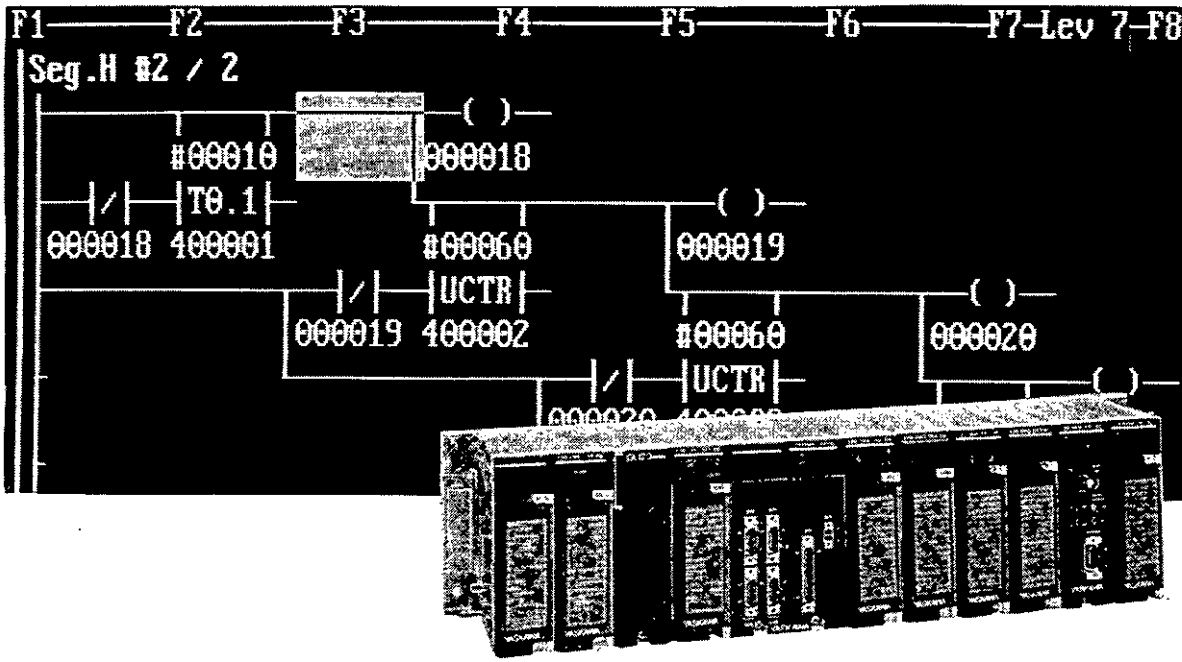
MEMOCON GL120, GL130

PC Link Module

USER'S MANUAL



YASKAWA

MANUAL NO. SIEZ-C825-70.4B

Manual Contents

This manual describes specifications and applications of the JAMSC-120NFB32100 PC Link Module.

Please read this manual carefully and be sure you understand the information provided before attempting to install and use the PC Link Module.

Visual Aids

The following aids are used to indicate certain types of information for easier reference.

Indicates references for additional information.

IMPORTANT — Indicates important information that should be memorized.

◀EXAMPLE▶ — Indicates application examples.

Indicates supplemental information.

◗SUMMARY — Indicates a summary of the important points of explanations.

Note — Indicates inputs, operations, and other information required for correct operation but that will not cause damage to the device.

Indicates definitions of terms used in the manual.

NOTICE

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in injury to people or damage to the products.

⚠**WARNING** Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.

⚠**Caution** Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

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CONTENTS

Introduction and Precautions

1

This chapter gives precautions and warnings concerning the use of this product and the manual. **You must read this chapter before reading the rest of the manual or using the product.**

1.1 Overview of Manual

- This manual describes how to use the PC Link Module. Read this manual carefully to ensure the proper use of the PC Link. Also, keep this manual in a safe place so that it can be used whenever necessary.
- This manual describes the following PC Link Module: Model JAMSC-120NFB23100.
- Refer to the following manuals for related Peripheral Devices and Modules.

	Manual Name	Manual Number	Content
CPU Module	MEMOCON GL120, GL130 Hardware User's Manual	SIEZ-C825-20.1	Describes the following for the GL120 and GL130: 1) System configuration 2) System components 3) Functions and specifications 4) Installation and wiring 5) Panel layout and hole dimensions 6) External dimensions
	MEMOCON GL120, GL130 Software User's Manual, Volume 1	SIEZ-C825-20.11	Describes the following for the GL120 and GL130: 1) Operating principles 2) I/O allocation 3) Overview of instructions 4) Instruction processing times
	MEMOCON GL120, GL130 Software User's Manual, Volume 2	SIEZ-C825-20.12	Describes the programming instructions used to create ladder programs for the GL120 and GL130. The following instructions are described in other manuals. 1) Expansion Math instructions: Software User's Manual (Vol.3) 2) Process Control Instructions: Software User's Manual (Vol.4) 3) Communications Instructions: COM: COM Instructions User's Manual FBUS: PC Link Module User's Manual MSTR: MEMOBUS PLUS User's Manual 4) Motion Control Instructions (ladder motion instructions) 4-axis Motion Module MC20 Software User's Manual 5) Motion Language 4-axis Motion Module MC20 Software User's Manual
Communications Module	MEMOCON GL120, GL130 MEMOBUS User's Manual	SIEZ-C825-70.13	Describes the functions, specifications, and usage of the MEMOBUS.
Human-machine Interface	MEMOCON GL120, GL130 Programming Panel P120 (MEMOSOFT) User's Manual	SIEZ-C825-60.7	Describes the functions, specifications, and usage of the Programming Panel P120 (with built-in MEMOSOFT).
	MEMOCON GL120, GL130 MEMOSOFT for DOS User's Manual	SIEZ-C825-60.10	Describes the functions and usage of the MEMOSOFT for DOS.

- Thoroughly check the specifications and conditions or restrictions of the product before use.

1.2 Precautions

This section outlines general precautions that apply to using this manual and the product. You must read this section first before reading the remainder of the manual.

1.2.1 Safety Precautions

- MEMOCON was not designed or manufactured for use in devices or systems that concern people's lives. Users who intend to use the product described in this manual for special purposes such as devices or systems relating to transportation, medical, space aviation, atomic power control, or underwater use must contact Yaskawa Electric Corporation beforehand.

- This product has been manufactured under strict quality control guidelines. However, if this product is to be installed in any location in which a failure of MEMOCON involves a life and death situation or in a facility where failure may cause a serious accident, safety devices MUST be installed to minimize the likelihood of any accident.

1.2.2 Installation Precautions

Abide by the following precautions when installing MEMOCON systems.

- The installation environment must meet the environmental conditions given in the product catalog and manuals. Using the MEMOCON in environments subject to high temperatures, high humidity, excessive dust, corrosive gases, vibration, or shock can lead to electrical shock, fire, or faulty operation. Do not use the MEMOCON in the following locations.
  - Locations subject to direct sunlight or ambient temperatures not between 0 and 60 °C.
  - Locations subject to relative humidity in excess of 95%, rapid changes in humidity, or condensation.
  - Locations subject to corrosive or flammable gas.
  - Locations that would subject the MEMOCON to direct vibration or shock.
  - Locations subject to contact with water, oil, chemicals, etc.
- Install the MEMOCON as described in this product manual. Improper installation can cause product failure, malfunctions, or Modules or other components to fall off.
- Do not allow wire clippings or other foreign matter to enter the MEMOCON. Foreign matter can cause fires, product failure, or malfunctions.

1.2.3 Wiring Precautions

- Wiring must be performed by qualified personnel.

  Mistakes in wiring can cause fires, product failure, or malfunctions.

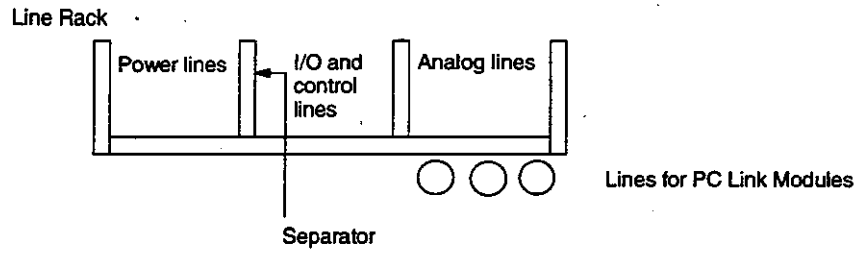
- Insert the interface cables properly.

  Insert the connectors of the various interface cables that are to be connected to MEMOCON into the communication ports and attach them properly. Improper insertion of interface cables may cause operational errors in the MEMOCON.

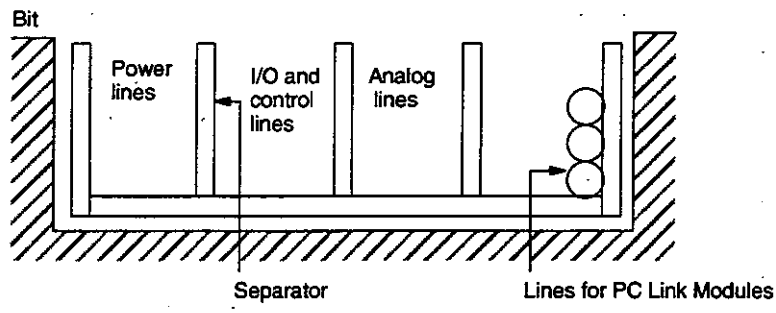
- Separate wiring properly.

  I/O lines connecting the MEMOCON to external devices must be selected based on the following considerations: mechanical strength, resistance to noise, wiring distance, signal voltage, etc.

  I/O lines must be separated from power lines both within and outside of the control panel to minimize the affects of noise. Faulty operation can result if I/O lines are not sufficiently separated from power lines.



When wiring MEMOBUS Module cables outside of the control panel, place them in a duct or conduit by themselves to minimize the affects of noise. Faulty operation can result if MEMOBUS lines are not sufficiently insolated.



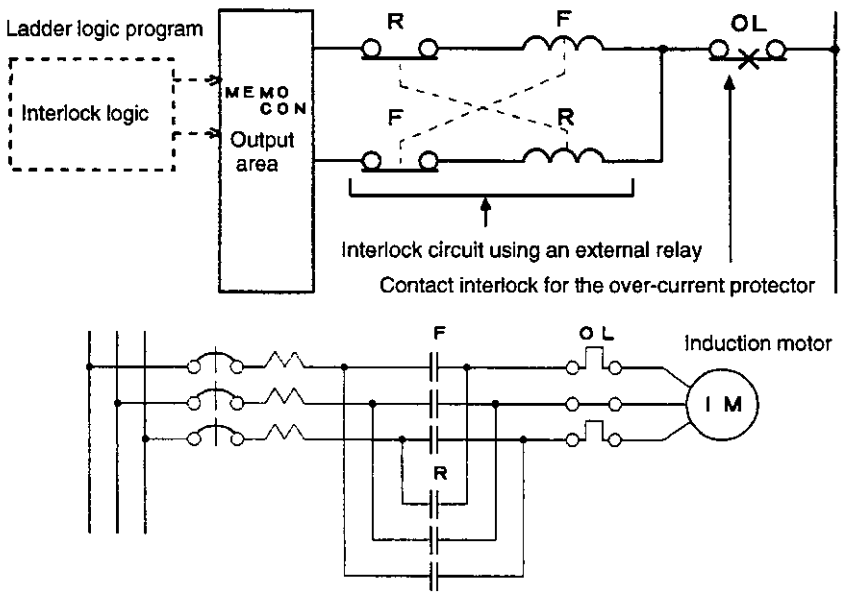
1.2.4 Application Safety Precautions

⚠ **WARNING** Externally connect emergency stop, interlock circuits and other switches to the MEMOCON.

External interlocks for the MEMOCON

Externally connect an interlock to the MEMOCON if there is any chance that MEMOCON failure could result in bodily harm as well as equipment or accessory damage.

Always use an external interlock system as shown in the example below when reciprocal operations (i.e., forward and reverse directions) are being undertaken with the motor.



An interlock circuit is generally written into the MEMOCON ladder logic program to ensure that forward and reverse signals are not simultaneously output. As well, an external interlock circuit must be provided using external relays for the same purpose.

⚠ **WARNING** Operations such as RUN, STOP, forced output, and program change during operation must be carried out with care. Operational errors may damage the machine or cause accidents.

⚠ **Caution** Do not access the system (ATTACH operation) from more than one Programming Panel at the same time. Multiple access can destroy CPU memory.

1.2.5 MODEM Power ON/OFF Precautions

Be sure to follow the procedures regarding the power ON and OFF sequence given below.

Note Be very careful when turning power ON and OFF whenever you are using modems. Turning power to the slave ON and OFF with the modem turned ON will cause the modem to output spurious signals to the 2-core twisted pair cable for several tens of milliseconds. A transmission error is generated when these signal are sent to other modems.
In order to avoid this situation, we recommend a power supply sequencing procedure of turning the slave ON before turning the modem ON, turning the modem OFF before turning the slave OFF, or turning both OFF simultaneously.

1.2.6 Maintenance

Do not attempt to disassemble or modify the MEMOCON in any way. Doing so can cause fires, product failure, or malfunctions.

Make sure that equipment power is turned OFF before mounting or removing the MEMOCON Modules.

1.3 Using this Manual

This manual is written for those who already have a basic knowledge of MEMOCON PLCs. We recommend reading the *MEMOCON GL120, GL130 Hardware User's Manual* before attempting to read this manual.

- **Meaning of Basic Terms**

  In this manual, the following terms indicate the meanings as described below, unless otherwise specified.

  - **PLC = Programmable (Logic) Controller**

  - **PP = Programming Panel**

- **Description of Technical Terms**

  The shaded technical terms in this manual are briefly explained in the **Glossary** provided at the bottom of the page. An example is shown below.

Glossary

The following types of terms are described.

- Specific sequence control terms required for explanation of functions.

- Terms that are specific to programmable controllers and electronic devices.

Overview

2

This chapter outlines the functions of the PC Link.

2.1 Functions and System Configuration

This section outlines the functions and system configuration of the PC Link.

2.1.1 Overview of Functions

1) The PC Link Module (also referred to as "PC Link") speeds up data transfer between Yaskawa PLCs. PC Links can also connect to Yaskawa system controllers thus forming a flexible industrial transmission system.

2) PC Links use coaxial cables as transmission lines and allow N:N communications in **token** passing mode where a token is used to control the right to transmit information. The PC Link allows the user to select the baud rate up to a maximum of 4 Mbps. The maximum transmission distance is 1 km (the transmission distance depends on the baud rate and the cable used).

3) PC Links have the following three transmission functions:

a) Link Transmissions between PLCs

Data links are used to cyclically transmit data at high speed, and useful in transmitting small amounts of data (such as control commands or responses) at high speed or at regular intervals.

b) Message Transmissions between PLCs

Messages are transmitted using four FBUS communication instructions to transmit data, and are useful in transmitting large amounts of data (such as monitoring or operation screen data) or transmitting data when an event occurs.

c) Host Computer, PP, and FA Monitor ACGC Communications

The PC Link has one MEMOBUS port. If a Programming Panel is connected to the MEMOBUS port, up to 32 PLCs can be programmed or monitored without having to use modems. The MEMOBUS port can also connect to FA Monitor ACGC, commercially available graphic panels, or computers.

Token

A token represents the access right on a loop or bus network. Normally, a token packet (usually 8-bit data) circulates through a network. A station that receives the token gains the access right.

2.1.2 System Configuration Overview

1) The following figure illustrates the PC Link system configuration.

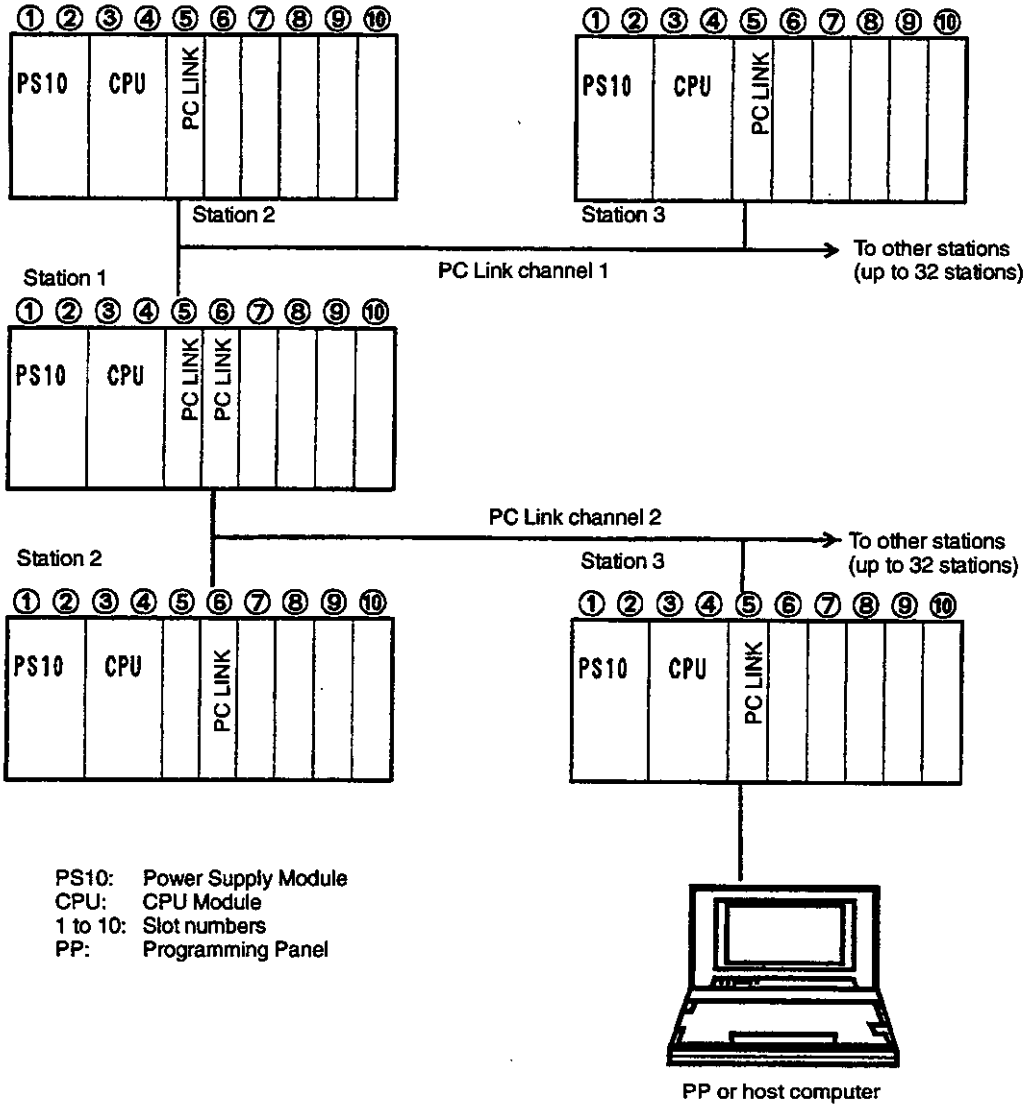


Figure 2.1 PC Link Configuration

2) PC Links can be created between the following devices:

- MEMOCON GL120 and GL130
- Earlier Yaskawa PLCs (MEMOCON-SC GL40, GL60, and GL70)
- Yaskawa System Controllers (CP3300, CP3500, CP5500, and CP9200)

3) Up to two PC Links can be installed in each MEMOCON GL120 or GL130. Each PC Link has one PC Link port. Up to 32 PLCs can connect to each PC Link port (each of these PLCs must have one PC Link).

4) The PLCs connected to a PC Link are assigned station addresses from 1 to 32. The transmission line connecting the PC Link to the 32 stations is called a channel. When two PC Links are used, one channel is called channel 1 and the other is called channel 2.

5) Coaxial cables are used to connect stations. A terminator with a termination resistance of 75 Ω must be connected to PLCs at both ends of each cable.

6) Each PC Link has one MEMOBUS port, which can connect to a Programming Panel via an RS-232C cable. The MEMOBUS port can also connect to a Yaskawa FA Monitor ACGC or a computer. This enables the Programming Panel, ACGC, or computer to communicate with the PLCs at all stations connected by the coaxial cables through the MEMOBUS protocol. In this way, up to 32 GL120 or GL130 PLCs can be used as MEMOBUS slaves and monitored without having to use modems.

2.2 Overview of PC Link Functionality

This section provides an overview of PC Link functions. The PC Link has the following three functions:

- Link transmissions between PLCs (performed cyclically)
- Message transmissions between PLCs (performed when an event occurs)
- Host computer communications (MEMOBUS port used)

2.2.1 Token Passing

1) The PC Link transmission mechanism is based on token passing. A token always circulates around a channel. A station that receives the token (representing the right to send) can transmit data.

2) A token is passed in ascending order of station address, as shown in *Figure 2.2*, below. Stations do not have to be arranged in ascending order of station address.

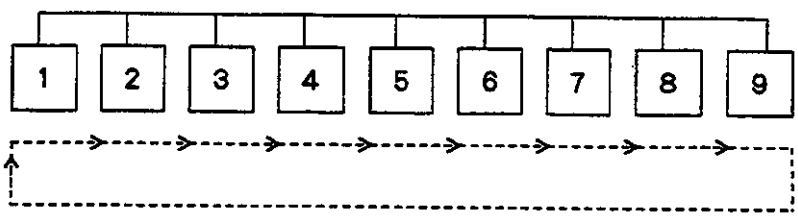


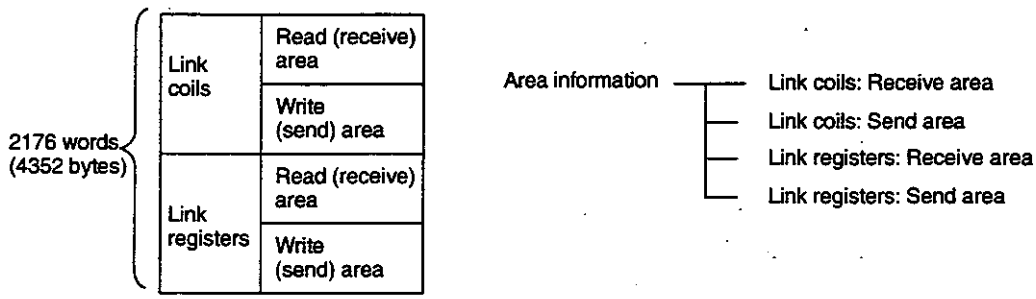
Figure 2.2 Token Passing

3) Each station can send data while holding the token. In the PC Link, each station can hold the token for 1 to 255 ms. If the station has no data to send, it passes the token to the next station.

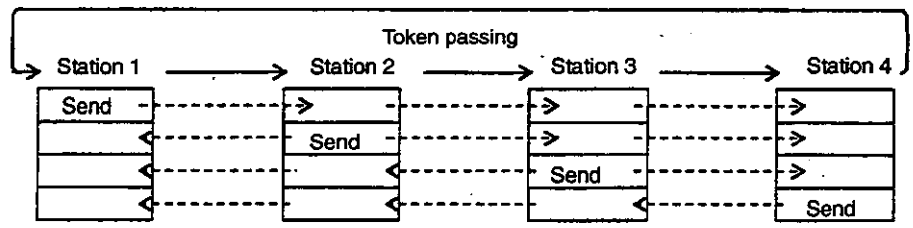
2.2.2 Link Transmissions

1) The PC Link has a 2176 word (4352-byte: coils 256 bytes, registers 4096 bytes) virtual shared memory called "link memory." The link memory has a register area and a coil area. For each station, write (send) areas and read (receive) areas must be preset. This task of presetting these areas is called "allocation." It is performed for each station by using a Programming Panel.

2) Link Memory Structure



3) Conceptual Diagram of Link Transmissions for Four Stations



In the above figure, each blank rectangle represents a receive area.

4) Each station writes transmission data in the preset areas in its own link memory. When receiving the token, the station sends the transmission data and area information to all other stations. These stations write the received data in the appropriate areas in their own link memory according to the area information.

5) In this way, the contents of the link memory at each station are updated each time the token is passed.

2.2.3 Message Transmissions

1) Message transmissions are performed between PLCs by using FBUS communications instructions to transfer messages when an event occurs. The following message transmissions are available:

- MEMOBUS message transmissions
- General message transmissions

a) MEMOBUS Message Transmissions

MEMOBUS messages are transmitted using the MSND and MRCV instructions to transmit through the MEMOBUS protocol. The master station sends a MEMOBUS query message to one or more slaves and receives a response message from each. The conventional MEMOBUS protocol supports only 1:N communications, while the enhanced function of the PC Link supports N:N communications. See section *4.3 General Message Transmission* for details of the MEMOBUS protocol.

b) General Message Transmissions

General messages are transmitted using the SEND and RECV instructions to transfer messages of arbitrary data size between 1 to 254 words. Unlike the MEMOBUS message transmission mode, function loading is not required. Because transmitting general messages enables a large amount of register data to be transmitted at a time, it can provide highly efficient data transmission which is best suited for applications. See section *4.3 General Message Transmissions* for details on the general message transmission mode.

2) The send-receive buffer for message transmission is separated from that for link transmission. Therefore, any increase in the amount of message data transmitted does not affect link transmissions.

2.2.4 Host Computer Communications

1) Communications with host computers use the MEMOBUS port to communicate through the MEMOBUS protocol.

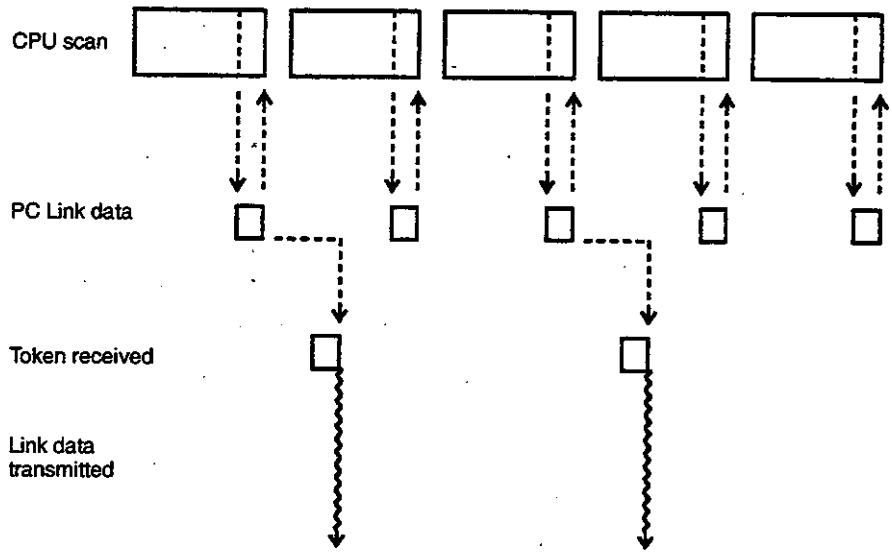
2) Up to 32 MEMOBUS slaves can be connected on one PC Link line without having to use modems.

3) For details about MEMOBUS see the *MEMOBUS User's Manual* (SIEZ-C825-70.13).

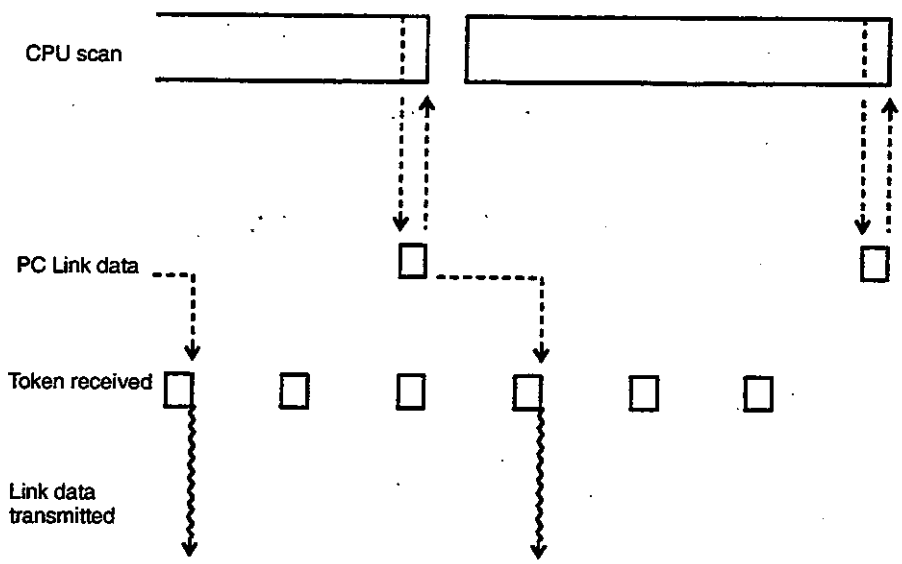
2.2.5 CPU Scan and Link Data Transmissions

1) As shown in the figure below, link data is transmitted the next time the token is received after the data is updated by CPU.

a) Token Cycle Time Longer than CPU Scan



b) Token Cycle Time Shorter than CPU Scan



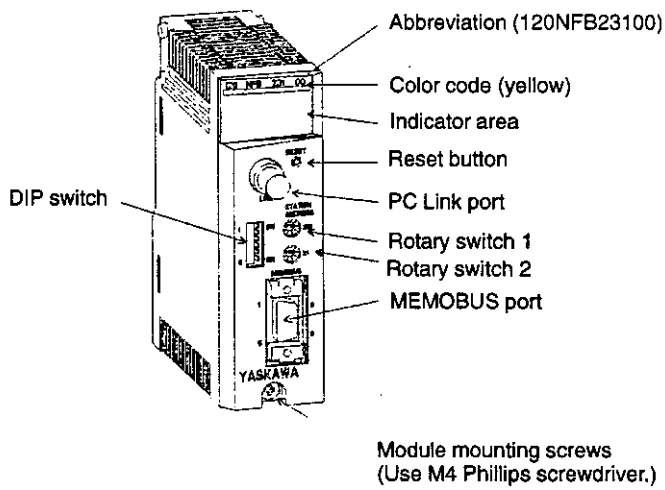
Note Link data is updated at the low-speed scan level.

2.3 External Appearance and Specifications

This section describes the specifications of the PC Link.

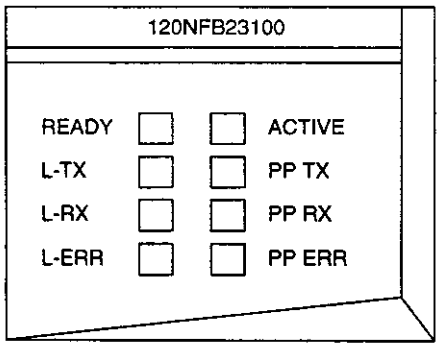
2.3.1 External Appearance of PC Link

1) Appearance



2) Indicators

a) Indicator Area



b) LED Indicators

Indicator	Description	Color
READY	Lights when the PC Link Module is operating normally.	Green
L-TX	Lights when the PC Link port is receiving data.	Green
L-RX	Lights when the PC Link port is sending data.	Green
L-ERR	Lights for 10 ms when an error occurs during data transmission from the PC Link port.	Red
ACTIVE	Lights when CPU is active.	Green
PP TX	Lights when the MEMOBUS port is sending data.	Green
PP RX	Lights when the MEMOBUS port is receiving data.	Green
PP ERR	Lights for 10 ms when an error occurs during data transmission from the MEMOBUS port.	Red

c) Status Error Display

Error	LED Indicator			
	READY	PP ERR	L-ERR	Remarks
ROM Error	○●	○●	○●	Continuously checked
RAM Error	○●	●	○●	Checked at power ON
Common Memory Error	○●	○●	●	
Watchdog Timer Error	○	○●	○●	Continuously checked
Station Address Error	○	○●	●	Checked at power ON

Display Status: ○: Lit ●: Not lit ○●: Flashing

3) Station Address

The station address of a PC Link Module is set using two rotary switches on the front panel of the Module. The range of possible settings is from 1 to 32 (2-digit decimal). The Module will not operate with any other setting. This address is also used as the station's link port address and its PP port address.

Press the reset button and restart the Module after changing the station address.

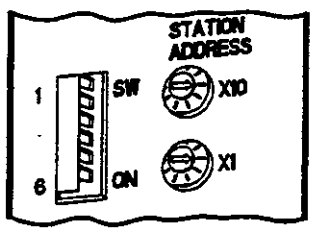


Figure 2.3 Station Address Switches on Front Panel of PC Link Module

4) Baud Rate

The DIP switch on the front panel is used to set the baud rate of the PC Link port.

Table 2.1 DIP Switch Settings

Pin Number	Setting		
1	ON	Self-diagnosis mode	
	OFF	PC Link mode (normally OFF)	
2	Not used		
3	ON	Use channel 2.	
	OFF	Use channel 1.	
4	ON	Holding mode: Holds station link data immediately before the station malfunctions.	
	OFF	Clear mode: Resets link data on a failed station to "OFF" or "0."	
5 & 6	**5**	**6**	**Baud Rate**
	ON	ON	4 Mbps
	ON	OFF	2 Mbps
	OFF	ON	1 Mbps
	OFF	OFF	0.5 Mbps

Note All stations on the same channel must be set to the same baud rate.

2.3.2 General Specifications

1) The following table shows the general specifications of the PC Link.

Item		Specification
Physical Environment	Ambient Temperature	0 to 60 °C
	Storage Temperature	–25 to 85 °C
	Humidity	30% to 95% RH (with no condensation)
	Storage Humidity	5% to 95% RH (with no condensation)
	Dust	Free from conductive dust
	Pollution Level	Conforming to JIS B3501: Pollution level 1
	Corrosive Gas	Free from corrosive gas
	Altitude	Up to 2,000 meters above sea level
Mechanical Conditions	Vibration Resistance	Conforming to JIS B3502 10 to 57 Hz; displacement amplitude; 0.075 mm 57 to 150 Hz; Constant acceleration: 9.8 m/s^2 (1G) Sweep cycles: 10 for X, Y, and Z axes (Trace interval: 1 octave per minute)
	Shock Resistance	Conforming to JIS B3502 Acceleration peak value: 147 m/s^2 (15G) Working time: 11 ms Direction of shock: ±X, ±Y, and ±Z (twice each)
Electrical Conditions	Noise Immunity	Conforming to JIS B3502 Normal mode: 1,500 Vp-p Common mode: 1,500 Vp-p Pulse width: 100 ns/1 µs Rise time: 1 ns (Tested with noise simulator)
Installation Conditions	Cooling Method	Natural air cooling

2.3.3 Module Specifications

1) The table below gives the Module specifications of PC Link.

Table 2.2 Module Specifications

Item	Specification
Model Name	PCLINK-COAX
Model	JAMSC-120NFB23100
Function	Communications between interconnected PLCs through special references.
Indicators	READY: Lights for a normal Module. ACTIVE: Lights when CPU is active. PP TX: Lights while the PP port is transmitting. PP RX: Lights while the PP port is receiving. PP ERR: Lights for a PP port communication error. L-TX: Lights while the link port is transmitting. L-RX: Lights while the link port is receiving. L-ERR: Lights for a link port communication error.
Ports	PC Link Port = 1
	MEMOBUS Port = 1
Switches	Reset Station address Baud rate setting
Consumed Current	800 mA at 5 VDC
Mounting Base	CPU Base
Hot Swapping	Available
Dimensions in mm	40.34 x 130 x 103.85 (WxHxD) mm
Approximate Mass	300 g

2) Up to two PC Link Modules can be installed on the MEMOCON GL120 or GL130.

2.3.4 Transmission Specifications

1) This section describes the specifications of the PC Link port and the MEMOBUS port.

a) PC Link Port Specifications

Item	Specification
Topology	Bus (Party line)
Media Access Control Method	Token passing bus (N:N communication)
Transmission Medium	Coaxial cable (75 Ω)
Transmission Method	Baseband (Manchester coding)
Data Baud Rate	500 kbps,1 Mbps, 2 Mbps, 4 Mbps (Selected on DIP switch on front of Module) Select according to transmission distances.
Max. Cable Length	1 km (Depending on the data baud rate and cable used)
RAS	Failed stations: Automatic line disconnect and automatic recovery
Synchronization	Frame
Transmission Format	Conforming to HDLC
Insulation	Pulse transformer
Number of Stations	32 stations max.
Station Address	1 to 32 (Set on rotary switch on front of Module.)
Connector	BNC connector
Number of ports	1

b) MEMOBUS Port Specifications

Item	Specification
Standard	Conforming to EIA RS-232C
Synchronization	Half duplex, start-and-stop
Data Baud Rate	9,600 bps
Data Bits	8 bits
Stop Bits	1 bit
Parity Check	Even
Protocol	MEMOBUS protocol
Station Address	1 to 32 (identical with station addresses for PC Link port)
Connector	D-SUB 9-pin connector (female)
Number of ports	1

2) Link Data Reference Numbers

Item	Reference Number
Link Coils	Du0001 to Du2048
Link Registers	Ru0001 to Ru2048

u: 1 or 2 (channel number)

2.3.5 Cable Specifications

See chapter *6 Cabling* for details on how to wire or connect devices.

1) Yaskawa Standard Coaxial Cables

Use the same coaxial cables as for GL120 or GL130 Remote I/O Systems. The following table shows the types and specifications of Yaskawa standard coaxial cables.

Model	Cable Length in Meters (Inches)	Cable Type to be Used	Remarks
JZMSZ-W60-1	2 m (78.74)	3C-2V (in-panel)	BNC connectors at both ends
JZMSZ-W60-2	3 m (118.18)		
JZMSZ-W60-3	5 m (196.85)		
JZMSZ-W61-1	2 m (78.74)	5C-FB (panel to panel)	F Connectors (F-5FB) at both ends Gold-plated contact
JZMSZ-W61-2	5 m (196.85)		
JZMSZ-W61-3	10 m (393.7)		
JZMSZ-W61-4	20 m (787.4)		

2) Other Coaxial Cables

The table below shows the types and specifications of coaxial cables manufactured by Fujikura Ltd.

Model (Fujikura Ltd.)	Electrostatic and Magnetic Shield	Application	Conditions	Signal Attenuation:Pas (dB/km)			
				0.5 MHz	1 MHz	2 MHz	4 MHz
3C-2V	Not provided	In-panel	Exclusive duct	9.0	12.0	17.0	25.0
3C-2V (Cu, Fe) ZV	Provided		Low-voltage electrical duct				
5C-2V	Not provided	Panel to Panel	Exclusive duct	5.1	7.6	11.0	16.0
5C-2V (Cu, Fe) ZV	Provided		Low-voltage electrical duct				
5C-FB	Not provided	Panel to Panel	Exclusive duct	4.8	7.4	10.5	14.0
5C-FB (Cu, Fe) ZV	Provided		Low-voltage electrical duct				
7C-FB	Not provided	Panel to Panel	Exclusive duct	4.2	5.8	7.6	10.0
7C-FB (Cu, Fe) ZV	Provided		Low-voltage electrical duct				
7C-FL	Not provided	Panel to Panel	Exclusive duct	2.9	3.8	5.6	8.1
7C-FL (Cu, Fe) ZV	Provided		Low-voltage electrical duct				
12C-5AF	Not provided	Panel to Panel	Exclusive duct	1.46	2.2	3.2	4.5
12C-5AF (Cu, Fe) ZV	Provided		Low-voltage electrical duct				

Note (a) Coaxial cables equivalent to the above can be applicable.

(b) Signal attenuation: Pas (dB/km) shows typical values.

3) Coaxial Connectors

The following table shows the types and specifications of coaxial connectors.

Connector	Name	Type	Model Name	Remarks	Manufacturer
Connection	BNC connector	BNC-P-3-Ni-CAu	BNC-P-3	For 3C-2V, Gold-plated contact	Dai-Ichi Electronic Ind.
	F connector	FSPW-5-Ni-CAu		For 5C-2V, Gold-plated contact	Fujikura Ltd.
		F-5FB		For 5C-FB, Gold-plated contact	Fujikura Ltd.
		FSPW-7-Ni-CAu		For 7C-FL, Gold-plated contact	Fujikura Ltd.
		F-7FB		For 7C-FB, Gold-plated contact	Fujikura Ltd.
	Fitting connector	FT-12C-2.9-TC31		For 12C-5AF, Gold-plated contact	Fujikura Ltd.
		FT-7C-FL		For 7C-FB, Gold-plated contact	Fujikura Ltd.
Branch	T connector	413592-2		For connection and branch	AMP
Conversion	Conversion adapter	T-0298		For conversion of BNC and F connectors	Yaskawa Electric Corporation
	Conversion connector	FTR-FJ		For conversion of fitting and F connectors	Fujikura Ltd.
Junction	Junction connector	F-A		For connection of F connectors to each other	Fujikura Ltd.
		FI-A		For connection of fitting connectors to each other	Fujikura Ltd.
Termination	Terminator	221629-5		For termination of both ends of transmission	AMP

Note (a) All of the above connectors have a connection loss of 0 dB.

(b) Waterproof and insulate the junction of the coaxial cable (e.g., wrap with self sealing tape).

(c) See section *6.3.5 Grounding* for details.

4) MEMOBUS Cables

MEMOBUS cables are RS-232C cable for connecting a Programming Panel, ACGC, or host computer to the MEMOBUS port. Yaskawa provides the standard cables shown below.

Type	Name	Model Name	Model	Description	Length
MEMOBUS cable	W0200 cable	W0200-03	JZMSZ-120W0200-03	1) This cable is used to connect a personal computer made by NEC (PC-98) to the MEMOBUS port. 2) It has a D-SUB connector (25-pin, male) on the personal computer end.	2.5 m
		W0200-15	JZMSZ-120W0200-15		15.0 m
	W0201 cable	W0201-03	JZMSZ-120W0201-03	1) This cable is used to connect a personal computer made by NEC (PC-98) to the MEMOBUS port. 2) It has a half-pitch connector (MDR 14-pin, one-touch lock, straight) on the personal computer end.	2.5 m
		W0201-15	JZMSZ-120W0201-15		15.0 m
	W0202 cable	W0202-03	JZMSZ-120W0202-03	1) This cable is used to connect a DOS personal computer to the MEMOBUS port. 2) It has a D-SUB connector (9-pin, female) on the personal computer end.	2.5 m
		W0202-15	JZMSZ-120W0202-15		15.0 m
	W0203 cable	W0203-03	JZMSZ-120W0203-03	1) This cable is used to connect a Programming Panel (P120) to the MEMOBUS port. 2) It has a D-SUB connector (9-pin, female).	2.5 m
		W0203-15	JZMSZ-120W0203-15		15.0 m
	W0204 cable	W0204-05	JZMSZ-120W0204-05	1) This cable is used to connect an FA monitor (ACGC4200) to the MEMOBUS port.	5.0 m
		W0204-10	JZMSZ-120W0204-10		10.0 m
		W0204-15	JZMSZ-120W0204-15		15.0 m
	W0205 cable	W0205-01	JZMSZ-120W0205-01	1) This cable is used to connect an 2000-series modem J2078 to the MEMOBUS port.	1.0 m
		W0205-03	JZMSZ-120W0205-03		3.0 m
		W0205-05	JZMSZ-120W0205-05		5.0 m
	W0206 cable	W0206-01	JZMSZ-120W0206-01	1) This cable is used to connect an commercially available modem AX/2400C to the MEMOBUS port.	1.0 m
		W0206-03	JZMSZ-120W0206-03		3.0 m
		W0206-05	JZMSZ-120W0206-05		5.0 m

a) JZMSZ-120W0200 and JZMSZ-120W0204 Connections

Pin#	PC Link	Direction	Pin#	Personal Computer Made by NEC (PC-98) D-SUB 25-pin Connector
	Signal Name			Signal Name
1	PGND (protective ground)		1	PGND (protective ground) (vacant)
2	TXD (transmission data)	→	3	RXD (reception data)
3	RXD (reception data)	←	2	TXD (transmission data)
4	RTS (request to send)	→	4	RTS (request to send)
5	CTS (clear to send)	←	5	CTS (clear to send)
6	DSR (data set ready)	→	20	DTR (data terminal ready)
7	SGND (signal ground)	↔	7	SGND (signal ground)
8	TEST			
9	DTR (data terminal ready)	←	6	DSR (data set ready)

b) JZMSZ-120W0201 Connections

Pin#	PC Link	Direction	Pin#	Personal Computer Made by NEC (PC-98) Half-pitch Connector
	Signal Name			Signal Name
1	PGND (protective ground)			
2	TXD (transmission data)	→	1	RXD (reception data)
3	RXD (reception data)	←	9	TXD (transmission data)
4	RTS (request to send)	→	10	RTS (request to send)
5	CTS (clear to send)	←	4	CTS (clear to send)
6	DSR (data set ready)	→	11	DTR (data terminal ready)
7	SGND (signal ground)	↔	14	SGND (signal ground)
8	TEST			
9	DTR (data terminal ready)	←	2	DSR (data set ready)
		→	12	RSEN
		→	13	SGND (signal ground)

c) JZMSZ-120W0202 Connections

Pin#	PC Link	Direction	Pin#	DOS D-SUB 9-pin Connector
	Signal Name			Signal Name
1	PGND (protective ground)		1	PGND (protective ground) (vacant)
2	TXD (transmission data)	→	2	RXD (reception data)
3	RXD (reception data)	←	3	TXD (transmission data)
4	RTS (request to send)	→	7	RTS (request to send)
5	CTS (clear to send)	←	8	CTS (clear to send)
6	DSR (data set ready)	→	4	DTR (data terminal ready)
7	SGND (signal ground)	↔	5	SGND (signal ground)
8	TEST (vacant)		9	(vacant)
9	DTR (data terminal ready)	←	6	DSR (data set ready)

d) JZMSZ-120W0203 Connections

Pin#	PC Link	Direction	Pin#	P120 D-SUB 9-pin Connector
	Signal Name			Signal Name
1	PGND (protective ground)	←	1	CD (vacant)
2	TXD (transmission data)	→	2	RXD (reception data)
3	RXD (reception data)	←	3	TXD (transmission data)
4	RTS (request to send)	→	7	RTS (request to send)
5	CTS (clear to send)	←	8	CTS (clear to send)
6	DSR (data set ready)	→	4	DTR (data terminal ready)
7	SGND (signal ground)	←	5	SGND (signal ground)
8	ESTUS	→	9	ESTUS
9	DTR (data terminal ready)	←	6	DSR (data set ready)

System Configuration

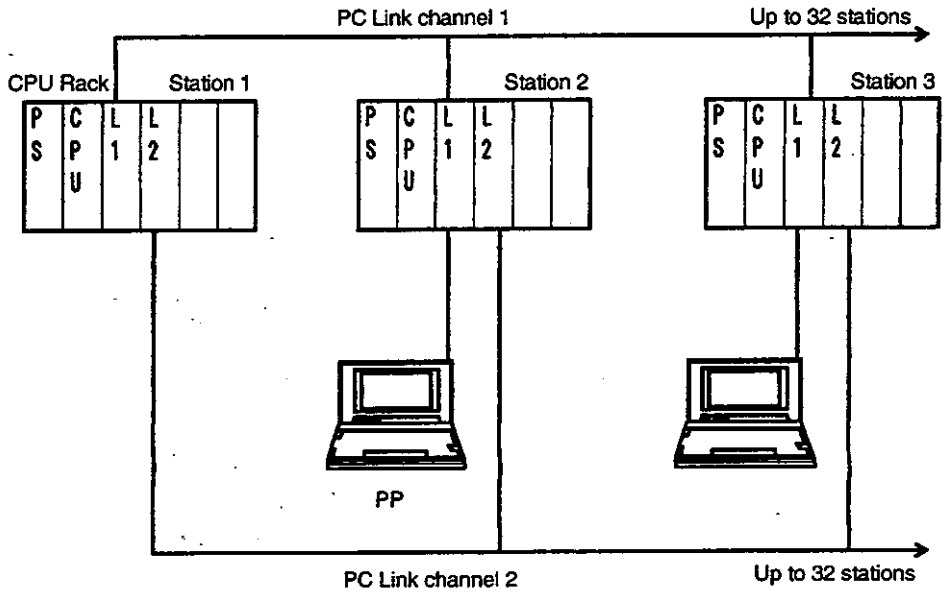
3

This chapter describes the hardware of the PC Link, including the system configuration, equipment connections, and transmission parameters.

3.1 Example System Configuration

This section provides an example of PC Link system configuration.

1) The following example is a PC Link system using two channels.



L1, L2: PC Link Module
PS: Power Supply Module
CPU: CPU Module
PP: Programming Panel

3.2 Connecting PC Link to Other Devices

This section describes the parts required to connect the PC Link to other devices

3.2.1 Connecting PC Link Modules

1) The parts required to connect one PC Link Module to another are shown below.

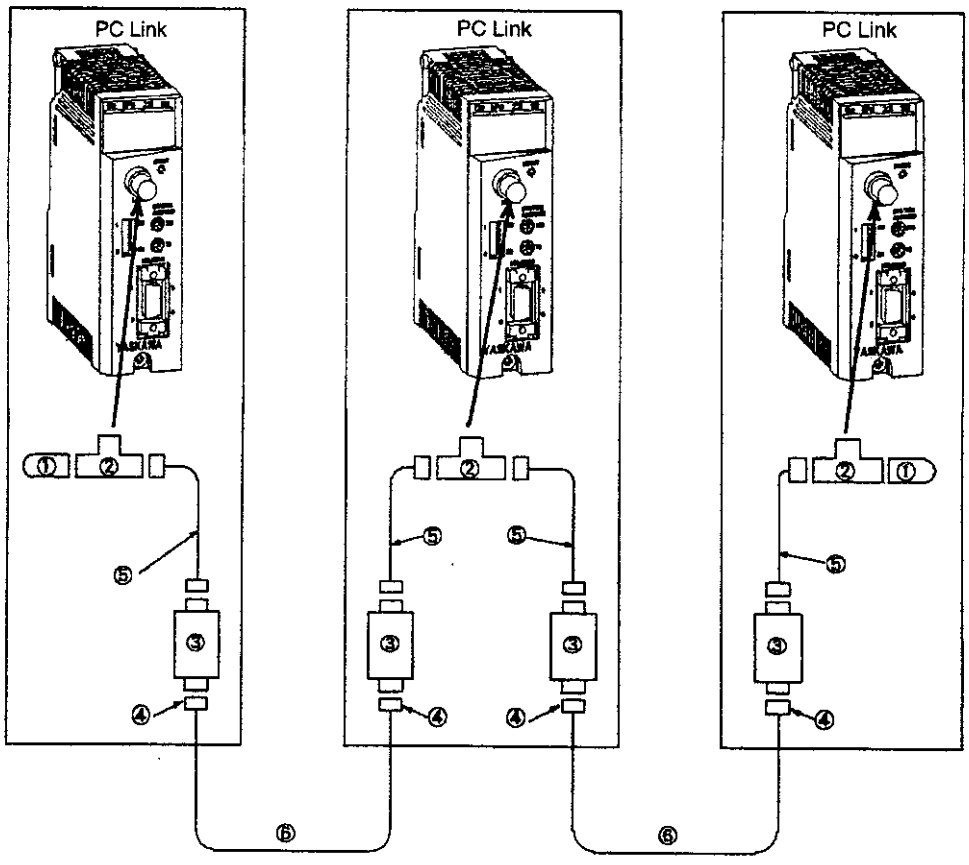


Figure 3.1 Connecting PC Link Modules

Table 3.1 Coaxial Cable Parts

No.	Parts Name	Model	Remarks
1	Terminator	221629-5	This terminator is used to terminate the transmission path.
2	T Adapter	413592-2	This adapter is used to connect a BNC Connector to a station Module.
3	Conversion Adapter	T-0298	This adapter is used to connect a BNC Connector to an F Connector.
4	F Connector	F-5FB	This connector is used to terminate the trunk cables.
5	W60 Cable	JZMSZ-W60-□ W60-1: 2.0 m W60-2: 3.0 m W60-3: 5.0 m	• This cable is used as in–panel branch cables. • This cable has two BNC connctors at each end.
6	Panel-to-panel Coaxial Cable (see note.)	5C, 7C, 11C, 12C, etc.	Select an appropriate model according to the connection distance.

Note W61 trunk cables with Fconnectors at both ends are also provided by Yaskawa.

Table 3.2 MEMOBUS Cables

No.	Cable Name	Model	Length	Remarks
1	W0200 cable	JZMSZ-120W0200-03	2.5 m	Connection cable for a personal computer made by NEC (PC-98), with D-SUB connector (25-pin, male)
		JZMSZ-120W0200-15	15.0 m	
2	W0201 cable	JZMSZ-120W0201-03	2.5 m	Connection cable for a personal computer made by NEC (PC-98), with half-pitch connector (MDR 14-pin)
		JZMSZ-120W0201-15	15.0 m	
3	W0202 cable	JZMSZ-120W0202-03	2.5 m	Connection cable for DOS personal computer, with D-SUB connector (9-pin, female)
		JZMSZ-120W0202-15	15.0 m	
4	W0203 cable	JZMSZ-120W0203-03	2.5 m	Connection cable for P120, with D-SUB connector (9-pin, female)
		JZMSZ-120W0203-15	15.0 m	
5	W0204 cable	JZMSZ-120W0204-05	5.0 m	Connection cable for ACGC4200
		JZMSZ-120W0204-10	10.0 m	
		JZMSZ-120W0204-15	15.0 m	

3.3 Transmission Time

This section describes how to calculate approximate transmission times required. Use these values as guidelines in system design.

3.3.1 PC Link Data Transmissions

1) Transmission Delays

a) Transmission Time Tsnd (ms)

- The frame format of link data transmitted via the link line is shown in the following illustration.

Header: 32 bytes
Data: 1 to 512 bytes
FCS (frame check sequence): 2 bytes
EOF (end of frame): 1 byte

The fixed part of the frame is thus 35 bytes.

The transmission time is calculated as follows:

Tsnd (ms) = (35 + Nd) x 8 ÷ f ÷ 1000

Nd: Number of data items (bytes)
f: Baud rate (Mbps)

◀EXAMPLE▶

In this example, the number of data items is 68 for the following WMAP allocation:

Link coils: 32 points
Link registers: 32 registers

The transmission time for this allocation is as follows:

Baud Rate	4 Mbps	2 Mbps	1 Mbps	0.5 Mbps
Transmission Time	0.21 ms	0.41 ms	0.82 ms	1.65 ms

b) Transmission Processing Time Ts (= 1 ms x number of stations)

The transmission processing time is the time required to process the transmission data after the token for link data transmission processing has been acquired. It takes about 1 ms per station regardless of the amount of transmission data and the baud rate.

c) Token Rotation Time Tg (ms)

The token moves around the logical ring, and a station can transmit to the link line only while it holds the token. The processing time for each station to acquire and pass the token to the next station is about 1 ms. This time also includes the token transmission time (fixed regardless of the baud rate).

The maximum time Tg required for a station to release the token and acquire the next token is calculated as follows:

Tg (ms) = ΣTsnd + Ts + 1 $\times$ Ns
ΣTsnd: Sum of data transmission times for other stations
Ns: Number of stations
Ts: Transmission processing time at other stations (= (Ns – 1) x 1)

d) Reception Processing Time Trcv

Trcv varies with PLC scan time and reception timing. The maximum value is 2 x scan time.

2) Transmission Times

The figure below shows the transmission timing when two stations are used. The transmission timing varies with the number of stations because the value of Tg changes.

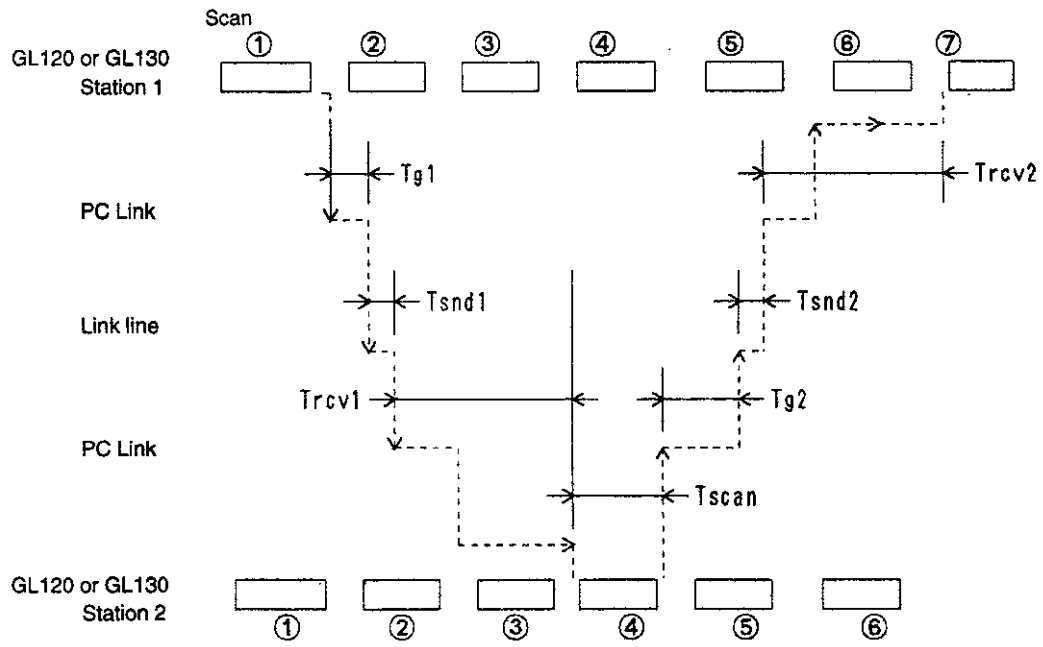


Figure 3.3 Transmission Timing

The time required for link data to reach the CPU at station 2 from the CPU at station 1 is the sum of the following:

Token rotation time (Tg1)
Station 1 link data transmission time (Tsnd1)
Reception processing time (Trcv1)

The time required for link data to reach the CPU at station 1 from the CPU at station 2 is the sum of the following:

Token rotation time (Tg2)
Station 1 link data transmission time (Tsnd2)
Reception processing time (Trcv2)

Add one scan period for ladder processing time when a ladder diagram is used to process received link data and the result is either sent to another station or output.

3) Calculation Example

a) **Conditions**

Number of stations:	4
Number of link data items:	68 bytes per station
[Link coils:	32 points (4 bytes)]
[Link registers:	32 registers (62 bytes)]
Baud rate:	4 Mbps
Scan period:	30 ms (Scan period is the same for all stations)
Transmission data:	Prepared for all stations

No MEMOBUS transmissions

b) **Station 1 to Station 2 Arrival Time**

Tg1 = 0.21 × 3 + 3 + 4 = 7.63 (ms)
Tsnd1 = 0.21 (ms)
Trcv1 = 60 (ms)

Therefore, the maximum arrival time is 67.84 ms.

c) **Station 2 to Station 1 Arrival Time**

Tg2 = 0.21 × 3 + 3 + 4 = 7.63 (ms)
Tsnd2 = 0.21 (ms)
Trcv2 = 60 (ms)

Adding one scan period (30 ms) for ladder processing at station 2 to the sum above yields a time of 67.84 ms.

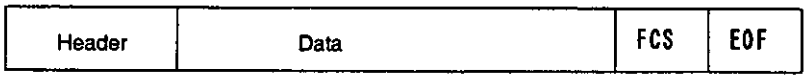
d) The total time required is (b) + (c) + Tscan (1 sacn).
(b) + (c) + Tscan (1 sacn) = 67.84 + 67.84 + 30 = 165.68 (ms)

3.3.2 MEMOBUS Port Transmissions

1) Transmission Delays

a) Transmission Time on the Link Line Tsnd (ms)

- The frame format of MEMOBUS data transmitted onto the link line is shown in the following illustration.



Header:	18 bytes
Data:	7 to 255 bytes
FCS (frame check sequence):	2 bytes
EOF (end of frame):	1 byte

Therefore, the fixed part of the frame is 21 bytes.

- Transmission time is calculated as follows:

$$Tsnd\ (ms) = (21 + Nmd) \times 8 \div f \div 1000$$

Nmd: Number of data items (bytes)
f: Baud rate (Mbps)

The number of data items depends on the transmission message from the device connected to the MEMOBUS port, or the response message from the destination station.

b) Transmission Time on the RS-232C Line: T_{232C} (ms)

The transmission time between the MEMOBUS port and a connected device (MEMOBUS, etc.) is expressed by the following equation:

$$T_{232C} = \frac{Nmd \times 11 \times 1000}{9600}\ [ms]$$

Nmd: Number of data items in item *a)*, above.

c) Processing Time for Transmission to the Link Line

Processing time is required to transmit both data received from the MEMOBUS port and the response message from the CPU to the link line. This time is also required for transmission processing after the token has been acquired. The time is about 0.5 ms regardless of the amount of transmission data and the baud rate.

d) Token Rotation Time Tg (ms)

As with link data transmissions, a station can transmit message data to the link line only while it holds the token. The processing time for each station to acquire and pass the token to the next station is about 1 ms. This time also includes the token transmission time. (Fixed regardless of the baud rate.)

As with link data transmissions, a station can transmit message data to the link line only while it holds the token. The processing time for each station to acquire and pass the token to the next station is about 1 ms. This time also includes the token transmission time. (Fixed regardless of the baud rate.)

The maximum time Tg required for a station to release the token and acquire the next token is calculated as follows:

$$Tg\ (ms) = Ns \times 1 + Ts + \Sigma Tsnd$$

Ns: Number of stations

Ts: Transmission processing time at the other station
$= (Ns - 1) \times 1$

$\Sigma Tsnd$: Sum of data transmission times for other stations (both link data and message data)

Nf: Number of frames of message data for other station

e) Token Holding Time

The token holding time ranges from 1 to 255 ms. Data can be transmitted onto the link line throughout the token holding time. Even though holding time may still be available, the token will be passed to the next station if there is no other transmission data.

The transmission processing time, token rotation time, and token holding time are not separate for link and message data transmission. They are interrelated and must be considered together.

2) Transmission Times

The transmission time required for communications from the MEMOBUS port to a station is the sum of the following times:

a) Command transmission time to the MEMOBUS port

b) Token rotation time

c) Command transmission time to the link line

d) Reception processing time at the destination station

e) Token rotation time

f) Response transmission time to the link line

g) Response transmission time from the MEMOBUS port

The following example shows how to calculate the required transmission time.

3) Calculation Example

The following example calculates the time required to read 125 holding registers before a response is returned. Link data is also transmitted in this example. Here, it is assumed that no other stations are currently transferring message data.

Conditions

Number of stations:	4
Number of link data items:	68 bytes per station
[Link coil:	32 points (4 bytes)]
[Link register:	32 registers (62 bytes)]
Baud rate:	4 Mbps
Scan period:	30 ms (Scan period is the same for all stations)
Transmission data:	Prepared for all stations

a) Command Transmission Time to the MEMOBUS Port

The number of command characters is 8 bytes, so the transmission time is calculated as follows:

$$\frac{8 \times 11 \times 1000}{9600} \doteqdot 9.17\ [ms]$$

b) Token Rotation Time

As all stations transmit link data, the token rotation time is as follows:

$$Tg = 4 \times 1 + 3 \times 1 + 3 \times 0.21 = 7.63\ (ms)$$

c) Command Transmission Time to the Link Line

The time required to transmit the command to the link line is the sum of the link data transmission processing time, the link data transmission time, the message data (command) transmission processing time, and the message data transmission time.

Link data transmission processing time:	1 ms
Link data transmission time:	0.21 ms
Command transmission processing time:	0.5 ms
Message transmission time:	(21 + 8) x 8 ÷ 4 = 58 (μs)

Therefore, the command transmission time is about 1.77 ms.

Note This value indicates that all data can be transmitted within the token holding time (255 ms or less).

d) Reception Processing Time at the Destination Station

A maximum of two scan periods are required. This time can thus be calculated as follows:

2 x scan period + command processing time = 2 x 30 + 2 = 62 (ms)

INFO Some commands are divided into two scans. If two scans are required, add one more scan time plus a command processing time of 2 ms.

e) Token Rotation Time

As in b), the token rotation time is as follows:

Tg = 4 x 1 + 3 x 1 + 3 x 0.21 = 7.63 (ms)

f) Response Transmission Time to the Link Line

The time required to transmit the response to the link line is the sum of the link data transmission processing time, the link data transmission time, the message data (response) transmission processing time, and the message data transmission time.

Link data transmission processing time:	1 ms
Link data transmission time:	0.21 ms
Response transmission processing time:	0.5 ms

Because the number of response characters is 255 bytes, the response transmission time is calculated as follows:

(21 + 255) x 8 ÷ 4 ÷ 1000 = 0.552 ms

The response transmission time is about 2.26 ms.

g) Response Transmission Time from the MEMOBUS Port

The number of response characters is 255 bytes, so the transmission time is as follows:

$$\frac{255 \times 11 \times 1000}{9600} \doteqdot 292.18 \text{ [ms]}$$

The total of 382.64 ms for items a) to g) above is the desired total transmission time (maximum).

4) Influences on Message Transmission

The following factors prolong the transmission time of link data when a Programming Panel or other devices are connected to MEMOBUS ports.

a) Processing time to transmit the command to the link line (0.5 ms)

b) Time to transmit the command to the link line.

c) Processing time to transmit the response to the link line (0.5 ms)

d) Time to transmit the response to the link line.

In the example shown above, item *3)*, the link data transmission period for transmitting message data is prolonged as follows

Command transmission influence: About 0.56 ms
Response transmission influence: About 1.05 ms

Each command and response transmission is on a different transmission cycle, so they are each affected.

When more than one Programming Panel is connected to the MEMOBUS ports, the value for each must be added to the transmission time.

3.3.3 Time Required to Transfer Message Data between PLCs

1) Transmission Delays

a) Transmission Time on the Link Line

- The frame format of message data transmitted onto the link line is shown in the following illustration.

Header:	18 bytes
Data:	7 to 255 bytes
FCS (frame check sequence):	2 bytes
EOF (end of frame):	1 byte

Therefore, the fixed part of the frame is 21 bytes.

- Transmission time is calculated as follows:

$$Tsnd\ (ms) = (21 + Nmd) \times 8 \div f \div 1000$$

Nmd: Number of data items (bytes)
f: Baud rate (Mbps)

The number of data items depends on the response message from the destination station.

b) Processing Time for Transmission to the Link Line

Processing time is required to transmit the response message from the CPU to the link line. This time is also required for transmission processing after the token has

been acquired. The time is about 0.5 ms regardless of the amount of transmission data and the baud rate.

c) Token Rotation Time Tg (ms)

As with link data transmissions, a station can transmit message data to the link line only while it holds the token. The processing time for each station to acquire and pass the token to the next station is about 1 ms. This time also includes the token transmission time (fixed regardless of the baud rate).

The maximum time Tg required for a station to release the token and acquire the next token is calculated as follows:

$$Tg\ (ms) = Ns \times 1 + Ts + \Sigma Tsnd$$

Ns: Number of stations
Ts: Transmission processing time at other station
(= (Ns –1) x1 + Nf x 0.5)
ΣTsnd: Sum of data transmission times for other stations
(both link data and message data)
Nf: Number of frames of message data for other station

d) Token Holding Time

The token holding time ranges from 1 to 255 ms. Data can be transmitted onto the link line throughout the token holding time. Even though holding time may still be available, the token will be passed to the next station if there is no other transmission data.

The transmission processing time, token rotation time, and token holding time are not separate for link and message data transmission. They are interrelated and must be considered together.

2) Transmission Time

The transmission time required for communications to a station is the sum of the following times:

a) Token rotation time

b) Time required to transmit the command to the link line

c) Reception processing time at the destination station

d) Token rotation time at the destination station

e) Time required to transmit the response to the link line

f) Reception processing time

The following example shows how to calculate the required transmission time.

3) Calculation Example

The following example calculates the time required to read 125 holding registers before a response is returned. Link data is also transmitted in this example. Here, it is assumed that no other stations are currently transferring message data.

Conditions:

Number of stations:	4
Number of link data items:	68 bytes per station
[Link coil:	32 points (4 bytes)]
[Link register:	32 registers (62 bytes)]
Baud rate:	4 Mbps
Scan period:	30 ms (Scan period is the same for all stations)
Transmission data:	Prepared for all stations

a) Token Rotation Time

As all stations transmit link data, the token rotation time is as follows:
Tg = 4 x 1 + 3 x 1 + 3 x 0.21 = 7.63 (ms)

b) Command Transmission Time to the Link Line

The time required to transmit the command to the link line is the sum of the link data transmission processing time, the link data transmission time, the message data (command) transmission processing time, and the message data transmission time.

Link data transmission processing time:	1 ms
Link data transmission time:	0.21 ms
Command transmission processing time:	0.5 ms
Message transmission time:	(21 + 8) x 8 ÷ 4 ÷ 1000 = 0.058 (ms)

Therefore, the command transmission time is about 1.77 ms.

Note This value indicates that all data can be transmitted within the token holding time (255 ms or less).

c) Reception Processing Time at the Destination Station

A maximum of two scan periods are required. This time can thus be calculated as follows:

2 x scan period + command processing time = 2 x 30 + 2 = 62 (ms)

INFO Some commands are divided into two scans. If two scans are required, add one more scan period plus a command processing time of 2 ms.

d) Token Rotation Time

As in a), the token rotation time is as follows:

4 x 1 + 3 x 1 + 3 x 0.21 = 7.63 (ms)

e) Response Transmission Time to the Link Line

The time required to transmit the response to the link line is the sum of the link data transmission processing time, the link data transmission time, the message data (response) transmission processing time, and the message data transmission time.

Link data transmission processing time:	1 ms
Link data transmission time:	0.21 ms
Response transmission processing time:	0.5 ms

Because the number of response characters is 255 bytes, the response transmission time is calculated as follows:

$$(21 + 255) \times 8 \div 4 \div 1000 = 0.552 \text{ ms}$$

The response transmission time is about 2.26 ms.

f) Reception Processing Time

Maximum scan time + command processing time = 2 x 30 + 2 = 62 ms

The total of 143.29 ms for items a) to e) above is the desired total transmission time (maximum).

Transmission Procedures

4

This chapter describes the procedures for link transmissions between PLCs, message transmissions, communications with host computers, and other transmission procedures.

4.1 Data Links between PLCs

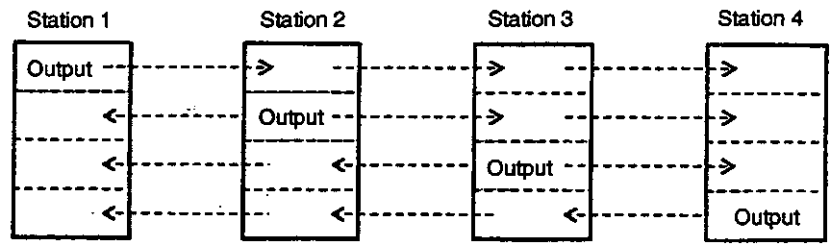
This section describes allocations required to transfer link data between PLCs.

4.1.1 Link Data Transfer

1) The PC Link has a memory for link data called the link memory. The CPU at each station transfers link data by reading and writing the link memory for PC Links according to the allocation data (see section *4.1.4 Allocation*). The PC Link transmits data between stations to transfer link data according to the allocation data.

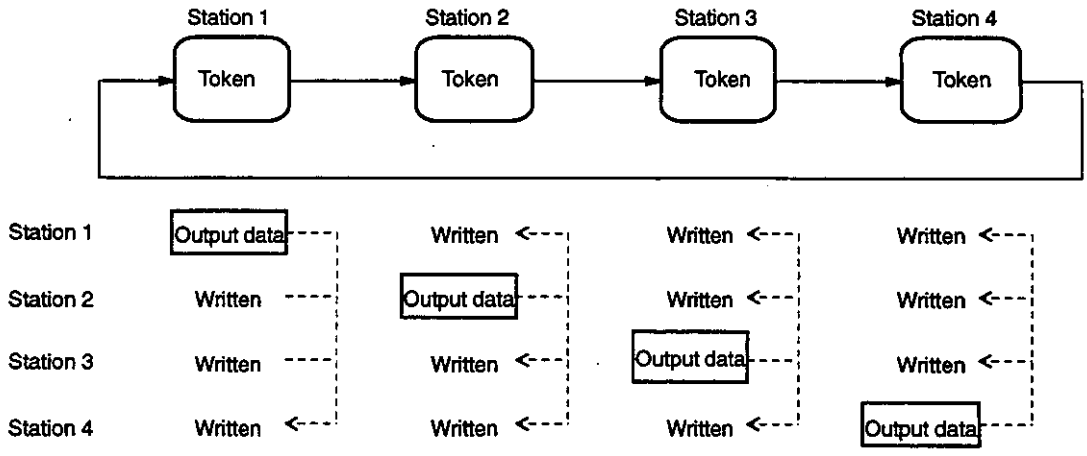
2) The write area in the link memory at each station is determined by allocation. The PC Link at each station cyclically transmits the link data written by the local CPU to all other stations. It also receives the link data written by the CPUs at other stations and stores the data in its own link memory. In this way, the contents of the link memory at each station remain the same.

3) The following figure illustrates the link data flow in a 4-station system. The areas labeled "output" indicate the write areas allocated to each CPU.



Link memory for each station

4) The following figure illustrates token circulation and link data flow.



IMPORTANT The link data shown in the figures above is written to the link memory of the PC Link. The link memory must be allocated before the CPU can refer to the link data. If memory references are not allocated, all input data will be "0" (OFF).

5) Link data is divided into link coils and link registers. Each is assigned reference numbers as shown below.

Item	Reference Numbers
Link coils	Du0001 to Du2048
Link registers	Ru0001 to Ru2048

u: 1 or 2 (channel number)

When the PC Link is connected to a MEMOCON-SC GL40, GL60, or GL70, the reference numbers of link coils and link registers are Du0001 to Du1024 and Ru0001 to Ru1024, respectively.

4.1.2 Setting Transmission Parameters

1) Programming Panels can be used to set transmission parameters (channel, station address, group address, number of FBUS retries, token holding time, token check time, station search time, and FBUS timeout time) as shown in the following tables.

Transmission Parameter	Lower Limit	Upper Limit	Resolution	Default
Channel	1	2	1	–
Station Address (ST#)	1	32	1	–
Group Address *1	129	160	1	160
FBUS Retry *2	0	3	1	0

*1: Group Address:
An address used when data is transmitted by group during message transmission.

*2:FBUS Retry: The number of retries when a communications error occurs.

Transmission Parameter	Lower Limit (ms)	Upper Limit (ms)	Resolution (ms)	Standard Setting (ms)
Token Holding Time*1	1	255	1	10
Token Check Time*2	50	2550	10	500
Station Search Time*3	100	25500	100	1000
FBUS Timeout Time*4	0	25500	100	0

*1 Token Holding Time:
The time a station holds the token. (If this time is too short, transmissions will not be possible.)

*2: Token Check Time:
The time used to determine whether each station is normal or faulty. (A station that does not transmit data within this time is considered to be faulty.)

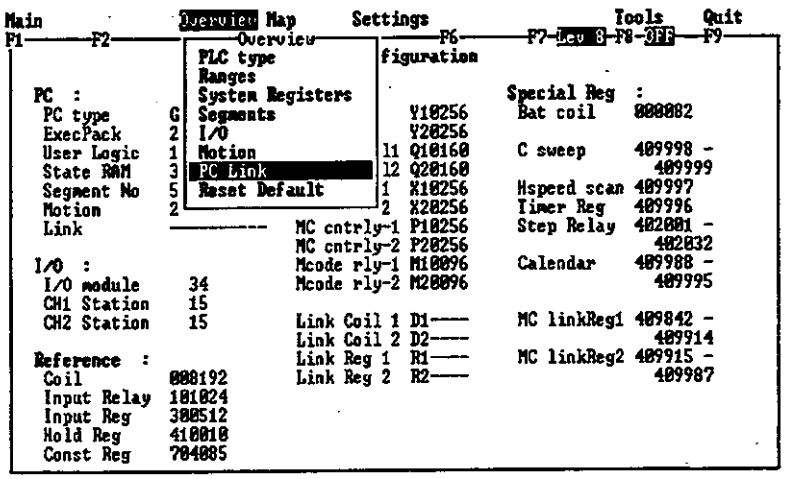
*3: Station Search Time:
The time used to check whether new stations have been added. (A search is conducted in 4-station units during each search period to check whether new stations have been added.)

*4: FBUS Timeout Time: The time to detect a communications error (time-out).

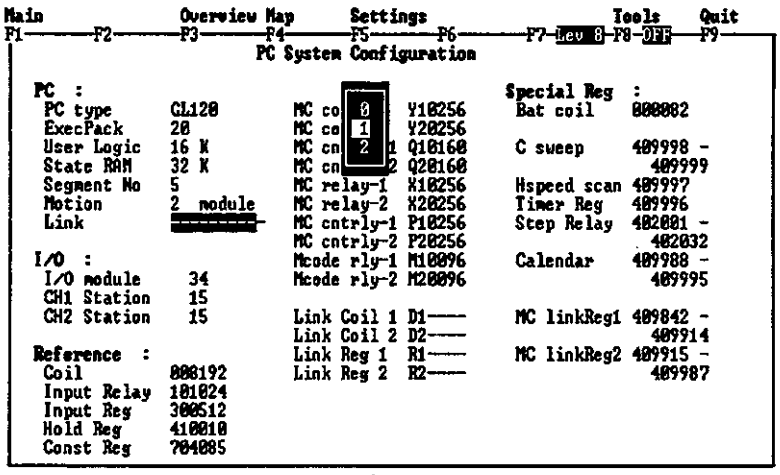
4.1.3 Setting PC Links

Number of PC Link Modules (Default = 0)

Select **PC Link** from the Overview Menu using the Arrow Keys and press Return.



Select the number of PC Link Modules to be used using the Arrow Keys and press Return.



Here, the number of PC Link Modules is changed to 1. The reference number for Link Module 1 is displayed. Channel 1 will be used.

4.1.4 Allocation

1) Memory must be allocated to define link data exchanges between PLCs. Memory is allocated using the Programming Panel.

2) Memory is allocated at each station for the individual CPUs, and the allocations are stored in the backup memory of each CPU.

3) The allocations are written into a write map (WMAP) and a read map (RMAP), as described next.

a) WMAP

The write map determines the link data transmitted (i.e., output) by the CPU to other stations through the PC Link. Link data for the station cannot be transmitted to other stations if the WMAP is not set.

b) RMAP

The read map determines the link data referred to by the CPU. All input link data will be "0" (OFF) if the CPU refers to link data not set in the RMAP.

IMPORTANT

(1) As with input relays, the link coils and link registers set in RMAP must be only referenced so that they are not confused with received link data.

(2) The WMAP and RMAP allocations described above must be set for the CPU at each station. Allocations are made based on the references and size of the link data as shown in *Table 4.1*.

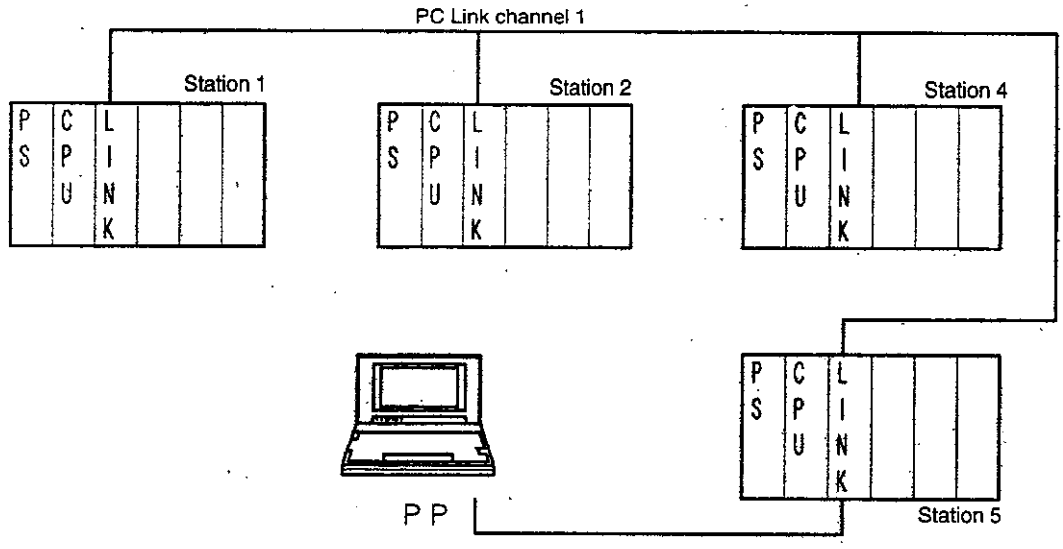
Table 4.1 Allocated Data

Allocated Item	Description
First Reference for Link Data	Specifies the first reference in the link data. Link coils: DuX (Du0001 to Du2033) Link registers: RuY (Ru0001 to Ru2048) Where X = 16n+1 (n = 0, 1, 2, ... 127) and Y = 1 to 2048 u: channel no. 1 or 2
Link Data Size	Link data is specified using sequential numbers. Link data is allocated according to the first reference for the link data and the link data size. Link coils: Units of 16 points Link registers: Number of registers

IMPORTANT The maximum WMAP for a single station is a total of 512 bytes of coils and register data. The following equation must be satisfied.
Number of coils ÷ 8 + registers x 2 ≦ 512

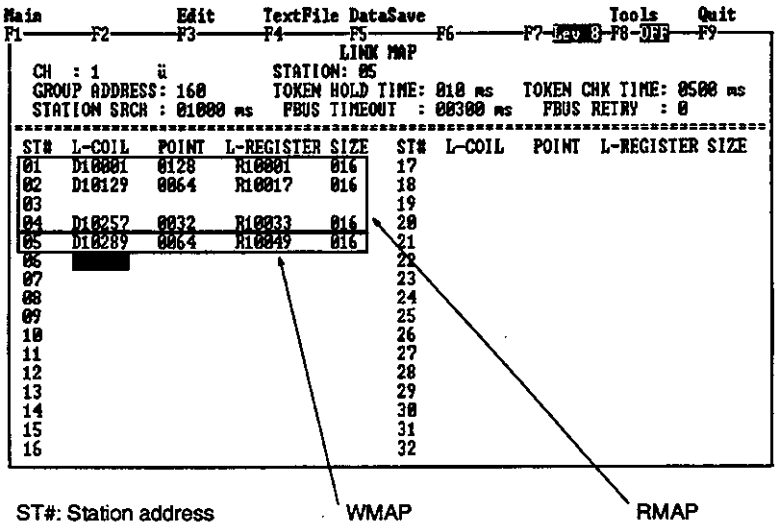
4) Allocation Screen

a) The following figure is an example of system configuration.



Note In this configuration, station 3 is not used. (See the screen example below.)

Example of Allocation Screen (for Station 5)



ST#: Station address WMAP RMAP

b) This particular allocation screen displays the WMAP (write data) setting of station 5 and the RMAP (receive data) settings for data received from stations 1, 2, and 4.

c) WMAP allocation for other stations corresponding to RMAP can be performed using the Text File function described on page 4-13.

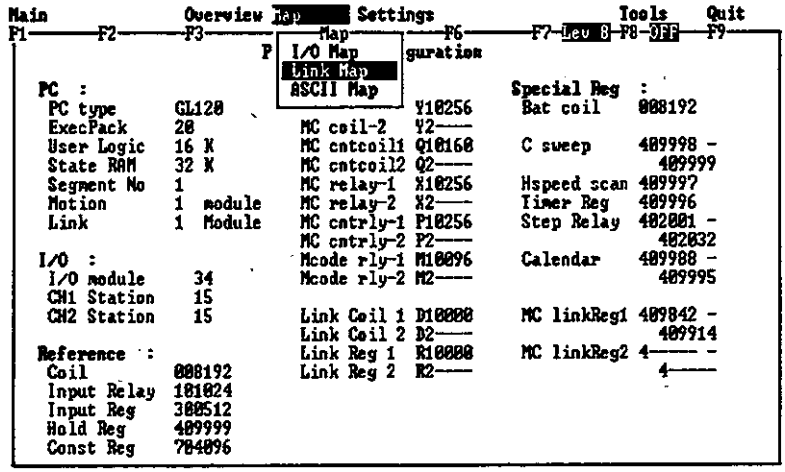
d) RMAP must be set within the WMAP range for the CPU at each station (1, 2, 4, and 5).

4.1.5 Allocation Procedure

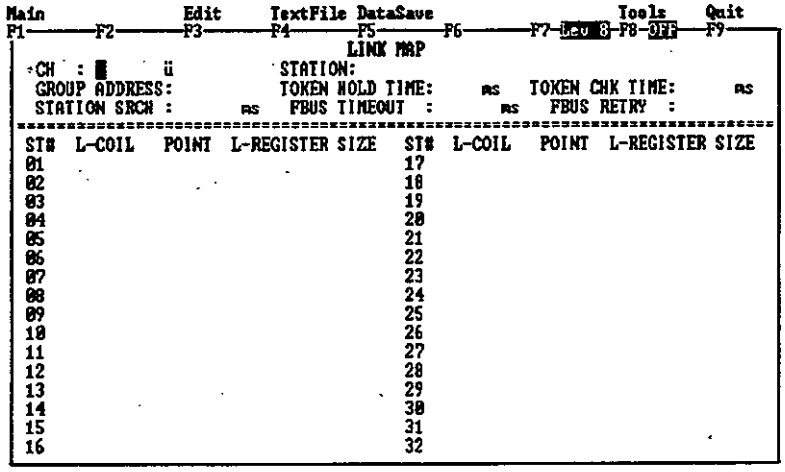
The PC Link allows the user to refer to reference data in other PLCs connected with the PC Link. To do so, use a Programming Panel to allocate link data. The procedure for allocating link data is described below. For details on how to activate a Programming Panel, see the *Programming Panel User's Manual.*

1) Activating the PC Link Allocation Screen

Press the Up or Down Arrow Key to move the menu cursor to **Link Map** on the Map Menu, then press Return.



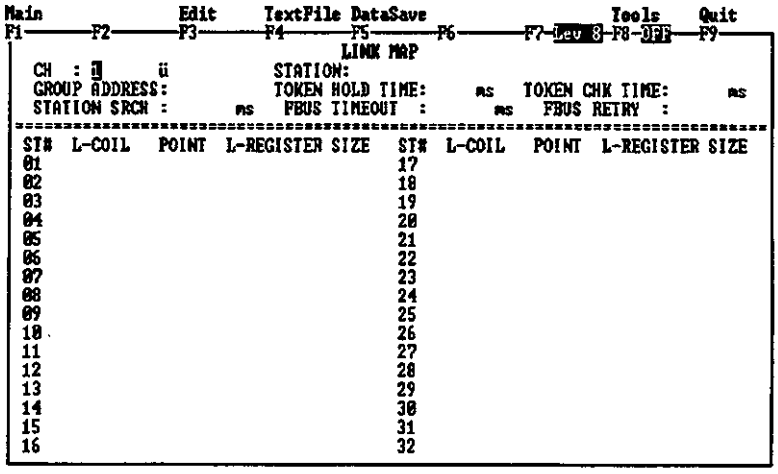
The PC Link Map Screen is displayed.



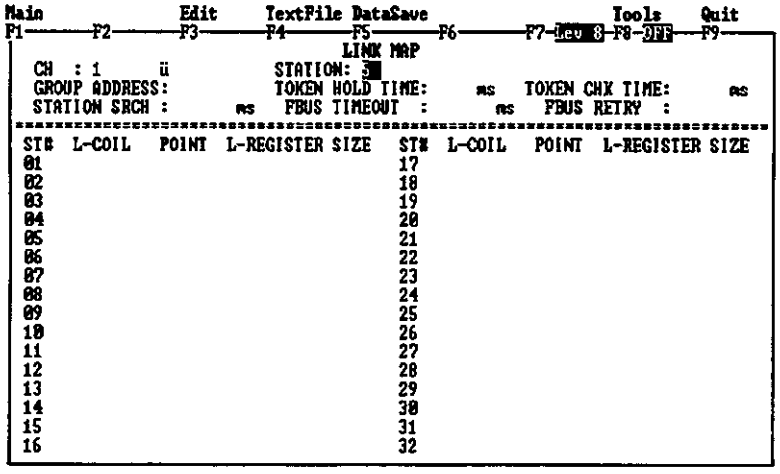
2) Specifying the PC Link Parameters

Specify the channel number, station address, and communications parameters for the PC Link Module.

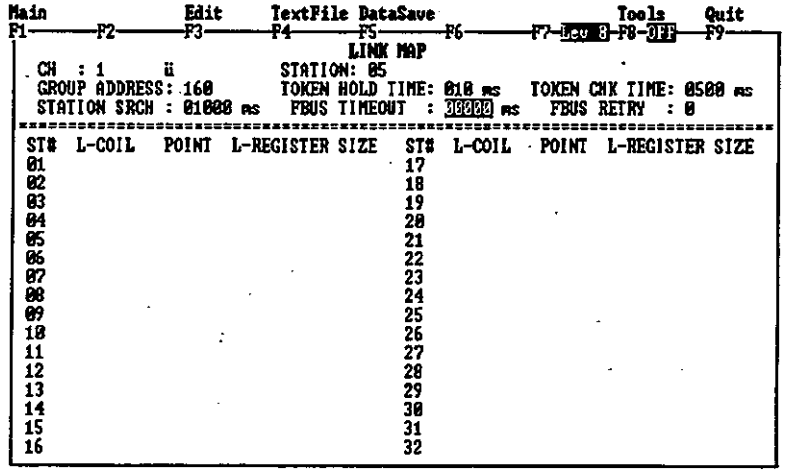
Enter the channel number set on the DIP switch on the PC Link Module, then press Return.



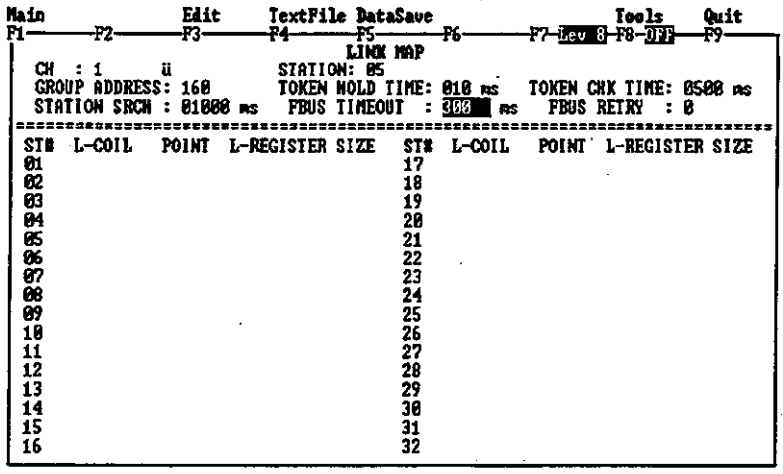
Enter the station address set on the rotary switch on the PC Link Module, then press Return. In online mode, the station addresses are automatically displayed.



The communications parameters for the PC Link Module are displayed. In offline mode, the initial values are displayed. To change the FBUS timeout time, for example, press the Up or Down Arrow Key to move the cursor to the FBUS Timeout field.



Enter 300 as the FBUS timeout time, then press Return.



Specify other communications parameters in the same way as above.

INFO To switch the channel, move the cursor to the Channel field, then enter the channel number and station address.

3) Allocating Link References

The following example shows how to allocate link coils and link registers.

Press the Home Key to move the cursor to the link reference allocation area.

In this example, link coils and link registers will be allocated to station 1. First, enter the lower-place four digits of the number of the first link coil to be allocated. In this case, enter 1 because the leading zeros can be omitted. Then, press Return.

```
Main          Edit     TextFile DataSave                Tools    Quit
F1------F2------F3------F4------F5------F6------F7-Lev 8-F8-OFF--F9------
                              LINK MAP
 CH  : 1      ü          STATION: 05
 GROUP ADDRESS: 160      TOKEN HOLD TIME: 010 ms   TOKEN CHK TIME: 0500 ms
 STATION SRCH : 01000 ms  FBUS TIMEOUT  : 00300 ms   FBUS RETRY  : 0
================================================================================
ST#  L-COIL    POINT  L-REGISTER SIZE   ST#  L-COIL    POINT  L-REGISTER SIZE
01   [      ]                          17
02                                     18
03                                     19
04                                     20
05                                     21
06                                     22
07                                     23
08                                     24
09                                     25
10                                     26
11                                     27
12                                     28
13                                     29
14                                     30
15                                     31
16                                     32
```

Specify the number of points in multiples of 16 points. In this example, enter 128 and press Return.

```
Main          Edit     TextFile DataSave                Tools    Quit
F1------F2------F3------F4------F5------F6------F7-Lev 8-F8-OFF--F9------
                              LINK MAP
 CH  : 1      ü          STATION: 05
 GROUP ADDRESS: 160      TOKEN HOLD TIME: 010 ms   TOKEN CHK TIME: 0500 ms
 STATION SRCH : 01000 ms  FBUS TIMEOUT  : 00300 ms   FBUS RETRY  : 0
================================================================================
ST#  L-COIL    POINT  L-REGISTER SIZE   ST#  L-COIL    POINT  L-REGISTER SIZE
01   D10001    128                      17
02                                     18
03                                     19
04                                     20
05                                     21
06                                     22
07                                     23
08                                     24
09                                     25
10                                     26
11                                     27
12                                     28
13                                     29
14                                     30
15                                     31
16                                     32
```

Allocate link registers in the same way as above.

INFO

1) Pressing the Home Key switches the cursor between the communications parameter area and the link reference allocation area.

2) To specify the reference number of a link coil or link register, the user can just enter the lower-place four digits of the reference number because leading zeros can be omitted. To

specify D10017 as the reference number of a link coil, for example, just enter 17. The full reference number, D10017, may be entered if desired.

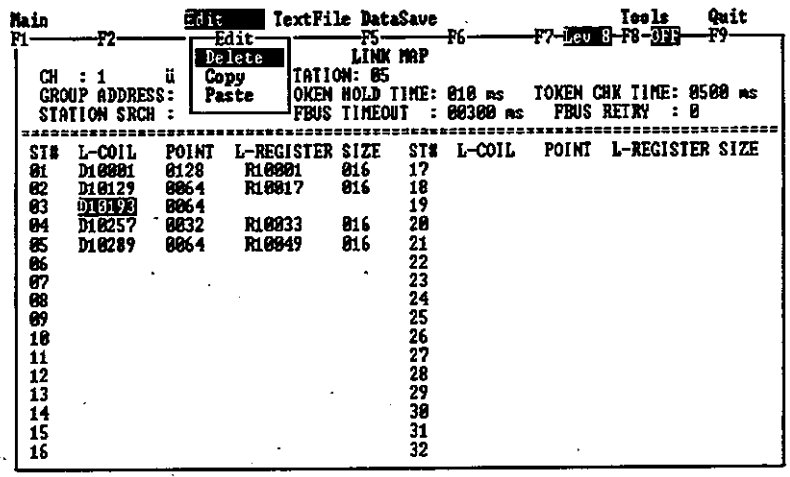
3) For the reference numbers of link coils, specify 16n + 1 (n = 0, 1, 2, ...). For the number of points, specify 16n (n = 1, 2, ...). No such restrictions apply to link registers.

4) Moving the Allocated Reference Data

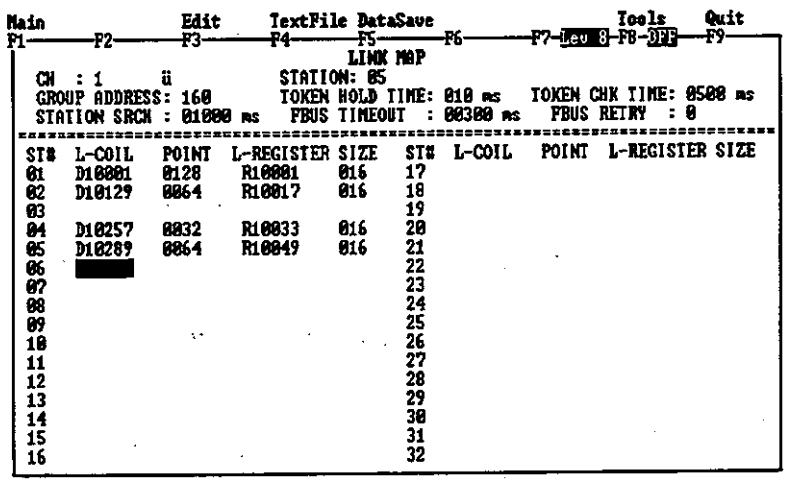
Press the Up or Down Arrow Key to move the cursor to the reference data to be moved.

Press the Tab Key to switch to the menu cursor.

Press the Up or Down Arrow Key to move the menu cursor to **Delete** on the Edit Menu, then press Return.

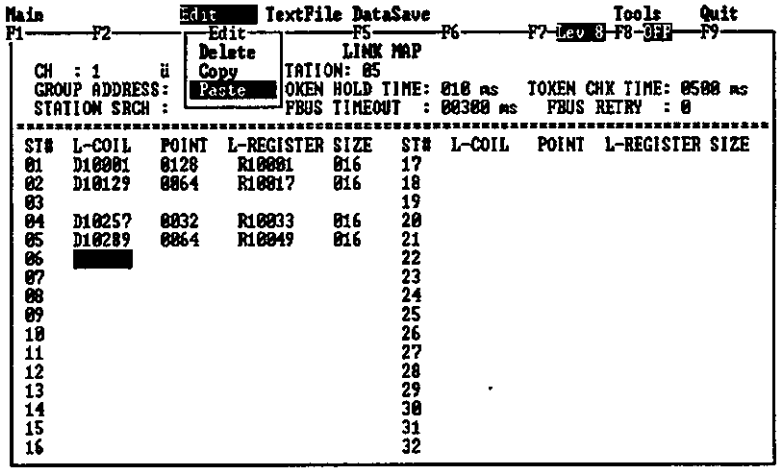


The reference data in the cursor position is deleted. Then, press the Up or Down Arrow Key to move the cursor to the destination station address (ST#).

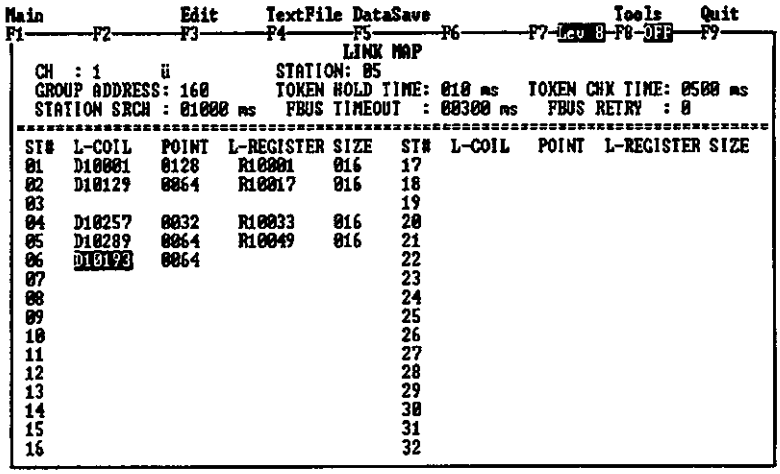


Press the Tab Key to switch to the menu cursor.

Press the Up or Down Arrow Key to move the menu cursor to **Paste** on the Edit Menu, then press Return.



The deleted reference data is copied to the cursor position.



5) Text File Functions

There are two Text File functions.

- **Text File Import**

  This function imports ASCII text files created in MEMOSOFT format. The imported file data is overwritten in the table as link communications parameters and allocation data.

- **Text File Export**

  This function stores edited link communications parameters and allocation data as ASCII text files. Standard text editors can be used to edit these text files. After being edited, the text files can be imported through MEMOSOFT.

As described above, allocation tables are stored as text files, which can be then imported by other programs. This allows different programs to process the allocation tables.

The text file format is shown below.

```
AAA,BBB,CCCC,DDDDD,EEEE,F
1, GGGG,HHHH,IIII,JJJ
2, GGGG,HHHH,IIII,JJJ
3, GGGG,HHHH,IIII,JJJ
              :
32, GGGG,HHHH,IIII,JJJ
```

AAA:	Group address
BBB:	Token holding time
CCCC:	Token check time
DDDDD:	Station search time
EEEEE:	FBUS timeout time
F:	Number of FBUS retries
GGGG:	Lower-place four digits of reference number of first link coil
HHHH:	Number of coil points
IIII:	Lower-place four digits of reference number of first link register
JJJ:	Size (number of link registers)

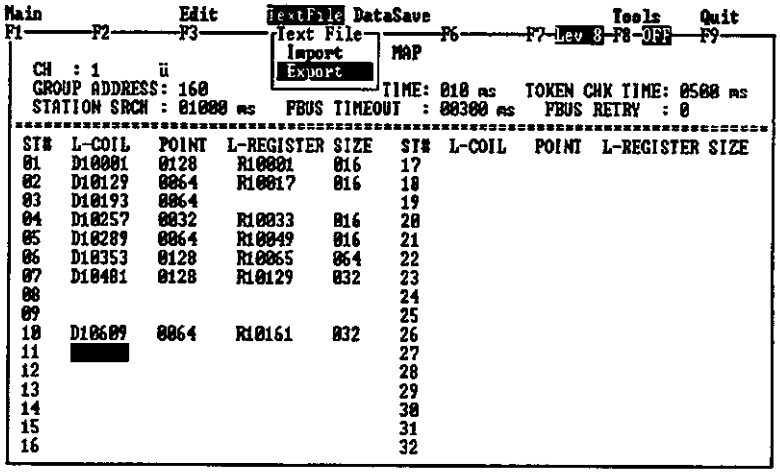
The following is an example of a text file.

```
160,010,0050,00010,00003,0
1, 0001, 0016, 0001, 032
2, 0017, 0032, 0033, 016
3, 0049, 0016, 0049, 064
              :
32, 0993, 0032, 1000, 024
```

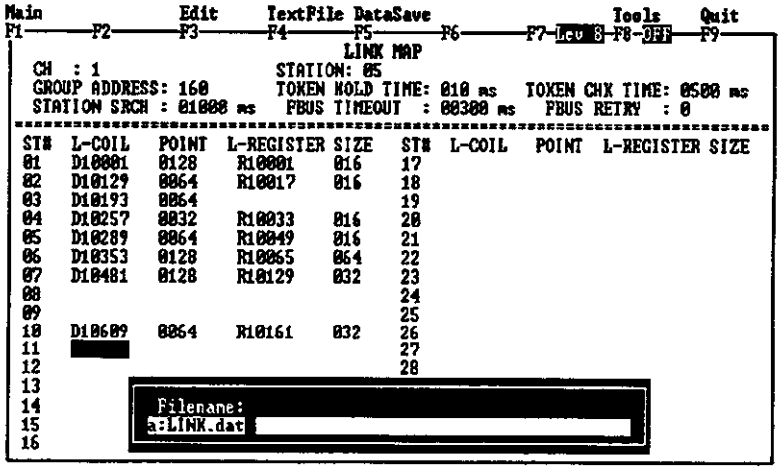
• **Export**

Press the Tab Key to switch to the menu cursor.

Press the Up or Down Arrow Key to move the menu cursor to **Export** on the Text File Menu, then press Return.



The window for entering a file name is displayed. Specify the export destination file name, then press Return.

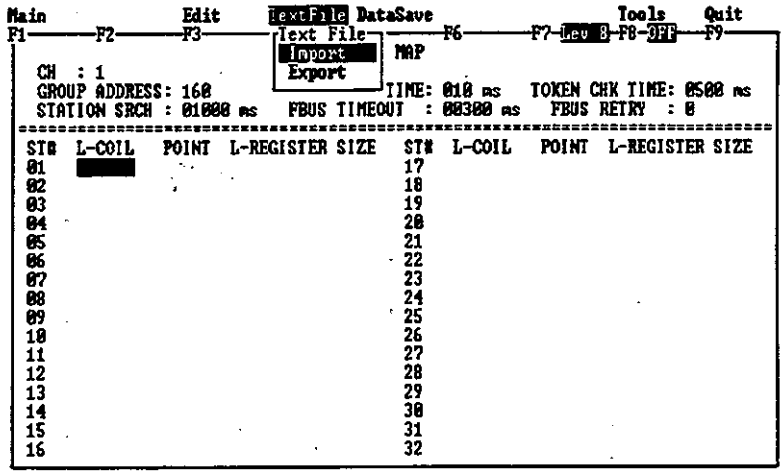


Link data is exported to the specified file. If the directory name is not specified, the link data is stored in the MEMOSOFT directory.

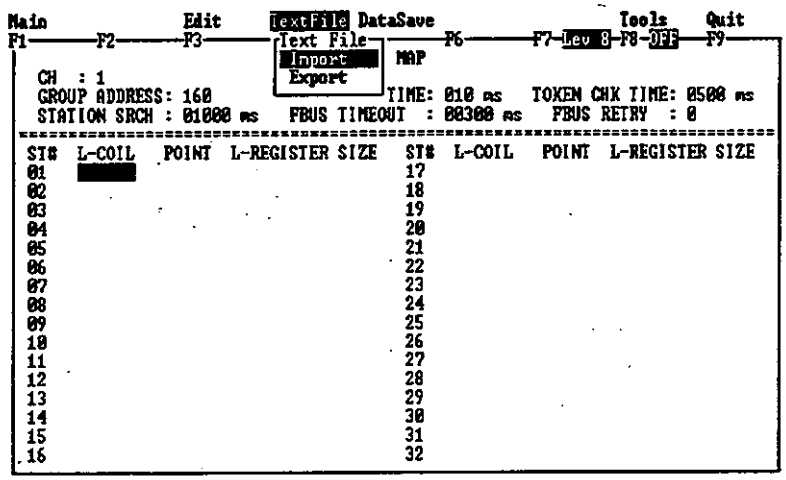
- **Import**

Press the Tab Key to switch to the menu cursor.

Press the Up or Down Arrow Key to move the menu cursor to **Import** on the Text File Menu, then press Return.



The window for entering a file name is displayed. Specify the import source file name and press Return.



The specified file is imported as link data. If the directory name is not specified, the file is imported from the MEMOSOFT directory.

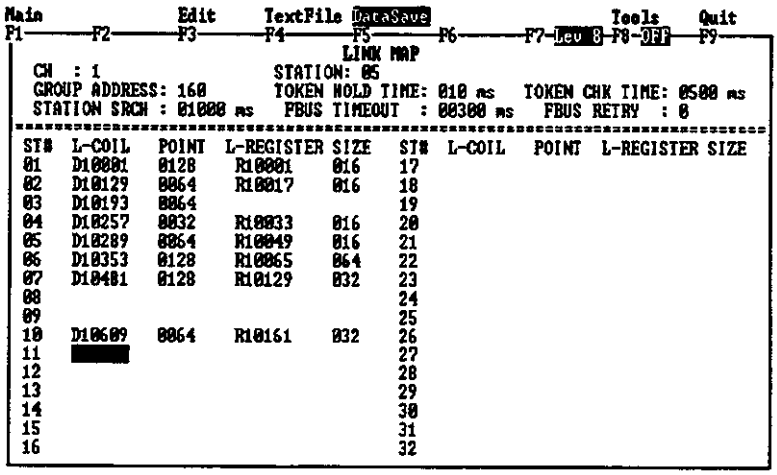
6) Data Save

The Data Save function exports the current allocation data to a PLC in online or debug mode. In offline mode, the allocation data is exported as file data.

Normally, export processing is performed when the PC Link allocation screen is closed. The Data Save function allows the user to export allocation data at any time. In other words, the user can export allocation data to PLC while the PC Link allocation screen is open. The Data Save function is useful in debugging.

Press the Tab Key to switch to the menu cursor.

Press the Up or Down Arrow Key to move the menu cursor to **Data Save**, then press Return.



The allocation data is exported to the PLC at station 05.

4.2 MEMOBUS Message Transmission

This section describes how to transmit MEMOBUS messages.

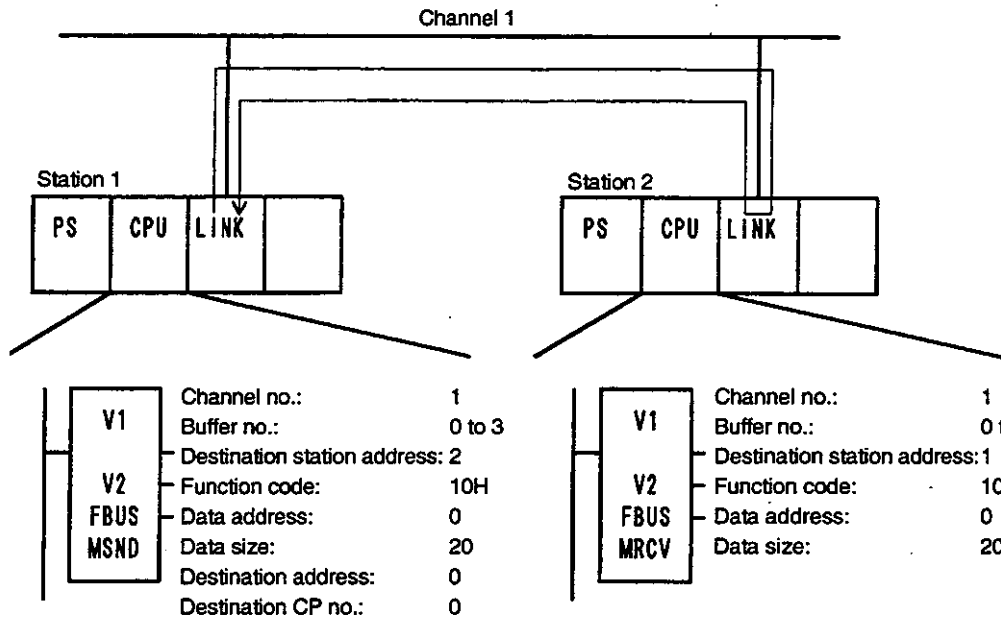
4.2.1 Overview

1) MEMOBUS messages are transmitted and received through the user program using the MEMOBUS protocol.

2) A Master transmits MEMOBUS command messages to Slaves with the MSND instruction, and receives response messages from the Slaves with the MRCV instruction. N:N communications are possible.

3) The figure below gives an example of MEMOBUS message flow.

◀EXAMPLE▶ The following example shows how to write the content of holding registers 400001 to 400020 at station 1 to registers 400001 to 400020 at station 2.



In this example, the MEMOBUS command generated by MSND at station 1 sends data to station 2 through channel 1. The MRCV at station 2 writes the data to specified registers, and returns a response to MSND. The results of this process are verified by the MSND status.

INFO Function code 10H is a hexadecimal number.

4.2.2 FBUS MEMOBUS MASTER Instruction (MSND)

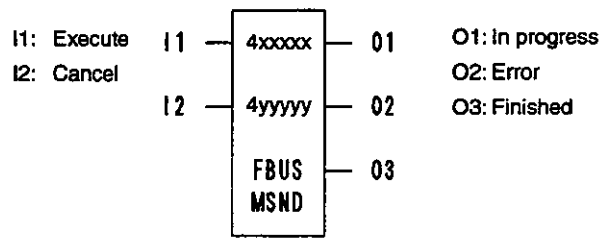
1) Function

a) MSND transmits a MEMOBUS command to one or more slaves (MRCV) and receives a MEMOBUS response from the slave.

b) MSND can be used to read or write the status of the following: coils (0x), input relays (1x), holding registers (4x), and input registers (3x).

c) The FBUS MEMOBUS MASTER instruction can be executed in high-speed or low-speed scan mode.

2) Structure



3) Execution Conditions

a) The buffer specified by the buffer number must be inactive.

b) I1 must be ON.

c) I2 must be OFF.

4) Input and Output Definitions

a) I1: Execute

MSND is executed when I1 is ON, as long as I2 is not ON. To execute MSND, always leave I2 OFF.

b) I2: Cancel

I2 cancels MSND execution. When I2 is turned ON, O1, O2, and O3 are all turned OFF. I2 takes precedence over I1. When I2 is turned ON, the status register, the middle element 4yyyyy, is cleared.

A transitional contact is normally used for I1 and I2.

c) O1: In Progress

O1 is turned ON when I1 turns ON and MSND is executed. O1 is turned OFF when MSND is completed or stopped. O1 is also turned OFF when an error occurs during MSND execution.

d) O2: Error

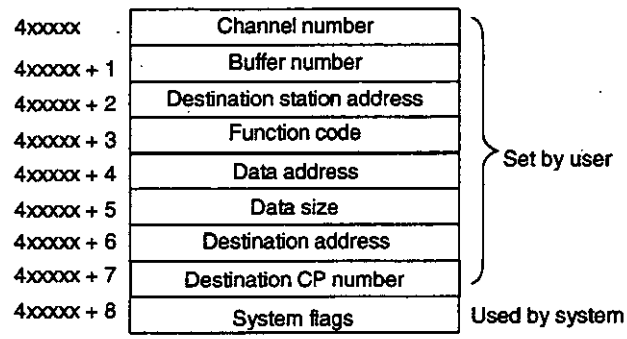
O2 is turned ON just for one scan when MSND is terminated due to an error. Error details are set in the status register (4yyyyy).

e) O3: Finished

O3 is turned ON just for one scan when MSND terminates normally. "0" is set in the status register (4yyyyy).

5) Top Element

Nine consecutive holding registers starting from 4xxxxx are used. The first eight registers contain user-specified information to control MSND. The last register is used by the system for flags.



IMPORTANT The registers for the top element of MSND must not be shared with other FBUS instructions because these registers are specific to MSND.

a) Channel Number (4xxxxx)

1 or 2: Specify the channel number of the PC Link.

b) Buffer Number (4xxxxx + 1)

0 to 3: Specify the buffer number to use in the Modules specified by the channel number.

The GL120 or GL130 transmits messages through the buffers in the specified PC Link. Because the PC Link has four buffers for each channel, it can initiate four FBUS instructions at a time.

c) Destination Station Address (4xxxxx + 2)

1 to 32: Transmits a message to the specified station.

129 to 160: Transmits a message to stations with the specified group address (group transmission). Specify the group address with a Programming Panel during allocation.

255: Transmits a message to all stations (broadcasting).

d) Function Code (4xxxxx + 3)

Specify the MEMOBUS function code to be transmitted.

00H:	Not used
01H:	Read coil status
02H:	Read input relay status
03H:	Read holding register
04H:	Read input register
05H:	Write single coil
06H:	Write single holding register
07H:	Not used
08H:	Loopback test
09H to 0EH:	Not used
0FH:	Write multiple coils
10H:	Write multiple holding registers
11H on:	Not used

e) Data Address (4xxxxx + 4)

Specify the leading address at the local station when reading or writing data. To determine the data address, remove the reference symbol from the reference number, then subtract 1 from the value. If, for example, the reference number is 400001, the data address is 00000 (00001 – 1 = 00000). The data address setting range must be the same as the reference range of the system.

f) Data Size (4xxxxx + 5)

Specify the size of the data starting from the specified data address. Specify the data size in bits or words. The data size setting range varies according to the function code.

Function		Data Size Setting Range
00H:	Not used	..... Not valid
01H:	Read coil status	..... 1 to 2000 bits
02H:	Read input relay status	..... 1 to 2000 bits
03H:	Read holding register	..... 1 to 125 words
04H:	Read input register	..... 1 to 125 words
05H:	Write single coil	..... Not needed
06H:	Write single holding register	..... Not needed
07H:	Not used	..... Not valid
08H:	Loopback test	..... Not needed
09H to 0EH:	Not used	..... Not valid
0FH:	Write multiple coils	..... 1 to 800 bits
10H:	Write multiple holding registers	..... 1 to 100 words
11H on:	Not used	

Even if the specified data size is within the range shown above, a data address error will occur when the data size plus the data address exceeds the reference range of the system.

g) Destination Address (4xxxxx + 6)

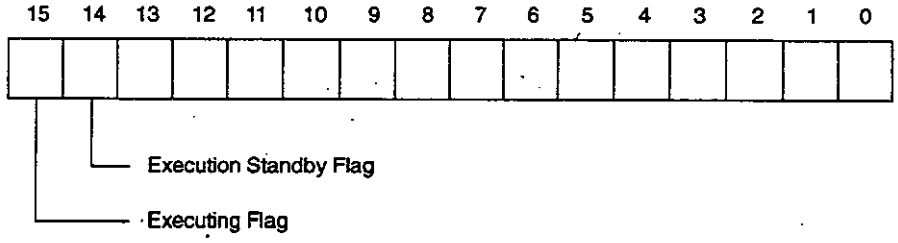
Specify the leading address of the read or write destination station that issues the MRCV instruction. The specification procedure is the same as for data address.

h) Destination CP Number (4xxxxx + 7)

If the destination is CP-3500, specify 1, 2, 3, or 4 as the CP number. If the destination is other than CP-3500, specify 0.

i) System Flags (4xxxxx + 8)

This register indicates the instruction execution status. Do not allow the user program to change the bit settings after the initial scan.

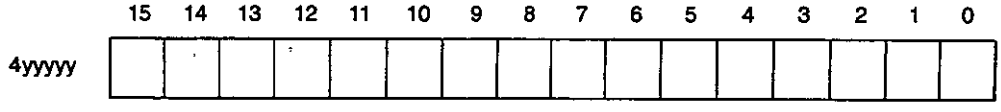


Bit Number	Meaning
15	Executing Flag • This bit is set to 1 while the instruction is being executed. It is not set to 1 if the instruction is not executed regardless of the status of I1. This flag is linked to O1.
14	Execution Standby Flag • This bit is set to 1 when the instruction has been initiated (I1 is ON) but has not entered an executing state. It indicates standby status when multiple FBUS instructions are initiated.
13 ... 0	Not used. Always set to 0.

Bits 14 and 15 are never simultaneously ON.

6) Middle Element

The system uses one 4yyyyy register. This register contains error status information when the FBUS instruction is terminated due to an error.



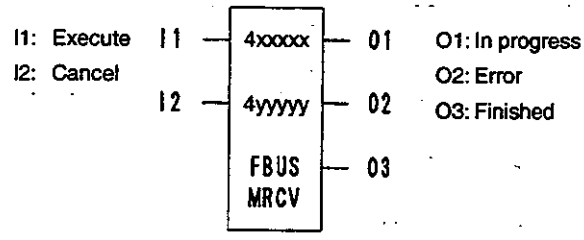
Bit Number	Meaning
15	Module specification error • The specified channel has no Module or contains faulty Modules.
14 to 12	Not used
11	Parameter setting error • Channel number, destination station address, or buffer number is outside the allowable range.
10	Data size error • The size of the transmit or receive data is outside the allowable range.
9	Address setting error • An attempt was made to transmit a data address or a data address plus data size (last address) that is outside the reference range of the system or an invalid data address was received.
8	Function code error • An attempt was made to transmit an unused function code (00H, 07H, 09H, 0AH, 0BH, 0CH, 0DH, 0EH, 11H or later) or an unused function code was received.
7 to 4	Not used
3	Data reception error • An error was detected in lower-level programs.
2	Reset status or out-of-PC Link • The PC Link is currently in reset status, or a station failed to receive the token even after the token check time expired.
1	Command sequence error • A sequence error occurred in the MSND instruction interface with PC Link.
0	Parameter format error

4.2.3 FBUS MEMOBUS SLAVE Instruction (MRCV)

1) Function

MRCV receives MEMOBUS commands via the channel specified by the channel number and transmits a MEMOBUS response to the master.

2) Structure



3) Execution Conditions

a) The buffer specified by the buffer number must be inactive.

b) I1 must be ON.

c) I2 must be OFF.

4) Input and Output Definitions

a) I1: Execute

MRCV is executed when I1 is ON, as long as I2 is not ON. To execute MRCV, always leave I2 OFF.

b) I2: Cancel

I2 stops MRCV. When I2 is turned ON, O1, O2, and O3 are all turned OFF. I2 takes precedence over I1. When I2 is turned ON, the status register, the middle element 4yyyyy, is cleared.

A transitional contact is normally used for I1 and I2.

c) O1: In Progress

O1 is turned ON when I1 executes MRCV. It is turned OFF when MRCV is completed or stopped. O1 is also turned OFF when an error occurs during MRCV execution.

d) O2: Error

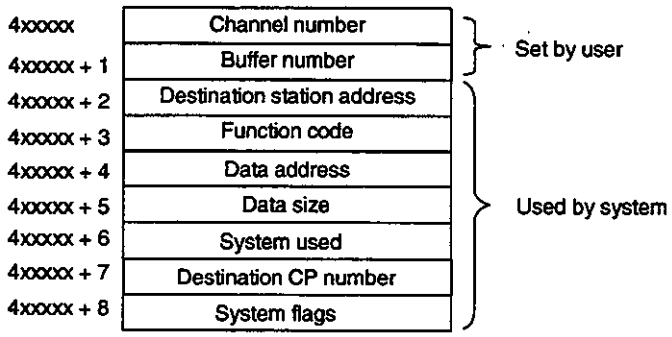
O2 is turned ON just for one scan when MRCV is terminated due to an error. Error details are set in the status register (4yyyyy).

e) O3: Finished

O3 is turned ON just for one scan when MRCV terminates normally. "0" is set in the status register (4yyyyy).

5) Top Element

Nine consecutive holding registers starting from 4xxxxx are used. The first two registers contain user-specified information to control MRCV. The remaining seven registers are used by the system.



IMPORTANT The registers for the top element of MRCV must not be shared with other FBUS instructions because these registers are specific to MRCV.

a) Channel Number (4xxxxx)

1 or 2: Specify the channel number of the PC Link.

b) Buffer Number (4xxxxx + 1)

0 to 3: Specify the buffer number to use in the Modules specified by the channel number.

c) Destination Station Address (4xxxxx + 2)

The station address of the sender station that issued MSND is output.

d) Function Code (4xxxxx + 3)

The received MEMOBUS function code is output.

00H:	Not used
01H:	Read coil status
02H:	Read input relay status
03H:	Read holding register
04H:	Read input register
05H:	Write single coil
06H:	Write single holding register
07H:	Not used
08H:	Loopback test
09H to 0EH:	Not used
0FH:	Write multiple coils
10H:	Write multiple holding registers
11H on:	Not used

e) Data Address (4xxxxx + 4)

The address at the sender station that issued MSND is output. If, however, the received data address or the last address exceeds the reference range of the system, the data is not stored in the holding register. Instead, an address setting error is set in the error status register of middle element.

f) Data Size (4xxxxx + 5)

The data size requested by the sender station that issued MSND is output. If, however, the received data size exceeds the reference range of the system, a data size error is set in the error status register.

g) System Used (4xxxxx + 6)

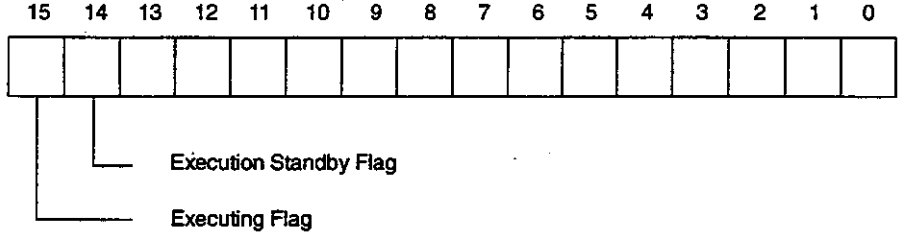
Do not allow the user program to change the bit settings after the initial scan.

h) Destination CP Number (4xxxxx + 7)

The CP number of the sender station that issued MSND is output.

i) System Flags (4xxxxx + 8)

This register indicates the instruction execution status. Do not allow the user program to change the bit settings after the first scan.

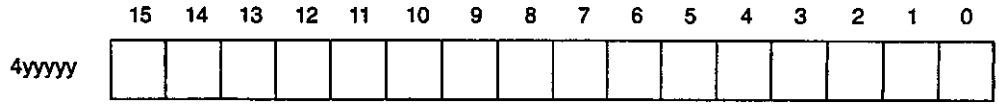


Bit Number	Meaning
15	Executing Flag • This bit is set to 1 while the instruction is being executed. It is set to 1 only if the instruction is executed when I1 is turned ON. This bit is linked to O1.
14	Execution Standby Flag • This bit is set to 1 when the instruction has been initiated (I1 is turned ON) but has not entered an execution state. It indicates wait status when multiple FBUS instructions are initiated.
13 0	Not used. Always set to 0.

Bits 14 and 15 are never simultaneously ON.

6) Middle Element

The system uses one 4yyyyy register. This register contains error status information when the FBUS instruction is terminated due to an error.



Bit Number	Meaning
15	Module specification error • The specified channel has no Modules or contains faulty Modules.
14 to 12	Not used
11	Parameter setting error • Channel number, destination station address, or buffer number is outside the allowable range.
10	Data size error • The size of the transmit or receive data is outside the allowable range.
9	Address setting error • An attempt was made to transmit a data address or a data address plus data size (last address) that is outside the reference range of the system or an invalid data address was received.
8	Function code error • An attempt was made to transmit an unused function code (00H, 07H, 09H, 0AH, 0BH, 0CH, 0DH, 0EH, 11H or later) or an unused function code was received.
7 to 4	Not used
3	Data reception error • An error was detected in lower-level programs.
2	Reset status or out-of-PC Link • The PC Link is currently in reset status, or a station failed to receive the token even after the token check time expired.
1	Command sequence error • A sequence error occurred in the MRCV instruction interface with PC Link.
0	Parameter format error

4.3 General Message Transmissions

This section describes how to transmit general messages.

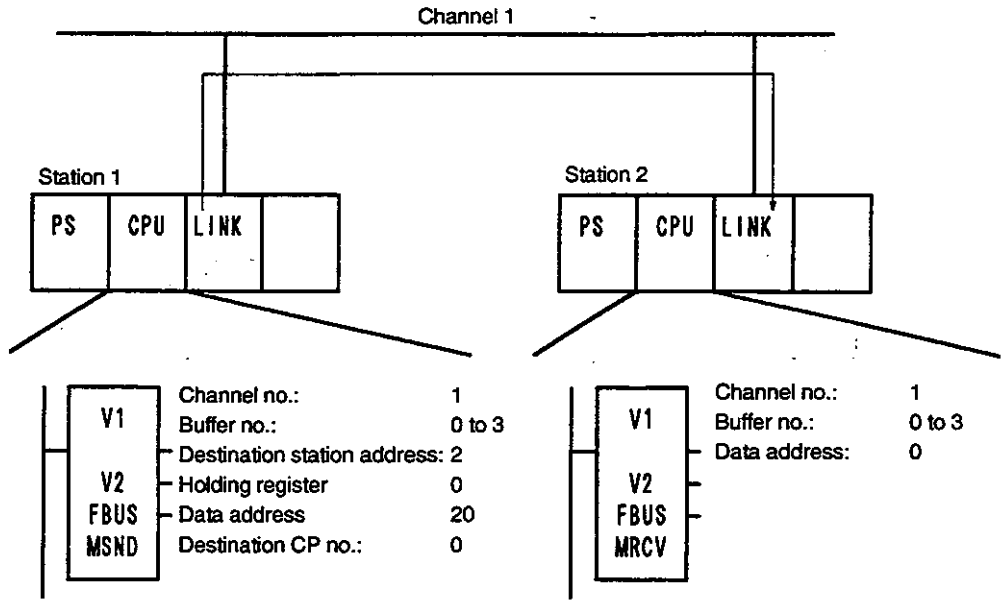
4.3.1 Overview

1) General messages are transmitted through the user program using the SEND and RECV. Unlike MEMOBUS messages, the transmit format is not defined for general messages.

2) General messages allow transmissions to be optimized for an application because unique user message formats as well as the transmission order can both be defined, enabling highly efficient transmissions. N: N communications are possible.

3) The figure below gives an example of general message flow.

◀EXAMPLE▶ The following example shows how to write the contents of holding registers 400001 to 400020 at station 1 to registers 400001 to 400020 at station 2.



In this example, data is sent to the destination station address and channel number specified by SEND at station 1. At station 2, RECV accepts the data from station 1, but does not return a response to station 1.

IMPORTANT Four buffers are provided for message communications, so up to 4 functions can be performed simultaneously. The same communications buffers are used both for MEMOBUS and general messages.

4.3.2 FBUS MESSAGE SEND Instruction (SEND)

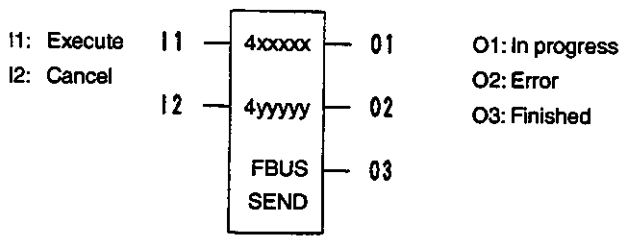
1) Function

a) SEND transmits data to a destination station issuing RECV. It does not receive a response from the destination station.

b) SEND can be executed in high-speed or low-speed scan mode.

c) SEND can transmit data only from holding registers (4x).

2) Structure



3) Execution Conditions

a) The buffer specified by the buffer number must be inactive.

b) I1 must be ON.

c) I2 must be OFF.

4) Input and Output Definitions

a) I1: Execute

SEND is sent when I1 is ON. If, however, I2 is ON, I1 does not execute SEND. To execute SEND, always leave I2 OFF.

b) I2: Cancel

I2 stops SEND. When I2 is turned ON, O1, O2, and O3 are all turned OFF. I2 takes precedence over I1.

A transitional contact is normally used for I1 and I2.

c) O1: In Progress

O1 is turned ON when I1 executes SEND. It is turned OFF when SEND is completed or stopped. O1 is also turned OFF when an error occurs during SEND execution.

d) O2: Error

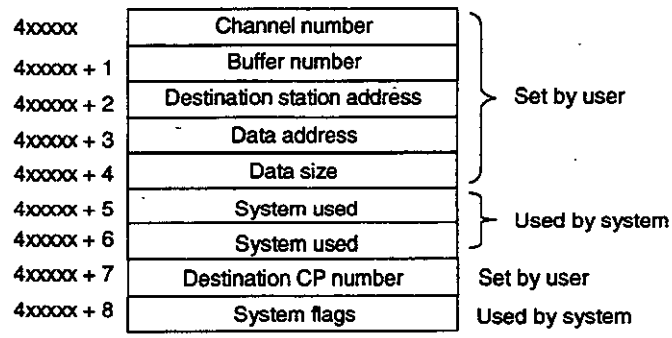
O2 is turned ON just for one scan when SEND is terminated due to an error. Error details are set in the status register (4yyyyy).

e) O3: Finished

O3 is turned ON just for one scan when SEND terminates normally. "0" is set in the status register (4yyyyy).

5) Top Element

Nine consecutive holding registers starting from 4xxxxx are used.



IMPORTANT The registers for the top element of SEND must not be shared with other FBUS instructions because these registers are specific to SEND.

a) Channel Number (4xxxxx)

1 or 2: Specify the channel number of the PC Link.

b) Buffer Number (4xxxxx + 1)

0 to 3: Specify the buffer number to use in the Modules specified by the channel number.

The GL120 or GL130 transmits messages through the buffers in the specified PC Link. Because the PC Link has four buffers for each channel, it can initiate four FBUS instructions at a time.

c) Destination Station Address (4xxxxx + 2)

1 to 32: Transmits a message to the specified station.

129 to 160: Transmits a message to stations with the specified group address (group transmission). Specify the group address with a Programming Panel during allocation.

255: Transmits a message to all stations (broadcasting).

d) Data Address (4xxxxx + 3)

Specify the leading reference of the holding register from which data is to be transmitted. If, for example, the reference number is 400001, the data address is 00000 (00001 – 1 = 00000). The holding register address must be set within the holding register reference range of the system.

e) Data Size (4xxxxx + 4)

Specify the size of the data starting from the specified data address. For the size, specify the number of words between 1 and 254, inclusive. Even if the specified data size is within the above range, a data address error will occur when the data size plus the data address exceeds the holding register reference range of the system.

f) System Used (4xxxxx + 5)

Do not allow the user program to change the bit settings after the initial scan.

g) System Used (4xxxxx + 6)

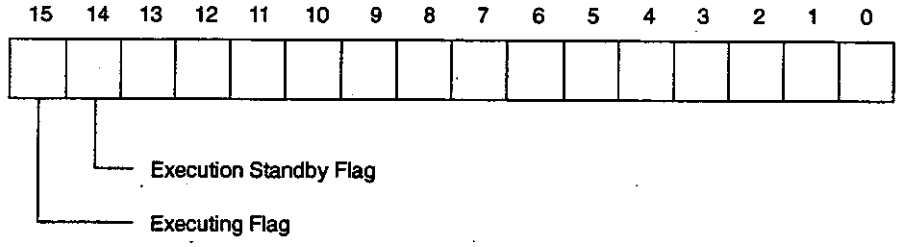
Do not allow the user program to change the bit settings after the initial scan.

h) Destination CP Number (4xxxxx + 7)

If the destination is CP-3500, specify 1, 2, 3, or 4 as a CP number. If the destination is other than CP-3500, specify 0.

i) System Used (4xxxxx + 8)

This register indicates the instruction execution status. Do not allow the user program to change the bit settings after the initial scan.

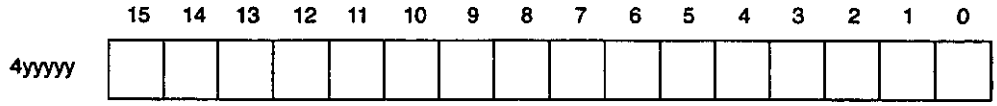


Bit Number	Meaning
15	Executing Flag • This bit is set to 1 while the instruction is being executed. It is set to 1 only if the instruction is executed when I1 is turned ON. This bit is linked to O1.
14	Execution Standby Flag • This bit is set to 1 when the instruction has been initiated (I1 is turned ON) but has not entered an execution state. It indicates wait status when multiple FBUS instructions are initiated.
13 0	Not used. Always set to 0.

Bits 14 and 15 are never simultaneously ON.

6) Middle Element

The system uses one 4yyyyy register. This register contains error status information when the FBUS instruction is terminated due to an error.



Bit Number	Meaning
15	Module specification error • The specified channel has no Modules or contains faulty Modules.
14 to 12	Not used
11	Parameter setting error • Channel number, destination station address, or buffer number is outside the allowable range.
10	Data size error • The size of the transmit data is outside the allowable range.
9	Address setting error • An attempt was made to transmit a data address or a data address plus data size (last address) that is outside the reference range of the system or an invalid data address was received.
8	Function code error • An attempt was made to transmit an unused function code (00H, 07H, 09H, 0AH, 0BH, 0CH, 0DH, 0EH, 11H or later) or an unused function code was received.
8 to 4	Not used
3	Data reception error • An error was detected in lower-level programs.
2	Reset status or out-of-PC Link • The PC Link is currently in reset status, or a station failed to receive the token even after the token check time expired.
1	Command sequence error • A sequence error occurred in the SEND instruction interface with PC Link.
0	Parameter format error

4.3.3 FBUS MESSAGE RECEIVE Instruction (RECV)

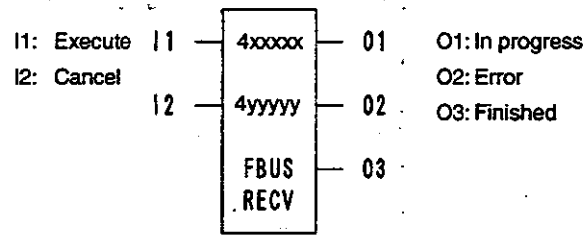
1) Function

a) RECV receives data from the sender station that issued SEND. It does not return a response to the sender station.

b) RECV can be executed in high-speed or low-speed scan mode.

c) RECV can receive data only from holding registers (4x).

2) Structure



3) Execution Conditions

a) The buffer specified by the buffer number must be inactive.

b) I1 must be ON.

c) I2 must be OFF.

4) Input and Output Definitions

a) I1: Execute

RECV is executed when I1 is ON. If, however, I2 is ON, I1 does not execute RECV. To execute RECV, always leave I2 OFF.

b) I2: Cancel

I2 stops RECV. When I2 is turned ON, O1, O2, and O3 are all turned OFF. I2 takes precedence over I1. When I2 is turned ON, the status registers, the middle element 4yyyyy, is cleared.

A transitional contact is normally used for I1 and I2.

c) O1: In progress

O1 is turned ON when I1 executes RECV. It is turned OFF when RECV is completed or stopped. O1 is also turned OFF when an error occurs during SEND execution.

d) O2: Error

O2 is turned ON just for one scan when RECV is terminated due to an error. Error details are set in the status register (4yyyyy).

e) O3: End

O3 is turned ON just for one scan when RECV terminates normally. "0" is set in the status register (4yyyyy).

5) Top Element

Nine consecutive holding registers starting from 4xxxxx are used.

4xxxxx	Channel number	Set by user
4xxxxx + 1	Buffer number	
4xxxxx + 2	Destination station address	Used by system
4xxxxx + 3	Data address	Set by user
4xxxxx + 4	Data size	Used by system
4xxxxx + 5	Limit size	Set by user
4xxxxx + 6	System used	Used by system
4xxxxx + 7	Destination CP number	
4xxxxx + 8	System flags	

IMPORTANT The registers for the top element of RECV must not be shared with other FBUS instructions because these registers are specific to RECV.

a) Channel Number (4xxxxx)

1 or 2: 1 or 2: Specify the channel number of the PC Link Module.

b) Buffer Number (4xxxxx + 1)

0 to 3: Specify a buffer number used in the Module specified by the channel number.

The GL120 or GL130 transmits messages through the buffers in the specified PC Link. Because the PC Link has four buffers for each channel, it can initiate four FBUS instructions at a time.

c) Destination Station Address (4xxxxx + 2)

The station address of the sender station that issued SEND is output.

d) Data Address (4xxxxx + 3)

Specify the leading reference of the holding register in which received data is to be stored. If, for example, the reference number is 400001, the data address is 00000

(00001 – 1 = 00000). If the holding register address exceeds the holding register reference range of the system, or the holding register address plus data size of the received data exceeds the holding register reference range of the system, the received data will not be stored in the holding register. Instead, a data address error is set in the error status register of the middle element.

e) Data Size (4xxxxx + 4)

The data size requested by the sender station that issued SEND is output. If, however, the size of the received data exceeds the limit size or 254 words, the received data will not be stored in the holding register. Instead, a data size error is set in the error status register.

f) Limit Size (4xxxxx + 5)

Specify the limit size of the data that can be received in the holding register area starting from the data address. If the size of the data sent by the sender station is equal to or smaller than the limit size, the received data will be stored in the holding register. If 0 is specified as the limit size, all received data is stored in the holding register.

g) System Used (4xxxxx + 6)

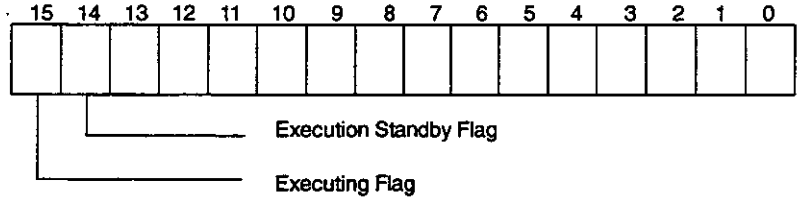
Do not allow the user program to change the bit settings after the initial scan.

h) Destination CP Number (4xxxxx + 7)

The CP number of the sender station is output.

i) System Flags (4xxxxx + 8)

This register indicates the instruction execution status. Do not allow the user program to change the bit settings after the initial scan.

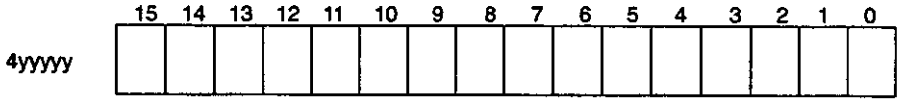


Bit Number	Meaning
15	Executing Flag • This bit is set to 1 while the instruction is being executed. It is set to 1 only if the instruction is executed when I1 is turned ON. This bit is linked to O1.
14	Execution Standby Flag • This bit is set to 1 when the instruction has been initiated (I1 is turned ON) but has not entered an execution state. It indicates wait status when multiple FBUS instructions are initiated.
13 0	Not used. Always set to 0.

Bits 14 and 15 are never simultaneously ON.

6) Middle Element

The system uses one 4yyyyy register. This register contains error status information when the FBUS instruction is terminated due to an error.



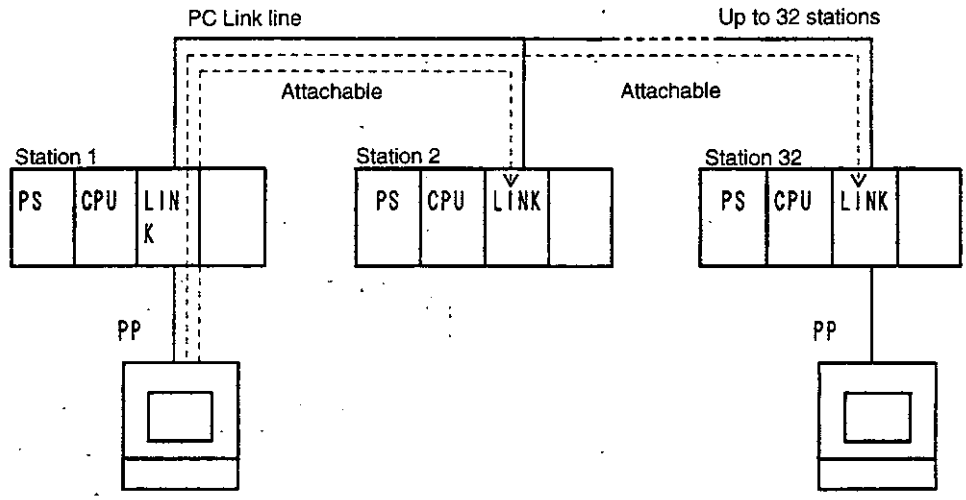
Bit Number	Meaning
15	Module specification error • The specified channel has no Modules or contains faulty Modules.
14 to 12	Not used
11	Parameter setting error • Channel number, destination station address, or buffer number is outside the allowable range.
10	Data size error • The size of the receive data or limit size is outside the allowable range.
9	Address setting error • An attempt was made to transmit a data address or a data address plus data size (last address) that is outside the reference range of the system or an invalid data address was received.
8 to 4	Not used
3	Data reception error • An error was detected in lower-level programs.
2	Reset status or out-of-PC Link • The PC Link is currently in reset status, or a station failed to receive the token even after the token check time expired.
1	Command sequence error • A sequence error occurred in the MRCV instruction interface with PC Link.
0	Parameter format error

4.4 Communications with Host Computers

This section describes the remote PP function as an example of communications with host computers.

Remote PP Function

1) Connecting a Programming Panel (PP) to the MEMOBUS port allows the user to perform allocation tasks or monitor and modify programs.



a) A Programming Panel can connect to the MEMOBUS port of any station.

b) Multiple Programming Panels can connect to the MEMOBUS port.

c) Change the protocol setting in the MEMOSOFT communications parameters to REMOTE MEMOBUS.

d) The PLC address of a Programming Panel connected to a station is the station address on the PC Link.

e) The monitor function for P120 element status cannot be used.

f) The MEMOBUS transmit/receive buffers and the link data transmit/receive buffers are completely separate, so link data communications are not affected by MEMOBUS communications traffic regardless of the amount.

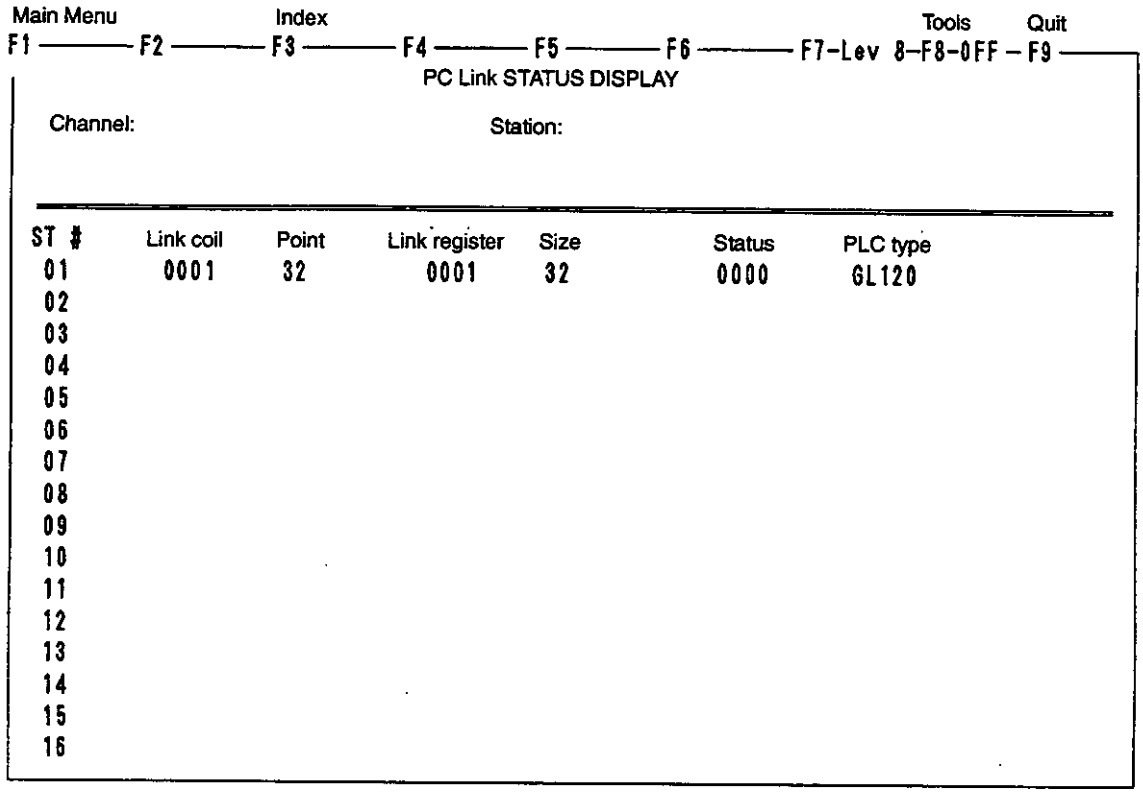
g) The Programming Panel for the GL120 and GL130 differs from that for the GL40, GL60, and GL70. These Programming Panels, however, can connect to CPUs through the MEMOBUS port on any PC Link.

⚠ **Caution** Do not access the the system (ATTACH operation) of the single CPU Module from more than one Programming Panel at the same time. Multiple access to single CPU Module can destroy CPU memory.

4.5 PC Link Status Display

■ The PC Link Status Display screen shows the current status of each station.

1) The PC Link Status Display screen shows PC Link allocation information, PC Link status, and the type of the PLC connected to the PC Link. Du and Ru are omitted in the link coil and link register columns, respectively.



The status of stations 17 to 32 can be displayed by moving the cursor or by pressing the PageUp Key.

```
Main Menu          Index                                          Tools    Quit
F1 ——— F2 ——— F3 ——— F4 ——— F5 ——— F6 ——— F7-Lev 8-F8-OFF - F9 ———
                          PC Link STATUS DISPLAY

 Channel:                              Station:

 ST #    Link coil   Point   Link register   Size        Status      PLC type
  17
  18
  19
  20
  21
  22
  23
  24
  25
  26
  27
  28
  29
  30
  31
  32
```

2) PC Link Status

PC Link status is represented as bit information.

MSB LSB

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

Bit	Explanation
D15 D14 D13 D12	(HEX) 10s digit Station type 01 (H): GL60V 02: CP3500 03: CP5500 04: CP9200 08: GPIB 10: GL60S, 40S, 70H, GL120, 130.
D11 D10 D9 D8	1s digit
D7	Normal reception of link data
D6	Initial state (transmission not started)
D5	Not used
D4	Bits D0 to D3 enabled (error occurred)
D3	Timeout: token check time has expired.
D2	Area error: The link coil size exceeds 4,096 points, or the link register size exceeds 256 registers.
D1	Reference error: References exceeds 2,048.
D0	Received data length error: Allocated data size exceeds 512 bytes.

PC Link Setup and Maintenance

5

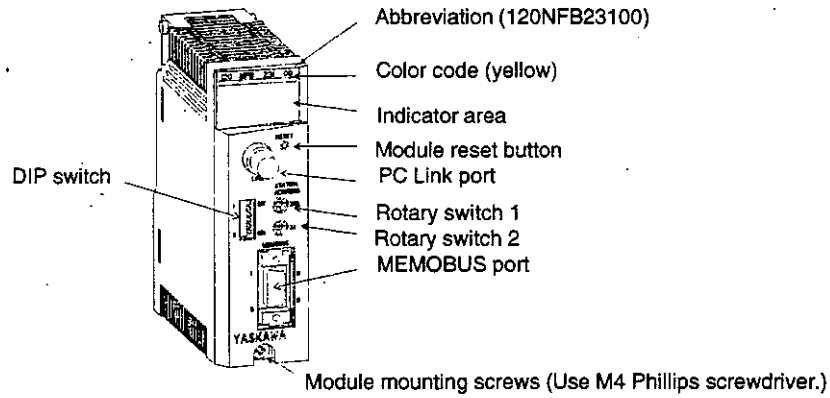
This chapter describes how to set up, start, and troubleshoot PC Links.

5.1 PC Link Module

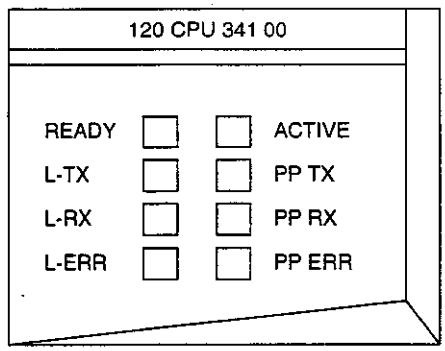
This section describes the switch settings for the PC Link Module.

5.1.1 External Appearance

1) PC Link (Model: JAMSC-120NFB23100)



2) Detailed View of Indicator Area



Indicator Name	Color	Description
READY	Green	Lights when the PC Link Module is operating normally.
L-TX	Green	Lights when the PC Link port is sending data.
L-RX	Green	Lights when the PC Link port is receiving data.
L-ERR	Red	Lights for 10 ms when an error occurs during data transmission from the PC Link port.
ACTIVE	Green	Lights when CPU is active.
PP TX	Green	Lights when the MEMOBUS port is sending data.
PP RX	Green	Lights when the MEMOBUS port is receiving data.
PP ERR	Red	Lights for 10 ms when an error occurs during data transmission from the MEMOBUS port.

3) Status Error

a) LEDs on the front panel of the PC Link Module indicate status error details.

Table 5.1 Errors and LED Indicators

Error	LED Indicator			
	READY	PP ERR	L-ERR	Remarks
ROM Error	○●	○●	○●	Continuously checked
RAM Error	○●	●	○●	Checked at power ON
Common Memory Error	○●	○●	●	
Watchdog Timer Error	○	○●	○●	Continuously checked
Station Address Error	○	○●	●	Checked at power ON

Display status: ○: Lit ●: Not lit ○●: Flashing

b) Actions to take when status error occurs:

- If a ROM, RAM, common memory, or watchdog timer errors occur, replace the Module.
- If a station address error occurs, adjust the station address switches on the front panel of the Module until the station address is between 1 and 32, then press the reset button.

5.1.2 Switch Settings

1) The PC Link Module reads and stores the switch settings when the power is turned ON. The switches can be set before or after the Module is installed.

2) Reset Button

If the switch settings are changed after the power is turned ON, always reactivate the Module by pressing the reset button or turning the power OFF and then ON.

3) Station Address

The station address of a PC Link Module is set using two rotary switches on the front panel of the Module. The range of possible settings is from 1 to 32 (2-digit decimal). The Module will not operate with any other settings. The station address is used both for the link port and the MEMOBUS port address. Always reactivate the Module by pressing the reset switch whenever the station address is changed.

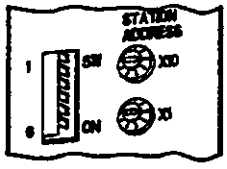


Figure 5.1 Switches on the Front Panel of PC Link

4) Baud Rate Settings

Set the baud rate of the PC Link port by using the DIP switch on the front panel. Always reactivate the Module by pressing the reset button whenever the baud rate is changed.

Table 5.2 DIP Switch Settings

Pin Number	Setting		
1	ON	Self-diagnosis mode	
	OFF	PC Link mode (normally OFF)	
2	Not used		
3	ON	Used as Channel 2	
	OFF	Used as Channel 1	
4	ON	Holding mode: Holds station link data immediately before the station malfunctions.	
	OFF	Clear mode: Resets link data on a failed station to "OFF" or "0"	
5 & 6	**5**	**6**	**Baud Rate**
	ON	ON	4 Mbps
	ON	OFF	2 Mbps
	OFF	ON	1 Mbps
	OFF	OFF	0.5 Mbps

IMPORTANT

(1) All stations on the same channel must be set to the same baud rate.

(2) Use channel 1 when only one PC Link Module is used.

5.2 Maintenance

This section describes the system start-up, transmission control, and troubleshooting procedures.

5.2.1 System Start-up

1) If link data has been allocated, link data is automatically transferred when initialization processing is completed after the power is turned ON.

2) Allocation data is stored in the backup memory of CPU. Once allocation data has been set, it need not be reset until a change is required.

3) No restrictions apply to the power ON sequence of PC Link Modules. Any power ON sequence will initiate link data transfer.

4) The PC Link uses the token passing method to transmit data. Link data transfer starts among the stations at which the PC Link Modules have been turned ON.

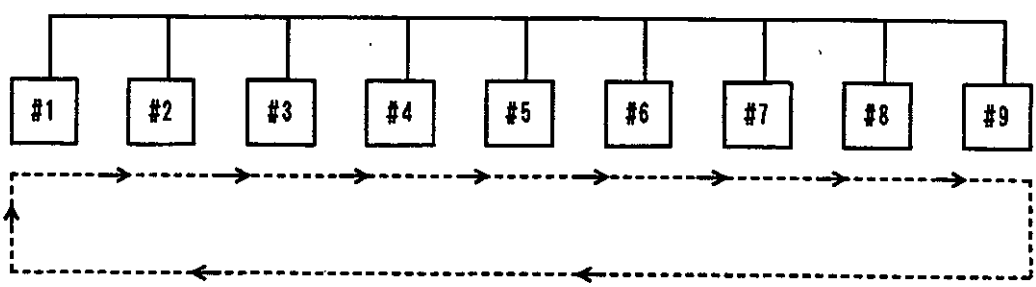
5

5.2.2 Transmission Control Procedures

1) Token Passing

The PC Link transmission mechanism is based on token passing. A station that receives the token (representing the right to transmit) can transmit data. The token always circulates through the channel.

The token is transferred from one station to another in ascending order of station address as shown in the figure below.



The physical location of each station does not have to be in the same order as the station addresses.

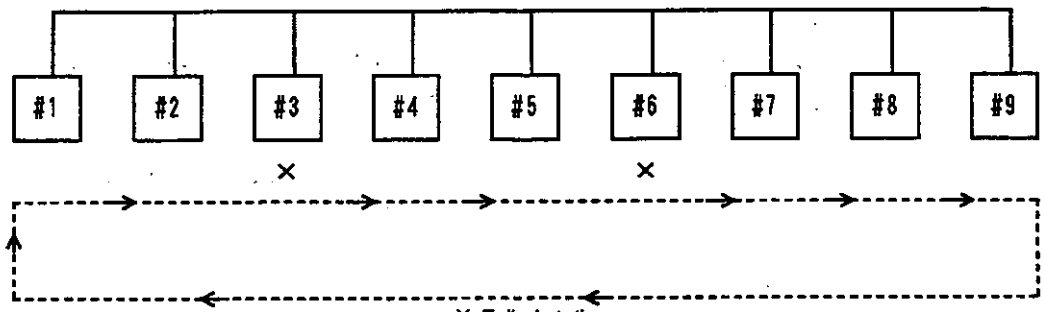
a) When receiving the token, a station with transmission data can transmit the data during the token holding time. The token holding time for the PC Link is between 1 and 255 ms.

b) A station without transmission data will pass the token to the next station.

2) Error Processing

a) Bypassing Faulty Stations

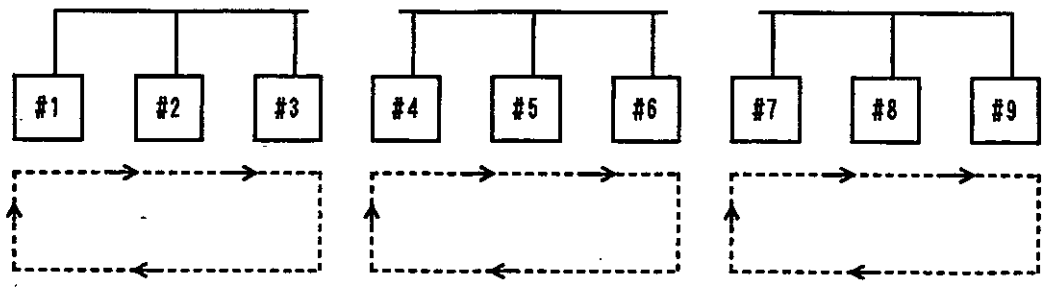
As shown in the figure below, a token is not passed to stations that cannot transmit data due to a malfunction or stations that have been turned OFF. Data transmissions continue with the remaining stations.



X: Failed station

b) Disconnected Channels

A token is passed in ascending order of station address among the stations connected by a channel. If, however, the channel is disconnected at two locations as shown in the figure below, three tokens will be used. In this situation, reflections may interrupt transmissions because no terminators are present.



c) Connecting New Stations to a Channel

When the number of stations connected to a channel is less than the maximum number (32), the PC Link periodically checks whether new stations have been added to

the channel (station search interval: 100 to 25,500 ms). This function helps maintain the token passing route called the "logical ring."

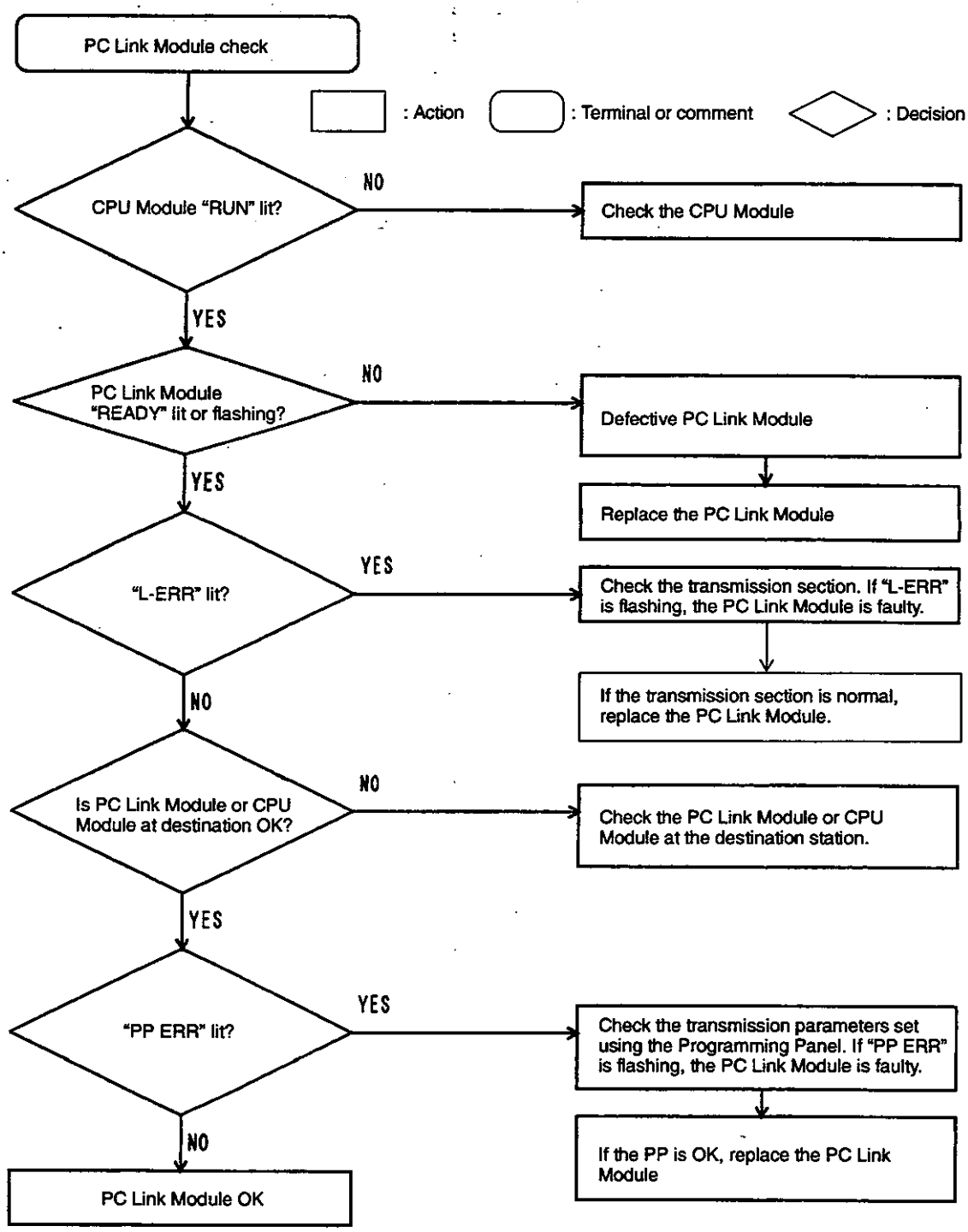
When new stations are added to the logical ring, the logical ring is reorganized after a maximum of 204 seconds (for a station search time of 25.5 seconds). Then, the token will again be passed in ascending order of station address.

Thus, a station can be connected to the logical ring correctly whenever the station is turned ON. Stations that have recovered from failures are also automatically connected to the logical ring.

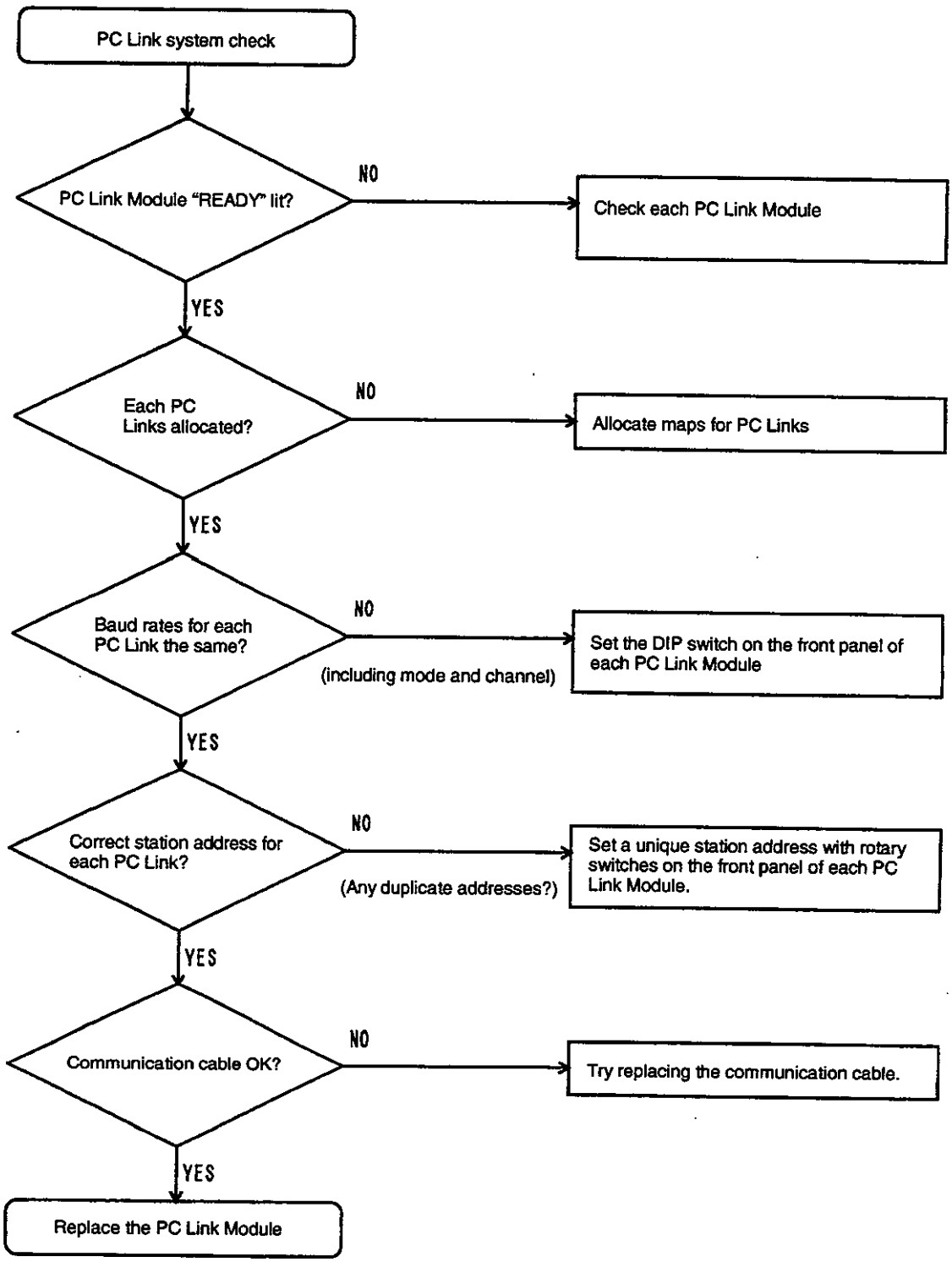
5.2.3 Troubleshooting Procedure

Use the following flowcharts to troubleshoot PC Link Modules during maintenance.

1) Check the PC Link Module for Errors

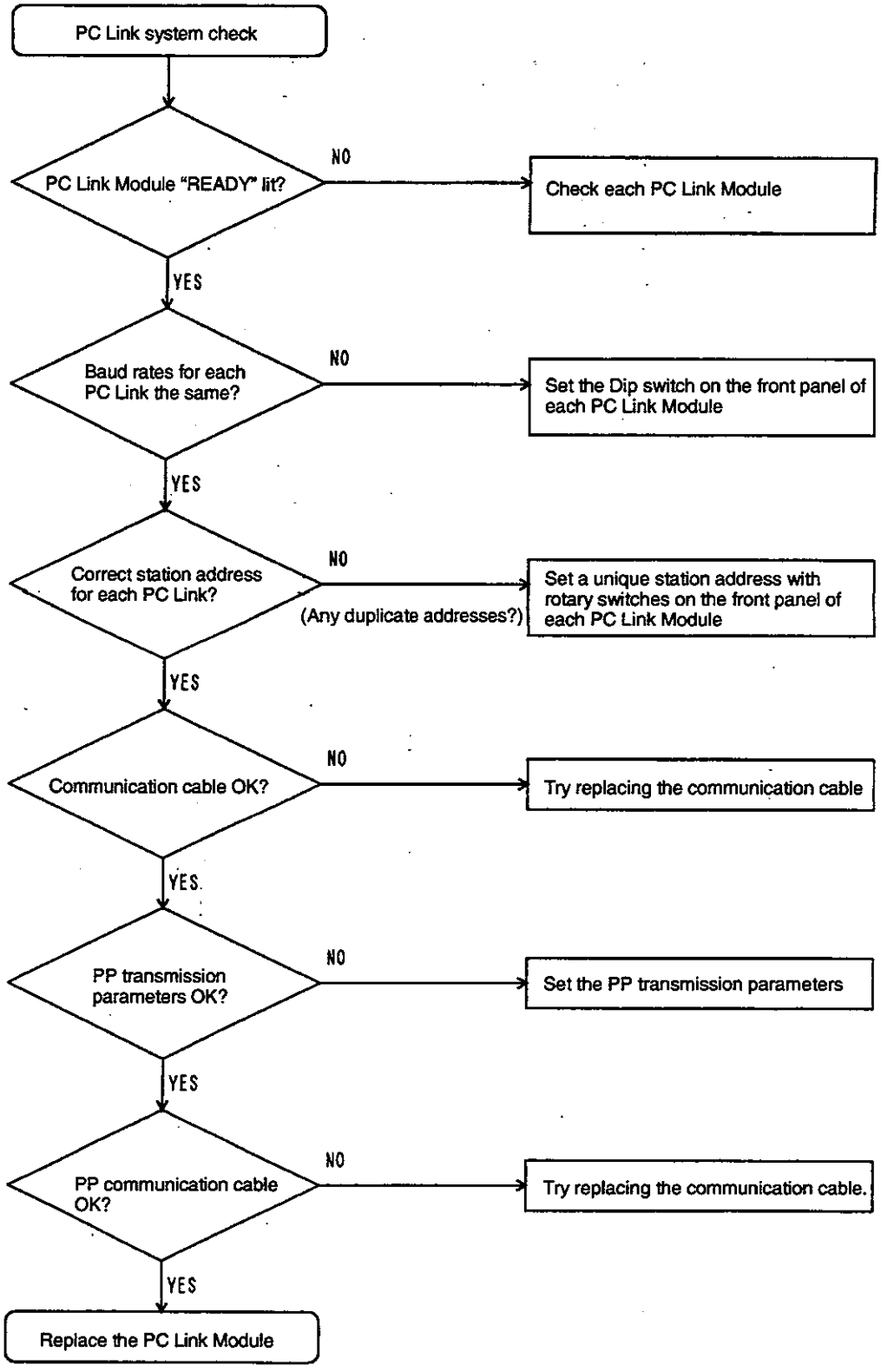


2) PC Link I/O Not Serviced



IMPORTANT The station address and baud rate for the PC Link Module is read only when power is turned ON or when the reset button is pressed. Be sure to turn the power OFF and ON or press the reset button after changing the setting.

3) Unable to Communicate with PC Link Modules from MEMOBUS Port



IMPORTANT The station address and baud rate for the PC Link Module is read only when power is turned ON or when the reset button is pressed. Be sure to turn the power OFF and ON or press the reset button after changing the setting.

Wiring

6

This chapter describes how to wire the PC Link.

6.1 Installation Environment

This section describes the appropriate installation environment for PC Link Modules.

1) For installation of the GL120 and GL130, always follow the general specifications and the environmental conditions for each module. Normally, install the PC Link under the following environmental conditions:

   a) Ambient temperature: Between 0 and 60 °C.

   b) Humidity: Between 30% and 95% RH.

   c) No condensation resulting from sudden temperature changes.

   d) No vibration or shock.

   e) No flammable or corrosive gas.

   f) No dust, oil mist, conductive powder, salinity, or organic solvent.

   g) No strong electric or magnetic field.

   h) No direct sunlight.

2) Because PC Link Modules are mutually connected with coaxial cables, take special care that these cables are routed properly. Never route cables overhead.

6.2 Transmission Distance

This section describes how to calculate the PC Link transmission distance.

6.2.1 Calculating the Transmission Distance

1) The PC Link transmission distance varies according to the number of PC Link Modules connected, the type of the coaxial cable used, and the baud rate.

2) The PC Link insertion loss and coaxial cable transmission loss also vary according to the baud rate.

3) The method for calculating transmission distance (L) is described below.

L = PL/Pa (km)

Where, PL = Pdr – Pm – Pt – Psn = Pdr – 4.0 – 1.0 – Psn (dB)

PL: Permissible loss of coaxial cable (dB)
Pa: Signal dB loss of coaxial cable (dB/km)
Pdr: Difference between transmission and reception levels (dB)

Pdr = Pd – Pr + Px
= 19.4 dB + Px

Pd = 68.9 dB (Ed = 2.8 Vp): Transmission level
Pr = 49.5 dB (Er = 0.3 Vp): Reception level
Px = –3.4, –2.4, –1.9, –1.4 dB: Compensation (for baud rates 4, 2, 1, and 0.5 Mbps)

Pm: Noise margin (dB)
Pt: Power supply and temperature variations (dB)
Psn: Insertion loss of PC Link Module (dB)

Table 6.1 shows the relationship between the permissible loss of coaxial cables and the baud rate. *Table 6.2* shows the relationship between the insertion loss of PC Link Modules and the baud rate. *Table 6.3* shows the signal dB loss of coaxial cables.

Table 6.1 Permissible Loss of Coaxial Cable: PL

Baud Rate (Mbps)	Difference between Transmission and Reception Levels: Pdr (dB)	Permissible Loss of Coaxial Cable: PL (dB)		
			n = 2	n = 32
4	16.0	PL(4) = 11.0 – Psn(4)	10.78 dB	7.5 dB
2	17.0	PL(2) = 12.0 – Psn(2)	11.76 dB	8.1 dB
1	17.5	PL(1) = 12.5 – Psn(1)	12.22 dB	8.0 dB
0.5	18.0	PL(0.5) = 13.0 – Psn(0.5)	12.66 dB	7.5 dB

Table 6.2 Insertion Loss of PC Link Module: Psn

Baud Rate (Mbps)	Insertion Loss of PC Link Module: PSn (dB)			
	Ps	n=10	n=20	n=32
4	0.11 dB/unit	1.1 dB	2.2 dB	3.5 dB
2	0.12 dB	1.2 dB	2.4 dB	3.9 dB
1	0.14 dB	1.4 dB	2.8 dB	4.5 dB
0.5	0.17 dB	1.7 dB	3.4 dB	5.5 dB

Psn = Ps x n
Where, n is the number of PC Link Modules.

Table 6.3 Signal dB Loss of Coaxial Cable: Pa

Cable Type (manufactured by Fujikura Ltd.)	Signal dB Loss: Pa (dB/km)			
	0.5 MHz	1 MHz	2 MHz	4 MHz
3C-2V,3C-2V (Cu,Fe) ZV	9.0	13.8	20	28.8
5C-2V,5C-2V (Cu,Fe) ZV	5.1	8.8	12.7	18.4
5C-FB,5C-FB (Cu,Fe) ZV	4.8	7.4	10.5	14.0
7C-FB,7C-FB (Cu,Fe) ZV	4.2	5.8	7.6	10.0
7C-FL,7C-FL (Cu,Fe) ZV	2.9	4.4	6.4	9.3
12C-5AF,12C-5AF (Cu,Fe) ZV	1.46	2.2	3.2	4.5

Note Signal dB loss (Pa): Multiply the standard value by 1.15.

6.2.2 Maximum Transmission Distance

1) *Table 6.4* shows the maximum transmission distance (Lmax) applicable when 16 PC Link Modules and an in-panel cable 3C-2V of 50 meters or less are used. *Table 6.5* shows the maximum transmission distance (Lmax) applicable when 32 PC Link Modules and an in-panel cable 3C-2V of 100 meters or less are used.

Table 6.4 Example of Maximum Transmission Distance: Lmax (16 Modules)

Baud Rate (Mbps)	Coaxial Cable Length: km				Maximum Transmission Distance: Lmax (km)
	3C-2V	5C-2V	7C-FL	12C-5AF	
4	0.05	0.42	0	0	0.47
	0.05	0.05	0	1.29	1.39
	0.05	0	0.83	0	0.88
2	0.05	0.71	0	0	0.76
	0.05	0.05	0	2.27	2.37
	0.05	0	1.41	0	1.46
1	0.05	1.03	0	0	1.08
	0.05	0.05	0	3.35	3.45
	0.05	0	2.16	0	2.21

Table 6.5 Example of Maximum Transmission Distance: Lmax (32 Modules)

Baud Rate (Mbps)	Coaxial Cable Length: km				Maximum Transmission Distance: Lmax (km)
	3C-2V	5C-2V	7C-FL	12C-5AF	
4	0.1	0.25	0	0	0.35
	0.1	0.1	0	0.52	0.72
	0.1	0	0.49	0	0.59
2	0.1	0.48	0	0	0.58
	0.1	0.1	0	1.30	1.50
	0.1	0	0.95	0	1.05
1	0.1	0.70	0	0	0.80
	0.1	0.1	0	2.06	2.26
	0.1	0	1.47	0	1.57

6.3 Wiring

This section describes how to connect, wire, and ground the PC Links.

6.3.1 Connecting the PC Links

Figure 6.1 and *6.2* are PC Link connection diagrams. PC Link Modules are connected using coaxial cables and coaxial connectors. Coaxial cables are divided into in-panel cables and panel-to-panel cables as shown in *Figure 6.1* and *6.2*.

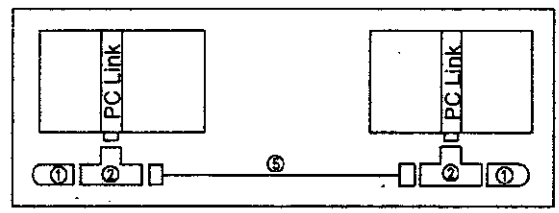


Figure 6.1 In-panel Wiring

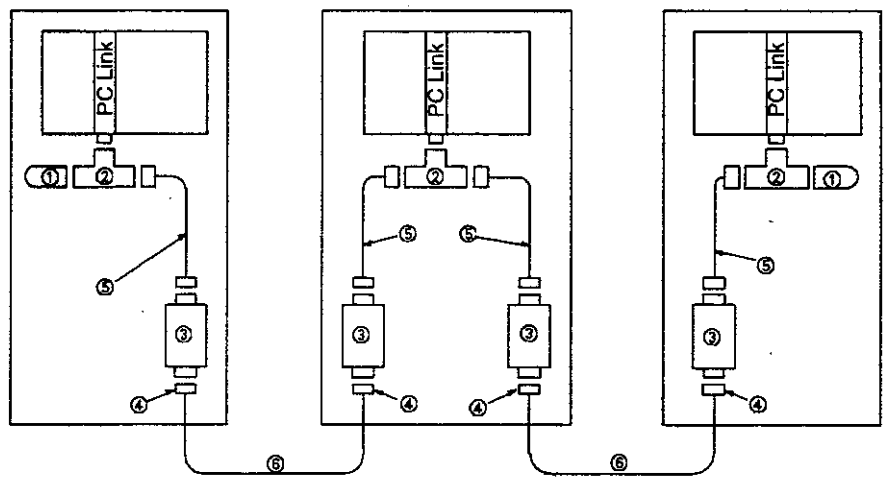


Figure 6.2 Panel-to-Panel Wiring

6.3.2 In-Panel Wiring

1) Applicable Cables

Cable	Type	Manufacturer
Coaxial cable	3C-2V	Fujikura Ltd
Coaxial cable shielded with copper/iron	3C-2V(Cu, Fe) ZV	Fujikura Ltd

2) Cables Prepared by Yaskawa

Type	Cable length in m	Connector	Type
JZMSZ-W60-1	2 m	BNC Connectors at both ends (BNC-P-3)	3C-2V
JZMSZ-W60-2	3 m		
JZMSZ-W60-3	5 m		

3) Connection between devices

Figure 6.3 shows the connections between PC Link modules and Conversion Adapter or between modules.

a) Connect T Connector for branch to BNC Connector on the front panel.

b) Connect the BNC Connector at one end of the coaxial cable (3C-2V) to the T Adapter and the BNC Connector at the other end to the Conversion Adapter.

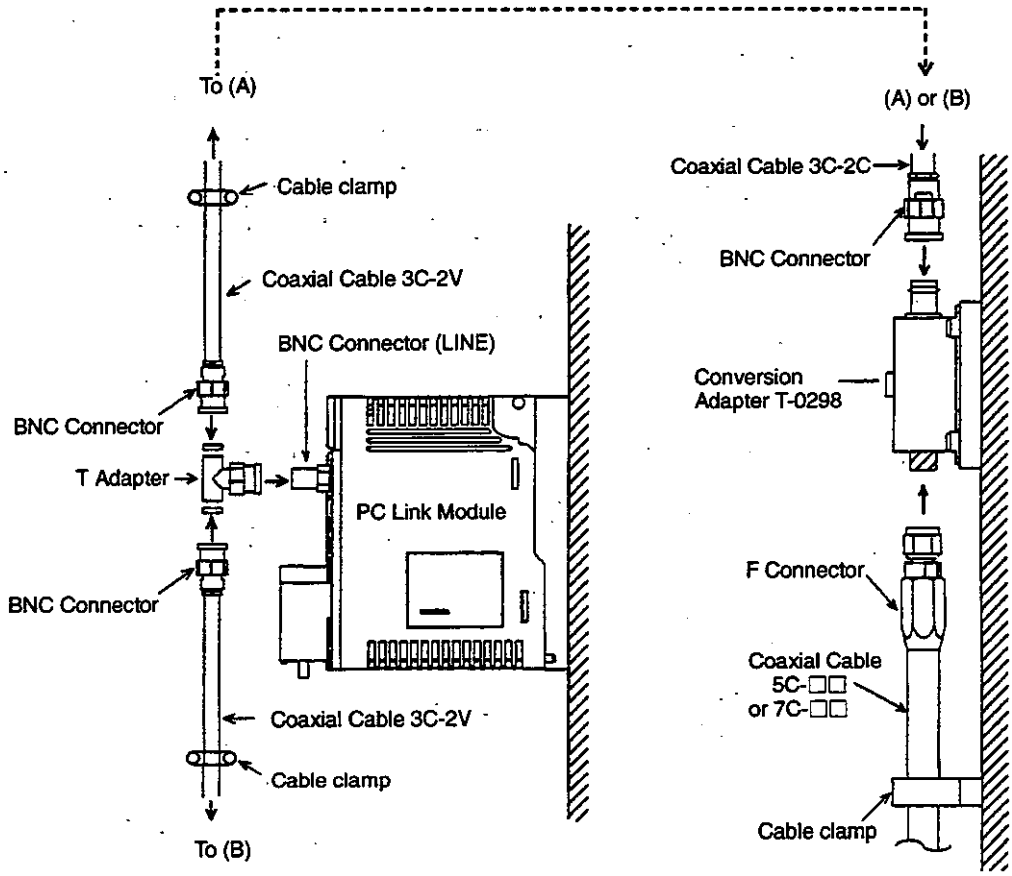


Figure 6.3 Connecting Method

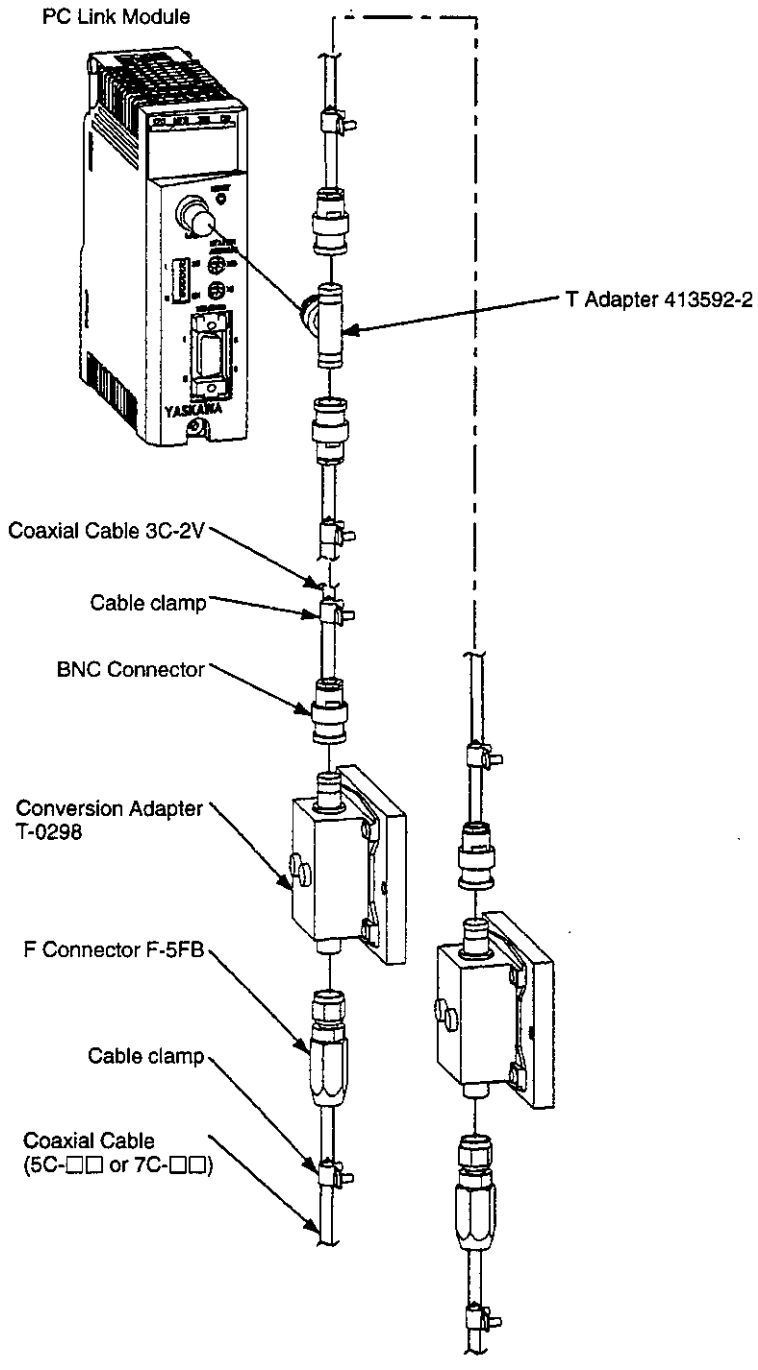


Figure 6.4 Connecting the PC Link Module

4) Connecting Different Types of Coaxial Cables

a) For Coaxial Cables 5C-□□ and 7C-□□, use F Connectors to connect to Conversion Adapters.

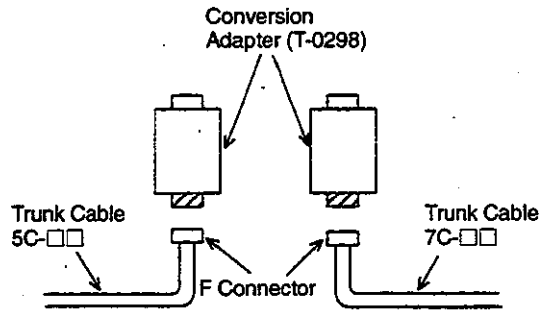


Figure 6.5 Connection of 5C - □□ and 7C - □□

b) For trunk Coaxial Cables 12C-5AF, first connect to smaller Coaxial Cables 5C-□□ and 7C-□□ with Conversion Connectors, then connect these cables to Conversion Adapters with F Connectors.

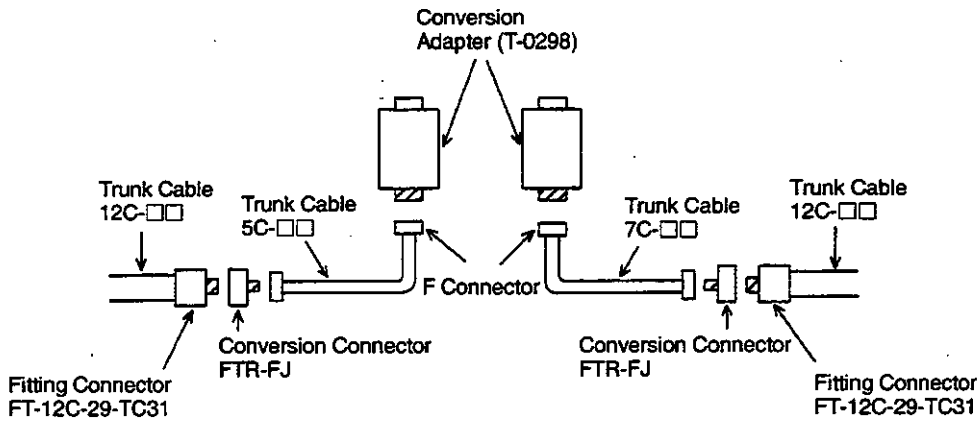


Figure 6.6 Connection using F Connector

c) Use Junction Connectors to connect trunk Coaxial Cables of the same size.

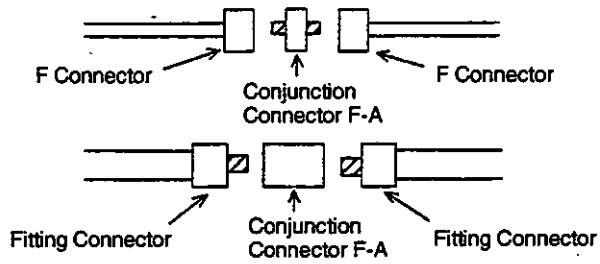


Figure 6.7 Connecting Trunk Coaxial Cables

5) Shield Treatment

For shielded coaxial cables, ground the shield at one point (ground resistance: 100 Ω max). See section *6.3.5 Grounding* for details.

6) Separating Coaxial Cables from Other Cables

Separate coaxial cables from other cables as described below.

a) Separating from Low-voltage Cables

Keep coaxial cables at least 100 mm away from low-voltage cables. Alternatively, use coaxial cables shielded with copper or iron (hereafter referred to as shielded coaxial cables).

b) Separating from Operation Circuit Cables

Keep shielded coaxial cables at least 100 mm away from operation circuit cables. Alternatively, shield the operation circuit cables.

c) Separating from Main Circuit Cables

Keep shielded coaxial cables away from main circuit cables as shown in *table 6.6*. Alternatively, shield the main circuit cables.

Table 6.6 Recommended Distance between Shielded Coaxial Cable and Main Circuit Cable

Main Circuit	Recommended Distance
125 V, 10 A	300 mm or more
250 V, 50 A	450 mm or more
440 V, 200 A	600 mm or more
3 kV to 6 kV, 800 A	1200 mm or more

6

6.3.3 Indoor Panel-to-Panel Wiring

1) Applicable Cables

Cable	Type	Manufacture
Coaxial Cable	5C-2V	Fujikura Ltd.
	5C-FB	Fujikura Ltd.
	7C-FL	Fujikura Ltd.
	7C-FB	Fujikura Ltd.
	12C-5AF	Fujikura Ltd.
Coaxial Cable shielded with copper/iron	5C-2V (Cu, Fe) ZV	Fujikura Ltd.
	5C-FB (Cu, Fe) ZV	Fujikura Ltd.
	7C-FL (Cu, Fe) ZV	Fujikura Ltd.
	7C-FB (Cu, Fe) ZV	Fujikura Ltd.
	12C-5AF (Cu, Fe) ZV	Fujikura Ltd.

2) Cables Prepared by Yaskawa

Type	Cable Length in m	Connector	Type
JZMSZ-W61-1	2.5 m	F Connectors (F-5FB) at both ends	5C-FB
JZMSZ-W61-2	5 m		
JZMSZ-W61-3	10 m		
JZMSZ-W61-4	20 m		

3) Shield Treatment

Ground the copper or iron shield at one point (ground resistance: 100 Ω max). See section *6.3.5 Grounding* for details.

4) Separating Coaxial Cables from Other Cables

a) Shielded Coaxial Cables

(1) Accommodate the shielded coaxial cable in a low-voltage circuit duct separated from a general operation circuit as shown in *Figure 6.8 (a)*. If the low-voltage circuit and general operation circuit are in the same duct, separate them by at least 100 mm, then accommodate the shielded coaxial cable on the low-voltage circuit side as shown in *Figure 6.8 (b)*.

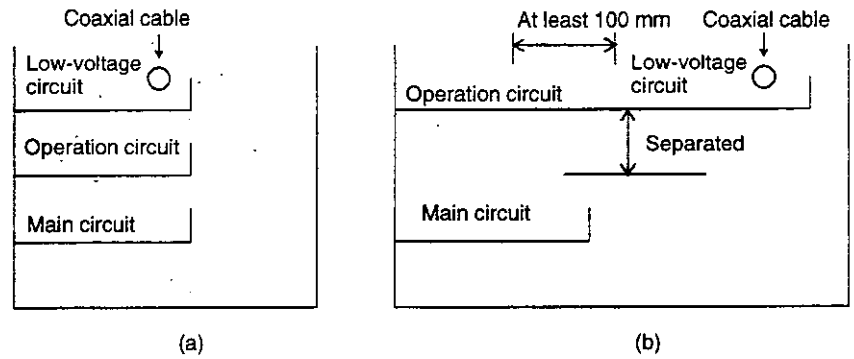


Figure 6.8 Separating Wire Ducts

(2) Use a dedicated duct cover so as not to leave a gap between the duct and the cover. The following *table 6.8* shows the recommended distance between a shielded coaxial cable and a main circuit.

Table 6.8 Recommended Distance between Shielded Coaxial Cable and Main Circuit

Main Circuit	Recommended Distance
125 V, 10 A	300 mm or more
250 V, 50 A	450 mm or more
440 V, 200 A	600 mm or more
3 kV to 6 kV, 800 A	1200 mm or more

b) Unshielded Coaxial Cables

(1) Coaxial Cables 5C-□□ and 7C-□□ must be accommodated separately in a metallic conduit or metallic duct as shown in *Figures 6.9 (a)* and *(b)*.

(2) Coaxial Cables 12C-5AF are inflexible and hardly fit in with a metallic conduit. Therefore, accommodate them in a metallic duct as shown in *Figures 6.9 (b)* and *(d)*.

(3) Always ground both ends of a metallic conduit or duct. The conduit or duct should be grounded at as many points as possible.

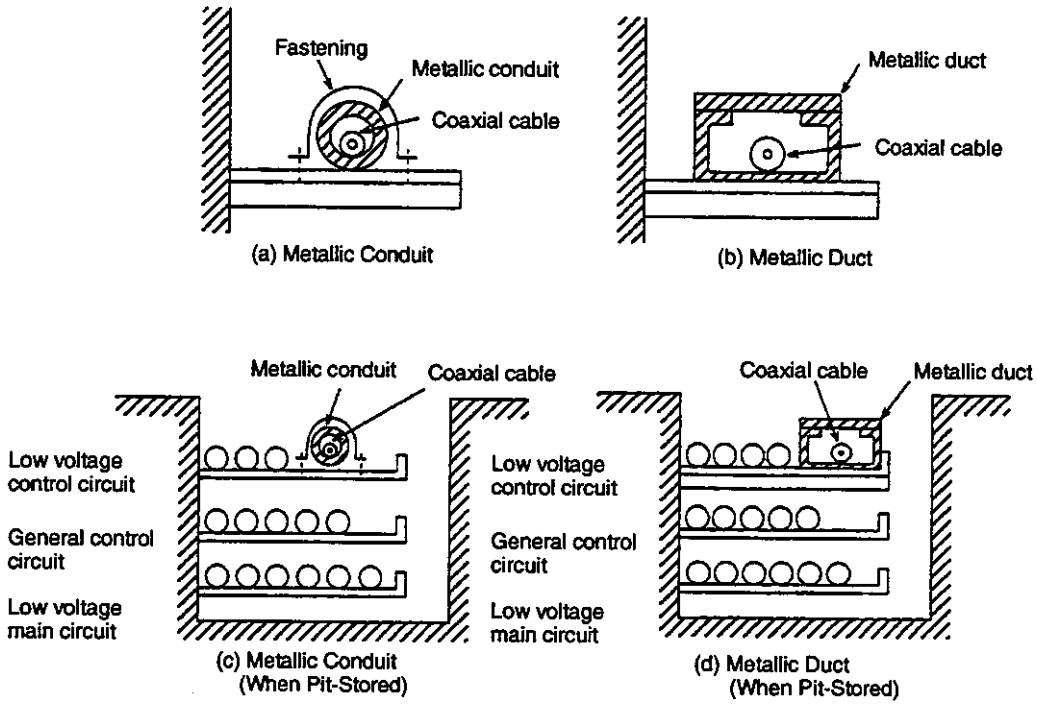


Figure 6.9 Coaxial Cable Installation

5) Bending Coaxial Cables

a) When bending a coaxial cable, always follow the radius of curvature shown in *Figure 6.10* and *table 6.8* below.

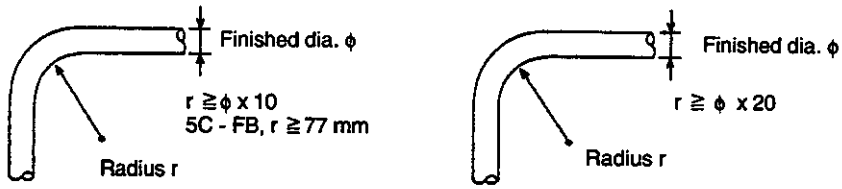


Figure 6.10 Cable Bending

b) Use a metallic conduit in the bent part of the coaxial cable so that the metallic conduits remain connected each other. For 5C-□□ and 7C-□□, the radius of curvature must be at least 20 times the outside diameter of a finished cable as shown in *Figure 6.11.*

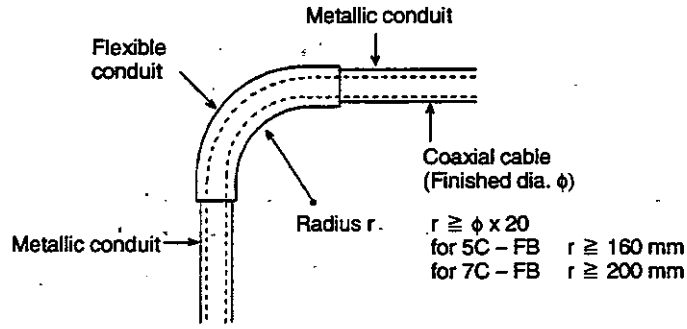


Figure 6.11 Metallic Conduit Bending

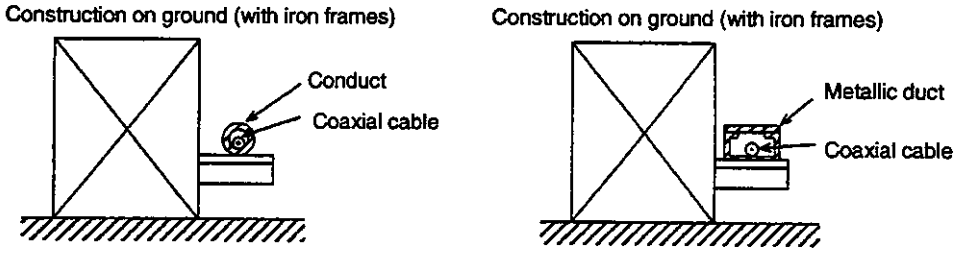
Table 6.8 Minimum Radius of Curvature for Coaxial Cables

Cable (Manufactured by Fujikura Ltd.)	Type	Outside Diameter of Finished Cable: DIA (ø) in mm	Radium of Curvature: r (mm)
Coaxial Cable	5V-2V	7.5	r = ø × 10 = 75
	5C-FB	7.7	r = ø × 10 = 77
	7C-FB	10.0	r = ø × 10 = 100
	7C-FL	10.0	r = ø × 10 = 100
	12C-5AF	15.3	r = ø × 20 = 306
Shielded Coaxial Cable	5C-2V (Cu, Fe) ZV	12.0	r = ø × 10 = 120
	5C-FB (Cu, Fe) ZV	12.0	r = ø × 10 = 120
	7C-FB (Cu, Fe) ZV	13.0	r = ø × 10 = 130
	7C-FL (Cu, Fe) ZV	14.5	r = ø × 10 = 145
	12C-5AF (Cu, Fe) ZV	20.0	r = ø × 20 = 400

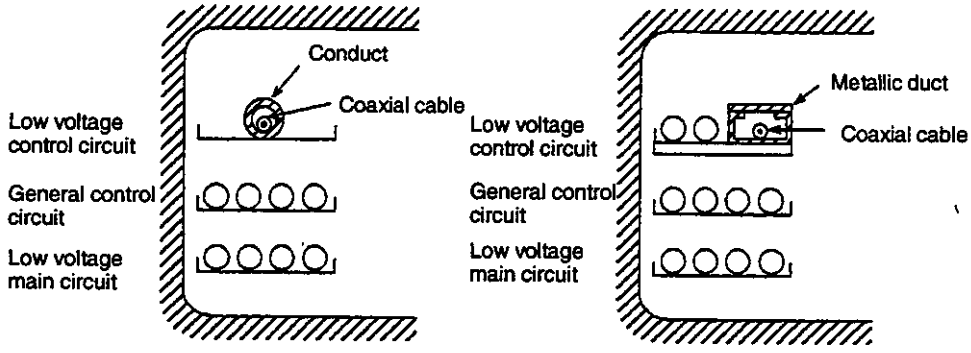
6.3.4 Outdoor Panel-to-Panel Wiring

1) The procedures for laying coaxial cables are basically the same as those described in section *6.3.3 Indoor Panel-to-Panel Wiring*, but note the following differences.

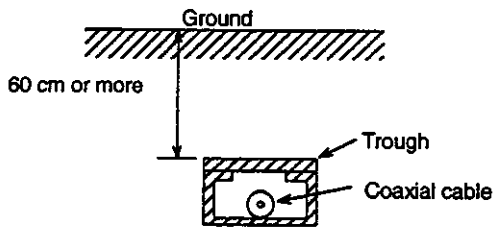
a) For outdoor wiring, always lay coaxial cables along above ground structures (steel frames). If no such structures are available, accommodate the cables in an underground pit or tunnel or bury the cables in the ground.



(a) Construction on Ground



(b) Underground Pit or Tunnel



(c) Burying in the Ground

Figure 6.12 Laying Coaxial Cables between Buildings

b) Do not route bare coaxial cables overhead. Otherwise, the cables may receive noise induced from airborne radio waves and cause transmission errors.

⚠**Caution** The PC Link system is not protected from lightening surge. Never route wires overhead. Otherwise, the equipment may be damaged by lightening.

IMPORTANT

(1) Coaxial cable expands and contracts with temperatures. The thermal expansion coefficient of coaxial cables is about 0.005% per degree (°C). For example, a coaxial cable of 500 m expands 25 cm when the temperature increases 10°C. Normally, this extent of expansion can be compensated through the entire cable route. When coaxial cables are routed through an above ground structure, however, changes in the cable length may not be compensated because of large temperature fluctuations. Therefore, let the coaxial cable have some play at the inlet and outlet of each metallic conduit so that changes in the cable length can be compensated.

(2) If water is trapped in a metallic conduit or duct and freezes in winter, it applies mechanical stress to the coaxial cable. To prevent this, drill drain holes in the metallic conduit or duct.

6.3.5 Grounding

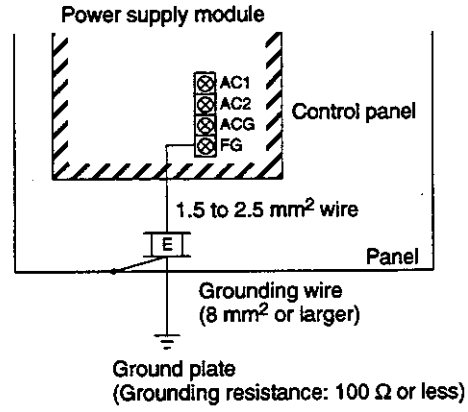
1) Grounding Procedure

a) Installing Equipment

The mounting base on which each module of the PLC is to be installed must be mounted on an integrated steel base (frame). Always leave coaxial connectors above the ground.

b) Ground Wire

Mount an "E" ground terminal in the control panel and connect the terminal to the cabinet of the control panel. Also, connect the "E" ground terminal to the FG terminal on the power supply module. For the ground wire between the "E" terminal and the ground plate, use a ground wire of at least 8 mm^2 (AWG8) and also make the wire as short as possible. If the distance between the "E" ground terminal and the ground plate is long, use a thick ground wire so that the sum of the ground resistance and the ground wire resistance is 100 Ω or less.



c) Ground Plate

The ground plate should be as close to the PLC control panel as possible and kept at least 15 meters away from the ground plates of other high-voltage control panels (Group B in *table 6.9* below). The ground resistance must be 100 Ω or less.

d) Sharing Ground

Basically, a PLC should have its own ground. If a PLC must share the ground wire and ground plate with other control panels, use the following information as guidelines.

Table 6.9 Shared Use of Ground Wire and Ground Plate

Shared Use Permitted (Group A Panel)	Computer panel, instrumentation control panel, I/O relay panel, general control circuit panel. etc.
Shared Use NOT Permitted (Group B Panel)	High-voltage main circuit panel, large-capacity thyristor panel, etc.

2) Shielded Coaxial Cables

Ground the shield of the shielded coaxial cable at one point. The figure below shows examples of grounding shielded coaxial cables (Sa, Sb, Sc, and Sd: relay terminals).

a) Sb and Sc Connected

Ground the shield at point Ea or Ed in the figure.

b) Shield Not Groundable at Point Ea or Ed

Sb and Sc can be grounded at point Eb.

c) Shielded Coaxial Cable Inside a Panel

Connect point e on the shield to point d on the shield of the panel-to-panel shielded coaxial cable via relay terminal Sd.

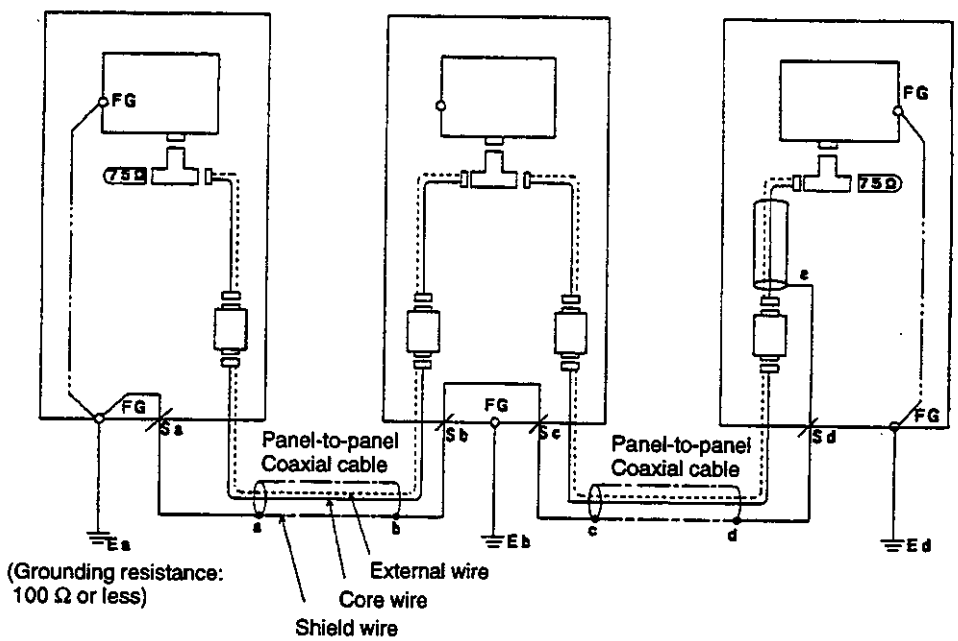


Figure 6.13 Example of Coaxial Cable Grounding

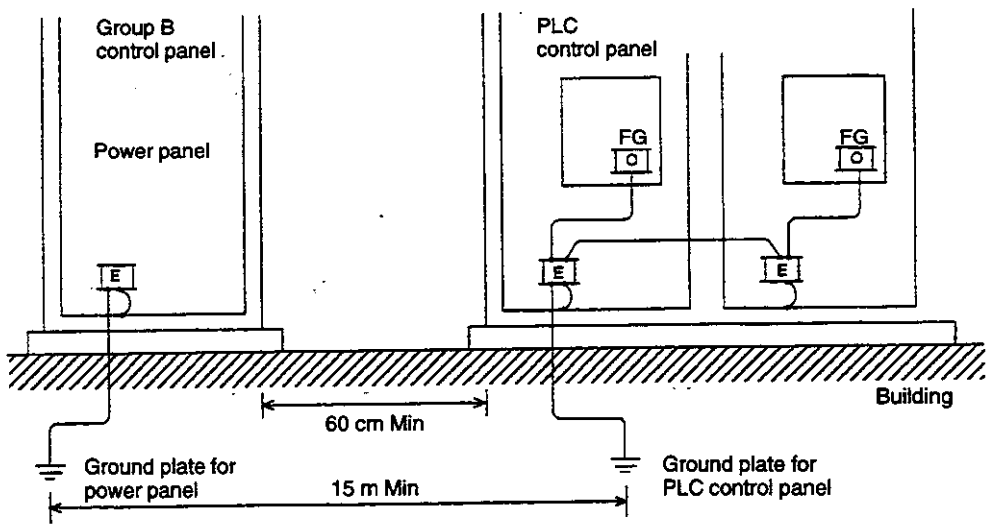
3) Metallic Conduit and Metallic Duct

Always ground both ends of a metallic conduit or duct. Each metallic conduit and duct should be grounded at as many points as possible.

6.3.6 Grounding the Control Panel

1) Separating PLC Control Panels from High-voltage Control Panels

Do not install a PLC control panel and a high-voltage control panel (Group B in the preceding *table 6.9*) side by side. If a PLC control panel must be installed near a high-voltage control panel, always keep the PLC control panel at least 60 cm away from the high-voltage control panel. Likewise, keep the ground wire at least 60 cm away from that of the high-voltage control panel and keep the ground plate at least 15 m away from that of the high-voltage control panel.



2) Installing PLC Control Panels and Other Control Panels Side by Side

PLC control panels and Group A control panels (in the preceding *table 6.9*) can be installed side by side. In this case, these control panels are electrically connected to each other through the channel base. To further ensure safe grounding, connect the "E" terminals of these control panels with a ground wire of at least 8 mm^2 as shown in the figure below. Then, connect one of the "E" terminals to the ground plate.

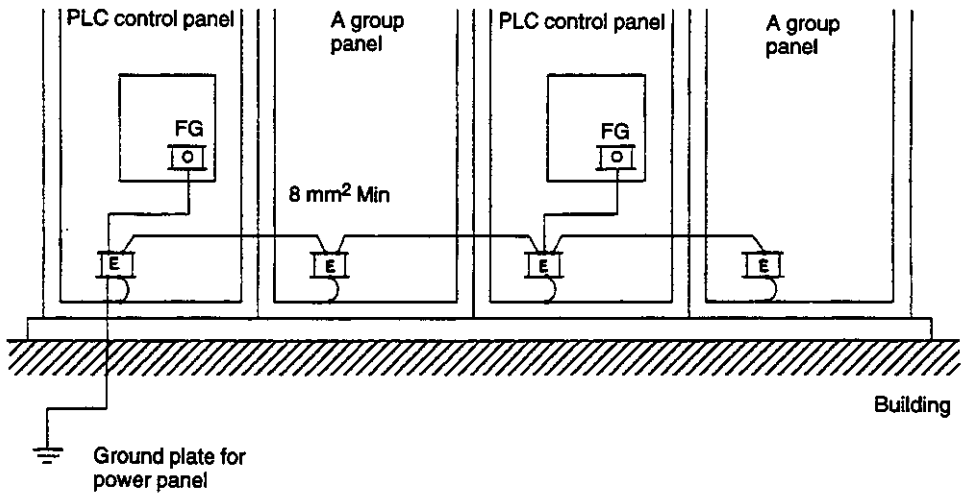


Figure 6.14 Separation from Group A Panel

3) Insulating the PLC Control Panel

When a PLC control panel is installed in a steel-frame building, it is grounded through the building. This will not cause a problem If, however, a PLC control panel is installed near a high-voltage control panel, a ground current from the high-voltage control panel will cause ground noise to the PLC control panel. To prevent this, insulate the PLC control panel from the building as shown in the figure below. Then, connect the "E" terminal of the PLC control panel to its own ground plate.

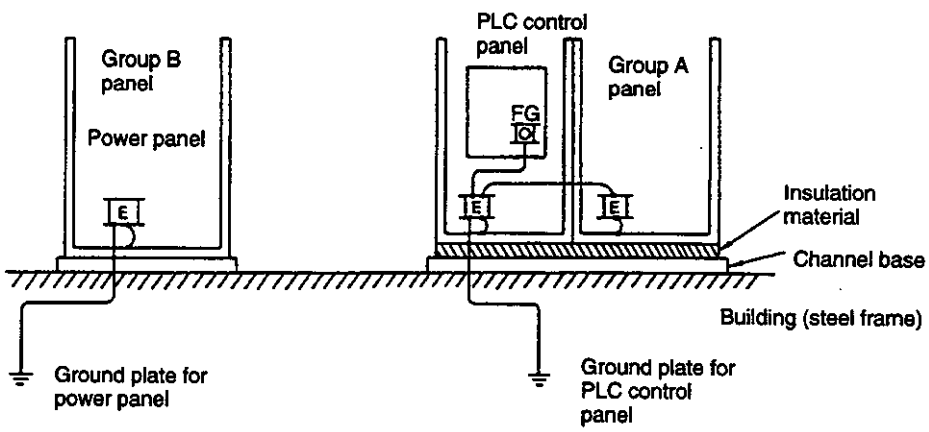


Figure 6.15 Remote I/O Panel Insulation

Appendix A

External Diagrams of PC Link Components

This appendix provides external diagrams of the following PC Link components:

PC LINK Module (JAMSC-120NFB23100)

Coaxial Cable (JSMSZ-W60-□)

Coaxial Cable (JZMSZ-W61-□)

T Adapter (413592-2)

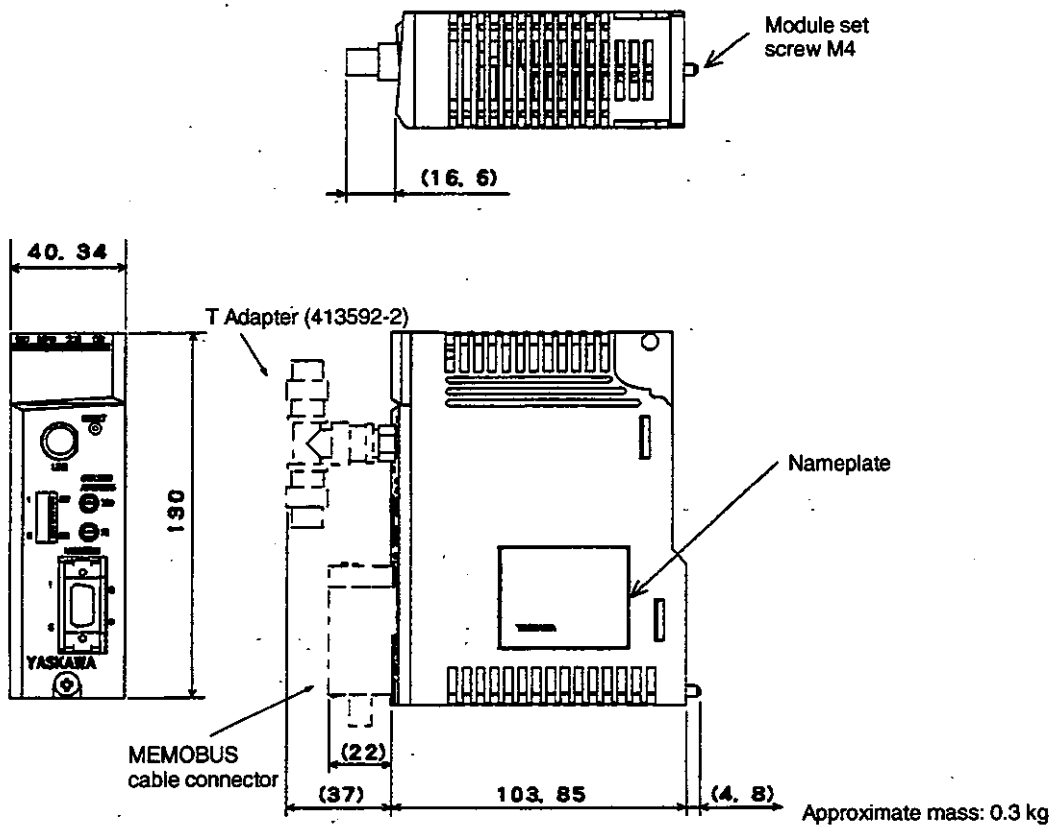
Conversion Adapter (T-0298)

Junction Connector (F-A)

F Connector (F-5FB)

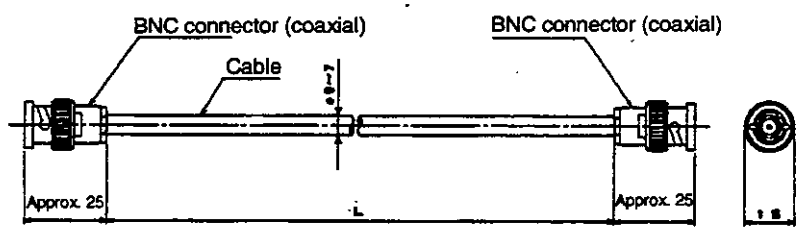
Terminator (221629-5)

1) PC LINK Module (JAMSC-120NFB23100) Unit: mm



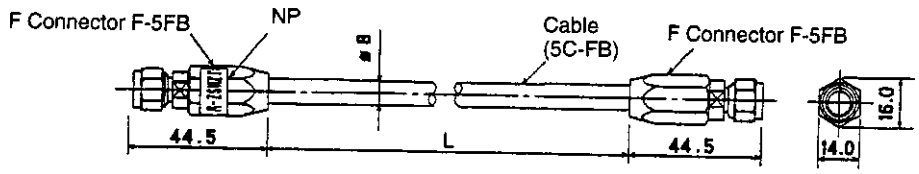
Approximate mass: 0.3 kg

2) Coaxial Cable (JZMSZ-W60-□) Unit: mm



Type	Length (L)	Approximate Mass
JZMSZ-W60-1	2000 mm	0.3 kg
JZMSZ-W60-2	3000 mm	0.4 kg
JZMSZ-W60-3	5000 mm	0.5 kg

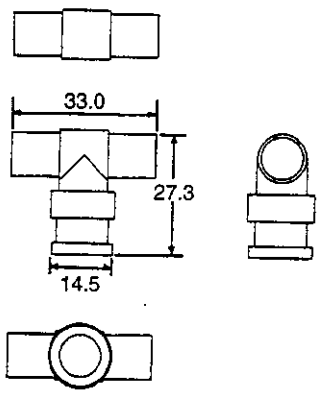
3) Coaxial Cable (JZMSZ-W61-□) Unit: mm



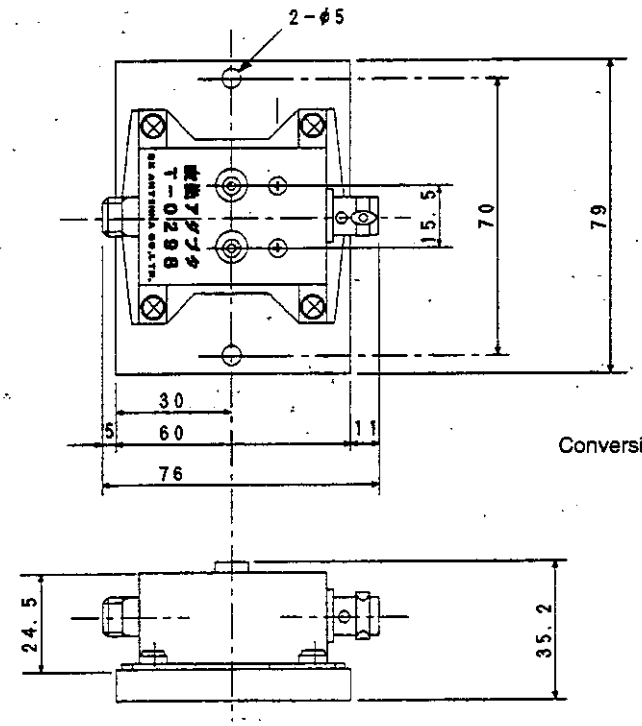
Type	Length (L)	Approximate Mass
JZMSZ-W61-1	2000 mm	0.3 kg
JZMSZ-W61-2	5000 mm	0.5 kg
JZMSZ-W61-3	10000 mm	0.8 kg
JZMSZ-W61-4	20000 mm	1.4 kg

A

4) T Adapter (413592-2) Unit: mm

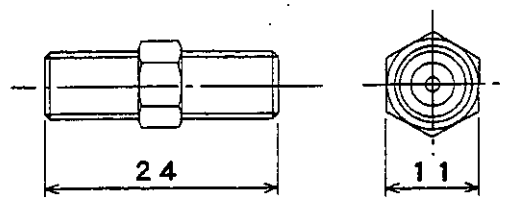


5) Conversion Adapter (T-0298) Unit: mm

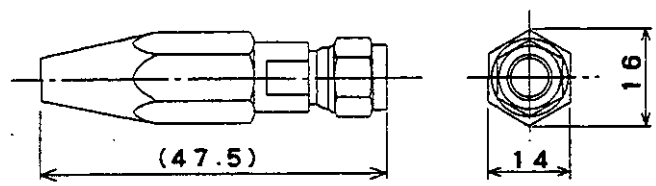


Conversion Adapter

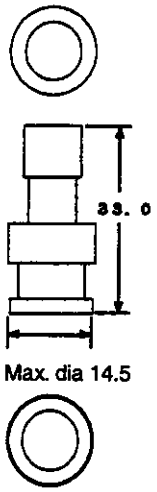
6) Junction Connector (F-A) Unit: mm



7) F Connector (F-5FB) Unit: mm



8) Terminator (221629-5) Unit: mm



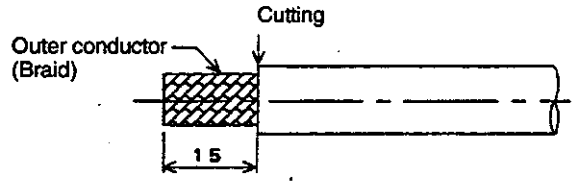
Appendix B

Installing Coaxial Connectors

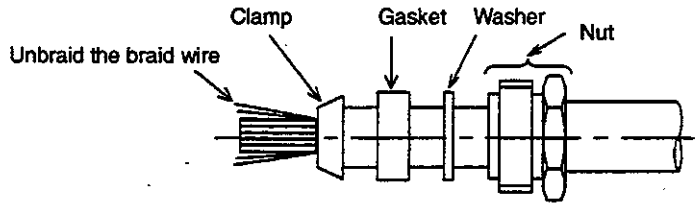
This appendix describes how to install and fit BNC and F Connectors.

B.1 BNC Connector Installation

1) Remove the sheath to 15 mm from the cable leading end. Use a cutter knife or pipe cutter (IFV1638).



2) Sequentially insert nut, washer, gasket, and clamp onto the coaxial cable.

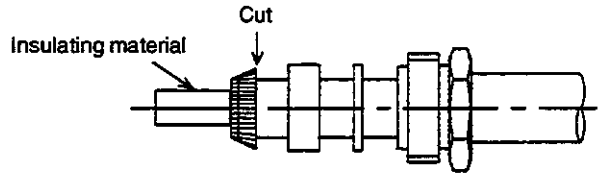


Note a) Place the nut, washer, and gasket over the sheath.

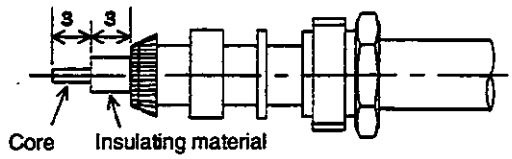
b) Place the clamp over the braided wire until it reaches the sheath cut surface.

c) After placing the clamp, unbraid the braided wire.

3) Turn back the braided wires along the clamp taper, and cut them to the same dimension as the taper.

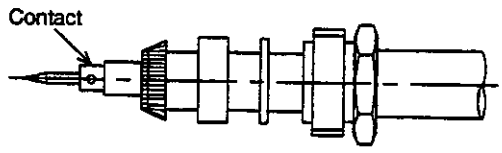


4) Remove the insulating material, leaving about 3 mm, to expose the core. Cut the core leading end, so that the bare core is 3 mm.



Note Be careful not to damage the core.

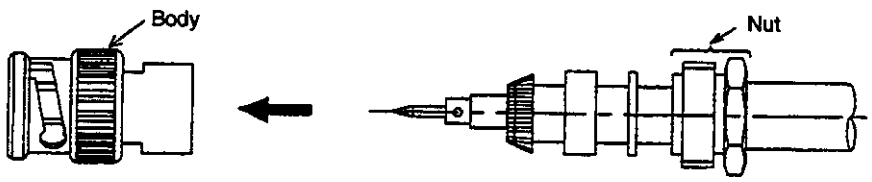
5) Pass the core through the contact, and solder.



Note a) Solder quickly, being careful not to deform the insulating material.

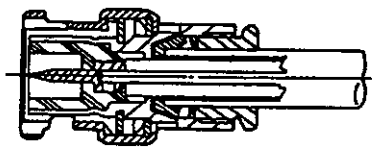
b) Do not permit the solder to form in a lump, or a gap between the contact and insulating material.

6) Insert the contact int the body.



Note Insert the contact in the body to the end.

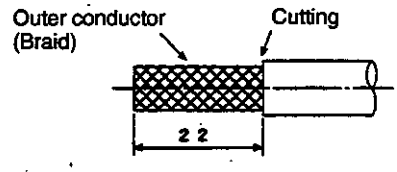
7) Using a wrench, turn the nut to tighten the body. This completes connector installation.



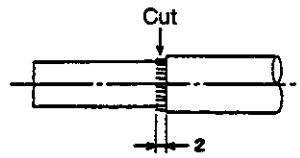
B.2 F Connector Installation

1) Treat the ends of coaxial cable, using a cutter knife or pipe cutter (IFV1638).

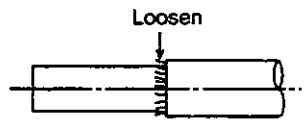
a) Remove the sheath to 22 mm from the cable leading end.



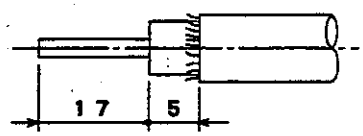
b) Using nippers, remove braided wires, leaving them about 2 mm.



c) Loosen the braided wires.

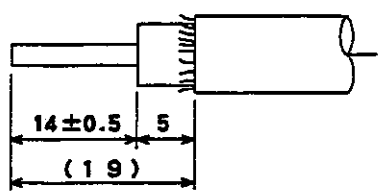


d) Pull out the insulating material 17 mm from the leading end.



Note Be sure not to damage the core.

e) Cut the core leading, and adjust the bare core to 14 ± 0.5 mm.

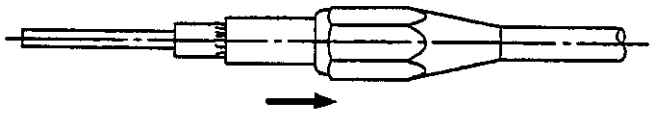


Note a) The bare core must be 14 ± 0.5 mm.

b) Leave aluminum foil about 5 mm.

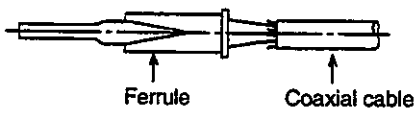
c) Leave braided wires loose.

2) Insert F Connector nut into the coaxial cable.



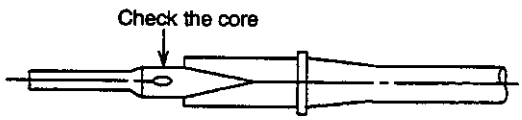
3) Press a ferrule into the coaxial cable.

a) Insert the cable leading into the ferule.



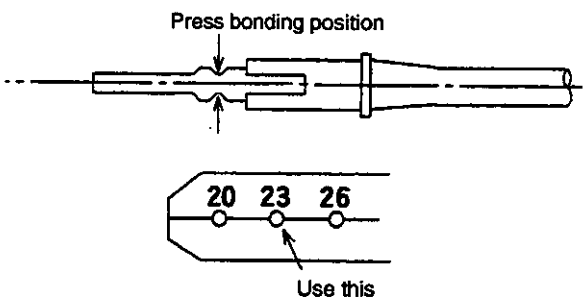
Note During insertion, be careful not to turn up aluminum foil.

b) Check through the contact window to make sure that the core is correctly inserted into the contact.



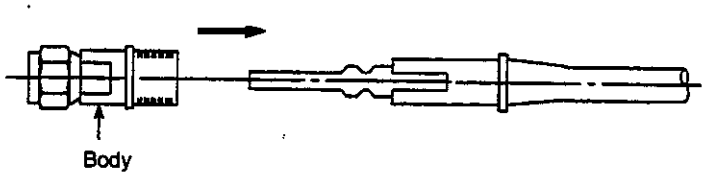
4) Press to bond the ferule contact.

For press bonding, use an crimping tool (FC-1, DIA 23 mm, made by Fujikura Ltd.). The press bonding position is at the contact window.

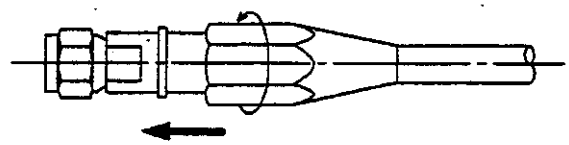


Note Be careful not to bend the contact.

5) Insert the body into the ferule.



6) Using a wrench, tighten the nut until the rubber gasket is completely hidden. This completes the connector installation.

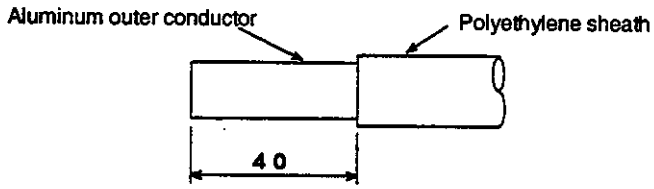


Note Fix the body with a wrench or an adjustable spanner (12 mm width across flat) and turn the nut for tightening with a wrench or an adjustable spanner (14 mm width across flat).

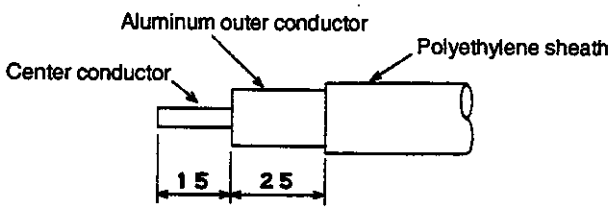
B.3 Fitting Connector Installation

1) Treat the ends of a coaxial cable, using a cutter knife or pipe cutter (IFV1638).

a) Remove the sheath to 40 mm from the cable leading end.

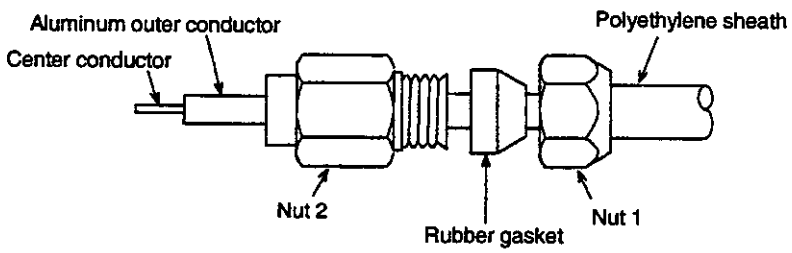


b) Remove the aluminum outer conductor and insulating material to 15 mm from the cable leading end.

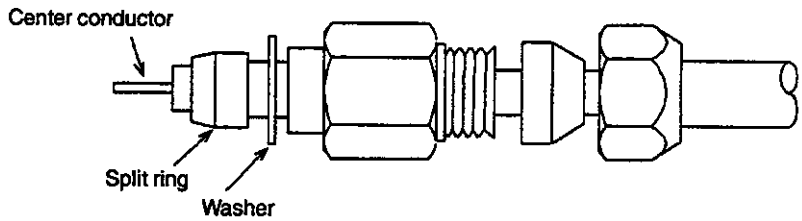


Note Be careful not to bend or damage the center conductor.

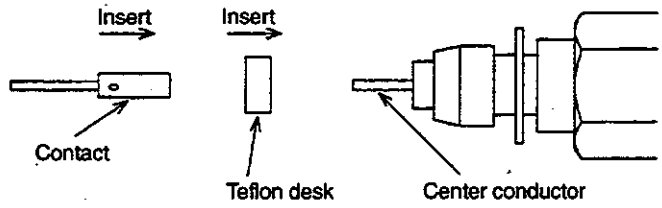
2) Sequentially insert nut, rubber gasket, and nut 2 onto the coaxial cable.



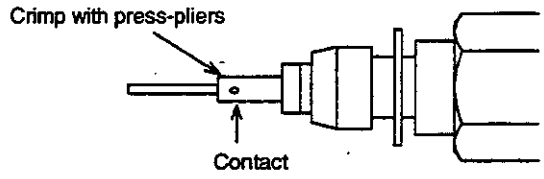
3) Insert washer and split ring onto the aluminum outer conductor.



4) Sequentially insert Teflon disk and contact onto the center conductor.

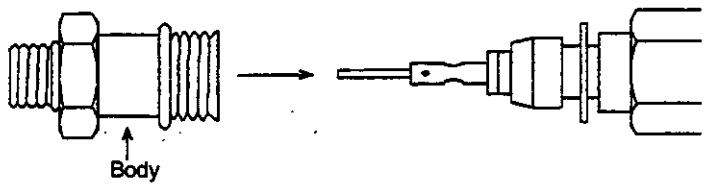


5) Press to bond the contact, using 9.5 mm coaxial-cable press-pliers.

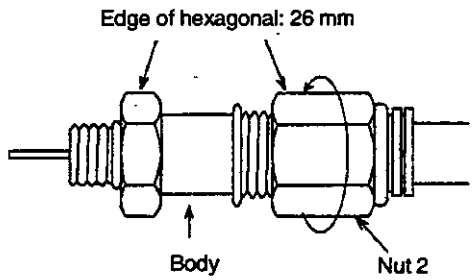


Note Check through the contact window to make sure that the contact is inserted.

6) Insert the contact into the body.

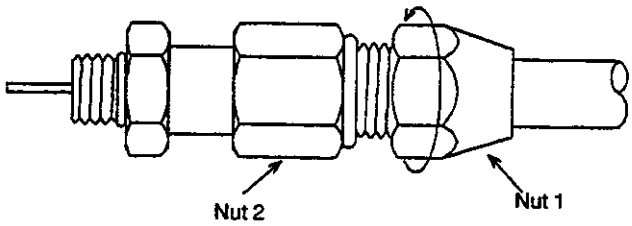


7) Tighten the body and nut 2.



Note Fully inset the body and tighten nut 2.

8) Tighten nut 1. This completes the connector installation.



Note Secure nut 2, then turn to tighten nut 1.

B.4 Tool list

Coaxial Cable Stripper

Manufacturer: Nihon Weidmuller Co., Ltd.

Table B.1 Coaxial Cable Stripper

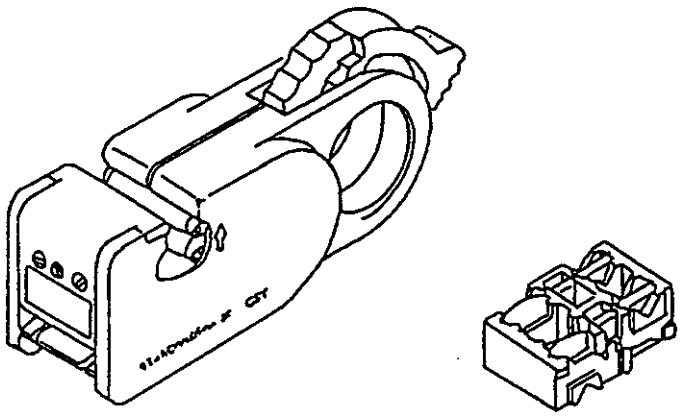
Specifications		
Length	100 mm	
Mass	65 g	
Height	42 mm	
Width	26 mm	
Sheath Trim		
Coaxial Cable	2.5 to 8 mm Dia	
	RG58, 59, 62, 71, 174, 187, 188	
Order Data		
Type	No.	Sheath Trim
Coaxial Cable Stripper	903050	
Screw Holder	903206	
Blade Cassette (Gray)	903205	Approx. 3.9 mm (B)
Blade Cassette (Red)	903204	Approx. 6 mm (B)
Blade Cassette (Yellow)	903203	Approx. 12 mm (B)
Blade Cassette (Blue)	903202	Approx. 6.5 mm (B)
Blade Cassette (Brown)	903201	Approx. 7.5 mm+ Approx. 3.5 mm (C+B)
Blade Cassette (Green)	903200	Approx. 7.1 mm + Approx. 5.1 mm (C+B)

Sheath Trimming Dimensions

Blade Cassette:
Gray/Red/Yellow/Blue

Blade Cassette:
Green/Brown

Coaxial cable stripper cannot be used for the cable type 7C, 7C2V, 11C, and 12C.



Coaxial cable stripper

Blade cassette

Figure B.1 Coaxial Cable Stripper and Blade Casette

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W

Y

MEMOCON GL120, GL130
PC Link Module
USER'S MANUAL

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YASKAWA ELECTRIC CORPORATION

YASKAWA

MANUAL NO. SIEZ-C825-70.4B

Specifications are subject to change without notice
for ongoing product modifications and improvements.

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