

SYSMAC

3G8F7-CLK13-E (Optical Ring, H-PCF Cable)

3G8F7-CLK12-EV1 (Optical Ring, H-PCF Cable)

3G8F7-CLK53-E (Optical Ring, GI Cable)

3G8F7-CLK52-EV1 (Optical Ring, GI Cable)

3G8F7-CLK23-E (Twisted-pair Cable)

3G8F7-CLK21-EV1 (Twisted-pair Cable)

Controller Link Support Boards for PCI Bus

OPERATION MANUAL

OMRON

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3G8F7-CLK21-EV1 (Twisted-pair Cable)

**Controller Link Support Boards for PCI Bus
Operation Manual**

Revised December 2018

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. Additionally, there may be severe property damage.
-  **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
-  **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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About this Manual:

This manual describes the operation of the 3G8F7-CLK13-E, 3G8F7-CLK12-EV1, 3G8F7-CLK53-E, 3G8F7-CLK52-EV1, 3G8F7-CLK23-E, and 3G8F7-CLK21-EV1 Controller Link Support Boards for PCI Bus and includes the sections described below. Controller Link Support Boards are used to connect IBM PC/AT or compatible computers to a Controller Link Network. The following three manuals are directly related to application of the Controller Link Network.

Name	Contents	Cat. No. (suffixes omitted)
3G8F7-CLK13-E, 3G8F7-CLK12-EV1, 3G8F7-CLK53-E, 3G8F7-CLK52-EV1, 3G8F7-CLK23-E, 3G8F7-CLK21-EV1 Controller Link Support Boards for PCI Bus Operation Manual (this manual)	Operating procedures for Controller Link Support Boards for PCI bus connections. Controller Link Support Boards are used to connect IBM PC/ATs or compatibles to a Controller Link Network.	W383
3G8F7-CLK13-E, 3G8F7-CLK12-EV1, 3G8F7-CLK53-E, 3G8F7-CLK52-EV1, 3G8F7-CLK23-E, 3G8F7-CLK21-EV1 Controller Link Support Boards for PCI Bus Installation Guide	Installation and setup procedures for Controller Link Support Boards for PCI bus connections. Controller Link Support Boards are used to connect IBM PC/ATs or compatibles to a Controller Link Network.	W467
3G8F5-CLK11-E, 3G8F5-CLK21-E Controller Link Support Boards for ISA Bus Operation Manual	Installation, setup, and operating procedures for Controller Link Support Boards for ISA bus connections. Controller Link Support Boards are used to connect IBM PC/ATs or compatibles to a Controller Link Network.	W307
C200HW-ZW3AT2-E-V2 Controller Link Support Software Operation Manual	Installation and operating procedures for the Controller Link Support Software. The Controller Link Support Software enables manually set data links and other procedures for a Controller Link Network.	W369
CS1W-CLK23, CS1W-CLK21-V1, CJ1W-CLK23, CJ1W-CLK21-V1, C200HW-CLK21, CVM1-CLK21, CQM1H-CLK21 Controller Link Units (Wired and Optical) Operation Manual	Installation, setup, and operating procedures for the Optical and Wired Controller Link Units. Controller Link Units are used to connect C200HX/HG/HE, CV-series, and CS1-series PLCs to a Controller Link Network.	W309
CS1W-CLK13, CS1W-CLK12-V1, CVM1-CLK12, CS1W-CLK53, CS1W-CLK52-V1, CVM1-CLK52 Optical Ring Controller Link Units Operation Manual	Installation, setup, and operating procedures for the Optical Ring Controller Link Units. Controller Link Units are used to connect C200HX/HG/HE CV-series, and CS1-series PLCs to a Controller Link Network.	W370

About this Manual, Continued

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 Controller Link Support Board.

Section 1 outlines the functions of the Controller Link Support Board, including applications, and the differences between the Controller Link Support Board and the Controller Link Unit.

Section 2 describes how to wire the power supply cables and communications cables to the Controller Link Support Board.

Section 3 describes creating applications (user programs) that control the Controller Link Support Board.

Section 4 details the C-language library functions supported by the Controller Link Support Board.

Section 5 describes how to use data links in a Controller Link Network.

Section 6 explains how to use the message service provided by a Controller Link Support Board.

Section 7 describes the method used to connect multiple networks.

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

Section 9 provides information on troubleshooting errors that occur during Controller Link 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.

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PRECAUTIONS

This section provides general precautions for using the Controller Link Support Board for PCI Bus and related devices.

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

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1 Intended Audience

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

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

2 General Precautions

The user must operate the product according to the performance specifications described in the 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 Controller Link Support Board for PCI Bus 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 Controller Link Support Board for PCI Bus 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 Controller Link Support Board for PCI Bus to the above mentioned applications.

3 Safety Precautions

 **WARNING** Never attempt to disassemble any Controller Link Support Board for PCI Bus 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), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the Programmable Controller or another external factor affecting the operation of the Programmable Controller. "Programmable Controller" indicates the CPU Unit and all other Units and is abbreviated "PLC" in this manual. Not doing so may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

- The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. Unexpected operation, however, may still occur for errors in the I/O control section, errors in I/O memory, and other errors that cannot be detected by the self-diagnosis function. As a countermeasure for all such errors, external safety measures must be provided to ensure safety in the system.
- The PLC outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- Provide measures in the computer system and programming to ensure safety in the overall system even if communications errors or malfunctions occur in data link communications or remote I/O communications.
- When the 24-VDC output (service power supply to the PLC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

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

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

 **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 Controller Link Support Board for PCI Bus 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 Controller Link Support Board for PCI Bus 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 Controller Link Support Board for PCI Bus or the computer into which it is installed.

Note Refer also to *1-4 Applications 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 Ω 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 Controller Link Support Board for PCI Bus 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 Controller 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.

6 Conformance to EC Directives

6-1 Applicable Directives

- EMC Directives

6-2 Applicable Directives

EMC Directives

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

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

Note Applicable EMC (Electromagnetic Compatibility) standards are as follows:

EMS (Electromagnetic Susceptibility):	EN61000-6-2
EMI (Electromagnetic Interference):	EN61000-6-4

6-3 Applicable Directives

The 3G8F7-CLK13-E, 3G8F7-CLK12-EV1, 3G8F7-CLK53-E, 3G8F7-CLK52-EV1, 3G8F7-CLK23-E, and 3G8F7-CLK21-EV1 Controller Link Support Boards comply with EC Directives. To ensure that the machine or device in which any of these Controller Link Support Boards is used complies with EC directives, the Board must be installed as follows:

- 1,2,3...**
1. Reinforced insulation or double insulation must be used for the DC power supplies used for the communications and I/O power supplies.
 2. Controller Link Support Boards complying with EC Directives also conform to the Common Emission Standard (EN61000-6-4). Particularly for the 10-m radiated emission, the structure of the control panel, relations to other connected devices, and wiring can affect compliance of the overall system. The customer must, therefore, perform final checks to confirm that devices and the overall machine conform to EC standards even when individual devices conform.
 3. For the Controller Link Support Boards, the backup power supply that is used may affect compliance for surge immunity (IEC61000-4-5) even though common immunity (EN61000-6-2) standards for EMS are met. Either use the recommended OMRON Power Supply (S82K Series) or take countermeasures for surge on the primary side.

SECTION 1

Outline of Functions

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

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1-1 Overview

1-1-1 What Is the Controller Link?

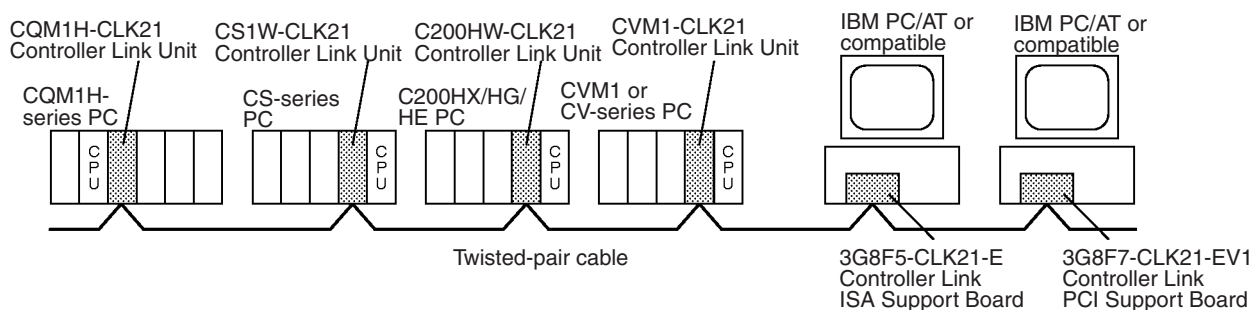
The Controller Link is an FA network that can send and receive large data packets flexibly and easily among advanced OMRON Programmable Controllers (CS-series, CJ-series, C200HX/HG/HE-series, CQM1H-series, CVM1, and CV-series PCs) and IBM PC/AT or compatible computers.

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

The network is connected using either shielded twisted-pair cable or optical fiber cable, and high-volume data transmissions at high speed enable construction of a wide range of networks, from low-level systems to high.

Wired System (Twisted-pair Cable)

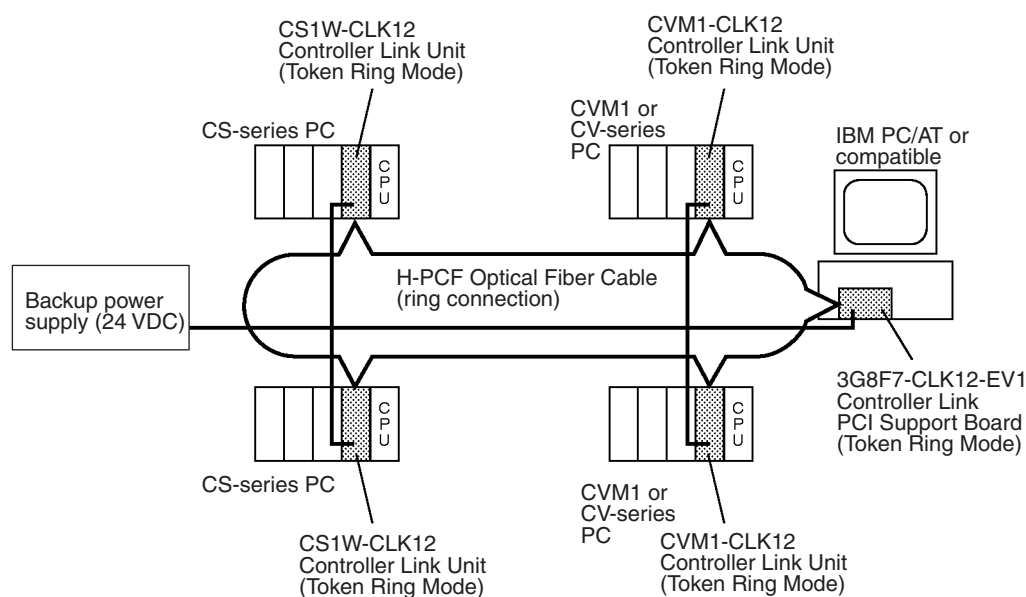
Wired Systems are supported by CS-series, CJ-series, C200HX/HG/HE, CQM1H-series CVM1, and CV-series PCs.

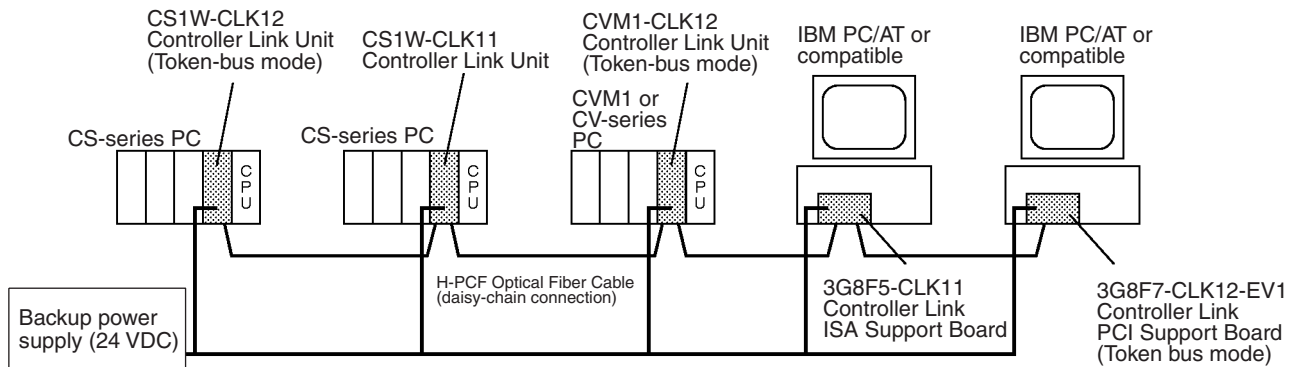


Optical Bus or Optical Ring System (H-PCF Cable)

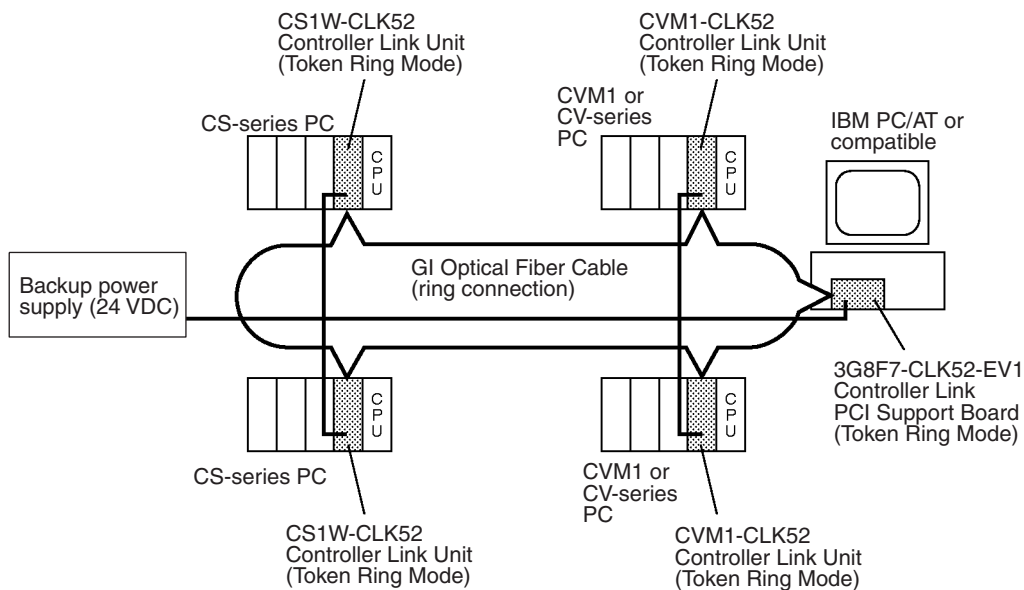
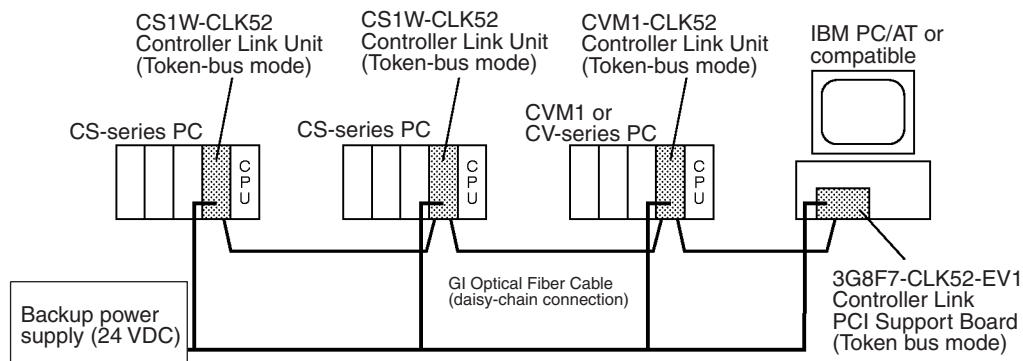
Optical Systems are supported by CS-series, CVM1, and CV-series PCs.

Token Ring Mode

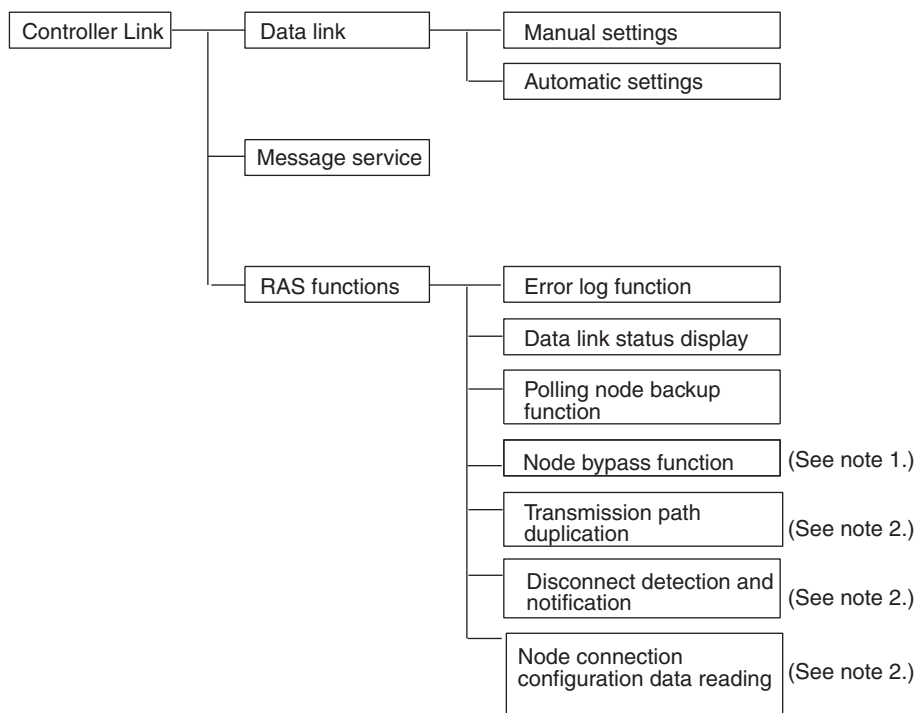


Tokenbus Mode**Optical Bus or Optical Ring System (GI Cable)**

Optical Systems are supported by CS-series, CJ-series, CVM1, and CV-series PCs.

Token Ring Mode**Token-bus Mode**

The functions of a Controller Link Network are outlined below.



- Note**
1. Optical Systems and Optical Ring Systems only.
 2. Only for Optical Ring Systems in Token Ring Mode.

1-1-2 Features

The Controller 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 for large capacities of data as listed below.

Item		Specifications	
Number of data link words	Send areas per node	CS or CJ Series	CS1W-CLK23 or CJ1W-CLK23: 4,000 words max. CS1W-CLK21-EV1 or CJ1W-CLK21-EV1: 1,000 words max.
		C200HX/HG/HE, CVM1/CV, CQM1H	1,000 words max.
		Computers	3G8F7-CLK23-E: 4,000 words max. 3G8F7-CLK21-EV1, 3G8F5-CLK21-E1: 1,000 words max.
	Data link areas (send and receive) that can be created per node	CS or CJ Series	CS1W-CLK23 or CJ1W-CLK23: 20,000 words max. CS1W-CLK21-EV1 or CJ1W-CLK21-EV1: 20,000 words max. (unit version 1.2 or later) 12,000 words max. (Pre-Ver. 1.2)
		C200HX/HG/HE, CVM1/CV, or CQM1H	8,000 words max.
		Computers	32,000 or 62,000 words max. (See note 2.)

Note The following models must be used to create a wired network that contains more than 32 nodes: 3G8F7-CLK23-E, 3G8F7-CLK21-EV1, CS1W-CLK23, CS1W-CLK21-V1, CJ1W-CLK23, and CJ1W-CLK21-V1.

Data links can be automatic set, or they can be set 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 users to receive only the required data, thereby increasing data link efficiency.

Message Service

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

Twisted-pair Cable or Optical Fiber Cable Connection

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

Features of Twisted-pair Cable

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

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

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

Features of Optical and Optical Ring Systems

Optical fiber cable (H-PCF cable or GI 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 using adhesive polishing). With GI cable, the communications distance can be up to 30 km (2 km max. between nodes using 62.5/125 μm cable), which allows long-distance and large-scale networks.

Once the optical fiber cable has been fitted with special connectors, the cables can be easily connected or disconnected.

Communications between Different PCs

The following Controller Link Units are available for communications between different PCs. Wired Units and Optical Units, however, cannot be used together in the same Controller Link Network. (Optical and Optical Ring Units can exist in one Controller Link Network using H-PCF cables, but with GI cables, on an Optical Ring Unit is available.)

Wired System

- Controller Link Unit for CS-series Programmable Controllers
- Controller Link Unit for CJ-series Programmable Controllers
- Controller Link Units for C200HX/HG/HE Programmable Controllers
- Controller Link Units for CV-series Programmable Controllers
- ISA Bus Controller Link Support Board for IBM PC/AT or compatibles

- PCI Bus Controller Link Support Board

Optical Ring System with H-PCF Cables

- Controller Link Unit for CS-series Programmable Controllers
- Controller Link Unit for CVM1/CV-series Programmable Controllers
- PCI Bus Controller Link Support Board

Optical Ring System with GI Cables

- CS-series and CJ-series Programmable Controllers
- CVM1/CV-series Programmable Controllers
- PCI Bus Boards

Optical System with H-PCF Cables

- Controller Link Unit for CS-series and CJ-series Programmable Controllers
- ISA Bus Controller Link Support Board for IBM PC/AT or compatibles

Flexible Internetwork Connections

The Controller Link Network can be connected to another network (Ethernet, SYSMAC NET Link, SYSMAC LINK, or another Controller Link network) through a CS-series or CV-series PC. By installing Ethernet, SYSMAC NET Link, or SYSMAC LINK, or Controller Link Communications Units on the same CS1-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.

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 Controller Link Unit and Support Board status are also available, as are the data link and network status.

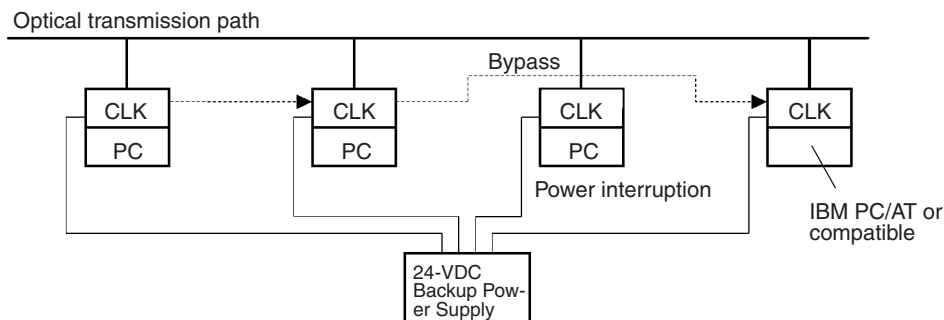
Polling Node Backup Function

When an error occurs in the polling node that controls the Controller Link Network, another node automatically becomes the polling node with the help of the Polling node backup function. 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 or Optical Ring Controller 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 Controller Link Unit/Support Board.



Transmission Path Duplication	In Token Ring Mode in an Optical Ring System (H-PCF cable or GI cable), data transmission will be unaffected even by a cable or connector break at one location in the ring connection. With the optical cable wired in a ring shape, a break at one point will simply cause the transmission to be routed on the other path.
Disconnect Detection and Notification	Even with transmission path duplication, the network will be broken if disconnections occur in two or more places. In Token Ring Mode in an Optical Ring System (H-PCF cable or GI cable), the location of a disconnection can be detected and identified by means of the node status information given for all nodes. This function can be used to prevent system crashes in advance, e.g., by performing maintenance when a disconnection occurs at one location.
Node Connection Configuration Data Reading	In Token Ring Mode in an Optical Ring System (H-PCF cable or GI cable), connection data can be read for all of the nodes in the network. The information that can be read includes the order in which the nodes are connected and which of two optical connectors is connected to which node. Special support software (Controller Link Support Software, Ver. 2.00 or later) is required to read the node connection configuration data.

Using Repeater Units for T-Branches, Network Extensions, Network Expansions, Converting Network Sections to Optical Fiber, and Device Modularization

T-Branches enable greater wiring freedom during layout, restructuring, and expansion of networks.

Wire-to-Wire Repeater Units enable Controller Link T-Branches. T-Branches provide the following advantages:

- Cabling can conform to the layout of equipment.
- It is possible to add nodes by adding or inserting Repeater Units at branch points of an existing wired Controller Link system.
- If Repeater Units are installed at likely future branch points in the network in advance, new nodes can be added by simply connecting them to these Repeater Units.

The total length of wired networks can be extended.

At a baud rate of 2 Mbps, conventional wired networks can be up to 500 m long. By using two Repeater Units, this can be extended to a maximum of 1.5 km.

The maximum number of nodes can be extended to 62 for wired networks.

By combining version-1 Controller Link Units/Support Boards and a Repeater Unit, it is possible to construct networks containing up to 62 nodes.

Improved noise resistance through the use of optical cabling.

By installing two Wire-to-Optical Repeater Units, optical cabling can be used for sections of the network that are the source of noise.

Devices can be modularized.

- Devices can be modularized according to Repeater Units, making wiring easier when adding, removing, or modifying devices.
- When starting up devices, components can be added to the network and debugged as they are completed.

Refer to the *Controller Link Unit Operation Manual* (W309) for information on using Repeater Units.

Features and Functions of Version-1 and CLK23 Models

The following features and functions apply to the CS1W-CLK23, CS1W-CLK21-V1, CJ1W-CLK23, and CJ1W-CLK21-V1 Controller Link Units and the 3G8F7-CLK23-E and 3G8F7-CLK21-EV1 Controller Link Support Board only.

Up to 62 nodes can be connected.

Overview

When a CS1W-RPT01 Repeater Unit is used, the maximum number of nodes that can be used in the network increases to 62. (The previous limit was 32.)

Method

Use Repeater Units and select *Max Node Number set 62* in the FinsGateway drive settings to enable a maximum of 62 nodes.

Restrictions

- The maximum of 62 nodes cannot be achieved if pre-version-1 models are used together in the same network with version-1 models or with CLK23 models (i.e., the CS1W-CLK23, CJ1W-CLK23, or 3G8F7-CLK23-E).
- Using the maximum 62 nodes can be enabled using FinsGateway 2003. This setting is not possible with FinsGateway version 3.□□.

Automatic data link creation is possible with 1:N allocations.

Overview

It is possible to perform unequal 1:N allocations of data between nodes with automatic data link creation. This makes it easy to perform data links that formerly required the user to manually edit data link parameters.

The following four automatic data link creation patterns can be used:

- Equality layout (the previous pattern)
- 1:N allocation, common type
- 1:N allocation, 1 to 1 type
- 1:N allocation, chain type

This setting can be made in CS-series or CJ-series Controller Link Units.

Method

Allocation addresses and sizes are all specified using the Automatic Data Link Creation Parameters (D30000 × Unit No. + 12 to 20) in the DM Parameter Area. These values can be set using the CX-Net in the CX-Programmer version 3.2 or later.

Objective

This function is effective in applications that collect data from slave PCs into a master PC.

Restrictions

- A Controller Link Support Board cannot be set as the startup node.
- These settings can be made using FinsGateway 2003. They are not possible with FinsGateway version 3.□□.

Automatic data link creation with 1:N allocations cannot be performed if pre-version-1 models are used together in the same network with version-1 models or with CLK23 models (i.e., the CS1W-CLK23, CJ1W-CLK23, or 3G8F7-CLK23-E).

Change manually created data link tables during data link operation.

Overview

It is possible to modify a manually created data link table while data links are running.

Note This is possible only with manually created data link tables. Any attempt to change automatically created data link tables when data links are running will fail and an error message saying that the tables cannot be edited during data link operation will be displayed.

Method

This function can be set using the CX-Net in CX-Programmer version 3.2 or later.

Objectives

- In systems that operate non-stop and cannot be turned OFF, this function makes it possible to change the data link table to accommodate the addition of new nodes and to transfer data link tables without having to stop manually set data link communications.
- If this function is combined with the use of Repeater Units to add network nodes, it becomes possible to construct systems of greater flexibility.

Operation

When a node is being modified online, this function temporarily stops refreshing of data link data until modifications have been completed.

Nodes will participate in data links after changes to the data link table have been completed.

Note Refer to the *Controller Link Unit Operation Manual* (W309) for information on changing user-set data link tables while the data links are active.

Overview of 3G8F7-CLK23-E, 3G8F7-CLK13-E, and 3G8F7-CLK53-E Features and Functions

The 3G8F7-CLK23-E, 3G8F7-CLK13-E, and 3G8F7-CLK53-E are upwardly compatible from the 3G8F7-CLK21-EV1, 3G8F7-CLK12-EV1, and 3G8F7-CLK52-EV1, respectively.

The following data link functions have been added to the features and functions of the 3G8F7-CLK21-EV1, 3G8F7-CLK12-EV1, and 3G8F7-CLK52-EV1.

All other functions and performance are the same as for the 3G8F7-CLK21-EV1, 3G8F7-CLK12-EV1, and 3G8F7-CLK52-EV1.

Model number	3G8F7-CLK21-EV1, 3G8F7-CLK12-EV1, or 3G8F7-CLK52-EV1	3G8F7-CLK23-E, 3G8F7-CLK13-E, or 3G8F7-CLK53-E
Number of send words per node (total of area 1 and area 2)	1,000 words max.	4,000 words max.
Number of error log records	39 max.	64 max.

When configuring a system using data links in which the number of send words per node exceeds 1,000 words, all Controller Link Units and Support Boards must be the CS1W-CLK□3, CJ1W-CLK□3, or 3G8F7-CLK□3-E.

When using other Controller Link Units or Support Boards together in the same network, use a maximum of 1,000 send words per node.

Units and Support Boards Supporting Up to 4,000 Send Words Per Node**Wired Networks**

	Model
Units	CS1W-CLK23 (CS-series Unit) CJ1W-CLK23 (CJ-series Unit)
Support Board	3G8F7-CLK23-E (Support Board for PCI Bus)

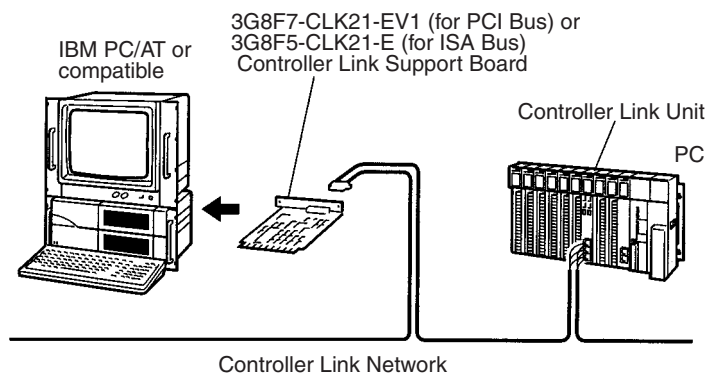
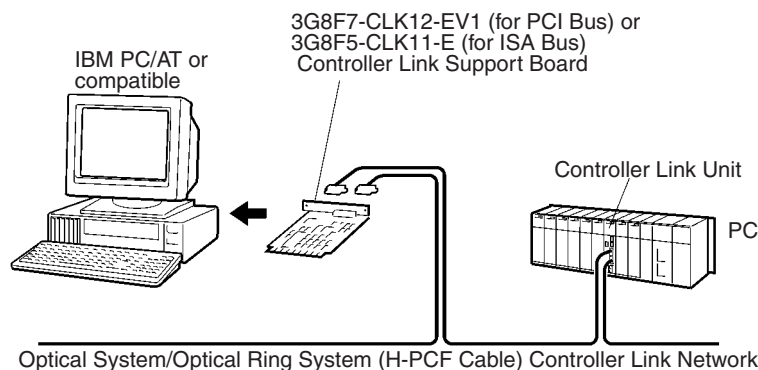
Optical Networks

	Model
Units	CS1W-CLK13 (CS-series Unit, H-PCF Cable) CS1W-CLK53 (CJ-series Unit, GI Cable)
Support Board	3G8F7-CLK13-E (Support Board for PCI Bus, H-PCF Cable) 3G8F7-CLK53-E (Support Board for PCI Bus, GI Cable)

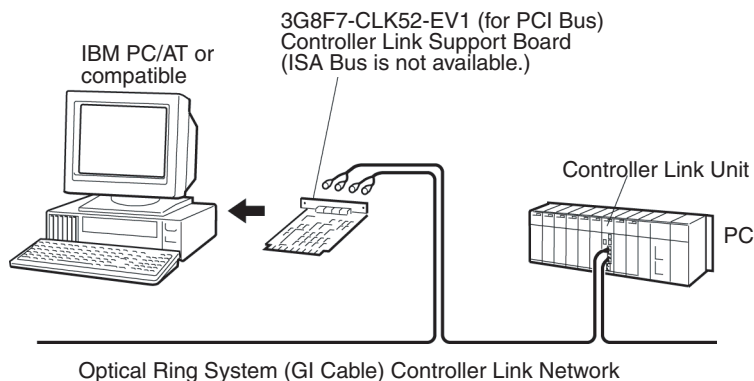
1-1-3 What Is a Controller Link Support Board?

A Controller Link Support Board is used to directly connect an IBM PC/AT or compatible with an ICA or PCI bus to a Controller Link Network. A Controller Link Support Board supports data links, a message service, and RAS functions in the same way as a Controller 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.

Wired System**Optical System/Optical Ring System (H-PCF Cable)**

Optical Ring System (GI Cable)



1-1-4 Features of PCI Bus Controller Link Support Boards

The Controller Link Support Board for PCI Bus can be used to configure various communications applications using FinsGateway Controller Link (PCI).

User application		PLC Reporter 32, DataFlowNavi for Access, AIMAX-FA, etc.
C Library	Compolet	
FinsGateway Controller Link (PCI)		
PCI Bus Controller Link Support Board		

The Board is equipped with the FinsGateway Controller Link (PCI) and C Library (Win32 DLL) as standard features. With the Board, user applications can be created using the C language (Microsoft Visual C++ .NET 2003, Microsoft Visual C++ Ver. 6.0). An overview of how to use the C Library is described later in this manual.

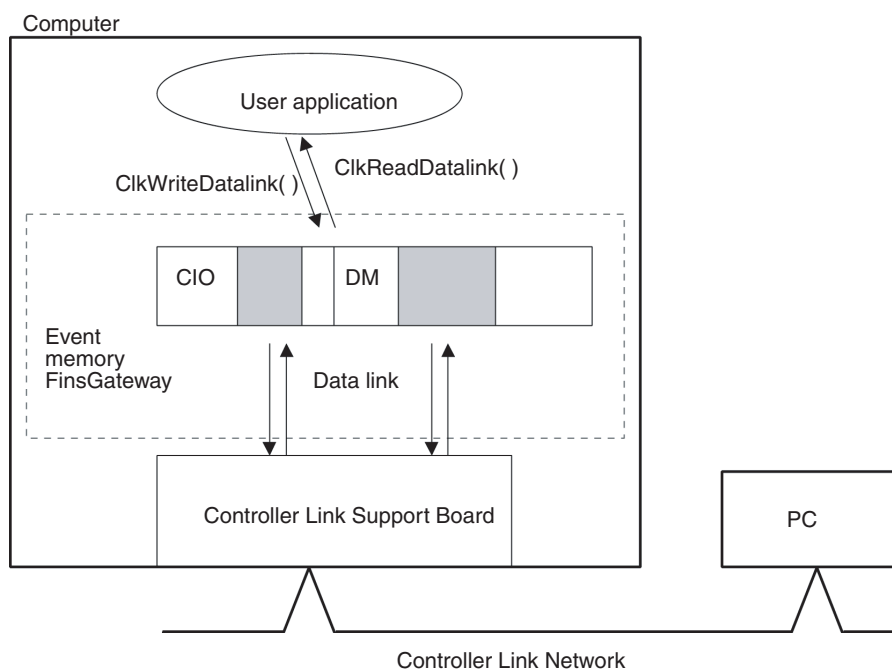
SYSMAC Compolet Version 2 provides ActiveX controls for PC communications. User applications can be created more easily using Microsoft Visual Basic. PLC Reporter 32, DataFlowNavi for Access, and AIMAX-FA are software packages of communications middleware. These software packages must be purchased separately.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

1-1-5 Outline of PCI Bus Controller Link Support Board Functions

Data Links

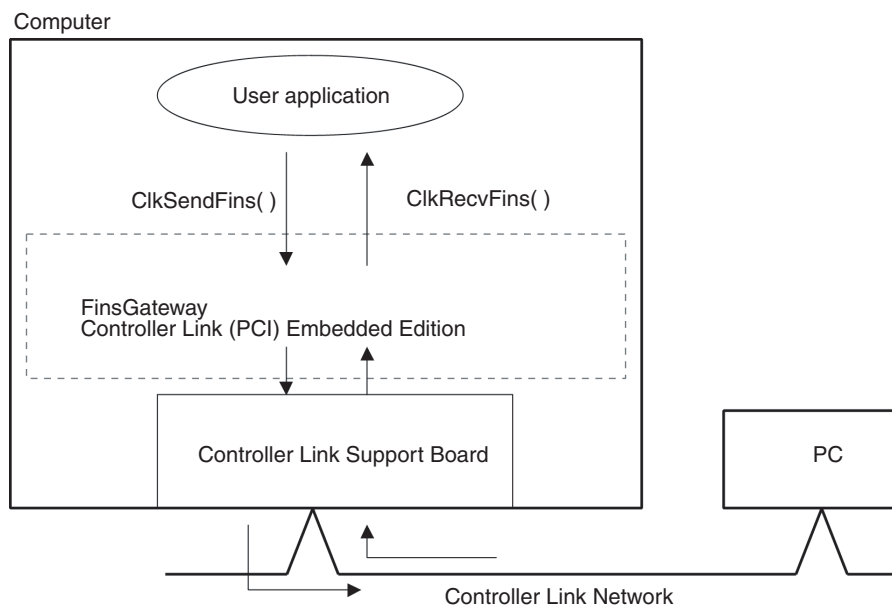
Controller Link Support Board data link data is stored in the event memory in the computer. Event memory is shared memory with names such as DM or CIO, and is stored in the computer memory. Event memory recreates virtually the DM Area and CIO Area of a PC.

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

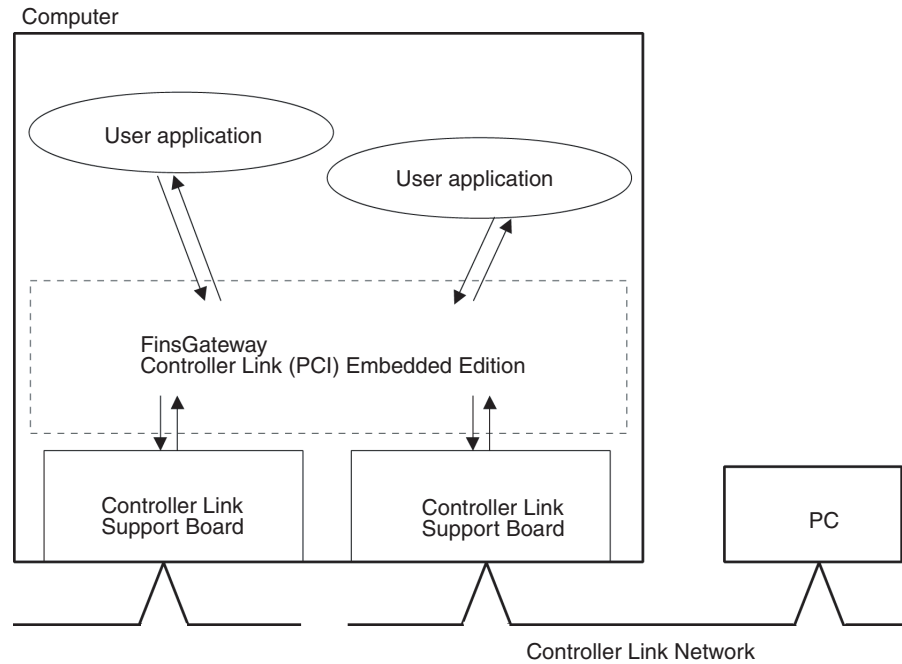


Message Service

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



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

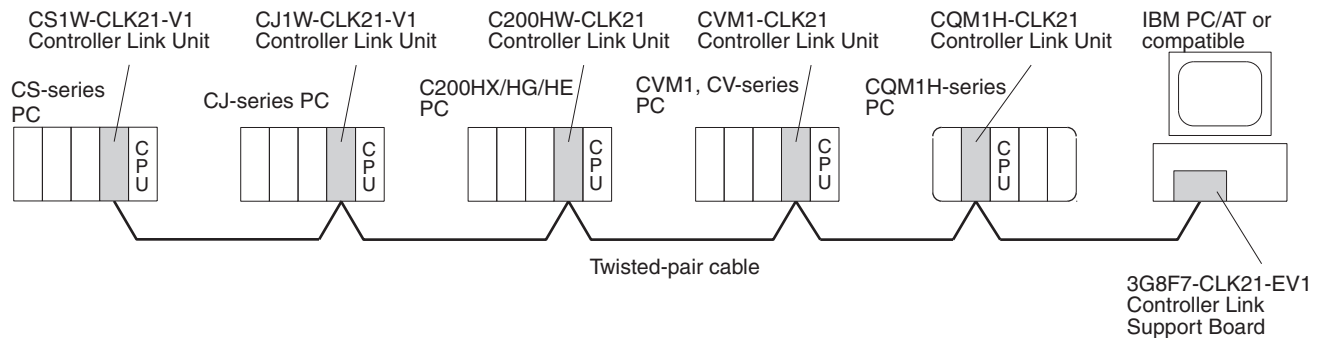


1-2 Specifications and Configurations

1-2-1 System Configuration

Wired System (Twisted-pair Cable)

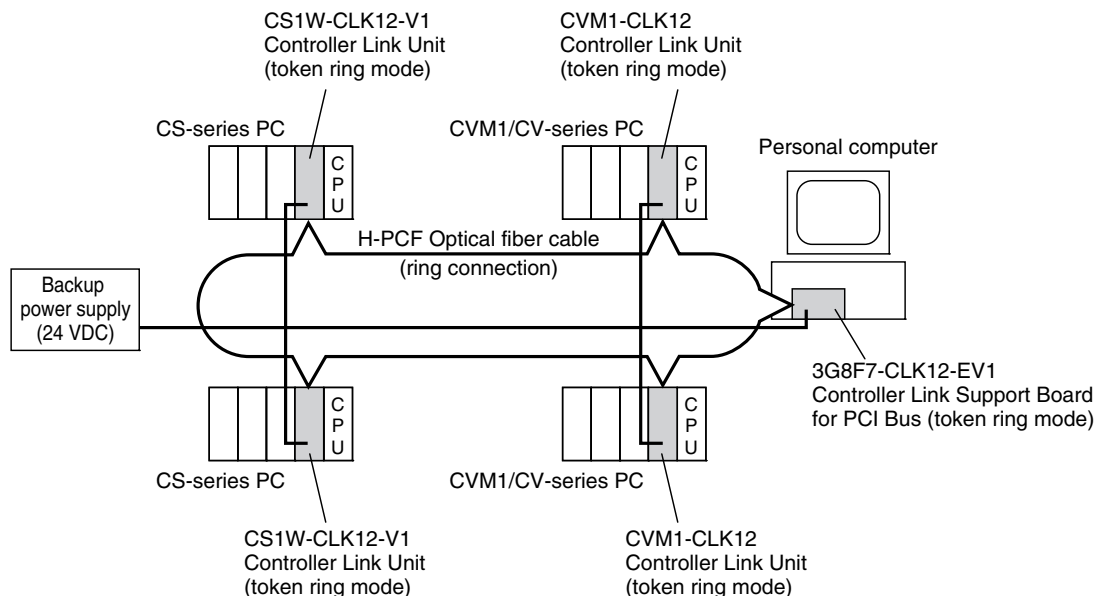
Wired Systems are supported by CS-series, CJ-series, C200HX/HG/HE, CVM1, and CV-series PCs.



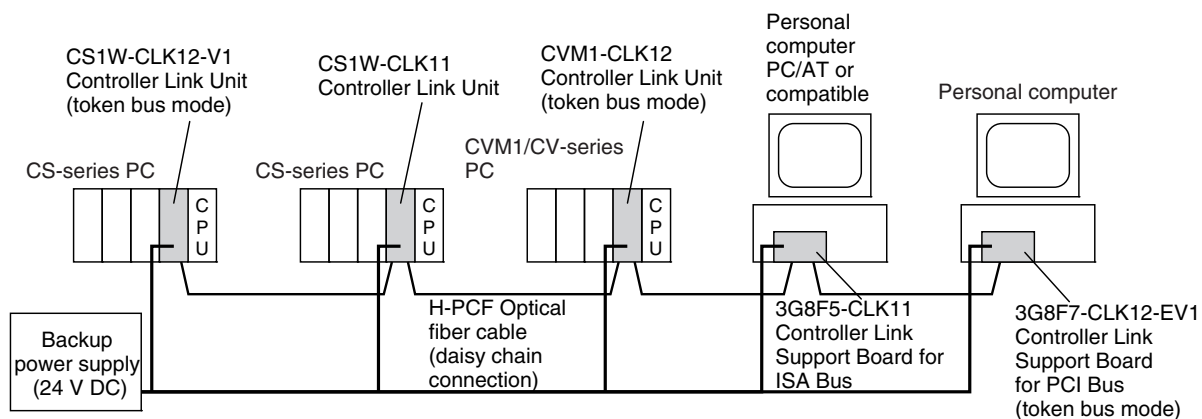
Optical Bus or Optical Ring System (H-PCF Cable)

Optical Systems are supported by CS-series, CVM1, and CV-series PCs.

Token Ring Mode

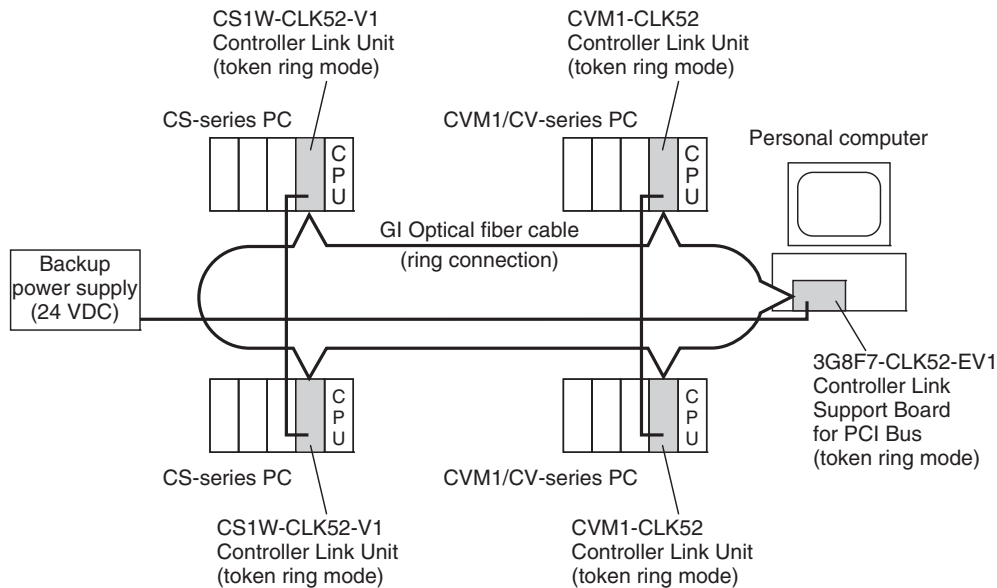
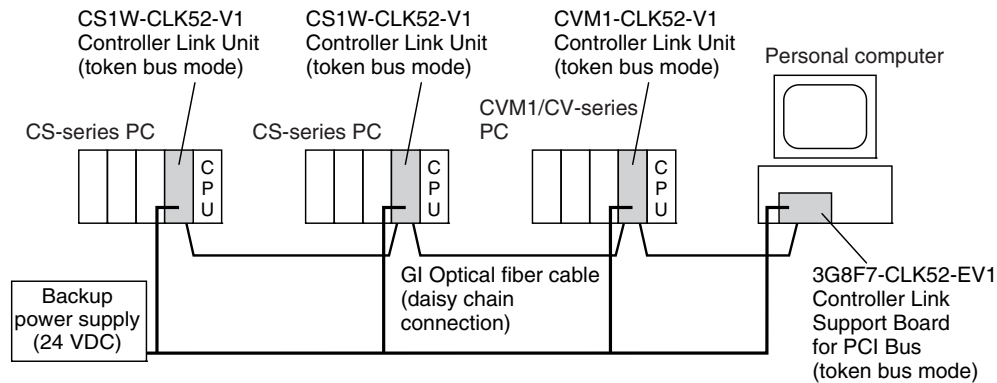


Token-bus Mode



Optical Bus or Optical Ring System (GI Cable)

Optical Systems are supported by CS-series, CVM1, and CV-series PCs.

Token Ring Mode**Token-bus Mode**

Note A maximum of 4 PCI Bus Controller Link Support Boards can be mounted. (Different types of system can be mounted simultaneously.) PCI Bus Controller Link Support Boards can also be used with ISA Bus Controller Link Support Boards. If PCI Bus and ISA Bus Controller Link Support Boards are used together, however, a separate ISA Bus FinsGateway Controller Link Driver is required.

1-2-2 PCI Bus Controller Link Support Board Models

System	Product	Model
H-PCF cable optical ring	Controller Link Support Board for PCI Bus	3G8F7-CLK13-E
GI cable optical ring		3G8F7-CLK12-EV1
Twisted-pair Cable		3G8F7-CLK53-E
		3G8F7-CLK23-E
		3G8F7-CLK21-EV1

1-2-3 Communications Specifications

Optical Ring System (Joint Ring/Daisy Chain Connections)

Items	Specifications	
Type	Optical ring, H-PCF cable	Optical ring, GI cable
Model	3G8F7-CLK13-E 3G8F7-CLK12-EV1	3G8F7-CLK53-E 3G8F7-CLK52-EV1
Communications method	N:N token-ring method (Token Ring Mode) N:N token-bus method (token-bus mode)	
Code	Manchester code	
Modulation	Baseband code	
Synchronization	Flag synchronization (conforms to HDLC frames)	
Transmission path format	Ring method (Token Ring Mode) Daisy-chain method (token-bus mode)	
Transmission speed	2 Mbps	
Maximum transmission distance	20 km	30 km
Maximum distance between nodes	Crimp cut: 800 m Adhesive: 1 km (See note 1.)	62.5/125 μ m: 2 km 50/125 μ m: 1 km
Medium	H-PCF cable (optical two-core cable)	GI cable (optical two-core cable, 62.5/125 μ m or 50/125 μ m)
Node connection method	Connected via a special (full-lock connector) connector. (A half-lock connector can also be used.)	Connected via ST connectors.
Maximum number of nodes	62 nodes (See notes 2 and 3.)	
Communications functions	Data links and message service	
Number of data link words	Transmission area per node: 3G8F7-CLK13-E and 3G8F7-CLK53-E: 4,000 words max. 3G8F7-CLK12-EV1 and 3G8F7-CLK52-EV1: 1,000 words max. Number of data link words that can be used in one network (total transmission): 62,000 words max. (See note 3.)	
Data link areas	FinsGateway Event Memory	
Message length	2,012 bytes max. (including the header)	
RAS functions	Polling node backup function Self-diagnosis function (hardware checking at startup) Echoback test and broadcast test (using the FINS command) Watchdog timer Error log function Node bypass function Transmission path duplication (For ring method in Token Ring Mode only.) Disconnect detection and notification (Token Ring Mode only.) Node connection configuration data reading (For ring method in Token Ring Mode only.)	
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. With the token-bus method, the maximum number of nodes in an Optical Bus System with optical bus nodes (i.e., model numbers ending in CLK11) is 32 (node addresses 1 to 32).
 3. The maximum number of words in an Optical System with optical bus nodes (i.e., model numbers ending in CLK11) is 32,000 words.

Wired System

Items	Specifications
Type	Wired
Model	3G8F7-CLK23-E 3G8F7-CLK21-EV1
Communications method	N:N token bus
Code	Manchester code
Modulation	Baseband code
Synchronization	Flag synchronization (conforms to HDLC frames)
Transmission path form	Multi-drop bus
Baud rate and maximum transmission distance	The maximum transmission distance varies with the baud rate as follows: 2 Mbps: 500 m 1 Mbps: 800 m 500 Kbps: 1 km
Media	Specified shielded twisted-pair cable Number of signal lines: 2, shield line: 1
Node connection method	Connect with provided connector
Maximum number of nodes	32 nodes or 62 nodes
Communications functions	Data links and message service
Number of data link words	Transmission area per node: 3G8F7-CLK23-E: 4,000 words max. 3G8F7-CLK21-EV1: 1,000 words max. Number of data link words in one network (send/receive: 32,000 words max., but 62,000 words max. if the maximum of 62 nodes is used)
Data link areas	FinsGateway event memory
Message length	2,012 bytes max. (including the header)
RAS functions	Polling node backup function Self-diagnosis function (hardware checking at startup) Inter-node test and broadcast test (using the FINS command) Watchdog timer Error log function
Error control	Manchester code check CRC check ($CCITT X^{16} + X^{12} + X^5 + 1$)

Note At least one Repeater Unit is required to construct networks that uses a node address higher than 32. The following Controller Link Units/Support Boards must also be used, and the Wired Network 62 Node Enable Bit of the DM Parameter Area software switch of all nodes must be turned ON (62 nodes max.).

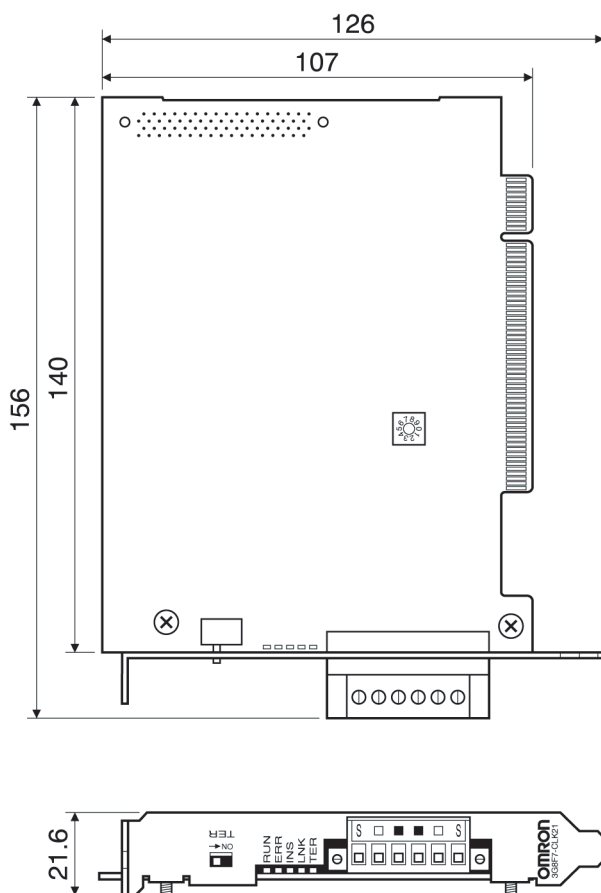
CS1W-CLK23, CS1W-CLK21-V1, CJ1W-CLK23, CJ1W-CLK21-V1, 3G8F7-CLK23-E, and 3G8F7-CLK21-EV1

1-2-4 General Specifications

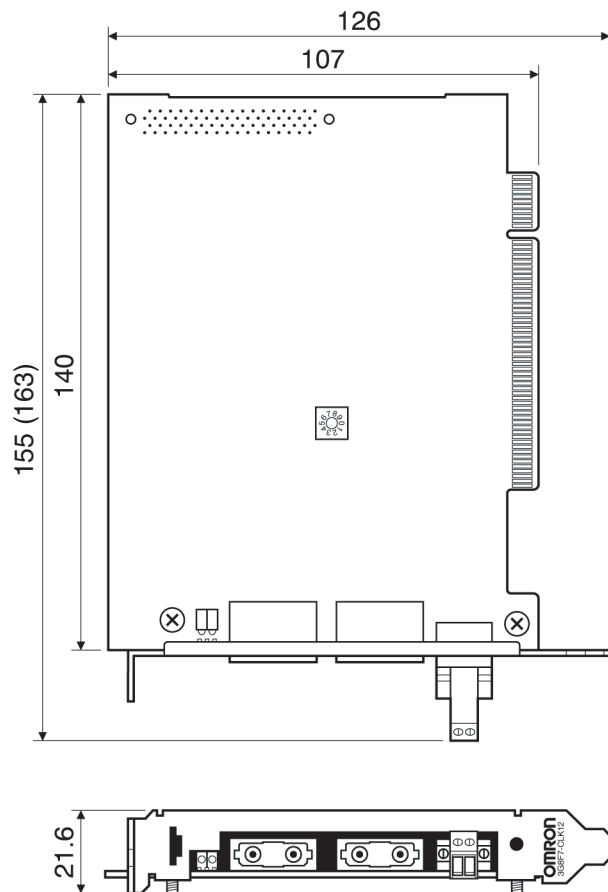
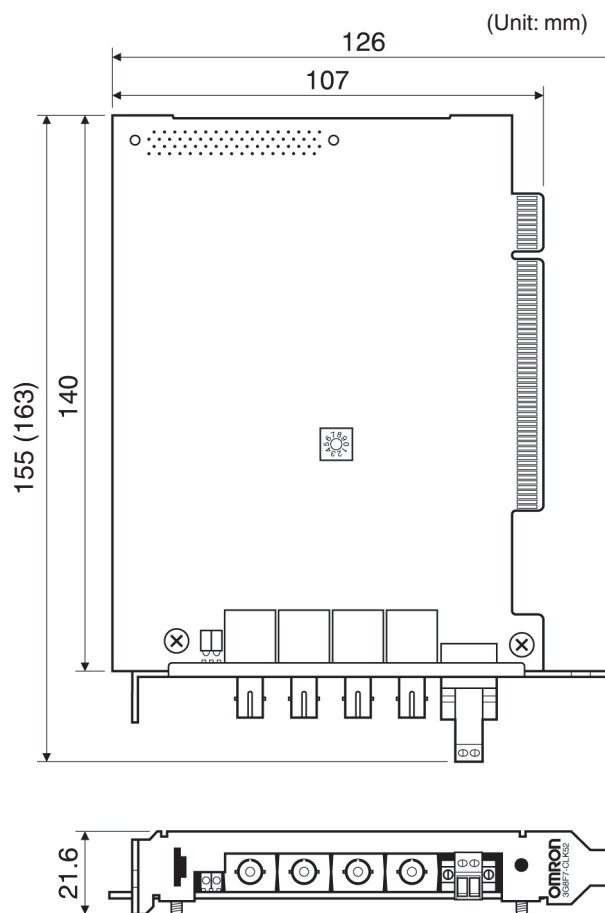
Items	Controller Link Support Board for PCI Bus		
	Wired system: 3G8F7-CLK23-E 3G8F7-CLK21-EV1	Optical system, H-PCF cable: 3G8F7-CLK13-E 3G8F7-CLK12-EV1	Optical system, GI cable: 3G8F7-CLK53-E 3G8F7-CLK52-EV1
External dimensions	106 × 140 mm (W × L)		
Weight	104 g	120 g (excluding mounting bracket)	124 g (excluding mounting bracket)
Current consumption	0.35 A max. at 5 VDC	Without power supply: 0.54 A max. at 5 VDC With power supply: 0.35 A max. at 5 VDC	Without power supply: 0.60 A max. at 5 VDC With power supply: 0.35 A max. at 5 VDC
Installation environment conditions	Same as for computer.		

1-2-5 Dimensions

Wired Models (3G8F7-CLK23-E and 3G8F7-CLK21-EV1)

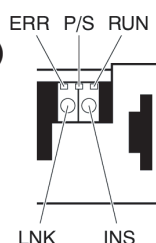


(Unit: mm)

H-PCF Cable Optical Ring Models
(3G8F7-CLK13-E and 3G8F7-CLK12-EV1)**GI Cable Optical Ring Models**
(3G8F7-CLK53-E and 3G8F7-CLK52-EV1)

Note The dimensions given in parentheses are for when the previous connector is mounted.

1-2-6 Indicators

Optical Ring System
(H-PCF Cable and GI Cable)

Wired 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 1.)	Power supply ON	Green	Lit	Backup power supply is ON.
			Not lit	Backup power supply is OFF.
TER (See note 2.)	Terminating resistance setting	Yellow	Lit	Terminating resistance switch is ON (resistance is connected).
			Not lit	Terminating resistance switch is OFF (resistance is not connected).

- Note**
1. The P/S indicator is mounted to the Optical Ring Units only.
 2. The TER indicator is mounted to the Wired Units only.

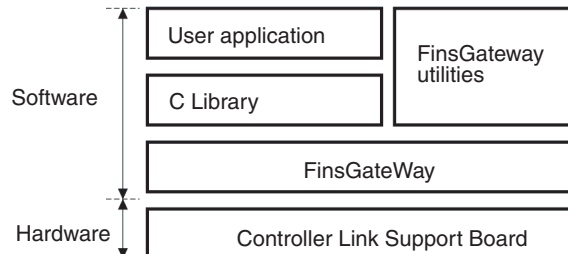
1-2-7 Product Components

System	Model	Contents
Wired system	3G8F7-CLK23-E 3G8F7-CLK21-EV1	Controller Link Support Board × 1 CD-ROM × 1 Installation guide × 1 Communications connector × 1 Board ID switch number/indicator label × 1 User registration card (software license agreement) × 1
Optical ring system, H-PCF cable	3G8F7-CLK13-E 3G8F7-CLK12-EV1	Controller Link Support Board × 1 CD-ROM × 1
Optical ring system, GI cable	3G8F7-CLK53-E 3G8F7-CLK52-EV1	Installation guide × 1 Optical cable bracket × 1 Power supply connector × 1 Board ID switch number/indicator label × 1 User registration card (software license agreement) × 1

- Note**
1. The following software is supplied on the CD-ROM.
 - FinsGateway Version 2003 (PCI-CLK Edition)
 - FinsGateway Version 3 (PCI-CLK Edition)

- Setup Diagnostic Utility
 - C Library
2. The DOS operating system for an IBM PC/AT or compatible is not provided with the Support Board. The operation system must be acquired separately.

1-2-8 Software Configuration



Note A CLK 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 Applicable Computers, Operating Systems, and Libraries

The following table lists the operating environment for Controller Link Support Boards for PCI Bus connections.

Compatible computers	FinsGateway version	Compatible OS	Compatible language
IBM PC/AT or compatible • CPU: Intel Celeron 400 MHz or better • Main memory: 128 MB minimum • 1 or more PCI bus slots (PCI bus revision 2.0 or later, power supply: 5 V) • Free hard disk space: 70 MB min. (not including user applications) • CD-ROM drive: One required for software installation • Display: VGA (640 × 480 (pixels) min.) (Other conditions conform to the OS.)	FinsGateway Version 2003	• Windows 10 Professional (32 bit) • Windows 10 Enterprise (32 bit) • Windows 10 Home (32 bit) • Windows 8.1 Professional (32 bit) • Windows 8.1 Enterprise (32 bit) • Windows 8.1 (32 bit) • Windows 8 Professional (32 bit) • Windows 8 Enterprise (32 bit) • Windows 8 (32 bit) • Windows 7 Professional (32 bit) • Windows 7 Home Premium (32 bit) • Windows Vista Business • Windows Vista Home Premium	Microsoft Visual C++ Ver. 6.0 (Service Pack 3) Microsoft Visual C++ .NET 2003 (When using the C language library provided in the CD-ROM with the product)

- Note**
1. There are two versions for FinsGateway (Version 2003 and Version 3) provided on the CD-ROM that comes with the product. The applicable OS depends on the version of FinsGateway.
 2. When using Windows NT 4.0 (service pack 3 or later), Windows ME, or Windows 98SE, install FinsGateway Version 3. Using version 3 of the FinsGateway, however, with disable the following functions supported by version-1 Controller Link Support Boards for PCI Bus: Automatic 1:N data link allocations, changing data link tables while data links are active, and using 62 wired nodes. Maximum number of data link send words per node: 4,000
 3. Use FinsGateway Version 2003.21 or higher to use up to 4,000 data link send words per node.

4. FinsGateway version 2003.40 is required to use Windows 10 (32 bit), Windows 8 (32 bit), Windows 8.1 (32 bit), Windows 7 (32 bit) or Windows Vista. (The version of FinsGateway that is installed can be confirmed by starting the FinsGateway Settings program and checking the product information provided on the Info Tab Page.)

FinsGateway version	Automatic allocation of 1:N data link tables	Setting 62 wired nodes	Changing data link tables with active data links	Maximum number of data link send words per node: 4,000
FinsGateway Version 2003	Supported.	Supported.	Supported.	Supported. (FinsGateway Version 2003.21 or higher)
FinsGateway Version 3	Not supported.	Not supported.	Not supported.	Not supported.

5. A Controller Link Support Board cannot be used with Windows 95 or Windows NT 3.51 or earlier.
6. Controller Link Support Boards for PCI Bus connection may not operate correctly when used with other computers or operating systems. Always use the Controller Link Support Board with a personal computer and OS that satisfy the above conditions.
7. Controller Link Support Boards conform to PCI Local Bus Specifications, Revision 2.0.
8. User applications can also be written with Microsoft Visual Basic Version 6.0 if the optional SYSMAC Compolet Version 2 is purchased.
9. User applications can also be written with Microsoft Visual Basic .NET or Microsoft Visual Basic .NET 2003 if the optional SYSMAC Compolet Version 2003 is purchased. SYSMAC Compolet Version 2003 can be used only with FinsGateway 2003. Microsoft .NET framework 1.0 or 1.1 is required to use SYSMAC Compolet Version 2003. Refer to the operation manual for SYSMAC Compolet Version 2003 for details.

1-3 Basic Procedures

Initial Procedure

Refer to the *Controller 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 Controller Link Support Software or the FinsGateway utilities, and transfer the data to the Board.

Note When the data link tables and routing tables are transferred to the Controller 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 of the FINS message service, or by using a PC software switch operation.

Message Service Procedure

- 1,2,3...**
1. Create routing tables using the Controller Link Support Software or the Fin-sGateway utilities, and transfer the tables to the Board.
Note When the data link tables and routing tables are transferred to the Controller Link Support Board, they are save 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 Controller Link Support Board is mounted to a computer, make sure that the same Board IDs is not set for more than one Board. Up to 4 Boards can be mounted.

Note Refer to the *Controller Link Support Board Installation Guide* (W467).

Terminating Resistance Switch (Wired Systems Only)

Turn ON the terminating resistance switch only for the nodes at both ends of a wired Controller Link Network and turn OFF the switch for all other nodes.

Note Refer to the *Controller Link Support Board Installation Guide* (W467).

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*.

Baud Rates (Wired Systems Only)

Set the same baud rate for all nodes on the same network.

Note Refer to the *Controller Link Support Board Installation Guide* (W467).

Routing Tables

When a CV-series PC is connected to the network, set routing tables at all the nodes.

Note Routing tables are not required if all the CV-series CPU Units in the Controller Link Network have been manufactured on or after May 1996. The manufacturing date can be determined from the four-digit lot number on the side of the CPU Unit.

Lot No.: ☐ ☐ 5 6 Manufactured in May 1996

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

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

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.

Precautions when Connecting Nodes Using a Repeater Unit

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

If the Controller Link Support Board is the polling node and data links are operating on the network, do not open the Board for three seconds after closing the Board.

If the Controller Link Support Board is the polling node and data links are operating on the network, do not add the Board to the network for three seconds after leaving the network.

When data links are active in the existing network, check the following items before adding nodes to the network. If the inappropriate data link tables or parameters are set, the system may not operate properly.

- If the new node will participate in user-set data links, make sure that the appropriate data link tables are set in the corresponding nodes.
- If the new node will not participate in user-set data links, make sure that the data link tables of the corresponding nodes are deleted.
- If automatic settings are used, make sure that the appropriate DM Area parameters have been set.

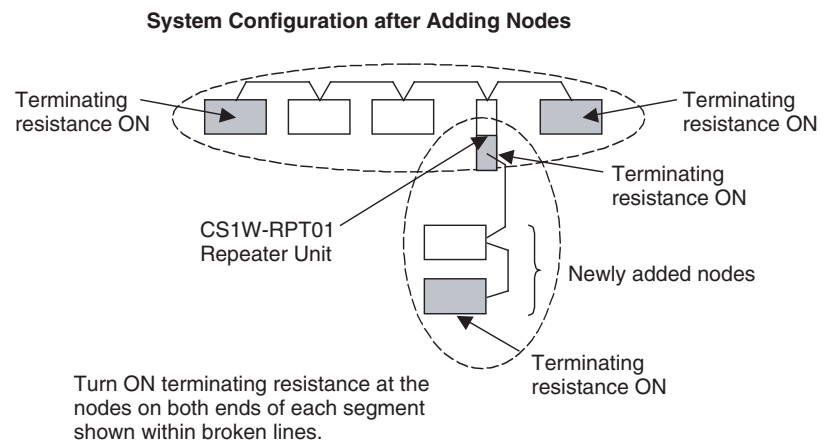
Before adding nodes, check user programming for the existing network to confirm that the new data transmissions created by adding new nodes can be performed. If the ladder program is not suitable, the system may not operate properly.

Make sure that the node addresses of the new nodes are not already being used by other nodes in the same network. If the same node address is used by more than one node, a node duplication error will be detected when the node is added, communications will stop, and the node with the same address will not be able to join the network. Data may also be unexpectedly received from the incorrectly set node. To restore a Controller Link System with a duplicated address, reset the node address correctly, then turn ON the power to the corresponding PCs again, or restart the Controller Link Support Boards and Units.

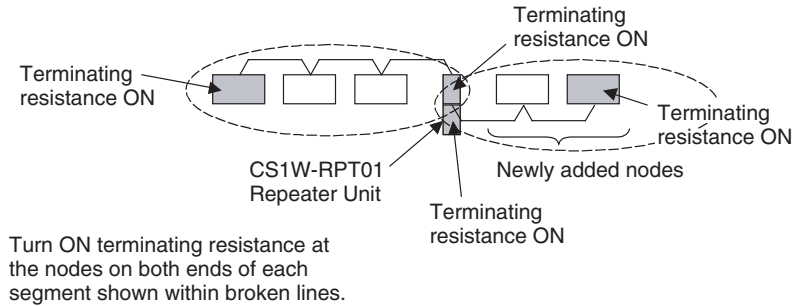
Always set the baud rate of the new nodes and the Repeater Unit to the same baud rate used for the existing network. If a different baud rate is set when adding a new node, the communications for the whole network including the existing network will be unstable and communications errors will occur.

Set the terminating resistance of the new nodes to the Repeater Unit as shown in the following diagram. If terminating resistance is set incorrectly, communications errors may occur.

- Adding Nodes Using T-branch Lines



- Adding Nodes with a Repeater Unit at One End



Before connecting the new nodes to the existing network, always set the polling/pollled node setting in the Controller Link Support Board driver properties to *Polled*. If the nodes are connected to the existing network with this setting set to *Polling*, the corresponding node may become the polling node for the network, which will affect the network in the following ways. After the new nodes are participating in the network normally, return the polling/pollled node setting to polling node.

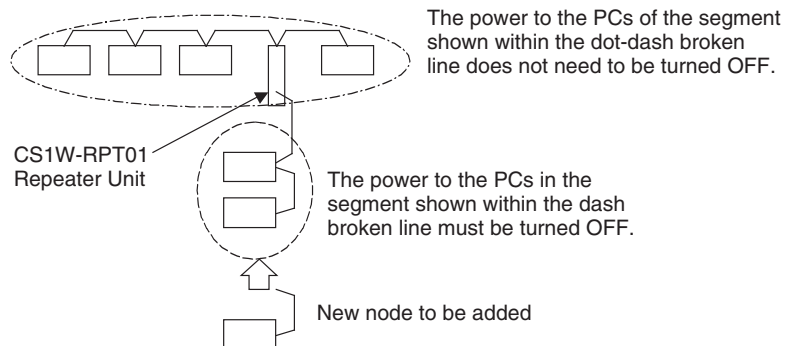
- When the data link startup switch of the new node is OFF, all the data links for the whole network including the existing network will be inactive.
- When the network parameters being used are different from the default values, the network parameters will return to the default values.

After confirming that the new node has properly joined the network, set the polling/pollled node setting in the Controller Link Support Board driver properties to *Polling*.

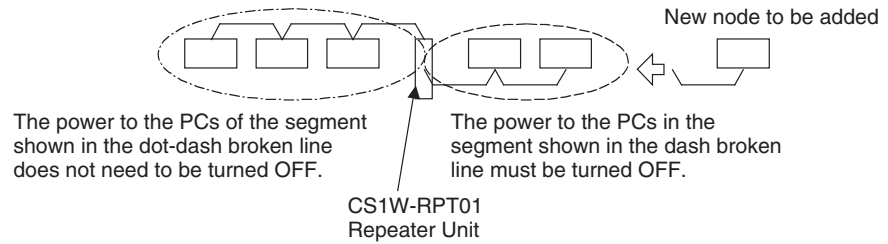
Always set the *Max Node Number set 62* option in the Controller Link Support Board driver properties of the new node to match the settings of the existing network. If different settings are used, the network may not be configured correctly.

When a new node is to be added to a system that is already wired over a long distance using T-branch lines or Repeater Units, turn OFF the power to the PCs in the segment where the node is to be added. The power to the PCs in segments separated by Repeater Units does not need to be turned OFF. Refer to the *Controller Link Unit Operation Manual (W309)*.

Systems with an Existing T-branch Line



Systems Wired with an Existing Repeater Unit



Others Precautions

Observe the following precautions.

- The Controller Link Support Board can be used only with the specified OS.

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

- Set the IRQ (interrupt request) of the Controller Link Support Board so that it does not overlap with other resources.

Note Refer to the *Controller Link Support Board Installation Guide* (W467).

- 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.
- If using an Optical Ring System, the same type of transmission path must be set for all nodes. If the transmission path node settings are different, the network will not be configured correctly.
- Wired Systems cannot be used together with Optical or Optical Ring Systems.
- If using Optical System Units (model numbers ending in CLK11) and H-PCF Cable Optical Ring System models (model numbers ending in CLK12, CLK12-EV1, or CLK13-E) together, observe the following precautions.
 - The transmission paths for the H-PCF Cable Optical Ring System Units must be set to Token Bus Mode for all nodes. If the transmission path settings are different, the network will not be configured correctly.
 - Set node addresses from 1 to 32 for all nodes.
 - Set the polling node/pollled node software switches for all the Optical Ring System Units for the polled node. If an optical ring node is the polling node when the network is started, the maximum node address in the network parameters will be set to 62, and the Network Parameter Error (ERH) indicators on the Optical System Units will light.
- GI Cable Optical Ring System Units (model numbers ending 3G8F7-CLK53-E, and 3G8F7-CLK52-EV1) cannot be used together with Optical System Units (model numbers ending CLK11) or H-PCF Cable Optical Ring System Units (model numbers ending 3G8F7-CLK13-E, and 3G8F7-CLK12-EV1).
- If using ring wiring, connect the nodes in node address order (i.e., node 1, node 2.... node 62, node 1) as much as possible to reduce the effect on communication time if a wire breaks. For details on communications time, refer to *8-2 Communications Cycle Time*.

- To construct a network that uses a node address higher than 32, it is necessary for all nodes to be one of the following Units: 3G8F7-CLK21-EV1, CS1W-CLK23, CJ1W-CLK23, CS1W-CLK21-V1, CJ1W-CLK21-V1, or 3G8F7-CLK23-E.

In addition, the Wired Network 62 Node Enable Bit in the DM Parameter Area software switches of all nodes must be turned ON to enable 62 nodes maximum. With the 3G8F7-CLK23-E and 3G8F7-CLK21-EV1, make sure that *Max Node Number set 62* is selected in the FinsGateway driver properties. If different settings are specified, the network will not be correctly configured.

- The *Max Node Number set 62* DM Parameter Area software switch for the CS1W-CLK23-E, CS1W-CLK 21-EV1, CJ1W-CLK23-E, and CJ1W-CLK 21-EV1 Units is enabled when the power is turned ON again.
- When using automatic data link creation with 1:N allocation, all nodes must be following Units/Boards. Other models cannot participate in data links that employ 1:N allocations.

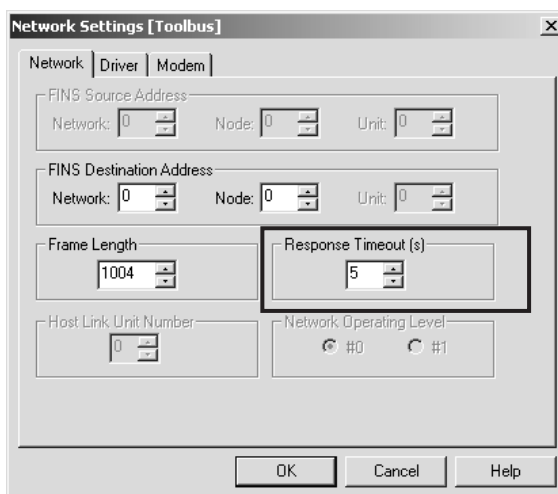
Wired Networks	CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK23-E, CS1W-CLK21-V1, CJ1W-CLK21-V1, and 3G8F7-CLK21-EV1
Optical Ring Networks using H-PCF Cable	CS1W-CLK13, 3G8F7-CLK13-E, CS1W-CLK12-V1 (See note.), and 3G8F7-CLK12-EV1
Optical Ring Networks using GI Cable	CS1W-CLK53, 3G8F7-CLK53-E, CS1W-CLK52-V1 (See note.), and 3G8F7-CLK52-EV1

Note Lot numbers 030601 or later.

- If the total number of data link words is increased, the PLC cycle time and the communications cycle time will be increased. In that case, observe the following precautions.
 - Check to make sure that it will not cause problems if performance in responses to external devices is reduced.
 - In message communications, extending the communications cycle time may result in timeout errors waiting for responses. In that case, lengthen the response monitor time as described below.

SEND, RECV, and CMND instructions:
 Response monitor time setting area for local node control data.
 For details, refer to *6-1 Introduction*.

PLC Programming Devices:
 PLC Programming Device *Response Timeout* setting
 For details on settings, refer to the operation manual for the PLC Programming Device that is being used.



Example: CX-Programmer Response Timeout Setting

SECTION 2

Wiring

This section describes how to wire the power supply cables and communications cables to the Controller Link Support Board.

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2-1 Connecting Wired Systems

This section describes the methods for wiring network communications cables to the Controller Link Support Board (3G8F7-CLK23-E and 3G8F7-CLK21-EV1).

2-1-1 Devices Required for Connection

The Wired Controller Link System uses the shielded twisted-pair cable specified below.

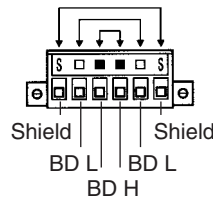
Model	Manufacturer
ESVC 0.5X2C-13262	Bando Densen Co.
ESNC 0.5X2C-99-087B	Nihon Electric Wire & Cable Co.
ESPC 1PX0.5 mm ²	Nagaoka Electric Wire Co.

- Note**
1. Be sure to use the communications cable described above.
 2. If another communications cable is used, normal operation cannot be assured.
 3. For manufacturers of the specified cable, refer to the appendix, *Standard Models*.

2-1-2 Communications Cable

Wire the communications cable to connect identical signals.

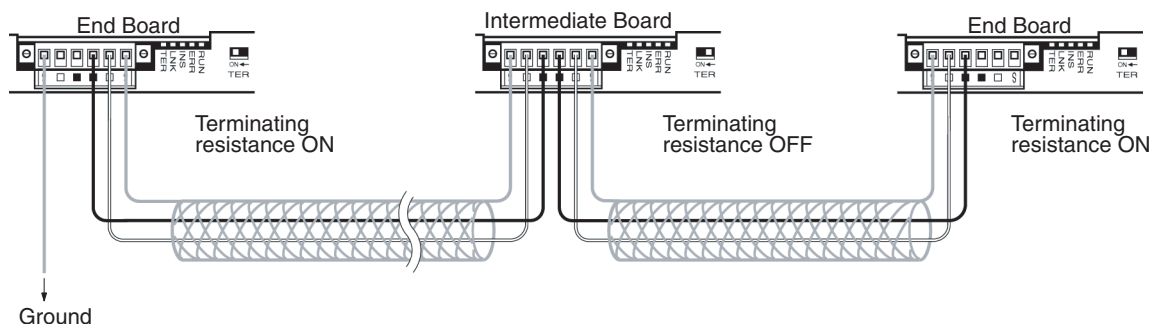
- Note**
1. Use the cable specified for the communications cable.
 2. Keep communications cable separated from power lines or a high-tension lines to prevent influences from electronic noise.
 3. Ground the shield line of the communications cable at one end of the network. Do not ground the shield at both ends.
 4. Do not connect the shield cable of the communications cable to a ground that is also being used for power-system devices, such as inverters.
 5. Turn ON the terminating resistance switch at the nodes at both ends of the network to connect terminating resistance. Turn OFF the terminating resistance switch at all nodes.
 6. Do not run wiring outdoors. If outdoor wiring is necessary, take protection measures against lightning, such as underground wiring or wiring inside pipes.
 7. The minimum length of the communications cable between nodes is 1 m. Prepare the communications cables at a length of 1 m or more.
 8. Use the multidrop method for connecting nodes. Normal communications will not be possible with T branches.
 9. Terminals for the same signal on the connector are connected internally in the Controller Link Support Board.



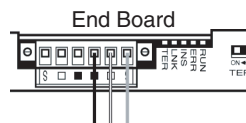
10. Although this section discusses wiring Controller Link Support Boards only, a Controller Link Unit could take the place of any Board and can be connected in the same fashion as a Board.

11. The ground wire connected to the connector of a Controller Link Support Board must be 2.5 mm² or less.

Connect all the shield lines of the communication cables and then ground the shield at one end of the network. The wiring method is shown below.



Note The terminals of the same type are connected internally. Connections can thus be made to either the right or left half of the end Boards.

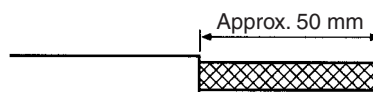


Refer to the *Controller Link Unit Operation Manual (W309)* for information on wiring Repeater Units.

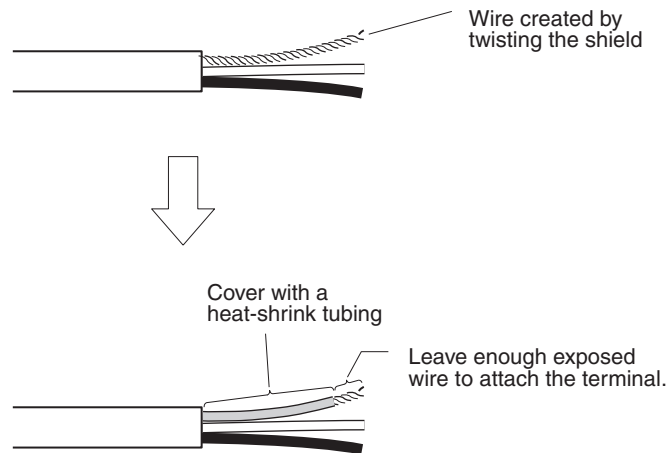
2-1-3 Connecting Cables to Communications Connectors

When connecting a communications cable to a Controller Link Support Board, connect the cable to the attached connector first and then attach to the connector on the Board. Connect the communications cable to the connector using the following procedure.

- 1,2,3...**
1. Peel back the cover of the cable for about 50 mm without scratching the mesh of the shield. Do not peel too much because it may cause a short-circuit.



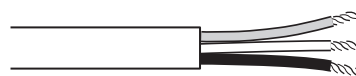
2. Twist the mesh of the shield to form a line on the end on which the shield is to be connected to a node.
3. Apply a heat-shrink tubing to the twisted shield line, leaving enough bare wire to attach the crimp terminal.



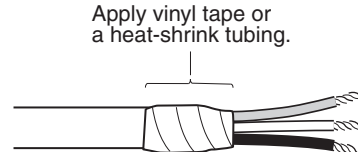
Note (a) Turn OFF the power supply to the computer before connecting the communications cable or connecting/disconnecting a connector.

(b) Use the connector attached to a Controller Link Support Board.

4. Strip the insulation far enough to attach the crimp terminals and twist the wire strands tight.

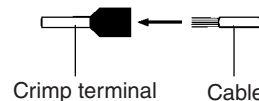


5. Apply electrical tape or heat-shrink tubing to the end of the cable cover that was peeled in step 1

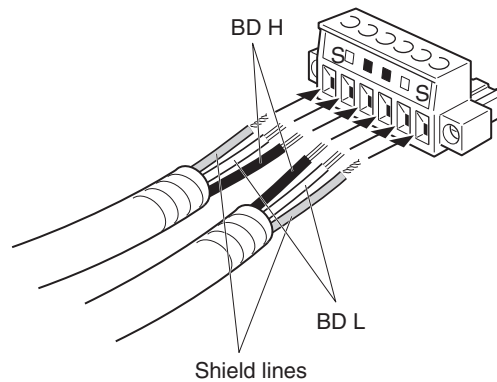


6. Attach the crimp terminals to the shield wire and signal wires. Apply electrical tape or heat-shrink tubing to the connections.

Note We recommend the Phoenix AI-series crimp terminals shown in the following diagram. The Phoenix Company's ZA3 crimping tool can be used to attach these terminals.



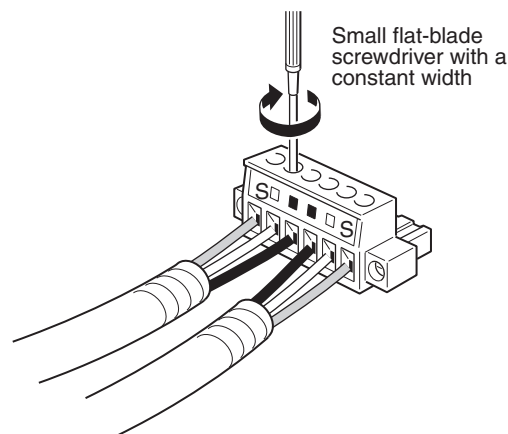
7. Carefully insert the signal line and shield line into each hole of the connector. Insert as marked on the connector. The following example shows connection to a Board in the middle of the Network.



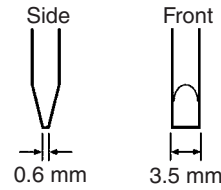
- Note** (a) Loosen the screws in the connector enough to allow the terminal to pass before inserting the signal line. If the screw is not loosened, the signal line will go completely into the connector and you will not be able to secure the line.
- (b) Attach crimp terminals to the wires. Never connect a bare power supply wire directly into the connector.
- (c) Marks are provided on the connector for the signal lines. Connect the signal lines according to the marks. The marks correspond to signal lines as listed below.

Marking	Signal name	Line color
■	BD H (communication data high side)	Black
□	BD L (communication data low side)	White
S	SHLD (shield)	---

- (d) The lines can be connected to either the right or left half of the connector at the node at either end of the network.
- (e) The shield wire connections are different if grounding each node individually. Refer to *2-1-2 Communications Cable* to connect the shield wire to the connector.
8. Firmly secure each signal line with the signal line screw on the connector. An ordinary flat-blade screwdriver with a tip that tapers at the end is not suitable because it cannot be inserted far enough. Use a small flat-blade screwdriver with a constant width. The appropriate tightening torque is 0.2 N·m.



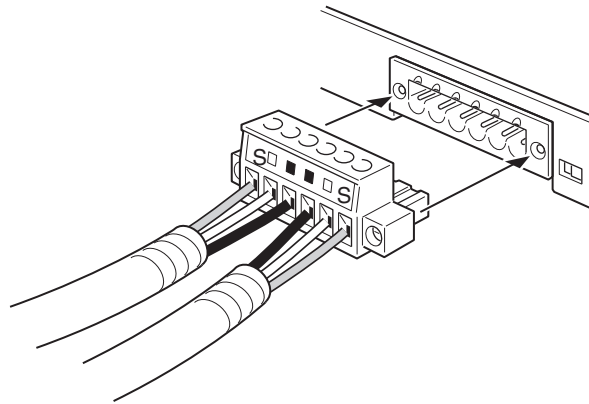
Note The following screwdriver is available from OMRON.
Model: XW4Z-00C



2-1-4 Connecting the Connector to the Board

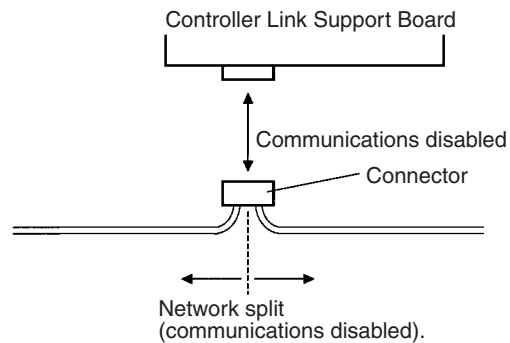
Connect the connector on the communications cable to the connector on the Board using the following procedure.

- 1,2,3...**
1. Connect the connector on the communications cable to the connector on the Board as shown below.

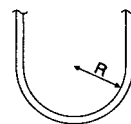


2. Secure the connector to the Board by tightening the screws on the connector. The appropriate tightening torque is 0.2 N·m.

- Note**
1. If the connector is disconnected, communications for the Board that was disconnected with other nodes in the network will be disabled and the network will be split into two at point of disconnection. Utmost care is necessary to prevent disconnection of a connector during communications.



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



4. Do not place heavy objects on the communications cable.

5. Supply power only after checking the wiring thoroughly.

2-2 Connecting H-PCF Cable Optical Ring System Cables

This section describes how to connect the communications cable to the Controller Link Support Board (3G8F7-CLK13-E and 3G8F7-CLK12-EV1) for H-PCF Cable Optical Ring Systems.

2-2-1 Communications Cables

Optical Bus or Optical Ring System (H-PCF Cable)

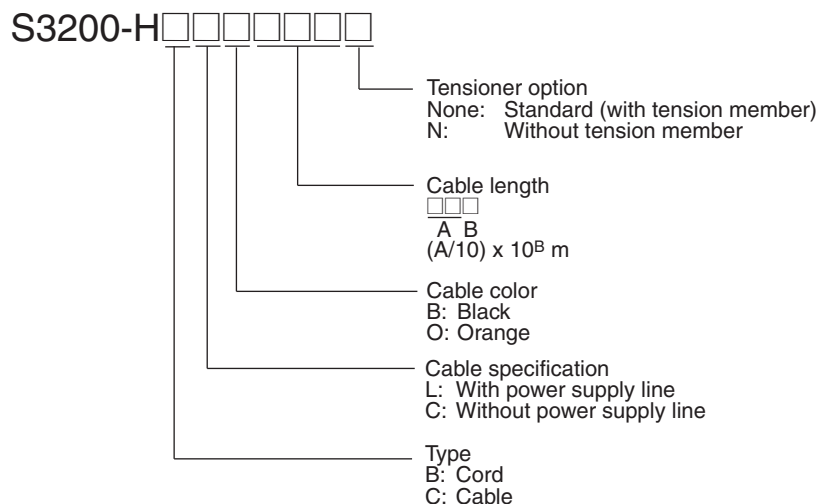
The following devices are required for the Optical Bus or Optical Ring (H-PCF) Controller Link Network. The cable and connectors are the same as those used for Optical SYSMAC LINK Networks.

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:



Name	Model	Specifications
Connector	S3200-COCF2071	Use to connect a cable to a node. (Full-lock connector for crimp-cut cable.)
	S3200-COCF2571	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 Controller 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.

No Longer Manufactured

Name	Model	Replacement model
Connector	S3200-COCF2011	S3200-COCF2071
	S3200-COCF2511	S3200-COCF2571

Optical Fiber Cables with Connectors (Indoor Use Only)

The following Optical Fiber Cables are available with Connectors (lap/polished type) already attached.

Specifications	Length	Model
Optical Fiber Cable Connectors: CF-2001H ↓ CF-2001H	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: CF-2001H ↓ CF-2501H	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: CF-2501H ↓ CF-2501H	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 a specialist tradesman if cables with outdoor specifications are required.
 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 Controller 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	CAK-0057	Crimp-cut tool for the S3200-COCF2071/2571 Connectors
Optical Power Tester	S3200-CAT2700	With S3200-CAT2702 Head Unit and adapter for the S3200-COCF2071/2571 Connectors
Master Fiber Set	S3200-CAT2001H	One meter cable for use with the S3200-CAT2702 Head Unit

An S3200-COCF2071/2571 optical connector can be assembled by adding the JRFK-57PLUS (Sumitomo Electric Industries) to the S3200-CAK1062.

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

No Longer Manufactured

Name	Model	Specifications
Optical Fiber Assembly Tool	S3200-CAK1062	Crimp-cut tool for the S3200-COCF2011/2511 Connectors

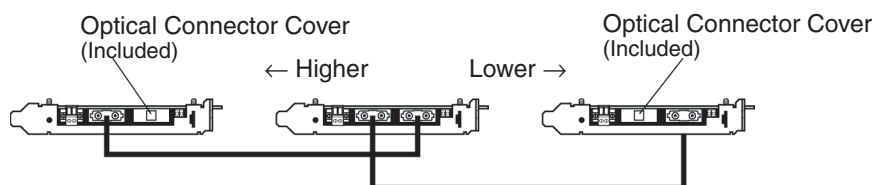
2-2-2 Optical Fiber Cables (H-PCF Cables)**Optical Ring System in Token Bus Mode**

All of the nodes in the Optical Controller 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 2-1-1 *Devices Required for Connection Devices* for details on available Optical Fiber Cables. Refer to 2-2-3 *Installing Connectors* for details on connecting the Optical Fiber Cables to the Controller Link Board.

Note

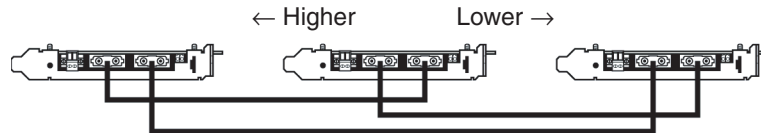
1. Always use the specified Optical Fiber Cables.
2. The maximum distance between nodes depends on the method used to attach the connector to the cable.
3. In a system using Optical System Units (model numbers ending CLK11) in Token Bus Mode (daisy chain connections), the maximum number of nodes is 32 (i.e., node addresses 1 to 32).

Optical Ring System in Token Ring Mode

Connect all the nodes in a ring using 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.



Refer to *2-1-1 Devices Required for Connection* for details on available Optical Fiber Cables. Refer to page 38 *Installing Connectors* for details on connecting the Optical Fiber Cables to the Controller Link Board.

- 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 Controller Link Support Board.

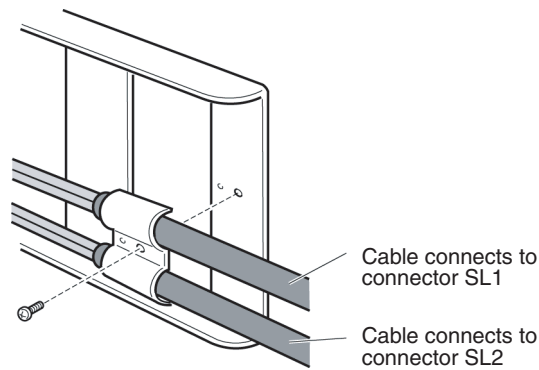
This manual does not provide details on Optical Fiber Cable preparation.

Connect the nodes in order beginning with the highest node in the network and continuing on to lower nodes. When connecting a ring, also connect the end node in the ring to the start node.

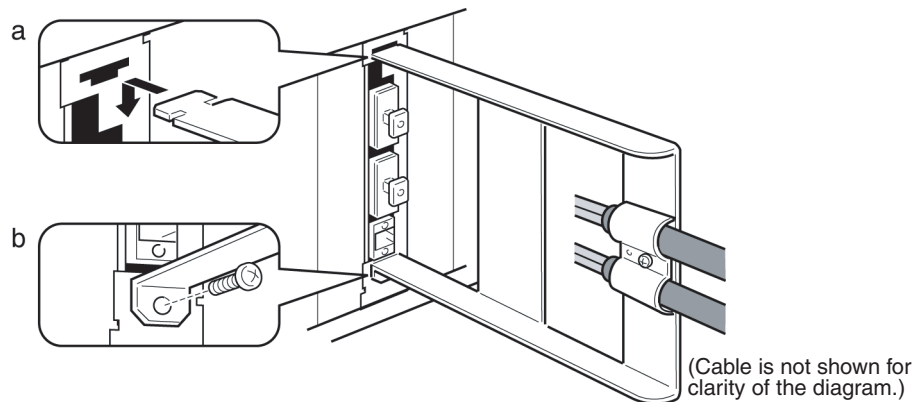
- Always turn OFF the computer and backup power supply before connecting Optical Fiber Cables or the backup power supply connector.
- Special tools are required to attach Optical Fiber Cables to the connectors. The cable may disconnect from the connector if the proper tools and methods are not used during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

Connection Procedure

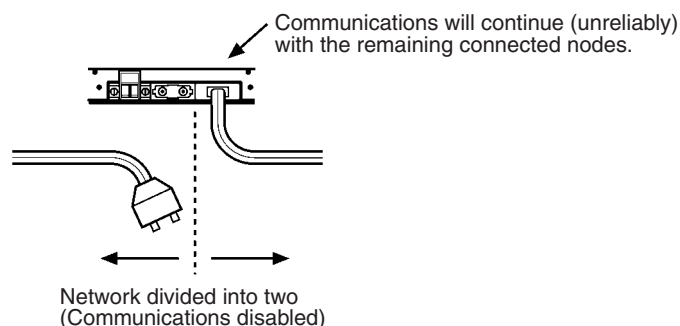
- 1,2,3...**
1. The Optical Fiber Cable's power supply line is not used, so it can be cut.
 2. As shown in the following diagram, secure the Optical Fiber Cable, and secure the holding piece to the mounting bracket. Secure the two cables simultaneously for nodes (except the end nodes). Pay attention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

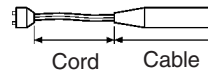


4. Remove the Optical Connector Cover from the Board again. If there are covers on the end connectors of the Optical Fiber Cable, remove them.
5. Double-check the direction of the cables. The cable from the node higher in the network connects to the Board's right connector and the cable to the node lower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

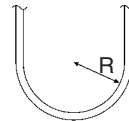


- Do not pull on the Optical Fiber Cable.

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).



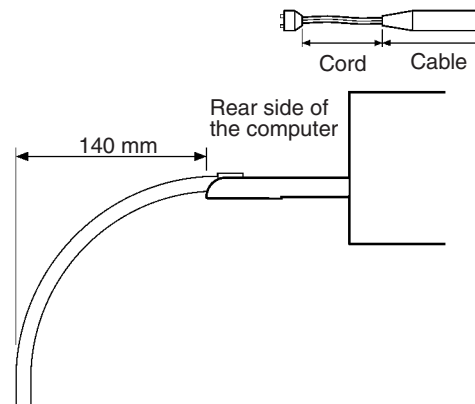
- Do not bend the cable past its natural bending radius. The minimum radius for bends is 10 cm.



- 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 Optical Ring System (GI Cable) Wiring

This section describes how to wire the communications cables to a GI cable Ring System Controller Link Support Board (3G8F7-CLK53-E and 3G8F7-CLK52-EV1).

2-3-1 Communications Cables

The following devices are required for the Optical Ring (GI) Controller Link Network.

Optical Fiber Cables

Use Optical Fiber Cables (Graded Index: GI) with the following optical specifications.

50/125 μm AGF Cable

Item	Minimum	Standard	Maximum	Unit	Conditions	
Numerical Aper- ture (N.A.)	---	0.21	---	---	Theoretical value	
Transmission loss	---	---	3.0 Lf	dB	0.5 km ≤ Lf	λ = 0.8 μm T _a = 25°C
			3.0 Lf + 0.2		0.2 km ≤ Lf < 0.5 km	
			3.0 Lf + 0.4		Lf < 0.2 km	
Connection loss	---	---	1.0		λ = 0.8 μm, one location	
Transmission bandwidth	500	---	---	MHz·km	λ = 0.85 μm (LD)	

Note L_f is fiber length in km, T_a is ambient temperature, and λ is the peak wavelength of the test light source.

62.5/125 μm AGF Cable

Item	Minimum	Standard	Maximum	Unit	Conditions	
Numerical Aper- ture (N.A.)	---	0.28	---	---	Theoretical value	
Transmission loss	---	---	3.5 Lf	dB	0.5 km ≤ Lf	λ = 0.8 μm T _a = 25°C
			3.5 Lf + 0.2		0.2 km ≤ Lf < 0.5 km	
			3.5 Lf + 0.4		Lf < 0.2 km	
Connection loss	---	---	1.0		λ = 0.8 μm, one location	
Transmission bandwidth	200	---		MHz·km	λ = 0.85 μm (LD)	

Note L_f is fiber length in km, T_a is ambient temperature, and λ is the peak wavelength of the test light source.

Connectors

ST Connector

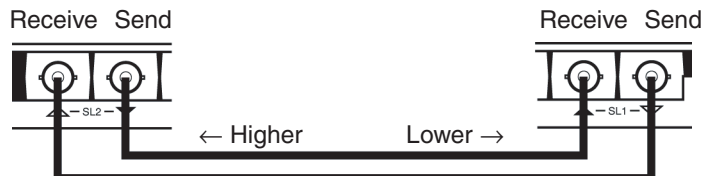
2-3-2 GI Optical Fiber Cable Wiring

Optical Ring System in Token Bus Mode

All of the nodes in the Optical Controller Link Network are connected in a line (daisy-chain configuration) with H-PCF Optical Fiber Cable.

Refer to the following diagram when making the connections.

Connect the upper node SL2 receive connector to next lower node SL1 send connector and connect the upper node SL2 send connector to next lower node SL1 receive connector.



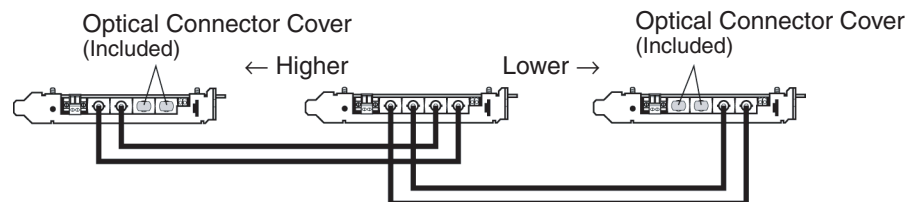
The connector with the triangle facing up is the receive connector, and with the triangle facing down is the send connector. The color of the triangle indicates the upper node Board and next lower node Board; Be sure to connect triangles of the same color.

There is an ID mark on one end of each pair of Optical Fiber Cables. Use this mark to identify the code.

Incorrect connections may result in a broken wire being incorrectly detected, and may cause unexpected operation.

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.

Also be sure to cover the unused connectors on the highest and lowest nodes in the network with the provided Optical Connector Covers.



Refer to *2-1-1 Devices Required for Connection* for details on available Optical Fiber Cables. Refer to *2-2-3 Installing Connectors* for details on connecting the Optical Fiber Cables to the Controller Link Board.

Note

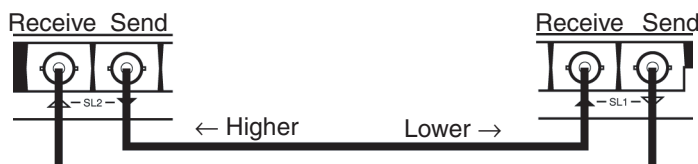
1. Always use the specified Optical Fiber Cables.
2. The code for the Optical Fiber Cables can be identified from cable marks and color, but OMRON recommends adding tags to prevent incorrect connection during installation.
3. The maximum distance between the nodes depends on the type of GI cable (core diameter), as follows:
 62.5/125 μm : 2 km maximum distance between nodes
 50/125 μm : 1 km maximum distance between nodes

Optical Ring System in Token Ring Mode

Connect all the nodes in a ring using GI Optical Fiber Cables.

Refer to the following diagram when making the connections.

Connect the upper node SL2 receive connector to next lower node SL1 send connector and connect the upper node SL2 send connector to next lower node SL1 receive connector.

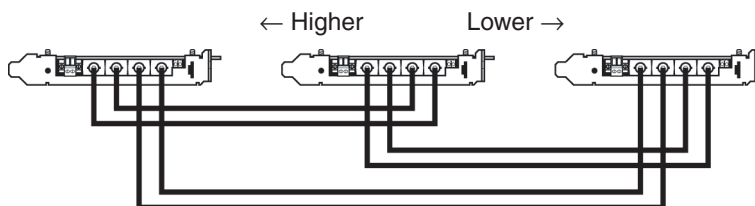


The connector with the triangle facing up is the receive connector, and with the triangle facing down is the send connector. The color of the triangle indicates the upper node Board and next lower node Board; Be sure to connect triangles of the same color.

There is an ID mark on one end of each pair of Optical Fiber Cables. Use this mark to identify the code.

Incorrect connections may result in a broken wire being incorrectly detected, and may cause unexpected operation.

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.



Refer to 2-1-1 *Devices Required for Connection* for details on available Optical Fiber Cables. Refer to page 38 *Installing Connectors* for details on connecting the Optical Fiber Cables to the Controller Link Board.

Note

1. Always use the specified Optical Fiber Cables.
2. The code for the Optical Fiber Cables can be identified from cable marks and color, but OMRON recommends adding tags to prevent incorrect connection during installation.
3. The maximum distance between the nodes depends on the type of GI cable (core diameter), as described below.
 62.5/125 μm : 2 km maximum distance between nodes
 50/125 μm : 1 km maximum distance between nodes

2-3-3 Installing Connectors

A special connector is used to connect the Optical Fiber Cable to the Controller Link Support Board.

Connect the nodes in order beginning with the highest node in the network and continuing on to lower nodes. When connecting a ring, also connect the end node in the ring to the start node.

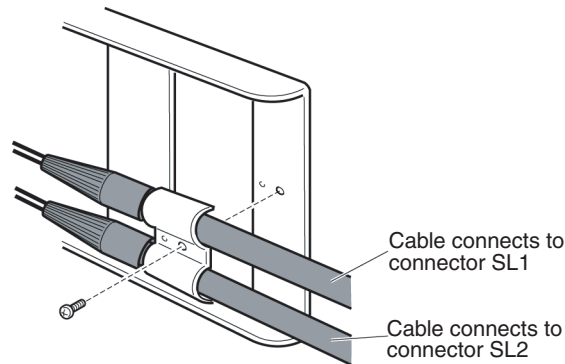
- Always turn OFF the computer and backup power supply before connecting Optical Fiber Cables or the backup power supply connector.

- 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.

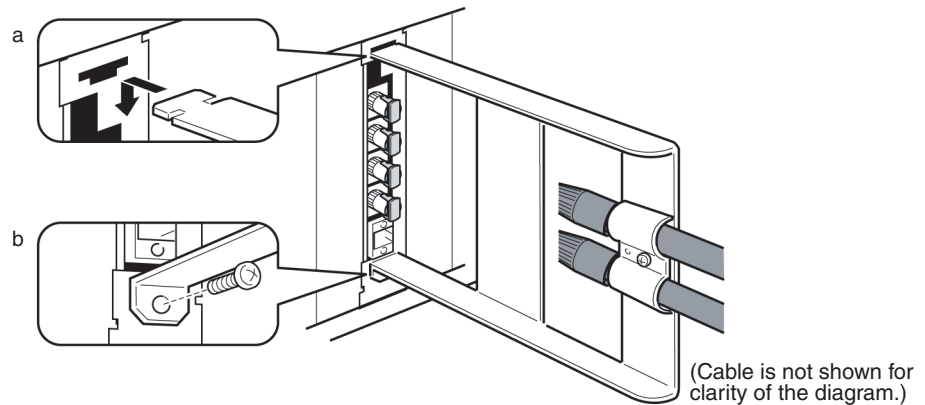
Connection Procedure

1,2,3...

1. Secure the Optical Fiber Cable tension member.
2. As shown in the following diagram, secure the Optical Fiber Cable, and secure the holding piece to the mounting bracket. Secure the two cables simultaneously for nodes except the start and 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).

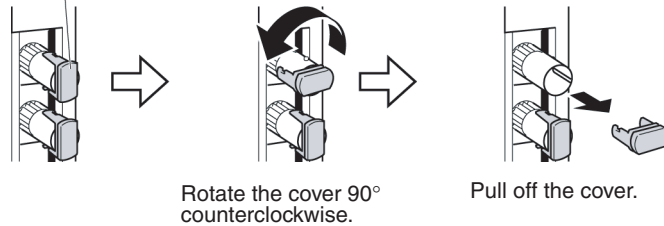


3. Install the mounting bracket on the Board with the screws provided. Insert the tip of the mounting bracket with the grooves into the hole on the board surface until it locks firmly (a), and then secure the other end of the mounting bracket using the screw (b). Take care not to bend or pull the Optical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



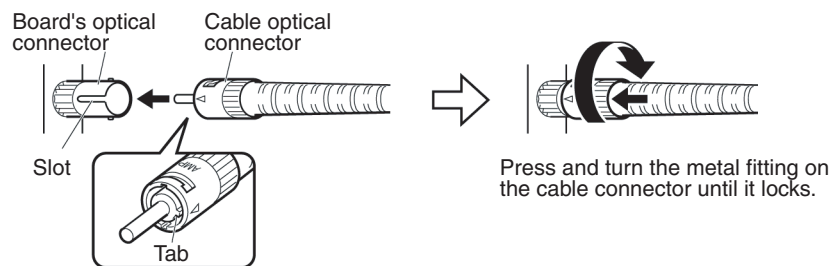
4. Remove the Optical Connector Covers from the Unit's connectors shown in the following diagram if there are covers protecting the connectors. Remove the covers from the tips of the cables' ST connectors if there are covers protecting the ST connectors.

GI Cable Optical Connector Cover



Note To replace the Optical Connector Cover, just reverse the steps shown in the diagram above.

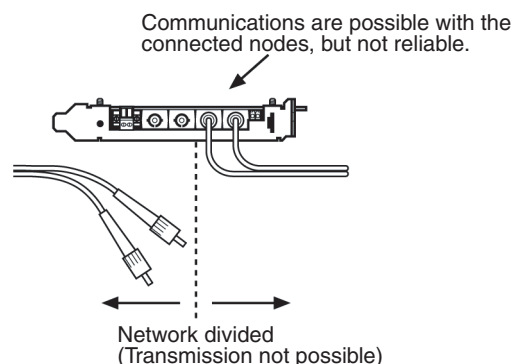
5. Turn the cable connector so that the tab in the connector faces left and aligns with the slot in the Board's connector. Insert the cable connector fully into the Board's optical connector. Press and turn the cable's connector clockwise to lock the connector in place.



Align the tab in the cable connector with the slot in the Board's connector and fully insert the cable connector.

Note To remove the connector, just reverse the steps shown in the diagram above. (Press and turn the cable connector's metal fitting counterclockwise to unlock the connector.)

- Insert the connectors completely and always check that the connectors are locked before starting operation.
- If a connector becomes disconnected while in token-bus mode, 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. Be sure not to remove connectors during communications.

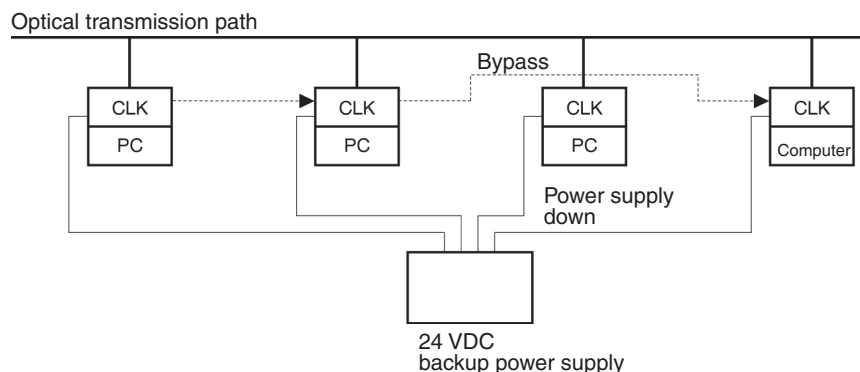


When installing Optical Fiber Cables, be sure to stay within the specifications (e.g., tensile strength, bending, lateral pressure) for the cables used.

When inserting or removing the Optical Fiber Cables, be sure to hold the connector part firmly.

2-4 Backup Power Supply Wiring (Optical Ring Systems Only)

A node bypass function can be used with an Optical Ring Controller Link System (either H-PCF cable or GI 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.

2-4-1 Backup Power Supply Specifications

The input specifications for the backup power supply to the Controller 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

- 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 to satisfy the specifications described above using the node power supply connectors and terminal positions.
- Power supply from the backup power supply is given priority. Consider the following points when designing a system.
 - Turn ON the backup power supply before turning ON the power supply to the PC and computer.
 - The communications data will be corrupted in the instant when the backup power supply is turned ON or OFF.
 - 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.
 - 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.

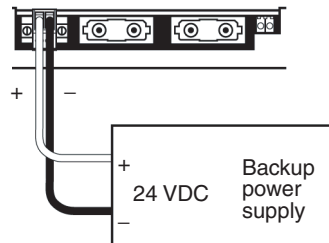
- e. Use a backup power supply with double or reinforced insulation.
3. Use the correct power supply voltage, as given above.

2-4-2 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 the special crimp terminals to the power supply wires. (Use the same crimp terminals as the wired system communications cables. Refer to *2-1-2 Communications Cable* for details.)
- 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.
- If the connectors on boards in adjacent slots come into contact with each other, mount one of the boards in a different slot.

Connect the power supply cable to the cable connector and then secure it to the Board, as shown in the following diagram. (The following diagram shows a Board using H-PCF cables, but the diagram for GI cables is the same.) Be sure that the power supply polarity is not reversed.



The connector for the backup power supply is the same as the communications connector for Wired Controller Link Support Boards. Refer to *2-1-3 Connecting Cables to Communications Connectors* for details on preparing the power supply wires and connecting them to the connector, and mounting the cable connectors.

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 Controller Link Support Board.

3-1	Basic Flow	50
3-1-1	Data Link Procedure	50
3-1-2	Message Service Procedure	51
3-2	Using the C Library	52

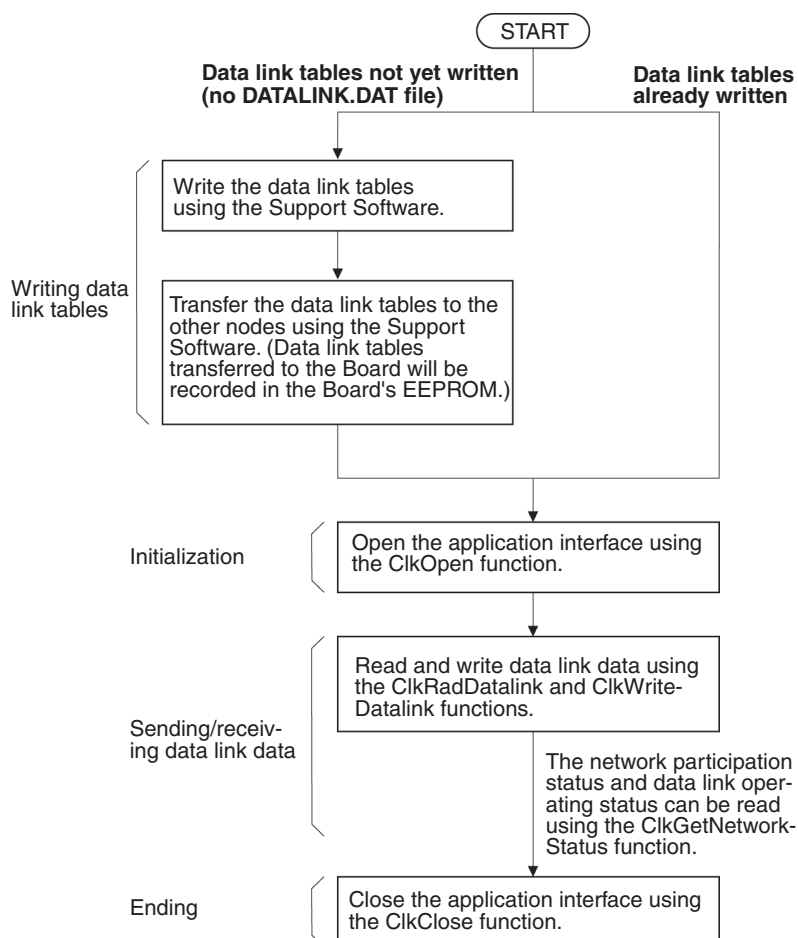
3-1 Basic Flow

This section describes the basic procedural flow in creating the applications (user programs) necessary to use the Controller 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 *Controller Link Support Board Installation Guide* (W467) 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 ClkSendFins function.
 3. Information on errors that occur in using the C library can be read using the CkGetLastError function.

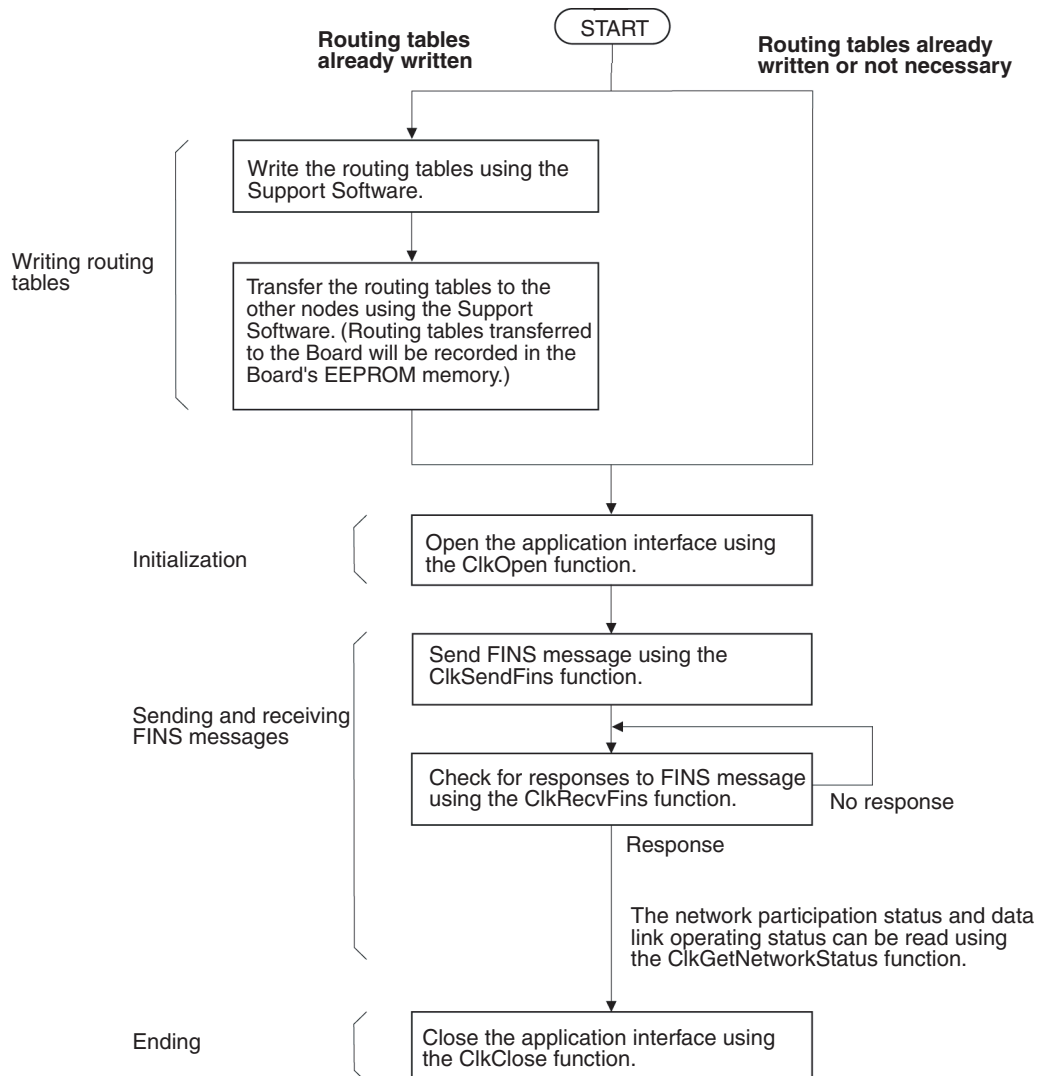
For details on various methods for making programs, refer to the following resources.

- 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: *Controller 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 `ClkSetMessageOnArrival` and `ClkSetThreadMessageOnArrival` functions to register the Windows-based messages to be used for notification. When not using Windows-based messages, check periodically for FINS messages using `ClkRecvFins`.

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: *Controller Link Support Software Operation Manual (W369)*

3-2 Using the C Library

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

Fine name	Contents
CLK_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
<code>ClkOpen</code>	Board Open	Opens the application interface and gets a CLK handle.	56
<code>ClkClose</code>	Board Close	Closes the application interface and releases the CLK handle.	57
<code>ClkSendFins</code>	FINS Message Send	Sends a FINS message.	57
<code>ClkRecvFins</code>	FINS Message Receive	Receives a FINS message.	58
<code>ClkWriteDatalink</code>	Data Link Data Write	Writes data to a data link area.	59
<code>ClkReadDatalink</code>	Data Link Data Read	Reads data from a data link area.	59
<code>ClkGetNetworkStatus</code>	Network Status Read	Reads the network status.	60
<code>ClkGetRingStatus</code>	Optical Ring Status Read	Reads the optical ring status.	61
<code>ClkSetMessageOnArrival</code>	FINS Message Reception Notification Registration to Window	Makes settings to notify the specified window with a Windows message when a FINS message is received.	61
<code>ClkSetThreadMessageOnArrival</code>	FINS Message Reception Notification Registration to Thread	Makes settings to notify the specified thread with a Windows message when a FINS message is received.	62
<code>ClkClearMessageOnArrival</code>	FINS Message Reception Notification Clear	Clears windows message notification when a FINS message is received.	63
<code>ClkGetLastError</code>	Detailed Error Information Acquire	Gets an error code generated when a CLK library function is used.	63

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\Controller Link\Lib.
 4. Include the following line at the beginning of the program:
#include <CLK_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\Controller 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 "CLK_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 Controller 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-language library functions supported by the Controller Link Support Board.

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4-1 Library Functions

This section describes the library functions used for the Control Link Support Boards for PCI bus. Refer to *SECTION 3 Creating Applications Using the C Library* for application methods.

Functions

Function name	Name	Function	Page
ClkOpen	Board Open	Opens the application interface and gets a CLK handle.	56
ClkClose	Board Close	Closes the application interface and releases the CLK handle.	57
ClkSendFins	FINS Message Send	Sends a FINS message.	57
ClkRecvFins	FINS Message Receive	Receives a FINS message.	58
ClkWriteDatalink	Data Link Data Write	Writes data to a data link area.	59
ClkReadDatalink	Data Link Data Read	Reads data from a data link area.	59
ClkGetNetworkStatus	Network Status Read	Reads the network status.	60
ClkGetRingStatus	Optical Ring Status Read	Reads the optical ring status.	61
ClkSetMessageOnArrival	FINS Message Reception Notification Registration to Window	Makes settings to notify the specified window with a Windows message when a FINS message is received.	61
ClkSetThreadMessageOnArrival	FINS Message Reception Notification Registration to Thread	Makes settings to notify the specified thread with a Windows message when a FINS message is received.	62
ClkClearMessageOnArrival	FINS Message Reception Notification Clear	Clears windows message notification when a FINS message is received.	63
ClkGetLastError	Detailed Error Information Acquire	Gets an error code generated when a CLK library function is used.	63

4-1-1 ClkOpen()

Board Open

Function

Opens the application interface and gets a CLK handle.

Call Format

```
PCLKHANDLE ClkOpen(BYTE byAppUnitAdr, INT *piRetErr);
```

Arguments

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

Return Value

A CLK handle is returned if the function ends normally.

CLK_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 AppUnitAdr. 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 Controller Link Support Board is not mounted. (Detailed error information = ERR_NO_CLKUNIT: No CLK 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 PC at a different node.

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

Opens the application interface and gets a CLK handle.

Call Format

```
INT ClkClose(PCLKHANDLE hCLK);
```

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()

Return Value

CLK_SUCCESS is returned if the function ends normally.

CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

If the application is ended without using ClkClose(), the address specified for ClkOpen() cannot be used again. Always execute ClkClose() for all CLK handles obtained with ClkOpen() before ending the application.

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

Sends a FINS message.

Call Format

```
INT ClkSendFins(PCLKHANDLE hCLK, PCLKHEADER pHeader, LPVOID lpMessage, DWORD dwSize);
```

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
PCLKHEADER	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

CLK_SUCCESS is returned if the function ends normally.

CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

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

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

The amount of data that can be sent and received will be limited by the type of networks through which the message must pass. The largest value that the send buffer (dwSize) can be set to is 1,998 bytes. The limit when passing through a SYSMAC LINK Network is 542 bytes.

If SID is -1, autoincrementing will be used for the SID. (There is only one SID memory area for each process when automatically incrementing functions internally. There are not separate areas for each network handle or thread.)

The function will end in an error if a FINS message send buffer size of less than 2 bytes is specified in the argument. (Detailed error information = ERR_SEND_BUFFER_SIZE: Send message size error)

The function will end in an error if SID is not set to between –1 and 255. The error code will be 39 (SID setting error).

4-1-4 ClkRecvFins()

FINS Message Receive

Function

Receives a FINS message.

Call Format

INT ClkRecvFins(PCLKHANDLE hCLK, PCLKHEADER pHeader, LPVOID lpMessage, DWORD dwSize, DWORD dwTimeLimit);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
PCLKHEADER	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 received is returned as the number of bytes if the function ends normally.

CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

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

Refer to *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 if a FINS message receive buffer size of less than 2 bytes is specified in the argument. (Detailed error information = ERR_RECV_BUFFER_SIZE: Receive message size error)

The function will end in an error if a message reception area 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 reception wait time is set to 0 and a FINS message has not yet been received. (Detailed error information = 38: Receive timeout)

The function will end in an error if the reception wait time elapses without receiving a FINS message. (Detailed error information = 38: Receive timeout)

The function will end in an error if the received FINS message is larger than the reception buffer size. The portion of the FINS message that fits will be stored in the reception buffer. (Detailed error information = ERR_MSG_SIZE_OVER: Receive buffer size error)

4-1-5 ClkWriteDatalink()

Data Link Data Write

Function

Writes data to a data link area.

Call Format

INT ClkWriteDatalink(PCLKHANDLE hCLK, PEMCLKADDRESS pEmAddress, LPWORD lpWriteData, DWORD dwSize);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
PEMCLKADDRESS	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

CLK_SUCCESS is returned if the function ends normally.

CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

Refer to *Structure Descriptions* for information on the starting address structure for writing data.

The function will end in an error if a data size of 0 is specified for write data size specified as the argument. (Detailed error information = ERR_WRITE_BUFFER_SIZE: Write data size error)

The function will end in an error if access is requested to 3 or more different memory areas for one CLK handle. (Detailed error information = ERR_MEMORY_AREA: Multiple memory area specification error)

The function will end in an error if a memory name specified in the argument does not exist. (Detailed error information = ERR_NO_MEM_TYPE: No such memory)

4-1-6 ClkReadDatalink()

Data Link Data Read

Function

Reads data from a data link area.

Call Format

INT ClkReadDatalink(PCLKHANDLE hCLK, PEMCLKADDRESS pEmAddress, LPWORD lpReadData, DWORD dwSize);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
PEMCLKADDRESS	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

CLK_SUCCESS is returned if the function ends normally.

CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

Refer to *Structure Descriptions* for information on the starting address structure for reading data.

The function will end in an error if 0 is specified for the read data size specified as the argument. (Detailed error information = ERR_READ_BUFFER_SIZE: Read data size error)

The function will end in an error if access is requested to 3 or more different memory areas for one CLK handle. (Detailed error information = ERR_MEMORY_AREA: Multiple memory area specification error)

The function will end in an error if a memory name specified in the argument does not exist. (Detailed error information = ERR_NO_MEM_TYPE: No such memory)

4-1-7 ClkGetNetworkStatus()

Network Status Read

Function Reads the network status.

Call Format INT ClkGetNetworkStatus(PCLKHANDLE hCLK, BYTE byNet, PNST-BUFFER pBuffer);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
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 CLK_SUCCESS is returned if the function ends normally.
CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

Refer to *Structure Descriptions* for information on the read data structure.

The read data size is fixed. Provide a memory area the size of the PNST-BUFFER structure as a read data storage buffer.

If the function is executed for a Board that is not part of a 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 if an error response code is returned for the FINS message. (Detailed error information = ERR_RESPONSE: Error response code error)

The function will end in an error if a Controller Link Support Board is not mounted for the network specified by the Board network address specified as an argument. (Detailed error information = ERR_NO_CLKUNIT: No CLK Unit)

The function will end in an error if a message reception area cannot be obtained because of insufficient memory. (Detailed error information = ERR_NO_MEMORY: Memory acquisition error).

The function will end in an error if a network address of 0 is specified when there is more than one network. (Detailed error information = ERR_NETWORK_ADDRESS).

4-1-8 ClkGetRingStatus()

Optical Ring Status Read

Function Reads the optical ring status.

Call Format INT ClkGetRingStatus(PCLKHANDLE hCLK, BYTE byNet, PRINGBUFFER pBuffer);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
BYTE	byNet	Network address of the Broad to read the optical ring status for
PRINGBUFFER	pBuffer	Pointer to the buffer structure to store the read data

Return Value CLK_SUCCESS is returned if the function ends normally.
CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description Refer to *Structure Descriptions* for information on the read data structure.
The read data size is fixed. Provide a memory area the size of the PNST-BUFFER structure as a read data storage buffer.
The function will end in an error if an error response code is returned for the FINS message. (Detailed error information = ERR_RESPONSE: Error response code error)
The function will end in an error if a Controller Link Support Board is not mounted for the network specified by the Board network address specified as an argument. (Detailed error information = ERR_NO_CLKUNIT: No CLK Unit)
The function will end in an error if it is executed for a Wired Board or an Optical Board in token bus mode. (Detailed error information = ERR_NOT_RING_MODE: Wrong operating mode)
The function will end in an error if a message reception area cannot be obtained because of insufficient memory. (Detailed error information = ERR_NO_MEMORY: Memory acquisition error)
The function will end in an error if a network address of 0 is specified when there is more than one network. (Detailed error information = ERR_NETWORK_ADDRESS).

4-1-9 ClkSetMessageOnArrival()

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 ClkSetMessageOnArrival(PCLKHANDLE hCLK, HWND hWnd, UINT uMsg);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
HWND	hWnd	Window handle to receive event notification
UINT	uMsg	Message to use for notification (WM_USER to 0x7FFF)

Return Value CLK_SUCCESS is returned if the function ends normally.
CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

Both ClkSetMessageOnArrival and ClkSetThreadMessageOnArrival cannot be registered at the same time.

The function will end in an error if a null pointer is specified for the window handle specified as the argument. (Detailed error information = ERR_WINDOWHANDLE_PARA: Window handle error)

The function will end in an error if an illegal value is specified for the window handle specified as the argument. (Detailed error information = 67: Illegal window handle)

The function will end in an error if the message specified in the argument is over 0x7FFF. (Detailed error information = ERR_MESSAGE_PARA: Message type error)

The function will end in an error if a message has already been registered for FINS message reception. (Detailed error information = 69: Duplicated message registration error)

4-1-10 ClkSetThreadMessageOnArrival() 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 ClkSetThreadMessageOnArrival(PCLKHANDLE hCLK, DWORD dwThreadId, UINT uMsg);
```

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()
DWORD	dwThreadId	Thread ID to receive event notification
UINT	uMsg	Message to use for notification (WM_USER to 0x7FFF)

Return Value

CLK_SUCCESS is returned if the function ends normally.

CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

Description

Both ClkSetMessageOnArrival and ClkSetThreadMessageOnArrival cannot be registered at the same time.

The function will end in an error if a null pointer is specified for the window handle specified as the argument. (Detailed error information = ERR_WINDOWHANDLE_PARA: Window handle error)

The function will end in an error if an illegal value is specified for the window handle specified as the argument. (Detailed error information = 67: Illegal window handle)

The function will end in an error if the message specified in the argument is over 0x7FFF. (Detailed error information = ERR_MESSAGE_PARA: Message type error)

The function will end in an error if a message has already been registered for FINS message reception. (Detailed error information = 69: Duplicated message registration error)

4-1-11 ClkClearMessageOnArrival()

FINS Message Reception Notification Clear

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

Call Format INT ClkClearMessageOnArrival(PCLKHANDLE hCLK);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()

Return Value CLK_SUCCESS is returned if the function ends normally.
CLK_ERROR is returned if the function ends in an error. Detailed error information can be obtained using ClkGetLastError().

4-1-12 ClkGetLastError()

Detailed Error Information Acquire

Function Gets detailed error information generated when a Controller Link library function is used.

Call Format INT ClkGetLastError(PCLKHANDLE hCLK);

Arguments

Type	Variable name	Description
PCLKHANDLE	hCLK	The CLK handle obtained with ClkOpen()

Return Value Detailed error information is returned if the function ends normally.
CLK_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 CLKHEADER/*PCLKHEADER Structure

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

Type	Variable name	Contents
BYTE	BylcfBits	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 ClkSendFins(), set the destination network address. For ClkRecvFins(), the network address of the source of the FINS message is stored.
BYTE	byNodeAddr	Source/destination node address For ClkSendFins(), set the destination node address. For ClkRecvFins(), the node address of the source of the FINS message is stored.
BYTE	byUnitAddr	Source/destination unit address For ClkSendFins(), set the destination unit address. For ClkRecvFins(), 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. For ClkRecvFins(), the SID of the received FINS message is stored.

4-2-2 EMCLKADDRESS/*PEMCLKADDRESS Structure

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

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 ClkGetNetworkStatus().

Type	Variable name	Contents
BYTE	byConnectionMethod	Wired/optical discrimination, transmission path form, etc. Note When optical and optical ring connections are combined, the maximum number of nodes supported will be given as 62 nodes for an optical ring connection even if the maximum number of nodes is 32.
BYTE	byMyNodeAddr	Local unit address Stores the local unit address set for the Controller Link Board.
BYTE	byMyUnitAddr	Local unit address Stores the local unit address set for the Controller Link Board.
BYTE	byMyNetAddr	Local network address Stores the local network address set for the Controller Link Board.
BYTE	abyNodeList[32]	Network participation status Stores a list of the nodes participating in the network. Note For Wired Systems with a maximum of 32 nodes, the above information is valid through node 32 (lower 4 bytes of abyNodeList[16]).
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 Stores undetermined data.

Type	Variable name	Contents
BYTE	byStatus2	Baud rate, power supply status, terminating resistance setting status For Wired Systems, stores the set baud rate and the setting of the terminating resistance switch. For Optical Ring System, stores the power supply status. Bit Wired System 0: Terminating resistance switch OFF 1: Terminating resistance switch ON Optical System 0: No backup power supply 1: Backup power supply
BYTE	byStatus3	Error information 1 Stores information such as whether or not there is an error log recorded, node address setting errors, etc. 1: Error history 1: Fatal data link error 1: Communications controller send section error 1: Node address setting error 1: Node address duplicated 1: Network parameter mismatch 1: Communications controller hardware error
BYTE	byStatus4	Reserved area Stores undetermined data.
BYTE	byStatus5	Error information 2 Stores information such as EEPROM write errors, setting table errors, etc. 1: EEPROM write error 1: Network parameter error 1: Data link table error 1: Routing table error
BYTE	byStatus6	Reserved area Stores undetermined data.

Type	Variable name	Contents
BYTE	byStatusFlag	Data link operation status and data link mode Stores the data link operation status, data link mode, etc. Bit 7 6 5 4 3 2 1 0 Bit 7 6 5 4 3 2 1 0 —: Not specified Current Data Link Mode 0: User-set links 1: Automatic Data Link Operating Status 0: Stopped 1: Running
BYTE	abyDataLinkStatus[62]	Data link status Stores the data link status. Bit [0] 7 6 5 4 3 2 1 0 [1] Node 1 [2] Node 2 [3] Node 3 [60] Node 61 [61] Node 62 Node Data Link Status 7 6 5 4 3 2 1 0 —: Not specified PC Operating Status 0: Stopped 1: Running (PC program being executed.) CPU Unit Error Status 0: No error 1: Error Data Link Communications Error Status 0: Normal 1: Error (Data link data not received normally.) Data Link Participation Status 0: Not participating or data links stopped 1: Participating Offset Error Status (Offset larger than number of send words) 0: Normal 1: Error Insufficient Reception Area (Data larger than data link reception area. Overflow data discarded.) 0: Normal 1: Insufficient Excess Reception Area (Data smaller than data link reception area. Overflow area data not specified.) 0: Normal 1: Excess Note For Wired Systems with a maximum of 32 nodes, the above information is valid through node 32 (abyDataLinkStatus[32]).

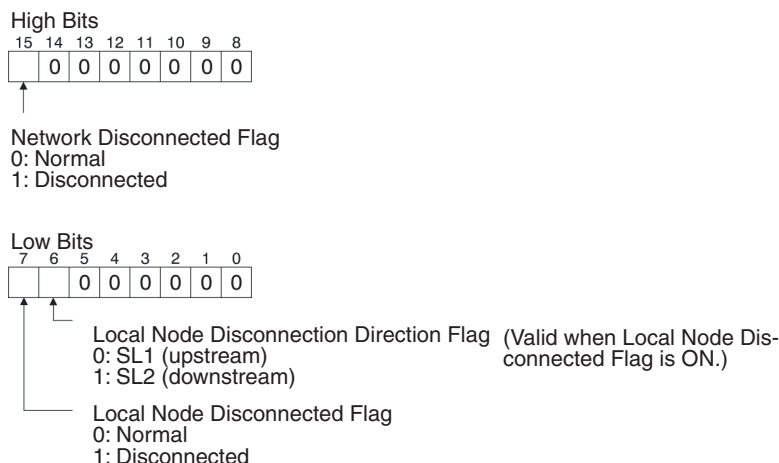
4-2-4 RINGBUFFER/*PRINGBUFFER Structure

This structure stores optical ring status that has been read. It is used by ClkGetRingStatus().

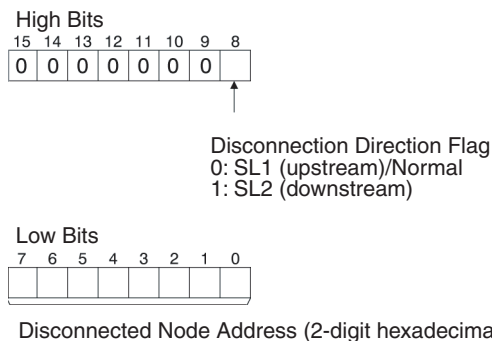
Type	Variable name	Contents
WORD	wDisConnectionFlag	Disconnected Line Flags (See graphic following this table.)
WORD	wDisConnectionNodeInfo1	Disconnected node information 1 (See graphic following this table.)
WORD	wDisConnectionNodeInfo2	Disconnected node information 2 (See graphic following this table.)
BYTE	abyDisConnectionInfoRecordTime[6]	Starting time for disconnected information storage (See graphic following this table.)
DWORD	dwNetworkSeparationCount	Number of network separations
DWORD	dwNewsorkDisConnectionCount	Number of network disconnections
DWORD	dwLocalNodeDisConnectionCount	Number of local node disconnections
DWORD	dwNetworkDisConnectionMaxCycleCount	Maximum number of cycles with continuous disconnection
DWORD	dwFrameDropOutsCountSL1	Number of frame dropouts for SL1
DWORD	dwFrameDropOutsCountSL2	Number of frame dropouts for SL2
DWORD	dwFrameBrakesCountSL1	Number of broken frames for SL1
DWORD	dwFrameBrakesCountSL2	Number of broken frames for SL2
DWORD	dwCrcErrorCountSL1	Number of CRC errors for SL1
DWORD	dwCrcErrorCountSL2	Number of CRC errors for SL2

For more information on the Disconnected Line Flags and Disconnected Node Information, refer to the *Optical Ring Controller Link Units Operation Manual* (Cat. No. W370).

Disconnected Line Flags



Disconnected Node Information



Disconnected node information can be read out for up to two disconnections:
 Disconnected Node Information 1 and Disconnected Node Information 2.

Starting Time for Disconnected Information Storage

Bit	7	0
[0]	Minutes	
[1]	Seconds	
[2]	Date of month	
[3]	Hour (24-hr time)	
[4]	Year (rightmost 2 digits)	
[5]	Month	

The time when recording disconnection information was started is stored as shown above. All data is BCD.

4-3 Detailed Error Information

The information read by ClkGetLastError is listed in the following table. Macro names for error codes are defined in CLK_LIB.H.

Error code	Macro name	Meaning
1	ERR_UNIT_ADDRESS	Unit address range error
2	ERR_NO_CLKUNIT	Controller 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 designation error
30	---	Service not defined.
31	---	Incorrect network handle
32	---	Memory insufficient; cannot execute.
33	---	Unit of the same unit address already exists.

Error code	Macro name	Meaning
34	---	Network busy; cannot execute.
35	---	Reception buffer overflow
36	---	Data size error
37	---	FINS header error
38	---	Reception timeout (no receive data)
39	---	Invalid SID setting
40	---	Version is not supported; impossible to execute.
41	---	Wrong setting in routing tables; cannot reach final network
42	---	Routing table error
43	---	Allowed number of gateways exceeded
44	---	Version already in locked state and can't change.
45	---	Attempted to make header to response.
46	---	Attempted to make response to command that requires no response.
47	---	Could not make event object to be used for send data notice.
48	---	Could not make list object to be used to receive data.
49	---	Failed in standby process of exclusive control of shared memory.
50	---	Failed in mapping of shared memory.
51	---	Name of object is too long.
52	---	Attempted to release unused unit address.
53	---	Unexpected error occurred.
54	---	Failed to initialization of shared memory.
55	---	Failed in attachment to shared memory.
56	---	Number of units (units) simultaneously usable exceeded.
57	---	Send destination unit does not existence.
58	---	Could not notify data transmission.
59	---	Exit from receive standby due to abnormal end of other process.
60	---	Failed in receive standby.
61	---	All reserved area of network handle is fully used.
62	---	Incoming data is not received yet.
63	---	Invalid Windows message type
64	---	Failed in message notice.
65	---	Invalid prototype
66	---	Buffer is too short.
67	---	Invalid Windows handle
68	---	Failed in beginning thread for sending message.
69	---	Message registration duplication error

SECTION 5

Data Links

This section describes how to use data links in a Controller Link Network.

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5-1 What Are Data Links?

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

Two data link areas, area 1 and area 2, can be set for each node.

Data links can be set in either of the following ways.

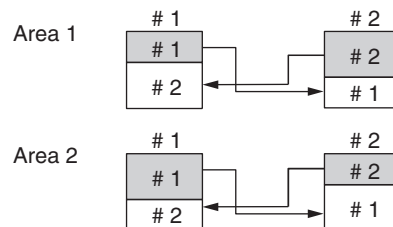
- Data link areas can be manually set by inputting data link tables through the CLK Data Link Setting Utility in the FinsGateway or the Controller Link Support Software. Data link tables are created to define the data links. These tables enable user-specified allocation of data link areas.
- Data links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

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

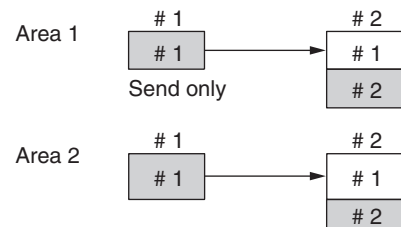
- Data links are enabled concurrently for area 1 and area 2.
- Separate settings (first link words and send area size) are made in area 1 and area 2. The sequences of send and receive words are the same in area 1 and area 2.
- Not all nodes must participate in the data links.

Manually Setting Data Links

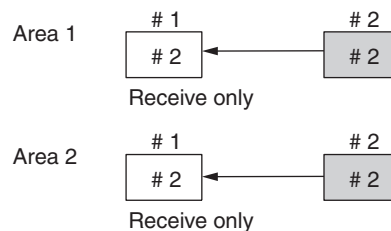
Example 1: The order of send and receive nodes is free.



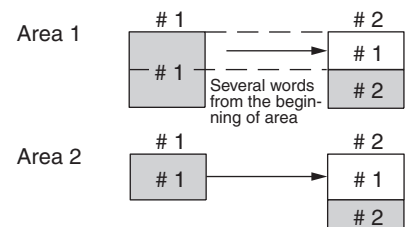
Example 2: Some nodes can send data without receiving data.



Example 3: Some nodes can receive data without sending data.



Example 4: A node can receive only a specified number of words from the beginning of an area.



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

- Data links are set in the Controller Link Unit or Board of each node using the CLK Data Link Setting Utility in the FinsGateway or Controller Link Support Software or CX-Programmer.
- At PCs, area 1 and area 2 can be selected from memory areas, including the DM Area and EM Area.
- A send area and its size can be allocated freely for each node.
- The sequence of receive nodes can be changed.

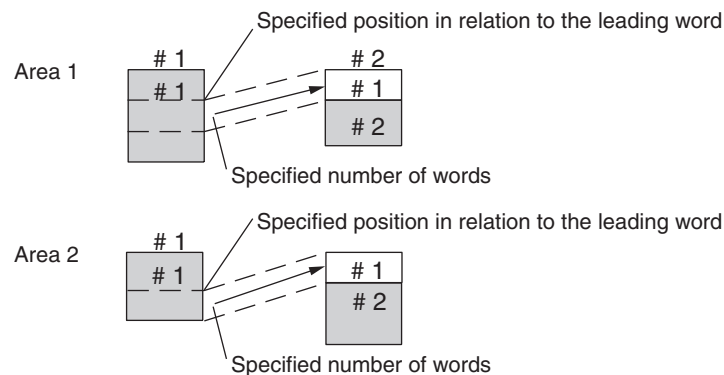
- Nodes can be set that only send or only receive data.
- Only part of send data can be received and an offset can be used to specify the beginning of the desired part.

Manual Setting Options

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

Offsets

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

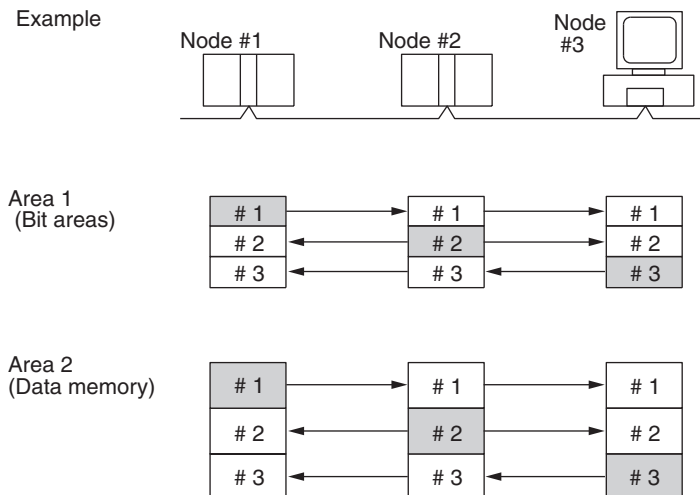


Easy Setting: “Set All”

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

Note Easy Setting appears as “Set All” on the Controller Link Support Board screen.

Automatically Setting Data Links with Equality Layout



Automatic setting can be used to create simple data links.

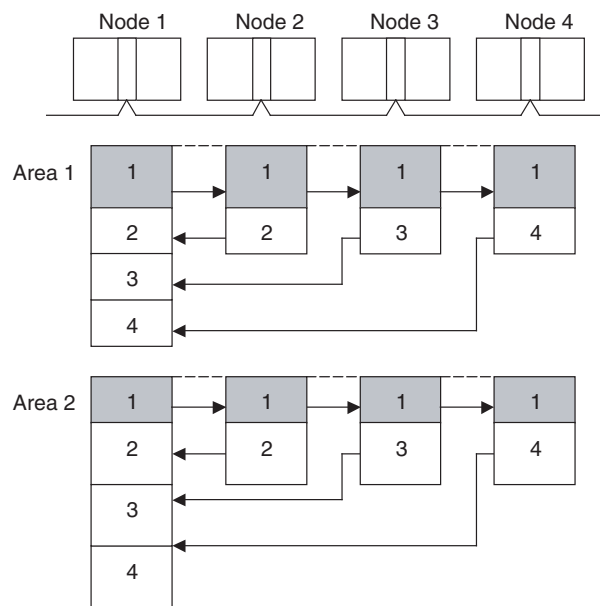
- Using a Programming Device (such as a Programming Console), set the automatic data link mode in the DM parameter area of the startup node.
- Area 1 can be selected from bit areas (i.e., IR, CIO, and LR areas) and area 2 can be selected from Data Memory.
- A computer cannot be used as the startup node if data links are being automatically set. When automatically setting data links, computers can only participate in the data links.

- The maximum number of send/receive words is 8,000 when data links are automatically set, even for computers. This is because computers relay on the Controller Link Unit settings in the startup node.
- In areas 1 and 2 send areas for each node are of the same size.
- Send nodes are in the same ascending order as node numbers.
- It is not possible to receive only a part of send data.
- All nodes can be specified to either participate or not participate in the data link.
- The data link areas are exactly the same and common to all nodes participating in the data links.

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

Automatic Setting Data Links with 1:N Allocations

This method is used to simplify setting of 1:N allocation data links between master and slave nodes.



- There are three types of 1:N allocations.
- Programming Devices (including Programming Consoles) are used to set the automatic data link mode in the DM Parameter Area of the PC used as the startup node.
- Node 1 is the master node.
- Areas 1 and 2 can be selected from bit-access areas or the DM Area.
- The send area sizes of the master and slave nodes are the same for each area.
- Send nodes are in the same ascending order as node numbers.
- All nodes can be specified to either participate or not participate in the data link.
- The data link areas (data link start words) are common to all nodes participating in the data links.

- Note
1. Automatic data link creation with 1:N allocations can only be used with the following Controller Link Units and Support Boards:

Wired Networks	CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK23-E, CS1W-CLK21-V1, CJ1W-CLK21-V1, and 3G8F7-CLK21-EV1
Optical Ring Networks using H-PCF Cable	CS1W-CLK13, 3G8F7-CLK13-E, CS1W-CLK12-V1 (See note 2.), and 3G8F7-CLK12-EV1
Optical Ring Networks using GI Cable	CS1W-CLK53, 3G8F7-CLK53-E, CS1W-CLK52-V1 (See note 2.), and 3G8F7-CLK52-EV1

2. Lot numbers 030601 or later.

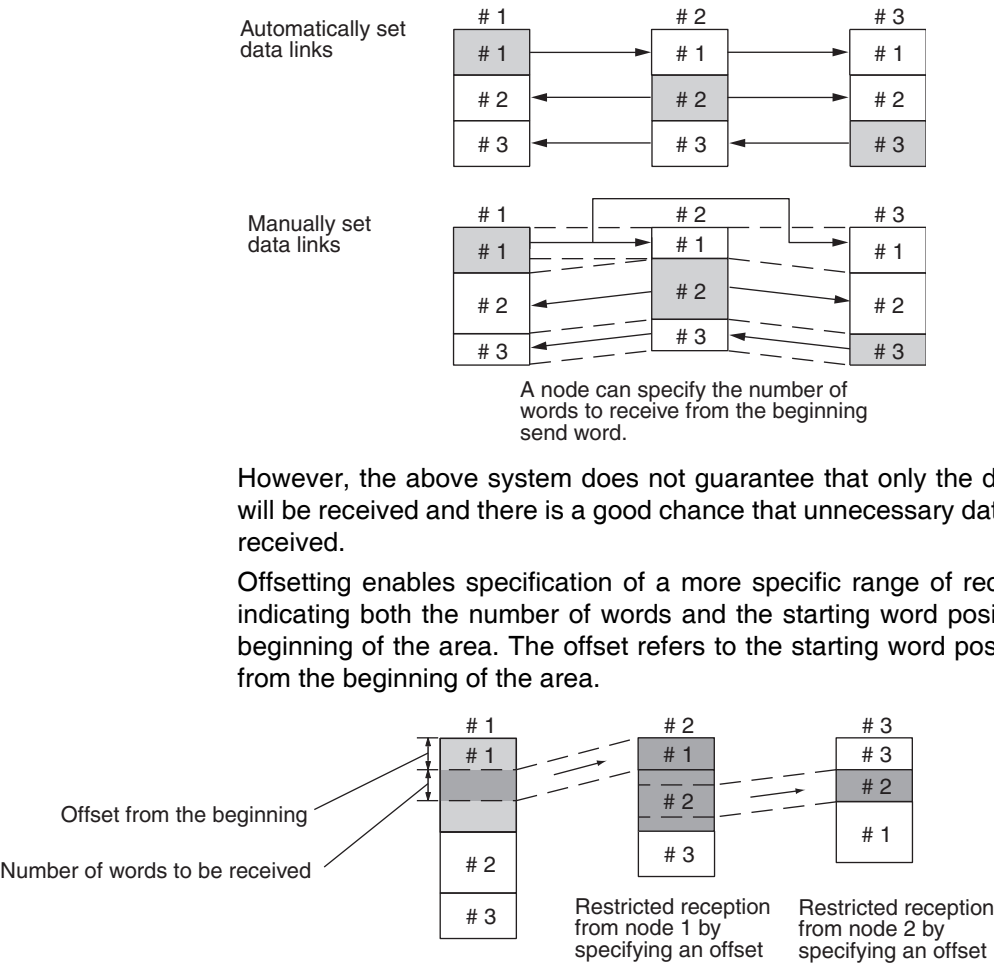
3. Controller Link Units and Support Boards other than those listed above cannot participate in 1:N allocation data links. They can, however, join the network if a parameter in the DM Parameter Area is set so that they do not participate in the data links.

4. The Controller Link Support Board can be used in automatic data link creation with 1:N allocations, but it cannot be the startup node. Use a Controller Link Unit on the same network as the startup node.

5. For automatic data link creation with 1:N allocations, use the CX-Net in CX-Programmer version 3.2 or later.

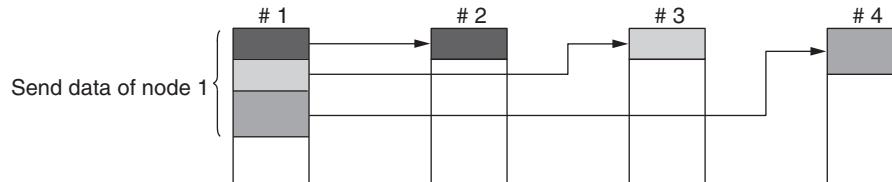
Using Offsets

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



Application Example of Using Offsets

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

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

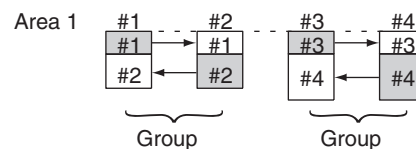
Item		Description	
No. of data link nodes		Optical Ring System: 62 nodes max. (2 nodes min.) Wired System: 32 nodes max. (2 nodes min.)	
Number of data link words	Send areas per node	CS or CJ Series	CS1W-CLK23 or CJ1W-CLK23: 4,000 words max. CS1W-CLK21-EV1 or CJ1W-CLK21-EV1: 1,000 words max.
		C200HX/HG/HE, CVM1/CV, CQM1H	1,000 words max.
		Computers	3G8F7-CLK23-E: 4,000 words max. 3G8F7-CLK21-EV1, 3G8F5-CLK21-E: 1,000 words max.
	Data link areas (send and receive) that can be created per node	CS or CJ Series	CS1W-CLK23-E or CJ1W-CLK23-E: 20,000 words max. CS1W-CLK21-EV1 or CJ1W-CLK21-EV1: 20,000 words max. (unit version 1.2 or later) 12,000 words max. (Pre-Ver. 1.2)
		C200HX/HG/HE, CVM1/CV, CQM1H	8,000 words max.
		Computers	32,000 or 62,000 words max. (See note 2.)
Allocation of data link areas		Manual setting	Area 1, 2: Bit-access area (IR, CIO, and LR Areas) DM Area (DM and EM Areas)
		Automatic setting equality layout	Area 1: IR, CIO, or LR Area Area 2: DM Area (DM and EM Areas)
		Automatic setting 1:N allocations	Area 1, 2: Bit-access area (IR, CIO, and LR Areas) DM Area (DM and EM Areas)

- Note**
- Up to 62 nodes can be set by using Repeater Units when the network is configured with only the 3G8F7-CLK21-EV1, CS1W-CLK23, CJ1W-CLK23, or 3G8F7-CLK23-E.
 - When optical and optical ring connections are combined, the maximum number of nodes is 32 and the maximum number of data link words for a computer for manual settings is 32,000 words.

5-1-2 Differences Between Manual and Automatic Setting

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

- Note**
1. Automatically set data links cannot be started from the Controller Link Support Board.
The Controller Link Support Board can participate in automatically set data links.
 2. If data links are manually set, send/receive area can be selected in each node, allowing send/receive groups to be created within the network in area 1 and area 2, as shown below.



5-2 Setting Data Links

5-2-1 Selecting Manual or Automatic Setting

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

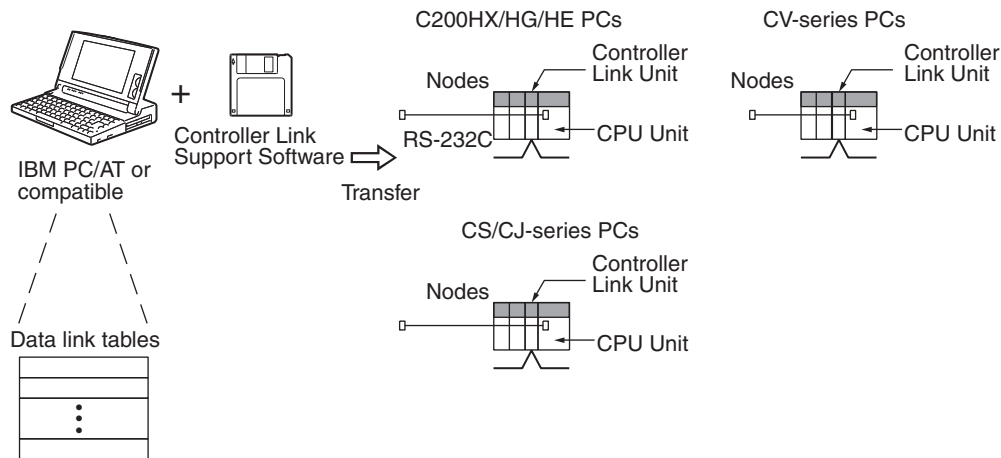
- Note**
1. The data link mode can only be specified in the Controller Link Unit. Refer to the *Controller Link Units Operation Manual* (W309) for more details.
 2. When the Controller Link Support Board has been set as the startup node, data links must be manually set.

3. A data link mode can be set in a data link startup node only. The data link mode setting is determined by the data link mode of the startup node even if the data link mode settings of the nodes participating in the data links are different from the settings in the startup node.
4. In manual setting, a data link table must be set in the data link startup node and in automatic setting, automatic data link setting parameters must be set in the data link startup node. Data links will not be started unless the settings are correct.
5. Always check whether the data link settings for all startup nodes in the corresponding network are correct to prevent starting up using with incorrect data link modes and parameters. Make sure that both automatic setting and manual setting modes are not used together in the same network and that automatic settings with different parameters are not used.

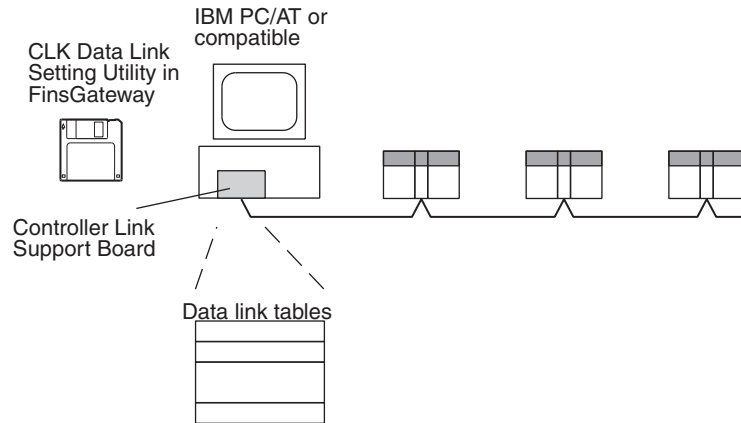
5-2-2 Manual Setting

Transfer the data link tables that were created on the Support Software to the Controller Link Unit and the Controller Link Support Board at all node participating in the data links.

Transferring from a Programming Device



- Note**
1. Data link tables cannot be set in the Controller Link Support Board using the CX-Net in the CX-Programmer. Use the CLK Data Link Setting Utility in FinsGateway or the Controller Link Support Software (version 2.00 or higher).
 2. Refer to the *Controller Link Support Software Operation Manual* (W369) or the *CX-Net Operation Manual* for actual setting procedures.
 3. When transferring the data link tables to a Controller Link Unit for a CV-series PC, set the System Protect Keyswitch on the CPU Unit to "NORMAL." Otherwise, data link tables cannot be written normally.

Transferring from a Computer Node

Note To create data link tables for nodes in the network using the CLK 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. Refer to *1-4 Applications Precautions* for details. Refer to FinsGateway online help for actual setting procedures for the CLK Data Link Setting Utility.

5-2-3 Data Link Table Specifications for Controller Link Support Boards

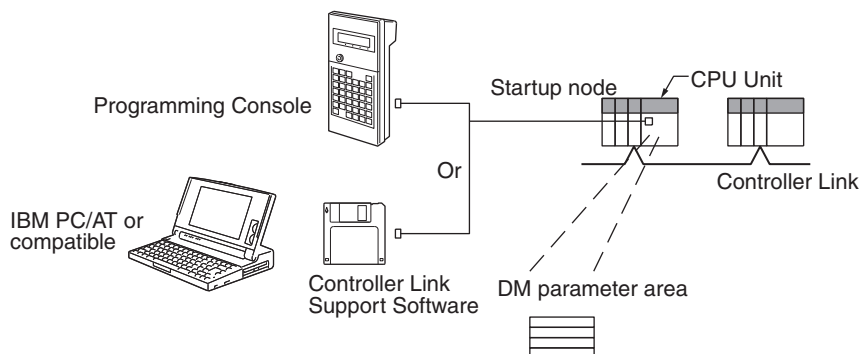
Setting item		Setting range
Nodes		Optical Ring: 1 to 62 (1 to 32 when optical and optical ring connections are combined.) Wired: 1 to 32 (Up to 62 nodes can be set by using Repeater Units when the network is configured with only the 3G8F7-CLK21-EV1, CS1W-CLK23, CJ1W-CLK23, or 3G8F7-CLK23-E.) Set the addresses of the refresh nodes.
First data link status word		The first data link status word is fixed; the setting cannot be changed. Set to –.
Area 1	Data link start word	Set the start word within the FinsGateway event memory setting range. The defaults are CIO 0 to CIO 32767 and DM 0 to DM 32767.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 4,000 (3G8F7-CLK□3-E) 0 to 1,000 (3G8F7-CLK21/12/52-EV1) Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.
Area 2	Data link start word	Set the start word within the FinsGateway event memory setting range. The defaults are CIO 0 to CIO 32767 and DM 0 to DM 32767.
	Number of words	Remote nodes: 0 to the number of source words Set the number of words to be received. Local node: 0 to 4,000 (3G8F7-CLK□3-E) 0 to 1,000 (3G8F7-CLK21/12/52-EV1) Set the number of words to be transmitted. The total number of words in area 1 and area 2 in each node must not exceed 1,000. The numbers of words in both area 1 and area 2 in each node must not be set to 0.
	Offset	Remote nodes: 0 to one less than number of source words Set the offset for the data to be received. Local node: Cannot be set. This setting is not required if an offset is not used.

- Note**
1. The maximum number of words for area 1 and area 2 combined must be no more than 62,000 for optical ring connections and no more than 32,000 words for wired connections or systems that combine optical and optical ring connections.
 2. Data link areas in the Controller 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.
 3. Be sure to delete data link tables for all nodes not participating in the data links.
 4. When using the Controller Link Support Software, set the “PC type” to “others.”

5-2-4 Automatic Setting: “Select All”

Data links can be automatically created by setting values in the DM parameter area of the PC's CPU Unit of the startup node. The settings are made using a Programming Console “or the SYSMAC Support Software.

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**
- Parameters for automatically setting data links can only be set in PCs. Refer to the *Controller Link Units Operation Manual* (W309) for details.
 - A computer (Controller Link Support Board) cannot be the startup node for an automatically setting data links.
 - A computer can participate in automatically set data links created using 1:N allocations with equality layout. Data link tables are not required in the computer (the data link tables in the startup node will be used).
 - Refer to the *Controller Link Units Operation Manual* (W309) for details on automatically setting data links with 1:N allocations.

5-2-5 Example of Automatic Setting with Equality Layout

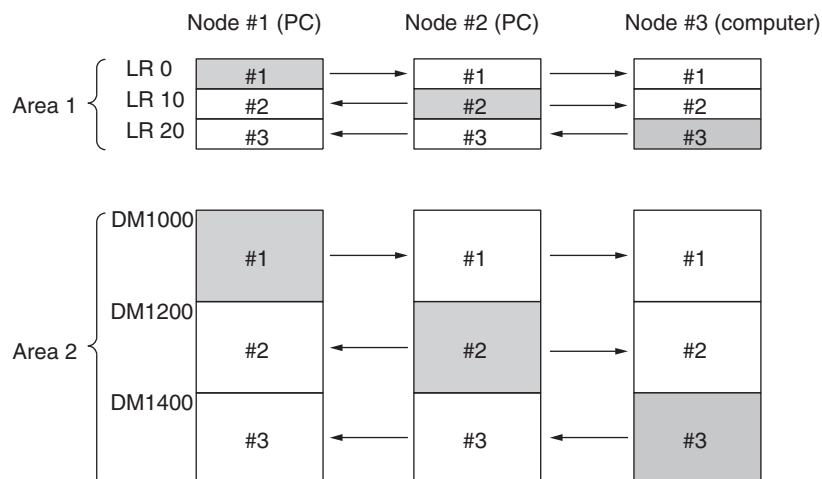
This section shows an example of DM parameter area settings and the data link areas that are created as a result.

DM Parameter Area Settings

Set the parameters in the startup node as follows:

N	0	0	1	0	← Data link mode: Automatic
N+1	0	0	0	0	← Area 1 data link start word: LR 00
N+2	8	6	0	0	
N+3	0	0	1	0	← Number of words: 10
N+4	1	0	0	0	← Area 2 data link start word: DM 1000
N+5	8	2	0	0	
N+6	0	2	0	0	← Number of words: 200
N+7	0	3	1	0	← First data link status word: IR 310
N+8	0	0	0	7	← Participating nodes: #1, #2, and #3
N+9	0	0	0	0	

Data Link Areas Created



Note Refer to the *Controller Link Units Operation Manual (W309)* for an example of automatically setting data links with 1:N allocations.

5-3 Starting and Stopping Data Links

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

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

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

- **Manually Set Data Links**

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

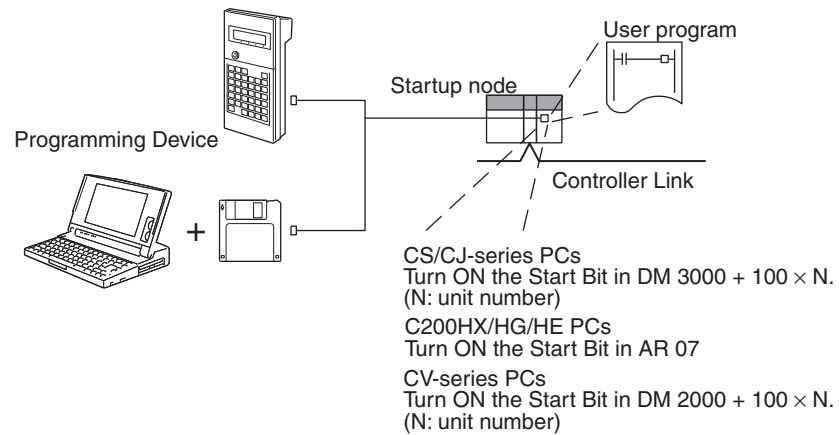
Be sure that data link tables are deleted from nodes that are not participating in the data links.

- **Automatically Set Data Links**

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

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

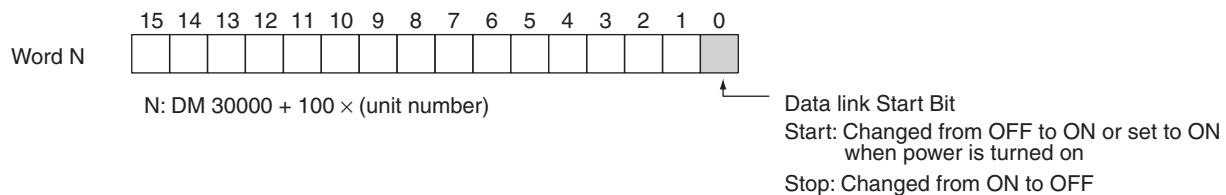
Set the software switches (AR or DM Start Bit) in the PC to ON using a Programming Device or from the ladder-diagram program.



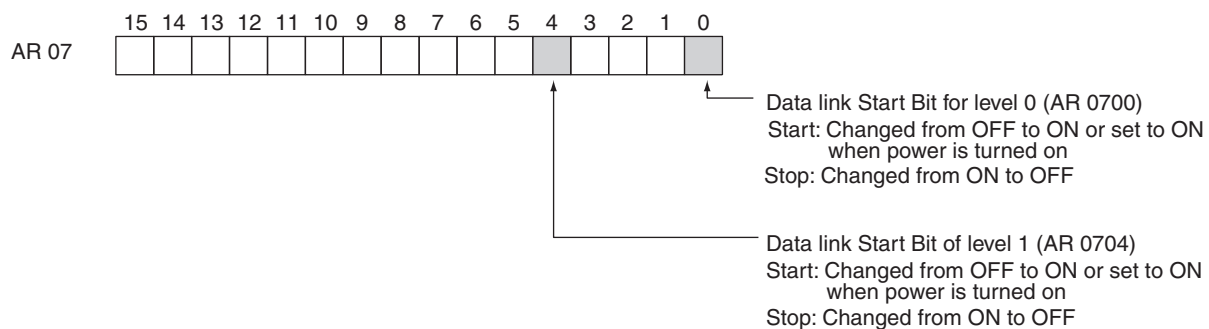
The data links will start when the Start Bit changes from OFF to ON or is already ON when power is turned ON. The data links will stop when the Start Bit changes from ON to OFF.

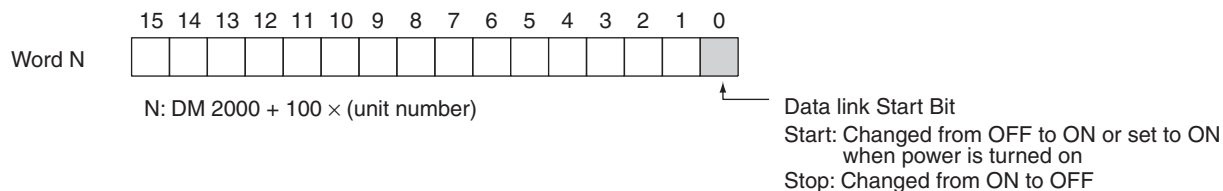
- Note**
1. Refer to the *Controller Link Units Operation Manual* (W309 or W370) for details on starting and stopping data links using a Programming Device or ladder program.
 2. The data in the AR and DM Areas is retained when power is turned off. Therefore, by setting in the AR and DM Areas can be made in advance to start data links as soon as power is turned on. It is recommended to set the Start Bit to ON in multiple nodes that are participating in the data link so that the data links will start even if the startup node is down. The same data link settings must be set in these nodes for automatically set data links.

CS-series or CJ-series Startup Node

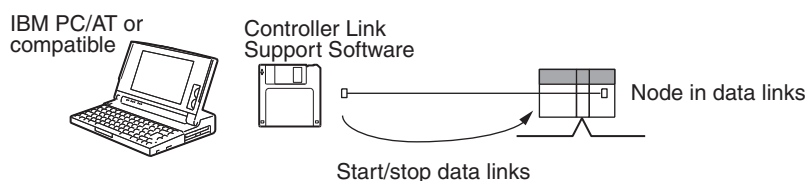
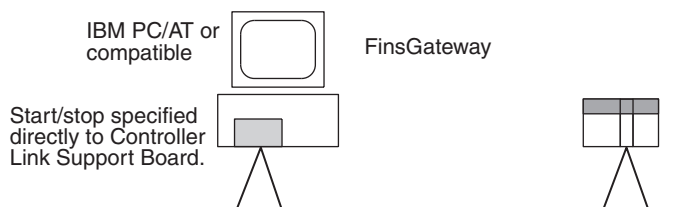


C200HX/HG/HE Startup Node

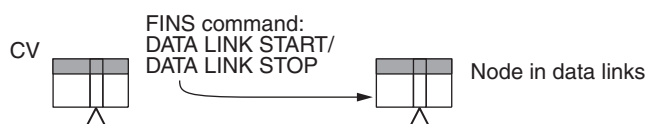


CV-series Startup Node**5-3-2 Using the Controller Link Support Software**

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

Using a Programming Device Connected to PC Node**Using a Computer Node with FinsGateway****5-3-3 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 Controller Link to a node that is in the data links.

Sending FINS Commands from a Computer Node**Issuing the FINS Command from CV-series, CS-series, and CJ-series PCs**

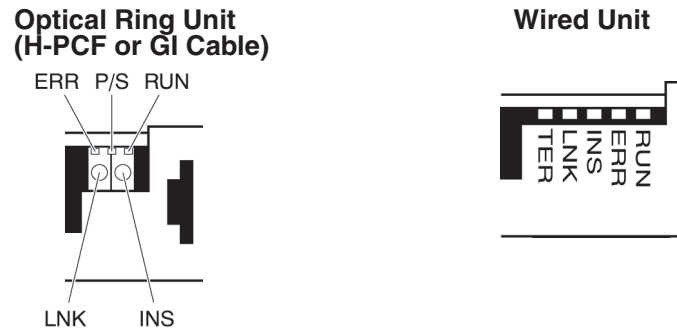
5-4 Checking Data Link Status

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.



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.
		OFF	Not in data links or data links are inactive.

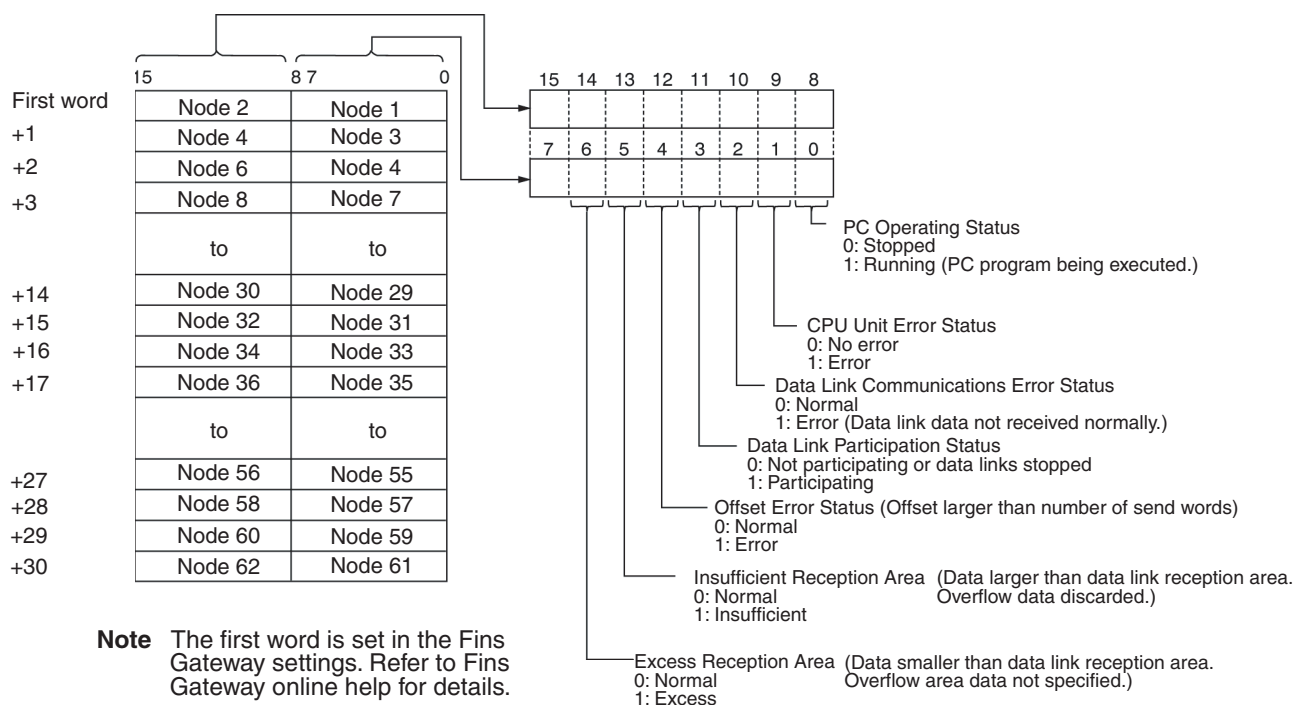
The LNK indicator will be lit at all node participating in the data links as long as operation is normal. The data link mode (manual/automatic) can be checked using the M/A indicator. The M/A indicator is only available in the Controller Link Unit and cannot be used in the Controller Link Support Board. Refer to *9-1 Troubleshooting Using Indicators* for details.

5-4-2 Data Link Status Area

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

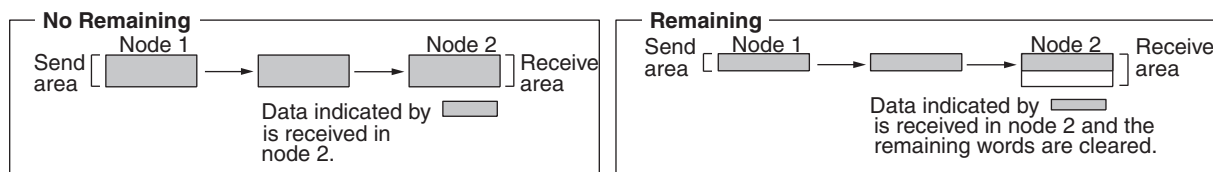
Data link status can be monitored using the CLK Data Link Setting Utility in FinsGateway or it can be stored in FinsGateway event memory. Refer to the FinsGateway online help and installation guide for details.

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

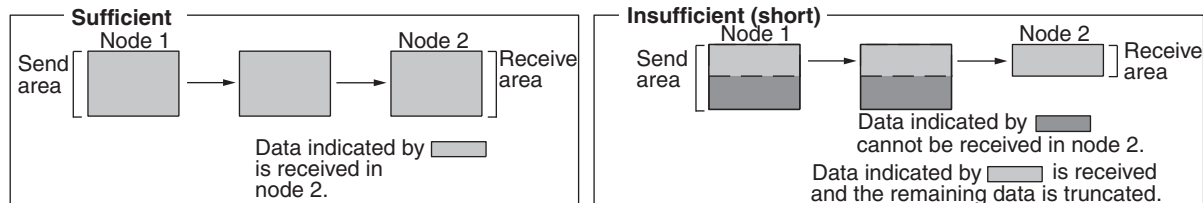


Status	Values	Description
PC status	0: Program execution stopped 1: Program being executed	Indicates if the PC program is being executed or not. Always 1 for Controller Link Support Board nodes.
CPU Unit error	0: No error 1: Error	Indicates if an error has occurred in the PC. Always 0 for Controller Link Support Board nodes.
Communications error	0: Normal 1: Error	Indicates if data link data for node was received normally or not.
Data link participation	0: Not participating in data links or data links inactive 1: Participating in data links	Indicates data link participation status.
Offset error	0: No error 1: Error	"Error" indicates that the offset is larger than the number of send words. The data links will operate and the node will remain participating in the data links. The receive area at nodes with this error will be all zeros.
Receive area remaining	0: No receive area remaining 1: Receive area remaining	A receive area is "remaining" if the number of words in the receive area is larger than the number of send words. Data will be received normally and all words in the receive area beyond those containing the send words will have indeterminate status.
Insufficient (short) receive area	0: Receive area not short 1: Receive area short	A receive area is "short" if the number of send words is larger than the number of words in the receive area. Data will be received normally, but all words that will not fit in the receive area will be discarded.

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



- The following shows an example of an insufficient receive area.



- Note**
1. A communications error will occur in a node that is not participating in the network.
 2. When a communications error occurs or a node is separated from the network, previous status will be retained for other node status.
 3. A node which is participating in the network but is not participating in the data links will show the PC operating status and PC error.
 4. On the Controller Link Support Board, a node participating in the network but not in the data links will show the PC operating status, PC errors, communications errors, and data link participation for all nodes.
 5. When there is not enough receive data to filling a receive area ("area remaining") at a computer node, the status of the rest of the receive area will be indeterminate.

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 Controller 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 Changing the Data Link Tables with Active Data Links

5-5-1 Overview

The data link tables can be changed and data link tables can be allocated for newly added nodes while the system's data links are active if the following Controller Link Units and Support Boards are used.

- Models that Support Data Link Table Changes during Active Data Links

Wired Networks	CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK23-E, CS1W-CLK21-V1, CJ1W-CLK21-V1, and 3G8F7-CLK21-EV1
Optical Ring Networks using H-PCF Cable	CS1W-CLK13, 3G8F7-CLK13-E, CS1W-CLK12-V1 (See note 1.), and 3G8F7-CLK12-EV1
Optical Ring Networks using GI Cable	CS1W-CLK53, 3G8F7-CLK53-E, CS1W-CLK52-V1 (See note 1.), and 3G8F7-CLK52-EV1

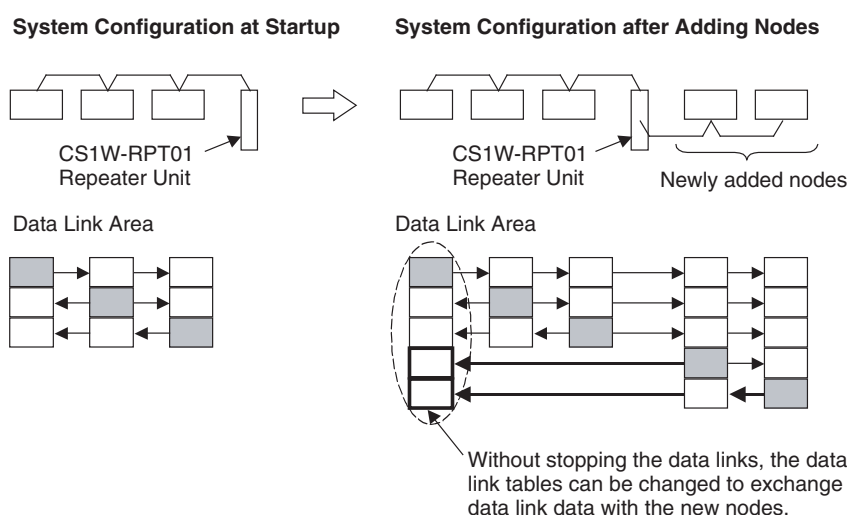
- Note**
1. Lot numbers 030601 or later.

- When using Controller Link Units and Support Boards that are not listed in the above table, data link tables cannot be changed while data links are active.
- CX-Programmer version 3.2 must be used to change data link tables with active data links. CX-Programmer version 3.1 or earlier versions cannot be used.

Caution Check that the contents of the data link table to be changed are correct for the corresponding node before changing them. If an incorrect data link table is set, the unexpected operation of the system may result in injury.

Caution Check that the effects of the data link table to be changed has been considered in the user programs before changing a data link table.

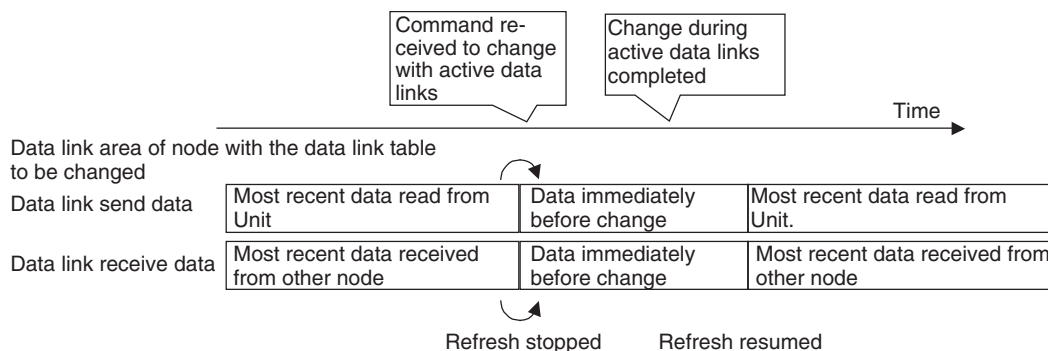
5-5-2 Example of Changing Data Link Table with Active Data Links



5-5-3 Operations when Changing Data Link Tables

The Controller Link Unit/Support Board that receives the command from the CX-Programmer version 3.2 or later to change a data link table with active data links will temporarily stop refreshing data with the PC or computer, change to the new data link table (data link refresh allocation) and then resume refreshing data links.

Nodes with data link tables that are changed will send the data from immediately before the tables were changed while PC and computer data link refreshing is stopped.



Data link communications will continue, so the Communications Error Flag for the data link status will not turn ON in any of the nodes in the network.

Refer to *5-5-4 Timing Required to Change Data Link Tables with Active Data Links (Theoretical)* for details on timing required to change the data link tables.

5-5-4 Timing Required to Change Data Link Tables with Active Data Links (Theoretical)

When changing data link tables with active data links for Controller Link Support Boards, the data refresh for the corresponding node will stop temporarily. During that time, even if the data in the data link send area in the computer is refreshed, it will not be sent as data link data to other nodes. Data received from other nodes will also not be shown in the data link receive areas of the other nodes. The data refresh interrupt timing (maximum theoretical value) is as follows:

Data link refresh maximum interrupt time = Communications cycle time $\times$ 3 + 250 ms + Computer overhead time (See note 1.) (ms)

- Note**
1. The overhead time of the computer varies somewhat with the MPU processing capability and the load created by other applications.
 2. Consider the effect of the data link refresh interrupt time on the applications when changing the data link tables. If the maximum interrupt time is not suitable for the user application, transfer the data link table after stopping the data links from a Programming Device as before, and then restart the data links.
 3. Refer to the *Controller Link Units Operation Manual* (W309) for information on changing data link tables with active data links.

SECTION 6

Message Service

This section explains how to use the message service provided by a Controller Link Support Board.

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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	2,012 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>ClkSendFins</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. Fixed-format data is prepared by the program and sent by executing <i>clksend</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>ClkRecvFins</i> library function	These library functions and driver call receive command/response data. Data received by the Controller 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>clkrecv</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 *ClkSendFins* or *ClkRecvFins* 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

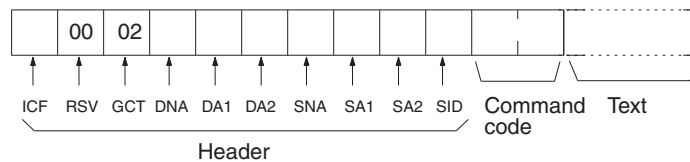
This section explains the format of the FINS commands and responses specified by the “*clksend*” library function.

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.

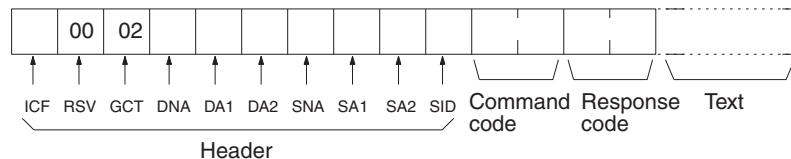
6-2-1 Headers

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



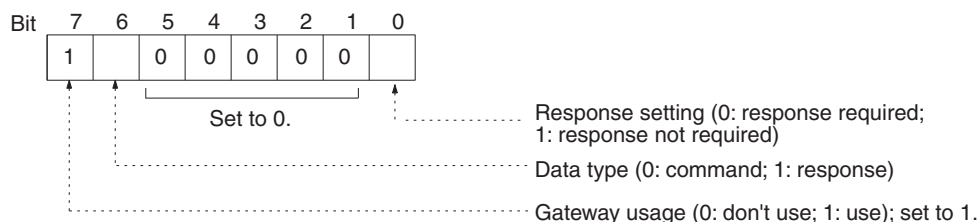
Response Data Structure



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 Controller 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 Controller 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 Controller 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

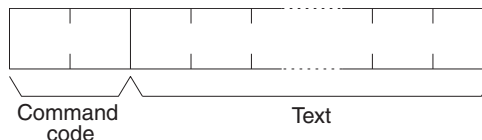
6-2-2 Parameters

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

6-2-3 Data Formats

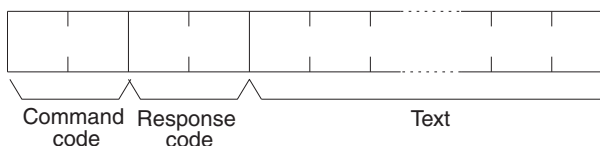
Commands

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 library function for message transmission. There are two bytes available for the command code and 0 to 2,000 bytes for the text.



Responses

When the library function for message reception 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 code and response code, and 0 to 1,998 bytes for the text.



Note When multiple networks are connected, there are limits to the amount of data that can be transmitted or received via the Controller Link Network and the host link function.

6-3 Commands and Responses for the Support Board

6-3-1 Command Codes

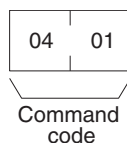
Command code		Data link operation mode		Name	Page
		Active	Inactive		
04	01	Not valid	Valid	DATA LINK START	95
	02	Valid	Not valid	DATA LINK STOP	96
05	01	Valid	Valid	CONTROLLER DATA READ	96
06	01	Valid	Valid	CONTROLLER STATUS READ	97
	02	Valid	Valid	NETWORK STATUS READ	99
	03	Valid	Valid	DATA LINK STATUS READ	101
	04	Valid	Valid	CONNECTION CONFIGURATION INFORMATION READ	102 (See note.)
	05	Valid	Valid	NETWORK DISCONNECTION INFORMATION READ	104 (See note.)
	06	Valid	Valid	NETWORK DISCONNECTION INFORMATION CLEAR	106 (See note.)
08	01	Valid	Valid	ECHOBACK TEST	107
	02	Valid	Valid	BROADCAST TEST RESULTS READ	107
	03	Valid	Valid	BROADCAST TEST DATA SEND	108
21	02	Valid	Valid	ERROR LOG READ	108
	03	Valid	Valid	ERROR LOG CLEAR	109

Note Command codes 06 04, 06 05, and 06 06 are supported only by the Optical Ring Controller Link Support Boards in Token Ring Mode.

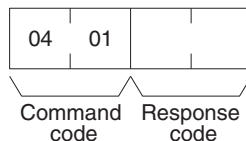
6-3-2 DATA LINK START

Starts the Controller 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.

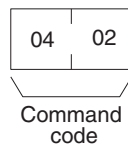
The node that receives this command and starts the data links will become the data link startup node.

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

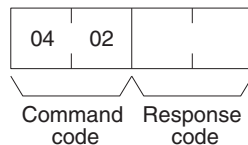
6-3-3 DATA LINK STOP

Stops the Controller Link Network data links.

Command Block



Response Block



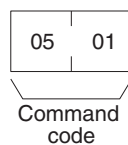
The DATA LINK STOP command can be received only while the data links is active. An error will occur if this command is sent at any other time.

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

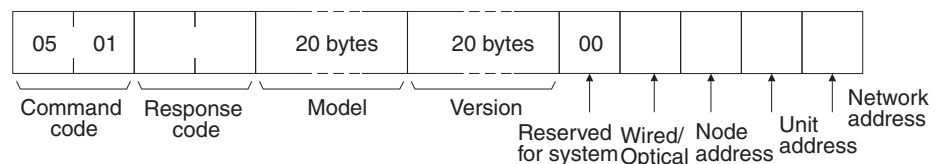
6-3-4 CONTROLLER DATA READ

Reads the Controller Link Support Board's model, version, node address, unit address, connection type, and network address data.

Command Block



Response Block



Parameters

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

Model

3G8F7-CLK21-E□□□□□□□□ (Wired)

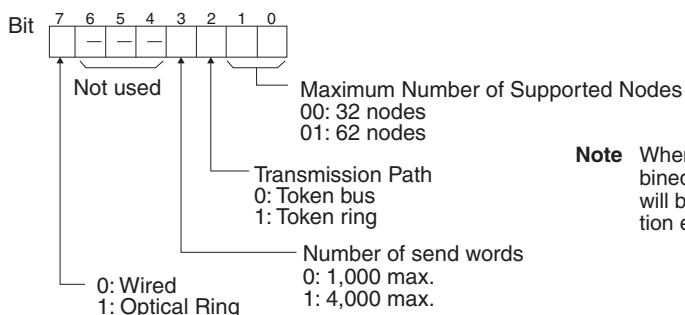
3G8F7-CLK12-E□□□□□□□□ (Optical Ring, H-PCF cable)

3G8F7-CLK52-E□□□□□□□□ (Optical Ring, GI cable)

Version

V1.01□V2.03□□□□□□□□

The first "V1.01" represents the Support Board version number, and the second represents the Communications Controller version number.

Connection Type: Wired/Optical (response)

Note When optical and optical ring connections are combined, the maximum number of nodes supported will be given as 62 nodes for an optical ring connection even if the maximum number of nodes is 32.

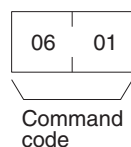
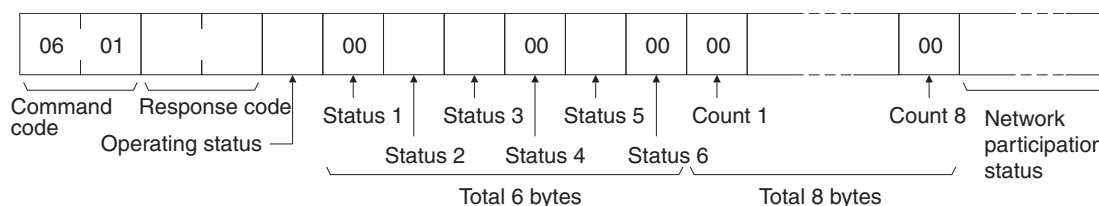
Node address (response): The Support Board's node address is returned between 01 and 3E Hex (1 to 62).

Unit address (response): The unit address set for the Support Board is returned between 10 and 1F Hex (16 to 31). It is returned even when a unit address setting error is generated.

Network address (response): The network address set for the Support Board in the routing table is returned between 00 and 7F Hex (0 to 127). If the routing table setting has not been made, 00 Hex is returned.

6-3-5 CONTROLLER STATUS READ

Reads the Controller Link Support Board's controller status.

Command Block**Response Block****Parameters**

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

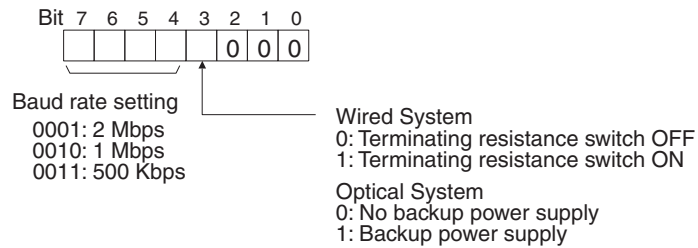
00 (Hex): Data links inactive.

01 (Hex): Data links active.

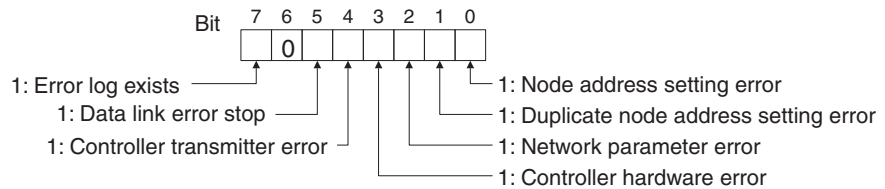
02 (Hex): Local data links not active. (The data links are active in the network, but the source node is not participating.)

Status 1, Status 4, Status 6 (response): Not used by Controller Link. Always set to 00 (Hex).

Status 2 (response): This byte contains the following information for Controller Link Support Boards. (It is always 00 Hex for Wired Controller Link Support Boards.)

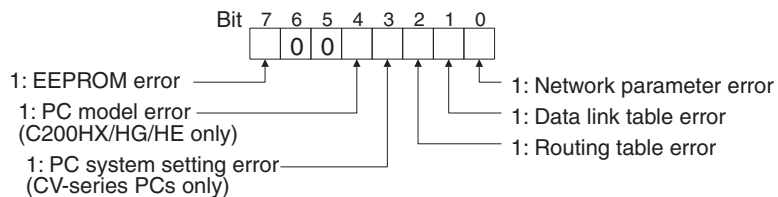


Status 3 (response): Error information. The configuration is as follows:



Note A network parameter 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 error occurs, the actual network parameter contents are automatically registered to that Unit.

Status 5 (response): Error information related to the Support Board and the PC. The configuration is as follows:



A network parameter error, data link table error, or routing table error occurs if an error is discovered when the parameters and tables are checked at power up.

A PC system setting error occurs if the Controller Link Unit is not properly recognized by a CS-series, CJ-series, or CV-series PC.

A PC model error occurs if a C200HX/HG/HE Controller Link Unit is mounted to another type of PC.

Count 1 to Count 8 (response): The total number of times for each of the items listed below is returned as 1 byte of hexadecimal data.

- Count 1: Number of CRC errors
- Count 2: Number of token re-sends
- Count 3: Number of token returns
- Count 4: Number of token timeouts
- Count 5: Number of polling timeouts
- Count 6: Number of controller changes
- Count 7: Number of active node changes
- Count 8: Reserved for system use.

Network participation status (response): The following diagram shows the bits corresponding to node addresses in the Controller Link Network. When a bit is returned as "1," it means that the corresponding node is active (i.e., participating) in the network.

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

(All boxes marked by "—" are reserved for system use and fixed at "0.")

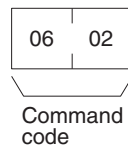
Reserved for system use.

Bytes 5 to 8 are all reserved for Wired Networks set for a maximum of 32 nodes.

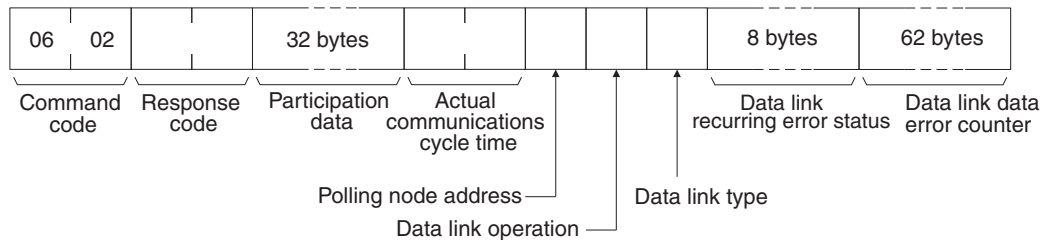
6-3-6 NETWORK STATUS READ

Reads the operating status of the entire Controller Link Network.

Command Block



Response Block

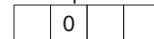


Parameters

Participation data (response): This parameter indicates the active status of individual nodes with respect to the network (i.e. their participation in the network). As shown in the following diagram, that status is expressed in four bits corresponding to the node address.

Bit	7	6	5	4	3	2	1	0
Byte 1	Node #1				Reserved (0)			
Byte 2	Node #3				Node #2			
Byte 3	Node #5				Node #4			
Byte 17	Node #32				Node #32			
Byte 18	Node #35				Node #34			
Byte 32	Reserved (0)				Node #62			

Participation Status of Individual Nodes



0: Not part of network
1: Part of network

0: Normal disconnection (Applicable only for inactive nodes.)
1: Abnormal disconnection

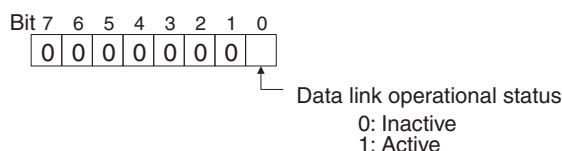
0: Normal node
1: Non-responding node (No response to polling)

All data from the upper 4 bits of byte 16 (node address 33) though byte 32 are reserved for Wired Units (always 0).

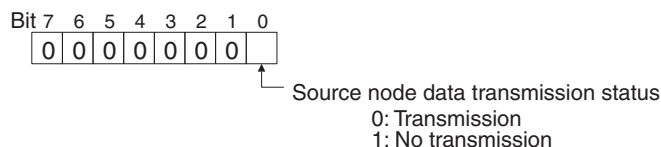
Actual communications cycle time (response): The actual communications cycle time is returned in units of 100 μ s in hexadecimal.

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

Data link operation (response): Indicates the status of data link operation in the network.



Data link type (response): Indicates the data transmission status of the source node's data links. It is configured as shown in the following diagram. This parameter is valid only during data link operation. While data link operation is inactive, the value from the previous operation is retained.



Data link recurring error status (response): Indicates whether an error continues to occur at a node when data link data is received. If an error continues to occur at the same node when the data is received, the bit corresponding to that node turns to "1" (i.e., turns ON). The configuration is shown in the following diagram.

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

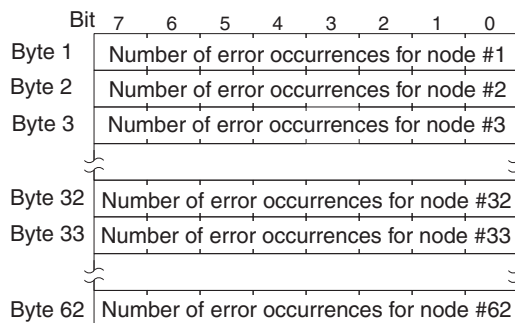
The numbers in the boxes indicate the node addresses. The bit status of a particular node address shows whether or not there is a recurring data link error at that node.

0: No recurring error
1: Recurring error

Reserved for system use.

All bytes from 5 to 8 are reserved for Wired Networks set for a maximum of 32 nodes.

Data link data error counter (response): The total number of data link data reception errors occurring at all nodes (node addresses 1 to 62) is returned as a total count from the time the power was turned on. It is expressed, in hexadecimal, as one byte per node. The count can range from 0 to 255 (i.e., 0 to FF in hexadecimal).

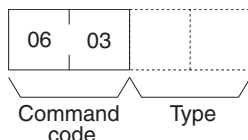


All bytes from 33 to 62 are reserved for Wired Networks set for a maximum of 32 nodes.

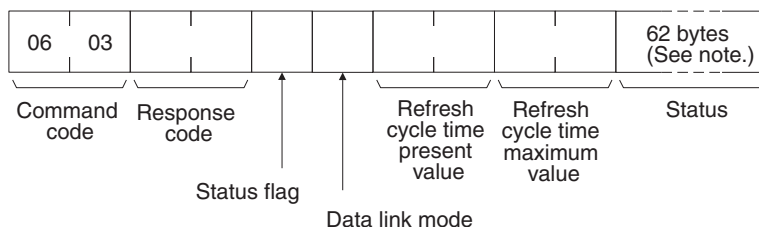
6-3-7 DATA LINK STATUS READ

Reads the data link operational status.

Command Block



Response Block



Note The length is 32 bytes for Wired Units if the type is set to 0000 hex or omitted.

Parameters

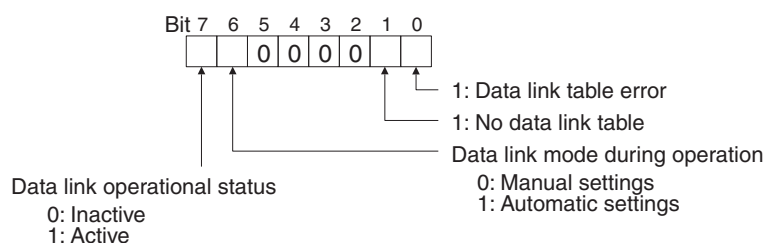
Type (command):

0000 hex: Returns status from 32 nodes.

0001 hex: Returns status from 62 nodes.

Omitted: Returns status from 32 nodes.

Status flag (response): The overall data link status is returned in one byte of data, as shown in the following diagram.



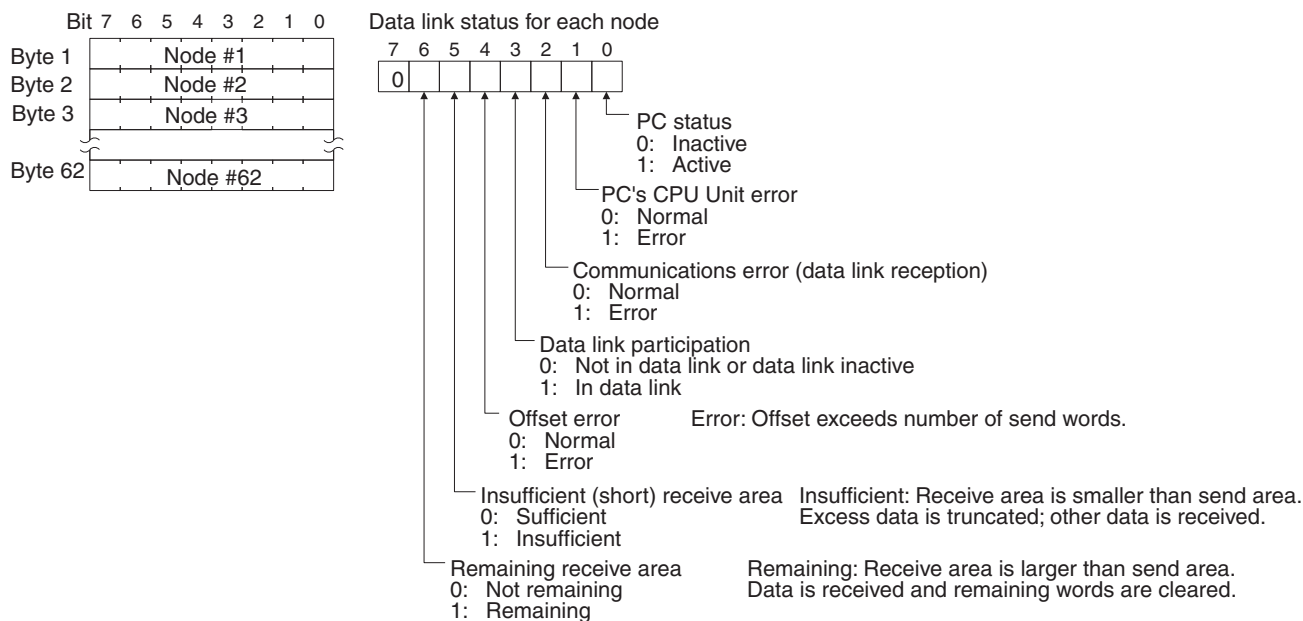
Data link mode (response): The data link mode during operation is returned in one byte of data, as follows:

01 (Hex): Automatic

03 (Hex): Manual

Refresh cycle time present value, refresh cycle time maximum value (response): The present value and the maximum value of the cycle time for refreshing the data link area are both returned in units of 1 ms, in hexadecimal, within a range of 0000 to 00FF (decimal: 0 to 255). With the Support Board, both the present value and the maximum value will be 0.

Status (response): The data link status of each mode is returned as shown in the following diagram. It is the same as the data link read using a library function. (Refer to page 85.)



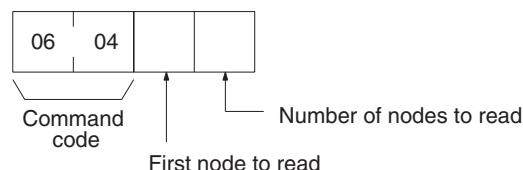
Only node addresses 1 to 32 (i.e., 32 bytes) are returned for Wired Units if the type is set to 0000 hex or omitted.

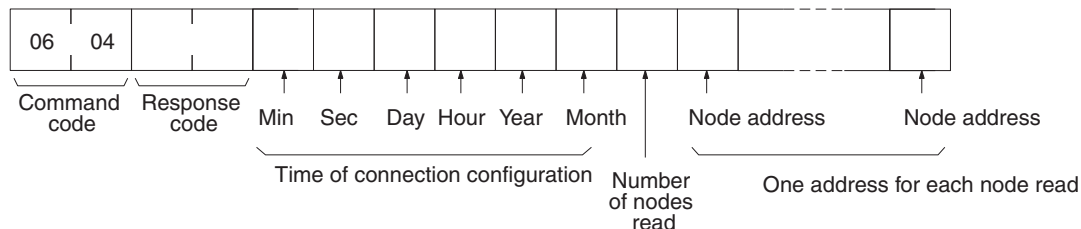
- Note**
1. The length of data returned is different for Wired and Optical Ring Units.
 2. The data link status is not refreshed while the data links are inactive.
 3. Nodes which are not active in the network or participating in the data links will generate communications errors.
 4. Any node which is not active in the network retains the status that existed immediately prior to the generation of the communications error.
 5. Only the PC operation status and PC error status will be refreshed for nodes that are not participating in a data link that is active in the network.

6-3-8 CONNECTION CONFIGURATION INFORMATION READ

Reads the node address of Controller Link Units and Boards connected to the ring in order in the downstream direction. This command is supported only by the Optical Ring Controller Link Support Units and Boards in Token Ring Mode (H-PCF or GI cable).

Command Block



Response Block**Parameters**

First node to read (command): Specify the node to start the configuration from counting downstream direction (SL2) from the local node. The number is specified as a 2-digit hexadecimal value between 00 and 3E (decimal 0 to 62).

Number of nodes to read (command and response): In the command, specify the number of node addresses to return as a 2-digit hexadecimal value between 00 and 3E (decimal 0 to 62). If 00 is specified, the node addresses of all nodes downstream from the current node will be returned. The response will return the number of node addresses actually read as a 2-digit hexadecimal value between 00 and 3E (decimal 0 to 62).

For this command, the node address of the local node is always returned first regardless of the setting for the first node to read. The number of other nodes for which addresses are returned will thus be one less than the specified number of addresses. The node address of the specified first node will be returned as the second node address.

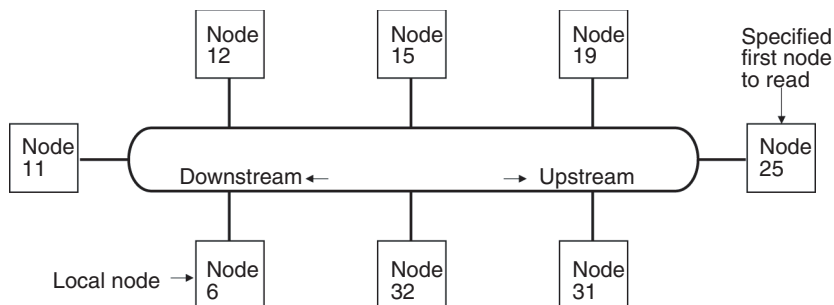
Time of connection configuration (response): These parameters show the seconds, minutes, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the connection configuration was last updated. The information is updated each communications cycle in Token Bus Mode as long as the ling connection status is normal. The time will be taken from the clock data in the local node.

Node address (response): Node addresses are returned in order as 1-byte hexadecimal values starting from the node address of the local node and then the node address of the node specified as the first node to read.

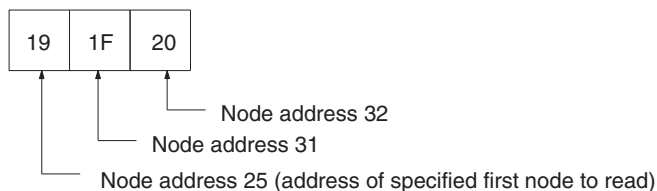
Description

If the number of nodes to read and the specified first node to read are such that the local node is included in the reading range, node addresses will be read only through the node next to and upstream from the local node. The read will end normally.

Example: In the following example, the first node to read is specified as 5 and the number of nodes to read is specified as 6.



The following response will be returned.

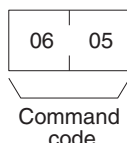


- Note**
1. If there is a disconnection in the network, but most recently updated information will be read.
 2. If a node is down, it will be skipped even if the connections are normal.

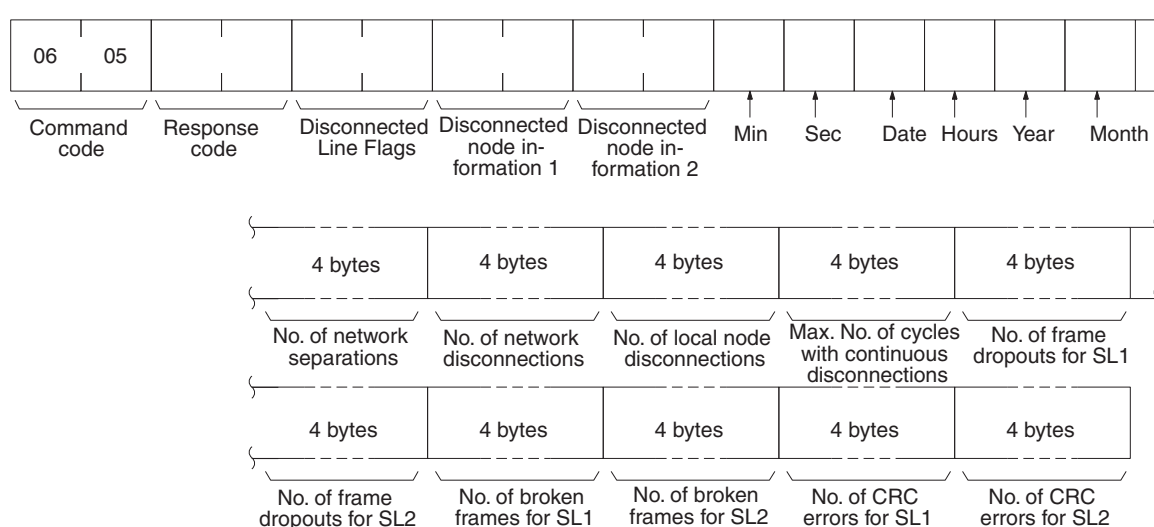
6-3-9 NETWORK DISCONNECTION INFORMATION READ

Read the Controller Link Board/Unit disconnection information. This command is supported only by the Optical Ring Controller Link Support Units and Boards in Token Ring Mode (H-PCF or GI cable).

Command Block

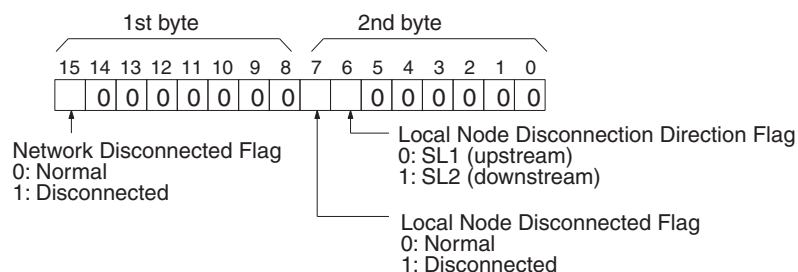


Response Block

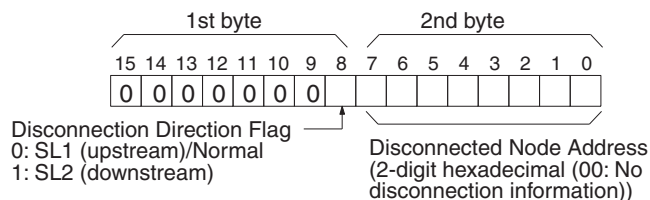


Parameters

Disconnected Line Flags (response): The line disconnection status is returned as follows:



Disconnected node information 1 and 2 (response): The address of the disconnected node and the direction of the disconnection from the node (upstream or downstream) are returned.



Disconnected node information is returned for two disconnections: Disconnected Node Information 1 and Disconnected Node Information 2.

Starting time for disconnection information storage (response): These parameters show the seconds, minutes, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the last time the local node was turned ON, the Controller Link Unit/Board was reset, or the disconnection information was cleared. The time will be taken from the clock data in the local node.

Number of network separations (response): Specifies the number of times the local node has been separated from the network since the starting time for disconnection information. The value is given as an 8-digit hexadecimal value.

Number of network disconnections (response): Specifies the number of times disconnection information has been received from the polling node since the starting time for disconnection information. If the same disconnection information is received two or more communications cycles in a row, it is considered a continuous disconnection and not counted. The value is given as an 8-digit hexadecimal value.

Number of local node disconnections (response): Specifies the number of times a disconnection has occurred at the local node since the starting time for disconnection information. If the disconnection information is the same two or more communications cycles in a row, it is considered a continuous disconnection and not counted. The value is given as an 8-digit hexadecimal value.

Maximum number of cycles with continuous disconnection (response): Specifies the largest number of cycles that disconnection information has been received from the polling node since the starting time for disconnection information. The value is given as an 8-digit hexadecimal value. This value can be multiplied by the maximum communications cycle time of the Controller Link Network to estimate the time that data has not been sent and received.

Number of frame dropouts for SL1 and SL2 (response): Specifies the number of frames that have been normally received by other systems but have not been received at all at the local node since the starting time for disconnection information. The value is given as an 8-digit hexadecimal value.

Number of broken frames for SL1 and SL2 (response): Specifies the number of frames that have been normally received by other systems but for which only the carrier was received at the local node since the starting time for disconnection information. The value is given as an 8-digit hexadecimal value.

Number of CRC errors for SL1 and SL2 (response): Specifies the number of CRC and Manchester errors since the starting time for disconnection information. The value is given as an 8-digit hexadecimal value.

Description

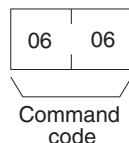
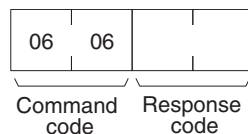
Disconnection information can be used for Optical Ring Controller Link Units and Boards that are in Token Ring Mode to notify the polling node of information on disconnections and then notify all nodes of the disconnection information from the polling node. The disconnection information can be used to determine the location of the disconnection. For details, refer to the *Optical Ring Controller Link Units Operation Manual* (W370).

None of the disconnection information except for the Disconnected Line Flags is cleared when communications recover. The Disconnected Line Flags always show the most current disconnection status. Disconnected Node Information 1 and 2 are overwritten whenever new information is generated.

Disconnection information can be cleared either by executing the NETWORK DISCONNECTION INFORMATION CLEAR (06 06) FINS command or from the Controller Link Support Software (Ver. 2.00 or higher). (The FINS command must be executed for each node separately.)

6-3-10 NETWORK DISCONNECTION INFORMATION CLEAR

Clears the network disconnection information. This command is supported only by the Optical Ring Controller Link Support Units and Boards in Token Ring Mode (H-PCF or GI cable).

Command Block**Response Block****Description**

None of the disconnection information except for the Disconnected Line Flags is cleared when communications recover. The Disconnected Line Flags always show the most current disconnection status. Disconnected Node Information 1 and 2 are overwritten whenever new information is generated. This command, however, can be used to clear the disconnection information to its default status.

When the command is executed, the disconnection information and the ring status is cleared from the Controller Link Unit/Board and the starting time for disconnection information is reset. (The time will be taken from the clock data in the local node.)

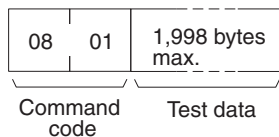
Disconnection information is cleared only from the node that receives this command. The command must be sent to all nodes in the network to clear all of the disconnection information.

Disconnection information can also be cleared from the Controller Link Support Software (Ver. 2.00 or higher), and can be cleared for all nodes at the same time (in one operation).

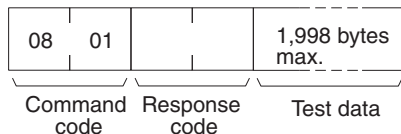
6-3-11 ECHOBACK TEST

Executes an echoback communications test between specified nodes.

Command Block



Response Block



Parameters

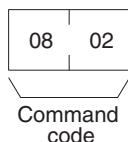
Test data (command, response): For the command, up to 1,998 bytes of data can be specified to be sent to a specified node. For the response, the test data that was sent by the command is returned unchanged.

An error is generated if the data returned by the response is different from the data that was sent by the command.

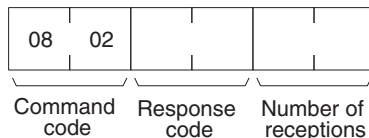
6-3-12 BROADCAST TEST RESULTS READ

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 6-3-13 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.

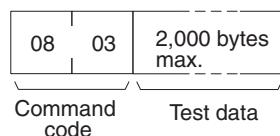
An error will be generated if that number of receptions differs from the number of times that the BROADCAST TEST DATA SEND command was issued during that same period.

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

6-3-13 BROADCAST TEST DATA SEND

Broadcasts test data to all nodes in a specified network.

Command Block



There is no response to this command.

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

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

Destination unit address: FE (Hex)
(for the Controller Link Support Board or Unit)

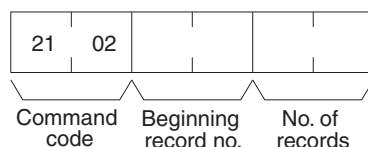
Response required/not required flag: 1 (response not required)

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 6-3-12 BROADCAST TEST RESULTS READ.

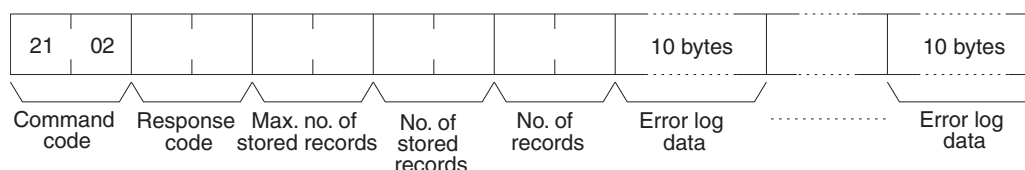
6-3-14 ERROR LOG READ

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 in hexadecimal).

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

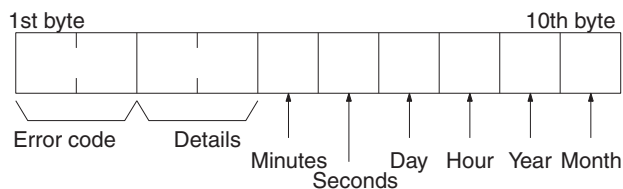
Max. no. of stored records (response): Specifies the maximum number of records that can be recorded, within a range of 0001 to 0040 in hexadecimal (decimal: 1 to 64).

No. of stored records (response): The number of records that have been recorded by the time the command is executed.

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*.

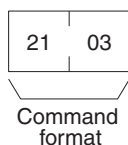
Date and time: These parameters show the seconds, minutes, hour (0 to 23), date, month, and year (the rightmost two digits) in BCD specifying the time that the error occurred.

Note If the PC does not have the specified number of records, all the records that have been stored in the PC up to the point that the command is executed will be returned.

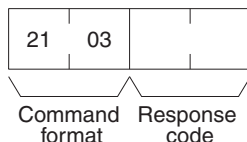
6-3-15 ERROR LOG CLEAR

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

Command Block



Response Block

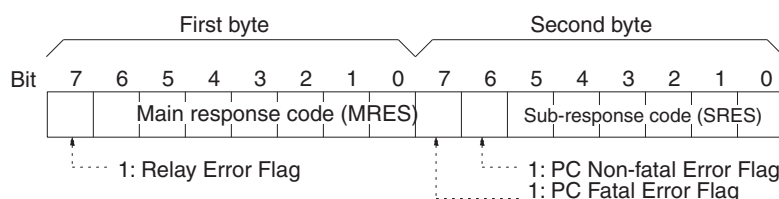


6-4 Response Codes

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.

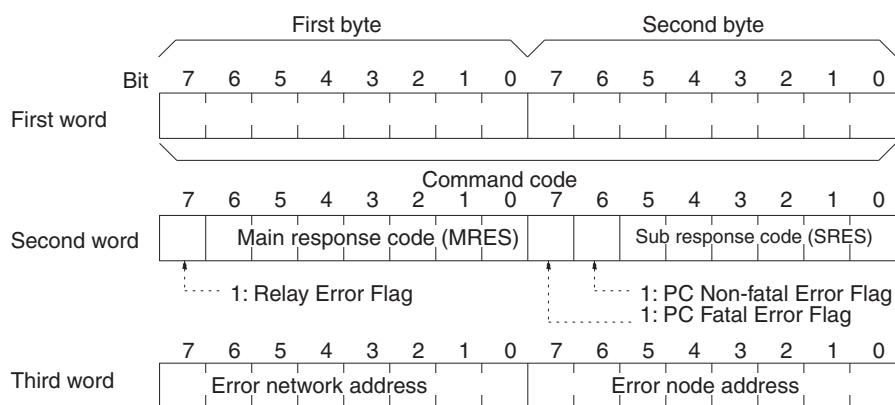
If bit 7 of the first byte is ON, a network relay error has occurred. Refer to 6-4-2 *Network Relay Errors* for details on troubleshooting the error.

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

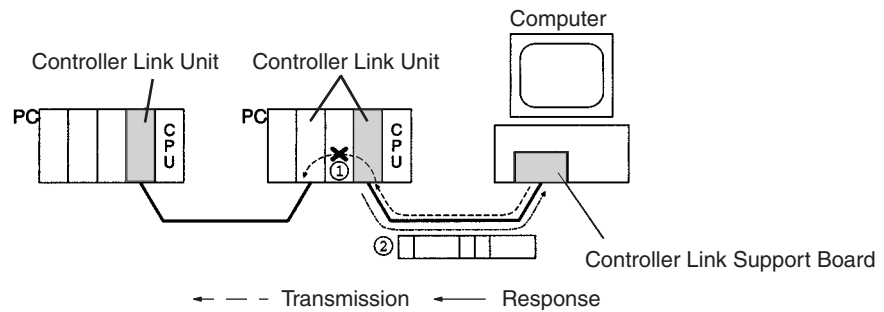
A relay error indicates that the command did not reach the Unit to which it was sent. There are two types of situation in which this can occur. Example 1 (below) shows a situation in which a relay error occurs when data cannot be transferred from one Communications Unit to another in an interconnected 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:

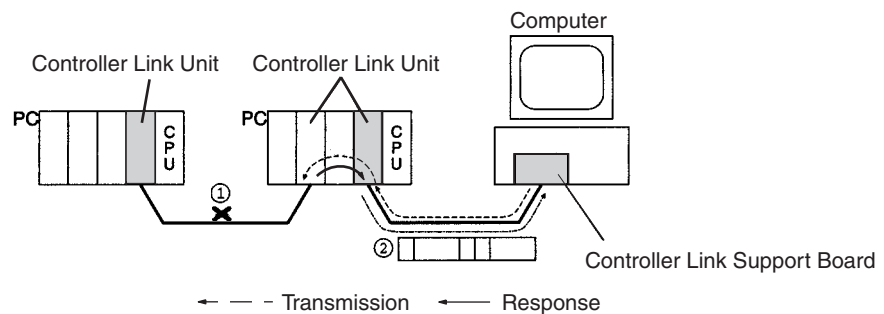
- (1) The transmitted data fails to be received.
- (2) The relay error and response code are returned to the command source.

Example 1

In this example, data cannot be transferred between Controller 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.
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.

Main code	Sub-code	Probable cause	Remedy
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.
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.

Main code	Sub-code	Probable cause	Remedy
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.
20: Read not possible	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.
	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.

Main code	Sub-code	Probable cause	Remedy
21: Write not possible	01	The specified area is read-only or is write-protected.	If the specified area is read-only, the write cannot be performed. If it is write-protected, turn off the write-protect switch and execute the instruction again.
	02	The data is protected.	Execute the instruction again after issuing the PROGRAM AREA PROTECT CLEAR command to the 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.
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.
	08	The mode is wrong and the step cannot be executed.	Check whether the step has active status or not.
23: No Unit	01	A file device does not exist where specified.	Mount the Memory Card or disk
	02	The specified memory does not exist.	Check the specifications of the installed file memory.
	03	No clock exists.	Check the model number.
24: Start/stop not possible	01	The data link tables either have not been created or are incorrect.	Set the data link tables correctly.

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.	If the error occurred in internal memory or the EM Unit, correct the data in the command and execute it again. If the error occurred in a Memory Card or EM used for file memory, the file data has been corrupted. Execute the MEMORY CARD FORMAT command for the PC. If the above remedies do not eliminate the error, replace the faulty memory.
	10	Terminator not connected in SYSMAC BUS System.	Connect the terminator correctly.

Main code	Sub-code	Probable cause	Remedy
26: Command error	01	The specified area is not protected. This response code will be returned if an attempt is made to clear protection on an area that is not protected.	The program area is not protected, so it isn't necessary to clear protection.
	02	An incorrect password has been specified.	Specify a password that is registered.
	04	The specified area is protected.	Execute the command again after executing the PROGRAM AREA PROTECT CLEAR command for the 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. (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.)	Execute the command again after the access right has been released. (The command can be executed after the ACCESS RIGHT FORCED ACQUIRE or ACCESS RIGHT RELEASE command is completed. Releasing the access right might affect processes in progress at the node that held the access right.)
40: Abort	01	Command was aborted with ABORT command.	---

SECTION 7

Network Interconnections

This section describes the method used to connect multiple networks.

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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

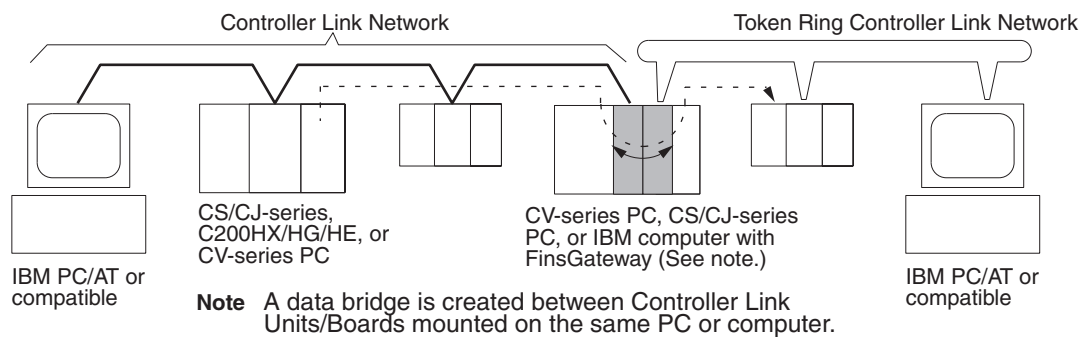
- Controller Link Networks
- SYSMAC NET Link Networks
- SYSMAC LINK Networks

OA Networks

Ethernet

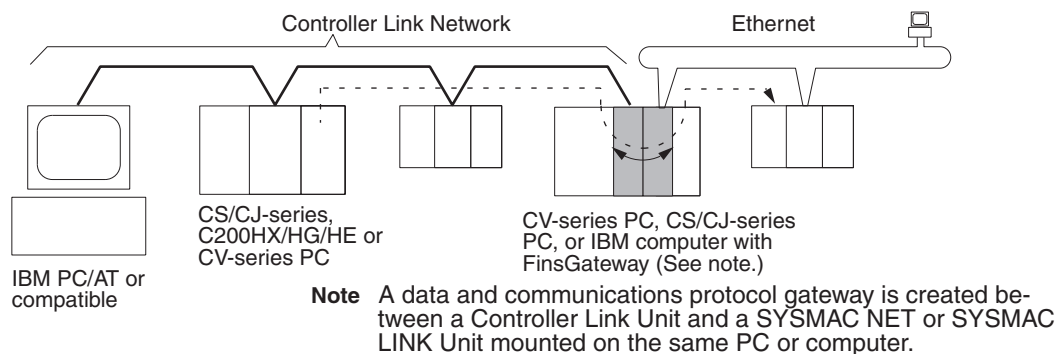
7-1-1 Interconnecting Controller Link Networks

Controller Link Networks can be connected through CV-series PCs, CS-series PCs, CJ-series PCs, or computers with FinsGateway.

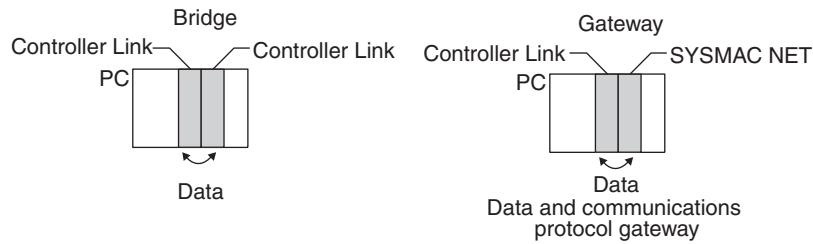


7-1-2 Interconnecting Different Types of Networks

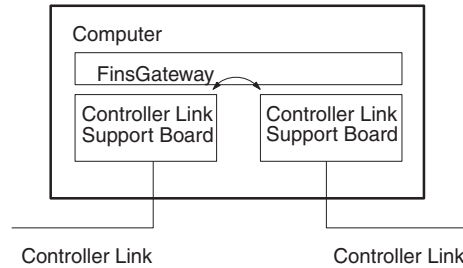
CV-series PCs, CS-series PCs, or computers with FinsGateway can be used to connect a Controller Link Network with a SYSMAC NET or SYSMAC LINK Network.



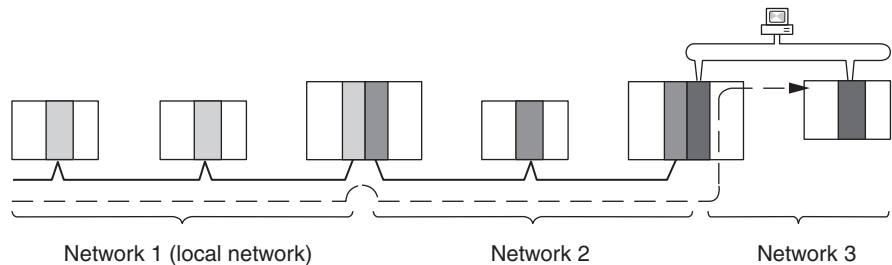
- Note**
1. A bridge is used between Communications Units/Boards to connect the same type of networks.
 2. A gateway is used between Communications Units/Boards to connect different types of networks.



- **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 with a Controller Link, the maximum amount of data is limited by any network the data passes through, i.e., the network with the smallest capacity will determine the limit.

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

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

7-2 Routing Tables

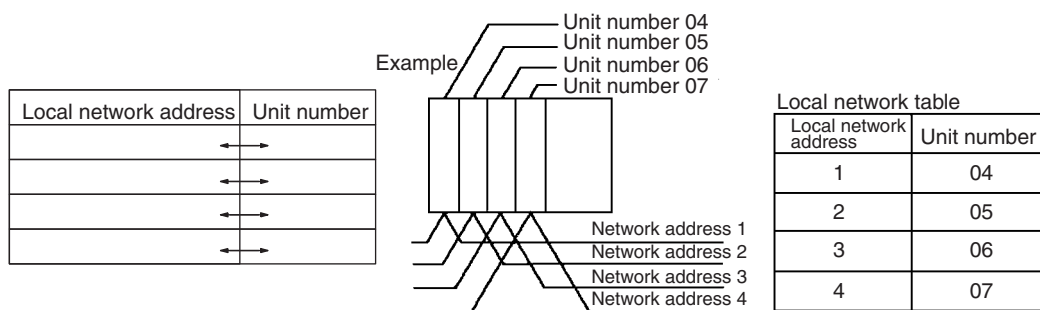
Routing tables that define the communications path from the Controller Link Unit on the local PC to the network connected to the destination PC must be created in order to send and receive data across networks.

Creating Routing Tables

Routing tables consists of a local network table and a relay network table.

Local Network Table

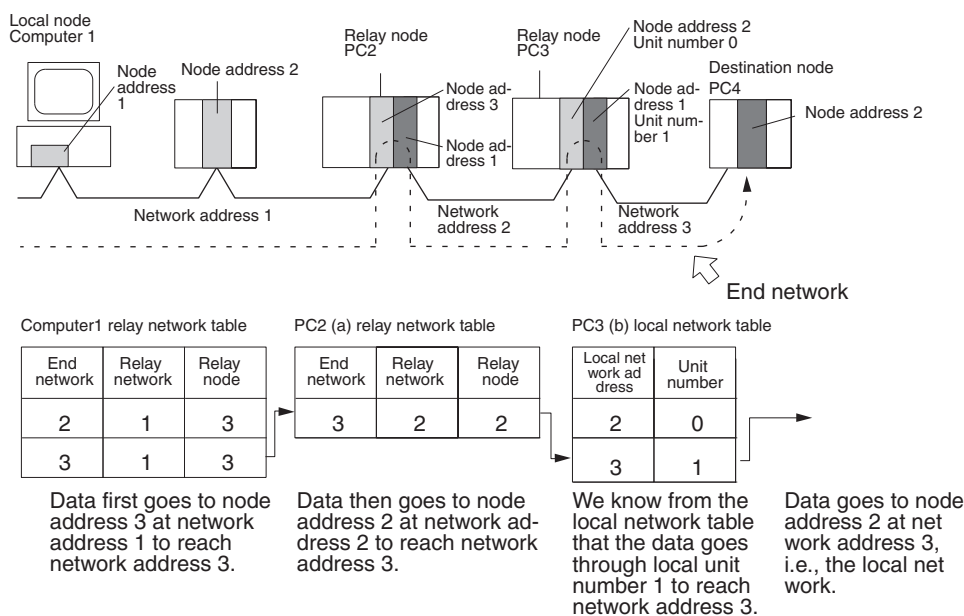
The local network table lists the unit numbers and corresponding network addresses for the Controller Link Unit and Support Board unit numbers. With the Support Board, only one entry can be set in the table.



- Note**
1. The unit number is set between 00 and 15 using the rotary switch on the front panel of CV-series, CS-series, and CJ-series Controller Link Units, and is the same as the operating level for C200HX/HG/HE PCs. For the Support Board, the unit number is 16 less that the unit address (i.e., the Communications Unit number) 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.



- Note**
- (1) The above example shows the routing tables required to send a message from the personal computer to PC4. To send from PC4 to the personal computer, similar routing table entries would be required.
 - (2) Refer to 7-3 *Setting Routing Tables* for a routing table setting example.

7-3 Setting Routing Tables

This section describes routing table settings.

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

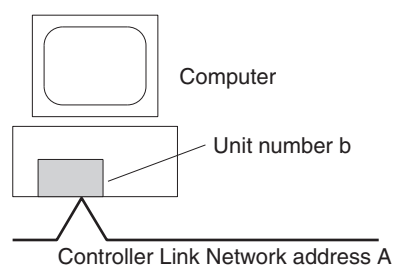
For specific procedures, see the FinsGateway online help, *Controller Link Support Software Operation Manual* (W308,) or *CX-Programmer User's Manual*.

7-3-1 Example Routing Table Settings

This section shows examples of routing table settings.

Example 1

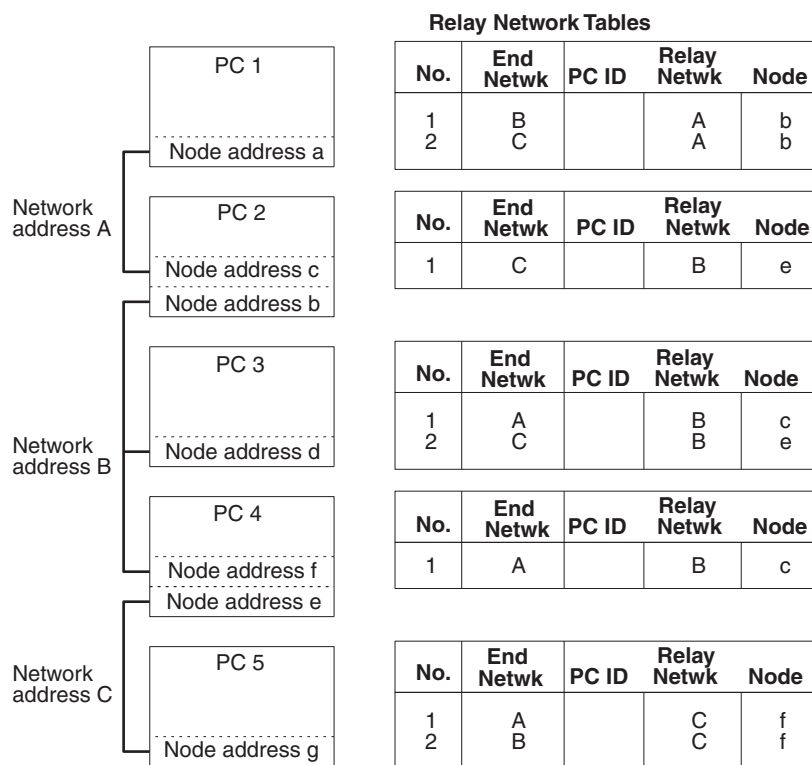
The example below shows local network table settings when a Support Board is mounted to a computer.



Local Network Table		
No.	Loc Netwk	SIOU unit #
1	A	b

Example 2

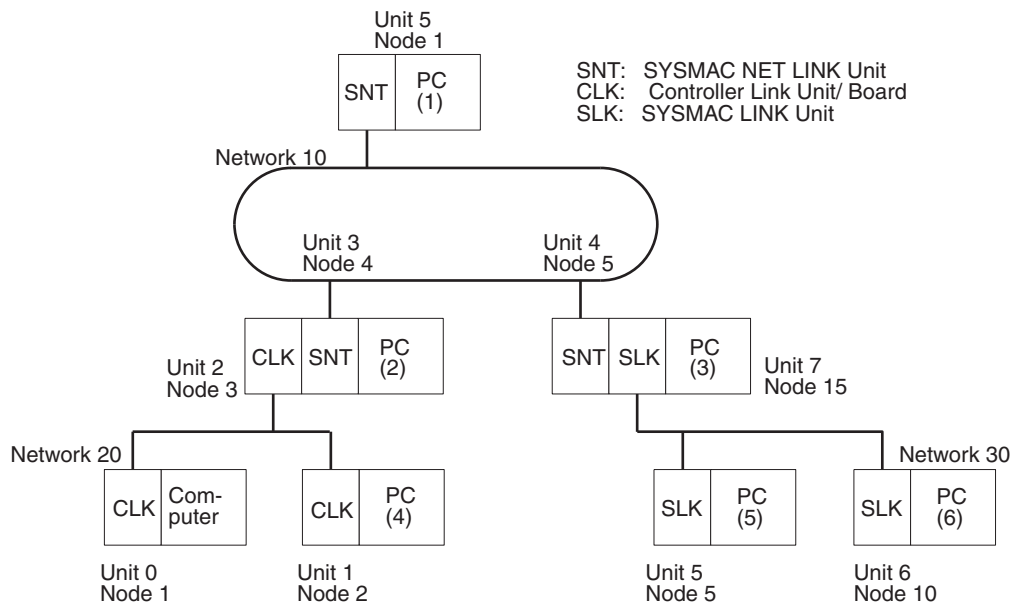
The following example show the settings for a relay network table connecting three networks.



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 2 3	020	01

Relay Network Table

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

Routing Tables on PC 5**Local Network Table**

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

Relay Network Table

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

Routing Tables on PC 6**Local Network Table**

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

Relay Network Table

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

SECTION 8

Communications Timing

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

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8-1 Network Parameters

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

8-1-1 Controller Link Communications

The token bus method is used for communications in the Controller 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 interferences to data transmission within the network.

The token travels from smaller node addresses to larger, and then back to the beginning again, without regard to the order in which the nodes are connected. If the node has data to send, it will attach the data to the token and send them together. If the node has no data to send, it will pass the token to the next node.

For Wired or Optical Networks, or Optical Ring Networks in Token Bus Mode, a token is passed between nodes connected in a daisy-chain bus called a token bus. With an Optical Ring Network in Token Bus Mode, this is called a token ring because the bus is connected in a ring. With a token ring, two transmission paths can be used (transmission path duplication) to create a more robust system.

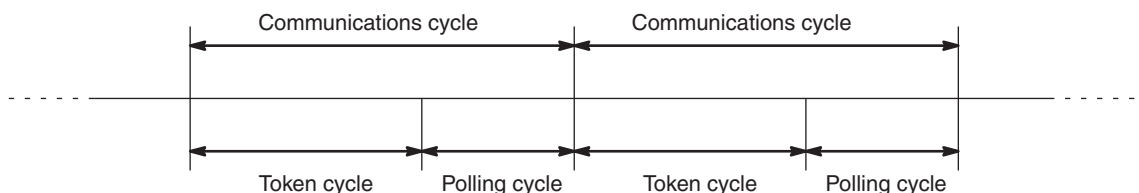
Polling Node

Each Controller Link Network always has a Unit that controls communications within the network. This Unit is called the “polling node.” Normally, the node that has the smallest node address in the network is the polling node. 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 smallest 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 smallest 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 Controller 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.
Refresh Cycle Time	The refresh cycle time is the time, during data link operation, from when the contents of the data link areas are refreshed until the next time they are refreshed. The refresh cycle time will vary depending on factors such as the communications cycle time, the number of data link words, and so on. The refresh cycle time value can be displayed by the Controller Link Support Software's data link status monitoring function. There is no refresh cycle time for the Support Board, because the data link areas are constantly refreshed by the data link data that is received. When the refresh cycle time for the Support Board is read by the Controller Link Support Software, therefore, the value will always be 0.

8-1-3 Network Parameters

Network parameters are also used to control network operations. Network parameters are read from the polling node and distributed to all other nodes when the Controller Link Network is started. In this way, all nodes on the network always have the same network parameter settings. If nodes are connected to the network halfway during network operation, the network parameter settings will also be distributed to these nodes when they are connected. The following three network parameters can be specified.

Maximum Node Address	This parameter specifies the maximum node address of nodes to be checked by the polling node. The default is 32 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. Setting this parameter to a high value increases the communications cycle time, but reduces the time required to recognize that nodes have been removed from or added to the network. Reducing the setting of this parameter shortens the communications cycle time but delays a network response when a node is disconnected from or connected to the network.
No. of Event-frames per Communications Cycle	This parameter specifies the maximum number of event frames (communications other than data links, such as message service transmissions) that can be transferred during a communications cycle. Specify a value in units of 128 bytes. The default is 35 ($128 \times 35 = 4,480$ bytes). Increasing the setting of this parameter increases the communications cycle time but allows for more event communications such as the message service. Too small a parameter value restricts event communications, resulting in an error. See 8-2 <i>Communications Cycle Time</i> for the effects of network parameters on communication cycle times.

8-1-4 Specifying Network Parameters

The network parameters can be specified from the Controller Link Support Software. This section describes only the allowable setting range for each network parameter. Refer to the *Controller Link Support Software Operation Manual* (W308) for setting procedures.

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

Network parameter	Setting range	Default value
Maximum node address	2 to 62	62 (See note 1.)
Number of polled nodes per communications cycle	1 to 61 (See note 2.)	4
No. of event-frames per communications cycle	16 to 238	35

Note The default value is 32 for Wired Controller Link Support Boards and 62 for Optical Ring Controller Link Support Boards.

The network parameters become valid immediately after being set.

Note

1. Always stop the data link before changing network parameters.
2. Specify a value for the maximum node address that is equal to or greater than the maximum node address in the Controller Link Network.

8-2 Communications Cycle Time

This section describes how to calculate the communications cycle time. When accurate timing is required, it is necessary to understand the time required for sending and receiving data link data and the timing for exchanging data.

8-2-1 Active Data Links

The following equations are used to calculate the communications cycle time when data links are operating. (The communications cycle time will vary somewhat depending on the baud rate and the conditions at that particular time.)

Wired Networks

Baud rate	Equation
2 Mbps	$10 \times A + 600 \times B + 290 \times C + 320 \times D + 4 \times E + 3,290$ (μ s)
1 Mbps	$18 \times A + 1,150 \times B + 370 \times C + 360 \times D + 8 \times E + 3,770$ (μ s)
500 Kbps	$34 \times A + 2,260 \times B + 530 \times C + 440 \times D + 16 \times E + 4,730$ (μ s)

Optical Networks

Baud rate	Equation
2 Mbps (Fixed)	Token Ring Mode $9.1 \times A + 1,740 \times B + 960 \times C + 1,100 \times D + 4 \times E + 2 \times F + 4,800$ (μ s)
	Token Bus Mode $9.1 \times A + 1,300 \times B + 290 \times C + 320 \times D + 4 \times E + 2 \times F + 2,290$ (μ s)

Note The meanings of the variables in the above formulas are as follows:

- A: Total number of data link words within the network
(total number of words in send areas of all nodes)
- B: Number of polled nodes per communications cycle
(value specified in the network parameters)
- C: Number of nodes connected to the network

- D: Number of nodes that send messages during the communications cycle
 E: Total number of bytes in messages transmitted during the communications cycle
 F: Extra communications time for long-distance cable connections. If L is the cable length in km, then $F = 7 \times L \text{ } \mu\text{s}$ for H-PCF cable and $F = 5 \times L \text{ } \mu\text{s}$ for GI cable.

Calculation Example for Wired Networks

Communications conditions are as follows:

Type:	Wired
Transmission medium:	Twisted-pair cables
Baud rate:	2 Mbps
Network parameters:	Defaults
Max node address:	32
Polled nodes per comm cycle:	4
Event-frames per comm cycle:	35
Network configuration:	8 nodes
Total number of data link words:	8,000 words
Nodes that send messages:	2 nodes
Bytes in all messages sent:	$2,012 \times 2 \text{ bytes}$

In this example, A to E in the equation have the following values.

- A: 8,000
 B: 4
 C: 8
 D: 2
 E: 4,024

The communications cycle time is thus as follows:

$$10 \times 8,000 + 600 \times 4 + 290 \times 8 + 320 \times 2 + 4 \times 4,024 + 3,290 = 104,746 \text{ } (\mu\text{s}) \\ \cong 105 \text{ (ms)}$$

Calculation Example for Optical Ring Networks with H-PCF Cable

Communications conditions are as follows:

Type:	Optical Ring
Transmission medium:	H-PCF cable
Transmission distance:	8 km
Baud rate:	2 Mbps (fixed)
Network parameters:	Defaults
Max node address:	62
Polled nodes per comm cycle:	4
Event-frames per comm cycle:	35
Network configuration:	8 nodes
Total number of data link words:	8,000 words
Nodes that send messages:	2 nodes
Bytes in all messages sent:	$2,012 \times 2 \text{ bytes}$

In this example, A to E in the equation have the following values.

- A: 8,000
 B: 4
 C: 8
 D: 2

E: 4,024

F: 7×8

The communications cycle time for Token Ring Mode is thus as follows:

$$9.1 \times 8,000 + 1,740 \times 4 + 960 \times 8 + 1,100 \times 2 + 4 \times 4,024 + 2 \times 7 \times 8 + 4,800 = 110,648 \text{ (}\mu\text{s)} \cong 111 \text{ (ms)}$$

The communications cycle time for Token Bus Mode is thus as follows:

$$9.1 \times 8,000 + 1,300 \times 4 + 290 \times 8 + 320 \times 2 + 4 \times 4,024 + 2 \times 7 \times 8 + 2,290 = 99,458 \text{ (}\mu\text{s)} \cong 100 \text{ (ms)}$$

8-2-2 Inactive Data Links

The following equations are used to calculate the communications cycle time when the data links are inactive. (The communications cycle time will vary somewhat depending on the baud rate and the conditions at that particular time.)

Wired Networks

Baud rate	Equation
2 Mbps	$600 \times B + 110 \times C + 320 \times D + 4 \times E + 2,290 \text{ (}\mu\text{s)}$
1 Mbps	$1,150 \times B + 150 \times C + 360 \times D + 8 \times E + 2,690 \text{ (}\mu\text{s)}$
500 Kbps	$2,260 \times B + 230 \times C + 440 \times D + 16 \times E + 3,490 \text{ (}\mu\text{s)}$

Optical Ring Networks

Baud rate	Equation
2 Mbps (fixed)	Token Ring Mode $1,740 \times B + 450 \times C + 1,100 \times D + 4 \times E + 2 \times F + 3,000 \text{ (}\mu\text{s)}$
	Token Bus Mode $1,300 \times B + 110 \times C + 320 \times D + 4 \times E + 2 \times F + 1,800 \text{ (}\mu\text{s)}$

Note B: Number of polled nodes per communications cycle (value specified in the network parameter)
 C: Number of nodes connected to network
 D: Number of nodes that send messages during the communications cycle
 E: Total number of bytes in messages transmitted during the communications cycle
 F: Extra communications time for long-distance cable connections.
 If L is the cable length in km, then $F = 7 \times L \text{ }\mu\text{s}$ for H-PCF cable and $F = 5 \times L \text{ }\mu\text{s}$ for GI cable.

Calculation Example for Wired Networks

Communications conditions are as follows:

Type:	Wired
Transmission medium:	Twisted-pair cables
Baud rate:	2 Mbps
Network parameters:	Defaults
Max node address:	32
Polled nodes per comm cycle:	4
Event-frames per comm cycle:	35
Network configuration:	8 nodes
Nodes that send messages:	2 nodes
Bytes in all messages sent:	$2,012 \times 2 \text{ bytes}$

In this example, B to E in the equation have the following values.

B: 4
C: 8
D: 2
E: 4,024

The communications cycle time is thus as follows:

$$600 \times 4 + 110 \times 8 + 320 \times 2 + 4 \times 4,024 + 2,290 = 22,306 \text{ (}\mu\text{s)} \\ \cong 22 \text{ (ms)}$$

Calculation Example for Optical Ring Networks with H-PCF Cable

Communications conditions are as follows:

Type:	Optical Ring
Transmission medium:	H-PCF cable
Transmission distance:	8 km
Baud rate:	2 Mbps (fixed)
Network parameters:	Defaults
Max node address:	62
Polled nodes per comm cycle:	4
Event-frames per comm cycle:	35
Network configuration:	8 nodes
Nodes that send messages:	2 nodes
Bytes in all messages sent:	$2,012 \times 2$ bytes

In this example, B to F in the equation have the following values.

B: 4
C: 8
D: 2
E: 4,024
F: 7×8

The communications cycle time for Token Ring Mode is thus as follows:

$$1,740 \times 4 + 450 \times 8 + 1,100 \times 2 + 4 \times 4,024 + 2 \times 7 \times 8 + 3,000 = 31,968 \text{ (}\mu\text{s)} \\ \cong 32 \text{ (ms)}$$

The communications cycle time for Token Bus Mode is thus as follows:

$$1,300 \times 4 + 110 \times 8 + 320 \times 2 + 4 \times 4,024 + 2 \times 7 \times 8 + 1,800 = 24,728 \text{ (}\mu\text{s)} \\ \cong 25 \text{ (ms)}$$

8-2-3 Maximum Delay for Line Disconnections in Token Ring Mode

Although the duplicated transmission lines used in Token Ring Mode for Optical Ring Networks will ensure that communications continue even if the transmission line is broken in one location, the communications cycle time will be affected.

The data that is received first from the SL1 or SL2 reception interfaces is actually used, but the data that would normally be received first may be lost. The difference in time to receive the same data on SL1 and SL2 is thus the delay that can occur for line disconnections.

This delay results as the token is passed between nodes. The delay for the entire network will thus be the total of all the delays between each node pair, and the total delay time will increase the communications cycle time.

With a Controller Link Network, the token is moved for the following.

- Normal token passing
- Token passing for new node checks by the polling node (depends on the number of polled nodes set in the network parameters)
- Token passing for responses to messages.

Although the actually delay time will depend on the location of the line disconnection point, differences in the time required to receive the token can be reduced by setting node addresses in order on the network.

Maximum Communications Cycle Time Delay with Node Addresses Set in Order

The maximum delay in the communications cycle time can be calculated as follows if the node addresses are set in the order that the nodes are connected in the network.

- A: Number of polled nodes per communications cycle
(value specified in the network parameter)
- B: Number of nodes that send messages during the communications cycle
- C: Number of nodes connected to network
- D: Extra communications time for long-distance cable connections.

If L is the cable length in km, then $F = 7 \times L \text{ } \mu\text{s}$ for H-PCF cable and $F = 5 \times L \text{ } \mu\text{s}$ for GI cable.

$$(A \times 4 + B \times 2 + 1) \times (3 \times C + D) \text{ } (\mu\text{s})$$

Calculation Example for Optical Ring Networks with H-PCF Cable

Communications conditions are as follows:

Type:	Optical Ring
Transmission medium:	H-PCF cable
Transmission distance:	8 km
Baud rate:	2 Mbps (fixed)
Network parameters:	Defaults
Max node address:	62
Polled nodes per comm cycle:	4
Event-frames per comm cycle:	35
Network configuration:	8 nodes
Nodes that send messages:	2 nodes
Bytes in all messages sent:	$2,012 \times 2 \text{ bytes}$

In this example, B to F in the equation have the following values.

- A: 4
B: 8
C: 2
D: 7×8

The communications cycle time delay for Token Ring Mode is thus as follows:

$$(4 \times 4 + 2 \times 2 + 1) \times (3 \times 8 + 7 \times 8) = 1,680 \text{ } (\mu\text{s})$$

$$\cong 1.7 \text{ (ms)}$$

The percentage change for active data links would be as follows (refer to *Calculation Example for Optical Ring Networks with H-PCF Cable* under 8-2-1 *Active Data Links*):

$$(111 + 1.7)/111 \times 100$$

$$\cong 101.5 \text{ (%)}$$

The percentage change for inactive data links would be as follows (refer to *Calculation Example for Optical Ring Networks with H-PCF Cable* under 8-2-2 *Inactive Data Links*):

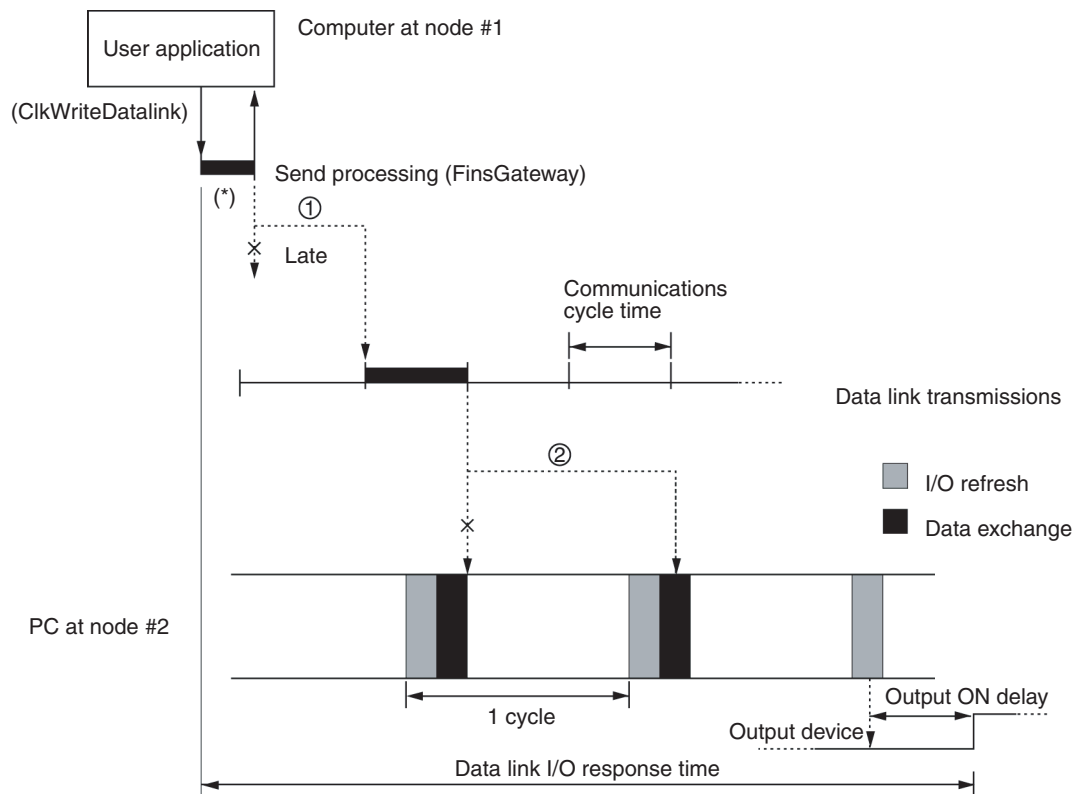
$$(32 + 1.7)/32 \times 100 \\ \cong 105.3 (\%)$$

8-3 Data Link I/O Response Time

The data links of the Controller Link Support Board require a slight time delay from the time the data link area of one node is changed until this change is reflected in the data link area at another node. This time delay is called the data link I/O response time.

8-3-1 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 (#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.

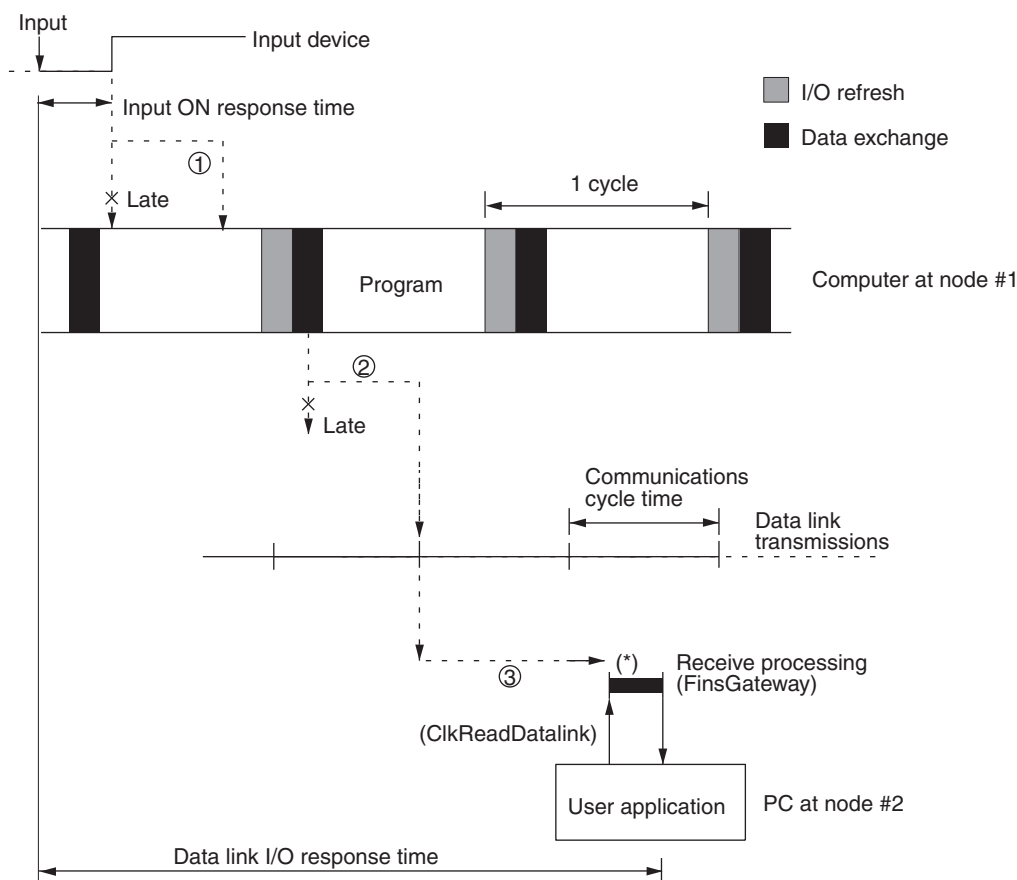
- 1,2,3...**
1. Data exchange occurs just after the computer at node #1 passes the token that makes it the polling node, causing a delay of up to one communications cycle time before the data is transferred in data link processing.
 2. The data transferred in data link processing arrives at the PC at node #2 after data exchange, so the data will not be read into the PC until the next data exchange, causing a delay of up to one cycle. (If the cycle time of the PC at node #2 is longer than the communications cycle time, the delay would be approximately two cycles.)

The maximum number of words that can be transferred in one data exchange is 3,700 words for the CVM1 and CV-series PCs and 7,800 words for the CS-series and CJ-series PCs.

- Note**
1. Noise may increase I/O delays.
 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 Controller Link Unit and the PC, refer to the *Controller Link Units Operation Manual* (W309 or W370).

8-3-2 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 (#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.

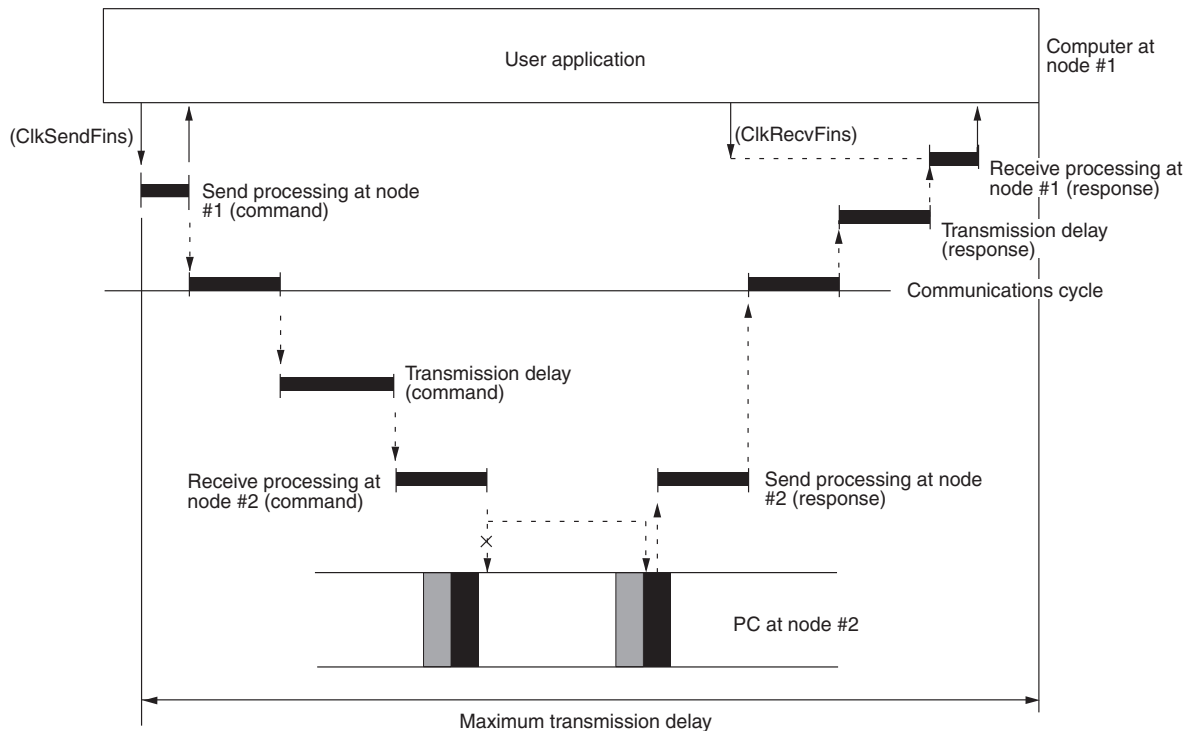
- 1,2,3...**
1. The input arrives in the PC just after I/O refreshing, causing a delay of up to one cycle before the input is read into the PC.
 2. Data exchange occurs just after the PC at node #2 passes the token that makes it the polling node, causing a delay of up to one communications cycle time 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 ClkReadDatalink library function. This delay will vary depending on the contents of the user application.

- Note**
1. Noise may increase I/O delays.

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 *Controller Link Units Operation Manual (W309)* for details on the time required for data exchanges between the Controller Link Unit and the PC.

8-4 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 CS-series PC) by the user application at the computer at node #1.



Maximum 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 8-2 *Communications Cycle Time* (on page 128).

Transmission Delay Time

Transmission delay time varies with the baud rate.

Baud rate	Transmission delay time
2 Mbps	Number of words transferred × 0.008 + 0.112 ms
1 Mbps	Number of words transferred × 0.016 + 0.224 ms
500 Kbps	Number of words transferred × 0.032 + 0.448 ms

Receive Processing at Node #2

Number of words transferred $\times 0.00125 + 2.3$ ms

Send Processing at Node #2

Number of words transferred $\times 0.00125 + 3.0$ 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 *Controller Link Units Operation Manual* (W309 or W370) for details on the time from reception at the Controller Link Unit until transmission.

SECTION 9

Troubleshooting and Maintenance

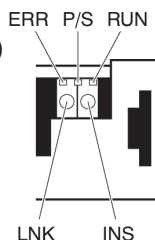
This section provides information on troubleshooting errors that occur during Controller Link Support Board operation, as well as daily inspection, cleaning, and other maintenance procedures.

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9-1 Troubleshooting Using Indicators

This section describes the errors shown by the Controller Link Support Board indicators and possible remedies.

**Optical Ring System
(H-PCF Cable and GI Cable)**



Wired 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.
PS)	Lit	Backup power supply is ON.
TER	Lit	Terminating resistance switch is ON (resistance is connected).

- Note**
1. The P/S indicator is mounted to the Optical Ring Units only.
 2. The TER indicator is mounted to the Wired Units only.

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

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

Note Be sure to turn OFF the power to 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 Controller Link Support Board is faulty.	If the ERC indicator still lights when the Board is mounted on another computer, replace the Controller Link Support Board.
				The setting of the Wired Network 62 Node Enable Bit (i.e., the <i>Max Node Number set 62</i> option) is not set correctly.	Select the <i>Max Node Number set 62</i> option in the driver properties and restart CLKPCI_UNIT.
				The Wired Network 62 Node Enable Bit is ON (i.e., the <i>Max Node Number set 62</i> option is selected) and the node address set for the local node is larger than the maximum node address backed up in EEPROM in the Board.	Set the node address temporarily to 32 or less, join the network, and change the maximum node address to 62 in the network parameters using the CX-Net or the FinsGateway manually set data link setting program. Once this has been done, set the node address to the desired value.

Indicators			Error history	Probable cause	Probable remedy
RUN	ERR	INS			
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 Controller Link Support Board has become loose.	Secure the Controller Link Support Board firmly.
				The Controller Link Support Board is mounted in the wrong slot.	Refer to the <i>Installation Guide</i> and mount the Board correctly.
				The Controller Link Support Board is faulty.	If the indicators do not light when the Board is mounted in another computer, replace the Controller 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 SYSMAC LINK network.	Check the networks and correct the cable connections.
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 Controller 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 Controller Link Support Software or reset the node address to below the maximum.
			---	No other nodes exist.	Make sure that 2 or more nodes exist within the Network.
			---	No node has been set as a polling node.	Refer to <i>Installation Guide</i> and set at least one polling node. (A Controller Link Support Board should normally be set as the polling node.)

9-1-2 Troubleshooting with 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 Controller 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
LNK		
Lit	Data link operating normally.	---
Flashing	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.
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 Controller 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
LNK		
Lit	Data link operating normally.	---
Flashing	When manual setting was used, there is an error in the data link table.	Refer to 5-2-2 <i>Manual Setting</i> and reset the data link table.
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, reset the parameters in the startup node's DM Area, and then restart the data link. The Controller Link Support Board cannot become the start-up node for automatic setting, so set on the PC to which the Controller Link Unit is mounted. For details refer to the <i>Controller Link Units Operation Manual</i> (W309).

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 Controller 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
LNK		
Not lit	Data link stopped normally.	---

Troubleshooting of Other Errors

To configure a network that uses a node address higher than 32, all nodes must be CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, or 3G8F7-CLK23-E. The Wired Network 62 Node Enable Bit in the DM Parameters Area must also be turned ON (62 nodes max.) for all nodes. (For Controller Link Support Boards, select the *Max Node Number set 62* option in the driver properties.) If the nodes are set differently, the network will not be configured correctly. If the settings are incorrect, the following problems will occur.

Configuring a Network with 33 Nodes or More

Problem	Status	Cause and remedy
The node is not present in the network. (ERC (ERR) indicator: ON RUN indicator: OFF INS indicator: OFF)	The ERC (ERR) indicator is ON in the CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, or 3G8F7-CLK23-E and a node address higher than 32 is set.	The Wired Network 62 Node Enable Bit in the DM Parameters Area is turned OFF. Turn ON the Wired Network 62 Node Enable Bit and then turn the power supply OFF and ON again. For a Controller Link Support Board for PCI Bus, select the <i>Max Node Number set 62</i> option and restart CLKPCI_UNIT.
	The ERC indicator is ON in the C200HW-CLK21, CQM1H-CLK21, CVM1-CLK21, CS1W-CLK21, CJ1W-CLK21, or 3G8F7-CLK21 and a node address higher than 32 is set.	The Units that can be used to configure a network that uses a node address higher than 32 are the CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, and 3G8F7-CLK23-E only. Either configure the network using compatible Units and Boards, or split the network into two separate networks.
The node is not present in the network (ERC (ERR) indicator: OFF RUN indicator: ON INS indicator: OFF)	The INS indicator is ON for some nodes in the same network. Those nodes are C200HW-CLK21, CQM1H-CLK21, CVM1-CLK21, CS1W-CLK21, CJ1W-CLK21, or 3G8F7-CLK21.	
	The INS indicator is ON for some nodes in the same network. Those nodes are CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-3G8F7-CLK21-EV1, or 3G8F7-CLK23-E.	The Wired Network 62 Node Enable Bit in the DM Parameters Area of the polling node (CS1W-CLK21-V1 or CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23 with INS indicator ON) is OFF. Turn ON the Wired Network 62 Node Enable Bit, then turn the power supply OFF and ON again. For a Controller Link Support Board for PCI Bus, select the <i>Max Node Number set 62</i> option and restart CLKPCI_UNIT. The maximum number of nodes set in the network parameters is less than the number of nodes present in the network. Use CX-Net or the Controller Link Support Software to read the network parameters, and check the maximum number of nodes setting. Set the maximum number of nodes to a number that is the same or larger than the number of nodes in the network.
The maximum number of nodes in the network is set to 32.	The polling node is a C200HW-CLK21, CQM1H-CLK21, CVM1-CLK21, CS1W-CLK21, CJ1W-CLK21, or 3G8F7-CLK21.	The Units that can be used to configure a network that uses a node address higher than 32 are the CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, and 3G8F7-CLK23-E only. Either configure the network using compatible Units and Boards, or split the network into two separate networks.
	The polling node is a CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-3G8F7-CLK21-EV1, or 3G8F7-CLK23-E.	The Wired Network 62 Node Enable Bit in the DM Parameters Area of the polling node (CS1W-CLK21-V1 or CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23 with INS indicator ON) is OFF. Turn ON the Wired Network 62 Node Enable Bit, then turn the power supply OFF and ON again. For a Controller Link Support Board for PCI Bus, select the <i>Max Node Number set 62</i> option and restart CLKPCI_UNIT.

Problem	Status	Cause and remedy
The data link status is showing statuses of 32 nodes only.	The data link status storage area is set to default settings, and the data link status storage format specification in the DM Parameters Area is set to the 8-bit format.	The default area for storing data link status is the Special I/O Unit Area. The data for only node addresses 1 to 32 is reflected when the data link status storage format specification is set to 8 bits. Change to the 4-bit format or specify a different area for storing data link status.
	The polling node is a C200HW-CLK21, CQM1H-CLK21, CVM1-CLK21, CS1W-CLK21, CJ1W-CLK21, or 3G8F7-CLK21.	The Units that can be used to configure a network of a network that uses a node address higher than 32 are the CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, and 3G8F7-CLK23-E only. Either configure the network using compatible Units and Boards, or split the network into two separate networks.
	The polling node is a CS1W-CLK21-V1, CJ1W-CLK-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, or 3G8F7-CLK23-E.	The Wired Network 62 Node Enable Bit in the DM Parameters Area of the polling node (CS1W-CLK21-V1 or CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23 with INS indicator ON) is OFF. Turn ON the Wired Network 62 Node Enable Bit, then turn the power supply OFF and ON again. For a Controller Link Support Board for PCI Bus, select the <i>Max Node Number set 62</i> option and restart CLKPCI_UNIT.
Error occurs when transferring data link tables.	The data link table being transferred is for a C200HW-CLK21, CQM1H-CLK21, CVM1-CLK21, CS1W-CLK21, CJ1W-CLK21, or 3G8F7-CLK21.	The Units that can be used to configure a network of a network that uses a node address higher than 32 are the CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, and 3G8F7-CLK23-E only. Either configure the network using compatible Units and Boards, or split the network into two separate networks.
The data link status is showing statuses of 32 nodes only.	The polling node is a C200HW-CLK21, CQM1H-CLK21, CVM1-CLK21, CS1W-CLK21, CJ1W-CLK21, or 3G8F7-CLK21.	
	The polling node is a CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, or 3G8F7-CLK23-E.	The Wired Network 62 Node Enable Bit in the DM Parameters Area of the polling node (CS1W-CLK21-V1 or CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23 with INS indicator ON) is OFF. Turn ON the Wired Network 62 Node Enable Bit, then turn the power supply OFF and ON again. For a Controller Link Support Board for PCI Bus, select the <i>Max Node Number set 62</i> option and restart CLKPCI_UNIT.

Configuring a Network with 32 Nodes or Less

Problem	Status	Cause and Remedy
The node is not present in the network. (ERC (ERR) indicator: ON RUN indicator: OFF INS indicator: OFF)	The node with the ERC (ERR) indicator ON is set to a node address of 33 or higher.	Reset the node address between 1 and 32, then turn the power OFF and ON again.
The maximum number of nodes in the network is set to 62.	A CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, or 3G8F7-CLK23-E is present in the network.	The Wired Network 62 Node Enable Bit in the DM Parameters Area of the CS1W-CLK21-V1 or CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23 is ON. Turn OFF the Wired Network 62 Node Enable Bit, then turn the power supply OFF and ON again.
The data link status is showing statuses for 62 nodes.	The corresponding node is a CS1W-CLK21-V1, CJ1W-CLK21-V1, CS1W-CLK23, CJ1W-CLK23, 3G8F7-CLK21-EV1, or 3G8F7-CLK23-E.	For a Controller Link Support Board for PCI Bus, select the <i>Max Node Number set 62</i> option and restart CLKPCI_UNIT.
The network participation status is showing statuses for 62 nodes.		

9-2 Status Information and Troubleshooting

The Controller 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 ClkGetNetworkStatus function and tells how to troubleshoot error information obtained.

9-2-1 Troubleshooting with the ClkGetNetworkStatus Function

The following network status is read by ClkGetNetworkStatus().

Type	Variable name	Contents
BYTE	byConnectionMethod	Wired/optical discrimination, transmission path form, etc. Bit Bit 7 6 5 4 3 2 1 0 Bit 7: Not specified. Maximum number of nodes supported 00: 32 nodes 01: 64 nodes Transmission path 0: Token bus 1: Token ring Connection type 0: Wired 1: Optical ring Note When optical and optical ring connections are combined, the maximum number of nodes supported will be given as 62 nodes for an optical ring connection even if the maximum number of nodes is 32.
BYTE	byMyNodeAddr	Local unit address Stores the local unit address set for the Controller Link Board.
BYTE	byMyUnitAddr	Local unit address Stores the local unit address set for the Controller Link Board.
BYTE	byMyNetAddr	Local network address Stores the local network address set for the Controller Link Board.
BYTE	abyNodeList[32]	Network participation status Stores a list of the nodes participating in the network. Bit Bit 7 6 5 4 3 2 1 0 Node Participation Information 7 6 5 4 3 2 1 0 0: Not participating in network 1: Participating in network 0: Normal disconnection 1: Error disconnection (when not participating) 0: Normal 1: No response to polling. Note For Wired Networks set to a maximum of 32 nodes, the above information is valid through node 32 (lower 4 bytes of abyNodeList[16]).
WORD	wCommunicationCycleTime	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.

Type	Variable name	Contents																
BYTE	byStatus1	Reserved area Stores undetermined data.																
BYTE	byStatus2	Baud rate, power supply status, terminating resistance setting status For Wired Systems, stores the set baud rate and the setting of the terminating resistance switch. For Optical Ring System, stores the power supply status. Bit <table><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></td><td></td><td></td><td></td><td></td><td>0</td><td>0</td><td>0</td></tr></table> Baud rate 0x1: 2 Mbits/s 0x2: 1 Mbits/s 0x3: 500 kbits/s Wired System 0: Terminating resistance switch OFF 1: Terminating resistance switch ON Optical System 0: No backup power supply 1: Backup power supply	7	6	5	4	3	2	1	0						0	0	0
7	6	5	4	3	2	1	0											
					0	0	0											
BYTE	byStatus3	Error information 1 Stores information such as whether or not there is an error log recorded, node address setting errors, etc. <table><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></td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 1: Error history 1: Fatal data link error 1: Communications controller send section error 1: Node address setting error 1: Node address duplicated 1: Network parameter mismatch 1: Communications controller hardware error	7	6	5	4	3	2	1	0		0						
7	6	5	4	3	2	1	0											
	0																	
BYTE	byStatus4	Reserved area Stores undetermined data.																
BYTE	byStatus5	Error information 2 Stores information such as EEPROM write errors, setting table errors, etc. Bit <table><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></td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td></tr></table> 1: EEPROM write error 1: Network parameter error 1: Data link table error 1: Routing table error	7	6	5	4	3	2	1	0		0	0	0	0			
7	6	5	4	3	2	1	0											
	0	0	0	0														
BYTE	byStatus6	Reserved area Stores undetermined data.																

Type	Variable name	Contents
BYTE	byStatusFlag	Data link operation status and data link mode Stores the data link operation status, data link mode, etc. Bit 7 6 5 4 3 2 1 0 Bit 7 6 5 4 3 2 1 0 —: Not specified Current Data Link Mode 0: User-set links 1: Automatic Data Link Operating Status 0: Stopped 1: Running
BYTE	abyDataLinkStatus[62]	Data link status Stores the data link status. Bit [0] 7 6 5 4 3 2 1 0 Node 1 [1] Node 2 [2] Node 3 [60] Node 61 [61] Node 62 Node Data Link Status 7 6 5 4 3 2 1 0 —: Not specified PC Operating Status 0: Stopped 1: Running (PC program being executed.) CPU Unit Error Status 0: No error 1: Error Data Link Communications Error Status 0: Normal 1: Error (Data link data not received normally.) Data Link Participation Status 0: Not participating or data links stopped 1: Participating Offset Error Status (Offset larger than number of send words) 0: Normal 1: Error Insufficient Reception Area (Data larger than data link reception area. Overflow data discarded.) 0: Normal 1: Insufficient Excess Reception Area (Data smaller than data link reception area. Overflow area data not specified.) 0: Normal 1: Excess Note For Wired Networks set for a maximum of 32 nodes, the above information is valid through node 32 (abyDataLinkStatus[31]).

9-2-2 Error Processing

Data Link Status: abyDataLinkStatus []

Bit status	Probable cause	Probable remedy
PC's CPU Unit error is 1: 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.
Data Link Communications Error Status is 1: ON	The relevant node is not in the Network.	Enter the node in the Network.
	A communications error has occurred as a result of noise.	Conduct an echoback test using the Controller Link Support Software and if this does not correct the error, check the usage environment.
	A communications error has occurred.	Refer to 9-1-1 <i>Using the RUN, ERR and INS Indicators</i> and troubleshoot accordingly.
Data link participation is 0: OFF	The relevant node is not part of data links.	Enter the relevant node in data links. If an error occurs, refer to page 140, <i>Node Cannot Participate in Data Link</i> and troubleshoot accordingly.
	There are no active data links in the Network.	Activate the data links.
Offset error is 1: ON	The offset is greater than the number of send words at the relevant node.	Check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area short is 1: ON	The send area at the relevant node is larger than the receive area and some data cannot be received.	When the intention is not to receive all data, use as is (data that cannot be received will be read and discarded.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.
Receive area remaining is 1: ON	The send area at the relevant node is smaller than the receive area and some of the area will be unused.	When the intention is to leave some space in the receive area, use as is (the surplus receive area will be unspecified data.) When it differs from the intended data link, check the number of send words at the relevant node, the number of receive words at the local node and the offset, then reset the data link table correctly.

Note Data link status can also be monitored from the CLK Data Link Setting Utility.

Other Status

Bit status	Probable cause	Probable remedy
Error log exists is 1: ON	Error information on the Controller Link Support Board (an error log) has been recorded.	Using the Controller Link Support Software or an FINS command, read the cause of the current error. Alternatively, use past error log records to troubleshoot the problem.
Communications controller send error is 1: ON	The Controller Link Support Board is faulty.	Replace the Controller Link Support Board.
Communications controller hardware error is 1: ON	The Controller Link Support Board is faulty.	Replace the Controller Link Support Board.
Network parameter mismatch is 1: ON	The network parameters in EEPROM do not agree with those being used by the network	Use the Controller Link Support Software to check the current parameters and correct the settings as required.
Node address duplicated is 1: 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.
EEPROM error is 1: ON	An error has occurred while writing data to the CPU Unit's EEPROM.	Check the status of bits 00 to 02 in the variable and correct any problems found. If the error occurs again, replace the CPU Unit.
Routing table error is 1: ON	The routing table data within the CPU Unit's EEPROM is damaged.	Refer to <i>7-3 Setting Routing Tables</i> and reset the routing tables correctly. If the error occurs again, replace the Controller Link Support Board.
	There is an error in the routing table setting.	When using a routing table, refer to <i>7-3 Setting Routing Tables</i> and reset the routing tables correctly. If no routing tables are being used, delete the tables.
Data link table error is 1: ON	The data link table data in the EEPROM of the CPU Unit is damaged.	Refer to <i>5-3 Starting and Stopping Data Links</i> and reset the data link tables correctly. If the error occurs again, replace the CPU Unit.
	There is an error in the data link table settings.	When using manually set data links, refer to <i>5-3 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.
Network parameter area is 1: ON	Network parameters in EEPROM are damaged.	Refer to <i>8-1-3 Network Parameters</i> and reset the data correctly.
		Initialize the network parameters from the Controller Link Support Software and cycle the power to the computer. If the problem persists, replay the 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.	Either set the EEPROM Clear Bit in the DM parameter area to ON, or use the Initialize network parameters operation on the Maintenance Menu of the Controller Link Support Software to initialize the network parameters and then cycle the power supply. Refer to <i>8-1-3 Network Parameters</i> and reset the network parameters or the node address.

9-3 Error Log

The error log records errors that occur in the Controller Link Support Board and the time they occur. The error log can be read or cleared using the Controller Link Support Software, a PC Programming Device, such as the SYS-MAC Support Software, or the message service (FINS commands for the Controller Link Support Board.)

9-3-1 Error Log Table

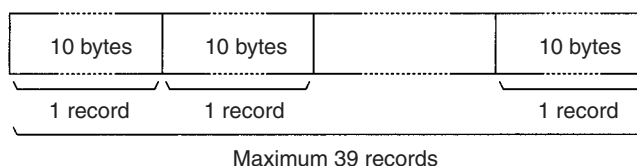
Errors are recorded in an error log table in the Board's RAM, with one record for each error and a maximum of 39 records.

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 automatically reads the Board's RAM when the power is turned ON again.)

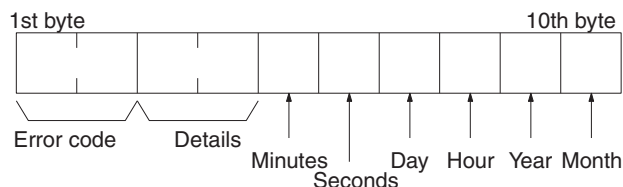
Item	Specification
No. of records	39 max.
Data code	Binary (Times are in BCD)
Length of each record	10 bytes
Configuration of records	Error code: 2 bytes (Refer to 9-3-2 Error Codes) Detail code: 2 bytes (Refer to 9-3-2 Error Codes) Time: 6 bytes (Refer to the Time Information)
Record order	From the 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 computer's time information can be read and used in the Controller Link Support Board. When the time cannot be read from the computer, all error log times will be 0. When error logs are read from the Controller Link Support Software, 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.

Error code	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte	2nd byte		
0001 Hex	CPU Unit watchdog timer error	00 Hex	00 Hex	Replace the CPU Unit.	Yes
0002 Hex	CPU Unit service monitor error	Monitor time (ms)		Check the environment settings.	Yes
0003 Hex	CPU Unit RAM error	01 Hex: Cyclic 02 Hex: Event 04 Hex: CPU bus link	00 Hex	Check the environment settings.	Yes
0004 Hex	CPU Bus Unit ID number error	00 Hex	00 Hex	Check the I/O tables.	Yes
0005 Hex	Unit number error	Unit set value	CPU Unit detected value	Check the unit number settings and recreate the I/O tables.	Yes
0006 Hex	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 Hex	I/O bus error	00 Hex	00 Hex	Check the environment settings.	Yes
000F Hex	CPU Unit initialization error			Check the environment settings.	Yes
0010 Hex	System capacity exceeded			Reduce the number of CPU Bus Units mounted in one PC.	Yes
0011 Hex	CPU Unit initialization timeout			Check the environment settings.	Yes
0012 Hex	CPU Unit memory error	01 Hex: Read error	01 Hex: Data link tables 02 Hex: Network parameters 03 Hex: Routing tables 04 Hex: System setup	Check the relevant settings.	Yes
0013 Hex	CPU Unit write-protected	02 Hex: Write error		Release write protection for the CPU Unit.	Yes

Error code	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte	2nd byte		
0101 Hex	Transmission failed; local node not in Network	Command block Bits 0 to 7: Source node address Bits 8 to 14: Source Network address Bit 15: OFF Response block Bits 0 to 7: Destination node address Bits 8 to 14: Destination Network address Bit 15: ON (1st byte: bits 8 to 15; 2nd byte, bits 0 to 7)		Refer to <i>9-1 Troubleshooting Using Indicators</i> and place the local node into Network.	No
0103 Hex	Transmission failed; retry count exceeded			Using the Controller Link Support Software or FINS commands, run echoback test and check operating environment if errors occur.	No
0104 Hex	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 Hex	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 Hex	Transmission failed; redundant node address			Correct node addresses so that they are unique within the same Network.	No
0107 Hex	Transmission failed; destination node not in Network			Refer to <i>9-1 Troubleshooting Using Indicators</i> and place destination node into Network.	No
0108 Hex	Unit missing; cannot execute.			Refer to the <i>Installation Guide</i> and check the Controller Link unit number.	No
0109 Hex	Transmission failed; destination busy			Increase number of retries or reconfigure system to distribute load.	No
010A Hex	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 Hex	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 Hex	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

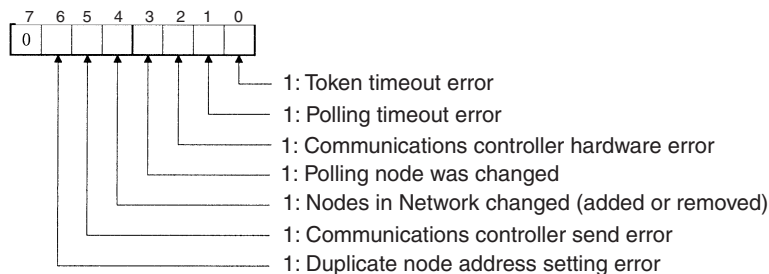
Error code	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte	2nd byte		
010D Hex	Transmission failed; destination address incorrect	Command block Bits 0 to 7: Source node address Bits 8 to 14: Source Network address Bit 15: OFF Response block Bits 0 to 7: Destination node address Bits 8 to 14: Destination Network address Bit 15: ON (1st byte: bits 8 to 15; 2nd byte, bits 0 to 7)		Check routing tables.	No
010E Hex	Transmission failed; routing tables not registered				No
010F Hex	Transmission failed; routing table error				No
0110 Hex	Transmission failed; too many relay points			Check routing tables and system configuration. Do not try to access Networks separated by more than one other Network.	No
0111 Hex	Transmission failed; command packet too long			Be sure to use the correct FINS command format.	No
0112 Hex	Transmission failed; header error.				No
0113 Hex	I/O setting error; cannot send.			Correct either the system configuration or the registered I/O tables.	No
0114 Hex	CPU bus error; cannot send.			Check the Board and cable connections and clear the error.	No
0115 Hex	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 Hex	CPU Bus Unit error; cannot send.			Check the Board and cable connections and clear the error.	No
0117 Hex	Internal buffer full			Increase number of retries or reconfigure system to distribute load.	No
0118 Hex	Illegal packet discarded			Check for nodes sending illegal data.	Yes
0124 Hex	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 Hex	EEPROM error	01 Hex: Read error 02: Hex: Write error	01 Hex: Data link tables 02 Hex: Network parameters 03 Hex: Routing tables	Reset the relevant data. If the error occurs again replace the Controller Link Support Board.	Yes
0206 Hex	Number of participating nodes decreased (local node still participating)	Network parameters maximum node address	Number of non-participating nodes	Check network parameters, node participation, cables, and terminating resistance.	No (See note 3.)
0207 Hex	Number of participating nodes decreased (local node not participating)				No (See note 3.)
0208 Hex	polling node changed	Address of previous polling node	Address of new polling node	Check previous polling node.	No (See note 3.)
0209 Hex	Network parameter disagreement	00 Hex	Address of polling node	Using the Controller Link Support Software, check network parameters.	Yes
020C Hex	Time out with token	00 Hex	Error status (See note 4.)	Check network parameters, node participation, cables, and terminating resistance.	No
0210 Hex	Communications controller transmitter error	00 Hex		Replace the Controller Link Support Board.	Yes

Error code	Contents	Detail code		Correction	Recorded in EEPROM
		1st byte	2nd byte		
0211 Hex	Duplicate node address error (connected to SYSMAC LINK by mistake)	00 Hex	Local node address	Reset so that each node address is used only once within the same Network.	No (See note 3.)
0214 Hex	Node address setting error	Not set		Correct the node address setting.	Yes
0216 Hex	Backup power supply error	00 Hex	Error type 01 Hex: OFF to ON 02 Hex: OFF to ON	Check the backup power supply and the power supply cables.	Yes
021A Hex	Set table logic error	00 Hex	01 Hex: Network parameters 02 Hex: Data link tables 03 Hex: Routing tables	Reset the appropriate data.	Yes
021B Hex	Hardware error	00 Hex: SL1 error 01 Hex: SL2 error	Error status (See note 4.)	Replace the Controller Link Support Board.	No (See note 3.)
021C Hex	Data link error stopped	Not set		Stop the user application, reset the computer, and retry.	Yes
021E Hex	Network line disconnection	Ring status (See note 5.)		Refer to information in previous sections of this manual.	Yes
0220 Hex	Additional information 1 for number of participating nodes decreased (0206 Hex)	Bits 00 to 15 correspond to disconnected nodes 1 to 16		Check the network parameters, the disconnected node, and the cables.	No (See note 3.)
0221 Hex	Additional information 2 for number of participating nodes decreased (0206 Hex)	Bits 00 to 15 correspond to disconnected nodes 17 to 32			No (See note 3.)
0222 Hex	Additional information 3 for number of participating nodes decreased (0206 Hex)	Bits 00 to 15 correspond to disconnected nodes 33 to 48			No (See note 3.)
0223 Hex	Additional information 4 for number of participating nodes decreased (0206 Hex)	Bits 00 to 15 correspond to disconnected nodes 49 to 62			No (See note 3.)
0300 Hex	Packet discarded	Not set		Conduct an echoback test and find the cause of the error.	Yes
0601 Hex	Unit error	Not set		Check the operating environment.	Yes

- Note**
- Errors indicated by error codes 0101 to 0116 are recorded only when the frame was discarded because transmission was impossible.
 - Error codes 021E to 0223 Hex are recorded only for Optical Ring Networks.
 - Recorded in EEPROM for the 3G8F7-CLK13-E, 3G8F7-CLK23-E, and 3G8F7-CLK53-E.

4. Error Status

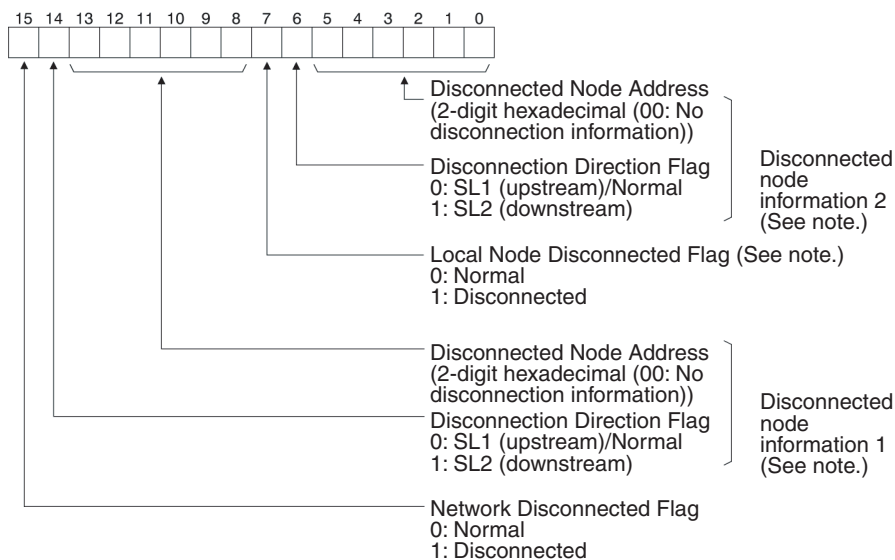
The status of each bit indicates that an error has occurred as given in the diagram below.



Note If the data link tables have not been set, event ID97 will be logged in the event log. Event ID97 indicates that a type of event memory not supported by Fins-Gateway was set for data link data transfer, making data transfer between the Support Board and event memory impossible. (ID97 is logged when data link tables are not set.)

Event ID97 will no longer be logged if the data link tables are set. If data links are not being used, operation should be normal and this event can be ignored.

5. Ring Status



Note Valid only when bit 15 (Network Disconnected Flag) is ON. The previous information will be maintained for the Local Node Disconnected Flag and the Disconnected Node Information even if bit 15 is OFF (normal).

9-3-3 Reading and Clearing Error Logs

Error logs can be read or cleared using the FinsGateway, Controller Link Support Software, CX-Programmer, PC Programming Devices, or the message service. The following examples are for the Controller Link Support Software and the message service. When using other Programming Devices, refer to the Programming Device's operation manual for details.

Controller Link Support Software

Read or clear the error log using the following procedure.

- 1,2,3...**
1. Display the Main Menu.
 2. Select "E: Error log."
 3. Select "R: Read."
 4. Designate the node. The error log for the designated node will be displayed.
 5. Press the F7 (Clear) Key. The designated node error log will be cleared.

Message Service

Reading an Error Log

Send the ERROR LOG READ FINS command (command code 2102) to the appropriate node. Refer to *6-3-14 ERROR LOG READ*.

Clearing an Error Log

Send the ERROR LOG CLEAR FINS command (command code 2103) to the appropriate node. Refer to *6-3-15 ERROR LOG CLEAR*.

9-4 Cleaning and Inspection

9-4-1 Cleaning

Conduct the following periodic cleaning to keep the Controller 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

Controller 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 Controller Link Support Board is a Network device. If the Board is damaged, it will effect the entire Network, so always ensure repairs are undertaken immediately. We recommend that you have a spare Controller 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 small address will become the polling node and communicate the initial network parameter status to other nodes, so there is the chance that network parameters in the entire Network will be damaged.
 2. The data link table, network parameters, and routing table are stored in the Controller 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 Controller Link Support Software.

- 1,2,3...**
1. Turn OFF the power supply to the computer of the Board to be replaced.
 2. Detach the communications cables attached to the Controller Link Support Board to be replaced and remove the Board.
 3. Set the new Controller Link Support Board's ID switch and the terminating resistance switch to the same as for the previous Board.
 4. Mount the Controller 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 **CLK (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 **Controller 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 Controller Link (PCI) 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 **CLK (PCI)** and click the **Start** Button.
 8. Using the CLK Data Link Setting Utility in the FinsGateway or the Controller Link Support Software, read the network parameters and make sure the Network is operating normally.
 9. Using the CLK Data Link Setting Utility in the FinsGateway or the Controller Link Support Software, 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 page 156, 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 CLK Data Link Setting Utility in the FinsGateway or the Controller Link Support Software.

Note The following procedure can be used to start the CLK 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 A

Standard Models

Controller Link Support Boards for PCI Bus

Applicable computer	Connection type	Model number	Remarks
IBM PC/AT or compatible	Wired	3G8F7-CLK23-E 3G8F7-CLK21-EV1	Include FinsGateway Controller Link (PCI) Embedded Edition (Version 3)
	Optical Ring for H-PCF cable	3G8F7-CLK13-E 3G8F7-CLK12-EV1	
	Optical Ring for GI cable	3G8F7-CLK53-E 3G8F7-CLK51-EV1	

Controller Link Support Boards for ISA Bus

Applicable computer	Connection type	Model number	Remarks
IBM PC/AT or compatible	Wired	3G8F5-CLK21-E	Controller Link Support Software included.
	Optical	3G8F5-CLK11-E	

Controller Link Units

Applicable PC	Connection type	Model number	Remarks
CV-series PCs	Wired	CVM1-CLK21	---
	Optical Ring for H-PCF cable	CVM1-CLK12	
	Optical Ring for GI cable	CVM1-CLK52	
C200HX/HG/HE PCs	Wired	C200HW-CLK21	
CS-series PCs	Wired	CS1W-CLK23 CS1W-CLK21 (-V1)	
	Optical	CS1W-CLK11	
	Optical Ring for H-PCF cable	CS1W-CLK13 CS1W-CLK12 (-V1)	
	Optical Ring for GI cable	CS1W-CLK53 CS1W-CLK52 (-V1)	
CJ-series PCs	Wired	CJ1W-CLK23	
		CJ1W-CLK21 (-V1)	

Controller Link Support Software

Applicable computer	Model number	Remarks
IBM PC/AT or compatible	C200HW-ZW3AT2-EV2	English version

Wired Communications Cables

Model	Manufacturer	Remarks
Li2Y-FCY2 × 0.56 qmm	Kromberg & Schubert, Komtec Department	German company
1 × 2 × AWG-20PE + Tr.CUSN + PVC	Draka Cables Industrial	Spanish company
#9207	Belden	USA company
ESVC 0.5 × 2 C-13262	Bando Densen Co.	Japanese company
ESNC 0.5 × 2C-99-087B	Nihon Electric Wire & Cable Co.	Japanese company
ESPC 1P × 0.5 mm ²	Nagaoka Electric Wire Co.	Japanese company

Optical Fiber Cable Connectors and Accessories for Optical Ring Networks with H-PCF Cable

Name	Model	Remarks
Optical Connector	S3200-COCF2071	Connects a cable to a node. Two connectors are required for each cable. (Full-lock connector for crimp-cut cable.)
	S3200-COCF2571	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	CAK-0057	For the S3200-COCF2071/2571 Connectors
Optical Power Tester	S3200-CAT2700	S3200-CAT2702 Head Unit, For the S3200-COCF2071/2571 Connectors
Master Fiber Set	S3200-CAT2001H	For the S3200-COCF2011/2511 Connectors

No Longer Manufactured

Name	Model	Replacement model
Connector	S3200-COCF2011	S3200-COCF2071
	S3200-COCF2511	S3200-COCF2571

An S3200-COCF2071/2571 optical connector can be assembled by adding the JRFK-57PLUS (Sumitomo Electric Industries) to the S3200-CAK1062.

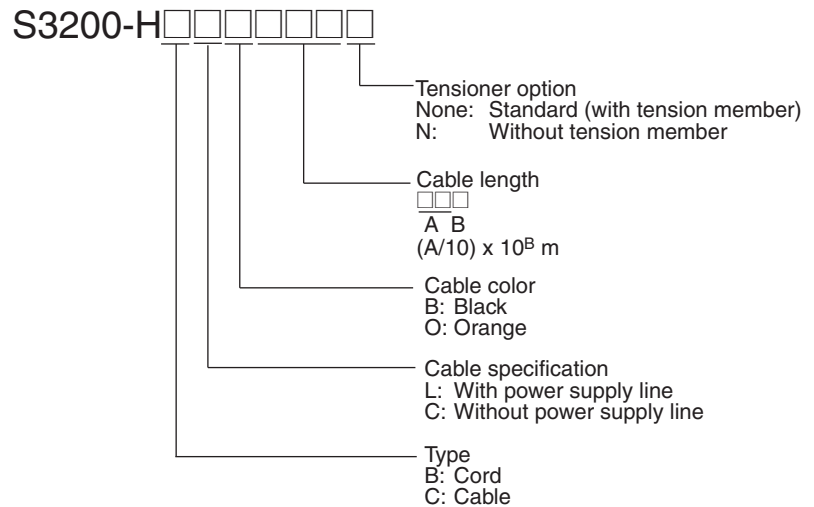
No Longer Manufactured

Name	Model	Specifications
Optical Fiber Assembly Tool	S3200-CAK1062	Crimp-cut tool for the S3200-COCF2011/2511 Connectors

Indoor H-PCF Optical Fiber Cables for Optical Ring Networks

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 for Optical Ring Networks

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 Controller Link Network.)

Specifications	Length	Model
Optical Fiber Cable Connectors: CF-2001H ↓ CF-2001H	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.)

Specifications	Length	Model
Optical Fiber Cable Connectors: CF-2001H ↓ CF-2501H	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: CF-2501H ↓ CF-2501H	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 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.

GI Optical Fiber Cables for Optical Ring Networks

Use graded index (GI) optical fiber cables with the following optical characteristics.

50/125 μm AGF

Item	Min.	Typical	Max.	Unit	Conditions	
Numerical aper- ture	---	0.21	---	---	Theoretical value	
Transmission loss	---	---	3.0 Lf	dB	0.5 km ≤ Lf	λ = 0.8-μm band Ta = 25°C
			3.0 Lf + 0.2		0.2 km ≤ Lf < 0.5 km	
			3.0 Lf + 0.4		Lf < 0.2 km	
Connection loss	---	---	1.0		λ = 0.8-μm band, 1 location	
Transmission band	500	---	---	MHz · km	λ = 0.85 μm (LD)	

Lf: Fiber length in km, Ta: Ambient temperature, λ : Center wavelength of measurement light source

62.5/125 μm AGF

Item	Min.	Typical	Max.	Unit	Conditions	
Numerical aper- ture	---	0.28	---	---	Theoretical value	
Transmission loss	---	---	3.5 Lf	dB	0.5 km ≤ Lf	λ = 0.8-μm band Ta = 25°C
			3.5 Lf + 0.2		0.2 km ≤ Lf < 0.5 km	
			3.5 Lf + 0.4		Lf < 0.2 km	
Connection loss	---	---	1.0		λ = 0.8-μm band, 1 location	
Transmission band	200	---	---	MHz · km	λ = 0.85 μm (LD)	

Lf: Fiber length in km, Ta: Ambient temperature, λ : Center wavelength of measurement light source

Connectors for GI Cable for Optical Ring Networks

Use ST connectors.

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Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. W383-E1-06



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
01	January 2001	Original production
02	June 2003	Changes and additions made to add version-1 Boards and CJ-series PCs. The major changes are as follows: Page xv: EC Directive information added. Page 4: Table changed. Pages 7, 20, 23, 66, 71, 72, 77, and 128: Information added. Pages 10 and 11: Graphics changed. Page 13: Information on using 62 nodes in a Wired Network added. Page 16: Product component list changed for wired system. Page 17: Information added in and after table. Page 22: Table corrected. Page 27: Table corrected and table added at bottom of page. Page 28: Connector type added above first table, second table corrected and information added after it, and table added. Page 49: Information added to description in two places. Page 50: "Detailed error information" changed in two places. Pages 52 and 53: Information added to description. Page 53: Error code changed from 70 to 69. Page 56: Data type changed to DWORD at bottom of page. Pages 57, 59, 87, 88, and 130: Information restricting context to 32 nodes added. Page 61: Table corrected. Pages 65, 71: "Equality Layout" added. Page 89: Note changed and "type" added. Page 90: Callout changed in first illustration. Page 126: Two rows added to table. Page 138: Information added after first illustration. Page 144: Top table corrected and information added following it.
03	May 2006	"CS1-series" changed to "CS-series" throughout the manual. Page v: Information on general precautions notation added. Page x: Information on liability and warranty added. Page xv: EMC standards changed. Page xvi: Common emission standard and common immunity standard changed. Page 24: "PLC" corrected to "PC" (Programmable Controller).

Revision History

Revision code	Date	Revised content
04	September 2007	Added the 3G8F7-CLK13-E, 3G8F7-CLK23-E, and 3G8F7-CLK53-E throughout the manual. Page xx: Changed specific model numbers to "Controller Link Support Boards." Pages 4, 73, 74: Changed table. Page 8: Changed first item under <i>Restrictions</i> and last paragraph on page. Page 9: Added material before section 1-1-3. Page 10: Changed version of Microsoft Visual C++. Pages 17 and 18: Changed dimensions diagrams. Pages 22, 24, 48, : Changed catalog number from W388 to W467. Page 25: Removed first and last items and changed three items in middle of page (starting with "if using Optical Units"). Page 26: Changed first item and added item after it. Page 45: Changed bulleted items. Page 63: Changed first diagram in table. Page 67: Added error codes. Pages 74, 76: Added note. Page 111: Changed last third of table. Page 77: Added material to first row of table and removed material from third and sixth rows. Page 104: Changed ranges in <i>No. of stored records (response)</i>. Page 116: Changed section on relay network table.
05	March 2011	Pages xvi and xvii: Changed "PC" to "PLC." Page xvi: Changed last warning. Page xvii: Changed first sentence. Page 21: Added compatible operating systems. Page 22: Added a new note 4. Page 30: Added row to table. Page 36: Changed model numbers in bottom table. Page 68: Added note below table. Page 153: Changed bottom note. Page 158: Changed last model number in top table and added rows to it. Page 159: Changed model numbers in bottom table. Page 160: Changed model numbers in top table.
06	December 2018	Revisions made due to changes in the supported OS. (Changed to Windows Vista/7/8/8.1/10 support)

OMRON Corporation **Industrial Automation Company**
Kyoto, JAPAN

Contact: www.ia.omron.com

Regional Headquarters

OMRON EUROPE B.V.

Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC

2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A.
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.

No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.

Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

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