Cat. No. W309-E1-06

SYSMAC
CS1W-CLK21
CJ1W-CLK21
C200HW-CLK21
CVM1-CLK21
CQM1H-CLK21

Controller Link Units

OPERATION MANUAL

OMRON

CS1W-CLK21
CJ1W-CLK21
C200HW-CLK21
CVM1-CLK21
CQM1H-CLK21
Controller Link Units

Operation Manual

Revised February 2003

Notice:

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

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

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

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

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

OMRON Product References

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

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

The abbreviation “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, setup, and operation of the C200HW-CLK21, CS1W-CLK21, CJ1W-CLK21, CVM1-CLK21, and CQM1H-CLK21 Controller Link Units for CQM1H-series, C200HX/HG/HE, CS/CJ-series, CVM1, and CV-series PLCs and includes the sections described below. The Controller Link Units are used to connect these PLCs to a Controller Link Network. The following three manuals are directly related to application of the Controller Link Network.

Name	Contents	Cat. No. (suffixes omitted)
SYSMAC CS1W-CLK21, CJ1W-CLK21, C200HW-CLK21, CVM1-CLK21. CQM1H-CLK21 Controller Link Units Operation Manual (this manual)	Installation, setup, and operating procedures for the Controller Link Units. Controller Link Units are used to connect PLCs to a Controller Link Network.	W309
3G8F7-CLK12-E/CLK52-E/CLK21-E Controller Link Support Boards for PCI Bus Operation Manual	Operating procedures for Controller Link Support Boards for PCI bus connections. Controller Link Support Boards are used to connect IBM PC/ATs or compatibles to a Controller Link Network.	W383
3G8F7-CLK12-E/CLK52-E/CLK21-E Controller Link Support Boards for PCI Bus Installation Guide	Installation and setup procedures for Controller Link Support Boards for PCI bus connections. Controller Link Support Boards are used to connect IBM PC/ATs or compatibles to a Controller Link Network.	W388
3G8F5-CLK11-E, 3G8F5-CLK21-E Controller Link Support Boards for ISA Bus Operation Manual	Installation, setup, and operating procedures for Controller Link Support Boards for ISA bus connections. Controller Link Support Boards are used to connect IBM PC/ATs or compatibles to a Controller Link Network.	W307
CS1W-CLK12, CVM1-CLK12 Optical Ring Controller Link Units Operation Manual	Installation, setup, and operating procedures for the Optical Ring Controller Link Units. Controller Link Units are used to connect C200HX/HG/HE CV-series, and CS1-series PLCs to a Controller Link Network.	W370
C200HW-ZW3AT2-E-V2 Controller Link Support Software Operation Manual	Installation and operating procedures for the Controller Link Support Software. The Controller Link Support Software enables manually set data links and other procedures for a Controller Link Network.	W369

Depending on the system, you may also need the SYSMAC or CV Support Software, the CX-Programmer, or a Programming Console. Refer to the body of this manual for details. Please read this manual and related manuals carefully and be sure you understand the information provided before attempting to install and operate a Controller Link Unit.

Precautions provides general precautions for using the Controller Link Unit and related devices.

Section 1 provides basic information on Controller Link Networks, and will give the reader an overview of what Controller Link Networks can do and how best to use them.

Section 2 describes the basic procedures to use the Controller Link Unit. The settings necessary for using each of the functions are also explained briefly. For more details, refer to the following sections on individual functions.

Section 3 describes how to install a Controller Link Unit and how to wire the Controller Link Network.

Section 4 describes the settings required for starting communications. These basic settings are required for both data links function and the message service. Carry out the settings described here before turning on power to the Controller Link Unit.

Section 5 describes how to use data links in a Controller Link Network. Refer to *SECTION 2 Basic Procedures* for an outline of data link application.

Section 6 explains how to use the message service provided by a Controller Link Unit. It also explains the FINS commands and responses supported by Controller Link Units and those supported by C200HX/HG/HE, CVM1, and CV-series PLCs.

Section 7 describes the method used to connect multiple networks through CS/CJ-series, CVM1, and CV-series PLCs. The section also describes remote programming and monitoring with Programming Devices.

Section 8 explains details on Controller Link Network communications. Refer to this section for network communications that require accurate communications timing.

Section 9 provides information on troubleshooting errors that occur during Controller Link Unit operation, as well as daily inspection, cleaning, and other maintenance procedures.

Appendix A provides a list of standard OMRON products related to Controller Link Networks, and ***Appendix B*** provides easy reference to the words in PLC memory areas used by Controller Link Networks.

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

PRECAUTIONS

This section provides general precautions for using the Controller Link Unit and related devices.

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

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 PLCs and related devices. 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 and all PLC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PLC System to the above mentioned applications.

3 Safety Precautions

⚠ WARNING Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

⚠ WARNING Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

⚠ 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. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.

- The PLC outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-VDC output (service power supply 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.

⚠ **Caution** Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.

⚠ **Caution** Confirm safety at the destination node before transferring a program to another node or changing contents of the I/O memory area. Doing either of these without confirming safety may result in injury.

4 Operating Environment Precautions

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

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

⚠ **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

⚠ **Caution** The operating environment of the PLC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PLC System. 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 Applications Precautions

Observe the following precautions when using the Controller Link Unit.

⚠ 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 or the backup power supply to the PLC or the computer before attempting any of the following. Performing any of the following with the power supply turned ON may lead to electrical shock:
  - Installing or removing the Controller Link Unit.
  - Assembling the Units.
  - Setting DIP or rotary switches.
  - Connecting or disconnecting any cables or wiring.
  - Connecting or disconnecting any terminal block.

⚠ Caution Failure to abide by the following precautions could lead to faulty operation or the PLC or the system or could damage the PLC or PLC Units. Always heed these precautions.

- Always use the power supply voltages specified in the operation manuals. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.
- Install the Units properly as specified in the operation manuals. Improper installation of the Units may result in malfunction.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.

- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Wire all connections correctly.
- Mount Units only after checking terminal blocks completely.
- Be sure that the Bus Connection Units and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Use special packing box when transporting the Controller Link Unit. Handle the product carefully so that no excessive vibration or impact is applied to the product during transportation.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
    - Changing the operating mode of the PLC.
    - Force-setting/force-resetting any bit in memory.
    - Changing the present value of any word or any set value in memory.
- Inappropriate settings in data link tables or routing tables can cause unexpected system operation. Always check table settings before starting operation, and always test the settings in trial operation before starting or stopping the data links in actual operation.
- CPU Bus Units will be automatically restarted when routing tables are transferred from a Programming Device to the CPU Unit. Resetting is required to use the new tables. Confirm that restarting the CPU Bus Units will not adversely affect system operation before transferring routing tables.
- Observe the following precautions when wiring the communications cables.
    - Separate the cables from the power lines or high-tension lines.
    - Do not bend the cables.
    - Do not pull on the cables.
    - Do not place heavy objects on top of the cables.
    - Route cables inside conduits.
- Before touching the Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up.

6 Conformance to EC Directives

The Controller Link Units conform to EMC and Low Voltage Directives as follows:

EMC Directives

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

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

Note Applicable EMS (Electro-Magnetic Susceptibility) and EMI (Electro-Magnetic Interference) standards in the EMC (Electro-Magnetic Compatibility) standards are as follows:

Controller Link Unit	EMS	EMI
CJ1W-CLK21 C200HW-CLK21 CS1W-CLK21 CQM1H-CLK21	EN61131-2	EN50081-2 (Radiated emission: 10-m regulations)
CJ1W-CLK21	EN61000-6-2	

Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards for the PLC (EN61131-2).

The Controller Link Units that comply with EC Directives (CVM1-CLK21, C200HW-CLK21, CS1W-CLK21, CJ1W-CLK21, and CQM1H-CLK21) must be installed as follows:

1,2,3...

1. The Controller Link Units are designed for installation inside control panels. All Controller Link 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 and I/O power supplies.
3. The Controller Link Units 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.

SECTION 1
Features and System Configuration

This section provides basic information on Controller Link Networks, and will give the reader an overview of what Controller Link Networks can do and how best to use them.

1-1 Overview

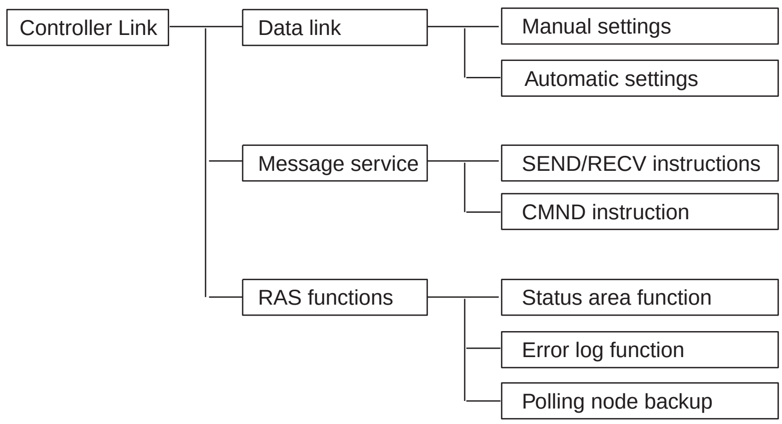
1-1-1 What Is the Controller Link?

The Controller Link is an FA network that can send and receive large data packets flexibly and easily among the OMRON C200HX/HG/HE Programmable Controllers (PLCs), CS-series PLCs, CJ-series PLCs, CVM1 PLCs, CV-series PLCs, CQM1H-series PLCs, and IBM PC/AT or compatible computers.

The Controller Link supports data links that enable data sharing and a message service that enables sending and receiving data when required. Data link areas can be freely set to create a flexible data link system and effectively use data areas.

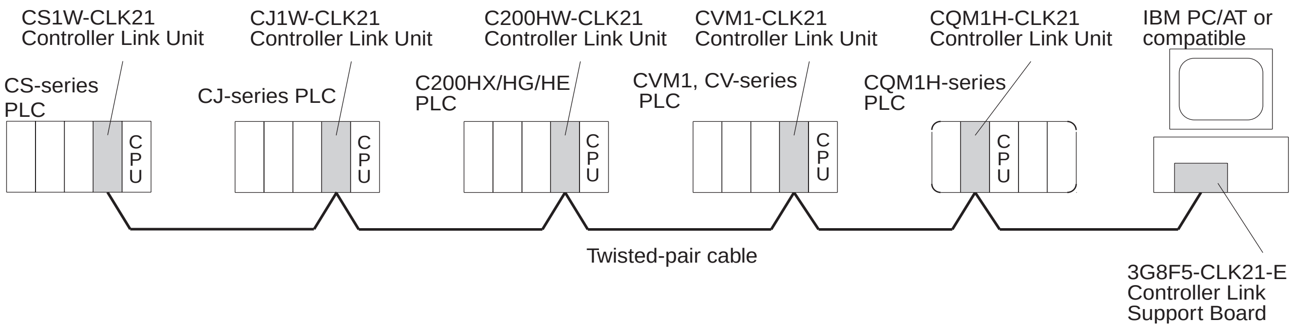
The network is connected using shielded twisted-pair cable and high-volume data transmissions at high speed enable construction of a wide range of networks, from low-level systems to high. (Refer to the *CS1W-CLK12, CVM1-CLK12 Optical Ring Controller Link Units Operation Manual* (W370) for detail on optical fiber connections.)

The functions of a Controller Link Network are illustrated below.



Wired System (Twisted-pair Cable)

CS-series, CJ-series, C200HX/HG/HE, CVM1, CV-series, and CQM1H-series PLCs

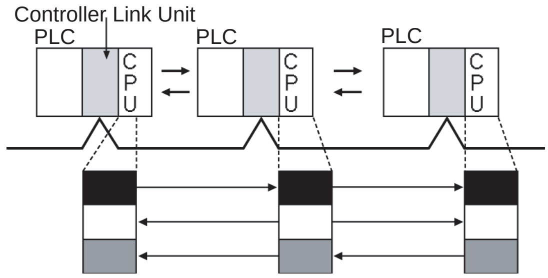


Data Links

Data links allow the constant sharing of data in predetermined data areas between nodes, between PLCs, or between a PLC and an IBM PC/AT or compatible computer on the network. Data links do not require the use of communications programs on the PLC (CPU Unit) or IBM PC/AT or compatible computer. Data written in the send area of the local node will be automatically sent to the receive area of other nodes.

The I/O area (CIO area), link area (LR area), data memory area (DM area), and extended data memory area (EM area) can be freely set in the send or receive area. (The area used for sending or receiving data using the data link function is called “data link area.”)

The data link area can be set automatically or manually.



Constant data exchange (sharing)

Automatic Setting

Used for simple data link processing. Data link can be performed by simply setting parameters in the DM area of the PLC.

Send data size per node is the same for all nodes. All nodes participating in the data link share the same data.

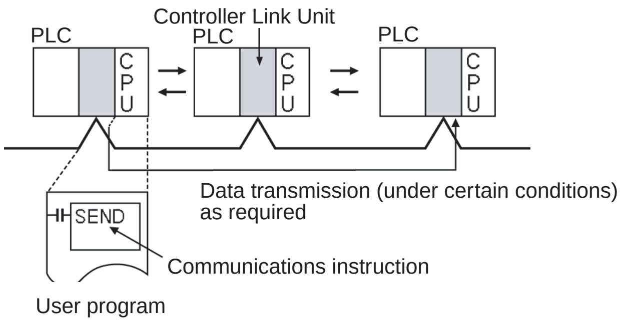
Manual Setting

Used for flexible data link processing depending on each system.

Using the Controller Link Support Software, individual data link tables can be set for each node and the data link area can be freely allocated for each node. Send data size per node can be freely set. It is also possible to set nodes for only send or receive data. With the Controller Link Unit, the data link can be set to receive only a part of the data link area of other nodes.

Message Service

This function controls data transmission with particular nodes, reading or writing of status data, changing of operation modes, etc., by executing communications instructions on a program. The communications instructions include SEND/RECV instructions for data transmission and CMND instructions for issuing various commands.



SEND/RECV

The SEND or RECV instruction sends or receives data in an area of a particular node.

The SEND instruction sends data from an area of the local node and writes to an area in the designated node.

The RECV instruction requests the designated node to send area data and writes the data to the local node.

CMND

The CMND instruction issues a command to read or write data of other nodes, control, or read error logs. With the Controller LInk Unit, OMRON’s command protocol called “FINS commands” is used.

Note Since the C200HX/HG/HE PLCs do not support the CMND instructions, arbitrary commands cannot be issued.

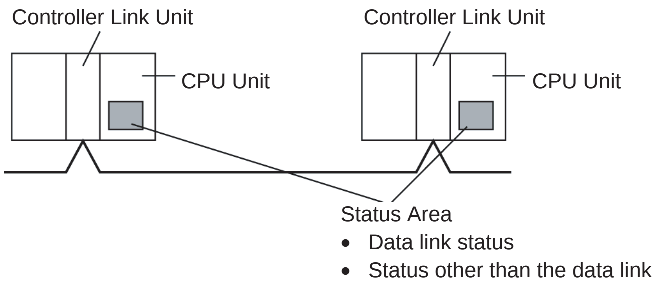
RAS

RAS performs real-time monitoring of the network status. If an error occurs in the network, RAS records and displays the time and contents of the error.

Status Area

Data Link Status Area
When the data link function is used, the data link status is reflected in the data link status area of the PLC.

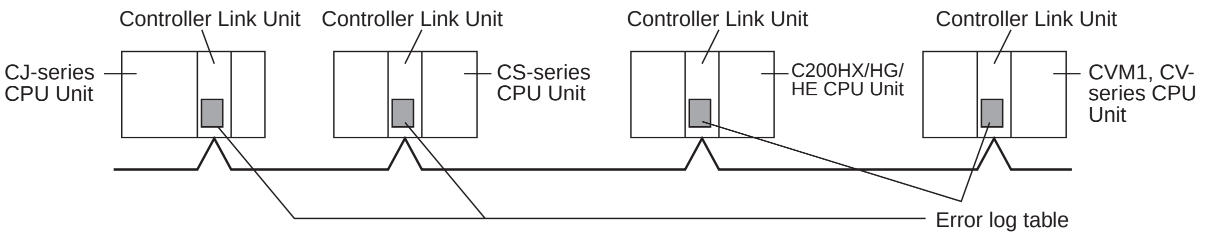
Network Status Area Other than the Data Link:
The network status such as the state of node participation is reflected in the status area of the PLC.



Error Log

The error log function records contents (codes) and times of errors that occur in the network into the RAM or EEPROM, up to the maximum of 39 errors.

The recorded errors can be read using the Controller Link Support Software or the message service function.



1-1-2 Features

The Controller Link Network has the following features to meet the various requirements of FA sites.

Data Links

Flexible and efficient data links can be created for large capacities of data as listed below.

Item	Specifications
Number of send words per node	1,000 max.
Number of send and receive words per node	Controller Link Support Board: 32,000 max. C200HX/HE/HG, CVM1, CV-series, and CQM1H-series PLCs: 8,000 max. CS/CJ-series PLCs: 12,000 max. IBM PC/AT or compatible: 32,000 max. (PCI or ISA Board)

Data links can be automatically set, or they can be set by the user to freely change the sizes of the data areas used. A data link can also be created so that one node receives only part of the data sent from another node. This function enables users to receive only the required data, thereby increasing data link efficiency.

Message Service

The message service can send and receive up to 2,012 bytes of data (including the FINS header), allowing high volumes of data to be sent and received without having to split it up.

Twisted-pair Cable or Optical Fiber Cable Connection

The Controller Link Units can be connected to the network using either shielded twisted-pair cables or optical fiber cables. Select the system that suits your application.

Features of Twisted-pair Cable

Twisted-pair cable is easy to connect and maintain. The cable can be processed much more easily than coaxial or optical cable, thereby reducing the cost of tools and assembly time.

Connections are made to a terminal block on the Controller Link Unit and to a special connector on the Controller Link Support Board for easy system assembly and modification.

The network is equipped with the required terminating resistance built into the Units allowing the terminating resistance to be easily set at both ends of the network using a simple switch.

Features of Optical Fiber Cable

Optical Fiber Cable has superior noise resistance, so this system can provide highly reliable communications even in very noisy conditions.

The communications distance can be up to 20 km total (1 km max. between nodes) if H-PCF cable is used and up to 30 km total (2 km max. between nodes) if GI cable is used, which allows long-distance or large-scale networks.

Once the Optical Fiber Cable has been fitted with special connectors, the cables can be easily connected or disconnected.

Compatible with Different Node Configurations

The following Controller Link Units are available for communications between different models. It must be noted, however, that the wired system and optical system cannot exist in one Controller Link Network.

Wired System

- Controller Link Unit for CS/CJ-series Programmable Controllers
- Controller Link Unit for C200HX/HG/HE Programmable Controllers
- Controller Link Unit for CVM1 and CV-series Programmable Controllers
- Controller Link Unit for CQM1H-series Programmable Controllers
- Controller Link Support Board for IBM PC/ATs or compatibles (ISA or PCI bus)

Flexible Inter-network Connections

The Controller Link Network can connect to other networks (Ethernet, SYSMAC NET, SYSMAC LINK, and another Controller Link network) via CVM1, CV-series, CS-series, or CJ-series PLCs. By installing a Communications Unit for the Ethernet, SYSMAC NET or SYSMAC LINK on the same CS/CJ-series or CV-series PLC as a Controller Link Unit, a message service can be created with nodes in interconnected networks through the CVM1 or CV-series PLC. Up to three network levels are possible.

Note CS/CJ-series PLC cannot be connected directly to SYSMAC NET networks and CJ-series PLC cannot be connected directly to SYSMAC LINK networks

The programming and monitoring of other PLCs on the network can be conducted from Programming Devices connected to the PLC's CPU Unit. Internetwork connections are possible in this case also and can cover up to three network levels.

Improved Error Handling

An error log enables quick handling of errors by recording the time the error occurred and error details. The current Controller Link Unit and Support Board status are also available, as are the data link and network status.

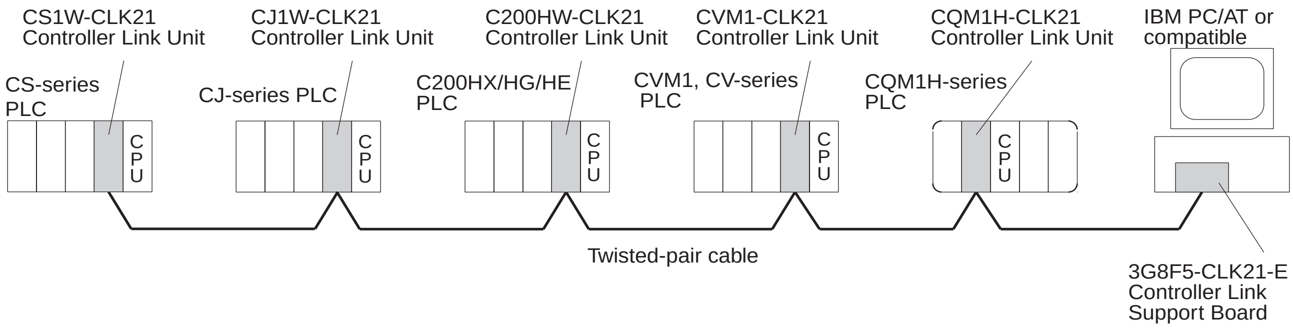
When an error occurs in the polling node that controls the Controller Link Network, another node automatically becomes the polling node. This prevents an error at a single node from influencing other nodes on the network, achieving a highly reliable system.

1-2 Specifications and Configurations

1-2-1 System Configuration

Wired system

Connects CS/CJ-series, C200HX/HG/HE, CVM1, CV-series PLCs, and IBM PC/AT or compatible computers.



1-2-2 General Specifications

General specifications are the same for the C200HX/HG/HE, CS-series, CJ-series, CVM1, CV-series, and CQM1H-series PLCs.

1-2-3 Communications Specifications

Wired System

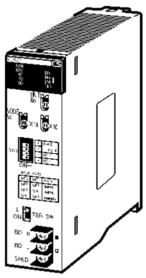
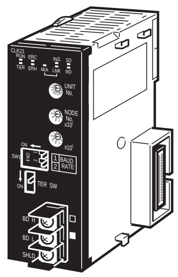
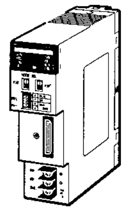
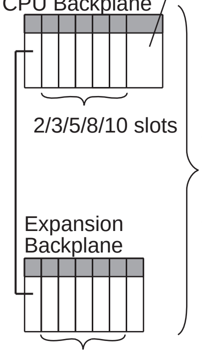
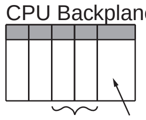
Items	Specifications
Communications method	N:N token bus
Code	Manchester code
Modulation	Baseband code
Synchronization	Flag synchronization (conforms to HDLC frames)
Transmission path form	Multi-drop bus
Baud rate and maximum transmission distance	The maximum transmission distance varies with the baud rate as follows: 2 Mbps: 500 m 1 Mbps: 800 m 500 Kbps: 1 km
Media	Specified shielded twisted-pair cable Number of signal lines: 2, shield line: 1
Node connection method	PLC: Connected to a terminal block IBM PC/AT or compatible: Connected via a special connector (included)
Maximum number of nodes	32 nodes
Communications functions	Data links and message service
Number of data link words	Transmission area per node: 1,000 words (2,000 bytes) max. Data link area in one C200HX/HG/HE, CVM1, CV-series, or CQM1H-series PLC (send/receive): 8,000 words (16,000 bytes) max. Data link area in one CS/CJ-series PLC (send/receive): 12,000 words (24,000 bytes) max. Data link area in one IBM PC/AT or compatible (transmission/reception): 32,000 words (64,000 bytes) max. Number of data link words in one network (total transmission): 32,000 words (64,000 bytes) max.
Data link areas	Bit areas (IR, AR, LR, CIO), data memory (DM), and extended data memory (EM)
Message length	2,012 bytes max. (including the header)
RAS functions	Polling node backup function Self-diagnosis function (hardware checking at startup) Echoback test and broadcast test (using the FINS command) Watchdog timer Error log function
Error control	Manchester code check CRC check (CCITT $X^{16} + X^{12} + X^5 + 1$)

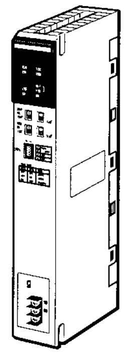
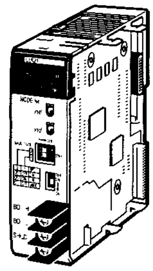
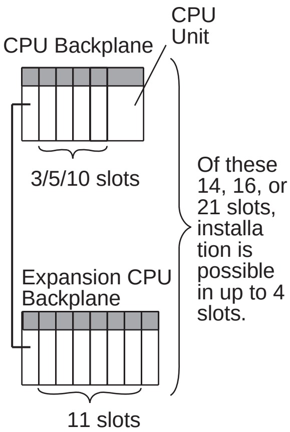
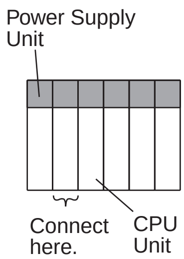
Note The maximum distance between nodes depends on the connector and cable processing methods.

1-2-4 Controller Link Unit Models and PLCs

Wired System

There are four Controller Link Units: One for CVM1 and CV-series PLCs, one for CS/CJ-series PLCs, one for the C200HX/HG/HE PLC, and one for CQM1H-series PLCs.

Item	Specifications		
Model	CS1W-CLK21	CJ1W-CLK21	C200HW-CLK21
External appearance			
Installation devices	None required.	None required.	C200HW-COM01/04 Communications Board and C200HW-CE001/002/012 Bus Connection Unit
PLC	CS-series PLCs	CJ-series PLCs	C200HX/HG/HE PLCs (Except C200HE-CPU11(-Z))
Max No. of Units per PLC	4 maximum including optical models 	4 maximum on CPU or Expansion Rack	2 maximum 
Installation site	Install onto a CPU Backplane or CS-series Expansion Backplane (Classified as a CPU Bus Unit.)	Install onto a CPU Rack or Expansion Rack (Classified as a CPU Bus Unit.)	Install onto a CPU Backplane. (Classified as a Special I/O Unit for communications.)
Storage location for network parameters	CPU Bus Unit Area (in the CPU Unit parameter area)		Controller Link Unit
Storage location for routing tables	CPU Unit parameter area		DM 6450 to DM 6499 in CPU Unit
Weight	400 g	110 g	400 g
Current consumption	330 mA	350 mA	300 mA

Item		
Model	CVM1-CLK21	CQM1H-CLK21
External appearance		
Installation devices	None required.	None required.
PLC	CVM1 and CV-series PLCs	CQM1H-CPU51/61
Max No. of Units per PLC	4 maximul  	1 maximum 
Installation site	Install onto a CPU Backplane or Expansion CPU Backplane (Classified as a CPU Bus Unit.)	Connected as a Communications Unit between Power Supply Unit and CPU Unit.
Storage location for network parameters	CPU Bus Unit Area (in the CPU Unit parameter area)	Controller Link Unit
Storage location for routing tables	CPU Unit parameter area	DM 6450 to DM 6499 in CPU Unit
Weight	550 g	200 g
Current consumption	300 mA	290 mA

Note A Controller Link Support Board can be installed into an IBM PC/AT or compatible computer to connect the computer to the network. Refer to the *Controller Link Support Boards Operation Manual (W307)* for details.

1-2-5 Devices for Connection

To set up a Controller Link Network the following devices are needed in addition to a Controller Link Unit and a PLC.

Communications Cables

The following shielded twisted-pair cables are recommended for Wired Controller Link Network connections.

Model	Manufacturer	Remarks
Li2Y-FCY2 x 0.56 qmm	Kromberg & Schubert, Komtec Department	German company
1 x 2 x AWG – 20PE + Tr.CUSN + PVC	Draka Cables Industrial	Spanish company
#9207	Belden	USA company
ESVC 0.5 x 2 C-1362	Bando Densen Co.	Japanese company
ESNC 0.5 x 2 C-99-087B	Nihon Electric Wire & Cable Co.	Japanese company

Note Use the special connector provided with the Board to connect the Controller Link Support Board to the network.

Relay Terminal Blocks

The following Relay Terminal Block can be used to make maintenance easier by facilitating replacement of the Controller Link Unit after system operation has begun.

Name	Model	Remarks
Relay Terminal Block for Wired Controller Link Units	CJ1W-TB101	Cannot be used on the nodes on the ends of the network

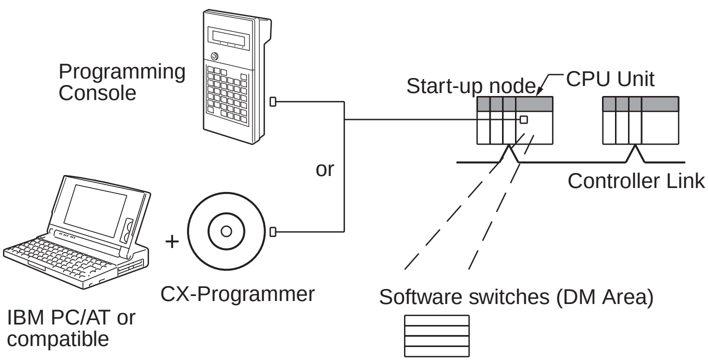
Note Normally, the communications cable must be disconnected from a Wired Controller Link Unit to replace it. Doing this, however, will interrupt communications on the network, requiring that all node be turned OFF to ensure safety before replacing a Unit. With the above Relay Terminal Block, a Controller Link Unit can be replaced by turning OFF only the specific Unit being replaced, i.e., without turning OFF any other Units. The communications cables are left connected to the Relay Terminal Block and only the Relay Terminal Block is removed from the Controller Link Unit. (The built-in terminating resistance connected at the Units at the end of the network prevents using the Relay Terminal Block on the end Units.) Refer to *Appendix C Using the Relay Terminal Block* for details on using the Terminal Relay Block.

1-2-6 Programming Devices

A Programming Device for the PLC, the Controller Link Support Software, or CX-Programmer are needed to use a Controller Link Network.

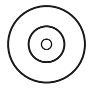
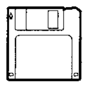
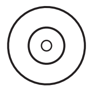
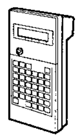
Programming Device for the PLC

One of the following Programming Devices is necessary when using the automatically setting data links or the message service.



The following operations are possible.

- Selecting manual or automatic setting for data links.
- Setting the data link mode to “automatic” (software switch setting).
- Starting/stopping data links (Start Bit: ON/OFF)
- Programming for the message service.
- Reading (monitoring) the network status.

Programming Device	External appearance	Model	Applicable PLCs
CX-Programmer (for PLC)		WS02-CXP□□-E	CS/CJ-series, C200HX/HG/HE, CVM1-series, and CQM1H-series PLCs
SYSMAC Support Software (for PLC)		C500-ZL3AT1-E	C200HX/HG/HE and CVM1 PLCs
CV Support Software (for PLC)		CV500-ZS3AT1-EV2	CVM1 and CV-series PLCs
SYSMAC-CPT (for PLC)		WS01-CPTB1-E	C200HX/HG/HE and CVM1 PLCs
Programming Console		CQM1-PRO01-E C200H-PRO27-E	C200HX/HG/HE, C200H/C200HS, CQM1, and CQM1H-series PLCs
		CVM1-PRS21-EV1	CVM1 and CV-series PLCs

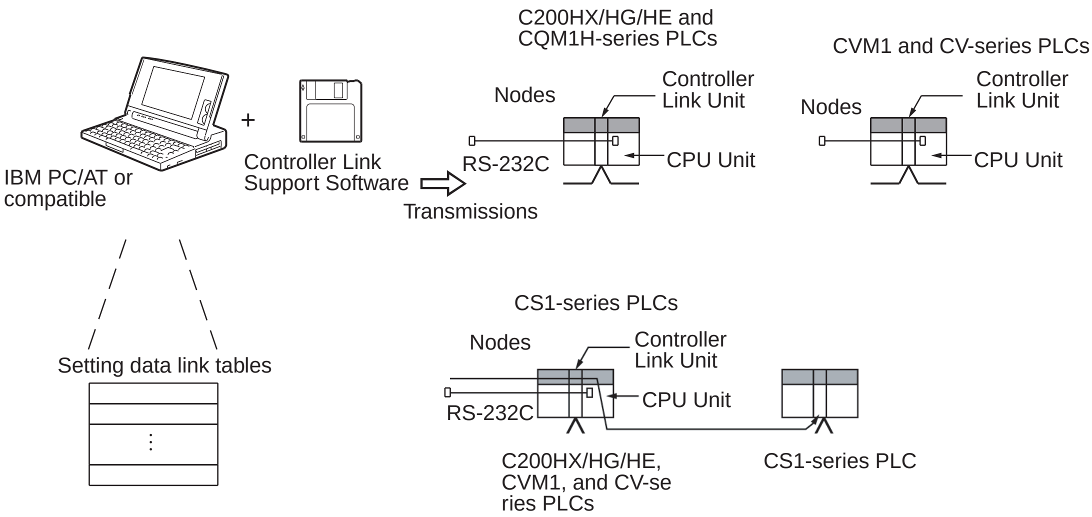
Controller Link Support Software (Version 2.00)

The Controller Link Support Software can be used to manually set data links, to set Controller Link parameters, and to monitor the Controller Link Network. The Controller Link Support Software is run on a personal computer connected to a C200HX/HG/HE, CVM1, or CV-series PLC or a personal computer in which a Controller Link Support Board has been mounted.

- Setting the data link mode to “manual” (creating and storing data link tables).
- Starting/stopping data links.
- Reading (monitoring) network status.
- Reading error logs.
- Setting routing tables.
- Testing the Network.
- Changing network parameters.
- Reading the network connection configuration data and status (in token-ring mode only).

Using an Independent Computer

A computer that is not part of the Network can be used to control the Controller Link Network.

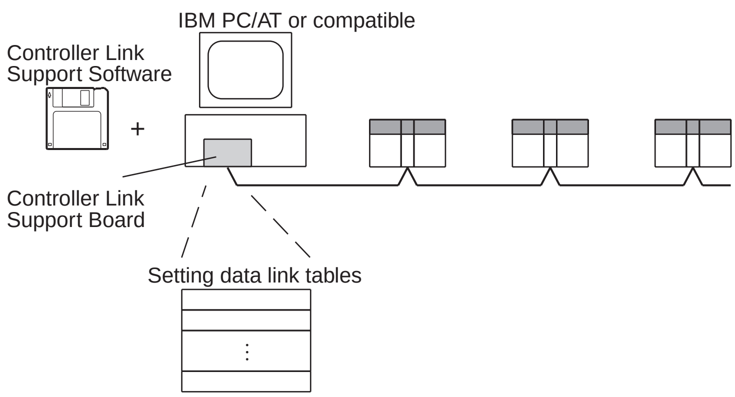


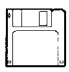
Note

1. The Controller Link Support Software cannot be connected to a CS/CJ-series PLC. It is possible to monitor and set a Controller Link Unit on a CS/CJ-series via the network by connecting the computer running the Controller Link Support Software to a C200HX/HG/HE, CVM1, CV-series, or CQM1H-series PLC.
2. The Controller Link Support Software can be used as a part of the SYSMAC Support Software.

Using a Computer Node

A computer that is a node on the Network can also be used to control the Controller Link Network.



Software		External appearance	Model	Applicable PLCs	Remarks
Controller Link Support Software	Purchased separately		C200HW-ZW3AT2-EV2	CS/CJ, C200HX/HG/HE, CVM1, CV-series, or CQM1H-series PLC	For IBM PC/AT or compatible
	Provided with Controller Link Support Board		3G8F5-CLK21-EV2		For Controller Link Support Board (included with the Board) (Wired systems)
			3G8F5-CLK11-E		For IBM PC/AT or compatible (included with the Board) (Optical systems)

Note Use Controller Link Support Software version 1.1 for an ISA Controller Link Support Board.

The Controller Link Support Software can also be used with the Controller Link Support Board.

Controller Link Support Software Menu Overview

Menu items:

- Data Link
  - Edit table
  - Save table
  - Print table
  - Copy table
  - Retrieve table
  - Start/Stop
  - Initialize table
  - Transfer table
  - Monitor status
  - Check table
  - Delete table
  - Device info set
- Set Network parameters
- Routing tables
- Echoback test
- Broadcast test
- Monitor Network
- Display Error log
- Display Node status
- Display Board setup
- Maintenance
  - Unit backup
  - Board backup
  - Initialize network parameters
- Connection Info*
- Edit PC ID
- System setup

*Optical Ring Link Systems only.

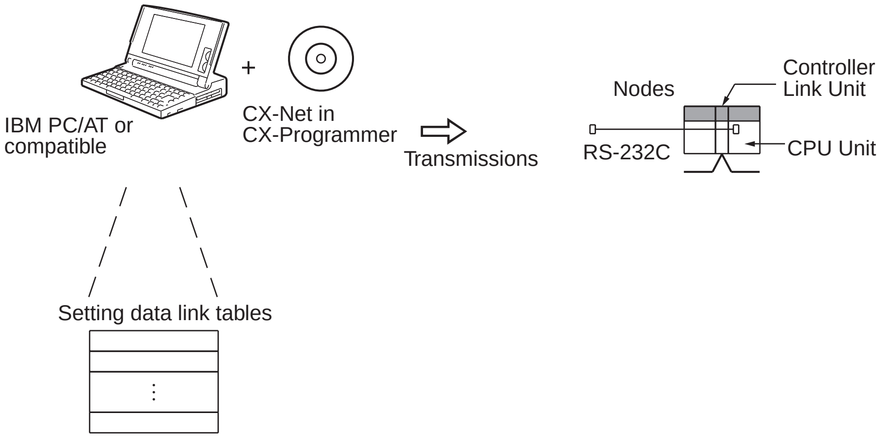
Note Refer to the *Controller Link Support Software Operation Manual (W308)* for detailed operating procedures.

CX-Programmer

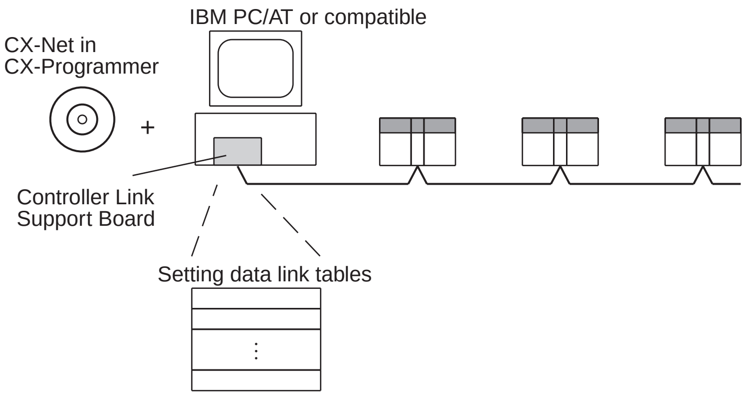
The CX-Net operations within the CX-Programmer is required when using user-set data links, or when setting or monitoring detailed settings of the Controller Link Unit. This software can be used with a CS/CJ-series PLC and is ideal for the following applications.

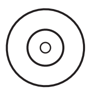
- Setting the data link mode to “manual” (creating and storing data link tables).
- Starting/stopping data links.
- Reading (monitoring) network status.
- Reading error logs.
- Setting routing tables.
- Testing the Network.
- Changing network parameters.

When Operating on Personal Computer as Peripheral Software



When Operating on Personal Computer Connected as a Node



Software	External appearance	Model	Applicable PLCs
CX-Programmer		WS02-CXP□□-E	CS/CJ-series, C200HX/HG/HE, CVM1, CV-series, and CQM1H-series PLCs

Note
1. For further details about the CX-Programmer, refer to the *WS02-CXP□□-E CX-Programmer Operation Manual.*
2. Use version 1.54 or later of CX-Net in version 2.04 or later of the CX-Programmer for the CJ-series Controller Link Unit.

1-3 Selection of Communications Functions

Select the data link function if alarm or status data (in bits) must be constantly shared between PLCs or between a PLC and an IBM PC/AT or compatible computer or if the present value or set value data (in words) must be constantly shared between PLCs or between a PLC and an IBM PC/AT or compatible computer.

Select the message service function (SEND/RECV instructions or CMND instructions) if data (in words) must be sent (or received) from one PLC to other PLCs in other nodes or from one PLC to IBM PC/AT or compatible computers.

1-4 Basic Procedures

Preparations

C200HX/HG/HE and CQM1H-series PLCs

1,2,3...

1. Set the node address on the front rotary switches.
   - 01 to 32
2. Set the baud rate and operating level on the front DIP switch.
   - 2 M, 1 M, or 500 Kbps
   - Operating level 0 or operating level 1 (C200HX/HG/HE PLCs only)
3. Set the terminating resistance on the sliding switch.
   - ON or OFF (Only the end nodes are set to ON.)
4. Register routing tables as required.

CVM1, CV-series, and CS/CJ-series PLCs

1,2,3...

1. Set the Unit number on the front rotary switches.
   - 00 to 15 (0 to F: CS/CJ-series display is in hexadecimal)
2. Set the node address on the front rotary switches.
   - 01 to 32
3. Set the baud rate and operating level on the front DIP switch.
   - 2 M, 1 M, or 500 Kbps (wired systems only)
4. Set the terminating resistance on the front slide switch.
   - ON or OFF (Only the terminal node is set to ON.)
5. Register routing tables.

Data Link Procedure

1,2,3...

1. Connect power to all nodes.
2. Connect the Programming Device to the PLC.
3. Create I/O tables (not necessary for C200HX/HG/HE and CQM1H-series PLCs and not necessary for CJ-series PLCs unless user-created I/O tables have been specified).
4. Set the data link mode in the data link parameters in the DM area of the startup node to either automatic or manual data link creation using the Programming Device.

Manually Setting Data Links

1,2,3...

1. Register data link tables for all nodes using the Controller Link Support Software or CX-Programmer.
2. Start the data links either using the Controller Link Support Software, CX-Programmer, or by turning ON the Start Bit from the Programming Device.

Automatically Setting Data Links

1,2,3...

1. Set the DM area of the startup node using the Programming Device.
2. Start the data links by turning ON the Start Bit from the Programming Device.

Message Service Procedure

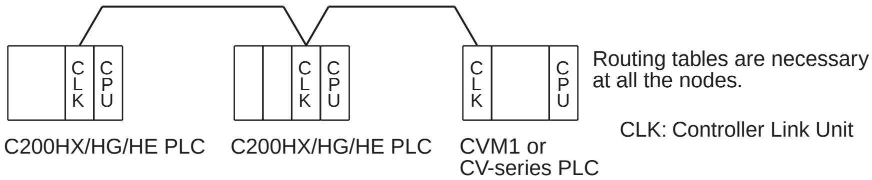
1,2,3...

1. Turn ON the power.

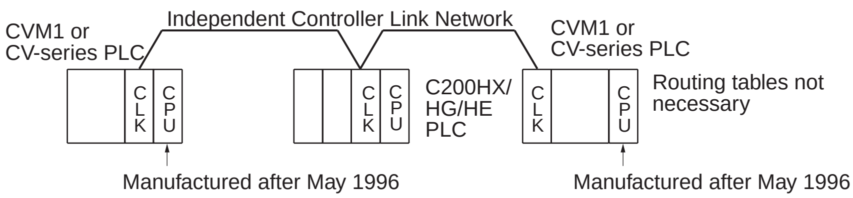
2. Create I/O tables (not necessary for C200HX/HG/HE and CQM1H-series PLCs and not necessary for CJ-series PLCs unless user-created I/O tables have been specified))
3. Execute communications instructions in the program.

1-5 Application Precautions

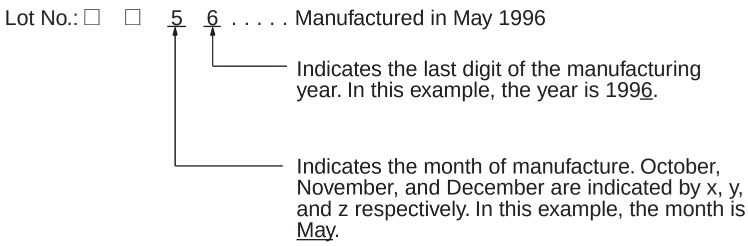
- Turn ON the terminating resistance switch only for the nodes at both ends of the network and turn OFF the switch for all other nodes.
- Turn OFF the power of all the nodes on the network before connecting or disconnecting a cable.
- Use the specified cable only.
- Set the same baud rate for all nodes on the same network.
- Be sure to set routing tables for CVM1 and CV-series PLCs. When a CVM1 or CV-series PLC is connected to the network, set routing tables at all the nodes.



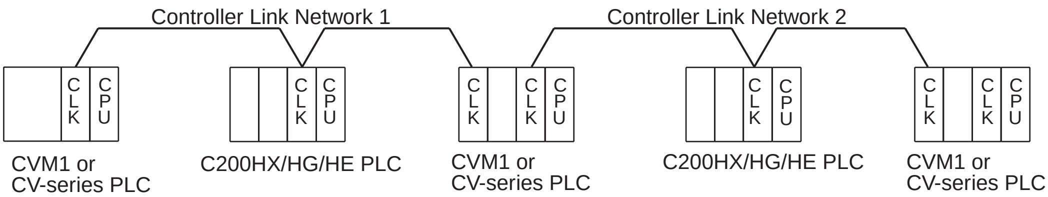
Note Routing tables are not required if all of the CVM1 and CV-series CPU Units if the Controller Link Network were manufactured on or after May 1996.



Note The manufacturing date can be determined from the four-digit lot number on the side of the CPU Unit.



- Set routing tables at all the nodes in all the networks when multiple networks are connected.



Routing tables are necessary at all the nodes regardless.

- When using the SEND/RECV or CMND instructions on a PLC for which routing tables have been set, be sure to specify the network addresses that are set in the routing tables.
- When using manually set data links, delete the data link tables from all nodes not participating in the data links.
- Do not transfer (write) routing tables when data links are active (i.e., started). CPU Bus Units and Communications Units are reset when routing tables are transferred.
- Do not restart or reset the polling node while data links are active.
- Be sure to set the bit in the DM Area's (CPU Bus Unit Area's) software switches (DM30000 + 100 × unit number) described as "always set to 0" to 0. Not doing so may result in the data link not starting properly. If a data link is started with bit 7 of the software switches set to 1, the data link status will be stored in a format different to the one described in this manual (when using CS-series or CJ-series Controller Link Units).

SECTION 2
Basic Procedures

This section describes the basic procedures to use the Controller Link Unit. The settings necessary for using each of the functions are also explained briefly. For more details, refer to the following sections on individual functions.

2-1 Data Links Procedures

2-1-1 Manually Setting Data Links

When the data link mode is set for manual data link table creation, the data link tables can be input using the Controller Link Support Software or CX-Programmer. Use the following procedure.

1,2,3...

1. Install and wire the Units.

Contents	Method	Nodes	Page
a. Mount the Units to the PLCs.	---	All nodes	40
b. Wire the Network.	---	All nodes	44

2. Prepare for communications.

Contents	Method	Nodes	Page
a. Set the unit number.	Use the front rotary switches.	CS/CJ-series, CVM1, and CV-series PLCs only	62
b. Set the node address.	Use the front rotary switches.	All nodes	59,62
c. Set the baud rate.	Use the DIP switch.	All nodes	59, 63
d. Set the operating level.	Use the DIP switch.	C200HX/HG/HE PLCs only	59
e. Set the terminal resistance	Use the front switch for CVM1, CV-series, CS/CJ-series, and CQM1H-series PLCs or the bottom switch for C200HX/HG/HE PLCs.	All nodes End nodes on the network: ON All other nodes: OFF	60, 63

3. Turn ON the power to the PLC.

Contents	Method	Nodes	Page
Turn ON the power to the PLC.	---	All nodes	---

4. Connect the Programming Device.

Contents	Method	Nodes	Page
Connect the Programming Console or Controller Link Support Software.	Use the special connection cable.	CS/CJ-series, CVM1, and CV-series PLCs	10

5. Create I/O tables.

Contents	Method	Nodes	Page
Input the I/O tables.	Use the SYSMAC Support Software or Programming Console.	CS/CJ-series, CVM1, and CV-series PLCs only	---

6. Set the data link mode.

Contents	Method	Nodes	Page
Set data link mode to manual.	Use the SYSMAC Support Software or Programming Console.	Data link startup node only The node that is used to start the data link is called the startup node. It is necessary to decide beforehand which node will be the startup node.	73

Note Be sure that the data link mode in the data link parameters in the DM Area is set to 00 when using manually set data links.

7. Register the data link tables by making the following settings for each node.

<table>
<tr><th colspan="2">Contents</th><th>Method</th><th>Nodes</th><th>Page</th></tr>
<tr><td colspan="2">First data link status word</td><td rowspan="8">Use the Controller Link Support Software or CX-Programmer.</td><td rowspan="8">All nodes within the network
Delete from the data link tables all nodes that are not in a data link.</td><td rowspan="8">75</td></tr>
<tr><td colspan="2">Data link nodes</td></tr>
<tr><td rowspan="3">Area 1</td><td>First data link status words</td></tr>
<tr><td>Numbers of data link words</td></tr>
<tr><td>Data link offsets</td></tr>
<tr><td rowspan="3">Area 2</td><td>First data link status words</td></tr>
<tr><td>Numbers of data link words</td></tr>
<tr><td>Data link offsets</td></tr>
</table>

Note Offsets are used to control where data is placed within the receive area.

8. Start the data links.

Contents	Method	Nodes	Page
Start the data links.	Switch the Data link Start/Stop Bit (listed below) from OFF to ON using either the Programming Device, the user program, the Controller Link Support Software or CX-Programmer.	Data link startup node (The Start Bit can be turned ON in more then one node to make sure the data links start even when the startup node is down.)	100

Note **a)** Data link Start/Stop Bit (N= unit number):

CS/CJ Series: Word 0 of DM30000 + 100 × N
C200HX/HG/HE: AR 0700 (operating level #0), AR 0704 (operating level #1)
CVM1/CV Series: Word 0 of DM 2000 + 100 × N
CQM1H Series: AR 0700

b) The data links will not start if there is an error in the data link tables in the startup node.

9. Stop the data links.

Contents	Method	Nodes	Page
Stop the data links.	Switch the Data link Start/Stop Bit (listed below) from OFF to ON using either the Programming Device, the user program, the Controller Link Support Software or CX-Programmer.	Any node that is active in the data link	100

Note Data link Start/Stop Bit (N= unit number):

CS/CJ Series:	Word 0 of DM30000 + 100 × N
C200HX/HG/HE:	AR 0700 (operating level #0), AR 0704 (operating level #1)
CVM1/CV Series:	Word 0 of DM 2000 + 100 × N
CQM1H Series:	AR 0700

2-1-2 Automatically Setting Data Links

Data link tables can be automatically created by setting the data link mode to automatic data link table creation. Use the following procedure.

1,2,3... 1. Install and wire the Units.

Contents	Method	Nodes	Page
a. Mount the Units to the PLCs.	---	All nodes	40
b. Wire the Network.	---	All nodes	44

2. Prepare for communications.

Contents	Method	Nodes	Page
a. Set the unit number.	Use the front rotary switches.	CS/CJ-series, CVM1, and CV-series PLCs only	62
b. Set the node address.	Use the front rotary switches.	All nodes	59, 63
c. Set the baud rate.	Use the DIP switch.	All nodes	59, 63
d. Set the operating level.	Use the DIP switch.	C200HX/HG/HE PLCs only	59
e. Set the terminal resistance	Use the front switch for CVM1, CV-series, CS/CJ-series, and CQM1H-series PLCs or the bottom switch for C200HX/HG/HE PLCs.	All nodes End nodes on the network: ON All other nodes: OFF	60, 63

3. Turn ON the power to the PLC.

Contents	Method	Nodes	Page
Turn ON the power to the PLC.	---	All nodes	---

4. Connect the Programming Device.

Contents	Method	Nodes	Page
Connect the Programming Console or Controller Link Support Software.	Use the special connection cable.	CS/CJ-series, CVM1, and CV-series PLCs only	10

5. Create I/O tables.

Contents	Method	Nodes	Page
Create the I/O tables.	Use the SYSMAC Support Software or Programming Console.	CS/CJ-series, CVM1, and CV-series PLCs only	---

6. Set the parameters for automatic data link creation.

<table>
<tr><th colspan="2">Contents</th><th>Method</th><th>Nodes</th><th>Page</th></tr>
<tr><td colspan="2">a. Set the data link mode to automatic.</td><td rowspan="9">Use the SYSMAC Support Software or Programming Console.</td><td>Data link startup node only
The node that is used to start the data link is called the startup node. It is necessary to decide beforehand which node will be the startup node.</td><td>73</td></tr>
<tr><td rowspan="3">Area 1</td><td>b. Set the area</td><td rowspan="3">Data link startup node only
Only when Area 1 is used</td><td rowspan="8">89</td></tr>
<tr><td>c. Set the data link start word</td></tr>
<tr><td>d. Set the no. of data link words</td></tr>
<tr><td rowspan="3">Area 2</td><td>e. Set the area</td><td rowspan="3">Data link startup node only
Only when Area 2 is used</td></tr>
<tr><td>f. Set the data link start word</td></tr>
<tr><td>g. Set the no. of data link words</td></tr>
<tr><td colspan="2">h. Set the first data link status word</td><td>Data link startup node only
(This setting may be omitted.)</td></tr>
<tr><td colspan="2">i. Set the nodes to participate in the data links.</td><td>Data link startup node only</td></tr>
</table>

7. Start the data links.

Contents	Method	Nodes	Page
Start the data links.	Switch the Data link Start/Stop Bit (listed below) from OFF to ON using either the Programming Device, or the user program.	Data link startup node (The Start Bit can be turned ON in more then one node to make sure the data links start even when the startup node is down.)	100

Note Data link Start/Stop Bit (N= unit number):

CS/CJ Series: Word 0 of DM30000 + 100 $\times$ N
C200HX/HG/HE: AR 0700 (operating level #0),

	AR 0704 (operating level #1)
CVM1/CV Series:	Word 0 of DM 2000 + 100 × N
CQM1H Series:	AR 0700

8. Stop the data links.

Contents	Method	Nodes	Page
Stop the data links.	Switch the Data link Start/Stop Bit (listed below) from OFF to ON using either the Programming Device, or the user program.	Any node that is active in the data link	100

Note Data link Start/Stop Bit (N= unit number):

CS/CJ Series:	Word 0 of DM30000 + 100 × N
C200HX/HG/HE:	AR 0700 (operating level #0), AR 0704 (operating level #1)
CVM1/CV Series:	Word 0 of DM 2000 + 100 × N
CQM1H Series:	AR 0700

Note The data links will not start if there is an error in the data link tables in the startup node. Data links can be started and stopped using the Controller Link Support Software.

2-2 Message Service Procedure

The following steps outline the basic procedure for using the message service.

1,2,3...

1. Install and wire the Units.

Contents	Remarks	Page
a. Mount the Units to the PLCs.	---	40
b. Wire the Network.	---	44

2. Prepare for communications.

Contents	Remarks	Page
a. Set the unit number.	CS/CJ-series, CVM1, and CV-series PLCs only	62
b. Set the node address.	---	59, 62
c. Set the baud rate.	---	59, 63
d. Set the operating level.	C200HX/HG/HE PLCs only	59
e. Set the terminal resistance.	---	60, 63

3. Turn ON the power to the PLC.

Contents	Remarks	Page
Turn ON the power to the PLC.	---	---

4. Create the I/O tables.

Contents	Remarks	Page
Create the I/O tables.	CS/CJ-series, CVM1, and CV-series PLCs only	---

5. Register routing tables if using inter-network connections.

Contents	Remarks	Page
a. Set the local network table	---	183
b. Set the relay network table	---	

Note Routing tables are required if any of the CVM1 and CV-series CPU Units in the Network has been manufactured on or before April 1996.

Lot No.: □ □ 4 6 . . . . . Manufactured in April 1996

6: Indicates the last digit of the manufacturing year. In this example, the year is 1996.

4: Indicates the month of manufacture. October, November, and December are indicated by x, y, and z respectively. In this example, the month is April.

6. Create the user program.

Contents	Remarks	Page
a. Prepare the send and receive data in memory.	Stored in the memory areas of the source node	112
b. Prepare the control data for the communications instruction.		
c. Check the conditions for executing the SEND/RECV or CMND instruction.	The standard input conditions are the Active Node Flags for the source and destination nodes, and the Port Enabled Flag.	134
d. Execute the SEND/RECV or CMND instruction.	---	
e. Execute other instructions are required for the results of the communications instruction, (e.g., retry or error processing if an error occurs).	The standard input condition is the Port Error Flags. C200HX/HG/HE PLCs have 1 communications port for each operating level. When 2 or more communications instructions are executed at the same time, exclusive control is necessary. CS-series, CJ-series, CVM1, and CV-series PLCs have 8 communications ports. When 9 or more communications instructions are executed at the same time, exclusive control is necessary. CQM1H-series PLCs have only 1 communications port. When 2 or more communications instructions are executed at the same time, exclusive control is necessary.	

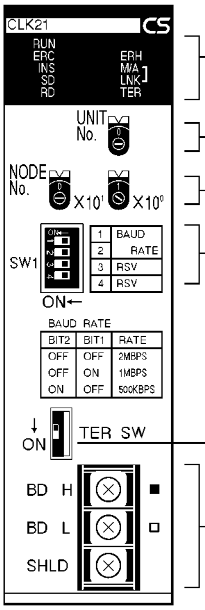
SECTION 3
Installation and Wiring

This section describes how to install a Controller Link Unit and how to wire the Controller Link Network.

3-1 Component Names and Functions

This section describes the names and functions of the Controller Link Unit components. This section also describes the operation of the indicators.

3-1-1 CS-series Controller Link Units



Indicators (Refer to p.29 and 220)
LED indicators that display the Unit and network status.

Unit number switch (Refer to p.52)

One rotary switch. The unit number is set in single-digit hexadecimal for the network to which the PLC is connected.

Node address switches (Refer to p.53)

Two rotary switches. The node address of the Unit on the Controller Link Network is set in 2-digit decimal.

Baud rate switch (Refer to p.54)

A four-pin DIP switch. The following setting is made.
Pins 1, 2: Baud rate
Pins 3, 4: Not used (always OFF)

Terminating resistance switch (Refer to p.54)

A slide switch. Use this switch to set the terminating resistance to ON for nodes at both ends of the Controller Link Network.

Terminal block for the communications cable (Refer to p.45)

Terminals to connect to the Controller Link Network communications cable (twisted-pair cable).

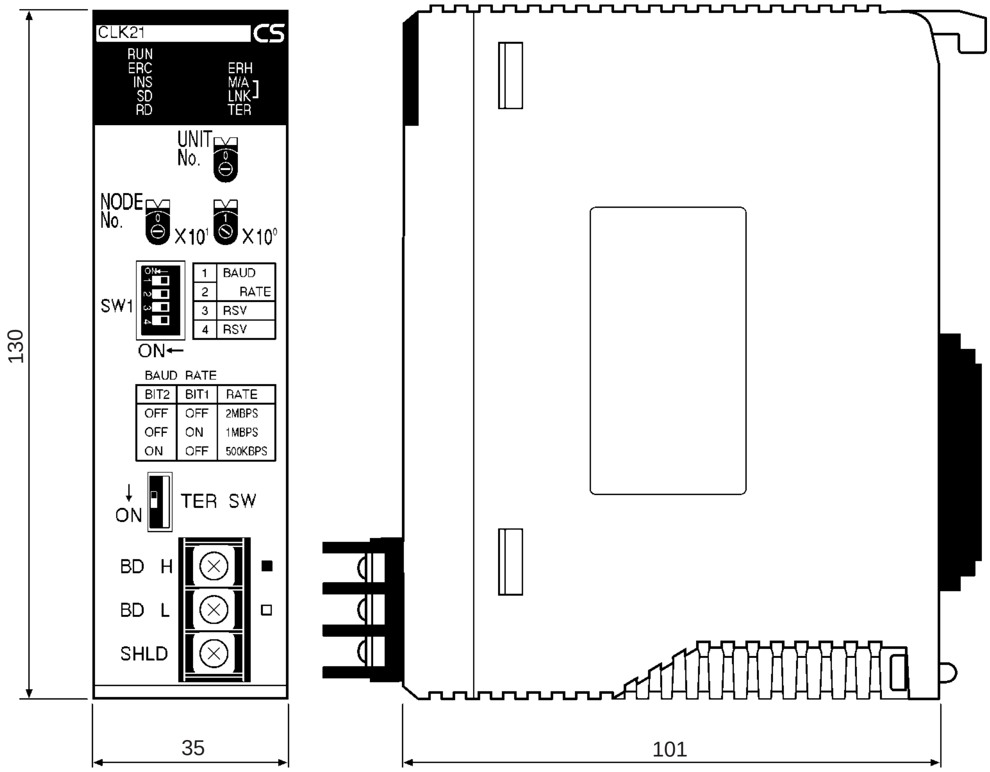
Wired Unit Indicators

Name	Color	Status	Meaning
RUN (operating)	Green	Lit	Unit operating normally.
		Not lit	Unit error.
ERC (communications error)	Red	Lit	Communications error, node address setting error (same address set twice), or hardware error.
		Not lit	Normal operation
ERH (PLC error)	Red	Lit	PLC error, PLC interface error, EEPROM error, unit number error, or I/O table not set
		Not lit	No error.
INS (network participation)	Yellow	Lit	Unit is participating (inserted) in the network.
		Not lit	Unit is not participating (inserted) in the network.
SD (send)	Yellow	Lit	Data transmission.
		Not lit	No data transmission.
RD (receive)	Yellow	Lit	Data reception.
		Not lit	No data reception.
M/A (data link mode)	Yellow	Lit	Manual (see note) **Note:** M/A is always not lit when data links are not active in the network.
		Not lit	Automatic
LNK (data link)	Yellow	Lit	Data links participating.
		Flashing	Error in data link table.
		Not lit	Not in a data link or data link inactive.
TER (terminating resistance)	Yellow	Lit	Terminating resistance switch ON.
		Not lit	Terminating resistance switch OFF.

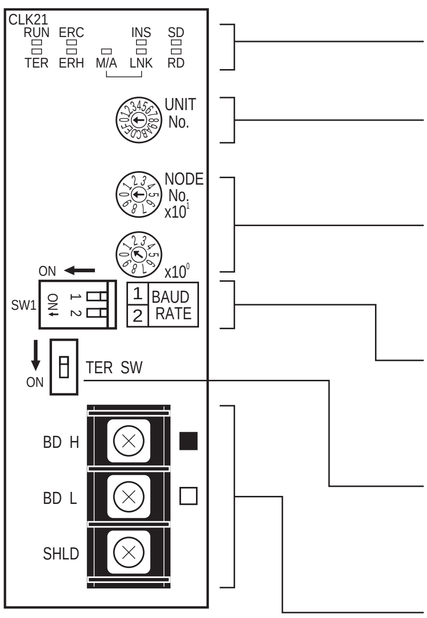
Note Even when the local node does not participate in the data link, the indicator will be lit if there are manually set data links active on the network.

For details refer to *9-1 Troubleshooting Using Indicators*.

Dimensions (Unit: mm)



3-1-2 CJ-series Controller Link Units



Indicators (Refer to page 29, page 220)
LED indicators that display the Unit and network status.

Unit Number Switch (Refer to page 52)
One rotary switch. The unit number is set in single-digit hexadecimal for the network to which the PLC is connected.

Node address switches (Refer to page 53)
Two rotary switches. The node address of the Unit on the Controller Link Network is set in 2-digit hexadecimal.

Baud rate switch (Refer to page 54)
A 2-pin DIP switch used to set the baud rate.

Terminating resistance switch (Refer to page 54)
A slide switch. Use this switch to set the terminating resistance to ON for nodes at both ends of the Controller Link Network.

Terminal block for the communications cable (Refer to page 44)
Terminals to connect the Controller Link Network communications cable (twisted-pair cable).

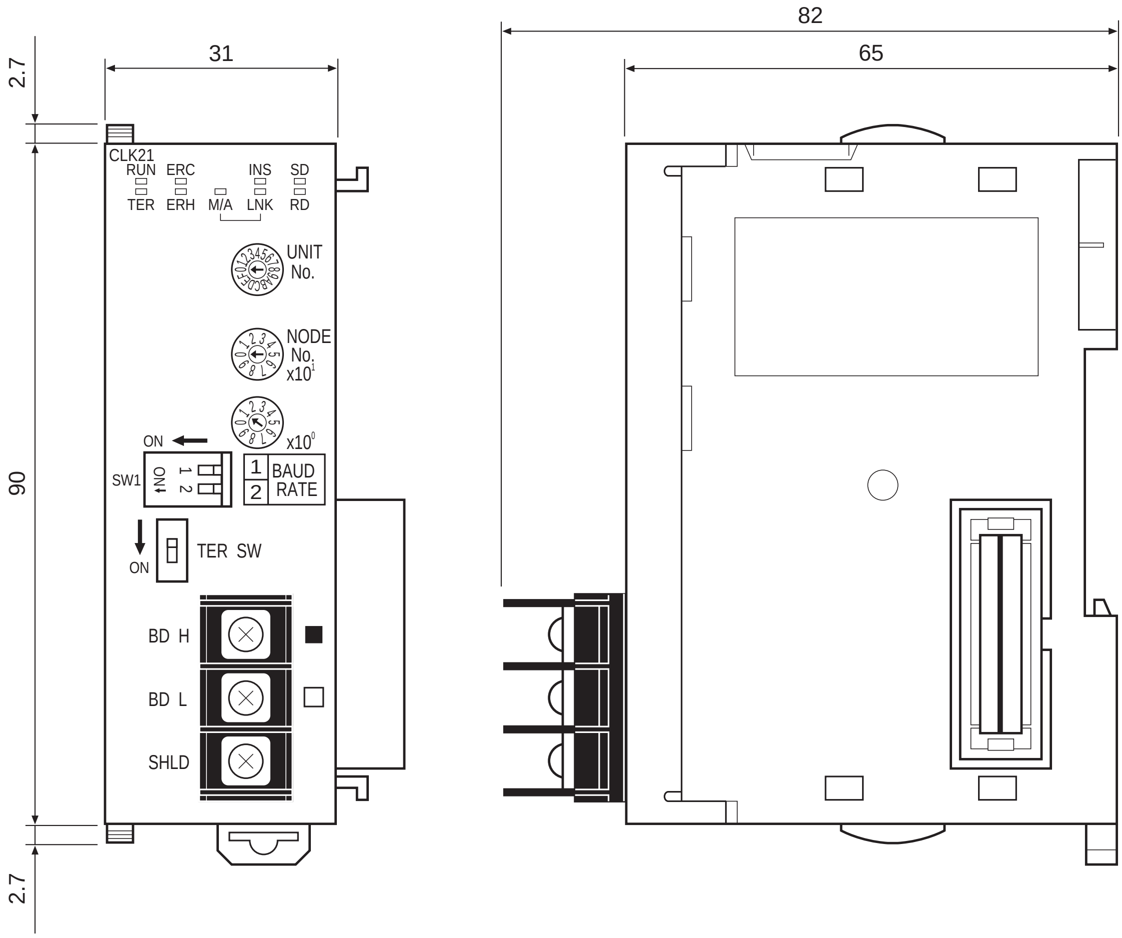
Wired Unit Indicators

<table>
<tr><th>Name</th><th>Color</th><th>Status</th><th colspan="2">Meaning</th></tr>
<tr><td rowspan="2">RUN
(operating)</td><td rowspan="2">Green</td><td>Lit</td><td colspan="2">Unit operating normally.</td></tr>
<tr><td>Not lit</td><td colspan="2">Unit error.</td></tr>
<tr><td rowspan="2">TER
(terminating resistance)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Terminating resistance switch is ON.</td></tr>
<tr><td>Not lit</td><td colspan="2">Terminating resistance switch is OFF.</td></tr>
<tr><td rowspan="2">ERC (communications error)</td><td rowspan="2">Red</td><td>Lit</td><td colspan="2">Communications error, node address setting error (same address set twice), or hardware error.</td></tr>
<tr><td>Not lit</td><td colspan="2">Normal operation</td></tr>
<tr><td rowspan="2">ERH
(PLC error)</td><td rowspan="2">Red</td><td>Lit</td><td colspan="2">PLC error, PLC interface error, EEPROM error, unit number error, or I/O table not set</td></tr>
<tr><td>Not lit</td><td colspan="2">No error.</td></tr>
<tr><td rowspan="2">INS
(network participation)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Unit is participating (inserted) in the network.</td></tr>
<tr><td>Not lit</td><td colspan="2">Unit is not participating (inserted) in the network.</td></tr>
<tr><td rowspan="2">SD
(send)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Data transmission.</td></tr>
<tr><td>Not lit</td><td colspan="2">No data transmission.</td></tr>
<tr><td rowspan="2">RD
(receive)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Data reception.</td></tr>
<tr><td>Not lit</td><td colspan="2">No data reception.</td></tr>
<tr><td rowspan="2">M/A
(data link mode)</td><td rowspan="2">Yellow</td><td>Lit</td><td>Manual
(see note)</td><td rowspan="2">Note:
M/A is always not lit when data links are not active in the network.</td></tr>
<tr><td>Not lit</td><td>Automatic</td></tr>
<tr><td rowspan="3">LNK
(data link)</td><td rowspan="3">Yellow</td><td>Lit</td><td colspan="2">Data links participating.</td></tr>
<tr><td>Flashing</td><td colspan="2">Error in data link table.</td></tr>
<tr><td>Not lit</td><td colspan="2">Not in a data link or data link inactive.</td></tr>
</table>

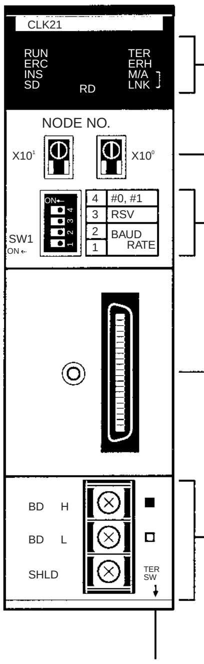
Note Even when the local node does not participate in the data link, the M/A indicator will be lit if there are manually set data links active on the network.

For details, refer to *9-1 Troubleshooting Using Indicators*.

Dimensions (Unit: mm)



3-1-3 C200HX/HG/HE Controller Link Unit



Indicators (Refer to p. 34 and 220)

LED indicators that display the Unit and network status.

Node address switches (Refer to p. 59)

Two rotary switches. The node address of the Unit on the Controller Link Network is set in 2-digit decimal.

Baud rate and operating level settings (Refer to p. 59)

A four-pin DIP switch. The following settings are made.

Pins 1, 2: Baud rate
Pin 3: Not used (leave set to OFF)
Pin 4: Operating level

Bus Connection Unit Connector (Refer to p. 40)

Connector used for connection to the CPU Unit.

Terminal block for the communications cable (Refer to p. 45)

Terminals to connect to the Controller Link Network communications cable (twisted-pair cable).

Terminating resistance switch (underneath the Unit) (Refer to p. 60)

A slide switch. Use this switch to set the terminating resistance to ON for nodes at both ends of the Controller Link Network.

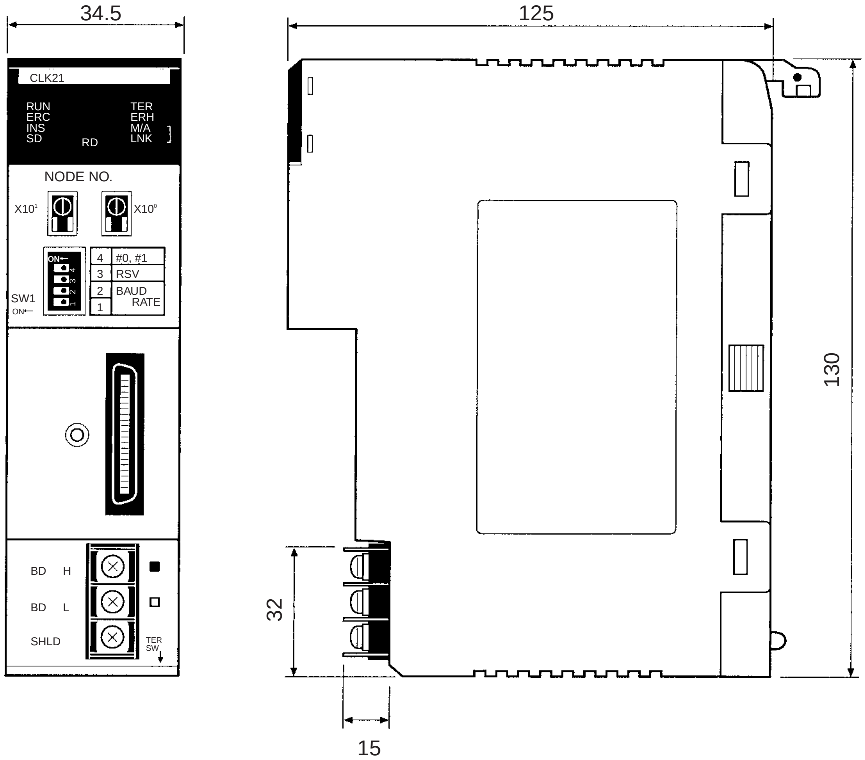
Wired Unit Indicators

<table>
<tr><th>Name</th><th>Color</th><th>Status</th><th colspan="2">Meaning</th></tr>
<tr><td rowspan="2">RUN
(operating)</td><td rowspan="2">Green</td><td>Lit</td><td colspan="2">Unit operating normally.</td></tr>
<tr><td>Not lit</td><td colspan="2">Unit error.</td></tr>
<tr><td rowspan="2">TER
(terminating resistance)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Terminating resistance switch ON.</td></tr>
<tr><td>Not lit</td><td colspan="2">Terminating resistance switch OFF.</td></tr>
<tr><td rowspan="2">ERC (communica-tions error)</td><td rowspan="2">Red</td><td>Lit</td><td colspan="2">Communications error, node address setting error (same address set twice), or hardware error.</td></tr>
<tr><td>Not lit</td><td colspan="2">Normal operation</td></tr>
<tr><td rowspan="2">ERH
(PLC error)</td><td rowspan="2">Red</td><td>Lit</td><td colspan="2">PLC error, PLC interface error, EEPROM error, or PLC model setting error.</td></tr>
<tr><td>Not lit</td><td colspan="2">No error.</td></tr>
<tr><td rowspan="2">INS
(network participation)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Unit is participating (inserted) in the net-work.</td></tr>
<tr><td>Not lit</td><td colspan="2">Unit is not participating (inserted) in the network.</td></tr>
<tr><td rowspan="2">M/A
(data link mode)</td><td rowspan="2">Yellow</td><td>Lit</td><td>Manual
(see note)</td><td rowspan="2">Note:
M/A is always not lit when data links are not active in the network.</td></tr>
<tr><td>Not lit</td><td>Automatic</td></tr>
<tr><td rowspan="3">LNK
(data link)</td><td rowspan="3">Yellow</td><td>Lit</td><td colspan="2">Data links participating.</td></tr>
<tr><td>Flashing</td><td colspan="2">Error in data link table.</td></tr>
<tr><td>Not lit</td><td colspan="2">Not in a data link or data link inactive.</td></tr>
<tr><td rowspan="2">SD
(send)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Data transmission.</td></tr>
<tr><td>Not lit</td><td colspan="2">No data transmission.</td></tr>
<tr><td rowspan="2">RD
(receive)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Data reception.</td></tr>
<tr><td>Not lit</td><td colspan="2">No data reception.</td></tr>
</table>

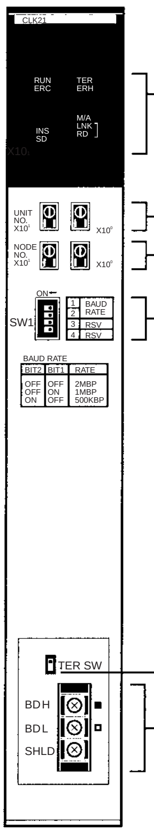
Note Even when the local node does not participate in the data link, the indicator will be lit if there are manually set data links active on the network.

For details refer to *9-1 Troubleshooting Using Indicators*.

Dimensions (Unit: mm)



3-1-4 CVM1 and CV-series Controller Link Unit



Indicators (Refer to p. 36 and 228)

LED indicators that display the Unit and network status.

Unit number switches (Refer to p. 62)

Two rotary switches. The unit number is set in 2-digit decimal for the Network to which the PLC is connected.

Node address switches (Refer to p. 62)

Two rotary switches. The node address of the Unit on the Controller Link Network is set in 2-digit decimal.

Baud rate switch (Refer to p. 63)

A four-pin DIP switch. The following setting is made.
Pins 1, 2: Baud rate
Pins 3, 4: Not used (always OFF)

Terminating resistance switch (Refer to p. 63)

A slide switch. Use this switch to set the terminating resistance to ON for nodes at both ends of the Controller Link Network.

Terminal block for the communications cable (Refer to p. 45)

Terminals to connect to the Controller Link Network communications cable (twisted-pair cable).

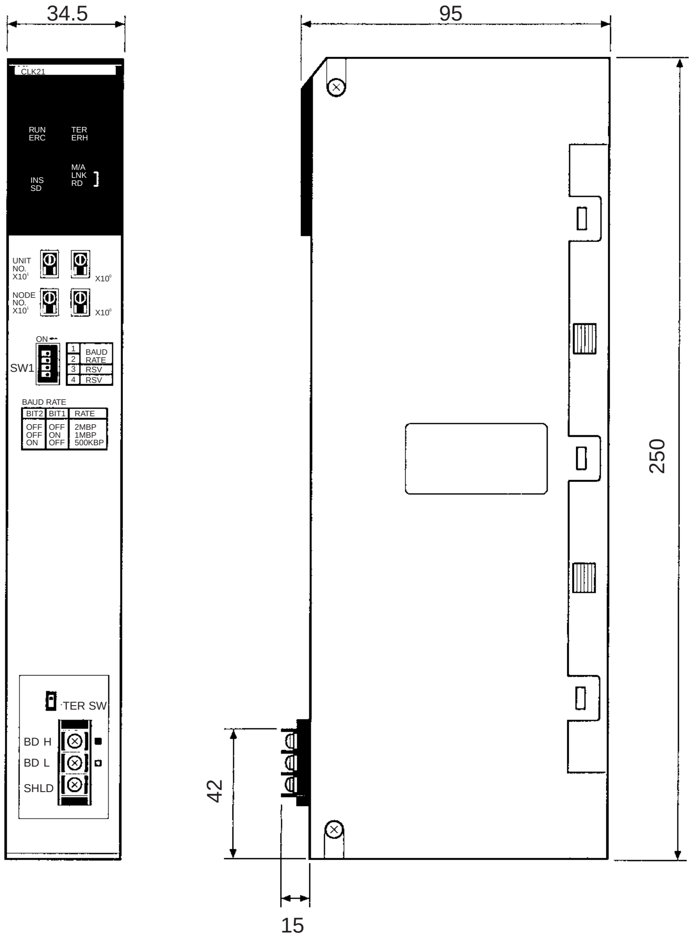
Wired Unit Indicators

<table>
<tr><th>Name</th><th>Color</th><th>Status</th><th colspan="2">Meaning</th></tr>
<tr><td rowspan="2">RUN
(operating)</td><td rowspan="2">Green</td><td>Lit</td><td colspan="2">Unit operating normally.</td></tr>
<tr><td>Not lit</td><td colspan="2">Unit error.</td></tr>
<tr><td rowspan="2">TER
(terminating resistance)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Terminating resistance switch ON.</td></tr>
<tr><td>Not lit</td><td colspan="2">Terminating resistance switch OFF.</td></tr>
<tr><td rowspan="2">ERC (communica-tions error)</td><td rowspan="2">Red</td><td>Lit</td><td colspan="2">Communications error, node address setting error (same address set twice), or hardware error.</td></tr>
<tr><td>Not lit</td><td colspan="2">Normal operation</td></tr>
<tr><td rowspan="2">ERH
(PLC error)</td><td rowspan="2">Red</td><td>Lit</td><td colspan="2">PLC error, PLC interface error, EEPROM error, unit number error, or I/O table not set</td></tr>
<tr><td>Not lit</td><td colspan="2">No error.</td></tr>
<tr><td rowspan="2">INS
(network participation)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Unit is participating (inserted) in the net-work.</td></tr>
<tr><td>Not lit</td><td colspan="2">Unit is not participating (inserted) in the network.</td></tr>
<tr><td rowspan="2">M/A
(data link mode)</td><td rowspan="2">Yellow</td><td>Lit</td><td>Manual
(see note)</td><td rowspan="2">Note:
M/A is always not lit when data links are not active in the network.</td></tr>
<tr><td>Not lit</td><td>Automatic</td></tr>
<tr><td rowspan="3">LNK
(data link)</td><td rowspan="3">Yellow</td><td>Lit</td><td colspan="2">Data links participating.</td></tr>
<tr><td>Flashing</td><td colspan="2">Error in data link table.</td></tr>
<tr><td>Not lit</td><td colspan="2">Not in a data link or data link inactive.</td></tr>
<tr><td rowspan="2">SD
(send)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Data transmission.</td></tr>
<tr><td>Not lit</td><td colspan="2">No data transmission.</td></tr>
<tr><td rowspan="2">RD
(receive)</td><td rowspan="2">Yellow</td><td>Lit</td><td colspan="2">Data reception.</td></tr>
<tr><td>Not lit</td><td colspan="2">No data reception.</td></tr>
</table>

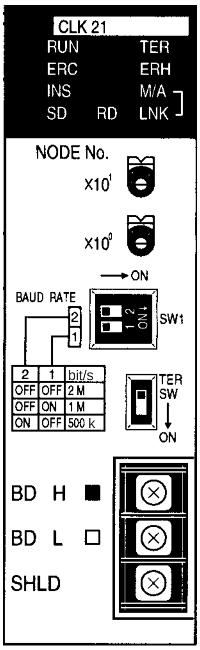
Note Even when the local node does not participate in the data link, the indicator will be lit if there are manually set data links active on the network.

For details refer to *9-1 Troubleshooting Using Indicators*.

Dimensions (Unit: mm)



3-1-5 CQM1H-series Controller Link Unit



Indicators (Refer to p. 38 and 220)

LED indicators that display the Unit and network status.

Node address switches (Refer to p. 64)

Two rotary switches. The node address of the Unit on the Controller Link Network is set in 2-digit decimal.

Baud rate switch (Refer to p. 65)

Terminating resistance switch (Refer to p. 65)

A slide switch. Use this switch to set the terminating resistance to ON for the nodes at both ends of the Controller Link Network.

Terminal block for the communications cable (Refer to p. 45)

Terminals to connect to the Controller Link Network communications cable (twisted-pair cable).

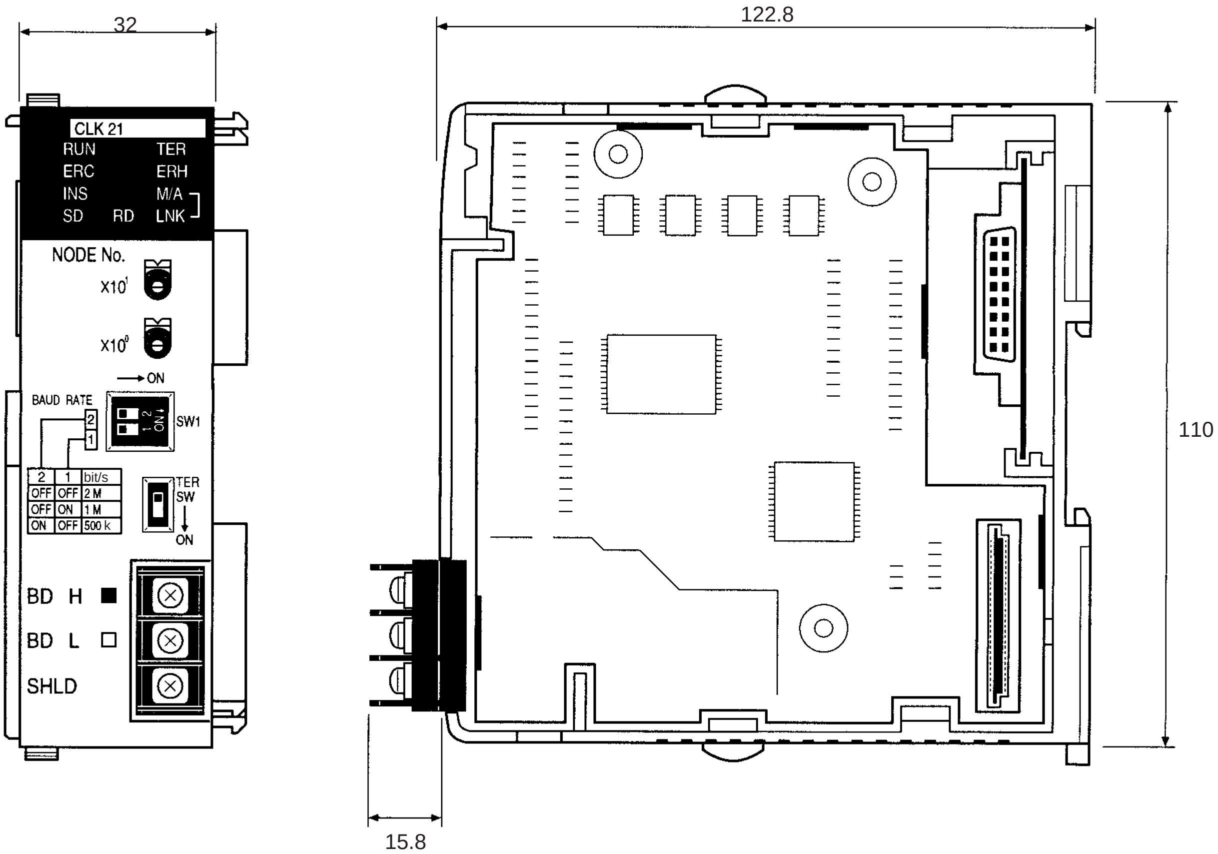
Wired Unit Indicators

Name	Color	Status	Meaning
RUN (operating)	Green	Lit	Unit operating normally.
		Not lit	Unit error.
TER (terminating resistance)	Yellow	Lit	Terminating resistance switch ON.
		Not lit	Terminating resistance switch OFF.
ERC (communications error)	Red	Lit	Communications error, node address setting error (same address set twice), or hardware error.
		Not lit	Normal operation
ERH (PLC error)	Red	Lit	PLC error, PLC interface error, or EEPROM error
		Not lit	No error.
INS (network participation)	Yellow	Lit	Unit is participating (inserted) in the network.
		Not lit	Unit is not participating (inserted) in the network.
M/A (data link mode)	Yellow	Lit	Manual (see note) **Note:** M/A is always not lit when data links are not active in the network.
		Not lit	Automatic
LNK (data link)	Yellow	Lit	Participating in data links.
		Flashing	Error in data link tables.
		Not lit	Not in a data link or data link inactive.
SD (send)	Yellow	Lit	Data transmission.
		Not lit	No data transmission.
RD (receive)	Yellow	Lit	Data reception.
		Not lit	No data reception.

Note Even when the local node does not participate in the data link, the indicator will be lit if there are manually set data links active on the network.

For details refer to *9-1 Troubleshooting Using Indicators*.

Dimensions (Unit: mm)



3-2 Installation

The Controller Link Unit is mounted onto a CPU Backplane or Expansion CPU Backplane for use. For detailed information on into a PLC installation procedures, refer to the PLC Installation Guide.

Note

1. Always turn off power to the PLC before mounting the Controller Link Unit into the Backplane or connecting the Bus Connection Unit.
2. Be sure that all screws on the Backplane, the Bus Connection Unit, the terminal block, and cables are tightened firmly. If screws work loose, a malfunction may occur as a result of vibration.
3. A label has been placed over the upper surface of the Controller Link Unit to prevent scraps of wire from entering the Unit. Conduct wiring and installation with this label in place. If wire scraps get into the Unit, it will malfunction.
4. Remove the label after wiring and installing the Controller Link Unit to prevent overheating. Overheating will cause the Unit to malfunction.

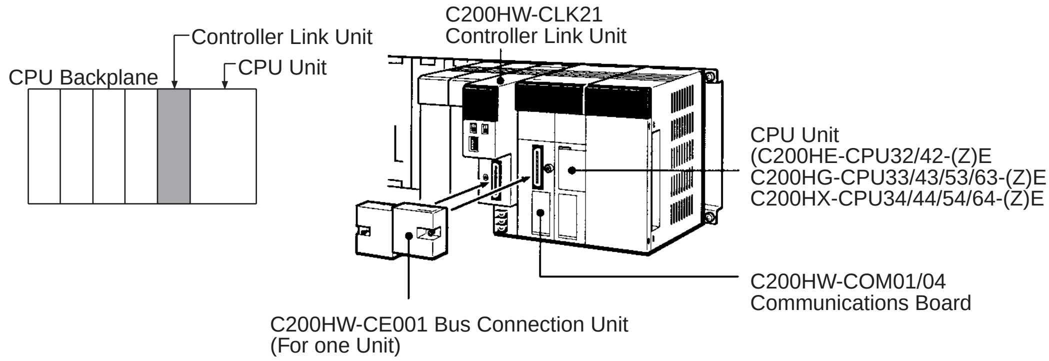
3-2-1 C200HX/HG/HE PLCs

Up to two C200HX/HG/HE Controller Link Units can be mounted on the CPU Rack. Controller Link Units cannot be mounted to an Expansion I/O Rack or a Slave Rack.

Note Tighten the screws on the Backplane to a torque of 1.2 N • m.
Tighten the screws on the Bus Connection Unit to a torque of 0.4 N • m.

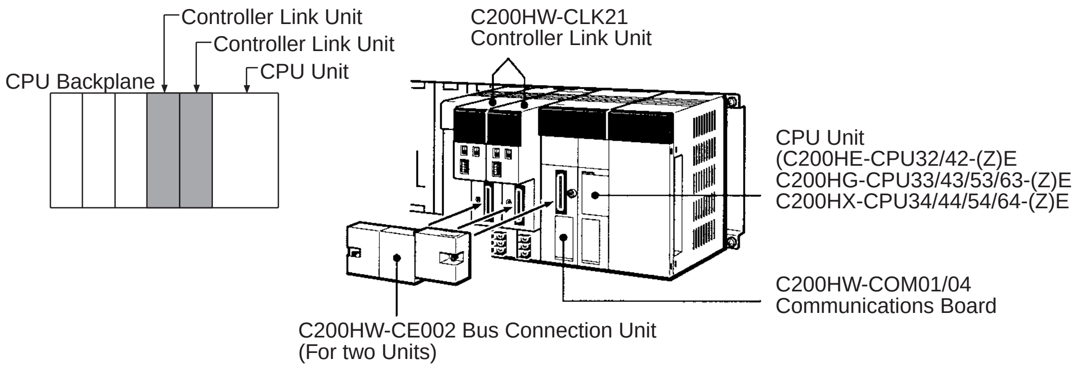
Installing One Controller Link Unit

Mount the Unit in the slot on the left of the CPU Unit.



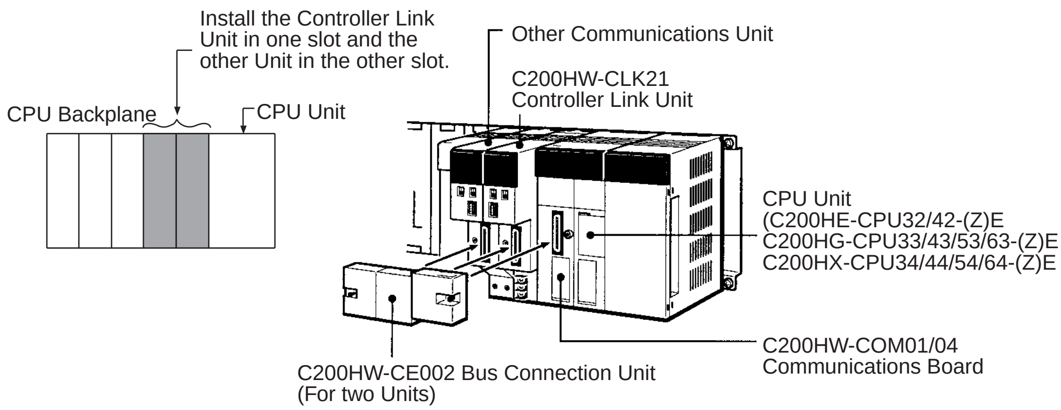
Installing Two Controller Link Units

Mount the Units in the two slots on the left of the CPU Unit.



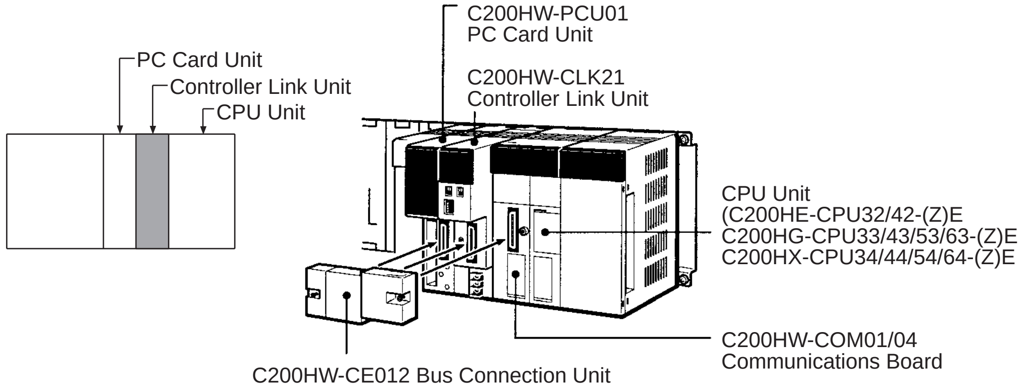
Installing with Another Communications Unit

When installing a Controller Link Unit along with another Communications Unit, such as a SYSMAC LINK Unit or a SYSMAC NET LINK Unit mount both Units in the 2 slots on the left of the CPU Unit.



Installing with a PC Card Unit

When installing a Controller Link Unit along with a PC Card Unit, mount the Controller Link Unit in the first slot on the left of the CPU Unit. Use the C200HW-CE012 Bus Connection Unit.

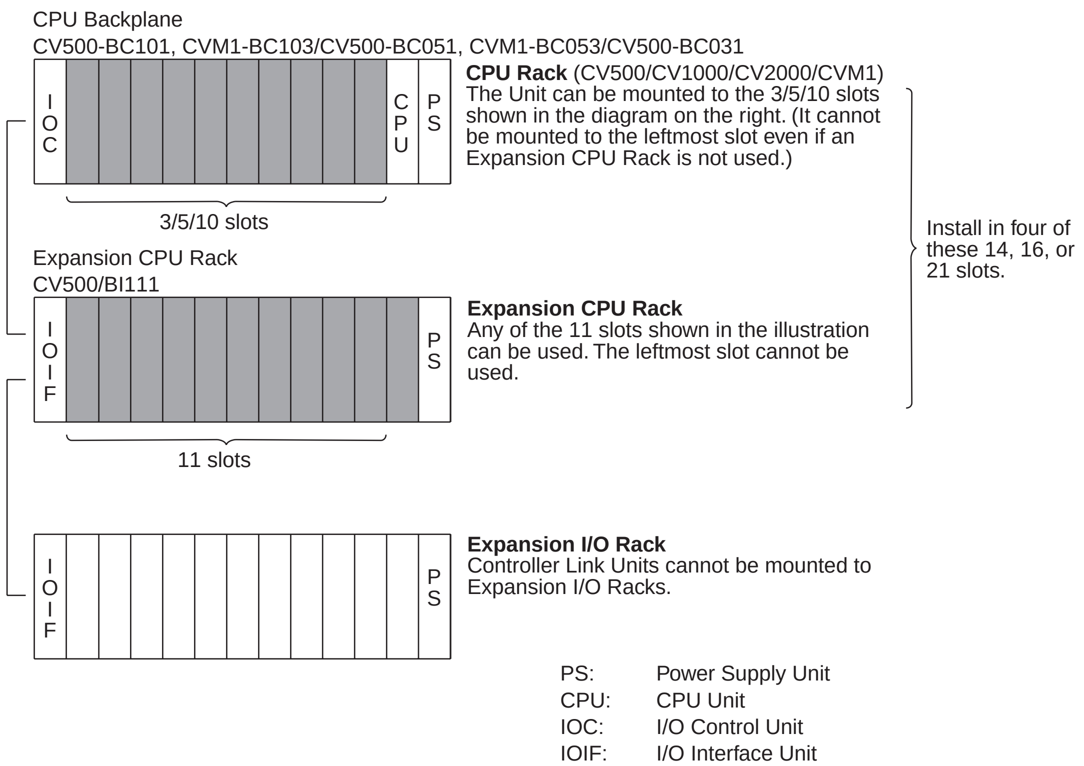


3-2-2 CVM1 and CV-series PLCs

Up to four Controller Link Units for CVM1 and CV-series PLCs can be installed in a CPU Backplane or a Expansion CPU Rack (including both Optical and Wired Units). Controller Link Units cannot be installed on an Expansion I/O Rack, a SYSMAC BUS Slave Rack, or a SYSMAC BUS/2 Slave Rack.

The CVM1 and CV-series Controller Link Unit is classified as a CPU Bus Unit and must be mounted in a CPU bus slot.

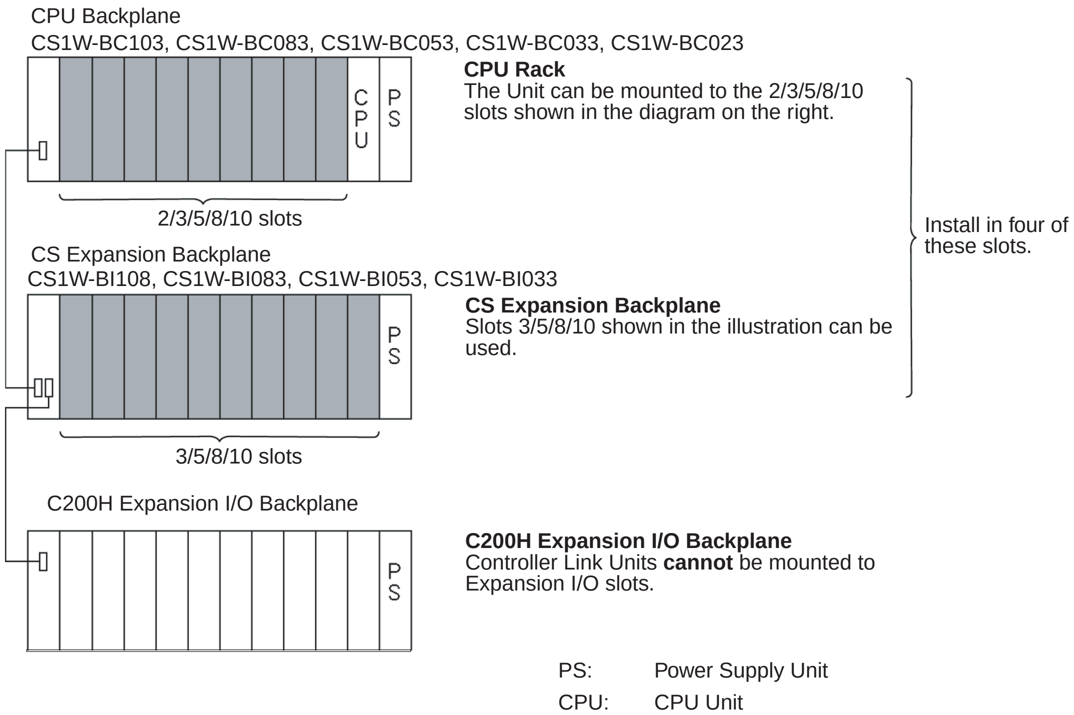
Note Tighten the screws on the Backplane to a torque of 1.2 N • m.
Tighten the fixed screws on the CPU Unit to a torque of 0.9 N • m.



3-2-3 CS-series PLCs

Up to a total of four Controller Link Units (wired, optical, and optical ring) for CS-series PLCs can be installed in a CPU Backplane or a CS Expansion Rack. Controller Link Units cannot be installed on an C200H Expansion I/O Rack or a SYSMAC BUS Slave Rack.

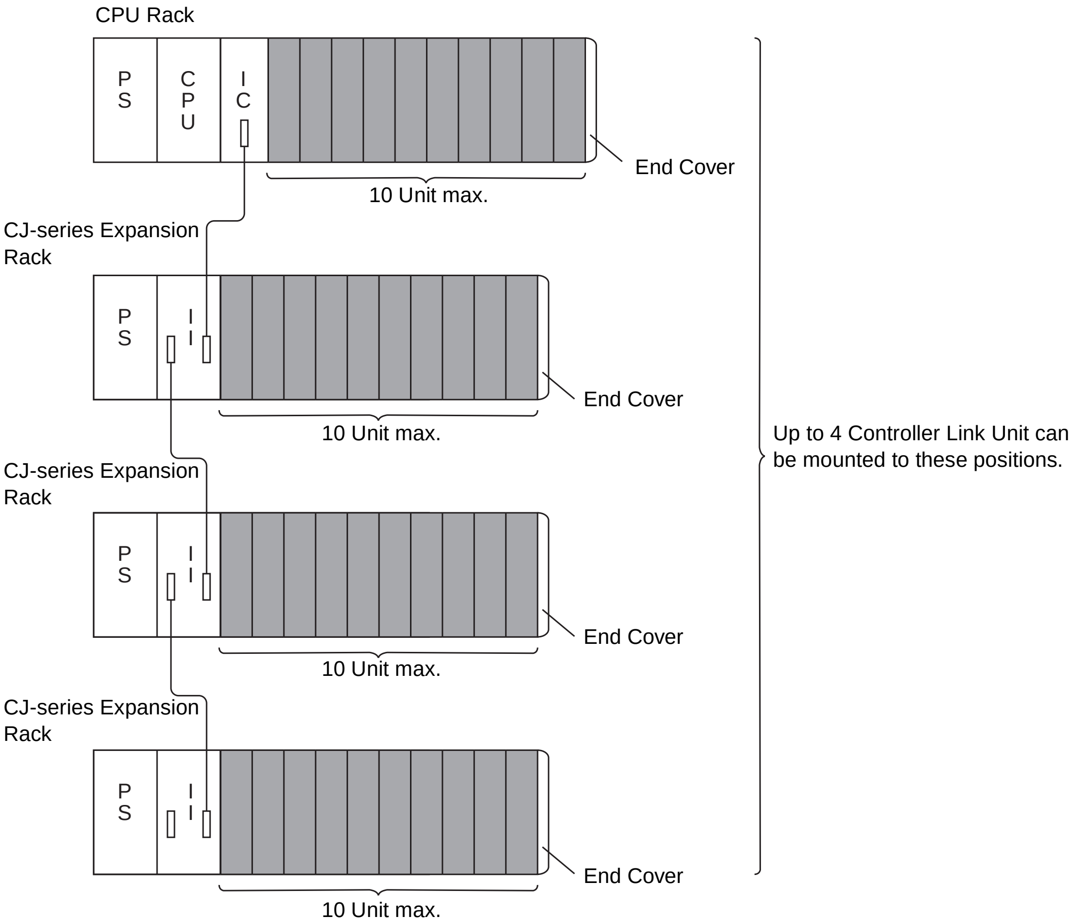
Note Tighten the screws on the Backplane to a torque of 0.9 N • m.
Tighten the fixed screws on the CPU Unit to a torque of 0.4 N • m.



Note When installing several CS-series CPU Bus Units at the same time, a total of 16 CS-series CPU Bus Units maximum may be installed.

3-2-4 CJ-series PLCs

Up to a total of four Controller Link Units for CJ-series PLCs can be connected in a CPU Rack or a Expansion Rack. (Be sure to secure the Units with the top and bottom sliders.)



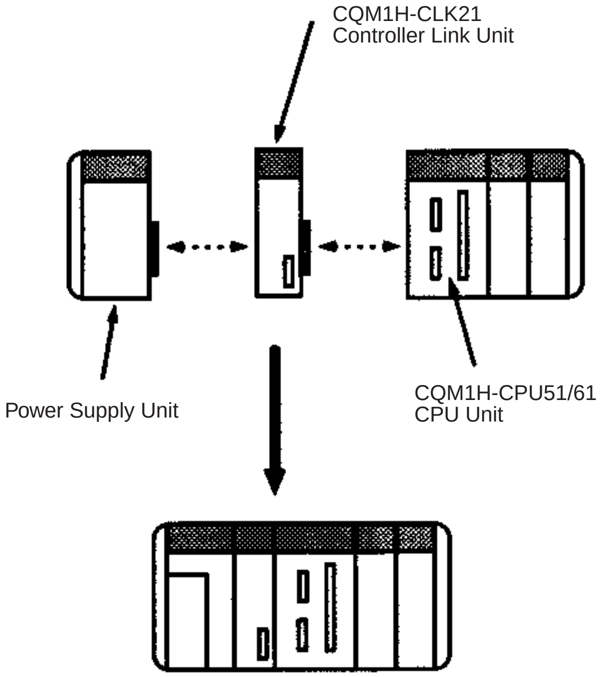
PS: Power Supply Unit
CPU: CPU Unit
IC: I/O Control Unit
II: I/O Interface Unit

Note When installing several CJ-series CPU Bus Units at the same time, a total of 16 CJ-series CPU Bus Units maximum may be installed.

3-2-5 CQM1H-series PLCs

Only one Controller Link Unit can be connected in a CQM1H-series PLC. Connect the Controller Link Unit to the left side of the CPU Unit and then connect the Power Supply Unit to the left of the Controller Link Unit.

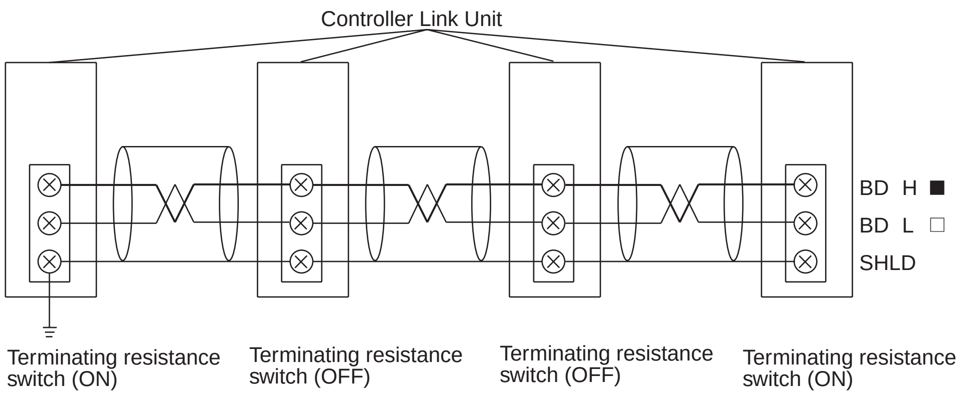
After the Units have been connected, secure them with the slide locks on the top and bottom of the Units.



Note The CQM1H-CLK21 Controller Link Unit can be connected only to the CQM1H-CPU51/61 CPU Unit. It cannot be connected to the CQM1H-CPU11/21 CPU Unit.

3-3 Wired Controller Link Unit Wiring

Using the specified twisted-pair cable, connect all nodes using the multidrop method.



3-3-1 Communications Cables

The following shielded twisted-pair cables should be used for Controller Link Network connections.

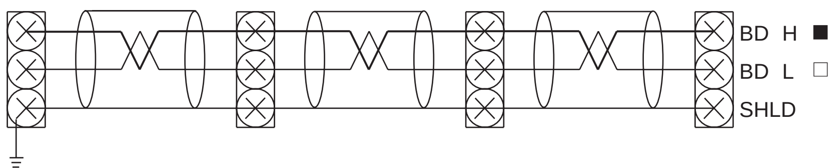
Model	Manufacturer
Li2Y-FCY2 x 0.56 qmm	Kromberg & Schubert, Komtec Department
1 x 2 x AWG – 20PE + Tr.CUSN + PVC	Draka Cables Industrial
#9207	Belden
ESVC 0.5 x 2 C	Bando Densen Co.
ESNC0.5X2C-99-087B	Japan Electric Wire & Cable Co.

Note

1. Use the specified cable only.
2. Keep communications cables separated from power lines or a high-tension lines to prevent influences from electronic noise.
3. Do not connect the shield cable of the communications cable to a ground that is also being used for power-system devices, such as inverters.
4. Ground the shield line of the communications cable at one end of the network. Do not ground the shield at both ends.
5. Do not run wiring outdoors. If outdoor wiring is necessary, take protective measures against lightning, such as underground wiring or wiring inside pipes.
6. The minimum length of the communications cable between nodes is 1 m. Prepare the communications cables at a length of 1 m or more.
7. Use the multidrop method for connecting nodes. Normal communications will not be possible with T branches.
8. Turn ON the terminating resistance switch at the nodes at both ends of the network to connect terminating resistance. Turn OFF the terminating resistance switch at all other nodes.
9. A label has been placed over the upper surface of the Controller Link Unit to prevent scraps of wire from entering the Unit. Conduct wiring and installation with this label in place. If wire scraps get into the Unit, it will malfunction (C200HW-CLK21, CS1W-CLK21, CJ1W-CLK21, and CQM1H-CLK21 only).
10. Remove the label after wiring to avoid overheating. Overheating will cause the Unit to malfunction (C200HW-CLK21, CS1W-CLK21, CJ1W-CLK21, and CQM1H-CLK21 only).

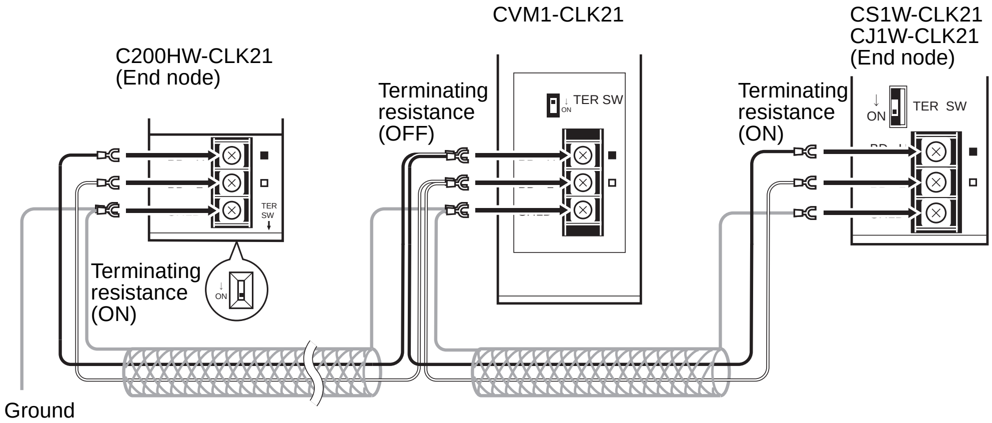
Connecting the Shield Line

Connect both ends of the shield line to the terminal blocks and earth the terminal block at the one end of the network.



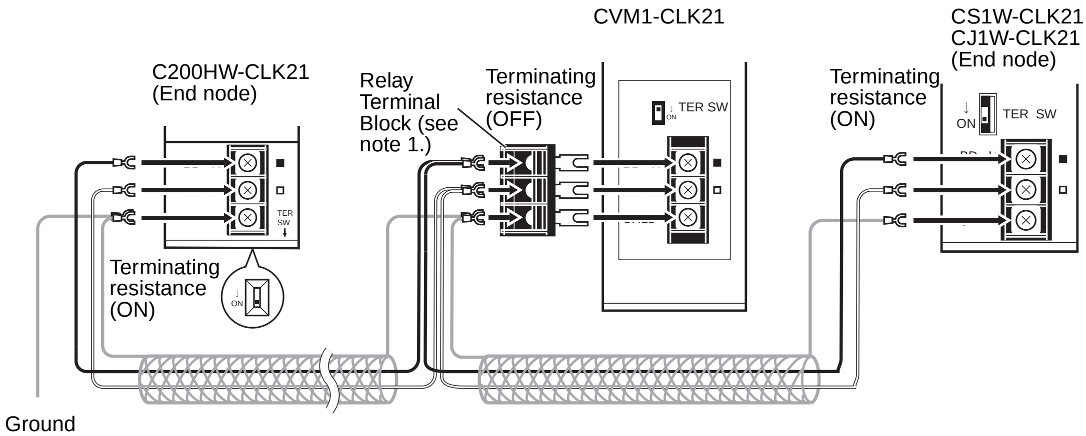
Terminal Block Connections

Not Unit a Relay Terminal Block



Note Use the recommended crimp terminals when connecting the cable's signal lines or shield line to the terminal blocks. Short circuits can damage the Units.

Using a Relay Terminal Block



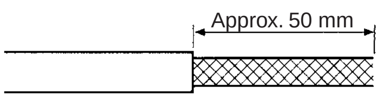
Note
1. Mounting and dismounting during communications is not possible for Relay Terminal Blocks connected to the nodes at the ends of the network (i.e.: the nodes with terminating resistance).
2. Use the recommended crimp terminals when connecting the cable's signal lines or shield line to the terminal blocks. Short circuits can damage the Units.

3-3-2 Connecting the Communications Cables

Use crimp terminals when connecting communications cables to a Controller Link Unit. Use the following procedure to connect communications cables to a terminal block.

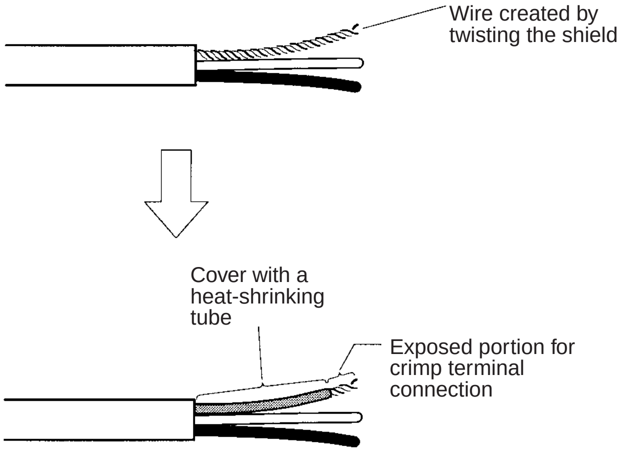
1,2,3...

1. Peel back the cover of the cable for about 50 mm without scratching the mesh of the shield. Do not peel too much because it may cause a short-circuit.

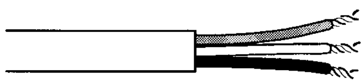


2. Twist the mesh of the shield to form a line.

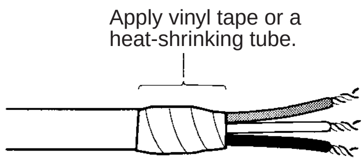
3. Leave the tip of the wire created by twisting the shield exposed and cover the remaining section with a heat-shrinking tube.



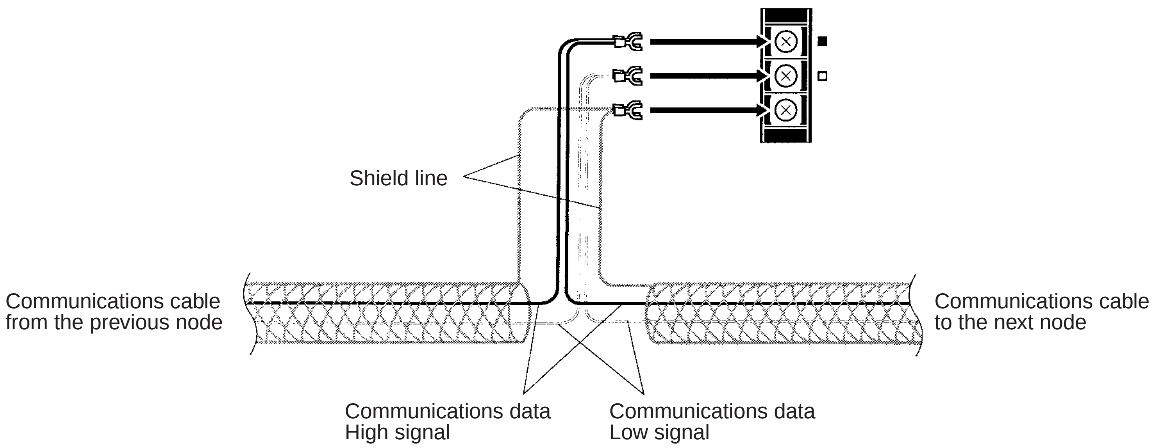
4. Remove enough of the cover from the signal lines to allow the crimp terminals to be connected, taking care not to damage the signal lines. Damage to the signal lines could cause the cable to break.
5. Twist firmly the portion of the signal lines that are exposed.



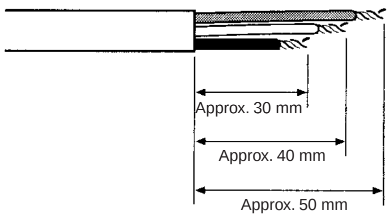
6. Apply vinyl tape or heat-shrinking tube to the end of the cover that was peeled in step 1.

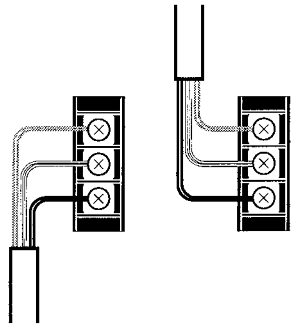


7. Mount the crimp terminal onto the signal lines and the shield line. Use M3 crimp terminals.
8. Connect the signal lines and the shield line to the terminal block using the markings on the terminal block.

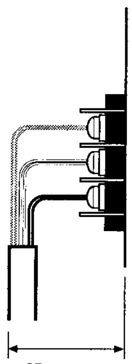


Note a) You can change the length of the signal lines as shown in the following diagrams to make wiring a lot easier.



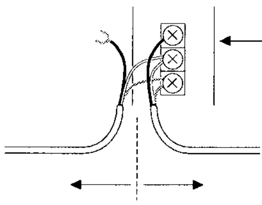


b) The approximate dimension for when the cable has been wired from the terminal block along the front of the Unit is shown in the following diagram.

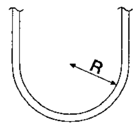


Note
1. Always turn OFF the power to the PLC before connecting the communications cables.
2. Always use a crimp terminal for wiring. If a wire that has only been twisted is connected directly to a terminal block, short circuit, malfunction and product damage will result.
3. Use the recommended crimp terminals.
4. When mounting the crimp terminal, always use the appropriate tools for each crimp terminal and follow the appropriate installation procedures. Contact the crimp terminal manufacturer for details on the appropriate tools and procedures. Failure to use the appropriate tools and procedures could cause cables to break.
5. Measure the length of peeled cable during installation according to the crimp terminal used and make sure that the peeled length is not too long. Cover the compressed section of the crimp terminal and cable with vinyl tape or heat-shrinking tube.
6. Be sure not to confuse the signal lines and shield line connections.
7. Tighten the screws on the terminal block firmly. The correct tightening torque is 0.5 N.
8. If a signal line disconnects from the terminal, either the Unit will be unable to communicate with other nodes on the network or that section of the net-

work will be isolated from other nodes. Be sure not to pull on the signal lines.



9. Do not pull on a communication cable.
10. When bending a communications cable, allow 60 mm or more for the bending radius (R).



11. Do not place any object on the communications cable.
12. Supply power only after checking the wiring thoroughly.
13. Connect the terminal block only after checking it thoroughly.
14. Marks are provided on the terminal block for the signal lines. Connect the signal lines according to the marks. The marks correspond to signal lines as listed below.

Mark	Signal name	Line color
■	BDH (communications data high)	Black
□	BDL (communications data low)	White
None	SHLD (shield)	---

SECTION 4
Preparations for Communications

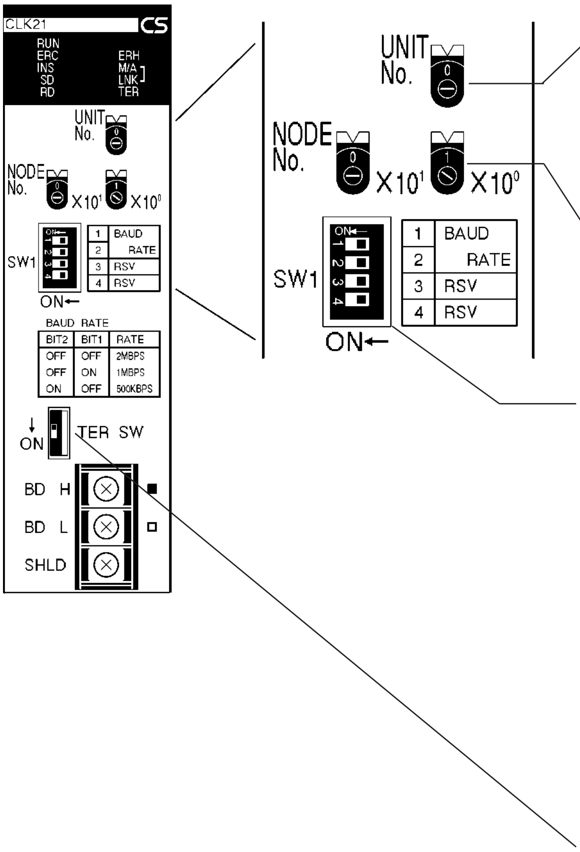
This section describes the settings required for starting communications. These basic settings are required for both data links function and the message service. Carry out the settings described here before turning on power to the Controller Link Unit.

4-1 CS-series Controller Link Units

The following settings are required for a Controller Link Unit used with a CS-series PLC.

Item	Switch	Page
Unit number	Unit number setting switch	52
Node address	Node address switches	53
Baud rate	Baud rate, pins 1 and 2	54
Terminating resistance	Terminating resistance switch	54

4-1-1 Overview



Unit Number

Setting range	Nodes
01 to F (default is 0)	All nodes in the Network

Node Address

Setting range	Nodes
01 to 32 (default is 01)	All nodes in the Network

Baud Rate

Pins		Baud rate	Maximum transmission distance	Nodes
Pin 1	Pin 2			
OFF	**OFF**	2 Mbps	500 m	Set same rate for all nodes in the Network.
ON	OFF	1 Mbps	800 m	
OFF	ON	500 Kbps	1 km	
ON	ON	Cannot be set.		

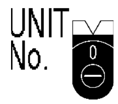
Note Factory default setting is in bold.
Always leave pins 3 and 4 OFF.

Terminating Resistance

Front switch	Terminating resistance	Nodes
OFF (factory default)	Not connected	All nodes in the Network Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.
ON	Connected	

4-1-2 Unit Number

Set the unit number for each Unit using the rotary switches on the front of the Unit. The unit number is used to identify a CPU Bus Unit within the PLC. Any unit number can be set between 0 and F in hexadecimal (00 to 15 in decimal)



Note: The factory default settings are shown above.

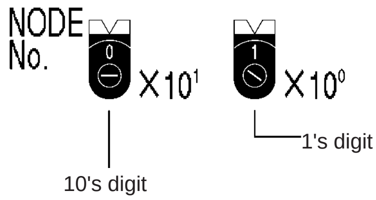
Item	Specifications
Setting method	Single-digit hexadecimal
Setting range	0 to F (decimal 00 to 15, default is 0)
Node	All nodes in the Network

Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

Note
1. Always turn OFF the PLC's power before setting the unit number.
2. When setting a Unit for the first time or changing the existing setting, create a I/O table in the PLC's CPU Unit.
3. Do not set the same unit number twice within the same PLC. An error will occur if the same unit number is set for two different Unit, and the CPU Unit will not be able to recognize the Units.
4. When the Unit is recognized by the PLC's CPU Unit, "NS" will be shown in the I/O table displayed for the CX-Programmer programming device.
5. The default setting is "0."
6. The unit number determines the words used by the Controller Link Unit in PLC memory.

4-1-3 Node Addresses

Set the node addresses of each Unit on the Network using the rotary switches on the front of the Unit. The node address is used to identify each node in the Network can be set to any number between 01 and 32.



Note: The factory default settings are shown above.

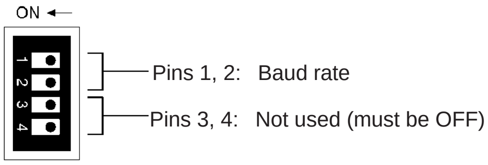
Item	Specifications
Setting method	2-digit decimal
Setting range	01 to 32 (default is 01)
Node	All nodes in the Network

Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

Note
1. Always turn OFF the PLC's power before setting the node address.
2. Do not set the same node address twice within the same Network. An error will occur if the same address is set for two different nodes. The ERC indicator on the front of the Unit will light (Communications Error Flag) and either communications will stop, or the INS indicator will not light and you will be unable to participate in the Network.
3. The send sequence for the data link areas is determined according to the sequence of node addresses for automatically set data links.
4. Assign node addresses consecutively beginning from 01 whenever possible to minimize Network construction time.

4-1-4 Baud Rates

Set the following pins for the baud rate settings (DIP switch).



Note: The factory default settings are shown above.

Note
1. Always turn OFF the PLC's power before setting the baud rate.
2. Keep pins 3 and 4 set to OFF.

Baud Rate (Pins 1 and 2)

Set the same baud rate for all the nodes on the Network using DIP switch pins 1 and 2 on the front of the Unit. The baud rate is set as shown below.

The maximum transmission distance will also change according to the setting.

Pins		Baud rate	Maximum transmission distance
Pin 1	Pin 2		
OFF	**OFF**	2 Mbps	500 m
ON	OFF	1 Mbps	800 m
OFF	ON	500 Kbps	1 km
ON	ON	Do not set.	

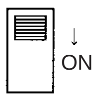
Note The factory default setting is shown in bold.

Note
1. Set the same baud rate for all the nodes on the Network. Normal communication cannot be performed unless the same baud rate is set for all the nodes.
2. The default setting is 2 Mbps, 500 m.

4-1-5 Terminating Resistance

Turn ON the terminating resistance using the switch on the bottom of the Unit for the Units of both ends of the Network. The terminating resistance is required at both ends of a Network to absorb unnecessary signals and reduce noise.

The Controller Link Unit has built-in terminating resistance, which can be connected simply by turning ON the slide switch.



Bottom switch	Terminating resistance
OFF (factory default)	Not connected.
ON	Connected.

Note
1. Always turn OFF the PLC's power before setting the terminating resistance switch.
2. Turn ON the switch to connect terminating resistance at the nodes at both ends of the Network and turn OFF the switch at all other nodes. Normal communication cannot be performed in the Network unless all the nodes are set properly.
3. The TER LED indicator will light when the terminating resistance switch is set to ON.

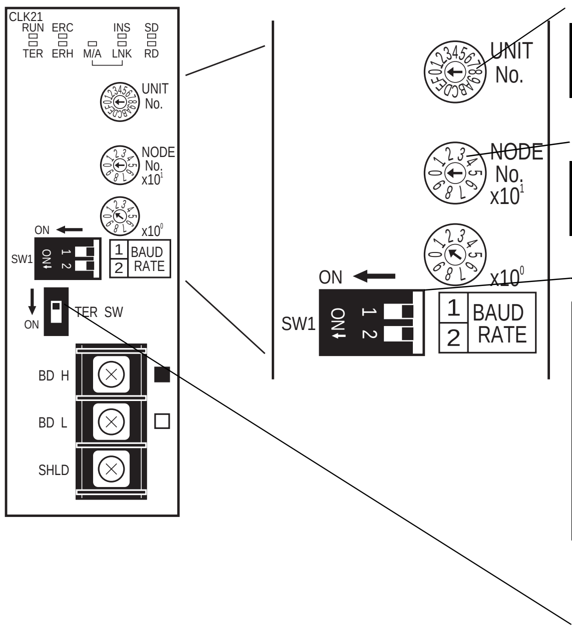
4. The default setting is OFF (not connected).

4-2 CJ-series Controller Link Units

The following settings are required for a Controller Link Unit used with a CJ-series PLC.

Item	Switch	Page
Unit number	Unit number setting switch	56
Node address	Node address switches	56
Baud rate	Baud rate, pins 1 and 2	57
Terminating resistance	Terminating resistance switch	57

4-2-1 Overview



Unit Number

Setting range	Nodes
01 to F (default is 0)	All nodes in the Network

Node Address

Setting range	Nodes
01 to 32 (default is 01)	All nodes in the Network

Baud Rate

Pins		Baud rate	Maximum transmission distance	Nodes
Pin 1	Pin 2			
OFF	**OFF**	2 Mbps	500 m	Set same rate for all nodes in the Network.
ON	OFF	1 Mbps	800 m	
OFF	ON	500 Kbps	1 km	
ON	ON	Cannot be set.		

Note Factory default setting is in bold.

Terminating Resistance

Front switch	Terminating resistance	Nodes
OFF (factory default)	Not connected	All nodes in the Network Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.
ON	Connected	

4-2-2 Unit Number

Set the unit number for each Unit using the rotary switches on the front of the Unit. The unit number is used to identify a CPU Bus Unit within the PLC. Any unit number can be set between 0 and F in hexadecimal (00 to 15 in decimal).

Note: The factory default settings are shown.

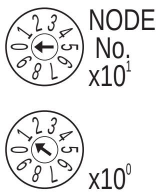
Item	Specifications
Setting method	Single-digit hexadecimal
Setting range	0 to F (decimal 00 to 15, default is 0)
Node	All nodes in the Network

Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

Note
1. Always turn OFF the PLC's power before setting the unit number.
2. When setting a Unit for the first time or changing the existing setting, create a I/O table in the PLC's CPU Unit.
3. Do not set the same unit number twice within the same PLC. An error will occur if the same unit number is set for two different Unit, and the CPU Unit will not be able to recognize the Units.
4. When the Unit is recognized by the PLC's CPU Unit, "NS" will be shown in the I/O table displayed for the CX-Programmer programming device.
5. The default setting is "0."
6. The unit number determines the words used by the Controller Link Unit in PLC memory.

4-2-3 Node Addresses

Set the node addresses of each Unit on the Network using the rotary switches on the front of the Unit. The node address is used to identify each node in the Network can be set to any number between 01 and 32.



Note: The factory default settings are shown.

Item	Specifications
Setting method	2-digit decimal
Setting range	01 to 32 (default is 01)
Node	All nodes in the Network

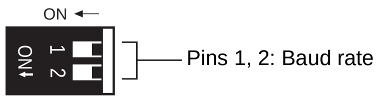
Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

Note
1. Always turn OFF the PLC's power before setting the node address.
2. Do not set the same node address twice within the same Network. An error will occur if the same address is set for two different nodes. The ERC indicator on the front of the Unit will light (Communications Error Flag) and either communications will stop, or the INS indicator will not light and you will be unable to participate in the Network.
3. The send sequence for the data link areas is determined according to the sequence of node addresses for automatically set data links.

4. Assign node addresses consecutively beginning from 01 whenever possible to minimize Network construction time.

4-2-4 Baud Rates

Set the following pins for the baud rate settings (DIP switch).



Note: The factory default settings are shown.

Note Always turn OFF the PLC's power before setting the baud rate.

Baud Rate (Pins 1 and 2)

Set the same baud rate for all the nodes on the Network using DIP switch pins 1 and 2 on the front of the Unit. The baud rate is set as shown below.

The maximum transmission distance will also change according to the setting.

Pins		Baud rate	Maximum transmission distance
Pin 1	Pin 2		
OFF	**OFF**	2 Mbps	500 m
ON	OFF	1 Mbps	800 m
OFF	ON	500 Kbps	1 km
ON	ON	Do not set.	

Note The factory default setting is shown in bold.

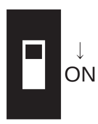
Note

1. Set the same baud rate for all the nodes on the Network. Normal communication cannot be performed unless the same baud rate is set for all the nodes.
2. The default setting is 2 Mbps, 500 m.

4-2-5 Terminating Resistance

Turn ON the terminating resistance using the switch on the bottom of the Unit for the Units of both ends of the Network. The terminating resistance is required at both ends of a Network to absorb unnecessary signals and reduce noise.

The Controller Link Unit has built-in terminating resistance, which can be connected simply by turning ON the slide switch.



Bottom switch	Terminating resistance
OFF (factory default)	Not connected.
ON	Connected.

Note

1. Always turn OFF the PLC's power before setting the terminating resistance switch.
2. Turn ON the switch to connect terminating resistance at the nodes at both ends of the Network and turn OFF the switch at all other nodes. Normal communication cannot be performed in the Network unless all the nodes are set properly.
3. The TER LED indicator will light when the terminating resistance switch is set to ON.

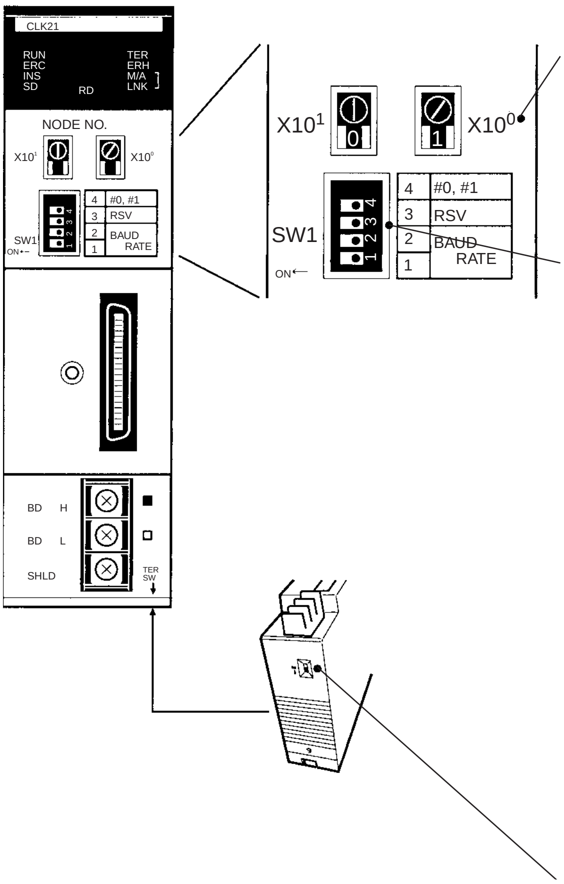
4. The default setting is OFF (not connected).

4-3 C200HX/HG/HE Controller Link Units

The following settings are required for a Controller Link Unit used with a C200HX/HG/HE PLC.

Item	Switch	Page
Node address	Node address switches	59
Baud rate	Baud rate and operating level switch, pins 1 and 2	59
Operating level	Baud rate and operating level switch, pin 4)	59
Terminating resistance	Terminating resistance switch	60

4-3-1 Overview



Node Address

Setting range	Nodes
01 to 32 (default is 01)	All nodes in the Network

Baud Rate and Operating Level

•Baud Rate

Pins		Baud rate	Maximum transmission distance	Nodes
Pin 1	Pin 2			
OFF	**OFF**	2 Mbps	500 m	Set same rate for all nodes in the Network.
ON	OFF	1 Mbps	800 m	
OFF	ON	500 Kbps	1 km	
ON	ON	Cannot be set.		

Note Factory default setting is in bold.
Always leave pin 3 OFF.

•Operating Level

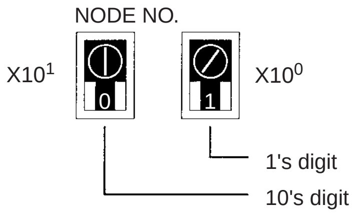
Pin 4	Operating level	Nodes
OFF (factory default)	Level 1	All nodes in the Network Set so that only one Communications Unit is set to the same level in the same PLC.
ON	Level 0	

Terminating Resistance

Bottom switch	Terminating resistance	Nodes
OFF (factory default)	Not connected	All nodes in the Network Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.
ON	Connected	

4-3-2 Node Addresses

Set the node addresses of each Unit on the Network using the rotary switches on the front of the Unit. The node address is used to identify each node in the Network can be set to any number between 01 and 32.



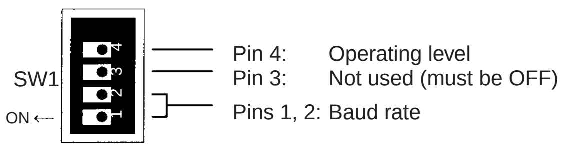
Item	Specifications
Setting method	2-digit decimal
Setting range	01 to 32 (default is 01)
Node	All nodes in the Network

Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

Note
1. Always turn OFF the PLC's power before setting the node address.
2. Do not set the same node address twice within the same Network. An error will occur if the same address is set for two different nodes. The ERC indicator on the front of the Unit will light and either communications will stop, or the INS indicator will not light and you will be unable to participate in the Network.
3. The send sequence for the data link areas is determined according to the sequence of node addresses for automatically set data links.
4. Assign node addresses consecutively beginning from 01 whenever possible to minimize Network construction time.

4-3-3 Baud Rates and Operating Levels

Set the following pins for the baud rate and operating level settings (DIP switch).



Note: The factory default settings are shown above.

Note
1. Always turn OFF the PLC's power before setting the baud rate or operating level.
2. Keep pin 3 set to OFF. If it is turned ON, internal data may be erased.

Baud Rate (Pins 1 and 2)

Set the same baud rate for all the nodes on the Network using DIP switch pins 1 and 2 on the front of the Unit. The baud rate is set as shown below.
The maximum transmission distance will also change according to the setting.

Pins		Baud rate	Maximum transmission distance
Pin 1	Pin 2		
OFF	**OFF**	2 Mbps	500 m
ON	OFF	1 Mbps	800 m
OFF	ON	500 Kbps	1 km
ON	ON	Do not set.	

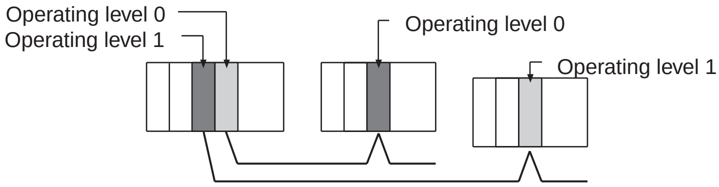
Note The factory default setting is shown in bold.

Note Set the same baud rate for all the nodes on the Network. Normal communication cannot be performed unless the same baud rate is set for all the nodes.

Setting the Operating Level (Pin 4)

With C200HX/HG/HE PLCs, Networks can be constructed by mounting up to two Communications Units, such as Controller Link Units, SYSMAC LINK Units and SYSMAC NET Link Units for the same PLC Each of these Units must run on a different operating level.

Set the Controller Link Unit to operating level 1 or 0 using DIP switch pin 4 on the front of the Unit.



Note It is not necessary to use the same operating level for all nodes in the same Network.

Pin 4	Operating level	Node
OFF (factory default)	Operating level 1	Set all the nodes on the Network to either Operating level.
ON	Operating level 0	

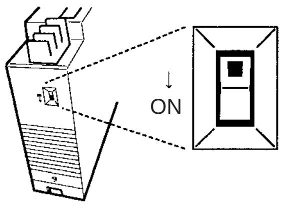
Note

1. Do not use the same operating level for more than one Unit mounted to the same PLC. An error will occur is the same operating level is set twice.
2. Operating levels are used by the CPU Unit to distinguish different Communications Units. Each node can have a different operating level, i.e., it is not necessary to use the same operating level for all nodes in the same Network.

4-3-4 Terminating Resistance

Turn ON the terminating resistance using the switch on the bottom of the Unit for the Units of both ends of the Network. The terminating resistance is required at both ends of a Network to absorb unnecessary signals and reduce noise.

The Controller Link Unit has built-in terminating resistance, which can be connected simply by turning ON the slide switch.



Bottom switch	Terminating resistance
OFF (factory default)	Not connected.
ON	Connected.

Note

1. Always turn OFF the PLC's power before setting the terminating resistance switch.
2. Turn ON the switch to connect terminating resistance at the nodes at both ends of the Network and turn OFF the switch at all other nodes. Normal communication cannot be performed in the Network unless all the nodes are set properly.

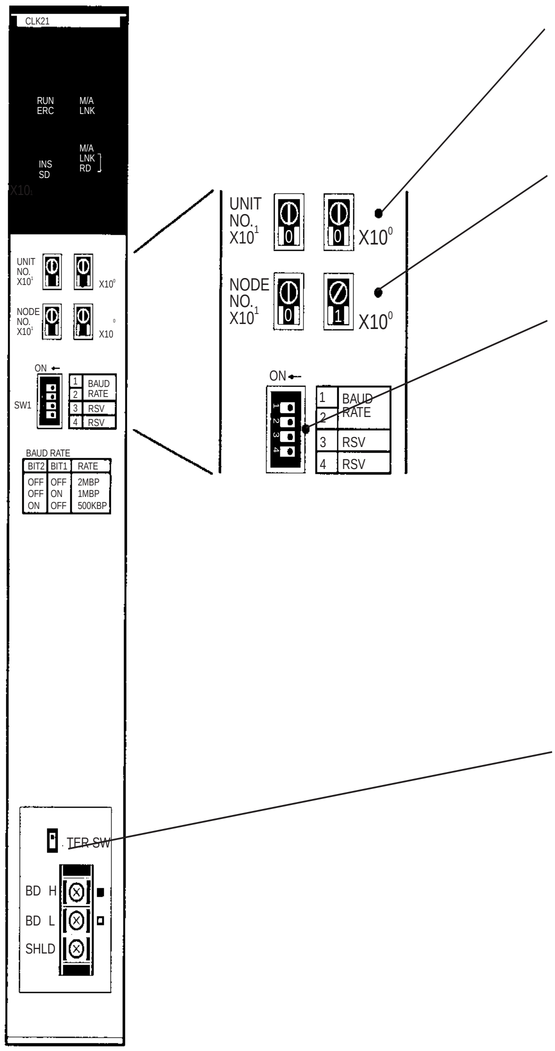
3. The TER LED indicator will light when the terminating resistance switch is set to ON.

4-4 CVM1 and CV-series Controller Link Units

The following settings are required for a Controller Link Unit when used with a CVM1 or CV-series PLC.

Item	Switch	Page
Unit number	Unit number switch	62
Node address	Node address switch	62
Baud rate	Baud rate switch, pins 1 and 2	63
Terminating resistance	Terminating resistance switch	63

4-4-1 Overview



Unit Number

Setting range	Nodes
00 to 15 (default is 00)	All nodes in the Network

Node Addresses

Setting range	Nodes
01 to 32 (default is 01)	All nodes in the Network

Setting Baud Rates

Switch		Baud rate	Maximum transmission distance	Nodes
Pin 1	Pin 2			
OFF	**OFF**	2 Mbps	500 m	Set same rate for all nodes in Network.
ON	OFF	1 Mbps	800 m	
OFF	ON	500 Kbps	1 km	
ON	ON	Do not set.		

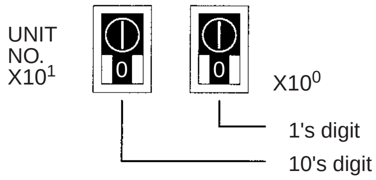
Note The factory default setting is in bold.
Always keep pins 3 and 4 set to OFF.

Terminating Resistance

Bottom switch	Terminating resistance	Nodes
OFF (factory default)	Not connected	All the nodes Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.
ON	Connected	

4-4-2 Unit Number

Set the unit number for each Unit using the rotary switches on the front of the Unit. The unit number is used to identify a CPU Bus Unit within the PLC. Any unit number can be set between 00 and 15.



Item	Specifications
Setting method	2-digit decimal
Setting range	00 to 15 (default is 00)
Node	All nodes in the Network

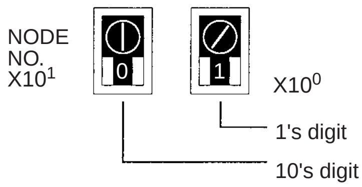
Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

Note
1. Always turn OFF the PLC’s power before setting the unit number.
2. When setting a Unit for the first time or changing the existing setting, create a I/O table in the PLC’s CPU Unit.
3. Do not set the same unit number twice within the same PLC. An error will occur if the same unit number is set for two different Unit, and the CPU Unit will not be able to recognize the Units.
4. When the Unit is recognized by the PLC’s CPU Unit, “NS” will be shown in the I/O table displayed for the CX-Programmer (Windows-based Support Software).
5. The default setting is “0.”
6. The unit number determines the words used by the Controller Link Unit in PLC memory.

4-4-3 Node Addresses

Set the node address of each Unit in the Network using the rotary switch on the front of the Unit. The node address is used to identify each node in the Network.

The node address can be set to any value between 01 and 32.



Item	Specifications
Setting method	2-digit decimal
Setting range	01 to 32 (default is 01)
Node	All nodes in the Network

Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

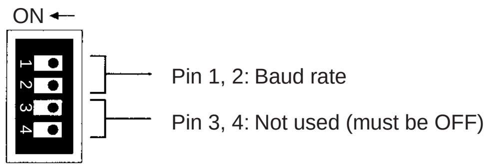
Note
1. Always turn OFF the PLC’s power before setting the node address.
2. Do not set the same node address twice within the same Network. An error will occur if the same address is set for two different nodes. The ERC indi-

cator on the front of the Unit will light and either communications will stop, or the INS indicator will not light and you will be unable to participate in the Network.

3. The send sequence for the data link areas is determined according to the sequence of node addresses for automatically set data links.
4. Assign node addresses consecutively beginning from 01 whenever possible to minimize Network construction time.

4-4-4 Baud Rates

Set the following pins for the baud rate setting (DIP switch).



The factory default setting is shown above.

Note
1. Always turn OFF the PLC's power before setting the baud rate.
2. Keep pins 3 and 4 set to OFF. If they are turned ON, internal data may be erased.

Set the same baud rate for all the nodes on the Network using DIP switch pins 1 and 2 on the front of the Unit. The baud rate is set as shown below.

The maximum transmission distance will also change according to the setting.

Switch		Baud rate	Maximum transmission distance
Pin 1	Pin 2		
OFF	**OFF**	2 Mbps	500 m
ON	OFF	1 Mbps	800 m
OFF	ON	500 Kbps	1 km
ON	ON	Do not set.	

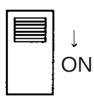
Note The factory default setting is shown in bold.

Note Set the same baud rate for all the nodes on the Network. Normal communication cannot be performed unless the same baud rate is set for all the nodes.

4-4-5 Terminating Resistance

Turn ON the terminating resistance using the switch on the bottom of the Unit for the Units of both ends of the Network. The terminating resistance is required at both ends of a Network to absorb unnecessary signals and reduce noise.

The Controller Link Unit has built-in terminating resistance, which can be connected simply by turning ON the slide switch.



Switch at the front	Terminating resistance
OFF (factory default)	Not connected.
ON	connected

Note
1. Always turn OFF the PLC's power before setting the terminating resistance switch.

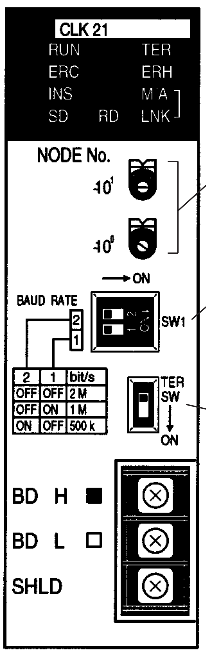
2. Turn ON the switch to connect terminating resistance at the nodes at both ends of the Network and turn OFF the switch at all other nodes. Normal communication cannot be performed in the Network unless all the nodes are set properly.
3. The TER indicator will light when the terminating resistance switch is set to ON.

4-5 CQM1H-series Controller Link Units

The following settings are required for a Controller Link Unit when used with a CQM1H-series PLC.

Item	Switch	Page
Node address	Node address switch	64
Baud rate	Baud rate switch, pins 1 and 2	65
Terminating resistance	Terminating resistance switch	65

4-5-1 Overview



Node Addresses

Setting range	Nodes
01 to 32 (default is 01)	All nodes in the Network

Setting Baud Rate

Switch		Baud rate	Maximum transmission distance	Nodes
Pin 1	Pin 2			
OFF	**OFF**	2 Mbps	500 m	Set same rate for all nodes in Network.
ON	OFF	1 Mbps	800 m	
OFF	ON	500 Kbps	1 km	
ON	ON	Do not set.		

Note The factory default setting is in bold.

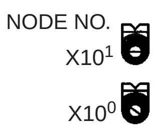
Terminating Resistance

Switch	Terminating resistance	Nodes
OFF (default)	Not connected	All the nodes
ON	Connected	Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.

4-5-2 Node Addresses

Set the node address of each Unit in the Network using the rotary switch on the front of the Unit. The node address is used to identify each node in the Network.

The node address can be set to any value between 01 and 32.



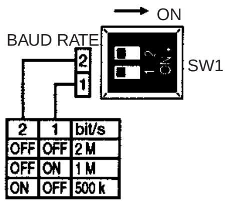
Item	Specifications
Setting method	2-digit decimal
Setting range	01 to 32 (default is 01)
Node	All nodes in the Network

Set the node address using a small flat-blade screwdriver, being careful not to damage the rotary switches.

Note
1. Always turn OFF the PLC's power before setting the node address.
2. Do not set the same node address twice within the same Network. An error will occur if the same address is set for two different nodes. The ERC indicator on the front of the Unit will light and either communications will stop, or the INS indicator will not light and you will be unable to participate in the Network.
3. The send sequence for the data link areas is determined according to the sequence of node addresses for automatically set data links.
4. Assign node addresses consecutively beginning from 01 whenever possible to minimize Network construction time.

4-5-3 Baud Rates

Set the following pins for the baud rate setting (DIP switch).



Note Always turn OFF the PLC's power before setting the baud rate.

Set the same baud rate for all the nodes on the Network using DIP switch pins 1 and 2 on the front of the Unit. The baud rate is set as shown below.

The maximum transmission distance will also change according to the setting.

Switch		Baud rate	Maximum transmission distance
Pin 1	Pin 2		
OFF	**OFF**	2 Mbps	500 m
ON	OFF	1 Mbps	800 m
OFF	ON	500 Kbps	1 km
ON	ON	Do not set.	

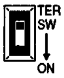
Note The factory default setting is shown in bold.

Note Set the same baud rate for all the nodes on the Network. Normal communication cannot be performed unless the same baud rate is set for all the nodes.

4-5-4 Terminating Resistance

Turn ON the terminating resistance using the switch on the bottom of the Unit for the Units of both ends of the Network. The terminating resistance is required at both ends of a Network to absorb unnecessary signals and reduce noise.

The Controller Link Unit has built-in terminating resistance, which can be connected simply by turning ON the slide switch.



(The diagram shows the factory setting.)

Switch at the front	Terminating resistance
OFF (default)	Not connected.
ON	connected

Note

1. Always turn OFF the PLC's power before setting the terminating resistance switch.
2. Turn ON the switch to connect terminating resistance at the nodes at both ends of the Network and turn OFF the switch at all other nodes. Normal communication cannot be performed in the Network unless all the nodes are set properly.
3. The TER indicator will light when the terminating resistance switch is set to ON.
4. The switch is factory-set to OFF (terminating resistance not connected).

SECTION 5
Data Links

This section describes how to use data links in a Controller Link Network. Refer to *SECTION 2 Basic Procedures* for an outline of data link application.

5-1 What Are Data Links?

Data links automatically exchange data in the preset areas between nodes (PLCs and/or computers) on one network. Data links can be freely created for CS/CJ-series PLCs, C200HX/HG/HE PLCs, CVM1, CV-series PLCs, CQM1H-series PLCs, and IBM PC/AT or compatible computers.

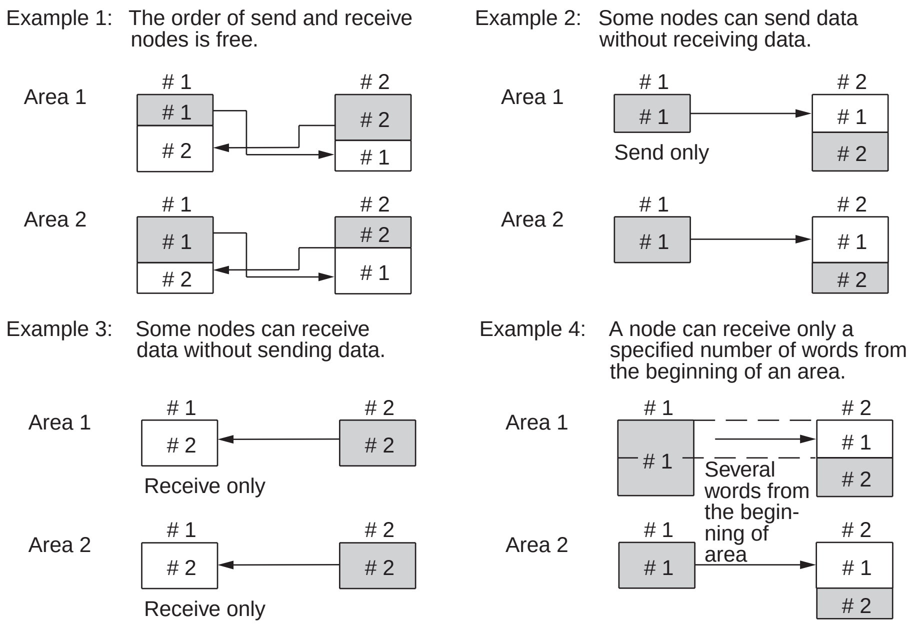
Two data link areas, area 1 and area 2, can be set for each node. Data links can be set in either of the following ways.

- Data link areas can be manually set by inputting data link tables through Controller Link Support Software. Data link tables are created to define the data links. These tables enable free allocation of data link areas.
- Data links can be set automatically from a Programming Device. With automatically set data links, all link areas are the same size.

Both automatic setting and manual setting cannot be used together in the same network. The following rules apply to these two methods of setting data links.

- Data links are enabled concurrently for area 1 and area 2.
- Separate settings (data link start words and send area size) are made in area 1 and area 2. The sequences of send and receive words are the same in area 1 and area 2.
- Not all nodes must participate in the data links.

Manually Setting Data Links



Manually set data links are used to create flexible data links that meet the needs of the individual system.

- Data links are set in the Controller Link Unit or Board of each node using the Controller Link Support Software.
- Area 1 and area 2 can be selected from PLC memory areas, including the DM Area and EM Area.
- A send area and its size can be allocated freely for each node.
- The sequence of receive nodes can be changed.
- Nodes can be set that only send or only receive data.

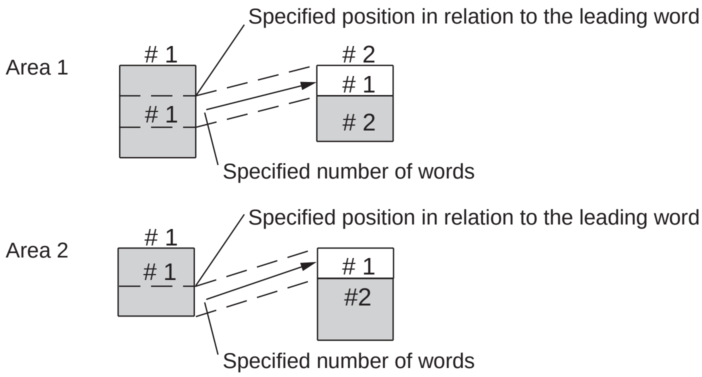
- Only part of send data can be received and an offset can be used to specify the beginning of the desired part.

Manual Setting Options

The following options can be set when manually setting data links.

Offsets

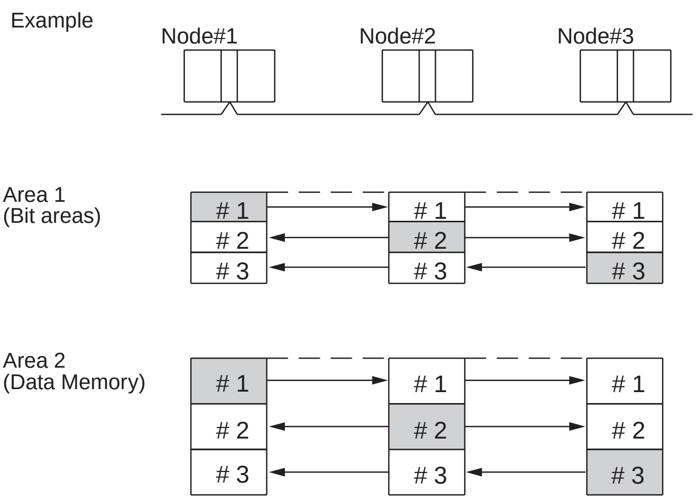
Data of the only the specified number of words can be received starting from the specified word position. The starting word is set as an offset from the beginning of the send data. The following is an example.



Easy Setting

The send data areas of all nodes can be set to the same size (same as for automatic setting described next).

Automatically Setting Data Links



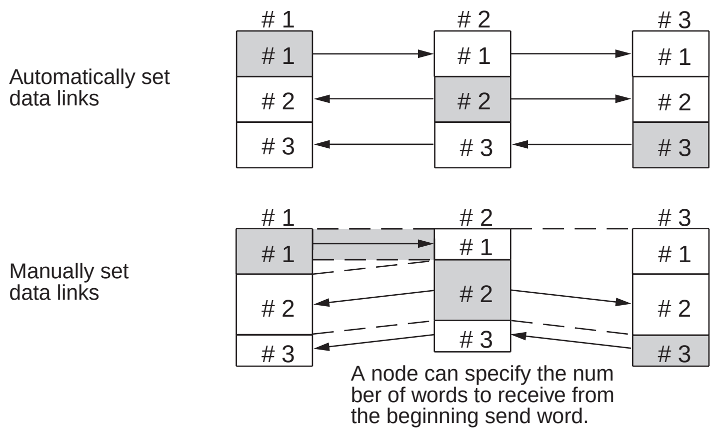
Automatic setting can be used to create simple data links.

- Using a Programming Device (such as a Programming Console), set the automatic data link mode in the DM parameter area of the startup node.
- Area 1 can be selected from bit areas (i.e., IR, CIO, and LR areas) and area 2 can be selected from Data Memory.
- In areas 1 and 2 send areas for each node are of the same size.
- Send nodes are in the same ascending order as node numbers.
- It is not possible to receive only a part of send data.
- All nodes can be specified to either participate or not participate in the data link.
- The data link areas are exactly the same and common to all nodes participating in the data links.

Note The Controller Link Support Software contains a function called "Easy Setting" that can be used within the manual data link mode to register the same data links as automatic setting. The "Easy Setting" can be used first, and then the send size of each node and other settings can be changed as required.

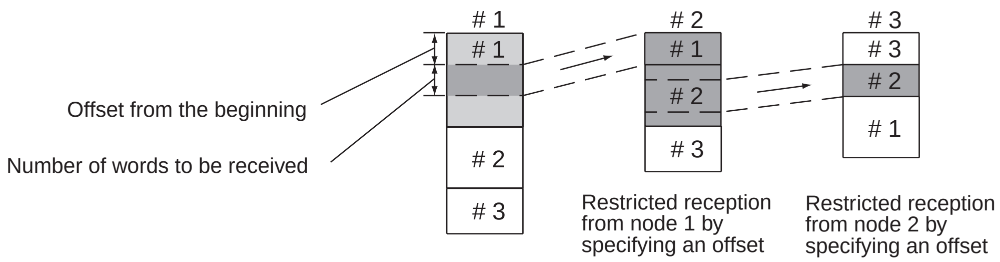
Using Offsets

For automatically set data links, all of the send words transmitted by a node are received by other nodes with no change in size. For manually set data links, the size of a receive area can be restricted by specifying a number of words from the beginning word of the words sent by another node.

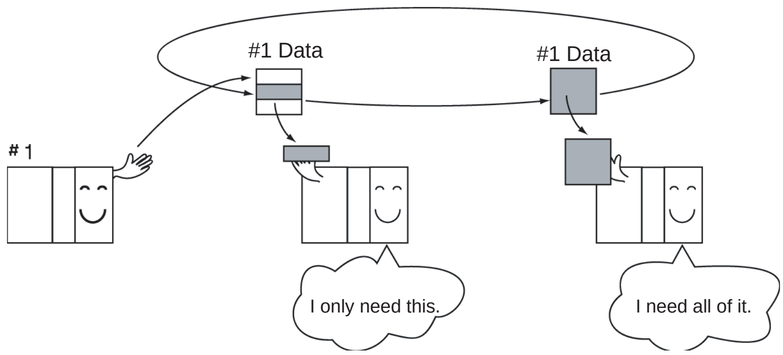


However, the above system does not guarantee that only the desired words will be received and therefore the receive node may receive unnecessary data.

Offsetting enables specification of a more specific range of receive data by indicating both the number of words and the starting word position from the beginning of the area. The offset refers to the starting word position counted from the beginning of the area.

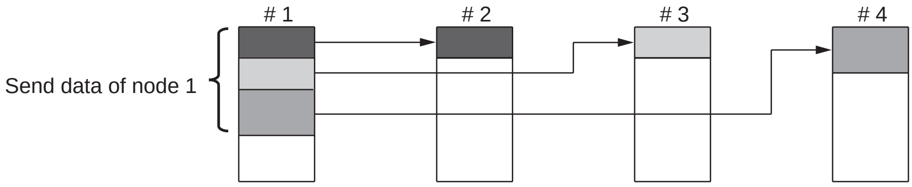


Offsetting Image



Application Example of Using Offsets

In the following example, the send data from node 1 is split into three parts and each part is received by a different node, i.e., each of the other nodes receives only part of the send data from node 1. This enables effective use of data link memory areas without wasting space. In this way, a type of message service (i.e., specific data to a specific node) can be achieved through data links.



5-1-1 Data Link Specifications

Item	Description	
No. of data link nodes	32 max., 2 min.	
Number of data link words	Number of send/receive words per node (total of area 1 and area 2): CS/CJ Series: 12,000 words max. C200HX/HG/HE, CVM1, CV, CQM1H: Up to 8,000 IBM PC/AT or compatible: Manual setting: Up to 32,000; Automatic setting: Up to 8,000 Number of send words per node (total of area 1 and area 2): Up to 1,000	
Allocation of data link areas	Manual setting	Area 1, 2: Bit area (IR, CIO, and LR Areas) Data Memory (DM and EM Areas) However, area 1 and area 2 cannot be set in the same memory area.
	Automatic setting	Area 1: IR, CIO, or LR Area Area 2: Data Memory (DM and EM Areas)

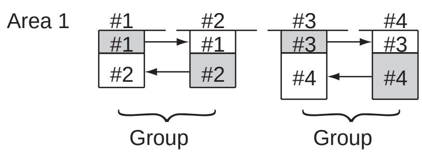
5-1-2 Differences Between Manual and Automatic Setting

Item	Manual setting	Automatic setting
Determination of nodes to be in a data link	Determined by setting data link tables.	Determined by the data link parameters set in the data link startup node (the node used to start the data links).
Data link settings	Set in data link tables that are set in the nodes to participate in data links.	Determined by the data link parameters set in the data link startup node (the node used to start the data links).
Data link areas 1 and 2	In each node, area 1 and area 2 are selected from bit areas (IR, CIO, and LR Areas) and Data Memory (DM and EM Areas). However, areas 1 and 2 cannot be set in the same memory area.	Area 1 is selected from bit areas (IR, CIO, and LR Areas) and area 2 is selected from Data Memory (DM and EM Areas).
Refresh starting word	Can be set freely in each node. (See note a))	Can be set freely. (See note a))
Data link status area	Selected from bit areas (IR, CIO, and LR Areas) and Data Memory (DM and EM Areas) in each node.	Selected from bit areas (IR or CIO Areas).
Refresh sequence	Can be set in each node freely.	Node addresses are in ascending order.
Data reception	It is possible to set in each node whether the entire data or a part of the data sent from another node is received. It is also possible to not receive the data sent from a specific node. (See note b))	The entire data sent from each node that is participating in the data link is received.
Data transmission	The send sizes can be set freely in each node. It is also possible for certain node not to send data. (See note b))	In area 1 and area 2, data send sizes are the same in each node.

Note a) The following are true for computer nodes (i.e., computers with a Controller Link Support Board mounted).

- The data link starting position is fixed.
- Because areas such as bit areas and DM are not available, areas must be made available on the computer for linking.
- Automatically set data links cannot be started from the Controller Link Support Board.
- The Controller Link Support Board can participate in automatically set data links.

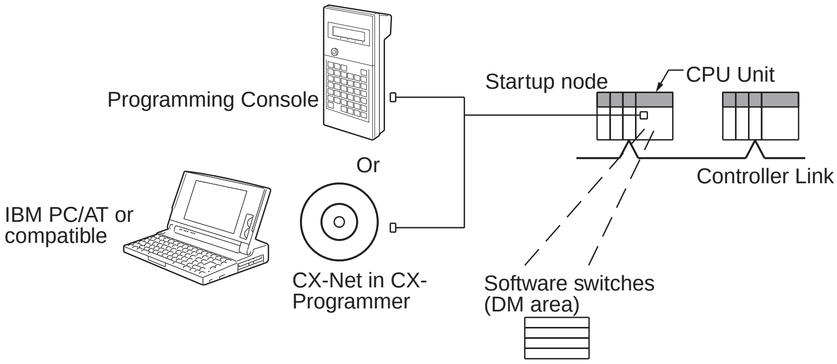
b) If data links are manually set, send/receive area can be selected in each node, allowing send/receive groups to be created within the network in area 1 and area 2, as shown below.



5-2 Setting Data Links

5-2-1 Selecting Manual or Automatic Setting

Specify either the manual or automatic data link mode in the following DM parameter area of the PLC's CPU Unit of the startup node, using a PLC Programming Device.



CS/CJ-series Startup Nodes

N: DM 30000 + 100 x Unit number of Controller Link Unit

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

0: Always 0.
–: Other setting

Data link mode
00: Manual setting
01: Automatic setting

C200HX/HG/HE Startup Nodes

N: Level 0 = DM 6400
Level 1 = DM 6420

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

0: Always 0.
–: Other settings

Data link mode
00: Manual setting
01: Automatic setting

CVM1 and CV-series Startup Nodes

N: DM 2000 + 100 x unit number of Controller Link Unit

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

0: Always 0.
–: Other setting

Data link mode
00: Manual setting
01: Automatic setting

CQM1H-series Startup Nodes

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DM 6400	–	–	0	–	0	0	0	0	0	0			0	0	0	0

0: Always 0.
– : Other setting

Data link mode
00: Manual setting
01: Automatic setting

Note 1. Be sure to set the bit in the DM Area's (CPU Bus Unit Area's) software switches (DM30000 + 100 × unit number) described as "always set to 0" to 0. Not doing so may result in the data link not starting properly. If a data link is started with bit 7 of the software switches set to 1, the data link status will be stored in a format different to the one described in this manual (when using CS-series or CJ-series Controller Link Units).

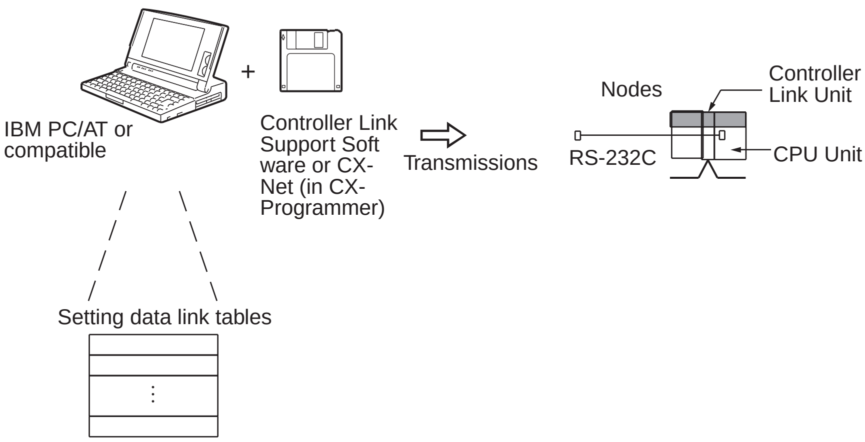
2. The default data link mode is for manual setting (00), but check the setting from the Programming Device.
3. A data link mode can be set in a data link startup node only. The data link mode setting is determined by the data link mode of the startup node even if the data link mode settings of the nodes participating in the data links are different from the settings in the startup node.
4. In manual setting, a data link table must be set in the data link startup node and in automatic setting, automatic data link setting parameters must be set in the data link startup node. Data links will not be started unless the settings are correct.

5-2-2 Manual Setting

Transfer the data link tables that were created on the Controller Link Support Software or CX-Net (in CX-Programmer) to the Controller Link Unit or the Controller Link Support Board (for IBM PC/AT or compatible computers).

The data link tables are transferred from a computer running the Controller Link Support Software. The computer can either be a node in the network or a computer attached as a Programming Device.

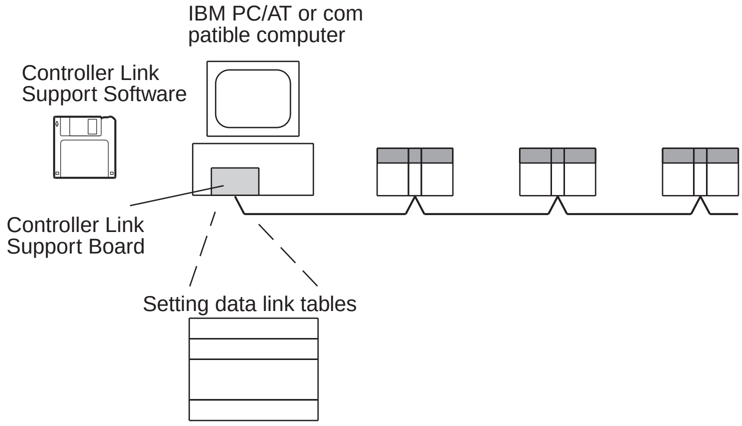
Transferring from a Programming Device



Note
1. When transferring data link tables to a CS/CJ-series PLC, turn OFF pin 1 of the DIP switch on the CPU Unit. Otherwise, data link tables cannot be written normally.
2. When transferring the data link tables to a CVM1 or CV-series PLC, set the System Protect Keyswitch on the CPU Unit to “NORMAL.” Otherwise, data link tables cannot be written normally.
3. Use the CX-Net in CX-Programmer version 1.20 or later for CQM1H Controller Link Units. The Controller Link Support Software can also be used. (The Controller Link Support Software can be integrated into the SYSMAC Support Software. Refer to the *Controller Link Support Software Operation Manual* (W308) for details.)
4. When using the Controller Link Support Software to set a CJ-series Controller Link Unit, use one of the following methods to set the type of PLC.
   - Set the type of PLC to “Others.”
   - Add the following information to the device information setting file (CLKTYPE.TXT) in the Controller Link Support Software to add the

CJ-series PLC and then set the CJ-series PLC.
CJ1G-CPU44: Same settings as the CS1G-CPU44-E
CJ1G-CPU45: Same settings as the CS1G-CPU45-E
For details on editing device information setting files, refer to the *Controller Link Support Software Operation Manual* (W308).

Transferring from a Computer Node



A data link table is created for each node using the Controller Link Support Software. The data link tables contain all the settings required to create the data links.

Note
1. The following three methods can be used to start data links. (See p. 100.)
    - Using a software switch
    - Using the Controller Link Support Software or CX-Net (in CX-Programmer)
    - Using an FINS command
2. To create data link tables using the Controller Link Support Software, the network must have been constructed correctly. Set routing tables at each node as required. See *Applications Precautions on page xiv.* for details.

Data Link Table Specifications

CS/CJ-series PLCs

Setting item	Setting range
PC model	Set the model of the PLC's CPU Unit.
Nodes	1 to 32 Set the address of the refresh nodes. It cannot be set to a parameter exceeding the "maximum node address" of the network parameter.
First data link status word	Set the first word to store data link status. An area of 16 words is used. CIO Area: CIO 001 to CIO 6128 (*1) LR Area: LR 00 to LR 184 (*2) DM Area: DM 0000 to DM 32752 EM Area: Banks 00 to 12, EM 0000 to EM 32752 *1: When IR 000 is specified or when the default setting (——) is left unchanged, the default first status word will be used. Refer to *5-4 Checking Data Link Status* for details. *2: When a word between LR 000 and LR 184 is specified, the data link area will be allocated between CIO 1000 and CIO 1184.

<table>
<tr><th colspan="2">Setting item</th><th>Setting range</th></tr>
<tr><td rowspan="3">Area 1</td><td>Data link start word</td><td>CIO Area: CIO 000 to CIO 6143
LR Area: LR 00 to LR 199 (*)
DM Area: DM 0000 to DM 32767
EM Area: Banks 00 to 12, EM 0000 to EM 32767
The same area cannot be set for both area 1 and area 2. Set different areas.
*: When a word between LR 000 and LR 199 is specified, the data link area will be allocated between CIO 1000 and CIO 1199.</td></tr>
<tr><td>Number of words</td><td>Remote nodes: 0 to the number of source words
Set the number of words to be received.
Local node: 0 to 1,000
Set the number of words to be transmitted.
The total number of words in area 1 and area 2 in each node must not exceed 1,000.
The numbers of words in both area 1 and area 2 in each node must not be set to 0.</td></tr>
<tr><td>Offset</td><td>Remote nodes: 0 to one less than number of source words
Set the offset for the data to be received.
Local node: Cannot be set.
This setting is not required if an offset is not used.</td></tr>
<tr><td rowspan="3">Area 2</td><td>Data link start word</td><td>CIO Area: CIO 000 to CIO 6143
LR Area: LR 00 to LR 199 (*)
DM Area: DM 0000 to DM 32767
EM Area: Banks 00 to 15, EM 0000 to EM 32767
(EM must be installed)
The same area cannot be set for both area 1 and area 2. Set different areas.
*: When a word between LR 000 and LR 199 is specified, the data link area will be allocated between CIO 1000 and CIO 1199.</td></tr>
<tr><td>Number of words</td><td>Remote nodes: 0 to the number of source words
Set the number of words to be received.
Local node: 0 to 1,000
Set the number of words to be transmitted.
The total number of words in area 1 and area 2 in each node must not exceed 1,000.
The numbers of words in both area 1 and area 2 in each node must not be set to 0.</td></tr>
<tr><td>Offset</td><td>Remote nodes: 0 to one less than number of source words
Set the offset for the data to be received.
Local node: Cannot be set.
This setting is not required if an offset is not used.</td></tr>
</table>

Note a) The total number of words in data link send and receive areas must not exceed 12,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

(Data link start word – 1) + (Total number of send/receive words in area 1 or area 2)

≤ 6143 (CIO Area)
199 (LR Area)
32767 (DM Area, EM Area)

c) Refer to the *Controller Link Support Boards Operation Manual (W307)* for information on the Controller Link Support Board.

C200HX/HG/HE PLCs

Setting item		Setting range
PC model		Set the model of the PLC's CPU Unit.
Nodes		1 to 32 Set the address of the refresh nodes. It cannot be set to a parameter exceeding the "maximum node address" of the network parameter.
First data link status word		Set the first word to store data link status. An area of 16 words is used. IR Area: IR 001 to IR 220, IR 300 to IR 496 (*) LR Area: LR 00 to LR 48 DM Area: DM 0000 to DM 5984 EM Area: Banks 00 to 15, EM 0000 to EM 6128 (EM must be installed) *: When IR 000 is specified or when the default setting (——–) is left unchanged, the default first status word will be used. Refer to *5-4 Checking Data Link Status* for details.
Area 1	Data link start word	IR Area: IR 000 to IR 235, IR 300 to IR 511 LR Area: LR 00 to LR 63 DM Area: DM 0000 to DM 5999 EM Area: Banks 00 to 15, EM 0000 to EM 6143 (EM must be installed) The same area cannot be set for both area 1 and area 2. Set different areas.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 1,000 Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.

Setting item		Setting range
Area 2	Data link start word	IR Area: IR 000 to IR 235, IR 300 to IR 511 LR Area: LR 00 to LR 63 DM Area: DM 0000 to DM 5999 EM Area: Banks 00 to 15, EM 0000 to EM 6143 (EM must be installed) The same area cannot be set for both area 1 and area 2. Set different areas.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 1,000 Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.

Note a) The total number of words in data link send and receive areas must not exceed 8,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

(Data link start word – 1) + Total number of send/receive words in area≤235 (First word IR 000 to IR 235)
511 (First word IR 300 to IR 511)
63 (LR Area)
5999 (DM Area)
6143 (EM Area)

c) Refer to the *Controller Link Support Boards Operation Manual (W307)* for information on the Controller Link Support Board.

CVM1 and CV-series PLCs

Setting item	Setting range
PC model	Set the model of the PLC's CPU Unit.
Nodes	1 to 32 Set the address of the refresh nodes. It cannot be set to a parameter exceeding the “maximum node address” of the network parameter.

Setting item		Setting range
First data link status word		Set the first word to store data link status. An area of 16 words is used. CIO Area: CIO 0001 to CIO 2540 (*1) LR Area: LR 000 to LR 184 (*2) DM Area: DM 0000 to DM 8176 (CV500/CVM1-CPU01-EV☐) DM 0000 to DM 24560 (Other CPU Units) EM Area: Banks 00 to 07, EM 0000 to EM 32750 (EM must be installed) *1: When CIO 000 is specified or when the default setting (– – – – –) is left unchanged, the default first status word will be used. Refer to *5-4 Checking Data Link Status* for details. *2: When a word between LR 000 and LR 184 is specified, the data link area will be allocated between CIO 1000 and CIO 1184.
Area 1	Data link start word	CIO Area: CIO 0000 to CIO 2555 LR Area: LR 000 to LR 199 (*) DM Area: DM 0000 to DM 8191 (CV500/CVM1-CPU01-EV☐) DM 0000 to DM 24575 (Other CPU Units) EM Area: Banks 00 to 07, EM 0000 to EM 32765 (EM must be installed) The same area cannot be set for both area 1 and area 2. Set different areas. *: When a word between LR 000 and LR 199 is specified, the data link area will be allocated between CIO 1000 and CIO 1199.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 1,000 Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.

Setting item		Setting range
Area 2	Data link start word	CIO Area: CIO 0000 to CIO 2555 LR Area: LR 000 to LR 199 (*) DM Area: DM 0000 to DM 8191 (CV500/CVM1-CPU01-EV☐) DM 0000 to DM 24575 (Other CPU Units) EM Area: Banks 00 to 07, EM 0000 to EM 32765 (EM must be installed) The same area cannot be set for both area 1 and area 2. Set different areas. *: When a word between LR 000 and LR 199 is specified, the data link area will be allocated between CIO 1000 and CIO 1199.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 1,000 Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.

Note **a)** The total number of words in data link send and receive areas must not exceed 8,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

(Data link start word – 1) + Total number of send/receive words in area≤2555 (CIO Area)
199 (LR Area)
8191 (DM Area for CV500/CVM1-CPU01-EV☐)
24575 (DM Area for other CPU Units)
32765 (EM Area)

c) Refer to the *Controller Link Support Boards Operation Manual (W307)* for information on the Controller Link Support Board.

CQM1H-series PLCs

Setting item	Setting range
PC model	Set the model of the PLC’s CPU Unit.
Nodes	1 to 32 Set the address of the refresh nodes. It cannot be set to a parameter exceeding the “maximum node address” of the network parameters.
First data link status word	Set the first word to store data link status. An area of 16 words is used. IR Area: IR 001 to IR 232 LR Area: LR 00 to LR 48 DM Area: DM 0000 to DM 5984 EM Area: EM 0000 to EM 6128 (EM must be installed) When IR 000 is specified or when the default setting (———) is left unchanged, the default first status word will be used. Refer to *5-4 Checking Data Link Status* for details.

Setting item		Setting range
Area 1	Data link start word	IR Area: IR 000 to IR 247 LR Area: LR 00 to LR 48 DM Area: DM 0000 to DM 5984 EM Area: EM 0000 to EM 6128 (EM must be installed) The same memory area cannot be set for both area 1 and area 2. Set different memory areas.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 1,000 Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.
Area 2	Data link start word	IR Area: IR 000 to IR 247 LR Area: LR 00 to LR 48 DM Area: DM 0000 to DM 5984 EM Area: EM 0000 to EM 6128 (EM must be installed) The same memory area cannot be set for both area 1 and area 2. Set different memory areas.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 1,000 Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.

Note **a)** The total number of words in data link send and receive areas must not exceed 8,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

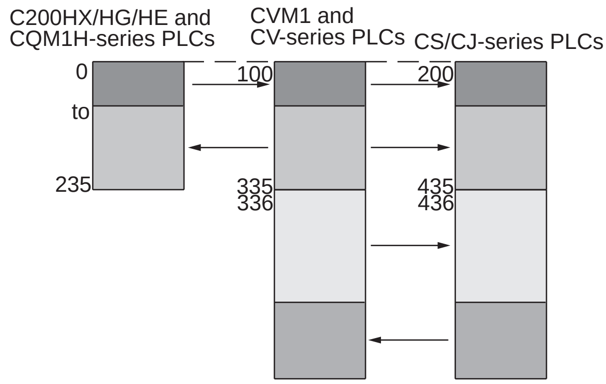
(Data link start word – 1) + Total number of send/receive words in area≤247 (IR Area)
63 (LR Area)
5999 (DM Area)
6143 (EM Area)

c) Refer to the *Controller Link Support Boards Operation Manual (W307)* for information on the Controller Link Support Board.

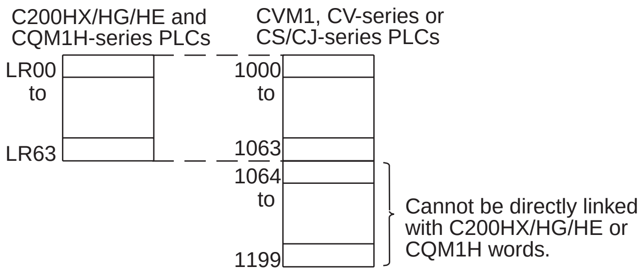
Precautions

C200HX/HG/HE, CS/CJ-series, CVM1, CV-series, and CQM1H-series PLCs have different-sized memory areas. When data links are manually set, provided the PLCs are set so as not to receive data in the areas indicated in the following diagram, the data link setting area is not limited by the small area size of the PLC.

Example:



If the LR Area in the C200HX/HG/HE or CQM1H Series is manually set for a data link with a CVM1, CV-series or CS/CJ-series PLC, the LR words will be linked to CIO 1000 to CIO 1063 in the CVM1, CV-series or CS/CJ-series PLC. CIO 1064 to CIO 1199 cannot be linked with C200HX/HG/HE or CQM1H-series PLCs in this way.

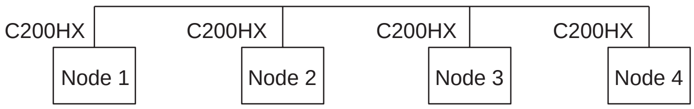


5-2-3 Manual Setting Examples

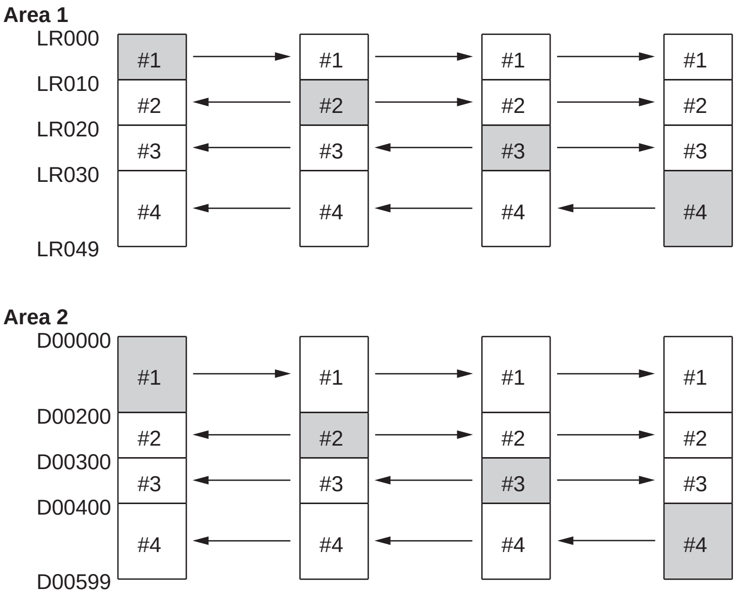
This section shows examples of manually creating data link tables on the Controller Link Support Software. Sample files containing the data link tables are provided on the installation disk for the Software.

SAMPLE1.CLK: Same Allocation to All Nodes

Data Link Area Structure



Data Link Areas



Device Information Settings

Device Info set DataLink table

Node	Model name	Node	Model name
01	C200HX	17	
02	C200HX	18	
03	C200HX	19	
04	C200HX	20	
05		21	
06		22	

Data Link Tables

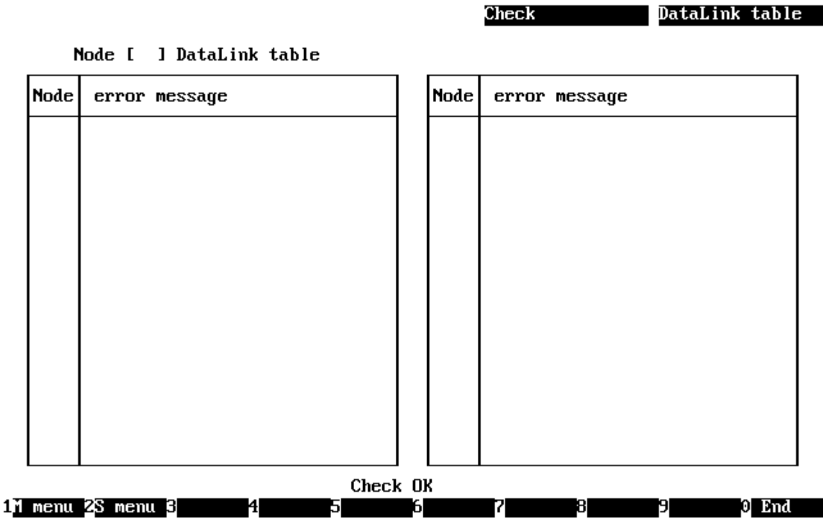
Edit DataLink table

Node[01] PCtype[C200HX] Num of Nd [4] Status Word[--------]

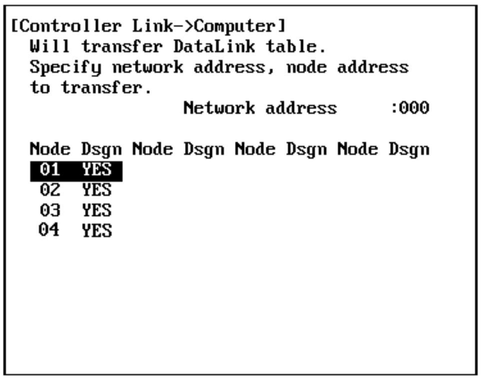
Node	<Area1> Link Start Word[L00000] Link Wd	Num Wd	Source Wd	<Area2> Link Start Word[D00000] Link Wd	Num Wd	Source Wd
01	L00000	10	Send Area	D00000	200	Send Area
02	L00010	10	L00010	D00200	100	D00200
03	L00020	10	L00020	D00300	100	D00300
04	L00030	20	L00030	D00400	200	D00400

Set exactly the same table for nodes 2, 3, and 4. To do this, the copy function can be used to copy the data link table for node 1 to nodes 2, 3, and 4.

Checking the Data Link Tables



Transferring the Data Link Tables

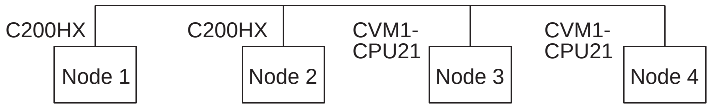


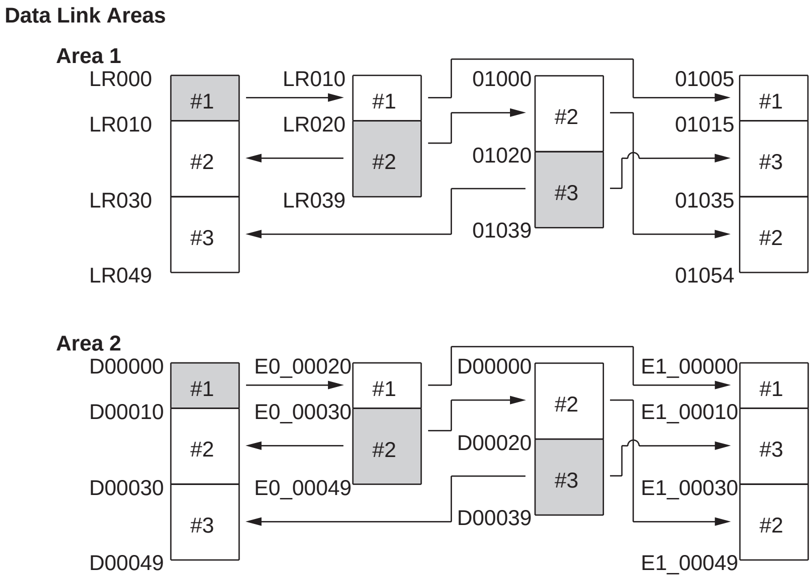
Saving the Data Link Tables

SAMPLE2.CLK: Different Allocations to Each Node

Data links can be created so that one node does not receive from all other nodes or so that some nodes do not send or receive any data at all. In the following example, node 2 does not receive data from node 3 and node 3 does not receive data from node 1. Node 4 does not send any add; it only receives data from other nodes.

Data Link Area Structure





Only nodes in which a data link table has been created can participate in the data links.

In the data link table, the node sequence can be changed freely; however, the data link areas must be created consecutively.

Device Information Setting

Device Info set DataLink table

Node	Model name	Node	Model name
01	C200HX	17	
02	C200HX	18	
03	CVM1-CPU21	19	
04	CVM1-CPU21	20	
05		21	
06		22	

Data Link Tables

```
                                                Edit              DataLink table
 Node[01]  PCtype[C200HX    ]  Num of Nd [ 3]       Status Word[--------]
Node|<Area1>   Link Start Word[L00000  ] |<Area2>   Link Start Word[D00000  ]
    |  Link Wd   Num Wd Source Wd        |  Link Wd   Num Wd Source Wd
 01 |  L00000       10   Send Area       |  D00000       10   Send Area
 02 |  L00010       20   L00020          |  D00010       20   E0_00030
 03 |  L00030       20   01020           |  D00030       20   D00020
```

```
                                                Edit              DataLink table
 Node[02]  PCtype[C200HX    ]  Num of Nd [ 2]       Status Word[--------]
Node|<Area1>   Link Start Word[L00010  ] |<Area2>   Link Start Word[E0_00020]
    |  Link Wd   Num Wd Source Wd        |  Link Wd   Num Wd Source Wd
 01 |  L00010       10   L00000          |  E0_00020     10   D00000
 02 |  L00020       20   Send Area       |  E0_00030     20   Send Area
```

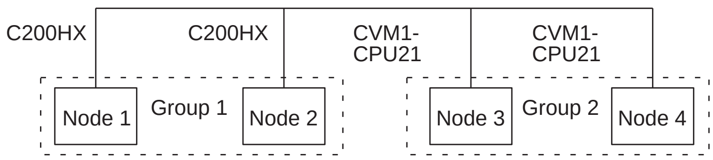
```
                                                Edit              DataLink table
 Node[03]  PCtype[CVM1-CPU21]  Num of Nd [ 2]       Status Word[--------]
Node|<Area1>   Link Start Word[01000   ] |<Area2>   Link Start Word[D00000  ]
    |  Link Wd   Num Wd Source Wd        |  Link Wd   Num Wd Source Wd
 02 |  01000        20   L00020          |  D00000       20   E0_00030
 03 |  01020        20   Send Area       |  D00020       20   Send Area
```

```
                                                Edit              DataLink table
 Node[04]  PCtype[CVM1-CPU21]  Num of Nd [ 3]       Status Word[--------]
Node|<Area1>   Link Start Word[01005   ] |<Area2>   Link Start Word[E1_00000]
    |  Link Wd   Num Wd Source Wd        |  Link Wd   Num Wd Source Wd
 01 |  01005        10   L00000          |  E1_00000     10   D00000
 03 |  01015        20   01020           |  E1_00010     20   D00020
 02 |  01035        20   L00020          |  E1_00030     20   E0_00030
```

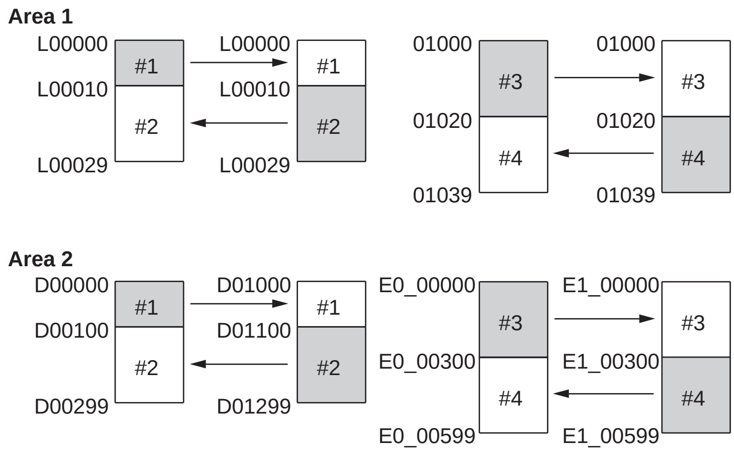
SAMPLE3.CLK: Creating Data Link Groups within a Network

A data links consisting of multiple groups within a single network can be created by setting data link tables. Send and receive areas are created for only the nodes in each group, as shown below.

Data Link Area Structure



Data Link Areas



Device Information Setting

```
                                              Device Info set  DataLink table

Node  |         Model name          || Node  |         Model name
------+-----------------------------++-------+----------------------------
  01  |C200HX                       ||  17   |
  02  |C200HX                       ||  18   |
  03  |CVM1-CPU21                   ||  19   |
  04  |CVM1-CPU21                   ||  20   |
  05  |                             ||  21   |
  06  |                             ||  22   |
```

Data Link Tables

```
                                              Edit             DataLink table
 Node[01]  PCtype[C200HX     ]  Num of Nd [ 2]      Status Word[--------]

Node|<Area1>    Link Start Word[L00000   ]|<Area2>    Link Start Word[D00000   ]
    |  Link Wd    Num Wd Source Wd        |  Link Wd    Num Wd Source Wd
----+-------------------------------------+-----------------------------------
 01 |  L00000       10    Send Area       |  D00000      100    Send Area
 02 |  L00010       20    L00010          |  D00100      200    D01100
```

```
                                              Edit             DataLink table
 Node[02]  PCtype[C200HX     ]  Num of Nd [ 2]      Status Word[--------]

Node|<Area1>    Link Start Word[L00000   ]|<Area2>    Link Start Word[D01000   ]
    |  Link Wd    Num Wd Source Wd        |  Link Wd    Num Wd Source Wd
----+-------------------------------------+-----------------------------------
 01 |  L00000       10    L00000          |  D01000      100    D00000
 02 |  L00010       20    Send Area       |  D01100      200    Send Area
```

```
                                              Edit             DataLink table
 Node[03]  PCtype[CVM1-CPU21]  Num of Nd [ 2]      Status Word[--------]

Node|<Area1>    Link Start Word[01000    ]|<Area2>    Link Start Word[E0_00000]
    |  Link Wd    Num Wd Source Wd        |  Link Wd    Num Wd Source Wd
----+-------------------------------------+-----------------------------------
 03 |  01000        20    Send Area       |  E0_00000    300    Send Area
 04 |  01020        20    01020           |  E0_00300    300    E1_00300
```

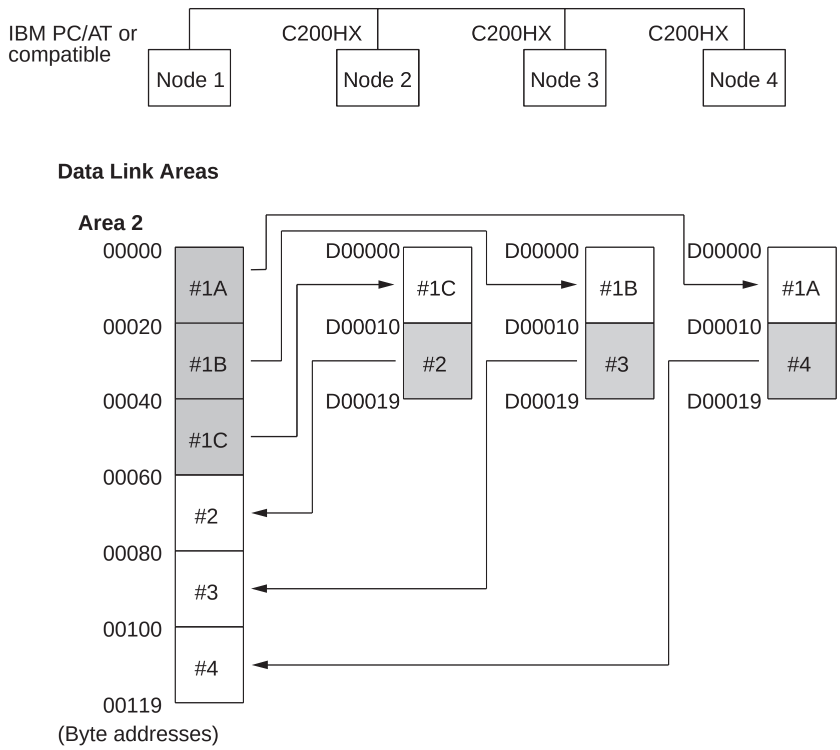
```
                                              Edit             DataLink table
 Node[04]  PCtype[CVM1-CPU21]  Num of Nd [ 2]      Status Word[--------]

Node|<Area1>    Link Start Word[01000    ]|<Area2>    Link Start Word[E1_00000]
    |  Link Wd    Num Wd Source Wd        |  Link Wd    Num Wd Source Wd
----+-------------------------------------+-----------------------------------
 03 |  01000        20    01000           |  E1_00000    300    E0_00000
 04 |  01020        20    Send Area       |  E1_00300    300    Send Area
```

SAMPLE4.CLK: Receiving Only Part of Send Data and Offsets

Only area 2 is used in this example.

Note A Controller Link Support Board is used in this example. The Support Board does not have memory areas. The area settings are ignored and byte addresses are used. Refer to the *Controller Link Support Boards Operation Manual (W307)* for details on using a Controller Link Support Board.

Data Link Area Structure



Device Information Setting

Device Info set DataLink table

Node	Model name	Node	Model name
01	CLK Board	17	
02	C200HX	18	
03	C200HX	19	
04	C200HX	20	
05		21	
06		22	

Data Link Tables

Edit DataLink table

Node[01] PCtype[CLK Board] Num of Nd [4] Status Word[--------]

Node	<Area1> Link Start Word[00000] Link Wd	Num Wd	Source Wd	<Area2> Link Start Word[D00000] Link Wd	Num Wd	Source Wd
01	00000	0	Send Area	D00000	30	Send Area
02	00000	0	00000	D00030	10	D00010
03	00000	0	00000	D00040	10	D00010
04	00000	0	00000	D00050	10	D00010

Edit DataLink table

Node[02] PCtype[C200HX] Num of Nd [2] Status Word[--------]

Node	<Area1> Link Start Word[00000] Link Wd	Num Wd	Source Wd	Offset	<Area2> Link Start Word[D00000] Link Wd	Num Wd	Source Wd	Offset
01	00000	0	00000	0	D00000	10	D00020	20
02	00000	0	Send Area	---	D00010	10	Send Area	---

Edit DataLink table

Node[03] PCtype[C200HX] Num of Nd [2] Status Word[--------]

Node	<Area1> Link Start Word[00000] Link Wd	Num Wd	Source Wd	Offset	<Area2> Link Start Word[D00000] Link Wd	Num Wd	Source Wd	Offset
01	00000	0	00000	0	D00000	10	D00010	10
03	00000	0	Send Area	---	D00010	10	Send Area	---

Edit DataLink table

Node[04] PCtype[C200HX] Num of Nd [2] Status Word[--------]

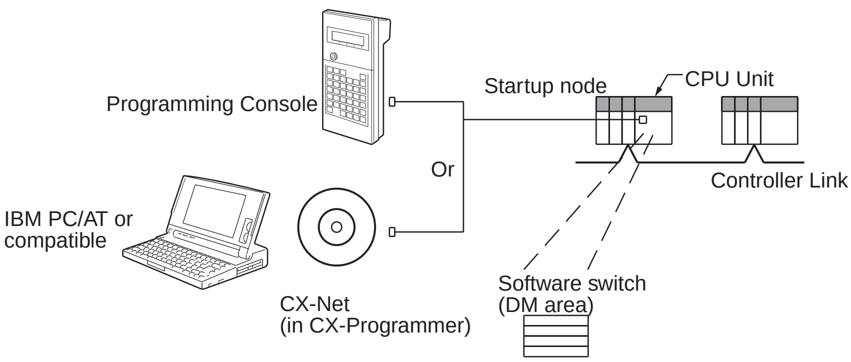
Node	<Area1> Link Start Word[00000] Link Wd	Num Wd	Source Wd	<Area2> Link Start Word[D00000] Link Wd	Num Wd	Source Wd
01	00000	0	00000	D00000	10	D00000
04	00000	0	Send Area	D00010	10	Send Area

5-2-4 Automatic Setting: "Select All"

Data links can be automatically created by setting values in the DM parameter area of the PLC's CPU Unit of the startup node. The settings are made using a Programming Console or the CX-Net in the CX-Programmer.

The startup node is the node from which the data links are activated. When automatically setting data links, data link operation is based on the values set in the startup node.

Note Automatic setting appears as "Select All" on the Controller Link Support Software message screens.



Note Data links can be started using one of the following (See p 100.)

- Using a software switch
- Using Controller Link Support Software or CX-Net (in CX-Programmer)
- Using FINS commands.

CS/CJ-series Startup Node

Set the following DM parameter area of the PLC of the startup node.

N: DM 30000 + 100 × Controller Link Unit number

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

0: Always specify 0.
–: By other setting

Bits 5 and 4: Data link mode
Set to 01 for automatic setting.
(00 is for manual setting. Other values are invalid.)

	15 to 8	7 to 0
N+1	Area 1 data link start word (BCD)	
N+2	Area 1 type	00
N+3	Number of send words per node of area 1 (BCD)	
N+4	Rightmost 4 digits of data link start word of area 2 (DM area) (BCD)	
N+5	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
N+6	Number of send words per node of area 2 (BCD)	
N+7	First data link status word (BCD)	

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+8	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
N+9	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

← Nodes to participate in the data links
The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.
Participate: 1
Not participate: 0

BCD: Set the value as binary-coded decimal.

Settings

Item	Setting range
Data link mode	Specify automatic (01).
Area 1 data link start word	Set the word address in BCD. CIO Area: CIO 000 to CIO 6143 LR Area: LR 00 to 199 (*) *: When a word between LR 000 and LR 199 is specified, the data link area will be allocated between CIO 1000 and CIO 1199.
Area 1 type	Set the area for area 1 in BCD. IR Area: 80 LR Area: 86 Area 1 not used: 00
Number of send words per node of area 1	Set the number of words in BCD between 0 and 1,000. The total number of send words for area 1 and area 2 must not exceed 1,000. When area 1 is not used, set to 0.
Area 2 data link start word	Set the word address in BCD. DM Area: DM 0000 to DM 32767 EM Area: Banks 00 to 12, EM 0000 to EM 32767
Area 2 type	Set the area type for area 2 in BCD. DM Area: 82 EM Area: Banks 00 to 07: 90 to 97 Banks 08 to 12: A8 to AC Area 2 not used: 00

Item	Setting range
Number of send words per node of area 2	Set the number of words in BCD between 0 and 1,000. The total number of send words of area 1 and area 2 must not exceed 1,000. When area 2 is not used, set to 0.
First data link status word	Set in BCD the first word used for storing data link status. An area of 16 words is used for storing status. 0 (*), IR 000 to IR 6128 Status is stored in an the IR Area only. *: When 0 is set, the status is saved in IR 1500 + unit number x 25 (+ 7 to + 22).
Nodes to participate in the data links	Set to ON (1) the bits corresponding to the nodes participating in the data links. The data link will not start unless the startup node itself is set as a participating node. The data link will not start if the node is set to a parameter exceeding the “maximum node address” of the network parameter.

Note **a)** The total number of words in data link send and receive areas must not exceed 12,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

(Data link start word – 1) + Total number of send/receive words in area ≤ 6143 (CIO Area)
199 (LR Area)
32767 (DM Area, EM Area)

c) When using area 1 only, set the data link start word, type, and the number of send words of area 2 to 0.

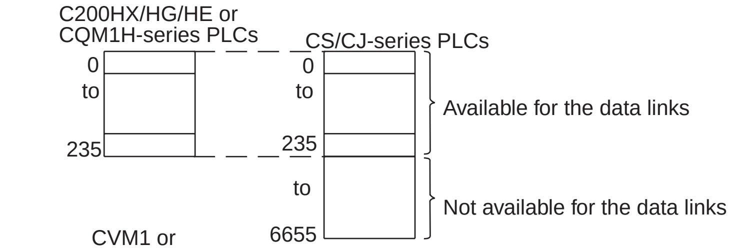
d) When using area 2 only, set the data link start word, type, and the number of send words of area 1 to 0.

e) The startup node must be set as a participating node of the data links. If not, the data links will not start.

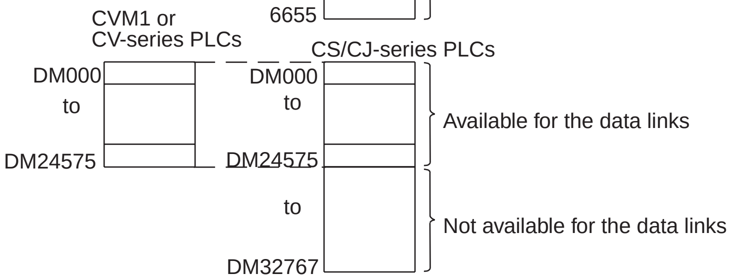
Note 1. When data links are automatically created for networks containing C200HX/HG/HE PLCs, CS/CJ-series PLCs, CVM1, CV-series, and CQM1H-series PLCs, the linkable area is restricted to the area of the

CVM1, CV-series, C200HX/HG/HE, or CQM1H-series PLC because it is smaller than that of CS/CJ-series PLCs.

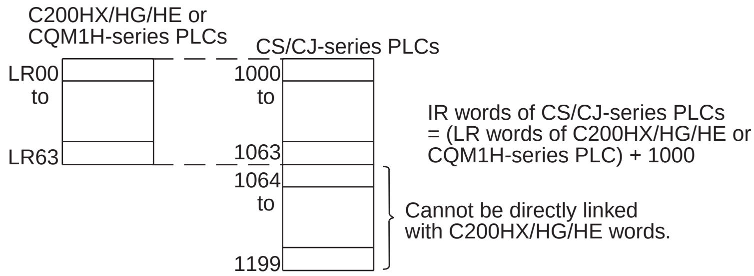
Example: IR/CIO Area



Example: DM Area



2. If the LR Area in the C200HX/HG/HE or CQM1H-series PLC is automatically set for a data link with a CVM1, CV-series PLC or CS/CJ-series PLC, the LR words will be linked to CIO 1000 to CIO 1063 in the CVM1, CV-series or CS/CJ-series PLC. CIO 1064 to CIO 1199 cannot be linked with C200HX/HG/HE or CQM1H-series PLCs in this way.



C200HX/HG/HE Startup Node

Set the following DM parameter area of the PLC of the startup node.

N: Level 0 = DM 6400
Level 1 = DM 6420

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

0: Always specify 0.
–: By other setting

Data link mode (bits 5 and 4)
Set to 01 for automatic setting.
(00 is for manual setting. Other values are invalid.)

	15 to 8	7 to 0
N+1	Area 1 data link start word (BCD)	
N+2	Area 1 type	00
N+3	Number of send words per node of area 1 (BCD)	
N+4	Rightmost 4 digits of data link start word of area 2 (DM area) (BCD)	
N+5	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
N+6	Number of send words per node of area 2 (BCD)	
N+7	First data link status word (BCD)	

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+8	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
N+9	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

← Nodes to participate in the data links
The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.
Participate: 1
Not participate: 0

BCD: Set the value as binary-coded decimal.

Settings

Item	Setting range
Data link mode	Specify automatic (01).
Area 1 data link start word	Set the word address in BCD. IR Area: IR 000 to IR 235, IR 300 to IR 511 LR Area: LR 00 to 63
Area 1 type	Set the area for area 1 in BCD. IR Area: 80 LR Area: 86 Area 1 not used: 00
Number of send words per node of area 1	Set the number of words in BCD between 0 and 1,000. The total number of send words for area 1 and area 2 must not exceed 1,000. When area 1 is not used, set to 0.
Area 2 data link start word	Set the word address in BCD. DM Area: DM 0000 to DM 5999 EM Area: Banks 00 to 15, EM 0000 to EM 6143
Area 2 type	Set the area type for area 2 in BCD. DM Area: 82 EM Area: Banks 00 to 07: 90 to 97 Banks 08 to 15: A8 to AF Area 2 not used: 00
Number of send words per node of area 2	Set the number of words in BCD between 0 and 1,000. The total number of send words of area 1 and area 2 must not exceed 1,000. When area 2 is not used, set to 0.

Item	Setting range
First data link status word	Set in BCD the first word used for storing data link status. An area of 16 words is used for storing status. 0 (*), IR 001 to IR 220, IR 300 to IR 496 Status is stored in an the IR Area only. *: When 0 is set, status of nodes 1 to 6 is stored in CIO 239 to CIO 241 for level 0 and in CIO 243 to CIO 245 for level 1.
Nodes to participate in the data links	Set to ON (1) the bits corresponding to the nodes participating in the data links. The data link will not start unless the startup node itself is set as a participating node. The data link will not start if the node is set to a parameter exceeding the “maximum node address” of the network parameter.

Note **a)** The total number of words in data link send and receive areas must not exceed 8,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

(Data link start word – 1) + Total number of send/receive words in area ≤ 235 (First word IR 000 to IR 235)
511 (First word IR 300 to IR 511)
63 (LR Area)
5999 (DM Area)
6143 (EM Area)

c) When using area 1 only, set the data link start word, type, and the number of send words of area 2 to 0.

d) When using area 2 only, set the data link start word, type, and the number of send words of area 1 to 0.

e) The startup node must be set as a participating node of the data links. If not, the data links will not start.

CVM1 or CV-series Startup Node

Set the following DM parameter area of the PLC of the startup node.

N: DM 2000 + 100 × (Unit number of Controller Link Unit)

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

0: Always 0.
–: Other settings

Data link mode (bits 5 and 4)
Set to 01 for automatic setting.
(00 is for manual setting. Other values are invalid.)

	15 to 8	7 to 0
N+1	Area 1 data link start word (BCD)	
N+2	Area 1 type	
N+3	Number of send words per node of area 1 (BCD)	
N+4	Rightmost 4 digits of data link start word of area 2 (BCD)	
N+5	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
N+6	Number of send words per node of area 2 (BCD)	
N+7	First data link status word (BCD)	

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+8	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
N+9	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

BCD: Set the value as binary-coded decimal.

Nodes to participate in the data links
The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.
Participate: 1
Not participate: 0

Settings

Item	Setting range
Data link mode	Specify automatic (01).
Area 1 data link start word	Set the word address in BCD. CIO Area: CIO 0000 to CIO 2555 LR Area: LR 000 to LR 199 (*) *: When a word between LR 000 and LR 199 is specified, the data link area will be allocated between CIO 1000 and CIO 1199.
Area 1 type	Set the area for area 1 in BCD. CIO Area: 80 LR Area: 86 Area 1 not used: 00
Number of send words per node of area 1	Set the number of words in BCD between 0 and 1,000. The total number of send words of area 1 and area 2 must not exceed 1,000. When area 1 is not used, set to 0.
Area 2 data link start word	Set the word address in BCD. DM Area: DM 0000 to DM 8191 (CV500/CVM1-CPU01) DM 0000 to DM 24575 (Other CPU Units) EM Area: Banks 00 to 07, EM 0000 to EM 32765 (EM must be installed)
Area 2 type	Set the area for area 2 in BCD. DM Area: 82 EM Area: Banks 00 to 07: 90 to 97 Area 2 not used: 00

Item	Setting range
Number of send words per node of area 2	Set the number of words in BCD between 0 and 1,000. The total number of send words of area 1 and area 2 must not exceed 1,000. When area 2 is not used, set to 0.
First data link status word	Set in BCD the first word used for storing data link status. An area of 16 words is used for storing status. 0 (*) or CIO 0001 to CIO 2540 Status is stored in the CIO area only. *: When 0 is set, the status is saved in CIO 1500 + unit number x 25 (+ 7 to + 22).
Nodes participating in the data links	Set to ON (1) the bits corresponding to the nodes participating in the data links. The data link will not start unless the startup node itself is set as participating node. The data link will not start if the node is set to a parameter exceeding the “maximum node address” of the network parameter.

Note **a)** The total number of words in data link send and receive areas must not exceed 8,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

(Data link start word – 1) + Total number of send/receive words in area ≤ 2555 (CIO Area)
199 (LR Area)
8191 (DM Area for CV500/CVM1-CPU01)
24575 (DM Area for other CPU Units)
32765 (EM Area)

c) When using area 1 only, set the data link start word, type, and the number of send words of area 2 to 0.

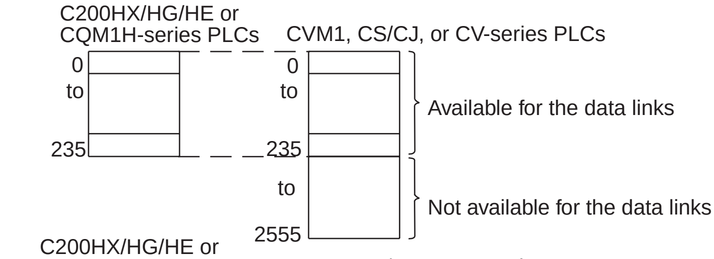
d) When using area 2 only, set the data link start word, type, and the number of send words of area 1 to 0.

e) The startup node must be registered as a participating node of the data links. If not, the data links will not start.

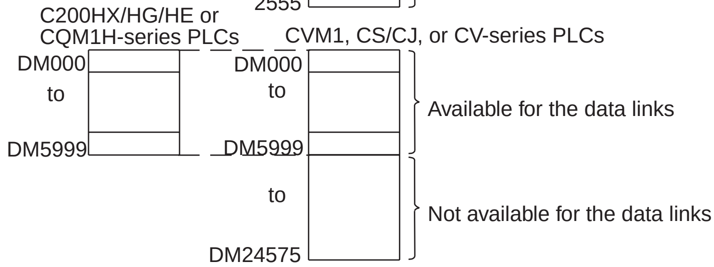
Note 1. When data links are automatically created for networks containing C200HX/HG/HE, CS/CJ-series, CVM1, CV-series, and CQM1H-series PLCs, the linkable area is restricted to the area of the C200HX/HG/HE or

CQM1H-series PLC because it is smaller than that of CVM1, CV-series or CS/CJ-series PLCs.

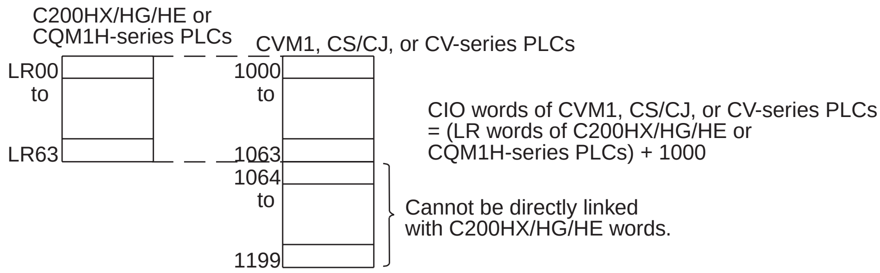
Example: IR/CIO Area



Example: DM Area



2. If the LR Area in a C200HX/HG/HE or CQM1H-series PLC is manually set for a data link with a CVM1, CV-series, or CS/CJ-series PLC, the LR words will be linked to CIO 1000 to CIO 1063 in the CVM1, CV-series or CS/CJ-series PLC. CIO 1064 to CIO 1199 cannot be linked with C200HX/HG/HE or CQM1H-series PLCs in this way.



CQM1H-series Startup Node

Set the following DM parameter area of the PLC of the startup node.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DM 6400	–	–	0	–	0	0	0	0	0	0			0	0	0	0

0: Always 0.
– : Other settings

Bits 5 and 4: Data link mode
Set to 01 for automatic setting.
(00 is for manual setting. Other values are invalid.)

	15 to 8	7 to 0
DM 6401	Area 1 data link start word (BCD)	
DM 6402	Area 1 type	00
DM 6403	Number of send words per node of area 1 (BCD)	
DM 6404	Rightmost 4 digits of data link start word of area 2 (BCD)	
DM 6405	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
DM 6406	Number of send words per node of area 2 (BCD)	
DM 6407	First data link status word (BCD)	

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DM 6408	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
DM 6409	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

BCD: Set the value as binary-coded decimal.

Nodes to participate in the data links
The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.
Participate: 1
Not participate: 0

Settings

Item	Setting range
Data link mode	Specify automatic (01).
Area 1 data link start word	Set the word address in BCD. IR Area: IR 0000 to IR 247 LR Area: LR 00 to LR 63
Area 1 type	Set the area for area 1 in BCD. IR Area: 80 LR Area: 86 Area 1 not used: 00
Number of send words per node of area 1	Set the number of words in BCD between 0 and 1,000. The total number of send words of area 1 and area 2 must not exceed 1,000. When area 1 is not used, set to 0.
Area 2 data link start word	Set the word address in BCD. DM Area: DM 0000 to DM 5999 EM Area: EM 0000 to EM 6143 (EM must be installed)
Area 2 type	Set the area for area 2 in BCD. DM Area: 82 EM Area: 90 Area 2 not used: 00
Number of send words per node of area 2	Set the number of words in BCD between 0 and 1,000. The total number of send words of area 1 and area 2 must not exceed 1,000. When area 2 is not used, set to 0.

Item	Setting range
First data link status word	Set in BCD the first word used for storing data link status. An area of 16 words is used for storing status. 0 (*) or IR 001 to IR 232 Status is stored in the IR area only. *: When 0 is set, the status for nodes 1 to 6 is stored in IR 91 to IR 93.
Nodes participating in the data links	Set to ON (1) the bits corresponding to the nodes participating in the data links. The data link will not start unless the startup node itself is set as participating node. The data link will not start if the node is set to a parameter exceeding the “maximum node address” of the network parameter.

Note **a)** The total number of words in data link send and receive areas must not exceed 8,000 per node.

b) The following values must be satisfied for each node for the data link area 1 and area 2 so that the final word in the data link does not go beyond the last word in the PLC memory area.

(Data link start word – 1) + Total number of send/receive
words in area ≤ 247 (IR Area)
63 (LR Area)
5999 (DM Area)
6143(EM Area)

c) When using area 1 only, set the data link start word, type, and the number of send words of area 2 to 0.

d) When using area 2 only, set the data link start word, type, and the number of send words of area 1 to 0.

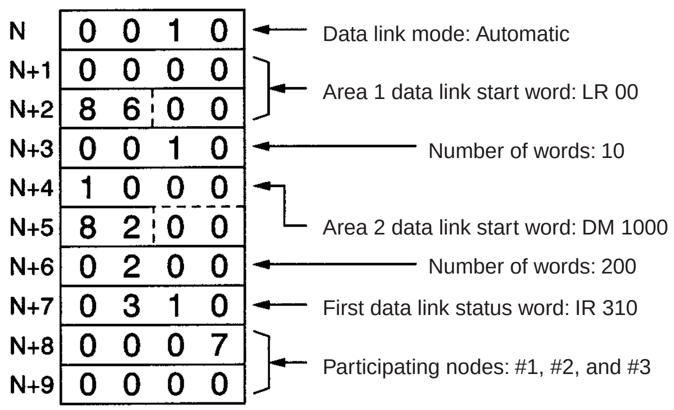
e) The startup node must be registered as a participating node of the data links. If not, the data links will not start.

5-2-5 Automatic Setting Example

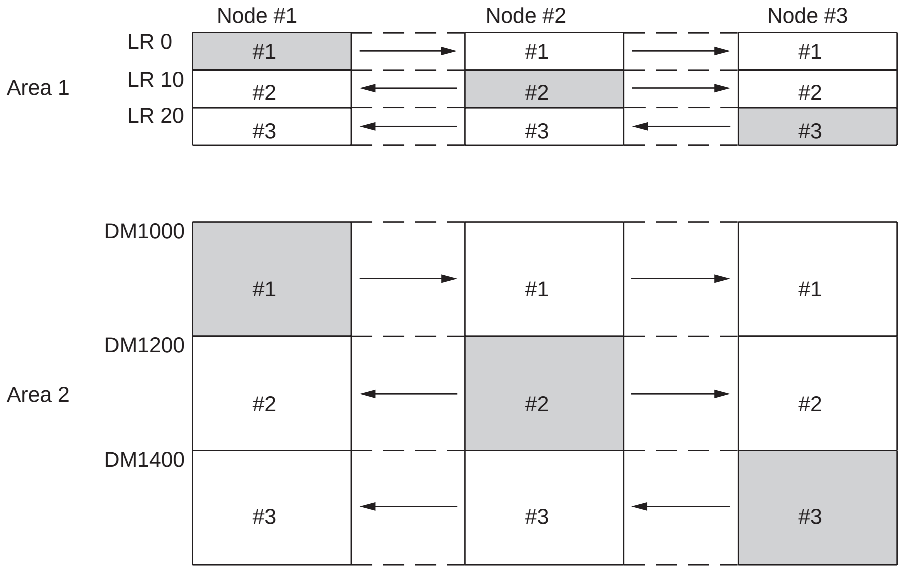
This section shows an example of DM parameter area settings and the data link areas that are created as a result.

DM Parameter Area Settings

Set the parameters in the startup node as follows:



Data Link Areas Created



5-3 Starting and Stopping Data Links

Data link must be started after data link areas have been created. Use any of the methods described below for the startup node to start and stop data links. (The procedure for stopping data links is performed on participating nodes.) These methods are the same for both manually and automatically set data links.

Note The data link mode (manual setting or automatic setting) and data link method are determined according to the data link setting in the startup node. In the startup node, set a data link table in the case of manual setting and data link automatic setting parameters in the case of automatic setting. If the settings are incorrect, the data link will not start.

⚠ **Caution** Check the following items before starting data links. If incorrect data link tables or parameters are set, injury may result due to unexpected operation of the system. Even if the correct data link tables and parameters have been set, do not start or stop data links before verifying that there will be no adverse influence on the system.

•Manually Set Data Links

Check the data link tables in each node participating in the data link to see that they are correct.

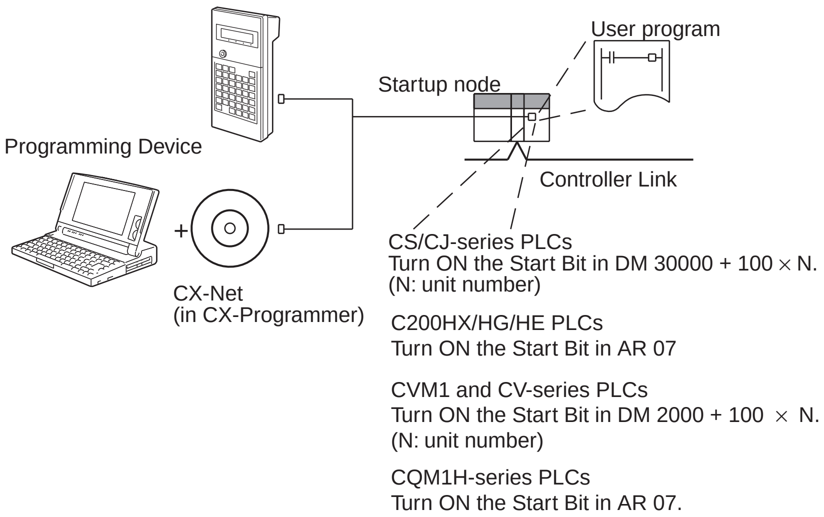
Be sure that data link tables are deleted from nodes that are not participating in the data links.

•Automatically Set Data Links

Be sure that the correct DM parameters have been set in the data link startup node.

5-3-1 Using a Programming Device or the User Program

Set the software switch (AR or DM Start Bit) in the PLC to ON using a Programming Device or from the user program.

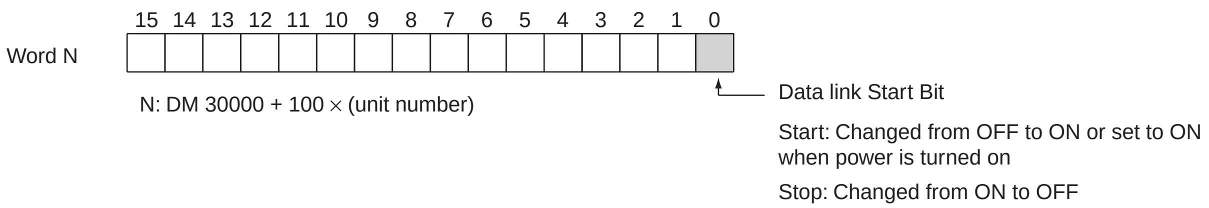


The data links will start when the Start Bit changes from OFF to ON or is already ON when power is turned on. The data links will stop when the Start Bit changes from ON to OFF.

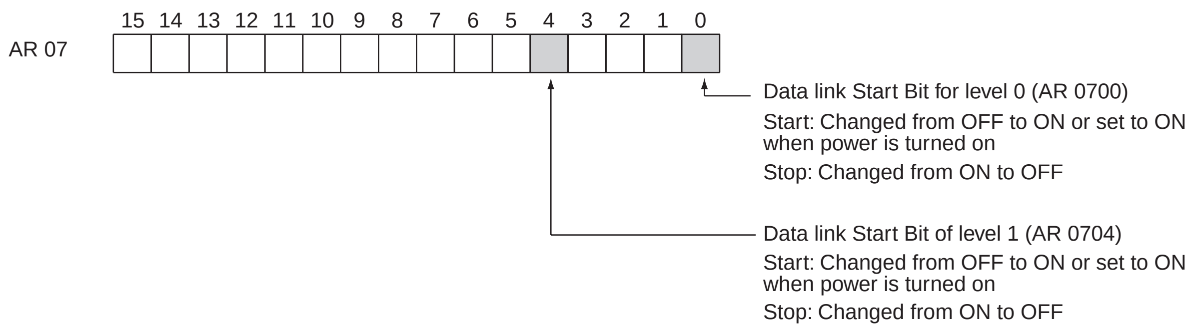
Note The data in the AR and DM Areas is retained when power is turned off. Therefore, by setting in the AR and DM Areas can be made in advance to start data links as soon as power is turned on.

It is recommended to set the Start Bit to ON in multiple nodes that are participating in the data link so that the data links will start even if the startup node is down. The same data link settings must be set in these nodes for automatically set data links.

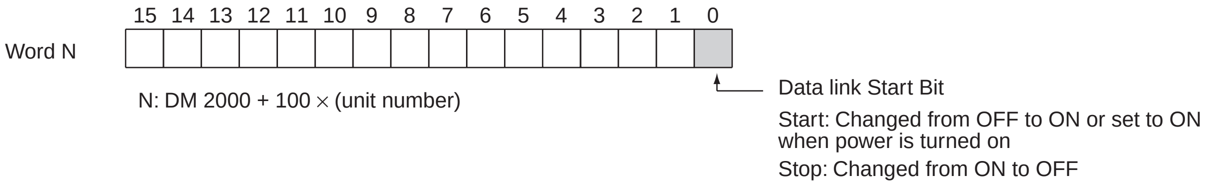
CS/CJ-series Start Bit



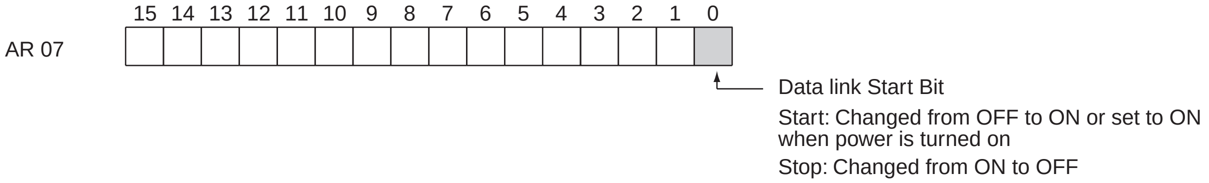
C200HX/HG/HE Start Bit



CVM1 and CV-series Start Bit



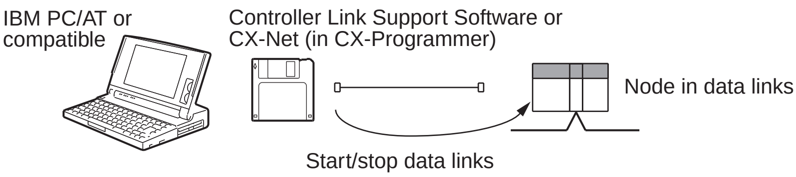
CQM1H-series Start Bit



5-3-2 Using the Controller Link Support Software and CX-Programmer

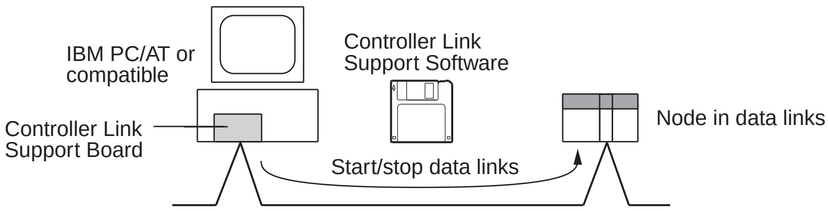
Data links can be started or stopped using commands on the Data Link Menu of the Controller Link Support Software. The node for which starting and stopping is being specified must participate in the data links.

Using a Programming Device Connected to PLC Node



Note The Controller Link Support Software cannot be connected to a CS1-series PLC. Use the CX-Net (in CX-Programmer).

Using a Computer Node

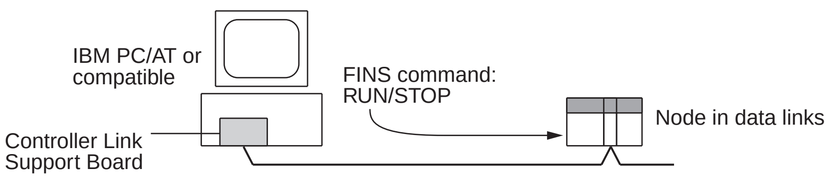


Data links can be started or stopped from the Controller Link Support Board on the local node.

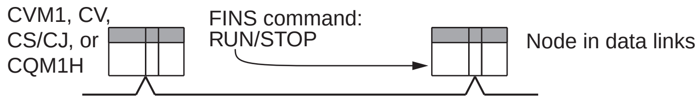
5-3-3 Using FINS Commands

Data links can be started and stopped by sending the RUN and STOP FINS commands from a node on the Controller Link to a node that is in the data links.

Issuing the FINS Command from a Computer Node



Issuing the FINS Command from CVM1, CV-series, CS/CJ-series, and CQM1H-series PLCs



Data links can be stopped by sending the FINS command "STOP." The node to which the FINS command is issued must be participating in the data link.

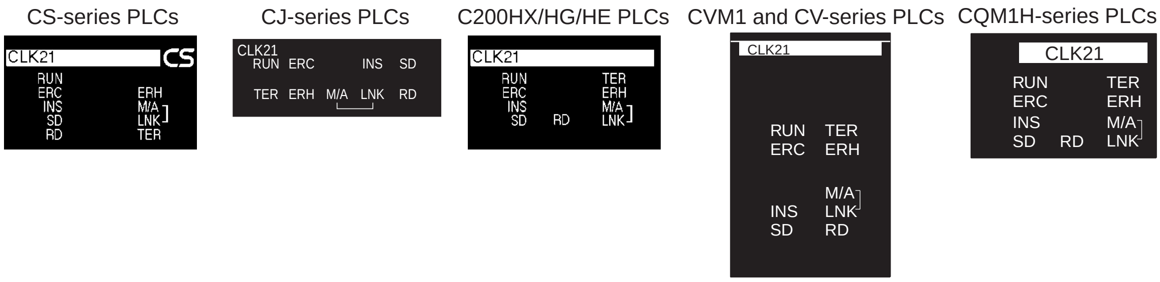
5-4 Checking Data Link Status

There are two methods for checking the status of active data links:

- Check the LED indicators on the front of the Units.
- Check the data link status area.

5-4-1 LED Indicators

Check the LINK and M/A indicators on the front of the unit.



Make sure that the LNK indicator is ON at nodes participating in the active data links.

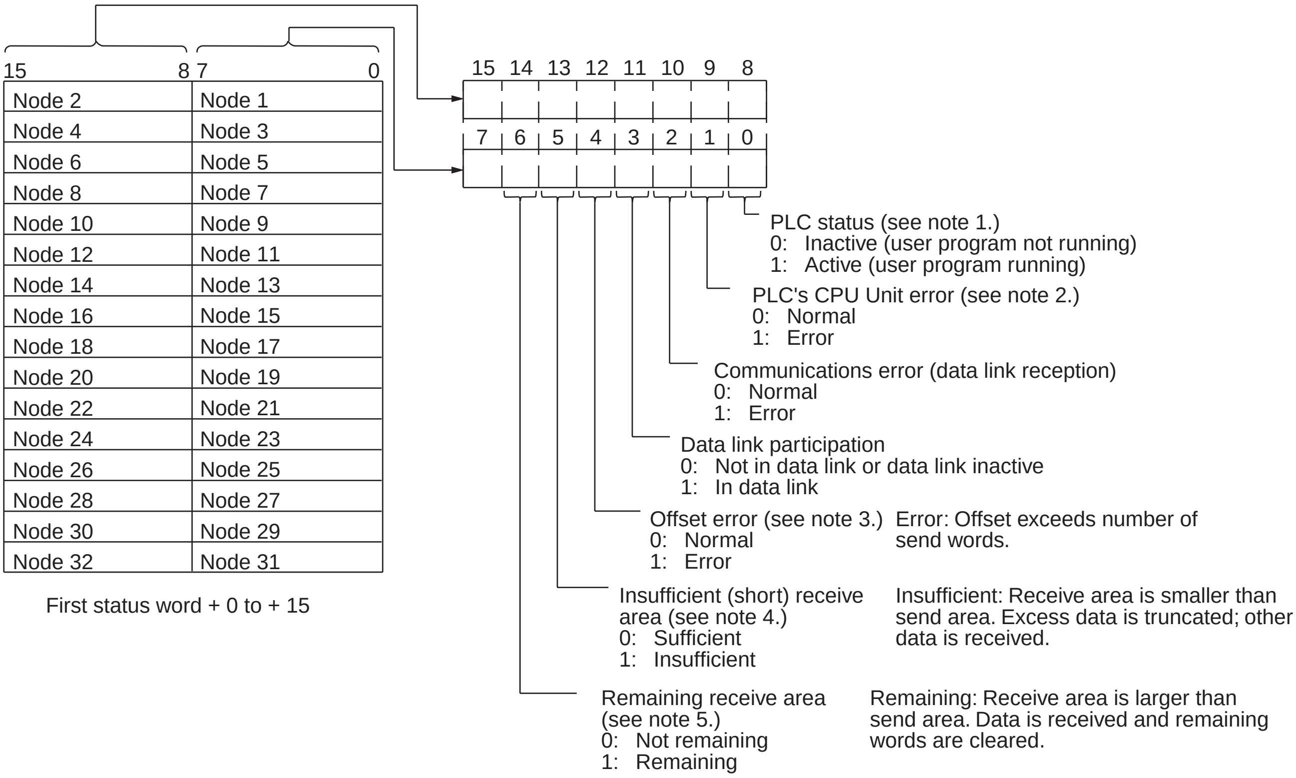
<table>
<tr><th>Name</th><th>Color</th><th>Status</th><th colspan="2">Contents</th></tr>
<tr><td rowspan="3">LNK
(data link)</td><td rowspan="3">Yellow</td><td>ON</td><td colspan="2">Participating in data links.</td></tr>
<tr><td>Flashing</td><td colspan="2">Data link table setting error</td></tr>
<tr><td>OFF</td><td colspan="2">Not in data links or data links are inactive.</td></tr>
<tr><td rowspan="2">M/A
(data link mode)</td><td rowspan="2">Yellow</td><td>ON</td><td>Manual</td><td rowspan="2">Note: This indicator will always be OFF when the data links are not active.</td></tr>
<tr><td>OFF</td><td>Automatic</td></tr>
</table>

The LNK indicator will be lit at all node participating in the data links as long as operation is normal. The data link mode (manual/automatic) can be checked using the M/A indicator. See *9-1 Troubleshooting Using Indicators* for details.

5-4-2 Data Link Status Area

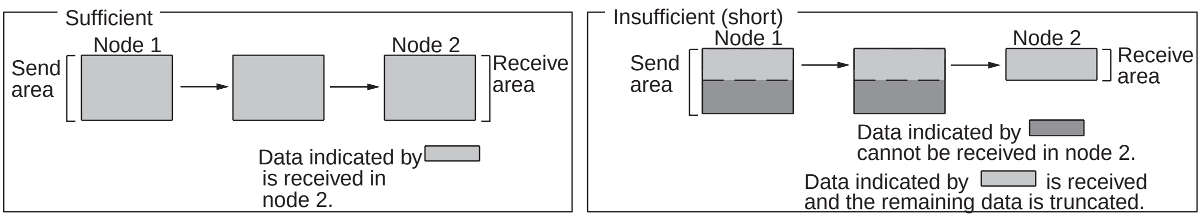
The data link status area can be used to check for errors when data link does not operate normally even though no abnormality has been detected by the PLC's CPU Unit or the Controller Link Unit. The data link status area contains the data link status information shown below. This status information is stored in the same words for C200HX/HG/HE PLCs, CS/CJ-series, CVM1, CV-series, and CQM1H-series PLCs.

See *9-2 Status Area and Troubleshooting* for troubleshooting procedures.

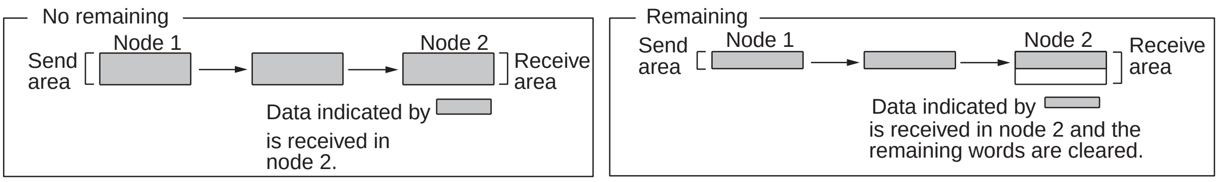


Note 1. Always 1 for the Controller Link Support Board.

2. Always 0 for the Controller Link Support Board.
3. Even if an offset error occurs, the data link will operate and the node will participate in the data links. In the node where the offset error occurred, however, all receive area words will be cleared to 0.
4. The following shows an example of an insufficient (short) receive area.



5. The following shows an example of a remaining receive area.



Note 1. Be sure to set the bit in the DM Area's (CPU Bus Unit Area's) software switches (DM30000 + 100 × unit number) described as "always set to 0" to 0. Not doing so may result in the data link not starting properly. If a data link is started with bit 7 of the software switches set to 1, the data link status will be stored in a format different to the one described in this manual (when using CS-series or CJ-series Controller Link Units).

2. A communications error will occur in a node that is not participating in the network. When a communications error occurs, previous status is retained for other nodes status.
3. Only the PLC status and the PLC's CPU Unit error status are refreshed for nodes that are participating in the network, but not participating in the data links.
4. When the data link status area is set in the IR, CIO, or LR Area, the data link status will be instantaneously set to 0 when the mode of the PLC's CPU Unit is changed.

The flags in the data link status operate as follows:

Name	Function
Data link participation	The corresponding flag will turn ON if the node has never participated in the data link normally. The flag will not turn OFF once it has turned ON even if the node is no longer participating in the data links.
Communications error	The corresponding flag will turn ON if continuous data link data cannot be received from the node, e.g., due to a cable break. The flag will turn OFF again if normal data is received.
PLC's CPU Unit error	The corresponding flag will turn ON if the CPU Unit has a fatal error, non-fatal error, or watchdog timer error. The flag will turn OFF again if the node returns to normal. The status of this flag is based on data sent from the node and will not turn ON if data cannot received, e.g., due to a Communications Error. Make sure that the Communications Error Flag is OFF before checking this flag.
PLC status	The corresponding flag will turn ON if the user program is being executed in the CPU Unit. It will turn OFF is the user program is not being executed. The status of this flag is based on data sent from the node and will not turn ON if data cannot received, e.g., due to a Communications Error. Make sure that the Communications Error Flag is OFF before checking this flag.

The Data Link Participation Flag and the PLC Status Flag can be used to see if the system has started normally. These flags, however, cannot be used to detect communications errors. Use the Communications Error Flag and PLC's CPU Unit Error Flag to detect errors.

If the Local Node Data Link Participation Flag is OFF, the previous status will be maintained as the data link status and may not be correct. Make sure that the Local Node Data Link Participation Flag is ON before checking data link status.

Note The following Local Node Data Link Participation Flags are available.

CS/CJ-series, CVM1, CV-series PLCs:
Bit 15 in 1500 + 25 x unit number + 6
C200HX/HG/HE PLCs: SR 25205
CQM1H-series PLCs: IR 9015

The data link status storage area is set as follows:

Data link mode	PLC and operating level	First data link status word	Setting range	Default status
Automatic	CS/CJ-series PLC	Specify in DM 30000 + 100 $\times$ N + 7	16 words between CIO 000 and 6640	CIO 1500 + 25 $\times$ N + 7 to 22
	C200HX/HG/HE Level 0	Specify in DM 6407	16 words between IR 000 and IR 220 or IR 300 to IR 496	IR 239 to IR 241 (see note b))
	C200HX/HG/HE Level 1	Specify in DM 6427		IR 243 to IR 245 (see note b))
	CVM1 or CV-series PLC	Specify in DM 2000 + 100 $\times$ N + 7	16 words between CIO 000 and 2540	CIO 1500 + 25 $\times$ N + 7 to 22
	CQM1H-series PLC	Specify in DM 6407	16 words between IR 000 and IR 232	IR 91 to IR 93 (see note b))
Manual	CS/CJ-series PLC	Specify in the data link tables	16 words in the following ranges CIO: 0 to 6640 LR: 0 to 184 DM: 0 to 32752 EM: 0 to 32752	CIO 1500 + 25 $\times$ N + 7 to 22
	C200HX/HG/HE Level 0		16 words in the following ranges IR: 0 to 220 IR: 300 496 LR: 0 to 48 DM: 0 to 5984 EM: 0 to 6128	IR 239 to IR 241 (see note b))
	C200HX/HG/HE Level 1			IR 243 to IR 245 (see note b))
	CVM1 or CV-series PLC		16 words in the following ranges CIO: 0 to 2540 LR: 0 to 184 DM: 0 to 24560 EM: 0 to 32750	CIO 1500 + 25 $\times$ N + 7 to 22
	CQM1H-series PLC		16 words in the following ranges IR: 0 to 232 LR: 0 to 48 DM: 0 to 5984 EM: 0 to 6128	IR 91 to IR 93 (see note b))

Note a) N: Unit number

b) Only status for nodes 1 to 6 are saved.

5-4-3 Checking by Manipulating Bit/Word Status

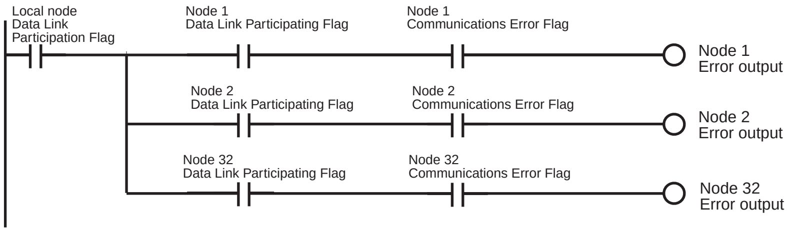
After you have confirmed that the data link function is operating normally, check to see whether or not the data link is operating as intended, i.e., check to see if the desired bits/words data is being transferred to the intended words at other nodes.

Although the data link function itself may be operating correctly, the data link areas may have been input incorrectly.

Change the contents of a bit or word in a data link send area using a Programming Device or the user program and check whether the change is reflected in data link areas of other nodes as intended.

Note Do not restart the polling node of the Controller Link Network while data links are active. Otherwise, the data links may stop.

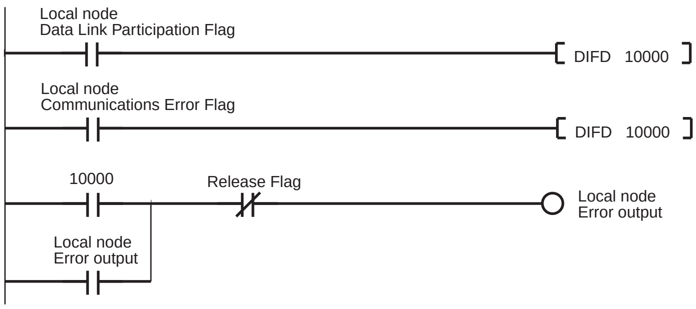
5-4-4 Error Detection Program Example



When the source node's data link is participating, the AND condition of the data link status for each node can be taken using the Data Link Participation Flag and the Communications Error Flag, and the error output.

The following example shows an error output program for cases where the local node data link stops.

The local node's Communications Error Flag (in the data link status area) will be turned ON if the local node is isolated from the network while the data link is active. In this case, the data link remains active, so the node's Data Link Participation Flag will remain ON even though the node is isolated from the network.

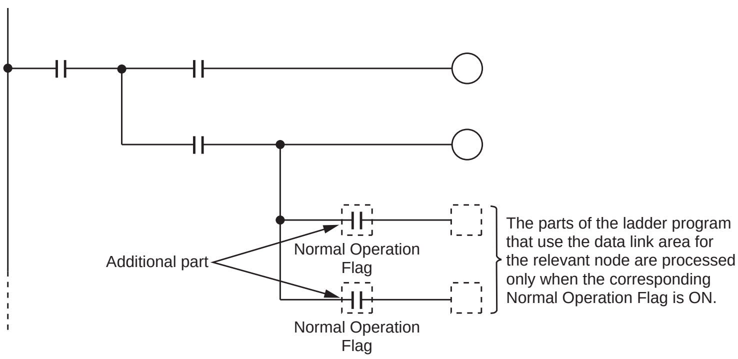


5-4-5 Programming Examples for Processing Data when Errors Occur

If a communications error occurs in a data link and valid data link data cannot be received, the previous data is stored in the data link area. To stop processing using the data link data when an error occurs, refer to the following program example.

Processing Data Only when Data Links Are Operating Normally

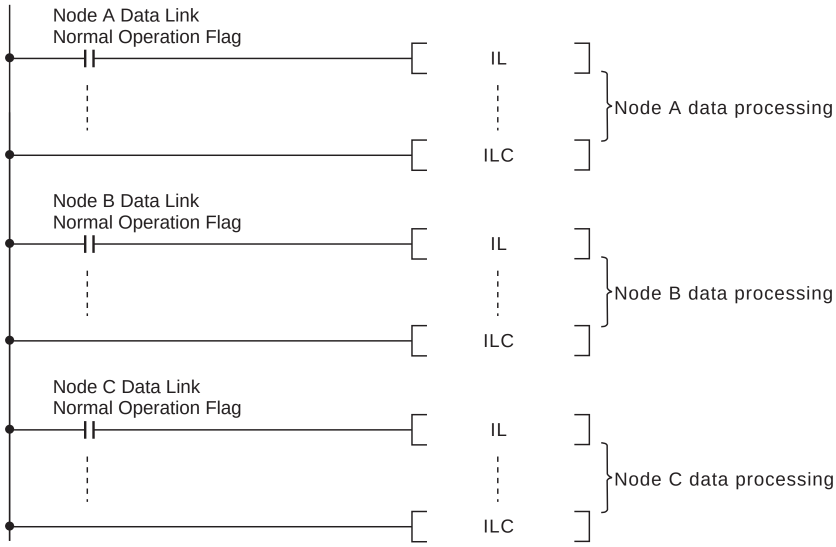
Perform processing only when the data links are operating normally by including an AND condition for the Data Link Normal Operation Flag in the part of the program that handles data link data for each node. This is an example of programming locks in the appropriate places.



“Data Link Normal Operating Flags” can be created using the programming described in *5-4-4 Error Detection Program Example*.

Processing Data Only when Operation Is Normal Using the IL-ILC and JMP-JME Instructions

Perform processing only when operation is normal by creating a program based on program blocks that process data for each node with the IL-ILC and JMP-JME programs.



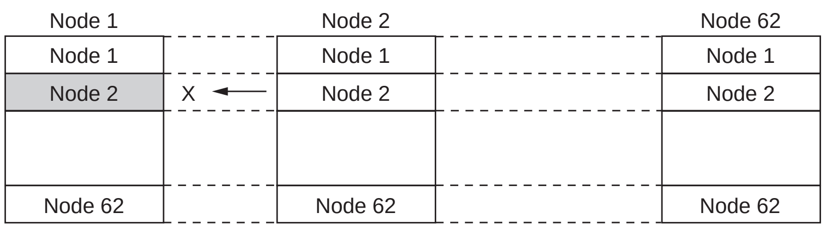
“Data Link Normal Operating Flags” can be created using the programming described in *5-4-4 Error Detection Program Example*.

Writing 0000 in the Data Link Area when Errors Occur

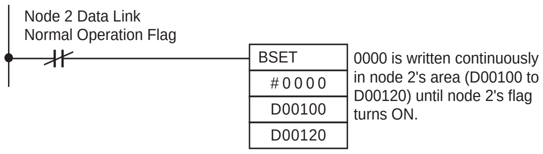
When data links are not operating normally, write 0000 to the data link area of the node with the error to stop other data being received.

As an example, the following example shows how to write 0000 in the data link area of node 2 (D00100 to D00120) using the BSET (block set) instruction when an error occurs at node 2.

■ **Data Link Example: Communications Error at Node 2**



■ Example of Programming for Node 1 to Handle Communications Errors at Node 2



Insert the above programming at the start of the program.

"Data Link Normal Operating Flags" can be created using the programming described in *5-4-4 Error Detection Program Example*.

Note

1. With Controller Link data links, if there is an error at the source node, the previous data (i.e., data received immediately before the error) continues to be stored in the data link receive area of the node receiving the data. To clear the data in the receive area to 0 when an error occurs, include the appropriate programming for clearing to 0, with reference to the above example.
2. Refresh processing for the data used in Controller Link data links is performed between the Controller Link Unit and CPU Unit with every cycle and so the above programming must be included at the start of the program. This method (i.e., clearing to 0) can be used with C200HX/HG/HE, CS1, and CS1-H CPU Units as long as the DLNK instruction is not used, and can be used with CVM1/CV CPU Units as long as CPU execution processing is set to synchronous processing. It cannot be used with C200HX/HG/HE or CS1-H CPU Units if the DLNK instruction is used, or with CVM1/CV CPU Units if CPU execution processing is set to asynchronous processing. (This is because when the DLNK instruction is used with CS1-H CPU Units, or when asynchronous processing is set for the CVM1/CV CPU Units, the refreshing of data for data links is not synchronized with the instruction execution cycle.)

SECTION 6
Message Service

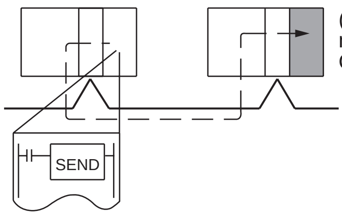
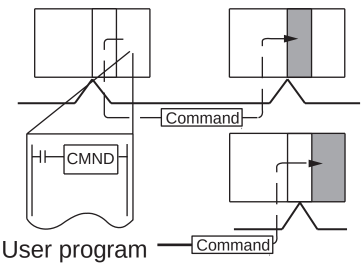
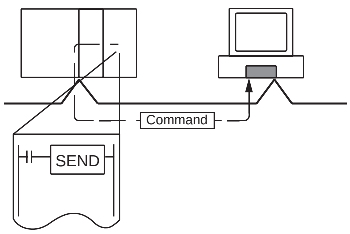
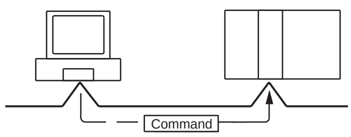
This section explains how to use the message service provided by a Controller Link Unit. It also explains the FINS commands and responses supported by Controller Link Units and those supported by C200HX/HG/HE, CS/CJ-series, CVM1 and CV-series PLCs.

6-1 Introduction

A message service is a command/response system used for data transmission between nodes on a network, i.e., PLC to PLC, PLC to computer, and computer to PLC). The message service can also be used to control operations, such as mode changes. The message service is implemented by sending commands from the user program. The following communications instructions are used:

SEND and RECV: Instructions for sending and receiving data.

CMND: An instruction for sending FINS commands. Some FINS commands are supported by Controller Link Units, and other FINS commands supported by the PLC's CPU Unit.

Message service		SEND/RECV instructions	CMND instruction (FINS commands)
Source node to destination node	PLC to PLC	C200HX/HG/HE, CS/CJ-series, CVM1, CV-series, or CQM1H-series PLC C200HX/HG/HE, CS/CJ-series, CVM1, CV-series, or CQM1H-series PLC  (Command for CPU Unit) User program A program is not required for receiving responses when the PLC executes SEND and RECV.	CS/CJ-series, CVM1, CV-series, or CQM1H-series PLC (Not supported by the C200HX/HG/HE.) C200HX/HG/HE, CS/CJ-series, CVM1, CV-series, or CQM1H-series PLC  (Command for Controller Link Unit) (Command for CPU Unit) User program A program is not required for receiving responses when the PLC executes commands.
	PLC to computer	C200HX/HG/HE, CS/CJ-series, CVM1, CV-series, or CQM1H-series PLC Computer  A program is required for sending and receiving data with the computer. A program is not required for receiving responses when the PLC executes commands.	
	Computer to PLC	(The equivalent of SEND/RECV and CMND are sent from the computer pro gram.) Computer C200HX/HG/HE, CS/CJ-series, CVM1, CV-se ries, or CQM1H-series PLC  (Command for Controller Link Unit or CPU Unit) Programming is required to receive responses at the computer.	

Message service	SEND/RECV instructions	CMND instruction (FINS commands)
Source node: Destination node	SEND: 1:1 or 1:N (broadcast) There are no responses for broadcasting.	1:1 or 1:N (broadcast) There are no responses for broadcasting.
	RECV: 1:1	
Data length	1,980 bytes max. (990 words)	1,990 bytes max.

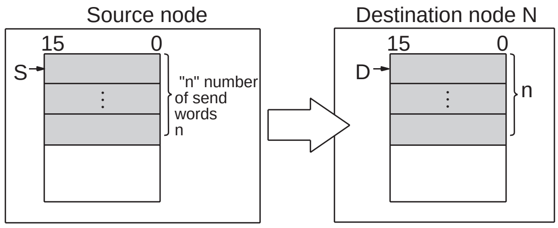
6-1-1 SEND and RECV

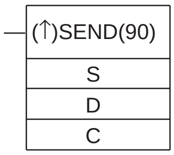
I/O memory data from other nodes can be read or written by simply using the program in the CPU Unit of a C200HX/HG/HE, CS/CJ-series, CVM1, CV-series, or CQM1H-series PLC to execute SEND and RECV.

CS/CJ-series PLCs

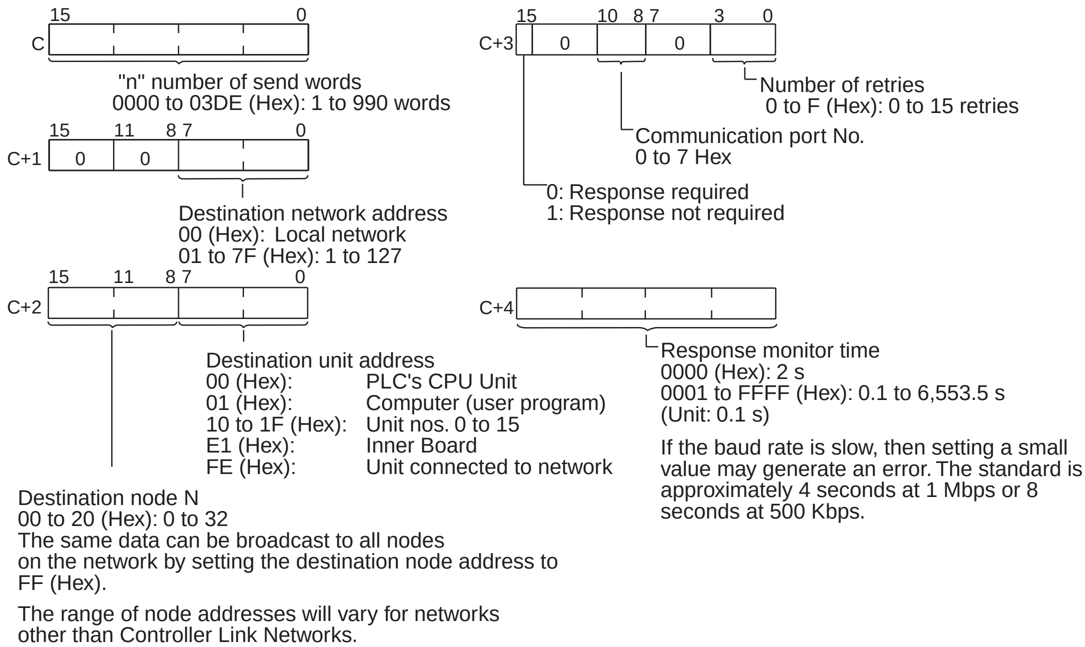
SEND

SEND transmits “n” words beginning with S (the beginning word for data transmission at the source node) to “n” words beginning with D (the beginning word for data reception at the destination node, N.)





S: Source node beginning send word
D: Destination node beginning receive word
C: Source node first control data word

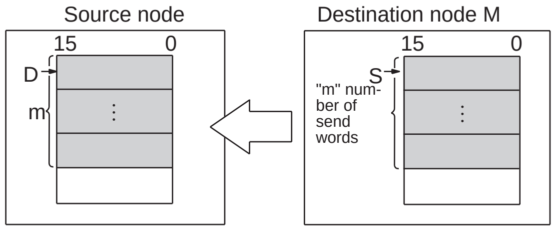


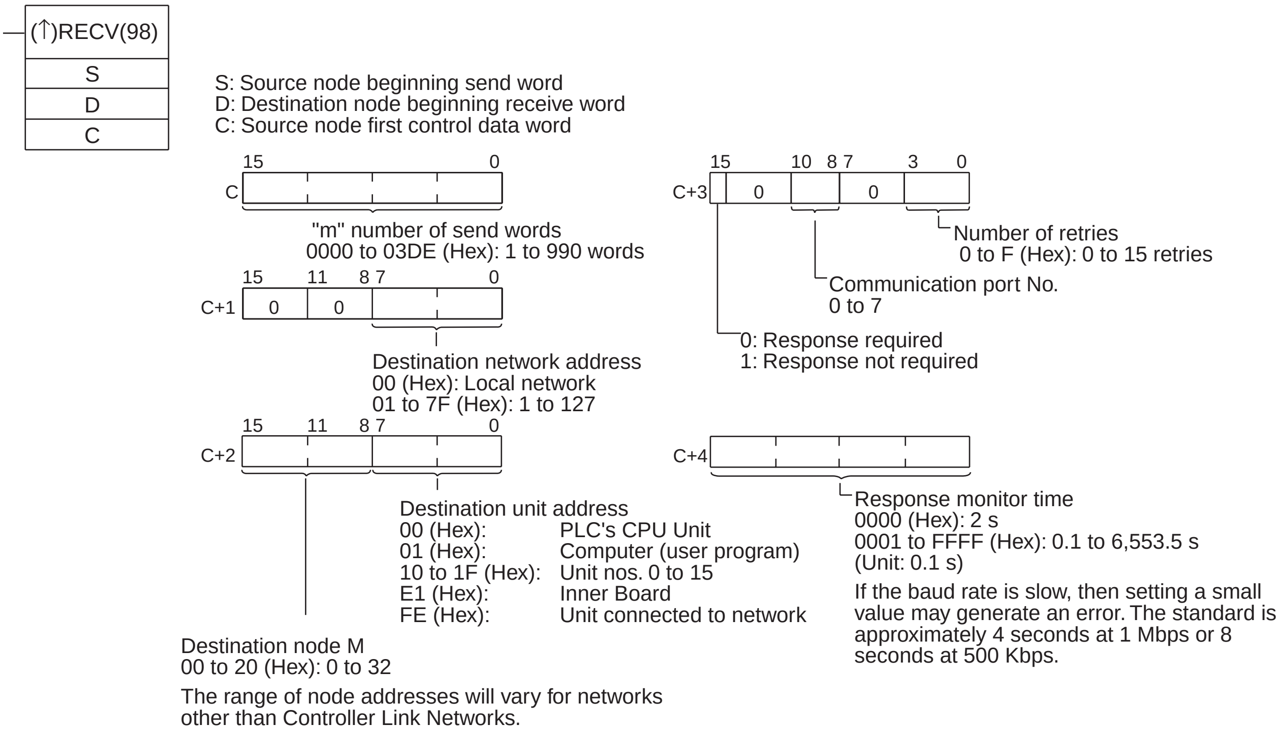
Note 1. When communicating with a CVM1 or CV-series PLC manufactured prior to April 1996 on the local network, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.

2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than "0" for the number of retries.

RECV

RECV receives "m" words beginning with S (the beginning word for data transmission at the destination node, M) to the words beginning with D (the beginning word for data reception at the source node).





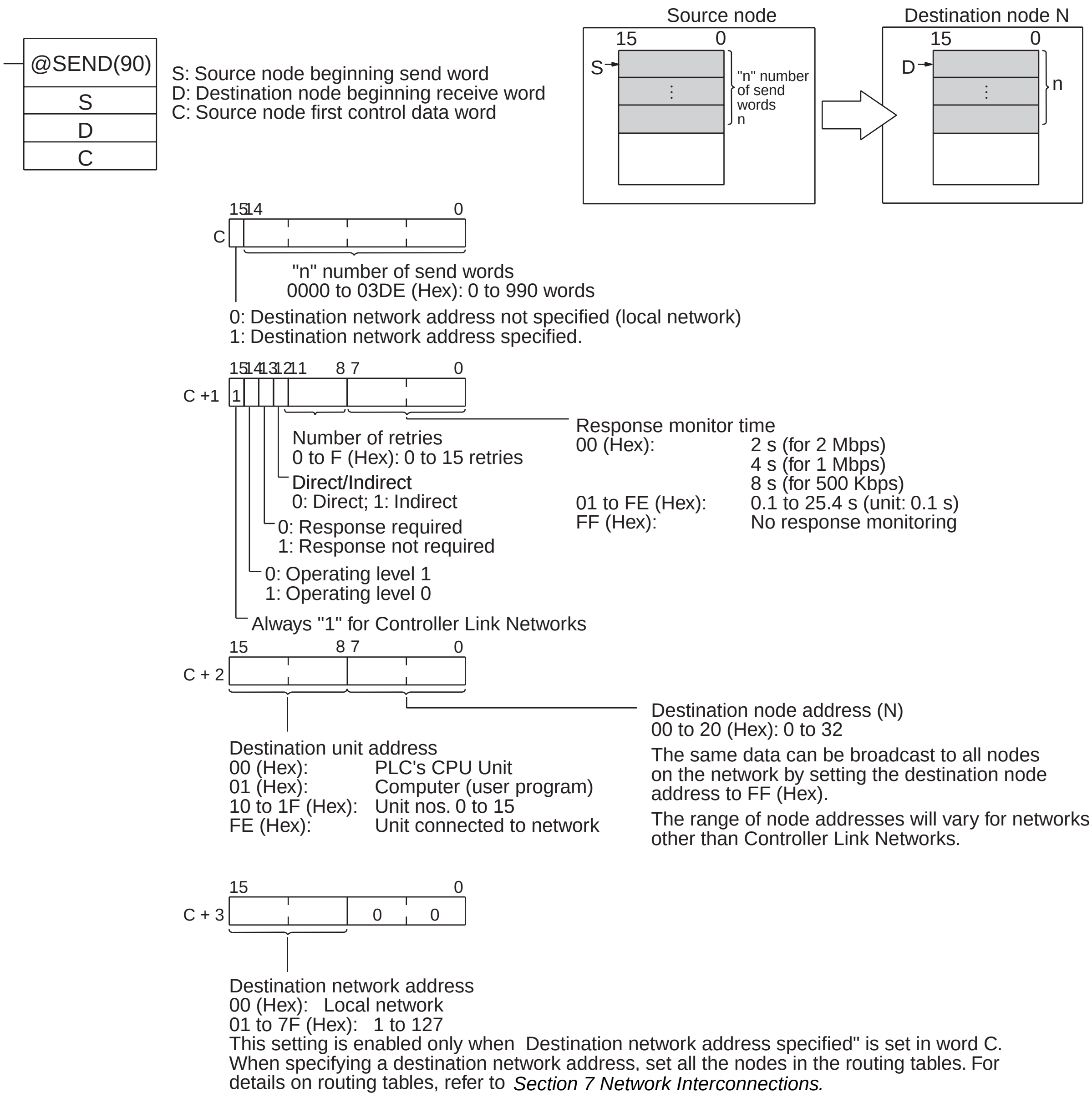
Note

1. When communicating with a CVM1 or CV-series PLC manufactured prior to April 1996 on the local network, the local network address cannot be set to "00." Set a number other than "00" as the local network address in the routing tables, and then specify that number.
2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than "0" for the number of retries.

C200HX/HG/HE PLCs

SEND

SEND transmits “n” words beginning with S (the beginning source word for data transmission at the source node) to the “n” words beginning with D (the beginning destination word for data reception at destination node N).

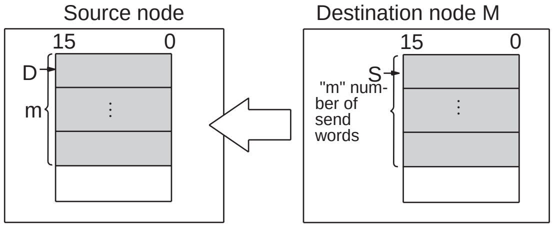


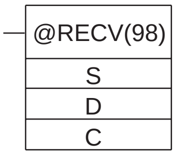
Note
1. When communicating in the same network with a CVM1 or CV-series PLC manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.
2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend pro-

cessing is performed automatically once the number of retries has been set, so be sure to specify a number other than “0” for the number of retries.

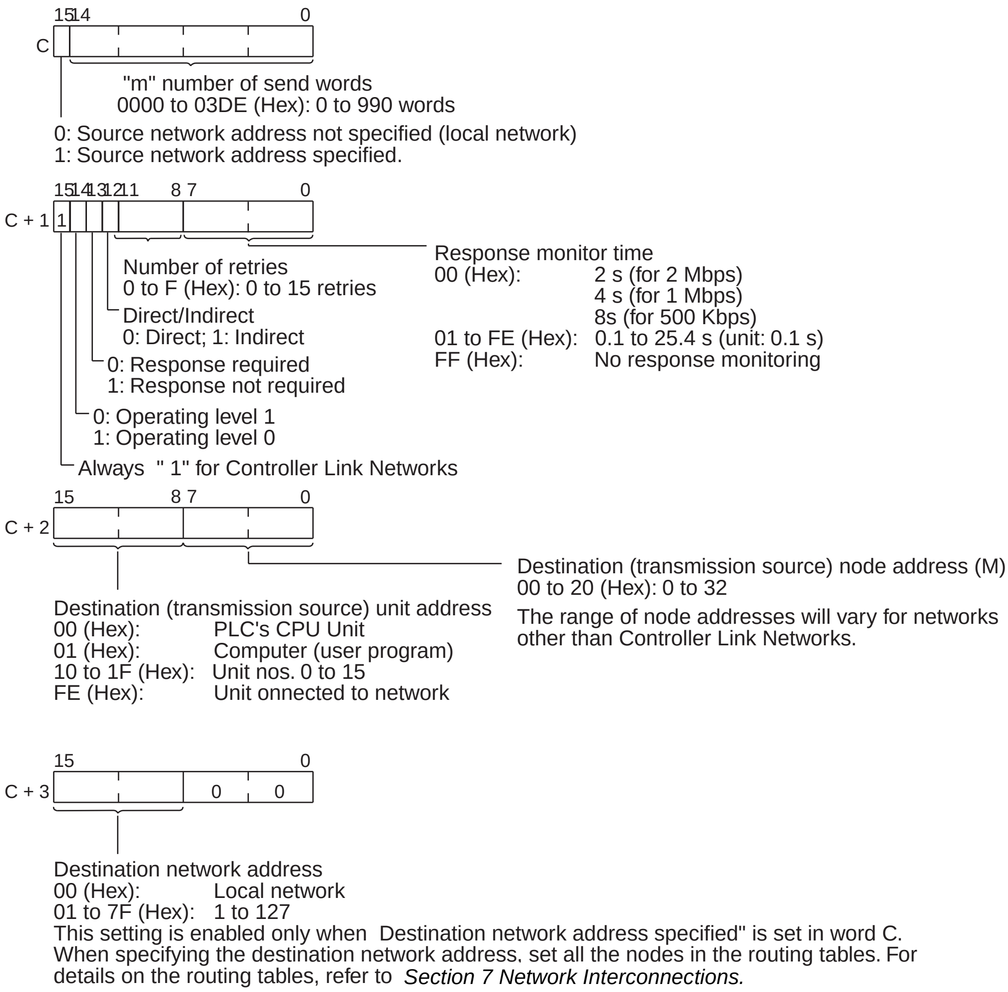
RECV

RECV receives “m” words beginning with S (the beginning word for data transmission at the destination node, M) to the words from D (the beginning word for data reception at the source node) onwards.





S: Destination node beginning send word
D: Source node beginning receive word
C: Source node first control data word



Note 1. When communicating in the same network with a CVM1 or CV-series PLC manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.

2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than "0" for the number of retries.

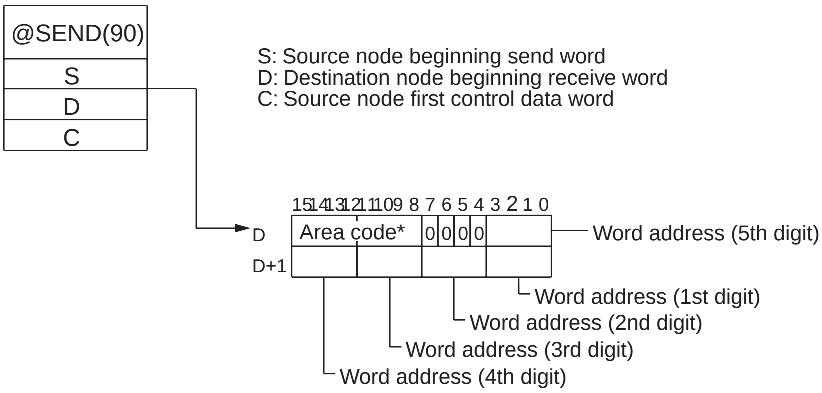
Indirect Designation of Beginning Words

CVM1, CV-series, and CS/CJ-series PLCs have a larger area than C200HX/HG/HE PLCs, so the beginning words for sending and receiving at destination nodes cannot always be directly specified by means of SEND and RECV operands. Moreover, depending on circumstances, it may be desirable to change the beginning word at destination nodes.

In such cases, set the "Direct/Indirect" control data designation to "1" (Indirect), and specify the beginning words for sending and receiving as described below.

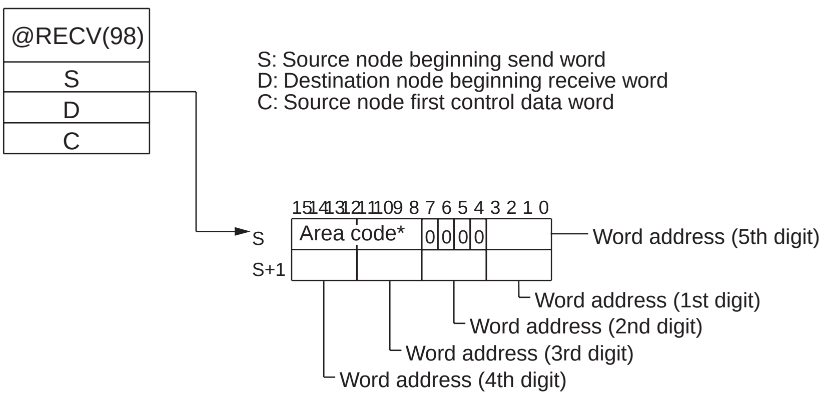
SEND

The beginning receive word is determined by the contents of the destination node's D and D+1 words.



RECV

The beginning send word is determined by the contents of the destination node's S and S+1 words.



Note Specify the area code according to the following table.

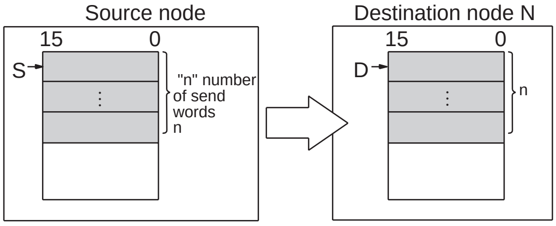
Destination node: CS/CJ-series PLC		Destination node: C200HX/HG/HE or CQM1H-series PLC		Destination node: CVM1 or CV-series PLC	
Area	**Code**	**Area**	**Code**	**Area**	**Code**
CIO (IR etc.)	00	IR (Internal Relay)	00	CIO	00
TIM (Timer) (see note 1)	03	LR (Link Relay)	06	CPU Bus Link	01
CNT (Counter) (See note 2.)	04	HR (Holding Relay)	07	Auxiliary	02
DM (Data Memory) (see note 2)	05	AR (Auxiliary Relay)	08	Timer	03
EM (Expansion DM) Banks 0 to 7 Banks 8 to 15 Current bank	10 to 17 A8 to AC 18	TC (Timer/Counter)	03	Counter	04
		DM (Data Memory)	05	DM (Data Memory)	05
		EM (Expansion DM) Banks 0 to 7 Banks 8 to 15 Current bank (CQM1H: Bank 0 only)	10 to 17 28 to 2F 18	EM (Expansion DM) Banks 0 to 7 Current bank	10 to 17 18

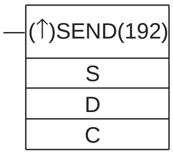
Note
1. Words 0 to 2555 in the IR Area can send and receive data.
2. Timer/counters numbers 0 to 2047 can send and receive data.

CVM1 and CV-series PLCs

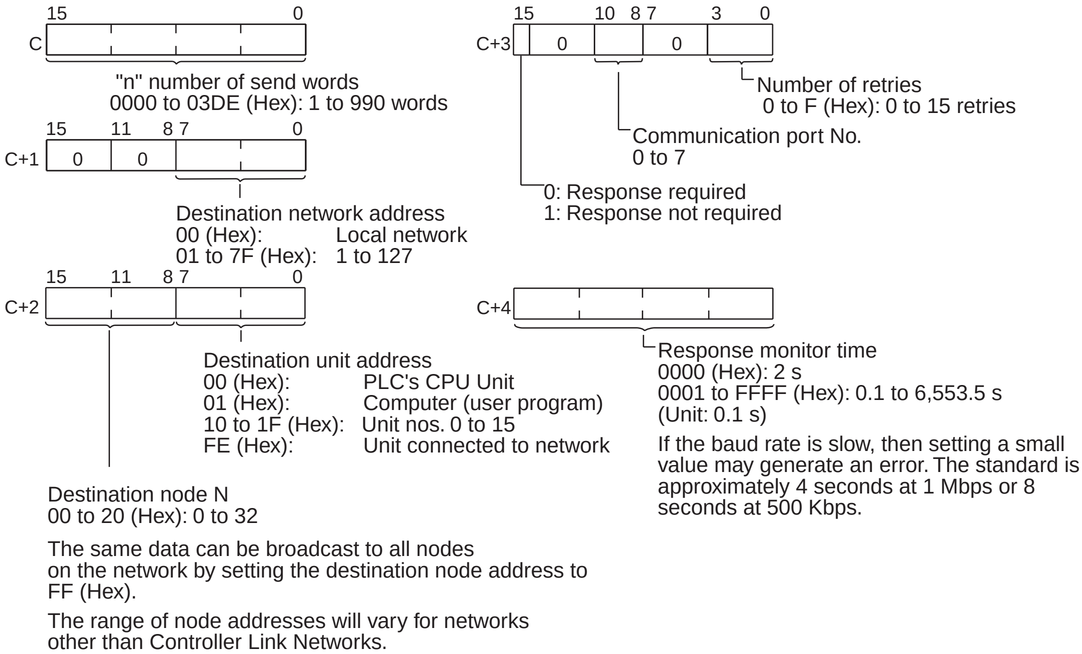
SEND

SEND transmits “n” words beginning with S (the beginning word for data transmission at the source node) to “n” words beginning with D (the beginning word for data reception at the destination node, N.)





S: Source node beginning send word
D: Destination node beginning receive word
C: Source node first control data word

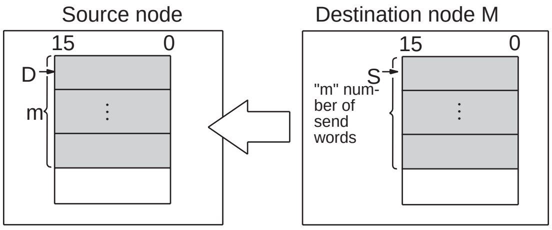


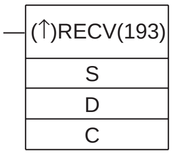
Note

1. When using CVM1 and CV-series PLCs manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.
2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than “0” for the number of retries.

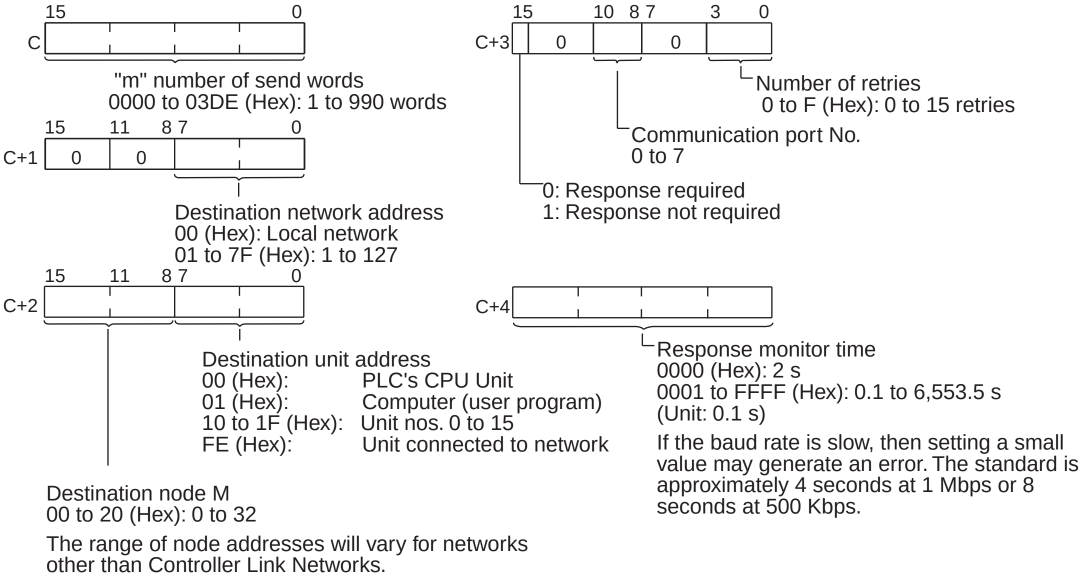
RECV

RECV receives “m” words beginning with S (the beginning word for data transmission at the destination node, M) to the words beginning with D (the beginning word for data reception at the source node).





S: Source node beginning send word
D: Destination node beginning receive word
C: Source node first control data word



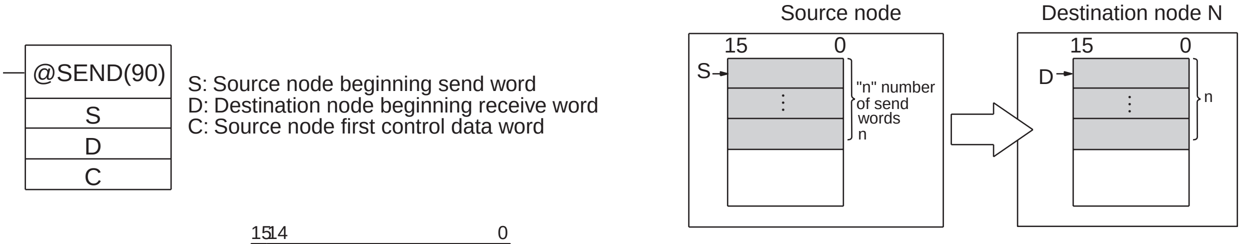
Note

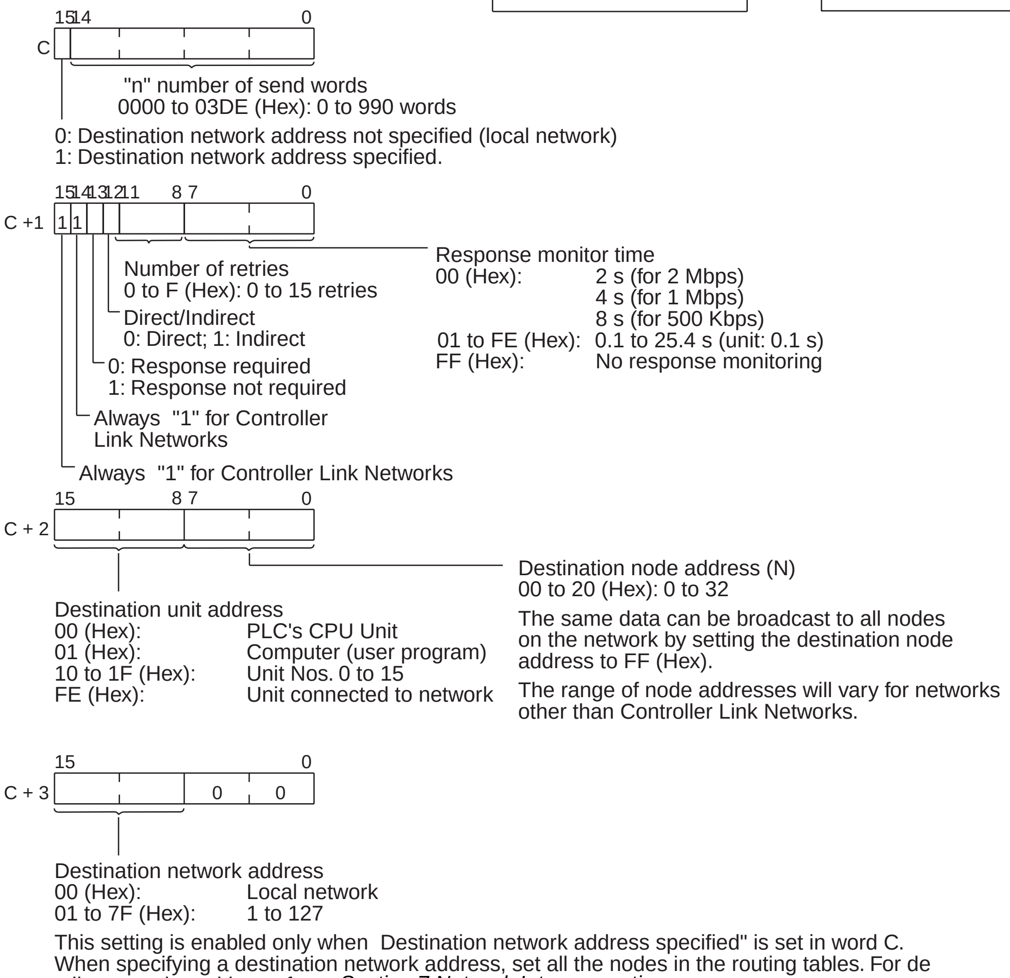
1. When using CVM1 and CV-series PLCs manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.
2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than “0” for the number of retries.

CQM1H-series PLCs

SEND

SEND transmits “n” words beginning with S (the beginning word for data transmission at the source node) to “n” words beginning with D (the beginning word for data reception at the destination node, N.)





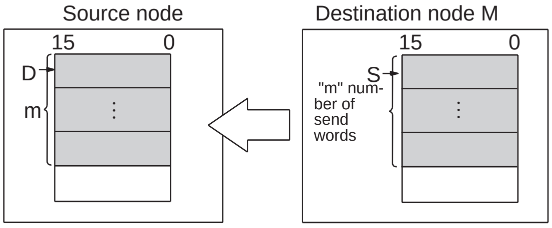
Note

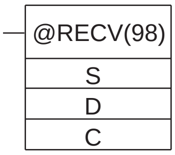
1. When communicating in the same network with CVM1 and CV-series PLCs manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.
2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are executed. With the SEND, RECV, and CMND instructions, resend pro-

cessing is performed automatically once the number of retries has been set, so be sure to specify a number other than “0” for the number of retries.

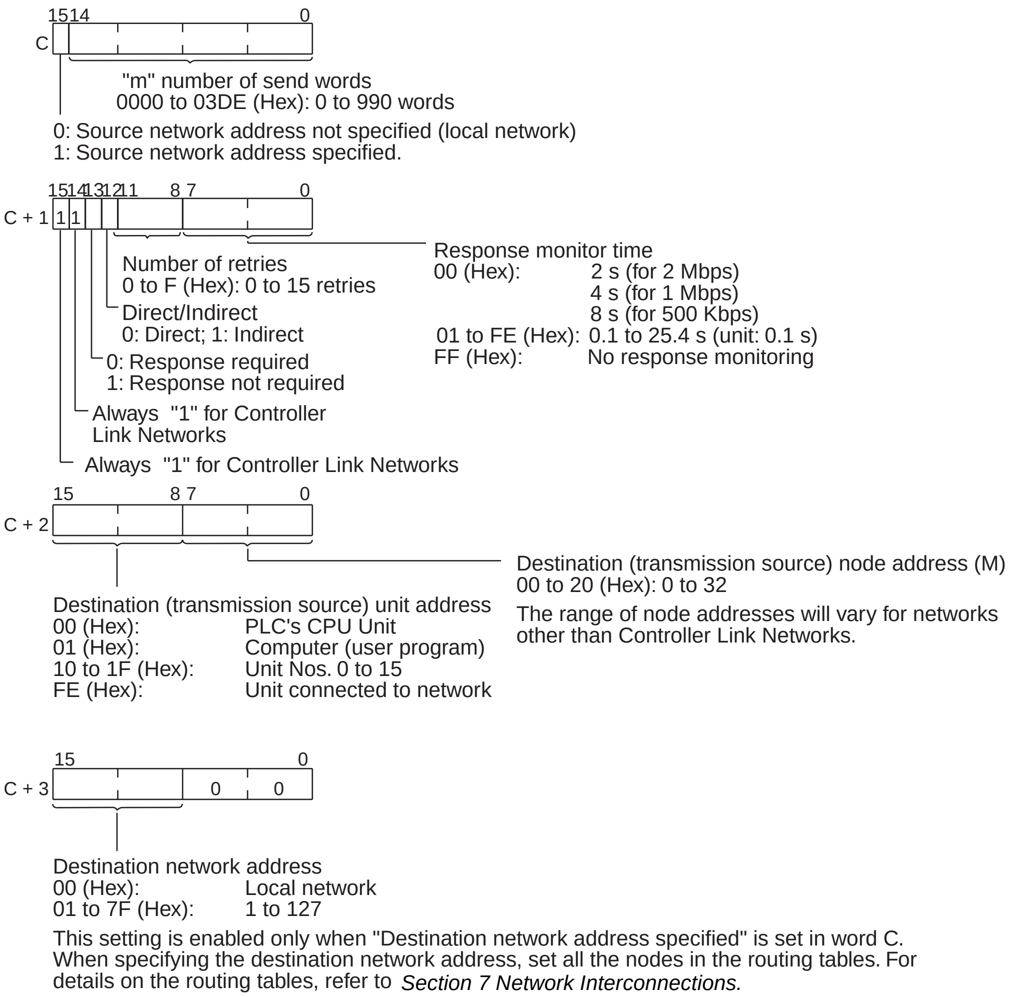
RECV

RECV receives “m” words beginning with S (the beginning word for data transmission at the destination node, M) to the words from D (the beginning word for data reception at the source node) onwards.





S: Destination node beginning send word
D: Source node beginning receive word
C: Source node first control data word



Note 1. When communicating in the same network with CVM1 and CV-series PLCs manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.

2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than “0” for the number of retries.

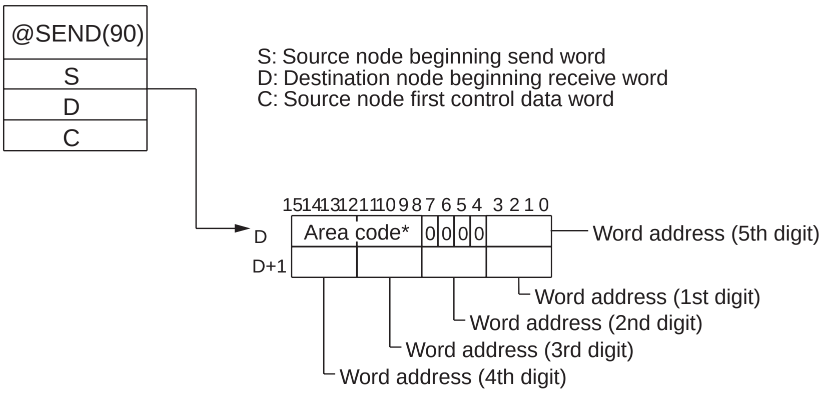
Indirect Designation of Beginning Words

CVM1, CV-series, and CS/CJ-series PLCs have a larger area than CQM1H-series PLCs, so the beginning words for sending and receiving at destination nodes cannot always be directly specified by means of SEND and RECV operands. Moreover, depending on circumstances, it may be desirable to change the beginning word at destination nodes.

In such cases, set the “Direct/Indirect” control data designation to “1” (Indirect), and specify the beginning words for sending and receiving as described below.

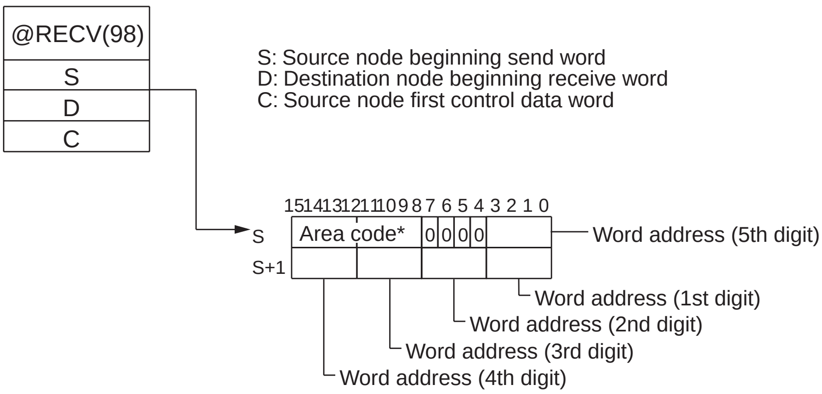
SEND

The beginning receive word is determined by the contents of the destination node’s D and D+1 words.



RECV

The beginning send word is determined by the contents of the destination node’s S and S+1 words.



Note Specify the area code according to the following table.

Destination node: CS/CJ-series PLC		Destination node: C200HX/HG/HE or CQM1H-series PLC		Destination node: CVM1 or CV-series PLC	
Area	**Code**	**Area**	**Code**	**Area**	**Code**
CIO (IR, etc.) (see note 1)	00	IR (Internal Relay)	00	CIO	00
TIM (Timer) (see note 2)	03	LR (Link Relay)	06	CPU Bus Link	01
CNT (Counter) (see note 2)	04	HR (Holding Relay)	07	Auxiliary	02
DM (Data Memory)	05	AR (Auxiliary Relay)	08	Timer	03
EM (Expansion DM) Banks 0 to 7 Banks 8 to 15 Current bank	10 to 17 A8 to AC 18	TC (Timer/Counter)	03	Counter	04
		DM (Data Memory)	05	DM (Data Memory)	05
		EM (Expansion DM) Banks 0 to 7 Banks 8 to 15 Current bank (CQM1H: Bank 0 only)	10 to 17 28 to 2F 18	EM (Expansion DM) Banks 0 to 7 Current bank	10 to 17 18

Note
1. Words 0 to 2555 in the IR Area can send and receive data.
2. Timer/counters numbers 0 to 2047 can send and receive data.

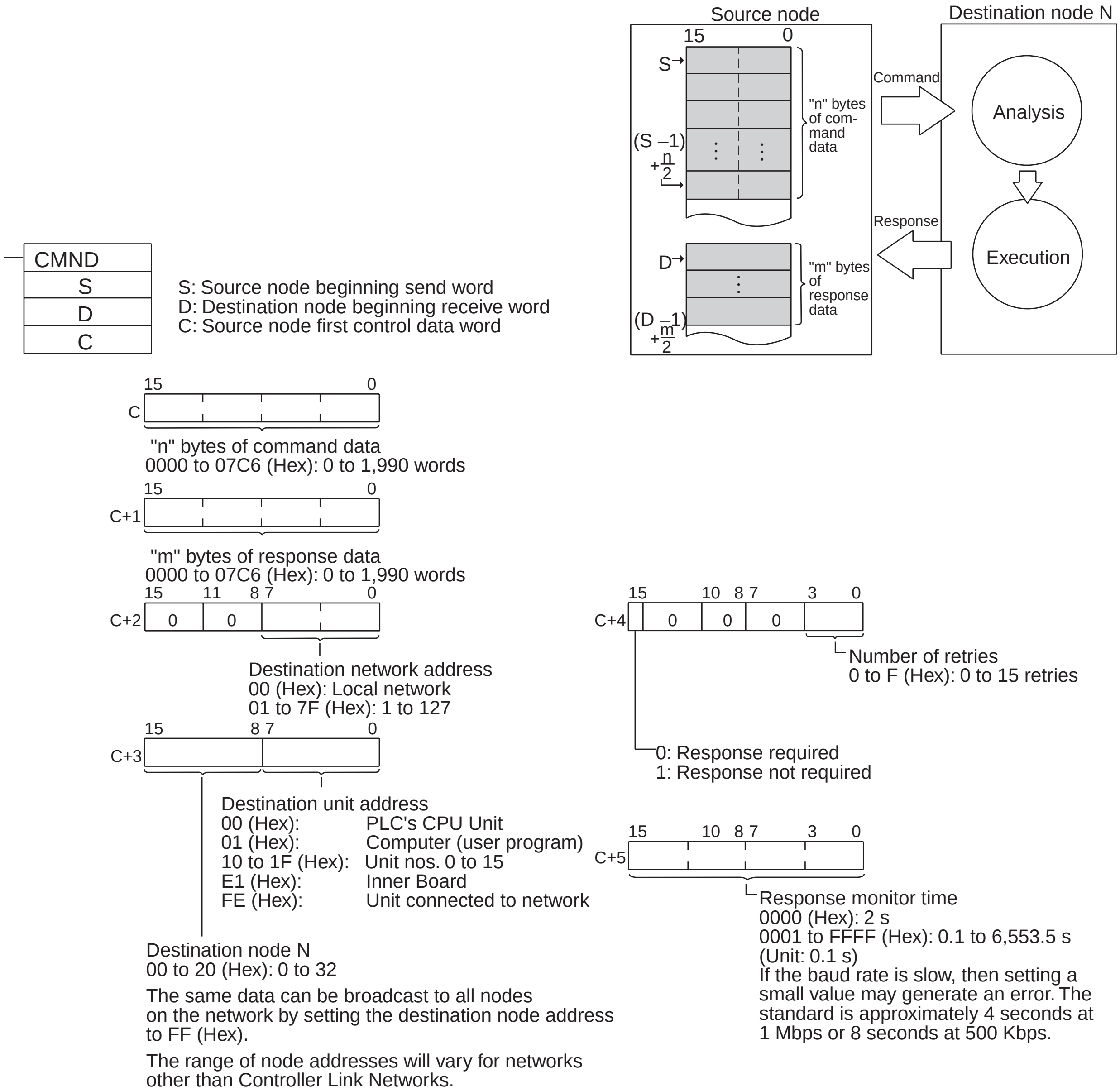
6-1-2 CMND (CVM1, CV-series, CS/CJ-series, and CQM1H-series PLCs Only)

The CMND instruction can be executed in the user program in a CVM1, CV-series, CS/CJ-series, or CQM1H-series PLC to perform operations such as reading and writing memory data from and to other nodes, reading status information, and changing the operating mode.

CS/CJ-series PLCs

CMND sends “n” bytes of command data beginning with S (the beginning send word for storing command data at the source node) to destination node

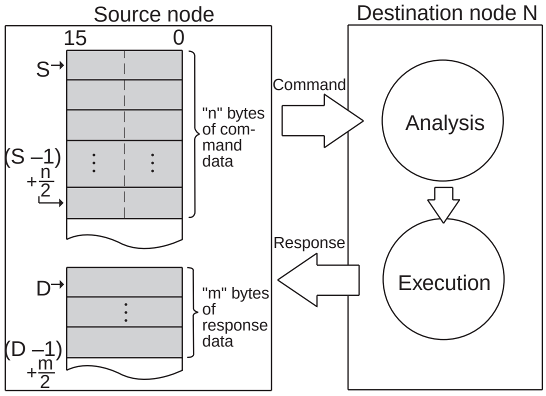
N. In return, “m” bytes of response data are stored at the source node beginning with D (the beginning receive word for storing response data).

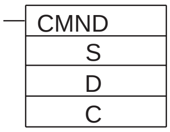


Note With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than “0” for the number of retries.

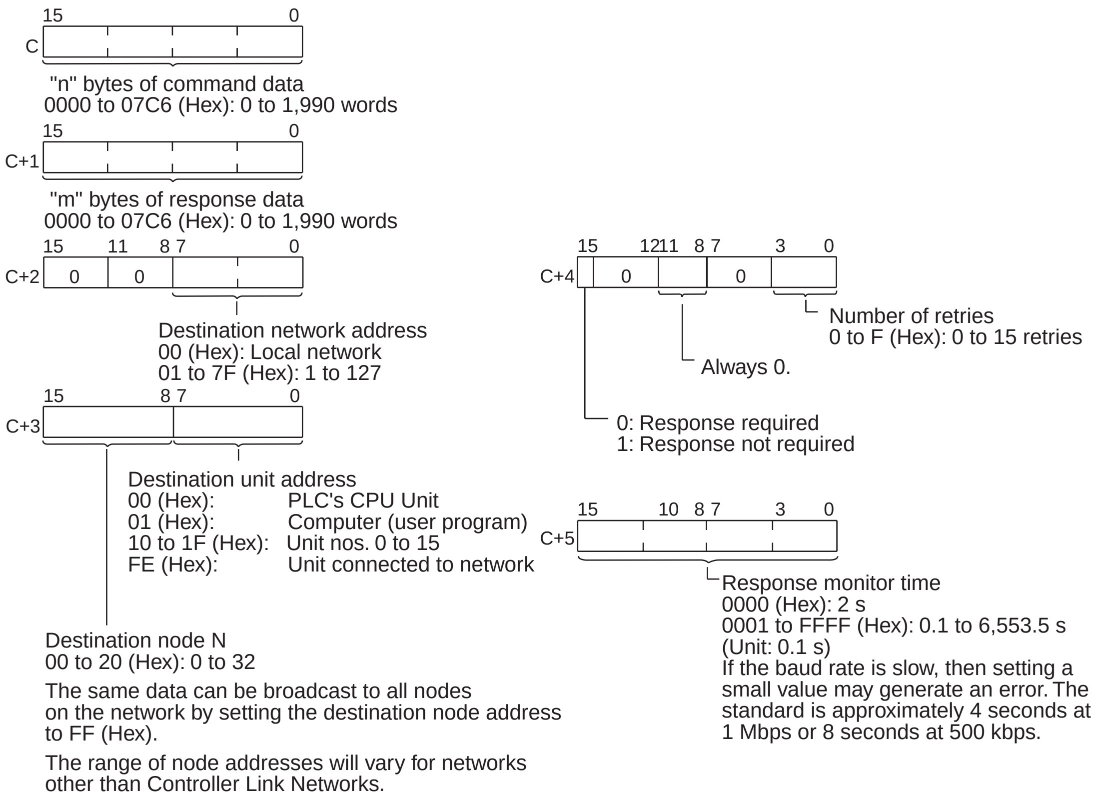
CVM1 and CV-series PLCs

CMND sends “n” bytes of command data beginning with S (the beginning word for storing command data at the source node) to node N. In return, “m” bytes of response data are stored at the source node beginning with D (the beginning word for storing response data).





S: Source node beginning send word
D: Destination node beginning receive word
C: Source node first control data word



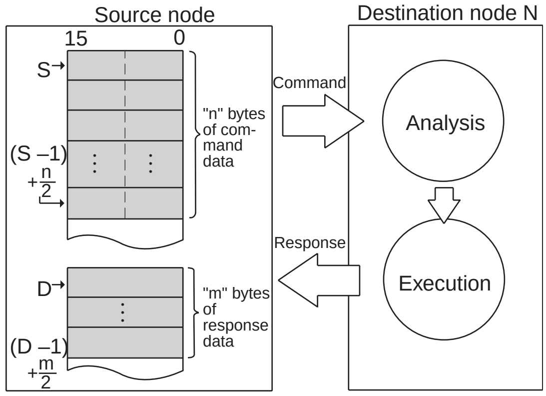
Note

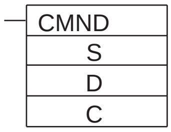
1. When using CVM1 and CV-series PLCs manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.
2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend pro-

cessing is performed automatically once the number of retries has been set, so be sure to specify a number other than “0” for the number of retries.

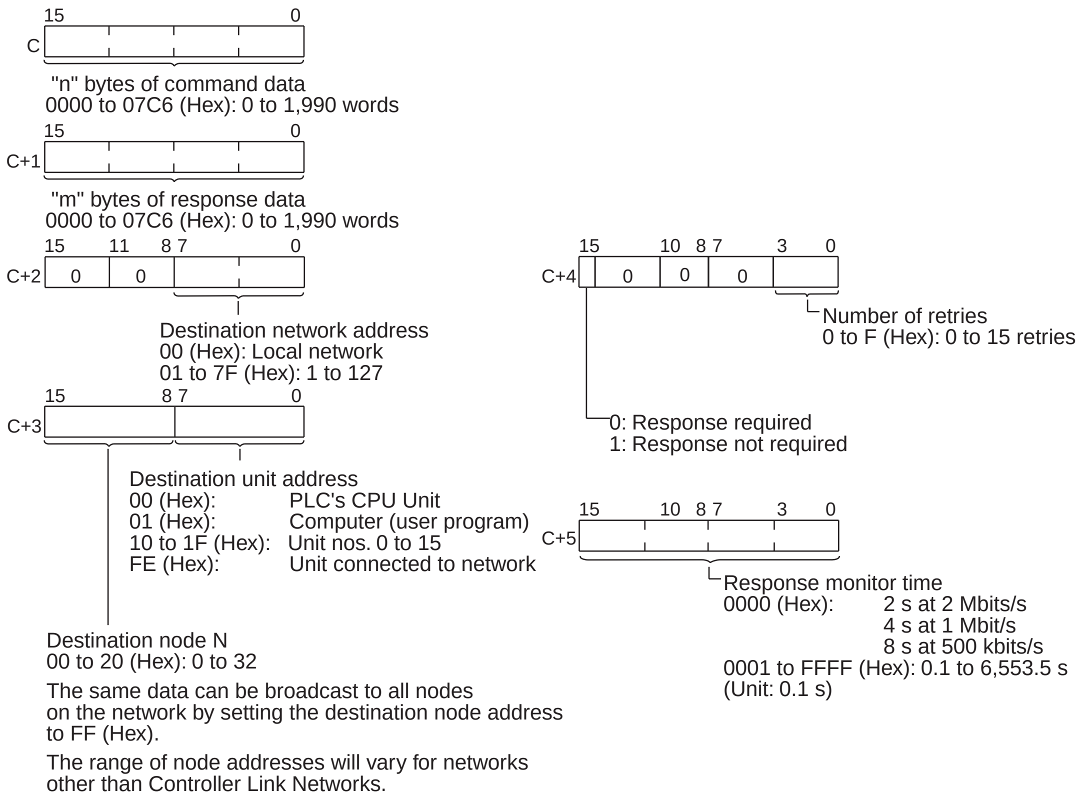
CQM1H-series PLCs

CMND sends “n” bytes of command data beginning with S (the beginning word for storing command data at the source node) to node N. In return, “m” bytes of response data are stored at the source node beginning with D (the beginning word for storing response data).





S: Source node beginning send word
D: Destination node beginning receive word
C: Source node first control data word



Note

1. When using CVM1 and CV-series PLCs manufactured prior to April 1996, the local network address cannot be set to “00.” Set a number other than “00” as the local network address in the routing tables, and then specify that number.
2. With the message service, there is no guarantee that a message to a destination node will reach its destination. It is always possible that the message may be lost in transit due to noise or some other condition. When

using the message service, it is advisable to prevent this situation from occurring by performing resend processing at the node where instructions are issued. With the SEND, RECV, and CMND instructions, resend processing is performed automatically once the number of retries has been set, so be sure to specify a number other than "0" for the number of retries.

Example: Commands for CVM1, CV-series and CS/CJ-series PLCs

Type of command		Code	CS/CJ	CVM1/CV
For memory areas (CIO, DM, EM, TC, transition, step, forced ON/OFF)	MEMORY AREA READ	0101	Yes	Yes
	MEMORY AREA WRITE	0102	Yes	Yes
	MEMORY AREA FILL	0103	Yes	Yes
	MULTIPLE MEMORY AREA READ	0104	Yes	Yes
	MEMORY AREA TRANSFER	0105	Yes	Yes
For parameter areas (PLC system setting, I/O table registration, routing table, etc.)	PARAMETER AREA READ	0201	Yes	Yes
	PARAMETER AREA WRITE	0202	Yes	Yes
	PARAMETER AREA CLEAR	0203	Yes	Yes
For program areas (UM)	PROGRAM AREA PROTECT	0304	Yes	Yes
	PROGRAM AREA PROTECT CLEAR	0305	Yes	Yes
	PROGRAM AREA READ	0306	Yes	Yes
	PROGRAM AREA WRITE	0307	Yes	Yes
	PROGRAM AREA CLEAR	0308	Yes	Yes
PLC mode	RUN	0401	Yes	Yes
	STOP	0402	Yes	Yes
PLC model data	CONTROLLER DATA READ	0501	Yes	Yes
	CONNECTION DATA READ	0502	Yes	Yes
PLC status data	CONTROLLER STATUS READ	0601	Yes	Yes
	CYCLE TIME READ	0620	Yes	Yes
PLC internal clock	CLOCK READ	0701	Yes	Yes
	CLOCK WRITE	0702	Yes	Yes
Messages	MESSAGE READ	0920	Yes	Yes
	MESSAGE CLEAR		Yes	Yes
	FAL/FALS READ		Yes	Yes
Access rights	ACCESS RIGHT ACQUIRE	0C01	Yes	Yes
	ACCESS RIGHT FORCED ACQUIRE	0C02	Yes	Yes
	ACCESS RIGHT RELEASE	0C03	Yes	Yes
Error data	ERROR CLEAR	2101	Yes	Yes
	ERROR LOG READ	2102	Yes	Yes
	ERROR LOG CLEAR	2103	Yes	Yes

Type of command		Code	CS/ CJ	CVM1/ CV
File Memory	FILE NAME READ	2201	Yes	Yes
	SINGLE FILE READ	2202	Yes	Yes
	SINGLE FILE WRITE	2203	Yes	Yes
	MEMORY CARD FORMAT	2204	Yes	Yes
	FILE DELETE	2205	Yes	Yes
	VOLUME LABEL CREATE/ DELETE	2206	No	Yes
	FILE COPY	2207	Yes	Yes
	FILE NAME CHANGE	2208	Yes	Yes
	FILE DATA CHECK	2209	No	Yes
	MEMORY AREA FILE TRANSFER	220A	Yes	Yes
	PARAMETER AREA FILE TRANSFER	220B	Yes	Yes
	PROGRAM AREA FILE TRANSFER	220C	Yes	Yes
Forced set/reset	FORCED SET/RESET	2301	Yes	Yes
	FORCED SET/RESET CANCEL	2302	Yes	Yes

For details on commands for CS/CJ-series PLCs, refer to the *CS/CJ-series Programmable Controllers Programming Manual (W340)*. For details on commands for CVM1 and CV-series PLCs, refer to the *FINS Commands Reference Manual (W227)*. For details on commands for C200HX/HG/HE PLCs, refer to *6-6 Commands and Responses for C200HX/HG/HE and CQM1H-series PLCs*. For details on commands for Controller Link Units, refer to *6-5 Commands and Responses for Controller Link Units*.

6-1-3 Send/Receive Data Areas

The data areas that can be used as operands in the SEND and RECV instructions depend on the PLC, as shown in the following tables. Be sure to set the operands so that the end of the data area is not exceeded.

CS/CJ-series PLCs

Area	Range
CIO (IR etc.)	CIO 0000 to CIO 6143
Work Area (WR)	W000 to W511
Holding Area	HR000 to HR511
Auxiliary Area	AR000 to AR959 (See note 1.)
Timer	T0000 to T4095
Counter	C0000 to C4095
Data Memory	DM00000 to DM32767
Extended Data Memory	EM00000 to EM32767 (See note 2.)

Note

1. Writing is not possible to words A000 through A447 in the Auxiliary Area.
2. A maximum of thirteen banks can be used for Expansion DM. For details on extended data memory and the number of banks, refer to the operation manual for the PLC model that is being used.

C200HX/HG/HE PLCs

Area	Range
Internal Relay Area 1	IR 000 to IR 235 (See note 1.)
Special Relay Area 1	SR 236 to SR 255 (See note 1.)
Special Relay Area 2	SR 256 to SR 299 (See note 1.)
Internal Relay Area 2	IR 300 to IR 511 (See note 1.)
Link Relay	LR 00 to LR 63
Holding Relay	HR 00 to HR 99
Timer/Counter	T/C 000 to T/C 511
Auxiliary Relay	AR 00 to AR 27
Data Memory	DM 0000 to DM 6655
Extended Data Memory	EM 0000 to EM 6143 (See note 2.)

Note

1. Words in the Internal Relay Area 1 (IR 000 to IR 235) and Special Relay Area 1 (SR 236 to SR 255) are continuous in memory, and any range of words within these areas can be transferred in a single operation. The same is true for Special Relay Area 2 (SR 256 to SR 299) and Internal Relay Area 2 (IR 300 to IR 511). You cannot, however, transfer data in a range that crosses the boundary between Special Relay Area 1 (SR 236 to SR 255) and Special Relay Area 2 (SR 256 to SR 299).
   SR 253 to SR 255 cannot be written at the source node, even if they are specified by the RECV instruction's beginning receive word at the source node.
2. For details on extended data memory and the number of banks, refer to the operation manual for the PLC model that is being used.

CVM1 and CV-series PLCs

Area	Range	
	CV500, CVM1-CPU01	CV1000/2000, CVM1-CPU11/21
CIO Area	0000 to 2555	
CPU Bus Link Area	G000 to G255 (See note 1.)	
Auxiliary Area	A000 to A511 (See note 2.)	
Timer Area	T000 to T511	T000 T1023
Counter Area	C000 to C511	C000 to C1023
DM Area	DM0000 to DM8191	DM0000 to DM24575
Expansion DM Area	---	EM00000 to EM32765 (See note 3.)

Note

1. Writing is not possible to words G000 through G007 in the CPU Bus Link Area.
2. Writing is not possible to words A256 through A511 in the Auxiliary Area.
3. Expansion DM can be used by mounting an Expansion DM Unit to a CV1000/2000 or CVM1-CPU11/21 PLC. A maximum of eight banks can be used, depending on the type of Expansion DM. For details, refer to the CVM1 and CV-series PLC operation manuals.

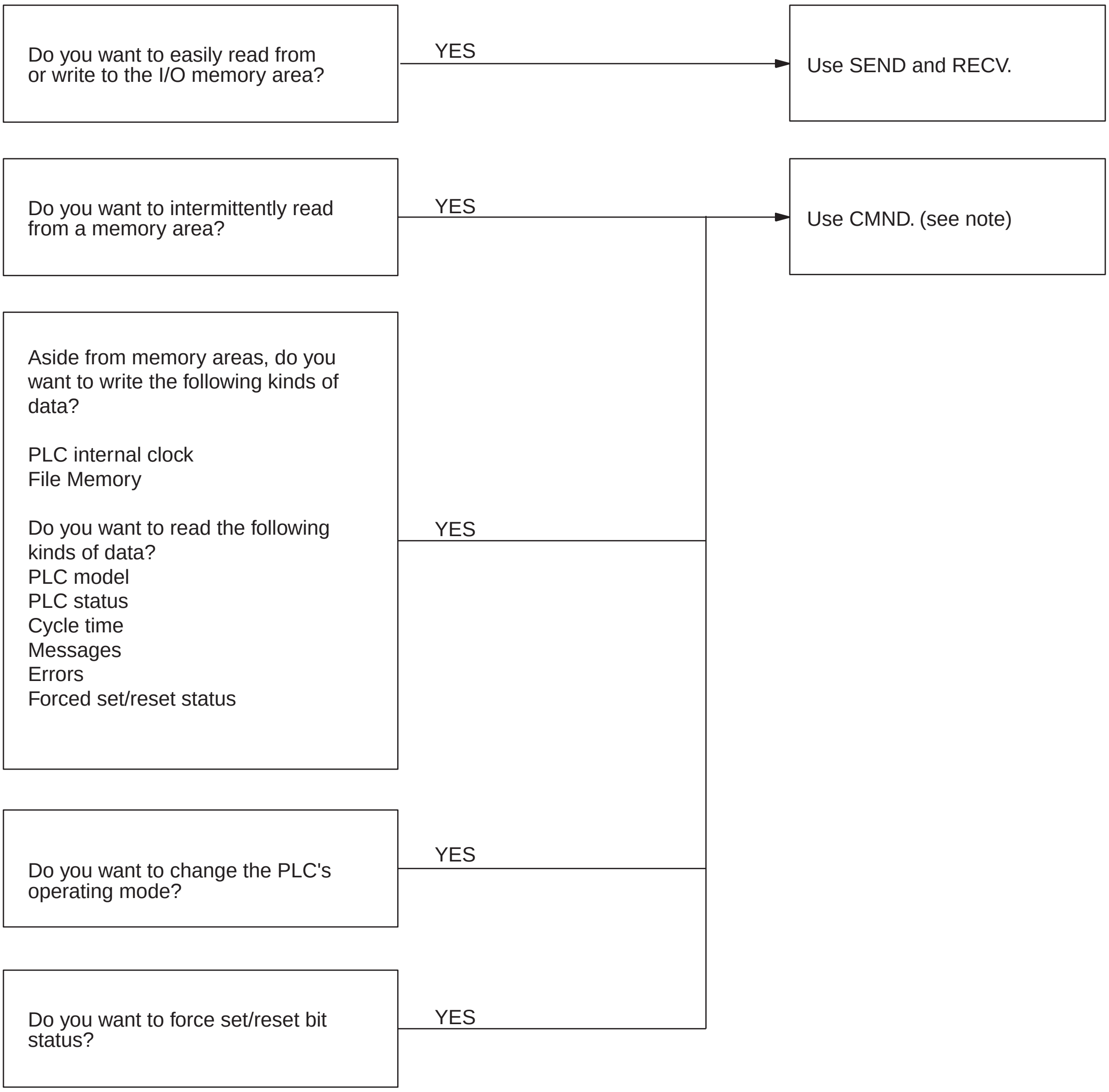
CQM1H-series PLCs

Area	Range
IR/SR Area	IR 000 to SR 255 (See note 1.)
LR Area	LR 00 to LR 63
HR Area	HR 00 to HR 99
Timer/Counter Area	TIM/CNT 000 to TIM/CNT 511
AR Area	AR 00 to AR 27

Area	Range
Data Memory	DM 0000 to DM 6655
Extended Data Memory	EM 0000 to EM 6143 (See note 2.)

Note
1. SR 253 to SR 255 cannot be written at the source node, even if they are specified by the RECV instruction's beginning receive word at the source node.
2. For details on extended data memory, refer to the operation manual for the PLC model that is being used.

6-2 Selecting Communications Instructions



Note CMND cannot be used with C200HX/HG/HE PLCs.

6-2-1 Message Service Operations

Instruction	Source node			Destination node			Communications contents	Data length	Broadcasting	Network connections
	C200HX/HG/HE	CQM1H	CS/CJ, CVM1, or CV	C200HX/HG/HE or CQM1H	CS/CJ, CVM1, or CV	Computer				
SEND and RECV	Yes	Yes	Yes	Yes	Yes	Yes (See note 2.)	Read to and write from all I/O memory areas.	990 words max. (1,980 bytes)	SEND only (no response)	Yes (up to three levels including local network), via CS/CJ-series, CVM1, or CV-series PLCs.
CMND (See note 1.)	**No**	Yes	Yes	Yes	Yes	Yes (See note 2.)	**Data read/write:** Read to and write from all I/O memory areas. Read PLC model. Read status data. Read time data. Read and write File Memory data. Read PLC mode. **PLC Control:** Change PLC mode. Forced set/reset Clear PLC errors.	2,012 bytes max.	Yes (no response)	

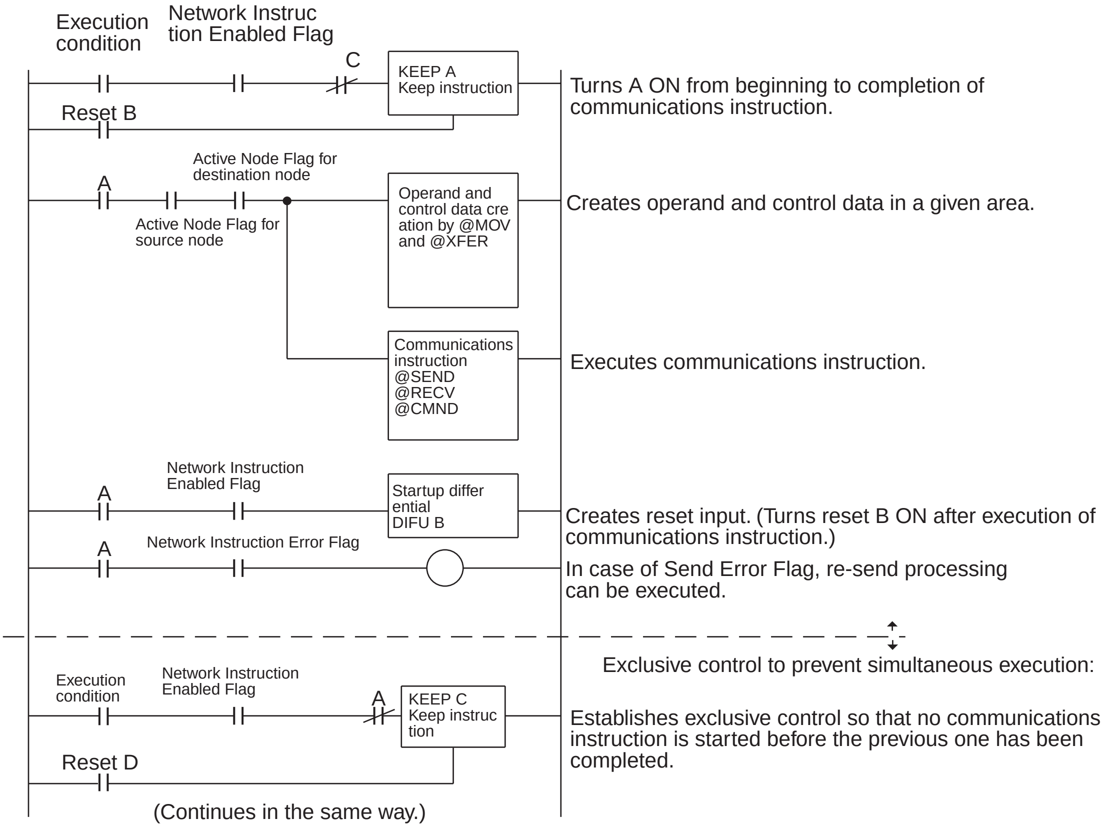
Note
1. CMND cannot be used with C200HX/HG/HE PLCs.
2. If a computer is receiving commands, a program is required at the computer for sending back responses.

6-2-2 Message Service Specifications

Item	Specifications
Transmission format	C200HX/HG/HE PLCs 1:1 SEND or RECV 1:N SEND (broadcast) CS/CJ-series, CVM1,CV-series, or CQM1H-series PLCs 1:1 SEND, RECV, or CMND 1:N SEND or CMND; (broadcast)
Packet length	SEND: 990 words (1,980 bytes) max. RECV: 990 words (1,980 bytes) max. CMND: 1,990 bytes max.
Data content	SEND: Command and response for a request to send data are transferred. RECV: Command and response for a request to receive data are transferred. CMND: A wide range of command/response data can be sent.
Number of simulta-neous commands	C200HX/HG/HE PLCs: One at a time for each of 2 operating level. CS/CJ-series, CVM1, and CV-series PLCs: One for each of eight ports (ports 0 to 7). CQM1H-series One
Response monitor time	C200HX/HG/HE or CQM1H-series PLCs 00: Default setting 2 seconds (2 Mbps) 4 seconds (1 Mbps) 8 seconds (500 Kbps) FF: No monitoring 01 to FE: User settings (in increments of 100 ms, 100 to 25,400 ms) CS/CJ-series, CVM1, and CV-series PLCs 0000: Default setting (2 s) 0001 to FFFF: User settings (in increments of 0.1 s, 0.1 to6553.5 s)
Number of retries	0 to F: 0 to 15

6-3 Using the Message Service

With SEND, RECV, and CMND, the Network Instruction Enabled Flag and Network Instruction Error Flag are generally written into the program as input conditions, as shown below. Only one instruction can be executed at a time for any given communications port. Exclusive control thus must be incorporated to execute two or more instructions per operating level with C200HX/HG/HE PLCs, nine or more instructions with CS/CJ-series, CVM1, and CV-series PLCs (because CVM1 and CV-series PLCs have eight ports), or two or more instructions with CQM1H-series PLCs.



SEND/RECV Flags

CS/CJ-series PLCs

Name	Address		Contents
	Word	Bit	
Network Instruction Enabled Flag	A202	Port number corresponds to bit number, i.e., port 0: bit 00, port 1: bit 01, etc.	0: Execution not enabled (executing) 1: Execution enabled (not executing)
Network Instruction Error Flag	A219	Port number corresponds to bit number plus 8, i.e., port 0: bit 08, port 1: bit 09, etc.	0: Normal end 1: Abnormal end

Note With CS/CJ-series PLCs, ports 0 to 7 are also used for executing the PMCR (Protocol Macro) instruction, therefore these flags are used for the 4 instructions, SEND/RECV/CMND/PMCR. When the PMCR command is being executed, the same port cannot be used for SEND/RECV/CMND instructions.

C200HX/HG/HE PLCs

Name	Operating level	Address	Contents
Network Instruction Enabled Flag	1	SR 25204	0: Execution not possible (already executing) 1: Execution possible (not executing)
	0	SR 25201	
Network Instruction Error Flag	1	SR 25203	0: Normal end 1: Abnormal end
	0	SR 25200	

CVM1, and CV-series PLCs

Name	Address		Contents
	Word	Bit	
Network Instruction Enabled Flag	A502	Port number corresponds to bit number, i.e., port 0: bit 00, port 1: bit 01, etc.	0: Execution not enabled (executing) 1: Execution enabled (not executing)
Network Instruction Error Flag	A502	Port number corresponds to bit number plus 8, i.e., port 0: bit 08, port 1: bit 09, etc.	0: Normal end 1: Abnormal end

CQM1H-series PLCs

Name	Address	Contents
Network Instruction Enabled Flag	AR 0209	0: Execution not possible (already executing) 1: Execution possible (not executing)
Network Instruction Error Flag	AR 0208	0: Normal end 1: Abnormal end

Network Status

The nodes on the network are shown in the following illustrations.

C200HX/HG/HE PLCs

Operating level 0	Operating level 1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AR 08	AR 12	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
AR 09	AR 13	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of network
1: Part of network

CS/CJ-series, CVM1, and CV-series PLCs

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CIO 1500 + 25 x N + 2	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
CIO 1500 + 25 x N + 3	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

N: Unit number

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of the network
1: Part of the network

CQM1H-series PLCs

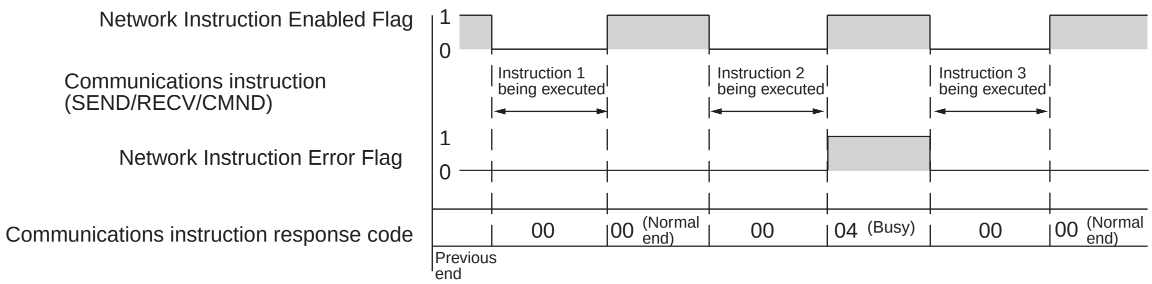
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
IR 192	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
IR 193	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of network
1: Part of network

SEND/RECV Flag Operations

- The Network Instruction Enabled Flag turns OFF during transmission or reception, and ON after the data transmission or reception has been completed (regardless of whether an error occurs).
- The Network Instruction Error Flag retains its status until the next data transmission or reception.
- Even when there is an abnormal end, the Network Instruction Error Flag turns OFF when the next communications instruction is executed.

Example



Communications Instruction Response Codes

The status after a communications instruction has been executed is reflected in the words shown in the following table. During instruction execution, it becomes “00” or “0000,” and it is reflected here after the execution has been completed.

PLC	Word	Bits	Contents
CS/CJ-series	A203	---	Port 0 response code
	A204	---	Port 1 response code
	A205	---	Port 2 response code
	A206	---	Port 3 response code
	A207	---	Port 4 response code
	A208	---	Port 5 response code
	A209	---	Port 6 response code
	A210	---	Port 7 response code
C200HX/HG/HE	SR 237	08 to 15	Operating level 1 response code
		00 to 07	Operating level 0 response code
CVM1 and CV-series	A503	---	Port 0 response code
	A504	---	Port 1 response code
	A505	---	Port 2 response code
	A506	---	Port 3 response code
	A507	---	Port 4 response code
	A508	---	Port 5 response code
	A509	---	Port 6 response code
	A510	---	Port 7 response code
CQM1H-series	AR 02	00 to 07	Response code

C200HX/HG/HE and CQM1H-series PLC Response Codes

The results of executing SEND and RECV instructions are reflected as shown in the following table.

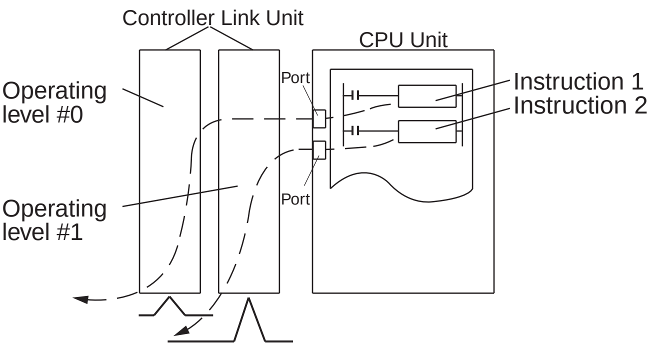
Code	Contents	Meaning
00 (Hex)	Normal end	Data transfer was completed successfully.
01 (Hex)	Parameter error	SEND/RECV instruction operands are not within specified ranges.
02 (Hex)	Transmission impossible	The source node is not in the network or the Unit was reset during execution of the instruction.
03 (Hex)	Destination node error	The destination node is not in the network.
04 (Hex)	Destination node busy error	The destination node is busy and cannot receive the command.
05 (Hex)	Response timeout	A response was not received within the time limit.
06 (Hex)	Response error	The response received from the destination node was incorrect.
07 (Hex)	Communications controller error	An error occurred in the communications controller.
08 (Hex)	Setting error	The destination node address was set incorrectly.
09 (Hex)	CPU Unit error	A CPU Unit error occurred in the PLC of the destination node.
10 (Hex)	Routing error	Command could not be sent because of incorrect routing.
11 (Hex)	Relay error	Command did not reach the destination node because of an error at the relay station.
12 (Hex)	Source node busy error	The source node is busy and cannot send the command.

CS/CJ-series, CVM1, and CV-series Response Codes

The results of executing SEND, RECV, and CMND instructions are reflected as one word (two bytes) of data. Instruction response codes are the same as FINS command response codes. Response code bits 08 to 15 correspond to the first byte of the response code, and response code bits 00 to 07 correspond to the second byte of the response code. For details, refer to *6-7 Response Codes*.

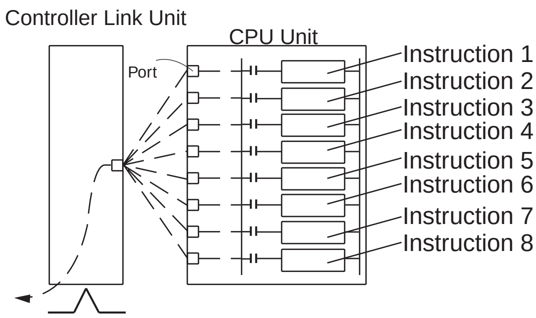
Simultaneous Execution of Communications Instructions

C200HX/HG/HE PLCs



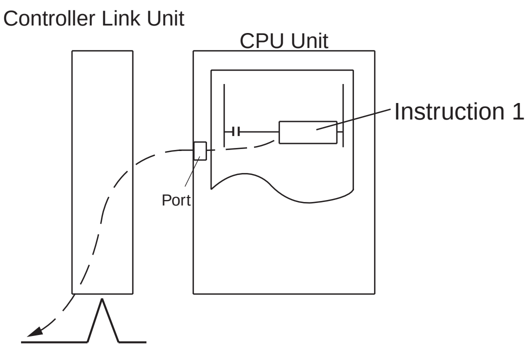
There is only one communications port per operating level, so no more than one communications instruction can be executed per operating level at one time. When both operating levels are used, two instructions can be executed simultaneously.

CS/CJ-series, CVM1, and CV-series PLCs



There are eight communications ports, so eight communications can be executed simultaneously. Only one message is refreshed from the CPU Unit to the Controller Link Unit and one from the Controller Link Unit to the CPU Unit for each CPU Bus Unit service time.

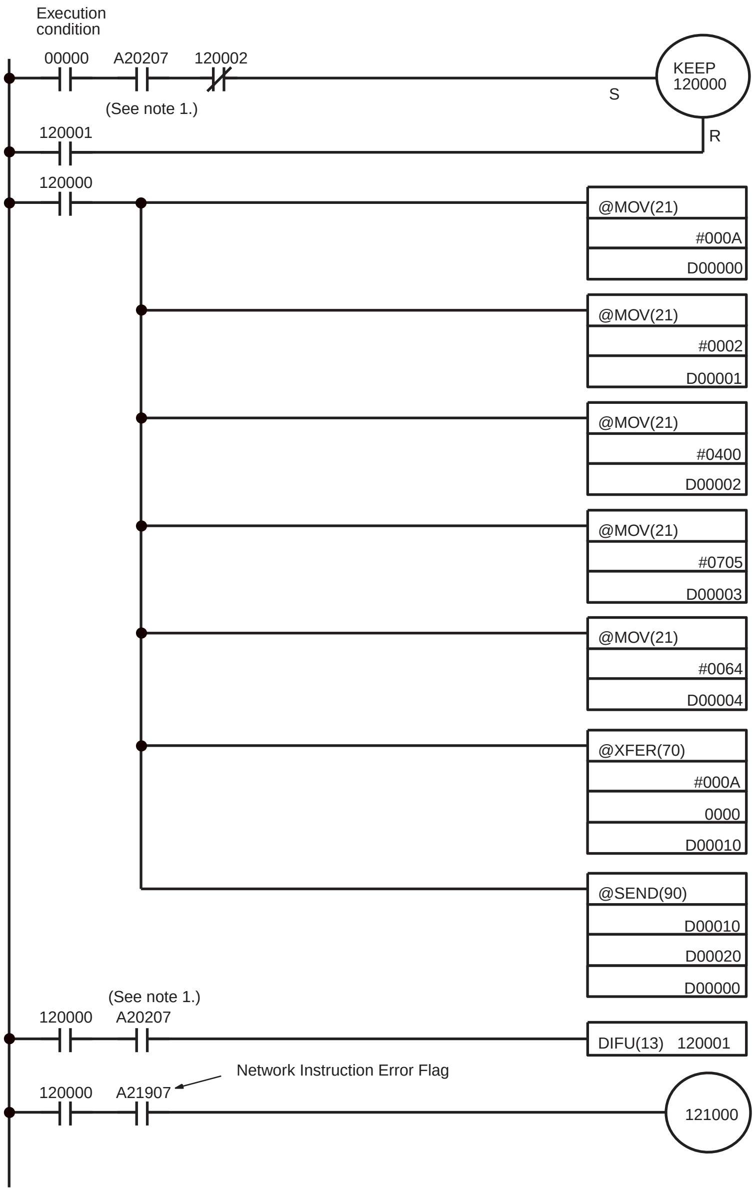
CQM1H-series PLCs



There is only one communications port, so no more than one communications instruction can be executed at one time.

PLC Programming Examples

CS/CJ-series PLCs



The transmission program will run when CIO 00000 turns ON, provided that the Network Instruction Enabled Flag is ON and the RECV instruction has not been executed.

CIO 12000 remains ON while the SEND instruction is being executed, and it turns OFF when instruction execution has been completed.

Control Data Preparation

Word	Content		Meaning
D00000	0 0	0 A	10 send words
D00001	0 0	0 2	Destination network address= 2
D00002	0 4	0 0	Destination node address = 4 Destination Unit address = 0
D00003	0 7	0 5	Response required Port No. 7 used No. of resends = 5
D00004	0 0	6 4	Response monitoring time = 10 s

Transfers the 10 words beginning at CIO 0000 to the 10 words beginning at DM 0010.

Transfers the 10 words beginning at DM 00010 of the source node to the words beginning with DM 0020 at network address 2, node address 4, and Unit address 0 (PLC).

Creates reset input.

Turns ON to indicate transmission error.

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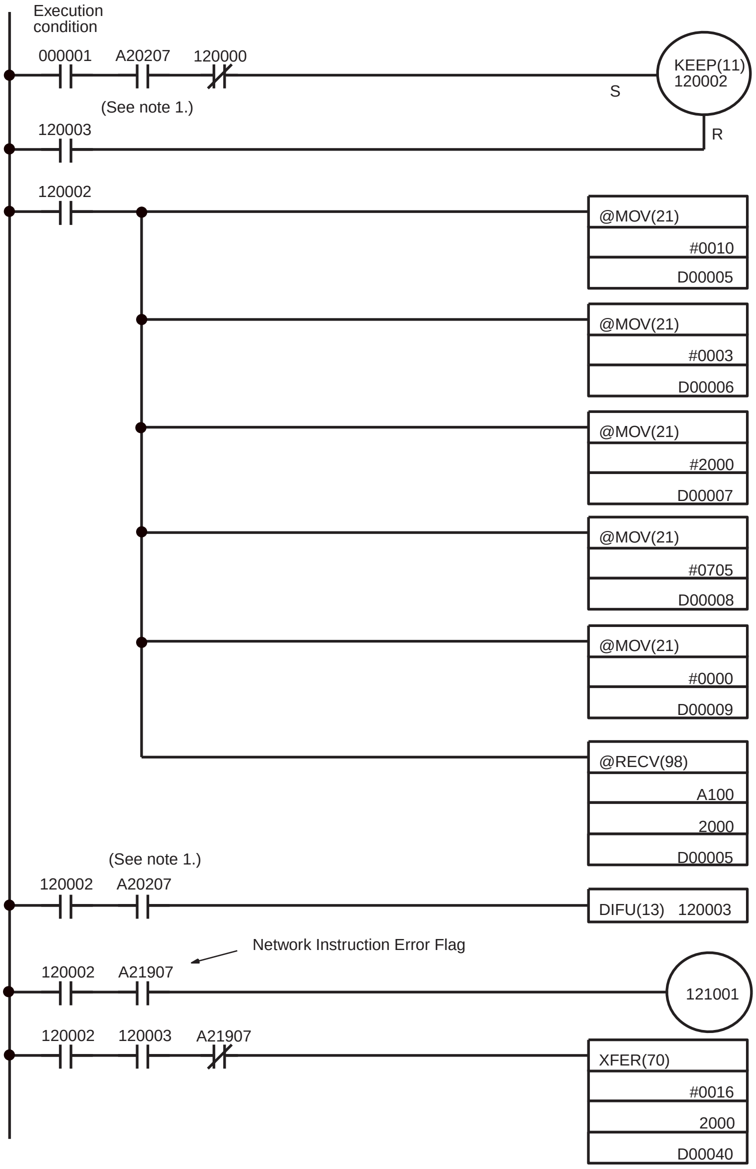


The reception program will run when CIO 00001 turns ON, provided that the Network Instruction Enabled Flag is ON and the SEND instruction has not been executed.

CIO 120002 remains ON while the RECV instruction is being executed, and it turns OFF when instruction execution has been completed.

Control Data Preparation

Word	Content	Meaning
D00005	0 0 10	16 send words
D00006	0 0 0 3	Destination network address= 3
D00007	2 0 0 0	Destination node address = 32 Destination Unit address = 0
D00008	0 7 0 5	Response required Port No. 7 used No. of resends = 5
D00009	0 0 0 0	Response monitoring time = Default

Transfers the 16 words beginning at A100 of network address 3, node address 32, and Unit address 0 (PLC) to 2000.

Creates reset input.

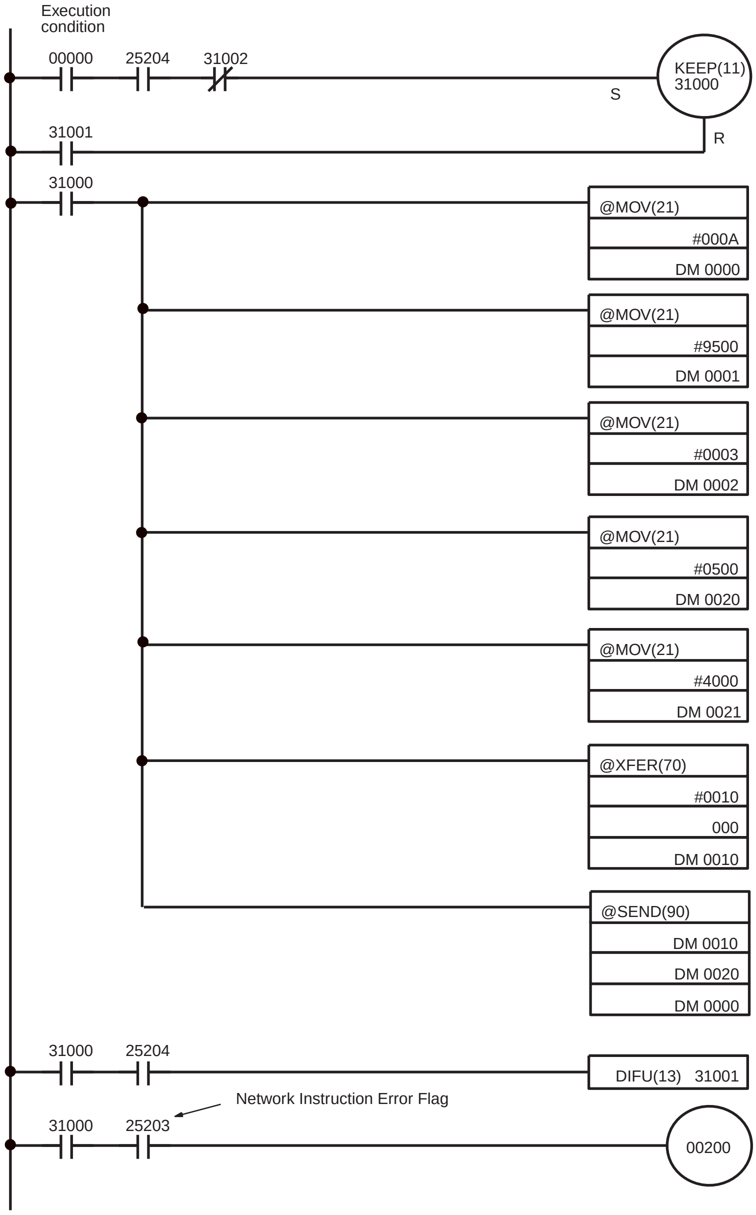
Turns ON to indicate reception error.

Transmitted data (16 words from 2000) moved into words beginning at D00040 for storage.

Note

1. With CS/CJ-series PLCs, the Network Instruction Enabled Flag in A20200 to A20207 corresponding to communications ports will be OFF even when PMCR (PROTOCOL MACRO) is being executed.
2. When using the sample program, make sure that the bits and words used in the sample program are not the same as those in the user program or by Special I/O Units.

C200HX/HG/HE PLCs



The transmission program will run when IR 00000 turns ON, provided that the Network Instruction Enabled Flag is ON and the RECV instruction has not been executed.

IR 31000 remains ON while the SEND instruction is being executed, and it turns OFF when instruction execution has been completed.

Control Data Preparation

DM 0000	0 0	0 A	10 send words*
DM 0001	9 5	0 0	Operating level 1**
DM 0002	0 0	0 3	Node 3, Unit 0 (a PLC)

* No destination network address specified
** Response required, 5 retries, direct designation, monitoring time: default

Beginning Word for Indirect Receiving by Destination Node

DM 0020	0 5	0 0	Beginning word for receiving (by destination node) = DM4000 (05: DM designation)
DM 0021	4 0	0 0	

Transfers the 10 words beginning at IR 000 to the 10 words beginning at DM 0010.

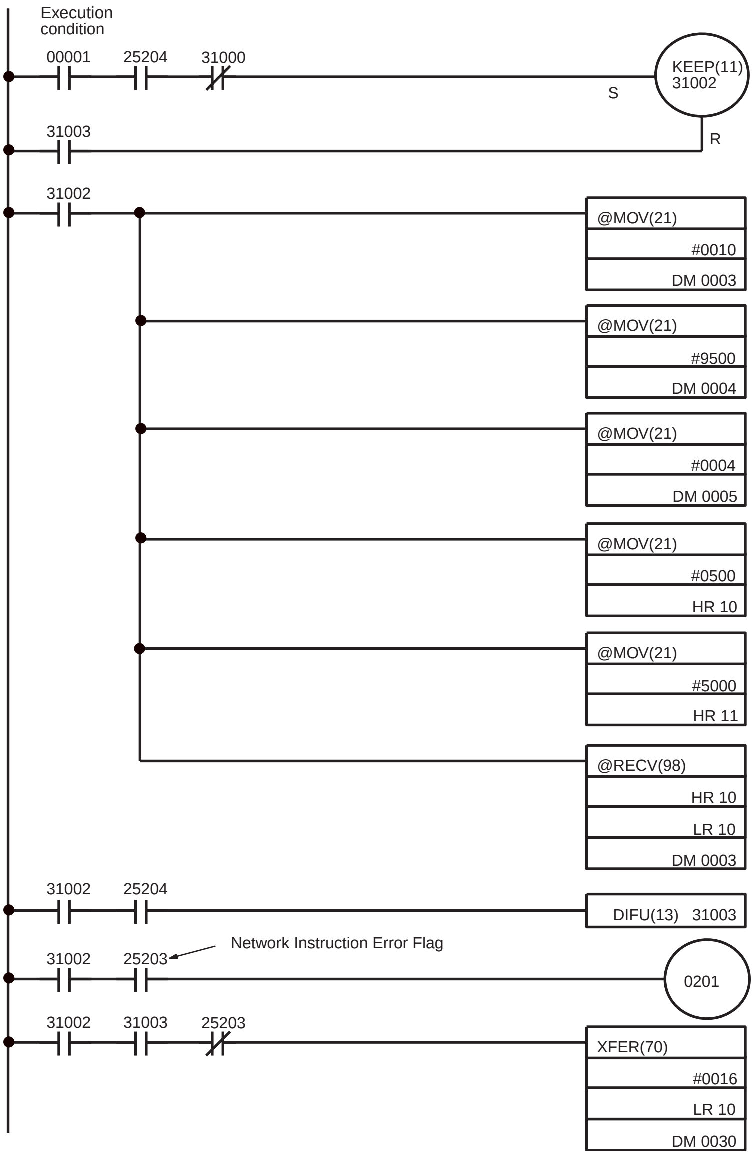
Transfers the 10 words beginning at DM 0010 of the source node to the words beginning with DM 0020 at node address 3.

Creates reset input.

Turns ON to indicate transmission error.

(Continued on the next page)

(Continued from the previous page)



The reception program will run when IR 00001 turns ON, provided that the Network Instruction Enabled Flag is ON and the SEND instruction has not been executed.

IR 31002 remains ON while the RECV instruction is being executed, and it turns OFF when instruction execution has been completed.

Control Data Preparation

DM 0003	0 0	1 0	16 receive words*
DM 0004	9 5	0 0	Operating level 1**
DM 0005	0 0	0 4	Node 4, Unit 0 (a PLC)

* No destination network address specified
** Response required, 5 retries, direct designation, monitoring time: default

Beginning Word for Indirect Sending by Destination Node

HR 10	0 5	0 0
HR 11	5 0	0 0

Beginning word for sending (by destination node) = DM5000 (05: DM designation)

Data for 16 words from DM 5000 (HR10, HR11) of the node address 4 is received in LR 10 and after.

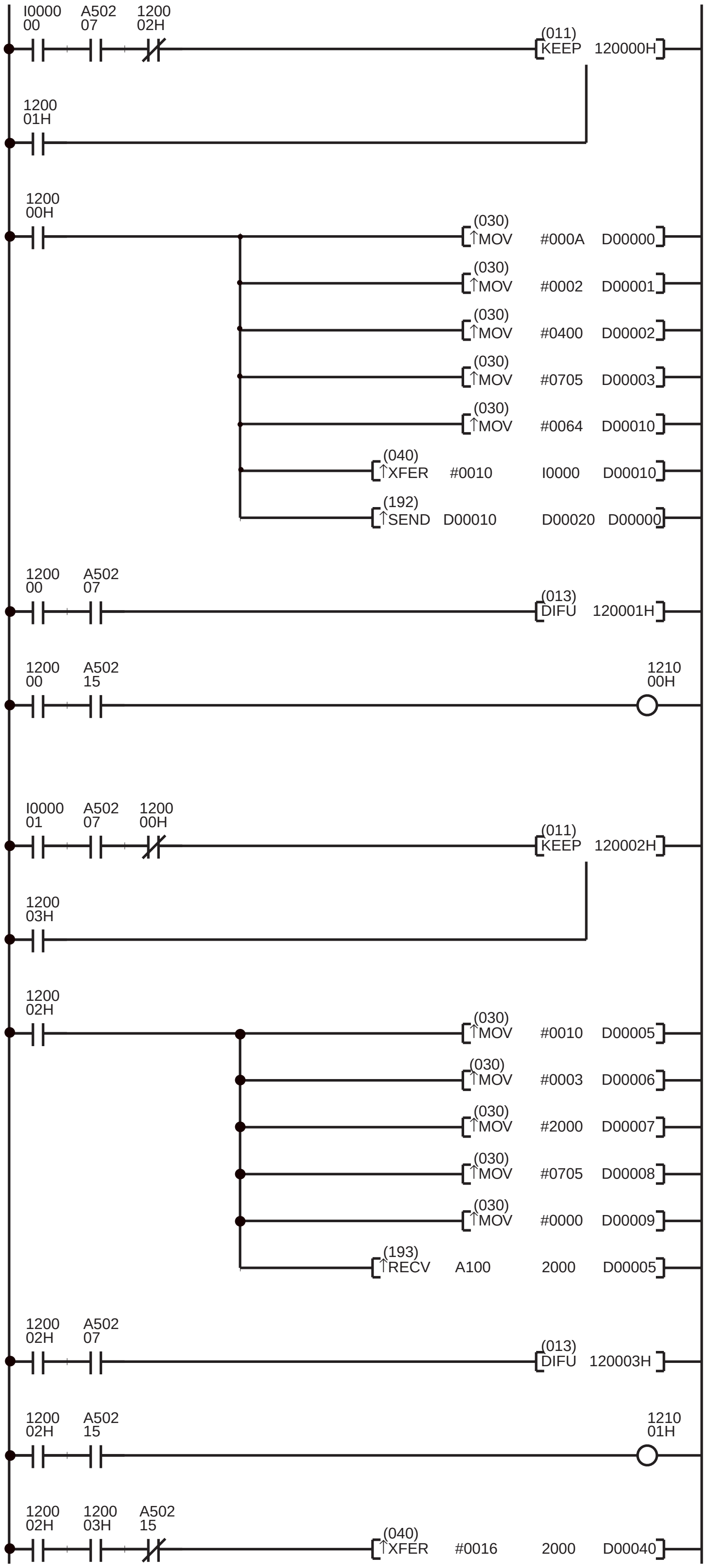
Creates reset input.

Turns ON to indicate reception error.

Transmitted data (16 words from LR 10) moved into words beginning at DM 0030 for storage.

Note When using the sample program, make sure that the bits and words used in the sample program are not the same as those in the user program or by Special I/O Units.

CVM1 and CV-series PLCs



The transmission program will run when I000000 is ON, provided that the Network Instruction Enabled Flag for port 7 is ON and the RECV instruction has not been executed.

CIO 120000H remains ON while the SEND instruction is being executed, and it turns OFF when the execution of the instruction has been completed.

Word	Content		Meaning
D00000	00	0A	No. of send words: 10H
D00001	00	02	Destination network address: 2
D00002	04	00	Destination node address: 4 Destination unit address: 0
D00003	07	05	Response required Communications port no.: 7 Number of retries: 5
D00004	00	64	Response monitor time: 10 s

The 10-word data starting from I0000 is stored in D00010 and following words.

Transfers 10 words of data from the source node to the PLC (from D00020 onwards) at network address 2, node no. 4, unit address 0.

Creates reset input.

Transmission error display

The reception program will run when I000001 is ON, provided that the Network Instruction Enabled Flag for port 7 is ON and the SEND instruction has not been executed.

CIO 120002H remains ON while the RECV instruction is being executed, and it turns OFF when the execution of the instruction has been completed.

Word	Content		Meaning
D00005	00	10	Number of receive words: 16H
D00006	00	03	Destination network address: 3
D00007	20	00	Destination node address: 32 Destination Unit address: 0
D00008	07	05	Response required Communications port no.: 7 Number of retries: 5
D00009	00	00	Response monitor time: Default

Transfers 16 words of data (from A100 onwards) from the PLC at network address 3, node no. 32, unit address 0, to words 2000 onwards.

Creates reset input.

Reception error display
Reception data processing
When the data is received without an error, the 16-word data received at CIO 2000 and following words is stored in D00040 and following words on the same PLC.

Note When using the sample program, make sure that the bits and words used in the sample program are not the same as those in the user program or Special I/O Units.

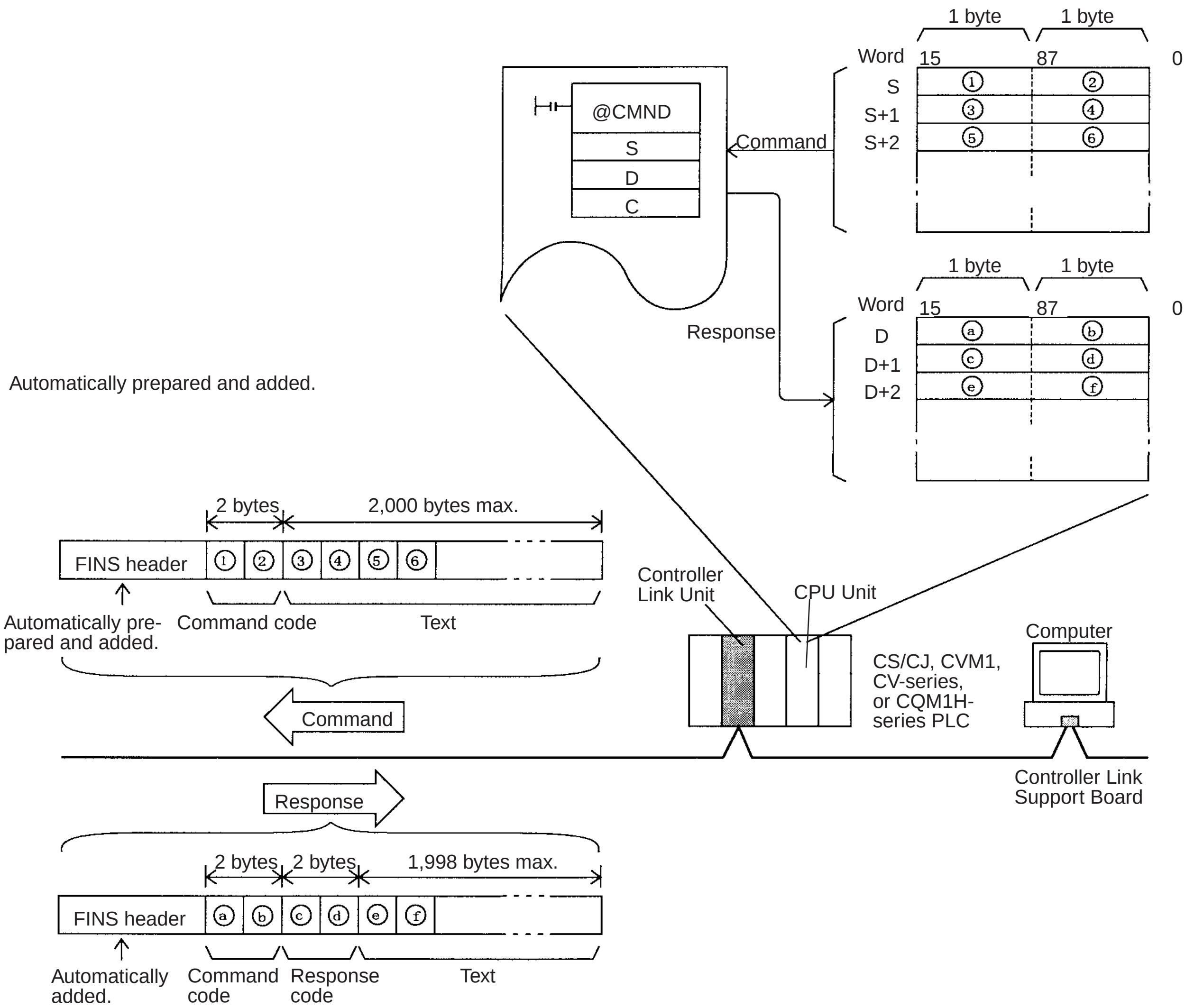
6-4 FINS Commands and Responses

6-4-1 FINS Communications Service

The FINS communications service is a communications protocol developed by OMRON for FA control devices. It can be used for reading from and writing to PLC memory, or for controlling various operations, without having to create a user's program at the PLC. The FINS communications service has its own independent address system which does not rely on the actual network address system, so it can carry out communications in the same way regardless of whether the PLC at the local node is on a Controller Link Network or some other FA network (e.g., SYSMAC NET or SYSMAC LINK). For details on FINS commands, refer to the *FINS Commands Reference Manual (W227)*.

6-4-2 Sending and Receiving FINS Commands and Responses

FINS commands can be sent by using the CMND instruction with a CVM1, CV-series, CS/CJ-series, or CQM1H-series PLC. The following diagram shows the data format for sending FINS commands and receiving responses. The data that is sent and received is all hexadecimal unless otherwise noted.



Command Codes

The command code consists of two bytes of data, and indicates the contents of the command. A FINS command must begin with a 2-byte command code, and any parameters must follow the command code.

Response Codes

The response code consists of two bytes of data, and indicates the result of the command execution. The first byte is the MRES (main response code), which indicates the broad classification of the execution result. The second byte is the SRES (sub-response code), which gives the detailed classification.

The following table shows the main response codes and the execution results. For a more detailed listing of response codes, including the sub-response codes, refer to *6-7 Response Codes*.

MRES	Execution result	MRES	Execution result
00	Normal completion	21	Write not possible
01	Local node error	22	Not executable in current mode
02	Destination node error	23	No unit
03	Communications controller error	24	Start/stop not possible
04	Not executable (service not supported)	25	Unit error
05	Routing error	26	Command error
10	Command format error	30	Access error

MRES	Execution result	MRES	Execution result
11	Parameter error	40	Service interrupted by abort
20	Read not possible	---	---

6-4-3 Applicable Units for FINS Commands

The parameters used with FINS commands and responses depend on the Unit to which the command is being sent. The FINS commands and responses addressed to Controller Link Units, to C200HX/HG/HE PLCs, and to CQM1H-series PLCs are explained in this manual. For explanations of FINS commands for other Units, refer to the *FINS Commands Reference Manual (W227)*.

C200HX/HG/HE and CQM1H-series PLCs do not directly support FINS commands, but the Controller Link Unit automatically converts the command format so that C200HX/HG/HE and CQM1H-series PLCs can process them. The Unit also converts the response format so that the response can be returned to the source of the command.

When FINS commands are sent via a Host Link System for CVM1, CV-series, or CS/CJ-series PLCs, be sure to use the command format for relaying between networks.

6-5 Commands and Responses for Controller Link Units

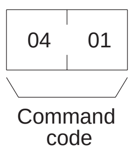
6-5-1 Command Codes

Command code		Data link operation mode		Name	Page
		Active	Inactive		
04	01	Not valid	Valid	DATA LINK START	146
	02	Valid	Not valid	DATA LINK STOP	147
05	01	Valid	Valid	CONTROLLER DATA READ	147
06	01	Valid	Valid	CONTROLLER STATUS READ	148
	02	Valid	Valid	NETWORK STATUS READ	150
	03	Valid	Valid	DATA LINK STATUS READ	152
08	01	Valid	Valid	ECHOBACK TEST	153
	02	Valid	Valid	BROADCAST TEST RESULTS READ	153
	03	Valid	Valid	BROADCAST TEST DATA SEND	155
21	02	Valid	Valid	ERROR LOG READ	155
	03	Valid	Valid	ERROR LOG CLEAR	156

6-5-2 DATA LINK START

Starts the Controller Link Network data links.

Command Block



Response Block

04	01		
Command code		Response code	

The DATA LINK START command can be received for either automatically or manually set data links. An error will occur if manually set data links are specified and yet data link tables do not exist.

The node that receives this command and starts the data links will become the data link startup node. For automatically set data links, the data links will be executed according to the settings at the startup node.

6-5-3 DATA LINK STOP

Stops the Controller Link Network data links.

Command Block

04	02
Command code	

Response Block

04	02		
Command code		Response code	

The DATA LINK STOP command can be received only while the data links are active. An error will occur if this command is sent at any other time.

This command can be received by any node that is participating in the data link.

6-5-4 CONTROLLER DATA READ

Reads the Controller Link Unit's model, version, and node address data.

Command Block

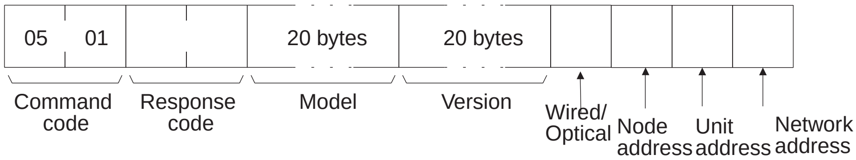
05	01
Command code	

Response block

<u>For C200HX/HG/HE, CVM1, and CV-series PLCs</u>

05	01			20 bytes	20 bytes	00	
Command code		Response code		Model	Version	Reserved for system	Node address

For CS/CJ-series and CQM1H-series PLCs



Parameters

Model, version (response): The Controller Link Unit's model and version are returned as shown below, each 20 characters in ASCII code. If fewer than 20 bytes of data are used, 20 (Hex) (i.e., spaces) will be returned for the remaining bytes. In the version numbers shown below, the spaces are represented by boxes (□).

Model

Unit for C200HX/HG/HE PLCs: C200HW-CLK21□□□□□□□□
Unit for CVM1/CV-series PLCs: CVM1-CLK21□□□□□□□□□□
Unit for CS-series PLCs: CS1W-CLK21□□□□□□□□□□
Unit for CJ-series PLCs: CJ1W-CLK21□□□□□□□□□□
Unit for CQM1H-series PLCs: CQM1H-CLK21□□□□□□□□□

Version

PLCs other than CJ-series PLCs: V1.00□V1.00□□□□□□□□□

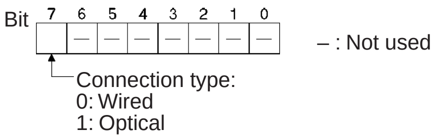
The first version number represents the Communications Controller version number, and the second represents the Unit version number.

CJ-series PLCs: V2.00□V2.00□V2.00□□□

The first version number represents the data link layer Communications Controller version number, the second represents the network layer Communications Controller version number, and the third represents the Unit version number.

Wired/Optical (Response)

The connection method for the Controller Link Unit (wired or optical). The configuration is as follows:



Node address (response): The Controller Link Unit's node address is returned between 01 and 20 Hex (1 to 32).

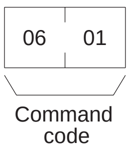
Unit Address (response): The Unit address set for the Controller Link Unit (10 Hex + Unit number), is returned in hexadecimal. Even when there is a Unit number setting error, the Unit address is returned.

Network Address: The Controller Link Unit's network address, as set in the routing table, is returned in hexadecimal. When the routing table has not been set, the address becomes 00 Hex.

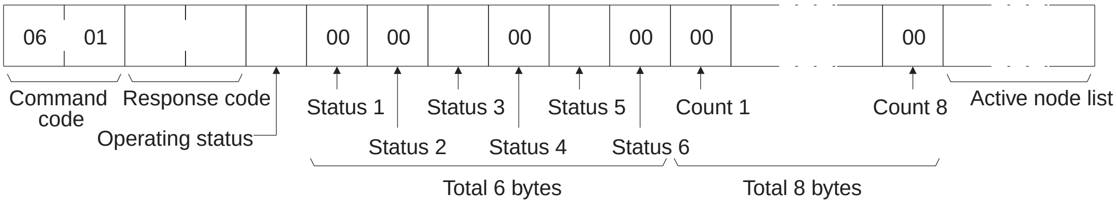
6-5-5 CONTROLLER STATUS READ

Reads the Controller Link Unit's controller status.

Command Block



Response Block



Parameters

Operating status (response): The operating status of the data links as follows:

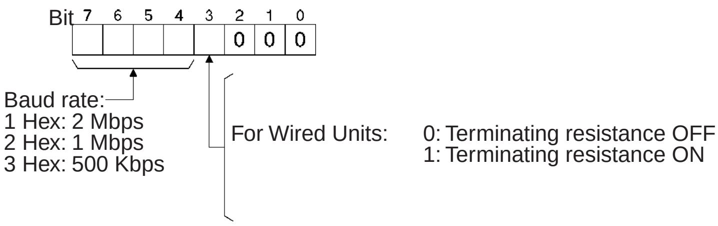
00 (Hex): Data links inactive.

01 (Hex): Data links active.

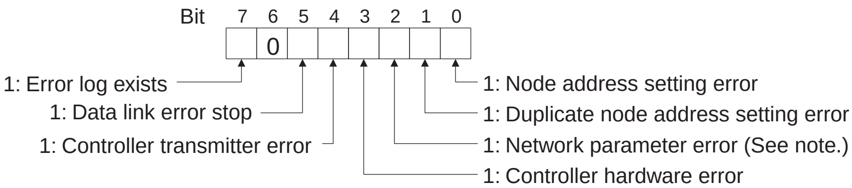
02 (Hex): Local data links not active. (The data links are active in the network, but the local node is not participating.)

Status 1, Status 4, Status 6 (response): Not used by the Controller Link Unit. Always set to 00 (Hex).

Status 2 (response): For C200HX/HG/HE, CVM1, and CV-series Controller Link Units, always set to 00 (Hex). For CS/CJ-series and CQM1H-series PLCs, the Unit's setting status is returning in the following configuration.

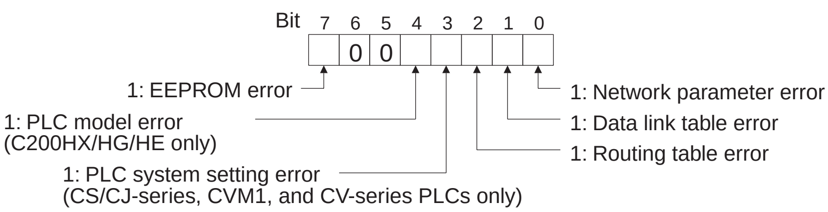


Status 3 (response): Error information. The configuration is as follows:



Note With CS/CJ-series Optical Controller Link Units, this bit will be 1, even if the Unit is mistakenly connected to an Optical SYSMAC LINK Network.

Status 5 (response): Error information related to the Unit and the PLC. The configuration is as follows:



A network parameter error, data link table error, or routing table error occurs if an error is discovered when the parameters and tables are checked at power up.

A PLC system setting errors occurs if the Controller Link Unit is not properly recognized by a CS/CJ-series, CVM1, or CV-series PLC.

A PLC model error occurs if a C200HX/HG/HE Controller Link Unit is mounted to another type of PLC.

Count 1 to Count 8 (response): The total number of times for each of the items listed below is returned as 1 byte of hexadecimal data.

Count 1: Number of CRC errors
Count 2: Number of token re-sends
Count 3: Number of token returns
Count 4: Number of token timeouts
Count 5: Number of polling timeouts
Count 6: Number of controller changes
Count 7: Number of active node changes
Count 8: Reserved for system use.

Network participation status (response): The following diagram shows the bits corresponding to node addresses in the Controller Link Network. When a bit is returned as “1,” it means that the corresponding node is participating in the network.

Bit	7	6	5	4	3	2	1	0
Byte 1	8	7	6	5	4	3	2	1
Byte 2	16	15	14	13	12	11	10	9
Byte 3	24	23	22	21	20	19	18	17
Byte 4	32	31	30	29	28	27	26	25
Byte 5	–	–	–	–	–	–	–	–
Byte 6	–	–	–	–	–	–	–	–
Byte 7	–	–	–	–	–	–	–	–
Byte 8	–	–	–	–	–	–	–	–

Reserved for system use.

The numbers in the boxes indicate the node addresses. The bit status of a particular node address shows whether or not that node participates in the network.

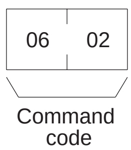
0: Not part of network
1: Part of network

(All boxes marked by "–" are reserved for system use and fixed at "0.")

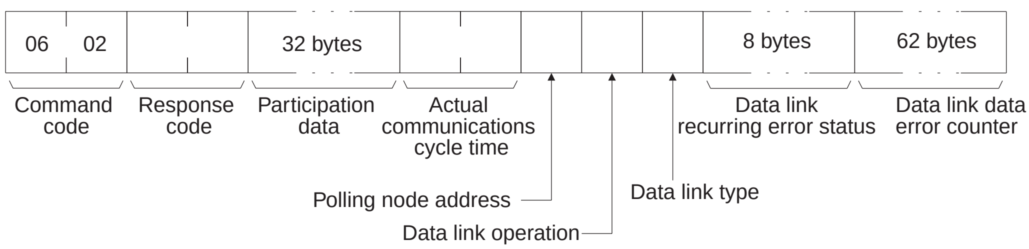
6-5-6 NETWORK STATUS READ

Reads the operating status of the entire Controller Link Network.

Command Block

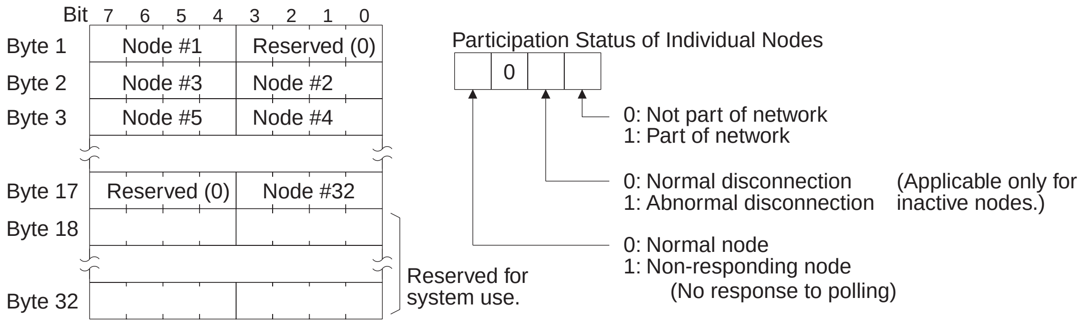


Response Block



Parameters

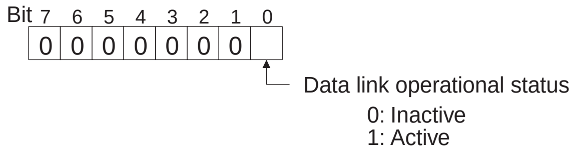
Participation data (response): This parameter indicates the active status of individual nodes with respect to the network (i.e. their participation in the network). As shown in the following diagram, that status is expressed in four bits corresponding to the node address.



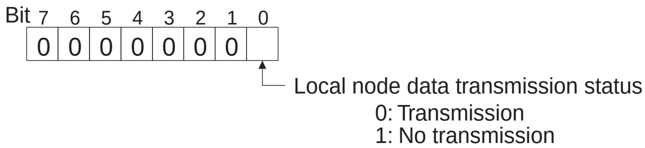
Actual communications cycle time (response): The actual communications cycle time is returned in units of 100 µs in hexadecimal.

Polling node address: The current polling node address is returned in hexadecimal.

Data link operation (response): Indicates the status of data link operation in the network.



Data link type (response): Indicates the data transmission status of the local node's data links. It is configured as shown in the following diagram. This parameter is valid only during data link operation. While data link operation is inactive, the value from the previous operation is retained.



Data link recurring error status (response): Indicates whether an error continues to occur at a node when data link data is received. If an error continues to occur at the same node when the data is received, the bit corresponding to that node turns to "1" (i.e., turns ON). The configuration is shown in the following diagram.

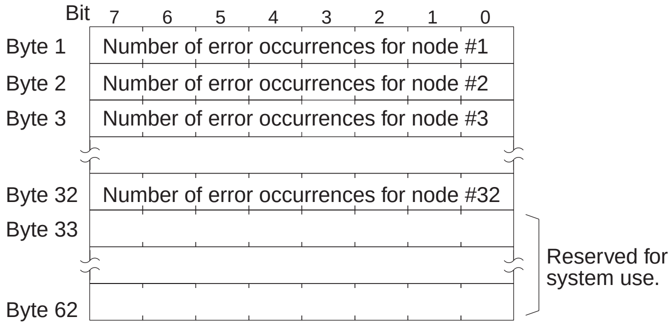
Bit	7	6	5	4	3	2	1	0
Byte 1	8	7	6	5	4	3	2	1
Byte 2	16	15	14	13	12	11	10	9
Byte 3	24	23	22	21	20	19	18	17
Byte 4	32	31	30	29	28	27	26	25
Byte 5	–	–	–	–	–	–	–	–
Byte 6	–	–	–	–	–	–	–	–
Byte 7	–	–	–	–	–	–	–	–
Byte 8	–	–	–	–	–	–	–	–

Reserved for system use. (Bytes 5 to 8)

The numbers in the boxes indicate the node addresses. The bit status of a particular node address shows whether or not there is a recurring data link error at that node.

0: No recurring error
1: Recurring error

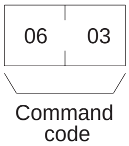
Data link data error counter (response): The total number of data link data reception errors occurring at all nodes (node addresses 1 to 32) is returned as a total count from the time the power was turned on. It is expressed, in hexadecimal, as one byte per node. The count can range from 0 to 255 (i.e., 0 to FF in hexadecimal).



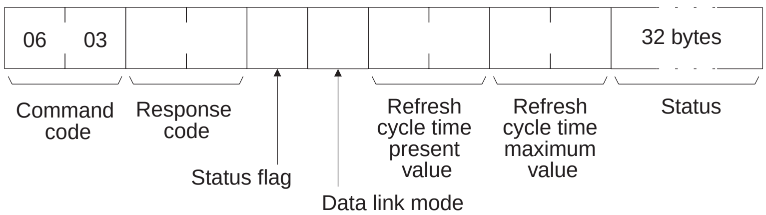
6-5-7 DATA LINK STATUS READ

Reads the data link operational status.

Command Block

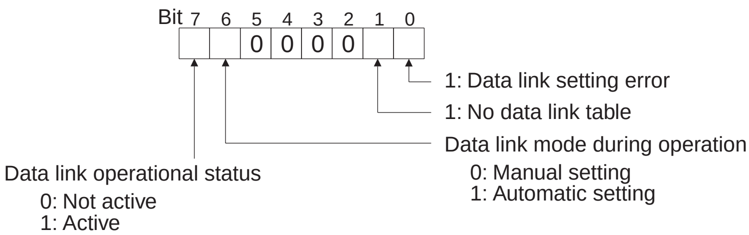


Response Block



Parameters

Status flag (response): The overall data link status is returned in one byte of data, as shown in the following diagram.

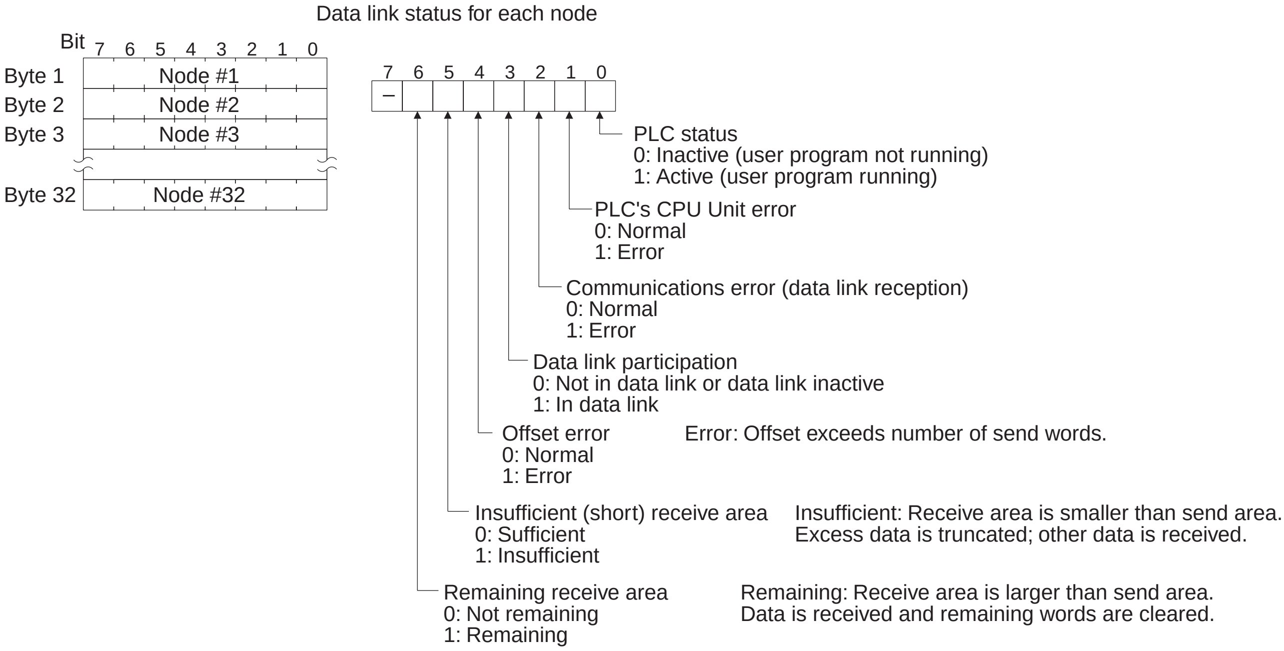


Data link mode (response): The data link mode during operation is returned in one byte of data, as follows:

01 (Hex): Automatic
03 (Hex): Manual

Refresh cycle time present value, refresh cycle time maximum value (response): The present value and the maximum value of the cycle time for refreshing the data link area are both returned in units of 1 ms, in hexadecimal, within a range of 0000 to 00FF (decimal: 0 to 255).

Status (response): The data link status of each mode is returned as shown in the following diagram. It is the same as the data link status in the PLC. (Refer to page 103.)

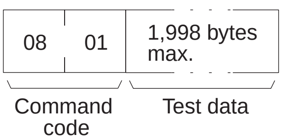


Note
1. The data link status is not refreshed while the data links are inactive.
2. Nodes which are not active in the network or participating in the data links will generate communications errors.
3. Any node which is not active in the network retains the status that existed immediately prior to the generation of the communications error.
4. Only the PLC operation status and PLC error status will be refreshed for nodes that are not participating in a data link that is active in the network.

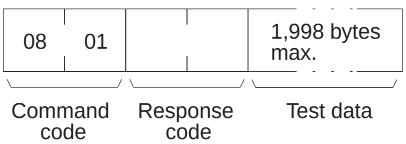
6-5-8 ECHOBACK TEST

Executes an echoback communications test between specified nodes.

Command Block



Response Block



Parameters

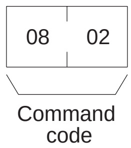
Test data (command, response): For the command, up to 1,998 bytes of data can be specified to be sent to a specified node. For the response, the test data that was sent by the command is returned unchanged.

An error is generated if the data returned by the response is different from the data that was sent by the command.

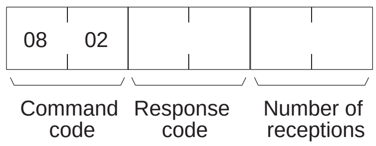
6-5-9 BROADCAST TEST RESULTS READ

Reads for each node the results (number of receptions) of a BROADCAST TEST DATA SEND command that has been sent to all nodes in a specified network. (For details on the BROADCAST TEST RESULTS SEND command, refer to *6-5-10 BROADCAST TEST DATA SEND*.

Command Block



Response Block



Parameters

Number of receptions (response): The number of times that broadcast test data has been received at the command destination node from the time that the last BROADCAST TEST RESULTS READ command was sent until this one was sent is returned.

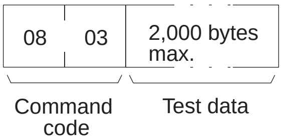
An error will be generated if that number of receptions differs from the number of times that the BROADCAST TEST DATA SEND command was issued during that same period.

The *number of receptions* value being retained at the destination node is cleared when the BROADCAST TEST RESULTS READ command is executed.

6-5-10 BROADCAST TEST DATA SEND

Broadcasts test data to all nodes in a specified network.

Command Block



There is no response to this command.

The control data must be set as follows when this command is issued:

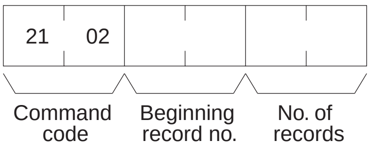
Destination node address:	FF (Hex) (for broadcasting the data)
Destination unit address:	FE (Hex) (for the Controller Link Unit)
Response required/not required:	1 (response not required)

The transmission and reception status is checked by comparing the number of times this command is issued with the *number of receptions* parameter of the BROADCAST TEST RESULTS READ command. (For details, refer to *6-5-9 BROADCAST TEST RESULTS READ*.

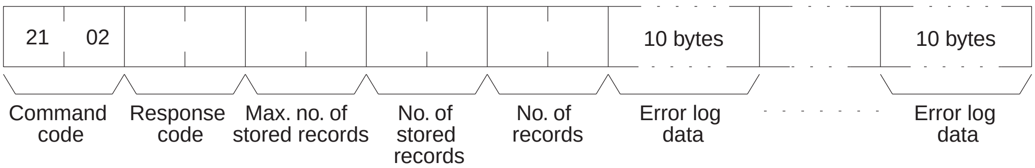
6-5-11 ERROR LOG READ

Reads the PLC's error log.

Command Block



Response Block



Parameters

Beginning record no. (command): Specifies the first record to be read, in two bytes (four digits) in hexadecimal. (The first record number is 0000 in hexadecimal. Designate the record number within a range of 0000 to 0026 in hexadecimal (decimal: 0 to 38)).

No. of records (command and response): Specifies the number of records to be read, within a range of 0001 to 0027 in hexadecimal (decimal: 1 to 39). The response gives the number of records actually read.

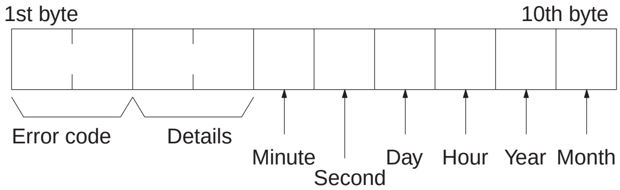
Max. no. of stored records (response): Specifies the maximum number of records that can be recorded, within a range of 0001 to 0027 in hexadecimal (decimal: 1 to 39).

No. of stored records (response): The number of records that have been recorded by the time the command is executed. The response will be given within a range of 0001 to 0027 hexadecimal (decimal: 1 to 39).

Error log data (response): The specified error log records are 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, details: These parameters show the contents of errors. For details, refer to *9-3-2 Error Codes.*

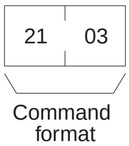
Date and time: These parameters show the seconds, minutes, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

Note
1. If the PLC does not have the specified number of records, all the records that have been stored in the PLC up to the point that the command is executed will be returned.
2. If there is no error log registered, a response code of 1103 (Hex) will be returned.

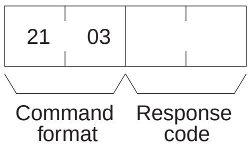
6-5-12 ERROR LOG CLEAR

Clears all error log records and sets the error log pointer to 0.

Command Block



Response Block



6-6 Commands and Responses for C200HX/HG/HE and CQM1H-series PLCs

6-6-1 Command Codes

Command code		PLC mode			Name	Page
		RUN	MONITOR	PROGRAM		
01	01	Valid	Valid	Valid	MEMORY AREA READ	159
	02	Valid	Valid	Valid	MEMORY AREA WRITE	160
	04	Valid	Valid	Valid	MULTIPLE MEMORY AREA READ	161
03	06	Valid	Valid	Valid	PROGRAM AREA READ	162
	07	Not valid	Not valid	Valid	PROGRAM AREA WRITE	162
04	01	Valid	Valid	Valid	RUN	163
	02	Valid	Valid	Valid	STOP	164
05	01	Valid	Valid	Valid	CONTROLLER DATA READ	164
06	01	Valid	Valid	Valid	CONTROLLER STATUS READ	165
07	01	Valid	Valid	Valid	CLOCK READ	166
	02	Not valid	Valid	Valid	CLOCK WRITE	166
21	01	Valid	Valid	Valid	ERROR CLEAR	167
23	01	Not valid	Valid	Valid	FORCED SET/RESET	168
	02	Not valid	Valid	Valid	FORCED SET/RESET CANCEL	169
	0A	Valid	Valid	Valid	MULTIPLE FORCED STATUS READ	169

6-6-2 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		
IR Area 1, 2 SR Area 1, 2	Bit status	00000 to 51115	0000 to 01FF	00 to 0F	00	1
	Word contents	000 to 511		00 to 00	80	2
LR Area	Bit status	LR 0000 to LR 6315	03E8 to 0427	00 to 0F	00	1
	Word contents	LR 00 to LR 63		00 to 00	80	2
HR Area	Bit status	HR 0000 to HR 9915	0428 to 048B	00 to 0F	00	1
	Word contents	HR 00 to HR 99		00 to 00	80	2
AR Area	Bit status	AR 0000 to AR 2715	048C to 04A7	00 to 0F	00	1
	Word contents	AR 000 to AR 27		00 to 00	80	2
Timer/ Counter Area	Status	T/C 000 to T/C 511	0000 to 01FF	00 to 00	01	1
	PV				81	2
DM Area	Word contents	DM 0000 to DM 6655	0000 to 19FF	00 to 00	82	2
Expansion DM	Word contents	EM 0000 to EM 6143	0000 to 17FF	00 to 00	90 to 97, 98, and A8 to AF (See note.)	2

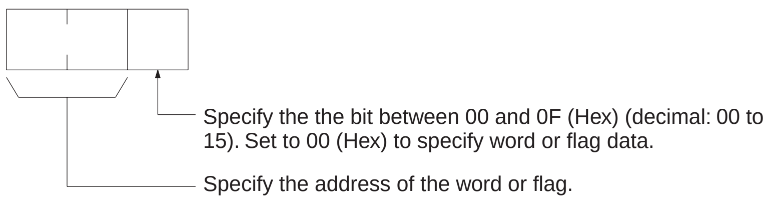
Note The meanings of the memory area codes for the Expansion DM area are shown in the following table. Only the current bank (98) or bank 0 (90) can be specified for CQM1H-series PLCs.

Memory area code	Meaning
90 to 97	Banks 0 to 7
98	Current bank
A8 to AF	Banks 8 to 15

Memory area size varies depending on the PLC model. For details, refer to the operation manual of the specific PLC that is being used.

Word/Bit Addresses

Each word/bit address specifies a specific bit or word.



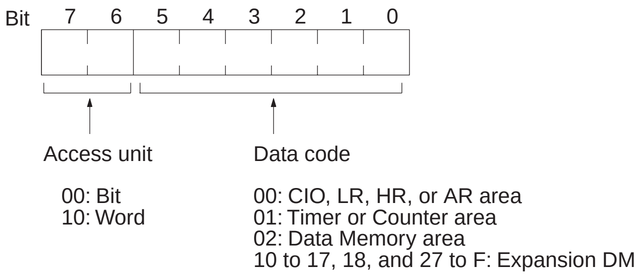
To obtain the corresponding address of the desired word or bit, add the data area word address (hexadecimal) to the first address of the range of addresses used for that data area in communications. For example, the address for word AR 13 is computed as follows:

First address for AR area;	048C (Hex)
048C + 0D (13 in BCD);	0499 (Hex)

The word address for AR 13 would be 04990C (Hex) (the memory area code would specify this as a word) and the address of bit 12 (C Hex) in AR 13 would be 04990C (Hex).

Memory Area Code

The unit of access (bit or word) and the data code are specified as shown in the following illustration.



Number of Bytes/Element

The number of bytes of read or write data per element is as follows depending on the access unit.

1 Byte/element for bit access

2 Bytes/element for word access

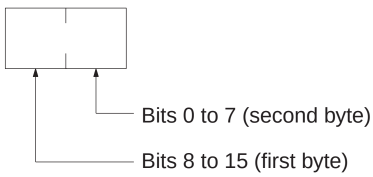
Data Configuration

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)

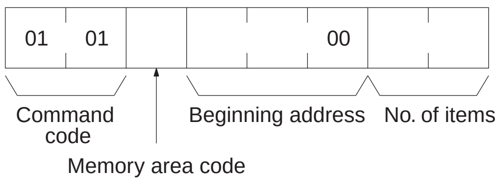
Word Contents or PV (Two Bytes)



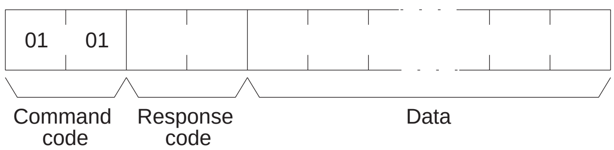
6-6-3 MEMORY AREA READ

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 (Hex) for the 3rd byte.

No. of items (command): The number of items to be read. Specify 0000 to 03E7 (Hex) (0 to 999 decimal). The command can be completed normally even if zero items are specified.

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 areas can be read. (Refer to *6-6-2 Memory Area Designations* for PLC word/bit address designations):

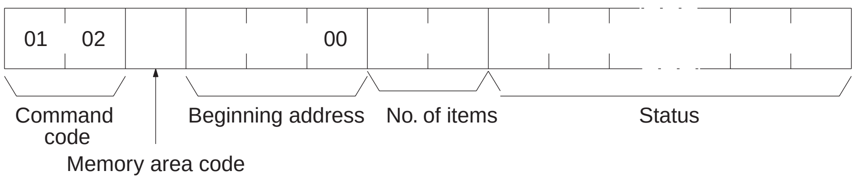
Memory area	Data	Memory area code	No. of bytes
IR, SR, LR, HR, or AR	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents	90 to 97, 98, and A8 to AF	2

6-6-4 MEMORY AREA WRITE

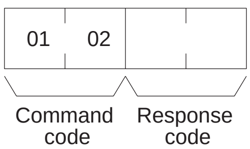
Writes data to the specified number of consecutive words starting from the specified word. All words must be in the same memory area. (Here, all memory areas with the same memory area code are considered as one area).

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 (Hex) for the 3rd byte.

No. of items (command): The number of items to be written. Specify 0000 to 03E5 (Hex) (0 to 997 decimal). The command can be completed normally even if zero items are specified.

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 *6-6-2 Memory Area Designations*-for the word/bit address designations):

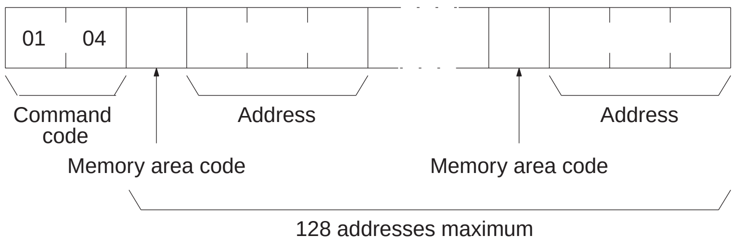
Memory area	Data	Memory area code	No. of bytes
IR, SR, LR, HR, or AR	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents	90 to 97, 98, and A8 to AF	2

6-6-5 MULTIPLE MEMORY AREA READ

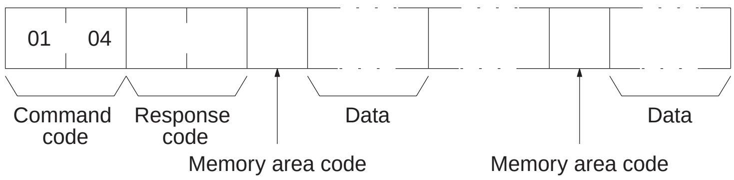
Reads the contents of the specified number of non-consecutive memory area words, starting from the specified word.

Note If there is an error in the command code or an address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Address (command): The word/bit/flag to read. The content of up to 128 words can be read. If one or more EM Area words is included in the data to be read, the maximum number of words that can be read will be limited to 100.

Data (response): The data in the specified memory area(s) will be returned in sequence starting from the beginning address.

Memory Areas

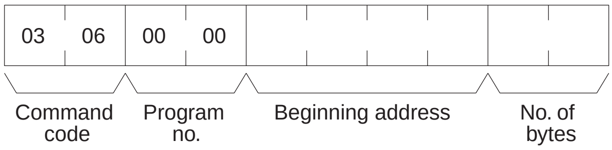
The following data can be written. (Refer *6-6-2 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
IR, SR, LR, HR, or AR	Bit status	00	1
	Word contents	80	2
Timer/Counter	Status	01	1
	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents	90 to 97, 98, and A8 to AF	2

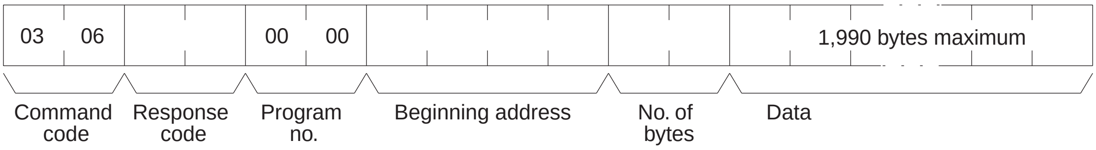
6-6-6 PROGRAM AREA READ

Reads the contents of the specified number of consecutive program area words starting from the specified word. The program is read a machine language (object code). A maximum of 1,990 bytes can be read with each command.

Command Block



Response Block

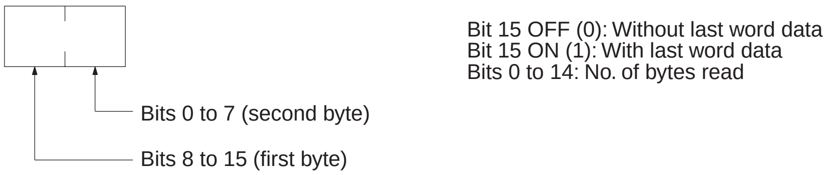


Parameters

Program no. (command and response): Set to 0000 (Hex).

Beginning address (command and response): Set an relative byte address with 00000000 (Hex) as the starting address. The beginning word must be an even number. The address set in the command will be returned in the response.

No. of bytes (command and response): The number of bytes in an even number 07C6 (Hex) (1990 in decimal) or smaller. The number of bytes actually read will be returned in the response. Bit 15 will be ON (1) in the response block when the last word data of the program area is returned.



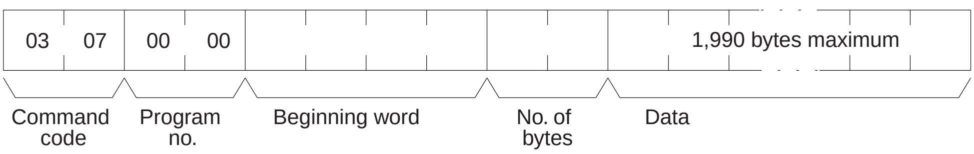
Data (response): The data in the specified program area will be returned in sequence starting from the beginning word.

Note If the designated number of bytes is larger than the program area, the program will be read through the final address and a response code indicating an address range error or response length error will be returned.

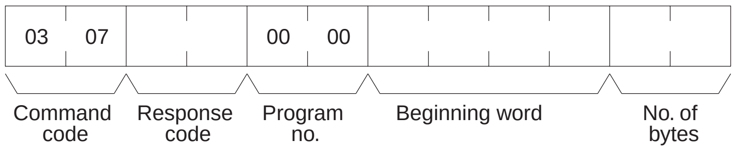
6-6-7 PROGRAM AREA WRITE

Writes data to the specified number of consecutive program area words starting from the specified word. A maximum of 1,990 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. The data is written to the program area at the machine language (object code) level.

Command Block



Response Block



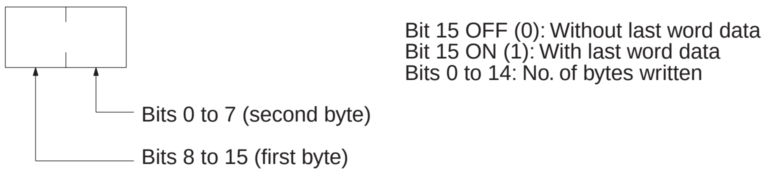
Parameters

Program no. (command and response): Set to 0000 (Hex).

Beginning word (command and response): Set a relative byte address with 00000000 (Hex) as the starting address. The beginning word must be an even number. The address set in the command will be returned in the response.

No. of bytes (command and response): The command specifies the number of bytes of data to write. This must be an even number of 07C6 (Hex) or smaller (1990 or smaller in decimal). The number of bytes actually written will be returned in the response. The leftmost bit (bit 15) is used to indicate the completion of the command. It must be turned ON (1) when writing data to the last address in the program area so that the PLC can generate an index*. To write only an index marker, specify 8000 (Hex) for the number of bytes.

*Generating an index is a process that enables a program to be used by the PLC after it has been written. A program will not run properly if the index has not been generated.

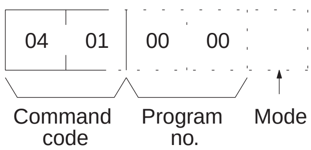


Data (command): The data to be written.

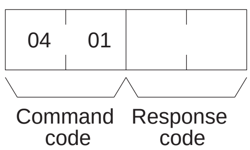
6-6-8 RUN

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

Command Block



Response Block



Parameters

Program no. (command and response): Set to 0000 (Hex).

Mode (command): As follows:

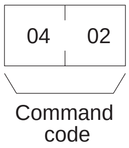
02 (Hex):	MONITOR mode
04 (Hex):	RUN mode

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

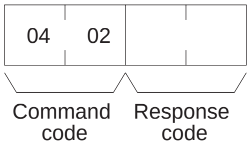
6-6-9 STOP

Changes the PLC to PROGRAM mode, stopping program execution.

Command Block



Response Block

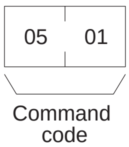


6-6-10 CONTROLLER DATA READ

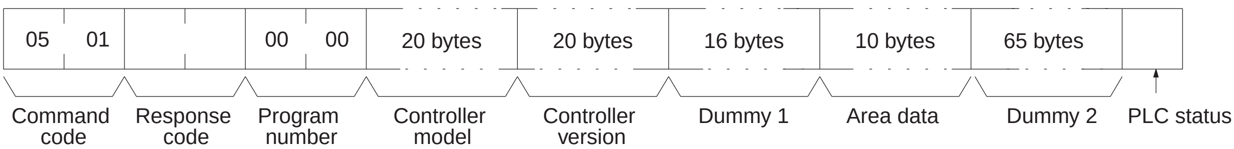
Reads the following data:

- Controller model and version
- Area data
- PLC status

Command Block



Response Block

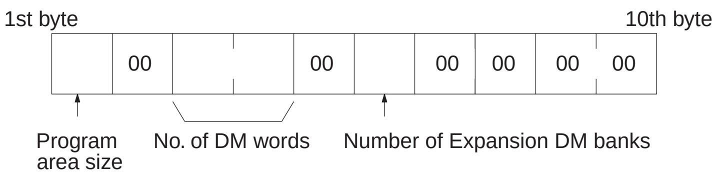


Parameters

Controller model and Controller version (response): Both are returned in ASCII, within 20 bytes (i.e., within 20 ASCII characters). If the model or version information does not require 20 bytes of data, the remainder of the bytes will be filled with spaces (20 hexadecimal).

Dummy 1 and Dummy 2 (response): All zeros (Hex) will be returned.

Area data (response): As follows:



Item	Meaning	Unit (Hex)
Program area size	The size of PLC Setup and program area	K words (1K words = 1,024 words; 1 word = 2 bytes))
No. of DM words	Total words in the DM area	Words (1 word = 2 bytes)
Number of Expansion DM banks	Number of banks in the Expansion DM area	Banks

PLC status (response): The status of connected tools is returned:

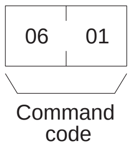
00 (Hex): No recognized tool connected

80 (Hex): Recognized tool connected

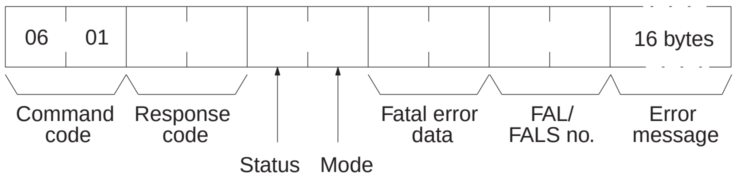
6-6-11 CONTROLLER STATUS READ

Reads the status of the Controller.

Command Block



Response Block



Parameters

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

00 (Hex): Stop (program not being executed)

01 (Hex): Run (program being executed)

80 (Hex): CPU Unit on standby

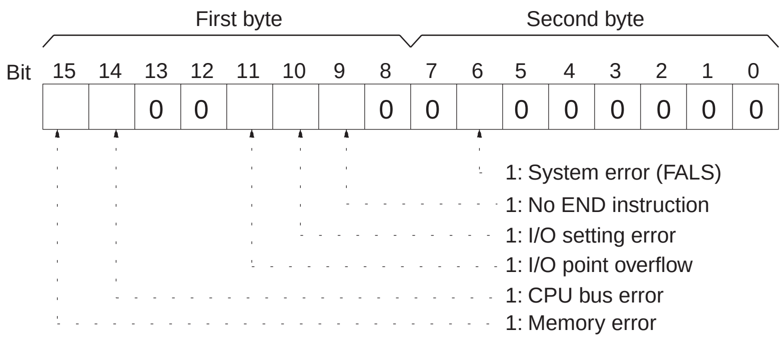
Mode (response): One of the following PLC modes:

00 (Hex): PROGRAM

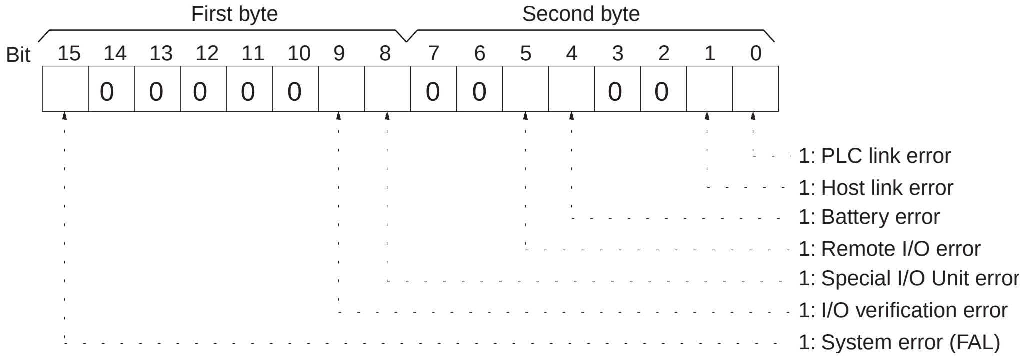
02 (Hex): MONITOR

04 (Hex): RUN

Fatal error data (response): The contents of fatal error information from the PLC. (For details refer to the operation manual of the PLC that is being used.)



Non-fatal error data (response): The contents of non-fatal error information from the PLC. (For details refer to the operation manual of the PLC that is being used.)



FAL/FALS No. (response): The number of the highest priority FAL/FALS error is returned as BCD between 00 and 99 (decimal) to the second byte. The first byte is always 00 (Hex). If no error has occurred, 0000 (Hex) is returned.

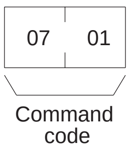
Error message (response): The error message of the present FAL/FALS number is returned as 16 or fewer ASCII characters (16 or fewer bytes). If there is no error, nothing will be returned.

6-6-12 CLOCK READ

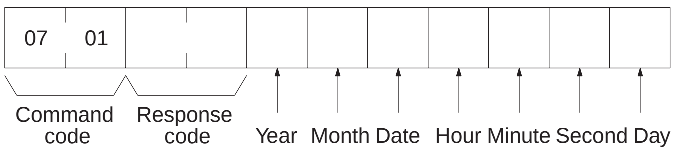
Reads the clock.

With CQM1H-series PLCs, all zeros will be returned if the CPU Unit does not contain a Memory Cassette with a 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

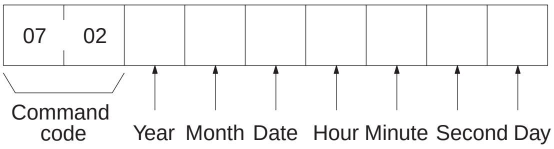
6-6-13 CLOCK WRITE

Sets the clock.

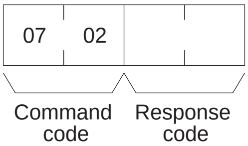
With CQM1H-series PLCs, the time will not be written unless the CPU Unit contains a Memory Cassette with a clock.

Note Be sure to specify all data.

Command Block



Response Block



Parameters

Year, month, date, hour, minute, second, day (command): Each specified value is expressed in BCD.

The ranges for setting these items are shown in the following table.

Parameters	Range
Year	00 to 99 (rightmost 2 digits)
Month	01 to 12
Date	00 to 31
Hour	00 to 23
Minute	00 to 59
Second	00 to 59

Day: As follows:

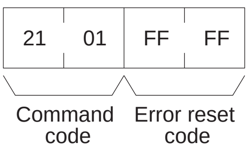
Value	**00**	**01**	**02**	**03**	**04**	**05**	**06**
Day	Sun	Mon	Tues	Wed	Thur	Fri	Sat

6-6-14 ERROR CLEAR

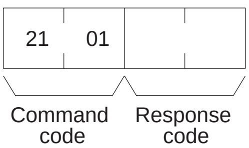
Clears errors from the PLC. A normal response will be returned even if an error has not occurred.

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

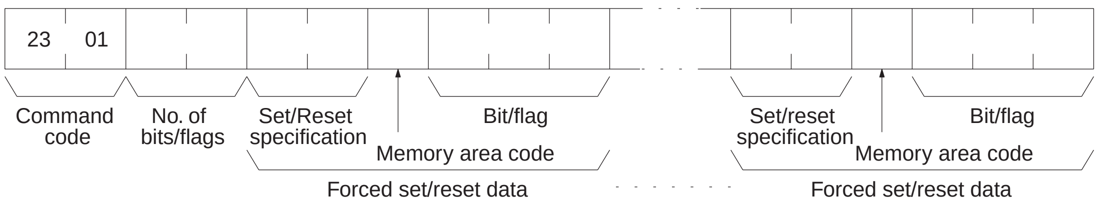
Error reset code (command): Set to FFFF (Hex).

6-6-15 FORCED SET/RESET

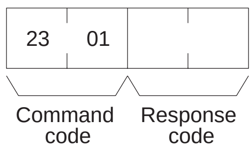
Forcibly sets (ON) or resets (OFF) bits/flags or releases forced set/reset status. Bits/flags that are forced ON or OFF will remain ON or OFF and cannot be written to until the forced status is released.

Note This command cannot be used to release the status of Completion Flags for timers or counters. If forced status is released and the Completion Flag is turned ON, it will be force-set; if forced status is released and the Completion Flag is turned OFF, it will be force-reset.

Command Block



Response Block



Parameters

No. of bits/flags (command): The number of bits/flags to be processed.

Note Multiple bits/flags can be forced set/reset, and the status will be retained until the forced set/reset is cleared.

Set/Reset specification (command): The action to be taken for each bit/flag:

Value	Function
0000 (Hex)	Force-reset (OFF)
0001 (Hex)	Force-set (ON)
8000 (Hex)	Forced status released and bit/flag turned OFF (0).
8001 (Hex)	Forced status released and bit/flag turned ON (1).
FFFF (Hex)	Forced status released.

Note “Forced status” is the ON/OFF status of bits/flags which is forcibly retained as write protected.

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

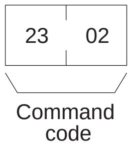
Refer to *6-6-2 Memory Area Designations* for memory area designations.

Memory area	Data	
IR, SR, LR, HR, and AR areas	Bits status	00
Timer/Counter	Completion Flag status	01

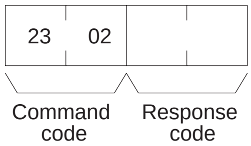
6-6-16 FORCED SET/RESET CANCEL

Cancels the forced status of all bits/flags that have been forced ON or forced OFF. (“Forced status” is the ON/OFF status of bits/flags which has been forcibly retained as write protected.)

Command Block



Response Block



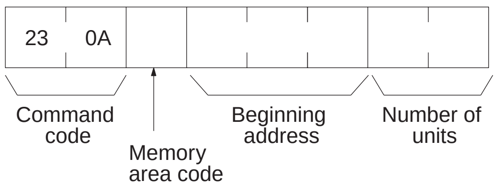
Note The bits (flags) in the following memory areas can be force-set or force-reset.

Memory area	Data
IR, SR, LR, HR, and AR areas	Bit status
Timer/Counter	Completion Flag status

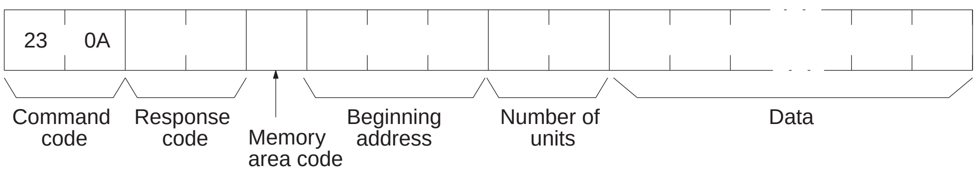
6-6-17 MULTIPLE FORCED STATUS READ

Reads the forced status of the specified range of words or timers/counters.

Command Block



Response Block



Parameters

Memory area code, Beginning address, Number of units (command, response): Specify the memory area code, the beginning address in that area, and the number of words or timers/counters to read. The number of units can be set from 0001 to 0040 (Hex) (1 to 64 in decimal). The total of 64 continuous bits (for 4 words) for the number of bits or words and the total of 64 units (for 32 words) for the timers/counters can be read at one time.

The actual area, beginning address, and number of units read will be returned in the response.

Memory Areas

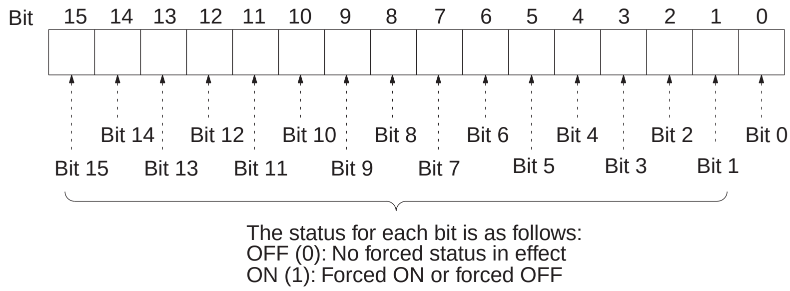
Forced status can be read in the following areas. Refer to *6-6-2 Memory Area Designations* for memory area designations.

Area	Data type	Memory area code	Number of bytes
IR, SR, LR, HR, and AR areas	PV of word	80	2
Timer/counter area	Completion Flag status	01	1

Note Forced status is read by words for the IR, SR, LR, HR, or AR area and by bits/flags for the Timer/Counter area.

Data (response): Forced status is returned beginning from the specified word or timer/counter. The number of bytes returned will be (the number of units) x (the number of bytes/unit).

IR, SR, LR, HR, and AR Areas:



Timers/Counters: Status of the Completion Flag will be returned as follows:

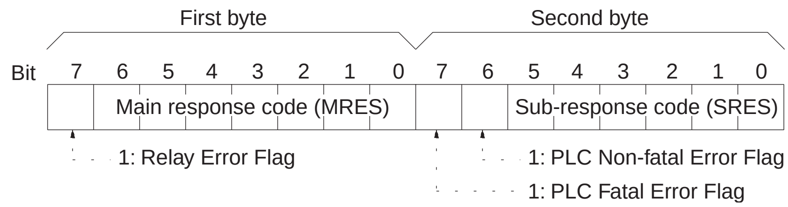
00 (Hex): No forced status in effect
01 (Hex): Forced ON or forced OFF

6-7 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. For further troubleshooting information, refer to *SECTION 9 Troubleshooting and Maintenance* of this manual and to the operation manuals for specific Units or Systems.

6-7-1 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.

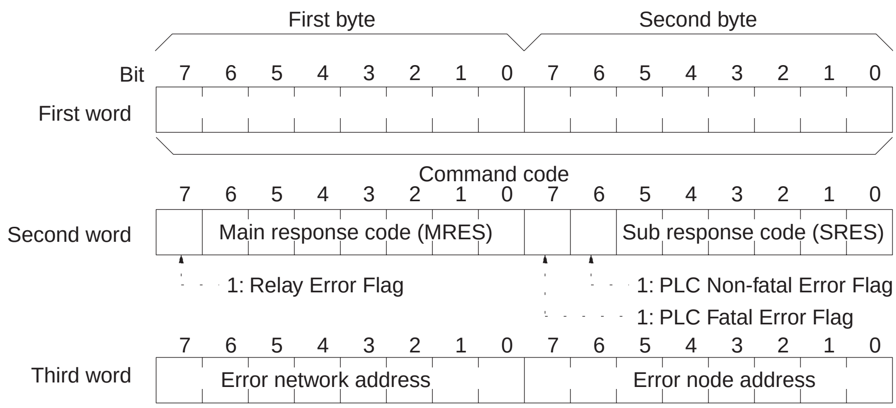
If bit 7 of the first byte is ON, a network relay error has occurred. Refer to *6-7-2 Network Relay Errors* for details on troubleshooting the error.

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.

6-7-2 Network Relay Errors

A network relay error will occur whenever a command cannot reach the destination. These errors can occur for several reasons: 1) Data was not successfully passed between two Link Units, 2) Data was not passed successfully between a Link Unit and another Unit, such as the PLC's CPU Unit, or 3) The destination of a gateway does not exist. In any case, the Unit that was not able to transfer data will return a response indicating a network relay error.

Bit 7 of the first byte of the response code will be ON if a network relay error has occurred. When this happens, two more bytes of data will follow the response code to indicate the location of the error. This information, along with the response code, should enable you to track the error.



Error network address:	00 to 7F (Hex) (0 to 127 in decimal)		
Error node address:	Controller Link:	01 to 20 (Hex) (1 to 32 in decimal)
	Ethernet:	01 to 7E (Hex) (1 to 126 in decimal)
	SYSMAC NET:	01 to 7E (Hex) (1 to 126 in decimal)
	SYSMAC LINK:	01 to 3E (Hex) (1 to 62 in decimal)

Relay Errors

A relay error indicates that the command did not reach the Unit to which it was sent. There are several types of situation in which this can occur. Example 1 (below) shows a situation in which a relay error occurs when data cannot be transferred from one Communications Unit to another in an interconnected network. Example 2 shows a similar situation, except that the destination Unit is something other than a Communications Unit. In Example 3, the relay error occurs because either the specified destination node or the next relay node does not exist.

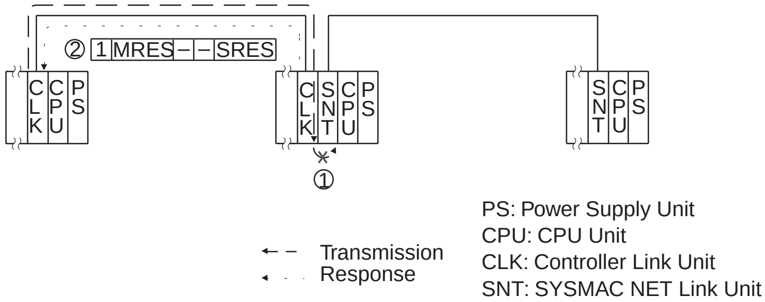
In the three diagrams, the numbers indicate the following:

(1)The transmitted data fails to be received.

(2)The relay error and response code are returned to the command source.

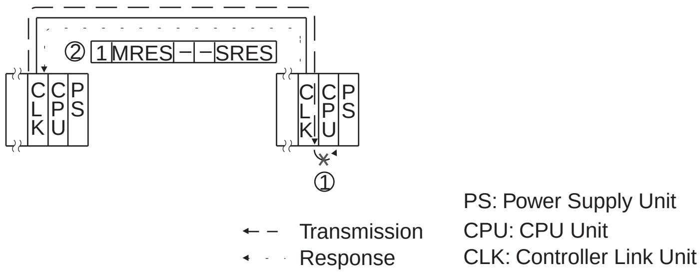
Example 1

In this example, data cannot be transferred between Controller Link Units due to some cause such as a routing table error.



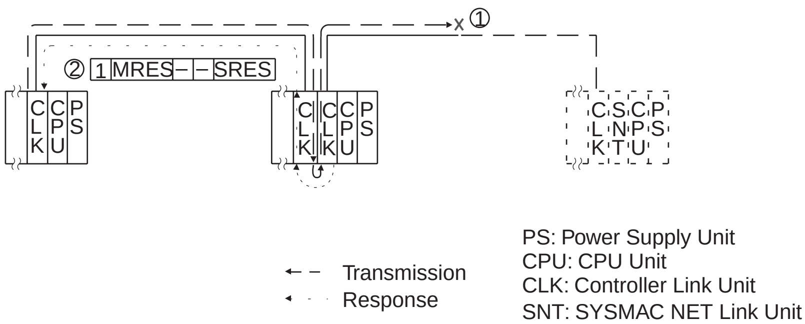
Example 2

In this example, data cannot be transferred between a Controller Link Unit and a CPU Unit.



Example 3

In this example, the specified destination node or the next relay node does not exist.



If an error occurs, check the MRES and SRES codes for the node in question, and correct the problem.

6-7-3 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	Remedy
00: Normal completion	00	---	---
	01	Service was interrupted	Check the contents of the destination transmission area of third node.
			Check the data link status.

Main code	Sub-code	Probable cause	Remedy
01: Local node error	01	Local node not part of Network	Add to Network.
	02	Token time-out, node address too large	Set the local node's node address below the maximum node address.
	03	Number of transmit retries exceeded	Check communications with ECHOBACK TEST. If the test fails, check network.
	04	Maximum number of frames exceeded	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)	Correctly set the Controller Link BIOS /N option. Make sure the node address is within specified range and that there are no node addresses that are set twice.
	06	Node address duplication error	Make sure that there are no node addresses that are set twice.
02: Destination node error	01	Destination node not part of Network	Add to Network.
	02	No node with the specified node address	Check the destination node's node address.
	03	Third node not part of Network	Check the third node's node address.
		Broadcasting was specified.	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	Increase the value for the response watchdog timer interval in the control data.
		Frame lost in transmission	Check the error log and correct the process.
03: Communications controller error	01	Error occurred in the communications controller, ERC indicator is lit	Take corrective action, referring to communications controller errors and remedies table at end of this section.
	02	CPU Unit error occurred in the PLC at the destination node	Clear the error in the CPU Unit (refer to the PLC's operation manuals).
	03	A controller error has prevented a normal response from being returned.	Check network communications status and reset the controller board. If the error still exists, replace the controller board.
	04	Unit address setting error	Make sure the Unit address is within the specified range and that there are no node addresses that are set twice.
04: Not executable	01	An undefined command has been used.	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.	Check the unit model and version.
05: Routing error	01	Destination node address is not set in the routing table.	Set the destination node address in the routing table.
	02	Routing table isn't registered.	Set the source nodes, destination nodes, and relay nodes in the routing table.
	03	Routing table error	Set the routing table correctly.
	04	The maximum number of relay nodes (2) was exceeded in the command.	Redesign the network or reconsider the routing table to reduce the number of relay nodes in the command.

Main code	Sub-code	Probable cause	Remedy
10: Command format error	01	The command is longer than the max. permissible length.	Check the command format of the command and set it correctly.
	02	The command is shorter than min. permissible length.	Check the command format of the command and set it correctly.
	03	The designated number of data items differs from the actual number.	Check the number of items and the data, and make sure that they agree.
	04	An incorrect command format has been used.	Check the command format of the command and set it correctly.
	05	An incorrect header has been used. (The local node's relay table or relay node's local network table is wrong.)	Set the routing table correctly.
11: Parameter error	01	A correct memory area code has not been used or Extended Data Memory is not available.	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.	Set the correct access size for the command.
	03	The first address is in an inaccessible area.	Set a first address that is in an accessible area.
	04	The end of specified word range exceeds the acceptable range.	Check the acceptable limits of the data area and set the word range within the limits.
			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.	Check the program number and be sure that it is set correctly.
	09	The sizes of data items in the command block are wrong.	Check the command data and be sure that the sixes of the data items are correct.
			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.	Either abort the current IOM break function processing, or wait until it is completed and execute the command.
			Check the data link tables for node addresses that have been set twice.
	0B	The response block is longer than the max. permissible length.	Check the command format and set the number of items correctly.
	0C	An incorrect parameter code has been specified.	Check the command data and reenter it correctly.
			Check the data link table file for corruption.

Main code	Sub-code	Probable cause	Remedy
20: Read not possible	02	The data is protected.	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command to the PLC.
		An attempt was made to download a file that is being uploaded.	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.	Set or reset the registered table.
		Too many 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.	Check the program number and be sure that it is set correctly.
	06	A non-existing file has been specified.	Check whether the correct file name was used.
	07	A verification error has occurred.	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 to the PLC.
		An attempt was made to simultaneously download and upload a file.	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 the Unit is set for automatic generation.	Change the data link mode to manual.
	03	The number of files exceeds the maximum permissible.	Write the file(s) again after erasing unneeded files, or use different disk or Memory Card that has free space.
		Too many files open.	Close open files and re-execute the command.
	05	A non-existing program no. has been specified.	Check the program number and be sure that it is set correctly.
	06	A non-existent file has been specified.	Check the file name and execute again.
	07	The specified file already exists.	Change the name of the file and execute the instruction again.
	08	Data cannot be changed.	---

Main code	Sub-code	Probable cause	Remedy
22: Not executable in current mode	01	The mode is wrong (executing).	Check the operating mode.
		Data links are active.	Check the data link status before execution.
	02	The mode is wrong (inactive).	Check the operating mode.
		Data links are active.	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 control node.	Check which node is the control node.
	08	The mode is wrong and the step cannot be executed.	Check whether the step has active status or not.
23: No Unit	01	A file device does not exist where specified.	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 have not been created or are incorrect.	Set the data link tables correctly.
25: Unit error	02	Parity/checksum error occurred because of incorrect data.	Transfer correct data into memory.
	03	I/O setting error (The registered I/O configuration differs from the actual.)	Either change the actual configuration to match the registered one, or generate the I/O table again.
	04	Too many I/O points	Redesign the system to remain within permissible limits.
	05	CPU bus error (An error occurred during data transfer between the CPU Unit and a CPU Bus Unit.)	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.)	Check the system’s settings and eliminate any settings that occur twice.
	07	I/O bus error (An error occurred during data transfer between the CPU Unit and an I/O Unit.)	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.)	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.)	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	0D	Duplication in SYSMAC BUS word allocation.	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.	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 for the PLC. 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	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.	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 executing the PROGRAM AREA PROTECT CLEAR command for the PLC.
		To many commands at destination.	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 links.	Execute the service from a node that is part of the data links.
		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.	Make the necessary settings.
	09	Service cannot be executed because necessary settings haven't been made in the command data.	Check the command format of and make the necessary settings.
	0A	The specified action or transition number has already been registered.	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.	Eliminate the cause of the error and execute the ERROR CLEAR command.
30: Access right error	01	The access right is held by another node. (Either a Programming Device at the other node is executing an SFC online edit, or the other node is executing an ACCESS RIGHT ACQUIRE or ACCESS RIGHT FORCED ACQUIRE command.)	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.)
40: Abort	01	Command was aborted with ABORT command.	---

SECTION 7
Network Interconnections

This section describes the method used to connect multiple networks through CS/CJ-series, CVM1, and CV-series PLCs. The section also describes remote programming and monitoring with Programming Devices.

7-1 What is Network Interconnection?

Network interconnection enables commands and responses for the message service to be sent and received across multiple networks. The four networks listed below can be interconnected to achieve this.

FA Networks

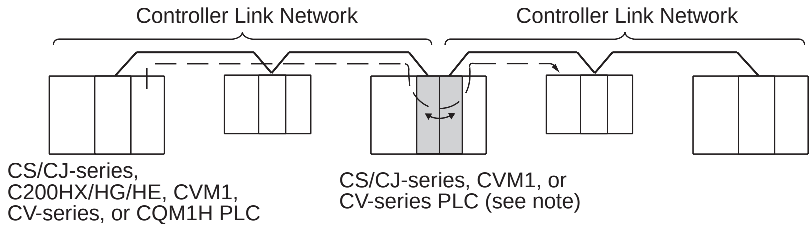
- SYSMAC NET Link Networks
- SYSMAC LINK Networks
- Controller Link Networks

OA Network

- Ethernet Networks

7-1-1 Interconnecting Controller Link Networks

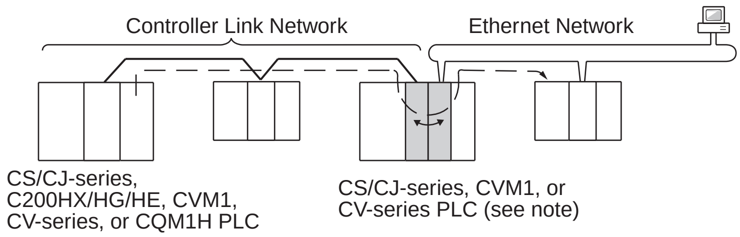
Controller Link Networks can be connected through a CS/CJ-series, CVM1, or CV-series PLC.



Note A data bridge is created between Controller Link Units mounted on the same CS/CJ-series, CVM1, or CV-series PLC.

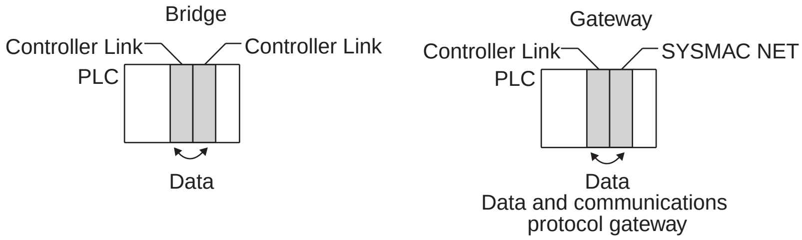
7-1-2 Interconnecting Different Types of Networks

A CS/CJ-series, CVM1, or CV-series PLC can be used to connect a Controller Link Network with an Ethernet, SYSMAC NET, or SYSMAC LINK Network.

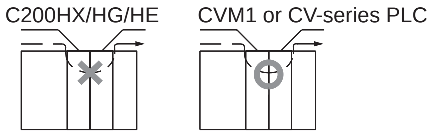


Note A data and communications protocol gateway is created between a Controller Link Unit and an Ethernet, SYSMAC NET, or SYSMAC LINK Unit mounted to the same CS/CJ-series, CVM1, or CV-series PLC.

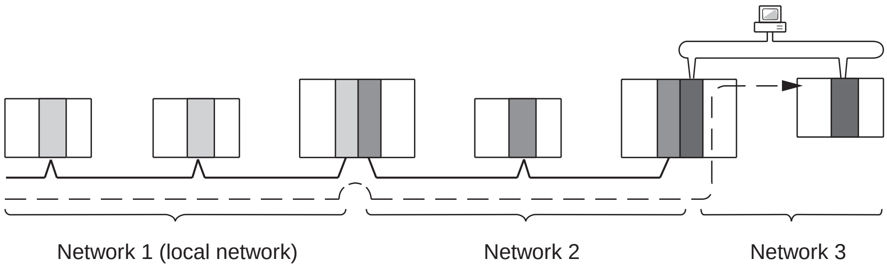
Note
1. A bridge is used between Communications Units to connect the same type of networks.
2. A gateway is used between Communications Units to connect different types of networks.



- Although a C200HX/HG/HE PLC supports multiple (maximum of 2) Communications Units, it cannot function as a data bridge or a data and communications protocol gateway.



- A CQM1H-series PLC supports only one Communications Unit. It cannot function as a data bridge or a data and communications protocol gateway.
- Communications across bridges or gateways can include up to three networks, including the local network (data generating network).



Although 2,012 bytes of data (including the header) can be sent and received with a Controller Link, the maximum amount of data is limited by any network the data passes through, i.e., the network with the smallest capacity will determine the limit.

If, for example, data passes through a SYSMAC LINK network as shown in the figure on the preceding page, the amount of data sent and received from the Controller Link is limited to 552 bytes (including the header) because the SYSMAC LINK Network can only handle that many bytes.

See the manual for the network you are using in order to determine the maximum amount of data for each network.

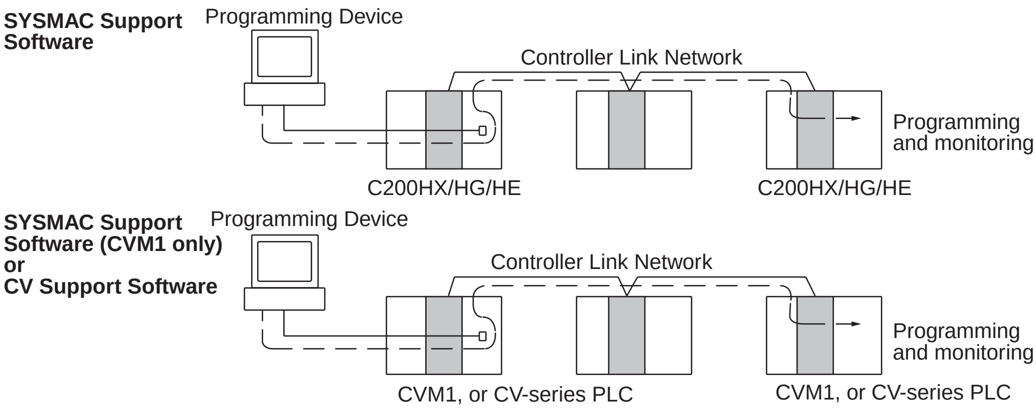
7-2 Remote Programming and Monitoring

A remote PLC can be programmed and monitored across a network from a Programming Device connected to a PLC.

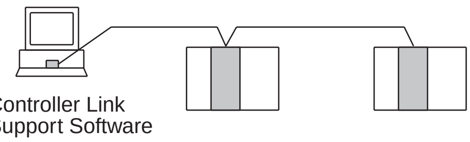
7-2-1 Local Networks

SYSMAC Support Software and CV Support Software

A Programming Device connected to a C200HX/HG/HE, CVM1, or CV-series CPU Unit can program and monitor a C200HX/HG/HE, CVM1, or CV-series PLC on the same network. Programming and monitoring are possible, however, only for the same type of CPU Unit as the one to which the Programming Device is connected. For example, if the Programming Device is connected to a CVM1 or CV-series PLC, you can only program and monitor CVM1 or CV-series PLCs on the network.



Note A factory automation node computer cannot remotely program or monitor. The node can only monitor Controller Link Network status.

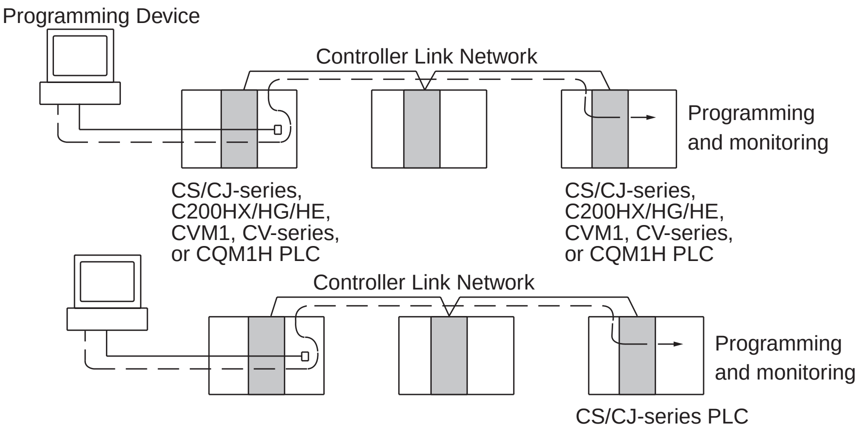


CX-Programmer

A CX-Programmer connected to a CS/CJ-series, C200HX/HG/HE, CVM1, CV-series, or CQM1H CPU Unit can program and monitor a CPU Unit on the same network. Programming and monitoring are possible, including CPU

Units that are different to the one to which the Programming Device is connected.

CX-Programmer



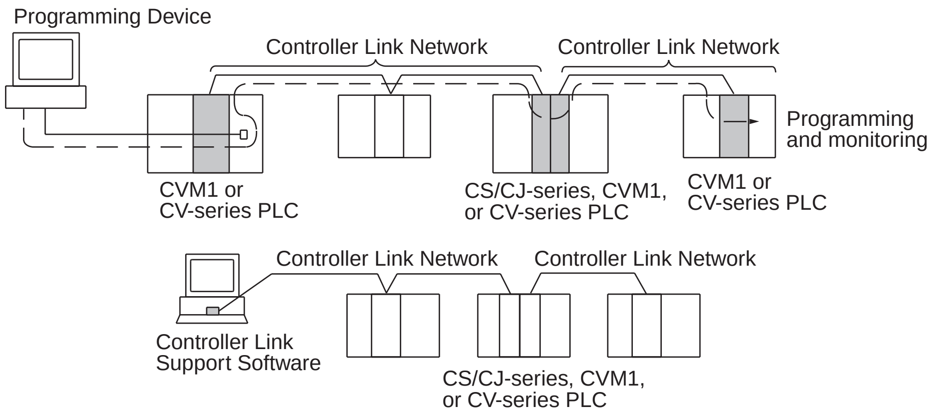
Note Remote programming and monitoring are possible from a factory automation node computer using the CX-Programmer.

7-2-2 Remote Controller Link Networks

SYSMAC Support Software or CV Support Software

A Programming Device connected to a CVM1 or CV-series CPU Unit can program and monitor a CVM1 or CV-series PLC on another Controller Link Network through a CVM1 or CV-series PLC. Other types of PLC cannot be programmed or monitored on remote networks.

SYSMAC Support Software (CVM1 Only) or CV Support Software

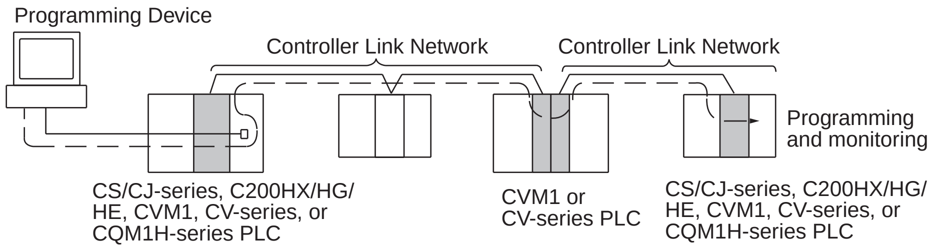


Note Remote programming and monitoring is not possible from computer nodes. Computer nodes can only monitor Controller Link Network status. A Programming Device connected to a C200HX/HG/HE PLC cannot remotely program or monitor a node on a remote network.

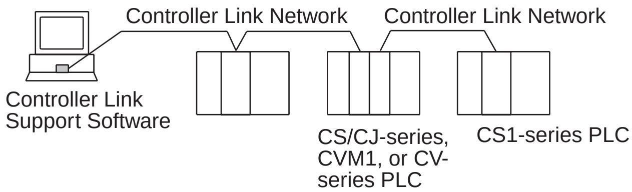
CX-Programmer

A CX-Programmer connected to a CS/CJ-series, C200HX/HG/HE, CVM1, CV-series, or CQM1H-series CPU Unit can program and monitor any other PLC on another Controller Link Network. Other types of PLC, different to the one to which the CX-Programmer is connected can also be programmed or monitored on remote networks.

CX-Programmer



CX-Programmer



Note Remote programming and monitoring is possible from computer nodes.

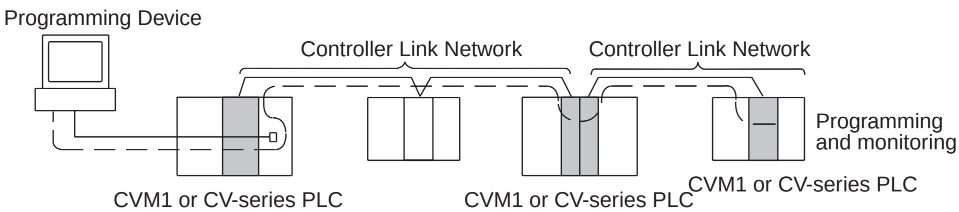
Note
1. Version 1.20 of CX-Programmer must be used for the CQM1H-series Controller Link Unit.
2. Use CX-Programmer version 2.04 or later for a CJ-series Controller Link Unit.

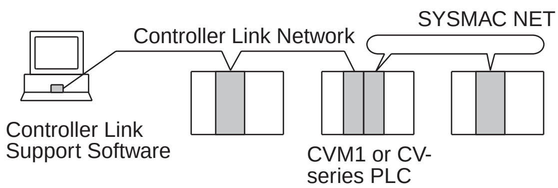
7-2-3 Other Remote Networks

SYSMAC Support Software or CV Support Software

A Programming Device connected to a CVM1 or CV-series CPU Unit can program and monitor a CVM1 or CV-series PLC on a different type of network (SYSMAC NET or SYSMAC LINK) through a CVM1 or CV-series PLC. Other types of PLC cannot be programmed or monitored on remote networks.

SYSMAC Support Software (CVM1 Only) or CV Support Software



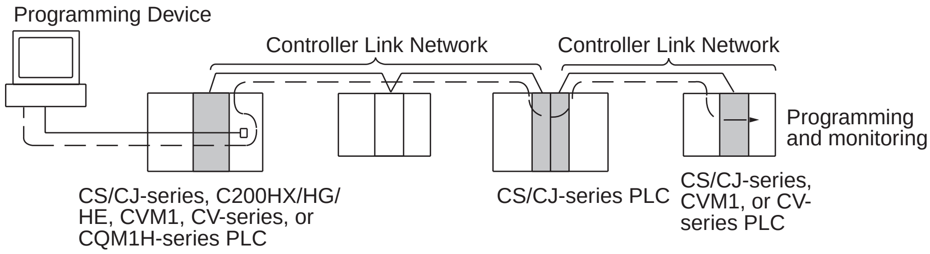


Note Remote programming and monitoring is not possible from computer nodes. Computer nodes can only monitor Controller Link Network status.
A Programming Device connected to a C200HX/HG/HE PLC cannot remotely program or monitor a node on a remote network.

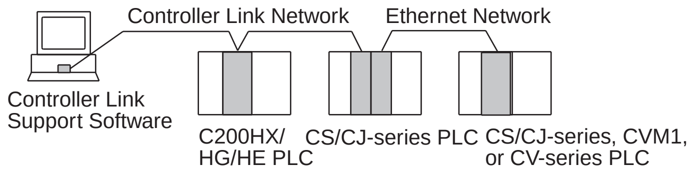
CX-Programmer

A CX-Programmer connected to a CS/CJ-series, C200HX/HG/HE, CVM1, CV-series, or CQM1H-series CPU Unit can program and monitor any other PLC on a different type of network (Ethernet, SYSMAC NET, or SYSMAC LINK) through a CS/CJ-series, CVM1, or CV-series PLC.

CX-Programmer



CX-Programmer



Note Remote programming and monitoring is possible from computer nodes.

Note
1. Version 1.20 of CX-Programmer must be used for the CQM1H-series Controller Link Unit.
2. Use CX-Programmer version 2.04 or later for a CJ-series Controller Link Unit.

7-3 Routing Tables

Routing tables that define the communications path from the Controller Link Unit on the local PLC to the network connected to the destination PLC must be created in order to send and receive data across networks. Each CPU Unit implements the message service or remote programming/monitoring to the appropriate Unit according to the routing tables.

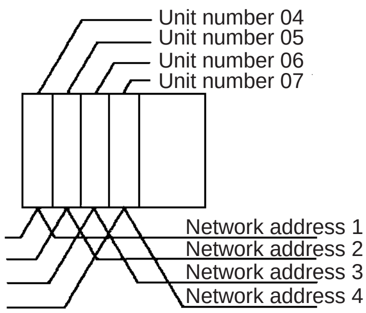
Creating Routing Tables

Routing tables consists of a local network table and a relay network table.

Local Network Table

A local network table provides unit numbers and network addresses corresponding to the Units mounted to the PLC.

Example



Local network table

Local network address	Unit number
1	04
2	05
3	06
4	07

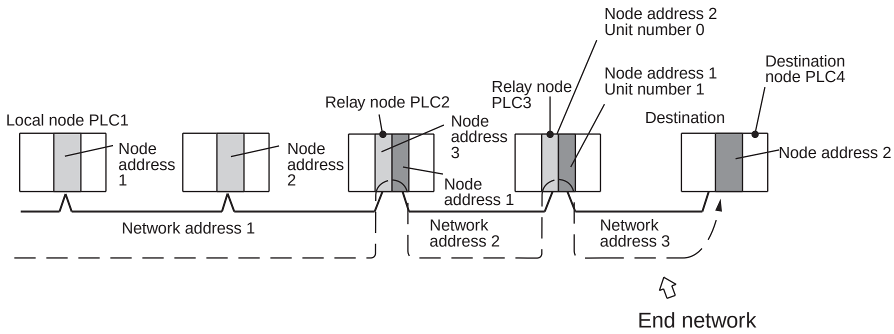
Note
1. The unit number is set between 0 and 15 using the rotary switch on the front panel of Controller Link Units for CS/CJ-series, CVM1, and CV-series PLCs, and is the same as the operating level for C200HX/HG/HE PLCs. Set operating level 0 for CQM1H-series Control Link Units.
2. The network address is the address of the network connected to the Unit (between 1 and 127). The address is set when the local network table is created.

Relay Network Table

A relay network table provides the node and network addresses corresponding to the initial relay point (first point the data must go to) en route to a target network (end network) not directly connected to the local PLC.

The table traces the route from the relay point to the end network.

The example below shows the routing tables for the route from local node PLC1 (network address 1, node address 1) to PLC4 (network address 3, node address 2).



PLC1 relay network table

End network	Relay network	Relay node
2	1	3
3	1	3

Data first goes to node address 3 at network address 1 to reach network address 3.

PLC2 relay network table

End network	Relay network	Relay node
3	2	2

Data then goes to node address 2 at network address 2 to reach network address 3.

PLC3 local network table

Local network address	Unit number
2	0
3	1

We know from the local network table that the data goes through local unit number 1 to reach network address 3.

Data goes to node address 2 at network address 3, i.e., the local network.

7-4 Setting Routing Tables

This section describes routing table settings.

Routing tables are set through the CX-Net (in CX-Programmer), SYSMAC LINK, or Controller Link Support Software. This section describes setting procedures and setting details.

See the operating manual of the Programming Device you are using for the specific setting procedure.

Note

1. Routing tables cannot be set through Programming Consoles.
2. Networks cannot be crossed by a Programming Device without setting routing tables. Routing tables can therefore be set only for nodes connected to the Programming Device and other nodes in the same network. Disconnect and reconnect the Programming Device to each network when setting routing tables in multiple networks.
3. Make sure that the routing tables are properly set at all nodes on the network. If a message is sent to a node without correct routing tables, transmission will not work properly and a response may not be returned.
4. When using a CVM1 or CV-series CPU Unit manufactured prior to April 1996, be sure to register routing tables whether or not the PLC is connecting multiple networks. The date of production can be checked on the lot number as explained below. (The lot number is a four-digit number written on the side panel of the CPU Unit.)

Note Routing tables are required if any of the CVM1 or CV-series CPU Units in the network have been manufactured on or before April 1996.

Lot No.: □ □ 4 6 ..... Manufactured in April 1996

Indicates the last digit of the manufacturing year. In this example, the year is 1996.

Indicates the month of manufacture. October, November, and December are indicated by x, y, and z respectively. In this example, the month is April.

5. Routing tables are handled differently with C200HX/HG/HE PLCs depending on whether they are used in a Controller Link or SYSMAC NET Network. Be sure to register both Controller Link and SYSMAC NET routing tables when SYSMAC NET Link Units are installed at the same time. See the *SYSMAC NET Link Unit Operation Manual (W114)* for further details.

7-4-1 Routing Table Setting Procedure

The procedure for setting routing tables is described below.

1,2,3...
1. Edit the local network table.
2. Edit the relay network table.
3. Save the routing tables.

Repeat the editing and saving steps for all nodes set with the routing tables.

4. Connect the Programming Device to a PLC.
5. Turn ON the Routing Table Enable Bit for C200HX/HG/HE and CQM1H-series PLCs only.
6. Transfer the routing tables.

7-4-2 Editing Local Network Tables

Use the routing table editing function on the Programming Device to edit the local network table as shown on the screen given below.

[Local Network table]

No.	Loc Netwk	SIOU unit #	No.	Loc Netwk	SIOU unit #
1			9		
2			10		
3			11		
4			12		
5			13		
6			14		
7			15		
8			16		

Local network:
Address 1 through 127 for the network connected to the Communications Unit

SIOU Unit No.:
Unit number of the Communications Unit (operating level for C200HX/HG/HE PLCs; always 0 for CQM1H-series Units). (CS/CJ-series, CVM1, or CV-series: 0 to 15, C200HX/HG/HE: 0,1, CQM1H-series: 0) Set the unit number of all Communications Units (SYSMAC NET Link Units, SYSMAC Link Units and Controller Link Units) as well as the address of network connected to it.

Be sure to set the same address for each network when setting routing tables (local and relay network tables) in multiple PLCs.

7-4-3 Editing Relay Network Tables

Use the routing table editing function on the Programming Device to edit the local network table as shown on the screen given below.

[Relay Network table]

No.	End Netwk	Relay PC ID	Relay Netwk	Relay node	No.	End Netwk	Relay PC ID	Relay Netwk	Relay node
1					11				
2					12				
3					13				
4					14				
5					15				
6					16				
7					17				
8					18				
9					19				
10					20				

End network:
Network address of the end network (1 through 127)

Relay network:
Network address of the first relay point on the way to the end network (1 through 127)

Relay node:
Node address of the first relay point on the way to the end network
(SYSMAC NET: 1 through 126, SYSMAC LINK: 1 through 62, and Controller Link: 1 through 32, Ethernet: 1 through 127)

Set all networks not directly connected to the PLC.

Be sure to set the same address for each network when setting routing tables (local and relay network tables) in multiple PLCs.

Note
1. Do not set the same end network more than once with the C200HX/HG/HE or CQM1H-series PLCs. Routing may fail.
2. The PC ID is any unique name given to a specific node.
   When setting the PC ID, simply input the ID. Network and node addresses will be input for you automatically. See the operation manual for SYSMAC, CV, or Controller Link Support Software for further details.

7-4-4 Saving Routing Tables

After editing local and relay network tables on the Programming Device, save the tables.

Note When setting routing tables in multiple PLCs, edit and save all routing tables and then transfer them together to work more efficiently.

7-4-5 Connecting to the PLC

Connect the Programming Device to a PLC in the network to transfer the routing tables. All PLCs receiving the routing table settings must have power turned ON for the transfer.

Note The Programming Device must be disconnected and then reconnected to a PLC on each network.

7-4-6 Routing Table Enable Bit (C200HX/HG/HE and CQM1H-series Only)

Routing tables are written to DM 6450 through DM 6499 with C200HX/HG/HE and CQM1H-series PLCs. Do not write any other data in these words when using routing tables.

Make sure that bit 12 of the DM word shown below is set at 1 (ON) to allow you to set and use routing tables.

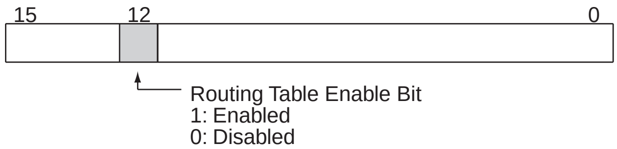
C200HX/HG/HE

Operating level 0: DM 6400

Operating level 1: DM 6420

CQM1H

DM 6400



DM 6450 through DM 6499 can be used as desired if the Routing Table Enable Bit is set at 0 to disabled routing tables.

7-4-7 Transferring Routing Tables

Routing tables saved on a Programming Device can be read from memory and transferred to the PLCs on the network. First load and transfer routing tables to the PLC connected to the Programming Device. This enables networks to be distinguished even when multiple Communications Units are connected, and it enables routing tables to be transferred to other nodes on the network.

Once routing tables are transferred to the PLC connected to the Programming Device as well as all nodes on the same network, disconnect the Programming Device, reconnect it to a PLC on another network, and repeat the procedure.

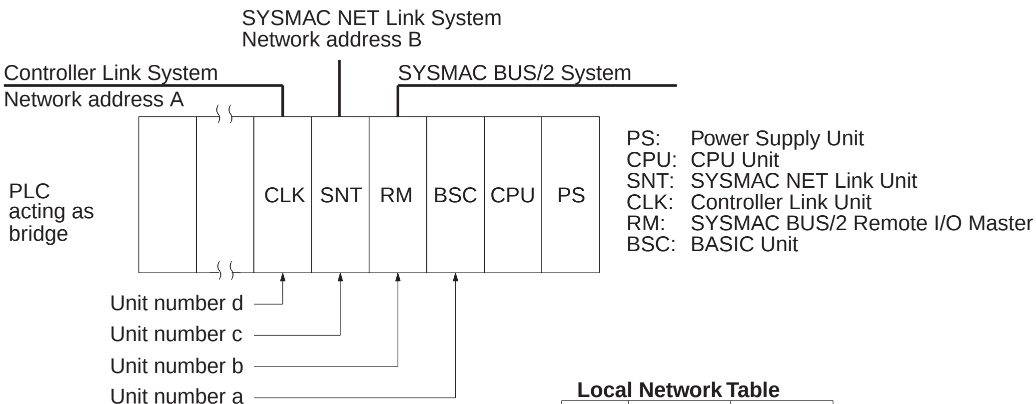
⚠ **Caution** CPU Bus Units are reset when routing tables are transferred from a Programming Device to a PLC to allow set routing tables to be read. Make sure that resetting CPU Bus Units will not cause equipment damage or dangerous system behavior before transferring tables.

7-4-8 Example Routing Table Settings

This section shows examples of routing table settings.

Example 1

The example below shows local network table settings when multiple CPU Bus Units are mounted in a single CVM1 or CV-series PLC.



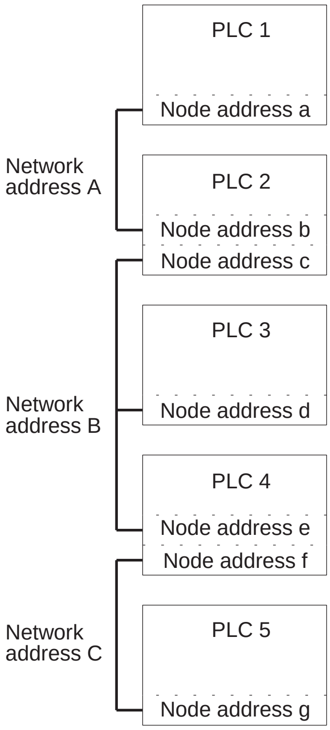
Local Network Table

No.	Loc Netwk	SIOU unit #
1	A	(d)
2	B	(c)

Do not register SYSMAC BUS/2 Master Units and BASIC Units in local network tables because these Units do not connect to networks.

Example 2

The following example show the settings for a relay network table connecting three networks.



Relay Network Tables

No.	End Netwk	PC ID	Relay Netwk	Node
1	B		A	b
2	C		A	b

No.	End Netwk	PC ID	Relay Netwk	Node
1	C		B	e

No.	End Netwk	PC ID	Relay Netwk	Node
1	A		B	c
2	C		B	e

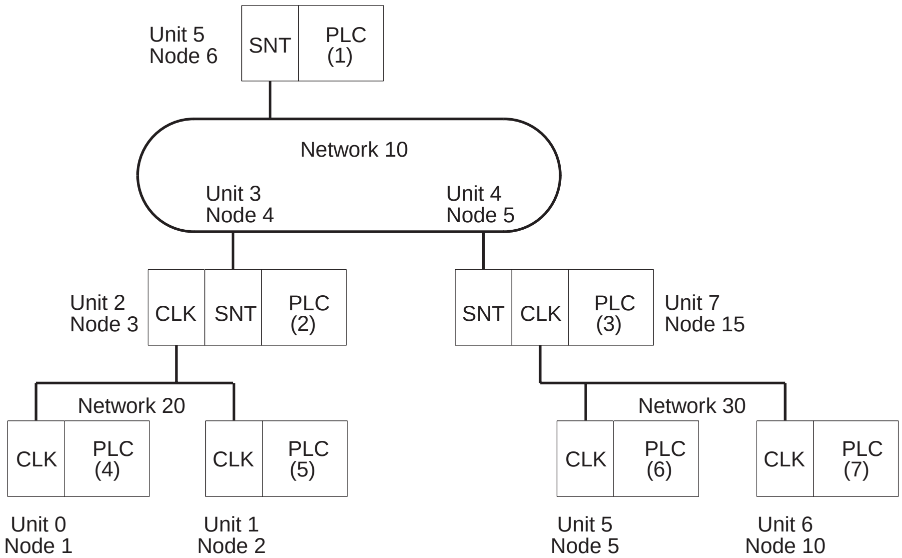
No.	End Netwk	PC ID	Relay Netwk	Node
1	A		B	c

No.	End Netwk	PC ID	Relay Netwk	Node
1	A		C	f
2	B		C	f

On closer examination of the relay network table for PLC#, we see that the relay network is B and the relay node is c when network A is the destination, and that the relay network is B and the relay node is e when network C is the destination.

Example 3

The network structure example in the figure below shows routing tables for all nodes.



Routing Tables on PLC 1

Local Network Table

No.	Loc Netwk	SIOU unit#
1	010	05
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	020		010	004
2	030		010	005
3				

Routing Tables on PLC 2

Local Network Table

No.	Loc Netwk	SIOU unit#
1	010	03
2	020	02
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	030		010	005
2				
3				

Routing Tables on PLC 3

Local Network Table

No.	Loc Netwk	SIOU unit#
1	010	04
2	030	07
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	020		010	004
2				
3				

Routing Tables on PLC 4

Local Network Table

No.	Loc Netwk	SIOU unit#
1	020	00
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	010		020	003
2	030		020	003
3				

Routing Tables on PLC 5

Local Network Table

No.	Loc Netwk	SIOU unit#
1	020	01
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	010		020	003
2	030		020	003
3				

Routing Tables on PLC 6

Local Network Table

No.	Loc Netwk	SIOU unit#
1	030	05
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	010		030	015
2	020		030	015
3				

Routing Tables on PLC 7

Local Network Table

No.	Loc Netwk	SIOU unit#
1	030	06
2		
3		

Relay Network Table

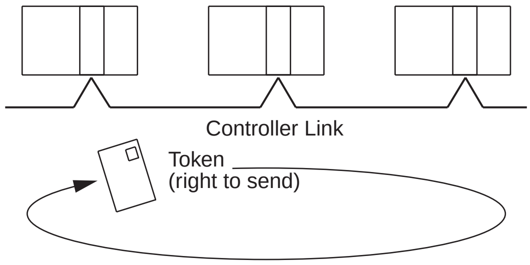
No.	End Netwk	PC ID	Relay Netwk	Node
1	010		030	015
2	020		030	015
3				

SECTION 8
Communications Timing

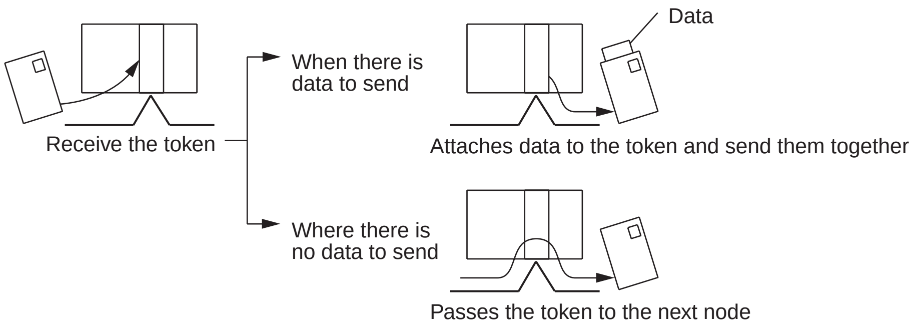
This section explains details on Controller Link Network communications. Refer to this section for network communications that require accurate communications timing.

8-1 Communications Mechanism

8-1-1 Data Transmissions over the Network



In a Controller Link Network, token passing is used to control network access. The right to send, called a "token," circulates around the network. A node that receives the token is allowed to send data. If the node has data to send, it will attach the data to the token and send them together. If the node has no data to send, it will pass the token to the next node.



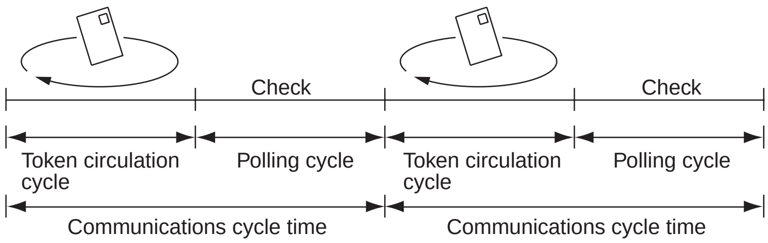
A token can be thought of as a circulating envelope. This envelope is circulated through the network and the person who receives the envelope will put a destination and a memo into the envelope to send his or her message to somebody else. This method is called "token passing." The Controller Link Network is a bus network that uses token passing.

The overall network communications procedure is explained below.

1,2,3...

1. The Unit at the node that manages the network, called the "polling node," transfers the token. The token is circulated through the network in ascending order of node addresses. One cycle in which the token is circulated among all nodes on the network is called a "token circulation cycle."
2. After one token circulation cycle is complete, the polling node checks the network connection status. One cycle in which the connection status of all nodes on the network is checked is called a "polling cycle."
3. After one polling cycle is complete, the polling node transfers the token again.

The procedure is then repeated. In a Controller Link Network, the total time required for a token circulation cycle and a polling cycle is called the "communications cycle time." Communications processing is executed by repeating the communications cycle.



Polling Node

Each Controller Link Network always has a Unit that controls communications within the network. This Unit is called the "polling node." Normally, the node that has the smallest node address in the network is the polling node (see note). All Units at nodes other than the polling node are called "polled nodes" (or polled units). The polling node controls the token, checks the network, and performs other relevant tasks. Should the polling node break down, the node with the next smallest node address is automatically selected as the polling node to prevent the entire network from shutting down.

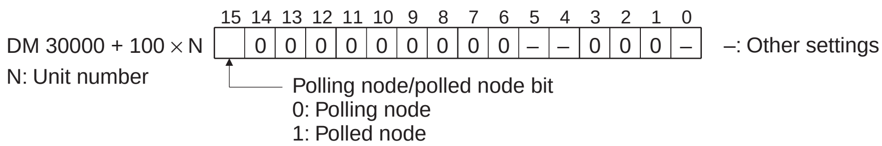
Note The node with the smallest node address is not always the polling node, depending on the Unit start-up sequence, models, settings, and Unit status.

When the polling node breaks down, the next polling node is temporarily disconnected from the network, reconstructs the network, and then reconnects to the network. Polling nodes remain connected to the network.

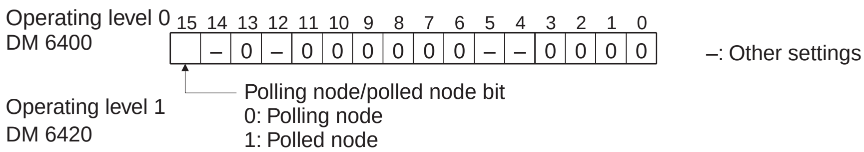
8-1-2 Setting the Polling and Polled Nodes

Use the Programming Device for the PLC to set Units as polling node or polled node in the DM parameter area.

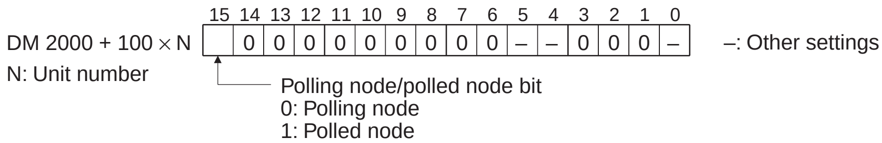
CS/CJ-series Controller Link Units



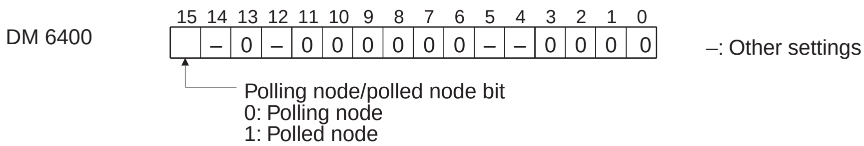
C200HX/HG/HE Controller Link Units



CVM1 and CV-series Controller Link Units



CQM1H-series Controller Link Units



If the node is always to be connected as a polled node when the power is turned on, set it as a polled node. If the node can become a polling node when the power is turned on, set it as a polling node. One of the nodes set as a polling node will serve as the actual polling node. Except for maintenance after Unit replacement (see *9-5 Handling Precautions*), set the Units all nodes as polling nodes (set the polling node/polled node bit to “0”).

8-1-3 Network Parameters

Network parameters are also used to control network operations. Network parameters are read from the polling node and distributed to all other nodes when the Controller Link Network is started. In this way, all nodes on the network always have the same network parameter settings. If nodes are connected to the network halfway during network operation, the network parameter settings will also be distributed to these nodes when they are connected. The following three network parameters can be specified.

Maximum Node Address

This parameter specifies the maximum node address of nodes to be checked by the polling node. The default is 32. Reducing the setting of this parameter reduces the number of nodes checked by the polling node and can thus avoids unnecessary check operations. However, if the network contains nodes with node addresses greater than the setting of the parameter, these nodes will not be connected to the network.

No. of Polled Nodes per Communications Cycle

This parameter specifies the number of nodes to be checked (polled) by the polling node during each polling cycle. The default is 4. Setting this parameter to a high value increases the communications cycle time, but reduces the time required to recognize that nodes have been removed from or added to the network. Reducing the setting of this parameter shortens the communications cycle time but delays a network response when a node is disconnected from or connected to the network.

No. of Event-frames per Communications Cycle

This parameter specifies the maximum number of event frames (communications other than data links, such as message service transmissions) that can be transferred during a communications cycle. Specify a value in units of 128 bytes. The default is 35 (128×35 = 4,480 bytes).

Increasing the setting of this parameter increases the communications cycle time but allows for more event communications such as the message service. Too small a parameter value restricts event communications, resulting in an error. See *8-2 Communications Cycle Time* (on page 197) for the effects of network parameters on communication cycle times.

8-1-4 Specifying Network Parameters

The network parameters can be specified from the Controller Link Support Software. This section describes only the allowable setting range for each network parameter. Refer to the *Controller Link Support Software Operation Manual (W308)* for setting procedures.

The following table shows the setting range and default for network parameters.

Network parameter	Setting range	Default value
Maximum node address	2 to 32	32
Number of polled nodes per communications cycle	1 to 31	4
Maximum no. of event-frames per communications cycle	6 to 238	35

The network parameters become valid immediately after being set.

Note
1. Always stop the data link before changing network parameters.
2. Specify a value for the maximum node address that is equal to or greater than the maximum node address in the Controller Link Network.
3. For the CVM1 and CV-series PLCs, always set the System Protect Key Switch on the CPU Unit to NORMAL. Otherwise, the network parameter settings will not be stored normally.

8-2 Communications Cycle Time

This section describes how to calculate the communications cycle time.

8-2-1 Active Data Links

The following equations are used to calculate the communications cycle time when data links are operating.

Wired Systems

Baud rate	Equation
2 Mbps	$10 \times A + 600 \times B + 290 \times C + 320 \times D + 4 \times E + 3,290$ (µs)
1 Mbps	$18 \times A + 1,150 \times B + 370 \times C + 360 \times D + 8 \times E + 3,770$ (µs)
500 Kbps	$34 \times A + 2,260 \times B + 530 \times C + 440 \times D + 16 \times E + 4,730$ (µs)

Note A: Total number of data link words within the network (total number of words in send areas of all nodes)
B: Number of polled nodes per comm cycle (value specified in the network parameters)
C: Number of nodes connected to the network
D: Number of nodes that send messages during the communications cycle
E: Total number of bytes in messages transmitted during the communications cycle

The number of bytes in each message differs according to the instruction being issued.

Instruction	When sent	When received
SEND	Number of words to be sent × 2 + 18	14
RECV	18	Number of words to be received × 2 + 14
CMND	Number of bytes in command data + 10	Number of bytes in response data

Calculation Example

Communications conditions are as follows:

Transmission medium:	Twisted-pair cable
Baud rate:	2 Mbps
Network parameters:	Defaults
Max node address:	32
Polled nodes per comm cycle:	4
Event-frames per comm cycle:	35
Network configuration:	8 nodes
Total number of data link words:	8,000 words
Nodes that send messages:	2 nodes
Bytes in all messages sent:	2,012 × 2 bytes

In this example, A to E in the equation have the following values.

A: 8,000
B: 4
C: 8
D: 2
E: 4,024

The communications cycle time is thus as follows:

$10 \times 8{,}000 + 600 \times 4 + 290 \times 8 + 320 \times 2 + 4 \times 4{,}024 + 3{,}290 = 104{,}746\ (\mu s)$
$\cong 105$ (ms)

8-2-2 Inactive Data Links

The following equations are used to calculate a communications cycle time when the data link is inactive.

Wired Systems

Baud rate	Equation
2 Mbps	$600 \times B + 110 \times C + 320 \times D + 4 \times E + 2{,}290\ (\mu s)$
1 Mbps	$1{,}150 \times B + 150 \times C + 360 \times D + 8 \times E + 2{,}690\ (\mu s)$
500 Kbps	$2{,}260 \times B + 230 \times C + 440 \times D + 16 \times E + 3{,}490\ (\mu s)$

Note B: Number of polled nodes per communications cycle (value specified in the network parameter)
C: Number of nodes connected to network
D: Number of nodes that send messages during the communications cycle
E: Total number of bytes in messages transmitted during the communications cycle

The number of bytes in each message differs according to the instruction being issued.

Instruction	When sent	When received
SEND	Number of words to be sent × 2 + 18	14
RECV	18	Number of words to be received × 2 + 14
CMND	Number of bytes in command data + 10	Number of bytes in response data

Calculation Example

Communications conditions are as follows:

Transmission medium:	Twisted-pair cables
Baud rate:	2 Mbps
Network parameters:	Defaults
Max node address:	32
Polled nodes per comm cycle:	4
Event-frames per comm cycle:	35
Network configuration:	8 nodes
Nodes that send messages:	2 nodes
Bytes in all messages sent:	2,012 × 2 bytes

In this example, B to E in the equation have the following values.

B: 4
C: 8
D: 2
E: 4,024

The communications cycle time is thus as follows:

$600 \times 4 + 110 \times 8 + 320 \times 2 + 4 \times 4{,}024 + 2{,}290 = 22{,}306$ (μs)
$\cong 22$ (ms)

8-3 Data Link I/O Response Time

When accurate communications timing is required, you need to understand data exchange timing and the time required for data transmission and reception via data links. Use the information described in this section as reference information for system construction.

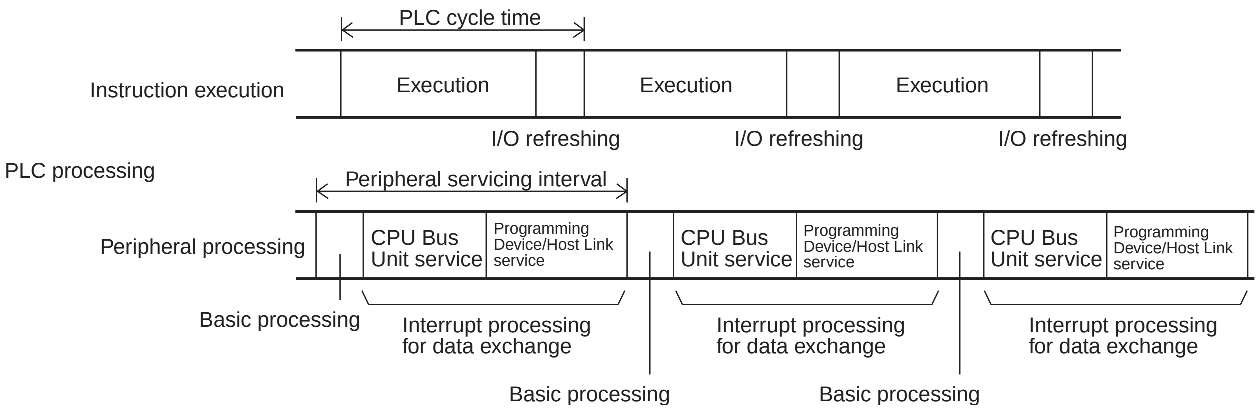
8-3-1 Data Exchange Timing

This section describes data exchange timing for data links between the Controller Link Unit and the PLC's CPU Unit. Data exchange is executed as interrupt processing during CPU Bus Unit or Programming Device/Host Link servicing performed by the CPU Unit. This interrupt processing is executed each time data exchange between the local node and each node connected via a data link is completed.

Data exchange timing differs depending on the CPU Unit model and the CPU Unit the Execute Process (asynchronous or synchronous) specified in PLC Setup, as described below.

CVM1 and CV-series PLCs Under Asynchronous Operation

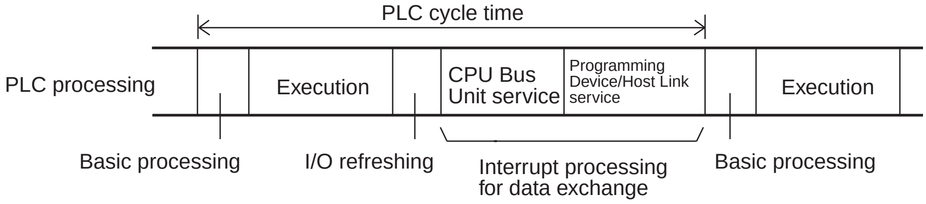
When a CVM1 or CV-series CPU Unit is operating in asynchronous mode, data exchange with the Controller Link Unit is executed as interrupt processing during peripheral processing, regardless of the cycle time of PLC instruction execution. Data exchange timing is as follows:



More than one data exchange can be executed during a PLC cycle, depending on the data exchange timing. If interrupt processing for data exchange is executed, the peripheral servicing interval will be lengthened by the time required for the interrupt processing (see *8-3-2 Data Processing Time* on page 200).

CS/CJ-series PLCs, CVM1 and CV-series PLCs in Synchronous Mode, CQM1H-series PLCs, and C200HX/HG/HE PLCs

When a CS/CJ-series, CQM1H-series, CVM1, or CV-series PLC is operating in synchronous mode, a CQM1H-series, or a C200HX/HG/HE PLC is operating, data exchange with the Controller Link Unit is executed as interrupt processing during peripheral processing for the PLC cycle. Data exchange timing is as follows:



If interrupt processing for data exchange is executed, the PLC cycle time will be lengthened by the time required for the interrupt processing (see *8-3-2 Data Processing Time* below).

8-3-2 Data Processing Time

The time required for interrupt processing for data exchange (data processing time) can be roughly estimated as shown in the following table.

Data link scale	Equation for estimating data processing time
Data link is established for both areas 1 and 2	0.001 × Total number of data link words + 1.7 (ms)
Data link is established for only area 1 or area 2	0.001 × Total number of data link words + 1.4 (ms)

The number of words processed in a single data exchange is shown in the following table for each series of PLC. If the number of data link words exceeds the value shown in the table, data exchange will be executed as several separate processes.

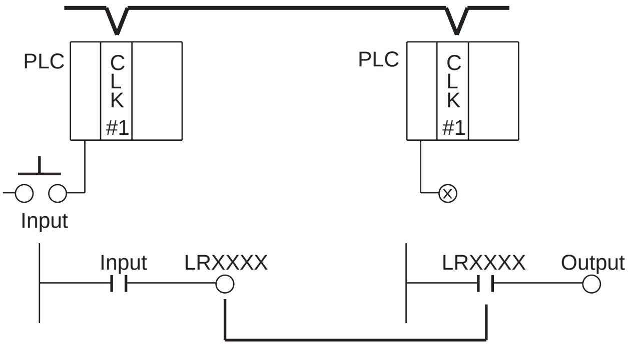
PLCs	Words per data exchange
CS/CJ-series PLCs	Approx. 7,800 words
CVM1 and CV-series PLCs	Approx. 3,700 words
C200HX/HG/HE PLCs	Approx. 4,000 words
CQM1H-series PLCs	Approx. 1,200 words

Note

1. Use the above equations only if only one Controller Link Unit is mounted on the PLC. If other CPU Bus Units are mounted on the PLC, obtain the refresh times for each CPU Bus Unit and add to the above equations.
2. The execution of some items takes precedence over data link area refreshing. For example, data link area refreshing will not take place during execution of the SEND(192), RECV(193), or FAL(006) instruction.

8-3-3 Calculation Example

The data links of the Controller Link Unit require a slight time delay from the time the data link area of one node is changed until this change is reflected in the data link area at another node. This time delay is called the data link I/O response time. The following is a calculation example of the maximum and minimum I/O response times for the system configuration shown below.



CLK: Controller Link Unit

System configuration

Baud rate:	2 Mbps
Maximum node address:	32
Number of polled nodes per comm cycle:	4
Number of event-frames per comm cycle:	35
Nodes in network:	8 nodes
Nodes in data links:	8 nodes
Words sent in area 1:	8 words per node
Words in area 2:	16 words per node

No messages communications are performed.

A single Controller Link Unit is mounted to each CPU Rack.

The data link I/O response time depends on the communications cycle time, input ON delay, output ON delay, and the cycle times of the PLCs involved. The values are detailed below.

Communications Cycles Time

Communications cycle time =
$10 \times (8 + 16) \times 8 + 600 \times 4 + 290 \times 8 + 320 \times 0 + 4 \times 0 + 3{,}290$
$= 9{,}930\ \mu s \cong 9.9$ ms

Input ON Delay

The input ON delay is the time it takes for an input device to turn ON an input to the PLC after receiving an input signal. In this system the input ON delay is 1.5 ms.

Output ON Delay

The output ON delay is the time it takes for an output device to turn ON an output signal after receiving an output from the PLC. In this system the output ON delay is 15 ms.

Cycle Times

The cycle time of the PLC at node #1 is 15 ms or 8 ms.

The cycle time of the PLC at node #7 is 20 ms or 8 ms.

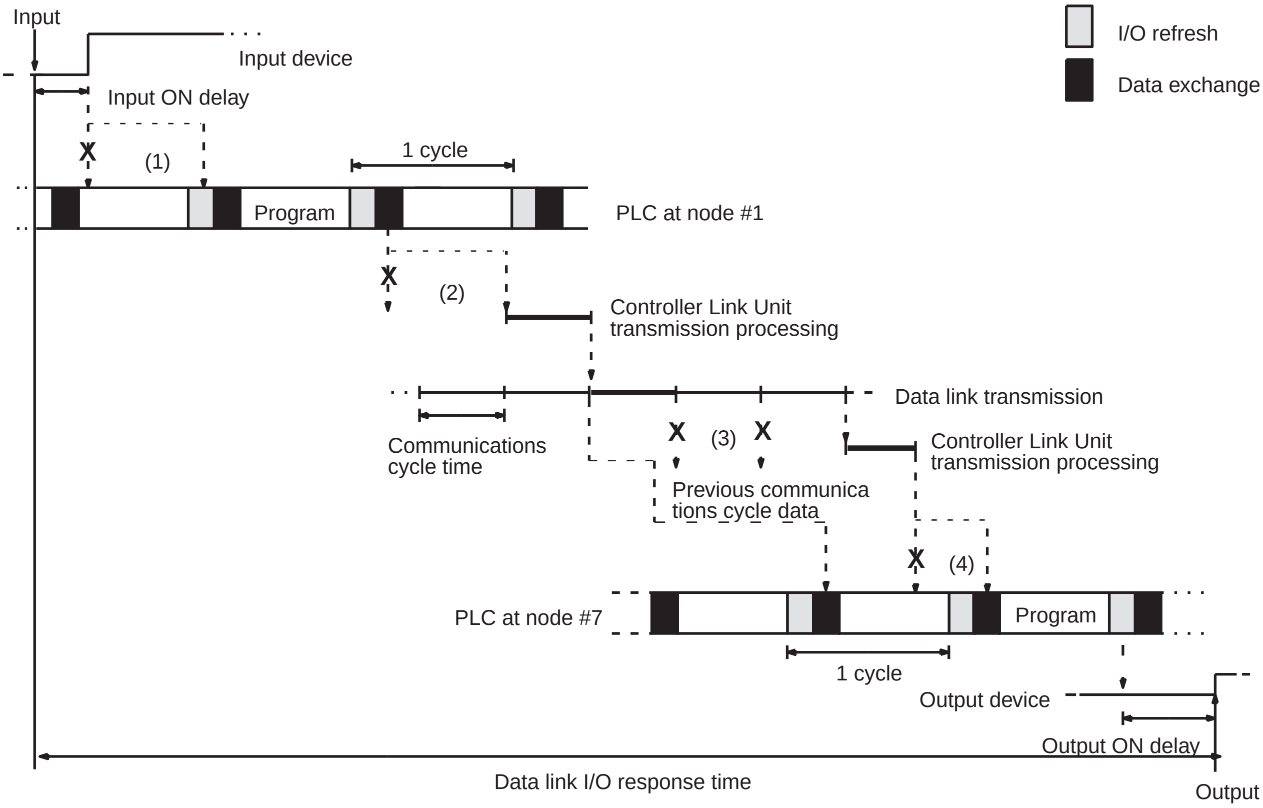
CVM1, CV-series, CS/CJ-series PLCs Under Synchronous Operation or C200HX/HG/HE and CQM1H-series PLCs

Maximum I/O Response Time

The maximum data link I/O response time is calculated for four cases.

Case 1

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PLC at nodes #1 and 7 are greater than the communications cycle time.



There are four points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1,2,3...

1. The input arrives in the PLC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PLC.
2. Data exchange occurs just after the PLC at node #1 passes the token that makes it the polling node, causing a delay of up to one communications cycle time before the data is transferred in data link processing.
3. At node #7, data from the previous data exchange is still being transferred, causing a delay of up to one cycle before the input is read into the PLC.
4. The data transferred in data link processing arrives at the PLC at node #7 after data exchange, so the data will not be read into the PLC until the next data exchange, causing a delay of up to one cycle.

   The maximum number of words that can be exchanged in a single data exchange is approx. 7,800 words for CS/CJ-series PLCs, approx. 3,700 words for CVM1 and CV-series PLCs, approx. 4,000 for C200HX/HG/HE PLCs, and approx. 1,200 words for CQM1H-series PLCs.

The equation for maximum data link I/O response time is as follows:

Input ON delay	1.5 ms
Cycle time of PLC at node #1 × 2	15 ms × 2
Communications cycle time × 3	9.9 ms × 3
PLC cycle time at node #7 × 3 (see note)	20 ms × 3 (see note)
Output ON delay	15 ms
Total (data link I/O response time)	136.2 ms

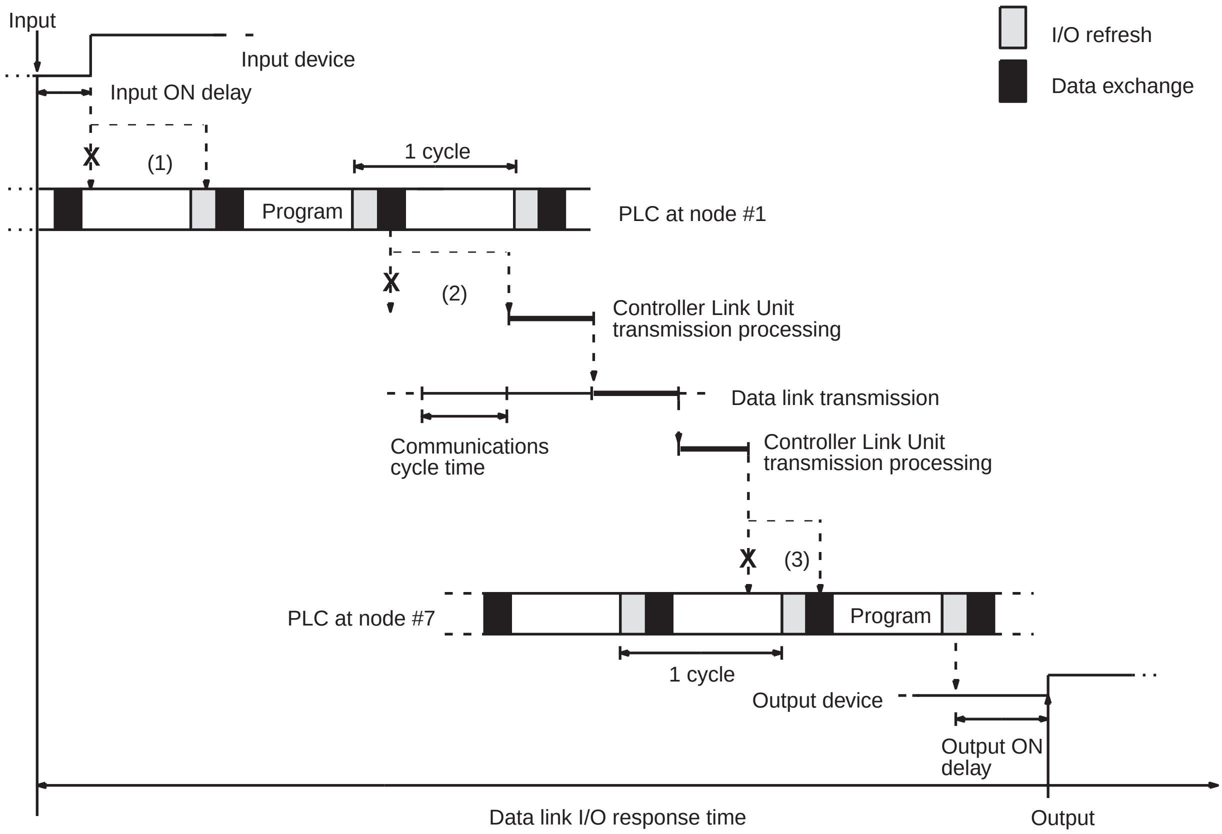
Note If the total number of data link words is greater than the maximum number of words that can be exchanged per data exchange, the maximum data link I/O response time will be cycle time of PLC at node #7 × 4.
In case of the CQM1H, however, the cycle time will be incremented by the value obtained from dividing the total number of data link words by the maximum number of words (1,200 words) per time.
For example, if the total number of data link words is 5,000, the result will be as shown below.

5,000/1,200 = 2.5 (approx. 3)
Cycle time of PLC at node #7 × (3+3)

Noise may increase I/O delays.

Case 2

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PLC at node #1 ≥ the communications cycle time and the cycle time of the PLC at node #7 < the communications cycle time.



There are three points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1,2,3...
1. The input arrives in the PLC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PLC.
2. Data exchange occurs just after the PLC at node #1 passes the token that makes it the polling node, causing a delay of up to one communications cycle time before the data is transferred in data link processing.
3. The data transferred in data link processing arrives at the PLC at node #7 after data exchange, so the data will not be read into the PLC until the next data exchange, causing a delay of up to one cycle.

   The maximum number of words that can be exchanged in a single data exchange is approx. 7,800 words for CS/CJ-series PLCs, approx. 3,700 words for CVM1 and CV-series PLCs, approx. 4,000 for C200HX/HG/HE PLCs, and approx. 1,200 words for CQM1H-series PLCs.

The equation for maximum data link I/O response time is as follows:

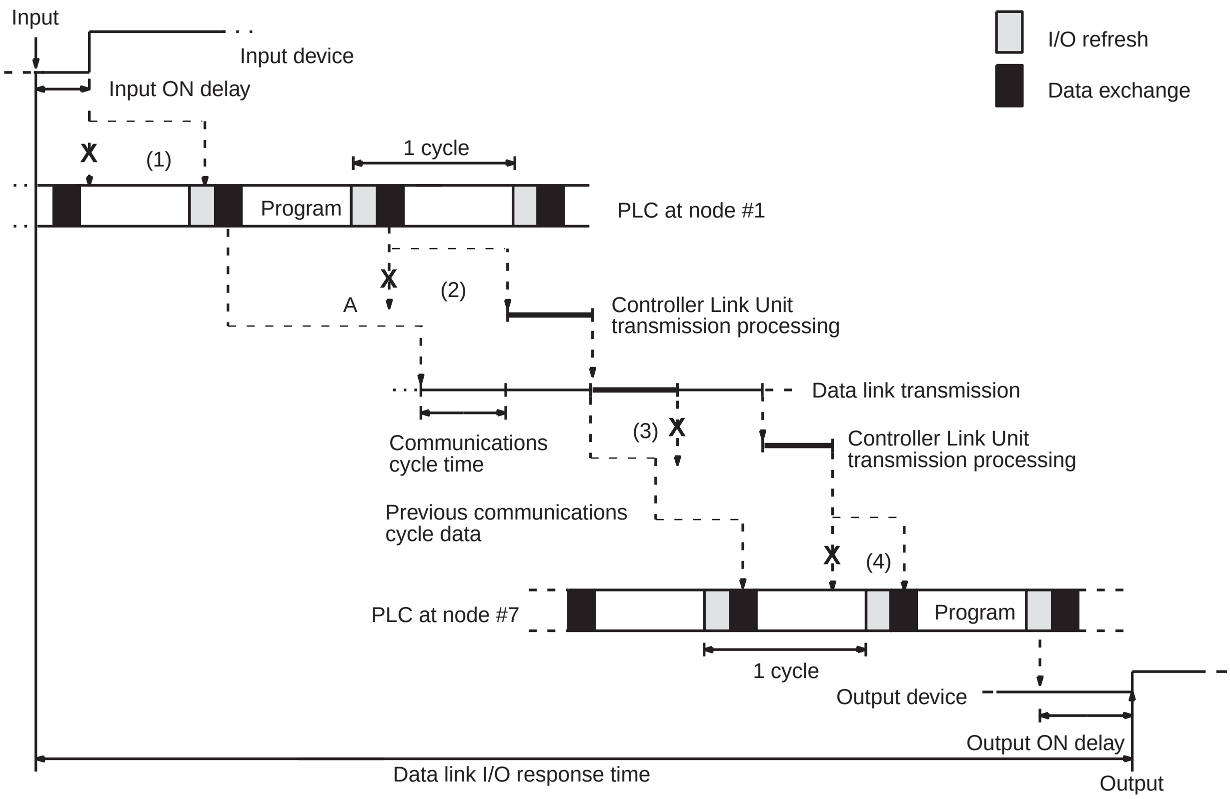
Input ON delay	1.5 ms
Cycle time of PLC at node #1 × 2	15 ms × 2
Communications cycle time × 3	9.9 ms × 3
PLC cycle time at node #7 × 2 (see note)	8 ms × 2 (see note)
Output ON delay	15 ms
Total (data link I/O response time)	92.2 ms

Note If the total number of data link words is greater than the maximum number of words that can be exchanged per data exchange, the maximum data link I/O response time will be cycle time of PLC at node #7 × 3.
In case of the CQM1H, however, the cycle time will be incremented by the value obtained from dividing the total number of data link words by the maximum number of words (1,200 words) per time.
For example, if the total number of data link words is 5,000, the result will be as shown below.
5,000/1,200 = 2.5 (approx. 3)
Cycle time of PLC at node #7 × (2+3)

Noise may increase I/O delays.

<u>Case 3</u>

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PLC at node #1 < the communications cycle time and the cycle time of the PLC at node #7 ≥ the communications cycle time.



There are four points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1,2,3...

1. The input arrives in the PLC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PLC.
2. At point A, data from the previous exchange is still being transferred, so new data cannot be exchanged, causing a delay of one communications cycle time. Furthermore, the data exchange then occurs just after the PLC at node #1 passes the token for the polling node, causing another delay of one communications cycle time before the data is transferred in data link processing.
3. At node #7, data from the previous data exchange is still being transferred, causing a delay of up to one cycle before the input is read into the PLC.
4. The data transferred in data link processing arrives at the PLC at node #7 after data exchange, so the data will not be read into the PLC until the next data exchange, causing a delay of up to one cycle.

   The maximum number of words that can be exchanged in a single data exchange is approx. 7,800 words for CS/CJ-series PLCs, approx. 3,700 words for CVM1 and CV-series PLCs, approx. 4,000 for C200HX/HG/HE PLCs, and approx. 1,200 words for CQM1H-series PLCs.

The equation for maximum data link I/O response time is as follows:

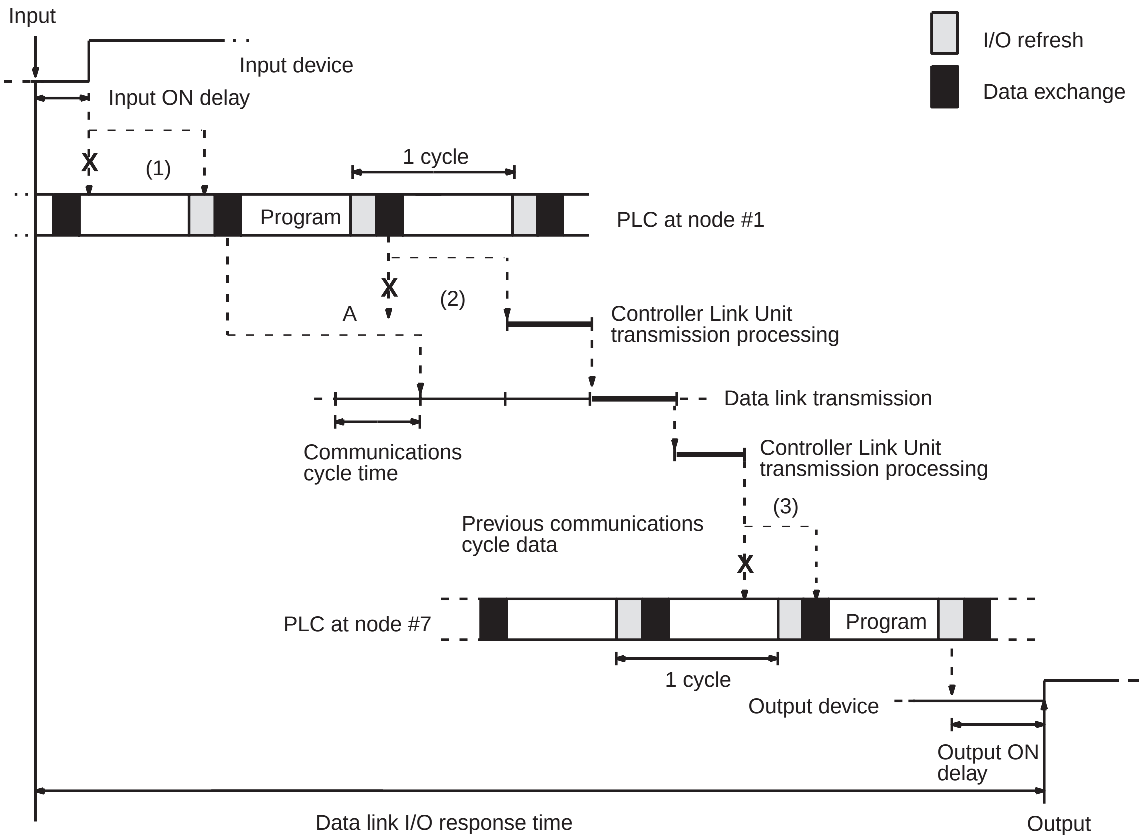
Input ON delay	1.5 ms
Cycle time of PLC at node #1 × 2	8 ms × 2
Communications cycle time × 3	9.9 ms × 3
PLC cycle time at node #7 × 3 (see note)	20 ms × 3 (see note)
Output ON delay	15 ms
Total (data link I/O response time)	122.2 ms

Note If the total number of data link words is greater than the maximum number of words that can be exchanged per data exchange, the maximum data link I/O response time will be cycle time of PLC at node #7 $\times$ 4.
In case of the CQM1H, however, the cycle time will be incremented by the value obtained from dividing the total number of data link words by the maximum number of words (1,200 words) per time.
For example, if the total number of data link words is 5,000, the result will be as shown below.
5,000/1,200 = 2.5 (approx. 3)
Cycle time of PLC at node #7 $\times$ (3+3)

Noise may increase I/O delays.

Case 4

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PLC at node #1 < the communications cycle time and the cycle time of the PLC at node #7 < the communications cycle time.



There are three points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1,2,3...

1. The input arrives in the PLC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PLC.
2. At point A data from the previous data exchange is still being transferred, so the new data cannot be exchanged, causing a delay of up to one communications cycle time. Furthermore, the data exchange then occurs just after the PLC at node #1 passes the token that makes it the polling node, causing another delay of up to one communications cycle time before the data is transferred in data link processing.

3. The data transferred in data link processing arrives at the PLC at node #7 while data exchange is taking place, so the data will not be read into the PLC until the next data exchange, causing a delay of up to one cycle.

   The maximum number of words that can be exchanged in a single data exchange is approx. 7,800 words for CS/CJ-series PLCs, approx. 3,700 words for CVM1 and CV-series PLCs, approx. 4,000 for C200HX/HG/HE PLCs, and approx. 1,200 words for CQM1H-series PLCs.

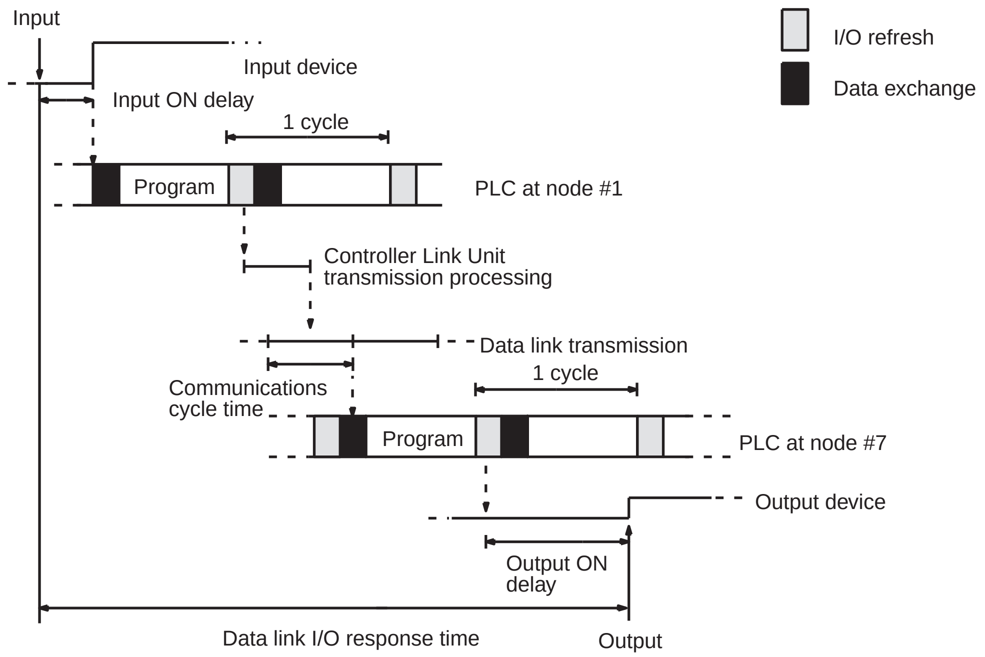
The equation for maximum data link I/O response time is as follows:

Input ON delay	1.5 ms
Cycle time of PLC at node #1 × 2	8 ms × 2
Communications cycle time × 4	9.9 ms × 4
PLC cycle time at node #7 × 2 (see note)	8 ms × 2 (see note)
Output ON delay	15 ms
Total (data link I/O response time)	88.1 ms

Note If the total number of data link words is greater than the maximum number of words that can be exchanged per data exchange, the maximum data link I/O response time will be cycle time of PLC at node #7 × 3.
In case of the CQM1H, however, the cycle time will be incremented by the value obtained from dividing the total number of data link words by the maximum number of words (1,200 words) per time.
For example, if the total number of data link words is 5,000, the result will be as shown below.
5,000/1,200 = 2.5 (approx. 3)
Cycle time of PLC at node #7 × (2+3)

Noise may increase I/O delays.

Minimum Response Time



The equation for minimum data link I/O response time is as follows:

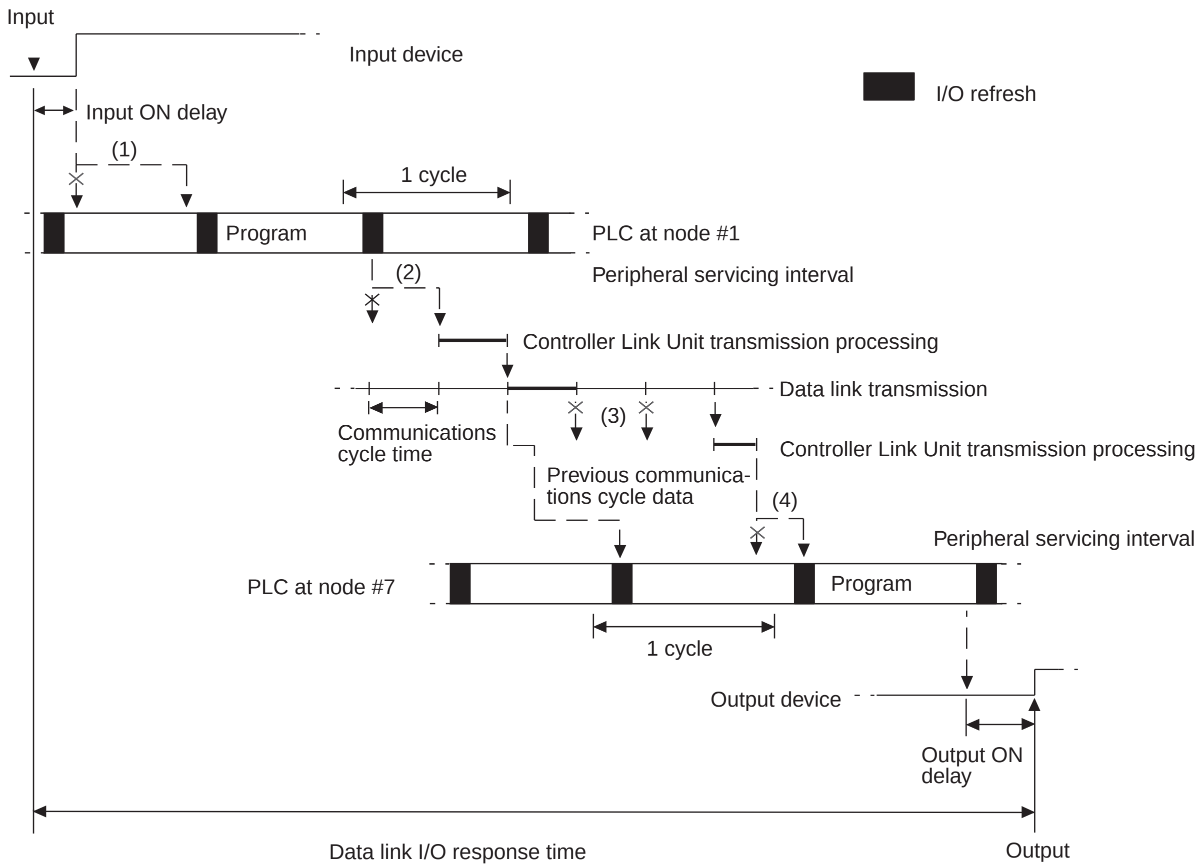
Input ON delay	---
Cycle time of PLC at node #1	15 ms
PLC cycle time at node #7	20 ms
Output ON delay	---
Total (data link I/O response time)	35 ms

Note If the total number of data link words is greater than the maximum number of words that can be exchanged per data exchange, the maximum data link I/O response time will be cycle time of PLC at node #7 × 3.
In case of the CQM1H, however, the cycle time will be incremented by the value obtained from dividing the total number of data link words by the maximum number of words (1,200 words) per time.
For example, if the total number of data link words is 5,000, the result will be as shown below.
5,000/1,200 = 2.5 (approx. 3)
Cycle time of PLC at node #7 × (1+3)

Noise may increase I/O delays.

CVM1 and CV-series PLCs Under Asynchronous Operation

Maximum Response Time



There are five points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1,2,3... 1. The input arrives in the PLC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PLC.

2. Data exchange occurs just after the PLC at node #1 passes the token that makes it the polling node, causing a delay of up to one communications cycle time before the data is transferred in data link processing.
3. At node #7, data from the previous data exchange is still being transferred, causing a delay of up to one cycle before the input is read into the PLC.
4. The data transferred in data link processing arrives at the PLC at node #7 after data exchange, so the data will not be read into the PLC until the next data exchange, causing a delay of up to one peripheral servicing interval.

   Up to 3,700 words can be transferred in a single data exchange, so a delay of another peripheral servicing interval will occur if more than 3,700 words are being transferred.
5. The data is received after the PLC at node #7 has executed the instruction, causing a delay of up to one cycle time.

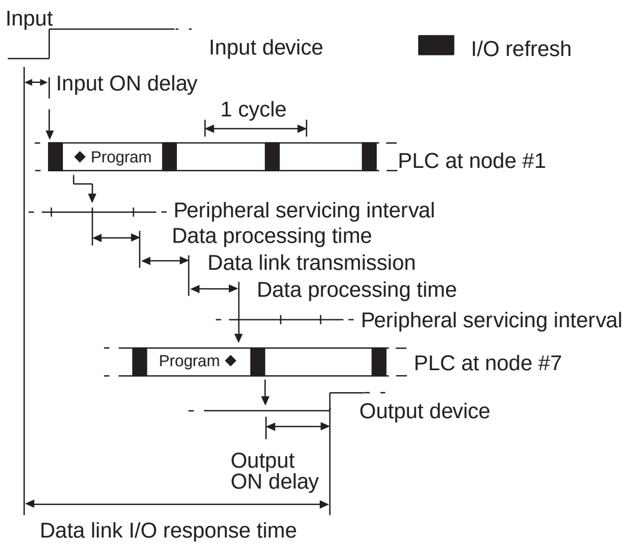
Assume that the peripheral servicing interval of the PLCs at nodes #1 and #7 is 10 ms. The equation for maximum data link I/O response time is as follows:

Input ON delay	1.5 ms
Cycle time of PLC at node #1 × 2	15 ms × 2
Peripheral servicing interval of PLC at node #1	10 ms
Communications cycle time × 4	9.9 ms × 3
Peripheral servicing interval of PLC at node #7 × 2	10 ms × 2
PLC cycle time at node #7 × 2 (see note)	20 ms × 2 (see note)
Output ON delay	15 ms
Total (data link I/O response time)	146.2 ms

Note If the total number of data link words is greater than the maximum number of words that can be exchanged per data exchange, the maximum data link I/O response time will be cycle time of PLC at node #7 × 3.

Noise may increase I/O delays.

Minimum Response Time



In this case, the data processing time required for data exchange and the data transmission time are not negligible and need to be included in the calculation. Each time can be determined as follows.

Data Processing Time (see page 200.)

$0.0025 \times (8 + 16) \times 8 + 4.7 = 5.18 \cong 5.2$ ms

Data Transmission Time

Data transmission time varies with the baud rate.

Baud rate	Data transmission time
2 Mbps	Number of data link words × 0.008 ms
1 Mbps	Number of data link words × 0.016 ms
500 Kbps	Number of data link words × 0.032 ms

In this example, the number of data link words is $(8 + 16) \times 8 = 192$, so the data transmission time can be determined as follows:
$0.008 \times (8 + 16) \times 8 = 1.536 \cong 1.5$ ms

Assume that the sum of the instruction execution time and I/O refresh time for the PLCs at nodes #1 and #7 is 1 ms. The equation for minimum data link I/O response time is as follows:

Input ON delay	---
Instruction execution time + I/O refresh time for PLC at node #1	1 ms
Data processing time	5.2 ms
Data link transmission time	1.5 ms
Data processing time	5.2 ms
Instruction execution time + I/O refresh time for PLC at node #7	1 ms
Output ON delay	---
Total (data link I/O response time)	13.9 ms

Noise may increase I/O delays.

8-4 Message Delay Times

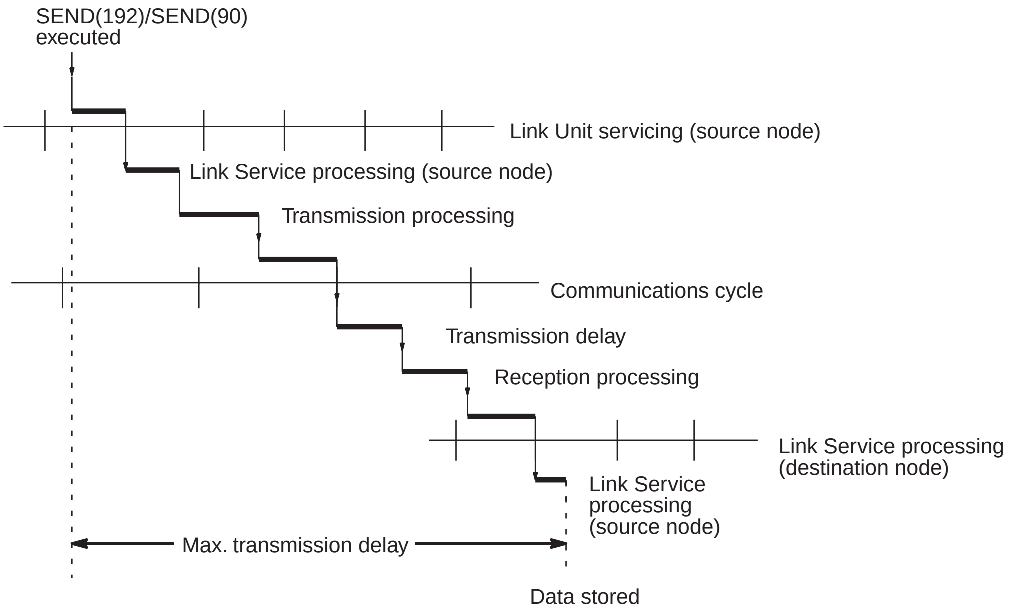
The two charts which follow indicate the sequence of processing which will enable users to calculate the maximum delay time to be expected between the time SEND(192) or RECV(193) is executed and the time the data is stored in the destination or source node’s memory area, ready for use by other instructions in the program.

8-4-1 CS/CJ-series, CVM1, and CV-series PLCs

SEND

The following diagram indicates the data flow which will yield the maximum delay time from the time SEND(192)/SEND(90) is executed by the user program to the time the Controller Link Unit stores the data in the destination Unit’s memory.

Note Be sure to take into account the time required for data links and program execution, which are not included in the following example.



Max. transmission delay = Link Unit servicing interval (source node) + Link service processing (source node) + Transmission processing + Communications cycle time + Transmission delay + Reception processing + Link Unit servicing interval (destination node) + Link service processing (destination node)

Link Servicing Interval (Source and Destination Nodes)

Link servicing depends on the execution mode of the PLC. The execution modes on the source and destination modes need not be the same.

For synchronous execution, links are serviced once per PLC execution cycle. For asynchronous execution, links are serviced according to the peripheral servicing interval. Refer to the operation manual for the PLC for details. Refer to the *CVM1 and CV-series PLCs Operation Manual: Ladder Diagrams (W202)* or *CS/CJ-series PLCs Programming Manual (W340)* for details.

Link Service Processing (Source and Destination Nodes)

Link service processing is the same as the PLC's peripheral servicing and is approximately 1 ms for Controller Link Units.

Transmission Processing

Number of words transferred × 0.00075 ms + 2 ms

Communications Cycle Time (with Data Links Inactive)

See *8-2 Communications Cycle Time* (on page 197).

Transmission Delay Time

Transmission delay time varies with the baud rate.

Baud rate	Transmission delay time
2 Mbps	Number of words transferred × 0.008 + 0.112 ms
1 Mbps	Number of words transferred × 0.016 + 0.224 ms
500 Kbps	Number of words transferred × 0.032 + 0.448 ms

Reception Processing

Number of words transferred × 0.00075 + 1.3 ms

Note The I/O response time can increase due to noise or restrictions on the number of frames that can be transmitted while data links are operating.

Example

In this example, the maximum transmission delay is calculated for an instruction sending 256 words of data in a system with 32 nodes. Network specifics are detailed below:

Baud rate:	2 Mbps
Max. node address:	32
Number of nodes:	32
Number of polled nodes per comm cycle:	4
Source node execution:	Synchronous
Destination node execution:	Asynchronous
Number of words:	256
Data link:	Inactive

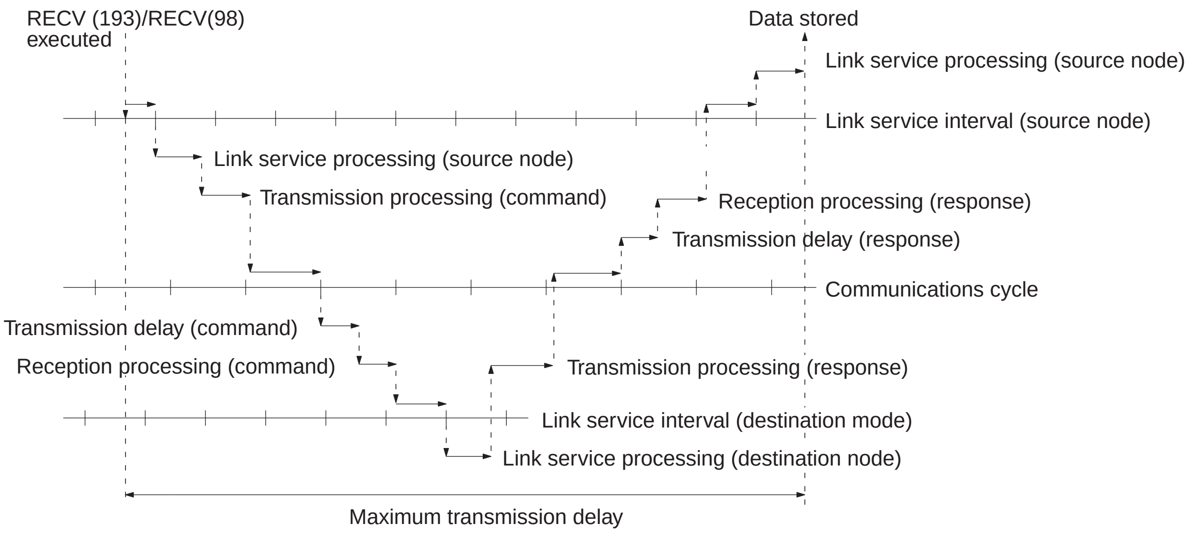
Link servicing interval (source node)	PLC cycle time (source node)
Link service processing (source node)	1 ms
Transmission processing	$0.00075 \times 256 + 2 = 2.192 \cong 2.2$ ms
Communications cycle time (see note)	$600 \times 4 + 110 \times 32 + 320 \times 0 + 4 \times 0 + 2{,}290 = 8{,}210\ \mu s \cong 8.2$ ms
Transmission delay	$0.008 \times 256 + 0.112 = 2.16 \cong 2.2$ ms
Reception processing	$0.00075 \times 256 + 1.13 = 1.492 \cong 1.5$ ms
Link servicing interval (destination node)	As required by Programming Device
Link service processing (destination node)	1 ms
Total (max. transmission delay)	**PLC cycle time (source node) + Peripheral servicing interval (destination node) + 16.1 ms**

Note This communications cycle time is calculated assuming that there is no node that transmits event frames before the SEND command is sent.

RECV Instruction Maximum Delay Time

The data flow which will yield the maximum transfer interval from the time the RECV(193)/RECV(98) instruction is executed by the user program to the time the Controller Link Unit stores the data in the local Unit's memory area is described below.

Note Be sure to take into account the time required for data links and program execution, which are not included in the following example.



Max. transmission delay = Link servicing interval (source node) + <u>Link service processing (source node)</u> + Transmission processing (command) + Communications cycle + Transmission delay (command) + Reception processing (command) + Link servicing interval (destination node) + <u>Link service processing (destination node)</u> + Transmission processing (response) + Communications cycle + Transmission delay (response) + Reception processing (response) + Link servicing interval (source node) + <u>Link service processing (source node)</u>.

<u>Link Servicing Interval (Source and Destination Nodes)</u>

Link servicing depends on the execution mode of the PLC. The execution modes on the source and destination modes need not be the same.

For synchronous execution, links are serviced once per PLC execution cycle. For asynchronous execution, links are serviced according to the peripheral servicing interval. Refer to the *CVM1 and CV-series PLCs Operation Manual: Ladder Diagrams (W202)* for details.

<u>Link Service Processing (Source and Destination Nodes)</u>

Link service processing is the same as the PLC's peripheral servicing and is approximately 1 ms for Controller Link Units.

<u>Transmission Processing</u>

Commands: 2 ms
Responses: Number of words transferred $\times$ 0.00075 ms + 2 ms

<u>Communications Cycle Time (with Data Links Inactive</u>

See *8-2 Communications Cycle Time* (on page 197).

<u>Transmission Delay Time</u>

Transmission delay time varies with the baud rate.

Baud rate	Transmission delay time
2 Mbps	Number of words transferred $\times$ 0.08 + 0.112 ms
1 Mbps	Number of words transferred $\times$ 0.016 + 0.224 ms
500 Kbps	Number of words transferred $\times$ 0.032 + 0.448 ms

Note Commands: Transmission delay time is calculated assuming that the number of words to be transferred is zero.
Responses: Transmission delay time is calculated according to the number of words to be transferred.

Reception Processing

Commands: 1.3 ms
Responses: Number of words transferred × 0.00075 ms + 2 ms

The I/O response time can increase due to noise or restrictions on the number of frames that can be transmitted while the data link is operating.

Example

In this example, the maximum transmission delay is calculated for an instruction receiving 256 words of data in a system with 32 nodes. Network specifics are detailed below:

Baud rate:	2 Mbps
Max. node address:	32
Number of nodes:	32
Number of polled nodes per comm cycle:	4
Source node execution:	Synchronous
Destination node execution:	Asynchronous
Number of words:	256
Data link:	Inactive

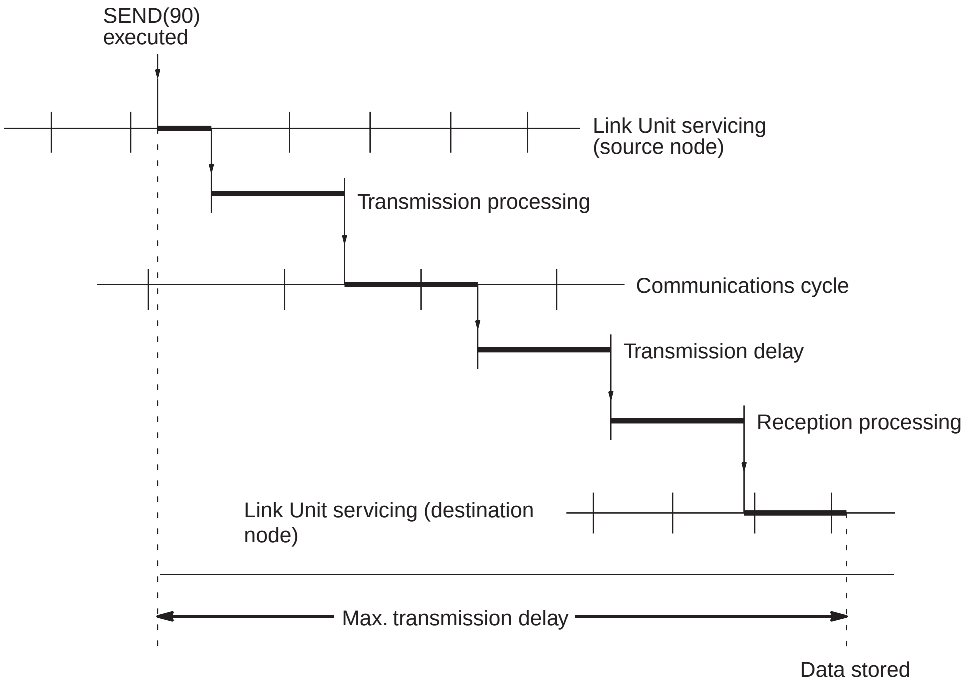
Link Unit servicing (source node) × 2	PLC cycle time (source node) × 2
Link service processing (source node) × 2	1 ms × 2 = 2 ms
Transmission processing (command)	2 ms
Communications cycle × 2 (see note)	(600 × 4 + 110 × 32 + 320 × 0 + 4 × 0 + 2,290) × 2 = 8,210 µs × 2 ≅ 16.4 ms
Transmission delay (command)	0.112 ≅ 0.1 ms
Reception processing (command)	1.3 ms
Link servicing interval (destination node)	As required by Programming Device (destination node)
Link service processing (destination node)	1 ms
Transmission processing (response)	0.00075 × 256 + 2 = 2.192 ≅ 2.2 ms
Transmission delay (response)	0.008 × 256 + 0.112 = 2.16 ≅ 2.2 ms
Reception processing (response)	0.00075 × 256 + 2 = 2.192 ≅ 2.2 ms
Total (max. transmission delay)	**PLC cycle time (source node) × 2 + Peripheral servicing time (destination node) + 29.4 ms**

Note This communications cycle time is calculated assuming that there is no node that transmits event frames before the RECV command is sent.

8-4-2 C200HX/HG/HE and CQM1H-series PLCs

SEND(90)

The following diagram indicates the data flow which will yield the maximum delay time from the time SEND(90) is executed by the user program to the time the Controller Link Unit stores the data in the destination Unit's memory.



Max. transmission delay = Link Unit servicing interval (source node) + Transmission processing + Communications cycle time + Transmission delay + Reception processing + Link Unit servicing interval (destination node).

Link Servicing Interval (Source and Destination Nodes)

Link service processing is the same as the PLC's peripheral servicing and is approximately 1 ms for Controller Link Units.

Transmission Processing

Responses: Number of words transferred × 0.00125 ms + 3 ms

Communications Cycle Time (with Data Links Inactive)

See *8-2 Communications Cycle Time* (on page 197).

Transmission Delay Time

Transmission delay time varies with the baud rate.

Baud rate	Transmission delay time
2 Mbps	Number of words transferred × 0.08 + 0.112 ms
1 Mbps	Number of words transferred × 0.016 + 0.224 ms
500 Kbps	Number of words transferred × 0.032 + 0.448 ms

Reception Processing

Responses: Number of words transferred × 0.00125 ms + 2.3 ms

Note The I/O response time can increase due to noise or restrictions on the number of frames that can be transmitted while the data link is operating.

Example

In this example, the maximum transmission delay is calculated for an instruction sending 256 words of data in a system with 32 nodes. Network specifics are detailed below:

Baud rate: 2 Mbps
Max. node number: 32
Number of nodes: 32
Number of polled nodes: 4
Number of words: 256
Data link: halted

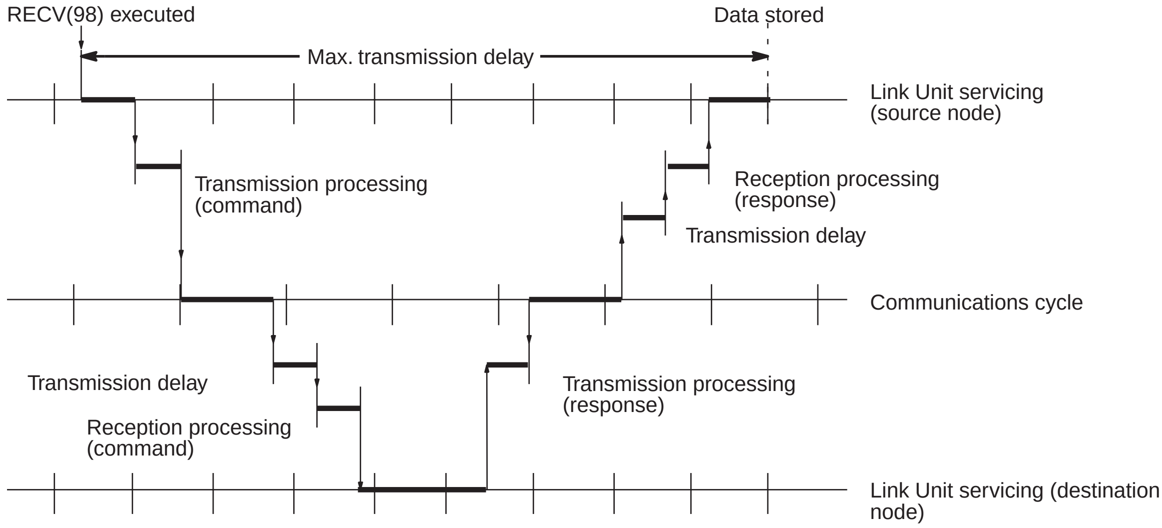
Link Unit servicing (source node)	PLC cycle time (source node)
Transmission processing	0.00125 × 256 + 3 = 3.32 ≅ 3.3 ms
Communications cycle time (see note)	600 × 4 + 110 × 32 + 320 × 0 + 4 × 0 + 2,290 = 8,210 μs ≅ 8.2 ms
Transmission delay (command)	0.008 × 256 + 0.112 = 2.16 ≅ 2.2 ms
Reception processing	0.00125 × 256 + 2.3 = 2.62 ≅ 2.6 ms
Link servicing interval (destination node)	PLC cycle time (destination node)
Total (max. transmission delay)	**PLC cycle time (source node) × 2 + PLC cycle time (destination node) + Peripheral servicing time (destination node) + 16.3 ms**

Note This communications cycle time is calculated assuming that there is no node that transmits event frames before the SEND command is issued.

RECV(98) Instruction Maximum Delay Time

The following indicates the data flow which will yield the maximum transfer interval from the time the RECV(98) instruction is executed by the user program to the time the Controller Link Unit stores the data in the local Unit's memory area.

Note Be sure to take into account the time required for data links and program execution, which are not included in the following example.



Max. transmission delay = Link Unit servicing interval (source node) + Transmission processing (command) + Communications cycle + Transmission delay (command) + Reception processing (command) + Link Unit servicing interval (destination node) + Transmission processing (response) + Communications cycle + Transmission delay (response) + Reception processing (response) + Link Unit servicing interval (source node).

Link Servicing Interval (Source and Destination Nodes)

Link service processing is the same as the PLC's peripheral servicing and is approximately 1 ms for Controller Link Units.

Transmission Processing

Commands: 2 ms
Responses: Number of words transferred × 0.00125 ms + 3 ms

Communications Cycle Time (with Data Links Inactive)

See *8-2 Communications Cycle Time* (on page 197).

Transmission Delay Time

Transmission delay time varies with the baud rate.

Baud rate	Transmission delay time
2 Mbps	Number of words transferred × 0.008 + 0.112 ms
1 Mbps	Number of words transferred × 0.016 + 0.224 ms
500 Kbps	Number of words transferred × 0.032 + 0.448 ms

Note Commands: Transmission delay time is calculated assuming that the number of words to be transferred is zero.
Responses: Transmission delay time is calculated according to the number of words to be transferred.

Reception Processing

Commands: 2.3 ms
Responses: Number of words transferred × 0.00125 ms + 2.3 ms

The I/O response time might increase due to noise or restrictions on the number of frames that can be transmitted while the data link is operating.

Example

In this example, the maximum transmission delay is calculated for an instruction receiving 256 words of data in a system with 32 nodes. Network specifics are detailed below:

Baud rate:	2 Mbps
Max. node number:	32
Number of nodes:	32
Number of polled nodes:	4
Number of words:	256
Data links:	Halted

Link Unit servicing (source node) × 2	PLC cycle time (source node) × 2
Transmission processing (command)	3.3 ms
Communications cycle time × 2 (see note)	(600 × 4 + 110 × 32 + 320 × 0 + 4 × 0 + 2,290) × 2 = 8,210 µs × 2 ≅ 16.4 ms
Transmission delay (command)	0.112 ≅ 0.1 ms
Reception processing (command)	2.3 ms
Link Unit servicing (destination node)	PLC cycle time (destination node)
Transmission processing (response)	0.00125 × 256 + 3 = 3.32 ≅ 3.3
Transmission delay (response)	0.008 × 256 + 0.112 = 2.16 ≅ 2.2
Reception processing (response)	0.00125 × 256 + 2.3 = 2.62 ≅ 2.6
Total (max. transmission delay)	**PLC cycle time (source node) × 2 + PLC cycle time (destination node) + Peripheral servicing time (destination node) + 29.9 ms**

Note This communications cycle time is calculated assuming that there is no node that transmits event frames before the SEND command is executed.

SECTION 9
Troubleshooting and Maintenance

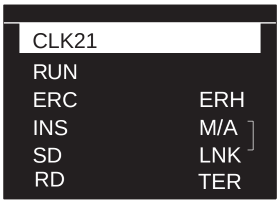
This section provides information on troubleshooting errors that occur during Controller Link Unit operation, as well as daily inspection, cleaning, and other maintenance procedures.

9-1 Troubleshooting Using Indicators

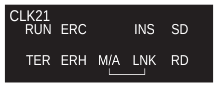
This section describes the errors indicated by the Controller Link Unit indicators and possible remedies.

9-1-1 CS/CJ-series Controller Link Units

CS-series Unit



CJ-series Unit



RUN: Operating
ERC: Communications error
ERH: PLC error
INS: Network participation
LNK: Data link
M/A: Data link mode
TER: Terminating resistance

Troubleshooting with RUN, ERC, ERH and INS Indicators

The RUN, ERC, ERH, and INS indicators can be used to check whether Controller Link Unit startup and Network participation are operating normally.

Note Be sure to turn off the power to the PLC before performing any of the following.

- Disconnecting the Unit or connectors.
- Securing Units or connectors.
- Setting hardware switches.

Indicators				Probable cause	Probable remedy
RUN	ERC	ERH	INS		
Lit	Not lit	Not lit	Lit	Unit operating normally; Network participation normal.	---
Not lit	Lit	---	---	Controller Link Unit faulty.	If the ERC indicators still lights when the Unit is mounted on another PLC, replace the Controller Link Unit.
					Reset the node address to within the 1 to 32 range (for CS/CJ Series only).
Not lit	Not lit	Not lit	Not lit	Power is not being supplied correctly to the PLC.	Check the power supply voltage and supply at the recommended voltage.
				The Controller Link Unit has become loose.	Secure the Controller Link Unit firmly.
				The Controller Link Unit is mounted in the wrong position.	Refer to *3-2-3 CS-series PLCs* or *3-2-4 CJ-series PLCs* and mount the Unit correctly.
				The Controller Link Unit is faulty.	If the indicators do not light when the Unit is mounted in another PLC, replace the Controller Link Unit.

Indicators				Probable cause	Probable remedy
RUN	**ERC**	**ERH**	**INS**		
Lit	Lit	---	Not lit	The node address is outside the setting range.	Reset the node address to within the 1 to 32 range.
				The same node address is being used by two different Units.	Reset so that each node address is used only once within the same Network.
				The Unit is connected to a SYSMAC LINK Network (Optical Units only).	Check the Network and reconnect cables correctly.
Lit	---	Lit	---	Routing table setting error	Remake and set the routing table correctly, referring to *7-4 Setting Routing Tables.* When no routing table is being used, delete the routing table.
				The Unit is mounted to a non-compatible PLC.	Refer to *1-2-4 Controller Link Unit Models and PLCs* and reinstall the Unit on the appropriate PLC.
				An error has occurred in the PLC.	Refer to the PLC's operation manual and correct the error. If the error occurs again, replace the PLC.
				EEPROM error	Refer to *9-2 Status Area and Troubleshooting*, correct the data where the error has occurred, and reset the Unit. If the error occurs again, replace the Controller Link Unit.
				Two Units connected to the same PLC have the same unit number.	Reset so that Units connected to the same PLC (including the CPU Expansion Racks), do not have the same unit number.
				Either there is an error in the PLC I/O table or no table has been created.	Create a correct I/O table for the PLC.

Indicators				Probable cause	Probable remedy
RUN	**ERC**	**ERH**	**INS**		
Lit	---	---	Not lit	Terminating resistance is not set correctly. (Wired Unit)	Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.
				Cables are not connected correctly.	Check the cable connections are reconnect correctly.
				The node address is larger than the maximum node address set for the network parameters.	Either reset the maximum node address using the Controller Link Support Software or reset the node address to below the maximum.
				No other nodes exist.	Make sure that 2 or more nodes exist within the Network.
				No nodes have been set as polling nodes.	Refer to *8-1-2 Setting the Polling and Polled Nodes* and set at least one polling node. (Controller Link Units should normally be set as polling nodes.)
				The set baud rate is different to other nodes (Wired Unit).	Refer to Section *SECTION 4 Preparations for Communications* and reset the baud rate.

Troubleshooting with LNK and M/A Indicators

Data Link Cannot be Started

The following table describes the LNK and M/A indicators at the startup node and their use in troubleshooting when a data link cannot be started.

Starting a data link depends on the Controller Link Unit operating normally and participating in the Network. Refer to *Troubleshooting with RUN, ERC, ERH and INS Indicators* earlier in this section and check Unit operation before using the following table.

Indicators		Probable cause	Probable remedy
LNK	**M/A**		
Lit	---	Data link operating normally.	---
Flashing	---	There is an error in the data link tables.	When the ERH indicator is flashing, remake and set the data link tables.
		When manual setting is used, either data link tables have not been created for the startup node or there is an error in the data link tables.	Refer to *5-2-2 Manual Setting* and set data link tables for the startup node.
		When automatic setting is used, either the data link parameters for the startup node have not been set or there is an error in the data link tables.	Refer to *5-2-4 Automatic Setting: "Select All"* and set the automatic parameters for starting the data links.
Not lit	Lit	Manually set data links are already operating on the same Network.	Stop the manually set data links that are operating and restart the data links.

Indicators		Probable cause	Probable remedy
LNK	**M/A**		
Not lit	Not lit	Automatically set data links are already operating on the same Network.	Stop the automatically set data links that are operating and restart the data links.
		There is an error in the startup node PLC.	Refer to the PLC's operation manual and correct the error. If the error reoccurs, replace the PLC.

Node Cannot Participate in Data Link

The following table describes the LNK and M/A indicators when a node cannot participate in the data links.

Data link participation depends on the Controller Link Unit operating normally and participating in the Network. Refer to *Troubleshooting with RUN, ERC, ERH and INS Indicators* earlier in this section and check Unit operation before using the following table.

Indicators		Probable cause	Probable remedy
LNK	**M/A**		
Lit	---	Data link operating normally.	---
Flashing	Lit	When manual setting is used, there is an error in the data link table.	Refer to *5-2-2 Manual Setting* and remake the data link table.
Flashing	Not lit	When automatic setting is used, the data link parameters at the startup node are incorrect for the local node (the data link area is out of range for the local node.)	Refer to *5-2-4 Automatic Setting: "Select All"*, reset the parameters for the startup node DM Area so that the local node can participate in the data link, and then restart the data link.
		When automatic setting is used, the local node is not set to participate in the data link at the startup node.	Stop the data link, reset the parameters for the startup node DM Area so that the local node can participate in the data link, and then restart the data link.
Not lit	Lit	When manual setting is used, there are no data link tables set for the local node.	Set data link tables for the local node.

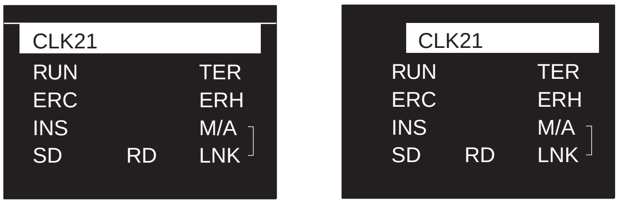
Data Link Cannot be Stopped

Stopping the data link depends on the Controller Link Unit operating normally and participating in the Network. Read the above explanations before attempting to stop operation.

Note Stop the data link from the node at which the LNK indicator is lit (indicating active data links). Data links cannot be stopped from nodes which do not have active data links.

9-1-2 C200HX/HG/HE and CQM1H-series Controller Link Units

C200HX/HG/HE Unit CQM1H-series Unit



RUN: Operating
ERC: Communications error
INS: Network participation
LNK: Data link
M/A: Data link mode
TER: Terminating resistance set

Troubleshooting with RUN, ERC, ERH and INS Indicators

The RUN, ERC, ERH, and INS indicators can be used to check whether Controller Link Unit startup and Network participation are operating normally.

Note Be sure to turn off the power to the PLC before performing any of the following.

- Disconnecting the Unit or connectors.
- Securing Units or connectors.
- Setting hardware switches.

Indicators				Probable cause	Probable remedy
RUN	**ERC**	**ERH**	**INS**		
Lit	Not lit	Not lit	Lit	Unit operating normally; Network participation normal.	---
Not lit	Lit	---	---	Controller Link Unit faulty.	If the ERC indicators still lights when the Unit is mounted on another PLC, replace the Controller Link Unit.
Not lit	Not lit	Not lit	Not lit	Power is not being supplied correctly to the PLC.	Check the power supply voltage and supply at the recommended voltage.
				The Controller Link Unit has become loose.	Secure the Controller Link Unit firmly.
				The Bus Connection Unit has become loose.	Tighten the mounting screws on the Bus Connection Unit.
				The Controller Link Unit is mounted in the wrong slot.	Refer to *3-2-1 C200HX/HG/HE PLCs* and *3-2-4 CJ-series PLCs* and mount the Unit correctly.
				The Controller Link Unit is faulty.	If the indicators do not light when the Unit is mounted on another PLC, replace the Controller Link Unit.
Lit	Lit	---	Not lit	The node address is outside the setting range.	Reset the node address to within the 1 to 32 range.
				The same node address is being used by two different Units.	Reset so that each node address is used only once within the same Network.

Indicators				Probable cause	Probable remedy
RUN	**ERC**	**ERH**	**INS**		
Lit	---	Lit	---	Routing table setting error or a Routing Table Enable Bit setting error.	Remake and set the routing table correctly, referring to *7-4 Setting Routing Tables.* When no routing table is being used, turn OFF the Routing Table Enable Bit.
				The Unit is mounted to a non-compatible PLC.	Refer to *1-2-4 Controller Link Unit Models and PLCs* and reinstall the Unit on the appropriate PLC.
				An error has occurred in the PLC.	Refer to the PLC's operation manual and correct the error. If the error occurs again, replace the PLC.
				EEPROM error	Refer to *9-2 Status Area and Troubleshooting*, correct the data where the error has occurred, and reset the Unit. If the error occurs again, replace the Controller Link Unit.
Lit	---	---	Not lit	Terminating resistance is not set correctly.	Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.
				Cables are not connected correctly.	Check the cable connections and reconnect correctly.
				The node address is larger than the maximum node address set for the network parameters.	Either reset the maximum node address using the Controller Link Support Software or reset the node address to below the maximum.
				No other nodes exist.	Ensure that 2 or more nodes exist within the Network.
				No nodes have been set as polling nodes.	Refer to *8-1-2 Setting the Polling and Polled Nodes* and set at least one polling node. (Controller Link Units should normally be set as polling nodes.)
				The same operating level is set more than once for the same PLC.	Reset so that each operating level is used only once.
				The Bus Connection Unit has become loose.	Tighten the mounting screws on the Bus Connection Unit (C200HX/HG/HE PLCs only).
				The set baud rate is different to other nodes.	Refer to *SECTION 4 Preparations for Communications* and set all nodes on the network to the same baud rate.

Troubleshooting with LNK and M/A Indicators

Data Link Cannot be Started

The following table describes the LNK and M/A indicators at the startup node and their use in troubleshooting when a data link cannot be started.

Starting a data link depends on the Controller Link Unit operating normally and participating in the Network. Refer to *Troubleshooting with RUN, ERC, ERH and INS Indicators* earlier in this section and check Unit operation before using the following table.

Indicators		Probable cause	Probable remedy
LNK	M/A		
Lit	---	Data link operating normally.	---
Flashing	---	There is an error in the data link tables.	If the ERH indicator is lit, reset the data link tables.
		When manual setting is used, either data link tables have not been created for the startup node or there is an error in the data link tables.	Refer to *5-2-2 Manual Setting* and set data link tables for the startup node.
		When automatic setting is used, either the data link parameters for the startup node have not been set or there is an error in the data link tables.	Refer to *5-2-4 Automatic Setting: "Select All"* and set the automatic parameters for starting the data links.
Not lit	Lit	Manually set data links are already operating on the same Network.	Stop the manually set data links that are operating and restart the data links.
Not lit	Not lit	Automatically set data links are already operating on the same Network.	Stop the automatically set data links that are operating and restart the data links.
		There is an error in the startup node PLC.	Refer to the PLC's operation manual and correct the error. If the error reoccurs, replace the PLC.

Node Cannot Participate in Data Link

The following table describes the LNK and M/A indicators when a node cannot participate in the data links.

Data link participation depends on the Controller Link Unit operating normally and participating in the Network. Refer to *Troubleshooting with RUN, ERC, ERH and INS Indicators* earlier in this section and check Unit operation before using the following table.

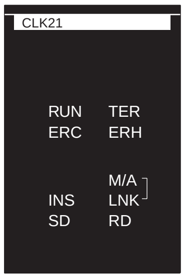
Indicators		Probable cause	Probable remedy
LNK	M/A		
Lit	---	Data link operating normally.	---
Flashing	Lit	When manual setting is used, there is an error in the data link table.	Refer to *5-2-2 Manual Setting* and remake the data link table.
Flashing	Not lit	When automatic setting is used, the data link parameters at the startup node are incorrect for the local node (the data link area is out of range for the local node.)	Refer to *5-2-4 Automatic Setting: “Select All”*, reset the parameters for the startup node DM Area so that the local node can participate in the data link, and then restart the data link.
Not lit	Lit	When manual setting is used, there are no data link tables set for the local node.	Set data link tables for the local node.
Not lit	Not lit	When automatic setting is used, the startup node is not set to participate in the data links.	Stop the data links, remake and set the parameters in the startup node’s DM Area, and then restart the data link.

Data Link Cannot be Stopped

Stopping the data link depends on the Controller Link Unit operating normally and participating in the Network. Read the above explanations before attempting to stop operation.

Note Stop the data link from the node at which the LNK indicator is lit (indicating active data links). Data links cannot be stopped from nodes which do not have active data links.

9-1-3 CVM1 and CV-series Controller Link Units



RUN: Operating
ERC: Communications error
INS: Network participation
LNK: Data link
M/A: Data link mode

Troubleshooting with RUN, ERC, ERH and INS Indicators

The RUN, ERC, ERH and INS indicators can be used to check whether Controller Link Unit startup and Network participation are operating normally.

Note Be sure to turn off the power to the PLC before performing any of the following.

- Disconnecting the Unit or connectors.
- Securing Units or connectors.
- Setting hardware switches.

Indicators				Probable cause	Probable remedy
RUN	**ERC**	**ERH**	**INS**		
Lit	Not lit	Not lit	Lit	Unit operating normally; Network participation normal.	---
Not lit	Lit	---	---	Controller Link Unit faulty.	If the ERC indicators still lights when the Unit is mounted on another PLC, replace the Controller Link Unit.
Not lit	Not lit	Not lit	Not lit	Power is not being supplied correctly to the PLC.	Check the power supply voltage and supply at the recommended voltage.
				The Controller Link Unit has become loose.	Secure the Controller Link Unit firmly.
				The Controller Link Unit is mounted in the wrong slot.	Refer to *3-2-2 CVM1 and CV-series PLCs* and mount the Unit correctly.
				The Controller Link Unit is faulty.	If the indicators do not light when the Unit is mounted in another PLC, replace the Controller Link Unit.
Lit	Lit	---	Not lit	The node address is outside the setting range.	Reset the node address to within the 1 to 32 range.
				The same node address is being used by two different Units.	Reset so that each node address is used only once within the same Network.

Indicators				Probable cause	Probable remedy
RUN	ERC	ERH	INS		
Lit	---	Lit	---	Routing table setting error or a Routing Table Enable/Disable Bit setting error.	Remake and set the routing table correctly, referring to *7-4 Setting Routing Tables.* When no routing table is being used, set the Routing Table Enable/Disable Bit to OFF.
				The Unit is mounted to a non-compatible PLC.	Refer to *1-2-4 Controller Link Unit Models and PLCs* and reinstall the Unit on the appropriate PLC.
				An error has occurred in the PLC.	Refer to the PLC's operation manual and correct the error. If the error occurs again, replace the PLC.
				EEPROM error	Refer to *9-2 Status Area and Troubleshooting*, correct the data where the error has occurred, and reset the Unit. If the error occurs again, replace the Controller Link Unit.
				The unit number is not set in the range from 0 to 15.	Reset the Unit number to within a range of 0 to 15.
				The same unit number is set more than once for the same PLC.	Reset so that each unit number is set only once within the same PLC (including the Expansion CPU Backplane.)
				I/O tables have not been created for the PLC or they are faulty.	Create I/O tables for the PLC correctly.

Indicators				Probable cause	Probable remedy
RUN	ERC	ERH	INS		
Lit	---	---	Not lit	Terminating resistance is not set correctly.	Turn ON the terminating resistance at the nodes at both ends of the Network and turn it OFF at all other nodes.
				Cables are not connected correctly.	Check the cable connections are reconnect correctly.
				The node address is larger than the maximum node address set for the network parameters.	Either reset the maximum node address using the Controller Link Support Software or reset the node address to below the maximum.
				No other nodes exist.	Make sure that 2 or more nodes exist within the Network.
				No nodes have been set as polling nodes.	Refer to *8-1-2 Setting the Polling and Polled Nodes* and set at least one polling node. (Controller Link Units should normally be set as polling nodes.)
				The set baud rate is different to other nodes (Wired Unit).	Refer to *SECTION 4 Preparations for Communications* and set all nodes on the network to the same baud rate.

Troubleshooting with LNK and M/A Indicators

Data Link Cannot be Started

The following table describes the LNK and M/A indicators at the startup node and their use in troubleshooting when a data link cannot be started.

Starting a data link depends on the Controller Link Unit operating normally and participating in the Network. Refer to *Troubleshooting with RUN, ERC, ERH and INS Indicators* earlier in this section and check Unit operation before using the following table.

Indicators		Probable cause	Probable remedy
LNK	**M/A**		
Lit	---	Data link operating normally.	---
Flashing	---	There is an error in the data link tables.	When the ERH indicator is flashing, remake and set the data link tables.
		When manual setting is used, either data link tables have not been created for the startup node or there is an error in the data link tables.	Refer to *5-2-2 Manual Setting* and set data link tables for the startup node.
		When automatic setting is used, either the data link parameters for the startup node have not been set or there is an error in the data link tables.	Refer to *5-2-4 Automatic Setting* and set the automatic parameters for starting the data links.
Not lit	Lit	Manually set data links are already operating on the same Network.	Stop the manually set data links that are operating and restart the data links.
Not lit	Not lit	Automatically set data links are already operating on the same Network.	Stop the automatically set data links that are operating and restart the data links.
		There is an error in the startup node PLC.	Refer to the PLC's operation manual and correct the error. If the error reoccurs, replace the PLC.

Node Cannot Participate in Data Link

The following table describes the LNK and M/A indicators when a node cannot participate in the data links.

Data link participation depends on the Controller Link Unit operating normally and participating in the Network. Refer to *Troubleshooting with RUN, ERC, ERH and INS Indicators* earlier in this section and check Unit operation before using the following table.

Indicators		Probable cause	Probable remedy
LNK	M/A		
Lit	---	Data link operating normally.	---
Flashing	Lit	When manual setting is used, there is an error in the data link table.	Refer to *5-2-2 Manual Setting* and remake the data link table.
Flashing	Not lit	When automatic setting is used, the data link parameters at the startup node are incorrect for the local node (the data link area is out of range for the local node.)	Refer to *5-2-4 Automatic Setting: "Select All"*, reset the parameters for the startup node DM Area so that the local node can participate in the data link, and then restart the data link.
Not lit	Lit	When manual setting is used, there are no data link tables set for the local node.	Set data link tables for the local node.
Not lit	Not lit	When automatic setting is used, the startup node is not set to participate in the data links.	Stop the data links, remake and set the parameters in the startup node's DM Area, and then restart the data link.

Data Link Cannot be Stopped

Stopping the data link depends on the Controller Link Unit operating normally and participating in the Network. Read the above explanations before attempting to stop operation.

Note Stop the data link from the node at which the LNK indicator is lit (indicating active data links). Data links cannot be stopped from nodes which do not have active data links.

9-2 Status Area and Troubleshooting

The status of the Unit and the communications status of the Controller Link Unit is recorded in the Status Area of the PLC. The cause of errors can be found by searching the Status Area. The Status Area can be read using a Programming Console, the SYSMAC Support Software, or the Controller Link Support Software.

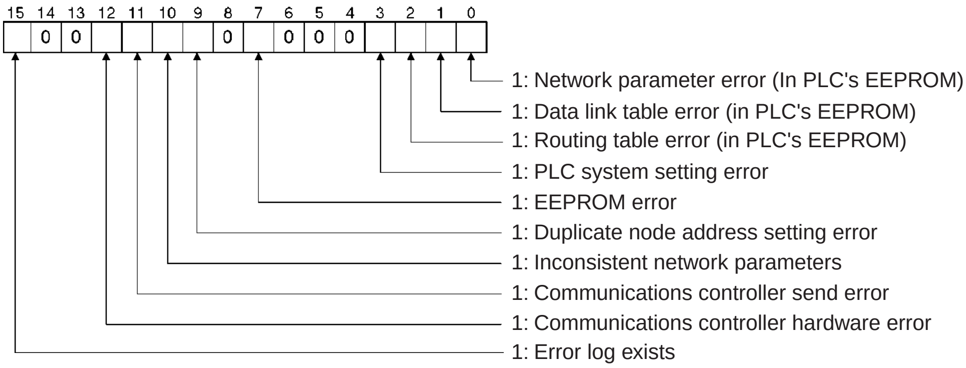
This section explains the contents of the Status Area and tells how to troubleshoot errors recorded there.

9-2-1 CS/CJ-series Controller Link Units

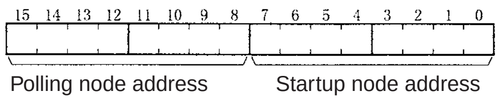
The status of the Unit and Network is indicated in the following manner in the PLC.

Status Area

Error Information:
CIO 1500 + 25 x (Unit No.)



Polling Node Address, Startup Node Address: CIO 1500 + 25 x (Unit No.) + 1



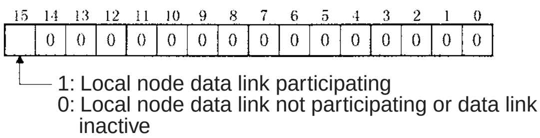
Each node address is displayed in 2-digit BCD.

Network Participation Status: CIO 1500 + 25 x (Unit No.) + 2, + 3

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+ 2	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
+ 3	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

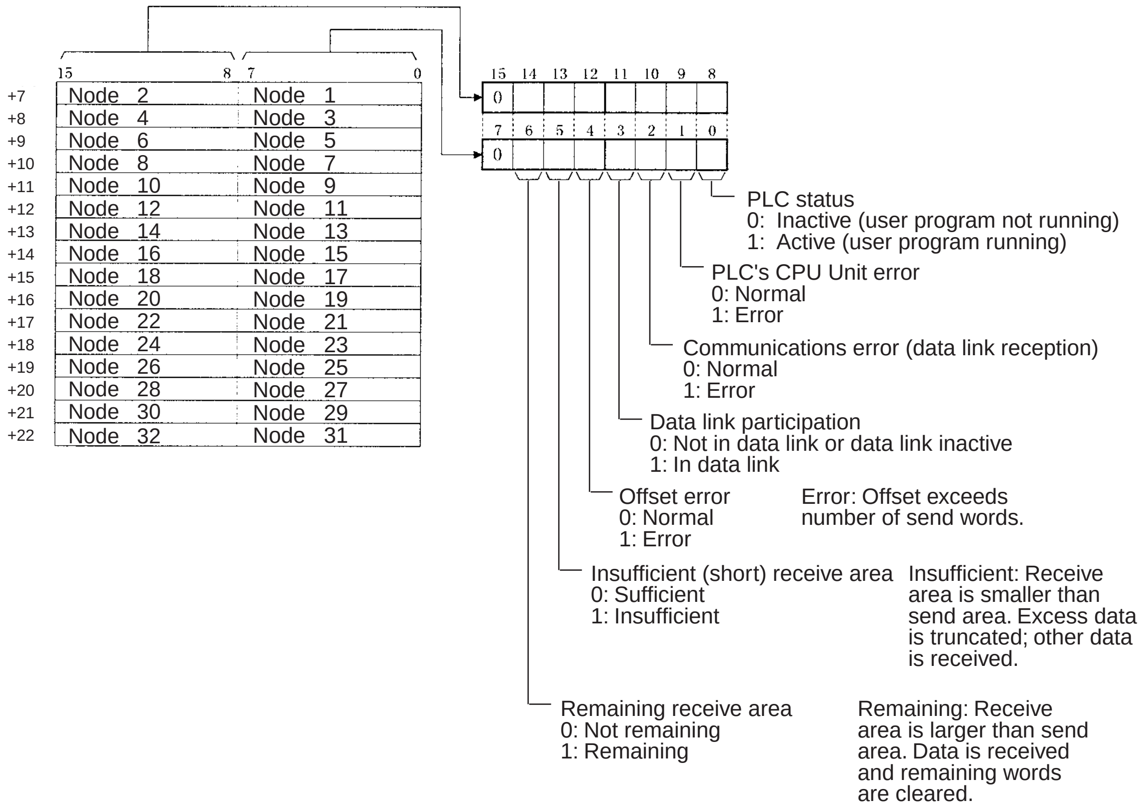
The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of the network
1: Part of the network

Local Data Link Participation Status: CIO 1500 + 25 x (Unit No.) + 6



Note Data link status is valid only when the local node is participating in the data link. Confirm that the Local Data Link Active Bit is ON before referencing the data link status.

Data Link Status: CIO 1500 + 25 x (Unit No.) + 7 to + 22



When the first data link status word is set to the default (0000) for either the manually set data link tables or automatically set data link tables (In the first data link status word parameter), the data link status is stored in the above area (CIO 1500 + 25 × (Unit No.) (+ 7 to +22)).

When a different area has been set for the first data link status word, the status is stored in the specified area. The status storage format is the same as the one shown in the above diagram.

Note Refer to *5-4 Checking Data Link Status* for details on status flags.

Bit Status and Error Processing

Data Link Status

Bit status	Probable cause	Probable remedy
PLC's CPU Unit error is 1: ON	A fatal PLC error, non-fatal PLC error, or a watchdog timer error has occurred.	Refer to the PLC's operation manual and correct the error. If the error occurs again, replace the PLC.
	The Unit is mounted to a non-compatible PLC.	Refer to *1-2-4 Controller Link Unit Models and PLCs* and mount onto the correct PLC.

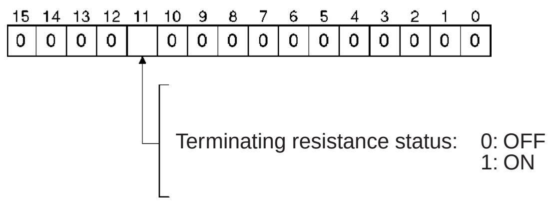
Bit status	Probable cause	Probable remedy
Communications error is 1: ON	The relevant node is not in the Network.	Enter the node in the Network.
	A communications error has occurred as a result of noise.	Conduct an echoback test using the Controller Link Support Software and if this does not correct the error, check the usage environment.
	A communications error has occurred.	Refer to page 228 *Troubleshooting with RUN, ERC, ERH and INS Indicators* and troubleshoot accordingly.
Data link participation is 0: OFF	The relevant node is not part of data links.	Enter the relevant node in data links. If an error occurs, refer to page 232 *Node Cannot Participate in Data Link* and troubleshoot accordingly.
	There are no active data links in the Network.	Activate the data links.
Offset error is 1: ON	The offset is greater than the number of send words at the relevant node.	Check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area insufficient (short) is 1: ON	The send area at the relevant node is larger than the receive area and some data cannot be received.	When the intention is not to receive all data, use as is (data that cannot be received will be read and discarded.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area remaining is 1: ON	The send area at the relevant node is smaller than the receive area and some of the area will be unused.	When the intention is to leave some space in the receive area, use as is (the surplus receive area will be cleared to 0.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.

Other Status

Bit status	Probable cause	Probable remedy
Error log exists (CIO 1500 + 25 × n, bit 15) is 1: ON	Error information on the Controller Link Unit (an error log) has been recorded.	Using the Controller Link Support Software or an FINS command, read the cause of the current error. Alternatively, use past error log records to troubleshoot the problem.
Communications controller send error (CIO 1500 + 25 × n, bit 11) is 1: ON	The Controller Link Unit is faulty.	Replace the Controller Link Unit.
Inconsistent network parameters (CIO 1500 + 25 × n, bit 10) is 1: ON	Indicates that the network parameters recorded in the CS/CJ Bus Unit Area differ from the values of the Network in use.	Check the network parameters on the Network in use using the Controller Link Support Software, and reset necessary parameters.
Node address duplicate setting error (CIO 1500 + 25 × n, bit 9) is 1: ON	The same node address has been used more than once.	Reset so that each node address is used only once within the same Network.
EEPROM error (CIO 1500 + 25 × n, bit 7) is 1: ON	An error has occurred while writing data to the CPU Unit's EEPROM.	Check the status of bits 00 to 02 in (CIO 1500 + 25 × n, and correct any problems found. If the error occurs again, replace the CPU Unit.
PLC system setting error (CIO 1500 + 25 × n, bit 3) is 1: ON	The CPU Unit's EEPROM data is damaged.	Check the status of bits 00 to 02 in (CIO 1500 + 25 × n, and correct any problems found. If the error occurs again, replace the CPU Unit.
	The PLC is protected.	Set the PLC's protect switch to OFF.
Routing table error (CIO 1500 + 25 × n, bit 2) is 1: ON	The routing table data within the CPU Unit's EEPROM is damaged.	Refer to *7-4 Setting Routing Tables* and reset the routing tables correctly. If the error occurs again, replace the Controller Link Unit.
	There is an error in the routing table setting.	When using a routing table, refer to *7-4 Setting Routing Tables* and reset the routing tables correctly. If no routing tables are being used, delete the tables.

Bit status	Probable cause	Probable remedy
Data link table error (CIO 1500 + 25 × n, bit 1) is 1: ON	The data link table data in the CS/CJ CPU Bus Unit Area is damaged.	Refer to *5-3 Starting and Stopping Data Links* and reset the data link tables correctly. If the error occurs again, replace the CPU Unit.
	There is an error in the data link table settings.	When using manually set data links, refer to *5-3 Starting and Stopping Data Links* and remake and set the data link tables correctly. When manually set data links are not being used, delete the data link tables.
Network parameter error (CIO 1500 + 25 × n, bit 0) is 1: ON	The network parameter data in the CS/CJ CPU Bus Unit Area is damaged.	Refer to *8-1-3 Network Parameters* and reset the data correctly. If the error occurs again, replace the CPU Unit.
		Either set the EEPROM Clear Bit in the DM parameter area to ON, or use the Initialize network parameters operation on the Maintenance Menu of the Controller Link Support Software to initialize the network parameters and then cycle the power supply.
	There is an error in the network parameter settings, or node address of the local node is larger then the maximum address set within the network parameters.	Refer to *8-1-3 Network Parameters* and reset the network parameters or the node address.

Terminating Resistance Status: CIO 1500 + 25 x (Unit No.) + 24

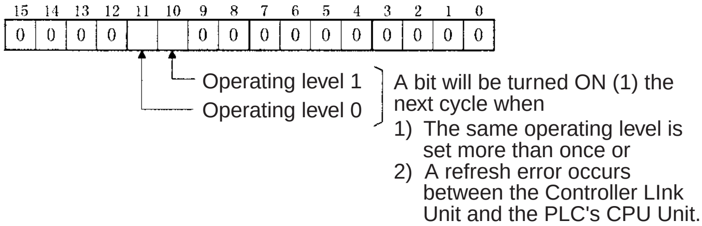


9-2-2 C200HX/HG/HE Controller Link Units

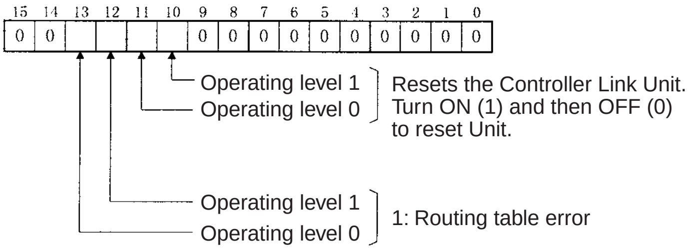
The status of the Unit and Network is indicated in the following manner in the PLC.

Status Area

Duplicate Operating Levels/Refresh Error: AR 00



Routing Table Error/Unit Restart Bits: AR 01



Network Participation Status: AR 08, AR 09, AR 12, AR 13

Operating level 0
AR 08
AR 09

Operating level 1
AR 12
AR 13

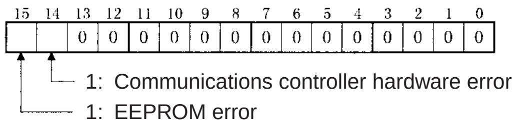
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of network
1: Part of network

Communications Controller Hardware Error, EEPROM Error: AR 11, AR 15

Operating level 0
AR 11

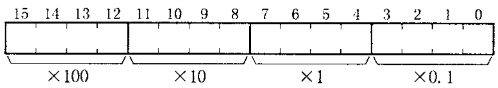
Operating level 1
AR 15



Service Time: AR 16, AR 17

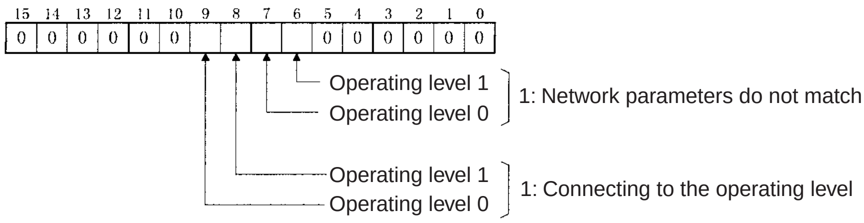
Operating level 0
AR 16

Operating level 1
AR 17

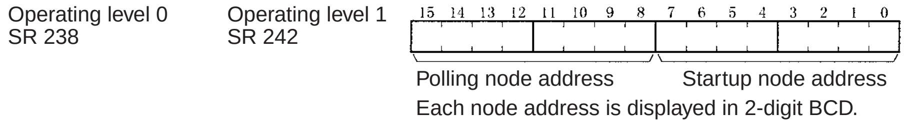


The service time for each PLC cycle is calculated by the PLC and displayed in 0.1-ms units in 4-digit BCD.

Operating Level Connection Status, Inconsistent Network Parameters: AR 24

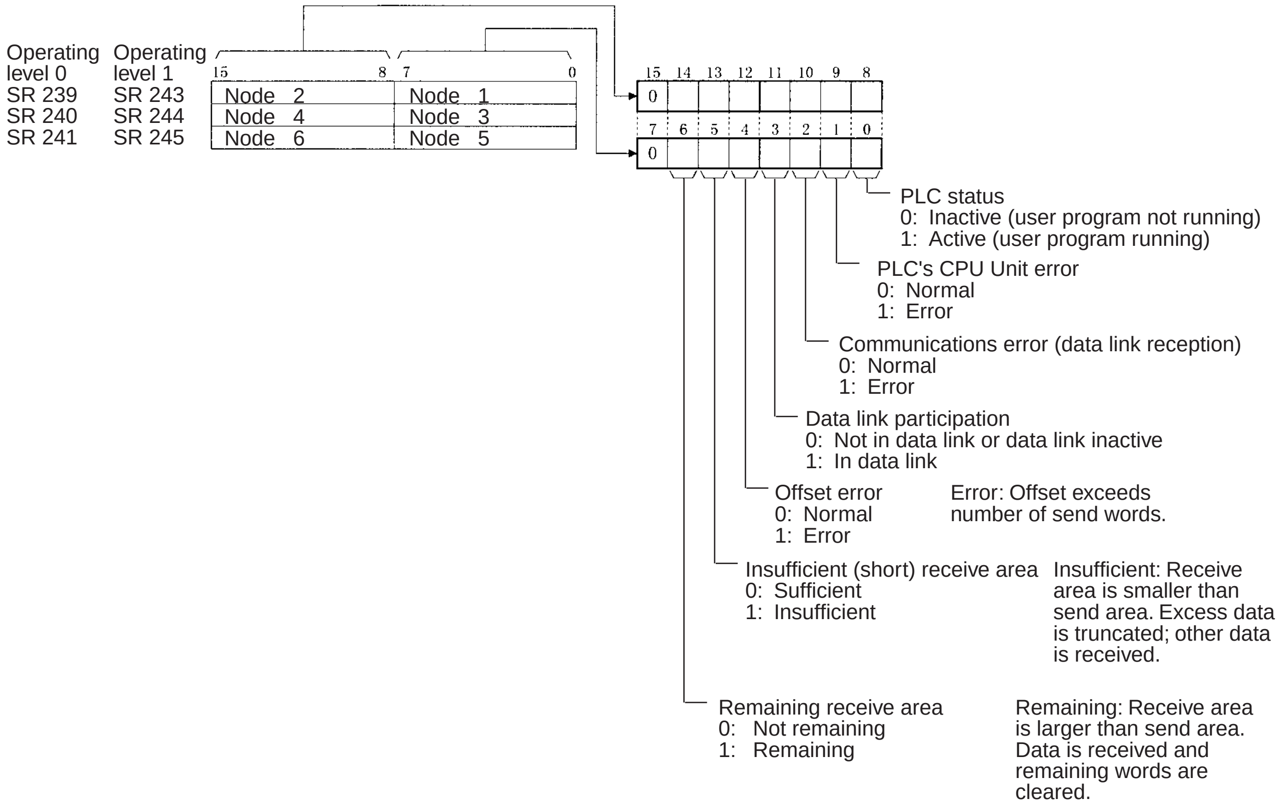


Polling Node Address, Startup Node Address: SR 238, SR 242

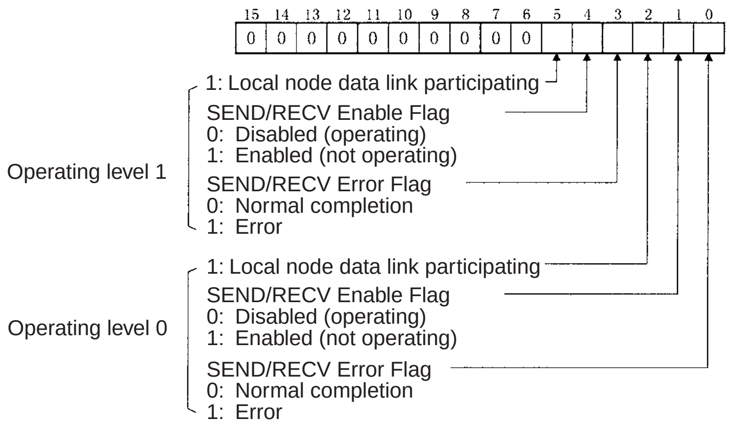


Data Link Status: SR 239 to SR 241, SR 243 to SR 245

When the data link status stored in the start word for the manual setting data link table or automatic setting data link parameters is not set or is set to 0, the data link status of only node addresses 1 to 6 will be displayed in the following area.

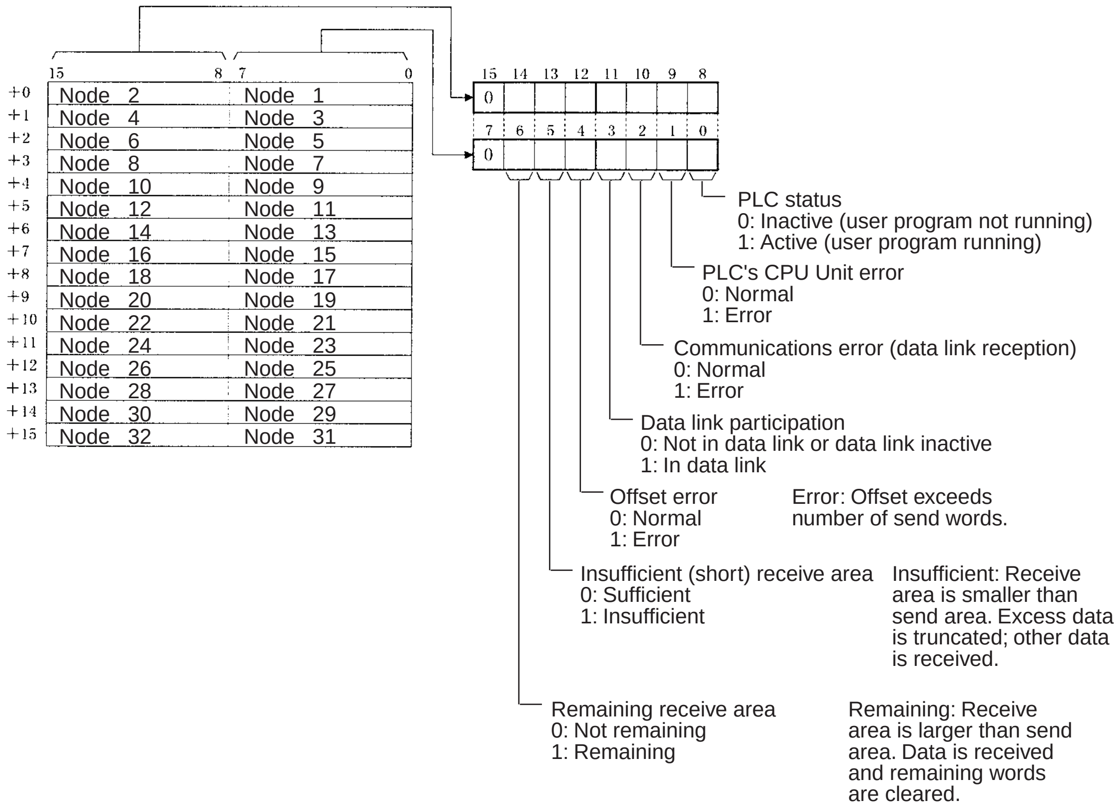


Operating Level Status: SR 252



Note Data link status is valid only when the local node is participating in the data link. Confirm that the local node's data links are active in the operating level status in SR 252 before referencing the data link status.

Data Link Status: First Data Link Status Word + 0 to + 15



Note Refer to *5-4 Checking Data Link Status* for details on status flags.

Troubleshooting with Status Flags

Data Link Status

Bit status	Probable cause	Probable remedy
PLC's CPU Unit error is 1: ON	A fatal PLC error, non-fatal PLC error, or a watchdog timer error has occurred.	Refer to the PLC's operation manual and correct the error. If the error occurs again, replace the PLC.
	The Unit is mounted to a non-compatible PLC.	Refer to *1-2-4 Controller Link Unit Models and PLCs* and mount onto the correct PLC.
Communications error is 1: ON	The relevant node is not in the Network.	Enter the node in the Network.
	A communications error has occurred as a result of noise.	Conduct an echoback test using the Controller Link Support Software and if this does not correct the error, check the usage environment.
	A communications error has occurred.	Refer to page 220 *Troubleshooting with RUN, ERC, ERH and INS Indicators* and troubleshoot accordingly.

Bit status	Probable cause	Probable remedy
Data link participation is 0: OFF	The relevant node is not part of data links.	Enter the relevant node in data links. If an error occurs, refer to page 223 *Node Cannot Participate in Data Link* and troubleshoot accordingly.
	There are no active data links in the Network.	Activate the data links.
Offset error is 1: ON	The offset is greater than the number of send words at the relevant node.	Check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area insufficient (short) is 1: ON	The send area at the relevant node is larger than the receive area and some data cannot be received.	When the intention is not to receive all data, use as is (data that cannot be received will be read and discarded.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area remaining is 1: ON	The send area at the relevant node is smaller than the receive area and some of the area will be unused.	When the intention is to leave some space in the receive area, use as is (the remaining receive area will be cleared to 0.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.

Other Status

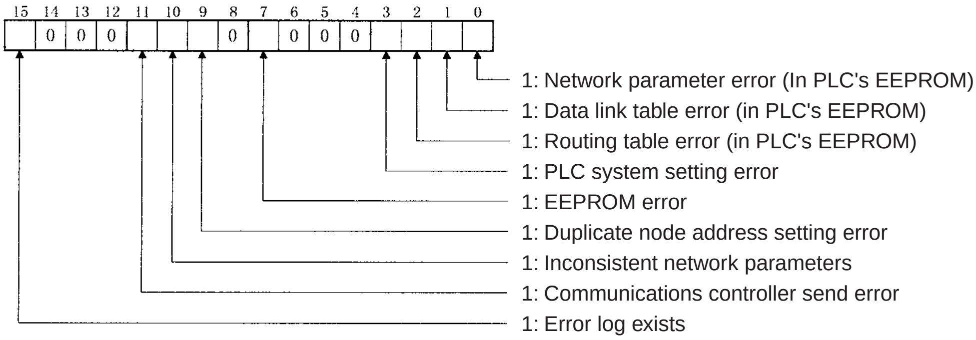
Bit status	Probable cause	Probable remedy
Duplicate Operating Levels/Refresh Error: Operating level 0: AR0011 Operating level 1: AR0010 One of the above flags is 1: ON	The same operating level is set twice within the same PLC.	If two units are required, set them to different operating levels.
	A refresh error has occurred between the PLC and the Unit.	Secure the Controller Link Unit firmly. For C200HX/HG/HE PLCs, tighten the screws on the Bus Connection Unit. If the error occurs even when the Unit is mounted on another PLC, replace the Controller Link Unit.
Routing Table Error/Unit Restart: Operating level 0: AR0113 Operating level 1: AR0112 One of the above flags is 1: ON	The routing table data within the DM Area is damaged.	Refer to *7-4 Setting Routing Tables* and reset correctly. If the error occurs again, replace the Controller Link Unit.
	There is an error in the routing table setting or a Routing Table Enable Bit (software switch) setting error.	When using routing tables refer to *7-4 Setting Routing Tables* and reset them correctly. When no routing tables are being used, turn OFF the Routing Table Enable Flag.
Communications controller hardware error: Operating level 0: AR1114 Operating level 1: AR1514 One of the above flags is 1: ON	The Controller Link Unit is faulty.	Replace the Controller Link Unit.
EEPROM error: Operating level 0: AR1115 Operating level 1: AR1515 One of the above flags is 1: ON	An error occurred when writing data to EEPROM.	Remake and set the data link table and the network parameters. If the error occurs again, replace the Controller Link Unit.
	The EEPROM data link tables or the network parameters are damaged.	
	There is an error in the data link or network parameter settings.	
Inconsistent network parameters: Operating level 0: AR2407 Operating level 1: AR2406 One of the above flags is 1: ON	Indicates that the network parameters in the EEPROM of the Controller Link Unit differ from those in the Network.	Check the network parameters on the Network, using the Controller Link Support Software, and reset the necessary parameters.

9-2-3 CVM1 and CV-series Controller Link Units

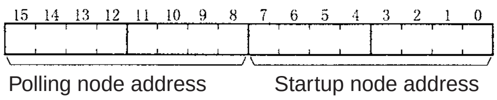
The status of the Unit and Network is indicated in the following manner in the PLC.

Status Area

Error Information: CIO 1500 + 25 x (Unit No.)



Polling Node Address, Startup Node Address: CIO 1500 + 25 x (Unit No.) + 1



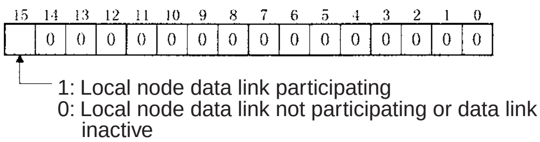
Each node address is displayed in 2-digit BCD.

Network Participation Status: CIO 1500 + 25 x (Unit No.) + 2, + 3

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+ 2	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
+ 3	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

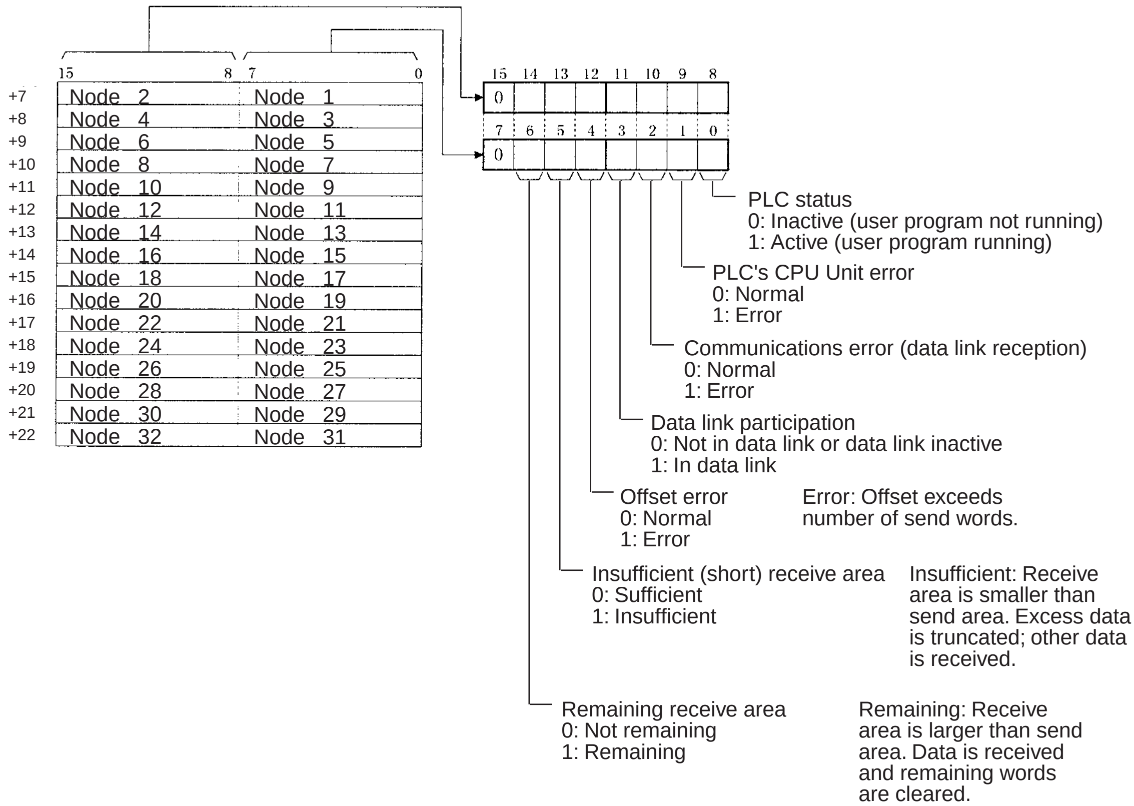
The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of the network
1: Part of the network

Local Data Link Participation Status: CIO 1500 + 25 x (Unit No.) + 6



Note Data link status is valid only when the local node is participating in the data link. Confirm that the Local Data Link Active Bit is ON before referencing the data link status.

Data Link Status: CIO 1500 + 25 x (Unit No.) + 7 to + 22



When the first data link status word is set to the default (0000) for either the manually set data link tables or automatically set data link tables (In the first data link status word parameter), the data link status is stored in the above area (CIO 1500 + 25 × (Unit No.) (+ 7 to +22)).

When a different area has been set for the first data link status word, the status is stored in the specified area. The status storage format is the same as the one shown in the above diagram.

Note Refer to *5-4 Checking Data Link Status* for details on status flags.

Bit Status and Error Processing

Data Link Status

Bit status	Probable cause	Probable remedy
PLC's CPU Unit error is 1: ON	A fatal PLC error, non-fatal PLC error, or a watchdog timer error has occurred.	Refer to the PLC's operation manual and correct the error. If the error occurs again, replace the PLC.
	The Unit is mounted to a non-compatible PLC.	Refer to *1-2-4 Controller Link Unit Models and PLCs* and mount onto the correct PLC.

Bit status	Probable cause	Probable remedy
Communications error is 1: ON	The relevant node is not in the Network.	Enter the node in the Network.
	A communications error has occurred as a result of noise.	Conduct an echoback test using the Controller Link Support Software and if this does not correct the error, check the usage environment.
	A communications error has occurred.	Refer to page 228 *Troubleshooting with RUN, ERC, ERH and INS Indicators* and troubleshoot accordingly.
Data link participation is 0: OFF	The relevant node is not part of data links.	Enter the relevant node in data links. If an error occurs, refer to page 232 *Node Cannot Participate in Data Link* and troubleshoot accordingly.
	There are no active data links in the Network.	Activate the data links.
Offset error is 1: ON	The offset is greater than the number of send words at the relevant node.	Check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area insufficient (short) is 1: ON	The send area at the relevant node is larger than the receive area and some data cannot be received.	When the intention is not to receive all data, use as is (data that cannot be received will be read and discarded.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area remaining is 1: ON	The send area at the relevant node is smaller than the receive area and some of the area will be unused.	When the intention is to leave some space in the receive area, use as is (the surplus receive area will be cleared to 0.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.

Other Status

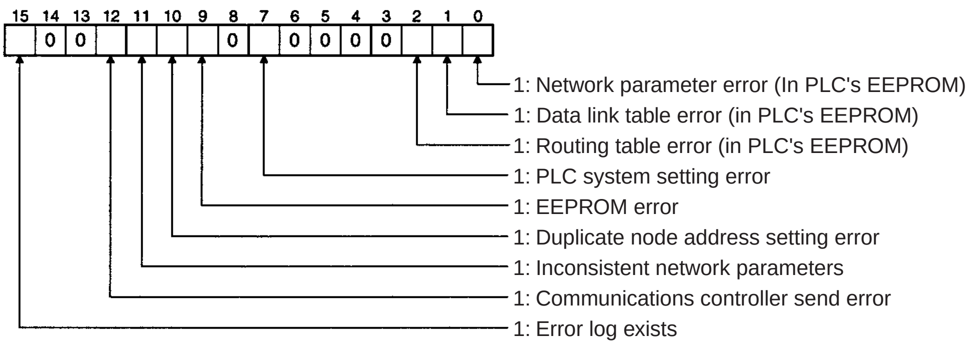
Bit status	Probable cause	Probable remedy
Error log exists (CIO 1500 + 25 $\times$ n, bit 15) is 1: ON	Error information on the Controller Link Unit (an error log) has been recorded.	Using the Controller Link Support Software or an FINS command, read the cause of the current error. Alternatively, use past error log records to troubleshoot the problem.
Communications controller send error (CIO 1500 + 25 $\times$ n, bit 11) is 1: ON	The Controller Link Unit is faulty.	Replace the Controller Link Unit.
Inconsistent network parameters (CIO 1500 + 25 $\times$ n, bit 10) is 1: ON	Indicates that the network parameters recorded in the CPU Unit's EEPROM differ from the values of the Network in use.	Check the network parameters on the Network in use using the Controller Link Support Software, and reset necessary parameters.
Node address duplicate setting error (CIO 1500 + 25 $\times$ n, bit 9) is 1: ON	The same node address has been used more than once.	Reset so that each node address is used only once within the same Network.
EEPROM error (CIO 1500 + 25 $\times$ n, bit 7) is 1: ON	An error has occurred while writing data to the CPU Unit's EEPROM.	Check the status of bits 00 to 02 in (CIO 1500 + 25 $\times$ n, and correct any problems found. If the error occurs again, replace the CPU Unit.
PLC system setting error (CIO 1500 + 25 $\times$ n, bit 3) is 1: ON	The CPU Unit's EEPROM data is damaged.	Check the status of bits 00 to 02 in (CIO 1500 + 25 $\times$ n, and correct any problems found. If the error occurs again, replace the CPU Unit.
	The PLC is protected.	Set the PLC's protect switch to OFF.
Routing table error (CIO 1500 + 25 $\times$ n, bit 2) is 1: ON	The routing table data within the CPU Unit's EEPROM is damaged.	Refer to *7-4 Setting Routing Tables* and reset the routing tables correctly. If the error occurs again, replace the Controller Link Unit.
	There is an error in the routing table setting.	When using a routing table, refer to *7-4 Setting Routing Tables* and reset the routing tables correctly. If no routing tables are being used, delete the tables.

Bit status	Probable cause	Probable remedy
Data link table error (CIO 1500 + 25 × n, bit 1) is 1: ON	The data link table data in the EEPROM of the CPU Unit is damaged.	Refer to *5-3 Starting and Stopping Data Links* and reset the data link tables correctly. If the error occurs again, replace the CPU Unit.
	There is an error in the data link table settings.	When using manually set data links, refer to *5-3 Starting and Stopping Data Links* and remake and set the data link tables correctly. When manually set data links are not being used, delete the data link tables.
Network parameter error (CIO 1500 + 25 × n, bit 0) is 1: ON	The CPU Unit's EEPROM data link tables or the network parameters are damaged.	Refer to *8-1-3 Network Parameters* and reset the data correctly. If the error occurs again, replace the CPU Unit.
		Either set the EEPROM Clear Bit in the DM parameter area to ON, or use the Initialize network parameters operation on the Maintenance Menu of the Controller Link Support Software to initialize the network parameters and then cycle the power supply.
	There is an error in the network parameter settings, or node address of the local node is larger then the maximum address set within the network parameters.	Refer to *8-1-3 Network Parameters* and reset the network parameters or the node address.

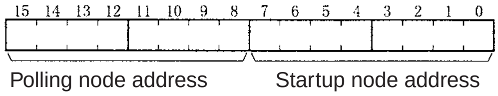
9-2-4 CQM1H-series Controller Link Units

Status Area

Error Information: IR 190



Polling Node Address, Startup Node Address: IR 191



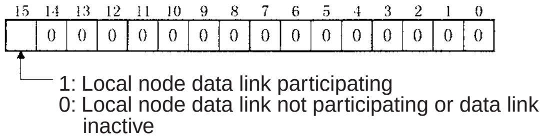
Each node address is displayed in 2-digit BCD.

Network Participation Status: IR 192 and IR 193

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
IR 192	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
IR 193	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of the network
1: Part of the network

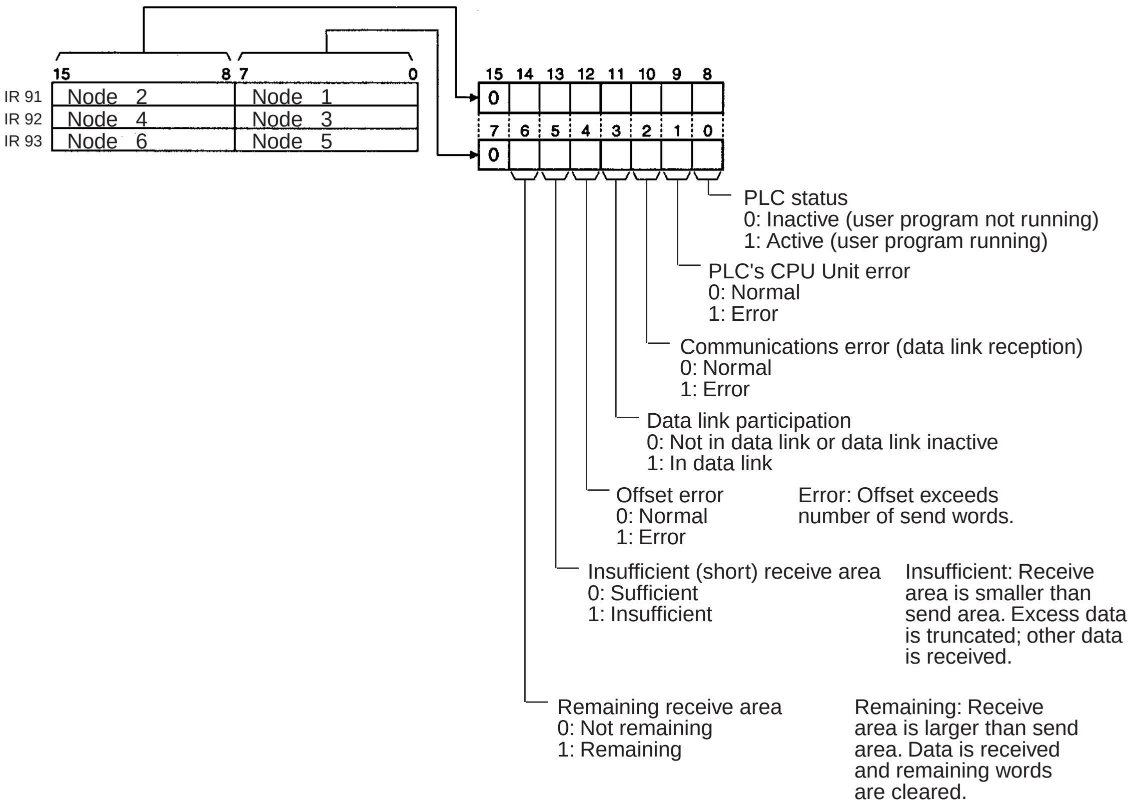
Local Data Link Participation Status: IR 90



Note Data link status is valid only when the local node is participating in the data link. Confirm that the Local Data Link Active Bit is ON before referencing the data link status.

Data Link Status: IR 91 to IR 93

When the first data link status word is not set or is set to the default (0000) for either the manually set data link tables or automatically set data link tables, the data link status is stored in the following words for nodes 1 to 6 only.



Note Refer to *5-4 Checking Data Link Status* for details on status flags.

Bit Status and Error Processing

Data Link Status

Bit status	Probable cause	Probable remedy
PLC's CPU Unit error is 1: ON	A fatal PLC error, non-fatal PLC error, or a watchdog timer error has occurred.	Refer to the PLC's operation manual and correct the error. If the error occurs again, replace the PLC.
	The Unit is mounted to a non-compatible PLC.	Refer to *1-2-4 Controller Link Unit Models and PLCs* and mount onto the correct PLC.
Communications error is 1: ON	The relevant node is not in the Network.	Enter the node in the Network.
	A communications error has occurred as a result of noise.	Conduct an echoback test using the Controller Link Support Software and if this does not correct the error, check the usage environment.
	A communications error has occurred.	Refer to page 228 *Troubleshooting with RUN, ERC, ERH and INS Indicators* and troubleshoot accordingly.
Data link participation is 0: OFF	The relevant node is not part of data links.	Enter the relevant node in data links. If an error occurs, refer to page 232 *Node Cannot Participate in Data Link* and troubleshoot accordingly.
	There are no active data links in the Network.	Activate the data links.
Offset error is 1: ON	The offset is greater than the number of send words at the relevant node.	Check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.

Bit status	Probable cause	Probable remedy
Receive area insufficient (short) is 1: ON	The send area at the relevant node is larger than the receive area and some data cannot be received.	When the intention is not to receive all data, use as is (data that cannot be received will be read and discarded.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area remaining is 1: ON	The send area at the relevant node is smaller than the receive area and some of the area will be unused.	When the intention is to leave some space in the receive area, use as is (the surplus receive area will be cleared to 0.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.

Other Status

Bit status	Probable cause	Probable remedy
Error log exists (IR 19015) is 1: ON	Error information on the Controller Link Unit (an error log) has been recorded.	Using the Controller Link Support Software or an FINS command, read the cause of the current error. Alternatively, use past error log records to troubleshoot the problem.
Communications controller send error (IR 19011) is 1: ON	The Controller Link Unit is faulty.	Replace the Controller Link Unit.
Inconsistent network parameters (IR 19010) is 1: ON	Indicates that the network parameters recorded in the CPU Unit's EEPROM differ from the values of the Network in use.	Check the network parameters on the Network in use using the Controller Link Support Software, and reset necessary parameters.
Node address duplicate setting error (IR 19009) is 1: ON	The same node address has been used more than once.	Reset so that each node address is used only once within the same Network.
EEPROM error (IR 19007) is 1: ON	An error has occurred while writing data to the CPU Unit's EEPROM.	Check the status of bits IR 19000 to IR 19002 and correct any problems found. If the error occurs again, replace the CPU Unit.
PLC system setting error (IR 19003) is 1: ON	The EEPROM data is damaged.	Check the status of bits IR 19000 to IR 19002 and correct any problems found. If the error occurs again, replace the CPU Unit.
Routing table error (IR 19002) is 1: ON	The routing table data within the CPU Unit's EEPROM is damaged.	Refer to *7-4 Setting Routing Tables* and reset the routing tables correctly. If the error occurs again, replace the Controller Link Unit.
	There is an error in the routing table setting.	When using a routing table, refer to *7-4 Setting Routing Tabless* and reset the routing tables correctly. If no routing tables are being used, delete the tables.
Data link table error (IR 19001) is 1: ON	The data link table data in the EEPROM of the CPU Unit is damaged.	Refer to *5-3 Starting and Stopping Data Links* and reset the data link tables correctly. If the error occurs again, replace the CPU Unit.
	There is an error in the data link table settings.	When using manually set data links, refer to *5-3 Starting and Stopping Data Links* and remake and set the data link tables correctly. When manually set data links are not being used, delete the data link tables.

Bit status	Probable cause	Probable remedy
Network parameter error (IR 19000) is 1: ON	The CPU Unit's EEPROM data link tables or the network parameters are damaged.	Refer to *8-1-3 Network Parameters* and reset the data correctly. If the error occurs again, replace the CPU Unit.
		Either set the EEPROM Clear Bit in the DM parameter area to ON, or use the Initialize network parameters operation on the Maintenance Menu of the Controller Link Support Software to initialize the network parameters and then cycle the power supply.
	There is an error in the network parameter settings, or node address of the local node is larger then the maximum address set within the network parameters.	Refer to *8-1-3 Network Parameters* and reset the network parameters or the node address.

Terminating Resistance Status: IR 95

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

Bit 11: Terminating resistance status: 0: OFF
1: ON

9-3 Error Log

The error log records errors that occur in the Controller Link Unit and the time they occur. The error log can be read or cleared by using Programming Devices, such as the Controller Link Support Software, the CX-Programmer, or the SYSMAC Support Software, or by using the message service (FINS commands for the Controller Link Unit.)

9-3-1 Error Log Table

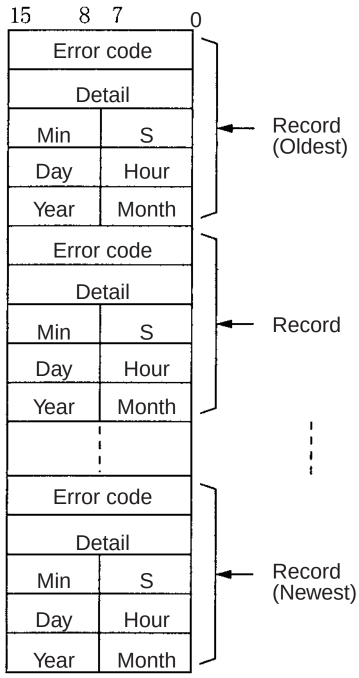
Errors are recorded in an error log table in the Unit's RAM, with one record for each error and a maximum of 39 records.

Errors of significance are also recorded in the Unit's EEPROM so that when the power to the Unit is turned OFF or reset, a record of the error will remain. (The error log table in EEPROM automatically reads the Unit's RAM when the power is turned ON again.)

Item	Specification
No. of records	39 max.
Data code	Binary (Times are in BCD)
Length of each record	10 bytes
Configuration of records	Error code: 2 bytes (Refer to page 254) Detail code: 2 bytes (Refer to page 254) Time: 6 bytes (Refer to the following page)
Record order	From the oldest record to the most recent.

If the number of records exceeds 39, the oldest record will be deleted and the most recent error recorded.

Error Log Table Configuration



Time Information

The time is recorded in BCD with one byte each for the year (the rightmost two digits), month, day, hour, seconds, and minutes of the time the error occurred.

Note
1. The PLC's time information can be read and used in the Controller Link Unit. When the time cannot be read from the PLC, all error log times will but 0. This can occur for PLC startup errors, Unit No. errors, CPU Unit errors, or PLC model errors. When error logs like these are read from the Controller Link Support Software, they will be dated 0 s, 0 min, 0 hr, 0 day, 0 month, 2000.
2. When replacing the battery for CS/CJ-series PLCs, it will be necessary to switch the power supply ON and reset the internal clock.
   If the internal clock is not reset, time information in the error log will not be recorded correctly.
3. The time information will be all zeros for CQM1H-series PLCs unless a Memory Cassette with a clock is mounted in the CPU Unit. The time information will be all zeros in the year 2000 if it is read from Support Software.

9-3-2 Error Codes

The following table lists the error codes (in 4-digit hexadecimal) and the contents of the errors.

Error code	Contents	Detail code		Correction	Written to EEPROM	Applicable PLC
		1st byte	2nd byte			
0001 Hex	PLC watchdog timer error	00 Hex	00 Hex	Replace PLC's CPU Unit.	Yes	All
0002 Hex	PLC service monitor error	Monitor time (unit: ms)		Check operating environment.	Yes	CV, CS/CJ
0003 Hex	PLC shared RAM error	01 Hex: Cyclic 02 Hex: Event 04 Hex: CPU bus link	00 Hex	Check operating environment.	Yes	CV
0004 Hex	CPU Bus Unit ID number error	00 Hex	00 Hex	Check I/O Connecting Cables.	Yes	CV, CS/CJ
0005 Hex	Unit number error	Unit set value	The value recognized by the CPU Unit	Check the Unit number setting. Recreate the I/O table.	Yes	CV
0006 Hex	CPU Unit error	Bit 11: No relevant Unit in I/O table. Bit 12: Hardware test unit number recognized. Bit 13: Incorrect unit number. Bit 14: Duplicated unit number.		Check the Unit number settings. Recreate the I/O table.	Yes	CV, CS/CJ
000D Hex	PLC model error	Not set		Refer to *1-2-4 Controller Link Unit Models and PLCs and PLCs* and check the PLC model.	Yes	C200HX/HG/HE
000E Hex	I/O Bus error	00 Hex fixed	00 Hex fixed	Check the operating environment.	Yes	CS/CJ
000F Hex	PLC initialization error			Check the operating environment.	Yes	CS/CJ
0010 Hex	PLC Setup exceeds capacity			Reduce the number of CPU Bus Units mounted on each CPU Unit by one.	Yes	CS/CJ
0011 Hex	PLC initialization error (Time out)			Check the operating environment.	Yes	CS/CJ
0012 Hex	CPU Unit memory error	01 Hex: Read error 02 Hex: Write error	01 Hex: Data link table 02 Hex: Network parameters 03 Hex: Routing table 04 Hex: PLC Setup Area	Reset the appropriate data.	Yes	CS/CJ
0013 Hex	CPU Unit write-protected			Release the CPU Unit write protect.	Yes	CS/CJ

<table>
<tr><th rowspan="2">Error code</th><th rowspan="2">Contents</th><th colspan="2">Detail code</th><th rowspan="2">Correction</th><th rowspan="2">Written to EEPROM</th><th rowspan="2">Applicable PLC</th></tr>
<tr><th>1st byte</th><th>2nd byte</th></tr>
<tr><td>0101 Hex</td><td>Transmission failed; local node not in Network</td><td colspan="2" rowspan="7">Command block
Bits 0 to 7:
Source node address
Bits 8 to 14:
Source Network address
Bit 15:
OFF
Response block
Bits 0 to 7:
Destination node address
Bits 8 to 14:
Destination Network address
Bit 15:
ON
(1st byte: bits 8 to 15; 2nd byte, bits 0 to 7)</td><td>Refer to page 220 Troubleshooting Using Indicators and place the local node into Network.</td><td>No</td><td>All</td></tr>
<tr><td>0103 Hex</td><td>Transmission failed; retry count exceeded</td><td>Using the Controller Link Support Software or FINS commands, run echoback test and check operating environment if errors occur.</td><td>No</td><td>All</td></tr>
<tr><td>0104 Hex</td><td>Transmission failed; maximum number of frames exceeded.</td><td>Reduce the number of events per communications cycle or increase the maximum number of network parameter frames.</td><td>No</td><td>All</td></tr>
<tr><td>0105 Hex</td><td>Transmission failed; node address incorrect</td><td>Refer to 4-2 CJ-series Controller Link Unitsor 4-4 CVM1 and CV-series Controller Link Units and check node address settings to be sure they are within range and unique.</td><td>No</td><td>All</td></tr>
<tr><td>0106 Hex</td><td>Transmission failed; redundant node address</td><td>Correct node addresses so that they are unique within the same Network.</td><td>No</td><td>All</td></tr>
<tr><td>0107 Hex</td><td>Transmission failed; destination node not in Network</td><td>Refer to 9-1 Troubleshooting Using Indicators and place destination node into Network.</td><td>No</td><td>All</td></tr>
<tr><td>0108 Hex</td><td>Transmission failed; specified Unit does not exist</td><td>Refer to 4-4 CVM1 and CV-series Controller Link Units and check unit address and unit number of destination.</td><td>No</td><td>All</td></tr>
</table>

Error code	Contents	Detail code		Correction	Written to EEPROM	Applicable PLC
		1st byte	2nd byte			
0109 Hex	Transmission failed; destination busy	**Command block** Bits 0 to 7: Source node address Bits 8 to 14: Source Network address Bit 15: OFF **Response block** Bits 0 to 7: Destination node address Bits 8 to 14: Destination Network address Bit 15: ON (1st byte: bits 8 to 15; 2nd byte, bits 0 to 7)		Increase number of retries or reconfigure system to distribute load.	No	All
010A Hex	Transmission failed; communications controller error			Conduct an echo-back test and if the effects of noise are considerable, reconsider the operating environment. Restart the Controller Link Unit. If the error occurs again, replace the Unit.	Yes	All
010B Hex	Transmission failed; PLC error			Refer to the PLC operating manual. If the error occurs again, replace the PLC.	No	All
010C Hex	Transmission failed; unit number incorrect			Check unit number settings to be sure they are within range and unique.	No	CV, CS/CJ
010D Hex	Transmission failed; destination address incorrect			Check routing tables.	No	All
010E Hex	Transmission failed; routing tables not registered			Check routing tables	No	All
010F Hex	Transmission failed; routing table error			Check routing tables.	No	All
0110 Hex	Transmission failed; too many relay points			Check routing tables and system configuration. Do not try to access Networks separated by more than one other Network.	No	All
0111 Hex	Transmission failed; command packet too long			Be sure to use the FINS command format.	No	All
0112 Hex	Transmission failed; header error.			Be sure to use the correct FINS command format.	No	All
0113 Hex	Transmission failed; I/O setting error			Check I/O table accuracy.	No	CV, CS/CJ
0114 Hex	Transmission failed; CPU bus error			Check Unit and cable connections and clear error.	No	CV, CS/CJ
0115 Hex	Transmission failed; redundant I/O allocations			Check unit numbers for redundancy within the same PLC.	No	CV, CS/CJ
0116 Hex	Transmission failed; CPU Bus Unit error			Check Unit and cable connections and clear error.	No	CV, CS/CJ

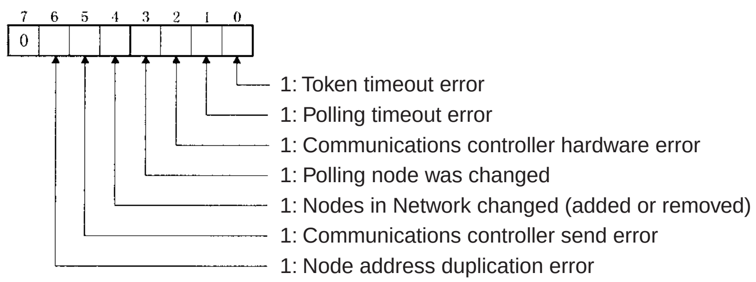
Error code	Contents	Detail code 1st byte	Detail code 2nd byte	Correction	Written to EEPROM	Applicable PLC
0117 Hex	Internal buffer full	**Command block** Bits 0 to 7: Source node address Bits 8 to 14: Source Network address Bit 15: OFF **Response block** Bits 0 to 7: Destination node address Bits 8 to 14: Destination Network address Bit 15: ON (1st byte: bits 8 to 15; 2nd byte, bits 0 to 7)		Increase number of retries or reconfigure system to distribute load.	No	All
0118 Hex	Illegal packet discarded			Check for nodes sending illegal packets.	Yes	All
0203 Hex	EEPROM error	01 Hex: Read error 02: Hex: Write error	01 Hex: Data link tables 02 Hex: Network parameters 03 Hex: Routing tables	For CVM1 and CV-series PLCs, check that the PLC is not protected. Remake and set the relevant data. If the error occurs again for the CVM1 and CV-series, replace the CPU Unit and for the C200HX/HG/HE PLCs, replace the Controller Link Unit.	Yes	C200HX/HG/HE, CV, CQM1H
0206 Hex	Number of participating nodes decreased (local node still participating)	Network parameters maximum node address	Number of non-participating nodes	Check network parameters, node participation, cables, and terminating resistance.	No	All
0207 Hex	Number of participating nodes decreased (local node not participating)				No	All
0208 Hex	Polling node changed	Address of previous polling node	Address of new polling node	Check previous polling node.	No	All
0209 Hex	Inconsistent network parameter	00 Hex	Address of polling node	Using the Controller Link Support Software, check network parameters.	Yes	All
020C Hex	Time out with token	00 Hex	Error status (see note)	Check network parameters, node participation, cables, and terminating resistance.	No	All
0210 Hex	Communications controller send error	00 Hex	Error status (see note)	Replace the Controller Link Unit.	Yes	All
0211 Hex	Duplicate address error	00 Hex	Local node address	Reset so that each node address is used only once within the same Network.	No	All
0214 Hex	Node address setting error	Not specified		Check the node address settings and correct them.	Yes	CS/CJ, CQM1H

Error code	Contents	Detail code		Correction	Written to EEPROM	Applicable PLC
		1st byte	2nd byte			
0216 Hex	Backup power supply error (Optical Units only)	00 Hex fixed	Backup power supply error distinction: 01 Hex: OFF to ON 02 Hex: ON to OFF	Check the status of the backup power supply and power supply cables.	Yes	CS/CJ, CQM1H
021A Hex	Set table logic error	00 Hex	01 Hex: Network parameters 02 Hex: Data link tables 03 Hex: Routing tables	Remake and set the appropriate data.	Yes	All
021B Hex	Hardware error	00 Hex	Error status (see note)	Replace the Controller Link Unit.	No	All
021C Hex	Data link error inactive	Not set		Restart the Controller Link Unit.	Yes	All
0220 Hex	Reduced number of participating nodes (separated nodes)	Separated nodes 1 to 16 correspond to bits 0 to 15 (1st byte: bits 8 to 15, 2nd byte: bits 0 to 7)		Check the node parameters, the separated nodes, cables, and terminating resistance settings.	Yes	CJ
0221 Hex		Separated nodes 17 to 32 correspond to bits 0 to 15 (1st byte: bits 8 to 15, 2nd byte: bits 0 to 7)				
0300 Hex	Packet discarded	Not set		Conduct an echo-back test and find the cause of the error.	No	All
0601 Hex	Unit error	Not set		Check the operating environment.	Yes	All

Note
1. Applicable PLCs: CV = CVM1 and CV-series PLCs, CS/CJ = CS-series and CJ-series PLCs, All = All models of PLC.
2. Errors indicated by error codes 0101 to 0116 are recorded only when the frame was discarded because transmission was impossible.

Error Status

The status of each bit indicates that an error has occurred as given in the diagram below.



9-3-3 Reading and Clearing Error Logs

Error logs can be read or cleared using the Controller Link Support Software, the CX-Programmer, PLC Programming Devices, or the message service. The following examples are for the Controller Link Support Software and the message service. When using a PLC Programming Device, refer to the Programming Device's operation manual for details.

Controller Link Support Software

Read or clear the error log using the following procedure.

1,2,3...

1. Display the Main Menu.
2. Select "E: Error log."
3. Designated the node. The error log for the designated node will be displayed.
4. Press the F7 (Clear) Key. The designated node error log will be cleared.

Message Service

Reading an Error Log

Send the ERROR LOG READ FINS command (command code 2102) to the appropriate node. Refer to *6-5-11 ERROR LOG READ*.

Clearing an Error Log

Send the ERROR LOG CLEAR FINS command (command code 2103) to the appropriate node. Refer to *6-5-12 ERROR LOG CLEAR*.

9-4 Cleaning and Inspection

This section describes cleaning and inspection procedures that are to be performed as daily maintenance.

9-4-1 Cleaning

Conduct the following periodic cleaning to keep the Controller Link Unit in optimum condition.

- Wipe the Unit with a dry, soft cloth daily.
- For stains that cannot be removed with a dry cloth, dip the cloth in medium strength alcohol (2%), wring the cloth tightly, and then wipe down the Unit.
- If glue, vinyl, or tape is left on the Unit for long periods of time, it will stain. Remove these items during cleaning.

⚠ **Caution** Do not use volatile solvents such as benzine or paint thinner, or chemical cloths for cleaning. They will damage the quality of the coating on the Unit.

9-4-2 Inspection

Controller Link Units must be inspected on a regular basis to ensure correct operation. Inspections should be conducted once every 6 to 12 months. If the Unit is subject to extremes in temperature or humidity, inspections should be conducted on a more regular basis.

Tools and Equipment Need for Inspection

The following tools and equipment will be needed to perform inspection and adjustments.

- Assorted flat-blade and Phillips screwdrivers

- Circuit tester or digital voltmeter
- Industrial-grade alcohol and clean cotton cloth
- Synchroscope
- Pen-chart recording oscilloscope
- Thermometer, hygrometer

Inspection Items

Inspect the follow items to see if they deviate from the prescribed standards. If any items do deviate from the standard either adjust so they are within the operating range or adjust the Unit accordingly.

Item	Description	Inspection instrument
Ambient conditions	Temperature: 0° to 55°C	Thermometer
	Humidity: 10% to 90% (no condensation or freezing)	Hygrometer
	Dust-free	Sight
Installation	Units securely attached? Communications cable connectors tight? Communications cabling used for external wiring intact (no breaks)?	Flat-blade screwdriver and sight

9-5 Handling Precautions

The Controller Link Unit is a Network device. If the Unit is damaged, it will effect the entire Network, so always ensure repairs are undertaken immediately. We recommend that you have a spare Controller Link Unit on hand so that repairs may be conducted quickly.

9-5-1 Replacing the Unit

Observe the following precautions when replacing the Unit.

- Always turn OFF the power before replacing the Unit.
- Check that the new Unit is not faulty.
- If you suspect that a poor connection is the cause of a malfunction, clean the connectors using a clean, soft cloth and industrial-grade alcohol. Remove any lint or threads left from the cloth, and remount the Unit.
- When returning a faulty Unit for repairs, always attach a detailed fault report to the Unit and return to you nearest OMRON outlet as listed at the back of this manual.

Note

1. In order to prevent faulty operation be sure to turn off the power to all nodes before replacing the Unit.

   Relay Terminal Blocks (CJ1W-TB101) can be used on any node but the end nodes to enable replacing the Controller Link Unit with the communications cable connected and turn OFF the power to only the Unit being replaced. Refer to *Appendix C Using the Relay Terminal Block* for details.
2. When replacing the Unit, do not reconnect that node to the Network before carrying out the procedures listed below. In particular, a node with a small address will become the polling node and communicate the initial network parameter status to other nodes, so there is the chance that network parameters in the entire Network will be damaged.

9-5-2 Setting the Unit after Replacement

After replacing a Controller Link Unit, reset the hardware switches, software switches, and data link tables, and wire it in the same manner as the previous Unit. This section describes settings that require particular care. Refer to the Unit replacement methods later in this section for details on replacing the Unit.

⚠ **Caution** After replacing the CPU Unit, transfer important data, such as DM and HR Area contents, to the new CPU Unit before restarting operation. Depending on the program, accidents can occur as a result of incorrect DM or HR Area contents.

CS/CJ-series, CVM1, and CV-series Controller Link Units store data such as data link tables, network parameters, and routing tables in the CPU Unit. When replacing the CPU Unit, reset these settings using the Controller Link Support Software.

Resetting Network Parameters

When a C200HX/HG/HE or CQM1H-series Controller Link Unit has been replaced or a CPU Unit has been replaced for a CS/CJ-series, CVM1, or CV-series Controller Link Unit, it is necessary to reset the network parameters, data link tables, and routing tables. This sections describes the resetting procedure for the network parameters. For details on data link table resetting procedures, refer to *5-2 Setting Data Links* and for routing table resetting procedures, refer to *7-4 Setting Routing Tables*.

1,2,3...

1. Network parameters are read from the polling node when the Network is activated and this information is distributed to all nodes in the Network. For this reason, set the polled/polling node setting in the DM parameter area for the node replaced to a polled node before reconnecting the Unit to the Network. For C200HX/HG/HE and CQM1H-series Controller Link Units, the EEPROM Clear Bit in the DM parameter area will already be set to clear EEPROM (ON or 1).

CS/CJ-series Controller Link Units

DM 30000 + 100 × n
n = Unit number

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

– : Other settings

Bit 15: Polled node/polling node 0: Polling node
1: Polled node

C200HX/HG/HE Controller Link Units

Operating level 0 DM 6400
Operating level 1 DM 6420

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

–: Other settings

Bit 14: EEPROM Clear Bit 0: Do not clear EEPROM
1: Clear EEPROM

Bit 15: Polled node/polling node 0: Polling node
1: Polled node

CVM1 and CV-series Controller Link Units

DM 2000 + 100 × n
n = Unit number

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

– : Other settings

Bit 15: Polled node/polling node 0: Polling node mode
1: Polled node

CQM1H-series Controller Link Units

DM 6400

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

–: Other settings

EEPROM Clear Bit 0: Do not clear EEPROM
1: Clear EEPROM

Polled node/polling node 0: Polling node
1: Polled node

2. Turn the power off once, connect the Controller Link Network and turn the power on again. Check that the Unit is participating in the Network.

   If the INS indicator is lit and the ERC and ERH indicators are off, then the Unit is in the Network.
3. Return the Polled node/polling node setting of the node in which the Unit was replaced to “polling node.” For C200HX/HG/HE and CQM1H-series Controller Link Units, the EEPROM Clear bit will already be set to not clear EEPROM.

CS/CJ-series Controller Link Units

DM 30000 + 100 × n
n = Unit number

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

– : Other settings

Polled node/Polling node 0: Polling node
1: Polled node

C200HX/HG/HE Controller Link Units

Operating level 0 DM 6400 Operating level 1 DM 6420

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

–: Other settings

EEPROM Clear Bit 0: Do not clear EEPROM
1: Clear EEPROM

Polled node/polling node 0: Polling node
1: Polled node

CVM1 and CV-series Controller Link Units

DM 2000 + 100 × n
n = Unit number

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

– : Other settings

Polled node/Polling node 0: Polling node mode
1: Polled node

CQM1H-series Controller Link Units

DM 6400

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

–: Other settings

EEPROM Clear Bit 0: Do not clear EEPROM
1: Clear EEPROM

Polled node/polling node 0: Polling node
1: Polled node

4. Restart the Controller Link Unit or turn the power off and then back on again, and then check to see if the Unit is participating in the Network.

   If the INS indicator is lit and the ERC and ERH indicators are not lit, then the Unit is in the Network.

Note Restart the Unit only when the data links are halted.

Using the above procedure to reset the network parameters of the node that was replaced to the same as the other nodes in the Network.

Caution When a C200HX/HG/HE or CQM1H-series Controller Link Unit has been replaced or a CPU Unit has been replaced for a CS/CJ-series, CVM1, or CV-series Controller Link Unit, do not connect that node to the Network before carrying out the above procedures. In particular, a node with a small address will become the polling node and communicate the initial network parameter status to other nodes, so there is the chance that network parameters in the entire Network will be damaged.

9-5-3 Replacing the Unit

C200HX/HG/HE and CQM1H-series Controller Link Units

Using the Controller Link Support Software

1,2,3...

1. From the Maintenance Menu on the Controller Link Support Software, select "Unit Back-up" and then "Unit –> Computer." The data will be saved as a file in the Unit's EEPROM.

   Data link tables and network parameters are saved in this way.
2. Turn off all nodes in the Controller Link Network.
3. Detach the communications cables and the Bus Connection Unit attached to the Controller Link Unit to be replaced and remove the Unit.
4. Mount the new Controller Link Unit in the PLC and connect the communications cables and the Bus Connection Unit. (Refer to *SECTION 3*)
5. Set the node address, baud rate, operating level (front DIP switch, C200HX/HG/HE only) and the terminating resistance for the new Unit to the same settings as the previous Unit. (Refer to *SECTION 4.*)
6. Turn on only those PLCs for which Units were replaced.
7. From the Maintenance Menu on the Controller Link Support Software, select "Unit Back-up" and then "Computer –> Unit" and the data saved in step 1. will be loaded to the Unit's EEPROM.
8. Cycle the power supply to the PLC where the Unit was replaced.
9. Turn on all other nodes in the Controller Link Network.
10. Using the Controller Link Support Software, read the network parameters and make sure the Network is operating normally.
11. If the data links are not activated automatically, activate the data links from the data link startup node.
12. Check that the data links are operating normally by using the "Data Link Status Monitor" on the Controller Link Support Software.

Not Using the Controller Link Support software

Note When manually set data links are used, the Controller Link Support Software is essential. When the Controller Link Unit being replaced does not have active manually set data links or it has active automatically set data links, the replacement process can be carried out without the Controller Link Support Software. In this case, however, a Programming Device is necessary.

1,2,3...

1. Turn off all nodes in the Controller Link Network.
2. Detach the communications cables and the Bus Connection Unit attached to the Controller Link Unit to be replaced and remove the Unit.
3. Mount the new Controller Link Unit in the PLC and connect the communications cables and the Bus Connection Unit. (Refer to *SECTION 3.*)

4. Set the node address, baud rate, operating level (front DIP switch, C200HX/HG/HE only) and the terminating resistance for the new Unit to the same settings as the previous Unit. (Refer to *SECTION 4*.)
5. Turn ON only those PLC for which Units were replaced.
6. Set the following software switches on the new Controller Link Unit using the Programming Device.
   - Polled node/ polling nodes: ON (polled node)
   - EEPROM Clear But: ON (EEPROM Clear)

	Operating level 0	Operating level 1
C200HX/HG/HE	DM 6400	DM 6420
CQM1H Series	DM 6400	

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

– : Other settings

EEPROM Clear Bit 0: Do not clear EEPROM
1: Clear EEPROM

Polled node/polling node 0: Polling node
1: Polled node

7. Turn off the power again to PLCs for which the Controller Link Unit has been changed.
8. If the CPU Unit DIP switch pin 5 of the PLC for which the Controller Link Unit has been replaced is ON (automatic transmission), set to OFF (no automatic transmission.)
9. Turn off all nodes in the Controller Link Network.
10. If the Controller Link Support Software can be operated, use it to read the network parameters and make sure the Network is operating normally.
11. If the data links are not activated automatically, activate the data link from the data link startup node.
12. If the Controller Link Support Software can be operated, use it to check that the data links are operating normally by monitoring the data link status.
13. Return the software switches set in step 6. in the new Controller Link Unit to the following settings using the Programming Device.
    - Polled node/polling node: OFF (polling node)
    - EEPROM Clear Bit: OFF (Do not clear EEPROM)

	Operating level 0	Operating level 1
C200HX/HG/HE	DM 6400	DM 6420
CQM1H Series	DM 6400	

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

–: Other settings

EEPROM Clear Bit 0: Do not clear EEPROM
1: Clear EEPROM

Polled node/polling node 0: Polling node
1: Polled node

Check the above if the Controller Link Support Software can be used.

14. If DIP switch pin 5 on the CPU Unit was switched from ON to OFF in set 8., turn the PLC OFF once, return the DIP switch to ON, and turn the power ON again.

CS/CJ-series, CVM1, and CV-series Controller Link Units

Note CS/CJ-series, CVM1, and CV-series Controller Link Unit data is stored in the EEPROM of the CPU Unit. For this reason even if the Controller Link Unit is replaced, on the hardware settings must be made to return all settings to their previous status. If, however, the CPU Unit is replaced, the data link tables and routing tables will need to be reset.

1,2,3...
1. Turn off all nodes in the Controller Link Network.
2. Detach the communications cables attached to the Controller Link Unit to be replaced and remove the Unit.

3. Mount the new Controller Link Unit in the PLC and connect the communications cables. (Refer to *SECTION 3*.)
4. Set the unit number, node address, baud rate, and the terminating resistance for the new Unit to the same settings as the previous Unit. (Refer to *SECTION 4*.)
5. Turn on the power to the PLCs at all nodes in the Controller Link Network other than those for which the Controller Link Unit was replaced.
6. Check that all the other nodes are active and then turn on the power to the PLC with the Controller Link Unit that was replaced.
7. Using the Controller Link Support Software, read the network parameters and make sure the Network is operating normally.
8. If the data links are not activated automatically, start the data links from the data link startup node.
9. Check that the data links are operating normally by monitoring them from the Controller Link Support Software.

Appendix A
Standard Models

Controller Link Units

Applicable PLC	Model number	Remarks
CVM1 and CV-series PLCs	CVM1-CLK21	See *CPU Units and Programming Devices* in this appendix.
C200HX/HG/HE PLC	C200HW -CLK21	
CS-series PLCs	CS1W-CLK21	
CJ-series PLCs	CJ1W-CLK21	
CQM1H-series PLCs	CQM1H -CLK21	

Controller Link Support Board

Applicable computer	Model number	Remarks
IBM PC/AT or compatible	3G8F5-CLK21-E	Controller Link Support Software included.

Controller Link Support Software

Applicable computer	Model number	Remarks
IBM PC/AT or compatible	C200HW-ZW3AT2-EV2	For CS/CJ-series, C200HX/HG/HE, CVM1, and CV-series PLCs

Communications Cables (Twisted-pair Cables)

Model	Manufacturer	Remarks
Li2Y-FCY2 x 0.56 qmm	Kromberg & Schubert, Komtec Department	German company
1 x 2 x AWG – 20PE + Tr.CUSN + PVC	Draka Cables Industrial	Spanish company
#9207	Belden	USA company
ESVC 0.5 x 2 C-1362	Bando Densen Co.	Japanese company
ESNC 0.5 x 2 C-99-087B	Nihon Electric Wire & Cable Co.	Japanese company

Relay Terminal Block

Name	Model number	Remarks
Wired Controller Link Unit Relay Terminal Block	CJ1W-TB101	Cannot be used on the nodes on both ends of the network.

CX-Programmer with CX-Net

Applicable computer	Name	Model number	Applicable PLCs
IBM PC/AT or compatible running Windows 95/ 98 or Windows NT	CX-Programmer with CX-Net	WS02-CXP☐☐-EV2	CS/CJ-series, C200HX/HG/HE, CVM1, CV-series, and CQM1H-series PLCs

CPU Units and Programming Devices

CPU Units

PLC	Model number	Remarks
CS-series PLCs	CS1H-CPU67-V1 CS1H-CPU66-V1 CS1H-CPU65-V1 CS1H-CPU64-V1 CS1H-CPU63-V1 CS1G-CPU45-V1 CS1G-CPU44-V1 CS1G-CPU43-V1 CS1G-CPU42-V1	Earlier versions of the CPU Units can also be used.
CJ-series PLCs	CS1G-CPU45 CS1G-CPU44	---
SYSMAC C200HX, C200HG, or C200HE or C200HZ PLCs	C200HE-CPU32/42-(Z)E C200HG-CPU33/43/53/63-(Z)E C200HX-CPU34/44/54/64-(Z)E	---
SYSMAC CV500, CV1000, or CV2000 PLCs (see note 1)	CV500-CPU01-EV1 CV1000-CPU01-EV1 CV2000-CPU01-EV1	Earlier versions of the CPU Units can also be used.
SYSMAC CVM1 PLCs (see note 1)	CVM1-CPU01-EV2 CVM1-CPU11-EV2 CVM1-CPU21-EV2 CVM1D-CPU21-E	Earlier versions of the CPU Units can also be used.
SYSMAC CQM1H-series PLCs	CQM1H-CPU51 CQM1H-CPU61	---

Note Routing tables are required if any of the CVM1 or CV-series CPU Units in the network have been manufactured on or before April 1996. The manufacturing data can be determined from the lot number on the side of the CPU Unit.

Lot No.: ☐ ☐ 4 6 .... Manufactured in April 1996

Indicates the last digit of the manufacturing year. In this example, the year is 1996.

Indicates the month of manufacture. October, November, and December are indicated by x, y, and z respectively. In this example, the month is April.

Other Products Used with Controller Link Units

Name	Model number	Remarks
Bus Connection Unit	C200HW-CE001	Required to connect a Controller Link Unit to a C200HZ, C200HX, C200HG, or C200HE CPU Unit.
	C200HW-CE002	Required to connect two Controller Link Units, or one Controller Link Unit and one other Communications Unit to a C200HZ, C200HX, C200HG, or C200HE CPU Unit.
	C200HW-CE012	Required to mount both a Controller Link Unit and a PLC Card Unit to a C200HZ, C200HX, C200HG, or C200HE CPU Unit.
Communications Boards	C200HW-COM01 C200HW-COM04	Required to mount a Controller Link Unit to a C200HZ, C200HX, C200HG, or C200HE CPU Unit.

Refer to the operation manual for the relevant PLC for further information on the above products.

Appendix B
Memory Areas

This appendix provides easy reference to the words in PLC memory areas used by Controller Link Networks.

CS/CJ-series PLCs

Auxiliary Area

Word(s)	Bit(s)	Function
A202	00 to 07	Communications Port Enabled (Network Communications Enabled) Flags
A203 to A210	00 to 15	Port #0 to #7 Completion Codes
A219	00 to 07	Port #0 to #7 Execute Error (Network Communications Execute Error) Flags
A302	00 to 15	CS/CJ CPU Bus Unit Initializing Flags
A401	13	Duplicate Number Error Flag (fatal error)
A402	03	CS/CJ CPU Bus Unit Setting Error Flag
	07	CS/CJ CPU Bus Unit Error Flag
A410	00 to 15	CPU Bus Unit Duplicate Number
A417	00 to 15	CS/CJ CPU Bus Unit Error, Unit Number Flags
A427	00 to 15	CS/CJ CPU Bus Unit Setting Error Unit Number
A501	00 to 15	CS/CJ CPU Bus Unit Restart Bits

Network Status Flags

Bits A20200 through A20207 are turned ON to indicate that ports #0 through #7, respectively, are enabled for the SEND(90), RECV(98), CMND(490) and PMCR. Bits A219200 through A219207 are turned ON to indicate that an error has occurred in ports #0 through #7, respectively, during data communications using SEND(90), RECV(98), CMND(490), or PMCR. Refer to page 134.

A203 through A210 contain the completion codes for ports #0 through #7, respectively, following data communications using SEND(90), RECV(98), CMND(490), or PMCR. Refer to page 134.

CS/CJ CPU Bus Unit Initializing Flags

Bits A30200 through A30215 turn ON while the corresponding CS/CJ CPU Bus Units (Units #0 through #15, respectively) are initializing.

CS/CJ CPU Bus Unit Setting Error Flag and Unit Number

Bit A40203 is turned ON when the CS/CJ CPU Bus Units actually installed differ from the Units registered in the I/O table. The unit number of the CS/CJ CPU Bus Unit involved is written to word A427.

Bits A42700 through A42715 correspond to CS/CJ CPU Bus Units #0 through #15, respectively. When a error occurs, the bit corresponding to the unit number of the CS/CJ CPU Bus Unit involved is turned ON.

CS/CJ CPU Bus Unit Error Flag

Bit A40207 is turned ON when a parity error occurs during the transmission of data between the CPU Unit and CS/CJ CPU Bus Units. The unit number of the CS/CJ CPU Bus Unit involved is written to word A417.

CS/CJ CPU Bus Unit Numbers

Bits A41000 through A41015 correspond to CS/CJ CPU Bus Units #0 through #15, respectively. When two CPU Bus Units have the same unit number, the bits corresponding to the unit numbers of the CS/CJ CPU Bus Units involved are turned ON.

CS/CJ CPU Bus Unit Duplication Error Flag

Bit A40113 is turned ON when two CS/CJ CPU Bus Units have been assigned the same unit number. The duplicated unit number is indicated in A410.

CS/CJ CPU Bus Unit Error, Unit Number Flags

When an error occurs in a data exchange between the CPU Unit and an CS/CJ CPU Bus Unit, the CS/CJ CPU Bus Unit Error Flag (A40207) is turned ON and the bit in A417 corresponding to the unit number of the Unit where the error occurred is turned ON.

CS/CJ CPU Bus Unit Restart Bits

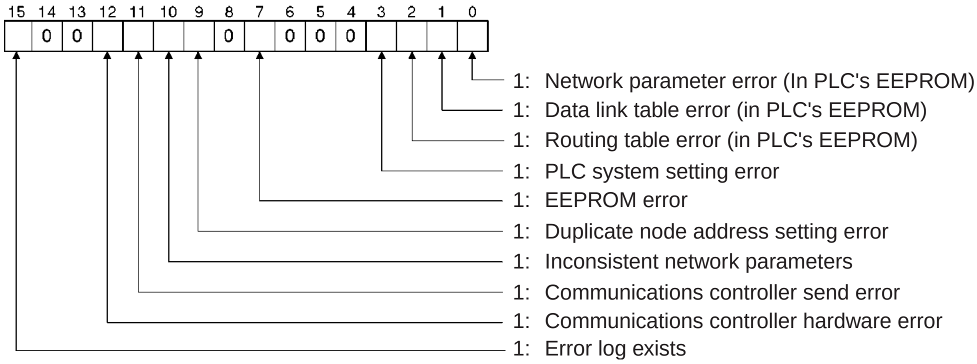
Bits A50100 through A50115 can be turned ON to reset CS/CJ CPU Bus Units number #0 through #15, respectively. The Restart Bits are turned OFF automatically when restarting is completed.

CIO Area: CS/CJ CPU Bus Unit Area

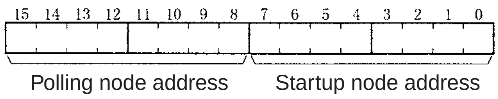
The CS/CJ CPU Bus Unit Area (CIO Area) is allocated to CS/CJ CPU Bus Units according to the unit numbers assigned to them, as shown below. Each Unit is allocated 25 words.

Unit no.	Words	Unit no.	Words
0	1500 to 1524	8	1700 to 1724
1	1525 to 1549	9	1725 to 1749
2	1550 to 1574	10	1750 to 1774
3	1575 to 1599	11	1775 to 1799
4	1600 to 1624	12	1800 to 1824
5	1625 to 1649	13	1825 to 1849
6	1650 to 1674	14	1850 to 1874
7	1675 to 1699	15	1875 to 1899

Error Information: CIO 1500 + 25 x (Unit No.) (See page 243)



Polling Node Address, Startup Node Address: CIO 1500 + 25 x (Unit No.) + 1 (See page 243)



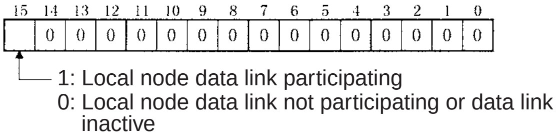
Each node address is displayed in 2-digit BCD.

Network Participation Status: CIO 1500 + 25 x (Unit No.) + 2, + 3 (See pages 135, 243)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+ 2	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
+ 3	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of the network
1: Part of the network

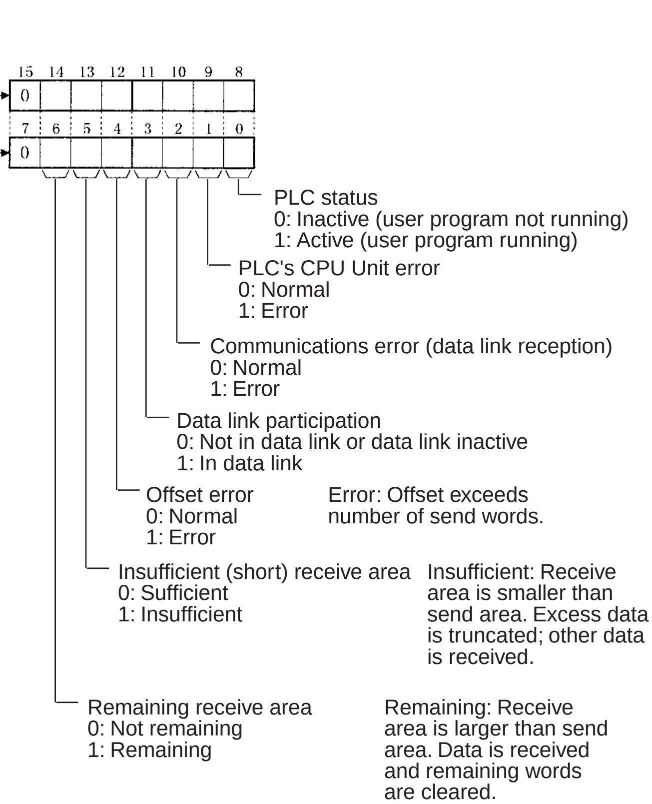
Local Data Link Participation Status: CIO 1500 + 25 x (Unit No.) + 6 (See page 243)



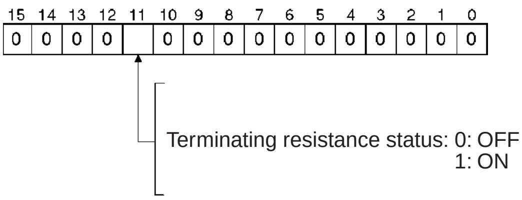
Data Link Status: CIO 1500 + 25 x (Unit No.) + 7 to + 22 (See pages 103, 244)

When the first data link status word for manually set data link tables or for automatically set data links is not set or is set to 0, the data link status is stored in the words shown below.

Word	15–8	7–0
+7	Node 2	Node 1
+8	Node 4	Node 3
+9	Node 6	Node 5
+10	Node 8	Node 7
+11	Node 10	Node 9
+12	Node 12	Node 11
+13	Node 14	Node 13
+14	Node 16	Node 15
+15	Node 18	Node 17
+16	Node 20	Node 19
+17	Node 22	Node 21
+18	Node 24	Node 23
+19	Node 26	Node 25
+20	Node 28	Node 27
+21	Node 30	Node 29
+22	Node 32	Node 31



Terminating Resistance Status (CIO 1500 + 25 x (Unit No.) + 24 (See page 244)

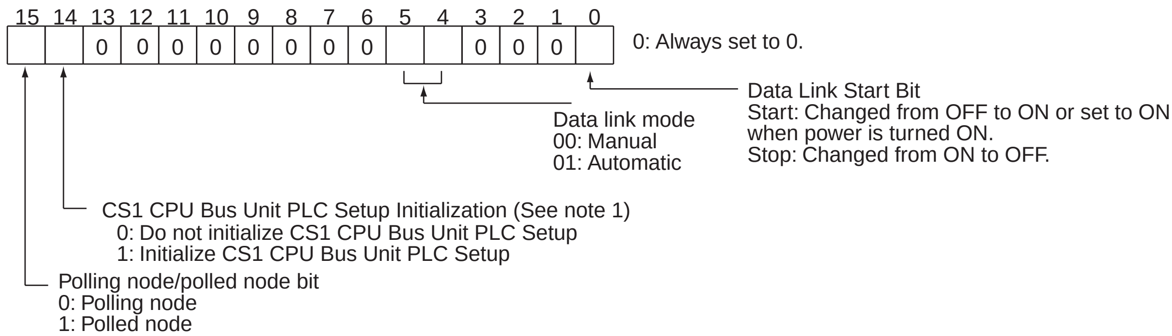


DM Area: CS/CJ CPU Bus Unit Area

The CS/CJ CPU Bus Unit Area (data memory) is allocated to CS/CJ CPU Bus Units according to the unit numbers assigned to them, as shown below. Each Unit is allocated 100 words, of which 10 words are used. In the Controller Link Unit this area is called the DM Area.

Unit no.	Words	Unit no.	Words
0	DM30000 to DM30009	8	DM30800 to DM30809
1	DM30100 to DM30109	9	DM30900 to DM30909
2	DM30200 to DM30209	10	DM31000 to DM31009
3	DM30300 to DM30309	11	DM31100 to DM31109
4	DM30400 to DM30409	12	DM31200 to DM31209
5	DM30500 to DM30509	13	DM31300 to DM31309
6	DM30600 to DM30609	14	DM31400 to DM31409
7	DM30700 to DM30709	15	DM31500 to DM31509

Software Switches (DM30000 + 100 × Unit No.) (See pages 93, 188, 195, 257)



Note 1: Initializes the network parameters registered in the CS1 CPU Bus Unit PLC Setup Area on the CPU Unit and clears the data link tables.

2: Be sure to set the bit in the DM Area's (CPU Bus Unit Area's) software switches (DM30000 + 100 × unit number) described as "always set to 0" to 0. Not doing so may result in the data link not starting properly. If a data link is started with bit 7 of the software switches set to 1, the data link status will be stored in a format different to the one described in this manual (when using CS-series or CJ-series Controller Link Units).

Parameters for Automatically Setting Data Links: DM30000 + 100 × (Unit No.) + 1 to 9 (See page 93)

	15 ... 8	7 ... 0
+1	Area 1 data link start word (BCD)	
+2	Area 1 type	00
+3	Number of send words per node of area 1 (BCD)	
+4	Rightmost 4 digits of data link start word of area 2 (DM area) (BCD)	
+5	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
+6	Number of send words per node of area 2 (BCD)	
+7	First data link status word (BCD)	

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+8	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
+9	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

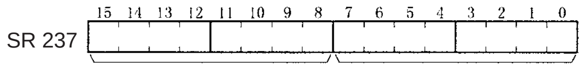
BCD: Set the value as binary-coded decimal.

← Nodes to participate in the data links
The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.
Participate: 1
Not participate: 0

C200HX/HG/HE PLCs

SR Area

Communications Instruction Response Codes (See page 136.)

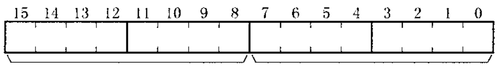


Operating level 1 response code   Operating level 0 response code
Each response code is in 2-digit hexadecimal.

Polling Node Address, Startup Node Address: SR 238, SR 242 (See page 239)

Operating level 0
SR 238

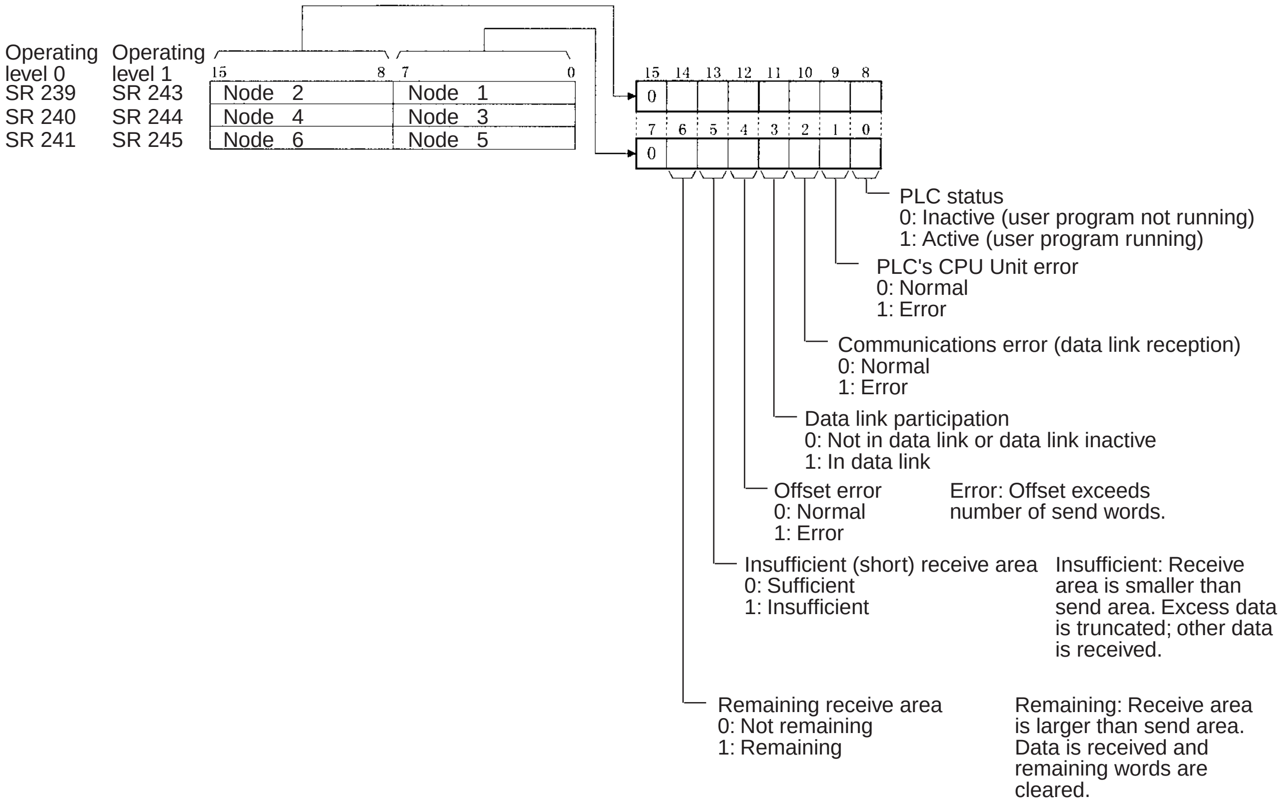
Operating level 1
SR 242



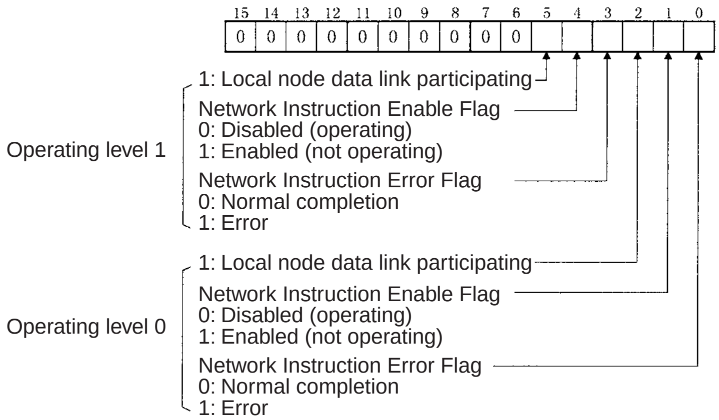
Polling node address   Startup node address
Each node address is in 2-digit BCD.

Data Link Status: SR 239 to SR 241, SR 243 to SR 245 (See pages 103, 239)

When the first data link status word for manually set data link tables or for automatically set data links is not set or is set to 0, the data link status of only node addresses 1 to 6 will be given in the following area.

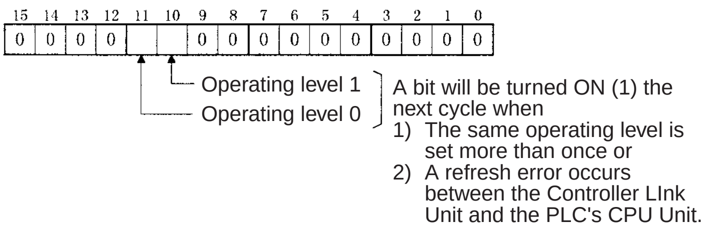


Operating Level Status: SR 252 (See pages 134, 239)

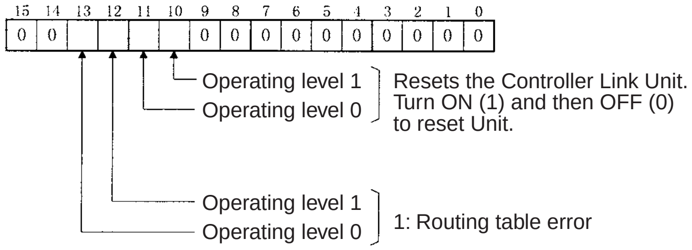


AR Area

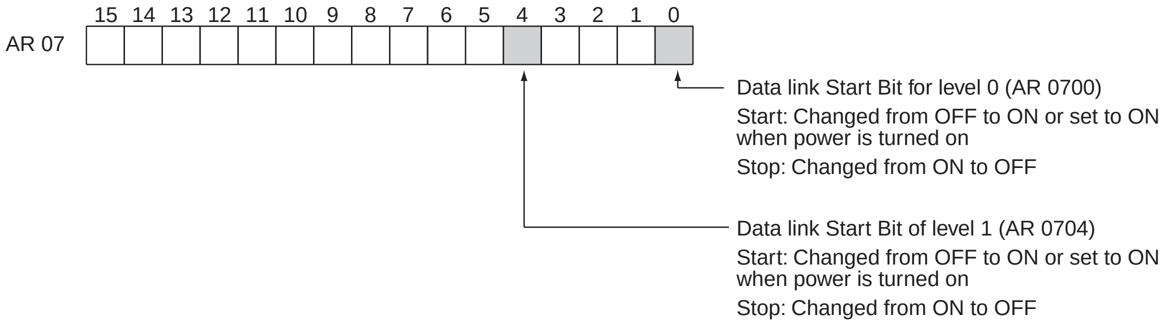
Duplicate Operating Levels/Refresh Error: AR 00 (See page 238)



Routing Table Error/Unit Restart Bits: AR 01 (See page 238)



Data Link Start Bits (See page 101)



Network Participation Status: AR 08, AR 09, AR 12, AR 13 (See pages 135, 238)

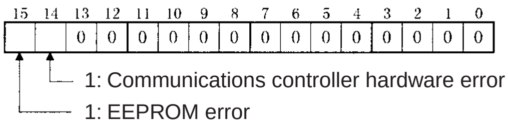
Operating level 0	Operating level 1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AR 08	AR 12	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
AR 09	AR 13	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of network
1: Part of network

Communications Controller Hardware Error, EEPROM Error: AR 11, AR 15 (See page 238)

Operating level 0
AR 11

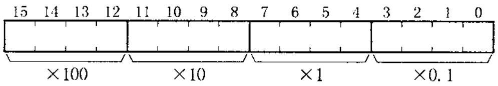
Operating level 1
AR 15



Service Time: AR 16, AR 17 (See page 238)

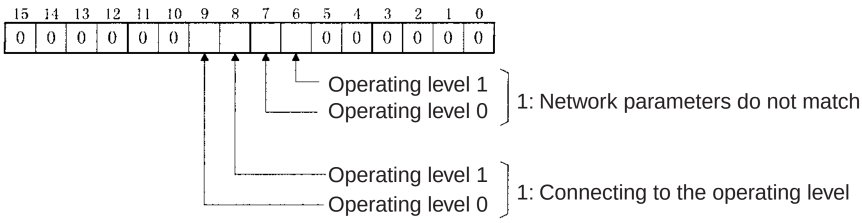
Operating level 0
AR 16

Operating level 1
AR 17



The service time for each PLC cycle is calculated by the PLC and displayed in 0.1-ms units in 4-digit BCD.

Operating Level Connection Status, Inconsistent Network Parameters: AR 24



DM Parameter Area

Software Switches (See pages 93, 188, 195, 257)

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

Bits 5 and 4: Data link mode
00: Manual
01: Automatic

Bit 12: Routing table enabled/disabled
1: Enabled
0: Disabled

Bit 14: EEPROM Clear Bit 0: Do not clear EEPROM
1: Clear EEPROM

Bit 15: Polling node/polled node bit
0: Polling node
1: Polled node

Parameters for Automatically Setting Data Links: DM 6400 to DM 6409, DM 6420 to DM 6429 (See page 93)

Level 0	Level 1	15 to 8	7 to 0
DM 6401	DM6421	Area 1 data link start word (BCD)	
DM 6402	DM6422	Area 1 type	00
DM 6403	DM6423	Number of send words per node of area 1 (BCD)	
DM 6404	DM6424	Rightmost 4 digits of data link start word of area 2 (DM area) (BCD)	
DM 6405	DM6425	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
DM 6406	DM6426	Number of send words per node of area 2 (BCD)	
DM 6407	DM6427	First data link status word (BCD)	

		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DM 6408	DM6428	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
DM 6409	DM 6429	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

BCD: Set the value as binary-coded decimal.

Nodes to participate in the data links
The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.
Participate: 1
Not participate: 0

Routing Tables (DM 6450 to DM 6499) (See page 188)

When the use of routing tables is enabled by the software switch setting, the routing tables are stored in these words. Do not use them for anything else.

CVM1 and CV-series PLCs

Auxiliary Area

Word(s)	Bit(s)	Function
A001	00 to 15	CPU Bus Unit Restart Bits
A015	00 to 15	CPU Bus Service Disable Bits
A302	00 to 15	CPU Bus Unit Initializing Flags
A401	12	CPU Bus Error Flag
A402	03	CPU Bus Unit Setting Error Flag
	07	CPU Bus Unit Error Flag
A405	00 to 15	CPU Bus Unit Error Unit Number
A410	00 to 15	CPU Bus Unit Duplicate Number
A422	00 to 15	CPU Bus Unit Error Unit Number
A427	00 to 15	CPU Bus Unit Setting Error Unit Number
A502	00 to 07	Port #0 to #7 Enabled Flags
	08 to 15	Port #0 to #7 Execute Error Flags
A503 to A510	00 to 15	Port #0 to #7 Completion Codes (See page 136)

CPU Bus Unit Restart Bits

Bits A00100 through A00115 can be turned ON to reset CPU Bus Units number #0 through #15, respectively. The Restart Bits are turned OFF automatically when restarting is completed.

Do not turn these bits ON and OFF in the program; manipulate them from the CVSS.

CPU Bus Service Disable Bits

Bits A01500 through A01515 can be turned ON to stop service to CPU Bus Units numbered #0 through #15, respectively. Turn the appropriate bit OFF again to resume service to the CPU Bus Unit.

CPU Bus Unit Initializing Flags

Bits A30200 through A30215 turn ON while the corresponding CPU Bus Units (Units #0 through #15, respectively) are initializing.

CPU Bus Error and Unit Flags

Bit A40112 is turned ON when an error occurs during the transmission of data between the CPU Unit and CPU Bus Units, or a WDT (watchdog timer) error occurs in a CPU Bus Unit. The unit number of the CPU Bus Unit involved is contained in word A405.

Bits A40500 through A40515 correspond to CPU Bus Units #0 through #15, respectively. When a CPU Bus Error occurs, the bit corresponding to the unit number of the CPU Bus Unit involved is turned ON.

CPU Bus Unit Setting Error Flag and Unit Number

Bit A40203 is turned ON when the CPU Bus Units actually installed differ from the Units registered in the I/O table. The unit number of the CPU Bus Unit involved is written to word A427.

Bits A42700 through A42715 correspond to CPU Bus Units #0 through #15, respectively. When a error occurs, the bit corresponding to the unit number of the CPU Bus Unit involved is turned ON.

CPU Bus Unit Error Flag and Unit Numbers

Bit A40207 is turned ON when a parity error occurs during the transmission of data between the CPU Unit and CPU Bus Units. The unit number of the CPU Bus Unit involved is written to word A422.

Bits A42200 through A42215 correspond to CPU Bus Units #0 through #15, respectively. When a CPU Bus Unit Error occurs, the bit corresponding to the unit number of the CPU Bus Unit involved is turned ON.

CPU Bus Unit Numbers

Bits A41000 through A41015 correspond to CPU Bus Units #0 through #15, respectively. When two CPU Bus Units have the same unit number, the bits corresponding to the unit numbers of the CPU Bus Units involved are turned ON.

Network Status Flags

Bits A50200 through A50207 are turned ON to indicate that ports #0 through #7, respectively, are enabled for the SEND(192), RECV(193), and CMND(194). Bits A50208 through A50215 are turned ON to indicate that an error has occurred in ports #0 through #7, respectively, during data communications using SEND(192), RECV(193), or CMND(194).

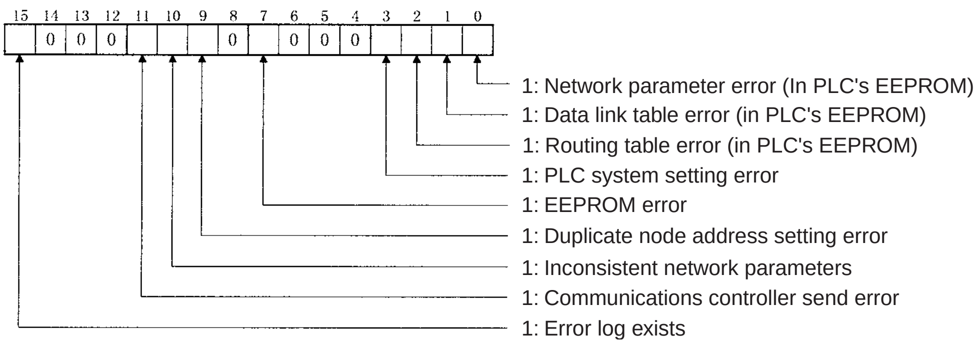
A503 through A510 contain the completion codes for ports #0 through #7, respectively, following data communications using SEND(192), RECV(193), or CMND(194).

CIO Area: CPU Bus Unit Area

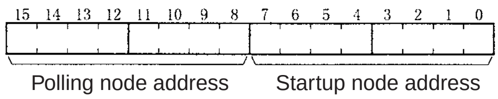
The CPU Bus Unit Area is allocated to CPU Bus Units according to the unit numbers assigned to them, as shown below. Each Unit is allocated 25 words. The Controller Link Units use 22 of the words allocated to them.

Unit no.	Words	Unit no.	Words
0	1500 to 1524	8	1700 to 1724
1	1525 to 1549	9	1725 to 1749
2	1550 to 1574	10	1750 to 1774
3	1575 to 1599	11	1775 to 1799
4	1600 to 1624	12	1800 to 1824
5	1625 to 1649	13	1825 to 1849
6	1650 to 1674	14	1850 to 1874
7	1675 to 1699	15	1875 to 1899

Error Information: CIO 1500 + 25 x (Unit No.) (See page 243)



Polling Node Address, Startup Node Address: CIO 1500 + 25 x (Unit No.) + 1 (See page 243)



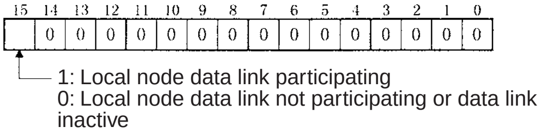
Each node address is displayed in 2-digit BCD.

Network Participation Status: CIO 1500 + 25 x (Unit No.) + 2, + 3 (See pages 135, 243)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+ 2	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
+ 3	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

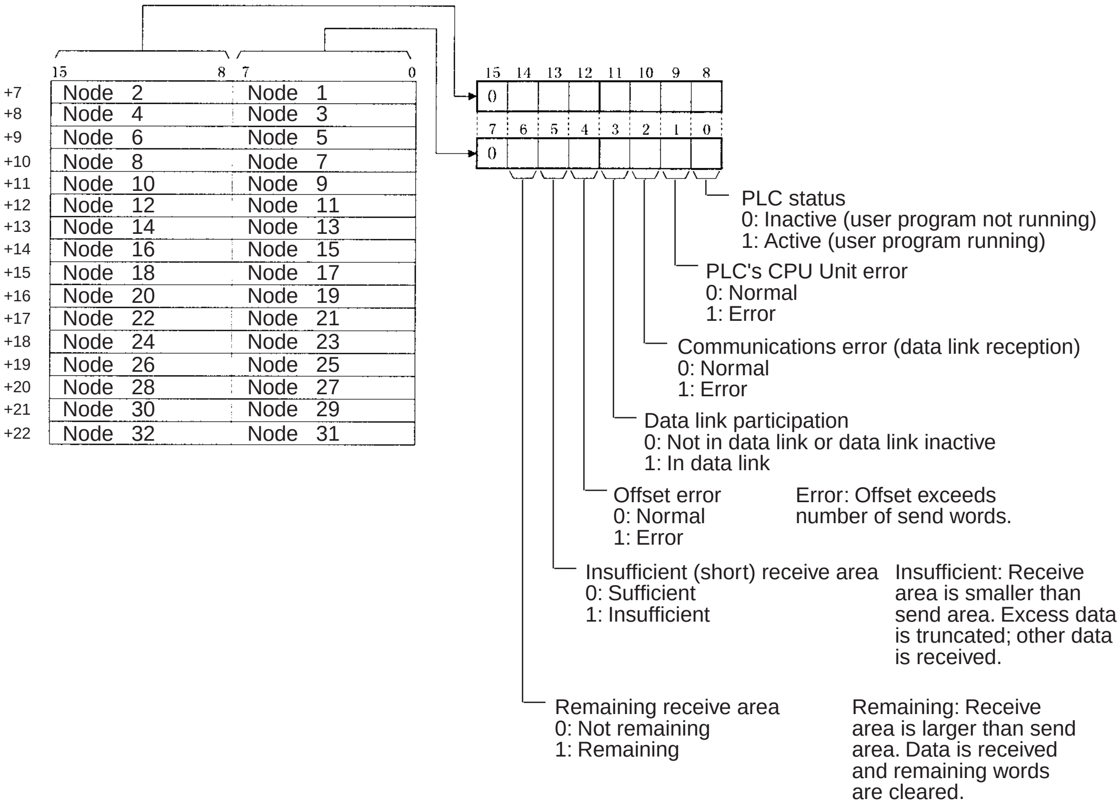
The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of the network
1: Part of the network

Local Data Link Participation Status: CIO 1500 + 25 x (Unit No.) + 6 (See page 243)



Data Link Status: CIO 1500 + 25 x (Unit No.) + 7 to + 22 (See pages 103, 244)

When the first data link status word for manually set data link tables or for automatically set data links is not set or is set to 0, the data link status is stored in the words shown below.



DM Area: CPU Bus Unit Area

The CPU Bus Unit Area (data memory) is allocated to CPU Bus Units according to the unit numbers assigned to them, as shown below. Each Unit is allocated 100 words, of which 10 words are used. In the Controller Link Unit this area is called the DM Area.

Unit no.	Words	Unit no.	Words
0	DM2000 to DM2009	8	DM2800 to DM2809
1	DM2100 to DM2109	9	DM2900 to DM2909
2	DM2200 to DM2209	10	DM3000 to DM3009
3	DM2300 to DM2309	11	DM3100 to DM3109
4	DM2400 to DM2409	12	DM3200 to DM3209
5	DM2500 to DM2509	13	DM3300 to DM3309
6	DM2600 to DM2609	14	DM3400 to DM3409
7	DM2700 to DM2709	15	DM3500 to DM3509

Software Switches (DM20000 + 100 × Unit No.) (See pages 93, 188, 195, 257)

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

Data link Start Bit
Start: Changed from OFF to ON or set to ON when power is turned on
Stop: Changed from ON to OFF

Data link mode
Set to 01 for automatic setting.
(00 is for manual setting. Other values are invalid.)

EEPROM Clear Bit* 0: Do not clear EEPROM
1: Clear EEPROM

Polling unit/polled unit bit
0: Polling unit
1: Polled unit

*Clears the network parameters, data link tables, and routing tables stored in EEPROM in the PLC's CPU Unit.

Parameters for Automatically Setting Data Links: DM 2000 + 100 x (Unit No.) + 1 to + 9 (See page 95)

	15 to 8	7 to 0
+1	Area 1 data link start word (BCD)	
+2	Area 1 type	
+3	Number of send words per node of area 1 (BCD)	
+4	Rightmost 4 digits of data link start word of area 2 (BCD)	
+5	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
+6	Number of send words per node of area 2 (BCD)	
+7	First data link status word (BCD)	

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+8	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
+9	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

BCD: Set the value as binary-coded decimal.

Nodes to participate in the data links

The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.

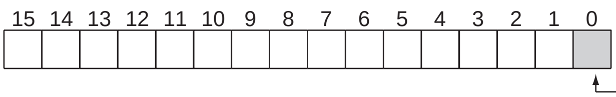
Participate: 1
Not participate: 0

CQM1H-series PLCs

AR Area

Word	Bits	Name	Contents
AR 00	11	Communications Unit Error Flag	Turns ON when an error occurs in a Communications Unit.
AR 01	11	Communications Unit Restart Bit	Turn ON this bit to restart the Communications Unit.
AR 02	00 to 07	Response code	Contains the completion code for network instructions (SEND(90), RECV(98), or CMND(—)). (See page 136.)
	08	Network Instruction Error Flag	0: Normal end to SEND(90), RECV(98), or CMND(—). 1: Abnormal end (See page 135.)
	09	Network Instruction Enable Flag	0: SEND(90), RECV(98), or CMND(—) execution not possible (already executing) 1: Execution possible (not executing) (See page 135.)
	15	Communications Unit Connected Flag	Turns ON when a Communications Unit is mounted to the PLC.
AR 03	00 to 15	Communications Unit Servicing Time	Indicates the servicing time for the last cycle in 0.1-ms units (4-digit BCD.)

Data Link Start Bit: AR 07 (See page 73.)



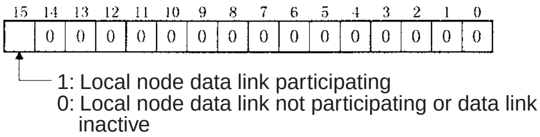
Data link Start Bit (AR0700)

Start: Changed from OFF to ON or set to ON when power is turned on

Stop: Changed from ON to OFF

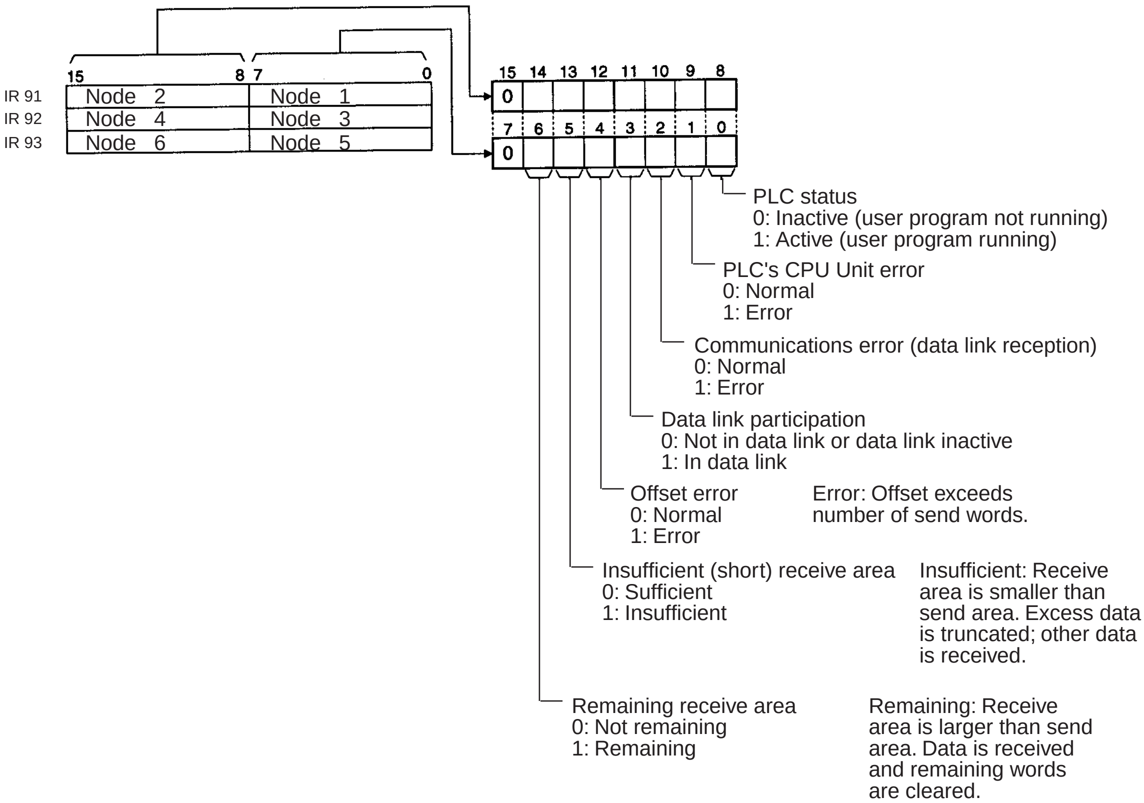
Communications Unit Flags, Control Bits, and Status Information

Local Data Link Participation Status: IR 90

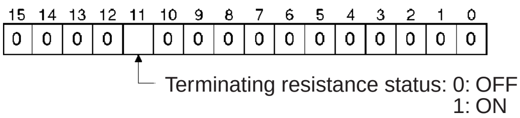


Data Link Status: IR 91 to IR 93 (See pages 103 and 248.)

When the first data link status word is not set or is set to the default (0000) for either the manually set data link tables or automatically set data link tables, the data link status is stored in the following words for nodes 1 to 6 only.

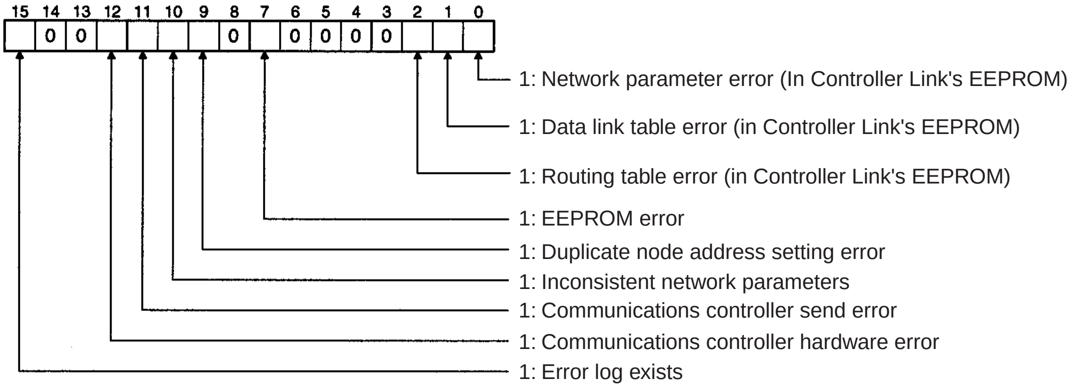


Terminating Resistance Status: IR 95 (See page 252.)

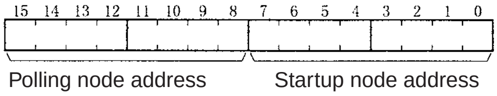


Controller Link Status Information

Error Information: IR 190 (See page 248.)



Polling Node Address, Startup Node Address: IR 191 (See page 248.)



Each node address is displayed in 2-digit BCD.

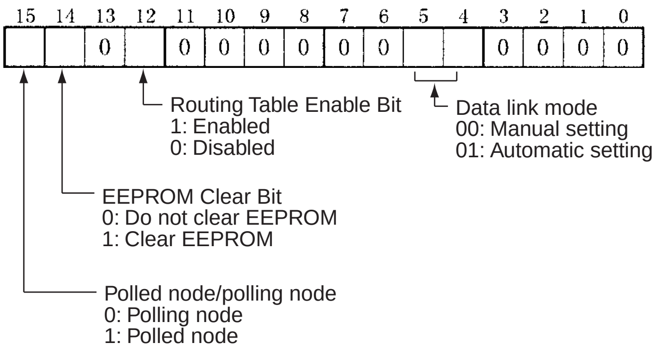
Network Participation Status: IR 192 and IR 193 (See page 248.)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

The numbers in the squares indicate node addresses.
The corresponding node participation status is as follows:
0: Not part of the network
1: Part of the network

PLC Setup Settings in DM Area

Control Bits: DM 6400 (See pages 73, 188, 195, and 261.)



Automatic Data Link Parameters: DM 6401 to 6409 (See page 98.)

DM 6401	Area 1 data link start word (BCD)	
DM 6402	Area 1 type	00
DM 6403	Number of send words per node of area 1 (BCD)	
DM 6404	Rightmost 4 digits of data link start word of area 2 (BCD)	
DM 6405	Area 2 type	Leftmost digit of data link start word of area 2 (BCD)
DM 6406	Number of send words per node of area 2 (BCD)	
DM 6407	First data link status word (BCD)	

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DM 6408	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
DM 6409	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

← Nodes to participate in the data links

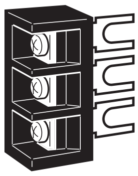
The numbers indicate node numbers.
The value assigned indicates whether the node is to participate in the data links.

Participate: 1
Not participate: 0

BCD: Set the value as binary-coded decimal.

Appendix C
Using the Relay Terminal Block

This appendix describes how to use the CJ1W-TB101 Wired Controller Link Unit Relay Terminal Block. Using a Relay Terminal Block enables replacing a Controller Link Unit while network communications are still in progress.

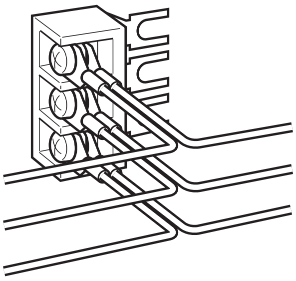
Appearance	Name	Model number	Remarks
	Wired Controller Link Unit Relay Terminal Block	CJ1W-TB101	Cannot be used on the nodes on both ends of the network.

Relay Terminal Blocks (CJ1W-TB101) can be used on any node but the end nodes to enable replacing the Controller Link Unit with the communications cable connected and turn OFF the power to only the Unit being replaced.

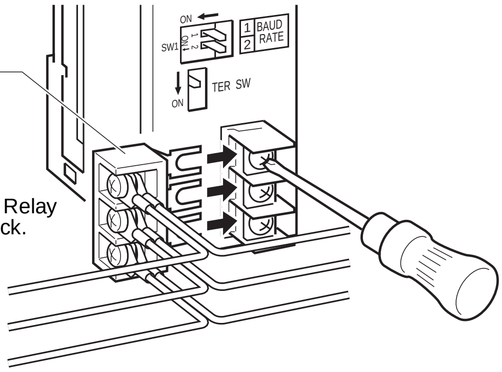
Note The built-in terminating resistance connected at the Units at the end of the network prevents using the Relay Terminal Block on the end Units.

Connecting the Relay Terminal Block to the Communications Terminal Block on the Controller Link Unit

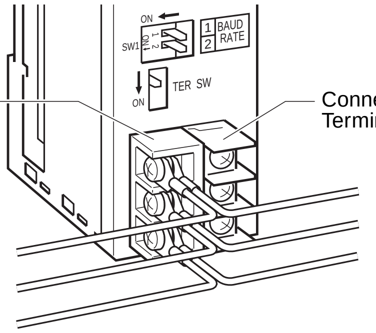
1. Connect the communications cables from the two adjacent nodes together to the terminals on the Relay Terminal Block. The tightening torque for the Relay Terminal Block terminal screws is 0.5 N·m.



2. Remove the terminal block cover from the communications terminal block on the Controller Link Unit and loosen the three screws on the communications terminal block. (If adjacent Units are close enough to interfere with work, remove the three screws.)
3. Confirming that the signal lines and shield lines are aligned properly with the markings on the Controller Link Unit, insert the Relay Terminal Block and tighten the screws on the communications terminal block to secure the Relay Terminal Block. The tightening torque for the three communications terminal block terminal screws is 0.5 N·m.



4. Attach the terminal block cover to the communications terminal block on the Controller Link Unit.



Replacing a Controller Link Unit with a Relay Terminal Block

Use the following procedure to replace a Controller Link Unit with a Relay Terminal Block. The communications cables are left connected to the Relay Terminal Block during the procedure, and only the Relay Terminal Block itself must be disconnected from the Controller Link Unit and then connected to the new Controller Link Unit.

The following procedure describes only steps required for the Relay Terminal Block. Refer to *9-5-1 Replacing the Unit* for details on the replacement operation.

1. Turn OFF the power supply to the PLC with the Unit to be replaced.
2. Remove the communications terminal block cover from the Unit.
3. Loosen the three screws on the communications terminal block. (If adjacent Units are close enough to interfere with work, remove the three screws.)
4. Remove the Relay Terminal Block with the communications cables still attached to it.

⚠ **Caution** Do not allow the metal portions of the Relay Terminal Block or the communications cable crimp terminals to come into contact with any conductive material.

5. Replace the Controller Link Unit. Set the node number, baud rate, operating level, and terminating resistance switches on the new Unit to the same settings as the previous Unit. With the C200HX/HG/HE or CQM1H PLC, turn ON the power to the PLC, download the data that was backed up from the previous Unit to EEPROM in the new Unit, and then turn OFF the power again.
6. Remove the communications terminal block cover from the new Unit.
7. Loosen the three screws on the communications terminal block on the new Unit. (If adjacent Units are close enough to interfere with work, remove the three screws.)
8. Attach the Relay Terminal Block to the new Unit with the communications cables still attached to it, making sure to align the signal lines and shield line with the markings on the Controller Link Unit.
9. Tighten the screws on the communications terminal block to secure the Relay Terminal Block. The tightening torque for the three communications terminal block terminal screws is 0.5 N·m.
10. Attach the terminal block cover to the communications terminal block on the Controller Link Unit.

11. Turn ON the power supply to the new Unit. (The power supply to other nodes should still be ON.)

Note 1. Signal will still be flowing through the communications cables during the replacement procedure if the network is still operating. Use an insulated screwdriver and be very sure that the metal portions of the Relay Terminal Block or the communications cable crimp terminals do not come into contact with any conductive material.

2. Replace the Unit only after confirming that doing so will not affect the system, including the affects of separated nodes or communications errors.

3. Always turn OFF the power supply to all nodes when connecting communications cables to or removing them from the Relay Terminal Unit.

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Revision History

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

Cat. No. W309-E1-06

Revision code

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

Revision code	Date	Revised content
1	February 1997	Original production
2	August 1997	Removed “-HZ” model suffix throughout the manual. **Page 76:** “CMND” corrected to “SEND” in the diagram for the “PC to computer” message service in the table. **Page 88:** “C” bit added to the program example. **Page 145:** Second sentence removed and the equations corrected for *8-3-2 Data Processing Time.*
3	February 1999	CS1W-CLK11 and CS1W-CLK21 Controller Link Units for CS/CJ-series PCs added. “Common memory” corrected to “shared memory” throughout the manual. Addition of new 3G8F5-CLK11-E optical model and optical system information throughout the manual.
4	September 1999	CQM1H-CLK21 Controller Link Units for CQM1H-series PCs added.

Revision code	Date	Revised content
5	May 2001	CJ1W-CLK21 Controller Link Units for CJ-series PCs added (including changing “CS1” to “CS” or CS/CJ” according to context). An appendix was added on the Relay Terminal Block. Information on optical systems removed. **Page xiii:** “Connector” changed to “any terminal block.” **Page xiv:** “Connector” removed, “communications connector” changed to “Bus Connection Unit,” and “backup power supply cable” removed. **Page xv:** “CS1W-CLK11” removed. **Page 3:** Graphic altered. **Page 5:** Information added on personal computer boards. **Page 6:** Information on H-PCF and GI cables added. **Pages 6 and 17:** Note changed/added. **Pages 10 and 16:** Information added/changed in table. **Pages 11 and 12:** Information added on wiring. **Page 15:** Note and information following it removed and other changes. **Page 17:** Note added in graphic. **Page 19:** Parenthetic information changed in procedure. **Page 30:** Unit number callout corrected. **Page 45:** Recommended wire added. **Page 54:** Corrected “bottom switch” to “front switch.” **Page 76:** Notes changed. **Page 146:** Corrected version information. **Page 159:** Restriction added on number of read words. **Page 250:** First paragraph in *9-3 Error Log* corrected.
06	February 2003	“PC” changed to “PLC” throughout the manual. Information related to the CQM1H-CLK21 was added and information related to the CS1W-CLK21 was removed. In addition, the following changes were made. **Page v:** Changes made to information on product references. **Page 17, 73, 104, 272:** Information on software switches added. **Pages 52, 55:** Changes made to table giving baud rates. **Pages 79, 80:** “-EV☐” added to model numbers in several of places. **Page 100:** Parenthetic information added to first paragraph. **Page 107:** Programming examples added. **Pages 137, 141:** Numerical change: 120000 changed to 121000. **Pages 214, 216:** “Scan” changed to “cycle” in several places. **Page 250:** Minor change made to first paragraph.

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

Regional Headquarters

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

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

OMRON ASIA PACIFIC PTE. LTD.
83 Clemenceau Avenue,
#11-01, UE Square,
Singapore 239920
Tel: (65)6835-3011/Fax: (65)6835-2711

Authorized Distributor:

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OPERATION MANUAL

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