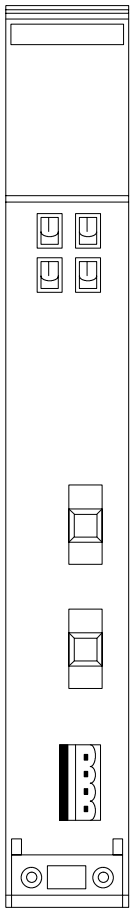
SYSMAC CV-series

SYSMAC NET Link

System Manual

Revised May 1993



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 warnings in this manual. Always heed the information provided with them.

Caution Indicates information that, if not heeded, could result in minor injury or damage to the product.

DANGER! Indicates information that, if not heeded, could result in loss of life or serious injury.

OMRON Product References

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

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

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

Visual Aids

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

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

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

TABLE OF CONTENTS

About this Manual:

This manual describes the installation and operation of a SYSMAC CV-series SYSMAC NET Link System and includes the sections described below.

Please read this manual completely and be sure you understand the information provide before attempting to install and operation a SYSMAC NET Link System**.**

Section 1 provides an overview of OMRON networks for FA systems and describes the basic features and setup procedure of the SYSMAC NET Link System. Details are provided in the remaining sections of the manual.

Section 2 describes the components of the SYSMAC NET Link Units and the procedures required to install the SYSMAC NET Link Units.

Section 3 describes some of the basic features in a SYSMAC NET Link System, including the basics of data transmissions and data links. This section should be read first before proceeding on to details in the remainder of the manual.

Section 4 describes communications between network nodes and provides the command and response formats for CV-mode commands. Refer to *Section 9 Systems Combining C-series and CV-series PCs* for details on C-mode commands.

Section 5 describes the procedures for setting up and controlling data links to automatically exchange data between nodes.

Section 6 provides the details of the RAS (reliability, availability, and serviceability) functions of the SYSMAC NET Link Unit, including the automatic loopbacks, node bypasses, internode tests, and error logs.

Section 7 describes the troubleshooting of the SYSMAC NET Link System using the indicators on the SYSMAC NET Link Unit and the data available in PC memory.

Section 8 describes the basic hardware inspection and maintenance procedures for the SYSMAC NET Link System.

Section 9 describes procedures required for SYSMAC NET Link Systems that combine C-series and CV-series PCs, including the C-mode commands that are used in such Systems.

Appendix A provides a list of OMRON products used with SYSMAC NET Link Systems.

Appendix B provides tables of technical specifications.

Appendix C provides a quick reference for status words allocated to SYSMAC NET Link Units in the CPU Bus Unit Area of the PC.

Appendix D describes setting up an IBM PC/AT or compatible computer to operate as a node on a SYSMAC NET Link Network.

SECTION 1
Introduction

This section provides an overview of OMRON networks for FA systems and describes the basic features and setup procedure of the SYSMAC NET Link System. Details are provided in the remaining sections of the manual.

1-1 FA Systems

1-1-1 Overview

OMRON's FA Systems combine Programmable Controllers (PCs) and host computers in on-site production control networks providing advanced control and management capabilities. The type of FA system and the software required is determined by the amount of transmission data, the number of PCs to be applied on the production lines, and the kind of control operation. OMRON thus offers three types of FA System to provide for a wide range of needs:

- SYSMAC NET Link System
- SYSMAC LINK System
- SYSMAC BUS/2 Remote I/O System

All of these systems incorporate unique features. The SYSMAC NET Link System provides the most comprehensive capabilities and can be easily interconnected with the other Systems in very large networks and interconnected with a computer integrated manufacturing system (CIM) for even greater control capabilities.

A typical network consists of the following types of devices:

IBM PC/AT or Compatible Connected to a PC on the network to program and set the nodes on the networks.

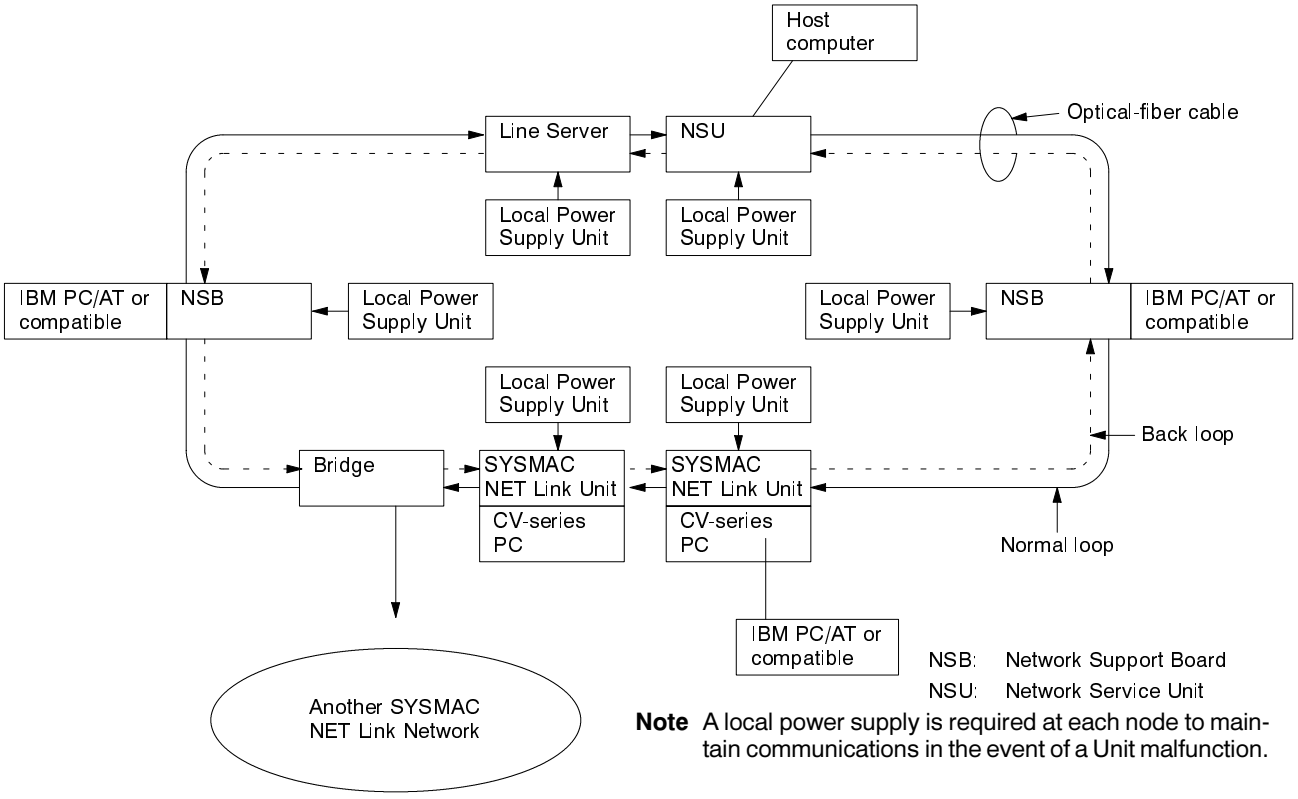
Network Service Board (NSB) An interface used to connect an IBM PC/AT or compatible computer to the network. The NSB is inserted into an expansion slot of the computer.

Network Service Unit (NSU) An interface used to connect a host computer other than an IBM PC/AT or compatible computer to the network.

Line Server A device which generates a signal (token) for the network.

Bridge A device used to connect two networks together.

Power Supply Used to maintain the optical transmission paths of the network.



Note A local power supply is required at each node to maintain communications in the event of a Unit malfunction.

1-1-2 Relationship between Systems

Of OMRON's three FA Systems, the SYSMAC NET Link System is the highest level networking system. OMRON's three kinds of FA Systems (SYSMAC NET, SYSMAC LINK, SYSMAC BUS/2) are related to each other as described below.

SYSMAC BUS/2

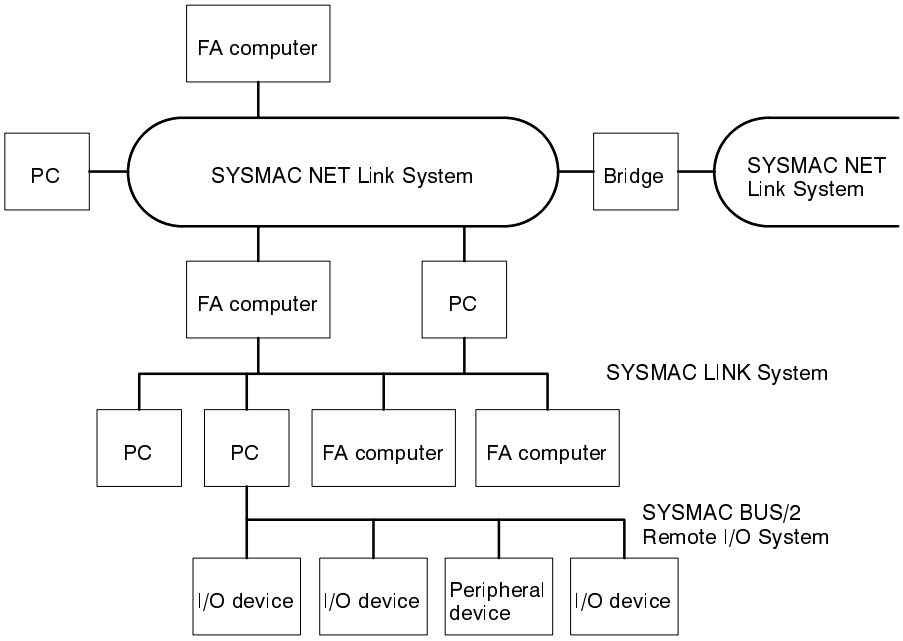
The SYSMAC BUS/2 Remote I/O System connects a PC to remote I/O devices allowing distributed control using a single PC.

SYSMAC LINK System

The SYSMAC LINK System is usually a medium-sized network using a comparatively large number of PCs for large data transmission. The SYSMAC LINK System allows the nodes on the network to communicate with each other without programming via data links. If the network is connected to another network, the data links allow communications between the networks.

SYSMAC NET Link System

The SYSMAC NET Link System is a LAN (Local Area Network) system used for large data transmission. By connecting the SYSMAC NET Link System to other lower-level networks, you can be in full control of the whole production line.



Note A large host computer other than an IBM PC/AT -compatible computer can be connected to the SYSMAC NET Link System using an NSU.

1-2 SYSMAC NET Link System Features

The SYSMAC NET Link System is a versatile LAN (Local Area Network) that provides the following features.

Reliable, Fast, High-capacity Communications

Optical fiber cables are used to connect the SYSMAC NET Link Unit and other nodes, which will allow highly reliable communications without being influenced by electrical noise. The SYSMAC NET Link Unit transmits data as large as 2 kb at high speed (2 Mbps).

Large-scale Systems

The SYSMAC NET Link System can include up to 126 nodes (SYSMAC Link Units, NSBs, and NSUs), and the distance between two nodes can be 800 m maximum (or use a repeater to allow up to 3 km).

Bridging Networks

A Bridge can be used to connect a SYSMAC NET Link System to another SYSMAC NET Link System. The SYSMAC NET Link Unit also has a bridge feature that enables SYSMAC NET Link Systems to communicate with one another through PCs that belong to two or more networks. A separate SYSMAC NET Link Unit is required for each SYSMAC NET Link Network.

If you mount a SYSMAC LINK Unit or SYSMAC BUS/2 Remote I/O Unit together with the SYSMAC NET Link Unit on a PC in a network, the network can communicate with a SYSMAC Link System or SYSMAC BUS/2 Remote I/O System. This feature is called a gateway.

Active Communications

The SYSMAC NET Link Unit allows data exchange between two PCs or between a host computer and a PC on a network. To send data to a PC on the network, send a command to the SYSMAC NET Link Unit on the PC to read or write data without having to program the transfer in the PC itself.

Distributed Control

The SYSMAC NET Link Unit features data links that eliminate the need for a communications program. Data links make it possible to automatically exchange data between two nodes. Because data written at remote PCs is automatically transferred to each PC in the data link, the PCs can access data originating at other PC merely by reading from it's own memory.

Versatile Diagnostics

A variety of versatile diagnostic commands are available, which allow easy and convenient daily maintenance.

RAS Functions

The SYSMAC NET Link Unit incorporates RAS (Reliability, Assurance, and Safety) functions such as automatic loopback (useful when a transmission path is disconnected), node bypass (in the event of power failure), tests between two nodes, and error recording.

Combine C-/CV-series PCs

The CV-series SYSMAC NET Link Unit can be connected to C-series SYSMAC NET LINK Units to provide communications between C-series and CV-series PCs.

1-3 Settings

The following provides an overview of the settings for the SYSMAC NET Link Unit.

1-3-1 Network Setup

This section provides an overview of the setting and other steps necessary to setup a SYSMAC NET Link System.

Network Addresses (Routing Tables)

For data exchange between networks using the PCs, you must set routing tables in the PC's memory that lists the addresses of the networks.
The routing table includes the following:

- Relay Network Table
  Describes the path to take to reach any other network.
- Local Network Table
  Describes the Communications Units mounted at the local node and the networks they belong to.

The routing tables can be set on the PC using the CVSS on an IBM PC/AT compatible computer or using a routing table setting command from another node. For details refer to p. 23.

Node Addresses

Each node requires a node address. If a node is occupied by a SYSMAC NET Link Unit, the node address is set on rotary switches on Unit. For details refer to p. 10.

Unit Numbers

If you mount more than one Communications Unit on a single PC, each Unit requires a unit number for identification. For the SYSMAC NET Link Unit, this number is set using rotary switches. Unit numbers are required for communications between networks. Without them, the PC cannot identify the Units. Unit addresses, which are required for datagram service, are determined from unit numbers. For details refer to p. 10.

Communications Settings

The following Communications Unit settings are required from the CVSS.

- Transmission/Reception Code
  Designate binary or ASCII to be used for transmission and reception of data. For details refer to p. 42.
- Datagram format (FINS/C mode)
  Designate CV-mode or C-mode for the datagram format (command/response).

Note Use the CVSS to set communications unit settings. Refer to the *CVSS Operation Manual: Online* for details.

1-3-2 Data Link Settings

The following settings are required for data links. For details refer to *Section 5 Data Links*.

Data Link Nodes

The nodes that will be part of a data link are designated in the data link tables on the master node.

Communications Settings

The following settings must be made at each node. After the settings have been made, restart the PC or SYSMAC NET Link Unit.

- Master/Slave
  Each node must be set either as a master or as a slave in the data link.
- Data Link Tables
  Select the method of setting data link tables: automatic or manual. If automatic setting is used, designate the data link areas (I/O Area or DM Area). These settings are effective only on the master node.
- Number of Words
  If automatic setting is used, designate the number of data link words per node. The settings are effective only on the master node.
- Transmission Delay
  Designate the transmission delay between two slave nodes. Transfer the setting directly into the memory of the master node or set the delay from the CVSS. The settings are effective only on the master node.

Note Use CVSS to set any of the system setting switches. Refer to the *CVSS Operation Manual: Online* for details.

1-3-3 Connecting SYSMAC NET Link Units

The SYSMAC NET Link System requires that the SYSMAC NET Link Units be wired and that the network nodes be connected via optical fiber cable.

1-3-4 Other Settings

The following additional settings may be required. Refer to *Section 2 Installation* for details.

Data Link Tables

You will need to set the data link tables if you have specified manually set data links. The settings can be made from a PC, IBM PC/AT or compatible, or peripheral devices connected to the network. For details refer to p. 104.

Response Monitor Time

Before you carry out a test between two nodes, you can adjust the monitor time (i.e., the period that the Unit will wait for a response). Set the monitor time as a parameter in the SEND(192), RECV(193), or CMND(194) instructions used for datagram service.

Software Switches

Software switches can are used in the following cases:
To start and stop node tests and to designate nodes for the test. Refer to *Section 6 RAS Functions* for details.

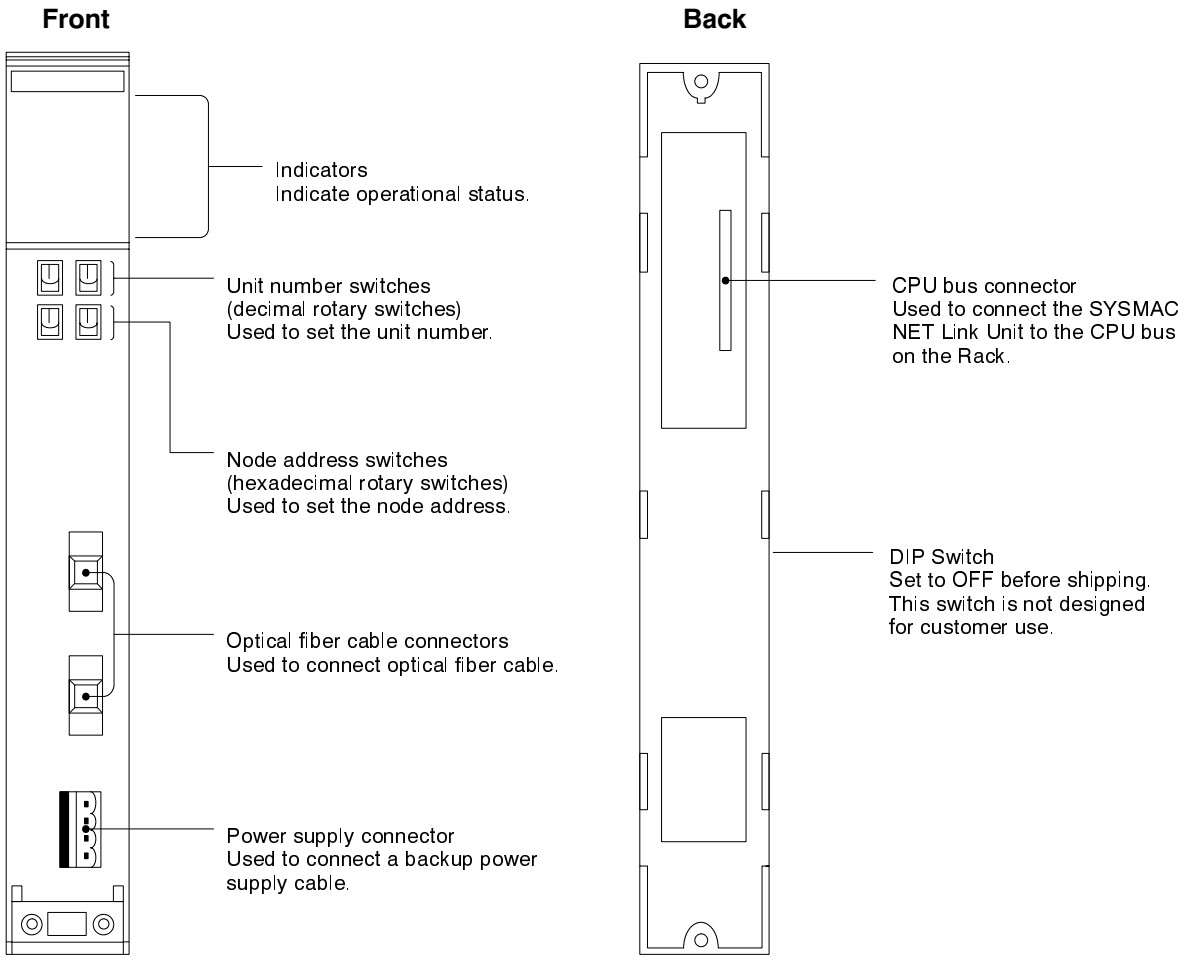
To start and stop data links. Refer to *Section 6 RAS Functions* for details.

SECTION 2
Installation

This section describes the components of the SYSMAC NET Link Units and the procedures required to install the SYSMAC NET Link Units.

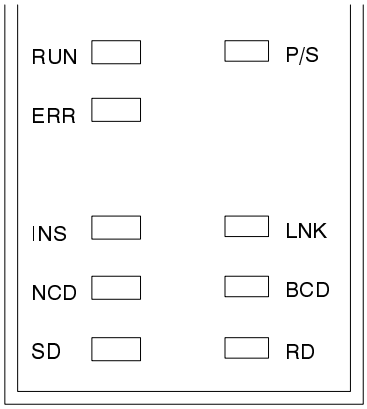
2-1 Nomenclature

2-1-1 Front and Back Panels



2-1-2 Indicators

The indicators shown in the following illustration will be lit, off, or flashing according to the operating status of the SYSMAC NET Link Unit, as described in the following table.

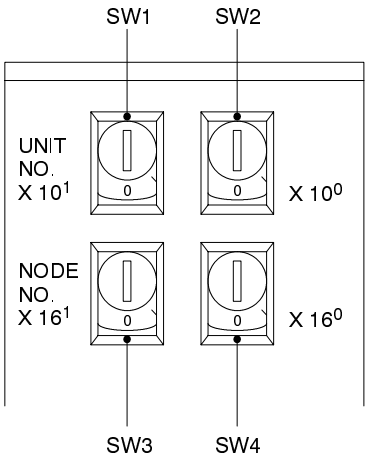


Indicator	Color	Indication	Meaning	Page
RUN	Green	Lit	Unit is operating.	124, 131
		Not lit	Error has occurred.	
P/S (power supply)	Green	Lit	Power is on.	113
		Not lit	Power is not on.	
ERR (error)	Red	Lit	Initial setting error (see note) occurred or error occurred during test between two nodes.	117, 124, 131
		Not lit	Initial settings are normal and no error occurred during test between two nodes.	
INS (Network insertion)	Orange	Lit	Unit can communicate.	---
		Not lit	Unit cannot communicate.	
LNK (data link)	Orange	Lit	Unit is part of active data link.	124, 133, 134
		Flashing	Data link error has occurred.	
		Not lit	Unit is not part of active data link.	
NCD (normal carrier detected)	Orange	Lit	Unit is receiving normal loop communications data.	124, 131
		Not lit	Unit is not receiving normal loop communications data.	
BCD (back loop carrier detected)	Orange	Lit	Unit is receiving backloop communications data.	124, 131
		Not lit	Unit is not receiving backloop communications data.	
SD (send)	Orange	Lit	Unit is sending data.	---
		Not lit	Unit is not sending data.	
RD (receive)	Orange	Lit	Unit is receiving data.	---
		Not lit	Unit is not receiving data.	

Note The following are initial setting errors: Node address error, unit number error, PC setup error, and routing table error.

2-1-3 Rotary Switches

The SYSMAC NET Link Unit provides a decimal rotary switch and hexadecimal rotary switch on the front panel with which you set the node address and unit number. You must turn off the PC when setting the rotary switches. If you have changed the settings when the PC is not turned off, you must restart the SYSMAC NET Link Unit or the PC to use the new settings.



Set the unit number with SW1 and SW2. Set the node address with SW3 and SW4. The setting ranges are as follows:

Switches	Range
SW1 and SW2 for unit number	00 to 15 (decimal)
SW3 and SW4 for node address	01 to 7E (hexadecimal); 1 to 126 (decimal)

Unit Number

Set ten's digit with SW1 and one's digit with SW2. The following illustration shows that a unit number of 12 has been set.

Note

1. All unit numbers must be between 00 and 15 or an error will result and the ERR LED on the front panel will be lit.
2. Each Unit connected to the same PC must have a unique number.
3. You must turn off the PC to set the rotary switches, or if you have changed the settings when the PC is not turned off, you must restart the SYSMAC NET Link Unit or the PC to use the new setting.

Unit Address

The datagram service must be able to designate not only the nodes, but also the peripheral devices connected to nodes. The unit address, which is automatically calculated from the unit number, is used to designate not only the node, but the device at the node (e.g., PC, SYSMAC Link Unit, or peripheral device). The following table shows the unit addresses (hexadecimal) calculated from the unit numbers (hexadecimal) and the corresponding unit address for peripheral devices.

Device	Unit address (hexadecimal)
PC (CPU)	00
SYSMAC NET Link Unit	FE
CPU Bus Unit	10 + unit number

Unit number: 0 to F (0 to 15 decimal)

Example: The unit address of SYSMAC NET Link Unit with a unit number of 12 as a CPU Bus Unit would be 10 + C = 1C (hexadecimal).

Node Address

All node addresses must be between 1 and 126 in decimal. To set the node address, you must first convert it to a hexadecimal value and then set the sixteen's

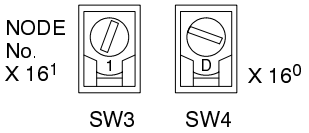
digit with SW3 and one's digit with SW4. The setting range for the switches is thus 01 to 7E.

The node address can be calculated from the switch setting using the following formula:

Node address (decimal) = Value on SW3 x 16 + value on SW4

Example: The switch setting for a SYSMAC NET Link Unit with a node address of 29 (decimal) would be computed as follows:

29 = 1 x 16 + 13 = 1D (hexadecimal)



Note

1. An error will result if the node addresses are not between 1 and 126.
2. Each node on a network must have a unique address.
3. You must turn off the PC to set the rotary switches, or if you have changed the settings when the PC is not turned off, you must restart the SYSMAC NET Link Unit or the PC to use the new setting.

2-2 Wiring

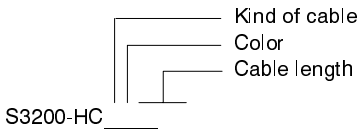
Optical fiber cables are used to connect the SYSMAC NET Link Units into a network. The procedure for connect the Units is described in this section.

Materials

The following are required to connect the SYSMAC NET Link Units.

Optical Fiber Cable

Use the following H-PCF optical fiber cable.



Kind of Cable

L	With power line
C	Without power line

Color

B	Black
O	Orange

Cable Length

101	10 m
501	50 m
102	100 m
502	500 m
103	1,000 m

Optical Fiber Cable Connector

The following two kinds of optical fiber cable connectors are required.

Purpose	Model	Required number
Connecting node and cable	S3200-COCF2011 (fulllock) S3200-COCF2511 (halflock)	Two per node
Connecting two cables	S3200-COCF62M and S3200-COCF62F to be used in combination S3200-COIAT2000	One per joint

Note If you connect two optical fiber cables, the maximum transmission distance of each optical fiber cable will decrease because of loss at the joint. For details, refer to the H-PCF Optical Fiber Cable Installation Manual.

Tools

Use the following tools to connect an optical fiber cable to the connector.

Optical connector assembly tool set: S3200-CAK1062

Optical Power Tester

Both the S3200-CAT2000 and S3200-CAT3200 include a general-purpose tester and a Head Unit (S3200-CAT2002 or S3200-CAT3202). If you need to test SYSMAC NET Link Units that use all the optical fiber cables listed in the above table, purchase the S3200-CAT2000 and S3200-CAT2002 Head Unit or the S3200-CAT3200 and S3200-CAT3202 Head Unit.

There is no difference between the S3200-CAT2000 and S3200-CAT3200 except for the Head Unit. If you use all the connectors listed in the above table, purchase a combination of the S3200-CAT2000 and S3200-CAT3202 or the S3200-CAT3200 and S3200-CAT2002.

Set	Head Unit	Applicable connector
S3200-CAT2000	S3200-CAT2002	S3200-COCF2011 or S3200-COCF2511
S3200-CAT3200	S3200-CAT3202	S3200-COCF62M or S3200-COCF62F

Master Fiber

Model	Applicable connector
S3200-CAT2001H	S3200-COCF2011 or S3200-COCF2511
S3200-CAT3201	S3200-COCF62M or S3200-COCF62F

Note To connect an optical fiber cable to a connector, refer to the Instruction Sheet for the S3200-CAK1010 Tools.

Transmission Distance

An optical fiber cable with H-PCF crimp-style connectors on both ends has a maximum transmission distance of 800 m. (There is a loss of approximately 1.5 dB due to the connectors.)

Connecting Units

After attaching the connectors to optical fiber cables to make a transmission path, connect them to the SYSMAC NET Link Unit as follows referring to the following diagram (numbers in parentheses refer to the following steps):

1, 2, 3...

1. Attach the bracket to the Unit and secure tightly with the screws and bushes.
2. Disconnect the power supply connector from the SYSMAC NET Link Unit.
3. Connect the power supply lines to the connector with a flat blade screwdriver. Make sure that no bared wires are exposed outside the connector. The connection order of the wires from the uppermost side to the lowermost side is as follows except for the terminator:

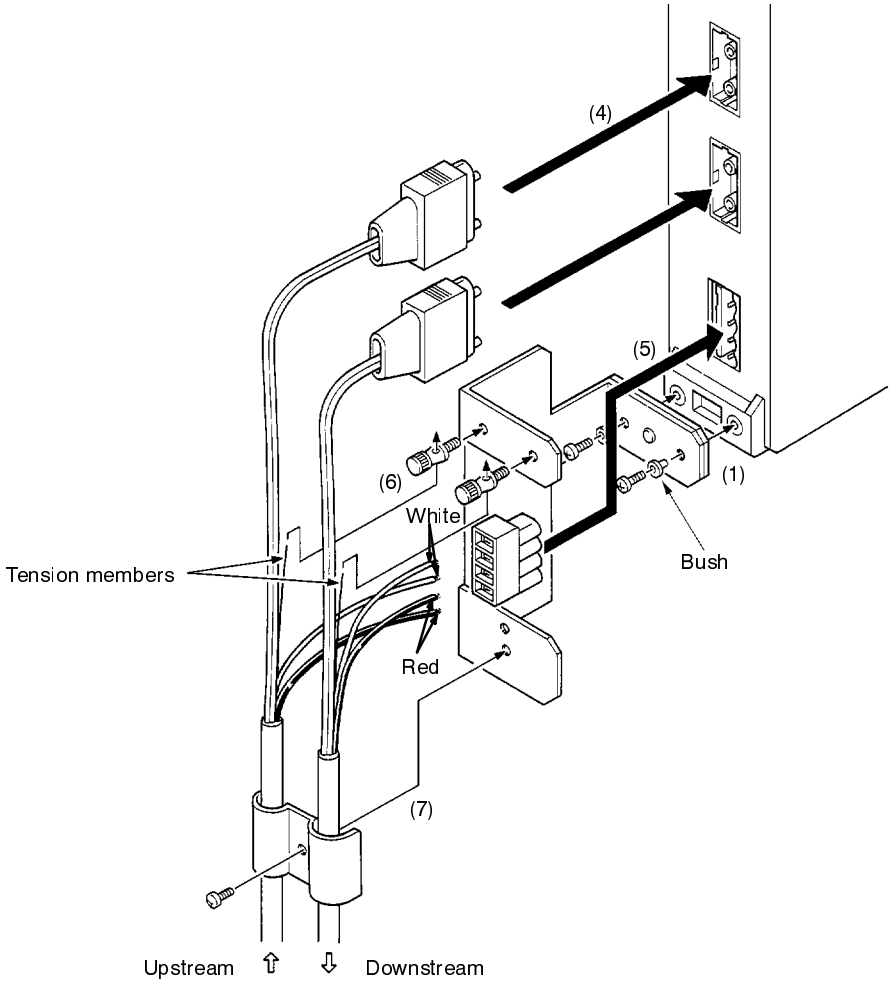
   a) White for downstream side

b) White for upstream side

c) Red for downstream side

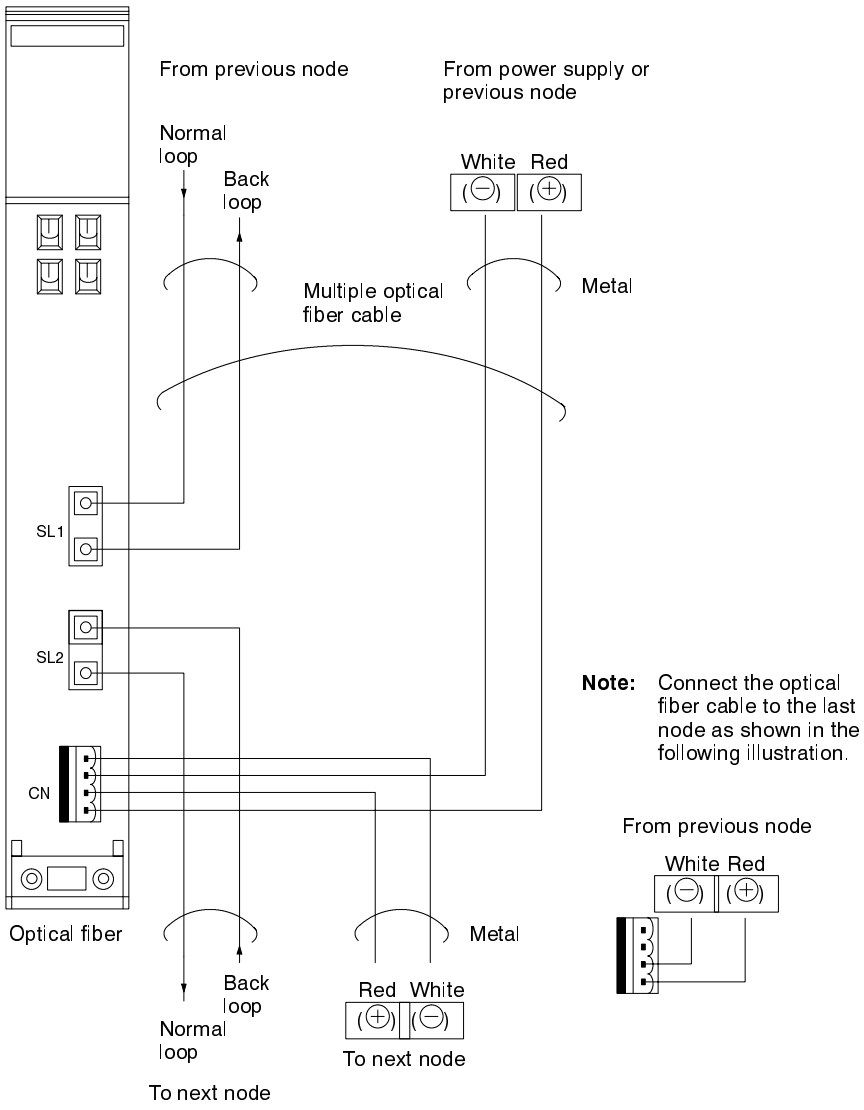
d) Red for upstream side

4. Insert the optical fiber cable connector for the upstream side to the upper connector and the optical fiber cable connector for the downstream side to the lower connector securely on the SYSMAC NET Link Unit so that the protruding part of both the connectors is on the left side.
5. Insert the power supply connector to the SYSMAC NET Link Unit.
6. Pass the tension members through the holes in the terminals and securely fasten the terminals with the screws.
7. Fasten the optical fiber cables securely to the bracket with the screw. Any bends in the optical fiber cables must be 100 mm or greater in radius.

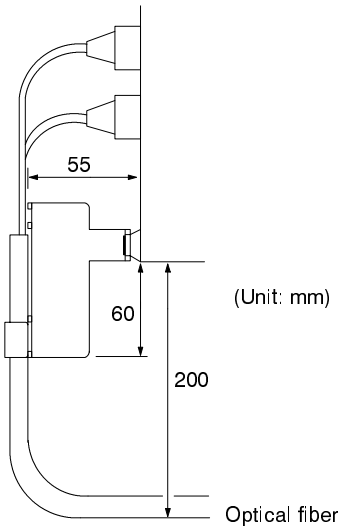


Laying Cables

Connect the cable to each node as shown in the following illustration. SL1 of the SYSMAC NET Link Unit connects to SL2 of the previous (upstream) node and SL2 connects to SL1 of the next (downstream) node.



Any bends in the optical fiber cables must be 100 mm or greater in radius. Therefore, before mounting the SYSMAC NET Link Unit, make sure that the depth of the panel is sufficient to accommodate the Unit and the cables.

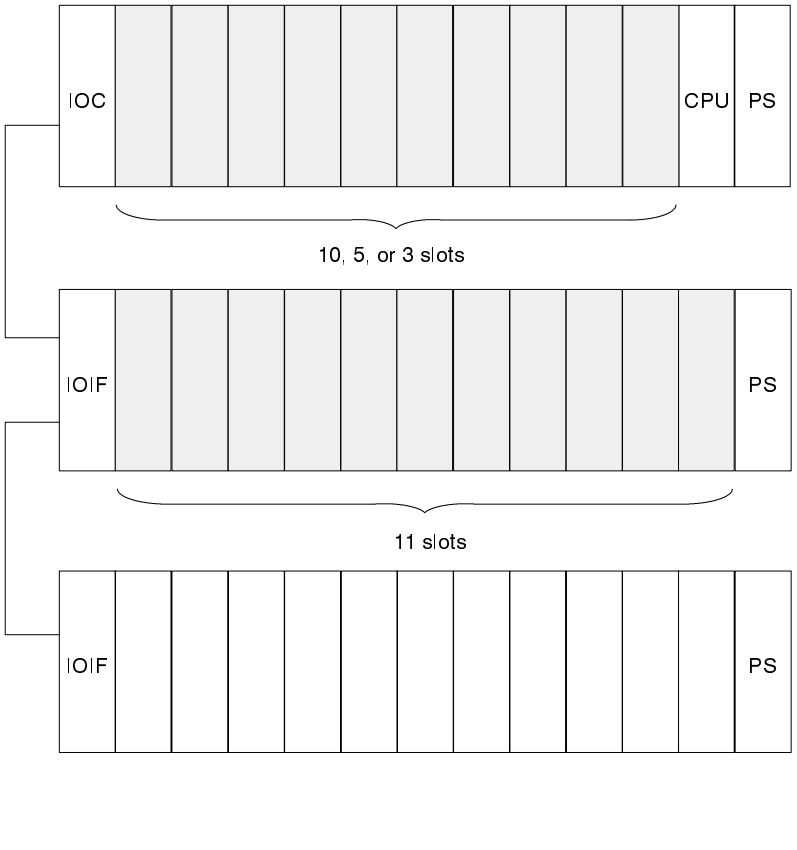


2-3 Mounting to Racks

You can mount the SYSMAC NET Link Unit to the Backplane of the CPU or Expansion CPU Rack of a CV-series PC.

Mounting to Backplane

Mount up to four CV500-SNT31 SYSMAC NET Link Units to the CV500-BC101/051/031 Backplane or CV500-BC111 Expansion CPU Backplane as shown in the following illustrations. The maximum number of special CPUs (such as SYSMAC LINK and SYSMAC BUS/2 Units) that can be mounted to the backplane or expansion CPU backplane is 16.



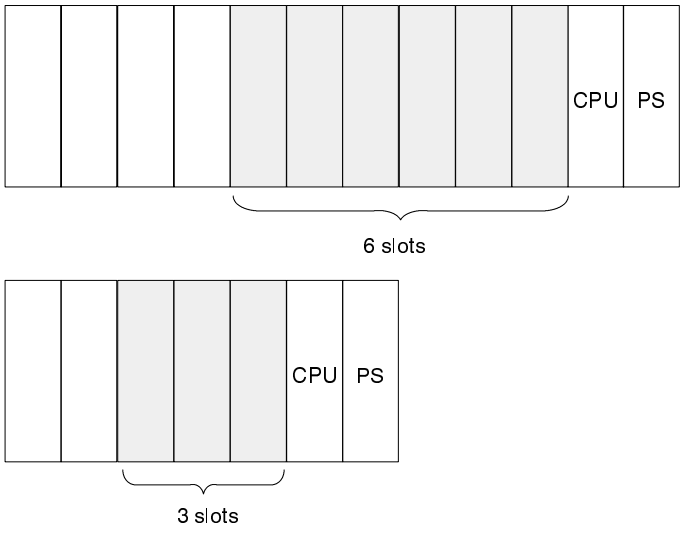
CPU Rack
(CV500-BC101/051/031)
Any of the slots shown in the illustration are available. The farthest left slot cannot be used.

Expansion CPU Rack
(CV500-BC111)
Any of the 11 slots as shown in the illustration are available.

Expansion I/O Rack
All slots are not available.

IOIF: I/O Interface Unit
IOC: I/O Control Unit
CPU: CPU
PS: Power Supply Unit

The CVM1-BC103/053 CPU Backplanes can also be used, but the Unit must be mounted to the rightmost 6 slots on the CVM1-BC103 or to the rightmost 3 slots on the CVM1-BC103.

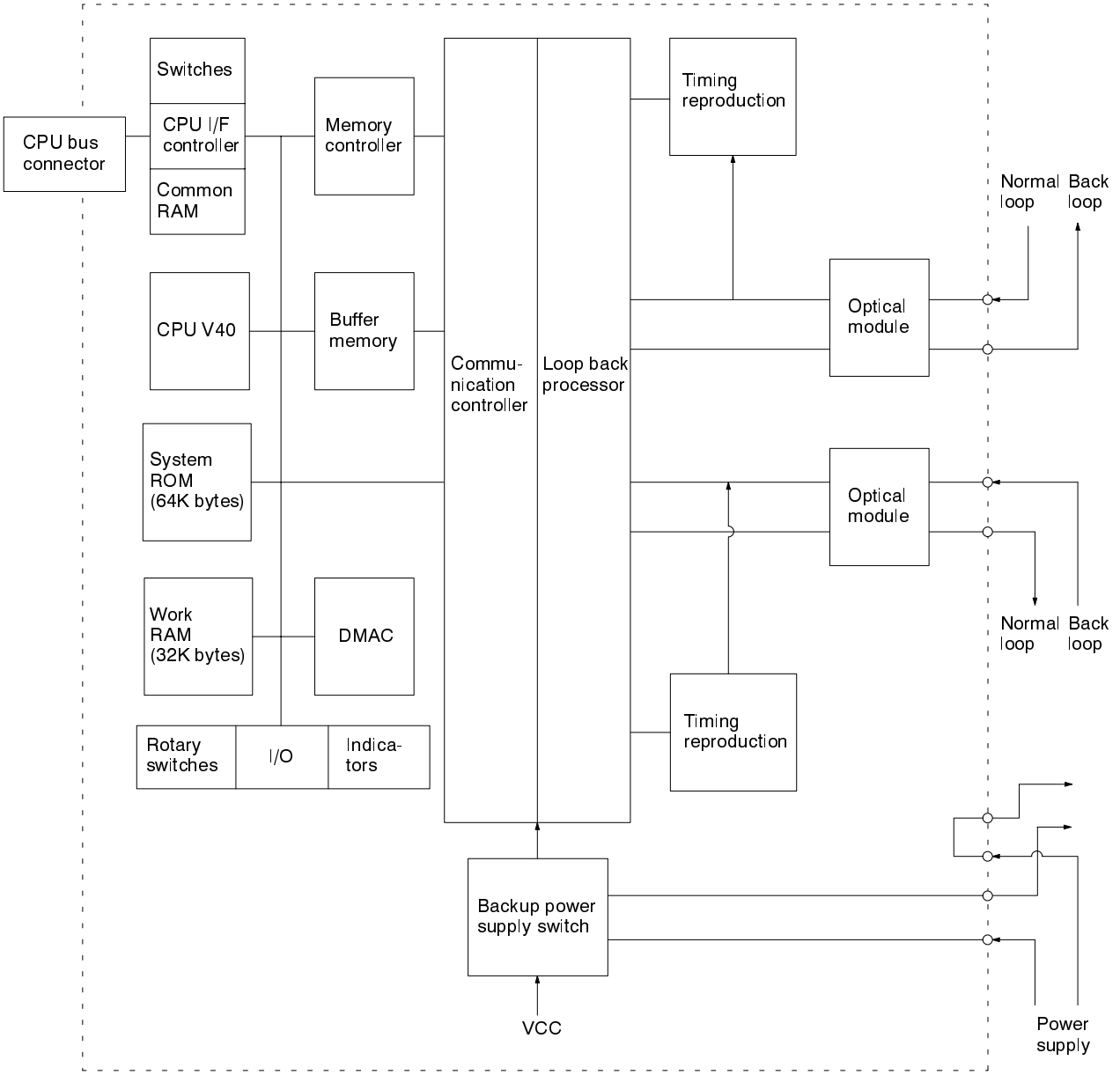


CPU Rack
(CVM1-BC103)

CPU Rack
(CVM1-BC053)

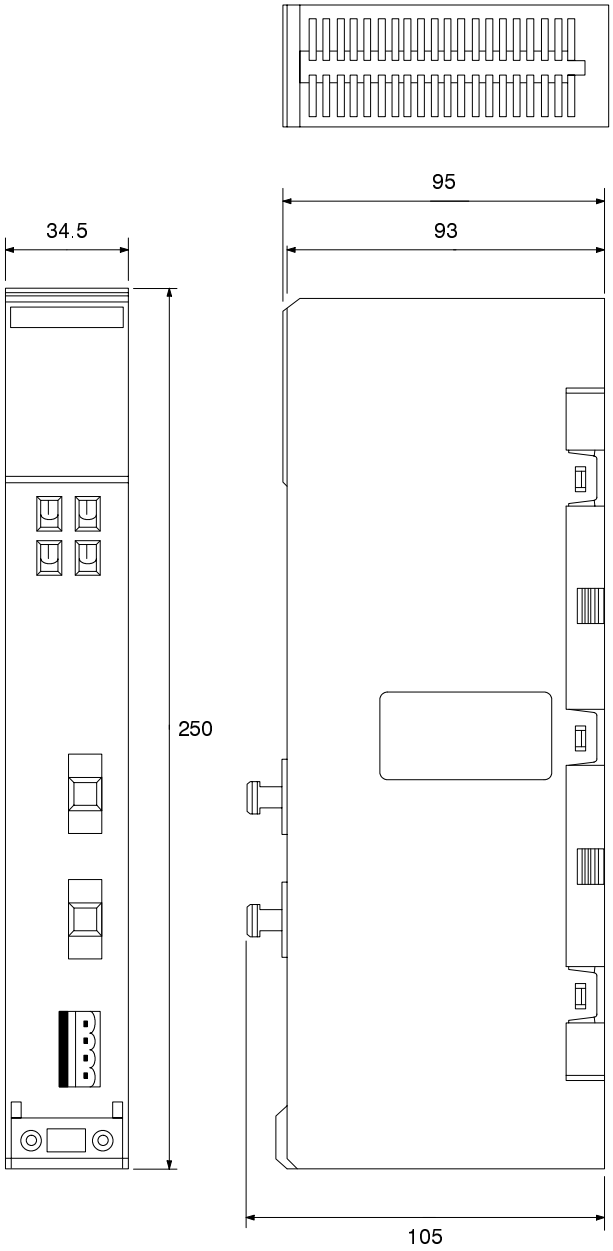
2-4 Block Diagram

The following diagrams shows the basic internal arrangement of the CV500-SNT31 SYSMAC NET Link Unit.



2-5 Dimensions

The dimensions of the CV500-SNT31 SYSMAC NET Link Unit are shown below. All dimensions are given in millimeters.



SECTION 3
Basic System Features

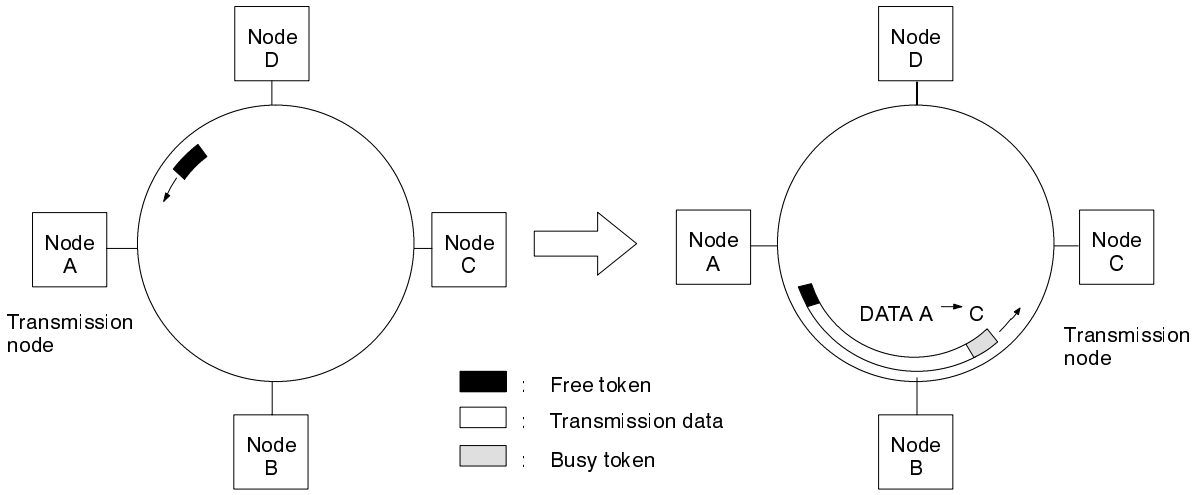
This section describes some of the basic features in a SYSMAC NET Link System, including the basics of data transmissions and data links. Details on commands and data links are provided in later sections of this manual.

3-1 Data Transmissions

This section introduces the basic data transmission features of the SYSMAC NET Link Unit.

3-1-1 Token Ring

The SYSMAC NET Link System works in a loop configuration. Communications among nodes follows a protocol called token ring. The token ring architecture controls network communications by passing a token around the loop. When a node detects a free token, it has the option to transmit data to any other node. This is the only time the node is allowed to transmit. When it detects the free token, it holds the free token and releases a busy token. Then the transmitting node releases the data packet. When the node has completed transmission, it releases the free token. The token is then available to the rest of the network. The token ring network allows only the node with the token to transmit data on the network.



3-1-2 Datagram Service

The SYSMAC NET Link Unit incorporates a datagram service, which allows data exchange between PCs or an IBM PC/AT or compatible and PC on a network by designating the destination node for data transmission. When the local node sends a command code block to the designated node, the designated node returns a response code for it. For details refer to *Section 4 Datagram Service*.

3-1-3 Data Links

The SYSMAC NET Link Unit incorporates a data link capability, which enables PCs to share data automatically. With data links, the nodes can communicate with one another so that the designated areas of the nodes will always be the same. All you have to do is to write or read the data to or from the designated area of the local node to access data originating at another node or automatically send data to another node. For details refer to *Section 5 Data Links*.

3-1-4 Diagnostics and Name Service

The SYSMAC NET Link Unit incorporates diagnostic features and a name service.

Diagnostics

The diagnostic features enable a node to diagnose another node on the same network as follows:

- Status Read Response
  Enables the local node to read the status of the designated node.

- Memory Dumping Response
  Enables the designated node to dump memory.
- Memory Write Response
  Enables the designated node to write to memory from 0000:0100 to 0000:7FFF (segment:offset).
- Echo-back Response
  Enables the designated node to send back a copy of data that has been transmitted.
- Broadcast Test Response
  Enables the local node to broadcast a transmission to all nodes. The results from each node can be read by executing STATUS READ.
- Loop Check Function
  Enables the local node to check the loop.
- Scope Function
  Enables the local node to collect the transmission data of the designated node.

Name Service

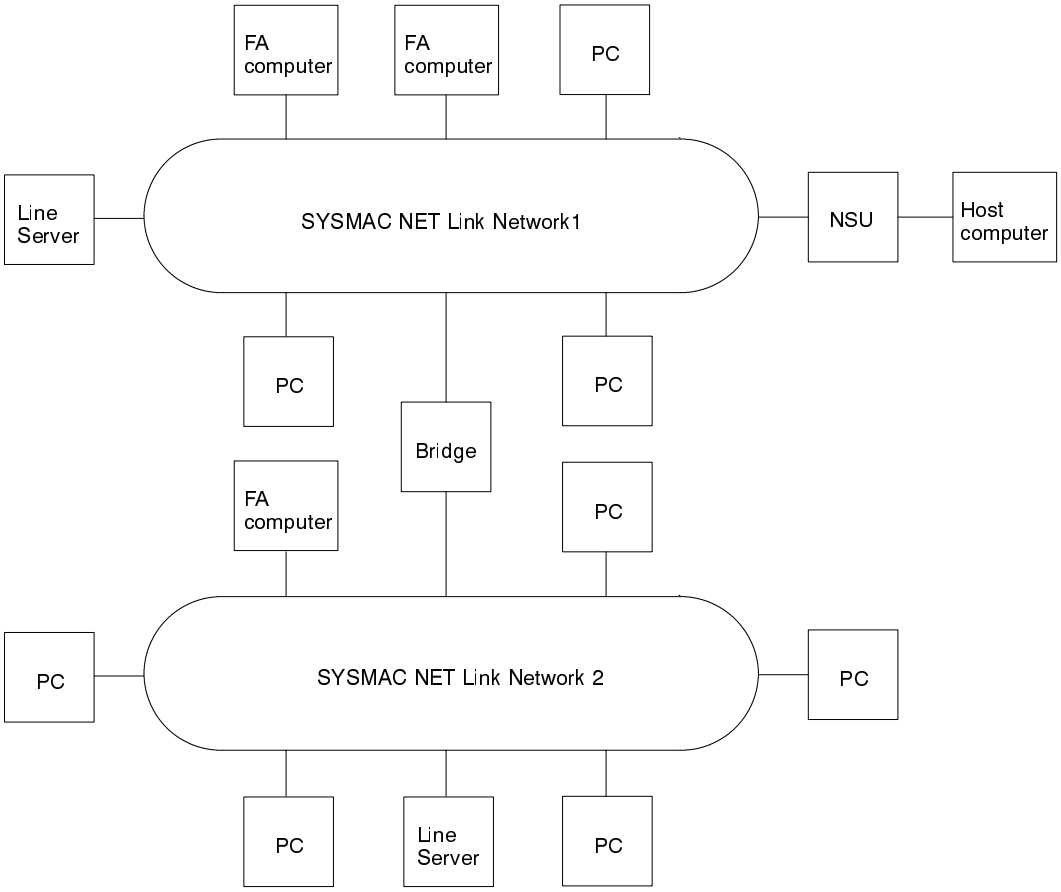
Names can be assigned to nodes for use in delivering commands. When a command using a specified name is sent, the node with the specified name responds. Datagram service commands and responses and used to set, read, and delete names.

3-2 Connections between Networks

The SYSMAC NET Link Unit allows data transfer between networks either through a separate device called a Bridge or through a PC that belongs to two or more networks.

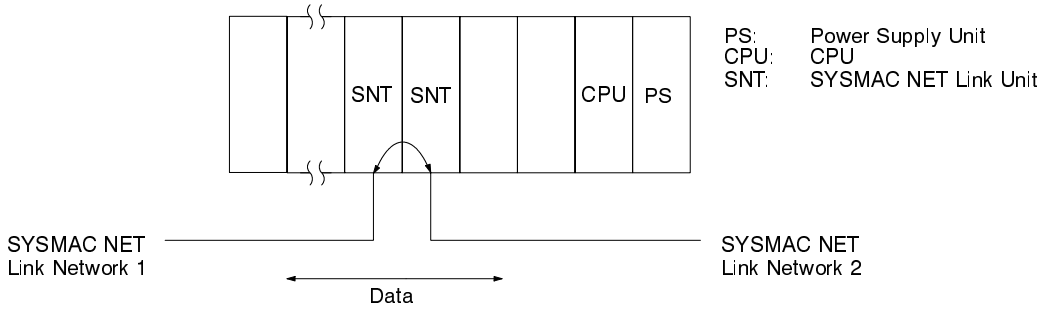
3-2-1 S3200-NSUG4-00E Bridge

A single Bridge connects two networks as shown in the following diagram. Each network can support up to 20 Bridges. Each Bridge counts as a node in each of the networks to which it is connected.



3-2-2 Bridging via PCs

If you mount more than one SYSMAC NET Link Unit on a single PC, the PC will allow data transfer between nodes on different networks, thus functioning like a Bridge.



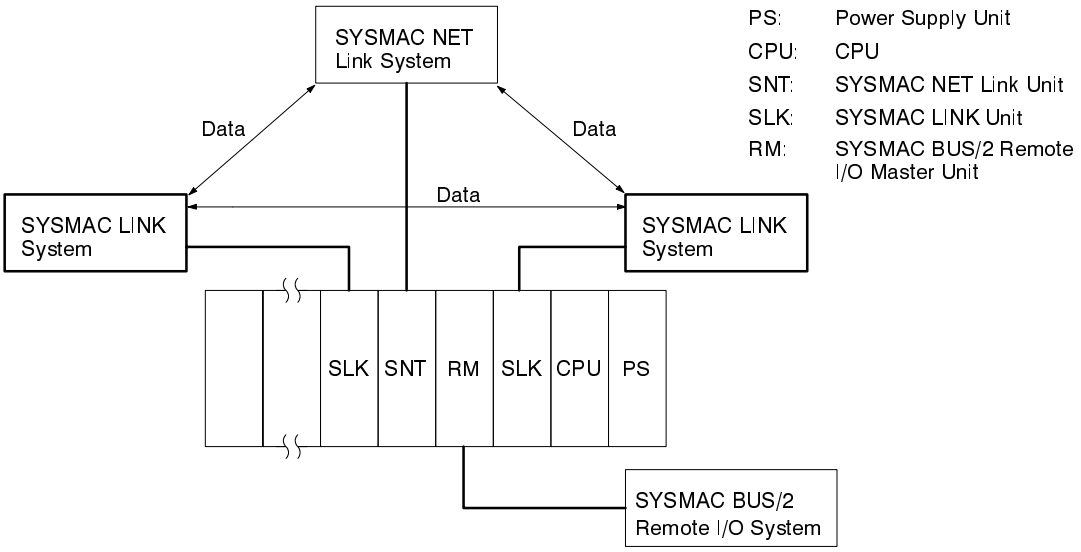
It is possible to transmit commands to nodes on remove networks through combinations of S3200-NSUG410 Bridges and bridging PCs.

Note a) You can mount up to 4 SYSMAC NET Link Units to a single SYSMAC CV-series PC.

b) Use the S3200-NSUG410 Bridge rather than a bridging PC if you need to bridge networks frequently or if you require high-speed network communications.

Gateways

If you mount one or more SYSMAC Link Units (CV500-SLK11 and CV500-SLK21) and one or more SYSMAC NET Link Units on the same PC, the PC will allow data transfer between nodes on different types of networks using a function called a gateway.

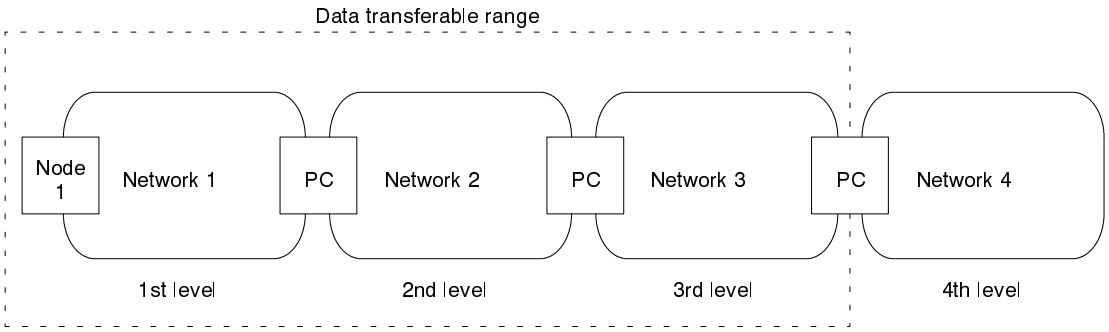


If you connect a peripheral device (e.g., IBM PC/AT-compatible) to a Slave Rack in the above SYSMAC BUS/2 Remote I/O System, it would be possible to program or monitor the PCs in the SYSMAC NET Link Systems and the SYSMAC LINK System as well as the PC through the Remote I/O Master Unit of the SYSMAC BUS/2 System. Furthermore, the PCs and FA computers (e.g., IBM PC/AT-compatible) on each network can also exchange data with each other and with the PCs in the various networks.

Note The maximum number of data bytes that can be exchanged among the Systems will be limited to 552 when communicating through a gateway.

Communications Limit

There is a limit to number networks through which data can be transferred. Data cannot be exchanged with a network that is three or more networks away. In the following diagram, node 1 in Network 1 can exchange data with nodes in the second-level and third-level networks in the following diagram, but not with nodes in the fourth-level network.



3-3 Routing Tables

Routing tables must be set in the PC to exchange data between two networks. The routing tables provides the data transmission path between the local network and remote networks.

There are two kinds of routing tables, local network tables and relay network tables.

Local Network Tables

A local network table provides the network address and corresponding unit number for each SYSMAC NET Link Unit or SYSMAC LINK Unit that is mounted to the PC. You can set up to 16 local networks for a single PC. Table entries are not necessary for SYSMAC BUS/2 Remote I/O Systems.

Relay Network Tables

A relay network table provides the transmission path from the local network to the designated network. There can be up to 20 entries in a relay network table for a single PC. You need not set a relay network table if there will be no data exchanges with remote networks.

3-3-1 Setting Routing Tables

Routing tables can be set from a computer on the network or from a CV-series PC by sending a PARAMETER AREA WRITE command. For details, refer to *Section 4-10-7 Parameter Area Write*.

The routing tables can also be set using CVSS. Refer to the *CVSS Operation Manual: Online* for details.

Note After you set the routing tables with PARAMETER AREA WRITE, be sure to restart the PC. You do not need to restart the PC if you have set the routing table with CVSS because CVSS automatically resets the PC.

3-3-2 Local Network Tables

A local network table consists of a list of unit numbers and the corresponding network addresses for all local networks. If a single PC is mounted with more than one SYSMAC NET Link Unit and/or SYSMAC LINK Unit, the local network table will need to list the corresponding network for each Unit.

Note The SYSMAC BUS/2 Remote I/O System does not have a network address and is not registered in local network tables.

Setting Data

Set the following data for each Unit.

Item	Range	Contents
Local network address	1 to 127	The address of the network to which the SYSMAC NET Link or SYSMAC LINK Unit belongs
CPU Bus Unit unit number	0 to 15	The unit number of the SYSMAC NET Link Unit or SYSMAC LINK Unit

The local network table setting display will appear on the CVSS as follows:

[Local Network Table]

#	Loc Netwk	SIOU unit #
1	001	00
2		
3		
4		
5		
6		
7		
8		

#	Loc Netwk	SIOU unit #
9		
10		
11		
12		
13		
14		
15		
16		

3-3-3 Relay Network Tables

To exchange data between two networks, you must set a relay network table that specifies the data transmission path for remote networks.

Setting Data

Data transmission paths include the following.

Item	Range	Contents
Destination network	1 to 127	The network address of the designated node
Relay network	1 to 127	The address of the network through which the destination network can be reached
Relay node	1 to 126	The address of the node on the relay network through which the destination network can be reached

The relay network table setting display will appear on the CVSS as shown below. You can register up to 20 destination networks.

[Relay Network Table]

#	End Netwk	Relay PC ID	Relay Netwk	Relay node
1	002		001	001
2				
3				
4				
5				
6				
7				
8				
9				
10				

#	End Netwk	Relay PC ID	Relay Netwk	Relay node
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Each node can be assigned a unique PC name (PC ID). If a node has a PC name (the name of the PC on the node), you need not designate the network address or node address. For details, refer to the *CVSS Operation Manual: Online*.

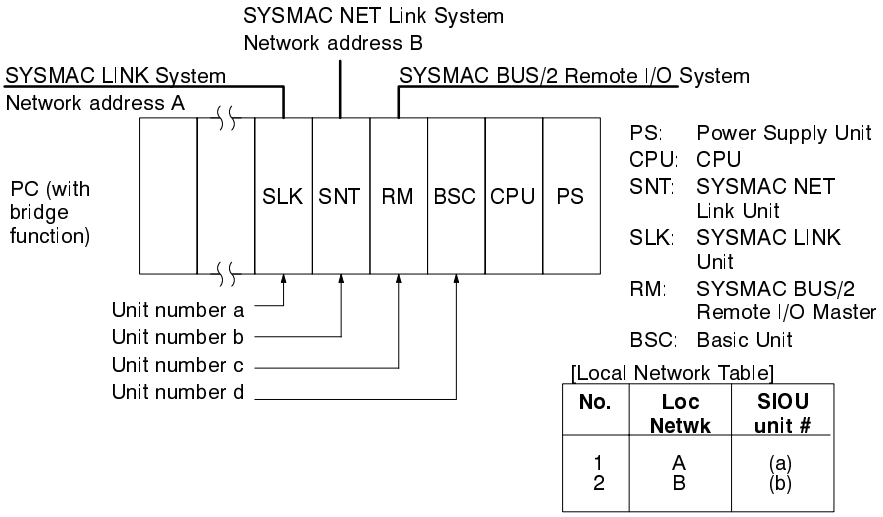
Note

1. You must set a relay network table that will not conflict with the local network table or a routing table error will result.
2. Each network in the entire interconnected system must have a unique address.
3. The node address range for SYSMAC NET Link Units must be between 1 and 126.
4. The node address range for SYSMAC LINK Units must be between 1 and 62.

3-3-4 Routing Table Examples

Local Network Table with More Than One Unit

The following illustration shows an example of routing table settings for a single PC mounted with more than one Unit. The PC shown here belongs to two networks that require routing tables, and there are thus two entires in the local network table. The SYSMAC BUS/2 System does not have a network address and is not registered on the local network table.

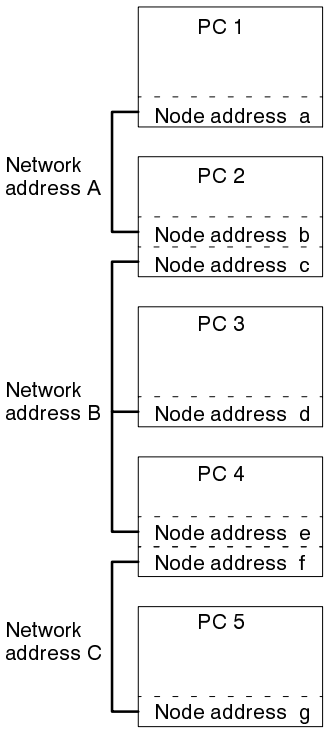


[Local Network Table]

No.	Loc Netwk	SIOU unit #
1	A	(a)
2	B	(b)

Three Connected Networks

The following shows an example of routing table setting with three networks connected to one another. Take a look at the relay network table for PC 3. When network A is the destination network for PC 3, B is the relay network and c is the relay node. When network C is the destination network, B is the relay network and e is the relay node.



[Relay Network Tables]

No.	End Netwk	Relay PC ID	Relay Netwk	Relay node
1	B		A	b
2	C		A	b

No.	End Netwk	Relay PC ID	Relay Netwk	Relay node
1	C		B	e

No.	End Netwk	Relay PC ID	Relay Netwk	Relay node
1	A		B	c
2	C		B	e

No.	End Netwk	Relay PC ID	Relay Netwk	Relay node
1	A		B	c

No.	End Netwk	Relay PC ID	Relay Netwk	Relay node
1	A		C	f
2	A		C	f

SECTION 4
Datagram Service

This section describes communications between network nodes and provides the command and response formats for CV-mode commands. Refer to *Section 9 Systems Combining C-series and CV-series PCs* for details on C-mode commands.

4-1 Introduction

The SYSMAC NET Link Unit provides a datagram service, which enables data transmissions between PCs, or an IBM PC/AT or compatible computers and PC on a network. This service also enables data exchange between two networks.

The datagram service allows the local node to send a command with data to a destination node and the destination node to return an appropriate response according to the command. The service is associated with broadcast transmissions, which enable a node to send the data to all the other nodes on the same network.

4-1-1 PC Communications

The SYSMAC NET Link Unit enables a PC to communicate with other nodes on the same network in four ways as follows:

- **Data from an IBM PC/AT or Compatible Computer**
  A program is required on the IBM PC/AT-compatible computer so that it can send data to the PC.
- **Data from Another PC**
  The NETWORK SEND (SEND(192)), NETWORK RECEIVE (RECV(193)), and DELIVER COMMAND (CMND(194)) instructions enable a PC to exchange data with another PC automatically, although you need to set the data necessary for exchange.
- **Data to an IBM PC/AT or Compatible Computer**
  You need a program on the IBM PC/AT or compatible computer so that it can send a response block to the PC according to the type of command received.
- **Data to Another PC**
  When the SYSMAC NET Link Unit on the PC receives a command from another node, it interprets the command and automatically sends an appropriate response block to the node. You do not need to program the PC to send the data.

Datagram Size

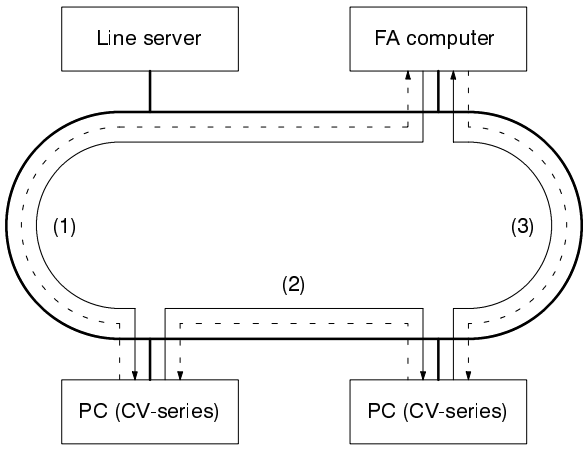
The SYSMAC NET Link Unit will disregard a datagram that contains more than 2 Kb of data. If a datagram which contains more than 2 Kb of data is received by a SYSMAC NET Link Unit, an error will result.

Retries

You can set the PC so that it will automatically retry transmission for SEND(193), RECV(193), and CMND(194) up to 15 times to the destination node when the PC does not receive a response from the destination node. Set the number of retries to between 1 and 15.

4-1-2 Data Flow

The following graphics show the flow of data on a network.



Command
Response

1: Command sent from FA computer and response returned from CV-series PC.
2: Command sent from CV-series PC and response returned from CV-series PC.
3: Command sent from CV-series PC and response returned from FA computer.

4-1-3 Communications between C-series and CV-series PCs

All PCs must be in C-mode to exchange data between C-series and CV-series PC. The SEND(192) and RECV(193) instructions are used. For details refer to *Section 8 Systems Combining C-series and CV-series PCs.*

4-2 PC Network Instructions

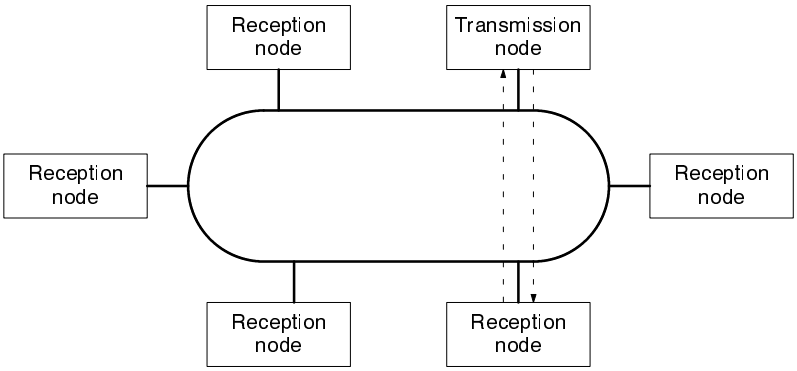
PCs can send commands to other nodes by executing the SEND(192), RECV(193), and CMND(194) instructions in the PC's ladder diagram program.

4-2-1 Node Designations

PC instructions can be used to transmit to either a specific node in a local or remote network or to broadcast to all nodes in a local network.

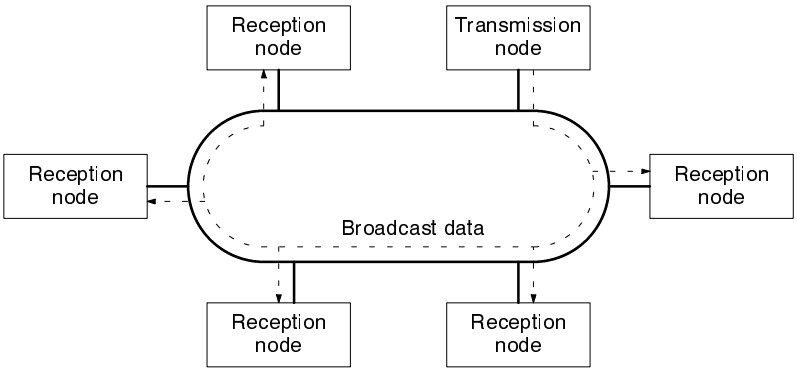
Specific Nodes

To send a command to one node, specify the destination node by adding the network address and node address of the destination to the SEND(192), RECV(193), and CMND(194) instruction data. The unit address can also be designated to enable the PC to exchange data with CPU Bus Units.



Broadcasting

To broadcast to all nodes in a local network, set the node address to FF. There will be no response from the nodes for broadcast data.



4-2-2 Communications Specifications

The PC's communications specifications are given in the following table.

Item	Specifications
Destination	1:1 SEND(192), RECV(193), CMND(194) instructions 1:N SEND(192), CMND(194) instructions (broadcasting) There will be no response from the nodes for broadcasting. N is 126 max. in SYSMAC NET Link Systems; 62 max. in SYSMAC Link Systems.
Data length	SEND(192): 990 words (1,980 bytes) max. RECV(193): 990 words (1,980 bytes) max. CMND(194): 2,000 bytes max.
Contents of transmission	SEND(192): Command requiring the destination node to send specified data RECV(193): Command requiring the destination node to receive specified data CMND(194): Commands other than the above
Communications port number	Ports 0 to 7 (8 transmissions can occur simultaneously)
Response monitor time	0000: 2 s (default) 0001 to FFFF: 0.1 to 6,553.5 s in 0.1-s increments (specified by user)
Number of retries	0 to 15 times

Note The maximum data length is limited to 512 bytes for data exchange between the PC and SYSMAC LINK Systems or the PC and SYSMAC BUS/2 Remote I/O Systems.

4-2-3 Data Areas

The available data areas for data exchange using the SEND(192) and RECV(193) instructions varies with the CV-series PC model as follows:

Data area	CV1000/CV2000/ CVM1-CPU11-E	CV500/CVM1-CPU01-E
CIO Area	0000 to 2555 (see note 2)	
Auxiliary Area	A000 to A511	
CPU Bus Link Area	G000 to G255	
DM Area	D00000 to D24575	D00000 to D08191
EM Area	E00000 to E32765 (8 banks)	---
Timer Area	T0000 to T1023	T0000 to T0511
Counter Area	C0000 to C1023	C0000 to C0511

Note

1. Areas other than those listed above must not be used.
2. The following CIO Area words can be used for data exchange: 0000 to 0999, 1000 to 1063, 1064 to 1163, 1164 to 1191, and 1192 to 2555. Do not use any other part of CIO Area.
3. G000 to G007 and A256 to A511 are read-only.
4. The EM Area is available only when you mount the Expansion Memory Unit to the PC. Up to 8 banks (32 K words per bank) can be used (the number of available banks varies with the model of the Expansion Memory Unit). For details, refer to the *CV-series PC Operation Manual: Ladder Diagrams*.

4-2-4 Communications Ports

When you have executed the SEND(192), RECV(193), or CMND(194) instruction, the status information of the instruction for each communications port will be held in the Auxiliary Area of the PC. Using this status information, the PC can adjust the execution timing of the SEND(192), RECV(193), and CMND(194) instructions while the user's program is running.

Timing

You can use eight communications ports simultaneously to execute the SEND(192), RECV(193), and/or CMND(194) instructions. You cannot, howev-

er, execute more than one instruction per port at the same time. If you want to execute more than one instructions in sequence at the same port, use network communication Enabled Flags and to be sure that only one instruction is being executed for each port at any one time. Network communication Enabled Flags are contained in the status data.

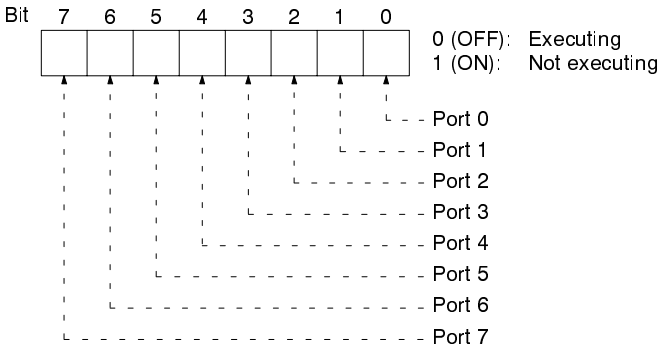
Status Data

The following table shows the configuration of the status data in the Auxiliary Area.

Word	Bit 15 to 8	Bit 7 to 0
A502	Execute Error Flags	Enabled Flags
A503	Completion code for port 0	
A504	Completion code for port 1	
A505	Completion code for port 2	
A506	Completion code for port 3	
A507	Completion code for port 4	
A508	Completion code for port 5	
A509	Completion code for port 6	
A510	Completion code for port 7	

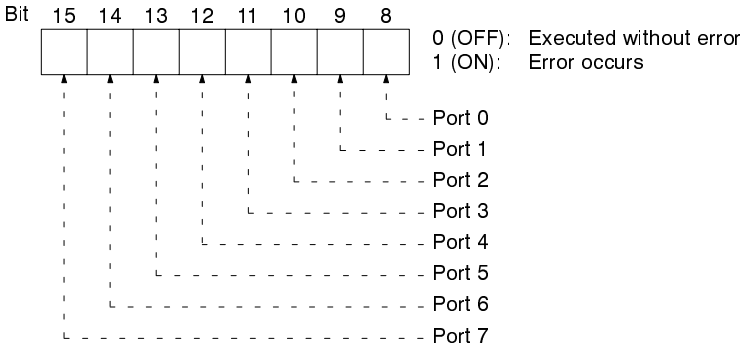
Enabled Flags (Word A502)

Each bit in word A502 corresponds to a port, as shown below. A port is available for instruction execution is its Enabled Flags is ON (1).



Execute Error Flags (Word A502)

Each bit in word A502 corresponds to a port as shown below. The ON/OFF condition of the bits will be retained until execution of the next instruction.

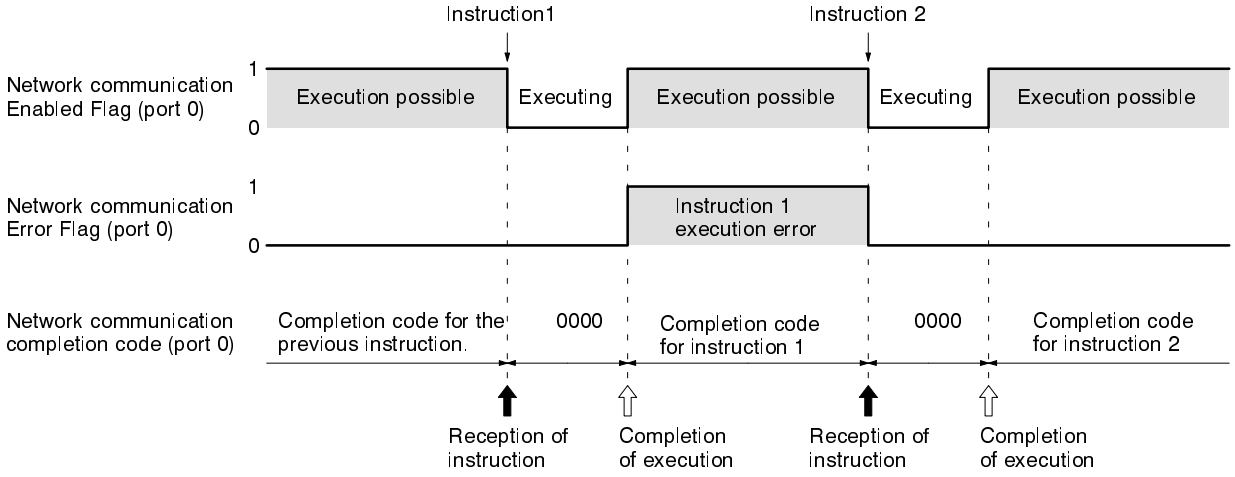


Completion Codes (Words A503 to A510)

The status after execution of an instruction will be shown by a completion code. The completion code will be retained until the PC executes the next instruction for that port. The completion code is 0000 while an instruction is being executed. There is no difference in content between completion codes and response codes. For details, refer to *Section 7 Troubleshooting*.

Flag Timing

The following timing chart shows the timing of the Enabled Flag, Execute Error Flag, and Completion Code. In this example, two instructions are executed at port 0 and there was an error when instruction 1 was being executed.



Execute Error Flag and Completion Codes with CMND(194)

The following will cause the Execute Error Flag to turn ON and/or will be output as the completion code when the CMND(194) instruction is executed.

1, 2, 3...

1. A response time-out error.
2. The number of transmission data bytes exceeding the maximum permissible range (more than 1,990 bytes for the SYSMAC NET Link Unit).
3. The number of response data bytes exceeding the number of reception data bytes that you set (in this case, no response will be recorded).

Errors other than the above will be output as the response code.

4-2-5 NETWORK SEND Instruction – SEND(192)

The SEND(192) instruction allows a PC to write data to the memory of a device located at a node on a local or remote network.

Format

The format of the SEND(192) instruction is as follows:

Ladder Symbol

(192)
SEND S D C

Variations

j SEND(192)

Operand Data Areas

S: 1st source word	CIO, G, A, T, C, DM, DR*, IR*
D: 1st destination word	CIO, G, A, T, C, DM, DR*, IR*
C: 1st control word	CIO, G, A, T, C, DM, DR*, IR*

*Indirect addressing only

Control Data

Set the destination node address to $FF to broadcast the data to all nodes in the designated network or to $00 to send to a destination within the node of the PC executing the send.

Word	Bits 00 to 07	Bits 08 to 15
C	Number of words (1 to 0990 in 4-digit hexadecimal, i.e., $0001 to $03DE)	
C+1	Destination network address (0 to 127, i.e., $00 to $7F)	Bits 08 to 11: ($0 to $F) Bits 12 to 15: Set to 0.
C+2	Destination unit	Destination node address
C+3	Bits 00 to 03: No. of retries (0 to 15 in hexadecimal, i.e., $0 to $F) Bits 04 to 07: Set to 0.	Bits 08 to 11: Transmission port number ($0 to $7) Bit 12 to 14: Set to 0. Bit 15: ON: No response. OFF: Response returned.
C+4	Response monitoring time ($0001 to $FFFF = 0.1 to 6553.5 seconds)	

Note Transmissions cannot be sent to the PC executing the send.

1, 2, 3...

1. Number of Words
   Set the total number of words to be transferred.
2. Interrupt Number
   The BASIC Unit interrupt number is used when a BASIC Unit is designated. Set the interrupt number to 0 when sending to any destination other than a BASIC Unit.
3. Destination Network Address
   Set the destination network address to 00 if the destination network address is a local network. If more than one SYSMAC LINK Unit or SYSMAC NET Link Unit is mounted to the PC, the network of the Unit with the smallest unit number will be considered to be the local network.
4. Destination Node Address
   Set the destination node address to FF for broadcasting within the local network. Set to 00 for transmission to a device at the local node.
5. Destination Unit Address
   Set the destination unit to 00 if the destination is a PC. If the destination is a user's application on an IBM PC/AT-compatible computer, set the destination unit number to 00 to 02 according to the kind of application. For a BASIC Unit, add 10 to the unit number (0 to F) so that the destination unit address is from 10 to 1F.

Destination	Address (hexadecimal)
PC (CPU)	00
NSB	00 (user application)
NSU	01 or 02 (user application)
BASIC Unit	Unit no. + 10 (10 to 1F for Unit 0 to F (0 to 15))

6. Response Flag (Bit 15 of C+3)
   Usually set this bit to OFF (0: required). If you do not need any response, set the bit to ON (1: not required).
7. Communications Port No.
   Set the communications port number that the SEND(192) instruction will be sent from. Ports 1 to 7 are not available if you use the SYSMAC NET Link Unit in C-mode.
8. Number of Retries
   Set the number of retries for unsuccessful transmissions. You can set the number between 1 to 15. If 15 has been set, for example, the SEND(192) instructions will be re-transmitted up to 15 times when the PC does not receive a response from the destination node.

9. Response Monitor Time (Unit: 0.1 S)
   Designates the length of time that the PC retries transmission when bit 15 of C+3 is OFF and no response is received. The default value is $0000, which indicates 2 seconds. The response function is not used when the destination node address is set to $FF, broadcasting to all nodes in the network.

Range of Control Data The permissible ranges of control data to be set are as follows:

Item	Value
Number of words	0001 to 03DE (1 to 990 words)
Interrupt number	0: PC or IBM PC/AT or compatible computer 1 to F (1 to 15): BASIC Unit
Destination network address	00: Local network 01 to 7F: Destination network address
Destination node address	00: Transmission within local node 01 to 7E: Destination node address (1 to 126) (SYSMAC NET) 01 to 3E: Destination node address (1 to 62) (SYSMAC LINK) FF: Broadcasting
Destination unit address	00: PC 00: IBM PC/AT-compatible computer, NSB user's application 01, 02: NSU 10 to 1F: BASIC Unit (unit numbers 0 to F)
Response flag	0 (OFF): Required 1 (ON): Not required
Communications port number	0 to 7 (0 to 7)
Number of retries	0 to F (0 to 15)
Response monitor time	0000: 2 s (default) 0001 to FFFF: 0.1 to 6,553.5 s with 0.1-s increments (set by the user)

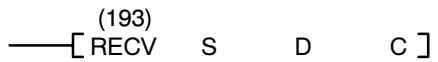
Note When broadcasting, there is no response from the nodes.

4-2-6 NETWORK RECEIVE Instruction – RECV(193)

The RECV(193) instruction enables the local node to write to its memory data from a node either on a local or remote network.

Format The format of the RECV(193) instruction is as follows:

Ladder Symbol



Variations

j RECV(193)

Operand Data Areas

S: 1st source word	CIO, G, A, T, C, DM, DR*, IR*
D: 1st destination word	CIO, G, A, T, C, DM, DR*, IR*
C: 1st control word	CIO, G, A, T, C, DM, DR*, IR*

*Indirect addressing only

Control Data

Set the source node address to $00 to send data within the PC executing the instruction.

Word	Bits 00 to 07	Bits 08 to 15
C	Number of words (1 to 0990 in 4-digit hexadecimal, i.e., $0001 to $03DE)	
C+1	Source network address (0 to 127, i.e., $00 to $7F)	Bits 08 to 11: ($0 to $F) Bits 12 to 15: Set to 0.
C+2	Source unit	Source node address
C+3	Bits 00 to 03: No. of retries (0 to 15 in hexadecimal, i.e., $0 to $F) Bits 04 to 07: Set to 0.	Bits 08 to 11: Transmission port number ($0 to $7) Bit 12 to 14: Set to 0. Bit 15: ON: No response. OFF: Response returned.
C+4	Response monitoring time ($0001 to $FFFF = 0.1 to 6553.5 seconds)	

Note Transmissions cannot be received from the PC executing RECV(193).

1, 2, 3...

1. Number of Words
   Set the total number of words to be transferred.
2. Interrupt Number
   The BASIC Unit interrupt number can be set when a BASIC Unit is designated. Set the interrupt number to 0 when sending to any destination other than a BASIC Unit.
3. Source Network Address
   Set the Source network address to 00 if you send the data to within the local network. If more than one SYSMAC LINK Unit or SYSMAC NET Link Unit is mounted to the PC, the network of the Unit with the smallest unit number will be considered to the local network.
4. Source Node Address
   Set the source node address to 00 for transmission to devices at the local node.
5. Source Unit Address
   Set the source unit number to 00 if the destination is a PC. If it is a user application on the IBM PC/AT or compatible computer, set the destination unit to 00 to 02 according to the application. For a BASIC Unit, add 10 to the unit number (0 to F) so that the destination unit address is from 10 to 1F.

Destination	Address (hexadecimal)
PC (CPU)	00
NSB	00 (user application)
NSU	01 or 02 (user application)
BASIC Unit	Unit no. + 10 (10 to 1F for Unit 0 to F (0 to 15))

6. Communications Port Number
   Set the communications port number that the RECV(193) instruction will be sent to.
7. Number of Retries
   Set the number of retries for unsuccessful transmissions. You can set the number between 1 to 15. If 15 has been set, for example, the RECV(193) instructions will be re-transmitted up to 15 times when the PC does not receive a response from the destination node.
8. Response Monitor Time
   Designates the length of time that the PC retries transmission when bit 15 of C+3 is OFF and no response is received. The default value is $0000, which indicates 2 seconds.

Range of Control Data The permissible ranges of control data to be set are as follows:

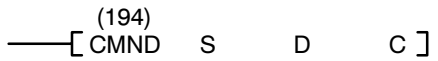
Item	Value
Number of words	0001 to 03DE (1 to 990 word)
Interrupt number	0: PC or IBM PC/AT or compatible computer 1 to F (1 to 15): BASIC Unit
Source network address	0: Local network 01 to 7F: Source network address
Source node address	00: Transmission within local PC 01 to 7E: Source node address (1 to 126) (SYSMAC NET) 01 to 3E: Source node address (1 to 62) (SYSMAC LINK) FF: Broadcasting
Source unit address	00: PC 00: IBM PC/AT-compatible computer, NSB user's application 01, 02: NSU 10 to 1F: BASIC Unit (for unit numbers 0 to F)
Communications port number	0 to 7 (0 to 7)
Number of retries	0 to F (0 to 15)
Response monitor time	0000: 2 s (default) 0001 to FFFF: 0.1 to 6,553.5 s in 0.1-s increments (set by the user)

4-2-7 DELIVER COMMAND Instruction – CMND(194)

The CMND(194) instruction controls the destination node with a command block and response block (refer to *4-5 CV-mode Commands for PCs* and *4-6 CV-mode Commands for SYSMAC NET Link Units*).

Format The format of the CMND(194) instruction is as follows:

Ladder Symbol



Variations

j CMND(194)

Operand Data Areas

S: 1st command word	CIO, G, A, T, C, DM, DR*, IR*
D: 1st response word	CIO, G, A, T, C, DM, DR*, IR*
C: 1st control word	CIO, G, A, T, C, DM, DR*, IR*

*Indirect addressing only

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

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

Word	Bits 00 to 07	Bits 08 to 15
C	Number of bytes to send (0 to 1990, i.e., $0000 to $07C6)[1]	
C+1	Number of bytes to receive (0 to 1990, i.e., $0000 to $07C6)[1]	
C+2	Destination network address (0 to 127, i.e., $00 to $7F)[2]	Bits 08 to 11: ($0 to $F)[3] Bits 12 to 15: Set to 0.
C+3	Destination unit[4]	Destination node address[5]
C+4	Bits 00 to 03: No. of retries (0 to 15 in hexadecimal, i.e., $0 to $F) Bits 04 to 07: Set to 0.	Bits 08 to 11: Transmission port number ($0 to $7) Bit 12 to 14: Set to 0. Bit 15: ON: No response. OFF: Response returned.
C+5	Response monitoring time ($0001 to $FFFF = 0.1 to 6553.5 seconds)[6]	

Note Transmissions cannot be sent to the PC executing CMND(194).

1, 2, 3...

1. Number of Bytes to Send
   Set the total number of bytes of command data (including the command code) stored at the first command and following words of the command block.
2. Number of Bytes to Receive
   Set the total number of bytes of response data (including the response code) to be stored at the first response and following words of the response block.

Note Maximum number of bytes that can be sent or received is as follows:

System	Max. number of bytes
SYSMAC NET Link	$07C6 (1990)
SYSMAC LINK	$021E (542)
SYSMAC BUS/2	$021E (542)

3. Interrupt Number
   The BASIC Unit interrupt number can be set when a BASIC Unit is designated. Set the interrupt number to 0 when sending to any destination other than a BASIC Unit.
4. Destination Network Address
   Set the destination network address to 00 if sending the command to a node in the local network. If more than one SYSMAC LINK Unit or SYSMAC NET Link Unit is mounted to the PC, the network of the Unit with the smallest unit number will be considered to be the local network.
5. Destination Node Address
   Set the destination node address to FF for broadcasting within the local network. Set to 00 for transmission to a device at the local node. The destination node address can have the following values:

System/type of transmission	Possible values
SYSMAC NET Link System	$01 to $7E (nodes 1 to 126)
SYSMAC LINK System	$01 to $3E (nodes 1 to 62)
Broadcast to all nodes in network	$FF
Transmit within the PC	$00

6. Destination Unit Designation
   Set the network destination address as follows:

Destination	Designation (hexadecimal)
PC (CPU)	00
NSB	00 (user application)
NSU	01 or 02 (user application)
SYSMAC NET Link Unit	FE
CPU Bus Unit	Unit no. + 10 (10 to 1F for Unit 0 to F (0 to 15))

7. Response Flag
   Usually set this bit to OFF (0: required). If no response is required, set the bit to ON (1: Not required).
8. Communications Port Number
   Set the communications port number that the CMND(194) instruction will be sent to.
9. Number of Retries
   Set the number of retries for unsuccessful transmissions. You can set the number between 1 to 15. If 15 has been set, for example, the CMND(194) instructions will be re-transmitted up to 15 times when the PC does not receive a response from the destination node.
10. Response Monitor Time (Unit: 0.1 S)
    Designates the length of time that the PC retries transmission when bit 15 of C+3 is OFF and no response is received. The default value is $0000, which indicates 2 seconds.

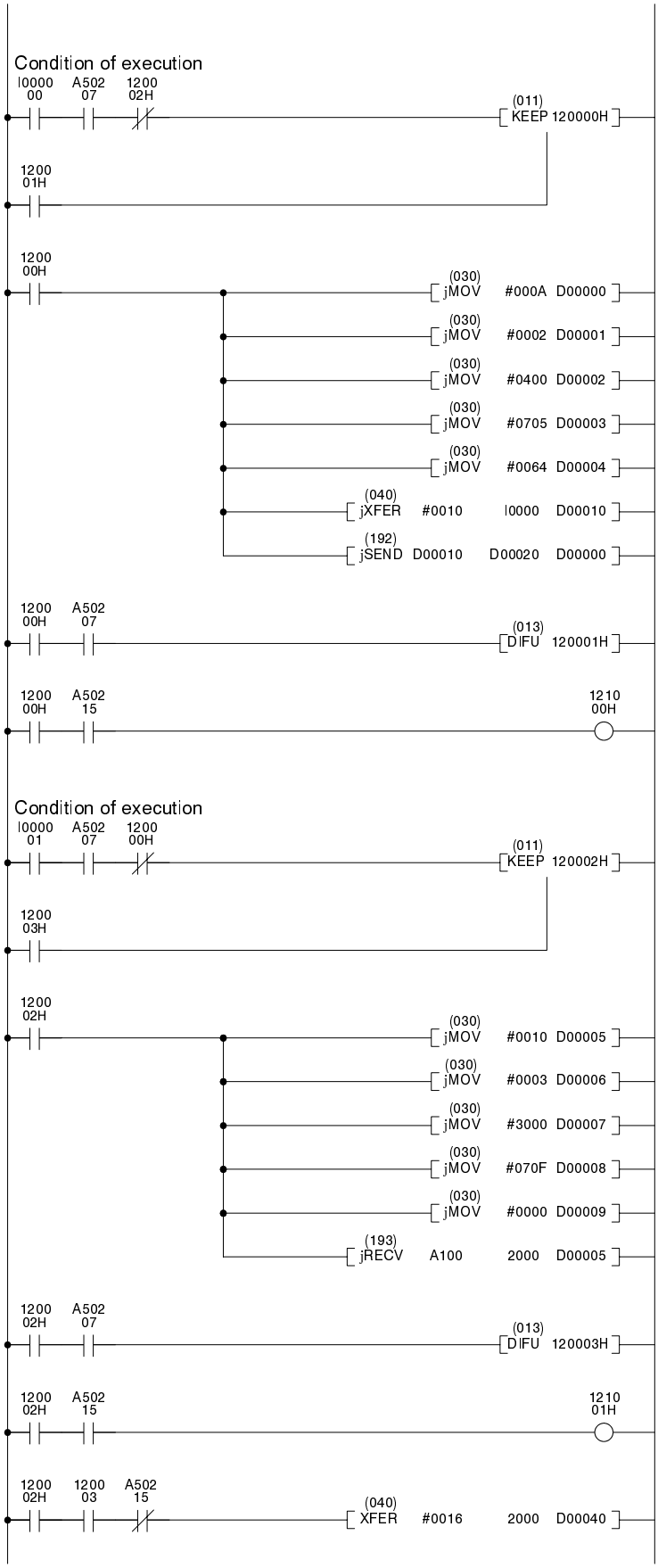
Note If more than the *number of bytes to receive* is received, no response will be stored. If fewer bytes are received, the response data will be stored and the unused memory area of the PC will remain unused.

Range of Control Data The permissible ranges of control data are as follows:

Item	Value
Number of bytes to send	0002 to 07C6 (2 to 1,990 bytes)
Number of bytes to receive	0002 to 07C6 (2 to 1,990 bytes)
Destination network address	00: Local network 01 to 7F: Destination network address
Destination node address	00: Transmission within local PC 01 to 7E: Destination node address (1 to 126) (SYSMAC NET) 01 to 3E: Destination node address (1 to 62) (SYSMAC LINK) FF: Broadcasting
Destination unit address	00: PC 00: NSB user's application 01, 02: NSU user's application SYSMAC NET Link Unit: FE 10 to 1F: BASIC Unit (unit number: 0 to F)
Response flag	0 (OFF): Required 1 (ON): Not required
Communications port number	0 to 7 (0 to 7)
Number of retries	0 to F (0 to 15)
Response monitor time	0000: 2 s (default) 0001 to FFFF: 0.1 to 6,553.5 s with 0.1-s increments (set by the user)

Note In the case of broadcasting, set the response flag bit to ON (1: not required).

4-2-8 Program Example



The SEND(192) program section will run when I000000 is ON, provided that the Enabled Flag for port 7 is ON and the RECV(193) instruction has not been executed.

120000H is ON while the SEND(192) instruction is being executed, and it goes OFF when the execution of the instruction has been completed.

The 10-word data starting from D00010 on the local PC is sent to D00020 and following words on the PC with a unit address of 0, node address of 4, and network address of 2.

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

Storing the Send Data
The 10-word data starting from I0000 is stored in D00010 and following words on

Transmission error display

The RECV(193) program will run when I000001 is ON, provided that the Enabled Flag for port 7 is ON and the SEND(192) instruction has not been executed.

120002H is ON while the RECV(193) instruction is being executed, and it goes OFF when the execution of the instruction has been completed.

The 16-word data starting from A100 on the PC with a unit address of 0, node address of 48, network address of 3 is stored at 2000 and following words a the local PC.

Word	Content	Meaning
D00005	00 10	Number of words: 16
D00006	00 03	Destination network address: 3
D00007	30 00	Destination node address: 48 Destination Unit address: 0
D00008	07 0F	Communications port no.: 7 Number of retries: 15
D00009	00 00	Response monitor time: Default

Reception error display

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

Note To execute more than one instruction in sequence at the same port, you must use the Enabled Flags to be sure that only one instruction is being executed at the same time for any one port (refer to page 31).

4-2-9 Transmission Time

Transmission Delay

The transmission delay can be calculated as follows:

$Td = Ts + Tg + T + (ns * Tn) + (ls * To) + T_{LS} + Tr$

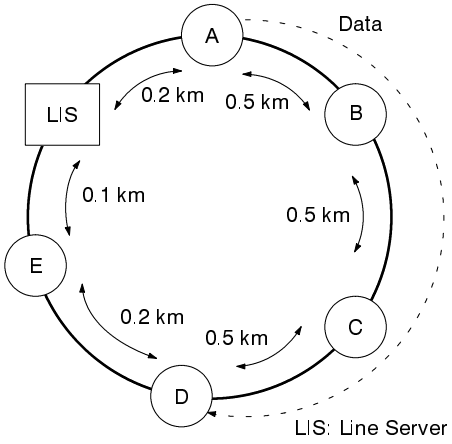
- Td: Time delay
- Ts: DMA send time (approximately 4 ms per byte)
- Tg: Token detection time
- T: Data send/receive time (approximately 4 ms per byte)
- ns: Number of nodes between the local node and destination
- Tn: Passing delay per node, approximately 2 ms per node (equivalent to 4-bit data)
- ls: Cable (length in km) for data transmission
- To: Delay on fiber, approximately 5 ms per km (10-bit data per km)
- Tls: Line Server passing delay, approximately 10 ms (equivalent to 20-bit data) 0 ms when Line Server is not passed.
- Tr: DMA receive time

The token detection time (T) is between 0 and $Tg_{max.}$ The $Tg_{max.}$ value can be obtained from the following.

$Tg_{max.} = l * to + n * Tn + T_{LS} + x * T$

- l: Loop cable length
- To: Delay time on fiber, approximately 5 ms per km (10-bit data per km)
- n: Number of nodes on network
- Tn: Passing delay per node, approximately 2 ms per node (equivalent to 4-bit data)
- Tls: Line Server passing delay, approximately 10 ms (equivalent to 20-bit data) 0 ms when Line Server is not passed.
- x: Number of nodes currently sending data
- T: Data send/receive time (approximately 4 ms per byte)

Example: 2,048-byte data is sent from node A to node D in the following network on condition that there are no nodes (x = 0) currently sending data and the data is not sent via the Line Server (Tls = 0).



Ts = T = Tr = 2048 * 4 ms = 8.2 ms
ns = 2
ls = 0.5 + 0.5 + 0.5 = 1.5 km
l = 0.5 + 0.5 + 0.5 + 0.5 +0.2 + 0.1 + 0.2 = 2 km
n = 5

The maximum token detection time can be obtained as follows:
$Tg_{max.} = (2 * 5) + (5 * 2) + 0 + 0 = 20$ ms
The maximum time delay can thus be obtained as follows:
Td = 8.2 ms + 20 ms + 8.2 ms + (2 * 2 ms) + (1.5 * 5 ms) + 0 ms + 8.2 ms = 24.6 ms

Internal Processing Time of SYSMAC NET Link Unit

In the case of data exchange between two CV500-SNT31's or between the CV500-SNT31 and a computer, the internal processing time of the SYSMAC NET Link Unit will delay the transmission of the data. The required total processing time varies with the CPU processing mode of the PC as follows:

- Synchronous Processing
  Maximum processing time (approx.) = 6 ms + number of bytes x 3 ms (40 ms for ASCII data) + 1 scan time
- Non-synchronous Processing
  Maximum processing time (approx.) = 6 ms + number of bytes x 3 ms (40 ms for ASCII data) + 10 ms

Note

1. 6 ms: Internal processing time
2. Number of bytes: The total number of bytes sent as a command block and response block.
3. 1 scan time: Data is read or written in synchronization with the PC's I/O cycle.
4. 10 ms: Maximum time required for the SYSMAC NET Link Unit and PC to exchange data.

4-3 Commands

The following datagram service commands and responses can be used on the SYSMAC NET Link Unit.

4-3-1 Command Modes

The following two command modes are available on the SYSMAC NET CV-series SYSMAC NET Link Unit:

- C-mode commands
- CV-mode (FINS) commands

CV-mode commands are explained below. For C-mode commands, refer to *8-2 PC Bridging and C-mode Commands*. Set either C-mode or CV-mode commands from the communications unit settings using a Peripheral Device (CVSS). For details on a specific Peripheral Device, refer to the operation manual for that Peripheral Device. You must select one of the two modes, both forms of commands cannot be used at the same time.

4-3-2 Destination Units

The processing of a command block and a response block vary with the destination Unit. The destination Unit is designated in the control data (destination unit address). This manual explains command and response blocks sent to CV-series PCs and SYSMAC NET Link Units (CV500-SNT31). For commands or responses for other Units, refer to the relevant operation manual.

4-3-3 Codes

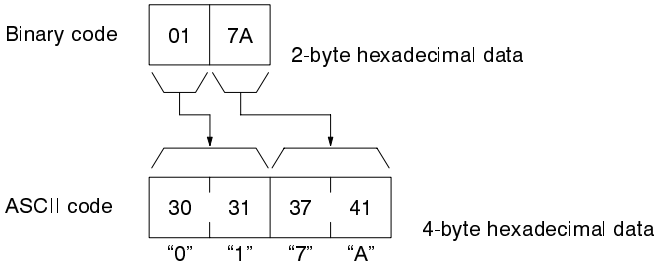
Either of the following two codes can be used for data exchange:

- Binary (BIN)
- ASCII

Only binary code is used for the internal processing of the SYSMAC NET Link Unit. If high-speed, large-scale data transfer is required, specify BIN (binary) under the communications unit setting from a Peripheral Device (CVSS).

ASCII

If the system is set for ASCII, each data byte is divided into two digits (the upper digit and lower digit) and converted into two bytes each of numerical ASCII data.



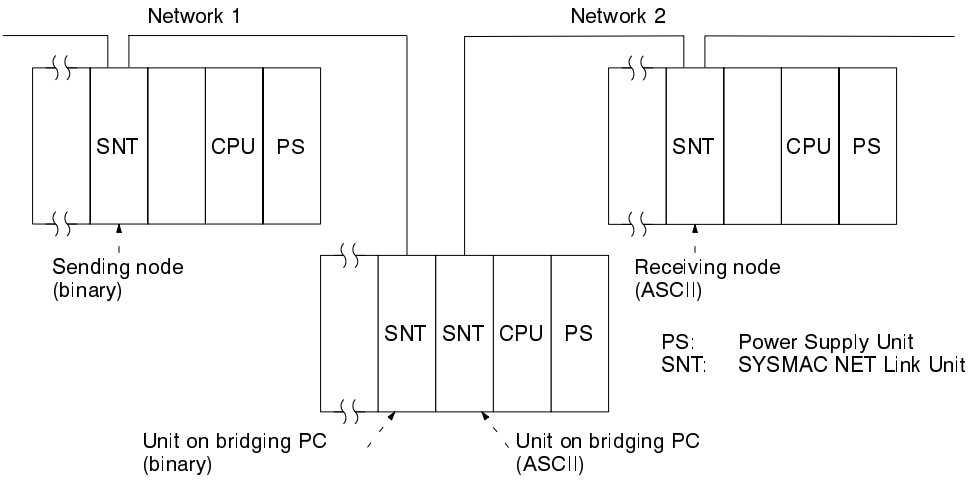
Note

1. If you select ASCII for the SYSMAC NET Link Unit, hexadecimal data will be expressed in ASCII. The following is an example of data in both binary and ASCII (such as a file name) for the file name ASCII.DAT

	A	S	C	I	I	_	_	_	.	D	A	T
Binary data:	41	53	43	49	49	20	20	20	2E	44	41	54
ASCII data												
IBM PC/AT:	4153434949202020 2E444154											
PC:	34	31	35	33	34	33	34	39	34	39	32	30 32
	30	32	30	32	45	34	34	34	31	35	34	

2. Set the SYSMAC NET Link Units so that data exchange in the datagram service is done in one code only, either ASCII or binary within the same network or when communication through a Bridge.

   You can use both ASCII and binary code if you bridge through a PC. Data is converted between binary and ASCII in the PC when it bridges the transmission.



4-4 Using Commands and Responses

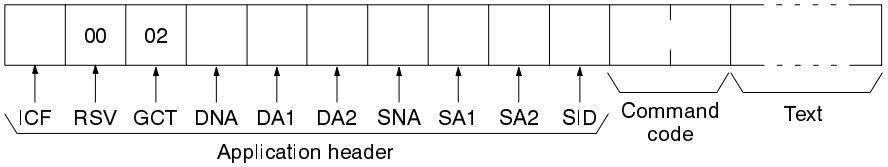
The use of a command or response block varies with the device (IBM PC/AT-compatible computer or CV-series PC) that sends the block.

4-4-1 IBM PC/AT and Compatible Computers

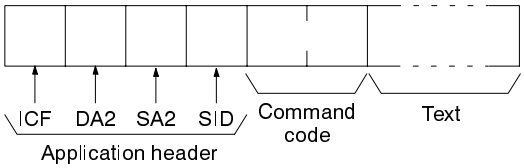
Add the application header as a prefix to the command code so that CV-mode commands can be used on the IBM PC/AT or compatible computer, as follows:

Commands

When Using Bridging PC (Effective Only when ICF Bit 7 is ON)



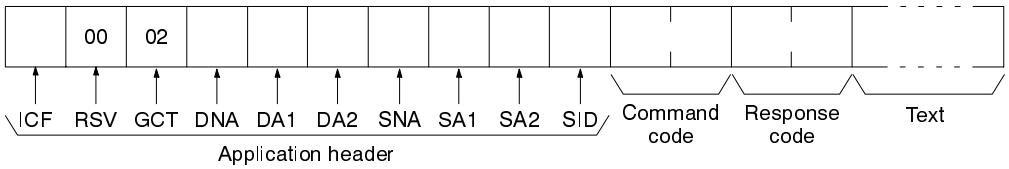
When Not Using Bridging PC



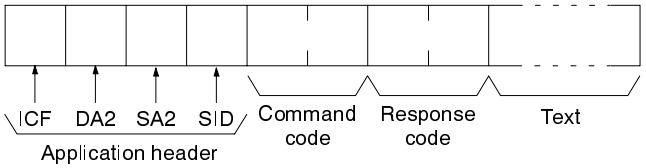
Responses

A response block includes a response code (a 2-byte code in binary) added to the command code as follows:

When Using Bridging PC (Effective Only when ICF Bit 7 is ON)



When Not Using Bridging PC



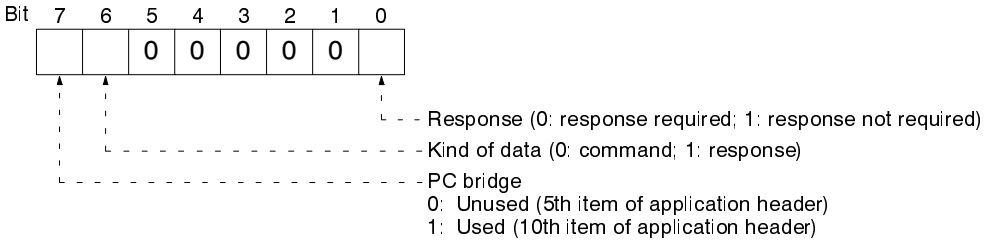
Text Length

The length of the text will be as follows:

Conditions		Command	Response
Binary	Bridging PC used	1,988 bytes max.	1,986 bytes max.
	Bridging PC not used	1,994 bytes max.	1,992 bytes max.
ASCII	Bridging PC used	1,976 bytes max.	1,972 bytes max.
	Bridging PC not used	1,988 bytes max.	1,984 bytes max.

Application Header Data

ICF (Information Control Field)
The configuration of the ICF is as follows:



RSV (Reservation of System)
Set to 00.

GCT (Permissible Number of Bridges)
Set to 00.

DNA (Destination Network Address)

00: Local network
01 to 7F: Destination network address (1 to 127)

DA1 (Destination Node Address)

01 to 7E: Node in SYSMAC NET Link System (1 to 126)
01 to 3E: Node in SYSMAC LINK System (1 to 62)
FF: Broadcasting

DA2 (Destination Unit Address)

00: PC (CPU)
EE: SYSMAC NET Link Unit
10 to 1F: CPU Bus Unit

SNA (Source Network Address)

00: Local network
01 to 7F: Destination network address (1 to 127)

SA1 (Source Node Address)

01 to 7E: Node in SYSMAC NET Link System (1 to 126)
01 to 3E: Node in SYSMAC LINK System (1 to 62)

SA2 (Source Node Address)

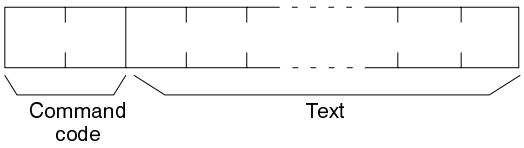
00: PC (CPU)
10 to 1F: CPU Bus Unit

SID (Service ID)
The SID is used to identify the node that data is sent from. Set from 00 to FF for the SID.

4-4-2 PCs

Command

The command block starts at the first command word specified in the CMND(194) instruction. The format of the command block is as follows:

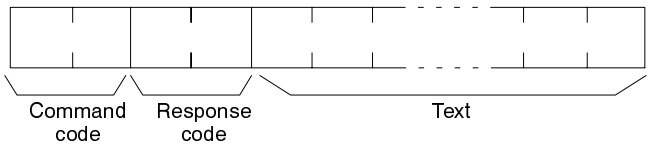


The length of the text is as follows:

Binary	1,988 bytes max.
ASCII	990 bytes max.

Response

A response block starts at the first response word specified in the CMND(194) instruction is used. The format of the response block is as follows:



The length of the text is as follows:

Binary	1,986 bytes max.
ASCII	993 bytes max.

4-5 CV-mode Command Lists

4-5-1 Commands for PCs

Command code		Name	PC mode				Page
			RUN	MONITOR	DEBUG	PROGRAM	
01	01	MEMORY AREA READ	Valid	Valid	Valid	Valid	p. 52
	02	MEMORY AREA WRITE	Valid	Valid	Valid	Valid	p. 53
	03	MEMORY AREA FILL	Valid	Valid	Valid	Valid	p. 54
	04	MULTIPLE MEMORY AREA READ	Valid	Valid	Valid	Valid	p. 55
	05	MEMORY AREA TRANSFER	Valid	Valid	Valid	Valid	p. 56
02	01	PARAMETER AREA READ	Valid	Valid	Valid	Valid	p. 57
	02	PARAMETER AREA WRITE	Valid	Valid	Valid	Valid	p. 58
	03	PARAMETER AREA CLEAR	Valid	Valid	Valid	Valid	p. 60
03	04	PROGRAM AREA PROTECT	Valid	Valid	Valid	Valid	p. 61
	05	PROGRAM AREA PROTECT CLEAR	Valid	Valid	Valid	Valid	p. 62
	06	PROGRAM AREA READ	Valid	Valid	Valid	Valid	p. 63
	07	PROGRAM AREA WRITE	Not valid	Valid	Valid	Valid	p. 63
	08	PROGRAM AREA CLEAR	Not valid	Not valid	Not valid	Valid	p. 64
04	01	RUN	Valid	Valid	Valid	Valid	p. 65
	02	STOP	Valid	Valid	Valid	Valid	p. 65
05	01	CONTROLLER DATA READ	Valid	Valid	Valid	Valid	p. 65
	02	CONNECTION DATA READ	Valid	Valid	Valid	Valid	p. 67
06	01	CONTROLLER STATUS READ	Valid	Valid	Valid	Valid	p. 68
	20	CYCLE TIME READ	Valid	Valid	Not valid	Not valid	p. 70
07	01	CLOCK READ	Valid	Valid	Valid	Valid	p. 70
	02	CLOCK WRITE	Valid	Valid	Valid	Valid	p. 71
09	20	MESSAGE READ	Valid	Valid	Valid	Valid	p. 71
		MESSAGE CLEAR	Valid	Valid	Valid	Valid	p. 72
		FAL/FALS READ	Valid	Valid	Valid	Valid	p. 73
0C	01	ACCESS RIGHT ACQUIRE	Valid	Valid	Valid	Valid	p. 73
	02	ACCESS RIGHT FORCED ACQUIRE	Valid	Valid	Valid	Valid	p. 73
	03	ACCESS RIGHT RELEASE	Valid	Valid	Valid	Valid	p. 75
21	01	ERROR CLEAR	Valid	Valid	Valid	Valid	p. 75
	02	ERROR LOG READ	Valid	Valid	Valid	Valid	p. 77
	03	ERROR LOG CLEAR	Valid	Valid	Valid	Valid	p. 77

Command code		Name	PC mode				Page
			RUN	MONITOR	DEBUG	PROGRAM	
22	01	FILE NAME READ	Valid	Valid	Valid	Valid	p. 78
	02	SINGLE FILE READ	Valid	Valid	Valid	Valid	p. 79
	03	SINGLE FILE WRITE	Valid	Valid	Valid	Valid	p. 80
	04	MEMORY CARD FORMAT	Valid	Valid	Valid	Valid	p. 81
	05	FILE DELETE	Valid	Valid	Valid	Valid	p. 81
	06	VOLUME LABEL CREATE/DELETE	Valid	Valid	Valid	Valid	p. 81
	07	FILE COPY	Valid	Valid	Valid	Valid	p. 82
	08	FILE NAME CHANGE	Valid	Valid	Valid	Valid	p. 83
	09	FILE DATA CHECK	Valid	Valid	Valid	Valid	p. 83
	0A	MEMORY AREA FILE TRANSFER	Valid	Valid	Valid	Valid	p. 84
	0B	PARAMETER AREA FILE TRANSFER	Valid	Valid	Valid	Valid	p. 85
	0C	PROGRAM AREA FILE TRANSFER	(see note)	Valid	Valid	Valid	p. 86
23	01	FORCED SET/RESET	Not valid	Valid	Valid	Valid	p. 87
	02	FORCED SET/RESET CANCEL	Not valid	Valid	Valid	Valid	p. 88

Note When the PC is in RUN mode, data transfers from files to the program area are not possible, but transfers from the program area to files are possible.

4-5-2 Commands for SYSMAC NET Link Units

Command code		Name	Page
02	20	DATA LINK TABLE READ	p. 89
	21	DATA LINK TABLE WRITE	p. 90
04	01	RUN (see note)	p. 91
	02	STOP (see note)	p. 92
	03	RESET	p. 92
05	01	CONTROLLER DATA READ (see note)	p. 92
06	01	CONTROLLER STATUS READ (see note)	p. 93
	03	DATA LINK STATUS READ	p. 94
08	01	LOOP BACK TEST	p. 94
21	02	ERROR LOG READ (see note)	p. 95
	03	ERROR LOG CLEAR (see note)	p. 96
26	01	NAME SET	p. 96
	02	NAME DELETE	p. 97
	03	NAME READ	p. 97

Note These commands are also used to send data to the PC.

4-6 Response Codes

A response code consists of two bytes. If a command is completed normally, a response code of 00 00 will be returned. The first two digits of a response code are called a main response code (MRES) and the last two digits are called a sub-response code (SRES). If command execution results in an error, one of the response codes listed in the following table will be returned. Refer to *Section 7 Troubleshooting* for details.

MRES	Description
00	Normal completion
01	Local node error
02	Destination node error
03	Controller error
04	Not executable
05	Routing error
10	Command format error
11	Parameter error
20	Read not possible
21	Write not possible
22	Not executable in current PC mode
23	No Unit
24	No Unit
25	Unit error
26	Command error
30	Access right error

4-7 Memory Area Designations

The following table gives the addresses that can be used when reading or writing PC data. The *Data area address* column gives the normal addresses used in the PC program. The *Address used in communications* column are the addresses used in CV-mode commands and responses. These addresses are combined with the memory area codes to specify PC memory locations. These addresses are not the same as the actual memory addresses of the data.

The *No. of bytes* column specifies the number of bytes to read or write data for that area. The number of bytes varies for the same area depending on the memory area code.

Data specified as “with forced status” or in the “forced status area” will indicate whether bits have been force-set or force-reset from a Peripheral Device.

CV500/CVM1-CPU01-E

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary Areas	Bit status	CIO TR G A	000000 to 242715 TR0 to TR7 G00000 to G25515 A00000 to A51115	000000 to 097B0F 09FF00 to 09FF07 0A0000 to 0AFF0F 0B0000 to 0CFF0F	00	1
	Bit status (with forced status)	CIO G	000000 to 242715 G00000 to G25515	000000 to 097B0F 0A0000 to 0AFF0F	40	1
	Word contents	CIO TR G A	0000 to 2427 G000 to G255 A000 to A511	000000 to 097B00 09FF00 0A0000 to 0AFF00 0B0000 to 0CFF00	80	2
	Word contents (with forced status)	CIO G	0000 to 2427 G000 to G255	000000 to 097B00 0A0000 to 0AFF00	C0	4

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
Timer Area/ Counter Area	Completion Flag status	TIM CNT	T0000 to T0511 C0000 to C0511	000000 to 03DF00 080000 to 0BDF00	01	1
	Completion Flag status (with forced status)	TIM CNT	T0000 to T0511 C0000 to C0511	000000 to 03DF00 080000 to 0BDF00	41	1
	PV	TIM CNT	T0000 to T0511 C0000 to C0511	000000 to 01FF00 080000 to 09FF00	81	2
DM Area	Word contents	DM	D00000 to D08191	000000 to 1FFF00	82	2
Transition Area	Flag status	TN	TN0000 to TN0511	000000 to 03DF00	03	1
Step Area	Flag status	ST	ST0000 to ST0511	000000 to 03DF00	04	1
	Status		NA	000000 to 0DFF00	44	1
	Step timer PV		NA	000000 to 0DFF00	84	2
Forced Status	Bit status	CIO G	000000 to 242715 G00000 to G25515	000000 to 097B0F 0A0000 to 0AFF0F	05	1
	Word contents	CIO G	0000 to 2427 G000 to G255	000000 to 097B00 0A0000 to 0AFF00	85	2
Action Area	Flag status		NA	000000 to 1FFF00	1B	1
Register Area	Register contents	IR DR	IR0 to IR2 DR0 to DR2	000000 to 000200 000300 to 000500	9C	2
Interrupt Area	Unit interrupt source		NA	000100	DD	4
	Scheduled interrupt interval		NA	000200		4

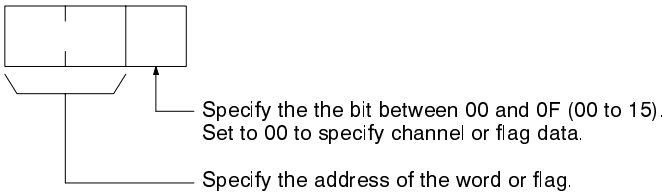
CV1000/CV2000/CVM1-CPU11-E

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary Areas	Bit status	CIO TR G A	000000 to 255515 TR0 to TR7 G00000 to G25515 A00000 to A51115	000000 to 09FB0F 09FF00 to 09FF07 0A0000 to 0AFF0F 0B0000 to 0CFF0F	00	1
	Bit status (with forced status)	CIO G	000000 to 255515 G00000 to G25515	000000 to 09FB0F 0A0000 to 0AFF0F	40	1
	Word contents	CIO TR G A	0000 to 2555 G000 to G255 A000 to A511	000000 to 09FB00 09FF00 0A0000 to 0AFF00 0B0000 to 0CFF00	80	2
	Word contents (with forced status)	CIO G	0000 to 2555 G000 to G255	000000 to 09FB00 0A0000 to 0AFF00	C0	4
Timer Area/ Counter Area	Completion Flag status	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03FF00 080000 to 0BFF00	01	1
	Completion Flag status (with forced status)	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03FF00 080000 to 0BFF00	41	1
	PV	TIM CNT	T0000 to T1023 C0000 to C1023	000000 to 03FF00 080000 to 0BFF00	81	2
DM Area	Word contents	DM	D00000 to D24575	000000 to 5FFF00	82	2
Transition Area	Flag status	TN	TN0000 to TN1023	000000 to 03FF00	03	1
Step Area	Flag status	ST	ST0000 to ST1023	000000 to 03FF00	04	1
	Status		NA	000000 to 0FFF00	44	1
	Step timer PV		NA	000000 to 0FFF00	84	2

Memory area	Data		Data area address	Address used in communications	Memory area code	No. of bytes
Forced Status	Bit status	CIO G	000000 to 255515 G00000 to G25515	000000 to 09FB0F 0A0000 to 0AFF0F	05	1
	Word contents	CIO G	0000 to 2555 G000 to G255	000000 to 09FB00 0A0000 to 0AFF00	85	2
Expansion DM Area	Word contents	Banks 0 to 7	E00000 to E32765 to E00000 to E32765	000000 to 7FFD00 to 000000 to 7FFD00	90 to 97	2
		Current bank	E00000 to E32765	000000 to 7FFD00	98	2
Action Area	Flag status		NA	000000 to 1FFF00	1B	1
Register Area	Register contents	IR DR	IR0 to IR2 DR0 to DR2	000000 to 000200 000300 to 000500	9C	2
	Expansion DM current bank		NA	000600		2
Interrupt Area	Unit interrupt source		NA	000100	DD	4
	Scheduled interrupt interval		NA	000200		4

Word/Bit Addresses

Each word/bit address specifies a specific bit or word. The rightmost two digits of the address specify bit 00 to 15 (or 00 if not required), and leftmost four digits specify the word address.



To obtain the corresponding address of the desired word or bit, add the data area word address (hexadecimal) to the first address of the range of addresses used for that data area in communications. For example, the address for word G134 is computed as follows:

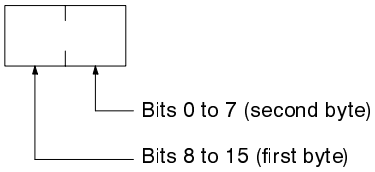
First address for CPU Bus Link Area;	0A00
0A00 + 86 (134 in BCD);	0A86

The word address for C134 would thus be 0A8600 (the memory area code would specify this as a word) and the address of bit 12 in C134 would be 0A860C.

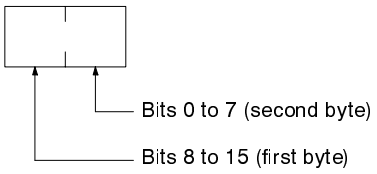
Data Configuration

The configuration of the various types of data that can be read or written is shown below. The number of bytes required for each type of data is also given.

- Flag or Bit Status (One Byte)
  00: Bit is OFF (0)
  01: Bit is ON (1)
- Word Contents, PV (Two Bytes)

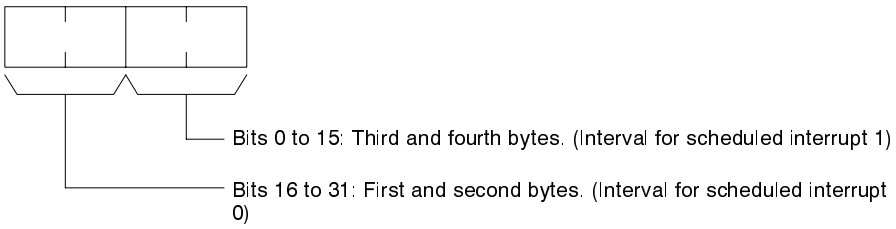


- Current Bank Number of Expansion DM (Two Bytes)



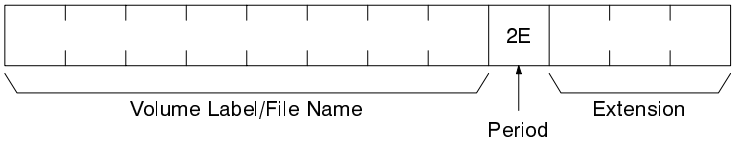
Bits 15 OFF (0): No expansion DM
Bits 15 ON (1): Expansion DM
Bits 0 to 14: Current bank (Bits 0 to 14 are valid only when expansion DM is available.)

• Scheduled Interrupt Interval



4-8 Volume Labels and File Names

Each volume label or file name consists of 12 bytes as follows:



Volume Label/File Name Each volume label or file name must have eight ASCII characters with or without spaces (ASCII 20). If less than eight letters are used, add spaces to the end of the label/name.

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

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

4-9 CV-mode Response Codes

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

Main code	Description
00	Normal completion
04	Not executable
10	Command format error
11	Parameter error
20	Read not possible
21	Write not possible
22	Not executable in current PC mode
23	No Unit
25	Unit error
26	Command error
30	Access right error

Special Response Codes

The PC may return C-series response formats when CV-mode commands are used in the following cases:

- If there is an FCS error in the command block, the following response will be returned:

  @00FA13*CR

- If the data length after the FA code is short and does not reach SRC, the following response will be returned:

  @00FA14*CR

- If the FA code is wrong, the following response will be returned:

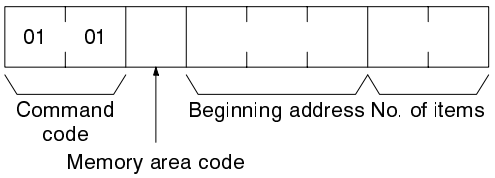
  @00IC4A*CR

4-10 CV-mode Commands for PCs

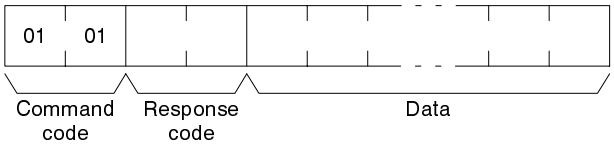
4-10-1 MEMORY AREA READ

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

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Beginning address (command): The address of the first word/bit/flag to read from memory.

No. of items (command): The number of items to be read.

Data (response): The data from the specified words is returned in sequence starting from the beginning address. The required number of bytes in total is calculated as follows:

Number of bytes required by each item x Number of items

Memory Areas

The following data can be read (refer to *4-7 Memory Area Designations* for PC word/bit address designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Bit status	00	1
	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2

Memory area	Data	Memory area code	No. of bytes
DM	Word contents	82	2
Transition	Flag status	03	1
Step	Flag status	04	1
Forced status	Bit status	05	1
	Word contents	85	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2
Action	Flag status	1B	1

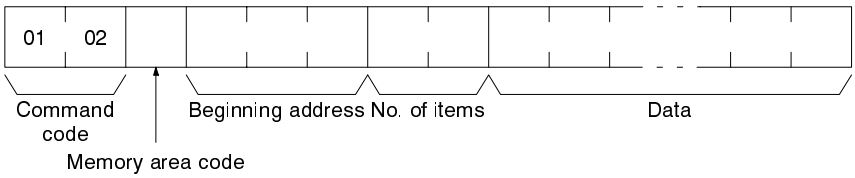
4-10-2 MEMORY AREA WRITE

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

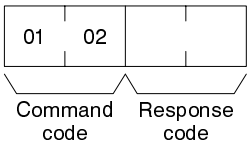
Note

1. The MEMORY AREA WRITE command can be executed regardless of the PC's operating mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.
2. When data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

Memory area code (command): The data area to write.

Beginning address (command): The first word/value to write.

No. of items (command): The number of items to be written. Set the number of items to 0001 when writing a step timer PV, register value, or interrupt status.

Data (command): The data to be written. The required number of bytes in total is calculated as follows:

Number of bytes required by each item x Number of items

The following data can be written (refer to *4-7 Memory Area Designations* for the word/bit address designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
Step	Step timer PV	84	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2
Register	Register contents	9C	2
	Current expansion DM bank		
Interrupt status	Scheduled interrupt interval	DD	4

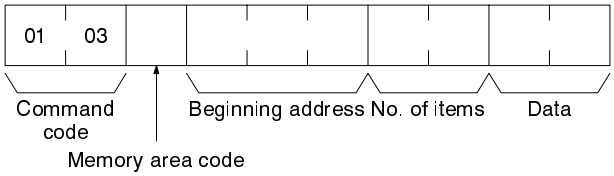
4-10-3 MEMORY AREA FILL

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

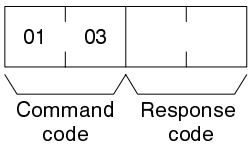
Note

1. The MEMORY AREA FILL command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.
2. When data is written in the Timer/Counter PV Area, the Completion Flag will be turned OFF (0).

Command Block



Response Block



Parameters

Memory area code (command): The data area to write.

Beginning address (command): The first word/values to write.

No. of items (command): The number of items to write.

Data (command): The data to be written to the memory area starting from the Beginning address. The data to be written should consist of two bytes.

The following data can be written (refer to *4-7 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	PV	81	2

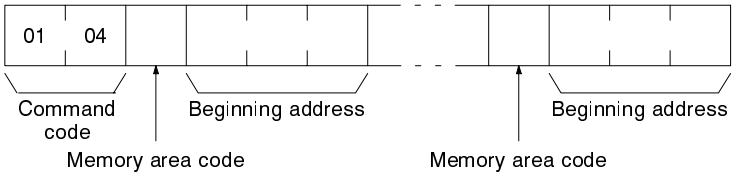
Memory area	Data	Memory area code	No. of bytes
DM	Word contents	82	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2

4-10-4 MULTIPLE MEMORY AREA READ

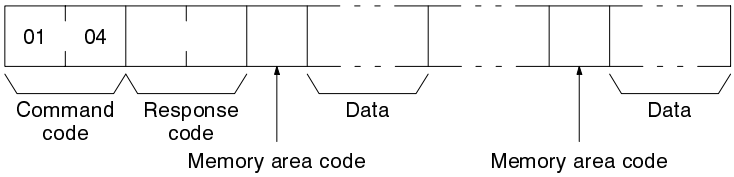
Reads the contents of the specified number of non-consecutive memory area words, starting from the specified word.

Note If there is an error in the command code or a beginning address, no data will be read.

Command Block



Response Block



Parameters

Memory area code (command): The data area to read.

Beginning address (command): The first word/bit/flag to read.

Data (response): The data in the specified memory area(s) will be returned in sequence starting from the beginning address.

Memory Areas

The following data can be written (refer to *4-7 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Bit status	00	1
	Bit status (with forced status)	40	1
	Word contents	80	2
	Word contents (with forced status)	C0	4
Timer/Counter	Completion Flag status	01	1
	Completion Flag status (with forced status)	41	1
	PV	81	2
DM	Word contents	82	2
Transition	Flag status	03	1
	Flag status (with forced status)	43	1
Step	Flag status	04	1
	Status	44	1
	Step Timer PV	84	2

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

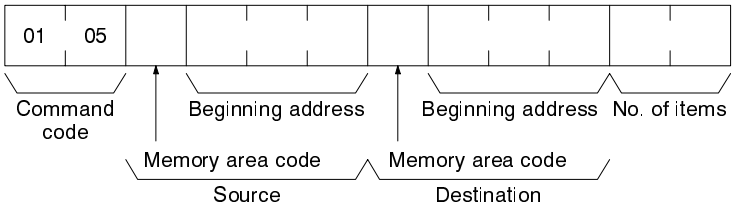
4-10-5 MEMORY AREA TRANSFER

Copies and transfers the contents of the specified number of consecutive memory area words to the specified memory area. All source words must be in the same area and all designation words must be written to the same area (here, all memory areas with the the same memory area code are considered as one area).

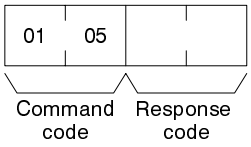
Note

1. The MEMORY AREA TRANSFER command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.
2. When data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

Memory area code (command): The data area to transfer from and the data area to transfer to.

Beginning address (command): The first word/value to transfer from and the first word to transfer to.

No. of items (command): The number of items to transfer (each item consists of two bytes).

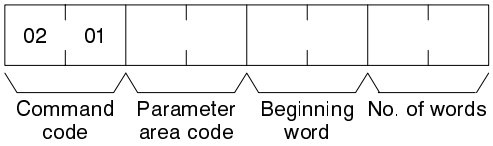
The following data can be transferred (refer to *4-7 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2

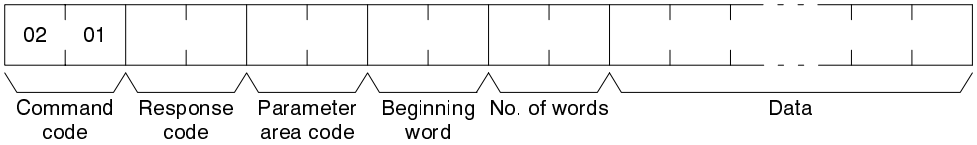
4-10-6 PARAMETER AREA READ

Reads the contents of the specified number of consecutive parameter area words starting from the specified word. All words in the specified parameter area must be read at the same time to ensure complete data. A maximum of 266 words can be read with each command. To read larger parameter areas, use multiple commands and specify the beginning word and number of words for each.

Command Block



Response Block

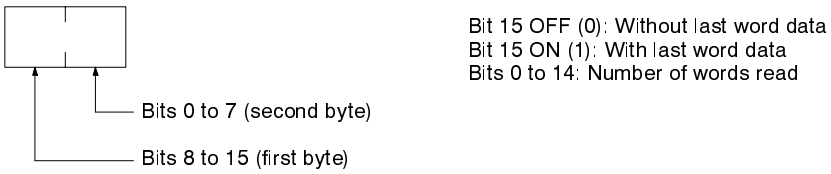


Parameters

Parameter area code (command and response): The parameter area to read.

Beginning word (command and response): The first word to read.

No. of words (command and response): Bits 0 to 14 are used to specify the number of words to be read (each word consists of two bytes). Bit 15 must be OFF (0) in the command block. When the contents in the response block contains the last word of data in the specified parameter area, bit 15 will be ON (1).



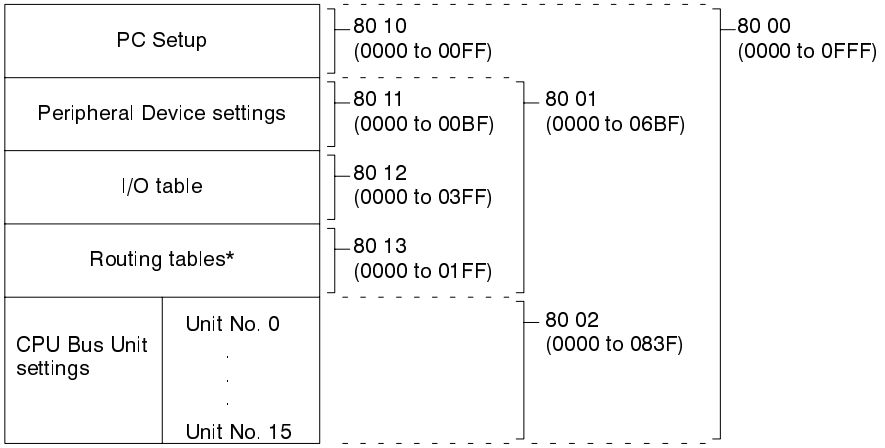
Data (response): The data in the specified parameter area will be returned in sequence starting from the beginning word. The leftmost bits (bits 8 to 15) of each word are read first, followed by the rightmost bits (bits 0 to 7). The required number of bytes in total for each read is calculated as follows:

Number of words x 2 (each word consists of two bytes)

Parameter Areas

There are five parameter areas, each of which has consecutive word addresses

beginning from 0000. The following data can be read. The word ranges in parentheses show the possible values for the beginning word.



Note *Although the routing tables have a 512-word area (0000 to 01FF0), only a 48-word area (0000 to 003F) of it can read.

4-10-7 PARAMETER AREA WRITE

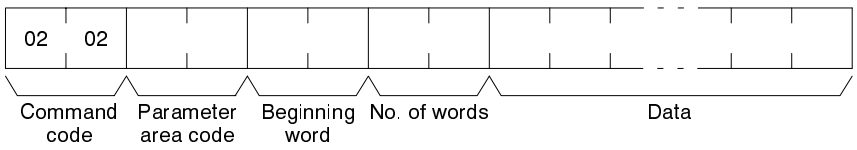
Writes data to the specified number of consecutive parameter area words starting from the specified word. All words in the specified parameter area must be written at the same time to ensure complete data. A maximum of 266 words can be written with each command. To write larger parameter areas, use multiple commands and specify the beginning word for each.

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

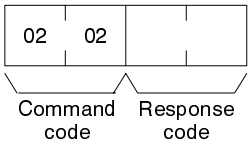
Note

1. The PARAMETER AREA WRITE command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.
2. If any other device has the access right, nothing will be written to the specified parameter area.
3. If memory is write-protected via the key switch on the front panel of the PC, nothing will be written to the specified parameter area.

Command Block



Response Block

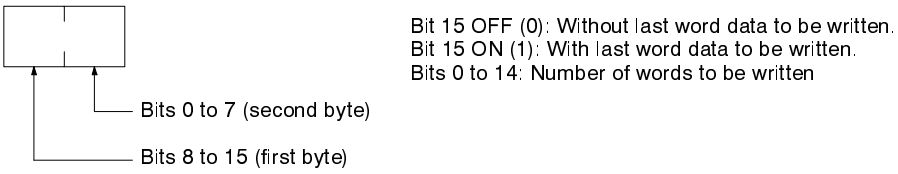


Parameters

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

Beginning word (command): The first word to write.

No. of words (command): Bits 0 to 14 are used to specify the number of words to be written (each word consists of two bytes). Bit 15 must be ON (1) when data is written to the last word in the specified parameter area or no data will be written. If the number of write words is set to 0000, no words will be written and a normal response code will be returned.

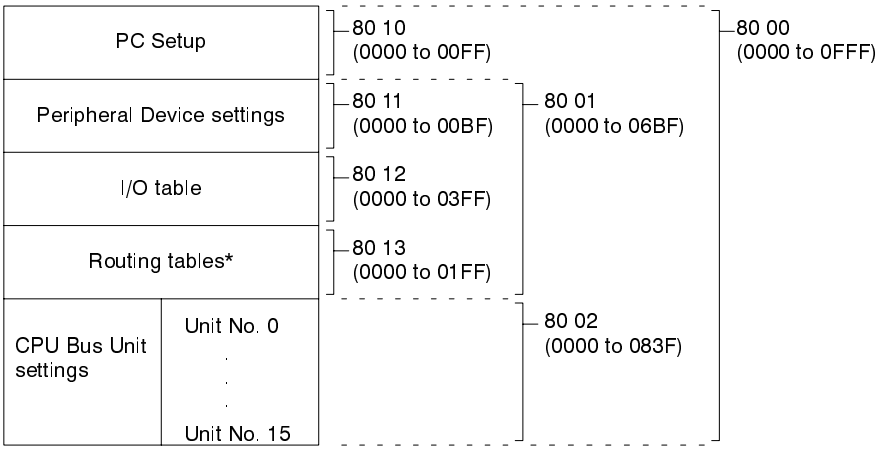


Data (command): The data to be written. The leftmost bits (bits 15 to 8) of each word must be specified first, followed by the rightmost bits (bits 7 to 0). The required number of bytes in total for each write can be calculated as follows:

No. of words x 2 (each word consists of two bytes)

Parameter Areas

There are five parameter areas, each of which has consecutive word addresses beginning from 0000. The following data can be read. The word ranges in parentheses show the possible values for the beginning word.

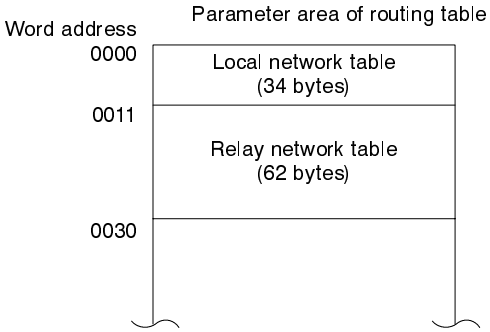


Note *Only a 48-word area (0000 to 003F) of the routing tables is available. The data must be written to the 48-word area in sequence beginning from 0000 or an error will result as the PC automatically does a format check in order to prevent routing errors.

Writing Routing Tables

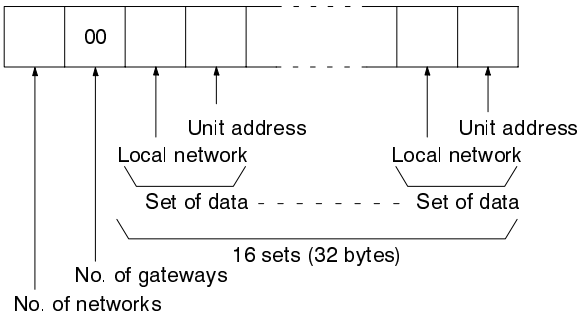
You can write a routing table directly to the PC's Parameter Area from an IBM PC/AT or compatible computer. After you write the routing table, you must restart the PC so that the routing table that you set will be effective. For details, refer to *3-3 Routing Table.*

The configuration of a routing table is as follows:



Local Network Table

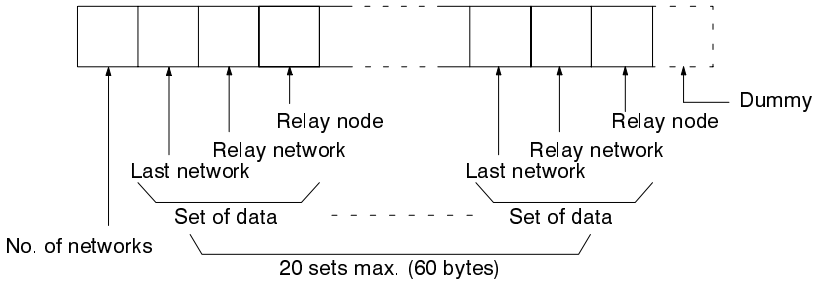
The following is the configuration of a local network table. A local network table must consist of 34 bytes. If the local network table that you created contains less than 34 bytes, you need to add dummy data to create 34-byte data before you designate the data for the relay network table.



- Number of Networks
  Designate the number of local networks from 00 to 10 (0 to 16).
- Number of Gateways
  Set to 00.
- Local Network
  Designate the address of the local network from 01 to 7F (1 to 127).
- Unit Address
  Designate the Unit address for SYSMAC NET Link Unit or SYSMAC LINK Unit from 10 to 1F (16 to 31). A Unit address consists of the 10 (hexadecimal) added to the Unit number.

Relay Network Table

The configuration of a relay network table is as follows:



- Number of Networks
  Designate the number of relay networks from 00 to 14 (0 to 20).
- Destination Network
  Designate the destination network from 01 to 7F (1 to 127).
- Relay Network
  Designate the relay network address from 01 to 7F (1 to 127).
- Relay Node
  Designate the relay node address from 01 to 7E (1 to 126).
- Dummy
  The number of written data words must always be an even number. If it is an odd number, add a byte of data (any data will do) to make it an even number.

4-10-8 PARAMETER AREA CLEAR

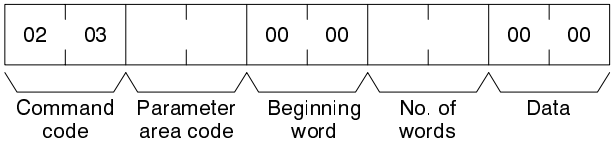
Writes all zeros to the specified number of consecutive parameter area words to clear the previous data. The I/O table can be cleared only when the PC is in PROGRAM mode.

Always clear the entire range of the specified parameter area.

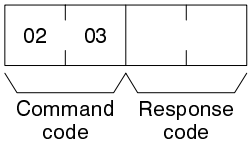
Note

1. The PARAMETER AREA CLEAR command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in the RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.
2. If any other device holds the access right, nothing can be written to the specified parameter area.
3. If memory is write-protected via the key switch on the front panel of the PC, nothing can be written to the specified parameter area.

Command Block



Response Block



Parameters

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

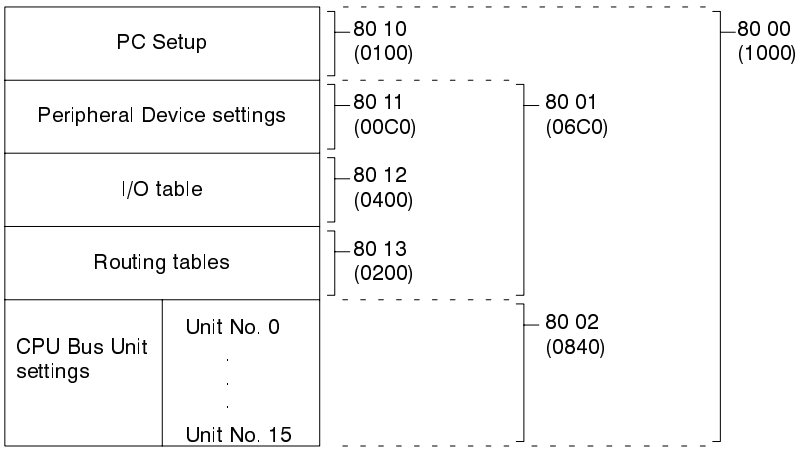
Beginning word (command): Set to 0000.

No. of words (command): The number of words to clear (see diagram below).

Data (command): Set to 0000. The number of word addresses where the data (0000) should be written is specified by the number of words in the command block.

Parameters Areas

The available parameter areas and the number of words in each are as shown below. The number of words in the parentheses is specified as the number of words to clear.

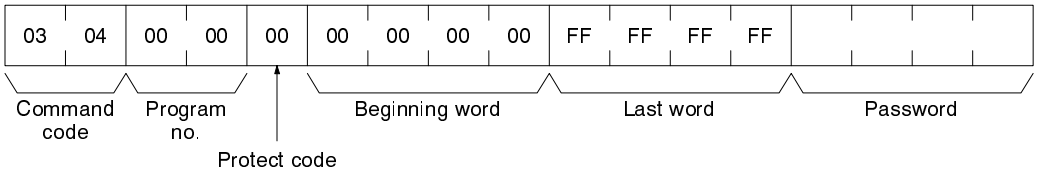


4-10-9 PROGRAM AREA PROTECT

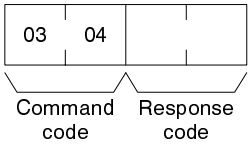
Protects the program by removing all read/write access rights.

Note
1. The program cannot be protected if any other device holds the access right.
2. If memory is write-protected via the key switch on the front panel of the PC, the PROGRAM AREA PROTECT command will not be effective.

Command Block



Response Block



Parameters

The command will be executed normally even if the beginning word and last word are set to values other than those shown above.

Program no. (command): Set to 0000.

Protect code (command): Set to 00.

Beginning word (command): Set to 00000000

Last word (command): Set to FFFFFFFF

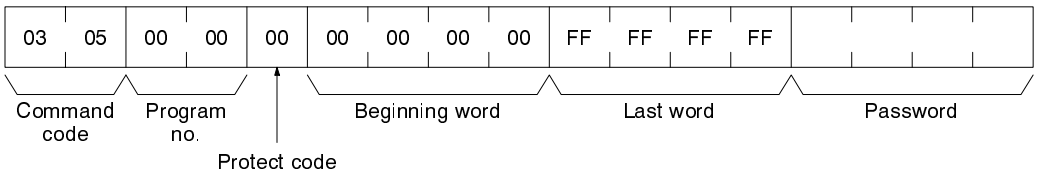
Password (command): Set any four ASCII characters. The password is used with the PROGRAM AREA PROTECT CLEAR command (refer to page *4-10-10 PROGRAM AREA PROTECT CLEAR*).

4-10-10 PROGRAM AREA PROTECT CLEAR

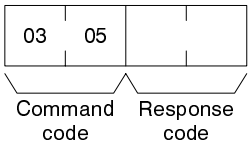
Restores write and read access rights so that data can be written to and read from the program area.

Note
1. Protection cannot be cleared if any other device holds the access right.
2. If memory is write-protected via the key switch on the front panel of the PC, the PROGRAM AREA PROTECT CLEAR command is not effective.

Command Block



Response Block



Parameters

The command will be executed normally even if the beginning word and last word are set to values other than those shown above.

Program no. (command): Set to 0000.

Protect code (command): Set to 00.

Beginning word (command): Set to 00000000

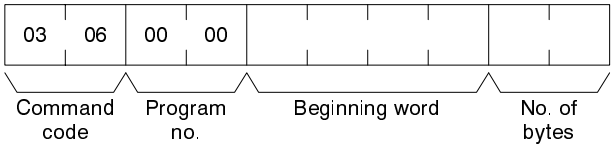
Last word (command): Set to FFFFFFFF

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

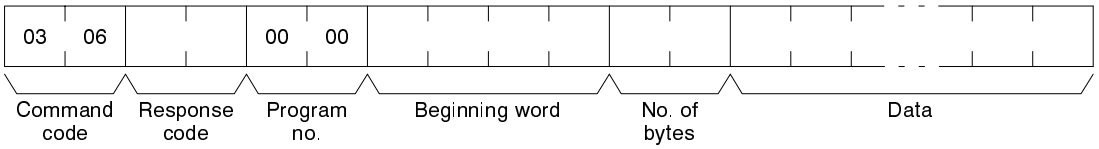
4-10-11 PROGRAM AREA READ

Reads the contents of the specified number of consecutive program area words starting from the specified word. A maximum of 530 bytes can be read with each command. To read larger amounts of data, use multiple commands and specify the beginning word and number of words for each.

Command Block



Response Block

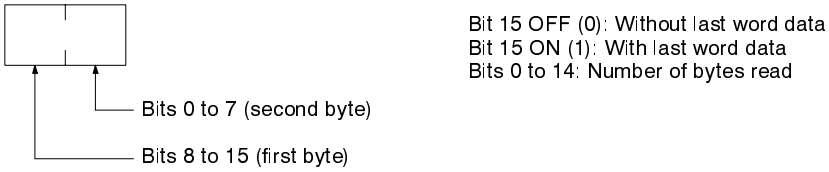


Parameters

Program no. (command and response): Set to 0000.

Beginning word (command and response): Set between 00000E00 and 0000FFFE for the CV500/CVM1 and between 00000E00 and 0001FFFE for the CV1000/CV2000. The beginning word must be an even number.

No. of bytes (command and response): The number of bytes in an even number (530 or smaller). Bit 15 must be OFF (0) in the command block. Bit 15 will be ON (1) in the response block when the last word data of the program area is returned.



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

4-10-12 PROGRAM AREA WRITE

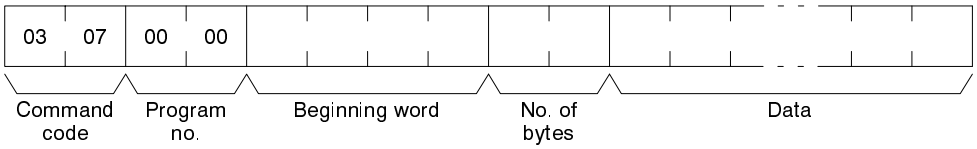
Writes data to the specified number of consecutive program area words starting from the specified word. A maximum of 530 bytes can be written with each command. To write larger amounts of data, use multiple commands and specify the beginning word and number of words for each.

Note

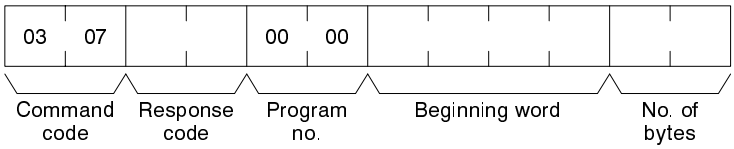
1. If memory is write-protected via the key switch on the PC's front panel or by the PROGRAM AREA PROTECT command (refer to *4-10-9 PROGRAM AREA PROTECT*), nothing will be written to the program area.
2. The PROGRAM AREA WRITE command can be executed as long as the PC is not in RUN mode. It is the user's responsibility to program steps to pro-

hibit this command from being executed when the PC is in MONITOR or DEBUG mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.

Command Block



Response Block

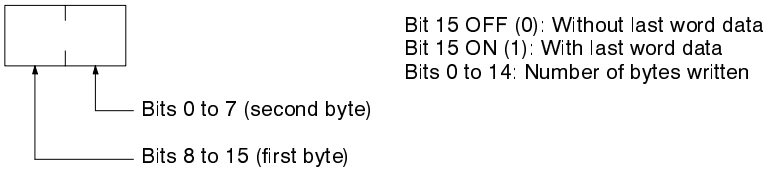


Parameters

Program no. (command and response): Set to 0000.

Beginning word (command and response): Set between 00000E00 and 0000FFFE for the CV500/CVM1 and between 00000E00 and 0001FFFE for the CV1000/CV2000. The beginning word must be an even number.

No. of bytes (command and response): The number of bytes in an even number (530 or smaller). Bit 15 must be ON (1) when data is written to the last word in the specified parameter area or no data will be written.



Data (command): The data to be written.

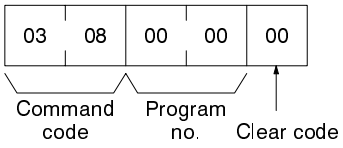
4-10-13 PROGRAM AREA CLEAR

Clears the contents of the program area.

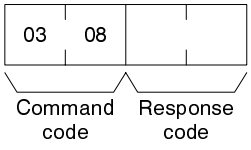
Note

1. If memory is write-protected via the key switch on the front panel of the PC, the PROGRAM AREA CLEAR command is not effective.
2. The PROGRAM AREA CLEAR command will clear the program area even if memory is write-protected by the PROGRAM AREA PROTECT command (refer to *4-10-9 PROGRAM AREA PROTECT*).
3. If any other device holds the access right, the PROGRAM AREA CLEAR command is not effective.

Command Block



Response Block



Parameters

Program no. (command): Set to 0000.

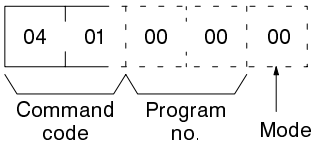
Clear code (command): Set to 00.

4-10-14 RUN

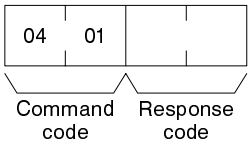
Changes the PC to DEBUG, MONITOR, or RUN mode, enabling the PC to execute its program.

Note If any other device holds the access right, the PC mode will not be changed.

Command Block



Response Block



Parameters

Program no. (command): Set to 0000.

Mode (command): As follows:

01: DEBUG mode

02: MONITOR mode

04: RUN mode

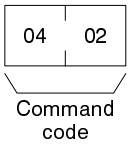
Note If the mode is not specified, the PC will go to MONITOR mode.

4-10-15 STOP

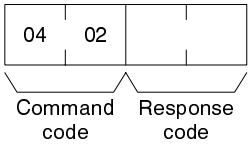
Changes the PC to PROGRAM mode, stopping program execution.

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

Command Block



Response Block



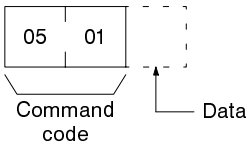
4-10-16 CONTROLLER DATA READ

Reads the following data:

- Controller model and version
- Area data

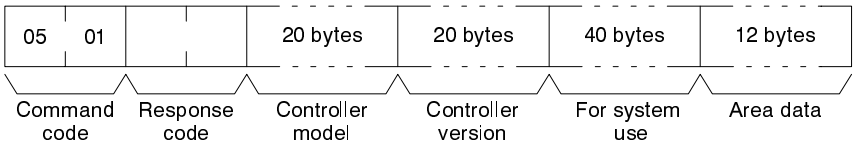
- Remote I/O data
- CPU Bus Unit configuration
- PC status

Command Block

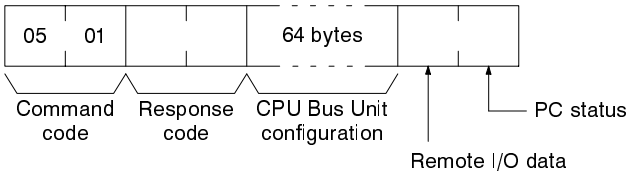


Response Block

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



The format is as follows if 01 is specified as the data to be read:



Parameters

Data (command): Specify as follows to read the desired data:

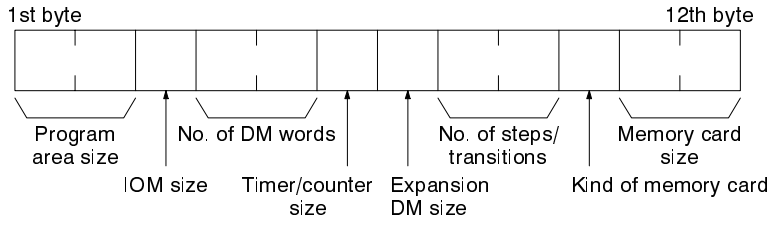
Value	00	01
Data to be read	Controller model Controller version Area data	CPU Bus Unit configuration Remote I/O data PC status

Note If no data is specified, all data will be read consecutively

Controller model and Controller version (response): Both are read in ASCII codes (20 bytes (i.e. 20 ASCII characters) max. each)

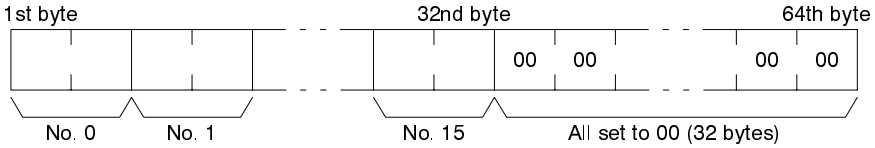
For system use (response): Reserved for system use.

Area data (response): As follows:

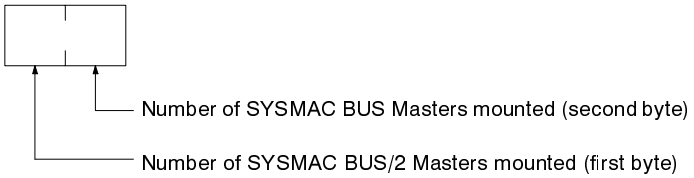


Item	Meaning	Unit
Program area size	The size of PC Setup and program area	K words (1K words = 1,024 words)
IOM size	The size of the area in which bit/word commands can be used.	K bytes (1K bytes = 1,024 bytes)
No. of DM words	Total words in the DM area	K words
Timer/counter size	Maximum number of timers/counters available	Timers/Counters
Expansion DM size	Banks in the expansion DM area	Banks (1 bank = 32,766 words)
No. of steps/transitions	Maximum number of steps/transitions available	Steps/transitions
Kind of memory card	00: No memory card 01: SPRAM 02: EPROM 03: EEPROM	---
Memory card size	Size of the memory card	K byte (1 word = 2 bytes)

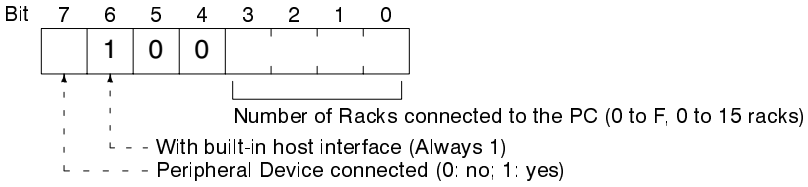
CPU Bus Unit configuration (response): Each CPU Bus Unit has a code assigned to it consisting of two ASCII characters (two bytes). These codes are given in the numerical order according to the unit number of the CPU Bus Units (unit 0 to 15).



Remote I/O data (response): The number of remote I/O systems (SYSMAC BUS and SYSMAC BUS/2) is returned in two bytes as follows:



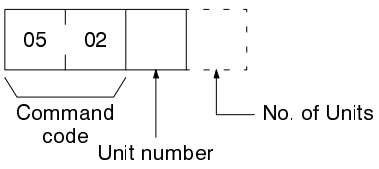
PC status (response): The following single byte (8 bits) is returned:



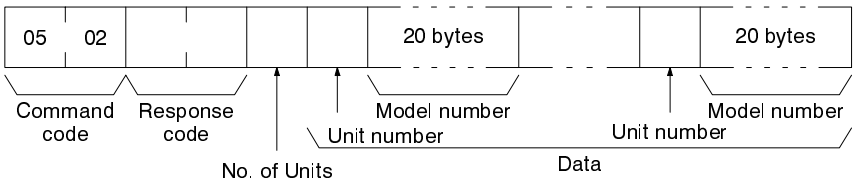
4-10-17 CONNECTION DATA READ

Reads the model number of the specified Units.

Command Block



Response Block



Parameters

Unit number (command and response): The unit number of the first Unit whose model number is to be read. If the specified Unit does not exist, the CONTROLLER DATA READ command is executed from the next Unit.

No. of Units (command): The number of Units for which the model number is to be read. A number between 01 and 19 (hexadecimal) can be specified. If the number of Units is not specified, 19 (25 units) will be used.

No. of Units (response): The number of Units for which a model number is being returned. If bit 7 is ON (1), the model number of the last Unit is being returned.

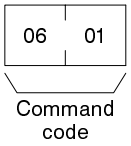
Unit number and model number (response): The Unit number and model number. The model number is provided in up to 20 ASCII characters.

4-10-18 CONTROLLER STATUS READ

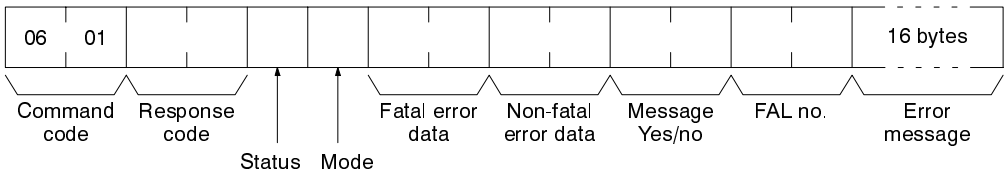
Reads the status of the Controller.

Note To read the error log, read the appropriate Auxiliary Area words or execute the ERROR LOG READ command (refer to *4-10-29 ERROR LOG READ*).

Command Block



Response Block



Parameters

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

00: Stop (program not being executed)

01: Run (program being executed)

80: CPU on standby (the start switch is OFF or the CPU is waiting for a signal from a device such as a SYSMAC BUS/2 Remote I/O Slave Unit).

Mode (response): One of the following PC modes:

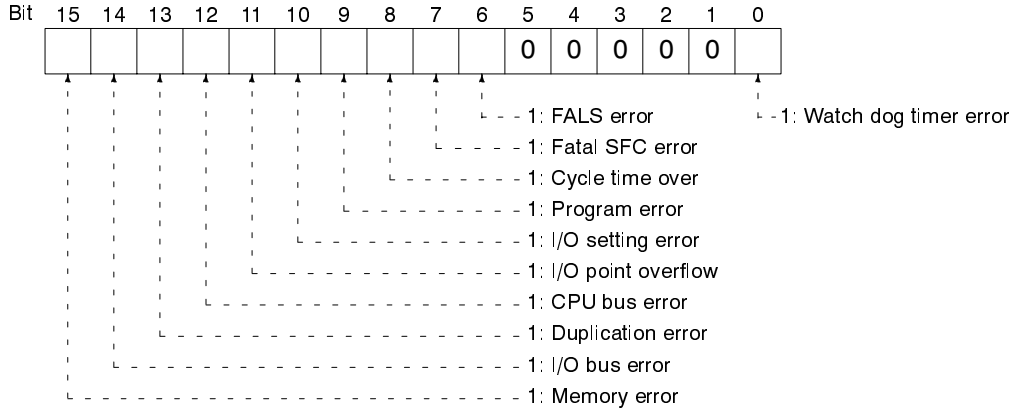
00: PROGRAM

01: DEBUG

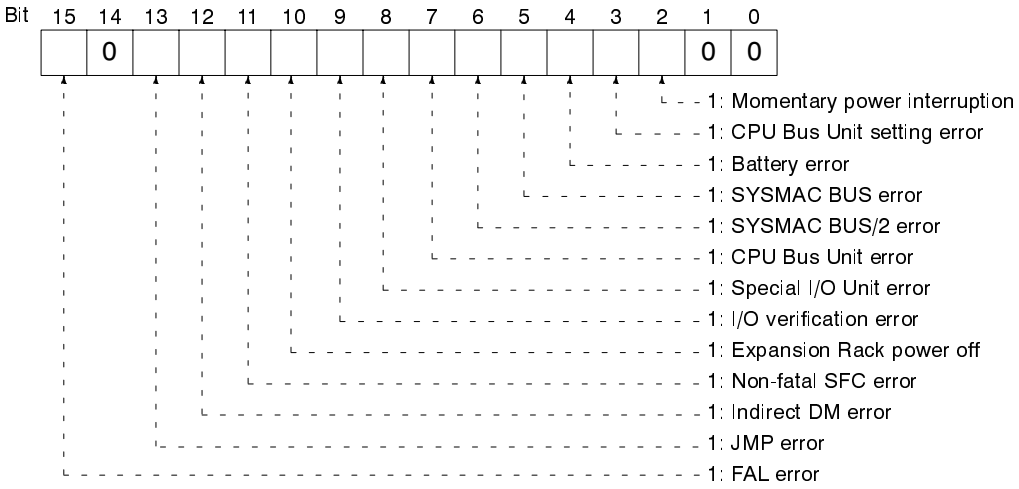
02: MONITOR

04: RUN

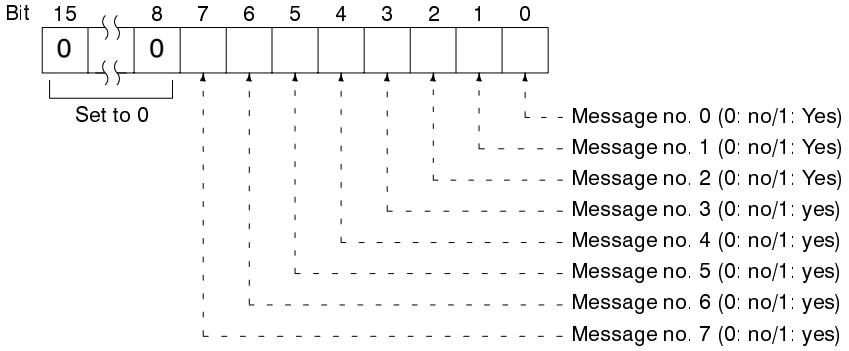
Fatal error data (response): The contents of A401 (for details refer to the *CV-series PC Operation Manual: Ladder Diagrams*):



Non-fatal error data (response): The contents of A402 (for details refer to the *CV-series PC Operation Manual: Ladder Diagrams*):



Message yes/no (response): If MSG(195) has been executed, the bit corresponding to the message number will be ON (1) as shown below. To read the messages generated by MSG(195), execute the MESSAGE READ command (refer to *4-10-22 MESSAGE READ*).



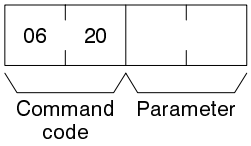
FAL no. (response): The contents of A400 (the highest priority error; for details refer to the *CV-series PC Operation Manual: Ladder Diagrams*).

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

4-10-19 CYCLE TIME READ

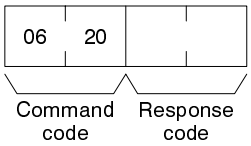
Initializes the PC's cycle time history or reads the average, max., and min. cycle time.

Command Block

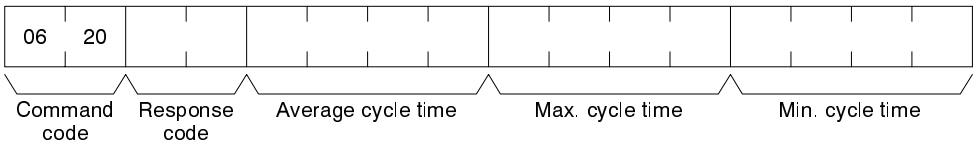


Response Block

The response format is as follows when the parameter is 00 (when initializing):



The response format is as follows when the parameter is 01 (when reading):



Parameters

Parameter code (command): As follows:

00: Initializes the cycle time.

01: Reads the average, maximum, and minimum cycle time.

Average cycle time, max. cycle time, min. cycle time (response): Each value is expressed in 8-digit BCD in 0.1-ms increments. For example, if 00 00 06 50 is returned, the cycle time is 65 ms.

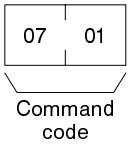
The average cycle time is obtained as follows:

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

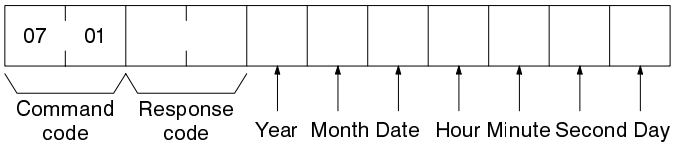
4-10-20 CLOCK READ

Reads the clock.

Command Block



Response Block



Parameters

Year, month, date, hour, minute, second, day (response): Each value is expressed in BCD.

Year: The rightmost two digits of the year.

Hour: 00 to 23.

Day: As follows:

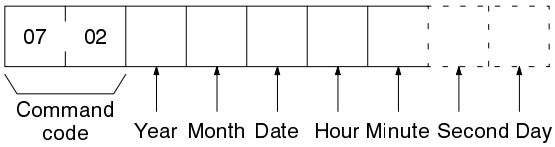
Value	00	01	02	03	04	05	06
Day	Sun	Mon	Tues	Wed	Thu	Fri	Sat

4-10-21 CLOCK WRITE

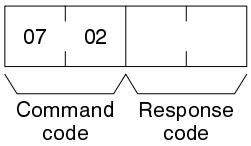
Sets the clock.

Note
1. The PC automatically checks the range of the specified data. If any portion of the data is incorrect, the clock will not be set.
2. If any other device holds the access right, the clock will not be set.

Command Block



Response Block



Parameters

Year, month, date, hour, minute, second, day (command): Each specified value is expressed in BCD.

Year: The rightmost two digits of the year.

Hour: Specify 00 to 23.

Day: As follows:

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

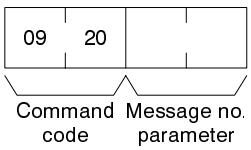
Note
1. If the second or day are not specified, 00 will be set as the second and the previous value will be kept for the day .
2. The PC does not check the day from the date. This means that no error will occur even if the date and day do not agree.

4-10-22 MESSAGE READ

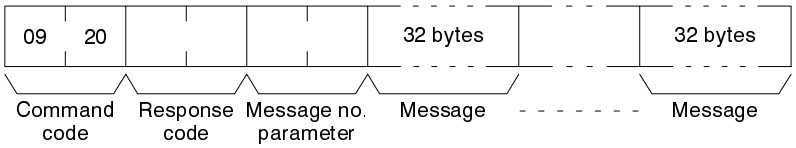
Reads messages generated by MSG(195).

Note The MESSAGE READ, MESSAGE CLEAR (refer to *4-10-23 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *4-10-24 FAL/FALS READ*) share the same command code. They are distinguished by bits 14 and 15 of the two-byte parameter following the command code. To read MSG(195) messages, bits 14 and 15 must be OFF (0).

Command Block

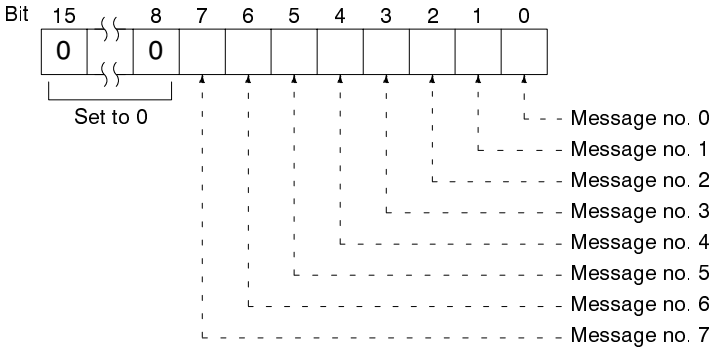


Response Block



Parameters

Message no. parameter (command and response): In the command block, turn ON (1) the bits of the messages to be read. In the response block, the bits of the messages being returned will be ON (1). If no bits are turned ON in the command block, all bits will be OFF (0) in the response block and no further data will be returned.



Message (response): Each message is read in the numerical order according to the message number. Each message consists of 32 ASCII characters (32 bytes). The total number of bytes of the messages is calculated as follows:

The number of messages * 32 bytes

If no message has been registered for a message number that has been requested, 32 spaces (ASCII 20) will be returned.

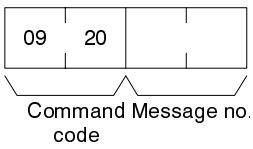
4-10-23 MESSAGE CLEAR

Clears messages generated with MSG(195).

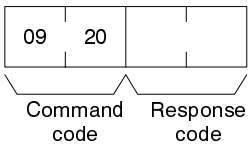
Note

1. The MESSAGE READ, MESSAGE CLEAR (refer to *4-10-23 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *4-10-24 FAL/FALS READ*) share the same command code. They are distinguished by bits 14 and 15 of the two-byte parameter following the command code. To clear messages, bit 14 must be ON (0) and bit 15 must be OFF (0).
2. If any other device holds the access right, messages will not be cleared.

Command Block

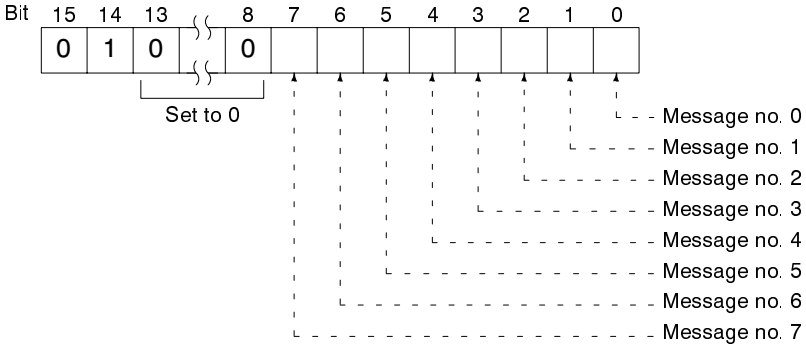


Response Block



Parameters

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

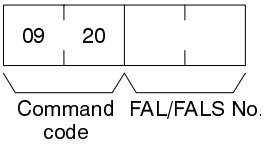


4-10-24 FAL/FALS READ

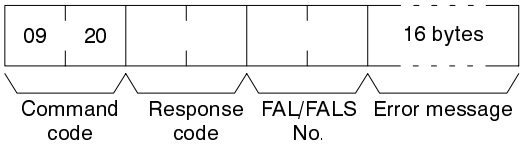
Reads FAL/FALS messages.

Note The MESSAGE READ (refer to *4-10-22 MESSAGE READ)*, MESSAGE CLEAR (refer to *4-10-23 MESSAGE CLEAR*), and FAL/FALS READ commands (refer to *4-10-24 FAL/FALS READ*) share the same command code. They are distinguished by bits 14 and 15 of the two-byte parameter after the command code. To read FAL/FALS messages, bit 14 must be OFF (0) and bit 15 must be ON (1).

Command Block

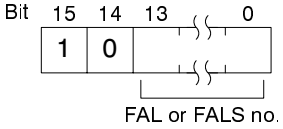


Response Block



Parameters

FAL/FALS no. (command and response): In the command block, specify in hexadecimal in bits 0 to 13 the FAL or FALS number to be read as shown below. In the response block, the FAL or FALS number is returned.



Error message (response): The error message specified in the FAL(006) or FALS(007) instruction. If there is no error, 16 spaces (ASCII 20) will be returned.

4-10-25 ACCESS RIGHT ACQUIRE

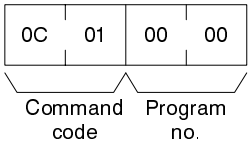
Acquires the access right as long as no other device holds it. Execute the ACCESS RIGHT ACQUIRE command when you need to execute commands continuously without being interrupted by other devices. As soon as the execution of the commands has been completed, execute the ACCESS RIGHT RELEASE command to release the access right (refer to *4-10-27 ACCESS RIGHT RELEASE*). If another devices holds the access right, the device will be identified in the response.

Note

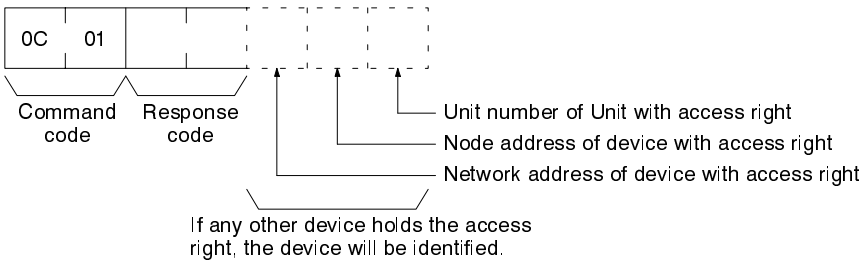
1. If any other device has the access right, the access right cannot be acquired with this command; use the ACCESS RIGHT FORCED ACQUIRE command (refer to *4-10-26 ACCESS RIGHT FORCED ACQUIRE*).
2. The following commands cannot be executed by other devices if the host computer holds the access right. Do not restrict the access right unless necessary.

PARAMETER AREA WRITE	PARAMETER AREA CLEAR
PROGRAM AREA PROTECT	PROGRAM AREA CLEAR
PROGRAM AREA PROTECT CLEAR	
PROGRAM AREA WRITE	RUN
STOP	CLOCK WRITE
MESSAGE CLEAR	ACCESS RIGHT ACQUIRE
ERROR CLEAR	ERROR LOG CLEAR
PARAMETER AREA FILE TRANSFER	
PROGRAM AREA FILE TRANSFER	
FORCED SET/RESET	FORCED SET/RESET CANCEL

Command Block



Response Block



4-10-26 ACCESS RIGHT FORCED ACQUIRE

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

Note

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

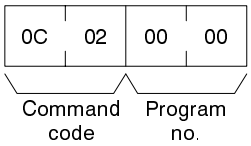
PARAMETER AREA WRITE	PARAMETER AREA CLEAR
PROGRAM AREA PROTECT	PROGRAM AREA CLEAR
PROGRAM AREA PROTECT CLEAR	
PROGRAM AREA WRITE	RUN
STOP	CLOCK WRITE
MESSAGE CLEAR	ACCESS RIGHT ACQUIRE
ERROR CLEAR	ERROR LOG CLEAR
PARAMETER AREA FILE TRANSFER	
PROGRAM AREA FILE TRANSFER	
FORCED SET/RESET	FORCED SET/RESET CANCEL

3. When the ACCESS RIGHT FORCED ACQUIRE command is executed while any other device has the access right, the access right of the other de-

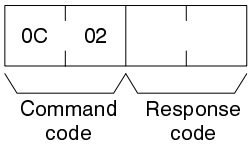
vice will be canceled. If possible, wait until the other device completes the present operation, and then execute the ACCESS RIGHT ACQUIRE command (refer to *4-10-25 ACCESS RIGHT ACQUIRE*).

4. The device that has lost the access right is not notified.

Command Block



Response Block

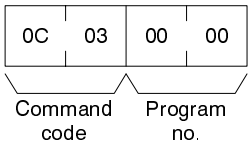


Parameters **Program no. (command):** Set to 0000.

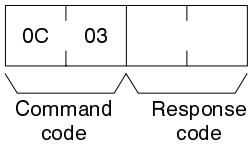
4-10-27 ACCESS RIGHT RELEASE

Releases the access right regardless of what device holds it. A normal response code will returned even when another device held the access right or when no device held the access right.

Command Block



Response Block



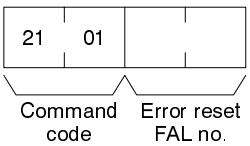
Parameters **Program no. (command):** Set to 0000.

4-10-28 ERROR CLEAR

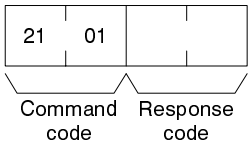
Clears errors or error messages from the PC. A normal response will be returned even if the error has not occurred.

Note The cause of the error must be removed before executing the ERROR CLEAR command or the same error will occur again after the ERROR CLEAR command is executed.

Command Block



Response Block



Parameters

Error reset FAL no. (command): The code of the error to be reset.

The following codes can be used regardless of the PC's mode:

Code	Meaning
FFFE	Present error cleared. Resets the highest priority error.
0001	Expansion rack power off
0002	Power interruption error. This error occurs when the CPU power has been interrupted.
00A0 to 00A7	SYSMAC BUS error
00B0 to 00B3	SYSMAC BUS/2 error
00E7	I/O verification error. This error occurs if the I/O table differs from the actual I/O points in the System.
00F4	Non-fatal SFC error. This error occurs when there is an error while the PC is executing an SFC program.
00F6	No EM Area: Specified EM Area does not exist (generated at execution)
00F7	Battery error
00F8	Indirect DM error. This error occurs when a mistake has occurred in indirectly addressing the DM Area.
00F9	JMP error. This error occurs when a jump has been specified without a destination.
0200 to 0215	CPU Bus Unit error (the rightmost two digits are the unit number in BCD of the Unit that has the error). This error occurs if there is a parity error at the time of data transfer between the CPU Bus Unit and CPU or if the CPU Bus Unit has a watchdog timer error.
0400 to 0415	CPU Bus Unit setting error (the rightmost two digits are the unit number in BCD of the Unit that has the error).
4100 to 42FF	FAL(006) executed in the user program.

The following codes can be used only when the PC is in PROGRAM mode:

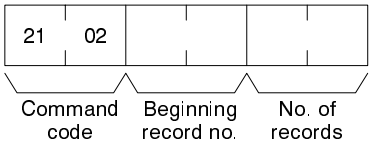
Code	Meaning
FFFF	All errors cleared.
809F	Cycle time too long
80C0 to 80C7	I/O bus error. This error occurs when there is an error in an I/O bus check or a Unit has been removed or added when power is turned on to the PC.
80E0	I/O setting error. This error occurs if the I/O table differs from actual I/O points in the System.
80E1	I/O points overflow
80E9	Duplication error. This error occurs if the same unit number is assigned more than one Unit or the same word is allocated more than once.
80F0	Program error. This error occurs if a program that exceeds memory capacity is executed.
80F1	Memory error. This error occurs if an error is found in the PC's memory, memory card, or PC Setup during an memory error check.
80F3	SFC definition error. This error occurs if an SFC syntax error has been discovered and the program will not execute.
80FF	System error. This error occurs if the CPU has a watchdog timer error.
8100 to 8115	CPU bus error. The rightmost two digits are the unit number in BCD of the CPU Bus Unit that has the error. This error occurs if an error is discovered during a CPU bus check.
C100 to C2FF	FALS(007) executed.

4-10-29 ERROR LOG READ

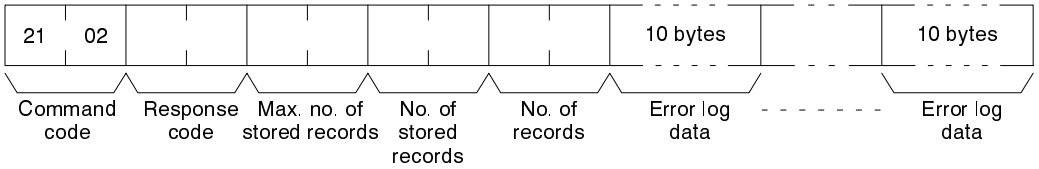
Reads the PC's error log.

Note
1. When the PC does not have the specified number of records, all the records that have been stored in the PC will be read and an address range overflow error will result.
2. If the data is too large and exceeds the permissible length of the response block, the part in excess will not be read and a response length overflow error will result.

Command Block



Response Block



Parameters

Beginning record no. (command): The first record to be read (the first record number is 0000).

Max. no. of stored records (response): The maximum number of records that can be recorded.

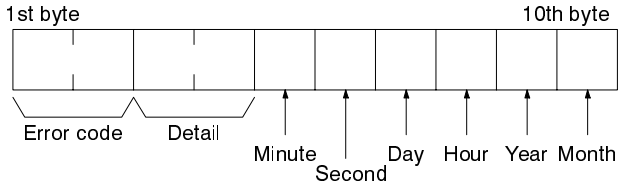
No. of stored records (response): The number of records that have been recorded.

No. of records (command and response): The number of records read.

Error log data (response): The specified error log records will be returned in sequence starting from the beginning record number. The total number of bytes required is calculated as follows:

Number of records x 10 bytes

The configuration of each error record is as follows:



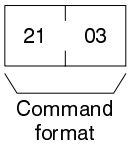
Each data includes the second, minute, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

4-10-30 ERROR LOG CLEAR

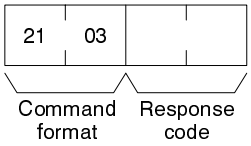
Clears all error log records.

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

Command Block



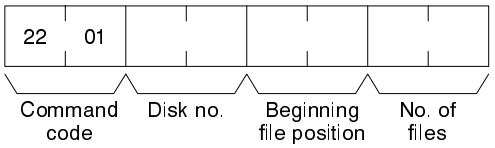
Response Block



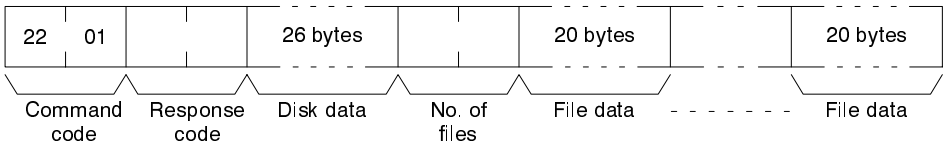
4-10-31 FILE NAME READ

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

Command Block



Response Block



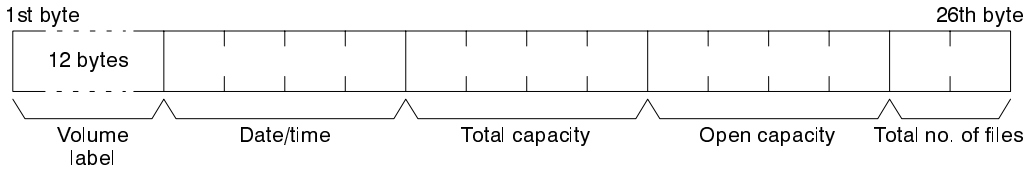
Parameters

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

Beginning file position (command): The first file to be read (the first file number is 0000).

No. of files (command): The number of files to be read.

Disk data (response): The data from the file device, the configuration of which is as follows:



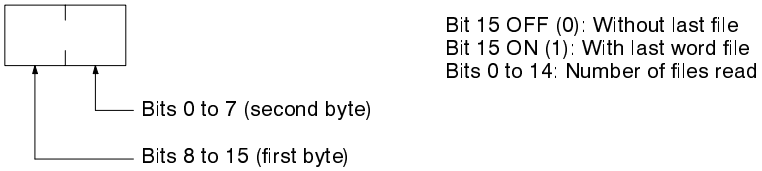
Volume Label
The volume label registered with the file device (refer to *4-8 Volume Labels and File Names* for the configuration of the volume label). If no volume label has been registered, 20 spaces (ASCII 20) will be returned.

Date/Time
The date and time that the volume label was created (see next page).

Total Capacity and Open Capacity
The total capacity of the file device and the number of bytes still available (hexadecimal).

Total No. of Files
The number of files recorded in the file device.

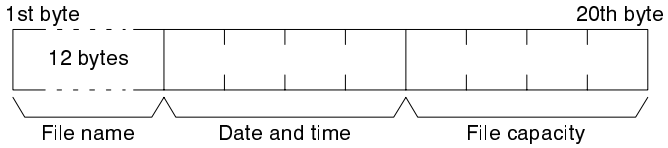
No. of files (response): The number of files that have been read. Bit 15 is ON (1) if the last file is included.



File data (response): Each file data consists of 20 bytes. The specified files will be transmitted in sequence starting from the first file. The total number of bytes required is calculated as follows:

Number of read files x 20 bytes

The data for each file data is as follows:

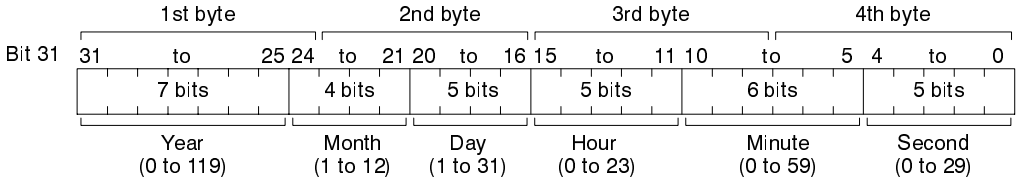


File Name
The name of the file (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

Date/Time
The date and time that the file was created (see below).

File Capacity
The capacity (bytes) of the file.

Date/Time The configuration of the clock data (four bytes or 32 bits) is as follows:



All data values are in BCD.

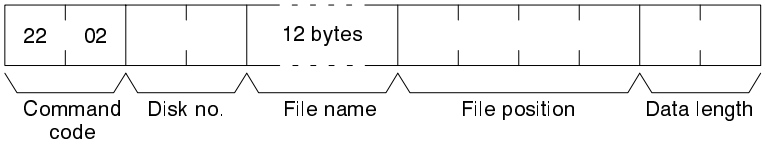
Year: Add 1980.

Second: Multiply by two.

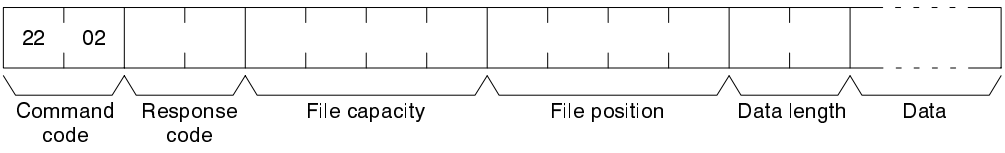
4-10-32 SINGLE FILE READ

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

Command Block



Response Block



Parameters

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

Beginning file name (command): The name of the file to be read (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

File position (command and response): The number of bytes from the start of the file from which to start reading (files start at 00000000).

Data length (command and response): The number of bytes of data to read.

File capacity (response): The capacity (bytes) of the file that was read.

Note If the SINGLE FILE READ command is executed for a file with a file capacity of 0 bytes, the data length will be returned as 0000 and no data will be read.

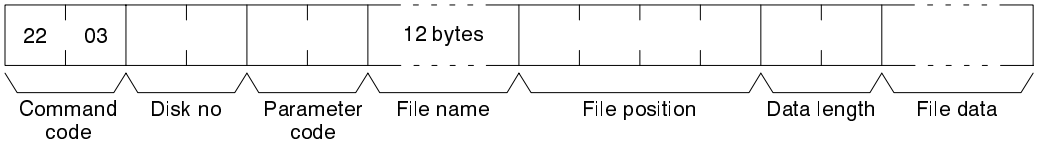
Data (response): The specified data in sequence starting from the specified byte.

4-10-33 SINGLE FILE WRITE

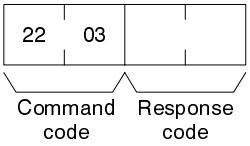
Writes a new file to the file device connected to the PC or appends/overwrites an existing file stored in the file device. Designation can be made to protect existing files if an attempt is made to create a new file of the same name as an existing file. When a new file is written or an existing file is modified, the file will record the clock data of the PC as the date of the file.

Note Writing a new file or modifying an existing file must be done within the capacity of the file device or the SINGLE FILE WRITE command cannot be executed.

Command Block



Response Block



Parameters

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

Parameter code (command): As follows:

0000: Writes a new file. If a file with the same name already exists, the new file will not be created.

0001: Writes a new file. If a file with the same name already exists, it will be overwritten

0002: Add data to an existing file.

0003: Overwrite an existing file.

File name (command): The name of the file to be written (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

File position (command): The number of bytes from the start of the file from which to start writing (files start at 00000000). To create a new file or add data to an existing file, specify 00000000 as the file position.

Data length (command and response): The number of bytes to be written.

Note A new file with a file capacity of 0 (no data) will be created if SINGLE FILE WRITE is executed with 0000 as the data length.

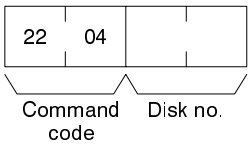
File data (response): The data to be written to the file.

4-10-34 MEMORY CARD FORMAT

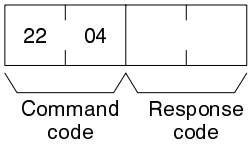
Formats a memory card. Always execute the MEMORY CARD FORMAT before using a new memory card as a file device.

Note If the MEMORY CARD FORMAT command is executed, all data will be cleared from the memory card.

Command Block



Response Block



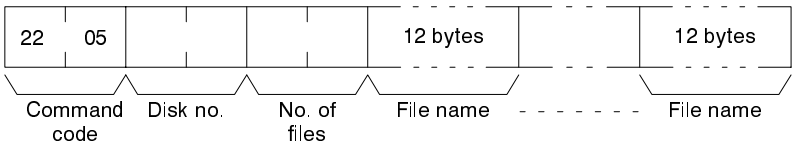
Parameters **Disk no. (command):** Set to 0000 for the file device (memory card).

4-10-35 FILE DELETE

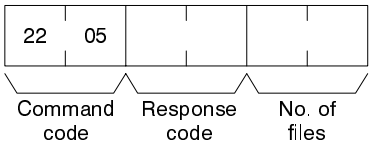
Deletes files stored by the file device connected to the PC.

Note
1. The specified files will be deleted in sequence. If non-existing file names have been specified, the PC will ignore them and the operation will continue.
2. If the specified number of files and the number of file names do not coincide, no files will be deleted.

Command Block



Response Block



Parameters

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

No. of files (command): The number of files to be deleted.

File name (command): The names of the files to be deleted (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

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

4-10-36 VOLUME LABEL CREATE/DELETE

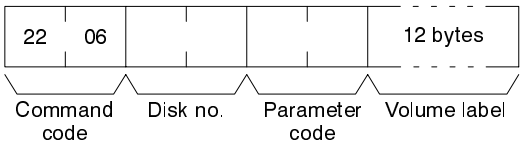
Creates a volume label on the file device connected to the PC or deletes an existing volume label from the file device.

Only one volume label can be created for a single memory card or for all the expansion DM memory banks.

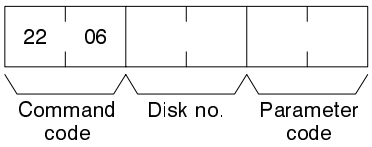
When a volume label is generated, the clock data of the PC will be recorded as the date of the volume label.

Command Block

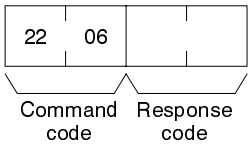
The command format for creating a volume label is as follows:



The command format for deleting a volume label is as follows:



Response Block



Parameters

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

Parameter code (command and response): As follows:

0000: Creates a new volume label. If a label already exists, nothing will be executed.

0001: Creates a volume label. If a label already exists, it will be deleted.

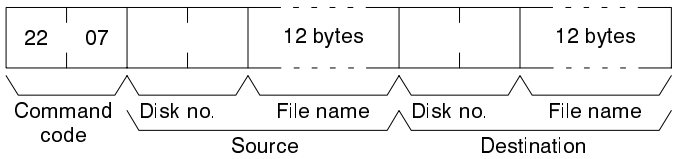
0002: Deletes an existing volume label.

Volume label (command): The volume label to be written (refer to *4-8 Volume Labels and File Names* for the configuration of the volume label).

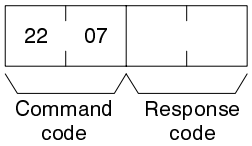
4-10-37 FILE COPY

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

Command Block



Response Block



Parameters

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

File name (command): The file to be copied and a new name for the copied file (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

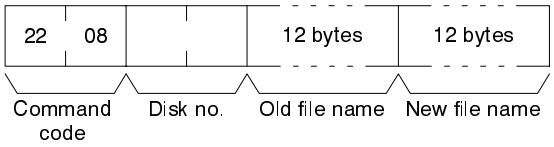
Note a) The file will not be copied if an existing file name is given.

b) The copied file is given the same date as the original file.

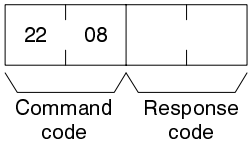
4-10-38 FILE NAME CHANGE

Changes a file name.

Command Block



Response Block



Parameters

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

Old and new file names (command): The original file name and a new name for the file (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

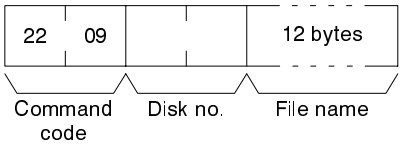
Note a) The file name will not be changed if an existing file name is given for the new file.

b) The new file is given the same date as the original file.

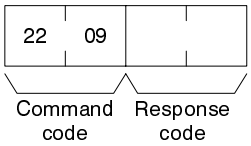
4-10-39 FILE DATA CHECK

Does a data check on a file stored in the file device connected to the PC by confirming the checksum at the beginning of the file.

Command Block



Response Block



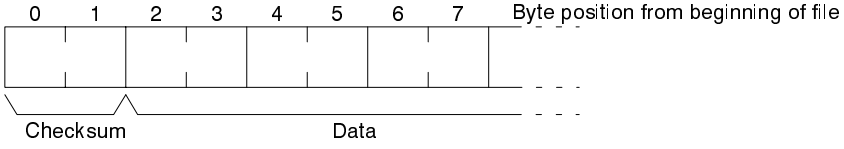
Parameters

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

File name (command): The file to be checked (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

File Data Check

The configuration of a file stored in the file device is as follows:



Checksum

The first two bytes of a file are called the checksum, which is the rightmost two bytes resulting from adding all data words (two bytes each). If the number of all bytes is odd, a byte of 00 is added to it so that the number of the number of bytes is even.

Example

- **Data:** 13 3A E4 F3 CC 0B 3C 5F A2
- **Words:** 133A E4F3 CC0B 3C5F A200
- **Total:** 133A + E4F3 + CC0B + 3C5F + A200 = 2A297
- **Checksum:** A2 97

Data

"File data" refers to the data in a file that a file device stores. A file data check is done with the checksum. To complete a file data check, the data words starting from the third byte are added and the result is compared with the checksum. If these values are the same, the file is assumed to contain no errors; if the values differ, a parity/sum check error will result. A file with a capacity of two bytes has a checksum of 0000.

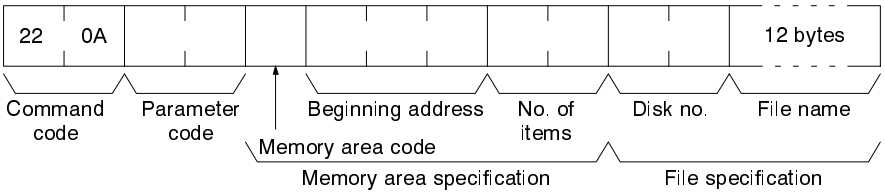
4-10-40 MEMORY AREA FILE TRANSFER

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

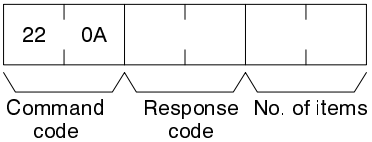
Note

1. The checksum is stored at the front (bytes 0 and 1) of the file. Thus file transfer or comparison is effective from the next byte after the checksum.
2. The MEMORY AREA FILE TRANSFER command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.
3. If data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

Parameter code (command): As follows:

0000: Data transfer from the PC memory area to the file device.

0001: Data transfer from the file device to the PC memory area.

0002: Data compared.

Memory area code (command): The memory area to be used for data transfer or comparison.

Beginning address (command): The first word/value in the memory area to be transferred or compared.

No. of items (command and response): In the command block, the number of items to be transferred or compared. In the response block, the number of items transferred or compared

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

File name (command): The file to be transferred or compared (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

Memory Areas

The following data can be used for transfer or comparison (refer to *4-7 Memory Area Designations* for memory area designations):

Memory area	Data	Memory area code	No. of bytes
CIO, TR, CPU Bus Link, and Auxiliary	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2
DM	Word contents	82	2
Expansion DM	Word contents, specified bank	90 to 97 (banks 0 to 7)	2
	Word contents, current bank	98	2

4-10-41 PARAMETER AREA FILE TRANSFER

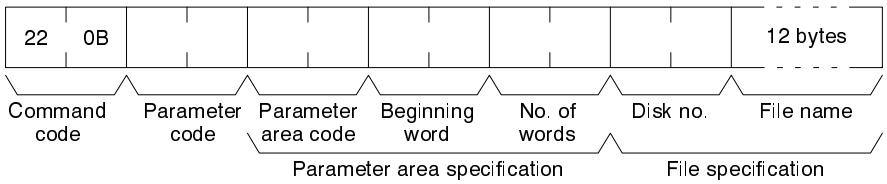
Compares or transfers data between the PC's parameter area and the file device connected to the PC. The clock data of the PC upon completion of the PARAMETER AREA FILE TRANSFER command will be recorded as the date of the file that has been transferred.

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

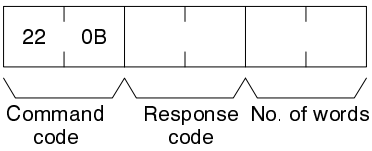
Note

1. The checksum is stored at the front (bytes 0 and 1) of the file. Thus file transfer or comparison is effective from the next byte after the checksum.
2. The PARAMETER AREA FILE TRANSFER command can be executed regardless of the PC's mode. It is the user's responsibility to program steps to prohibit this command from being executed when the PC is in RUN mode if such protection is necessary. Execute the CONTROLLER STATUS READ command (refer to *4-10-18 CONTROLLER STATUS READ*) to read the PC's mode.
3. This command cannot be executed if any other device holds the access right or when memory is write-protected via the key switch on the front panel of the PC.

Command Block



Response Block



Parameters

Parameter code (command): As follows:

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

0001: Data transfer from the file device to the PC's parameter area.

0002: Data compared.

Parameter area code (command): The parameter area to be used for data transfer or comparison.

Beginning word (command): The first word in the parameter area to be transferred or compared. Each parameter area has consecutive word addresses beginning at 0000 (see below).

No. of words (command and response): In the command block, the number of data words to be transferred or compared. In the response block, the number of words transferred or compared

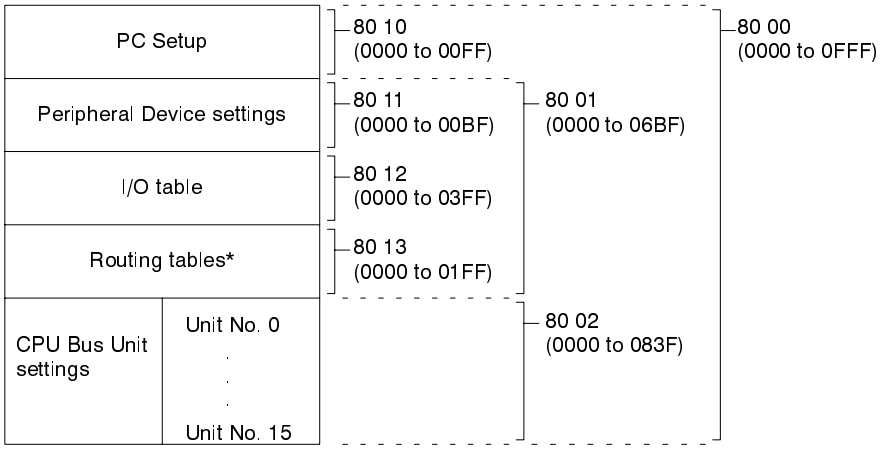
Note If 0000 is specified as the number of items, no data will be transferred or compared and a normal response code will be returned.

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

File name (command): The file to be transferred or compared (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

Parameter Areas

The following shows the parameter areas and the words that can be specified. The word ranges in parentheses show the possible values for the beginning word.



Note *Although the routing tables have a 512-word area (0000 to 01FF0), only a 48-word area (0000 to 003F) of it can read/written.

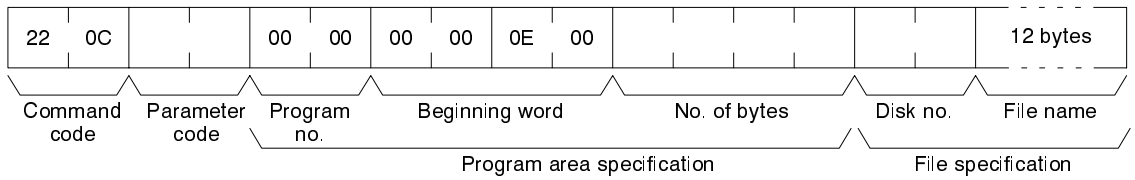
4-10-42 PROGRAM AREA FILE TRANSFER

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

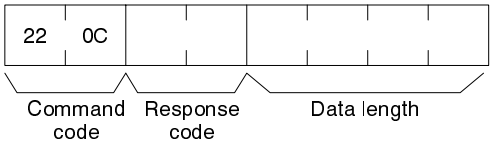
Note 1. The checksum is stored at the front (bytes 0 and 1) of the file. Thus file transfer or comparison is effective from the next byte after the checksum.

2. This command cannot be executed when the access right is held by any other device or when the PC is write-protected by the key switch on the front panel.
3. The PROGRAM AREA FILE TRANSFER command cannot be executed when the PC is in the RUN mode.

Command Block



Response Block



Parameters

Parameter code (command): As follows:

0000: Data transferred from the program area to the file device.

0001: Data transferred from the file device to the program area.

0002: Data compared.

Program no. and beginning word (command): As follows:

0000: Program number

00000E00: Beginning word

No. of bytes (command): The number of data bytes to be transferred or compared as follows:

0000F1FE: CV500/CVM1

0001F1FE: CV1000/CV2000

Note If 00000000 is specified as the number of transfer data bytes, no file transfer or comparison will be performed and a normal response code will be read.

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

File name (command): The file to be transferred or compared (refer to *4-8 Volume Labels and File Names* for the configuration of the file name).

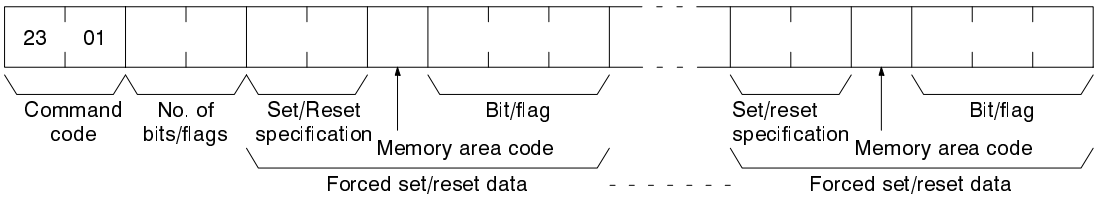
Data length (response): The number of bytes that have been transferred or compared.

4-10-43 FORCED SET/RESET

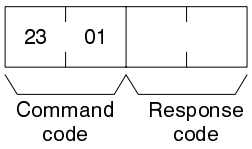
Force-sets (ON) or force-resets (OFF) bits/flags or releases force-set status. Bits/flags that are forced ON or OFF will remain ON or OFF and cannot be written to until the forced status is released.

Note This command cannot be used to release the status of Completion Flags for timers or counters. Use the FORCE SET/RESET CANCEL command . For details refer to *4-10-44 FORCED SET/RESET CANCEL*).

Command Block



Response Block



Parameters

No. of bits/flags (command): The number of bits/flags to be controlled.

Set/Reset specification (command): The action to be taken for each bit/flag

Value	Name
0000	Force-reset (OFF)
0001	Force-set (ON)
8000	Forced status released and bit turned OFF (0)
8001	Forced status released and bit turned ON (1)
FFFF	Forced status released

Memory area code (command): The memory area of the bit or flag to be controlled.

Bit/Flag (command): The bit or flag to be controlled.

Memory Areas

The bits (flags) in the following memory areas can be forced set/reset or released. Refer to *4-7 Memory Area Designations* for memory area designations.

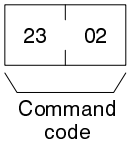
Memory area	Data	Memory area code
CIO, TR, and CPU Bus Link (see note)	Bits status	00
Timer/Counter	Completion Flag status	01
Transition	Flag status	03

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

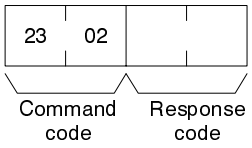
4-10-44 FORCED SET/RESET CANCEL

Cancels all bits (flags) that have been forced ON or forced OFF.

Command Block



Response Block



Note The bits (flags) in the following memory areas can be forced set or forced reset.

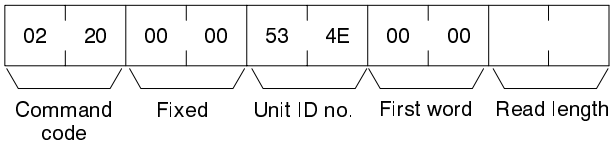
Memory area	Data	Memory code
CIO, TR, CPU Bus Link, and Auxiliary	Bits status	00
Timer/Counter	Completion Flag status	01
Transition	Flag status	03

4-11 CV-mode Commands for SYSMAC NET Link Units

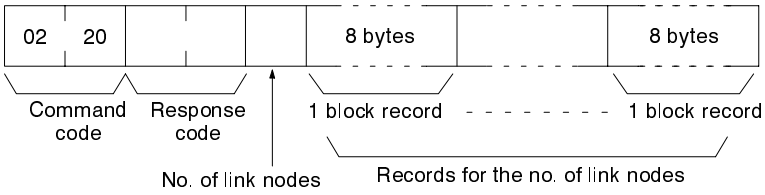
4-11-1 DATA LINK TABLE READ

Reads the contents of the data link table.

Command Block



Response Block



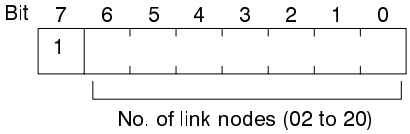
Parameters

Unit ID no. (command): Designate S (53) and N (4E) in ASCII.

Beginning word (command): Set to 0000.

Read length (command): Regardless of the value that you designate, the data link tables for the number of link nodes that has been set will be read.

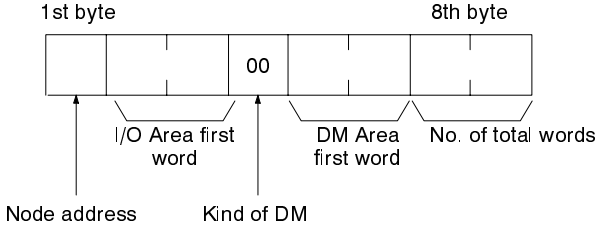
No. of link nodes (response): The number of link nodes set in the data link table will be returned; the configuration is as follows (bit 7 is always set to 1):



One-block record (response): The construction of a one-block record is shown below. One-block records will be returned in sequence according to the setting order in the data link table (in the case of automatic setting, they will be returned in node address order). The total number of bytes required is as follows:

Number of link nodes x 8 bytes

The configuration of the one-block record is as follows:



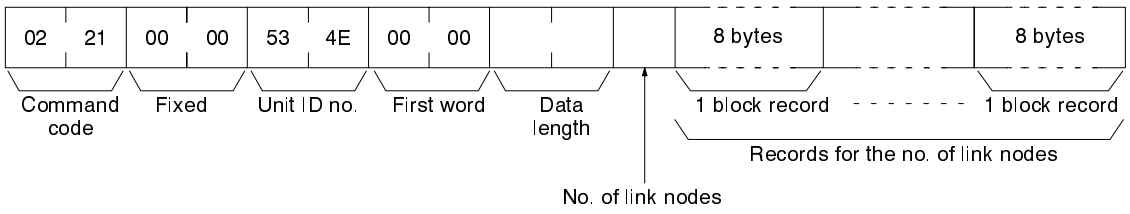
- Node Address
  The construction of a node address is shown below. It expresses the status of the data link node address of the one-block record and the data link on the node.
- I/O Area First Word
  The first word in a data link in the I/O Area.
- Kind of DM
  Set to 00.
- DM Area First Word
  The first word of a data link in the DM Area.
- No. of Total Words
  The total number of words of the I/O and DM Area varies with the block as follows:
  1st block: The total number of data link words in the I/O Area.
  2nd block: The total number of data link words in the DM Area.
  3rd block and succeeding blocks: Set to 0000.

4-11-2 DATA LINK TABLE WRITE

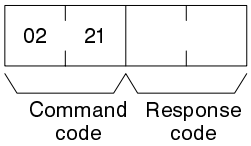
Writes the data link table.

Note
1. You cannot write a data link table when the data link is active
2. The data set on each node must begin with the first node of the data link area.
3. You cannot set a vacant area between two data link areas. For details, refer to *Section 5 Data Links*.

Command Block



Response Block



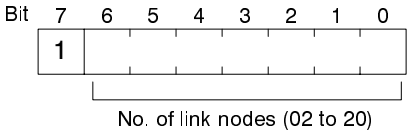
Parameters

Intelligent ID no. (command): Designate S (53) and N (4E) in ASCII.

First word (command): Set to 0000.

Data length (command): Regardless of the value you designate, the data link tables for the *number of link nodes* will be written.

No. of link nodes (response): Designate the number of link nodes to be set in the data link table in a range between 02 and 20 (2 and 32); the configuration is as follows (bit 7 is always set to 1):

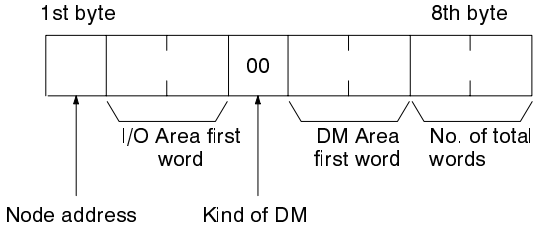


One-block record (command): The construction of a one-block record is shown below. One-block records will be sent in sequence according to the set-

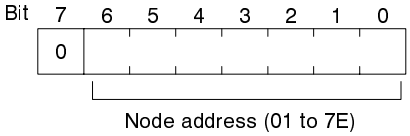
ting order in the data link table. The total number of bytes required is as follows:

Number of link nodes x 8 bytes

The configuration of the one-block record is as follows:



- Node Address
  The node address provides the data link node address for the one-block record and the status of the data link. The configuration of the node address is as follows (bit 7 is always set to 0):



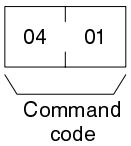
- I/O Area First Word
  This is the first word in a data link in the I/O Area. The data link will extend from the first word through the word just before the first word designated for the I/O Area in the next record. For the last record, the data link will extend from the first word through the number of words required to make the *total number of words* in the first block.
- Kind of DM
  Set to 00.
- DM Area First Word
  This is the first word in a data link in the DM Area. The data link will extend from the first word through the word just before the first word designated for the DM Area in the next record. For the last record, the data link will extend from the first word through the number of words required to make the *total number of words* in the second block.
- No. of Total Words
  The total number of words used for data links in the I/O and DM Area. These are given only in the first and second blocks, as shown below
  First block: The total number of data link words in the I/O Area.
  Second block: The total number of data link words in the DM Area.
  Other blocks: Set to 0000.

4-11-3 RUN

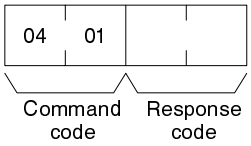
Activates the data links.

Note
1. This command will result in an error if data links have not be created either automatically or manually.
2. This command must be sent to the master node or an error will result.

Command Block



Response Block

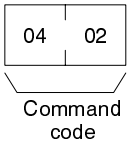


4-11-4 STOP

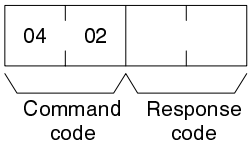
Stops the data links

Note
1. This command can be executed only when the data links are active or an error will result.
2. This command must be sent to the master node or an error will result.

Command Block



Response Block

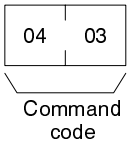


4-11-5 RESET

Resets the SYSMAC NET Link Unit.

Note
1. No response will be returned for this command.
2. When this command is executed, only the data that has been stored in the transmission buffer will be sent.

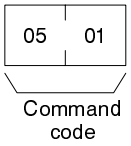
Command Block



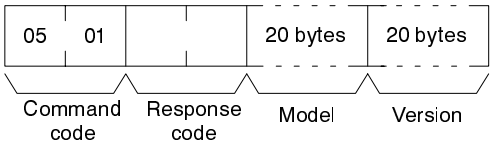
4-11-6 CONTROLLER DATA READ

Reads the model and version of the SYSMAC NET Link Unit.

Command Block



Response Block



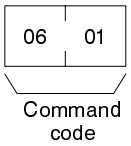
Parameters

Model and Version (response): Both are read in ASCII (20 bytes (i.e. 20 ASCII characters) max. each).

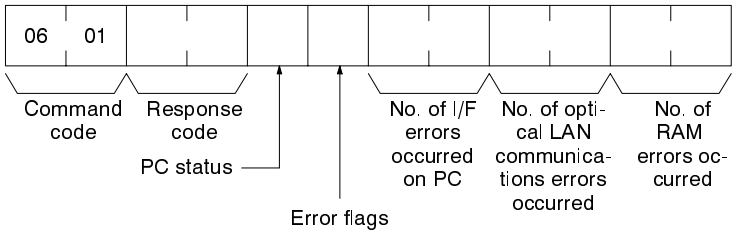
4-11-7 CONTROLLER STATUS READ

Reads the status of the PC and the SYSMAC NET Link Unit.

Command Block

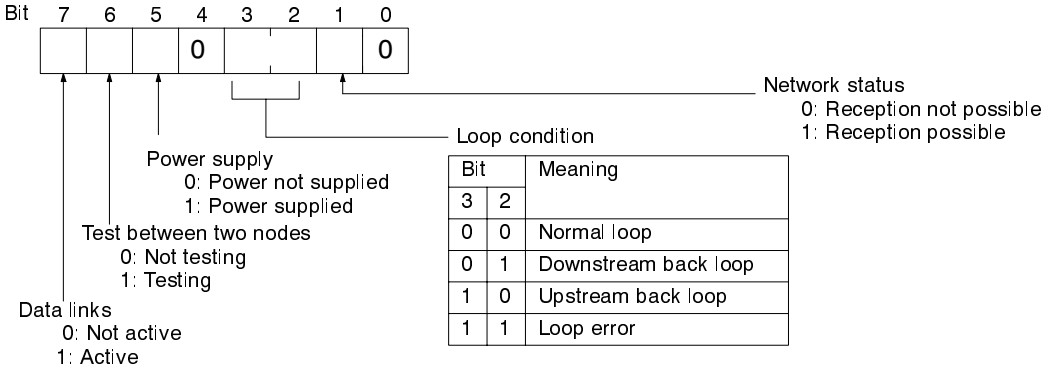


Response Block



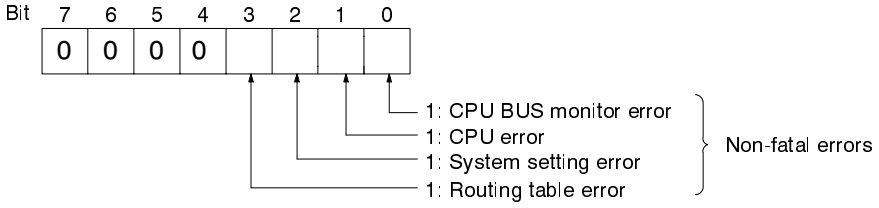
Parameters

PC status (response): The operating status of the PC will be returned as shown in the following diagram. For details on loop conditions, refer to *6-1 Automatic Loopback.*



Bit		Meaning
3	2	
0	0	Normal loop
0	1	Downstream back loop
1	0	Upstream back loop
1	1	Loop error

Error flags: The error flags of the PC will be returned as shown in the following diagram. Refer to *7-1-3 Error Check, Unit Error Flag Area* for details on PC errors.



No. of I/F Errors Occurred on PC (response)
For details, refer to *7-1-3 Error Check*.

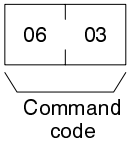
No. of Optical LAN Communications Errors Occurred
For details, refer to *7-1-3 Error Check*.

No. of RAM Errors Occurred
For details, refer to *7-1-3 Error Check*.

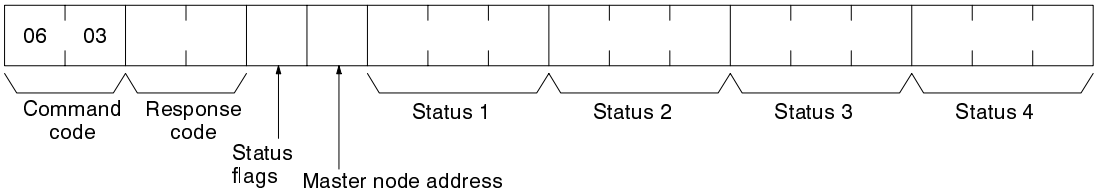
4-11-8 DATA LINK STATUS READ

Reads the data link status of the SYSMAC NET Link.

Command Block

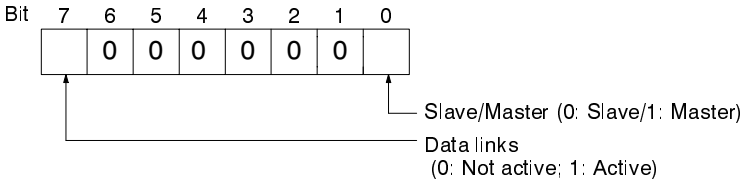


Response Block



Parameters

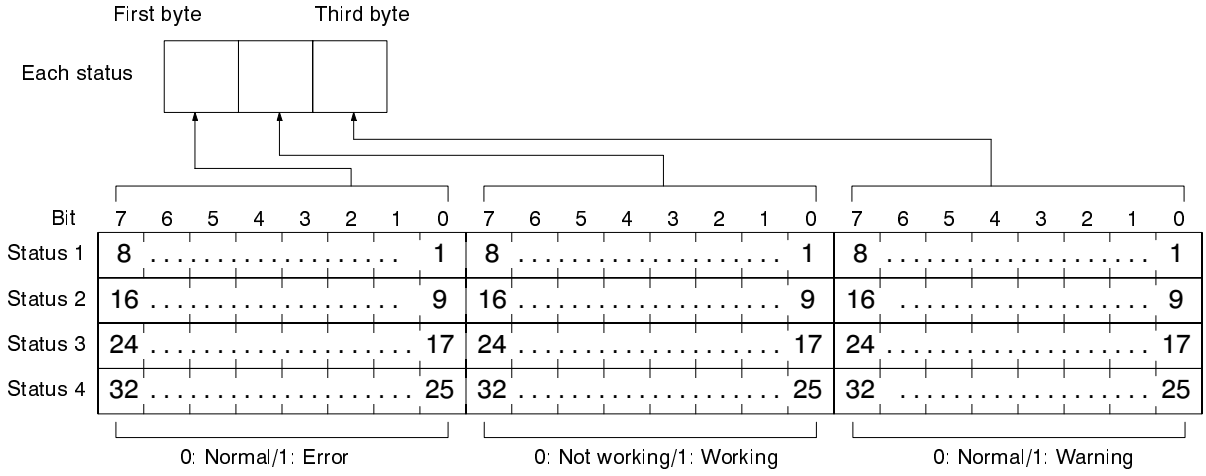
Status flags (response): A one-byte data link status will be returned as follows:



Slave/master: Bit 0 specifies the setting of the node on which the data link status has been read.

Master node address (response): The node address of the master node of the data link will be returned.

Status 1 through 4 (response): The data link status (error, mode, and warning status) on each node is returned in one-byte of data as follows:



The figures as shown in each box specify the order of nodes set on the data link table. In the case of automatic setting, the figures will correspond to the node address.

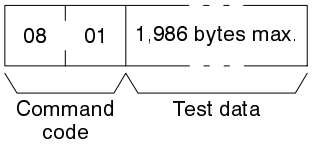
4-11-9 LOOPBACK TEST

Executes a loop back test between the local node and a destination node.

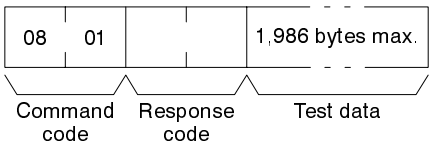
Note 1. The destination node is designated in the control data using the CMND(194) instruction.

2. The unit address must designate a SYSMAC NET Link Unit.
3. When the ASCII data including the application header is 1,999 bytes or larger, no response will be returned because the data of the response block would be more than 2,000 bytes.

Command Block



Response Block



Parameters

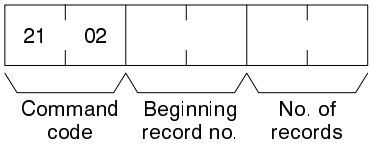
Test data (command and response): In the command block, designate the data to be transmitted to the destination node. The designated data consists of 1,986 bytes maximum (binary data). In the response block, the test data from the command block will be returned as it is. If the test data in the response block is different from that in the command block, an error has occurred.

4-11-10 ERROR LOG READ

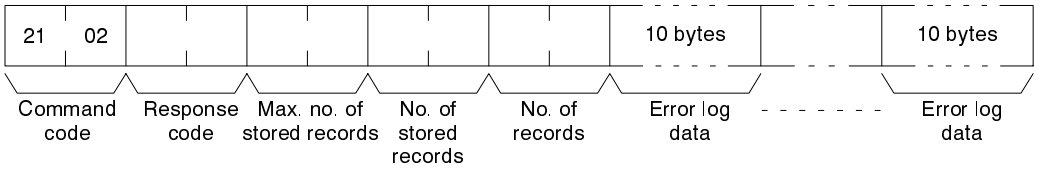
Reads the PC's error log.

Note If the number of records that you designate in the command block exceeds the actual number of stored records, all the stored records will be returned and no error will occur.

Command Block



Response Block



Parameters

Beginning record no. (command): Designates the beginning record number in a range of 0000 to 0018 (0 to 24) (the first record is 0000).

No. of records (command and response): Designates the number of records to be read in a range of 0001 to 0019 (1 to 25).

Max. no. of stored records (response): The maximum number of stored records varies with the kind of Unit. The SYSMAC NET Link Unit can store 25 records maximum.

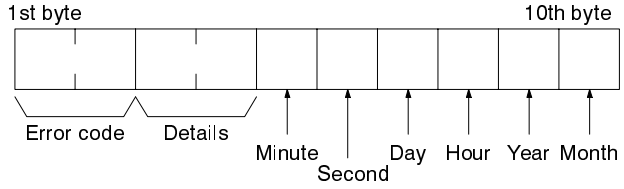
No. of stored records (response): The number of records that have been recorded.

Error log data (response): The specified error log records will be returned in sequence starting from the beginning record number. The total number of bytes

required is calculated as follows:

No. of records x 10 bytes

The configuration of each error record is as follows:



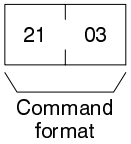
- Error Code and Details
  The error code and details vary with the kind of Unit.
- Minute, Second, Day, Hour, Year, and Month
  Each record includes the second, minute, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

4-11-11 ERROR LOG CLEAR

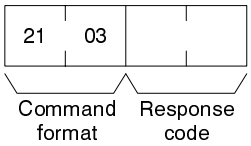
Clears all error log records.

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

Command Block



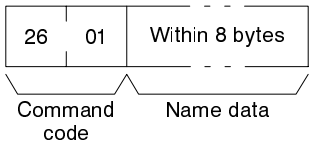
Response Block



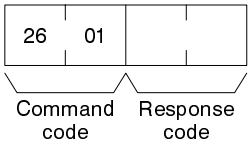
4-11-12 NAME SET

Registers a name for the SYSMAC NET Link Unit.

Command Block



Response Block



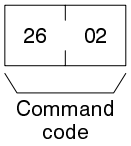
Parameters

Name data (command): The data set must be within 8 bytes in ASCII. Do not use the NULL (00) code.

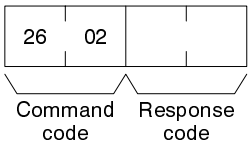
4-11-13 NAME DELETE

Deletes the name of a SYSMAC NET Link Unit.

Command Block



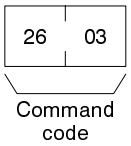
Response Block



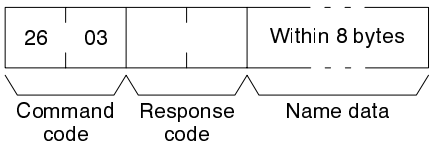
4-11-14 NAME READ

Reads the name of a SYSMAC NET Link Unit.

Command Block



Response Block



Parameters

Name data (response): The data previously set within 8 bytes in ASCII will be returned.

SECTION 5
Data Links

This section describes the procedures for setting up and controlling data links to automatically exchange data between nodes.

5-1 Introduction

Data links are one of the basic features provided by the SYSMAC NET Link Unit. Data links can be set up between PCs to automatically exchange data without special programming.

5-1-1 Features

The main features of the data links are as follows:

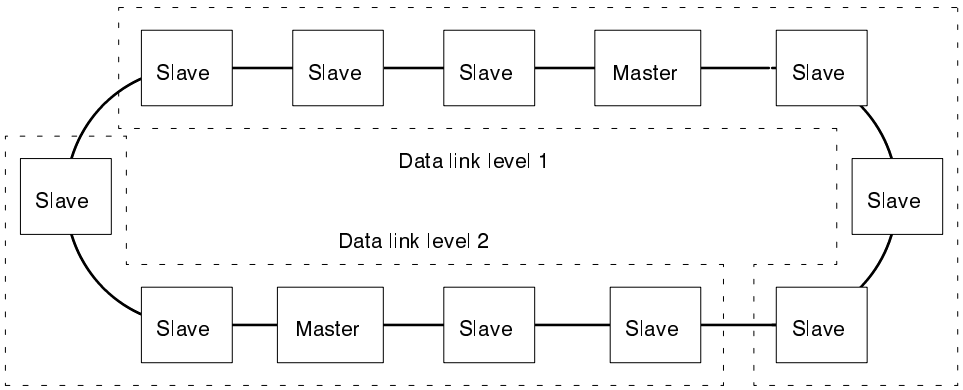
Data Exchange

Data links enable the PCs to exchange data automatically. A data link table is required for each node to use data links. The data link areas set in the data link table will be used for data exchange. The PCs automatically exchange data so that all the nodes share the same information. Each PC writes data to its write area in the data link area so that all the other PCs can read the data. The PC reads the data of the other PCs via the read areas in the data link area (i.e., the write areas for the other PCs).

Data Link Levels

PCs belonging the same group can exchange data. Such a group is called a data link level. Each data link level must have a Master that controls data exchange. All nodes other than the Master on a data link level are called Slaves. The Master can participate in the data links or it can merely control the data links.

It is possible for a single network to include up to four data link levels. Each data link level consists of up to 32 nodes. If the Master does not participate in the data links, up to 32 Slaves can participate in the data links.



Data Link Areas

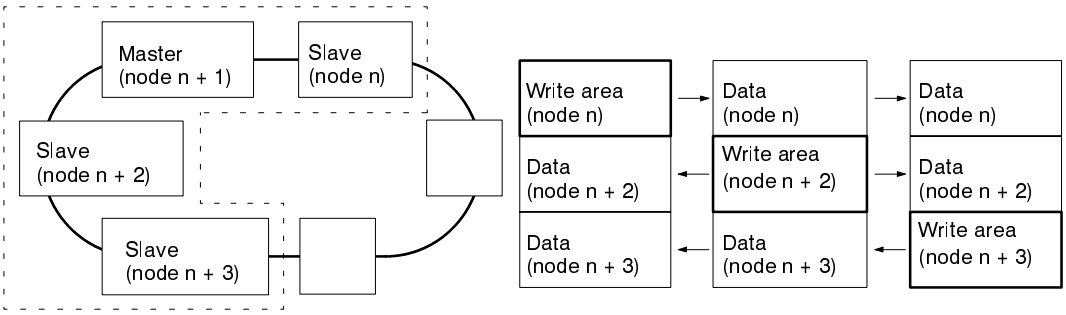
The I/O Area and DM Area on each PC (node) can be set as data link areas for the node. The data link areas for each node consists of 254 words maximum (127 words each in the I/O Area and DM Area).

Note Data is broadcast to all PCs in a data link. Be careful that you are accessing the correct data when programming applications.

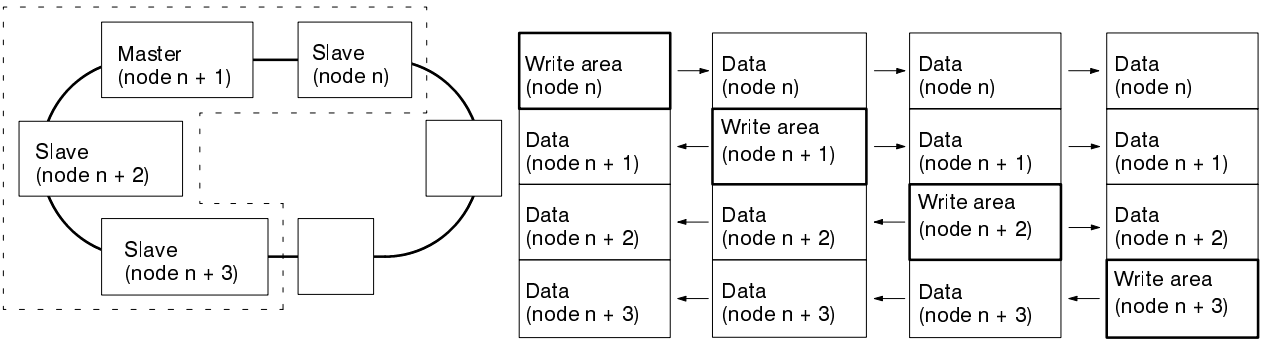
Flow of Data

A data link level can include a total of 32 nodes: the Master and 31 Slaves or 32 Slaves. The flow of data depends on whether the Master participates in the data link.

In the following example, the Master is not participating in the data link. The nodes enclosed by the dotted lines forms a data link level.



The following is an example of a data link in which the Master is participating.



Note
1. All data link areas will be refreshed continuously while the data link is active.
2. All zeros are input to the data link area of any node that is not participating in the data link even though the node is listed in the data link table.

5-1-2 Automatic Setting and Manual Setting

Before activating a data link, set data link areas for each node. The data link areas can be automatically set from a IBM PC/AT or compatible computer or the communications unit settings on the Master node.

Data Link Specifications

The specifications of data links are as follows:

Item	Automatic setting	Manual setting
Data link levels	Only one data link level can be set within a network.	Up to four data link levels can be set within a network.
Data link tables	Automatically set according to communications unit settings on the Master.	Set from a IBM PC/AT or compatible computer connected to the network (CVSS).
Word allocation	Each node has the same number of link words. I/O Area: 2, 4, 8, 16 or 32 words DM Area: Twice as many words as I/O Area. The link area per node is set. I/O Area: 1000 to 1063 DM Area: 0000 to 0127	Up to 254 link words (4,064 points) can be set on each node (3,584 words per data link level) The link area of each node can be set freely. Any part of the I/O Area and DM Area can be a data link area. There is a maximum number of link words per node for each area as follows: I/O Area: 127 words DM Area: 127 words
Node allocation	The participating nodes are automatically decided by the number of link words set by system. The Master does not have to participate in the data link.	Any 32 nodes at any of the node address (1 to 126) can participate in the data link. The Master does not have to participate in the data link.

5-1-3 CV-series PC Data Link Areas

The data link area varies with the model.

When setting automatically, the ranges of the data link area are as follows:

Area	Data link area
I/O Area	1000 to 1063
DM Area	D00000 to D00127

When setting manually, the ranges of the data link area are as follows:

Area	CV1000/CV2000/ CVM1-CPU11-E	CV500/CVM1-CPU01-E
I/O Area	0000 to 2555	
DM Area	D00000 to D24575	D00000 to D08191

5-2 Automatic Setting

It is possible to allocate the data link area and designate the participating nodes automatically.

5-2-1 Settings

The methods and items to be set are explained in this section.

Communications Unit Setting

The allocation of the data link area on each node is done according to the communications unit setting in PC's memory. These settings can be made from a IBM PC/AT or compatible computer running CVSS. It is necessary to change the settings only in the master; the settings in slaves may be left at the defaults.

Items	Contents
Setting of Master and Slaves	Designate the Master and Slaves (PCs are set by default to Slaves).
Link areas	Set the following when at the Master. 1. Specify automatic setting of data link tables. 2. Select the data link areas: I/O Area only DM Area only I/O Area and DM Area
Setting of link words	Designate the number of data link words per node at the Master.
Setting of transmission delay time	Select from the following at the Master (default: 5 ms): 5, 10, 20, or 30 ms

After completing the settings, reset the SYSMAC NET Link Units or PCs by turning them off and on.

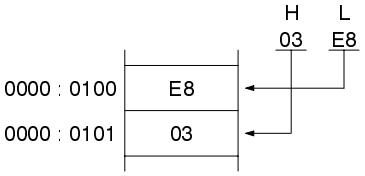
The setting of the transmission delay time depends on the load condition of the network. Set it to 30 ms if the load is heavy or the error status flag is ON. You can also set the transmission delay time in the Master by writing directly to PC memory. Set the time in hexadecimal in the following two-byte area after you turn on the PC and before the data link has been activated.

Segment: Offset (0000:0100)

Set the timer value (0100 to FFFF) in 2-ms units (i.e., a setting of 1 is made for 2 ms). Set the rightmost digits first and then the leftmost.

To set a transmission delay time of two seconds, for example, use the following:

2 s = 2000 ms = 1000 (decimal) = 03E8 (hexadecimal)



Refer to the following for setting the transmission delay time.

Transmission delay time	No. of Masters
5 ms	1
10 ms	2
20 ms	3
30 ms	4

Caution The transmission delay time set on the PC will be cleared when you turn off the PC and must be reset every time the system is turned on.

5-2-2 Data Link Area Allocation

The following table shows the words that will be allocated to each node address for the various area possible settings and number of words.

I/O Area (words)	DM Area (words)	Area setting				
		I/O: 2 words DM: 4 words	I/O: 4 words DM: 8 words	I/O: 8 words DM: 16 words	I/O: 16 words DM: 32 words	I/O: 32 words DM: 64 words
1000 to 1001	D00000 to D00003	#1	#1	#1	#1	#1
1002 to 1003	D00004 to D00007	#2				
1004 to 1005	D00008 to D00011	#3	#2			
1006 to 1007	D00012 to D00015	#4				
1008 to 1009	D00016 to D00019	#5	#3	#2		
1010 to 1011	D00020 to D00023	#6				
1012 to 1013	D00024 to D00027	#7	#4			
1014 to 1015	D00028 to D00031	#8				
1016 to 1017	D00032 to D00035	#9	#5	#3	#2	
1018 to 1019	D00036 to D00039	#10				
1020 to 1021	D00040 to D00043	#11	#6			
1022 to 1023	D00044 to D00047	#12				
1024 to 1025	D00048 to D00051	#13	#7	#4		
1026 to 1027	D00052 to D00055	#14				
1028 to 1029	D00056 to D00059	#15	#8			
1030 to 1031	D00060 to D00063	#16				
1032 to 1033	D00064 to D00067	#17	#9	#5	#3	#2
1034 to 1035	D00068 to D00071	#18				
1036 to 1037	D00072 to D00075	#19	#10			
1038 to 1039	D00076 to D00079	#20				
1040 to 1041	D00080 to D00083	#21	#11	#6		
1042 to 1043	D00084 to D00087	#22				
1044 to 1045	D00088 to D00091	#23	#12			
1046 to 1047	D00092 to D00095	#24				
1048 to 1049	D00096 to D00099	#25	#13	#7	#4	
1050 to 1051	D00100 to D00103	#26				
1052 to 1053	D00104 to D00107	#27	#14			
1054 to 1055	D00108 to D00111	#28				
1056 to 1057	D00112 to D00115	#29	#15	#8		
1058 to 1059	D00116 to D00119	#30				
1060 to 1061	D00120 to D00123	#31	#16			
1062 to 1063	D00124 to D00127	#32				

5-3 Manual Setting

When setting manually, data link tables can be set much more flexibly.

5-3-1 Settings

The following settings are required to manually set data link areas.

Communications Unit Setting Allocate the data link area on each master node using the communications unit settings in the PC's memory. These settings can be made from the CVSS. You may leave the settings of the Slaves set to the defaults.

Items	Contents
Setting of Master and Slaves	Designate the Master and Slaves (PCs are set by the default to Slaves).
Link areas	Set the following at the Master. 1. Specify manual setting of data link tables. 2. Set the data link tables to establish data link areas. The tables are set from a Peripheral Device (CVSS).
Setting of link words	This setting is not necessary for manually set data link tables.
Setting of transmission delay time	Select from the following at the Master (default: 5 ms): 5, 10, 20, and 30 ms

After completing the settings, reset the SYSMAC NET Link Units or PCs by turning them off and on.

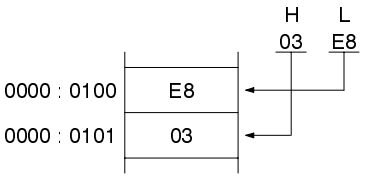
The setting of the transmission delay time depends on the load condition of the network. Set it to 30 ms if the load is heavy or the error status flag is ON. You can also set the transmission delay time in the Master by writing directly to PC memory. Set the time in hexadecimal in the following two-byte area after you turn on the PC and before the data link has been activated.

Segment: Offset (0000:0100)

Set the timer value (0100 to FFFF) in 2-ms units (i.e., a setting of 1 is made for 2 ms). Set the rightmost digits first and then the leftmost.

To set a transmission delay time of two seconds, for example, use the following:

2 s = 2000 ms = 1000 (decimal) = 03E8 (hexadecimal)



Refer to the following for setting the transmission delay time.

Transmission delay time	No. of Masters
5 ms	1
10 ms	2
20 ms	3
30 ms	4

Caution The transmission delay time set on the PC will be cleared when you turn off the PC and must be reset every time the system is turned on.

5-3-2 Data Link Tables

Data link tables include the setting necessary for data exchange using data links. Set the data link tables at the Master. Settings are made from the CVSS.

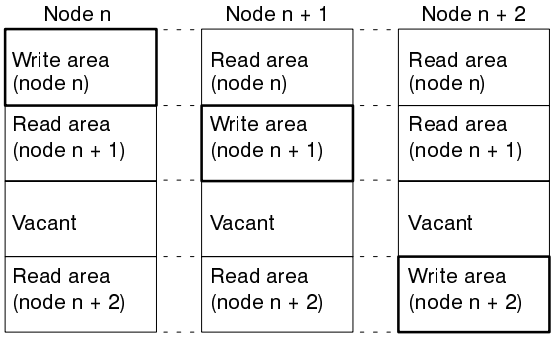
Precautions

An error will occur in the following cases:

At the time of data exchange, the Master checks the table on the local node and the Slaves check the table sent from the Master. If any node has an error, the LNK indicator on the SYSMAC NET Link Unit will flash and the node cannot participate in the data link.

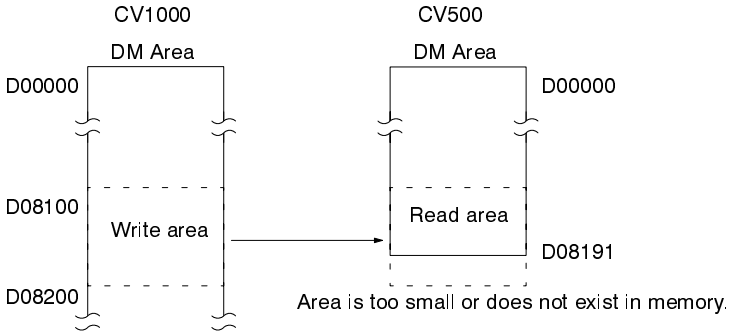
If you create gaps in a data link, the LNK indicator on the SYSMAC NET Link Unit on the Master will flash and no data will be exchanged.

Data Link Areas



If the write areas of the master exceed the capacity of the memory, the LINK indicator on the SYSMAC NET Link Unit on the Master will flash and no data will be exchanged. If the write area of a slave exceeds the capacity of the memory, the LNK indicator on the SYSMAC NET Link Unit on the slave will flash and the node will not participate in the data link.

Sometimes a data link table error may not be detected by a sending node, in which case, the destination node will notify the master of the error. This can occur when exchanging data with a PC that has a smaller data area, e.g., between the DM Areas in CV500 and CV1000 PCs. Use DATA LINK STATUS READ to read the condition of the error.



Data on D08100 to D08191 will be received. Data on D08192 to D08199 will be trashed.

Network Configuration

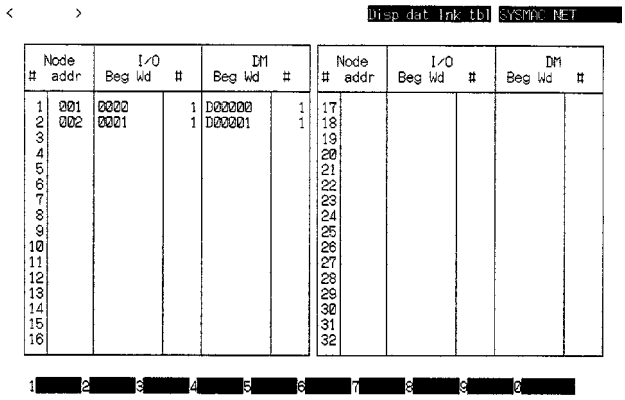
Do not construct the following networks.

The data link table for a data link level must not include the Master on a different data link level. A node can be designated as a Slave by more than one Master belonging to different data link levels. In this case, the node will work as a Slave only for the data link level activated first, i.e., earlier than the others.

If you have mounted more than one SYSMAC NET Link Unit on a single PC, do not use both of them to set a data links; use only one of them or the data link area data will be destroyed.

5-3-3 Setting Data Links

The following is a data link table set with the CVSS on the IBM PC/AT or compatible computer. For details, refer to the *CVSS Operation Manual: Offline.*



Item	Range
Node address	1 to 126
I/O Area first word	0000 to 2555
I/O Area words	0 to 127
DM Area first words	D00000 to D24575
DM Area words	0 to 127

5-4 Starting and Stopping Data Links

Data links can be activated and deactivated as described in the following sections.

5-4-1 Activation of Data Link

There are two ways to activate data links.

Using CVSS

Data links can be activated through the Master. For details, refer to the *CVSS Operation Manual*. When data links are started from the CVSS, the Data Link Start Bit will be turned ON.

Using Commands

Data links can be activated by sending the RUN command from another node (IBM PC/AT or compatible computer or PC) to the Master. In this case, the Data Link Start Bit will remain OFF even when the data links are active.

5-4-2 Deactivation of Data Link

There are two ways to deactivate the data links as follows:

Using CVSS

Data links can be deactivated through the Master. For details, refer to the *CVSS Operation Manual*. When data links are stopped from the CVSS, the Data Link Start Bit will be turned OFF.

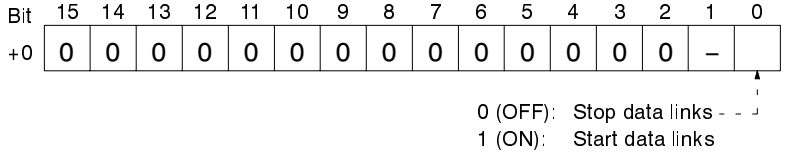
Using Commands

Data links can be deactivated by sending the STOP command from another node (IBM PC/AT or compatible computer or PC) to the Master.

5-5 Data Link Start Bit

The data link start bit is bit 00 of the first word allocated to the SYSMAC NET Link Unit in the CPU Bus Unit Area. Data links are activated or deactivated by turning ON or OFF this bit. The address of the word is calculated as follows:

Word: 1500 + (25 x Unit no.)



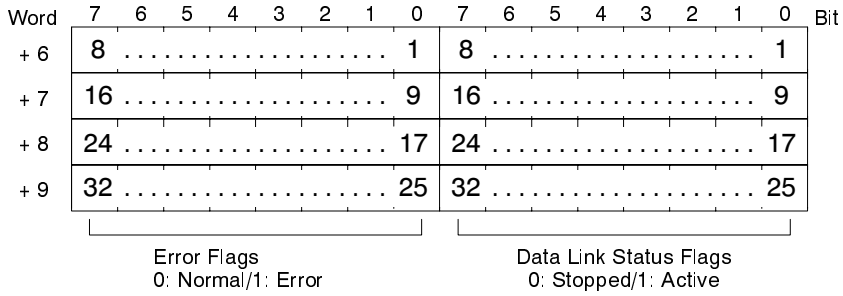
5-6 Data Link Status

Data link status is provided in the status words. The words allocated to the SYSMAC NET Link Unit in the CPU Bus Unit Area and varies with the unit number of the SYSMAC NET Link Unit.

5-6-1 Status Words

The configuration of the status words on the memory is as follows:

Word: 1500 + (25 x Unit no.) + 6 to 9

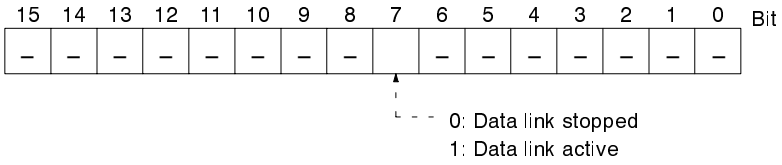


- Bits in Status Words (1 to 32)
  When setting a data link table automatically, the above numbers correspond to the node addresses. When setting manually, the numbers are in the same order as the nodes are set in the data link table.
- Error Flags
  If a transmission error occurs, the error bit will be 1. This bit is read-only. If this bit becomes 1 frequently, check the network configuration including the setting of the Master, Slaves, and transmission delay time.
- Data Link Status Flags
  The operating status of each PC is expressed by the bits as follows:
  0: Stopped; 1: Active

5-6-2 Data Link Active Flag

Bit 07 in the sixth status word indicates the operating condition of the entire data link system.

Word: 1500 + (25 x Unit no.) + 5



5-7 Data Links Combining CV-series and C-series PCs

It is possible to construct data links between C-series PCs and CV-series PCs.

5-7-1 Data Link Areas

The following is a conversion table for the corresponding data link areas of the CV-series and C-series PCs. Make sure to use the proper areas for the data link.

C-series PC		CV series PC	
Area	**Words**	**Area**	**Words**
IR area	IR 000 to IR 252	I/O Area	0000 to 0252
LR area	LR 00 to LR 63		1000 to 1063
HR area	HR 00 to HR 99		1064 to 1163
DM Area	DM 0000 to DM 9999	DM Area	D00000 to D09999

5-7-2 Specifications

There is no difference in data link specifications between the C-series and CV-series PCs.

Item	Specification
No. of data link levels	4 levels max. per network
No. of data link nodes	32 nodes max. per data link level
No. of link words	Maximum number of words per node for the C-series PC: LR area: 32 words Others: 99 words

5-7-3 Automatic Setting

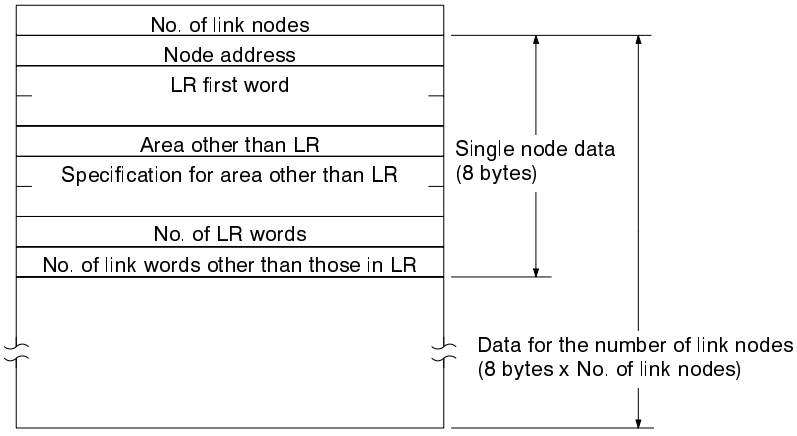
The C-series PC as the Master of a data link can exchange data with CV-series PCs as Slaves on a data link level. For automatic setting and area allocation of the C-series SYSMAC NET Link Unit, refer to the *C-series SYSMAC NET Link System Manual.*

Note The CV-series PC cannot be a Master when the data link contains one or more C-series PCs.

5-7-4 Manual Setting

Data Link Tables

The configuration of the C-series PC's data link table is the same as that of the CV-series PC's. Refer to the above table to convert the CV-series PC's words into the C-series PC's before use.



Item	Specification
No. of link nodes	02 to 20 (2 to 32 decimal)
Node address	01 to 7E (1 to 126 decimal)
LR first word	First LR write word for the node
Areas other than link area	00: I/O Area 01: HR Area 02: DM Area

Each data word is hexadecimal. Set unused areas to 00.

Example: If you have designated the LR first word to 0 for the data exchange on a CV-series PC, the write area will begin from word 1000 in the I/O Area for the number of LR words that you have designated. If you designate the HR area (01), words 1064 to 1163 in the I/O Area will be the data link area.

Note The CV-series PC cannot be a Master if the data links contain one or more C-series PCs.

Precautions

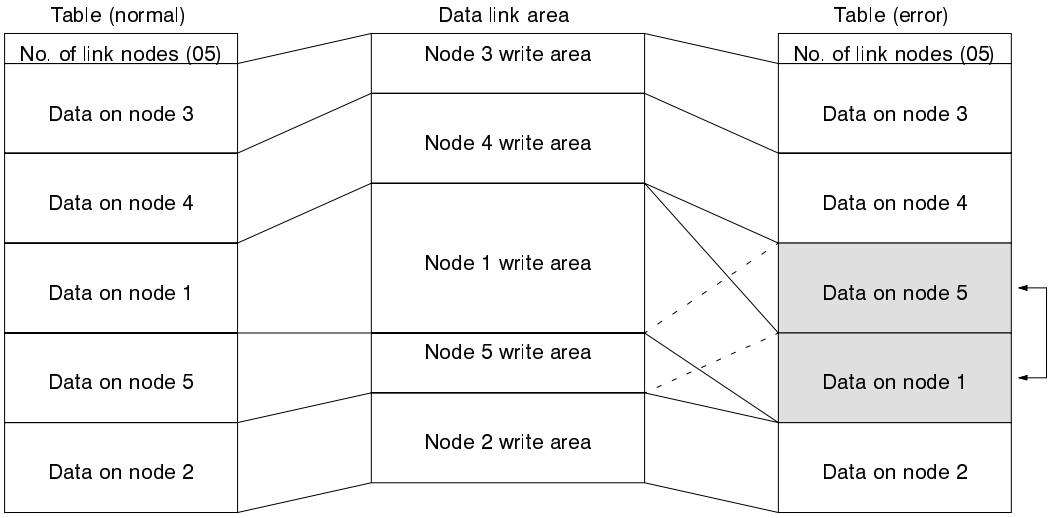
Data links cannot be created for some combinations of areas.

Area other than LR		Link area	
		Data link executed	Data link not executed
Data link executed	I/O area	Data link not possible	Data link possible
	HR area	Data link not possible	Data link possible
	DM Area	Data link possible	Data link possible
Data link not executed		Data link possible	---

Data links will not work if there are gaps in the data link area settings.

Setting Order

Data links will not work if the nodes are not set in the same order in the data link tables. In the following tables, the order needs to be changed in the table on the right as shown by the arrows before the data links can be established.



Setting

Use the C-mode command DATA LINK TABLE WRITE to create data link tables from a IBM PC/AT or compatible computer for data links consisting of CV-series and C-series PCs.

SECTION 6
RAS Function

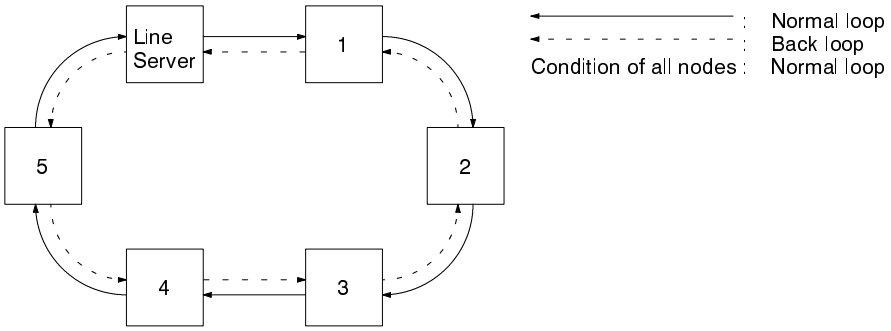
This section provides the details of the RAS (reliability, availability, and serviceability) functions of the SYSMAC NET Link Unit, including the automatic loopbacks, node bypasses, internode tests, and error logs.

6-1 Automatic Loopback

The automatic loopback function of the SYSMAC NET Link Unit on a network prevents the whole network from being disabled when there is a failure on optical transmission paths. The loopback function automatically makes new communications paths at the time of any optical fiber cable is disconnected.

6-1-1 Normal Loop

The following illustration is an example of a normal loop. Each box in the illustration represents a node.

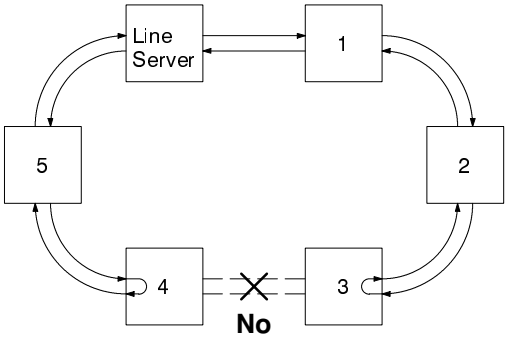


6-1-2 Abnormal Loops

Abnormal loops are shown below. Each box in the illustrations represents a node.

Disconnected Optical Fiber Cable

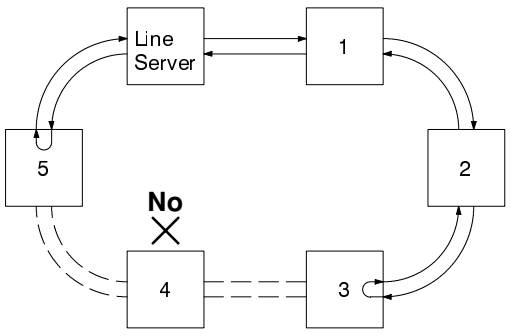
The following illustration shows that the optical fiber cables between node 3 and node 4 are disconnected. In this case, node 3 is an upstream backloop node and node 4 is a downstream backloop node. The condition of the other nodes are normal. For the indicator status of each Unit at this time, refer to *7-1 Status Words.*



Condition of node 3: Upstream back loop
Condition of node 4: Downstream back loop
Condition of nodes 1, 2, and 5: Normal loop

Error on Node 4

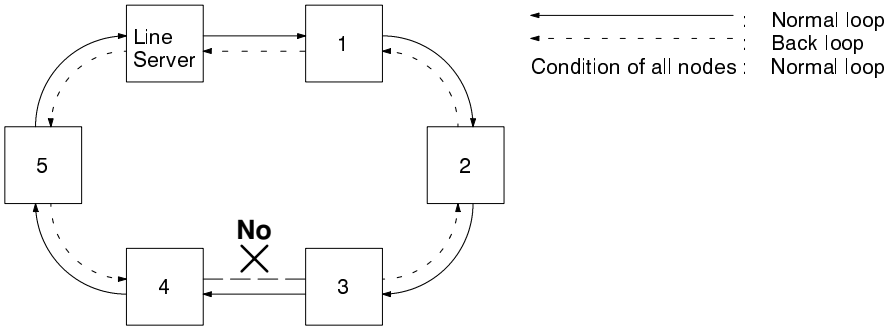
The following illustration shows that node 4 has an error. Node 3 is an upstream backloop node and node 5 is a downstream backloop node. For the status of the indicators on each Unit in this case, refer to *7-1 Status Words.*



Condition of node 3: Upstream back loop
Condition of node 5: Downstream back loop
Condition of node 1 and 2: Normal loop
Condition of node 4: Abnormal loop

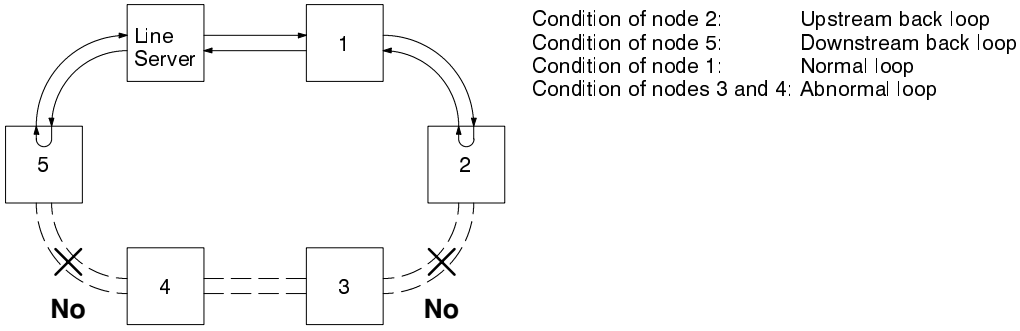
Disconnected Optical Fiber Backloop

The following illustration shows that the optical fiber cable for the backloop between node 3 and node 4 is disconnected. This does not interfere network communication. In this case all nodes are normal.



Disconnection of Two Optical Fiber Cables

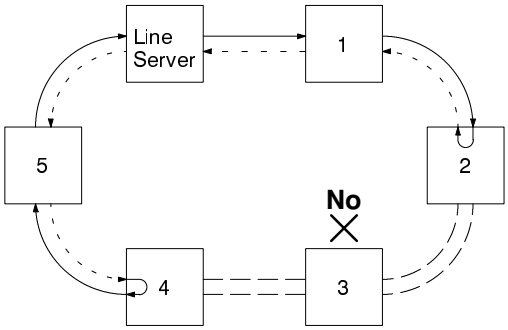
The following illustration shows that the optical fiber cables between node 2 and node 3 as well as the optical fiber cables between node 4 and node 5 are disconnected. In this case node 2 is an upstream backloop node and node 5 is a downstream backloop node. Node 3 and Node 4 will have an error and will be excluded from the network because they are completely separated from the Line Server. For the status of the indicators on each Unit at this time, refer to *7-1 Status Words.*



6-2 Node Bypass Function

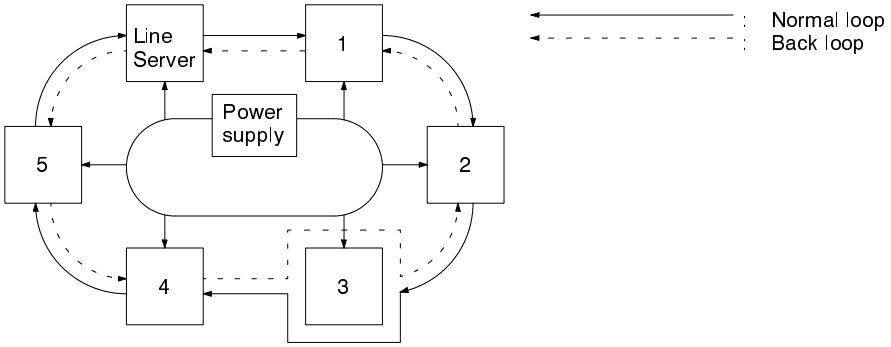
The node bypass function of the SYSMAC NET Link Unit prevents the whole network from being disabled if there is a node malfunctioning or a power failure. The node bypass function automatically makes new communications paths and maintains the network.

The following illustrations show that node 3 is turned off. This example assumes that no backup power supply is connected to node 3. Therefore the automatic loopback function is working to keep the rest of the network operating.



The following example shows that a backup power supply is connected to node 3. Therefore, the node bypass function is working. When a backup power

supply is connected to the SYSMAC NET Link Unit, the P/S indicator on the Unit will be lit. For the status of the indicators on each Unit, refer to *7-1 Status Words.*



Note Follow the instructions below before connecting a backup power supply to each node.

a) Be sure to turn off the backup power supply before connecting or disconnecting the power supply connector to the node.

b) Turn on the backup power supply before the network is active. Turn it off after you shut down the system. If you turn on or off the backup power supply during data exchange, the transmitted data may be changed or lost.

6-3 Internode Tests

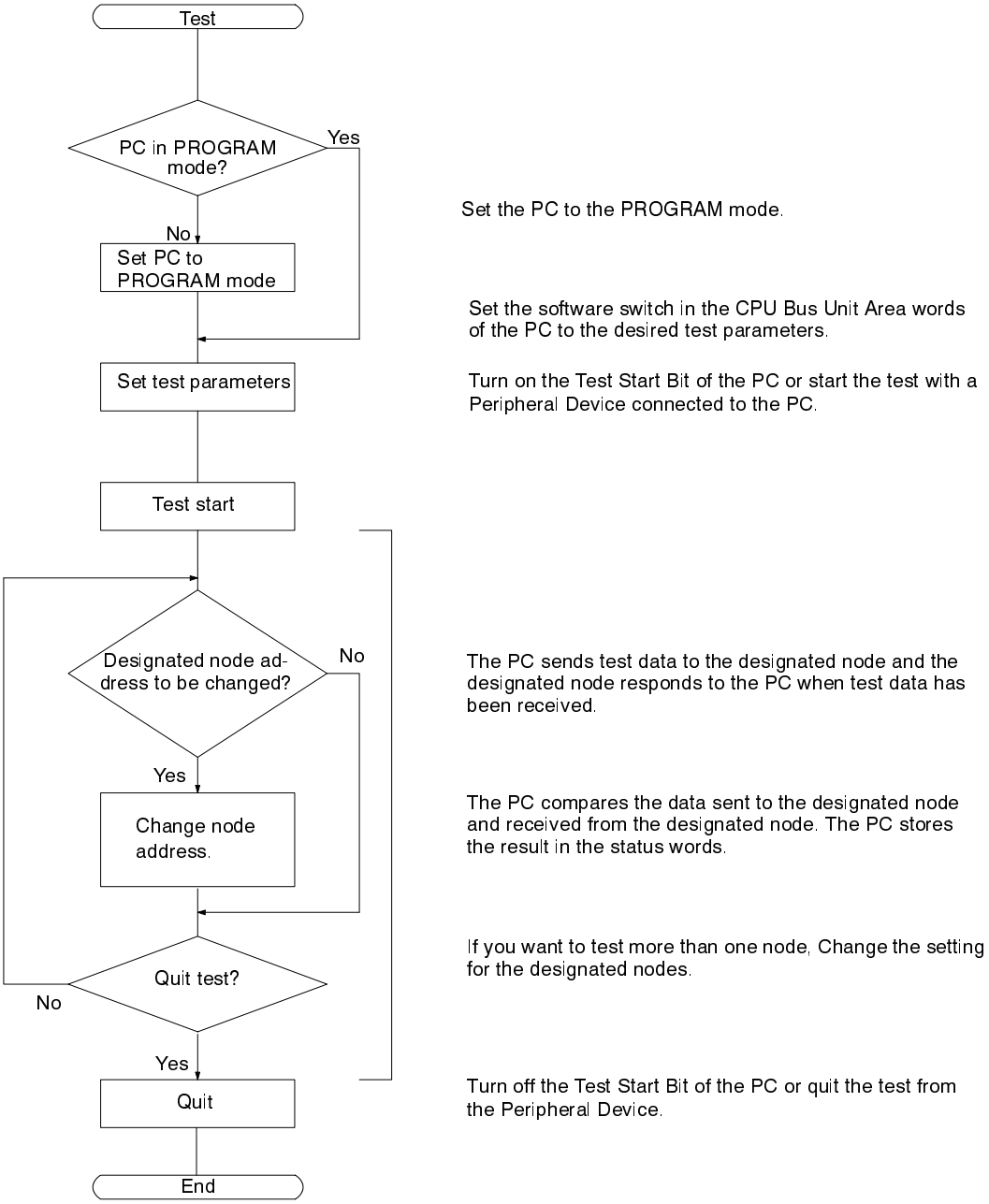
If you need to check the condition of network communications, execute tests between two nodes and check the contents of the data that is returned from the node.

6-3-1 Execution

Use the CVSS to write the necessary parameters for the test to the appropriate words in the CPU Bus Unit Area words allocated to the SYSMAC NET Link Unit and then use the Test Start Bit in the same words to start and stop the tests.

Steps

The following flow chart shows the steps taken for tests between two nodes.



PC Settings

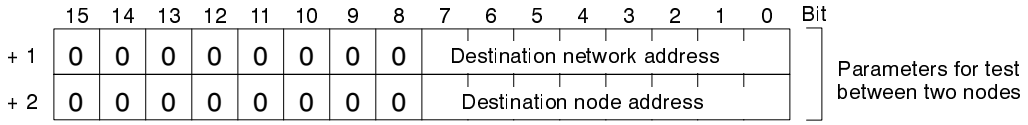
The SYSMAC CV-series PC on the node sending the test transmission must be in PROGRAM mode before starting the tests. The PC on the destination node can be in any mode.

Test Parameters

You can write the test parameters to the software switches in the CPU Bus Unit Area in the PC directly or set them via CVSS. Here we will explain the software switches. For setting the parameters via the CVSS, refer to the *CVSS Operation Manual: Online.*

Before you execute tests, set the following parameters in the PC. These parameters will be effective immediately after setting. There is no need to restart the PC.

Word: 1500 + (25 x Unit no.) + 1 to 2



Parameter	Setting range
Destination network address	00 to 7F (0 to 127 decimally)
Destination node address	01 to 7E (0 to 126 decimally)

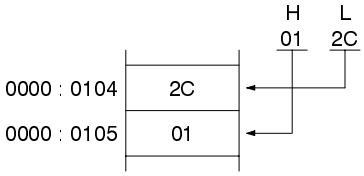
If the destination network address is 00, tests between two nodes in the local network will be executed. The destination node address must not be FF because broadcasting is not possible for internode tests. Do not set a value beyond the setting range specified in the above table or an error will result.

Response Monitor Time

If you do not set any response monitor time, 1 second will be used as a default value. If no response returns after the response monitor time, a time out error will result.

Use the memory write function (DIAG function) and write the response monitor time to the following two-byte area in the PC at the node sending the test transmission. The value that you set will be effective immediately after setting. Write the rightmost value first and then leftmost value, in 10-ms units. Do not write a value of 0000.

The following shows how to set a response monitor time of 3 s.
3 s = 3000 ms = 300 (10-ms increments, decimal) = 012C (10-ms increments in hexadecimal codes)

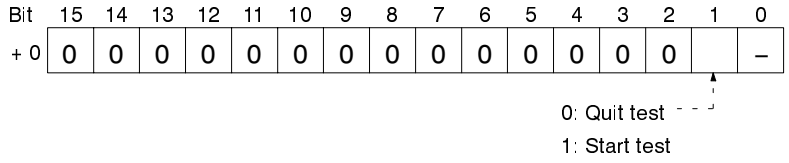


Execution of Test

There are two ways to execute tests between two nodes as follows:

Tests between two nodes will start and continue when the Test Start Bit in the PC's memory is turned ON. The Test Start Bit is the bit 01 of the first word allocated to the SYSMAC NET Link Unit in the CPU Bus Unit Area of the PC.

Word: 1500 + (25 x Unit no.)



You can execute tests between two nodes via the CVSS. For details refer to the *CVSS Operation Manual: Online*.

Note

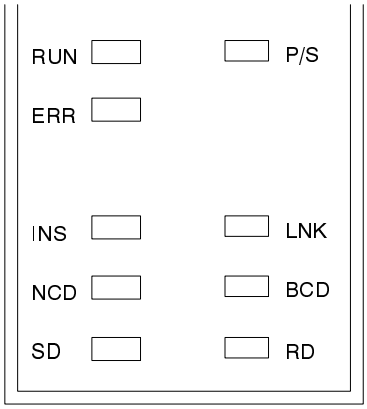
1. You cannot use more than one SYSMAC NET Link Unit on a single SYSMAC CV-series PC for tests between two nodes.
2. Refer to the *CVSS Operation Manual: Online* for details on setting software switches from the CVSS.

6-3-2 Test Results

You will know the result of the test from the ERR indicator on the front panel of the SYSMAC NET Link Unit and by reading the status words.

Indicators

Refer to the following table for the results of the tests that you carried out.



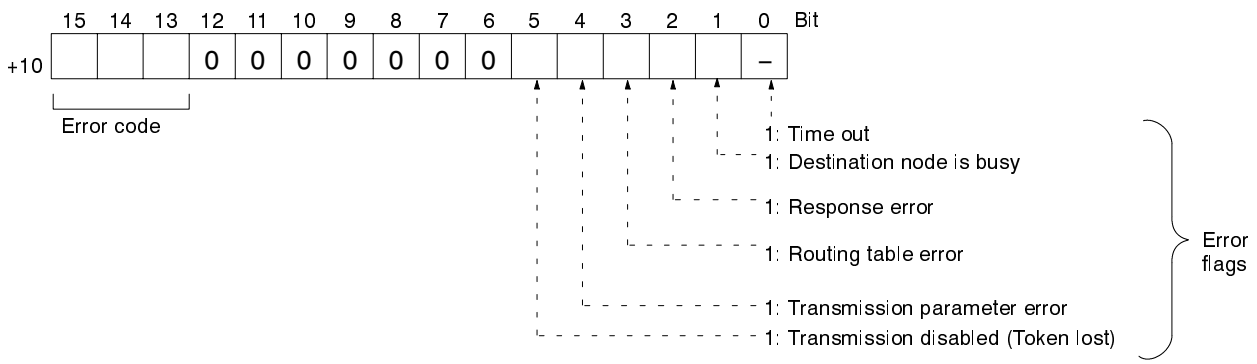
ERR indicator	Result
Lit	There was an error.
Not lit	There was no error.

Status Words

The results the tests and the cause of any error will be stored in the status words on the node where the tests started.

The results of the tests will be stored as follows:

Word: 1500 + (25 x Unit no.) + 10



Bit			Meaning
15	14	13	
0	0	0	Normal
0	0	1	Time out
0	1	0	Destination node is busy
0	1	1	Response error
1	0	0	Routing table error
1	0	1	Transmission parameter error
1	1	0	Transmission disabled (Token is lost)

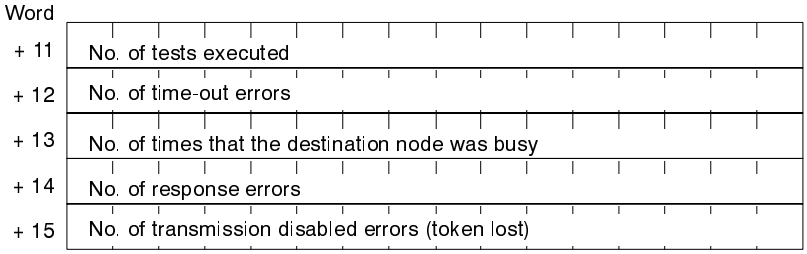
Note Transmission parameter errors include mode errors.

Error Codes
The result of the latest test will be coded and stored.

Error Flags
The corresponding Error Flags will be ON (1) if an error occurs. These Flags will maintain status until the completion of the test.

Test and Error Counts
The number of tests and errors will be stored as follows:

Word: 1500 + (25 x Unit no.) + 11 to 15



Note The contents of the above words and the test status words will be maintained until you execute another test, restart the SYSMAC NET Link Unit, or change the mode of the PC (if the above words are not designated as part of a holding area).

6-4 Error Log

Errors when the SYSMAC NET Link Unit is operating are recorded in an error log.

6-4-1 Features

The error log enables the SYSMAC NET Link Unit to record errors which occurred during the operation of the Unit. The contents of the log can be read or cleared through the CVSS or the IBM PC/AT or compatible computer using CV-mode commands.

Items Recorded

Errors occurring only during the operation of the SYSMAC NET Link Unit are recorded. Any error occurring when turning the power on or at the time of starting the operation of the Unit will not be recorded because such errors should be discovered by the user immediately. The following errors are recorded:

Errors in network communications
Data exchange errors
PC errors

Error Log Table

Error are recorded as individual records. The specifications of the error log table are as follows:

Item	Specification
Length of record	10 bytes
No. of records	25 max.
Data code	Binary
Configuration of record	Error code: 2 bytes Detailed information: 2 bytes Time information: 6 bytes

Error Log Overflows When a new record is added to the error log that already has 25 records, the oldest record will be lost and the second oldest record will be regarded as the 1st record. Consequently the new record will be the 25th record.

Note When you reset the SYSMAC NET Link Unit, all records will be cleared.

6-4-2 Error Codes

The following table lists all error codes and the contents of the errors.

Error code	Contents	Detailed code	
		1st byte	2nd byte
0001	Unit watchdog timer error	00	00
0002	CPU bus monitor timeout	Monitor time (unit: ms)	
0003	CPU bus parity error	01: Cyclic 02: Event	00
0101	Transmission disabled by loop error	Command block Bit 7: 0 Bits 0 to 6: Local network address Response block Bit 7: 1 Bits 0 to 6: Destination network address	Command Sending node address Response Destination node address
0102	Transmission disabled by lost token		
0104	Transmission disabled by packet size overflow		
0108	No Unit		
010A	Communications controller error		
010B	Execution disabled by Unit error		
010D	Routing error		
010E	Routing table not registered		
010F	Routing logic error		
0110	Too many relay points		
0111	Packet size error		
0114	CPU bus error		
0116	CPU Bus Unit error		
0117	Internal buffer busy		
0118	Wrong packet discarded		
0216	Power supply error	00	01: OFF to ON 02: ON to OFF
0217	Loop error	00	00: Normal 01: Downstream backloop 02: Upstream backloop 03: Loop error

6-4-3 Time Data

Time data is recorded in numerical order according to the word address as follows:

Word	Bit	Data	Setting range
+0	0 to 7	Seconds	BCD: 00 to 59
	8 to 15	Minutes	BCD: 00 to 59
+1	0 to 7	Hour	BCD: 00 to 23 (24-hour system)
	8 to 15	Day	BCD: 01 to 31
+2	0 to 7	Month	BCD: 01 to 12
	8 to 15	Year	BCD: 00 to 99 (rightmost two digits of the year)

Note BCD stands for binary coded decimal.

SECTION 7
Troubleshooting

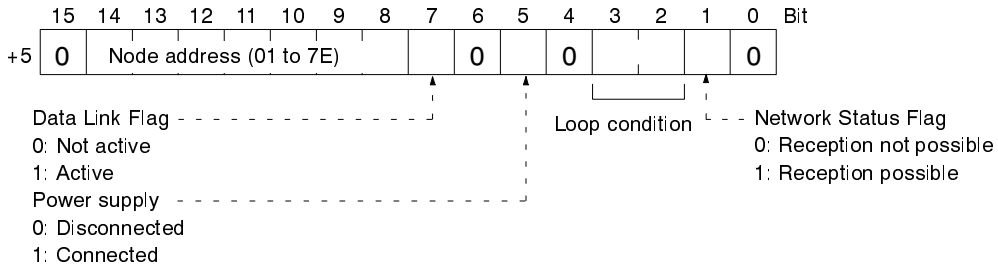
This section describes the troubleshooting of the SYSMAC NET Link System using the indicators on the SYSMAC NET Link Unit and the data available in PC memory.

7-1 Status Words

The operational status of the SYSMAC NET Link Unit can be accessed through the status words in the CPU Bus Unit Area of the PC.

7-1-1 Node Address and Network Status

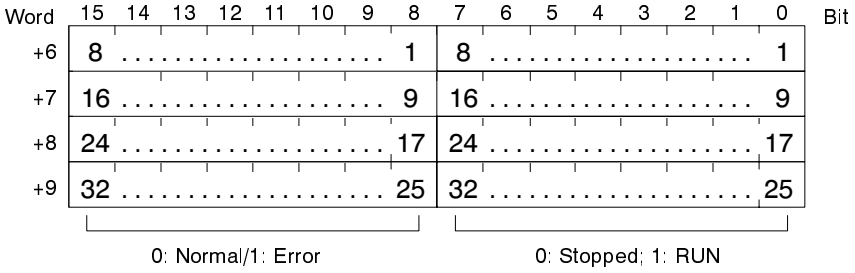
Word: 1500 + (25 x Unit no.) + 5



Bit 3	Bit 2	Loop condition
0	0	Normal loop
0	1	Downstream backloop
1	0	Upstream backloop
1	1	Loop error

7-1-2 Data Link Status Words

Word: 1500 + (25 x Unit no.) + 6 to 9



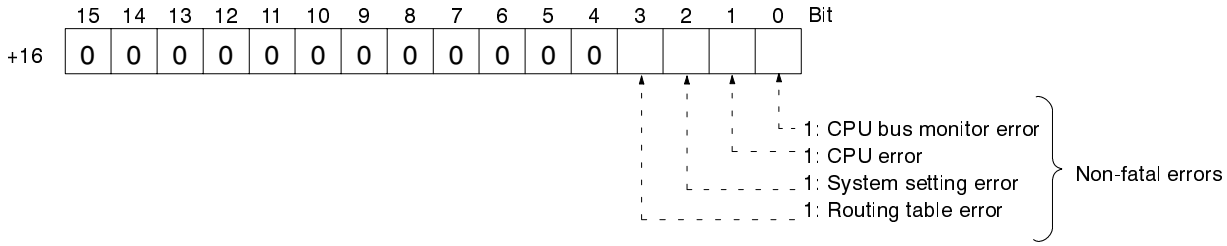
The above numbers 1 to 32 represent the nodes participating in the data link. If the data links were automatically generated, these number will be the same as the node addresses. If the data link tables were manually input, the numbers will be in the same order as the nodes set in the data link table

Bits 8 to 15 of each word will turn ON if no data is received from the designated node within a specified time period. If these bits turn ON (1) frequently, you need to change the transmission delay time, configuration of the system, or designation of the Master and Slaves. Bits 0 to 7 of each word indicate the operational status of the PC at the nodes participating in the data link. When these bits are ON, the PC at the corresponding node is executing the user program.

7-1-3 Error Check

One of the status words provides four Error Flags for checking for errors. You can also check for errors by referring to the error log.

Unit Error Flags **Word: 1500 + (25 x Unit no.) + 16**



Unit response to error	Kind of error	Cause
The Unit continues operating (non-fatal errors)	CPU bus monitor error	The CPU interface on PC has an error.
	CPU error	CPU watchdog timer on PC has an error.
	System setting error	System settings not completed.
	Routing table error	The routing tables have an error.

When any of the above errors occurs, the ERR indicator will be lit.

PC Interface Errors **Word: 1500 + (25 x Unit no.) + 17**

The number of errors that have occurred is recorded as a hexadecimal value. The value is incremented by one when the Unit cannot access the PC for a certain period.

Communications Errors **Word: 1500 + (25 x Unit no.) + 18**

The number of errors that have occurred is recorded as a hexadecimal value. The value is incremented by one when the Unit requests to send on the optical LAN network but connect secure a free token for a certain period of time (i.e., when the token has been lost).

RAM Errors **Word: 1500 + (25 x Unit no.) + 19**

The number of errors that have occurred is recorded as a hexadecimal value. The value is incremented by one when there is a parity error between the PC and Unit.

Error Log

Error records are stored in the error log. For details refer to *Section 6-4, Error Log.*

7-2 Error Processing and Correction

Error processing and correction are explained in this section.

7-2-1 Troubleshooting from Indicators

You can troubleshoot the following errors from indicators on the SYSMAC NET Link Unit.

Error	Possible cause	Correction
RUN indicator is not lit	Power is not supplied properly	Supply proper voltage
	SYSMAC NET Link Unit is defective	Replace SYSMAC NET Link Unit
	SYSMAC NET Link Unit is not mounted securely with mounting screws	Mount securely and tighten the screws
	SYSMAC NET Link Unit is not mounted	Mount SYSMAC NET Link Unit correctly
ERR indicator is lit	Node address or unit number setting is wrong	Set correct node address or unit number and restart the Unit
	Error occurred during tests between two nodes	Check test status words (refer to p. 117)
	Other error	Check status words
LNK indicator is not lit	Correct data link table is not made at the Master	Make proper data link table
	Data link table at the Master does not include all Slaves	Make proper data link table
	The same node address is set more than once	Set correct node addresses
NCD indicator is not lit; BCD indicator is lit	Upstream optical fiber cable is broken	Replace optical fiber cable
	Upstream node has an error	Replace the defective Unit
BCD indicator is not lit and NCD indicator is lit	Downstream optical fiber cable is broken	Replace optical fiber cable
	Downstream node has an error	Replace the defective Unit
NCD indicator or BCD indicator are not lit	Line server power is not being supplied properly	Supply proper voltage
	Upstream and downstream Optical fiber cables are broken	Replace optical fiber cable
	Upstream and downstream nodes have errors	Replace the defective Units

7-2-2 Data Link Errors

You can troubleshoot the following errors from the data link status words.

Error	Possible cause	Correction
Slave error flag is ON	Slave power supply is off or cable is cut	Check Slave power supply or connections
	Master cannot receive data sent in one scan time	Increase the data link transmission delay time or alter the network so that each nodes will be connected to loads that are about even in capacity.
Data link operation flag is OFF	Master power supply is off	Supply power to Master
	Master is stopped.	Reset the system

Note
1. After you correct the error, reset the system.
2. Be sure to turn off the PC before you mount or dismount the SYSMAC NET Link Unit.

7-2-3 Response Code List

You may troubleshoot the following errors from the response codes when the SEND(192), RECV(193), or CMND(194) instructions have been used. For the storage area of the response codes refer to *4-2-4 Communications Port.*

Main code		Sub-code		Check point	Possible cause	Correction
Value	Meaning	Value	Meaning			
00	Normal completion	00	Normal completion	---	---	---
01	Local node error	01	Local node not included in network	Check the network status of the local node	Disconnection of optical fiber cable or Line Server	Connect the optical fiber cable or Line Server.
		02	Token time out	Check the network status of the local node	Disconnection of optical fiber cable or Line Server	Connect the optical fiber cable or Line Server.
02	Designated node error	04	Buffer is busy	---	Too many data receptions at the designated node	Alter the system.
		05	Response time out	---	Message frame damaged by noise	Increase the number of retries. Check for noise by conducting tests between two nodes.
				Check control data of instruction	Short response monitor time	Refer to Section 4 and set a larger response monitor time parameter.
03	Controller error	02	PC error	PC on designated node	PC error on designated node	Refer to Operation Manual for the PC and restore the error.
		04	Unit no. setting error	Unit no.	Wrong unit no.	Refer to Section 2 and set the rotary switch to a unique unit no. within the permissible range.
04	Setting range error	01	Undefined command	Command code	Wrong command code	Use a proper command code.
		02	Undefined port no.	Port no. of SEND(192) and RECV(193) instruction	SEND(192) and RECV(193) instructions were not issued at port 0 in the C mode.	Issue SEND(192) and RECV(193) instructions at port 0 in the C mode.
05	Routing error	01	Routing table error	Routing tables	Wrong node address	Refer to Section 3 and set a proper address on the routing tables.
		02	No routing tables	Routing tables	No registered routing table	Refer to Section 3 for setting correct routing table.
		03	Routing table logic error	Routing tables	Wrong node address format	Refer to Section 3 for setting correct routing tables.
		04	Too many relay points	Network configuration	Data exchange beyond three network levels	Alter the network or the routing tables so that data change is always within three levels.

Main code		Sub-code		Check point	Possible cause	Correction
Value	Meaning	Value	Meaning			
10	Command format error	01	Command length over	Command data	Command length is too long.	Refer to Section 4 and set proper command data.
		02	Insufficient command length	Command data	Short command length	Refer to Section 4 and set proper command data.
		03	Wrong items/data	Command data	Designated number of items do not coincide with write data.	Designate the number of items according to the number of write data.
		04	Command format error	Command data	Format is different.	Refer to Section 4 and set proper command data.
		05	Header error	Application header	Wrong application header	Refer to Section 4 and designate a correct application header.
11	Parameter error	01	No area designation	Parameter code in command data	Parameter code does not include the corresponding code or no expansion DM is available.	Refer to Section 4 and designate a correct code.
		02	Access size error	Designation of access size in command data	Designation of access size is wrong or the number of the first word is odd numbered.	Refer to Section 3 and designate a correct access size.
		03	First word designation error	First word in command data	First word in access prohibit area	Designate the first word in the area other than the access prohibit area.
		04	Address range over	First word and number of items in command data	Last address in access prohibit area	Designate the first word in the area other than the access prohibit area.
		06	No corresponding program no.	Program no. in command data	Nonexisting program no.	Set effective program numbers.
		09	Item size error	Command data	Wrong size of items in command data	Check the command data carefully and make the data according to it size.
		0A	Data duplication error	Command data	Duplication of contents of command data	Refer to Section 4 and set proper command data.
		0B	Response length over	No. of items in command data	Response exceeding than maximum permissible length	Refer to Section 4 and designate the number of items in the command format.
		0C	Parameter error	Parameters in command data	Parameters are wrongly set	Designate correct parameters in the command data.

Main code		Sub-code		Check point	Possible cause	Correction
Value	**Meaning**	**Value**	**Meaning**			
20	Reading disabled	02	Protection	---	Program area protected	Execute PROGRAM AREA PROTECT CLEAR and read again.
		03	No table registered	Corresponding table	No table	Set the table.
					Table error	Set the table correctly.
		04	No data searched	---	No data corresponding to searching data	---
		05	No corresponding program no.	Program no. in command data	Nonexisting program no.	Set effective program numbers.
		06	No corresponding file	File name and filing device	No corresponding file in designated filing device	Recheck the file name.
		07	Collation error	Contents of memory	No corresponding data	Rewrite the data with correct data.
21	Writing disabled	01	Read only	---	Read-only area	If writing protect is ON, release it and write again. You cannot write data to the read-only area.
		02	Protection	---	Program area protected	Execute PROGRAM AREA PROTECT CLEAR and read again.
			Data link table writing disabled	System setting	Writing is disabled due to data link table automatic setting	Change the system setting to data link table manual setting.
		03	Registration disabled	No. of files in filing device	No. of files exceeding permissible number	Delete unnecessary files or prepare additional memory for the files.
		05	No corresponding program no.	Program no. in command data	Nonexisting program no.	Set effective program numbers.
		06	No corresponding file	---	No corresponding file in designated filing device	---
		07	File name duplication	File name	Same name file existing in designated filing device	Change the file name and write again.
		08	Alternation disabled	Contents of memory	Permission denied because error would be caused by alternation	---

Main code		Sub-code		Check point	Possible cause	Correction
Value	**Meaning**	**Value**	**Meaning**			
22	Mode difference	01	Already executing	---	Different mode	Check the mode
			Data link activated	Data link status	Execution disabled due to active data link	Check the data link status.
		02	Data link inactive	---	Different mode	Check the mode
			Data link inactive	Data link status	Execution disabled due to inactive data link	Check the data link status.
		03	Different PC mode	---	Different command mode	Check the operating mode of the PC.
		04	Different PC mode	---	Different command mode	Check the operating mode of the PC.
		05	Different PC mode	---	Different command mode	Check the operating mode of the PC.
		06	Different PC mode	---	Different command mode	Check the operating mode of the PC.
		07	Corresponding node is not Master	System setting	Corresponding node is not Master	Designate the node as the Master.
		08	No step executed	---	Different command mode	Check the status of the step.
23	No corresponding unit	01	No filing device	Configuration of corresponding Unit	No memory as a filing device	Install the memory (filing device).
		02	No corresponding memory	---	No file memory	Install the file memory.
		03	No clock	---	No clock installed	Check the model.
24	Start/Stop disabled	01	No data link table registered	Data link table	No data link table registered	Refer to Section 5 and make a data link table.

Main code		Sub-code		Check point	Possible cause	Correction
Value	**Meaning**	**Value**	**Meaning**			
25	Unit error	02	Parity/ Checksum error	Contents of corresponding memory	Error in contents of memory	Transmit the correct data to the memory.
		03	I/O setting error	Configuration of I/O Unit	Difference in configuration between registered I/O and actual I/O	Use the registered I/O configuration or make the I/O table again.
		04	I/O points over	I/O points registered in I/O table	Registered I/O points and remote I/O points exceeding permissible range	Alter the contents so that the registered I/O points will be within the permissible range.
		05	CPU bus error	CPU bus line	Data transmission error between CPU and CPU Bus Unit	Make sure that the Units and cables are connected correctly and execute ERROR CLEAR.
		06	I/O duplication error	System settings, rack no., unit no., and I/O allocations	Duplicated numbers	Set so that the numbers will not be duplicated.
		07	I/O bus error	I/O bus line	Data transmission error between CPU and I/O unit	Make sure that the Units and cables are connected correctly and execute ERROR CLEAR.
		09	SYSMAC BUS/2 error	SYSMAC BUS/2 transmission path	SYSMAC BUS/2 data transmission error	Make sure that the Units and cables are connected correctly and execute ERROR CLEAR.
		0A	CPU Bus Unit error	CPU Bus Unit transmission path	CPU Bus Unit data transmission error	Make sure that the Units and cables are connected correctly and execute ERROR CLEAR.
		0D	SYSMAC BUS no. duplication	Transmission I/O unit no.	Remote optical duplication	Change the I/O Unit numbers that have been duplicated.
		0F	Memory error	Condition of memory	Error caused by internal memory, memory card, or Expansion DM Unit test	Write the correct data to the internal memory or Expansion DM Unit again. If you have been using a memory card or Expansion DM Unit as a filing device, this code will return if the file data is damaged. Format the Expansion DM in this case. If the error cannot be cleared, change the memory unit for a new one.
		10	No SYSMAC BUS terminator	---	No terminator designated	Designate the terminator.

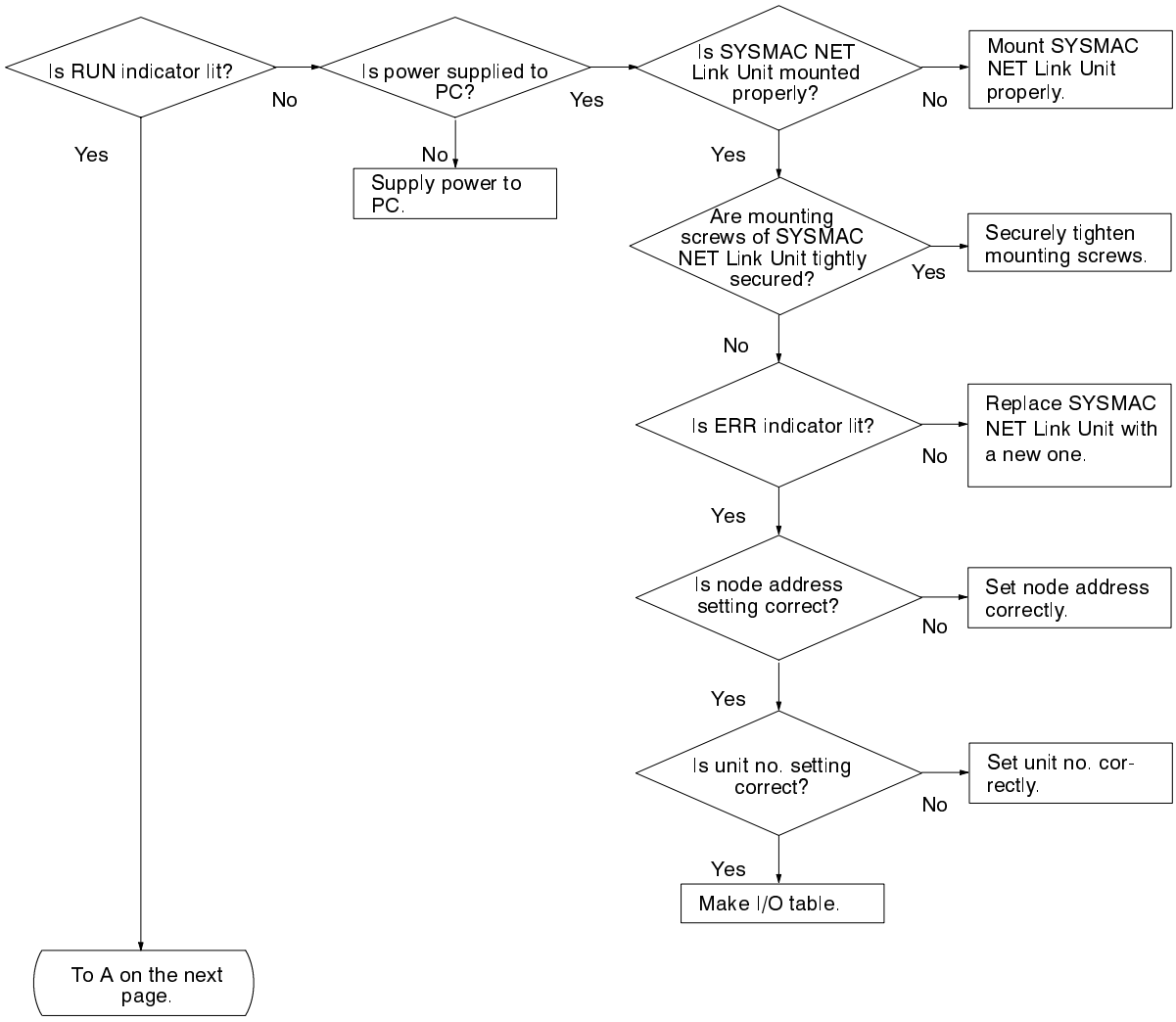
Main code		Sub-code		Check point	Possible cause	Correction
Value	**Meaning**	**Value**	**Meaning**			
26	Command error	01	Executing PROTECT CLEAR	Protection in program area	No protection being executed	No need to execute PROTECT CLEAR because no protection is being executed in the program area.
		02	Password not coincide	---	Designated password does not coincide with registered one	Designate the registered password.
		04	Protection	---	Protection	Execute PROGRAM AREA PROTECT CLEAR and read again.
		05	Service being executed	---	Service being executed	Execute the command again after present service execution is over or interrupt the service execution.
		06	No service	---	No service being executed	Execute the corresponding service as required.
		07	No execution right	LNK indicator of Unit	No execution right held	The local node is not participating in the data link. Execute from a node that is participating in the data link.
		08	No environment set	Setting before execution	No setting before execution of service	Set the necessary.
		0A	Designated number defined	Action and transition no. of program stored in program area	Attempted to register with the number already used.	Use a different number.
		0B	ERROR CLEAR disabled	Error that you tried to clear	Cause of error has not been solved.	Solve the cause of the error and execute ERROR CLEAR.
30	Access control error	01	No access right	---	Access right held by another node, CVSS on another node executing SFC online edit, or another node issuing ACCESS RIGHT ACQUIRE or ACCESS RIGHT FORCED ACQUIRE.	Execute the command again after the access right is released. If you execute ACCESS RIGHT FORCED ACQUIRE or ACCESS RIGHT RELEASE, you can execute the command. In this case, however, the node that has had the access right may have an error.

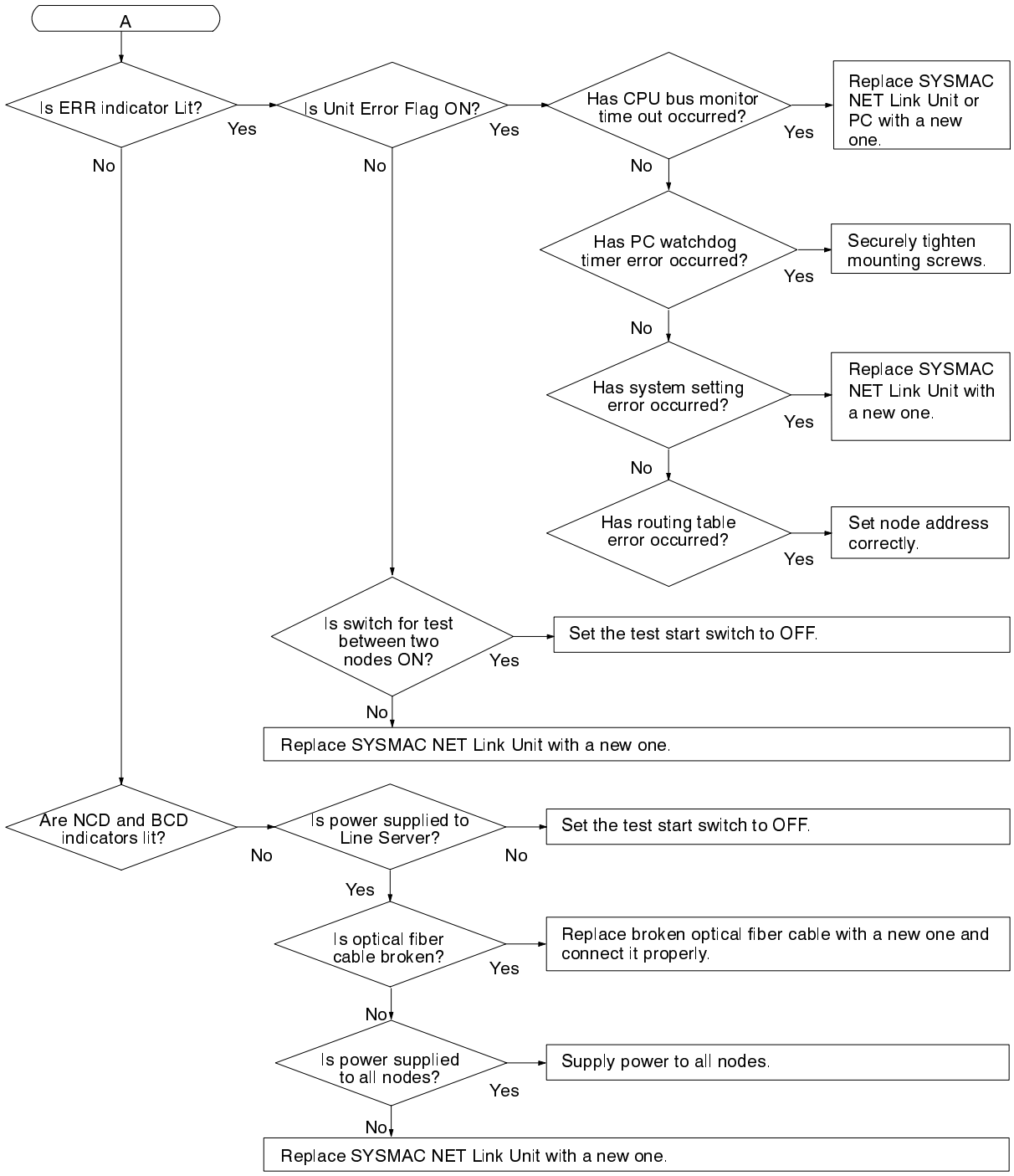
7-3 Troubleshooting Flowcharts

When an unknown error arises, use the following troubleshooting flowcharts to identify and correct the problem.

7-3-1 Network Disabled

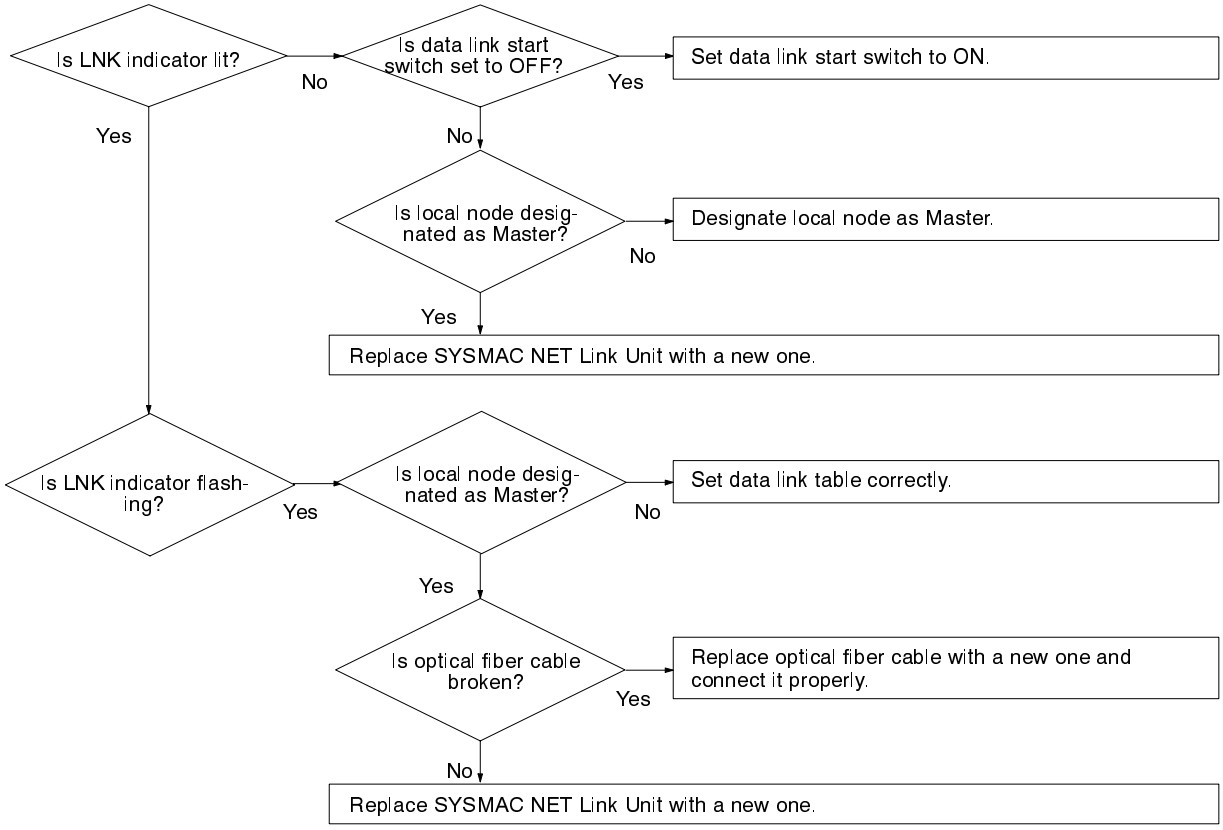
If the network that you constructed does not work, follow the procedures shown in the following flowchart.




A
Is ERR indicator Lit?
Yes
No
Is Unit Error Flag ON?
Yes
No
Has CPU bus monitor time out occurred?
Yes
Replace SYSMAC NET Link Unit or PC with a new one.
No
Has PC watchdog timer error occurred?
Yes
Securely tighten mounting screws.
No
Has system setting error occurred?
Yes
Replace SYSMAC NET Link Unit with a new one.
No
Has routing table error occurred?
Yes
Set node address correctly.
Is switch for test between two nodes ON?
Yes
Set the test start switch to OFF.
No
Replace SYSMAC NET Link Unit with a new one.
Are NCD and BCD indicators lit?
No
Is power supplied to Line Server?
No
Set the test start switch to OFF.
Yes
Is optical fiber cable broken?
Yes
Replace broken optical fiber cable with a new one and connect it properly.
No
Is power supplied to all nodes?
Yes
Supply power to all nodes.
No
Replace SYSMAC NET Link Unit with a new one.

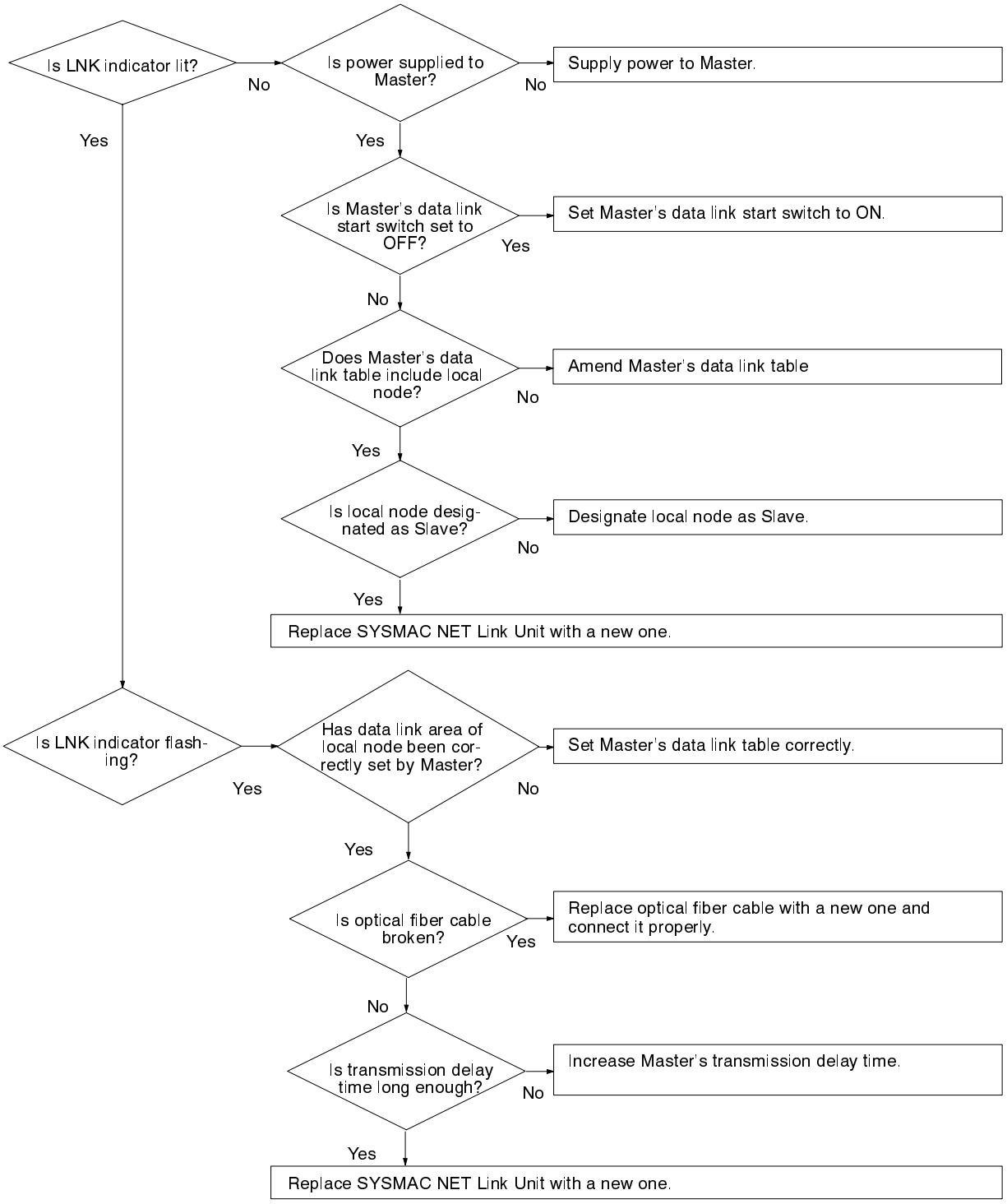
7-3-2 No Data Link Activated (Master)

If you cannot start the data link from the node on which the Master is located, following the procedures shown in the following flowchart.



7-3-3 Data Link Participation Denied (Slave)

If a Slave cannot participate in the data link, troubleshoot the problem with the following chart.



SECTION 8
Maintenance and Inspection

This section describes the basic hardware inspection and maintenance procedures for the SYSMAC NET Link System.

8-1 Maintenance

If any of the SYSMAC NET Link Units in the network is defective, it will adversely affect the performance of the network. When there is a defective Unit, replace it promptly. We recommend you keep spare SYSMAC NET Link Units on hand to minimize system downtime in the event of failure.

8-1-1 Replacing SYSMAC NET Link Units

Observe the following precautions when replacing defective Units.

- Check first for faulty connections. Remove the Unit and wipe the connector pins with a clean, all-cotton cloth moistened with industrial alcohol and test the System again before proceeding.
- Turn power off before replacing the Unit.
- When you have replaced the Unit, make sure that the new Unit is functioning properly. The problem may not have been with the Unit.
- When returning a defective Unit OMRON, enclose a detailed written description of the problem.

8-1-2 Replacing PCs

When you replace a PC, be sure to transfer the following parameters to the new PC. These parameters are stored in the CPU's EEPROM.

- Routing tables
- Data link tables
- System parameters

Routing Tables

When you have been using routing tables, you will need to set them in the new PC.

Data Link Tables

When data link tables have been manually set, you will need to set then in the new PC before the data links can be activated.

System Parameters

Set the system parameters again when you have replaced the PC.

8-2 Inspection

Regular inspections and appropriate maintenance are essential to ensure the full life of your SYSMAC NET Link Unit.

8-2-1 Inspection Points

Semiconductor elements are employed as main components of the Net Link Unit. Semiconductors are, however, subject to deterioration under severe environmental conditions and should be inspected periodically. The standard inspection cycle is six months to one year. The frequency of inspection should be increased if necessary.

If conditions are found to be outside the criteria shown in the following table, the necessary corrections should be made so that the criteria are met.

Item	Contents	Criteria
Environmental conditions	Ambient temperature in control panel	0% to 55%C
	Humidity	10% to 90% without condensation
	Dust	Must be relatively dust-free
Mounting	SYSMAC NET Link Unit firmly secured?	Mounting screws must not be loose.
	Connecting cables securely connected?	Mounting screws must not be loose.
	Cables firmly secured?	Mounting screws must not be loose.
	Cables not worn	Must be apparently in good condition

8-2-2 Necessary Tools

You need to prepare the following tools.

Always Required

Phillips screwdriver, flat-blade screwdriver
Volt-ohm-milliammeter
Industrial alcohol
All-cotton cloth

Occasionally Required

Synchroscope
Pen-writing oscillograph
Thermometer
Hydroscope

SECTION 9
Systems Combining C-series and CV-series PCs

This section describes procedures required for SYSMAC NET Link Systems that combine C-series and CV-series PCs, including the C-mode commands that are used in such Systems.

9-1 Overview

A network can include both C-series SYSMAC NET Link Units (mounted to C-series PCs) and CV-series SYSMAC NET Link Units (mounted to the CV-series PCs) so that these PCs can exchange data with one another.

Command Modes

A CV-series SYSMAC NET Link Unit can be used in either of the following two modes. The C-mode enables it to communicate with C-series SYSMAC NET Link Units on the same network.

CV-mode
Used by networks that include only CV-series PCs. Communications are not possible with C-series PCs in this mode.

C-mode
Used by networks that include both CV-series and C-series PCs. The CV-series PCs and the C-series PCs can exchange data in the C-mode using SEND(90/192) and RECV(98/193) instructions. The Units must be set to C-mode in the communications unit settings.

Settings

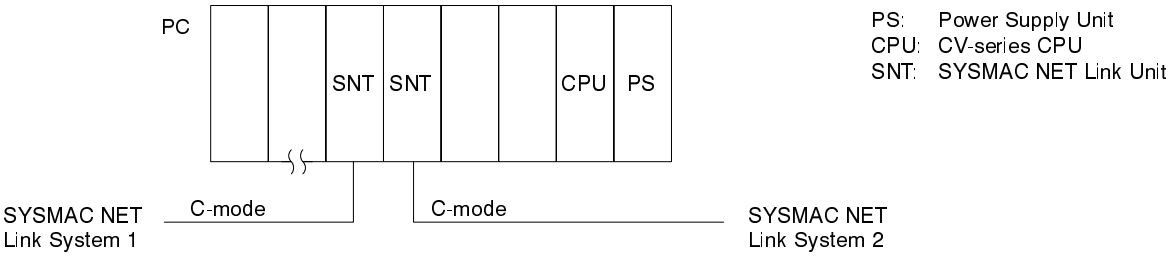
Use the IBM PC/AT compatible computer to set the datagram message specifications of the communications unit settings to C-mode. Restart the Unit or the PC after changing the mode.

Note The command and response application headers, which are made automatically by the SYSMAC NET Link Unit, in the CV-mode are different from those in the C-mode. Be sure to use the correct application header for data exchange between the IBM PC/AT or compatible computers and PCs.

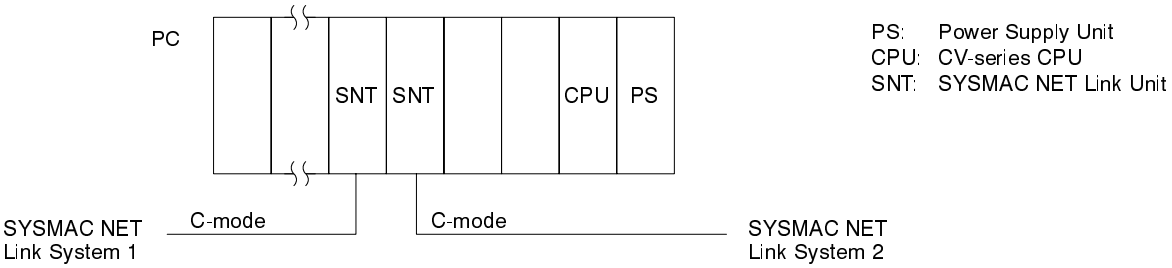
9-1-1 Combining Modes on PCs

A single PC supports up to four SYSMAC NET Link Units, each of which can be in either the CV-mode or C-mode.

All Units in C-mode

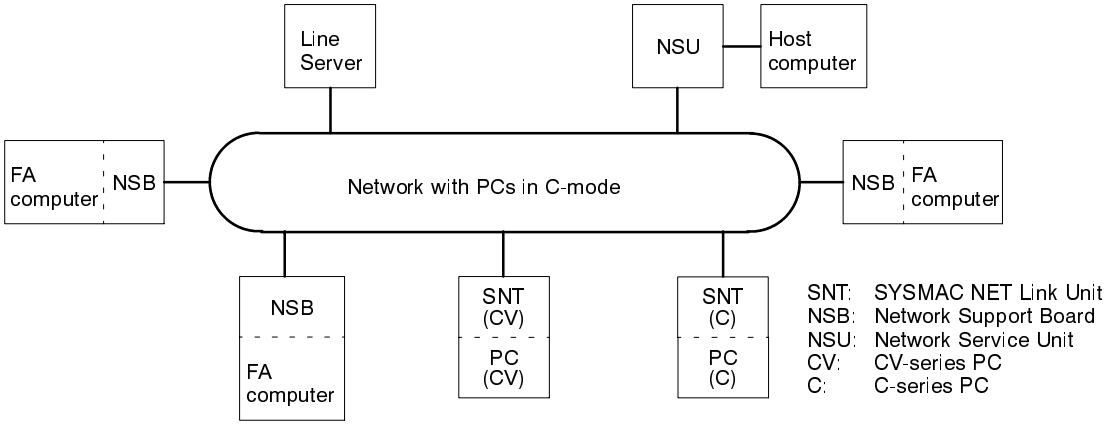


Units in Both C-mode or CV-mode

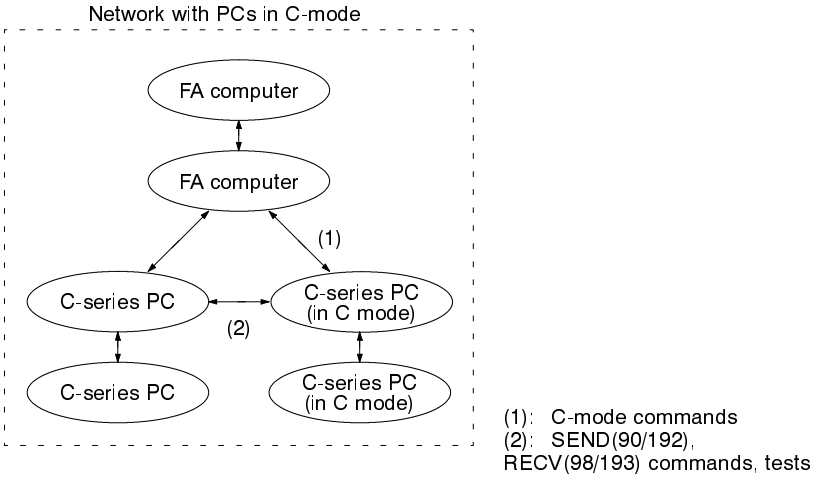


9-1-2 Networks Combining C-series and CV-series PCs

The network example shown in the following illustrations include both C-series and CV-series PCs. The network can include a single Line Server and 126 nodes (PCs and IBM PC/AT or compatible computers) connected with two-core optical fiber cable.

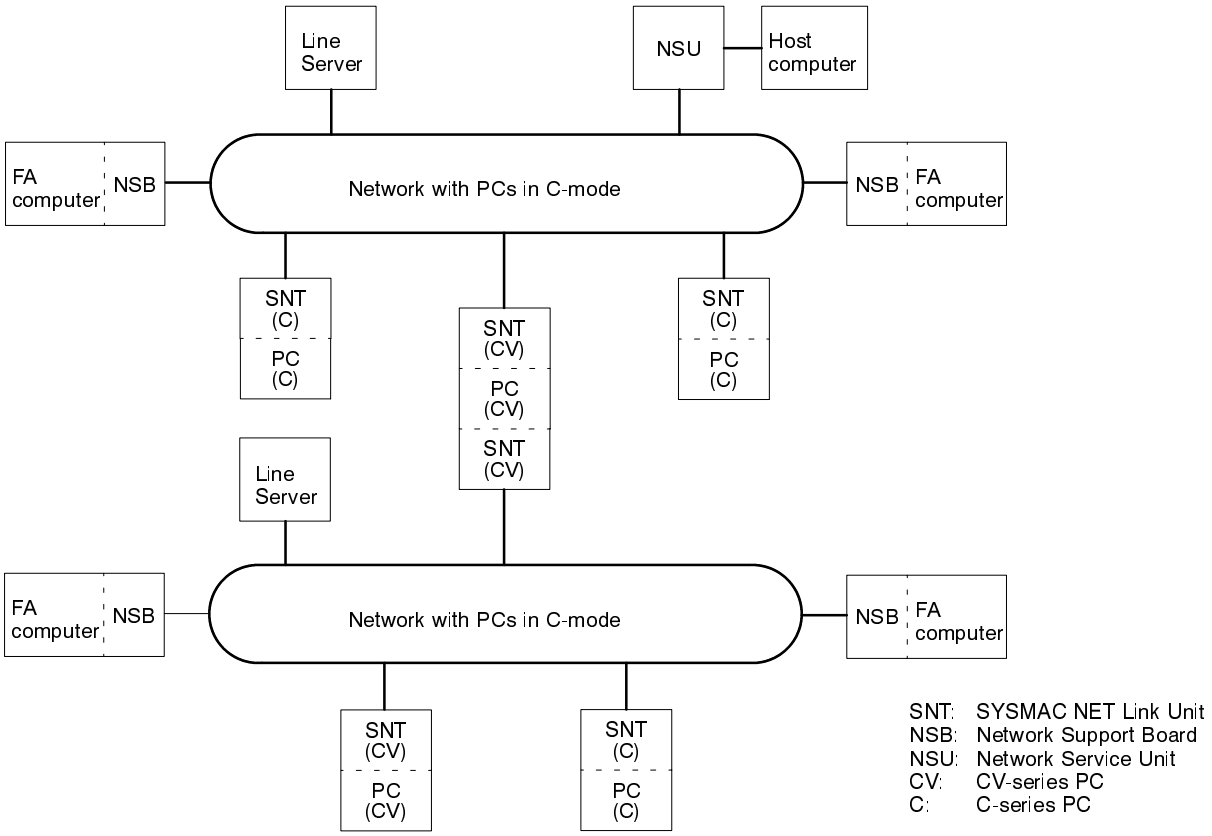


In the above system, data exchange is possible in the following combinations.

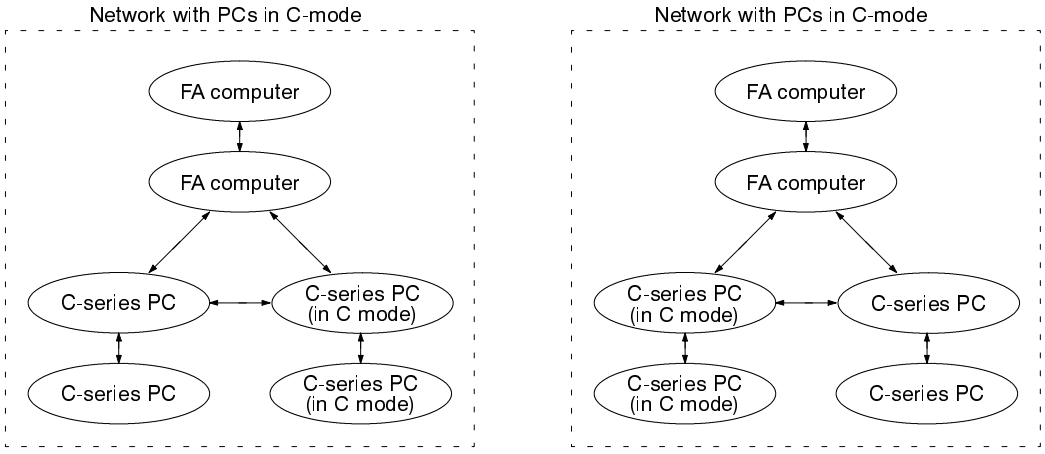


Interconnected Networks

There are three kinds of multiple network configuration, which vary with the command modes and network connections. The following is an example of one network connected to another in C-mode. A network can connect up to 20 networks in C-mode.

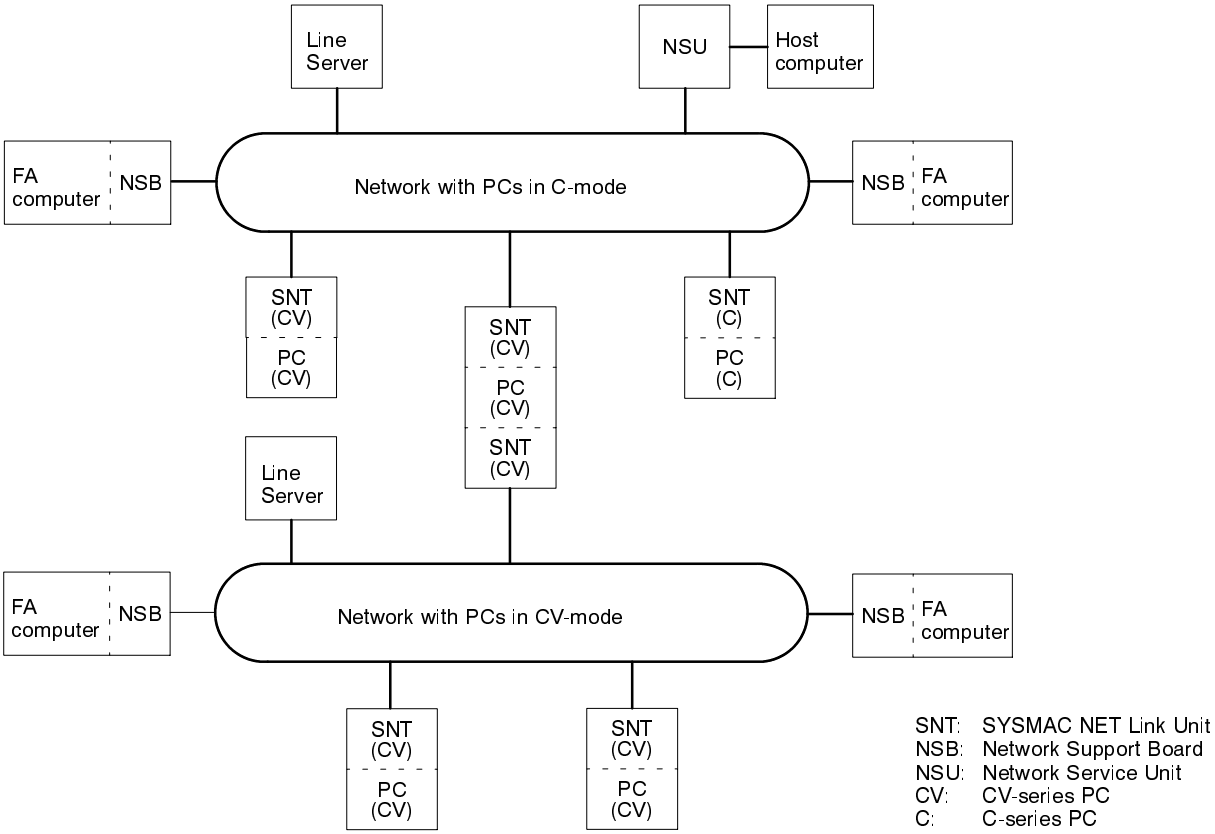


In the above system, data exchange is possible in the following combinations. Data cannot be exchanged between the two networks because PC cannot bridge two networks set for C-mode operation.

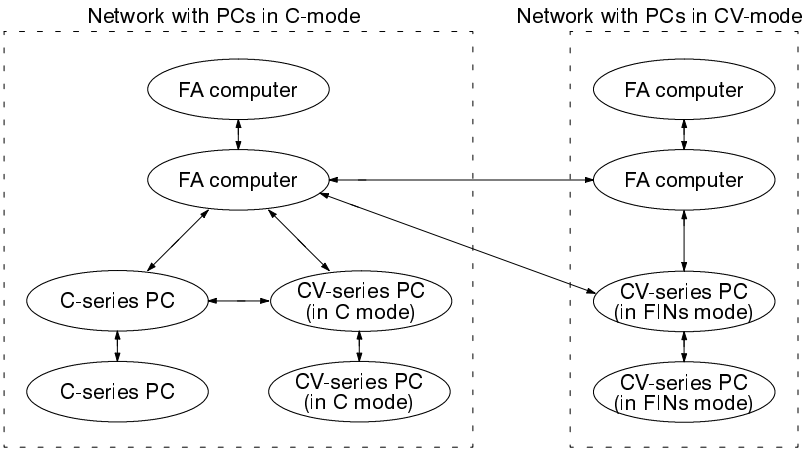


Note PCs cannot bridge networks in the C-mode.

The following is an example of a network in the C-mode connected to another that is in the CV-mode. A network in the C-mode can connect up to 20 networks in the CV-mode.

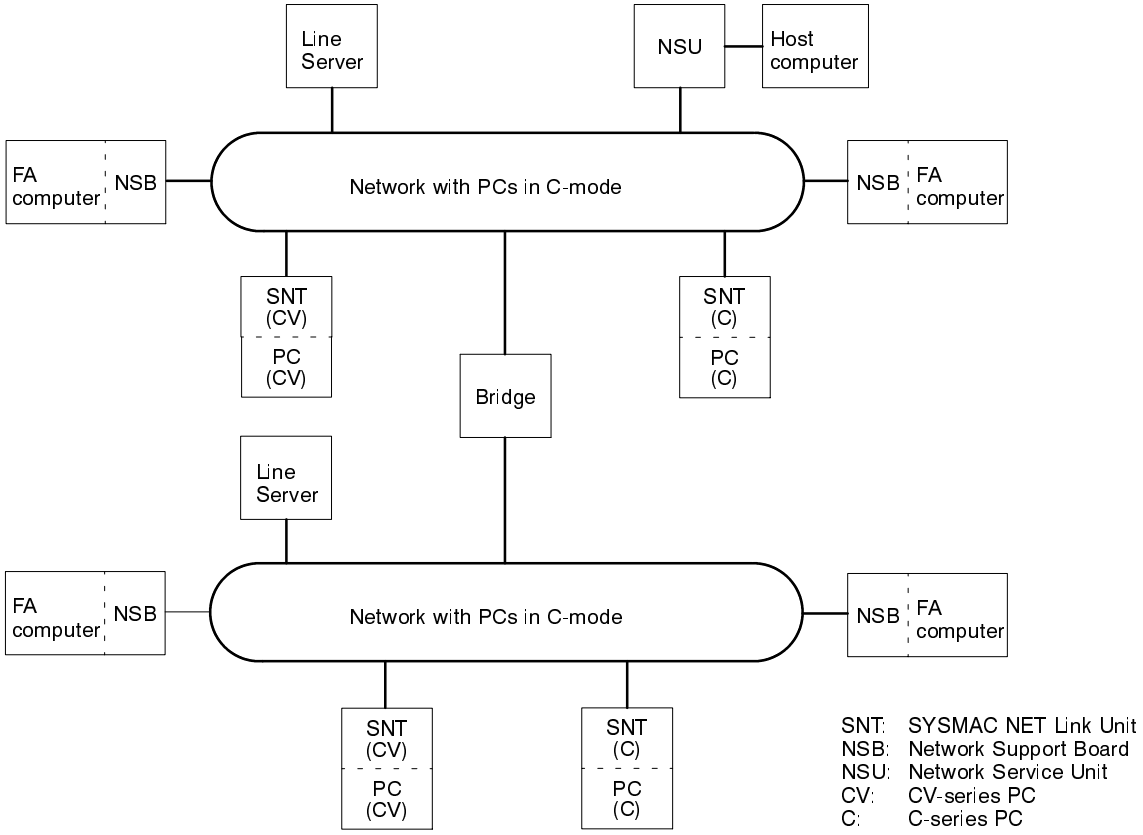


In the above system, data exchange is possible in the following combinations. Data can be exchanged between the two networks, but only between computers in the C-mode network and PCs operating in CV-mode or computers in the CV-mode network.

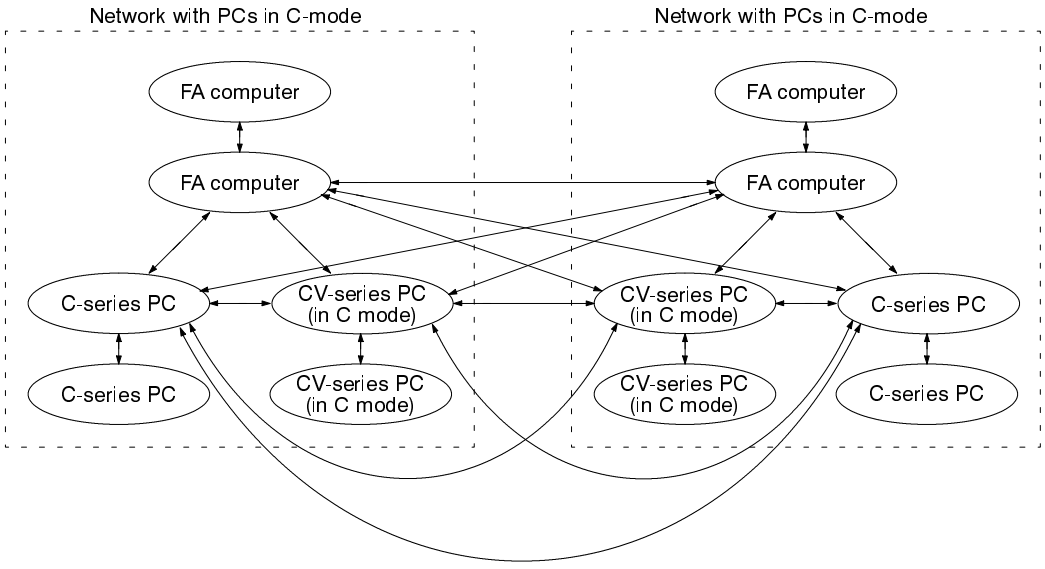


Note PC bridging networks cannot interface CV-mode commands to C-mode commands.

The following is an example of a network connected to another both in the C-mode using the S3200-NSUG410 Bridge. These networks include both C-series and CV-series PCs. The S3200-NSUG410 Bridge allows data exchange among the IBM PC/AT or compatible computers, CV-series PCs, and C-series PCs.

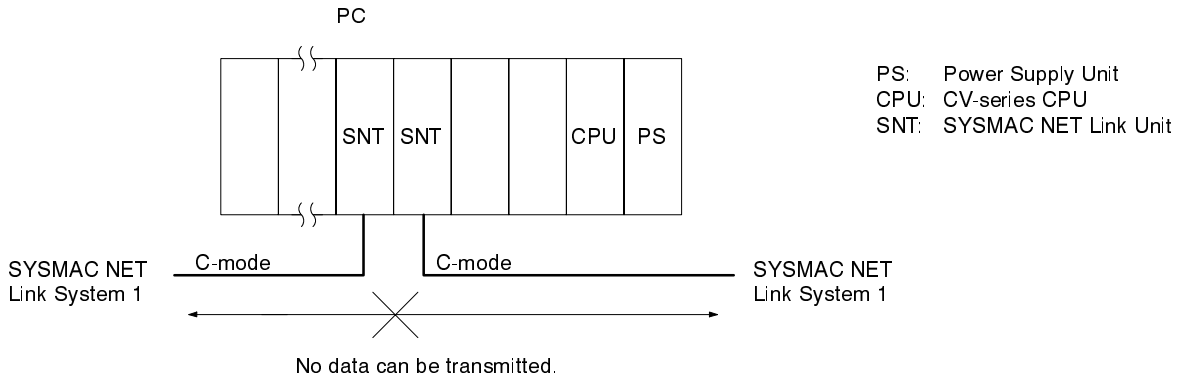


In the above system, data exchange is possible in any combination, as shown below.



9-2 Bridging Across PCs

PCs cannot bridge data transmissions between two networks in the C-mode.



When a network in the C-mode is connected to another network that is in the CV-mode, a PC can bridge IBM PC/AT or compatible computers or an IBM PC/AT or compatible computer on the network in the C-mode and a CV-series PC on the network in the CV-mode.

To exchange data between nodes among networks other than the above, use the S3200-NSUG410 or S3200-NSUG4003 Bridge. Refer to the examples in the previous section.

9-3 Data Areas

The following table lists C-series PC data areas and the corresponding CV-series PC memory areas. Use these tables when using the datagram service or data links in C-mode.

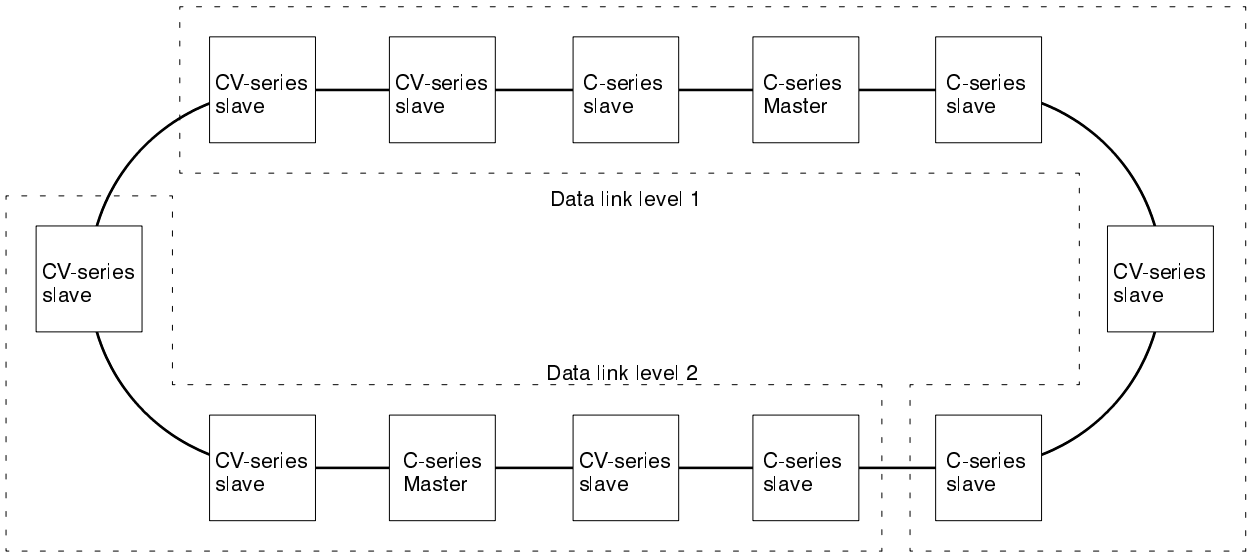
C-series PC		CV-series PC	
Area	**Words**	**Area**	**Words**
IR area	IR 000 to IR 255	I/O area	0000 to 0255
LR area	LR 00 to LR 63		1000 to 1063
HR area	HR 00 to HR 99		1064 to 1163
AR area	AR 00 to AR 27		1164 to 1191
TC Completion Flag status	TC 000 to TC 511	Timer Completion Flag status	T0000 to T0511
TC present value	TC 000 to TC 511	Timer present value	T0000 to T0511
DM area	DM 0000 to end of area	DM area	D00000 to end of area

9-4 Data Links

SYSMAC NET Links in the C-mode enable CV-series PCs to exchange data with C-series PCs.

9-4-1 System Configuration

The following is an example of a data link configuration.



A single network can include four data links, each of which can include up to 32 nodes.

To make a data link table manually on a CV-series PC, use DATA LINK TABLE GENERATION in the C-mode.

Note
1. A CV-series PC can be a Master for a data link in C-mode.
2. The datagram mode can be set to either the CV-mode or C-mode without affecting data links.

9-4-2 Specifications

The specifications of the data links are as follows:

Item	Automatic setting	Manual setting
No. of data link levels	1 level max. per network	4 levels max. per network
No. of data link nodes	Decided by the number of link words (2, 4, 8, 16, or 32 nodes).	32 nodes maximum per data link level (32 Slaves if the Master does not participate in the data link and 31 Slaves if the Master participates in the data link).
No. of link words	Select 2, 4, 8, 16, or 32 words per node (I/O Area). In the DM Area, the number of words will be twice as many as those in the I/O Area.	The maximum number of words per node is as follows: I/O Area: 127 words DM Area: 127 words
Allocation of the data link words	I/O Area: 1000 to 1063 DM Area: 0000 to 0127	Set in the I/O and DM Areas from FA computer or CVSS.

9-4-3 Data Link Areas

The following table lists the CV-series PC data areas and the corresponding C-series PC data areas that can be used in manually set data links.

C-series PC		CV-series PC	
Area	**Words**	**Area**	**Words**
IR area	000 to 255	I/O Area	0000 to 0255
LR area	LR 00 to LR 63		1000 to 1063
HR area	HR 00 to HR 99		1064 to 1163
DM area	DM 0000 to DM 9999	DM Area	D00000 to D09999

Note

1. The maximum word number varies with the C-series PC.
2. I/O Area words from 1000 to 1063 will be used for automatically set data links in CV-series PCs. These corresponds to the LR Area on C-series PCs.
3. No CV-series PC can be a Master in a data link.
4. Either the automatic setting or manual setting of a data link is possible with the C-series PC as a Master.

9-4-4 Data Link Tables

There is no difference in setting data link tables between data links that includes only CV-series SYSMAC NET Link Units and those that include both CV-series and C-series SYSMAC NET Link Units. For details, refer to *Section 5 Data Links*.

9-5 Datagram Services

Data is transmitted in the form of datagrams by the SYSMAC NET Link Units in C-mode.

9-5-1 Overview

When both C-series and CV-series SYSMAC NET Link Units are on a network, data exchange is possible between PCs by using SEND(90/192) and RECV(98/193) instructions. C-mode commands can be used by the C-series SYSMAC NET Link Unit as well as the CV-series SYSMAC NET Link Unit. Any of the CV-series PCs on a network can also be controlled from IBM PC/AT or compatible computers.

Note

1. Do not use CV-mode commands for the CV-series SYSMAC NET Link Unit set in the C-mode.
2. Not all C-mode commands can be used by CV-series SYSMAC NET Link Units and some C-mode commands have different functions when they are used on the CV-series SYSMAC NET Link Unit. For details refer to *8-6 C-mode Commands.*

9-5-2 PC Network Instructions

Data can be exchanged freely between two nodes on a network that includes both C and CV-series PCs by using the SEND(90/192) and RECV(98/193) instructions.

Specifications

The specifications of the SEND(90/192) and RECV(98/193) instructions are as follows:

Item	Specifications
Transmissions	SEND(90/192), RECV(98/193) instructions: 1:1 SEND(90/192) instruction: 1:126 max. (no response, polling)
Data length	SEND(90/192) instruction: 990 words (1,980 bytes) max. RECV(98/193) instruction: 990 words (1,980 bytes) max. (same area, binary)
Data	SEND(90/192) instruction: Commands requesting data transmission and response RECV(98/193) instruction: Commands requesting data reception and response
Communications port number	Port 0 only (error will result if ports 1 to 7 are used)
Response monitor time	0000: 2 s (default value) 0001 to FFFF: 100 to 6,553,500 ms in 100-ms increments
No. of retries	Set between 0 and 15

Use SEND(90/192) and RECV(98/193) instructions in the C-mode in the same manner as in the CV-mode. For details refer to *4-2 Data Exchange with the SEND(192), RECV(193), and CMND(194) Instructions.*

Note

1. Set the receiver's unit address to 00 or an error will result.
2. Set the communications port number to 0 or an error will result.
3. Command codes 60 and 61 are used for the SEND(90/192) and RECV(98/193) instructions respectively. The PC can execute these instructions only.
4. Do not use the CMND(194) instruction in the C-mode.

Transmission and Reception Areas

Before the SYSMAC NET Link Unit executes the SEND(90/192) instruction, the Unit checks the first word for transmission, and before the Unit executes the RECV(98/193) instruction, the Unit checks the first word for reception. If the areas are in the permissible ranges, the Unit converts the words into the corresponding ones of the C-series PC for the command. If the areas are not in the permissible ranges, an error will be recorded in the status words of the Unit and the instruction will not be executed. The following table lists the available ranges and areas. Only the areas listed can be used

CV-series PC		C-series PC	
Area	**Words**	**Area**	**Words**
I/O area	0000 to 0999	IR area	IR 000 to IR 999
	1000 to 1063	LR area	LR 00 to LR 63
	1064 to 1163	HR area	HR 00 to HR 99
	1164 to 1191	AR area	AR 00 to AR 27
	Others	Unavailable	
TIM present value	T0000 to T0511	TC present value	TC 000 to TC 511
DM area	D00000 to D09999	DM area	DM 00000 to DM 09999

The following table lists the sizes of the various areas for C-series PCs. Area prefixes have been dropped from the addresses.

Area	C500	C200H	C1000H	C2000H
IR area	00 to 60	000 to 252	000 to 252	000 to 252
LR area	00 to 31	00 to 63	00 to 63	00 to 63
HR area	00 to 31	00 to 99	00 to 99	00 to 99
AR area	---	00 to 27	00 to 27	00 to 27
TC area (present values)	000 to 127	000 to 511	000 to 511	000 to 511
DM area	000 to 511	000 to 999	0000 to 4095	0000 to 6655

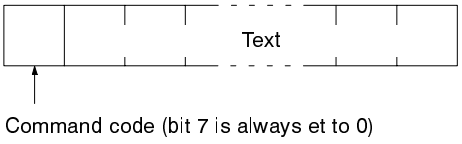
Note Do not designate data from the CV-series PC that occupies two areas of the C-series PC for data transmission or reception. For example, sending data from between I/O words 990 and 1010 cannot be done because these words are in both the IR area and LR area of C-series PCs.

9-5-3 C-mode Command Format

The basic C-mode command and response format is described in this section

Command

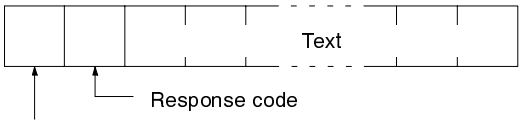
The command block format sent from an IBM PC/AT or compatible computer is as follows:



Code	Command code	Text
Binary	1 byte	1,999 bytes max.
ASCII	2 bytes	1,998 bytes max.

Response

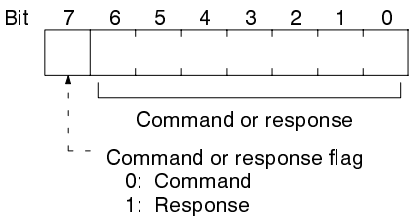
The PC returns the following response block:



Code	Command code	Response code	Text
Binary	1 byte	1 byte	1,998 bytes max.
ASCII	2 bytes	2 bytes	1,996 bytes max.

Command Code

The formation of a command code in the command or response block is shown below. Bit 7 of the command code is 0 and that of the response code is 1.



Memory Area Designations The read and write first words in the data areas in the CV-series PC must correspond to areas in the C-series PC. For data reception, refer to the following conversion table. The read and write areas vary with the model of PC. Prefixes have been dropped from the addresses.

Parameter range in C-mode		Available read/write area		
Area	**Words**	**Area**	**CV1000, CV2000, or CVM1-CPU11-E**	**CV500 or CVM1-CPU01-E**
IR area	0000 to 2555	I/O area	0000 to 2555	
LR area	00 to 63		1000 to 1063	
HR area	00 to 99		1064 to 1163	
AR area	00 to 27		1164 to 1191	
TIM Completion Flag status	0000 to 2047	TIM Completion Flag status	0000 to 1023	000 to 511
CNT Completion Flag status	2048 to 4095	CNT Completion Flag status	0000 to 1023	000 to 511
TIM present value	0000 to 2047	TIM present value	0000 to 1023	000 to 511
CNT present value	2048 to 4095	CNT present value	0000 to 1023	000 to 511
DM area	00000 to 24575	DM area	00000 to 24575	0000 to 8191

9-5-4 C-mode Command List

Command code	Name	PC-mode			Page
		RUN	**MONITOR**	**PROGRAM**	
00	IR AREA READ	Valid	Valid	Valid	p. 152
01	IR AREA WRITE	Not valid	Valid	Valid	p. 153
02	LR AREA WRITE	Valid	Valid	Valid	p. 154
03	LR AREA READ	Not valid	Valid	Valid	p. 153
04	HR AREA READ	Valid	Valid	Valid	p. 154
05	HR AREA WRITE	Not valid	Valid	Valid	p. 155
06	TC PV READ	Valid	Valid	Valid	p. 155
07	TC PV WRITE	Not valid	Valid	Valid	p. 156
08	COMPLETION FLAG READ	Valid	Valid	Valid	p. 156
0A	DM AREA READ	Valid	Valid	Valid	p. 157
0B	DM AREA WRITE	Not valid	Valid	Valid	p. 157
10	STATUS READ	Valid	Valid	Valid	p. 157
11	STATUS WRITE	Valid	Valid	Valid	p. 159
12	ERROR READ	Valid	Valid	Valid	p. 160
13	FORCE SET/RESET	Not valid	Valid	Valid	p. 161
14	FORCED SET/RESET CANCEL	Not valid	Valid	Valid	p. 161
17	PROGRAM READ	Valid	Valid	Valid	p. 162
18	PROGRAM WRITE	Not valid	Not valid	Valid	p. 162
19	I/O TABLE READ	---	---	---	p. 163
1A	I/O TABLE GENERATION	Not valid	Not valid	Valid	p. 163

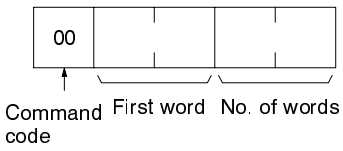
Command code	Name	PC-mode			Page
		RUN	MONITOR	PROGRAM	
1C	AR AREA READ	Valid	Valid	Valid	p. 164
1D	AR AREA WRITE	Not valid	Valid	Valid	p. 164
1E	DATA LINK STATUS READ	Valid	Valid	Valid	p. 165
1F	DATA LINK TABLE READ	---	---	---	p. 166
20	DATA LINK TABLE WRITE	---	---	---	p. 167
21	DATA LINK START	---	---	---	p. 168
22	DATA LINK STOP	---	---	---	p. 168
23	ROUTING TABLE WRITE	---	---	---	p. 168
24	ROUTING TABLE READ	---	---	---	p. 169
25	TEST	---	---	---	p. 170
26	INITIALIZE	---	---	---	p. 170
2A	NAME SET	Valid	Valid	Valid	p. 171
2B	NAME DELETE	Valid	Valid	Valid	p. 171
2C	NAME READ	Valid	Valid	Valid	p. 171
2D	TIME DATA SET	Valid	Valid	Valid	p. 172
60	DATA TRANSMIT	Valid	Valid	Valid	p. 172
61	DATA READ	Valid	Valid	Valid	p. 173

9-6 C-mode Commands

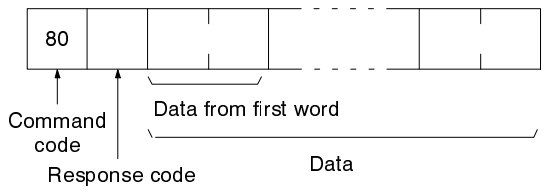
9-6-1 IR AREA READ

Reads the contents of the specified number of consecutive IR (CIO) Area words starting from the specified word.

Command Block



Response Block



Parameters

First word and no. of words (command): Specify the number of words to be read from the CIO Area between 0000 and 2555.

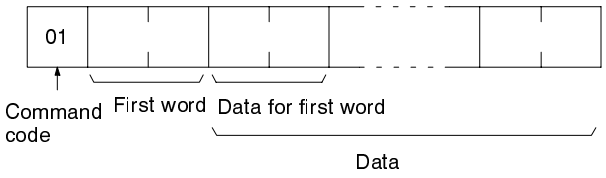
Data (response): The contents of the specified CIO Area will be returned from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

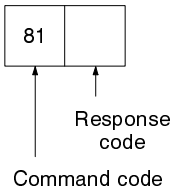
9-6-2 IR AREA WRITE

Writes data to the specified number of consecutive IR (CIO) Area words starting from the specified words.

Command Block



Response Block



Parameters

First word (command): Specify the address of the first word to be written in CIO Area (0000 to 2555).

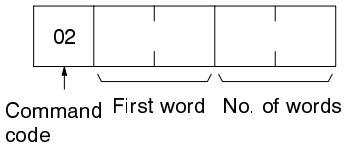
Data (command): Specify the data to be written to the specified CIO Area starting from the first word. The total number data bytes are calculated as follows:

Number of words x 2 bytes/word

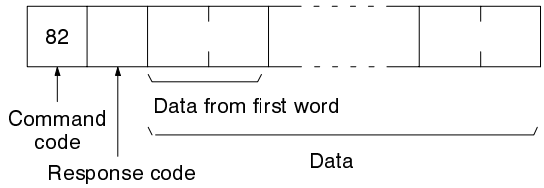
9-6-3 LR AREA READ

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

Command Block



Response Block



Parameters

First word and no. of words (command): Specify the number of words to be read from the LR Area between 1000 and 1063.

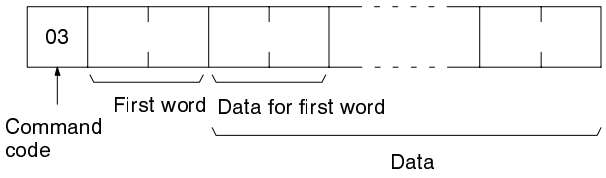
Data (response): The data in the specified LR Area will be returned in sequence starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

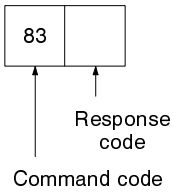
9-6-4 LR AREA WRITE

Writes data to the specified number of consecutive LR Area words starting from the specified word.

Command Block



Response Block



Parameters

First word (command): Specify the address of first word to be written in LR Area (1000 to 1063).

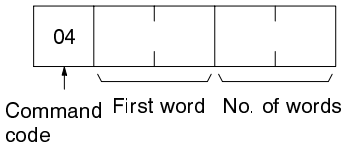
Data (response): Write the data to the specified LR Area starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

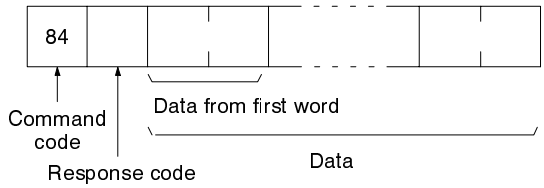
9-6-5 HR AREA READ

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

Command Block



Response Block



Parameters

First word and no. of words (command): Specify the number of words to be read from the HR Area between 1064 and 1163.

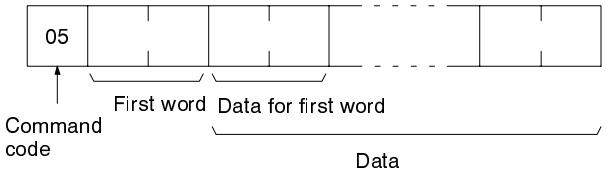
Data (response): The data in the specified HR Area will be returned in sequence starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

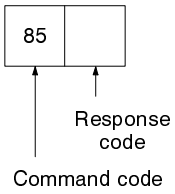
9-6-6 HR AREA WRITE

Writes data to the specified number of consecutive HR Area words starting from the specified word.

Command Block



Response Block



Parameters

First word (command): Specify the address of first word to be written in HR Area (1064 to 1163).

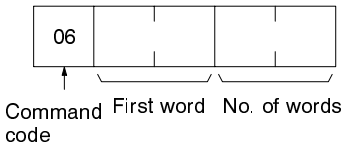
Data (response): Write the data to the specified HR Area starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

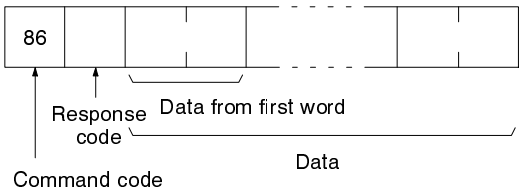
9-6-7 TC PV READ

Reads the present value of the timers for the specified number of consecutive TC Area words starting from the specified word.

Command Block



Response Block



Parameters

First word and no. of words (command): Specify the number of words to be read from the TC Area between 0000 and 4095.

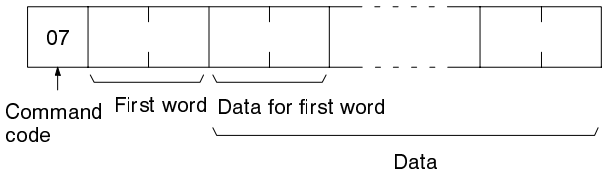
Data (response): The BCD data for the specified present values will be returned in sequence starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

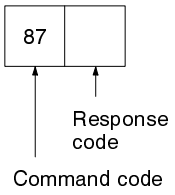
9-6-8 TC PV WRITE

Writes present values to the specified number of consecutive TC Area words starting from the specified word.

Command Block



Response Block



Parameters

First word (command): Specify the address of first word to be read from TC PV Area (0000 and 4095).

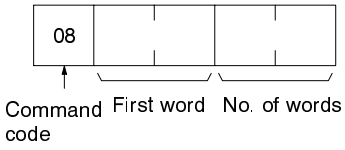
Data (response): Specify the present values to be written to the specified TC words starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

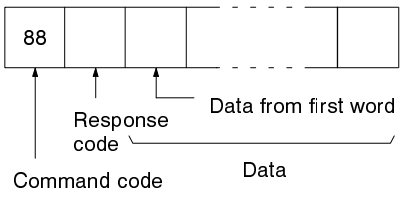
9-6-9 COMPLETION FLAG READ

Reads the ON/OFF status of the Completion Flags for the specified number of consecutive TC Area words starting from the specified word.

Command Block



Response Block



Parameters

First word and no. of words (command): Specify the number of words to be read from the TC UP Area between 0000 and 4095.

Data (response): The status from the specified TC Area will be returned in sequence starting from the first word. Each word to be read will be as follows:

01: ON
00: OFF

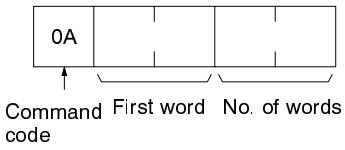
The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

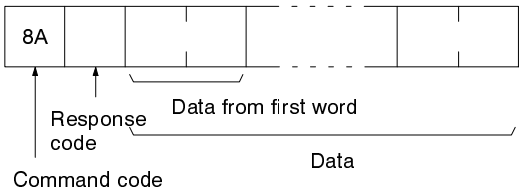
9-6-10 DM AREA READ

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

Command Block



Response Block



Parameters

First word and no. of words (command): Specify the number of words.

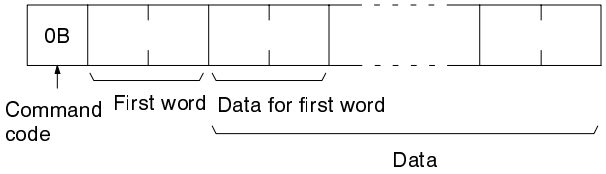
Data (response): The data in the specified DM Area will be returned in sequence starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

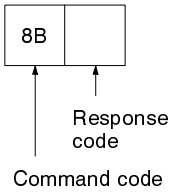
9-6-11 DM AREA WRITE

Writes data to the specified number of consecutive DM Area words starting from the specified word.

Command Block



Response Block



Parameters

First word (command): Specify the address of first word.

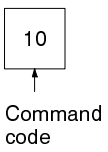
Data (response): Write the data to the specified DM Area starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

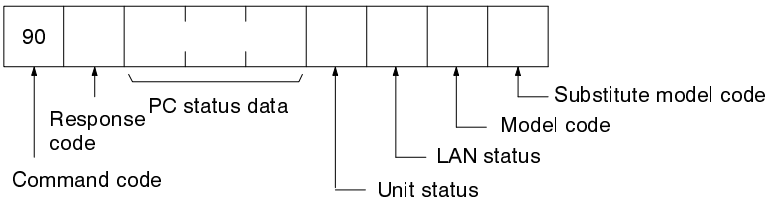
9-6-12 STATUS READ

Reads the operating status of the PC.

Command Block



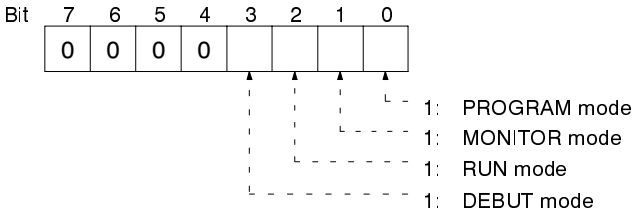
Response Block



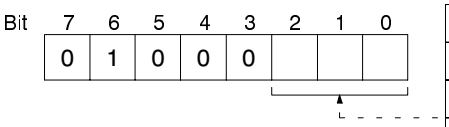
Parameters

PC status data (response): The status consists of three bytes. The leftmost byte is for the PC's operating mode, the byte in the middle is for the size of the program area, and the rightmost byte is for the size of the DM Area.

Leftmost Byte



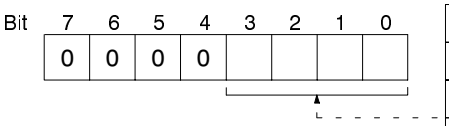
Middle Byte



Bit			Program area
2	1	0	
0	0	0	No program
0	0	1	16K bytes
0	1	0	32K bytes
0	1	1	48K bytes
1	0	0	64K bytes
1	0	1	128K bytes
1	1	1	512K bytes

Note The program area size refers to the capacity of the internal program area.

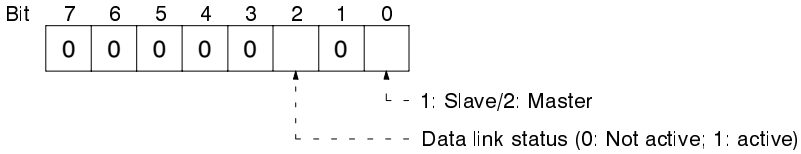
Rightmost Byte



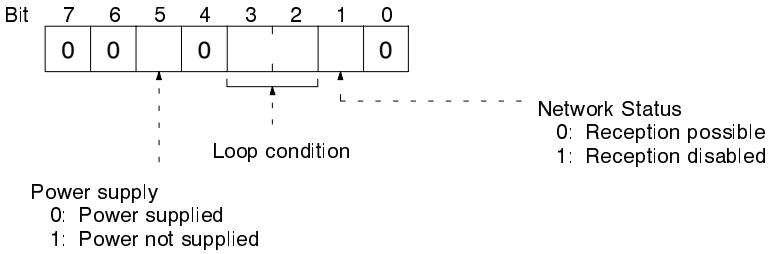
Bit				DM size
3	2	1	0	
0	0	0	0	512 words
0	0	0	1	1,024 words
0	0	1	0	1,536 words
0	0	1	1	2,048 words
0	1	0	0	2,560 words
0	1	0	1	3,072 words
0	1	1	0	3,584 words
0	1	1	1	4,096 words
1	0	0	0	8,192 words
1	0	0	1	24,576 words

Note The DM Area size refers to the capacity of the internal DM Area.

Unit status (response): The setting of the master and slaves and operating condition of the data link will be returned as one byte of data.



System status (response): The condition of the power supply, loop, and insertion will be returned as one byte of data.



Bit 3	Bit 2	Loop condition
0	0	Routing table error
0	1	Response error
1	0	Designated node is busy
1	1	Time out

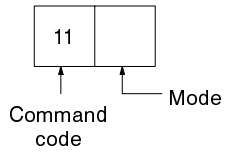
Model code, submodel code (response): The data consisting of two bytes specifying the PC model will be returned as follows:

Model code	Submodel code	PC Model
02	02	C500
0E	03	C1000H
0E	01	C2000H
0E	02	C200H
0F	04	CV500/CVM1-CPU01-E
0F	05	CV1000/CV2000/ CVM1-CPU11-E

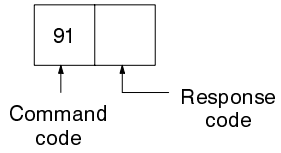
9-6-13 STATUS WRITE

Changes the operating mode of the PC.

Command Block

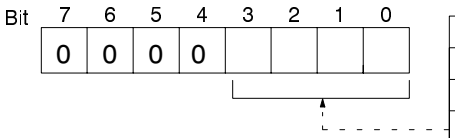


Response Block



Parameters

Mode data (command): The mode data consists of two byes as follows:

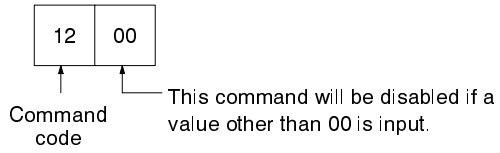


Bit				PC-mode
3	2	1	0	
0	0	0	1	PROGRAM
0	0	1	0	MONITOR
0	1	0	0	RUN
1	0	0	0	DEBUG

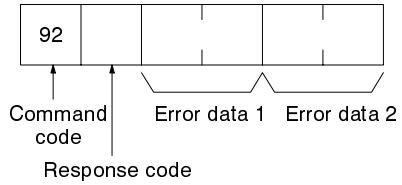
9-6-14 ERROR READ

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

Command Block

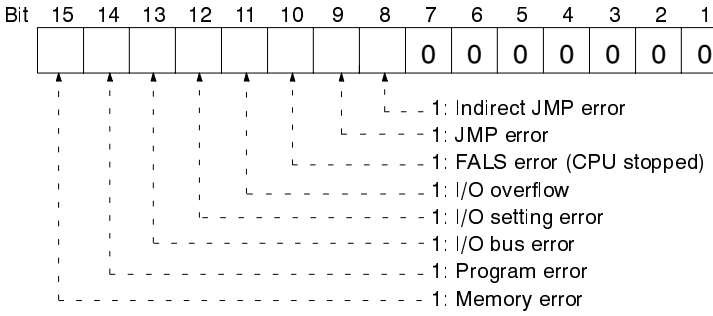


Response Block

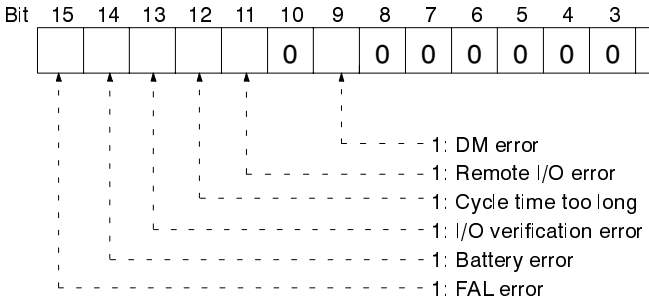


Parameters

Error data 1 (response): Two bytes (one word) of data will be returned as follows:



Error data 2 (response): Two bytes (one word) of data will be returned as follows:

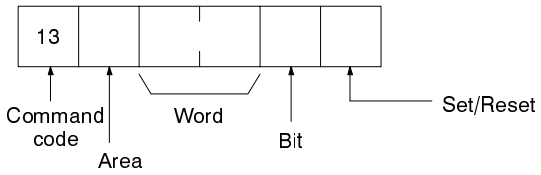


9-6-15 FORCE SET/RESET

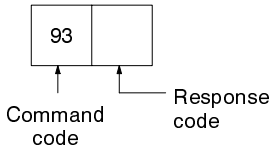
Force-sets or force-resets a bit in the CIO, LR, HR, or AR Area or a Completion Flag in the TC Area.

Note An error will result if the bit specification is wrong.

Command Block



Response Block



Parameters

Area, word, and bit (command): Specify the bit to be force-set or force-reset as follows:

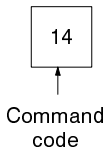
- Area
  Specify the area as follows:
  00: CIO Area
  01: LR Area
  02: HR Area
  03: TC Area
  04: AR Area
- Word
  Specify the word address in 2 bytes of hexadecimal data.
- Bit
  Specify the bit number in 1byte hexadecimal coded data between 00 to 0F (0 to 15). This data is not used for the TC Area.

Set/Rest (command): Specify as follows:
00: Reset
Other than 00: Set

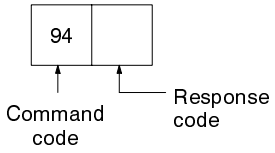
9-6-16 FORCED SET/RESET CANCEL

Cancels all force-set and force-reset bits.

Command Block



Response Block

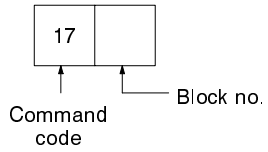


9-6-17 PROGRAM READ

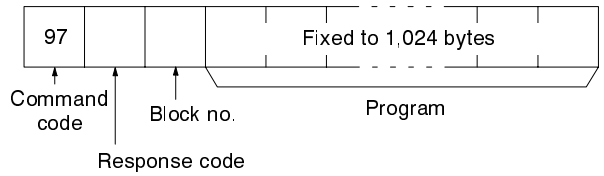
Reads the contents of the PC program memory in blocks of machine code (object code level).

Note This command enables reading up to block number 127 (an address of 0001FFFF when binary codes are used and 0000FFFF when ASCII codes are used).

Command Block

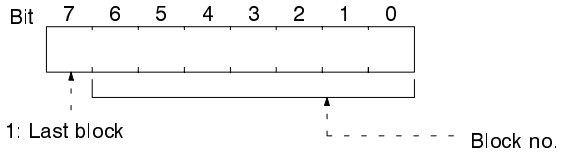


Response Block

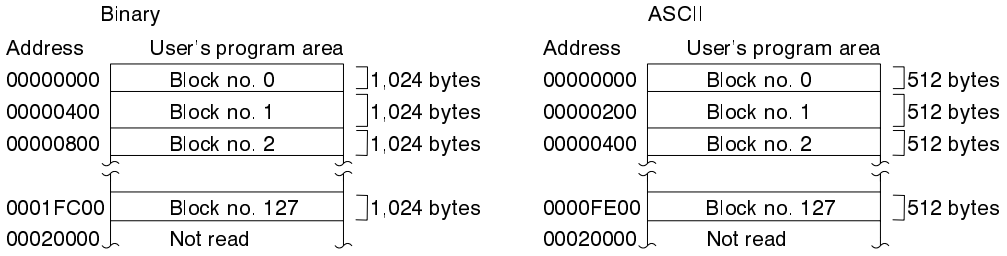


Parameters

Block no. (command and response): In the command block, specify the number of the block with bits 0 to 6 in a range of 0 to 127. Bit 7 is always 0. In the response block, the block number that has been read will be returned. If the last block in the user's program area is read, the rightmost bit will be ON (1).



Block numbers corresponds to the user's program area as follows:

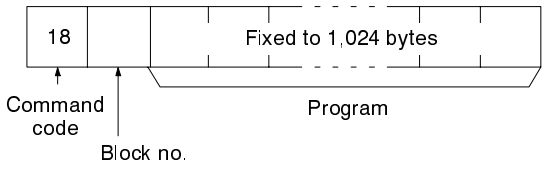


Program (response): The contents (program) of the specified block will be returned.

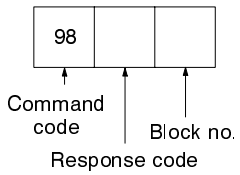
9-6-18 PROGRAM WRITE

Writes a machine language (object code level) program into the PC program memory.

Command Block



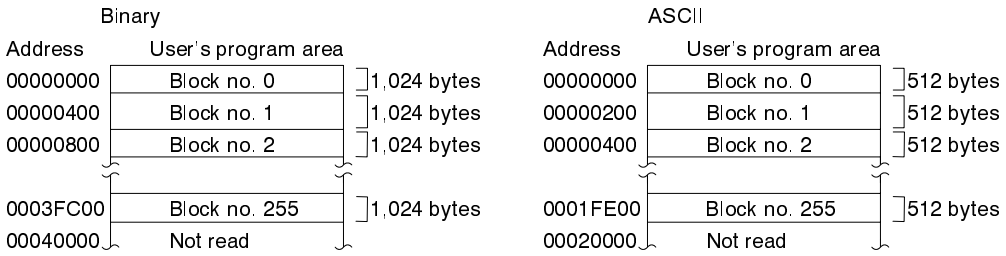
Response Block



Parameters

Block no. (command and response): In the command block, specify the number of the block where data will be written in a range of 0 to 255. In the response block, the block number where the data will be written will be returned. If the data is written to the last block in the user's program area, 00 will be returned.

Block numbers corresponds to the user's program area as follows:



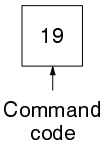
Program (command): The program data can be as large as the maximum memory size.

9-6-19 I/O TABLE READ

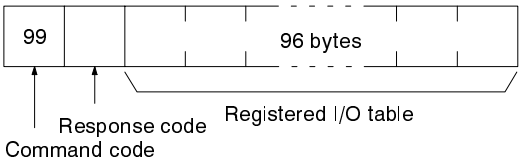
Reads the I/O table registered in the PC.

Note The actual I/O Units connected to the PC cannot be read.

Command Block



Response Block



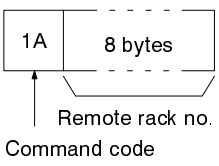
Parameters

Registered I/O table (response): The registered I/O table will be returned. For the details of the I/O table refer to your PC's Operation Manual.

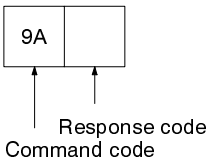
9-6-20 I/O TABLE GENERATION

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

Command Block



Response Block



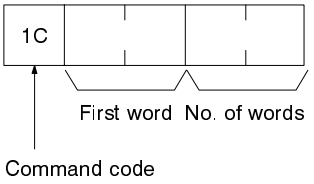
Parameters

Remote rack no. (command): Any number can be specified when using the CV-series PC.

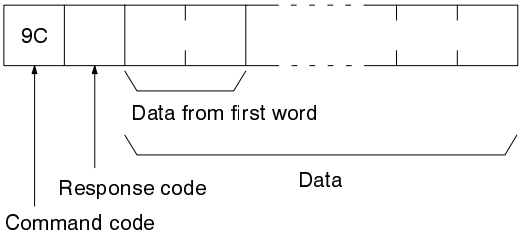
9-6-21 AR AREA READ

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

Command Block



Response Block



Parameters

First word and no. of words (command): Specify the number of words.

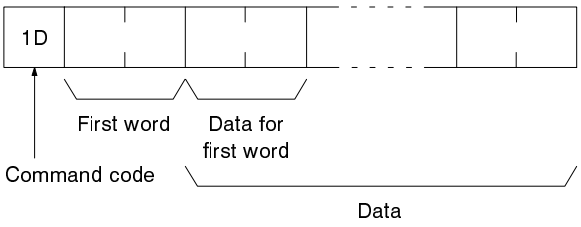
Data (response): The contents of the specified AR Area will be returned from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

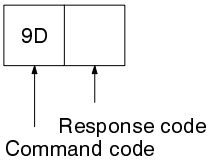
9-6-22 AR AREA WRITE

Writes data to the specified number of consecutive AR Area words starting from the specified words.

Command Block



Response Block



Parameters

First word (command): Specify the address of first word.

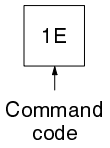
Data (command): Specify the data to be written to the specified AR Area starting from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

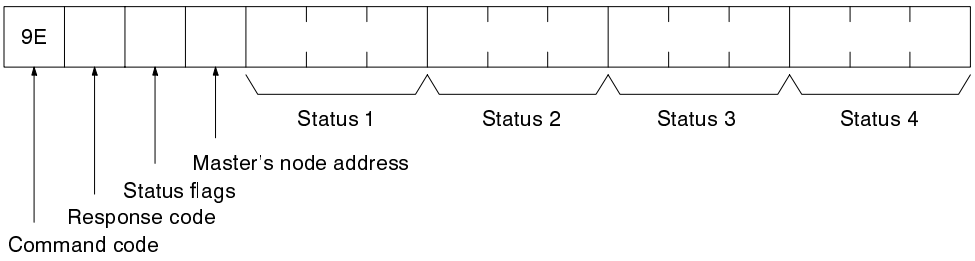
9-6-23 DATA LINK STATUS READ

Reads the operating status of the data links.

Command Block

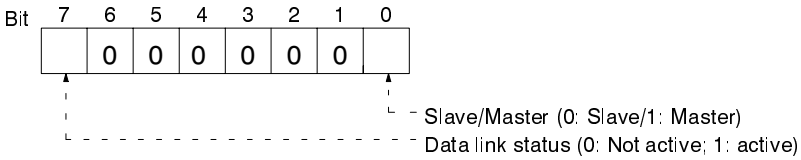


Response Block



Parameters

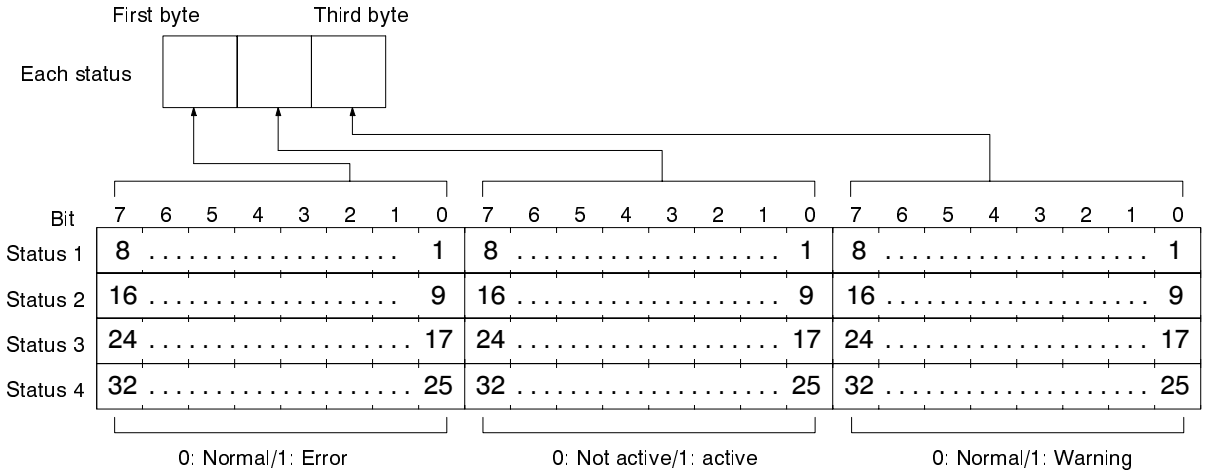
Status flags (response): The status consists of one byte as follows:



Bit 0 shows the setting of the node and the data link status shows the whole data link status.

Master's node address (response): The node address of the Master in the data link will be read.

Status 1 to 4 (response): Each status is one byte of data showing the condition of the node (mode or existence of an error or warning). The data link status on each node will be returned as follows:

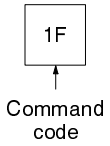


The numbers shown in each box specify the order of nodes set on the data link table. In the case of automatic setting, the figures will correspond to the node address.

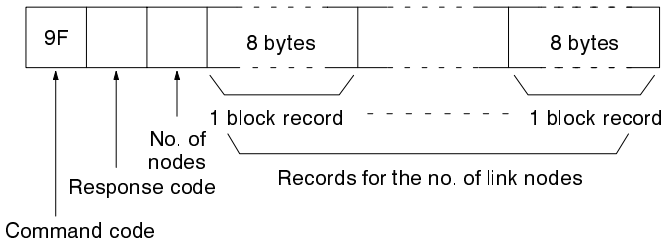
9-6-24 DATA LINK TABLE READ

Reads the data link table that has been set.

Command Block



Response Block

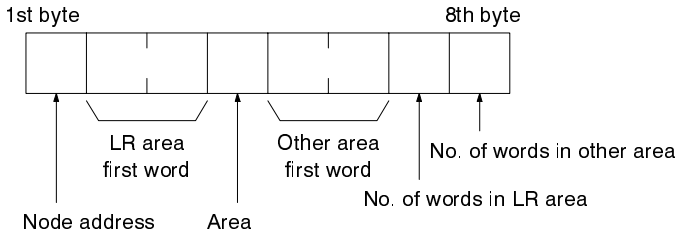


Parameters

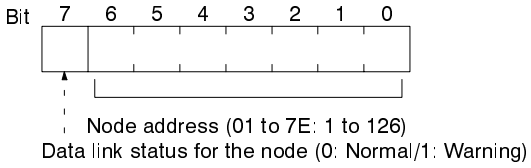
No. of nodes (response): The number of nodes that has been registered on the data link table will be returned. There can be between 2 and 32 nodes.

One block record (response): The formation of each block of record will be returned in order (numerical order according to the node address in the case of automatic setting). The total number of data bytes is calculated as follows: Number of words x 8 bytes/word (less than 32 nodes or 256 bytes).

The formation of each block record is as follows:



- Node address
  The node address of the data link node and the data link status of the node, the formation of which is as follows (for warning, refer to page 105):



- LR area first word
  The data link area first word in the LR area.
- Area
  There are three areas other than the LR area, where data link is possible, as follows:
  00: CIO Area
  01: HR Area
  02: DM Area
- Other area first word
  The first word number in the data link area.

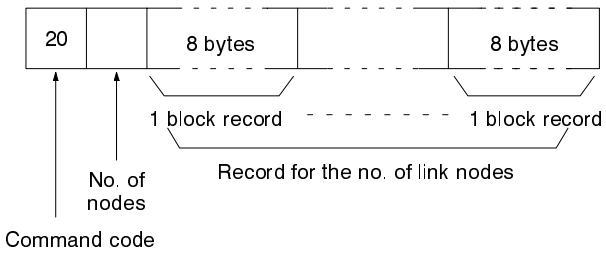
- No. of words in LR Area
  The number of data link words in the LR Area on the node in a range of 0 to 32.
- No. of words in other area
  The number of data link words in the areas other than the LR area in a range of 0 to 99.

9-6-25 DATA LINK TABLE WRITE

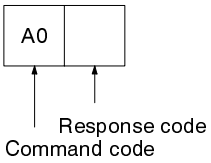
Writes data link table data to the Master to make a data link table.

Note
1. This command can be executed on the Master only.
2. No data link table can be generated and this command will not be executed while the data links are active.
3. A data link table that has a gap in the data link area cannot be made.

Command Block



Response Block



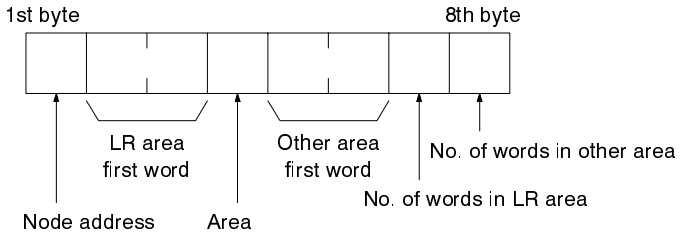
Parameters

No. of nodes (command): Specifies the number of link nodes to be set on the data link table in a range of 2 to 32.

One block record (response): Specify the formation of the data link area in the chronological order. The total number of data bytes is calculated as follows;

Number of words x 8 bytes (less than 32 nodes or 256 bytes).

The formation of each block record is as follows:



- Node address
  The node address of the data link node for the one block record in a range of 1 to 126.
- LR area first word
  The data link area first word in the LR area.
- Area
  There are three areas other than the LR Area, where data link is possible, as follows:
  00: CIO Area
  01: HR Area
  02: DM Area

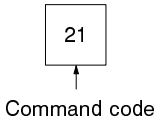
- Other area first word
  The first word number in the data link area.
- No. of words in LR Area
  The number of data link words in the LR Area on the node in a range of 0 to 32.
- No. of words in other area
  The number of data link words in the areas other than the LR area in a range of 0 to 99.

9-6-26 DATA LINK START

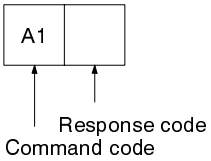
Starts data links by sending this command to the Master.

Note This command can be executed on the Master only.

Command Block



Response Block

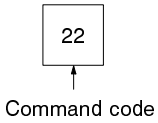


9-6-27 DATA LINK STOP

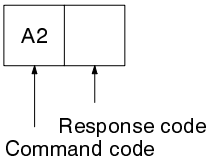
Stops data links by sending this command to the master.

Note This command can be executed on the Master only.

Command Block



Response Block

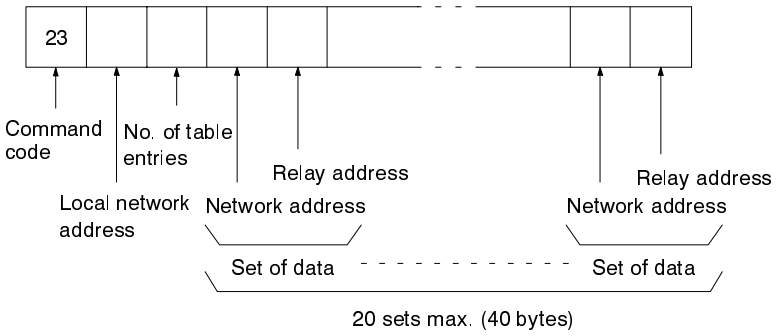


9-6-28 ROUTING TABLE WRITE

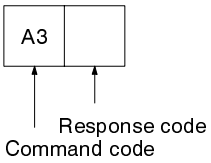
Sets a relay network table for communications between networks.

Note
1. A routing table will be effective after resetting the PC on the node or executing INITIALIZE (refer to page 170).
2. This command is not effective on relay nodes.
3. The routing table set by this command is the relay network table. The local network address, network address, and relay address correspond to the relay network address, destination network address, and relay node. For details refer to page 24.

Command Block



Response Block



Parameters

Local network address (command)

No. of table entries (command): Specify the number of table entires (pairs of a network address and relay address) set in the routing table in a range of 0 to 20. If only the local network address is being set, set the number of entries to 00 and write this as the last parameter.

Network address, relay address (command): Specifies the route for network communication with pairs of a network address and relay address up to 20 pairs maximum. The network address and relay address setting ranges and the meanings are given in the following table.

Item	Range	Meaning
Network address	01 to 7F (1 to 127)	Network address for mutual communication
Relay address	01 to 7E (1 to 126)	Relay node address on local network

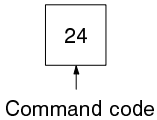
9-6-29 ROUTING TABLE READ

Reads the current relay network table.

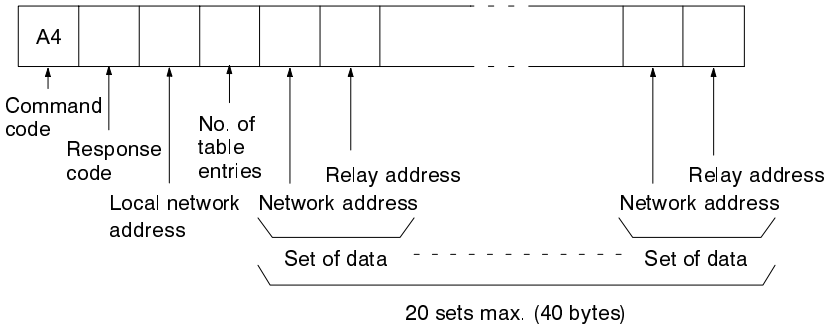
Note

1. The local network table cannot be read.
2. The routing table set by this command is the relay network table. The local network address, network address, and relay address correspond to the relay network address, destination network address, and relay node. For details refer to page 24.

Command Block



Response Block



Parameters

Local network address (response)

No. of table entries (response): The number of table entires (pairs of a network address and relay address) set in the routing table in a range of 0 to 20. If only the local network address is set, the number of entries will be 00 this will be the last parameter.

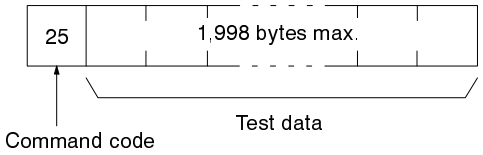
Network address, relay address (response): Specifies the route for network communication with pairs of a network address and relay address up to 20 pairs maximum. The network address and relay address setting ranges and the meanings are given in the following table.

Item	Range	Meaning
Network address	01 to 7F (1 to 127)	Network address for mutual communication
Relay address	01 to 7E (1 to 126)	Relay node address on local network

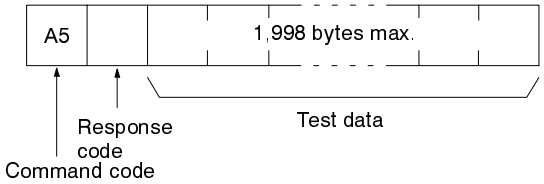
9-6-30 TEST

Executes a loopback test between the designated nodes.

Command Block



Response Block



Parameters

Test data (command and response): Specifies the data up to 1,998 bytes (at the time of BIN setting) that is transmitted to the designated node in the command block. The transmitted test data will be returned without any change in the response block. This means that if there is any difference between the transmitted data and returned data, there must have been an error.

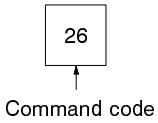
9-6-31 INITIALIZE

Initializes the SYSMAC NET Link Unit.

Note

1. No response will be returned.
2. Due to the time required for initialization, a node that has received this command cannot receive the next command for approximately 100 ms.

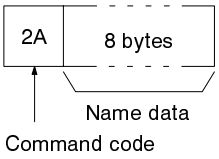
Command Block



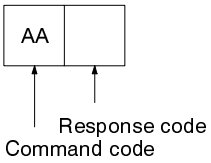
9-6-32 NAME SET

Sets a name for a node (PC)

Command Block



Response Block



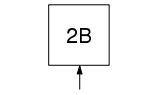
Parameters

Name data (command): Specifies a name within eight bytes of ASCII (do not use 00).

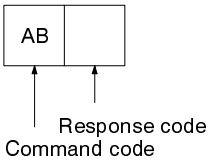
9-6-33 NAME DELETE

Deletes the name that has been set on a node (PC).

Command Block



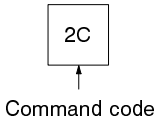
Response Block



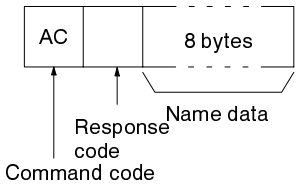
9-6-34 NAME READ

Reads the name that has been set on a node.

Command Block



Response Block



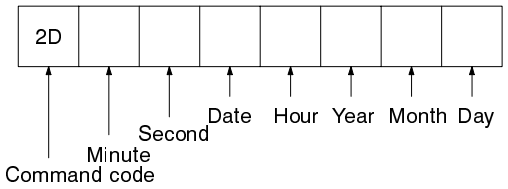
Parameters

Name data (command): The name that has been set within eight bytes in ASCII codes will be returned.

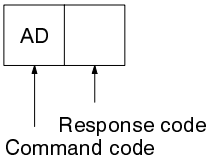
9-6-35 TIME DATA SET

Sets time data.

Command Block



Response Block



Parameters

Minute, second, date, hour, year, month, day (command): Specify in BCD. Specify the rightmost two digits of the year. The specified ranges are as follows:

Item	Range
Minute	00 to 59
Second	00 to 59
Date	01 to 31
Hour	00 to 23
Year	00 to 99
Month	01 to 12
Day	00 to 06

Days correspond as follows

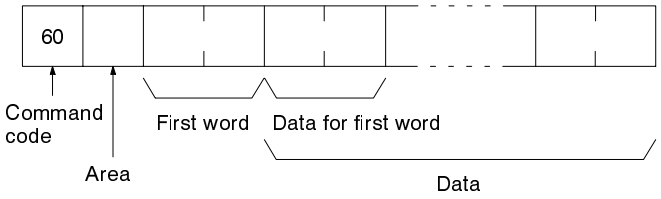
Value	00	01	02	03	04	05	06
Day	SUN	MON	TUE	WED	THU	FRI	SAT

9-6-36 DATA TRANSMIT

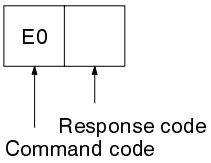
Writes data to the consecutive words in the specified area on the specified node starting from the specified word.

Note This command is the same as the one executed when executing the SEND(90/192) instruction.

Command Block



Response Block



Parameters

Area (command): Specify the area where the data is written as follows:
00: CIO Area
01: LR Area
02: HR Area
03: TC Area (present value)
04: DM Area
05: AR Area

First word (command): Specify the address of first word.

Data (command): Specify the data up to 1,996 bytes to be written to the specified area starting from the first word. The total number of data bytes is calculated as follows:

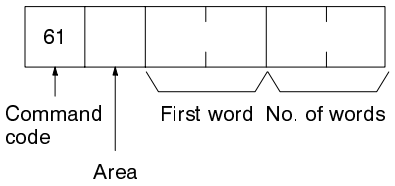
Number of words x 2 bytes/word

9-6-37 DATA READ

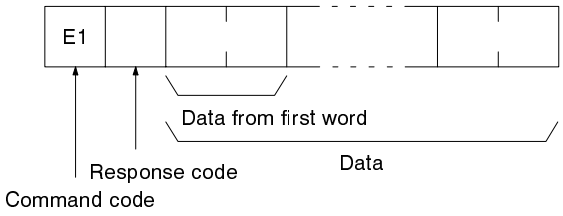
Writes data to the consecutive area on the specified node starting from the specified words.

Note This command is the same as the one executed when executing the RECV(98/193) instruction.

Command Block



Response Block



Parameters

Area (command): Specify the area where the data is written as follows:
00: CIO Area
01: LR Area
02: HR Area
03: TC Area (present value)
04: DM Area
05: AR Area

First word and no. of words (command): Specify the number of words to be read from the area between 1 and 999.

Data (response): The contents up to 999 words (1,998 bytes) of the specified area will be returned from the first word. The total number of data bytes is calculated as follows:

Number of words x 2 bytes/word

9-7 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 response block. The header code will specify the command.

Response code	Meaning
00	Normal completion
01	Not executable in RUN mode
02	Not executable in MONITOR mode
03	Not executable in PROGRAM mode
04	Not executable in DEBUG mode
05	Not executable because CPU is on standby.
06	Not executable because the SYSMAC NET Link Unit is busy
07	Not executable with present I/O or name
09	Not executable because of CPU change
0A	Not executable because protection is effective
0B	Not executable because file memory has not been initialized
10	Format error (parameter length error)
11	Parameter error, data code error, data length error, or code error.
12	Instruction not found
13	Address overflow
14	Block number error
20	Not executable due to unexecuteable error clear or unexecuteable DM size change
21	Not executable because of CPU error
22	Not executable because there is no memory mounted
23	Not executable with only 8 Kbytes of memory
24	Not executable with PROM
25	I/O table generation impossible
26	Not executable because the Unit is not a control unit
27	Checksum error
28	EEPROM is write-protected
29	Not executable because there is no network path setting
2A	Not executable because of a routing table error
30	Data link table generation is impossible (data link operation, default table)

Response code	Meaning
31	Not executable because of data link is active
32	Not executable because the data link is not active
33	Not executable because of a data link table error
34	Not executable because the data link table has not been registered
35	Not executable because the Unit is not a Master

Appendix A
Standard Models

SYSMAC NET Link Unit

Name	Model
SYSMAC NET Link Unit	CV500-SNT31

PC (CPU)

Name	Model
SYSMAC CV500	CV500-CPU01-E
SYSMAC CV1000	CV1000-CPU01-E
SYSMAC CV2000	CV2000-CPU01-E
SYSMAC CVM1	CVM1-CPU01-E
	CVM1-CPU11-E

Peripheral and Related Devices

Name	Model	Remarks
SYSMAC NET Link Unit (C-series)	C500-SNT31-V4	C500, C1000H, and C2000H
	C200H-SNT31	C200H
Line Server	S3200-LSU03-01E	24 VDC version; One per network
Power supply (for C200H)	C200H-APS01	For one SYSMAC NET Link Unit
	C200H-APS02	For two SYSMAC NET Link Units
Bridge	S3200-NSUG4-00E	24 VDC; Used to connect two networks
Network Service Unit (NSU)	S3200-NSUA1-00E	24 VDC; RS232C, 2 words
Network Support Board (NSB)	S3200-NSB11-E	IBM PC/AT or compatible; Includes SYSMAC NET Support Software
SYSMAC NET Interface board	FIT10-IF401	Ladder Pack FIT10-MF101-V4E

Cables

Name	Specification		Model
H-PCF cable (two-core, two optical paths)	Black	10 m	S3200-HCLB101
		50 m	S3200-HCLB501
		100 m	S3200-HCLB102
		500 m	S3200-HCLB502
		1,000 m	S3200-HCLB103
	Orange	10 m	S3200-HCLO101
		50 m	S3200-HCLO501
		100 m	S3200-HCLO102
		500 m	S3200-HCLO502
		1,000 m	S3200-HCLO103

When placing your order, specify the type of the cable by adding codes to the model number as shown below.

S3200-H_____ __

Kind of cable
B: Cord
C: Cable

Power supply line
L: With power supply line
C: Without power supply line

Color of fiber
B: Black
O: Orange

Length
__ __
A B
(A/10) x 10^B m

Option
Blank: Standard
N: Without tension member

Appendix B
Specifications

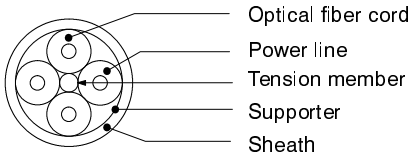
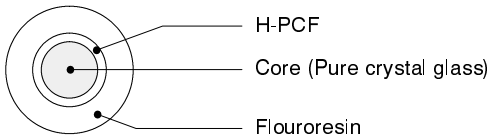
Communications

Standard communication specifications are the same as those for the CV-series PC.

Item	Rating
Communications mode	N:N token ring
Communications code	Manchester code
Modulation mode	Base band mode
Transmission path	Ring
Baud rate	2 Mbps
Transmission distance	800 m between two nodes (3 km with a Repeater)
Number of connecting nodes	127 max. including a Line Server
Transmission cable	2-core optical fiber cable (H-PCF)
Connector	Full- or half-lock crimp-style connector
Link services	Datagram service, data links
No. of data link words	3,584 words (in I/O Area and DM Area)
Datagram size	2 kb max. per message
Capacity of transmission buffer	1 message
Capacity of reception buffer	15 message
RAS (Reliability, Assurance, And Safety) functions	1. Automatic loopbacks (useful when a transmission path is disconnected) 2. Node bypasses (useful in the event of power failure) 3. Internode tests 4. Watchdog timer 5. Error detection (CRCCCITT: Generating function = $X^{16} + X^{12} + X^5 + 1$) 6. Error log

Specifications of Optical Fiber Cable

The specifications of the optical fiber cable connecting to the SYSMAC NET Link Unit are given in the following table.

Item		Specifications
Model		S3200-HCLB
Cross section	Cable	
	PCF optical fiber cord	
Diameter		8.6 + 1.0 mm
Bending radius	Cable	100 mm
	Cord	50 mm
Withstand tension	Cable	75 kg
	Cord	25 kg
	Between connectors	2 kg/core
Withstand pressure		100 kg/50 mm
Weight		85 kg/km
Storage temperature		–40%C to 70%C
Operating temperature		–20%C to 70%C
Transmission loss		7 dB/km
Diameter of core		200 mm
Diameter of the cover		230 mm
No. of cores		2
No. of transmission paths		2
Thickness of transmission path		0.75 mm^2

We recommend the user to use H-PCF cables to connect nodes because H-PCF cables can be adjusted to the length that you need and connected to or disconnected from connectors with ease. Suitable cable connectors for all nodes are available. Contact your OMRON representative for optical fiber cables with specifications other than the above. You need special tools to connect an H-PCF cable to a connector.

Appendix C
Status Words

The SYSMAC NET Link Unit's status words are allocated in the PC in the CPU Bus Unit Area according to the unit number; 25 words are allocated per Unit.

Unit no.	Words	Unit no.	Words
0	1500 to 1524	8	1700 to 1724
1	1525 to 1549	9	1725 to 1749
2	1550 to 1574	10	1750 to 1774
3	1575 to 1599	11	1775 to 1799
4	1600 to 1624	12	1800 to 1824
5	1625 to 1649	13	1825 to 1849
6	1650 to 1674	14	1850 to 1874
7	1675 to 1699	15	1875 to 1899

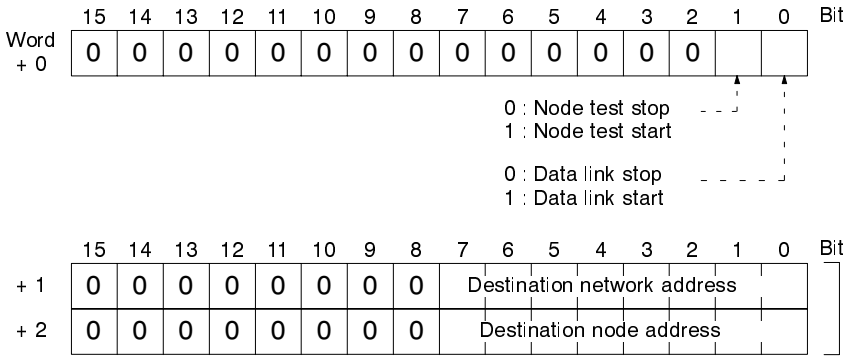
Configuration of Status Words

The configuration of the status words is as follows:

Word		
+0 to +4	Software switches	5 words
+5	Node address and network status	1 word
+6 to +9	Data link status	4 words
+10 to +15	Internode test status	6 words
+16	Unit Error Flags	1 word
+17	No. of errors at PC's interface	1 word
+18	No. of optical LAN communication errors	1 word
+19	No. of RAM errors	1 word
+20 to +24	Unused	5 words

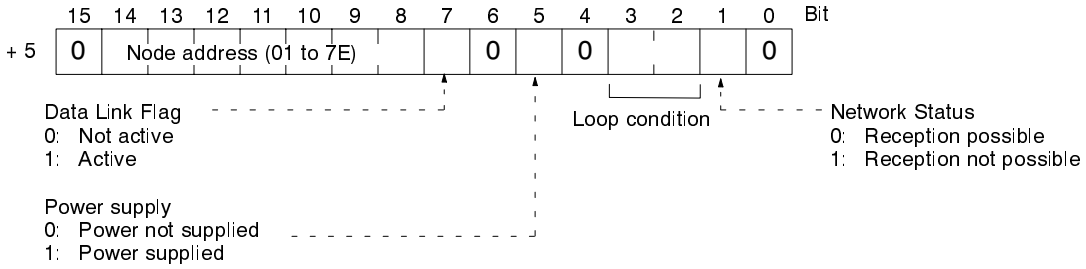
Software Switches (refer to pages 6 and 116)

Word: 1500 + (25 x Unit no.) + 0 to 2



Node Address and Network Status (refer to page 122)

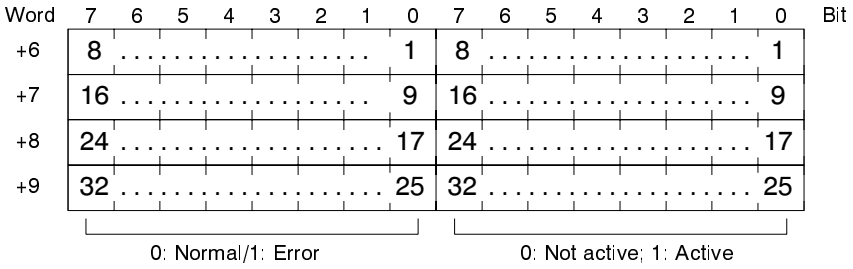
Word: 1500 + (25 x Unit no.) + 5



Bit 3	Bit 2	Loop condition
0	0	Normal loop
0	1	Downstream backloop
1	0	Upstream backloop
1	1	Loop error

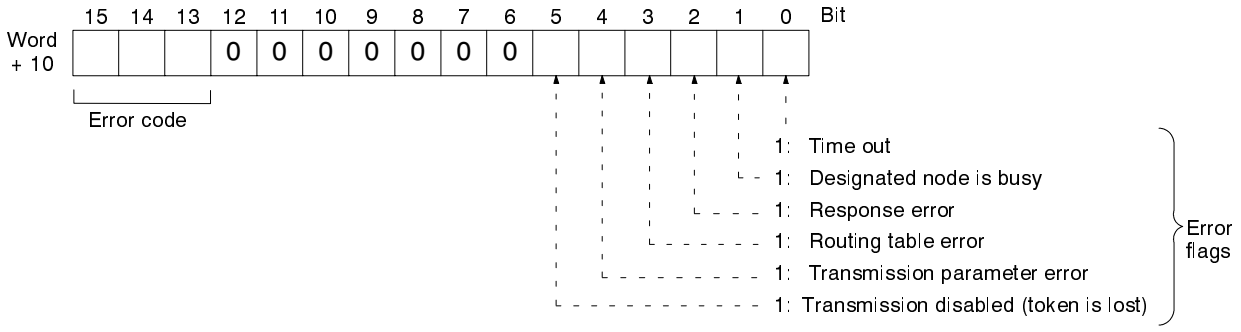
Data Link Status (refer to pages 107 and 122)

Word: 1500 + (25 x Unit no.) + 6 to 9



Internode Test Status (refer to page 117)

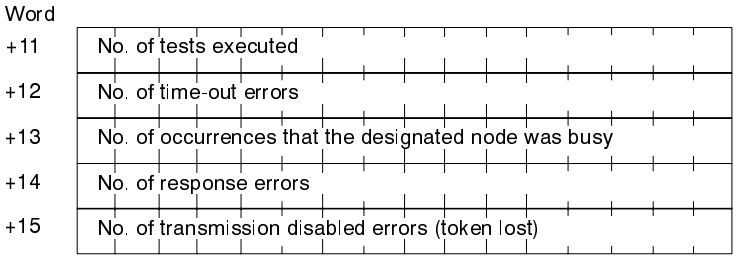
Word: 1500 + (25 x Unit no.) + 10



Error code			Meaning
Bit 15	Bit 14	Bit 13	
0	0	0	Normal
0	0	1	Time out
0	1	0	Designated node is busy
0	1	1	Response error
1	0	0	Routing table error
1	0	1	Transmission parameter error
1	1	0	Transmission disabled (Token is lost)

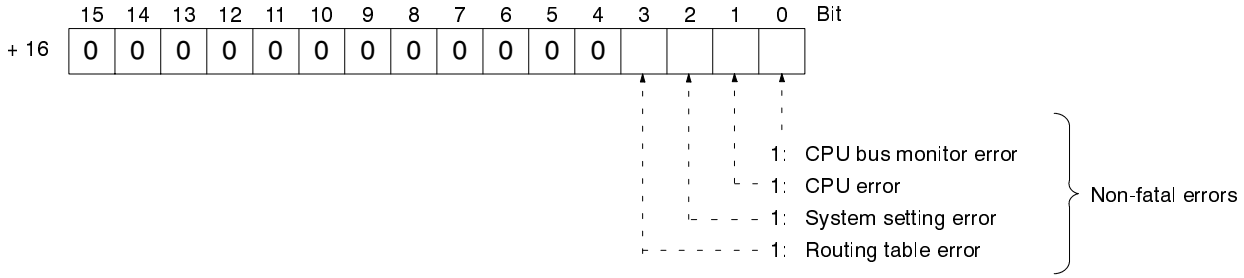
Note Transmission parameter errors include mode errors

Word: 1500 + (25 x Unit no.) + 11 to 15



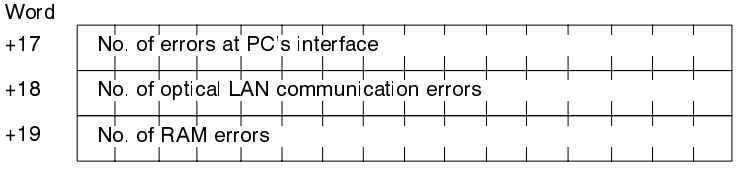
Unit Error Flags (refer to page 123)

Word: 1500 + (25 x Unit no.) + 16



Number of Errors (refer to page 123)

Word: 1500 + (25 x Unit no.) + 17 to 19



Appendix D
IBM PC/AT and Compatible Computers

The SYSMAC NET Link System can be controlled by connecting an IBM PC/AT or compatible computer to the network. This appendix explains the basic procedures for setting routing tables on the computer and program examples . For details, refer to the *SYSMAC Network Support Board Operation Manual*.

SYSMAC Network Support Board

An IBM PC/AT or compatible computer is connected to the network via a Network Support Board (NSB). The NSB is inserted to an expansion slot on the computer. The NSB is provided with SYSMAC NET Link Support Software.

Computer	Model
IBM PC/AT or compatible	S3200-NSB11-E

Routing Tables

Mutual communication between networks requires routing tables. The routing tables require the following files.

File	Contents
ROUTE.DAT	Data file where routing tables are written.
RTREAD.EXE	Utility file incorporating routing table set and read scripts
RTSET.EXE	Utility file incorporating automatic routing table generation scripts

Setting

Use an application such as EDLIN.EXE of MS-DOS to make a routing table file (ROUTE.DAT) as shown below. In this example, there are three relay nodes set in the table.

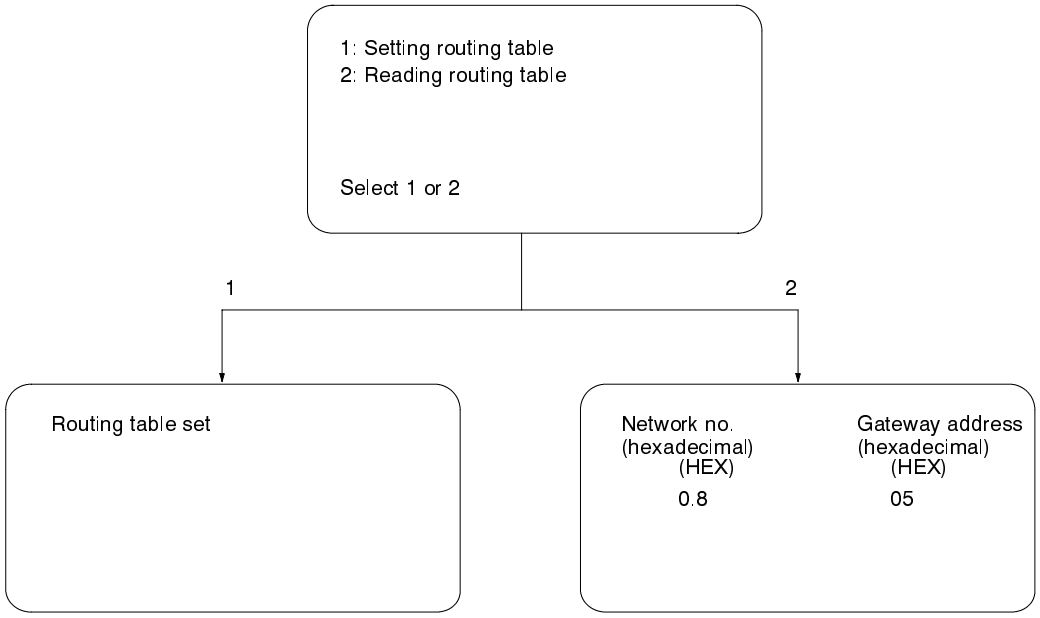
```
A>EDLIN ROUTE. DAT
*L
     1:02000000, 05 (Send data to node 5 for network address 2)
     2:0A000000, 09 (Send data to node 9 for network address 10)
     3:7F000000, 2C (Send data to node 44 for network address 127)
*E
```

Designated node address (hexadecimal)

Designated network address (hexadecimal)

Set the routing tables on the computer as follows:

When using RTREAD.EXE, input A>RTREAD to display the following.



Note The tables registered on the computer will be read when you have selected "2: Routing table read." It does not mean that ROUTE.DAT will be read.

When using RTSET.EXE, input A>RTSET. The routing tables will be set automatically. If you want to set the routing tables automatically when booting the computer, register this command in AUTOEXEC.BAT.

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 Input 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 passed 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 a memory of a PC and which is shared by other PCs in the same 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 A 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, which 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 PC, 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.

handshaking The process whereby two devices exchange basic signals to coordinate communications between them.

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 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, an 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 A 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 as 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 which 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, which 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 devices 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 or 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 which 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 which 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 which 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 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 specify-

ing 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) which 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 Devices 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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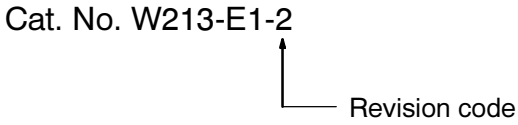
Revision History

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	June 1992	Original production
2	May 1993	Minor changes to add CV2000 and CVM1.