Normal Response

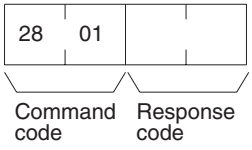


Error Responses

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.



Parameters

Destination node address (command): The node address of the destination of the explicit message. (The node address of the local Master Unit is speci-

fied 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.

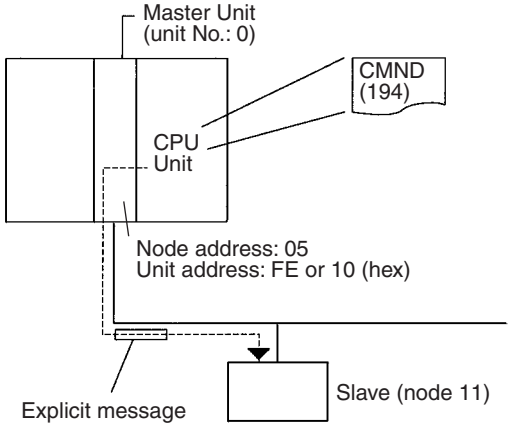
Error code (response): An error code defined by DeviceNet.

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 ODVA to obtain DeviceNet specifications. Contact information is provided below.
   TEL: 1 734-975-8840
   FAX: 1 734-922-0027
   Email: odva at odva.org
   Website: http://www.odva.org/
6. For details on explicit messages to OMRON Special I/O Slaves, refer to the *DeviceNet Slaves Operation Manual* (W347).

4-5-2 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)

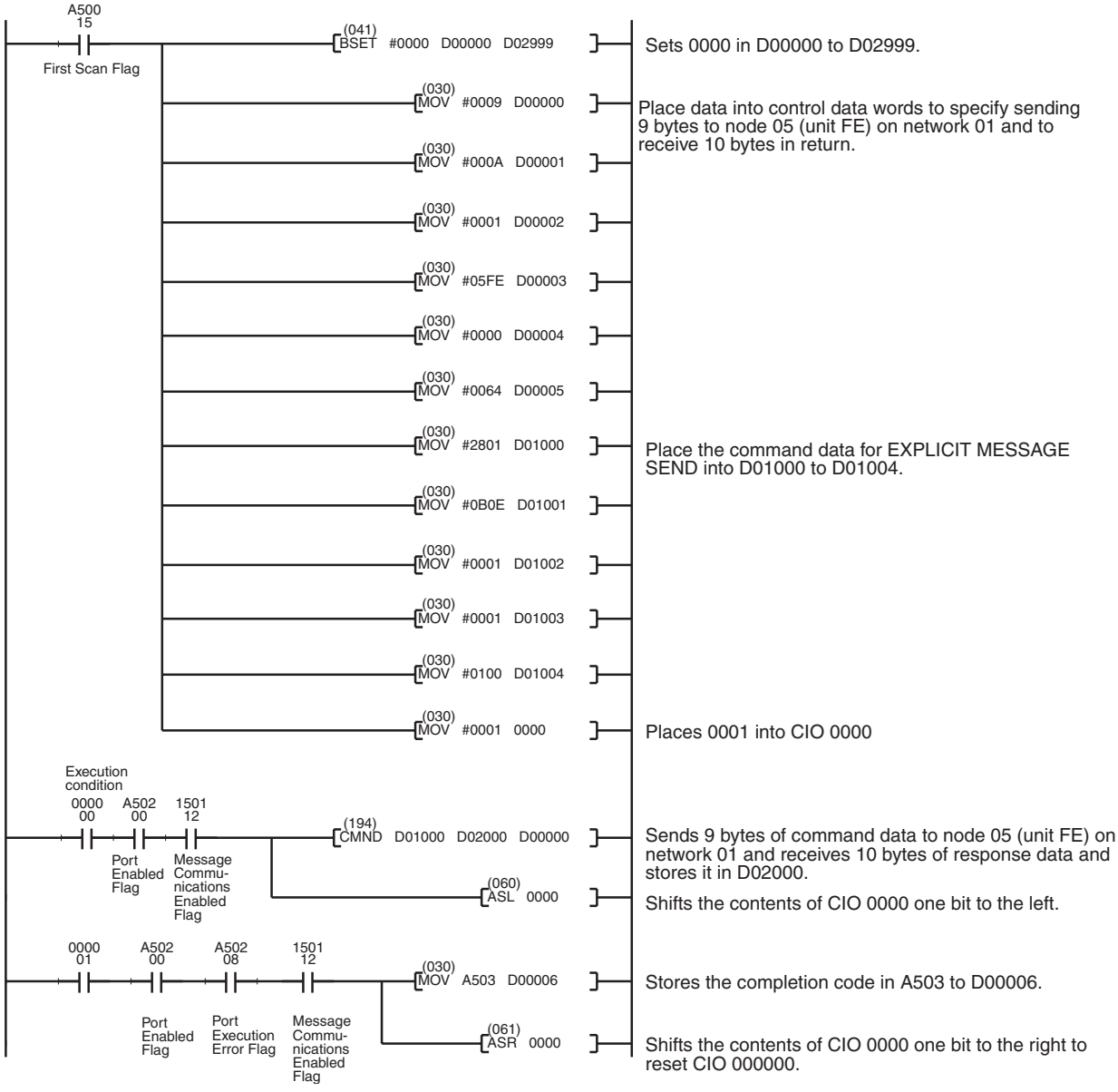
D01000 = 2801:	Command Code
D01001 = 0B0E:	Slave node address: 11 Service code:0E
D01002 = 0001:	Class ID: 0001
D01003 = 0001:	Instance ID: 0001
D01004 = 0100:	Attribute ID: 01

D = D02000:First response word at local node

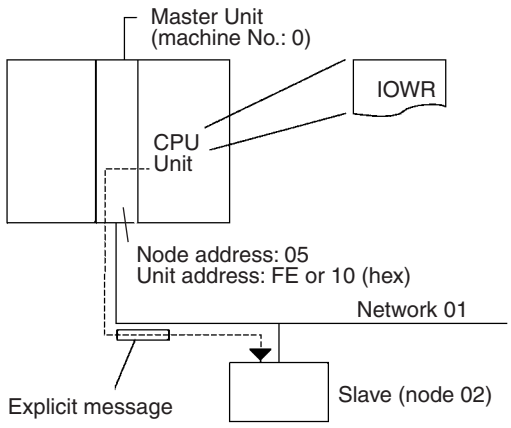
C = D00000:First control word

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)

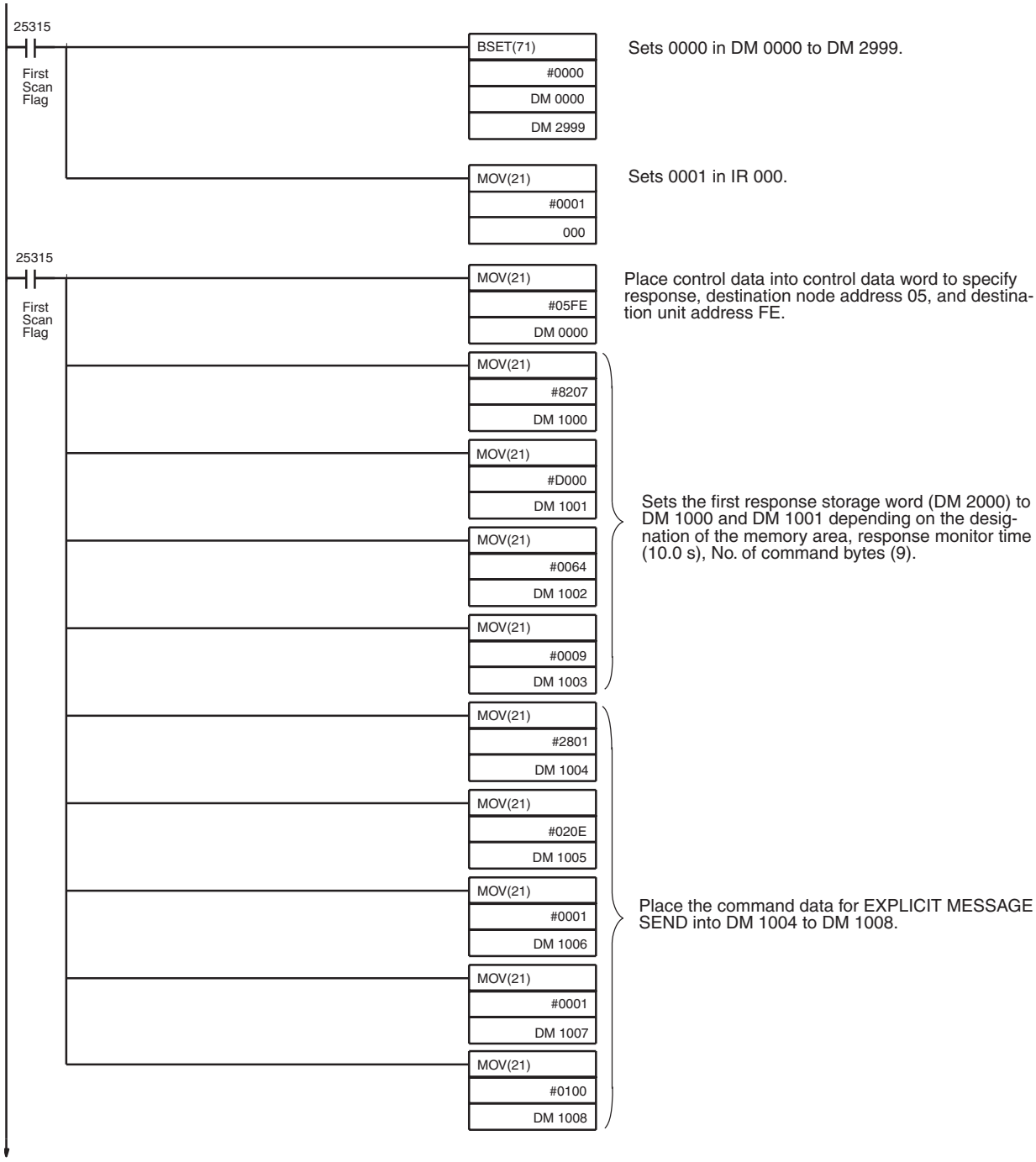
S = DM 1000:First source word

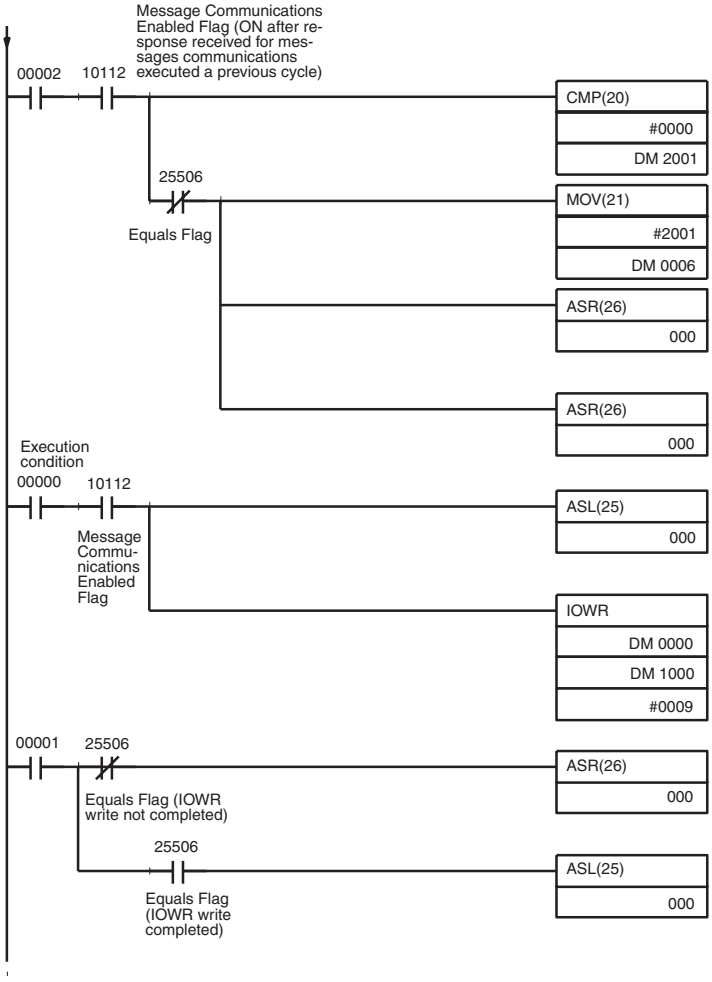
Settings (hex)

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 5
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.

5-1 Software Switch/Status Area Location 122
5-2 Software Switches 123
5-2-1 Software Switch Functions 123
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5-3-1 Status Area Configuration 125
5-3-2 Master Status Area 1 127
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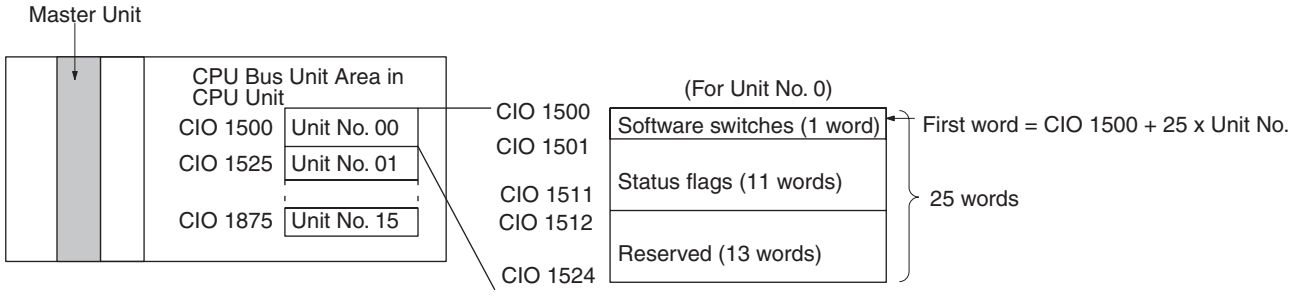
5-3-6 Registered Slave Data 131
5-3-7 Normal Slave Data 132

5-1 Software Switch/Status Area Location

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 PLCs, the software switch and status flag data is stored in the CPU Bus Unit Area, and in CS-series and C200HX/HG/HE/HS PLCs, it is stored in the Special I/O Unit Area.

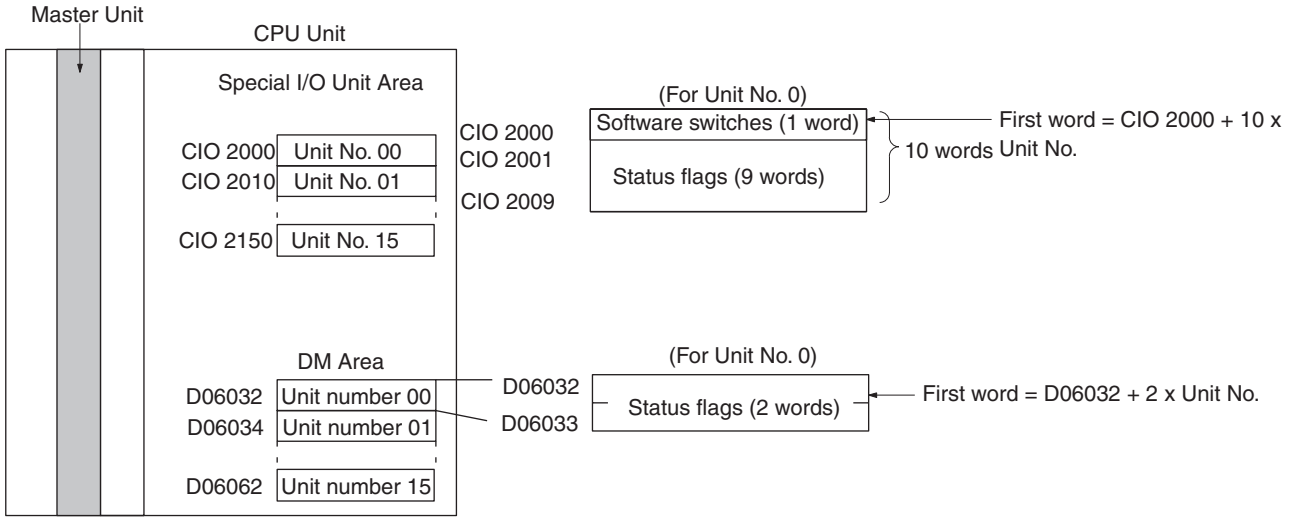
CVM1 and CV-series PLCs

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.



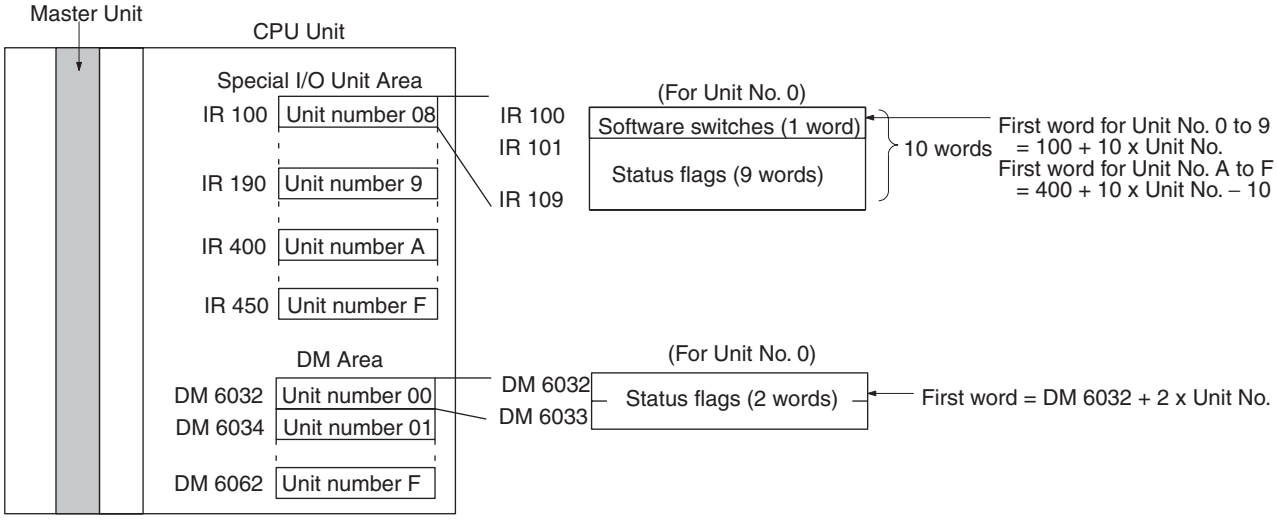
CS-series PLCs

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 PLCs

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.

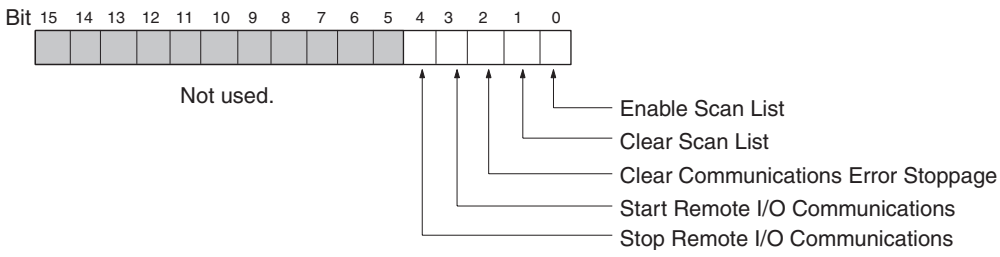


5-2 Software Switches

5-2-1 Software Switch Functions

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 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 *3-2 Scan Lists* for more details.

The following diagram shows the locations of the software switches.



Name	CVM1 and CV-series PLCs	CS-series PLCs	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 PLC 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 PLC 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.

Note The unit number (0 to 15) is set with the rotary switch(es) on the front of the Unit.

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 PLC 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 PLC 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.

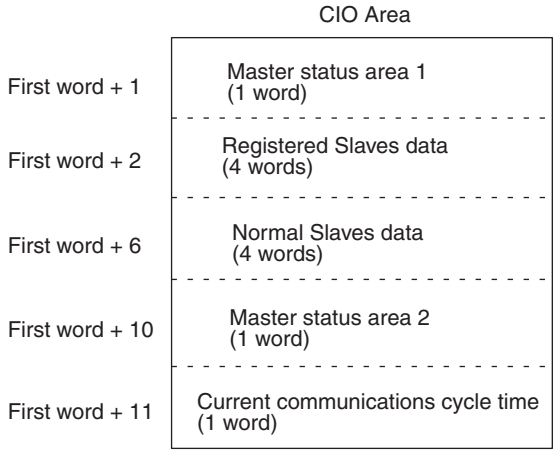
The Remote I/O Communications Operating Flag will turn OFF when remote I/O communications have stopped. Check that this flag is OFF and then turn OFF the Stop Remote I/O Communications software switch.

5-3 Status Area

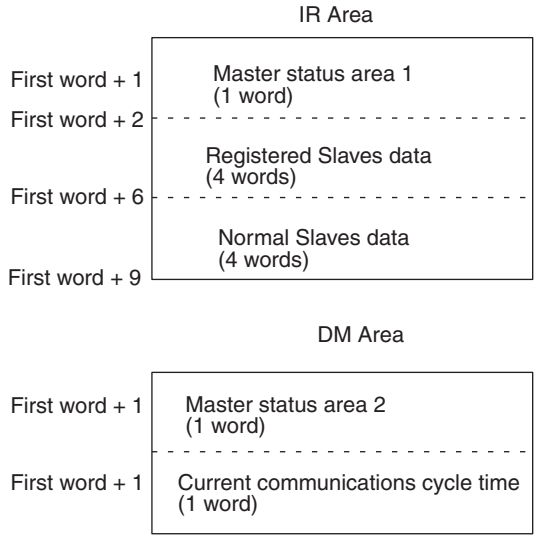
5-3-1 Status Area Configuration

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 PLCs). The 11 words are divided into five areas, as shown in the following diagram.

CVM1 and CV-series PLCs



CS-series and C200HX/HG/HE/HS PLCs



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

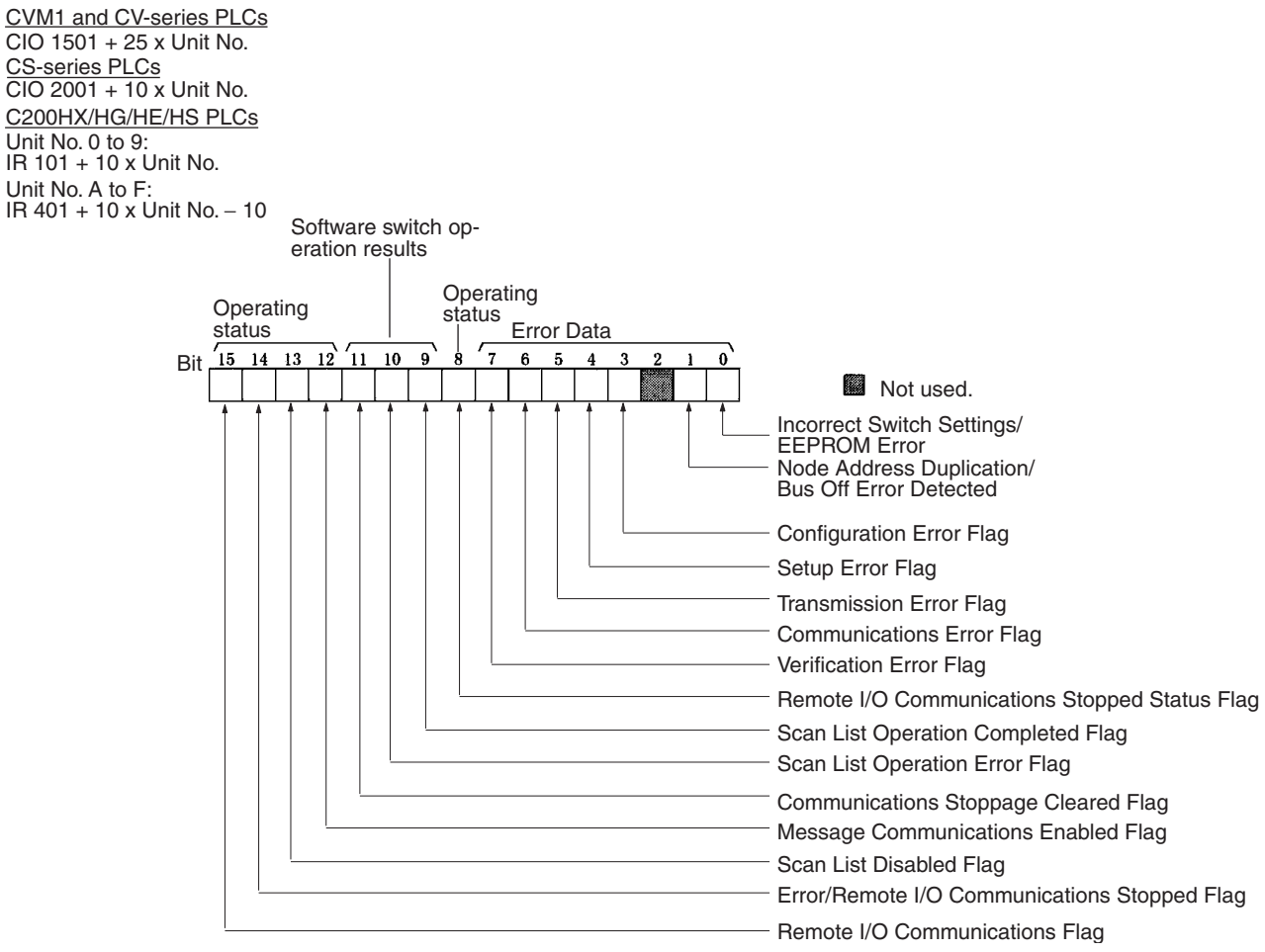
This word contains status data on the error log and Configurator scan lists.

Current Communications Cycle Time

This word contains the current communications cycle time.

5-3-2 Master Status Area 1

The following diagram shows the structure of Master Status Area 1.



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 PLC mounting error occurred for a C200HX, C200HG, C200HE, or C200HS PLC.
- A routing table error occurred for a CVM1 or CV-series PLC.

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 PLCs, this flag will be ON (1) when message communications are possible; it will be OFF (0) when message communications are not possible due to a Bus Off or other error.

For CS-series and C200HX/HG/HE/HS PLCs, this flag will be ON (1) when message 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 PLCs.
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.

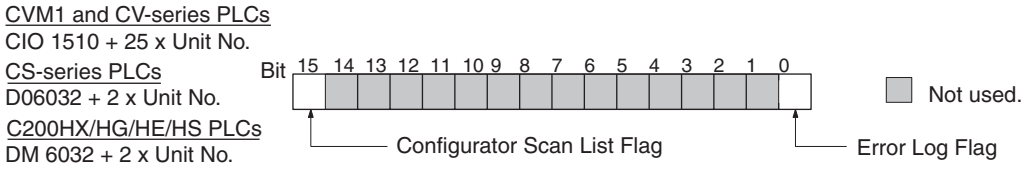
This flag will remain ON if communications were stopped due to a communications error, network power supply error, or transmission timeout error but remained stopped even though the cause of the error has been cleared.

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 *6-1-4 System Startup Time* for details.

5-3-3 Master Status Area 2

The following diagram shows the structure of Master Status Area 2.



Error Log Flag (Bit 00)

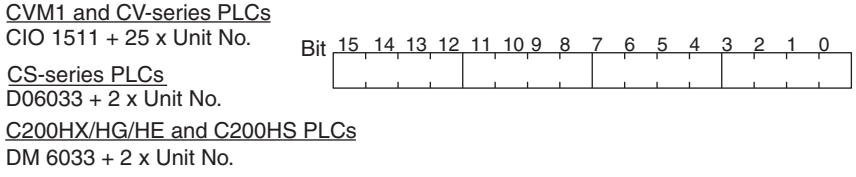
This flag is turned ON (1) when there is an error log recorded in the Master Unit and OFF when there is no error log. The error log will be cleared when the Master Unit is reset, power is turned off, or an error log clear operation is performed.

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.

5-3-4 Current Communications Cycle Time

The following diagram shows the structure of Current Communications Cycle Time in memory.



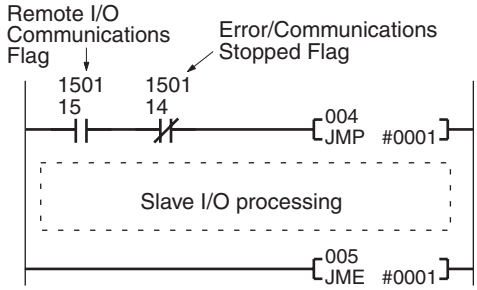
The current communications cycle time is stored in the above word as 4-digit BCD in ms. The value is truncated at the decimal point. The value is refreshed each PLC execution cycle for CS-series, C200HX/HG/HE, and C200HS PLCs; it is refreshed each peripheral servicing time for CVM1 and CV-series PLCs.

5-3-5 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 Com-

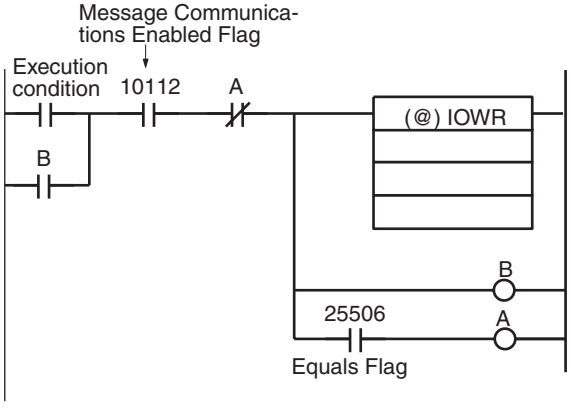
munications Flag is ON). The following example is for CVM1 and CV-series PLCs.



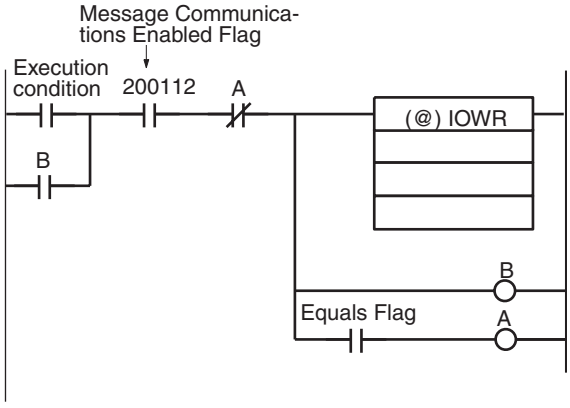
Message Communications

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: CS Series, Unit No. 0



Note Always use the Message Communications Enabled Flag as an input condition.

5-3-6 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 PLCs
CIO 1502 + 25 x Unit No.
CS-series PLCs
CIO 2002 + 10 x Unit No.
C200HX/HG/HE PLCs
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.

5-3-7 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 PLCs
CIO 1506 + 25 x Unit No.
CS-series PLCs
CIO 2006 + 10 x Unit No.
C200HX/HG/HE PLCs
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.

All bits will be OFF if remote I/O communications have not started even once 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.

Status of Flags when an Error Has Occurred

The Slave's 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 has occurred, these flags will retain the status they had just before the error occurred.

Status of flags in the Normal Slave Data Area		Error	Change in Master Status Area 1	Code on 7-segment Display
Change in flag status	Slave's flag is turned OFF when an error occurs in the Slave.	Setup error	Bits 04 and 14 go ON.	d0, d1, or d2
		Verification error	Bits 07 and 14 go ON.	d5 or d6
		Communications error (Master set to continue communications after remote I/O communications error.)	Bits 06 and 14 go ON.	d9
	The flag for the Slave where the first error occurred is turned OFF. The other flags maintain status that existed prior to the error.	Communications error (Master set to stop communications after remote I/O communications error.)		d9 and A0
No change in flag status	All flags maintain status that existed prior to the error.	Transmission timeout	Bits 05 and 14 go ON.	E2 (or E2 and A0)
		Network power supply error		E0 (or E0 and A0)

SECTION 6
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.

6-1 Remote I/O Communications Characteristics 134
6-1-1 Communications Cycle Time and Refresh Time 134
6-1-2 I/O Response Time. 136
6-1-3 More than One Master in Network 142
6-1-4 System Startup Time 143
6-2 Message Communications Time 144

6-1 Remote I/O Communications Characteristics

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

The equations provided here are valid under the following conditions:

1,2,3...

1. The Master Unit is operating with the scan list enabled.
2. All of the required Slaves are participating in communications.
3. No errors are being indicated at the Master Unit
4. Messages 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.

6-1-1 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 142.

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 communications time
+ 0.01 × N + 1.0 [ms]

Communications Time Per Slave:
This is the communications time required for a single Slave (refer to page 135).
"Σ (Communications time per Slave)" represents the total of the "Communications time per Slave" for all the Slaves in the network.

High-density Unit Processing Time:
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.

Explicit Message Communications Time:
0.11 × T_B + 0.6 [ms]
Only added as delay time resulting from explicit message communications (send or receive).
T_B =The baud rate factor
(500 kbps: T_B = 2; 125 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 PLC's CPU and the DeviceNet Master Unit. The PLC's cycle time is increased when a Master Unit is mounted, as shown below.

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

Master Unit for CVM1 and CV-series PLCs (CVM1-DRM21-V1)

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

Master Unit for C200HX/HG/HE and C200HS PLCs (C200HW-DRM21-V1)

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

PLC	DeviceNet Unit I/O refreshing time (ms)
CS Series, C200HX, C200HG, and C200HE	1.72 + 0.022 × the number of words refreshed
C200HS	2.27 + 0.077 × 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.

6-1-2 I/O Response Time

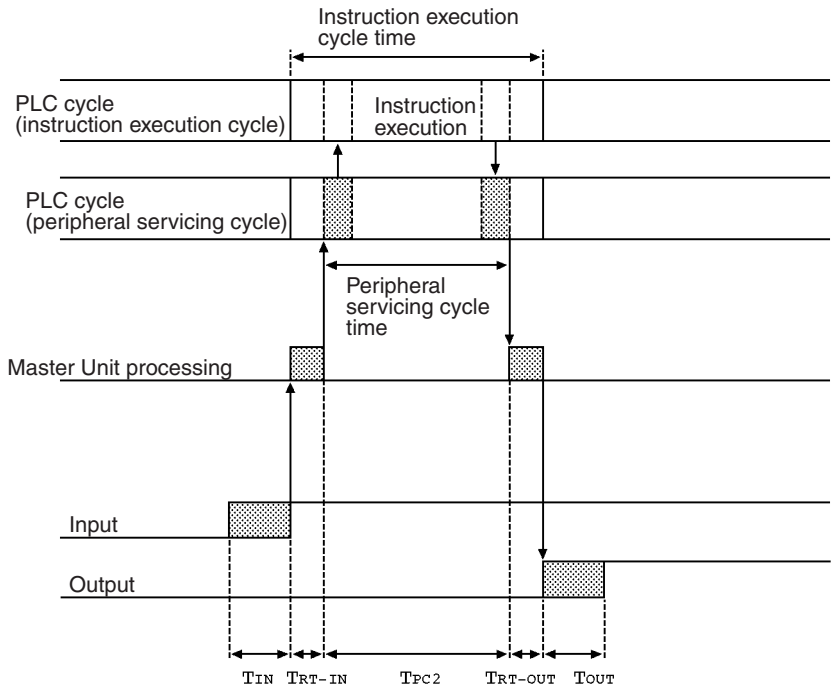
The I/O response time is the time it takes from the reception of an input signal at an Input Slave to the output of the corresponding output signal at an Output Slave.

CVM1 and CV-series PLCs (Asynchronous Mode)

The following timecharts show the minimum and maximum I/O response times of the DeviceNet network for a CVM1 or CV-series PLC 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 135.)
$T_{RT\text{-}OUT}$:Output Slave's communications time/Slave (See page 135.)
T_{PLC2}:The PLC's peripheral servicing cycle time

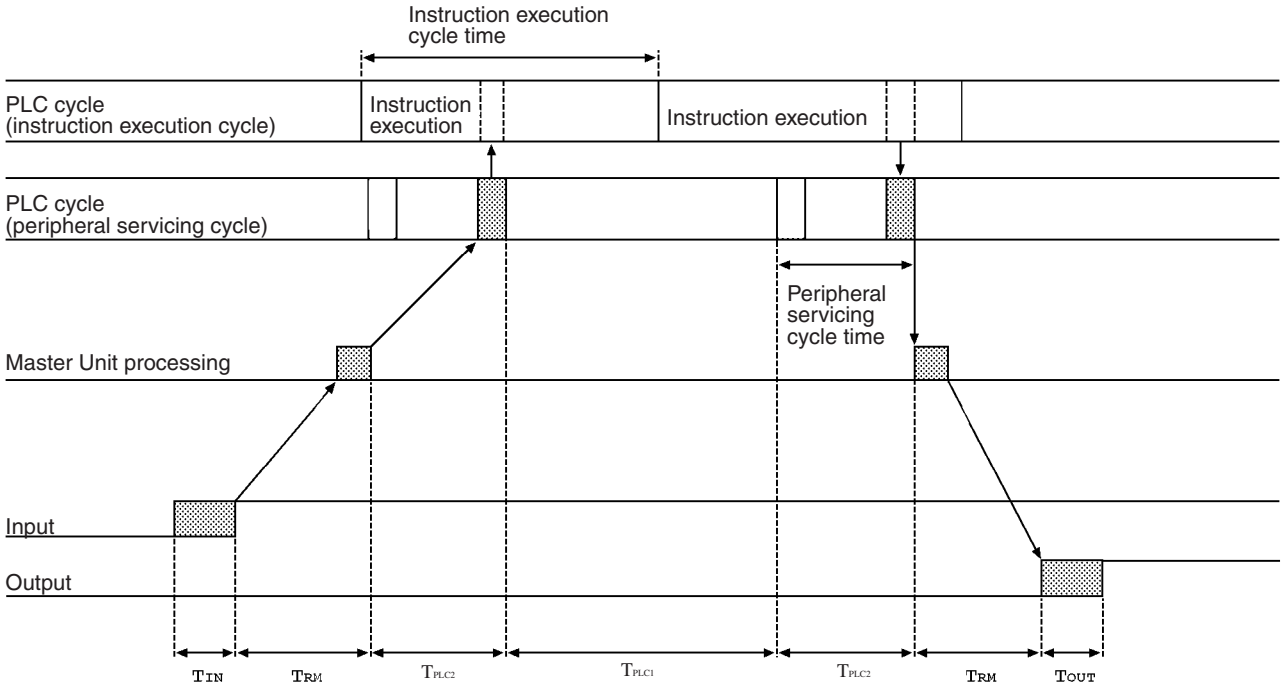
The minimum I/O response time (T_{MIN}) is the total of the following terms:

$$T_{MIN} = T_{IN} + T_{RT\text{-}IN} + T_{PLC2} + T_{OUT} + T_{RT\text{-}OUT}$$

Note
1. Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 135 and to the PLC's Operation Manual for details on the PLC'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 134.)
T_{PLC1}: The PLC's instruction execution cycle time
T_{PLC2}: The PLC's peripheral servicing cycle time

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

$$T_{MAX} = T_{IN} + 2 \times T_{RM} + T_{PLC1} + 2 \times T_{PLC2} + T_{OUT}$$

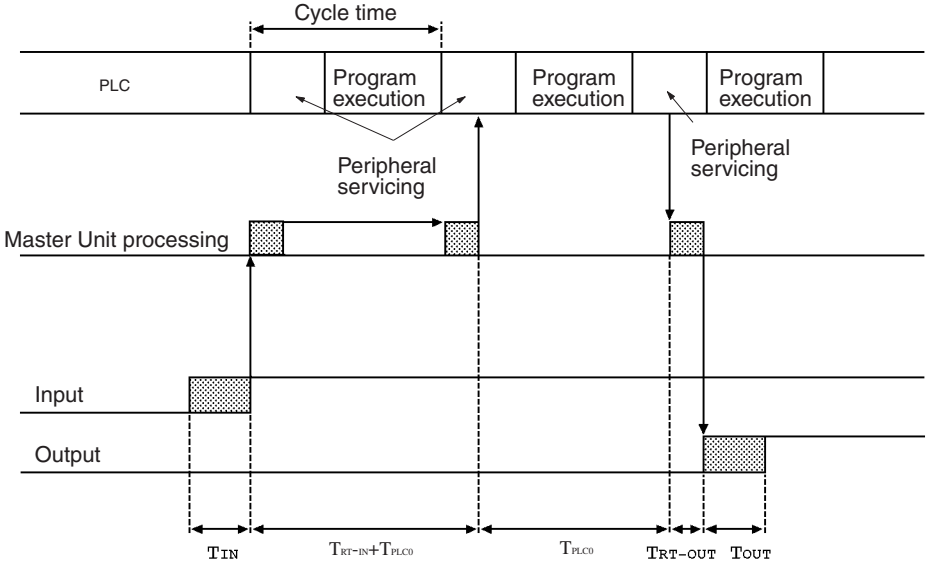
Note
1. Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 135 and to the PLC's Operation Manual for details on the PLC's peripheral servicing cycle time.

CVM1 and CV-series PLCs (Synchronous Mode)

The following timecharts show the minimum and maximum I/O response times of the DeviceNet network for a CVM1 or CV-series PLC 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 135.)

$T_{RT\text{-}OUT}$: Output Slave's communications time/Slave (See page 135.)

T_{PLC0}: The PLC's cycle time (program execution + peripheral servicing)

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

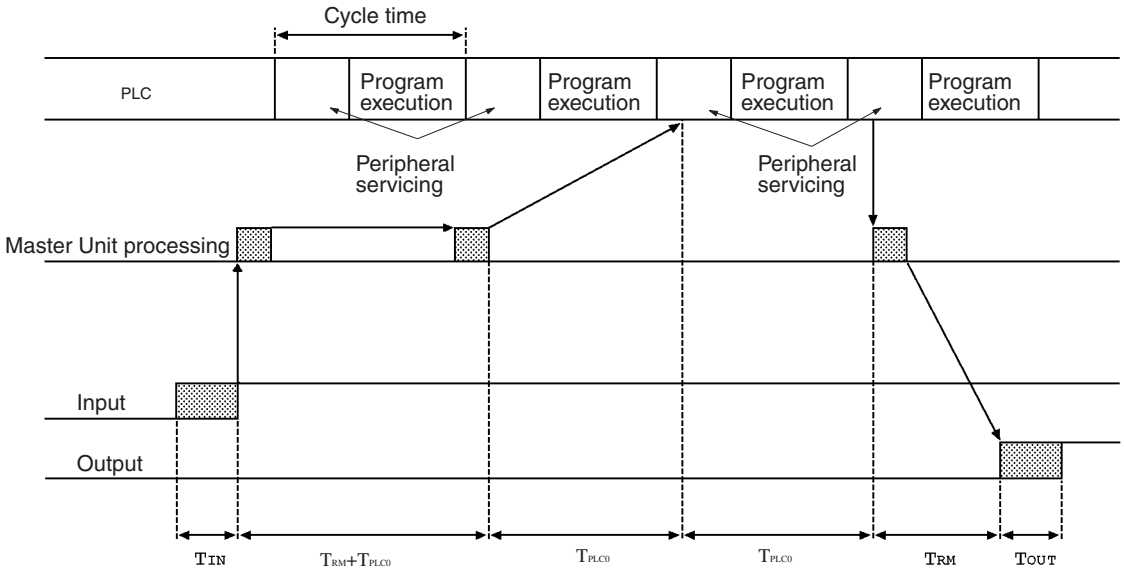
$$T_{MIN} = T_{IN} + T_{RT\text{-}IN} + 2 \times T_{PLC0} + T_{RT\text{-}OUT} + T_{OUT}$$

Note

1. Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 135 and to the PLC's Operation Manual for details on the PLC'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 134.)

T_{PLC0}: The PLC's cycle time (program execution + peripheral servicing)

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

$$T_{MAX} = T_{IN} + 2 \times T_{RM} + 3 \times T_{PLC0} + T_{OUT}$$

Note

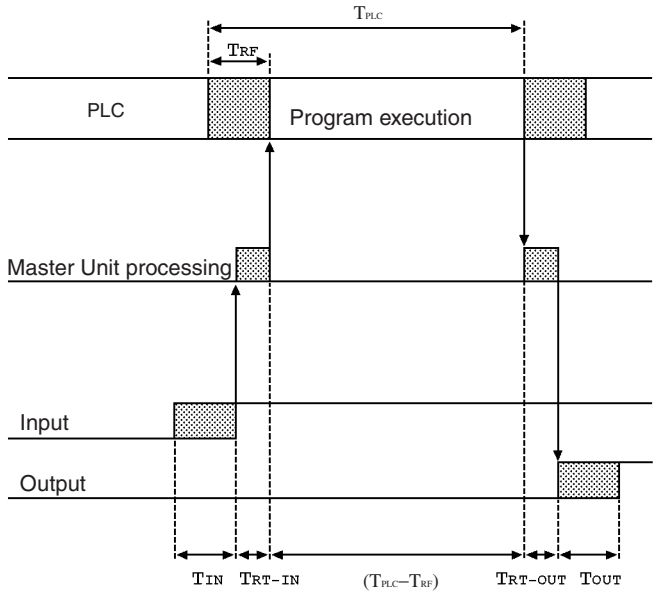
1. Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 135 and to the PLC's Operation Manual for details on the PLC's peripheral servicing cycle time.

C200JX/HG/HE and C200HS PLCs

The following timecharts show the minimum and maximum I/O response times of the DeviceNet network with a C200HX/HG/HE or C200HS PLC.

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
$T_{RT\text{-}IN}$: Input Slave's communications time/Slave (See page 135.)
$T_{RT\text{-}OUT}$: Output Slave's communications time/Slave (See page 135.)
T_{PLC}: The PLC's cycle time
T_{RF}: The PLC's DeviceNet Unit refresh time (See page 135.)

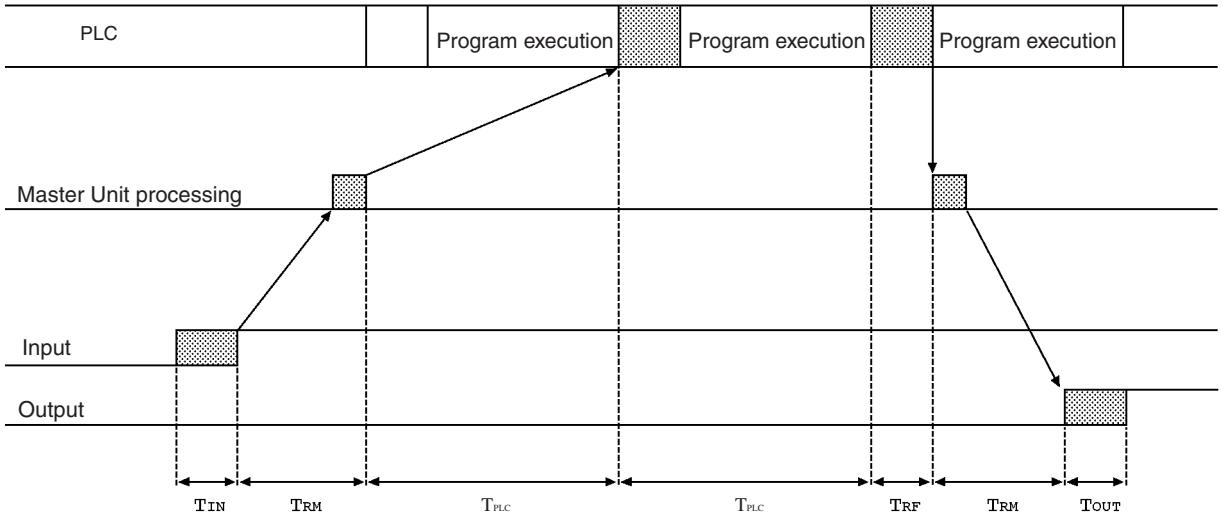
The minimum I/O response time (T_{MIN}) is the total of the following terms:

$$T_{MIN} = T_{IN} + T_{RT\text{-}IN} + (T_{PLC} - T_{RF}) + T_{RT\text{-}OUT} + T_{OUT}$$

Note
1. Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 135 and to the PLC's Operation Manual for details on the PLC'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 134.)
T_{PLC}: The PLC's cycle time
T_{RF}: The PLC's DeviceNet Unit refresh time (See page 135.)

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

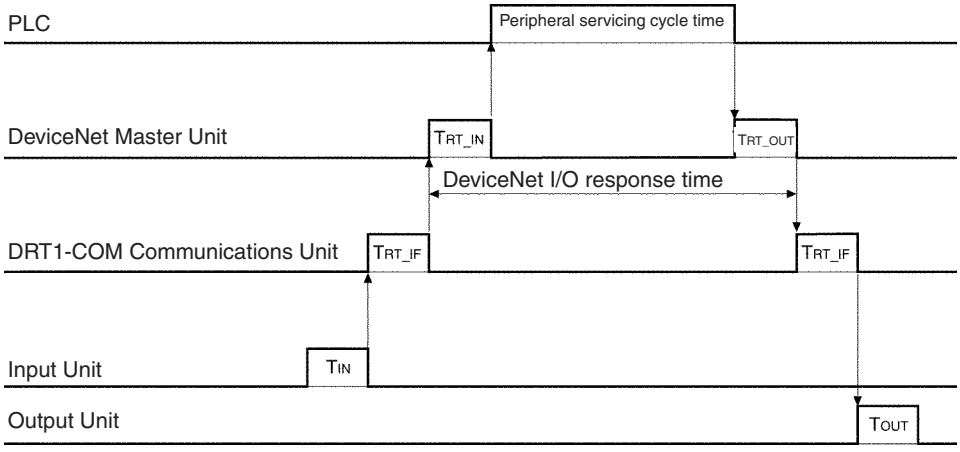
$$T_{MAX} = T_{IN} + 2 \times T_{RM} + 2 \times T_{PLC} + T_{RF} + T_{OUT}$$

Note
1. Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on the Input and Output Slaves' delay times.
2. Refer to *Refresh Time* on page 135 and to the PLC's Operation Manual for details on the PLC'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-IF}: I/O Unit interface communications time (1.5 ms)
T_{RT-IN}: Input Slave's communications time/Slave (See page 135.)
T_{RTOUT}: Output Slave's communications time/Slave (See page 135.)
(With the MULTIPLE I/O TERMINAL, T_{RT-IN} and T_{RT-OUT} will be the equal to the communications time for one Slave.)

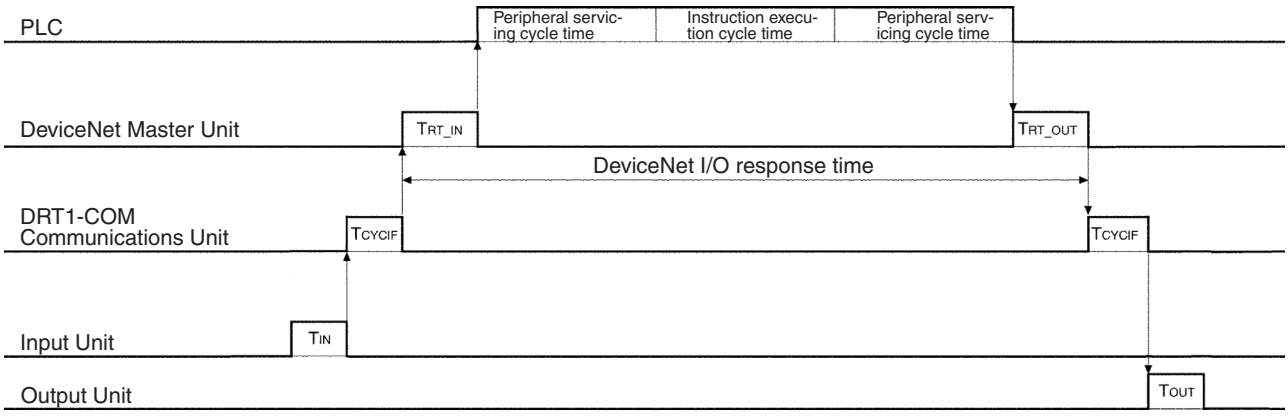
The minimum I/O response time (T_{MIN}) is the total of the following terms:

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

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 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 PLC's Operation Manual for details on the PLC'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_{RM}: The communications cycle time for the total Network (See page 134.)

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

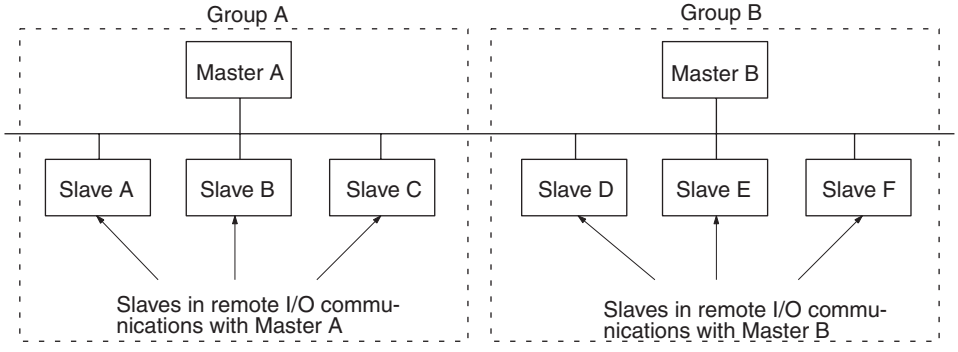
$$T_{MAX} = T_{IN} + T_{CYCIF} \times 2 + (\text{DeviceNet I/O response time}) + T_{OUT}$$

Note For details on the Input 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 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.

6-1-3 More than One Master in Network

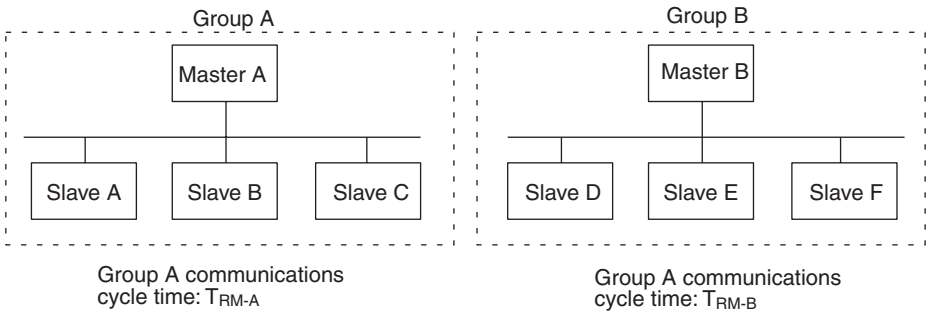
The following equation shows the remote I/O communications cycle time (T_{RM}) when there is more than one Master in the Network and message communications are not being performed. An example for two Master Unit is used.

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.

6-1-4 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.

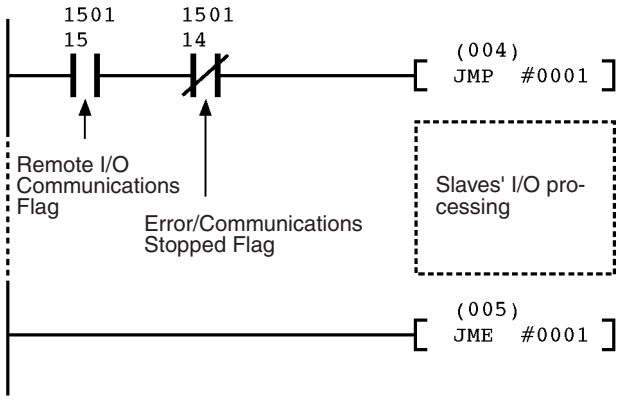
Case	Slave's indicator status	System startup time
The Master is started just after Slave startup.	The NS indicator is OFF or flashing green.	6 seconds
Just the Master is restarted.	The NS indicator is flashes red while the Master is OFF.	8 seconds
Just the Slaves are restarted.	---	10 seconds

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 *5-3 Status Area* for details on Master Status Area 1.

This programming is for a CVM1 or CV-series PLC and a Master Unit with a unit number of 00.



Note Include only the Slaves' I/O processing between the JMP(004) and JME(005) instructions. If actual I/O processing is performed, the Slaves' I/O processing will not be executed when a communications error occurs and the previous values will be maintained.
Use the PLC's Output OFF Bit to turn OFF the PLC's outputs if the Slave's I/O is being used with actual I/O and it is necessary to turn OFF the PLC's outputs before remote I/O communications are started or after a communications error occurs.

6-2 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 log of the Master Unit. If an error occurs, read the error log using the FINS command or monitor the error log 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) ÷ 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 (see note) + 0.11 × 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 × 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 7
Troubleshooting and Maintenance

This section 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.

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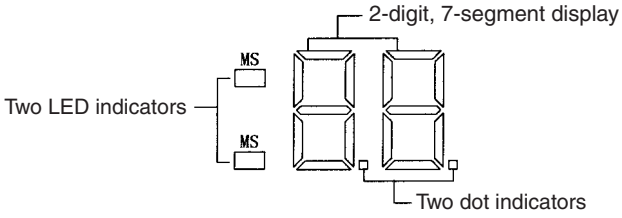
7-1 Indicators and Error Processing

7-1-1 Master Unit Indicators

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.



7-1-2 MS and NS Indicators

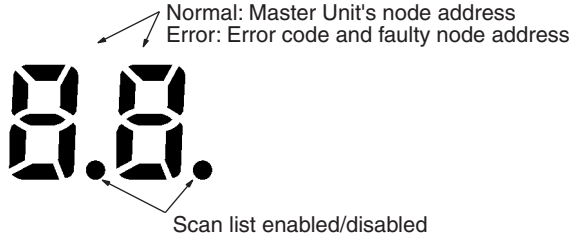
The MS (Module Status) and NS (Network Status) indicators can be green or red and they can be OFF, flashing, or ON. The following table shows the meaning of these indicator conditions.

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, PLC initialization error, PLC 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.

7-1-3 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

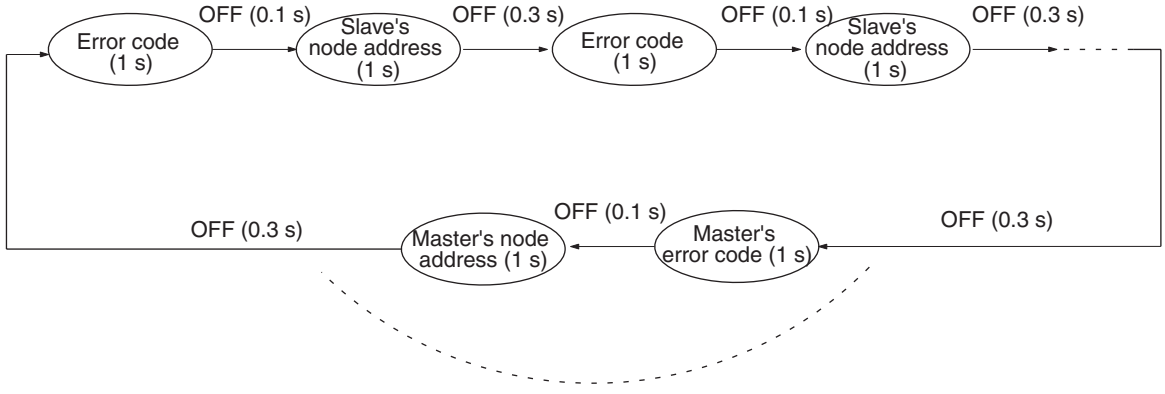
The dots at the lower-right corner of each digit show whether the scan list is enabled or disabled for DeviceNet remote I/O communications. The dots are ON when the scan list is disabled and OFF when the scan list is enabled.

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.



If there is an error at the Master Unit.

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.

7-1-4 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 PLC.	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 PLC. The same Unit number has been used for more than one C200HS PLC. Unit numbers A to F have been used for a C200HX/HG/HE PLC that supports less than 881 I/O points. The Master Unit is not registered in the I/O table for a C200HX/HG/HE PLC. 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.	---

7-1-5 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	PLC Watchdog Timer Error	Either a watchdog timer error occurred in the PLC or power isn't being supplied to the PLC properly. Master Unit operation will stop. Refer to the PLC'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 the communications error (error d9), network power supply error (error E0), or transmission timeout (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 PLC wasn't in PROGRAM mode. Switch the PLC 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 times. 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)	---	PLC mounting error (for V1 Master Units only; see note 1 at end of table)	CS-series and C200HX/HG/HE PLCs: A Configurator was not used to configure a network that includes another DeviceNet Master Unit, a SYSMAC BUS Remote I/O Master Unit, or I/O Link Unit. C200HS PLCs: A Configurator was not used to configure a network that includes another DeviceNet Master Unit or an I/O Link Unit. Master Unit operation will continue with remote I/O communications (including I/O refreshing) stopped. Bits 03 and 14 will be ON in Master Status Area 1. Create a scan list using the configurator. (V1 Master Units: When a PLC mounting error occurs, remote I/O communications will stop, but message communications and software switch/status area refreshes will continue. A PLC mounting error will always occur the first time PLC power is turned ON with more than one Master Unit, but the error can be eliminated by registering proper parameters in all Master Units.) When the Master Unit is being used with an I/O Link Unit, set a lower unit number on the Master Unit. Also, use a Programming Console or Configurator to change the I/O area allocated to the I/O Link Unit.
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 Master Units without the “V1” suffix in the 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 for mismatched Master/Slave baud rates, loose or broken cables, noise, incorrect cable lengths, and improper installation of the Terminating Resistors.

Display/Indicator status			Error	Probable cause and remedy
7-segment	**MS**	**NS**		
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.
F4 ⇔ Mnn	Flashing (green)	OFF	Configuration error: PLC mounting error (Master Units without the "V1" suffix 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 PLC.
F5 ⇔ Mnn	Flashing (green)	OFF	Initialization error with PLC	An error occurred during initialization with the PLC. Master Unit operation will stop. Check the following items and restart the PLC. • I/O table in CPU Unit. • Error log in CPU Unit. • Unit number of Master Unit.
F6 ⇔ Mnn	Flashing (red)	OFF	PLC interface error	An error occurred in communications with the PLC. Master Unit operation will stop. Check the following items and restart the PLC. CVM1 and CV-series PLCs • CPU Unit status. • IOSP instruction programming methods • CPU Bus Unit servicing setting (A015) CS-series, C200HX/HG/HE, and C200HS PLCs • 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 original version of the Master Unit (lacking the "V1" suffix), Master Unit operation would stop with an F4 error code displayed for a PLC mounting error. With V1 Master Units, remote I/O communications will stop for PLC 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 PLC and the Master Unit, but software switches and the status area will be refreshed.
2. With the original version of the Master Unit (lacking the "V1" suffix), 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 PLC and the Master Unit) and only software switches and the status area will be refreshed.

7-2 Error Log Function

7-2-1 Introduction

Up to 20 records of errors can be set in an 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.

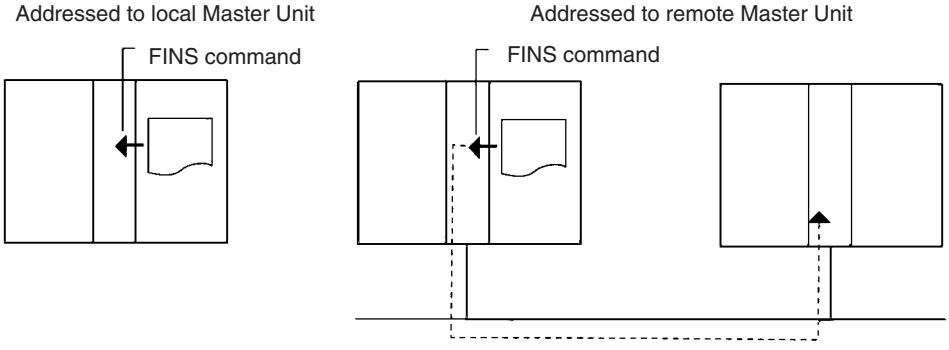
Note The content of the error log is cleared when power is turned OFF or when the Master Unit is reset.

FINS Commands

The following FINS commands can be sent from a CPU Unit to the Master Unit to read and clear the error log.

- ERROR LOG READ, command code 21 02
- ERROR LOG CLEAR, command code 21 03

The data that was read can be stored in the DM area of the PLC.

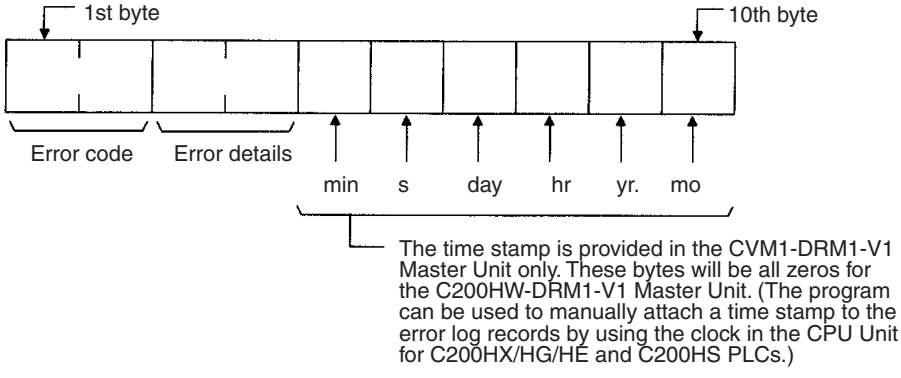


Configurator

The Master error log read operation can be used from the Configurator to monitor the error log. With the Configurator, the error log can only be monitored and the data cannot be saved.

7-2-2 Error Log Data

Each record in the error log 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 Even with the CVM1-DRM21-V1, the time stamp is not provided for any error that occurs during initialization with the PLC.

7-2-3 Error Codes

The error codes used in the error log 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.

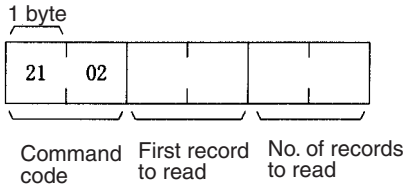
Error code (hex)	Error details		Error		Meaning	7-segment display
0002	Code from 7-segment display on Master Unit	Error node address	PLC interface error		Error occurred in PLC interface.	F6
0006			Initialization error with PLC		Error occurred in initialization with PLC.	F5
000B			Routing table error		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.	d6
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			PLC mounting error		A PLC 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 log from the Configurator, the information in the "Meaning" column is also displayed.

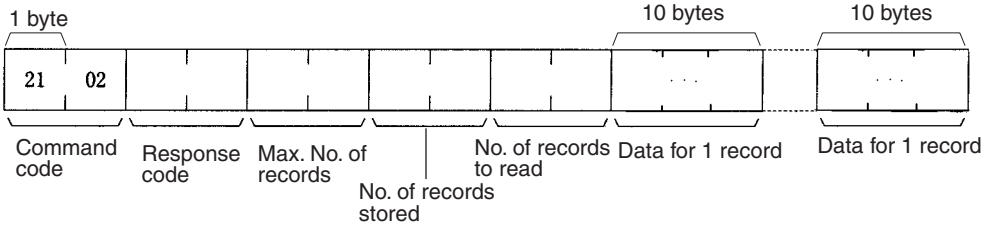
7-2-4 FINS Commands for Error Logs

ERROR LOG READ

Command Block

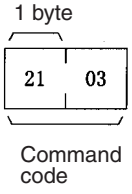


Response Block

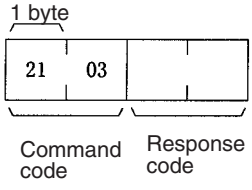


ERROR LOG CLEAR

Command Block



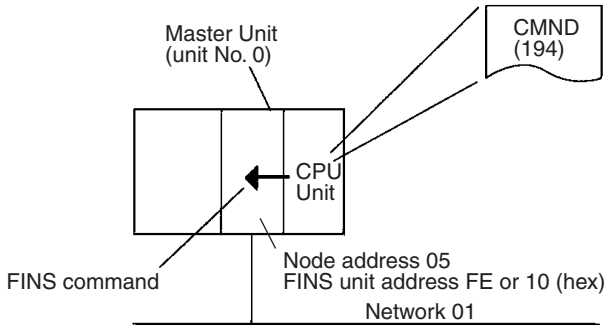
Response Block



7-2-5 Programming Examples

This section describes how to read the error log data from the Master Unit and store it in the DM area of the PLC. Examples are given for both CVM1/CV-series PLCs and C200HX/HG/HE PLCs.

CVM1 and CV-series PLCs: Using CMND(194)



The program reads 20 records of error log data from the Master Unit, stores the data, and then clears the error log. This process is repeatedly executed. The ERROR LOG READ (21 02) and ERROR LOG CLEAR (21 03) commands are used.

The ERROR LOG READ command is stored in memory starting from D01000 and the ERROR LOG 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 LOG 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 LOG 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 Log

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).

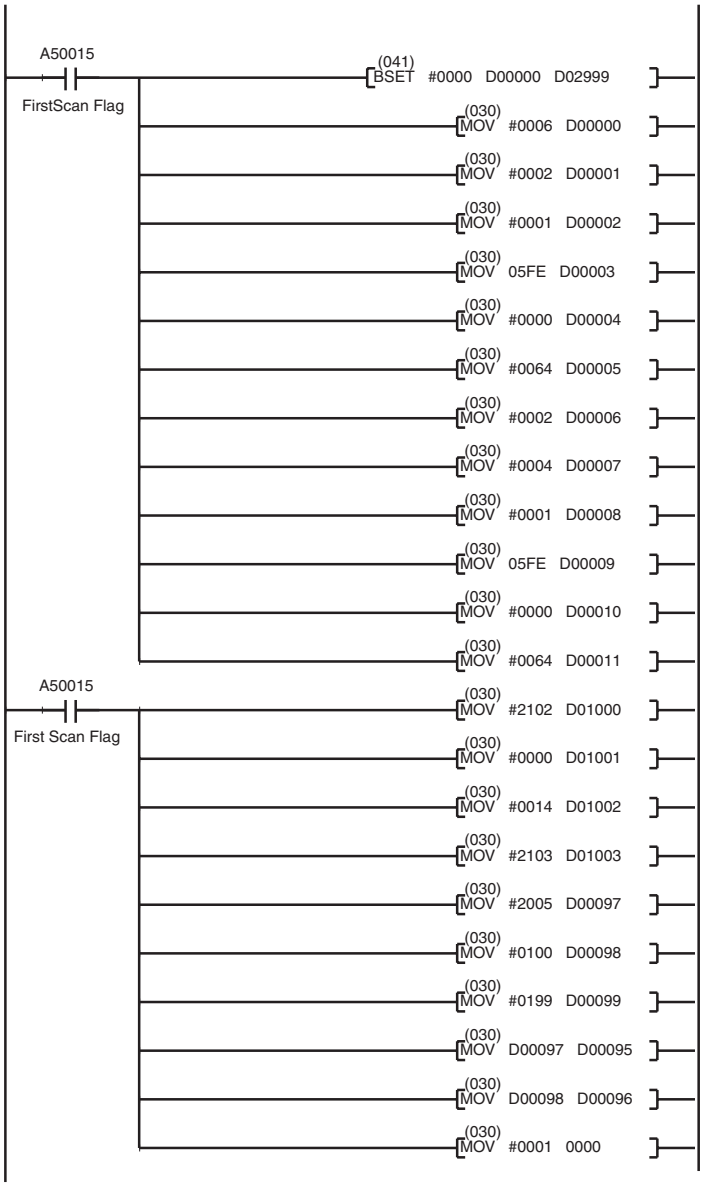
D00000 = 0006:	Number of command bytes
D00001 = 00D2:	Number of response bytes
D00002 = 0001:	Destination network address (01)
D00003 = 05FE:	Destination node address (05) Destination FINS unit address (FE = Master Unit)
D00004 = 0000:	Response, communications port 0, no retries
D00005 = 0064:	Response monitoring time

Clearing the Error Log

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 log from the Master Unit at node 05 of network 01.

Place data into control data words to specify clearing the error log from the Master Unit at node 05 of network 01.

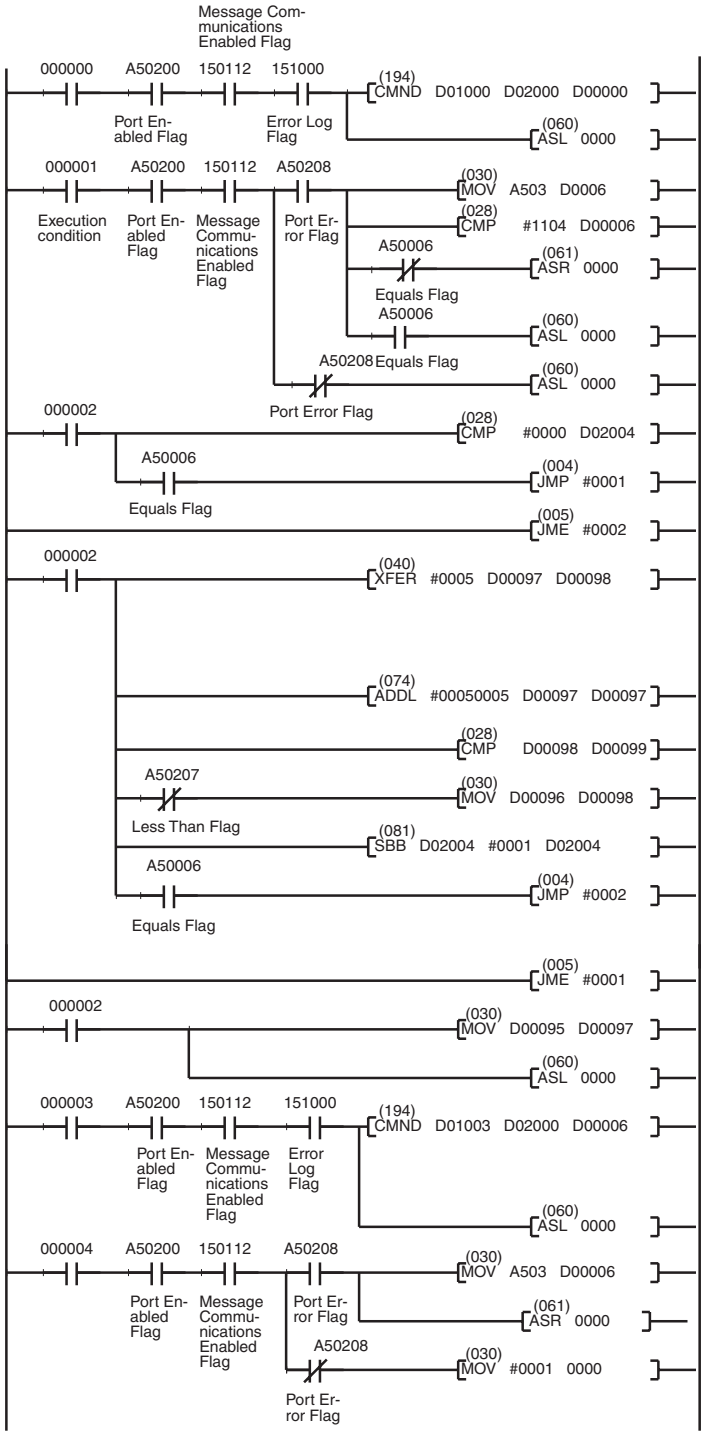
Place the command data for ERROR LOG READ into D01000 to D01002.

Places the command data for ERROR LOG 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 log data word, and the last error log 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 log 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 log 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.

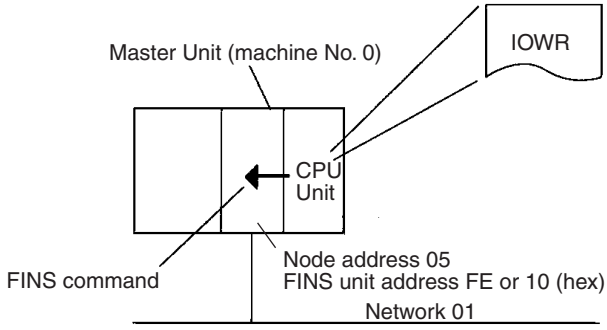
Stores the completion code in D00006

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 error log again.

C200HX/HG/HE PLCs: Using IOWR

The following explanation also applies to CS-series PLCs, but the 3rd operand of the IOWR instruction (D: Destination information) is specified differently in CS-series PLCs.



The program reads 20 records of error log data from the Master Unit, stores the data, and then clears the error log. This process is repeatedly executed. The ERROR LOG READ (21 02) and ERROR LOG CLEAR (21 03) commands are used.

The ERROR LOG READ command is stored in memory starting from DM 1000 and the ERROR LOG 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 log 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 log (which is all zeros when read out).

If the ERROR LOG 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 LOG 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 Log

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 Log

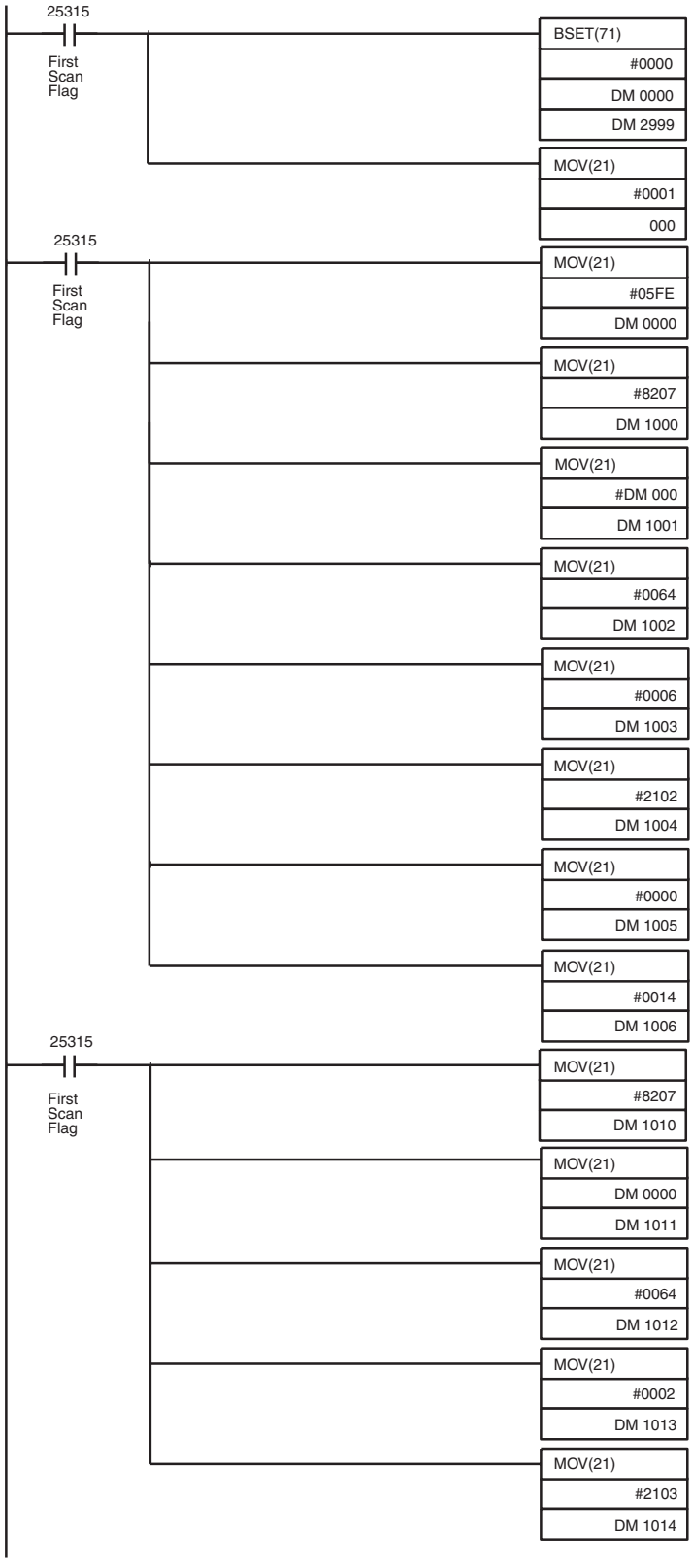
C = DM 0000:Control word

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.

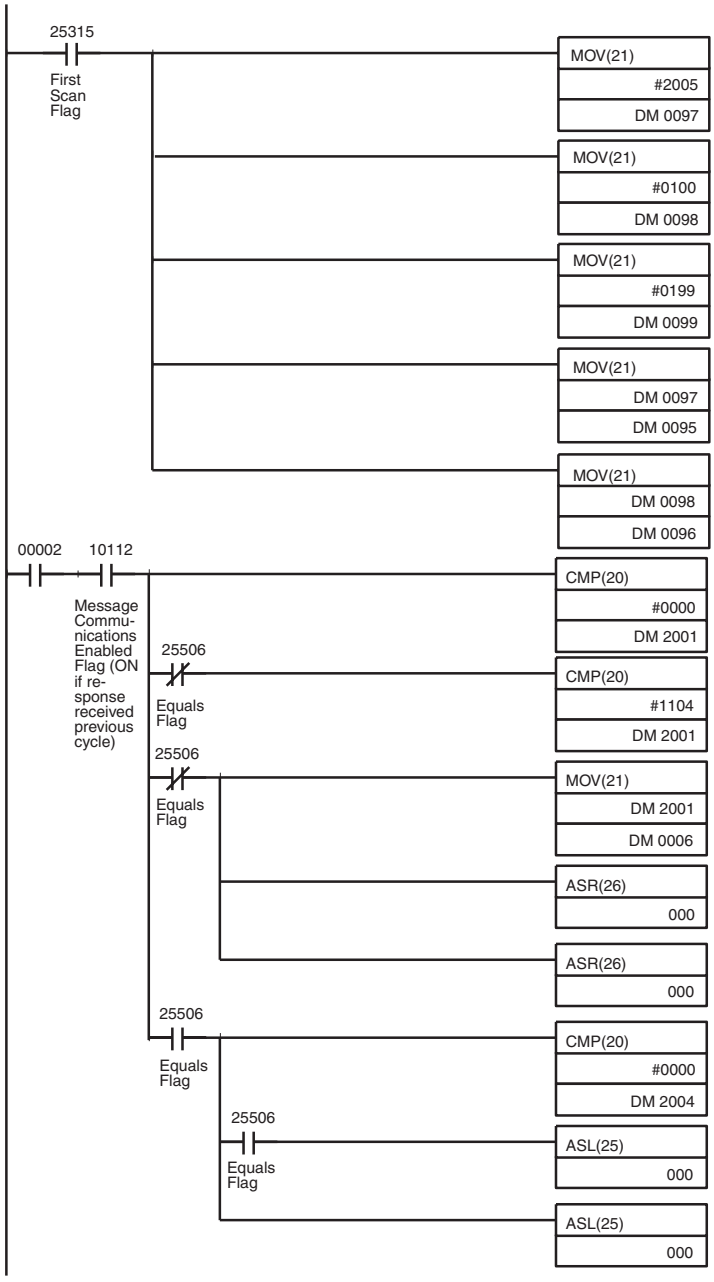
Sets the contents of IR 000 to 0001 (i.e., turns ON IR 00000).

Place data into control data words to specify reading 20 records from the error log from the Master Unit at node 05 of network 01.

Place the command data for ERROR LOG READ into DM 1004 to DM 1006.

Place data into control data words to specify clearing the error log from the Master Unit at node 05 of network 01.

Places the command data for ERROR LOG 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 log data word, and the last error log data word, respectively.

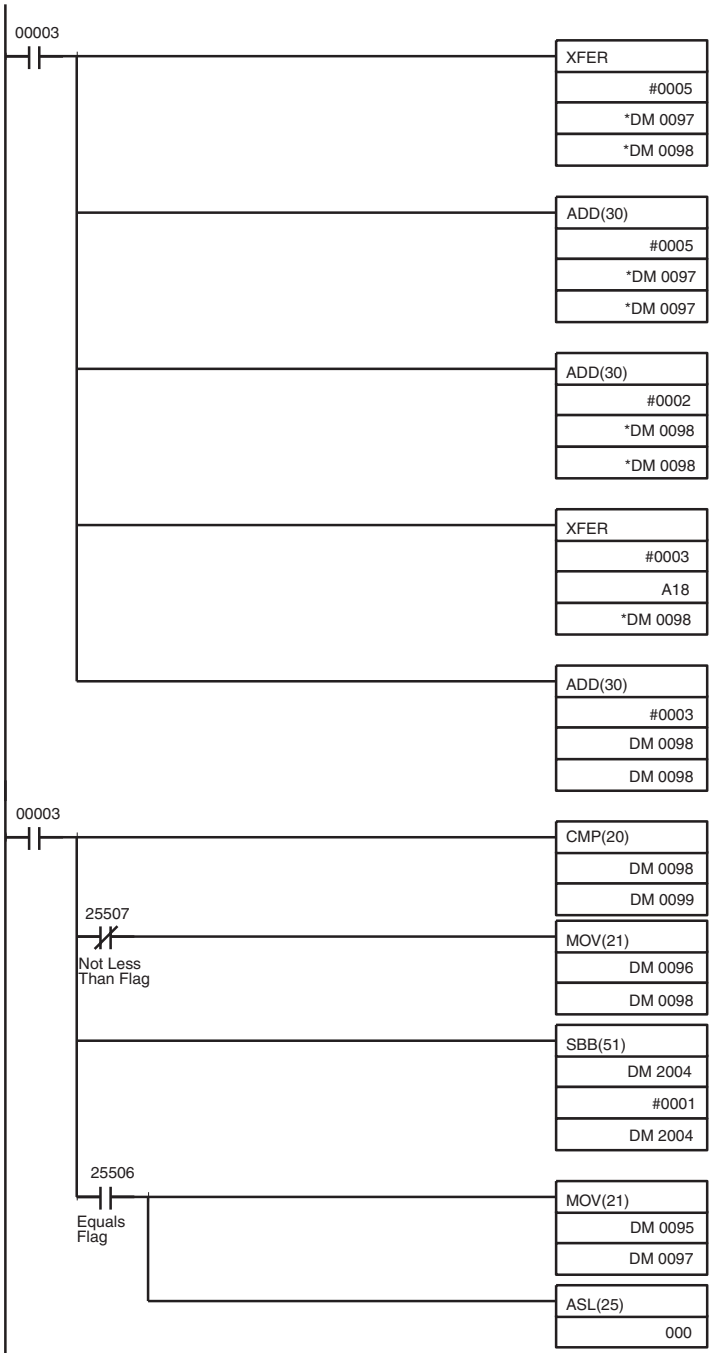
Transfer the contents of DM 0097 and DM 0098 to DM 0095 and DM 0096.

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 log 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.

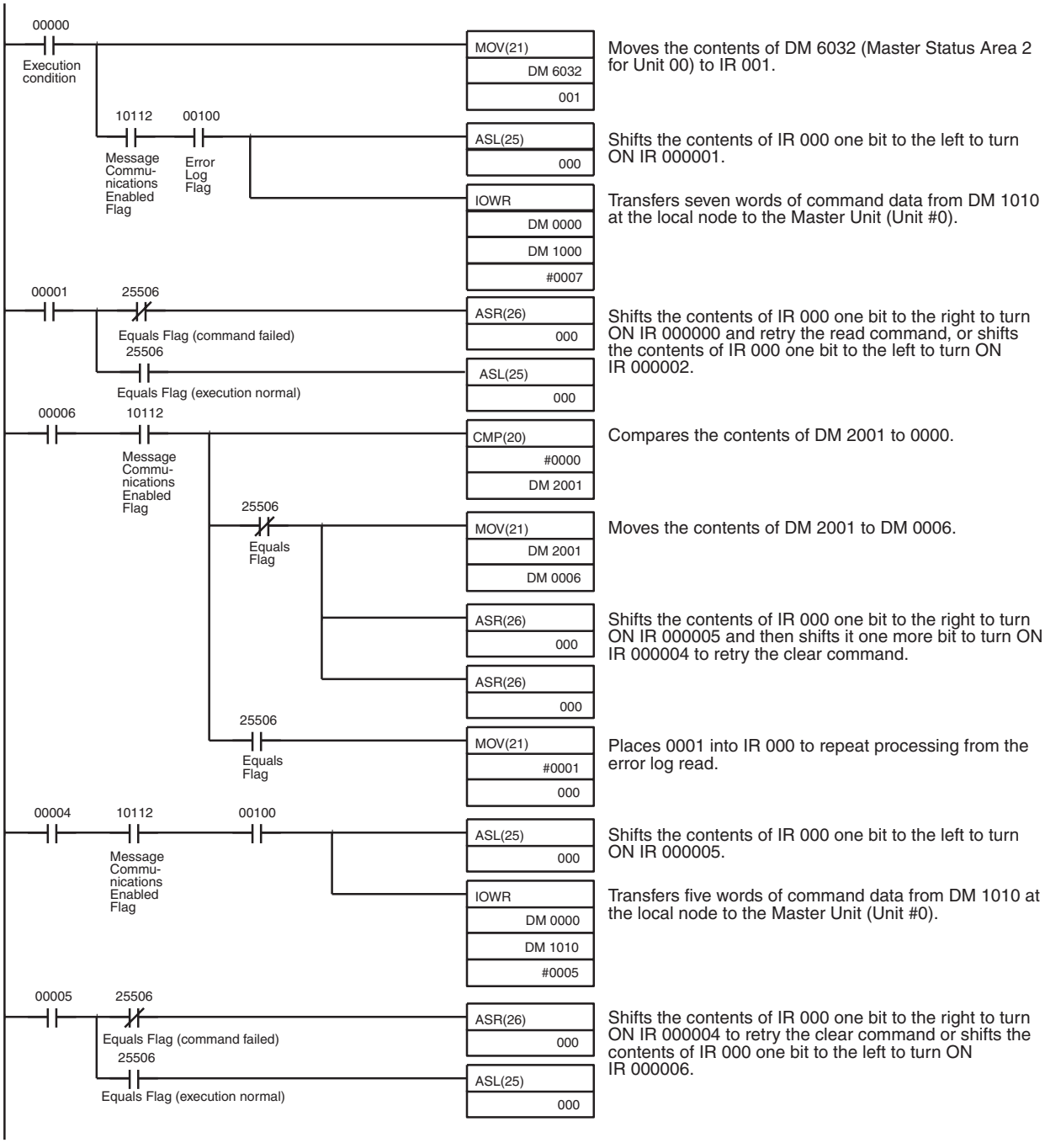
Adds 0003 to the contents of DM 0098 to change to the address to the next word after the time stamp.

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 log).



7-3 Troubleshooting

7-3-1 Master Unit Troubleshooting

The indicators of a Master Unit connected to a C200HX, C200HG, C200HE, or C200HS PLC 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 PLC's Special I/O Unit area.

PLC Error (CVM1-DRM21-V1)

Use the following table to troubleshoot errors in a PLC that has a CVM1-DRM21-V1 Master Unit installed. Refer to the *CV-series PLCs 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.

PLC Error (C200HW-DRM21-V1)

Use the following table to troubleshoot errors in a PLC that has a C200HW-DRM21-V1 Master Unit installed. Refer to the *CS 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 PLC. • Check whether the Master Unit is mounted in the Backplane correctly. • When a watchdog timer (WDT) error has occurred in the PLC, follow the procedures described in the PLC'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 *page 150 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 *page 150 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. Refer to the *DeviceNet Operation Manual* (W267) for details. • Check whether the communications cables are wired correctly. Refer to the *DeviceNet Operation Manual* (W267) for details. • Check whether the power supply is set correctly. Refer to the *DeviceNet Operation Manual* (W267) 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 the *DeviceNet Operation Manual* (W267). 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 PLC 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 PLC 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 PLC's Operation Manual for details on the IOM Hold Bit (CS 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.

7-4 Maintenance

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

7-4-1 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.

7-4-2 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	Refer to the Slave's specifications.	Thermometer
	Ambient and cabinet humidity	Refer to the Slave's specifications.	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	---

7-4-3 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 configuration 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

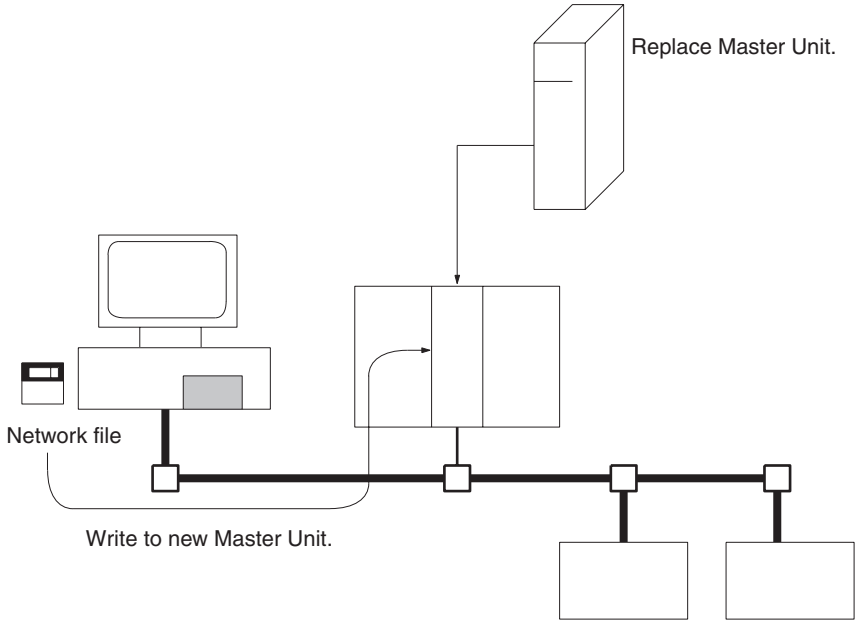
Perform one of the following procedures.

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.

SECTION 8
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 PLCs.

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8-28 MESSAGE CLEAR 203
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8-30 ACCESS RIGHT ACQUIRE 205
8-31 ACCESS RIGHT FORCED ACQUIRE. 206
8-32 ACCESS RIGHT RELEASE 206
8-33 ERROR CLEAR. 207
8-34 ERROR LOG READ 208

8-35 ERROR LOG CLEAR 209
8-36 FILE NAME READ 209
8-37 SINGLE FILE READ 211
8-38 SINGLE FILE WRITE 211
8-39 MEMORY CARD FORMAT 212
8-40 FILE DELETE 213
8-41 VOLUME LABEL CREATE/DELETE 213
8-42 FILE COPY 214
8-43 FILE NAME CHANGE 214
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8-45 MEMORY AREA FILE TRANSFER 216
8-46 PARAMETER AREA FILE TRANSFER 217
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8-48 FORCED SET/RESET 219
8-49 FORCED SET/RESET CANCEL 220

8-1 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 PLC operating modes during which they are enabled.

Name	Command code		PLC mode				Page
			RUN	MONITOR	DEBUG	PROGRAM	
MEMORY AREA READ	01	01	Valid	Valid	Valid	Valid	180
MEMORY AREA WRITE		02	Valid	Valid	Valid	Valid	181
MEMORY AREA FILL		03	Valid	Valid	Valid	Valid	182
MULTIPLE MEMORY AREA READ		04	Valid	Valid	Valid	Valid	183
MEMORY AREA TRANSFER		05	Valid	Valid	Valid	Valid	184
COMPOSITE REGISTRATION READ		10	Valid	Valid	Valid	Valid	185
REGISTER COMPOSITE READ		11	Valid	Valid	Valid	Valid	186
PARAMETER AREA READ	02	01	Valid	Valid	Valid	Valid	187
PARAMETER AREA WRITE		02	Valid	Valid	Valid	Valid	189
PARAMETER AREA CLEAR		03	Valid	Valid	Valid	Valid	190
PROGRAM AREA PROTECT	03	04	Valid	Valid	Valid	Valid	191
PROGRAM AREA PROTECT CLEAR		05	Valid	Valid	Valid	Valid	192
PROGRAM AREA READ		06	Valid	Valid	Valid	Valid	192
PROGRAM AREA WRITE		07	Not valid	Valid	Valid	Valid	193
PROGRAM AREA CLEAR		08	Not valid	Not valid	Not valid	Valid	194
RUN	04	01	Valid	Valid	Valid	Valid	194
STOP		02	Valid	Valid	Valid	Valid	195
CONTROLLER DATA READ	05	01	Valid	Valid	Valid	Valid	195
CONNECTION DATA READ		02	Valid	Valid	Valid	Valid	198
CONTROLLER STATUS READ	06	01	Valid	Valid	Valid	Valid	199
CYCLE TIME READ		20	Valid	Valid	Not valid	Not valid	200
CLOCK READ	07	01	Valid	Valid	Valid	Valid	201
CLOCK WRITE		02	Valid	Valid	Valid	Valid	202
MESSAGE READ	09	20	Valid	Valid	Valid	Valid	202
MESSAGE CLEAR			Valid	Valid	Valid	Valid	203
FAL/FALS READ			Valid	Valid	Valid	Valid	204
ACCESS RIGHT ACQUIRE	0C	01	Valid	Valid	Valid	Valid	205
ACCESS RIGHT FORCED ACQUIRE		02	Valid	Valid	Valid	Valid	206
ACCESS RIGHT RELEASE		03	Valid	Valid	Valid	Valid	206
ERROR CLEAR	21	01	Valid	Valid	Valid	Valid	207
ERROR LOG READ		02	Valid	Valid	Valid	Valid	208
ERROR LOG CLEAR		03	Valid	Valid	Valid	Valid	209
FILE NAME READ	22	01	Valid	Valid	Valid	Valid	209
SINGLE FILE READ		02	Valid	Valid	Valid	Valid	211
SINGLE FILE WRITE		03	Valid	Valid	Valid	Valid	211
MEMORY CARD FORMAT		04	Valid	Valid	Valid	Valid	212

Name	Command code		PLC mode				Page
			RUN	MONITOR	DEBUG	PROGRAM	
FILE DELETE		05	Valid	Valid	Valid	Valid	213
VOLUME LABEL CREATE/DELETE		06	Valid	Valid	Valid	Valid	213
FILE COPY		07	Valid	Valid	Valid	Valid	214
FILE NAME CHANGE		08	Valid	Valid	Valid	Valid	214
FILE DATA CHECK		09	Valid	Valid	Valid	Valid	215
MEMORY AREA FILE TRANSFER		0A	Valid	Valid	Valid	Valid	216
PARAMETER AREA FILE TRANSFER		0B	Valid	Valid	Valid	Valid	217
PROGRAM AREA FILE TRANSFER		0C	(see note)	Valid	Valid	Valid	218
FORCED SET/RESET	23	01	Not valid	Valid	Valid	Valid	219
FORCED SET/RESET CANCEL		02	Not valid	Valid	Valid	Valid	220

Note When the PLC 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.

8-2 Memory Area Designations

The following table gives the addresses to use when reading or writing PLC data. The *Data area address* column gives the normal addresses used in the PLC 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 PLC 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	000000 to 255515 G00000 to G25515	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 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	D0000 to D24575	000000 to 5FFF00	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

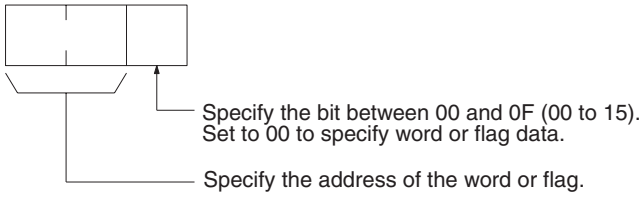
CV1000, CV2000, or CVM1-CPU11-E

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

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
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
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

8-2-1 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.

8-2-2 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.

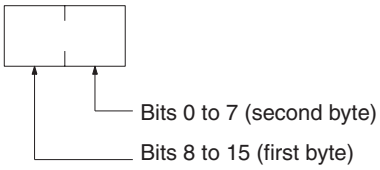
Flag or Bit Status (One Byte)

00: Bit is OFF (0)
01: Bit is ON (1)

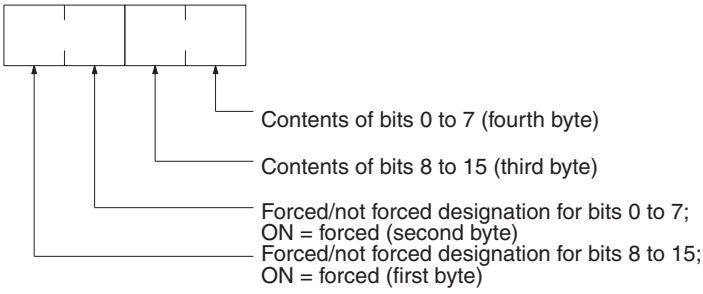
Flag or Bit Status with Forced Status (One Byte)

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)



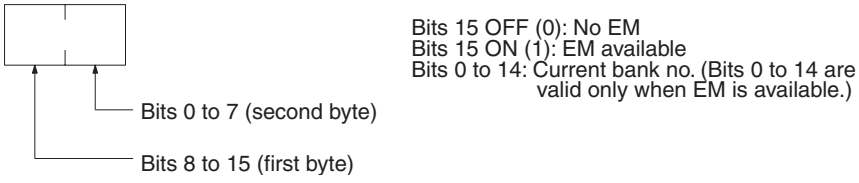
Word Contents or PV with Forced Status (Four Bytes)



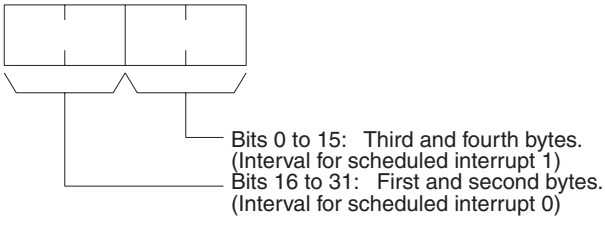
Step Status (One Byte)

00: INACTIVE
01: HALT
02: PAUSE
03: EXECUTE

Current EM Bank Number (Two Bytes)

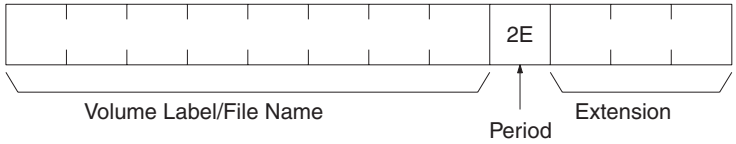


Scheduled Interrupt Interval



8-3 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.

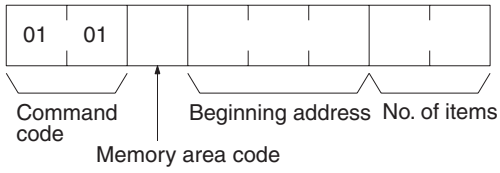
Extension An extension can be added to each volume label/file name so that the files can be classified. Each extension must have three ASCII characters with or without spaces. If less than three letters are used, add spaces to the end of the extension.

Period Add a period (ASCII 2E) between the volume label/file name and extension.

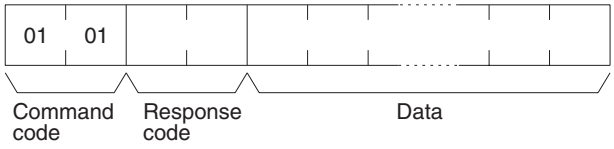
8-4 MEMORY AREA READ

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 *page 176 Memory Area Designations* for PLC 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

Memory area	Data	Memory area code	No. of bytes
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 *page 179 Data Configurations* for the various data configurations.

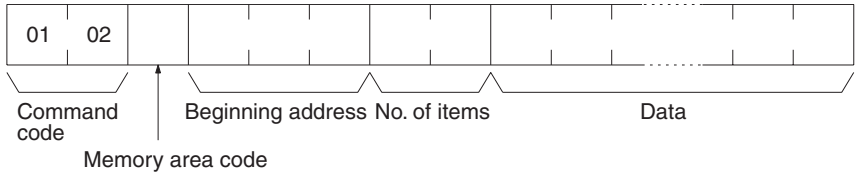
8-5 MEMORY AREA WRITE

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).

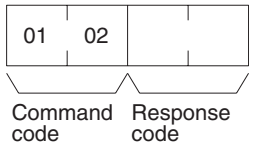
Note

1. The MEMORY AREA WRITE command can be executed regardless of the PLC's operating mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC'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 *page 176 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 *page 179 Data Configurations* for the various data configurations.

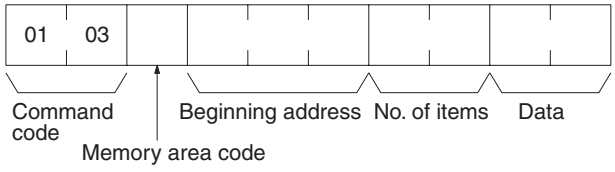
8-6 MEMORY AREA FILL

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).

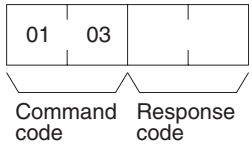
Note

1. The MEMORY AREA FILL command can be executed regardless of the PLC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC'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 *page 176 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

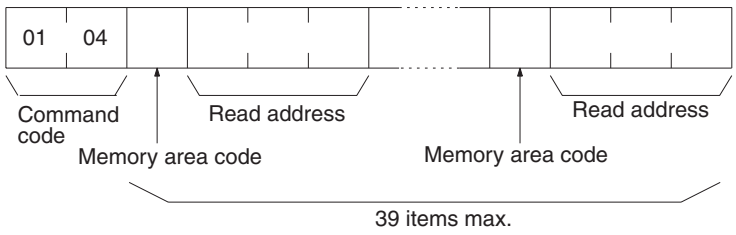
Note Refer to *page 179 Data Configurations* for the various data configurations.

8-7 MULTIPLE MEMORY AREA READ

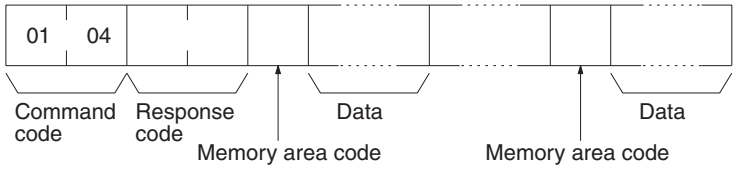
Reads the contents of the specified number of non-consecutive memory area words, starting from the specified word.

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 *page 176 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

Memory area	Data	Memory area code	No. of bytes
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 *page 179 Data Configurations* for the various data configurations.

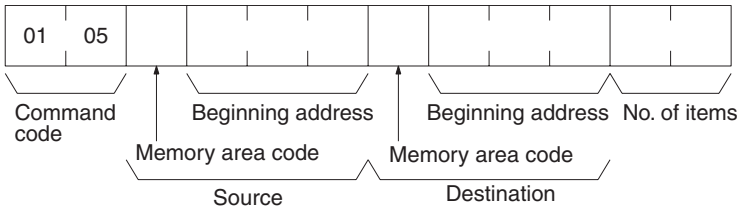
8-8 MEMORY AREA TRANSFER

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).

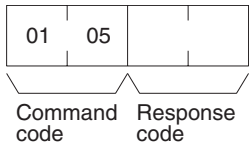
Note

1. The MEMORY AREA TRANSFER command can be executed regardless of the PLC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC'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 *page 176 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

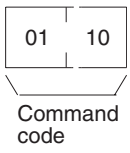
8-9 COMPOSITE REGISTRATION READ

Reads the memory areas according to the addresses specified with the COMPOSITE READ REGISTRATION command (01 11).

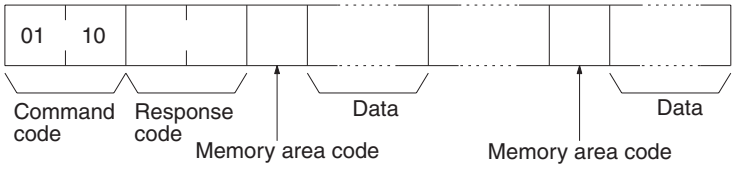
Note

1. Although this command is addressed to the CPU Unit, it is actually processed by the DeviceNet 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.

8-10 REGISTER COMPOSITE READ

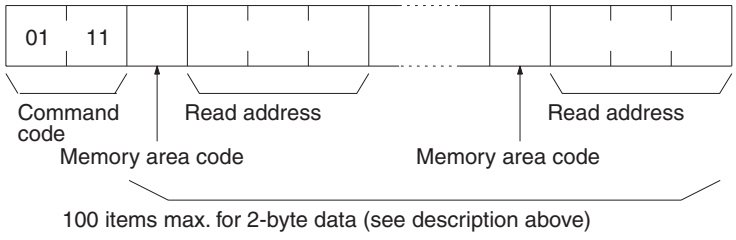
Registers the contents to be read with the COMPOSITE REGISTRATION READ command (01 10). Up to 100 items can be registered for reading for 2-bytes data; up to 50 items for 4-byte data, i.e., up to 200 bytes of data can be read.

The contents registered with this command is effective until the power supply to the PLC 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.

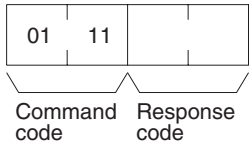
Note

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 *page 176 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

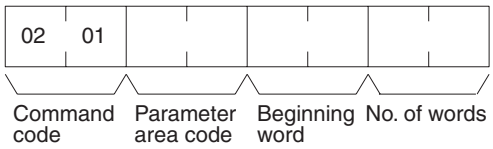
Memory area	Data	Memory area code	No. of bytes
Forced Status	Bit status	05	1
	Word contents	85	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2
Action	Flag status	1B	1
Register	Register contents	9C	2
	Expansion DM current bank no.		
Interrupt status	Scheduled interrupt interval	DD	4

Note Refer to *page 179 Data Configurations* for the various data configurations.

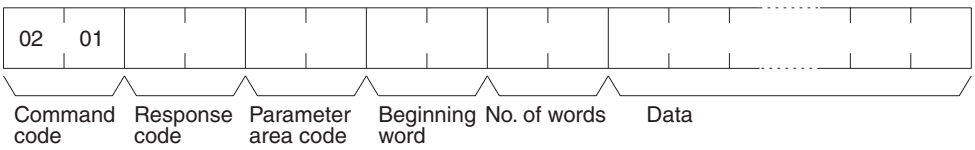
8-11 PARAMETER AREA READ

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

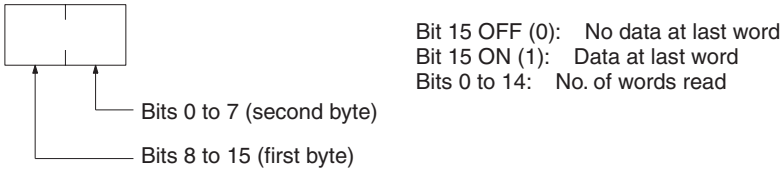


Parameters

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).

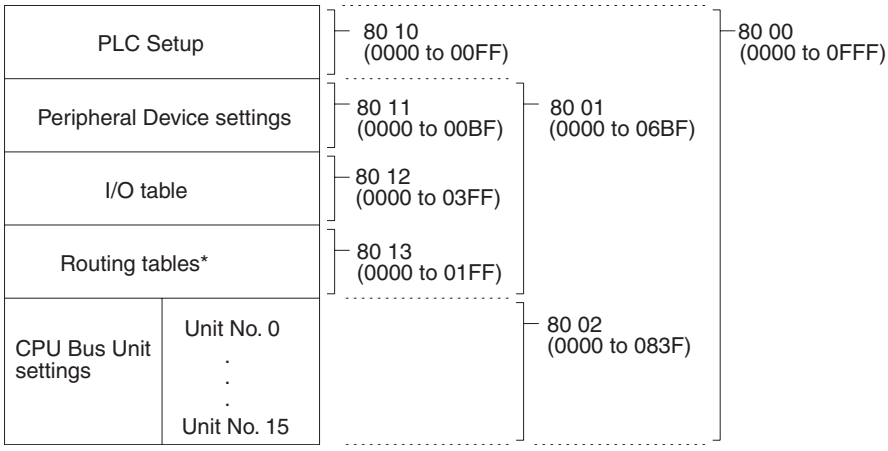


Data (response): The data in the specified parameter area will be returned in sequence starting from the beginning word. The leftmost bits (bits 8 to 15) of each word are read first, followed by the rightmost bits (bits 0 to 7). The required number of bytes in total for each read is calculated as follows:

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.

8-12 PARAMETER AREA WRITE

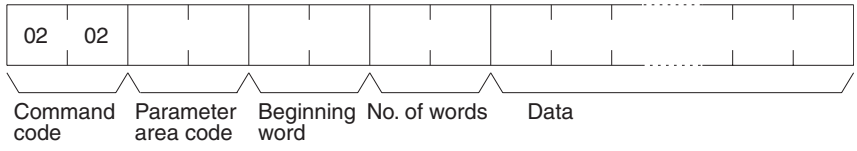
Writes data to the specified number of consecutive parameter area words starting from the specified word. All words in the specified parameter area must be written at the same time to ensure complete data. A maximum of 76 words can be written with each command. To write larger parameter areas, use multiple commands and specify the beginning word for each.

Data can be written to the I/O table only when the PLC is in PROGRAM mode.

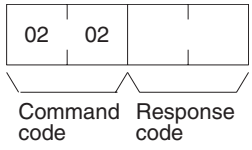
Note

1. The PARAMETER AREA WRITE command can be executed regardless of the PLC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC'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 PLC, nothing will be written to the specified parameter area.

Command Block



Response Block

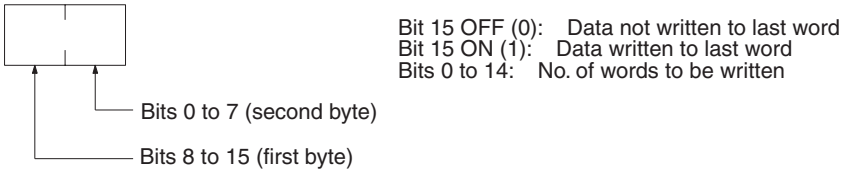


Parameters

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.



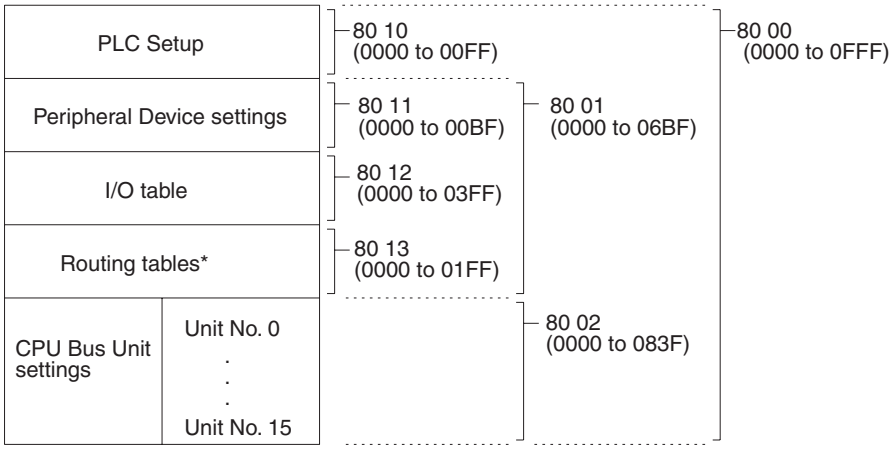
Data (command): The data to be written. The leftmost bits (bits 15 to 8) of each word must be specified first, followed by the rightmost bits (bits 7 to 0). The required number of bytes in total for each write can be calculated as follows:

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 PLC automatically does a format check in order to prevent routing errors.

8-13 PARAMETER AREA CLEAR

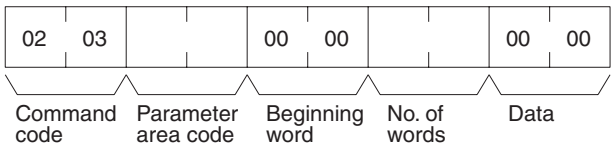
Writes all zeros to the specified number of consecutive parameter area words to clear the previous data. The I/O table can be cleared only when the PLC is in PROGRAM mode.

Always clear the entire range of the specified parameter area.

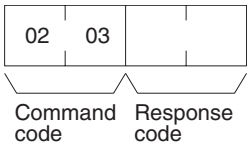
Note

1. The PARAMETER AREA CLEAR command can be executed regardless of the PLC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC'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 PLC, nothing can be written to the specified parameter area.

Command Block



Response Block



Parameters

Parameter area code (command): The parameter area to clear.

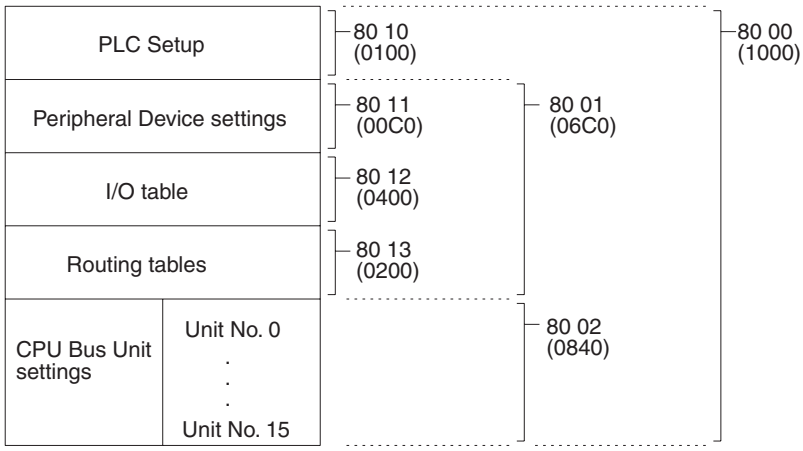
Beginning word (command): Fixed at 0000.

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.



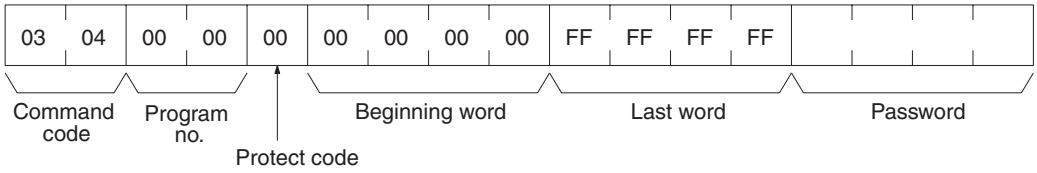
8-14 PROGRAM AREA PROTECT

Protects the program by making it read-only.

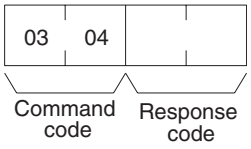
Note

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 PLC, 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 *page 192 PROGRAM AREA PROTECT CLEAR*).

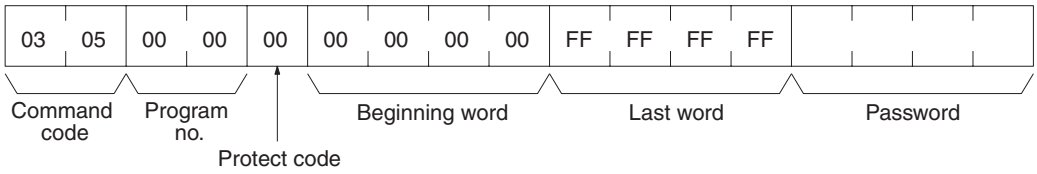
8-15 PROGRAM AREA PROTECT CLEAR

Restores write and read access rights so that data can be written to and read from the program area.

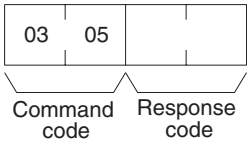
Note

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 PLC, 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

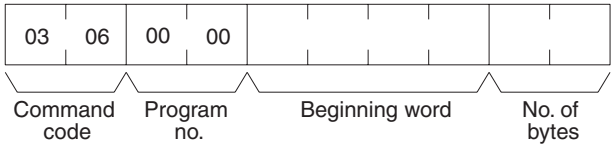
Last word (command): Set to FFFFFFFF

Password (command): The password that was set in the PROGRAM AREA PROTECT command.

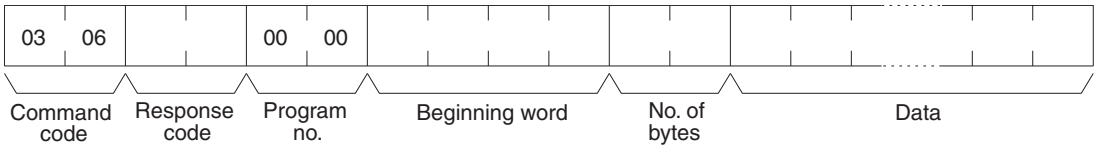
8-16 PROGRAM AREA READ

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

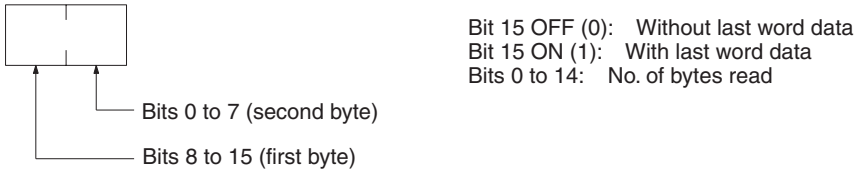


Parameters

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.



Data (response): The data in the specified program area will be returned in sequence starting from the beginning word.

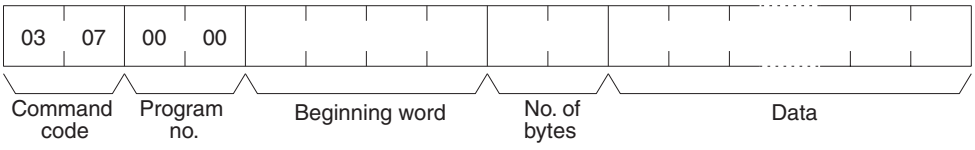
8-17 PROGRAM AREA WRITE

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.

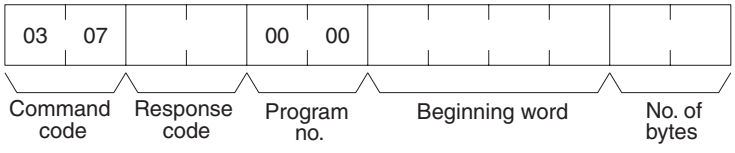
Note

1. If memory is write-protected via the key switch on the PLC's front panel or by the PROGRAM AREA PROTECT command (refer to *page 191 PROGRAM AREA PROTECT*), nothing will be written to the program area.
2. The PROGRAM AREA WRITE command can be executed as long as the PLC is not in RUN mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in MONITOR or DEBUG mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC's mode.

Command Block



Response Block

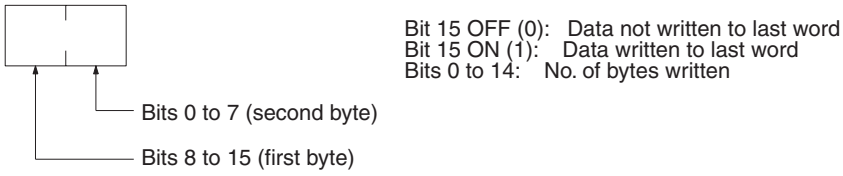


Parameters

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.



Data (command): The data to be written.

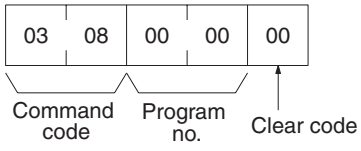
8-18 PROGRAM AREA CLEAR

Clears the contents of the program area.

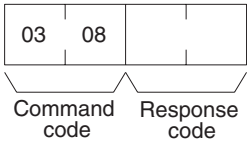
Note

1. If memory is write-protected via the key switch on the front panel of the PLC, 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 *page 191 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.

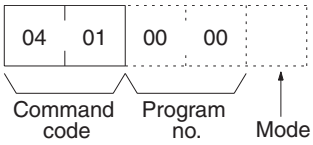
Clear code (command): Set to 00.

8-19 RUN

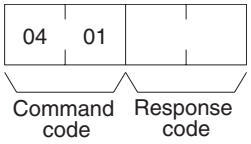
Changes the PLC to DEBUG, MONITOR, or RUN mode, enabling the PLC to execute its program.

Note If any other device holds the access right, the PLC 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

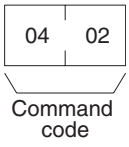
Note If the mode is not specified, the PLC will go to MONITOR mode.

8-20 STOP

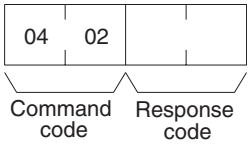
Changes the PLC to PROGRAM mode, stopping program execution.

Note If any other device holds the access right, nothing will be executed.

Command Block



Response Block

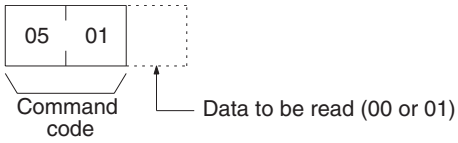


8-21 CONTROLLER DATA READ

Reads the following data:

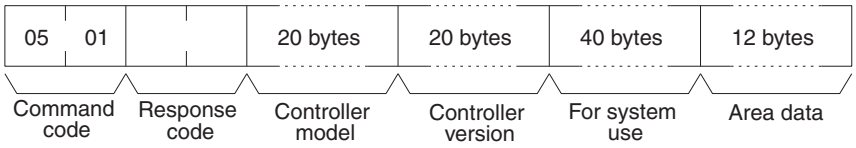
- Controller model and version
- Area data
- CPU Bus Unit configuration
- Remote I/O data
- PLC status

Command Block

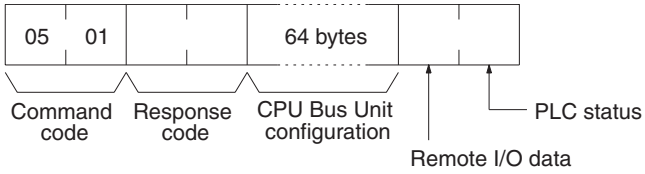


Response Block

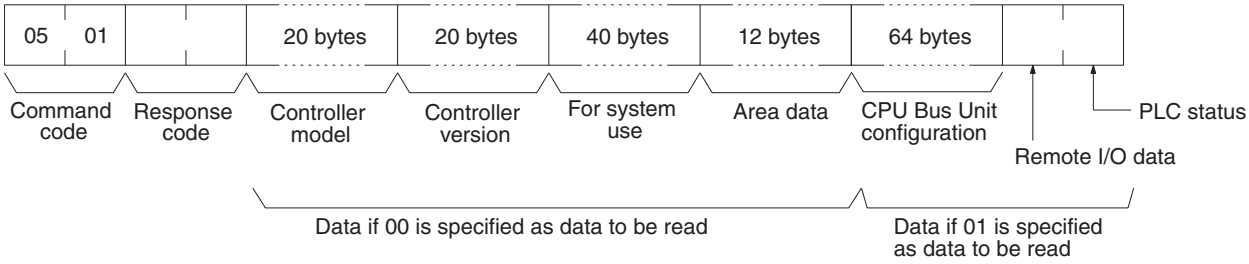
The format is as follows if 00 is specified as the data to be read:



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:

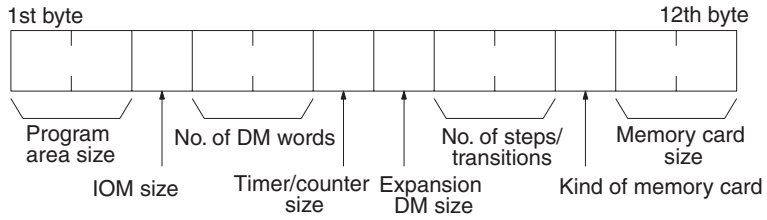
Value	00	01	Omitted
Data to be read	Controller model Controller version Area data	CPU Bus Unit configuration Remote I/O data PLC status	Controller model Controller version Area data CPU Bus Unit configuration Remote I/O data PLC status

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)

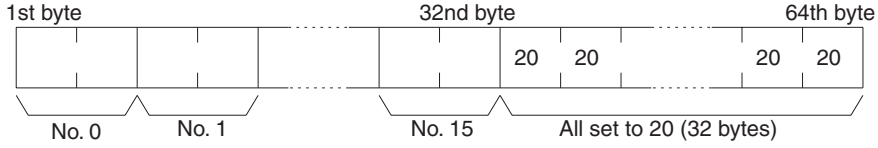
For system use (response): Reserved for system use.

Area data (response): As follows:

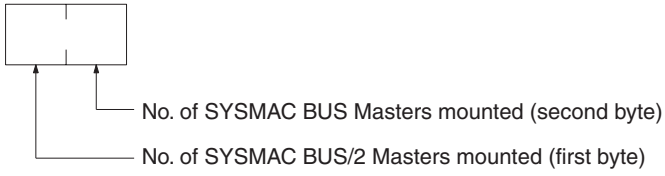


Item	Meaning	Unit
Program area size	The size of PLC Setup and program area	K words (1K words = 1,024 words)
IOM size	The size of the area in which bit/word commands can be used.	K bytes (1K bytes = 1,024 bytes)
No. of DM words	Total words in the DM area	K words
Timer/counter size	Maximum no. of timers/counters 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)

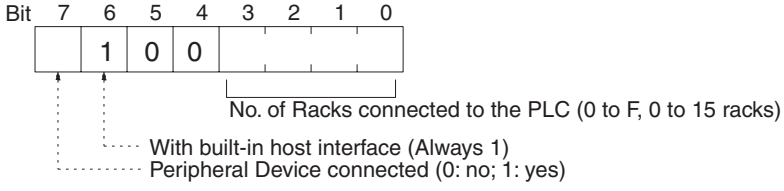
CPU Bus Unit configuration (response): Each CPU Bus Unit has a code assigned to it consisting of two ASCII characters (two bytes). These codes are given in the numerical order according to the unit number of the CPU Bus Units (unit 0 to 15).



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:



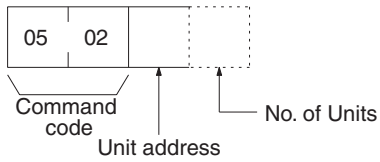
PLC status (response): The following single byte (8 bits) is returned:



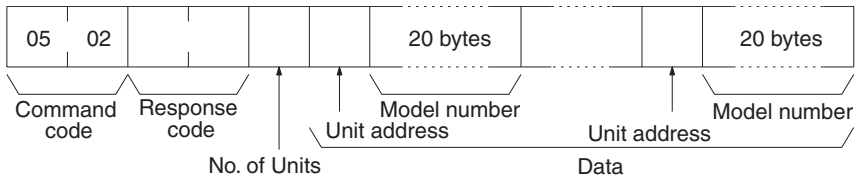
8-22 CONNECTION DATA READ

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.

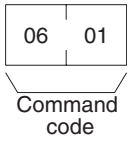
Unit address and model number (response): The unit address and model number. The model number is provided in up to 20 ASCII characters.

8-23 CONTROLLER STATUS READ

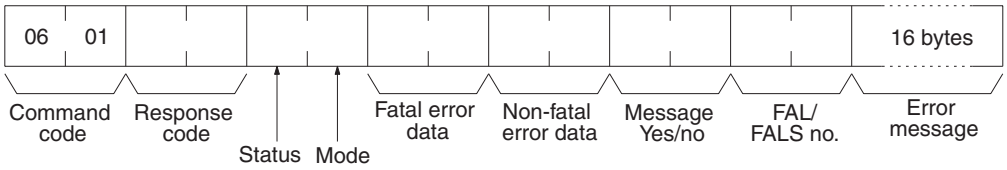
Reads the status of the Controller.

Note To read the error log, read the appropriate Auxiliary Area words or execute the ERROR LOG READ command (refer to *page 208 ERROR LOG READ*).

Command Block



Response Block



Parameters

Status (response): The operating status of the PLC 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 PLC modes:

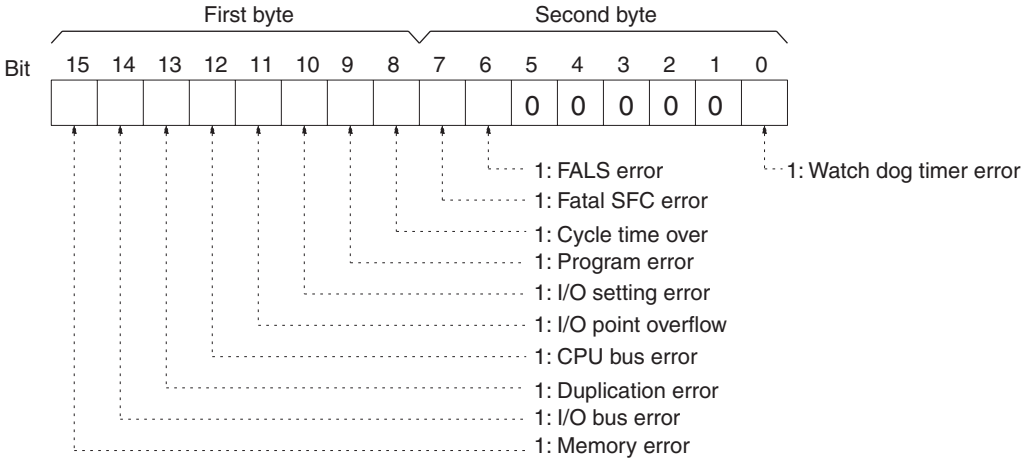
00: PROGRAM

01: DEBUG

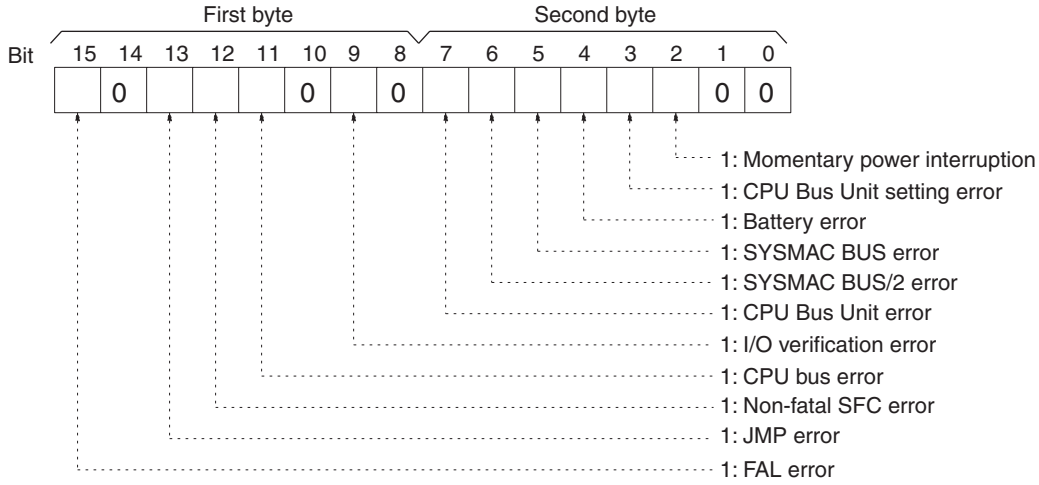
02: MONITOR

04: RUN

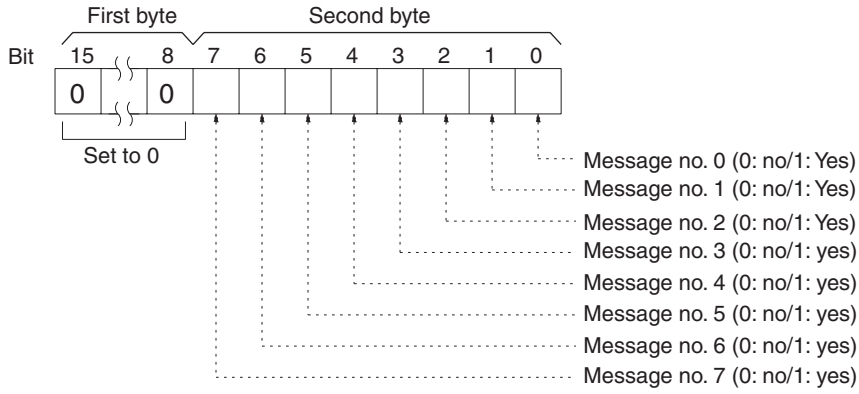
Fatal error data (response): The contents of PLC fatal error information (for details refer to the *CV-series PLC Operation Manual: Ladder Diagrams*):



Non-fatal error data (response): The contents of PLC non-fatal error information (for details refer to the *CV-series PLC 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 *page 202 MESSAGE READ*).



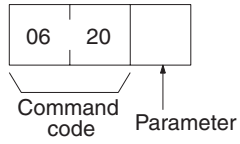
FAL/FALS no. (response): The highest priority FAL or FALS error. The actual value returned will be 4100 plus the FAL/FALS number; for details refer to the *CV-series PLC Operation Manual: Ladder Diagrams*). If no FAL or FALS error has occurred, 0000 will be returned.

Error message (response): The error message of the present FAL/FALS number. If there is no error, 16 spaces (ASCII 20) will be returned.

8-24 CYCLE TIME READ

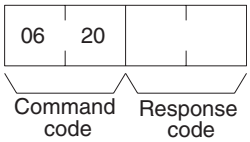
Initializes the PLC's cycle time history or reads the average, max., and min. cycle time.

Command Block

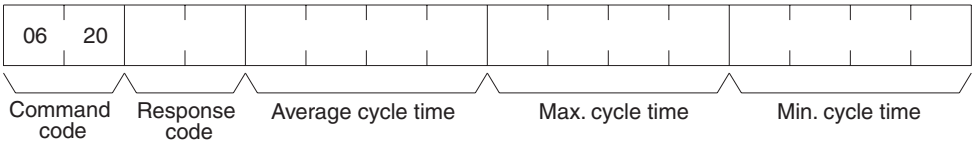


Response Block

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.

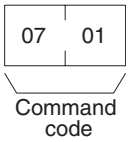
The average cycle time is obtained as follows:

Average cycle time = (max. cycle time + min. cycle time)/2

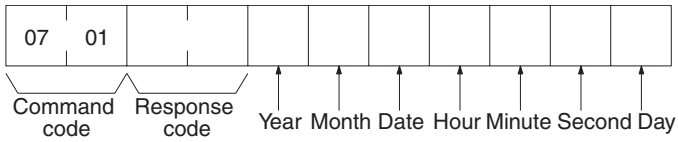
8-25 CLOCK READ

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:

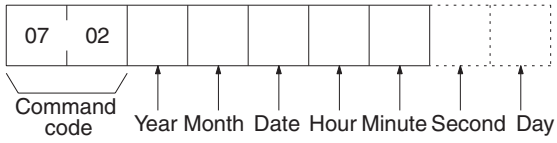
Value	**00**	**01**	**02**	**03**	**04**	**05**	**06**
Day	Sun	Mon	Tues	Wed	Thur	Fri	Sat

8-26 CLOCK WRITE

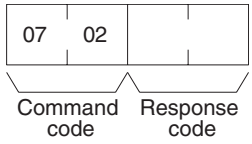
Sets the clock.

Note
1. The PLC 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

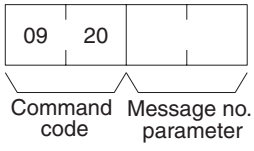
Note
1. If the second or day are not specified, 00 will be set as the second and the previous value will be kept for the day.
2. The PLC does not check the day from the date. This means that no error will occur even if the date and day do not agree.

8-27 MESSAGE READ

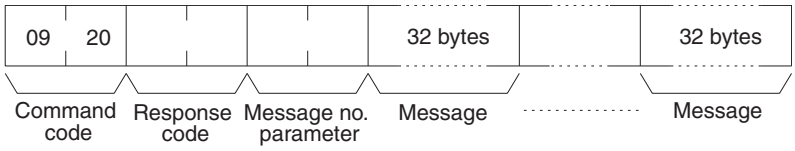
Reads messages generated by MSG(195).

Note The MESSAGE READ, MESSAGE CLEAR (refer to *page 203 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *page 204 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

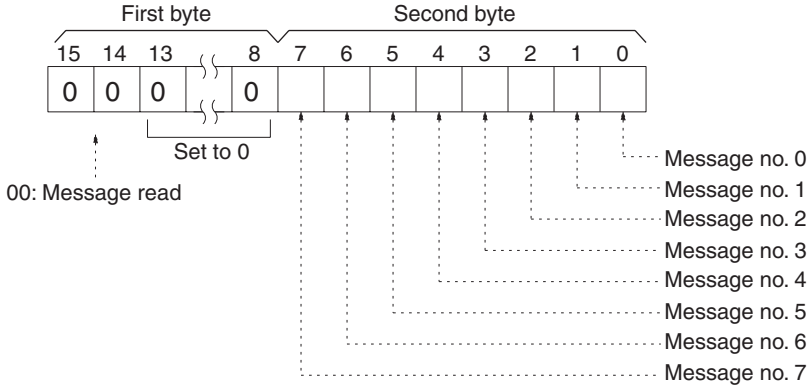


Response Block



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.

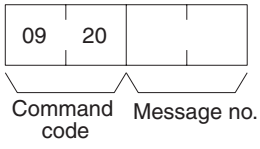
8-28 MESSAGE CLEAR

Clears messages generated with MSG(195).

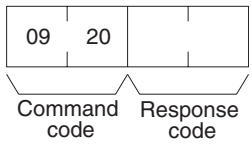
Note

1. The MESSAGE READ, MESSAGE CLEAR (refer to *page 202 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *page 204 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

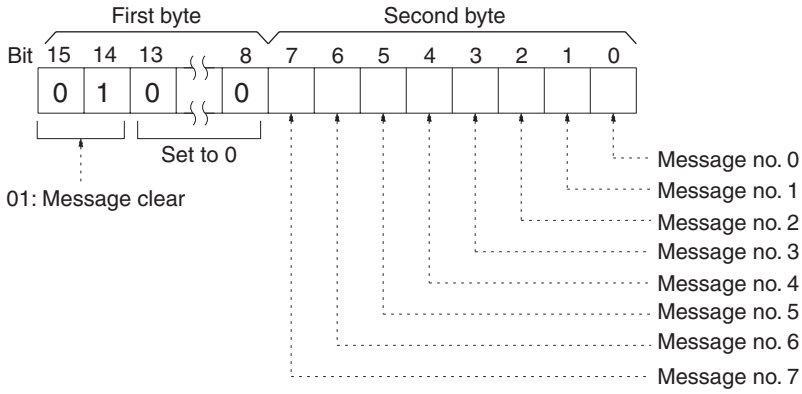


Response Block



Parameters

Message no. (command): Turn ON the bits of the messages to be cleared.

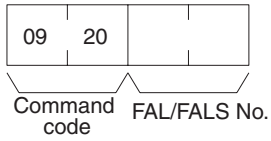


8-29 FAL/FALS READ

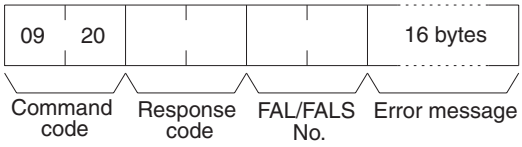
Reads FAL/FALS messages.

Note The MESSAGE READ (refer to *page 202 MESSAGE READ)*, MESSAGE CLEAR (refer to *page 203 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *page 204 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

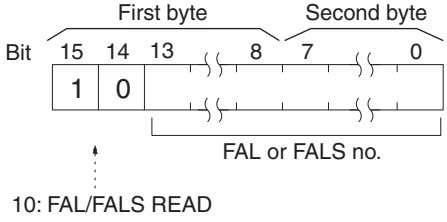


Response Block



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.

8-30 ACCESS RIGHT ACQUIRE

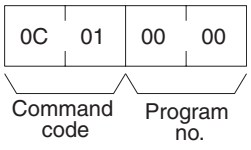
Acquires the access right as long as no other device holds it. Execute the ACCESS RIGHT ACQUIRE command when you need to execute commands continuously without being interrupted by other devices. As soon as the execution of the commands has been completed, execute the ACCESS RIGHT RELEASE command to release the access right (refer to *page 206 ACCESS RIGHT RELEASE*). If another devices holds the access right, the device will be identified in the response.

Note

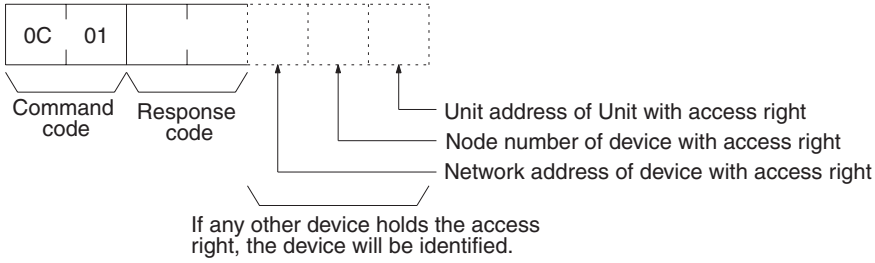
1. If any other device has the access right, the access right cannot be acquired with this command; use the ACCESS RIGHT FORCED ACQUIRE command (refer to *page 206 ACCESS RIGHT FORCED ACQUIRE*).
2. The following commands cannot be executed by other devices if the host computer holds the access right. 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.

8-31 ACCESS RIGHT FORCED ACQUIRE

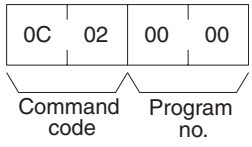
Acquires the access right even if another device already holds it.

Note

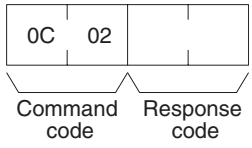
1. Even if any other device has the access right, the access right can be acquired with this command and a normal response code will be returned.
2. The following commands cannot be executed by other devices if the host computer holds the access right. Do not restrict the access right unless necessary.

   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 *page 205 ACCESS RIGHT ACQUIRE*).
4. The device that has lost the access right is not notified.

Command Block



Response Block

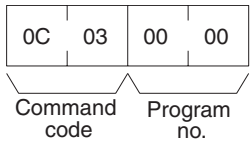


Parameters **Program no. (command):** Set to 0000.

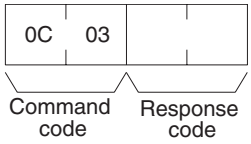
8-32 ACCESS RIGHT RELEASE

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



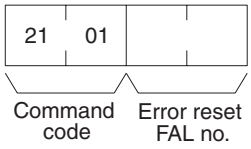
Parameters **Program no. (command):** Set to 0000.

8-33 ERROR CLEAR

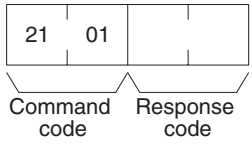
Clears errors or error messages from the PLC. A normal response will be returned even if the error has not occurred.

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 PLC'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 PLC 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.

Error code	Meaning
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 PLC 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 PLC.
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 PLC'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.

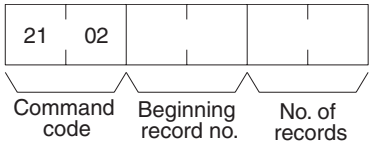
8-34 ERROR LOG READ

Reads the PLC's error log.

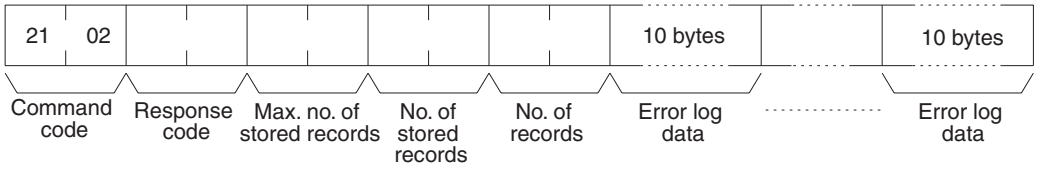
Note

1. When the PLC does not have the specified number of records, all the records that have been stored in the PLC 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.

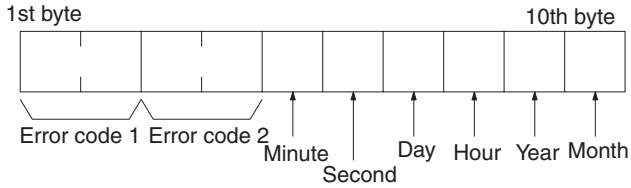
No. of stored records (response): The number of records that have been recorded.

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 207 for error code 1 and to the relevant operation manual or installation guide for error code 2.

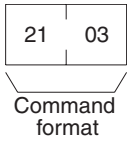
Each data includes the second, minute, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

8-35 ERROR LOG CLEAR

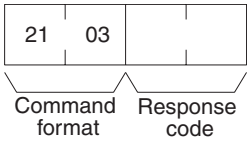
Clears all error log records.

Note This command cannot be executed if any other device has the access right.

Command Block



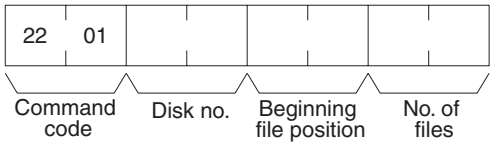
Response Block



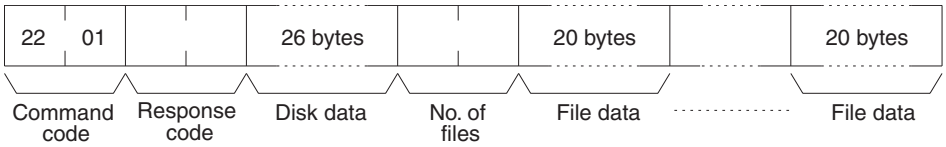
8-36 FILE NAME READ

Reads out data on the specified number of files stored in the file device connected to the PLC.

Command Block



Response Block



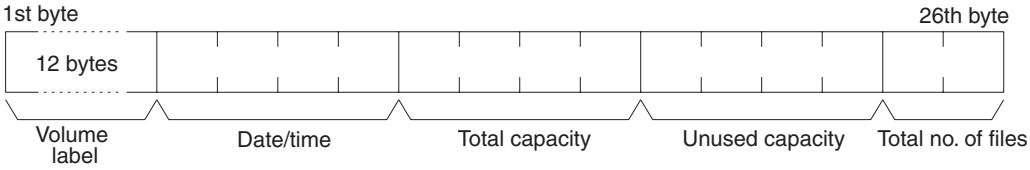
Parameters

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:



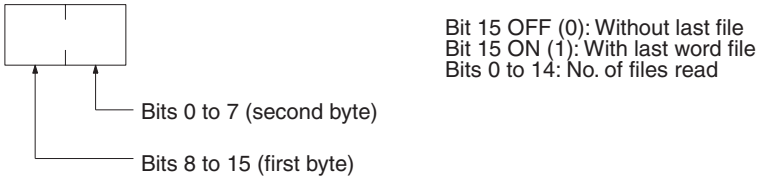
Volume Label
The volume label registered with the file device (refer to *page 179 Volume Labels and File Names* for the configuration of the volume label). If no volume label has been registered, 20 spaces (ASCII 20) will be returned.

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.

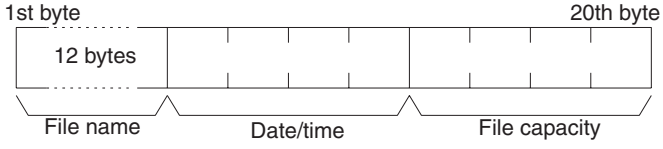
No. of files (response): The number of files that have been read. Bit 15 is ON (1) if the last file is included.



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:



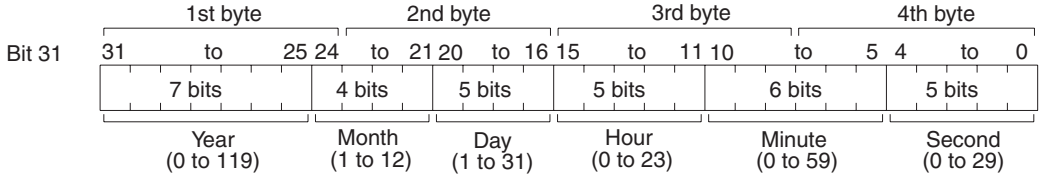
File Name
The name of the file (refer to *page 179 Volume Labels and File Names* for the configuration of the file name).

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.

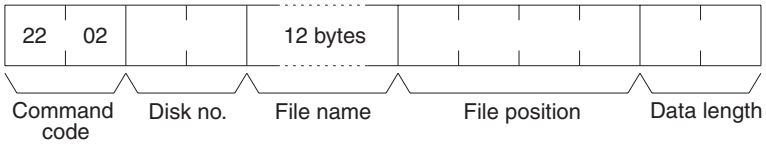
Year: Add 1980.

Second: Multiply by two.

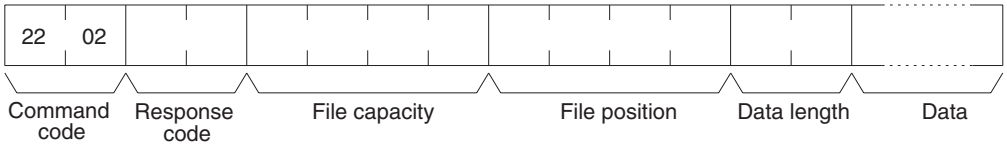
8-37 SINGLE FILE READ

Reads the contents of a file stored in the file device connected to the PLC.

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 *page 179 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.

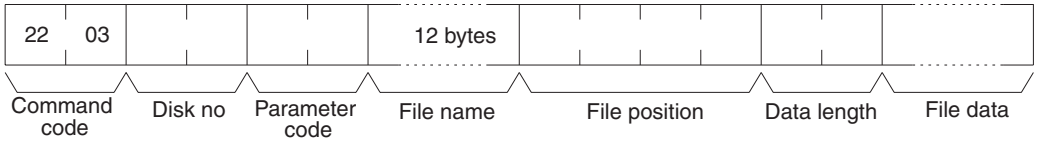
8-38 SINGLE FILE WRITE

Writes a new file to the file device connected to the PLC 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

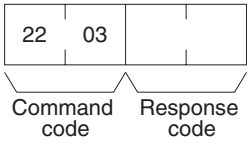
name as an existing file. When a new file is written or an existing file is modified, the file will record the clock data of the PLC as the date of the file.

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 *page 179 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.

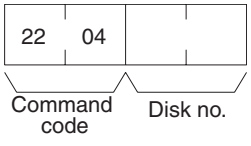
File data (response): The data to be written to the file.

8-39 MEMORY CARD FORMAT

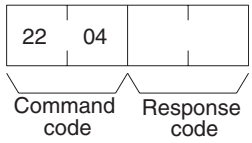
Formats a memory card. Always execute the MEMORY CARD FORMAT before using a new memory card as a file device.

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).

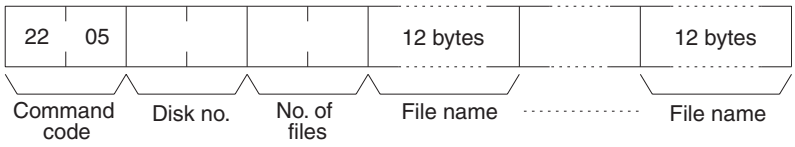
8-40 FILE DELETE

Deletes files stored by the file device connected to the PLC.

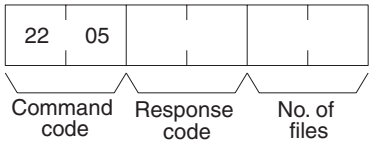
Note

1. The specified files will be deleted in sequence. If non-existing file names have been specified, the PLC 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 *page 179 Volume Labels and File Names* for the configuration of the file name).

No. of files (response): The number of files that have been deleted.

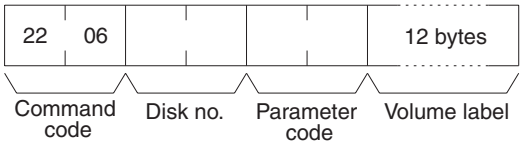
8-41 VOLUME LABEL CREATE/DELETE

Creates a volume label on the file device connected to the PLC or deletes an existing volume label from the file device.

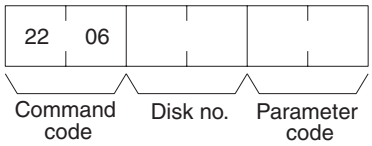
Only one volume label can be created for a single memory card.

When a volume label is generated, the clock data of the PLC will be recorded as the date of the volume label.

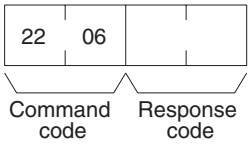
Command Block The command format for creating a volume label is as follows:



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.

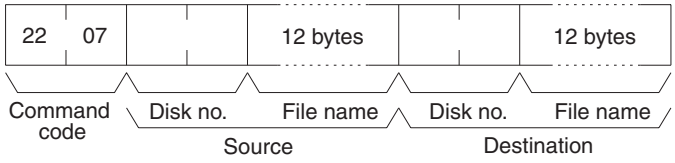
0002: Deletes an existing volume label.

Volume label (command): The volume label to be written (refer to *page 179 Volume Labels and File Names* for the configuration of the volume label).

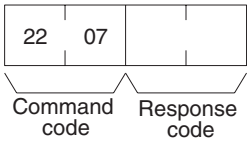
8-42 FILE COPY

Copies a file from one file device to another file device connected to the same PLC.

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 *page 179 Volume Labels and File Names* for the configuration of the file name).

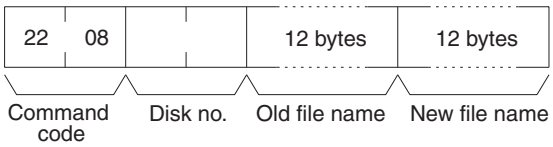
Note

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.

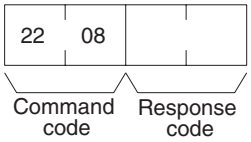
8-43 FILE NAME CHANGE

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 *page 179 Volume Labels and File Names* for the configuration of the file name).

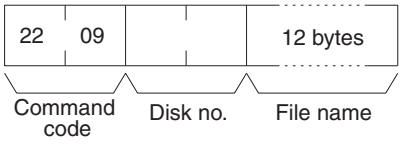
Note

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.

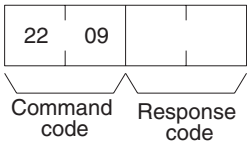
8-44 FILE DATA CHECK

Does a data check on a file stored in the extended memory (file device) connected to the PLC by confirming the checksum at the beginning of the file.

Command Block



Response Block



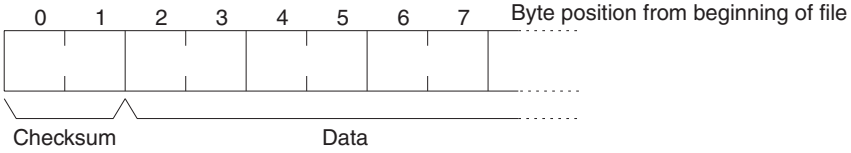
Parameters

Disk no. (command): Set to 0000 for the file device (memory cards).

File name (command): The file to be checked (refer to *page 179 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:**A297

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.

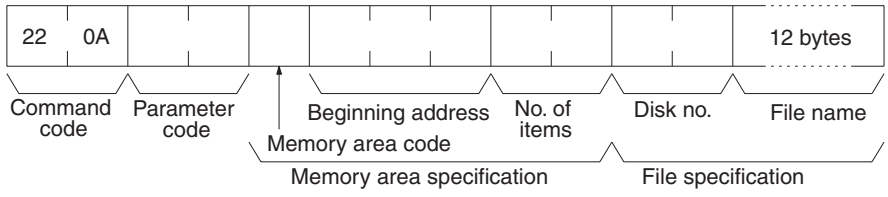
8-45 MEMORY AREA FILE TRANSFER

Transfers or compares data between the PLC memory areas and the file device connected to the PLC. The clock data of the PLC upon completion of the MEMORY AREA FILE TRANSFER command will be recorded as the date of the file that has been transferred.

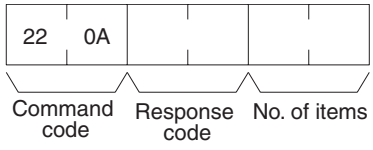
Note

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 PLC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC'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 PLC memory area to the file device.

0001: Data transfer from the file device to the PLC 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 *page 179 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 *page 176 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 *page 179 Data Configurations* for the various data configurations.

8-46 PARAMETER AREA FILE TRANSFER

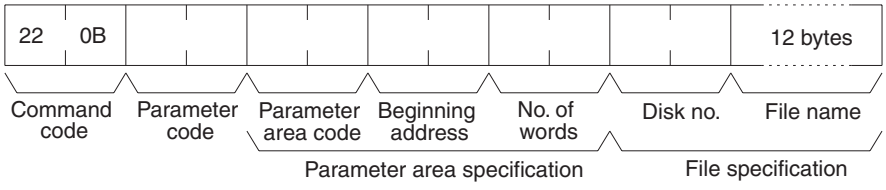
Compares or transfers data between the PLC's parameter area and the file device connected to the PLC. The clock data of the PLC upon completion of the PARAMETER AREA FILE TRANSFER command will be recorded as the date of the file that has been transferred.

A file can be transferred to the I/O table only when the PLC is in PROGRAM mode.

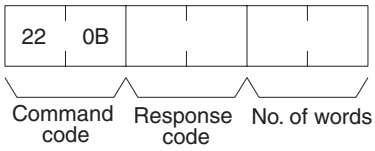
Note

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 PLC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PLC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *page 199 CONTROLLER STATUS READ*) to read the PLC'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 PLC.

Command Block



Response Block



Parameters

Parameter code (command): As follows:

0000: Data transfer from the PLC's parameter area to the file device.

0001: Data transfer from the file device to the PLC'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

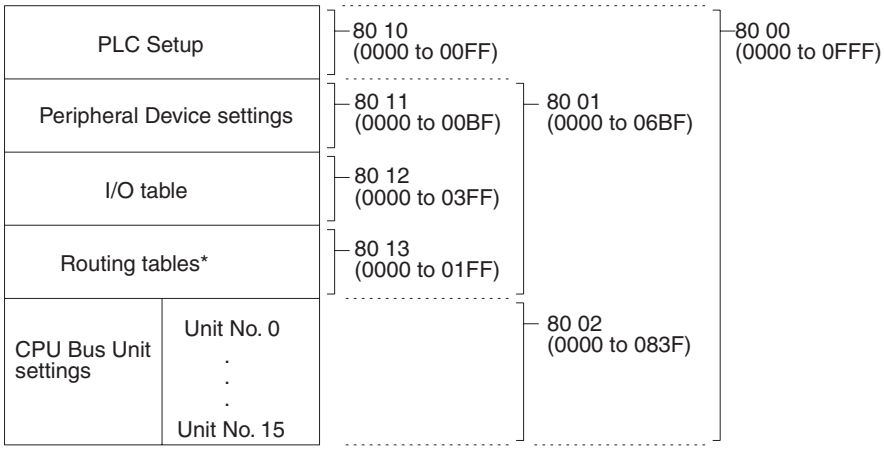
Note: If 0000 is specified as the number of items, no data will be transferred or compared and a normal response code will be returned.

Disk no. (command): Set to 0000 for the file device (memory cards).

File name (command): The file to be transferred or compared (refer to *page 179 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.

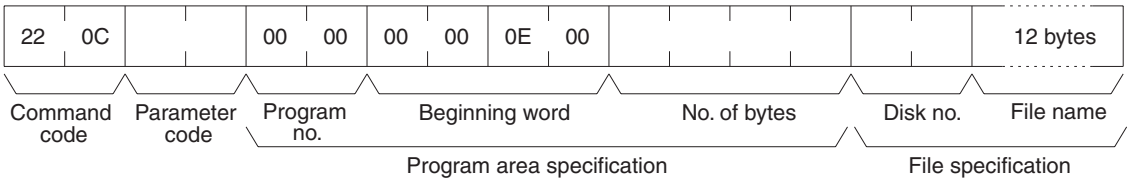
8-47 PROGRAM AREA FILE TRANSFER

Compares or transfers data between the PLC's program area and the file device connected to the PLC. The clock data of the PLC upon completion of the PROGRAM AREA FILE TRANSFER command will be recorded as the date of the file that has been transferred.

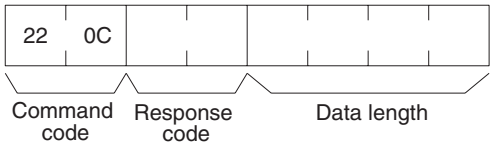
Note

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 PLC is write-protected by the key switch on the front panel.
3. The PROGRAM AREA FILE TRANSFER command cannot be executed when the PLC 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 *page 179 Volume Labels and File Names* for the configuration of the file name).

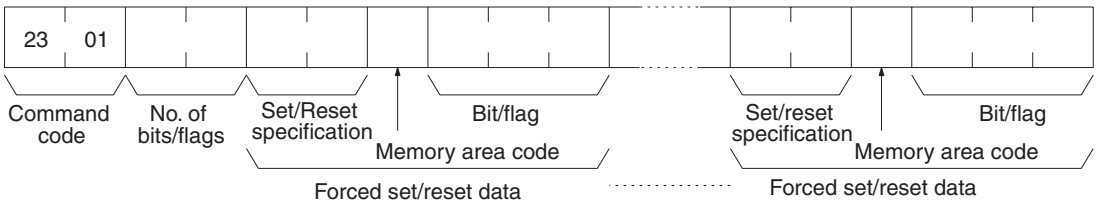
Data length (response): The number of bytes that have been transferred or compared.

8-48 FORCED SET/RESET

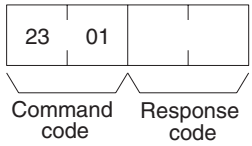
Force-sets (ON) or force-resets (OFF) bits/flags or releases force-set status. Bits/flags that are forced ON or OFF will remain ON or OFF and cannot be written to until the forced status is released.

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 *page 220 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 *page 176 Memory Area Designations* for memory area designations):

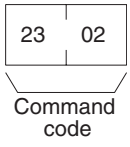
Memory area	Data	Memory area code
CIO, TR, and CPU Bus Link (see note)	Bits status	00
Timer/Counter	Completion Flag status	01
Transition	Flag status	03

Note FORCED SET/RESET cannot be used for the Auxiliary Area.

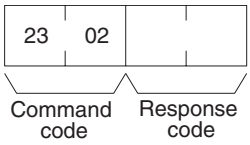
8-49 FORCED SET/RESET CANCEL

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 9
FINS Commands to CS-series and C200HX/HG/HE CPU Units

This section provides information on the FINS commands that can be addressed to the CPU Units of CS-series and C200HX/HG/HE PLCs.

9-1 Command List 224
9-2 Memory Area Designations 224
9-2-1 Word/Bit Addresses 225
9-2-2 Data Configuration. 226
9-3 MEMORY AREA READ. 226
9-4 MEMORY AREA WRITE. 227
9-5 MULTIPLE MEMORY AREA READ 228
9-6 COMPOSITE REGISTRATION READ 229
9-7 REGISTER COMPOSITE READ 229
9-8 CONTROLLER DATA READ. 230
9-9 CONTROLLER STATUS READ. 231
9-10 CLOCK READ. 231

9-1 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 CS-series and C200HX/HG/HE CPU Units. (These commands are supported in all PLC operating modes.)

Command code		Name	Page
01	01	MEMORY AREA READ	224
	02	MEMORY AREA WRITE	227
	04	MULTIPLE MEMORY AREA READ	228
	10	COMPOSITE REGISTRATION READ	229
	11	REGISTER COMPOSITE READ	229
05	01	CONTROLLER DATA READ	230
06	01	CONTROLLER STATUS READ	231
07	01	CLOCK READ	231

Note CS-series CPU Units support other commands that aren't listed in the table above, but only the commands listed above can be used when the CS-series PLC is connected via a C200HW-DRM21-V1 DeviceNet Master Unit

9-2 Memory Area Designations

The following table gives the addresses to use when reading or writing PLC data. The *Data area address* column gives the normal addresses used in the PLC 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 PLC 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 PLC being used. Refer to your PLC'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

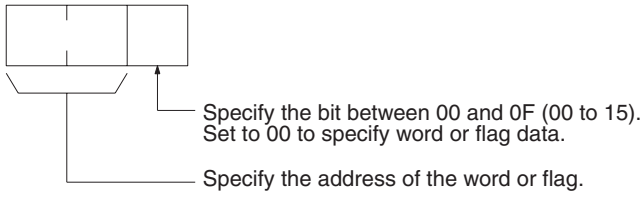
Memory area	Data	Data area address	Address used in communications		Memory area code	No. of bytes
			1st and 2nd bytes	3rd byte		
Timer Area/ Counter Area	Completion Flag status	TIM 000 to TIM 511 CNT 000 to CNT 511	0000 to 01FF	00 to 00	01	1
	PV	TIM 000 to TIM 511 CNT 000 to CNT 511		00 to 00	81	2
DM Area	Word contents	DM 0000 to DM 6655	0000 to 19F	00 to 00	82	2
EM Area	Word contents	EM 0000 to EM 6144	0000 to 17FF	00 to 00	90 to 97, 98, A8 to AF (see note)	2

Note

1. EM Area bank designations:
   90 to 97: Banks 0 to 7
   98: Current bank
   A8 to AF: Banks 8 to 15
2. Always use the memory area designations listed in the table above when specifying the beginning address for response storage in an IOWR instruction. A Special Unit Error will occur if the beginning storage address is specified incorrectly.

9-2-1 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.

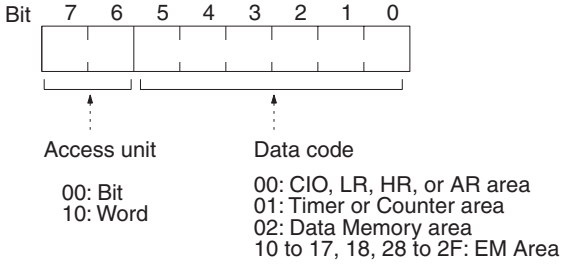


To obtain the corresponding address of the desired word or bit, add the data area word address (hexadecimal) to the first address of the range of addresses used for that data area in communications. For example, the address for word AR 13 is computed as follows:

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.



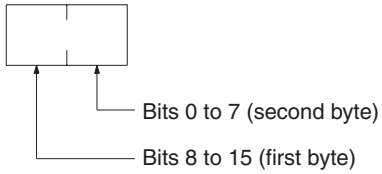
9-2-2 Data Configuration

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)

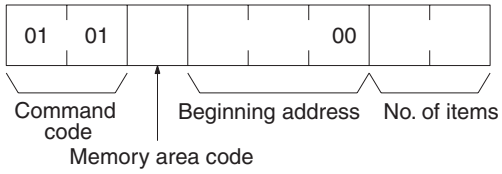
Word Contents or PV (Two Bytes)



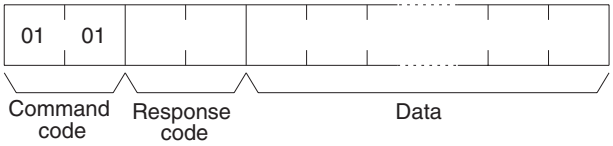
9-3 MEMORY AREA READ

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 *page 224 Memory Area Designations* for PLC 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
	PV	81	2
DM	Word contents	82	2
EM	Word contents	90 to 97, 98, A8 to AF	2

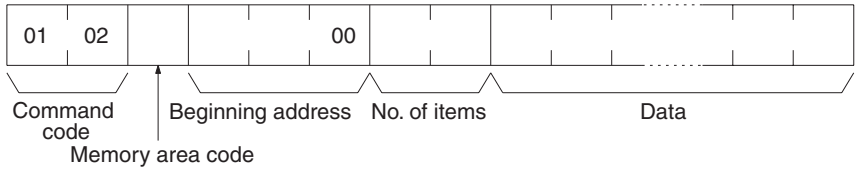
Note Refer to *page 226 Data Configurations* for the various data configurations.

9-4 MEMORY AREA WRITE

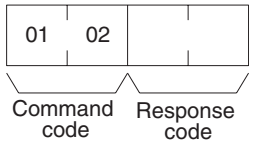
Writes data to the specified number of consecutive words starting from the specified word. All words must be in the same memory area (here, all memory areas with the same memory area code are considered as one area).

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 *page 224 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

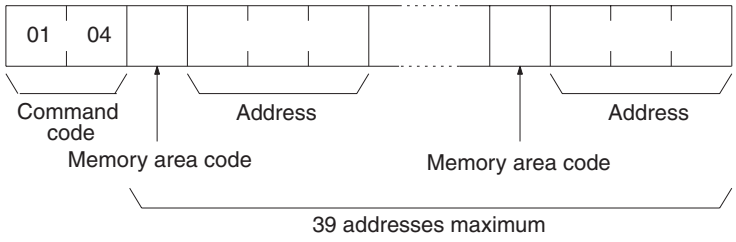
Note Refer to *page 226 Data Configurations* for the various data configurations.

9-5 MULTIPLE MEMORY AREA READ

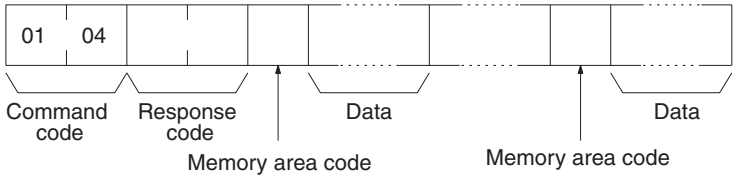
Reads the contents of the specified number of non-consecutive memory area words, starting from the specified word.

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 contents of up to 39 addresses can be read at one time when a C200HW-DRM21-V1 DeviceNet Master Unit is being used.

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 *page 224 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

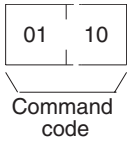
Note Refer to *page 226 Data Configurations* for the various data configurations.

9-6 COMPOSITE REGISTRATION READ

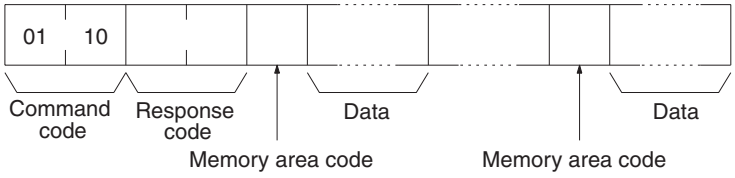
Reads the memory areas according to the addresses specified with the COMPOSITE READ REGISTRATION command (01 11).

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.

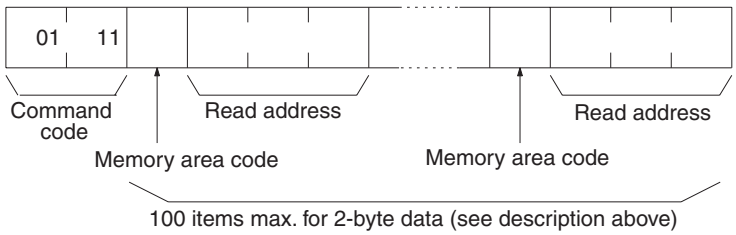
9-7 REGISTER COMPOSITE READ

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.

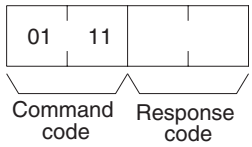
The contents registered with this command is effective until the power supply to the PLC is turned OFF or until the Master Unit is reset. This enables executing the COMPOSITE REGISTRATION READ command consecutively without having to specify the contents to be read again.

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 *page 224 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

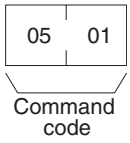
Note Refer to *8-2-2 Data Configurations* for the various data configurations.

9-8 CONTROLLER DATA READ

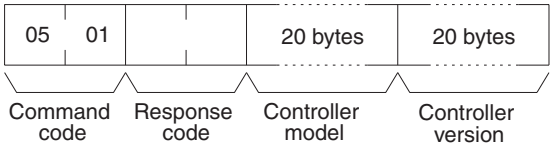
Reads the following data:

- Controller model and version

Command Block



Response Block



Parameters

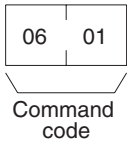
Controller model and Controller version (response): Both are returned in ASCII (20 bytes (i.e., 20 ASCII characters) max. each). The version of MPU1 is returned first followed by the version of MPU2. If the model or version infor-

mation does not require 20 bytes, the remainder of the 20 bytes will be filled with spaces (ASCII 20).

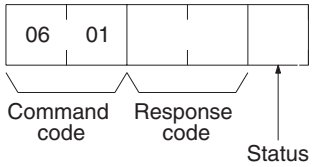
9-9 CONTROLLER STATUS READ

Reads the status of the Controller.

Command Block



Response Block



Parameters

Status (response): The operating status of the PLC as follows:

00: Stop (program not being executed)

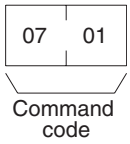
01: Run (program being executed)

80: CPU on standby

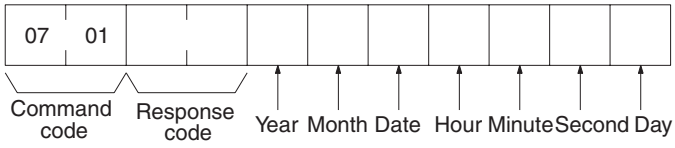
9-10 CLOCK READ

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 10
FINS Commands to DeviceNet Master Units

This section provides information on the FINS commands that can be addressed to the DeviceNet Master Units.

10-1 Command List 234
10-2 RESET 234
10-3 CONTROLLER DATA READ. 234
10-4 ECHOBACK TEST 235
10-5 ERROR LOG READ 235
10-6 ERROR LOG CLEAR 237

10-1 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	234
05	01	CONTROLLER DATA READ	234
08	01	ECHOBACK TEST	235
21	02	ERROR LOG READ	235
	03	ERROR LOG CLEAR	237

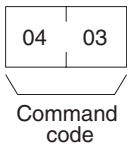
10-2 RESET

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.

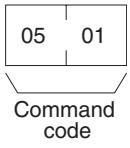
Command Block



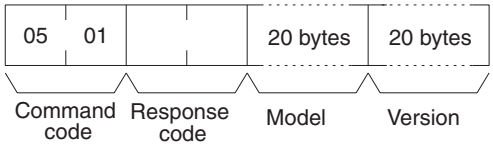
10-3 CONTROLLER DATA READ

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 PLCs. The following model data will be returned.

CVM1 and CV-series PLCs:CVM1-DRM21-V1
CS-series and C200HX/HG/HE/HS PLCs:C200HW-DRM21-V1

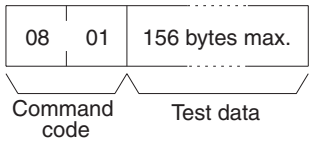
10-4 ECHOBACK TEST

Executes an echo test between the local node and a destination node.

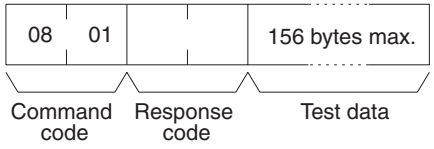
Note

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.

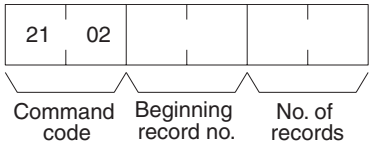
10-5 ERROR LOG READ

Reads the specified number of records from the error log file beginning with the specified record.

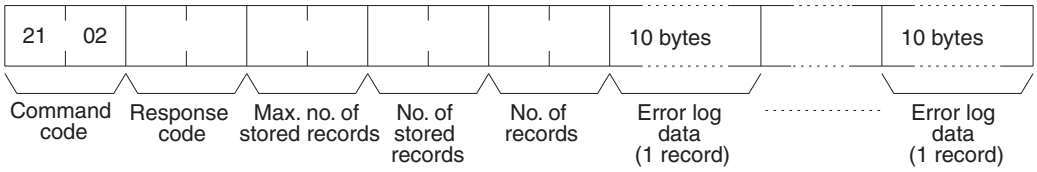
Note

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 log, a response code of 1103 will be returned (address range specification error) and no records will be returned.
2. The error log in the Master Unit is cleared when power to the PLC is turned off or the Master Unit is reset. Be sure to save the error log 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).

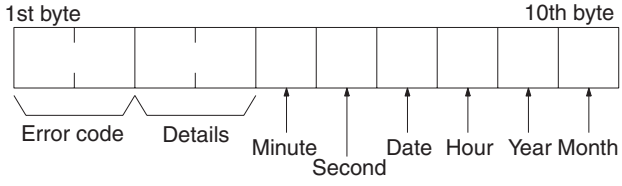
No. of records (command and response): Designates the number of records to be read in a range of 0001 to 0014 (1 to 20 in decimal). If more than 20 records is specified, all records through the last one will be returned along with a 110B error response code (response too long).

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.

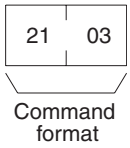
Note The time stamp is returned only for CVM1 and CV-series PLCs. All bytes will be all zeros for other PLCs. If the time of the error is required, use the clock function (CS Series: A351 to A354; C200HX/HG/HE and C200HS: AR 18 to AR 20).

10-6 ERROR LOG CLEAR

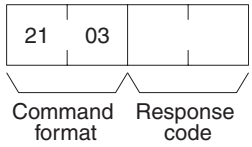
Clears all error log records to all zeros.

Note This command cannot be executed if any other device has the access right.

Command Block



Response Block

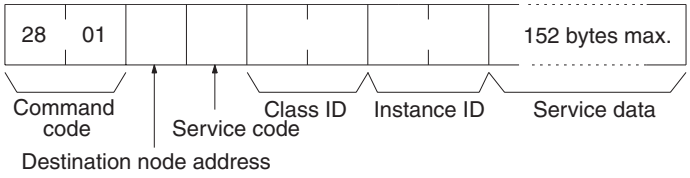


Appendix A
Sending Explicit Messages to DeviceNet Devices by Other Manufacturers

FINS Command: EXPLICIT MESSAGE SEND (28 01)

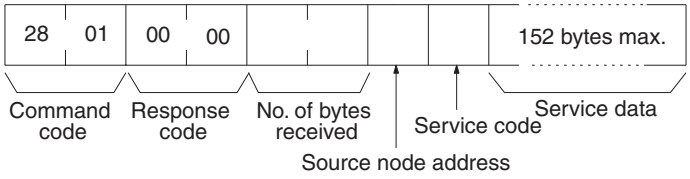
1. EXPLICIT MESSAGE SEND will send an explicit DeviceNet message to the specified object and receive a response.

Command Block



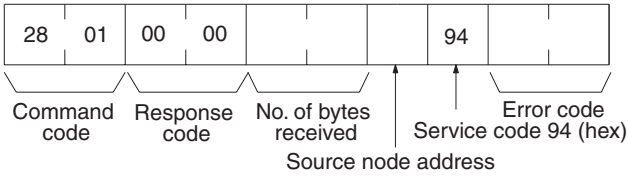
Response Block

Normal Response

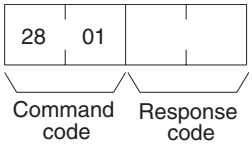


Error Responses

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.



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 ODVA to obtain DeviceNet specifications. Contact information is provided below.
   TEL: 1 734-975-8840
   FAX: 1 734-922-0027
   Email: odva at odva.org
   Website: http://www.odva.org/
6. For details on explicit messages to OMRON Special I/O Slaves, refer to the *DeviceNet Slaves Operation Manual* (W347).

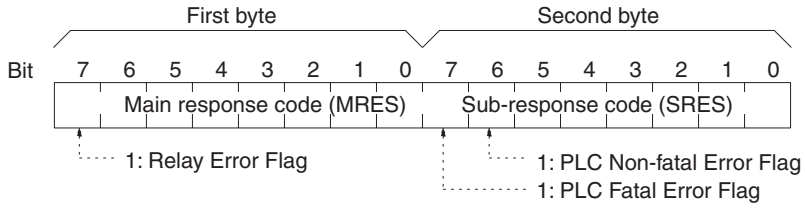
Appendix B

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 PLC or computer returning the response. Refer to the operation manual for the device returning the response for details when troubleshooting the error.

Note The CVM1-DRM21-V1 and C200HW-DRM21-V1 DeviceNet Master Units do not support communications between networks, so the Relay Error Flag (bit 7 of the first byte) is always OFF.

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.

Main code	Sub-code	Probable cause	Check point	Remedy
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 intern-ode 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.
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 log	Check the error log 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 PLC at the destination node	CPU Unit indicators at remote PLC'	Clear the error in the CPU (refer to the PLC'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.

Main code	Sub-code	Probable cause	Check point	Remedy
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 PLCs, 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 PLCs.
	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.
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.

Main code	Sub-code	Probable cause	Check point	Remedy
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.	PLC Setup	Change the PLC 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 PLC is in the PROGRAM mode.	---	Check the PLC's mode.
	04	The PLC is in the DEBUG mode.	---	Check the PLC's mode.
	05	The PLC is in the MONITOR mode.	---	Check the PLC's mode.
	06	The PLC is in the RUN mode.	---	Check the PLC'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 C

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 D

Connecting Another Company's Slaves

This appendix explains how to connect another company's Slaves to an OMRON Master Unit.

Procedure with the Configurator

We recommend using the Configurator when connecting another company's Slave to an OMRON Master.

Connection when the EDS File Is Available

The other company's Slave can be treated just like an OMRON Slave by installing the EDS file in the OMRON Configurator.

Manufacturers provide EDS files for each model of Slave that they manufacture and the EDS file contains data such as the Slave's ID, I/O data size, and other settings. If the EDS file has been installed in the Configurator, the Slave's settings can be changed and the Slave's I/O size is input automatically when the Master's scan list is created. Slaves' EDS files can usually be downloaded from the product catalog at the ODVA web site (http://www.odva.org/).

Locate the EDS file for the desired product in the downloaded file and install the EDS file in the Configurator. Refer to the Configurator's Operation Manual for details on installing the EDS files.

Connection when the EDS File Is Not Available

When the Slave's EDS file is not available, the parameters such as the connection type and data sizes must be input directly with the Configurator. (Always set the connection type that is supported by the Slave.)

The following table shows the connection types that are used in DeviceNet I/O communications.

Connection type	Description	Comments
Poll	The Master sends commands and receives responses individually with each Slave. Output data is included in the commands and input data is included in the responses.	---
Bit strobe	The Master broadcasts a command and multiple Slaves return responses, which include the input data.	The communications cycle time is shorter because the command is sent one time, but the bit strobe method can be used only with Slaves that have 8 bytes of input data or less.
Change of state (COS) (Not supported by the DeviceNet Units described in this manual.)	The Master or Slave transmits data when there is a change in the Unit's data.	Communications are executed only when there is a change in data. This method can increase overall network efficiency if there are Slaves that have infrequent data changes because those Slaves do not communicate more than necessary.
Cyclic (Not supported by the DeviceNet Units described in this manual)	The Master and Slaves transmit I/O data cyclically.	---

Procedure without the Configurator

Another company's Slave can be used without the Configurator if you know the exact number of input/output words occupied in the OMRON Master.

The number of input/output words refers to the "Produced Connection Size" and "Consumed Connection Size" in Connection object instance 2 (the Polled I/O Connection) or Connection object instance 3 (the Bit Strobed I/O Connection).

- Produced Connection Size
  This is the amount of memory (usually expressed in bytes) occupied as input words.
- Consumed Connection Size
  This is the amount of memory (usually expressed in bytes) occupied as output words.

If the connection size is an even number of bytes, the number of occupied words is: (bytes ÷ 2).

If the connection size is an odd number of bytes, the number of occupied words is: [(bytes +1) ÷ 2)].

If the connection size is 0 bytes, no words are occupied.

Appendix E
Master Unit Device Profile

Data Specifications

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 V DC, 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	0EGet_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	05Reset	No
		0EGet_Attribute_Single	No
		10Set_Attribute_Single	No

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 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.

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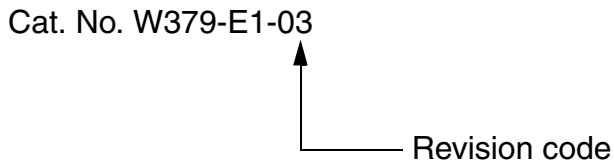
Revision History

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



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

Revision code	Date	Revised content
01	August 2002	Original production based on W267-E1-6.
02	January 2005	Changes were made throughout the manual to include the new CS1W-DRM21 with "-V1" suffix, including the following changes: **Page 8:** Changed the reference to include manuals for DRT1 and DRT2-series Slaves. **Page 11:** Added information on DRT2-series Slaves. **Page 57:** Added note on allocating I/O for DRT2-series Slaves. **Page 70:** Added new section (3-5) covering remote I/O communications for Smart Slaves **Page 124:** Changed "explicit message processing time" to "explicit message communications time" in the equation and changed the explanation. **Page 132:** Changed figure and explanation of maximum I/O response time. **Page 241:** Added information on COS and cyclic connections.
03	August 2010	**Page iii:** Added warranty information. **Page xiv:** Changed safety precautions. **Page 114 and 240:** Updated contact information for the ODVA. **Page 122:** Corrected "CIO 2159" to "CIO 2150." **Page 156:** Corrected "d5" to "d6."

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