User's Manual

LG Programmable Logic Controller

FieldBus Link Module *MASTER-K*

K7F-FUEA
K4F-FUEA
K3F-FUEA

LG Industrial Systems

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Chapter 1 Introduction

This User's Manual describes for the entire network of MASTER-K PLC system technically and in detail. Network of MASTER-K PLC system is MASTER-K Fnet and the characteristics are as follows :

MASTER-K Fnet

This is situated at lower level of CIM network structure, and an open network system based on IEC/ISA Fieldbus of which standardization is in proceeding. Main characteristics of this network are reduction of the price for installation and maintenance, variety of system configuration, ease of maintenance and repair, and ease of system modification. This network supports electric network(twisted pair cable) which is cheap and easy to install and optical network(optical cable) which has great performance at the place that electric environment is very poor, for variety of system configuration. This also provides the option module that is composed of repeater, optical/electric converter, and active coupler, in order to combine suitably these two networks according to the use.

Remark

1. MASTER-K Fnet is abbreviated as Fnet for simplicity of description.
2. Program in this User's Manual has been prepared on the basis of KGLWIN V1.3.

Modules configuring MASTER-K Fnet are classified as Table 1.1 according to the cable used. This may be referred to when user configures network.

Table 1.1 Type of MASTER-K PLC communication module

Network	Module	Type of connection cable	Name of communication module		Mounting base
MASTER-K Fnet	Master module (FMM)	Twisted pair (electric)	Interface	G0L-FUEA	Computer
				K7F-FUEA	K1000S
				K4F-FUEA	K300S
				K3F-FUEA	K200S
		Optical		K7F-FUOA	K1000S
	Slave module (FSM)	Twisted pair (electric)	Remote I/O	K7F-RBEA	K1000S
				K4F-RBEA	K300S
				G0L-SMQA	Single
		Optical		G0L-SMIA	Single
				G0L-SMHA	Single
				K7F-RBOA	K1000S
	Option module	Twisted pair	Repeater	G0L-FREA	Single
		Optical/Twisted pair	Optical/electric converter	G0L-FOEA	Single
		Optical	Active coupler	G0L-FACA G0L-FAPA G0L-FABA	Single
		Cable	Cable	G0C-T	Twisted pair cable
				G0C-F	Optical fiber cable

Chapter 2 Terms and concepts of communication

2.1 Description of terms

▣ Master module(Fnet Master Module ; FMM)

Fnet communication module mounted at I/O position of main base.

▣ Slave module(Fnet Slave Module; FSM)

Fnet communication module and stand-alone module mounted at CPU position of main base.

▣ Option module(Fnet Option Module)

Fnet communication module used for signal conversion, extension of communication distance, and regeneration and amplification of signal.

▣ Local station

The station that GMWIN is directly connected in order to download, monitor, and debug programs in the same network including CPU.

▣ Remote station

The opposite concept to local station, the other station to communicate with local station

▣ Remote I/O station

Input/output area that the remote communication module of PLC system instead of CPU of PLC refreshes I/O module mounted on remote station by receiving I/O data from master station.

▣ Fnet

Fieldbus is the lowest network connecting control device and instrumentation device, and the specification adopts three layers from seven layers of OSI. Three layers consist of the physical layer which consists of H2(1Mbps, electric), H1(31.23Kbps, electric), optical, and wireless, etc., the data link layer which adopts scheduled and circulated token bus, the application layer which plays a role of application, and additional user layer.

▣ Token

The right to transmit data of self station through controlling the right of accessing to physical medium.

▣ SAP(Service Access Point)

The factor to determine the characteristic of service used in communication, and to connect upper application layer with data link layer according to their characteristics. LSAP is divided into SSAP, which is SAP's own station and DSAP, which is SAP of other station. (LSAP = SSAP + DSAP, used for Mnet only)

▣ Fnet station number

The station number of communication module(K7F-FUEA,... etc.) adopting Fnet specification. The station number used in Fnet is set by the switch attached on the front of communication module, and used as station number of all services including *high speed link* service differently from the station number used for Mnet.

▣ Active coupler

This is a module connecting optical module each other when optical network is configured, and the optical distributor, which has function of regeneration and amplification of optical communication signal additionally.

▣ Repeater

This is used to extend the distance of cable for electric communication network, extends the distance of communication with regeneration and amplification of electric communication signal.

▣ E.O.C(Electric/Optical Converter)

This module converts optical communication signal to electric communication signal, or electric communication signal to optical communication signal, and has additional functions of regeneration and amplification of signal.

▣ Manchester Biphase-L

Data modulation method used in Fnet. Data is encoded and transmitted by using Manchester-l code, Received data encoded by Manchester will be decoded and converted.

▣ CRC(Cyclic Redundancy Check)

This is the one of error detection methods, which is an error detection method used most frequently for synchronizing transmission, and also called as cyclic code method.

▣ Terminal resistance

This is used to adjust mutual impedance of transmitting part and receiving part on physical layer, and terminal resistance of Fnet is 110Ω, 1/2W and terminal resistance of Mnet is 75Ω, 1/4W.

▣ High speed link

This is used among MASTER-K PLC communication modules only, and used to transmit and receive data at high speed, and executes communication by setting *high speed link* parameter of GMWIN.

▣ KGLWIN(Programming and debugging tool)

This software enables user to program in order to fit to the system, and to download, run, stop, and debug in MASTER-K PLC CPU module.

▣ FAM(FA Manager)

This software package is situated at upper level in factory automation, and enables user to connect with networks of several types, and enables user to execute *high speed link*, reading/writing variable, and download/upload program by mounting Fnet module of computer.

▣ Segment

Local network which connects all stations by using the same token, without using any connecting device(Gateway, EOC, Repeater).

▣ Network

Entire communication system, configured by one segment or more, that uses the same token.

2.2 Concept of Fnet communication

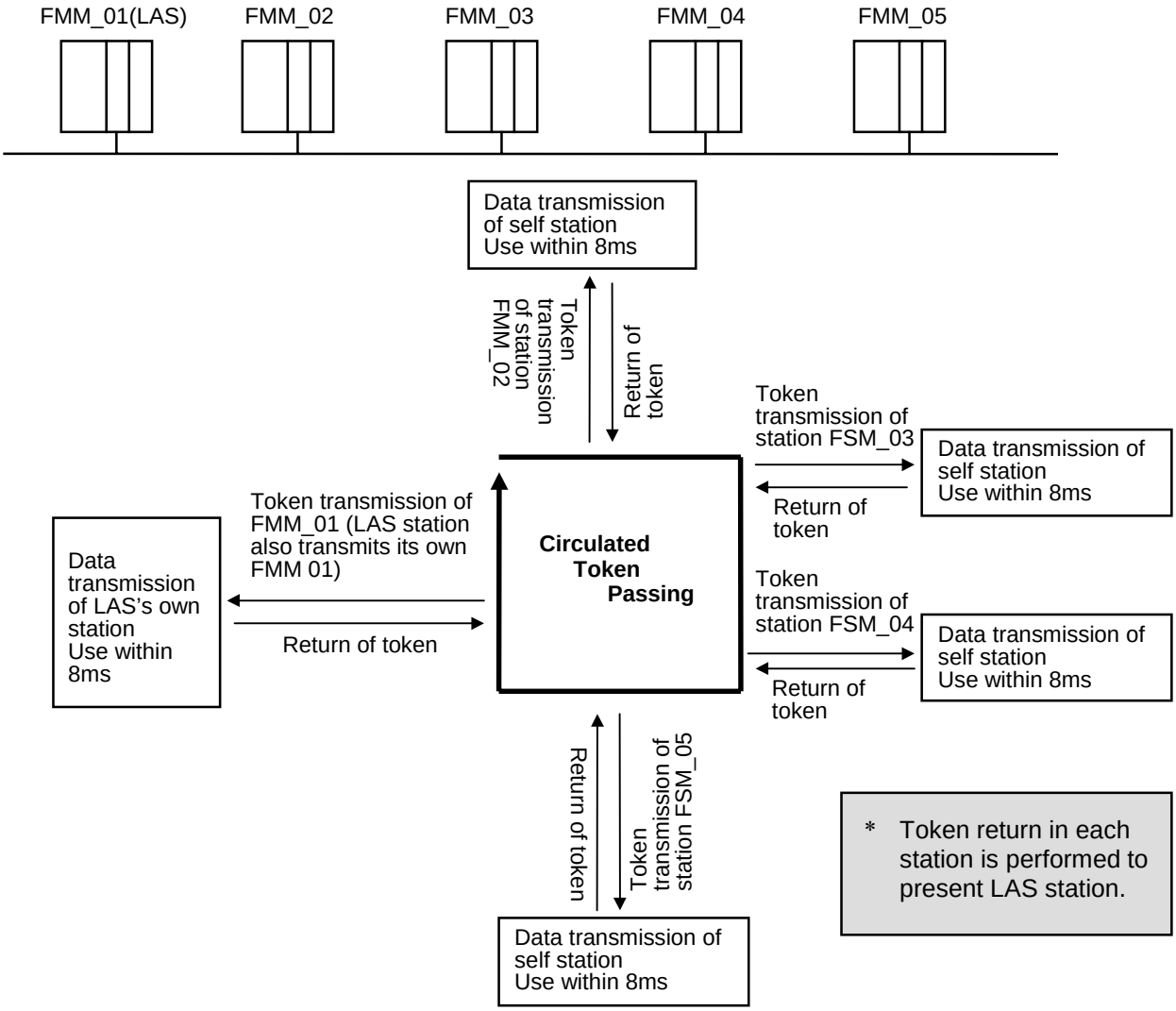
The method of Fnet communication is token distribution method by LAS(Link Active Scheduler). One of FMM communication modules can be LAS, but FSM communication modules cannot be LAS.

2.2.1 How to generate and move LAS

Among communication modules, LAS can be generated under the following conditions :

1) Among the stations connected to network, FMM communication module that the power is turned on first obtains LAS.
2) When the power become on at the same time among the stations connected to network, the communication module with the lowest station number obtains LAS.
3) If the present LAS station becomes down during normal communication, the communication module of the lowest station number among the rest of FMM station, obtains LAS.
4) Only one LAS exists through the entire network.

2.2.2 How to assign token(Suppose that the Station FMM_01 is LAS)



Chapter 3 General specifications

3.1 General specifications of communication module(Fnet)

General specifications of MASTER-K series are as follows :

Table 3.1 General specification

<table>
<tr><th>No.</th><th>Item</th><th colspan="6">Spec.</th><th>Related spec.</th></tr>
<tr><td>1</td><td>Operating temp.</td><td colspan="6">0℃ ~ +55℃</td><td></td></tr>
<tr><td>2</td><td>Storage temp.</td><td colspan="6">-25℃~+70℃</td><td></td></tr>
<tr><td>3</td><td>Operating moist.</td><td colspan="6">5~95% RH, non-condensing</td><td></td></tr>
<tr><td>4</td><td>Storage moist.</td><td colspan="6">5~95% RH, non-condensing</td><td></td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Vibration</td><td colspan="5">For discontinuous vibration</td><td rowspan="8">Each 10 times in X,Y,Z directions</td><td rowspan="8">ICE 1131-2</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td>Number</td></tr>
<tr><td>10≤f<57Hz</td><td colspan="2">-</td><td>0.075mm</td></tr>
<tr><td>57≤f<150Hz</td><td colspan="2">9.8 □{1G}</td><td>-</td></tr>
<tr><td colspan="5">For continuous vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td></tr>
<tr><td>10≤f<57Hz</td><td colspan="2">-</td><td>0.035mm</td></tr>
<tr><td>57≤f<150Hz</td><td colspan="2">4.9 □{0.5G}</td><td>-</td></tr>
<tr><td>6</td><td>Impact</td><td colspan="6">• Max. impact acceleration:147 □(15G)
• Authorized time : 11ms
• Pulse wave : Sign half-wave pulse(each 3 times in X,Y,Z directions)</td><td>IEC 1131-2</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Noise</td><td>Square wave Impulse noise</td><td colspan="5">±1,500V</td><td>Test spec. reference within LG Industrial Systems</td></tr>
<tr><td>Static electric discharging</td><td colspan="5">Voltage : 4kV(Contact discharging)</td><td>IEC 1131-2,
IEC 801-2</td></tr>
<tr><td>Radiation electric field noise</td><td colspan="5">27~500 MHz, 10V/m</td><td>IEC 1131-2,
IEC 801-3</td></tr>
<tr><td>Fast transient/burst noise</td><td>Segment</td><td>Power module</td><td>Digital input/ output (24V or more)</td><td>Digital input/output (less than 24V)Analog input/output communication interface</td><td>IEC 1131-2,
IEC 801-4</td></tr>
<tr><td></td><td>Voltage</td><td>2kV</td><td>1kV</td><td>0.25 kV</td><td></td></tr>
<tr><td>8</td><td>Ambient conditions</td><td colspan="6">No corrosive gas and dust</td><td></td></tr>
<tr><td>9</td><td>Height</td><td colspan="6">Up to 2,000m</td><td></td></tr>
<tr><td>10</td><td>Pollution level</td><td colspan="6">2 or less</td><td></td></tr>
<tr><td>11</td><td>Cooling type</td><td colspan="6">Natural air cooling</td><td></td></tr>
</table>

Remark

1. IEC(International Electro-technical Commission) : International non-governmental association, which establishes international standards in the field of electric and electronics.
2. Pollution level : This is an indication showing pollution of surrounding environment, which determines insulation performance of device, and generally the pollution level 2 means the conditions in which only non-conductive pollution occurs.
   But, temporary conduction may occur according to condensing.

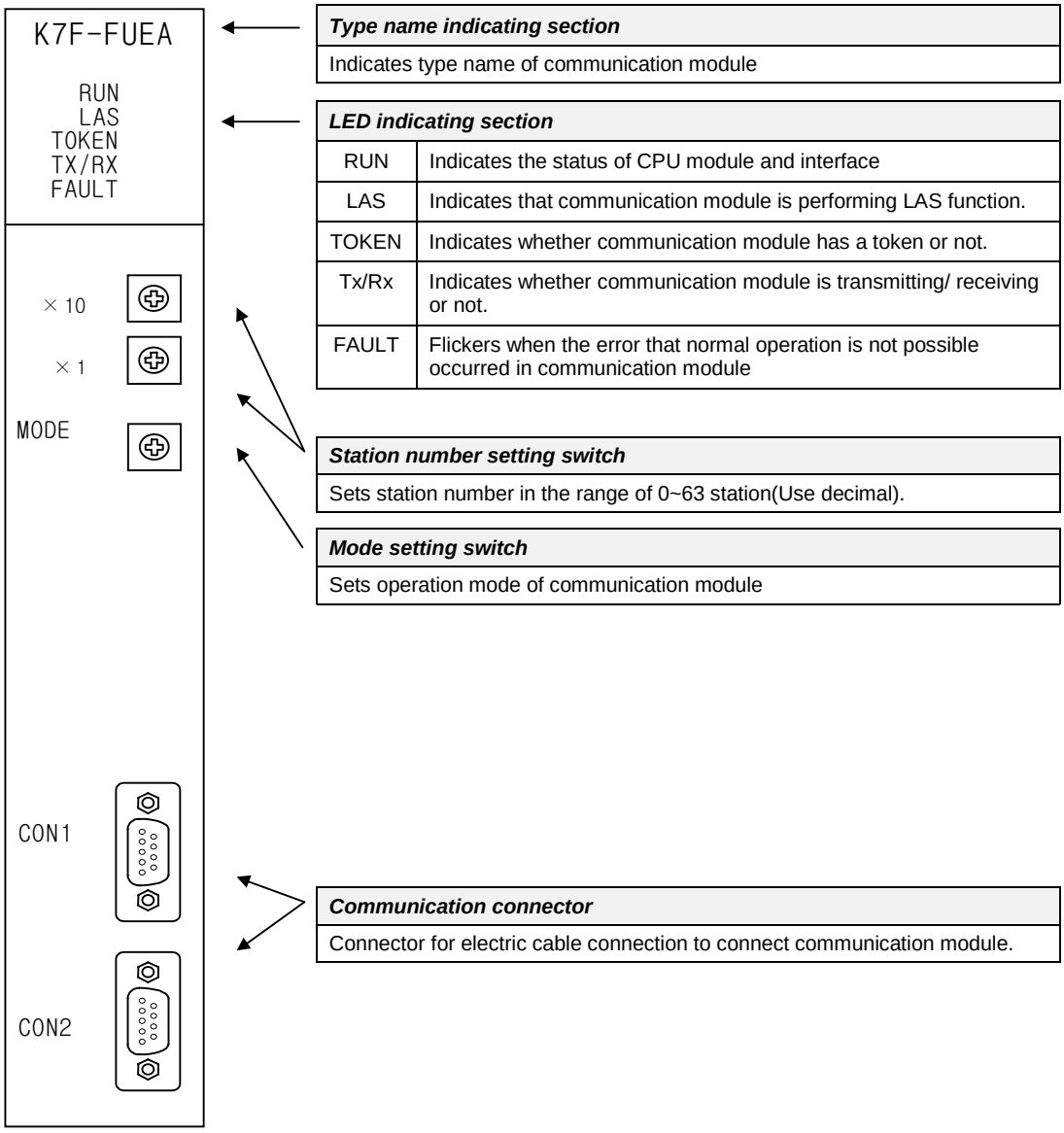
3.2 Structure and configuration

This describes the structure and configuration for representative type of Fnet and Mnet module.

3.2.1 Fnet master module structure : K7F-FUEA, K7F-FUOA, K4F-FUEA, K3F-FUEA

1) K7F-FUEA, K7F-FUOA, K4F-FUEA

Ex. of K7F-FUEA



Type name indicating section
Indicates type name of communication module

LED indicating section	
RUN	Indicates the status of CPU module and interface
LAS	Indicates that communication module is performing LAS function.
TOKEN	Indicates whether communication module has a token or not.
Tx/Rx	Indicates whether communication module is transmitting/ receiving or not.
FAULT	Flickers when the error that normal operation is not possible occurred in communication module

Station number setting switch
Sets station number in the range of 0~63 station(Use decimal).

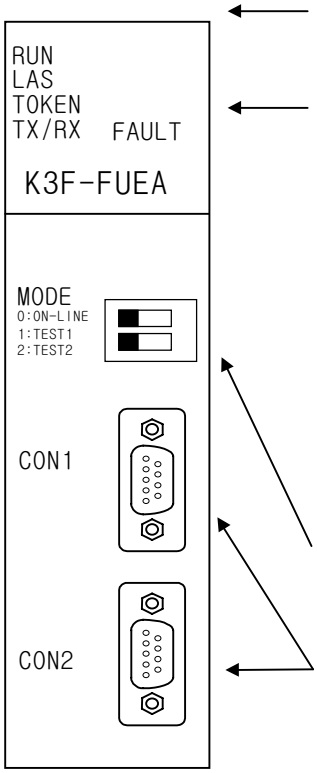
Mode setting switch
Sets operation mode of communication module

Communication connector
Connector for electric cable connection to connect communication module.

Remark

1. In the figure shown above, connector of K7F-FUOA is made of optical connector.
2. For mode setting switch, see 3.2.6 Fnet mode setting.

2) K3F-FUEA



LED indicating section	
RUN	Indicates the status of CPU module and interface
LAS	Indicates that communication module is performing LAS function.
TOKEN	Indicates whether communication module has a token or not.
Tx/Rx	Indicates whether communication module is transmitting/ receiving or not.
FAULT	Flickers when the error that normal operation is not possible occurred in communication module

Type name indicating section
Indicates type name of communication module

Mode setting switch
Sets operation mode of communication module

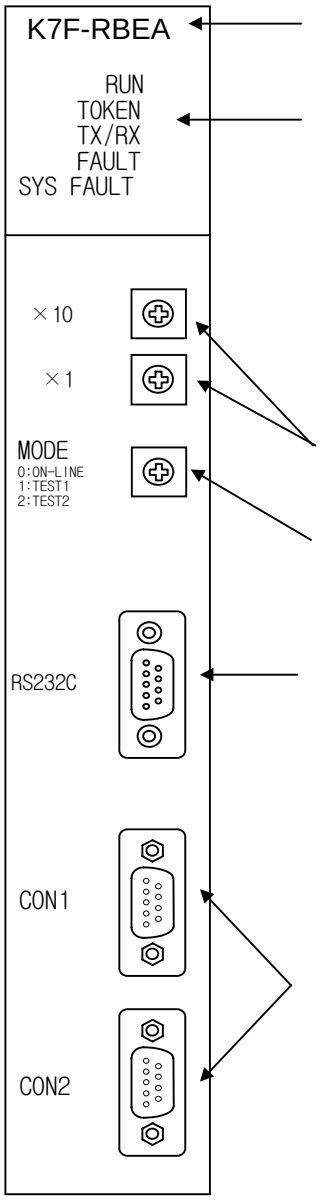
Communication connector
Connector for electric cable connection to connect communication module.

Remark

1. The station number setting switch is placed in the case.

3.2.2 Fnet slave module structure : K7F-RBEA, K7F-RBOA, K4F-RBEA

1) Front part(Ex. K7F-RBEA)



Type name indicating section
Indicates type name of communication module

LED indicating section	
RUN	Indicates the status of communication module
TOKEN	Indicates whether communication module has a token or not.
Tx/Rx	Indicates whether communication module is transmitting/receiving or not.
FAULT	Flickers when the communication error occurred.
SYS FAULT	Flickers when serious error of system itself or I/O module error occurred

Station number setting switch
Sets station number in the range of 0~63 station(Set in decimal).

Mode setting switch
Sets operation mode of communication module

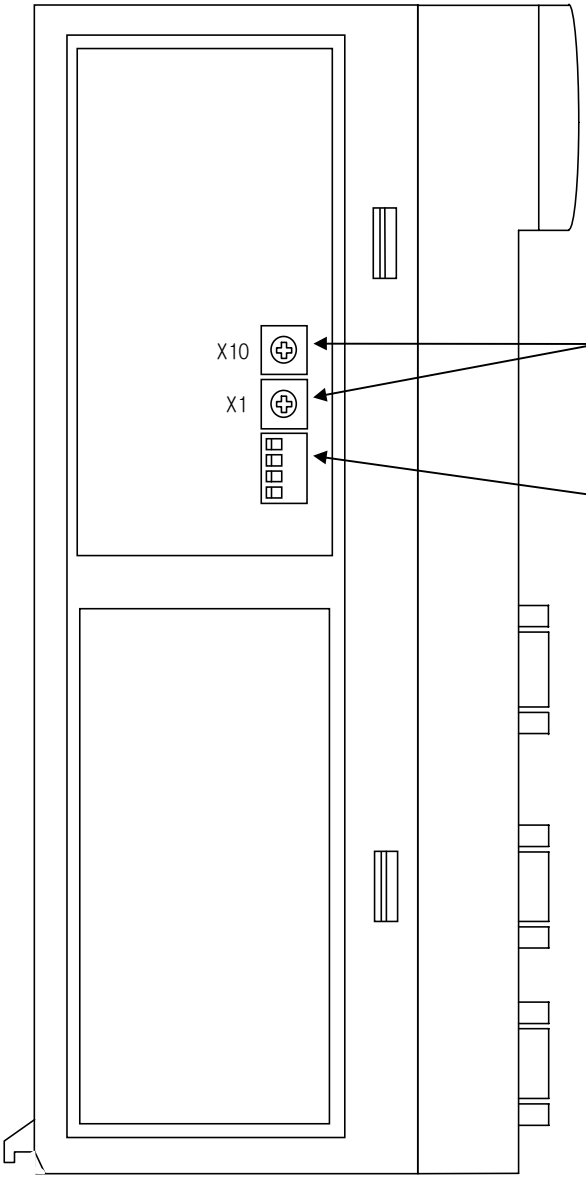
Communication connector (RS-232C)
Cable connector of KGLWIN connection.

Communication connector
Connector for electric cable connection to connect communication module.

Remark

In the figure shown above, connector of K7F-RBOA is made of optical connector, and there is no RS-232C port in K4F-RBEA.

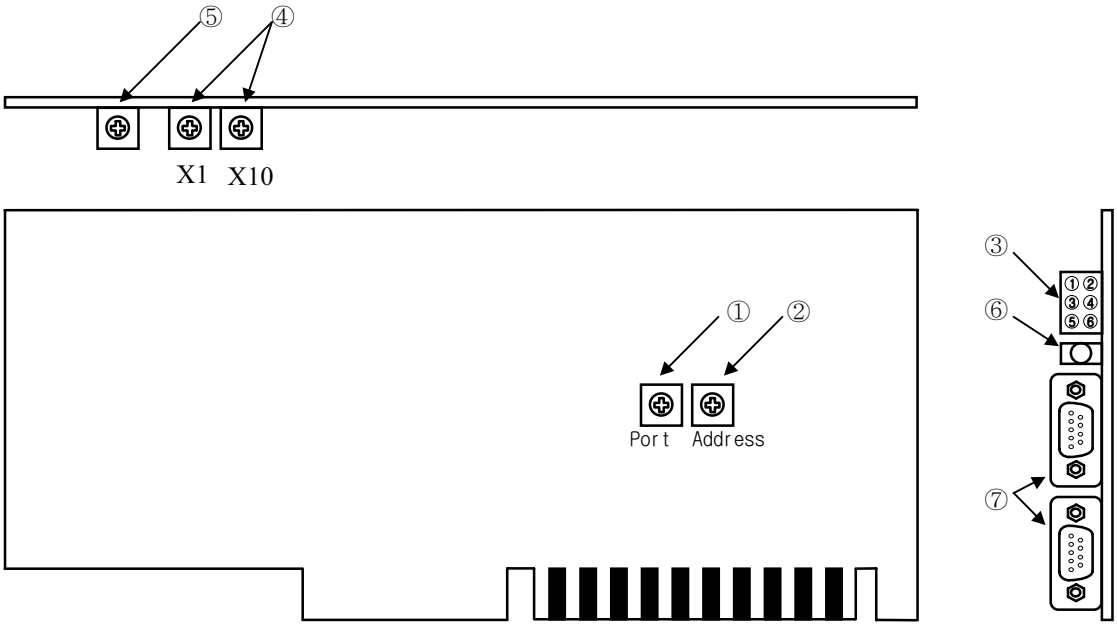
2) Side part(Ex. K7F-RBEA)



Station number setting switch
Sets master station number of remote communication module(Set in the range of 0~63 station using decimal).

Output of emergency data
Specifies output data type when communication failure by cable cut off. (See 3.2.6 Fnet mode setting)

3.2.3 Fnet Computer interface module structure : G0L-FUEA



	① Port selection	② Address selection
0	3E0	FC00
1	3C0	F800
2	3A0	F400
3	380	F000
4	360	EC00
5	340	E800
6	320	E400
7	300	E000
8	2E0	DC00
9	2C0	D800
A	2A0	D400
B	280	D000
C	260	CC00
D	240	C800
E	220	C400
F	200	C000

③ → ***LED indicating section***

No.1	POWER	Indicates whether power is being supplied to communication module
No.2	RUN	Indicates the status of CPU module and interface
No.3	LAS	Indicates that communication module is performing LAS function.
No.4	TOKEN	Indicates whether communication module has token or not.
No.5	Tx/Rx	Indicates whether communication module is transmitting/receiving or not.
No.6	FAULT	Flickers when the error that normal operation is not possible occurred in communication module

④ → ***Station number setting switch***

Sets station number in the range of 0~63 station(Set in decimal).

⑤ → ***Mode setting switch***

Sets operation mode of communication module

⑥ → ***Reset switch***

A switch to initialize communication module

⑦ → ***Communication connector***

Connector for electric cable connection to connect communication module.

Remark

1. For mode setting switch, see 3.2.6 Fnet mode setting.
2. Port is set to No.5(340) and address is set to No.9(D800) by factory default.
3. This should be set in order not to be duplicated with other device area of computer previously used, and add DEVICE=C:\WINDOWS\EMM386.EXE NOEMS X=D800-D8FF(if address has been set to No.9(D800)) in CONFIG.SYS to use set area for not continuous or extended area of computer but this module.

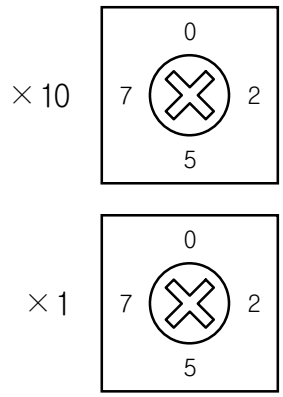
3.2.4 Fnet LED signal name and indication content

Device type	LED Name	Meaning of LED indication	LED On	LED Off
K7F-FUEA K7F-FUOA K4F-FUEA K3F-FUEA G0L-FUEA	RUN	Indicates the status of CPU module and interface	Normal	Abnormal
	LAS	Indicates that communication module is performing LAS function.	In proceeding	
	TOKEN	Indicates whether communication module has token or not.	Has	Does not have
	Tx/Rx	Indicates whether communication module is transmitting/ receiving or not.	Flicker during communication	
	FAULT	Indicates the status of communication module.	Abnormal	Normal
K7F-RBEA K7F-RBOA K4F-RBEA	RUN	Indicates the status of communication module.	Normal	Abnormal
	TOKEN	Indicates whether communication module has token or not.	Has	Does not have
	Tx/Rx	Indicates whether communication module is transmitting/ receiving or not.	Flicker during communication	
	FAULT	Indicates whether communication error exists or not.	Abnormal	Normal
	SYS FAULT	Indicates whether system error or I/O module error occurred or not.	Abnormal	Normal
G0L-SMQA G0L-SMIA G0L-SMHA	PWR	Indicates power status.	Power On	Power Off
	TRX	Indicates Tx/Rx or not of communication module.	Flicker during communication	
	ERR	Indicates communication error or not.	Abnormal	Normal

* For details on LED, see Appendix A1, LED indication.

3.2.5 Fnet station number setting

1) Local station number setting

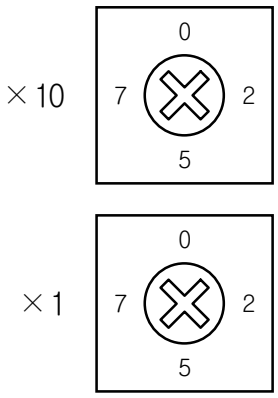
Applied Device type	Detailed drawing of station number switch	Description
K7F-FUEA K7F-FUOA K7F-RBEA K7F-RBOA K4F-FUEA K4F-RBEA K3F-FUEA G0L-FUEA G0L-SMQA G0L-SMIA G0L-SMHA		(1) Station number can be set from 0 to 63(Decimal). (2) Station number setting (Factory default is 0)

Switch	Setting
X 10	Sets ten's figure of station number
X 1	Sets one's figure of station number

(3) GM6 : The station setting switch is placed in the case.

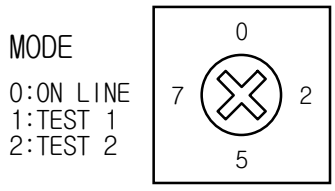
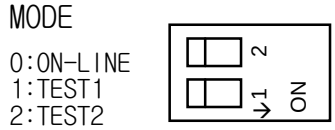
2) Master station number setting

Sets station number of Fnet master module, which can transmit and receive *high speed link* data in Fnet slave module(Station number switch is located inside of case).

Applied Device type	Detailed drawing of station number switch	Description
K7F-RBEA K7F-RBOA K4F-RBEA G0L-SMQA G0L-SMIA G0L-SMHA		(1) Station number can be set from 0 to 63(Decimal). (2) Station number setting (Factory default is 0) **Switch** / **Setting** X 10 — Sets ten's figure of station number X 1 — Sets one's figure of station number

3.2.6 Fnet mode setting

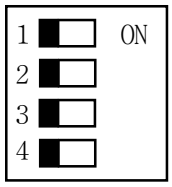
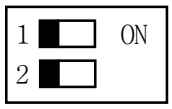
1) Test mode

Applied Device type	Detailed drawing of mode switch	Description
K7F-FUEA K7F-FUOA K7F-RBEA K7F-RBOA G0L-FUEA		(1) Mode can be set from 0 to 2. (GM6 : 0 ~ 3) (2) Mode setting (Factory default is 0) **Mode** / **Function** 0 — Performs normal operation 1 — Sets the unit as data transmitting station in communication test 2 — Sets the unit as data transmitting station in communication test * For details, see chapter 7, Diagnosis function.
K4F-FUEA K4F-RBEA		

2) Emergency data output setting

In Fnet slave module, when the communication with remote station is cut off by remote station error or line error during communication, setting of these switches specifies an operation between latching I/O data in slave module and outputting optional user-defined data.

<table>
<tr><th>Applied Device type</th><th>Detailed drawing of mode switch</th><th>Description</th></tr>
<tr><td>K7F-RBEA

K7F-RBOA</td><td> 
</td><td>
<table>
<tr><th>Mode</th><th>Function</th></tr>
<tr><td>  </td><td>Latches the last data during communication error.</td></tr>
<tr><td>  </td><td>Outputs user-defined data during communication error (Default is data reset).</td></tr>
</table>
</td></tr>
<tr><td>K4F-RBEA
G0L-SMQA
G0L-SMIA
G0L-SMHA</td><td> 
</td><td>
<table>
<tr><th>Mode</th><th>Function</th></tr>
<tr><td>  </td><td>Latches the last data during communication error.</td></tr>
<tr><td>  </td><td>Outputs user-defined data during communication error (Default is data reset).</td></tr>
</table>
</td></tr>
</table>

Remark

1. All of the switches are set to off by factory default.
2. User can input user-defined data for communication error in KGLWIN.
   (Refer to 6.6.7, Setting emergency output data of remote module.)

Chapter 4 Transmission specifications

4.1 Transmission specifications of Fnet

4.1.1 Transmission specifications of Fnet master module

Product of Fnet master module : K7F-FUEA, K7F-FUOA, K4F-FUEA, K3F-FUEA, G0L-FUEA

Table 4.1.1 Transmission specifications of Fnet master module

Item		Specification
Transmission speed		1Mbps common in Fnet module
Encoding type		Manchester Biphase-L
Electric	Transmission distance (per segment)	Max. 750m
	Transmission distance (during using repeater)	Max. 750m × (6 repeater + 1) = 5.25 km
	Transmission line	Twisted pair shielded cable
Optical	Transmission distance (per segment)	Max. 3km
	Transmission distance (during using EOC)	Max. 3km × (6 EOC +1) = 21km
	Transmission line	Optical cable
Max. number of station connection		Master + slave = 64 station (At least one master should be connected)
Max. size of protocol		256 byte
Access type of communication right		Circulated token passing
Communication type		Connection oriented service Connectionless service
Frame error check		CRC 16 = $X^{15} + X^{14} + X^{13} + ... + X^2 + X + 1$

4.1.2 Transmission specifications of Fnet slave module

Product of Fnet slave module : **K7F-RBEA, K7F-RBOA, K4F-RBEA, G0L-SMQA, G0L-SMIA, G0L-SMHA**

Table 4.1.2 Transmission specifications of Fnet slave module

Item		Specification
Transmission speed		1Mbps
Encoding type		Manchester Biphase-L
Electric	Transmission distance (per segment)	Max. 750m
	Transmission distance (during using repeater)	Max. 750m × (6 repeater + 1) = 5.25km
	Transmission line	Twisted pair shielded cable
Optical	Transmission distance (during segment)	Max. 3km × (6 EOC +1) = 21km
	Transmission line	Optical cable
Max. number of stations connected		Link master class + Remote slave class = 64
Max. size of protocol		256 byte
Access type of communication right		Circulated token passing
Communication type		Connection oriented service Connectionless service

4.1.3 Transmission specifications of Fnet option module

Product of Fnet option module : **G0L-FREA, G0L-FOEA, G0L-FACA**

1) Repeater (G0L-FREA)

Table 4.1.3(A) Transmission specifications of repeater

Item	Specification
Communication speed	1Mbps
Encoding type	Manchester Biphase-L
Transmission line(Cable)	Twisted pair shielded cable
Max. extension distance per module	750m
Max. number of repeater between stations	6 units
Max. distance between stations	5.25km(when 6 repeater is installed)
Frame error check	CRC 16 = $X^{15} + X^{14} + X^{13} + ... + X^2 + X + 1$

2) Electric/Optical converter (G0L-FOEA)

Table 4.1.3(B) Transmission specifications of electric/optical converter

Item	Specification
Communication speed	1Mbps
Encoding type	Manchester Biphase-L
Transmission line(Cable)	Optical cable, twist pair cable
Max. transmission distance	3km(Optical)/750m(electric)
Function of signal regeneration	Regenerating, Reshaping function
Frame error check	CRC 16 = $X^{15} + X^{14} + X^{13} + ... + X^2 + X + 1$

3) Active coupler (Product : G0L-FACA)

Table 4.1.3(C) Transmission specification of active coupler

Item	Specification
Communication speed	1Mbps
Encoding type	Manchester Biphase-L
Transmission line(Cable)	Optical cable
Max. transmission distance	3km
Function of signal regeneration	Regenerating, Reshaping function
Frame error check	CRC 16 = $X^{15} + X^{14} + X^{13} + ... + X^2 + X + 1$

4.3 Cable specifications

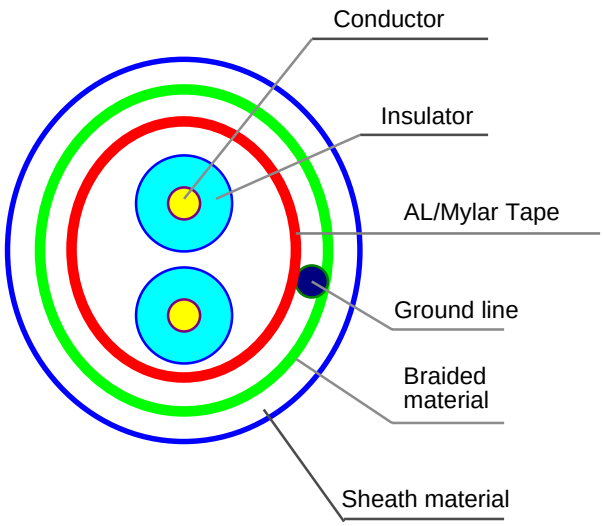
4.3.1 Twisted pair cable for Fnet

Type name of product : G0C-T□□□ (□□□ is length of cable, unit : m)
Ex.) Twisted pair cable 10m : G0C-T010

Table 4.3.1 Specifications of twisted pair cable for Fnet

Cable contents				
Product name		Low Capacitance LAN Interface Cable		
Type name		LIREV-AMESB		
Size		2 × 1.0mm (GS 92-3032, 18 AWG)		
Maker		LG CABLE CO.,LTD		
Electric characteristics				
Item		Unit	Characteristic	Test Condition
Conductor resistance		Ω/km	21.8 or less	Normal Temp.
Withstanding voltage(DC)		V/min	Withstands at 500V for 1 minute	In air
Insulation resistance		MEGA Ω-km	1,000 or more	Normal Temp.
Static electricity capacity		pF/m	45 or less	1 kHz
Characteristic impedance		Ω	120 ± 12	10 MHz
Characteristics in appearance				
Conductor	Number of core	CORE	2	
	Specification	AWG	18	
	Configuration	NO./mm	1/1.0	
	Outer diameter	mm	1.0	
Insulator	Thickness	mm	0.9	
	Outer diameter	mm	2.8	

- **Structural drawing**



4.3.2 Optical cable for Fnet

Type name : G0C-F□□□ (□□□ is length of cable, unit : m)
Ex.) Optical cable 10m : G0C-F010

Table 4.3.2 Specifications of optical cable

Cable contents	
Type name	Y22□□□□ : For indoor (for Bi-directional communication) D22□□□□ : For outdoor (for Bi-directional communication)
Connector type	ST - Type
Maker	Hewlett Packard(H.P)

Segment		For indoor(standard)	For outdoor(standard)
		Y22□□□□	**D22□□□□**
Outer diameter (mm)		2.9 × 5.8	4.8
Min. Radius of curvature	Loaded (cm)	5.0	7.5
	Unloaded (cm)	3.0	4.8
Weight(Kg/m)		16	21

Contents	Characteristic	Unit
Core	62.5	μm
Cladding	125	μm
Max. attenuation	5	dB/km
Standard attenuation	4.5	dB/km

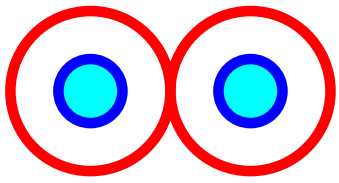
※ □□ □□

69 : Stainless
09 : Ceramic

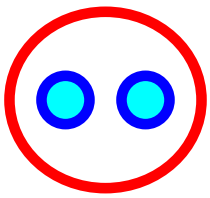
Connector type — Connector type

Ex.) If the cable type is Y226969, connector type is ST and the shape is stainless at both of the connectors.

- **Outside drawing of optical cable**



For indoor(Y22□□□□)



For outdoor(D22□□□□)

Chapter 6 Communication function

6.1 Programming method

In Fnet communication module, programming methods are divided into three :

– **High speed link**

High speed link is used when other station's data or information is exchanged in each given time and cyclically. Self or other station's data being in changing can be effectively used for operating system through cyclically referring, and the communication can be performed only through setting parameters.

For how to set, specify other station area and self area to be sent/received in parameter of KGLWIN, specify data size, speed, and station number, and then perform communication.

For data size, 1(16 points)~12,800 words for Mnet, and 1~3,840 words for Fnet can be communicated, and for communication cycle, 20ms~10sec. can be set according to communicating contents. Because simple parameter setting enables communication with other station, it is easy to use, and internal data processing is also high speed, thus many data can be cyclically processed at a time.

– **Programming**

High speed link is a cyclic communication, but the communication through function block is a service that communicates when special event occurs to perform communication with other station. It can be used when other station has error, which is sent to another station, or special contact is entered to communicate. For how to prepare programming, using function block according to data type previously created in KGLWIN program mode, specify the enable conditions, the module position in which communication module is mounted, station number, data area of self station, and other station area, and then prepare it.

– **Simultaneous use of high speed link and programming**

For some data, high speed link and program can be simultaneously used for program when the appropriate contents is sent if Tx/Rx of data are cyclically performed, and special event occurs.

Table 6.1 Difference between *high speed link* operation and operation through *function block*

Contents	*High speed link*	*Function block*
Basic unit of Tx/Rx data	1 word(16 points)	Available according to data type Ex.) Bit, Byte, Word…
Communication cycle	20ms~10sec.	Used whenever *function block* enable condition is started up.
Specifying station number	Used by setting station number of the front of communication module in parameter	Fnet uses the station number of the front of communication module, and Mnet uses MAC address.
How to operate	Parameter setting→downloading to PLC→*high speed link* allowed→RUN	Compiling→downloading to PLC→RUN
Control through CPU operation mode key	Used if *high speed link* is allowed even in state that CPU module is RUN, STOP, and PAUSE.	Performs operation according to operation mode of CPU module.

6.2 High speed link

6.2.1 Introduction

High speed link is a communication service which transmits data by setting link parameter, and a high speed data transmitting service that can exchange data after setting size of Tx/Rx(Transmission and Receive) data, period of Tx/Rx, area of Tx/Rx, and area of storage with parameter using KGLWIN or KLD-150S. The function is as follows :

☐ Function of *high speed link* block setting :

1) If there are many Tx/Rx areas, max. 64 blocks of each 32 of Tx/Rx can be set.
2) MASTER-K-Fnet can be set up to 60 word per block.
3) Max. link point can be used up to 3840 word in MASTER-K Fnet module.

☐ Function of Tx/Rx period setting :

User can set the period of Tx/Rx according to each block, and period of Tx/Rx can be set from 20ms to 10sec according to the area that quick Tx/Rx is specially needed or not, so entire communication efficiency can be improved.

☐ Function of Tx/Rx area setting :

Tx/Rx area can be set according to data block.

☐ Function of *high speed link* information :

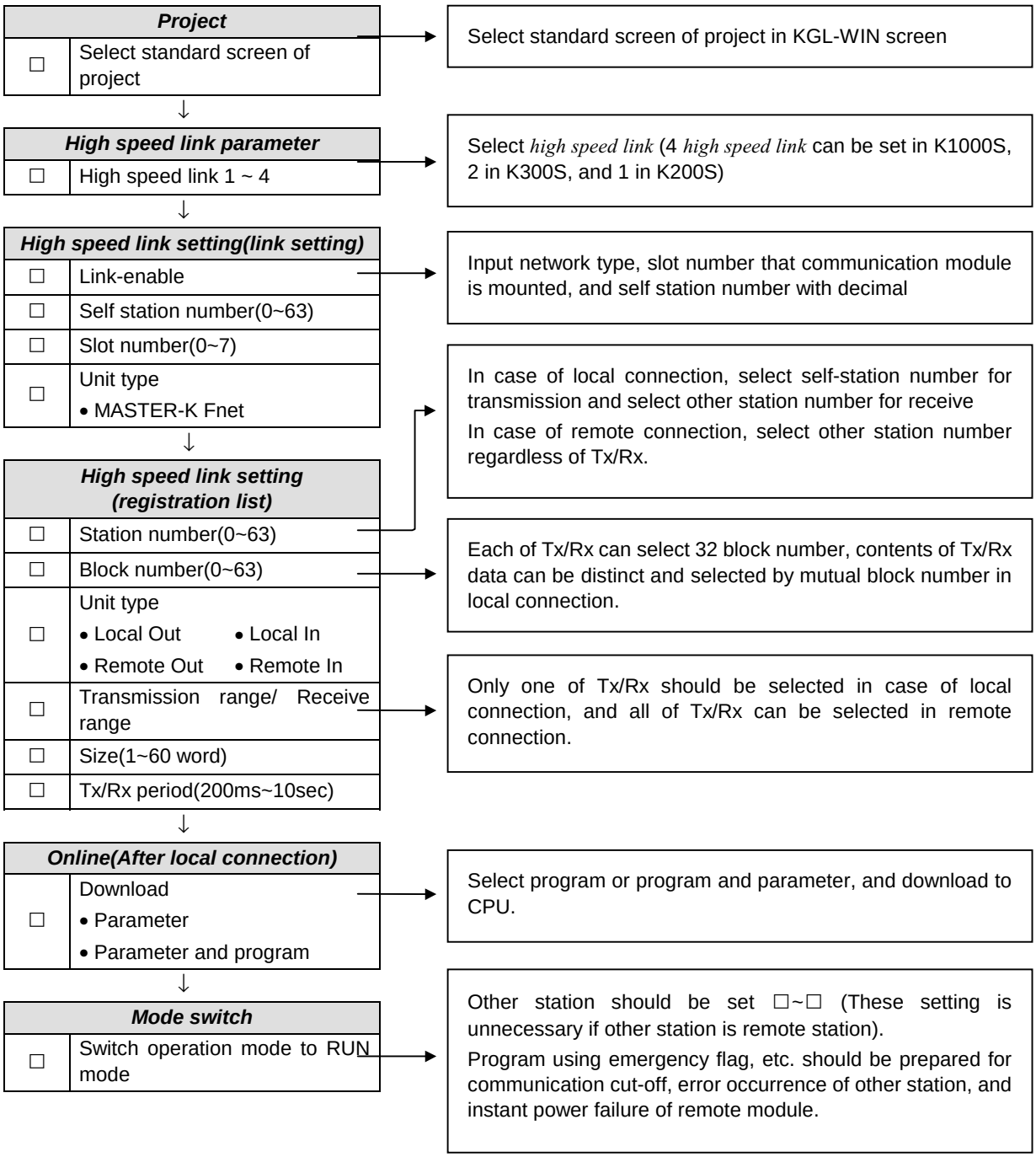
High speed link information is provided in special data register(D), so reliable communication system can be composed easily.

Table 6.2.1 shows *high speed link* point. Standard number of point for link is 1 word.

Table 6.2.1 Max. communication point according to device type

Item		Max. number of points for communication	Max. number of points for transmission	Max. number of blocks	Max. number of points per block	Remarks
Fnet communicat-ion module	K7F-FUEA/FUOA	3840 words	1920 words	64 blocks	60 words	Identical value for electric and optical
	K3L-RBEA/RBOA					
	K4F-FUEA					
	K4L-RBEA					
	K3F-FUEA					
	G0L-FUEA					

6.2.2 Setting sequence of *high speed link*



6.1.3 Parameter setting of *high speed link*

Selecting link parameter in project screen of KGL can set *high speed link* parameter. Setting sequence and functions according to each item are as follows:

(1) Preparing project of KGL
Fig. 6.1.1 is standard screen of project, and if user opens a project, it is displayed at the lower area of screen.

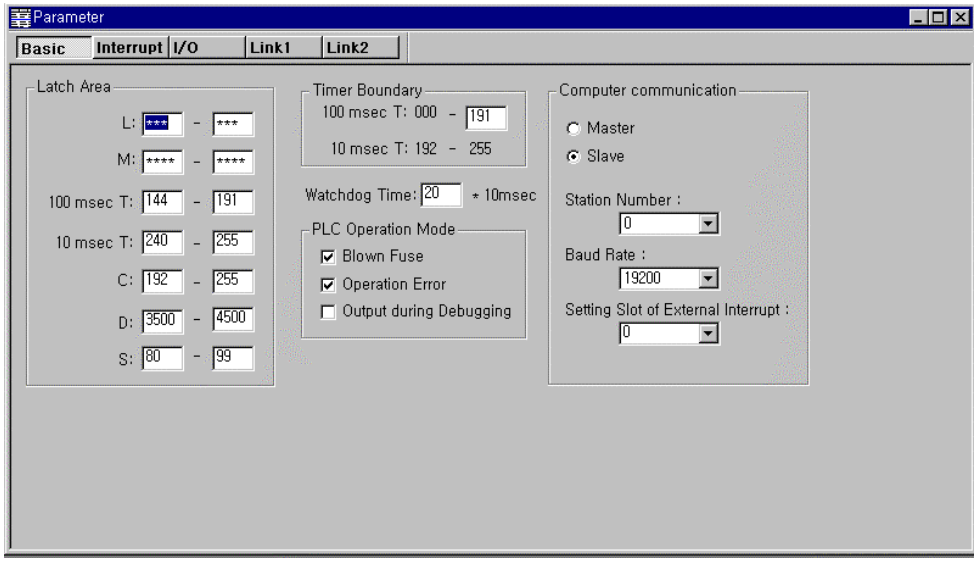


Fig. 6.1.1 Standard screen of KGL project(for K200S)

(2) Standard setting of link parameter
If user selects Link Parameter or High Speed Link1 in standard screen of KGL project as Fig. 6.1.1, standard screen of Link Parameter as Fig. 6.1.2 is displayed.

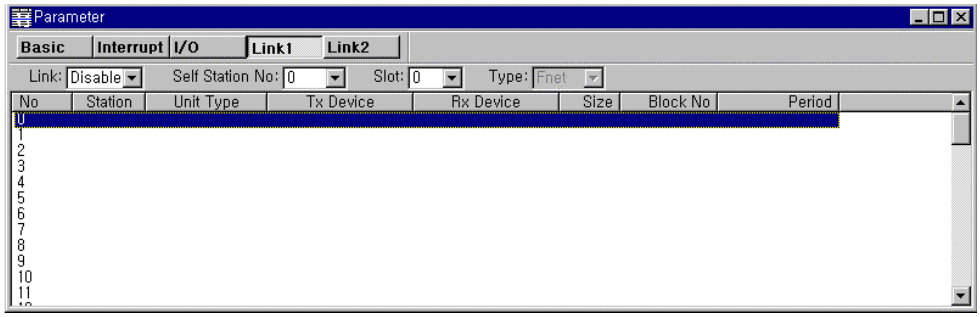


Fig. 6.1.2 Standard screen of link parameter

☐ **High speed link1 :**

This shows types of *high speed link* to modify, and max. 4 communication modules can be mounted in MASTER-K100S CPU, max. 2 can be mounted in MASTER-K300S, and 1 can be mounted in MASTER-K200S. High speed link number has nothing to do with slot number mounted, and only one *high speed link* parameter setting is possible for one communication module. Table 6.1.2 shows communication device type and max. number of mounting device according to MASTER-K CPU type.

Table 6.1.2 Mounting of communication module according to CPU type

Item	Communication module	Max. number of mounting devices	Remarks
MASTER-K1000S	K7F-FUEA, K7F-FUOA	4	Each of communication module can be combined.
MASTER-K300S	K4F-FUEA	2	
MASTER-K200S	K3F-FUEA	2	

☐ **Link Enable :**

Sets link permission of communication module, it will be enabled if item of Enable [ ] is selected with [X].

☐ **Self Station Number :**

Self station number can be set from 0 to 63 by using the switch for station number setting located at front part of communication module, and self station number should not be duplicated because it is peculiar number which distinguishes communication module of the same network.

☐ **Slot No :**

Slot number that communication module is mounted. A number can be selected with the range of 0 to 7.

☐ **No(Registration number) :**

Registration number is the serial number which shows sequence of registration of each parameter, and it can be set up to max. 64 with the number from 0 to 63, and it has nothing to do with the sequence of Tx/Rx.

(3) Detailed settings of link parameters

If user selects No.1 of *high speed link* registration number as Fig. 6.1.2, and clicks in Modify button or presses Enter key, Link Parameter Modify or Insert screen is displayed as Fig. 6.1.3.

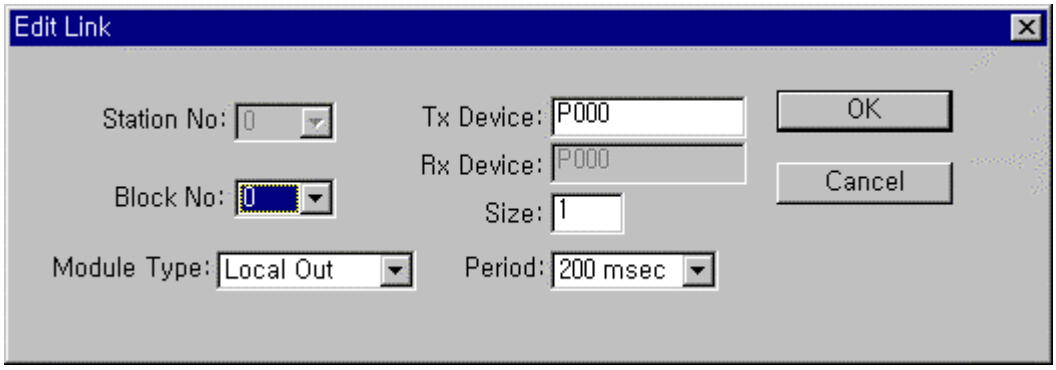


Fig. 6.1.3 Screen of Link Parameter Modify or Insert (for register No.1 of *high speed link* 1)

☐ Station No :

If user transmits data of setting item, self station number should be set, and if user receives them, other station number should be set. If the station type is slave, slave station number should be set for all of Tx/Rx. Setting method of station number is as Table 6.1.3.

Table 6.1.3 Setting method of station number

Unit Type	Station No	Station Range
Local Out	Self station number	0 ~ 63
Local In	Other(Local) station number	
Remote Out	Other(Remote) station number	
Remote In		

☐ Block No :

This is set to transmit and receive many data of several area from one station, and distinguishes data of many block each other. Station number and block number configured from transmission station is transmitted with transmission data. Block number and station number should be set for all of Tx/Rx station. Because storing the data in Receive Area can be made if the block No. is the same with other station No. of High Speed link Receiving parameter. Transmission block number can be set up to 32 and receive block number also can be set up to 32 for one station, so max. of each Tx/Rx block number is limited to 32. In this time, the same block No. setting with same station No. is impossible.

☐ Unit Type :

Types of other station or self station can be determined. If other station is slave, 'Remote Out' and 'Remote In' can be set. Setting of 'Remote Out' and 'Remote In' is impossible in Mnet system.

- Local Out : When data of self station is transmitted to other(local) station.
- Local In : When self station receives data of other(local) station.
- Remote Out : When data of self station is transmitted to remote slave module.
- Remote In : When self station receives data of remote slave module.

☐ Tx/Rx Device Name :

Tx/Rx Device Name means transmission and receive area, see Table 6.2.4 for setting.

Table 6.1.4 Setting area according to station type

Unit Type	Mode	Available setting area	Remarks
Local Out	Tx	All area of P,M,L,K,F,D,T,C	Transmission area of self station
	Rx	Setting is unnecessary	
Local In	Tx	Setting is unnecessary	
	Rx	Area of P,M,L,K,D,T,C	Receive area of self station
Remote Out	Tx	All area of P,M,L,K,F,D,T,C	Transmission area of self station
	Rx	P area	Receive area of remote station
Remote In	Tx	P area	Transmission area of remote station
	Rx	Area of P,M,L,K,D,T,C	Receive area of self station

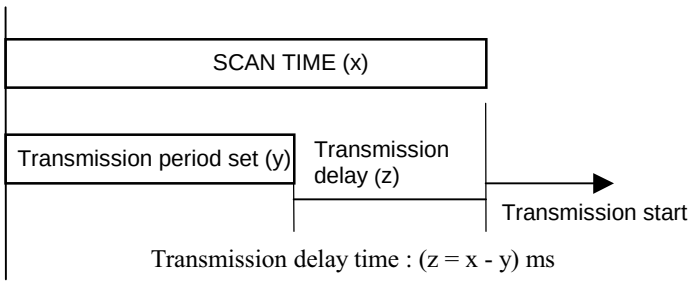
☐ **No :**

This means size of Tx/Rx data(unit is 1 word(16 points)), module type of Fnet system can be set up to 60 word and Mnet system can be set up to 200 word. If data size configured in receive mode is smaller than received data size, only the size of data configured in receive mode will be stored in storage area, so receive data can be selected according to the size of transmitted data.

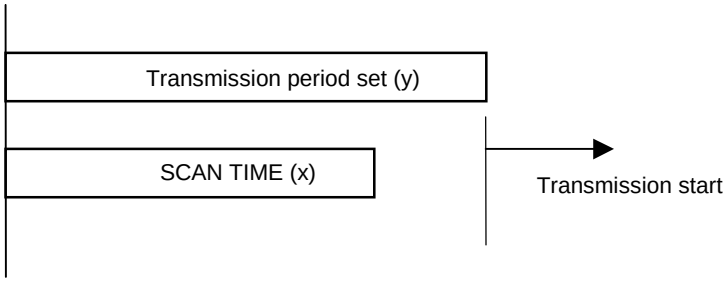
☐ **Tx/Rx Period :**

High speed link executes transmission and receive at that time when PLC program is finished by the parameter which user previously configured. If scan time of PLC program is short(within several ms), communication module transmits data according to program scan, and the increase of communication quantity with this causes reduction of communication efficiency. To prevent this, user can set communication period from 20ms to 10sec. Tx/Rx period means transmission period if selected block is set to transmission, and this means data receive checking period of selected block if it is set to receive. Transmission period determines data transmission period. For example, if transmission data is set to 200ms(standard value), it will be transmitted every 200ms. If scan time of PLC program is longer than transmission period previously set, it will be transmitted when program scan is finished, and transmission period will be the same as scan time of PLC program.

Fig. 6.1.4 shows the relation between transmission period and scan time.



(a) Delay time of data transmission if scan of PLC program is longer than transmission period



(b) Delay time of data transmission if scan of PLC program is shorter than transmission period

Fig 6.1.4 Scan of PLC program and transmission period

In case of data reception, it should be checked whether data of selected block is received exactly according to setting time, and RUN_LINK and LINK_TROUBLE contact can be made by setting selected TRX_MODE flag to ‘On’ when the data is received, and setting it to ‘Off’ when the data is not received. When user sets receive period, user must set bigger value than transmission period of other station to check whether transmission is normal.

6.1.4 Operation of high speed link

If user executes parameter download, after setting high speed link parameter and choosing OK, service of high speed link is started. At this time, selected link for standard screen of link parameter as shown Fig. 6.1.2 should be set to 'Enable'. Fig. 6.1.5 is screen of parameter download, and if user selects On-line menu and selects Download as shown in Fig. 6.1.2, Fig. 6.1.5 is displayed.

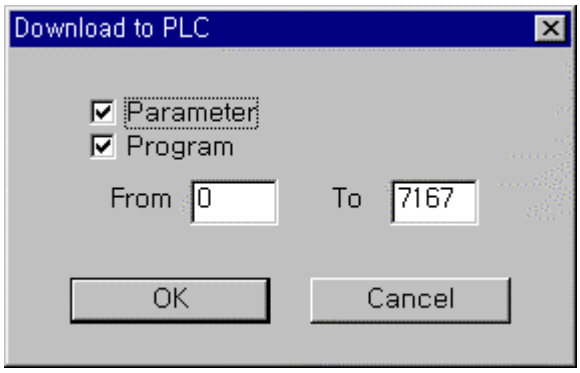


Fig. 6.1.5 Screen of parameter download

Like program, Download of high speed parameter is possible only if PLC is STOP mode. If *high speed link* is set to enable, it executes *high speed link* regardless of PLC operation mode. Battery is backed up in PLC CPU, and parameter and information of link-enable is preserved even if the power is cut off.
Operation relationship between PLC mode and *high speed link* is explained in Table 6.1.5.

Table 6.1.5 Relation between PLC mode and *high speed link*

Mode	Parameter download	Operation of *high speed link*	Remarks
RUN	X	O	If *high speed link* is allowed, *high speed link* will be operated regard less of PLC mode.
STOP	O	O	
PAUSE	X	O	
DEBUG	X	O	

6.1.5 Information of *high speed link*

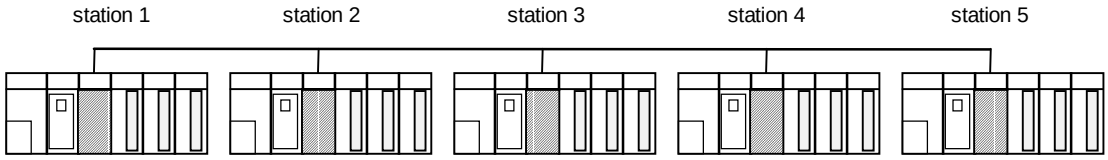
(1) Function of *high speed link* information
High speed link exchanges data among communication station of two or more. To confirm the reliability of data read from other station, it provides user with the information, which can check the state of *high speed link* service. Namely, there are entire information of RUN_LINK and LINK_TROUBLE, and individual information of HS_STATE, TRX_MODE, DEVICE_MODE, and DEV_ERROR, which shows communication state according to 64 registered item of in parameter. User can use device(see communication flag list of appendix) corresponding to the key word used in preparing program, monitor the state of *high speed link* using information monitor function of *high speed link*. Interlock operation with many PLC using *high speed link* should be performed, after confirming reliability of Tx/Rx data using *high speed link* by *high speed link* information like Run-Link, Link-Trouble.
Functions and definition of *high speed link* information are as Table 6.1.6.

Table 6.1.6 High speed link information

Segment	RUN_LINK	LINK-TROUBLE	Tx/Rx status (TRX_MODE)	Operation mode (DEV_MODE)	Error (DEV_ERROR)	High speed link status (HS_STATE)
Type of information	Entire information	Entire information	Individual information	Individual information	Individual information	Individual information
KEYWORD (=number of parameter, 1~4)	_HS□ RLINK	_HS□ LTRBL	_HS□TRX[n] (n=0..63)	_HS□MOD[n] (n=0..63)	_HS□ERR[n] (n=0..63)	_HS□ STATE[n] (n=0..63)
Monitor	Available					
Use of program						

(a) RUN_LINK(_HS□RLINK)

This is entire information indicates whether *high speed link* is made using parameter configured by user. This parameter can be set to 'On', if link-enable is 'On' and registered list setting of parameter is set to normal and all data which are appropriate to registered list setting of parameter are transmitted and received according to Tx/Rx period setting and the state of all other station's parameter setting is RUN and there is no error simultaneously. This is entire information contact, and if this is set to 'On' once, maintains 'On' until link-enable is set to 'Off'.



(a) Configuration of *high speed link* system

Station 1	Station 2	Station 3	Station 4	Station 5
Transmission : 2 word Receive : 2 word (Station No. 2) Receive : 2 word (Station No. 2)	Transmission : 2 word Receive : 2 word (Station No. 1) Receive : 2 word (Station No. 4)	Transmission : 2 word Receive : 2 word (Station No. 1) Receive : 2 word (Station No. 5)	Transmission : 2 word	Transmission : 2 word

(b) Example of *high speed link* parameter setting

Fig. 6.1.6 Condition of RUN_LINK On

Fig. 6.1.6 shows configuration of *high speed link* system to explain the conditions that RUN_LINK set to 'On'. It is explained considering that 5 station communication Module is connected with network as Fig.(a) and *high speed link* is made with the parameter set as Fig.(b).
In this system, the conditions that RUN_LINK of station 1 turns 'On' are as follows :

- ☐ Link-enable of self station(station 1) is 'On'
- ☐ State of self station(station 1) is RUN
- ☐ Self station(station 1) has no error
- ☐ Data configured with transmission parameter of self station(station 1) are transmitted according to transmission period.
- ☐ Receive data of station 2 or 3 are received according to receive period
- ☐ Operation mode of other station(station 2 or 3) which receives from self station(station 1) is RUN mode and has no error, and transmits and receives according to Tx/Rx period
- ☐ State of all station is RUN, data block is communicated normally, and the parameter configured in each station itself is communicated normally

If above 7 items are contented, RUN_LINK of station 1 is set to 'On'. If many PLC performs interlock operation through *high speed link*, user can verify reliability using RUN_LINK contact. Once RUN_LINK contact is set to 'On', it maintains the state until link-enable is set to 'Off'. User can use LINK_TROUBLE information contact for abnormal state monitoring like communication error.

(b) LINK_TROUBLE(_HS□LTRBL)
If RUN_LINK is 'On' and the case that doesn't comply with the condition of RUN_LINK to be 'On' is occurred, LINK_TROUBLE is set to 'On', and if the condition is removed, it is set to 'Off'.

(c) State of Tx/Rx(_TRX□STATE[0..63])
If Tx/Rx operation for registered item is performed exactly according to Tx/Rx period, appropriate bit is set to 'On' and if Tx/Rx operation for registered item is not performed according to Tx/Rx period, appropriate bit is set to 'Off'.

(d) Operation mode(_HS□MODE[0..63])
This mode shows operation mode information of max.64 according to registered list. If the station configured in registered items is RUN mode, appropriate bit is set to 'On'. In STOP/PAUSE/DEBUG mode, appropriate bit is set to 'Off'.

(e) Error(_HS□ERR[0..63])
This mode shows error mode information of max.64 according to registered list. Error shows overall situation that PLC can't operate user program normally. Other station performs normal operation if this is set to 'Off, and other station performs abnormal operation if this is set to 'On'.

(f) State of *high speed link*(_HS□STATE[0..63])
This shows overall information for registered list by overall of individual item information. Namely, This is set to 'On' if Tx/Rx state of selected list is normal, operation mode is RUN, and has no error. This is set to 'Off' if Tx/Rx state of selected list doesn't comply with above items.

Remark

Among keyword name used in items of (a)~(f)

☐ : Shows number of *high speed link* used in parameter setting(If communication module is 1 unit, 1 is normally used).

[0..63] : Shows registered number of individual parameter(This can be used to monitor communication state according to each parameter of 0~63 or this can be used in program).

(2) Information monitor of *high speed link*

High speed link information can be monitored using Monitoring Window and Read Information menu after online connection of KGL. There are two monitoring method. First, selects flag to monitor from Flag Monitor menu of Monitoring Window and monitors individual or entire information. Second, selects *High speed link* parameter menu of Read information and monitors entire information.

(a) Flag Monitor

With this function, user can monitor by choosing flag using appropriate Flag Monitor menu of KGL. If user selects Flag Monitor in Monitoring Window of On-line menu, Flag Monitor screen is displayed as Fig. 6.1.7, and if user presses Enter key, Register Flag screen is displayed. User can register flag by choosing appropriate high speed information flag from Register Flag screen. See flag list of appendix for flag information. If user registers in Fig. 6.1.7, monitoring is started in Flag Monitor screen as Fig. 6.1.8. If monitoring is not performed, check if monitoring is on.

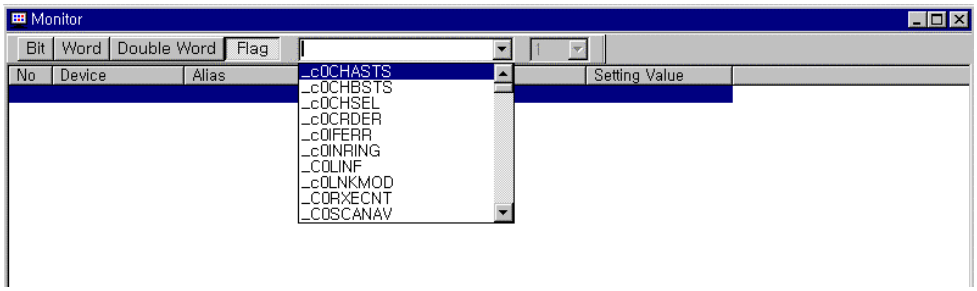


Fig. 6.1.7 Flag Monitor screen and Register Flag screen

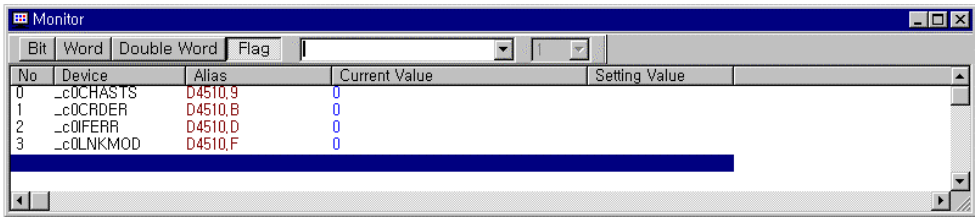


Fig. 6.1.8 Flag Monitor screen(the state that flag is registered)

(b) Monitor in Read Information

If user selects High speed link parameter in Read Information of On-line menu, detailed information for *high speed link* parameter is shown in Fig. 6.1.9. L00.S00 of type item means local 00 station and send 00 block, data(P1) of self station is transmitted to local station of station number 0 through No.0 block. L01.R01 means local 01 station and receive 01 block, transmission data of local station which is number 1 is received in P2.

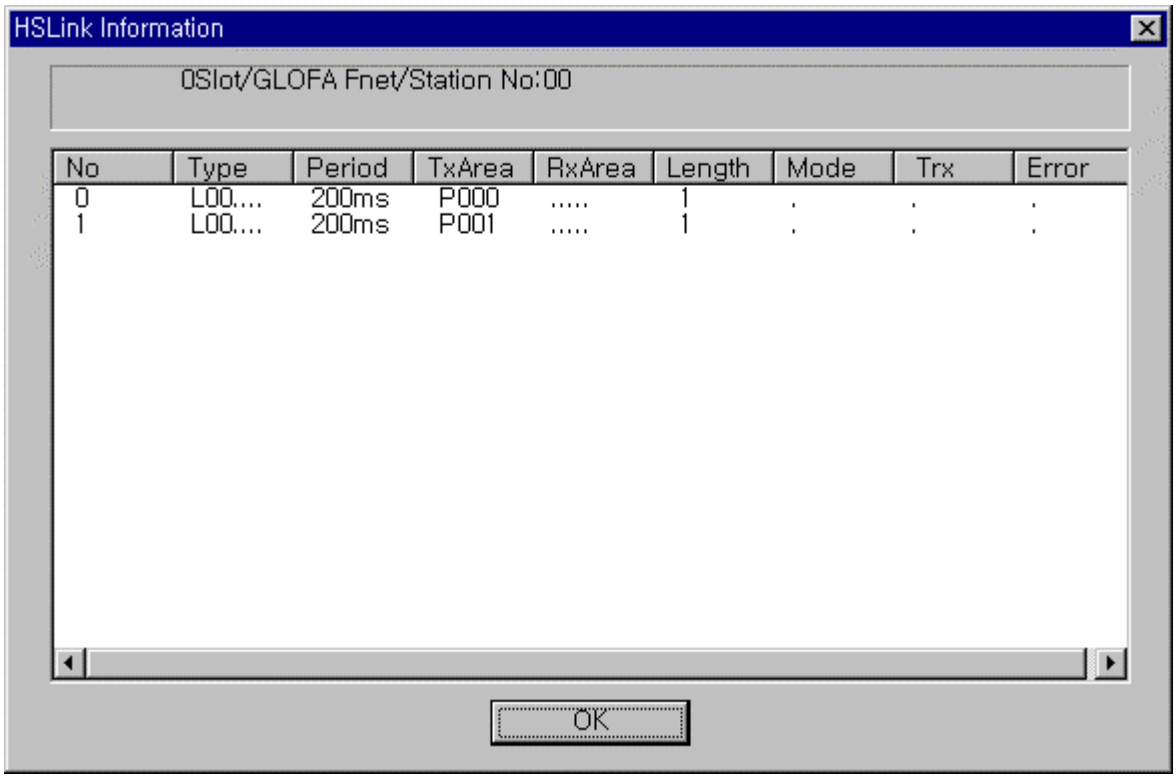
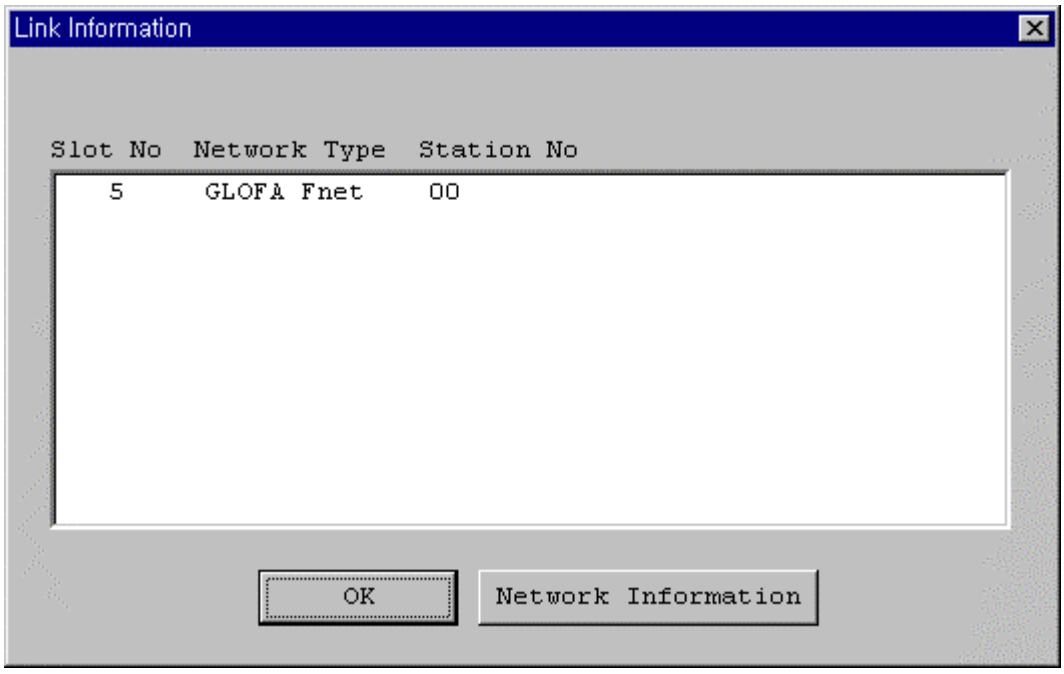


Fig. 6.1.9 High Speed Link Parameter

(c) Monitoring 'link information' in read information menu.



6.1.6 Speed calculation of *high speed link*

(1) Introduction

Transmission speed of *high speed link* data can be determined by many factors. Because one data block of a station is stored in receive area of other station through the path as Fig. 6.1.10.

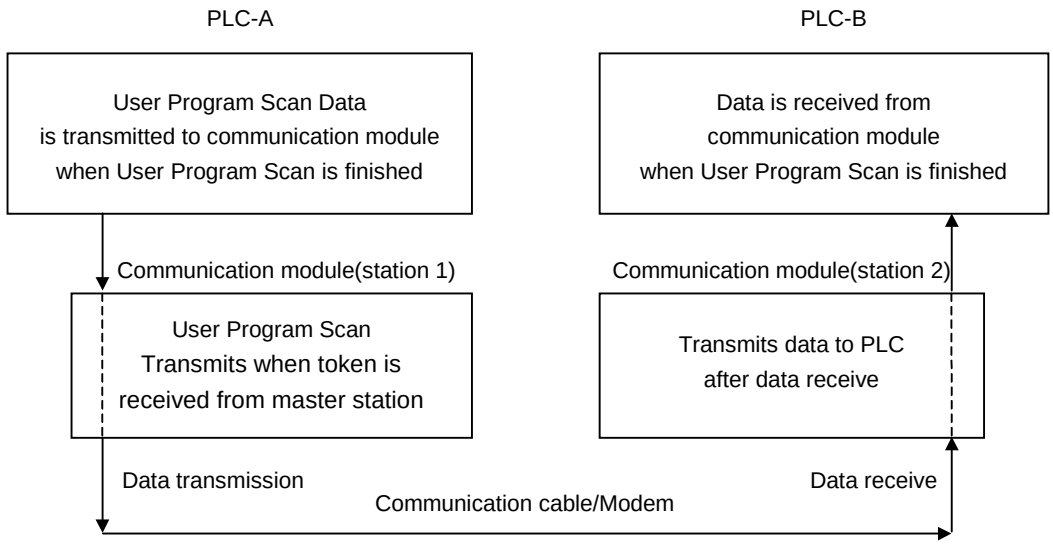


Fig. 6.1.10 Data transmission path through communication module

Three paths should be passed to transmit data to other staion through communication as Fig. 6.1.10, and transmission time is determined by the time taken according to each path. Main path of data transmission and the elements which affect the time taken according to each path are as Table 6.1.7.

Table 6.1.7 Data transmission path and time elements

Path	Time affecting elements
PLC CPU(A) → Com. module(station 1)	Scan time of PLC-A program
Comm. module(station 1) → Com. module(station 2)	Scan time of comm. + Scan time of comm. O/S
Comm. module(station 2) → PLC CPU(B)	Scan time of PLC-B program

Data from PLC CPU to communication module or from communication module to PLC CPU is transmitted when PLC user program is finished. Therefore, scan time of PLC user program is main element of data transmission, and if user selects PLC information of KGL On-line menu, user can know max./min./current scan time of program. Communication module should obtain communication right, namely, token to transmit data of itself, and this is determined according to token rotation time.

Fig. 6.1.11 shows transmission point according to the scan time of PLC program and communication.

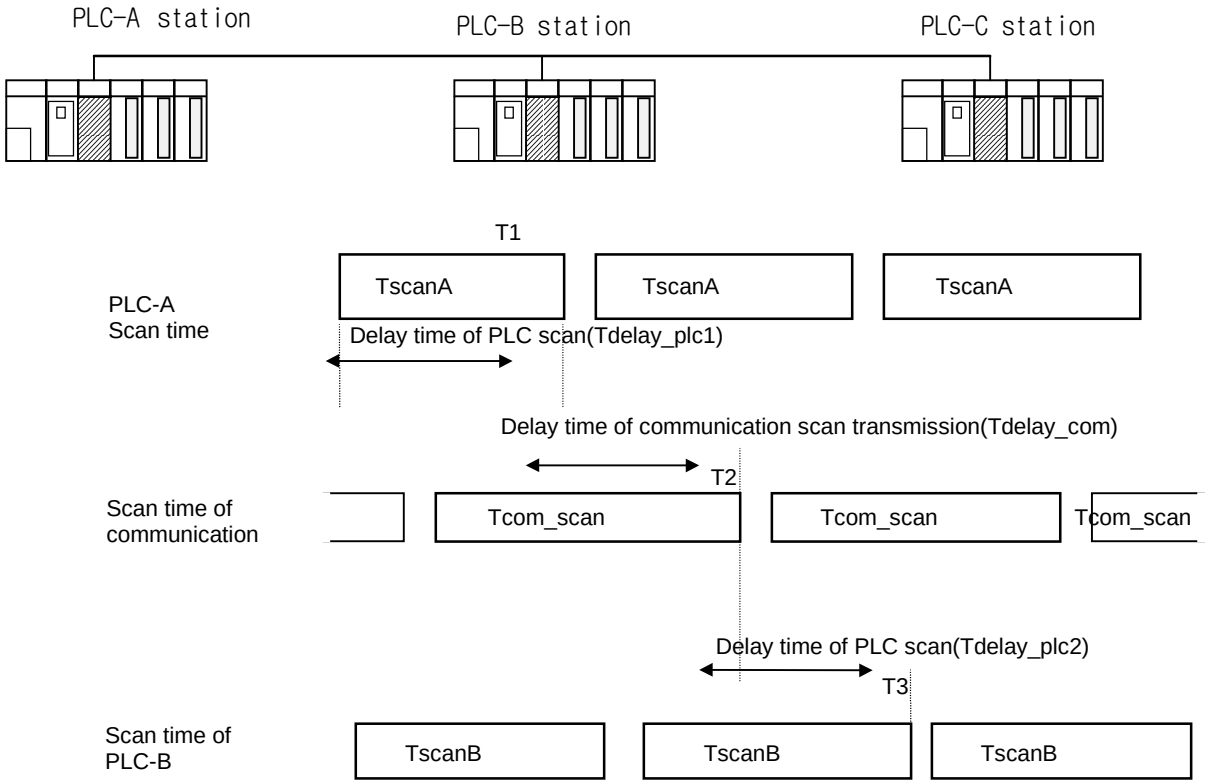


Fig. 6.1.11 Relation between PLC and communication in scan time

In Fig. 6.1.11, PLC-A station transmits data from T1 to communication module when program of PLC-A station finishes, so the time according to Tdelay_plc1 is delayed. Communication module receives data from PLC, waits during delay time of communication scan(Tdlay_com), and transmits data, max. delay time is Tcom_scan 1. Communication module, also in PLC-B, transmits receive data to PLC after waiting for the time of Tdelay_plc2, so max. delay time is TscanB 2. Delay time of communication is determined according to many factors, i.e. entire number of communication station, program size, and O/S scan time of communication module.

(2) Speed calculation method of *high speed link*

High speed link is max. time that data of one block is transmitted from PLC-A to PLC-B. Speed of *high speed link* is calculated with two different cases. One is applied to complex system that number of station is 10 or more and number of data exceeds 512 byte, and the other is applied to simple system. The calculation is as follows :

(a) Simple system

In a simple system that the number of entire communication station is less than 10 and the size of transmission data is below 512 byte, speed of *high speed link* is calculated with a simple equation as Equation 6-1.

St = P_scanA + C_scan + P_scanB ····· Equation 6.1

St = max. transmission time of *high speed link*
P_scanA = max. program scan time of PLC A
P_scanB = max. program scan time of PLC B
C_scan = max. communication scan time

Cscan = Th × Sn ····· Equation 6.2

Th = Token hold time : token using time per 1 station
Sn = Total station number

(b) Complex system

In a complex system that the number of entire communication station is 10 or more and the size of transmission data is 512 byte or more, speed of *high speed link* is calculated as Equation 6-3.

St = Et × To × Ntx + Mf ····· Equation 6.3

Et = Effective Tx ratio
To = Octel time(transmission time of one byte)
Ntx = Total Tx number
Mf = Margin factor, and each item is determined as follows :

☐ Et = St × Nf ····· Equation 6.4

St = total number of communication station
Nf = Network factor, constant value according to characteristic of communication system
Fnet system : 1.5, Mnet system : 1.2

☐ To = Octel time, time taken in transmitting one byte data as a serial data,
and this is determined as follows :
Fnet : 8 us, Mnet : 1.6 us

☐ Ntx = Number of total receive data including number of variable service,
and this is determined as follows by Fnet system and Mnet system :

– Fnet : Sum of transmission byte number of *high speed link* + Number of variable f/b × 256
– Mnet : Sum of transmission byte number of *high speed link* + Number of variable f/b × 1024

☐ Mf = Margin factor for elements which don't be expressed with above expressions, like O/S scan time of communication module, etc., and this is determined as follows :

– Fnet : 16ms, Mnet : 50ms

6.1.7 Ex. 1) : High speed link between PLCs of Fnet

This explains setting method of *high speed link* parameter for data communication with I/O structure as Fig. 6.1.6, in master system of MASTER-K Fnet as Fig. 5.2.2.

Table 6.1.6 I/O configuration and Tx/Rx flow

Tx/Rx structure		I/O configuration	Transmission area	Receive area
K1000S (station 0)	TX : → K1000S(station 1)	Slot 0 : Master Slot 1 : OUT 32 points Slot 2 : IN 32 points	P3, P4	-
	RX : ← K1000S(station 2)		-	D0100
K1000S (station 1)	TX : → K1000S(station 2)		P3, P4	-
	RX : ← K1000S(station 0)		-	D0100
K1000S (station 2)	TX : → K1000S(station 0)		P3, P4	-
	RX : ← K1000S(station 1)		-	D0100

All K1000S CPUs transmits input value of input module in self slot 2 with 2 word, saves receive data from other station at D0100 and D0101, and outputs it output module(P1, P2) of slot 1. Configuration and program of *high speed link* parameter for these data exchange is explained in Fig. 6.1.15 and Fig. 6.1.16. The same program can be used in each of them, but link parameter should be set differently(In Fnet communication of K300S, the same program and parameter can be used. With K200S, the address of D area should be changed).

(a) Preparing user program

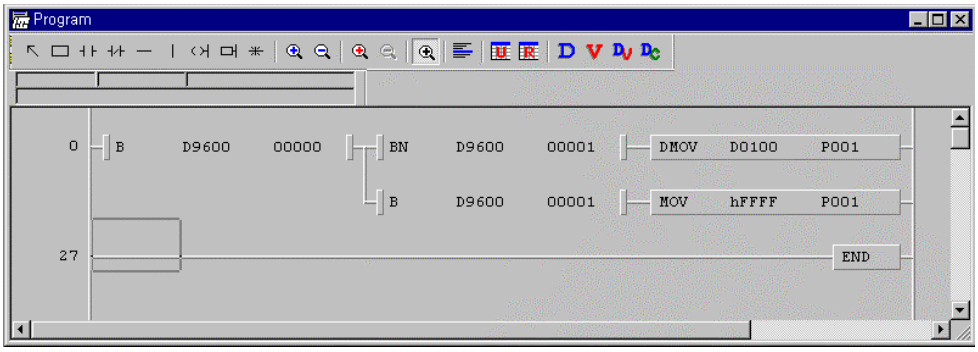


Fig. 6.1.15 User program of Ex.1

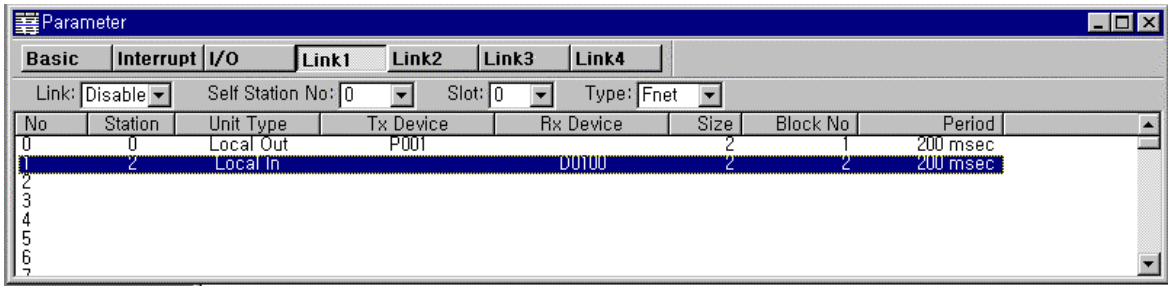
Fig. 6.1.15 is user program of Ex.1. If *high speed link* is normal(RUN_LINK=1, LINK_TROUBLE=0), it outputs receive data, D0100 and D0101, to output module of P001and P002. If *high speed link* is abnormal(LINK_TREBLE=1), it outputs emergency data, value of hFFFF, to P001. See *high speed link* information of 6.1.6 for link information(RUN_LINK, LINK_TROUBLE).

(b) Parameter setting of *high speed link*

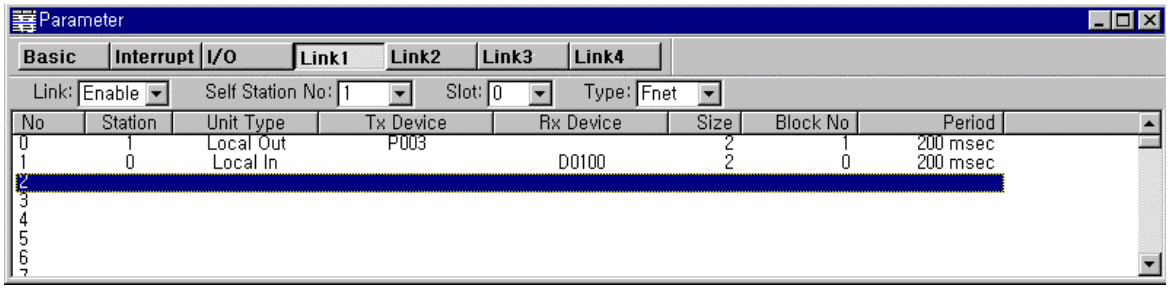
To exchange data of station 1, 2, and 3 as Table 6.1.6 in a system as Fig. 5.2.2, user should prepare user program as Fig. 6.1.15 and data Tx/Rx map as Table 6.1.6. For data Tx/Rx as Table, user should make parameter of *high speed link* and download PLC. Operation of *high speed link* is made as following sequence :

1) Assign station number and connect communication cable
2) Prepare user program(for each station)
3) Prepare data Tx/Rx map
4) Set parameter in the item for parameter setting of *high speed link* of KGL
5) Execute download of program and parameter in On-line menu
6) Change mode to RUN in On-line menu
7) Check the state of *high speed link* through flag monitor
8) Execute these procedure again from No. 1) if error occurred

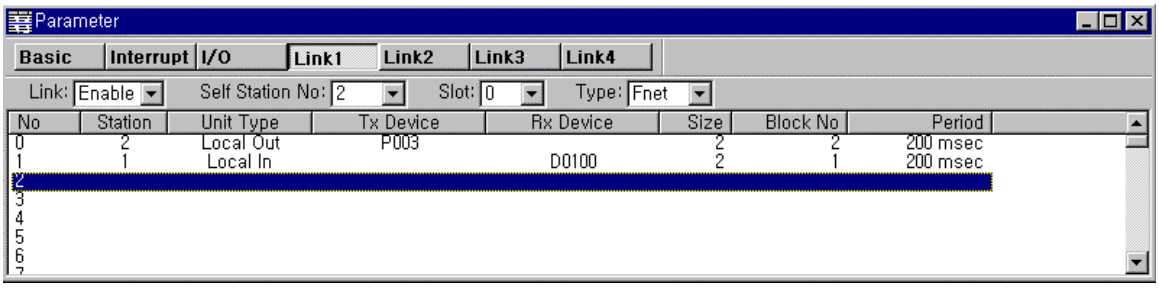
Parameter setting of *high speed link* for the system of Ex. 1 is as follows :



(A) High speed link parameter of K1000S(station 0)



(B) High speed link parameter of K1000S(station 1)



(C) High speed link parameter of K1000S(station 2)

Fig. 6.1.16 Example of link parameter setting

(c) Speed determination method of *high speed link*

The system of Ex. 1 is simple system that communication module transmits and receives 2 word data per each station. Therefore, Tx/Rx period setting of link parameter can be easily calculated using speed calculation expression of simple system in speed calculation method of 6.1.5.

Namely, in equation St = P_scanA + C_scan + P_scanB

St = max. transmission time of *high speed link*
P_scanA = max. program scan time of plc A
P_scanB = max. program scan time of plc B
C_scan = max. communication scan time,

P_scanA and P_scanB are scan time of K1000S PLC, and each of them in above program is 5ms(user can check this through PLC information of KGL).

Cscan = Th × Sn

(Th = Token hold time : token using time per 1 station
Sn = Total station number)

= 8ms × 3

= 24ms

St = P_scanA(=5ms) + P_scanB(=5ms) + Cscan(24ms) = 34ms

Therefore, Tx/Rx period should be set 34ms or more.

6.1.9 Ex. 3) : High speed link between master + slave + single remote I/O stations of Fnet

(a) System configuration

Fig. 6.1.18 explains parameter setting method for *high speed link* communication, which connects slave with single remote I/O through master of network-A/B PLC in slave class system of MASTER-K Fnet.

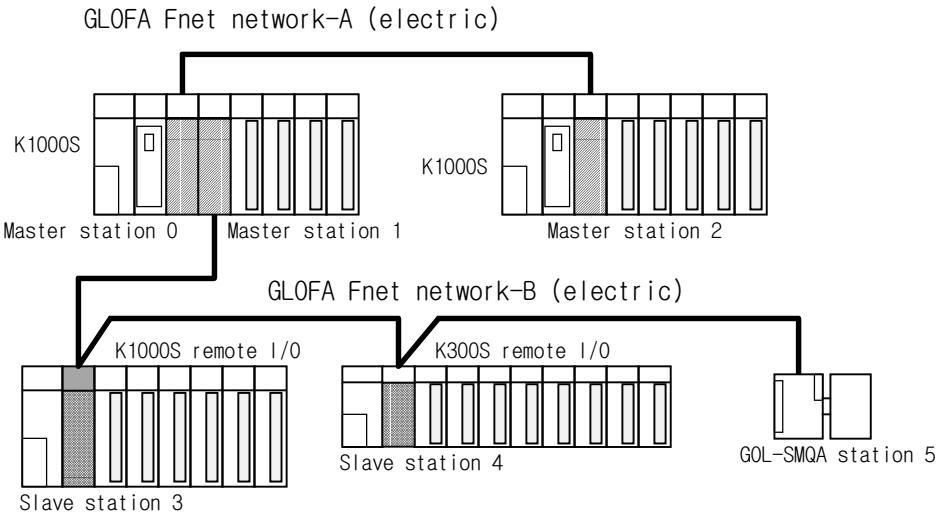


Fig. 6.1.18 Combined class system of MASTER-K Fnet master/slave

In this figure, network A is master class network, which configured with 2 master station. Network B is slave network which configured by master, slave, and single remote I/O. In the figure, master station 0 and 1 are master communication module of network-A, and they transmit receive data of master station 1 from K1000S-CPU(master station 0) to K1000S-CPU(master station 2). Master station 1 is master station of network-B, slave station 3 and 4, and single remote station 5, this controls I/O value of station 3, 4, and 5 through master station setting(master station 1). To do this, station 1 should be previously set to master station using dip switch in slave station 3 and 4, and single remote station 5. Setting of master station should be done previously before power on, and the station operates with the setting of power-on even if user change master station after power is on.

Table 6.1.8 explains station number assignment, I/O configuration, and mutual relation of data communication between two stations in system.

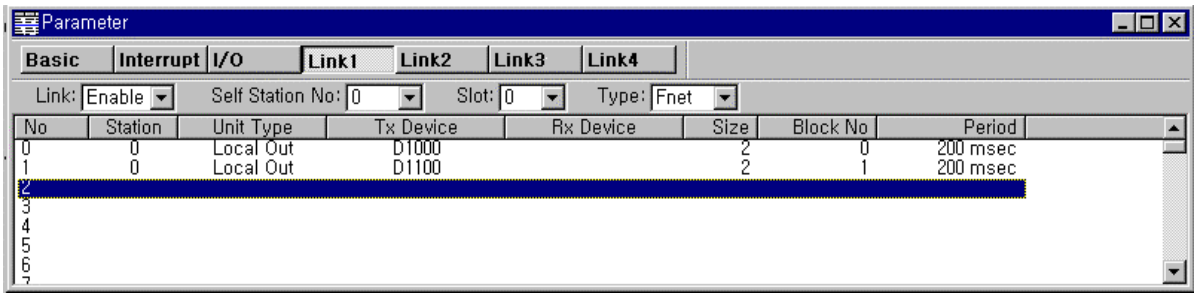
Table 6.1.8 I/O configuration and Tx/Rx flow

PLC type	I/O configuration	Tx/Rx relation of Local/Remote	Transmission area	Receive area
K1000S CPU	Slot 0:master(station 0) → network A Slot 1: master(station 1) → network B	Local transmission : master(station 2) Remote Tx/Rx : slave 3(station 3) Remote Tx/Rx : slave 4(station 4) Remote transmission : stand-alone remote(station 5)	D1000 D1100 D0000 D0010 D0200	D1000 D1100
K1000S CPU	Slot 0:master(station 2) → network A	Local receive : master(station 0)		D0000
K1000S slave	Slot 0:OUT 32 points Slot 1:IN 32points	Local : K1000S(station 1)	P0, P1	P2, P3
K300S slave	Slot 0:OUT 16 points Slot 1:IN 16 points	Local : K1000S(station 1)	P0, P1	P2, P3
Single Remote	OUT 16 points	Local : K1000S(station 1)	P0, P1	

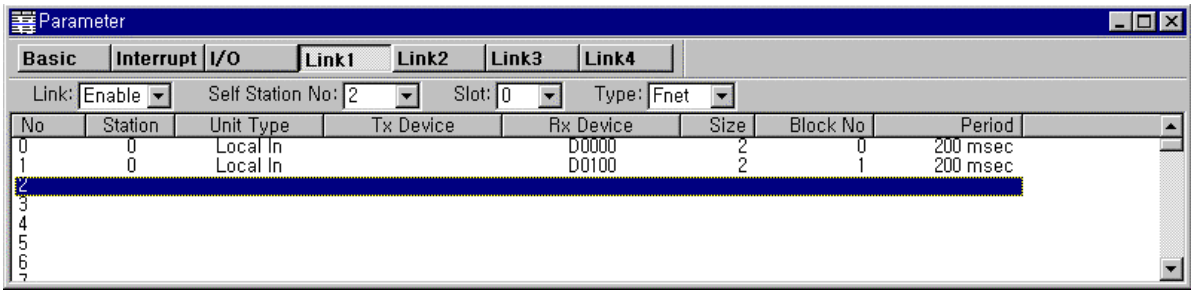
(b) Preparation of program and *high speed link* parameter

In Fig. 6.1.18, station 1 is master station, and this uses slave station 3, 4, and 5 as remote I/O. This station transmits self-station data of D0000, D0100, and D0200 area to P0 and P1 area of K1000S-slave, K300S-slave, and single remote I/O. This station receives data of P2 and P3 area of K1000S-slave and K300S-slave into D1000 and D1100 area, and transmits this data to master station 2 of K1000S-CPU through network A. To do this, station 1 should be set to master station in K1000S-slave, K300S-slave, and single remote I/O. This sets master station of remote I/O station, and remote station receives data of master station only which is set in self-station and transmits data of self-station to master station. After setting master station, parameter setting is needless in remote station, and *high speed link* operates according to parameter setting of master station (K1000S-CPU station 1). After setting parameter of each of network A and B as Fig. 6/1/19, download it to CPU, verify whether data in transmission area of K1000S is outputted to remote station and input value of slave station is received into receive area of K1000S. Verify the state of *high speed link* by monitoring RUN_LINK, LINK_TROUBLE (_HS0RLINK, _HS0LTRBL) through flag monitor in On-line menu.

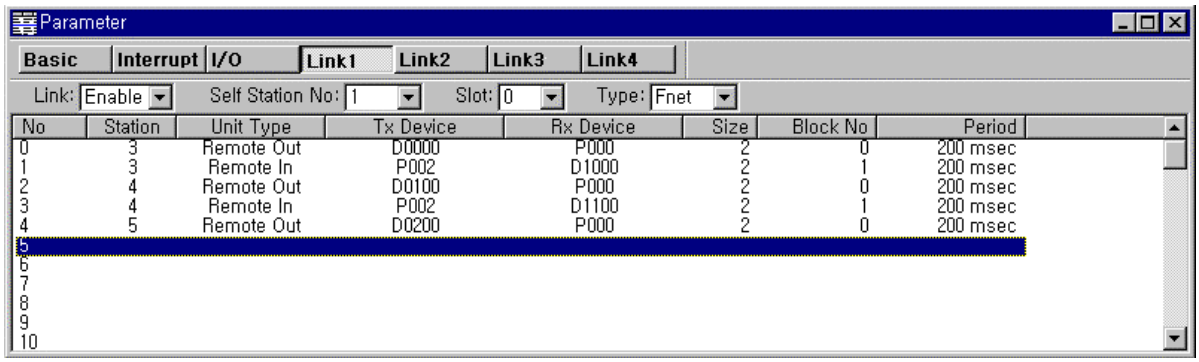
Fig. 6.1.19 is example of link parameter setting according to each station of Ex. 3.



(a) High speed link parameter of master station 0 in network A



(b) High speed link parameter of master station 2 in network A



(c) High speed link parameter of master station 3 in network A

Fig. 6.1.19 Example of parameter setting

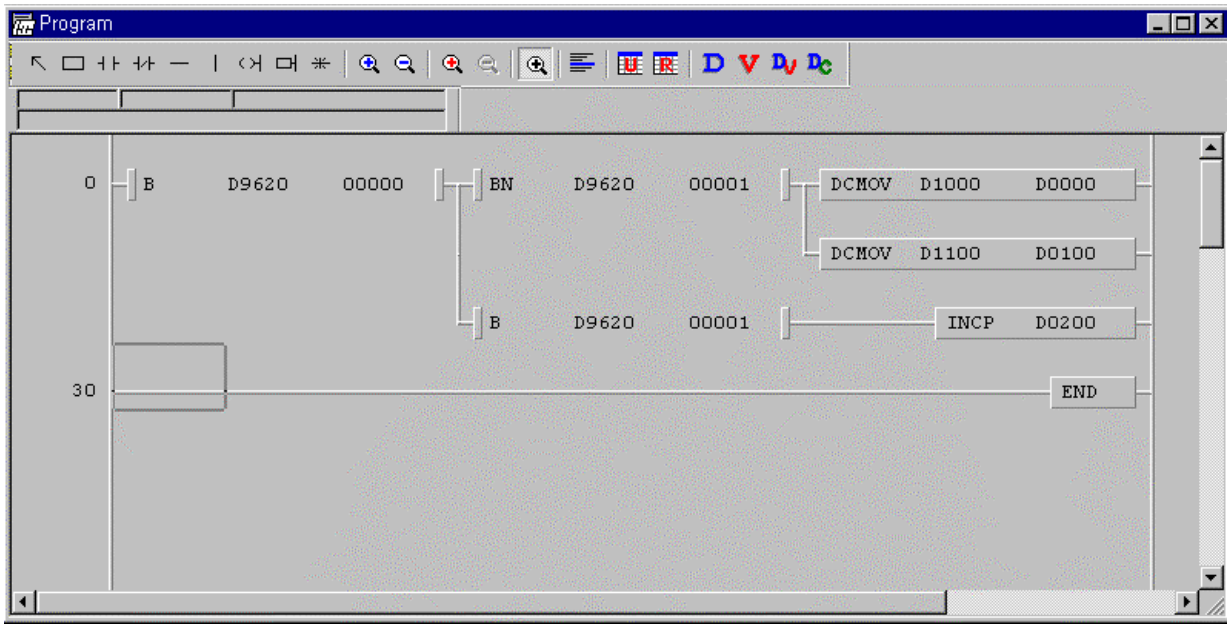


Fig. 6.1.20 Slave Tx/Rx program

Fig. 6.1.20 is K1000S PLC(Master 0 section) program of example 3. In normal operating, it converts input value received at slave 3 and slave 4, sends back them to output area of slave 3 and slave 4, counts error occurring frequency and stores it at D0200 area by monitoring link trouble contact point, sends it to the output area of slave 5. Run-link and link trouble contact point should use the value of high-speed link 2, and monitoring the status of high-speed link and identifying data reliability of the other part should use these two informations.

(c) Preparation of restarting program when slave power failure occurred

Fig. 6.1.21 is restarting program when power failure of slave station 3 occurred. Slave doesn't have self-program area, and Tx/Rx parameter is automatically set by hardware.

Therefore, when the power is cut off and recovered instantaneously in slave, slave monitors RUN_LINK information of mother station. If RUN_LINK is 'On', slave doesn't perform I/O refresh and stands by with the state of which waiting reset command of master station, and output module of slave maintains reset state. This is a function to prevent instantaneous output failure of system, which caused by instantaneous power failure of slave during interlocking operation of network. Slave restarts *high speed link* at that time when master station resets corresponding station using _FSMn_RESET flag as Fig. 6.1.21 in case of power failure.

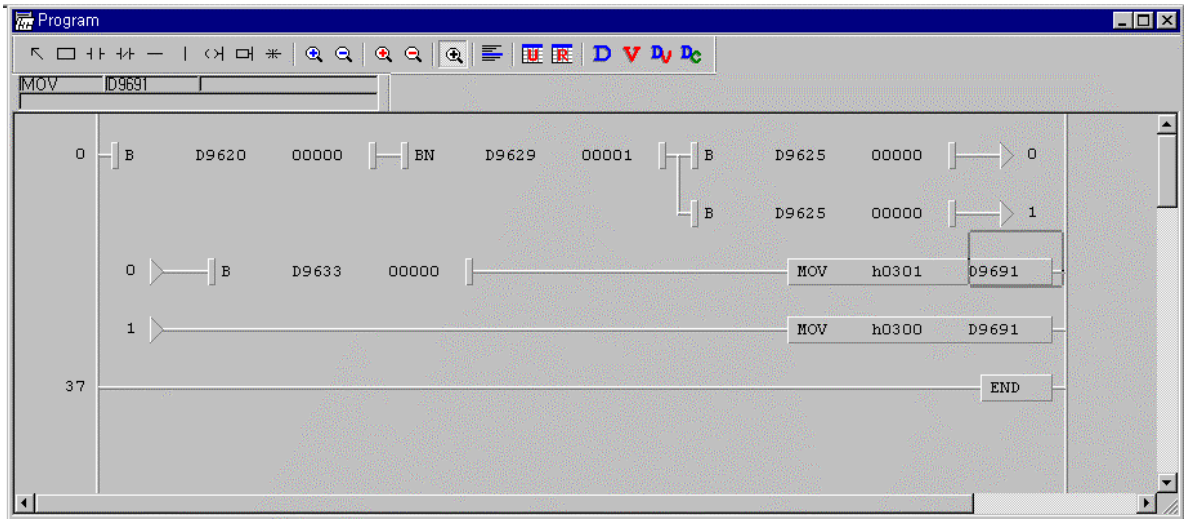


Fig. 6.1.21 SLAVE3 POWER OFF START PROGRAM

In the figure, _FSMn_ST_NO is number of slave, and _FSMn_RESET resets corresponding station. If this is '1', corresponding station is reset, and if this is '0', the station is restored to normal operation. Here, 'n' is slot number that master station is mounted, and this can be set from 0 to 7. This is reset program of slave 3, if RUN_LINK is '1', _HS2TRX is '1', and _HS2MODE and _HS2ERR are '0', this means that power of slave is cut off and recovered. Therefore, slave 3 is moved to _FSM1_ST_NO, and slave station is reset by setting _FSM1_ RESET to '1'. If _HS2MODE and _HS2TRX are '1', slave station is recovered by setting _FSM1_ RESET to '0'. Array values of *high speed link* individual information(values in [ ]) should be identical with parameter registration number of corresponding slave. If many numbers are registered, user can select one of them.

In Fig. 6.1.21, '[1]' is used between registration number 0 and 1.

Fig. 6.1.22 is example of slave4 power off start program. If program like this is set to all of slave station, reliable interlocking operation of entire network can be guaranteed.

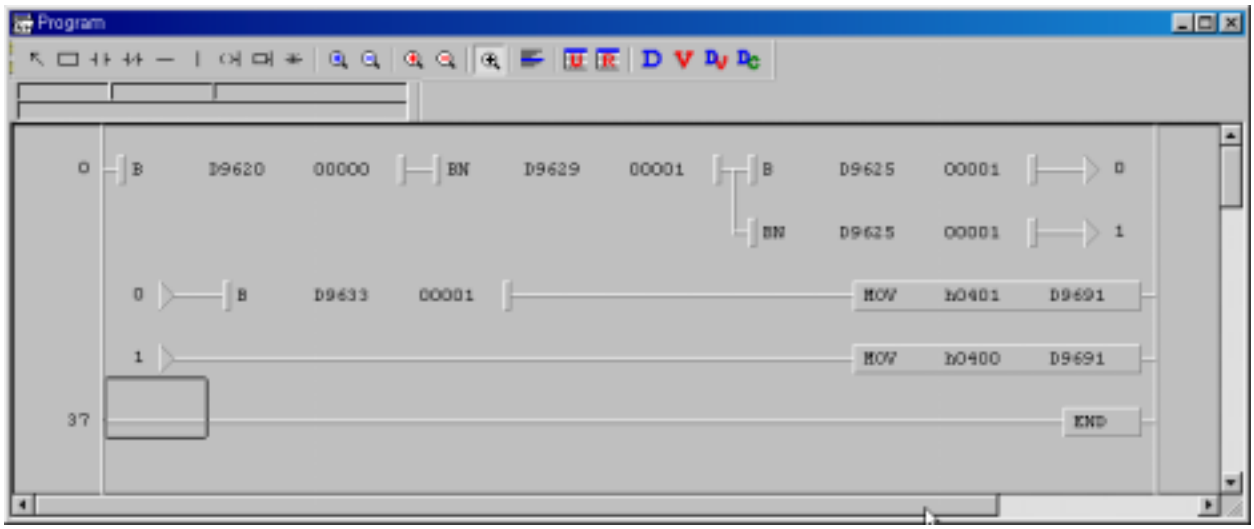


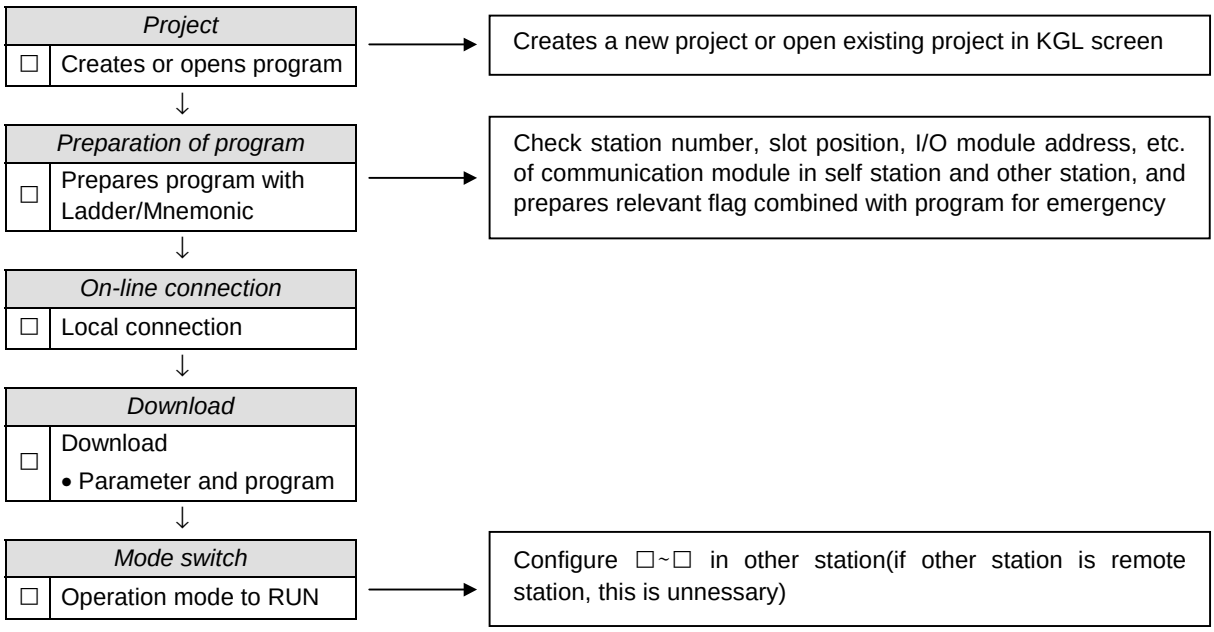
Fig. 6.1.22 SLAVE4 POWER OFF START PROGRAM

6.2 Communication instructions

6.2.1 Introduction

Communication instruction can be used to write data of self station to an area of other station or to read data of an area of other station. They can also be used to check the PLC state of other station, or to establish logical communication channel which may be used for communication with PLC of other company, or to access special module. This chapter explains type and using method of communication commands provided to user.

6.2.2 Using sequence of communication instructions



6.2.3 Type of communication commands

Commands that are used in preparing program are classified to 4 commands according to usage. READ and WRITE can be used in Fnet and Mnet, and CONNECT can be used in Mnet only. RPUT and RGET is remote only command, and this can be used in RBEA and RBOA only. Table 6.2.1 shows type and usage of communication commands.

Table 2.2.1 Type of communication command

Type	Usage	Available unit
READ, WRITE	Reads data of other station or writes data to other station	FUEA, FUOA, MUEA
STATUS	Checks present status of MASTER-K PLC	
RPUT, RGET	Reads or writes data in internal memory of special module	RBEA, RBOA

(a) READ

This is used to read data of indicated area in other station, min. data unit is 1 word, and setting of operand is as follows:

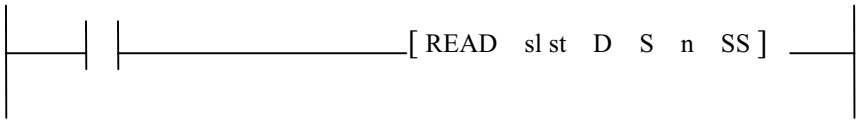


Table 6.2.2 Operand setting of READ command

Operand	Contents	Available area
sl	Slot number of FUEA to read	Integer from 0 to 7
st	Other station number to read	M, P, K, L, F, T, C, D, #D(see Remark)
D	Area of self station to store data which is read	M, P, K, L, T, C, D, #D
S	Other station area to read	M, P, K, L, F, T, C, D
n	Word number of data to read	Integer, D
SS	Indication of link status information(see Remark)	M, P, K, L, T, C, D, #D

Remark

Area of st can't be set with decimal and occupies 4 word, and this shouldn't be duplicated, so user should note this.

□ Structure of SS(Link status information area) is as follows:

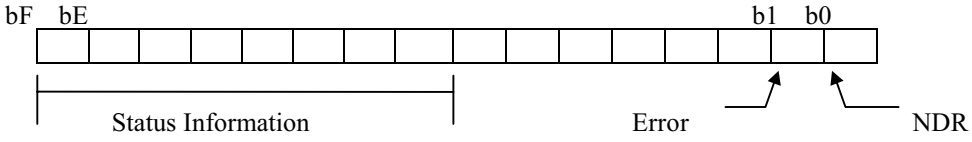


Fig. 6.2.1 Structure of SS

☐ NDR : The lowest bit of SS, this is 'On' for 1 scan after receiving data normally, and maintains 'Off' until receiving new data.

☐ Error : If error occurred after executing communication command, this is 'On' for 1 scan. Data is not transmitted or received, when error occurred.

☐ Status : If error bit is 'On', this expresses detailed code value of error, and maintains this value until NDR is set to 'On' normally or Error Bit is set to 'On'.

(b) WRITE

This is used to write data of self station to area of other station. Format is as follows:

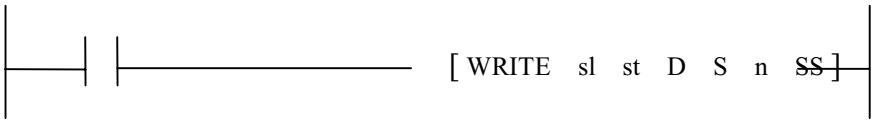


Table 6.2.3 Operand setting of WRITE command

Operand	Contents	Available area
sl	Slot number of FUEA to write	Integer from 0 to 7
st	Other station number to write	M, P, K, L, F, T, C, D, #D
D	CPU area of self station to write	M, P, K, L, T, C, D, #D
S	Other station area to store data which is written	M, P, K, L, F, T, C, D
n	Number of data words to write	Integer, D
SS	Indication of link status information	M, P, K, L, T, C, D, #D

☐ Specifications of st is identical with READ command, and specifications of SS is as follows:

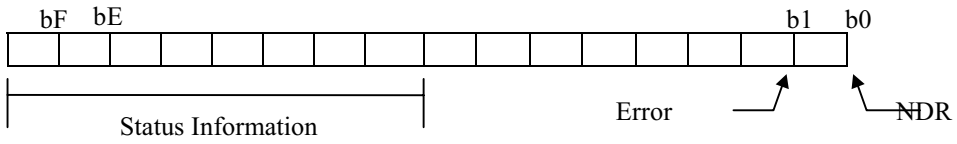


Fig. 6.2 Structure of SS

☐ DONE : If data is transmitted normally after executing communication command, this bit is set to 'On'. This is 'On' for 1 scan like NDR.

☐ Status, Error : These are identical with specifications of READ.

(c) STATUS

This is used to check the state of other station for control and monitor of the system. Operand setting is as follows:

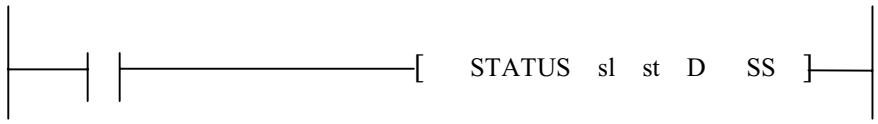


Table 6.2.4 Operand setting of STATUS command

Operand	Contents	Available area
Sl	Slot number of FUEA to read information	Integer from 0 to 7
St	Other station number to read information	M, P, K, L, F, T, C, D, #D
D	Area of self station(10word) to store data which is read	M, P, K, L, T, C, D, #D
SS	Indication of link status information	M, P, K, L, F, T, C, D

☐ The specifications of sl, st, and SS are identical with READ command, and the information of other station is shown in D through 10 word. See Appendix A3.3 for detailed information of 'D'.

(d) RGET

This is used to read the data of special module mounted in remote station, and this stores contents of internal memory in special module of remote station into area of self station. Setting of operand is as follows:

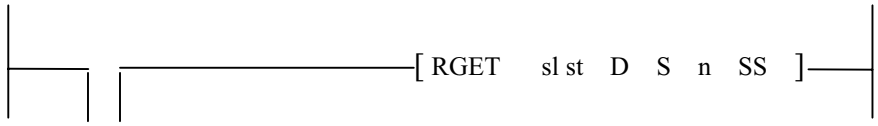


Table 6.2.6 Operand setting of RGET instruction

Operand	Contents	Available area
sl	See Remark	Integer (Hexadecimal)
St	See Remark	Integer (Hexadecimal)
D	Area of self station to store data which is read	M, P, K, L, T, C, D, #D
S	Internal memory area of special module in remote station to read	Integer
n	Number of data word to read	Integer, D
SS	Indication of link status information	M, P, K, L, T, C, D, #D

Remark

Hexadecimal is used in setting of sl and st, and standard format is as follows:

Structure of sl | h | A B | C D |

Upper(AB) : Type of special module in remote station.

Lower(CD) : Slot number of FUEA

Structure of st | h | A B | C D |

Upper(AB) : Slot number that special module is mounted

Lower(CD) : Station number of RBEA

☐ Code value of special module as Table 6.2.6 can be inputted for the value used in sl structure.

Table 6.2.7 Code value of special module

Module (K1000S)	K7F-AD4A	K7F-AD3A	K7F-AD4B	K7F-DI4A	K7F-DI3A	K7F-DV4A	K7F-DV3A	K7F-TC4A	K7F-RD3A
Code value	h00	h40	h0A	h01	h41	h02	h42	h03	h04
Module (K300S/200S)	K4F-AD2A	K4F-AD3A	K4F-DA1A	K4F-DV2A	K4F-DV3A	K4F-DI2A	K4F-DI3A	K4F-TC2A	K4F-RD2A
Code value	h80	hC0	h81	hC3	hC4	hC1	hC2	h83	h84

(e) RPUT

This is used to write data to common memory of special card mounted in remote station, and setting of

| |

operand is as follows(specifications of sl, st, and SS are identical with RGET):

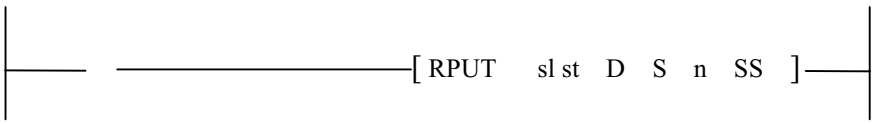
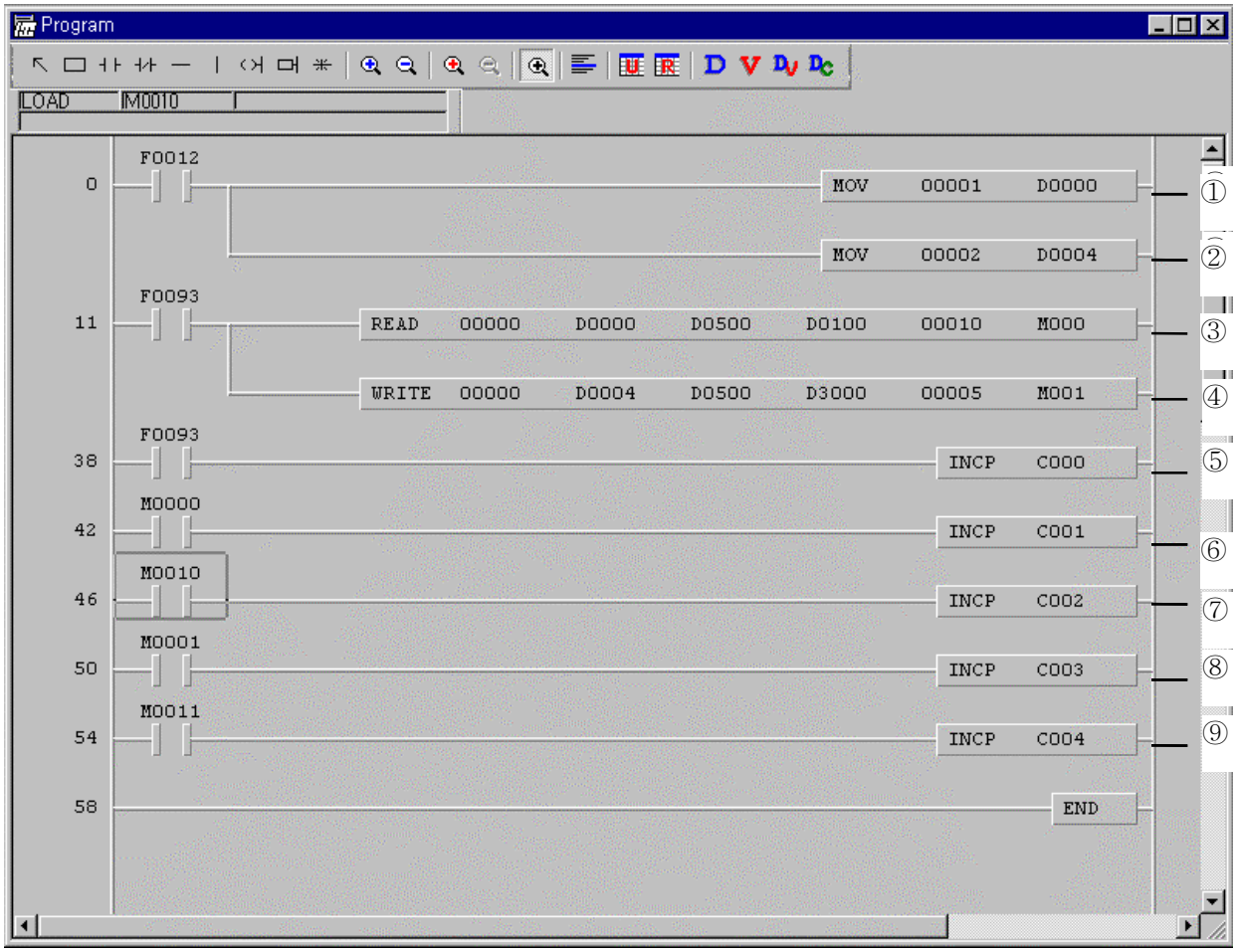


Table 6.2.8 Operand setting of RPUT command

Operand	Contents	Available area
D	Area of self station to store data which is written	M, P, K, L, T, C, D, #D
S	Internal memory area of special module in remote station to write	Integer
N	Number of data words to write	Integer, D
SS	Indication of link status information	M, P, K, L, T, C, D, #D

6.2.4 Usage of read/write commands in Fnet PLC + PLC system

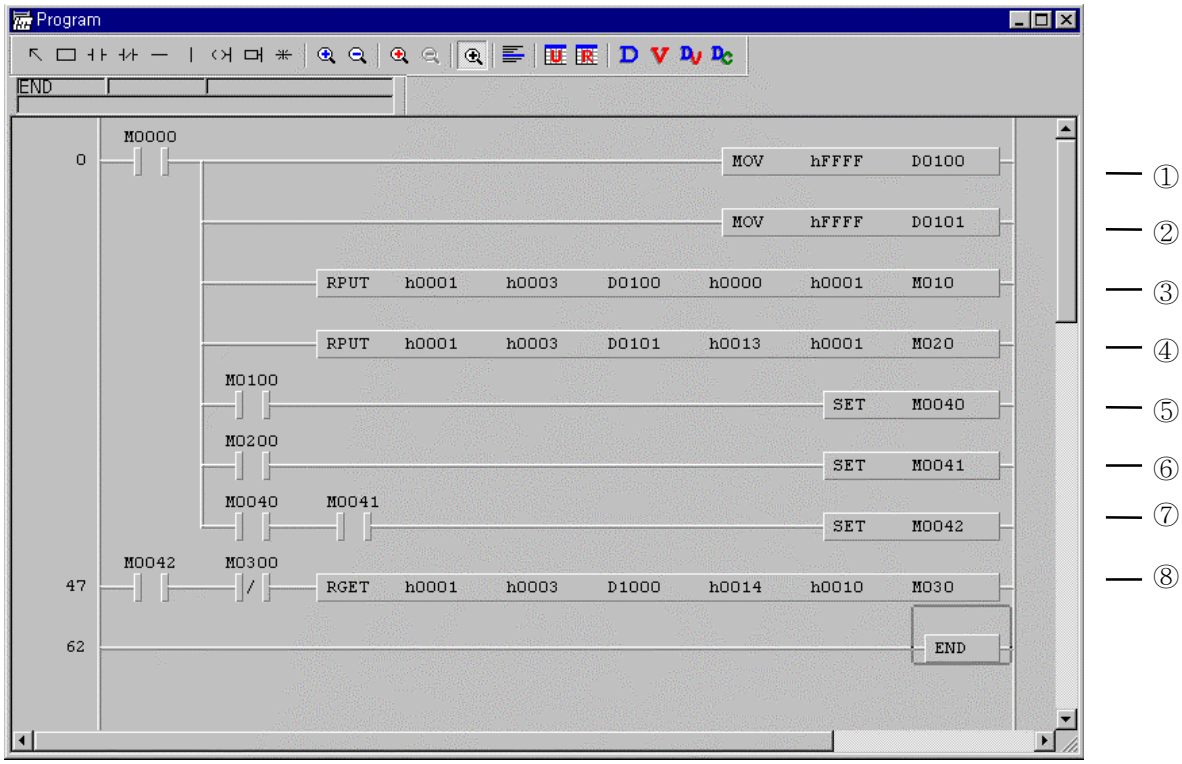
This chapter explains an example of program to be downloaded for communication with K1000S CPU(station 0) shown in Chapter 5.2.2 structureof MASTER-K Fnet master system(optical network).
This program is made to communicate together with K1000S CPU(station 1) and K1000S CPU(station 2) through Fnet communication module which is mounted in main board of self station using READ, WRITE command in K1000S CPU(station 0)
After creating or opening a project, edit a program as following :



☐ : Stores 1 to D0000 to set station number of K1000S(station 1)
☐ : Stores 2 to D0004 to set station number of K1000S(station 2) (4 word of D0000 ~ D0003 are devices for station 1, and D0004 ~ D0007 are devices for station 2)
☐ : Reads 10 word from D0100 of FUEA which has station number 1 and is set to D0000 through FUEA of slot 0, and stores them from D0500 to D0509 of self station (M000 shows the condition whether READ instruction executed communication or not)
☐ : Writes 5 word from D0500 of self station area which is set through FUEA of slot 0 into 5 word, from D3000 to 3004, of FUEA which has station number 3 (M001 shows the condition whether WRITE instruction executed communication or not)
☐ : Checks READ and WRITE instruction
☐ : Checks NDR of READ instruction
☐ : Checks DONE of WRITE instruction
☐ : Checks error of READ instruction
☐ : Checks error of WRITE instruction

6.2.5 Usage of RGET/RPUT in Fnet PLC + remote I/O(special module)

This chapter explains an example of program to be downloaded to K1000S CPU(station 0) shown in Chapter 5.2.4 structure of MASTER-K Fnet slave system(electric network). This program initializes special module(A/D) mounted in remote I/O that local station is connected with network, and stores internal memory information of special module(A/D) to self station.



☐/☐ : Writes data setting

☐/☐ : Writes D0100 and D0101 areas of self station to No. 0 and No. 13 of common memory in special module(A/D) mounted in slot 0 of RBEA which has station number 3 through FUEA mounted in slot 1.

☐/☐ : Checks whether normal communication is possible or not(M010, M020 are DONE)

☐ : Finishes normal communication of RPUT command

☐ : Stores 10 word from No. 14 of common memory in special module(A/D) mounted in slot 0 of RBEA which has station number 3 through FUEA mounted in slot 1 into 10 word from D1000 of self station.

6.3 KGLWIN communication service

6.3.1 Introduction

This function enables remote control of programming, download of user program, program debugging, and monitor in network system that PLCs are connected each other in Fnet, without moving physical connection of KGLWIN. Especially, user can access each device at one location without moving location when devices connected in network are apart distantly. KGLWIN communication service generates following path to accomplish the function.

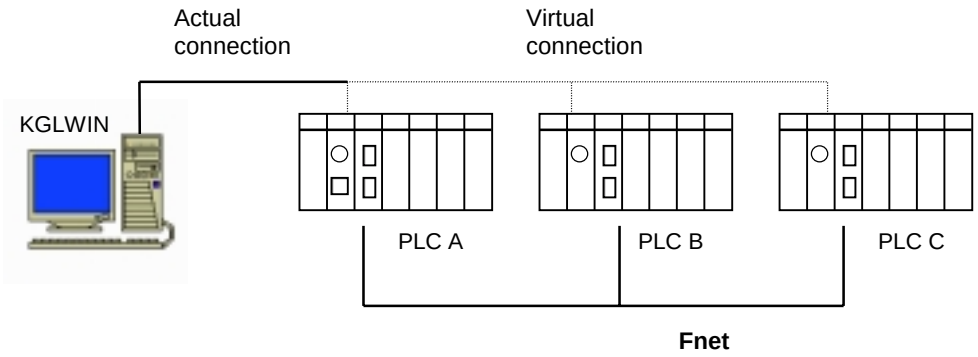


Fig. 6.3.1 KGLWIN communication connection (virtual connection)

In KGLWIN connection of Fig. 6.3.1, let us suppose a network that RS232C cable is connected to PLC A station and PLC A, PLC B, and PLC C are connected each other with Fnet or Mnet. To access PLC A, selects local connection in On-line menu of KGLWIN and accesses contents of PLC A station. After finishing access, disconnects the connection of PLC A station using disconnection menu to access contents of PLC C station. In remote connection of On-line menu, makes a connection by choosing communication module station number of PLC C(other station number to connect) and slot number of PLC A(slot number that communication module is mounted in PLC A which currently connected with KGLWIN). Then logical connection by RS232C and Fnet is made. This state is identical with the connection that RS232C cable is connected to PLC C station, and functions of program preparation, download, debugging, and monitor are possible in PLC C as in PLC A. This communication service of KGLWIN can be use to connect to the content of remote PLC. Connection from other PLC is possible even if a PLC is located at a location that physical access is hard, so this eliminates difficulty of re-programming. This functioî reduces time and effort for installation and change.

6.3.2 KGLWIN remote connection

All PLC, K1000S remote I/O station, and K300S remote I/O station that are connected with MASTER-K network can be connected each other by KGLWIN communication service. KGLWIN remote connection consists of remote 1 connection and remote 2 connection continuously.
Connection method of remote 1 and remote 2 is as follows:

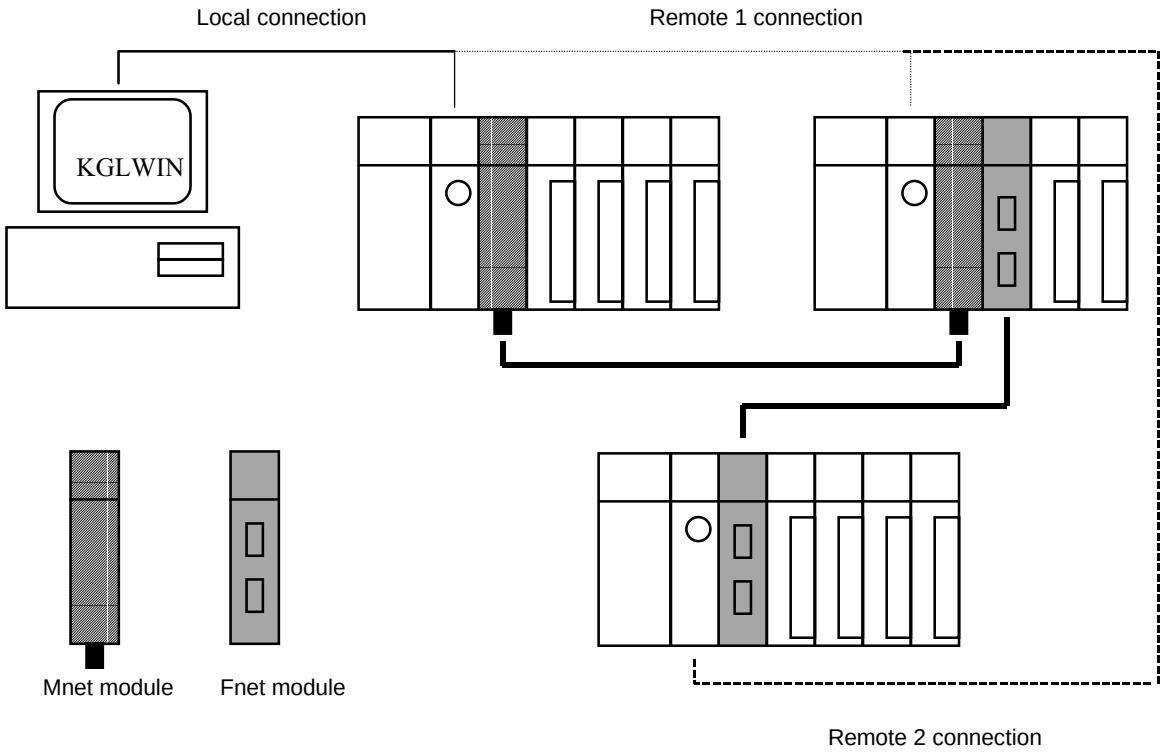
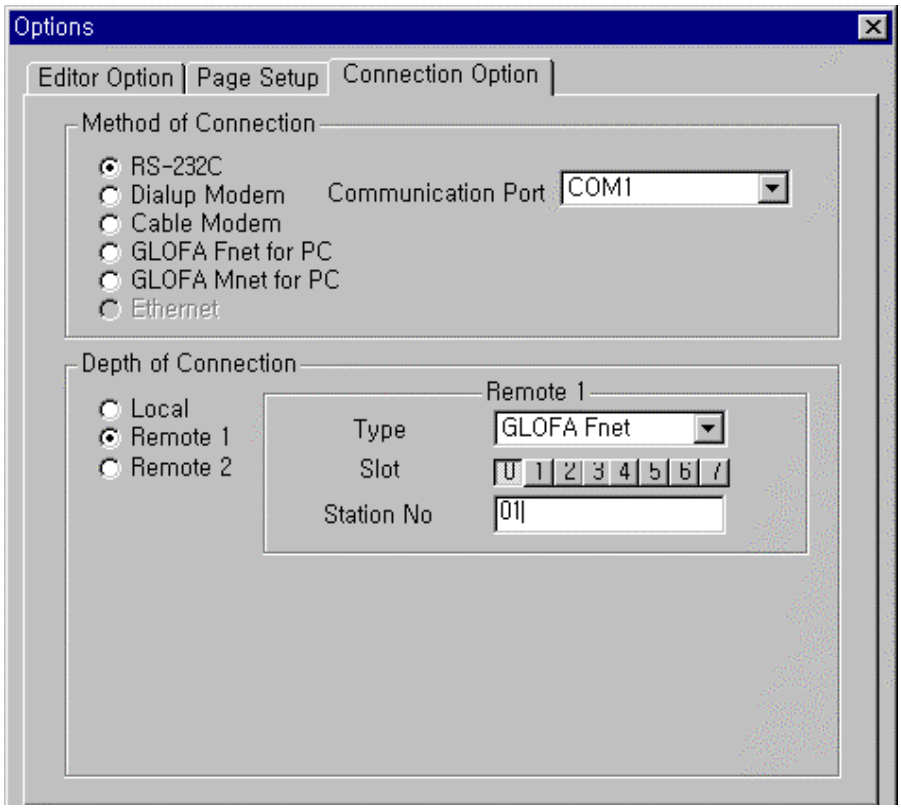


Fig. 6.3.2 KGL remote connection(remote 1 and 2)

Fig. 6.3.2 shows the connection of remote 1(PLC A, PLC B) and remote 2(PLC C) in a system configured with two network.

For making remote 1 connection should be in off-line state. In this state, select 'Connection option' at the 'Project – Option' menu.



For setting of slot number, input slot number of communication module mounted in PLC of self station which makes remote 1 connection.
Slot number of Fig. 6.1.2 is 0.

For setting of station number, input station number of communication module mounted in PLC which makes remote 1 connection, and input module number of PLC B, h00E091000001, in Fig. 6.1.2. Station number is written on the case of module for MASTER-K Mnet, and the value is set on station number switch in front of module can be used for MASTER-K Fnet. When user inputs station number, the type of 'h00E09100****' is used for hexadecimal, and decimal figure without 'h' is used for decimal.

For setting of password, input password of PLC which makes remote 1 connection.
Select 'OK' in this status.
If remote 1 connection is made, following message is displayed in lower part of KGL:

REMOTE 1 \ K200S \ REMOTE STOP

If connection is failed, following message is displayed:

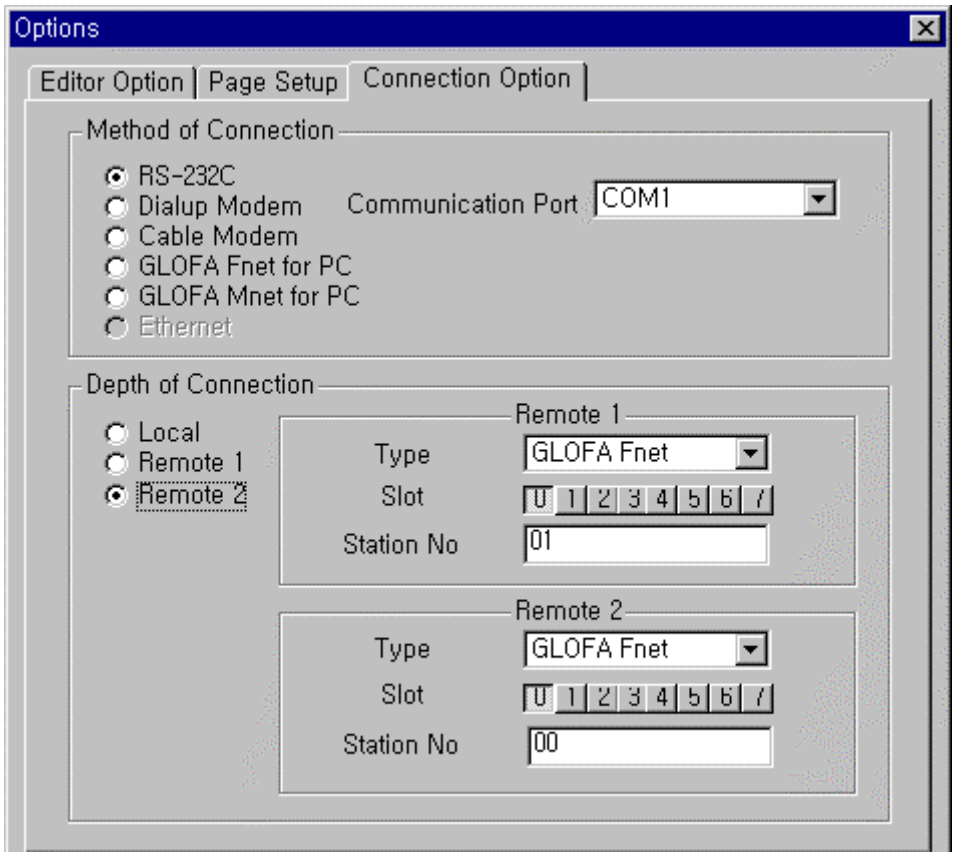
(Communication line error / internal protocol error)

If the type of PLC that remote 1 connection is made and the CPU type of project which currently opened are mismatched, remote connection is failed. If user changes PLC tyðe then, remote connection can be possible.

The state that remote 1 connection is finished is state of the same logical connection, and this is identical with connection of RS232C cable. All menu of On-line menu can be used.

Remote 2 connection executås remote 2 connection menu in Oî-line menu. In Fig. 6.1.2, remote 2 connection is made through following sequence:
KGL ▶ Mnet of PLC A ▶ Mnet of PLC B ▶ Fnet of PLC B ▶ Fnet module of PLC C

For remote 2 connection, select Connect of On-line menu and select Remote 2 menu as follows:



To set slot number in Slot No 1, input slot number 0 that communication module of PLC A is mounted for connection of PLC A ▶ PLC B. In slot No 2, input slot number 1 that communication module of PLC B is mounted for remote 2 connection of PLC B ▶ PLC C.

For setting of station number, specify station number of remote 1 connection and remote 2 connection respectively. Input h00E091000001, station number of PLC B, for remote 1 connection, input station number 5 of PLC C for remote 2 connection. Station number is set on station number switch in front of module can be used for MASTER-K Fnet. When user inputs station number, the type of 'h?????' is used for hexadecimal, and decimal figure without 'h' is used for decimal.

If user sets network type, station number, and slot number as the following with the value explained above, and click OK of dialog box, then following message is displayed in the lower screen part of KGL.

REMOTE2 \ K200S \ REMOTE STOP

Remote 2 connection is finished, and this is status of logical connection and this is the same as the connection that RS232C cable is connected to PLC E. User can use all menu of On-line menu.

Table 6.3.1 shows relations connectable between connection requesting device(Client) that RS232C cable is connected in KGLWIN communication service and connecting device(Server) which connects it according to the request of communication from Mnet/Fnet.

Table 6.3.1 Relation of roles between client and server of KGLWIN

Server Client	PC-module (KGLWIN)	K1000S	K300S	K200S	K1000S remote I/O	K300S remote I/O
PC-module(KGL)	X	O	O	O	O	O
K1000S	X	O	O	O	O	O
K300S	X	O	O	O	O	O
K200S	X	O	O	O	O	O
K1000S remote I/O	X	O	O	O	O	O
K300S remote I/O	X	X	X	X	X	X

There is the connector that RS232C can be connected, in K1000S remote I/O. Namely, KGLWIN can be connected to PLC of K1000S ~ K200S in K1000S remote I/O(This is not available in K300S remote).

Cautions when operated with remote 1 and remote 2 connection in KGLWIN

1) When project which is currently opened in KGLWIN and CPU type which is connected with remote 1 and 2 are not identical, remote connection is not possible.

2) When programming is made by connection of remote 1 and 2, user should open corresponding project of station to be connected and execute remote connection.

3) Remote connection is supported up to 2. Remote connection of more than 2 is impossible.

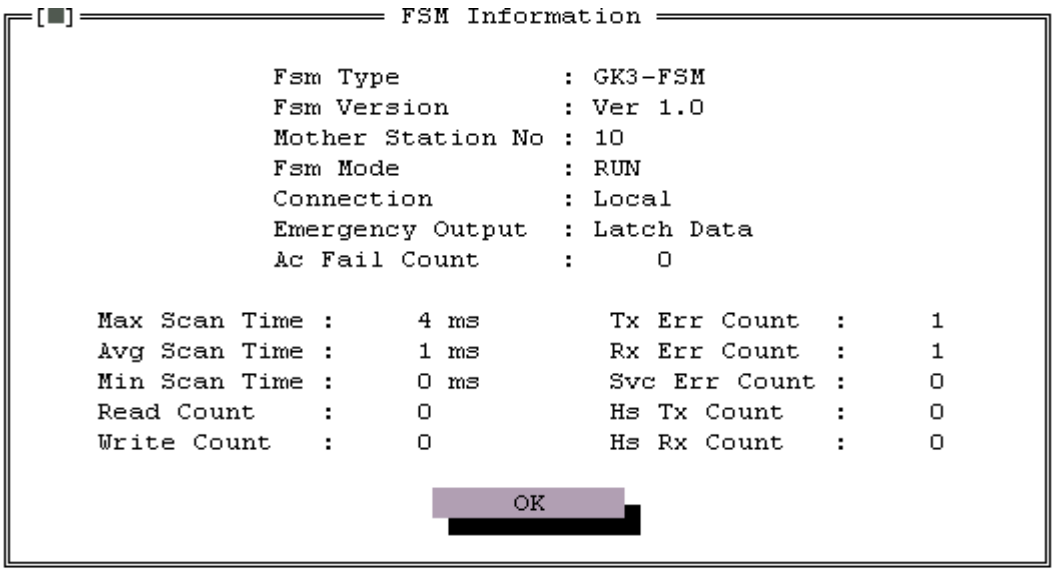
6.3.3 Functions on connecting KGLWIN to remote I/O station

This explains how to use the function with connecting remote I/O by KGL remote connection. When remote connection is made by remote I/O station, only restricted menu can be selected.

Available function list when connecting remote I/O station of KGLWIN

* Slave(PLC) information monitor in On-line menu
* I/O information monitor in On-line menu
* Flag monitor
* Setting of emergency output data
* Setting of forced I/O(P area only)

(a) Slave(PLC) information monitor
This function shows internal status in slave of remote I/O, and the following screen is displayed if user selects PLC information in On-line menu.



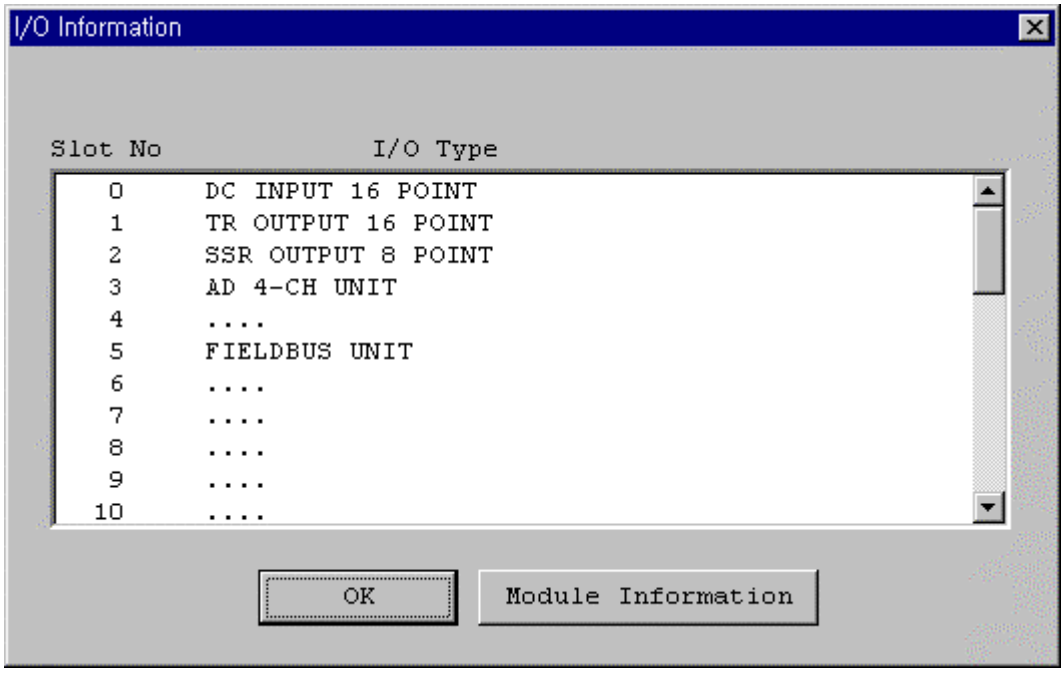
In the dialog box,

Fsm Type ☐ Slave type of remote I/O station.
Fsm Version ☐ O/S version No. of remote I/O station.
Mother station No ⇒ Communication module station No. of PLC which transmits and receives data with remote I/O Station.

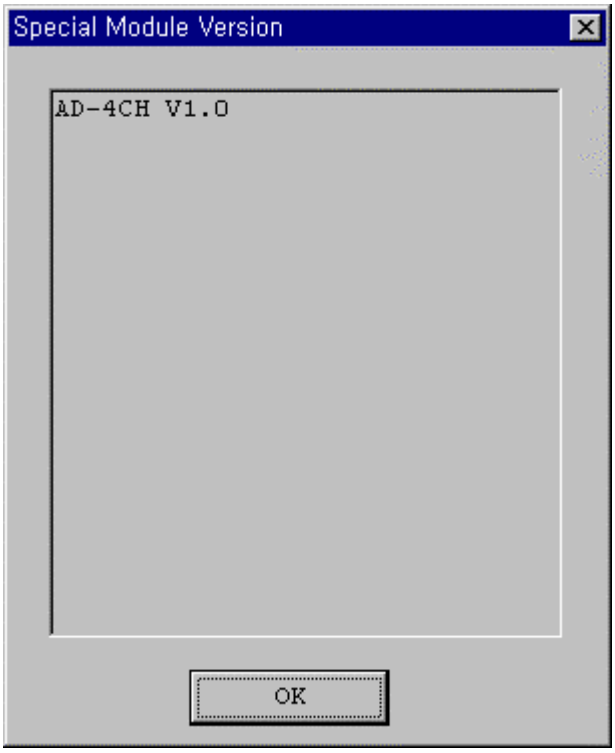
Fsm Mode	☐ Operation status of remote I/O station (RUN/STOP) RUN : normal operation STOP : I/O module error, self diagnosis error, and power error.
Connection	☐ Connection status between KGL and remote I/O Remote : remote connection of KGL from other station to remote I/O station Local : remote connection from remote I/O to other station.
Emergency Output	☐ Sets output data in case of communication failure Latch : maintains current output data User setting : outputs setting value in emergency data.
AC Fail Count	☐ Count of instantaneous power failure.
Max Scan Time	☐ Max. time that token goes round network once.
Avg Scan Time	☐ Average time that token goes round network once.
Min Scan Time that	☐ Min. time that token goes round network once.
Read Count	☐ Counts No. that read command is executed.
Write Count	☐ Counts No. that write command is executed.
Tx/Rx Err Count	☐ Count of error occurrence in frame transmitted from cable, this indicates stability of current network. If there are many errors, communication line, has problem and management is needed to prevent error.
Svc Err Count	☐ Counts No. of NAK response from other station during execution of communication command.
Hs Tx/Rx Count	☐ Increases receive count of *high speed link* if *high speed link* data is received, and increases transmission count of *high speed link* if *high speed link* data is transmitted.

(b) I/O monitor

I/O monitor function provides information for the module mounted in FSM slot, the following dialog box is displayed if user selects I/O information of On-line menu.



Here, when user want to monitor the information for special module except I/O module, version of special module is displayed as the following if user puts cursor to special module to be monitored and selects Special Module Information.



(c) Flag monitor

This monitors slave system flags stored in buffer memory of FSM. If user selects flag monitor in Monitoring of On-line menu and selects flag to be monitored, then monitor can be performed. See appendix A4.3 for slave system flag.

(d) Emergency output data

Emergency output data exist remote I/O station only. If communication is failed by any cause during *high speed link* communication, sets emergency output data for the cause to maintain stable status of external devices. If user selects Write Information in On-line menu and selects P area that emergency output data is to be chosen and clicks Edit Item, then dialog box that user can set emergency output is displayed.

In the dialog box, input as [☐] for the bit that output is to be On and click OK.

If user inputs the value with emergency output data service, the data which is set when power on/off of remote module is will be eliminated(remote module doesn't have battery which can remember values). Therefore, if user want to give emergency data regardless of power on/off, program should be made using the flag for remote module monitoring in KGLWIN.

(e) P area monitor and forced setting

P area monitor function monitors current value of I/O module, and this is used to verify output data of communication and input data which is read from external device. Select Monitoring in On-line menu and select Word, Bit, Dword, Complex monitor, and input P area to be monitored. For forced setting, value of P area can be set from Change Current I/O of Debug menu.

(f) If remote connection is made with K1000S/K300S remote I/O station, the following items are not executed :

a) Write of program and parameter

b) Read of program and parameter
c) Operation executed directly according to program
   * Time chart monitor of monitor
   * Link parameter of monitor
   * High speed link monitor
   * Forced I/O information
   * Setting link enable
   * Flash memory
   * Link information
   * Mode switch
d) Flash memory
e) Setting of link enable
f) Mnet parameter, Mnet information
g) I/O skip

6.3.4 Slave system flag

Information stored in internal memory of slave module can be monitored through flag monitor of FSM, and execution information of *high speed link* and communication instruction can easily be recognized through flag. See slave system flag of Appendix

Chapter 7 Diagnosis function

7.1 Self diagnosis function of Fnet communication module

7.1.1 Self diagnosis function during running

Error type occurred during normal operation can be known through LED which located on the front of the product. When LED operation is abnormal, see appendix A1.1/A1.2 LED indication if user can fix the error through relevant action, and contact Service station of our company for serious error of hardware.

Items	Contents	Remark
Diagnosis function (Initial self diagnosis)	** On-line mode ** 1) Memory access error of communication module 2) Common RAM access and Reading/Writing error 3) Interface error of PLC and IBM_PC 4) Frame error during communication 5) Error status in physical layer of other station during communication 6) Error in physical layer of self station during communication 7) Program execution error during communication	Error code is displayed through LED when error occurred (See Appendix A1.1/A1.2)
Diagnosis function (Communication diagnosis)	** Test mode ** 1) Diagnosis of network configuration status in physical layer by test. – Transmission error of physical layer – Receive error of physical layer 2) Interface error of CPU in communication module and communication chip.	Error code is displayed through LED when error occurred

7.1.2 Communication diagnosis by test mode

If LED indicates modem or cable problem of Fnet module, connect two module of Fnet with communication cable as Fig. 7.1.2, set the two station numbers identically, set operation mode switch on front part to test mode, and turn the power on, then diagnose the problem according to LED indication.

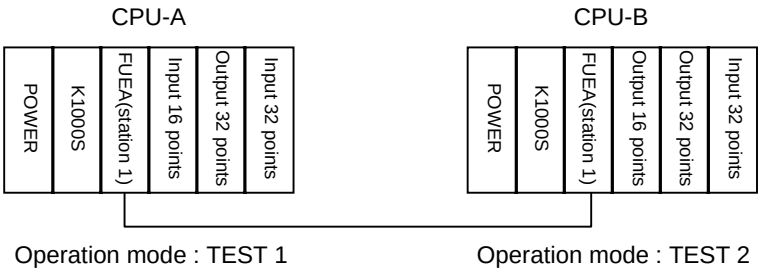
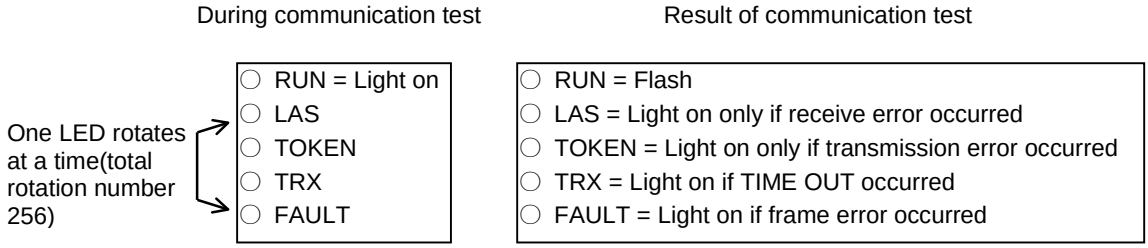


Fig. 7.1.2 Configuration of test system

● How to test

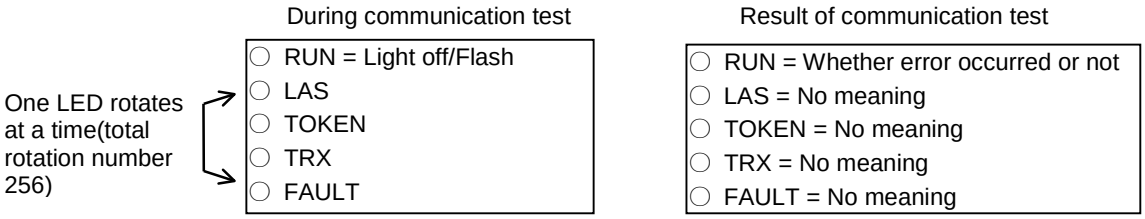
In a system configuration shown above, checks H/W between CPU-A and CPU-B and connection status.

1) In a test system configuration shown above, turn the power of CPU-A and CPU-B off and set the mode switch of appropriate module as follows :
   - ◆ Mode of communication module, CPU-A = TEST 1 (Transmission mode of communication test)
   - ◆ Sets station number switch of CPU-A to station 1 (Communication test for station 1)
   - ◆ Mode of communication module, CPU-B = TEST 2 (Receive mode of communication test)
     Don't change values of other switches.
   - ◆ Sets station number switch of CPU-B to station 1 (Communication test for station 1)
2) Power on CPU-A and CPU-B.
3) LEDs in communication module of CPU-A are operated as follows :



During communication test, rotates up while lighting on FAULT - TRX - TOKEN - LAS - FAULT LED 256 times, with RUN LED on. Test result is displayed through LED and the meanings are as shown above. These are displayed during two seconds, and reads station number switch and keep executing with the station.

4) LEDs in communication module of CPU-B are operated as follows :



During communication test, rotates up while lighting off FAULT - TRX - TOKEN - LAS - FAULT LED 256 times, with RUN LED on. Test result is displayed through RUN LED and communication error occurred during test if RUN LED is turned on.

If error occurs after testing, check the test condition is correct or not. If the same error occurs continuously, contact Service station of our company.

Chapter 8 Installation and testing operation

8.1 Installation and testing operation of Fnet communication module

MASTER-K communication module should be appropriately mounted according to PLC CPU type, and products of communication module which can be mounted according to CPU type are as follows :

Table 8.1 Mounting of communication module according to CPU type

CPU type	Mountable device type	Max. mounting number	Mounting location (slot)	Remark
K1000S	K7F-MUEA, K7F-FUEA, K7F-FUOA	4	Main base I/O	
	K7F-RBEA, K7F-RBOA	1	CPU	Remote I/O
K300S	K4F-FUEA	2	Main base I/O	
	K4F-RBEA	1	CPU	Remote I/O
K200S	K3F-FUEA	2	I/O	
FAM4.0	G0L-FUEA	1	16 bit extended slot	Mounted in PC
FAM4.0	G0L-MUEA	1	16 bit extended slot	Mounted in PC
-	G0L-SMQA	1	Stand-alone type	Remote output
-	G0L-SMIA	1	Stand-alone type	Remote input
-	G0L-SMHA	1	Stand-alone type	Remote combined

8.1.1 Installation of Fnet master module

1) In the types of master module, there are electric communication module of K7F-FUEA, K4F-FUEA, and K3F-FUEA, optical communication module of K7F-FUOA, and G0L-FUEA which is used in IBM-PC. Communication module can be mounted up to 4 in K1000S PLC, and these can be mounted only in main base.

2) Communication module can be mounted up to 2 in main base in K300S and K200S PLC(Extended base is not available for this module).

3) G0L-FUEA is mounted in one of 16 bit extended slot of compatible IBM PC, and setting of port and memory address shouldn't be duplicated with other device's(See 3.2.3 G0L-FUEA structure).

8.1.2 Installation of Fnet slave module

In types of slave module, there are electric communication module of K7F-RBEA and K4F-RBEA, optical communication module of K7F-RBOA, and standalone remote(G0L-SMQA, G0L-SMIA, G0L-SMHA) I/O station of 16 point output, input, and combined.
Fig. 8.1.2 shows example of mounting and extending of slave in MK base.

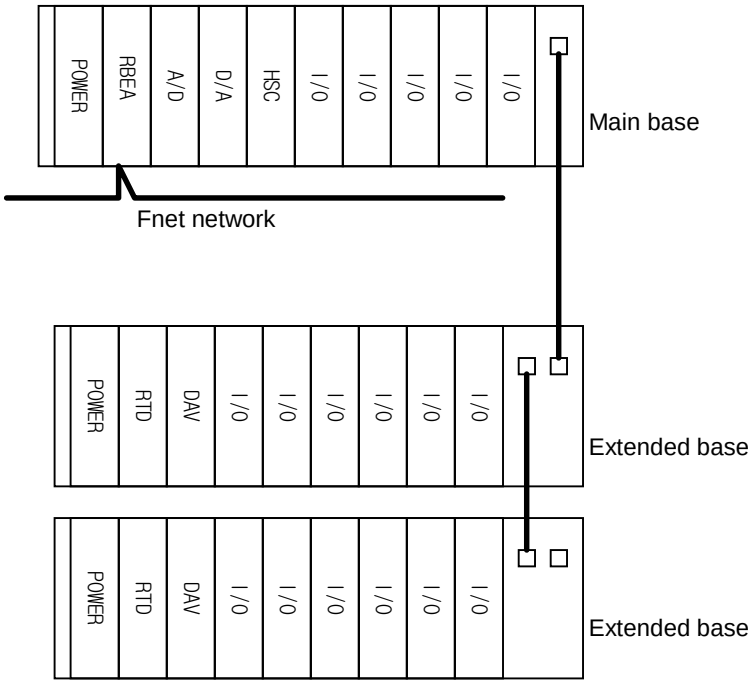


Fig. 8.1.2 How to mount and install

Table 8.1.2 shows list of module, which can be used with FSM.

Table 8.1.2 Mountable device in FSM

Available module name	**Not available module name**	
Product name	**Product name**	**Type name**
All types of I/O module		
D/A conversion module	Interrupt input module	K□F-INTA
Temperature conversion module	Fnet module	K□l-FUEA/FUOA
High speed counter module	PID control module	K□F-PIDA
	Analog timer	K□F-AT□A
A/D conversion module	PC communication module	K□L-CUEA

See mounting method of the manual according to CPU type for mounting method of base module.

8.1.3 Installation procedure of Fnet module

1) Install standard configuration that is needed in system configuration, and select communication module relevant to the type of device.

2) This communication module should be mounted when power is off.

3) When mounting this communication module, check whether connector of base that module will be mounted has foreign matters or not, and check whether connector pin of this module is normal.

4) All communication modules can't be mounted in extended base, they can be mounted only in CPU position of main base.

5) Combined mounting of Mnet module and Fnet master module is possible in device of K1000S. But mounting number of combined configuration should be 4 or less.

6) When mounting this module, insert projecting part of lower part into groove of base board exactly and press it until upper part is locked with locking device of base board, before connecting communication cable. If locking device is not locked completely, error of interface with CPU may be occurred.

7) Sets station number and operation mode using switch on the front part of communication module. There should be no duplicated station number in the same network.

8) Connect communication cable after mounting electric module, and install terminal resistance at CON1 or CON2 if this module is terminal (Fnet:110Ω).

9) Electric module cable should be connected tightly using screw of cable connector. If mounted station is not terminal, both side of cable can be connected any of CON1 and CON2.

10) Turn the power on after connecting communication cable, check whether this module operates normally through LED operation status. If it is normal, download corresponding program to KGLWIN and execute the program.

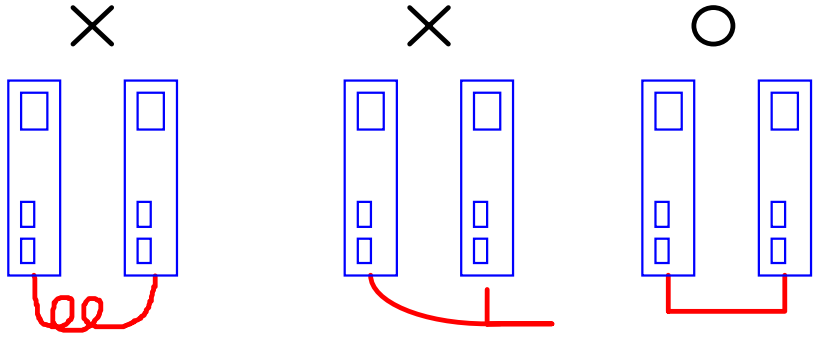
11) After mounting optical communication module, insert projecting part of cable connector into groove of communication module connector while pushing connector of optical connector into communication module connector and turning it clockwise direction.

12) Communication module for PC can be mounted in ISA bus, and switch of port address and memory address in this module should be configured according to memory environment of PC before mounting it. If port and memory are set to currently using area in PC memory environment, abnormal operation may be occurred or booting may not be possible(See 3.2.3 G0L-FUEA structure). Switch values of port and memory settings of this module are in appendix.

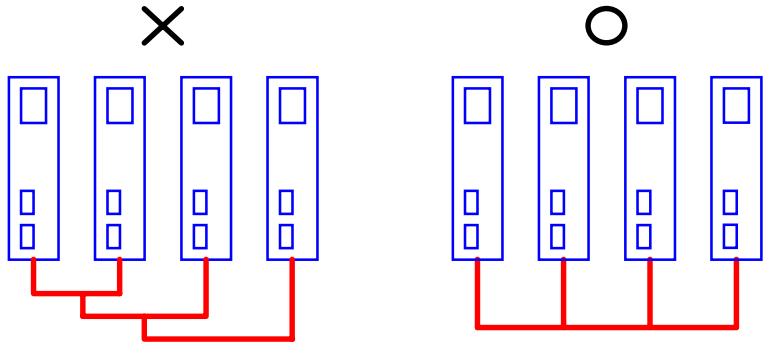
13) To mount communication module for PC, insert a module into slot accurately and tighten the module up with screw of upper part not to be shaken, before connecting communication cable.

8.1.4 Cautions on installation of Fnet module

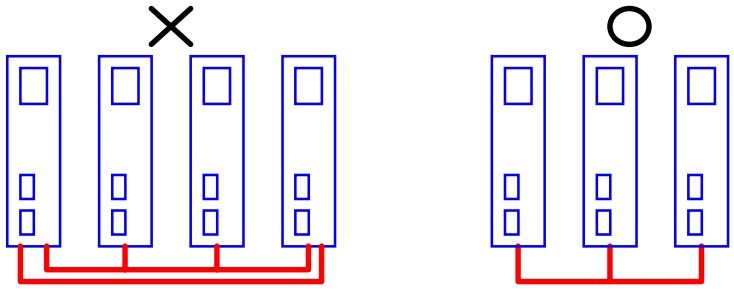
1) All other station including this station should have different station number. If duplicated number is used in connection, communication error occurs and normal communication is not possible.
2) If module is operated with normal communication, mode switch should be in Run mode. If mode switch of this module is set to test1 and turn the power on when other stations that are connected in network are already in communication, serious error may be occurred in communication of other stations.
3) For communication cable, cable of specified specification should be used. Using not specified cable may cause serious communication error.
4) Check whether communication cable has disconnection or short, before installation.
5) Tighten communication cable connector to fix the cable connection. If cable connection is not perfect, serious error can be occurred.
6) If communication cable is twisted as the following figure or not connected well, problem can be occurred in communication.



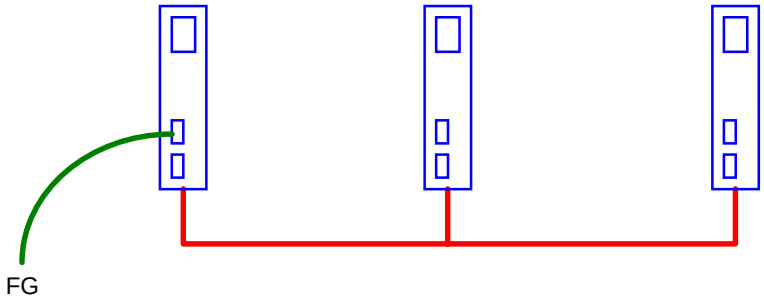
7) Branch of cable is not allowed.



8) Connection of network through communication cable should not be a closed circuit.



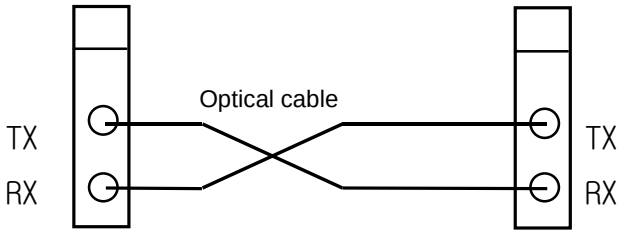
9) Choose one from both terminals in network system, connect its terminal connector with FG of PLC or installed device as the following.



Remark

If communication status is bad when connection is made as above, this is caused by serious noise from FG. Therefore, user should eliminate its cause or not connect to FG.

10) If communication cable is connected with long distance, wiring should be far away from power line or inductive noise.
11) Shield line of communication cable(twisted pair) should be connected firmly with connector body inside of the 9 pin metal case for connection(See 4.4.1 Electric(twisted pair) cable wiring).
12) Optical communication cable is consists of TX and RX line. Connect them to Tx/Rx connector of optical communication module as the following figure. If polarity of Tx/Rx is changed each other, communication is impossible, so polarity should not be changed(See 4.3.3 Optical cable connection).



13) For not using connector of optical communication module, cover should be used on connector part to prevent foreign matters from coming in.
14) If LED operation is abnormal, see ‘chap. 9 Troubleshooting’ of this manual to check the cause of the error. If the error occurs continuously after management, contact Service station.

8.1.5 Preparations during testing operation of Fnet module

This explains contents to be checked before testing operation of Fnet communication module.

1) Communication module to be mounted in PLC

Items to be checked	Contents
Mounting check of Base module	– Does using voltage of power module comply with specifications of power module? – Is battery of CPU module connected? – Is mounting of all base modules perfect? ⇨ See product manual according to each PLC type.
Connection status of Communication cable	– Is connection status of communication cable perfect? – Is connection type of each cable open loop?
Module mounting	– Is mounting status of communication module which is mounted in basic base perfect?
Switch checking	– Is the status of mode switch On-line(switch value is 0)? – Is station No. switch correctly set? – Is master station No. switch correctly set? (for slave module) – Is output option switch correctly set when communication is cut off? (for slave module)

2) Communication module to be mounted in PC

Items to be checked	Contents
Standard check	– Is PC appropriate IBM-PC compatible? – Has PC sufficient environment to install FAM4.0/KGLWIN? – Has PC space and empty slot to mount this module? – Can memory map of PC reserve empty space to use this module? ⇨ See user's manual of FAM4.0/ KGLWIN and Appendix of this manual.
Module mounting and FAM4.0/KGLWIN installation	– Reserve empty space of 32K byte in memory map of PC, select this area for the memory switch of this module, set port address. – Mount and fix this module into the slot to be inserted.
Switch recheck	– Are memory switch and port switch correctly set? – Is mode switch set to On-line(switch value is 0) status? – Is station number switch correctly set?

8.1.6 Testing operation procedure of Fnet module

This shows the sequence from completion of PLC installation to the testing operation.

1) Communication module to be mounted in PLC

Starting
Power on : (1) Check input power. (2) Check the connection of communication cable. (3) Power on. (4) Check power LED light of power module. (5) Check LED status of CPU module ⇨ If abnormal, see Troubleshooting of manual according to each PLC type. (6) Check whether LED status of communication module is normal or not. ⇨ If abnormal, see Chap. 9 Troubleshooting of this manual.
▼
Programming : Programming is prepared in KGLWIN, and it is written into CPU module. (Properly use flags that are related to emergency action for communication cut-off during communication with other station and monitoring of other station)
▼
Sequence check : Checks operation of communication module according to program.
▼
Program correction : Corrects if there is any error of sequence program.
▼
Program preservation : (1) Stores program into floppy disk or hard disk. (2) Prints circuit drawing and list with printer. (3) Writes program to memory module, if necessary.
End

2) Communication module to be mounted in PC

Starting
Power : (1) Check input power. (2) Check the connection of communication cable(when cable is connected). (3) Power on. (4) Check booting status of PC. ⇨ If abnormal, see Chap. 9 Troubleshooting of user's manual in FAM4.0/KGLWIN. (5) Check whether LED status of communication module is normal or not. ⇨ If abnormal, see Chap. 9 Troubleshooting of this manual. (6) Check whether this module is initialized or not by executing FAM4.0/KGLWIN. ⇨ See user's manual of FAM 4.0/KGLWIN. (7) Check LED status of this module. ⇨ See 'Appendix LED status' of this manual. If the operation is abnormal, see chap. 9 Troubleshooting. (8) Preparation and execution of program to be executed. ⇨ See user's manual of FAM4.0/KGLWIN. If the operation is abnormal, see chap. 9 Troubleshooting of this manual.

▼

End
(1) Stop all execution of FAM4.0/KGLWIN, and finish. (2) Check LED of this module.

8.2 Installation and testing operation of Fnet option unit

8.2.1 Active coupler of Fnet

1) Mounting and installation

Active coupler means the assembly of G0L-FAPA(Power)/ G0L-FABA(Base)/ G0L-FACA(Module), and this is used to dispart and connect optical signal to many places.

Fig. 8.2.1 shows example of active coupler communication module

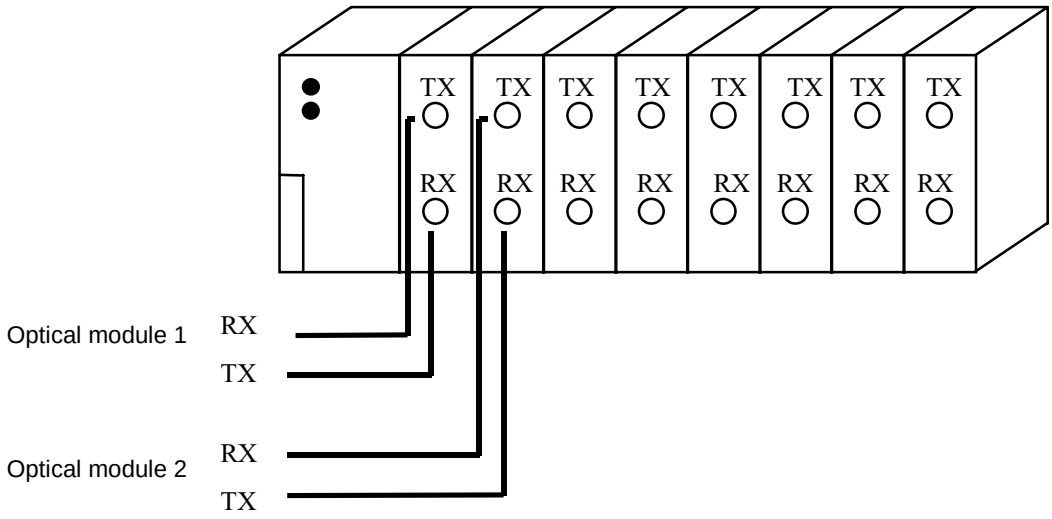
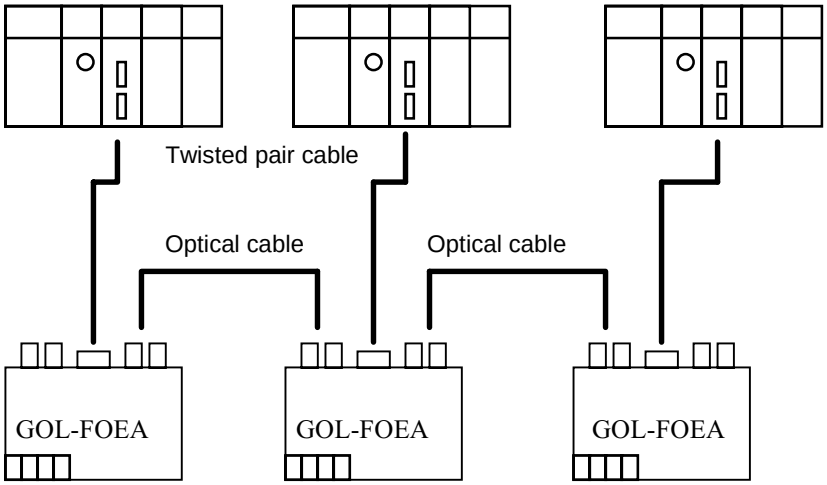


Fig. 8.2.1 Example of active coupler mounting

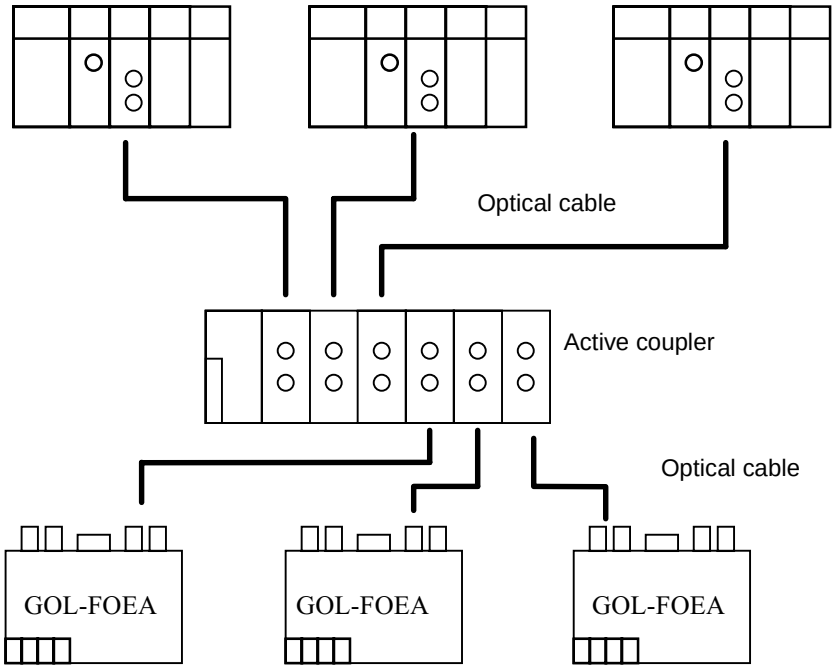
(1) Prepare standard configuration that is needed in system configuration, and select communication module that is relevant to the device type.
(2) This communication module should be mounted when power is off.
(3) When mounting this communication module, check whether connector of base that module will be mounted has foreign matters or not, and check whether connector pin of this module is broken or not.
(4) When mounting this module, push active coupler module into groove of upper and lower body in active coupler before connecting communication cable. Push it hard to be completely inserted in base board.
(5) Connect communication cable after mounting this module.
(6) Mount dummy module(G0L-FADA) to protect unused slot from foreign matters like dust or others.

8.2.2 E/O converter(Electric/optical signal converter)

This module(G0L-FOEA) converts electric and optical signal of Fnet each other, and this can be configured as follows :



[When optical cable is used to connect between Fnet modules of many stations]

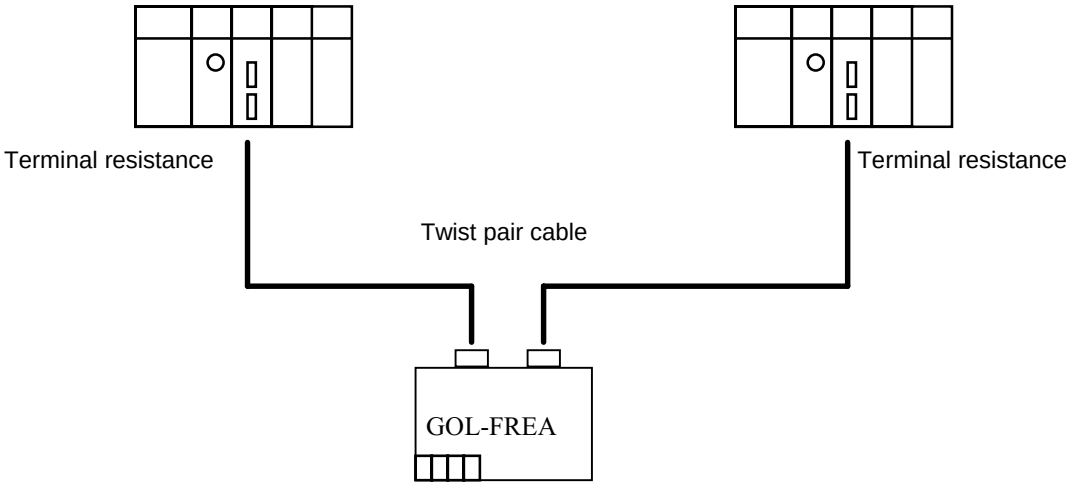


[When optical cable is used to connect between Fnet modules of many stations using active coupler]

1) Prepare standard configuration that is needed in system configuration, and select communication module that is relevant to the device type.
2) This communication module should be mounted when power is off.
3) Connect communication cable after mounting this module.
4) Completely connect the connector of optical cable by accurately inserting in Tx/Rx.

8.2.3 Repeater(Electric signal restructure)

Repeater(G0L-FREA) is used to restruct the electric signal of Fnet. Installation method is as follows :



[When the signal between Fnet modules is restruct(to make the signal level 'High')

1) Prepare standard configuration that is needed in system configuration, and select communication module that is relevant to the device type.
2) This communication module should be mounted when power is off.
3) To connect the cable of electric module, tighten the screw of cable connector to confirm the connection. Terminal resistance is built in the repeater.

8.3 Repair and check

Perform routine check and regular check to maintain the best status of this communication module.

8.3.1 Daily check

1) Master of Fnet

Items of routine check are as following table :

Table 8.3.1(A) Items of routine check

Items to be checked		Contents	Criteria of decision	Action to take
Cable connection status		Release of cable	Shall not be any release.	Tighten the cable.
Module connection status		Release of screw	Shall not be any release.	Tighten screw of module.
LED indication	RUN	Flicker check	Flash (Lights-out means interface cut-off with CPU).	See Appendix.
	LAS	Light on Check	LED of only one module among entire module of network should be lighted (Lights of two or more mean abnormal configuration of network).	See Appendix.
	TOKEN	Flicker check	Light off means abnormal (Duplicated station or cable error).	See Appendix.
	TX/RX	Flicker check	Light off means abnormal (Hardware error of module).	See Appendix.
	FAULT	Light off check	Regular flash means system error, and intermittence flash means communication error.	See Appendix.

2) Slave of Fnet

Items of routine check are as following table :

Table 8.3.1(B) Items of routine check

Items to be checked		Contents	Criteria of decision	Action to take
Cable connection status		Release of cable	Shall not be any release.	Tighten the cable.
Connection status of terminal block		Release of terminal screw	Shall not be any release.	Tighten screw of terminal.
		Gap between compression terminals	Shall be relevant gap.	Correct.
LED indication	RUN	Light on check	Check power if light off.	See Appendix.
	TOKEN	Flicker check	Light off means abnormal operation (Duplicated station or cable error).	See Appendix.
	TX/RX	Flicker check	Light off means abnormal operation (Duplicated station or cable error).	See Appendix.
	FAULT	Light off check	Intermittent flash means communication error (Cable connection error, or terminal resistance connection error).	See Appendix.
	SYS FAULT	Light off check	Regular flash means system error (Error code is displayed in LED).	See Appendix.

3) Communication module of Mnet

Items of routine check are as following table :

Table 8.3.1(C) Items of routine check

Items to be checked		Contents	Criteria of decision	Action to take
Cable connection status		Release of cable	Shall not be any release.	Tighten the cable.
Connection status of terminal block		Release of terminal screw	Shall not be any release.	Tighten screw of terminal.
		Gap between compression terminals	Shall be relevant gap.	Correct.
LED indication	RUN	Light on check	Light on (Lights-out means abnormal).	See Appendix.
	TX	Light on check in RUN status	Light on (Lights-out means abnormal).	See Appendix.
	RX	Light on check in RUN status	Light on (Lights-out means abnormal).	See Appendix.
	IN-RING	Light on/light off check	Light on (Light off means abnormal) Lights when cable is connected with other station.	See Appendix.
	FAULT	Light off check	Light off (Light on or flash error).	See Appendix.

8.3.2 Regular check

Check following items once or twice per six months, and perform relevant action to take.

Table 8.3.2 Items of regular check

Items to be checked		How to check	Criteria of decision	Action to take
Ambient environment	Ambient temperature	Check using thermometer and hydrometer.	0~55℃	Arrangement by general specification (If it is used in a class, environment of class is used as standard).
	Ambient humidity		5~95%RH	
	Ambient pollution	Check corrosive gas.	Shall not be any corrosive gas.	
Module status	Release, shaking	Shake communication module.	Shall not be any release or shaking.	Tighten the screw.
	Attachment of dust and foreign matter	Visual inspection.	Shall not be any attachment.	Remove
Connection status	Release of terminal screw	Tighten using driver.	Shall not be any release.	Tighten.
	Gap between compression terminals	Visual inspection.	Shall be relevant gap.	Correct.
	Release of connector	Visual inspection.	Shall not be any release.	Fix the connector Tighten the screw.
Power voltage check		Check voltage between terminal.	AC 85~132V AC 170~264V	Change supplied power.

Chapter 9 Troubleshooting

This chapter explains all of error contents which may occurs during system management, cause detection, and how to take action. If error occurred in communication module, error contents are displayed through LED of communication module. At this time, user can read error indication(Ex. FMM_06) according to appropriate LED status from Appendix, and perform troubleshooting according to error code(Ex. E00-01) from error indication in this chapter.

9.1 Abnormal operations

Table 9.1(A) H/W related error of communication module

Error code	Error indication (See LED contents of Appendix)	Error contents
E00-01	FMM_06 ~ FMM_10 FMM_24 ~ FMM_27 FSM_05 ~ FSM_10 FSM_32 MCM_06 ~ MCM_09	Hardware self diagnosis error among LED indication of each module.
E00-02	FMM_11 ~ FMM_13 MCM_11	Interface diagnosis error with PLC among LED indication of each module.
E00-03	FOU_41, FOU_42, FOU_43, FOU_44 FOU_51, FOU_52, FOU_61, FOU_62	Power and hardware error of FOU group occurred.
E00-04	FSM_08 ~ FSM_10	Initialization of I/O and special module in slave group.

Table 9.1(B) Abnormal communication status of communication module

Error code	Error indication	Error contents
E01-01	FMM_16 ~ FMM_21 FSM_13 ~ FSM_16 FSM_31 ~ FSM_33	Communication error in master and slave group of Fnet (Communication is not made well).
E01-02	MCM_12 ~ MCM_14	Communication error in communication module group of Mnet (Communication is not made well).
E01-03	FOU_41, FOU_42, FOU_43 FOU_51, FOU_61	Communication error in FOU group of Fnet (Communication is not made well).

Table 9.1(C) Abnormal interface operation of PLC of communication

Error code	Error indication	Error contents
E02-01	FMM_22, FMM_23 MCM_11	Interface with PLC in master and communication module group is not made well.
E02-02	FSM_08 ~ FSM_10	Interface error with I/O module in slave group of Fnet.

Table 9.1(D) Abnormal operation of *high speed link* function

Error code	Error indication	Error contents
E03-01	*High speed link* parameter error in error status dialog box.	This error happens when *high speed link* parameter is not set well or not set at all, or it is broken, after setting link-enable of on-line.
E03-02	*High speed link* communication is not performed.	When communication is not made well even though *high speed link* is normal after setting link-enable.
E03-03	Contacts of _HSxRLNK and _HSxTRX are not set to 'On' during *high speed link*.	When _HSxRLNK is not set to 'On' even though *high speed link* parameter is normal after setting link-enable.
E03-04	Contacts of _HSxTRBL, etc. are set to On during *high speed link*.	After setting link-enable and _HSxRLNK of *high speed link* is set to 'On', when HSxLTRBL is set to 'On' by the problem of PLC and communication in normal status.

Table 9.1(E) Abnormal operation of communication command service function

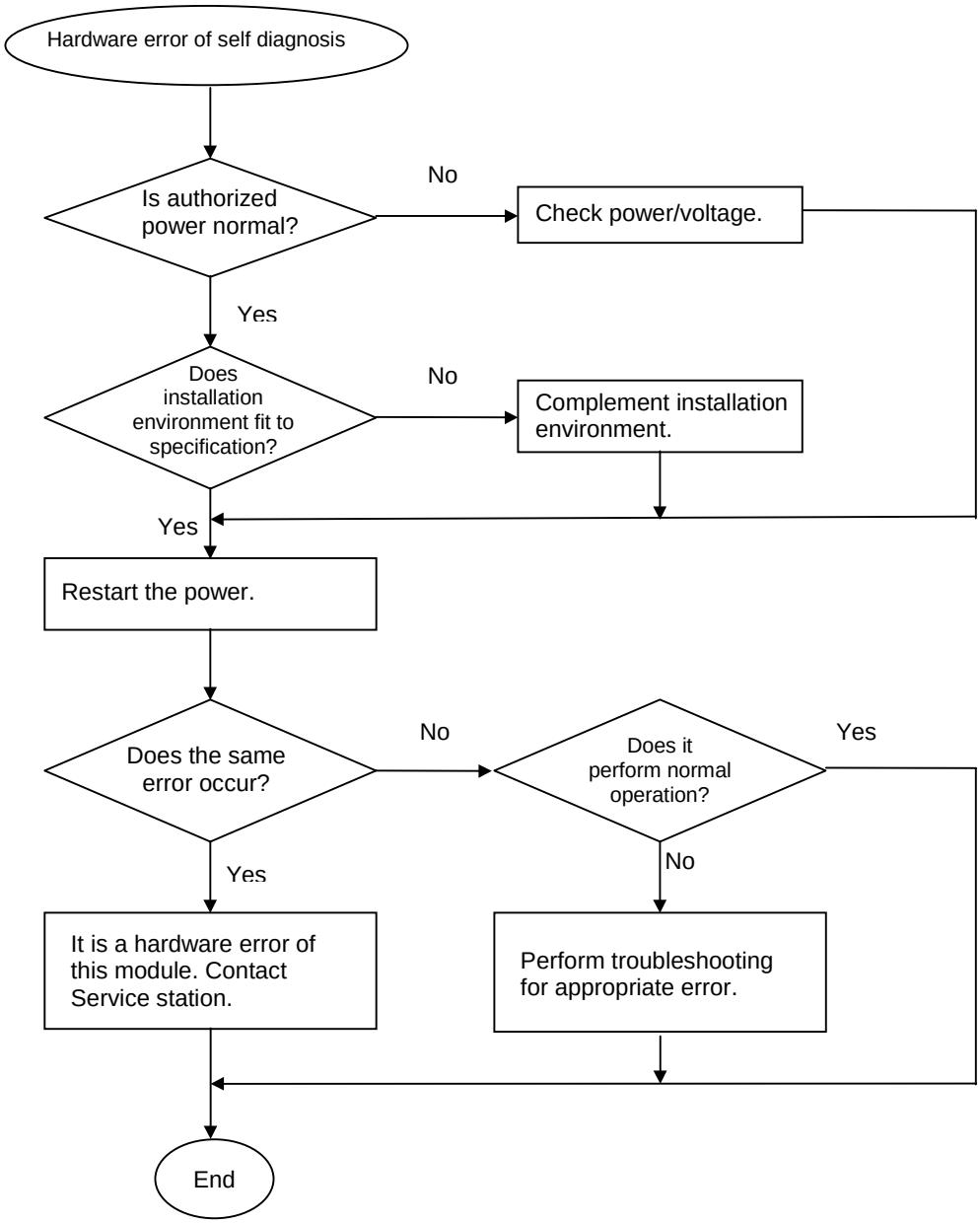
Error code	Error indication	Error contents
E04-01	When service is performed by Fnet, ERR contact of communication command is set to 'On' and the value of status is not '0'.	ERR of communication command is set to 'On', or NDR/ERR of communication command doesn't become '1'.
E04-02	When service is performed by Mnet, ERR contact of communication command is set to 'On' and the value of status is not '0'.	ERR of communication command is set to 'On', or NDR/ERR of communication command doesn't become '1'.

Table 9.1(F) Abnormal operation of GMWIN communication service function

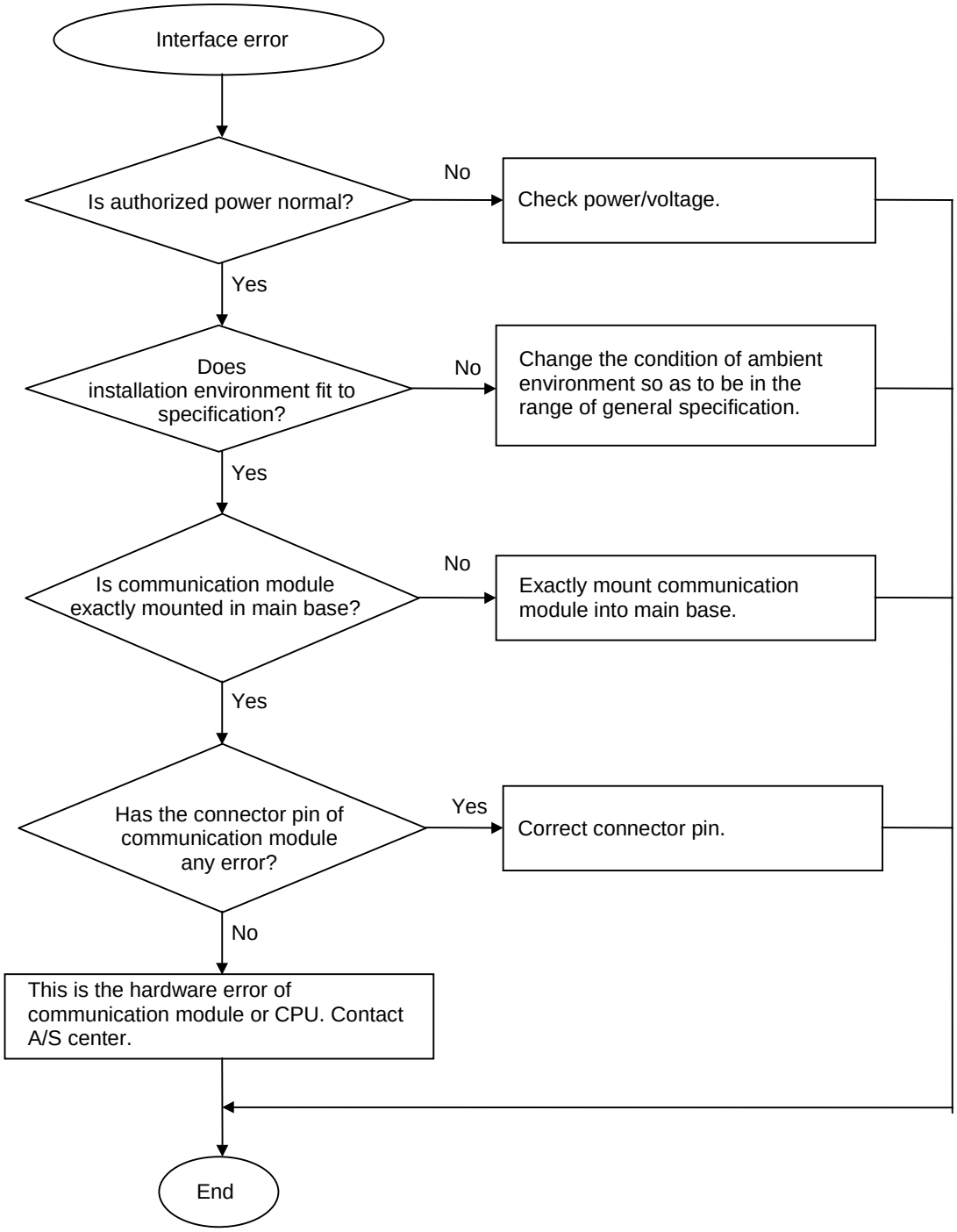
Error code	Error indication	Error contents
E05-01	Message of [No response] occurs during remote connection request.	RS-232C cable is not connected between GMWIN and PLC or the power of PLC is off.
E05-02	When other error message occurred during remote connection request.	Service is not performed well because request is not relevant.

9.2 Troubleshooting by each error code

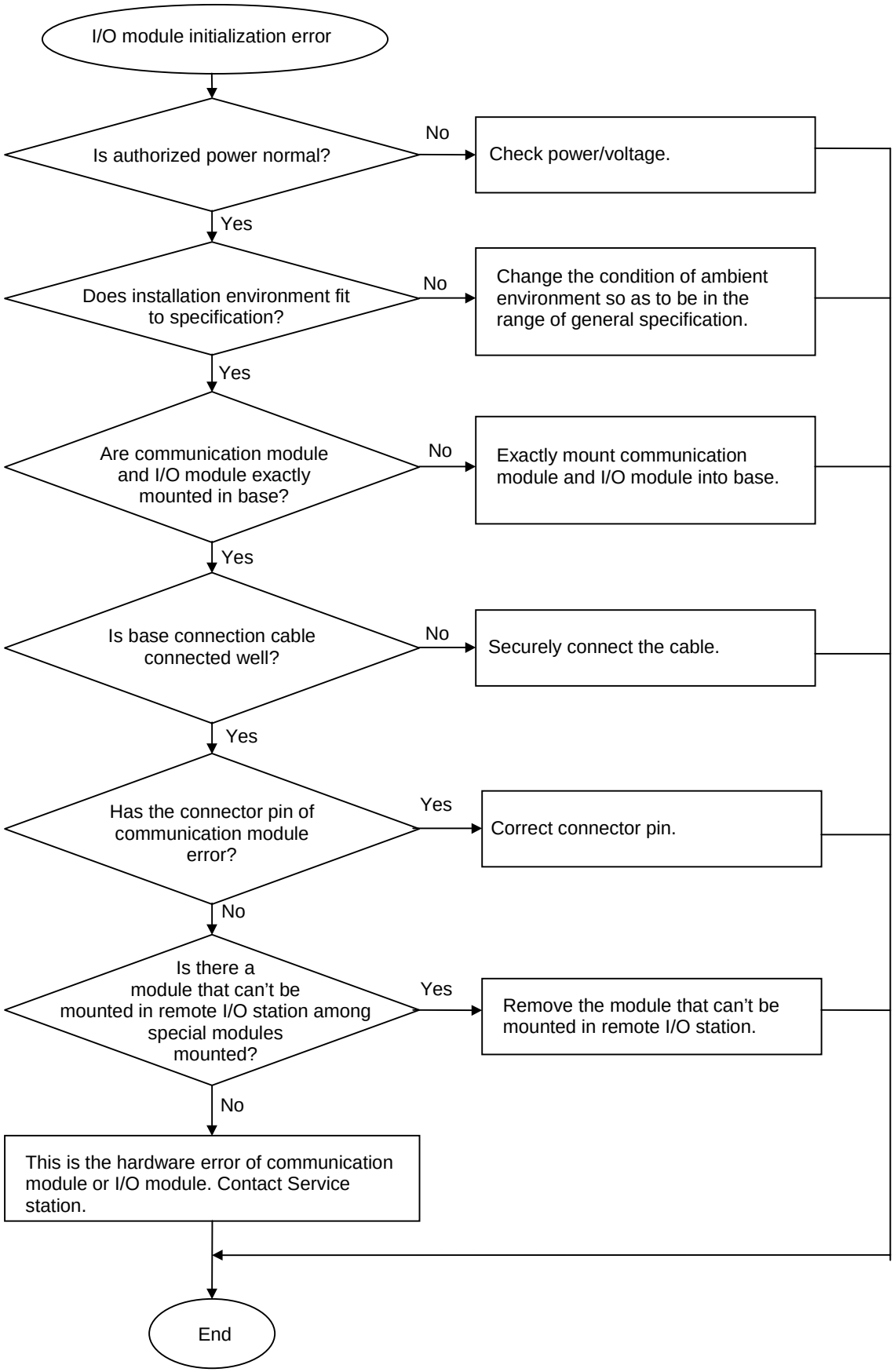
9.2.1 Error code E00-01 : Hardware error
E00-03 : Hardware error of option module



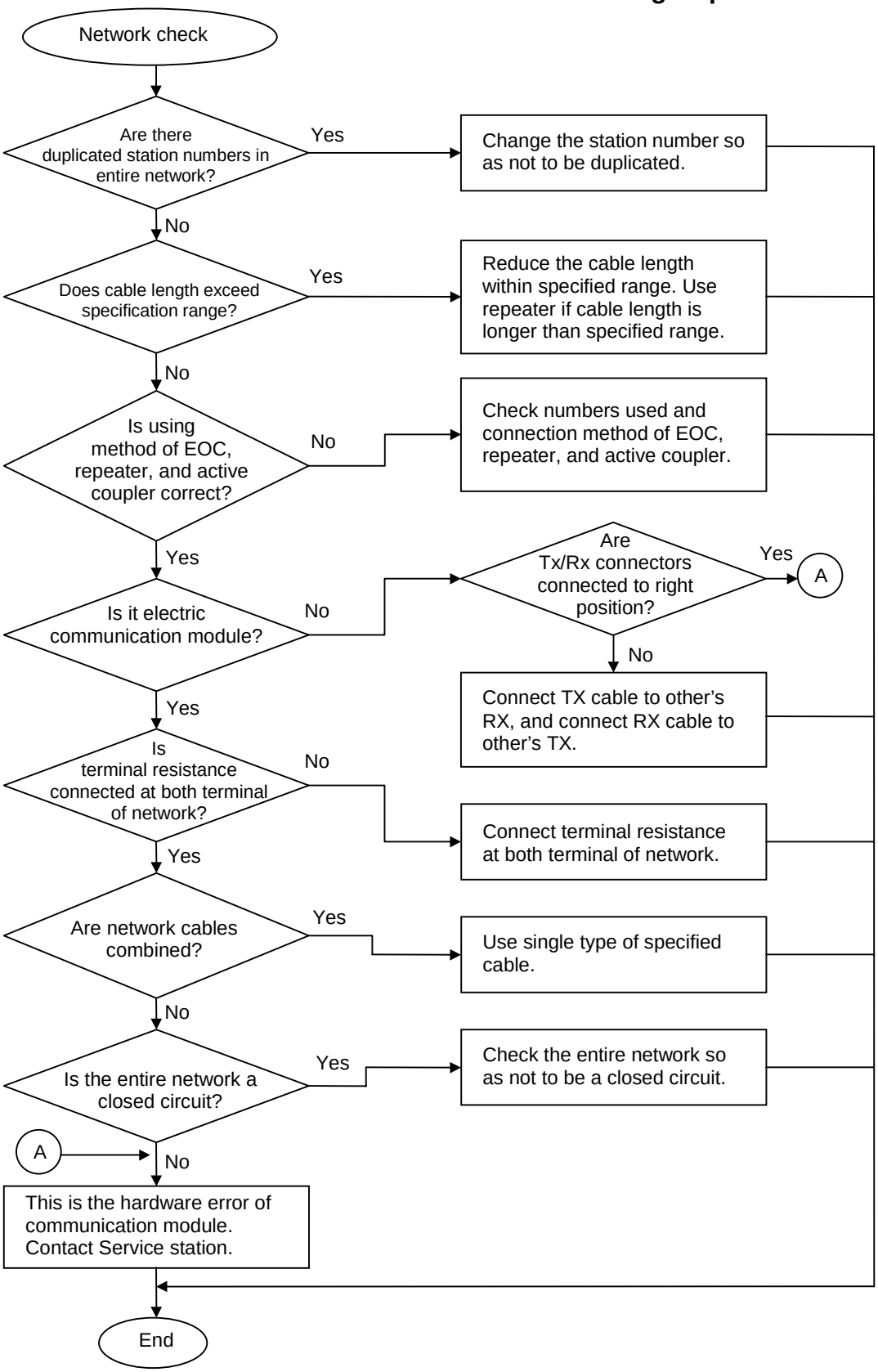
9.2.2 Error code E00-02 : Interface error



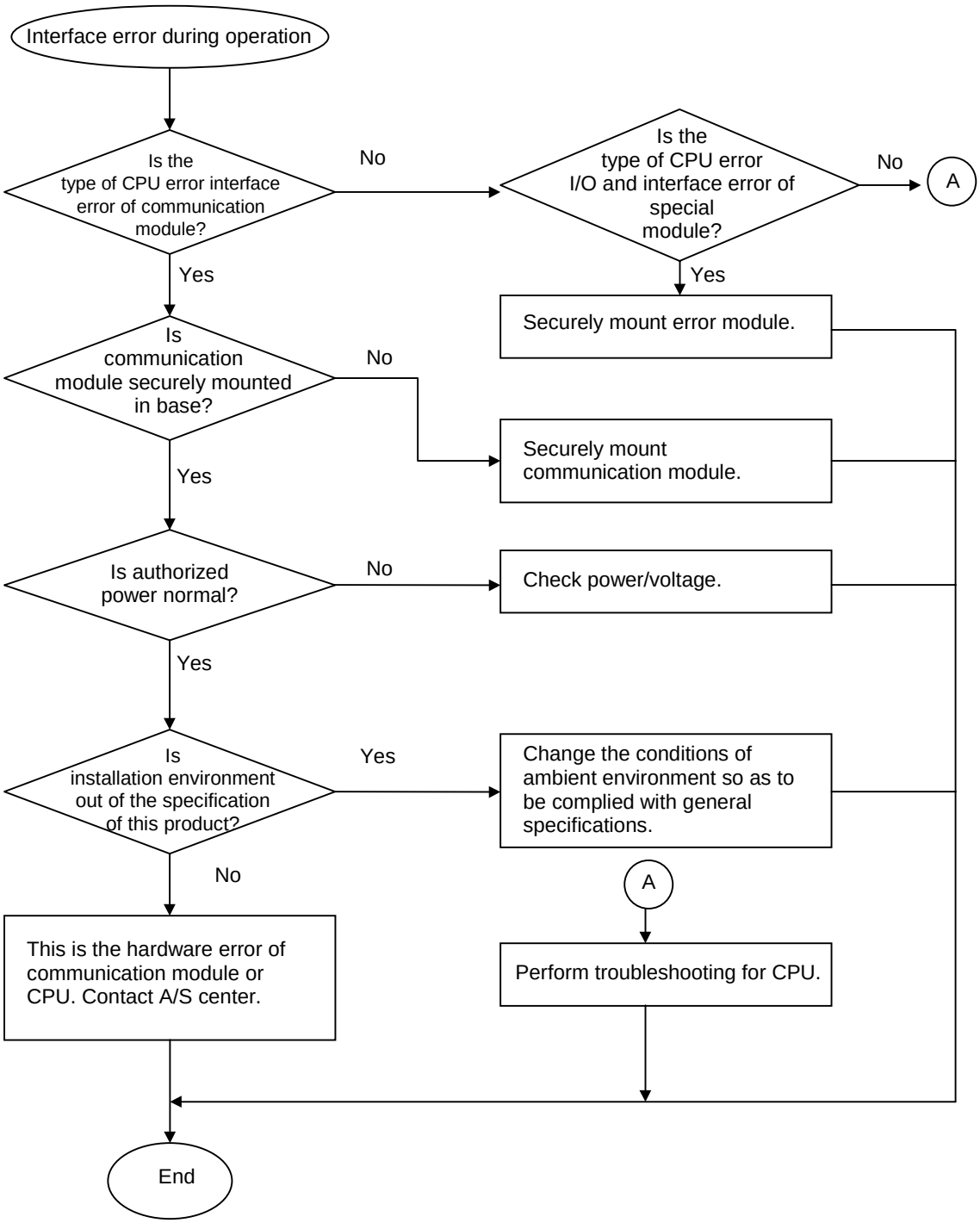
9.2.3 Error code E00-04 : I/O initialization error of FSM(Fieldbus Slave Module)



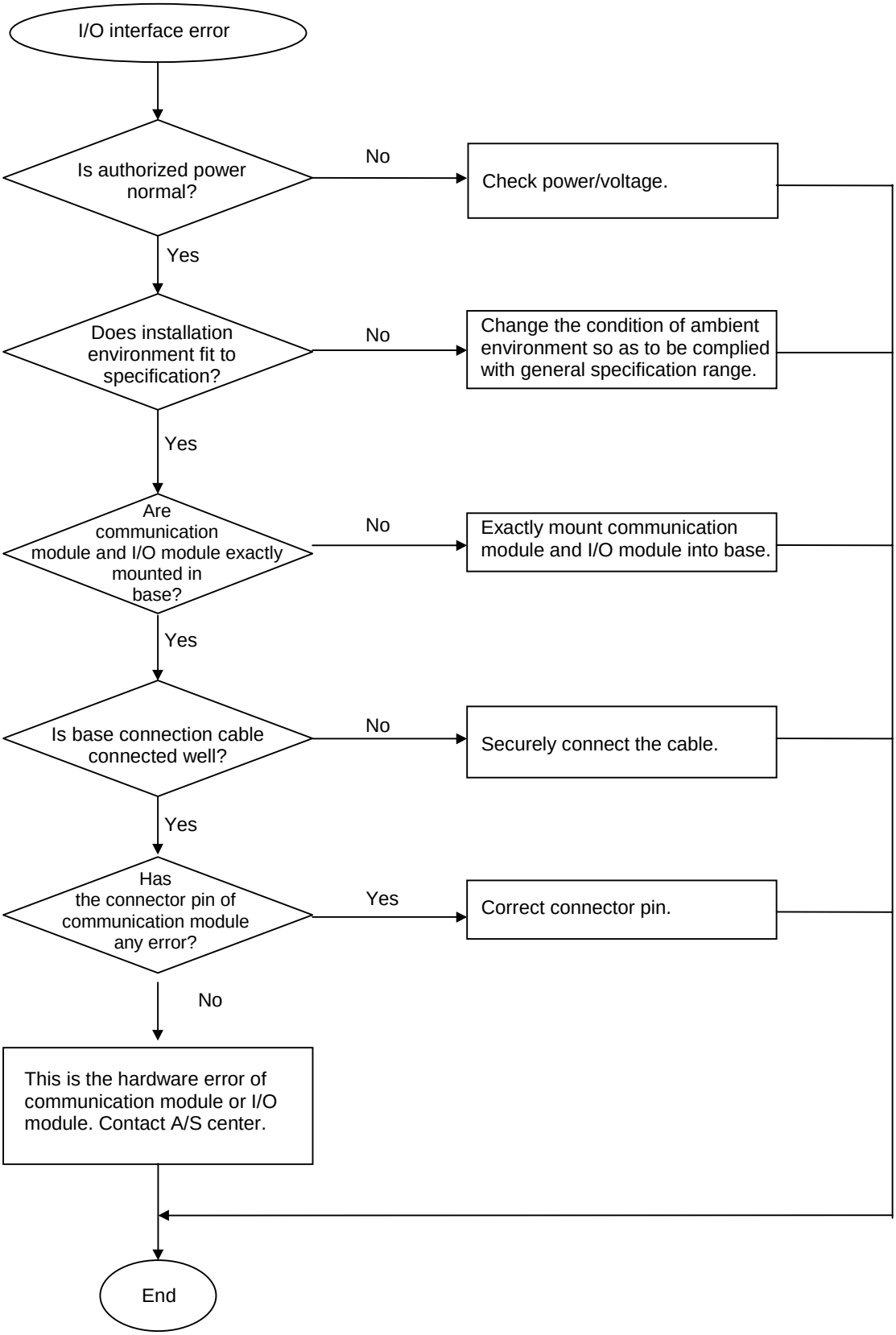
9.2.4 Error code E01-01 : Communication failure in Fnet
E01-02 : Communication failure in Mnet
E01-03 : Communication failure in FOU group



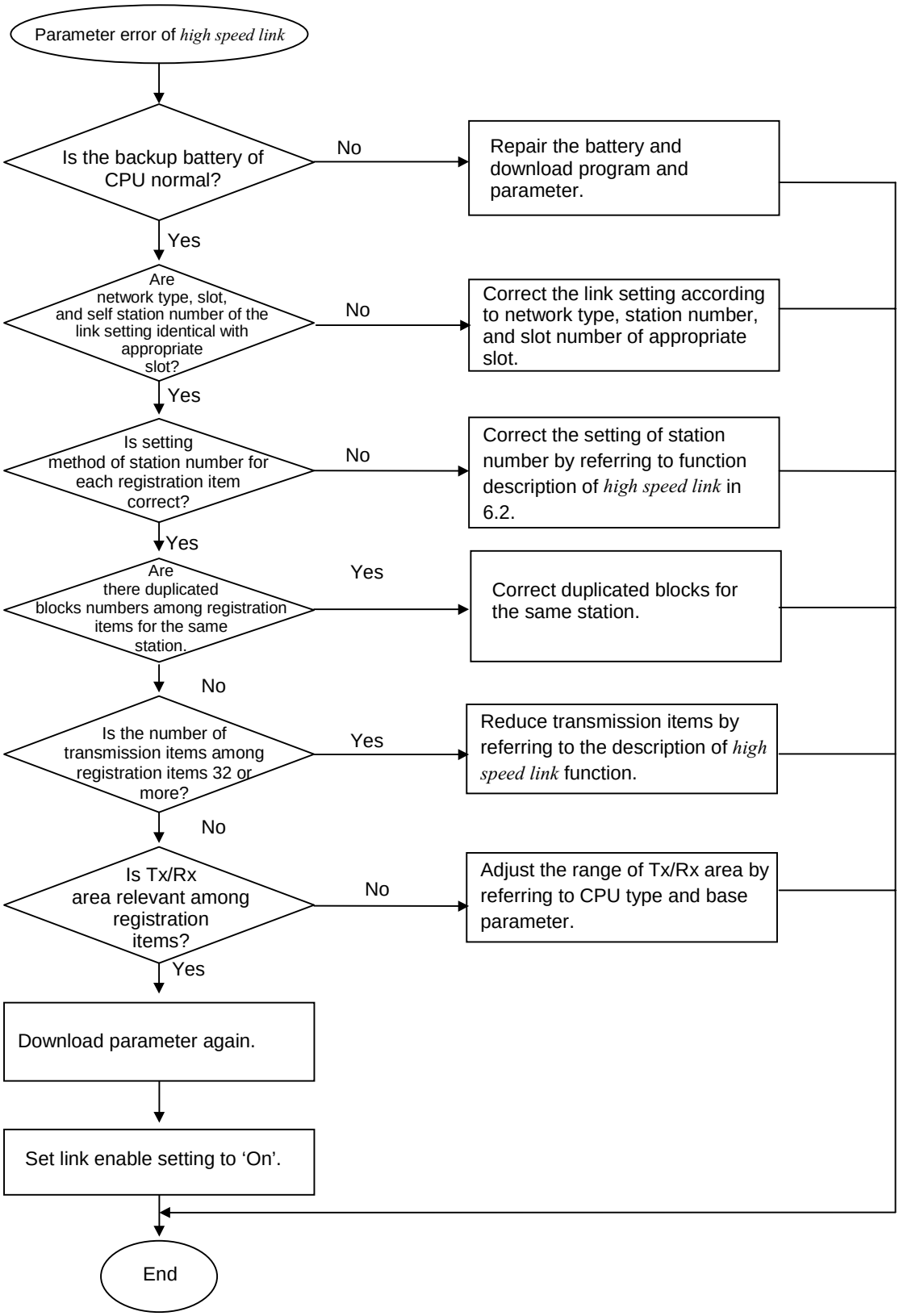
9.2.5 Error code E02-01 : PLC interface error during operation



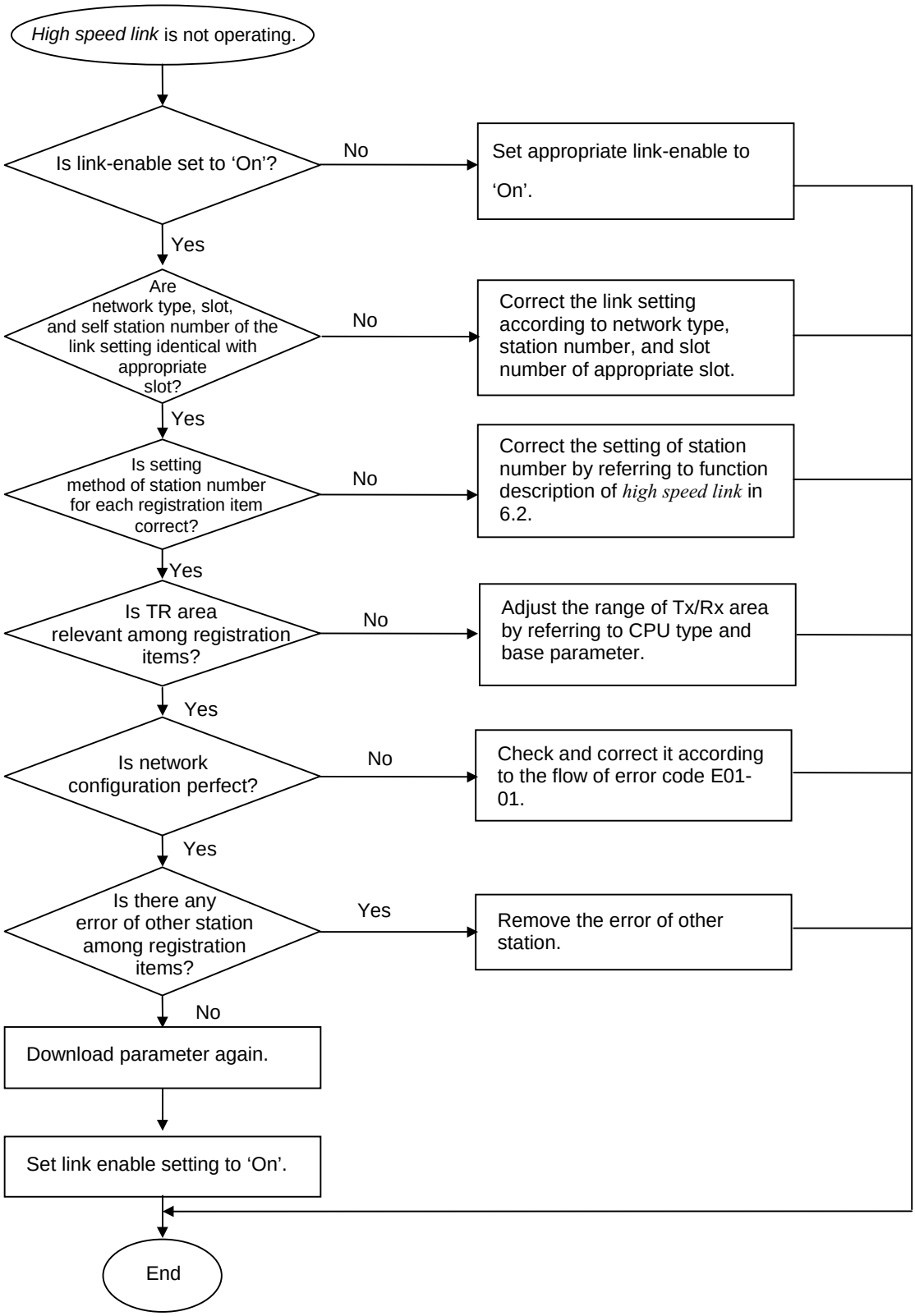
9.2.6 Error code E02-02 : Slave mounting and writing interface error during operation



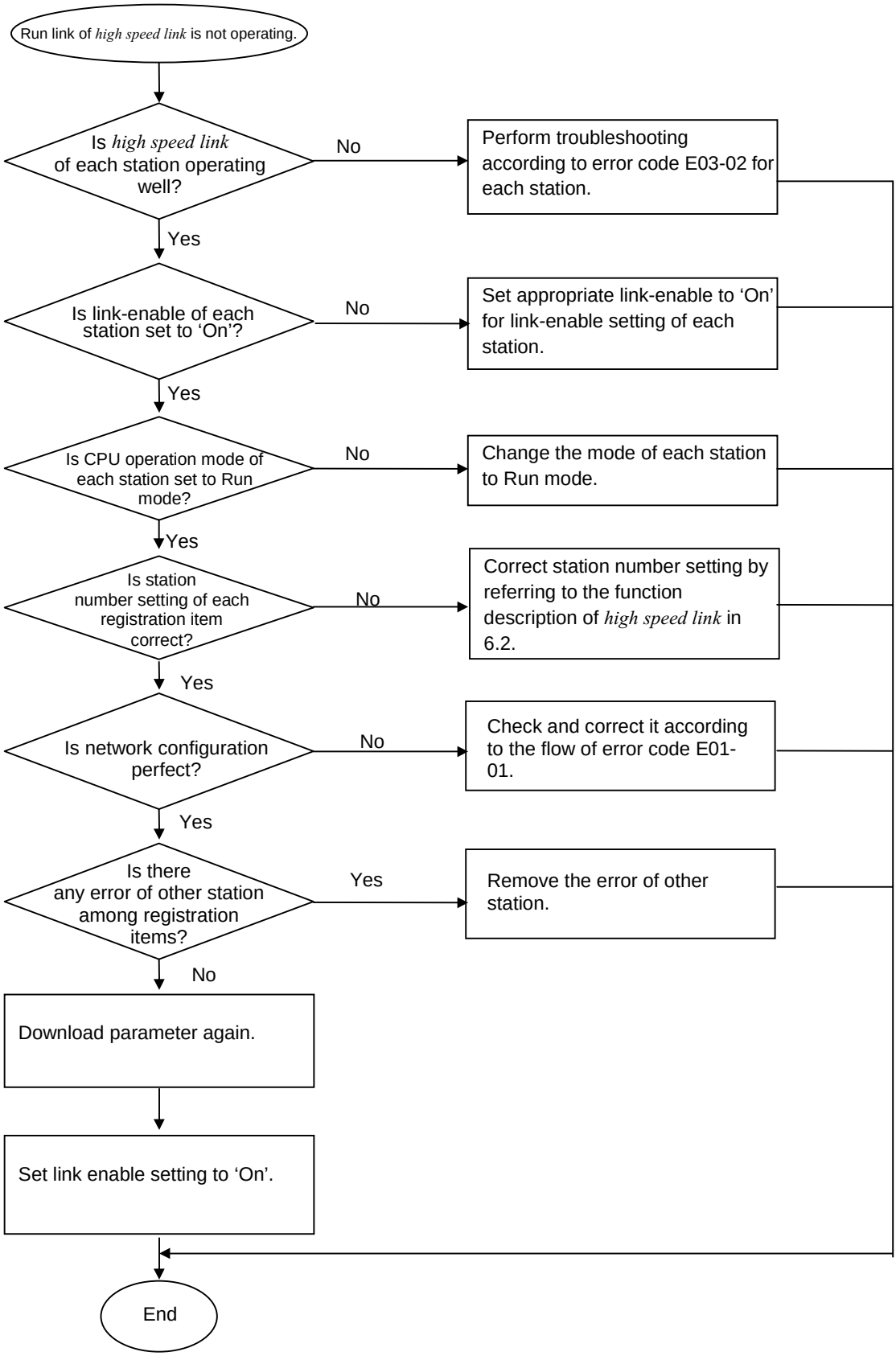
9.2.7 Error code E03-01 : *High speed link* parameter error



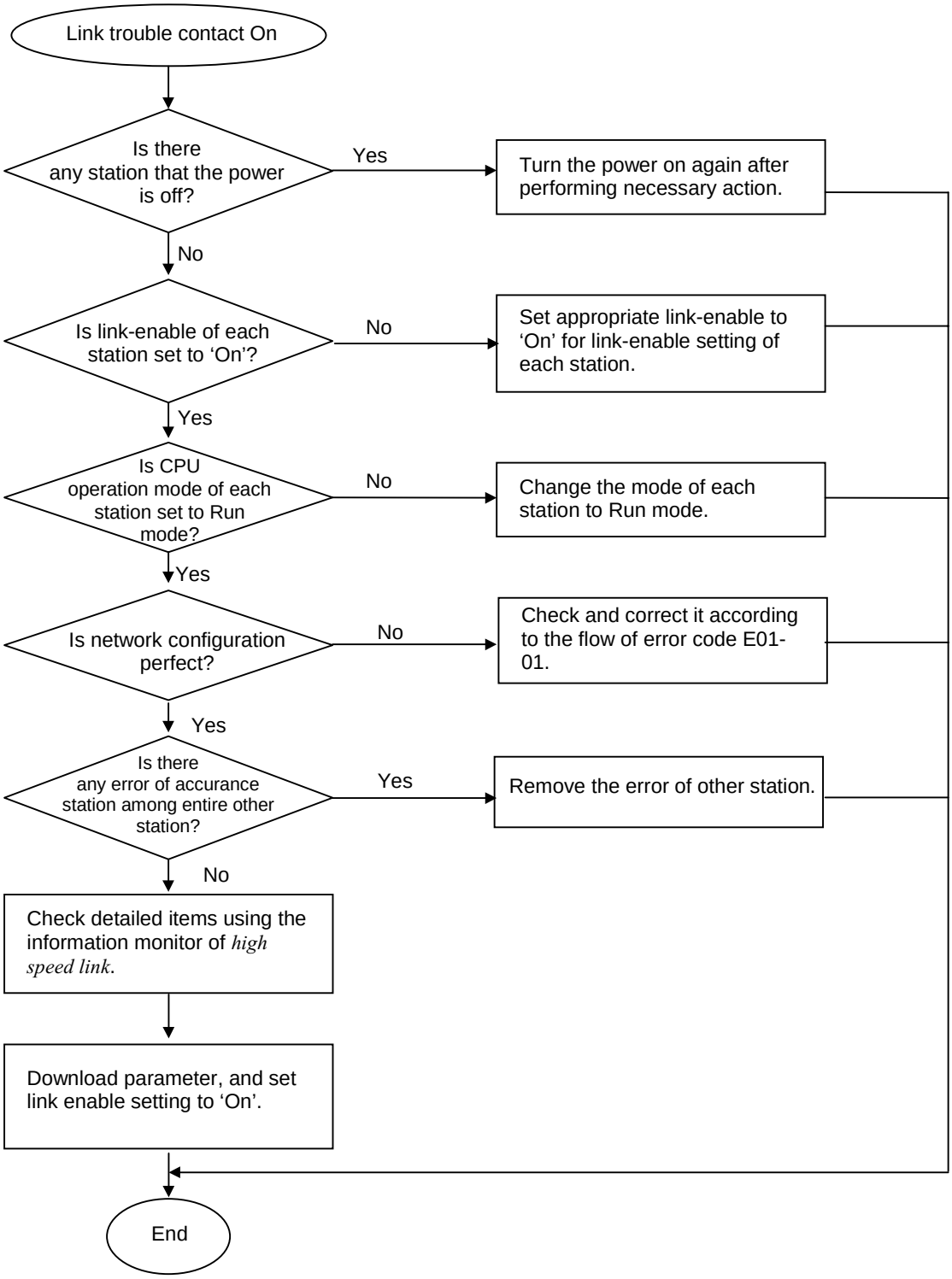
9.2.8 Error code E03-02 : *High speed link* not run



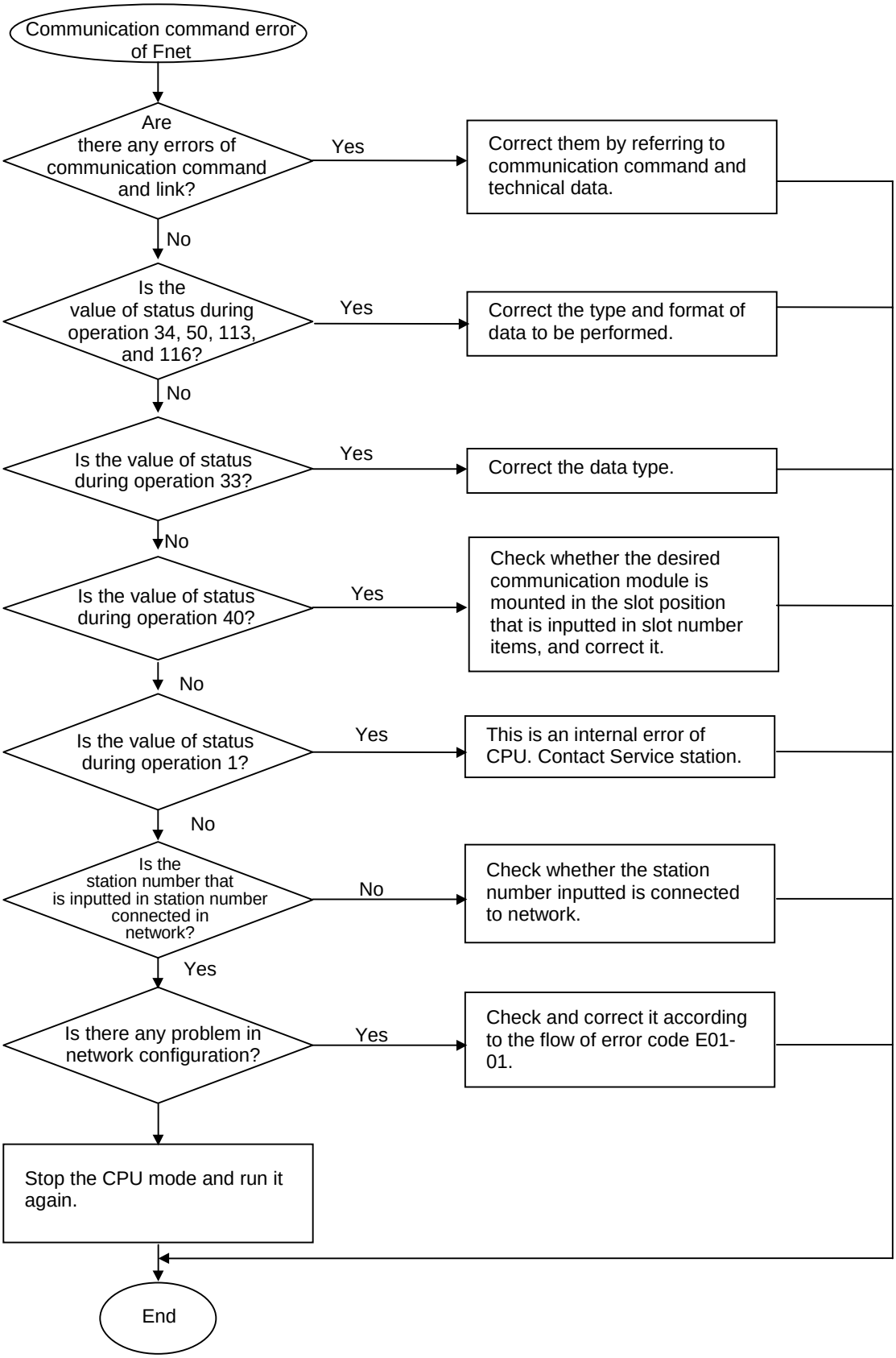
9.2.9 Error code E03-03 : Run link contact of *high speed link* not ON



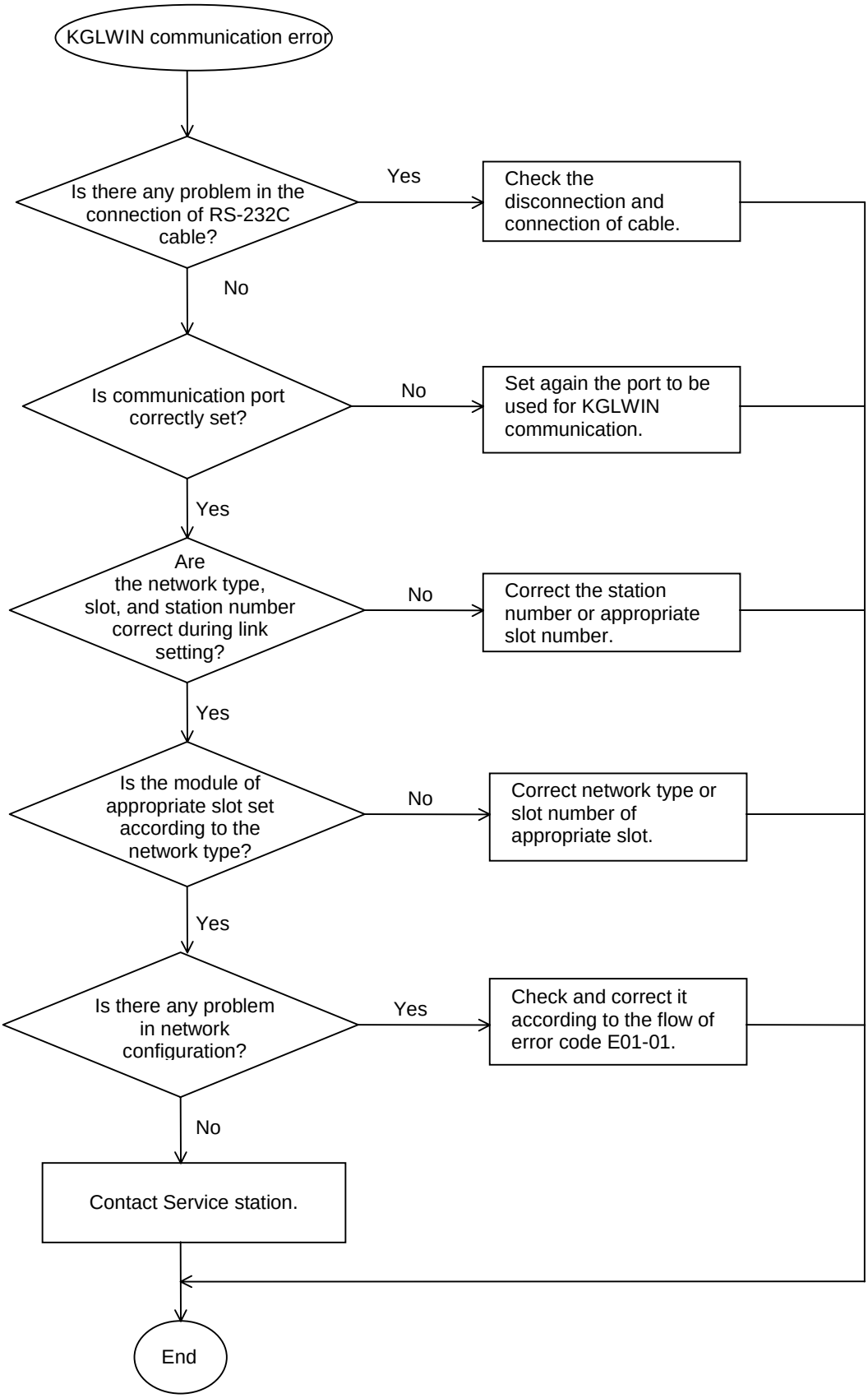
9.2.10 Error code E03-04 : Trouble contact of *high speed link* ON



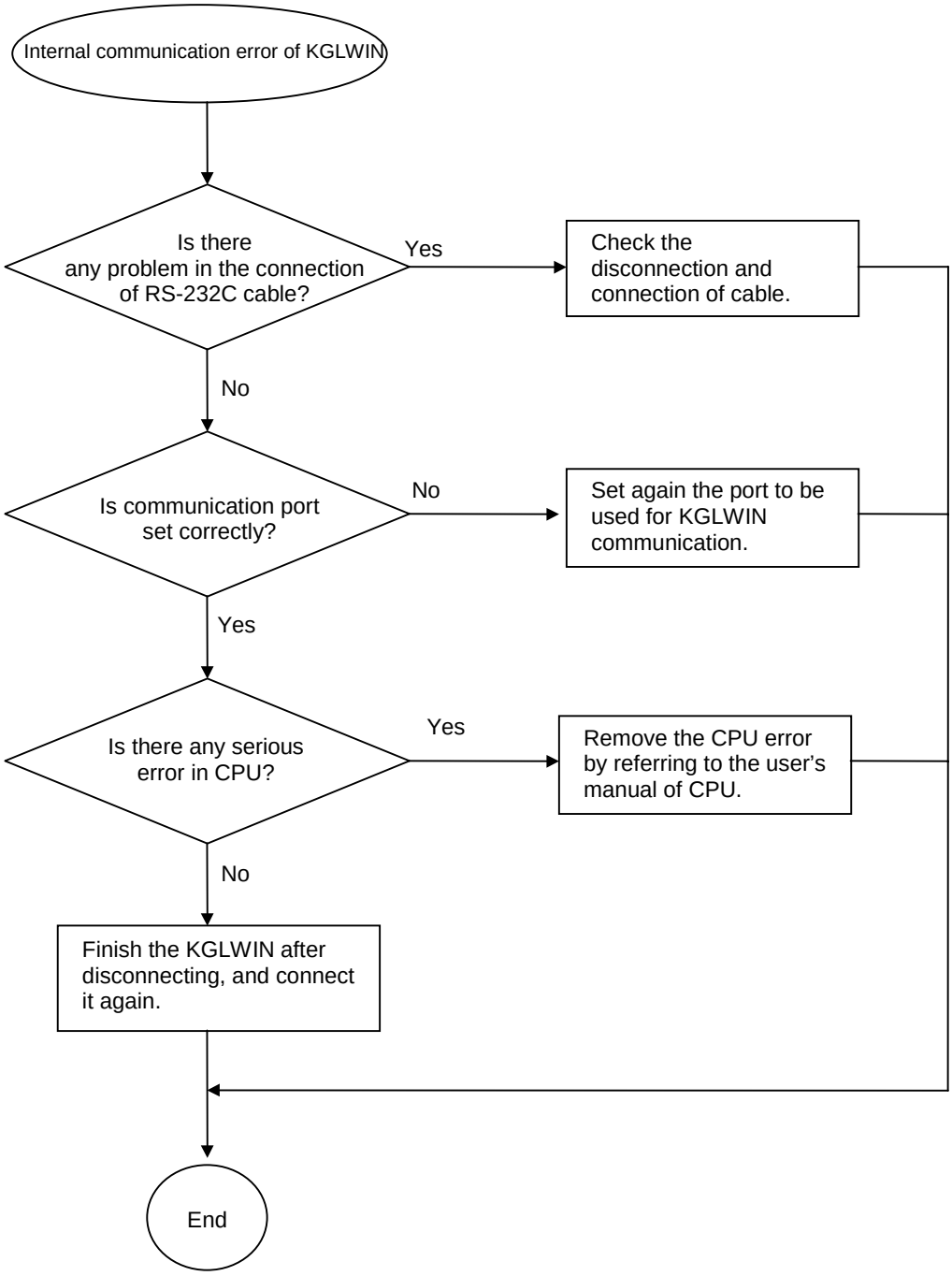
9.2.11 Error code E04-01 : Execution error of Fnet communication command
E04-02 : Execution error of Mnet communication command



9.2.12 Error code E05-01 : Time out error in KGLWIN communication



9.2.13 Error code E05-02 : Internal error of Fnet KGLWIN communication



Appendix

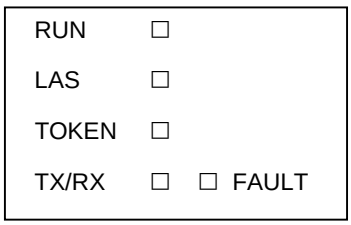
A1 LED Specifications

A1.1 LED specifications of Fnet master module

1) Units to be applied :

K7F-FUEA, K7F-FUOA, K4F-FUEA, , G0L-FUEA

K3F-FUEA



2) LED indication spec.

(1) RUN : Indicates that PLC CPU module and interface is proceeding actively.
- On : PLC and interface normal
- Off : Interface abnormal, or interface stopped

When normal, it seems to be 'On', but, because the flash cycle changes according to PLC scan, it may seem to be 'Off' in visual as it becomes 'On' at intervals or by once for 1~2 sec. when PLC User Program Scan is long(200ms or more), or communication module of 2 or more has been mounted on PLC so that many data may be exchanged. This is not abnormal operation of communication module, but because data processing speed has become late due to many communication quantity.

(2) LAS : The LED of the station that assign tokens to each station becomes On in order to perform data Tx/Rx with communication module connected. Among many communication stations, the communication module that is firstly powered on has LAS, and among all stations connected via single network, LAS LED of only one station becomes On.

- On : Being in performing function with Link Active Scheduler(LAS).
- Off : Being in performing function with Link Master(LM).

(3) TOKEN : Indicates that module is sending transmission data by assigning circulation token from LAS. If network has many stations connected, and each station has many data, LED flashes at late speed.

- On : Currently possesses circulation token.
- Off : Does not possess token.

(4) TX/RX : Indicates that self station is receiving data from other station or sending self data.

– On : Indicates that it is sending or receiving.
– Off : Indicates that there is no Tx/Rx frame.

(5) FAULT : This is a LED indicating whether error occurred in communication module, which becomes 'Off' during normal operation, and flashes at 1 sec. interval when error that normal operation is impossible occurs. The type of error is indicated through 5 LEDs of LED0(RUN)~LED4(FAULT).

☐ If it flashes at intervals, it means that there is a error in communication module, communication cable, terminal resistance, connection status, duplicated station, and the other. Thus, check the followings :

☐ Is terminal resistance correctly connected?
☐ Is cable securely connected?
☐ Is communication cable shield line connected with connector?(must be connected)
☐ Do cable and terminal resistance fit to the specifications?
☐ Is total length of cable 750m or less?
☐ Isn't there any duplicated station?

Table A.1.1 describes LED indication contents of Fnet master module.

Table A.1.1 LED indication contents of Fnet master group

Segment	Error type	LED status	Error contents
FMM_00	During power on	● ○ ○ ○ ○	Being in self diagnosis of internal memory 1 in this module
FMM_01		○ ● ○ ○ ○	Being in self diagnosis of internal memory 2 in this module
FMM_02		○ ○ ● ○ ○	Being in self diagnosis of communication
FMM_03		○ ○ ○ ● ○	Being in diagnosis of CPU and interface
FMM_04	Normal communication	● ○ ◍ ◍ ○	Module is not LAS.
FMM_05		● ● ◍ ◍ ○	Module is LAS.
FMM_06	Hardware error	● ○ ○ ○ ▥	Error in self diagnosis of internal memory 1
FMM_07		○ ○ ○ ● ▥	Error in self diagnosis of internal memory 2
FMM_08		○ ○ ● ○ ▥	Error in self diagnosis of communication
FMM_09		○ ○ ● ● ▥	Error in diagnosis of interface chip
FMM_10		○ ● ○ ○ ▥	Error in diagnosis of interface RAM
FMM_11		○ ● ○ ● ▥	Error 1 in diagnosis of CPU and interface
FMM_12		○ ● ● ○ ▥	Error 2 in diagnosis of CPU and interface
FMM_13		○ ● ● ● ▥	Error 3 in diagnosis of CPU and interface
FMM_14	System operation error	● ○ ○ ○ ▥	System error during operation
FMM_15		● ○ ○ ● ▥	
FMM_16	Abnormal communication	● ● ○ ○ ▤	Error in configuration of network
FMM_17		● ● ○ ◍ ▤	Repeated station No., abnormal terminal resistance
FMM_18		● ● ◍ ◍ ▤	Cable cut off/Short
FMM_19		● ● ○ ◍ ▤	Specified length of cable is not proper or hardware error of this module
FMM_20		● ○ ◍ ◍ ▤	
FMM_21		● ○ ○ ○ ▤	Error in configuration of network
FMM_22	Interface error	○ ● ◍ ◍ ○	Interface error(stopped) for LAS
FMM_23		○ ○ ◍ ◍ ○	Interface error(stopped) for not LAS
FMM_24	Not restorable error	● ● ● ● ●	Hardware error of communication module
FMM_25		● ○ ○ ○ ○	
FMM_26		○ ○ ○ ○ ○	
FMM_27		○ ○ ○ ○ ●	

※ LED position follows the sequence of signal RUN, LAS, TOKEN, TX/RX, and FAULT from left side.

● Light on ○ Light off

▥ Flash at 1 sec. interval

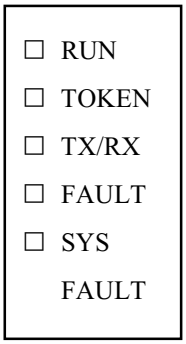
▤ Irregular non-interval flash or Off

◍ Irregular non-interval flash

A1.2 LED specifications of slave module

1) Units to be applied : K7F-RBEA, K7F-RBOA, K4F-RBEA

2) LED position



3) LED indication spec.

(1) RUN(LED 0) : Indicates RUN status, and means that I/O inspection and I/O refresh operation is normally being operated. This becomes off when power error of extension base, or error occurrence during special module access or I/O refresh.

– On : Indicates being in normal operation of slave.
– Off : Abnormal operation of slave.

(2) TOKEN(LED 1) : Indicates that module is sending transmission self data by assigning circulation token from LAS. This flashes during normal operation. If network has many stations connected, and each station has many data, LED flashes at slow speed.

– On : Currently possesses circulation token.
– Off : Does not possess token.

(3) TX/RX(LED 2) : Indicates that self station is receiving data from other station or sending self data.

– On : Indicates that it is sending or receiving.
– Off : Indicates that there is no Tx/Rx frame.

(4) FAULT(LED 3)

– Flash : Flashes when communication error/service error occur in link module.
– Off : Indicates being in normal operation.

☐ If it flashes at intervals, it means that there is an error in communication cable. Thus, check the followings :

☐ Is terminal resistance correctly connected?
☐ Is cable securely connected?
☐ Is communication cable shield line connected with connector body?(must be connected)
☐ Do cable and terminal resistance fit to the specifications?
☐ Is total length of cable 750m or less?
☐ Isn't there any duplicated station?

(5) SYS FAULT(LED 4) : This is a LED indicating error occurrence or not in communication module, which becomes 'Off' during normal operation and flashes at 1 sec. interval when error that normal operation is impossible occurs. The type of error is indicated through 5 LEDs of LED0~LED4.

Table A.1.2 LED indication specifications of slave group

Segment	Error type	LED status	Error contents
FSM_00	During power on	● ○ ○ ○ ○	Being in self diagnosis of internal memory 1 in this module
FSM_01		○ ● ○ ○ ○	Being in self diagnosis of internal memory 2 in this module
FSM_02		○ ○ ● ○ ○	Being in self diagnosis of communication
FSM_03		○ ○ ○ ● ○	Being in self diagnosis of special module interface RAM memory
FSM_04	Normal communication	● ◉ ◉ ○ ○	When module communication is normal.
FSM_05	Hardware error	○ ○ ○ ○ ▥	Error in self diagnosis of internal memory 1
FSM_06		○ ○ ○ ● ▥	Error in self diagnosis of internal memory 2
FSM_07		○ ○ ● ○ ▥	Error in self diagnosis of communication
FSM_08		○ ○ ● ● ▥	Error in writing/reading special module
FSM_09		○ ● ○ ○ ▥	Error in writing/reading I/O module
FSM_10		○ ● ○ ● ▥	Error in mounting module, Fuse problem
FSM_11	System operation error	● ○ ○ ○ ▥	System error during operation
FSM_12		● ○ ○ ● ▥	
FSM_13	Abnormal communication	● ◉ ◉ ▤ ○	Cable cut off, short
FSM_14		● ◉ ○ ▤ ○	Specified length of cable is not proper
FSM_15		● ○ ○ ▤ ○	Hardware error of this module
FSM_16			Error in configuration of network
FSM_17	Not restorable error	● ● ● ● ●	Hardware error of communication module
FSM_18		● ○ ● ○ ●	
FSM_19		○ ○ ○ ○ ○	
FSM_20		○ ○ ○ ○ ●	

※ LED position follows the sequence of signal RUN, TOKEN, TX/RX, FAULT, and SYS FAULT from left side.

● Light on ○ Light off

▥ Flash at 1 sec. interval

▤ Irregular non-interval flash or Off

◉ Irregular non-interval flash

A1.3 LED specifications of stand-alone type remote module(G0L-SMQA/SMIA/SMHA)

Segment	Error type	LED status PWR/ONTX/ERR	Error contents
FSM_30	Being in normal communication	● ● ○	Being in normal communication
FSM_31	Abnormal communication	● ● ⊜	Bad communication status
FSM_32	System error	● ○ ◍	Self diagnosis error of communication or system error during operation
FSM_33	No communication	● ○ ○	Not communicates with other station of network
FSM_34	Power off	○ ○ ○	Power off status

A1.4 LED specifications of repeater module(G0L-FREA)

Segment	Error type	LED status PWR/TRTA/TRXB	Error contents
FOU_40	Being in normal communication	● ● ●	Being in normal communication
FOU_41	Abnormal communication	● ● ○	Unstable status in side A communication
FOU_42		● ○ ●	Unstable status in side B communication
FOU_43	No communication	● ○ ○	Not communicates with other station of network
FOU_44	Power off	○ ○ ○	Power off status

A1.5 LED specifications of electric, optical signal switching module(G0L-FOEA)

Segment	Error type	LED status PWR/TRX	Error contents
FOU_50	Being in normal communication	● ●	Being in normal communication
FOU_51	Abnormal communication	● ○	Network not communicates
FOU_52	Power off	○ ○	Power off status

A1.6 LED specifications of active coupler module(optical signal distributor)

Segment	Error type	LED status PWR/TRX	Error contents
FOU_60	Being in normal communication	● ●	Being in normal communication
FOU_61	Abnormal communication	● ○	Network not communicates
FOU_62	Power off	○ ○	Power off status

● Light on ○ Light off

◍ Flash at 1 sec. interval

⊜ Irregular non-interval flash or Off

● Irregular non-interval flash

A2 Communication module setting in the Fnet PC

1) Units to be applied : G0L-FUEA/G0L-MUEA

2) Hardware setting : For PC communication module, Fnet module(G0L-FUEA) uses 32kbytes. Therefore, user must set to I/O address and memory base address in order that memory area may not overlap with other modules mounted on PC.

※ I/O address(port) size is 32 bytes, and memory size is 16 kbytes.

Table A2.1 Port/memory address map

Switch value (HEX)	Fnet module(G0L-FUEA)		Mnet module(G0L-MUEA)		Remark
	I/O Address	Memory Base	I/O Address	Memory Base	
0	3EO	FC00	3E0	FC00	*When factory default, I/O address is set to No.5(340), and memory base is set to No.D(C800).
1	3CO	F800	3C0	F800	
2	3AO	F400	3A0	F400	
3	380	F000	380	F000	
4	360	EC00	360	EC00	
5	340*	E800	340*	E800	
6	320	E400	320	E400	
7	300	E000	300	E000	
8	2EO	DC00	2E0	DC00	
9	2CO	D800	2C0	D800	
A	2AO	D400	2A0	D400	
B	280	D000	280	D000	
C	260	CC00	260	CC00	
D	240	C800*	240	C800*	
E	220	C400	220	C400	
F	200	C000	200	C000	

Remark

1. When I/O address and memory address overlap with an area used in other driver, PC will down. So set it in order not to overlap.
2. It is recommended that memory address is used within C800-DBFF address.
3. To use computer memory not as extended or expanded area but as this module's area, set to DEVICE=C:\WINDOWS\EMM386.EXE NOEMS X=C800-DBFF(when setting address to No.D, C800) in CONFIG.SYS.

A3 STATUS code value and description for Communication instructions

A3.1 Error received from communication module

Error No. (Decimal)	Description
0	OK(Success : No error)
1	Physical layer error of link side(Tx/Rx impossible) – Cause of self error and other station's power off, other station No. writing error, and failure, etc.
3	There is no identifier of *function block* to be received in communication channel. – Value not used in our company.
4	Data type mismatch
5	Reset received from other station – Value not used in our company.
6	Communication command of other station not ready – Value not used in our company.
7	Device state of remote station in wrong state – Value not used in our company.
8	Access denied to remote object
9	Communication commands of other station unable to process due to receiver overrun – Value not used in our company.
10	Time out for response waiting – When response has not been received from other station within a given time.
11	Structure error
12	Abort(Local/Remote) – Disconnected by serious error
13	Reject(Local/Remote) – Type unfitted to MMS, error caused by noise.
15	High speed communication and connection service error
34	Address error – Error of structure and range specified in specifications of communication module
35	Response error – When response not received as required or other station's CPU error
113	Object access unsupported – Out of VMD specific and symbolic address or exceeded max. value of data length
187	Received via another error code than specified code(Other company's communication code value) – Receiving another error code value than specified.

A3.2 STATUS values indicated in CPU

1) Error processed within communication commands

Error No. (Decimal)	Description
16	When position of computer communication module is wrongly specified.
17	Initialization error of communication module mounted in SLOT_NO
18	Input parameter setting error
19	Variable length error
20	Wrong response receiving from other station
21	When no response received from computer communication module (Out of waiting time - Time out)

2) Status error related to remote(FSM) *Function block*

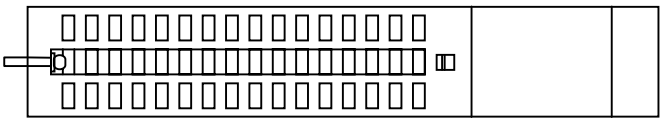
Error NO. (Decimal)	Description
128	FSM power error
129	BASE(Rack) No. error
130	Slot No. error
131	Module information error
132	Data range error(Invalid range)
133	Data type mismatch
134	IP module is not ready
135	Read / Write error of IP module
136	Access failure(BUS access error)
137	Another error than specified code

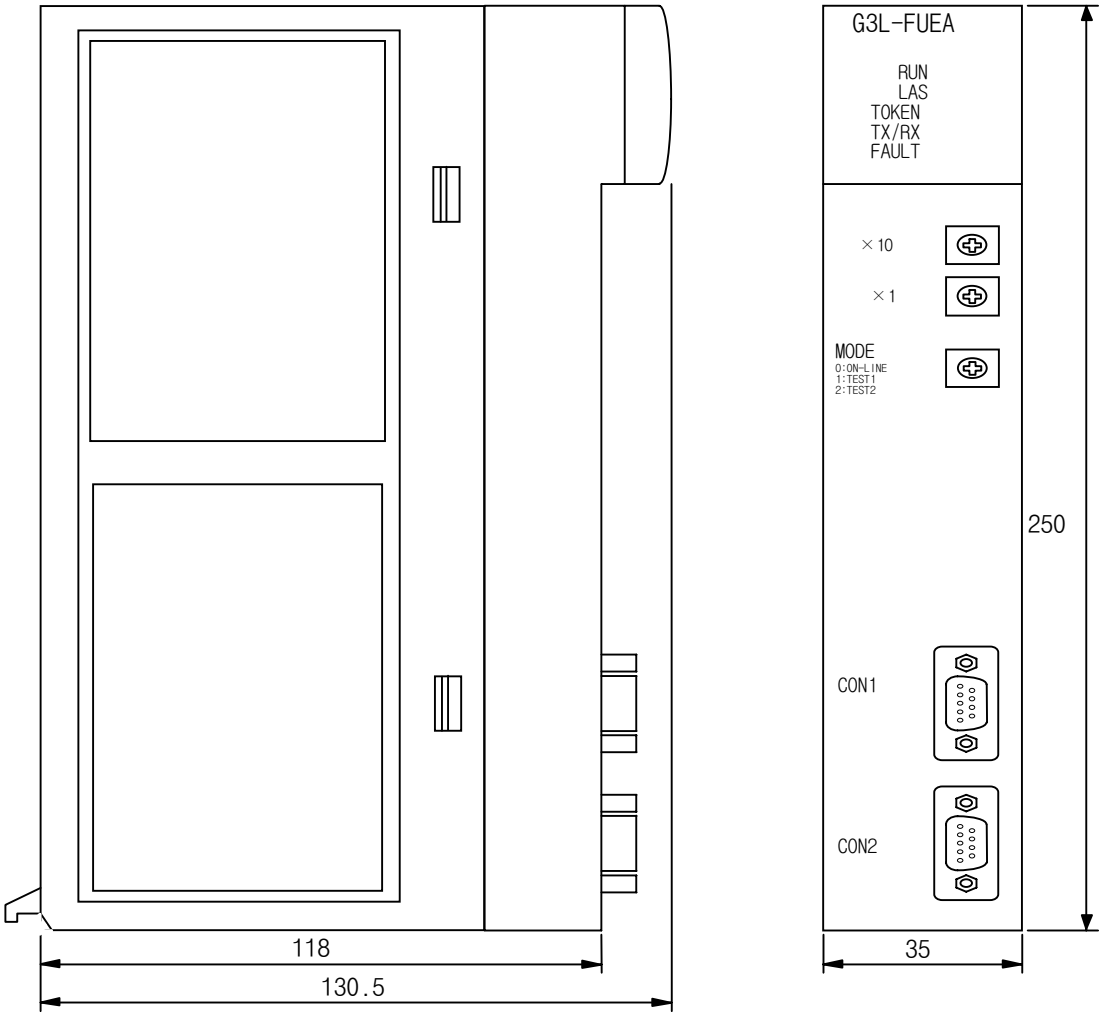
A4 Outward dimension

A4.1 For mounting K1000S

1) Fnet units to be applied

K7F-FUEA, K7F-FUOA, K7F-RBEA, K7F-RBOA



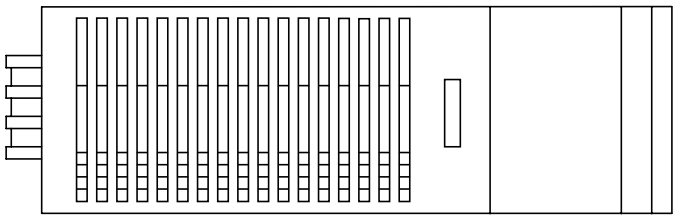


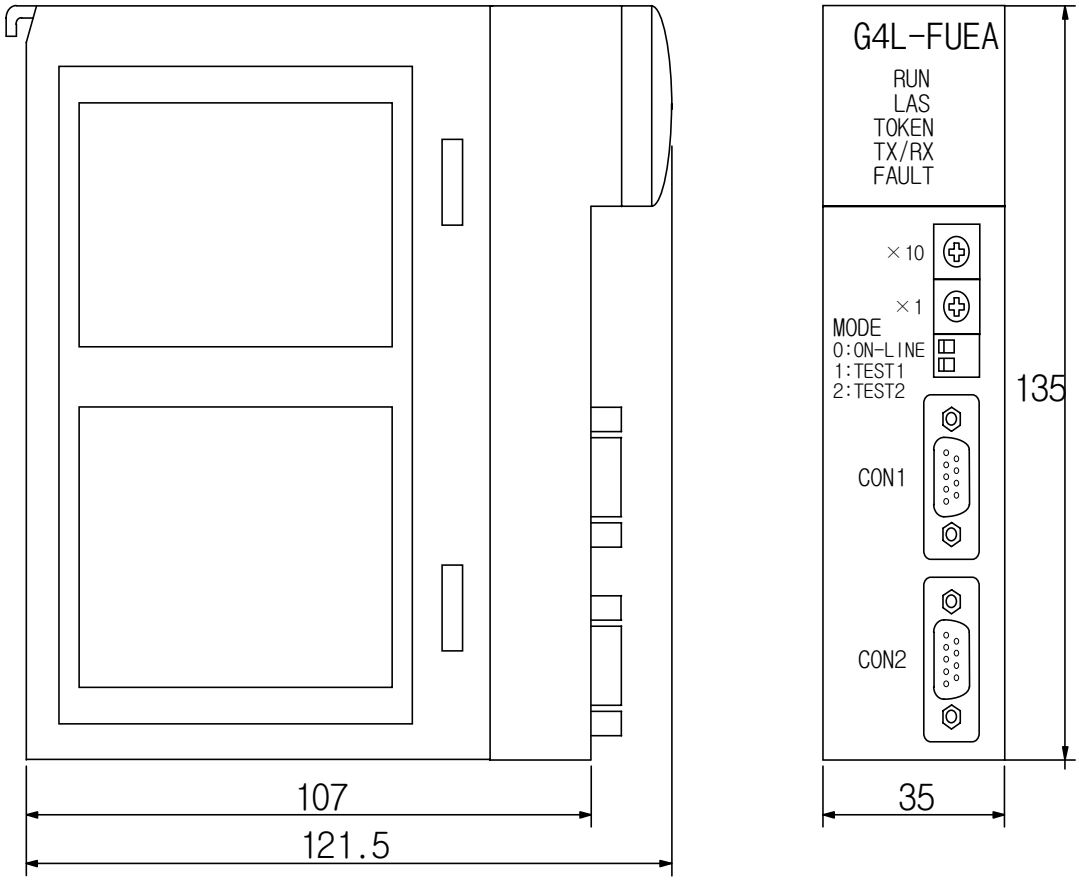
Unit : mm

A4.2 For mounting K300S

1) Fnet

K4F-FUEA, K4F-RBEA



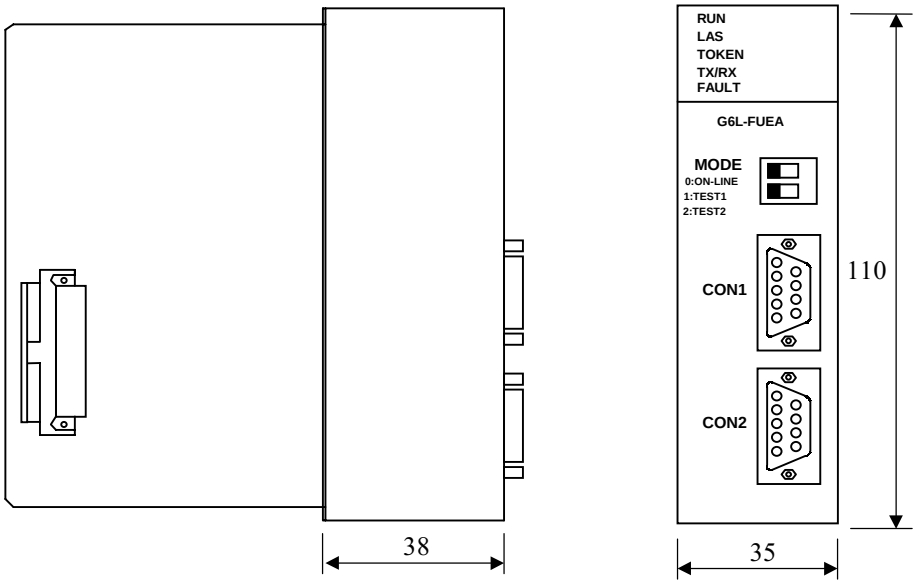


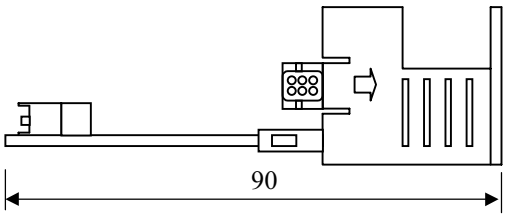
Unit : mm

A4.3 For mounting K200S

1) Fnet

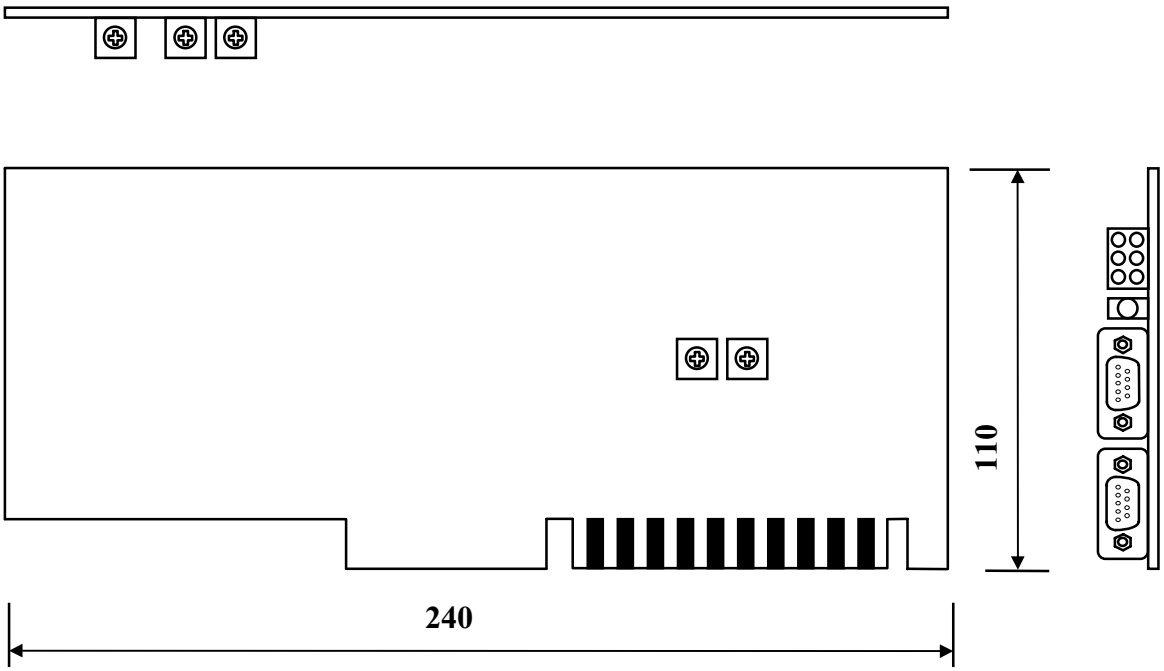
K3F-FUEA





A4.4 For mounting on PC(computer)

1) G0L-FUEA

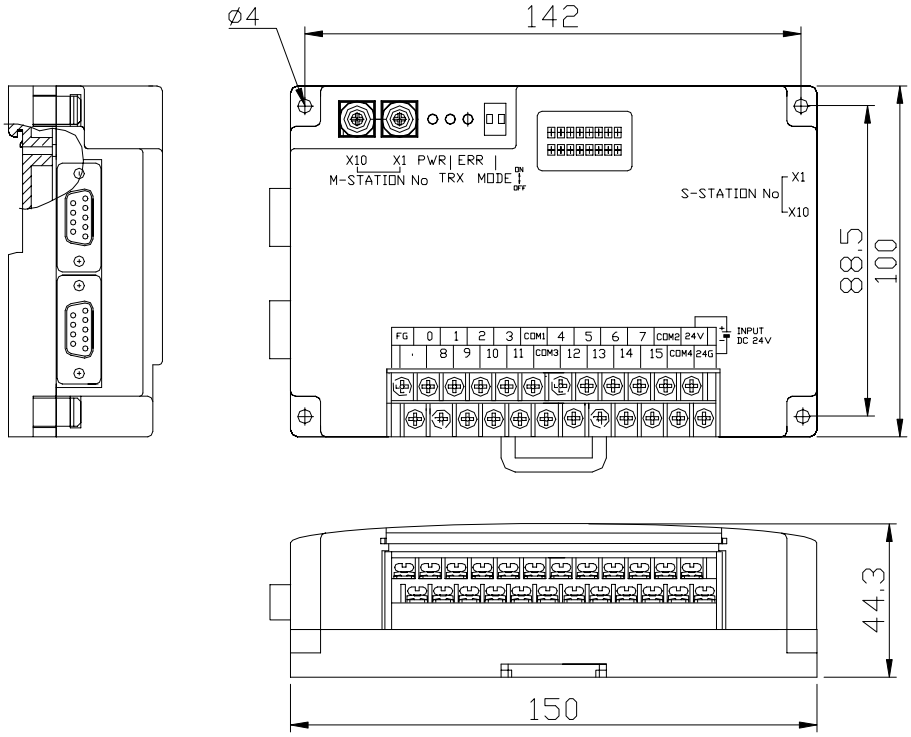


Unit : mm

A4.5 Fnet option module

1) Units to be applied

- Stand-alone remote (G0L-SMQA/G0L-SMIA/G0L-SMHA)
- Repeater(G0L-FREA)
- Optical, electric signal switching module(G0L-FOEA)



- Active coupler(with G0L-FAPA/G0L-FABA/G0L-FACA assembled)