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Programmable Logic Controller

XGT FEnet I/F Module

XGT Series

User's Manual

XGL-EFMT(B)
XGL-EFMF(B)
XGL-EH5T

⚠ Safety Instructions

● Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.

● Keep this manual within easy reach for quick reference.

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Safety Instructions

Before using the product …

For your safety and effective operation, please read the safety instructions thoroughly before using the product. Safety Instructions should always be observed in order to prevent accident or risk with the safe and proper use the product.

Instructions are divided into "Warning" and "Caution", and the meaning of the terms is as follows.

⚠ **Warning**
This symbol indicates the possibility of serious injury or death if some applicable instruction is violated

⚠ **Caution**
This symbol indicates the possibility of severe or slight injury, and property damages if some applicable instruction is violated

Moreover, even classified events under its ⚠ caution category may develop into serious accidents relying on situations. Therefore we strongly advise users to observe all precautions properly just like warnings.

The marks displayed on the product and in the user's manual have the following meanings.

⚠ Be careful! Danger may be expected.

⚡ Be careful! Electric shock may occur.

The user's manual even after read shall be kept available and accessible to any user of the product.

Safety Instructions

Safety Instructions for design process

> ### ⚠Warning
>
> 1. **Please install a protection circuit on the exterior of PLC so that the whole system may operate safely regardless of failures from external power or PLC.** Any abnormal output or operation from PLC may cause serious problems to safety in whole system.
>   (1) Install protection units on the exterior of PLC like an interlock circuit that deals with opposite operations such as emergency stop, protection circuit, and forward/reverse rotation or install an interlock circuit that deals with high/low limit under its position controls.
>   (2) If any system error (watch-dog timer error, module installation error, etc.) is detected during CPU operation in PLC, all output signals are designed to be turned off and stopped for safety. However, there are cases when output signals remain active due to device failures in Relay and TR which can't be detected. Thus, you are recommended to install an addition circuit to monitor the output status for those critical outputs which may cause significant problems.
> 2. **Never overload more than rated current of output module nor allow to have a short circuit**. Over current for a long period time may cause a fire .
> 3. **Never let the external power of the output circuit to be on earlier than PLC power**, which may cause accidents from abnormal output or operation.
> 4. **Please install interlock circuits in the sequence program for safe operations in the system when exchange data with PLC or modify operation modes using a computer or other external equipments** Read specific instructions thoroughly when conducting control operations with PLC.

Safety Instructions

Safety Instructions for design process

⚠ Caution

 I/O signal or communication line shall be wired at least 100mm away from **a high-voltage cable or power line.** Fail to follow this instruction may cause malfunctions from noise

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Safety Instructions on installation process

⚠ Caution

1. **Use PLC only in the environment specified in PLC manual or general standard of data sheet.** If not, electric shock, fire, abnormal operation of the product may be caused.

2. **Before install or remove the module, be sure PLC power is off.** If not, electric shock or damage on the product may be caused.

3. **Be sure that every module is securely attached after adding a module or an extension connector.** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused. In addition, contact failures under poor cable installation will be causing malfunctions as well.

4. **Be sure that screws get tighten securely under vibrating environments.** Fail to do so will put the product under direct vibrations which will cause electric shock, fire and abnormal operation.

5. **Do not come in contact with conducting parts in each module**, which may cause electric shock, malfunctions or abnormal operation.

Safety Instructions

Safety Instructions for wiring process

⚠️Warning

1. **Prior to wiring works, make sure that every power is turned off.** If not, electric shock or damage on the product may be caused.
2. **After wiring process is done, make sure that terminal covers are installed properly before its use.** Fail to install the cover may cause electric shocks.

⚠️ Caution

1. **Check rated voltages and terminal arrangements in each product prior to its wiring process.** Applying incorrect voltages other than rated voltages and misarrangement among terminals may cause fire or malfunctions.
2. **Secure terminal screws tightly applying with specified torque.** If the screws get loose, short circuit, fire or abnormal operation may be caused. Securing screws too tightly will cause damages to the module or malfunctions, short circuit, and dropping.
3. **Be sure to earth to the ground using Class 3 wires for FG terminals which is exclusively used for PLC**. If the terminals not grounded correctly, abnormal operation or electric shock may be caused.
4. **Don't let any foreign materials such as wiring waste inside the module while wiring,** which may cause fire, damage on the product or abnormal operation.
5. **Make sure that pressed terminals get tighten following the specified torque. External connector type shall be pressed or soldered using proper equipments.**

Safety Instructions

Safety Instructions for test-operation and maintenance

⚠ Warning

1. **Don't touch the terminal when powered**. Electric shock or abnormal operation may occur.
2. **Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
3. **Don't let the battery recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

⚠ Caution

1. **Do not make modifications or disassemble each module.** Fire, electric shock or abnormal operation may occur.
2. **Prior to installing or disassembling the module, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
3. **Keep any wireless equipment such as walkie-talkie or cell phones at least 30cm away from PLC**. If not, abnormal operation may be caused.
4. **When making a modification on programs or using run to modify functions under PLC operations, read and comprehend all contents in the manual fully.** Mismanagement will cause damages to products and accidents.
5. **Avoid any physical impact to the battery and prevent it from dropping as well.** Damages to battery may cause leakage from its fluid. When battery was dropped or exposed under strong impact, never reuse the battery again. Moreover skilled workers are needed when exchanging batteries.

Safety Instructions

Safety Instructions for waste disposal

⚠ Caution

‣ **Product or battery waste shall be processed as industrial waste.**
The waste may discharge toxic materials or explode itself.

Revision History

Version	Date	Remark	Page
V1.0	2005.03	First Edition	-
V1.1	2005.05	Adding the function description	-
V1.2	2005.09	Adding module detachment and how to change Setting PLC type at XG-PD Adding appendix (CPU memory device)	CH3.8 CH5.2 APPENDIX-
V1.3	2005.11	Fixing figure and adding contents	-
V1.4	2005.11	Fixing figure and contents	-

V1.5	2008.07	1. Adding models
		  -adding XGI/XGR redundant system
		  -adding switch module (XGL-EH5T)
		2. Adding E-mail service
		3. Adding error code table
		4. Adding CH 11 Compliance with EMC Specifications
		5. Fixing headquarter address
			CH1.3.2
			
			CH7.6
			CH10.4
			CH11
			
			Back cover-

V1.6	2009.09	1. Modifying Overview 2. Adding CPU 3. Adding contents on standard setting (One IP Solution, DHCP)	CH1.2.1 CH1.3.2 CH5.3
V1.7	2011.05	1. How to enable link through flag added 2. Write_NC, Send_NC" instruction added	CH5.5.2 CH7.2.1
V1.8	2013.10	1. Adding Communication load specifications 2. Changing Modbus server offset area	CH2.2.3 CH8.3.1
V1.9	2014.03	1. Changing Communication load specifications 2. Adding info-U, iXP 3. Adding XGR HS Link 4. Adding XGT Dedicated Communication's Header 5. Adding XGT Dedicated Communication's error Code 6. Adding High Performance XGT 7. Changing error code table	CH2.2.3 CH4 CH6.6~6.7 CH8.1.2 CH8 CH9.2.3 CH10.4
V 2.0	2014.11	XG5000 V4.0 UI Update	-
V2.1	2016.10	XGL-EFMTB, XGL-EFMFB contents added	-
V2.2	2017.06	Adding RAPIEnet protocol and Cnet protocol	-
V2.21	2017.09	Error code update	CH10.2.2

※ The number of User's manual is indicated right part of the back cover.

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Congratulations on purchasing PLC of LSIS Co.,Ltd.
Before use, make sure to carefully read and understand the User's Manual about the functions, performances, installation and programming of the product you purchased in order for correct use and importantly, let the end user and maintenance administrator to be provided with the User's Manual.

The User's Manual describes the product. If necessary, you may refer to the following description and order accordingly. In addition, you may connect our website (http://www.lsis.com/) and download the information as a PDF file.

Relevant User's Manuals

Title	Description
XG5000 User's Manual	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGK, XGB CPU
XG5000 User's Manual (for XGI, XGR)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGI, XGR CPU
XGK/XGB Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGK, XGB CPU.
XGI/XGR Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGI, XGR CPU.
XGK CPU User's Manual (XGK-CPUU/CPUH/CPUA/CPUS/CPUE/CPUSN/CPUHN/CPUUN)	XGK-CPUU/CPUH/CPUA/CPUS/CPUE/CPUSN/CPUHN/CPUUN user manual describing about XGK CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGI CPU User's Manual (XGI-CPUU/D,CPUU,CPUH,CPUS,CPUE,CPUUN)	XGI-CPUU/D,CPUU,CPUH,CPUS,CPUE,CPUUN user manual describing about XGI CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGR redundant series User's Manual	XGR- CPUH/F, CPUH/T user manual describing about XGR CPU module, power module, extension drive, base, IO module, specification of extension cable and system configuration, EMC standard

Currently user manual of FEnet I/F module is written based on the following version.

Related OS version list

Item	OS version
XGK-CPUU, CPUH, CPUA, CPUS, CPUE	V4.55
XGI-CPUU/D, CPUU, CPUH, CPUS, CPUE	V4.06
XGK-CPUSN, CPUHN, CPUUN	V1.05
XGI-CPUUN	V1.12
XGR-CPUH/F, CPUH/T, CPUH/S	V2.72
XG5000	V4.21

◎ Table of Contents ◎

Chapter 1 Overview

Chapter 2 Product Specifications

Chapter 3 Installation and Operation

Chapter 4 System Configuration

Chapter 5 XG5000 Program

Chapter 6 High-speed Link Service

Chapter 7 P2P Service

Chapter 8 Dedicated Communication

Chapter 9 Remote Connection Service

Chapter 10 Troubleshooting

Chapter 11 Compliance with EMC Specifications

Appendix

Chapter 1 Overview

1.1 Introduction

This user's manual is prepared to describe Fast Ethernet Interface module of XGT series PLC (hereinafter referred to as FEnet I/F module, 1Gbps).

Ethernet is a 'technical standard' established by the international organization of IEEE.

Communication is controlled by CSMA/CD method and network can be established with easy. In addition, a great amount of data can be transferred with high speed. FEnet I/F module is an interface module to communicate data between higher level system such as host PC and PLC, or between PLCs with electric/optical media (10BASE-T/100BASE-TX/1000BASE-T, 100BASE-FX/1000X).
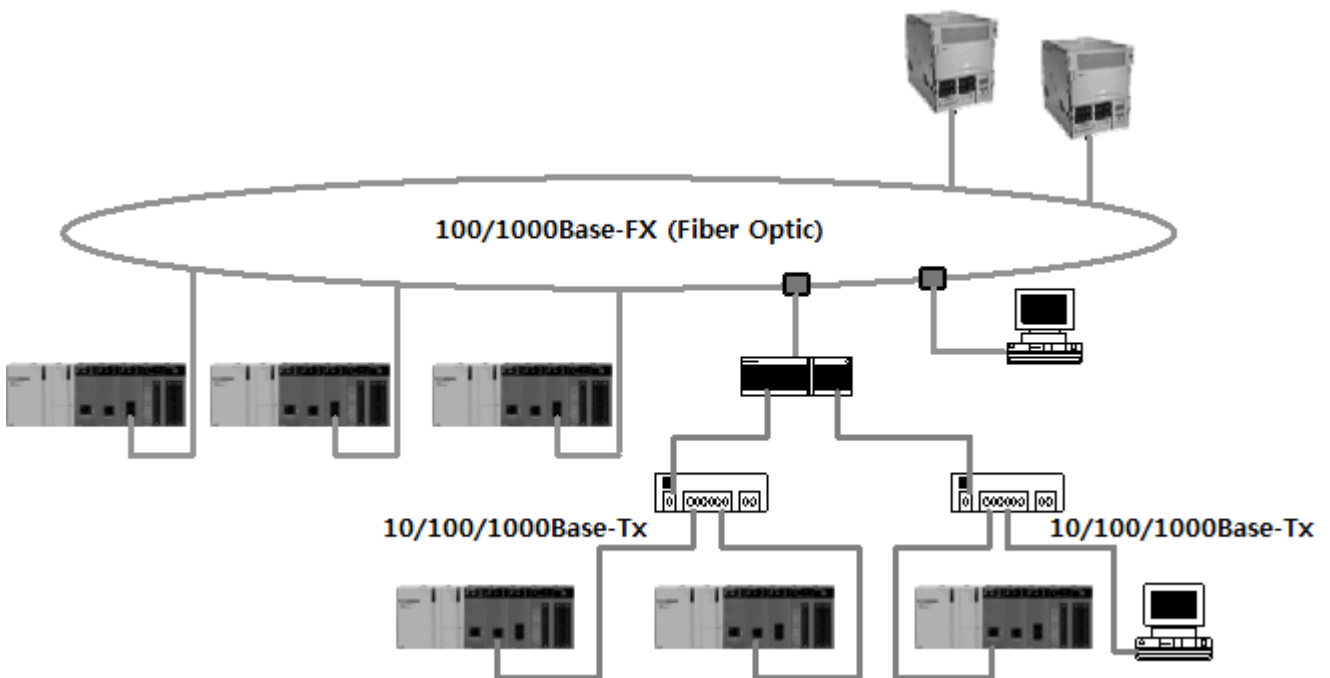
[Fig. 1.1.1] Configuration diagram of FEnet system

FEnet I/F module has variety applicable communication systems. Refer to Chapter 4 System Configuration for detailed system configuration and its description.

1) Communication between PLC and host PC (MMI)
2) Mutual exchange or monitoring data between PLCs /monitoring
3) Data management or system control for field devices.

1.2 Features of FEnet I/F Module

1.2.1 Characteristic of FEnet I/F module

XGT FEnet I/F module supports TCP/IP and UDP/IP protocols and has the features as specified below;

Fast Ethernet (FEnet I/F module) **:**

▶ Module exchange on CPU RUN with module exchange switch in the CPU is possible.

▶ Module exchange on CPU RUN with module exchange wizard of XG5000 is possible.

▶ Conforms to IEEE 802.3 standard (Ethernet standard supported).

▶ High-speed link service supported for communication between LSIS' PLCs with high speed.

▶ XG5000, a communication parameter configuration tool, is provided.

▶ High-speed link block setting available to link between modules.
   (Max. Send Data: 64blocks x 200 words, Max. Receive Data: 128 blocks x 200 words, Totally
   128 blocks can be setup. (Send + Receive)) .

▶ In addition to High-speed link service, Communication with up to 16 Ethernet devices is
   available (dedicated communication + P2P communication).
   (FEnet V6.0 or above, Communication with up to 32 Ethernet devices is available.)

▶ Loader service (XG5000 connection) is supported through Ethernet: (dedicated TCP/IP PORT:
   2002 allotted).

▶ It is easy to connect with other company's Ethernet device through P2P communication and
   XG5000. (Variable READ/WRITE service is available (through Dynamic Connection))

▶ 10BASE-T/100BASE-TX/1000BASE-T, 100BASE-FX/1000X media supported.

▶ Data is accessible via the public network.

▶ LS protocol (XGT) and other company's protocol (MODBUS TCP) supported
   (dedicated service)

▶ Convenient client function supported for communication between LSIS' PLCs and for
   communication with other company's Ethernet device.
   (XGT, Modbus TCP P2P client function)

▶ Dynamic IP supported to make ADSL network available

▶ Access table provided for host PC (MMI) and communication security.

▶ Dynamic Connection/Disconnection supported through P2P service.

▶ Various diagnosis functions and status information of modules and network provided.
   1) CPU module status
   2) Communication module status
   3) Communication service (High-speed link, dedicated service, P2P) status
   4) Autoscan function used to visualize the information of LSIS' communication
      modules connected within the network
   5) PING test function provided to check if other modules exist.
   6) Type and average amount of packet received by communication module provided
      (network load predictable)
   7) Diagnosis function provided for communication module through the network.

▶ E-MAIL service (ASCII) provided.

▶ Up to 24 Ethernet communication modules can be installed on main and extension base.

   (For XGR, FEnet module can be installed on only main base)

▶ One IP Solution function provided   (XGR O/S Version 2.4 or above)

▶ XGT Cnet dedicated protocol support (FEnet OS V 6.0 or above)

▶ Support MODBUS RTU protocol (FEnet OS V6.0 or above)

▶ MODBUS ASCII protocol support (FEnet OS V6.0 or above)

▶ RAPIEnet protocol support (FEnet OS V6.0 or above)

1.2.2 Characteristic of XGL-EH5T (switch)

Switch module is HUB module having the switching function for interface with system based on Ethernet or XGT FEnet module. It improves the weak points of the external hub module (using external power source and low reliability) and it can be installed on XGT base to simplify the work and reduce the fault factor.

(1) Available to install at XGT base
It doesn't need a external power source and can be installed at XGT base. Compact size for easy installation

(2) Reliability applying to industrial standard
It passed the noise, environment test based our company standard comparing other switches

(3) Built-in Auto Cross Over function (For convenience of wiring)

(4) High speed link function is guaranteed
It canceled Broadcast storm function for normal operation of High speed link packet

(5) CHS GROUND supported at RJ-45 connector
In case of using shielded cable (FTP/STP), effective for reducing the transmission error rate

1.3 Product Configuration

1.3.1 Designation

Product configuration of XGT FEnet I/F module is as follows;

Designations		Description	Remarks
XGK/XGI/XGR	XGL-EFMT	10BASE-T/100BASE-TX	Category 5 or more(STP)
	XGL-EFMTB	100BASE-TX/1000BASE-T	Category 5 or more(STP)
	XGL-EFMF	100BASE-FX	Fiber Optic (SC)
	XGL-EFMFB	100BASE-FX/1000X	Fiber Optic(LC/SFP)
	XGL-EH5T	10/100BASE-TX	Switch

Notes

1) AUI (10BASE-5) is not supported in XGT series.
2) In the case that UTP cable is used, use the switching hub of 100Mbps, which can be used together with the 10Mbps Ethernet device (category 3 or less) but its baud rate will be limited to 10Mbps.
   Pay attention to installation of the system.
3) XGL-EH5T can be installed on XGT base and used as switch without specific program. It has maximum 100Mbps speed

---

1.3.2 Available units to be installed on each CPU

The maximum installation number of modules based on CPU type of each FEnet I/F module is described in the table below. After due consideration of the number of communication modules available, apply such applicable modules to the system configuration.

Segment	XGK								XGI						XGR		
	CPUH	CPUU	CPUA	CPUS	CPUE	CPUSN	CPUHN	CPUUN	CPUU	CPUH	CPUS	CPUE	CPUU/D	CPUUN	CPUH/T	CPUH/F	CPUH/S
Number of HS Link use module(Maximum)	12 units														6 units		
Number of P2P use modules(maximum)	8 units														6 units		
Maximum number of modules(server use modules included)	24 units														6 units		

1.4 Software for Product Application

The following is for main programming tools and other producing software needed to use FEnet I/F module. For more precise application of program and communication, please refer to the details below so to apply to the system.

1.4.1 Checking software

(1) Application to XGT series

Classification		Programming tool and Frame Setting
XGL-EFMT(B)	10BASE-T/100BASE-TX/1000BASE-T	XG5000
XGL-EFMF(B)	100BASE-FX/1000X	
XGL-EH5T	Switch	No relation

(2) CPU version to use FEnet I/F module

Section	Section	Available version (recommended)	Reference
XGK series	XGK-CPUH	V4.55	
	XGK-CPUS	V4.55	
	XGK-CPUA	V4.55	
	XGK-CPUE	V4.55	
	XGK-CPUU	V4.55	
	XGK-CPUSN	V1.05	
	XGK-CPUHN	V1.05	
	XGK-CPUUN	V1.05	
XGI series	XGI-CPUU/D	V4.06	
	XGI-CPUU	V4.06	
	XGI-CPUH	V4.06	
	XGI-CPUS	V4.06	
	XGI-CPUE	V4.06	
	XGI-CPUUN	V1.12	
XGR series	XGR-CPUH/T	V2.72	
	XGR-XPUH/F	V2.72	
Software	XG5000	V4.21	

Notes
1) The software above can be downloaded presently from the web site for its application. If the Internet is not available, please visit the nearest agent of service center to get the applicable installation CD-ROM to use. Internet web site : http://www.lsis.com
2) RS-232C and USB port of CPU module is available for downloading the program made by XG5000 and communication configuration made by XG5000. Refer to CPU or XG5000 manual for connection diagram of each cable.
3) At the lower version than above table, some function may not work properly. Check the version before using
4) Use XG5000 V4.21 or above to operate RAPIEnet, XGT Cnet, Modbus RTU / ASCII (FEnet V6.0 or above) function.

1.4.2 XG5000

XG5000 is exclusive software to setup parameters, edit frames and diagnose communication modules of XGT series PLC and network necessary for operation of all the communication modules including FEnet I/F module.

Refer to Chapter 5 XG5000 for more details.

The figure below shows the initial screen of XG5000.
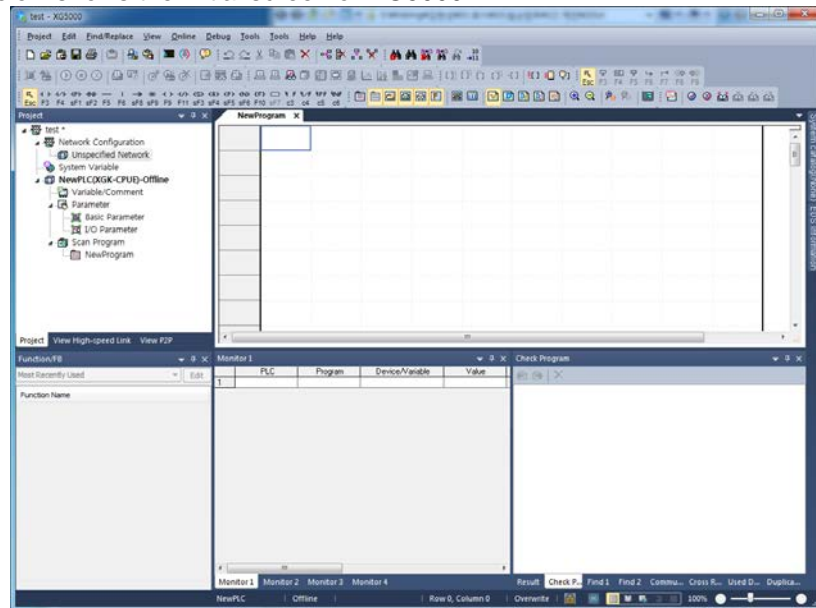
[Fig. 1.4.1] Initial screen of XG5000

1.4.3 Version checking

Prior to use of FEnet I/F module, please check the version of the applicable module.

(1) Through XG5000

Connect with communication module directly via on-line so to read information of the communication module.

If interface status with CPU is normal, the information will be acquired as shown below.

a) Execute XG5000.
b) Use on-line connection with CPU.
c) If connection between XG5000 and CPU is established, execute diagnosis of XG5000.
d) On the system diagnosis screen, execute communication module status.
e) Software information will be displayed on the right bottom of the communication module status screen.
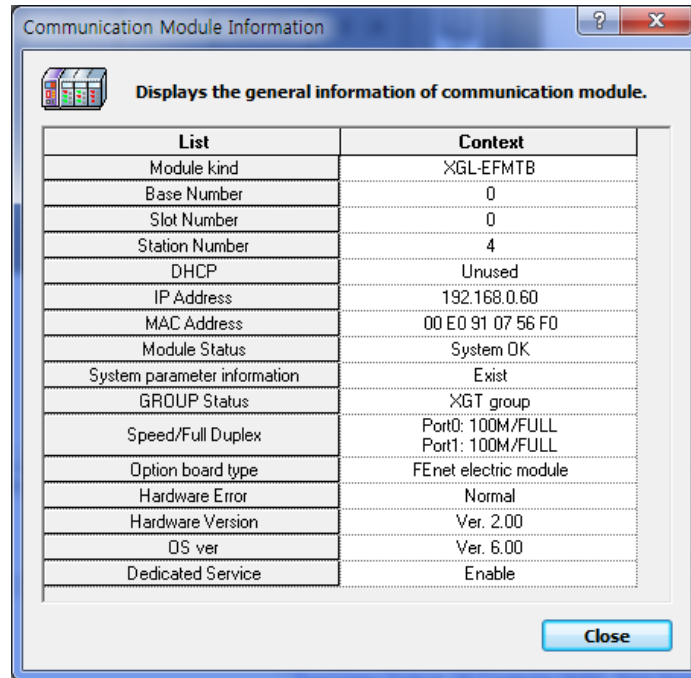
[Fig. 1.4.2] Checking module version through XG5000

2) Through the case label of the product

On the external case of each communication module, product information of the module is printed. The version can be checked module may be removed and then installed if on-line checking is unavailable due to unavailable external connection device with PC.

The label is adhered to the back of the product where designation and version information of the product are described.

Chapter 2 Product Specifications

2.1 General Specifications

General specifications of XGT series are as shown in Table 2.1.

No.	Items	Specification					Reference
1	Ambient Temp.	0 ~ 55 °C					
2	Storage Temp.	−25 ~ +70 °C					
3	Ambient humidity	5 ~ 95%RH (Non-condensing)					
4	Storage humidity	5 ~ 95%RH (Non-condensing)					
5	Vibration Immunity	Occasional vibration			-		IEC61131-2
		Frequency	Acceleration	Pulse width	Times		
		5 ≤ f < 8.4Hz	–	3.5mm	10 times each direction (X,Y and Z)		
		8.4 ≤ f ≤ 150Hz	9.8m/s^2(1G)	–			
		Continuous vibration					
		Frequency	Acceleration	Pulse width			
		5 ≤ f < 8.4Hz	–	1.75mm			
		8.4 ≤ f ≤ 150Hz	4.9m/s^2(0.5G)	–			
6	Shocks Immunity	• Peak acceleration : 147 m/s^2(15G) • Duration : 11ms • Pulse wave type : Half-sine (3 times each direction per each axis)					IEC61131-2
7	Noise Immunity	Square wave impulse noise	AC : ±1,500V DC : ±900V				LSIS internal test spec.
		Electrostatic discharge	Voltage: 4kV (Contact discharge)				IEC61131-2 IEC61000-4-2
		Radiated electromagnetic field noise	80 ~ 1000 MHz, 10V/m				IEC61131-2, IEC61000-4-3
		Fast transient /Burst noise	Classification	Power supply	Digital/Analog Input/Output, Communication Interface		IEC61131-2 IEC61000-4-4
			Voltage	2kV	1kV		
8	Operation ambience	Free from corrosive gases and excessive dust					
9	Altitude	Less than 2,000m					
10	Pollution degree	Less than 2					
11	Cooling method	Air-cooling					

Notes

1) IEC(International Electro technical Commission.
  : An international nongovernmental organization which promotes internationally cooperated standardization in electric/electronic fields, publishes international standards and manages applicable estimation system related with.
2) Pollution level
  : An index indicating pollution level of the operating environment which decides insulation performance of the devices. Generally, Pollution level 2 indicates the state that only non-conductive pollution occurs generally. However, this state contains temporary conduction due to dew produced.

2.2 Performance Specifications

Specifications for system configuration are as described below according to media of FEnet I/F module. Refer to the table below for system configuration.

2.2.1 XGL-EFMT(B)/EFMF(B)

Item			Product Name			
			XGL-EFMT	XGL-EFMTB	XGL-EFMF	XGL-EFMFB
Transmission Specification	Baud rate		10/100Mbps	10/100/1000 Mbps	100Mbps	100/1000Mbps
	Transmission Type		Base Band			
	Max. extended length between nodes		100m (Node-Hub)		2km	
	Max. protocol size		1,500 Byte			
	Access method to service zone		CSMA/CD			
	Frame error check		CRC 32			
Basic Specification	Current consumption (5V)	100Mbps	410 mA	560mA	630 mA	750mA*
		1Gbps	-	900mA	-	740mA*
	Weight		105 g	146 g	120 g	156 g

*Formerica SFP standard

[Table 2.2.1] Performance Specification of FEnet I/F module

2.2.2 XGL-EH5T

| Item		XGL-EH5T(Switch)
Transmission Specification	Transmission speed	10/100Mbps
	Port type and number	10/100BASE-TX, TP cable, RJ-45 socket, 5 port
	Comm. Interface	Auto-Crossing, Auto-Nego.,Auto-Polirity
	Transmission length	100m
	Node interval	-
	Diagnosis	LED (PWR power, Link Status, Data)
Basic Specification	5V side consumption current (mA)	550
	Weight (g)	90

[Table 2.2.2] Performance Specification of FEnet switch module

2.2.3 Specification of Communication load amount

Communication load amount have two types. One is media interrupt that received every second in FEnet media, the other is the sending load amount(by link I/F) from CPU to FEnet. If exceeding FEnet granted media interrupt load amount and sending load amount, it will fail. Make network system to prevent badly intended DDOS and ARP based attack.

(1) Communication load amount by media interrupt
  ▶ Load by Frme from media
  ▶ Diagnose load by packet
  ▶ FEnet module's max load amount by media interrupt(Server operation standard)
    XGL-EFMT/EFMF: about 1200 packets/sec
    XGL-EFMTB/EFMFB: about 5,000 packets/sec
    (5,000 packets/sec means moment load amount. For example 600 packets(or more) per 100ms makes problem)
  ▶ How to check:XG5000->[Online]-> [set communication module]-> [system diagnosis]
    -> [media information] -> [packet/sec]
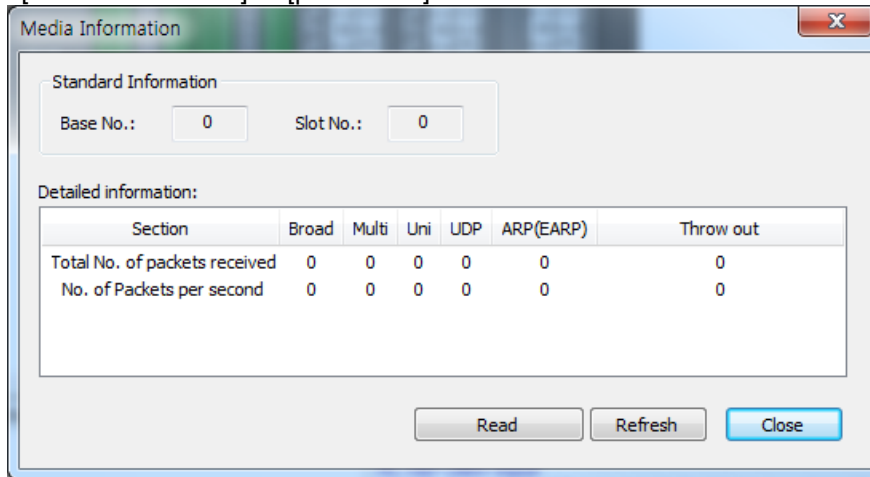
  ▶ Symptoms of FEnet module when exceeding max load amount: communication error, diagnosis service error, connection error
  ▶ If receive block is not set in high speed link parameter, interrupt still occur. It might be influenced by load amount.
  ▶ Symptoms of exceeding max load amount: set communication period in FEnet module which high speed link transmission is set longer than previous set period.
    ex)20ms → 200ms

(2) XGK/I/R system's send packets load (Load by link I/F interrupt)
  ▶ Load by data amount sending CPU module to Communication module
  ▶ Scan time of CPU module, high speed link service period, P2P setting will choose load amount.
  ▶ Max available sending(=transmission) block in high speed link of FEnet module considering Link I/F interrupt
    ((Sending period/ Max CPU scan time) * 8 blocks)/2 =max sending blocks
  ▶ Solution when exceeding max send/receive load: Change the RAPIEnet module's sending period which high speed link set or Change number of blocks
  ▶ Max sending blocks considering CPU scan time and high speed link

2.3 Structure and Characteristics

2.3.1 Structure of XGL-EFMT(B)/EFMF(B)

(1) XGL-EFMT/XGL-EFMF

◀ LED display

◀ Media connector

XGL-EFMT   XGL-EFMF
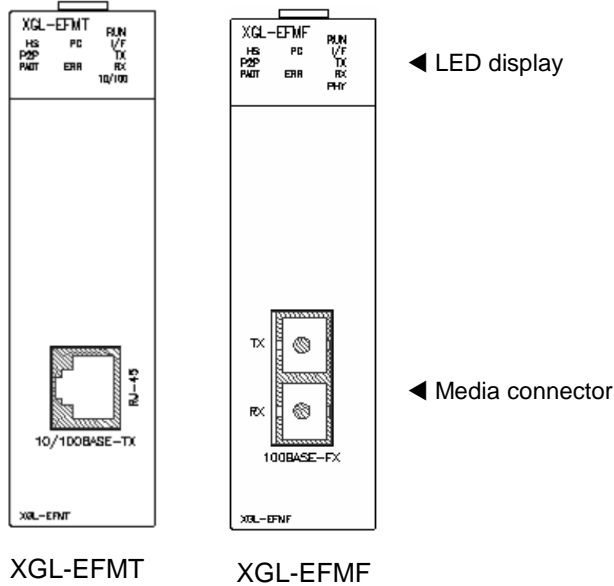
The table 2.3.1 explains the details of LED display. Refer to chapter 10 Troubleshooting of this manual for judgment and action of trouble based on the status of LEDs.

LED	Contents
RUN	Indicates whether initialization is done successfully and it works properly. In case initialization is done successfully, LED is on. In case initialization is not normal or done abnormally, LED is off.
I/F	Indicates whether FEnet I/F module interface with CPU or not. In case of normal, LED flickers. In case of abnormal, LED holds on or off
HS	Indicates whether High speed link service is normal or not. In case HS link setting is done, service is enabled and service is executed normally, LED is on. Though the user sets the HS link, if the user doesn't enable the HS link service, service is not executed.

LED	Contents
P2P	Indicates whether P2P service is normal or not. In case P2P setting is done, P2P service is enabled and service is executed normally, LED is on. Though the user sets the P2P, if the user doesn't enable the P2P service, service is not executed.
PADT	Indicates whether PADT is connected or not through FEnet I/F module. If PADT is connected, LED is on. If not, LED is off.
PC	Indicates whether there's Ethernet dedicated service connection or not. If dedicated service is executed, LED is on. If not LED is off.
ERR	Indicates hardware error. It means heavy error so if this LED is on, contact custom service center.
TX	Indicates whether FEnet I/F module is transmitting or not. In case of transmission, LED is on. When transmission and stop is repeated, LED will flicker
RX	Indicates whether FEnet I/F module is receiving or not. In case of transmission, LED is on. When transmission and stop is repeated, LED will flicker
PHY	Indicates speed of media. In case of 100Mbps, LED is on. In case of 10Mbps, LED is off. When setting the media speed as Auto, the module detects the speed of media. In case the user selects the one (10Mbps or 100Mbps), that is reflected in LED

[Table 2.3.1 LEDs of XGL-EMFT/EFMF module]

(2) XGL-EFMTB/XGL-EFMFB
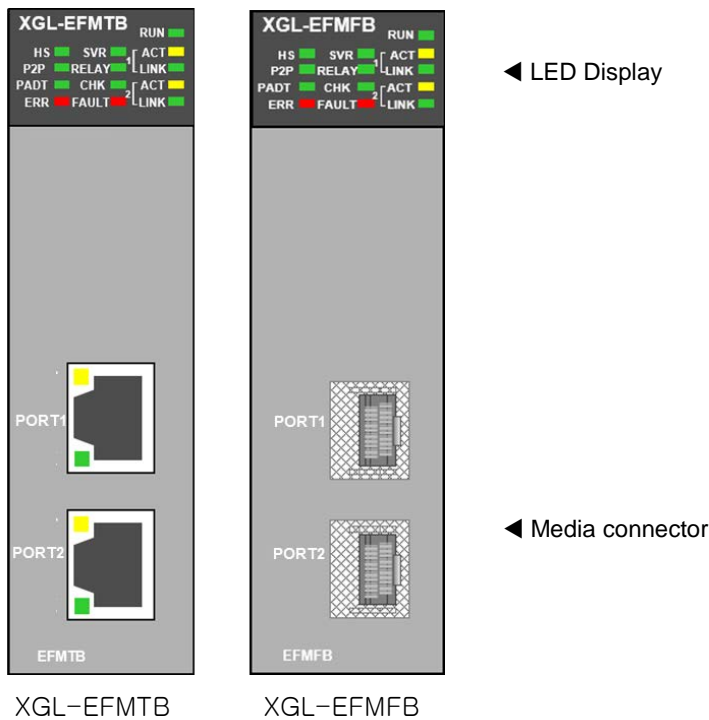

XGL-EFMTB   XGL-EFMFB

The table 2.3.2 explains the details of LED display. Refer to chapter 10 Troubleshooting of this manual for judgment and action of trouble based on the status of LEDs.
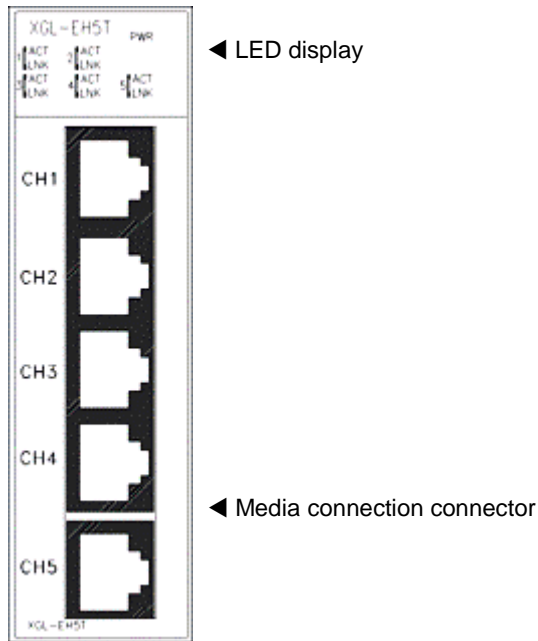
LED	Contents
RUN	Indicates whether initialization is done successfully and it works properly. In case initialization is done successfully, LED is on. In case initialization is not normal or done abnormally, LED is off.
HS	Indicates whether High speed link service is normal or not. In case HS link setting is done, service is enabled and service is executed normally, LED is on. Though the user sets the HS link, if the user doesn't enable the HS link service, service is not executed.
P2P	Indicates whether P2P service is normal or not. In case P2P setting is done, P2P service is enabled and service is executed normally, LED is on. Though the user sets the P2P, if the user doesn't enable the P2P service, service is not executed.
PADT	Indicates whether PADT is connected or not through FEnet I/F module. If PADT is connected, LED is on. If not, LED is off.
SVR	Indicate whether connection with remote Ethernet interface communication device(include PC) and dedicated communication service. In case dedicated communication is used, LED is on.
ERR	Indicates hardware error. It means heavy error so if this LED is on, contact custom service center.
RELAY	If the Relay option of the basic parameter is checked, it turns ON when the media speed of Port 1 and Port 2 is the same and the frame can be relayed. In V6.0 or above, Relay LED will blink if the media speed is different between the two ports even if the Relay option is checked. * Relay function is not supported at 10Mbps, so if Relay option is checked at 10Mbps, Relay LED will be off.
CHK	1. LED is OFF: normal operation 2. LED is ON - If there is no basic parameter - If there is an error in the basic parameter (when the module type is different) - There is an error in the basic parameters (when the media type and the type of the installed media are different) - If there is an error in the basic parameter (if there is an error in the IP setting) - If there is an error in the RAPIEnet slave parameter (V6.0 or above) - When there is a station number duplicated on the RAPIEnet network. (Not a collision of the local station number) (V6.0 or above) 3. Blinking - During Flash Write. (V6.0 or above) - When the RAPIEnet network is changed to Ring -> Line (250ms On, 250ms Off) (V6.0 or above) - When discarding received messages due to heavy load (V6.0 or above)
FAULT	1. LED is OFF: normal operation 2. LED is ON - If RAPIEnet is set and a RAPIEnet station number is duplicated (V6.0 or above) - IP conflict occurs. - While erasing flash 3. Blinking - If there is an error in the communication frame (CRC error and other errors) - When an error occurs in the slave during RAPIEnet slave control
ACT	In case Ethernet I/F module send and receive data, LED is on. In case send and stop send operations are repeat, LED is flickering.
LNK	In case Ethernet I/F module connect link with network, LED is on

[Table 2.3.2 LEDs of XGL-EFMTB/EFMFB module]

2.3.2 Structure of XGL-EH5T module
(1) XGL-EH5T

◀ LED display

◀ Media connection connector

XGL-EH5T

Special setting is not necessary and this module gets the power from power. If all LEDs except power LED flicker one time after power on, switch module is normal.

LED description of XGL-EH5T

| LED status		Off	Flicker	ON
PWR		Power is OFF	-	Power is ON
1	ACT	Not Sending/Receiving data	Sending/Receiving data	-
	LNK	10Mbps Link	-	100Mbps Link
2	ACT	Not Sending/Receiving data	Sending/Receiving data	-
	LNK	10Mbps Link	-	100Mbps Link
3	ACT	Not Sending/Receiving data	Sending/Receiving data	-
	LNK	10Mbps Link	-	100Mbps Link
4	ACT	Not Sending/Receiving data	Sending/Receiving data	-
	LNK	10Mbps Link	-	100Mbps Link
5	ACT	Not Sending/Receiving data	Sending/Receiving data	-
	LNK	10Mbps Link	-	100Mbps Link

2.4 Cable Specifications

2.4.1 UTP cable

UTP cable is classified into 2 types based on the following criteria.

① Shield: classified into 3 (UTP, FTP, STP)

② Frequency band used: classified into 7 (Cat.1~7)

1) Type of cables (shield)

Classification	Details	Purpose
UTP (or U.UTP)	Unshielded cable. High speed data transmission.	Max. 200MHz Phonetic+Data+Low grade of video signal
FTP (or S.UTP)	Shielded cable core only.	Max.100MHz Electronic impediment (EMI) and electric stability considered Phonetic+Data+Low grade of video signal
STP (or S.STP)	Double-shielded cable. Shielded core and Individually Pair cable	Max. 500MHz Phonetic+Data+Video signal Substitute for 75Ω coaxial cable
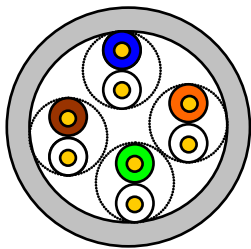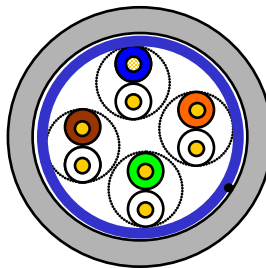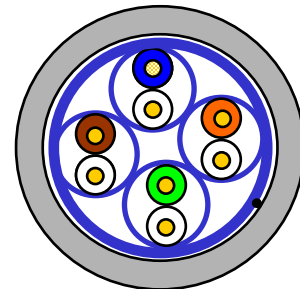
UTP   FTP   STP

Notes

1) UTP : Unshielded   Twisted Paired Copper Cable

   FTP : (Overall) Foiled Twisted Paired Copper Cable

   STP : (Overall) Shielded(and Shielded Individually Pair)Twisted Paired Copper Cable

2) Patch Cable(or Patch Cord)

   Conductor composed of stranded cable instead of solid conductor may be used to increase the flexibility of UTP 4-pair cable. And surface specification and materials used is Un-coated AWG 24 (7/0203A).

   In other words, the diameter of a single cable is 0.203mm, and this cable is of 1+6 structure as standardized with annealed copper cable.

3) It is recommended to use S,STP cable in PLC Ethernet.   If it's not possible because of field conditions, error (communication error and module error by noise) might occur.

2) Classification based on frequency used

Classification	Frequency used (MHz)	Transmission Speed (Mbps)	Purpose
Category 1	Phonetic Frequency	1	Phone network (2-Pair)
Category 2	4	4	Multi-Pair communication cable
Category 3	16	16	Phone network + Computer network
Category 4	20	20	1) Computer network transmission speed Up 2) Low-loss communication cable
Category 5 and Enhanced Category 5	100	100	1) Digital Phone network + Computer network 2) Low-loss, broadband cable
Category 6 Category 6A	250 500	1000 10000	-
Category 7 Category 7A	600 1000	10000 10000	-

Notes

1) Presently classified items are Category 3, 5, En-Cat.5 and Cat.6 inside and outside of the country, where Category 4 has been replaced by Category 5 and Category 7 is being under development all over the world as STP structure.

3) Example (CTP-LAN5) of Category 5 twisted-pair cable (UTP)

Item	Unit		Value
Conductor resistance(Max)	Ω/km		93.5
Insulation resistance(Min)	MΩ·km		2,500
Voltage endurance	V/min		AC 500
Characteristic impedance	Ω(1~100MHz)		100 ± 15
Attenuation	dB/100m or less	10MHz	6.5
		16MHz	8.2
		20MHz	9.3
Near-end crosstalk Attenuation	dB/100m or less	10MHz	47
		16MHz	44
		20MHz	42

2.4.2 Optical cable

Item	Value
Cable Type	Twin strands of multi-mode fiber optic cable(MMF)
Connector	XGL-EFMF: SC type connector XGL-EFMFB: LC type connector
Diameter of optical fiber	62.5/125 μm (62.5 μm fiber optic core and 125 μm outer cladding)
Wavelength used	1,310 nm
Attenuation	2dB/1,000m or less
Near-end crosstalk Attenuation	11dB or less

Notes

1) Since the type of the connectable cable used for communication module differs from each other based on the system configuration and its environment, applicable professional advice will be required prior to installation.
2) The optical cable may have communication errors due to attenuation if any fingerprint or contamination is stuck on the sectional end of the cable during its treatment.

Chapter 3 Installation and Operation

3.1 Precautions for Installation

3.1.1 Installation

(1) For system configuration through FEnet I/F module

1) Check the basic factors necessary for system configuration so to select an appropriate communication module.
2) Select the cable to be used for communication module to use. (only one is available between 10/100 BASE-TX and 100BASE-FX).
3) Before installing communication module, check if there is no foreign element on the connector of base and module, and no damage on the connector pin of the module.
4) All kinds of communication modules can be installed on the extension base fundamentally, however, it is recommended to install communication modules on the slot as near as possible to CPU.
5) For installation of the module, exactly insert the protuberant part at the bottom of the module with the communication cable disconnected into the base groove and then apply enough strength until its top is locked up with the locking device of the base. If the lock is not applied, it may cause an error on the interface with CPU.
6) The cable available for the communication module shall be installed with one type only between 10/ 100BASE-TX and 100BASE-FX.
7) Select standard products of switching hub and cable, which are necessary for communication with FEnet I/F module.

(2) For system configuration through switch module
1) Check the foreign substance at the connector and damage of connector pin
2) This module gets power from base so this module is not recognized by CPU. This module can be installed on any base. (main or extension)
3) For installation of the module, exactly insert the protuberant part at the bottom of the module with the communication cable disconnected into the base groove and then apply enough strength until its top is locked up with the locking device of the base. If the lock is not applied, it may cause detachment.
4) 10/100BASE-TX can be applied to this switch module.

3.1.2 Operation steps

The steps for operating FEnet I/F module from installation to operation will be described below. After the product installation is complete, install and configure the system to be operated as specified in the following steps.

Operation Steps.
1) Install FEnet I/F module on the base
2) Connect FEnet I/F module with other network.
3) Turn the system power on
4) Run XG5000 to setup basic parameters.
5) After the basic parameters are downloaded, reset the module.
6) After the module reset, check if RUN and I/F RUN LEDs of the module are normal.
7) If LED and CPU are normal, check the status information of the communication module and CPU with the diagnosis function of XG5000.
8) If the module status is normal, check if response comes in when PING test is executed through a computer connected to the network if a computer is connected to the network. If computer is not connected to the network, use the live check item among diagnosis services of XG5000 to check the response.
9) Setup the communication services and download the setup items to the PLC with XG5000.
10) Enable communication service.
11) After programming with XG5000, write it on CPU to start the operation.

Notes
1) After station No. and IP address are specified through XG5000, surely reset the applicable module. The first station No. and IP address (including frames) will keep the value read from the communication module when initialized. Any changed details during communication will not be applied during Run.

3.2 Installation of the Product

3.2.1 Installation of XGL-EFMT(B)
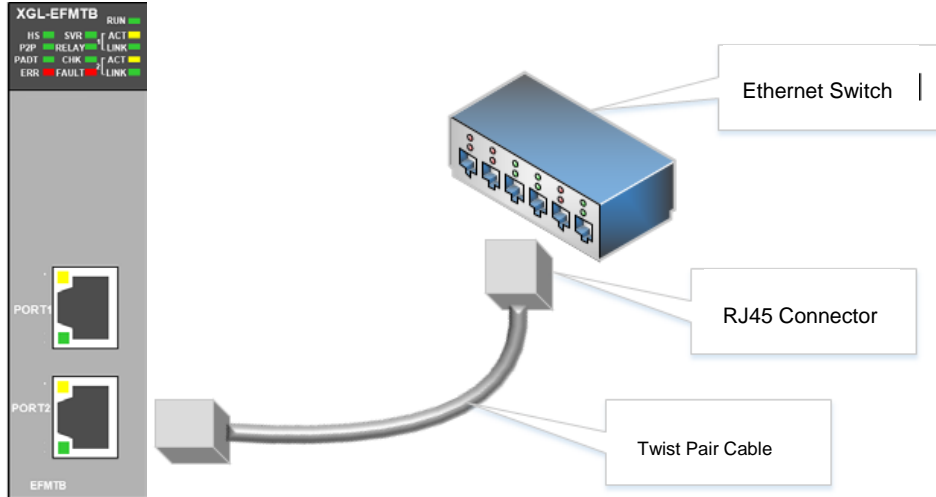
[Fig. 3.2.1] Installation of XGL-EFMT(B)

The maximum cable length of a segment in 10/100BASE-TX system is 100m (distance between module and hub). Generally, the hub is of straight cable with TD and RD stranded inside.
If only 2 communication modules are connected 1 to 1, cross-cable form shall be used.

Pin No.	Sign	Straight cable between hub and module	1 to 1 cross-cable
1	TD+	1 — 1	1 — 3
2	TD-	2 — 2	2 — 6
3	RD+	3 — 3	3 — 1
6	TRD2+	4 — 4	4 — 7
4	TRD2-	5 — 5	5 — 8
5	RD-	6 — 6	6 — 2
7	TRD3+	7 — 7	7 — 4
8	TRD3-	8 — 8	8 — 5

| **Notes** |
| --- |
| 1) Since the structure of 10/100BASE-TX cable is vulnerable to external noise, the cable needs to be stranded as twisted (two lines twisted with each other) between cables of the pin No.1 and 2 of TD+ and TD- and between cables of the pin No.3 and 6 of RD+ and RD- so to be strong against noise
 2) Hub power shall be separated from PLC power to be used against the noise.
 3) Contact professional manufacturers for processing cable terminal, manufacture and installation. |

(1) Precautions for UTP installation

1) In order to transmit reliable 100Mbps sign with UTP cable, use the cable conforming to the characteristics of Category 5.
2) Be careful not to exceed the tension strength of the cable intensely during wiring.
3) When escaping from the coat (sheathed), let it as long as the length only to be wired and with the insulation kept from damage.
4) Jumper wire and patch code shall be applied rather loosely. If wired too tight, the characteristics of Category 5 may be deteriorated.
5) When UTP cable is installed, a suitable distance shall be maintained between EMI source and UTP cable.

Condition	Min. separation distance		
	2.0 kVA or less	2.5 kVA	5.0 kVA or more
Power line unshielded, or electric facility open or near to nonmetallic pipe	127mm	305mm	610mm
Power line unshielded, or electric facility near to metallic pipe buried	64mm	152mm	305mm
Power line inside metallic pipe buried (or equivalently shielded) near to metallic pipe buried	-	76mm	152mm
Transformer, electric motor, fluorescent lamp	1,016mm 305mm		

Notes
1) If voltage is 480V, rated power is 5 kVA or more, separate calculation is needed.

3.2.2 Installation of XGL-EFMF(B)
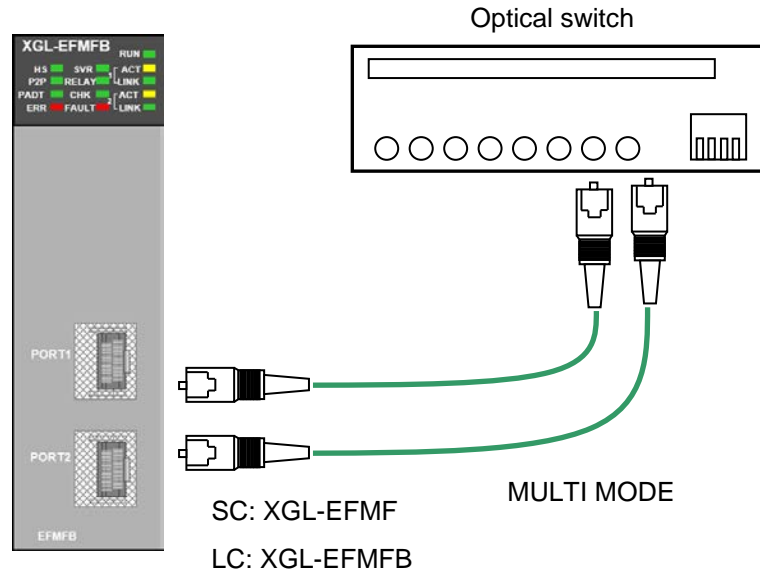
[Fig. 3.2.2] Installation of XGL-EFMF(B)

The maximum cable length of segment in 100BASE-FX system is 2km (distance between module and optical switch). In case of XGL-EFMF(B), refer to SFP specification. Let the module's Tx cross-connected with the optical switch's Rx, and the module's Rx with the optical switch's Tx.

Notes

1) Since the optical cable is vulnerable to impact, pressure, folding and pulling, pay good attention to its treatment.
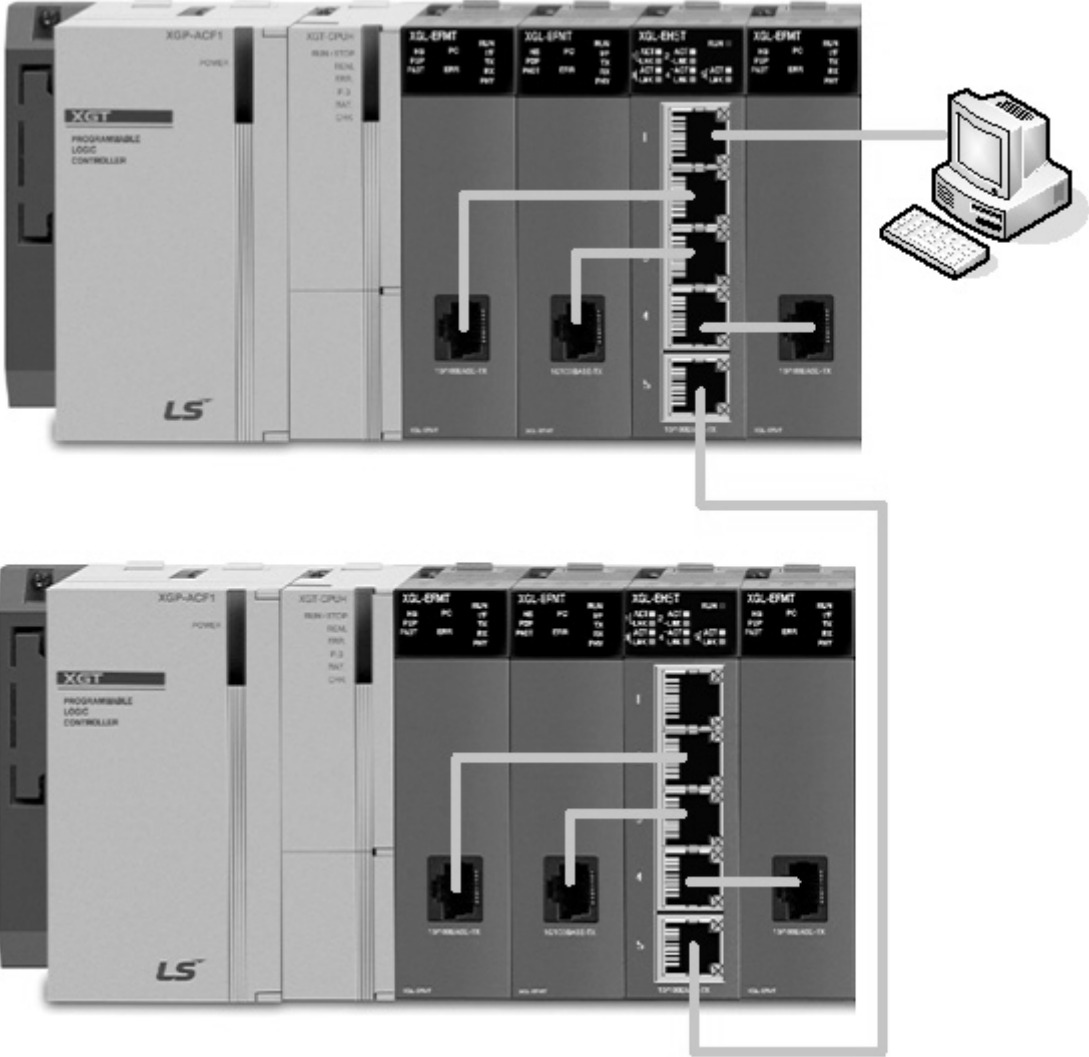
The optical contact between the connector and the end of the cable may have communication errors if contaminated, which may result in unavailable communication.

If the cable is installed outdoors, additional countermeasures are required to protect the cable suitably for the installation environment.
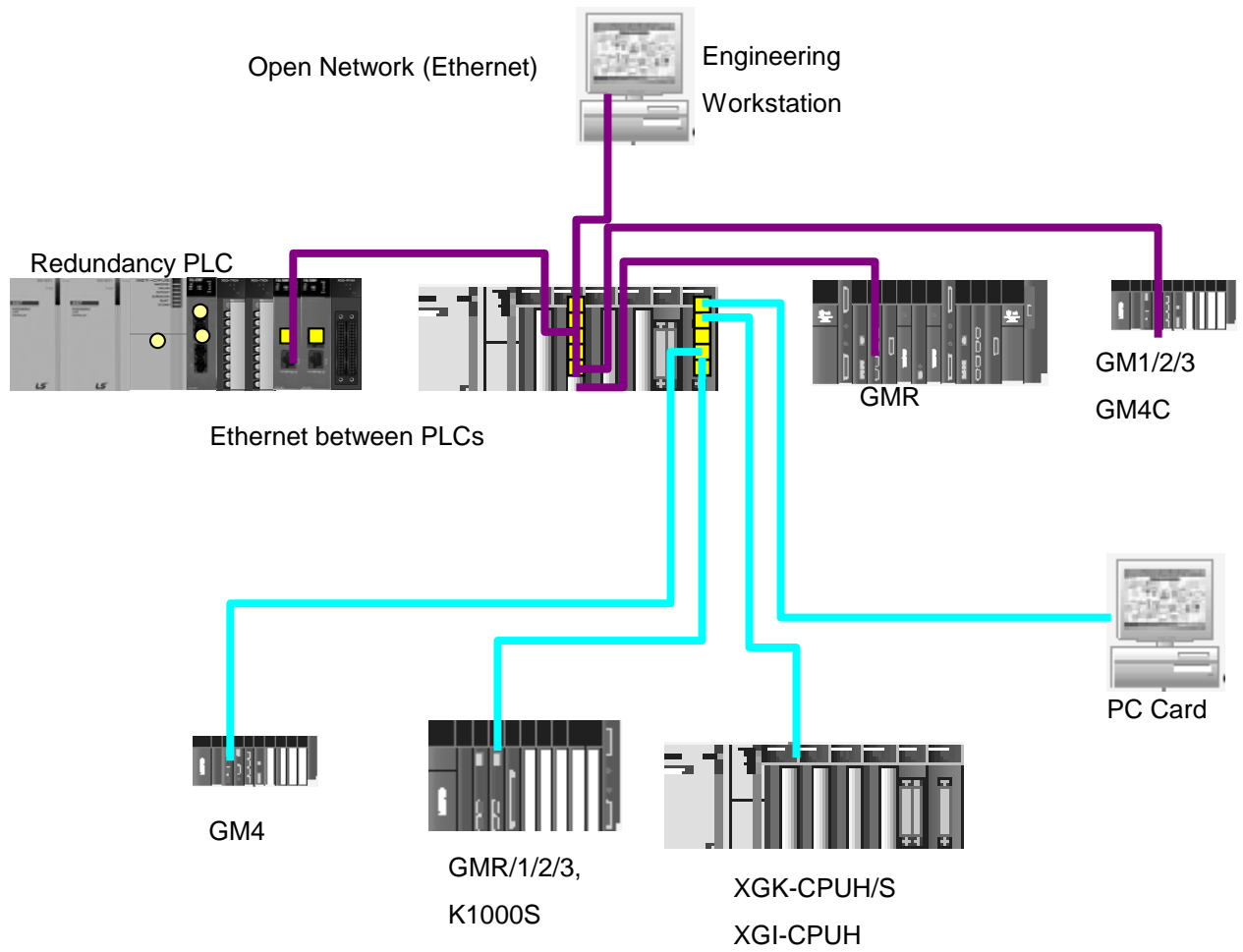

3.2.3 Installation of XGL-EH5T

This switch module provides interface used between Ethernet module using 10/100BASE-TX.
So interfaces between PCs are also supported.

Twist Pair Cable

[Figure 3.2.3] Installation of XGL-EH5T

Open Network (Ethernet)

Engineering
Workstation

Redundancy PLC

Ethernet between PLCs

GMR

GM1/2/3
GM4C

PC Card

GM4

GMR/1/2/3,
K1000S

XGK-CPUH/S
XGI-CPUH

[Figure 3.2.4] System configuration example using XGL-EH5T

(1) Installation of cable

XGL-EH5T uses UTP cable that is same one used in XGL-EFMT. For more detail, refer to 3.2.1.
This switch module provides Auto Cross Over function so the user can use both cross and direct
cable.

3.3 Operation

Check status of LEDs of FEnet I/F module when power turned on after communication cable is connected. If normal, download the applicable program to PLC via XG5000 so to execute the program.

3.3.1 Precautions for system configuration

1) IP addresses shall be surely different from each devices in 1 network system including FEnet I/F module. If there are more than 1 devices of same IP address in 1 network system, communication error may occur, leading to communication trouble. HS link station No. of all stations also shall be different from each FEnet I/F module to use HS link service.
2) Use the communication cable as specified only. If not, fatal error may occur to communication.
3) Check communication cable if opened or shorted prior to installation.
4) Tighten up communication cable connector until connected firmly. If cable connection is unstable, fatal error may occur to communication.
5) If cable is connected long distance, keep the cable far away from power line or inductive noise.
6) Since the flexibility of coaxial cable is low, it is to be diverged min. 30cm away from the connector in communication module. If the cable is bent at a right angle or transformed compulsorily, cable disconnection or connector damage in communication module may be caused.
7) If the status of LEDs is abnormal, refer to Chapter 10 Troubleshooting to check for causes and available actions against the status of LEDs. Contact customer service center if the error is as before
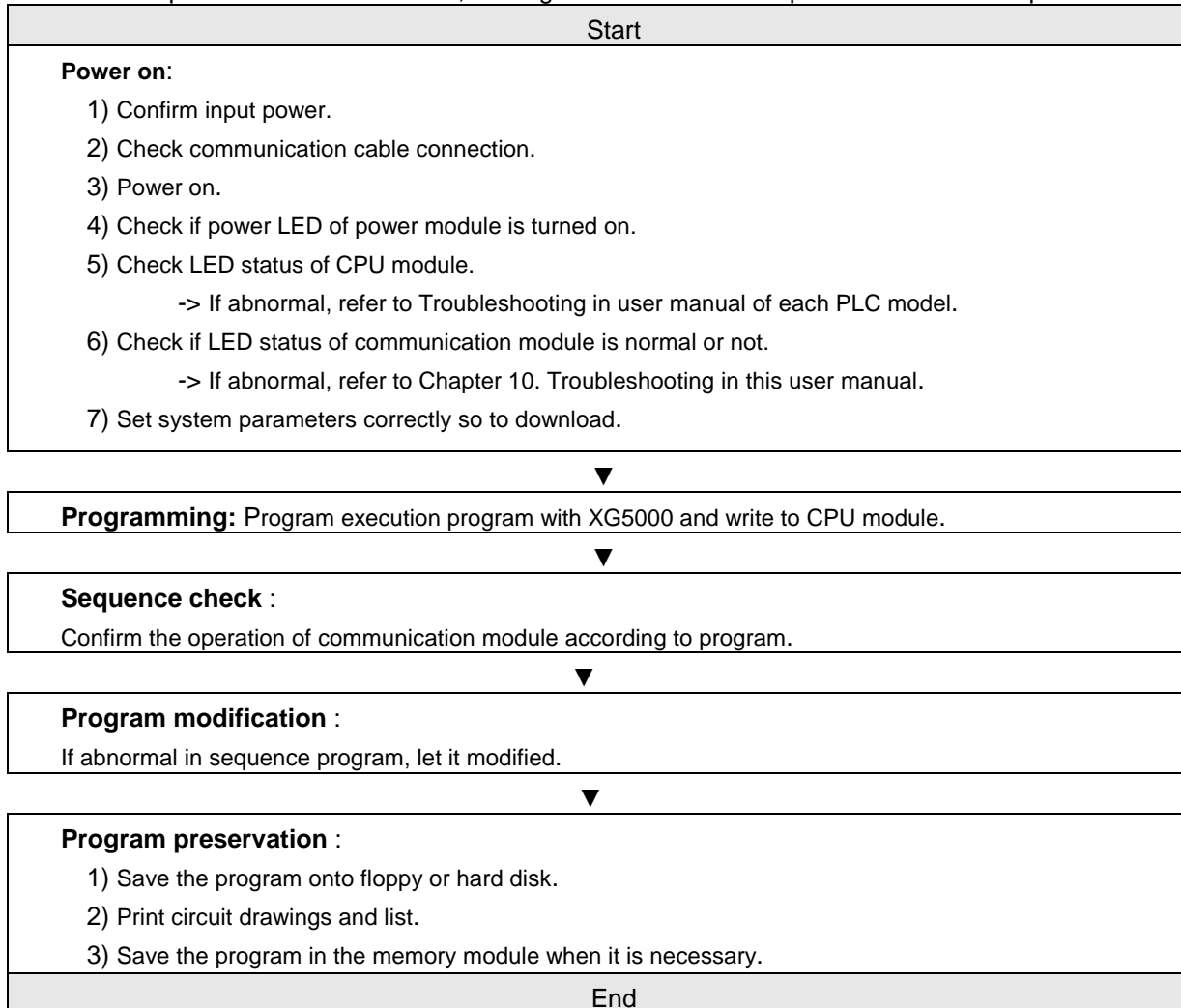
3.3.2 Checklist prior to test operation
Check items are described below prior to operation of the FEnet I/F module.

1) Communication module installed on PLC

Check items	Description
Installation and inspection of basic S/W	- Is installation and operation of XG5000 normal?
Communication cable connection (If cable is connected)	- Is connection and tab status of communication cable normal? - Is the status of LEDs and cable connection normal?
Module installation	- Is the FEnet I/F module installed correctly on basic base?

2) Steps of operation

The steps will be described below, starting from installation complete on PLC to test operation

Start

Power on:
 	
   1) Confirm input power.
   2) Check communication cable connection.
   3) Power on.
   4) Check if power LED of power module is turned on.
   5) Check LED status of CPU module.
         -> If abnormal, refer to Troubleshooting in user manual of each PLC model.
   6) Check if LED status of communication module is normal or not.
         -> If abnormal, refer to Chapter 10. Troubleshooting in this user manual.
   7) Set system parameters correctly so to download.

▼

Programming: Program execution program with XG5000 and write to CPU module.

▼

Sequence check : Confirm the operation of communication module according to program.

▼

Program modification : If abnormal in sequence program, let it modified.

▼

Program preservation :
 	
   1) Save the program onto floppy or hard disk.
   2) Print circuit drawings and list.
   3) Save the program in the memory module when it is necessary.

End

3.3.3 How to install or remove the module

Follow the steps described below to replace or remove the applicable module due to its hardware error or system change.

(1) To replace the communication module
    (1) Power off the base where the communication module is installed on.
    (2) Disconnect the network cable.
    (3) Install a new module as specified in the steps of 3.3.2 above.

(2) Replacement by the module change switch of CPU
    Refer to how to use the module exchange switch of CPU

(3) Replacement by the module wizard switch of XG5000
    Refer to how to use the module change wizard of XG5000

Notes
1) When FEnet I/F module is replaced, reset the opposite side device (MMI or PC). The device may stop communicating due to the time out of the applicable module

Chapter 4 System Configuration

4.1 Configuration of Network System

4.1.1 LSIS' PLCs Ethernet system

LSIS's Ethernet system can connect to Internet public network using open protocol TCP/IP. So you can monitor local PLC via broadband monitoring system[1,2], GLOFA VIEW using Internet. And you can monitor PLC via local monitoring system connected to local network.
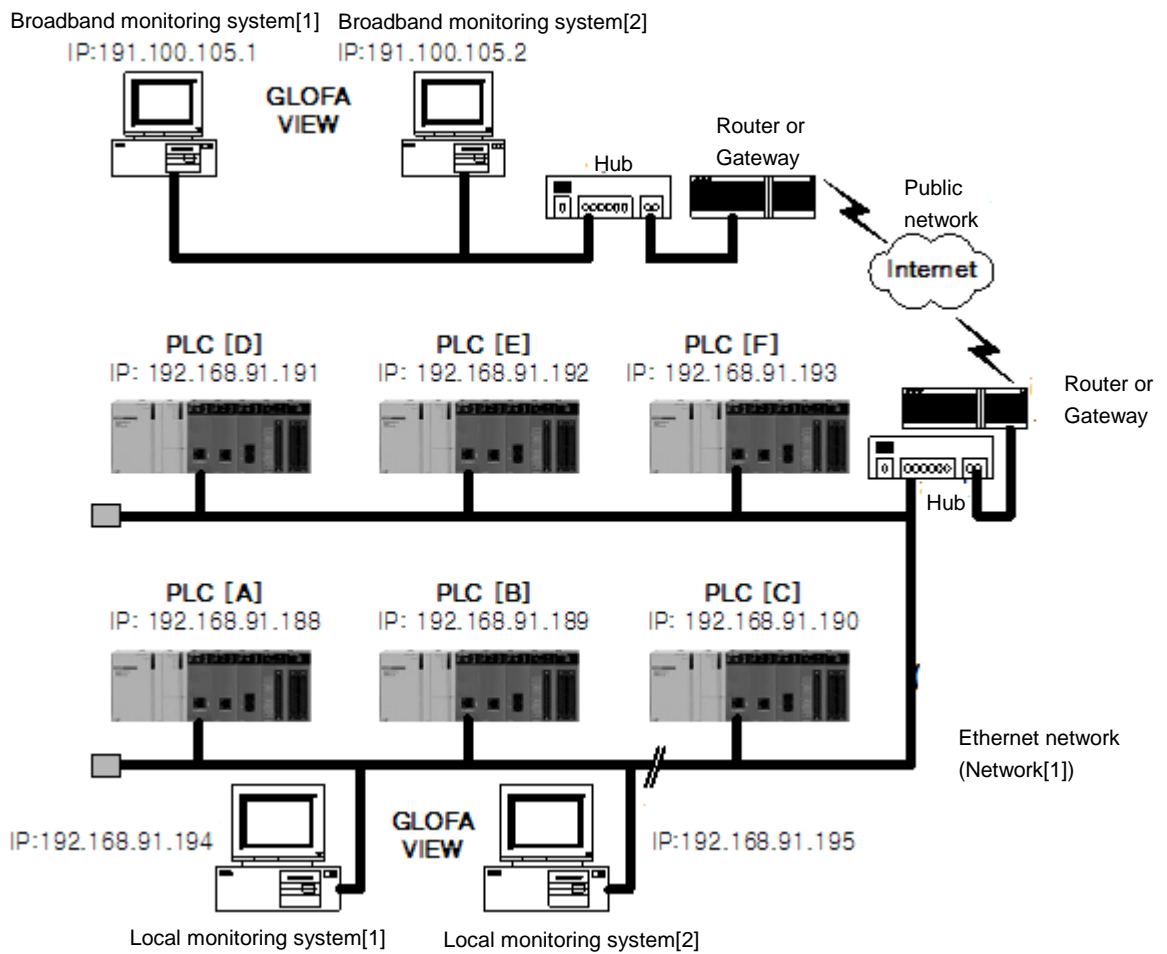
[Fig.4.1.1] Ethernet System [Public network with LSIS' PLCs]

4.1.2 Dedicated Network composed of LSIS' PLCs

You can configure Ethernet system with dedicated network not connected to public network, Internet. Figure 4.1.2 shows example using dedicated network. Each PLC is connected to the dedicated Ethernet network via FEnet module and they can transmit and receive each other's data using P2P, High Speed Link and the dedicated service.

[Fig.4.1.2] Ethernet System (Dedicated Network with LSIS' PLCs)

4.1.3 Dedicated Network composed of LSIS' and Other Company's PLCs

Figure 4.1.3 shows Ethernet system composed of LSIS's and other company's PLCs. LSIS's PLC can us user-defined communication. So if you know the frame structure of other company's PLCs, LSIS's PLC can communicate with other PLC.
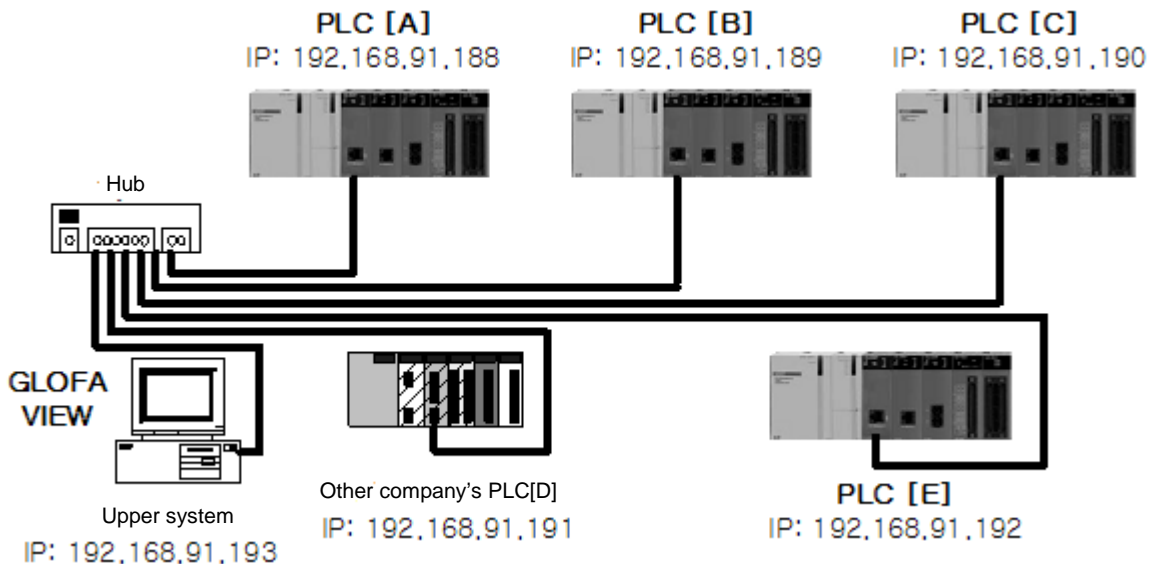
[Fig.4.1.3] Ethernet System (Dedicated Network with LSIS' and Other Company's PLCs)
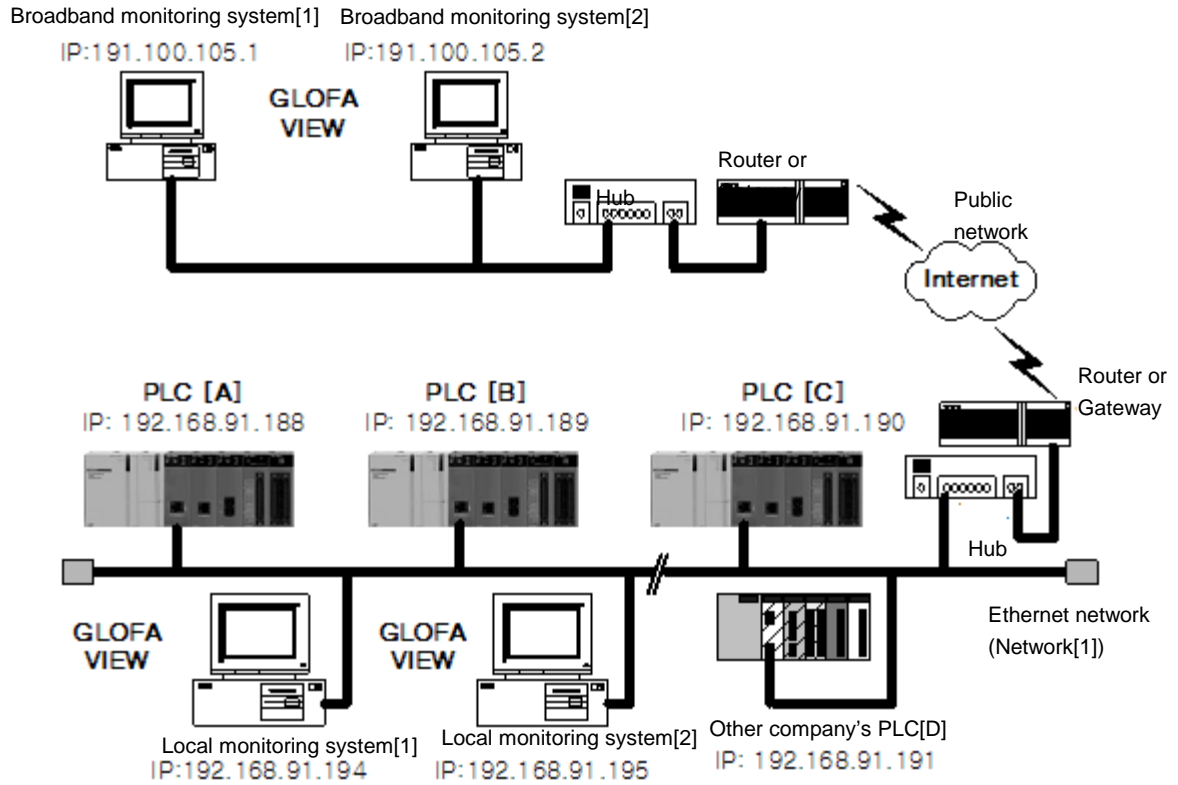
4.1.4 Public Network and Dedicated Network system

LSIS's Ethernet system can connect to Internet public network using open protocol TCP/IP. So you can monitor local PLC via broadband monitoring system[1,2], GLOFA VIEW using Internet. And you can monitor PLC via local monitoring system connected to local network.
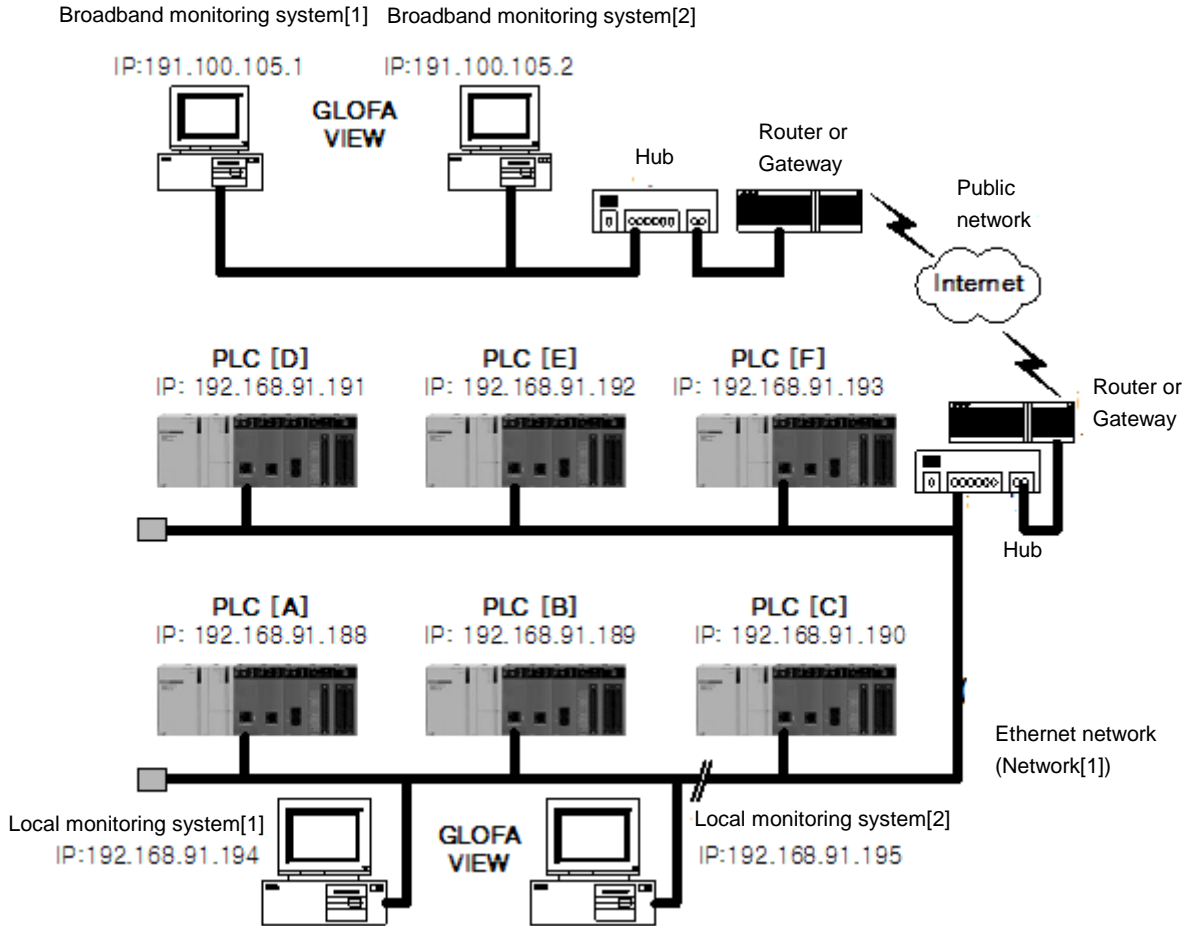
[Fig.4.1.4] Ethernet System (Public Network + Dedicated Network)

4.1.5 Public Network and Dedicated Network system composed of LSIS' and other company's PLCs


[Fig.4.1.5] Ethernet System (Public Network + Dedicated Network + Other Company's System)

4.1.6 System configuration using dedicated Ethernet between HMIs, PLCs at XGR system

At XGR system, Ethernet module should be installed at main base and same slot of A/B bases. Ethernet module installed at base acting as MASTER executes the communication service but Ethernet module installed at base acting as STANDBY CPU doesn't execute the communication service.
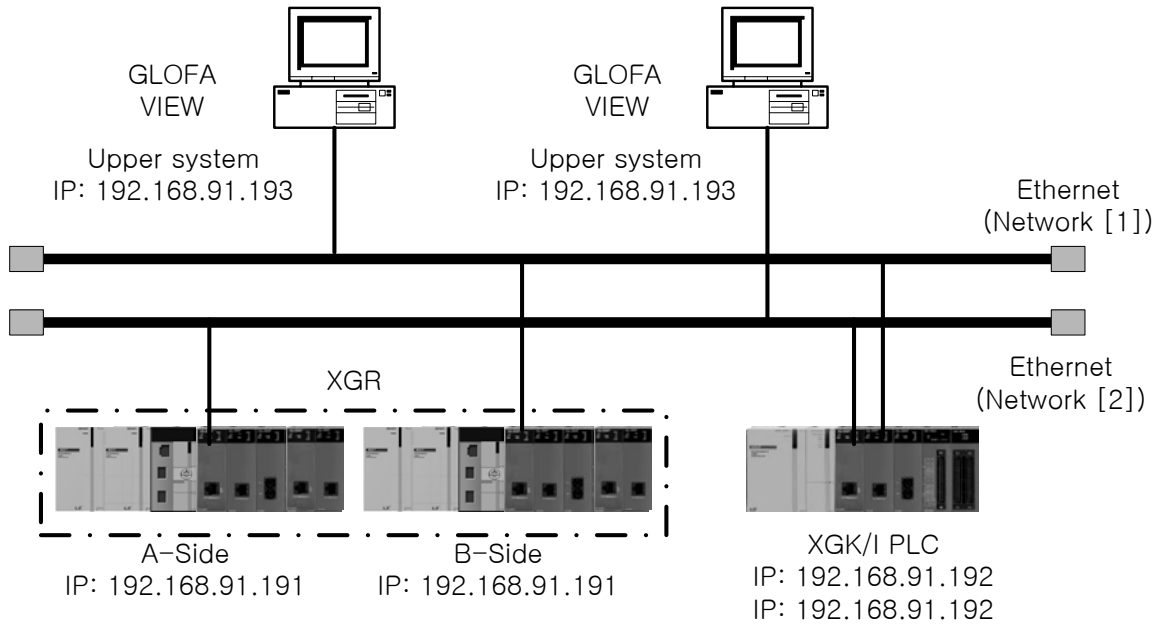

[Figure 4.1.6] XGT Ethernet redundancy system (Redundant Network)
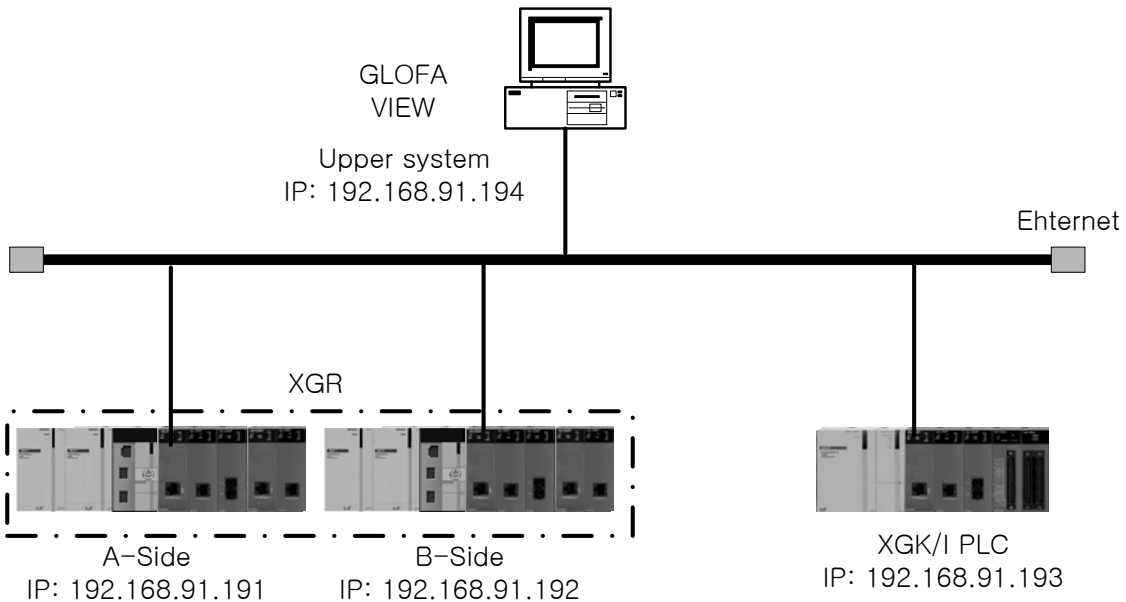
[Figure 4.1.7] Communication as XGT redundant system (Single network)

4.1.7 System configuration using dedicated Ethernet between HMIs, PLCs at XGR system

For communication with upper system, previous PLC system and other company's controller, Ethernet communication module can be used and For communication with XGT PLC, industrial Ethernet communication can be used to improve the reliability and speed.
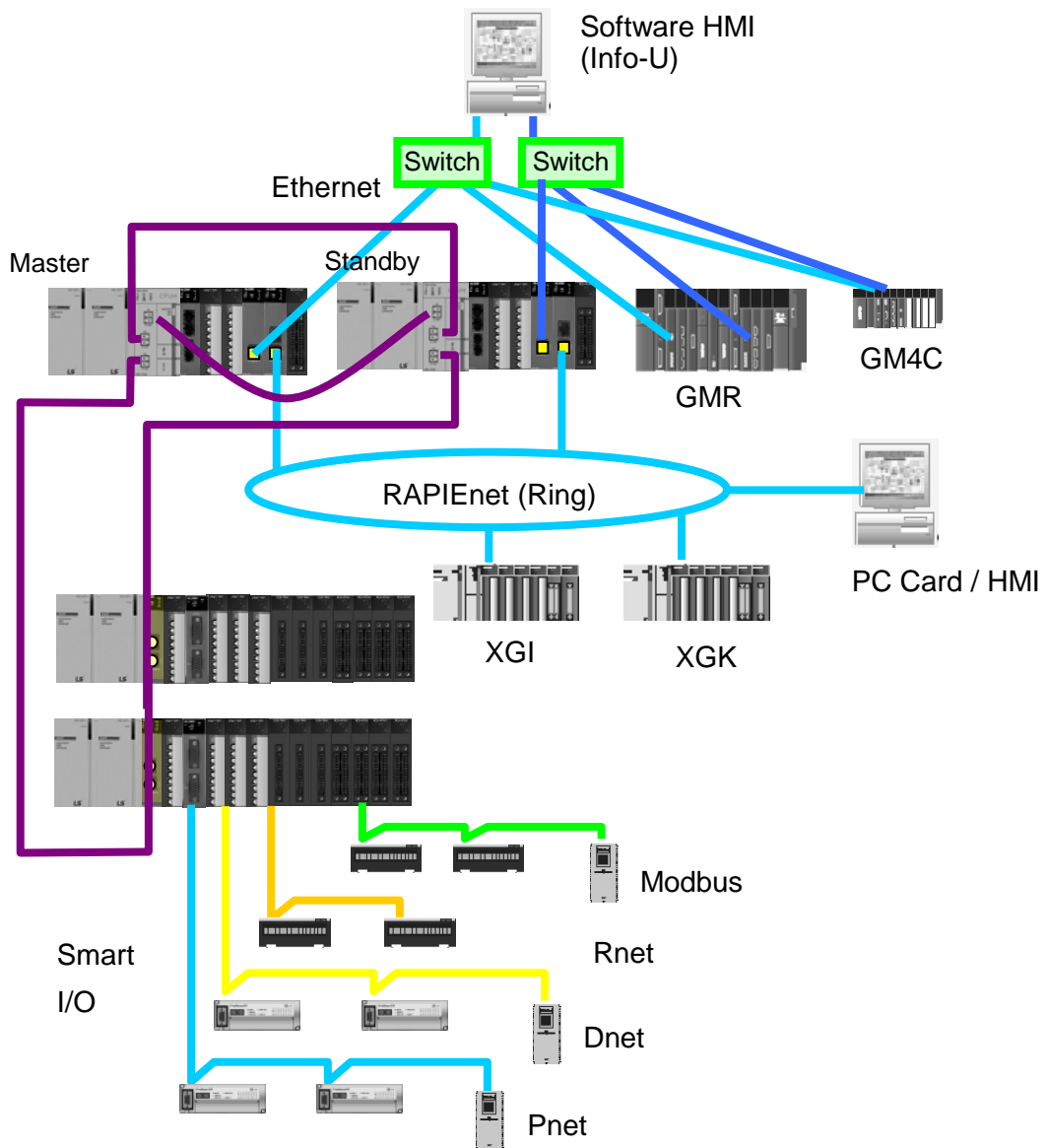
[Figure 4.1.8] XGT redundancy system (Between HMIs, PLCs)