

**3G8F7-SLK11-E (Optical Fiber Cable)**

**3G8F7-SLK21-E (Coaxial Cable)**

**SYSMAC LINK PCI Support Boards**

**Operation Manual**

*Produced March 2001*

## ***Read and Understand this Manual***

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

## ***Warranty and Limitations of Liability***

### ***WARRANTY***

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

## ***Application Considerations***

### ***SUITABILITY FOR USE***

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

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

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

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

### ***PROGRAMMABLE PRODUCTS***

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

## ***Disclaimers***

### ***CHANGE IN SPECIFICATIONS***

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

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

### ***DIMENSIONS AND WEIGHTS***

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

### ***PERFORMANCE DATA***

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

### ***ERRORS AND OMISSIONS***


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





## Notice:

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

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

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

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

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

## OMRON Product References

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

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

The abbreviation “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.

**Reference** Indicates supplementary information on related topics that may be of interest to the user.

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

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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.



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## About this Manual:

This manual describes the operation of the 3G8F7-SLK11-E and 3G8F7-SLK21-E SYSMAC LINK PCI Support Boards and includes the sections described below. SYSMAC LINK Support Boards are used to connect IBM PC/AT or compatible computers to a SYSMAC LINK Network. The following three manuals are directly related to application of the SYSMAC LINK Network.

Name	Contents	Cat. No. (suffixes omitted)
3G8F7-SLK11-E/SLK21-E SYSMAC LINK PCI Support Boards Operation Manual (this manual)	Operating procedures for SYSMAC LINK PCI Support Board connections. SYSMAC LINK Support Boards are used to connect IBM PC/ATs or compatibles to a SYSMAC LINK Network.	W390
3G8F7-SLK11-E/SLK21-E SYSMAC LINK PCI Support Board Installation Guide	Installation and setup procedures for SYSMAC LINK PCI Support Board connections. SYSMAC LINK Support Boards are used to connect IBM PC/ATs or compatibles to a SYSMAC LINK Network.	W389
3G8F5-SLK21-E SYSMAC LINK ISA Support Board Operation Manual	Installation, setup, and operating procedures for SYSMAC LINK Support Boards for ISA bus connections. SYSMAC LINK Support Boards are used to connect IBM PC/ATs or compatibles to a SYSMAC LINK Network.	W220
CV500, SLK11/21 SYSMAC LINK Units Operation Manual	Installation, setup, and operating procedures for the SYSMAC LINK Units are used to connect CV-series PCs to a SYSMAC LINK Network.	W202
CS1W-SLK11/21 SYSMAC LINK Units Operation Manual	Installation, setup, and operating procedures for the Optical Ring SYSMAC LINK Units. SYSMAC LINK Units are used to connect CS1-series PCs to a SYSMAC LINK Network.	W367

Depending on the system, you may also need the SYSMAC or CV Support Software or a Programming Console. Please read this manual and related manuals carefully and be sure you understand the information provided before attempting to install and operate a SYSMAC LINK Support Board.

**Section 1** outlines the functions of the SYSMAC LINK Support Board, including applications, and the differences between the SYSMAC LINK Support Board and the SYSMAC LINK Unit.

**Section 2** describes how to wire the power supply cables and communications cables to the SYSMAC LINK Support Board.

**Section 3** describes creating applications (user programs) that control the SYSMAC LINK Support Board.

**Section 4** details the C-language library functions supported by the SYSMAC LINK Support Board.

**Section 5** describes how to use data links in a SYSMAC LINK Network.

**Section 6** explains how to use the message service provided by a SYSMAC LINK Support Board.

**Section 7** describes the method used to connect multiple networks.

**Section 8** explains details on SYSMAC LINK Network communications. Refer to this section for network communications that require accurate communications timing.

**Section 9** provides information on troubleshooting errors that occur during SYSMAC LINK Support Board operation, as well as daily inspection, cleaning, and other maintenance procedures.

The **Appendix** provides a list of standard models.

### WARNING

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

# PRECAUTIONS

This section provides general precautions for using the SYSMAC LINK PCI Support Board and related devices.

**The information contained in this section is important for the safe and reliable application of the SYSMAC LINK PCI Support Board. You must read this section and understand the information contained before attempting to set up or operate a SYSMAC LINK PCI Support Board.**

- 1 Intended Audience .....
- 2 General Precautions .....
- 3 Safety Precautions .....
- 4 Operating Environment Precautions .....
- 5 Application Precautions .....

## 1 Intended Audience

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

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


## 2 General Precautions

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


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


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


This manual provides information for programming and operating the SYSMAC LINK PCI Support Board and related devices. Be sure to read this manual before attempting to use the software and keep this manual close at hand for reference during operation.

 **WARNING** It is extremely important that a SYSMAC LINK PCI Support Board and all related devices 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 SYSMAC LINK PCI Support Board to the above mentioned applications.

## 3 Safety Precautions


 **WARNING** Never attempt to disassemble any SYSMAC LINK PCI Support Board while power is being supplied. Doing so may result in serious electrical shock or electrocution.


 **WARNING** Never touch any of the terminals while power is being supplied. Doing so may result in serious electrical shock or electrocution.


 **WARNING** Provide safety measures in external circuits, i.e., not in the Programmable Controller (CPU Unit including associated Units; referred to as "PC"), in order to ensure safety in the system if an abnormality occurs due to malfunction of the PC or another external factor affecting the PC operation. Not doing so may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
- The PC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.


- The PC outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-VDC output (service power supply to the PC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

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


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

 **Caution** Tighten the connector screws for the backup power supply to the torque specified in this manual. The loose screws may result in burning or malfunction.


## 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 SYSMAC LINK PCI Support Board or the computer 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 SYSMAC LINK PCI Support Board or the computer. 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 SYSMAC LINK PCI Support Board or the computer into which it is installed.

**Note** Refer also to 1-4 *Application Precautions* for further information and additional precautions.

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

- Always ground the system to 100  $\Omega$  or less when installing the system to protect against electrical shock.
- Always turn OFF the power of the computer before attempting any of the following. Performing any of the following with the power supply turned on may lead to electrical shock:
  - Installing or removing the Support Board.
  - Assembling the Units.
  - Setting DIP switches or short-circuiting pins.
  - Connecting or disconnecting any cables or connectors.

 **Caution** Failure to abide by the following precautions could lead to faulty operation of the computer or the system or could damage the SYSMAC LINK PCI Support Board or related devices. 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.
- Always use the power supply voltage specified in the operation manuals. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Do not attempt to take the Boards apart, to repair the Boards, or to modify the Boards in any way.
- 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.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- Double-check all the wiring before turning ON the power supply. Incorrect wiring may result in burning.
- Wire correctly.
- Double-check all the connectors before mounting the Board.
- Be sure that the communications cable connectors and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Use a special packing box when transporting the Board. Handle the product carefully so that no excessive vibration or impact is applied to the product during transportation.

- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Observe the following precautions when wiring the communications cable or backup power supply cables.
  - Separate the cables from power lines or high-tension lines.
  - Do not bend the cables.
  - Do not pull on the cables.
  - Do not place heavy objects on top of the cables.
  - Route cables inside conduits.
- Before touching the Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- Do not touch the Board surfaces or parts.
- Install the Board according to instructions in the operation manuals. Improper installation may cause faulty operation.
- When using the Optical Ring SYSMAC LINK Support Board for public utilities systems, such as electricity, gas, or water supply, use the Optical Ring mode and provide appropriate fail-safe measures.

# SECTION 1

## Outline of Functions

This section outlines the functions of the SYSMAC LINK Support Board, including the applications of the SYSMAC LINK Support Board and the differences between the SYSMAC LINK Support Board and the SYSMAC LINK Unit.

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1-1-2	Features .....
1-1-3	What Is a SYSMAC LINK Support Board? .....
1-1-4	Features of SYSMAC LINK PCI Support Boards .....
1-1-5	Outline of PCI Bus SYSMAC LINK Support Board Functions .....
1-2	Specifications and Configurations .....
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1-2-3	Communications Specifications .....
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1-2-5	Dimensions .....
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1-2-8	Software Configuration .....
1-2-9	Compatible Computers, Operating Systems, and Libraries .....
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# 1-1 Overview

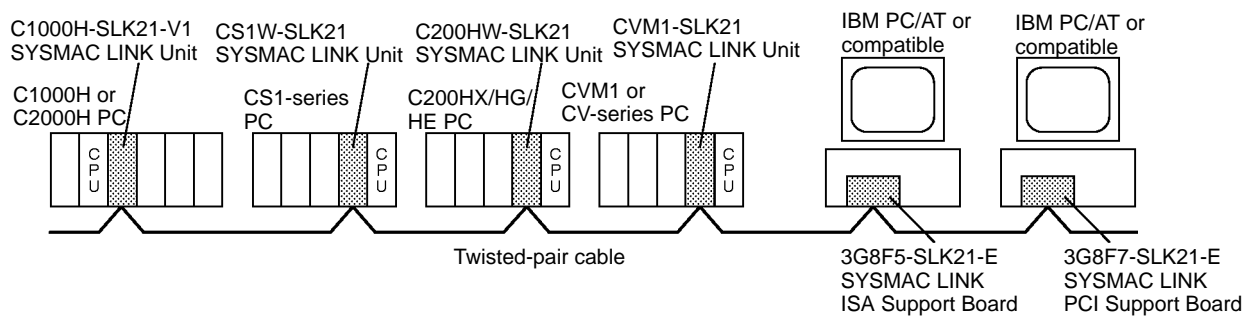
## 1-1-1 What Is the SYSMAC LINK?

The SYSMAC LINK is an FA network that can send and receive large data packets flexibly and easily among advanced OMRON Programmable Controllers (CS-series, C200HX/HG/HE-series, C-series, CVM1, and CV-series PCs) and IBM PC/AT or compatible computers.

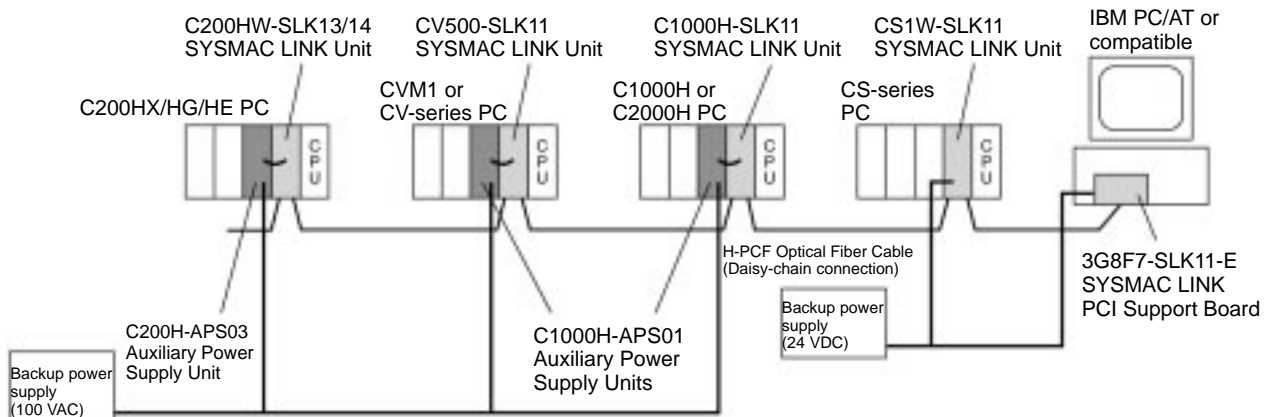
The SYSMAC LINK supports data links that continuously share certain ranges of data and a message service that can be used to send and receive specific data when required. Data link areas can be freely set to create a flexible data link system and effectively use data areas.

The network is connected using either coaxial cable or optical fiber cable, and high-volume data transmissions at high speed allow construction of a wide range of networks, from low-level systems to highly complex systems.

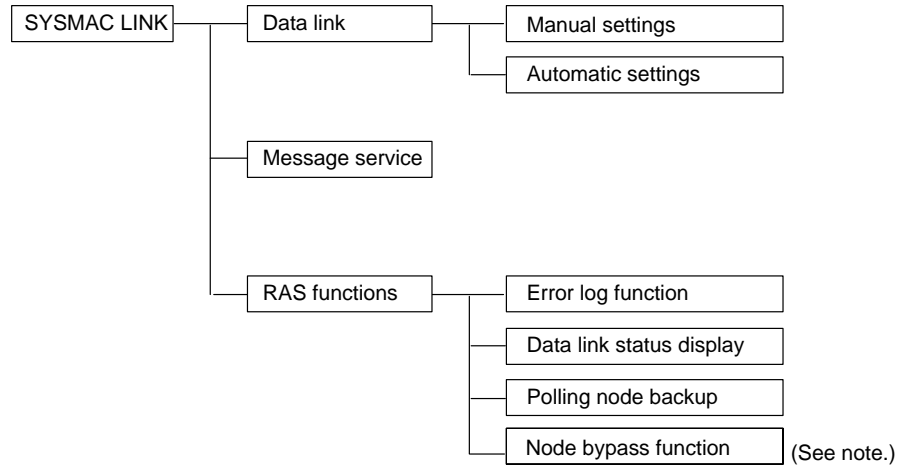
### Coaxial System



### Optical System



The functions of a SYSMAC LINK Network are outlined below.



**Note** Optical System only.

## 1-1-2 Features

The SYSMAC LINK FA Network has the following features to meet the various requirements of FA sites.

### Data Links

Flexible and efficient data links can be created to automatically transfer large amounts of data as listed below.

Item	Specifications
Number of send words per node	508 words max. (254 words max. in the CIO/LR Area and 254 words max. in the DM Area)
Number of send and receive words per node	Coaxial or Optical SYSMAC LINK PCI Support Board: 2,966 words max.

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

### Message Service

The message service can send and receive up to 552 bytes of data (including the FINS header), allowing large volumes of data to be sent and received without having to be split up.

### Coaxial Cable or Optical Fiber Cable Connection

The SYSMAC LINK Units can be connected to the network using either coaxial cable or optical fiber cables.

Optical fiber cable (H-PCF cable) has superior noise resistance, so the system can provide highly reliable communications even in very noisy conditions.

With H-PCF cable, the total communications distance can be up to 20 km (1 km max. between nodes when using the adhesive polishing method), which allows long-distance and large-scale networks.

### Communications between Different Models of PCs

The following SYSMAC LINK Units are available for communications between different PCs. Wired Units and Optical Units, however, cannot be used together in the same SYSMAC LINK Network.

#### **Coaxial System**

- SYSMAC LINK Unit for CS-series Programmable Controllers

- SYSMAC LINK Units for C200HX/HG/HE Programmable Controllers
- SYSMAC LINK Units for CVM1 and CV-series Programmable Controllers
- SYSMAC LINK Units for C1000H and C2000H Programmable Controllers
- SYSMAC LINK ISA Support Board for IBM PC/AT or compatibles
- SYSMAC LINK PCI Support Board for IBM PC/AT or compatibles

**Optical System with H-PCF Cables**

- SYSMAC LINK Unit for CS-series Programmable Controllers
- SYSMAC LINK Units for C200HX/HG/HE Programmable Controllers
- SYSMAC LINK Unit for CVM1 and CV-series Programmable Controllers
- SYSMAC LINK Unit for C1000H and C2000H Programmable Controllers
- SYSMAC LINK PCI Support Board for IBM PC/AT or compatibles

**Flexible Inter-network Connections**

The SYSMAC LINK Network can be connected to another network (Ethernet, SYSMAC NET Link, SYSMAC LINK, or Controller Link network) through a CS-series or CV-series PC. By installing Ethernet, SYSMAC NET Link\*, or SYSMAC LINK, or SYSMAC LINK Communications Units on the same CS-series PC or CV-series PC, a message service can be created with nodes in the interconnected networks through that PC. Up to three network levels are possible.

**Note** \*A SYSMAC NET Link Unit cannot be mounted in a CS-series PC.

**Improved Error Handling (RAS Functions)**

**Error Log and Data Link Status Display**

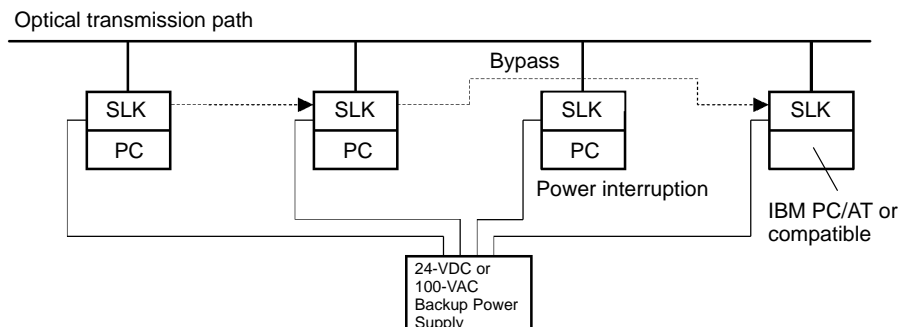
An error log enables quick handling of errors by recording the time the error occurred and error details. The current SYSMAC LINK Unit and Support Board status are also available, as are the data link and network status.

**Polling Node Backup**

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

**Node Bypass Function**

In an Optical SYSMAC LINK Network, data communications can be continued by bypassing the node, even when a node in the communications line malfunctions or the PC or computer power supply is turned OFF. This prevents the whole network system from being affected by a node malfunction or power interruption. To use the bypass node function, backup power must be supplied to the SYSMAC LINK Units/Support Boards.

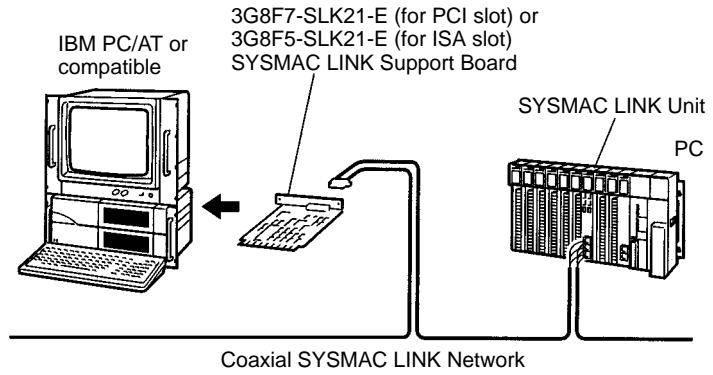


**1-1-3 What Is a SYSMAC LINK Support Board?**

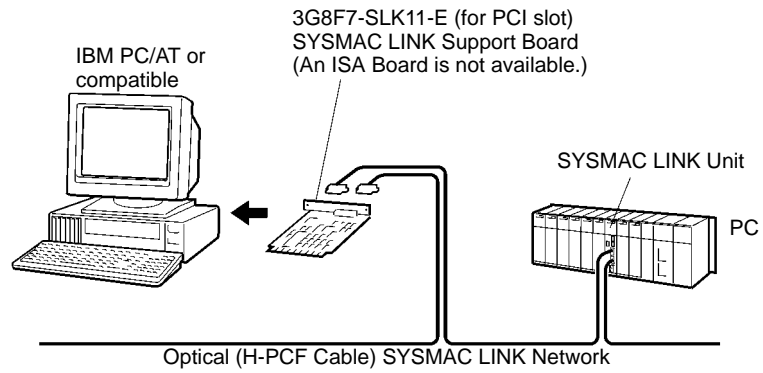
A SYSMAC LINK Support Board is used to directly connect an IBM PC/AT or compatible with an ISA or PCI slot to a SYSMAC LINK Network. A SYSMAC LINK Support Board supports data links, a message service, and RAS functions in the same way as a SYSMAC LINK Unit.

The Support Board is mounted in an expansion slot in the computer. The following Support Boards are available depending on the type of connection cable.

**Coaxial System**



**Optical System (H-PCF Cable)**



### 1-1-4 Features of SYSMAC LINK PCI Support Boards

The SYSMAC LINK PCI Support Board can be used to configure various communications applications using FinsGateway SYSMAC LINK (PCI) Embedded Edition.

User application		PLC Reporter 32, DataFlowNavi for Access, AIMAX-FA, etc.
C library	Compolet	
FinsGateway SYSMAC LINK (PCI) Embedded Edition		
PCI Bus SYSMAC LINK Support Board		

The Board is equipped with the FinsGateway SYSMAC LINK (PCI) Embedded Edition and C library (Win32 DLL) as standard features. With just the Board itself, user applications can be created using the C language (Microsoft Visual C++ Ver. 6.0). An overview of how to use the C library is described later in this manual.

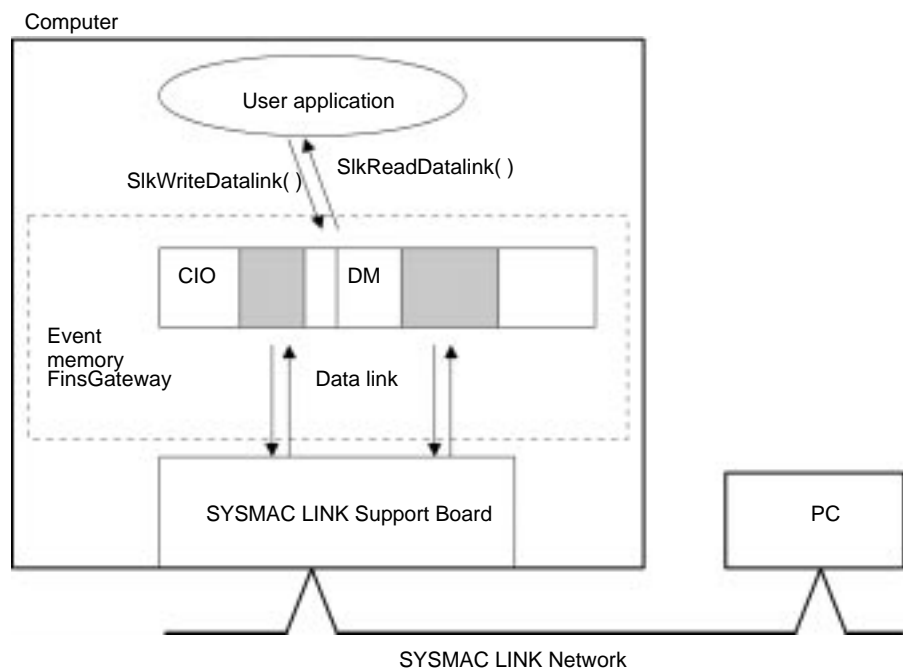
SYSMAC Compolet Version 2 provides ActiveX controls for PC communications. User applications can be created more easily using Microsoft Visual Basic. PLC Reporter 32, DataFlowNavi for Access, and AIMAX-FA are software packages of communications middleware. These software packages must be purchased separately. For details, refer to the manual for the appropriate software.

### 1-1-5 Outline of PCI Bus SYSMAC LINK Support Board Functions

#### Data Links

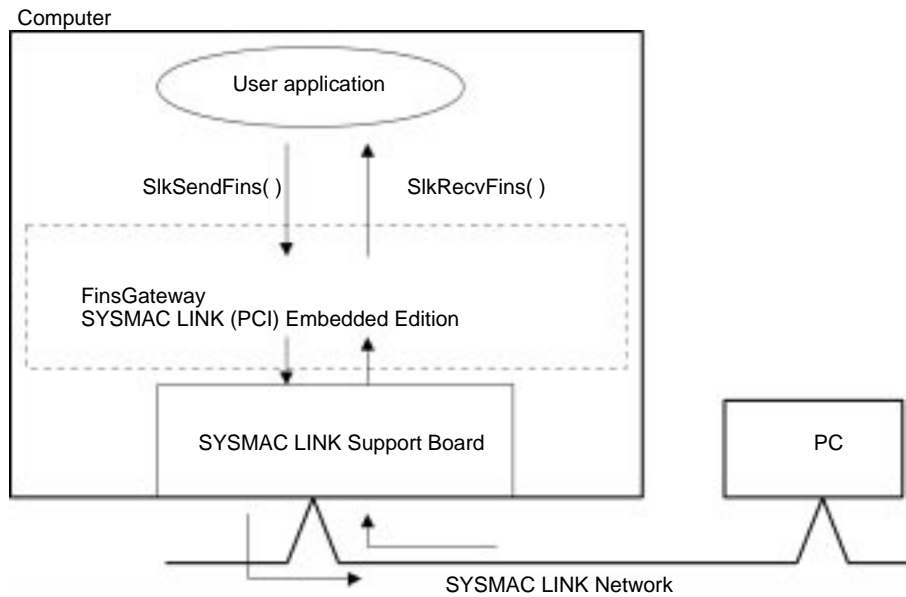
SYSMAC LINK Support Board data link data is stored in the event memory in the computer. Event memory is shared memory with names such as DM or CIO, and is stored in the computer memory. Event memory recreates virtually the DM Area and CIO Area of an OMRON PC.

Event memory can be written or read by executing the C library data link data read/write functions `SlkWriteDatalink( )` and `SlkReadDatalink( )` from the user program.

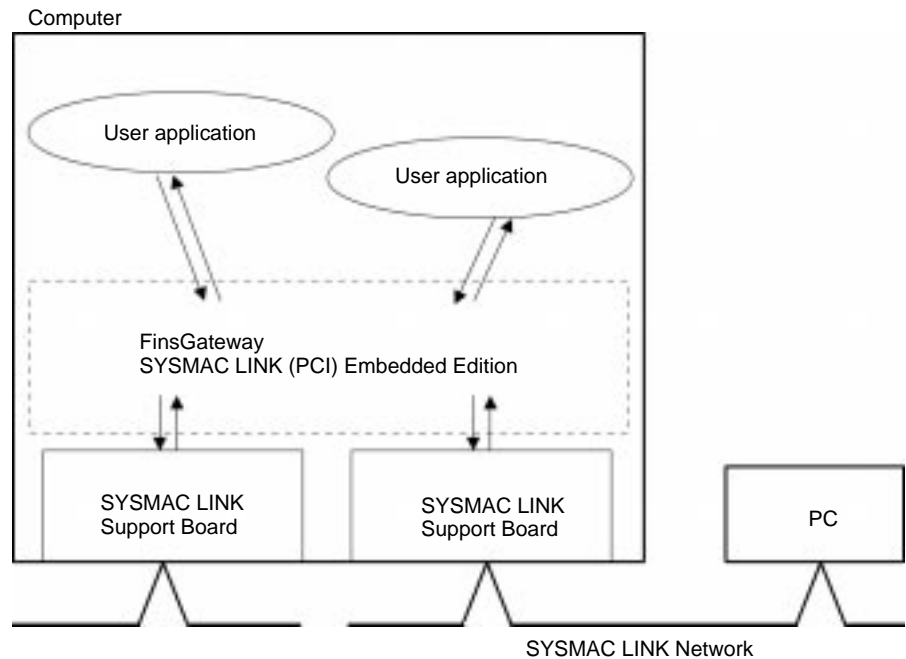


Message Service

FINS commands and FINS responses can be sent and received for specified nodes on the network by executing FINS message send/receive functions SlkSendFins( ) and SlkRecvFins( ) from the user program.



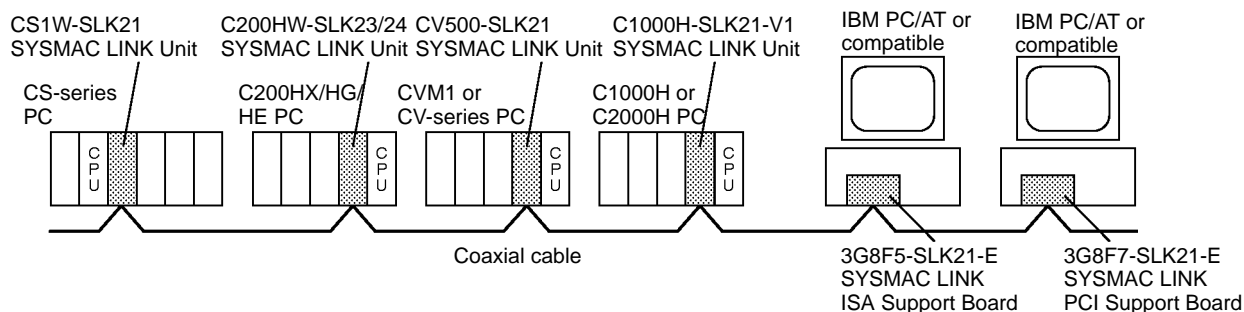
A maximum of 4 PCI Bus SYSMAC LINK Support Boards can be mounted to one computer. Consequently, multiple user applications can be executed simultaneously.



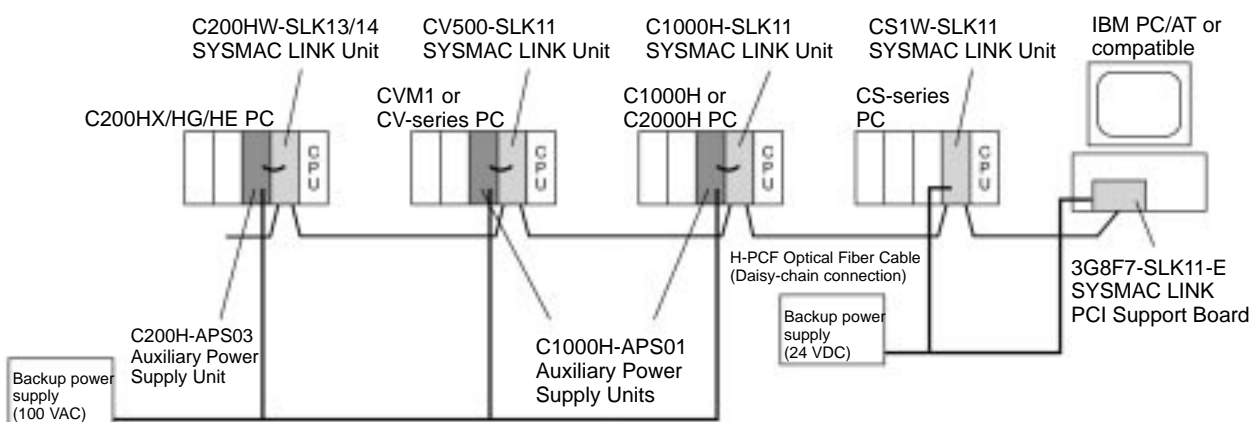
## 1-2 Specifications and Configurations

### 1-2-1 System Configuration

#### Coaxial System



#### Optical System



- Note**
1. A maximum of 4 PCI Bus SYSMAC LINK Support Boards can be mounted. (Different types of connection systems can be mounted simultaneously.)
  2. PCI Bus SYSMAC LINK Support Boards can also be used with ISA Bus SYSMAC LINK Support Boards. If PCI Bus and ISA Bus SYSMAC LINK Support Boards are used together, however, a separate ISA Bus FinsGateway SYSMAC LINK Driver is required.

### 1-2-2 PCI Bus SYSMAC LINK Support Board Models

Product	System	Model
SYSMAC LINK PCI Support Board	Optical (H-PCF Cable)	3G8F7-SLK11
	Coaxial (Coaxial Cable)	3G8F7-SLK21

### 1-2-3 Communications Specifications

#### Optical System

Items	Specifications
Type	Optical (H-PCF cable)
Model	3G8F7-SLK11
Communications method	N:N token-bus method
Code	Manchester code
Modulation	Baseband code
Synchronization	Flag synchronization (conforms to HDLC frames)
Transmission path format	Daisy-chain method

Items	Specifications
Transmission speed	2 Mbps
Maximum transmission distance	20 km
Maximum distance between nodes	Crimp cut: 800 m Adhesive: 1 km (See note 1.)
Transmission media	H-PCF cable (optical two-core cable)
Node connection method	Connected via a special (full-lock connector) connector. (A half-lock connector can also be used.)
Maximum number of nodes	62 nodes
Applicable Programming Devices	FinsGateway's SLK data link setting utility (See note 2.)
Communications functions	Data links and message service
Number of data link words	Transmission area per node: 508 words max. (254 words in the CIO/LR Area and 254 words in the DM Area) Number of data link words that can be used with one PCI Board (total transmission): 2,966 words max.
Data link areas	FinsGateway Event Memory
Message length	552 bytes max. (including the header)
RAS functions	Polling node backup function Self-diagnosis function (hardware checking at startup) Echoback test and broadcast test (using FINS commands) Watchdog timer Error log function Node bypass function
Error control	Manchester code check CRC check ( $CCITT X^{16} + X^{12} + X^5 + 1$ )

- Note**
1. The maximum distance between nodes depends on the connector and cable processing methods.
  2. The Board's data link tables can be set using CX-Net in CX-Programmer. Use the FinsGateway's SLK data link setting utility, or the SYSMAC LINK Support Software.



**Coaxial System**

Items	Specifications
Type	Coaxial
Model	3G8F7-SLK21
Communications method	N:N token bus
Code	Manchester code
Modulation	Baseband code
Synchronization	Flag synchronization (conforms to HDLC frames)
Transmission path form	Multi-drop bus
Transmission speed	2 Mbps
Maximum transmission distance	1 km
Transmission media	Coaxial cable (5C-2V)
Node connection method	BNC connectors
Applicable Programming Devices	FinsGateway's SLK data link setting utility (See note 1.)
Maximum number of nodes	62 nodes
Communications functions	Data links and message service
Number of data link words	Transmission area per node: 508 words max. (254 words in the CIO/LR Area and 254 words in the DM Area) Number of data link words that can be used with one PCI Board (total transmission): 2,966 words max.
Data link areas	FinsGateway's event memory
Message length	552 bytes max. (including the header)
RAS functions	Polling node backup function Self-diagnosis function (hardware checking at startup) Echoback test and broadcast test (using FINS commands) Watchdog timer Error log function
Error control	Manchester code check CRC check ( $CCITT X^{16} + X^{12} + X^5 + 1$ )

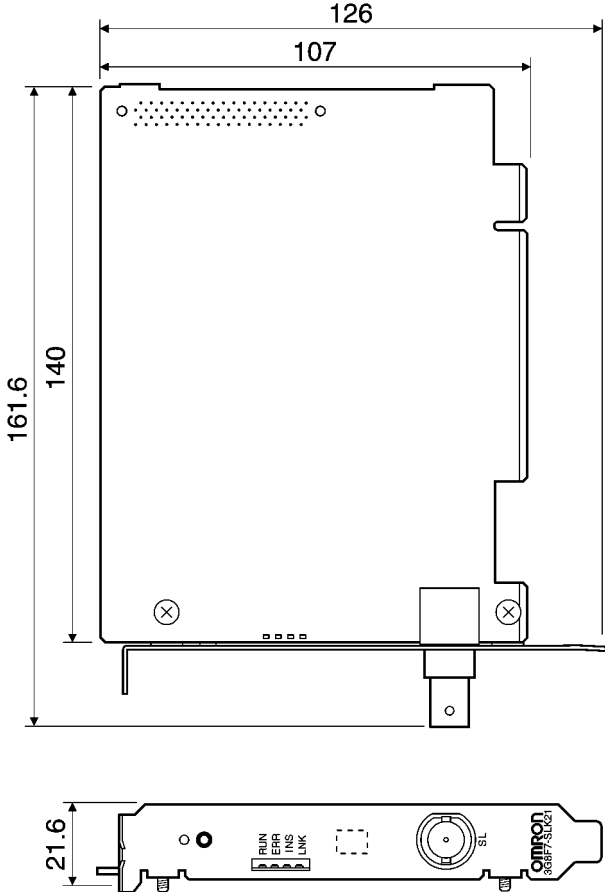
**Note** The Board's data link tables can be set using CX-Net in CX-Programmer. Use the FinsGateway's SLK data link setting utility, or the SYSMAC LINK Support Software.

**1-2-4 General Specifications**

Items	SYSMAC LINK PCI Support Board	
	Coaxial system: 3G8F7-SLK21	Optical system (H-PCF cable): 3G8F7-SLK11
External dimensions	106 x 140 mm (W x L)	
Weight	109 g (excluding mounting bracket)	120 g (excluding mounting bracket)
Current consumption	0.45 A max. at 5 VDC	Without power supply: 0.52 A max. at 5 VDC With power supply: 0.33 A max. at 5 VDC
Installation environment conditions	Same as for computer.	

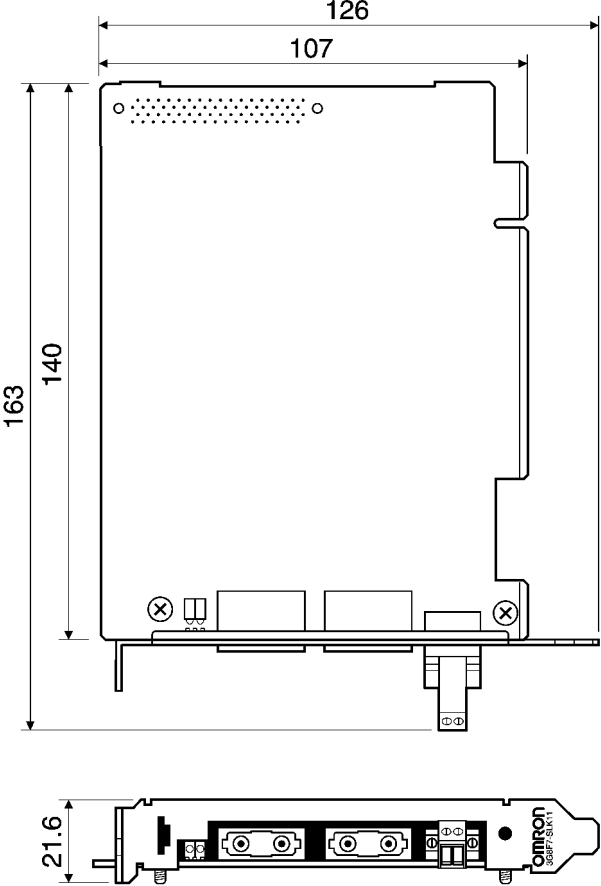
### 1-2-5 Dimensions

Coaxial Model (3G8F7-SLK21-E)



(Unit: mm)

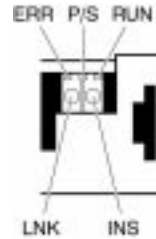
Optical Model, H-PCF Cable (3G8F7-SLK11-E)



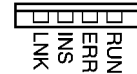
(Unit: mm)

### 1-2-6 Indicators

Optical System  
(H-PCF Cable)



Coaxial System



Name		Color	Status	Explanation
RUN	Operating	Green	Lit	The Board is operating normally.
			Not lit	A Board operating error (watchdog timer error) has occurred.
ERR	Error	Red	Lit	One of the following errors has occurred. Communications error Node address setting error (duplicate setting) Optical system connection error EEPROM error Hardware error Data link table error Routing table error Network parameter error
			Not lit	Operating normally (no errors in the setting tables).
INS	Participating in network	Yellow	Lit	Participating in network.
			Not lit	Not participating in network.
LNK	Sending data link	Yellow	Lit	Sending data link (participating in data link)
			Flashing	Error in the data link table settings.
			Not lit	Data link is stopped or Unit is not participating in data link.
PS (See note.)	Power supply ON	Green	Lit	Backup power supply is ON.
			Not lit	Backup power supply is OFF.

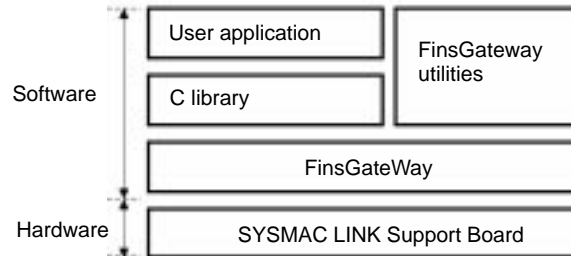
**Note** Only Optical Units are equipped with the P/S indicator.

### 1-2-7 Product Components

System	Model	Contents
Coaxial system	3G8F7-SLK21	SYSMAC LINK Support Board x 1 CD-ROM x 1 Installation guide x 1 F-type connector x 1 Insulating cover x 1 Cable mounting bracket x 1 Board ID switch number/indicator label x 1 User registration card (software license agreement) x 1
Optical system, H-PCF cable	3G8F7-SLK11	SYSMAC LINK Support Board x 1 CD-ROM x 1 Installation guide x 1 Optical cable bracket x 1 Power supply connector x 1 Board ID switch number/indicator label x 1 User registration card (software license agreement) x 1

- Note**
- The following software is supplied on the CD-ROM.
    - SYSMAC LINK (PCI) Driver
    - FinsGateway SYSMAC LINK (PCI) Embedded Edition
    - Setup Diagnostic Utility
    - C library
  - The computer's operating system is not provided with the Support Board. The operating system must be acquired separately.

## 1-2-8 Software Configuration



**Note** An SLK data link setting utility is included in the FinsGateway utilities. Make the data link table settings for the Board using this utility. For details, refer to FinsGateway online help.

## 1-2-9 Compatible Computers, Operating Systems, and Libraries

SYSMAC LINK Support Board	Compatible computer	Compatible operating system	Compatible language
All models	IBM PC/AT or compatible CPU: Intel Celeron 400 MHz or faster Main memory: 32 MB min. One PCI bus slot must be available. Available hard disk space: 70 Mbytes min. (not including space for user applications) CD-ROM drive: Required for software installation Display: VGA (640 x 480 pixels) or better display functionality (Other conditions conform to those of the OS.)	Windows 98 Windows 2000 Windows NT4.0 (Service Pack 3 or later)	Microsoft Visual C++ Ver 6.0 (Service Pack 3)

- Note**
1. Operation of the SYSMAC LINK Board can be guaranteed only under the computer and operating system specifications outlined above. Use a computer and operating system that meet these minimum specifications.
  2. The SYSMAC LINK Support Board cannot be used in a computer running Windows 95, Windows NT3.51, or other older operating systems.

## 1-3 Basic Procedures

### Initial Procedure

Refer to the *SYSMAC LINK Support Board Installation Guide* for information on the first three steps in the following procedure.

- 1, 2, 3...**
1. Set the Board ID on the Board switch.
  2. Install the Board into the computer.
  3. Install the software.
  4. Wire and connect the cables.
  5. Perform the following data link and/or message service procedure.

### Data Link Procedure

- 1, 2, 3...**
1. Create data link tables using the FinsGateway utilities and transfer the data to the Board.

**Note** When the data link tables and routing tables are transferred to the SYSMAC LINK Support Board, they are saved in backup memory (EEPROM) on the Board. It is not necessary to set the data again when the power is turned OFF and ON.

2. Read and write to the data link area using the utility applications that use the C library.

**Note** The data links can also be started by sending the data link activation command with the FINS message service, or by using a PC software switch operation.

### Message Service Procedure

1, 2, 3...

1. Create routing tables using the SYSMAC LINK Support Software or the FinsGateway utilities, and transfer the tables to the Board.

**Note** When the data link tables and routing tables are transferred to the SYSMAC LINK Support Board, they are saved in backup memory (EEPROM) on the Board. It is not necessary to set the data again when the power is turned OFF and ON.

2. Send and receive FINS messages using the utility applications that use the C library.

## 1-4 Applications Precautions

### Board ID Switch

If more than one SYSMAC LINK Support Board is mounted to a computer, set a unique Board ID on each Board. Up to 4 Boards can be mounted.

**Note** Refer to the *SYSMAC LINK PCI Support Board Installation Guide* (W389).

### Cables

Turn OFF the power of all the nodes on the network before connecting or disconnecting a cable.

**Note** Refer to *Section 2 Wiring*.

Use the specified cable only.

**Note** Refer to *1-2 Specifications and Configurations*.

### Routing Tables

Set routing tables at all the nodes in all the networks when multiple networks are connected to one PC.

**Note** Refer to *Section 7 Network Interconnections*.

When a routing table is transferred (written) to a PC, all CPU Bus and Communications Units are reset. The routing tables must not be transferred to a PC while the system is running.

### Data Links

When using a manually set data link, delete the data link tables from all nodes not participating in the data link.

The polling node must not be restarted or reset during data link operation.

If the SYSMAC LINK Support Board is the polling node and data links are operating on the network, wait at least three seconds after closing the Board before opening the Board again.

If the SYSMAC LINK Support Board is the polling node and data links are operating on the network, wait at least three seconds after removing the Board from the network before adding Board to the network again.

### Other Precautions

Observe the following precautions.

- The SYSMAC LINK Support Board can be used only with the specified computer operating systems.

**Note** Refer to *1-2 Specifications and Configurations*.

- Set the IRQ (interrupt request) of the SYSMAC LINK Support Board so that it does not conflict with other resources.

**Note** Refer to the *SYSMAC LINK PCI Support Board Installation Guide* (W389).

- If using the SEND, RECV, and CMND instructions with a PC on which the routing tables have been set, be sure to specify the network address set in the routing tables.
- Coaxial SYSMAC LINK Units/Boards cannot be combined with Optical SYSMAC LINK Units/Boards in the same network.
- SYSMAC LINK Units/Boards cannot be combined with Controller Link Units/Boards in the same network.

## SECTION 2

### Wiring

This section describes how to wire the power supply cables and communications cables to the SYSMAC LINK Support Board.

2-1	Connecting Coaxial Systems .....
2-1-1	Devices Required for Connection .....
2-1-2	Cable Connection Procedure .....
2-1-3	Attaching the Connector to the Board .....
2-1-4	Attaching Connectors to the Coaxial Cable .....
2-2	Connecting Optical Systems (H-PCF Cable) .....
2-2-1	Devices Required for Connection .....
2-2-2	Wiring the Optical Fiber Cables .....
2-2-3	Installing Connectors .....
2-3	Backup Power Supply Wiring (Optical Systems Only) .....
2-3-1	Backup Power Supply Specifications .....
2-3-2	Connecting the Backup Power Supply .....



## 2-1 Connecting Coaxial Systems

This section describes how to connect the network communications cables to the Coaxial SYSMAC LINK Support Board (3G8F7-SLK21).

### 2-1-1 Devices Required for Connection

#### Coaxial Cable and BNC Connectors

Use 5C-2V coaxial cable rated for indoor usage. Connect BNC connectors to the coaxial cable in order to connect it to the nodes in the SYSMAC LINK network.

#### F-type Adapter (C1000H-CE002)

Use an F-type Adapter to connect the coaxial cable to the Board. An F-type Adapter is included with the SLK21 Boards.

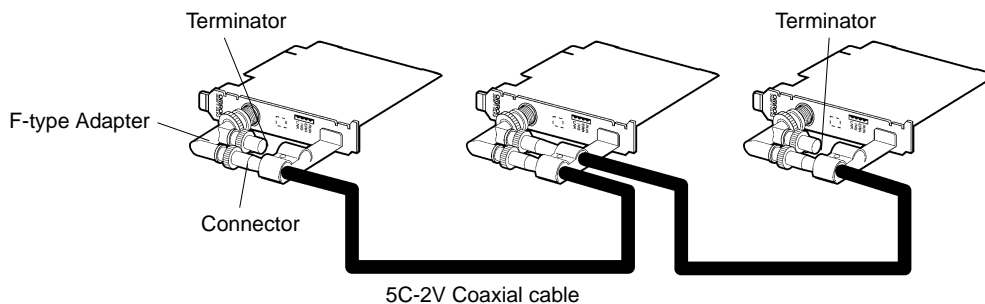
#### Terminator (C1000H-TER01)

Install Terminators in the F-type Adapters of the nodes at both ends of the network bus. Two Terminators are required for each network and the Terminators are sold separately.

### 2-1-2 Cable Connection Procedure

Use the following procedure when connecting coaxial cables.

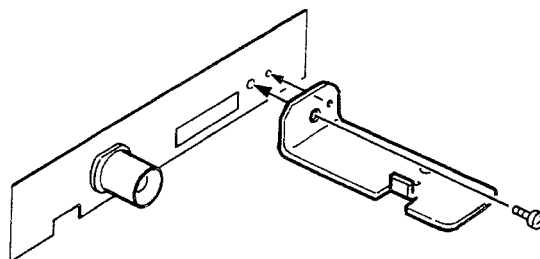
- 1, 2, 3... 1. Attach connectors to the coaxial cable.
2. Connect the cables to the F-type Adapters. At this point, install Terminators in the F-type Adapters of the nodes at each end of the network bus. When connecting or removing a connector, hold the connector itself securely.
3. Connect the F-type Adapter to the Board. Wire the Units/Boards in order starting from one end of the network.



### 2-1-3 Attaching the Connector to the Board

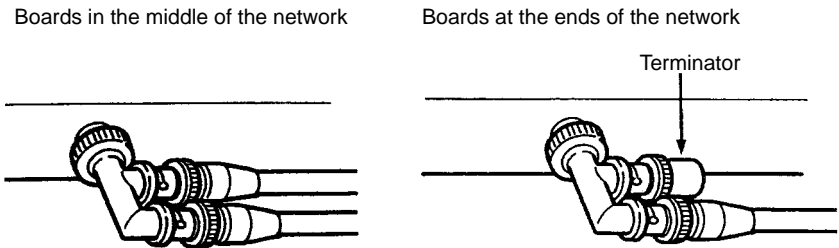
#### Attachment Procedure

- 1, 2, 3... 1. Align the Mounting Bracket and Board and attach the bracket with the provided screw. The Mounting Bracket has a small pin that fits into the Board when it is aligned correctly, as shown in the following diagram.

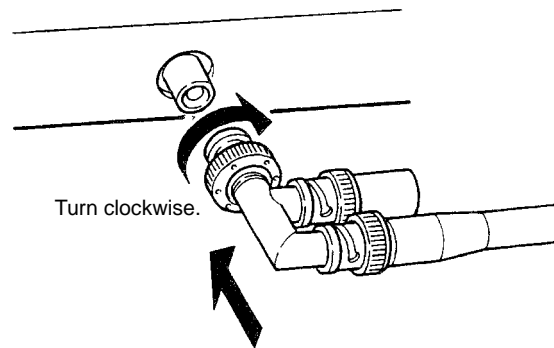


2. If the Board isn't at the end of the network, connect it to the adjacent nodes with two cables. The cables can be connected to either socket in the Board's F-type Adapter. If the Board is at one end of the network, connect it to the adjacent node and

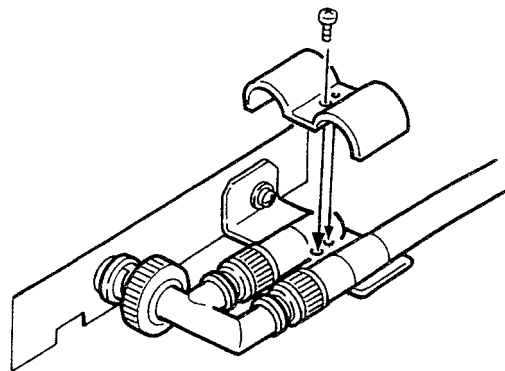
install a Terminator in the other socket. The Terminator can be connected to either socket in the Board's F-type Adapter.



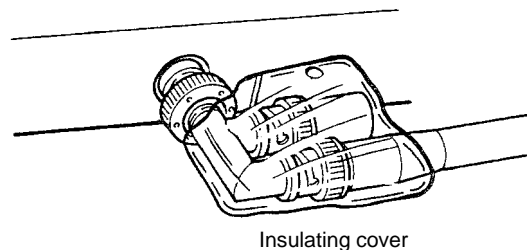
3. Push the F-type Adapter into the Board's BNC connector and turn the fitting clockwise until it locks.



4. Align the Mounting Bracket and clamp to secure the cable(s) and attach the clamp with the provided screw. The clamp has a small pin that fits into the Mounting Bracket when it is aligned correctly, as shown in the following diagram.

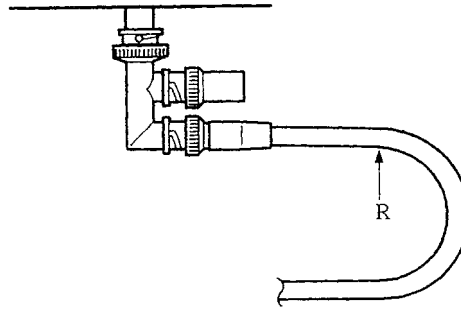


5. Cover the F-type Adapter with the insulating cover provided.



6. Do not bend the cable too sharply when handling it. The minimum bending radius is about 45 mm (about 6x the coaxial cable radius).

Provide wider turns for the permanent installation. The minimum bending radius for the permanent installation is about 110 mm (about 15× the coaxial cable radius).



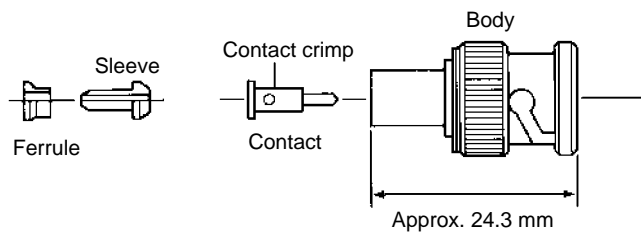
**Precautions**

Observe the following precautions regarding the communications cables:

- Always use the specified coaxial cable.
- Install the coaxial cable separately from power lines and high-voltage lines to prevent noise.
- Always install Terminators in the nodes at the ends of the network bus.
- Do not install the coaxial cable outdoors. If the cable must be installed outdoors, provide protection from lightning by installing the cable underground or inside conduit.
- The minimum cable length between nodes is 1 m. Do not assemble communications cables shorter than 1 m.
- Use the F-type connectors to connect nodes and use the multi-drop method.
- Before removing a coaxial cable, touch a grounded metal object to discharge any static electricity.
- Always turn OFF the computer before connecting the coaxial cable to the Board.
- Fully insert the cable's connector into the Board's BNC jack. Also, check that the connections are locked securely before starting operation.

**2-1-4 Attaching Connectors to the Coaxial Cable**

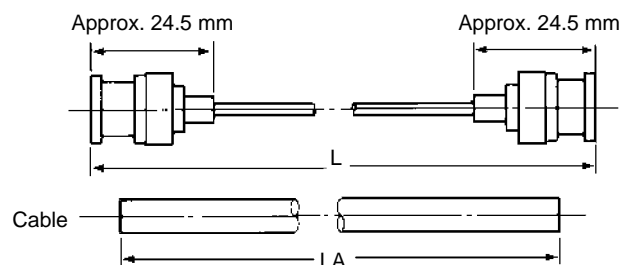
The following diagram shows the parts that make up the BNC connector.



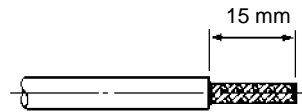
A hand crimp tool (CR-H-1130 by Dai-ichi Denshi Kogyo) must be used to crimp the connector onto the cable.

- 1, 2, 3...** 1. Cut the coaxial cable to the desired length.

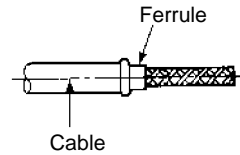
$$LA \text{ mm} = L \text{ mm} - 12 \text{ mm}$$



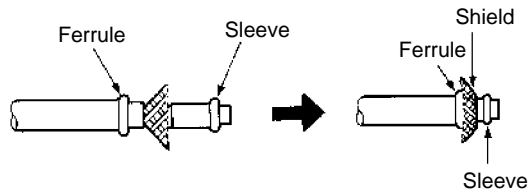
- Strip 15 mm of the cable sheathing. Strip the cable carefully so that the wire mesh shield is not cut or otherwise damaged.



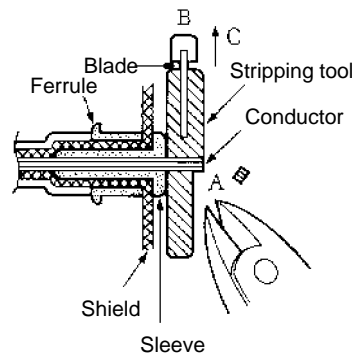
- Place the ferrule on the cable in the proper direction, as shown in the following diagram.



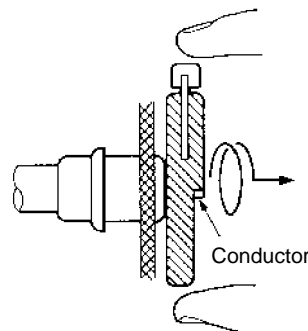
- Spread out the wire mesh shield at the end of the cable and insert the sleeve. Use the stripping tool to firmly push the sleeve until the flange fits snugly against the wire mesh shield.



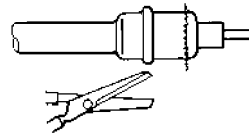
- At this stage, the polyethylene core and center conductor will be slightly long. Cut off the portion (A in the diagram) that protrudes past the stripping tool so that the polyethylene core is flush with the outer surface of the stripping tool.



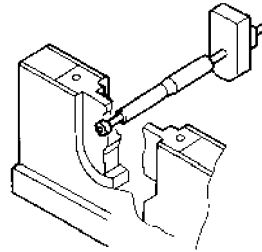
- Press the stripping tool's blade (B in the diagram) so that the blade cuts into the polyethylene core and rotate the tool several times. Hold the blade down and pull the tool off of the cable (direction D), as shown in the diagram.



- Use a pair of scissors to trim off the excess wire mesh shield, as shown in the diagram.

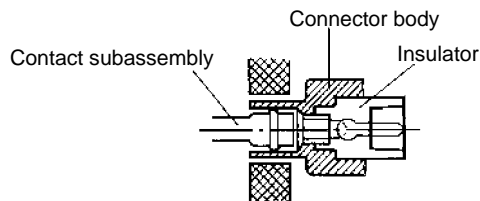


- Insert the contact into the contact crimp adapter and set it in the Crimp Tool's die. Slide the contact onto the central conductor until the contact touches the polyethylene core. Squeeze the Crimp Tool's handle strongly to crimp the contact.

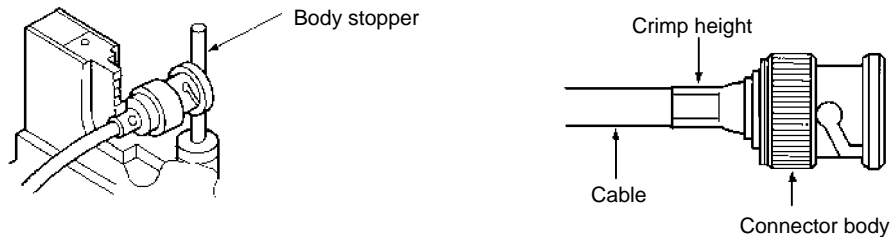


- Insert the completed contact subassembly into the body of the connector. Push the contact into the connector until the flared part of the contact enters the connector's insulator so that the tip of the contact is about even with the tip of the insulator.

After the flared part of the contact has been inserted into the insulator, do not rotate the connector body on the cable before crimping the connector body.



- Open the Crimp Tool's handle and place the connector into the Tool so that the tip of the connector touches the body stopper. Close the handle until the ratchet catches. Align the connector body's hole with the hexagonal sides of the die. If the connector has been crimped correctly, it will look like the connector on the right in the following diagram.

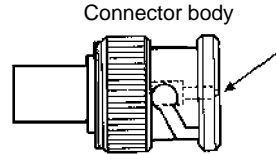


**Checking the Connector Installation**

Check that the connector body has been crimped onto the cable correctly. If the connector body wasn't pushed up against the body stopper, the middle of the connector body will be crimped, as shown in the example on the right.



Check that the tip of the contact is even with the front edge of the connector body.



Use a multimeter to check for electrical continuity at the following points.

- 1, 2, 3...**
1. There should be no continuity between the central conductor and wire mesh shield in the connector's plug shell.
  2. There should be continuity between the plug shells of the connectors at the ends of the cable.
  3. There should be continuity between the central conductors of the connectors at the ends of the cable.

**Note** Install the coaxial cable separately from power lines and high-voltage lines to prevent noise.

## 2-2 Connecting Optical Systems (H-PCF Cable)

This section describes how to connect the communications cable to a 3G8F7-SLK11 SYSMAC LINK Support Board in an H-PCF Cable Optical System.

### 2-2-1 Devices Required for Connection

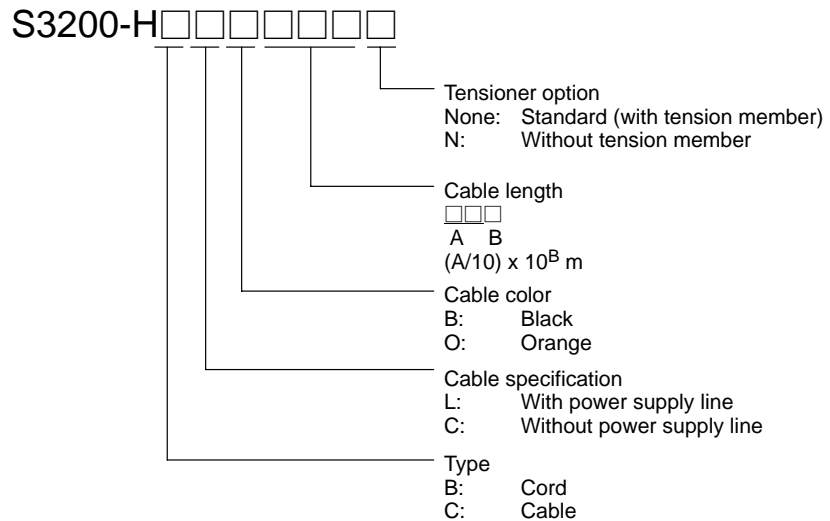
The following devices are required for the Optical (H-PCF Cable) SYSMAC LINK Network.

#### Optical Fiber Cables (Indoor Use Only)

Use the following Optical Fiber Cables (Hard Plastic-clad Fiber: H-PCF).

Name	Specifications	Model	
H-PCF cables	Black	10 m	S3200-HCCB101
		50 m	S3200-HCCB501
		100 m	S3200-HCCB102
		500 m	S3200-HCCB502
		1,000 m	S3200-HCCB103
	Orange	10 m	S3200-HCCO101
		50 m	S3200-HCCO501
		100 m	S3200-HCCO102
		500 m	S3200-HCCO502
		1,000 m	S3200-HCCO103

**Note** The Optical Fiber Cable model numbers are as follows:



#### Connectors

Name	Model	Specifications
Connector	S3200-COCF2011	Use to connect a cable to a node. (Full-lock connector for crimp-cut cable.)
	S3200-COCF2511	Use to connect a cable to a node. (Half-lock connector for crimp-cut cable.)
Inline Adapter	S3200-COAT2000	Use to connect or extend cables. (Use one adapter for each connection.)

- Note**
1. Either full-lock or half-lock connectors can be used in a SYSMAC LINK Network, but we recommend full-lock connectors to prevent accidental disconnections during operation.
  2. The maximum distance between nodes is slightly shorter for connectors with crimp-cut cables compared to connectors assembled with adhesive.

Also, the maximum distance is reduced due to extension loss when Inline Adapters are used to extend cables.

**Optical Fiber Cables with Connectors (Indoor Use Only)**

The following Optical Fiber Cables are available with Connectors already attached.

Specifications	Length	Model
Optical Fiber Cable Connectors: S3200-COCF2011 ↓ S3200-COCF2011	2 m	S3200-CN201-20-20
	5 m	S3200-CN501-20-20
	10 m	S3200-CN102-20-20
	15 m	S3200-CN152-20-20
	20 m	S3200-CN202-20-20
	Over 20 m	S3200-CN-20-20 (Specify length (m) when ordering.)
Optical Fiber Cable Connectors: S3200-COCF2011 ↓ S3200-COCF2511	2 m	S3200-CN201-20-25
	5 m	S3200-CN501-20-25
	10 m	S3200-CN102-20-25
	15 m	S3200-CN152-20-25
	20 m	S3200-CN202-20-25
	Over 20 m	S3200-CN-20-25 (Specify length (m) when ordering.)
Optical Fiber Cable Connectors: S3200-COCF2511 ↓ S3200-COCF2511	2 m	S3200-CN201-25-25
	5 m	S3200-CN501-25-25
	10 m	S3200-CN102-25-25
	15 m	S3200-CN152-25-25
	20 m	S3200-CN202-25-25
	Over 20 m	S3200-CN-25-25 (Specify length (m) when ordering.)

- Note**
1. Consult an electrician if cables with outdoor specifications are required. The cable must be protected from lightning by special installation such as installation within a conduit or underground.
  2. The cables listed above are black and have power supply lines and tension members, although the power supply lines aren't used in the SYSMAC LINK Network.
  3. All of the cables listed above are attached to the connectors with adhesive.
  4. Special training is required to assemble Optical Fiber Cables and connectors with adhesive.

**Optical Fiber Cable Accessories**

Use the following accessories to assemble and test Optical Fiber Cables.

Name	Model	Specifications
Optical Fiber Assembly Tool	S3200-CAK1062	Crimp-cut tool for the S3200-COCF2011/2511 Connectors
Optical Power Tester	S3200-CAT2700	With S3200-CAT2702 Head Unit and adapter for the S3200-COCF2011/2511 Connectors
Master Fiber Set	S3200-CAT2001H	One meter cable for use with the S3200-CAT2702 Head Unit

This manual does not provide details on Optical Fiber Cable preparation. For details, refer to the instructions provided with the S3200-CAK1062 Assembly Tool.



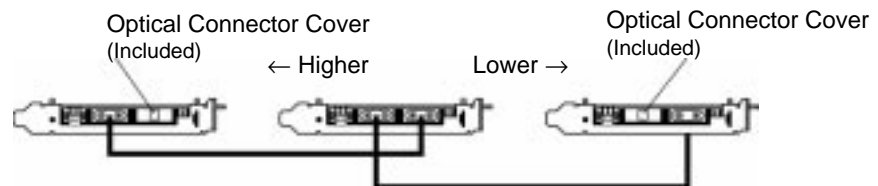
## 2-2-2 Wiring the Optical Fiber Cables

All of the nodes in the Optical SYSMAC LINK Network are connected in a line (daisy-chain configuration) with H-PCF Optical Fiber Cables.

Begin connection with the rightmost connector (SL1) of the highest node in the network and connect to the leftmost connector (SL2) in the next lower node, as shown in the following diagram.

The nodes can be connected in any order, but connect the nodes in the order of node addresses (i.e., node 1, node 2... node 62) as much as possible to reduce the effect on the communications time if a wire breaks.

Always cover the unused connectors on the highest and lowest nodes in the network with the enclosed Optical Connector Covers.



Refer to 2-2-1 *Devices Required for Connection* for details on available Optical Fiber Cables.

- Note**
1. Always use the specified Optical Fiber Cables.
  2. The maximum distance between nodes depends on the method used to attach the connector to the cable.

## 2-2-3 Installing Connectors

A special connector is used to connect the Optical Fiber Cable to the SYSMAC LINK Support Board.

This manual does not provide details on attaching Connectors to the Optical Fiber Cable.

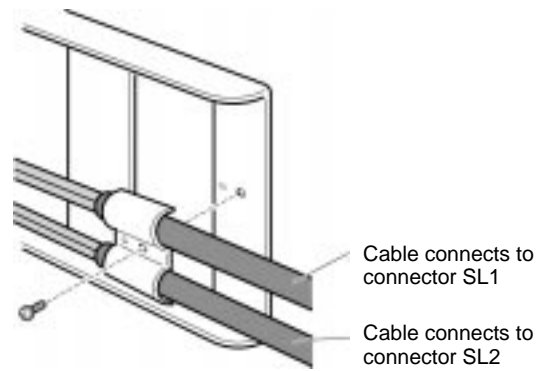
Connect the nodes in order beginning with the highest node in the network and continuing on to lower nodes.

- Always turn OFF the computer and backup power supply before connecting Optical Fiber Cables or the backup power supply connector.
- Special tools are required to attach Optical Fiber Cables to the connectors. The cable may disconnect from the connector if the proper tools and methods are not used during cable assembly.

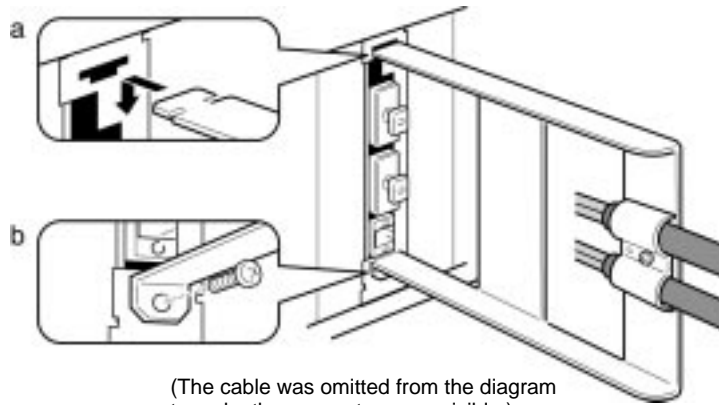
### Connection Procedure

- 1, 2, 3... 1. The Optical Fiber Cable's power supply line is not used, so it can be cut.
2. As shown in the following diagram, secure the Optical Fiber Cable, and secure the clamp to the mounting bracket. Secure the two cables simultaneously for nodes (except the end nodes). Pay attention to the orientation of the mounting bracket and the connector position when connecting the cable

from the highest node in the network to the rightmost connector (SL1), and the cable from the next lower node to the leftmost connector (SL2).



3. Install the mounting bracket on the Board with the screws provided. Insert the tip of the mounting bracket with the grooves into the hole on the Board surface until it locks firmly (a), and then secure the other end of the mounting bracket using the screw (b). Take care not to bend or pull the Optical Fiber Cable forcefully.

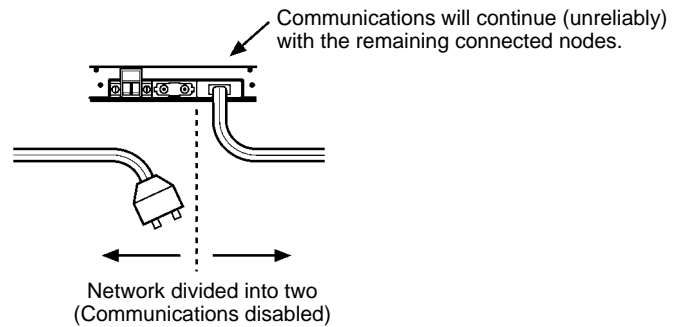


4. Remove the Optical Connector Cover from the Board again. If there are covers on the end connectors of the Optical Fiber Cable, remove them.
5. Double-check the direction of the cables. The cable from the node higher in the network connects to the Board's right connector and the cable to the node lower in the network connects to the Board's left connector. Insert the cable's connectors fully into the Board's connectors.

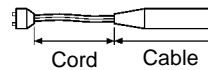
### Connection Precautions

- Insert the connectors completely and check that the connectors are locked before starting operation.

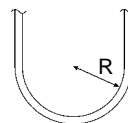
- If a connector becomes disconnected, the node will be unable to communicate with other nodes in that part of the network. The network will be divided into two and communications with the remaining nodes will be unreliable.



- Do not pull on the Optical Fiber Cable. The maximum tension that can be applied to the cord is 10 kg (about 22 lbs) and the maximum tension that can be applied to the cable is 50 kg (about 110 lbs).

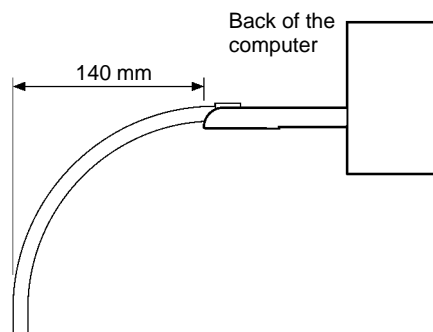
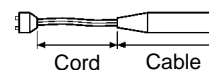


- Do not bend the cable past its natural bending radius. The minimum radius for bends is 10 cm.



- To prevent the Optical Fiber Cable from being pulled too forcefully, always use the cable mounting bracket and provide space behind the Board as shown in the following diagram. Do not exceed the maximum tension for the cord and cable:

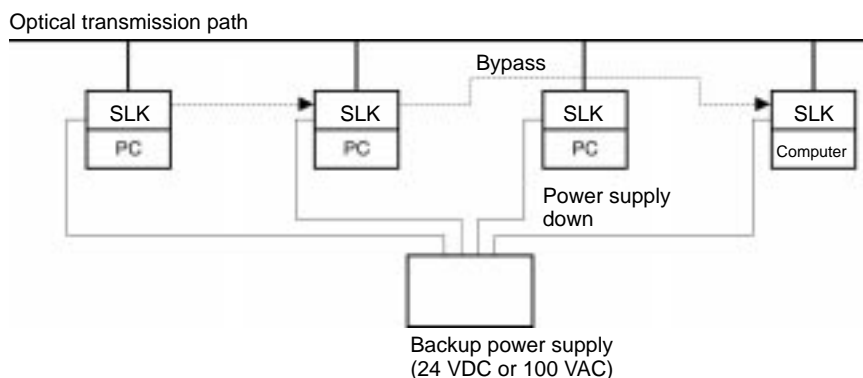
Cord: 0 kg (Do not apply any tension.)  
 Cable: 5 kg (about 11 lbs)



- Do not place objects on top of the Optical Fiber Cable. The maximum pressure that can be placed on the cord and cable is as follows:  
 Cord: 30 kg/10 cm  
 Cable: 50 kg/10 cm
- Inspect the connector before installing it.
- When connecting or disconnecting the Optical Fiber Cable, be sure to hold the connector firmly. (Do not pull on the cable itself.)

## 2-3 Backup Power Supply Wiring (Optical Systems Only)

A node bypass function can be used with an Optical Ring SYSMAC LINK System (H-PCF cable) by supplying a backup power supply to the Units and Boards. This will prevent the entire network from going down if a node malfunctions or the power supply to the PC or computer is turned OFF.



Each node requires a backup power supply for the node bypass function. Several nodes can be connected to a single power supply or each node can be connected to an independent power supply. If several nodes are connected to a single power supply, be sure to wire each node separately as shown in the diagram.

**Note** Use a separate power supply as the backup power supply. Do not use the same power supply being used as the I/O power supply, equipment (such as motors) power supply, or control power supply.

### 2-3-1 Backup Power Supply Specifications

The input specifications for the backup power supply to the SYSMAC LINK Unit and Support Board are described below. When providing a backup power supply, make sure that the following specifications are satisfied.

Item	Specifications
Power supply voltage	24 VDC
Allowable power supply voltage fluctuation range	20.4 to 26.4 VDC (24 VDC, -15 to +10%)
Consumption current	24 VDC, 400 mA max. (per node)
Inrush current	2.5 A max. (when 24-VDC rising time is 5 ms)

An OMRON S82K-series Power Supply Unit is recommended.

- Note**
1. If connecting multiple nodes to one power supply, or if the distance between the power supply and the node is great, carefully consider the maximum current and voltage needed to satisfy the specifications at the node's power supply connectors and terminals.
  2. Power supply from the backup power supply is given priority. Consider the following points when designing a system.
    - a) Turn ON the backup power supply before turning ON the power supply to the PC and computer.
    - b) The communications data will be corrupted in the instant when the backup power supply is turned ON or OFF.
    - c) To make sure that the node bypass function is operating when the power supply to the PC or computer is OFF, use a separate backup power supply that is not connected to the PC or computer.
    - d) Always use a separate backup power supply. Do not use the same supply as the I/O power supply, motor power cables, or control power cables.

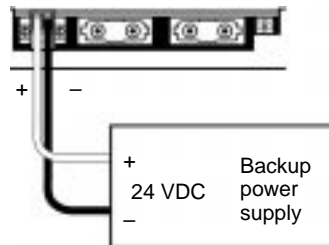
- e) Use a backup power supply with double or reinforced insulation.
3. Use the correct power supply voltage, as given above.

## 2-3-2 Connecting the Backup Power Supply

Observe the following precautions when connecting the backup power supply.

- Separate the backup power supply wires from other power lines and high-voltage lines to prevent noise.
- Attach special crimp terminals to the backup power supply wires.
- Do not reverse the power supply polarity.
- Tighten the power supply cable hold-down screws to 0.2 N·m.
- Do not pull on the power supply cable.
- Do not bend the power supply cable too sharply.
- Do not place any objects on top of the power supply cable.
- Verify that the connector is installed properly before using the power supply.
- Check the wiring configuration carefully before turning ON the power.

Connect the power supply cable to the cable connector and then secure it to the Board, as shown in the following diagram. Be sure that the power supply polarity is not reversed.



**Note** It is difficult to connect or disconnect the backup power supply connector after the Optical Fiber Cable's mounting bracket has been installed. Insert the connector before installing the mounting bracket.

# SECTION 3

## Creating Applications Using the C Library

This section describes how to create applications (user programs) that control the SYSMAC LINK Support Board.

- 3-1 Basic Flow .....
- 3-1-1 Data Link Procedure .....
- 3-1-2 Message Service Procedure .....
- 3-2 Using the C Library .....

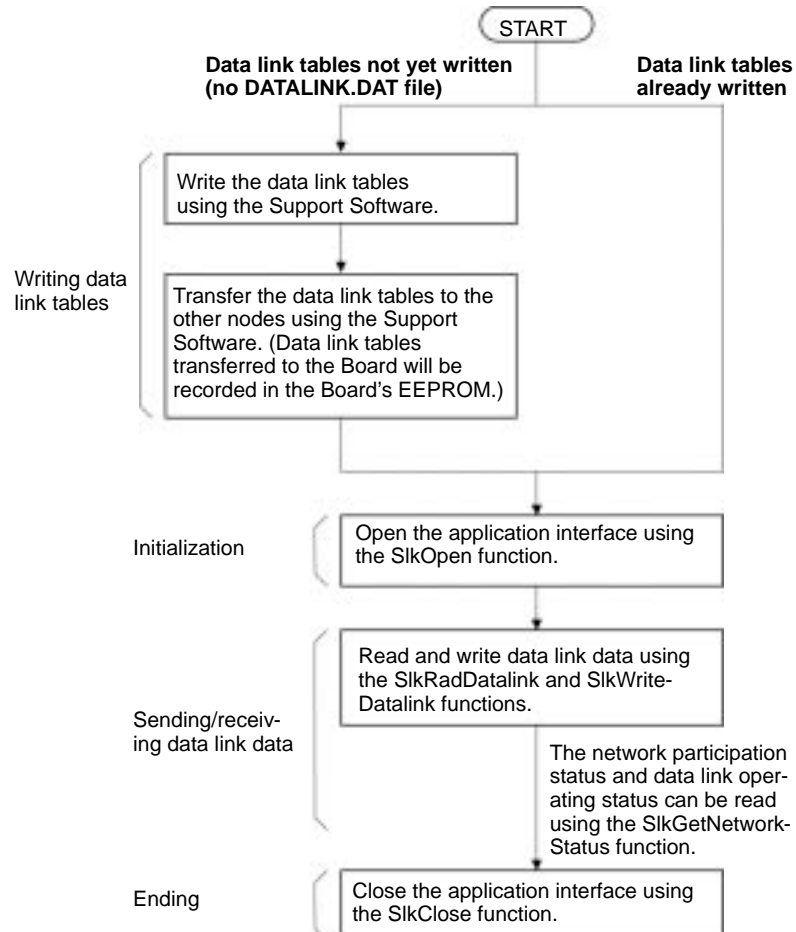
## 3-1 Basic Flow

This section describes the basic procedural flow in creating the applications (user programs) necessary to use the SYSMAC LINK Support Board data link function and the message service function. Create the applications according to the flowcharts in this section.

The following explanations assume that the driver and C library have already been installed. If they have not been, refer to *SYSMAC LINK PCI Support Board Installation Guide (W389)* before proceeding.

### 3-1-1 Data Link Procedure

The basic procedure for using data links is outlined in the following flowchart.



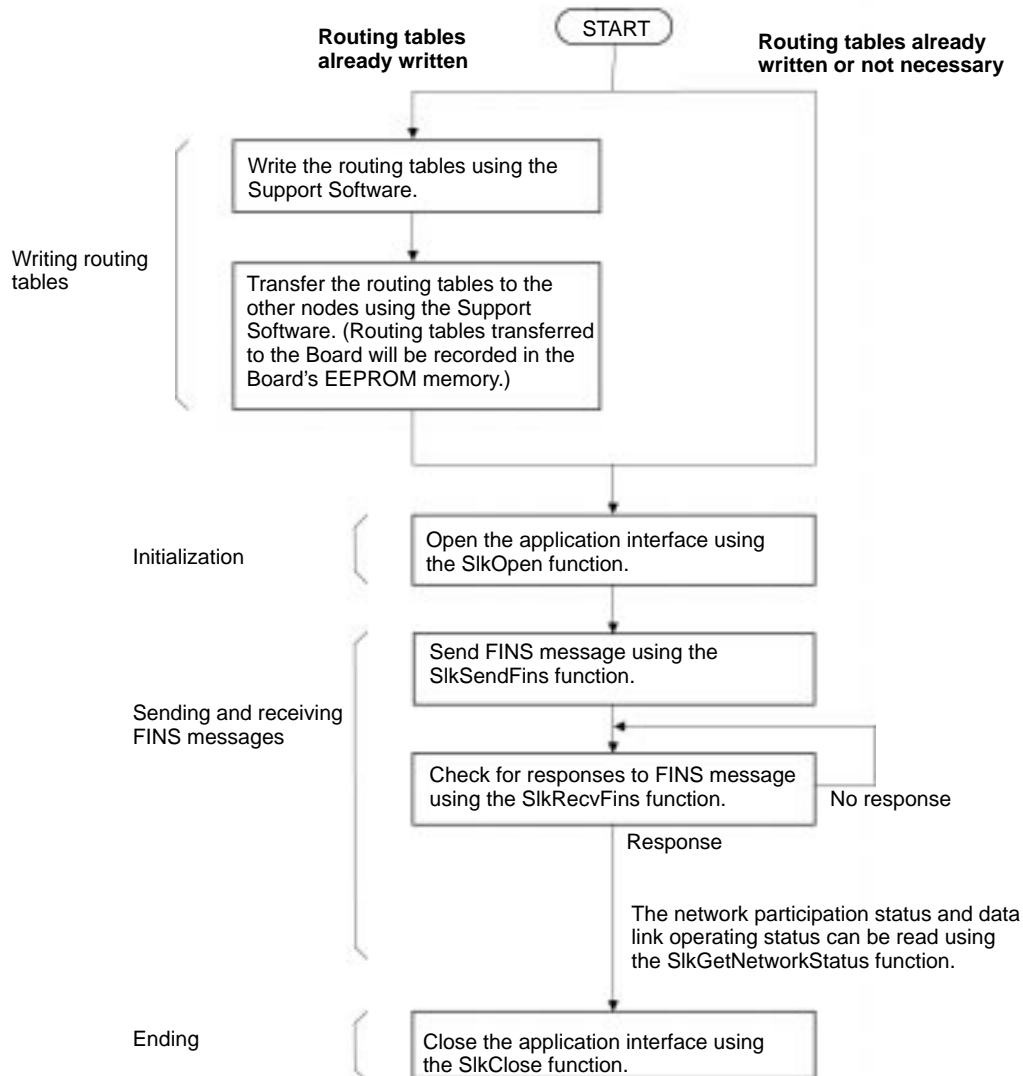
- Note**
1. Repeat the process to read/write data link data as often as required by the application.
  2. Data links can be started and stopped from other nodes, by sending FINS commands from Support Software, by using PC software switches, or by sending a FINS command from the application using the SlkSendFins function.
  3. Information on errors that occur in using the C library can be read using the SlkGetLastError function.

For details on various methods for making programs, refer to the following resources.

- Information on using the C library: *3-2 Using the C Library*
- Details on C library functions: *Section 4 C Language Function Reference*
- Support Software: *SYSMAC LINK Support Software Operation Manual (W369)*

### 3-1-2 Message Service Procedure

The basic procedure for using the message service is outlined in the following flowchart.



- Note**
1. Routing tables are not needed if all communications take place with other nodes in the local network, but routing tables must be prepared if there are communications between nodes on different networks.
  2. Repeat the process to send and receive FINS messages as often as required by the application.
  3. To use Windows-based messages to determine if a FINS message has been received, use the `SlkSetMessageOnArrival` and `SlkSetThreadMessageOnArrival` functions to register the Windows-based messages to be used for notification. When not using Windows-based messages, check periodically for FINS messages using `SlkRecvFins`.

For details on various methods for making programs, refer to the following resources.

- Information on using the C library: *3-2 Using the C Library*
- Details on C library functions: *Section 4 C Language Function Reference*



## 3-2 Using the C Library

The Microsoft Visual C++ library functions for the SYSMAC LINK Support Board are provided in the following file.

Fine name	Contents
SLK_LIB.LIB	Microsoft Visual C++ Ver. 6.0 (Service Pack 3) import library file

The library contains the following functions.

### Functions

Function name	Name	Function	Page
SlkOpen	Board Open	Opens the application interface and gets an SLK handle.	38
SlkClose	Board Close	Closes the application interface and releases the SLK handle.	39
SlkSendFins	FINS Message Send	Sends a FINS message.	39
SlkRecvFins	FINS Message Receive	Receives a FINS message.	40
SlkWriteDatalink	Data Link Data Write	Writes data to a data link area.	40
SlkReadDatalink	Data Link Data Read	Reads data from a data link area.	41
SlkGetNetworkStatus	Network Status Read	Reads the network status.	41
SlkSetMessageOnArrival	FINS Message Reception Notification Registration to Window	Makes settings to notify the specified window with a Windows message when a FINS message is received.	42
SlkSetThreadMessageOnArrival	FINS Message Reception Notification Registration to Thread	Makes settings to notify the specified thread with a Windows message when a FINS message is received.	43
SlkClearMessageOnArrival	FINS Message Reception Notification Clear	Clears windows message notification when a FINS message is received.	43
SlkGetLastError	Detailed Error Information Acquire	Gets an error code generated when a SLK library function is used.	44

## Setting Up Visual C++ Ver. 6

Use the following procedure to set up Microsoft Visual C++ to use the C library.

### Include Files

- 1, 2, 3... 1. Start Visual C++ Ver. 6.0 and select **Tools** and then **Options**.
2. Select the **Directory** Tab, set the directory being displayed to the one for the include files, click the first empty row in the list, and then click the ... Button at the left of the row.
3. Specify the folder in which the C library for the Support Board was installed and click the **OK** Button.  
The installation directory in the header file default for the C library is \Program Files\OMRON\SYSMAC LINK\Lib.
4. Include the following line at the beginning of the program:  

```
#include <SLK_LIB.h>
```

### Setting Up the Library File

- 1, 2, 3... 1. Start Visual C++ Ver. 6.0 and select **Tools** and then **Options**.
2. Select the **Directory** Tab, set the directory being displayed to the one for the library files, click the first empty row in the list, and then click the ... Button at the left of the row.
3. Specify the folder in which the C library for the Support Board was installed and click the **OK** Button.  
The installation directory in the header file default for the C library is \Program Files\OMRON\SYSMAC LINK\Lib.
4. Open the workspace for the program being created and select **Project** and then **Set**.
5. Select the **Link** Tab and input the library file name "SLK\_LIB.LIB" for the object/library module.  
Refer to the user's manual for Visual C++ or online help for information on Visual C++ other than that for setting up the install file and library file.

**Note** There are sample programs provided as Visual C++ V6.0 projects that use the C library for the Board. They can be found in the SYSMAC LINK\Sample directory using the installation directory specified during the installation procedure.

# SECTION 4

## C Language Function Reference

This section gives details on the C++ library functions supported by the SYSMAC LINK Support Board.

4-1	Library Functions .....	
4-1-1	SlkOpen() Board Open .....	
4-1-2	SlkClose() Board Close .....	
4-1-3	SlkSendFins() FINS Message Send .....	
4-1-4	SlkRecvFins() FINS Message Receive .....	
4-1-5	SlkWriteDatalink() Data Link Data Write .....	
4-1-6	SlkReadDatalink() Data Link Data Read .....	
4-1-7	SlkGetNetworkStatus() Network Status Read .....	
4-1-8	SlkSetMessageOnArrival() FINS Message Reception Notification Registration to Window .....	
4-1-9	SlkSetThreadMessageOnArrival() FINS Message Reception Notification Registration to Thread .....	
4-1-10	SlkClearMessageOnArrival() FINS Message Reception Notification Clear .....	
4-1-11	SlkGetLastError() Detailed Error Information Acquire .....	
4-2	Structure Descriptions .....	
4-2-1	SLKHEADER/*PSLKHEADER Structure .....	
4-2-2	EMSLKADDRESS/*PEMSLKADDRESS Structure .....	
4-2-3	NSTBUFFER/*PNSTBUFFER Structure .....	
4-3	Detailed Error Information .....	

## 4-1 Library Functions

This section describes the library functions for Microsoft Visual C++ (version 6.0). Refer to *Section 3 Creating Applications Using the C Library* for details on using the library file.

### Functions

Function name	Name	Function	Page
SlkOpen	Board Open	Opens the application interface and gets an SLK handle.	38
SlkClose	Board Close	Closes the application interface and releases the SLK handle.	39
SlkSendFins	FINS Message Send	Sends a FINS message.	39
SlkRecvFins	FINS Message Receive	Receives a FINS message.	40
SlkWriteDatalink	Data Link Data Write	Writes data to a data link area.	40
SlkReadDatalink	Data Link Data Read	Reads data from a data link area.	41
SlkGetNetworkStatus	Network Status Read	Reads the network status.	41
SlkSetMessageOnArrival	FINS Message Reception Notification Registration to Window	Makes settings to notify the specified window with a Windows message when a FINS message is received.	42
SlkSetThreadMessageOnArrival	FINS Message Reception Notification Registration to Thread	Makes settings to notify the specified thread with a Windows message when a FINS message is received.	43
SlkClearMessageOnArrival	FINS Message Reception Notification Clear	Clears windows message notification when a FINS message is received.	43
SlkGetLastError	Detailed Error Information Acquire	Gets an error code generated when an SLK library function is used.	44

### 4-1-1 SlkOpen()

### Board Open

#### Function

Opens the application interface and gets an SLK handle.

#### Call Format

```
PSLKHANDLE SlkOpen( BYTE byAppUnitAdr, INT *piRetErr);
```

#### Arguments

Type	Variable name	Description
BYTE	byAppUnitAdr	Unit address allocated to the application
INT*	piRetErr	Error information for SlkOpen()

#### Return Value

An SLK handle is returned if the function ends normally.

SLK\_ERROR is returned if the function ends in an error. Detailed error information is stored in piRetErr.

#### Description

Set a value between 1 and 15 for byAppUnitAdr. Set 0 when it is not necessary to set a specific application unit address. An unused unit address will be automatically allocated.

The function will end in an error if a SYSMAC LINK Support Board is not mounted. (Detailed error information = ERR\_NO\_SLKUNIT: No SLK Unit)

The function will end in an error if a handle cannot be obtained because of insufficient memory. (Detailed error information = ERR\_NO\_MEMORY: Memory acquisition error)

The function will end in an error if the unit address specified in the argument is not between 0 and 15. (Detailed error information = ERR\_UNIT\_ADDRESS: Unit address range error)

#### Supplemental Information

The unit address is different from the board ID on the Support Board.

It is not normally necessary to specify a unit address when sending a command from an application running on the computer and receiving a response. Always specify the unit address when sending a command to the application from an application running on a computer or from a PLC at a different node.

**4-1-2 SlkClose()****Board Close****Function**

Closes the application interface and releases the SLK handle.

**Call Format**

```
INT SlkClose( PSLKHANDLE hSLK );
```

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()

**Return Value**

SLK\_SUCCESS is returned if the function ends normally.

SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description**

If the application is ended without using SlkClose() to close the application interface, the address specified for SlkOpen() cannot be used again. Always execute SlkClose() for all SLK handles obtained with SlkOpen() before ending the application.

**4-1-3 SlkSendFins()****FINS Message Send****Function**

Sends a FINS message.

**Call Format**

```
INT SlkSendFins(PSLKHANDLE hSLK, PSLKHEADER pHeader, LPVOID lpMessage, DWORD dwSize );
```

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()
PSLKHEADER	pHeader	Pointer to the header information structure for the FINS message
LPVOID	lpMessage	Pointer to the send buffer for the FINS message
DWORD	dwSize	Size of FINS message send buffer

**Return Value**

SLK\_SUCCESS is returned if the function ends normally.

SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description**

Refer to *4-2 Structure Descriptions* for information on the header information structure.

Store the FINS message in the FINS message send buffer from the command code (MRC) on.

The network specifications determine the maximum amount of data that can be transferred through the network. The maximum size that can be specified for the send buffer (dwSize) is 542 bytes.

When -1 is specified for the Service ID (SID), the SID is automatically incremented and attached. The SID value incremented within the function is retained within that one process only. The incremented value is not managed on the network handle or thread level.

The function will end in an error in the following cases:

Error cause	Detailed error information
A FINS message send buffer size of less than 2 bytes was specified in the argument.	ERR_SEND_BUFFER_SIZE (Send message size error)
The argument's Service ID (SID) was not set between -1 and 255.	39 (SID setting error)

**4-1-4 SlkRecvFins()****FINS Message Receive****Function**

Receives a FINS message.

**Call Format**

INT SlkRecvFins(PSLKHANDLE hSLK, PSLKHEADER pHeader, LPVOID lpMessage, DWORD dwSize, DWORD dwTimeLimit );

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()
PSLKHEADER	pHeader	Pointer to the header information structure for the FINS message
LPVOID	lpMessage	Pointer to the receive buffer for the FINS message
DWORD	dwSize	Size of FINS message receive buffer
DWORD	dwTimeLimit	Reception wait time (unit: ms)

**Return Value**

The size of the FINS message that was receive is returned as the number of bytes if the function ends normally.

SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description**

The number of receive bytes in the return value is for all bytes starting from the command code (MRC) in the FINS message.

Refer to *4-2 Structure Descriptions* for information on the header information structure.

The FINS message from the command code (MRC) on will be stored in the FINS message receive buffer.

The function will end in an error in the following cases:

Error cause	Detailed error information
A FINS message receive buffer size of less than 2 bytes was specified in the argument.	ERR_RECV_BUFFER_SIZE (Receive message size error)
A message reception area cannot be reserved because of insufficient memory.	ERR_NO_MEMORY (Memory acquisition error)
The reception wait time is set to 0 and a FINS message has not yet been received.	38 (Receive timeout)
A FINS message was not received within the specified reception wait time.	38 (Receive timeout)
The received FINS message is larger than the reception buffer size.	ERR_MSG_SIZE_OVER (Receive buffer size error)

**4-1-5 SlkWriteDatalink()****Data Link Data Write****Function**

Writes data to a data link area.

**Call Format**

INT SlkWriteDatalink(PSLKHANDLE hSLK, PEMSLKADDRESS pEmAddress, LPWORD lpWriteData, DWORD dwSize);

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()
PEMSLKADDRESS	pEmAddress	Pointer to the starting address structure for writing data
LPWORD	lpWriteData	Pointer to the buffer to store the write data
DWORD	dwSize	Write data size (unit: words)

**Return Value** SLK\_SUCCESS is returned if the function ends normally.  
SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description** Refer to 4-2 *Structure Descriptions* for information on the starting address structure for writing data.

The function will end in an error in the following cases:

Error cause	Detailed error information
A value of 0 was specified for the argument's write data size.	ERR_WRITE_BUFFER_SIZE (Write data size error)
Access is requested to 3 or more different memory areas for one SLK handle.	ERR_MEMORY_AREA (Multiple memory area specification error)
The memory name specified in the argument does not exist.	ERR_NO_MEM_TYPE (No such memory)

### 4-1-6 SlkReadDatalink()

### Data Link Data Read

**Function** Reads data from a data link area.

**Call Format** INT SlkReadDatalink( PSLKHANDLE hSLK, PEMSLKADDRESS pEmAddress, LPWORD lpReadData, DWORD dwSize);

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()
PEMSLKADDRESS	pEmAddress	Pointer to the starting address structure for reading data
LPWORD	lpWriteData	Pointer to the buffer to store the read data
DWORD	dwSize	Read data size (unit: words)

**Return Value** SLK\_SUCCESS is returned if the function ends normally.  
SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description** Refer to 4-2 *Structure Descriptions* for information on the starting address structure for reading data.

The function will end in an error in the following cases:

Error cause	Detailed error information
A value of 0 was specified for the argument's read data size.	ERR_READ_BUFFER_SIZE (Read data size error)
Access is requested to 3 or more different memory areas for one SLK handle.	ERR_MEMORY_AREA (Multiple memory area specification error)
The memory name specified in the argument does not exist.	ERR_NO_MEM_TYPE (No such memory)

### 4-1-7 SlkGetNetworkStatus()

### Network Status Read

**Function** Reads the network status.

**Call Format** INT SlkGetNetworkStatus( PSLKHANDLE hSLK, BYTE byNet, PNSTBUFFER pBuffer);

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()
BYTE	byNet	Network address of the Board to read network status
PNSTBUFFER	pBuffer	Pointer to the buffer structure to store the read data

**Return Value**

SLK\_SUCCESS is returned if the function ends normally.

SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description**

Refer to *4-2 Structure Descriptions* for information on the read data structure. The read data size is fixed. Provide a memory area the size of the PNSTBUFFER structure as a read data storage buffer.

If the function is executed when the Board is not participating in the network, 0 will be set for the following members of the read data structure.

Network participation status

Communications cycle time

Polling node address

Data link operation status and data link mode

Data link status

The function will end in an error in the following cases:

Error cause	Detailed error information
An error response code was returned for the FINS message.	ERR_RESPONSE (Error response code error)
A SYSMAC LINK Support Board is not mounted in the network specified by the argument's network address.	ERR_NO_SLKUNIT (No SLK Unit)
A message reception area cannot be reserved because of insufficient memory.	ERR_NO_MEMORY (Memory acquisition error)
A value of 0 is specified for the network address, but there is more than one network.	ERR_NETWORK_ADDRESS (Network address specification error)

**4-1-8 SlkSetMessageOnArrival()****FINS Message Reception Notification Registration to Window****Function**

Makes settings to notify the specified window with a Windows message when a FINS message is received.

**Call Format**

INT SlkSetMessageOnArrival( PSLKHANDLE hSLK, HWND hWnd, UINT uMsg);

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()
HWND	hWnd	Window handle to receive event notification
UINT	uMsg	Message to use for notification (WM_USER to 0x7FFF)

**Return Value**

SLK\_SUCCESS is returned if the function ends normally.

SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description**

Both SlkSetMessageOnArrival and SlkSetThreadMessageOnArrival cannot be registered at the same time.



The function will end in an error in the following cases:

Error cause	Detailed error information
A null pointer is specified for the window handle specified as the argument.	ERR_WINDOWHANDLE_PARA (Window handle error)
An illegal value is specified for the window handle specified as the argument	67 (Illegal window handle)
The message specified in the argument is over 0x7FFF.	ERR_MESSAGE_PARA (Message type error)
A message has already been registered for FINS message reception.	69 (Duplicated message registration error)

### 4-1-9 SlkSetThreadMessageOnArrival() FINS Message Reception Notification Registration to Thread

**Function** Makes settings to notify the specified thread with a Windows message when a FINS message is received.

**Call Format** INT SlkSetThreadMessageOnArrival( PSLKHANDLE hSLK, DWORD dwThreadId, UINT uMsg);

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()
DWORD	dwThreadId	Thread ID to receive event notification
UINT	uMsg	Message to use for notification (WM_USER to 0x7FFF)

**Return Value** SLK\_SUCCESS is returned if the function ends normally.  
SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

**Description** Both SlkSetMessageOnArrival and SlkSetThreadMessageOnArrival cannot be registered at the same time.

The function will end in an error in the following cases:

Error cause	Detailed error information
A null pointer is specified for the window handle specified as the argument.	ERR_WINDOWHANDLE_PARA (Window handle error)
An illegal value is specified for the window handle specified as the argument	67 (Illegal window handle)
The message specified in the argument is over 0x7FFF.	ERR_MESSAGE_PARA (Message type error)
A message has already been registered for FINS message reception.	69 (Duplicated message registration error)

### 4-1-10 SlkClearMessageOnArrival() FINS Message Reception Notification Clear

**Function** Clears windows message notification when a FINS message is received.

**Call Format** INT SlkClearMessageOnArrival( PSLKHANDLE hSLK);

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()

**Return Value** SLK\_SUCCESS is returned if the function ends normally.  
SLK\_ERROR is returned if the function ends in an error. Detailed error information can be obtained using SlkGetLastError().

### 4-1-11 SlkGetLastError()

### Detailed Error Information Acquire

**Function** Gets detailed error information generated when a SYSMAC LINK library function is used.

**Call Format** INT SlkGetLastError( PSLKHANDLE hSLK);

**Arguments**

Type	Variable name	Description
PSLKHANDLE	hSLK	The SLK handle obtained with SlkOpen()

**Return Value** Detailed error information is returned if the function ends normally.  
SLK\_ERROR is returned if the function ends in an error.

**Description** Refer to 4-3 *Detailed Error Information* for details on the return value.

## 4-2 Structure Descriptions

### 4-2-1 SLKHEADER/\*PSLKHEADER Structure

This structure stores heading information for a FINS message. It is used by SlkSendFins() and SlkRecvFins().

Type	Variable name	Contents
BYTE	ByIcfBits	FINS header ICF Set the following for the FINS message: Command/response and response needed/not needed. 0x80 (128) Command requiring response 0x81 (129) Command not requiring response 0xC0 (192) or 0xC1 (193): Response
BYTE	byNetAddr	Source/destination network address For SlkSendFins(), set the destination network address. For SlkRecvFins(), the network address of the source of the FINS message is stored.
BYTE	byNodeAddr	Source/destination node address For SlkSendFins(), set the destination node address. For SlkRecvFins(), the node address of the source of the FINS message is stored.
BYTE	byUnitAddr	Source/destination unit address For SlkSendFins(), set the destination unit address. For SlkRecvFins(), the unit address of the source of the FINS message is stored.
INT	nSid	Service ID Any value can be set to identify the FINS message. (–1 to 255) (See note.) For SlkRecvFins(), the SID of the received FINS message is stored.

**Note** When –1 is specified for the Service ID (SID), the SID is automatically incremented and attached. The SID value incremented within the function is retained within that one process only. The incremented value is not managed on the network handle or thread level.

### 4-2-2 EMSLKADDRESS/\*PEMSLKADDRESS Structure

This structure stores heading information for a FINS message. It is used by SlkWriteDatalink() and SlkReadDatalink().

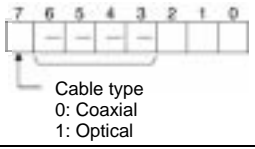
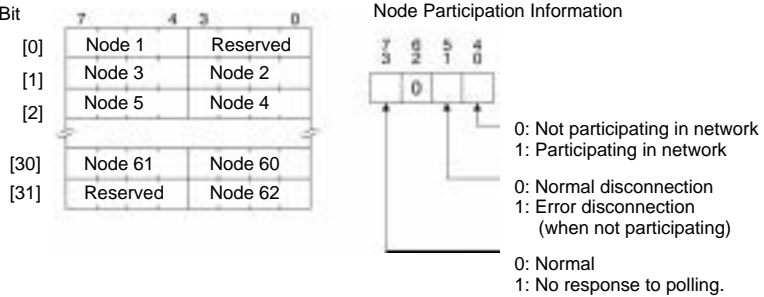
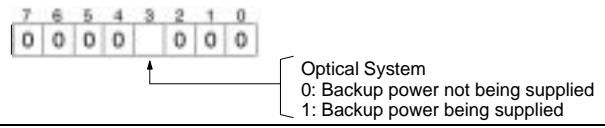
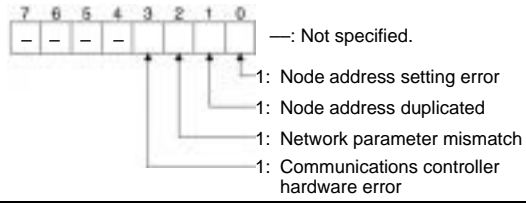
Type	Variable name	Contents
LPCTSTR	lpszMemName	Area type Specify the text string for the event memory area type set for the data link area.
DWORD	dwWordOffset	Number of offset words Set the number of words to offset from the beginning of the event memory area specified with lpszType.

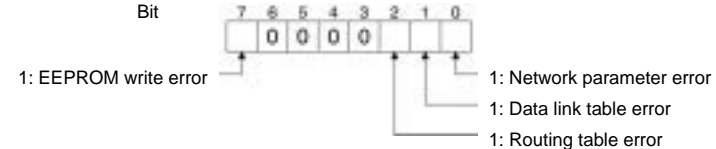
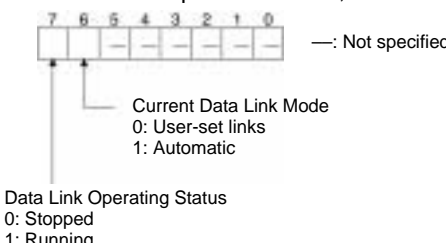
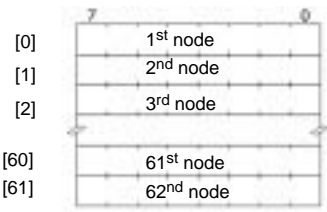
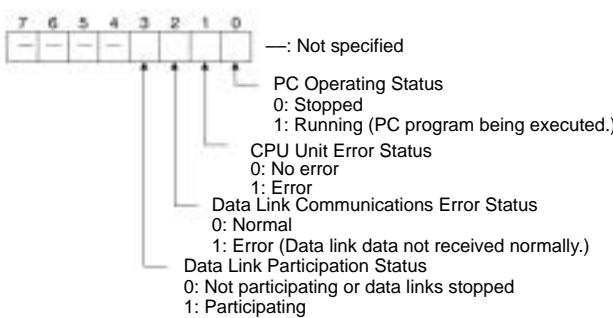
The areas and ranges that can be accessed can be changed using FinsGateway event memory settings. The default areas and ranges are listed in the following table.

Area	Designation	Range
CIO Area	CIO	0 to 32767
DM Area	DM	0 to 32767

### 4-2-3 NSTBUFFER/\*PNSTBUFFER Structure

This structure stores network status that has been read. It is used by `SlkGetNetworkStatus()`.

Type	Variable name	Contents
BYTE	byConnectionMethod	Specifies whether the system is a coaxial or optical system. Bit  —: Not specified.
BYTE	byMyNodeAddr	Local unit address Stores the local unit address set for the SYSMAC LINK Board.
BYTE	byMyUnitAddr	Always set to 0.
BYTE	byMyNetAddr	Always set to 0.
BYTE	abyNodeList[32]	Network participation status Stores a list of the nodes participating in the network. Bit 
WORD	wComunicationCycleTime	Communications cycle time Stores the current value of the communications cycle time. (unit: 0.1 ms)
BYTE	byPollingNodeAddr	Polling node address Stores the node address of the current polling node.
BYTE	byStatus1	Reserved area Contains undetermined data.
BYTE	byStatus2	Indicates the backup power supply's status when using an optical system. Bit 
BYTE	byStatus3	Error information 1 Stores information such as node address setting errors. 
BYTE	byStatus4	Reserved area Contains undetermined data.

Type	Variable name	Contents
BYTE	byStatus5	<p>Error information 2</p> <p>Stores information such as EEPROM write errors, setting table errors, etc.</p> <p>Bit</p>  <p>1: EEPROM write error</p> <p>1: Network parameter error</p> <p>1: Data link table error</p> <p>1: Routing table error</p>
BYTE	byStatus6	<p>Reserved area</p> <p>Contains undetermined data.</p>
BYTE	byStatusFlag	<p>Data link operation status and data link mode</p> <p>Stores the data link operation status, data link mode, etc.</p> <p>Bit</p>  <p>—: Not specified</p> <p>Current Data Link Mode</p> <p>0: User-set links</p> <p>1: Automatic</p> <p>Data Link Operating Status</p> <p>0: Stopped</p> <p>1: Running</p>
BYTE	abyDataLinkStatus[62]	<p>Data link status</p> <p>Stores the data link status. Data is stored for the nodes in the same order that the nodes are registered in the data link table for refreshing.</p> <p>Bit</p>  <p>[0] 1<sup>st</sup> node</p> <p>[1] 2<sup>nd</sup> node</p> <p>[2] 3<sup>rd</sup> node</p> <p>[60] 61<sup>st</sup> node</p> <p>[61] 62<sup>nd</sup> node</p> <p>Node Data Link Status</p>  <p>—: Not specified</p> <p>PC Operating Status</p> <p>0: Stopped</p> <p>1: Running (PC program being executed.)</p> <p>CPU Unit Error Status</p> <p>0: No error</p> <p>1: Error</p> <p>Data Link Communications Error Status</p> <p>0: Normal</p> <p>1: Error (Data link data not received normally.)</p> <p>Data Link Participation Status</p> <p>0: Not participating or data links stopped</p> <p>1: Participating</p>

## 4-3 Detailed Error Information

The information read by SlkGetLastError is listed in the following table. Macro names for error codes are defined in SLK\_LIB.H.

Error code	Macro name	Meaning
1	ERR_UNIT_ADDRESS	Unit address range error
2	ERR_NO_SLKUNIT	SYSMAC LINK Unit is missing.
3	ERR_NO_MEMORY	Memory could not be obtained.
4	ERR_MSG_SIZE_OVER	Reception message was too large.
5	ERR_NO_MEM_TYPE	Memory type does not exist.
6	ERR_RESPONSE	Response code error
7	ERR_SEND_BUFFER_SIZE	Send message size error
8	ERR_RECV_BUFFER_SIZE	Reception message size error
9	ERR_WRITE_BUFFER_SIZE	Write data size error
10	ERR_READ_BUFFER_SIZE	Read data size error
11	ERR_WINDOWHANDLE_PARA	Window handle error
12	ERR_MESSAGE_PARA	Message type error
13	ERR_MEMORY_AREA	Memory type designation error
14	ERR_INTERNAL_FAILURE	Unexpected error
15	ERR_NOT_RING_MODE	Not in Optical Token Ring Mode.
16	ERR_NETWORK_ADDRESS	Network address specification error
30	---	Service not defined.
32	---	Memory insufficient; cannot execute.
34	---	Network busy; cannot execute.
35	---	Reception buffer overflow
36	---	Data size error
37	---	FINS header error
38	---	Reception timeout
39	---	SID setting error
41	---	Destination address not in routing tables; cannot execute.
42	---	Routing table setting error; cannot execute.
43	---	Too many gateways.
67	---	Illegal window handle error
69	---	Message registration duplication error

# SECTION 5

## Data Links

This section describes how to use data links in a SYSMAC LINK Network.

- 5-1 What Are Data Links? .....
- 5-1-1 Data Link Specifications .....
- 5-2 Setting Data Links .....
- 5-2-1 Selecting Manual or Automatic Settings .....
- 5-2-2 Manual Setting .....
- 5-2-3 Data Link Table Settings (Manual Settings) .....
- 5-2-4 Automatic Setting: "Select All" .....
- 5-2-5 Data Area Allocation with Automatic Settings .....
- 5-3 Starting and Stopping Data Links .....
- 5-3-1 Using a Programming Device or a Ladder Program .....
- 5-3-2 Using Support Software .....
- 5-3-3 Using the SYSMAC LINK Unit's DIP Switch (C-Series Units Only) .....
- 5-3-4 Using FINS Commands .....
- 5-3-5 Data Link Timing Precautions .....
- 5-4 Checking Data Link Status .....
- 5-4-1 LED Indicators .....
- 5-4-2 Data Link Status Area .....
- 5-4-3 Checking by Manipulating Bit/Word Status .....
- 5-5 Data Link Performance .....
- 5-6 Data Link I/O Response Time .....
- 5-6-1 Computer to PC .....
- 5-6-2 PC to Computer .....

## 5-1 What Are Data Links?

A data link is a function that automatically exchanges the data in predetermined areas between nodes (PC ↔ PC or PC ↔ Computer) on one network. Data links can be created freely among CS-series PCs, C200HX/HG/HE PCs, CV-series PCs, and IBM PC/AT or compatible computers.

Two data link areas, area 1 and area 2, can be set in the Board.

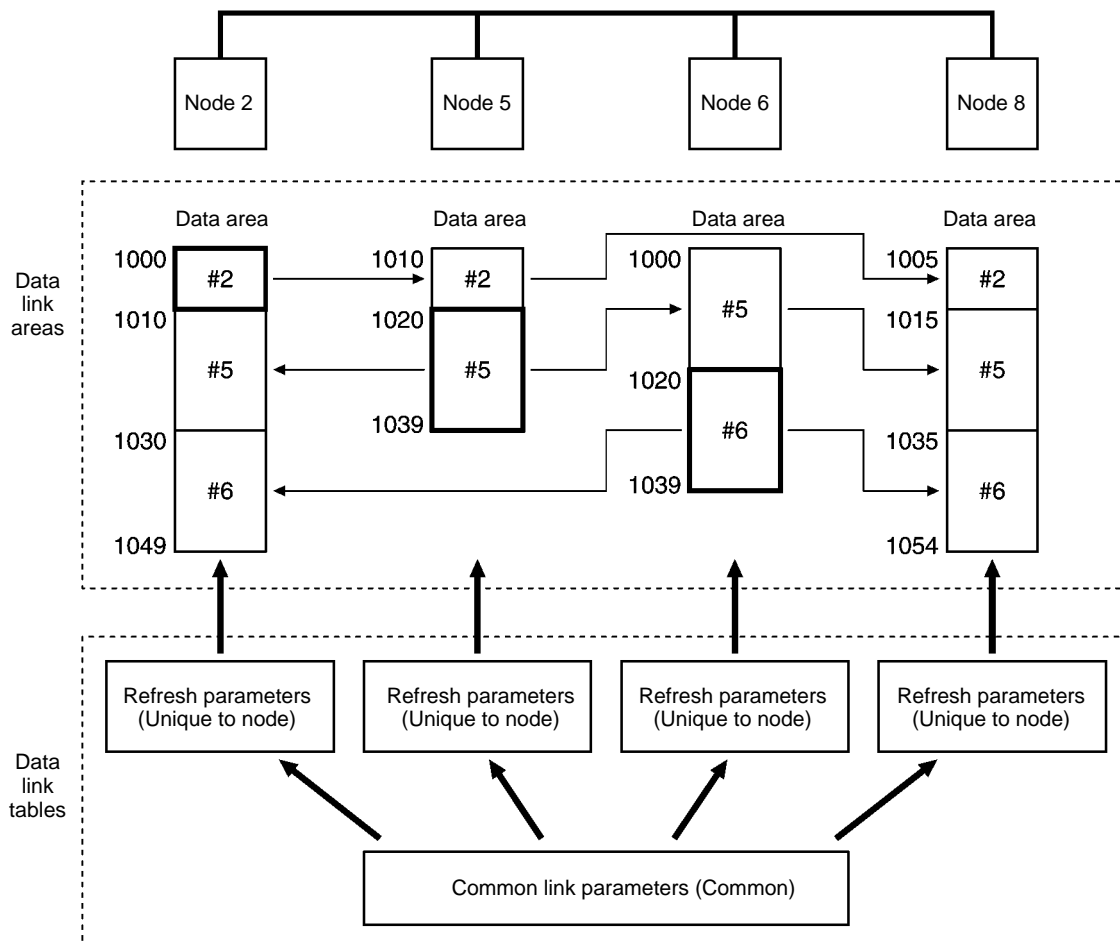
SYSMAC LINK data links can be set in two ways: manually or automatically.

- Data link areas can be manually set by inputting each node's data link table using the SYSMAC LINK Support Software or the FinsGateway's SLK Data Link Setting Utility. Data link tables are created to define the data links. The configuration of the data links can be set freely with manual settings.
- Data links can be set automatically from a Programming Device. With automatically set data links, each node has the same sized send area.

Either the automatic or the manual setting method must be used throughout the network. The two methods cannot be combined in the same network. The following rules apply to these two methods of setting data links.

- 1, 2, 3...
1. The data links in area 1 and area 2 can be used simultaneously.
  2. The settings (starting words and send area size) for areas 1 and 2 are completely independent. The send/receive order is the same for areas 1 and 2.
  3. It is not necessary for the Board to participate in the data links.

### Manually Setting Data Links



- Manually set data links when you want to create data links tailored to meet the requirements of your application. Data links can be set in each node's SYS-

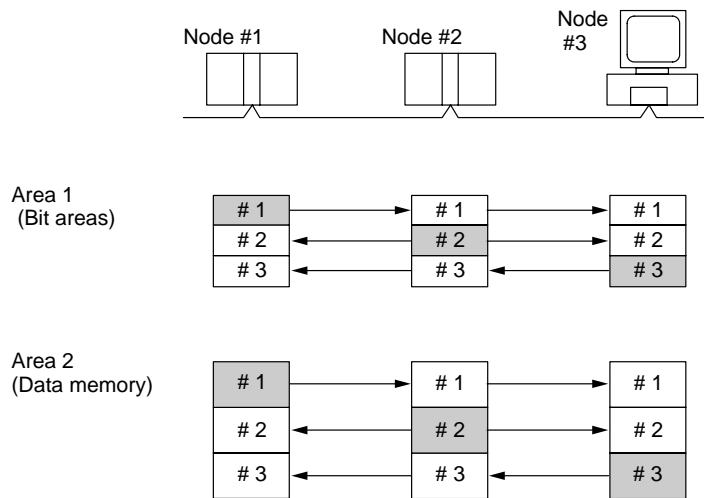


MAC LINK Unit or Board using the SYSMAC LINK Support Software or the FinsGateway's SLK Data Link Setting Utility.

- Each node's send area size and location can be allocated freely.
- It is possible to change the order in which data is received from the other nodes.
- Nodes can be set as send-only or receive-only.

**Automatically Setting Data Links**

The following diagram shows an example of automatic setting:



Automatically set data links when you want to create data links easily.

- Use a Programming Device (such as a Programming Console) to set the automatic data link mode in the startup PC's PC Setup or DM parameter area.
- The CIO or LR Area can be selected for area 1 and the DM Area can be selected for area 2.
- A computer cannot be used as the startup node if the data links are being automatically set.
- A computer can only participate in the data links if the data links are being automatically set.

**5-1-1 Data Link Specifications**

Item	Description						
Number of data link nodes	62 nodes max. (2 nodes min.)						
Number of data link words	Send and receive words per node	2,966 words max. (total in areas 1 and 2)					
	Send words per node	508 words max. (254 CIO/LR Area words and 254 DM Area words max.)					
Allocation of data link areas	Manual setting	Area 1: CIO Area or LR Area Area 2: DM Area The allocation is set in the data link table.					
	Automatic setting	Data area	Word addresses	Units (number of data link nodes)			
				2	4	8	16
		CIO/LR	1000 to 1063	32 words	16 words	8 words	4 words
	DM	D00000 to D00127	64 words	32 words	16 words	8 words	

## 5-2 Setting Data Links

### 5-2-1 Selecting Manual or Automatic Settings

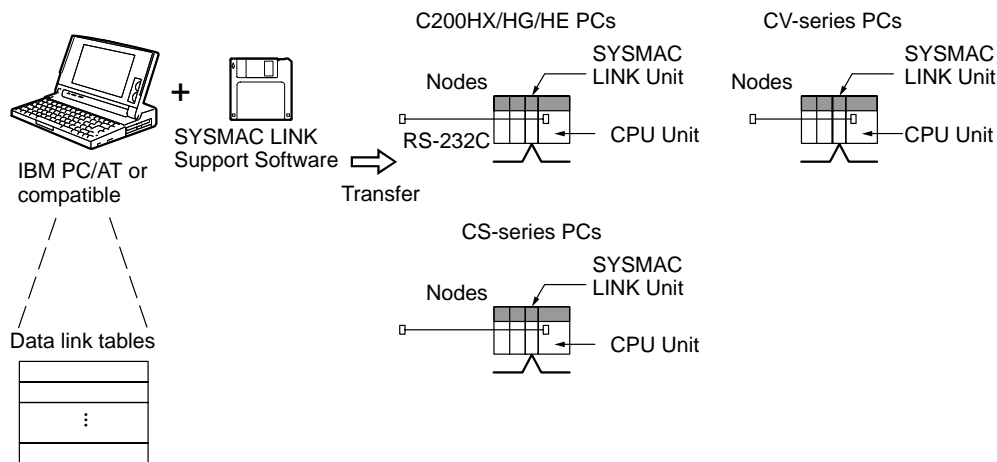
The data link mode (manual or automatic) is specified by using a Programming Device to set the data link mode parameter in the startup PC's PC Setup in the DM Parameter Area.

- Note**
1. The data link mode can be selected only with a SYSMAC LINK Unit. Refer to the *SYSMAC LINK Units Operation Manual (W202/W376)* for more details.
  2. Data links must be set manually when the SYSMAC LINK Support Board has been set as the startup node.
  3. The data link mode can be set in the data link startup node only. The data link mode setting is determined by the data link mode of the startup node even if the data link mode settings of the nodes participating in the data links are different from the settings in the startup node.
  4. In manual setting, a data link table must be set in the data link startup node and in automatic setting, automatic data link setting parameters must be set in the data link startup node. Data links will not be started unless the settings are correct.

### 5-2-2 Manual Setting

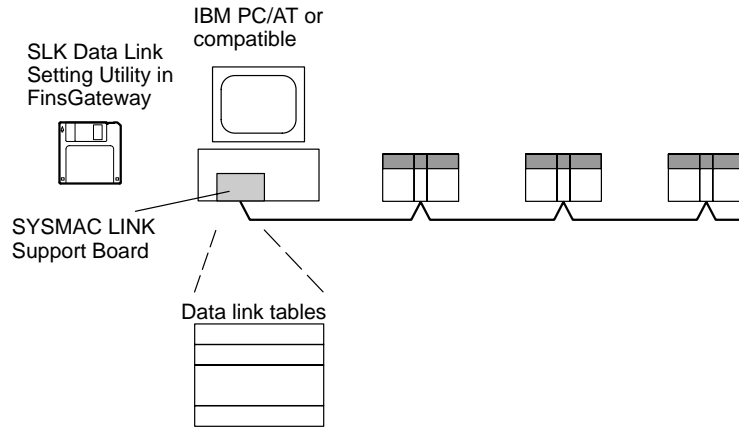
Transfer the data link tables that were created on the Support Software to the SYSMAC LINK Units and the SYSMAC LINK Support Boards of all nodes participating in the data links.

#### Transferring from a Programming Device



- Note**
1. Data link tables cannot be set in the SYSMAC LINK Support Board using the CX-Net in the CX-Programmer. Use the SLK Data Link Setting Utility in Fins-Gateway or the SYSMAC LINK Support Software (version 2.00 or higher).
  2. When transferring the data link tables to a SYSMAC LINK Unit in a CV-series PC, set the System Protect Keyswitch on the CPU Unit to "NORMAL." With a CS-series PC, set pin 1 of the CPU Unit's DIP switch to "OFF."
  3. The SYSMAC Support Software cannot be connected directly to a CS-series PC.

Transferring from a Computer Connected as a Node



- Note**
1. To create data link tables for nodes in the network using the SLK Data Link Setting Utility in the FinsGateway, the network must have been constructed correctly. Set routing tables at each node as required. When using manually set data links, be sure to delete data link tables for all nodes not participating in data link. See *1-4 Applications Precautions* for details. Refer to FinsGateway online help for actual setting procedures for the SLK Data Link Setting Utility.
  2. Refer to the FinsGateway online help for details on setting data link tables with the FinsGateway's SLK Data Link Setting Utility.

5-2-3 Data Link Table Settings (Manual Settings)

Item		Contents	
Common link parameters	Communications cycle time	Sets the data link's communications cycle time. Select either automatic calculation or a manual setting. The default setting is automatic calculation. The manual setting range is 5 to 255 ms. Refer to <i>5-2-4 Data Link Timing Precautions</i> if you are setting a fixed communications cycle time (manual setting).	
	Local node's send area size	CIO/LR Area	Set the size of the local node's send area in the CIO/LR Area. The setting range is 0 to 254 words.
		DM Area	Set the size of the local node's send area in the DM Area. The setting range is 0 to 254 words.
Refresh parameters	Data link starting word addresses	CIO/LR Area	Set the starting address of the local node's data link area in the CIO/LR Area. The setting range is 0 to 2550. (See note 1.)
		DM Area	Set the starting address of the local node's data link area in the DM Area. The setting range is 0 to 32767. (See note 1.)
	Node refresh order	Sets the order of the node addresses when the local node refreshes data in the data link area defined with the data link starting word addresses above. (The local node address indicates the send area. Other node addresses indicate areas that receive data from other nodes.)  For example, if "3, 2, 1" is input, the data link area is allocated to nodes 3, 2, and 1 starting from the data link starting word address. When the local node address is 1, data will be received from node 3, received from node 2, and then sent from the last area.  <b>Note</b> <ol style="list-style-type: none"> <li>1. Always include the local node in the node refresh order.</li> <li>2. When the node address of a node is omitted from the node refresh order, data will not be received from that node.</li> </ol>	

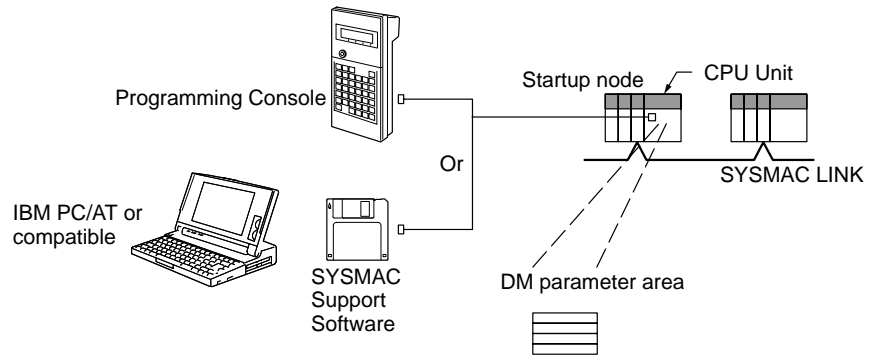
- Note**
1. The actual range of addresses in the CIO/LR and DM Areas depends upon the PC being used. Refer to the PC's Operation Manual for details on the actual data area ranges.

2. Refer to the CX-Net Operation Manual for details on setting parameters with CX-Net.
3. Data link areas in the SYSMAC LINK Support Board are allocated in the FinsGateway event memory. Refer to the FinsGateway online help for information on the area types and sizes in event memory.
4. If you are using a C-series SYSMAC LINK Unit with this Support Board, a CS-series SYSMAC LINK Unit, or a CV-series SYSMAC LINK Unit, the addresses 1000 to 1063 correspond to the 64 words in the LR area (LR 00 to LR 63). Set the data link words in the LR area of the C-series PC.
5. The data link words in the CIO or IR Area, and the words in the DM Area, are continuous.

### 5-2-4 Automatic Setting: “Select All”

Use a PC Programming Device (CX-Net, SYSMAC Support Software, or Programming Console) to set the appropriate value in the system settings or DM parameter area of the startup PC.

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



- Note**
1. Parameters for automatically setting data links can only be set in PCs. Refer to the *SYSMAC LINK Units Operation Manual (W202/W367)* for details.
  2. A computer (SYSMAC LINK Support Board) cannot be the startup node for an automatically setting data links.
  3. A computer can participate in automatically set data links. Data link tables are not required in the computer (the data link tables in the startup node will be used).

## 5-2-5 Data Area Allocation with Automatic Settings

The following table shows the allocation of the data link area when automatic settings are used. The numbers following the “#” symbol are the node addresses of the nodes in the data link.

CIO/LR Area addresses	DM Area addresses	CIO/LR: 4 words DM: 8 words	CIO/LR: 8 words DM: 16 words	CIO/LR: 16 words DM: 32 words	CIO/LR: 32 words DM: 64 words
1000 to 1003	D00000 to D00007	#1	#1	#1	#1
1004 to 1007	D00008 to D00015	#2			
1008 to 1011	D00016 to D00023	#3	#2		
1012 to 1015	D00024 to D00031	#4			
1016 to 1019	D00032 to D00039	#5	#3	#2	
1020 to 1023	D00040 to D00047	#6			
1024 to 1027	D00048 to D00055	#7	#4		
1028 to 1031	D00056 to D00063	#8			
1032 to 1035	D00064 to D00071	#9	#5	#3	#2
1036 to 1039	D00072 to D00079	#10			
1040 to 1043	D00080 to D00087	#11	#6		
1044 to 1047	D00088 to D00095	#12			
1048 to 1051	D00096 to D00103	#13	#7	#4	
1052 to 1055	D00104 to D00111	#14			
1056 to 1059	D00112 to D00119	#15	#8		
1060 to 1063	D00120 to D00127	#16			

**Note** If you are using a C-series SYSMAC LINK Unit together with a SYSMAC LINK Support Board, a CS-series SYSMAC LINK Unit, or a CV-series SYSMAC LINK Unit, addresses CIO 1000 to CIO 1063 correspond to LR 00 to LR 63 in the C-series PC and addresses D00000 to D00127 correspond to DM 0000 to DM 0127 in the C-series PC.

## 5-3 Starting and Stopping Data Links

The data link must be started after data link areas have been created. Use any of the methods described below for the startup node to start and stop data links. These methods are the same for both manually and automatically set data links.

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



### Caution

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

- **Manually Set Data Links**

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

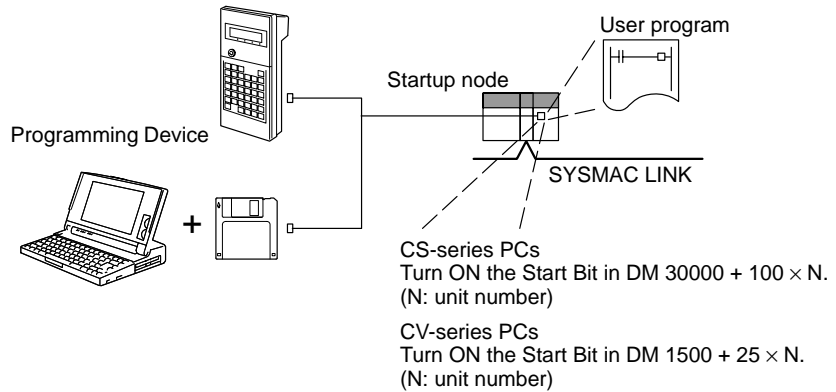
Be sure that data link tables are deleted from nodes that are not participating in the data links.

- **Automatically Set Data Links**

Set the appropriate settings in the data link startup PC's DM parameters or CPU Bus Unit system setup area.

### 5-3-1 Using a Programming Device or a Ladder Program

Set the software switches (AR or DM Start Bit) in the PC to ON using a Programming Device or from the ladder-diagram program.

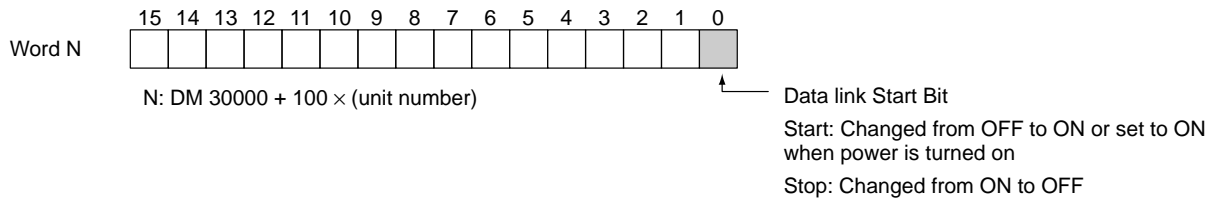


The data links will start when the Start Bit changes from OFF to ON or is already ON when power is turned ON. The data links will stop when the Start Bit changes from ON to OFF.

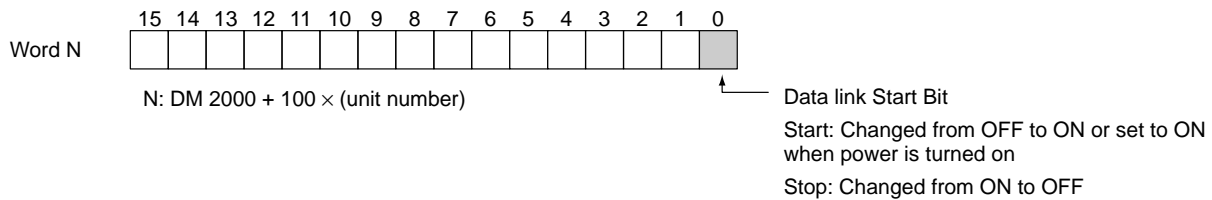
- Note**
1. Refer to the *SYSMAC LINK Units Operation Manual (W202/W367)* for details on starting and stopping data links using a Programming Device or ladder program.
  2. The data in the DM Area is retained even when the power is turned OFF. Therefore, settings can be made in the DM Area in advance so that the data links will start as soon as the power is turned ON.

When a CV-series PC is being used, specify the Start Bit in the Holding Area. We recommend turning ON the Start Bits in multiple nodes that are participating in the data link so that the data links will start even if the startup node is down. The same data link mode must be set in these nodes. Also, the same data link settings must be set in these nodes when automatic settings are being used for the data links.

#### CS-series Startup Node



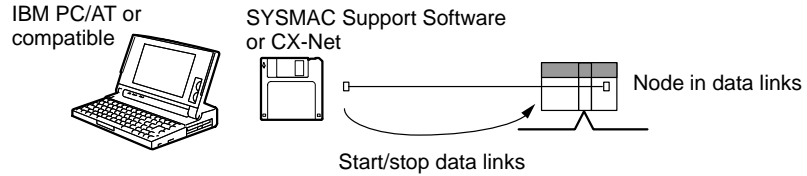
#### CV-series Startup Node



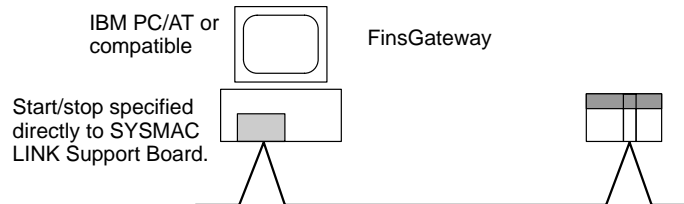
### 5-3-2 Using Support Software

Data links can be started or stopped using Support Software. The node which is being instructed to stop must be participating in the data links.

**Using a Computer Connected to a PC Node**



**Using a Computer Node with FinsGateway**



**5-3-3 Using the SYSMAC LINK Unit's DIP Switch (C-Series Units Only)**

Data links can be started turning with the Start Bit on the DIP switch on the front of a C-series SYSMAC LINK Unit. The data links will start when the Start Bit is turned from OFF to ON or is already ON when power is turned ON. The data links will stop when the Start Bit is turned from ON to OFF.

- Note**
1. Refer to the *SYSMAC LINK Units Operation Manual (W202/W367)* for details on starting and stopping data links using the Unit's DIP switch.
  2. If the DIP switch's Start Bit can be turned ON in advance so that the data links will start as soon as the power is turned ON.

We recommend turning ON the Start Bits in multiple nodes that are participating in the data link so that the data links will start even if the startup node is down. The same data link mode must be set in these nodes. Also, the same data link settings must be set in these nodes when automatic settings are being used for the data links.

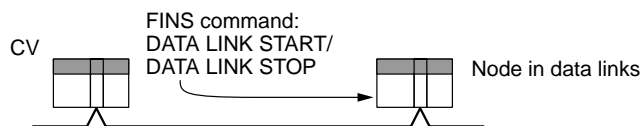
**5-3-4 Using FINS Commands**

Data links can be started and stopped by sending the DATA LINK START and DATA LINK STOP FINS commands from a node on the SYSMAC LINK to a node that is in the data links.

**Sending FINS Commands from a Computer Node**



**Issuing the FINS Command from a CV-series or CS-series PC**



Data links can be stopped in the same way by sending the DATA LINK STOP FINS command. The node receiving the FINS command must be participating in the data links in this case, too.

### 5-3-5 Data Link Timing Precautions

When the data link table’s communications cycle time is not being calculated automatically, set a fixed communications cycle time that is long enough. If the setting is too short, it will not be possible for 3G8F7-SLK11/21 SYSMAC LINK PCI Support Boards and CS1-series SYSMAC LINK Units to participate in data links. Furthermore, the data links will not start if the communications cycle time setting is too short and a SYSMAC LINK PCI Support Board or CS1-series SYSMAC LINK Unit is being used as the startup node.

If a timing error such as the one above occurs, the LNK indicator will be flashing quickly. At the same time, a “data link communications cycle time setting error” with error code 021D will be recorded in the error log.

#### Calculating the Minimum Communications Cycle Time

Use the following equation to estimate the minimum communications cycle time ( $T_{MIN}$ ) that can be set:

$$\begin{aligned}
 T_{MIN} = & \text{Maximum node address} \times 0.01 \\
 & + \text{Number of polled nodes} \times 0.25 \\
 & + \text{Number of linked nodes} \times 0.161 \\
 & + \text{Total number of data link area words} \times 0.01 \\
 & + 5.322 \text{ ms}
 \end{aligned}$$

The communications cycle time is expressed in ms units and fractions are rounded off.

#### Error Log Contents

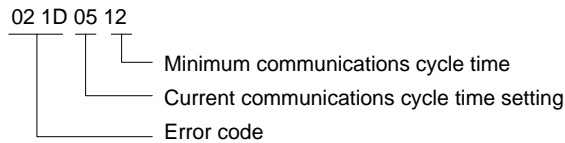
The following error log entry will be recorded if a “data link communications cycle time setting error” occurs.

Error code	Detailed information	
	First byte	Second byte
021D	Communications cycle time set in the data link table (ms units, two-digit hexadecimal)	Minimum communications cycle time that can be set (ms units, two-digit hexadecimal)

The second byte of the detailed information provided with error 021D provides the minimum communications cycle time that can be set.

Example:

A communications cycle time of 5 ms was set in the data link table, the LNK indicator is flashing quickly, and the error log contains the entry “021D 0512.” This error log entry indicates that the minimum communications cycle time is 18 ms (12 hexadecimal).



## 5-4 Checking Data Link Status

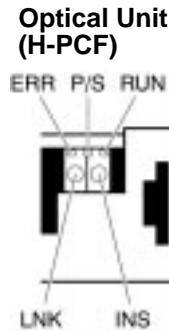
There are two methods for checking the status of active data links:

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

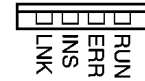


### 5-4-1 LED Indicators

Check the LNK indicator on the front of the Board.



Coaxial Unit



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

Name	Color	Status	Contents
LNK (data link)	Yellow	ON	Participating data links.
		Flashing	Data link table setting error.
		Flashing quickly	The data link table's communications cycle time setting is too short.
		OFF	Not in data links or data links are inactive.

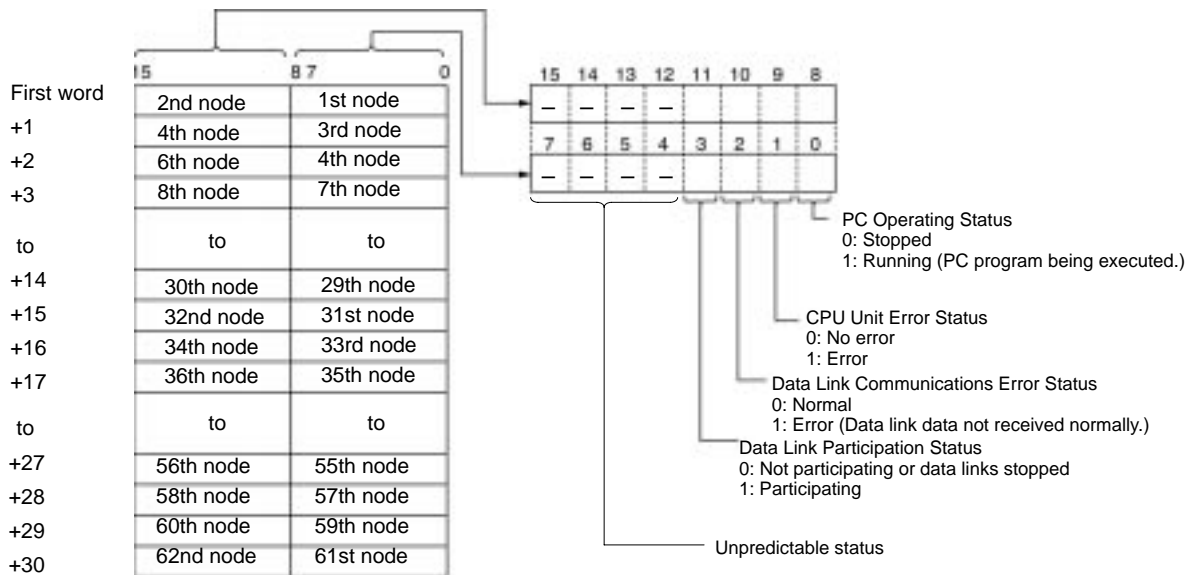
The LNK indicator will be lit at all node participating in the data links as long as operation is normal.

### 5-4-2 Data Link Status Area

The data link status area can be used to check for errors when data link does not operate normally even though no abnormality has been detected by the computer or the SYSMAC LINK Support Board.

Data link status can be monitored using the SLK Data Link Setting Utility in FinsGateway or it can be stored in FinsGateway event memory. Refer to the FinsGateway online help and installation guide for details.

See 9-2 Status Information and Troubleshooting for troubleshooting procedures.



**Note** The first word is set in the FinsGateway settings. Refer to FinsGateway online help for details.

Status	Values	Description
Data link participation	0: Not participating in data links or data links inactive 1: Participating in data links	Indicates the corresponding node's data link participation status.
Communications error	0: Normal 1: Error	Indicates if data link data for node was received normally or not.
CPU Unit error	0: No error 1: Error	Indicates if an error has occurred in the PC. Always 0 for SYSMAC LINK Support Board nodes.
PC status	0: Program execution stopped 1: Program being executed	Indicates if the PC program is being executed or not. Always 1 for SYSMAC LINK Support Board nodes.

- Note**
1. Communications errors will be indicated for node that are not participating in the network.
  2. When a communications error occurs in the local node or it is separated from the network, the local node retains the most recent status information it received for the other nodes in the network.

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

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

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

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

The contents of the data link areas set on the local node for the SYSMAC LINK Support Board can be read and written using the memory monitor program of the FinsGateway. For details refer to the FinsGateway online help.

## 5-5 Data Link Performance

When precise timing is required, it will be necessary to know the time required for to send and receive data through data links and the exact timing when the data is exchanged.

### Data Link Communications Cycle

In a SYSMAC LINK network, the data link service takes priority and the communications cycle time is fixed even if FINS message communications (instructions such as SEND, RECV, and CMND) are being used simultaneously.

#### Automatic Settings

The standard values shown in the following tables are generated automatically and set.

#### Coaxial System

Number of nodes in the data link	Data link area		
	CIO/LR only	DM only	CIO/LR and DM
2 nodes	17 ms	18 ms	19 ms
4 nodes	17 ms	18 ms	19 ms
8 nodes	18 ms	18 ms	19 ms
16 nodes	18 ms	19 ms	19 ms

**Optical System**

Number of nodes in the data link	Data link area		
	CIO/LR only	DM only	CIO/LR and DM
2 nodes	20 ms	21 ms	21 ms
4 nodes	20 ms	21 ms	22 ms
8 nodes	21 ms	21 ms	22 ms
16 nodes	21 ms	22 ms	22 ms

**Manual Settings**

When the communications cycle time varies due to noise or other factors, use the Support Software to set a fixed communications cycle time between 5 and 255 ms. If a fixed time is not set, the communications cycle time (T) will be calculated automatically with the following formula. The communications cycle time is expressed in ms units and fractions are rounded off.

**Coaxial System**

$$\begin{aligned}
 T \text{ (ms)} = & \text{Maximum node address} \times 0.085 \\
 & + \text{Number of event frames allowed} \times 0.654 \\
 & + \text{Number of polled nodes} \times 0.75 \\
 & + \text{Number of linked nodes} \times 0.056 \\
 & + \text{Total number of data link area words} \times 0.01 \\
 & + 1.322 \text{ ms}
 \end{aligned}$$

**Optical System**

$$\begin{aligned}
 T \text{ (ms)} = & \text{Maximum node address} \times 0.1115 \\
 & + \text{Number of event frames allowed} \times 0.77 \\
 & + \text{Number of polled nodes} \times 0.75 \\
 & + \text{Number of linked nodes} \times 0.056 \\
 & + \text{Total number of data link area words} \times 0.01 \\
 & + 1.322 \text{ ms}
 \end{aligned}$$

**Example Calculations**

The example calculations are based on the following network specifications:

Maximum node address: 62  
 Number of polled nodes: 4  
 Number of event frames allowed: 10  
 Number of linked nodes: 32  
 Total number of data link words: 2,000

## • Coaxial System:

$$\begin{aligned}
 T \text{ (ms)} &= 62 \times 0.085 + 10 \times 0.654 + 4 \times 0.75 + 32 \times 0.056 + 2,000 \times 0.01 \\
 &+ 1.322 \text{ ms} \\
 &= 37.924 \text{ ms} \\
 &\rightarrow 38 \text{ ms}
 \end{aligned}$$

## • Optical System:

$$\begin{aligned}
 T \text{ (ms)} &= 62 \times 0.1115 + 10 \times 0.77 + 4 \times 0.75 + 32 \times 0.056 + 2,000 \times 0.01 \\
 &+ 1.322 \text{ ms} \\
 &= 40.727 \text{ ms} \\
 &\rightarrow 41 \text{ ms}
 \end{aligned}$$

The communications cycle time (present value and maximum value) can be read or set with the Support Software or a command.

- Note**
1. Refer to *Section 8 Communications Timing* for details on the network parameters.
  2. The data link may not operate correctly if the communications cycle time is changed to a value shorter than the value that was automatically set by the system.
  3. If the LNK indicator on the front of a CS1W-SLK11/21 SYSMAC LINK Unit is flashing quickly (about 10 times/second), either change the data link table's

### Changing the Communications Cycle Time

communications cycle time setting to automatic calculation or set a longer manual setting.

When the communications cycle time is set to automatic calculation, the communications cycle time can be changed by changing the network parameters (maximum node address, number of event frames allowed, number of polled nodes) with the Support Software. The communications cycle time is set to automatic calculation, the communications cycle time will change just after the network parameters are changed.

The following table shows the default values and setting ranges of the network parameters.

Network parameter	Default value	Setting range
Maximum node address	62	2 to 62
Number of event frames allowed	10	5 to 255
Number of polled nodes	4	1 to 62

If the result of the following formula is positive, the communications cycle time will be reduced. If the result is negative, the communications cycle time will be increased. The units are ms and fractions are rounded off.

#### Coaxial System

$$\begin{aligned} \text{Change (ms)} = & (\text{Old max. node address} - \text{new max. node address}) \times 0.085 \\ & + (\text{Old no. of event frames} - \text{new no. of event frames}) \times 0.654 \\ & + (\text{Old no. of polled nodes} - \text{new no. of polled nodes}) \times 0.75 \end{aligned}$$

#### Optical System

$$\begin{aligned} \text{Change (ms)} = & (\text{Old max. node address} - \text{new max. node address}) \times 0.1115 \\ & + (\text{Old no. of event frames} - \text{new no. of event frames}) \times 0.77 \\ & + (\text{Old no. of polled nodes} - \text{new no. of polled nodes}) \times 0.75 \end{aligned}$$

#### Example Calculations

The example calculations are based on the following changes to the network parameters:

Maximum node address: 62 → 16

Number of event frames: 10 → 13

Number of polled nodes: 4 → 5

#### • Coaxial System

$$\begin{aligned} \text{Change (ms)} &= (62 - 16) \times 0.085 + (10 - 13) \times 0.654 + (4 - 5) \times 0.75 \\ &= 1.198 \text{ ms} \\ &\rightarrow 1 \text{ ms} \end{aligned}$$

#### • Optical System:

$$\begin{aligned} \text{Change (ms)} &= (62 - 16) \times 0.1115 + (10 - 13) \times 0.77 + (4 - 5) \times 0.75 \\ &= 2.069 \text{ ms} \\ &\rightarrow 2 \text{ ms} \end{aligned}$$

- Note**
1. If there are any nodes in the network with node addresses higher than the maximum node address set in the network parameters, those nodes will be unable to join the network or communicate through the network.
  2. If the number of event frames setting is too small, the FINS message communications that can be executed in one communications cycle (such as the SEND, RECV, and CMND instructions, echoback tests, and remote monitoring) will be overly restricted during data link operation and may end in errors.
  3. If the number of polled nodes setting is too small, it will take too long for a node to join the network when a Unit is reset or the PC's power is turned ON.

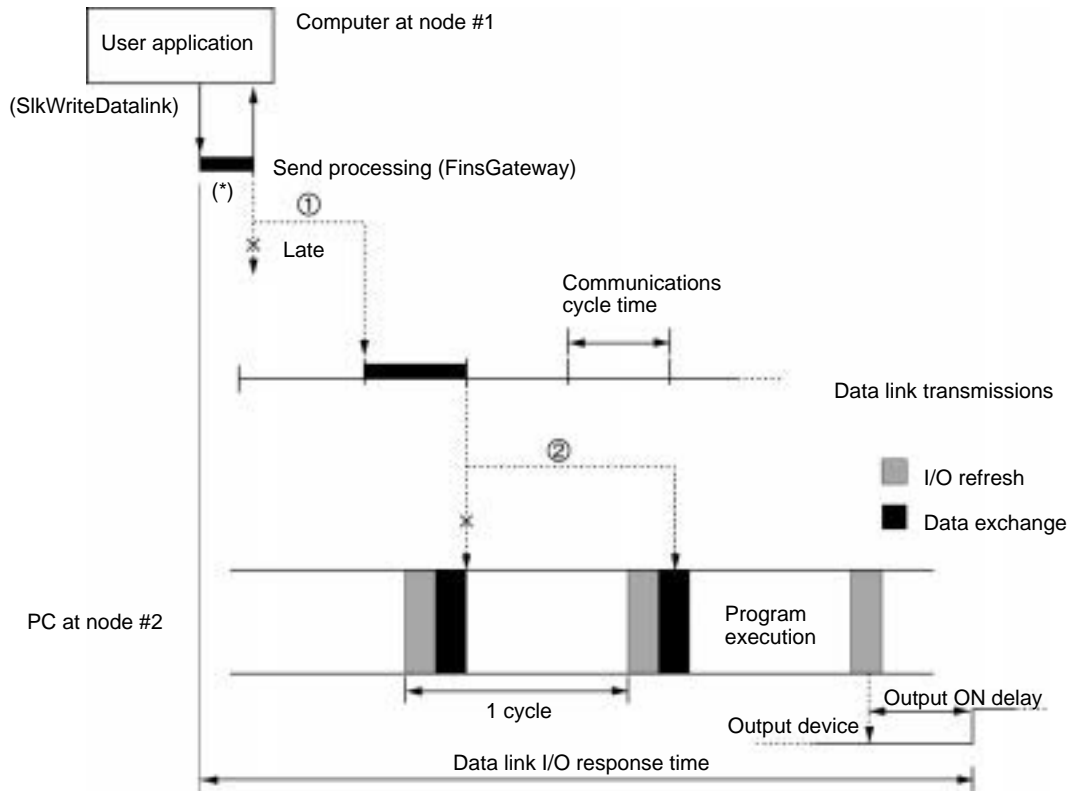
## 5-6 Data Link I/O Response Time

When the SYSMAC LINK Support Board's data link function is being used, there is a time delay from the time the data link area of one node is changed until this

change is reflected in the data link area at another node. This time delay is called the data link I/O response time.

### 5-6-1 Computer to PC

In the following diagram illustrating the maximum data link I/O response time, a CS-series PC is used for the PC (node #2) and the PC's cycle time is greater than or equal to the communications cycle time.



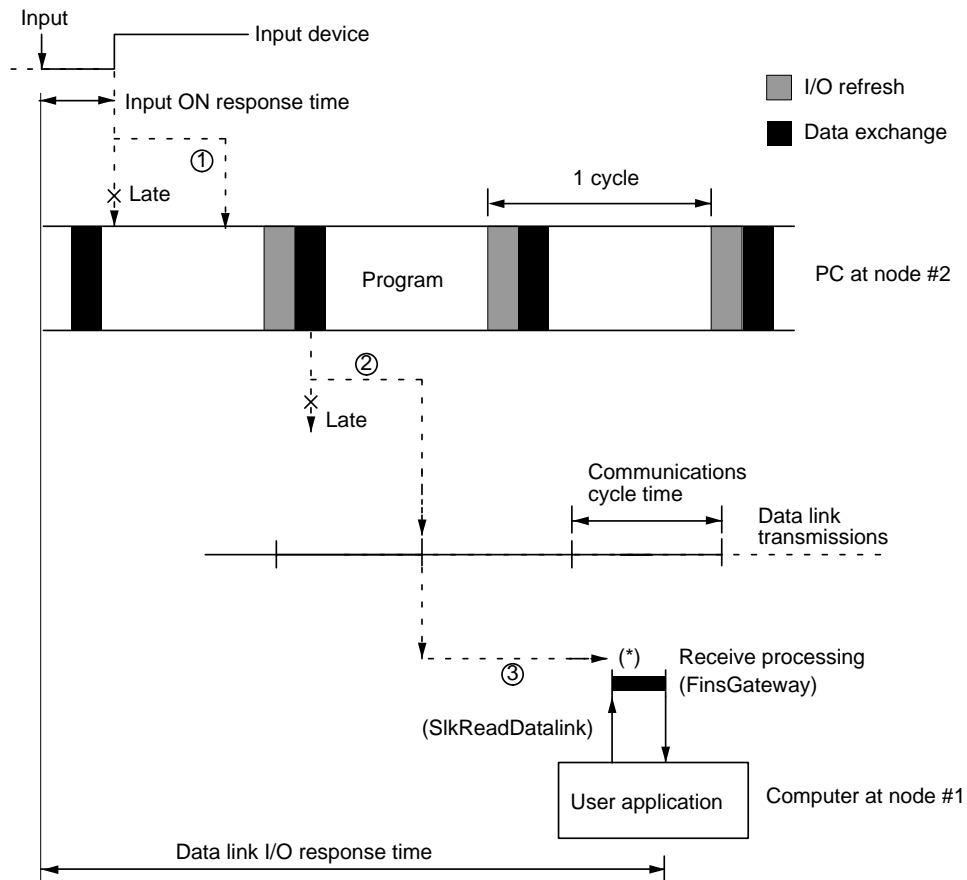
There are two points shown in the diagram above where processing is delayed.

- 1, 2, 3...**
1. Data exchange occurs just after the computer at node #1 receives the token that gives it the right to send data, so processing is delayed about one communications cycle time until the data is transferred in the next data exchange.
  2. The data link transmission just misses the PC's data exchange at node #2, so processing is delayed about one PC cycle until the data is read into the PC during the PC's next data exchange. (If the cycle time of the PC at node #2 is longer than the communications cycle time, the delay would be approximately two PC cycles.)

- Note**
1. The I/O response time may be increased by noise or other factors.
  2. The data send processing time for the area marked by the asterisk (\*) in the diagram will be affected by the processing capacity of the computer that is used.
  3. The communications cycle time may fluctuate.
  4. For details regarding the time required for data exchanges between the SYSMAC LINK Unit and the PC, refer to the *SYSMAC LINK Units Operation Manual (W202/W367)*.

## 5-6-2 PC to Computer

In the following diagram illustrating the maximum data link I/O response time, a CS-series PC is used for the PC (node #2) and the PC's cycle time is greater than or equal to 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 #2 passes the token that makes it the polling node, causing a delay of up to one communications cycle time before the data is transferred in data link processing.
  3. The data arrives at the Data Link Area of the Support Board mounted at the computer at node #1, but processing is delayed until the user application executes the SlkReadDatalink library function. This delay will vary depending on the contents of the user application.

- Note**
1. The I/O response time may be increased by noise or other factors.
  2. The data send processing time for the area marked by the asterisk (\*) in the diagram will be affected by the processing capacity of the computer that is used.
  3. The communications cycle time may fluctuate.
  4. Refer to the *SYSMAC LINK Units Operation Manual (W202/W367)* for details on the time required for data exchanges between the SYSMAC LINK Unit and the PC.

# SECTION 6

## Message Service

This section explains how to use the message service functions provided by a SYSMAC LINK Support Board.

6-1	Introduction .....
6-1-1	Message Service Specifications .....
6-1-2	Message Service Functions .....
6-2	FINS Command/Response Format .....
6-2-1	Headers .....
6-2-2	Parameters .....
6-2-3	Data Formats .....
6-3	Commands and Responses for the Support Board .....
6-3-1	Command Codes .....
6-3-2	DATA LINK START .....
6-3-3	DATA LINK STOP .....
6-3-4	CONTROLLER DATA READ .....
6-3-5	CONTROLLER STATUS READ .....
6-3-6	NETWORK STATUS READ .....
6-3-7	DATA LINK STATUS READ .....
6-3-8	ECHOBACK TEST .....
6-3-9	BROADCAST TEST RESULTS READ .....
6-3-10	BROADCAST TEST DATA SEND .....
6-3-11	ERROR LOG READ .....
6-3-12	ERROR LOG CLEAR .....
6-4	Response Codes .....
6-4-1	Configuration .....
6-4-2	Network Relay Errors .....
6-4-3	Response Codes and Troubleshooting .....

## 6-1 Introduction

A message service is a command/response system used for data transmission between nodes on a network, i.e., computer to computer, PC to computer, or computer to PC. The message service can also be used to control operations, such as mode changes. The message service is implemented by executing from the user program the library functions for sending or receiving messages.

### 6-1-1 Message Service Specifications

Communications from an computer are executed according to the specifications shown in the following table.

Item	Specifications
Direction of transmission	1:1 Message transmission or reception 1:N Message transmission (broadcast)
Data length	522 bytes max. (including FINS header)
Data content	Any command/response data can be sent or received. Depends on the message being sent.

### 6-1-2 Message Service Functions

FINS commands can be sent to specified nodes and FINS responses can be received by executing C library functions from the user program to send and receive messages.

Functions	Features
Sending Messages <i>SlkSendFins</i> library function (See note.)	This library function and driver call send command/response data. Can be issued with respect to any Units at a PC, or to the Support Board or user program at a computer. Mainly used for sending FINS commands and responses. The FINS commands and responses enable various types of control, and allow the status to be read. Data is prepared according to a fixed format in the program and sent by executing <i>SlkSendFins</i> . No special program is required at the receiving end if FINS commands and responses supported by the receiving Unit are used. When sending data to the computer with a user program, a program that can process the received data is required. When a response to a command is returned, a program for reading and analyzing the response is required.
Receiving Messages <i>SlkRecvFins</i> library function	These library functions and driver call receive command/response data. Data received by the SYSMAC LINK Support Board is read. Mainly used for receiving FINS commands and responses. The FINS commands and responses enable various types of control, and allow the status to be read. Data is received by executing <i>SlkRecvFins</i> , and it is analyzed by the program according to a fixed format. A program is required for analyzing the data that is received. A program is required for preparing and sending responses when commands requesting responses are received.

**Note** Using *SlkSendFins* or *SlkRecvFins* to send the "MEMORY AREA READ" and "MEMORY AREA WRITE" FINS commands for PCs is equivalent to executing the SEND and RECV ladder-diagram instructions.



## 6-2 FINS Command/Response Format

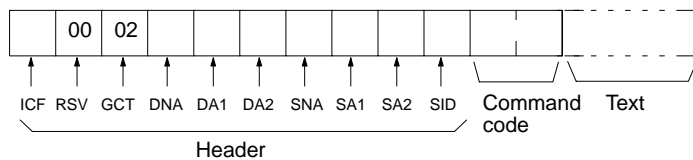
This section explains the format of the FINS commands and responses specified by the “*SikSendFins*” library function.

When actually sending or receiving message service data, the contents specified by the library function parameters are attached as a header. When the message service is used, however, there is normally no need to pay special attention to headers.

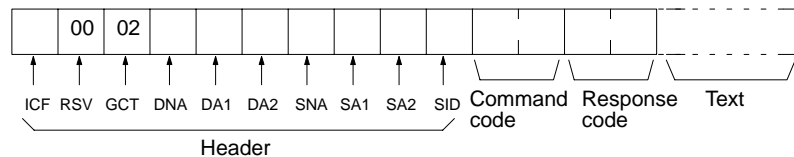
### 6-2-1 Headers

Although parameters are used to designate the source, the destination, and other required information, there are some cases where a header must be manually added before the command code. Refer to the operation manuals for individual systems to determine if a header is required. The header format described below is attached before the command code and the other parameters described for individual commands in the rest of this manual.

#### Command Data Structure



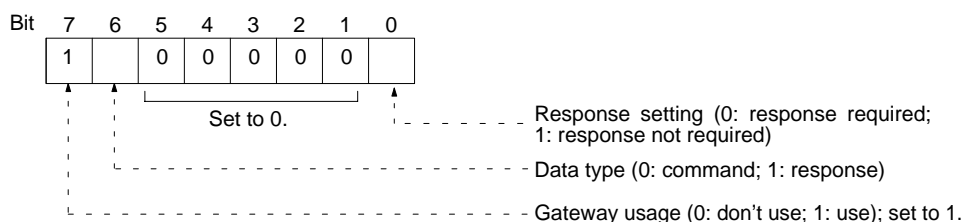
#### Response Data Structure



### Details

#### ICF

Information control field. Individual bits of the ICF are used as follows:



**Note** All settings below are shown in hexadecimal except where otherwise indicated.

#### RSV

Reserved. Set to 00.

#### GCT

Gateway count. Set to 02.

#### DNA

Destination network address. Specify within the following ranges.

00: Local network

01 to 7F: Remote network (1 to 127 decimal)

#### DA1

Destination node number. Specify within the following ranges.

01 to 3E: Node number in SYSMAC LINK network (1 to 62 decimal)

01 to 7E: Node number in SYSMAC NET network (1 to 126 decimal)

01 to 3E: Node number in SYSMAC LINK network (1 to 62 decimal)

FF: Broadcast transmission

- DA2** Destination unit address. Specify within the following ranges.  
 00: PC (CPU Unit)  
 01 to 0F: Application on FinsGateway (Refer to FinsGateway online help.)  
 10 to 1F: Board for CPU Bus Unit or computer  
 FE: Unit or Board connected to specified network  
 (Any Unit or Board in SYSMAC LINK, SYSMAC NET, or SYSMAC LINK network)
- SNA** Source network address. Specify within the following ranges.  
 00: Local network  
 01 to 7F: Remote network (1 to 127 decimal)
- SA1** Source node number. Specify within the following ranges.  
 01 to 3E: Node number in SYSMAC LINK network (1 to 62 decimal)  
 01 to 7E: Node number in SYSMAC NET network (1 to 126 decimal)  
 01 to 3E: Node number in SYSMAC LINK network (1 to 62 decimal)
- SA2** Source unit address. Specify within the following ranges.  
 00: PC (CPU Unit)  
 01 to 0F: Application on FinsGateway (Refer to FinsGateway online help.)  
 10 to 1F: Board for CPU Bus Unit or computer
- SID** Service ID. Used to identify the processing generating the transmission. Set the SID to any number between 00 and FF

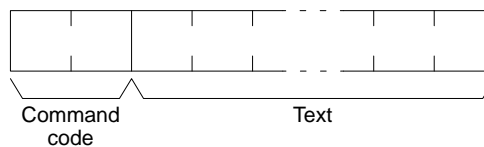
### 6-2-2 Parameters

All parameters are specified in hexadecimal unless otherwise specified. Where decimal is specified, it is indicated by BCD.

### 6-2-3 Data Formats

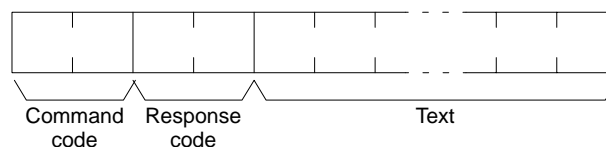
#### Commands

The command code and text for the command are stored in memory as operands and the transmission is executed using the required parameters. The specific method depends on the programming method being used. Prepare the transmission data from the command code to the end of the text (with the data determined by the individual command), and execute the SIkSendFins library function. There are two bytes available for the command code and 0 to 540 bytes for the text.



#### Responses

When the SIkRecvFins library function is executed, the data from the command code to the end of the text (with the data determined by the individual command) is stored as reception data, as shown in the following diagram. There are four bytes available for the command and response codes, and 0 to 538 bytes for the text.



**Note** When multiple networks are connected, there are limits to the amount of data that can be transferred via the SYSMAC LINK Network and the host link function.

## 6-3 Commands and Responses for the Support Board

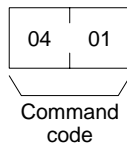
### 6-3-1 Command Codes

Command code	Data link operation mode		Name	Page	
	Active	Inactive			
04	01	Not valid	Valid	DATA LINK START	69
	02	Valid	Not valid	DATA LINK STOP	69
05	01	Valid	Valid	CONTROLLER DATA READ	70
06	01	Valid	Valid	CONTROLLER STATUS READ	70
	02	Valid	Valid	NETWORK STATUS READ	72
	03	Valid	Valid	DATA LINK STATUS READ	74
08	01	Valid	Valid	ECHOBACK TEST	75
	02	Valid	Valid	BROADCAST TEST RESULTS READ	75
	03	Valid	Valid	BROADCAST TEST DATA SEND	76
21	02	Valid	Valid	ERROR LOG READ	76
	03	Valid	Valid	ERROR LOG CLEAR	77

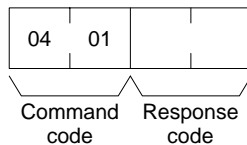
### 6-3-2 DATA LINK START

Starts the SYSMAC LINK Network data links.

#### Command Block



#### Response Block



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

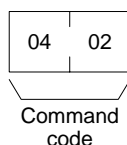
The node that receives this command and starts the data links will become the data link startup node.

**Note** The Support Board can participate in automatically set data links, but it cannot be the starting unit.

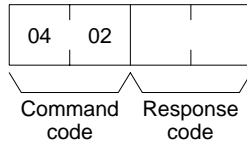
### 6-3-3 DATA LINK STOP

Stops the SYSMAC LINK Network's data links.

#### Command Block



Response Block



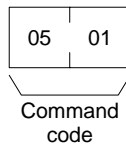
The DATA LINK STOP command can be received only while the data link is active. An error will occur if this command is sent at any other time.

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

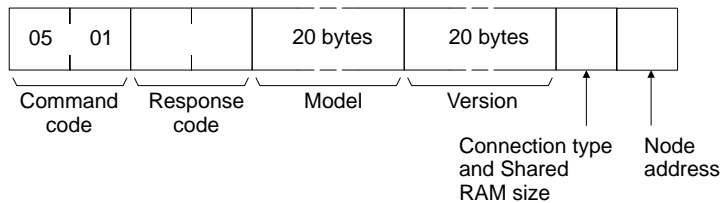
### 6-3-4 CONTROLLER DATA READ

Reads the SYSMAC LINK Support Board's model, version, connection type, shared RAM size, and node address data.

Command Block



Response Block



Parameters

**Model, version (response):** The SYSMAC LINK Support Board's model and version are returned as shown below, each 20 characters in ASCII. If fewer than 20 bytes of data are used, the remaining bytes will be packed with spaces (ASCII code 20 Hex). In the version numbers shown below, the spaces are represented by boxes (□).

**Model**

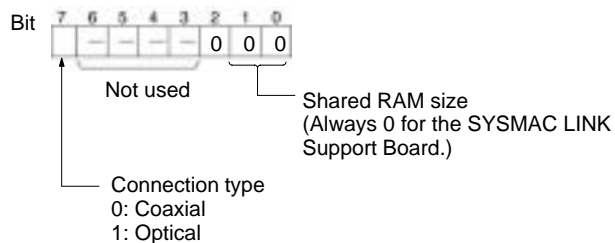
3G8F7-SLK21□□□□□□□□□□ (Coaxial)  
 3G8F7-SLK11□□□□□□□□□□ (Optical)

**Version**

V1.00□V1.00□□□□□□□□□□

The first "V1.00" represents the Communications Controller's version number, and the second represents the Support Board's version number.

**Connection Type and Shared RAM Size (response)**

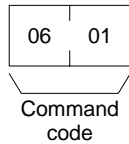


**Node address (response):** The Support Board's node address is returned between 01 and 3E Hex (1 to 62).

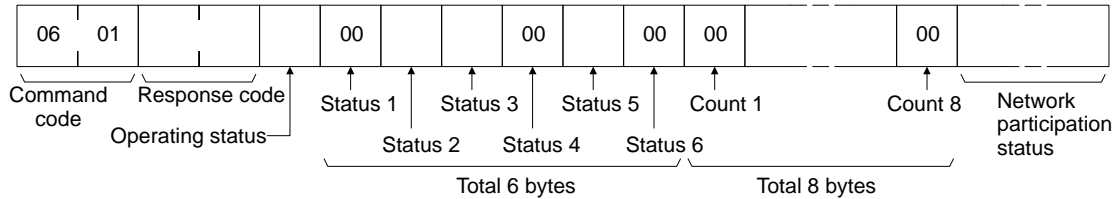
### 6-3-5 CONTROLLER STATUS READ

Reads the SYSMAC LINK Support Board's operating status (controller status).

**Command Block**



**Response Block**



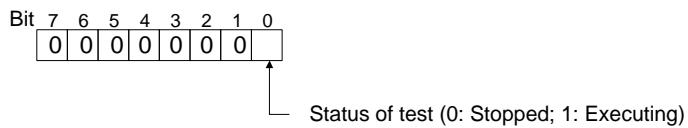
**Parameters**

**Operating status (response):** The operating status of the data links is as follows:

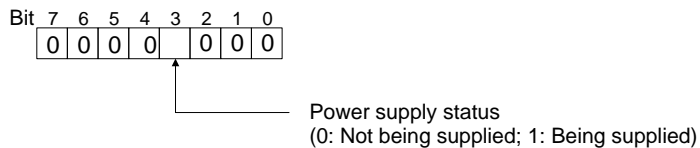
00 (Hex): Data links inactive.

01 (Hex): Data links active.

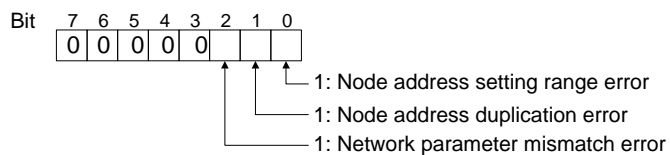
**Status 1 (response):** Indicates the status of test operation as follows. Always 00 with a SYSMAC LINK Support Board.



**Status 2 (response):** Indicates the circuit status as follows.

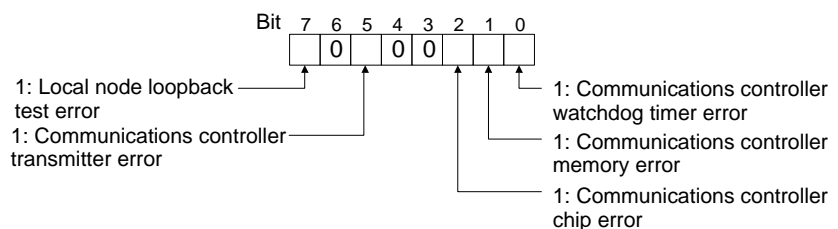


**Status 3 (response):** Indicates error information as follows.

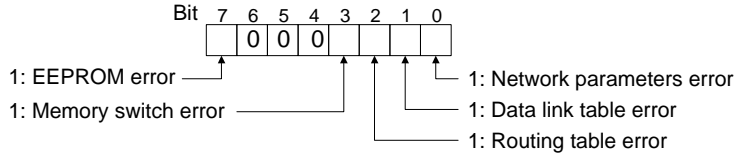


**Note** A network parameter mismatch error occurs if the registered network parameter contents do not match the actual network parameter contents after the power is turned ON. The system, however, will not stop. When a network parameter mismatch error occurs, the actual network parameter contents are automatically registered again.

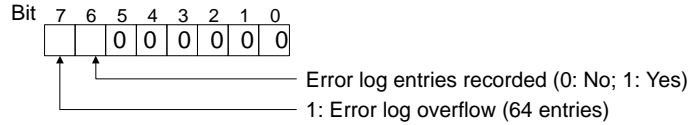
**Status 4 (response):** Indicates the cause of a communications controller error as follows.



**Status 5 (response):** Indicates the backup status as follows.



**Status 6 (response):** Indicates error log information as follows.



**Count 1 to Count 8 (response):** These 8 bytes count how many times the following events have occurred since the power was turned ON. Each counter can count from 0 to 255 (i.e., 0 to FF in hexadecimal).

- Count 1: Number of CRC errors
- Count 2: Number of token re-sends
- Count 3: Number of token returns
- Count 4: Number of token timeouts
- Count 5: Number of polling timeouts
- Count 6: Number of polling node changes
- Count 7: Number of active node changes
- Count 8: Number of communications controller data-transfer function stops

**Network participation status list (response):** These 8 bytes contain flags that indicate which nodes are participating in the network. A node is participating in the network (active) when the corresponding bit is ON.

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

The numbers in the boxes indicate the node addresses. The bit status of a particular node address shows whether or not that node is participating in the network.

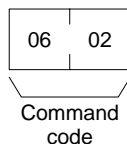
0: Not part of network  
1: Part of network

(The 2 bits marked with a “-” are always 0.)

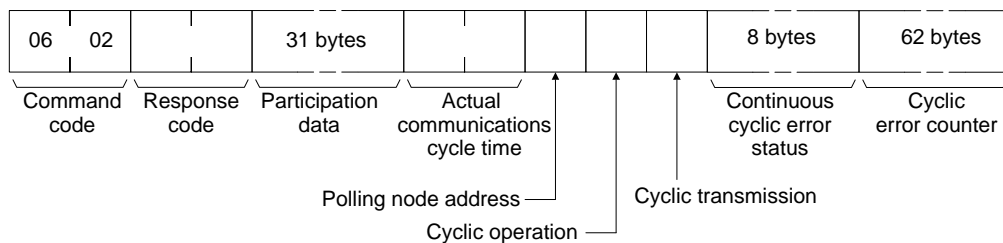
### 6-3-6 NETWORK STATUS READ

Reads the operating status of the entire SYSMAC LINK Network.

#### Command Block

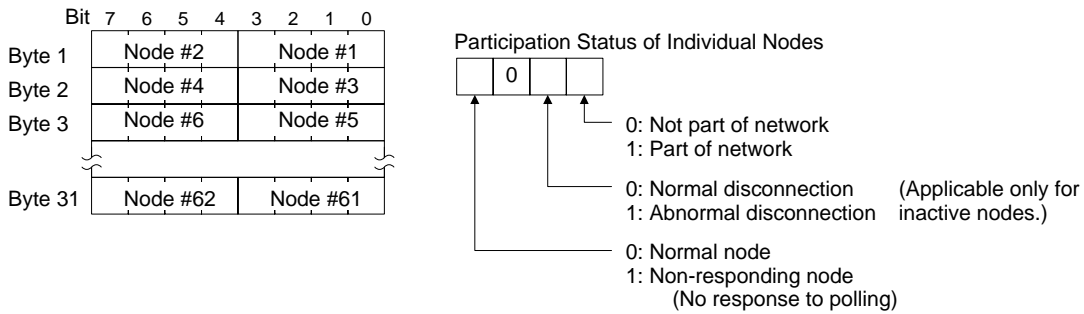


#### Response Block



**Parameters**

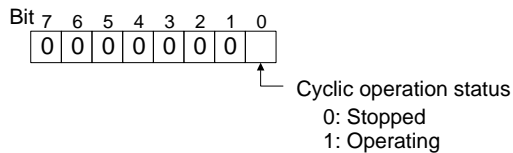
**Participation data (response):** These 31 bytes indicate the status of individual nodes within the network (i.e. their participation in the network). As shown in the following diagram, that status is expressed in four bits corresponding to the node address.



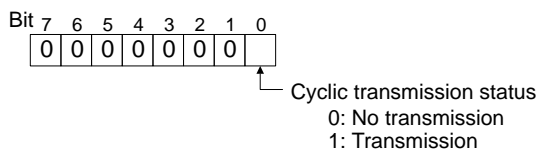
**Actual communications cycle time (response):** The actual communications cycle time is returned in units of 100 μs in hexadecimal.

**Polling node address (response):** The current polling node's node address is returned in hexadecimal.

**Cyclic operation (response):** Indicates the status of cyclic operation in the network.



**Cyclic transmission (response):** Indicates the status of cyclic transmissions.



**Continuous cyclic error status (response):** Indicates when continuous errors are occurring in cyclic transmission. If an error continues to occur at the same node during cyclic transmission, the corresponding bit is turned ON. The configuration is shown in the following diagram.

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

The numbers in the boxes indicate the node addresses. The bit status of a particular node address shows whether or not there is a recurring data link error at that node.

- 0: No recurring cyclic error
- 1: Recurring cyclic error

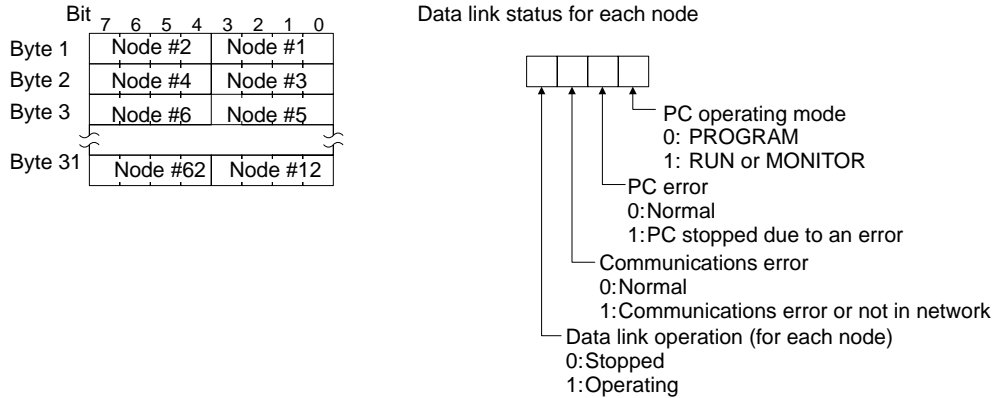
(The 2 bits marked with a “—” are always 0.)

**Cyclic error counter (response):** These bytes contain the total number of cyclic errors that occurred with each node (node addresses 1 to 62) since the power was turned ON. There is a one-byte counter allocated to each node and the





FinsGateway's SLK Data Link Setting Utility as described in 5-4-2 Data Link Status Area.

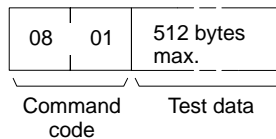


- Note**
1. The data link status is not refreshed while the data links are stopped.
  2. Communications errors will be indicated for nodes which are not active in the network or not participating in the data links.
  3. When a communications error occurs in a node, that node retains the most recent status information it received for the other nodes in the network.
  4. Only the PC operating status and PC error information will be reflected for nodes which are participating in the network but are not participating in the data links.

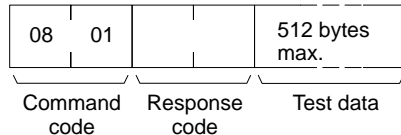
### 6-3-8 ECHOBACK TEST

Executes an echoback communications test between specified nodes.

#### Command Block



#### Response Block



#### Parameters

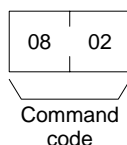
**Test data (command, response):** For the command, up to 512 bytes of data can be specified to be sent to a specified node. For the response, the test data that was sent by the command is returned unchanged.

Some kind of error occurred if the data returned in the response is different from the data that was sent in the command.

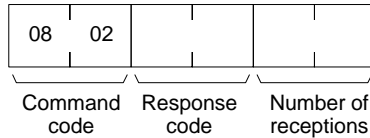
### 6-3-9 BROADCAST TEST RESULTS READ

Reads for each node the results (number of receptions) of a BROADCAST TEST DATA SEND command that has been sent to all nodes in a specified network. (For details on the BROADCAST TEST RESULTS SEND command, refer to 6-3-10 BROADCAST TEST DATA SEND.)

#### Command Block



**Response Block**



**Parameters**

**Number of receptions (response):** The number of times that broadcast test data has been received at the command destination node from the time that the last BROADCAST TEST RESULTS READ command was sent until this one was sent is returned.

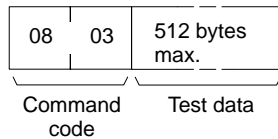
An error will be generated if that number of receptions differs from the number of times that the BROADCAST TEST DATA SEND command was issued during that same period.

The *number of receptions* value being retained at the destination node is cleared when the BROADCAST TEST RESULTS READ command is executed.

**6-3-10 BROADCAST TEST DATA SEND**

Broadcasts test data to all nodes in a specified network.

**Command Block**



There is no response to this command.

The control data must be set as follows when this command is issued:

Destination node address: FF (Hex) (for broadcasting the data)

Destination unit address: FE (Hex)  
(to SYSMAC LINK Support Boards/Units)

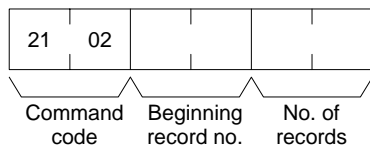
Response required/not required flag: 1 (response not required)

The transmission and reception status is checked by comparing the number of times this command is issued with the *number of receptions* parameter of the BROADCAST TEST RESULTS READ command. (For details, refer to 6-3-9 BROADCAST TEST RESULTS READ.

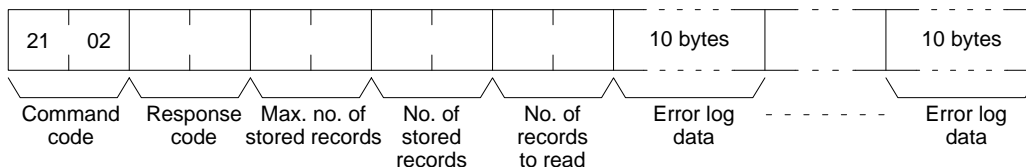
**6-3-11 ERROR LOG READ**

Reads the PC's error log.

**Command Block**



**Response Block**



**Parameters**

**Beginning record no. (command):** Specifies the first record to be read, in two bytes (four digits) in hexadecimal. (The first record number is 0000 hexadecimal).

**No. of records to read (command and response):** Specifies the number of records to be read, within a range of 0001 to 0027 hexadecimal (1 to 39 decimal).

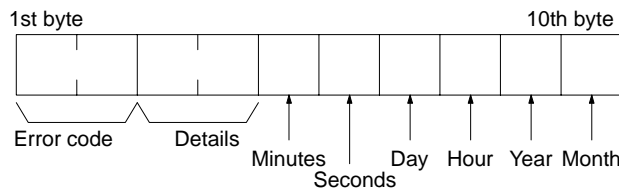
**Max. no. of stored records (response):** Specifies the maximum number of records that can be recorded, within a range of 0001 to 0027 hexadecimal (1 to 39 decimal).

**No. of stored records (response):** The number of records that have been recorded by the time the command is executed. For the SYSMAC LINK Support Board this is fixed at 0027 Hex (39 decimal.)

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

$$\text{No. of records} \times 10 \text{ bytes}$$

The configuration of each error record is as follows:



**Error code, details:** These parameters show the contents of errors. For details, refer to 9-3-2 *Error Codes*.

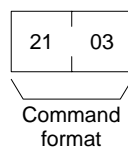
**Date and time:** These parameters show the seconds, minutes, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

**Note** If the PC does not have the specified number of records, the response will return all of the records that have been stored up to that point and the command will end normally.

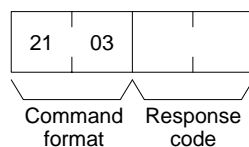
## 6-3-12 ERROR LOG CLEAR

Clears all error log records and sets the error log pointer to 0.

### Command Block



### Response Block

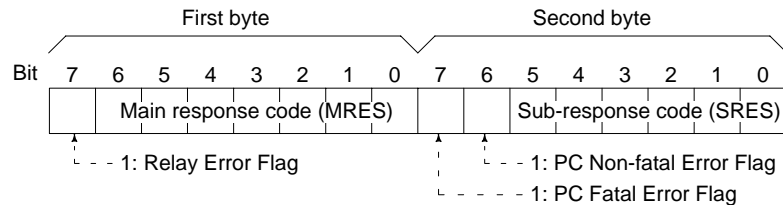


## 6-4 Response Codes

This section describes the response codes returned with responses to FINS commands. Response codes can be used to confirm normal completion of command execution or to troubleshoot problems when commands fail. For further troubleshooting information, refer to *Section 9 Troubleshooting and Maintenance* of this manual and to the operation manuals for specific Units or Systems.

### 6-4-1 Configuration

Response codes for FINS commands consist of two bytes that indicate the result of executing a command. The structure of the response codes is shown in the following diagram.



The main response code (MRES) in the first byte classifies the response and the sub-response code (SRES) in the second byte indicates details under the MRES classification.

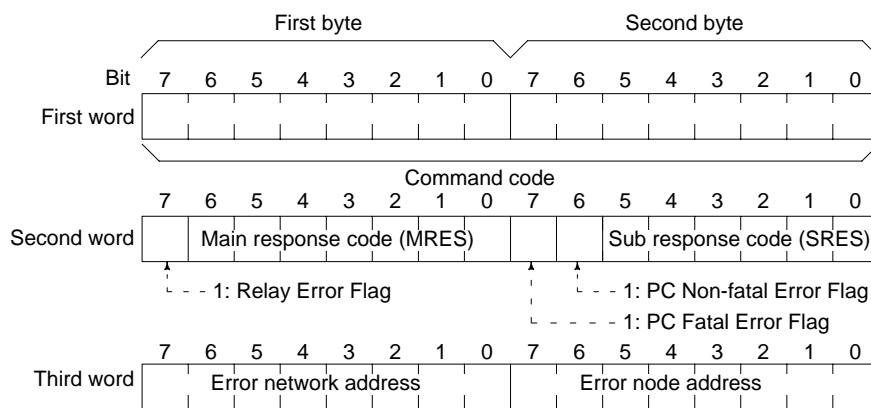
If bit 7 of the first byte is ON, a network relay error has occurred. Refer to 6-4-2 *Network Relay Errors* for details on troubleshooting the error.

If bit 6 or 7 of the second byte is ON, an error has occurred in the PC or computer returning the response. Refer to the operation manual for the device returning the response for details when troubleshooting the error.

### 6-4-2 Network Relay Errors

A network relay error will occur whenever a command cannot reach the destination. These errors can occur for several reasons: 1) Data was not successfully passed between two Link Units, 2) Data was not passed successfully between a Link Unit and another Unit, such as the PC's CPU Unit, or 3) The destination of a gateway does not exist. In any case, the Unit that was not able to transfer data will return a response indicating a network relay error.

Bit 7 of the first byte of the response code will be ON if a network relay error has occurred. When this happens, two more bytes of data will follow the response code to indicate the location of the error. This information, along with the response code, should enable you to track the error.



Error network address: 00 to 7F (Hex) (0 to 127 in decimal)

Error node address: Controller LINK: 01 to 3E (Hex) (1 to 62 in decimal)  
 SYSMAC NET: 01 to 7E (Hex) (1 to 126 in decimal)  
 SYSMAC LINK: 01 to 3E (Hex) (1 to 62 in decimal)

#### Relay Errors

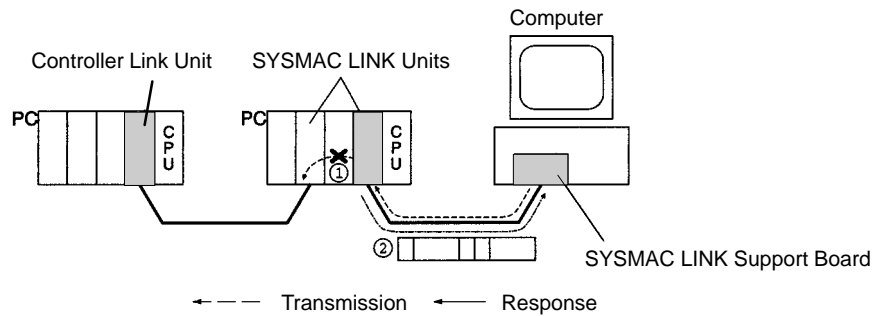
A relay error indicates that the command did not reach the Unit to which it was sent. There are two types of situation in which this can occur. Example 1 (below) shows a situation in which a relay error occurs when data cannot be transferred from one Communications Unit to another in an interconnected network. In Example 2, the relay error occurs because either the specified destination node or the next relay node does not exist.

In the two diagrams, the numbers indicate the following:

- (1) The transmitted data fails to be received.
- (2) The relay error and response code are returned to the command source.

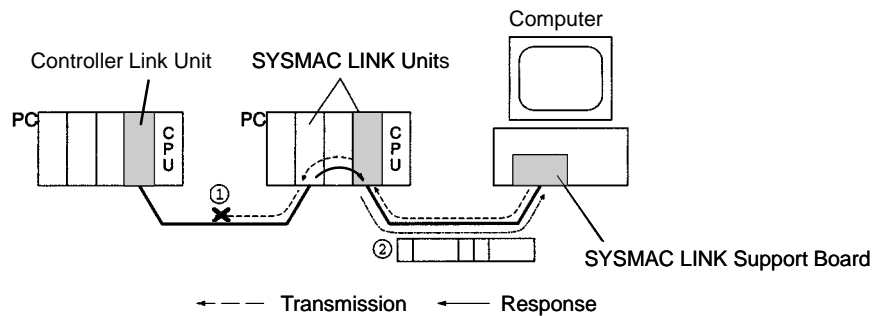
**Example 1**

In this example, data cannot be transferred between SYSMAC LINK Units due to some cause such as a routing table error.



**Example 2**

In this example, the specified destination node or the next relay node does not exist.



If an error occurs, check the MRES and SRES codes for the node in question, and correct the problem.

**6-4-3 Response Codes and Troubleshooting**

The table below lists response codes (main and sub-codes) returned after execution of the FINS commands, the probable cause of errors, and recommended remedies.

Upon receipt of some commands, the destination node will issue a request to another node; the other node is referred to as the third node.

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

Main code	Sub-code	Probable cause	Remedy
01: Source node error	01	Source node not part of Network	Add to Network.
	02	Token time-out, node address too large	Set the source node's node address below the maximum node address.
	03	Number of transmit retries exceeded	Check communications with echoback test. If the test fails, check network.
	04	Maximum number of frames exceeded	Either check the execution of events in the network and reduce the number of events occurring in one cycle, or increase the maximum number of frames.
	05	Node address setting error (range)	Correct the node address so that it is within specified range and that there are no node addresses that are set twice.
	06	Node address duplication error	Make sure that there are no node addresses that are set twice.
02: Destination node error	01	Destination node not part of Network	Add to Network.
	02	No node with the specified node address	Check the destination node's node address.
	03	Third node not part of Network	Check the third node's node address.
		Broadcasting was specified.	Check the control data and specify only one node as the third node.
	04	Busy error, destination node busy	Increase the number of transmit retry attempts or re-evaluate the system so that the destination node is not so busy receiving data.
	05	Response time-out, message packet was corrupted by noise	Increase the number of transmit retry attempts.
		Response time-out, response watchdog timer interval too short	Increase the value for the response watchdog timer interval in the control data.
Frame lost in transmission		Check the error log and correct the process.	
03: Communications controller error	01	Error occurred in the communications controller, ERC indicator is lit	Take corrective action, referring to communications controller errors and remedies table at end of this section
	02	CPU Unit error occurred in the PC at the destination node	Clear the error in the CPU Unit (refer to the PC's operation manuals)
	03	A controller error has prevented a normal response from being returned.	Check network communications status and reset the controller board. If the error still exists, replace the controller board.
	04	Unit address setting error	Make sure the unit address and unit number are within the specified ranges and that each number/address is set only once.
04: Not executable	01	An undefined command has been used.	Check the command code and be sure that the Unit supports it.
	02	Cannot process command because the specified unit model or version is wrong.	Check the unit model and version.
05: Routing error	01	Destination node address is not set in the routing table.	Set the destination node address in the routing table.
	02	Routing table isn't registered.	Set the source nodes, destination nodes, and relay nodes in the routing table.
	03	Routing table error	Set the routing table correctly.
	04	The maximum number of relay nodes (2) was exceeded in the command.	Redesign the network or reconsider the routing table to reduce the number of relay nodes in the command.

Main code	Sub-code	Probable cause	Remedy
10: Command format error	01	The command is longer than the max. permissible length.	Check the command format of the command and set it correctly.
	02	The command is shorter than min. permissible length.	Check the command format of the command and set it correctly.
	03	The designated number of data items differs from the actual number.	Check the number of items and the data, and make sure that they agree.
	04	An incorrect command format has been used.	Check the command format of the command and set it correctly.
	05	An incorrect header has been used. (The source node's relay table or relay node's local network table is wrong.)	Set the routing table correctly.
11: Parameter error	01	A correct memory area code has not been used or Extended Data Memory is not available.	Check the command's memory area code and set the appropriate code.
	02	The access size specified in the command is wrong, or the first address is an odd number.	Set the correct access size for the command.
	03	The first address is in an inaccessible area.	Set a first address that is in an accessible area.
	04	The end of specified word range exceeds the acceptable range.	Check the acceptable limits of the data area and set the word range within the limits.
			Check the data link tables to be sure the limit to link words has not been exceeded.
	06	A non-existent program no. has been specified.	Check the program number and be sure that it is set correctly.
	09	The sizes of data items in the command block are wrong.	Check the command data and be sure that the sizes of the data items are correct.
			Check the data link tables to be sure all nodes in the refresh parameters are in the common link parameters.
	0A	The IOM break function cannot be executed because it is already being executed.	Either abort the current IOM break function processing, or wait until it is completed and execute the command.
			Check the data link tables for node addresses that have been set twice.
0B	The response block is longer than the max. permissible length.	Check the command format and set the number of items correctly.	
0C	An incorrect parameter code has been specified.	Check the command data and reenter it correctly.	
		Check the data link table file for corruption.	

Main code	Sub-code	Probable cause	Remedy
20: Read not possible	02	The data is protected.	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command to the PC.
		An attempt was made to download a file that is being uploaded.	Check the file name and either interrupt servicing or wait for servicing to complete before re-executing the command.
	03	The registered table does not exist or is incorrect.	Set or reset the registered table.
		Too many files open.	Close open files and re-execute the command.
	04	The corresponding search data does not exist.	---
	05	A non-existing program no. has been specified.	Check the program number and be sure that it is set correctly.
	06	A non-existing file has been specified.	Check whether the correct file name was used.
	07	A verification error has occurred.	Check whether the memory contents are correct and replace if incorrect.
			Check the contents of the file. A read error may have occurred.
	21: Write not possible	01	The specified area is read-only or is write-protected.
02		The data is protected.	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command to the PC.
		An attempt was made to simultaneously download and upload a file.	Check the file name and either interrupt servicing or wait for servicing to complete before re-executing the command.
		The data link tables cannot be written manual because the Unit is set for automatic generation.	Change the data link mode to manual.
03		The number of files exceeds the maximum permissible.	Write the file(s) again after erasing unneeded files, or use different disk or Memory Card that has free space.
		Too many files open.	Close open files and re-execute the command.
05		A non-existing program no. has been specified.	Check the program number and be sure that it is set correctly.
06		A non-existent file has been specified.	---
07		The specified file already exists.	Change the name of the file and execute the instruction again.
08		Data cannot be changed.	Check the contents of the memory area being written to.



Main code	Sub-code	Probable cause	Remedy
22: Not executable in current mode	01	The mode is wrong (executing).	Check the operating mode.
		Data links are active.	Check the data link status before execution.
	02	The mode is wrong (inactive).	Check the operating mode.
		Data links are active.	Check the data link status before execution.
	03	The PC is in the PROGRAM mode.	Check the PC's mode and the computer mode.
	04	The PC is in the DEBUG mode.	Check the PC's mode and the computer mode.
	05	The PC is in the MONITOR mode.	Check the PC's mode and the computer mode.
	06	The PC is in the RUN mode.	Check the PC's mode and the computer mode.
07	The specified node is not the control node.	Check which node is the control node.	
23: No Unit	08	The mode is wrong and the step cannot be executed.	Check whether the step has active status or not.
	01	A file device does not exist where specified.	Mount the Memory Card or disk
	02	The specified memory does not exist.	Check the specifications of the installed file memory.
24: Start/stop not possible	03	No clock exists.	Check the model number.
		01	The data link tables either have not been created or are incorrect.

Main code	Sub-code	Probable cause	Remedy
25: Unit error	02	Parity/checksum error occurred because of incorrect data.	Transfer correct data into memory.
	03	I/O setting error (The registered I/O configuration differs from the actual.)	Either change the actual configuration to match the registered one, or generate the I/O table again.
	04	Too many I/O points	Redesign the system to remain within permissible limits.
	05	CPU bus error (An error occurred during data transfer between the CPU Unit and a CPU Bus Unit.)	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	06	I/O duplication error (A rack number, unit number, or I/O word allocation has been duplicated.)	Check the system's settings and eliminate any settings that occur twice.
	07	I/O bus error (An error occurred during data transfer between the CPU Unit and an I/O Unit.)	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	09	SYSMAC BUS/2 error (An error occurred during SYSMAC BUS/2 data transfer.)	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	0A	Special I/O Unit error (An error occurred during CPU Bus Unit data transfer.)	Check the Unit, Service Boards, and cable connections and issue the ERROR CLEAR command.
	0D	Duplication in SYSMAC BUS word allocation.	Check and regenerate the I/O table.
	0F	A memory error has occurred in internal memory, in the Memory Card, or in Expansion DM during the error check.	<p>If the error occurred in internal memory or the EM Unit, correct the data in the command and execute it again.</p> <p>If the error occurred in a Memory Card or EM used for file memory, the file data has been corrupted. Execute the MEMORY CARD FORMAT command for the PC.</p> <p>If the above remedies do not eliminate the error, replace the faulty memory.</p>
10	Terminator not connected in SYSMAC BUS System.	Connect the terminator correctly.	

Main code	Sub-code	Probable cause	Remedy
26: Command error	01	The specified area is not protected. This response code will be returned if an attempt is made to clear protection on an area that is not protected.	The program area is not protected, so it isn't necessary to clear protection.
	02	An incorrect password has been specified.	Specify a password that is registered.
	04	The specified area is protected.	Execute the command again after executing the PROGRAM AREA PROTECT CLEAR command for the PC.
		To many commands at destination.	The destination has received more than 5 commands. Either interrupt servicing or wait for servicing to complete before re-executing the command.
	05	The service is being executed.	Execute the command again after the service has been completed or aborted.
	06	The service is not being executed.	Execute the service if necessary.
	07	Service cannot be executed from source node because the source node is not part of the data links.	Execute the service from a node that is part of the data links.
		A buffer error has prevented returning a normal response.	Reset the board. If the error persists, replace the board.
	08	Service cannot be executed because necessary settings haven't been made.	Make the necessary settings.
	09	Service cannot be executed because necessary settings haven't been made in the command data.	Check the command format of and make the necessary settings.
	0A	The specified action or transition number has already been registered.	Execute the command again using an action or transition number that hasn't been registered.
0B	Cannot clear error because the cause of the error still exists.	Eliminate the cause of the error and execute the ERROR CLEAR command.	
30: Access right error	01	The access right is held by another node.	Execute the command again after the access right has been released.
		(Either a peripheral device at the other node is executing an SFC online edit, or the other node is executing an ACCESS RIGHT ACQUIRE or ACCESS RIGHT FORCED ACQUIRE command.)	(The command can be executed after the ACCESS RIGHT FORCED ACQUIRE or ACCESS RIGHT RELEASE command is completed. Releasing the access right might affect processes in progress at the node that held the access right.)
40: Abort	01	Command was aborted with ABORT command.	---

# SECTION 7

## Network Interconnections

This section describes the method used to connect multiple networks.

- 7-1 What is Network Interconnection? .....
- 7-1-1 Interconnecting SYSMAC LINK Networks .....
- 7-1-2 Interconnecting Different Types of Networks .....
- 7-2 Routing Tables .....
- 7-3 Setting Routing Tables .....
- 7-3-1 Example Routing Table Settings .....

## 7-1 What is Network Interconnection?

Network interconnection enables commands and responses for the message service to be sent and received across multiple networks, including FA and OA networks. The four networks listed below can be interconnected to achieve this.

### FA Networks

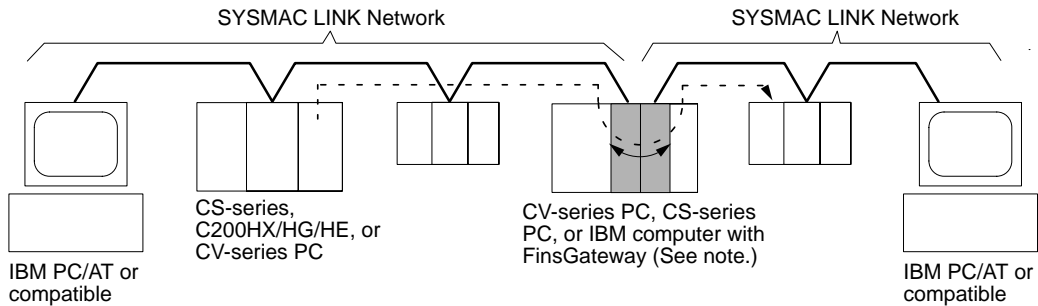
- Controller Link Networks
- SYSMAC NET Link Networks
- SYSMAC LINK Networks

### OA Networks

Ethernet Networks

### 7-1-1 Interconnecting SYSMAC LINK Networks

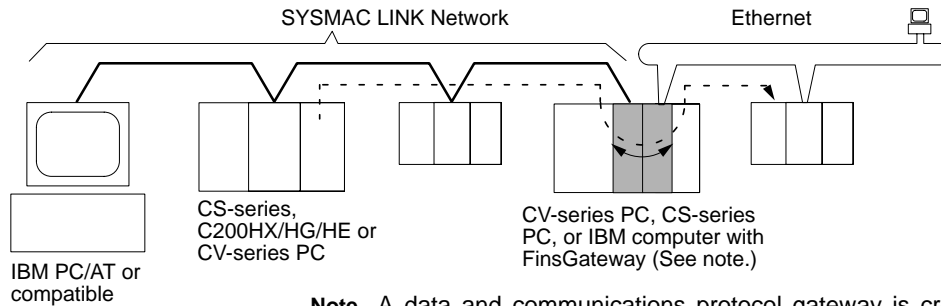
SYSMAC LINK Networks can be connected through CV-series PCs, CS1-series PCs, or computers with FinsGateway.



**Note** A data bridge is created between SYSMAC LINK Units mounted on the same PC.

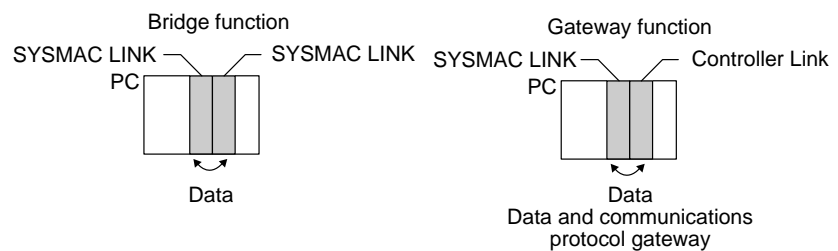
### 7-1-2 Interconnecting Different Types of Networks

CV-series PCs, CS-series PCs, or computers with FinsGateway can be used to connect a SYSMAC LINK Network with another network (SYSMAC NET Link, Controller Link, or Ethernet.)

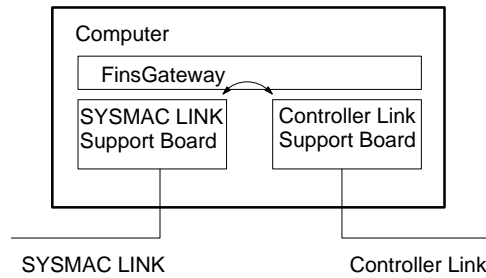


**Note** A data and communications protocol gateway is created between a SYSMAC LINK Unit and a SYSMAC NET Link or Controller Link Unit mounted on the same PC.

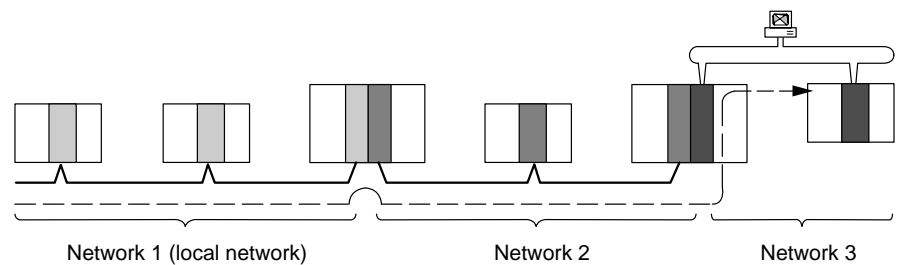
- Note**
1. A bridge is used between Communications Units/Boards to connect the same type of networks.
  2. A gateway is used between Communications Units/Boards to connect different types of networks.



- Computer Bridges and Gateways: FinsGateway automatically implements the bridge or gateway functionality. It does not need to be programmed by the user. The FinsGateway, however, does not connect all networks. Refer to the FinsGateway online help for details.



- Communications across bridges or gateways can include up to three networks, including the local network (data generating network).



Although 2,012 bytes of data (including the header) can be sent and received through a Controller Link Network, the maximum amount of data is limited by any network the data passes through, i.e., the network with the the smallest capacity will determine the limit.

If, for example, data passes through a SYSMAC LINK network as shown in the figure, the amount of data sent and received from the SYSMAC LINK is limited to 552 bytes (including the header) because the SYSMAC LINK Network can only handle that many bytes.

See the manual for the network you are using in order to determine the maximum amount of data for each network.

## 7-2 Routing Tables

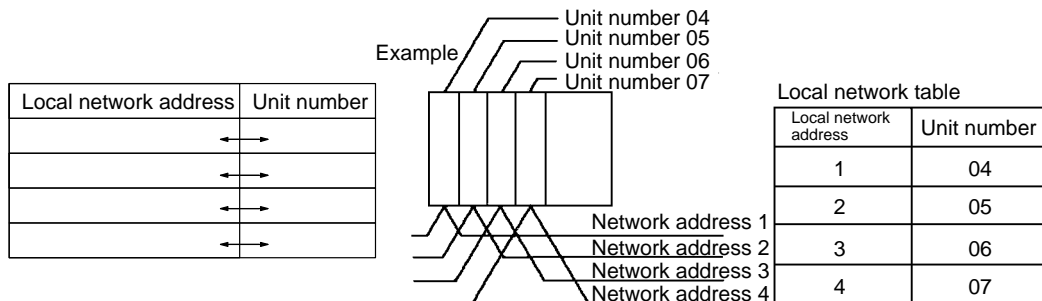
Routing tables that define the communications path from the SYSMAC LINK Unit on the local PC to the network connected to the destination PC must be created in order to send and receive data across networks.

### Creating Routing Tables

The routing table consists of a local network table and a relay network table.

#### Local Network Table

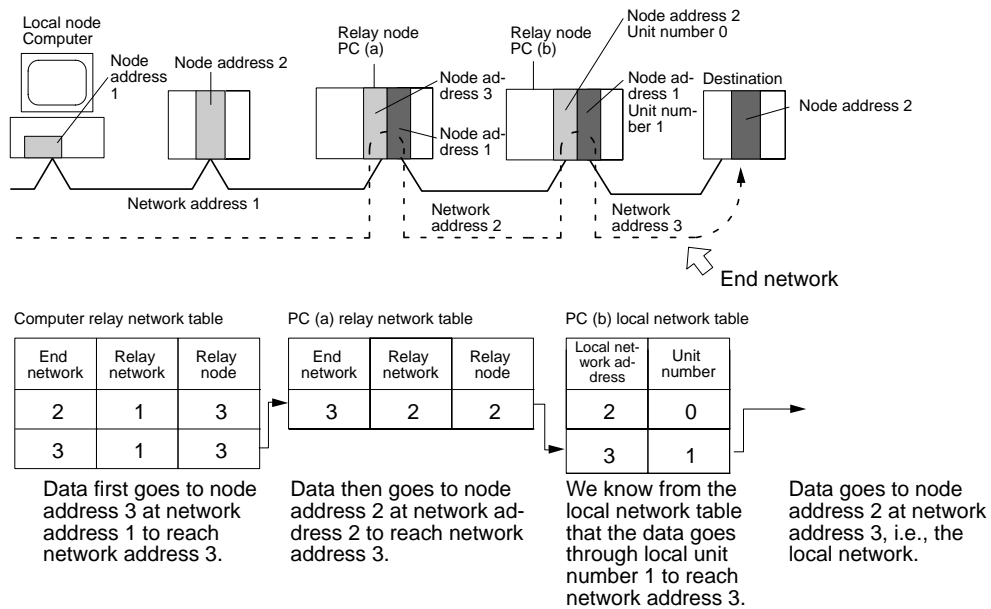
The local network table lists the unit numbers and corresponding network addresses for the SYSMAC LINK Unit and Support Board unit numbers.



- Note**
1. The unit number is set between 00 and 15 using the rotary switch on the front panel of CV-series and CS-series SYSMAC LINK Units, and is the same as the operating level for C200HX/HG/HE PCs. For a SYSMAC LINK Support Board, the unit number is 16 less than the unit address (i.e., the Communications Unit number: 16 to 31) set for the Board in the FinsGateway settings.
  2. The network address is the address of the network connected to the Unit (between 1 and 127). The address is set when the local network table is created.

**Relay Network Table**

A relay network table provides the node and network addresses corresponding to the initial relay point (first point the data must go to) en route to a target network (end network) not directly connected to the local PC. The table traces the route from the relay point to the end network.



**7-3 Setting Routing Tables**

This section describes routing table settings.

Routing tables are set through the FinsGateway, Controller Link Support Software, CX-Net, or SYSMAC LINK Support Software. This section describes setting procedures and setting details.

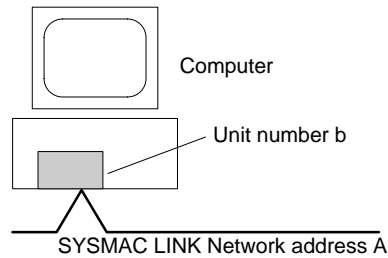
For specific procedures, see the FinsGateway online help, *SYSMAC LINK Support Software Operation Manual (W308)*, *CX-Programmer User's Manual*.

### 7-3-1 Example Routing Table Settings

This section shows examples of routing table settings for a SYSMAC LINK Support Board.

**Example 1**

The example below shows local network table settings when a SYSMAC LINK Support Board is mounted to a computer.

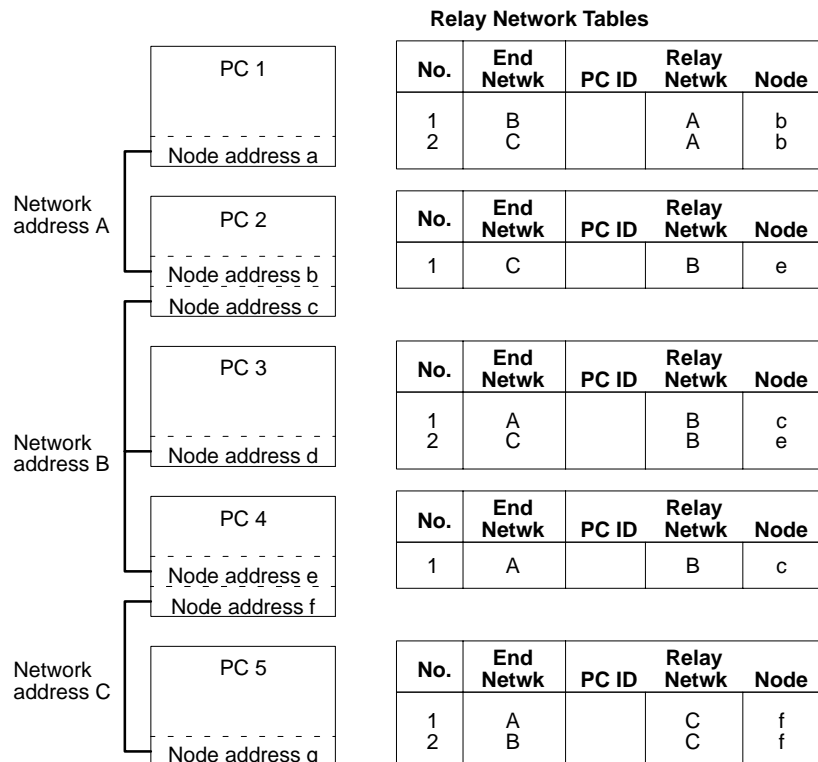


**Local Network Table**

No.	Loc Netwk	SIOU unit #
1	A	b

**Example 2**

The following example show the settings for a relay network table connecting three networks.

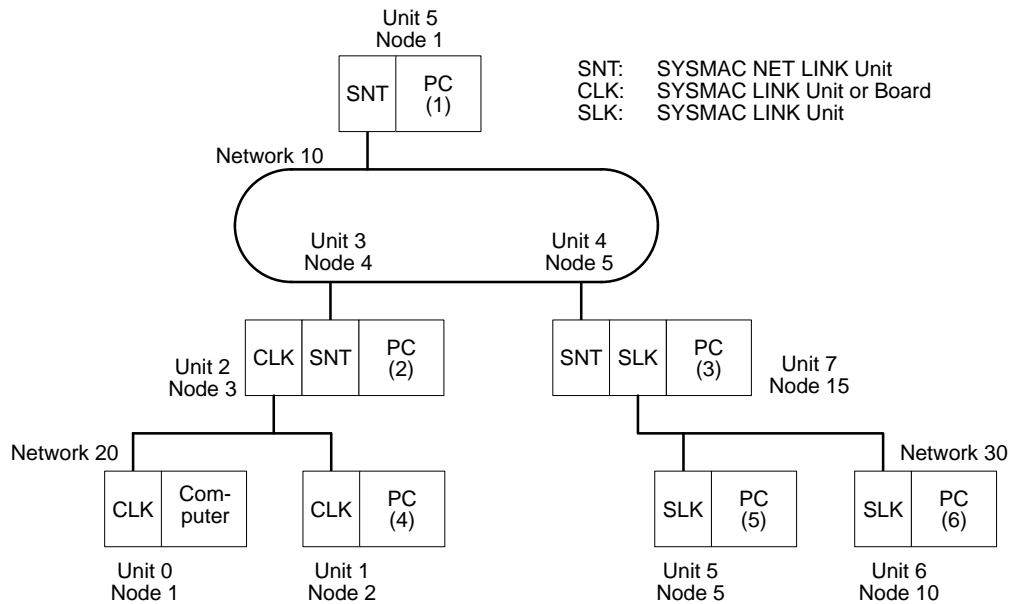


On closer examination of the relay network table for PC 3, we see that the relay network is B and the relay node is c when network A is the destination, and that the relay network is B and the relay node is e when network C is the destination.



**Example 3**

The network structure example in the figure below shows routing tables for all nodes.



**Routing Tables on PC 1**

Local Network Table

No.	Loc Netwk	SIOU unit#
1	010	05
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	020		010	004
2	030		010	005
3				

**Routing Tables on PC 2**

Local Network Table

No.	Loc Netwk	SIOU unit#
1	010	03
2	020	02
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	030		010	005
2				
3				

**Routing Tables on PC 3**

Local Network Table

No.	Loc Netwk	SIOU unit#
1	010	04
2	030	07
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	020		010	004
2				
3				

**Routing Tables on Computer**

Local Network Table

No.	Loc Netwk	SIOU unit#
1	020	00
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	010		020	003
2	030		020	003
3				

**Routing Tables on PC 4**

Local Network Table

No.	Loc Netwk	SIOU unit#
1	020	01
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	010		020	003
2	030		020	003
3				

**Routing Tables on PC 5**

Local Network Table

No.	Loc Netwk	SIOU unit#
1	030	05
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	010		030	015
2	020		030	015
3				

**Routing Tables on PC 6**

Local Network Table

No.	Loc Netwk	SIOU unit#
1	030	06
2		
3		

Relay Network Table

No.	End Netwk	PC ID	Relay Netwk	Node
1	010		030	015
2	020		030	015
3				

# SECTION 8

## Communications Timing

This section explains SYSMAC LINK Network communications in detail. Refer to this section for network communications that require accurate communications timing.

- 8-1 Network Parameters .....
- 8-1-1 SYSMAC LINK Communications .....
- 8-1-2 Communications Cycle .....
- 8-1-3 Network Parameters .....
- 8-1-4 Specifying Network Parameters .....
- 8-2 Message Service Delay Times .....

## 8-1 Network Parameters

This section explains how to use SYSMAC LINK Network communications and how to adjust the network parameters to match the system.

### 8-1-1 SYSMAC LINK Communications

The token bus method is used for communications in the SYSMAC LINK Network. With this method, a piece of data called a “token” is passed between the various nodes in the network. The only node that can transmit data at any given time is the one that currently holds the token, thereby preventing interference or conflicts in the transmission of data within the network.

The token travels from in node-address order beginning with the node with the lowest node address, without regard to the order in which the nodes are connected. When the token reaches the node with the highest address, it is passed back to the node with the lowest address to start the cycle over again. If a node has data to send, it will send that data and then pass the token to the next node. If the node has no data to send, it will just pass the token to the next node.

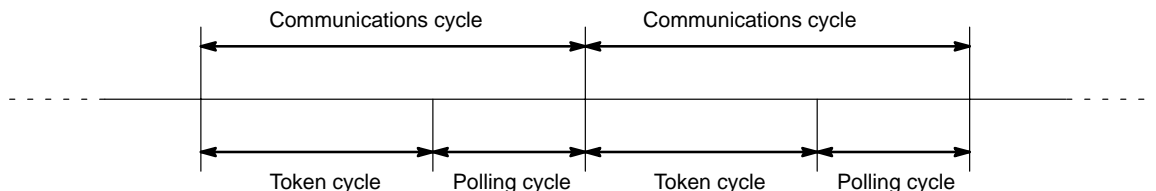
#### Polling Node

Each SYSMAC LINK Network always has a Unit that controls communications within the network. This Unit is called the “polling node.” Normally, the node that has the lowest node address in the network is the polling node. All Units at nodes other than the polling node are called “polled nodes.” The polling node controls the token, checks the network, and performs other relevant tasks. Should the polling node break down, the node with the next lowest node address is automatically selected as the polling node to prevent the entire network from shutting down.

**Note** There are times when the node with the lowest node address will not be the polling node depending on the order in which the nodes are started, models, settings, and node status.

### 8-1-2 Communications Cycle

The “communications cycle” is the cycle for repeating SYSMAC LINK Network processing. The time required for one communications cycle is called the “communications cycle time,” and each communications cycle is divided into a “token cycle” and a “polling cycle” as shown in the following diagram.



#### Token Cycle

The token cycle is the period during which the token is sent from the polling node to the nodes in order and returned to the polling node. During this cycle, any nodes with data to send will send that data. Data link data will also be sent during this cycle.

#### Polling Cycle

The polling cycle is the period during which the polling node checks the status of the nodes in the network. The polling node checks whether each node is actually participating in the network, whether there are any new nodes participating, and so on, and notifies all the nodes of the results of the check.

### 8-1-3 Network Parameters

Network parameters are also used to control network operations. Network parameters are read from the polling node and distributed to all other nodes when

the SYSMAC LINK Network is started. In this way, all nodes on the network always have the same network parameter settings. If nodes are connected to the network halfway during network operation, the network parameter settings will also be distributed to these nodes when they are connected. The following three network parameters can be specified.

#### Maximum Node Address

This parameter specifies the maximum node address of nodes to be checked by the polling node. The default is 32 for Wired Networks and 62 for Optical Ring Networks. Reducing the setting of this parameter reduces the number of nodes checked by the polling node and can thus avoid unnecessary check operations. However, if the network contains nodes with node addresses greater than the setting of the parameter, these nodes will not be connected to the network.

#### No. of Polled Nodes Per Communications Cycle

This parameter specifies the number of nodes to be checked (polled) by the polling node during each polling cycle. The default is 4.

Increasing this setting increases the communications cycle time, but reduces the time required to recognize that nodes have been removed from or added to the network. On the other hand, reducing this setting shortens the communications cycle time but delays a network response when a node is disconnected from or connected to the network.

#### No. of Event-frames per Communications Cycle

This parameter specifies the maximum number of event frames (communications other than data links, such as message service transmissions) that can be transferred during a communications cycle. Specify a value in units of 128 bytes. The default is 10 ( $128 \times 10 = 1,280$  bytes).

Increasing this setting increases the communications cycle time but allows for more event communications such as the message service. If this setting is too low, event communications will be restricted and errors will occur.

See 5-5 *Data Link Performance* for the actual effects of network parameter changes on communication cycle times.

### 8-1-4 Specifying Network Parameters

Set the network parameters from the FinsGateway's SLK Data Link Setting utility. This section describes only the allowable setting range for each network parameter. Refer to the FinsGateway online help for setting procedures.

The following table shows the setting range and default for network parameters.

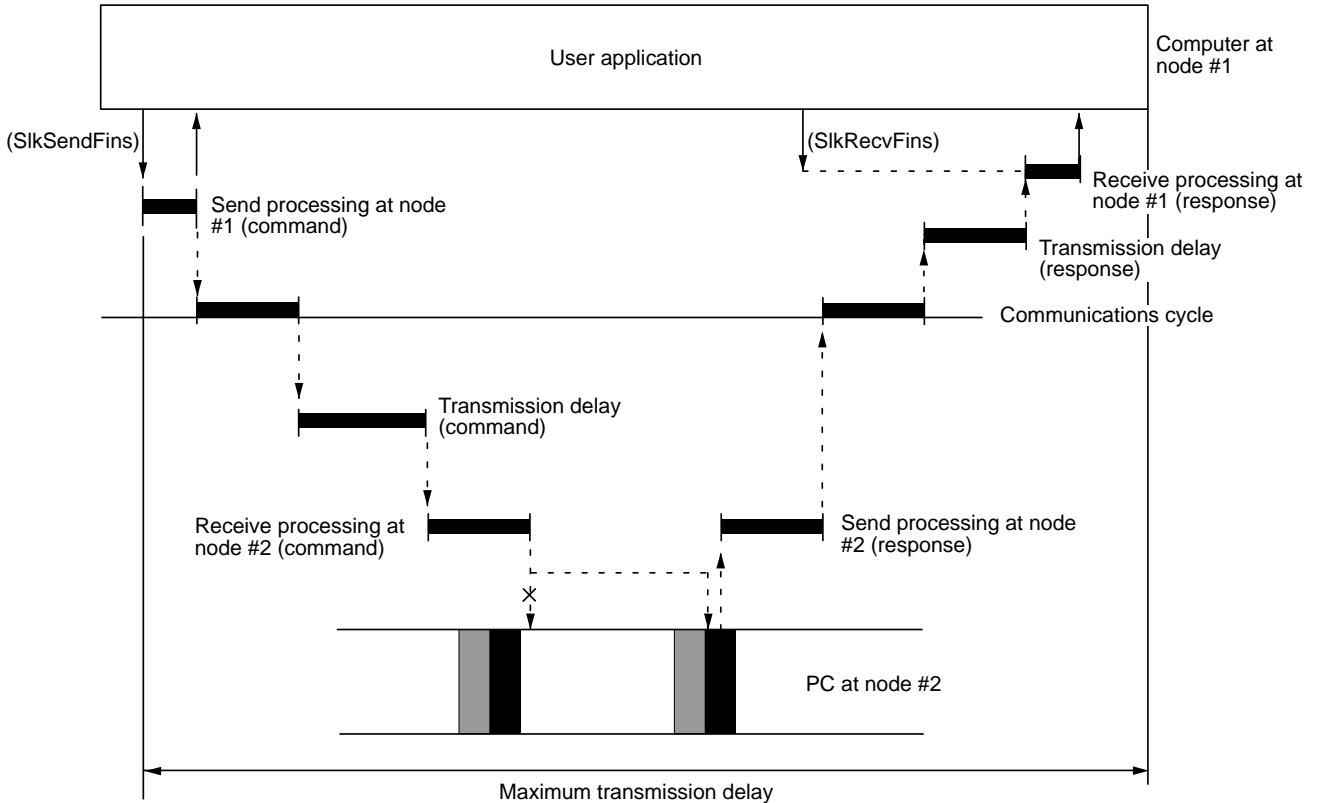
Network parameter	Setting range	Default value
Maximum node address	2 to 62	62
Number of polled nodes per communications cycle	1 to 61	4
No. of event-frames per communications cycle	5 to 255	10

The network parameters become valid immediately after being set.

- Note**
1. Always stop the data link before changing network parameters.
  2. Specify a value for the maximum node address that is equal to or greater than the highest node address in the SYSMAC LINK Network.

## 8-2 Message Service Delay Times

The following diagram illustrates the maximum message service transmission delay time. In this example, the MEMORY AREA READ FINS command is sent to the PC at node #2 (a CS1-series PC) by the user application at the computer at node #1.



Max. transmission delay time =

- Send processing (node #1) + Communications cycle time
- + Transmission delay time (for command) + Receive processing (node #2)
- + PC processing time (node #2) + Send processing (node #2)
- + Communications cycle time + Transmission delay time (for response)
- + Receive processing (node #1)

**Send/Receive Processing at Node #1**

Depends on the processing capacity of the computer that is used.

**Communications Cycle Time**

See 5-5 Data Link Performance.

**Transmission Delay Time**

Number of words transferred × 0.008 + 0.112 ms

**Receive Processing at Node #2**

Number of words transferred × 0.00125 + 2.3 ms

**Send Processing at Node #2**

Number of words transferred × 0.00125 + 3.0 ms

- Note**
1. The I/O response time can increase due to noise or restrictions on the number of frames that can be transmitted while data links are operating.
  2. Refer to the *SYSMAC LINK Units Operation Manual (W367)* for details on the time from reception at the SYSMAC LINK Unit until transmission.

# SECTION 9

## Troubleshooting and Maintenance

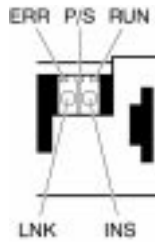
This section provides information on troubleshooting errors that occur during SYSMAC LINK Support Board operation, as well as daily inspection, cleaning, and other maintenance procedures.

9-1	Troubleshooting Using Indicators .....
9-1-1	Using the RUN, ERR, and INS Indicators .....
9-1-2	Troubleshooting with the LNK Indicators .....
9-2	Status Information and Troubleshooting .....
9-2-1	Troubleshooting with the SlkGetNetworkStatus Function .....
9-2-2	Error Processing .....
9-3	Error Log .....
9-3-1	Error Log Table .....
9-3-2	Error Codes .....
9-4	Cleaning and Inspection .....
9-4-1	Cleaning .....
9-4-2	Inspection .....
9-5	Handling Precautions .....
9-5-1	Replacing the Unit .....
9-5-2	Replacing the Board .....

## 9-1 Troubleshooting Using Indicators

This section describes the errors shown by the SYSMAC LINK Support Board's indicators and possible remedies.

### Optical System



### Coaxial System



Name	Status	Description
RUN	Lit	The Board is operating normally.
ERR	Lit	An error has occurred.
INS	Lit	Participating in network.
LNK	Lit	Sending data link (participating in data link)
	Flashing	Error in the data link table settings.
P/S	Lit	Backup power supply is ON. (Optical Units only.)

### 9-1-1 Using the RUN, ERR, and INS Indicators

The SYSMAC LINK Support Board's RUN, ERR, and INS indicators can be used to check whether SYSMAC LINK Support Board startup and Network participation are operating normally.

**Note** Be sure to turn OFF the computer before performing any of the following:

- Disconnecting the Board or connectors.
- Securing Board or connectors.
- Setting hardware switches.

Indicators			Error history	Probable cause	Probable remedy
RUN	ERR	INS			
Lit	Not lit	Lit	---	Unit operating normally; Network participation normal.	---
Not lit	Lit	---	---	The SYSMAC LINK Support Board is faulty.	If the ERR indicator still lights when the Board is mounted on another computer, replace the SYSMAC LINK Support Board.
Not lit	Not lit	Not lit	---	Power is not being supplied correctly to the computer.	Check the power supply voltage and supply at the recommended voltage.
				The SYSMAC LINK Support Board has become loose.	Secure the SYSMAC LINK Support Board firmly.
				The SYSMAC LINK Support Board is mounted in the wrong slot.	Refer to the <i>Installation Guide</i> and mount the Board correctly.
				The SYSMAC LINK Support Board is faulty.	If the indicators do not light when the Board is mounted in another computer, replace the SYSMAC LINK Support Board.
Lit	Lit	Not lit	0211 Hex	The same node address is being used by two different Units.	Reset so that each node address is used only once within the same Network.
				The Board is connected to a Controller Link network.	Check the networks and correct the cable connections.



Indicators			Error history	Probable cause	Probable remedy
RUN	ERR	INS			
Lit	Lit	---	021A Hex	Routing table setting error.	Reset the routing table correctly, referring to 7-3 <i>Setting Routing Tables</i> . When no routing table is being used, delete the routing table.
				There is an error in the data link table settings.	When using data links, refer to 5-2 <i>Setting Data Links</i> and correct the tables. When not using data links, delete the tables.
				EEPROM error	Refer to 9-2 <i>Status Information and Troubleshooting</i> , correct the data where the error has occurred, and reset the Board. If the error occurs again, replace the SYSMAC LINK Support Board.
Lit	---	Not lit	---	Cables are not connected correctly.	Check the cable connections and reconnect correctly.
			021A Hex	The node address is larger than the maximum node address set for the network parameters.	Either reset the maximum node address using the SYSMAC LINK Support Software or reset the node address to below the maximum.
			---	No other nodes exist.	Make sure that 2 or more nodes exist within the Network.
			---	No node has been set as a polling node.	Refer to <i>Installation Guide</i> and set at least one polling node. (A SYSMAC LINK Support Board should normally be set as the polling node.)

### 9-1-2 Troubleshooting with the LNK Indicators

#### Data Link Cannot be Started

The following table describes the LNK indicators at the startup node and their use in troubleshooting when a data link cannot be started.

Starting a data link depends on the SYSMAC LINK Support Board operating normally and participating in the Network. Refer to 9-1-1 *Using the RUN, ERR, and INS Indicators* earlier in this section and check Board operation before using the following table.

Indicators	Probable cause	Probable remedy
<b>LNK</b>		
Lit	Data link operating normally.	---
Flashing slowly	There is an error in the data link tables.	When the ERR indicator is flashing, reset the data link tables.
	When manual setting is used, either data link tables have not been created for the startup node or there is an error in the data link tables.	Refer to 5-2-2 <i>Manual Setting</i> and set data link tables for the startup node.
Flashing quickly	The data link table's communications cycle time setting is too short.	Change the data link table's communications cycle time setting to automatic calculation or set a longer manual setting.
Not lit	Manually set data links are already operating on the same Network.	Refer to 9-5 <i>Handling Precautions</i> .
	Automatically set data links are already operating on the same Network.	Refer to 9-5 <i>Handling Precautions</i> .

#### Node Cannot Participate in Data Link

The following table describes the LNK indicators when a node cannot participate in the data links.

Data link participation depends on the SYSMAC LINK Support Board operating normally and participating in the Network. Refer to 9-1-1 *Using the RUN, ERR,*

and *INS Indicators* earlier in this section and check Unit operation before using the following table.

Indicators	Probable cause	Probable remedy
<b>LNK</b>		
Lit	Data link operating normally.	---
Flashing slowly	When manual setting was used, there is an error in the data link table.	Refer to <i>5-2-2 Manual Setting</i> and reset the data link table.
Flashing quickly	The data link table's communications cycle time setting is too short.	Change the data link table's communications cycle time setting to automatic calculation or set a longer manual setting.
Not lit	For manual setting, there are no data link tables set for the local node.	Set data link tables for the local node.
	For automatic setting, the startup node is not set to participate in the data links.	Stop the data links, delete the parameters in the startup node's DM Area, and then restart the data link.  The SYSMAC LINK Support Board cannot become the start-up node with automatic settings, so set a PC in which a SYSMAC LINK Unit is mounted as the start-up node. For details refer to the <i>SYSMAC LINK Units Operation Manual (W202/W367)</i> .

**Data Links Cannot be Stopped**

The following explanation describes how to use the LNK indicator when the data links cannot be stopped. Stopping the data links depends on the SYSMAC LINK Support Board operating normally and participating in the Network. Read the above explanations before attempting to stop operation.

**Note** Stop the data link from the node at which the LNK indicator is flashing (indicating active data links). Data links cannot be stopped from nodes which do not have active data links.

Indicators	Probable cause	Probable remedy
<b>LNK</b>		
Not lit	Data link stopped normally.	---

## 9-2 Status Information and Troubleshooting

The SYSMAC LINK Support Board contains status information which reflects the current status of communications and the Board. This status information can be read using the STATUS READ or DATA LINK AREA READ FINS command. The cause of the error can be found by reading the status information.

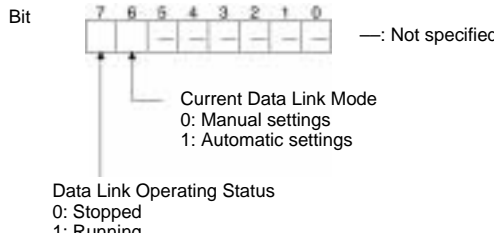
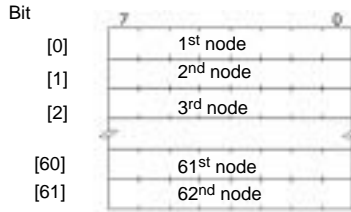
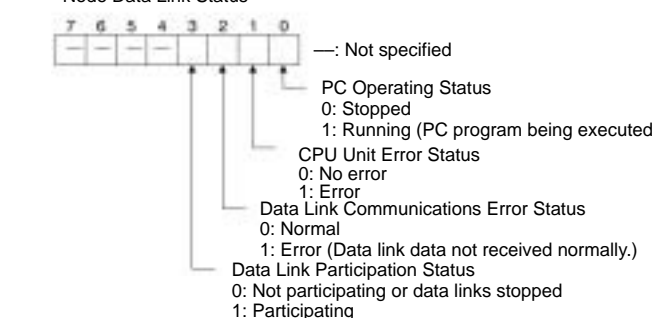
This section explains the contents accessed by the `SlkGetNetworkStatus` function and tells how to troubleshoot error information obtained.

### 9-2-1 Troubleshooting with the `SlkGetNetworkStatus` Function

The following network status is read by `SlkGetNetworkStatus()`.

Type	Variable name	Contents																
BYTE	byConnectionMethod	Indicates the type of connection (Coaxial or Optical) being used.  Bit <table style="margin-left: 20px;"> <tr> <td style="border: 1px solid black; padding: 2px;">7</td> <td style="border: 1px solid black; padding: 2px;">6</td> <td style="border: 1px solid black; padding: 2px;">5</td> <td style="border: 1px solid black; padding: 2px;">4</td> <td style="border: 1px solid black; padding: 2px;">3</td> <td style="border: 1px solid black; padding: 2px;">2</td> <td style="border: 1px solid black; padding: 2px;">1</td> <td style="border: 1px solid black; padding: 2px;">0</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">-</td> <td style="border: 1px solid black; padding: 2px;">-</td> <td style="border: 1px solid black; padding: 2px;">-</td> <td style="border: 1px solid black; padding: 2px;">-</td> <td style="border: 1px solid black; padding: 2px;">-</td> <td style="border: 1px solid black; padding: 2px;">0</td> <td style="border: 1px solid black; padding: 2px;">0</td> <td style="border: 1px solid black; padding: 2px;">0</td> </tr> </table> ---: Not specified.  Connection type 0: Coaxial 1: Optical	7	6	5	4	3	2	1	0	-	-	-	-	-	0	0	0
7	6	5	4	3	2	1	0											
-	-	-	-	-	0	0	0											
BYTE	byMyNodeAddr	Local node address  Stores the local node address set for the SYSMAC LINK Support Board.																
BYTE	byMyUnitAddr	A value of 0 will always be read for a SYSMAC LINK Support Board.																
BYTE	byMyNetAddr	A value of 0 will always be read for a SYSMAC LINK Support Board.																

Type	Variable name	Contents																																				
BYTE	abyNodeList[32]	<p>Network participation status</p> <p>Stores a list of the nodes participating in the network.</p> <p>Bit</p> <table border="1" data-bbox="638 262 957 472"> <tr> <td>7</td><td>4</td><td>3</td><td>0</td> </tr> <tr> <td>[0]</td><td>Node 1</td><td>Reserved</td><td></td> </tr> <tr> <td>[1]</td><td>Node 3</td><td>Node 2</td><td></td> </tr> <tr> <td>[2]</td><td>Node 5</td><td>Node 4</td><td></td> </tr> <tr> <td>[30]</td><td>Node 61</td><td>Node 60</td><td></td> </tr> <tr> <td>[31]</td><td>Reserved</td><td>Node 62</td><td></td> </tr> </table> <p>Node Participation Information</p> <table border="1" data-bbox="997 283 1141 367"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td> </tr> <tr> <td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table> <ul style="list-style-type: none"> <li>0: Not participating in network</li> <li>1: Participating in network</li> <li>0: Normal disconnection</li> <li>1: Error disconnection (when not participating)</li> <li>0: Normal</li> <li>1: No response to polling.</li> </ul>	7	4	3	0	[0]	Node 1	Reserved		[1]	Node 3	Node 2		[2]	Node 5	Node 4		[30]	Node 61	Node 60		[31]	Reserved	Node 62		7	6	5	4	3	2	1	0	0	0	0	0
7	4	3	0																																			
[0]	Node 1	Reserved																																				
[1]	Node 3	Node 2																																				
[2]	Node 5	Node 4																																				
[30]	Node 61	Node 60																																				
[31]	Reserved	Node 62																																				
7	6	5	4																																			
3	2	1	0																																			
0	0	0	0																																			
WORD	wCommunicationCycleTime	<p>Communications cycle time</p> <p>Stores the current value of the communications cycle time. (unit: 0.1 ms)</p>																																				
BYTE	byPollingNodeAddr	<p>Polling node address</p> <p>Stores the node address of the current polling node.</p>																																				
BYTE	byStatus1	<p>Reserved area</p> <p>Stores undetermined data.</p>																																				
BYTE	byStatus2	<p>For Optical Systems, this byte stores the power supply status.</p> <p>Bit</p> <table border="1" data-bbox="702 829 949 892"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table> <ul style="list-style-type: none"> <li>Optical System</li> <li>0: No backup power supply</li> <li>1: Backup power being supplied</li> </ul>	7	6	5	4	3	2	1	0	0	0	0	0	0	0	0	0																				
7	6	5	4	3	2	1	0																															
0	0	0	0	0	0	0	0																															
BYTE	byStatus3	<p>Error information 1</p> <p>Stores information such as whether or not there is an error log recorded, node address setting errors, etc.</p> <table border="1" data-bbox="893 1039 1149 1113"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table> <ul style="list-style-type: none"> <li>1: Error log recorded</li> <li>1: Fatal data link error</li> <li>1: Communications controller transmitter error</li> <li>1: Node address setting error</li> <li>1: Node address duplicated</li> <li>1: Network parameter mismatch</li> <li>1: Communications controller hardware error</li> </ul>	7	6	5	4	3	2	1	0	0	0	0	0	0	0	0	0																				
7	6	5	4	3	2	1	0																															
0	0	0	0	0	0	0	0																															
BYTE	byStatus4	<p>Reserved area</p> <p>Stores undetermined data.</p>																																				
BYTE	byStatus5	<p>Error information 2</p> <p>Stores information such as EEPROM write errors, setting table errors, etc.</p> <p>Bit</p> <table border="1" data-bbox="901 1396 1157 1470"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table> <ul style="list-style-type: none"> <li>1: EEPROM write error</li> <li>1: Network parameter error</li> <li>1: Data link table error</li> <li>1: Routing table error</li> </ul>	7	6	5	4	3	2	1	0	0	0	0	0	0	0	0	0																				
7	6	5	4	3	2	1	0																															
0	0	0	0	0	0	0	0																															
BYTE	byStatus6	<p>Reserved area</p> <p>Stores undetermined data.</p>																																				

Type	Variable name	Contents
BYTE	byStatusFlag	<p>Data link operation status and data link mode</p> <p>Stores the data link operation status, data link mode, etc.</p> <p>Bit</p>  <p>—: Not specified</p> <p>Current Data Link Mode 0: Manual settings 1: Automatic settings</p> <p>Data Link Operating Status 0: Stopped 1: Running</p>
BYTE	abyDataLinkStatus[62]	<p>Data link status</p> <p>Stores the data link status. Nodes are listed in the same order in which they are entered in the data link table for refreshing.</p> <p>Bit</p>  <p>Node Data Link Status</p>  <p>—: Not specified</p> <p>PC Operating Status 0: Stopped 1: Running (PC program being executed.)</p> <p>CPU Unit Error Status 0: No error 1: Error</p> <p>Data Link Communications Error Status 0: Normal 1: Error (Data link data not received normally.)</p> <p>Data Link Participation Status 0: Not participating or data links stopped 1: Participating</p>

## 9-2-2 Error Processing

### Data Link Status: abyDataLinkStatus [ ]

Bit status	Probable cause	Probable remedy
The "CPU Unit Error Status" flag is ON.	A fatal PC error, non-fatal PC error, or a watchdog timer error has occurred.	Refer to the PC's operation manual and correct the error. If the error occurs again, replace the PC.
	The Unit is mounted to a non-compatible PC.	Mount onto the correct PC.
The "Data Link Communications Error Status" flag is ON.	The relevant node is not in the Network.	Enter the node in the Network.
	A communications error has occurred as a result of noise.	Conduct an echoback test using the CX-Net or other method. If this does not correct the error, check the usage environment.
	A communications error has occurred.	Refer to 9-1-1 <i>Using the RUN, ERR, and INS Indicators</i> and troubleshoot accordingly.
The "Data Link Participation Status" flag is OFF.	The relevant node is not part of data links.	Enter the relevant node in data links. If an error occurs, refer to page 101, <i>Node Cannot Participate in Data Link</i> and troubleshoot accordingly.
	There are no active data links in the Network.	Activate the data links.

**Note** The data link status can also be monitored with the FinsGateway's SLK Data Link Setting Utility.

### Other Status

Bit status	Probable cause	Probable remedy
The "Error log recorded" flag is ON.	Error information on the SYSMAC LINK Support Board (an error log) has been recorded.	Using the SYSMAC LINK Support Software or an FINS command, read the cause of the current error. Alternatively, use past error log records to troubleshoot the problem.
The "Fatal data link error" flag is ON.	There is an error in the data link table settings.	Refer to 5-2 <i>Setting Data Links</i> and correct the data link table settings. After correcting the settings, stop the application and restart the system.
The "Communications controller transmitter error" flag is ON.	The SYSMAC LINK Support Board is faulty.	Replace the SYSMAC LINK Support Board.
The "Communications controller hardware error" flag is ON.	The SYSMAC LINK Support Board is faulty.	Replace the SYSMAC LINK Support Board.
The "Network parameter mismatch" flag is ON.	The network parameters in EEPROM do not agree with those being used by the network	Use the SYSMAC LINK Support Software to check the current parameters and correct the settings as required.
The "Node address duplicated" flag is ON.	The same node address has been set more than once.	Correct the node addresses so that each one is assigned to only one node.
The "EEPROM write error" flag is ON.	An error has occurred while writing data to the CPU Unit's EEPROM.	Check the status of bits 0 to 2 in the same byte and correct any problems found. If the error recurs, replace the SYSMAC LINK Support Board.

Bit status	Probable cause	Probable remedy
The "Routing table error" flag is ON.	The routing table data within the CPU Unit's EEPROM is damaged.	Refer to 7-3 <i>Setting Routing Tables</i> and reset the routing tables correctly. If the error recurs, replace the SYSMAC LINK Support Board.
	There is an error in the routing table setting.	When using a routing table, refer to 7-3 <i>Setting Routing Tables</i> and reset the routing tables correctly. If no routing tables are being used, delete the tables.
The "Data link table error" flag is ON.	The data link table data in the EEPROM of the CPU Unit is damaged.	Refer to 5-3 <i>Starting and Stopping Data Links</i> and reset the data link tables correctly. If the error recurs, replace the SYSMAC LINK Support Board.
	There is an error in the data link table settings.	When using manually set data links, refer to 5-3 <i>Starting and Stopping Data Links</i> and reset the data link tables correctly. When manually set data links are not being used, delete the data link tables.
The "Network parameter error" flag is ON.	Network parameters in EEPROM are damaged.	Refer to 8-1-3 <i>Network Parameters</i> and correct the settings. If the error recurs, replace the SYSMAC LINK Support Board.
	There is an error in the network parameter settings, or node address of the local node is larger than the maximum address set within the network parameters.	Refer to 8-1-3 <i>Network Parameters</i> and correct the network parameters or the node address settings.

## 9-3 Error Log

Information on errors that occur in the SYSMAC LINK Support Board is recorded in the Board's RAM or EEPROM. The entries that are stored in EEPROM will be retained even when the computer is turned OFF or reset.

The error log can be read or cleared using a Programming Device (FinsGateway or Controller Link Support Software) or the message service.

### 9-3-1 Error Log Table

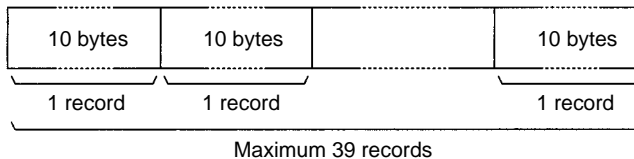
Errors are recorded in an error log table in the Board's RAM, with one record for each error and a maximum of 39 records.

Serious errors are also recorded in the Board's EEPROM so that when the power to the Board is turned OFF or reset, a record of the error will remain. (The error log table in EEPROM is automatically read to the Board's RAM when the power is turned ON again.)

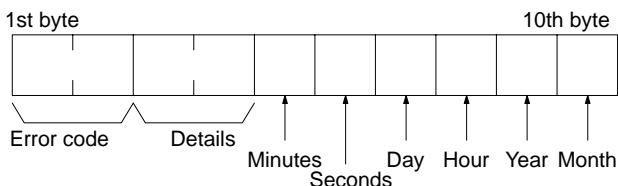
Item	Specification
No. of records	39 max.
Data code	Binary (The time/date information is in BCD.)
Length of each record	10 bytes
Configuration of records	Error code: 2 bytes (Refer to 9-3-2 <i>Error Codes</i> ) Detail code: 2 bytes (Refer to 9-3-2 <i>Error Codes</i> ) Time: 6 bytes (Refer to the <i>Time Information</i> )
Record order	From the oldest record to the most recent.

If the number of records exceeds 39, the oldest record will be deleted and the most recent error recorded.

### Error Log Table Configuration



#### Record Configuration



### Time Information

The time is recorded in BCD with one byte each for the year (the rightmost two digits), month, day, hour, seconds, and minutes of the time the error occurred.

**Note** The SYSMAC LINK Support Board reads and uses the computer's time information. If the time cannot be read from the computer, all error log times will be set to 0. (When these error log records are read, they will be dated 0 s, 0 min, 0 hr, 0 day, 0 month, 2000.)

### 9-3-2 Error Codes

The following table lists the error codes (in 4-digit hexadecimal) and the contents of the errors. All error codes and detail codes are in hexadecimal.

Error code (Hex)	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte (Hex)	2nd byte (Hex)		
0001	CPU Unit watchdog timer error	00	00	Replace the CPU Unit.	Yes
0002	CPU Unit service monitor error	Monitor time (ms)		Check the environment settings.	Yes
0003	CPU Unit RAM error	01: Cyclic 02: Event 04: CPU bus link	00	Check the environment settings.	Yes
0004	CPU Bus Unit ID number error	00	00	Check the I/O tables.	Yes
0005	Unit number error	Unit set value	CPU Unit detected value	Check the unit number settings and recreate the I/O tables.	Yes
0006	CPU error	Bit 11: Unit missing in registered I/O tables Bit 12: Hard test number detected Bit 13: Illegal number detected Bit 14: Unit number duplicated		Check the unit number settings and recreate the I/O tables.	Yes
000E	I/O bus error	00	00	Check the environment settings.	Yes
000F	CPU Unit initialization error			Check the environment settings.	Yes
0010	System capacity exceeded				Yes
0011	CPU Unit initialization timeout			Check the environment settings.	Yes

Error code (Hex)	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte (Hex)	2nd byte (Hex)		
0012	CPU Unit memory error	01: Read error 02: Write error	01: Data link tables 02: Network parameters 03: Routing tables 04: System setup	Check the relevant settings.	Yes
0013	CPU Unit write-protected			Release write protection for the CPU Unit.	Yes
0101	Transmission failed; local node not in Network	<b>Command block</b> Bits 0 to 7: Source node address Bits 8 to 14: Source Network address Bit 15: OFF <b>Response block</b> Bits 0 to 7: Destination node address Bits 8 to 14: Destination Network address Bit 15: ON (1st byte: bits 8 to 15; 2nd byte, bits 0 to 7)		Refer to <i>9-1 Troubleshooting Using Indicators</i> and place the local node into Network.	No
0103	Transmission failed; retry count exceeded			Using the SYSMAC LINK Support Software or FINS commands, run echoback test and check operating environment if errors occur.	No
0104	Transmission failed; maximum number of frames exceeded.			Check event status on the network. Reduce the number of events per communications cycle or increase the maximum number of network parameter frames.	No
0105	Transmission failed; node address incorrect			Refer to the <i>Installation Guide</i> and check node address settings to be sure they are within range and unique.	No
0106	Transmission failed; redundant node address			Correct node addresses so that they are unique within the same Network.	No
0107	Transmission failed; destination node not in Network			Refer to <i>9-1 Troubleshooting Using Indicators</i> and place destination node into Network.	No
0108	Unit missing; cannot execute.			Refer to the <i>Installation Guide</i> and check the SYSMAC LINK unit number.	No
0109	Transmission failed; destination busy			Increase number of retries or reconfigure system to distribute load.	No
010A	Transmission failed; communications controller error			Conduct an echoback test and if the effects of noise are considerable, reconsider the operating environment. Restart the computer. If the error occurs again, replace the Board.	Yes
010B	CPU Unit error; cannot send.	Refer to the manuals for the CPU Unit and correct the problem. If the problem cannot be corrected, replace the CPU Unit.	No		
010C	Unit number setting error; cannot send.	Refer to the <i>Installation Guide</i> and check node address settings to be sure they are within range and unique.	No		



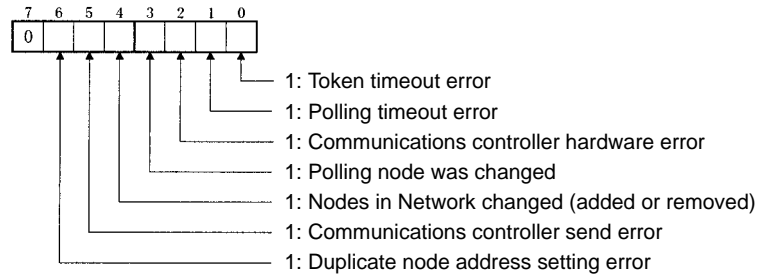
Error code (Hex)	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte (Hex)	2nd byte (Hex)		
010D	Transmission failed; destination address incorrect	<b>Command block</b> Bits 0 to 7: Source node address Bits 8 to 14: Source Network address Bit 15: OFF		Check routing tables.	No
010E	Transmission failed; routing tables not registered				No
010F	Transmission failed; routing table error				No
0110	Transmission failed; too many relay points	<b>Response block</b> Bits 0 to 7: Destination node address Bits 8 to 14: Destination Network address Bit 15: ON (1st byte: bits 8 to 15; 2nd byte, bits 0 to 7)		Check routing tables and system configuration. Do not try to access Networks separated by more than one other Network.	No
0111	Transmission failed; command packet too long				No
0112	Transmission failed; header error.				No
0113	I/O setting error; cannot send.			Correct either the system configuration or the registered I/O tables.	No
0114	CPU bus error; cannot send.			Check the Board and cable connections and clear the error.	No
0115	I/O duplication; cannot send.			Check the unit numbers to be sure the same number is not set twice in the same PC.	No
0116	CPU Bus Unit error; cannot send.			Check the Board and cable connections and clear the error.	No
0117	Internal buffer full			Increase number of retries or reconfigure system to distribute load.	No
0118	Illegal packet discarded			Check for nodes sending illegal data.	Yes
0124	Maximum frame length exceeded; cannot route.			Correct the FINS command format. Also, be sure that the parameters specified for the command do not produce a response that is too long.	No
0203	EEPROM error	01: Read error 02: Write error	01: Data link tables 02: Network parameters 03: Routing tables	Reset the relevant data. If the error occurs again replace the SYSMAC LINK Support Board.	Yes
0206	Number of participating nodes decreased (local node still participating)	Network parameters maximum node address	Number of non-participating nodes	Check network parameters, node participation, cables, and terminating resistance.	No
0207	Number of participating nodes decreased (local node not participating)				No
0208	polling node changed	Address of previous polling node	Address of new polling node	Check previous polling node.	No

Error code (Hex)	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte (Hex)	2nd byte (Hex)		
0209	Network parameter disagreement	00	Address of polling node	Using the SYSMAC LINK Support Software, check network parameters.	Yes
020C	Time out with token	00	Error status (See note 2.)	Check network parameters, node participation, cables, and terminating resistance.	No
0210	Communications controller transmitter error	00		Replace the SYSMAC LINK Support Board.	Yes
0211	Duplicate node address error (connected to Controller Link by mistake)	00	Local node address	Reset so that each node address is used only once within the same Network.	No
0214	Node address setting error	Not set		Correct the node address setting.	Yes
0216	Backup power supply error	00	Error type 01: OFF to ON 02: OFF to ON	Check the backup power supply and the power supply cables.	Yes
021A	Set table logic error	00	01: Network parameters 02: Data link tables 03: Routing tables	Reset the appropriate data.	Yes
021B	Hardware error	00: SL1 error 01: SL2 error	Error status (See note 2.)	Replace the SYSMAC LINK Support Board.	No
021C	Data link error stopped	Not set		Stop the user application, reset the computer, and retry.	Yes
021D	Communications cycle time setting error in data link table	Present cycle time setting (2-digit hexadecimal, ms units)	Minimum possible cycle time setting (2-digit hexadecimal, ms units)	Either change the data link table's communications cycle time setting to automatic setting or increase the manual setting.	Yes
0220	Additional information 1 for number of participating nodes decreased (0206)	Bits 00 to 15 correspond to disconnected nodes 1 to 16		Check the network parameters, the disconnected node, and the cables.	No
0221	Additional information 2 for number of participating nodes decreased (0206)	Bits 00 to 15 correspond to disconnected nodes 17 to 32			No
0222	Additional information 3 for number of participating nodes decreased (0206)	Bits 00 to 15 correspond to disconnected nodes 33 to 48			No
0223	Additional information 4 for number of participating nodes decreased (0206)	Bits 00 to 15 correspond to disconnected nodes 49 to 62			No
0300	Packet discarded	Not set		Conduct an echoback test and find the cause of the error.	Yes
0601	Unit error	Not set		Check the operating environment.	Yes

**Note** 1. Errors indicated by error codes 0101 through 0116 are recorded only when the frame was discarded because transmission was impossible.

## 2. Error Status

The status of each bit indicates that an error has occurred as given in the diagram below.



## 9-4 Cleaning and Inspection

### 9-4-1 Cleaning

Conduct the following periodic cleaning to keep the SYSMAC LINK Support Board in optimum condition.

- Wipe the Unit with a dry, soft cloth daily.
- If glue, vinyl, or tape is left on the Board for long periods of time, it will stain. Remove these items during cleaning.



#### Caution

Do not use volatile solvents such as benzene or paint thinner, or chemical cloths for cleaning. They will damage the quality of the coating on the Board.

### 9-4-2 Inspection

SYSMAC LINK Support Boards must be inspected on a regular basis to ensure correct operation. Inspections should be conducted once every 6 to 12 months. If the Board is subject to extremes in temperature or humidity, inspections should be conducted on a more regular basis.

### Tools and Equipment Need for Inspection

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

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

**Inspection Items**

Inspect the following items to see if they deviate from the prescribed standards. If any items do deviate from the standard either adjust so they are within the operating range or adjust the Board accordingly.

Item	Description	Inspection instrument
Ambient conditions	Temperature: 5° to 45°C	Thermometer
	Humidity: 8% to 80% (no condensation or freezing)	Hygrometer
	Dust-free	Sight
Installation	Board securely attached? Communications cable connectors tight? Communications cables securely locked into place? Communications cabling used for external wiring intact (no breaks)?	Sight
Optical fiber deterioration	Optical loss increasing?	Confirm that optical loss has not increased since installation. 50/125 μm: 3.0 db/km 62.5/125 μm: 3.5 db/km

**9-5 Handling Precautions**

The SYSMAC LINK Support Board is a Network device. If the Board is damaged, it will affect the entire Network, so always ensure repairs are undertaken immediately. We recommend that you have a spare SYSMAC LINK Support Board on hand so that repairs may be conducted quickly.

**9-5-1 Replacing the Unit**

Observe the following precautions when replacing the Board.

- Always turn OFF the power to the computer before replacing the Board.
- Check that the new Board is not faulty.
- If you suspect that a poor connection is the cause of a malfunction, clean the connector terminals using a clean, soft cloth and industrial-grade alcohol. Remove any lint or threads left from the cloth, and remount the Board.
- When returning a faulty Board for repairs, always attach a detailed fault report to the Unit and return to you nearest OMRON outlet as listed at the back of this manual.

**Note** In order to prevent faulty operation be sure to turn off the power to all nodes before replacing the Board.

**9-5-2 Replacing the Board**

- Note**
1. When replacing the Board, do not reconnect that node to the Network before carrying out the procedures listed below. In particular, a node with a low node address setting will become the polling node and communicate the initial network parameter status to other nodes, so there is the chance that network parameters in the entire Network will be damaged.
  2. The data link table, network parameters, and routing table are stored in the SYSMAC LINK Support Board's EEPROM. When the Board has been replaced, make these settings again before starting operation.

The following procedure can be used to automatically set the network parameters in EEPROM from other nodes operating on the network. The data link tables will need to be reset from the FinsGateway's SLK Data Link Setting utility.

- 1, 2, 3...
  1. Turn OFF the power supply to the computer containing Board to be replaced.
  2. Detach the communications cables attached to the SYSMAC LINK Support Board to be replaced and remove the Board.
  3. Set the new SYSMAC LINK Support Board's ID switch to the same setting that was set on the previous Board.
  4. Mount the SYSMAC LINK Support Board in the expansion slot of the computer and connect the communications cables.
  5. Turn ON the power supply to the computer where the Board was replaced and open the FinsGateway settings.
  6. Use the following procedure to set the Board as a polled node.
    - a) Click the **Basic** Tab in the FinsGateway Settings.
    - b) Click the **Drivers** Icon.
    - c) Select **SLK (PCI)** and click the **Properties** Button.
    - d) Select the Board to be set and click the **Change** Button.
    - e) Click the **Driver** Tab in the **SYSMAC LINK (PCI) Lists** Dialog Box.
    - f) Remove the check from the setting for the polling unit.
    - g) Click the **OK** Button.
  7. Use the following procedure to start the SLKPCI-UNIT service from the FinsGateway Settings so the Board will participate in the network.
    - a) Click the **Basic** Tab in the FinsGateway Settings.
    - b) Click the **Services** Icon.
    - c) Select **SLKPCI-UNIT** and click the **Start** Button.
  8. Using the SLK Data Link Setting Utility in the FinsGateway or the SYSMAC LINK Support Software, read the network parameters and make sure the Network is operating normally.
  9. Using the SLK Data Link Setting Utility in the FinsGateway, register data link tables and routing tables in the new Board.
  10. Change the Board to the polling node from the FinsGateway Settings, reversing the procedure in step 6., above. The RUN and INS indicators should light on the Board. The LNK indicator may also light.
  11. Check that the data links are operating normally by using the SLK Data Link Setting Utility in the FinsGateway.

**Note** The following procedure can be used to start the SLK Data Link Setting Utility in FinsGateway.

- 1, 2, 3...
  1. Click the **Basic** Tab in the FinsGateway Settings.
  2. Click the **Networks** Icon.
  3. Select the desired Board and click the **Properties** Button.
  4. Click the **Data Links** Tab.
  5. Click the **Set Data Links** Tab.

Refer to FinsGateway online help for details.

## Appendix Standard Models

### SYSMAC LINK Support Boards for PCI Bus

Applicable computer	Connection type	Model number	Remarks
IBM PC/AT or compatible	Coaxial	3G8F7-SLK21-E	Include FinsGateway SYSMAC LINK (PCI) Embedded Edition (Version 3)
	Optical	3G8F7-SLK11-E	

### SYSMAC LINK Support Boards for ISA Bus

Applicable computer	Connection type	Model number	Remarks
IBM PC/AT or compatible	Coaxial	3G8F5-SLK21-E	---

### SYSMAC LINK Units

Applicable PC	Connection type	Model number	Remarks
CV-series PCs	Coaxial	CV500-SLK21	---
	Optical	CV500-SLK11	
C200HX/HG/HE PCs	Coaxial	C200HW-SLK23/24	
C1000H/C2000H PCs	Coaxial	C1000H-SLK21-V	
	Optical	C1000H-SLK11	
CS1-series PCs	Coaxial	CS1W-SLK21	
	Optical	CS1W-SLK11	

### Specified Coaxial Cable and Accessories

Item	Model number	Manufacturer
Coaxial cable	5C-2V	---
F-type Adapter	C1000H-CE002	OMRON
Terminator	C1000H-TER01	OMRON

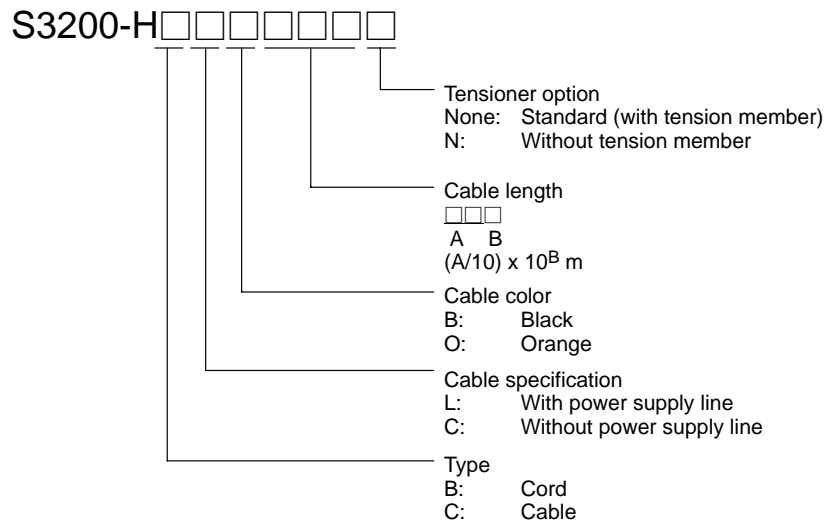
### Connectors and Tools for Optical Fiber Cable

Name	Model	Remarks
Optical Connector	S3200-COCF2011	Connects a cable to a node. Two connectors are required for each cable. (Full-lock connector for crimp-cut cable.)
	S3200-COCF2511	Connects a cable to a node. Two connectors are required for each cable. (Half-lock connector for crimp-cut cable.)
	S3200-COIAT2000	Connects two cables. One adapter is required to connect two cables.
Optical Fiber Assembly Tool	S3200-CAK1062	For the S3200-COCF2011/2511 Connectors
Optical Power Tester	S3200-CAT2700	S3200-CAT2702 Head Unit, For the S3200-COCF2011/2511 Connectors
Master Fiber Set	S3200-CAT2001H	For the S3200-COCF2011/2511 Connectors

## Indoor H-PCF Optical Fiber Cables

Name	Specifications		Model
H-PCF cables	Black	10 m	S3200-HCCB101
		50 m	S3200-HCCB501
		100 m	S3200-HCCB102
		500 m	S3200-HCCB502
		1,000 m	S3200-HCCB103
	Orange	10 m	S3200-HCCO101
		50 m	S3200-HCCO501
		100 m	S3200-HCCO102
		500 m	S3200-HCCO502
		1,000 m	S3200-HCCO103

**Note** The Optical Fiber Cable model numbers are as follows.



## Indoor H-PCF Optical Fiber Cable with Connectors

The following Optical Fiber Cables are available with Connectors already attached. (These cables have power supply lines and tension members, which aren't used in the SYSMAC LINK Network.)

Specifications	Length	Model
Optical Fiber Cable Connectors: S3200-COCF2011 ↓ S3200-COCF2011	2 m	S3200-CN201-20-20
	5 m	S3200-CN501-20-20
	10 m	S3200-CN102-20-20
	15 m	S3200-CN152-20-20
	20 m	S3200-CN202-20-20
	Over 20 m	S3200-CN-20-20 (Specify length (m) when ordering.)
Optical Fiber Cable Connectors: S3200-COCF2011 ↓ S3200-COCF2511	2 m	S3200-CN201-20-25
	5 m	S3200-CN501-20-25
	10 m	S3200-CN102-20-25
	15 m	S3200-CN152-20-25
	20 m	S3200-CN202-20-25
	Over 20 m	S3200-CN-20-25 (Specify length (m) when ordering.)

Specifications	Length	Model
Optical Fiber Cable Connectors: S3200-COCF2511	2 m	S3200-CN201-25-25
↓	5 m	S3200-CN501-25-25
S3200-COCF2511	10 m	S3200-CN102-25-25
	15 m	S3200-CN152-25-25
	20 m	S3200-CN202-25-25
	Over 20 m	S3200-CN-25-25 (Specify length (m) when ordering.)

**Note** Special training is required to assemble Optical Fiber Cables and connectors with epoxy adhesive. Contact your OMRON dealer for details on other optical fiber cords and cables.



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