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SYSMAC CV-series
CV500/CV1000/CV2000/CVM1
Programmable Controllers

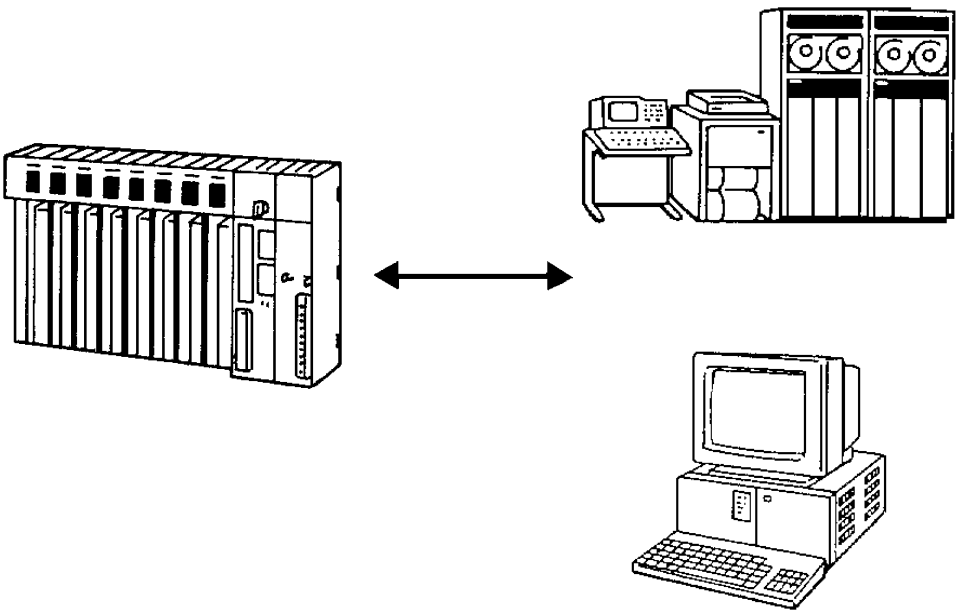
OPERATION MANUAL
Host Link System
CV500-LK201 Host Link Unit

OMRON

SYSMAC CV-series
CV500/CV1000/CV2000/CVM1
Programmable Controllers

Operation Manual:
Host Link System, CV500-LK201 Host Link Unit

Revised May 2002



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.

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

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

Visual Aids

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

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

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

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About this Manual:

This manual describes the host interface built into the SYSMAC CV-series Programmable Controllers (PCs), and CVM1, and the CV500-LK201 Host Link Unit. The host interface provided by the CPU is functionally the same as the interface provided in the CV500-LK201 Host Link Units. This manual is designed to accommodate users of either interface type and the user should not feel that both types of interfaces are required to run a fully operational Host Link System. Many of the features and functions are the same for both the CPU host interface and Host Link Unit. However, features and functions that differ between the two types of interface are described separately in this manual, and the user should refer to the sections that apply to the interface being used. *1-1 Overview* provides a general description of the Host Link System and the differences between the two types of interface.

This manual is designed to be used together with two other CV-series PC operation manuals and an installation guide. The entire set of CV-series PC manuals is listed below. Only the basic portions of the catalog numbers are given; be sure you have the most recent version for your area.

Manual	Cat. No.
CV-series PC Installation Guide	W195
CV-series PC Operation Manual: SFC	W194
CV-series PC Operation Manual: Ladder Diagrams	W202
CV-series PC Operation Manual: Host Link System, CV500-LK201	W205

Programming and operating CV-series PCs are performed with the CV Support Software (CVSS), the SYSMAC Support Software (SSS), and the CV-series Programming Console for which the following manuals are available.

Product	Manuals
CVSS	The CV Series Getting Started Guidebook (W203) and the CV Support Software Operation Manuals: Basics (W196), Offline (W201), and Online (W200).
SSS	SYSMAC Support Software Operation Manuals: Basics (W247), C-series PC Operations (W248), and CVM1 Operations (W249)
CV-series Programming Console	CVM1-PRS21-E Programming Console Operation Manual (W222)

Note The CVSS does not support new instructions added for version-2 CVM1 PCs. The SSS does not support SFC programming (CV500, CV1000, or CV2000).

Please read this manual completely together with the other CV-series PC and CVSS manuals and be sure you understand the information provide before attempting to install, program, or operate a CV-series PC. The basic content of each section of this manual is outlined below.

Section 1 provides an overview of the operation, features, and technical specifications of the Host Link System. It also describes the types of system configuration available for the Host Link System using either RS-422 or RS-232C connections.

Section 2 provides information on setting the switches that control communications parameters for the CPU. These switches can be also be set to use the communications parameters specified in the PC Setup in the CPU. In addition, this section provides information on the Host Link Unit switches setting and CPU Bus Unit System Setup parameters that control communications.

Section 3 describes how to connect the Host Link Unit, host link interfaces, Link Adapters, and host computer. Refer to *Section 1 Introduction* for details on the system configuration. Refer to the *CV-series PC Installation Guide* for general installation procedures and precautions.

Section 4 describes both the test methods used to check communications and the specifications of the commands that are used for communications control and timing. For communications in CV (FINS) mode, refer to *FINS Command Reference Manual*.

Section 5 provides details on all C-mode commands. For basic information on C-mode communications, refer to *4-3 C-mode Commands*.

Section 6 provides information on maintenance and troubleshooting for the Host Link System. For the troubleshooting of the CPU, refer to the *CV-series PC Operation Manual: Ladder Diagrams*.

Four ***Appendices*** provide information on standard models, specifications, and Host Link Unit memory allocations. Sample programs which include commands for the host computer are also provided.

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

SECTION 1
Introduction

This section provides an overview of the operation, features, and technical specifications of the Host Link System. It also describes the types of system configuration available for the Host Link System using either RS-422 or RS-232C connections.

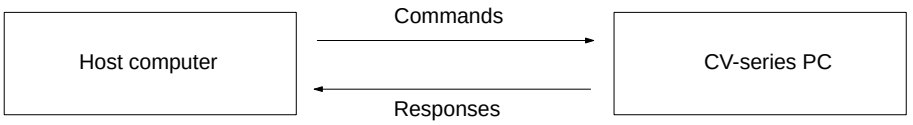
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1-1 Overview

1-1-1 Communications

The Host Link System is an optimum and economical communications method for any size of FA system. The Host Link System can incorporate one or more host computers interconnected to one or more PCs.

A Host Link System allows a host computer to monitor the operating status and data areas of the PCs and to control PC operation through transfers of data and programs.

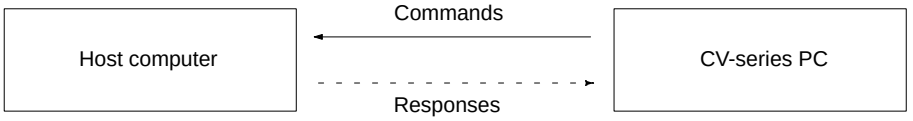


As shown in the figure above, data transfer between the host computer and the Host Link System is normally initiated when a host computer sends a command to a PC in the Host Link System. The PC processes each command sent by the host computer and transmits the results to the host computer.

The user can control the PCs in the Host Link System and monitor operation with one or more host computers. For example, on a production site, a single host computer makes it possible to monitor and control the operation of the PCs by transferring data and programs required for production.

Transmissions from PCs

The CV500-LK201 Host Link Unit also allows a CV-series PC to send a command to a host computer, thus enabling the PC to inform the host computer of any abnormality arising on the production line that the PC is controlling. The PC can also communicate with the host computer to check the operating conditions of the host computer.



⚠ Caution Transfer only uppercase letters using the host links. Lowercase text cannot be processed.

1-1-2 Features

CV-series PCs feature a built-in host interface. With this interface, it is possible to create a Host Link System consisting of CV-series PCs without using any optional Units. When a single interface is not sufficient, however, the CV500-LK201 Host Link Unit can be mounted to a PC Rack to connect to more than one host computer. The system created by connecting one or more PCs to one or more host computers via either the host interface on the CPU or a Host Link Unit mounted to a PC Rack is called a Host Link System. The main advantages of the Host Link System are described below.

Communications Use either RS-232C or RS-422 communications.

Multiple PCs Connections Up to 32 PCs can be connected to a host computer via RS-422 communications.

Host Monitoring and Control The operating status of the PCs and its memory contents can be monitored and controlled from the host computer.

New Command System A new command mode called FINS, or CV mode, is provided in addition to the conventional command mode used by the C-series PCs. Refer to the *FINS Command Reference Manual*.

Double-check System All communications are subject to a parity check and frame check sequence (FCS) to help eliminate almost all transmission data errors.

Two Communications Ports The Host Link Unit incorporates two communications ports: a 25-pin RS-232C port and a 9-pin RS-232C or RS-422 (selectable) port. It is possible to use these two ports simultaneously, thus allowing the Host Link Unit to connect to two host computers.

Commands from PC to Host Computers Although the host interface on the CPU allows a host computer to send commands to PCs and the PCs to respond to the commands, the PC cannot send commands to the host computer. The Host Link Unit, however, makes it possible for the PCs to send commands to the host computer, thus enabling commands generated by executing SEND(192), RECV(193), and CMND(194) instructions. The Host Link Unit also enables any node on the network to send commands to the host computer, even across multiple network levels.

Note The communications delay varies with the baud rate, the amount of data, and the PC's execution method (i.e., synchronous or asynchronous). For example, if the PC uses synchronous execution, the PC's cycle time will increase transmission delays. If high-speed processing is required from the host, these factors must be considered.

1-1-3 Differences between Host Interface and Host Link Unit

The following table lists the differences between host interface functionality on the CPU and the functionality of the Host Link Unit.

Feature	CPU host interface	Host Link Unit
Number of communications ports	One: RS-232C/RS-422 (selectable)	Two: RS-232C port and RS-232C/RS-422 port (selectable)
Communications method	Full duplex	Half duplex or full duplex (selectable)
Xon/Xoff control	Unavailable	Possible using full duplex communications
CTS signal control	Unavailable	Possible to set the CTS signal to ON (0 V) continuously.
Unit number	Not required	Set with the unit number switch on the front panel.
Node number	Set in the PC Setup	The node number of port 2 is set with the node number switch on the front panel. The node number of port 1 is always set to 00.
Optical interface connection	Power must be supplied from an AC Adapter.	No AC Adapter is required as long as port 1 is used because power is supplied through the connector.
Wrap communication test	Not supported	Executed via DIP switch setting. A connector must be prepared for a wrap communication test.
Operating parameters	Set in the PC Setup.	Set in the CPU Bus Unit System Setup.
Sending commands to host computers	Not possible.	Possible to send CV-mode (FINS) commands.

1-1-4 Differences between C-series and CVM1/CV-series Host Links

This section lists the differences between C-series and CVM1/CV-series Host Links. Use this information as reference when converting from the C Series to the CVM1/CV Series.

Frame Size when Dividing Transmissions into Multiple Frames

Item	C-series Host Links	CVM1/CV-series Host Links
Frame size	A total of 29 words of data is returned in each frame.	A total of 30 words of data is returned in each frame.
Applicable models	C-series Host Link Units	Built-in RS-232C ports or peripheral ports on SRM1, CPM1, CPM1A, CQM1, C200HS, C200HX/HG/HE, and other CPU Units. CVM1/CV-series built-in Host Links CV500-LK201 Host Link Unit

Note The user program may need to be altered to enable correct reading of data for the above difference in frame size. Be sure to check operation and correct the program as required.

C-mode Commands Not Supported by CVM1/CV-series Host Links

Item	C-series Host Links	CVM1/CV-series Host Links
Supported C-mode commands	All C-mode commands	The following C-mode commands are supported only by built-in Host Links for CPU Unit of version 2 (-V2) or later and cannot be used on other CVM1/CV-series Host Links. RL/WR: LINK AREA READ/WRITE RH:WH: HOLDING AREA READ/WRITE CR: DM AREA READ/WRITE R#/R$/R%: SV READ 1/2/3 W#/W$/W%: SV WRITE1/2/3

Note When the model is changed so that the above commands are no longer supported, change the user program to perform the same operation using other C-mode commands or FINS commands.

Communications Port Signals Different communications signals are used for Host Link communications for the C Series and CVM1/CV Series depending on the model and the type of port. Differences in the signals are listed below by port.

RS-232C Port

Signals	C-series Host Links	CVM1/CV-series Host Links
ST1, ST2, RT	Used.	Not used.

If the SR1, SR2, and RT signals are not used, the same communications cable can be used even if the model is changed. If the SR1, SR2, and RT signals are used, synchronized transfer of data will not be possible if the model is changed. Change the system to sync on the CD (carrier detected) signal. Part of the cable wiring must also be changed.

RS-422 Port

Signal	C-series Host Links	CVM1/CV-series Host Links
SG	Used by some models: SG Used C200H-LK202-V1 3G2A6-LK202-EV1 3G2A5-LK201-EV1 SG Not Used C500-LK203	Not used.

1-1-5 New/Improved Commands for the CPU Host Interface

New C-mode commands have been added for the CPU Host Interface and the functionality of existing commands has been improved as follows:

New Commands

- RL/WL: Read and write commands for the CIO Area.
- RH/WH: Read and write commands for the CIO Area.
- CR: Read command for the DM Area.
- R#/R$/R%: SV read commands.
- W#/W$/W%: SV change commands.
- *: Initialization command.

Improved Commands

- The Link Area (CIO 1000 to CIO 1063) and Holding Area (CIO 1200 to CIO 1299) can now be specified for the KS, KR, KC, and QQ commands.
- CVM1-CPU21-EV2 can now be read for the MM command.

The above new and improved commands can also be used with all V1 CPUs with lot numbers in which the rightmost digit is 5 (□□□5) or higher.

Note The above new and improved commands cannot be used with the CV500-LK201 Host Link Unit.

1-2 System Configuration

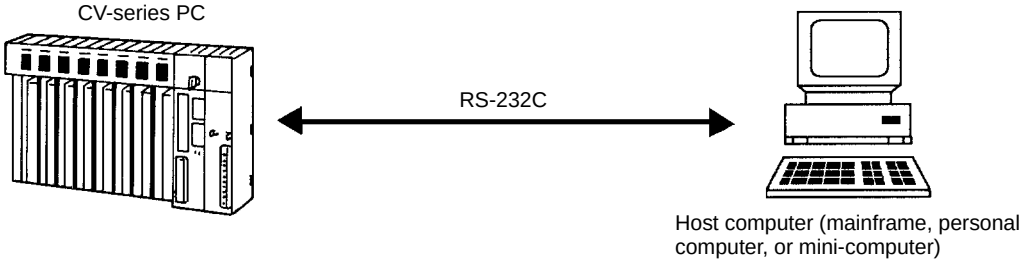
A Host Link System can be connected using RS-232C and/or RS-422 lines.

1-2-1 RS-232C

If a RS-232C line is used to connect a Host Link System, only one PC can be connected to the host computer.

Transmission Distance

The maximum transmission distance varies with the method in which a host computer and PC are connected. There are three connection methods available: via wire cable, via Optical Fiber Cable and an Optical Interface, and via optical fiber cable and Link Adapters.



RS-232C Cable

The maximum transmission distance is 15 m if a host computer and PC are connected via RS-232C cable.

Optical Interface

The maximum transmission distance is 500 m if a host computer and PC are connected via two Z3RN-A-5 Optical Interfaces and a Z3F2-4D□M Optical Fiber Cable. The following accessories are necessary. Here, RS-232C cable connects the PC to one Optical Interface and the host computer to the other Optical Interface, and the Optical Fiber Cable connects the two Optical Fiber Interfaces. The AC Adapters provide power to the Optical Interfaces.

Optical Interface

The maximum transmission distance is 500 m if a host computer and PC are connected via two Z3RN-A-5 Optical Interfaces and a Z3F2-4D□M Optical Fiber Cable. The following accessories are necessary. Here, RS-232C cable connects the PC to one Optical Interface and the host computer to the other Optical Interface, and the Optical Fiber Cable connects the two Optical Fiber Interfaces. The AC Adapters provide power to the Optical Interfaces. Refer to *Appendix B Specifications* for Link Adapters specifications.

Item	Model	Required number	Remarks
Optical Interface	Z3RN-A-5	2	Converts wire to optical signals.
Optical Fiber Cable	Z3F2-4D□M	1	The box in the model number indicates one of the following cable lengths: 1, 5, 10, 20, 30, 50, 100, 200, 400, 500 m.
AC Adapter	Z3GP-01	2	5 VAC power supply for Optical Interfaces

Note The cable connecting the Optical Interface and the connector on the PC (for conversion between 25 pins and 9 pins) is not available from OMRON.

Link Adapters

The host computer and PC can be connected via an optical fiber cable and two 3G2A9-AL004-E (or 3G2A9-AL004-PE) Link Adapters. Here, RS-232C cable connects the PC to one Link Adapter and the host computer to the other Link Adapter, and the optical fiber cable connects the two Link Adapters. The maximum transmission distance varies with the kind of optical fiber cable as follows:

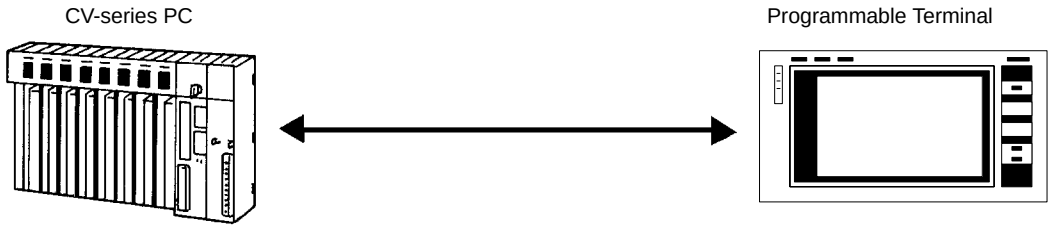
Cable	3G2A9-AL004-PE	3G2A9-AL004-E
APF	20 m	Connection impossible
PCF	200 m	800 m

APF: all-plastic fiber; PCF: plastic-clad fiber

Connection with Programmable Terminals

The Host Link System makes it possible for a PC to connect not only to a host computer but also a Programmable Terminal (PT). The PT connected to the PC displays information on the system controlled by the PC as well as errors that may occur in the system.

Note The CPU Unit will change to MONITOR mode if a PT is connected via a Host Link connection when the CPU Unit is operating in RUN mode. Use an NT Link connection when connecting in RUN mode. (The mode will not change if the connection is made through an NT Link connection.)

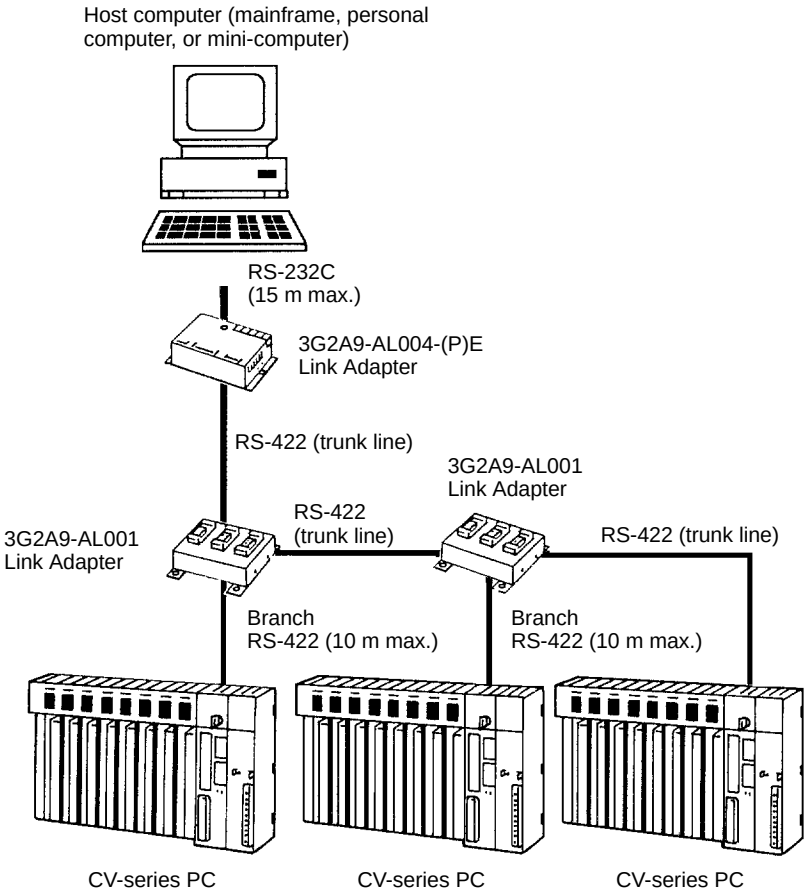


1-2-2 RS-422

RS-422 lines can be used to connected up to 32 PCs to the same host computer.

Transmission Distance

The maximum transmission distance varies with the method in which a host computer and PCs are connected. There are two connection methods available: via RS-232C wire cable and via optical fiber cable. Either method requires the use of Link Adapters. The overall arrangement of system components is the same regardless of whether wire or optical fiber cable is used. A system with wire components is shown below. Refer to *Appendix B Specifications* for Link Adapters specifications.



RS-422 Cable

The host computer can be connected to up to 32 PCs through RS-422 wire cables. If the host computer has a RS-422 port, it can be connected directly to the first 3G2A9-AL001 Link Adapter. If the host computer has only a RS-232C port, use a 3G2A9-AL004-E or 3G2A9-AL004-PE Link Adapter to convert RS-232C to RS-422 as shown above. The maximum cable lengths are as follows:

Length of RS-232C cable	15 m max.
Total length of RS-422 cable	500 m max.
Length of each RS-422 branch	10 m max.

Optical Fiber Cable

The 3G2A9-AL004-E or 3G2A9-AL004-PE and 3G2A9-AL002-E or 3G2A9-AL002-PE Link Adapters can be used to connect a Host Link System using optical fiber cables. The 3G2A9-AL004-E or 3G2A9-AL004-PE Link Adapters are used to convert between wire and optical lines and the 3G2A9-AL002-E or 3G2A9-AL002-PE Link Adapters are used to branch optical lines. In the diagram shown above, the AL001 Link Adapters would be replaced

with 3G2A9-AL002-E or 3G2A9-AL002-PE Link Adapters, the 3G2A9-AL004-E or 3G2A9-AL004-PE Link Adapter would be replaced with a 3G2A9-AL004-E or 3G2A9-AL004-PE Link Adapter and then 3G2A9-AL004-E or 3G2A9-AL004-PE Link Adapters would be inserted before each PC to convert back to wire cable. The maximum transmission distance varies with the Link Adapter and the kind of optical fiber cable as follows:

Cable	3G2A9-AL002-PE 3G2A9-AL004-PE	3G2A9-AL002-E 3G2A9-AL004-E
APF	20 m	Connection impossible
PCF	200 m	800 m

APF: all-plastic fiber; PCF: plastic-clad fiber

1-3 Communications Specifications

The specifications of the host interface on the PC's CPU are as follows:

Communications method	Four-wire, half duplex
Synchronization method	Start-stop, 1 or 2 stop bits (set in PC Setup)
Baud rate	1200/2400/4800/9600/19200 bps (set in PC Setup)
Transmitted code	7- or 8-bit ASCII (set in PC Setup)
Error detection	Vertical parity, even/odd (set in PC Setup)
Interface	RS-232C/RS-422 (set on selector on CPU)
Transmission distance	RS-232C: 15 m max.; RS-422: 500 m total max. (See details under *System Configuration*.)

The following are the communications specifications of the Host Link Unit. (The general specifications of the Host Link Unit are the same as those of the CV-series PCs.)

Item	Port 1	Port 2
Interface	RS-232C	RS-232C or RS-422 (selectable)
Communications method	Half duplex or full duplex; Set in CPU Bus Unit System Setup.	RS-232C: Half duplex or full duplex; Set in CPU Bus Unit System Setup. RS-422: Full duplex
Synchronization method	Start-stop, 1 or 2 stop bits; Set in CPU Bus Unit System Setup.	Start-stop, 1 or 2 stop bits; Set in CPU Bus Unit System Setup.
Baud rate	1200, 2400, 4800, 9600, or 19200 bps; Set in CPU Bus Unit System Setup.	1200, 2400, 4800, 9600, or 19200 bps; Set in CPU Bus Unit System Setup.
Transmitted code	7- or 8-bit ASCII; Set in CPU Bus Unit System Setup.	7- or 8-bit ASCII; Set in CPU Bus Unit System Setup.
Error detection	Vertical parity, even/odd/none; Set in CPU Bus Unit System Setup. FCS (frame checksum sequence)	Vertical parity, even/odd/none; Set in CPU Bus Unit System Setup. FCS (frame checksum sequence)
Transmission control	Xon/Xoff control; Set in CPU Bus Unit System Setup.	Xon/Xoff control; Set in CPU Bus Unit System Setup.
Transmission distance	15 m max.	RS-232C: 15 m max.; RS-422: 500 m total max.

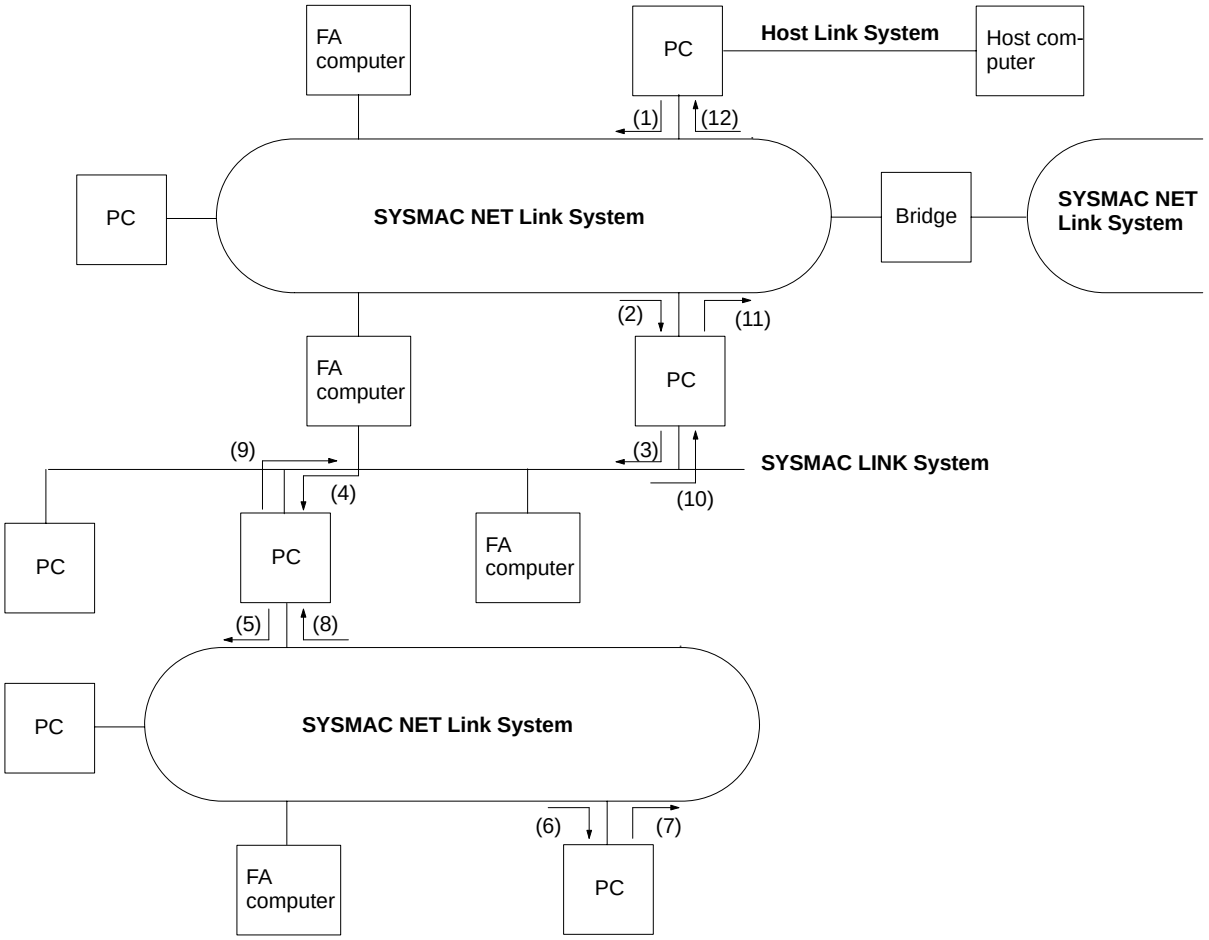
1-4 Gateway Function

A host computer in a Host Link System can communicate with CV-series PCs or IBM PC/AT or compatible computers on other networks through the Host Link System. Communications are possible to up to two networks away from the local Host Link System (three including the local Host Link System). The PC must belong to a SYSMAC LINK or SYSMAC NET Link System to use the gateway function. The gateway function is actually a feature of the SYSMAC LINK and SYSMAC NET Link Systems and is not possible unless a SYSMAC LINK and/or SYSMAC NET Link Unit is mounted to at least one of the PCs in the Host Link System.

In the following example, the host computer connected to the Host Link System can communicate with the PCs in the SYSMAC LINK System and the SYSMAC NET Link Systems. The numbers in parentheses indicate the various networks through which communications can move.

Although either CV- or C-mode commands can be used to control the PCs in the local Host Link System, only CV-mode commands (FINS commands) can be used to control the PCs in other Systems.

Refer to the *SYSMAC LINK System Manual* or the *SYSMAC NET Link System Manual* for details on the gateway function. Refer to *FINS Command Reference Manual* for details on sending commands to PCs on remote networks.



SECTION 2
Switch Settings and Communications Parameters

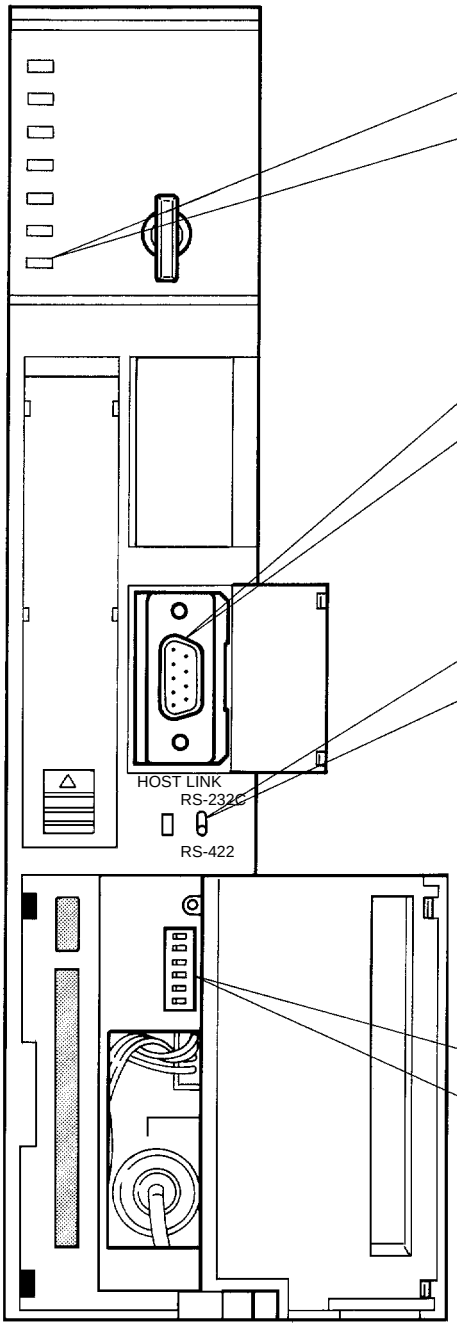
This section provides information on setting the switches that control communications parameters for the CPU. These switches can be also be set to use the communications parameters specified in the PC Setup in the CPU. In addition, this section provides information on the Host Link Unit switches setting and CPU Bus Unit System Setup parameters that control communications.

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2-1 CPU Settings and Parameters

2-1-1 Interface-related Components on CPU

The following illustration shows the various parts of a CV-series CPU that are related to a Host Link System. Details on the operation of these parts are provided later in the manual.



COMM (communications) indicator (Orange)
Lit when data is being transferred or received via the host interface.

Host interface port
Connected to RS-232C or RS-422 connector.

Transmission path selector
Set to RS-232C for RS-232C communications. Set to RS-422 for RS-422 communications.

DIP switch		
Pin 6	**ON:**	Connects termination resistance for RS-422.
	OFF:	Disconnects termination resistance for RS-422.
Pin 4 (see note 1)	**ON:**	Sets the following communications parameters: Baud rate: 9,600 bps Unit number: 0 Parity: Even Data length: 7 bits Stop bits: 2
	OFF:	Sets communications parameters from the PC Setup.
Pin 3	**ON:**	Enables connection to PT via host link connector.
	OFF:	Enable connection to host link via host link connector.

Note 1. The ON conditions of the communications settings (pin 4) shown above apply to CPUs with a lot number of "□□75" or greater (manufactured in and after July 1995.) The settings for those with a lot number of "□□65" or smaller (manufactured in and before June 1995) are as follows:
Stop Bits: 1
Baud Rate: 2400 bps

2. The cable connecting to the host interface is not available from OMRON. Refer to *Section 3 Installation* and prepare an appropriate cable.
3. For setting the termination resistance of the pin 6, refer to *Section 3 Installation*.
4. The cable connecting the Optical Interface and the connector on the PC (for conversion between 25 pins and 9 pins) is not available from OMRON.

2-1-2 Communications Parameters in PC Setup

If pin 4 of the DIP switch on the CPU is turned OFF, the communications parameters for the host interface will be set according to the PC Setup contained in the CPU. The PC Setup is set from a Peripheral Device, such as the CVSS, and can be either set offline and then transferred to the CPU or can be set online.

The following parameters can be set. The default setting of each parameter is shown. These defaults are different from those used if pin 4 is turned ON, i.e., you can select either the pin 4 defaults or the defaults listed below to achieve different settings without specifying them individually. Refer to the CVSS operation manuals for details on changing settings in the PC Setup.

Parameters	Possible settings	Default
Baud rate	1200, 2400, 4800, 9600, or 19200 bps	9600 bps
Stop bits	Either 1 or 2 stop bits	2 stop bits
Parity	Even, odd, or no parity	Even parity
Data length (Data bits)	Either 7-bit or 8-bit data	7-bit data
Unit number*	00 to 31 (Used by host computer to identify PCs.)	00

Note *The unit number of the host interface corresponds to the node number of Host Link Units.

2-2 Host Link Unit Settings and Parameters

2-2-1 Host Link Unit Setting Procedure

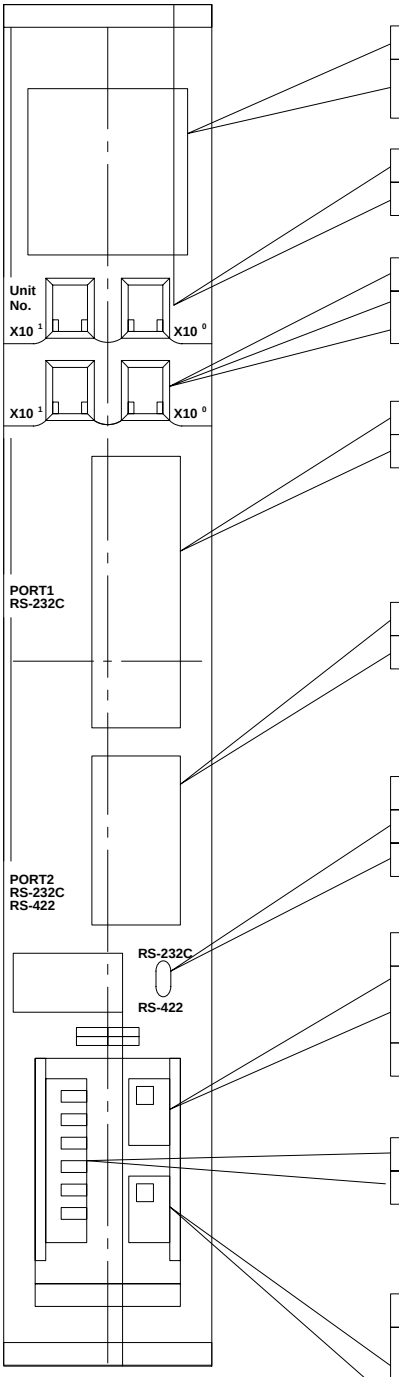
Use the following setting procedure for each Unit.

1, 2, 3...

1. Design the system, including the devices to be connected and the connection methods, referring to *Section 1 Introduction*.
2. Prepare cables referring to *Section 3 Installation*.
3. Set Host Link Unit switches referring to *2-2-2 Host Link Unit Setting*.
4. Set the CPU Bus Unit System Setup referring to *2-2-3 CPU Bus Unit System Setup* and the *CVSS Operation Manual: Online*.
5. Connect the system referring to *Section 3 Installation*.
6. Test communications referring to *Section 4 Communications*.
7. Operate the system for final checking.

2-2-2 Host Link Unit Components

The following illustration shows the components of the Host Link Unit.



Indicators
It is possible to monitor the working condition of the Host Link Unit with these indicators.

Unit number switch
The unit number is set with this decimal rotary switch.

Node number switch
The node number at communications port 2 is set with this decimal rotary switch.

Communications port 1 (RS-232C only, 25 pins)
Connects to an RS-232C cable.

Communications port 2 (RS-232C/RS-422 selectable, 9 pins)
Connects to an RS-232C or RS-422 cable.

Communications path selector	
Top	Selects RS-232C for communications port 2.
Bottom	Selects RS-422 for communications port 2.

5-V output switch	
Top	5 V, which is used if the optical interface is connected to communications port 1, is supplied to pin number 14 of communications port 1.
Bottom	5 V is not supplied to communications port 1.

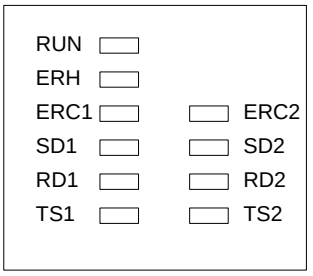
DIP switch
Basic operations of the Unit are set here.

Terminator switch	
Top	Connects termination resistance for RS-422 communications.
Bottom	Disconnects termination resistance.

Note Cables for the connectors (ports 1 and 2) are not available from OMRON.

Indicators

The status of the Host Link Unit can be determined using the status of the indicators on the Host Link Unit.



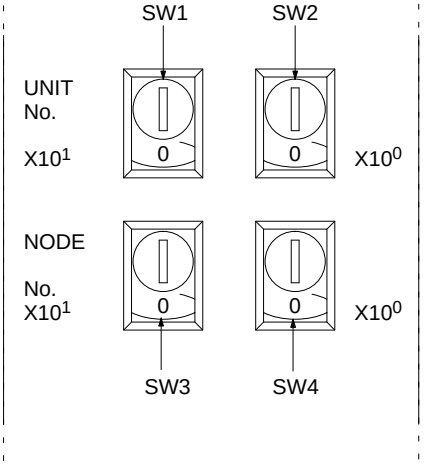
Indicator	Color	Status	Meaning
RUN	Green	Lit	The Host Link Unit is normal.
		Not lit	The Host Link Unit has an error.
ERH (PC error)	Red	Lit	The PC has an error or either the unit number setting or I/O table is wrong.
		Not lit	The PC is normal.
ERC1 (transmission error 1)	Red	Lit	Communications port 1 has a transmission error (parity, framing, FCS, or overrun error).
		Not lit	Communications port 1 is normal.
ERC2 (transmission error 2)	Red	Lit	Communications port 2 has a transmission error (parity, framing, FCS, or overrun error) or the node number setting is wrong.
		Not lit	Communications port 2 is normal.
SD1 (send 1)	Orange	Lit	Data is being transmitted from communications port 1.
		Not lit	No data is being transmitted from communications port 1.
SD2 (send 2)	Orange	Lit	Data is being transmitted from communications port 2.
		Not lit	No data is being transmitted from communications port 2.
RD1 (receive 1)	Orange	Lit	Data is being received at communications port 1.
		Not lit	No data is being received at communications port 1.
RD2 (receive 2)	Orange	Lit	Data is being received at communications port 2.
		Not lit	No data is being received at communications port 2.
TS1 (test 1)	Orange	Lit	A wrap test is being executed at communications port 1.
		Flashing	A wrap test at communications port 1 has been completed.
		Not lit	No wrap test is being executed at port 1.
TS2 (test 2)	Orange	Lit	A wrap test is being executed at communications port 2.
		Flashing	A wrap test at communications port 2 has been completed.
		Not lit	No wrap test is being executed at port 2.

Rotary Switch Settings

The Host Link Unit provides rotary switches on the front panel used to set the Host Link Unit's unit number and node number for identification in the Host Link System. Set the rotary switches only when the PC is turned off.

Location of Rotary Switches

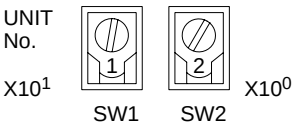
The rotary switches are located beneath the indicators and appear as shown in the following illustration. SW1 and SW2 are used to set the Host Link Unit's unit number as a CPU Bus Unit; SW3 and SW4 are used to set the node number for the Host Link Unit's communications port 2.



Unit Number (SW1 and SW2)

Set the unit number to a unique number between 0 and 15 in the decimal. This is the unit number of the Host Link Unit as a CPU Bus Unit. Do not use the same number on two CPU Bus Units in the same PC.

Set the 10's digit of the unit number with SW1 and the 1's digit with SW2. In the following example, the unit number is set to 12.



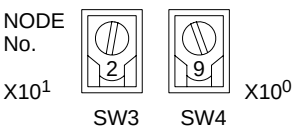
Note

1. The node number must not be larger than 15. If a node number larger than 15 is set, an error will result and the ERH indicator on the display panel will light.
2. Each CPU Bus Unit for a PC must have a unique unit number.

Node Number of Communications Port 2 (SW3 and SW4)

If more than one PC is connected to a host computer (e.g., one via the CPU's host interface and one via the Host Link Unit), each link is identified by a node number. The node number of port 2 is set here. The node number of communications port 1 is fixed to 00.

Set a node number between 0 and 31 in decimal. Set the 10's digit of a node number with SW3 and the 1's digit with SW4. In the following example, the node number of the Host Link Unit is set to 29.



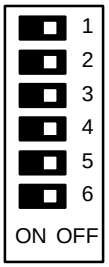
Note

1. The node number must not be larger than 31. If a node number larger than 31 is set, an error will result and the ERC2 indicator on the display panel will light.

2. Each node number must be unique in the same Host Link System.
3. The node number of the Host Link Unit's communications port 1 is fixed to 00.
4. The node number of the CPU's host interface is set in the PC Setup. (In the PC Setup, the node number of the host interface is called the "unit #.")

DIP Switch Settings

Pins 1 through 6 on Host Link Unit's DIP switch are used to control certain communications parameters and tests. These pins are turned ON when they are slid to the left and turned OFF when they are slid to the right.



The following settings are possible with the DIP switch.

Pin	Function	Setting	
1	Communications parameters for communications ports 1 and 2 (see note)	ON	Sets the following communications conditions for communications ports 1 and 2. Baud rate: 9,600 bps Stop bits: 2 Parity: Even number Data length: 7 bits Xon/Xoff control: Not executed Communications method: Full duplex
		OFF	Executes the Host Link Unit's communication using the values in the PC's CPU Bus Unit System Setup. The following are default values: Baud rate: 9,600 bps Stop bits: 2 Parity: Even number Data length: 7 bits Xon/Xoff control: Not executed Communications method: Full duplex
2	CTS control for communications port 1	ON	Turns ON (sets to 0 V) the CTS signal (clear to send). This pin must be turned ON if the Host Link Unit is connected to a host computer.
		OFF	Receives an external signal for CTS. This switch must be turned OFF while a wrap communications test is being executed.
3	CTS control for communications port 2	ON	Turns ON (sets to 0 V) the CTS signal (possible to receive). This pin must be turned ON if the Host Link Unit is connected to a host computer via an RS-232C cable. This pin, however, need not be turned ON if the Host Link Unit is connected to a host computer via an RS-422 cable.
		OFF	Receives an external signal for CTS. This switch must be turned OFF while a wrap communications test is being executed.
4	Not used	ON	Always turn OFF.
		OFF	
5	Wrap communications test	ON	Executes a wrap communications test.
		OFF	Enables normal Host Link Unit operation.
6	Test port designation	ON	Designates port 2 for the wrap communications test.
		OFF	Designates port 1 for the wrap communications test.

Note The ON conditions of the communications settings (pin 1) shown above apply to CPUs with a lot number of "□□75" or greater (manufactured in and after July

1995.) The settings for those with a lot number of "□□65" or smaller (manufactured in and before June 1995) are as follows:
Stop Bits: 1
Baud Rate: 2400 bps.

Switch Setting Procedure

Switch Settings for Communications Port 1

The setting procedure for the DIP switch is as follows for port 1 (25 pins):

1, 2, 3...

1. Turn OFF pin number 1 to specify use of the parameters in the CPU System Setup. Unless these parameters have been changed, the default values will be set.
2. Turn ON DIP switch pin 2. When this is done, the RS and CS pins of the connector need not be short-circuited.
3. Make sure that pin 4 is OFF.
4. Turn OFF pin 5 to set normal operations. This pin is turned ON only when performing a wrap communications test.
5. Turn ON the 5-V output switch if an optical interface is going to be used. This switch should be turned ON only after connecting the optical interface.

or Turn OFF the 5-V output switch if an optical interface is not going to be used.

Switch Settings for Communications Port 2

The setting procedure for the DIP switch is as follows for port 2 (9 pins):

1, 2, 3...

1. Specify either RS-232C or RS-422 communications.
2. If RS-232C communications are specified, turn ON DIP switch pin 3. When this is done, the RS and CS pins of the connector need not be short-circuited.

or If RS-422 communications are specified, turn ON the terminator switch at the last Unit on the RS-422 communications line.

3. Turn OFF pin number 1 to specify use of the parameters in the CPU System Setup. Unless these parameters have been changed, the default values will be set.
4. Make sure that pin 4 is OFF.
5. Turn OFF pin 5 to set normal operations. This pin is turned ON only when performing a wrap communications test.
6. Turn ON the 5-V output switch if an optical interface is going to be used. This switch should be turned on only after connecting the optical interface.

or Turn OFF the 5-V output switch if an optical interface is not going to be used.

2-2-3 CPU Bus Unit System Setup

Settings for the Host Link Unit are made in the CPU Bus Unit's System Setup. The CPU Bus Unit's System Setup parameters are set from the CVSS (CV Support Software) and supported by version 2 of the CVSS [CV500-ZS3AT1-EV2 (3.5" disks), CV500-ZS5AT1-EV2 (5.25" disks)].

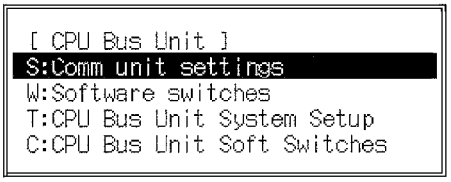
Setting Procedure

The system settings of the Host Link Unit are explained below. For details, refer to the *CVSS Operation Manual: Online*.

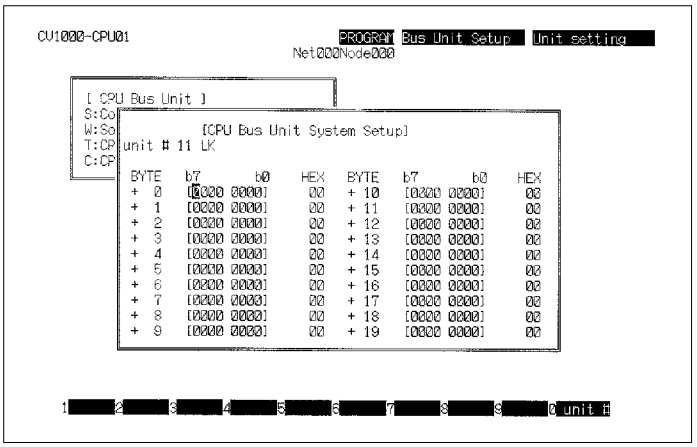
1, 2, 3...

1. Set the rotary switches on the Host Link Unit (refer to page 16).
2. Mount the Host Link Unit to the PC and turn ON the PC (refer to *Section 3 Installation*).
3. Start the CVSS and switch to online mode.
4. Create the I/O table.

5. Select “CPU Bus Setting.” The following menu will be displayed.



6. Select “CPU Bus Unit System Setup.” The following screen will appear.

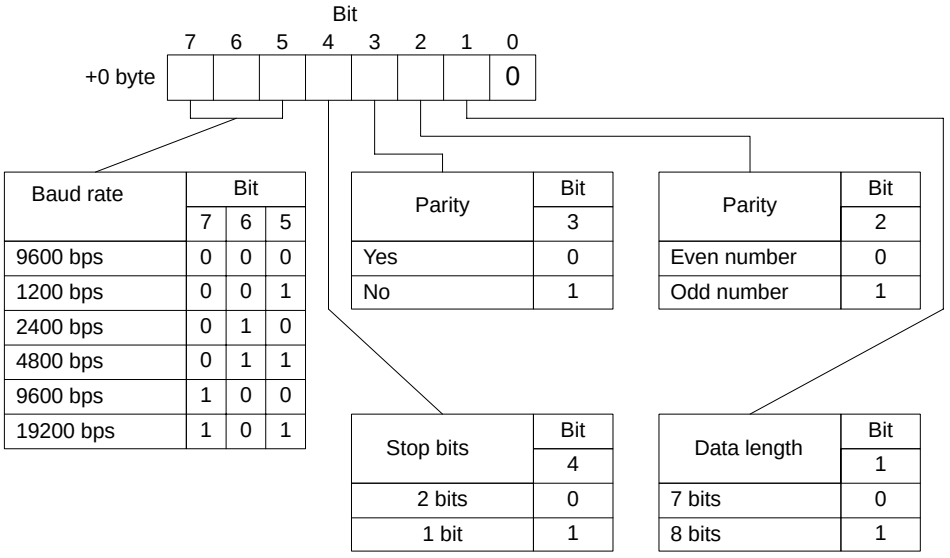


7. Press F10 and then input the unit number of the Host Link Unit. The default value will be displayed if no other value has been input.
8. Refer to the table below for the settings. These settings are made by turning ON and OFF the bits in the various bits of the System Setup. These bytes and how they correspond to the various settings are described following the table.
9. To make the settings effective, turn the PC OFF and ON or restart the Host Link Unit.

Item	Setting	Default
Baud rate	1200, 2400, 4800, 9600, or 19200 bps	9600 bps
Stop bits	1 stop bit or 2 stop bits	2 stop bits
Parity	Even number, odd number, or nil	Even number
Data length	7- or 8-bit ASCII	7-bit ASCII
Xon/Xoff control	Execute or not execute (effective only when the Host Link Unit is in full duplex communications mode)	Not execute
Communications method	Full duplex or half duplex (The half duplex system is effective only when an RS-232C cable is used for communication.)	Full duplex
Retries	Set to retry or not to retry. If retries are specified, the Host Link Unit will attempt to transmit again when a data transmission is interrupted.	No retries
Transmission stop code (Xoff)	This setting is effective only when Xon/Xoff control is used.	13 (hexadecimal)
Transmission stop cancel code (Xon)	This setting is effective only when Xon/Xoff control is used.	11 (hexadecimal)
Transmission delay time	The interval between the RS signal is ON and data transmission is done with this setting. The setting is effective in half duplex communications mode only. The setting range is 0 to 510 ms (255 x 2) with 2-ms increments. If 0 ms is set, data will be transmitted within 1 ms after the RS signal is ON.	0 ms

Settings for Communications Port 1

The setting of communications port 1 are as follows:



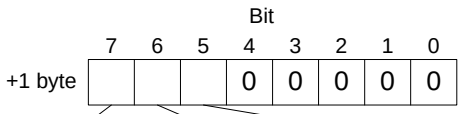
Baud rate	Bit		
	7	6	5
9600 bps	0	0	0
1200 bps	0	0	1
2400 bps	0	1	0
4800 bps	0	1	1
9600 bps	1	0	0
19200 bps	1	0	1

Parity	Bit
	3
Yes	0
No	1

Parity	Bit
	2
Even number	0
Odd number	1

Stop bits	Bit
	4
2 bits	0
1 bit	1

Data length	Bit
	1
7 bits	0
8 bits	1

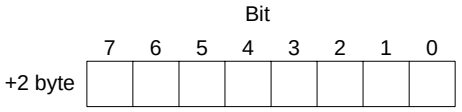


Xon/Xoff control	Bit
	7
Not executed	0
Executed	1

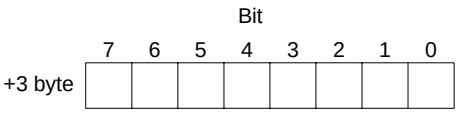
Communications mode	Bit
	6
Full duplex	0
Half duplex	1

Retries	Bit
	5
No	0
Yes	1

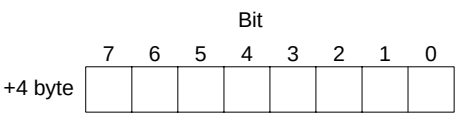
Set the Xoff (transmission stop) code in the +2 byte. The default is 13 hexadecimal and its bit string is as follows: 13 = 00010011



Set the Xon (transmission stop cancel) code in the +3 byte. The default is 11 hexadecimal and its bit string is as follows: 11 = 00010001



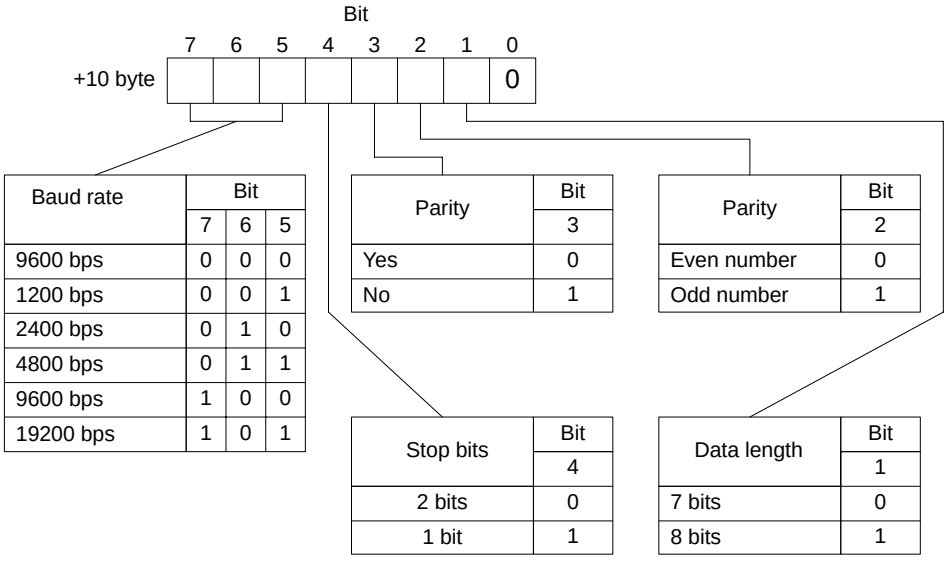
Set the transmission delay time in the +4 byte. The default is 0 ms and its bit string is as follows: 00 = 00000000



Set the +5 to +9 bytes to 0.

Setting of Communications Port 2

The setting of communications port 2 is as follows:



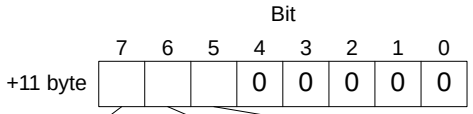
Baud rate	Bit		
	7	6	5
9600 bps	0	0	0
1200 bps	0	0	1
2400 bps	0	1	0
4800 bps	0	1	1
9600 bps	1	0	0
19200 bps	1	0	1

Parity	Bit
	3
Yes	0
No	1

Parity	Bit
	2
Even number	0
Odd number	1

Stop bits	Bit
	4
2 bits	0
1 bit	1

Data length	Bit
	1
7 bits	0
8 bits	1

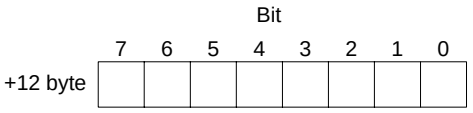


Xon/Xoff control	Bit
	7
Not executed	0
Executed	1

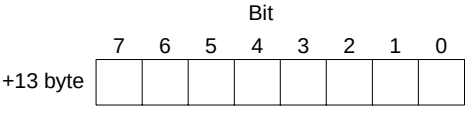
Communications mode	Bit
	6
Full duplex	0
Half duplex	1

Re-transmission	Bit
	5
No	0
Yes	1

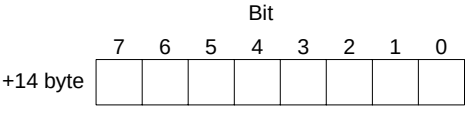
Set the Xoff (transmission stop) code in the +12 byte. The default is 13 hexadecimal and its bit string is as follows: 13 = 00010011



Set the Xon (transmission stop cancel) code in the +13 byte. The default is 11 hexadecimal and its bit string is as follows: 11 = 00010001



Set the transmission delay time in the +14 byte. The default is 0 ms and its bit string is as follows: 00 = 00000000



Set the +5 to +9 bytes to 0.

Host Link Unit System Setting Procedure

Use the following procedure to set the CPU Bus Unit System Setup for the Host Link Unit.

1, 2, 3...

1. Set the baud rate, number of stop bits, parity, and data length as required.
2. If connecting to a Programmable Terminal, specify full duplex communications and turn OFF Xon/Xoff control. No other settings are required for connection to a Programmable Terminal.

or If connecting to a host computer and commands will not be sent from the Host Link Unit to the host computer, set full duplex communications and turn OFF Xon/Xoff control. No other settings are required

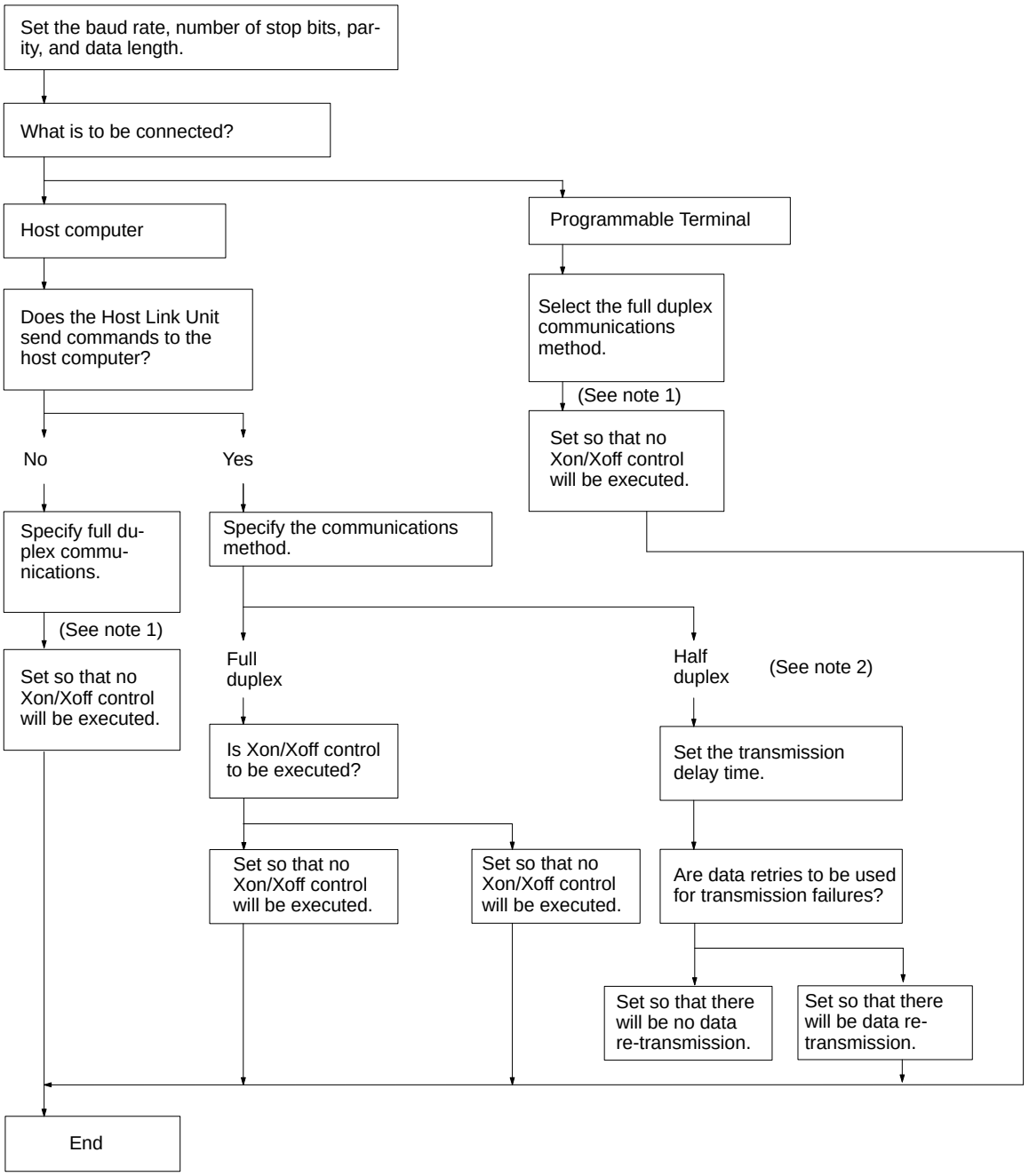
or If connecting to a host computer and commands will be sent from the Host Link Unit to the host computer, determine whether full- or half-duplex communications are required and continue to the next step.

3. If full-duplex communications are to be used, set Xon/Xoff control are required. This is the last setting that is required.

or If half-duplex communications are to be used, set the transmission delay time.

4. Set whether or not retries are to be made.

The following flowcharts illustrates the above procedure.



Note 1. Specify full-duplex communications method and turn OFF the Xon/Xoff control in the following cases:

- If the Host Link Unit is connected to a host computer and no commands will be sent from the Host Link Unit to the host computer.
- If a PC is connected.

In the above cases, actual communications control is executed in half duplex even though the full duplex communications are specified. If the Host Link Unit is used simultaneously with the CPU's host interface, full-duplex communications must be specified to enable normal communications.

2. Only full-duplex communications are possible for RS-422 communications at communications port 2.

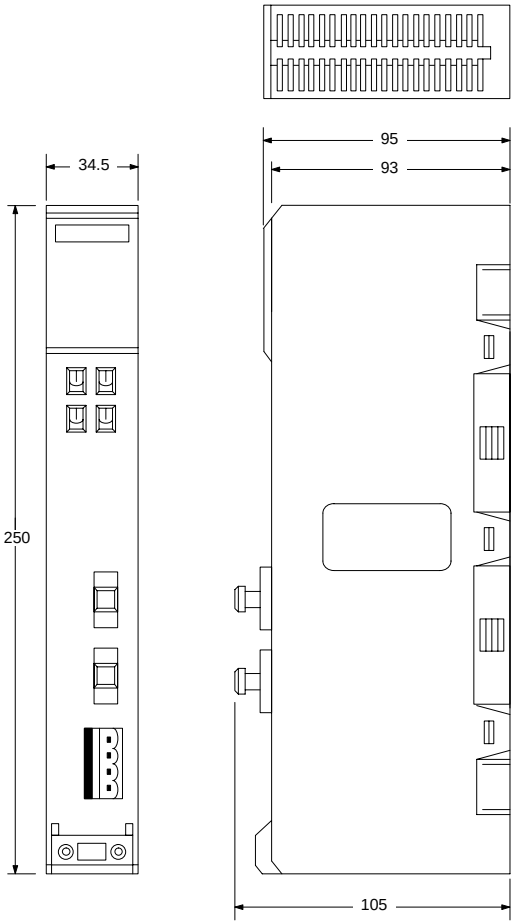
SECTION 3
Installation

This section describes how to connect the Host Link Unit, host link interfaces, Link Adapters, and host computer. Refer to *Section 1 Introduction* for details on the system configuration. Refer to the *CV-series PC Installation Guide* for general installation procedures and precautions.

3-1 Host Link Unit Dimensions 26
3-2 Mounting the Host Link Unit 27
3-3 Connection Cables for the Host Link Unit 27
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3-1 Host Link Unit Dimensions

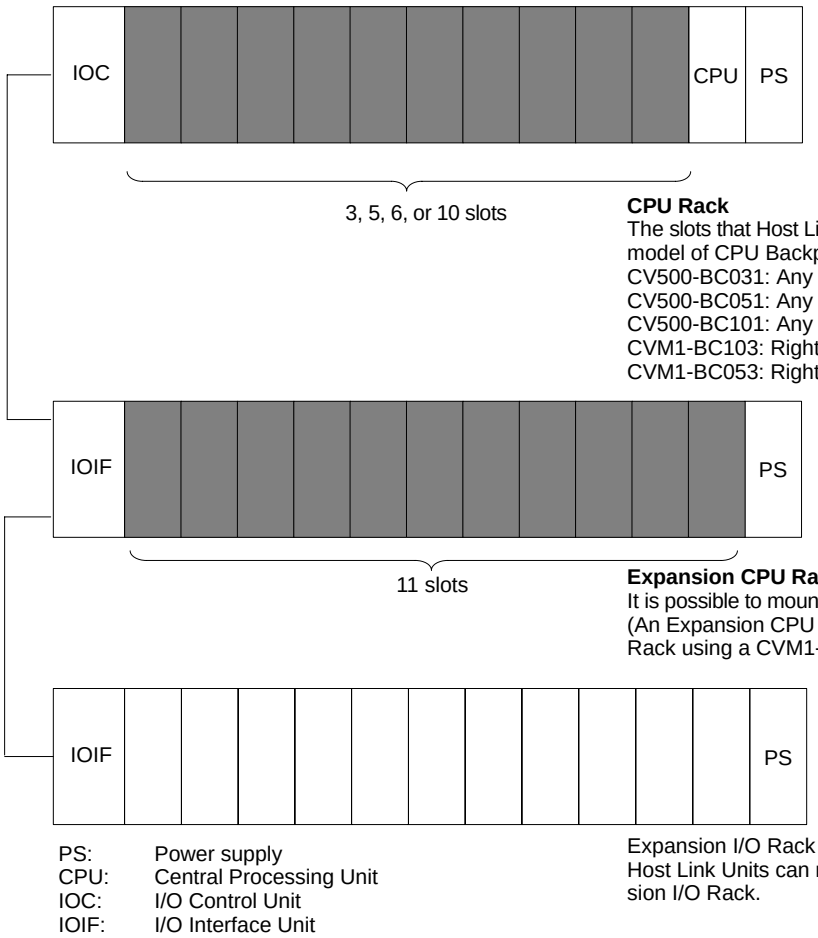
All dimensions are in millimeters in the following diagram of the CV500-LK201 Host Link Unit. For the CPU dimensions and general installation procedures, refer to the *CV-series PC Installation Guide*.



3-2 Mounting the Host Link Unit

Mounting Position

Up to four CV500-LK201 Host Link Units can be mounted to any of the slots on a CV-series CPU Rack or Expansion CPU Rack except when the CVM1-BC103 or CVM1-BC053 Backplane is used. On a CVM1-BC103 Backplane, Host Link Units must be mounted to the rightmost 6 slots; on a CVM1-BC053 Backplane, the rightmost 3 slots.



CPU Rack
The slots that Host Link Units can be mounted to varies with the model of CPU Backplane as follows:
CV500-BC031: Any slots (3 slots total)
CV500-BC051: Any slots (5 slots total)
CV500-BC101: Any slots (10 slots total)
CVM1-BC103: Rightmost 6 slots only
CVM1-BC053: Rightmost 3 slots only

Expansion CPU Rack
It is possible to mount Host Link Units to any of the 11 slots. (An Expansion CPU Rack cannot be connected to a CPU Rack using a CVM1-BC053/103 Backplane.)

Expansion I/O Rack
Host Link Units can not be mounted to an Expansion I/O Rack.

Current Consumption and Weight

The maximum current consumption of the Host Link Unit is 600 mA if an optical interface is not used. If 5 V is supplied when using an optical interface, however, the current consumption increases by 100 mA. When using the Host Link Unit with other Units, make sure that the actual current consumption of the Host Link Unit does not exceed the total permissible current consumption (refer to the *CV-series PC Installation Guide* for details).

The Host Link Unit weighs 550 g maximum.

3-3 Connection Cables for the Host Link Unit

Basic cable wiring procedures are described in *3-9 Wiring*. Details and examples are provided in the remaining subsections of *Section 3*.

Communications Port 1 Connection Cable

Port 1 supports only RS-232C connections, which are described in the next subsection.

To connect to a Programmable Terminal (PT), you will need to prepare a cable according to the information on page 37.

To connect to a host computer, you will need to prepare a full-duplex or half-duplex cable according to the information starting on page 35.

Communications Port 2 Connection Cable

Port 1 supports either RS-232C or RS-422 connections. RS-232C connections are described in the next subsection and RS-422 connections are described beginning on page 31.

If you are going to use an optical interface via RS-232C, you will need to prepare a 9-to-25 pin conversion cable according to the information in the section starting on page 38.

To connect to a Programmable Terminal (PT) via RS-232C, you will need to prepare a cable according to the information on page 37. To connect to a host computer, you will need to prepare a full-duplex or half-duplex cable according to the information on page 35.

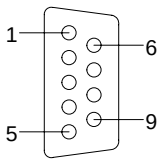
3-4 RS-232C Connections

3-4-1 CPU Connections

Specifications

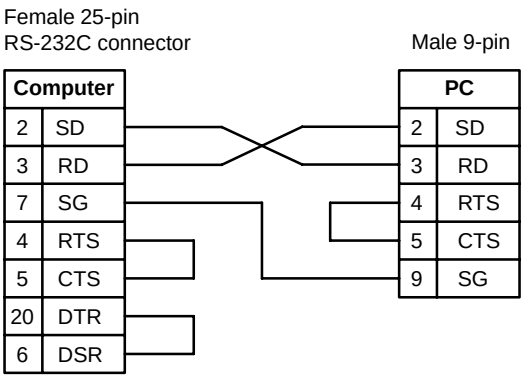
Electrical characteristics: Conforming to EIA RS-232C
Direction of signal: Viewed from the PC.
Maximum cable length: 15 m

Host interface pin No.	Signal	Symbol	Direction of signal
Connector hood	Frame ground	FG	---
9	Signal ground	SG (GND)	---
2	Send data	SD (TXD)	Output
3	Receive data	RD (RXD)	Input
4	Request to send	RS (RTS)	Output
5	Clear to send	CS (CTS)	Input



Connection Method

The following diagram shows the connections between the host computer and the PC. When RS-232C cable is used, a host computer can be connected to only one PC.



Recommended Cable

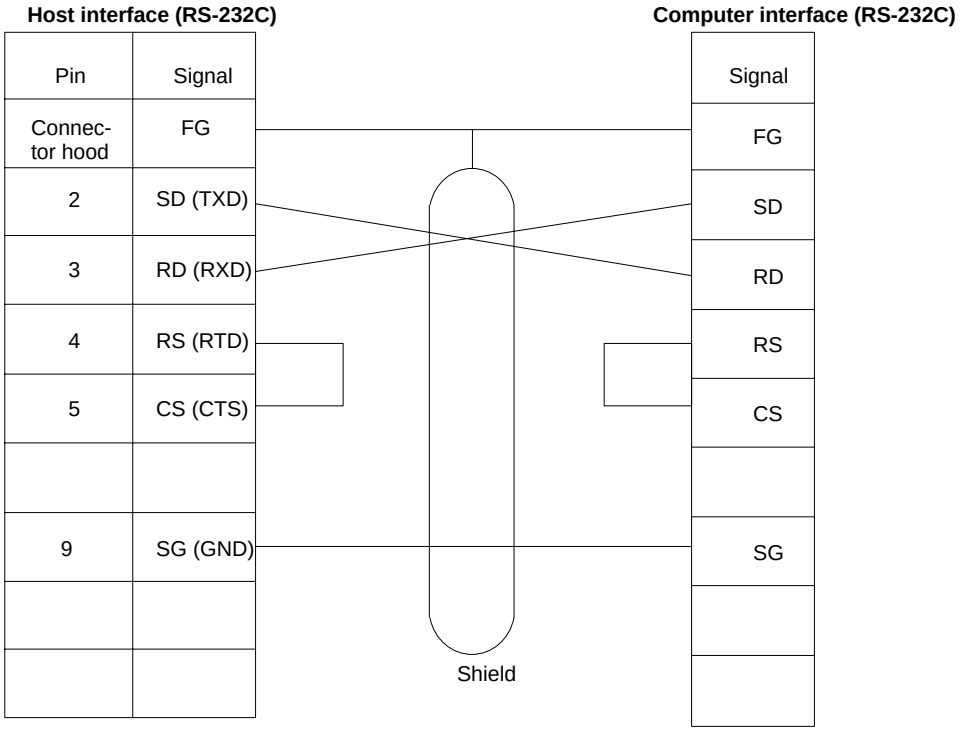
The following cables are recommended for connecting the host computer and PC. Other cables can be used if desired as long as they meet the required specifications.

Manufactured by Fujikura: UL2464 AWG28 x 5P IFS-RVV-SB (UL approved)
Manufactured by Hitachi: UL2464-SB 5P x AWG28 (UL approved)

Note
1. Ground the FG terminals of both the PC and the host computer to a a resistance of 100 Ω or less. For details refer to the *CV-series PC Installation Guide* and your host computer manual.
2. The following Connector and Connector Hood (both OMRON) are provided with the CPU.

Connector	XM2A-0901
Connector hood	XM2S-0911

Connection Example The following diagram shows connections between the PC and host computer.



Note
1. Connect the shield of the cable to the FG (connector hood) of the PC.
2. Pins 1, 6, and 8 on the PC are used when RS-422 is used. Leave them unconnected when RS-232C is used.

3-4-2 Host Link Unit Connections

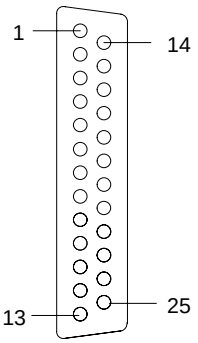
The specifications for RS-232C connections to the Host Link Unit are described in this subsection for ports 1 and 2. When RS-232C cable is used, a host computer can be connected to only one PC.

Communications Port 1

Electrical characteristics: Conforming to EIA RS-232C
Direction of signal: Viewed from the Host Link Unit.
Maximum cable length: 15 m

Host Link Unit connector pin no.	Signal	Symbol	Direction of signal	
			Input	Output
Connector hood	Frame ground	FG	---	---
1	Frame ground	FG	---	---
2	Send data	SD (TXD)	No	Yes
3	Receive data	RD (RXD)	Yes	No
4	Request to send	RS (RTS)	No	Yes
5	Clear to send	CS (CTS)	Yes	No

Host Link Unit connector pin no.	Signal	Symbol	Direction of signal	
			Input	Output
7	Signal ground	SG (GND)	---	---
8	Detect carrier data	CD (DCD)	Yes	No
14	5 V for optical interface	5 V	No	Yes
20	Data terminal ready	ER (DTR)	No	Yes



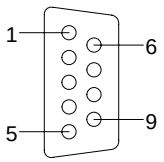
Communications Port 2

Electrical characteristics: Conforming to EIA RS-232C

Direction of signal: Viewed from the Host Link Unit.

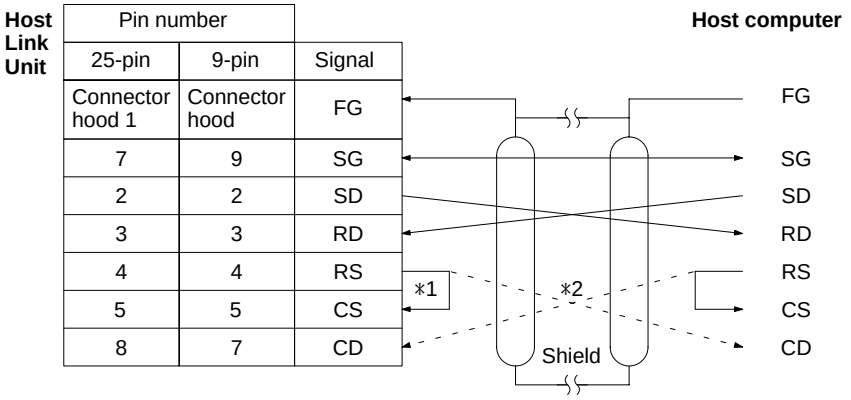
Maximum cable length: 15 m

Host Link Unit connector pin no.	Signal	Symbol	Direction of signal	
			Input	Output
Connector hood	Frame ground	FG	---	---
2	Send data	SD (TXD)	No	Yes
3	Receive data	RD (RXD)	Yes	No
4	Request to send	RS (RTS)	No	Yes
5	Clear to send	CS (CTS)	Yes	No
7	Detect carrier data	CD (DCD)	Yes	No
9	Signal ground	SG (GND)	No	No



Line Connections

The following diagram shows the connections between the host computer and the Host Link Unit. When RS-232C cable is used, a host computer can be connected to only one PC.



Note

1. It is not necessary to connect these terminals before connecting the host computer to the Host Link Unit as long as the CTS selector is turned ON.
2. The RS and CD terminals must be connected when connecting the host computer to the Host Link Unit using half-duplex communications.
3. Ground the FG terminals of both the PC and the host computer to a a resistance of 100 Ω or less. For details refer to the *CV-series PC Installation Guide* and your host computer manual.
4. Connect the Host Link Unit to the FG terminal of the host computer via the shield wire.

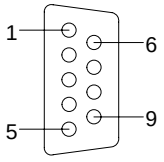
3-5 RS-422 Connections

3-5-1 CPU Connections

Specifications

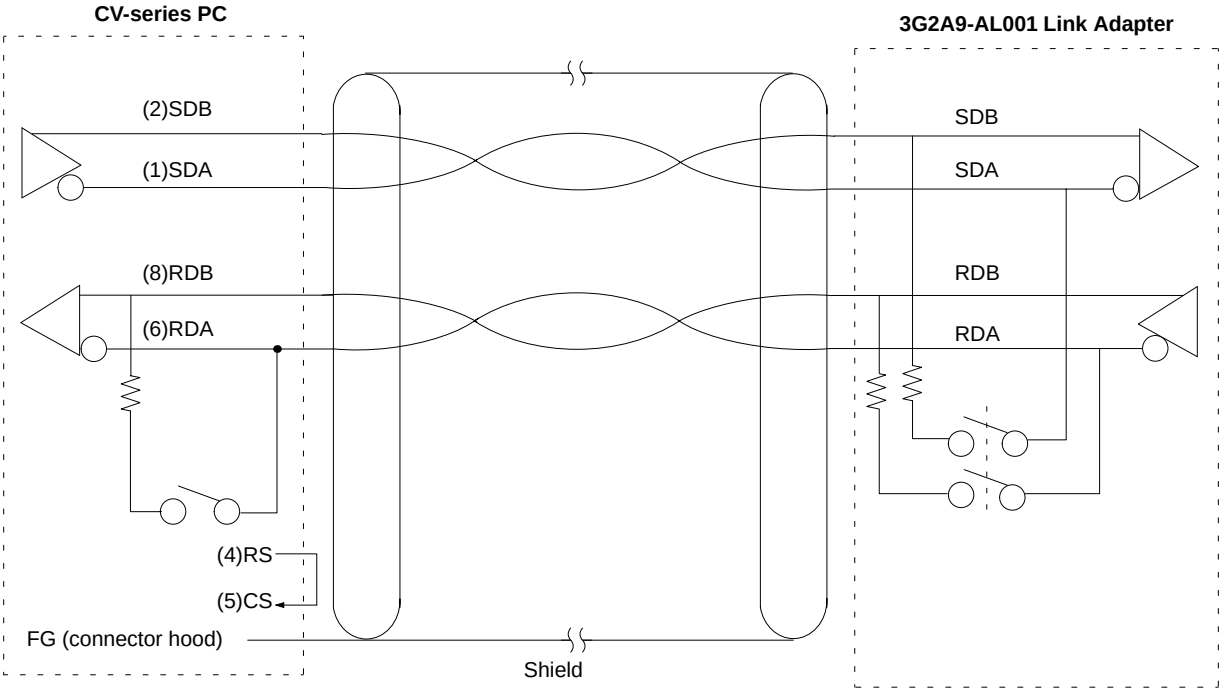
Electrical characteristics: Conforming to EIA RS-422
Direction of signal connection: Viewed from the PC.
Maximum cable length: 500 m total

Host interface pin No.	Signal	Symbol	Direction of signal
Connector hood	Frame ground	FG	---
1	Send data A	SDA (SD–)	Output
2	Send data B	SDB (SD+)	Output
6	Receive data A	RDA (RD–)	Input
8	Receive data B	RDB (RD+)	Input
4	Request to send	RS	Output
5	Clear to send	CS	Input



Connection Method

The following diagram shows the connections between a host computer and a 3G2A9-AL001 Link Adapter. When RS-422 cable is used, up to 32 PCs can be connected to one host computer.



Recommended Cable

The following cables are recommended for connecting the host computer and Link Adapter. Other cables can be used if desired as long as they meet the required specifications.

Manufactured by Fujikura: UL2464 AWG28 x 5P IFS-RVV-SB (UL approved)
Manufactured by Hitachi: UL2464-SB 5P x AWG28 (UL approved)

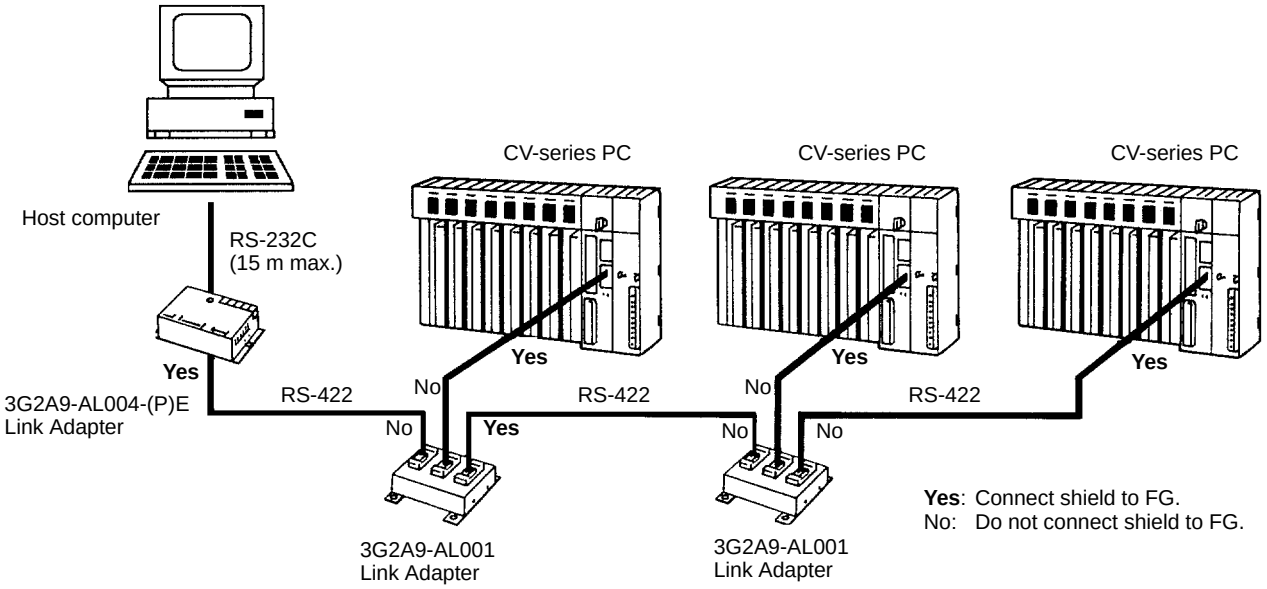
Note

1. Ground the FG terminals of both the PC and the host computer to a a resistance of 100 Ω or less. For details refer to the *CV-series PC Installation Guide* and your host computer manual.
2. The following Connector and Connector Hood (both OMRON) are provided with the CPU.

Connector	XM2A-0901
Connector hood	XM2S-0911

3. When using RS-422 cables to connect a Host Link System, the PC at each end of the communications line must have the built-in termination resistance connected by turning ON pin 6 of the DIP switch on the CPU. The other PCs must have termination resistance disconnected by turning this pin OFF. If termination resistance is not properly set, signal transmission will not be possible (refer to *3-5 RS-422 Connections*).
4. When connecting the shield to the frame ground, connect it at only one end of each cable section to prevent current flow (refer to *3-1 Preparations*).

Connect the frame ground to the shield at the connections to the PCs and at either end of the connections between Link Adapters. An example is shown below.



3-5-2 Host Link Unit Connections

The specifications for RS-422 connections to the Host Link Unit are described in this subsection for port 2. When RS-422 cable is used, a host computer can be connected to more than one PC.

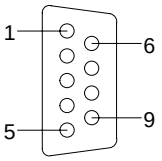
Communications Port 1

Electrical characteristics: Conforming to EIA RS-232C

Direction of signal: Viewed from the Host Link Unit.

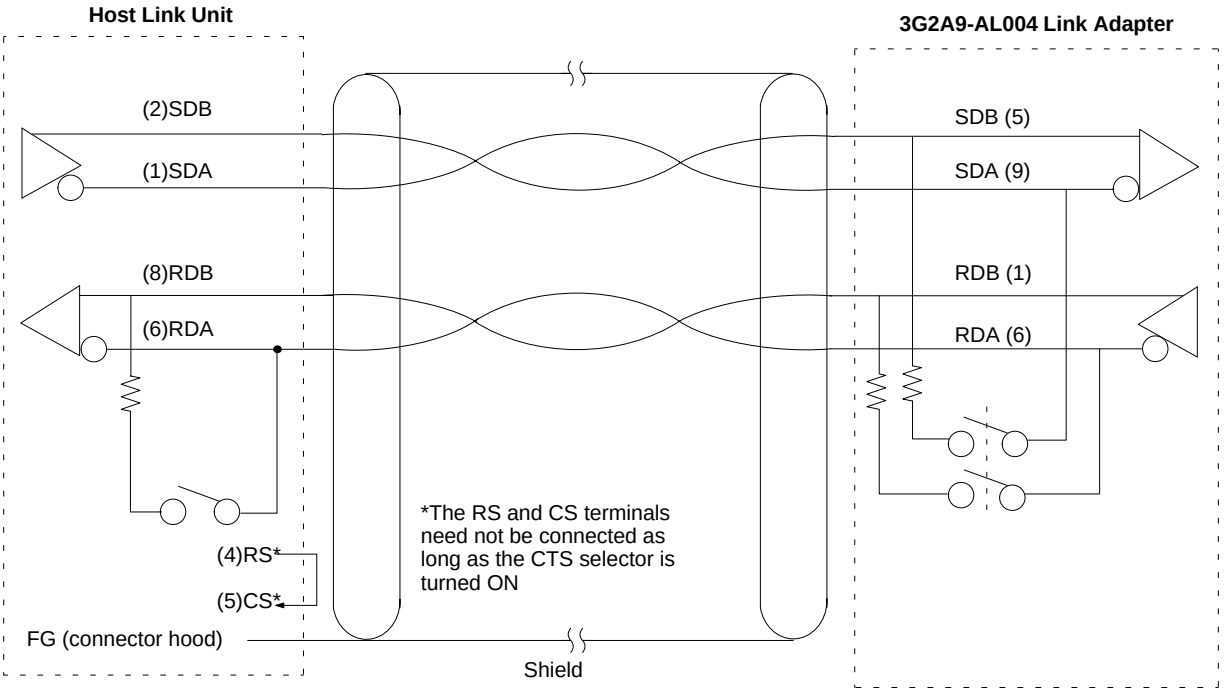
Maximum cable length: 500 m

Host Link Unit connector pin no.	Signal	Symbol	Direction of signal	
			Input	Output
Connector hood	Frame ground	FG	---	---
1	Send data A	SDA (SD–)	No	Yes
2	Send data B	SDB (SD+)	No	Yes
6	Receive data A	RDA (RD–)	Yes	No
8	Receive data B	RDB (RD+)	Yes	No



Line Connections

The following diagram shows the connections between a Host Link Unit and a 3G2A9-AL004 Link Adapter. When RS-422 cable is used, multiple PCs can be connected to one host computer by wiring through Link Adapters (see illustration on page 35).

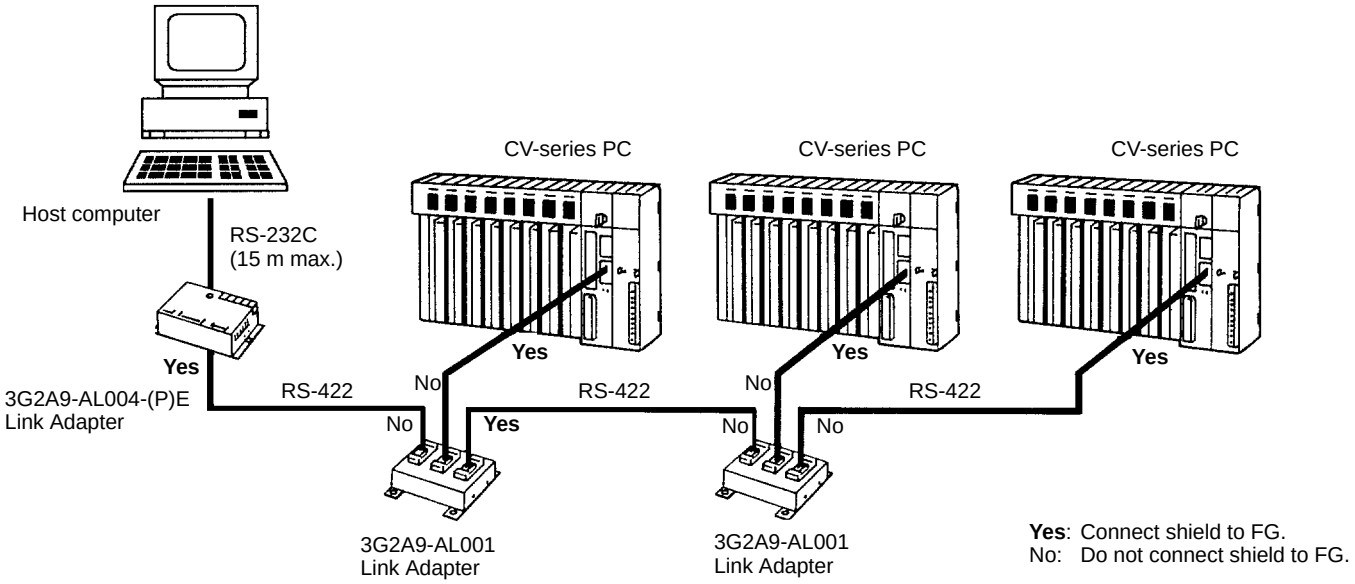


Note

1. Ground the FG terminals of both the PC and the host computer to a a resistance of 100 Ω or less. For details refer to the *CV-series PC Installation Guide* and your host computer manual.
2. The termination resistance must be turned ON at the Units (CPU, Host Link Unit, Link Adapter) at each end of the communications line and must be turned OFF at all other Units. Do not connect termination resistances to the other Units or normal transmission operation will not be possible (refer to *3-8 1-to-N Connection Examples*).
3. When connecting the shield to the frame ground, connect it at only one end of each cable section to prevent current flow (refer to the next subsection and to *3-9-4 Hood Assembly*).

Connecting Shield to FG

Connect the frame ground to the shield at the connections to the PCs and at either end of the connections between Link Adapters. An example is shown below.



3-6 1-to-1 Connection Examples

3-6-1 Host Link Unit Connection to Host Computer

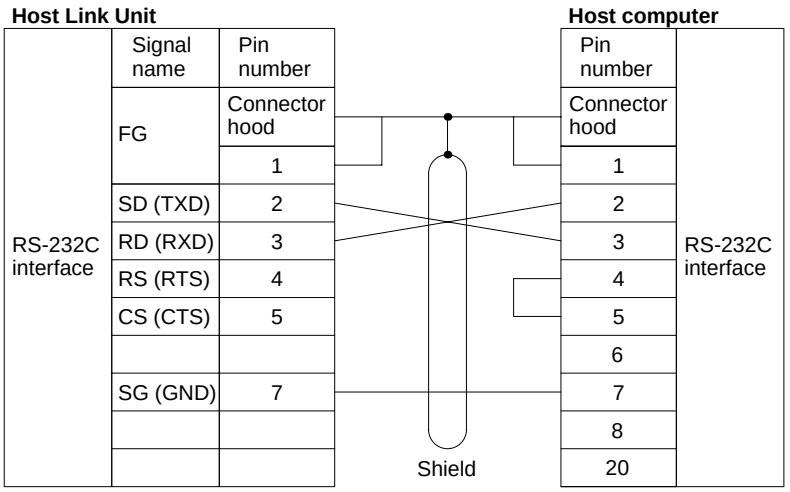
The diagrams below show 1-to-1 host link connections between the Host Link Unit and a host computer via an RS-232C cable.

The wiring method varies with the communications port used and the communications method (full duplex or half duplex).

Communications via Communications Port 1

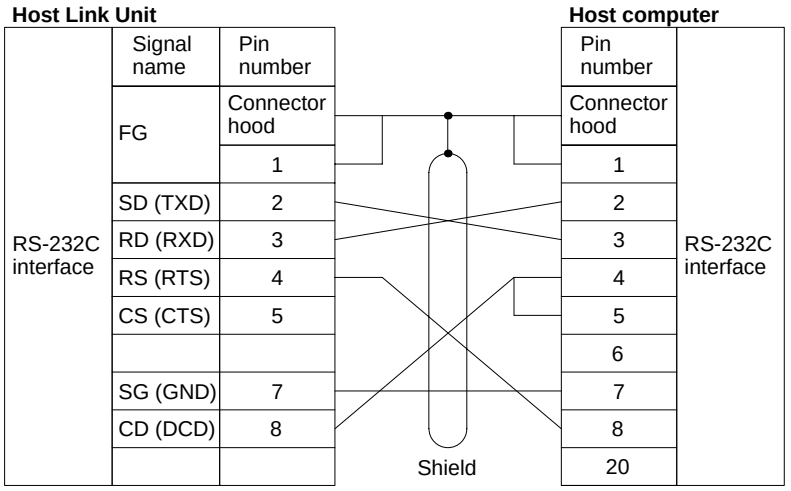
Full Duplex

The following diagram shows 1-to-1 host link connections using communications port 1 in full duplex. Full-duplex communication must be set using the Host Link Unit's CPU Bus Unit System Setup.



Half Duplex

The following diagram shows 1-to-1 host link connections using communications port 1 in half duplex. Half-duplex communications must be set using the Host Link Unit's CPU Bus Unit System Setup.

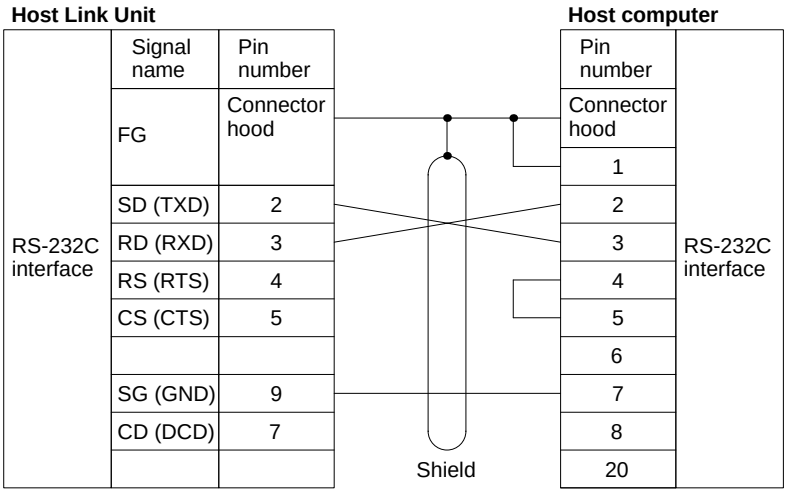


Note The CTS selector of the Host Link Unit must be turned ON (fixed to 0 V).

Communications via Communications Port 2

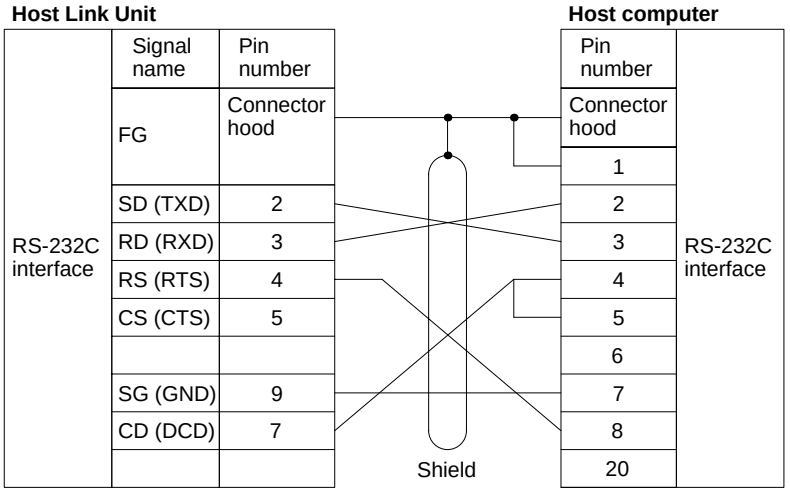
Full Duplex

The following diagram shows 1-to-1 host link connections using communications port 2 in full duplex. Full-duplex communications must be set using the Host Link Unit's CPU Bus Unit System Setup.



Half Duplex

The following diagram shows 1-to-1 host link connections using communications port 2 in half duplex. Half-duplex communications must be set using the Host Link Unit's CPU Bus Unit System Setup.



Note

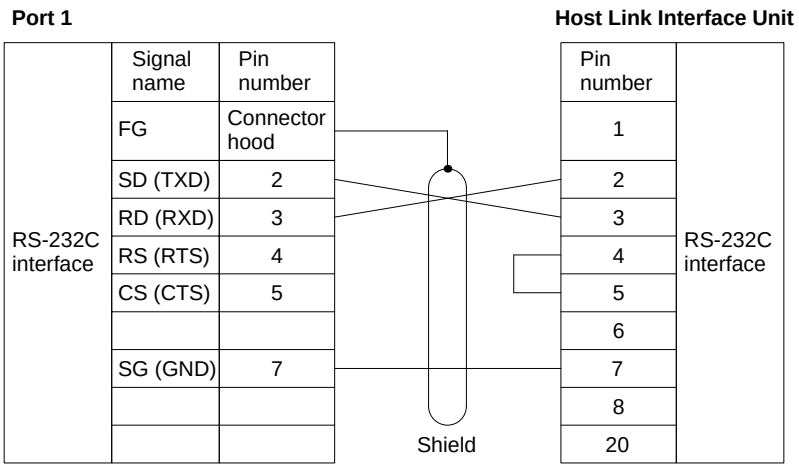
1. Pins 1, 6, and 8 of the Host Link Unit must be connected when RS-422 is used. These pins must not be connected when using RS-232C.
2. The CTS selector of the Host Link Unit must be turned ON (fixed to 0 V).

3-6-2 Host Link Unit Connection to PT

The diagrams below show 1-to-1 host link connections using OMRON's NT20M or NT600M PTs and the Host Link Unit via the PT's NT600M-LK201 Host Link Interface Unit. The connection method varies with the port.

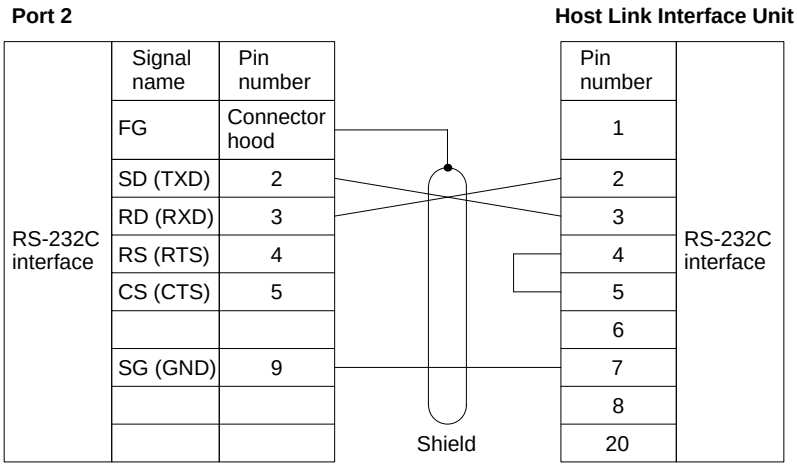
Connections via Communications Port 1

The following diagram shows the connections via communications port 1.



Connections via Communications Port 2

The following diagram shows the connections via communications port 2.



Note

1. Connect the shield to the connector hood and connector pin 1 of the Host Link Unit. The other end of the shield must be left unconnected.
2. Turn ON the CTS selector of the Host Link Unit (fixed to 0 V) and specify full-duplex communications with the CPU Bus Unit System Setup.
3. Refer to *Appendix A Standard Models* for a list of the PTs that can be used with the NT600M-LK201 Host Link Interface Unit.

3-7 Optical Interface Connections

The distance between a CPU or Host Link Unit and the host computer connected to it can be increased to a maximum of 500 m by using an optical interface.

3-7-1 Required Devices

The following devices are required to use an optical interface.

Name	Model	Required number	Remarks
Optical Module	Z3RN-A-5	2	RS-232C optical fiber conversion
Optical fiber	Z3F2-4D□M (see note)	1	PCF
AC Adapter	Z3-GP01	1 or 2	Two AC Adapters are required for port 2 and one AC Adapter is required for port 1.

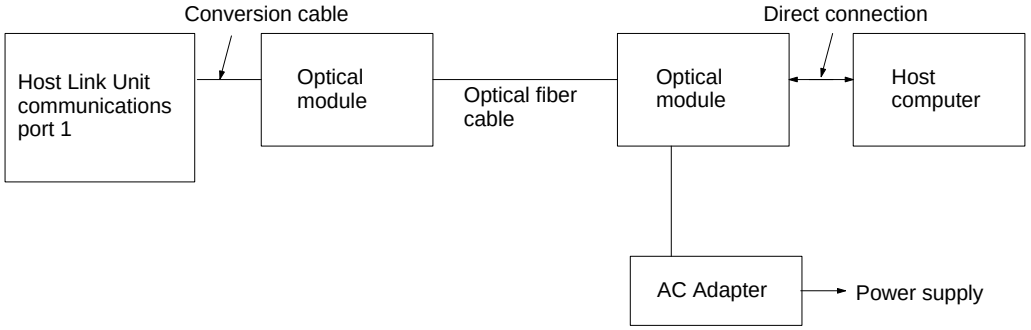
Note Cables with lengths of 1, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 250, 300, 350, 400, 450, and 500 m are available. When ordering, insert the required cable length before the M in the model number (replacing the box: □).

3-7-2 Connections to Optical Module

The connection method of the optical interface varies with the communications port.

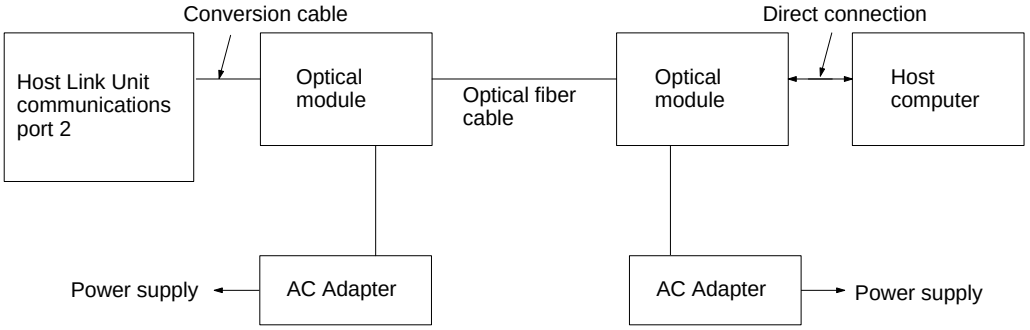
Communications Port 1 (25-pin connector)

It is possible to connect an Optical Module directly to communications port 1. By turning on the 5-V power supply switch of the Host Link Unit, 5 V is supplied to pin 14 of the communications port 1 so that no AC Adapter is required for the communications port 1.

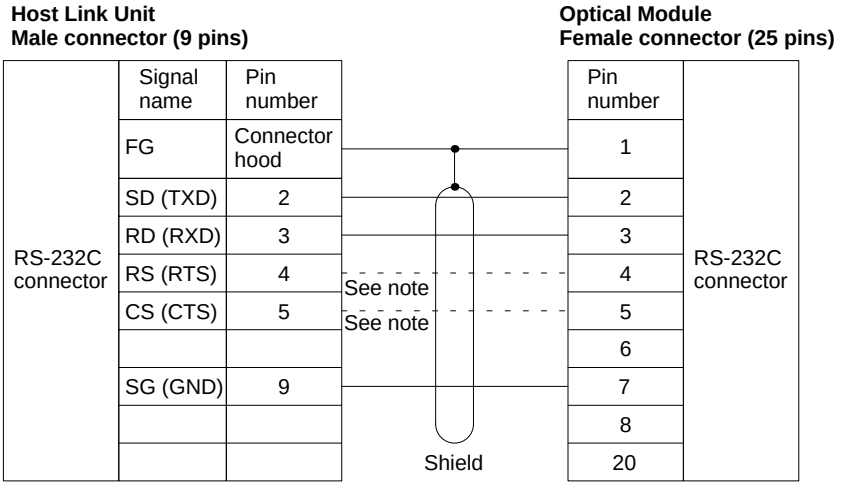


Communications Port 2 (9-pin connector)

It is impossible to connect an Optical Module to the 9-pin connector of the Host Link Unit directly. You must prepare a conversion cable to connect the Optical Module to the 9-pin connector. AC Adapters are required for the Optical Modules at the Unit and at the host computer. The following diagram shows the connections of the Host Link Unit to the host computer via communications port 2.



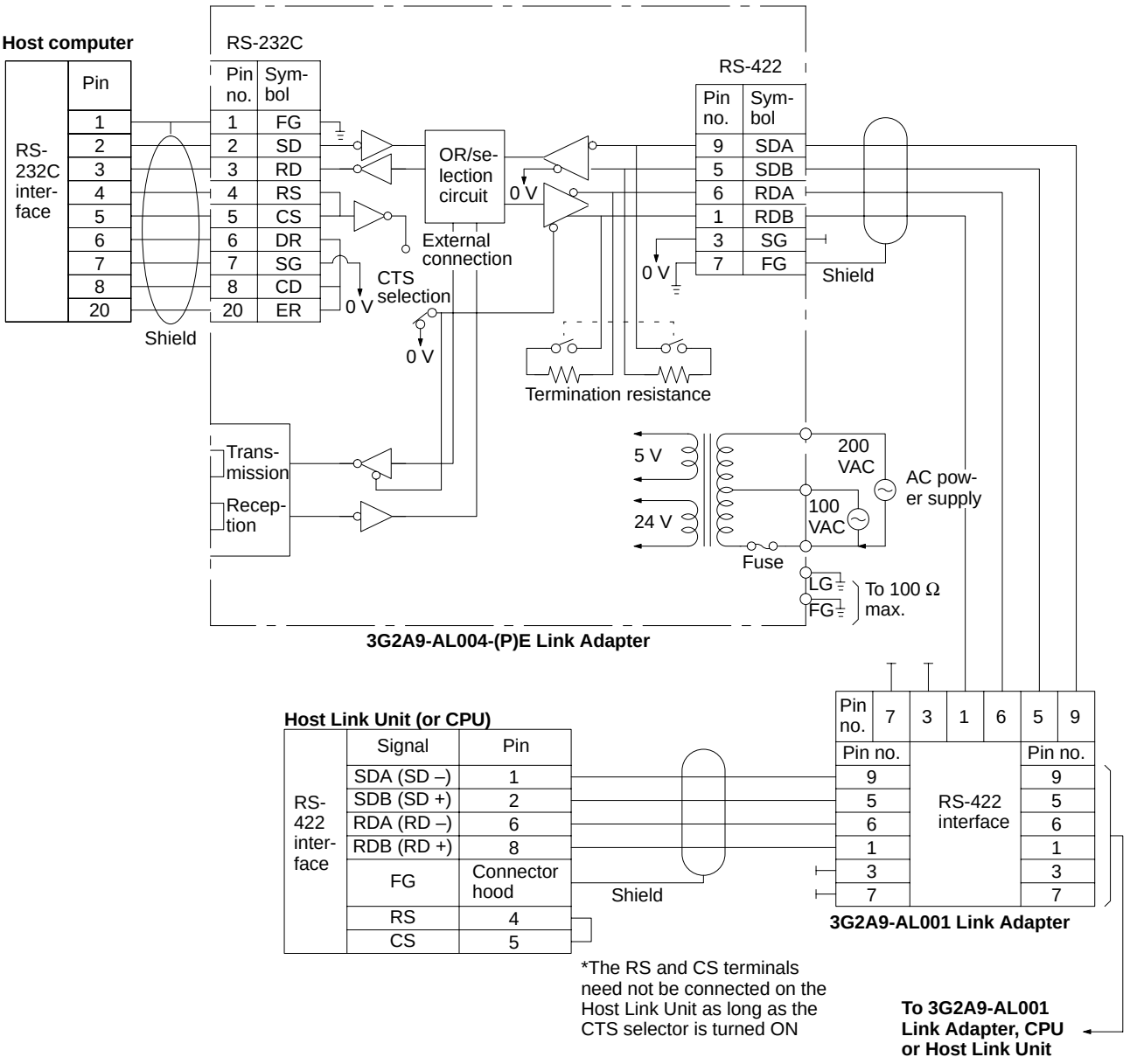
The following diagram shows the connections of the 9-pin to 25-pin conversion cable.



Note It is not necessary to connect these terminals before connecting the host computer to the Host Link Unit as long as the CTS selector is turned ON.

3-8 1-to-N Connection Example

The following diagrams show connections between the Host Link Unit and Link Adapters and between the Link Adapters and host computer.



Note

1. To connect more than one PC to a host computer, used the 3G2A9-AL004-E or 3G2A9-AL004-PE Link Adapter (for RS-232C-to-RS-422 cable conversion) and the 3G2A9-AL001 Link Adapter (to branch to other Units).
2. The shield of the cable must be connected to the connector hood of the PC for lines connecting PCs to Link Adapters, and to pin 7 on one and only one Link Adapter on lines connecting two Link Adapters.
3. Leave Host Link Unit pins 3, 4, 5, 7, and 9 unconnected. (Leave CPU pins 3, 7, and 9 unconnected and short-circuit pins 4 and 5.)

Cable Lengths and Termination Resistance

When connecting more than one PC to a host computer using RS-422, but sure to keep cable lengths within limits and to set termination resistance on the proper Units as described below.

Kind of Cable

Use shielded twisted-pair cable and separate the cables from other signal lines.

Cable Length

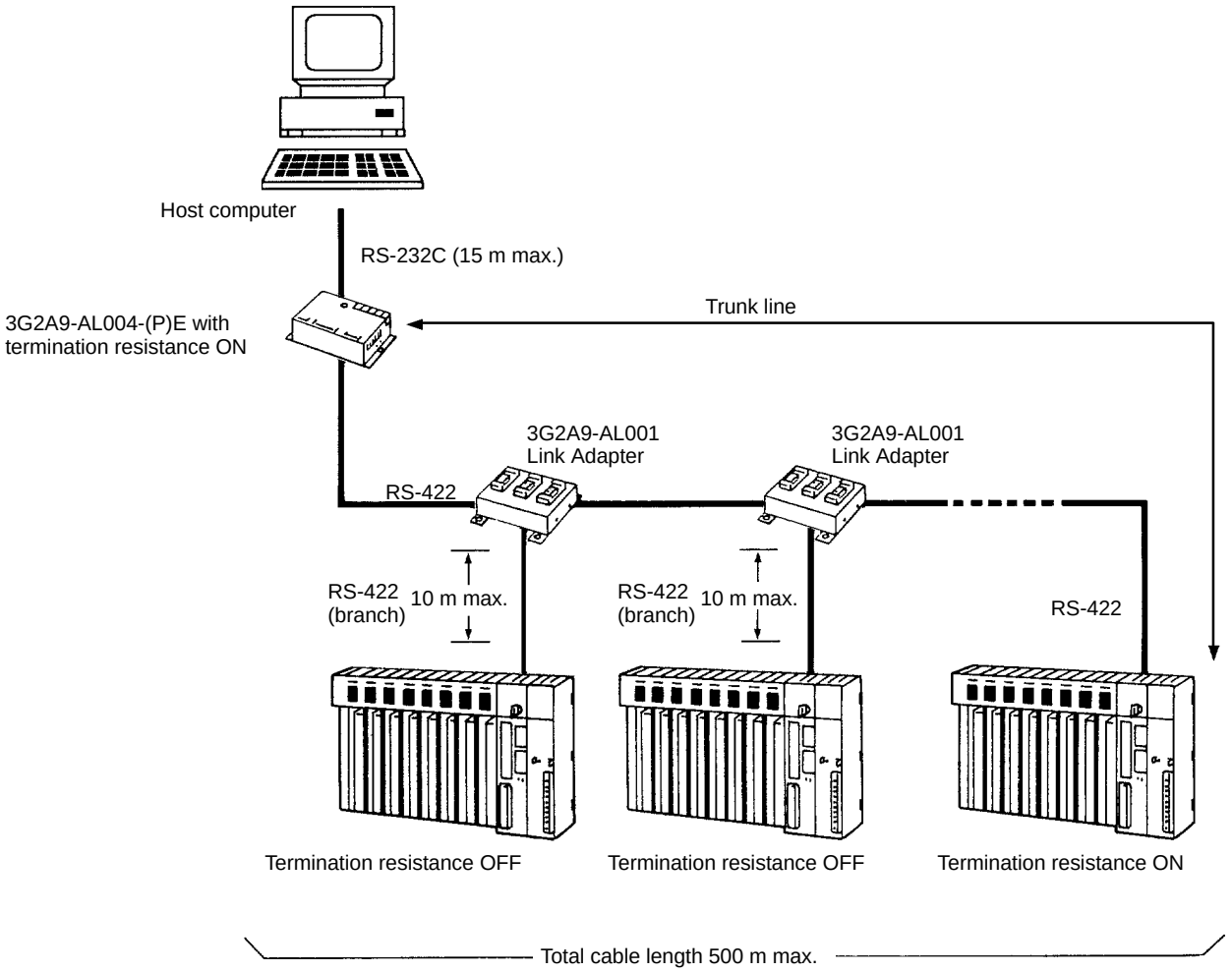
The sum of all cable lengths must be 500 m or less and the branch line from each Link Adapter must be 10 m or less.

Termination Resistance

The CPUs, Host Link Units, or Link Adapters at each end of the trunk line must have the termination resistance connected (turned ON). All other Units must have the termination resistance disconnected (turned OFF). If termination resistance is not set correctly, signal transmission will not be possible.

The termination resistance is connected to the CPU by turning ON pin 6 on the DIP switch on the CPU and disconnected by turning this pin OFF.

The termination resistance is connected to the Host Link Unit by turning ON the termination resistance switch of the Host Link Unit and disconnected by turning OFF the switch.



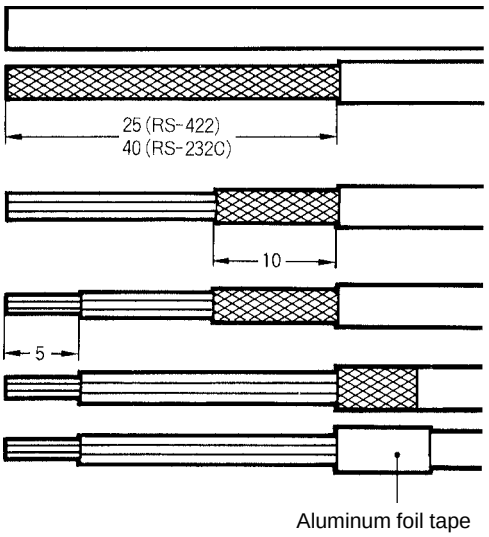
3-9 Wiring

Use the following procedures to wire RS-232C and RS-422 cables.

Connect the shield to the frame ground (FG, the connector hood at the PC) on the connector for the PC in all Systems and to one end of each line connecting two Link Adapters in RS-422 Systems. Refer to *3-5 RS-422 Connections* for details on connections between Link Adapters.

3-9-1 Connecting the Shield to FG

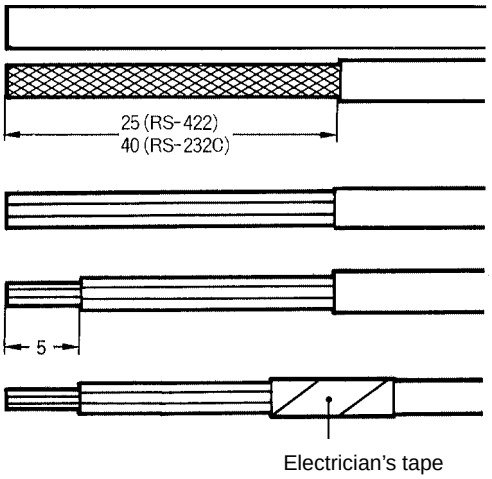
1, 2, 3... 1. Cut the cable to the required length, leaving sufficient leeway for wiring and laying the cables.
2. Use a razor blade to cut away the sheath, being careful not to damage the braiding underneath. Cut away 25 mm for RS-422 cable; 40 mm for RS-232C cable.
3. Use scissors to cut away all but 10 mm of the exposed braiding.
4. Use wire strippers to remove the insulation from the last 5 mm of each wire.
5. Fold the braiding back over the end of the sheath.
6. Wrap aluminum foil tape over the top of the braiding for one and a half turns.



3-9-2 Not Connecting the Shield to FG

1, 2, 3... 1. Cut the cable to the required length, leaving sufficient leeway for wiring and laying the cables.
2. Use a razor blade to cut away the sheath. Cut away 25 mm for RS-422 cable; 40 mm for RS-232C cable.
3. Use scissors to cut away the exposed braiding.
4. Use wire strippers to remove the insulation from the last 5 mm of each wire.

5. Wrap electrician's tape over the top and end of the the cut sheath.



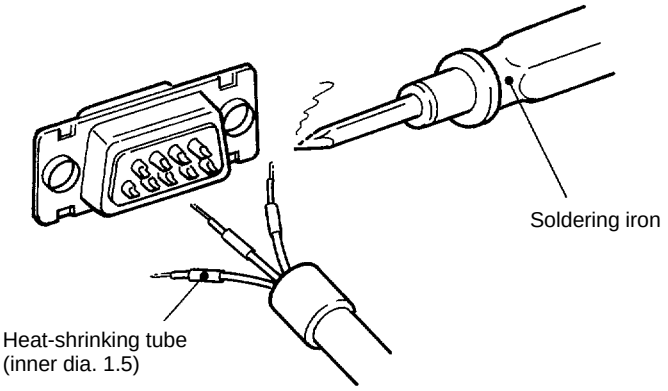
3-9-3 Soldering

Use the following procedure when soldering connectors.

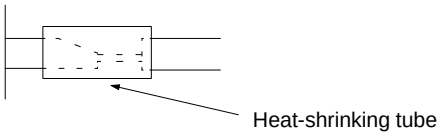
1, 2, 3... 1. Place heat-shrinking tubes over all wires. Be sure the tubes are far enough away from the end so as not to interfere with the soldering.

2. Pre-solder all wires and connector terminals.

3. Solder the wires, inserting 4 mm of the exposed 5 mm of wire into the connector terminal.

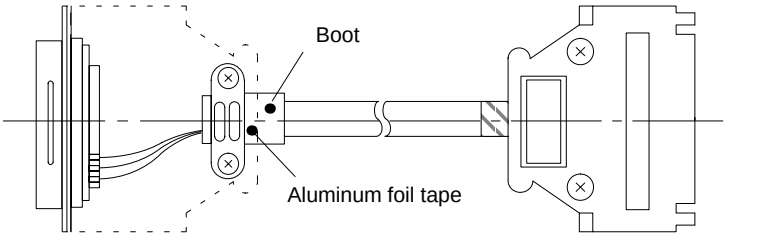


4. Move the heat-shrinking tubes onto the soldered area and shrink them into place.



3-9-4 Hood Assembly

Assemble the hood as shown in the following diagram.



3-9-5 Recommended Cables and Connectors

Recommended Cable

The following cables are recommended for connecting the host computer and the Host Link Unit. Other cables can be used if desired as long as they meet the required specifications.

Manufactured by Fujikura: UL2464 AWG28 x 5P IFS-RVV-SB (UL approved)

Manufactured by Hitachi: UL2464-SB 5P x AWG28 (UL approved)

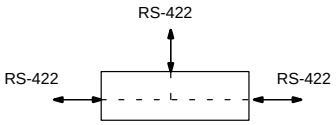
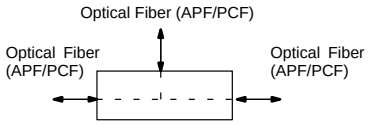
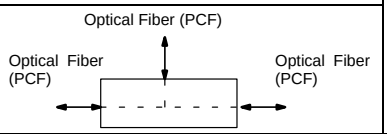
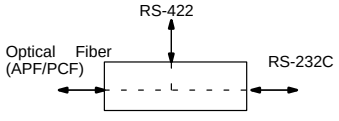
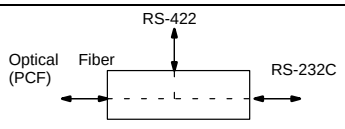
Connector

The following 9-pin connector, 25-pin connector, and connector hoods are provided with the Host Link Unit. The 9-pin connector is used at communications ports 2 and 25-pin connector is used at communications port 1.

Item	9-pin connector	25-pin connector
Connector	XM2A-0901	XM2A-2501
Connector hood	XM2S-0911	XM2S-2511

3-9-6 Link Adapters

The following tables gives the specifications for Link Adapters suitable for use In Host Link Systems. Refer to the *C-series Link Adapters Installation Guide* for details.

Link Adapter/ Application	Connection	Supply voltage	Operating voltage range	Power consumption	Weight
3G2A9-AL001 Branches RS-422 lines.		Not required	—	—	250 g max.
3G2A9-AL002-PE Branches APF/PCF lines.		100 to 120/ 200 to 240 VAC or 12 to 24 VAC/ DC	85 to 132/ 170 to 246 VAC or 10.2 to 26.4 VAC/ DC	10 VA max.	900 g max.
3G2A9-AL002-E Branches PCF lines.					
3G2A9-AL004-PE Converters APF/ PCF, RS-422, and RS-232C lines.		100 to 120/ 200 to 240 VAC	85 to 110 VAC 170 to 220 VAC	10 VA max.	1 kg max.
3G2A9-AL004-E Converters PCF, RS-422, and RS-232C lines.					

APF: all-plastic optical fiber cable; PCF: plastic-clad optical fiber cable

3-9-7 Cable Lengths

Wire Cables

RS-232C cable	15 m max.
Total length of RS-422 cable	500 m max.
Length of each RS-422 branch	10 m max.

Optical Fiber Cables

Cable	Units with “P” in suffix	Units without “P” in suffix
APF	20 m	Connection impossible
PCF	200 m	800 m

Note If the distance between a Link Adapter and a CPU’s host interface, a Link Adapter and Host Link Unit, or a Link Adapter and another Link Adapter must be more than 800 m, use 3G2A9-AL005(-P) or 3G2A9-AL006(-P) Link Adapters with quartz fiber cable. Refer to the *C-series Link Adapters Installation Guide* for details.

SECTION 4
Communications

This section describes both the test methods used to check communications and the specifications of the commands that are used for communications control and timing. For communications in CV (FINS) mode, refer to *FINS Command Reference Manual*.

4-1 Initial Communications Test 48
4-2 Wrap Communications Test 49
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4-2-3 Test Errors and Possible Corrections 52
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4-3-4 Right to Send 55
4-3-5 Frame Checksum (FCS) Calculation 56
4-4 Sending Commands to Host Computers 57
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4-4-2 Commands from PC Instructions 57
4-4-3 Command Format Received by Host Computers 58
4-4-4 Response Format Sent by Host Computer 59
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4-5 Communications Timing 64

4-1 Initial Communications Test

Prior to actual communications between the PC(s) and host computer, check the system by following the steps listed below.

1, 2, 3...

1. Check the settings of the DIP switches and selectors.
2. Make sure the baud rate, interface, and data formats match between the Unit(s) and the host computer.
3. Check the connections between the Unit(s) and the host computer.
4. Turn on power to the Unit(s), host computer, and any Link Adapters or Optical Interfaces in the System. If an error occurs, check all connections and settings again and correct the error before continuing.
5. If the Units are ready, prepare and execute a test from the host computer. There are two test methods that can be used:
   - **Test program:** Write a simple test program at the host computer. A sample program is provided in the next subsection.
   - **Terminal mode:** Input commands directly from the host computer in the terminal mode and check the response.

If the test is completed successfully, the system is operational.

Note

1. Input commands carefully at the host computer when using Terminal Mode.
2. If a normal response (00 or 00 00) is not returned, refer to remainder of this section for communications procedures and to *Section 5 C-mode Commands* and *Section 6 CV-mode Commands* for details on commands and responses.
3. If any of the following occur during the test, correct the error referring to *Section 6 Maintenance and Troubleshooting*. Indicators are those on the Host Link Unit.

   The RUN indicator goes out

   The RD1 or RD2 indicator does not light

   The SD1 or SD2 indicator does not light

   The ERH, ERC1, or ERC2 indicator lights

   An error response is received

   No response is received

Communications Test Program

The following program example is designed to send test data to the PC and return it unaltered to the host computer. By executing this program, the transmit data and receive data are both displayed on the screen of the host computer. If the transmit data and the receive data match, the system is operating properly. If an error has occurred while executing the program, the error number and the line in which the error has occurred will be displayed.

Note The FCS calculation subroutine starting from statement 180 is for data transmission. The data length L will differ for the response because the response contains other data such as FCS and *.

Host Computer and PC

Host computer: IBM PC/AT compatible
PC unit number (used as node number in Host Link System): 00

Program

```
10 CLOSE 1
20 CLS
30 ON ERROR GOTO 300
40 OPEN "COM:E72" FOR OUTPUT AS #1 . ... Open RS-232C
50 '************************************************************
60 *KEYIN
70 INPUT "TEST DATA INPUT -----", TD$  Test data input
80 TC$="@00TS" . ..... Creation of Unit no. and header code
90 T$=TC$+TD$ . ..... Creation of test command
100 GOSUB 190 . ..... Calculation of Frame Checksum
110 TXD$=T$+FCS$+"*" . ..... Receive data
120 PRINT TXD$ . ..... Receive data
130 PRINT #1, TXD$ . ..... Transmission
140 INPUT #1, RXD$ . ..... Reception
150 PRINT RXD$ . ..... Receive data display
160 GOTO 70
170 '************************************************************
180 *FCSSET
190 L=LEN(T$) . ..... Number of transmit data before FCS
200 A=0 . ..... Setting of initial value for EOR calculation
210 FOR J=1 TO L
220 TJ$=MID$(T$, J, 1)
230 A=ASC(TJ$) XOR A
240 NEXT J
250 FCS$=HEX$(A)
260 IF LEN(FCS$)=1 THEN FCS$="0"+FCS$
270 RETURN
280 '************************************************************
290 *EROPE
300 PRINT "ERL=";ERL, "ERR=";ERR . ..... Display of line no. containing error and error no.
310 CLOSE 1
320 END . ..... Closes RS-232C
330 '************************************************************
```

4-2 Wrap Communications Test

This section explains the wrap communications test for the two communications ports of the Host Link Unit.

Execute the wrap communications test as follows:

1, 2, 3...

1. Set the unit number to an appropriate number within a range of 0 to 15.
2. Set the node number to an appropriate number within a range of 0 to 31.
3. Set the DIP switch as shown in the following tables:

Wrap Communications Test at Communications Port 1

Pin	Setting
2	OFF
5	ON
6	OFF

Wrap Communications Test at Communications Port 2

Pin	Setting
3 (see note)	OFF
5	ON
6	ON

Note Pin 3 need not be set if the test is executed using RS-422.

4. Specify either RS-232C or RS-422 when executing the test at communications port 2.
5. Wire the connectors as described under *Connector Wiring* following this procedure.
6. Turn on the PC. The wrap communications test will be executed automatically. The status of each indicator will be as follows:

Test port	Status	Indicator	
		TS1	TS2
Communications port 1	Executing	Lit	Not lit
	Completed	Flashes	Not lit
Communications port 2	Executing	Not lit	Lit
	Completed	Not lit	Flashes

Note If there is no I/O table when the PC is turned on, no test will be executed and the indicators will display the status shown in the following table. If this occurs, generate an I/O table and then execute the test.

Test port	Indicator		
	TS1	TS2	ERH
Communications port 1	Flashes	Not lit	Lit
Communications port 2	Not lit	Flashes	Lit

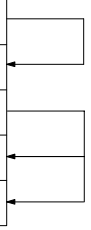
7. To execute the test for a different port, repeat from step 3 and turn on the PC again or restart the Unit.

4-2-1 Connector Wiring

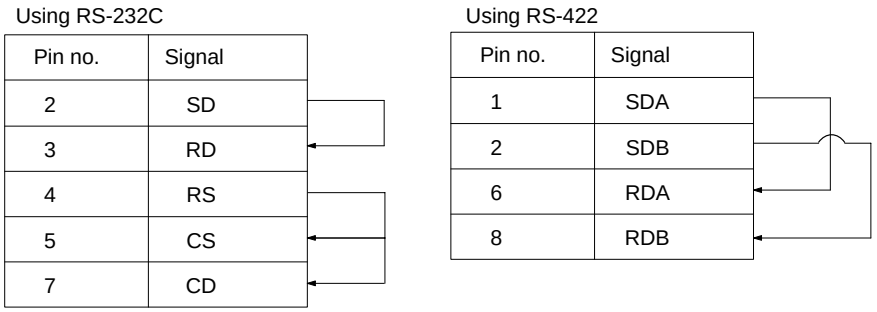
Wire the connectors for the wrap communications test according to the communications port as follows:

Communications Port 1

Pin no.	Signal
2	SD
3	RD
4	RS
5	CS
8	CD



Communications Port 2



4-2-2 Test Contents

The wrap communications test is executed at the communications port designated on the DIP switch. By wiring the connector as shown in the previous diagrams, data is looped back. The data looped back is compared with the original data to ascertain if they match.

Specifications

Baud rate: 1,200, 2,400, 4,800, 9,600, and 19,200 bps (switched in sequence automatically 5 times)

Stop bits: 2

Parity: Even

Data length: 7 bits

Data Transferred

The C-mode command TS is used to transfer 200 characters (209 characters including the header, all in hexadecimal, 00 to 63).

Completion of Test

When the test finishes, the TS1 or TS2 indicator, which has been lit, will start flashing. If there is an error during the test, the ERC1 indicator, ERC2 indicator, or ERH indicator will light

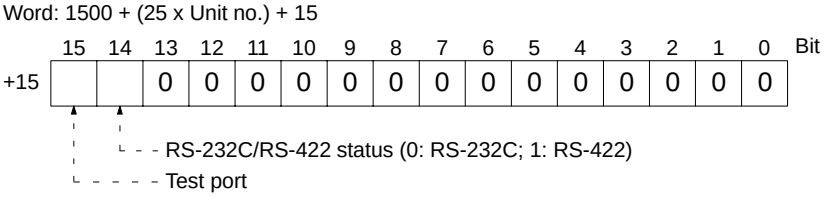
Indicators

The following table shows the meaning of each indicator.

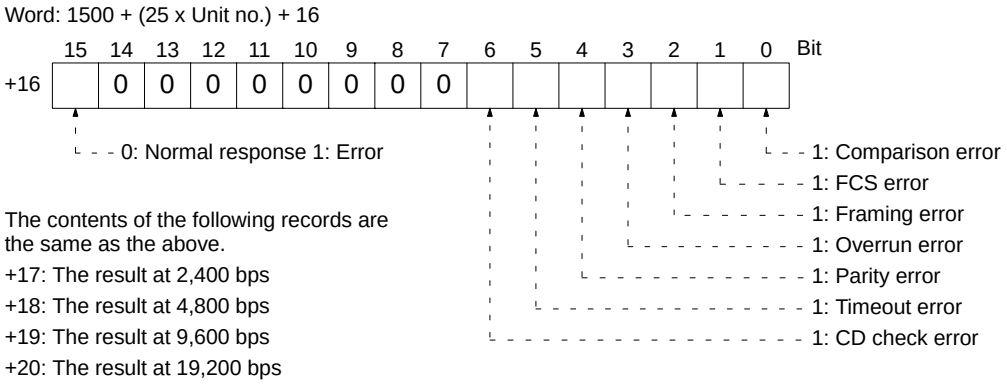
Indicator	Status	Meaning
TS1	Lit	The test is being executed at port 1.
	Flashes	The test at port 1 has been completed.
TS2	Lit	The test is being executed at port 2.
	Flashes	The test at port 2 has been completed.
ERC1	Lit	Port 1 has a transmission error.
ERC2	Lit	Port 2 has a transmission error.
ERH	Lit	There is a unit number setting or PC error, or no I/O table has been made.

Test Results

The results of the test that has been executed will be recorded in word 15 in the portion of the CPU Bus Unit Area allocated to the Host Link Unit in the PC. Words in this area are allocated according to unit number.



The result of the test for each communications speed is recorded at words 16 to 20 in the portion of the CPU Bus Unit Area allocated to the Host Link Unit in the PC. The following is an example of the contents of the record at a baud rate of 1,200 bps.



4-2-3 Test Errors and Possible Corrections

When there is an error during the wrap communications test, the cause of the error can be determined from the Host Link Unit's indicators. The following table lists the errors and probable causes of errors that can occur during the wrap communications test.

Indicator	Probable cause	Possible correction
RUN indicator is not lit.	No power is supplied to the PC or the voltage of the power supplied to the PC is low.	Supply power to the PC or increase the voltage of the power supplied to the PC.
	An error occurred in the Host Link Unit.	Restart the PC. If an error occurs again, replace the Host Link Unit.
	The Host Link Unit is not properly secured with screws.	Tighten the screws.
	The mounting position of the Host Link Unit is wrong.	Mount the Host Link Unit to the correct slot.
TS1 or TS2 indicator flashes and ERH indicator is lit.	The unit number setting is wrong (the same number has been assigned to two or more Units or the number is not between 0 and 16).	Set the unit number correctly and restart the PC.
	The I/O table is not set correctly.	Set the I/O table correctly.
TS1 or TS2 indicator flashes and EC1 or ERC2 indicator is lit.	DIP switch pin 2 or 3 is ON during the wrap communications test in RS-232C.	Set DIP switch pin 2 or 3 to OFF and restart.
	The wiring of the connector is wrong.	Wire the connector correctly.
	Others	Check the contents of the CPU Bus Unit Area.

4-3 C-mode Commands

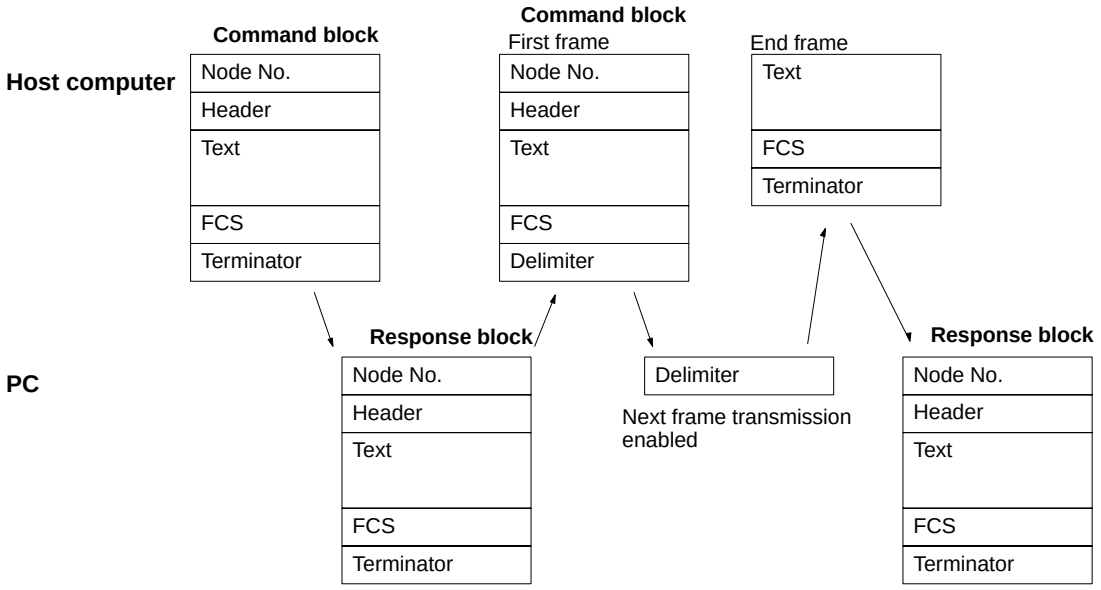
This section describes the communications method used in C mode. The commands used in C mode and the basic communications method are the same as those used with the C-series PCs and are the same as the C-mode commands used with the CPU's host interface. Details on commands not supported by the host interface are provided in *Section 5 C-mode Commands*. Refer to the *CV-series Operation Manual: Host Interface* for all other C-mode commands. The commands and command formats are the same for all other C-mode commands regardless of whether the host interface or the Host Link Unit is used.

⚠ Caution The node number assigned to a Host Link Unit on a Host Link System network is called the “unit number” for the PC in the PC Setup and in the header portions of command formats in the *CV-series PC Operation Manual: Host Interface*. When coding commands for the Host Link Unit, be sure to use the node number and not the unit number.

All commands and responses are transmitting in ASCII. Be sure that the data is in the correct form (BCD or hexadecimal) before converting it to ASCII for transmission. Data is handled in hexadecimal unless otherwise specified.

4-3-1 Communications Protocol

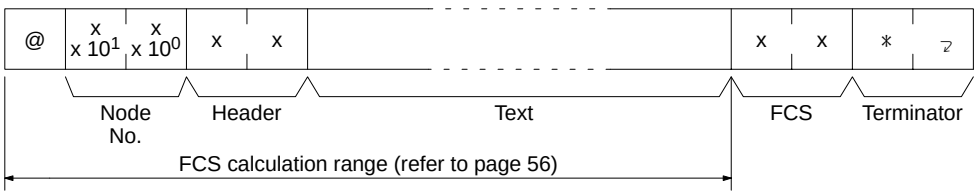
The host computer has the initial right to send. Data transfer between the host computer and the Host Link System is therefore initiated when the computer sends a command to a PC in the Host Link System. The arrows in the following diagram illustrate transfer of the right to send. Each command and each response is sent as a block, with longer block divided into two or more frames, as described in more detail later. Responses cannot be split into multiple frames.



4-3-2 Blocks

Data is sent in a Unit called a block. The data block sent from the host computer to the Host Link System is called a command block. The block returned from the PC to the computer is called a response block. The terminator in the command block enables the PC to send a response. The terminator in the response block enables the host computer to send another command.

Block Format



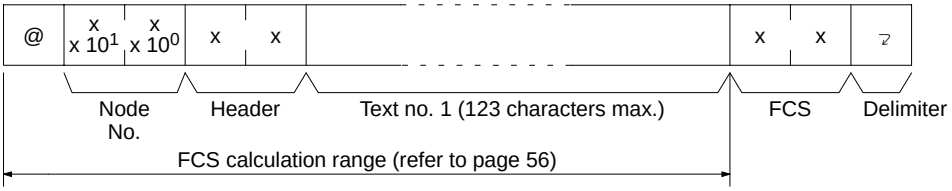
Node Number

The block format includes a node number so that the host computer can identify the Unit that the host computer is communicating with. If the Unit is a CPU, the node number set in the PC Setup must be used (the node number is called the unit number in the PC Setup). If the Unit is a Host Link Unit using port 1, 00 (30, 30) must be used. If the Unit is a Host Link Unit using port 2, the value set on the node number setting switch on the front panel of the Host Link Unit must be designated.

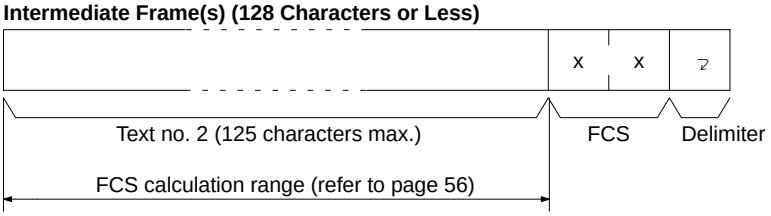
4-3-3 Blocks over 131 Characters Long

Each block is usually made up of one Unit called a frame, but long blocks of data (over 131 characters) must be divided into more than one frame. The first frame can have up to 131 characters, and subsequent frames can have up to 128 characters. In this case, the beginning and intermediate blocks end with a delimiter (CR), instead of a terminator (*CR).

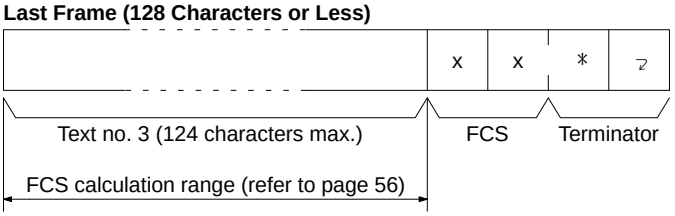
First Frame (131 Characters or Less)



Intermediate Frame(s) (128 Characters or Less)



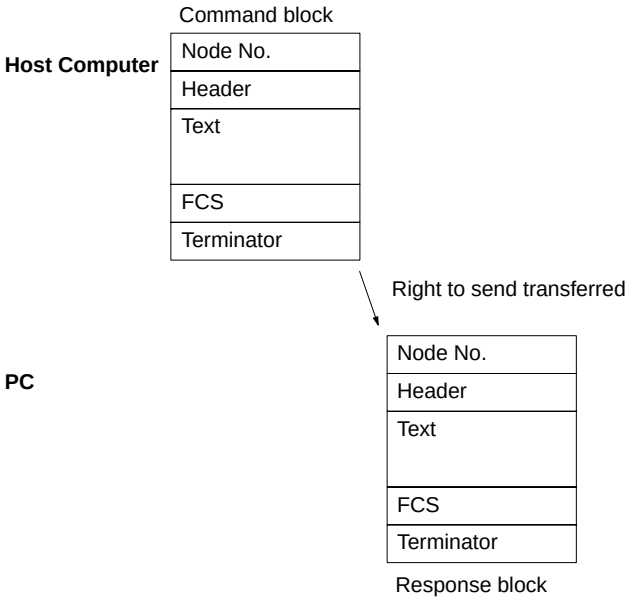
Last Frame (128 Characters or Less)



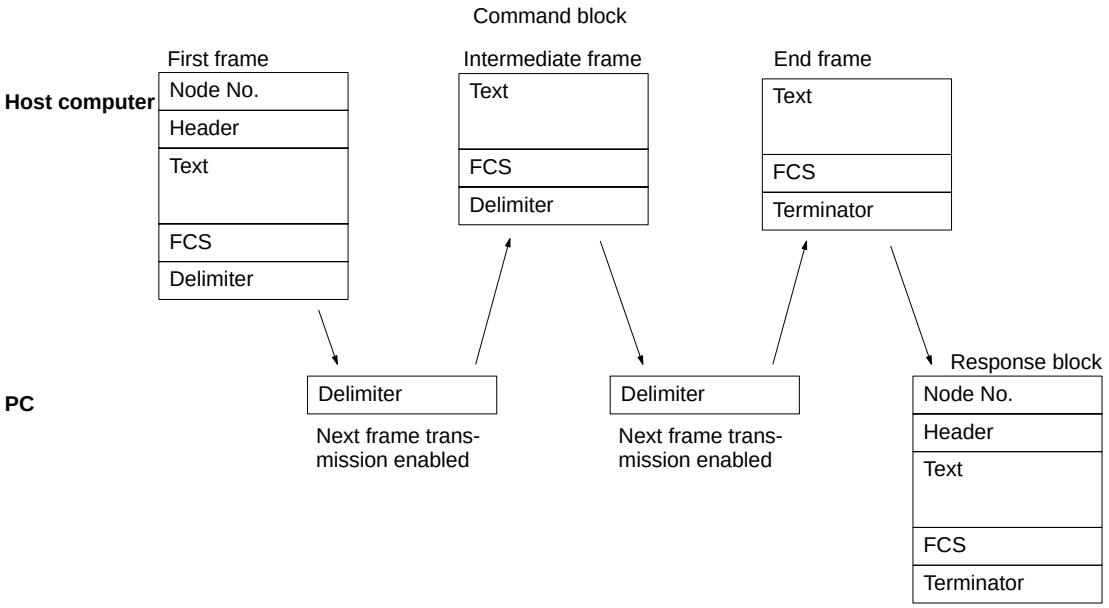
Note Do not separate a single word of data into different frames for any write command (such as WR, WL, WH, WC, or WD).

4-3-4 Right to Send

The terminator in a command block transferred by the host computer enables the PC to send a response.

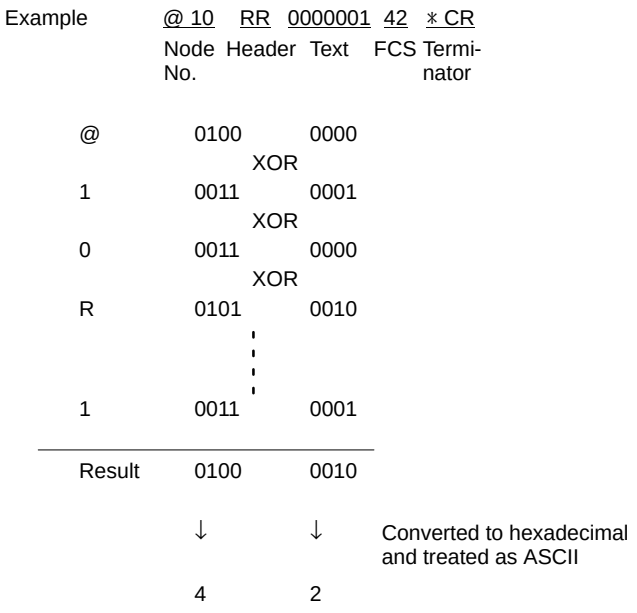


To send a command block with more than one frame from the computer, initially send only the first frame in the block and wait for the PC to return a delimiter. Do not send the next frame until the host computer has received the delimiter.



4-3-5 Frame Checksum (FCS) Calculation

The frame checksum is an 8-bit value converted into two ASCII characters. The 8-bit value is the result of an EXCLUSIVE OR sequentially performed between each character in a transmission, from the first character in the frame to the last character of the text in that frame.



FCS Calculation Program

The following program is an example of how frame checksum calculations can be performed on received data.

```
400 *FCSCHECK
405 L=LEN(RESPONSE$) ..................  Transmit/receive data
410 Q=0:FCSCK$=" "
415 A$=RIGHTS$(RESPONSE$, 1)
417 PRINT RESPONSE$, A$, L
420 IF A$="*" THEN LENGS=LEN(RESPONSE$)-3 ELSE LENGS=LEN(RESPONSE$)-2
430 FCSP$=MID$(RESPONSE$, LENGS+1, 2)  Receive FCS data
440 FOR I=1 TO LENGS ..................  Number of characters in FCS calculation range.
450 Q=ASC(MID$(RESPONSE$, I, 1)) XOR Q
460 NEXT I
470 FCSD$=HEX$(Q)......................  FCS calculation result
480 IF LEN(FCSD$)=1 THEN FCSD$="0"+FCSD$
490 IF FCSD$<>FCSP$ THEN FCSCK$="ERR"
495 PRINT "FCSD$=";FCSD$, "FCSP$=";FCSP$, "FCSCK$=";FCSCK$
500 RETURN
```

Note

1. Received data contains an FCS, delimiter/terminator, etc. If the data is not received normally, however, any of these parts may be missing or corrupted. Be sure to allow for the possibility of missing or corrupted data when receiving data at the host.
2. In this example, the code for CR (CHR$ (13)) is not included in RESPONSE$. Modify lines 415 and 420 to include the code for CR.

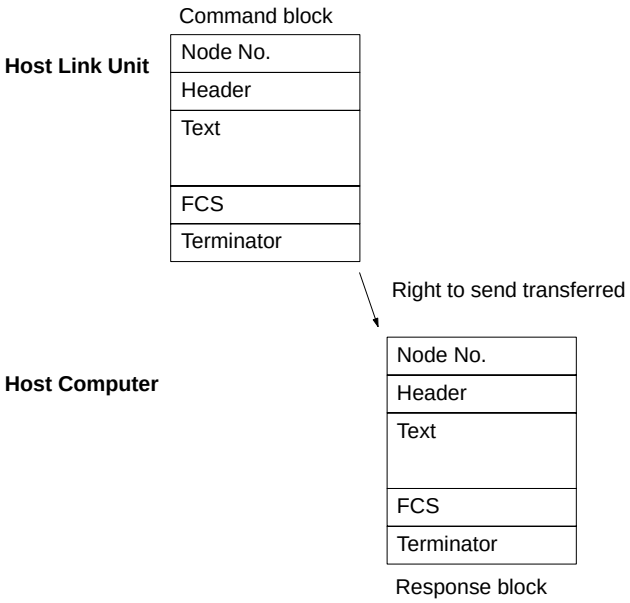
4-4 Sending Commands to Host Computers

Unlike the host interface on the CPU, a Host Link Unit has the right to start communications. This means that the PC can send commands (i.e., SEND(192), RECV(193), and CMND(194) instructions) to the host computer. Using this function, the PC can inform of the host computer of any error in operation. Therefore the host computer does not need to communicate with the PC regularly, which can reduce host computer overhead. Furthermore, a PC equipped with a SYSMAC NET Link Unit or SYSMAC LINK Unit can send commands to host computers connected to PCs on remote networks.

Note As a rule, communications initiated by Host Link Units should be used only when a PC is connected 1-to-1 to a host computer. If a host computer is connected to multiple PCs, simultaneous or overlapping transmissions from different PCs will collide, preventing proper communications. If you need to used Host Link Unit-initiated communications is a 1-to-N Host Link System, you will need to program the PCs so that no two or more transmissions will interfere with each other.

4-4-1 Transfer of Right to Send

A Host Link Unit that has received a SEND(192), RECV(193), or CMND(194) instruction from the PC has the right to send the command to the host computer. After the Host Link Unit has sent the command and the host computer detects the terminator of the command, the right to send will be transferred to the host computer, and the host computer will return a response.



4-4-2 Commands from PC Instructions

The PC sends commands (SEND(192), RECV(193), and CMND(194) instructions) in the direction opposite to the normal direction of communications in the Host Link System. Therefore, be aware of the following.

1, 2, 3...

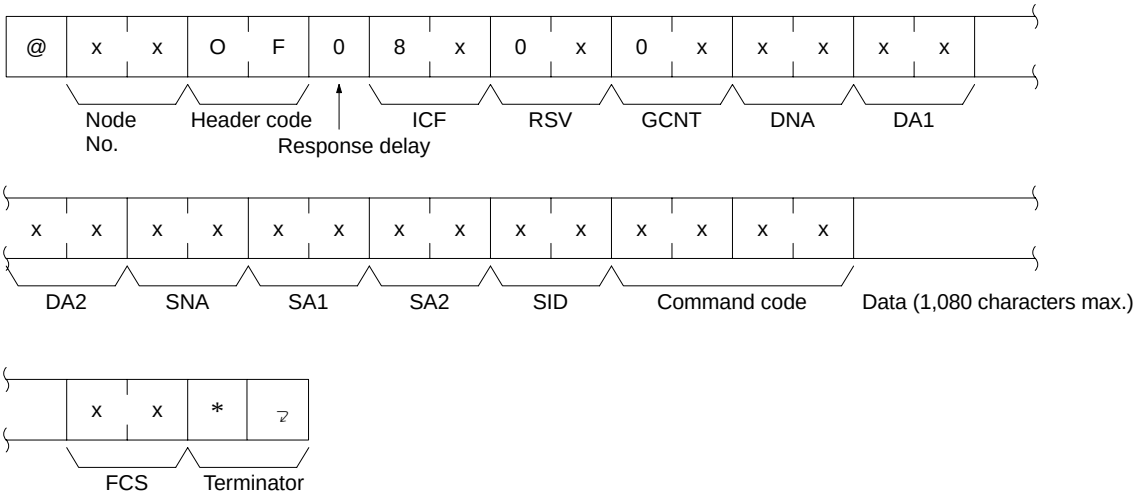
1. SEND(192), RECV(193), and CMND(194) instructions sent by the PC are converted into the CV-mode command format for network communications.
2. It is necessary to prepare a program to process the commands that the host computer receives. Interrupt processing is used for the reception of a command, so the program must be prepared with care (refer to *3-6 Communications Timing*).

3. The control data set is different from usual control data when commands (SEND(192), RECV(193), CMND(194) instructions) are sent by the PC.

For program examples that include commands for the host computer, refer to *Appendix D Sample Programs Including Commands for Host Computer*.

4-4-3 Command Format Received by Host Computers

CV-mode commands addressed to a host computer are received in the following format by the host computer.



Node Number

The block format includes a node number so that the host computer can identify the Unit that the host computer is communicating with. If the Host Link Unit uses port 1, 00 (30, 30) must be used. If the Host Link Unit uses port 2, the value set on the node number setting switches on the front panel of the Host Link Unit must be designated.

Header Code

The header code of the command block format must be set to OF (4F, 46).

Response Delay

The response delay must be set to 0 (39) for any FINS command.

ICF

Set to 80 (38, 30) if a response from the host computer is required and set to 81 (38, 31) if no response is required.

RSV

The port number to which the host computer is connected is set.

Examples:
Communications port 1: 00 (39, 30) or 01 (39, 31)
Communications port 2: 02 (30, 32)

GCNT

Subtract the number of relaying networks (SYSMAC LINK or SYSMAC NET) from 2 and set the resulting value.

Examples:
The number of networks is 0: 02 (30, 32)
The number of networks is 1: 01 (30, 31)
The number of networks is 2: 00 (30, 30)

DNA, DA1, DA2

DNA, DA1, and DA2 specify the Host Link Unit through which the data is sent.
DNA: Set to 00 through 7F to specify the network address of the PC to which the Host Link Unit is mounted.
DA1: Set to 01 through 7E to specify the node number (unit number) of the PC.
DA2: Set to 10 through 1F to specify the unit address of the Host Link Unit.

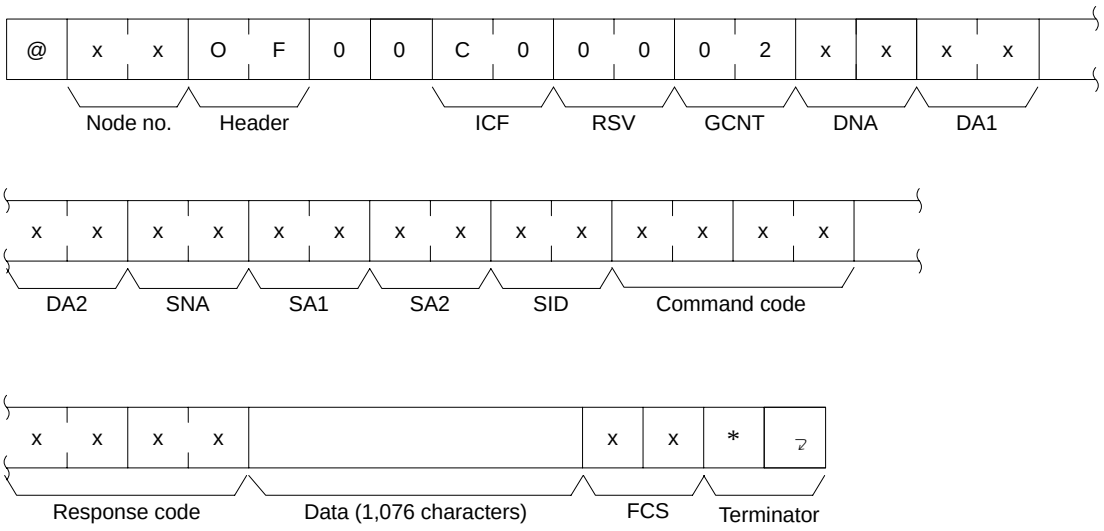
SNA, SA1, SA2

SNA, SA1, and SA2 specify the network addresses of the source node.
SNA: Set to 00 through 7F to specify the network address of the source node.
SA1: Set to 01 through 7E to specify the node number of the source node.
SA2: Set to the unit address of the source node.

SID Automatically set by the CPU for SEND(192), RECV(193), and CMND(194) instructions.

4-4-4 Response Format Sent by Host Computer

When a CV-mode command is received by the host computer, the host computer must return a response in the following format.



ICF Set to C0 (43, 30).

RSV Set to 00 (30, 30).

GCNT Set to 02 (39, 32)

DNA, DA1, DA2 Return the contents of SNA, SA1, and SA2 set in the command block format.

SNA, SA1, SA2 Return the contents of DNA, DA1, and DA2 set in the command block format.

SID Return the contents set in the command block format.

Command Code Return the contents set in the command block format.

Text The response block format can consist of 1,115 characters maximum; the number of characters used for data excluding the response code must be within 1,076.

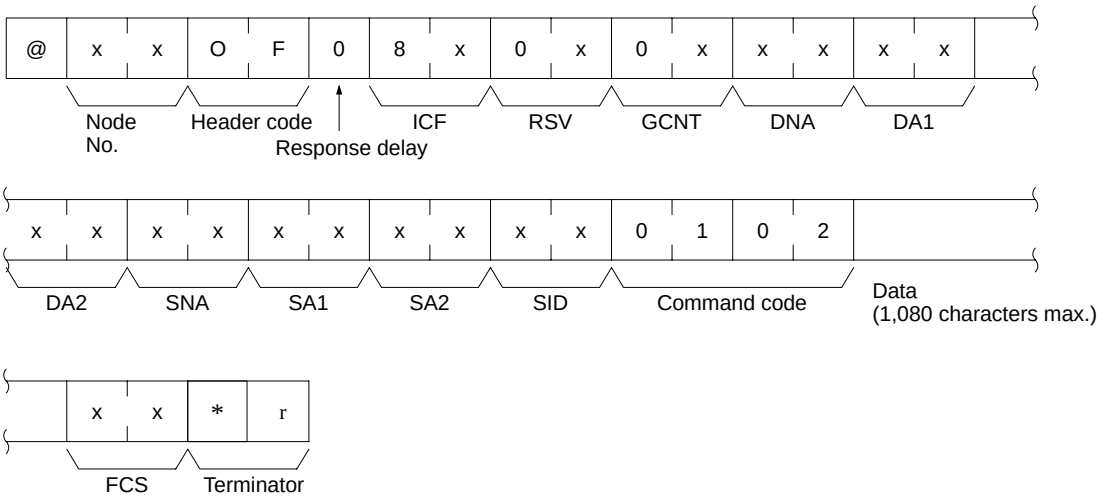
4-4-5 Commands from PCs

The SEND(192), RECV(193), and CMND(194) instructions are used in the PC's user program to execute data communications or controlling the host computer via Host Link System commands. This can be done either to a host computer connected to the local PC or to a host computer connected to a PC linked to the local PC via one or more networks. To send commands using SEND(192), RECV(193), and CMND(194) instructions to the host computer, the control data must be set as explained below. Refer to the *CV-series PC Operation Manual: Ladder Diagrams* for details.

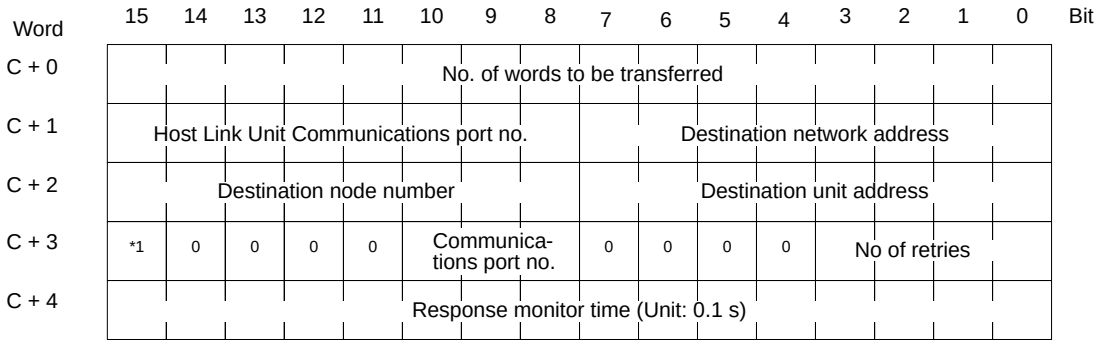
SEND(192) Instruction

The SEND(192) instruction enables the memory area data in the local PC to be sent to the host computer.

When the SEND(192) instruction is executed, the CV-mode command "MEMORY AREA WRITE" (command code 0102) is sent to the host computer in the following command block format.



Before executing the SEND(192) instruction, it is necessary to set the following control data beginning with the first control data word.



(*1) Response designation (0: Response required; 1: Response not required)

1, 2, 3...

1. No. of words to be transferred: Set the total number of words of data to be transmitted to the host computer.
2. Host Link Unit communications port no.: Set the communications port number of the Host Link Unit that is connected to the host computer.
3. Destination network address: Set the network address of the destination node. Set to 00 for communications within the local network.
4. Destination node number: Set the destination node number. Set to 00 for transmissions within the local PC.
5. Destination unit address: Set the unit address of the Host Link Unit that is connected to the host computer.
6. Response designation: Usually set this bit to 0 (OFF). If no response is required, set this bit to 1 (ON).
7. Communications port no.: Set the port number of the PC sending the SEND(192) instruction.
8. No. of retries: Set the upper limit of the number of retries for obtaining a response after the SEND(192) instruction is sent.

9. Response monitor time: Set the response monitor time if the response designation is set to OFF.

The setting range of each control data item is as follows:

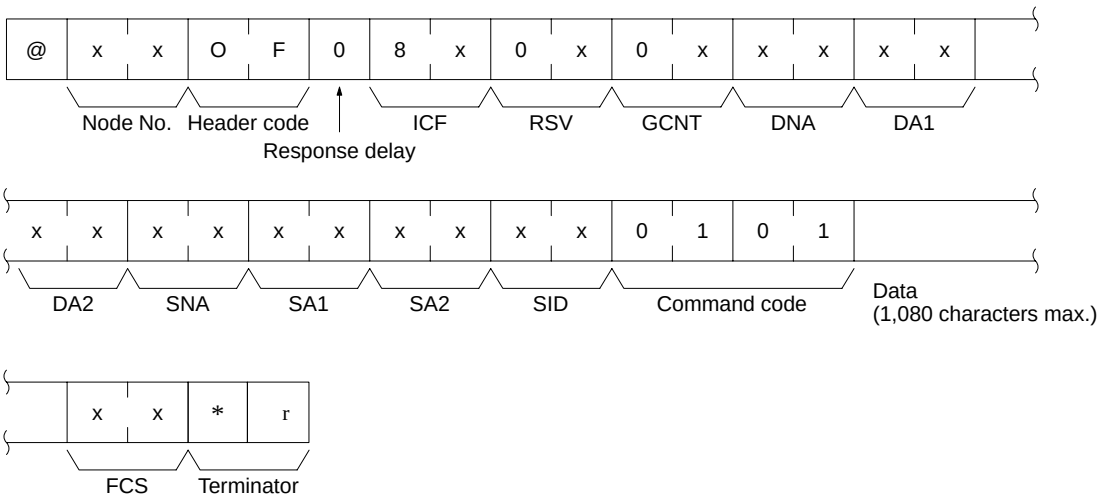
Item	Range
No. of words transferred	0001 to 0100 (1 to 256 words)
Host Link Unit communications port no.	00 or 01: Communications port 1 02: Communications port 2
Destination network address	00: Local network 01 to 7F: Network address (1 to 127)
Destination node number	00: Within local PC 01 to 7E: Node number (1 to 126) (SYSMAC NET) 01 to 3E: Node number (1 to 62) (SYSMAC LINK)
Destination unit address	10 to 1F: Host Link Unit (unit numbers 1 to 15)
Response response	0 (OFF): Response required 1 (ON): No response required
Communications port no.	0 to 7 (0 to 7)
No. of retries	0 to F (0 to 15)
Response monitor time	0000: Default (2 s) 0001 to FFFF (0.1 to 6,553.5 s with 0.1-s increments)

Note In order to execute the SEND(192) instruction properly, it is necessary to prepare a program on the host computer so that the host computer will process the data that the host computer has received.

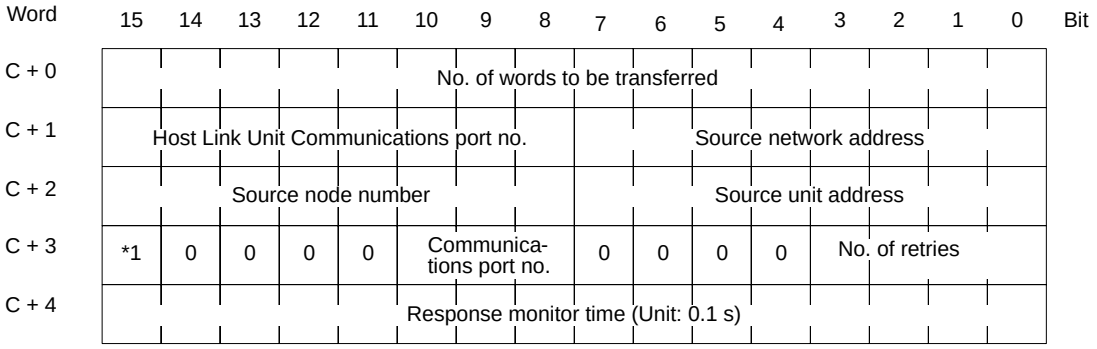
RECV(193) Instruction

The RECV(193) instruction enables data from the host computer to be written to the memory areas of the local PC.

When the RECV(193) instruction is executed, the CV-mode command "MEMORY AREA READ" (command code 0101) will be sent to the host computer in the following command block format.



Before executing the RECV(193) instruction, it is necessary to set the following control data beginning with the first control data word.



1, 2, 3...

1. No. of words to be transferred: Set the total number of words of data to be transmitted from the host computer.
2. Host Link Unit communications port no.: Set the communications port number of the Host Link Unit that is connected to the host computer.
3. Source network address: Set the network address of the source node. Set to 00 for communications within the local network.
4. Source node number: Set the source node number. Set to 00 for transmissions within the local PC.
5. Source unit address: Set the source unit address of the Host Link Unit that is connected to the host computer.
6. Communications port no.: Set the port number of the PC sending the RECV(193) instruction.
7. No. of retries: Set the upper limit of the number of retries for obtaining a response after the RECV(193) instruction is sent.
8. Response monitor time: Set the response monitor time, during which the Host Link Unit waits for the response.

The setting range of each control data item is as follows:

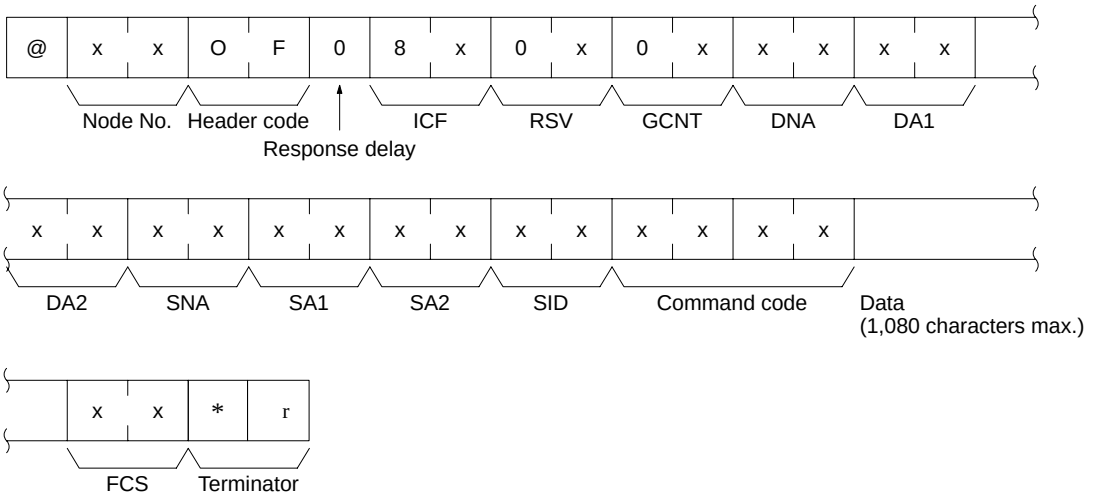
Item	Range
No. of words	0001 to 0100 (1 to 256 words)
Host Link Unit communications port no.	00 or 01: Communications port 1 02: Communications port 2
Source network address	00: Local network 01 to 7F: Network address (1 to 127)
Source node number	00: Within local PC 01 to 7E: Node number (1 to 126) (SYSMAC NET) 01 to 3E: Node number (1 to 62) (SYSMAC LINK)
Source unit address	10 to 1F: Host Link Unit (unit numbers 1 to 15)
Communications port no.	0 to 7 (0 to 7)
No. of retries	0 to F (0 to 15)
Response monitor time	0000: Default (2 s) 0001 to FFFF (0.1 to 6,553.5 s with 0.1-s increments)

Note In order to execute the RECV(193) instruction properly, it is necessary to prepare a program on the host computer so that the host computer will process the instruction that the host computer has received and transmit the proper data.

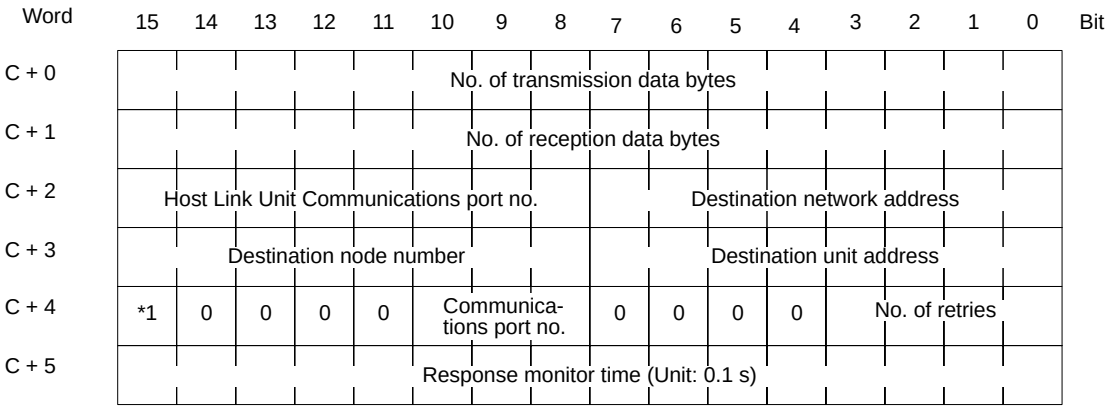
CMND(194) Instruction

The CMND(194) instruction enables the Host Link Unit to control the host computer using CV-mode commands and responses.

When the CMND(194) instruction is executed, the CV-mode command set with the control data will be sent to the host computer in the following command block format.



Before executing the CMND(194) instruction, it is necessary to set the following control data beginning with the first control data word.



(*1) Response designation (0: Response required; 1: Response not required)

1, 2, 3...

1. No. of transmission data bytes: Set the total number of bytes of command data (including the command code) stored in the beginning word and succeeding words.
2. No. of reception data bytes: Set the total number of bytes for the response data (including the command code and response code) to be stored in the beginning word and succeeding words.
3. Host Link Unit communications port no.: Set the communications port number of the Host Link Unit that is connected to the host computer.
4. Destination network address: Set the network address of the destination node. Set to 00 for communications within the local network.
5. Destination node number: Set the destination node number. Set to 00 for transmissions within the local PC.

6. Destination unit address: Set the destination unit address of the Host Link Unit that is connected to the host computer.
7. Response designation: Usually set this bit to 0 (OFF). If no response is required, set this bit to 1 (ON).
8. Communications port no.: Set the port number of the PC sending the CMND(194) instruction.
9. No. of retries: Set the upper limit of the number of retries for obtaining a response after the CMND(194) instruction is sent.
10. Response monitor time: Set the response monitor time, during which the Host Link Unit waits for the response.

Note If the response data returned is longer than the designated length of the reception data, the response data will not be stored. If the response data returned is shorter than the length of the reception data bytes set, the response data will be stored and the unused area will remain as it is.

The setting range of each control data item is as follows:

Item	Range
No. of transmission data bytes	0002 to 021E (2 to 542 bytes)
No. of reception data bytes	0002 to 021E (2 to 542 bytes)
Host Link Unit communications port no.	00 to 01: Communications port 1 01: Communications port 2
Destination network address	00: Local network 01 to 7F: Network address (1 to 127)
Destination node number	00: Within local PC 01 to 7E: Node number (1 to 126) (SYSMAC NET) 01 to 3E: Node number (1 to 62) (SYSMAC LINK)
Destination unit address	10 to 1F: Host Link Unit (unit numbers 0 to 15)
Response designation	0 (OFF): Response required 1 (ON): No response required
Communications port no.	0 to 7 (0 to 7)
No. of retries	0 to F (0 to 15)
Response monitor time	0000: Default (2 s) 0001 to FFFF (0.1 to 6,553.5 s with 0.1-s increments)

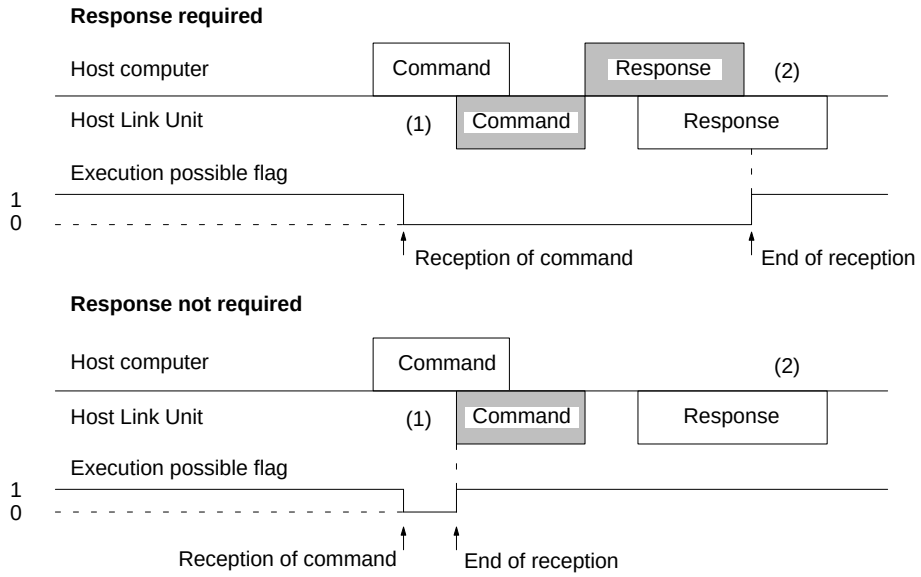
Note In order to execute the CMND(194) instruction properly, it is necessary to prepare a program on the host computer so that the host computer will execute the command that the host computer has received and transmit data.

4-5 Communications Timing

The transmission timing of commands sent to the host computer is explained below. The transmission timing varies with the communications system (i.e., the transmission timing in full-duplex communications (such as Xon/Xoff control) and that in half-duplex communications are different). Full-duplex or half-duplex communications is set in the CPU Bus Unit System Setup.

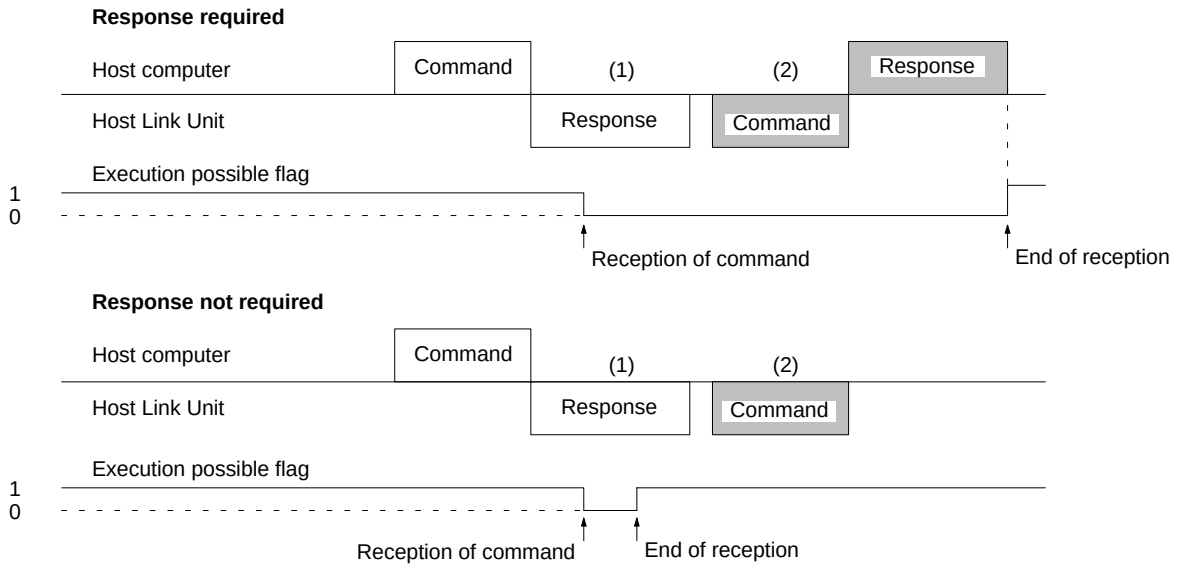
Full-duplex Communications

The following timing charts show the transmission timing in full-duplex communications in which the host computer is sending data.



It is possible to send a command to the host computer even if the Host Link Unit is receiving a command from the host computer (refer to (1) of the above). The response of the Host Link Unit for the command from the host computer will be transmitted only after the command to the host computer is completed (refer to (2) of the above). If no response from the host computer is required, the execution possible flag is ON when the command to the host computer is delivered from the PC to the Host Link Unit.

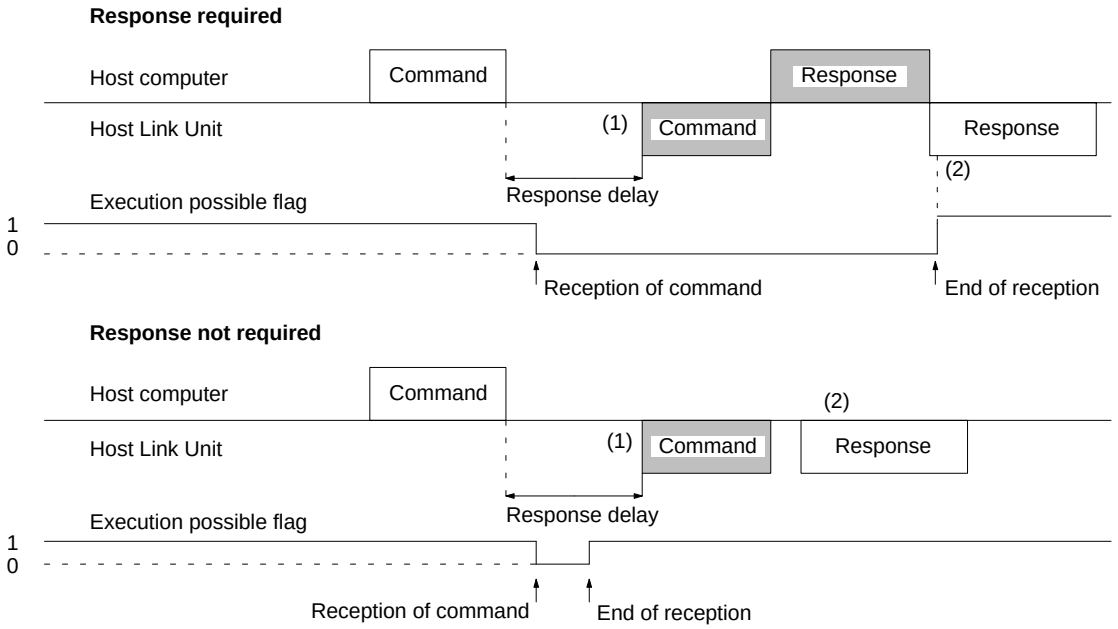
The following timing charts show the transmission timing in full-duplex communications in which a command is sent while the host computer is receiving data.



The above timing charts show that the Host Link Unit is transmitting a response for a command from the host computer (refer to (1)), in which case a command to the host computer from the Host Link Unit will be transmitted only after the Host Link Unit completes transmitting the response. If no response from the host

computer is required, the execution possible flag will turn ON when the command to the host computer is delivered from the PC to the Host Link Unit.

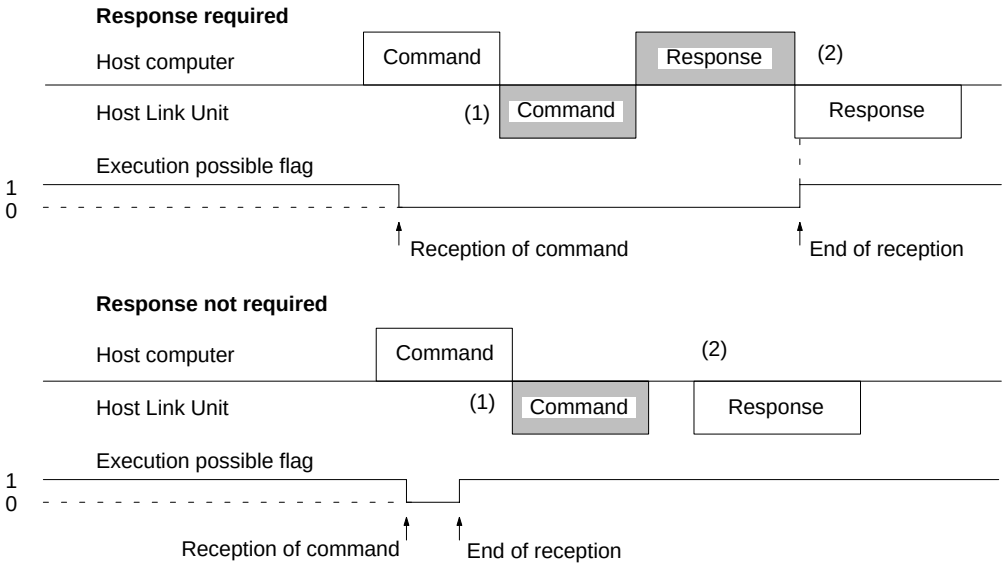
The following timing charts show the transmission timing in full-duplex communications in which the host computer is waiting to send a response after the host computer transmitted data.



If the command format sent from the host computer includes a response delay setting, the Host Link Unit will not send a command to the host computer until the response delay time passes (refer to (1) of the above). A response for a command from the host computer will be transmitted only after the Host Link Unit completes transmitting the command to the host computer (refer to (2) of the above). If no response from the host computer is required, the execution possible flag will turn ON when the command to the host computer is delivered from the PC to the Host Link Unit.

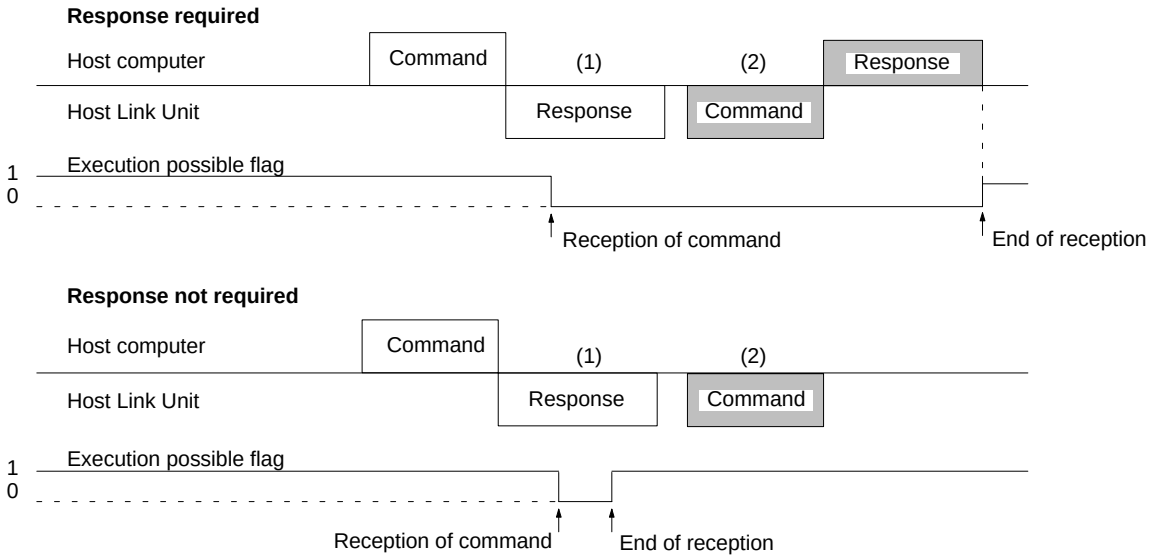
Half-duplex Communications

The following timing charts show the transmission timing in half-duplex communications in which the host computer is sending data.



A command from the Host Link Unit to the host computer is transmitted only after the Host Link Unit completes receiving the command from the host computer (refer to the above (1). A response of the Host Link Unit for a command from the host computer will be transmitted only after the command to the host computer is completed (if a response for the command is required, then the response of the Host Link Unit will be transmitted only after the response is received by the Host Link Unit) (refer to (2) of the above). If no response from the host computer is required, the execution possible flag will turn ON when the command to the host computer is delivered from the PC to the Host Link Unit.

The following timing charts show the transmission timing in half-duplex communications in which a command is sent while the host computer is receiving data.

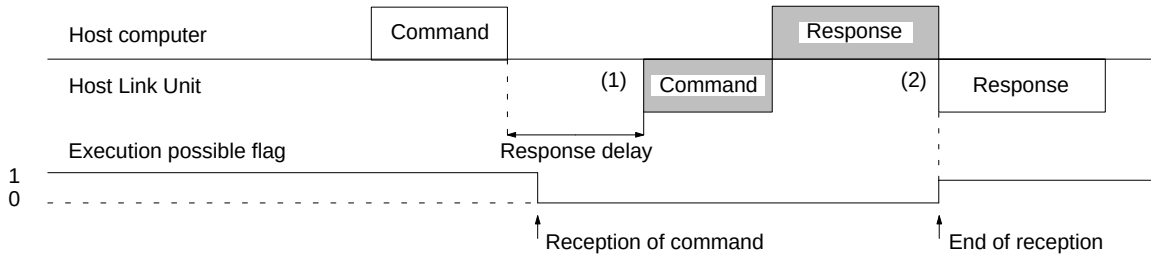


The above timing charts show that the Host Link Unit is transmitting a response for a command from the host computer (refer to (1)), in which case a command to the host computer from the Host Link Unit will be transmitted only after the Host

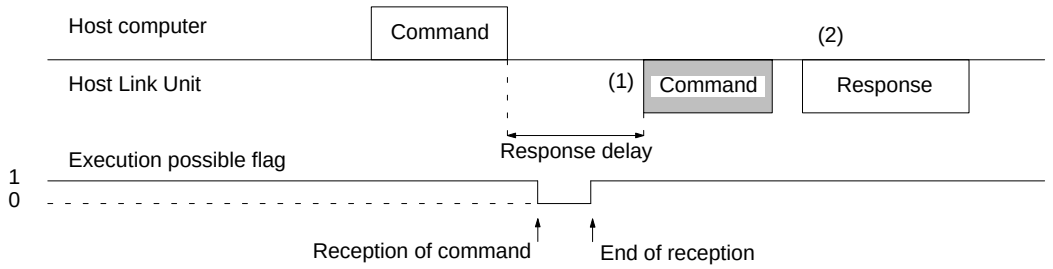
Link Unit completes transmitting the response. If no response from the host computer is required, the execution possible flag will turn ON when the command to the host computer is delivered from the PC to the Host Link Unit.

The following timing charts show the transmission timing in half-duplex communications in which the host computer is waiting to send a response after the host computer transmitted data.

Response required



Response not required



If the command format sent from the host computer includes the response delay setting, the Host Link Unit will not send a command to the host computer until the response delay time passes (refer to (1) of the above). A response for a command from the host computer will be transmitted only after the Host Link Unit completes transmitting the command to the host computer (refer to (2) of the above). If no response from the host computer is required, the execution possible flag will turn ON when the command to the host computer is delivered from the PC to the Host Link Unit.

Xon/Xoff Control Timing

Full-duplex communication between the host computer and PC is possible using the Xoff (transmission interrupt) code and Xon (transmission interrupt cancel) code, with which it is possible to control the transmission and reception of data. The default value of the Xoff code is 13 and that of the Xon code is 11 (both hexadecimal). The values can be changed using the CPU Bus Unit System Setup. No Xon or Xoff code will be retrieved as reception data. The following timing charts show Xon and Xoff control timing.

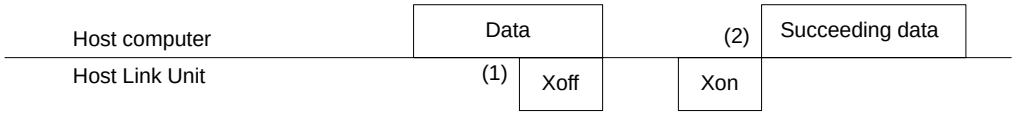
Data transmitted from Host Link Unit



The Host Link Unit stops transmitting the data when the Host Link Unit has received the Xoff code from the host computer (refer to (1) in the above timing chart). The Host Link Unit starts transmitting the data when the Host Link Unit

has received the Xon code from the host computer (refer to (2) in the above timing chart).

Data transmission from Host Computer



When the host computer receives an Xoff code from the Host Link Unit, the host computer stops transmitting data (refer to the above (1)) and when the host computer receives an Xon code from the Host Link Unit, the host computer resumes transmitting the data. Each communications port of the Host Link Unit incorporates eight buffers used for the transmission and reception of data. If seven of the eight buffers are in use, the Xoff code is transmitted and if two of the eight buffers are available, the Xon code is transmitted. If the Host Link Unit needs to transmit the Xon or Xoff code while the Host Link Unit is transmitting data, the data transmission is interrupted to send the code. After the code is transmitted, the Host Link Unit resumes transmitting the data.

Timing of Half-duplex Communication

If the Host Link Unit is connected to the host computer via an RS-232C interface, half-duplex communications are possible by selecting half-duplex communications using the CPU Bus Unit System Setup. In half-duplex communications, CD signals are checked and the reception of data will take precedence. In half-duplex communications, the following two settings are possible.

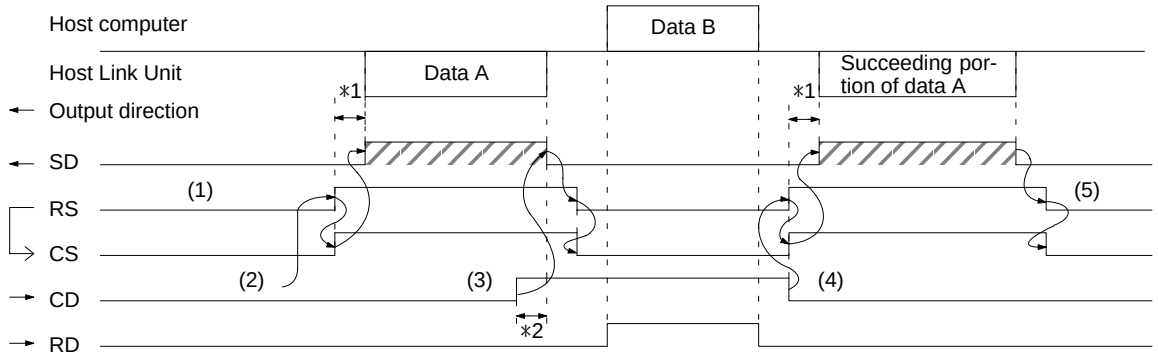
Retry Setting

Any data interrupted during transmission can be re-transmitted from the beginning or transmitted from the interrupted part.

Transmission Delay Time Setting

It is possible to adjust the time between turning ON the RS signal and the start of data transmission from 0 to 510 ms in 2-ms increments.

The following timing chart shows the timing of half-duplex communications.



Note

1. The abbreviations of the signals names are as follows:
   SD: send data, RS: request to send, CS: clear to send, CD: carrier detect, RD: receive data
2. Signal directions are in reference to the Host Link Unit.
3. *1 is the transmission delay time.

4. *2 is the time between CD signal detection and data transmission interruption, which changes with the baud rate as follows:

Baud rate (bps)	Maximum time (ms)
1,200	20.0
2,400	11.0
4,800	6.0
9,600	4.0
19,200	3.0

1, 2, 3...

1. The RS signal is OFF when no data is transmitted.
2. Data A is transmitted after confirming that the CD signal is OFF.
3. When the CD signal is ON while data A is being transmitted and the CD signal is detected, the transmission of the data will be interrupted, the RS signal will be turned OFF, and data B will be received.
4. When the Host Link Unit detects the CD signal going OFF, the transmission of data A will be resumed, in which case, if the retry setting has been set, data A will be re-transmitted from the beginning. If the retry setting has not been set, data A will be re-transmitted from the interrupted part.
5. When the transmission of data A is completed, the RS signal will turn OFF.

SECTION 5
C-mode Commands

This section provides details on all C-mode commands. For basic information on C-mode communications, refer to *4-3 C-mode Commands*.

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5-2 CIO AREA READ 73
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5-4 HOLDING AREA READ 74
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5-7 DM AREA READ 75
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5-9 DM AREA READ (FIXED) 76
5-10 CIO AREA WRITE 77
5-11 LINK AREA WRITE 77
5-12 HOLDING AREA WRITE 78
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5-16 SV READ 1 80
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5-22 STATUS READ 89
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5-33 I/O REGISTER 95
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5-36 INITIALIZE 98

5-1 C-mode Command List

The following tables lists all of the C-mode commands supported by Host Link Unit. The CPU supports all the following commands except the I/O REGISTER and the INITIALIZE commands. These two commands are not supported by the host interface. The commands and command formats are the same for all other C-mode commands regardless of whether the host interface or the Host Link Unit is used.

⚠ Caution The node number assigned to a Host Link Unit on a Host Link System network is called the “unit number” for the PC in the PC Setup and in the header portions of command formats in the *CV-series PC Operation Manual: Host Interface*. When coding commands for the Host Link Unit, be sure to use the node number and not the unit number.

Header code	Name	PC mode				Page
		RUN	MONITOR	DEBUG	PROGRAM	
RR	CIO AREA READ	Valid	Valid	Valid	Valid	73
RL	LINK AREA READ	Valid	Valid	Valid	Valid	73
RH	HOLDING AREA READ	Valid	Valid	Valid	Valid	74
RC	PV READ	Valid	Valid	Valid	Valid	74
RG	TC STATUS READ	Valid	Valid	Valid	Valid	75
RD	DM AREA READ	Valid	Valid	Valid	Valid	75
RJ	AUXILIARY AREA READ	Valid	Valid	Valid	Valid	76
CR	DM AREA READ (FIXED)	Valid	Valid	Valid	Valid	76
WR	CIO AREA WRITE	Not valid	Valid	Valid	Valid	77
WL	LINK AREA WRITE	Not valid	Valid	Valid	Valid	77
WH	HOLDING AREA WRITE	Not valid	Valid	Valid	Valid	78
WC	PV WRITE	Not valid	Valid	Valid	Valid	78
WD	DM AREA WRITE	Not valid	Valid	Valid	Valid	79
WJ	AUXILIARY AREA WRITE	Not valid	Valid	Valid	Valid	79
R#	SV READ 1	Valid	Valid	Valid	Valid	80
R$	SV READ 2	Valid	Valid	Valid	Valid	81
R%	SV READ 3	Valid	Valid	Valid	Valid	83
W#	SV CHANGE 1	Not valid	Valid	Valid	Valid	84
W$	SV CHANGE 2	Not valid	Valid	Valid	Valid	85
W%	SV CHANGE 3	Not valid	Valid	Valid	Valid	87
MS	STATUS READ	Valid	Valid	Valid	Valid	89
SC	STATUS WRITE	Valid	Valid	Valid	Valid	90
MF	ERROR READ	Valid	Valid	Valid	Valid	91
KS	FORCED SET	Not valid	Valid	Valid	Valid	92
KR	FORCED RESET	Not valid	Valid	Valid	Valid	92
KC	FORCED SET/RESET CANCEL	Not valid	Valid	Valid	Valid	93
MM	PC MODEL READ	Valid	Valid	Valid	Valid	94
TS	TEST	Valid	Valid	Valid	Valid	94
RP	PROGRAM READ	Valid	Valid	Valid	Valid	94
WP	PROGRAM WRITE	Not valid	Not valid	Not valid	Valid	95
MI	I/O TABLE GENERATE	Not valid	Not valid	Not valid	Valid	95
QQ	I/O REGISTER	Valid	Valid	Valid	Valid	95
XZ	ABORT (command only)	Valid	Valid	Valid	Valid	98

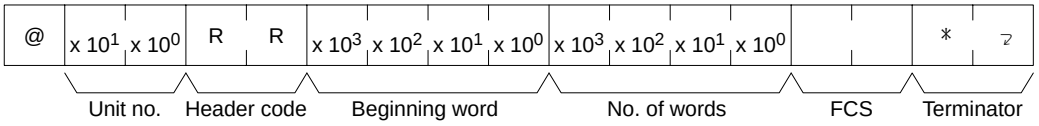
Header code	Name	PC mode				Page
		RUN	MONITOR	DEBUG	PROGRAM	
IC	Undefined Command Error (response only)	---	---	---	---	98
*	INITIALIZE (command only)	Valid	Valid	Valid	Valid	98

Note
1. The I/O REGISTER command (QQ) can be used only for CPUs of version 1 or later or for Host Link Units.
2. The INITIALIZE command (*) can be used only for CPUs of version 2 or later or for Host Link Units.
3. The following commands can be used only for CPUs of version 2 or later: RL, RH, CR, WL, WH, R#, R$, R%, W#, W$, and W%.

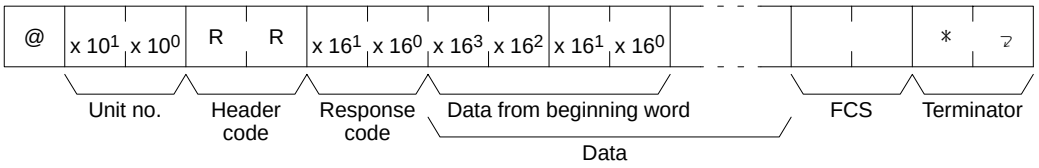
5-2 CIO AREA READ

Reads the contents of the specified number of CIO Area words, starting from the specified word.

Command Format



Response Format



Parameters

Beginning word: Specify in BCD the address of first word to be read from CIO Area (0000 and 2555).

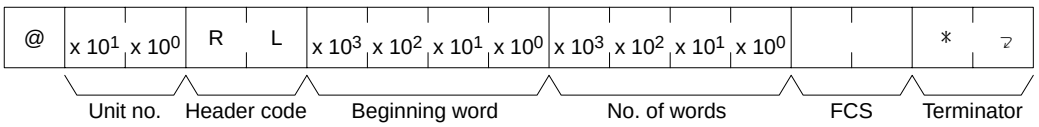
No. of words: Specify in BCD the number of words to read from the CIO Area between 0001 and 2556.

Data from beginning word: The contents of the beginning word will be returned in hexadecimal and followed immediately by the contents of the remaining words requested in the command.

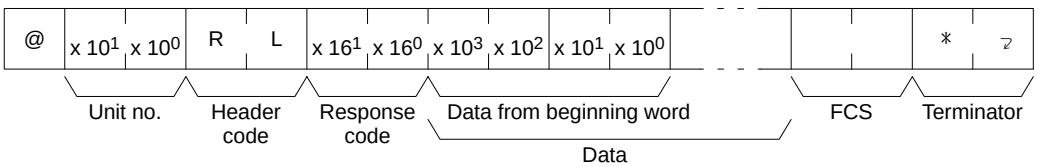
5-3 LINK AREA READ

Reads the contents of the specified number of Link Area words (CIO 1000 to CIO 1063), starting from the specified offset from the beginning of the area. This command will be processed properly regardless of whether or not the Link Area is actually set for use as data link words.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of first word to be read from Link Area as an offset from CIO 1000. The setting can be between 0000 and 0063.

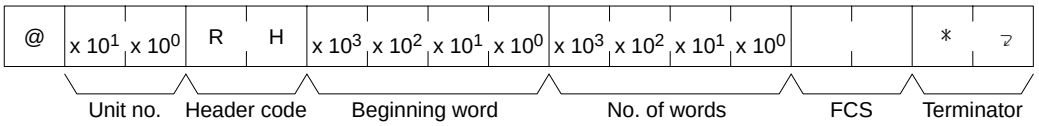
No. of words (command): Specify in BCD the number of words to read from the CIO Area between 0001 and 0064.

Data from beginning word (response): The contents of the beginning word will be returned in hexadecimal and followed immediately by the contents of the remaining words requested in the command.

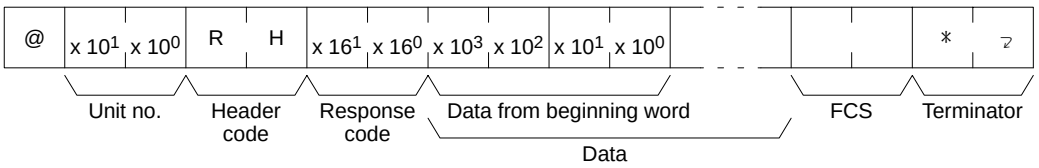
5-4 HOLDING AREA READ

Reads the contents of the specified number of Holding Area words (CIO 1200 to CIO 1299), starting from the specified offset from the beginning of the area. This command will be processed properly regardless of whether or not the Holding Area is actually set for use as holding words.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of first word to be read from Link Area as an offset from CIO 1200. The setting can be between 0000 and 0099.

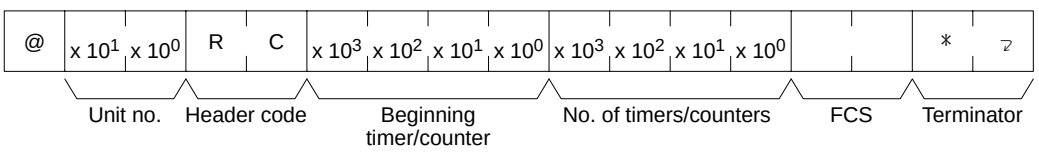
No. of words (command): Specify in BCD the number of words to read from the CIO Area between 0001 and 0100.

Data from beginning word (response): The contents of the beginning word will be returned in hexadecimal and followed immediately by the contents of the remaining words requested in the command.

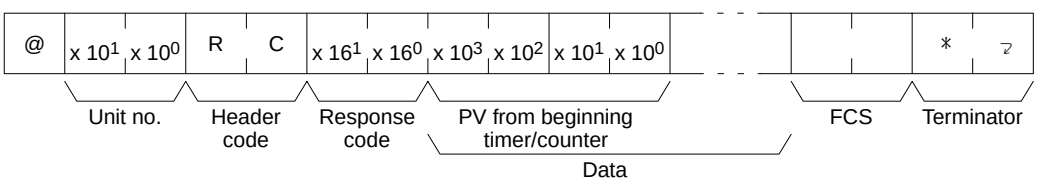
5-5 PV READ

Reads the specified number of timer/counter PVs (present values) starting from the specified timer/counter.

Command Format



Response Format



Parameters

Beginning timer/counter (command): Specify in BCD the address of the first timer to be read from the Timer Area (0000 through 0511 for the CV500 or CVM1-CPU01-E and 0000 through 1023 for the CV1000, CV2000, or CVM1-CPU11-E) or counter in the Counter Area (2048 through 2559 for the CV500 or CVM1-CPU01-E and 2048 through 3071 for the CV1000, CV2000, or CVM1-CPU11-E). The area prefix is not required.

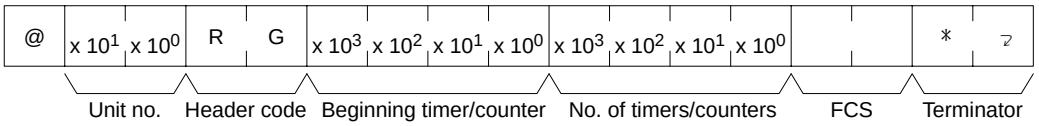
Number of timers/counters (command): Specify in BCD the number of timers/counters to be read from the Timer/Counter Area (0000 through 0511/1023).

Data (response): The PV of the specified timers/counters will be returned in BCD.

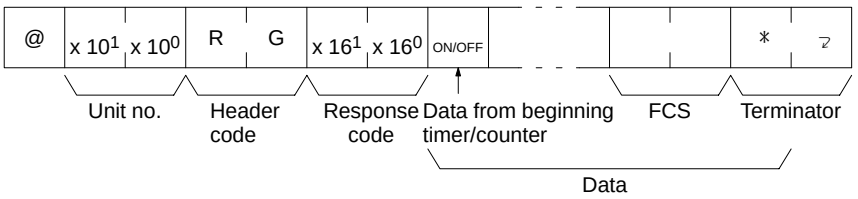
5-6 TC STATUS READ

Reads the status of the Completion Flags of the specified number of timers/counters starting from the specified timer/counter.

Command Format



Response Format



Parameters

Beginning timer/counter (command): Specify in BCD the address of the first timer to be read from the Timer Area (0000 through 0512 for the CV500 or CVM1-CPU01-E and 0000 through 1024 for the CV1000, CV2000, or CVM1-CPU11-E) or counter in the Counter Area (2048 through 2559 for the CV500 or CVM1-CPU01-E and 2048 through 3071 for the CV1000, CV2000, or CVM1-CPU11-E). The area prefix is not required.

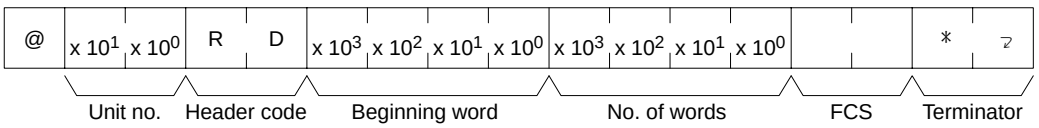
Number of timers/counters (command): Specify in BCD the number of timers/counters to be read from the Timer/Counter Area (0000 through 0511/1023).

Data (response): The status of the Completion Flags of the specified timers/counters will be returned. If a 1 is returned, the Completion Flag is ON; if a 0 is returned, the Completion Flag is OFF.

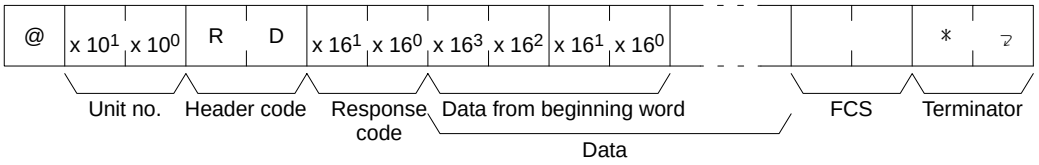
5-7 DM AREA READ

Reads the contents of the specified number of DM words starting from the specified word.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of the first word to be read from the DM Area (0000 through 8191 for the the CV500 or CVM1-CPU01-E and 0000 through 9999 for the CV1000, CV2000, or CVM1-CPU11-E). The area prefix is not required.

Number of words (command): Specify in BCD the number of words to be read (0001 through 8192 for the CV500 or CVM1-CPU01-E and 0001 through 9999 for the CV1000, CV2000, or CVM1-CPU11-E).

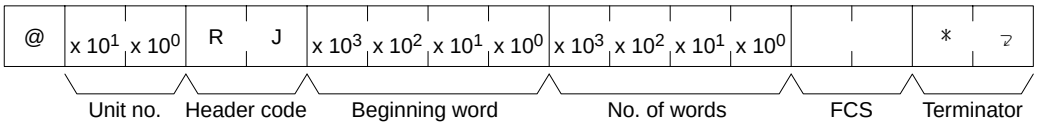
Data (response): The contents of the specified words will be returned in hexadecimal.

Note The DM Area in the CV1000, CV2000, or CVM1-CPU11-E runs from D00000 through D24575. In the above command format, however, only the words D0000 through D9999 can be read. To read the rest of the DM Area, execute the CV-mode MEMORY AREA READ command (command code: 01 01).

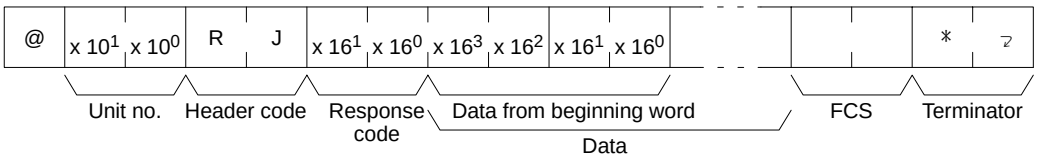
5-8 AUXILIARY AREA READ

Reads the contents of the specified number of Auxiliary Area words starting from the specified word.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of the first word to be read from the Auxiliary Area (0000 through 0511). The area prefix is not required.

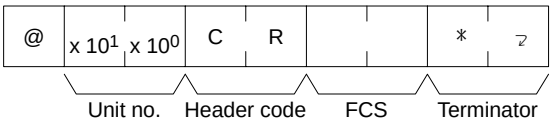
Number of words (command): Specify in BCD the number of words to be read (0001 through 0512).

Data (response): The specified data will be read in the hexadecimal.

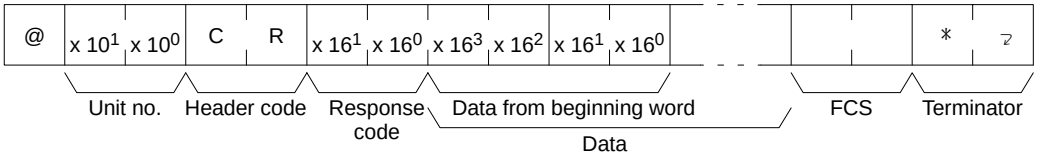
5-9 DM AREA READ (FIXED)

Reads the contents of DM Area words D00000 to D00007.

Command Format



Response Format

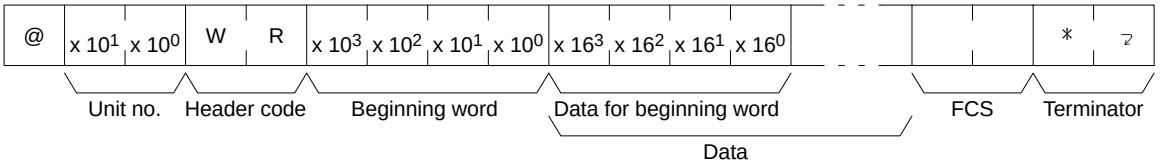


Parameters **Data (response):** The data of the eight words will be read in the hexadecimal.

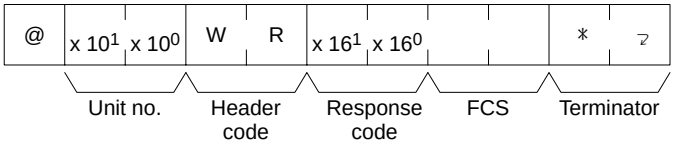
5-10 CIO AREA WRITE

Writes data to the CIO area starting from the specified word. The data to be written is specified word by word.

Command Format



Response Format



Parameters **Beginning word (command):** Specify in BCD the address of the first word to be written to in the CIO Area (0000 through 2555).

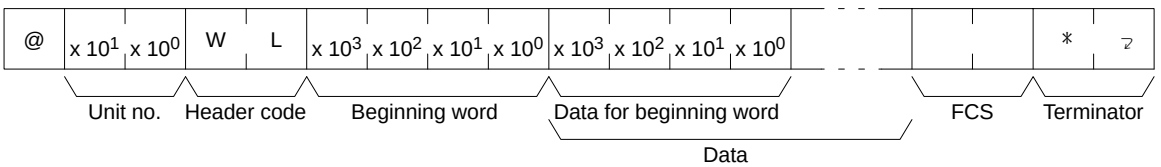
Data (command): Specify the data to be written in hexadecimal.

Note The boundary of the data area must not be exceeded. For example, if you specify CIO 2555 for the beginning word and try to write more than one word, an error will result and no data will be written.

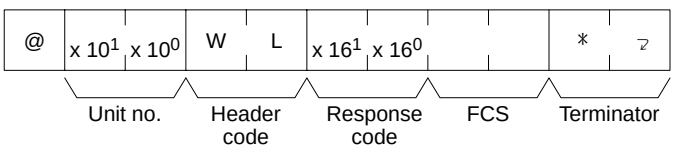
5-11 LINK AREA WRITE

Writes data to the specified number of Link Area words (CIO 1000 to CIO 1063), starting from the specified offset from the beginning of the area. This command will be processed properly regardless of whether or not the Link Area is actually set for use as data link words.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of first word to be written in the Link Area as an offset from CIO 1000. The setting can be between 0000 and 0063.

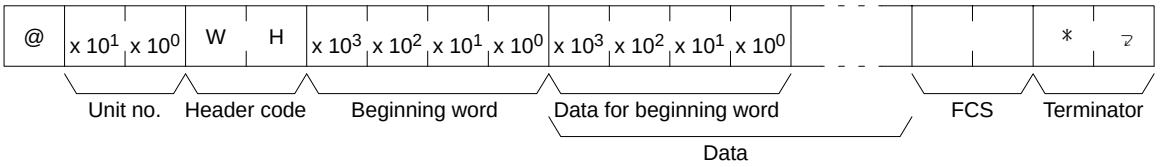
Data (command): Specify the data to be written in hexadecimal.

Note The boundary of the data area must not be exceeded. For example, if you specify “0060” for the beginning word and try to write more than four words, an error will result and no data will be written.

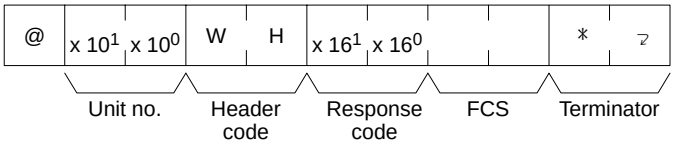
5-12 HOLDING AREA WRITE

Writes data to the specified number of Holding Area words (CIO 1200 to CIO 1299), starting from the specified offset from the beginning of the area. This command will be processed properly regardless of whether or not the Holding Area is actually set for use as holding words.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of first word to be written in the Link Area as an offset from CIO 1200. The setting can be between 0000 and 0099.

Data (command): Specify the data to be written in hexadecimal.

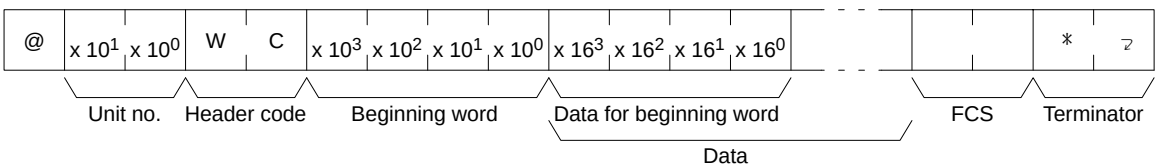
Note The boundary of the data area must not be exceeded. For example, if you specify “0098” for the beginning word and try to write more than two words, an error will result and no data will be written.

5-13 PV WRITE

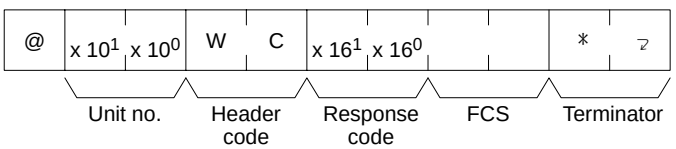
Writes PVs (present values) of timers/counters starting from the specified timer/counter.

Note When data is written, the Completion Flags of the timers/counters will be turned OFF.

Command Format



Response Format



Parameters

Beginning timer/counter (command): Specify in BCD the address of the first timer to be written to in the Timer Area (0000 through 0511 for the CV500 or CVM1-CPU01-E and 0000 through 1023 for the CV1000, CV2000, or CVM1-CPU11-E) or counter to be written to in the Counter Area (2048 through 2559 for the CV500 or CVM1-CPU01-E and 2048 through 3071 for the CV1000, CV2000, or CVM1-CPU11-E). The area prefix is not required.

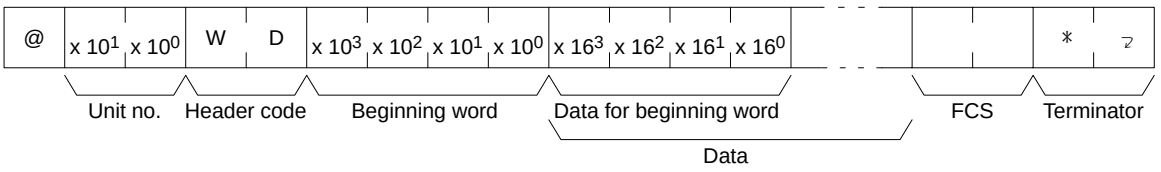
Data (command): Specify the PVs to be written in BCD.

Note The boundary of the data area must not be exceeded. For example, if you specify 510 for the beginning word and try to write more than two PVs for the CV500, an error will result and no data will be written.

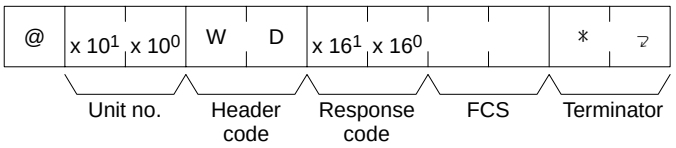
5-14 DM AREA WRITE

Writes data to the DM Area starting from the specified word. The data to be written is specified word by word.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of the first word to be written to in the DM area (0000 through 8191 for the CV500 or CVM1-CPU01-E and 0000 through 9999 for the CV1000, CV2000, or CVM1-CPU11-E). The area prefix is not required.

Data (command): Specify the data to be written in hexadecimal.

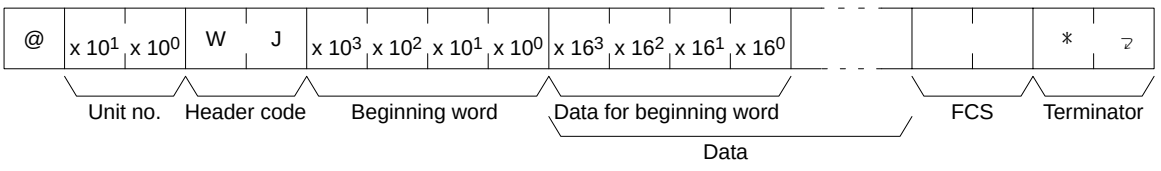
Note The DM Area in the CV1000, CV2000, or CVM1-CPU11-E runs from D00000 through D24575. In the above command format, however, only the words D0000 through D9999 can be written. To write data to the rest of the DM Area, execute the MEMORY AREA WRITE CV-mode command (command code: 01 02).

5-15 AUXILIARY AREA WRITE

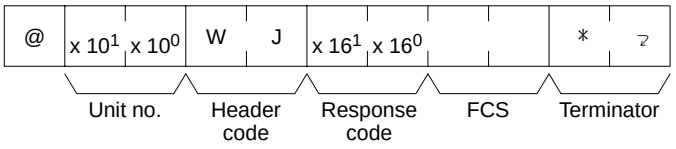
Writes data to the Auxiliary Area starting from the specified word. The data to be written is specified word by word.

Note All Auxiliary Area words from A0256 on are read-only.

Command Format



Response Format



Parameters

Beginning word (command): Specify in BCD the address of the first word to be written to in the Auxiliary Area (0000 through 0255).

Data (command): Specify the data to be written in hexadecimal.

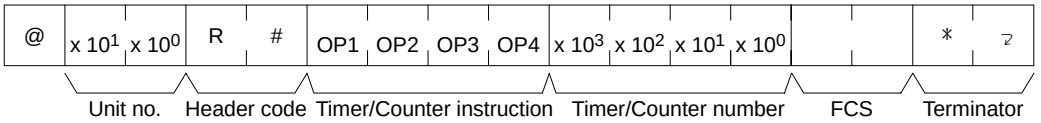
5-16 SV READ 1

Finds the specified timer or counter instruction in the program (main program area) and reads the constant SV in 4-digit BCD. The SV of the timer/counter must be a constant.

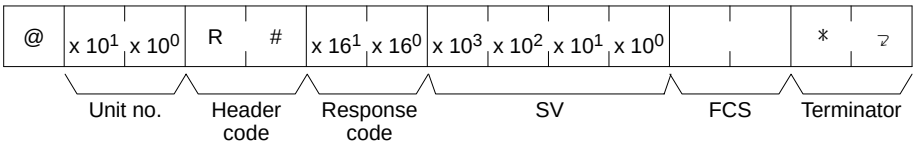
Note

1. Only the first instruction in the program that meets the specifications will be found.
2. Up to 10 seconds can be required to receive a response because the program is searched from the beginning.
3. If the SV is not defined using a constant, a response code of 16 will be returned indicating that the specified instruction does not exist.
4. Only the main program will be searched for CVM1 PCs.
5. If the PC is programmed using SFC, only action 0 will be searched. The entire main program will be searched if SFC programming is not used.

Command Format



Response Format



Parameters

Timer/Counter instruction (command): Specify in four letters the instruction used to create the timer/counter (see below).

Timer/Counter number (command): Specify the timer/counter number used to define the timer/counter.

Timer/Counter instruction				Instruction	Timer/Counter number
OP1	OP2	OP3	OP4		
T	M	H	W	HIGH-SPEED TIMER WAIT (TMHW<015>)	000 to 0511 (CVM1-CPU01-EV2 and CV500) 0000 to 1023 (other CPUs)
T	I	M	W	TIMER WAIT (TIMW<013>)	
C	N	T	W	COUNTER WAIT (CNTW<014>)	
T	I	M	H	HIGH-SPEED TIMER (TIMH(015))	
T	T	I	M	ACCUMULATIVE TIMER (TTIM(120))	
C	N	T	R	REVERSIBLE COUNTER (CNTR(012))	
T	I	M	*space*	TIMER (TIM)	
C	N	T	*space*	COUNTER (CNT)	

SV (response): The SV of the specified instruction in BCD.

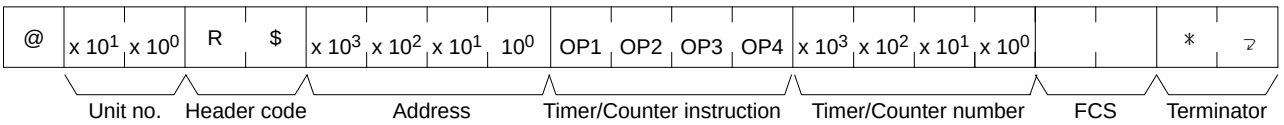
Note A total of four letters are required to specify the instruction. Be sure to include a space where necessary.

5-17 SV READ 2

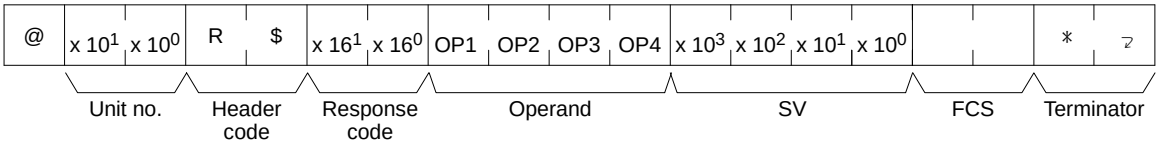
Finds the specified timer or counter instruction in the program (main program area) starting from the specified address and reads the constant SV in 4-digit BCD or reads the address of the word containing the SV. This command can be used to specify address in programs only up to 10K words in size.

Note
1. Only the first instruction in the program after the specified address that meets the specifications will be found.
2. Only the main program will be searched for CVM1 PCs.
3. If the PC is programmed using SFC, only action 0 will be searched. The entire main program will be searched if SFC programming is not used.

Command Format



Response Format



Parameters

Address (command): Specify the address from which to start searching for the timer/counter instruction in four digits of BCD.

Timer/Counter instruction (command): Specify in four letters the instruction used to create the timer/counter (see below).

Timer/Counter number (command): Specify the timer/counter number used to define the timer/counter.

Timer/Counter instruction				Instruction	Timer/Counter number
OP1	OP2	OP3	OP4		
T	M	H	W	HIGH-SPEED TIMER WAIT (TMHW<015>)	000 to 0511 (CVM1-CPU01-EV2 and CV500) 0000 to 1023 (other CPUs)
T	I	M	W	TIMER WAIT (TIMW<013>)	
C	N	T	W	COUNTER WAIT (CNTW<014>)	
T	I	M	H	HIGH-SPEED TIMER (TIMH(015))	
T	T	I	M	ACCUMULATIVE TIMER (TTIM(120))	
C	N	T	R	REVERSIBLE COUNTER (CNTR(012))	
T	I	M	*space*	TIMER (TIM)	
C	N	T	*space*	COUNTER (CNT)	

Note A total of four letters are required to specify the instruction. Be sure to include a space where necessary.

Operand (response): Specifies whether a constant or word was used to define the timer/counter and, if a word was used, specifies the data area of the word (see below).

SV or address (response): The SV of the specified instruction in BCD or the address of the word used for the SV.

Operand				Constant/Area	SV (see notes)
OP1	OP2	OP3	OP4		
C	O	N	*space*	Constant	0000 to 9999
C	I	O	*space*	CIO Area	0000 to 2555
G	R	*space*	*space*	CPU Bus Link Area	0000 to 0255
A	R	*space*	*space*	Auxiliary Area	0000 to 0511
T	I	M	*space*	Timer Area	0000 to 0511 or 0000 to 1023
C	N	T	*space*	Counter Area	
D	M	*space*	*space*	DM Area	00000 to 08191 or 00000 to 09999
D	M	*	*space*	Indirect DM address	
E	M	*space*	*space*	EM Area	00000 to 09999
E	M	*	*space*	Indirect EM address	
D	R	*space*	*space*	Data Register	0000 to 0002
I	R	*space*	*space*	Index Register	0000 to 0002
,	I	R	*space*	Indirect index register address	0000 to 0002 (offsets and other details cannot be read)

Note

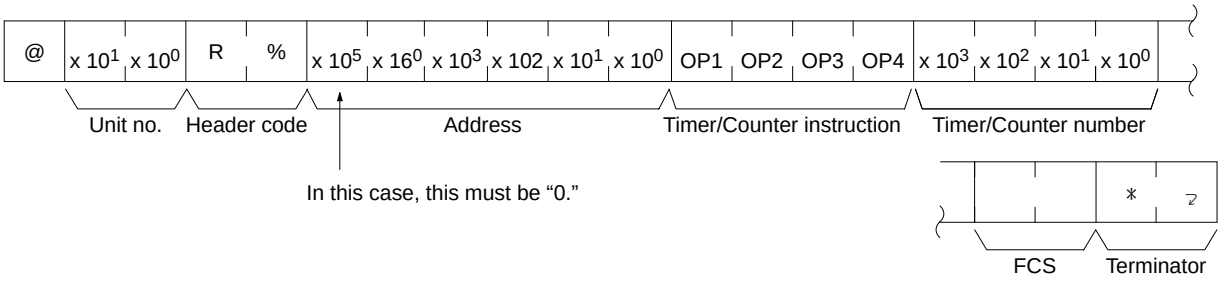
1. A total of four letters are required to specify the operand. Be sure to include spaces where necessary.
2. Word address ranges depend on the CPU being used. Refer to the *CV-series Operation Manual: Ladder Diagrams* for details.

5-18 SV READ 3

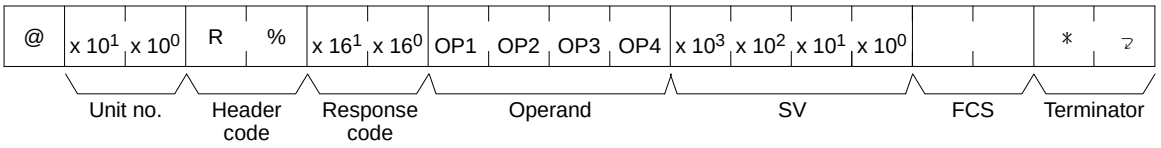
Finds the specified timer or counter instruction in the program (main program area) starting from the specified address and reads the constant SV in 4-digit BCD or reads the address of the word containing the SV. This command can be used to start reading past 10K words of program memory, i.e., 6-digit addresses.

Note
1. Only the first instruction in the program after the specified address that meets the specifications will be found.
2. Only the main program will be searched for CVM1 PCs.
3. If the PC is programmed using SFC, only action 0 will be searched. The entire main program will be searched if SFC programming is not used.

Command Format



Response Format



Parameters

Address (command): Specify the address from which to start searching for the timer/counter instruction in six digits of BCD.

Timer/Counter instruction (command): Specify in four letters the instruction used to create the timer/counter (see below).

Timer/Counter number (command): Specify the timer/counter number used to define the timer/counter.

Timer/Counter instruction				Instruction	Timer/Counter number
OP1	OP2	OP3	OP4		
T	M	H	W	HIGH-SPEED TIMER WAIT (TMHW<015>)	000 to 0511 (CVM1-CPU01-EV2 and CV500) 0000 to 1023 (other CPUs)
T	I	M	W	TIMER WAIT (TIMW<013>)	
C	N	T	W	COUNTER WAIT (CNTW<014>)	
T	I	M	H	HIGH-SPEED TIMER (TIMH(015))	
T	T	I	M	ACCUMULATIVE TIMER (TTIM(120))	
C	N	T	R	REVERSIBLE COUNTER (CNTR(012))	
T	I	M	*space*	TIMER (TIM)	
C	N	T	*space*	COUNTER (CNT)	

Note A total of four letters are required to specify the instruction. Be sure to include a space where necessary.

Operand (response): Specifies whether a constant or word was used to define the timer/counter and, if a word was used, specifies the data area of the word (see below).

New SV (response): The SV of the specified instruction in BCD or the address of the word used for the SV.

Operand				Constant/Area	SV (see note)
OP1	OP2	OP3	OP4		
C	O	N	*space*	Constant	0000 to 9999
C	I	O	*space*	CIO Area	0000 to 2555
G	R	*space*	*space*	CPU Bus Link Area	0000 to 0255
A	R	*space*	*space*	Auxiliary Area	0000 to 0511
T	I	M	*space*	Timer Area	0000 to 0511 or 0000 to 1023
C	N	T	*space*	Counter Area	
D	M	*space*	*space*	DM Area	00000 to 08191 or 00000 to 09999
D	M	*	*space*	Indirect DM address	
E	M	*space*	*space*	EM Area	00000 to 09999
E	M	*	*space*	Indirect EM address	
D	R	*space*	*space*	Data Register	0000 to 0002
I	R	*space*	*space*	Index Register	0000 to 0002
,	I	R	*space*	Indirect index register address	0000 to 0002 (offsets and other details cannot be read)

Note

1. A total of four letters are required to specify the operand. Be sure to include spaces where necessary.
2. Word address ranges depend on the CPU being used. Refer to the *CV-series Operation Manual: Ladder Diagrams* for details.

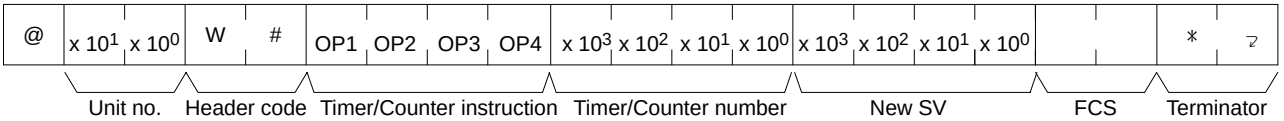
5-19 SV CHANGE 1

Finds the specified timer or counter instruction in the program (main program area) and changes the constant SV to a new 4-digit BCD value. The SV of the timer/counter must be a constant.

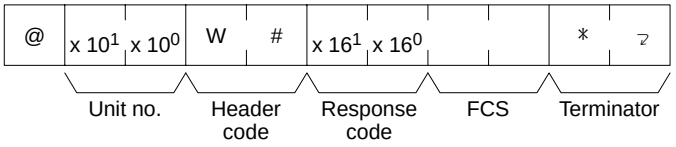
Note

1. Only the first instruction in the program that meets the specifications will be found.
2. Up to 10 seconds can be required to receive a response because the program is searched from the beginning.
3. If the SV is not defined using a constant, a response code of 16 will be returned indicating that the specified instruction does not exist.
4. Only the main program will be searched for CVM1 PCs.
5. If the PC is programmed using SFC, only action 0 will be searched. The entire main program will be searched if SFC programming is not used.

Command Format



Response Format



Parameters

Timer/Counter instruction (command): Specify in four letters the instruction used to create the timer/counter (see below).

Timer/Counter number (command): Specify the timer/counter number used to define the timer/counter.

Timer/Counter instruction				Instruction	Timer/Counter number
OP1	OP2	OP3	OP4		
T	M	H	W	HIGH-SPEED TIMER WAIT (TMHW<015>)	000 to 0511 (CVM1-CPU01-EV2 and CV500) 0000 to 1023 (other CPUs)
T	I	M	W	TIMER WAIT (TIMW<013>)	
C	N	T	W	COUNTER WAIT (CNTW<014>)	
T	I	M	H	HIGH-SPEED TIMER (TIMH(015))	
T	T	I	M	ACCUMULATIVE TIMER (TTIM(120))	
C	N	T	R	REVERSIBLE COUNTER (CNTR(012))	
T	I	M	*space*	TIMER (TIM)	
C	N	T	*space*	COUNTER (CNT)	

Note A total of four letters are required to specify the instruction. Be sure to include a space where necessary.

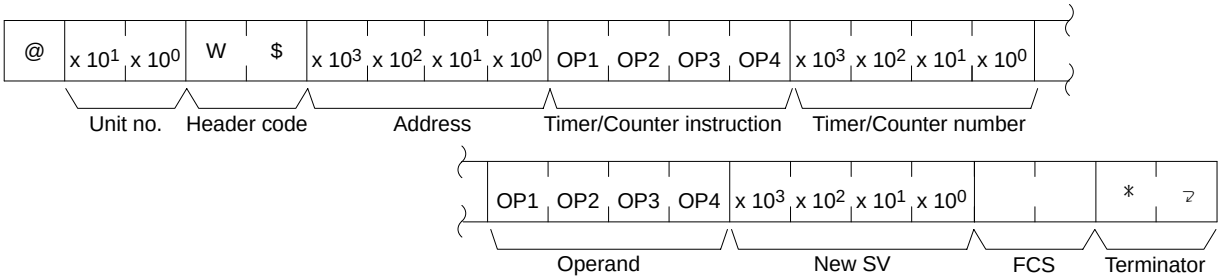
New SV (command): Specify the new constant SV in four digits of BCD.

5-20 SV CHANGE 2

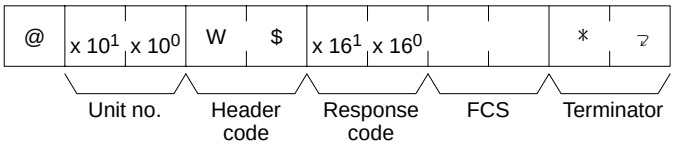
Finds the specified timer or counter instruction in the program (main program area) starting from the specified address and changes the constant SV in 4-digit BCD or the address of the word containing the SV. This command can be used to specify address in programs only up to 10K words in size.

Note
1. Only the first instruction in the program after the specified address that meets the specifications will be found.
2. Only the main program will be searched for CVM1 PCs.
3. If the PC is programmed using SFC, only action 0 will be searched. The entire main program will be searched if SFC programming is not used.

Command Format



Response Format



Parameters

Address (command): Specify the address from which to start searching for the timer/counter instruction in four digits of BCD.

Timer/Counter instruction (command): Specify in four letters the instruction used to create the timer/counter (see below).

Timer/Counter number (command): Specify the timer/counter number used to define the timer/counter.

Timer/Counter instruction				Instruction	Timer/Counter number
OP1	**OP2**	**OP3**	**OP4**		
T	M	H	W	HIGH-SPEED TIMER WAIT (TMHW<015>)	000 to 0511 (CVM1-CPU01-EV2 and CV500) 0000 to 1023 (other CPUs)
T	I	M	W	TIMER WAIT (TIMW<013>)	
C	N	T	W	COUNTER WAIT (CNTW<014>)	
T	I	M	H	HIGH-SPEED TIMER (TIMH(015))	
T	T	I	M	ACCUMULATIVE TIMER (TTIM(120))	
C	N	T	R	REVERSIBLE COUNTER (CNTR(012))	
T	I	M	*space*	TIMER (TIM)	
C	N	T	*space*	COUNTER (CNT)	

Note A total of four letters are required to specify the instruction. Be sure to include a space where necessary.

Operand (command): Specifies whether to use a constant or word to change the SV of the timer/counter and, if a word is used, specifies the data area of the word (see below).

New SV (command): Specifies the constant or address to change the SV to in BCD.

Operand				Constant/Area	New SV (see note)
OP1	OP2	OP3	OP4		
C	O	N	*space*	Constant	0000 to 9999
C	I	O	*space*	CIO Area	0000 to 2555
G	R	*space*	*space*	CPU Bus Link Area	0000 to 0255
A	R	*space*	*space*	Auxiliary Area	0000 to 0511
T	I	M	*space*	Timer Area	0000 to 0511 or 0000 to 1023
C	N	T	*space*	Counter Area	
D	M	*space*	*space*	DM Area	00000 to 08191 or 00000 to 09999
D	M	*	*space*	Indirect DM address	
E	M	*space*	*space*	EM Area	00000 to 09999
E	M	*	*space*	Indirect EM address	
D	R	*space*	*space*	Data Register	0000 to 0002
I	R	*space*	*space*	Index Register	0000 to 0002
,	I	R	*space*	Indirect index register address	0000 to 0002 (offsets and other details cannot be read)

Note

1. A total of four letters are required to specify the operand. Be sure to include spaces where necessary.
2. Word address ranges depend on the CPU being used. Refer to the *CV-series Operation Manual: Ladder Diagrams* for details.

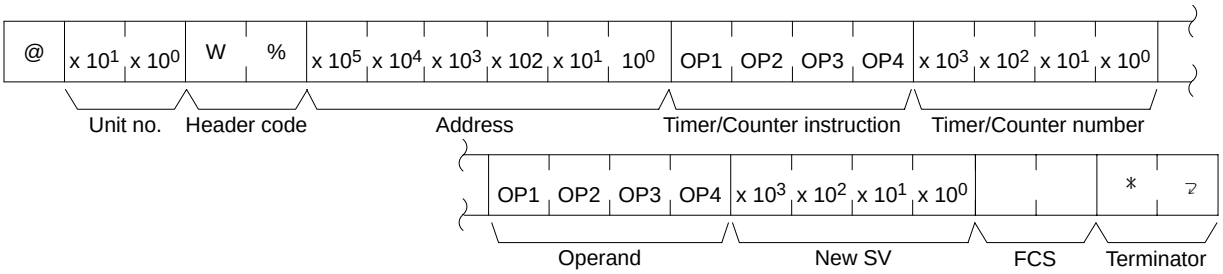
5-21 SV CHANGE 3

Finds the specified timer or counter instruction in the program (main program area) starting from the specified address and changes the constant SV in 4-digit BCD or the address of the word containing the SV. This command can be used to specify address in programs over 10K words in size.

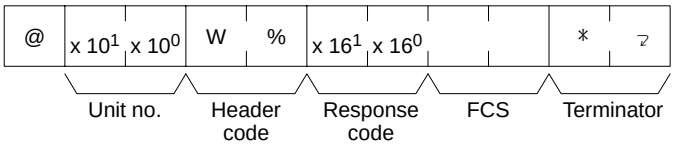
Note

1. Only the first instruction in the program after the specified address that meets the specifications will be found.
2. Only the main program will be searched for CVM1 PCs.
3. If the PC is programmed using SFC, only action 0 will be searched. The entire main program will be searched if SFC programming is not used.

Command Format



Response Format



Parameters

Address (command): Specify the address from which to start searching for the timer/counter instruction in six digits of BCD.

Timer/Counter instruction (command): Specify in four letters the instruction used to create the timer/counter (see below).

Timer/Counter number (command): Specify the timer/counter number used to define the timer/counter.

Timer/Counter instruction				Instruction	Timer/Counter number
OP1	**OP2**	**OP3**	**OP4**		
T	M	H	W	HIGH-SPEED TIMER WAIT (TMHW<015>)	000 to 0511 (CVM1-CPU01-EV2 and CV500) 0000 to 1023 (other CPUs)
T	I	M	W	TIMER WAIT (TIMW<013>)	
C	N	T	W	COUNTER WAIT (CNTW<014>)	
T	I	M	H	HIGH-SPEED TIMER (TIMH(015))	
T	T	I	M	ACCUMULATIVE TIMER (TTIM(120))	
C	N	T	R	REVERSIBLE COUNTER (CNTR(012))	
T	I	M	*space*	TIMER (TIM)	
C	N	T	*space*	COUNTER (CNT)	

Note A total of four letters are required to specify the instruction. Be sure to include a space where necessary.

Operand (command): Specifies whether to use a constant or word to change the SV of the timer/counter and, if a word is used, specifies the data area of the word (see below).

New SV (command): Specifies the constant or address to change the SV to in BCD.

Operand				Constant/Area	New SV (see note)
OP1	OP2	OP3	OP4		
C	O	N	*space*	Constant	0000 to 9999
C	I	O	*space*	CIO Area	0000 to 2555
G	R	*space*	*space*	CPU Bus Link Area	0000 to 0255
A	R	*space*	*space*	Auxiliary Area	0000 to 0511
T	I	M	*space*	Timer Area	0000 to 0511 or 0000 to 1023
C	N	T	*space*	Counter Area	
D	M	*space*	*space*	DM Area	00000 to 08191 or 00000 to 09999
D	M	*	*space*	Indirect DM address	
E	M	*space*	*space*	EM Area	00000 to 09999
E	M	*	*space*	Indirect EM address	
D	R	*space*	*space*	Data Register	0000 to 0002
I	R	*space*	*space*	Index Register	0000 to 0002
,	I	R	*space*	Indirect index register address	0000 to 0002 (offsets and other details cannot be read)

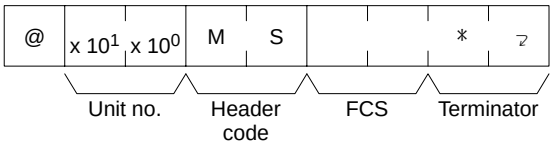
Note

1. A total of four letters are required to specify the operand. Be sure to include spaces where necessary.
2. Word address ranges depend on the CPU being used. Refer to the *CV-series Operation Manual: Ladder Diagrams* for details.

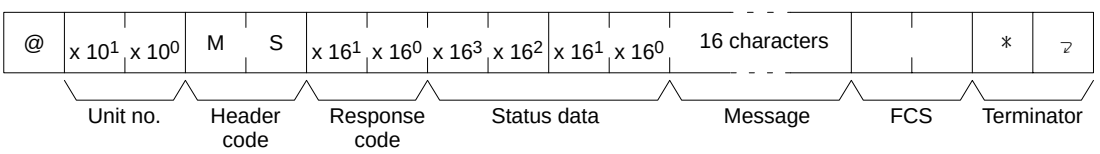
5-22 STATUS READ

Reads the operating status of the PC.

Command Format



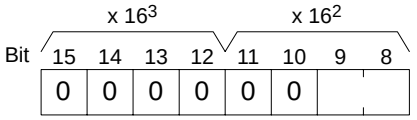
Response Format



Parameters

Status data (response): The status consists of two bytes. The leftmost byte is for the PC's operating mode and the rightmost byte is for the size of the program area and DM.

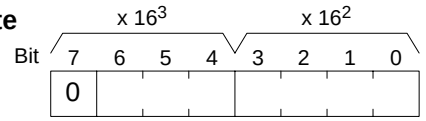
Leftmost byte



Bit		Mode
9	**8**	
0	0	PROGRAM
0	1	DEBUG
1	0	RUN
1	1	MONITOR

This order is reversed in the STATUS WRITE command format.

Rightmost byte



Bit			Program area
6	**5**	**4**	
1	0	0	64K bytes
1	0	1	128K bytes

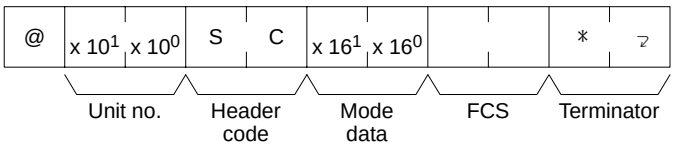
Bit				DM size
3	**2**	**1**	**0**	
1	0	0	0	8,192 words
1	0	0	1	24,576 words

Message (response): If an FAL or FALS error message exists, it will be returned. If an FAL or FALS error has not occurred, sixteen spaces (ASCII 20) will be returned.

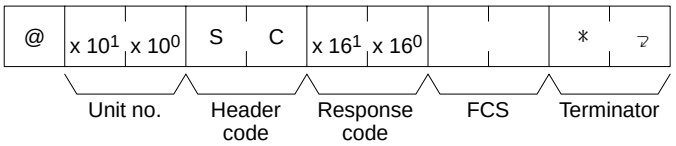
5-23 STATUS WRITE

Changes the operating mode of the PC.

Command Format

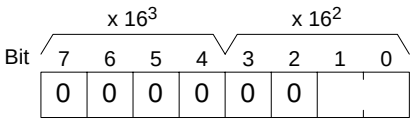


Response Format



Parameter

Mode data (command): The mode data consists of one byte. The rightmost 2 bits specify the PC's operating mode. The remaining bits must be all zeros.



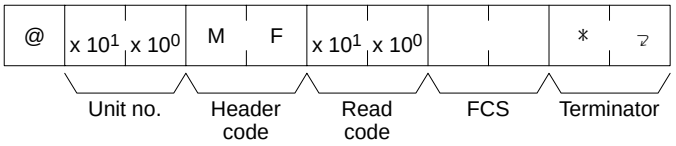
Bit		Mode
1	**0**	
0	0	PROGRAM
0	1	DEBUG
1	0	MONITOR
1	1	RUN

This order is reversed in the STATUS READ response format.

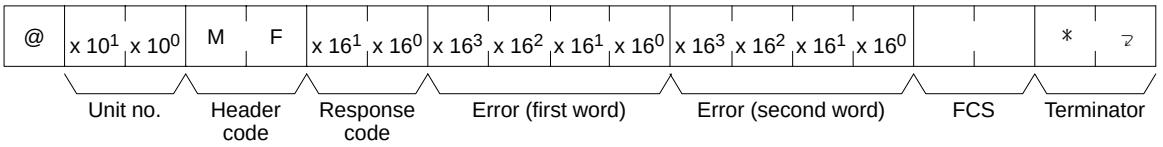
5-24 ERROR READ

Reads and clears errors in the PC. Also checks whether previous errors have been cleared.

Command Format



Response Format

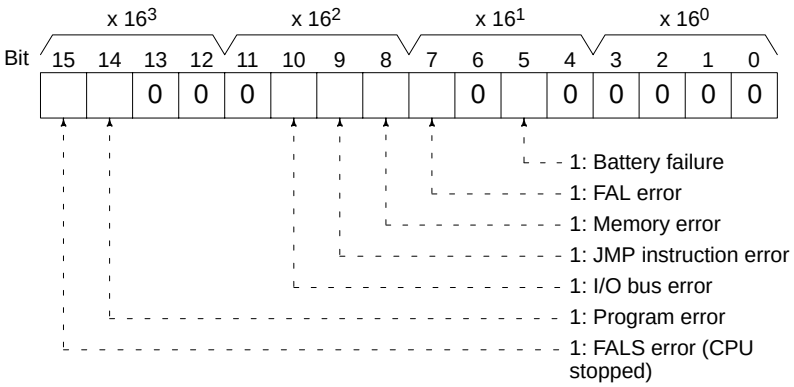


Parameters

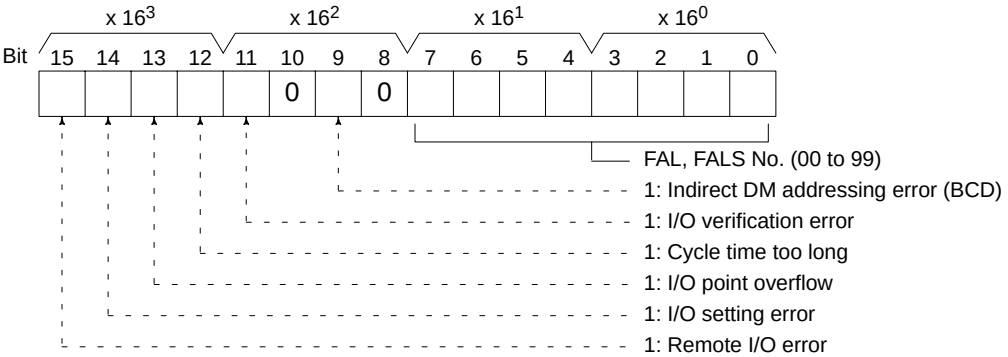
Read code (command): Set to 01 in BCD to read and clear the error. Set to 00 in BCD to just read the error.

Error (response): Error (first word) and (second word) provide the following information.

Error (first word)



Error (second word)

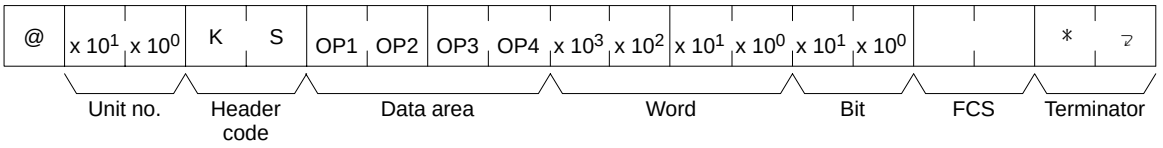


FALS and FAL numbers 1 through 511 can be used with the CV-series PC. In the above command block, however, only FAL numbers 00 through 99 can be read. To read FALS numbers 100 through 511, execute the CV-mode CONTROLLER STATUS READ command. If a FAL or FALS numbers 100 through 511 is read, the FAL number in the second word will not be accurate, but the FAL and FALS error bits will be turned ON properly in the first word.

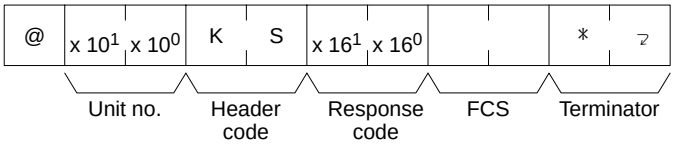
5-25 FORCED SET

Force-sets a bit in the CIO Area or a Completion Flag in the Timer, or Counter Area. Bits/flags forced ON with FORCED SET will remain ON until the FORCED SET/RESET CANCEL command is executed.

Command Format



Response Format



Parameters

Data area, word, bit (command format): Specify in four characters the CIO, Timer, or Counter Area to be force-set. Specify in BCD the word (four digits) and the bit to be force-set (2 digits).

Data area				Name	Word designation	Bit designation
OP1	OP2	OP3	OP4			
C	I	O	(S)	CIO Area	0000 to 2555 (all CV-series PCs)	00 to 15 (in BCD)
L	R	(S)	(S)	Link Area	0000 to 0063 (see note 1) (all CV-series PCs)	
H	R	(S)	(S)	Holding Area	0000 to 0099 (see note 2) (all CV-series PCs)	
T	I	M	(S)	Timer Area (see note 3)	0000 to 0511 (CV500 or CVM1-CPU01-E) 0000 to 1023 (CV1000, CV2000, or CVM1-CPU11-E)	00 (fixed)
C	N	T	(S)	Counter Area (see note 4)	0000 to 0511 (CV500 or CVM1-CPU01-E) 0000 to 1023 (CV1000, CV2000, or CVM1-CPU11-E)	

(S): Space

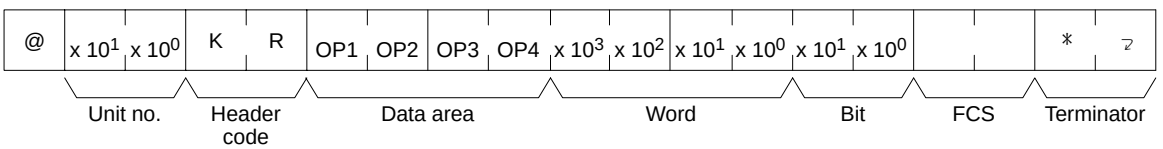
Note

1. These correspond to CIO words 1000 to 1063. They do not actually have to be set as link bits.
2. These correspond to CIO words 1200 to 1299. They do not actually have to be set as holding bits.
3. The relevant instructions are TIM, TIMH, TTIM, TIMW, and TMHW.
4. The relevant instructions are CNT, CNTR, and CNTW.
5. The space (S) is added because four characters are needed to specify a data area.

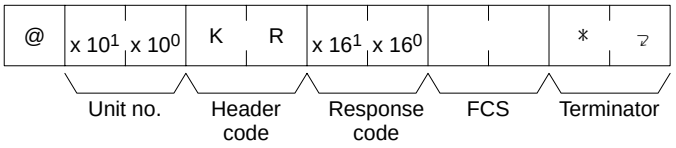
5-26 FORCED RESET

Force-resets a bit in the CIO Area or a Completion Flag in the Timer or Counter Area. Bits forced OFF with FORCED RESET will remain OFF until the FORCED SET/RESET CANCEL command is executed.

Command Format



Response Format



Parameters

Data area, word, bit (command format): Specify in four characters the CIO, Timer, or Counter Area to be force-reset. Specify in BCD the word (four digits) and the bit to be force-reset (2 digits).

Data area				Name	Word designation	Bit designation
OP1	OP2	OP3	OP4			
C	I	O	(S)	CIO Area	0000 to 2555 (all CV-series PCs)	00 to 15 (in BCD)
L	R	(S)	(S)	Link Area	0000 to 0063 (see note 1) (all CV-series PCs)	
H	R	(S)	(S)	Holding Area	0000 to 0099 (see note 2) (all CV-series PCs)	
T	I	M	(S)	Timer Area (see note 3)	0000 to 0511 (CV500 or CVM1-CPU01-E) 0000 to 1023 (CV1000, CV2000, or CVM1-CPU11-E)	00 (fixed)
C	N	T	(S)	Counter Area (see note 4)	0000 to 0511 (CV500 or CVM1-CPU01-E) 0000 to 1023 (CV1000, CV2000, or CVM1-CPU11-E)	

(S): Space

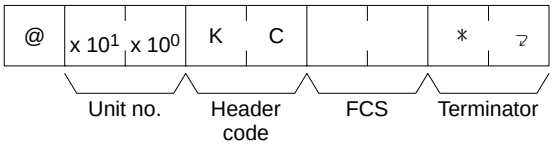
Note

1. These correspond to CIO words 1000 to 1063. They do not actually have to be set as link bits.
2. These correspond to CIO words 1200 to 1299. They do not actually have to be set as holding bits.
3. The relevant instructions are TIM, TIMH, TTIM, TIMW, and TMHW.
4. The relevant instructions are CNT, CNTR, and CNTW.
5. The space (S) is added because four characters are needed to specify a data area.

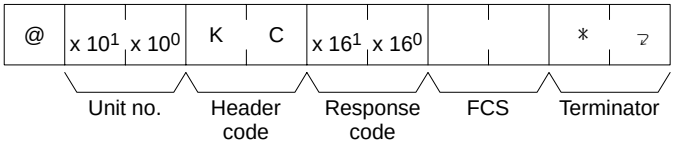
5-27 FORCED SET/RESET CANCEL

Cancels all forced-set and forced-reset bits.

Command Format



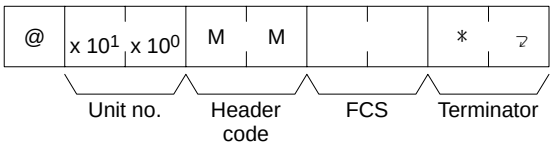
Response Format



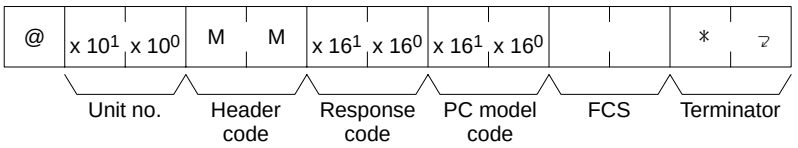
5-28 PC MODEL READ

Reads the model of the PC.

Command Format



Response Format



Parameter

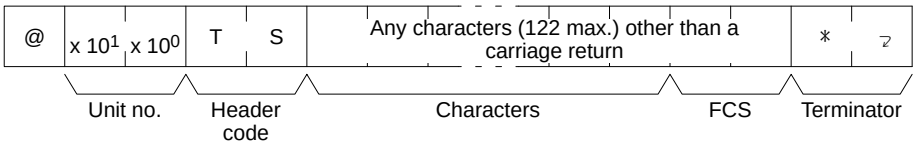
PC model code (response): The PC model code in the response format varies with the PC as follows:

PC model code	Model
22	CV2000
21	CV1000
20	CV500
42	CVM1-CPU21-E
41	CVM1-CPU11-E
40	CVM1-CPU01-E

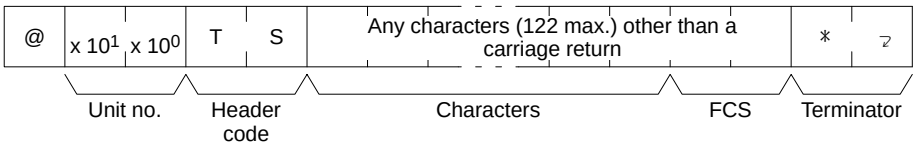
5-29 TEST

Transmits one block of data to the PC and then returns it unaltered to the host computer.

Command Format



Response Format



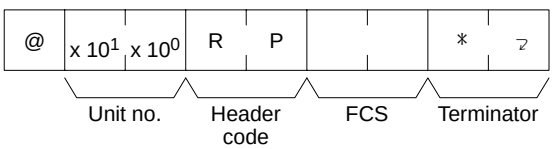
Parameters

Characters (command and response): In the command block, any characters other than a carriage return can be designated and the response data will be the designated characters unaltered.

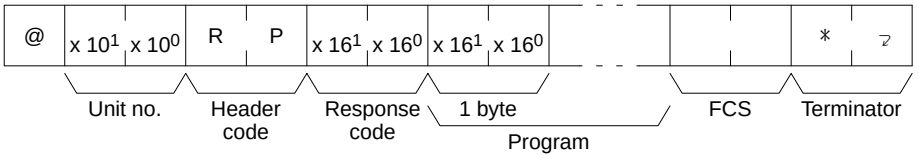
5-30 PROGRAM READ

Reads the contents of the PC program memory in machine code (octal).

Command Format



Response Format



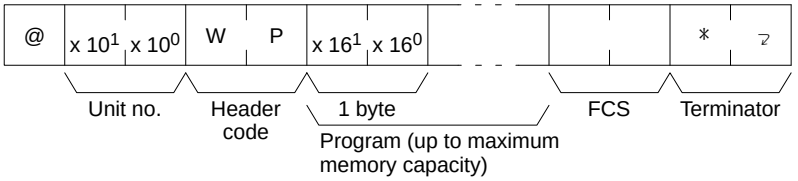
Parameter

Program (response): The program data will be as large as the memory size regardless of the size of the program.

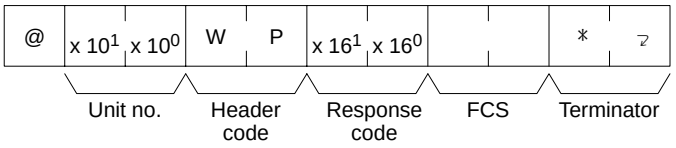
5-31 PROGRAM WRITE

Writes a machine language (octal) program into the PC program memory.

Command Format



Response Format



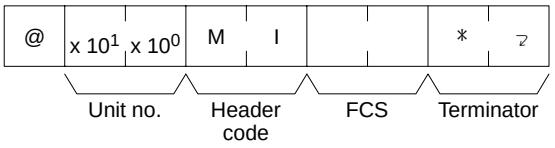
Parameter

Program (response): The program data can be as large as the maximum memory size.

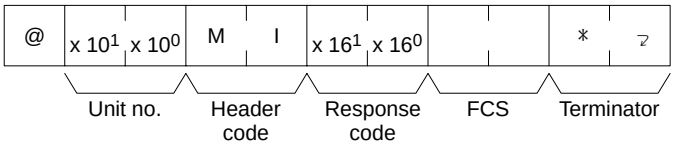
5-32 I/O TABLE GENERATE

Regenerates the I/O table to match the actual I/O connected to the PC.

Command Format



Response Format



5-33 I/O REGISTER

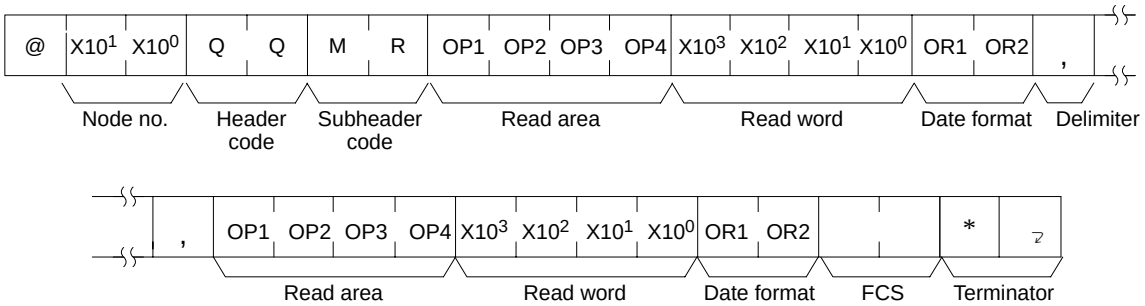
I/O REGISTER is used both to register memory area words or bits to be read and to actually read the content of the words and bits that have been registered.

⚠ Caution This command is supported only by CPUs of version 1 or later or by Host Link Units.

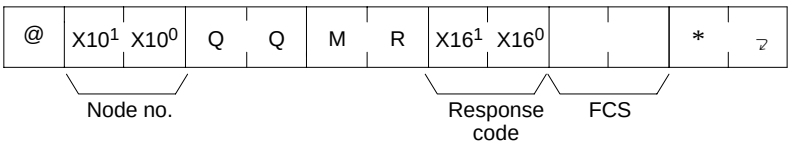
5-33-1 Registering Words/Bits

The following command is used to register words and/or bits to be read out. Words/bits can be registered in the CIO, AR, TIM, CNT, and/or DM Areas

Command Format



Response Format



Parameters

Read area (command): Designate the area to be read using the character codes listed in the table below.

Read word (command): Designate the word in the area to be read. The available range varies with the type of data (bit or word data).

Data type (command): Designate to read bit data or word data. A 0 or 1 will be returned if reading bit data is designated and one-word data will be returned if reading word data is designated.

Area	Specification				Data format	Read word
CIO Area	C	I	O	*space*	Bit: 00 to 15	0000 to 2555
					Word: CH	
Link Area	L	R	*space*	*space*	Bit: 00 to 15	0000 to 0063 (see note 1)
					Word: CH	
Holding Area	H	R	*space*	*space*	Bit: 00 to 15	0000 to 0099 (see note 2)
					Word: CH	
Auxiliary Area	A	R	*space*	*space*	Bit: 00 to 15	0000 to 0511
					Word: CH	
Timer Area (see note 3)	T	I	M	*space*	Bit: Characters other than CH	0000 to 0511 (0000 to 1023)
					Word: CH	
Counter Area (see note 4)	C	N	T	*space*	Bit: Characters other than CH	0000 to 0511 (0000 to 1023)
					Word: CH	0000 to 0511 (0000 to 1023)
DM Area	D	M	*space*	*space*	Word: Any character	0000 to 8191 (0000 to 9999)

Note

1. These correspond to CIO words 1000 to 1063. They do not actually have to be set as link bits.
2. These correspond to CIO words 1200 to 1299. They do not actually have to be set as holding bits.

3. The relevant instructions are TIM, TIMH, TTIM, TIMW, and TMHW.
4. The relevant instructions are CNT, CNTR, and CNTW.
5. Values in parentheses apply to CV1000, CV2000, CVM1-CPU11, and CVM1-CPU21 models.

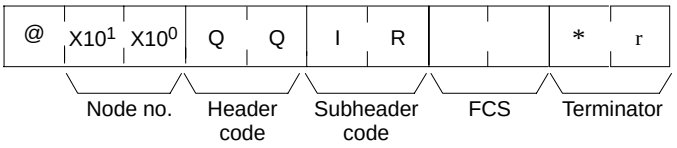
Delimiter (command): By inserting delimiter codes, it is possible to designate up to 128 words and/or bits. Words in the TIM and CNT Areas are regarded as two words.

Response code (response): 00 is returned if the operation was normal.

5-33-2 Reading Data

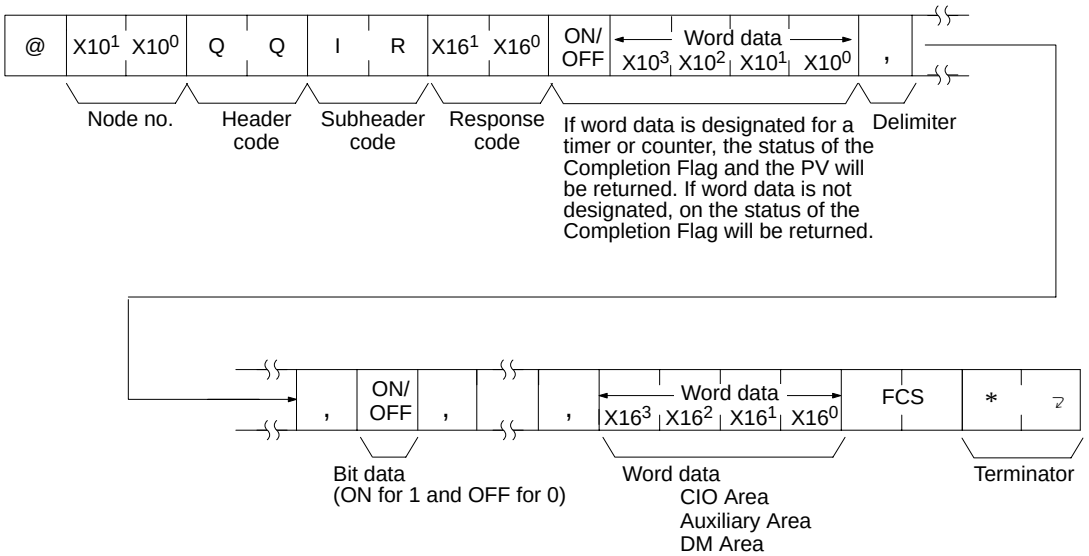
The following command is used to read the contents of the words/bits that have been registered.

Command Format



Response Format

The data will be returned in the the order registered.



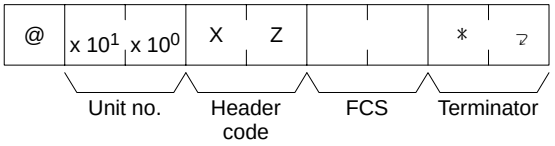
Parameters

Read area (command): The read data will be returned in the order in which the items were registered. If a bit number is designated, bit data (0 or 1) will be returned. if a word is designated, word data will be returned. If a word is designated of a timer or counter, bit data (Completion Flag status) followed by word data (PV) will be returned.

5-34 ABORT

Aborts the process being performed by the PC and enables reception of the next command. There is no response.

Command Format

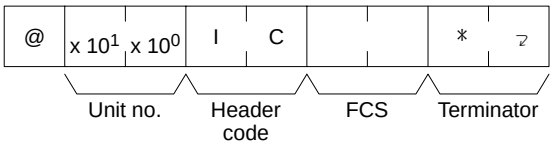


Note The PC requires 100 ms between reception of the ABORT command and the following command.

5-35 Response to an Undefined Command

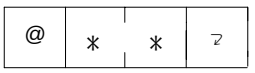
This response is sent if the PC cannot decode the header code of the command. If this response is received, check the header code that was sent in the previous command block.

Response Format



5-36 INITIALIZE

Initializes all Units in the network. This command does not required the node number or an FCS. No response format involves. It is possible to use this command only when the PC is mounted with the Host Link Unit.



Note Do not sent the node number or an FCS with the INITIALIZE command.

Caution This command is supported only by CPUs of version 2 or later or by Host Link Units.

SECTION 6
Maintenance and Troubleshooting

This section provides information on maintenance and troubleshooting for the Host Link System. For the troubleshooting of the CPU, refer to the *CV-series PC Operation Manual: Ladder Diagrams*.

6-1 Maintenance 100
6-2 Indicators 101
6-3 C-mode Response Codes 103
6-4 CV-mode Response Codes 104
6-4-1 Response Code Descriptions 105
6-4-2 Network Errors 106

6-1 Maintenance

This section explains maintenance methods of the Host Link System. The Host Link Unit is a part of a network. The malfunctioning of the Host Link Unit may influence the whole network. Therefore, if the Host Link Unit malfunctions, replace it promptly. In order to restore the network promptly, we recommend the user to stock extra Host Link Units.

Replacement

Read the following before replacing the Host Link Unit.

1, 2, 3...

1. Turn off the power before replacing the Host Link Unit.
2. After replacing a defected Host Link Unit with a new one, make sure that the new Unit works properly.
3. When sending a defected Host Link Unit to your OMRON representative, describe the defective condition in detail and attach the description to the Host Link Unit.
4. In the case of improper contact, clean the contacts of the Host Link Unit with a clean cotton cloth soaked with industrial-grade alcohol. Be sure to remove all cotton fibers from the contacts before mounting the Host Link Unit.

Setting after Replacing PCs

CPU Bus Unit System Setup parameters are stored in the EEPROM of the CPU. When replacing a PC with a new one, be sure to set CPU Bus Unit System Setup parameters on the new PC properly.

Note Refer to the *CV-series PC Installation Guide* for the maintenance of the CPU.

Periodical Maintenance

Periodical maintenance of the Host Link Unit is necessary in order to keep it in good condition.

Check Points

The Host Link Unit consists basically of semiconductors. Although a semiconductor has almost a limitless life, it may be deteriorated if used under improper environments. Therefore, periodical maintenance (once every six months to one year according to the operating environment) of the CPU and Host Link Unit is necessary. The following table lists the items that must be checked.

Item	Check	Criteria
Environment	Ambient temperature and temperature inside the panel	0° to 55°C
	Ambient humidity and humidity inside the panel	10% to 90% (with no condensation)
	Dust	No dust
Mounting condition	Mounting of Unit	To be properly mounted
	Connector	To be properly inserted
	Screws for external wiring	To be tightened securely
	External cable	To be in good condition upon visual check

Maintenance Tools

A Phillips screwdriver, flag-blade screwdriver, circuit tester, cotton cloth, and industrial-grade alcohol are required for periodical maintenance.

In addition, a synchroscope, pen-writing oscilloscope, thermometer, and hydroscope may be required occasionally.

6-2 Indicators

When the Host Link Unit has an error, the cause of the error can be determined from the Host Link Unit's indicators. The following table lists errors that can occur with the Host Link Unit and probable causes of the errors.

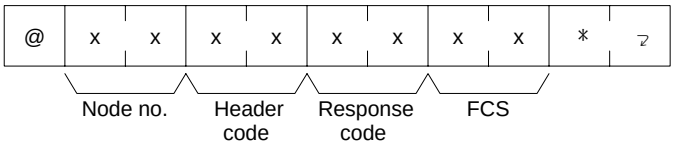
Indicator	Probable cause	Possible correction
RUN indicator is not lit.	No power is supplied to the PC or the voltage of the power supplied to the PC is low.	Supply power to the PC or increase the voltage of the power supplied to the PC.
	An error occurred in the Host Link Unit.	Restart the PC. If an error occurs again, replace the Host Link Unit.
	The Host Link Unit is not properly secured with screws.	Tighten the screws.
	The mounting position of the Host Link Unit is wrong.	Mount the Host Link Unit to a correct slot.
	The CPU restarted the Host Link Unit or the user's program turned the CPU Bus Unit Restart Bit ON.	Change the user's program so that the Restart Bit will not be turned ON. Refer to *Appendix B Memory Area Allocations*.
	The CPU stopped CPU Bus Unit service or the user's program turned ON the CPU Bus Unit Service Disable Bit.	Change the user's program so that the Service Disable Bit will not be turned ON. Refer to *Appendix B Memory Area Allocations*.
ERH indicator is lit.	The unit number setting is wrong (same number set twice or number is not between 0 and 16).	Set the unit number correctly and restart the PC.
	The I/O table is not set correctly.	Set the I/O table correctly from the CVSS.
	The CPU Bus Unit System Setup is corrupted.	Use CVSS and correct the settings for the CPU Bus Unit Setup.
	Other errors.	Check the status areas.
ERC1 indicator is lit.	A break was detected or a parity error, framing error, FCS error, or overrun error occurred when the Host Link Unit was receiving a command at communications port 1.	Send correct data.
	The communications setting (full duplex or half duplex) is wrong or the connector is wired incorrectly.	Correct the communications setting or the wiring.
	The cable connectors are loose.	Insert the cable connectors into the Host Link Unit securely.
	The transmission or reception circuit of the Host Link Unit is damaged.	Execute a wrap communications test and check the operation of the communications port. Refer to Appendix C.
	The transmission circuit of the host computer is damaged.	Use a protocol analyzer and check if the host computer is transmitting properly.

Indicator	Probable cause	Possible correction
ERC2 indicator is lit.	The node number setting is wrong (the node number is not between 0 to 31).	Set the node number correctly and restart the PC.
	A break was detected or a parity error, framing error, FCS error, or overrun error occurred when the Host Link Unit was receiving a command at communications port 2.	Send correct data.
	The communications setting (full duplex or half duplex) is wrong or the connector is wired incorrectly.	Correct the communications setting or the wiring.
	The cable connectors are loose.	Insert the cable connectors into the Host Link Unit securely.
	The transmission or reception circuit of the Host Link Unit is damaged.	Execute a wrap communications test and check the operation of the communications port. Refer to Appendix C.
	The transmission circuit of the host computer is damaged.	Use a protocol analyzer and check if the host computer is transmitting properly.
RD indicator is lit but SD indicator is not lit.	The data length, parity, stop bit, or baud rate of the Host Link Unit does not coincide with the value set on the host computer.	Use the CVSS and match the CPU BUS Unit System Setup parameters to the settings of the host computer.
	The communications setting (full duplex or half duplex) is wrong or the connector is wired incorrectly.	Correct the communications setting or the wiring.
	The CTS selector is set to OFF while a communications port is used in RS-232C.	Set the CTS selector to ON.
	The node number setting is wrong while communications port 2 is being used.	Set the node number correctly.
	The cable connectors are loose.	Insert the cable connectors into the Host Link Unit securely.
	The wiring of the cable is wrong.	Wire the cable correctly.
	The transmission or reception circuits of the Host Link Unit is damaged.	Execute a wrap communications test and check the operation of the communications port. Refer to Appendix C.
	The transmission circuit of the host computer is damaged.	Use a protocol analyzer and check if the host computer is transmitting properly.

Indicator	Probable cause	Possible correction
SD indicator is lit but RD indicator is not lit.	The communications path selector setting (RS-232C or RS-422) is wrong while communications port 2 is being used.	Select the communications path correctly.
	The cable connectors are loose.	Insert the cable connectors into the Host Link Unit securely.
	The wiring of the cable is wrong.	Wire the cable correctly.
	The transmission or reception circuit of the Host Link Unit is damaged.	Execute a wrap communications test and check the operation of the communications port.
	The transmission circuit of the host computer is damaged.	Use a protocol analyzer and check if the host computer is transmitting properly.
	The communications setting (full duplex or half duplex) is wrong or the connector is wired incorrectly.	Correct the communications setting or the wiring.
	The node number setting is wrong while communications port 2 is being used.	Set the node number correctly.

6-3 C-mode Response Codes

A response code is returned with all responses. If a command is completed normally, a response code of 00 will be returned. If command execution ends in an error, one of the response codes listed in the table below will be returned in the following format. The header code will specify the command.



Response code		Description
0	0	Normal completion
0	1	Not executable in RUN mode
0	2	Not executable in MONITOR mode
0	4	The boundary of a data area in PC memory has been exceeded.
0	B	Not executable in PROGRAM mode
0	C	Not executable in DEBUG mode
1	0	Parity error, probably caused by noise
1	1	Framing error (stop bit(s) not detected), probably caused by noise
1	2	Overrun (Next command was received before previous command was completely processed. Lower the baud rate if necessary and be sure to wait for a delimiter or terminator before sending the next command.)
1	3	FCS error, possibly caused by noise (check FCS calculations)
1	4	Format error (check command format)
1	5	Entry number data error (An attempt was made to write to a read-only or write-protected area.)
1	6	The specified instruction cannot be found because search data was not present. Check the starting address for the search and the specifications of the instruction.
1	8	Frame length error (Reduce the length of the command by splitting it into multiple frames.)
1	9	Not executable due to CPU error (Check the CPU error according to the CV-series PC *Operation Manual: Ladder Diagrams*.)
2	0	I/O table generation impossible (Slave not detected, too many words allocated, or same word allocated twice.) Check Slave settings and word allocations.

Response code		Description	
2	1	Execution is impossible due to PC's CPU error. (Turn the PC off and on.)	
2	2	The designated memory does not exist. (Turn the CPU off and mount the memory.)	
2	3	The protect switch of the designated memory unit is turned on. (Turn the protect switch off.)	
A	0	These are the same errors as listed above, but the error was discovered and communications aborted during transmission of multiple frames. The first frames will already have been written to memory.	Parity error in transmit data
A	1		Framing error in transmit data
A	2		Overrun in transmit data
A	3		FCS error in transmit data
A	4		Format error
A	5		Entry number data error in transmit data
A	8		Frame length error in transmit data
B	0	Not executed due to the program area. The expansion DM can be used only if the program area has a capacity of 16k bytes.	
Others		Error due to noise. The command must be transmitted again.	

Power Interruptions

The following error response codes may be returned for power interruptions. If one of these response codes is returned or no response code is received, execute the command again.

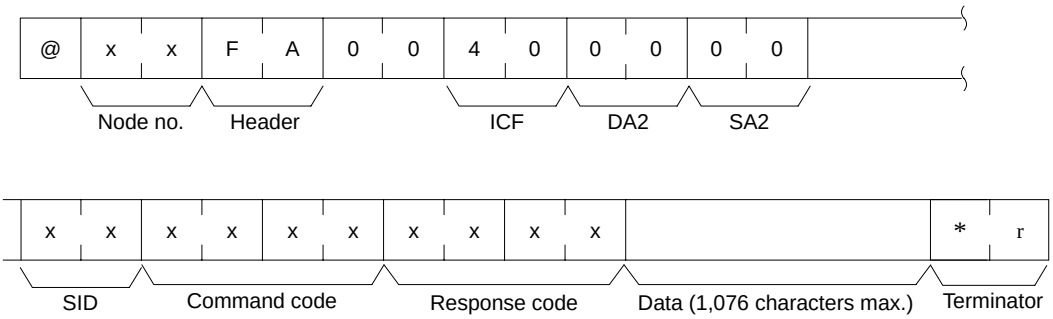
- Overrun error response
  @00FA1244∗CR
- Undefined command
  @00IC4A∗CR

6-4 CV-mode Response Codes

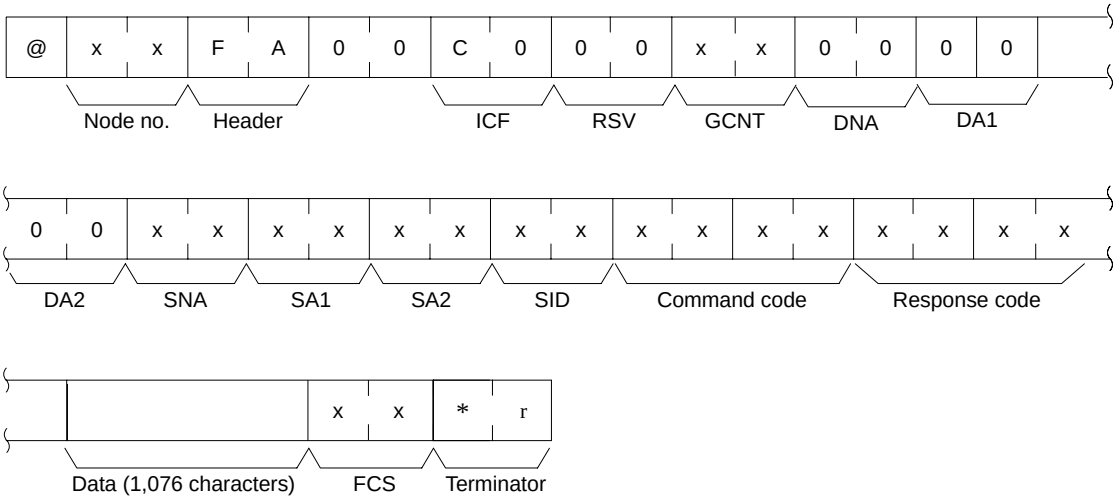
A response code is returned with each response If a command is completed normally, a response code of 00 00 will be returned. If command execution ends with an error, one of the response codes listed in the table in this section will be returned in the following formats.

It is possible to determine the cause of an error from the response code. If there was an error during network communications, bit 15 of the response code will be ON (1). If there was an error in the PC, bit 6 or 7 will be ON (in which case, refer to the *CV-series PC Installation Guide* and correct the error).

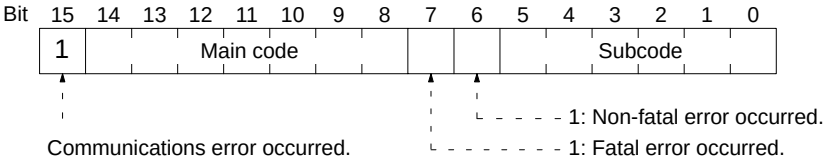
Responses without Network Communications



Responses with Network Communications



Response Code Format The bit format of the response code is shown below.



6-4-1 Response Code Descriptions

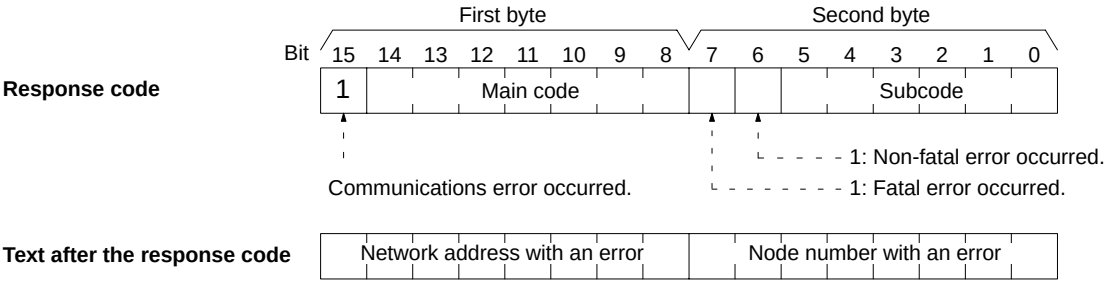
Main code	Description	Sub-code	Meaning
00	Normal completion	00	---
04	Not executable	01	All undefined command has been used.
		02	An incorrect unit or version specification has been used.
10	Command format error	01	The command is longer than the max. permissible length.
		02	The command is shorter than min. permissible length.
		03	The designated number of data items differs from the actual number of data items.
		04	An incorrect command format has been used.
		05	An incorrect header has been used.
11	Parameter error	01	A correct memory area code has not been used or Expansion Date Memory is not available.
		03	An incorrect beginning address has been used.
		04	An incorrect word range has been designated.
		05	The source and destination differ in access size.
		06	A non-existing program no. has been specified.
		09	The sizes of data items in the command block are wrong.
		0B	The response block is longer than the max. permissible length.
		0C	An incorrect parameter code has been specified.
20	Read not possible	02	The specified area is protected.
		04	The corresponding data does not exist.
		05	A non-existing program no. has been specified.
		06	A non-existing file has been specified.
		07	A verification error has occurred.

Main code	Description	Sub-code	Meaning
21	Write not possible	01	The specified area is read-only or is write-protected via the key switch, the PROGRAM AREA PROTECT command, or the PC Setup.
		02	The specified area is protected.
		04	The corresponding data does not exist.
		05	A non-existing program no. has been specified.
		06	A non-existing file has been specified.
		07	The specified file already exists.
		08	The operation failed due to improper data.
22	Not executable in current PC mode	03	The PC is in PROGRAM mode.
		04	The PC is in DEBUG mode.
		05	The PC is in MONITOR mode.
		06	The PC is in RUN mode.
23	No Unit	01	A file device does not exists where specified.
		02	The specified memory does not exist.
		03	No clock exists.
		04	The specified Unit does not exist.
25	Unit error	0F	A memory error has occurred in internal memory, in the memory card, or in expansion data memory.
26	Command error	01	The specified area is not protected. This response code will be returned if an attempt is made to clear an area that is not protected.
		02	An incorrect password has been specified.
		03	The specified program no. is an area that cannot be executed.
		04	The specified area is protected.
30	Access right error	01	The access right is held by another device.

Note If PCs are used in a network, response codes other than the above may be returned. Refer to the *CV-series SYSMAC LINK System Manual* or the *CV-series SYSMAC NET Link System Manua*l for response codes related to these Systems.

6-4-2 Network Errors

When a network error has occurred, it is possible to find from the response code and the succeeding text the node on which the error has occurred.



Network address with an error: 00 to 7F (0 to 127)

Node number with an error SYSMAC NET: 01 to 7E (1 to 126)

Node number with an error SYSMAC LINK: 01 to 3E (1 to 62)

After checking the node on which the error has occurred, take necessary steps for possible correction.

Relaying Errors

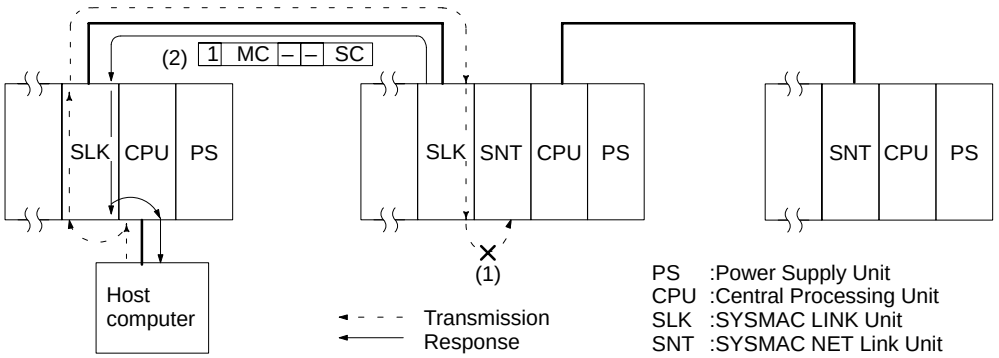
A relaying error occurs when a command from the Host Link Unit is not able to reach the destination node. There are basically three types of relaying errors: when data is not passed from one Link Unit to another, when data is not passed from a Link Unit to another Unit (e.g., a CPU), and when the destination node or relaying node does not exist. The following graphics show the examples of these relaying errors.

In the following examples, (1) indicates that transmission data was not relayed, and (2) indicates that the relaying error data and response code are returned to the Unit that issued them. MC stands for main code and SC stands for sub-code.

After ascertaining the node where the error occurred, determine the kind of error from the response code and take necessary steps for correction.

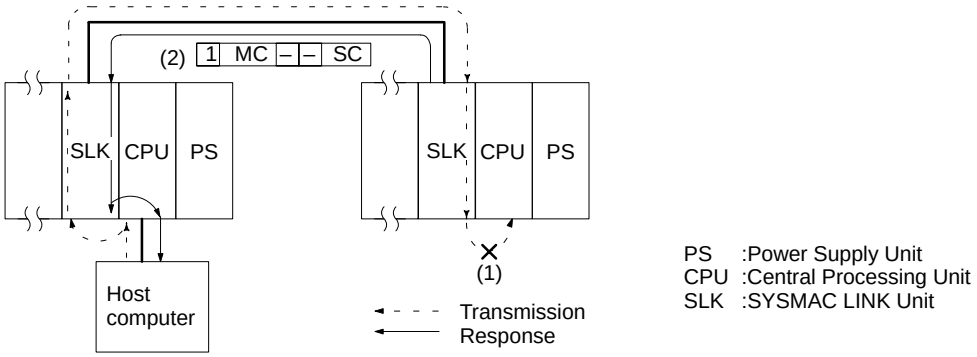
Example 1

In this example, data transmission between two Link Units was not possible, e.g., due to a routing table error.



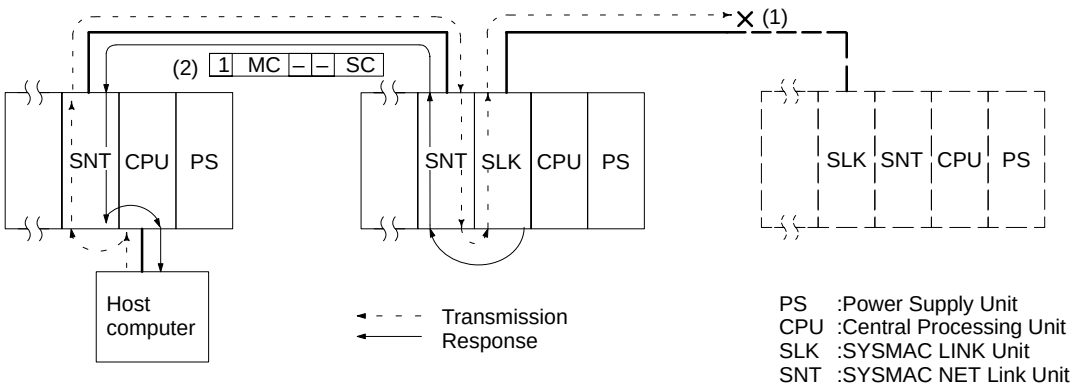
Example 2

In this example, data transmission from a Link Unit to the CPU was not possible, e.g., due to no Link Unit servicing



Example 3

In this example, no destination node or relaying node exists.



Appendix A
Standard Models

The following tables list some of the OMRON products related to the host interface and Host Link Unit. Refer to the *CV-series PC Installation Guide* for a general list of CV-series products.

Host Link Unit

Name	Model
Host Link Unit	CV500-LK201

PCs

Name	CPU model number
CV500	CV500-CPU01-EV1
CV1000	CV1000-CPU01-EV1
CV2000	CV2000-CPU01-EV1
CVM1	CVM1-CPU01-EV2
	CVM1-CPU11-EV2
	CVM1-CPU21-EV2

Link Adapters and Related Products

Name	Specification	Model
Link Adapter	Branching adapter for RS-422	3G2A9-AL001
	Branching adapter for APF or PCF	3G2A9-AL002-PE
	Branching adapter for PCF	3G2A9-AL002-E
	Converting adapter for APF or PCF and RS-232C or RS-422	3G2A9-AL004-PE
	Converting adapter for PCF and RS-232C or RS-422	3G2A9-AL004-E
Connector	RS-232C	XM2A-2501
	RS-422	XM2A-0901
Connector Hood	RS-232C	XM2A-2511
	RS-422	XM2A-0911

Note APF stands for all plastic optical fiber cable and PCF stands for plastic-clad optical fiber cable.

Programmable Terminals (PTs)

Host Link Interface Unit	Connecting PT	System ROM (see note)	Image data memory
NT20M-LK203-EV1	NT20M-DT121-V1	——	An image data memory board or memory chip is required.
	NT20M-DT125-V1		
	NT20M-DF121-V1		
	NT20M-DF125-V1		
NT600M-LK201	NT600M-DT122	NT600M-SMR01-E	
	NT600M-DF122		

Note For the system ROM and image data memory, refer to the *NT20M* or *NT600M PT Operation Manual*.

Connectors and Cables

Name	Specifications	Model	Maker
Multi-core cable	UL approved	UL2464 AWG28 x 5P IFS-RVV-SV	Fujikura
	UL approved	UL2464-SB 5P x AWG28	Hitachi
Connector	For Host Link Unit communications port 1 (25 pins)	XM2A-2501	OMRON
	For Host Link Unit communications port 2 or host interface on CPU (9 pins)	XM2A-0901	
Connector Hood	For Host Link Unit communications port 1 (25 pins)	XM2S-2511	OMRON
	For Host Link Unit communications port 2 or host interface on CPU (9 pins)	XM2S-0911	

Optical Interface

Name	Model	Required number	Remarks
Optical Module	Z3RN-A-5	2	Connects RS-232C cable to optical fiber cable.
Optical Fiber Cable	Z3F2-4S□M (see note)	1	PCF
AC Adapter	Z3-GP01	2 (1)	Two AC Adapters are required for port 2 and one AC adapter is required for port 1.

Note Cables with lengths of 1, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 250, 300, 350, 400, 450, and 500 m are available. When ordering, insert the required cable length before the M in the model number (replacing the box: □).

Connecting Cable

RS-422 and RS-232C connecting cables are not sold by OMRON and must be provided by the user.

Plastic-clad Optical Fiber Cable

Link Adapters with the suffix -P in the model number can be extended up to 200 m by using plastic-clad optical fiber cable. Those without the suffix -P in the model number can be extended up to 800 m.

Cable type	Description	Operating environment	Model
Indoor	0.1 m, with connector	Operating temperature: –10° to 70°C	3G5A2-OF011
	1 m, with connector		3G5A2-OF101
	2 m, with connector		3G5A2-OF201
	3 m, with connector		3G5A2-OF301
	5 m, with connector		3G5A2-OF501
	10 m, with connector		3G5A2-OF111
	20 m, with connector		3G5A2-OF211
	30 m, with connector		3G5A2-OF311
	40 m, with connector		3G5A2-OF411
	50 m, with connector		3G5A2-OF511
Indoor/outdoor	10 to 500 m, with connector (order in increments of 1 m)	Operating temperature: –10° to 70°C	3G5A2-OF002
	501 to 800 m, with connector (order in increments of 1 m)	Operating temperature: 0° to 55°C (Do not expose to direct sunlight)	

Note Since optical fiber cable cannot be spliced as easily as ordinary cables when damaged or extended, be sure to install an adequate length. The cable lengths above do not include connectors.

All Plastic Optical-Fiber Cable (APF)

Link Adapters with the suffix -P in the model number can be extended up to 20 m. The optical connector for the 3G5A2-PF002 must supplied by the user.

Name	Specifications	Model
Plastic Optical Fiber Cable	Cable only, 5 to 100 m in multiples of 5 m, or multiples of 200 or 500 m	3G5A2-PF002
Optical Connector A	2 pcs (brown), for plastic optical fiber 10 m long max.	3G5A2-CO001
Optical Connector B	2 pcs (black) for plastic optical fiber 8 to 20 m long	3G5A2-CO002
Plastic Optical Fiber Cable	1 m, w/optical connector A provided at both ends	3G5A2-PF101

Hard-plastic-clad Quartz Fiber Cable: H-PCF

Up to 800 m of H-PCF cable can be used between Units in the following systems: SYSMAC NET, SYSMAC LINK, and SYSMAC BUS/2. In the SYSMAC BUS system, up to 100 m of H-PCF cable can be used between Units whose model number suffix contains a P and up to 200 m between other Units whose model number does not contain a P.

You can used connector-equipped cables or assemble cables yourself. The following are required to assemble H-PCF cable: the cable itself, Optical Connectors, Cable Assembly Tool, Cable Cutter Optical Power Tester, Head Unit, and Master Fiber. The user must assemble and test the optical connectors. Refer to the *H-PCF Installation Manual* for details.

H-PCF cables can be used at an ambient temperature of between –20° and 70°C.

H-PCF Optical Fiber Cords and Cables

Cable type	Cable color	Cable length	Model
Two optical conductors with feeder	Black	10 meters	S3200-HCLB101
		50 meters	S3200-HCLB501
		100 meters	S3200-HCLB102
		500 meters	S3200-HCLB502
		1,000 meters	S3200-HCLB103
	Orange	10 meters	S3200-HCLO101
		50 meters	S3200-HCLO501
		100 meters	S3200-HCLO102
		500 meters	S3200-HCLO502
		1,000 meters	S3200-HCLO103
Without feeder	Black	10 m	S3200-HCCB101
		50 m	S3200-HCCB501
		100 m	S3200-HCCB102
		500 m	S3200-HCCB502
Two-core optical cord	Black	10 m	S3200-HBCB101
		50 m	S3200-HBCB501
		100 m	S3200-HBCB102
		500 m	S3200-HBCB502
		1,000 m	S3200-HBCB103

H-PCF Optical Fiber Cords and Cables with Connectors

The following diagram illustrates the model number for cables with connectors. tension members and power lines are provided in the cable. Half-lock connectors use the S3200-COCF2511 and are compatible with C200H SYSMAC LINK or SYSMAC NET Link Unit connectors. Full-lock connectors use the S3200-COCF2011 and are compatible with CV-series SYSMAC LINK or SYSMAC NET and C1000H SYSMAC LINK Link Unit connectors. Full-lock connectors cannot be used with C200H connectors.

The above connectors cannot be used with C500 SYSMAC NET Link Unit connectors, cable relays, or NSB. Refer to the *SYSMAC NET Link System Manual* for appropriate connectors for these applications.

S3200-CN□□□-□□-□□

Cable Length

201	2 m
501	5 m
102	10 m
152	15 m
202	20 m
Blank	Over 20 m*

Connector Type

20-20	Full-lock connecter on each end
20-25	One full-lock and one half-lock connector
25-25	Full lock connector on each end

*Specify lengths over 20 m separately when ordering.

Optical Connectors

Name	Model
SYSMAC NET: CV500-SNT31 SYSMAC LINK: CV500-SLK11, C1000H-SLK11 SYSMAC BUS/2: CV500-RM211/RT211	S3200-COCF2011
SYSMAC NET: C200H-SNT31 SYSMAC LINK: C200H-SLK11	S3200-COCF2511
SYSMAC NET: C500-SNT31-V4 S3200-LSU03-01E/NSB11-E S3200-NSUA1-00E/NSUG4-00E FIT10-IF401	S3200-COCH62M
SYSMAC BUS: 3G2A5-RM001-(P)EV1 3G2A5-RT001/RT002-(P)EV1 3G2A9-AL□□-(P)E	S3200-COCH82
SYSMAC NET Relay (M) Connector	S3200-COCF62M
SYSMAC NET Relay (F) Connector	S3200-COCF62F

Cable Assembly Tool and Cutter

Name	Model
Cable Assembly Tool	S3200-CAK1062

Optical Power Tester

Name	Model
SYSMAC NET: CV500-SNT31	S3200-CAT2000
SYSMAC LINK: CV500-SLK11 SYSMAC BUS/2: CV500-RM211/RT211	S3200-CAT2700
SYSMAC BUS: 3G2A5-RM001-(P)EV1 3G2A5-RT001/RT002-(P)EV1	S3200-CAT2820
SYSMAC NET: S3200-LSU03-01E FIT10-IF401	S3200-CAT3200

Note Each Optical Power Tester is provided with a replaceable Head Unit. There is no difference in type among all Optical Power Testers except for the head unit. This means the S3200-CAT2000 Optical Power Tester, for example, can be used as the S3200-CAT2700, S3200-CAT2820, or S3200-CAT3200 Optical Power Tester by just replacing the Head Unit of the S3200-CAT2000 with those for the S3200-CAT2700, S3200-CAT2820, or S3200-CAT3200.

Optical Power Tester Head Unit

Name		Model
SYSMAC NET:	CV500-SNT31	S3200-CAT2002
SYSMAC LINK:	CV500-SLK11	S3200-CAT2702
SYSMAC BUS/2:	CV500-RM211/RT211	
SYSMAC BUS:	3G2A5-RM001-(P)EV1 3G2A5-RT001/RT002-(P)EV1	S3200-CAT2822
SYSMAC NET:	S3200-LSU03-01E FIT10-IF401	S3200-CAT3202

Appendix B
Specifications

Host Interface Specifications

Communications method	Four-wire, half duplex
Synchronization method	Start-stop, 1 or 2 stop bits (set in PC Setup)
Baud rate	1200/2400/4800/9600/19200 bps (set in PC Setup)
Transmitted code	7- or 8-bit ASCII (set in PC Setup)
Error detection	Vertical parity, even/odd/none (set in PC Setup), FCS (frame check sequence)
Interface	RS-232C/RS-422 (set on selector on CPU)
Transmission distance	RS-232C: 15 m max.; RS-422: 500 m total max. (See details under *System Configuration*.)

Cable Lengths

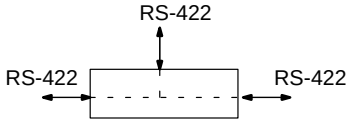
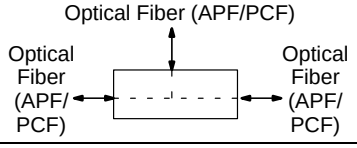
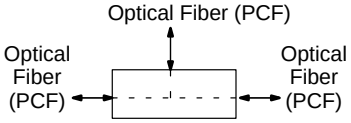
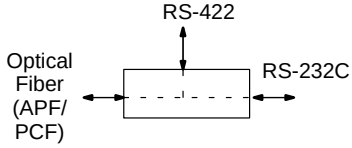
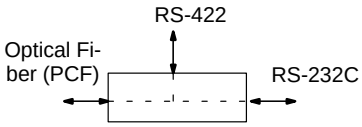
RS-232C cable	15 m max.
Total length of RS-422 cable	500 m max.
Length of each RS-422 branch	10 m max.

Optical Connections

Cable	Units with “P” in suffix	Units without “P” in suffix
APF	20 m	Connection impossible
PCF	200 m	800 m

Link Adapters

The following tables gives the specifications for Link Adapters suitable for use In Host Link Systems. Refer to the *Link Adapter Manual* for details).

Link Adapter	Connection	Supply voltage	Operating voltage range	Power consumption	Weight
3G2A9-AL001		Not required	—	—	250 g max.
3G2A9-AL002-PE		100 to 120/ 200 to 240 VAC or 12 to 24 VAC/ DC	85 to 132/ 170 to 246 VAC or 10.2 to 24.6 VAC/ DC	10 VA max.	900 g max.
3G2A9-AL002-E					
3G2A9-AL004-PE		100 to 120/ 200 to 240 VAC	85 to 110 VAC 170 to 220 VAC	10 VA max.	1 kg max.
3G2A9-AL004-E					

APF: all-plastic optical fiber cable; PCF: plastic-clad optical fiber cable

Host Link Unit Specifications

Item	Port 1	Port 2
Interface	RS-232C	RS-232C or RS-422 (selectable)
Communications method	Half duplex or full duplex; Set in CPU Bus Unit System Setup.	RS-232C: Half duplex or full duplex; Set in CPU Bus Unit System Setup. RS-422: Full duplex
Synchronization method	Start-stop, 1 or 2 stop bits; Set in CPU Bus Unit System Setup.	Start-stop, 1 or 2 stop bits; Set in CPU Bus Unit System Setup.
Baud rate	1200, 2400, 4800, 9600, or 19200 bps; Set in CPU Bus Unit System Setup.	1200, 2400, 4800, 9600, or 19200 bps; Set in CPU Bus Unit System Setup.
Transmitted code	7- or 8-bit ASCII; Set in CPU Bus Unit System Setup.	7- or 8-bit ASCII; Set in CPU Bus Unit System Setup.
Error detection	Vertical parity, even/odd/none; Set in CPU Bus Unit System Setup. FCS (frame checksum sequence)	Vertical parity, even/odd/none; Set in CPU Bus Unit System Setup. FCS (frame checksum sequence)
Transmission control	Xon/Xoff control; Set in CPU Bus Unit System Setup.	Xon/Xoff control; Set in CPU Bus Unit System Setup.
Transmission distance	15 m max.	RS-232C: 15 m max.; RS-422: 500 m total max.

Appendix C
Host Link Unit Memory Area Allocations

Auxiliary Area

Address	Bit(s)	Name	Function
A001	00 to 15	CPU Bus Unit Restart Bits	Turn a bit ON and OFF to restart the CPU Bus Unit. The bit numbers correspond to the unit numbers.
A015	00 to15	CPU Bus Service Disable Bits	Turn ON a bit to stop servicing a CPU Bus Unit. The bit numbers correspond to the unit numbers.
A302	00 to 15	CPU Bus Unit Initializing Flag	Turn ON when a CPU Bus Unit is being initialized. The bit numbers correspond to the unit numbers.
A401	12	CPU Bus Error Flag	Turns ON when there is a data transfer error on the CPU bus or a watchdog timer error in a CPU Bus Unit. Word A405 will contain the unit number of the Unit with the error.
A402	03	CPU Bus Unit Setting Error Flag	Turns ON if the registered CPU Bus Units and actual CPU Bus Units are different. Word A427 will contain the unit number of the Unit with the error.
	07	CPU Bus Unit Error Flag	Turns ON when there is a data transfer error between the PC and a CPU Bus Unit. Word A422 will contain the unit number of the Unit with error.
A405	00 to 15	CPU Bus Unit Error Unit Number	Contains the unit number of the CPU Bus Unit with an error. See CPU Bus Error Flag, A40112.
A410	00 to 15	CPU Bus Unit Duplicate Number	Turn ON if the same unit number is assigned to more than one CPU Bus Unit. The bit numbers correspond to the unit numbers.
A422	00 to 15	CPU Bus Unit Error Unit Number	Contains the unit number of CPU Bus Unit with an error. See CPU Bus Unit Error Flag, A40207.
A427	00 to 15	CPU Bus Unit Setting Error Unit Number	Contains the unit number of CPU Bus Unit with an error. See CPU Bus Unit Setting Error Flag, A40203.
A502	00 to 07	Port #0 to #7 Enabled Flags	Bits 00 to 07 correspond to communications ports 0 to 7. When a flag is ON, it is possible to execute the SEND(192), RECV(193), or CMND(194) instruction for that port. A flag is OFF while the SEND(192), RECV(193), or CMND(194) instruction is being executed for that port.
	08 to 15	Port #0 to #7 Execute Error Flags	Bits 00 to 07 correspond to communications port 0 to 7. A flag is ON when there is an error during the execution of the SEND(192), RECV(193), or CMND(194) instruction for that port. A flag is OFF when the SEND(192), RECV(193), or CMND(194) instruction has been executed without an error for that port.
A503	00 to 15	Port #0 to #7 Completion Codes	Port #0 Completion Code
A504	00 to 15		Port #1 Completion Code
A505	00 to 15		Port #2 Completion Code
A506	00 to 15		Port #3 Completion Code
A507	00 to 15		Port #4 Completion Code
A508	00 to 15		Port #5 Completion Code
A509	00 to 15		Port #6 Completion Code
A510	00 to 15		Port #7 Completion Code

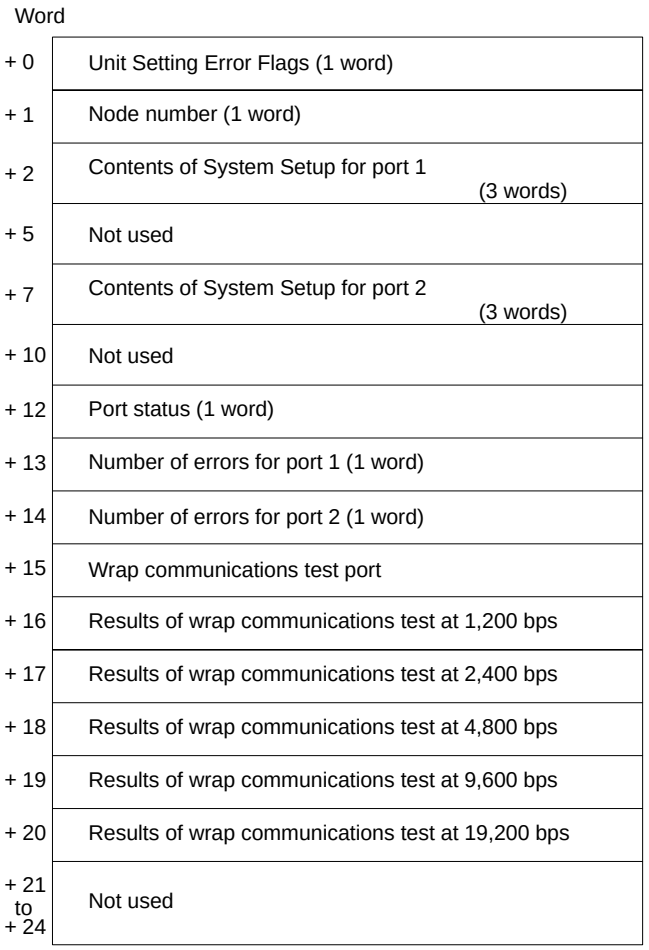
CPU Bus Unit Area

The status data area of the Host Link Unit is allocated in PC memory according to the unit number as shown in the following table. Each Unit is allocated 25 words.

Unit no.	Words allocated	Unit no.	Words allocated
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

Configuration of Status Data Area

The configuration of the status data area is as shown in the following diagram. Word addresses are shown relative to the first word allocated to the Unit in the CPU Bus Unit Area (see above), e.g., the first word for Unit #8 would be 1700 + 0, or 1700, and the last word would be 1700 + 24, or 1724.

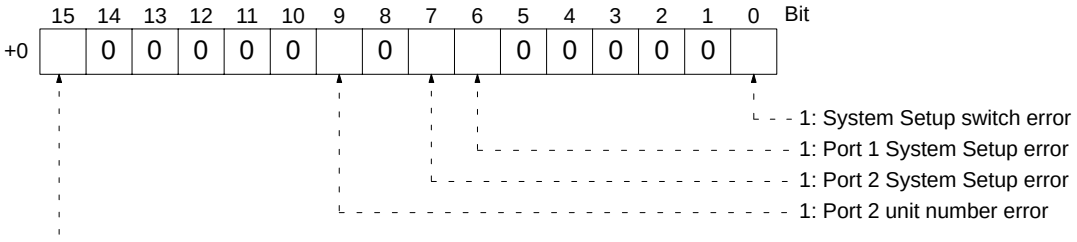


Details of Status Data Area

The bit configuration of each word in the Status Data Area is shown in the following diagrams.

Unit Setting Error Flags

Word: 1500 + (25 x unit number) + 0

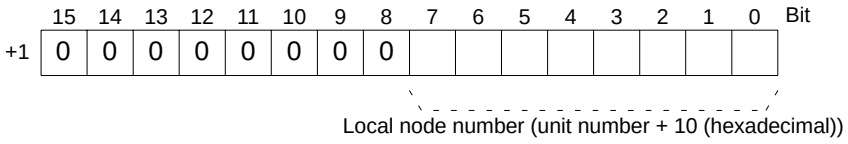


1: One of the following errors has occurred. (This bit will turn OFF when the power supply to the CPU Unit is turned ON or the Unit is restarted.)

CPU Unit watchdog timer error
Service error between CPU Unit and Host Link Unit
CPU Unit write error
System setup error
Execution not possible because Unit with specified unit number is missing
Data from Host Link cannot be processed due to CPU Unit error
Execution not possible because unit number is not between 0 and 15
Execution not possible because the command is too long
Execution not possible because of command header error
Execution not possible because of I/O table error
Data transfer between Host Link Unit and CPU Unit not possible because of CPU bus error
Execution not possible because of duplicate number usage in CPU Unit
Execution not possible because of Special I/O Unit error in Host Link Unit
Send data discarded because internal reception buffer is full
Illegal command discarded
Parity error, framing error, overrun error, or FCS error
Break detected

Local Node Number

Word: 1500 + (25 x unit number) + 1



Contents of CPU Bus Unit System Setup for Port 1

Word: 1500 + (25 x unit number) + 2 to 4

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

Baud rate

15	14	13	bps
0	0	0	9,600
0	0	1	1,200
0	1	0	2,400
0	1	1	4,800
1	0	0	9,600
1	0	1	19,200
1	1	0	Unused
1	1	1	

Data retries (0: no; 1: yes)
Communications method (0: full duplex; 1: half duplex)
Xon/Xoff control (0: no; 1: yes)
Data length (0: 7 bits; 1: 8 bits)

Parity

11	10	
0	0	Even number
0	1	Odd number
1	0	No parity
1	1	

Stop bits (0: 2 bits; 1: 1 bit)

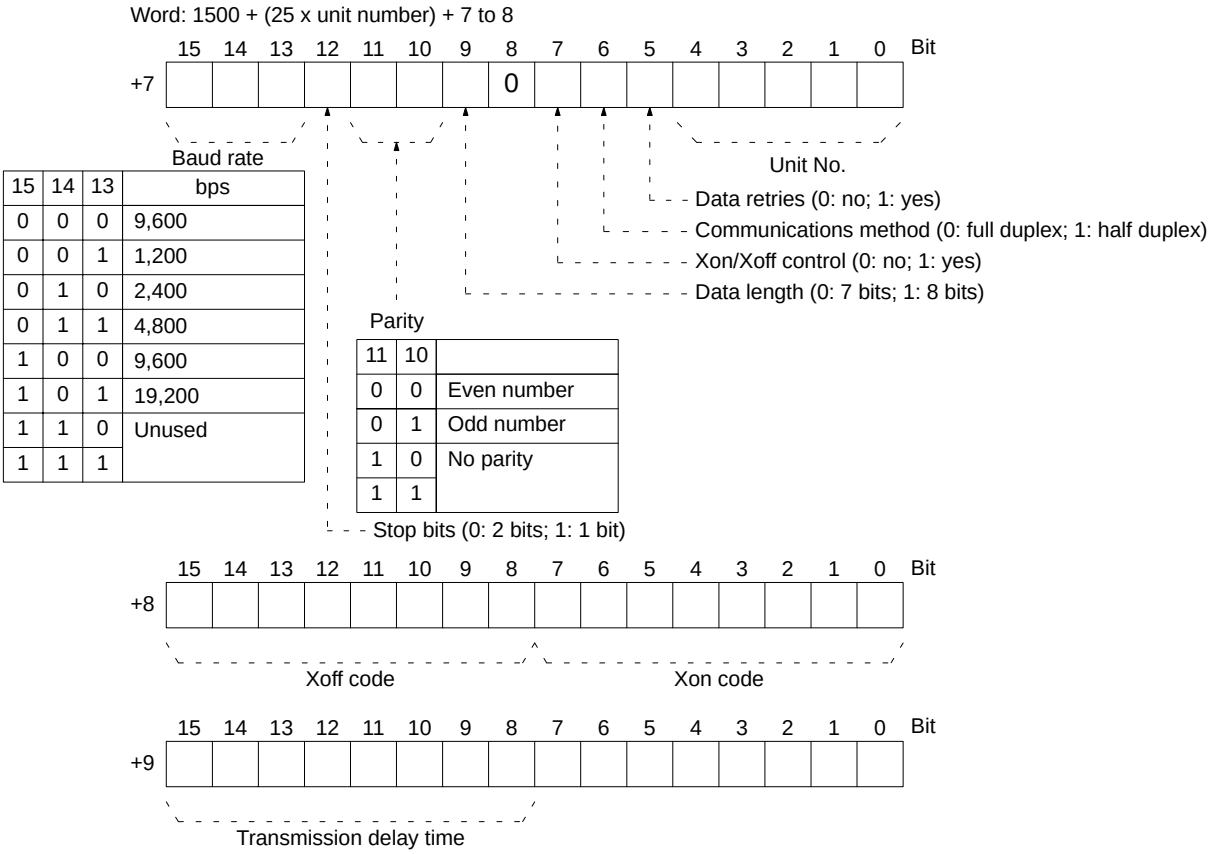
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Bit
+3																	

Xoff code Xon code

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

Transmission delay time

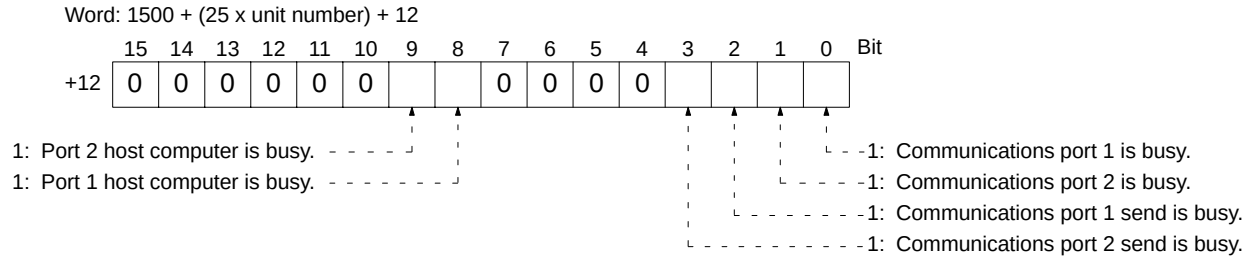
Contents of CPU Bus Unit System Setup for Port 2



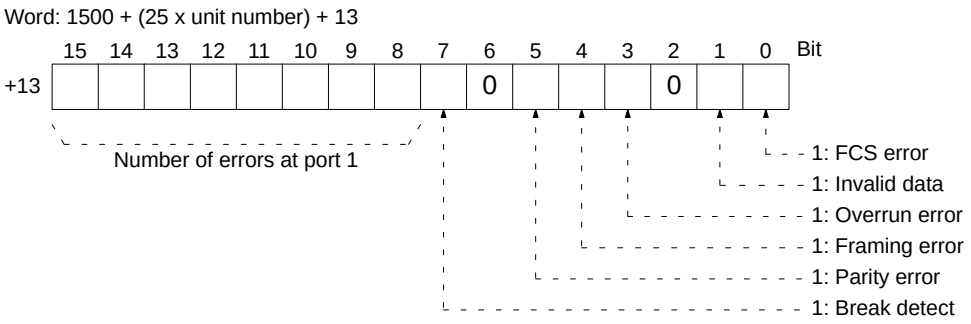
15	14	13	bps
0	0	0	9,600
0	0	1	1,200
0	1	0	2,400
0	1	1	4,800
1	0	0	9,600
1	0	1	19,200
1	1	0	Unused
1	1	1	

11	10	
0	0	Even number
0	1	Odd number
1	0	No parity
1	1	

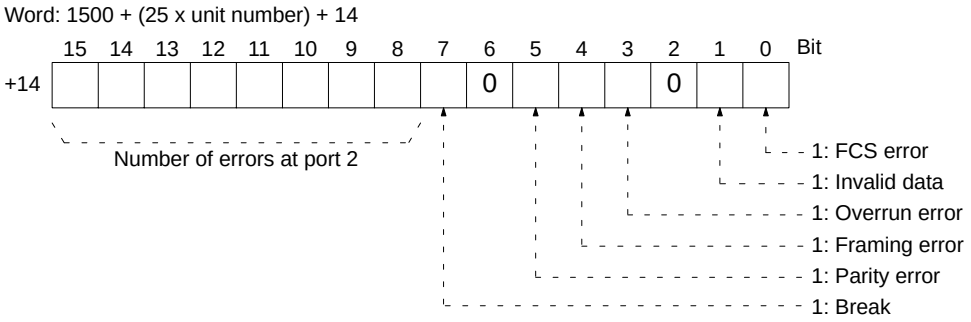
Port Status



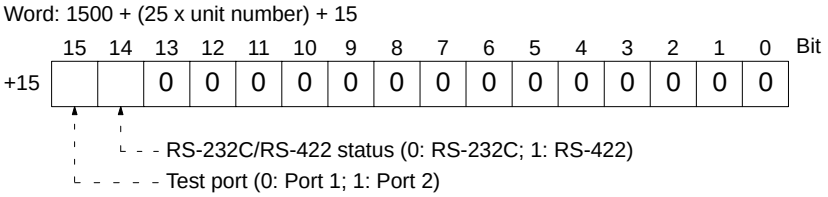
Number of Errors at Port 1



Number of Errors at Port 2

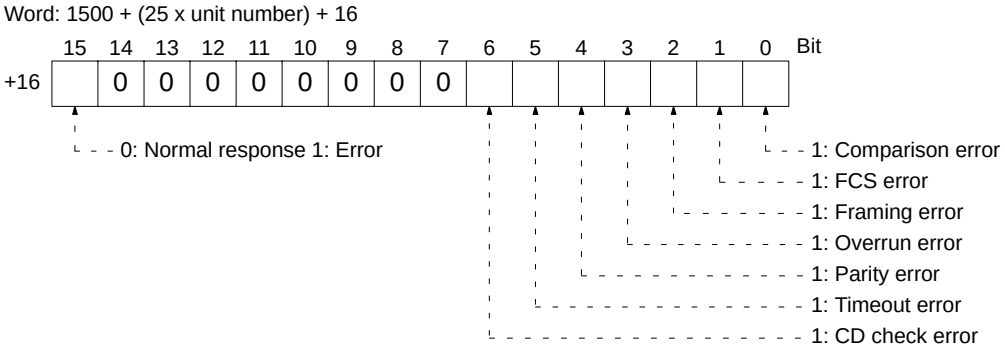


Wrap Communications Test Port



Results of Wrap Communications Test

The results of the tests at 1,200 to 19,200 bps are recorded in words 16 to 20. The contents is the same as that shown below for word 16.



The results for other baud rates are given in the following words.

+17: The result at 2,400 bps

+18: The result at 4,800 bps

+19: The result at 9,600 bps

+20: The result at 19,200 bps

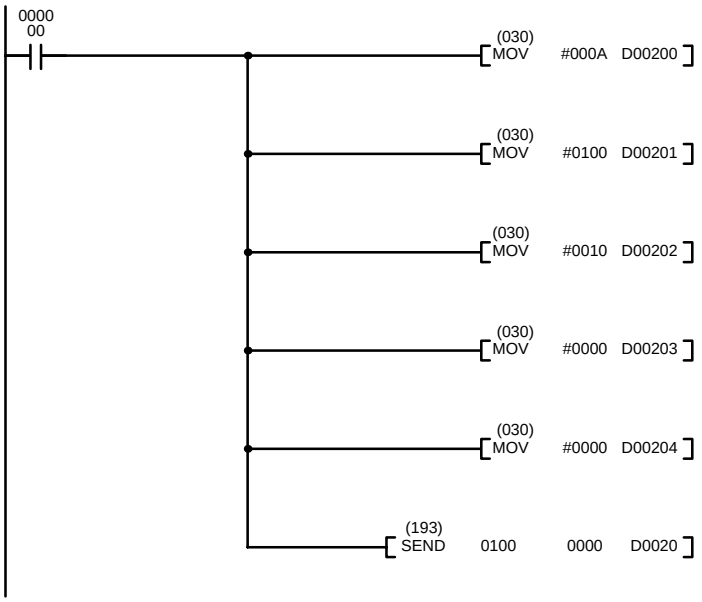
Appendix D
Sample Programs Including Commands for Host Computer

Program Example 1: Data Transfer to Host Computer (SEND)

In this example, the SEND instruction enables the designated word data of the PC to be displayed on the screen of the host computer after the word data is transferred to the host computer.

Ladder Program for PC

When bit 0000 is ON, the 10-word data of CIO words 100 to 109 is transferred to the host computer connected to port 1 of the Host Link Unit of unit address 10, node 0, network address 0.



Contents of Control Data

Word	Data	Meaning	
D00200	000A	No. of words transferred: 10	
D00201	0100	Port 1 of Host Link Unit	Network address: 0
D00202	0010	Node address: 0	Unit address of Host Link Unit: 10
D00203	0000	With response; communications port: 0	No. of re-transmitting operations: 0
D00204	0000	Response monitor time: 0000 (2 s)	

BASIC Program for Host Computer

```
10 '*************************************************************
20 '*****              CV Host Link Unit (CV500-LK201)              *****
30 '*****         Command (SEND instruction) for Host Computer      *****
40 '*****                  Sample Reception Program                 *****
50 '*************************************************************
60 '****************************************
70 '**********       Initial setting       **********
80 '****************************************
90 CLOSE 1
100 ON ERROR GOTO *EROPE
```

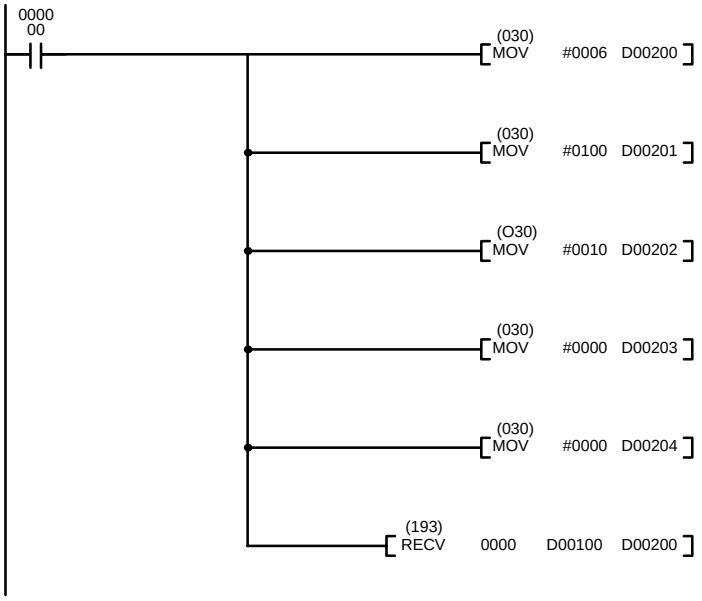
```
110 DIM CHDATA$(300)                                    :'Array declaration of the reception data.
120 OPEN "COM:E73" AS #1                                :'Opens the port.
130 '***************************************
140 '**********      Main processing      **********
150 '***************************************
160 INPUT #1,COMMAND$                                   :'Data reception via the PC line.
170 T$=LEFT$(COMMAND$,LEN(COMMAND$)-3)                  :'Checks the FCS.
180 GOSUB *FCS
190 IF FCS$<>MID$(COMMAND$,LEN(COMMAND$)-2,2) THEN ENDCODE$="1004#:GOTO *RE-
SPONSE
200 CMNDCODE$=MID$(COMMAND$,27,4)                       :'Checks the command code.
210 IF CMNDCODE$<>"0102" THEN ENDCODE$="0401":GOTO *RESPONSE
220 FOR I=0 TO VAL("&H"+MID$(COMMAND$,39,4))-1          :'Reads the data to be written.
230    CHDATA$(I)=MID$(COMMAND$,43+I*4,4)
240    PRINT "DATA";I+1;":";CHDATA$(I)
250 NEXT I
260 ENDCODE$="0000"                                     :'Assigns 0000 to the response code.
270 '***************************************
280 *RESPONSE                                           :'Creates a response frame.
290 RSV$=MID$(COMMAND$,9,2)                             :'Returns the RSV and SID that
300 DA$=MID$(COMMAND$,19,6)                             :'were received.
310 SA$=MID$(COMMAND$,13,6)                             :'Exchanges DNA, DA1, and DA2 with
320 SID$=MID$(COMMAND$,25,2)                            :'SNA, SA1, and SA2 and returns them.
330 TS="@000F00C0"+RSV$+"02"+DA$+SA$+SID$+CMNDCODE$+ENDCODE$
340 GOSUB *FCS
350 RESPONSE$=T$+FCS$+"*"
360 PRINT #1,RESPONSE$                                  :'Transmits the data via the PC line.
370 GOTO 160
380 '***************************************
390 '******FCS Operation Processing Subroutine*******
400 '***************************************
410 *FCS                                                :'Calculates the FCS.
420 L=LEN(T$)
430 A=0
440 FOR J=1 TO L
450     TJ$=MID$(T$,J,1)
460     A=ASC(TJ$) XOR A
470 NEXT J
480 FCS$=HEX$(A)
490 IF LEN(FCS$)=1 THEN FCS$="0"+FCS$
500 RETURN
510 '***************************************
520 '**********      Error processing     **********
530 '***************************************
540 *EROPE
550 PRINT "ERL=":ERL,"ERR";ERR
560 CLOSE 1
570 END
```

Program Example 2: Data Reading from Host Computer (RECV)

In this example, the RECV instruction enables the designated PC data to be read and stored in the DM area.

Ladder Program for PC

When bit 0000 is ON, 6-word data is read from the host computer connected to port 1 of the Host Link Unit of unit address 10, node 0, network address 0 and stored in and after DM 00100.



Contents of Control Data

Word	Data	Meaning	
D00200	0006	No. of words transferred: 6	
D00201	0100	Port 1 of Host Link Unit	Network address: 0
D00202	0010	Node address: 0	Unit address of Host Link Unit: 10
D00203	0000	With response; communications port: 0	No. of re-transmitting operations: 0
D00204	0000	Response monitor time: 0000 (2 s)	

BASIC Program for Host Computer

```
10 '************************************************************
20 '*****              CV Host Link Unit (CV500-LK201)                *****
30 '*****         Command (RECV instruction) for Host Computer        *****
40 '*****                  Sample Reception Program                   *****
50 '************************************************************
60 '****************************************
70 '**********       Initial setting        **********
80 '****************************************
90 CLOSE 1
100 ON ERROR GOTO *EROPE
110 DIM CHDATA$(300)                              :'Array declaration of the data.
120 CHDATA$(0)="0000":CHDATA$(1)="1111":CHDATA$(2)="2222"
130 CHDATA$(3)="3333":CHDATA$(4)="4444":CHDATA$(5)="5555"
140 OPEN "COM:E73" AS #1                          :'Opens the port.
150 '****************************************
160 '**********      Main processing      **********
170 '****************************************
180 RESPDATA$=""
```

```
190 INPUT #1,COMMAND$                                  :'Data reception via the PC line.
200 T$=LEFT$(COMMAND$,LEN(COMMAND$)-3)                 :'Checks the FCS.
210 GOSUB *FCS
220 IF FCS$<>MID$(COMMAND$,LEN(COMMAND$)-2,2) THEN ENDCODE$="1004":GOTO *RE-
SPONSE
240 CMNDCODE$=MID$(COMMAND$,27,4)                      :'Checks the command code.
250 IF CMNDCODE$<>"0101" THEN ENDCODE$="0401":GOTO *RESPONSE
260 FOR I=0 TO VAL("&H"+MID$(COMMAND$,39,4))-1         :'Set the data to be read.
270    RESPDATA$=RESPDATA$+CHDATA$(I)
280 NEXT I
290 PRINT "Reception data:";RESPDATA$
300 ENDCODE$="0000"                                    :'Assigns 0000 to the response code.
310 '*************************************
320 *RESPONSE                                          :'Creates a response frame.
330 RSV$=MID$(COMMAND$,9,2)                            :'Returns the RSV and SID that
340 DA$=MID$(COMMAND$,19,6)                            :'were received.
350 SA$=MID$(COMMAND$,13,6)                            :'Exchanges DNA, DA1, and DA2 with
360 SID$=MID$(COMMAND$,25,2)                           :'SNA, SA1, and SA2 and returns them.
370 TS="@000F00C0"+RSV$+"02"+DA$+SA$+SID$+CMNDCODE$+ENDCODE$+RESPDATA$
380 GOSUB *FCS
390 RESPONSE$=T$+FCS$+"*"
410 PRINT #1,RESPONSE$                                 :'Transmits the data via the PC line.
420 GOTO 180
430 '*************************************
440 '******FCS Operation Processing Subroutine*******
450 '*************************************
460 *FCS                                               :'Calculates the FCS.
470 L=LEN(T$)
480 A=0
490 FOR J=1 TO L
500     TJ$=MID$(T$,J,I)
510     A=ASC(TJ$) XOR A
520 NEXT J
530 FCS$=HEX$(A)
540 IF LEN(FCS$)=1 THEN FCS$="0"+FCS$
550 RETURN
560 '*************************************
570 '**********      Error processing      **********
580 '*************************************
590 *EROPE
600 PRINT "ERL=":ERL,"ERR";ERR
610 CLOSE 1
620 END
```

Glossary

address A number used to identify the location of data or programming instructions in memory or to identify the location of a network or a Unit in a network.

advanced instruction An instruction input with a function code that handles data processing operations within ladder diagrams, as opposed to a basic instruction, which makes up the fundamental portion of a ladder diagram.

allocation The process by which the PC assigns certain bits or words in memory for various functions. This includes pairing I/O bits to I/O points on Units.

analog Something that represents or can process a continuous range of values as opposed to values that can be represented in distinct increments. Something that represents or can process values represented in distinct increments is called digital.

Analog I/O Unit I/O Units that convert I/O between analog and digital values. An Analog Input Unit converts an analog input to a digital value for processing by the PC. An Analog Output Unit converts a digital value to an analog output.

AND A logic operation whereby the result is true if and only if both premises are true. In ladder-diagram programming the premises are usually ON/OFF states of bits or the logical combination of such states called execution conditions.

area See *data area* and *memory area*.

area prefix A one or two letter prefix used to identify a memory area in the PC. All memory areas except the CIO area require prefixes to identify addresses in them.

ASCII Short for American Standard Code for Information Interchange. ASCII is used to code characters for output to printers and other external devices.

asynchronous execution Execution of programs and servicing operations in which program execution and servicing are not synchronized with each other.

Auxiliary Area A PC data area allocated to flags and control bits.

auxiliary bit A bit in the Auxiliary Area.

back-up A copy made of existing data to ensure that the data will not be lost even if the original data is corrupted or erased.

BASIC A common programming language. BASIC Units are programmed in BASIC.

basic instruction A fundamental instruction used in a ladder diagram. See *advanced instruction*.

BASIC Unit A CPU Bus Unit used to run programs in BASIC.

baud rate The data transmission speed between two devices in a system measured in bits per second.

BCD Short for binary-coded decimal.

binary A number system where all numbers are expressed in base 2, i.e., numbers are written using only 0's and 1's. Each group of four binary bits is equivalent to one

hexadecimal digit. Binary data in memory is thus often expressed in hexadecimal for convenience.

binary-coded decimal A system used to represent numbers so that every four binary bits is numerically equivalent to one decimal digit.

bit The smallest piece of information that can be represented on a computer. A bit has the value of either zero or one, corresponding to the electrical signals ON and OFF. A bit represents one binary digit. Some bits at particular addresses are allocated to special purposes, such as holding the status of input from external devices, while other bits are available for general use in programming.

bit address The location in memory where a bit of data is stored. A bit address specifies the data area and word that is being addressed as well as the number of the bit within the word.

Branching Link Adapter A Link Adapter used to branch connections to Units in a Link System used either to prevent the entire System from shutting down for an interruption at only one point in the System or to enable connecting more than two Units in one System when each Unit provides only one connector.

buffer A temporary storage space for data in a computerized device.

building-block PC A PC that is constructed from individual components, or "building blocks." With building-block PCs, there is no one Unit that is independently identifiable as a PC. The PC is rather a functional assembly of Units.

bus A communications path used to pass data between any of the Units connected to it.

bus link A data link that passes data between two Units across a bus.

byte A unit of data equivalent to 8 bits, i.e., half a word.

central processing unit A device that is capable of storing programs and data, and executing the instructions contained in the programs. In a PC System, the central processing unit executes the program, processes I/O signals, communicates with external devices, etc.

channel See *word*.

character code A numeric (usually binary) code used to represent an alphanumeric character.

checksum A sum transmitted with a data pack in communications. The checksum can be recalculated from the received data to confirm that the data in the transmission has not been corrupted.

CIM Computer integrated manufacturing; a process where one or more computers are used to control and integrate manufacturing processes.

CIO Area A memory area used to control I/O and to store and manipulate data. CIO Area addresses do not require prefixes.

combined Link System A control system that includes more than one of the following systems: Remote I/O System, SYSMAC Link System, Host Link System, or SYSMAC NET Link System.

common (link) parameter table A table of settings in a SYSMAC LINK System that specifies what words are to be used in the data links for all PCs in the SYSMAC LINK System. See *refresh parameter table*.

common data Data that is stored in memory in a PC and that is shared by other PCs in the same system. Each PC has a specified section(s) of the area allocated to it. Each PC writes to the section(s) allocated to it and reads the sections allocated to the other PCs with which it shares the common data.

constant An input for an operand in which the actual numeric value is specified. Constants can be input for certain operands in place of memory area addresses. Some operands must be input as constants.

control bit A bit in a memory area that is set either through the program or via a Programming Device to achieve a specific purpose, e.g., a Restart Bit is turned ON and OFF to restart a Unit.

control signal A signal sent from the PC to effect the operation of the controlled system.

Control System All of the hardware and software components used to control other devices. A Control System includes the PC System, the PC programs, and all I/O devices that are used to control or obtain feedback from the controlled system.

controlled system The devices that are being controlled by a PC System.

CPU See *central processing unit*.

CPU Bus Unit A special Unit used with CV-series PCs that mounts to the CPU bus. This connection to the CPU bus enables special data links, data transfers, and processing.

CPU Rack The main Rack in a building-block PC, the CPU Rack contains the CPU, a Power Supply, and other Units. The CPU Rack, along with the Expansion CPU Rack, provides both an I/O bus and a CPU bus.

C-series PC Any of the following PCs: C2000H, C1000H, C500, C200H, C40H, C28H, C20H, C60K, C60P, C40K, C40P, C28K, C28P, C20K, C20P, C120, or C20.

CTS An acronym for clear-to-send, a signal used in communications between electronic devices to indicate that the receiver is ready to accept incoming data.

CV Support Software A programming package run on an IBM PC/AT or compatible to serve as a Programming Device for CV-series PCs.

CV-mode A form of communications useable only with CV-series PCs. See *C-mode*.

CV-series PC Any of the following PCs: CV500, CV1000, CV2000, or CVM1

CVSS See *CV Support Software*.

cycle One unit of processing performed by the CPU, including SFC/ladder program execution, peripheral servicing, I/O refreshing, etc. The cycle is called the scan with C-series PCs.

cycle time The time required to complete one cycle of CPU processing.

data area An area in the PC's memory that is designed to hold a specific type of data.

data length In communications, the number of bits that is to be treated as one unit in data transmissions.

data link An automatic data transmission operation that allows PCs or Units within PC to pass data back and forth via common data areas.

data link area A common data area established through a data link.

data link table A table of settings kept in memory that specifies what words are to be part of a data link for all PCs involved in the link.

data register A storage location in memory used to hold data. In CV-series PCs, data registers are used with or without index registers to hold data used in indirect addressing.

data sharing An aspect of SYSMAC Link Systems and SYSMAC NET Link Systems in which common data areas or common data words are created between two or more PCs.

data transfer Moving data from one memory location to another, either within the same device or between different devices connected via a communications line or network.

debug A process by which a draft program is corrected until it operates as intended. Debugging includes both the removal of syntax errors, as well as the fine-tuning of timing and coordination of control operations.

decimal A number system where numbers are expressed to the base 10. In a PC all data is ultimately stored in binary form, four binary bits are often used to represent one decimal digit, via a system called binary-coded decimal.

decrement Decreasing a numeric value, usually by 1.

default A value automatically set by the PC when the user does not specifically set another value. Many devices will assume such default conditions upon the application of power.

delimiter A code sent during communications between devices to indicate the end of the current transmission, but not the end of the entire transmission. See *terminator*.

destination The location where an instruction places the data on which it is operating, as opposed to the location from which data is taken for use in the instruction. The location from which data is taken is called the source.

digit A unit of storage in memory that consists of four bits.

DIP switch Dual in-line package switch, an array of pins in a signal package that is mounted to a circuit board and is used to set operating parameters.

distributed control An automation concept in which control of each portion of an automated system is located near the devices actually being controlled, i.e., control is decentralized and ‘distributed’ over the system. Distributed control is a concept basic to PC Systems.

DM Area A data area used to hold only word data. Words in the DM Area cannot be accessed bit by bit.

DM word A word in the DM Area.

downloading The process of transferring a program or data from a higher-level or host computer to a lower-level or slave computer. If a Programming Device is involved, the Programming Device is considered the host computer.

EEPROM Electrically erasable programmable read-only memory; a type of ROM in which stored data can be erased and reprogrammed. This is accomplished using a

	special control lead connected to the EEPROM chip and can be done without having to remove the EEPROM chip from the device in which it is mounted.
electrical noise	Random variations of one or more electrical characteristics, such as voltage, current, and data, that might interfere with the normal operation of a device.
EM Area	Extended Data Memory Area; an area that can be optionally added to certain PCs to enable greater data storage. Functionally, the EM Area operates like the DM Area. Area addresses are prefixes with E and only words can be accessed. The EM Area is separated into multiple banks.
EPROM	Erasable programmable read-only memory; a type of ROM in which stored data can be erased, by ultraviolet light or other means, and reprogrammed.
error code	A numeric code generated to indicate that an error exists, and something about the nature of the error. Some error codes are generated by the system; others are defined in the program by the operator.
even parity	A communication setting that adjusts the number of ON bits so that it is always even. See *parity*.
event processing	Processing that is performed in response to an event, e.g., an interrupt signal.
Expansion CPU Rack	A Rack connected to the CPU Rack to increase the virtual size of the CPU Rack. Units that may be mounted to the CPU Backplane may also be mounted to the Expansion CPU Backplane.
Expansion I/O Rack	A Rack used to increase the I/O capacity of a PC. In CV-Series PCs, either one Expansion I/O Rack can be connected directly to the CPU or Expansion CPU Rack or multiple Expansion I/O Racks can be connected by using an I/O Control and I/O Interface Units.
FA	Factory automation.
factory computer	A general-purpose computer, usually quite similar to a business computer, that is used in automated factory control.
fatal error	An error that stops PC operation and requires correction before operation can continue.
FCS	See *frame checksum*.
FINS	See *CV-mode*.
flag	A dedicated bit in memory that is set by the system to indicate some type of operating status. Some flags, such as the carry flag, can also be set by the operator or via the program.
force reset	The process of forcibly turning OFF a bit via a Programming Device. Bits are usually turned OFF as a result of program execution.
force set	The process of forcibly turning ON a bit via a Programming Device. Bits are usually turned ON as a result of program execution.
frame checksum	The results of exclusive ORing all data within a specified calculation range. The frame checksum can be calculated on both the sending and receiving end of a data transfer to confirm that data was transmitted correctly.

GPC An acronym for Graphic Programming Console.

Graphic Programming Console A programming device with advanced programming and debugging capabilities to facilitate PC operation. A Graphic Programming Console is provided with a large display onto which ladder-diagram programs can be written directly in ladder-diagram symbols for input into the PC without conversion to mnemonic form.

header code A code in an instruction that specifies what the instruction is to do.

hexadecimal A number system where all numbers are expressed to the base 16. In a PC all data is ultimately stored in binary form, however, displays and inputs on Programming Devices are often expressed in hexadecimal to simplify operation. Each group of four binary bits is numerically equivalent to one hexadecimal digit.

host computer A computer that is used to transfer data to or receive data from a PC in a Host Link System. The host computer is used for data management and overall system control. Host computers are generally small personal or business computers.

host interface An interface that allows communications with a host computer.

Host Link System A system with one or more host computers connected to one or more PCs via Host Link Units or host interfaces so that the host computer can be used to transfer data to and from the PC(s). Host Link Systems enable centralized management and control of PC Systems.

Host Link Unit An interface used to connect a C-series PC to a host computer in a Host Link System.

I/O allocation The process by which the PC assigns certain bits in memory for various functions. This includes pairing I/O bits to I/O points on Units.

I/O Block Either an Input Block or an Output Block. I/O Blocks provide mounting positions for replaceable relays.

I/O Control Unit A Unit mounted to the CPU Rack to monitor and control I/O points on Expansion CPU Racks or Expansion I/O Racks.

I/O delay The delay in time from when a signal is sent to an output to when the status of the output is actually in effect or the delay in time from when the status of an input changes until the signal indicating the change in the status is received.

I/O device A device connected to the I/O terminals on I/O Units, Special I/O Units, etc. I/O devices may be either part of the Control System, if they function to help control other devices, or they may be part of the controlled system.

I/O Interface Unit A Unit mounted to an Expansion CPU Rack or Expansion I/O Rack to interface the Rack to the CPU Rack.

I/O point The place at which an input signal enters the PC System, or at which an output signal leaves the PC System. In physical terms, I/O points correspond to terminals or connector pins on a Unit; in terms of programming, I/O points correspond to I/O bits in the IR area.

I/O refreshing The process of updating output status sent to external devices so that it agrees with the status of output bits held in memory and of updating input bits in memory so that they agree with the status of inputs from external devices.

I/O response time The time required for an output signal to be sent from the PC in response to an input signal received from an external device.

I/O Terminal A Remote I/O Unit connected in a Wired Remote I/O System to provide a limited number of I/O points at one location. There are several types of I/O Terminals.

I/O Unit The most basic type of Unit mounted to a Backplane. I/O Units include Input Units and Output Units, each of which is available in a range of specifications. I/O Units do not include Special I/O Units, Link Units, etc.

I/O verification error An error generated by a disagreement between the Units registered in the I/O table and the Units actually mounted to the PC.

I/O word A word in the CIO area that is allocated to a Unit in the PC System and is used to hold I/O status for that Unit.

IBM PC/AT or compatible A computer that has similar architecture to, that is logically compatible with, and that can run software designed for an IBM PC/AT computer.

initialize Part of the startup process whereby some memory areas are cleared, system setup is checked, and default values are set.

input The signal coming from an external device into the PC. The term input is often used abstractly or collectively to refer to incoming signals.

input bit A bit in the CIO area that is allocated to hold the status of an input.

Input Block A Unit used in combination with a Remote Interface to create an I/O Terminal. An Input Block provides mounting positions for replaceable relays. Each relay can be selected according to specific input requirements.

input device An external device that sends signals into the PC System.

input point The point at which an input enters the PC System. Input points correspond physically to terminals or connector pins.

input signal A change in the status of a connection entering the PC. Generally an input signal is said to exist when, for example, a connection point goes from low to high voltage or from a nonconductive to a conductive state.

Input Terminal An I/O Terminal that provides input points.

instruction A direction given in the program that tells the PC of the action to be carried out, and the data to be used in carrying out the action. Instructions can be used to simply turn a bit ON or OFF, or they can perform much more complex actions, such as converting and/or transferring large blocks of data.

interface An interface is the conceptual boundary between systems or devices and usually involves changes in the way the communicated data is represented. Interface devices such as NSBs perform operations like changing the coding, format, or speed of the data.

interrupt (signal) A signal that stops normal program execution and causes a subroutine to be run or other processing to take place.

Interrupt Input Unit A Rack-mounting Unit used to input external interrupts into a PC System.

IOIF An acronym for I/O Interface Unit.

IOM (Area) A collective memory area containing all of the memory areas that can be accessed by bit, including timer and counter Completion Flags. The IOM Area includes all memory area memory addresses between 0000 and 0FFF.

JIS An acronym for Japanese Industrial Standards.

jump A type of programming where execution moves directly from one point in a program to another, without sequentially executing any instructions in between. Jumps in ladder diagrams are usually conditional on an execution condition; jumps in SFC programs are conditional on the step status and transition condition status before the jump.

LAN An acronym for local area network.

least-significant (bit/word) See *rightmost (bit/word)*.

LED Acronym for light-emitting diode; a device used for indicators or displays.

leftmost (bit/word) The highest numbered bits of a group of bits, generally of an entire word, or the highest numbered words of a group of words. These bits/words are often called most-significant bits/words.

link A hardware or software connection formed between two Units. “Link” can refer either to a part of the physical connection between two Units or a software connection created to data existing at another location (i.e., data links).

link parameter table See *common link parameter table*.

Link System A system used to connect remote I/O or to connect multiple PCs in a network. Link Systems include the following: SYSMAC BUS Remote I/O Systems, SYSMAC BUS/2 Remote I/O Systems, SYSMAC LINK Systems, Host Link Systems, and SYSMAC NET Link Systems.

Link Unit Any of the Units used to connect a PC to a Link System. These include Remote I/O Units, SYSMAC LINK Units, and SYSMAC NET Link Units.

load The processes of copying data either from an external device or from a storage area to an active portion of the system such as a display buffer. Also, an output device connected to the PC is called a load.

local area network A network consisting of nodes or positions in a loop arrangement. Each node can be any one of a number of devices. This kind of network usually operates over a small area such as a group of offices or a factory floor.

local network table A table that specifies all of the networks that a PC belongs to and the unit numbers of the Units connecting the PC to each of these networks.

master In a SYSMAC NET Link System, a Unit specified to manage network communications.

master number A number assigned to a master in a SYSMAC NET Link System. This number is different from the unit number.

MCR Unit Magnetic Card Reader Unit.

megabyte A unit of storage equal to one million bytes.

memory area Any of the areas in the PC used to hold data or programs.

most-significant (bit/word) See *leftmost (bit/word).*

nesting Programming one loop within another loop, programming a call to a subroutine within another subroutine, or programming an IF–ELSE programming section within another IF–ELSE section.

Network Service Board A device with an interface to connect devices other than PCs to a SYSMAC NET Link System.

Network Service Unit A Unit that provides two interfaces to connect peripheral devices to a SYSMAC NET Link System.

network support table Tables of settings used to establish operating parameters for SYSMAC LINK and SYSMAC NET Link Systems.

node One of the positions in a LAN. Each node incorporates a device that can communicate with the devices at all of the other nodes. The device at a node is identified by the node number.

node number A number used to identify a node on a network. The node number of a CV-series PC is called the “unit number” in the PC Setup.

noise interference Disturbances in signals caused by electrical noise.

nonfatal error A hardware or software error that produces a warning but does not stop the PC from operating.

NOT A logic operation that inverts the status of the operand. For example, AND NOT indicates an AND operation with the opposite of the actual status of the operand bit.

NSB An acronym for Network Service Board.

NSU An acronym for Network Service Unit.

octal A number system where all numbers are expressed in base 8, i.e., numbers are written using only numerals 0 through 7.

odd parity A communications setting that adjusts the number of ON bits so that it is always odd. See *parity.*

OFF The status of an input or output when a signal is said not to be present. The OFF state is generally represented by a low voltage or by non-conductivity, but can be defined as the opposite of either.

OFF delay The delay between the time when a signal is switched OFF (e.g., by an input device or PC) and the time when the signal reaches a state readable as an OFF signal (i.e., as no signal) by a receiving party (e.g., output device or PC).

offset A positive or negative value added to a base value such as an address to specify a desired value.

ON The status of an input or output when a signal is said to be present. The ON state is generally represented by a high voltage or by conductivity, but can be defined as the opposite of either.

ON delay The delay between the time when an ON signal is initiated (e.g., by an input device or PC) and the time when the signal reaches a state readable as an ON signal by a receiving party (e.g., output device or PC).

operand The values designated as the data to be used for an instruction. An operand can be input as a constant expressing the actual numeric value to be used or as an address to express the location in memory of the data to be used.

operating error An error that occurs during actual PC operation as opposed to an initialization error and that occurs before actual operations can begin.

optical communications A communications method in which signals are sent over optical fiber cable to prevent noise interference and increase transmission distance.

OR A logic operation whereby the result is true if either of two premises is true, or if both are true. In ladder-diagram programming the premises are usually ON/OFF states of bits or the logical combination of such states called execution conditions.

output The signal sent from the PC to an external device. The term output is often used abstractly or collectively to refer to outgoing signals.

Output Block A Unit used in combination with a Remote Interface to create an I/O Terminal. An Output Block provides mounting positions for replaceable relays. Each relay can be selected according to specific output requirements.

output device An external device that receives signals from the PC System.

output point The point at which an output leaves the PC System. Output points correspond physically to terminals or connector pins.

output signal A signal being sent to an external device. Generally an output signal is said to exist when, for example, a connection point goes from low to high voltage or from a nonconductive to a conductive state.

Output Terminal An I/O Terminal that provides output points.

overflow The state where the capacity of a data storage location has been exceeded.

overwrite Changing the content of a memory location so that the previous content is lost.

parity Adjustment of the number of ON bits in a word or other unit of data so that the total is always an even number or always an odd number. Parity is generally used to check the accuracy of data after being transmitted by confirming that the number of ON bits is still even or still odd.

parity check Checking parity to ensure that transmitted data has not been corrupted.

PC An acronym for Programmable Controller.

PC configuration The arrangement and interconnections of the Units that are put together to form a functional PC.

PC System With building-block PCs, all of the Racks and independent Units connected directly to them up to, but not including the I/O devices. The boundaries of a PC System are the PC and the program in its CPU at the upper end; and the I/O Units, Special I/O Units, Optical I/O Units, Remote Terminals, etc., at the lower end.

PCB An acronym for printed circuit board.

PC Setup A group of operating parameters set in the PC from a Programming Device to control PC operation.

Peripheral Device Devices connected to a PC System to aid in system operation. Peripheral devices include printers, programming devices, external storage media, etc.

peripheral servicing Processing signals to and from peripheral devices, including refreshing, communications processing, interrupts, etc.

PID Unit A Unit designed for PID control.

polling The process whereby a device consecutively sends signals to other devices in the same network to pass data back and forth, e.g., as in a data link.

present value The current value registered in a device at any instant during its operation. Present value is abbreviated as PV. The use of this term is generally restricted to timers and counters.

printed circuit board A board onto which electrical circuits are printed for mounting into a computer or electrical device.

Programmable Controller A computerized device that can accept inputs from external devices and generate outputs to external devices according to a program held in memory. Programmable Controllers are used to automate control of external devices. Although single-unit Programmable Controllers are available, building-block Programmable Controllers are constructed from separate components. Such Programmable Controllers are formed only when enough of these separate components are assembled to form a functional assembly, i.e., there is no one individual Unit called a PC.

Programming Console The simplest form of Programming Device available for a PC. Programming Consoles are available both as hand-held models and as CPU-mounting models.

Programming Device A Peripheral Device used to input a program into a PC or to alter or monitor a program already held in the PC. There are dedicated programming devices, such as Programming Consoles, and there are non-dedicated devices, such as a host computer.

PROM Programmable read-only memory; a type of ROM into which the program or data may be written after manufacture, by a customer, but that is fixed from that time on.

PROM Writer A peripheral device used to write programs and other data into a ROM for permanent storage and application.

prompt A message or symbol that appears on a display to request input from the operator.

protocol The parameters and procedures that are standardized to enable two devices to communicate or to enable a programmer or operator to communicate with a device.

PV See *present value*.

Rack An assembly that forms a functional unit in a Rack PC System. A Rack consists of a Backplane and the Units mounted to it. These Units include the Power Supply, CPU, and I/O Units. Racks include CPU Racks, Expansion I/O Racks, and I/O Racks. The CPU Rack is the Rack with the CPU mounted to it. An Expansion I/O Rack is an additional Rack that holds extra I/O Units. An I/O Rack is used in the C2000H Duplex System, because there is no room for any I/O Units on the CPU Rack in this System.

rack number A number assigned to a Rack according to the order that it is connected to the CPU Rack, with the CPU Rack generally being rack number 0.

Rack PC A PC that is composed of Units mounted to one or more Racks. This configuration is the most flexible, and most large PCs are Rack PCs. A Rack PC is the opposite of a Package-type PC, which has all of the basic I/O, storage, and control functions built into a single package.

RAM Random access memory; a data storage media. RAM will not retain data when power is disconnected.

RAS An acronym for reliability, assurance, safety.

refresh The process of updating output status sent to external devices so that it agrees with the status of output bits held in memory and of updating input bits in memory so that they agree with the status of inputs from external devices.

refresh parameter (table) A table of settings that specifies which words in the data links for a System are to be refreshed for a particular PC. See *common link parameter table*.

relay-based control The forerunner of PCs. In relay-based control, groups of relays are interconnected to form control circuits. In a PC, these are replaced by programmable circuits.

reserved bit A bit that is not available for user application.

reserved word A word in memory that is reserved for a special purpose and cannot be accessed by the user.

reset The process of turning a bit or signal OFF or of changing the present value of a timer or counter to its set value or to zero.

response code A code sent with the response to a data transmission that specifies how the transmitted data was processed.

response format A format specifying the data required in a response to a data transmission.

Restart Bit A bit used to restart a Unit mounted to a PC.

restart continuation A process that allows memory and program execution status to be maintained so that PC operation can be restarted from the state it was in when operation was stopped by a power interruption.

retrieve The processes of copying data either from an external device or from a storage area to an active portion of the system such as a display buffer. Also, an output device connected to the PC is called a load.

retry The process whereby a device will re-transmit data that has resulted in an error message from the receiving device.

rightmost (bit/word) The lowest numbered bits of a group of bits, generally of an entire word, or the lowest numbered words of a group of words. These bits/words are often called least-significant bits/words.

rising edge The point where a signal actually changes from an OFF to an ON status.

ROM Read only memory; a type of digital storage that cannot be written to. A ROM chip is manufactured with its program or data already stored in it and can never

	be changed. However, the program or data can be read as many times as desired.
routing table	Tables of setting that specify what networks a device is a member of and what nodes must be passed through to reach other specific networks. See *local network table* and *relay network table*.
RS-232C interface	An industry standard for serial communications.
RS-422 interface	An industry standard for serial communications.
scan	The process used to execute a ladder-diagram program. The program is examined sequentially from start to finish and each instruction is executed in turn based on execution conditions. The scan also includes peripheral processing, I/O refreshing, etc. The scan is called the cycle with CV-series PCs.
scan time	The time required for a single scan of a ladder-diagram program.
self diagnosis	A process whereby the system checks its own operation and generates a warning or error if an abnormality is discovered.
series	A wiring method in which Units are wired consecutively in a string. In Link Systems wired through Link Adapters, the Units are still functionally wired in series, even though Units are placed on branch lines.
servicing	The process whereby the PC provides data to or receives data from external devices or remote I/O Units, or otherwise handles data transactions for Link Systems.
set	The process of turning a bit or signal ON.
set value	The value from which a decrementing counter starts counting down or to which an incrementing counter counts up (i.e., the maximum count), or the time from which or for which a timer starts timing. Set value is abbreviated as SV.
software error	An error that originates in a software program.
software protect	A means of protecting data from being changed that uses software as opposed to a physical switch or other hardware setting.
software switch	See *memory switch*.
Special I/O Unit	A Unit that is designed for a specific purpose. Special I/O Units include Position Control Units, High-speed Counter Units, Analog I/O Units, etc.
SRAM	Static random access memory; a data storage media.
subroutine	A group of instructions placed separate from the main program and executed only when called from the main program or activated by an interrupt.
SV	Abbreviation for set value.
synchronous execution	Execution of programs and servicing operations in which program execution and servicing are synchronized so that all servicing operations are executed each time the programs are executed.
syntax	The form of a program statement (as opposed to its meaning). For example, the two statements, `LET A=B+B` and `LET A=B*2` use different syntaxes, but have the same meaning.

syntax error An error in the way in which a program is written. Syntax errors can include 'spelling' mistakes (i.e., a function code that does not exist), mistakes in specifying operands within acceptable parameters (e.g., specifying read-only bits as a destination), and mistakes in actual application of instructions (e.g., a call to a subroutine that does not exist).

SYSMAC LINK System A communications system used to create data links and enable network communications between PCs.

SYSMAC NET Link System An optical LAN formed from PCs connected through SYSMAC NET Link Units. A SYSMAC NET Link System also normally contains nodes interfacing computers and other peripheral devices. PCs in the SYSMAC NET Link System can pass data back and forth, receive commands from any interfaced computer, and share any interfaced peripheral device.

SYSMAC NET Link Unit The Unit used to connect PCs to a SYSMAC NET Link System.

system configuration The arrangement in which Units in a System are connected. This term refers to the conceptual arrangement and wiring together of all the devices needed to comprise the System. In OMRON terminology, system configuration is used to describe the arrangement and connection of the Units comprising a Control System that includes one or more PCs.

system error An error generated by the system, as opposed to one resulting from execution of an instruction designed to generate an error.

system error message An error message generated by the system, as opposed to one resulting from execution of an instruction designed to generate a message.

terminator The code comprising an asterisk and a carriage return (* CR) that indicates the end of a block of data in communications between devices. Frames within a multi-frame block are separated by delimiters. Also a Unit in a Link System designated as the last Unit on the communications line.

timer A location in memory accessed through a TC bit and used to time down from the timer's set value. Timers are turned ON and reset according to their execution conditions.

TR Area A data area used to store execution conditions so that they can be reloaded later for use with other instructions.

TR bit A bit in the TR Area.

transfer The process of moving data from one location to another within the PC, or between the PC and external devices. When data is transferred, generally a copy of the data is sent to the destination, i.e., the content of the source of the transfer is not changed.

transmission distance The distance that a signal can be transmitted.

UM area The memory area used to hold the active program, i.e., the program that is being currently executed.

Unit In OMRON PC terminology, the word Unit is capitalized to indicate any product sold for a PC System. Though most of the names of these products end with the word Unit, not all do, e.g., a Remote Terminal is referred to in a collective sense as a Unit. Context generally makes any limitations of this word clear.

unit address A number used to control network communications. Unit addresses are computed for Units in various ways, e.g., 10 hex is added to the unit number to determine the unit address for a CPU Bus Unit.

unit number A number assigned to some Link Units, Special I/O Units, and CPU Bus Units to facilitate identification when assigning words or other operating parameters.

uploading The process of transferring a program or data from a lower-level or slave computer to a higher-level or host computer. If a Programming Device is involved, the Programming Device is considered the host computer.

watchdog timer A timer within the system that ensures that the scan time stays within specified limits. When limits are reached, either warnings are given or PC operation is stopped depending on the particular limit that is reached.

WDT See *watchdog timer*.

wire communications A communications method in which signals are sent over wire cable. Although noise resistance and transmission distance can sometimes be a problem with wire communications, they are still the cheapest and the most common, and perfectly adequate for many applications.

word A unit of data storage in memory that consists of 16 bits. All data areas consists of words. Some data areas can be accessed only by words; others, by either words or bits.

word address The location in memory where a word of data is stored. A word address must specify (sometimes by default) the data area and the number of the word that is being addressed.

word allocation The process of assigning I/O words and bits in memory to I/O Units and terminals in a PC System to create an I/O Table.

work area A part of memory containing work words/bits.

work bit A bit in a work word.

work word A word that can be used for data calculation or other manipulation in programming, i.e., a ‘work space’ in memory. A large portion of the IR area is always reserved for work words. Parts of other areas not required for special purposes may also be used as work words.

write protect switch A switch used to write-protect the contents of a storage device, e.g., a floppy disk. If the hole on the upper left of a floppy disk is open, the information on this floppy disk cannot be altered.

write-protect A state in which the contents of a storage device can be read but cannot be altered.

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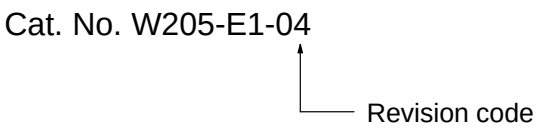
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Revision History

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



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 1992	Original production
1A	January 1993	The glossary has been updated. **Page 35:** Response codes 21 to 23, and B0 have been added to the table.
2	June 1993	CV2000 and CVM1 CPUs added. CV500-LK201 Host Link Unit added. In addition, the following corrections were made: The following terms were changed for consistency and clarity: node address to node number, PC to destination (where the destination may be other than the CPU), and unit number to unit address (when the value being referred to was not the unit number set for a CPU Bus Unit). **Page 13:** Signals added to table of RS-422 connections. **Page 26:** FCS calculation example corrected. **Page 27:** "I" added to line 460. **Page 28:** Descriptions of GCNT, DNA, DA1, DA2, and SA2 corrected. **Page 30:** FCS added to command block format for local communications. **Page 31:** FCS added to response block format for local communications. **Pages 49 and 71:** Command code for CYCLE TIME READ corrected to 06 20. **Pages 51 and 52:** Tables corrected for Transition Area, Step Area, Action Area, and Interrupt Area. **Pages 52 and 53:** Data formats added for data accompanied by forced status and for step status. **Page 78:** Error for 80F3 corrected to "Fatal SFC error." **Page 83:** "Or for all the expansion DM memory banks" removed from 6-41.
3	February 1995	Revisions made for new version-1 CPUs and version-2 CVM1 CPUs. **Page 2:** Caution added. **Page 4:** Section on new/improved commands added. **Page 8:** Order numbers added to the system diagram. **Page 10:** Function added for pin 3 of DIP switch. **Page 54:** EOR changed to XOR. **Page 70:** New commands and notes added to table. **Pages 71 to 84:** Commands added (see table on page 72) or changed. **Page 89:** Response code 16 added. **Page 95:** PCs List updated.
3A	July 1995	**Page 4:** Note added. **Page 10:** Pin 4 settings changed, notes added. **Page 15:** Pin 1 settings changed, note added.
04	May 2002	**Page 3:** Section 1-1-4 added. **Page 5:** Note added. **Page 117:** Description added to *Unit Setting Error Flags.*

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