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SYSMAC
C-Series
SYSMAC LINK

SYSTEM MANUAL

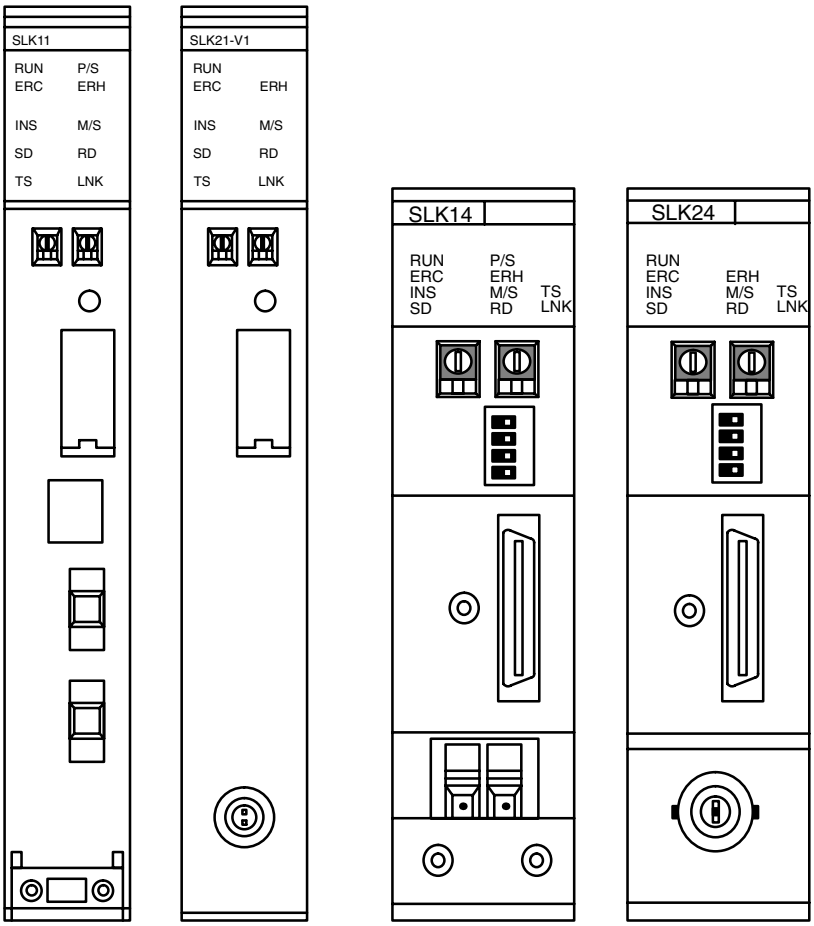
OMRON

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C-series SYSMAC LINK

System Manual

Revised September 2003



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

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

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

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

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

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

Visual Aids

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

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

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

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About this Manual:

This manual describes the installation and operation of C-series SYSMAC LINK Units and includes the sections described below.

Please read this manual completely and be sure you understand the information provide before attempting to install and operate a C-series SYSMAC LINK System.

Section 5 Introduction introduces the features and operations possible with SYSMAC LINK Units. It also describes the possible system configurations and compatibility with PCs and other Link Units.

Section 6 Unit Components and Switch Settings presents the names and functions of the SYSMAC LINK Units' components and the switch settings.

Section 7 Installation explains how to install SYSMAC LINK Systems.

Section 8 Basic Communications introduces the token bus method of communications used in SYSMAC LINK Systems and explains the basic settings necessary for operation.

Section 9 Data Links describes the operation of data links, procedures required to establish data links, and methods of monitoring data link operations.

Section 10 Data Read/Write Services describes the data read/write services, which provide data transmission between nodes and distributed control. The data read/write services include the NETWORK READ (RECV(98)) and NETWORK WRITE (SEND(90)) and instructions and CV-mode commands.

Section 11 Special Services provides information on remote programming and monitoring and RAS functions.

Section 12 Error Processing provides information to help identify and correct errors that might occur in the System.

Section 13 Inspection and Maintenance describes periodic maintenance required by the System and how to replace a SYSMAC LINK Unit.

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

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PRECAUTIONS

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

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

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1 Intended Audience

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

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

2 General Precautions

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

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

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

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

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

3 Safety Precautions

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

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

⚠ **WARNING** Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

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4 Operating Environment Precautions

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

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

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

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

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

5 Application Precautions

Observe the following precautions when using the PC system.

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

- Always ground the system to 100 Ω or less when installing the Units. Not connecting to a ground of 100 Ω or less may result in electric shock.
- Always turn OFF the power supply to the PC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
  - Mounting or dismounting Power Supply Units, I/O Units, CPU Units, Memory Units, or any other Units.
  - Assembling the Units.
  - Setting DIP switches or rotary switches.
  - Connecting cables or wiring the system.
  - Connecting or disconnecting the connectors.

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

- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.

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- Always use the power supply voltages specified in this manual. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltages may result in burning.
- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Wire correctly. Incorrect wiring may result in burning.
- Mount Units only after checking terminal blocks and connectors completely.
- Be sure that the terminal blocks, Memory Units, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
    - Changing the operating mode of the PC.
    - Force-setting/force-resetting any bit in memory.
    - Changing the present value of any word or any set value in memory.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- When replacing parts, be sure to confirm that the rating of a new part is correct. Not doing so may result in malfunction or burning.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.

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SECTION 1
Introduction

This section introduces the features and operations of the SYSMAC LINK Units. It also describes the possible system configurations and compatibility with PCs and other Link Units.

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1-1 OMRON Network Systems

As production processes become more complex and diversified, it is necessary to develop networks that link control components such as PCs to more powerful host computers in LANs that control entire production processes.

OMRON provides 3 types of network systems for large, medium, and small-scale networks.

SYSMAC NET Link System

The SYSMAC NET Link System is a high-speed, high-capacity LAN. It can be used as a gateway to a general LAN composed of different kinds of computers or to an Ethernet to create a large-scale network.

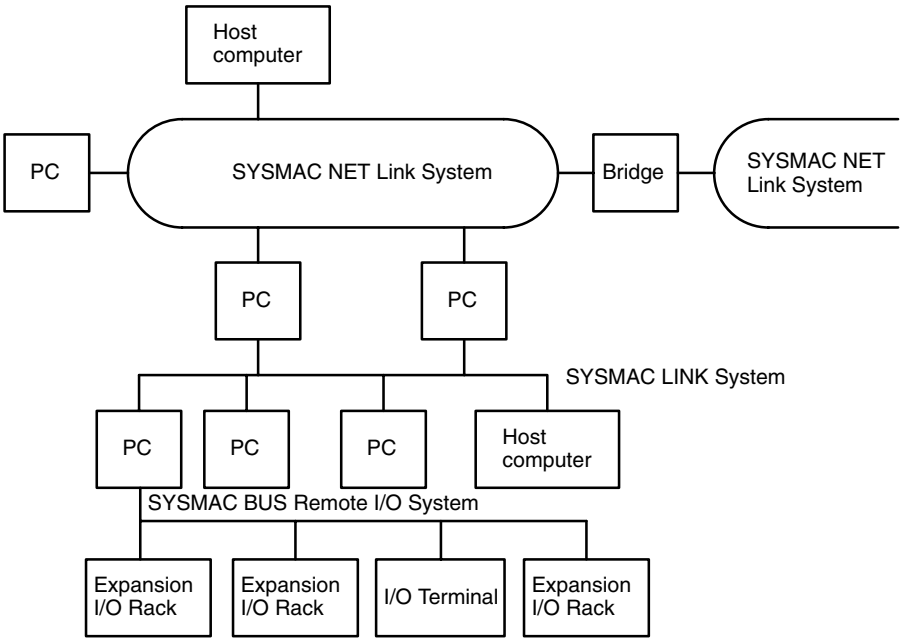
SYSMAC LINK System

The SYSMAC LINK System provides high-speed, high-capacity communications between any nodes (PCs, or IBM-PC/AT or compatible running SSS) in the network, as well as remote monitoring and programming functions and automatic data transfer via data links.

SYSMAC BUS System

The SYSMAC BUS Remote I/O System is used to link a single PC to remote racks called Slave Racks and/or components (e.g., I/O Terminals or Programmable Terminals) to form a small, decentralized control network.

Depending on the size and complexity of the production process, these systems can be used alone or in combination as shown below.



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1-2 SYSMAC LINK System Features

SYSMAC LINK Units are equipped with a variety of special features.

High Speed, Reliability, and Flexibility

The specialized communications LSIs used in all SYSMAC LINK Units deliver high speed, reliability, and flexibility in an advanced data link system, while optical fiber cable systems provide high-speed communications with unparalleled immunity to noise.

In the event of an error or failure in the polling unit, another node automatically takes over management of the SYSMAC LINK System without stopping the entire network. SSS or CVSS running on an IBM-PC/AT or compatible can monitor and/or program PCs anywhere in the network via the SYSMAC LINK System.

Distributed Control with Data Links

The data link function transfers data to and from other nodes automatically, establishing simple but powerful peer-to-peer links between nodes. Data links can be generated automatically between 2, 4, 8, or 16 nodes by changing the value of just one byte in the AR Area of the start-up node. Or the user can use the flexibility of manually generating data links to eliminate unused link words, improve data link I/O response time, and to even create several data link groups in one network.

The data link communications cycle time can be fixed at a constant value, so even simultaneous remote programming/monitoring and NETWORK READ/WRITE instruction (RECV(98)/SEND(90)) execution have no effect on the data link I/O response time.

Active PC Transmission

PCs can communicate actively with other PCs in the network. The four functions listed below can be performed from the PC's program using the SEND(90) and RECV(98) instructions (SEND(192), RECV(193), and CMND(194) in the CV-series).

1, 2, 3...

1. Broadcast transmission
2. Response monitoring time setting (response time-out setting)
3. Transmit retry setting
4. Enabling/disabling response

RAS Functions

SYSMAC LINK Units are equipped with three RAS functions (RAS is an acronym for reliability, availability, and serviceability). The Polling Unit Backup and Failed Node Bypass (optical systems only) functions prevent the network from failing when one Unit fails. The Internode Echo Test function aids in communications troubleshooting.

Remote monitoring of the network's operating status also aids in troubleshooting and quick correction of communications problems.

Improvements on the C200HS-SLK12/SLK22 (C200HW-SLK13/SLK14/SLK23/SLK24)

Up to 2,966 words can be linked using the data link function with the C200HW-SLK14/SLK24.

The input interrupt response time is 1 ms maximum when the new SYSMAC LINK Units are mounted to a C200HX, C200HG, or C200HE PC.

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1-3 System Configuration

Up to 62 nodes (including all PCs and, in coaxial systems, computers) can be connected in a SYSMAC LINK Network via SYSMAC LINK Units or Network Service Boards. One of the Units in the network will function as the polling unit and the remainder will be polled units. The polling unit manages the System communications during and after configuration.

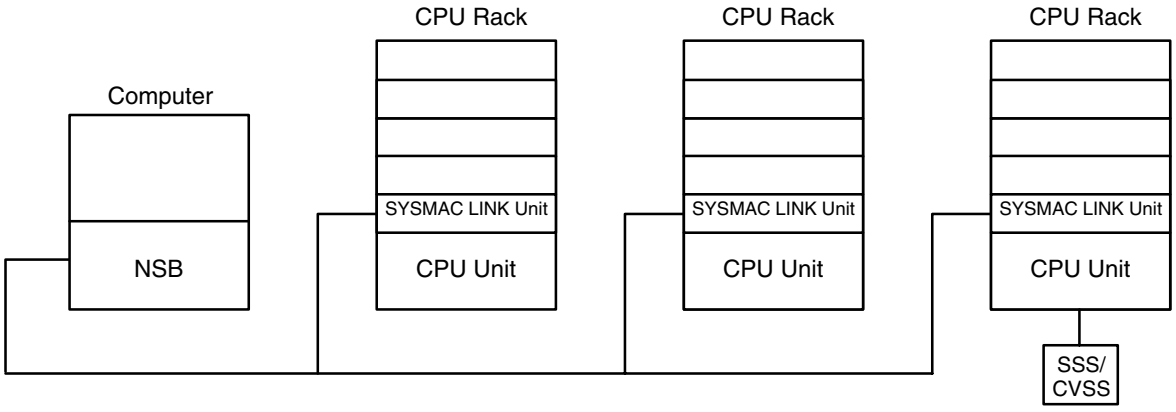
1-3-1 Single-level Systems

The following diagrams show the general configuration of Single-level SYSMAC LINK Systems connected with coaxial and optical fiber cables. The Systems are considered single-level because each PC has only one SYSMAC LINK Units mounted to it.

The SSS/CVSS connection is not a required part of the System. It is shown here because of its usefulness in monitoring and controlling not only the operation of the SYSMAC LINK System itself, but the general operation of all the PCs connected in the System.

Coaxial System

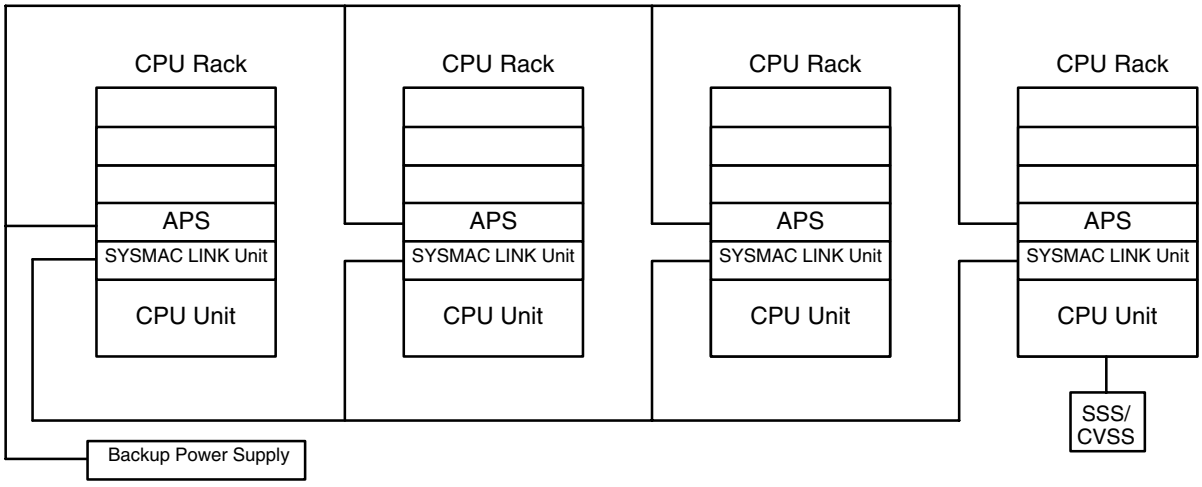
The abbreviation NSB indicates a SYSMAC LINK Network Service Board.



Note Terminators must be connected to the Units on the ends of the network.

Optical System

The abbreviation APS indicates an Auxiliary Power Supply Unit.



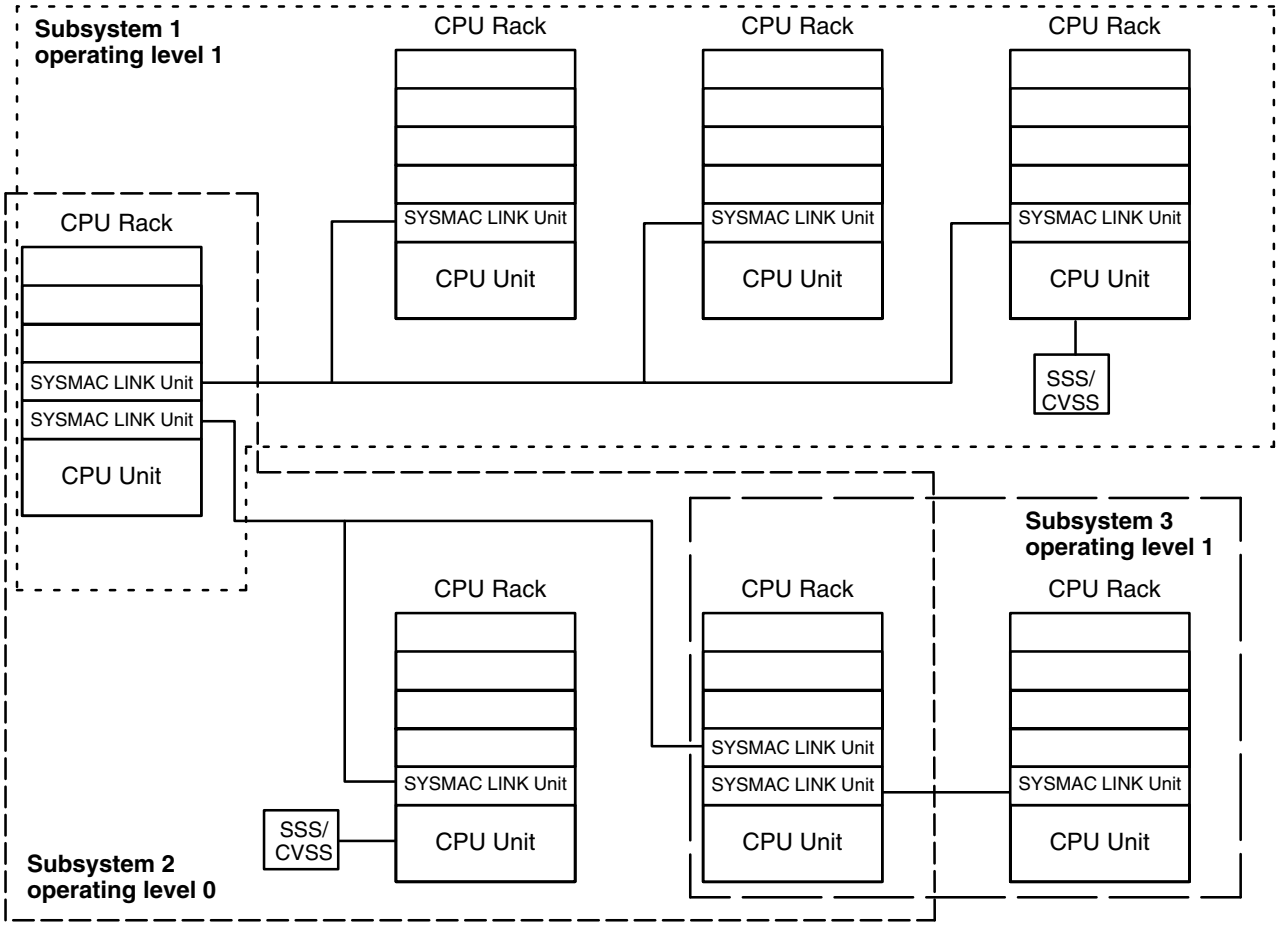
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1-3-2 Multilevel System

Each PC can have up to two SYSMAC LINK Units mounted. Each SYSMAC LINK Unit will connect it to a SYSMAC LINK Network, i.e., if a PC has two SYSMAC LINK Units mounted, it is part of two SYSMAC LINK Networks and the overall system is considered a Multilevel SYSMAC LINK System. Operating levels, which are described later in this manual, are used to differentiate between the two Networks to which one PC might belong.

The SSS/CVSS connection is not a required part of the System. It is shown here because of its usefulness in monitoring and controlling not only the operation of the SYSMAC LINK System itself, but the general operation of all the PCs connected in the same Network(s) as the PC to which the SSS/CVSS is connected.

The abbreviation SLK indicates a SYSMAC LINK Unit.



Note Terminators must be connected to the Units on the ends of networks connected by coaxial cable.

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1-4 Unit Compatibility

There are some restrictions regarding the models and versions of PCs to which SYSMAC LINK Units can be mounted. There are also limitations in using SYSMAC LINK Units together with other Link Units. These limitations are described in this section.

1-4-1 Compatibility with PCs

The following table shows which CPU Units are compatible with which SYSMAC LINK Units. The SYSMAC LINK Units cannot be used with other CPU Units or with a C2000H Duplex System (even one set for Simplex operation.)

A Communications Board equipped with a Link Interface (C200HW-COM01/04-EV1) is required to mount a SYSMAC LINK Unit to a C200HX, C200HG, or C200HE PC.

SYSMAC LINK Unit	Cable	Applicable CPU Unit(s)
C1000H-SLK21-V1	Coaxial	C1000H-CPU01-EV1 or C2000H-CPU01-EV1
C1000H-SLK11	Optical fiber	
C200HW-SLK23 C200HW-SLK24	Coaxial	C200H-CPU11-E C200H-CPU31-E C200HS-CPU31-E C200HS-CPU33-E C200HE-CPU32-E C200HE-CPU42-E C200HG-CPU33-E C200HG-CPU43-E C200HG-CPU53-E C200HG-CPU63-E C200HX-CPU34-E C200HX-CPU44-E C200HX-CPU54-E C200HX-CPU64-E
C200HW-SLK13 C200HW-SLK14	Optical fiber	

1-4-2 Compatibility with Other Link Units

C1000H-SLK11 and C1000H-SLK21-V1

The following combinations of Units can be mounted on a single C1000H or C2000H PC.

1, 2, 3...

1. Two SYSMAC LINK Units
2. One SYSMAC LINK Unit and one SYSMAC NET Link Unit
3. One SYSMAC LINK Unit and one Rack-mounting Host Link Unit

In addition to the Units in the above combinations you may also mount one CPU Unit-mounting Host Unit or up to two PC Link Units. Only one PC Link Unit can be mounted on the C500-BC081 and C500-BC051 Backplanes, because these Backplanes have only 3 linkable slots.

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When combining Units as shown above, use the following models.

Name	Model	Remarks
SYSMAC LINK Unit	C1000H-SLK11	Optical type
	C1000H-SLK21-V1	Coaxial type
SYSMAC NET Link Unit	C500-SNT31-V4	Other versions cannot be used.
Rack-mounting Host Link Units	C500-LK103 C500-LK103-P C500-LK203	Other versions cannot be used.
CPU Unit-mounting Host Link Units	3G2A6-LK101-EV1 3G2A6-LK101-PEV1 3G2A6-LK201-EV1 3G2A6-LK202-EV1	---
PC Link Units	C500-LK009-V1 C500-LK009	---

⚠ Caution Be sure to set a unique operating level for each system when combining SYSMAC LINK Units, SYSMAC NET Link Units, and/or Host Link Units (SYSMAC WAY) on the same PC.

C200HW-SLK13, C200HW-SLK14, C200HW-SLK23, and C200HW-SLK24

The following combinations of Units can be mounted on a single PC. Some power supplies might not have sufficient capacity for all system configurations; be sure to check power supply requirements and capacities carefully.

1, 2, 3...

1. Two SYSMAC LINK Units
2. One SYSMAC LINK Unit and one SYSMAC NET Link Unit

In addition to the Units in the above combinations you may also mount one CPU Unit-mounting Host Link Unit, up to two rack-mounting Host Link Units, or up to two PC Link Units. For the C200HX, C200HG, or C200HE PC, one SYSMAC LINK Unit and one PC Card Unit may be mounted.

When combining Units as shown above, use the following models.

Name	Model	Remarks
SYSMAC LINK Unit	C200HW-SLK13 C200HW-SLK14	Optical type
	C200HW-SLK23 C200HW-SLK24	Coaxial type
SYSMAC NET Link Unit	C200HS-SNT32	---
PC Card Unit	C200HW-PCU01	Can be used only with with the C200HX, C200HG, or C200HE.
Rack-mounting Host Link Units	C200H-LK101 (-PV1) C200H-LK201-V1 C200H-LK202-V1	---
CPU Unit-mounting Host Link Units	3G2A6-LK101-EV1 3G2A6-LK101-PEV1 3G2A6-LK201-EV1 3G2A6-LK202-EV1	Cannot be used with the C200HS, C200HX, C200HG, or C200HE.
PC Link Units	C200H-LK401	---

Note Be sure to set a unique operating level for each system when combining SYSMAC LINK Systems, SYSMAC NET Link Systems, and the PC Card Unit on the same PC.

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1-5 Precautions

- A Bus Connector is required to mount the C200HW-SLK13, C200HW-SLK14, C200HW-SLK23, or C200HW-SLK24. Refer to *Section 3 Installation* for details.
- Be sure to set different operating levels when mounting a SYSMAC LINK Unit on the same PC with a SYSMAC NET Link Unit, Host Link Unit (Rack-mounting type), or PC Card Unit. Refer to *Section 2 Unit Components and Switch Settings* for details.
- The input interrupt response speed is 1 ms max. for the C200HW-SLK13, C200HW-SLK14, C200HW-SLK23, or C200HW-SLK24 when mounted to the C200HX/HG/HE and 10 ms max. when mounted to the C200H or C200HS.
- The C200HW-SLK13, C200HW-SLK14, C200HW-SLK23, or C200HW-SLK24 are totally upwardly compatible from the C200HS-SLK12 and C200HS-SLK22.
- The power supply capacity depends on the CPU Unit that is being used. Refer to you PC's *Installation Guide* for details and do not run over the power supply capacity.

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SECTION 2
Unit Components and Switch Settings

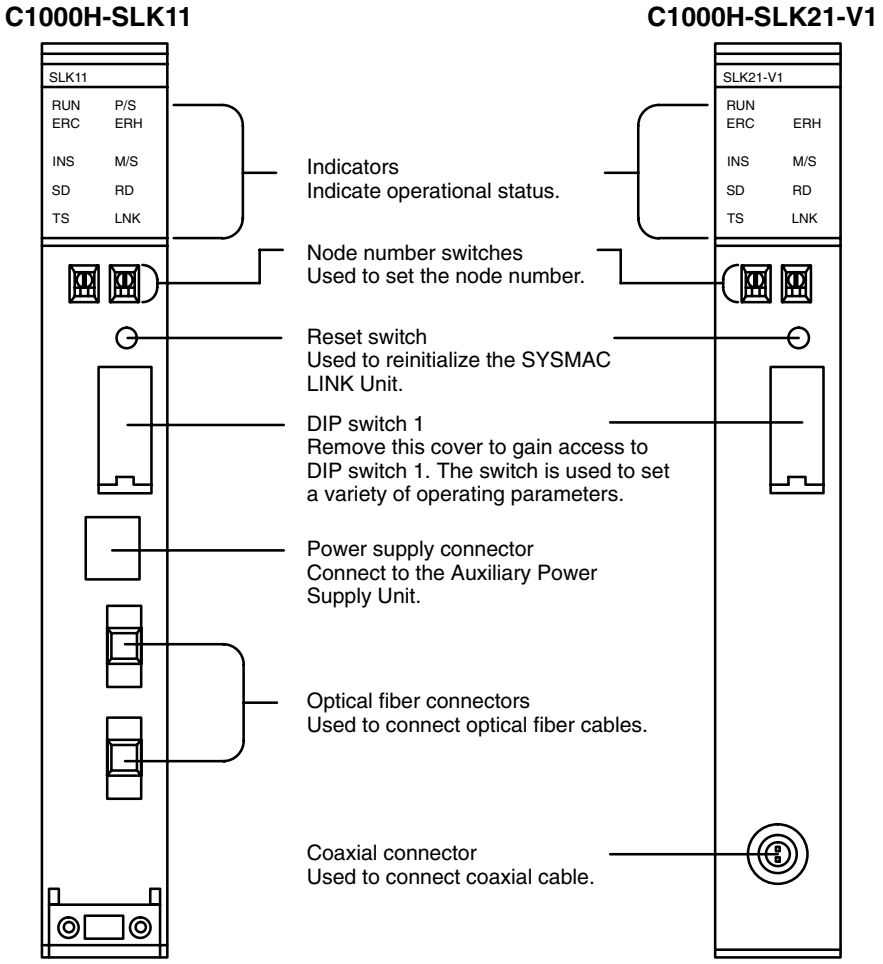
The names and functions of the SYSMAC LINK Units' components and switch settings are described in this section.

2-1 C1000H-SLK11/SLK21-V1 Components 10
2-2 C200HW-SLK13/14/23/24 Components 12
2-3 Indicators 13
2-4 Switches 14
2-4-1 C1000H-SLK11/SLK21-V1 14
2-4-2 C200HW-SLK13/14/23/24 14
2-5 Setting Switches 15
2-5-1 Node Number Switches 15
2-5-2 C1000H-SLK11/SLK21-V1 DIP Switch 1 16
2-5-3 C200HW-SLK13/14/23/24 DIP Switches 1 and 2 16

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2-1 C1000H-SLK11/SLK21-V1 Components

Front

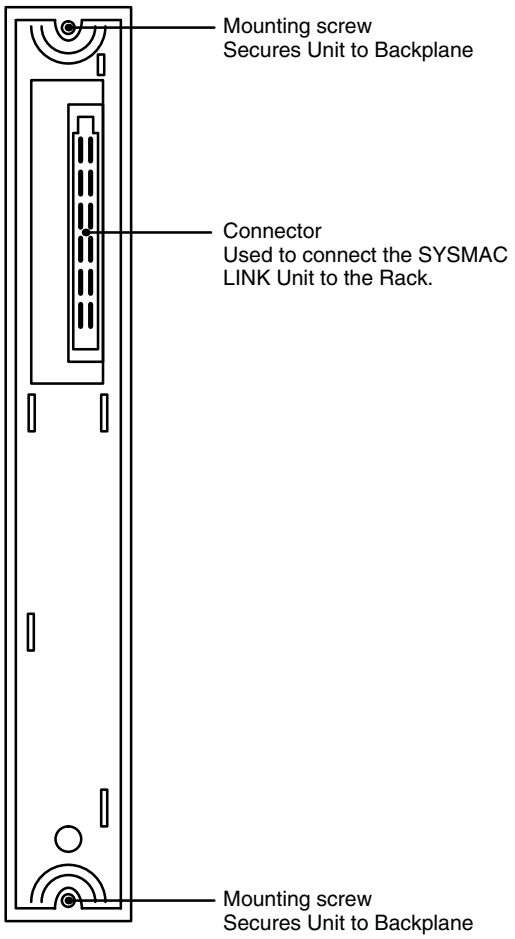


Note Do not push the Reset Switch on SYSMAC LINK Units when the RUN indicator is not lit (watchdog timer error).

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Back

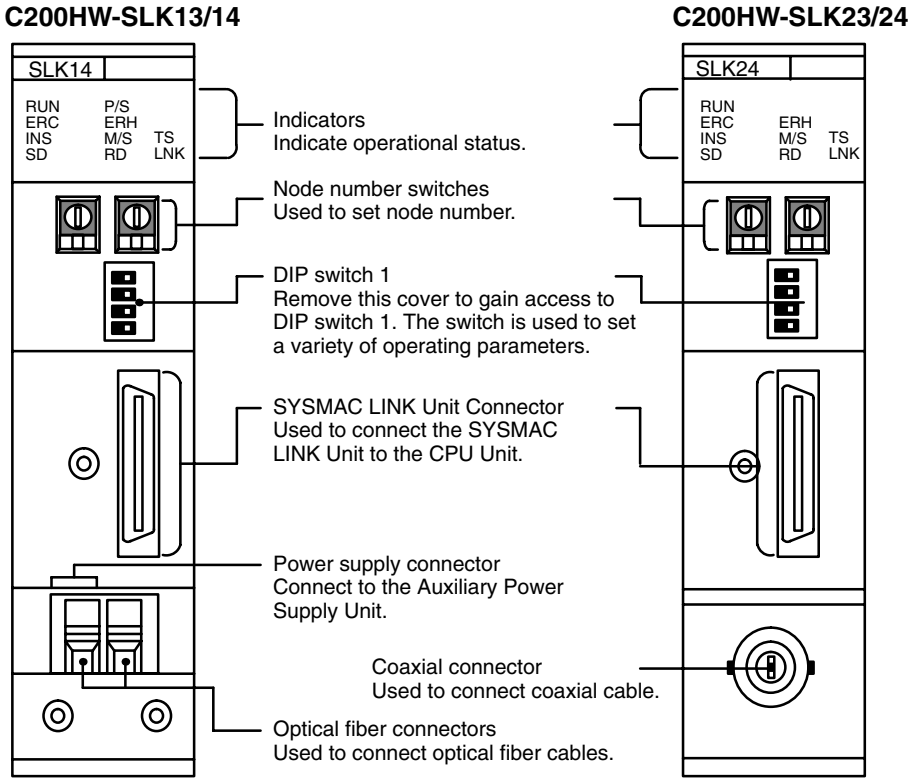
The backs of the C1000H-SLK11 and C1000H-SLK21-V1 are identical.



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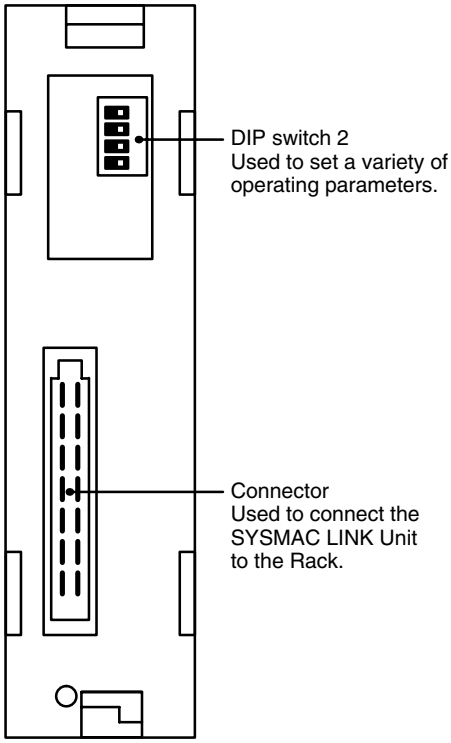
2-2 C200HW-SLK13/14/23/24 Components

Front



Back

The backs of the C200HW-SLK13/14 and C200HW-SLK23/24 are identical.

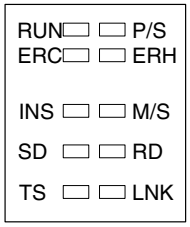


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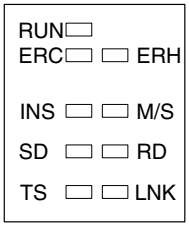
2-3 Indicators

The status of the SYSMAC LINK Unit is indicated by the indicators shown below. The Units that use coaxial cables (C1000H-SLK21-V1 and C200HW-SLK23/24) are not equipped with the P/S indicator.

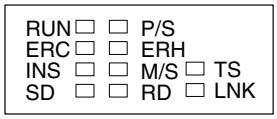
C1000H-SLK11



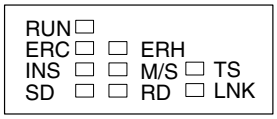
C1000H-SLK21-V1



C200HW-SLK13/14



C200HW-SLK23/24



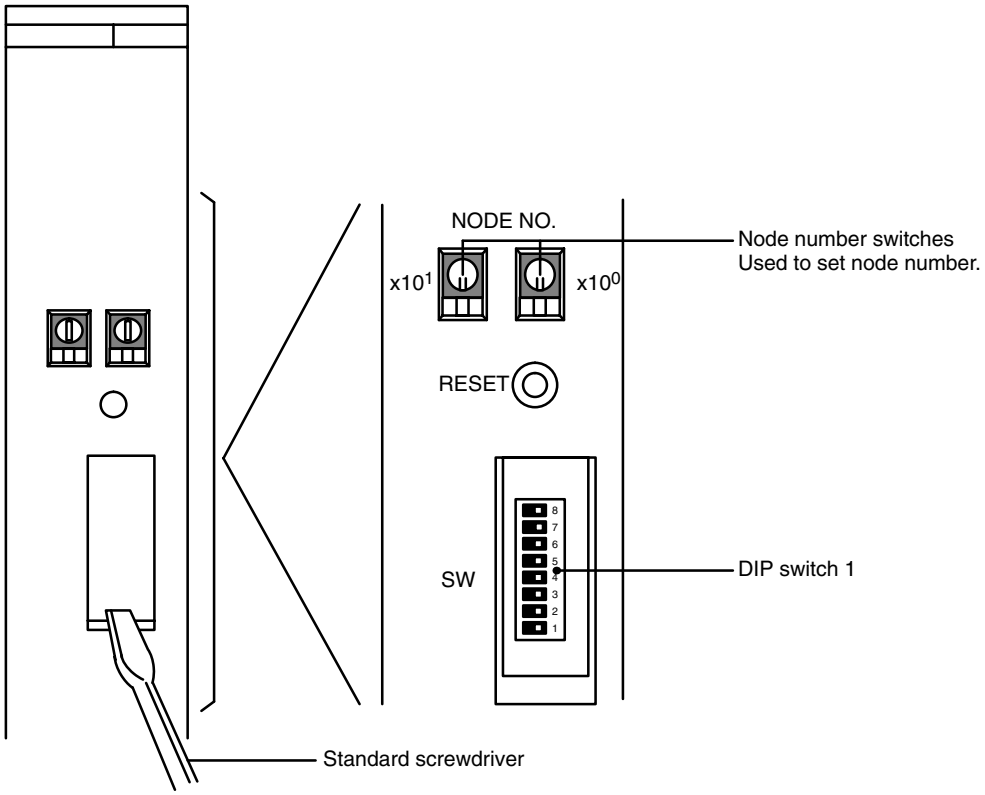
Indicator			Meaning
Name	**Color**	**Condition**	
RUN	Green	Lit	Unit is operating normally.
		Not lit	Watchdog timer error has occurred.
P/S (power supply on, optical units only)	Green	Lit	Power is being supplied from the Auxiliary Power Supply Unit.
		Not lit	Power is not being supplied from the Auxiliary Power Supply Unit.
ERC (communications error)	Red	Lit	Communications error has occurred, node number setting is incorrect, or same node number has been set twice.
		Not lit	None of the above errors has occurred.
ERH (PC error)	Red	Lit	PC CPU, PC model, PC version, PC interface, or EEPROM error has occurred.
		Not lit	None of the above errors has occurred.
INS (Network inclusion)	Orange	Lit	Unit is part of Network.
		Not lit	Unit is not part of Network.
M/S (polling unit)	Orange	Lit	Unit is polling unit.
		Not lit	Unit is not part of Network or is polled unit.
SD (transfer)	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
TS (test)	Orange	Lit	Test is being executed.
		Flashing	Test setting error has occurred.
		Not lit	Test is not being executed.
LNK (data link)	Orange	Lit	Unit is part of active data link.
		Flashing	Data link error has occurred.
		Not lit	Unit is not part of active data link.

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2-4 Switches

2-4-1 C1000H-SLK11/SLK21-V1

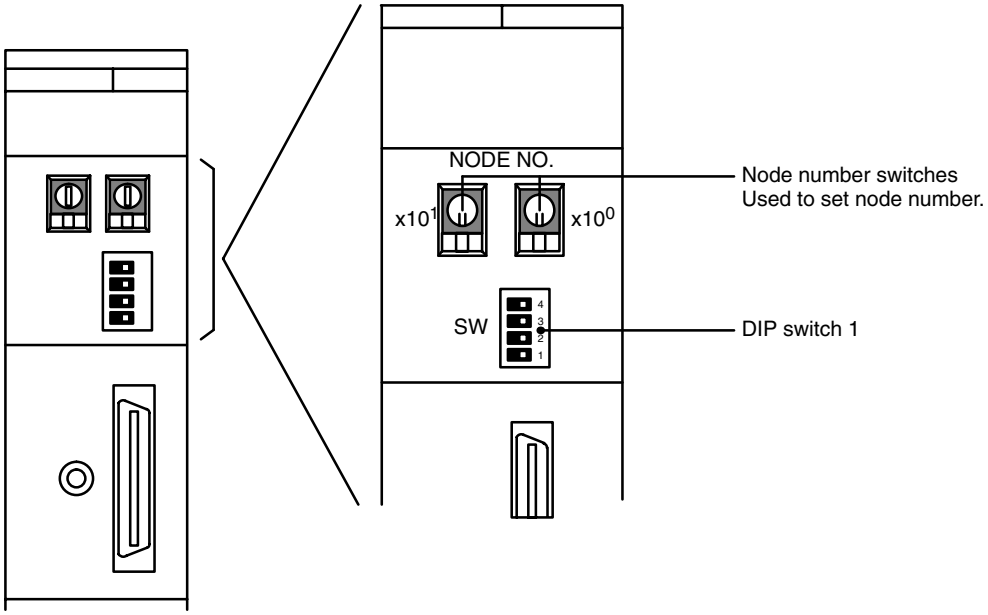
DIP switch 1 can be accessed by removing the cover from the front of the Unit with a standard screwdriver.



2-4-2 C200HW-SLK13/14/23/24

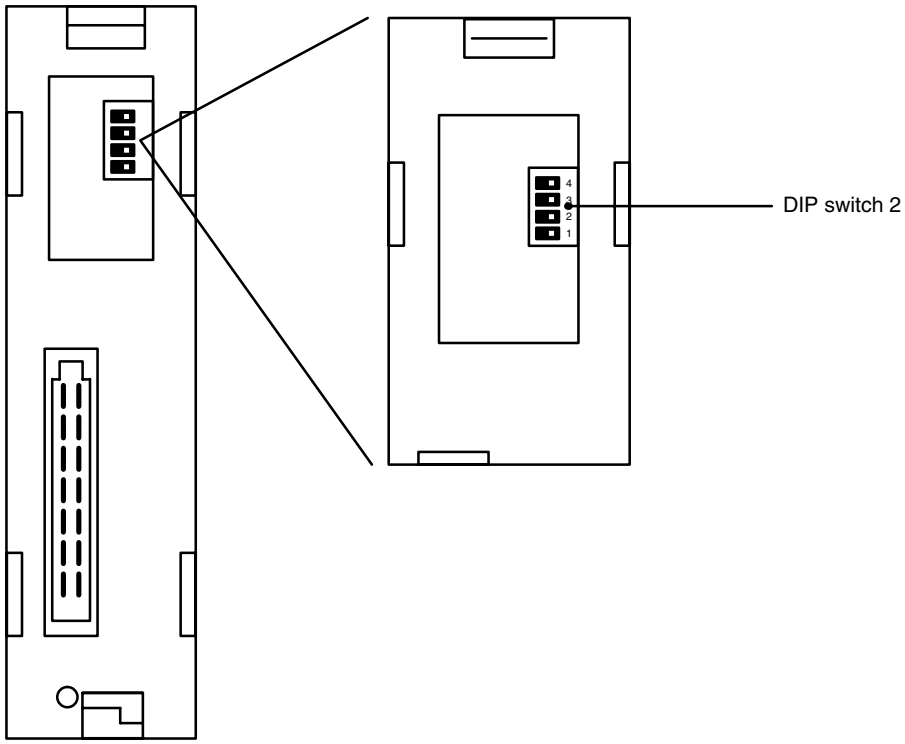
The node number switches and DIP switch 1 are located on the front of the Unit, and DIP switch 2 is located on the back.

Front



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Back



2-5 Setting Switches

Switch settings determine how the SYSMAC LINK Units will work together in a Network. Be sure to turn the power off to the PC before setting the switches. Errors in switch settings, which may not always be detected by the System, can cause faulty data communications. Set and check all switch settings carefully.

2-5-1 Node Number Switches

Turn off the power to the PC before setting the node number switches. Node number switches determine the node number. The left switch sets the tens digit; the right switch sets the ones digit. The node number must be between 01 and 62. Each SYSMAC LINK Unit in a Network must have a unique node number.

Use a small flat-blade screwdriver to set node number switches, being careful not to damage them.

Note Units in the same network must have unique node numbers.

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2-5-2 C1000H-SLK11/SLK21-V1 DIP Switch 1

Turn off the power to the PC before setting the DIP switch. DIP switch 1 is used to control the communications test, data link activation, operating level, PC operating mode when power is applied, network parameter initialization, and polling/polled unit operation. Refer to the pages indicated in the table for more details on these settings.

Pin	Function		Page
	When ON	When OFF	
1	Test activated.	Test stopped.	111
2	Data link activated.	Data link stopped.	58
3	Operating level 0	Operating level 1	38
4[1]	For maintenance use only. Leave this switch set to OFF.		---
5	PC enters MONITOR mode at start-up.	PC enters usual mode at start-up.	38
6[1]	Not used. Leave this switch set to OFF.		---
7[2]	Network Parameters initialized.	Network Parameters not initialized.	40
8[2]	Polled unit	Polling unit	39

Note
1. Pins 4 and 6 should always be OFF.
2. Pins 7 and 8 are normally OFF.

2-5-3 C200HW-SLK13/14/23/24 DIP Switches 1 and 2

Turn off the power to the PC before setting the DIP switches. DIP switch 1 is used to control the communications test, data link activation, and operating level. DIP switch 2 is used to control network parameter initialization and polling/polled unit operation Refer to the pages indicated in the tables for more details on these settings.

DIP Switch 1 (Front of the Unit)

Pin	Function		Page
	When ON	When OFF	
1	Test activated.	Test stopped.	111
2	Data link activated.	Data link stopped.	58
3	Operating level 0	Operating level 1	38
4*	For maintenance use only. Leave this switch set to OFF.		---

Note *Pin 4 should always be OFF.

DIP Switch 2 (Back of the Unit)

Pin	Function		Page
	When ON	When OFF	
1[1]	Not used. Leave this switch set to OFF.		---
2[1]	Not used. Leave this switch set to OFF.		---
3[2]	Network Parameters initialized.	Network Parameters not initialized.	40
4[2]	Polled unit	Polling unit	39

Note
1. Pins 1 and 2 should always be OFF.
2. Pins 3 and 4 are normally OFF.

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SECTION 3
Installation

This section explains how to install SYSMAC LINK Systems.

3-1 Mounting Position 18
3-1-1 C1000H 18
3-1-2 C2000H 18
3-1-3 C200H/C200HS 18
3-1-4 C200HX/C200HG/C200HE 19
3-2 Power Supply Unit Connection 20
3-2-1 Specifications and Components 20
3-2-2 Installation and Wiring 22
3-3 Bus Connector (C200HX/HG/HE/HS/H only) 25
3-4 Cable Connection 26
3-4-1 Coaxial Cable 26
3-4-2 Optical Fiber Cable 28
3-5 Dimensions 33

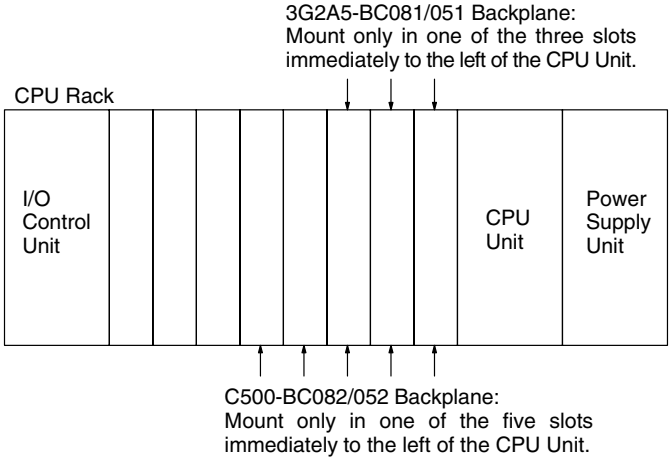
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3-1 Mounting Position

Note
1. Turn off power to the PC before mounting Units to the Backplane.
2. Tighten Backplane mounting screws firmly.

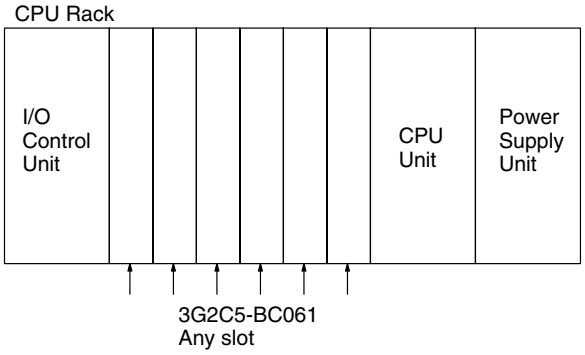
3-1-1 C1000H

The C1000H-SLK11/SLK21-V1 can be mounted in one of the first three slots to the left of (i.e., next to) the CPU Unit when using the 3G2A5-BC081/051 Backplane, and in one of the first five slots to the left of the CPU Unit when using a C500-BC082/052 Backplane.



3-1-2 C2000H

C1000H-SLK11/SLK21-V1 can be mounted in any slot in 3G2C5-BC061 Backplanes.

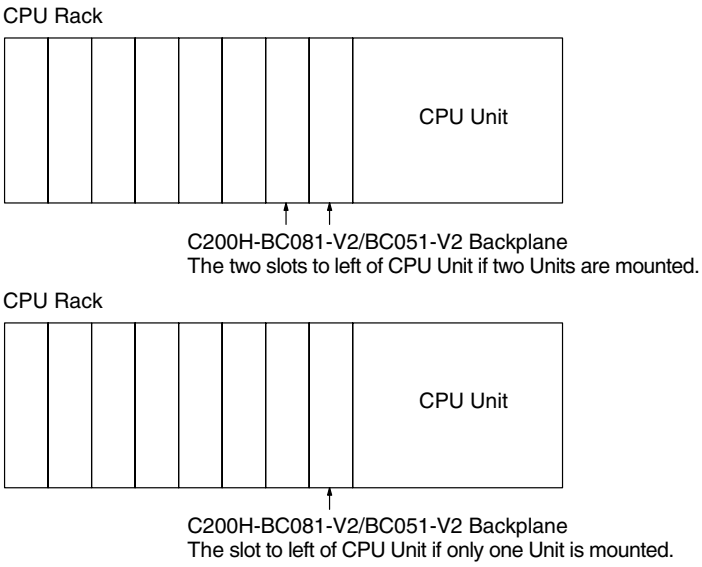


3-1-3 C200H/C200HS

The C200HW-SLK13/14/23/24 must be mounted in one of the two slots immediately to the left of the CPU Unit when using the C200H-BC081-V2 or C200H-BC051-V2 Backplane.

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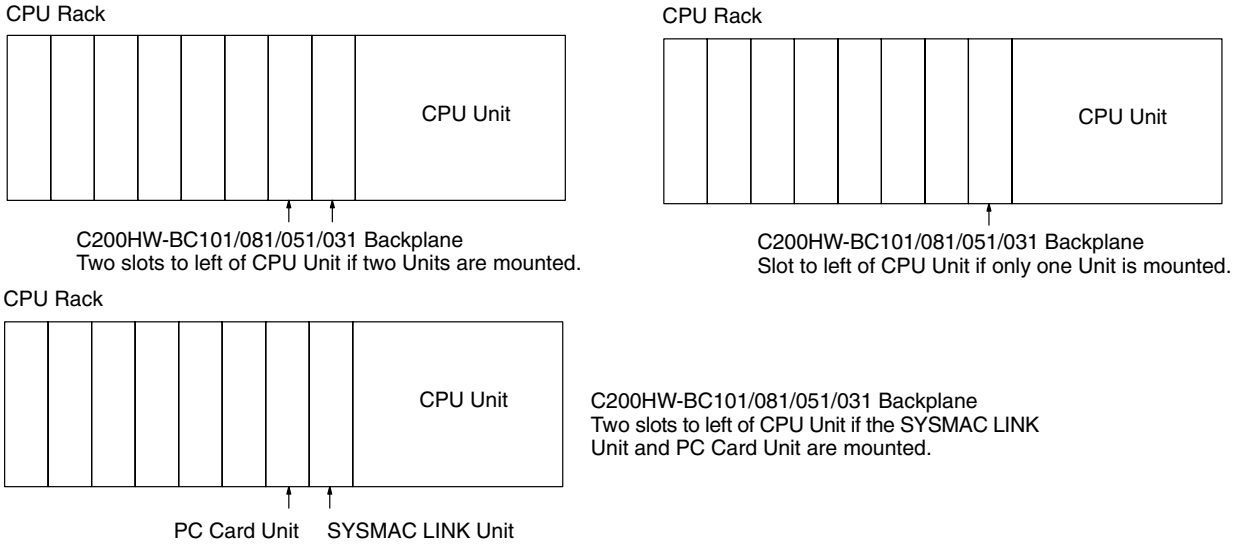
If only one Unit is mounted, it must in the slot immediately to the left of the CPU Unit. If two SYSMAC LINK Units, or one together with a SYSMAC NET Link Unit, are mounted, the SYSMAC LINK Unit can be mounted in either of the two slots immediately to the left of the CPU Unit.



Note Refer to *1-4-2 Compatibility with other Link Units* for details on using a C200HW-SLK13/14/23/24 SYSMAC LINK Unit with a SYSMAC NET Link Unit.

3-1-4 C200HX/C200HG/C200HE

The C200HW-SLK13/14/23/24 must be mounted in one of the two slots immediately to the left of the CPU Unit when using a C200HW-BC101/081/051/031 Backplane. If only one Unit is mounted, it must be in the slot immediately to the left of the CPU Unit. If two SYSMAC LINK Units, or one together with a SYSMAC NET Link Unit, are mounted, the SYSMAC LINK Unit can be mounted in either of the two slots immediately to the left of the CPU Unit. If one SYSMAC LINK Unit and one PC Card Unit are mounted, the SYSMAC LINK Unit must be in the slot immediately to the left of the CPU Unit.



Note 1. Refer to *1-4-2 Compatibility with other Link Units* for details on using a C200HW-SLK13/14/23/24 SYSMAC LINK Unit with a SYSMAC NET Link Unit.

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2. A Communications Board equipped with a Link Interface (C200HW-COM01/04-EV1) is required when mounting a SYSMAC LINK Unit to a C200HX, C200HG, or C200HE PC.

3-2 Power Supply Unit Connection

SYSMAC LINK Units that are connected with optical fiber cable (the C1000H-SLK11 and C200HW-SLK13/14) can be connected to an Auxiliary Power Supply Unit to provide backup power. By connecting the Unit to an Auxiliary Power Supply Unit, the entire system won't go down if the Unit fails for some reason.

The table below shows which Power Supply Units can be connected to the SYSMAC LINK Units.

SYSMAC LINK Unit	Corresponding Power Supply
C1000H-SLK11	C1000H-APS01
C200HW-SLK13/14	C200H-APS03

3-2-1 Specifications and Components

Specifications

The following specifications apply to both the C1000H-APS01 and C200H-APS03.

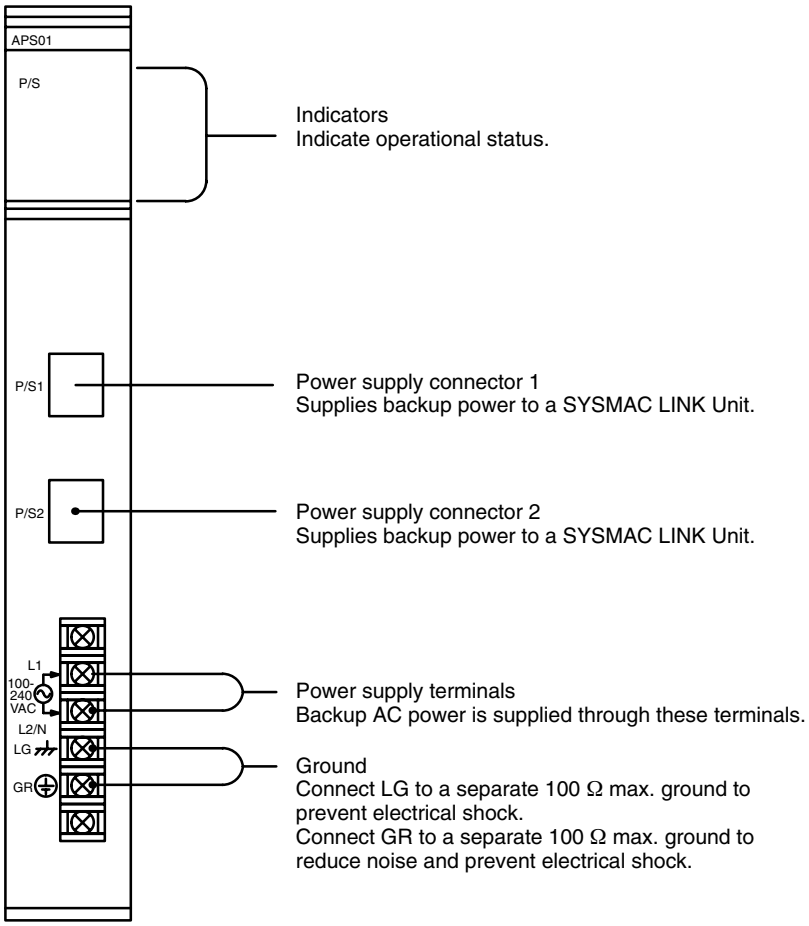
Item	Specification
Power supply voltage	100 to 120 VAC or 200 to 240 VAC (switchable)
Acceptable voltage range	85 to 132 VAC or 170 to 264 VAC
Power consumption	40 VA max.
Weight	0.5 kg max.
Other	Conform to C-series specifications

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Auxiliary Power Supply Unit Components

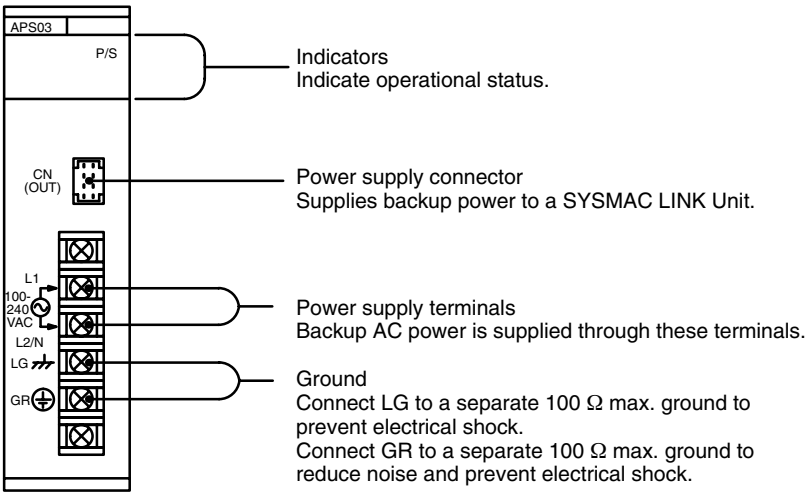
C1000H-APS01

The diagram below shows the components of the C1000H-APS01 Auxiliary Power Supply Unit and their functions.



C200H-APS03

The diagram below shows the components of the C200H-APS03 Auxiliary Power Supply Unit and their functions.



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Power Cables

The following table shows which power cables are included with the C1000H-APS01 and C200H-APS03 as accessories.

Unit	Power cable	Notes
C1000H-APS01	C1000H-CN111	1 cable provided
C200H-APS03	C200H-CN111	1 cable provided (for 1 SYSMAC LINK Unit)

When connecting 2 SYSMAC LINK Units to an Auxiliary Power Supply Unit, order the following cables separately as required.

Unit	Power cable	Notes
C1000H-APS01	C1000H-CN111	Same as the one provided with the Unit.
C200H-APS03	C200H-CN211	For connection to 2 SYSMAC LINK Units

Indicators

Indicator			Meaning
Name	Color	Condition	
P/S	Green	Lit	Power is being supplied to the SYSMAC LINK Unit.
		Not lit	Power is not being supplied to the SYSMAC LINK Unit.

Precautions

The backup function will be disabled when the PC's power is off, so connect the power supply terminals to an AC power supply other than the one connected to the PC.

Always supply power to the Power Supply Unit before supplying power to the PC.

Note

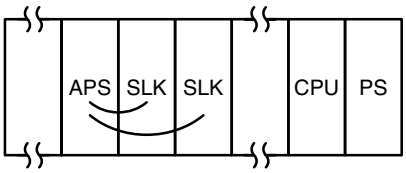
1. Turn off the power supply to the PC before mounting the Power Supply Unit.
2. Firmly tighten the Backplane mounting screws for the Power Supply Unit.
3. Leave the protective sticker in place on the Unit when wiring to prevent clippings and other foreign matter from entering the Unit during the wiring procedure.
4. Remove the protective sticker after completion of wiring before turning on power to the Unit. If Unit is operated with the protective sticker in place, the Unit may overheat, causing operational errors.
5. Do not pull on the cable. Pulling on the cable could break wires inside.
6. Do not bend the cable past the minimum radius. Bending the cable too far could break wires inside.

3-2-2 Installation and Wiring

C1000H/C2000H

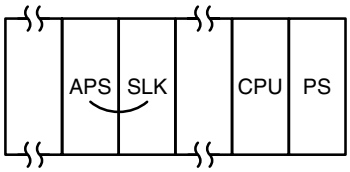
Mounting Position

The C1000H-APS01 can be mounted in any slot, but the power cables are relatively short, so the Power Supply Unit cannot be more than 2 slots from the SYSMAC LINK Unit. One Power Supply Unit can supply backup power to two SYSMAC LINK Units, as shown below.



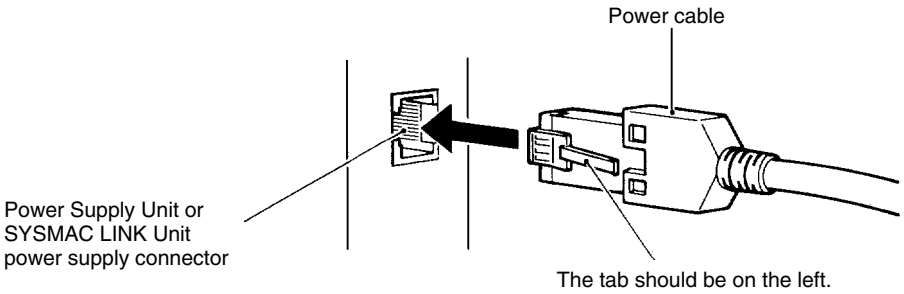
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In the following diagram, a Power Supply Unit is connected to just one SYSMAC LINK Unit.



Wiring

The Power Supply Unit and SYSMAC LINK Unit are connected by a power supply cable, as shown below. The cable can be plugged into either power supply connector on the Power Supply Unit.



Note

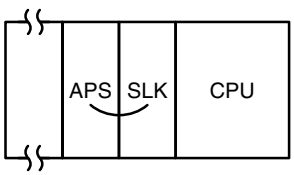
1. Turn off the power supply to the PC before mounting the Power Supply Unit.
2. Firmly tighten the Backplane mounting screws for the Power Supply Unit.
3. Leave the protective sticker in place on the Unit when wiring to prevent clippings and other foreign matter from entering the Unit during the wiring procedure.
4. Remove the protective sticker after completion of wiring before turning on power to the Unit. If Unit is operated with the protective sticker in place, the Unit may overheat, causing operational errors.
5. Do not pull on the cable. Pulling on the cable could break wires inside.
6. Do not bend the cable past the minimum radius. Bending the cable too far could break wires inside.

C200H/C200HS

Mounting Position

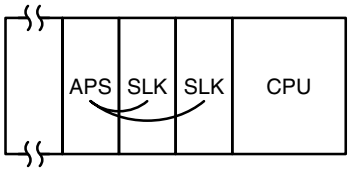
The C200H-APS03 can be mounted in any slot, but the power cable included with the Unit will only reach to the next slot, so the Power Supply Unit must be mounted next to the SYSMAC LINK Unit.

In the following diagram, a Power Supply Unit is connected to just one SYSMAC LINK Unit.



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One Power Supply Unit can supply backup power to two SYSMAC LINK Units. In this case an optional power cable that will supply the two SYSMAC LINK Units must be purchased separately. One branch of the cable will reach two slots from the Power Supply Unit, as shown below.

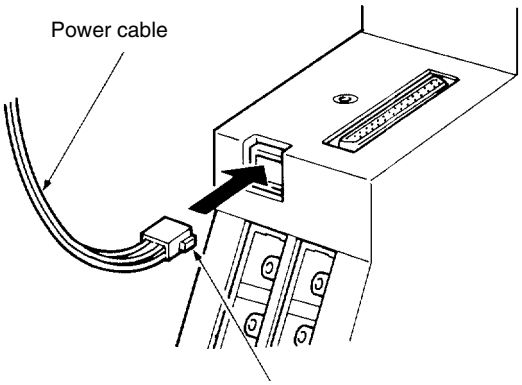


Note Connect the C200H-APS01 Power Supply Unit (for single-unit power supply) or the C200H-APS02 Power Supply Unit (for double-unit power supply) to the SYSMAC NET Link Unit. The C200H-APS03 Power Supply Unit cannot be connected to the SYSMAC NET Link Unit.

If the SYSMAC Link Unit is used in combination with the SYSMAC NET Link Unit, be sure to mount them and the Power Supply Unit in the correct positions.

Wiring

The Power Supply Unit and SYSMAC LINK Unit are connected by a power supply cable, as shown below. The tab on the connector should be on the right.



Note

1. Turn off the power supply to the PC before mounting the Power Supply Unit.
2. Leave the protective sticker in place on the Unit when wiring to prevent clippings and other foreign matter from entering the Unit during the wiring procedure.
3. Remove the protective sticker after completion of wiring before turning on power to the Unit. If Unit is operated with the protective sticker in place, the Unit may overheat, causing operational errors.
4. Do not pull on the cable. Pulling on the cable could break wires inside.
5. Do not bend the cable past the minimum radius. Bending the cable too far could break wires inside.

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3-3 Bus Connector (C200HX/HG/HE/HS/H only)

A Bus Connector is required to connect a C200HW-SLK13/14/23/24 SYSMAC LINK Unit to the CPU Unit of a C200HX, C200HG, C200HE, C200HS, or C200H PC.

There are three models of Bus Connector available. One is used when a single SYSMAC LINK Unit is being mounted on the CPU Rack, one is used when two Units are being mounted (either two SYSMAC LINK Units or a SYSMAC LINK Unit and a SYSMAC NET Link Unit), and one is used when a single SYSMAC LINK Unit and a single PC Card Unit are mounted (C200HX/HG/HE CPU Units only).

CPU Unit	Communications Board	Bus Connector	Function
C200HX, C200HG, C200HE	C200HW-COM01 or C200HW-COM04-EV1	C200HW-CE001	Used when mounting just one SYSMAC LINK Unit.
		C200HW-CE002	Used when mounting two SYSMAC LINK Units or a SYSMAC LINK Unit and a SYSMAC NET Link Unit.
		C200HW-CE012	Used when mounting one SYSMAC LINK Unit and one PC Card Unit.
C200H, C200HS	---	C200H-CE001	Used when mounting just one SYSMAC LINK Unit.
		C200H-CE002	Used when mounting two SYSMAC LINK Units or a SYSMAC LINK Unit and a SYSMAC NET Link Unit.

Bus Bar Connection

Connect the Bus Connector as described below after turning off the PC.

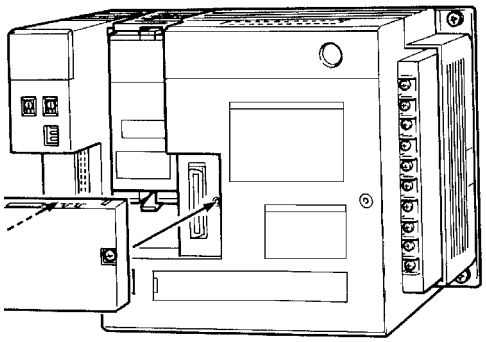
1, 2, 3...

1. When using the C200HS or C200H PC, align the Bus Connector so it fits into the connectors on both the SYSMAC LINK Unit and PC CPU Unit, and then press it into the connectors.

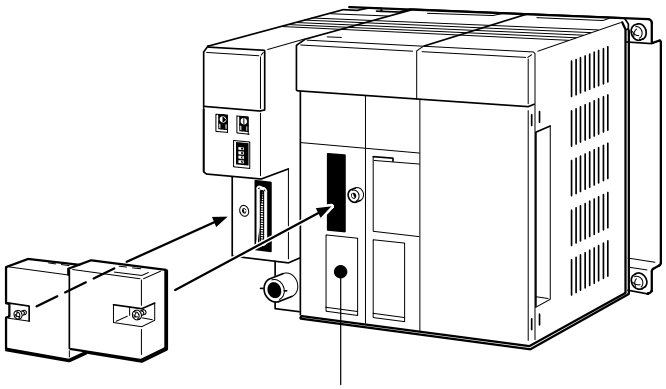
or When using the C200HX, C200HG, or C200HE PC, mount the Communications Board on the CPU Unit, align the Bus Connector so it fits into the connectors on both the SYSMAC LINK Unit and Communications Board, and then press it into the connectors.

2. Tighten the two screws on the Bus Connector to secure it.

C200HS, C200H



C200HX, C200HG, C200HE



Communications Board
C200HW-COM01 or
C200HW-COM04-EV1

Note

1. Turn off the power supply to the PC before connecting the Bus Connector.
2. Firmly tighten the mounting screws of the Bus Connector.

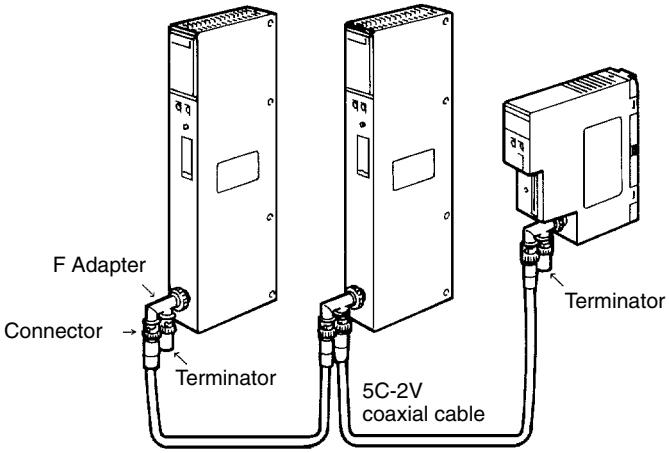
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3-4 Cable Connection

SYSMAC LINK Units can be connected with either coaxial cable or optical fiber cable. This section describes the procedures required to connect both types of cable.

3-4-1 Coaxial Cable

The diagram below shows a SYSMAC LINK System connected by coaxial cables.



Required Components

1, 2, 3...

1. Coaxial cable and connectors:

   Use 5C-2V coaxial cable designed for indoor use. Install connectors on each end of the cable. Cables must be continuous lengths only. No intervening cable connectors or breaks are permitted.

2. F Adapters (C1000H-CE001):

   Coaxial cables are connected to the SYSMAC LINK Units via F Adapters. One F Adapter is included as an accessory with SYSMAC LINK Units that use coaxial cables (C1000H-SLK21-V1 and C200HW-SLK23/24). An Attachment Stirrup (C200H-TL001) is also included with the C200HW-SLK23/24.

3. Terminator (C1000H-TER01):

   Two Terminators (sold separately) are required for the F Adapters at the ends of the network.

Connection Procedure

The connection procedure is described briefly below.

Note

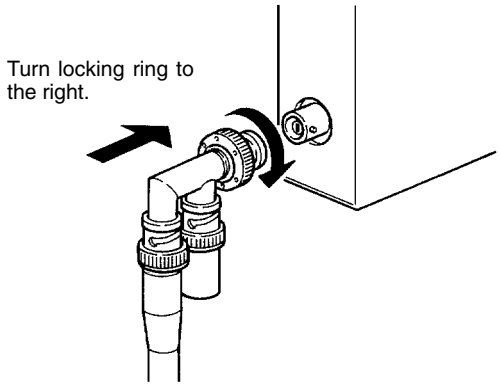
1. Turn off the power supply to the PC before connecting the cables.
2. Leave the protective sticker in place on the Unit when wiring to prevent wire clippings and other foreign matter from entering the Unit during the wiring procedure.
3. Remove the protective sticker after completion of wiring before turning on power to the Unit. If Unit is operated with the protective sticker in place, the Unit may overheat, causing operational errors.

1, 2, 3...

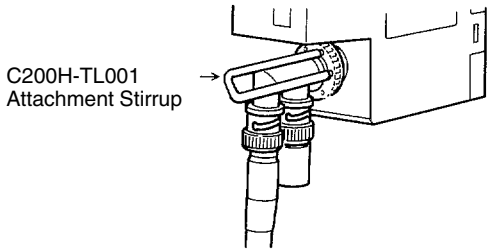
1. Install connectors on each end of the cables.
2. Connect the Terminators to the F Adapters at the ends of the network (i.e., to the unused connectors at the last Unit on each end). Hold the connector in one hand and press the resistor into it firmly with the other.

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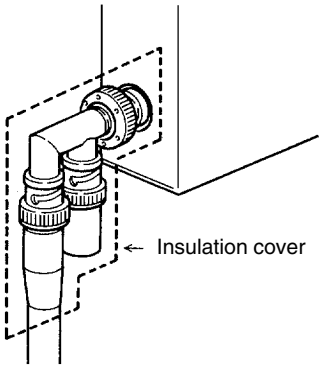
3. Connect the F Adaptors to the SYSMAC LINK Units by firmly pushing the adapter onto the coax connector on the Unit and turning the locking ring to the right until it locks. Start at one end of the network and connect the F Adapters to the other end in order.



With the C200H, C200HS, C200HX, C200HG, or C200HE, secure the F Adapter to the coaxial connector with an attachment stirrup.

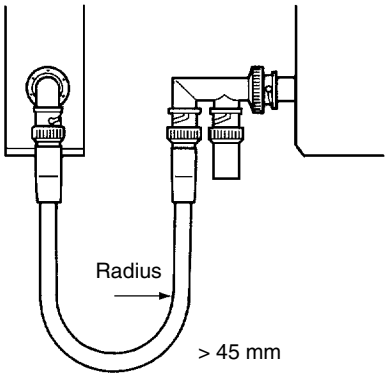


4. Place an insulation cover over the F Adapter.



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5. Any bends in the coaxial cable must be 45 mm in radius or greater (six times the outer diameter of the cable). When laying the cable, make wider bends of 110 mm in radius or greater (15 times the outer diameter of the cable).



Note
1. Check to be sure that the coaxial cable if firmly locked into place after connecting it.
2. Do not pull on the cable. Pulling on the cable could break wires inside.
3. Do not bend the cable past the minimum radius. Bending the cable too far could break wires inside.
4. Do not place heavy objects on the cable or connectors. Heavy objects could break wires inside.

3-4-2 Optical Fiber Cable

Required Components

1, 2, 3...

1. Optical fiber cable:

   Use Hard Plastic-clad Optical Fiber Cable (H-PCF). Refer to *Appendix A Standard Models* for details on available lengths and colors.

2. Optical Connectors:

   There are two types of Optical Connector available, as shown below. Use the cable splicing connector to splice cable.

Function	Model number	Number required
Node-cable connection	S3200-COCF2071	2 for each node
Cable splicing	S3200-COIAT2000 (inline adapter)	1 for each break in the cable

   Note Using an inline adapter to splice the cable will reduce the maximum transmission distance because of loss at the junction. Refer to your hard plastic-clad optical fiber cable (H-PCF) installation manual for details.

3. Optical Connector Assembly Tools:

   These tools are required to attach the Optical Fiber Cable to the Optical Connector.

Optical Connector Assembly Tool Set	Applicable Connectors
S3200-CAK1062	S3200-COCF2071 (C1000H) S3200-COCF2571 (C200HS)

   Note Optical fiber cable cutters are included.

4. Optical Fiber Tester (Optical Power Tester):

Tester Set	Head Unit	Applicable Connectors
S3200-CAT2700	S3200-CAT2702	S3200-COCF2071 (C1000H) S3200-COCF2571 (C200HS)

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5. Master Fiber:

Master Fiber	Applicable Connectors
S3200-CAT2001H	S3200-COCF2071 (C1000H) S3200-COCF2571 (C200HS)

Discontinued Products:

Name	Model number	Recommended replacement models	Manufacturer
Optical Connector	S3200-COCF2011	S3200-COCF2071	OMRON
	S3200-COCF2511	S3200-COCF2571	OMRON

Optical Connector Assembly

Follow the instructions provided with the S3200-CAK1062 Optical Connector Assembly Tool Set.

Connection Procedure

The connection procedure is described briefly below. Begin with the highest node in the network and connect the lower nodes in order.

Note

1. Turn off the power supply to the PC before connecting the cables.
2. Leave the protective sticker in place on the Unit when wiring to prevent clippings and other foreign matter from entering the Unit during the wiring procedure.
3. Remove the protective sticker after completion of wiring before turning on power to the Unit. If Unit is operated with the protective sticker in place, the Unit may overheat, causing operational errors.
4. Do not pull on the cable. Pulling on the cable could break fibers inside.
5. Do not bend the cable past the minimum radius. Bending the cable too far could break fibers inside.
6. Do not place heavy objects on the cable or connectors. Heavy objects could break fibers inside.

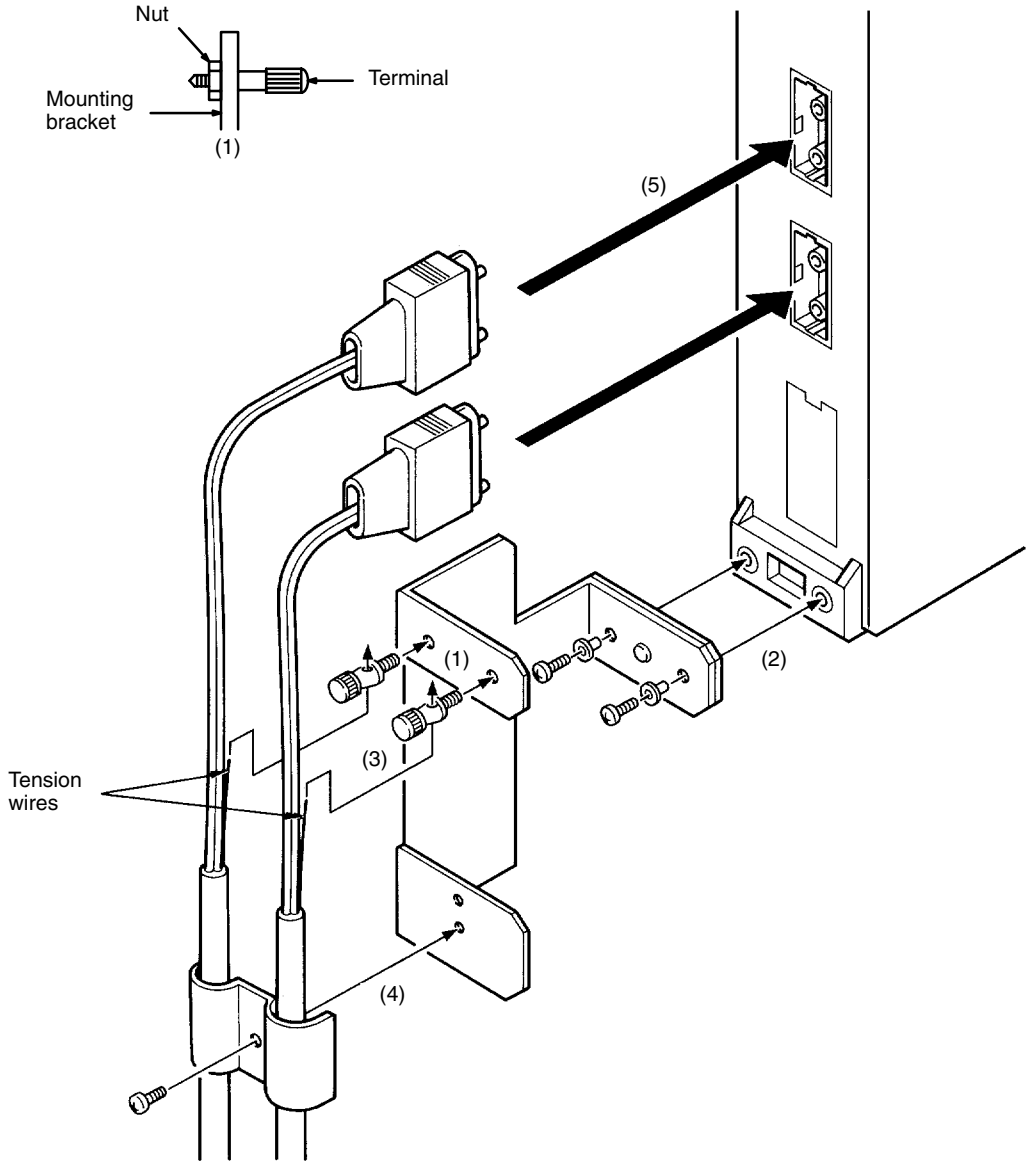
C1000H-SLK11

1, 2, 3...

1. Insert the terminals into the mounting bracket so that the tension wire holes are vertical, and then secure the terminals by tightening the nuts on the other side.
2. Insert the bushings into the mounting bracket and secure the bracket to the Unit with the Philips head screws provided.
3. If the cable has tension wires, thread them through the terminals and tighten the terminal screws to secure them.
4. Place the cables behind the clamp and secure them by tightening the Philips head screw provided. Secure both cables at once.

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5. Align the cable's Optical Connectors so that the tabs are on the left and insert them into the Unit's Optical Connectors.



Note Tighten the screws on the mounting bracket firmly.

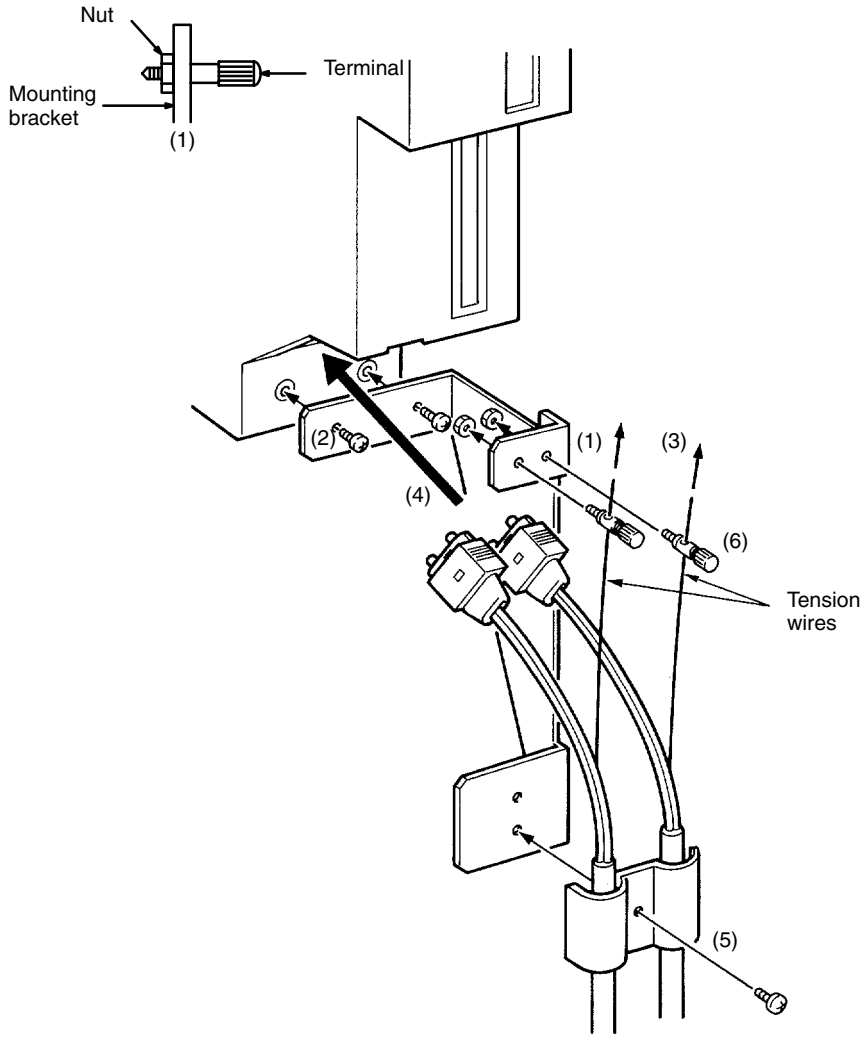
C200HW-SLK13/14

1, 2, 3...

1. Insert the terminals into the mounting bracket so that the tension wire holes are vertical, and then secure the terminals by tightening the nuts on the other side.
2. Secure the bracket to the Unit with the Philips head screws provided.
3. If the cable has tension wires, thread them through the terminals.
4. Insert the cable's Optical Connectors into the Unit's Optical Connectors.
5. Place the cables behind the clamp and secure them by tightening the Philips head screw provided. Secure both cables at once.

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6. If the cable has tension wires, tighten the terminal screws to secure them.



Note Tighten the screws on the mounting bracket firmly.

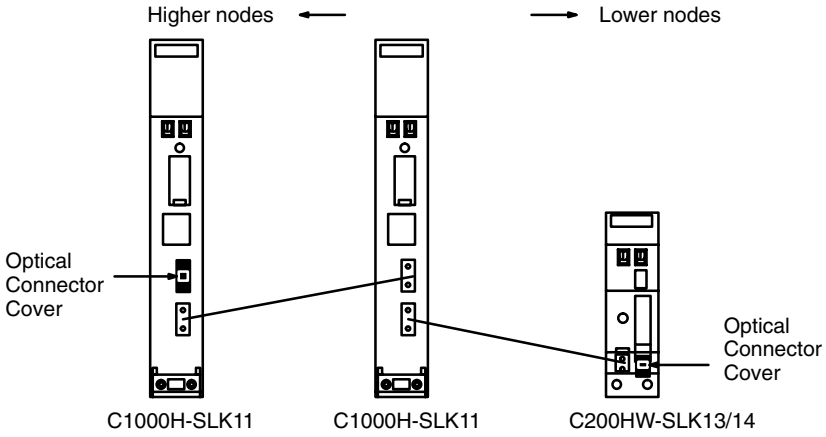
Precautions

1, 2, 3...

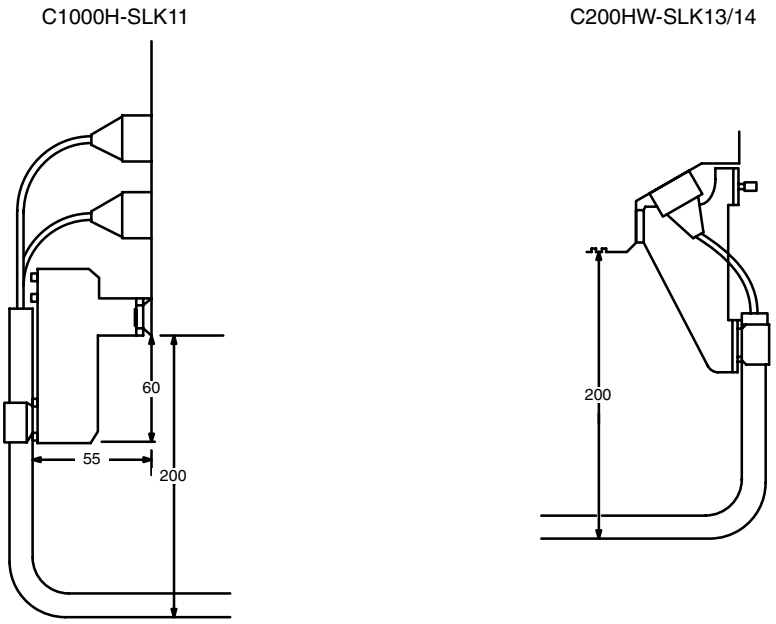
1. Use only the Hard Plastic-clad Optical Fiber Cable (H-PCF) listed in *Appendix A Standard Models*.
2. Any bends in the cable must be 10 cm in radius or greater.
3. Always hold the connector firmly when inserting or removing the cables.

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4. As shown in the diagram below, begin connecting the highest node of the network and connect the lower nodes in order. Cover the upper connector (SL1) of the highest node, and connect SL2 to SL1 of the next node. Continue connecting this way until the lowest node is reached and cover SL2 of the lowest node.



5. Allow sufficient clearance between the bottom of the Unit and the cable to prevent the cable from being bent too much, as shown in the diagram below. (The clearances are in millimeters.)

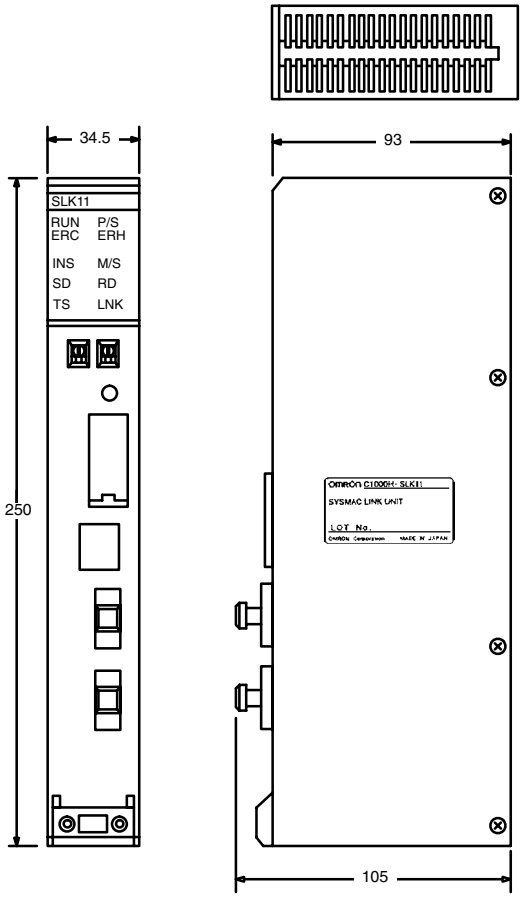


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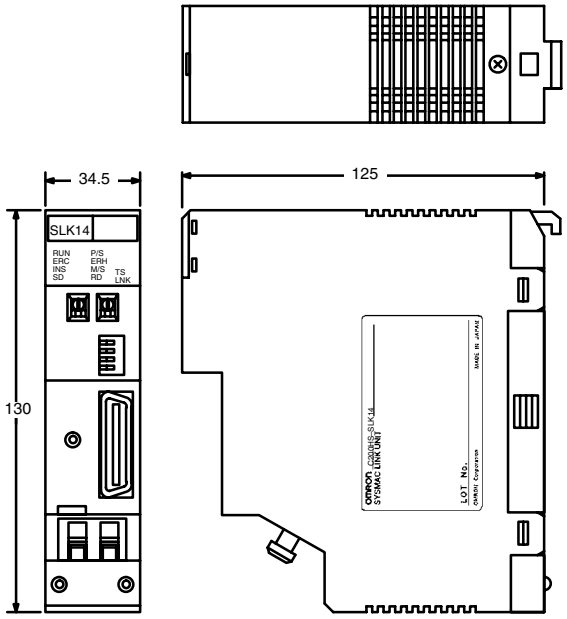
3-5 Dimensions

Dimensions for the SYSMAC LINK Units are shown below. All dimensions are in millimeters.

C1000H-SLK11

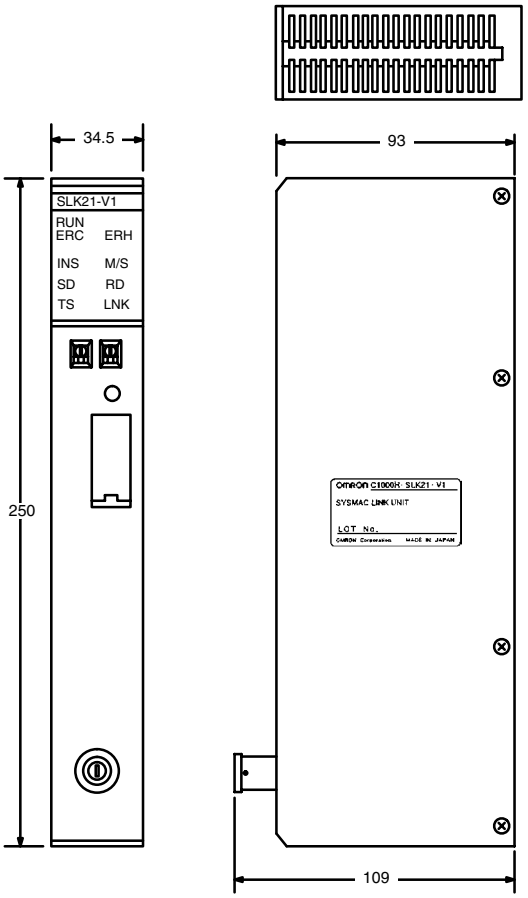


C200HW-SLK13/14

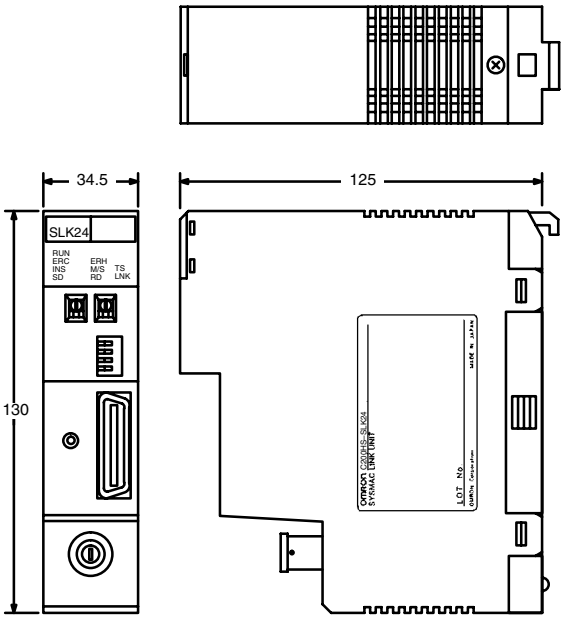


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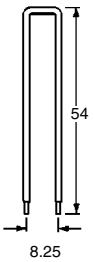
C1000H-SLK21-V1



C200HW-SLK23/24



C200H-TL001 F Adapter Attachment Stirrup



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SECTION 4
Basic Communications

A description of the token bus method of communications used in SYSMAC LINK Systems is described briefly in this section. The basic settings necessary for operation are also explained.

4-1 SYSMAC LINK System Communications 36
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4-3 Operating Levels 38
4-4 PC Mode at Start-up (C1000H only) 38
4-5 Polling Unit Setting 39
4-6 Setting Network Parameters 40
4-7 Network Parameter Initialization 41
4-8 Active Node Flags 42

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4-1 SYSMAC LINK System Communications

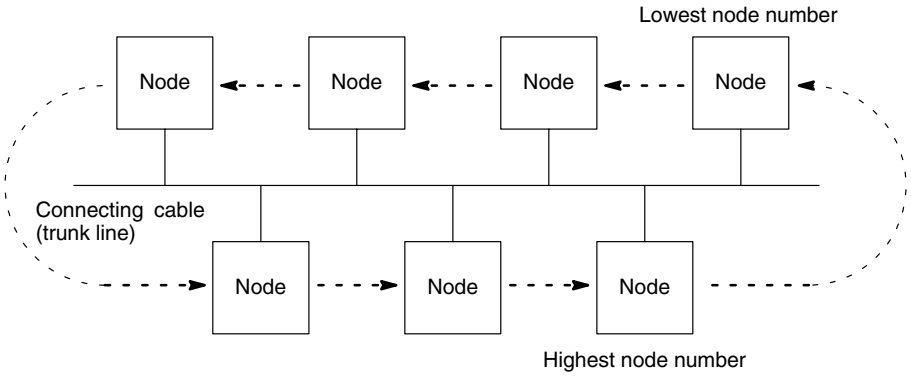
SYSMAC LINK Units communicate through the SYSMAC LINK Network, a token bus LAN. This section describes the **token bus communications** used in the SYSMAC LINK Network.

Token Bus Communications

In token bus communications, individual nodes are connected to a main trunk line as a common bus line, as shown in the figure below.

To avoid having two nodes attempt to transmit simultaneously, only one node has the right to transmit at a time. The Unit with that right is called the **polling unit**. The polling unit is identified by a **token** that is passed in sequence from the node to node, beginning with the node with the lowest node number.

If the token is passed to a node that doesn't have data to transmit, the token is immediately passed to the node with the next higher node number. The node with the highest node number passes the token back to the node with the lowest node number. In this way, each node in the network has its turn to transmit data without interfering with other nodes.



Polling Unit

In a SYSMAC LINK Network there is one node, called the **polling unit**, that controls communications in the network. Normally, the Unit with the lowest node number is the polling unit. If the polling unit happens to fail, the node with the next higher node number becomes the polling unit, preventing the whole network from failing.

Start-up Node

The node that starts the data link in a SYSMAC LINK Network is called the **start-up node**. The data link operates using the settings in the memory area of the PC at the start-up node. With automatic allocation of link words the settings in AR 07 are used, and with manual allocation the common link parameters in the start-up node are used.

The start-up node controls not only data link table generation, but is used to start and stop data link operation. Be sure to designate a Unit or Units participating in the data link as the start-up node(s) to enable this control.

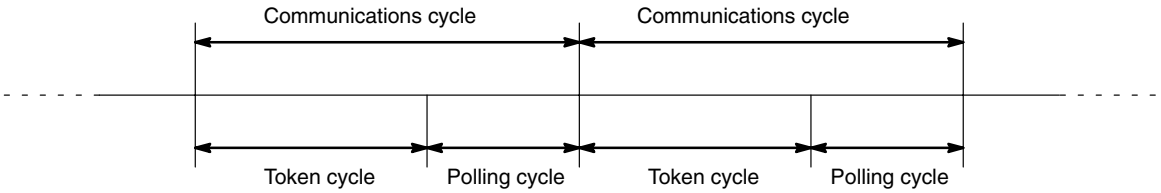
Communications Cycle

The token in a SYSMAC LINK Network is first sent out from the polling unit. The token is then is passed in sequence from the node to node by node number until it is finally returned to the polling unit. One complete circuit around the network is known as a **token cycle**.

At the end of each token cycle, the polling unit polls all of the nodes in the network to check whether any nodes have been added to or removed from the network. The updated information on the network is transmitted to all nodes. This polling and updating process is known as the **polling cycle**.

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When the control cycle is completed, the polling unit once again sends out the token, beginning the next token cycle. Together the token cycle and control cycle make up the communications cycle, and the time required for the communications cycle is known as the **communications cycle time**.



Network Parameters

The communications cycle time is one of the network parameters. The other network parameters are the number of polled units, maximum number of frames, and the maximum node number. These parameters are transmitted from the polling unit to the other nodes in the network. Refer to *4-6 Setting Network Parameters* for details on the network parameters.

Refresh Cycle Time

Data is refreshed between the SYSMAC LINK Unit and the PC's CPU Unit while a data link is active. The PC passes the data for the local words to the SYSMAC LINK Unit and receives the words written by other nodes from the SYSMAC LINK Unit. The time required to refresh the data is called the **refresh cycle time**. The refresh cycle time can be monitored from Peripheral Devices.

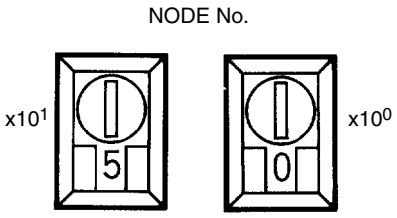
4-2 Setting Node Numbers

In token bus communications used in the SYSMAC LINK Network, the node numbers make a logical ring that the token is passed around. The logical ring of node numbers takes the place of the actual physical ring used in some other networks. Consequently, proper setting of the node numbers is essential to network operations.

Node number switches determine the node number. The left switch sets the tens digit; the right switch sets the ones digit. The node number must be in the range from 01 through 62. Each SYSMAC LINK Unit in a Network must have a unique node number.

Note Always turn the PC's power off before setting a Unit's node number.

Use a small flat-blade screwdriver to set node number switches, being careful not to damage them. The following example shows the node number set to 50.



Note
1. If the node number set on the Unit is outside of the allowed range (01 to 62), a communications error will occur and the red ERC indicator will light on the Unit's display.
2. Each Unit in the network must have a unique node number, so be sure not to use the same number in more than one Unit.

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3. The token is passed from node to node according to node numbers, so the more dispersed the node numbers are, the greater distance the token has to travel. In optical fiber systems, the communications cycle time depends on the distance the token has to travel, so set node numbers according to the nodes positions in the network if possible.
4. When a node number has been changed, activate that node last.

4-3 Operating Levels

Up to 2 Link Units can be mounted on a C-series PC at one time. Link Units include SYSMAC LINK Units, SYSMAC NET Link Units, Host Link Units, and PC Card Unit (C200HX/HG/HE CPU Units only). For details refer to *1-4-2 Compatibility with other Link Units*.

When two Link Units are mounted on one PC, it is necessary to differentiate between the two Networks to which the PC belongs. Units in one Network are assigned to operating level 0; Units in the other Network are assigned to operating level 1. These operating levels only distinguish between the two Networks and do not imply that one Network is operating above or below the other in any functional sense.

Setting Operating Levels

The operating level of all SYSMAC LINK Units (C1000H-SLK11/SLK21-V1 and C200HW-SLK13/14/23/24) is set with pin 3 of DIP switch 1, as shown below.

DIP switch 1, pin 3	Operating level
ON (1)	Operating level 0
OFF (0)	Operating level 1

Note

1. Always turn the PC's power off before setting a Unit's operating level.
2. When mounting a SYSMAC LINK Unit on the same PC with a SYSMAC NET Link Unit, Host Link Unit (Rack-mounting type), or PC Card Unit, be sure they are set to different operating levels.

4-4 PC Mode at Start-up (C1000H only)

This setting is available on the C1000H-SLK11 and C1000H-SLK21-V1 only. The PC mode at start-up can be set to MONITOR if it is not being controlled from the Programming Console of other Peripheral Device that might be connected to the PC.

Setting PC Mode at Start-up

The PC mode at start-up is set with pin 5 of DIP switch 1, as shown in the table below.

Pin 5	Other unit connected	Setting on other unit	PC mode at start-up
ON (1)	None[1]	---	MONITOR
	Programming Console	RUN	RUN
		MONITOR	MONITOR
		PROGRAM	PROGRAM
	Host Link Unit	DIP switch 1, pin 8: ON (1)	See note 2.
	(CPU Unit-mounting type)	DIP switch 1, pin 8: OFF (0)	MONITOR
	Host Link Unit	DIP switch 1, pin 8: ON (1)	MONITOR[3]
	(Backplane-mounting type)	DIP switch 1, pin 8: OFF (0)	MONITOR[3]
	SYSMAC NET Link Unit	DIP switch 3, pin 1: ON (1)	MONITOR[3]
		DIP switch 3, pin 1: OFF (0)	MONITOR[3]
	SYSMAC LINK Unit	DIP switch 1, pin 5: ON (1)	MONITOR[3]
		DIP switch 1, pin 5: OFF (0)	MONITOR[3]
	Other Peripheral Devices[4]	---	MONITOR

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Pin 5	Other unit connected	Setting on other unit	PC mode at start-up
OFF (0)	None[1]	---	RUN
	Programming Console	RUN	RUN
		MONITOR	MONITOR
		PROGRAM	PROGRAM
	Host Link Unit (CPU Unit-mounting type)	DIP switch 1, pin 8: ON (1)	RUN
		DIP switch 1, pin 8: OFF (0)	PROGRAM
	Host Link Unit (Backplane-mounting type)	DIP switch 1, pin 8: ON (1)	MONITOR[3]
		DIP switch 1, pin 8: OFF (0)	RUN[3]
	SYSMAC NET Link Unit	DIP switch 3, pin 1: ON (1)	MONITOR[3]
		DIP switch 3, pin 1: OFF (0)	RUN[3]
	SYSMAC LINK Unit	DIP switch 1, pin 5: ON (1)	MONITOR[3]
		DIP switch 1, pin 5: OFF (0)	RUN[3]
	Other Peripheral Devices[4]	---	PROGRAM

Note

1. None of the Link Units or Peripheral Devices listed in the table.
2. Never make this combination of pin settings.
3. When a Programming Console is also connected, the PC's start-up mode is always controlled by the mode setting on the Programming Console.
4. Other Peripheral Devices include Floppy Disk Interface Units, Printer Interface Units, PROM Writers, and Peripheral Interface Units.
5. Always turn the PC's power off before setting the PC mode at start-up.

4-5 Polling Unit Setting

The polling unit setting is used only when replacing a SYSMAC LINK Unit and is otherwise left set to OFF. Be sure to set the data link tables if data links are being set manually and to change any network parameters in Unit before performing the following procedure.

1, 2, 3...

1. When replacing a SYSMAC LINK Unit, set the Unit as the polling unit and then initialize the Unit by pressing the reset switch or turning on the power.
2. Check the status of the Unit's indicators to see whether the Unit has entered the network normally. The INS indicator should be ON, and the ERC and ERH indicators should be OFF.
3. If the indicators show that the Unit has entered the network normally, set the Unit as a polled Unit and initialize it again.
4. Check the status of the Unit's indicators to see whether the Unit has entered the network normally. The INS indicator should be ON, and the ERC and ERH indicators should be OFF.

If the indicators show that the Unit has entered the network normally again, it is ready to be used in the Network. If the indicators do not show the expected status, check the all switch and software settings and repeat the procedure.

C1000H Units

The polling unit is set with DIP switch 1, pin 8 on the C1000H-SLK11 and C1000H-SLK21-V1 Units, as shown below.

DIP switch 1, pin 8	Polling unit operation
ON (1)	Polled unit
OFF (0)	Polling unit

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C200HW Units

The polling unit is set with DIP switch 2, pin 4 on the C200HW-SLK13/14/23/24 Units, as shown below.

DIP switch 2, pin 4	Polling unit operation
ON (1)	Polled unit
OFF (0)	Polling unit

Note Always turn the PC's power off before changing the polling unit setting

4-6 Setting Network Parameters

The operation of the SYSMAC LINK Network is determined by the network parameters. Network parameters are set with Peripheral Devices such as the SSS/CVSS, and are automatically backed up in EEPROM within the SYSMAC LINK Unit.

The following table shows the network parameters, their default values, and the range within which the parameters can be set by the user. Default values and setting ranges are in decimal.

Network parameter	Default value	Setting range
Communications cycle time	Automatic	5 to 255
Maximum node number	62	2 to 62
Number of polled units per communications cycle	4	1 to 62
Maximum number of frames per communications cycle	10	5 to 255

Communications Cycle Time

This parameter sets a timer that fixes the length of the communications cycle to the specified time. The timer operates only when the data link is in operation. Set the communications cycle time when setting the data link table's common link parameters.

When the timer is in operation, the communications cycle time is fixed at the specified value, independent of the number of events that occur. Refer to *5-10 Data Link Characteristics* for the formula needed to calculate the communications cycle time when the data link is set for automatic generation.

Maximum Node Number

This parameter sets the maximum node number that a node can have and still be a part of the network. Nodes with node numbers greater than the maximum node number will not be polled, and therefore cannot participate in network communications. This eliminates unnecessary polling of units with node numbers above the maximum, and thus reduces the time required for communications.

Note Set the maximum node number above the highest node number set on the SYSMAC LINK Units currently connected.

Number of Polling Units

This parameter determines how many nodes will be polled by the polling unit during a polling cycle. Setting this to a high value increases the communications cycle time, but reduces the time required to recognize that nodes have been removed from or added to the network.

Maximum Number of Frames

This parameter determines how many event transmissions can take place during a token cycle when the data link is operating. With the default value of 10 frames, up to 4 event transmissions can be issued.

Event transmissions include instructions such as SEND(90) or RECV(98) instructions, as well as processes such as remote monitoring and remote programming from a SSS or CVSS.

Setting this parameter to a high value increases the communications cycle time, while setting it to a low value will cause errors because of restrictions on event transmissions when the data link is operating. Increase the number of frames by 3 for each additional event transmission when 5 or more event transmissions will occur while the data link is operating.

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Setting Network Parameters

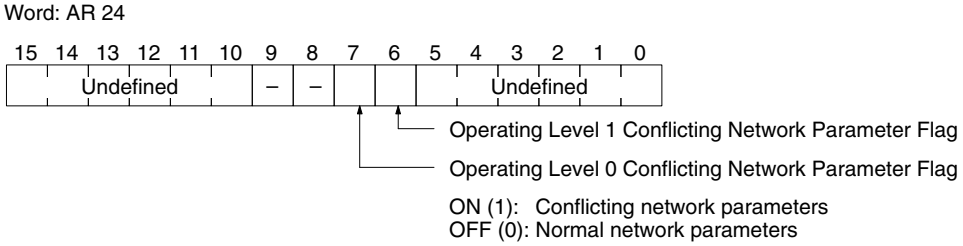
Network parameters are set with Peripheral Devices such as the SSS/CVSS. For details, refer to the Peripheral Device's *Operation Manual*. Set the network parameters after installing the network.

The network parameters must be set after the network has been assembled, and while data links are halted. Network parameters cannot be set while the data link is operating. Once the network parameters has been set, any new Units must be connected only while the System is in operation. A special procedure is required if new Units are connected while System operation is halted. Refer to *Section 9 Inspection and Maintenance* for this procedure.

Note If a Unit is initialized while the network parameters are being set, the network parameters will not be backed up properly and an EEPROM error might occur.

Conflicting Network Parameter

When the network parameters set from the Peripheral Device differ from existing network parameters, a flag is set in the AR area of the PC in the way shown below. The same AR bits are used in all PCs.



4-7 Network Parameter Initialization

The SYSMAC LINK Unit can be set so that the network parameters are initialized when the PC is turned on or the Unit is reset. Network parameters are otherwise not usually initialized unless an error has developed in the network parameters.

C1000H-SLK11/SLK21-V1

If pin 7 of DIP switch 1 is ON, the network parameters will be initialized when the PC is turned on or the C1000H-SLK11/SLK21-V1 is reset.

DIP switch 1, pin 7	Network parameter initialization
ON (1)	Network parameters will be initialized.
OFF (0)	Network parameters will be not be initialized.

C200HW-SLK13/14/23/24

If pin 3 of DIP switch 2 is ON, the network parameters will be initialized when the PC is turned on or the C200HW-SLK13/14/23/24 is reset.

DIP switch 2, pin 3	Network parameter initialization
ON (1)	Network parameters will be initialized.
OFF (0)	Network parameters will be not be initialized.

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4-8 Active Node Flags

The AR Area of the PC contains a record of the nodes that are active in the SYSMAC LINK System at the current time. Words AR 08 to AR 11 contain information on operating level 0, and words AR 12 to AR 15 contain information on operating level 1. These flags are refreshed every cycle while the SYSMAC LINK System is operating.

The body of the following table shows the node number assigned to each bit. If the bit is ON, the node is currently active.

Level 0	Level 1	Bit (body of table shows node numbers)															
		00	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**
AR 08	AR 12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AR 09	AR 13	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
AR 10	AR 14	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
AR 11	AR 15	49	50	51	52	53	54	55	56	57	58	59	60	61	62	*	**

*Communication Controller Error Flag
**EEPROM Error Flag

Note If one of the operating levels is not being used, the words allocated to it for active node flags are available for use in the program as work words.

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SECTION 5
Data Links

The operation of data links, procedures required to establish data links, and methods of monitoring data link operations are explained in this section.

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5-1 Data Link Overview

Data links can be created between the PCs in the same SYSMAC LINK Network to exchange data between the PCs. This data is transferred between interconnected PCs automatically without requiring the use of normal I/O Units.

A region of the LR and/or DM Areas is set aside as the **data link area** in each PC that is in the data link. A part of the data link area is allocated to the local node and the rest is allocated to other nodes. Data can be written to the part of the data link area allocated to the local node only. During data link refreshing, data written in the local node is transferred to those parts of other nodes' data link areas allocated to the local node. The result is that each PC in the data link has a common data link area, the only difference being in the read/write permissions for the various parts of it, i.e., it can write to only those words allocated to it.

Data Link Tables

The data link area in each PC is defined by a **data link table**. Data link tables can be generated automatically or manually. Automatic generation is accomplished simply by setting the value of a single word (AR 07) in the start-up node. Data link tables generated automatically are identical in all PCs in the data link, with the regions of the data areas listed below divided equally among 2, 4, 8, or 16 nodes. The areas used by each PC are listed in the following table.

C200H, C200H□, C1000H/C2000H	CV Series
LR 00 to LR 63	CIO 1000 to CIO 1063
DM 0000 to DM 0127	D00000 to D00127

Manual generation requires generation of a separate data link table for each node, but provides much greater flexibility in making data links among PCs. The following table shows the data areas in which data link tables can be manually generated.

C200H	C200H□	C1000H/C2000H
LR 00 to LR 63	LR 00 to LR 63	LR 00 to LR 63
DM 0000 to DM 0999	DM 0000 to DM 5999	DM 0000 to DM 4095

The maximum number of linked words in a node depends on the SYSMAC LINK Units used in the System, as shown in the following table.

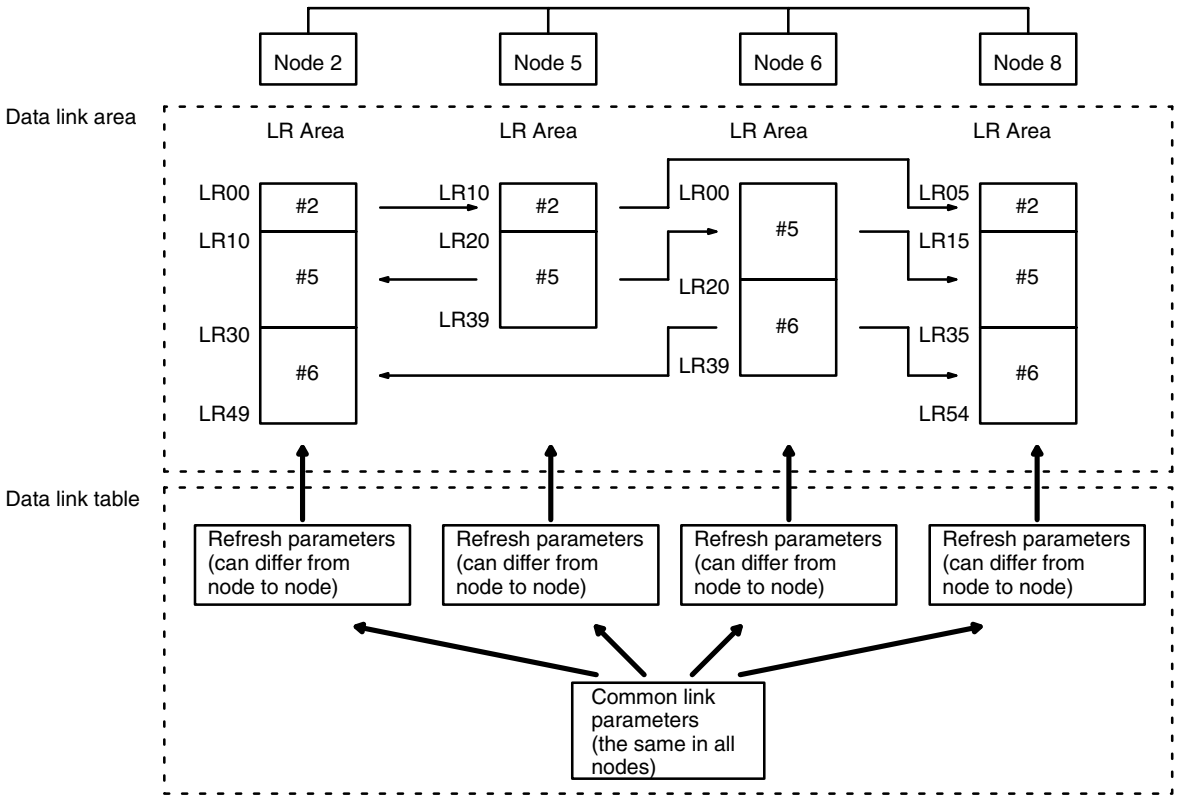
SYSMAC LINK Unit	Max. link words
C200HW-SLK13/23 only	918 words
C200HW-SLK14/24	2,966 words
C1000H-SLK14/24-V1	2,966 words
C200H-SLK11/SLK21-V1	918 words

Note

1. In a system that uses only C200HW-SLK13/23 Units, the maximum number of linked words is 918. If the C200HW-SLK13/23 is used in a system that contains C200HW or C1000H SYSMAC LINK Units, 2,966 words can be linked, but there is a limit on the words that can be accessed by the C200HW-SLK13/23. Refer to *5-6-1* Combining the C200HW-SLK13/23 with other SYSMAC LINK Units.
2. The data link is restricted to a maximum of 918 words whenever one or more C200H-SLK11/SLK21-V1 SYSMAC LINK Units are participating in the link.
3. When the C200HW-SLK14/24 is mounted to the C200H, data links for up to 2,966 words can be set, but only 918 words can be refreshed at the C200H node. There are no restrictions in node address or common link parameters when using the C200HW-SLK14/24.

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The following diagram shows the operation of a data link among four nodes in a network. This data link was generated manually.



Data Link Activation

Data links are activated either by a command sent from a CV-series PC, SSS, or CVSS or by SYSMAC LINK Unit switch settings. (Refer to *Section 2 Unit Components and Switch Settings* for details on hardware switch settings.) When activated, the settings in AR 07 of the PC at the start-up node will determine the nature of the links, i.e., whether the data link tables will be generated automatically or manually.

Data Link Operation

The orange LNK indicator on the front of the SYSMAC LINK Unit indicates the operational status of the data link, as shown below.

LNK indicator	Data link status
ON	The Unit is part of an active data link.
Flashing	A data link error has occurred.
OFF	The Unit is not part of an active data link.

5-2 Creating Data Links

There are two ways to create a data link between PCs, automatically and manually. The value of AR 07 not only determines whether data links will be created automatically or manually. If automatic generation is specified, the value of AR 07 also determines how many nodes will be linked and whether the LR Area, DM Area, or both will be used.

The other way to establish links is to create the link tables from the SSS/CVSS. When the SSS/CVSS is used to create link tables manually, there is far more flexibility in the structure of the data links than with automatic generation.

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Basic specifications for data links are provided in the following table.

Item	Description
No. of data link nodes	62 max., 2 min.
No. of linked words per node	LR area: 64 words max. (128 bytes) DM area: 254 words max. (508 bytes)
Max. number of linked words	2,966 words total in the LR and DM areas (918 words total when only C200HW-SLK13/23 Units are being used.)
Automatically generated data links	Settings in AR 07 determine whether LR 00 to LR 63 and/or DM 0000 to DM 0127 will be used as data link areas, and whether these areas will be divided equally among 2, 4, 8 or 16 nodes.
Manually generated data links	Set from the SSS/CVSS.
Data link table backup	EEPROM inside each SYSMAC LINK Unit

Other Link Systems

When both a SYSMAC LINK System data link and a SYSMAC NET Link System data link exist between two PCs, the words that are linked and the data link status area must not overlap; each System must have unique link words and status areas.

When a SYSMAC LINK Unit and a PC Link Unit are mounted on the same PC, do not use the LR area for a SYSMAC LINK System data link or data link status area.

5-3 Automatic Generation of Data Link Tables

AR 0700 through AR 0703 and AR 0704 through AR 0707 are used to specify both automatic generation and data link table structure, as shown below. The status of these bits is effective only in the PC at the start-up node.

The data in the first table is used to designate whether word allocation will be automatic (according to these AR bits) or whether it will be set manually (from a SSS/CVSS), and to designate which areas will be linked. The data in the second table is used to designate the number of words per node. If manual generation (the first setting in the first table) is used, the settings in the second table are ignored.

Operating level 0		Operating level 1		Setting	
AR 0700	AR 0701	AR 0704	AR 0705		
OFF	OFF	OFF	OFF	Manual generation	
ON	OFF	ON	OFF	Automatic generation	LR area only
OFF	ON	OFF	ON		DM area only
ON	ON	ON	ON		LR and DM areas

Words per Node

Operating level 0		Operating level 1		Words per node		Nodes in data link
AR 0702	AR 0703	AR 0706	AR 0707	LR area	DM area	
OFF	OFF	OFF	OFF	4	8	Up to 16
ON	OFF	ON	OFF	8	16	Up to 8
OFF	ON	OFF	ON	16	32	Up to 4
ON	ON	ON	ON	32	64	2

These settings are read every cycle while the SYSMAC LINK System is in operation.

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Allocated Words

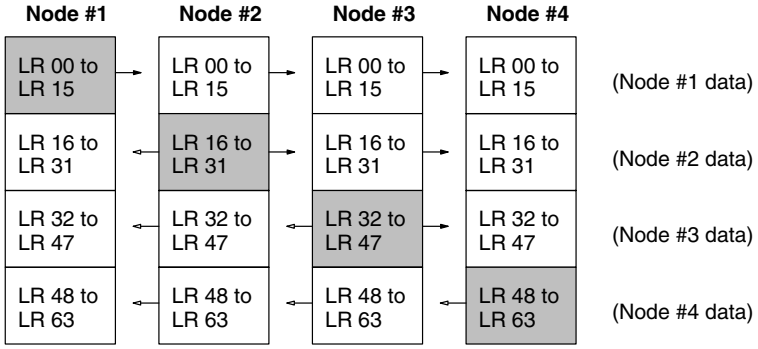
If automatic generation is specified by bits AR 0700/0701 or AR 0704/0705, the words allocated to each Unit are determined by the node number of the Unit and the Words per Node settings in the AR word shown above. Words are allocated as shown in the following table.

LR words*	DM words*	Words per node			
		4	8	16	32
00 to 03	0000 to 0007	Node #1	Node #1	Node #1	Node #1
04 to 07	0008 to 0015	Node #2			
08 to 11	0016 to 0023	Node #3	Node #2		
12 to 15	0024 to 0031	Node #4			
16 to 19	0032 to 0039	Node #5	Node #3	Node #2	
20 to 23	0040 to 0047	Node #6			
24 to 27	0048 to 0055	Node #7	Node #4		
28 to 31	0056 to 0063	Node #8			
32 to 35	0064 to 0071	Node #9	Node #5	Node #3	Node #2
36 to 39	0072 to 0079	Node #10			
40 to 43	0080 to 0087	Node #11	Node #6		
44 to 47	0088 to 0095	Node #12			
48 to 51	0096 to 0103	Node #13	Node #7	Node #4	
52 to 55	0104 to 0111	Node #14			
56 to 59	0112 to 0119	Node #15	Node #8		
60 to 63	0120 to 0127	Node #16			

Note *When combining CV-series PCs in data links with C-series PCs, LR 00 to LR 63 in C-series PCs correspond to CIO 1000 to CIO 1063 in CV-series PCs and DM 0000 to DM 0127 correspond to D00000 to D00127.

Data Flow

This example shows data flow resulting from automatic generation with four PCs exchanging 16 LR words each. The data link table information in AR 07 of the start-up node, indicates that only the LR Area will be used and it will be divided into 4 parts; this information is transmitted to all nodes. The AR 07 settings in other nodes are ignored. Shading indicates the words written and transmitted by each PC; non-shaded words are those received from other PCs.

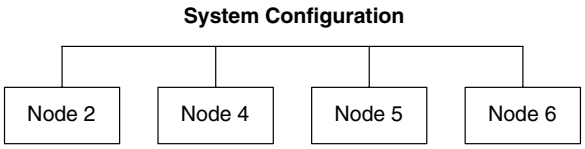


Data Link Area Refresh

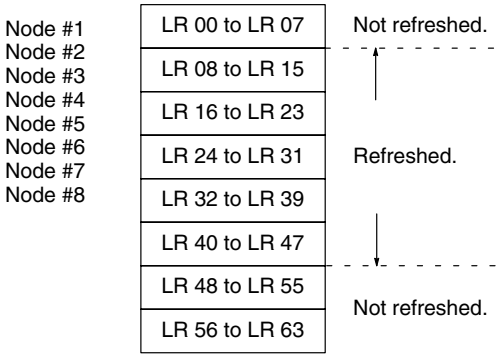
Data links are refreshed for all nodes between the lowest-numbered and the highest-numbered node designated to participate in the data link. Link words automatically allocated to nodes assigned numbers lower than the lowest-number participating node or higher than the highest-number participating node can be used as work words. Words allocated to a node number between the lowest and highest-numbered nodes cannot be used as work words even if there isn't a node with that node number.

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The example below shows a configuration consisting of four nodes that have been set to link 8 words per node in the LR area only. Of the eight possible nodes, only nodes #2, #4, #5, and #6 are actually in the System. Words normally allocated to nodes #1, #7, and #8 can therefore be used as work words, but words normally allocated to node #3 cannot, because they are refreshed by the System.



Refreshing for the above System will be as shown below:



5-4 Manual Generation of Data Link Tables

The CVSS is required to specify data link tables manually. Generating data link tables manually allows considerable flexibility in data links. Each PC can be set up independently to link to the desired PCs only.

To designate manual generation of data link tables, AR 0700 and AR 0701, or AR 0704 and AR 0705 (depending on the operating level) must be all turned OFF in the start-up node. The structure and operation of data link tables are described in this manual. Refer to the *CVSS Operation Manuals* for specific procedures and displays used in setting the tables.

Data link tables contain two types of information: common link parameters, which are the same in all nodes and control the overall structure of the data links, and refresh parameters, which are set independently for each node to determine which links are to be established for that node.

Common Link Parameters

Common link parameters determine the communications cycle time of the data link, which areas will be enabled for data links, and how many LR and DM words will be transmitted from each PC. The same common link parameters must be set in all nodes that are to be part of a data link in a Network. The displays used to input the common link parameters are shown following the table.

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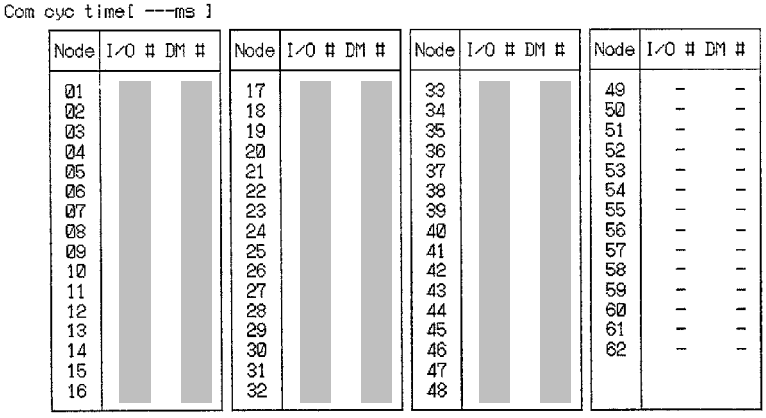
It is possible to transfer the common link parameters from the node to which the CVSS is connected to all the nodes designated by the CVSS.

Parameter	Description
Communications cycle time	The data link communications time between 5 and 255 ms. The communications cycle time will be self-generating if not specified.
No. of nodes in data link and their node numbers	This information is set automatically when the No. of LR words and No. of DM words parameters (see below) are entered.
No. of LR words* transmitted by each node	The number of LR words transmitted by each node 1 to 64: 1 to 64 words -: Not part of data link 0: Can read LR words from other nodes only.
No. of DM words* transmitted by each node	The number of DM words transmitted by each node 1 to 254: 1 to 254 words -: Not part of data link 0: Can read DM words from other nodes only.

Note

1. *When combining CV-series PCs in data links with C-series PCs, LR 00 to LR 63 in the C-series PCs correspond to CIO 1000 to CIO 1063 in the CV-series PCs and DM 0000 to DM 0127 correspond to D00000 to D00127.
2. When combining C1000H-SLK11/SLK21-V1 or C200HW-SLK14/24 Units with C200HW-SLK13/23 Units, all of the C200HW-SLK13/23 Units in the data link must be within the last 918 words in the data link area.

CVSS



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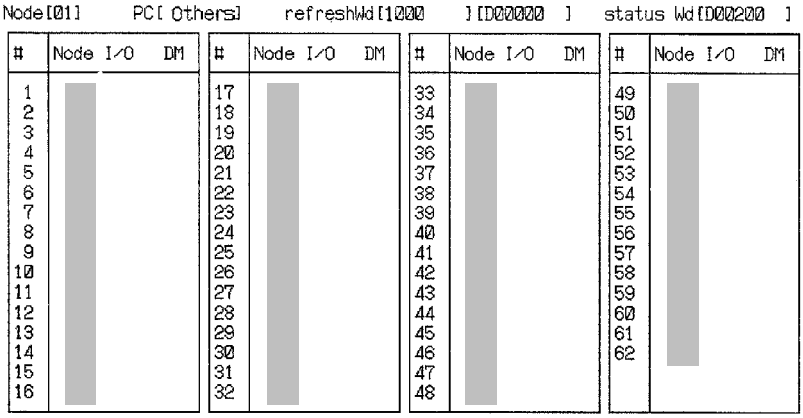
Refresh Parameters

Refresh parameters are set for each node to determine what links will actually be created for that node, i.e., the words whose contents will be automatically transferred from other nodes. Enter the link words in the LR and DM Areas for the local node as well as all of the nodes that the local node will link to.

Parameter	Description
PC model	Enter the model number of the PC at the local node (the node for which the refresh parameters are being set).
Node number	Enter the node numbers of the local node and nodes that the local node will link to. Nodes not set (set to "-") in the Common Link Parameters cannot be specified here.
No. of words per node	Indicates the number of LR and DM words in the data link for each node designated above. (Same as the "No. of LR words" and "No. of DM words" in the Common Link Parameters.)
Beginning status word	Sets the beginning word of the region in memory that will contain the Data Link Status Flags for the nodes in the data link. Refer to *5-9 Data Link Status* for details.
Beginning LR word	Sets the first word of the data link area in the LR Area (between 0 and 63).
Beginning DM word	Sets the first word of the data link area in the DM area. 0 to 999 for the C200H 0 to 5999 for the C200HX, C200HG, C200HE, or C200HS 0 to 4095 for the C1000H/C2000H

Note Refer to the *CVSS Operation Manual* for details on editing and setting data link tables.

CVSS



Note Refer to the following when creating a data link table with the CVSS in a SYSMAC LINK network that includes CV- and C-series PCs.

- The PC setting in the refresh parameter table of each C-series PC must be set to "Others."
- LR 00 to LR 63 of the C-series PC's LR area correspond to the CV-series PC's CIO 1000 to CIO 1063.

Table Backup

Data link tables are automatically backed up in the EEPROM of the Unit involved. Previously set data link tables are completely overwritten whenever new tables are created. If a Unit is turned off or re-initialized while the data link table is being set, the table might not be backed up properly.

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5-5 Data Link Table Examples

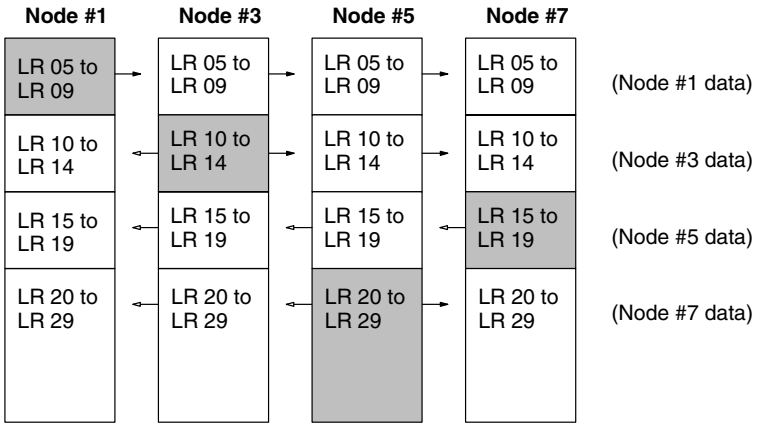
Three examples of manually generated data links are presented in this section. In the first, identical data link tables are set up in all nodes. In the second, a different data link table is set up in each node. In the third, data links are set up in two separate groups of PCs.

5-5-1 Identical Data Link Tables

To generate the same data link tables in all PCs in the Network, set the same refresh parameters for each node. Although refresh parameters must be set for each node, the copy function in the computer can copy a node's refresh parameters and greatly simplify the generation of the data link.

The data flow for an example configuration is shown below.

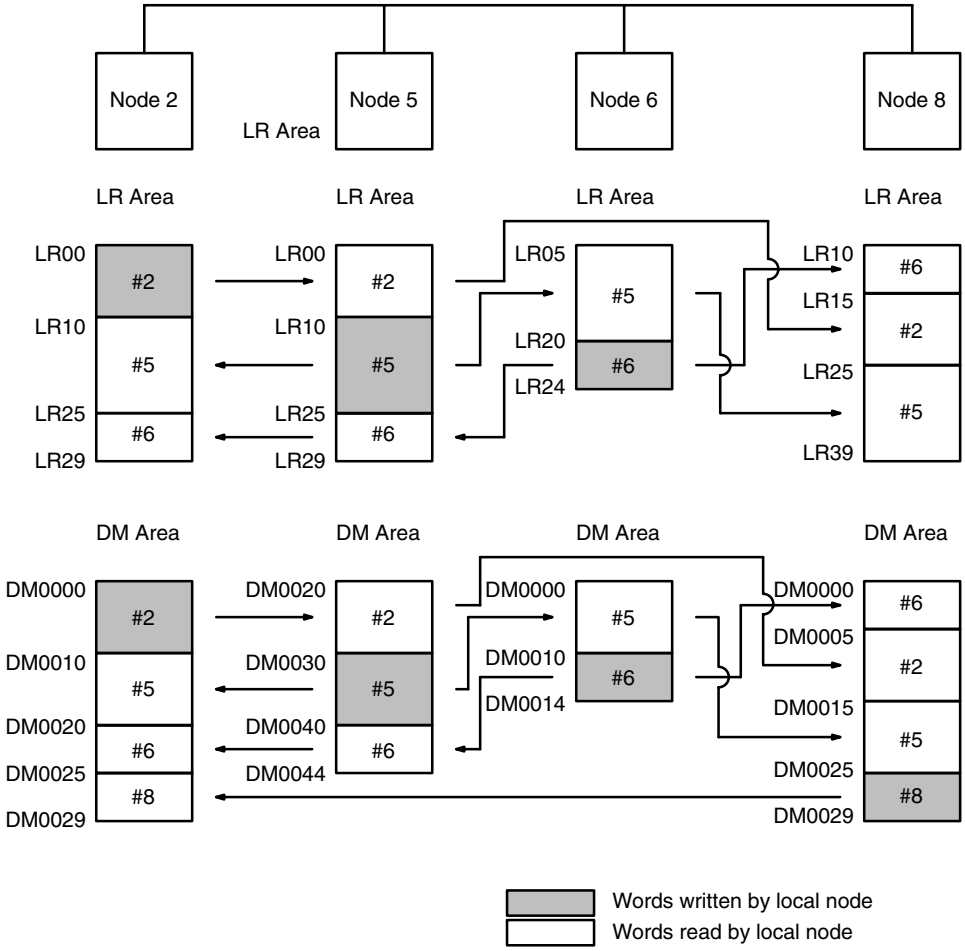
Data Flow



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5-5-2 Different Data Link Tables

In this example, the refresh parameters differ from node to node, so the data link tables will also differ from node to node. There are four nodes in the network (2, 5, 6, and 8), but some nodes will not receive data from others. The settings for the common link and refresh parameters are shown after the data flow.



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Common Link Parameters

These parameters are set from a SSS/CVSS, and need to be set only once for a SYSMAC LINK Network. Enter the communications cycle time and the number of DM and LR Area link words for each node in the data link, as shown below. (Setting the number of LR Area link words to zero for node 8 means that node 8 will be able to receive but not send data.)

With manual data link table generation, the number of link words sent from each node can be set in 1 word increments.

Com cyc time[---ms]

Node	I/O #	DM #	Node	I/O #	DM #	Node	I/O #	DM #	Node	I/O #	DM #
01	-	-	17	-	-	33	-	-	49	-	-
02	10	10	18	-	-	34	-	-	50	-	-
03	-	-	19	-	-	35	-	-	51	-	-
04	-	-	20	-	-	36	-	-	52	-	-
05	15	10	21	-	-	37	-	-	53	-	-
06	5	5	22	-	-	38	-	-	54	-	-
07	-	-	23	-	-	39	-	-	55	-	-
08	0	5	24	-	-	40	-	-	56	-	-
09	-	-	25	-	-	41	-	-	57	-	-
10	-	-	26	-	-	42	-	-	58	-	-
11	-	-	27	-	-	43	-	-	59	-	-
12	-	-	28	-	-	44	-	-	60	-	-
13	-	-	29	-	-	45	-	-	61	-	-
14	-	-	30	-	-	46	-	-	62	-	-
15	-	-	31	-	-	47	-	-			
16	-	-	32	-	-	48	-	-			

Refresh Parameters

These parameters are also set from a SSS/CVSS, and need to be set separately for each node in the data link. Enter the PC model, beginning LR and DM words, and beginning status word, then set the number of LR and DM link words for the local node each node that the local node will link to.

The number of LR and DM words set for each node in the common link parameters will be allocated to nodes automatically in the order that they have been entered into the refresh parameters table. Link word allocation starts at the beginning LR and DM words. The order of nodes in the refresh parameters table can be changed freely.

Node #2

In node 2, the data link area will be allocated to nodes 2, 5, 6, and 8 in that order, so the node 2 refresh parameters are set as shown below.

Node[01] PC[CV-ser] refreshWd[0000][D00000] status Wd[D00200]

#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM
1	02	10	10	17				33				49			
2	05	15	10	18				34				50			
3	06	5	5	19				35				51			
4	08	0	5	20				36				52			
5				21				37				53			
6				22				38				54			
7				23				39				55			
8				24				40				56			
9				25				41				57			
10				26				42				58			
11				27				43				59			
12				28				44				60			
13				29				45				61			
14				30				46				62			
15				31				47							
16				32				48							

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Node #5

In node 5, the data link area will be allocated to nodes 2, 5, and 6 in that order, so the node 5 refresh parameters are set as shown below. DM Area allocation is set to begin at DM 0020. (Node 8 data will not be received at node 5, so node 8 is not entered in the table.)

Node[01] PC[CV-ser] refreshWd[0000][D00000] status Wd[D00200]

#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM
1	02	10	10	17				33				49			
2	05	15	10	18				34				50			
3	06	5	5	19				35				51			
4				20				36				52			
5				21				37				53			
6				22				38				54			
7				23				39				55			
8				24				40				56			
9				25				41				57			
10				26				42				58			
11				27				43				59			
12				28				44				60			
13				29				45				61			
14				30				46				62			
15				31				47							
16				32				48							

Node #6

In node 6, the data link area will be allocated to nodes 5 and 6 in that order, so the node 6 refresh parameters are set as shown below. LR Area allocation is set to begin at LR 05. (Data from nodes 2 and 8 will not be received at node 6, so they are not entered in the table.)

Node[01] PC[CV-ser] refreshWd[0000][D00000] status Wd[D00200]

#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM
1	05	15	10	17				33				49			
2	06	5	5	18				34				50			
3				19				35				51			
4				20				36				52			
5				21				37				53			
6				22				38				54			
7				23				39				55			
8				24				40				56			
9				25				41				57			
10				26				42				58			
11				27				43				59			
12				28				44				60			
13				29				45				61			
14				30				46				62			
15				31				47							
16				32				48							

Node #8

In node 8, the data link area will be allocated to nodes 6, 2, 5, and 8 in that order, so the node 5 refresh parameters are set as shown below. LR Area allocation is set to begin at LR 10.

Node[01] PC[CV-ser] refreshWd[0000][D00000] status Wd[D00200]

#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM	#	Node	I/O	DM
1	02	10	10	17				33				49			
2	05	15	10	18				34				50			
3	06	5	5	19				35				51			
4	08	0	5	20				36				52			
5				21				37				53			
6				22				38				54			
7				23				39				55			
8				24				40				56			
9				25				41				57			
10				26				42				58			
11				27				43				59			
12				28				44				60			
13				29				45				61			
14				30				46				62			
15				31				47							
16				32				48							

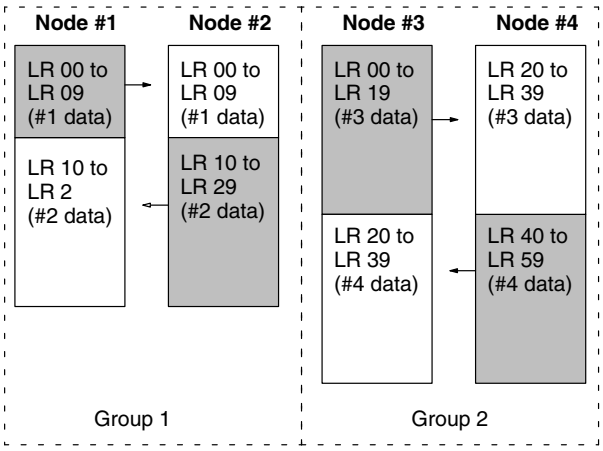
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5-5-3 Multiple Data Link Groups

The refresh parameters can be set up to simulate two or more groups of data links within one Network. Although the common link parameters must designate all the words to be transmitted by all nodes that are part of a data link, the refresh parameters can be set up so the PCs in the Network are separated into groups of PCs that only receive data from other PCs in the same group.

Although data is refreshed only within data link groups, all groups in one Network are always started and stopped together. The data flow for this System is shown below.

Data Flow



5-6 Restrictions on C200HW-SLK13/14/23/24 Data Link Areas

5-6-1 Combining the C200HW-SLK13/23 with other SYSMAC LINK Units

Manually generated data link areas can contain up to 2,966 words with C1000H-SLK11/SLK21-V1 or C200HW-SLK14/24 SYSMAC LINK Units but only 918 words max. with C200HW-SLK13/23 SYSMAC LINK Units, so the following conditions must be met in the common parameter table when the data link contains both C200HW-SLK13/23 and other SYSMAC LINK Units.

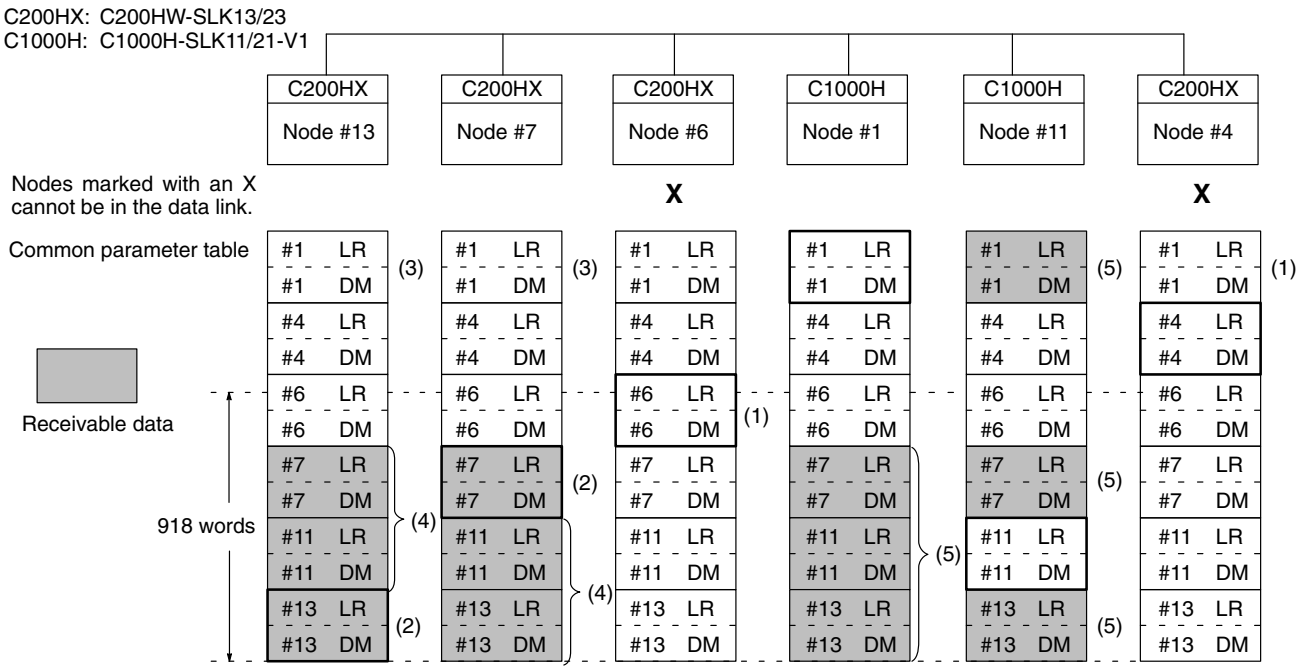
- Add the total number of words used by the nodes in the data link area (LR area + DM area) beginning with the node with the highest node number; all of the C200HW-SLK13/23 Units in the data link must be within the last 918 words in the data link area.
- The order in which the nodes are connected isn't important.
- Even when the C200HW-SLK13/23 Units only receive data from other nodes, they must be within the last 918 words in the data link area, because the maximum amount of data that can be received by C200HW-SLK13/23 Units is the last 918 words in the data link area.
- C1000H-SLK11/SLK21-V1 and C200HW-SLK14/24 SYSMAC LINK Units can use up to 2,966 words.

Note The simplest method to put the C200HW-SLK13/23 SYSMAC LINK Units within the last 918 words in the data link area is to increase their node numbers and place them at the end of the data link, but the following problems occur if the node numbers are raised:

- The data link communications cycle is longer because it is necessary to increase the maximum node number. (Refer to *page 64* for details.)
- It takes longer to recognize the withdrawal or addition of nodes in the network.

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Case 1



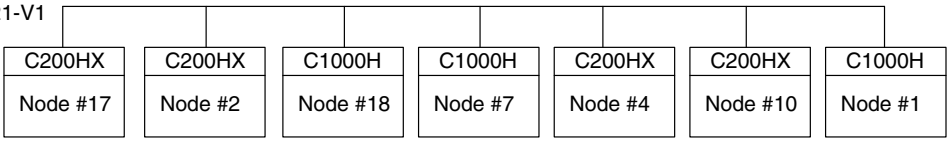
1, 2, 3...

1. The C200HW-SLK13/23 SYSMAC LINK Units with node numbers 4 and 6 cannot be in the data link because the local nodes' total transmission data would exceed 918 words (counting from the highest node number) if those nodes were in the data link. The SYSMAC LINK Units with node numbers 1 and 11 can be in the data link even if the total amount of data exceeds 918 words because they are C1000H-SLK11/SLK21-V1 Units.
2. The C200HW-SLK13/23 SYSMAC LINK Units with node numbers 7 and 13 can be in the data link because the local nodes' total transmission data does not exceed 918 words (counting from the highest node number).
3. The Units with node numbers 7 and 13 cannot receive data from node 1 because that node's data is beyond the 918-word limit.
4. The Units with node numbers 7 and 13 can receive data from nodes 7, 11, and 13 because these nodes' data is within the 918-word limit.
5. The Units with node numbers 1 and 11 can receive data from nodes 1, 7, 11, and 13. (These nodes can receive up to 2966 words.)

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Case 2

C200HX: C200HW-SLK13/23
C1000H: C1000H-SLK11/21-V1



Nodes marked with an X cannot be in the data link.

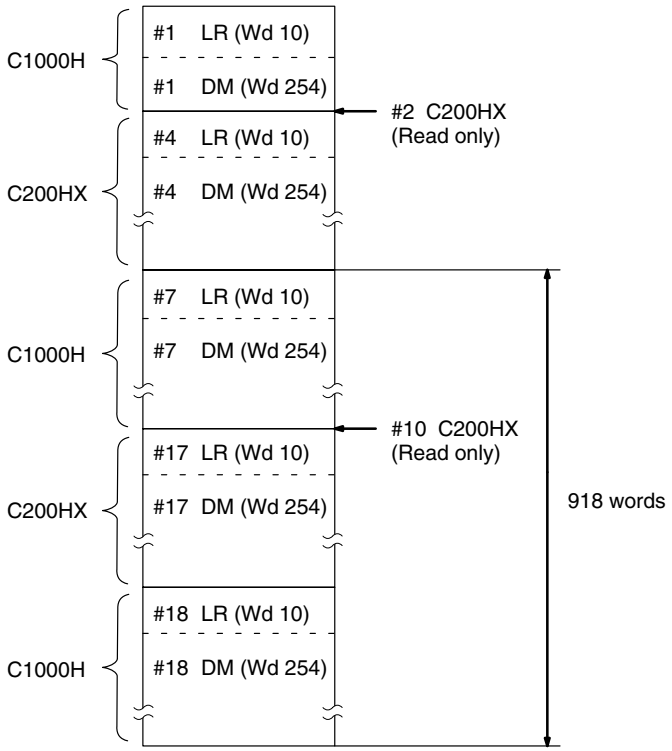
X X

Common Link Parameter Table

Com cyc time[---ms]

Node	I/O #	DM #	Node	I/O #	DM #	Node	I/O #	DM #	Node	I/O #	DM #
01	10	254	17	10	254	33	–	–	49	–	–
02	0	0	18	10	254	34	–	–	50	–	–
03	–	–	19	–	–	35	–	–	51	–	–
04	10	254	20	–	–	36	–	–	52	–	–
05	–	–	21	–	–	37	–	–	53	–	–
06	–	–	22	–	–	38	–	–	54	–	–
07	10	254	23	–	–	39	–	–	55	–	–
08	–	–	24	–	–	40	–	–	56	–	–
09	–	–	25	–	–	41	–	–	57	–	–
10	0	0	26	–	–	42	–	–	58	–	–
11	–	–	27	–	–	43	–	–	59	–	–
12	–	–	28	–	–	44	–	–	60	–	–
13	–	–	29	–	–	45	–	–	61	–	–
14	–	–	30	–	–	46	–	–	62	–	–
15	–	–	31	–	–	47	–	–			
16	–	–	32	–	–	48	–	–			

Data Link Area

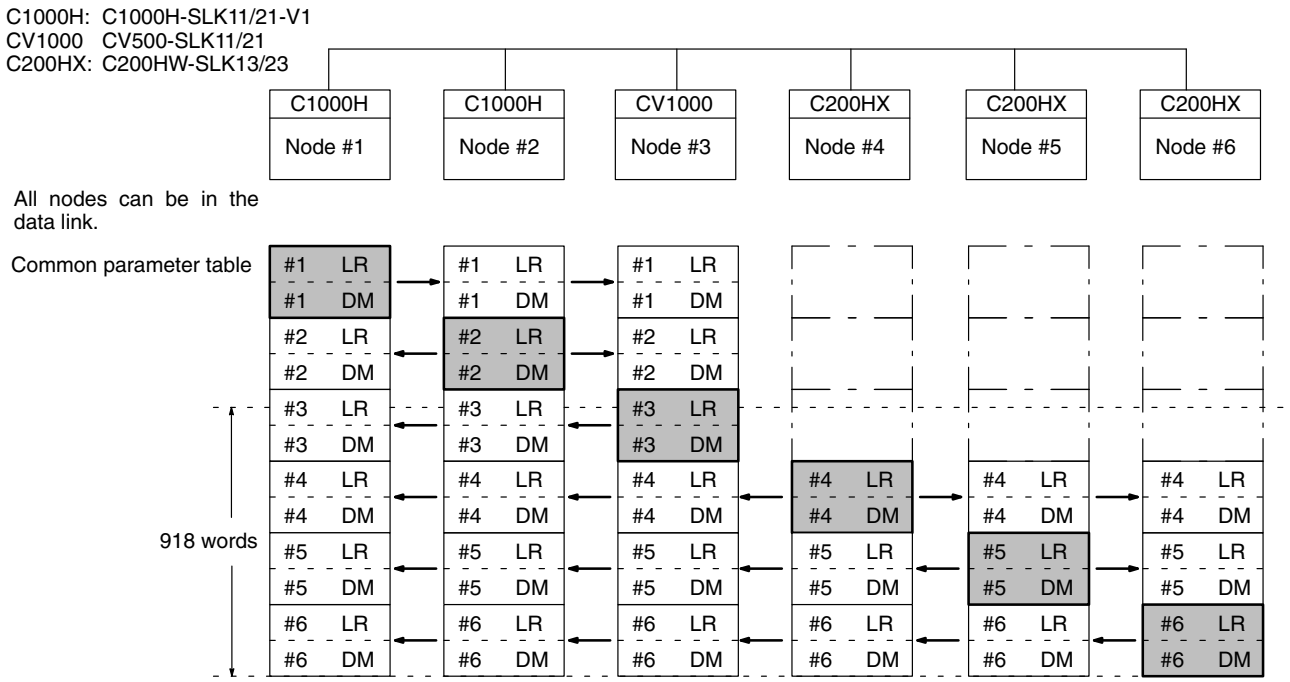


In this example the Units with node numbers 1, 7, 10, 17, and 18 can be part of the data link. Even though it is a read-only node and doesn't have transmission data, the C200HX with node number 2 cannot be part of the data link because its reception data would exceed 918 words.

The Units with node numbers 10 and 17 cannot receive data from node 1 because that node's data is beyond the 918-word limit, however the C1000H-SLK11/SLK21-V1 Units with node numbers 1, 7 and 18 can receive data from nodes 1, 7, 17, and 18.

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Case 3



In this example node numbers 1 through 6 can all be in the data link.

The C200HW-SLK13/23 Units with node numbers 4 through 6 can be in the data link because the local nodes' transmission data is within the 918-word limit.

The Units with node numbers 1 through 3 can receive data from all 6 nodes because they have a 2966-word limit.

The C200HW-SLK13/23 Units with node numbers 4 through 6 can receive data from the other nodes with node numbers 4 through 6.

5-6-2 Installing C200HW-SLK14/24 SYSMAC LINK Units on C200H PCs

When a C200HW-SLK14/24 SYSMAC LINK Unit is installed on a C200H PC, a data link with up to 2966 linked words can be made, but the maximum number of words that can be refreshed in a C200H node is 918. There are no restrictions on the node number settings or common link parameter settings when C200HW-SLK14/24 SYSMAC LINK Units are used.

5-7 Controlling Data Links

Data links can be activated or halted by changing the settings of the DIP switches on the start-up Unit, sending a command to the start-up Unit from a CV-series PC, SSS, or CVSS.

5-7-1 DIP Switch Settings

Data links can be started by turning ON pin 2 of DIP switch 1 of the SYSMAC LINK Unit that is to be used as the start-up Unit. This Unit (node) must be part of the data link. The AR settings in the start-up Unit will be used in creating data links.

Data link operation can be stopped by turning OFF pin 2 of DIP switch 1 on all nodes which are active in data link.

Note The PC must be turned off before changing DIP switch settings.

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5-7-2 DATA LINK START/HALT Commands

Data link operations can be initiated by issuing a DATA LINK START command from a CV-series PC or CVSS to the start-up node.

Data link operation can be stopped by issuing a DATA LINK HALT command from a CV-series PC or CVSS to the start-up node.

Refer to *6-6-1 DATA LINK START* and *6-6-2 DATA LINK HALT* for details.

5-8 Data Link Precautions

Be sure to consider the precautions listed below when activating a data link or adding a node to an existing data link.

Set-up and Activation

Be sure to consider the precautions listed below when setting up and activating a data link.

1, 2, 3...

1. Refresh parameters must be set for each node in the data link when manually generating data link tables. When a data link is started in a node that doesn't have a data link table, a data link table error will occur and the LNK indicator on that node will flash.

   Refresh parameters must be set for all nodes that are included in the common link parameters in the start-up node.
2. With automatic generation of data link tables, the start-up node must be one of the nodes in the data link defined by the settings in AR 07. The node numbers of the other nodes in the data link must also be in the range defined by the settings in AR 07.

   For example, if the settings in AR 07 divide the data link area among 4 nodes (node numbers 1 to 4), node 5 cannot be the start-up node or participate in the data link.
3. With manual generation of data link tables, the node number of the local node must be included in the local refresh parameters.
4. If the beginning LR or DM word in the refresh parameters is set too high, the LR or DM Area will be exceeded during automatic allocation of link words.

   If the data area is exceeded in the start-up node, the LNK indicator on the start-up node will flash and the data link will not operate. If the data area is exceeded in another node, the LNK indicator on that node will flash and it will not participate in the data link.
5. Do not turn on the data link activation switch (DIP switch 1, pin 2) on more than one node. Doing so will not trigger an error, but the start-up node cannot be correctly determined.

Adding Nodes

Be sure to consider the precautions listed below when adding a node to an operating data link.

1, 2, 3...

1. The node number of the node being added must be in the common link parameters of the operating data link.
2. If the start-up node of the operating data link is using manual generation of data link tables, the node being added must have its refresh parameters set.
3. If the start-up node of the operating data link is using automatic generation of data link tables, the common link parameters of the node being added must match those of the operating data link, or it cannot be a part of data link operations.

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5-9 Data Link Status

The operational status of the data links in operating levels 0 and 1 is indicated in the data link operating flags. SR 25202 is turned ON when a data link is active in operating level 0 and SR 25205 is turned ON when a data link is active in operating level 1. These flags and corresponding SR bits are shown below.

SR bit	Flag
25202	Operating Level 0 Data Link Operating Flag
25205	Operating Level 1 Data Link Operating Flag

Node Status

In addition to the overall operational status of the data link, the status of any node involved in data link operations can be checked from any other node included in data link operations. The Data Link Status Flags are contained in SR 238 to SR 245 when data link tables are generated automatically. The user selects the location of the data link status flags in the refresh parameters when data link tables are generated manually.

Note

1. If the Data Link Operating Flag for the local node is OFF, the data link status will remain the same as the status right before the data link was stopped. Therefore, there is no guarantee that other status information will be correct. When using the data link status, make sure that the Data Link Operating Flag for the local node is ON.
2. The Data Link Operating Flag for other nodes and PC Operating Flags are used to confirm that the system has been properly started. These flags alone cannot be used to detect communications errors. To detect communications errors, use the Communications Error Flag and PC Error Flag. The operation of each flag is described in the following table.

Flag	Flag operation
Data Link Operating Flag for local node	ON when the local node is participating in the data links. When this flag is OFF, data link communications will not be performed properly., and there is no guarantee that other status information is correct.
PC Operating Flag	ON when the PC in the node is operating. This flag operates according to data sent from the remote node and is thus valid only when the Communications Error Flag is OFF.
PC Error Flag	ON when an error (fatal error or watchdog timer error) has occurred in the PC. This flag operates according to data sent from the remote node and is thus valid only when the Communications Error Flag is OFF.
Communications Error Flag	ON when data link data is not received continually from the subject node due to a disconnection or other cause. The flag will turn OFF when data is received properly from the remote node.
Data Link Operating Flag for other nodes	ON after the remote node properly participates in the data links. The flag will remain ON even after the remote node ends participation in the data links.

Programming Example

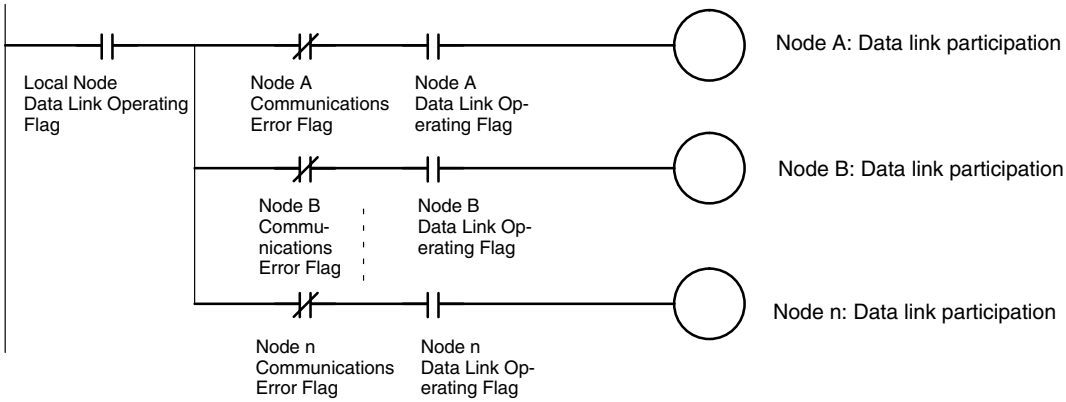
Programming examples using data link status are shown below for the C200H, C200HS, and C200HX/C200HG/C200HE.

Checking Data Link Participation of Other Nodes

As shown below, use an AND condition of a NO input of the Data Link Operating

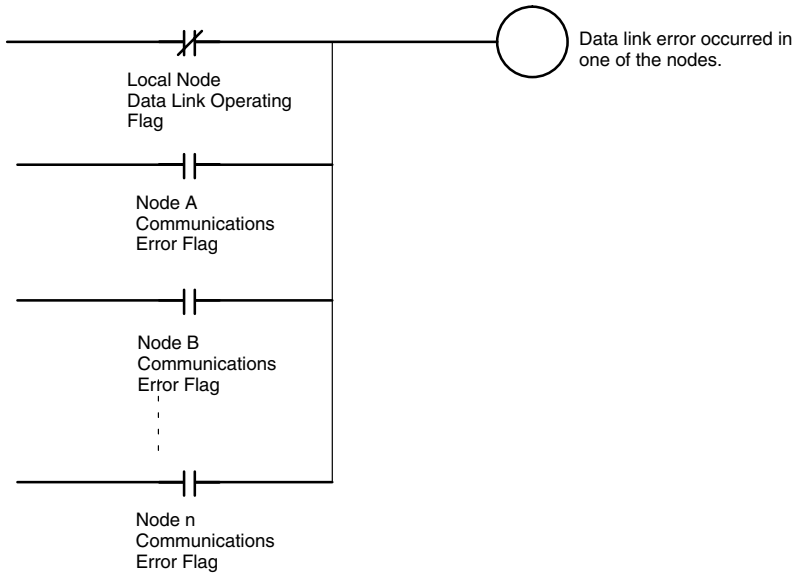
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Flag for the local node, a NC input of the Communications Error Flag for each node, and a NO input of the Data Link Operating Flag for each node.



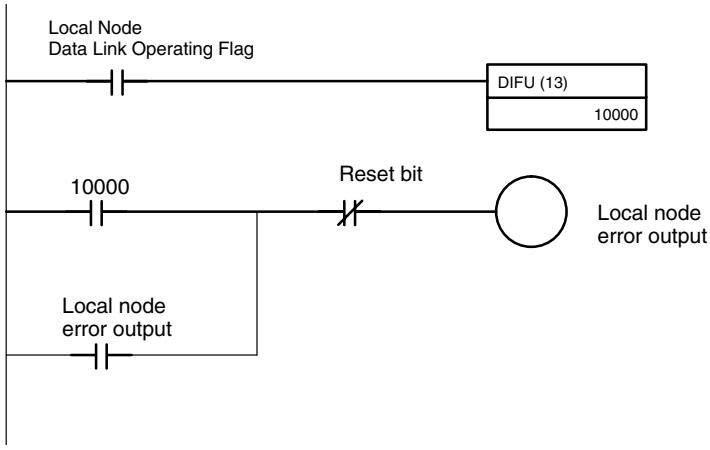
Checking for Data Link Errors any Node

As shown below, use an OR condition of a NC input of the Data Link Operating Flag for the local node and NO inputs of the Communications Error Flags of the other nodes.



Outputting a Local Node Error

The following programming can be used to output an error signal when local node data link operation stops.



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5-9-1 Automatic Data Link Table Generation

When data link tables are generated automatically, data link status is output to SR 238 through SR 241 for the operating-level-0 data link. And to SR 242 through SR 245 for the operating-level-1 data link.

Level 0	Level 1	Bits			
		00 to 03	04 to 07	08 to 11	12 to 15
SR 238	SR 242	Node 1	Node 2	Node 3	Node 4
SR 239	SR 243	Node 5	Node 6	Node 7	Node 8
SR 240	SR 244	Node 9	Node 10	Node 11	Node 12
SR 241	SR 245	Node 13	Node 14	Node 15	Node 16

Each of the above sets of four bits contains the four flags indicating data link status for a node, as shown below.

Bits	Flag	Function
00, 04, 08, or 12	PC Mode*	Turned ON to indicate the PC is in RUN or MONITOR mode. OFF indicates PROGRAM mode.
01, 05, 09, or 13	PC Fatal Error*	Turned ON to indicate the PC has stopped because of a fatal error.
02, 06, 10, or 14	Communications Error	Turned ON to indicate that there is a communications error (time out), that the Unit is not part of the System, or that the data link is not active.
03, 07, 11, or 15	Data Link Status	Turned ON to indicate the node is part of the data link. OFF indicates that the data link tables of the start-up node do not match, or no operation is possible because the data link table has not been created.

Note *The PC Mode and PC Fatal Error Flags are not valid when a communications error has occurred.

Any of the above bits that are not used by the System (i.e., those bits assigned to node numbers beyond the possible range) can be used for work bits.

5-9-2 Manual Data Link Table Generation

When data link tables are generated manually, data link status is output to consecutive words starting with the beginning status word designated in the refresh parameters. Data status is only available for the nodes designated in the refresh parameters, i.e., the nodes from which link data is being received. In the following table “m” is the beginning status word.

Word	Bits			
	00 to 03	04 to 07	08 to 11	12 to 15
m	Link no. 1	Link no. 2	Link no. 3	Link no. 4
m+1	Link no. 5	Link no. 6	Link no. 7	Link no. 8
m+2	Link no. 9	Link no. 10	Link no. 11	Link no. 12
m+3	Link no. 13	Link no. 14	Link no. 15	Link no. 16
⋮	⋮	⋮	⋮	⋮
m+14	Link no. 57	Link no. 58	Link no. 59	Link no. 60
m+15	Link no. 61	Link no. 62		

The actual link status table will be only as long as required to store the status of each node for which there is a link (see *Example*, below. Each of the above sets of four bits operates as shown below.

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Each of the above sets of four bits contains the four flags indicating data link status for a node, as shown below.

Bits	Flag	Function
00, 04, 08, or 12	PC Mode*	Turned ON to indicate the PC is in RUN or MONITOR mode. OFF indicates PROGRAM mode.
01, 05, 09, or 13	PC Fatal Error*	Turned ON to indicate the PC has stopped because of a fatal error.
02, 06, 10, or 14	Communications Error	Turned ON to indicate that there is a communications error (time out), that the Unit is not part of the System, or that the data link is not active.
03, 07, 11, or 15	Data Link Status	Turned ON to indicate the node is part of the data link. OFF indicates that the data link tables of the start-up node do not match, or no operation is possible because the data link table has not been created.

Note
1. *The PC Mode and PC Fatal Error Flags are not valid when a communications error has occurred.
2. This status must not overlap other areas which may be in use (for example, the data link area, SEND(90)/RECV(98) area, or areas used by the other Network).

Example

This example illustrates the location of data link status flags for a 10-node data link with the following parameters. These are the only words that will be used.

Refreshed nodes	1, 2, 3, 4, 10, 15, 20, 28, 55, 62
Beginning status word	DM 0120

Word	Bits			
	00 to 03	04 to 07	08 to 11	12 to 15
DM 0120	Node 1	Node 2	Node 3	Node 4
DM 0121	Node 10	Node 15	Node 20	Node 28
DM 0122	Node 55	Node 62	(Not used.)	(Not used.)

Status Areas

The following memory areas can be used to store the status data. Be sure to allow enough words after the beginning status word so that the entire link status area fits within the same data area.

Area	C200H□	C200H	C1000H	C2000H
IR and SR	0 to 252, 300 to 511	0 to 252	0 to 252	0 to 252
LR	0 to 63	0 to 63	0 to 63	0 to 63
HR	0 to 99	0 to 99	0 to 99	0 to 99
AR	0 to 27	0 to 27	0 to 27	0 to 27
T/C	0 to 511	0 to 511	0 to 511	0 to 511
DM	0 to 5999	0 to 999	0 to 4095	0 to 4095

Note The C200H□ PCs include the C200HX, C200HG, C200HE, and C200HS.

5-10 Data Link Characteristics

5-10-1 Data Link Communications Cycle Time

Data link servicing is given priority in SYSMAC LINK Systems. The communications time for a data link can thus be maintained as a constant, regardless of whether or not SEND(90)/RECV(98) are used. Fixing the data link communications time at a constant value fixes the data link I/O response time as well.

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The communications cycle time can be set either automatically (the default) or controlled externally.

Automatic Generation

When data link tables have been generated automatically, the communications time will be as follows for systems using coaxial cable:

No. of nodes	Data link area		
	LR and DM Areas	LR Area only	DM Area only
2	19 ms	17 ms	18 ms
4	19 ms	17 ms	18 ms
8	19 ms	18 ms	18 ms
16	19 ms	18 ms	19 ms

The communications time will be as follows for systems using optical fiber cable.

No. of nodes	Data link area		
	LR and DM Areas	LR Area only	DM Area only
2	21 ms	20 ms	21 ms
4	22 ms	20 ms	21 ms
8	22 ms	21 ms	21 ms
16	22 ms	21 ms	22 ms

Manual Generation

When data link tables have been generated manually, the communications cycle time can be set to a constant value or generated automatically.

The communications cycle time can be set as a constant from 5 to 255 ms in increments of 1 ms via the SSS/CVSS to eliminate variations caused by noise or other factors. When the communications cycle time is not set as a constant, it will be generated automatically according to the equations below. Round the result of the calculation to the nearest millisecond.

Communications cycle time (coaxial cable systems) =
Maximum node number × 85 μs + maximum number of frames × 654 μs
+ number of polled units × 750 μs + number of Link Units × 56 μs
+ total number of words × 10 μs + 1.322 ms

Communications cycle time (optical fiber cable systems) =
maximum node number × 111.5 μs + maximum number of frames × 770 μs
+ number of polled units × 750 μs + number of Link Units × 56 μs
+ total number of words × 10 μs + 1.322 ms

Note The present and maximum values of the communications cycle time can be monitored from a SSS/CVSS.

3.Example Calculations

The examples below calculate the communications cycle time for both coaxial and optical fiber cable with the following characteristics:

Maximum node number: 62
Maximum number of frames: . . 10
Number of polled units: 4
Number of Link Units 32
Total number of words 2000

Communications cycle time (coaxial cable systems) =
62 × 85 μs + 10 × 654 μs + 4 × 750 μs + 32 × 56 μs + 2000 × 10 μs + 1.322 ms
= 37.924 ms (38 ms after rounding)

Communications cycle time (optical fiber cable systems) =
62 × 111.5 μs + 10 × 770 μs + 4 × 750 μs + 32 × 56 μs + 2000 × 10 μs + 1.322 ms
= 40.727 ms (41 ms after rounding)

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Note Data links might not operate correctly if the communications cycle time is set to a value shorter than that generated automatically by the system.

Changing the Communications Cycle Time

When the communications cycle time is generated automatically, it can be changed by changing the other network parameters at the SSS/CVSS. The default values and setting ranges of the other network parameters are shown in the table below.

Network parameter	Default value	Setting range
Maximum node number	62	2 to 62
Number of polled units	4	1 to 62
Maximum number of frames	10	5 to 255

Use the following formulae to calculate the change in the communications cycle time that results from a change in other network parameters. A positive result indicates the communications cycle time has been decreased and a negative result indicates it has been increased. Round the result of the calculation to the nearest millisecond.

Change of the communications cycle time (coaxial cable systems) =
(old maximum node number - new maximum node number) × 85 μs
+ (old maximum number of frames - new maximum number of frames) × 654 μs
+ (old number of polled units - new number of polled units) × 750 μs

Change of the communications cycle time (optical fiber cable systems) =
(old maximum node number - new maximum node number) × 111.5 μs
+ (old maximum number of frames - new maximum number of frames) × 770 μs
+ (old number of polled units - new number of polled units) × 750 μs

Example Calculations

The examples below calculate the change of the communications cycle time for both coaxial and optical fiber cable when the other network parameters are changed as shown below:

Maximum node number: . . . . . Changed from 62 to 16
Maximum number of frames: . . Changed from 10 to 13
Number of polled units: . . . . . Changed from 4 to 5

Change of the communications cycle time (coaxial cable systems) =
(62 – 16) × 85 μs + (10 – 13) × 654 μs + (4 – 5) × 750 μs =
1.198 ms (1 ms after rounding)

Change of the communications cycle time (optical fiber cable systems) =
(62 – 16) × 111.5 μs + (10 – 13) × 770 μs + (4 – 5) × 750 μs =
2.069 ms (2 ms after rounding)

Note

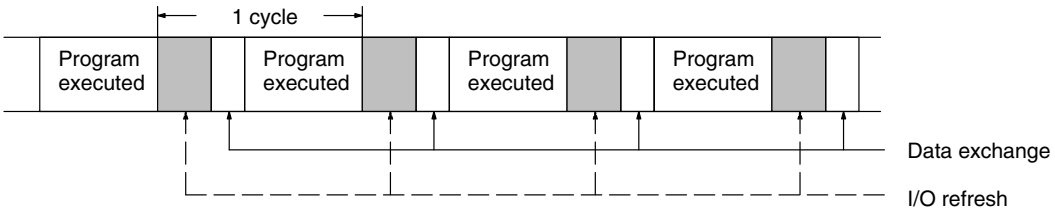
1. If the maximum node number is set below the node number of any nodes in the data link, those nodes will no longer be part of the data link.
2. If the maximum number of frames is set too low, errors might occur during execution of events such as SEND(90) and RECV(98) instructions, inter-node echo tests, and remote monitoring.
3. Lowering the number of polled units will increase the delay between resetting a Unit or turning on its PC's power and its entrance into the network.

5-10-2 Data Exchange Timing

Data exchange takes place at the end of the cycle during CPU Unit servicing for the SYSMAC LINK Unit, as indicated by the shaded areas in the diagrams. Data exchange is limited to maximum of 1,642 words per cycle.

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The timing relationship between program execution and the exchange of data between the PC and the SYSMAC LINK Unit's buffer memory is illustrated in the diagram below.



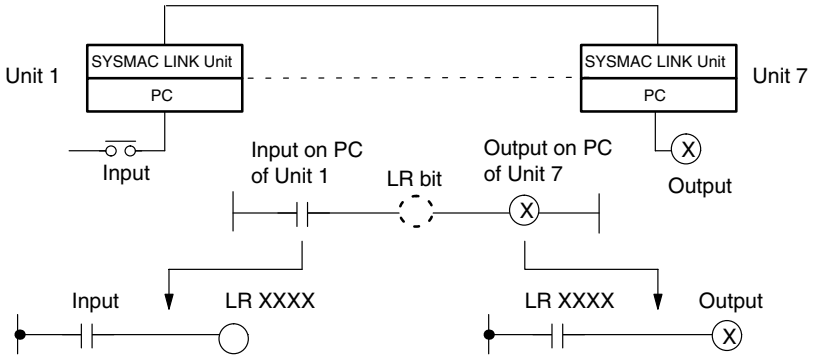
Note Data exchange is not synchronized with data link processing.

5-10-3 Data Link I/O Response Time

The data link I/O response time is the time it takes for data to be transferred to another node via the data link and output after it is input to the local node. In this section, example calculations of the minimum and maximum data link I/O response time are provided. The following system configuration is used in both calculations (just one SYSMAC LINK Unit is mounted on each PC):

System Configuration

Cable type: . . . . . Coaxial
Maximum node number: 62
Number of Link Units 8
Number of LR words . . . . . 8 words/node
Number of DM words . . . . . 16 words/node
Maximum number of frames: . . 10
Number of polled units: 4



The data link I/O response time depends on the communications cycle time, input ON delay, output ON delay, and the cycle times of the PCs involved. The values are detailed below.

Communications Cycle Time The communications cycle time is calculated in the manner described in *5-10-1 Data LInk Communications Cycle Time*.

Communications cycle time =
$62 \times 85\ \mu s + 10 \times 654\ \mu s + 4 \times 750\ \mu s + 8 \times 56\ \mu s + 24 \times 10\ \mu s + 1.322$ ms
= 18.500 ms (19 ms after rounding)

Input ON Delay The input ON delay is the time it takes for an input device to turn ON an input to the PC after receiving an input signal. In this system the input ON delay is 1.5 ms.

Output ON Delay The output ON delay is the time it takes for an output device to turn ON an output signal after receiving an output from the PC. In this system the output ON delay is 15 ms.

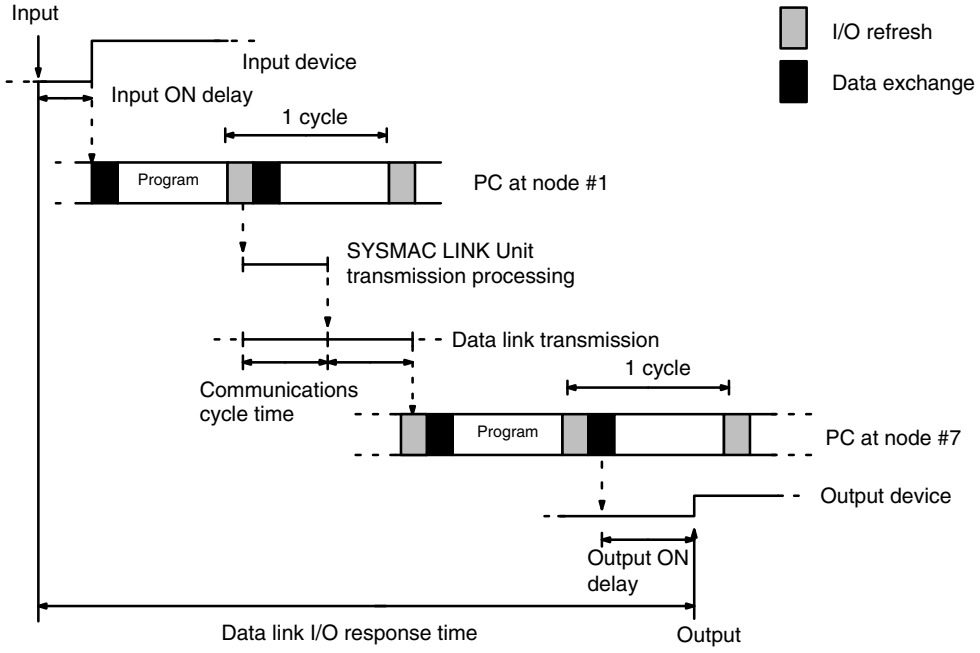
Node #1 PC Cycle Time The cycle time of the PC at node #1 is 20 ms or 15 ms.

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Node #7 PC Cycle Time The cycle time of the PC at node #7 is 50 ms or 15 ms.

Minimum Response Time

The following diagram illustrates the data flow that will produce the minimum response time, i.e., the time required if all signals and data transmissions are processed as soon as they occur.



The equation for minimum data link I/O response time is as follows:

Response time =
input ON delay (0 ms) + cycle time of PC at node #0 (20 ms)
+ communications cycle time (19 ms) × 2 + cycle time of PC at node #7 (50 ms)
+ output ON delay (0 ms)
= 108 ms

Note Noise may increase I/O delays.

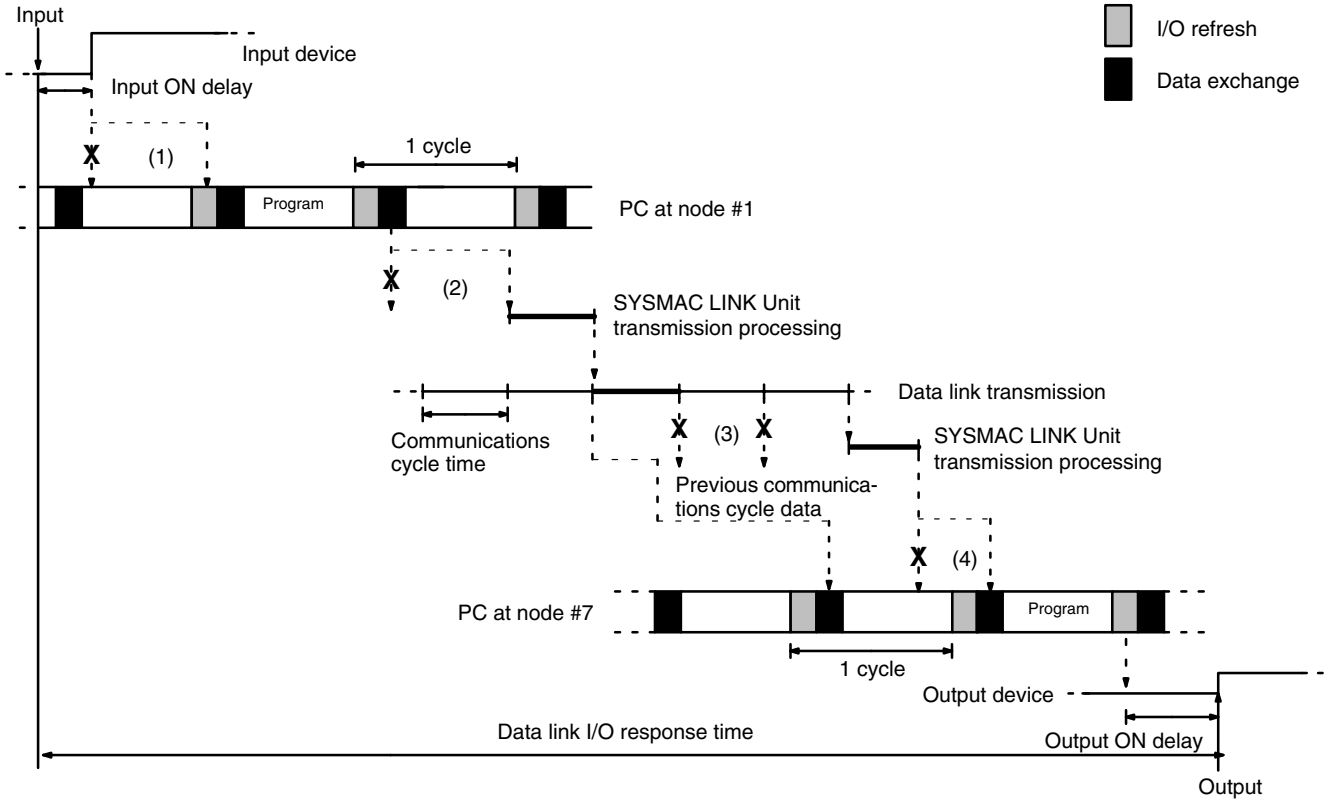
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Maximum Response Time

The maximum data link I/O response time is calculated for four cases.

Case 1

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PC at nodes #1 and 7 are greater than the communications cycle time.



There are four points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1, 2, 3...

1. The input arrives in the PC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PC.
2. Data exchange occurs just after the PC at node #1 passes the token that makes it the polling unit, causing a delay of up to one communications cycle time before the data is transferred in data link processing.
3. At node #7, data from the previous data exchange is still being transferred, causing a delay of up to one cycle before the input is read into the PC.
4. The data transferred in data link processing arrives at the PC at node #7 after data exchange, so the data will not be read into the PC until the next data exchange, causing a delay of up to one cycle.

   Up to 1,642 words can be transferred in a single data exchange, so a delay of another cycle will occur if more than 1,642 words are being transferred.

The equation for maximum data link I/O response time is as follows:
Response time =
input ON delay (1.5 ms) + cycle time of PC at node #1 (20 ms) × 2
+ communications cycle time (19 ms) × 3 + PC cycle time at node #7 (50 ms) × 3*
+ output ON delay (15 ms) = 263.5 ms*

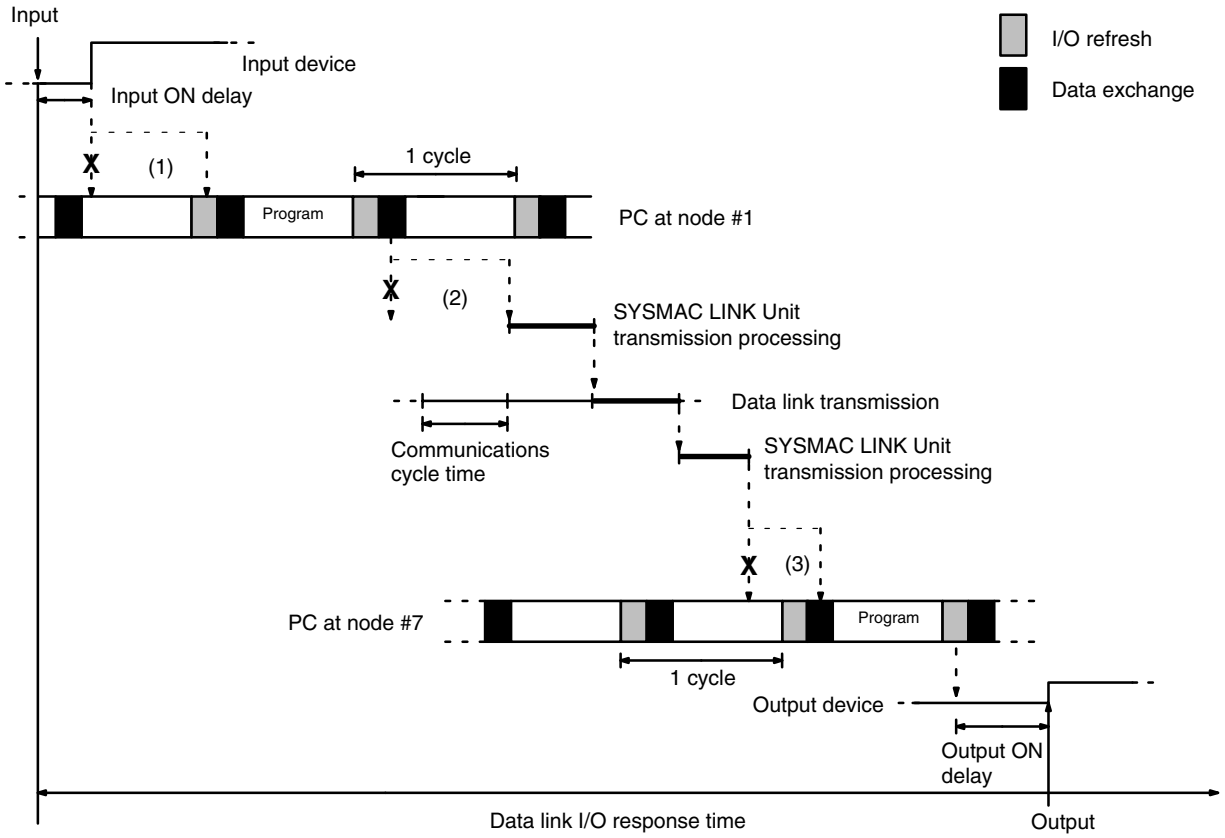
Note

1. *If more than 1,642 words are being transferred, 4 cycles of the PC at node #7 are required and the total response time becomes 313.5 ms.
2. Noise may increase I/O delays.

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Case 2

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PC at node #1 ≧ the communications cycle time and the cycle time of the PC at node #7 < the communications cycle time.



There are three points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1, 2, 3...

1. The input arrives in the PC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PC.
2. Data exchange occurs just after the PC at node #1 passes the token that makes it the polling unit, causing a delay of up to one communications cycle time before the data is transferred in data link processing.
3. The data transferred in data link processing arrives at the PC at node #7 after data exchange, so the data will not be read into the PC until the next data exchange, causing a delay of up to one cycle.

   Up to 1,642 words can be transferred in a single data exchange, so a delay of another cycle will occur if more than 1,642 words are being transferred.

The equation for maximum data link I/O response time is as follows:

Response time =
input ON delay (1.5 ms) + cycle time of PC at node #1 (20 ms) × 2
+ communications cycle time (19 ms) × 3 + PC cycle time at node #7 (15 ms) × 2*
+ output ON delay (15 ms)
= 143.5 ms*

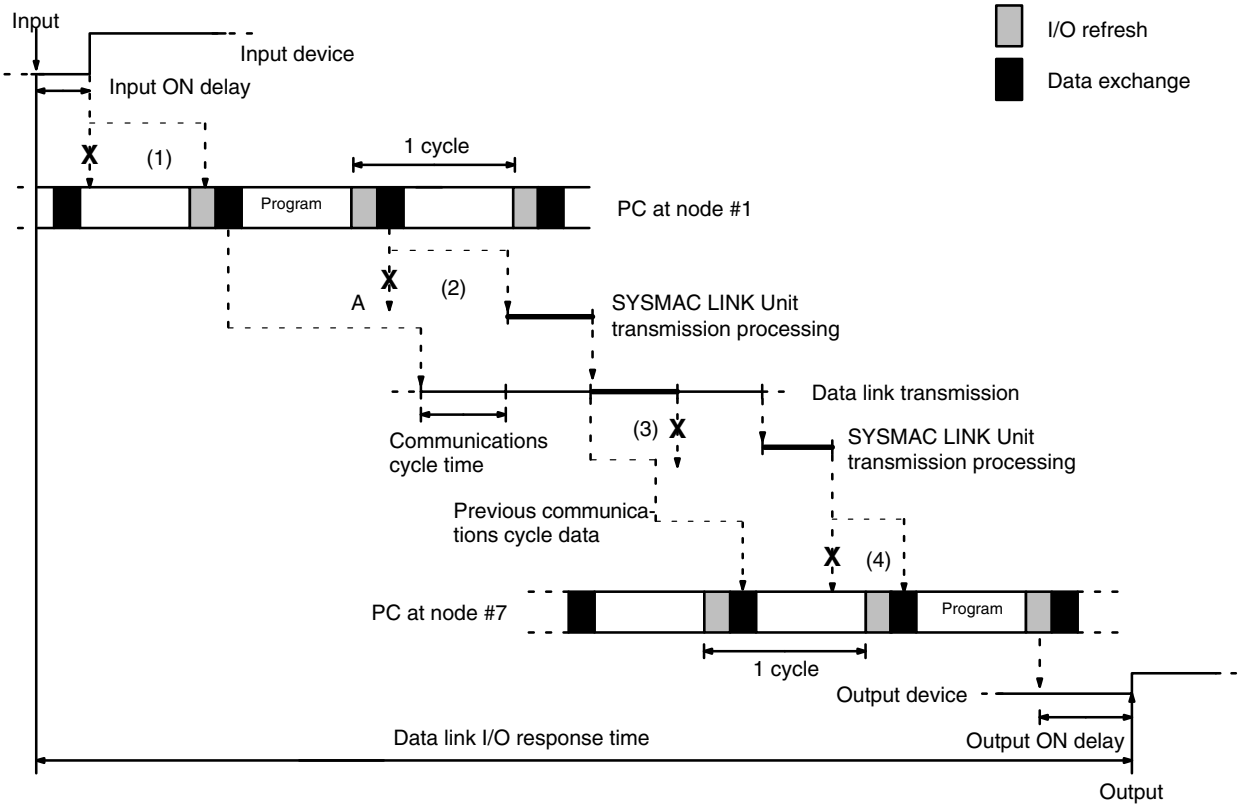
Note

1. *If more than 1,642 words are being transferred, 3 cycles of the PC at node #7 are required and the total response time becomes 158.5 ms.
2. Noise may increase I/O delays.

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Case 3

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PC at node #1 < the communications cycle time and the cycle time of the PC at node #7 ≧ the communications cycle time.



There are three points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1, 2, 3...

1. The input arrives in the PC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PC.
2. At point A, data from the previous exchange is still being transferred, so new data cannot be exchanged, causing a delay of one communications cycle time. Furthermore, the data exchange then occurs just after the PC at node #1 passes the token for the polling unit, causing another delay of one communications cycle time before the data is transferred in data link processing.
3. At node #7, data from the previous data exchange is still being transferred, causing a delay of up to one cycle before the input is read into the PC.
4. The data transferred in data link processing arrives at the PC at node #7 after data exchange, so the data will not be read into the PC until the next data exchange, causing a delay of up to one cycle.

   Up to 1,642 words can be transferred in a single data exchange, so a delay of another cycle will occur if more than 1,642 words are being transferred.

The equation for maximum data link I/O response time is as follows:

Response time =
input ON delay (1.5 ms) + cycle time of PC at node #1 (15 ms) × 2
+ communications cycle time (19 ms) × 3 + PC cycle time at node #7 (50 ms) × 3*
+ output ON delay (15 ms) = 253.5 ms*

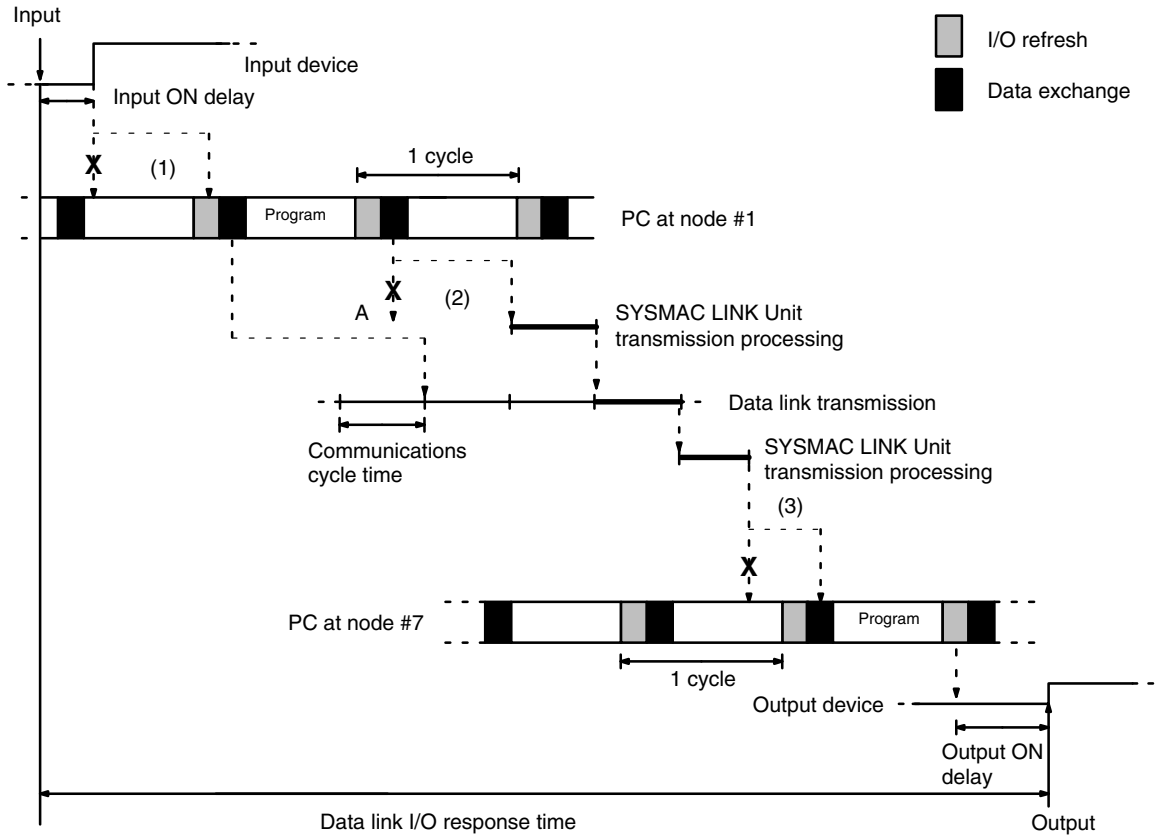
Note

1. *If more than 1,642 words are being transferred, 4 cycles of the PC at node #7 are required and the total response time becomes 303.5 ms.
2. Noise may increase I/O delays.

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Case 4

The following diagram illustrates the data flow that will produce the maximum data link I/O response time when the cycle time of the PC at node #1 < the communications cycle time and the cycle time of the PC at node #7 < the communications cycle time.



There are three points shown in the diagram above where processing is delayed, increasing the data link I/O response time.

1, 2, 3...

1. The input arrives in the PC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PC.
2. At point A data from the previous data exchange is still being transferred, so the new data cannot be exchanged, causing a delay of up to one communications cycle time. Furthermore, the data exchange then occurs just after the PC at node #1 passes the token that makes it the polling unit, causing another delay of up to one communications cycle time before the data is transferred in data link processing.
3. The data transferred in data link processing arrives at the PC at node #7 while data exchange is taking place, so the data will not be read into the PC until the next data exchange, causing a delay of up to one cycle.

   Up to 1,642 words can be transferred in a single data exchange, so a delay of another cycle will occur if more than 1,642 words are being transferred.

The equation for maximum data link I/O response time is as follows:

Response time =
input ON delay (1.5 ms) + cycle time of PC at node #1 (15 ms) × 2
+ communications cycle time (19 ms) × 3 + PC cycle time at node #7 (15 ms) × 2*
+ output ON delay (15 ms) = 133.5 ms*

Note

1. *If more than 1,642 words are being transferred, 3 cycles of the PC at node #7 are required and the total response time becomes 148.5 ms.
2. Noise may increase I/O delays.

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SECTION 6
Data Read/Write Services

The data read/write services include the SEND(90) and RECV(98) instructions and CV-mode commands. SYSMAC LINK Units can receive but not transmit CV-mode commands. The data read/write services allow data transmission between nodes and distributed control.

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6-1 About Data Read/Write Services

In addition to SEND(90) and RECV(98) instructions, a C-series PC equipped with a SYSMAC LINK Unit* can receive but not issue CV-mode commands. With these data read/write services, data can be transmitted between PCs and CVSS or CV-series PCs in the network and operation at other nodes can be controlled remotely.

The data read/write services use a command/response format. Each time that data or a command from a CVSS or CV-series PC is transmitted, the receiving node returns a response. If responses aren't needed, the Unit can be set so that responses are not returned. The same transmission can be broadcast simultaneously to all nodes on the network.

Note *The SYSMAC LINK Units covered in this manual can receive and process the CV-mode commands issued from a computer or CV-series PC, but the C200H-SLK21 and C1000H-SLK21 SYSMAC LINK Units cannot receive CV-mode commands.

Data Read/Write Service Transmissions

The data read/write services with the SYSMAC LINK Unit are primarily used in the 4 situations described below.

Computer Transmission Prepare a program in the computer that transmits commands and receives responses. Should the SYSMAC LINK Support Board be used, make sure that the proper drivers and files are installed. (When programming in the C code, transmit commands with `slksend` and receive responses with `slkrecv` or `slkrcvw`.)

PC Transmission Transfer data using the SEND(90) and RECV(98) instructions. You may need to move data being transferred to/from the location in memory specified in the instruction, but the actual transmission and reception is handled automatically. (No commands can be transmitted other than SEND(90) and RECV(98).)

Computer Reception A program that returns proper responses for received commands must be prepared in the computer prior to command reception.

PC Reception The SYSMAC LINK Unit receives and processes SEND(90), RECV(98), and CV-mode commands and returns the proper responses automatically. Since all of the processing is handled automatically, it isn't necessary to prepare a routine for command reception in the PC program.

6-2 NETWORK READ/WRITE Instructions

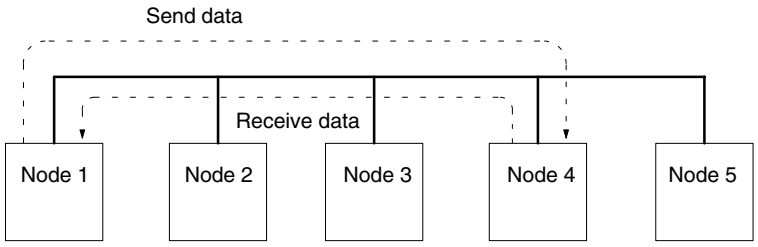
Data is sent from the PC to other nodes (PCs or computers) using the NETWORK READ/WRITE instructions (SEND(90) or RECV(98)) in the PC user program.

6-2-1 Specifying Destination Nodes

The following two types of communications, based on specifying destination nodes, are possible.

Sending and Receiving Data Between Specific Nodes

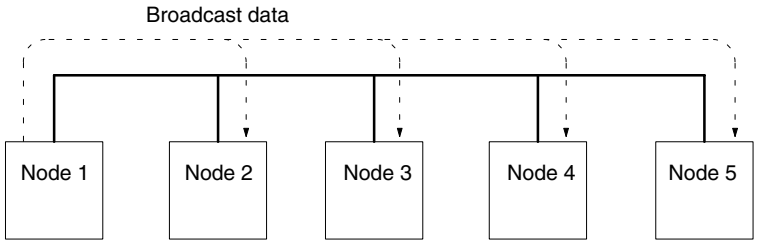
The SEND(90) and RECV(98) instructions can be used to transfer control data to or from a node specified by node address.



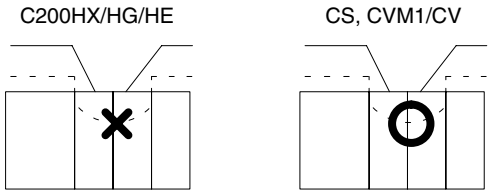
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Broadcasting Data

It is possible to transfer the same data to all nodes in a network simultaneously by designating the destination node as 00. This transmission is called broadcasting. No responses are returned to broadcasts. (Broadcasting cannot be performed with the RECV(98) instruction.)



Note With C200HX/HG/HE PCs, two Communications Units can be connected but the bridge function and gateway function cannot be used.



6-2-2 Instruction Specifications

The NETWORK READ/WRITE instructions (SEND(90)/RECV(98)) enable data to be sent and received between nodes within a single network under control of a user program. The user can specify that a receiving node send a response to the sending node to acknowledge receipt of the data. The basic specifications of these instructions are given in the following table.

Transmission format	1:1 data transfer 1:N data transmit only (broadcast mode; no response)
Packet length	256 words max. (within the same memory area only)
Data content	When SEND(90) is executed, command/response data for a data transmission request is transferred. When RECV(98) is executed, command/response data for a data reception request is transferred.
Response time-out parameters	00: 2 seconds FF: Response time-out ignored. 01 to FE: user-definable (in increments of 100 ms, 100 to 25,400 ms)
Number of retries	0 to 15

Data Transfer Area

The data transfer area, which is used for data transmission and reception using the SEND and RECV instructions, varies with the PC.

Area	C200HX/HG/HE	C200HS	C200H	C1000H	C2000H
IR and SR	000 to 511 (SEND) 000 to 252, 256 to 511 (RECV)	000 to 511 (SEND) 000 to 252, 256 to 511 (RECV)	000 to 255 (SEND) 000 to 252 (RECV)	000 to 255 (SEND) 000 to 252 (RECV)	000 to 255 (SEND) 000 to 252 (RECV)
LR	00 to 63	00 to 63	00 to 63	00 to 63	00 to 63
HR	00 to 99	00 to 99	00 to 99	00 to 99	00 to 99
AR	00 to 27	00 to 27	00 to 27	00 to 27	00 to 27
T/C	000 to 511	000 to 511	000 to 511	000 to 511	000 to 511
DM	0000 to 6655	0000 to 6655	0000 to 1999 (SEND) 0000 to 0999 (RECV)	0000 to 4095	0000 to 6655
EM	0000 to 6143	None			

Unit: word

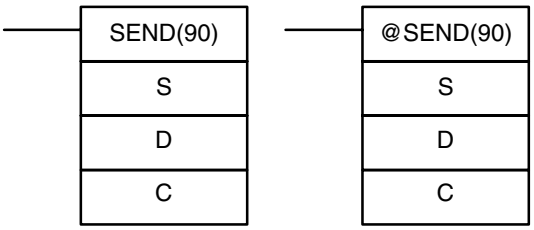
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Note The data transfer area must not exceed the above ranges.

6-2-3 NETWORK WRITE - SEND(90)

The ladder diagram programming symbols, operand names, and allowable data areas for SEND(90) are shown below.

Ladder Symbols



Operand Data Areas

S: Source beginning word
IR, SR, AR, DM, HR, TC, LR
D: Destination beginning word
IR, AR, DM, HR, TC, LR
C: First control data word
IR, AR, DM, HR, TC, LR

Limitations

C through C+2 must be within the same data area and must be within the values specified below. The first and last source word must be within the same data area.

Description

When executed with an ON execution condition, SEND(90) transfers data beginning at word S, to addresses specified by D in the designated node on the SYSMAC LINK System. The control words, beginning with C, specify the number of words to be sent, the destination node, and other parameters.

Bit 15 of C+1 determines whether the instruction is for a SYSMAC NET Link System or a SYSMAC LINK System.

Control Data

Set the destination node number to 00 to broadcast the data to all nodes in the network.

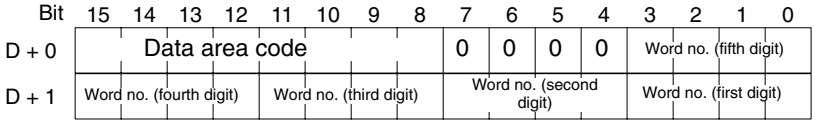
Word	Bits 00 to 07	Bits 08 to 15
C	Number of words (0 to 256 in 4-digit hexadecimal, i.e., 0000_{hex} to 0100_{hex})	
C+1	Response time limit (0.1 and 25.4 seconds in 2-digit hexadecimal without decimal point, i.e., 00_{hex} to FF_{hex}) **Note:** The response time will be 2 seconds if the limit is set to 0_{hex}. There will be no time limit if the time limit is set to FF_{hex}.	Bits 08 to 11: No. of retries (0 to 15 in hexadecimal, i.e., 0_{hex} to F_{hex}) Bit 12: Indirectly addressed beginning reception flag ON: Indirect addressing OFF: No indirect addressing Bit 13 ON: Response not returned. OFF: Response returned.[1] Bit 14 ON: Operating level 0 OFF: Operating level 1 Bit 15: Set to 1. (SYSMAC LINK flag)
C+2	Destination node number (1 to 62 in 2-digit hexadecimal, i.e., 01_{hex} to $3E_{hex}$)[2]	Bits 08 to 12: Destination node unit number (0 to 4)[3] Bits 13 to 15: Set to 0.

Note

1. If the instruction is set for broadcast transmission, no response will be returned even if bit 13 is OFF.
2. The node number of the PC executing the send cannot be set.
3. Set the destination node unit number to 00 when sending data to a PC. Settings 01 to 04 specify computer applications 1 to 4.

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4. Indirectly Addressed Beginning Reception Flag:
The CV-series PC has a larger data area than the C-series PC. Therefore, the beginning reception word of the destination node cannot be always designated by the operand of the SEND(90). If the beginning reception word cannot be designated, set the indirectly addressed beginning reception flag to 1 (ON: indirect addressing), in which case the second operand (D) will be the indirect beginning reception word, and it will be possible to designate the beginning reception word (rightmost word) of the destination node in BCD with the word designated by the second operand (D).



This operation is possible with a C200HW-SLK13/14/23/24 SYSMAC LINK Unit mounted in a C200HX, C200HG, C200HE, C200HS, or C200H PC only.

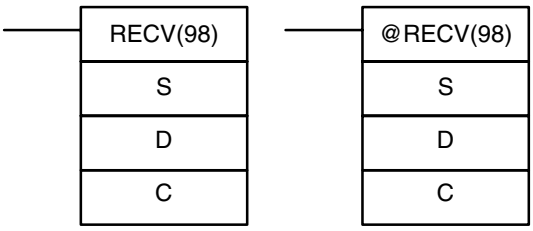
Refer to the following table to designate the data area.

Destination node (C-series PC)		Destination node (CV-series PC)		
Area	**Data area code**	**Area**		**Data area code**
I/O (IR)	00	Core I/O (CIO)		00
Link Relay (LR)	06	CPU Bus Link (G)		01
Holding Relay (HR)	07	Auxiliary (A)		02
Auxiliary Relay (AR)	08	Timer (T)		03
Timer/Counter (T/C)	03	Counter (C)		04
Data Memory (DM)	05	Data Memory (D)		05
		Extended Data Memory (E)	Banks 0 to 7	10 to 17
			Current bank	18

6-2-4 NETWORK READ - RECV(98)

The ladder diagram programming symbols, operand names, and allowable data areas for RECV(98) are shown below.

Ladder Symbols



Operand Data Areas

S: Source beginning word
IR, SR, AR, DM, HR, TC, LR
D: Destination beginning word
IR, AR, DM, HR, TC, LR
C: First control data word
IR, AR, DM, HR, TC, LR

Limitations

C through C+2 must be within the same data area and must be within the values specified below.

Description

When executed with an ON execution condition, RECV(88) transfers data beginning at S from a node on the SYSMAC LINK System to words beginning at D. The control words, beginning with C, provide the number of words to be received, the source node, and other transfer parameters.

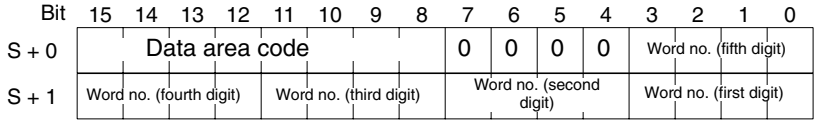
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Bit 15 of C+1 determines whether the instruction is for a SYSMAC NET Link System or a SYSMAC LINK System.

Word	Bits 00 to 07	Bits 08 to 15
C	Number of words (0 to 256 in 4-digit hexadecimal, i.e., 0000_{hex} to 0100_{hex})	
C+1	Response time limit (0.1 and 25.4 seconds in 2-digit hexadecimal without decimal point, i.e., 00_{hex} to FF_{hex}) **Note:** The response time will be 2 seconds if the limit is set to 0_{hex}. There will be no time limit if the time limit is set to FF_{hex}.	Bits 08 to 11: No. of retries (0 to 15 in hexadecimal, i.e., 0_{hex} to F_{hex}) Bit 12: Indirectly addressed beginning destination flag ON: Indirect addressing OFF: No indirect addressing Bit 13: Set to 0. Bit 14 ON: Operating level 0 OFF: Operating level 1 Bit 15: Set to 1. (SYSMAC LINK flag)
C+2	Source node number (1 to 62 in 2-digit hexadecimal, i.e., 01_{hex} to $3E_{hex}$)[1]	Bits 08 to 11: Source node unit number (0 to 4)[2] Bits 13 to 15: Set to 0.

Note

1. The node number of the PC executing RECV(98) cannot be set.
2. Set the source node unit number to 00 when sending data to a PC. Settings 01 to 04 specify computer applications 1 to 4.
3. Indirectly Addressed Beginning Destination Flag:
   The CV-series PC has a larger data area than the C-series PC. Therefore, the beginning destination word of the destination node cannot be always designated by the operand of the RECV instruction. If the beginning destination word cannot be designated, set the indirectly addressed beginning destination flag to 1 (ON: indirect addressing), in which case the first operand (S) will be the indirect beginning destination word, and it will be possible to designate the beginning destination word (rightmost word) of the destination node in BCD with the word designated by the first operand (S).



This operation is possible with a C200HW-SLK13/14/23/24 SYSMAC LINK Unit mounted in a C200HX, C200HG, C200HE, C200HS, or C200H PC only.

Refer to the following table to designate the data area.

Destination node (C-series PC)		Destination node (CV-series PC)		
Area	**Data area code**	**Area**		**Data area code**
I/O (IR)	00	Core I/O (CIO)		00
Link Relay (LR)	06	CPU Bus Link (G)		01
Holding Relay (HR)	07	Auxiliary (A)		02
Auxiliary Relay (AR)	08	Timer (T)		03
Timer/Counter (T/C)	03	Counter (C)		04
Data Memory (DM)	05	Data Memory (D)		05
		Extended Data Memory (E)	Banks 0 to 7	10 to 17
			Current bank	18

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6-2-5 Response Codes

When SEND(90) or RECV(98) is used in a SYSMAC LINK System, a response code is returned to indicate that the data transfer was completed successfully or identify the nature of the error when communications are not completed successfully.

The most recent response code will be retained until another SEND(90) or RECV(98) instruction is executed. The output bits and the error codes are as follows:

PC	Operating level	Bits[1]
C200HX, C200HG, C200HE, C200HS, C200H	Level 0	SR 23700 to SR 23707
	Level 1	SR 23708 to SR 23715
C1000H/C2000H	Levels 0 and 1[2]	SR 23700 to SR 23707

Response code	Name	Meaning
00	Normal end[3]	Data transfer was completed successfully.
01	Parameter error	SEND(90)/RECV(98) instruction operands are not within specified ranges.
02	Transmission impossible	The System was reset during execution of the instruction or the destination node is not in the System.
03	Destination not in System	The destination node is not in the System.
04	Busy error	The destination node is busy and cannot receive the transfer.
05	Response timeout	A response was not received within the time limit.
06	Response error	The response received from the destination node was incorrect.
07	Communications controller error	An error occurred in the communications controller.
08	Setting error	The node number was set incorrectly.
09	CPU Unit error	A CPU Unit error occurred in the PC of the destination node.

Note
1. The response codes listed here occupy only one byte, unlike the command/response response codes which occupy two bytes.
2. Only the most recent response code, from either level, is retained.
3. The response code will also be 00 while the instruction is being executed.

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6-2-6 Network Instruction Status Flags

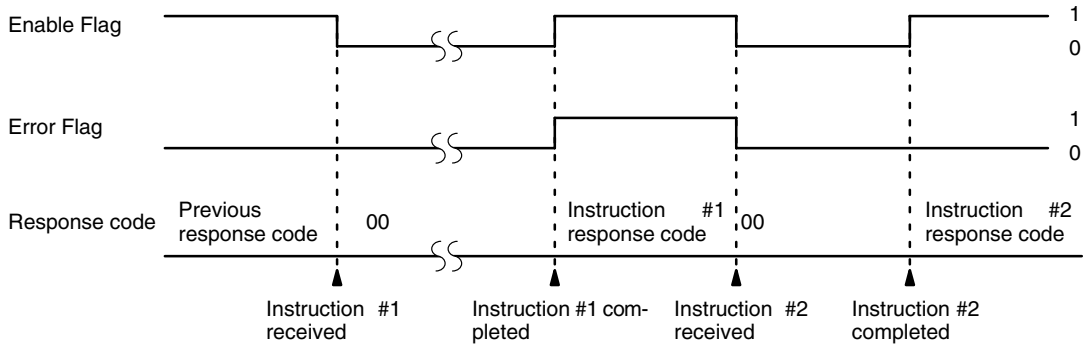
SEND(90) and RECV(98) are based on command/response processing. That is, the transmission is not complete until the sending node receives and acknowledges a response from the destination node. Operation without a response is also possible for SEND(90), if desired. The SEND(90)/RECV(98) Enable Flag is not turned ON until the first END(01) after the transmission is completed.

If multiple SEND(90)/RECV(98) operations are used, the following flags must be used to ensure that any previous operation is completed before attempting another. Because the C200H/C200HS provides separate flags for each operating level, it is possible to control these independently and have operations going on in both levels simultaneously. With the C1000H/C2000H, only one SEND(90)/RECV(98) operation should be performed in the network at a time, regardless of the number of operating levels.

C200HX/C200HG/C200HE/ C200HS/C200H	C1000H/C2000H	Functions
Enable Flag Level 0: SR 25201 Level 1: SR 25204	Enable Flag All levels SR 25204	OFF during SEND(90)/RECV(98) execution (including command response processing). Do not start a SEND(90)/RECV(98) operation unless this flag is ON.
Error Flag Level 0: SR 25200 Level 1: SR 25203	Error Flag All levels: SR 25203	OFF following normal completion of SEND/RECV (i.e., after reception of response signal) ON after an unsuccessful SEND(90)/RECV(98) attempt. Error status is maintained until the next SEND(90)/RECV(98) operation. Error types: Time-out error (command/response time greater than 1 second) Transmission data errors

Timing

The following diagram shows the status of the Enable Flag, Error Flag, and response code while two network instructions are issued in the C1000H PC. An error occurs during execution of first instruction.



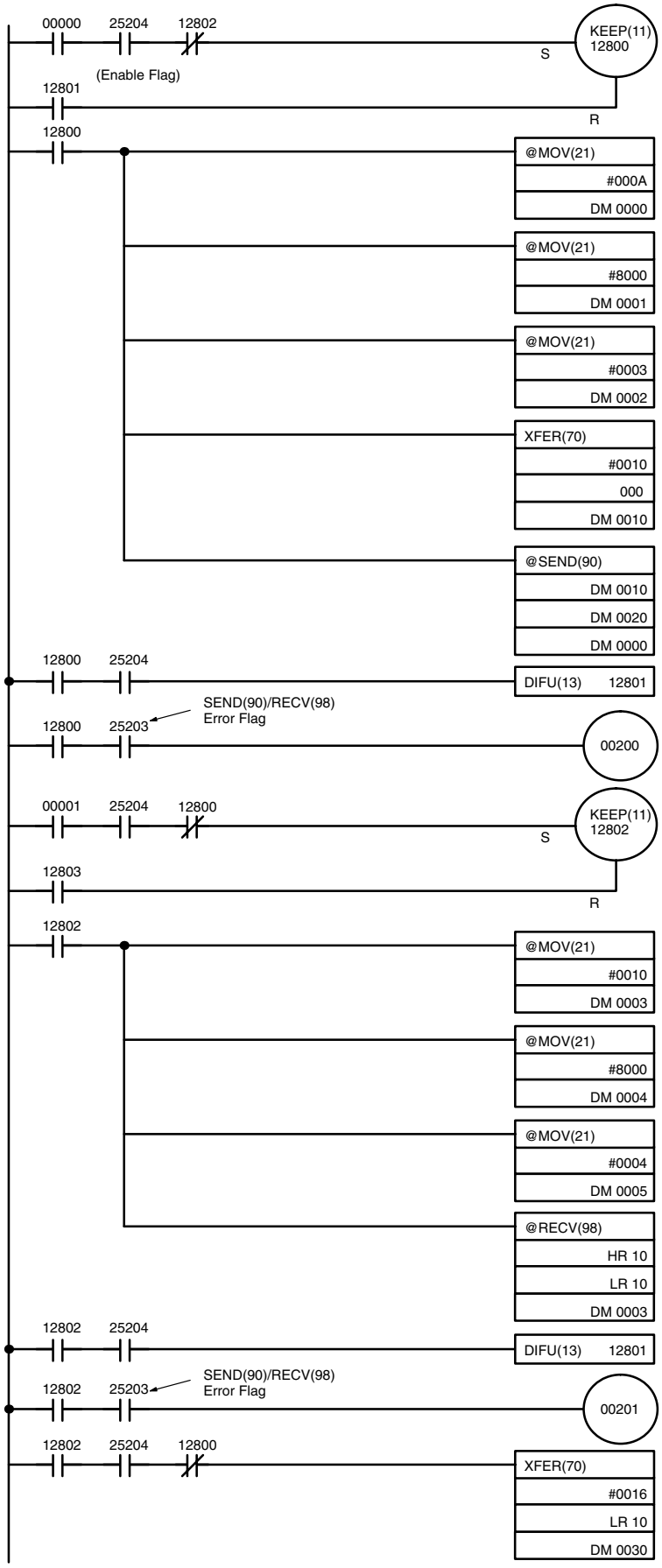
Data Processing for SEND(90)/RECV(98)

Data is transmitted for SEND(90) and RECV(98) for the C1000H/C2000H when SEND(90)/RECV(98) is executed and for the C200H/C200H□ when END(01) is executed. Final processing for transmissions/receptions is performed when END(01) is executed for all PCs.

Programming Example: Multiple SEND(90)/RECV(98)

To ensure successful SEND(90)/RECV(98) operations, the program must use the SEND(90)/RECV(98) Enable Flag and SEND(90)/RECV(98) Error Flags to confirm that execution is possible. The following program shows one way to do this:

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12800 prevents execution of SEND(90) until RECV(98) (below) is completed. IR 00000 is turned ON to start transmission.

Data is placed into control data words to specify the 10 words to be transmitted to node 3 in operating level 0.

DM 000	00	0A	10 words
DM 001	80	00	
DM 002	00	03	Node 3 (a PC)

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

Turns ON to indicate transmission error.

12802 prevents execution of RECV(98) when SEND(90) above has not completed. IR 00001 is turned ON to start transmission.

Data moved into control data words to specify the 16 words to be transmitted from node 4 in operating level 0.

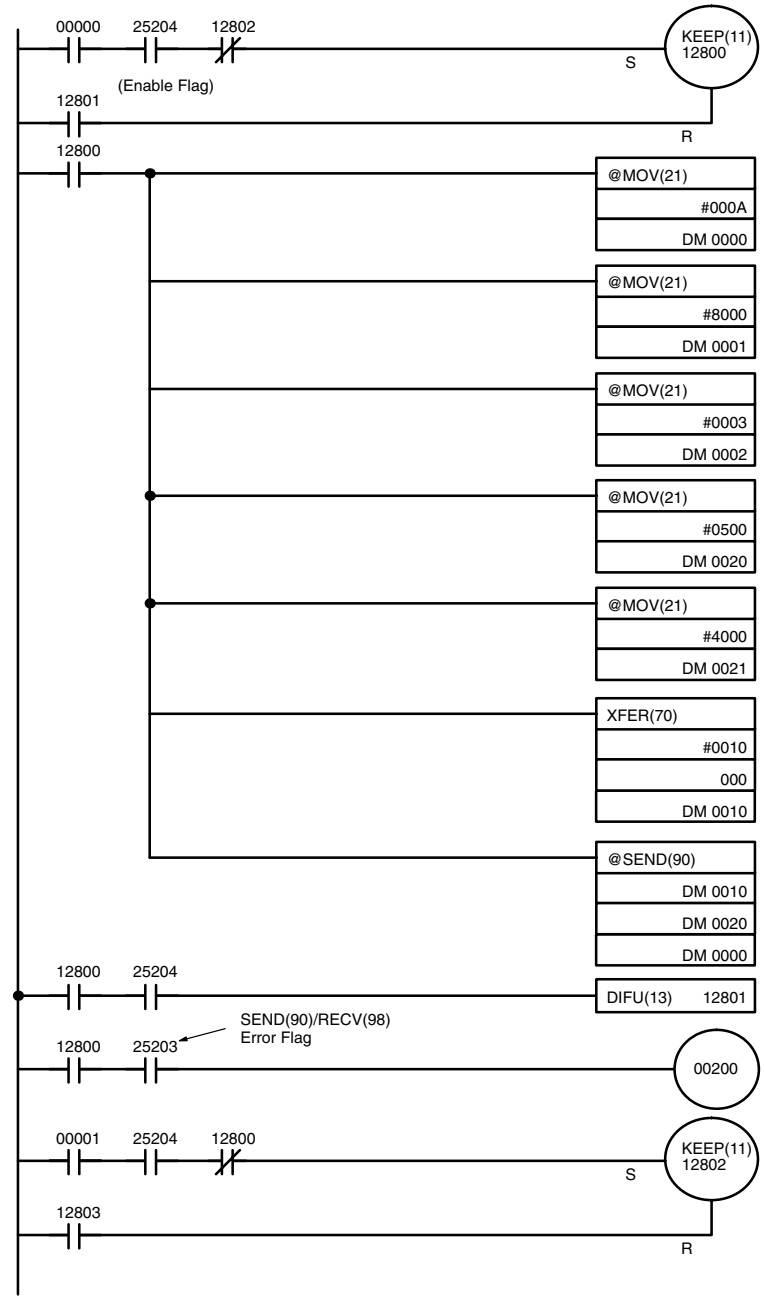
DM 003	00	10	16 words
DM 004	80	00	
DM 005	00	04	Node 4 (a PC)

Turns ON to indicate reception error.

Transmitted data moved into words beginning at DM 0030 for storage.

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Indirect Addressing of Beginning Words for C200H/C200H□ PCs



The transmission program is started when IR 00000 goes ON, provided that the SEND(90)/RECV(98) Enable Flag is ON (indicating RECV(98) isn't being executed).

IR 12800 is ON while SEND(90) is being executed.

Data is placed into control data words to specify the 10 words to be transmitted to node 3 in operating level 0.

DM 000	00	0A	10 words
DM 001	80	00	
DM 002	00	03	Node 3 (a PC)

Indirectly addressed beginning destination word. Beginning destination word in destination node = DM 4000.

DM 020	05	00
DM 021	40	00

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

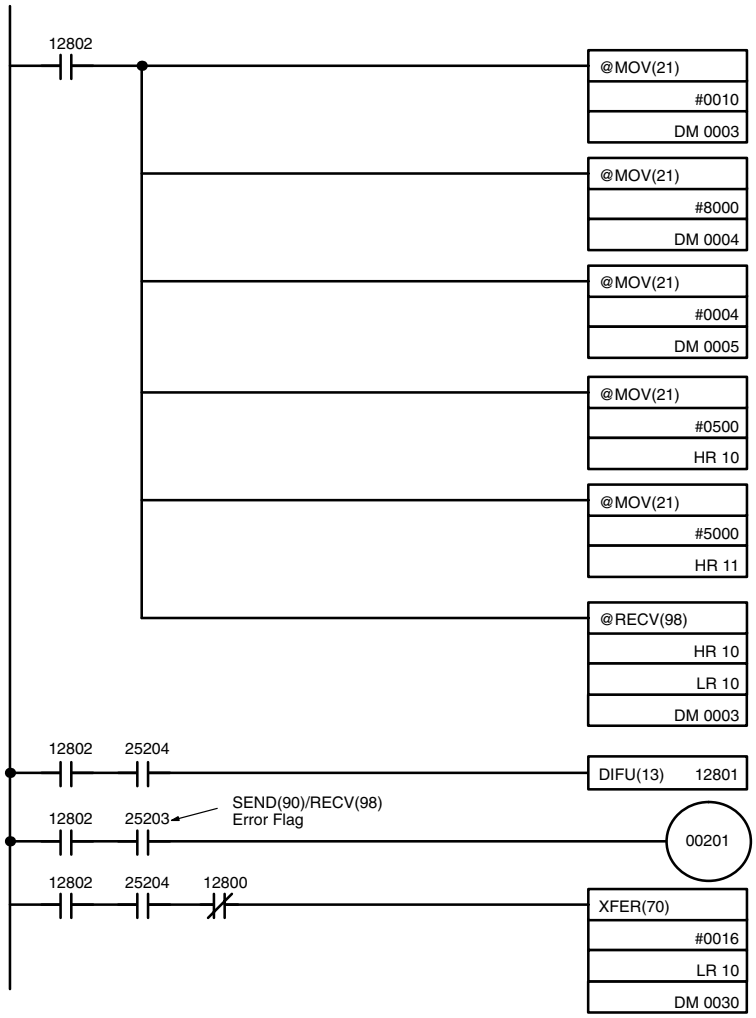
Turns ON to indicate transmission error.

12802 prevents execution of RECV(98) when SEND(90) above has not completed. IR 00001 is turned ON to start transmission.

(Continued on the next page)

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(Continued from previous page)



Data moved into control data words to specify the 16 words to be transmitted from node 4 in operating level 0.

DM 003	00	10	16 words
DM 004	80	00	
DM 005	00	04	Node 4 (a PC)

Indirectly addressed beginning destination word. Beginning destination word in destination node = DM 5000.

HR 10	05	00
HR 11	50	00

Turns ON to indicate reception error.

Transmitted data moved into words beginning at DM 0030 for storage.

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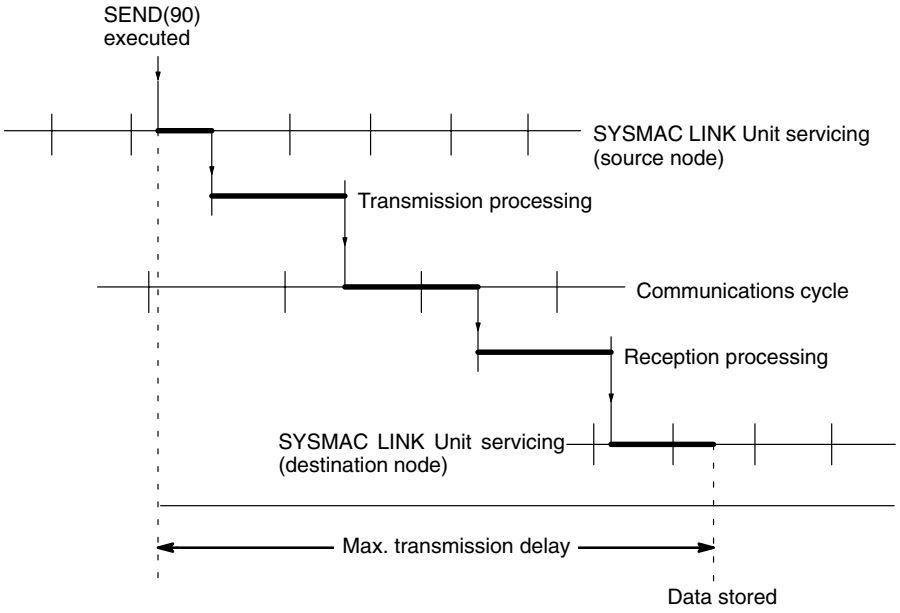
6-2-7 Delay Times

The two charts which follow indicate the sequence of processing which will enable users to calculate the maximum delay time to be expected between the time SEND(90) or RECV(98) is executed and the time the data is stored in the remote or local node's memory area, ready for use by other instructions in the program.

SEND(90)

The following diagram indicates the data flow which will yield the maximum delay time from the time SEND(90) is executed by the user program to the time the SYSMAC LINK Unit stores the data in the destination Unit's memory.

Note Be sure to take into account the time required for data links and program execution, which are not included in the following example.



Max. transmission delay = LINK Unit servicing interval (source node) + Transmission processing + Communications cycle time + Reception processing + LINK Unit servicing interval (destination node).

SYSMAC LINK Unit servicing is performed once per PC scan.

Delay cause		Delay (ms)
Transmission/reception processing		No. of words transferred × 0.013 ms + 5 ms
Communications cycle time[1]	Coaxial	Max. node no. × 0.01 ms + no. of nodes × 0.075 ms + no. of polled units × 0.75 ms + 1.322 ms
	Optical	Max. node no. × 0.01 ms + no. of nodes × 0.133 ms + no. of polled units × 0.75 ms + 1.322 ms

Note

1. When the data link is halted. Refer to *5-10-1 Data Link Communications Cycle Time* for details on the communications cycle time when the data link is operating.
2. The I/O response time might increase due to noise or restrictions on the number of frames that can be transmitted while the data link is operating.

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Example

In this example, the maximum transmission delay is calculated for an instruction sending 256 words of data in a system with 32 nodes. Network specifics are detailed below:

Max. node number: 32
Number of nodes: 32
Number of polled units: 4
Number of words: 256
Communications: coaxial cable
Data link: halted

Delay cause	Maximum delay (ms)
LINK Unit servicing	PC scan time
Transmission processing	8.328 ms
Communications cycle time	7.042 ms
Reception processing	8.328 ms

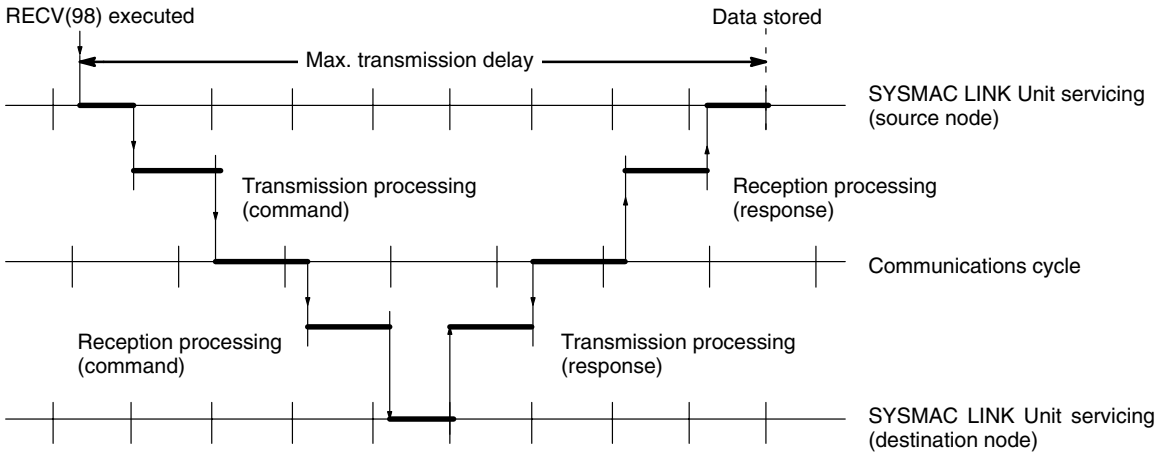
The maximum transmission delay is thus:

(PC scan time × 2) + 23.698 ms.

RECV(98) Instruction Maximum Delay Time

The following indicates the data flow which will yield the maximum transfer interval from the time the RECV(98) instruction is executed by the user program to the time the SYSMAC LINK Unit stores the data in the local Unit's memory area.

Note Be sure to take into account the time required for data links and program execution, which are not included in the following example.



Max. transmission delay = LINK Unit servicing interval (source node) + Transmission processing (command) + Communications cycle + Reception processing (command) + LINK Unit servicing interval (destination node) + Transmission processing (response) + Communications cycle + Reception processing (response) + LINK Unit servicing interval (source node).

SYSMAC LINK Unit servicing is performed once per PC scan.

Delay cause		Delay (ms)
Transmission/reception processing (command)		5 ms
Transmission/reception processing (response)		No. of words transferred × 0.013 ms + 5 ms
Communications cycle time[1]	Coaxial	Max. node no. × 0.01 ms + no. of nodes × 0.075 ms + no. of polled units × 0.75 ms + 1.322 ms
	Optical	Max. node no. × 0.01 ms + no. of nodes × 0.133 ms + no. of polled units × 0.75 ms + 1.322 ms

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Note

1. When the data link is halted. Refer to *5-10-1 Data Link Communications Cycle Time* for details on the communications cycle time when the data link is operating.
2. The I/O response time might increase due to noise or restrictions on the number of frames that can be transmitted while the data link is operating.

Example

In this example, the maximum transmission delay is calculated for an instruction receiving 256 words of data in a system with 32 nodes. Network specifics are detailed below:

Max. node number: 32
Number of nodes: 32
Number of polled units: 4
Number of words: 256
Communications: coaxial cable
Data link: halted

Delay cause	Maximum delay (ms)
LINK Unit servicing	PC scan time
Transmission processing (command)	5 ms
Reception processing (command)	5 ms
Communications cycle time (× 2)	7.042 ms (× 2)
Transmission processing (response)	8.328 ms
Reception processing (response)	8.328 ms

The maximum transmission delay is thus:

(PC scan time × 3) + 40.74 ms.

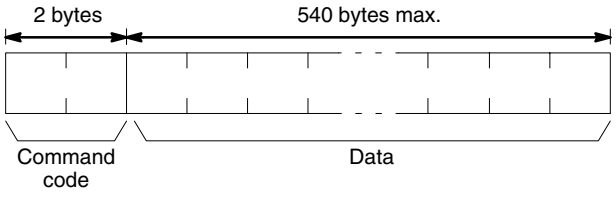
6-3 CV-mode Command/Response Format

This section describes the format of commands that can be received from computers or CV-series PCs and the responses that are returned. C-series SYSMAC LINK Units (except models C1000H-SLK21 and C200H-SLK21) can receive CV-mode (FINS) commands, but cannot transmit commands in this command/response format because they are not equipped with a COMMAND instruction (CMND(194) in CV-series PCs).

Unless another format is specifically indicated, all commands and responses are in hexadecimal. Commands that are sent to the PC CPU Unit differ from those that are sent to the SYSMAC LINK Unit.

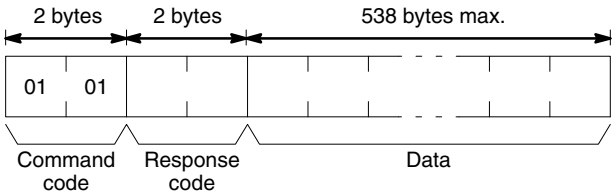
Command Format

Commands have the following format:



Response Format

Responses have the following format:



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6-3-1 List of CV-mode Commands for PCs

Command code		Name	PC mode			Page
			RUN	MONITOR	PROGRAM	
01	01	MEMORY AREA READ	Valid	Valid	Valid	90
	02	MEMORY AREA WRITE	Valid	Valid	Valid	90
	04	MULTIPLE MEMORY AREA READ	Valid	Valid	Valid	91
02	02	PARAMETER AREA WRITE	Not valid	Not valid	Valid	92
03	06	PROGRAM AREA READ	Valid	Valid	Valid	92
	07	PROGRAM AREA WRITE	Not valid	Not valid	Valid	93
04	01*	RUN	Valid	Valid	Valid	94
	02*	STOP	Valid	Valid	Valid	94
05	01*	CONTROLLER DATA READ	Valid	Valid	Valid	95
06	01*	CONTROLLER STATUS READ	Valid	Valid	Valid	95
07	01	CLOCK READ (C200H/C200H□ only)	Valid	Valid	Valid	97
	02	CLOCK WRITE (C200H/C200H□ only)	Not valid	Valid	Valid	97
21	01	ERROR CLEAR	Valid	Valid	Valid	98
22	0F	FILE MEMORY INDEX READ (C1000H/C2000H only)	Valid	Valid	Valid	98
	10	FILE MEMORY BLOCK READ (C1000H/C2000H only)	Valid	Valid	Valid	99
	11	FILE MEMORY BLOCK WRITE (C1000H/C2000H only)	Not valid	Valid	Valid	100
23	01	FORCED SET/RESET	Not valid	Valid	Valid	101
	02	FORCED SET/RESET CANCEL	Not valid	Valid	Valid	102
	0A	FORCED STATUS READ (C200H/C200□ only)	Valid	Valid	Valid	102

Note *These command codes are also used for CV-mode commands sent to SYSMAC LINK Units.

6-3-2 List of CV-mode Commands for SYSMAC LINK Units

Command code		Name	Data link mode		Page
			Operating	Halted	
04	01*	START DATA LINK	Not valid	Valid	103
	02*	HALT DATA LINK	Valid	Not valid	103
	03	RESET	Valid	Valid	104
05	01*	CONTROLLER DATA READ	Valid	Valid	104
06	01*	CONTROLLER STATUS READ	Valid	Valid	105
	02	NETWORK STATUS READ	Valid	Valid	107
	03	DATA LINK STATUS READ	Valid	Valid	108
08	01*	INTERNODE ECHO TEST	Valid	Valid	109
	02	BROADCAST TEST RESULTS READ	Valid	Valid	110
	03	BROADCAST TEST DATA SEND	Valid	Valid	110

Note *These command codes are also used for CV-mode commands addressed to PCs.

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6-3-3 CV-mode Response Codes

A 2-byte response code is returned with all responses. The first byte contains the main code indicating the general category of the response, and the second byte contains the sub-code giving more specific information. The table below shows the main codes. Refer to *8-1 Troubleshooting* for details on sub-codes.

Main code	Description
00	Normal completion
01	Source 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	Start/stop not possible
25	Unit error
26	Command error
30	Access right error

6-4 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 data area addresses normally used in the PC program. The *Address used in communications* column are the PC memory 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 *Bytes/item* column specifies the smallest increment of data that can be read or written for that area. The increment will be either words (2 bytes) or bytes (1 byte).

Memory area	Data	Data area address	Address used in communications	Memory area code	Bytes/ item
IR and SR	Bit status	00000 to 25515	000000 to 00FF0F	00	1
	Word contents	000 to 255	000000 to 00FF00	80	2
Link Relay	Bit status	LR 0000 to LR 6315	03E800 to 04270F	00	1
	Word contents	LR 00 to LR 63	03E800 to 042700	80	2
Holding Relay	Bit status	HR 0000 to HR 9915	042800 to 048B0F	00	1
	Word contents	HR 00 to HR 99	042800 to 048B00	80	2
Auxiliary Relay	Bit status	AR 0000 to AR 2715	048C00 to 04A70F	00	1
	Word contents	AR 00 to AR 27	048C00 to 04A700	80	2
Timer/Counter	Completion Flag status	TC 000 to TC 511	000000 to 01FF00	01	1
	PV	TC 000 to TC 511	000000 to 01FF00	81	2
DM Area	Word contents	DM 0000 to DM 9999	000000 to 270F00	82	2
EM Area	Word contents	EM 0000 to EM 6143	000000 to 17FF00	90 to 98	2

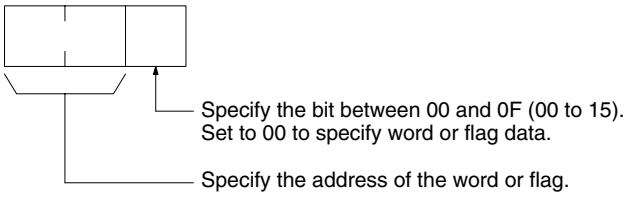
Note 1. The actual size of memory areas depends on the PC model being used. Refer to the *PC Operation Manual* for details on memory area ranges.

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2. The memory area codes for the EM Area are as follows: codes 90 through 97 specify banks 0 through 7 and code 98 specifies the current bank.

6-4-1 Word/Bit Addresses

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



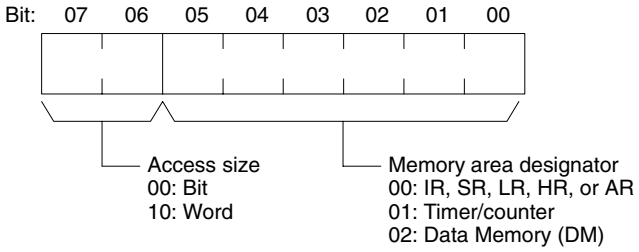
To obtain the corresponding address of the desired word or bit, add the data area word address (hexadecimal) to the first address of the range of addresses used for that data area in communications. For example, the address for word AR 13 is computed as follows:

First address for AR Area;	048C
048C + 0D (13 in BCD);	0499

The word address for AR 13 would thus be 049900 (the memory area code would specify this as a word) and the address of bit 12 in AR 13 would be 04990C.

6-4-2 Memory Area Code

The memory area code specifies the data area being accessed and whether a bit or word is being accessed, as shown below.



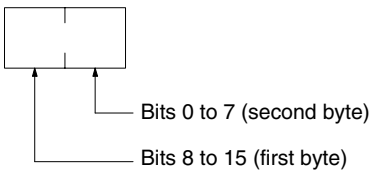
If the access size indicates a bit is being accessed, one byte of data will be read or written. If the access size indicates a word is being accessed, two bytes of data (one word) will be read or written.

6-4-3 Data Configuration

The configuration of the 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)



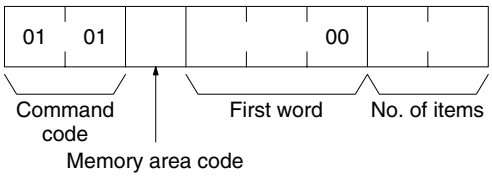
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6-5 CV-mode Commands for PCs

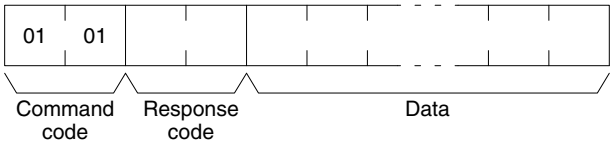
6-5-1 MEMORY AREA READ

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 same memory area code are considered as one area).

Command Block



Response Block



Parameters

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

First word (command): The address of the first word to read from memory. Set the third byte of the First word to 00.

No. of items (command): The number of items to be read. The number of items must be 0000 to 0100 (0 to 256 decimal). A normal completion response will be returned even if the number of items is set to 00.

Data (response): The data from the specified words is returned in sequence starting from the first word. Timer/counter PVs are returned in BCD. The total number of bytes is calculated as follows:

Bytes/item x No. of items

Memory Areas

The following data can be read (refer to *6-4 Memory Area Designations* for PC word/bit address designations):

Memory area	Data	Memory area code	Bytes/ item
IR, SR, LR, HR, and AR	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2
DM	Word contents	82	2
EM	Word contents	90 to 98	2

6-5-2 MEMORY AREA WRITE

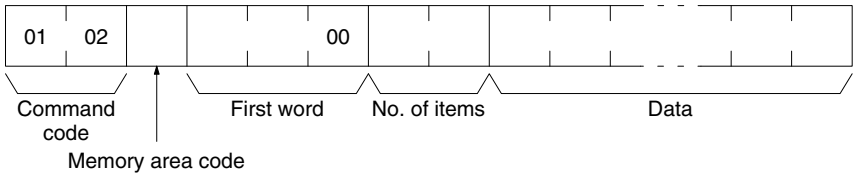
Writes data to the specified number of consecutive words starting from the specified word. All words must be in the same memory area (here, all memory areas with the the same memory area code are considered as one area).

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 *6-5-10 CONTROLLER STATUS READ*) to read the PC's mode.

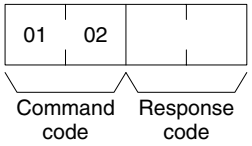
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2. When data is written to the Timer/Counter PV Area, the Completion Flags will be turned OFF (0).

Command Block



Response Block



Parameters

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

First word (command): The first word to write. Set the third byte of the first word to 00.

No. of items (command): The number of items to be written. The number of items must be 0000 to 0100 (0 to 256 decimal). A normal completion response will be returned even if the number of items is set to 00.

Data (command): The data to be written. Timer/counter PVs are returned in BCD. The total number of bytes is calculated as follows:

Bytes/item x No. of items

The following data can be written (refer *6-4 Memory Area Designations* for the word/bit address designations):

Memory area	Data	Memory area code	Bytes/ item
IR, SR, LR, HR, and AR	Word contents	80	2
Timer/Counter	PV	81	2
DM	Word contents	82	2
EM	Word contents	90 to 98	2

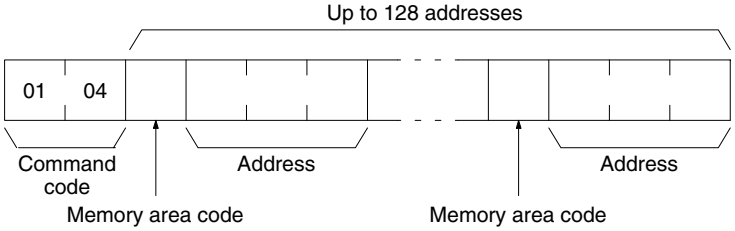
6-5-3 MULTIPLE MEMORY AREA READ

Reads the contents of the specified non-consecutive memory area bytes or words. Bytes or words can be read from up to 128 locations.

Note

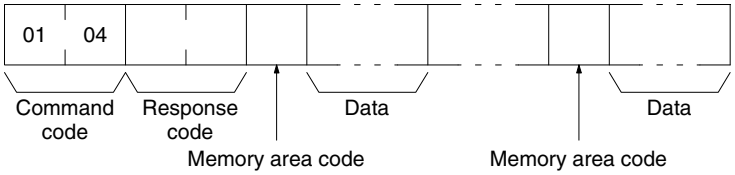
1. If there is an error in even one memory area code or address, no data will be read.
2. If EM is specified in the memory area code, the maximum number of locations from which bytes or words can be read will be 100.

Command Block



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Response Block



Parameters

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

Address (command): The addresses of the words/bits/flags to read.

Data (response): The response returns the memory area code(s) paired with the data from the specified memory area(s). There will be either one or two bytes of data per memory area code depending on the access size specified in the memory area code. Refer to *6-4-2 Memory Area Code* for details on access size.

Memory Areas

The following data can be read (refer to *6-4 Memory Area Designations* for memory area designations):

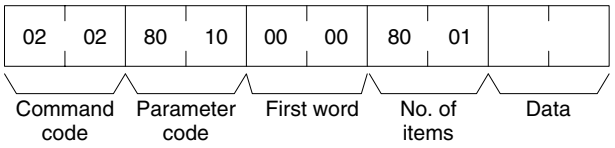
Memory area	Data	Memory area code	Bytes/ item
IR, SR, LR, HR, and AR	Bit status	00	1
	Word contents	80	2
Timer/Counter	Completion Flag status	01	1
	PV	81	2
DM	Word contents	82	2
EM	Word contents	90 to 98	2

6-5-4 PARAMETER AREA WRITE

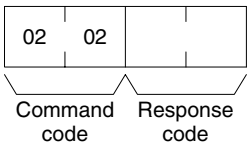
Writes data to the parameter area to designate the DM (data memory) size.

Note This command is available only on the SYSMAC C1000HF.

Command Block



Response Block



Parameters

Parameter code (command): 8010 (designate to change the DM size)

First word (command): 0000

No. of items (command): 8001

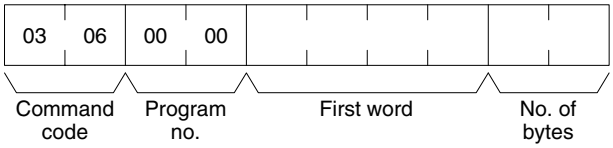
Data (command): Input 00 to designate a DM size of 4,095 words. If 00 is not input, a DM size of 10,000 words will be designated.

6-5-5 PROGRAM AREA READ

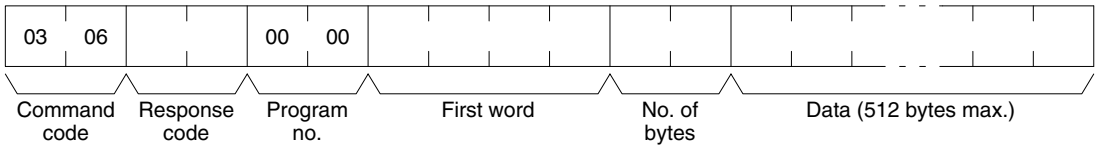
Reads the contents of the specified number of consecutive program area words starting from the specified word. The data is read in machine language (object code level). A maximum of 512 bytes can be read with each command. To read larger amounts of data, use multiple commands and specify the beginning word and number of words for each.

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Command Block



Response Block



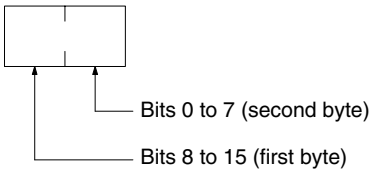
Parameters

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

First word (command and response): The program area begins at 00000000. The first word must be an even number and will be returned as is in the response.

No. of bytes (command and response): The number of bytes in an even number up to 0100 (512 decimal). Bit 15 will be ON (1) in the response block when the last word of data from the program area is in the data returned.

In the response, the no. of bytes is the actual number of bytes read.



Bit 15 OFF (0): Without last word data
Bit 15 ON (1): With last word data
Bits 0 to 14: No. of bytes read

If the no. of bytes specified in the command exceeds the number of bytes remaining in the program area, data will be read up to the last word in the program area and an *11 04* or *11 0B* parameter error response code will be returned.

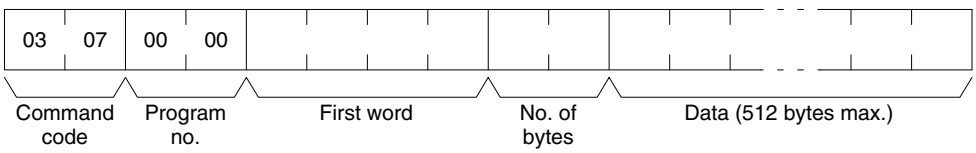
Data (response): The data in the specified program area will be returned in sequence starting from the beginning word.

6-5-6 PROGRAM AREA WRITE

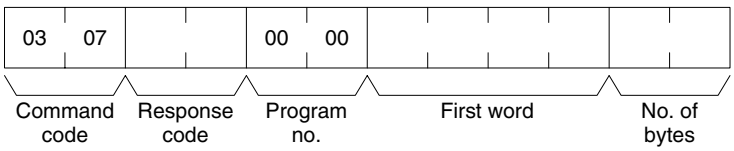
Writes data to the specified number of consecutive program area words starting from the specified word. The data is written in machine language (object code level). A maximum of 512 bytes can be written with each command. To write larger amounts of data, use multiple commands and specify the beginning word and number of words for each.

Note The PC will generate an index when bit 15 of the no. of bytes is ON, so bit 15 must be ON when data is written through the last word in the program area. If the no. of bytes is set to 8000, the PC will just generate an index.

Command Block



Response Block



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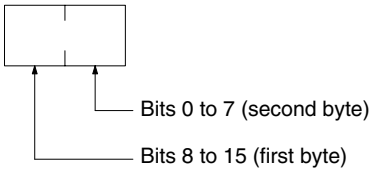
Parameters

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

First word (command and response): The program area begins at 00000000. The first word must be an even number and will be returned as is in the response.

No. of bytes (command and response): The number of bytes in an even number up to 0200 (512 decimal). Bit 15 must be ON (1) when data is written to the last word in the program area.

In the response, the no. of bytes is the actual number of bytes read.



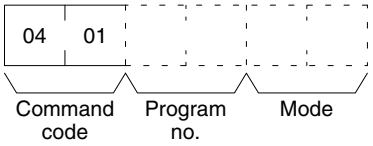
Bit 15 OFF (0): Without last word data
Bit 15 ON (1): With last word data
Bits 0 to 14: No. of bytes written

Data (command): The data to be written.

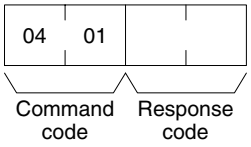
6-5-7 RUN

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

Command Block



Response Block



Parameters

Program no. (command): Set to 0000.

Mode (command): As follows:

0002: MONITOR mode

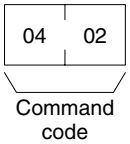
0004: RUN mode

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

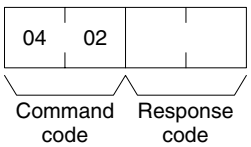
6-5-8 STOP

Changes the PC to PROGRAM mode, stopping program execution.

Command Block



Response Block



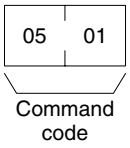
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6-5-9 CONTROLLER DATA READ

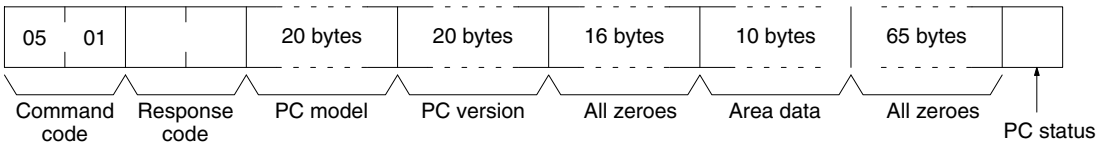
Reads the following data:

- PC model and version
- Area data
- PC status

Command Block



Response Block



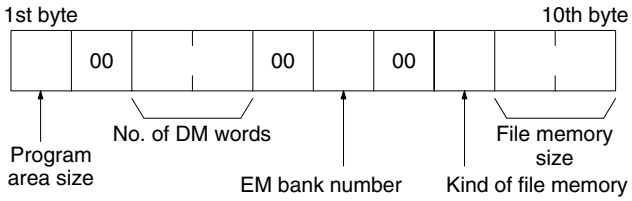
Parameters

PC model and version (response):
Both are read in ASCII codes (20 bytes (i.e. 20 ASCII characters) max. each). If the model or version requires less than 20 characters, the remaining bytes will be filled with spaces (ASCII code 20).

For the C1000H and C2000H, the version is returned for the MPU1 first followed by the version for the MPU2. If a version does not required 20 characters, the remaining bytes will be filled with spaces (ASCII code 20) for each.

All zeroes (response): These bytes contain zeroes.

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)
No. of DM words	Total words in the DM area	Words
EM bank number	Extended Data Memory (EM) Area bank number	Bank
Kind of file memory	00: No file memory 01: SPRAM 04: First half RAM, second half ROM	---
File memory size	0000: 0 (no file memory) 0001: 1000 0002: 2000	Blocks

PC status (response): The value of the byte returned indicates whether or not a Peripheral Device is connected.

00: No Peripheral Device connected.

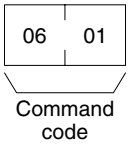
80: Peripheral Device connected.

6-5-10 CONTROLLER STATUS READ

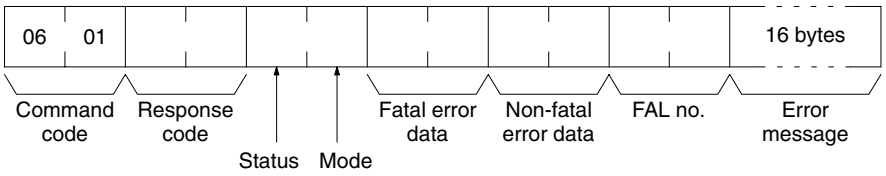
Reads the status of the PC.

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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 Unit on standby (the start switch is OFF or the CPU Unit is waiting for a Slave Rack to turn ON).

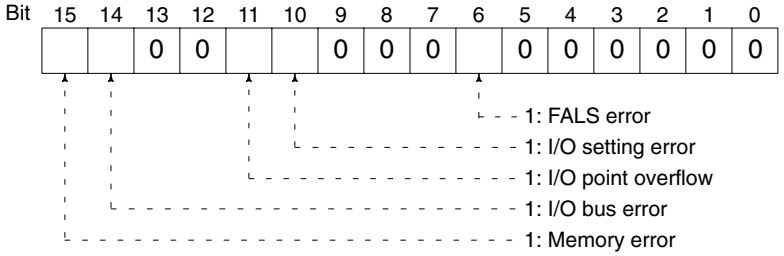
Mode (response): One of the following PC modes:

00: PROGRAM

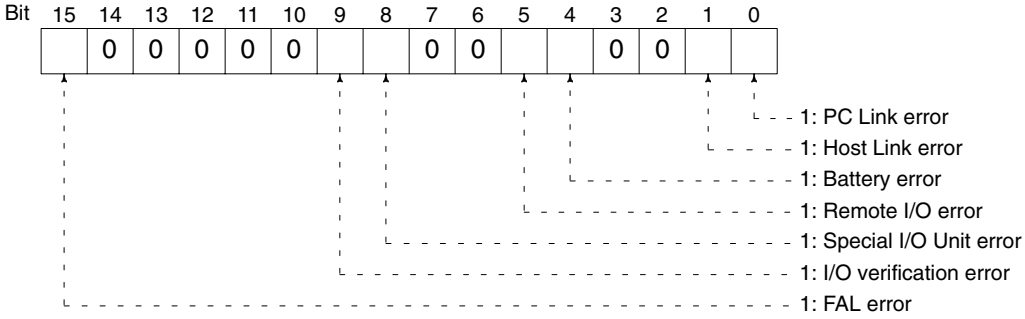
02: MONITOR

04: RUN

Fatal error data (response): The information contained in the fatal error data is shown below. Refer to the PC's *Operation Manual* for details on fatal errors.



Non-fatal error data (response): The information contained in the non-fatal error data is shown below. Refer to the PC's *Operation Manual* for details on non-fatal errors.



FAL no. (response): The second byte contains the FAL or FALS number of the highest priority error that has occurred in BCD. The first byte contains 00. The FAL no. range is therefore 00 to 99.

If neither an FAL nor an FALS error has occurred, the FAL no. will be 0000.

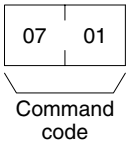
Error message (response): The error message of the present FAL number. The error message will be up to 16 ASCII characters. If there is no error message, the response will be shortened.

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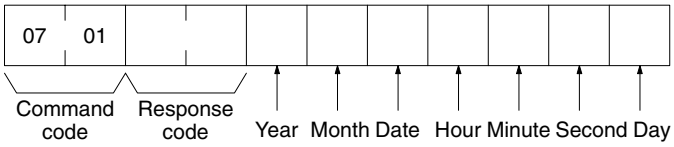
6-5-11 CLOCK READ

Reads the clock. This command can be used with the C200H, C200HS, C200HX, C200HG, and C200HE PCs only.

Command Block



Response Block



Parameters

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

Year: The rightmost two digits of the year.

Hour: 00 to 23.

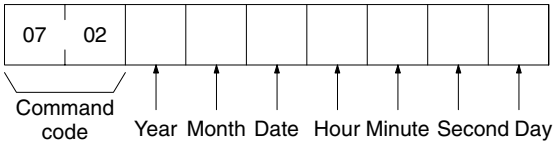
Day: As follows:

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

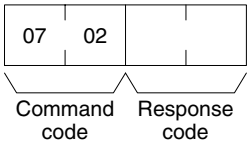
6-5-12 CLOCK WRITE

Sets the clock. This command can be used with the C200H, C200HS, C200HX, C200HG, and C200HE PCs only.

Command Block



Response Block



Parameters

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

Year: The rightmost two digits of the year.

Hour: Specify 00 to 23.

Day: As follows:

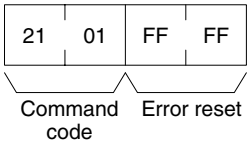
Value	00	01	02	03	04	05	06
Day	Sun	Mon	Tues	Wed	Thur	Fri	Sat

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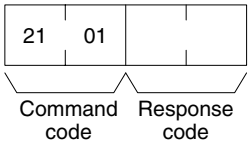
6-5-13 ERROR CLEAR

Clears errors from the PC.

Command Block



Response Block



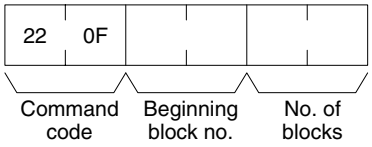
Parameters

Error reset (command): The code must be FFFF.

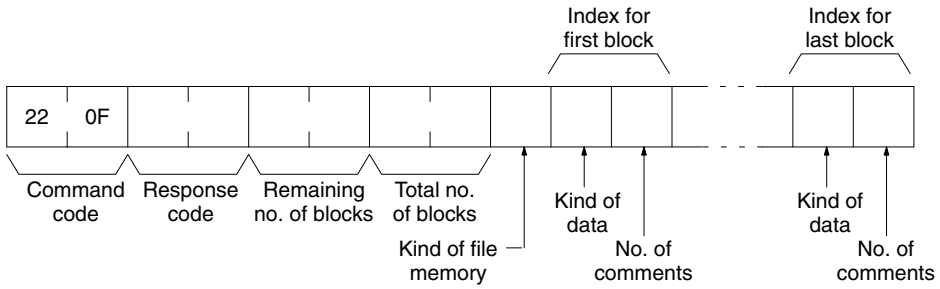
6-5-14 FILE MEMORY INDEX READ

Reads out the indices of a specified number of blocks stored in file memory. This command can be used with the C1000H and C2000H only.

Command Block



Response Block



Parameters

Beginning block no. (command): The first block to be read. The beginning block no. must be between 0000 and 03E7 (0 to 999 decimal) for 1000 block file memory, or 0000 and 07CF (0 to 1999 decimal) for 2000 block file memory.

No. of blocks (command): The number of blocks to be read. The no. of blocks must be between 01 and 80 (0 to 128 decimal).

Remaining no. of blocks (response): The number of blocks remaining after the read. The remaining no. of blocks will be between 0000 and 07CF (0 to 1999 decimal).

Total no. of blocks (response): The number of blocks in the file memory. The total no. of blocks will be between 0000 (0), 03E8 (1000), or 07D0 (2000).

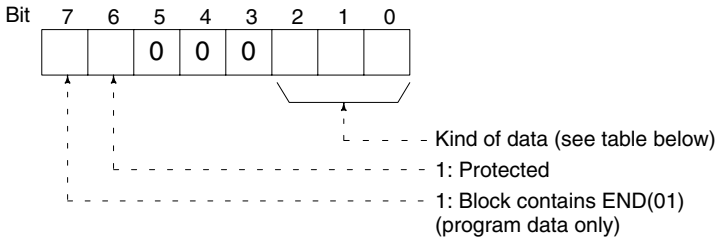
Kind of file memory (response): The kind of file memory installed, as follows:

00: All RAM

01: First half RAM, second half ROM

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Kind of data (response): The kind of data in this block, as follows:



Kind of data

Bits 0 to 2 indicate the kind of data, as shown in the following table.

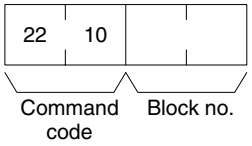
Bit status			Kind of data
2	1	0	
0	0	0	None
0	0	1	I/O data
0	1	0	Program
0	1	1	Comments

No. of comments (response): If the block contains comments data, this byte indicates the number of comments.

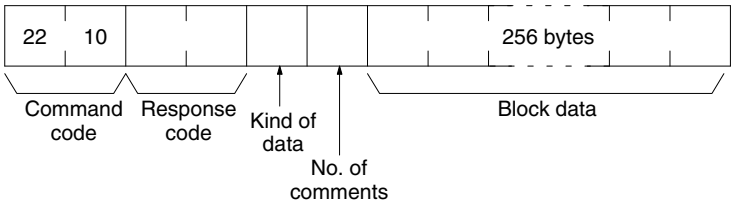
6-5-15 FILE MEMORY BLOCK READ

Reads the contents of the indicated block of file memory. This command can be used with the C1000H and C2000H only.

Command Block



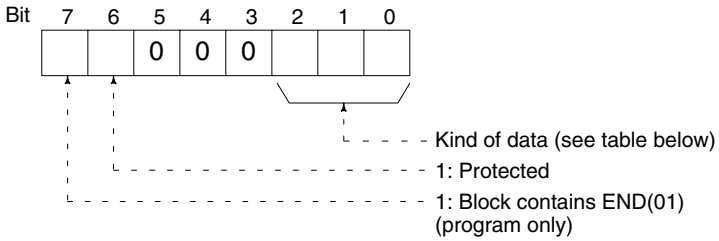
Response Block



Parameters

Block no. (command): The block number of the block to be read. The block no. must be between 0000 and 03E7 (0 to 999 decimal) for 1000 block file memory, or 0000 and 07CF (0 to 1999 decimal) for 2000 block file memory.

Kind of data (response): The kind of data in the block, as follows:



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Kind of data

Bits 0 to 2 indicate the kind of data, as shown in the following table.

Bit status			Kind of data
2	1	0	
0	0	0	None
0	0	1	I/O data
0	1	0	Program
0	1	1	Comments

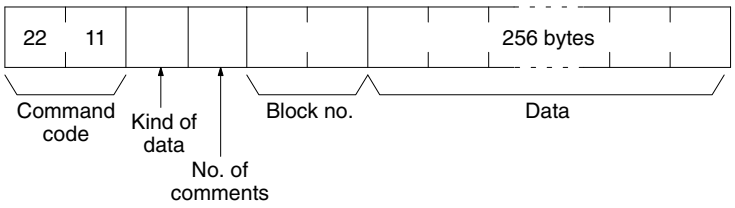
No. of comments (response): If the block contains comments data, this byte indicates the number of comments.

Block data (response): The 256 bytes of data from the indicated block.

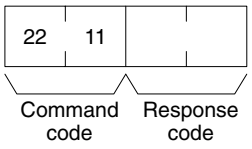
6-5-16 FILE MEMORY BLOCK WRITE

Writes the 256 bytes of data in the command to the indicated block of file memory. This command can be used with the C1000H and C2000H only.

Command Block

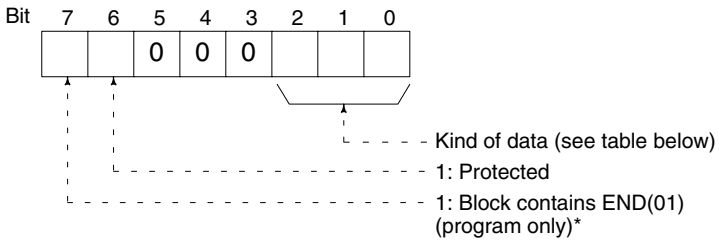


Response Block



Parameters

Kind of data (command): Indicate the kind of data in the block, as follows:



Kind of data

Bits 0 to 2 indicate the kind of data, as shown in the following table.

Bit status			Kind of data
2	1	0	
0	0	1	I/O data
0	1	0	Program
0	1	1	Comments

Note *Turn bit 7 ON when the block contains the END(01) instruction or the block is the last.

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No. of comments (command): If the block contains comments data, indicate the number of comments in this byte.

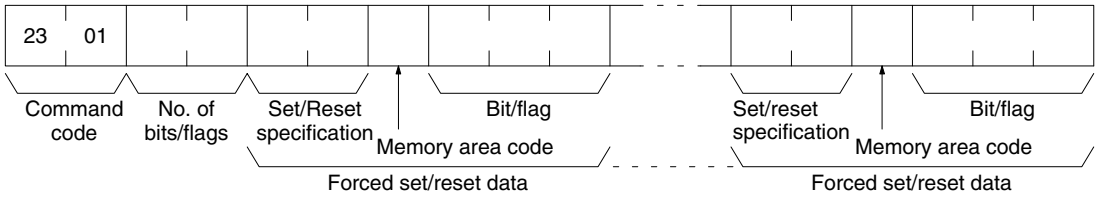
Block no. (command): The block number of the block to which data will be written. The block no. must be between 0000 and 03E7 (0 to 999 decimal) for 1000 block file memory, or 0000 and 07CF (0 to 1999 decimal) for 2000 block file memory.

Data (command): The 256 bytes of data that will be written to the indicated block.

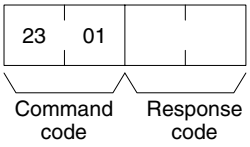
6-5-17 FORCED SET/RESET

Force-sets (ON) or force-resets (OFF) bits/flags or releases forced 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, e.g., by using this command.

Command Block



Response Block



Parameters

No. of bits/flags (command): The number of bits/flags to be forced set/reset or released.

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

Note

1. In the C1000H and C2000H, only the *Force-reset (0000)* and *Force-set (0001)* actions can be specified. Furthermore, only one bit can be force set/reset at a time. If force set/reset data for more than one bit is included in the command, only the last bit will be force set/reset. The forced status of the other bits/flags in the command will be released.
2. In the C200H/C200H□, two or more bits can be force set/reset. (Forced status will be maintained unless a forced status release action is performed.)
3. The *Forced status released and bit turned OFF (8000)* and *Forced status released and bit turned ON (8001)* actions cannot be performed on timer/counter Completion Flags. If these actions are specified, they revert to the *Force-reset (0000)* and *Force-set (0001)* actions, respectively.

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.

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Memory Areas

The bits (flags) in the following memory areas can be forced set/reset or released (refer to *6-4 Memory Area Designations* for memory area designations):

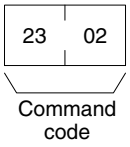
Memory area	Data	Memory area code	Bytes/ item
IR, SR, LR, HR, and AR	Bit status	00	1
Timer/Counter	Completion Flag status	01	1

Only the number of bits/flags indicated in *No. of bits/flags* will be forced set/reset or released.

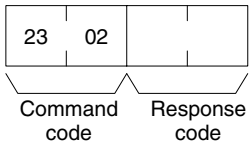
6-5-18 FORCED SET/RESET CANCEL

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

Command Block



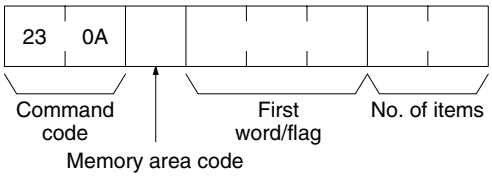
Response Block



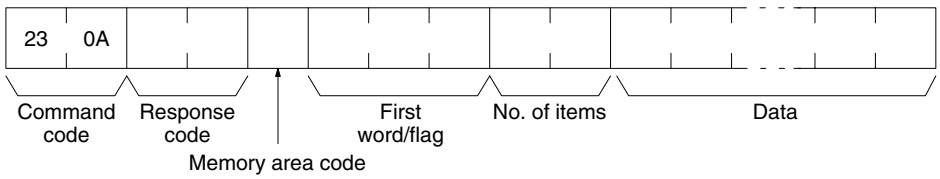
6-5-19 FORCED STATUS READ

Reads the forced status of a specified number of consecutive memory area words or Timer/Counter Completion Flags starting from the specified word or flag. All words must be in the same memory area (here, all memory areas with the same memory area code are considered as one area). This command can be used with the C200H, C200HS, C200HX, C200HG, and C200HE PCs only.

Command Block



Response Block



Parameters

Memory area code (command and response): The data area to read forced status.

First word/flag (command and response): The address of the first word or flag whose forced status will be read.

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No. of items (command and response): The number of items to be read. The number of items must be 0001 to 0040 (1 to 64 decimal).The forced status of up to 64 consecutive words or 512 flags can be read.

Data (response): The forced status data from the specified words or flags is returned in sequence starting from the first word/flag. The total number of bytes is calculated as follows:

Bytes/item x No. of items

When a bit is ON in the forced status data returned in the response, the status of the corresponding bit or flag has been forced (either force-set or force-reset). When a bit is OFF in the forced status data, the status of the corresponding bit or flag has not been forced.

Memory Areas

The following data can be read (refer to *6-4 Memory Area Designations* for PC word/bit address designations):

Memory area	Forced status data	Memory area code	Bytes/ item
IR, SR, LR, HR, and AR	Word	80	2
Timer/Counter	Completion Flag	01	1

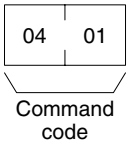
6-6 CV-mode Commands for SYSMAC LINK Units

6-6-1 DATA LINK START

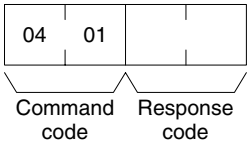
Activates data links in the SYSMAC LINK Network.

This command will be completed normally when link words are allocated automatically or via data link tables only.

Command Block



Response Block

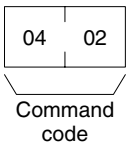


6-6-2 DATA LINK HALT

Stops data links in the SYSMAC LINK Network.

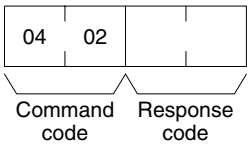
This command will be completed normally when the data link is in operation. If the data link is not in operation, an error will occur.

Command Block



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Response Block

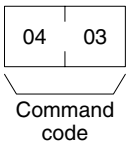


6-6-3 RESET

Resets the SYSMAC LINK Unit.

No response is returned when this command is executed.

Command Block

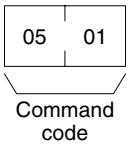


6-6-4 CONTROLLER DATA READ

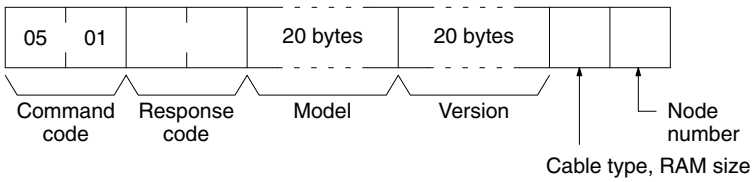
Reads the following data from the SYSMAC LINK Unit:

- Model and version
- Type of cable (coaxial or optical fiber)
- RAM size
- Node number

Command Block



Response Block

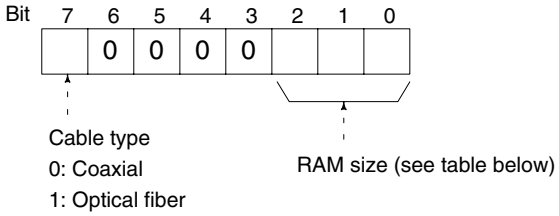


Parameters

Model and version (response):
Both the SYSMAC LINK Unit's model and version are read in ASCII codes (20 bytes (i.e., 20 ASCII characters) max. each). If the model or version requires fewer than 20 characters, the remaining bytes will be filled with spaces (ASCII code 20).

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Cable type and RAM size (response): The type of cable being used and the size of the RAM buffer in the controller are provided as follows:



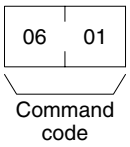
Bit status			RAM size
2	1	0	
0	1	0	4K bytes (C200HW-SLK13/23)
0	1	1	8K bytes (C1000H-SLK11/SLK21-V1)
1	0	0	16K bytes (C200HW-SLK14/24)

Node number (response): The value of the byte returned indicates the Unit's node number in 2-digit hexadecimal. The node number range is 01 to 3E (1 to 62 decimal).

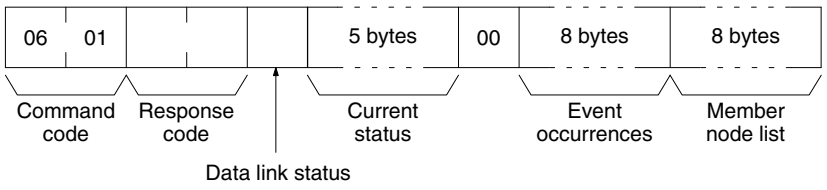
6-6-5 CONTROLLER STATUS READ

Reads the status of the SYSMAC LINK Unit.

Command Block



Response Block



Parameters

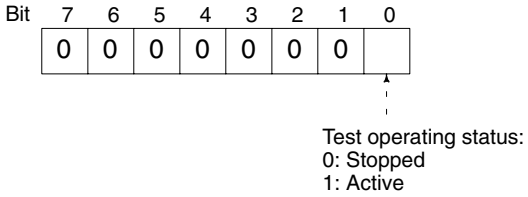
Data link status (response): The operating status of the data link as follows:

00: Halted

01: Active

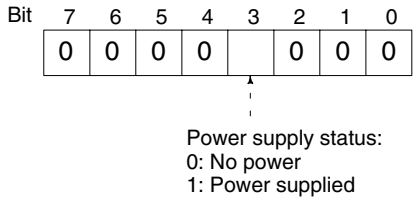
Current status (response): These five bytes provide information on the current status of the Unit.

First byte:

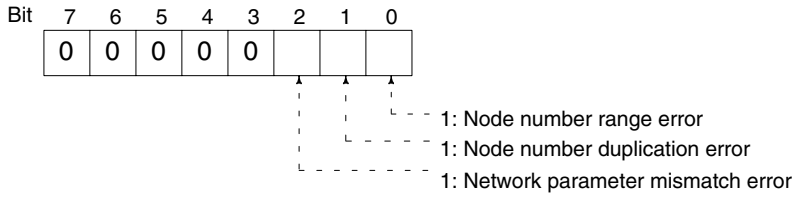


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Second byte:

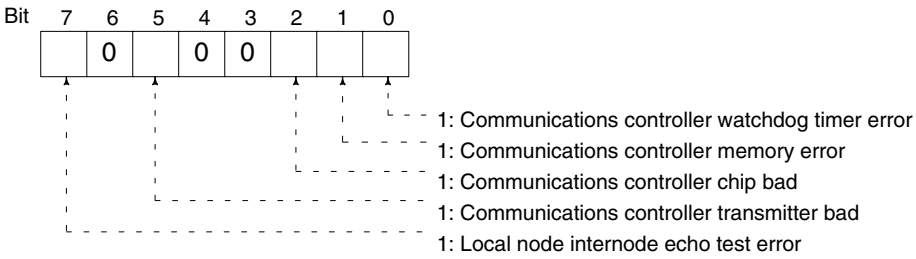


Third byte:

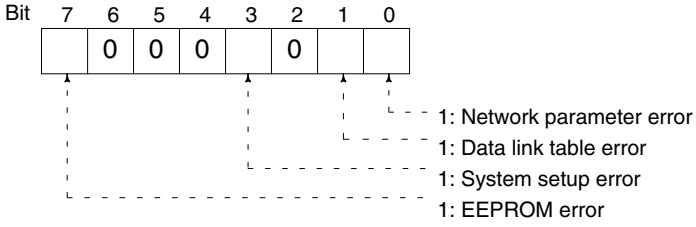


A network parameter mismatch error occurs when the parameters set in the Unit at initialization do not match those of the currently operating network. The network parameters will be reset automatically.

Fourth byte:



Fifth byte:



Event occurrences (response): These eight bytes indicate how many times the following events have occurred. Each number is 2-digit hexadecimal, so 00 to FF (0 to 255 decimal) occurrences can be recorded. If an event occurs more than 255 times, the number will remain at 255.

First byte: CRC errors
Second byte: Token retransmission
Third byte: Token rejections
Fourth byte: Token passing time outs
Fifth byte: Polling time outs
Sixth byte: Polling unit changes
Seventh byte: Member node changes
Eighth byte: Communication controller data transfer stops

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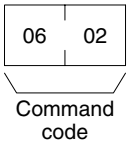
Member node list (response): These eight bytes indicate which node numbers are members of the network. When a bit in the following matrix is ON, the corresponding node is in the network. Bits 6 and 7 of the eighth byte are always OFF.

Bit	7	6	5	4	3	2	1	0
First byte	8	7	6	5	4	3	2	1
Second byte	16	15	14	13	12	11	10	9
Third byte	24	23	22	21	20	19	18	17
Fourth byte	32	31	30	29	28	27	26	25
Fifth byte	40	39	38	37	36	35	34	33
Sixth byte	48	48	46	45	44	43	42	41
Seventh byte	56	55	54	53	52	51	50	49
Eighth byte	-	-	62	61	60	59	58	57

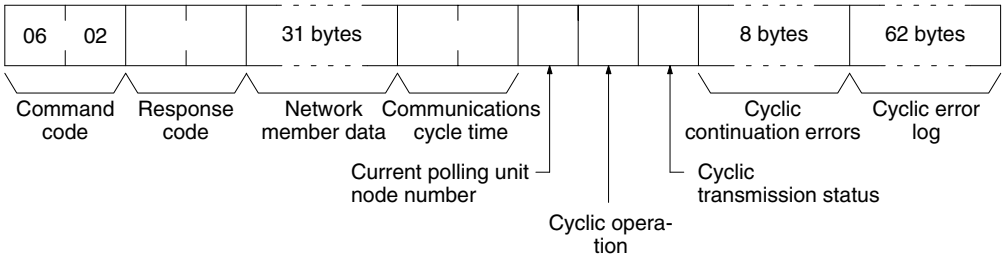
6-6-6 NETWORK STATUS READ

Reads the status of the SYSMAC LINK Network.

Command Block



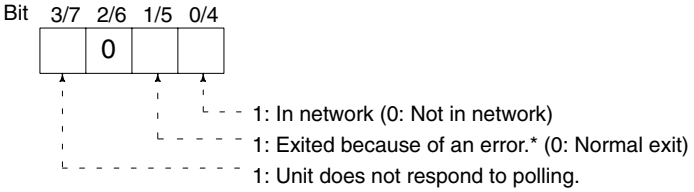
Response Block



Parameters

Network member data (response): Four bits are allocated to each node number to provide information on the status of nodes in the network as shown below. The function of each of the 4 bits is shown in the diagram following the table.

Byte	Bits 4 to 7	Bits 0 to 3
Byte 1	Node number 2	Node number 1
Byte 2	Node number 4	Node number 3
Byte 3	Node number 6	Node number 5
Byte 31	Node number 62	Node number 61



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Note *Bit 1/5 is used to indicate why the node is not in the network when bit 0/4 is OFF.

Communications cycle time (response): The actual communications cycle time is provided here in 4-digit hexadecimal in increments of 100 μs.

Current polling unit node number (response): The node number of the unit that currently is the polling unit.

Cyclic operation (response): Indicates the current status of cyclic operation, as follows:

00: Stopped

01: Active

Cyclic transmission status (response): Indicates the current status of cyclic transmission, as follows:

00: No transmission

01: Transmission

Cyclic continuation errors (response): These eight bytes indicate nodes in which non-fatal errors occurred in cyclic transmission. When a bit in the following matrix is ON, a non-fatal error occurred in the corresponding node. Bit 0 of the first byte and bit 7 of the eighth byte are always OFF.

Bit	7	6	5	4	3	2	1	0
First byte	7	6	5	4	3	2	1	-
Second byte	15	14	13	12	11	10	9	8
Third byte	23	22	21	20	19	18	17	16
Fourth byte	31	30	29	28	27	26	25	24
Fifth byte	39	38	37	36	35	34	33	32
Sixth byte	47	46	45	44	43	42	41	40
Seventh byte	55	54	53	52	51	50	49	48
Eighth byte	-	62	61	60	59	58	57	56

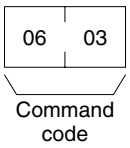
Cyclic error log (response): One of these 62 bytes is allocated to each node to indicate how many cyclic errors occurred since start-up. The first byte is allocated to node number 1, the second to node number 2, etc. Each number is 2-digit hexadecimal, so 00 to FF (0 to 255 decimal) errors can be recorded for each node. If more than 255 errors occur, the number will remain at 255.

6-6-7 DATA LINK STATUS READ

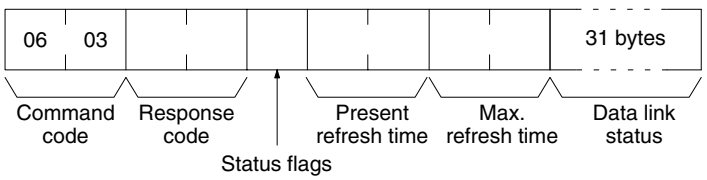
Reads the status of the data link.

The various data link status information described here will not be updated while the data link is halted.

Command Block



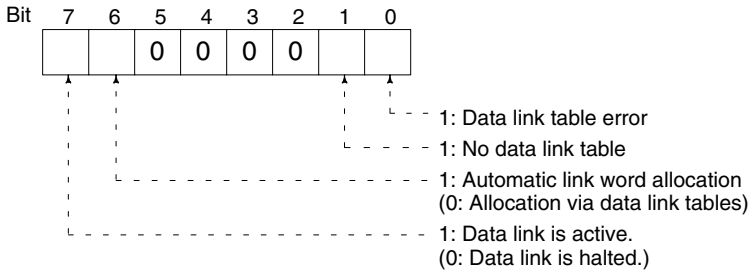
Response Block



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Parameters

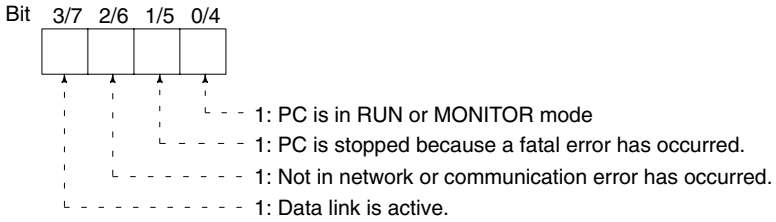
Status flags (response): This byte contains flags providing information on overall data link status, as follows:



Present and Max. refresh time (response): The present and maximum data link refresh times in 4-digit hexadecimal in increments of 1 ms. The range is 0005 to 00FF (5 to 255 ms, in decimal).

Data link status (response): Four bits are allocated to each node number to provide information on the status of the data links, as shown below. The function of each of the 4 bits is shown in the diagram following the table.

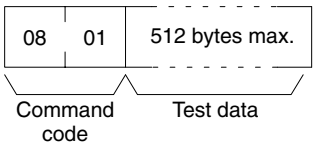
Byte	Bits 4 to 7	Bits 0 to 3
Byte 1	Node number 2	Node number 1
Byte 2	Node number 4	Node number 3
Byte 3	Node number 6	Node number 5
Byte 31	Node number 62	Node number 61



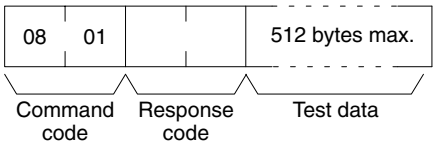
6-6-8 INTERNODE ECHO TEST

Performs an internode echo test with the indicated node.

Command Block



Response Block



Parameters

Test data (command and response): Up to 512 byte of test data can be included in the command. This data is transmitted to the indicated node and returned unchanged if communications are normal. If the data returned in the

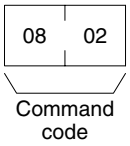
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response differs from that transmitted in the command, an error occurred in the internode echo test.

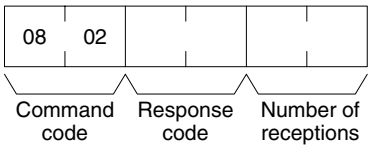
6-6-9 BROADCAST TEST RESULTS READ

Reads the results (number of receptions for each node) of the broadcast tests carried out using the BROADCAST TEST DATA SEND command. Refer to *6-6-10 BROADCAST TEST DATA SEND* for details on that command.

Command Block



Response Block



Parameters

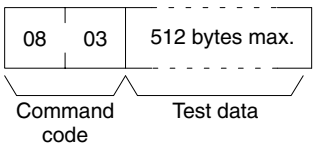
Number of receptions (response): The number of times that the BROADCAST TEST DATA SEND command has been executed since the last BROADCAST TEST RESULTS READ command was executed.

When this command is executed, the number of receptions data stored in the destination nodes is cleared. If the number of receptions does not equal the number of times that the BROADCAST TEST DATA SEND command has been executed since the last BROADCAST TEST RESULTS READ command was executed, an error has occurred.

6-6-10 BROADCAST TEST DATA SEND

Sends the test data in the command to all nodes in the specified network. No response will be returned when this command is executed, but reception of the test data can be verified by executing the BROADCAST TEST RESULTS READ command. Refer to *6-6-9 BROADCAST TEST RESULTS READ* for details.

Command Block



Note Make the following control data settings when executing this command:

a) Destination node number: FF (broadcast transmission)
b) Destination node unit number: FE (to SYSMAC LINK Units)
c) Response Flag (bit 13 of C+1): ON (response not returned)

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SECTION 7
Special Services

Information on remote programming and monitoring and RAS functions is provided in this section.

7-1 Remote Programming and Monitoring 112
7-2 RAS Functions 113
7-2-1 Internode Echo Test 113
7-2-2 Broadcast Test 115
7-2-3 Polling Unit Backup 115
7-2-4 Failed Node Bypass (Optical Networks Only) 116

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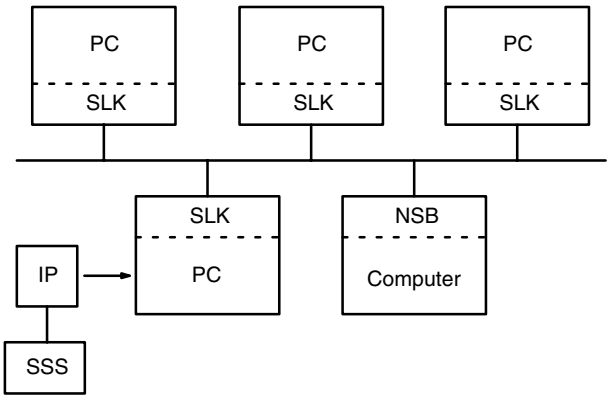
7-1 Remote Programming and Monitoring

Any C200HX, C200HG, C200HE, C200HS, C200H, C1000H, or C2000H (simplex) PC on a SYSMAC LINK Network can be remotely programmed and monitored using a SSS/CVSS connected to any other PC on the network. C2000H Duplex PCs cannot be remotely programmed and monitored through the SYSMAC LINK Network. Remote programming or monitoring of the CVM1 and CV-series PCs is not possible.

Peripheral Device Connection

The SSS is connected to C-series PCs via a C500-IP004 or C200H-IP006/007 Peripheral Interface Unit and can provide remote programming and monitoring capability for PCs in the same Network. In addition, the CVSS (CV Support Software, see note following diagram) running on an IBM-PC/AT or compatible can be used. The abbreviations in the diagram below indicate the following OMRON products:

SLK: SYSMAC LINK Unit
NSB: SYSMAC LINK Network Service Board
IP: Peripheral Interface Unit or Conversion Cable



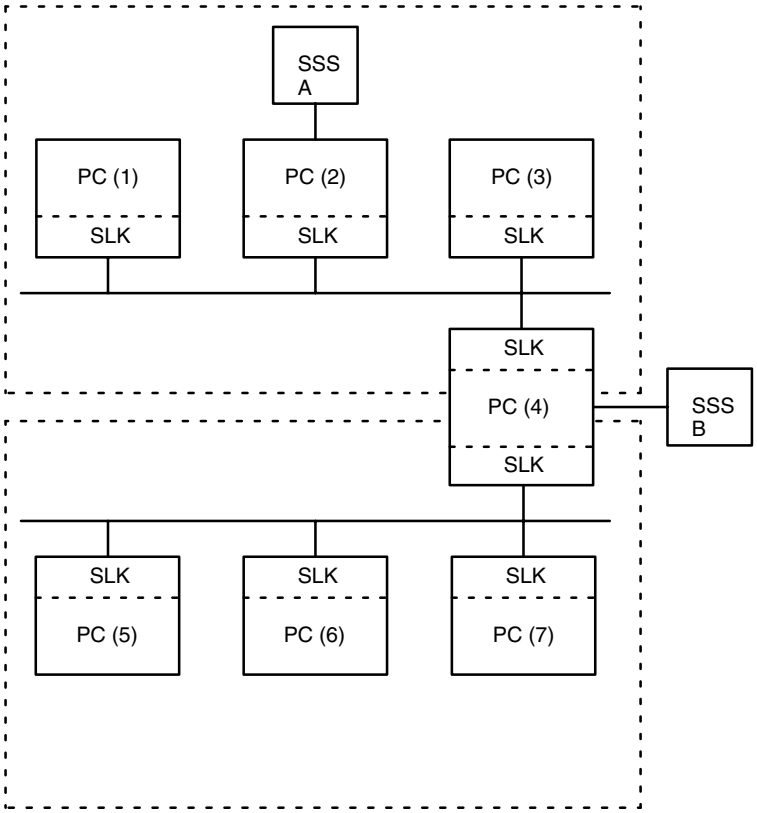
Note When the C- and CV-series PCs are in the same system configuration, CVSS on an IBM-PC/AT or compatible can be used.

Remote Communications Limits

The SSS can provide remote programming and monitoring capability for all PCs in the same Network. If the SSS is connected to a PC that is part of two Networks, i.e., one that has two SYSMAC LINK Units mounted to it, then remote programming and monitoring are possible for any PC in either Network.

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The SSS can only access PCs within the Network of which the PC it is connected to is a part. In the following diagram SSS A is attached to PC 1 and can remotely program and monitor PCs 1, 2, 3, 4, 5, 6, 7, and 8. SSS B is attached to PC 2 and can program and monitor only PCs 1, 2, 3, and 4.



7-2 RAS Functions

RAS is an acronym for Reliability, Availability, and Serviceability, and the RAS functions are intended to promote these three elements in the SYSMAC LINK Network.

7-2-1 Internode Echo Test

The internode echo test involves transmitting data to a specific node and requesting the node to send back the data that was sent. The results of the test are stored in the IR area. The internode echo test can also be executed with a CV-mode command. Refer to *6-6-8 INTERNODE ECHO TEST* for details.

Internode Test Functions

Internode Testing functions in the following manner:

1, 2, 3...

1. Test data is transmitted to a specified node.
2. The specified node returns the test data unaltered.
3. The original test data is compared to the data which was echoed back. If there is any discrepancy, an error code is generated.

Data Preparations

Using the Programming Console, set the node number of the destination PC in IR 23200 to IR 23207 for the C1000H/C2000H, IR 04000 to IR 04007 for the C200H, and IR 50000 to IR 50007 for the C200HS, C200HX, C200HG, or C200HE.

The node number must be between 1 and 62 ($01 to $3E) and can be changed during the test. Do not set the node number to the local node's node number or $00 (broadcast mode).

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Internode Test Execution

The test is initiated by moving the node number of the destination PC to IR 232 (IR 040 in the C200H and IR 500 in the C200HS, C200HX, C200HG, or C200HE) and then turning ON pin 1 of DIP switch 1. The overall procedure is listed below.

The PC that is initiating the test must be in PROGRAM mode. The PC receiving the transmission may be set in any mode.

The overall procedure for the test is as follows:

1, 2, 3...

1. Set the PC to PROGRAM mode.
2. Input the node number of the destination PC.
3. Turn ON pin 1 of DIP switch 1.
4. Check test results via indicators and/or returned data.
5. To test another node, change the destination node number and check results for the new node.
6. Turn OFF pin 1 of DIP switch 1.

Test Results

Test results are indicated both on the Unit indicators and stored in the IR area. The TS indicator displays the results of the test for each node.

Lit: . . . . . Testing in progress
Flashing: . . . . . Testing error
Not lit: . . . . . Test halted

The table below shows the results of the tests which will be stored in the IR area of the PC which initiated the test.

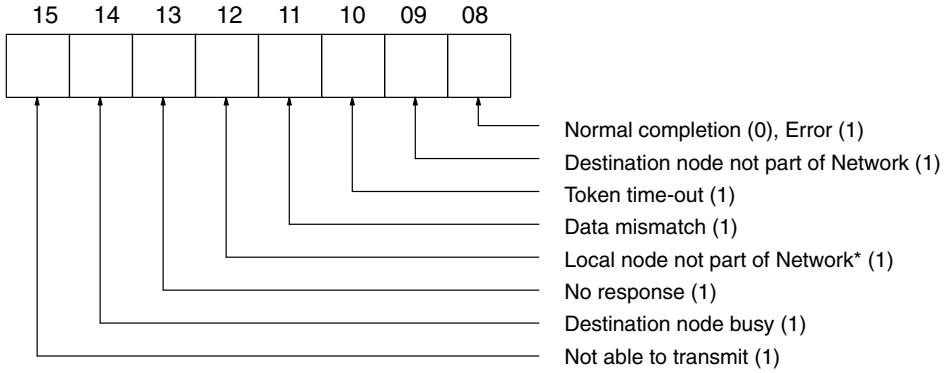
C200H□	C200H	C1000H/ C2000H	Bits 00 to 07		Bits 08 to 15
IR 500	IR 040	IR 232	Destination node number	* (07)	Set to zero.
IR 501	IR 041	IR 233	Number of test cycles		
IR 502	IR 042	IR 234	Number of errors		
IR 503	IR 043	IR 235	Number of times not able to transmit		Test status
IR 504	IR 044	IR 236	Number of no responses		Number of busy responses
IR 505	IR 045	IR 237	Number of no-token time-outs		Number of data mismatches

* Bit 07 will be turned ON when the destination node number designation is incorrect.

Number of test cycles is the total number of data packets sent and echoes received.

Number of errors is the total number of errors.

Test status is as follows.



Note *This error will occur when the communications chip is faulty, there is a node number setting error, or node number duplication error.

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Number of times not able to transmit is the number of times transmission was impossible because the destination node or the local node were not part of the Network, or node did not have the right to transmit.

Number of busy responses is number of times the node was unable to transmit because destination node was busy.

Number of no responses is the number of times the destination node did not respond.

Number of data conflicts is number of times test data did not match data echoed back.

Number of token time-outs is the number of times transmission was impossible because the node did not receive the token giving it polling unit status.

Note

1. Responses are monitored for two seconds.
2. When the destination node number is changed in IR 232 (IR 040 in the C200H and IR 500 in the C200HX, C200HG, C200HE, or C200HS), the test results in IR 233 to IR 237 (IR 041 to IR 045 in the C200H and IR 505 in the C200HX, C200HG, C200HE, or C200HS) will be initialized.

7-2-2 Broadcast Test

The broadcast test transmits data to all nodes in the network simultaneously and then reads the results (number of receptions for each node) of the test. The broadcast test can also be executed with CV-mode commands. Refer to *6-6-10 BROADCAST TEST DATA SEND* for details.

Broadcast Test Execution

The test can be executed with a SSS/CVSS. Refer to the Peripheral Device's *Operation Manual* for details.

The test proceeds as follows:

1, 2, 3...

1. The test data is transmitted to all nodes the specified number of times.
2. The number of receptions at each node is read out.
3. The test results (the number of transmissions and successful receptions) are displayed.

7-2-3 Polling Unit Backup

SYSMAC LINK Units provide an automatic backup function. In case of a failure or error in the SYSMAC LINK Unit which is currently the polling unit, the Network is automatically restructured. The lowest numbered functional node within the Network becomes the new polling unit, and the Network continues to function.

While the Network is restructuring itself, all data transmission stops. If the data link was operational when the polling unit failed, data is saved in the state it was just prior to the failure and data link operations will continue.

The time required to restructure the Network in the event of an error or failure may be calculated using the following formula:

Restructuring time =
(new polling unit node number + 1) x 20 ms + highest node number x 1 ms

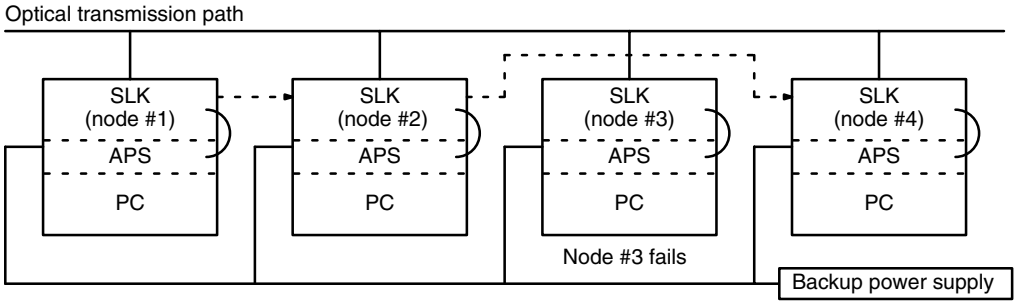
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7-2-4 Failed Node Bypass (Optical Networks Only)

SYSMAC LINK Networks using optical fiber cable and equipped with a back-up power supply and Power Supply Units have an automatic bypass function. If a failure or error occurs in a node of the network, that node will be bypassed, and the rest of the network will continue functioning.

In the example shown below, node 3 fails, but communications continue by bypassing node 3. The abbreviations in the diagram below indicate the following OMRON products:

SLK: SYSMAC LINK Unit (optical type)
APS: Auxiliary Power Supply Unit



The following table shows which Auxiliary Power Supply Units can be used with the SYSMAC LINK Units.

SYSMAC LINK Unit	Auxiliary Power Supply Unit
C1000H-SLK11	C1000H-APS01
C200HW-SLK13/14	C200H-APS03

⚠ Caution In an optical network, power supplied from the Power Supply Unit that is connected to each node will have precedence over power supplied from the back-up Power Supply Unit of the system. Be sure to turn on the Power Supply Units and the PCs simultaneously, or turn on the Power Supply Units first and then turn on the PCs. If the Power Supply Units are turned on or off, a transmission data error will result.

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SECTION 8
Error Processing

Information to help identify and correct errors that might occur is provided in this section.

8-1 Troubleshooting 118
8-2 Network Troubleshooting 124

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8-1 Troubleshooting

Error Indications

The table below lists error conditions, their probable cause, and possible remedies.

Error indicator	Probable cause			Remedy
RUN indicator not lit	SYSMAC LINK Unit faulty.			Replace Unit.
	PC not connected to power supply.			Connect to power supply (check connectors).
	PC's power supply voltage too low.			Adjust voltage to within recommended range.
	SYSMAC LINK Unit mounting screws are loose.			Tighten screws.
	SYSMAC LINK Unit mounted in wrong slot.			Move Unit to correct slot.
	PC faulty.			Replace PC.
ERC indicator lit	Node address setting is incorrect.	Not between 1 and 62		Set the node address to between 1 and 62.
		Duplicated setting		Set the node addresses again so that each address is used only once and then restart.
	Communications Controller is faulty.	Hardware problem in the communications part of the Unit.		Replace the SYSMAC LINK Unit.
		Power supply selection circuit is unstable.	Power Supply Unit is faulty.	Replace the Power Supply Unit.
			Power supply section of the Unit is faulty.	Replace the SYSMAC LINK Unit.
			Connectors are broken or have poor contact.	Check connectors and replace them if necessary.
			External power supply has dropped.	Check the primary side of the Power Supply Unit.
ERH indicator lit	Unit mounted to faulty PC.			Replace PC.
	Unit mounted to incompatible PC.			Replace PC.
	EEPROM error.			Re-initialize network parameters and data link tables or replace Unit.
	Watchdog timer error in PC.			Replace PC.
INS indicator not lit	Terminator connection faulty.			Connect Terminator correctly.
	Cable connection faulty.			Connect cables correctly.
	Local node's node number greater than the maximum node number set in the polling unit's network parameters.			Increase the maximum node number or decrease the local node number.
LNK indicator flashing	Data link table error on local node.			Re-create data link table.
	Error when reading EEPROM.			Re-create data link table or replace PC.
	Data link table of currently operating node and data link table of the local node don't match.			Stop data link and modify the data link table of either the currently operating node or the local node so they match.
	Local node has no data link table.			Create a data link table.

Note Node numbers cannot be modified with the power on. To change node numbers, first turn off the power, then change the settings, making sure not to duplicate any node numbers.

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Send (90)/RECV(98) Errors The table below lists response codes returned after execution of the SEND(90) and RECV(98) instructions, the probable cause of errors, and recommended remedies.

Response code	Item to check	Probable cause	Remedy
00: Normal completion	---	---	---
01: Parameter error	---	Local node parameter is outside of specified range.	Set the parameter correctly.
02: Unable to transmit	Network status of local node	Local node not part of Network.	Add to Network.
		Local node SYSMAC LINK Unit was initialized during instruction execution.	Execute the instruction again.
03: Destination node not in Network	Network status of destination node	Destination node not part of Network.	Add to Network.
		Destination node SYSMAC LINK Unit was initialized during instruction execution.	Execute the instruction again.
04: Busy error	---	Destination node is engaged in receiving data.	Increase the number of transmit retry attempts or re-evaluate the system so that the destination node is not so busy receiving data.
05: Response Time-out	---	Message packet was corrupted by noise.	Increase the number of transmit retry attempts. Perform an internode echo test to check noise level.
	Control data	Response watchdog timer interval too short.	Increase the value for the response watchdog timer interval.
06: Response Error	Destination node parameters	DM Area overrun because of DM Area size mismatch between PCs.	Check the first word of the data transfer area at the destination node and reset if necessary.
07: Communications controller error	AR 1114 (level 0) or AR 1514 (level 1)	An error has occurred in the local node communications controller.	Take corrective action, referring to communications controller errors and remedies table at end of this section.
08: Setting error	Node number	Check node number of local node.	Set the node number correctly. Make sure the node number is within specified range and that there are no duplicate node numbers.
09: PC error	Destination node indicators	A CPU Unit error at the destination node has occurred.	Clear the error in the CPU Unit (refer to the PC's Operating Manual).

CV-mode Command Errors The table below lists response codes (main and sub-codes) returned after execution of the CV-mode commands, the probable cause of errors, and recommended remedies. Upon receipt of some commands, the destination node will issue a request to another node; the other node is referred to as the third node.

Main code	Sub-code	Probable cause	Remedy
00: Normal completion	00	---	---
	01	Service was interrupted.	Check the contents of the destination transmission area of third node.

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Main code	Sub-code	Probable cause	Remedy
01: Local node error	01	Local node not part of Network.	Add to Network.
	02	Token time-out, node number too high.	Set the local node's node number below the maximum node number.
	03	Number of transmit retries exceeded.	Check communications with internode echo test. If the test fails, check network.
	04	Maximum number of frames exceeded.	Either check the execution of events in the network and reduce the number of events occurring in one cycle, or increase the maximum number of frames.
	05	Node number setting error (range).	Make sure the node number is within specified range and that there are no duplicate node numbers.
	06	Node number duplication error.	Make sure that there are no duplicate node numbers.
02: Destination node error	01	Destination node not part of Network.	Add to Network.
	02	No node with the specified node number.	Check the destination node's node number.
	03	Third node not part of Network.	Check the third node's node number.
	04	Busy error, destination node busy.	Increase the number of transmit retry attempts or re-evaluate the system so that the destination node is not so busy receiving data.
	05	Response time-out, message packet was corrupted by noise.	Increase the number of transmit retry attempts. Perform an internode echo test to check noise level.
		Response time-out, response watch-dog timer interval too short.	Increase the value for the response watch-dog timer interval.
03: Communications controller error	01	Error occurred in the communications controller, ERC indicator is lit.	Take corrective action, referring to communications controller errors and remedies table at end of this section.
	02	CPU Unit error occurred in the PC at the destination node.	Clear the error in the CPU Unit (refer to the PC's Operating Manual)
	04	Node number setting error.	Make sure the node number is within specified range and that there are no duplicate node numbers.
04: Not executable	01	An undefined command has been used.	Check the command code.
	02	Cannot process command because the specified unit model or version is wrong.	Check the unit model and version.
05: Routing error	01	Destination node number is not set in the routing table.	Set the destination node number in the routing table.
	02	Routing table isn't registered.	Set the source nodes, destination nodes, and relay nodes in the routing table.
	03	Routing table error.	Set the routing table correctly.
	04	The maximum number of relay nodes (2) was exceeded in the command.	Redesign the network or reconsider the routing table to reduce the number of relay nodes in the command.

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Main code	Sub-code	Probable cause	Remedy
10: Command format error	01	The command is longer than the max. permissible length.	Check the command format of the command and set it correctly.
	02	The command is shorter than min. permissible length.	Check the command format of the command and set it correctly.
	03	The designated number of data items differs from the actual number.	Check the number of items and the data, and make sure that they agree.
	04	An incorrect command format has been used.	Check the command format of the command and set it correctly.
	05	An incorrect header has been used. (The local node's relay table or relay node's local network table is wrong.)	Set the routing table correctly.
11: Parameter error	01	A correct memory area code has not been used or Expansion Data Memory is not available.	Check the command's memory area code and set the appropriate code.
	02	The access size specified in the command is wrong, or the first address is an odd number.	Set the correct access size for the command.
	03	The first address is in an inaccessible area.	Set a first address that is in an accessible area.
	04	The end of specified word range exceeds the acceptable range.	Check the acceptable limits of the data area and set the word range within the limits.
	06	A non-existent program no. has been specified.	Check the program number and be sure that it is set correctly.
	09	The sizes of data items in the command block are wrong.	Check the command data and be sure that the sixes of the data items are correct.
	0B	The response block is longer than the max. permissible length.	Check the command format and set the number of items correctly.
	0C	An incorrect parameter code has been specified.	Check the command data and reenter it correctly.
20: Read not possible	02	The program area is protected.	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command.
	03	The registered table does not exist or is incorrect.	Set or reset the registered table.
21: Write not possible	01	The specified area is read-only or is write-protected.	If the specified area is read-only, the write cannot be performed. If it is write-protected, turn off the write-protect switch and execute the instruction again.
	02	The program area is protected.	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command.
22: Not executable in current mode	01	The mode is wrong (being executed).	Check the operating mode.
	02	The mode is wrong (stopped).	Check the operating mode.
	03	The PC is in the PROGRAM mode.	Check the PC's mode.
	04	The PC is in the DEBUG mode.	Check the PC's mode.
	05	The PC is in the MONITOR mode.	Check the PC's mode.
	06	The PC is in the RUN mode.	Check the PC's mode.
	07	The specified node is not the control node.	Check which node is the control node.
23: No Unit	02	The specified memory does not exist.	Check the specifications of the installed file memory.
	03	No clock exists.	Check the model number.
24: Start/halt not possible	01	The data link table either hasn't been created or is incorrect.	Set the data link table correctly.

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Main code	Sub-code	Probable cause	Remedy
25: Unit error	12		
26: Command error	05	The service is being executed.	Execute the command again after the service has been completed or aborted.
	07	Service cannot be executed from local node because the local node is not part of the data link.	Execute the service from a node that is part of the data link.
	0B	Cannot clear error because the cause of the error still exists.	Eliminate the cause of the error and execute the ERROR CLEAR command.

Data Link Status Errors

The following table lists data link status errors, their probable cause, and possible remedies. Check all nodes in question.

Data link status	Point to check	Probable cause	Remedy
PC Error ON	PC Error Flag (bit 01, 05, 09, or 13 in the data link status flags)	A fatal error has caused the CPU Unit to halt (FALS instruction generated, etc.) CPU Unit error.	Clear the error in the CPU Unit, referring to the Unit's Operating Manual and Installation Guide.
		Connected to an incompatible PC.	Connect only to compatible PCs.
Communications error ON	Communications Error Flag (bit 02, 06, 10, or 14 in the data link status flags)	Error resulting from noise.	Run an internode echo test; if the results are not OK, re-check the operating environment.
		Unit in question is not part of the Network.	Add the Unit to the Network.
		Communications cycle time too short.	Increase communications cycle time.
Node not in data link	Data Link Member Flag (bit 03, 07, 11, or 15 in the data link status flags)	Node in question is not part of the data link.	Add the node in question to the data link.

Data Link Table Error Messages

The following tables list data link table errors, their probable cause, and possible remedies for the SSS/CVSS.

SSS/CVSS

Error	Probable Cause and Remedy
Write not possible	The number of LR Area data link words is greater than 64 words. The maximum number of LR Area data link words is 64 words in C-series PCs.
	The total number of data link words is greater than 2966 words (918 words when C200HW-SLK13/23 SYSMAC LINK Units are included). Make sure that the total number of data link words is 2966 words or less (918 words or less when C200HW-SLK13/23 SYSMAC LINK Units are included).
	The node number of a C200HW-SLK13/23 SYSMAC LINK Unit has been set incorrectly when the total number of data link words exceeds 918. Refer to *5-8 Data Link Precautions* for more details on node number settings.
	The refresh parameter's beginning DM or LR word setting is incorrect. When setting the beginning LR word for C-series SYSMAC LINK Units, LR words LR 00 to LR 63 correspond to CV-series addresses CIO 1000 to CIO 1063. Refer to page 44 for details on data link areas for different PC models.
	The refresh parameter's beginning DM or LR word setting is incorrect and the regions specified by the beginning DM or LR words cannot be used as a data link area. The data area regions that can be used as a data link area vary from PC to PC. Refer to page 44 for details on data link areas for different PC models. (Also, C-series addresses LR 00 to LR 63 correspond to CV-series addresses CIO 1000 to CIO 1063.)
	The refresh parameter's beginning status word setting is incorrect. Make sure that the beginning status word specifies a region that can be used for the data link status area (16 words). Refer to *5-8 Data Link Precautions* for more details.
	The refresh parameter's PC model setting is set to "CV-series." Set the PC model to "Other" when the setting is for a C-series SYSMAC LINK Unit.

Other Errors

The table below lists other errors not covered above. Probable causes and remedies are also provided.

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Error	Point to check	Probable cause		Remedy
Communications Controller error	AR 1114 for operating level 0 AR 1514 for operating level 1 ERC indicator	Noise or environmental influences.		Run an internode echo test; if an error occurs, recheck the operating environment.
		Consider replacing communications-related hardware if one of the following errors occurs: · Communications Controller watchdog timer error · Communications Controller memory error · Communications Controller chip bad · Transmitter portion of Communications Controller bad · Local node internode echo test error		Reinitialize the SYSMAC LINK Unit If the problem recurs, replace the Unit.
Communications Controller error	AR 1114 for operating level 0 AR 1514 for operating level 1	Hardware problem in the communications section of the Unit.	• Communications Controller memory error. • Communications Controller chip bad. • Transmission section of the Communications Controller bad. • Local node loopback test error. • Communications Controller watchdog timer error.	Replace the SYSMAC LINK Unit.
		Power supply selection circuit is unstable.	Power Supply Unit may be faulty.	Replace the Power Supply Unit.
			Power supply section of the Unit is faulty.	Replace the SYSMAC LINK Unit.
			Connectors are broken or have poor contact.	Check connectors and replace them if necessary.
			External power supply on the primary side of the Power Supply Unit has dropped.	Check the primary side of the Power Supply Unit.
EEPROM error	AR 1115 for operating level 0 AR 1515 for operating level 1 ERH indicator	Network parameters backed up in the EEPROM or data link table corrupted.		Reset the network parameters and data link tables in the node in question.
		Network parameters or data link table destroyed when backing up in EEPROM. When a network parameters mismatch occurs, the parameters have been destroyed. When the LNK indicator flashes, it indicates that the data link table has been destroyed.		(1) Reset the network parameters and data link tables using the SSS/CVSS. (2) Initialize the Unit by toggling DIP switch 1, pin 7 (C1000H-SLK11 or C1000H-SLK21) or DIP switch 2, pin 3 (C200HW-SLK13/14/23/24). a)If an EEPROM error continues to occur even after performing the reset actions above, the EEPROM has failed. Replace the Unit.
Network Parameters mismatch	AR 2406 for operating level 1 AR 2407 for operating level 0	Network parameters being used in the currently operating Network do not match the network parameters set in the Unit in question.		Use the SSS/CVSS to check the network parameters and reset them if necessary.

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8-2 Network Troubleshooting

Use the headings in this section to troubleshoot problems that occur in the Network and find a list of the probable causes of the problem.

Unable to operate network

Check indicators on the entire Network.

RUN indicator not lit

- Check whether power is being supplied to the PC at adequate voltage.
- Check whether mounting screws on Unit are tight.
- Check whether the Unit is mounted in a permissible slot on the Rack.
- Check whether the Unit operates normally when mounted on another PC.
- If none of the actions above solve the problem, replace suspect SYSMAC LINK Units.

INS indicator not lit

- Check whether local node number is greater than the maximum node number setting. If it is, lower local node number or increase maximum node number.
- Check whether the same node number has been assigned twice.
- In coaxial cable systems, check whether the Terminators are connected properly.
- Check whether all cables are connected properly.
- Check whether the cables transmit properly.

Unable to add local node to network

A local node cannot be added to the Network. (Check indicators on the node which cannot be added.)

RUN indicator not lit

- Check whether power is being supplied to the PC at adequate voltage.
- Check whether mounting screws on Unit are tight.
- Check whether the Unit is mounted in a permissible slot on the Rack.
- Check whether the Unit operates normally when mounted on another PC.
- If none of the actions above solve the problem, replace suspect SYSMAC LINK Units.

ERC indicator lit

- Check the PC's Communications Controller Error Flags. If ON, replace the SYSMAC LINK Unit.
- Check whether node number is within the range of 1 to 62. If not, reset to a unique node number from 1 to 62 (duplicate node numbers not permitted).
- Check for duplicate node numbers. Make sure each node number is assigned to only one unit.

ERH indicator lit

- Check whether the Unit is mounted to an incompatible model or version or PC. Replace PC if necessary.
- Check for CPU Unit error in the PC. Switch power off and turn on again. If problem occurs again, replace PC.
- Check for EEPROM error.

INS indicator not lit

- Check whether local node number is greater than the maximum node number setting. If it is, lower local node number or increase maximum node number.
- Check whether the same node number has been assigned twice.

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- In coaxial cable systems, check whether the Terminators are connected properly.
- Check whether all cables are connected properly.
- Check whether the cables transmit properly.

Data link cannot be started

Data link does not operate properly. Check indicators on the data link nodes.

LNK indicator is not lit and

RUN indicator not lit

- Check whether power is being supplied to the PC at adequate voltage.
- Check whether mounting screws on Unit are tight.
- Check whether the Unit is mounted in a permissible slot on the Rack.
- Check whether the Unit operates normally when mounted on another PC.
- If none of the actions above solve the problem, replace SYSMAC LINK Units.

ERC indicator lit

- Check the PC's Communications Controller Error Flags. If ON, replace the SYSMAC LINK Unit.
- Check whether node number is within the range of 1 to 62. If not, reset to a unique node number from 1 to 62 (duplicate node numbers not permitted).
- Check for duplicate node numbers. Make sure each node number is assigned to only one unit.

ERH indicator lit

- Check whether the Unit is mounted to an incompatible model or version or PC. Replace PC if necessary.
- Check for CPU Unit error in the PC. Switch power off and turn on again. If problem occurs again, replace PC.
- Check for EEPROM error.

INS indicator not lit

- Check whether local node number is greater than the maximum node number setting. If it is, lower local node number or increase maximum node number.
- Check whether the same node number has been assigned twice.
- In coaxial cable systems, check whether the Terminators are connected properly.
- Check whether all cables are connected properly.
- Check whether the cables transmit properly.

LNK indicator flashing

- Check whether a data link table has been created. If not, generate one.
- Check whether an EEPROM error has occurred. If so, investigate EEPROM error causes and remedies as outlined on page 123
- If a data link is already operating on the same Network, bring that data link to a halt, and start the data link that has the problem.
- If the LNK indicator flashing on other nodes, stop the data links in those nodes.

Data link cannot be stopped

Data link does not operate properly. Check indicator indicators on the data link nodes.

LNK indicator is not lit and

RUN indicator not lit

- Check whether power is being supplied to the PC at adequate voltage.
- Check whether mounting screws on Unit are tight.

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- Check whether the Unit is mounted in a permissible slot on the Rack.
- Check whether the Unit operates normally when mounted on another PC.
- If none of the actions above solve the problem, replace suspect SYSMAC LINK Units.

ERC indicator lit

- Check the PC's Communications Controller Error Flags. If ON, replace the SYSMAC LINK Unit.
- Check whether node number is within the range of 1 to 62. If not, reset to a unique node number from 1 to 62 (duplicate node numbers not permitted).
- Check for duplicate node numbers. Make sure each node number is assigned to only one unit.

ERH indicator lit

- Check whether the Unit is mounted to an incompatible model or version or PC. Replace PC if necessary.
- Check for CPU Unit error in the PC. Switch power off and turn on again. If problem occurs again, replace PC.
- Check for EEPROM error.

INS indicator not lit

- Check whether local node number is greater than the maximum node number setting. If it is, lower local node number or increase maximum node number.
- Check whether the same node number has been assigned twice.
- In coaxial cable systems, check whether the Terminators are connected properly.
- Check whether all cables are connected properly.
- Check whether the cables transmit properly.

Node cannot join data link

Node cannot be entered into the data link. Check indicators on the node which you want to add to data link.

LNK indicator is not lit and

RUN indicator not lit

- Check whether power is being supplied to the PC at adequate voltage.
- Check whether mounting screws on Unit are tight.
- Check whether the Unit is mounted in a permissible slot on the Rack.
- Check whether the Unit operates normally when mounted on another PC.
- If none of the actions above solve the problem, replace suspect SYSMAC LINK Units.

ERC indicator lit

- Check the PC's Communications Controller Error Flags. If ON, replace the SYSMAC LINK Unit.
- Check whether node number is within the range of 1 to 62. If not, reset to a unique node number from 1 to 62 (duplicate node numbers not permitted).
- Check for duplicate node numbers. Make sure each node number is assigned to only one unit.

ERH indicator lit

- Check whether the Unit is mounted to an incompatible model or version or PC. Replace PC if necessary.
- Check for CPU Unit error in the PC. Switch power off and turn on again. If problem occurs again, replace PC.
- Check for EEPROM error.

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INS indicator not lit

- Check whether local node number is greater than the maximum node number setting. If it is, lower local node number or increase maximum node number.
- Check whether the same node number has been assigned twice.
- In coaxial cable systems, check whether the Terminators are connected properly.
- Check whether all cables are connected properly.
- Check whether the cables transmit properly.

LNK indicator flashing

- Confirm that a data link table has been created. If not, do so.
- Check whether the data link tables of nodes which are currently in the data link match that of the local node. If not, stop data link operations and modify the data link table either in the local node or the nodes which are currently linked.
- If the data link tables do match, check whether an EEPROM error has occurred. If so, investigate EEPROM error causes and remedies.

LNK indicator still not lit

- When the data link tables have been generated automatically, confirm that the node number of the local node is within the range of node numbers set automatically. If not, either lower the node number of the local node so that it is within the range, or change the automatic settings in AR 07 to include the local node.
- Check whether the node number of the local node is included in the common link parameters in the data link tables of those nodes currently in the data link. If not, stop data link operations and modify the data link tables of either the active nodes or of the local node.

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SECTION 9
Inspection and Maintenance

This section contains information describing periodic maintenance required by the System and how to replace a SYSMAC LINK Unit.

9-1 Periodic Inspection 130
9-2 Replacing SYSMAC LINK Units 131

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9-1 Periodic Inspection

SYSMAC LINK Units must be inspected on a regular basis to ensure correct operation. SYSMAC LINK Units are built primarily of solid-state components and contain almost no parts subject to wear. Nevertheless, the life span of some solid-state components can be shortened as a result of adverse environmental conditions.

We recommend that the following points be checked at least once every 6 to 12 months as part of a standard inspection program. Ambient conditions should be checked more frequently. If any of these items deviate from the prescribed standards, take appropriate action to correct the condition.

Item	Description
Ambient conditions	Temperature: 0° to 55°C Humidity: 10% to 90% (no condensation) Dust-free
Installation	SYSMAC LINK Units securely attached? Cable connectors tight? Screws tightened on terminal blocks for external wiring? Cabling used for external wiring intact (no breaks)?

We recommend that users have backup Units available to make repairs and minimize down-time if a problem occurs in a SYSMAC LINK Unit.

Handling Precautions when Replacing Units

Please observe the following precautions in the event of a problem:

- Always turn the power off when replacing a SYSMAC LINK Unit.
- After replacing a Unit, always make the required settings before restarting operation.
- If a SYSMAC LINK Unit fails, replace it with a new one and immediately verify that the new Unit is working properly.
- When returning a malfunctioning SYSMAC LINK Unit for repair, please attach a detailed description of the problem to the Unit and return it to the sales office nearest you (see listing at the end of this manual).
- If you suspect that a poor connection is the cause of a malfunction, clean the connectors using a clean, soft cloth and industrial-grade alcohol. Remove any lint or threads left from the cloth, and re-mount the SYSMAC LINK Unit.

Interchanging C200HS-SLK12/22 and C200HW-SLK13/14/23/24 SYSMAC LINK Units

The C200HW-SLK13/14/23/24 SYSMAC LINK Units' functions are equal to or superior to those of the C200HS-SLK12/22 Units, so C200HS-SLK12/22 Units can be replaced with C200HW-SLK13/14/23/24 Units. Do not replace C200HW-SLK13/14/23/24 Units with C200HS-SLK12/22 Units.

Tools and Equipment Needed for Inspection

The following tools and equipment will be needed to perform inspection and adjustments.

- Assorted flat-blade and Phillips screwdrivers
- Circuit tester or digital VOM
- Industrial-grade alcohol and clean cotton cloth
- Synchroscope
- Pen-chart recording oscilloscope
- Thermometer, hygrometer

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9-2 Replacing SYSMAC LINK Units

Note

1. Data link tables and network parameters are stored in the EEPROM in the SYSMAC LINK Unit. Be extremely careful when removing this component from the old SYSMAC LINK Unit and inserting it in the new Unit.
2. Always turn off the power supply to the PC before attempting to replace a Unit.

Manually Set Data Link

If data links have been established manually, the data link table must be re-set after mounting the new Unit and before activating data links. If data link areas are set automatically, this re-set operation is unnecessary as long as SW1 and SW2 are set correctly.

Network Parameters

To use network parameters other than default values, use the following procedure after mounting the new Unit.

1, 2, 3...

1. Set SW1 pin 8 to ON (polling unit setting*).
2. After initializing the SYSMAC LINK Unit, confirm that it has correctly joined the Network by checking the indicators (INS LED lit, and ERC and ERH LEDs not lit indicate normal operation).
3. Set SW1 pin 8 to OFF (polled unit setting*).
4. After initializing the SYSMAC LINK Unit, confirm that it has correctly joined the Network by checking the indicators (INS LED lit, and ERC and ERH LEDs not lit indicate normal operation).

Note *Refer to *4-5 Polling Unit Setting* for more information on the polling unit.

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Appendix A
Standard Models

SYSMAC LINK Units

Name	Specifications	Model
SYSMAC LINK Unit	Use optical fiber cable. Refer to the tables below for accessories. Includes to secures the optical fiber cables to the Unit.	C200HW-SLK13 C200HW-SLK14
		C1000H-SLK11
	Use coaxial cable. Refer to the tables below for accessories.	C200HW-SLK23 C200HW-SLK24
		C1000H-SLK21-V1

Accessories

The required number of each of the following is included with the SYSMAC LINK Units. Replacement parts can be ordered using the following model numbers.

• Optical-type Units

Name	Specifications	
Optical Fiber Cable Mounting Bracket	Secures the optical fiber cables to the Unit and includes the following:	
	Mounting Bracket	M3 hexagonal nuts (2)
	Cable Retainer	Pan-head Phillips screws (M3 x 6) (2)
	Terminal screws (2)	Binding Phillips screw (M3 x 10)

• Coaxial Units

Name	Specifications	Model
F Adapter	One of each is included with the C200HW-SLK23/24 and C1000H-SLK21-V1.	C1000H-CE001
F Adapter cover		C1000H-COV01
F Adapter Attachment Stirrup	One is included with the C200HW-SLK23/24 only.	C200H-TL001

Related Items

The following items might be required depending on the SYSMAC LINK Unit and system configuration.

Name	Specifications		Model
Bus Connector (For C200HX/HG/HE)	Required to connect SYSMAC LINK Unit(s) to a C200HX/HG/HE.	Connects one Unit	C200HW-CE001
		Connects two Units	C200HW-CE002
	Required to connect one SYSMAC LINK Unit and one PC Card Unit to a C200HX/HG/HE.	Connects two Units	C200HW-CE012
Bus Connector (For C200H/HS)	Required to connect SYSMAC LINK Unit(s) to a C200H/HS.	Connects one Unit	C200H-CE001
		Connects two Units	C200H-CE002
Communications Board	Required to connect SYSMAC LINK Unit(s) to a C200HX/HG/HE.		C200HW-COM01 C200HW-COM04-EV1
Terminator	Two required for each Network connected with coaxial cable.		C1000H-TER01

Auxiliary Power Supply Units

Name	Specifications	Model
Auxiliary Power Supply Unit	For use with the C1000H-SLK11.	C1000H-APS01
	For use with the C200HW-SLK13/14.	C200H-APS03

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Accessories

The required number of each of the following is included with the Auxiliary Power Supply Units. Replacement parts can be ordered using the following model numbers.

Name	Specifications	Model
Power Supply Cable (Supplies one Unit.)	One is included with the C1000H-APS01.	C1000H-CN111
	One is included with the C200H-APS03.	C200H-CN111

Related Items

The following items will be required when connecting two Units to one Power Supply Unit.

Name	Specifications	Model
Power Supply Cable	Connects to one Unit. Order one more cable (one is included with the Power Supply Unit) when connecting two C1000H-SLK11 Units.	C1000H-CN111
	Connects to two Units. Order one when connecting two C200HW-SLK13/14 Units.	C200H-CN211

Applicable CPU Units

The following table shows which CPU Units are compatible with which SYSMAC LINK Units. The SYSMAC LINK Units cannot be used with other CPU Units or with a C2000H Duplex System (even one set for Simplex operation.) A Communications Board equipped with a Link Interface (C200HW-COM01/04-EV1) is required when mounting a SYSMAC LINK Unit to a C200HX/HG/HE PC.

SYSMAC LINK Unit	Specifications	Applicable CPU Unit(s)
C1000H-SLK21-V1	Coaxial-type	C1000H-CPU01-EV1 C2000H-CPU01-EV1
C1000H-SLK11	Optical-type	
C200HW-SLK23/24	Coaxial-type	C200H-CPU11-E C200H-CPU31-E C200HS-CPU31-E C200HS-CPU33-E C200HX-CPU34-E C200HX-CPU44-E C200HX-CPU54-E C200HX-CPU64-E C200HG-CPU33-E C200HG-CPU43-E C200HG-CPU53-E C200HG-CPU63-E C200HE-CPU32-E C200HE-CPU42-E
C200HW-SLK13/14	Optical-type	

Connectors and Related Items

The following tables list the optical and coaxial connectors as well as tools used to attach the connectors and test connections.

Optical-type

Name	Specifications	Model
Optical Connector	Connects the optical fiber cable to the C1000H-SLK11. (See note 1.) Two are required for each node.	S3200-COCF2071
	Connects the optical fiber cable to the C200HW-SLK13/14. Two are required for each node. (Can be used with the C1000H-SLK11 too.)	S3200-COCF2571
	This inline adapter splices optical fiber cable. One is required for each break in the cable.	S3200-COIA2000
Optical Connector Assembly Tools	For use with the S3200-COCF2071/COCF2571 Optical Connector. (Optical fiber cable cutters are included)	CAK-0057 (See note 2.)
Optical Power Tester	For use with the S3200-COCF2071/COCF2571 Optical Connector. (Head Unit model number: S3200-CAT2702)	S3200-CAT2700
Master Fiber	For use with the S3200-COCF2071/COCF2571 Optical Connector.	S3200-CAT2001H

Note 1. Never use the S3200-COCF2011 Optical Connector with C200HW-SLK13/14 SYSMAC LINK Units. The connector might become stuck in the Unit if inserted.

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2. The S3200-COCF2071/2571 Connectors can be assembled using the S3200-CAK1062 by adding the JRFK-57PWS (made by Sumitomo Electric Industries, Ltd.).

Coaxial-type Units

Name	Specifications	Model
BNC Connector	Crimp-on connector.	BNC-P-5C-CR10-B
Crimping Tool	Attaches the connector.	CR-H-1130

Cables

Optical Fiber Cable

The following table lists the Hard Plastic-clad Optical Fiber Cables that can be used with the C200HW-SLK13/14 and C1000H-SLK11.

Name	Specifications	Model
Optical Fiber Cable	Black, 10 m long	S3200-HCCB101
	Black, 50 m long	S3200-HCCB501
	Black, 100 m long	S3200-HCCB102
	Black, 500 m long	S3200-HCCB502
	Black, 1000 m long	S3200-HCCB103
	Orange, 10 m long	S3200-HCCO102
	Orange, 50 m long	S3200-HCCO501
	Orange, 100 m long	S3200-HCCO102
	Orange, 500 m long	S3200-HCCO502
	Orange, 1000 m long	S3200-HCCO103

The following table shows the code used the last 6 or 7 characters (after S3200-H) of the Optical Fiber Cable model numbers.

Character	Possible characters	Meaning
First	C or B	C indicates cord, and B indicates cable.
Second	C or L	C indicates no power cable, and L indicates power cable attached.
Third	B or O	B indicates black, and O indicates orange.
Fourth	A = 1 to 9	Cable length in scientific notation. L = A $\times$ 10^{B}.
Fifth	Always 0	
Sixth	B = 1 to 3	
Seventh	N or blank	N indicates no tension wires are attached.

Coaxial Cable

Use a high quality 5C-2V coaxial cable with the C200HW-SLK23/24 and C1000H-SLK21-V1.

Peripheral Devices

Name	Specifications	Model
SSS	IBM PC/AT or compatible, 3.5” disks	C500-ZL3AT1-E V1.1
CVSS	IBM PC/AT or compatible, 3.5” disks	CV500-ZS3AT1-EV2
Programming Console	Vertical, w/backlight	3G2A5-PRO13-E
	Horizontal, w/backlight	3G2A6-PRO15-E
	Hand-Held, w/backlight Except for C200H and C20, the Programming Console Adapter AP003 and connecting cable CN222/CN422 are necessary. They are sold separately.	C200H-PRO27-E

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Appendix B
Specifications

Communications Specifications

Item	Specification	
	C200HW-SLK23/SLK24 and C1000H-SLK21-V1	C200HW-SLK13/SLK14 and C1000H-SLK11
Communications method	Token ring (N:N)	
Transmission method	Manchester encoding, baseband	
Data transmission rate	2 Mbps	
Media	Coaxial cable (5C-2V)	Hard-plastic-clad quartz optical fiber cable
Transmission path	Bus	Daisy chain
No. of nodes	62 max.	
Distance between nodes	Total: 1 km	Total: 10 km (800 m max. between nodes if press-fit; 1 km if polished and connected) (see note 1)
Message length	512 bytes max. (not including header)	
Connectors	BNC (F Adaptor)	Full, half-lock press-in connector
Link functions	Data link, data read/write service	
Data link words	2,966 words max. in LR and DM Areas combined (918 words max. with only C200HW-SLK13/SLK23 in data link) (see note 2)	
Send/receive buffer capacity	Buffers for 13 messages (1-message send buffer +2-message receive buffer+10-message send/receive buffer)	
RAS functions	Automatic polling unit backup, self-diagnostics (internode echo tests), failed node bypass (optical systems only), watchdog timer, error (CRC-CCITT) detection = $X^{16} + X^{12} + X^5 + 1$	
Weight	C200HW-SLK23/SLK24: 0.4 kg max. C1000H-SLK21-V1: 0.6 kg max.	C200HW-SLK13/SLK14: 0.5 kg max. C1000H-SLK11: 0.7 kg max.

Note 1. A press-fit type connector, which ensures a transmission distance of 800 m, can be made by the user. A cable with connectors is a polished-connection type, and ensures a transmission distance of 1 km.

2. There are some usage restrictions in systems that incorporates the C200HW-SLK14/SLK24 or C1000H-SLK11/SLK21-V1 with the in the same system. Refer to *5-6-1 Combining the C200HW-SLK13/SLK23 with other SYSMAC LINK Units* for details.

SR and AR Bits

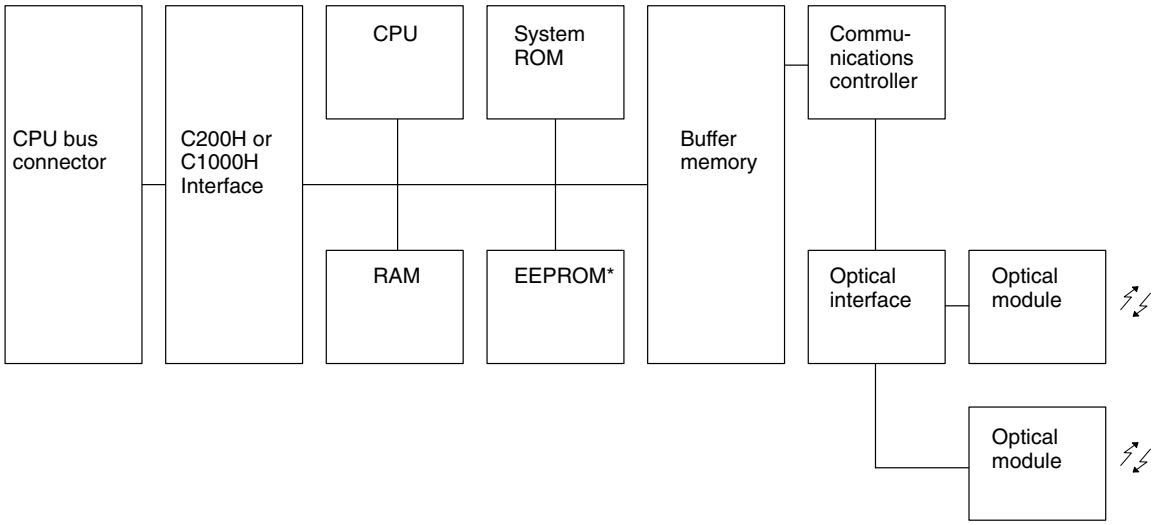
Refer to your PC's *Operation Manual* for tables of all SR and AR bits that can be used in relation to SYSMAC LINK Units.

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Appendix C
Internal Configuration

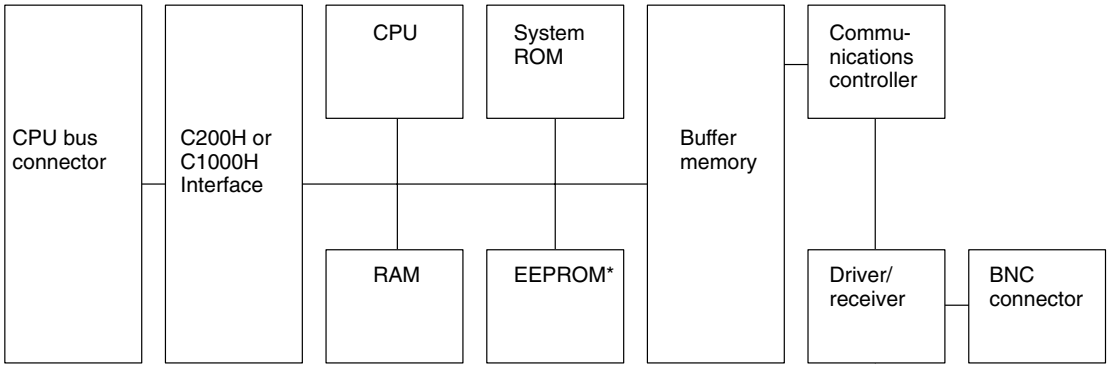
The diagrams below show the configuration of the internal components of SYSMAC LINK Units.

Optical Units



Note *Network parameters and data link tables are backed up in EEPROM.

Coaxial-cable Units



Note *Network parameters and data link tables are backed up in EEPROM.

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Glossary

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

AGF — All-glass optical fiber cable; also known as crystal optical fiber cable.

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.

APF — An acronym for all-plastic optical fiber cable.

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

auxiliary bit — A bit in the Auxiliary Area.

Backplane — A base to which Units are mounted to form a Rack. Backplanes provide a series of connectors for these Units along with wiring to connect them to the CPU Unit. Backplanes also provide connectors used to connect them to other Backplanes. In some Systems, different Backplanes are used for different Racks; in other Systems, Racks differ only by the Units mounted to them.

basic Link System — A control system that includes only one of the following systems: SYSMAC LINK System, Remote I/O System, PC Link System, Host Link System, or NET Link System.

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.

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 components.

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

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*.

C-mode The form of communications useable with either C-series or CV-series PCs. See *CV-mode*.

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

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.

common data areas LR data areas in separate PCs whose contents are kept the same. Each PC writes data to certain LR area words, and then transfers this data to the same LR area words in the other PCs that have a PC or SYSMAC LINK Unit connected in series with it. Common data areas are created in PC Link Systems and SYSMAC LINK Systems.

communications cable Cable used to transfer data between components of a control system and conforming to the RS-232C or RS-422 standards.

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.

controller A device on a general-purpose interface bus that is capable of controlling communications.

Converting Link Adapter A Link Adapter used to convert between different types of optical fiber cable, different types of wire cable, or between optical fiber cable and wire cable. Such conversion is necessary to connect Units that use different forms of communication.

CPU Backplane A Backplane used to create a CPU Rack.

CPU Rack Part of a building-block PC, the CPU Rack contains the CPU Unit, a Power Supply, and other Units. With most PCs, the CPU Rack is the only Rack that provides linkable slots.

CPU Unit See *central processing unit*.

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

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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.

CTS signal 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 Either of the following PCs: CV500 or CV1000.

CVSS See *CV Support Software*.

DAC See *Data Access Console*.

daisy-chain A serial connection method in which each device is connected through the previous device.

Data Access Console A Programming Device used to monitor and control memory area contents. The Data Access Console does not afford the wide range of programming capabilities as the GPC or CVSS and is designed for system monitoring and maintenance.

data area An area in the PC's memory that is designed to hold a specific type of data, e.g., the LR area is designed for to hold common data in a PC Link System.

data area boundary The highest address available within a data area. When designating an operand that requires multiple words, it is necessary to ensure that the highest address in the data area is not exceeded.

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 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.

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.

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

DIN track A rail designed to fit into grooves on various devices to allow the devices to be quickly and easily mounted to it.

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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 control, i.e., control is decentralized and 'distributed' over the system. Distributed control is a concept basic to PC Systems.

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.

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 (data) transfer A data transfer that is performed in response to an event, e.g., an interrupt signal.

event processing Processing that is performed in response to an event, e.g., an interrupt signal.

FA Factory automation.

fatal error An error that stops PC operation and requires correction before operation can continue.

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.

gateway An interface that connects two networks.

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.

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

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

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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 bit A bit in memory used to hold I/O status. Input bits reflect the status of input terminals; output bits hold the status for output terminals.

I/O capacity The number of inputs and outputs that a PC is able to handle. This number ranges from around one-hundred for smaller PCs to two-thousand for the largest ones.

I/O Control Unit A Unit mounted to the CPU Rack in certain PCs to monitor and control I/O points on Expansion I/O Units.

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 devices The devices to which terminals on I/O Units, Special I/O Units, or Intelligent I/O Units are connected. 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 I/O Rack in certain PCs to interface the Expansion I/O Rack to the CPU Rack.

I/O point The place at which an input signal enters the PC System or an output signal leaves the PC System. In physical terms, an I/O point corresponds to terminals or connector pins on a Unit; in terms of programming, an I/O point corresponds to an I/O bit 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 Unit The most basic type of Unit mounted to a backplane to create a Rack. 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 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.

increment Increasing a numeric value, usually by 1.

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.

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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.

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.

ladder diagram (program) A form of program arising out of relay-based control systems that uses circuit-type diagrams to represent the logic flow of programming instructions. The appearance of the program is similar to a ladder, and thus the name.

ladder diagram symbol A symbol used in drawing a ladder-diagram program.

ladder instruction An instruction that represents the conditions on a ladder-diagram program. The other instructions in a ladder diagram fall along the right side of the diagram and are called terminal instructions.

LAN An acronym for local area network.

leading zero One of one or more consecutive zeros in the leftmost digits of an address or numeric value.

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 Adapter A Unit used to connect communications lines, either to branch the lines or to convert between different types of cable. There are two types of Link Adapter: Branching Link Adapters and Converting Link Adapters.

Link Area A data area that is designed for use in data links.

linkable slot A slot on either a Backplane to which a Link Unit can be mounted. Backplanes differ in the slots to which Link Units can be mounted.

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Link System — A system that includes one or more of the following systems: SYSMAC LINK System, Remote I/O System, PC Link System, Host Link System, or NET Link System.

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

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.

loop connection — A method for connecting communications lines in which each Unit is connected to two other Unit to form a closed loop.

loop-back — The processes of using an alternate communications path that runs in the reverse direction of the normal communications path to prevent communications from being disabled when communications along the normal path are not possible.

MONITOR mode — A mode of PC operation in which normal program execution is possible, and which allows modification of data held in memory. Used for monitoring or debugging the PC.

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

Multilevel PC Link System — A PC Link System in which at least one PC has two PC Link Units mounted to it.

Multilink PC Link System — A PC Link System in which more than two PCs share a common data area.

Multilevel SYSMAC LINK System — A SYSMAC LINK System in which at least one PC has two PC Link Units mounted to it.

Network — See SYSMAC LINK Network.

network interrupt — An interrupt that occurs when data is received on the network interface.

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

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 address.

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.

NSB — An acronym for Network Service Board.

NSU — An acronym for Network Service Unit.

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.

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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).

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).

optical cable link In a Wired Remote I/O System, an optical cable connecting two Converting Link Adapters. Specified because the System otherwise uses wire communications.

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

optical connector A connector designed to be connected to an optical fiber cable.

optical fiber cable Cable made from light conducting filaments used to transmit signals.

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 bit A bit in the IR area that is allocated to hold the status to be sent to an output device.

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.

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

overseeing Part of the processing performed by the CPU Unit that includes general tasks required to operate the PC.

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.

PCB An acronym for printed circuit board.

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PC Link Subsystem — All of the PCs that share the same part of the LR are in a PC Link System. PC Link Subsystems exist within a PC Link System when one or more of the PCs in the System has two PC Link Units mounted to it. If Subsystems exist, the System is considered a Multilevel PC Link System.

PC Link System — A System in which PCs are connected through PC Link Units to enable them to share common data areas, i.e., each of the PCs writes to certain words in the LR area and receives the data of the words written by all other PC Link Units connected in series with it.

PC Link Unit — The Unit used to connect PCs in a PC Link System.

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 limits of the PC System on the upper end is the PC and the program in its CPU Unit and on the lower end, I/O Units, Special I/O Units, Optical I/O Units, Remote Terminals, etc.

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.

polled unit — Any of the Units in a PC Link system that share common data areas except for the Polling Unit.

polling — A method in which one element in a system monitors changes in the contents of certain data words to maintain accurate records of the contents. In a PC Link System, polling is performed by the polling unit to maintain common data areas among PCs.

polling unit — The PC Link Unit in a PC Link System that handles data transmissions to maintain common data areas within the PCs. In a PC Link System, the polling unit always shares common data areas with the polled units.

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

PROGRAM mode — A mode of operation that allows inputting and debugging of programs to be carried out, but that does not permit normal execution of the program.

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 Unit-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.

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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.
Rack	An assembly of various Units on a Backplane that forms a functional unit in a building-block PC System. Racks include CPU Racks, Expansion I/O Racks, I/O Racks, and Slave Racks.
read word	A word in the LR area that contains data transferred from another PC in a PC Link System. A read word cannot be written to by the PC.
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.
relay-based control	The forerunner of PCs. In relay-based control, groups of relays are wired to each other 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.
Restart Bit	A bit used to restart a Unit mounted to a PC.
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.
RS-232C interface	An industry standard for serial communications.
RS-422 interface	An industry standard for serial communications.
RTS signal	Request To Send: the BASIC Unit can be programmed to assert this signal when it wishes to send data through a communications port.
RUN mode	The operating mode used by the PC for normal control operations.
self diagnosis	A process whereby the system checks its own operation and generates a warning or error if an abnormality is discovered.
serial polling	A polling method in which each device being polled is polled one at a time in sequence.
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.
Single-level PC Link System	A PC Link System in which there is no PC with more than one PC Link Unit.
Single-link PC Link System	A PC Link System that connects only two PCs to each other.
Single-level SYSMAC LINK System	A SYSMAC LINK System in which there is no PC with more than one SYSMAC LINK Unit.

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slot A position on a Rack (Backplane) to which a Unit can be mounted.

Special I/O Unit A dedicated 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.

switching capacity The voltage/current that a relay can switch on and off.

SYSMAC LINK Network All the PCs connected in series via SYSMAC LINK Units that can join together to form data links or read and write data back and forth.

SYSMAC LINK System A Link System that contains two or more SYSMAC LINK Networks.

SYSMAC/NET Link Read/Write Instructions Programming instructions used to transfer data between PC connected in a SYSMAC LINK Network or NET Link Subsystem. The write instruction acronym is SEND(90) and is used to transfer data to another PC. The read instruction acronym is RECV(98) and is used to receive data from another PC.

system configuration The arrangement in which Units in a System are connected.

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.

transmission distance The distance that a signal can be transmitted.

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 number A number assigned to some Link Units and Special I/O Units to assign words and sometimes other operating parameters to it.

user program A program written by the user as opposed to programs provided with a product.

watchdog timer A timer within the system that ensures that the cycle 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.

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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 bit A bit in a work word.

work word A word that can be used for data calculation or other manipulation in programming, e.g., LR words not used in a PC Link or NET Link System.

write word A word written in the LR area by a PC in a PC Link System. The data of the write words is transferred to the rest of the PCs that share common data areas, i.e., the write words for one PC are read words for the rest of the PCs in the PC Link System.

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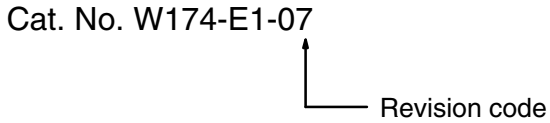
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Revision History

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



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

Revision code	Date	Revised content
1	August 1990	Original production
2	July 1992	Major rewrite for new version of product. Information on CV-mode commands and SYSMAC LINK Units using optical fiber cable was added.
2A	November 1992	**Page 22:** Diagram and note at bottom of page corrected.
3	August 1994	C200H-SLK11 and C200H-SLK21-V1 have been upgraded to C200HS-SLK12 and C200HS-SLK22. Backplane model numbers updated. Scan time changed to cycle time throughout the manual. **Pages 2, 3, 38, 43, 44, 46, 50, 51, 53, 57, 58, 64, 98, 101, 109:** "Host computer" changed to "CVSS" when related to the SYSMAC LINK. **Pages 2, 3, 4, 47, 49, 98:** "LSS" changed to "FIT" when related to the SYSMAC LINK. **Pages 4, 5, 24, 25, 104, 109, 110, 111, 112, and 117:** Terms unified to "Terminator" and "F Adapter." **Page 5:** "Compatibility with other PCs" updated. **Pages 6, 7:** "Compatibility with other Link Units" updated. **Page 22:** C200H Power Supply Unit information was corrected. **Page 24:** Model number correction. C200H-TL001 Attachment Stirrup added. **Page 25:** C200H-TL001 Attachment Stirrup added. **Pages 31, 32:** Models changed to C200H-SLK11 and C200H-SLK21-V1. C200H-TL001 Attachment Stirrup added. **Page 34:** Second paragraph of "Start-up Node" was rewritten. **Page 39:** Text added to *Setting Network Parameters*. **Page 44:** DM area information corrected in the top table. **Pages 44, 48:** CV Series added to the "Max. number of linked words (in Network)" in the table. **Page 46:** Sentence was added to the bottom of the page. **Pages 46, 49:** "Software" changed to "CVSS." **Page 49:** Note added. **Page 59:** Data Exchange timing diagram corrected. **Pages 60 to 62:** Minimum and maximum response time diagrams and descriptions corrected. Two cases added. **Page 64:** An addition about the SYSMAC LINK Support Board in *Computer Transmission*. **Page 65:** Data transfer area information added. **Page 66:** Note 4 added. **Page 67:** Note 3 added. **Page 69:** Indirect Addressing example added. **Page 73:** List to CV-mode commands for PCs corrected. **Page 80:** Parameters for RUN corrected. **Page 98:** C200H-IP006 Peripheral Interface Unit added to *Peripheral Device Connection*. LSS and CVSS information added. **Pages 101, 102:** Model number change. **Page 102:** Caution has been added. **Page 114:** A precaution on interchanging SYSMAC LINK Units added. **Page 121:** Weight and notes added to the table.
3A	October 1994	**Page 110:** Information of support software capabilities corrected (6 locations).
4	August 1996	New version of manual for C200HX/HG/HE. All references to FIT have been removed or replaced with references to SSS. Section of precautions added before section 1 and adjustments made to signal words for precautions. **Page 16:** Pin functions of pin 8^2 of the top table and 4^2 of the bottom table have been corrected.
5	January 1998	**Pages 6, 20, 129, 130:** "C200HW-COM04" changed to "C200HW-COM04-EV1." **Pages 7, 8, 19, 38:** PC Card Unit information for C200HX/HG/HE PCs added. **Page 25:** C200HW-CE012 Bus Connector and Communications Board information added. **Page 129:** C200HW-CE012 Bus Connector added to the list in *Related Items*.

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Revision code	Date	Revised content
6	March 2000	Updated the *Precautions*. **Page 60:** Added information on data link status, including table describing flag operation and programming examples. **Page 110:** Added comment that remote programming or monitoring of CVM1 and CV-series PCs is not possible. **Page 116:** Changed description of ERC indicator. **Page 121:** Changed description of Communications Controller error. **Page 133:** Changed description of send/receive buffer capacity.
07	September 2003	**Page xiii:** "Power Supply Units" added in one place. **Page 28:** Model numbers changed in several places. **Page 29:** Changes made to table and another table added. **Page 41:** Information on conflicting network parameters changed. **Page 67:** Numerical changes made in three places. **Page 75:** Information on NETWORK READ/WRITE instructions changed. **Page 91:** Line added at bottom of page. **Page 134:** Model numbers changed in several places in table at bottom of page and note added.

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