Chapter 1 Introduction

This User's Manual describes for the entire network of GLOFA PLC system technically and in detail. Network of GLOFA PLC system consists of GLOFA Mnet and GLOFA Fnet according to the type of the unit and the application, and the characteristics are as follows :

GLOFA Mnet

This is based on international standard network of factory automation, Mini-MAP(FAIS2.0) and situated at medium level of CIM network structure connecting medium/super controller(GM1, GM2, GM3 PLC) and medium/micro PC each other, and this is open network system for data communication of massive capacity and real time communication. This network is based on the international standard and can be connected easily with other company's communication module by simple parameter setting only.

GLOFA 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. GLOFA Mnet and GLOFA Fnet are abbreviated as Mnet and Fnet for simplicity of description.
2. Program in this User's Manual has been prepared on the basis of GMWIN2.0.

Modules configuring GLOFA Mnet and GLOFA 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 GLOFA PLC communication module

Network	Module	Type of connection cable	Name of communication module		Mounting base
GLOFA Mnet	Computer	Coaxial	Interface	G0L-MUEA	Computer
	Module			G3L-MUEA	GM1, GM2, GM3
GLOFA Fnet	Master module (FMM)	Twisted pair (electric)	Interface	G0L-FUEA	Computer
				G3L-FUEA	GM3
				G4L-FUEA	GM4
				G5L-FUEA	GM5
				G6L-FUEA	GM6
		Optical		G3L-FUOA	GM1, GM2, GM3
	Slave module (FSM)	Twisted pair (electric)	Remote I/O	G3L-RBEA	GM3
				G4L-RBEA	GM4
				G0L-SMQA	Single
		Optical		G0L-SMIA	Single
				G0L-SMHA	Single
				G3L-RBOA	GM3
	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

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.

▣ MCM communication module(Mnet Communication Module)

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

▣ 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.

▣ Mnet

This can be compared with the full map, which accommodates all of the concept and functions of the structure of seven layers suggested by OSI(Open Systems Interconnection). The specification consists of two lower layers(physical layer, data link layer) for the factory automation which demands reliability, rapid response, and real time control, one layer for application, and user layer for interface with user.

▣ 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.

▣ TAP

The coaxial line distributor that branches communication line to connect with several stations from one communication line in GLOFA Mnet.

▣ 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)

▣ Mnet station number

The unique station number of G3L-MUEA and G0L-MUEA communication module adopting Mini-MAP specification. This station number uses MAC address of 6 byte as Mnet station number according to communication specifications, and this is used as Mnet station number for all services except *high speed link*. The station number switch attached on the front of communication module is a *high speed link* station number of two byte used in *high speed link* service only.(*High speed link* is used in communication with GLOFA product only)

▣ Fnet station number

The station number of communication module(G3L-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 GLOFA 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.

▣ GMWIN(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 GLOFA 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 or Mnet 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

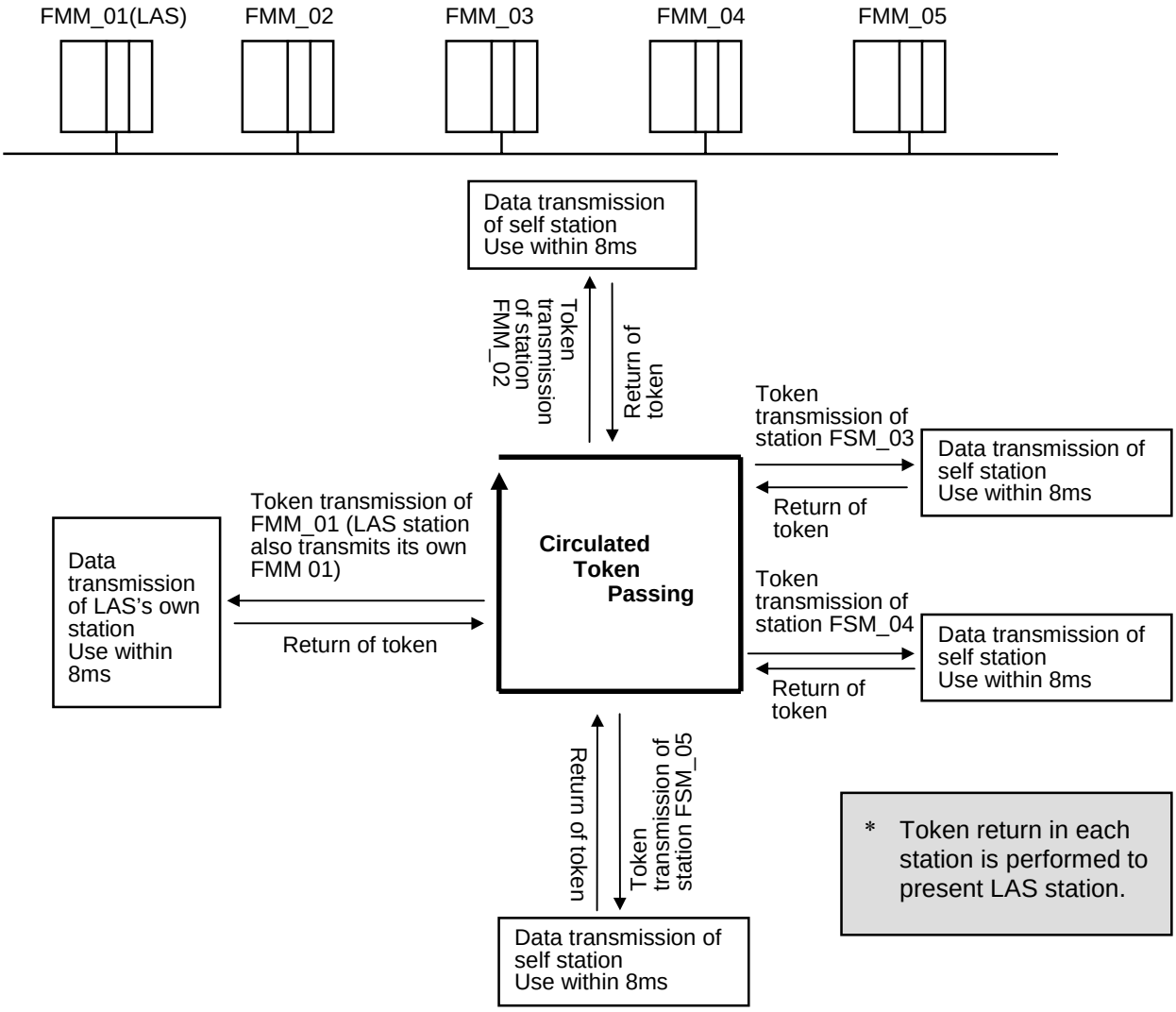
The method of Fnet communication is token distribution method by LAS(Link Active Scheduler). One of FMM communication modules can be LAS, but FSM communication modules cannot be LAS.

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)



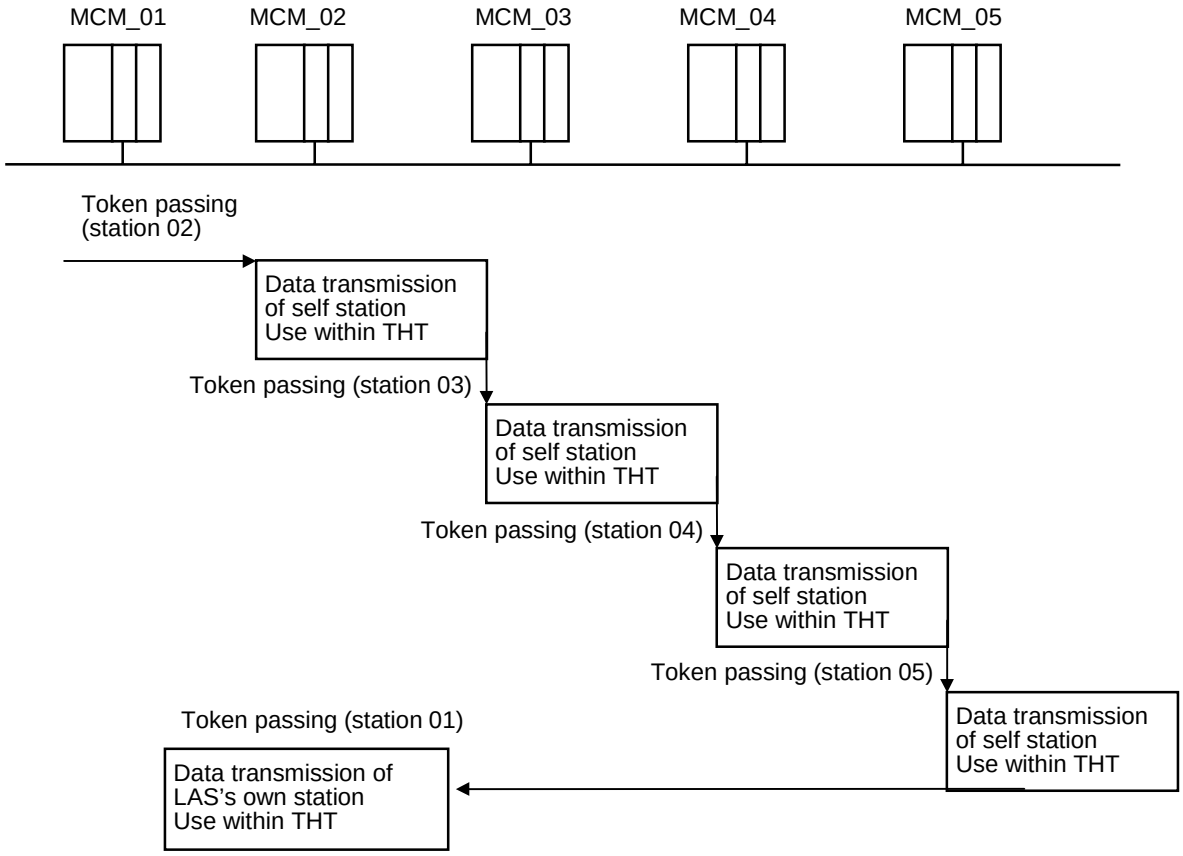
2.3 Concept of Mnet communication

Mnet communication method executes communication by using token passing method of IEEE 802.4.. In this method, a station receives the token transmitted from other station, transmits data of self station, and hands the token to next station.

2.3.1 How to generate and move token

1) Among the stations connected to network, communication module that the power is turned on first obtains token.
2) When the power is turned on at the same time among the stations connected to network, the communication module with the highest station number obtains token.
3) The station that generated token first, hands the token to the next station found, and stores the station number.
4) If the station that the token exists presently becomes down, the next highest station module generates token newly.
5) Only one token exists through the entire network.

2.3.2 Token Passing



THT : Token Hold Time(The time that one station can use token, which is set in network parameter. Default : 2.3 ms).

Chapter 3 General specifications

3.1 General specifications of communication module(Fnet, Mnet)

General specifications of GLOFA-GM 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℃~+75℃</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>Acceleration</td><td colspan="2">Amplitude</td></tr>
<tr><td>10≤f<57Hz</td><td>-</td><td colspan="2">0.075mm</td></tr>
<tr><td>57≤f<150Hz</td><td>9.8 □{1G}</td><td colspan="2">-</td></tr>
<tr><td colspan="5">For continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td colspan="2">Amplitude</td></tr>
<tr><td>10≤f<57Hz</td><td>-</td><td colspan="2">0.035mm</td></tr>
<tr><td>57≤f<150Hz</td><td>4.9 □{0.5G}</td><td colspan="2">-</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="5">7</td><td rowspan="5">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 rowspan="2">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 rowspan="2">IEC 1131-2,
IEC 801-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td>1kV</td><td>0.25 kV</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.

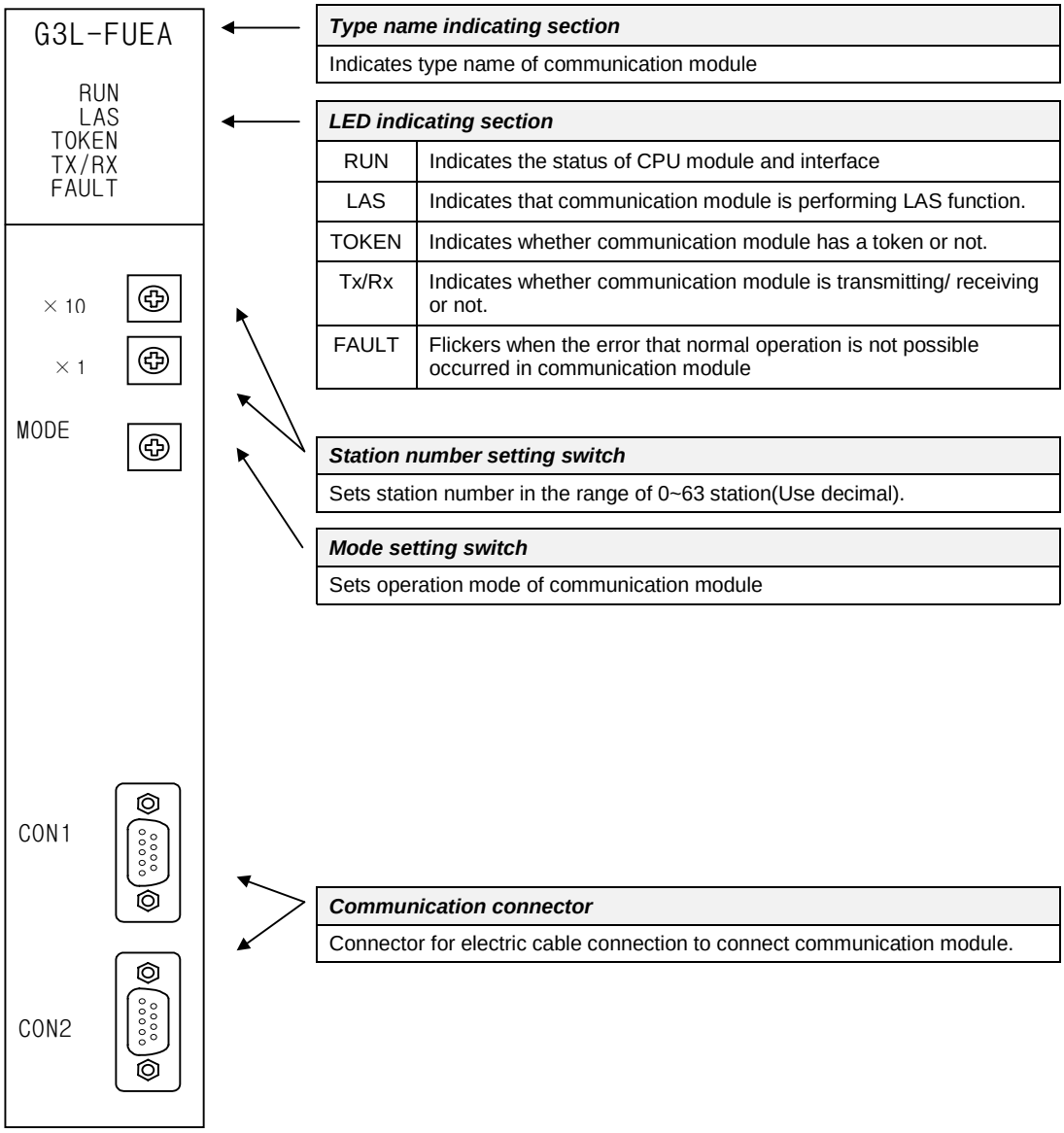
3.2 Structure and configuration

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

3.2.1 Fnet master module structure : G3L-FUEA, G3L-FUOA, G4L-FUEA, G6L-FUEA

1) G3L-FUEA, G3L-FUOA, G4L-FUEA

Ex. of G3L-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).

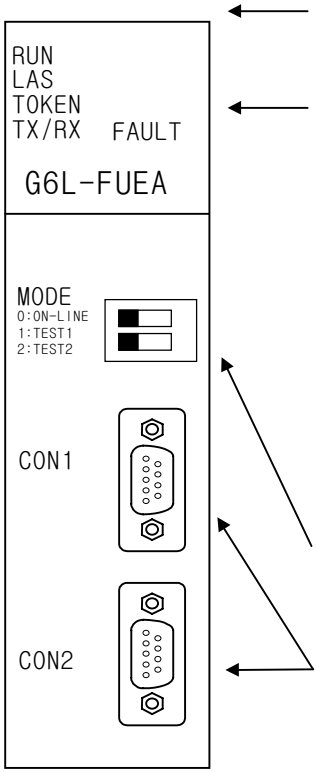
Mode setting switch
Sets operation mode of communication module

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

Remark

1. In the figure shown above, connector of G3L-FUOA is made of optical connector.
2. For mode setting switch, see 3.2.6 Fnet mode setting.

2) G6L-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

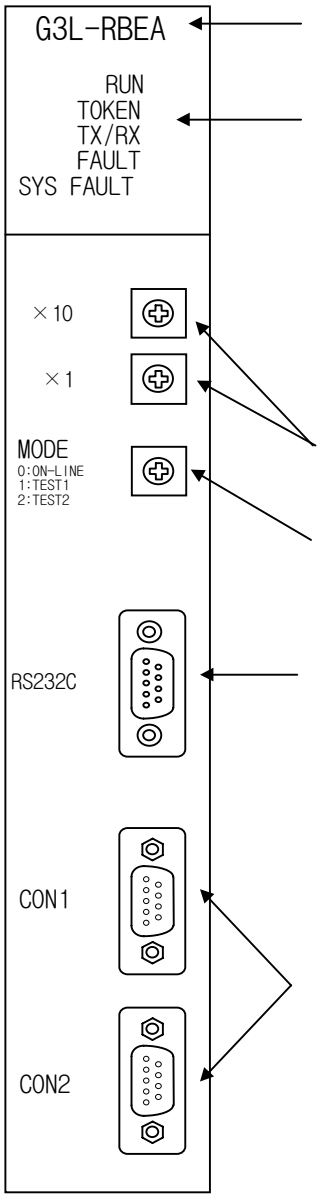
Communication connector
Connector for electric cable connection to connect communication module.

Remark

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

3.2.2 Fnet slave module structure : G3L-RBEA, G3L-RBOA, G4L-RBEA

1) Front part(Ex. G3L-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

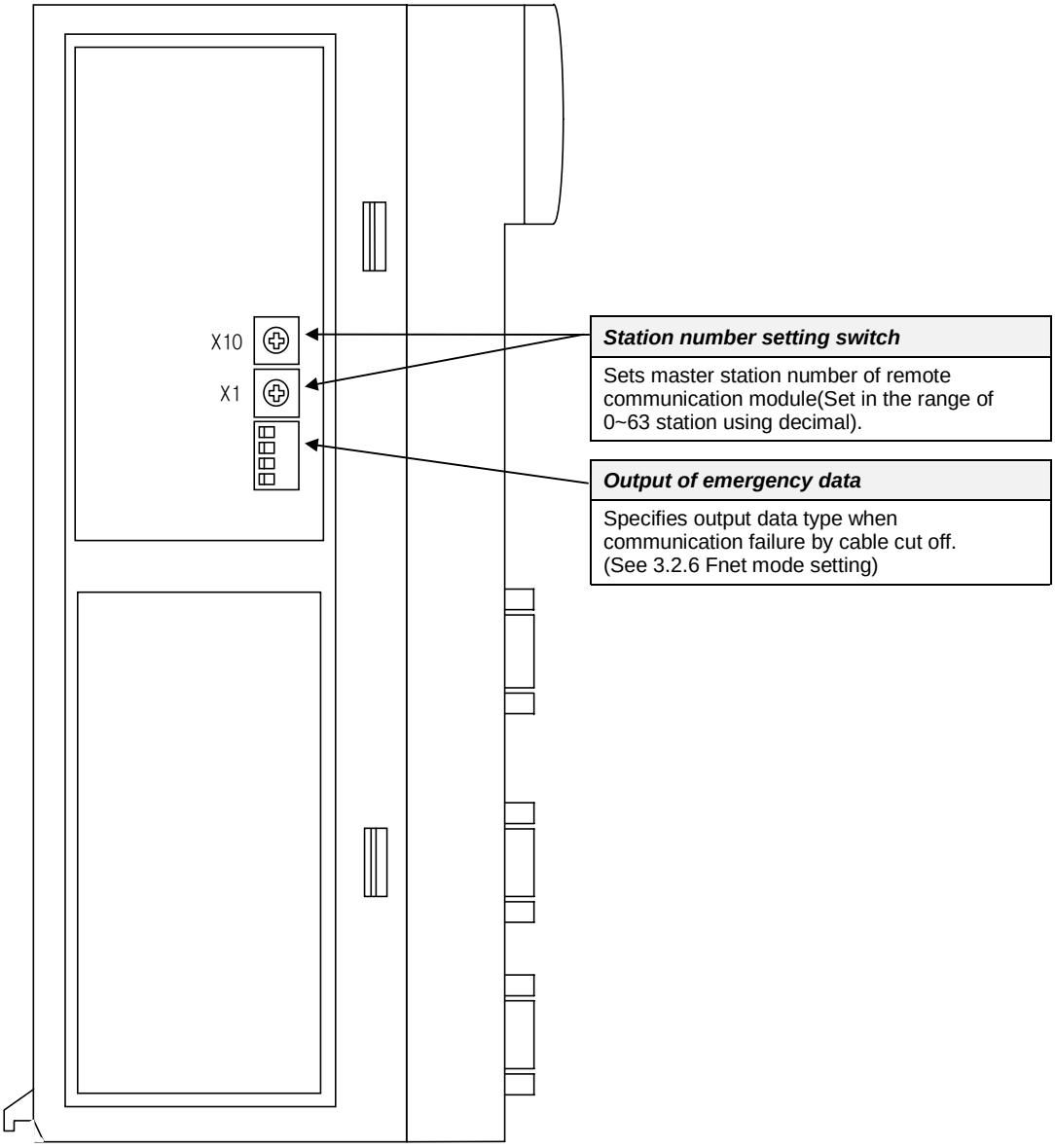
Communication connector (RS-232C)
Cable connector of GMWIN connection.

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

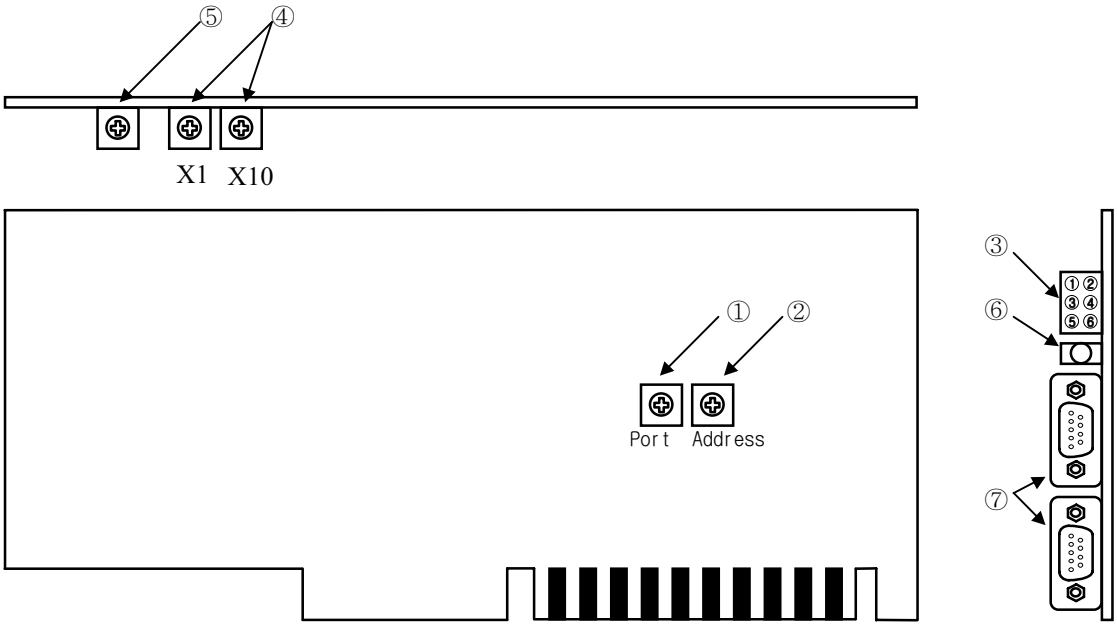
Remark

In the figure shown above, connector of G3L-RBOA is made of optical connector, and there is no RS-232C port in G4L-RBEA.

2) Side part(Ex. G3L-RBEA)



3.2.3 Fnet Computer interface module structure : G0L-FUEA



①

②

	Port selection	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.

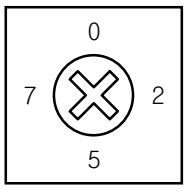
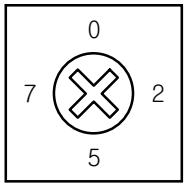
3.2.4 Fnet LED signal name and indication content

Device type	LED Name	Meaning of LED indication	LED On	LED Off
G3L-FUEA G3L-FUOA G4L-FUEA G6L-FUEA GOL-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
G3L-RBEA G3L-RBOA G4L-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

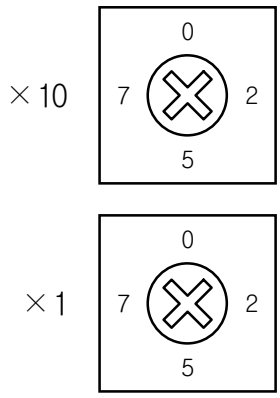
Applied Device type	Detailed drawing of station number switch	Description
G3L-FUEA G3L-FUOA G3L-RBEA G3L-RBOA G4L-FUEA G4L-RBEA G6L-FUEA G0L-FUEA G0L-SMQA G0L-SMIA G0L-SMHA	× 10  × 1 	(1) Station number can be set from 0 to 63(Decimal). (2) Station number setting (Factory default is 0)

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.

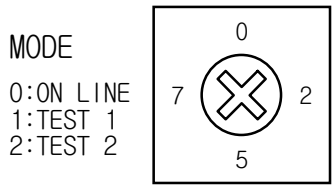
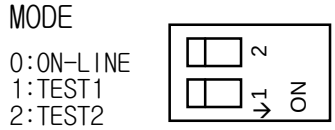
2) Master station number setting

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
G3L-RBEA G3L-RBOA G4L-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

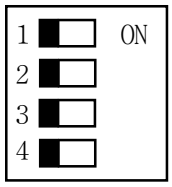
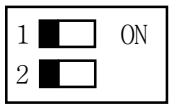
1) Test mode

Applied Device type	Detailed drawing of mode switch	Description
G3L-FUEA G3L-FUOA G3L-RBEA G3L-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.
G4L-FUEA G4L-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.

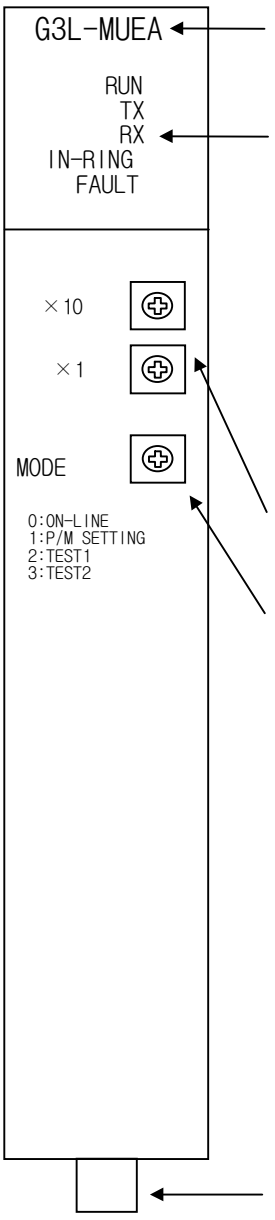
<table>
<tr><th>Applied Device type</th><th>Detailed drawing of mode switch</th><th>Description</th></tr>
<tr><td>G3L-RBEA

G3L-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>G4L-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 GMWIN *function block* program. (Refer to 6.6.7, Setting emergency output data of remote module.)

3.2.7 Mnet module structure : G3L-MUEA



Type name indicating section
Indicates type name of communication module

LED indicating section	
RUN	Indicates the status of CPU module and interface
TX	Indicates data and token transmission of communication module
RX	Indicates data and token receive of communication module
IN RING	Turns the lamp on if operating communication module is two or more, and flashes if operating module is just one
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(St in decimal).

Mode setting switch
Sets operation mode of communication module

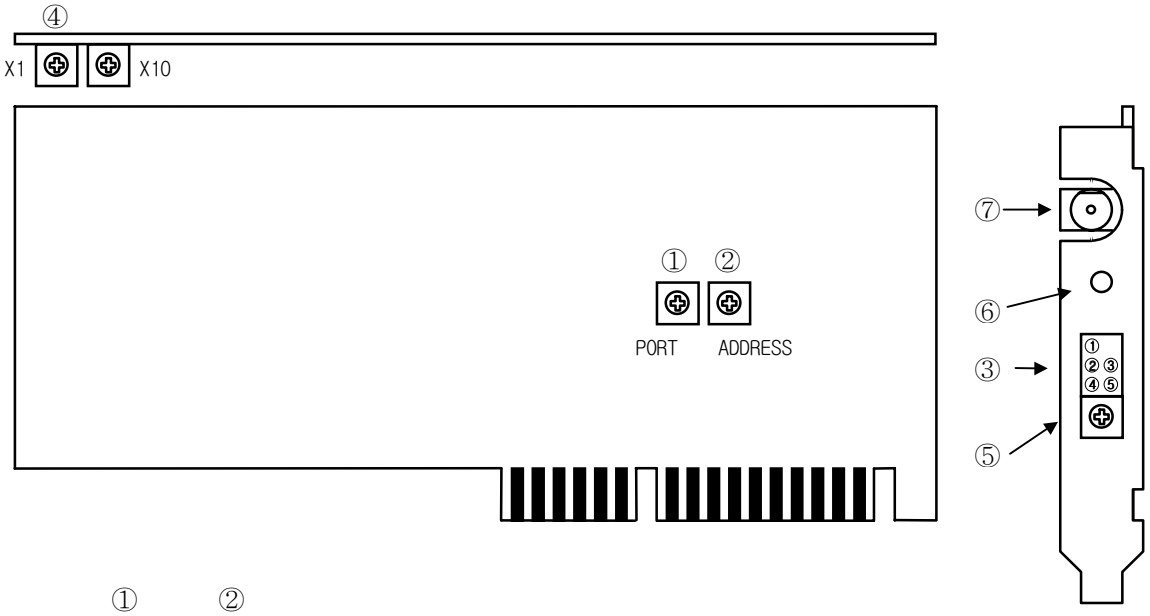
Communication connector
Connector for coaxial cable connection to connect communication module.

Mode setting

Applied device type	Detailed drawing of mode switch	Description
G3L-MUEA G0L-MUEA	MODE 0:ON LINE 1:P/M SETTING 2:TEST1 3:TEST2 0 7 2 5	(1) Mode can be set from 0 to 2. (2) Mode setting (Default is 0)

Mode	Function
0	Performs normal operation
1	Used for parameter setting of GMWIN
2	Sets when communication module is tested
3	Reservation(presently not available)

3.2.8 Mnet computer interface module structure : GOL-MUEA



① ②

	Port select-ion	Address select-ion
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	RUN	Indicates the status of IBM compatible PC and interface
No.2	TX	Indicates data and token transmission of communication module
No.3	RX	Indicates data and token receive of communication module
No.4	IN-RING	Lights on if operating communication module is two or more, and flashes if operating module is just one
No.5	FAULT	Flashes 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(see 3.2.7 G3L-MUEA structure)

⑥

Reset switch
A switch to initialize communication module

⑦

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

Remark

1. Port is set to No.5(340) and address is set to No.9(D800) by factory default.
2. This should be set in order not to be duplicated with other device area 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.

Chapter 4 Transmission specifications

4.1 Transmission specifications of Fnet

4.1.1 Transmission specifications of Fnet master module

Product of Fnet master module : G3L-FUEA, G3L-FUOA, G4L-FUEA, G5L-FUEA, G6L-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 : **G3L-RBEA, G3L-RBOA, G4L-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 = $X^{15} + X^{14} + X^{13} + ... + X^2 + X + 1$

4.2 Transmission specifications of Mnet

Table 4.2 Transmission specification of Mnet

Item	Specification
Communication line	75Ω coaxial cable (RG-6 / RG-11)
Max. number of stations connected	Max. 64 station
Communication speed	5 Mbps
Connection connector	75Ω female F series
Modulation type	Phase lock FSK (Frequency Shift Keying)
Transmission distance	Max. 900m
Max. protocol length	1 kbyte
Error detection	FCS(CRC 32 type)
Access type of communication right	Token passing bus type

4.3 Cable specifications

4.3.1 Twisted pair cable for Fnet

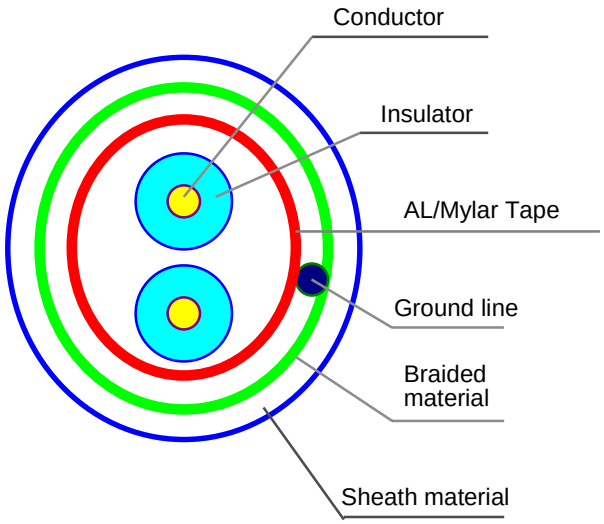
Type name of product : G0C-T□□□ (□□□ is length of cable, unit : m)

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

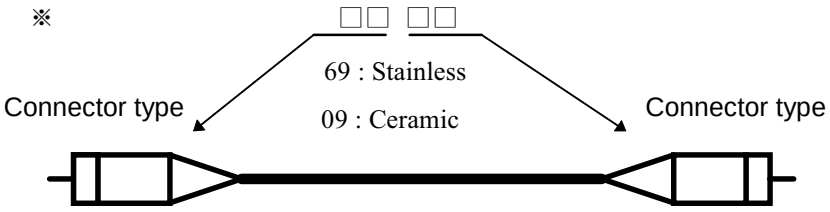
Type name : G0C-F□□□ (□□□ is length of cable, unit : m)
Ex.) Optical cable 10m : G0C-F010

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)

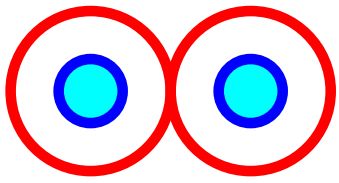
Segment		For indoor(standard)	For outdoor(standard)
		Y22□□□□	D22□□□□
Outer diameter (mm)		2.9 × 5.8	4.8
Min. Radius of curvature	Loaded (cm)	5.0	7.5
	Unloaded (cm)	3.0	4.8
Weight(Kg/m)		16	21

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

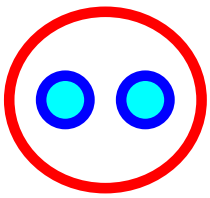


Ex.) If the cable type is Y226969, connector type is ST and the shape is stainless at both of the connectors.

- **Outside drawing of optical cable**



For indoor(Y22□□□□)



For outdoor(D22□□□□)

4.3.3 Coaxial cable for Mnet

1) Cable

When network is configured using Mnet communication module, RG-6(Drop cable) and RG-11(Trunk cable) which conform to IEEE 802.4 Carrier Band can be used. The following is specifications for RELCOM(USA) company product, so user may refer to the following.

Table 4.3.3(A) Cable specifications available in Mnet

Type	Attenuation distortion (dB/100m)		Distance(m)		Transmitting impedance
	10MHz	20MHz	5Mbps	10Mbps	Milli-ohm/meter max
RG-6(Drop) standard 5750	2.47	3.12	818	538	10
RG-11(Trunk) standard 5950	1.46	2.05	960	717	10

2) Tap

Tap is used to connect and to branch each station with trunk cable, and electric characteristic of Tap should be outstanding, and comply with specifications. The following is specifications of Tap(2-port and 4-port Tap) for RELCOM(USA) company product, so user may refer to the following.

Table 4.3.3(B) Tap specifications available in Mnet MCM group

Electric characteristic	CBT-2(2-port)	CBT-4(4-port)	Unit
Trunk to drop attenuation&distortion	20 ± 0.5	20 ± 0.5	dB min.
Trunk return loss	35	35	dB min.
Drop return loss	20	20	dB min.
Drop to drop Isolation	30	30	dB min.
Additional loss	0.3	0.5	dB min.