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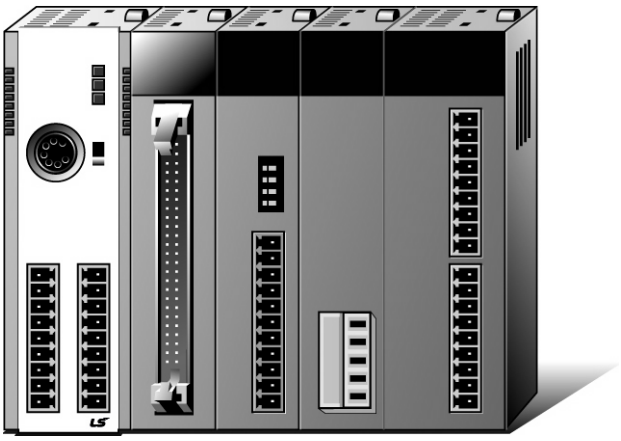
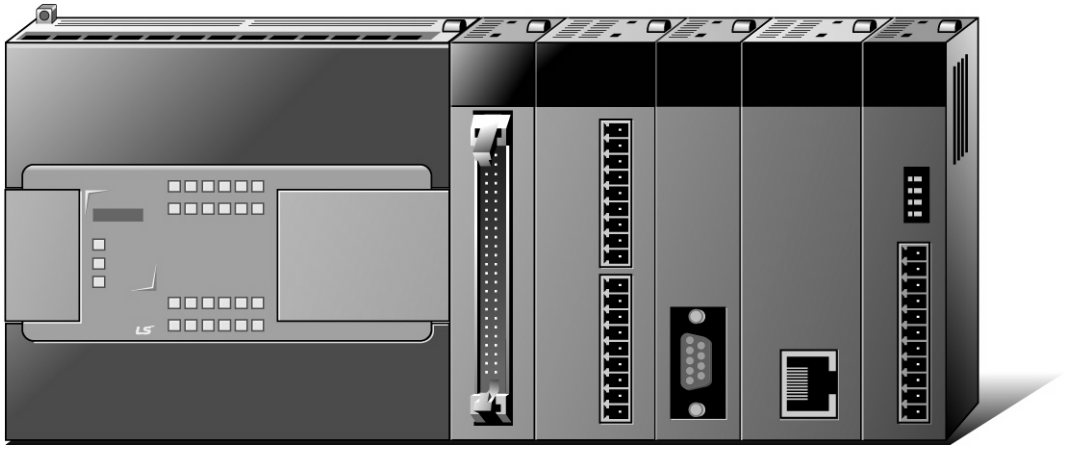
Programmable Logic Control

XGB FEnet I/F Module

XGT Series **User Manual**

XBL-EMTA





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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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 for design process

⚠ Warning

- **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.
  - 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.
  - 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.
- **Never overload more than rated current of output module nor allow to have a short circuit**. Over current for a long period time maycause a fire .
- **Never let the external power of the output circuit to be on earlier than PLC power**, which may cause accidents from abnormal output oroperation.
- **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 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

Safety Instructions on installation process

⚠ Caution

- **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.
- **Before install or remove the module, be sure PLC power is off.** If not, electric shock or damage on the product may be caused.
- **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.
- **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.
- **Do not come in contact with conducting parts in each module**, which may cause electric shock, malfunctions or abnormal operation.

Safety Instructions for wiring process

⚠ Warning

- **Prior to wiring works, make sure that every power is turned off.** If not, electric shock or damage on the product may be caused.
- **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

- **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.
- **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.
- **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.
- **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.
- **Make sure that pressed terminals get tighten following the specified torque. External connector type shall be pressed or soldered using proper equipments.**

Safety Instructions for test-operation and maintenance

⚠ Warning

- **Don't touch the terminal when powered**. Electric shock or abnormal operation may occur.
- **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.
- **Don't let the battery recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

⚠ Caution

- **Do not make modifications or disassemble each module.** Fire, electric shock or abnormal operation may occur.
- **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.
- **Keep any wireless equipment such as walkie-talkie or cell phones at least 30cm away from PLC**. If not, abnormal operation may be caused.
- **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.
- **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 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	2007. 8	First Edition	-
V1.1	2008. 5	1. Adding XGB compact type (1) Changing front cover (2) Modifying general specification (3) Modifying screen of basic setting (4) Modifying slot setting information (5) Modifying example of frame	 Front cover 2-1 6-2, 8-1 7-2 5-5, 6
V1.2	2009. 2	1. Adding XEC compact type 2. Adding E-mail service 3. Adding DHCP setting 4. Adding appendix	- Ch 7 6-3 A-1, A3~A6
V1.3	2011. 1	1. Modifying remote communication control	9-3, 6
V1.4	2013.11	1. Modifying Modbus communication error - Function code of request/response frame	5-9~5-15
V1.5	2015. 3	XG5000 V4.0 UI Update	-
V1.6	2020. 6	Modifying company name to LS ELECTRIC	-
V1.7	2022. 8	Homepage address changed	-
V1.8	2022. 10	Minimum distance specification between nodes added	Ch 2

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

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Congratulations on purchasing PLC of LS ELECTRIC 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.ls-electric.com/) and download the information as a PDF file.

Relevant User's Manuals

Title	Description	Manual code
XG5000 User's Manual	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGK, XGB CPU	10310000512
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	10310000834
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.	10310000510
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.	10310000833
XGB Hardware	XGB basic unit user's manual describing about power module, IO module, specification of extension cable and system configuration, internal high-speed counter standard of XGB basic unit	10310000694
XGB Hardware (IEC)	XGB basic unit user's manual describing about power module, IO module, specification of extension cable and system configuration, internal high-speed counter standard of XGB basic unit	10310000983

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Chapter 1 General

1.1 Before Reading This Manual

This manual includes specifications, installations and various services for Fast Ethernet Interface Module of XGB Ethernet PLC (Hereafter, referred to as XGB Fast Enet I/F module, 100Mbps). Ethernet is one of technical standards of IEEE. It provides HS data communication on the base of CSMA/CD network.
XGB Fast Enet I/F module is an interface module for data communication between PC devices by using the electrical media (10/100BASE-TX).

1.2 Before Using This Device

1.2.1 Relevant user manuals

Refer to below user manuals for writing program.

(1) XGT PLC Instruction and Programming manual
(2) XG5000 manual
(3) XGB series manual

1.2.2 Version Information

XGB Fast Enet I/F module (XBL-EMTA) is suitable to following versions.

(1) XG5000 programming tool: above Ver 2.0
(2) XGB CPU: Moduler type(above Ver 1.4), Compact type(abobe Ver 1.0)

1.3 Characteristics

XGB Fast Enet I/F module provides its services for ARP, ICMP, TCP/IP and UDP/IP protocol and includes following characteristics.

1.3.1 XGB Fast Ethernet I/F module characteristics

(1) Ethernet II, IEEE 802.3 standard functions
(2) HS link function for HS data communication between LS Electric modules
Communication dedicated parameter setting program (XG5000)
Send data Max. 32 blocks x 200 words, receive data, Max. 32 block x 200 words, Send-Receive Max. 64 blocks x 200 words
(3) HS link and communication is available with Max. 4 modules (Dedicated communication + P2P communication)
(4) Loader service by FEnet (XG5000): (Dedicated TCP/IP PORT: 2002 assignment)
(5) Connection to other system is available through P2P communication and XG5000
(Variable READ/WRITE services (Dynamic Connection function))

(6) Auto/10/100BASE-TX media service

(7) Various communication functions
System connection by using public network
LS Electric protocol (XGT) and other company protocol (Modbus TCP/IP) (dedicated service)
Simple client function for the communication between LS Electric communication module and other company communication module (XGT, Modbus TCP, user define P2P client function)
Host enable table for Upper PC (MMI) and communication protection
Dynamic Connection/Disconnection function by using P2P service

(8) Various diagnosis functions, module and network condition information
CPU module condition
Communication module condition
Communication service (HS rink, main service, P2P) condition
PING function to check the existence of other module
Packet types and minute packet reception rate to LS Electric communication module (it predicts network load)
Diagnosis function for communication module by network

1.3.2 Designation

XGB Fast Enet I/F module designates as below.

Designation	Description	Remark
XBL-EMTA	10/100BASE-TX	Over category 5, UTP cable

[Table 1-1] XBL-EMTA Designation

1.3.3 Max. modules can be installed

XGB series can be installed max. 2 communication modules.

Series	Max. modules can be installed
XGB	2

[Table 1-2] Max. modules can be installed

1.3.4 Relevant software

Essential programming tools and other configuration software for using XGB Fast Enet I/F module is as followings. Refer to followings and apply this suggestion for the right program and communication.

Designation	Programming Tool	Communication Setting Tool
XBL-EMTA	XG5000 (above Ver. 2.0)	XG-PD (above Ver. 2.0)

[Table 1-3] Relevant software

Remark

1) Download and usage of upper program is available at http://www.lselectric.co.kr or this program installation CD's can be provided by LS Electric distributors.
2) Programming for XG5000 is available by using Basic unit loader port and refer to cables from the wiring diagram of relevant Basic unit.

Chapter 2 Specifications

2.1 General Specifications

[Table 2-1] shows general specification of XGB series.

<table>
<tr><th>No.</th><th>Items</th><th colspan="5">Specifications</th><th>Related standards</th></tr>
<tr><td>1</td><td>Ambient temperature</td><td colspan="5">0 ~ 55 °C</td><td></td></tr>
<tr><td>2</td><td>Storage temperature</td><td colspan="5">–25 ~ +70 °C</td><td></td></tr>
<tr><td>3</td><td>Ambient humidity</td><td colspan="5">5 ~ 95%RH (Non-condensing)</td><td></td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="5">5 ~ 95%RH (Non-condensing)</td><td></td></tr>
<tr><td rowspan="9">5</td><td rowspan="9">Vibration resistance</td><td colspan="4">Occasional vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td>times</td><td rowspan="9">IEC61131-2</td></tr>
<tr><td>5 ≤ f < 8.4Hz</td><td colspan="2">–</td><td>3.5mm</td><td rowspan="5">10 times each directions (X, Y and Z)</td></tr>
<tr><td>8.4 ≤ f ≤ 150Hz</td><td colspan="2">9.8m/s²(1G)</td><td>–</td></tr>
<tr><td colspan="4">Continuous vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td></tr>
<tr><td>5 ≤ f < 8.4Hz</td><td colspan="2">–</td><td>1.75mm</td></tr>
<tr><td>8.4 ≤ f ≤ 150Hz</td><td colspan="2">4.9m/s²(0.5G)</td><td>–</td></tr>
<tr><td>6</td><td>Shock resistance</td><td colspan="5">• Peak acceleration: 147 m/s²(15G)
• Duration: 11ms
• Half-sine, 3 times each direction per each axis</td><td>IEC61131-2</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Noise resistance</td><td>Square wave Impulse noise</td><td colspan="4">AC: ±1,500 V
DC: ±900 V</td><td>LS ELECTRIC standard</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">4kV (Contact discharge)</td><td>IEC61131-2
IEC61000-1-2</td></tr>
<tr><td>Radiated electromagnetic field noise</td><td colspan="4">80 ~ 1,000 MHz, 10V/m</td><td>IEC61131-2,
IEC61000-1-3</td></tr>
<tr><td rowspan="2">Fast transient/bust noise</td><td>Segment</td><td>Power supply module</td><td colspan="2">Digital/analog input/output communication interface</td><td rowspan="2">IEC61131-2
IEC61000-1-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td colspan="2">1kV</td></tr>
<tr><td>8</td><td>Environment</td><td colspan="5">Free from corrosive gasses and excessive dust</td><td></td></tr>
<tr><td>9</td><td>Altitude</td><td colspan="5">Up to 2,000 ms</td><td></td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="5">2 or less</td><td></td></tr>
<tr><td>11</td><td>Cooling</td><td colspan="5">Air-cooling</td><td></td></tr>
</table>

[Table 2-1] General specification

Note

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

2.2 Transmission Specifications

[Table 2-2] shows transmission specifications of XGB Fast Enet I/F module media.

Item		Specifications	Remark
Transmission specifications	Transmission speed	Auto/10M/100Mbps	-
	Transmission type	Base band	-
	Flow control	HALF/FULL	-
	Modulation type	NRZI	▪4B/5B coding
	Transformer CT	1:1	▪Node-Hub
	Max. distance between nodes	100m	-
	Min. distance between nodes	1m or more Note1)	-
	Max. segment length	-	-
	Max. number of nodes	Hub connection	-
	Node interval	-	-
	Max. protocol size	Data 512byte	-
	Communication zone access method	CSMA/CD	-
	Check method for frame error	CRC32	-

[Table 2-2] Transmission specifications

*Note1) When using a cable of less than 1 m, the SNR (Signal to Noise Ratio) decreases due to the influence of reflected waves, which may cause Link Down or packet loss.

2.3 Cable Specifications

2.3.1 Cable classification

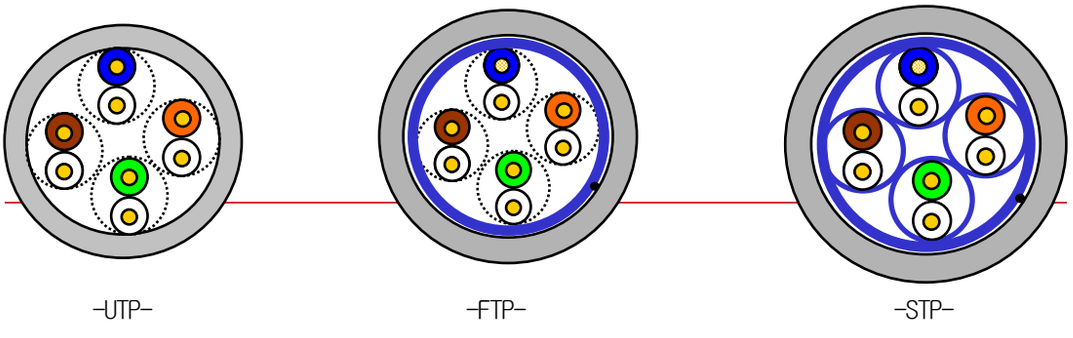
XGB Fast Enet I/F module uses UTP cable above Category 5. [Table 2-3] shows cable specifications.

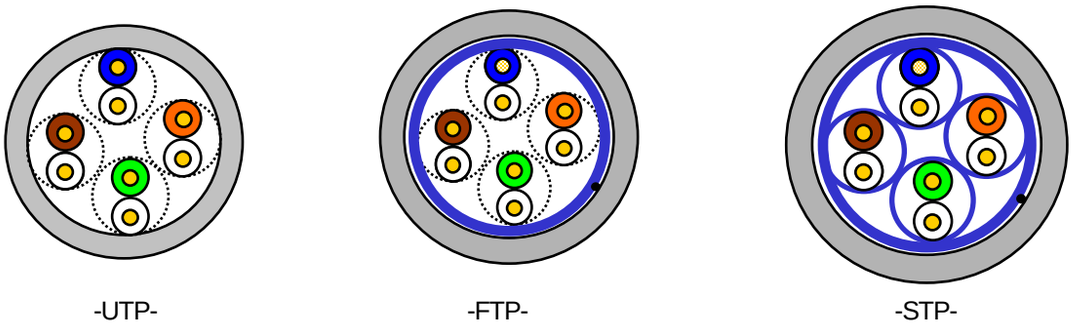
Classification	Details	Purpose
UTP(or U.UTP)	So called unshielded cable used for HS signal	· Max. 200MHz · Phonetic + Data + low grade of video signal
FTP(or S.UTP)	Cable with cable core only shielded solely	· Max.100MHz · Electromagnetic Interference (EMI) and electric stability considered · Phonetic + Data + low grade of video signal
STP(or S.STP)	Double-shielded structure, pair shielded and core shielded cable	· Max. 500MHz · Phonetic + Data + Video signal · Substitute for 75Ω coaxial cable

[Table 2-3] Cable class

Remark

1) XGB Fast Enet I/F module does not support AUI (10BASE-5).
2) Twisted paired cable unit (above category 5) takes 100Mbps class hub and if network speed is 10 Mbps, it can be used with 10Mbps class hub (below category 3). Be cautions prior to the installations.





Remark

1) UTP : Unshielded Twisted Pair Copper Cable
FTP : (Overall) Foiled Twisted Pair Copper Cable
STP : (Overall) Shielded (and Shielded Individually Pair) Twisted Pair Copper Cable
2) Patch Cable (or Patch Cord)
Stranded conductor composed of stranded cable instead of solid conductor may be used to increase the flexibility of UTP 4-paired cable. Representative specification and material are 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.

2.3.2 Frequency classification

Classification	Frequency (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	· Computer network transmission speed up · Low- loss communication cable
Category 5 & Enhanced Category5	100	100	· Digital phone network + computer network · Low -loss, broadband cable

[Table 2-4] Frequency classification

Remark

1) Presently Category 3, 5, En-Cat.5, and Cat.6 are commonly ued and classified under domestic/internalional makers, where Category 4 has been replaced by Category 5 and Category 7 is being developed all over the world as STP structure.

2.3.3 Category 5 twisted pair cable (UTP) examples (CTP-LAN5)

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

[Table 2-5] UTP cable specification

2.4 Performance Specifications

2.4.1 General performance specifications

[Table 2-6] shows general performance specifications of XGB Fast Enet I/F module.

Item		Specifications	Remark
Max. modules can be installed		2	-
Max. numbers of server connection channels		6 channels	▪ XGT server or modbus : 4 channels ▪ Remote 1: 1 channel ▪ Remote 2: 1 channel
Consumption	DC 5V	300㎃	-
Weight		71g	-

[Table 2-6] General performance specifications

2.4.2 Performance specifications by communication Service

[Table 2-7] shows performance specifications by communication service of XGB Fast Enet I/F module.

Item		Specifications			
		Driver	Communication method	Port Number	Remark
Function classification	Dedicated	XGT server	TCP/IP	2004	▪ Max. 4 channels ▪ Max. 512 bytes
			UDP/IP	2005	
		Mod bus TCP server	TCP/IP	502	
	HS link	-	UDP/IP	2006	▪ Max. 64 blocks ▪ 200 words per block
	P2P	XGT client	TCP/IP	2004	▪ Max. 3 channels ▪ Max. 32 blocks ▪ Max. 512 bytes
			UDP/IP	2005	
		Mod bus TCP client	TCP/IP	502	
		User define frame	TCP/IP	User's assignment	
			UDP/IP	User's assignment	
	Remote	Server	TCP/IP	2002	▪ Max. 1 channel
		Client	TCP/IP	2002	▪ Max. 1 channel

[Table 2-7] Performance specifications by communication service

2.4.3 Diagnosis function specifications

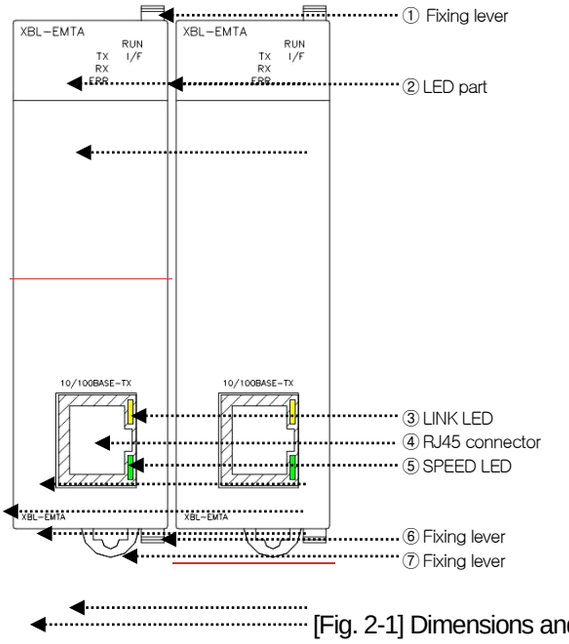
[Table 2-8] shows diagnosis function specifications of XGB Fast Enet I/F module.

Item			Specifications
Diagnosis Function	Communication module information		▪ HS link station no. ▪ IP/Subnet mask IP/Gateway IP/DNS Server IP ▪ Main service/HS link/P2P enable ▪ Setting media ▪ Hardware/ software version
	Service condition	Dedicated service	▪ Send packet number / Receive packet number / Error packet number / State ▪ Setting drive
		HS link	▪ Send/ Receive packet number ▪ HS link flag(Run, Link, Mode, State, TRX, Error)
		P2P service	▪ Connection state / Service state ▪ Service count / Error count
	Media Information	Total Send/Receive packet number	▪ Broad, Multi, Uni, UDP, ARP, EARP, Throw-out
		Packet Rate per sec.	
	Ping test		▪ IP Address / Setting times / Time out
	Auto scan		Non- service

[Table 2-8] Diagnosis function specification

2.5 Names of Parts

2.5.1 Names of parts



[Fig. 2-1] Dimensions and names of parts

2.5.2 Designation of parts

Item			Description	
①	Fixing lever		Extension module fixing part (the upper)	
②	LED	RUN	On	Normal operating
			Off	Stop operating
		I/F	flicker	Interface with CPU
			Off	Stop interface with CPU
		TX	flicker	Data transmission time
			Off	Stop data transmitting
		RX	flicker	Data receiving time
			Off	No data reception
		ERR	On	H/W error
			flicker	S/W error
③	LINK LED (Yellow)		flicker	Packet reception time
			Off	No packet reception
④	RJ45 connector		RJ45 connector part	
⑤	SPEED LED (Green)		On	100Mbps operating time
			Off	10Mbps operating time
⑥	Fixing lever		Expansion module fixing part (the lower)	
⑦	Fixing lever		DIN rail fixing part	

[Table 2-9] Designation of Parts

Chapter 3 Installation

3.1 Cautions for Installation

This device is highly reliable regardless of its installation environment. However the followings should be noted for securing reliability and stability.

3.1.1 Environmental conditions

(1) Install on a water-proof and dust control panel
(2) Place free of continuous impact or vibration
(3) Place out of direct sunrays
(4) Place without dewing by sudden temperature change
(5) Place where ambient temperature stays between 0-55℃.

3.1.2 Installation cautions

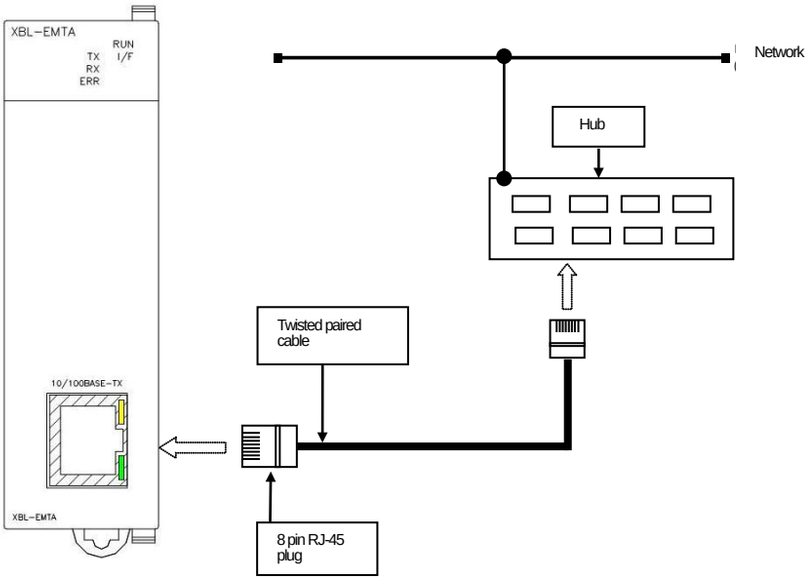
(1) If producing screw holes or wiring, it should be noted that any impurities from wiring work are not to be inserted into PLC.
(2) Install on an accessible place.
(3) Do not install on same panel with high voltage device.
(4) Maintain at least more than 50mm from duct or surrounding modules.
(5) Ground on a place where little noise is detected

3.1.3 Handling cautions

(1) Do not drop or do not apply any excessive impact on it.
(2) Do not separate PCB from case (shield), which may cause breakage.
(3) Make sure that while wiring, any impurities should not be inserted into the upper part of this module.
(4) Do not attach or detach the module once power is on.
(5) Cable should be selected considering the approved specification, install this device within the permitted max. distance.
(6) Communication cable shall be arranged so that it won't be influenced by any surge or induced noise generated from AC.
(7) If wiring is too close to any hot devices or materials or contacts with oils for a long time, it may cause short circuit, malfunction or breakdown.
(8) If wire by using pipes, it needs grounding pipes.

3.2 Installation and Wiring

3.2.1 Network connection



[Fig. 3-1] Network connection

3.2.2 UTP cable wiring

Max. distance between nodes of 10/100BASE-TX is 100m (The distance from the module to hub).
In general, the hub uses straight cable with TD and RD stranded inside. If only 2 of these communication modules are connected 1 to 1, cross-cable form should be used.

Pin no.	Signal	Straight cable (Module-Hub)	1 to 1 Cross-cable
1	TD+	1 — 1	1 — 3
2	TD-	2 — 2	2 — 6
3	RD+	3 — 3	3 — 1
6	RD-	6 — 6	6 — 2
4, 5, 7, 8	N/A		

[Table 3-1] Cable wiring

Remark

1) Hub power should be separated from PLC power.
2) Contact professional manufacturers for cable terminal.

(1) Cautions for UTP installation

(a) UTP cable should be satisfied the characteristics of category 5.
(b) Do not access Max. tension strength of the cable during a period of wiring processing.
(c) Do remove only the length of wiring, do not damage the insulator for removing covering (Sheath).
(d) Keep suitable distance between EMI source and UTP cable during the period of installing UTP cable.

Condition	Min. separation distance		
	2.0KVA or less	2.5 KVA	5.0KVA 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 light	1,016mm /305mm		

[Table 3-2] Cautions for UTP installation

3.2.3 Cautions for system and network connection

(1) IP address should be different including this module. If not, normal communication is not available.
(2) Set each exchange number differently for using HS link service.
(3) Use specified communication cable. Other cables may occur communication trouble.
(4) Check disconnection or short circuit of communication cable before installation.
(5) Do tighten communication cable connector.
(6) If cable connection is not stable, it may occur some severe trouble of communication.
(7) Wire communication cable separately from power supply line or inductive noise.

3.2.4 Check points before start-up

The following describes check points before start-up communication module.

(1) Communication module

Check points
Installation and operation of XG5000
Connection condition of communication cable (only the condition of connecting cable)
Module installation condition

[Table 3-3] Check points before start-up

(2) Start-up processing

It shows start -up from finishing installation of module on PLC.

Start
Power- ON : 1) Check power source 2) Check the connection of communication cable 3) Power- ON. 4) Check LED 'ON' of power supply 5) Check LED status on CPU module -> If abnormal, refer to the troubleshooting contents of each PLC manual. 6) Check LED status (normal/abnormal) of communication module -> If abnormal, refer to chapter 10. Troubleshooting of this manual. 7) Download after setting system parameter correctly
▼
Programming : Program at XG5000, Write on CPU module
▼
Sequence check : Check module operation by program
▼
Program correction : Do correct if sequence program has problem
▼
Saving program: 1) Save program in floppy disc or hard disc. 2) Print out circuit diagram and list by printer.
End

Chapter 4 System Configuration

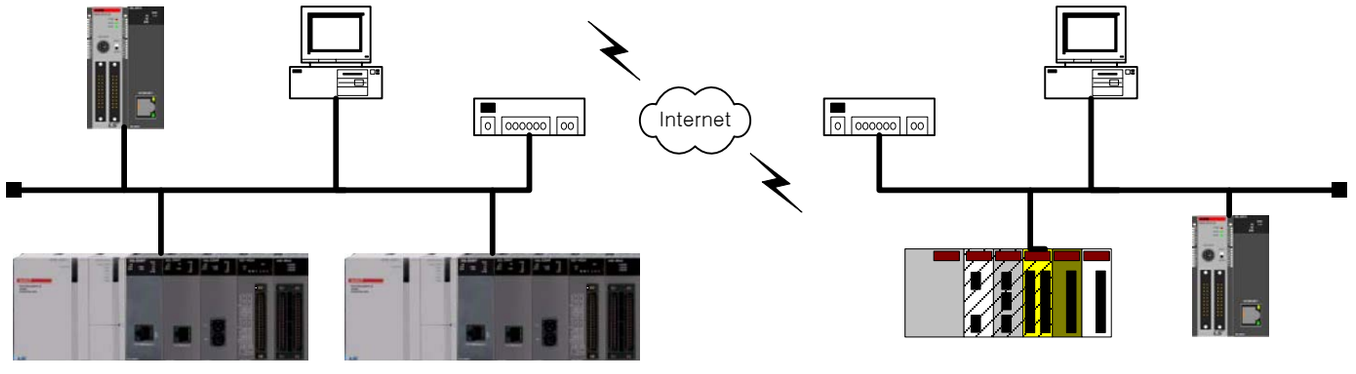
4.1 General

4.1.1 General

XGB Fast Enet I/F module supports open Enet. It provides network configuration that is to connect LS ELECTRIC and other company PLC, PC on network.

4.2 Examples of System Configuration

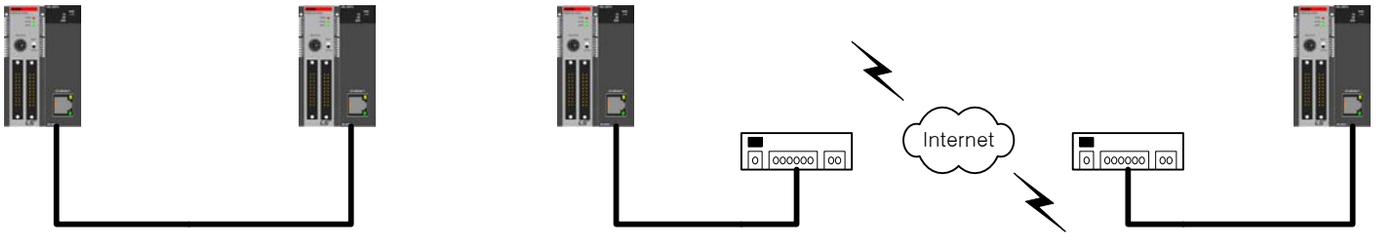
4.2.1 Combination network configuration



[Figure 4-1] Combination network configuration

XGB Fast Enet I/F module provides system configuration by using main communication, Modbus TCP/IP, user define frame, HS link communication connecting LS ELECTRIC PLC with other LS ELECTRIC PLC, PC on network.

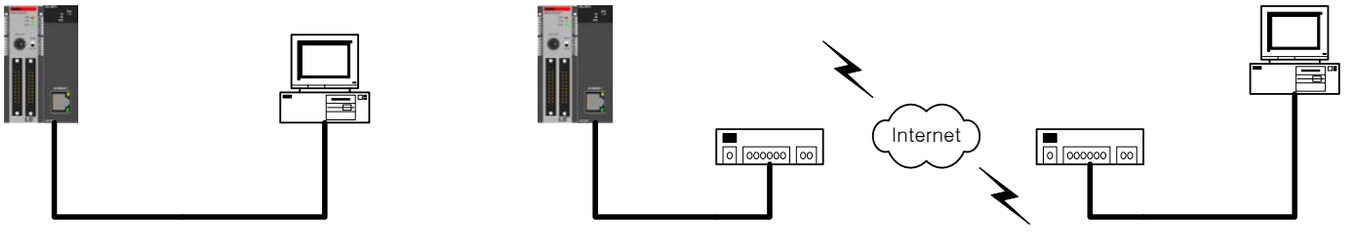
4.2.2 Network configuration using XGB



[Figure 4-2] Network configuration using XGB

Communication between XGB Fast Enet I/F modules is available to perform 1:1 communication by using cross cable or 1:N communication by connecting network. It provides data sending/receiving by using the dedicated service, Modbus TCP/IP, user define frame and HS link communication.

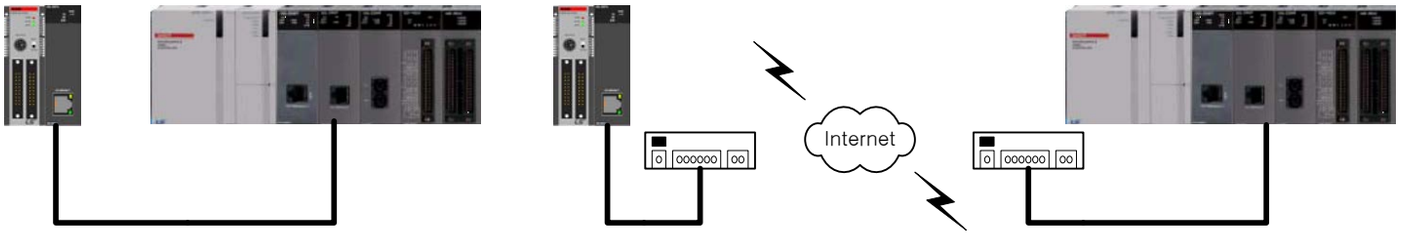
4.2.3 Network configuration using XGB and MMI



[Figure 4-3] Network configuration using XGB and MMI

Communication between XGB Fast Enet I/F module and PC is available to perform 1:1 communication by using cross cable or 1:N communication by connecting network. It provides connecting and data sending/receiving by using XG5000, XG-PD or MMI on PC. XG5000, XG-PD do download/upload parameter and program and furthermore these provide data sending/receiving by using the dedicated service, Modbus TCP/IP, user define frame.

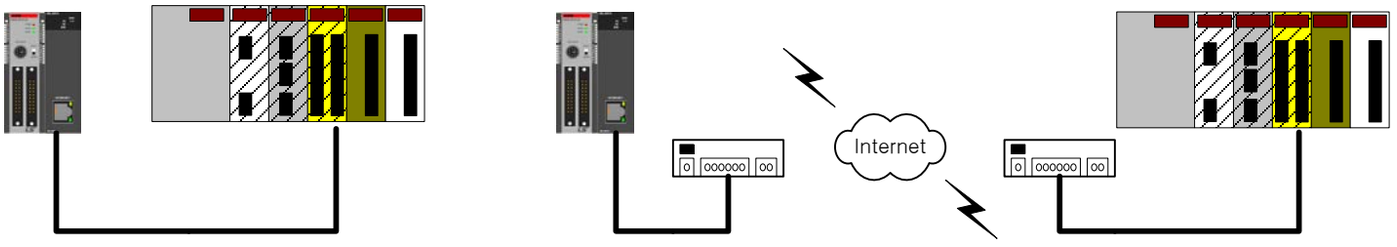
4.2.4 Network configuration between LS ELECTRIC modules



[Figure 4-4] Network configuration between LS ELECTRIC modules

XGB Fast Enet I/F module and Enet I/F of XGT series provide system configuration. 1:1 communication is available using cross cable or 1:N communication is available by connecting network. It provides data sending/receiving by using main service, Modbus TCP/IP, user define frame.

4.2.5 Network configuration using XGB and other LS ELECTRIC PLC



[Figure 4-5] Network configuration using XGB and other LS ELECTRIC PLC

XGB Fast Enet I/F module provides communication with other LS ELECTRIC PLC, HMI, MMI. . 1:1 communication is available using cross cable or 1:N communication is available by connecting network. To communicate, protocols between PLCs should be same.

Chapter 5 Protocols of Various Services

5.1 General

5.1.1 XGB Fast Enet I/F module protocol introduction

XGB Fast Enet I/F module supports open Ethernet. It provides network configuration that is to connect LS ELECTRIC and other company PLC, PC on network.

IP, each PLC parameters, and protocol need to be set in order to communicate after finishing network configuration. Supported protocols by XGB Fast Enet I/F module are XGT dedicated, Modbus TCP/IP, user define frame.

Each protocol supports server/client operation. Dedicated server and P2P function communicate according to the designated protocols.

5.1.2 Protocol by service

Each protocol's classified as server/client by its function. [Table 5-1] shows protocol by service.

Item		Specification			
		Driver	Communication method	Port No.	Remark
Communication function	Dedicated	XGT server	TCP/IP	2004	▪ Max. 4 channels ▪ Max. 512 bytes
			UDP/IP	2005	
		Modbus TCP server	TCP/IP	502	
	P2P	XGT client	TCP/IP	2004	▪ Max. 3 channels ▪ Max. 32 blocks
			UDP/IP	2005	
		Modbus TCP client	TCP/IP	502	
		User define frame	TCP/IP	User's assignment	
			UDP/IP	User's assignment	

[Table 5-1] Protocols of various services

5.2 XGT Dedicated Protocol

5.2.1 General

XGT main protocol does communicate between LS ELECTRIC Enet I/F modules. Read/write is available by instructions and communication is available on PC, HMI by using XGT dedicated protocol.

XGT dedicated communication is available in 2-ways communication method of TCP and UDP.

Protocol	Communication method	Port no.
XGT dedicated	TCP/IP	2004
	UDP/IP	2005

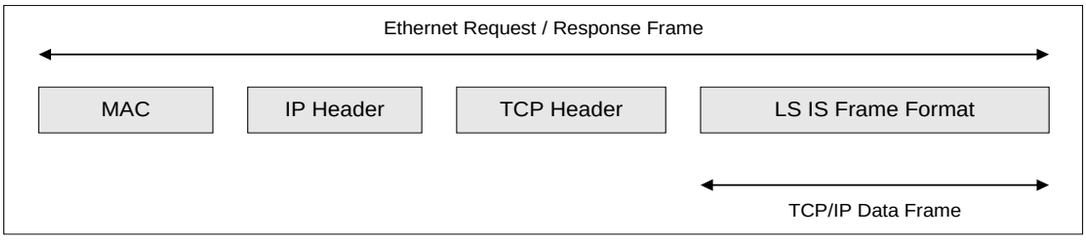
[Table 5-2] XGT main protocol

5.2.2 Frame structure

(1) XGT dedicated packet structure through Ethernet

During the period of communicating by using XGT dedicated protocol, it includes LSIS frame which includes MAC, IP header, TCP header and data for Ethernet communication.

[Fig. 5-1] shows XGT dedicated packet structure through Enet.

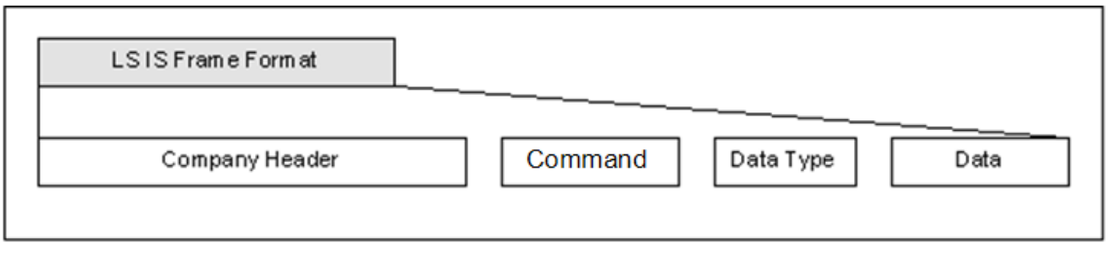


[Figure 5-1] XGT dedicated packet structure through Ethernet

(2) XGT dedicated frame structure

LS ELECTRIC dedicated frame for data communication includes LSIS ID, instruction, data type, data.

[Fig.5-2] shows XGT dedicated frame structure.



[Figure 5-2] XGT dedicated frame structure

5.2.3 XGT Dedicated Protocol Header Structure

Item	Size(byte)	Description
Company ID	10	"LSIS-XGT" + "NULL NULL(reserved area)" (ASCII CODE : 4C 53 49 53 2D 58 47 54 00 00)
PLC Info	2	* Client(MMI) ➔ Server(PLC) : Don't care (h00) * Server(PLC) ➔ Client(MMI) : Bit 00~05 : CPU TYPE 01(XGK/R-CPUH), 02(XGK-CPUS), 05(XGI-CPUU) Bit 06 : 0(Redundancy Master / Single), 1(Redundancy Slave) Bit 07 : 0(CPU normal operation), 1(CPU error) Bit 8~12 : System status 1(RUN),2(STOP), 4(ERROR), 8(DEBUG) Bit 13~15 : Reserved
CPU Info[1)]	1	It is determined to be the XGK/I/R series through a reserved area XGK: 0xA0,XGI: 0XA4,XGR: 0xA8 XGB(MK): 0xB0, XGB(IEC): 0xB4
Source of Frame	1	* Client(MMI) ➔ Server(PLC) : h33 * Server(PLC) ➔ Client(MMI) : h11
Invoke ID	2	ID used to discriminate the sequence among frames (This number is sent as attached to Response frame)
Length	2	Byte size of application Instructions.
FEnet Position	1	Bit 0~3 : FEnet I/F module's Slot No. Bit 4~7 : FEnet I/F module's Base No.
Reserved 2 (BCC)	1	h00 : Reserved area (Application Header's Byte Sum)

[Table 5-3] XGT Dedicated Protocol Header Structure

5.2.4 Instruction of XGT dedicated protocol

Using instructions of XGT dedicated protocol are 4 , each instruction does Read/Write, Request/Response.
In case of 'Individual', usable data types of each instruction are Bit, Byte, Word, DWord, LWord.
But for the 'Continuous', only Byte is usable.

Instruction	Instruction code	Data type			Treatment
Read	Request : 0x5400	Individual	0x0000	BIT	Reads data by each data type
			0x0100	BYTE	
			0x0200	WORD	
			0x0300	DWORD	
			0x0400	LWORD	
		Continuous	0x1400	BYTE	Reads byte type variables in block unit
	Response : 0x5500	Individual	0x0000	BIT	Responses to the request of Read data
			0x0100	BYTE	
			0x0200	WORD	
			0x0300	DWORD	
			0x0400	LWORD	
		Continuous	0x1400	BYTE	Response to the request of Read in block unit
Write	Request : 0x5800	Individual	0x0000	BIT	Writes by each data type
			0x0100	BYTE	
			0x0200	WORD	
			0x0300	DWORD	
			0x0400	LWORD	
		Continuous	0x1400	BYTE	Read byte type variables in block unit
	Response: 0x5900	Individual	0x0000	BIT	Responses to the request of Write data
			0x0100	BYTE	
			0x0200	WORD	
			0x0300	DWORD	
			0x0400	LWORD	
		Continuous	0x1400	BYTE	Responses to the request of Write in block unit

[Table 5-3] Instruction of XGT dedicated protocol

Note

(1) For timer/counter, bit allocation means a contact point and byte, word allocation means current value.
(2) Data register (D) is allocated with only byte and word
(3) In case of byte type instruction, address is double that of word address.
For example, in case of D1234, if it is allocated with word, address is %DW1234. But if it is allocated with byte, address will be %DB2468.

5.2.5 Header and data structure of XGT dedicated protocol

(1) Header and data structure

[Table 5-5] shows Company Header, Command, Data Type, Data, which included in LSIS frame of XGT dedicated protocol.

Item	Client(Request frame)				Server(Response frame)			
	Classification	Content		Size	Classification	Content		Size
Company Header	LSIS ID	LSIS ID 1		10	LSIS ID	LSIS ID 1 LSIS ID 2		10
	PLC information	h00~ h FF		2	PLC information	h 00~ h FF		2
	CPU information	h A0		1	CPU information	h A0		1
	Frame direction	h 33		1	Frame direction	h 11		1
	Frame order no.	h 0000~ h FFFF		2	Frame order no.	h 0000~ h FFFF		2
	Length	h 0000~ h 0100		2	Length	h 0000~ h 0100		2
	Position information	h 00~ h FF		1	Position information	h 00~ h FF		1
	Check sum	h 00~ h FF		1	Check sum	h 00~ h FF		1
Command	Instruction	h 5400	Read	2	Instruction	h 5500	Read	2
		h 5800	Write			h 5900	Write	
Data Type	Data type	h 0000	Bit	2	Data type	h 0000	Bit	2
		h 0100	Byte			h 0100	Byte	
		h 0200	Word			h 0200	Word	
		h 0300	DWord			h 0300	DWord	
		h 0400	LWord			h 0400	LWord	
		h 1400	Continuous			h 1400	Continuous	
Data	Reserved area	-		2	Reserved area	-		2
	Number of blocks	h 0100~ h 1000		2	Error status	h 0000~ h FFFF		2
	Length of variables(N)	h 0400~ h 1000		2	Data			2
	Data address	-		N				
	Number of data	h 0(M)00		M				

[Table 5-4] Header and data structure of XGT dedicated protocol

(2) Company ID

LS ELECTRIC network uses 2 LSIS(LS ELECTRIC) IDs. LSIS ID 1 is for operation of XGT, XGB series as a client.
In case of operating as a server, LSIS ID requested by a client, the client should use LSIS ID 1 or LSIS ID 2.

Classification	Format	Frame										Remark
LSIS ID 1	ASCII	L	S	I	S	-	X	G	T	/n	/n	XGT,XGB
	HEX	h 4C	h 53	h 49	h 53	h 2D	h 58	h 47	h 54	h 00	h 00	
LSIS ID 2	ASCII	L	G	I	S	-	G	L	O	F	A	GM,MK
	HEX	h 4C	h 47	h 49	h 53	h 2D	h 47	h 4C	h 4F	h 46	h 41	

[Table 5-5] LSIS ID

5.2.6 Frame examples

(1) Request frame for individual reading of variables

Classification	TYPE	Frame										Size
Company ID	ASCII	L	S	I	S	-	X	G	T	\n	\n	10
	HEX	0x4C	0x53	0x49	Ox53	Ox2D	0x58	0x47	0x54	0x00	0x00	
	ASCII	L	G	I	S	-	G	L	O	F	A	
	HEX	0x4C	0x47	0x49	0x53	0x2D	0x47	0x4C	0x4F	0x46	0x41	
PLC Info	HEX	0x00	0x00									2
CPU Info	HEX	0xA0										1
Source of Frame		0x33										1
Invoked ID		0x00	0x00									2
Length		0x0E	0x00									2
Position		0x00										1
Check Sum		0x4E										1
Command		0x54	0x00									2
Data Type		0x02	0x00									2
Reserved		0x00	0x00									2
Block No.		0x01	0x00									2
Variable Length		0x04	0x00									2
Data Address	ASCII	%	M	W	0							4
	HEX	0x25	0x4D	0x57	0x30							

[Table 5-6] Request frame for individual reading of variables

(2) Response frame for individual reading of variables

Classicication	TYPE	Frame										Size
Company ID	ASCII	L	S	I	S	-	X	G	T	\n	\n	10
	HEX	0x4C	0x53	0x49	Ox53	Ox2D	0x58	0x47	0x54	0x00	0x00	
	ASCII	L	G	I	S	-	G	L	O	F	A	
	HEX	0x4C	0x47	0x49	0x53	0x2D	0x47	0x4C	0x4F	0x46	0x41	
PLC Info	HEX	0x11	0x01									2
CPU Info		0xA0										1
Source of Frame		0x11										1
Invoked ID		0x00	0x00									2
Length		0x0E	0x00									2
Position		0x03										1
Check Sum		0x2F										1
Command		0x55	0x00									2
Data Type		0x02	0x00									2
Reserved		0x08	0x01									2
Error State		0x00	0x00									2
Variable Length		0x01	0x00									2
Data Count		0x02	0x00									2
Data		0x00	0x00									2

[Table 5-7] Response frame for individual reading of variables

(3) Request frame for continuous reading of variables

Classification	TYPE	Frame										Size
Company ID	ASCII	L	S	I	S	-	X	G	T	\n	\n	10
	HEX	0x4C	0x53	0x49	Ox53	Ox2D	0x58	0x47	0x54	0x00	0x00	
	ASCII	L	G	I	S	-	G	L	O	F	A	
	HEX	0x4C	0x47	0x49	0x53	0x2D	0x47	0x4C	0x4F	0x46	0x41	
PLC Info	HEX	0x00	0x00									2
CPU Info	HEX	0xA0										1
Source of Frame		0x33										1
Invoked ID		0x00	0x01									2
Length		0x10	0x00									2
Position		0x00										1
Check Sum		0x3F										1
Command		0x54	0x00									2
Data Type		0x14	0x00									2
Reserved		0x00	0x00									2
Block No.		0x01	0x00									2
Variable Length		0x04	0x00									2
Data Address	ASCII	%	M	B	0							4
	HEX	0x25	0x4D	0x42	0x30							
Data Count	HEX	0x02	0x00									2

[Table 5-8] Request frame for continuous reading of variables

(4) Response frame for continuous reading of variables

Classicication	TYPE	Frame										Size
Company ID	ASCII	L	S	I	S	-	X	G	T	\n	\n	10
	HEX	0x4C	0x53	0x49	Ox53	Ox2D	0x58	0x47	0x54	0x00	0x00	
	ASCII	L	G	I	S	-	G	L	O	F	A	
	HEX	0x4C	0x47	0x49	0x53	0x2D	0x47	0x4C	0x4F	0x46	0x41	
PLC Info	HEX	0x02	0x08									2
CPU Info		0xA0										1
Source of Frame		0x11										1
Invoked ID		0x00	0x01									2
Length		0x3F	0x00									2
Position		0x01										1
Check Sum		0x26										1
Command		0x55	0x00									2
Data Type		0x14	0x00									2
Reserved		0x00	0x00									2
Error State		0x00	0x00									2
Variable Length		0x01	0x00									2
Data Count		0x02	0x00									2
Data		0x00	0x00									2

[Table 5-9] Response frame for continuous reading of variables

5.3 Modbus TCP/IP Protocol

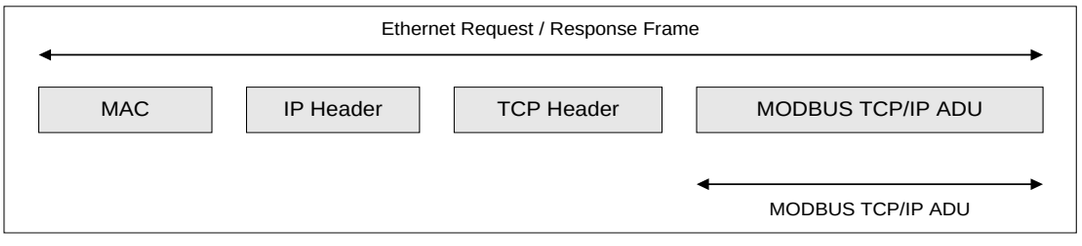
5.3.1 General

Modbus TCP/IP protocol function is to data Read/Write by using function codes. Modbus TCP/IP frame is composed of MAC, IP Header, TCP Header, Modbus ADU for Ethernet communication.

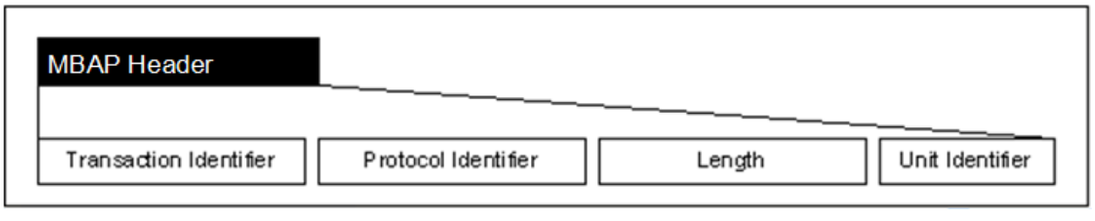
(1) ADU : Application Data Unit
(2) MBAP : MODBUS Application Protocol
(3) PDU : Protocol Data Unit

5.3.2 Structure of Modbus TCP/IP frame

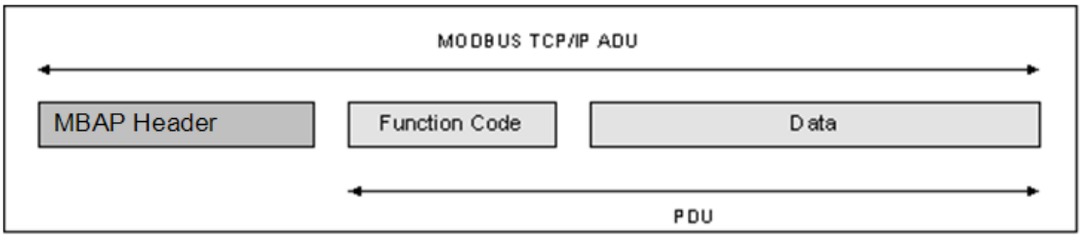
(1) Structure of Modbus TCP/IP frame through Enet



[Figure 5-3] Structure of Modbus TCP/IP frame through Enet



[Figure 5-4] Structure of Modbus TCP/IP ADU



[Figure 5-5] Structure of Modbus ADU

5.3.3 MBAP Header structure

Classification	Size	Description	Client	Server
Transaction Identifier	2 bytes	MODBUS Request/ Response treatment	Initializing	Response repeatedly if server responses
Protocol Identifier	2 bytes	0 = MODBUS protocol	Initializing	Reproducing it from request frame if server responses
	2 bytes	Frame size except MBAP	Making (If requested)	Server makes it (If it responses)
Unit Identifier	1byte	Classification of unit which connected to serial line	Initializing	Reproducing it from request frame if server responses

[Table 5-10] MBAP Header structure

5.3.4 Available function code

Classification	Function	Modbus mark
Function Code 01 (0x01)	Read output bit	Read Coils
Function Code 02 (0x02)	Read input bit	Read Discrete Inputs
Function Code 03 (0x03)	Read output word	Read Holding Registers
Function Code 04 (0x04)	Read input word	Write Input Register
Function Code 05 (0x05)	Write output bit	Write single Coil
Function Code 15 (0x0F)	Continuously write output bit	Write Multiple Coils
Function Code 16 (0x10)	Continuously write output word	Write Multiple Registers

[Table 5-11] Available function code

5.3.5 Frame structure by function code

(1) Function code 0x01: Read Coils

(a) Request

Classification	Size	Range
Function code	1 byte	0x01
Start address	2 bytes	0x0000 ~ 0xFFFF
Number of coils	2 bytes	0x0001 ~ 0x07D0 (2000 bits)

[Table 5-12] Function code 0x01 request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x01
Number of bytes	2 bytes	N
Coil status	n byte	n = N or N + 1

[Table 5-13] Function code 0x01 response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x81 (Function code + 0x80)
Exception code	1 byte	0x01,0x02,0x03,0x04

[Table 5-14] Function code 0x01 error frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x01	Function code	0x01
Start address (Upper byte)	0x00	Number of bytes	0x03
Start address (Lower byte)	0x13	Coil status (27-20)	0xCD
Number of coils (Upper byte)	0x00	Coil status (36-28)	0x6B
Number of coils (Lower byte)	0x13	Coil status (38-36)	0x05

[Table 5-15] Function code 0x01 frame examples

(2) Function code 0x02: Read input bit (Read Discrete Inputs)

(a) Request

Classification	Size	Range
Function code	1 byte	0x02
Start address	2 bytes	0x0000 ~ 0xFFFF
Number of input	2 bytes	0x0001 ~ 0x07D0 (2000 bits)

[Table 5-16] Function code 0x02 request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x02
Number of bytes	2 bytes	N
Input status	N x 1 bytes	-

[Table 5-17] Function code 0x02 response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x82 (Function code + 0x80)
Exception code	1 bytes	0x01,0x02,0x03,0x04

[Table 5-18] Function code 0x02 response frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x02	Function code	0x02
Start address (Upper byte)	0x00	Number of bytes	0x03
Start address (Lower byte)	0xC4	Coil status (27-20)	0xCD
Input status (Upper byte)	0x00	Coil status (36-28)	0x6B
Number of coils (Lower byte)	0x16	Coil status (38-36)	0x05

[Table 5-19] Function code 0x02 request frame examples

(3) Function code 0x03: Read Holding Registers

(a) Request

Classification	Size	Range
Function code	1 byte	0x03
Start address	2 bytes	0x0000 ~ 0xFFFF
Number of input	2 bytes	0x0001 ~ 0x007D (125 words)

[Table 5-20] Function code 0x03 request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x03
Number of bytes	2 bytes	2 x N
Input status	N x 2 bytes	-

[Table 5-21] Function code 0x03 response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x83 (Function code + 0x80)
Exception code	1 byte	0x01,0x02,0x03,0x04

[Table 5-22] Function code 0x03 error frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x03	Function code	0x03
Start address (Upper byte)	0x00	Number of bytes	0x06
Start address (Lower byte)	0x6B	Word status (108)	0x02
Number of words (Upper byte)	0x00	Word status (108)	0x2B
Number of words (Lower byte)	0x03	Word status (109)	0x00
		Word status (109)	0x00
		Word status (110)	0x00
		Word status (110)	0x64

[Table 5-23] Function code 0x03 frame examples

(4) Function code 0x04: Read Input Registers

(a) Request

Classification	Size	Range
Function code	1 byte	0x04
Start address	2 bytes	0x0000 ~ 0xFFFF
Number of input	2 bytes	0x0001 ~ 0x007D (125 words)

[Table 5-24] Function code 0x04 request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x04
Number of byte	2 bytes	2 x N
Input status	N x 2 bytes	-

[Table 5-25] Function code 0x04 response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x84 (Function code + 0x80)
Exception code	1 byte	0x01,0x02,0x03,0x04

[Table 5-26] Function code 0x04 error frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x04	Function code	0x04
Start address (Upper byte)	0x00	Number of bytes	0x02
Start address (Lower byte)	0x08	Word status (108)	0x00
Number of words (Upper byte)	0x00	Word status (108)	0x0A
Number of words (Lower byte)	0x01		

[Table 5-27] Function code 0x04 frame examples

(5) Function code 0x05: Write Single Coil

(a) Request

Classification	Size	Range
Function code	1 byte	0x05
Start address	2 bytes	0x0000 ~ 0xFFFF
Input value	2 bytes	0x0000 or 0xFF0D

[Table 5-28] Function code 0x05 request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x05
Number of bytes	2 bytes	0x0000 ~ 0xFFFF
Input status	2 bytes	0x0000 or 0xFF00

[Table 5-29] Function code 0x05 response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x85 (Function code + 0x80)
Exception code	1 byte	0x01,0x02,0x03,0x04

[Table 5-30] Function code 0x05 error frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x05	Function code	0x05
Start address (Upper byte)	0x00	Number of bytes	0x03
Start address (Lower byte)	0xC4	Coil status (27-20)	0xCD
Input status (Upper byte)	0x00	Coil status (36-28)	0x6B
Number of coils (Lower byte)	0x16	Coil status (38-36)	0x05

[Table 5-31] Function code 0x05 frame examples

(6) Function code 0x0F: Write Multiple Registers

(a) Request

Classification	Size	Range
Function code	1 byte	0x0F
Start address	2 bytes	0x0000 ~ 0xFFFF
Number of output	2 bytes	0x0001 ~ 0x07BD
Number of bytes	1 byte	N
Output value	N x 1 byte	

[Table 5-32] Function code 0x0F request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x0F
Number of bytes	2 bytes	0x0000 ~ 0xFFFF
Input status	2 bytes	0x0001 ~ 0x07B0

[Table 5-33] Function code 0x0F response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x8F (Function code + 0x80)
Exception code	1 byte	0x01,0x02,0x03,0x04

[Table 5-34] Function code 0x0F request frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x0F	Function code	0x0F
Start address (Upper byte)	0x00	Start address (Upper byte)	0x00
Start address (Lower byte)	0x13	Start address (Lower byte)	0x13
Number of output (Upper byte)	0x00	Number of output(Upper byte)	0x00
Number of output (Lower byte)	0x0A	Number of output(Lower byte)	0x0A
Number of bytes	0x02		
Output value (Upper byte)	0xCD		
Output value (Lower byte)	0x01		

[Table 5-35] Function code 0x0F request frame examples

(7) Function code 0x06: Write Single Register

(a) Request

Classification	Size	Range
Function code	1 byte	0x06
Start address	2 bytes	0x0000 ~ 0xFFFF
Output value	2 bytes	0x0000 or 0xFFFF

[Table 5-36] Function code 0x06 request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x06
Start address	2 bytes	0x0000 ~ 0xFFFF
Output value	2 bytes	0x0000 or 0xFFFF

[Table 5-37] Function code 0x06 response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x86 (Function code + 0x80)
Exception code	1 byte	0x01,0x02,0x03,0x04

[Table 5-38] Function code 0x06 error frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x06	Function code	0x06
Start address (Upper byte)	0x00	Number of bytes	0x00
Start address (Lower byte)	0x01	Coil status (27-20)	0x01
Input status (Upper byte)	0x00	Coil status (36-28)	0x00
Number of coils(Lower byte)	0x03	Coil status (38-36)	0x03

[Table 5-39] Function code 0x06 frame examples

(8) Function code 0x10: Write Multiple Registers

(a) Request

Classification	Size	Range
Function code	1 byte	0x10
Start address	2 bytes	0x0000 ~ 0xFFFF
Number of output	2 bytes	0x0001 or 0x07D8
Number of bytes	1 byte	2 x N
Output value	N x 2 bytes	value

[Table 5-40] Function code 0x10 request frame

(b) Response

Classification	Size	Range
Function code	1 byte	0x10
Number of bytes	2 bytes	0x0000 ~ 0xFFFF
Number of output	2 bytes	0x0001 ~ 0x007B

[Table 5-41] Function code 0x10 response frame

(c) Error

Classification	Size	Range
Function code	1 byte	0x90 (Function code + 0x80)
Exception code	1 byte	0x01,0x02,0x03,0x04

[Table 5-42] Function code 0x10 error frame

(d) Examples

Request frame		Response frame	
Classification	HEX	Classification	HEX
Function code	0x10	Function code	0x10
Start address (Upper byte)	0x00	Start address (Upper byte)	0x00
Start address (Lower byte)	0x01	Start address (Lower byte)	0x01
Number of output (Upper byte)	0x00	Number of output (Upper byte)	0x00
Number of output (Lower byte)	0x02	Number of output (Lower byte)	0x02
Number of bytes	0x04		
Output value (Upper byte)	0x00		
Output value (Lower byte)	0x0A		
Output value (Upper byte)	0x01		
Output value (Lower byte)	0x02		

[Table 5-43] Function code 0x10 frame examples

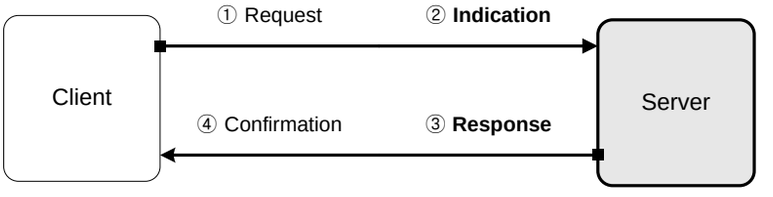
Chapter 6 Dedicated Service

6.1 Dedicated Service Function Introduction

6.1.1 Server model

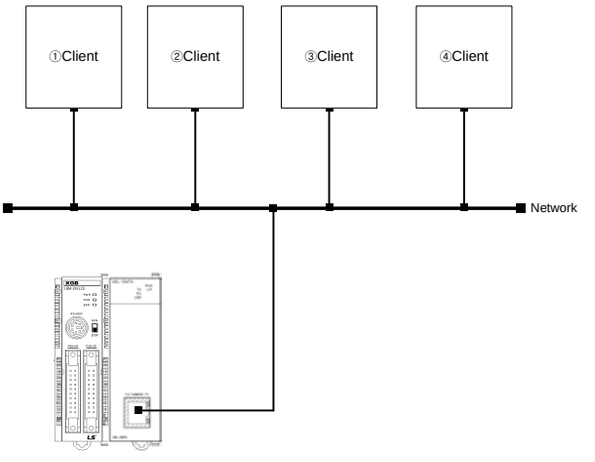
Dedicated service provides a server function as [Fig.6-1] Client/Server model
It operates data Read/Write by the protocol that the client connects and sets.

(1) Client/ Server model
Server does perform the function of ② Indication and ③ Response.



[Figure 6-1] Client/ Server model

6.1.2 System configuration



[Figure 6-2] Client/ Server system configuration

6.1.3 Dedicated service classification

Classification		Port no.	Protocol classification	Min./Max. connection numbers
XGT server	TCP XGT server	2004	TCP	1/4
	UDP XGT server	2005	UDP	1/4
Modbus TCP/IP server		502	TCP	1/4

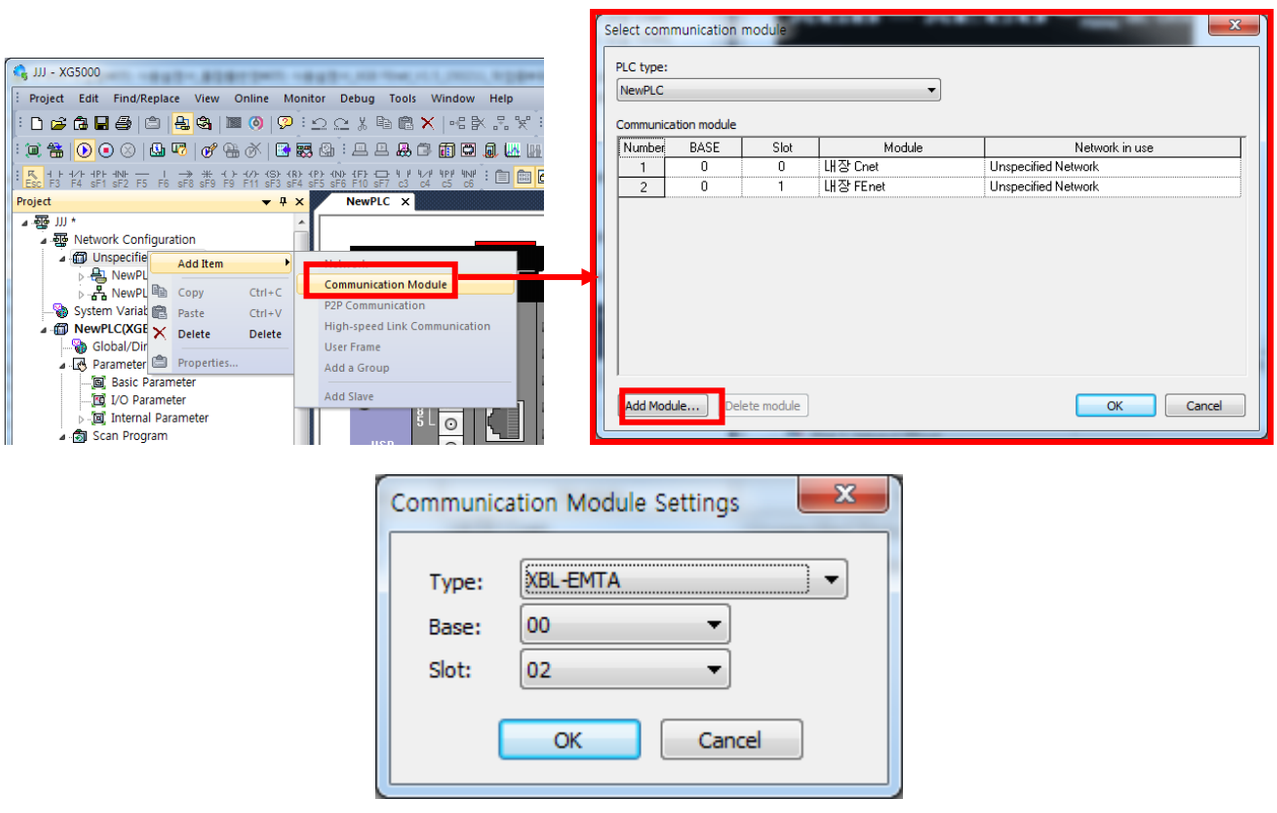
[Table 6-1] Dedicated service classification

6.2 Setting Dedicated Service

6.2.1 Basic parameter

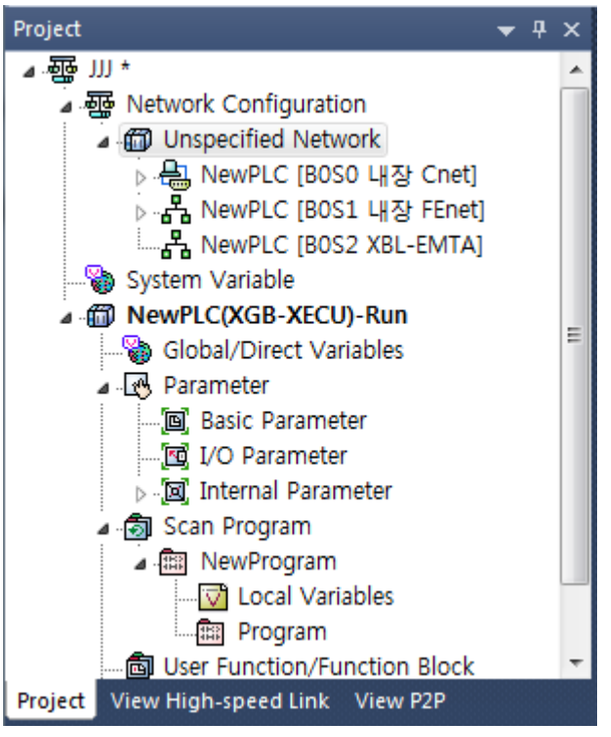
(1) Setting basic parameter in XG5000

Open XG5000. Then click right button of mouse while cursor is on the [Unspecified Network] in the Project window. Select [Add Item]-[Communication Module] and click [Add Module]. Set the type as [XBL-EMTA] and slot that slot number of XBL-EMTA mounted.



[Figure 6-3] Selecting basic parameter and setting communication module

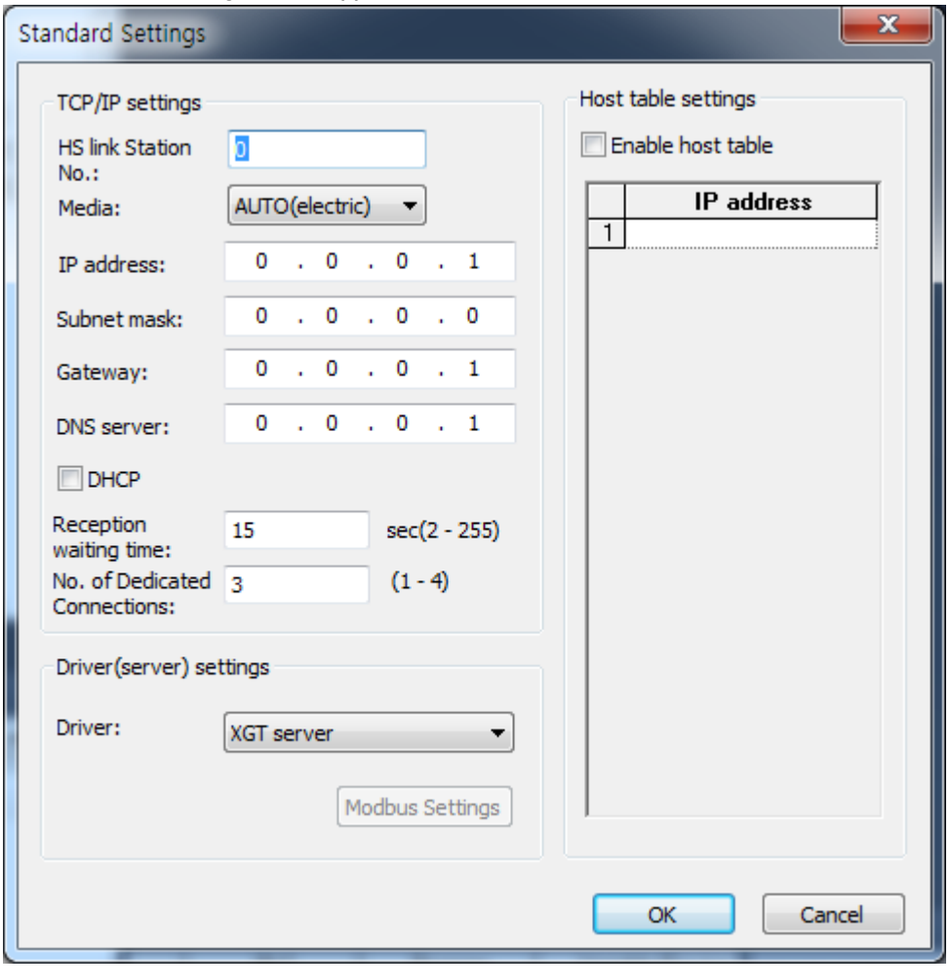
Click OK key. Then no.2 slot is changed into FEnet as figure below.



[Figure 6-4] Standard parameter setting

6.2.2 Basic setting

If you double-click the FEnet, basic setting window appears as follows



[Figure 6-5] Basic setting

Each item in [Figure 6.5] is described as follows:

(1) TCP/IP Setting

Category	Contents
High Speed Link station Number	Set the station number for high-speed link communication between XGT PLC FEnet I/F modules It is necessary to pay attention that FEnet I/F module doesn't have any duplicate station number with other FEnet I/F module on the network accessible by FEnet I/F module.
Media	Select a medium to be used. ▷ AUTO(electricity) : The medium of the current module is automatically selected. ▷ 10M/HALF : 10Mbps Half Duplex electricity ▷ 10M/FULL : 10Mbps Full Duplex electricity ▷ 100M/HALF : 100Mbps Half Duplex electricity ▷ 100M/FULL : 10Mbps Full Duplex electricity
IP Address	Set IP Address of FEnet I/F module.
Subnet mask	A value to decide whether the counterpart station is on the same network
Gateway	Gateway module address (router address) to send and/or receive data through the station and public line that uses a different network with self station
DNS server	Designate a domain name server
DHCP	When using Dynamic IP rather than static IP
Reception Waiting Time (Sec)	For dedicated communication, if no demand has been made for a certain amount of time while connecting to the upper PC or MMI, it assumes that the upper system has some problems, and then ends the connection with the dedicated service regardless of its normal shut down. This waiting time is used to reset the channel when any error may take place in the counterpart station or the cable is disconnected.
Number of dedicated connections	Available to set up to 4 TCP dedicated services that can be accessed simultaneously(P2P channel's number of dedicated accessed)

(2) Driver(Server) Setting

Category	Description
XGT server	Set when it is operated as a dedicated communication server.
Modbus TCP/IP Server	Set when it is operated as a Modbus Server driver

(3) Host Table Setting

Category	Description
Enable host table	When enabled, only the clients who have the registered IP address with host table are allowed to access.

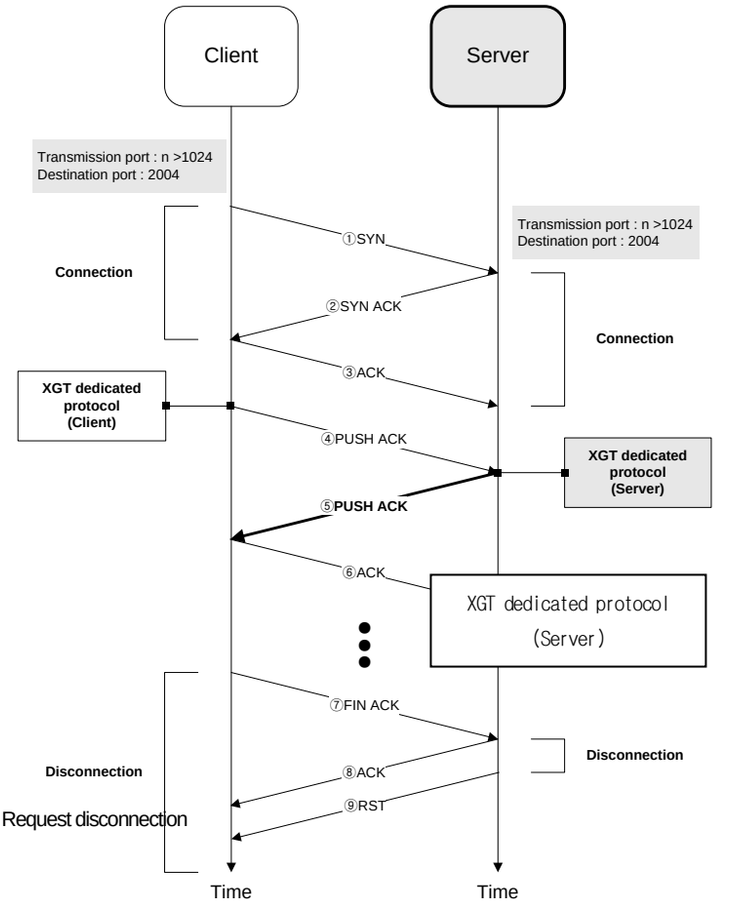
6.3 XGT Server

6.3.1 TCP XGT server

TCP XGT server operates as below [Fig.6-6] TCP XGT server operation flow.

Transmission port : n >1024
Destination port: 2004

XGT dedicated protocol
(Client)



[Figure 6-6] TCP XGT server operation flow

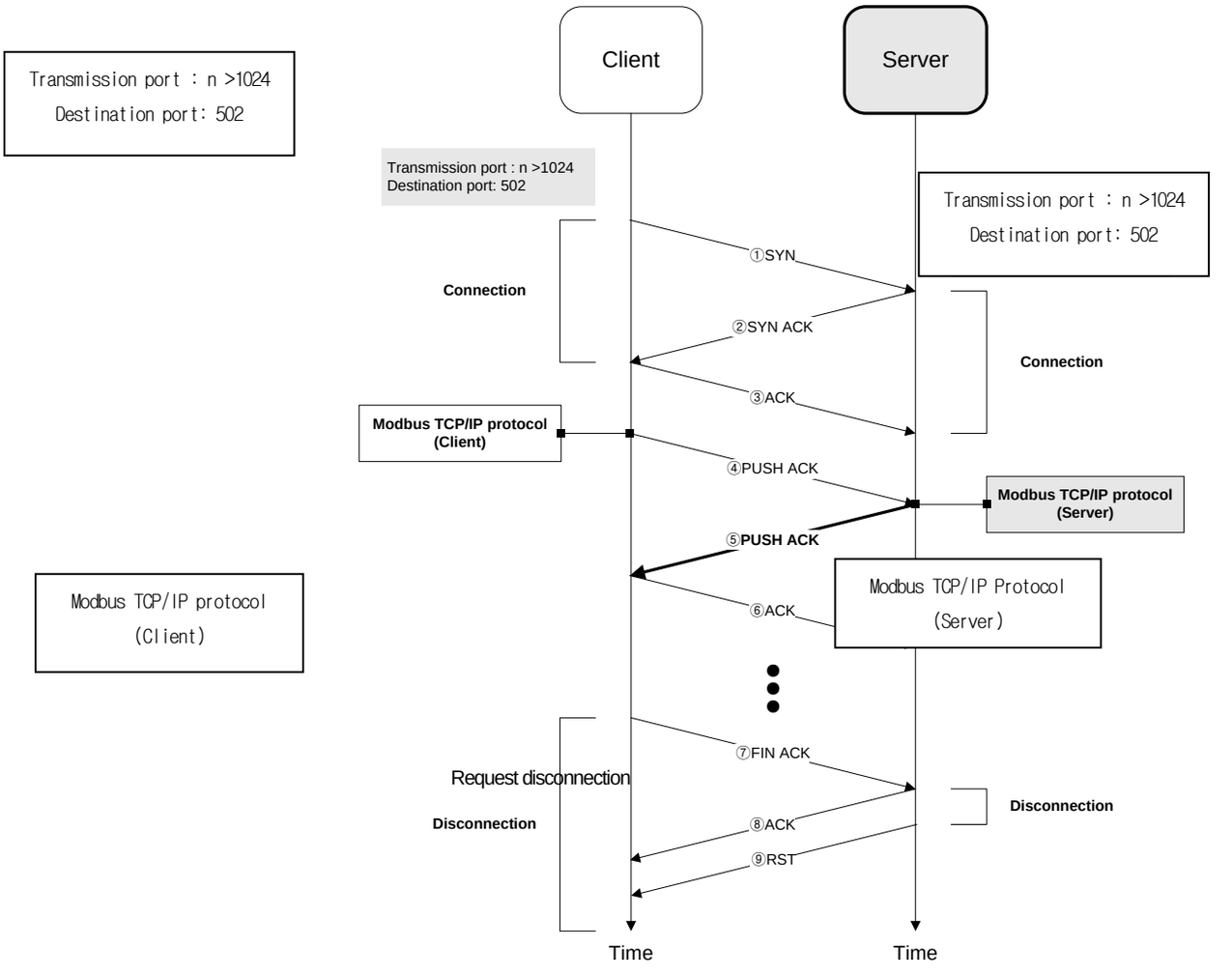
(1) Connection
  (a) Client does transmit ① SYN to serve. Server does ② SYN ACK.
  (b) Connection port no. is XGT dedicated protocol port no. 2004.
  (c) Client does connection check response ③ ACK.
  (d) Finishing ①~③ makes client/server connection.

(2) TCP XGT server
  (a) After connection, client does transmit ④ PUSH ACK according to XGT dedicated protocol.
  (b) Server does transmit ⑤ PUSH ACK for PUSH ACK Frame.
  (c) Client does transmit ⑥ACK.

(3) Disconnection
  (a) Client does transmit ⑦ FIN ACK (Request disconnection)
  (b) Server does transmit ⑧ RST and disconnect.

6.4 Modbus TCP/IP Server

Modbus TCP/IP server operates as below [Fig.6-7] Modbus TCP/IP Server operation flow.



[Figure 6-7] Modbus TCP/IP Server operation flow

(1) Connection
- (a) Client does transmit ① SYN to serve. Server does ② SYN ACK.
- (b) Connection port no. is XGT dedicated protocol port no. 502.
- (c) Client does connection check response ③ ACK.
- (d) Finishing ①~③ makes client/server connection.

(2) TCP XGT client
- (a) After connection, client does transmit ④ PUSH ACK according to XGT dedicated protocol.
- (b) Server does transmit ⑤ PUSH ACK for PUSH ACK Frame.
- (c) Client does transmit ⑥ACK.

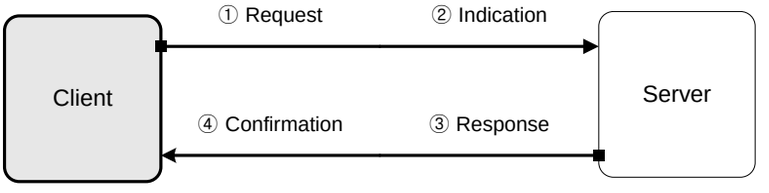
(3) Disconnection
- (a) Client does transmit ⑦ FIN ACK (Request disconnection)
- (b) Server does transmit ⑧ RST and disconnect.

Chapter 7 P2P Service

7.1 P2P Service Function

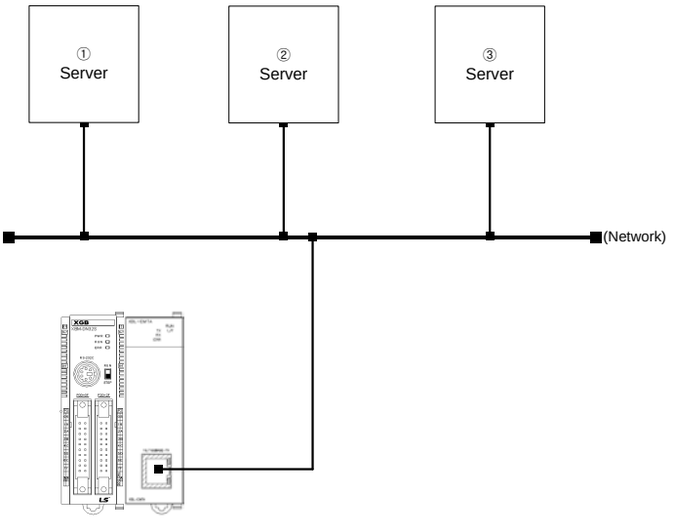
7.1.1 Client model

P2P service provides a client function as below [Fig.7-1] Client/Server model.
It requests data Read/Write to server. When each block operation status is ON, it provides the function of connecting request frame to the right channel and receiving response.
XGB Fast Enet I/F module communicates through Max.3 channels, each channel communicates by using different protocols.



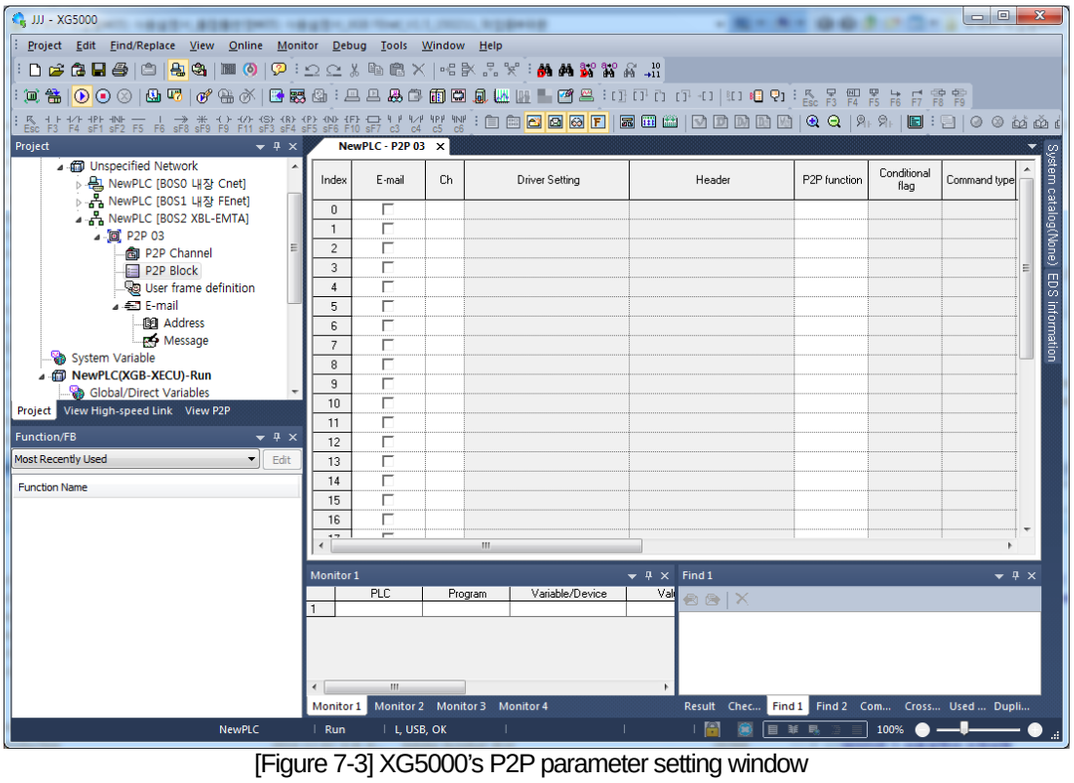
[Fig. 7-1] Client/Server model

Server executes ① Request and ④ Confirmation.



[Fig. 7-2] Client/Server system configuration

[Figure 7-3] indicates an example of P2P parameter setting on the XG5000



[Figure 7-3] XG5000's P2P parameter setting window

(1) P2P parameters registration window

- Up to 83P2P parameters can be setup.
- Respective P2P parameter is composed of P2P channel, P2P block, user frame definition and e-mail.

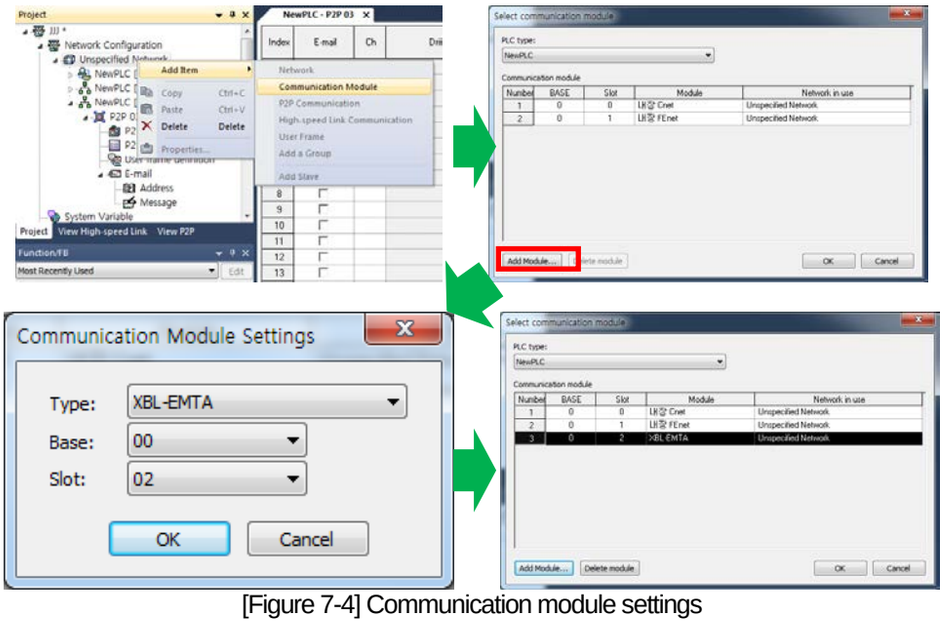
(2) P2P edit window

- Up to 32 P2P blocks can be registered and edited.
- Separate frame registration is available for respective drivers.

7.1.2 P2P parameter setting

(1) Communication module setting

For P2P service, you should set the communication module at Project -> Network Configuration.

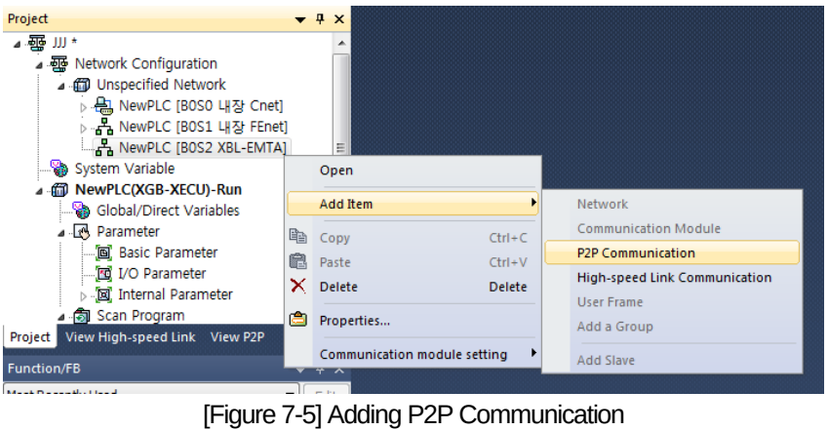


[Figure 7-4] Communication module settings

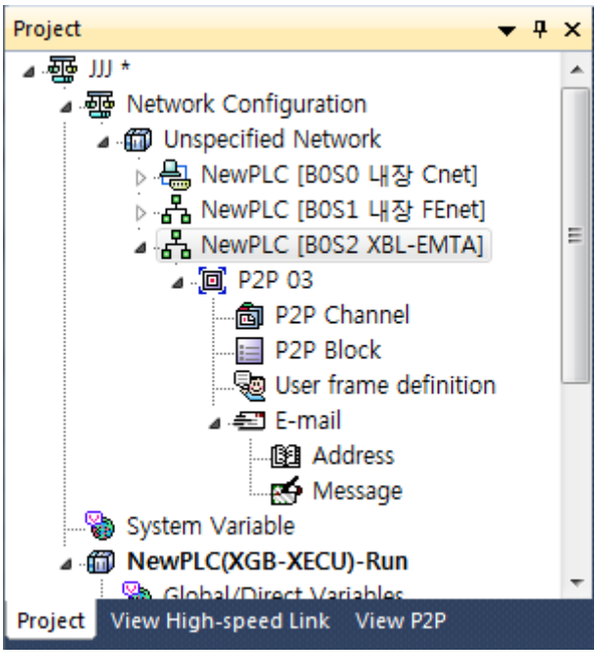
(a) At the [Fig.7-4] Network Configuration in project window, select [Add Item]-[Communication Module].
(b) Slot 0 is fixed as built-in Cnet.
(c) Click [Add Module].
(d) Set Type, Base and Slot and click [OK].
(e) Slot setting (modular types(01~07), compact types(01~10))
(f) The communication module added in [Select communication module] window.
(g) Clicking [OK] then communication module added in Unspecified Network as [Fig.7-5].

(2) P2P parameter configuration

After adding communication module in project window, add the P2P communication as [Fig. 7-5].
If add the P2P communication, the item will be added as [Fig. 7-6].



[Figure 7-5] Adding P2P Communication



[Figure 7-6] P2P parameter setting registration screen

(1) P2P channel

- Logical channel of P2P Service (IP, PORT, dedicated driver) can be setup.
- User frame definition, XGT client and MODBUS TCP client setting available.
- Communication device setting available which uses other protocol than XGT/MODBUS TCP.

(2) P2P block

- Separately operated 32 P2P blocks' setting.

(3) User frame definition

- Registration of user defined frames.

(4) E-mail

- Frame registration to transmit and receive e-mail frames.

7.2 Type of P2P Service

7.2.1 Type of P2P Instructions

(1) P2P instructions

6 instructions are available for programming P2P communication service, and each instruction will be used with different purpose according to respective service methods as described in the table below, for reference.

Classification	Instruction	Purpose
XGT Client	Read	Reads the area specified by destination station.
	Write	Transmits native station's area data to destination station.
User defined frame	Send	Transmits native station's area data to destination station.
	Receive	Saves the data received from destination station.
Modbus TCP Client	Read	Reads the area specified by destination station.
	Write	Transmits native station's area data to destination station.
E-mail	ESend	Transmits a message if an event occurs.

[Table 7-1] Type of P2P instructions

7.2.2 Type of P2P Service

(1) XGT Client

XGT Client service is used to communicate between XGT FEnet I/F modules. Through its own protocol built-in without additionally defined frame, the user can specify communication settings simply with basic settings of channel, data type (BIT, BYTE, WORD, etc.) and memory area. It uses port No.2004 for TCP, and port No.2005 for UDP protocol.

(2) User defined frame

For the communication with other company's device, this is used for user to define the other company's protocol in the XGT FEnet. Communication protocols are different depending on the maker and user can edit the frame depending on the characteristic of each communication module by using user defined frame. User defined frame basically consists of HEAD, BODY, TAIL

(3) Modbus TCP Client

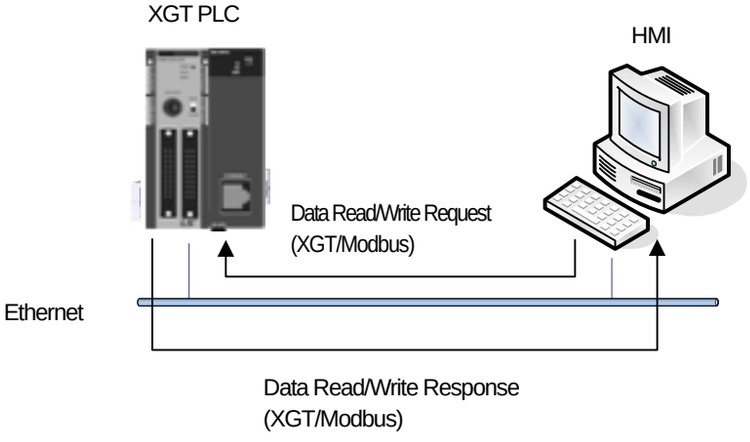
XGT FEnet supports Modbus protocol, industrial standard. Port number is fixed as 502.

7.3 How to Set P2P Service

7.3.1 Ethernet driver

(1) Driver setting

Ethernet driver stands for the XGT FEnet built-in server protocol. 2 kinds of server protocol, XGT server and MODBUS TCP/IP, are built in XGT FEnet I/F module. Ethernet (server) driver can be used to communicate between Ethernet devices with XGT or MODBUS TCP/IP protocol. The destination station in Ethernet communication system is generally HMI, where communication is available with the correspondent device only through parameters setting without additional communication programming by user. [Fig. 7.6] shows the typical example of communication with HMI with Ethernet driver used, where FEnet responds if HMI requests data.



[Figure 7-7] Example of Ethernet (server) driver application

(2) Type of Ethernet (server) drivers

Driver types available are as specified below;

Type	Description
XGT server	XGT FEnet dedicated protocol by LS ELECTRIC
Modbus TCP/IP server	Open type of protocol by Modicon

[Table 7-2] Types of Ethernet (server) drivers

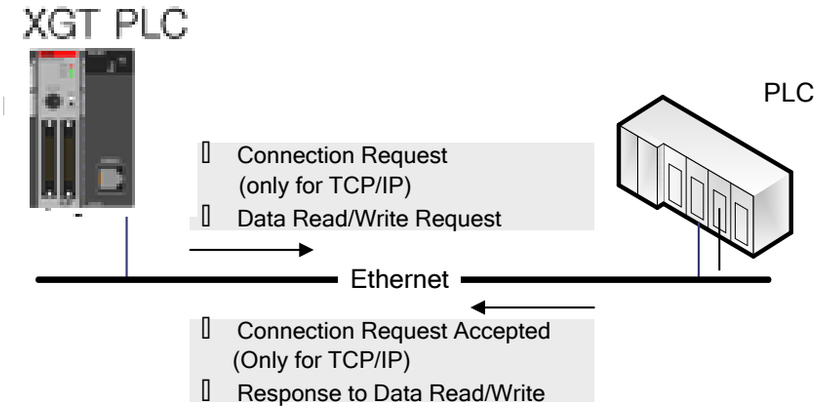
Notes

(1) The number of drivers is changeable according to specified Ethernet channel.
Be careful! If Ethernet channel is specified, the number of drivers available will be decreased as many as specified.

(2) Ethernet (server) driver supports 1:N communication, Accordingly, several master devices can take data through a specified port.

7.3.2 P2P channel

Ethernet P2P channel is used when XGT FEnet I/F module executes the master function of communication with built-in XGT protocol or user defined protocol.



[Figure 7-8] example using P2P channel information

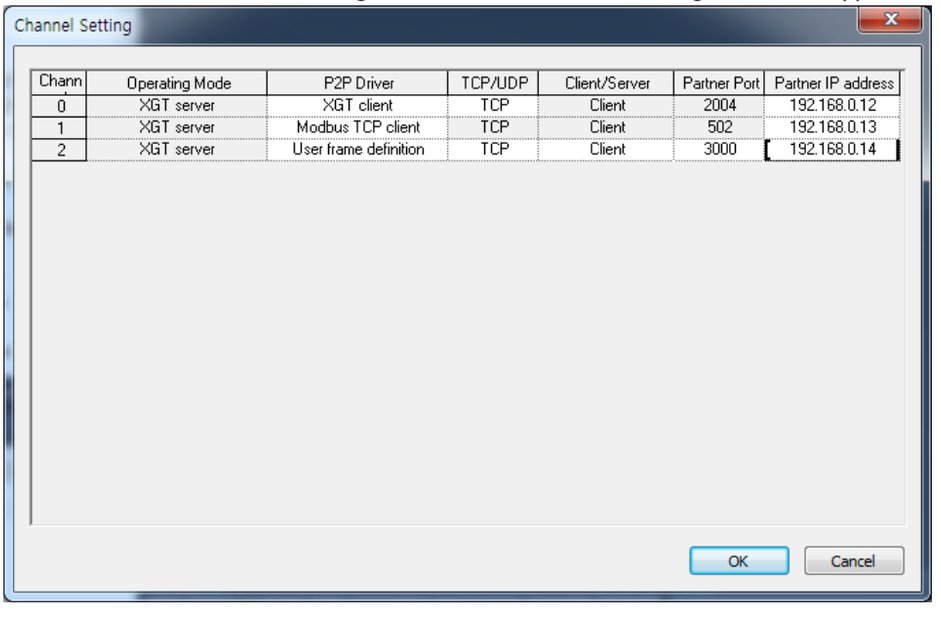
(1) Setting of P2P channel

FEnet I/F module can send and receive data using up to 4 channels, which consists of IP address and port number. fThe number of channels available for P2P service is the maximum number of channels (4) minus the number of dedicated connections in the basic parameters (The number of P2P channels = 4 – the number of dedicated connections).

P2P communication is available with simple parameters setting to communicate with the device using XGT or Modbus TCP protocol for user's convenience. And for the communication with other devices than described above, user can directly define frames as necessary.

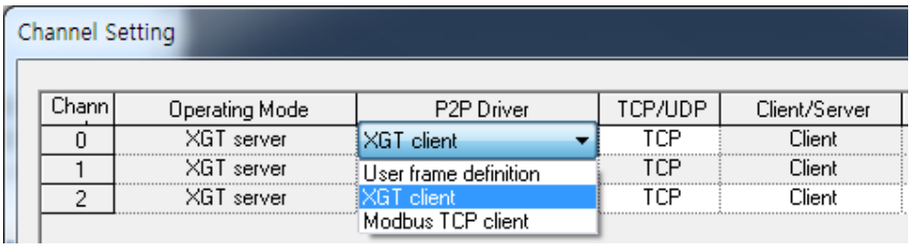
In addition, messages and e-mail addresses can be registered to transmit and receive e-mail frames (ASCII supports). However, it is not necessary to set the channel for e-mail communication.

If P2P channel is selected on the P2P setting window, the P2P channel setting window will appear as follows:



[Figure 7-9] P2P channel settings window

Select “P2P Driver” of the channel you want to set and set the P2P driver type



[Figure 7-10] P2P driver client setting

Drivers and details available in XGT FEnet I/F are as follows;

Items		Details
P2P Driver	User frame definition	Used to send/receive data with user defined frame.
	XGT client	XGT dedicated (Built-in) protocol (The user doesn’t need to define the frame)
	Modbus TCP client	MODBUS TCP protocol of MDICON
TCP/UDP		Selects TCP or UDP. If user select Modbus TCP, this item is fixed as TCP
Client/Server		Select Client/Server. If user select the protocol as XGT/Modbus TCP, this item is fixed as Client
Partner Port		Inputs port number of partner. When defining protocol as User frame definition, user can define port number (1~65535). For XGT client, this item is fixed as 2004 and for Modbus TCP client, this is fixed as 502.
Partner IP address		Input IP address of Partner device

[Table 7-3] Type of P2P driver clients

Note

1) Partner IP address
In case XGT is client, set the IP address of server device, If server uses DHCP for dynamic IP address, IP address may change. Therefore, check the IP address before using.

If XGT client or Modbus TCP client is selected as P2P driver type, user defined frame can not be used.

(2) How to use Modbus driver

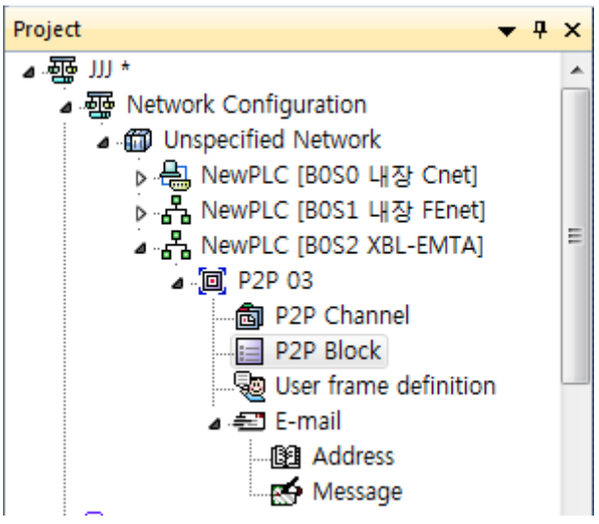
[Table 7-4] displays instructions and addresses of Modbus devices.

Code	Function code name	Modicon PLC data address	Remarks
01	Output Point Status Read (Read Coil Status)	0XXXX(bit-output)	Bit Read
02	Input Point Status Read (Read Input Status)	1XXXX(bit-input)	Bit Read
03	Output Register Read (Read Holding Registers)	4XXXX(word-output)	Word Read
04	Input Registers Read (Read Input Registers).	3XXXX(word-input)	Word Read
05	Output Point 1 Bit Write (Force Single Coil)	0XXXX(bit-output)	Bit Write
06	Output Register 1 Word Write (Preset Single Register)	4XXXX(word-output)	Word Write
15	Output Point Continuous Write (Force Multiple Coils)	0XXXX(bit-output)	Bit Write
16	Output Register Continuous Write (Preset Multiple Register)	4XXXX(word-output)	Word Write

[Table 7-4] Modbus TCP address MAP

7.3.3 P2P Block

If user select P2P block of relevant parameter, P2P parameter setting window will be displayed.



[Figure 7-11] selection of P2P block

Up to 32 independent blocks are available. If user selects some block at XG5000, user can set the function of block.

Index	E-mail	Ch	Driver Setting	Header	P2P function	Conditional flag	Command type	Data type	No. of variables	Data size	Destination station	Destination station number	Frame	Setting	Variable setting contents
0	☐	0	XGT client	LSIS-XGT	READ	_T1S	Single	1 BYTE	1					Setting	Number:1 READ1:%MB0,SAVE1:%MB100
1	☐	1	Modbus TCP client		READ	_T1S	Single	BIT	1		☑	0		Setting	Number:1 READ1:0x10000,SAVE1:%MX3300
2	☐	2	User frame definition		SEND	_T1S							send.TX	Setting	Number:1 READ1:%MB0,SIZE1:10

[Figure 7-12] P2P instruction

Each item is as follows

(1) E-mail

Used for E-mail service

(2) Channel

Select a communication port which will be used by the relevant block.

The communication port for each block is decided when P2P Channel is setup, which can not be changed during Run. Maximum number of channel is 4 minus “number of dedicated connections” in standard setting.

(3) Driver Setting

Indicates communication driver set in P2P setting. When setting channel, driver is loaded automatically according to channel. If it is deleted at P2P channel setting, driver will be deleted automatically. For more detail, refer to CH7.3.2 P2P channel.

(4) P2P function

You can select P2P function depending on the channel driver. You can let the driver execute READ or WRITE

- For XGT client, select READ/WRITE
- For Modbus TCP client, select READ/WRITE
- For User frame definition, select SEND/RECEIVE

1) READ
It is used when reading some area of partner device and save them. It is applied to XGT Client and Modbus TCP client driver

2) WRITE
It is used when writing the data at some area of partner area. It is applied to XGT Client and Modbus TCP client driver. Single and Continuous Write are supported. Writing at up to 4 independent areas is available.

3) Send
It is used when sending User defined protocol to external device. One frame is available per one Send function.It is applied to user frame definition. Memory setting about Variable sized/Fixed sized variable of relevant frame should be set. Before using this function, defining the frame to send is necessary.

4) Receive
It is used when receiving frame from external device. User can't select same frame about each P2P Frame Receive function block. One RX frame can be selected per one RX block.

(5) Condition flag

Define the condition to operate P2P block. A bit device is available for condition flag and the P2P block will be operated at the rising edge of the condition flag.

(6) Command type

Decide details of Read operation. Single and Continuous are available for Instruction Type.
Up to 4 memory areas are available for Single Read function, and Continuous Read reads as many bytes as defined on the 'Data Size' item.

(7) Data type

Define the format of the data the block will process. Bit, Byte, 2bytes (Word), 4bytes (Double Word) and 8bytes (Long Word) data are available

(8) Number of variables.

It is activated when 'Single' is selected in the 'Command type' field. Decide the number of areas to read. Up to 4 is available.

(9) Data size

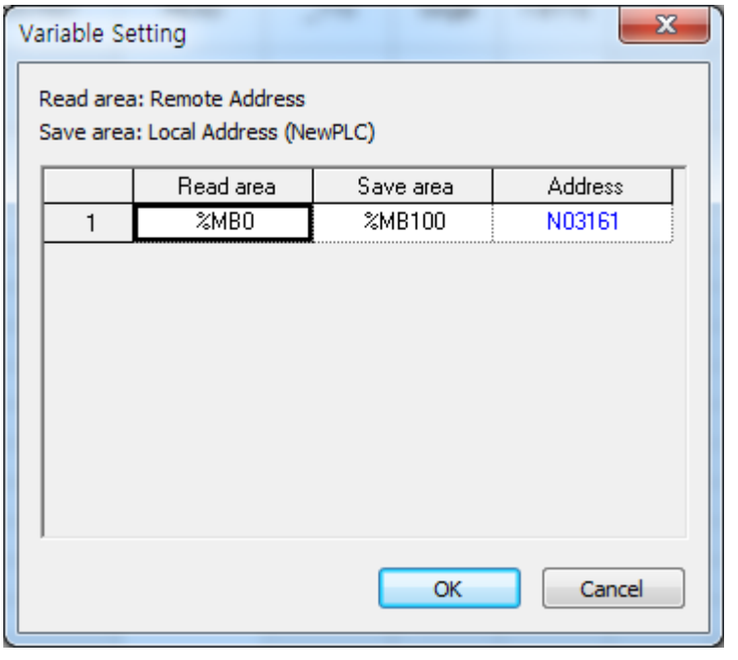
It is activated when 'Continuous' is selected in the 'Command' field. Meaning of data size is different depending on the Data type

(10) Frame

Selects the relevant frame (Group) to execute communication in case of User frame definition

(11) Setting

When setting XGT client or user definition frame, it defines the memory area to send/receive. In case of TX, it sets the self station's area where there is data to be sent and the partner station's area where received data will be saved



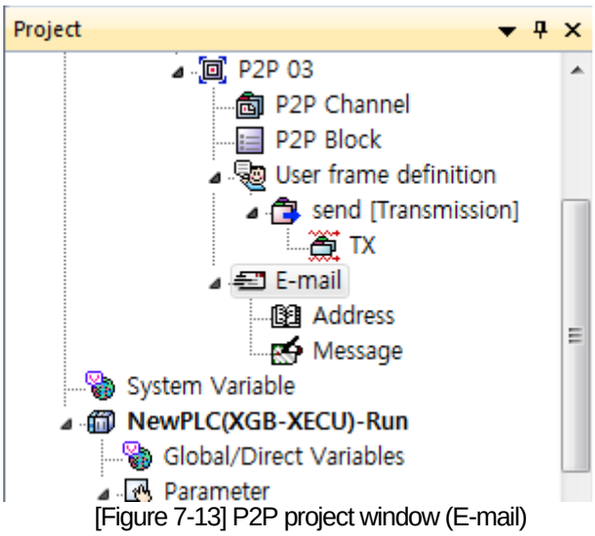
7.4 E-mail service using P2P service

7.4.1 E-mail service

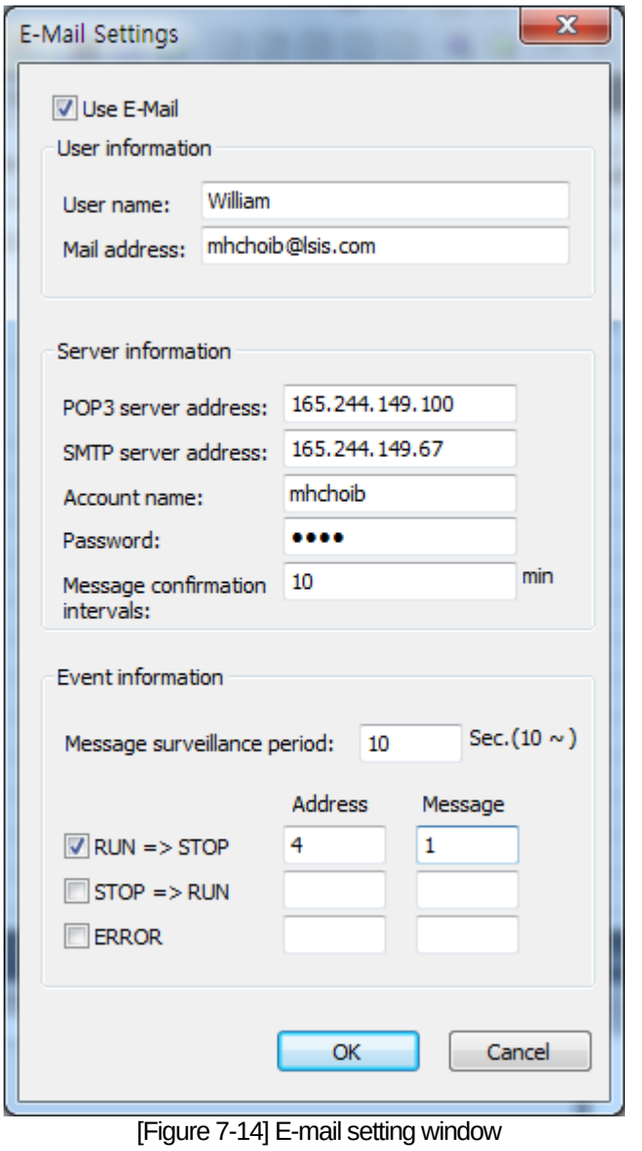
When there's problem, E-mail service can be used to notify the problem to manager. When status of CPU changes or specific event occurs, it notifies the status to manager by using E-mail service. But there is some restriction to use E-mail service. It supports ASCII and Decoding for security is not supported. Since authorization function is not supported, set the mail server not to do authorization process for TX.

(1) E-mail setting of P2P service

Double-click "E-mail" to activate the E-mail setting window



[Figure 7-13] P2P project window (E-mail)



[Figure 7-14] E-mail setting window

Item		Details
Use E-Mail		Determines whether to use E-mail service. In order to use E-mail function, check this box.
User information	User name	User name seen when partner receives the mail. If it is set as PLC, PLC will be name of E-mail sender.
	Mail address	E-mail address for reply Though PLC sends E-mail, other PC can receive the reply about E-mail PLC sent.

Item		Details
Server information	POP3 server address[note1)]	Server addresses receiving the E-mail from other device. Any mail server supporting POP3 can be used
	SMTP server address	Server addresses sending the E-mail to other device. Any mail server supporting SMTP can be used
	Account name[note2)]	Account name in the POP3
	Password[note2)]	Password to access POP3 account
	Message confirmation intervals[note3)]	Time of confirmation whether E-mail arrived or not

Note

Currently, XGB FEnet supports only TX function and RX function is not supported

Note1) POP3 service is related with mail server setting for RX. This is not used in the XGB.

Note2) Account name, password is related with authorization in case of TRX. This is not used in the XGB

Note3) This is related with process of RX message and not used in the XGB.

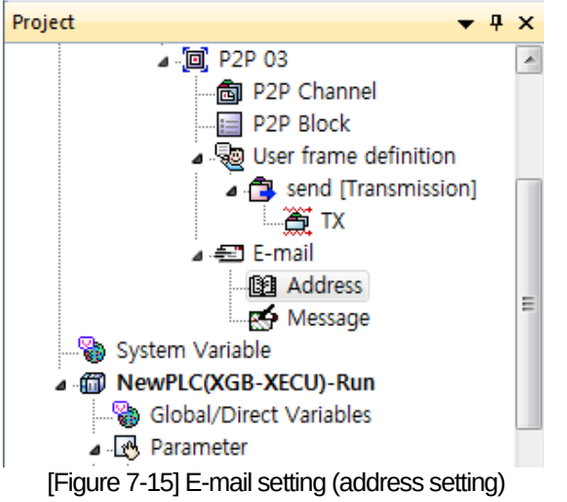
Event information monitors the CPU status periodically. If PLC becomes Stop mode or error status, communication parameter can't operate so this function is provided to prepare the Stop mode or error status.

Item		Details
Event information	Message surveillance period	Set to be larger than 10s. Time for checking whether PLC mode is changed.
	RUN -> STOP	Communication module sends message when mode of PLC is changed from Run to Stop
	STOP -> RUN	Communication module sends message when mode of PLC is changed from Stop to Run
	ERROR	Communication module sends message when error occurs regardless its status.

7.4.2 Writing address and message

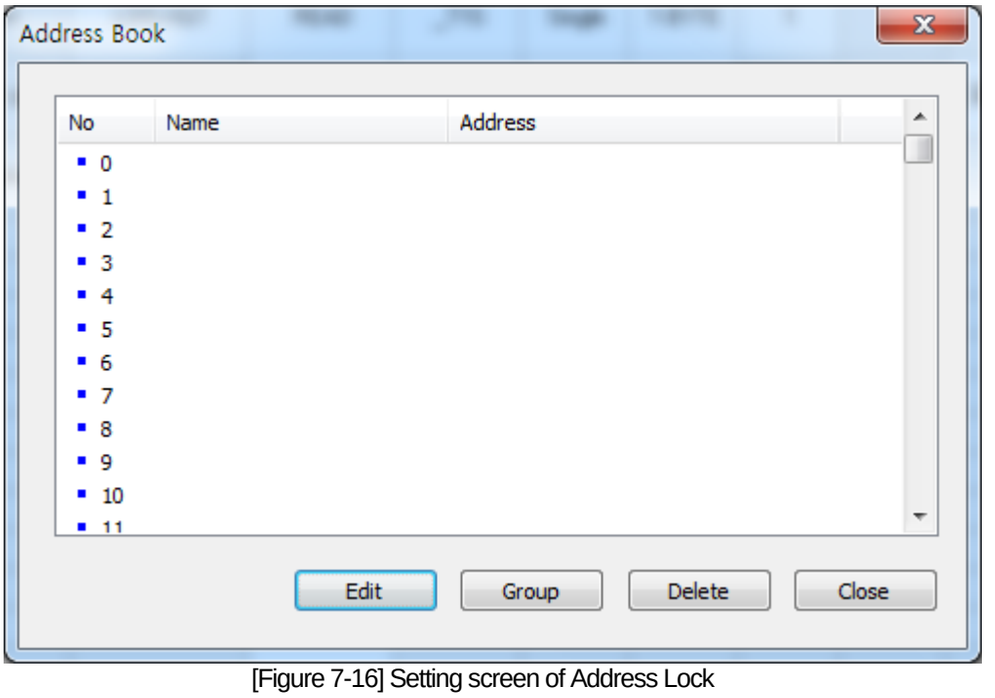
(1) Writing address

Double-click 'Address' to activate the following screen



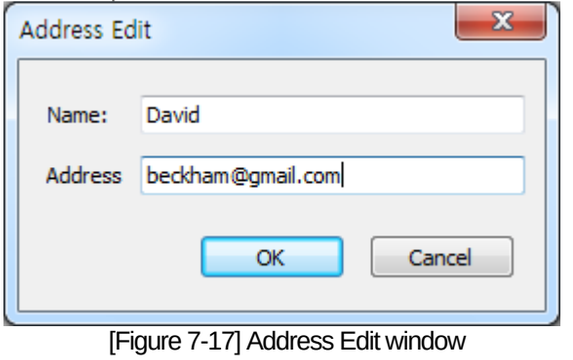
[Figure 7-15] E-mail setting (address setting)

Register the address to send E-mail on the following screen

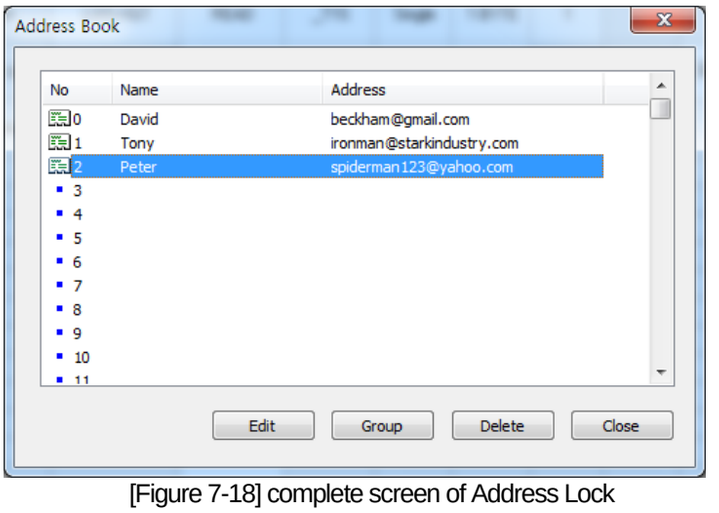


[Figure 7-16] Setting screen of Address Lock

Select the No and press Edit or double-click the No to active the following screen

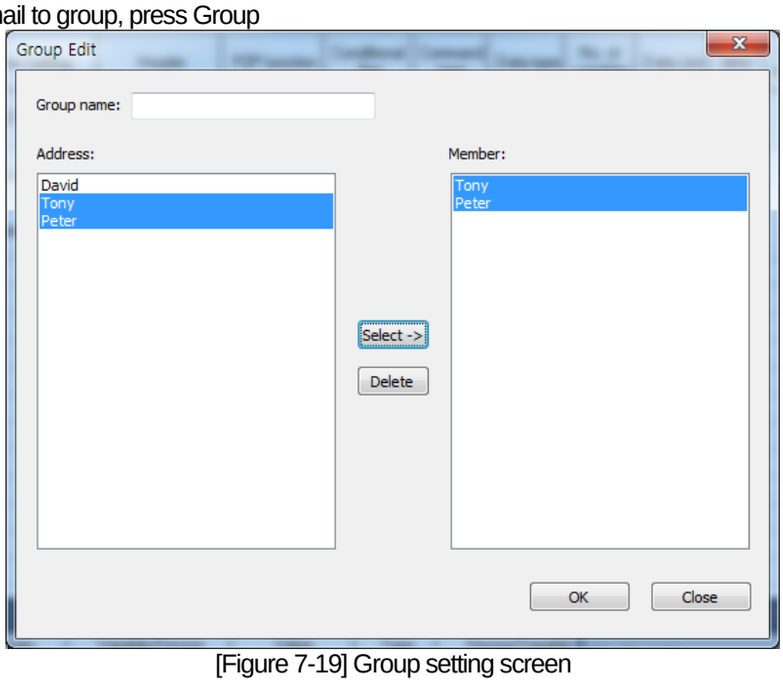


[Figure 7-17] Address Edit window

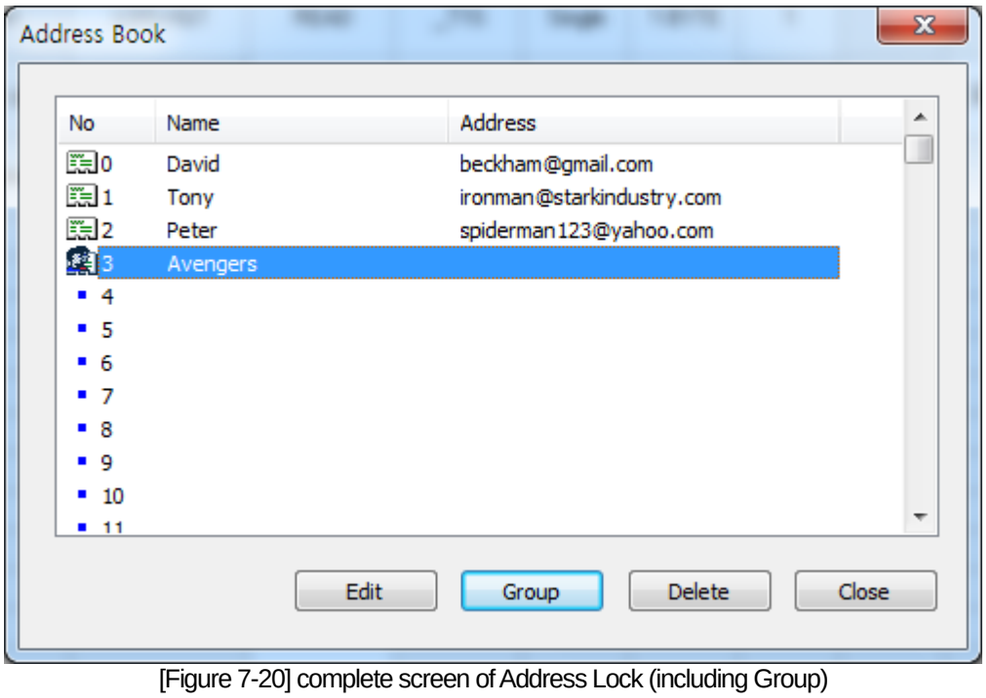


[Figure 7-18] complete screen of Address Lock

When sending E-mail to group, press Group



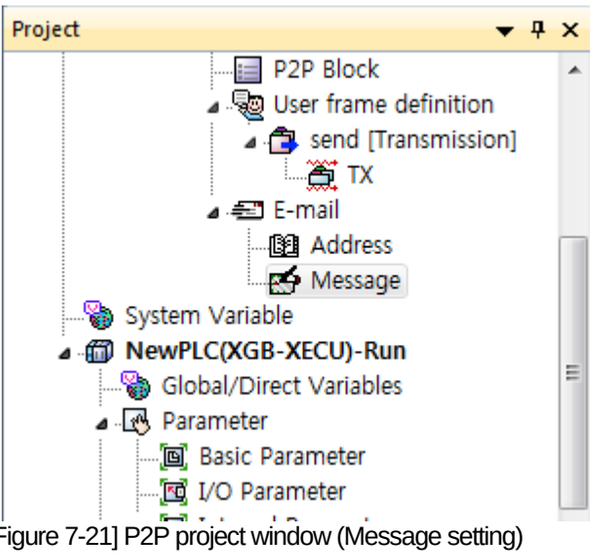
[Figure 7-19] Group setting screen



[Figure 7-20] complete screen of Address Lock (including Group)

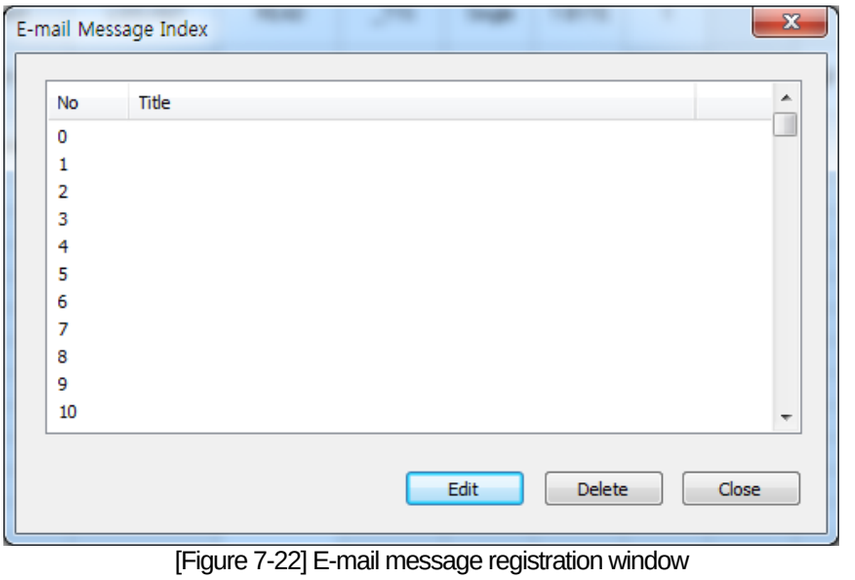
If you select Group, already registered individual address is indicated at left side. Select the individual address to be member of group and press OK to create Group address. In the above screen, if you send to Friend, Tony and Peter will get message simultaneously.

(2) Writing message
Press “Message” to edit message



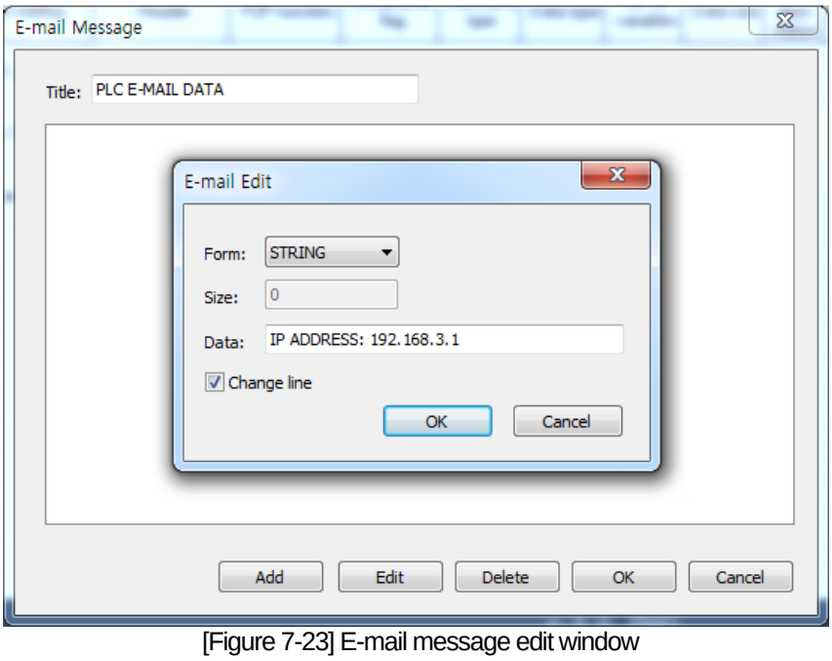
[Figure 7-21] P2P project window (Message setting)

The following figure is message edit window

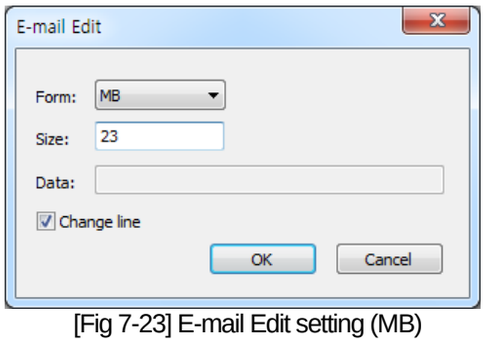


[Figure 7-22] E-mail message registration window

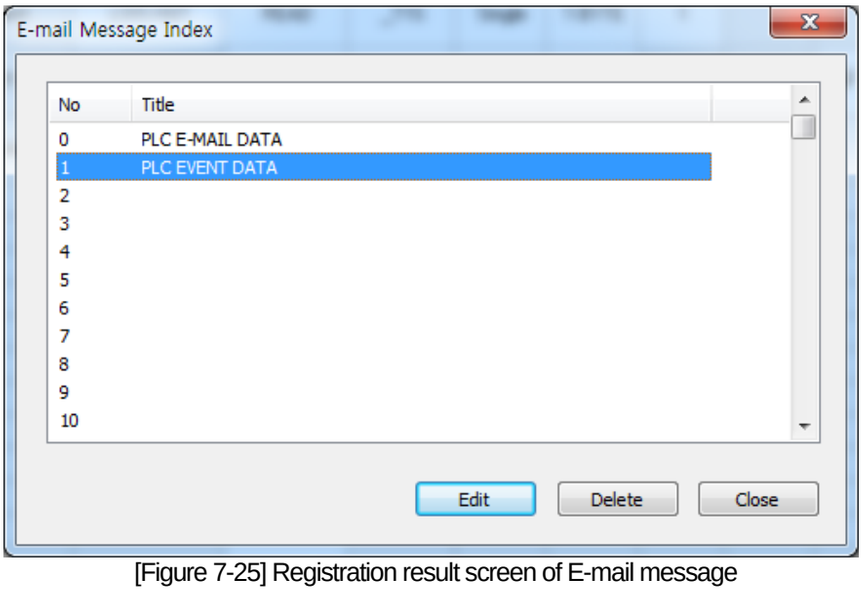
Click “Add” to activate the following screen. Set the Form and Size and write the message data.
Form is classified into String and Byte data receiving from CPU. Form MB is used to send as many message data of P2P ESend parameter’s message data as byte set in Size
“Change” is used to change the line when outputting the data at the received screen.



[Figure 7-23] E-mail message edit window



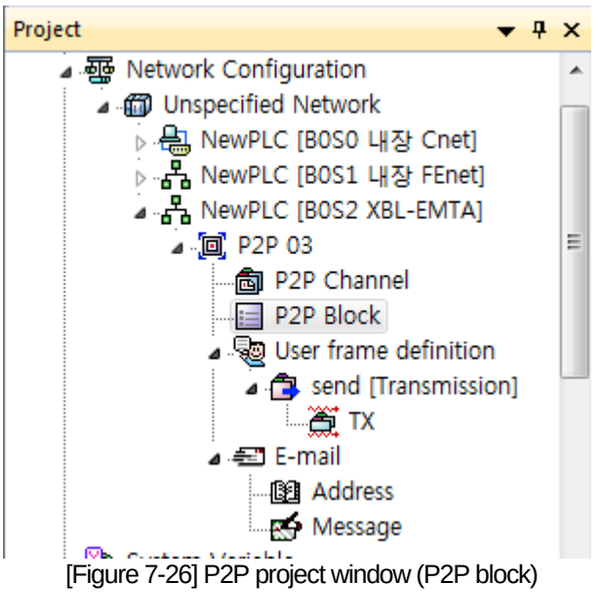
[Fig 7-23] E-mail Edit setting (MB)



[Figure 7-25] Registration result screen of E-mail message

7.4.3 Setting P2P block

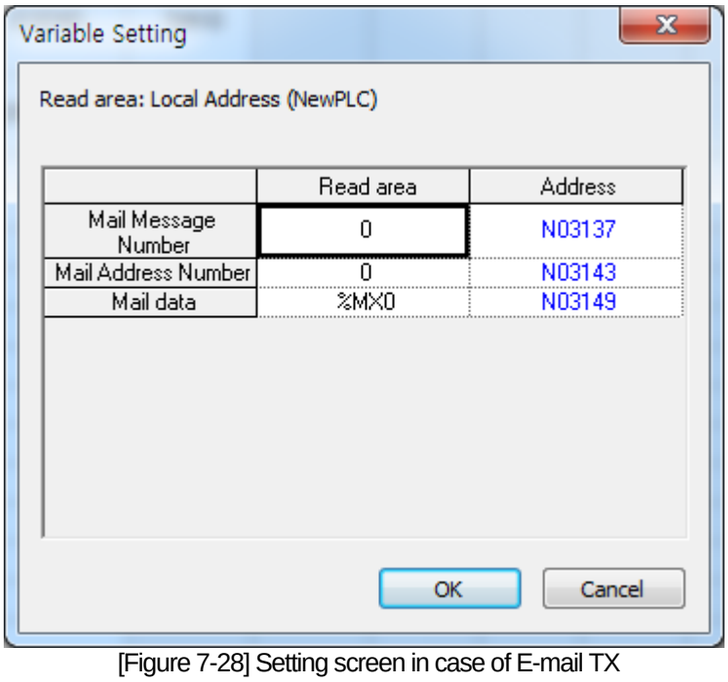
Sets the parameter of P2P block to send message set in the previous steps
If you sett the E-mail button after clicking the P2P block, you can select the P2P instruction.



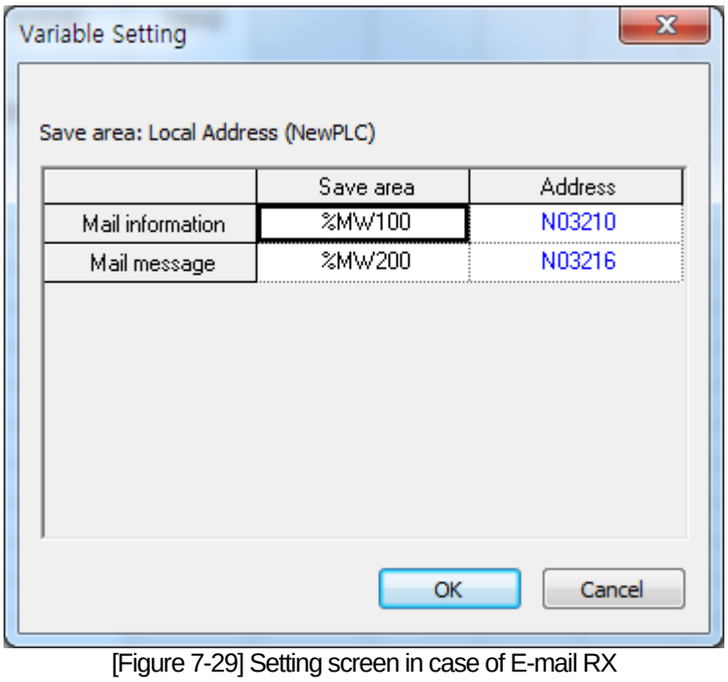
[Figure 7-26] P2P project window (P2P block)

Index	E-mail	Ch	Driver Setting	Header	P2P function	Conditional flag	Command type	Data type	No. of variables	Data size	Destination station	Destination station number	Frame	Setting	Variable setting contents
0	☑				ESEND	%MX0								Setting	Line:3 Mail Message Number:0 Mail Address Number:0 Mail data:%MX0
1	☑				ERECEIVE	%MX1								Setting	Line:2 Mail information:%MW100 Mail message:%MW200

[Figure 7-27] P2P parameter setting window



[Figure 7-28] Setting screen in case of E-mail TX



[Figure 7-29] Setting screen in case of E-mail RX

Item			Details
E-mail			Enables the E-mail service
P2P function		ESEND	Sends E-mail
		ERECEIVE[note1]	Receives E-mail
Conditional flag			Inputs device to use as start condition Memory area and flag are available
Setting	TX	Mail message number	Inputs index number of message list among the E-mail setting in P2P Determines title and data of mail
		Mail address number	Sets registration number set in Address Lock. Determines who to send When you want to send to many people, use Group. But before using Group, the address of partner should be inputted. The number of Group member is limited to maximum 10.
		Mail data	Indicates the start address of data to send. It sends as many data as the number of array (10 byte) starting the first of array applying to MB[10].
	RX[note2]	Mail information	Area where mail information is saved
		Mail message	Saves the received mail message at memory of PLC

Note

Currently, XGB FEnet supports only TX function and RX function is not supported

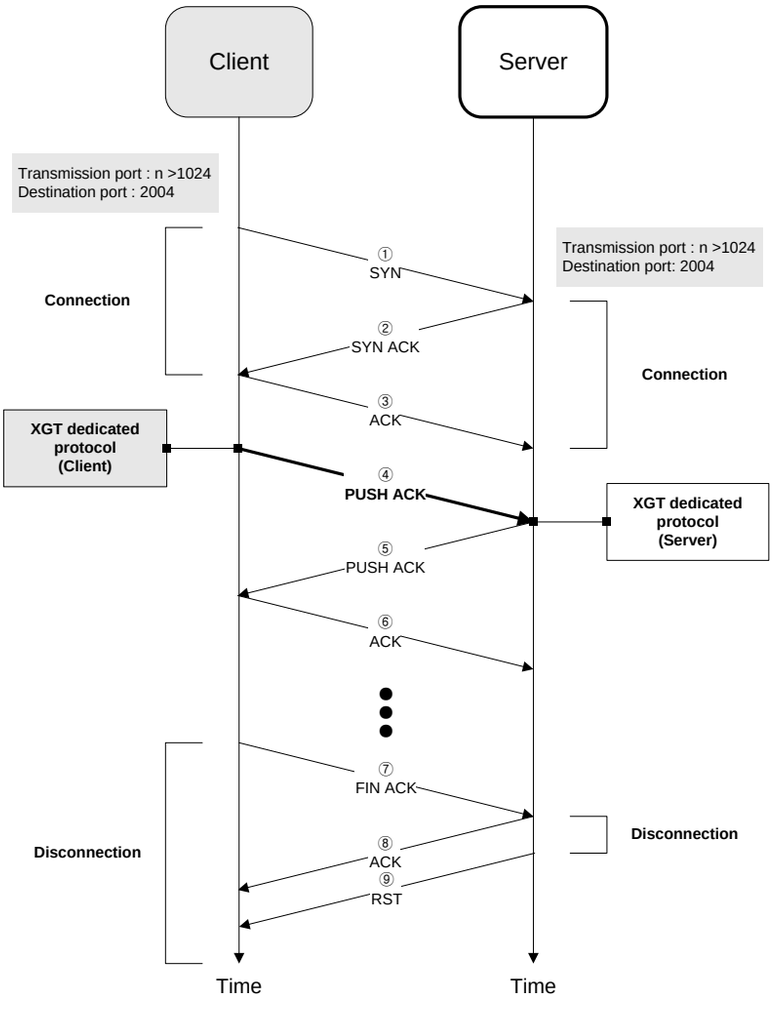
Note1) ERECEIVE block is related with e-mail RX setting. This is not used in the XGB.
But one RX block should be set for e-mail TX function

Note2) This is related with e-mail RX setting, not used in the XGB.

7.5 XGT Client

7.5.1 XGT client introduction

XGT Client provides a data read/write function sending request frame to server by using XGT dedicated protocol. It sends a frame when the operation condition of each block is ON. With 2 communication methods, TCP and UDP, XBL-EMTA can use XGT client function.

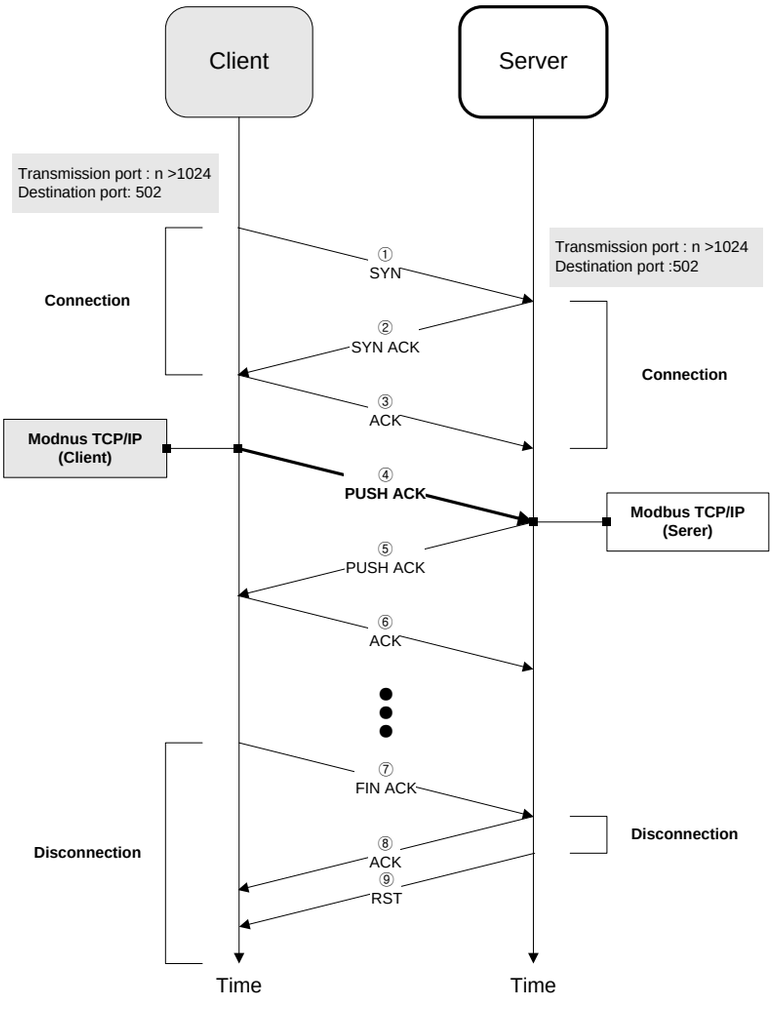


[Figure 7-30] Setting TCP XGT client channel

7.6 Modbus TCP Client

7.6.1 Modbus TCP Client

Modbus TCP client provides a data Read/Write function sending request frame to server using function code by Modbus TCP/IP protocol. It sends a frame when the operation condition of each block is ON.



[Figure 7-31] Setting TCP XGT client channel

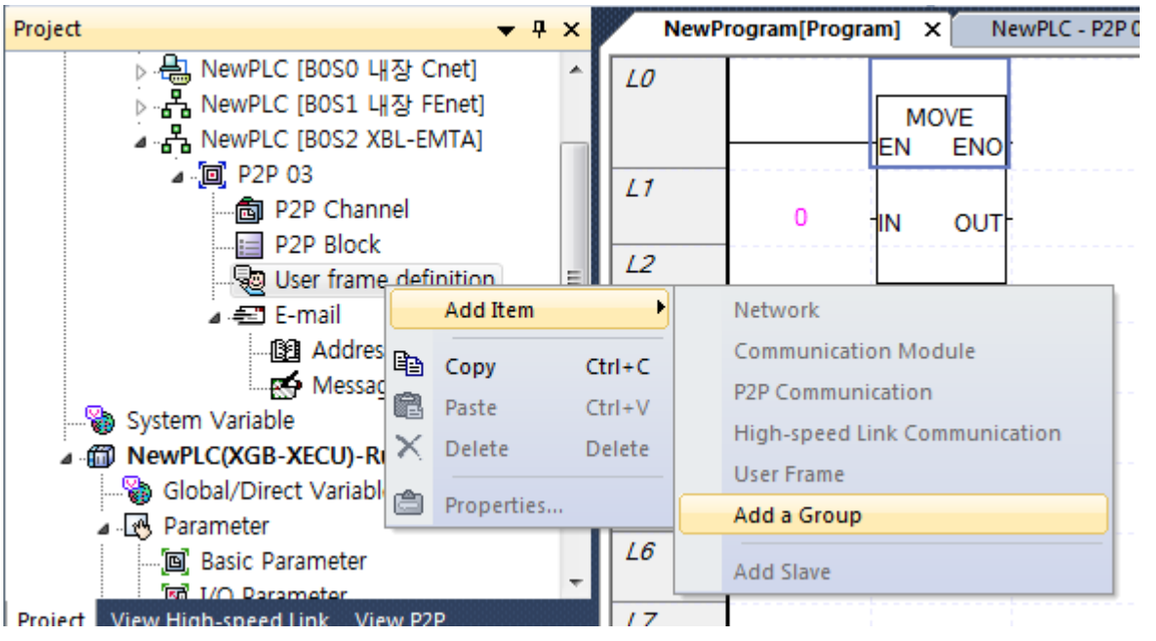
7.7 User Frame Definition

TRX frames must be defined if there are frames whose structure is different from the structure of XGT dedicated frame or Modbus TCP frames in the network. This is available only in P2P service.
All the frames are composed of Header, Data and Tail which can be omitted respectively.
In XGT, user defined frames are displayed with group name and frame name whose details are as follows;

7.7.1 Group

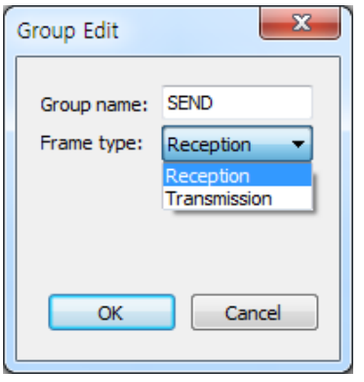
This is group of frame having same header and tail. For registration of frame, you have to register group.

(1) Adding user defined frame's group
Click the right button of the mouse after selecting "User frame definition". In the popup menu, select "Add Group" as shown in the [Fig. 7-32]



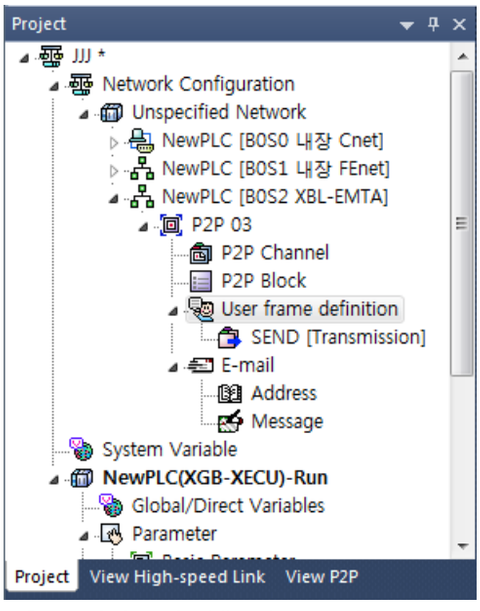
[Figure 7-32] Adding user frame definition group

(2) User frame definition group and selecting frame type
At the group edit, input group name and set the frame type.



[Figure 7-33] user frame definition group and selecting frame type

[Fig. 7-34] shows the result displayed at the project window when setting group name as “SEND” and frame type as Transmission.



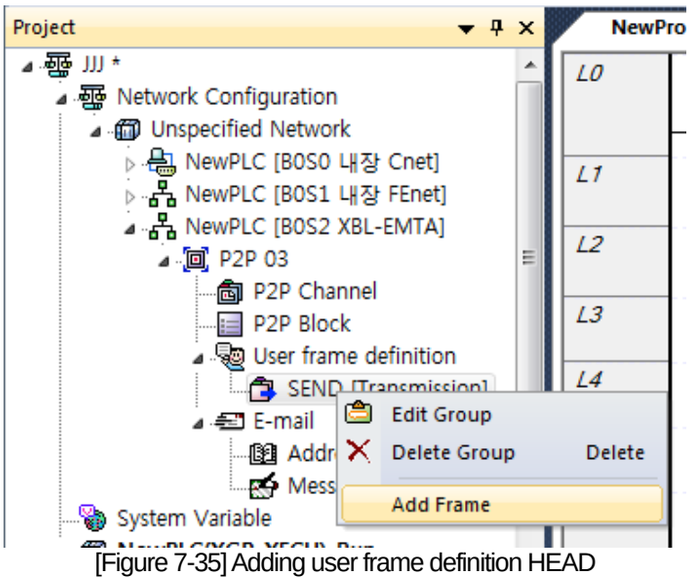
[Figure 7-34] completion of adding the user frame definition group

7.7.2 Frame

- Consists of Head, Body, Tail
- Defines TRX frame.
- You can add fixed, variable size variable to the Body
- A frame consists of several segments and for one Body, you can register up to 4 variable segments

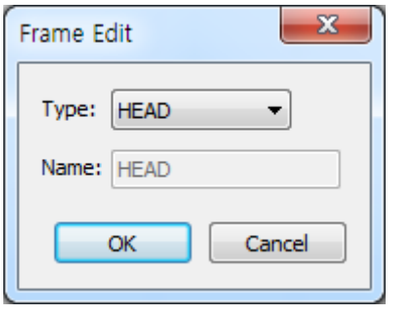
(1) Adding a frame in the group

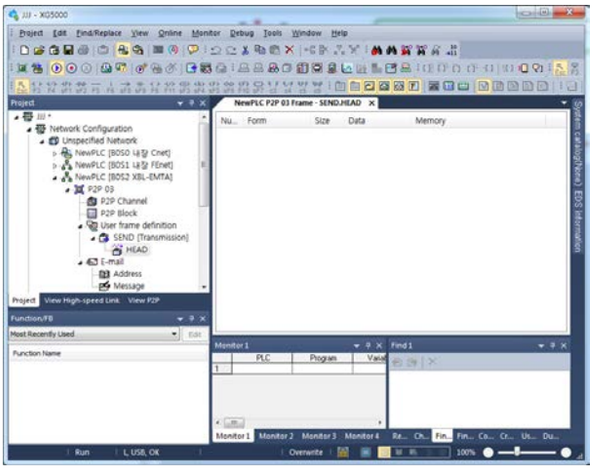
If you click the right button of the module at the added group as [Fig. 7-35], popup menu appears. After selecting “Add Frame”, select frame type/ [Fig. 7-36~38] shows the frame-added screen in the group when selecting HEAD, TAIL, and BODY respectively.



[Figure 7-35] Adding user frame definition HEAD

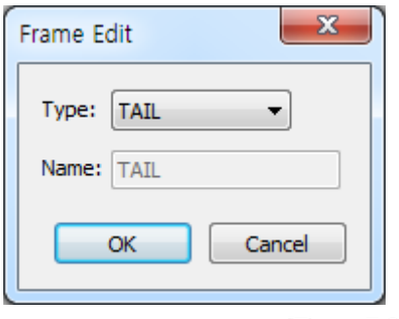
(a) Adding user frame definition HEAD

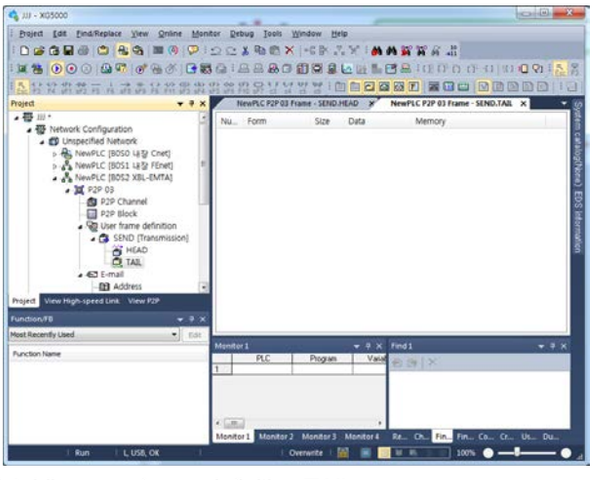




[Figure 7-36] Adding user frame definition HEAD

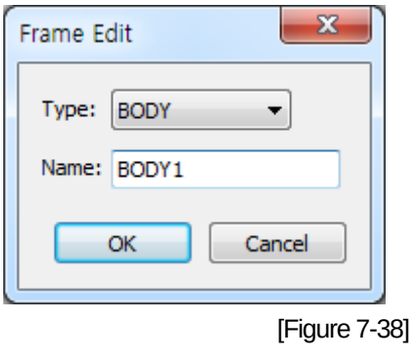
(b) Adding user frame definition TAIL

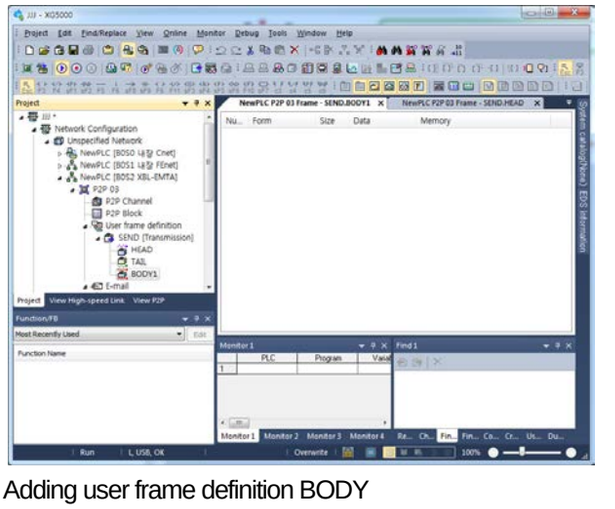




[Figure 7-37] Adding user frame definition TAIL

(c) Adding user frame definition BODY



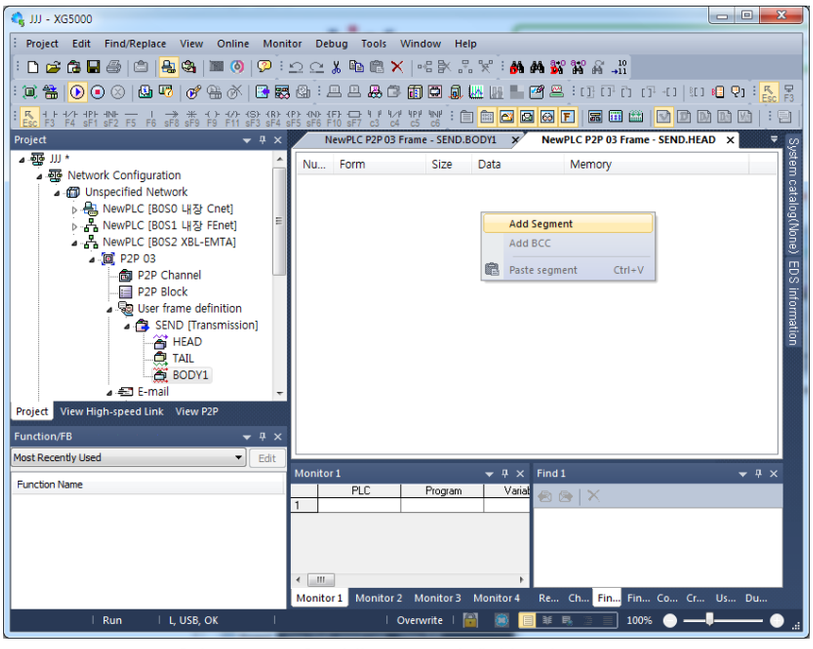


[Figure 7-38] Adding user frame definition BODY

7.7.3 Segment

(1) Type of segment

Header, Body and Tail of the frame consists of several segments and you can add them in the frame edit window.

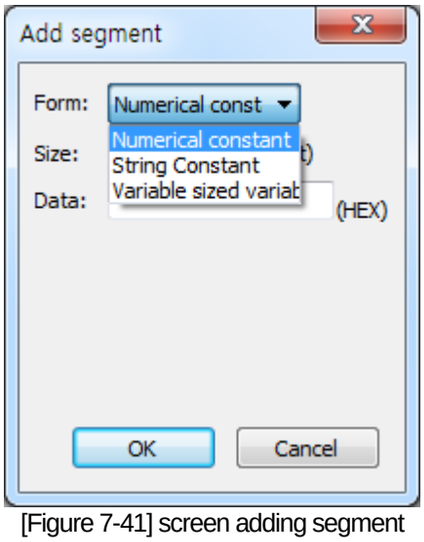


[Figure 7-39] Adding user definition frame segment

Number	Form	Size	Data	Memory
00	Numerical constant	1	05	
01	String Constant	3	TST	

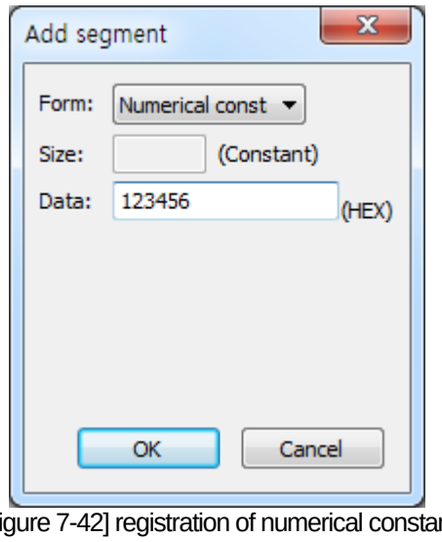
[Figure 7-40] Segment-registered screen example

There are 4 types of segment. Numerical constant, string constant, fix sized variable, variable sized variable.



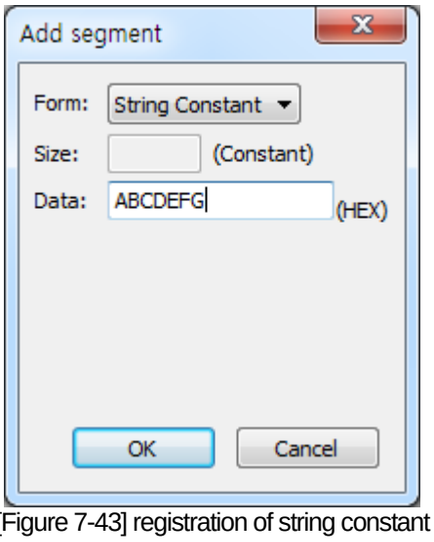
[Figure 7-41] screen adding segment

(a) Numerical constant
Defines the fixed part with constant among the frame and the data is specified with hexadecimal number



[Figure 7-42] registration of numerical constant

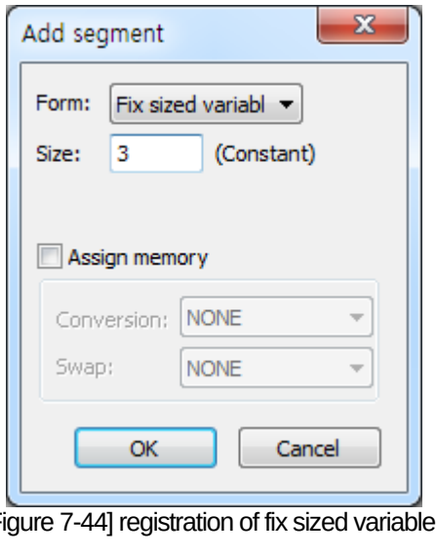
(b) String constant
Defines string constant among the frame and data is specified with ASCII



[Figure 7-43] registration of string constant

(c) Fix sized variable

Fix sized variable can be used in the only Body area of the frame. This is used when processing the size-fixed data (size is Byte unit). If you check “Assign memory”, you can save it at the PLC memory. At this time, the conversion and swap of data are available.



[Figure 7-44] registration of fix sized variable

(d) Variable sized variable

- Available in the Body area of the frame
- TX Frame

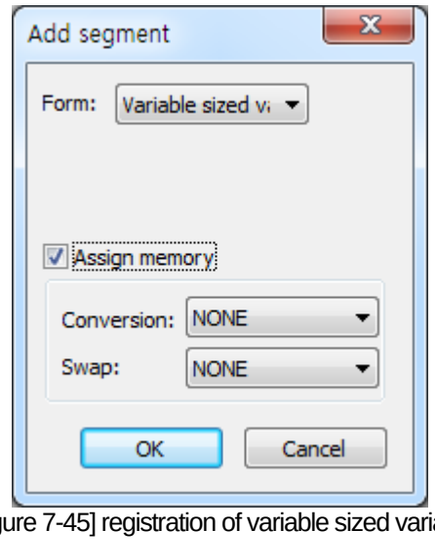
  Used when changing the length of frame

  Check “Assign memory” to configure the TX frame with the data from PLC memory.
- RX Frame

  Used when processing the variable sized data among the RX frames

  Registration available only in the last segment in the Body area

  Check “Assign memory” to save the data for the applicable segment among the received frames. (Swap and conversion are available)



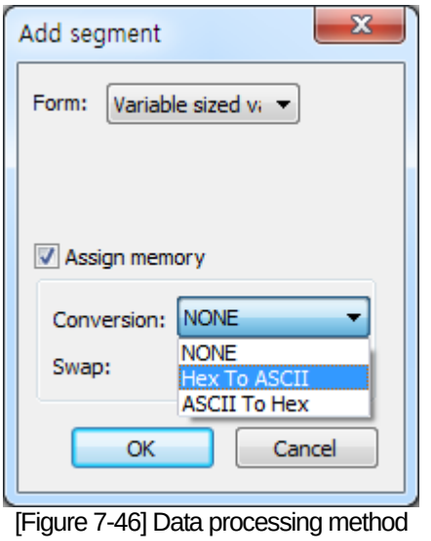
[Figure 7-45] registration of variable sized variable

(2) Data Conversion Processing

In order to convert data from Hexadecimal to ASCII code when frames are sent and received, or execute Byte swap, the following setting shall be specified on the frame edit window.

(a) Conversion

- Hex To ASCII
  TX: converts the data from PLC memory to ASCII code and configures TX frame.
  RX: converts the received data to ASCII and save them
- ASCII To Hex
  TX: converts the data from PLC memory to Hex and configures TX frame.
  RX: converts the received data to Hex and save them



[Figure 7-46] Data processing method

When 'Hex To ASCII' is selected, if 2 words of PLC memory, MW100/101, are used for TX frame configuration and the 0x34353637 is saved on MW100/101, the applicable segment of the TX frame will be filled with '4567',.
And when some of the received frames are converted to Hex and saved, if the value of applicable area is "4567", 0x3435 3637 will be saved on PLC memory,.

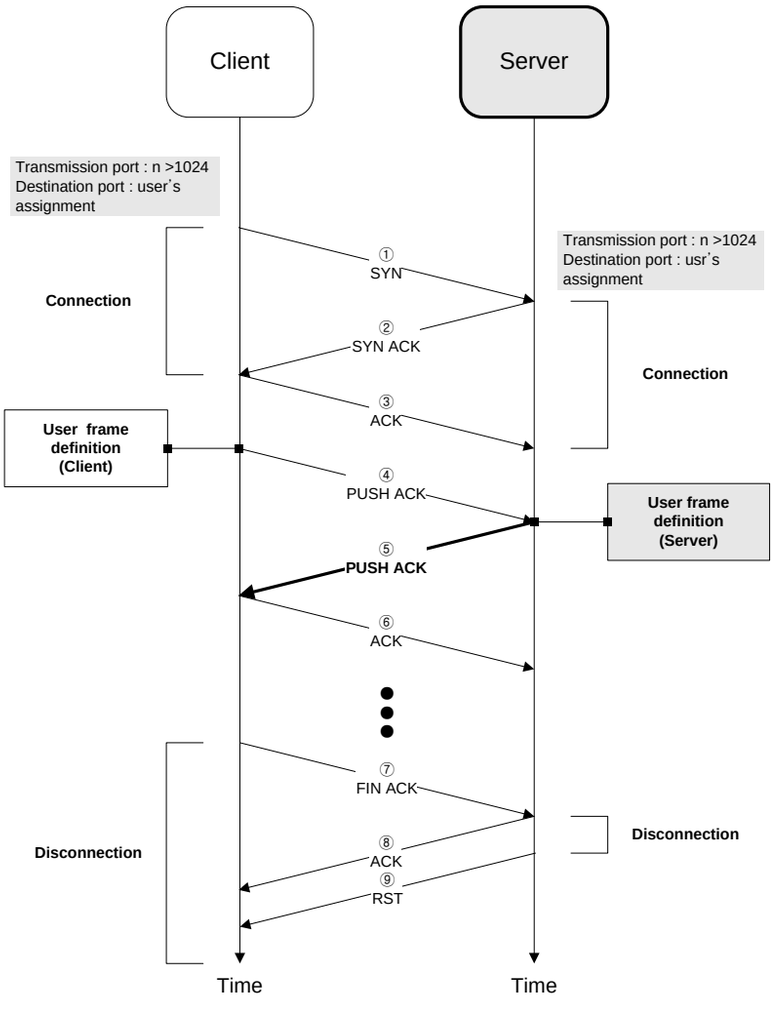
(b) SWAP

- 2 Bytes : 2 Bytes swap of applicable part among TRX frames
- 4 Bytes : 4 Bytes swap of applicable part among TRX frames
- 8 Bytes : 8 Bytes swap of applicable part among TRX frames

If 0x1234567811223344 is converted by respective methods above, its results are as follows;

- 2 Bytes swap : 0x3412785622114433
- 4 Bytes swap : 7856341244332211
- 8 Bytes swap : 4433221178563412

7.7.4 TCP/UDP user frame definition server



[Figure 7-47] TCP user frame definition server

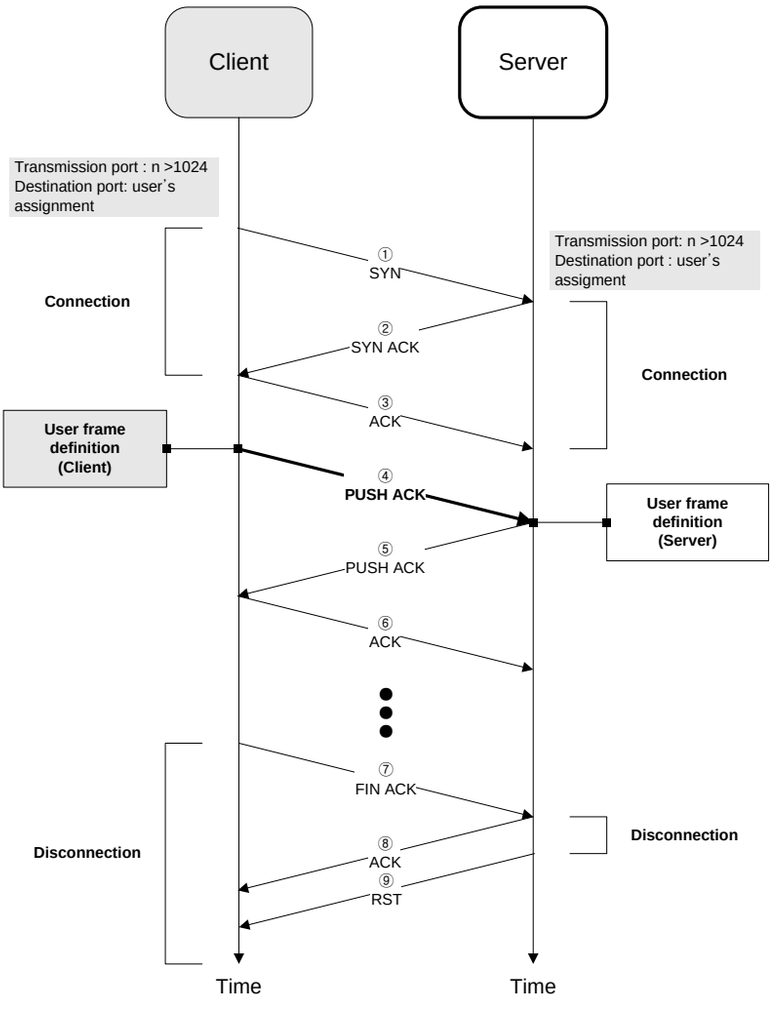
(1) TCP user frame definition server provides a function receiving the registered frame as the receiving block to the user's assigned port.

(2) In case of '①SYN ->②SYN ACK ->③ACK (Connection)-> the registered frame in reception block 's received from client', TCP user define frame treats the block.

(3) TCP user define frame does not receive if the port or frame type is different.

(4) In case of receiving registered frame in reception block to the block, UDP user frame server does receive.

7.7.5 TCP user frame definition client



[Figure 7-48] TCP user frame definition client

(1) TCP user define frame client provides a function sending the registered frame as the sending block to the user's assigned port.

(2) In case of operation condition –'ON' in block, TCP user define frame client does ①SYN, and send the registered frame in sending block to the port.

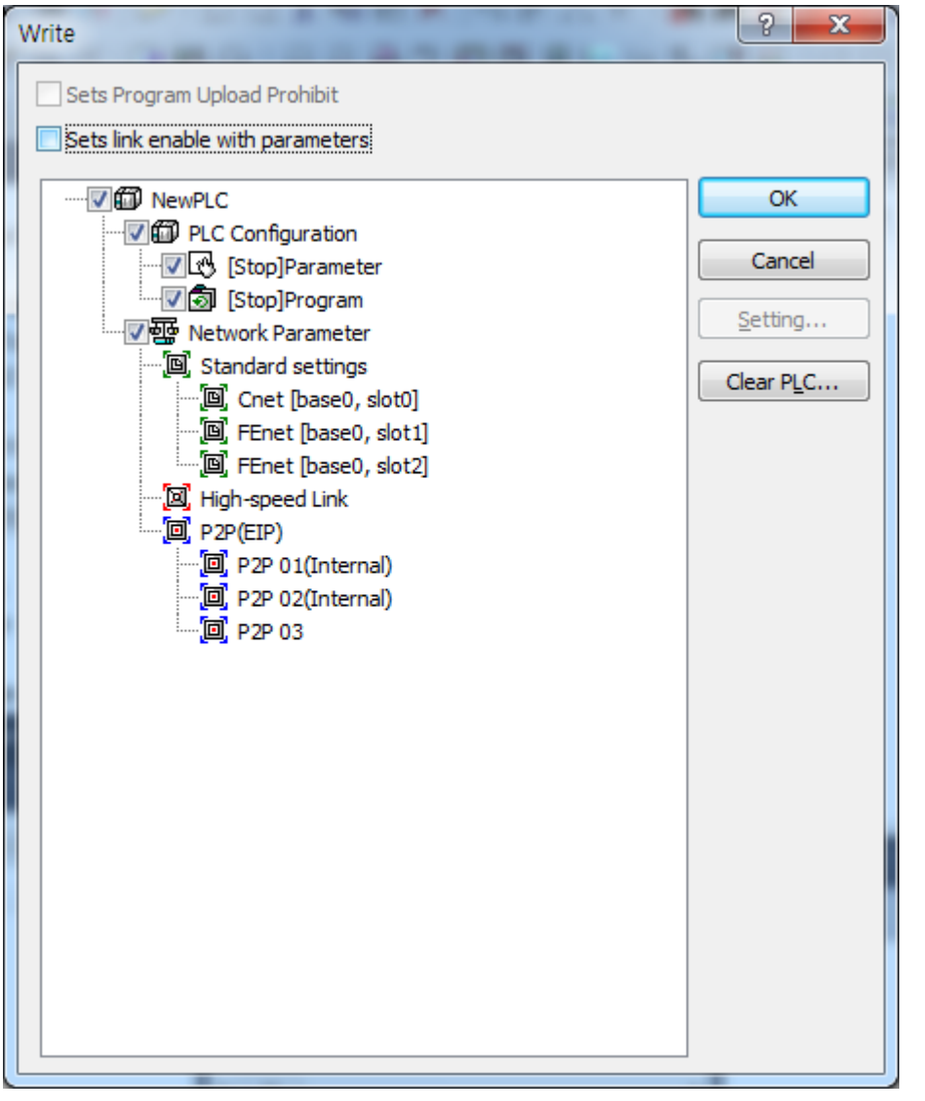
(3) In case of UDP user defined frame client does not do ①SYN, it sends the frame to the port when the operation condition is 'ON'.

7.8 P2P Service Operation

After P2P parameters are specified, download the parameters onto PLC CPU and start the P2P service. It is supposed that P2P parameters to download are already prepared and connection is available with the applicable PLC CPU.

(1) Downloading P2P parameters

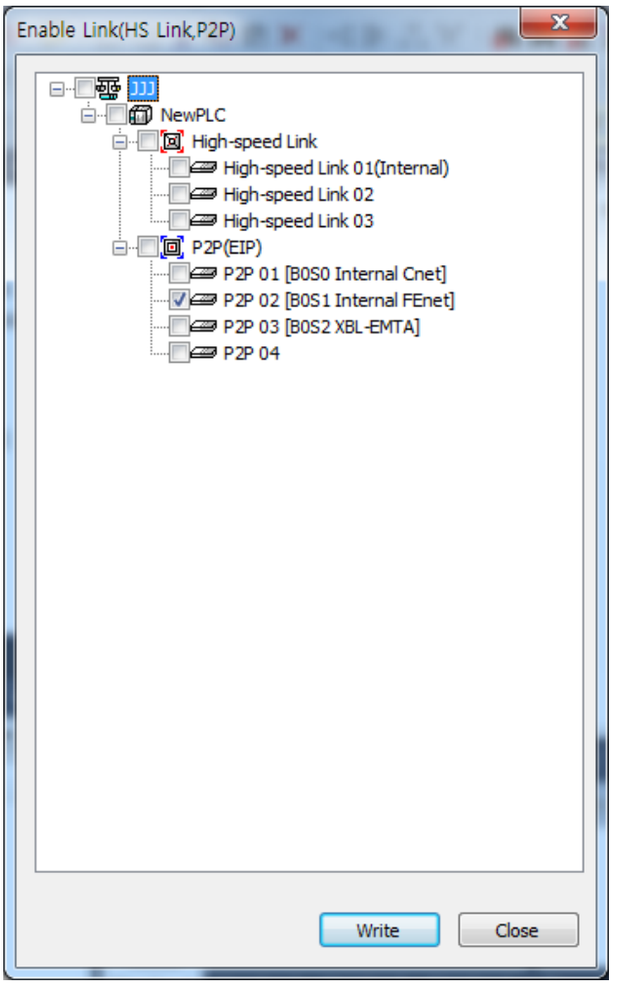
In order to download the prepared P2P parameters, select [Online] → [Write] on XG5000 menu window to display the parameters downloading window. Select the item to be downloaded and press "OK".



[Figure 7-49] downloading P2P parameters

(2) Starting P2P service

After P2P parameters are downloaded, enable the P2P to start the P2P service. Select [Online] -> [Communication module setting] -> [Enable Link] (HS link, P2P)] on the menu.



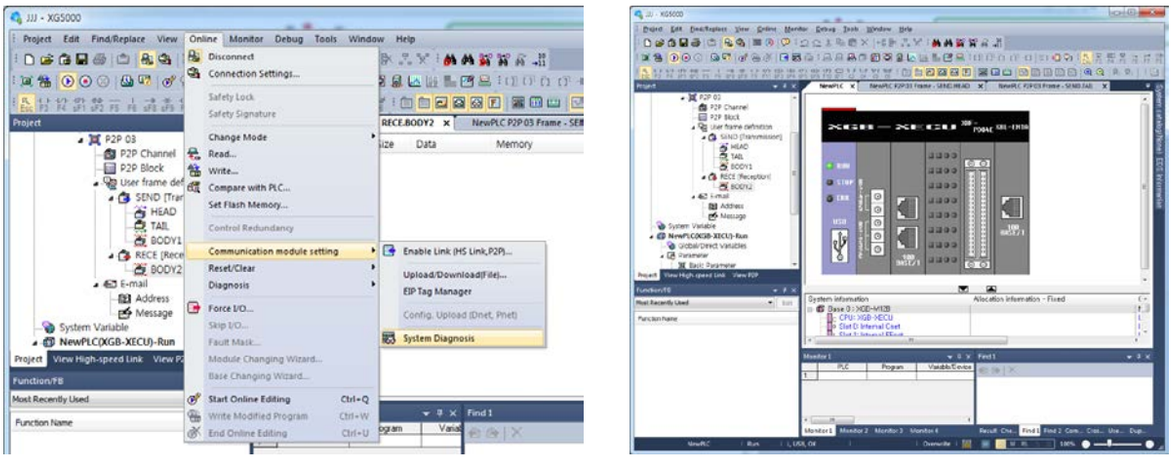
[Figure 7-50] Enabling P2P service

Select P2P parameters to start on the [Enable Link (HS link, P2P)] window. The already checked P2P parameters are under a run mode, whose P2P service will stop if cancelled.

After downloading, you can check whether P2P service is operating or not by selecting [System diagnosis] menu.

7.9 P2P Diagnosis Function

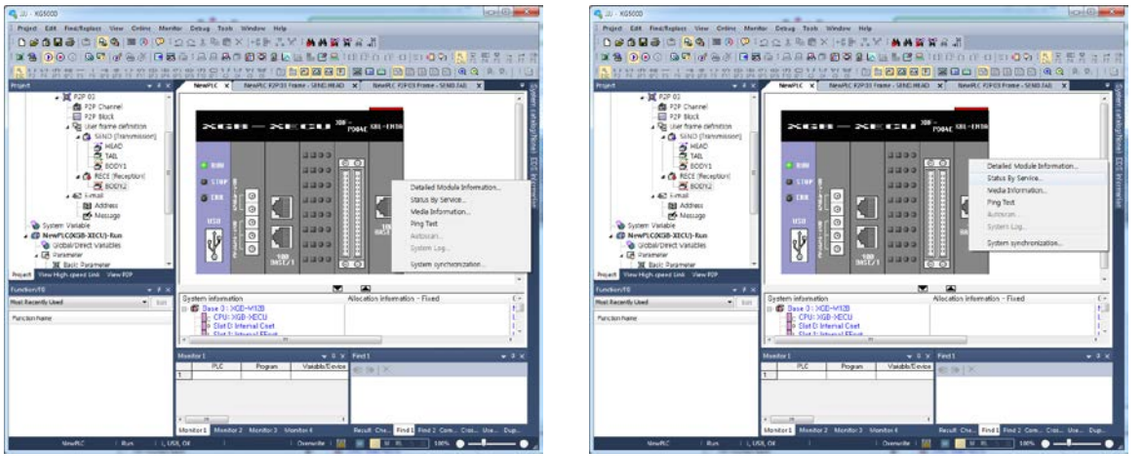
7.9.1 Service status diagnosis using XG5000



[Figure 7-51] System diagnosis

(1) After connecting through XG5000, click System Diagnosis as the left screen of [Figure 7-51].

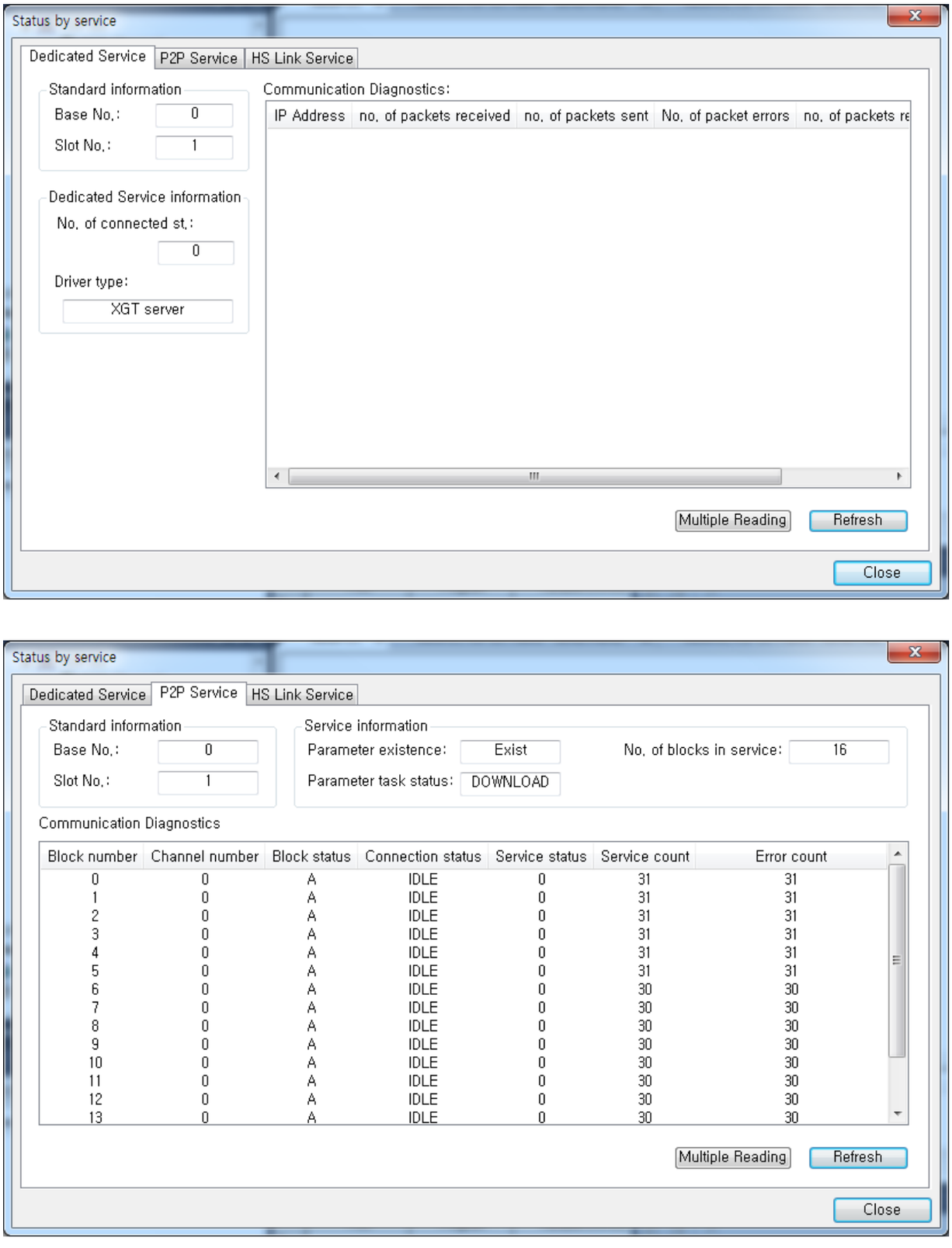
(2) It shows present system picture as the right screen of [Figure 7-51]



[Figure 7-52] System diagnosis menu

(3) Keep positioning on the module as the left screen of [Figure 7-52] and click the right button of mouse.

(4) Select “Status By Service” as the right screen of [Figure 7-52], click it.



[Figure 7-53] Status by service

(5) It shows 'Status by service' window as the upper screen of [Fig. 7-53].

(6) Select P2P service tap, it shows P2P service condition as the lower screen of [Fig. 7-53].

Chapter 8 High Speed Link Service

8.1 General

8.1.1 General

HS link service is a communication method between XGB Series and XGT Series PLC communication modules. This service provides that function does send/ receive data periodically by setting parameters.
HS link service does send frame to Subnet Broadcast by using UDP protocol.
Devices installed in same Subnet receives this Broadcast frame at the same time, it provides data treatment when one frame is registered in reception list.
Followings are HS link functions.

(1) Setting HS link block
Max. 64 blocks can be set in case of lots Send/Receive area.
Max. 200 words can be set per 1 block.

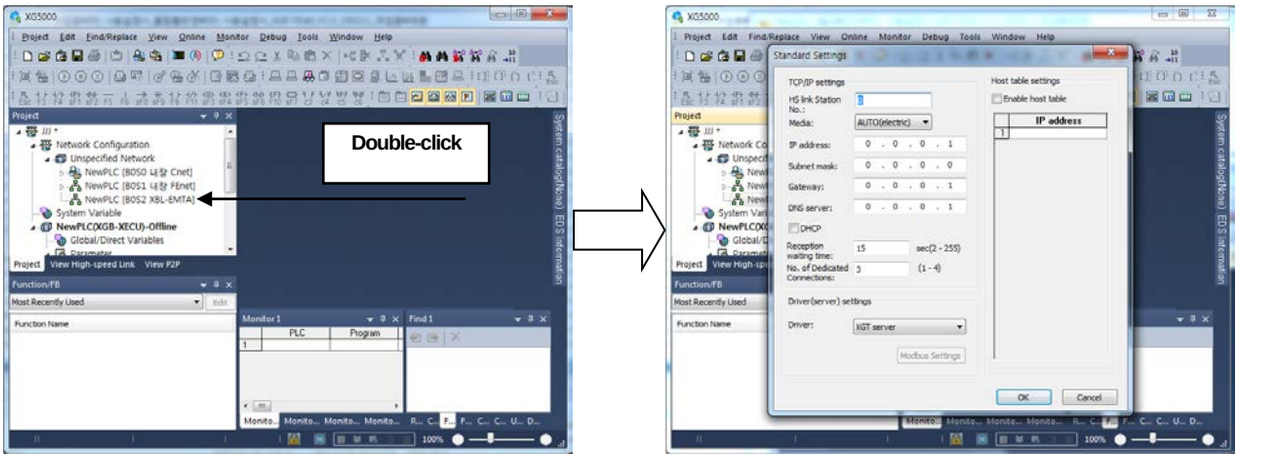
(2) Setting Period type
User can set period of type by parameter
User can set period of Send/Receive, 20ms~10sec.

(3) Setting area of Send/Receive
User can set area of Send/Receive by data block.
Max. 32 blocks of each Send/Receive are available.

(4) HS link information
HS link operation condition can be check through Flag.
Comfortable system diagnosis using XG5000.

8.2 Setting HS link service

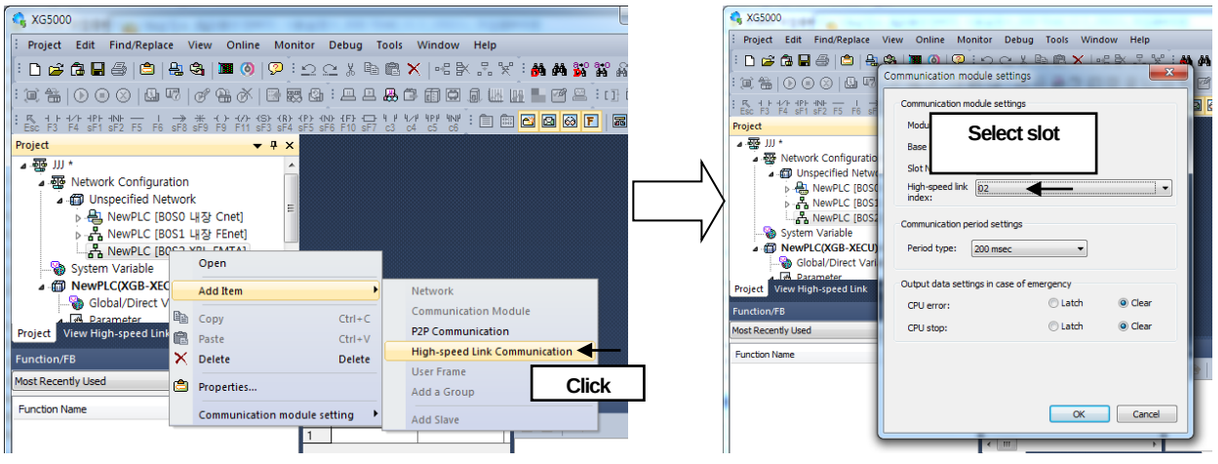
8.2.1 Basic parameter



[Fig. 8-1] Setting basic parameter station no.

8.2.2 HS link parameter

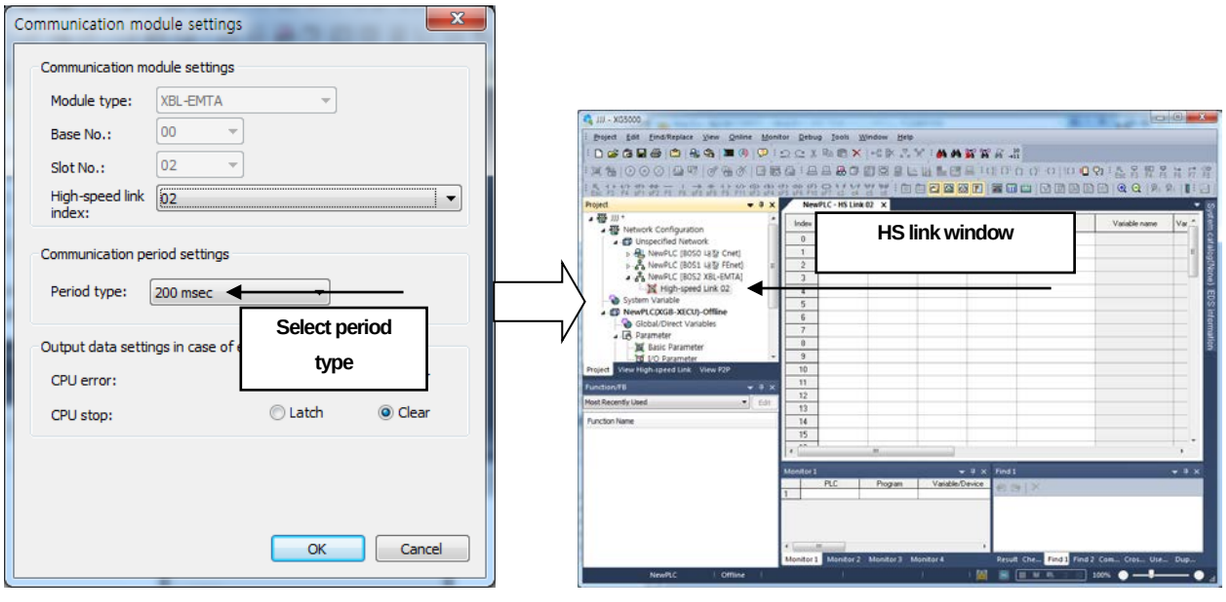
(1) Setting communication module



[Fig. 8-2] Setting communication module in HS link parameter

(a) Right click FEnet module in project tree and select [Add Item]-[High-speed Link Communication] as [Fig. 8-2].

(b) Double-clicking shows communication module information setting window as the right screen of [Fig.8-2].

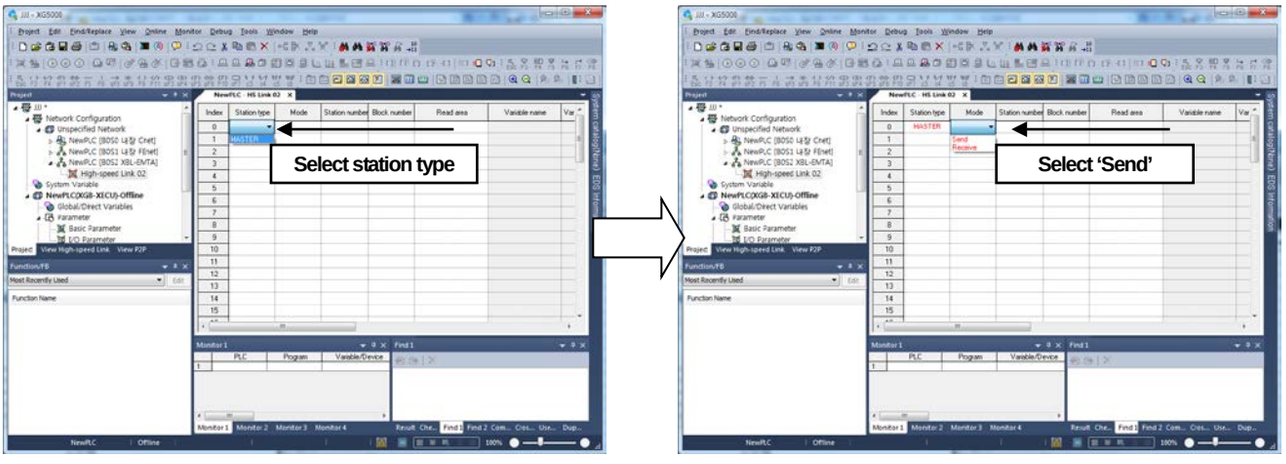


[Fig. 8-3] Finishing HS link communication module setting

(c) Select the desired period of communication as the left screen of [Fig. 8-3].

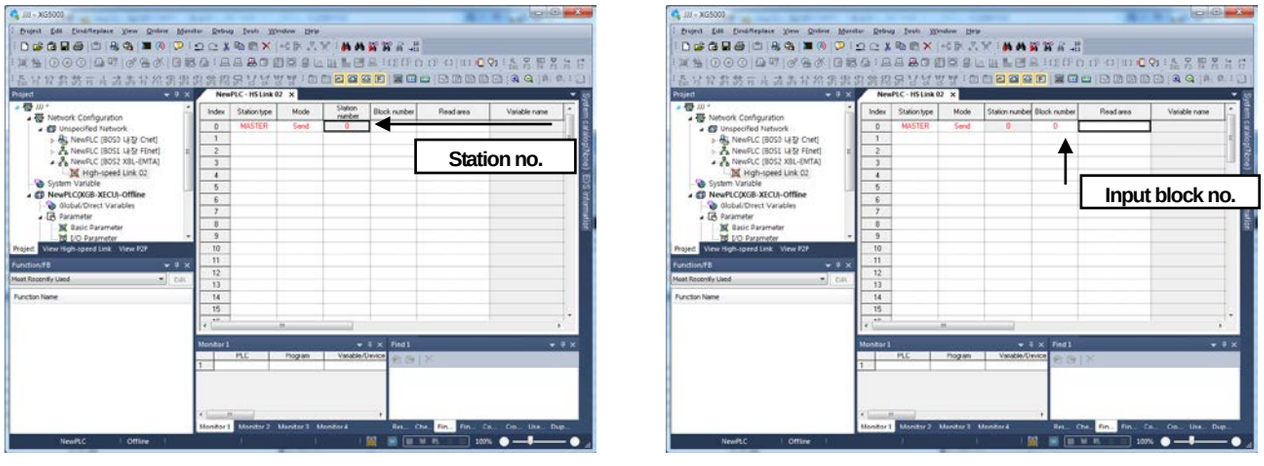
(d) Clicking enter key shows block setting screen as the right screen of [Fig. 8-3].

(2) Setting HS link sending block



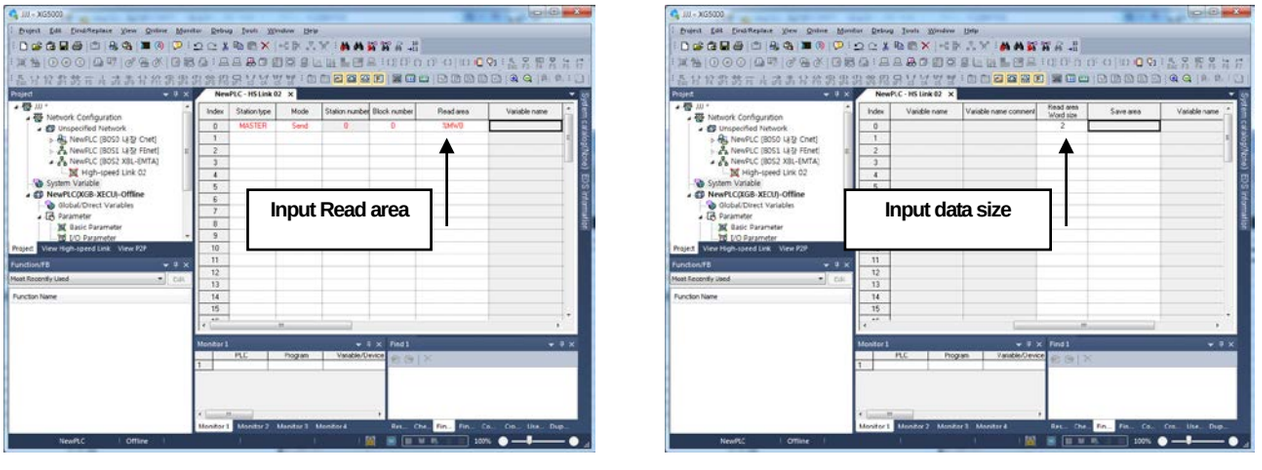
[Fig. 8-4] Setting HS link Sending Block station type and mode

(a) Set station type 'MASTER' as the left screen of [Fig. 8-4].
(b) Select 'Send' in the mode as the right screen of [Fig. 8-4].



[Fig. 8-5] Setting HS link sending block station no. and block no.

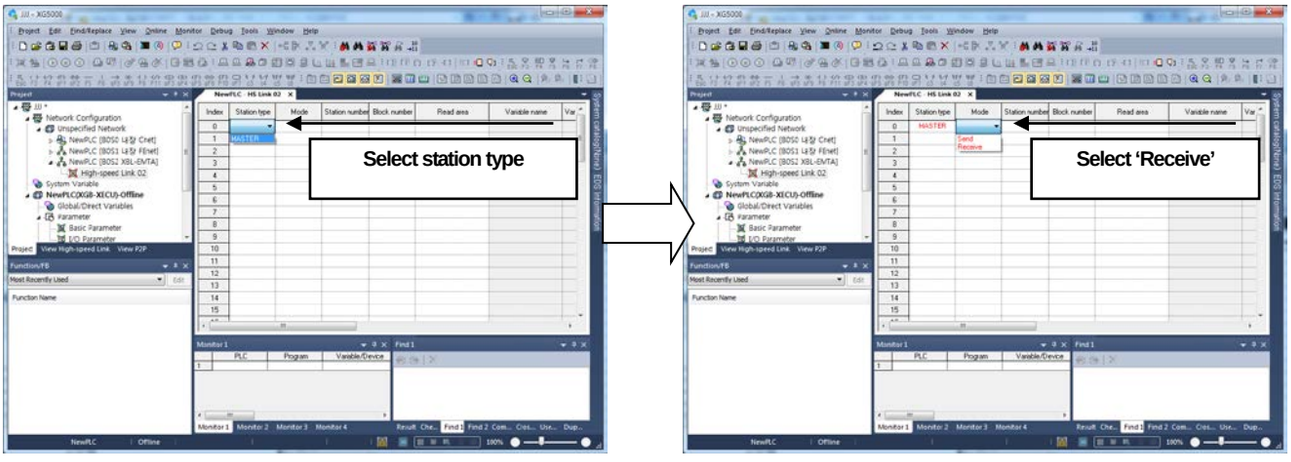
(c) When an user selects "send" as the left screen of [Fig. 8-5], it sets station no. as that in basic parameter automatically.
(d) Input block no. as the right screen of [Fig. 8-5].



[Fig. 8-6] Finishing HS link sending block data size setting

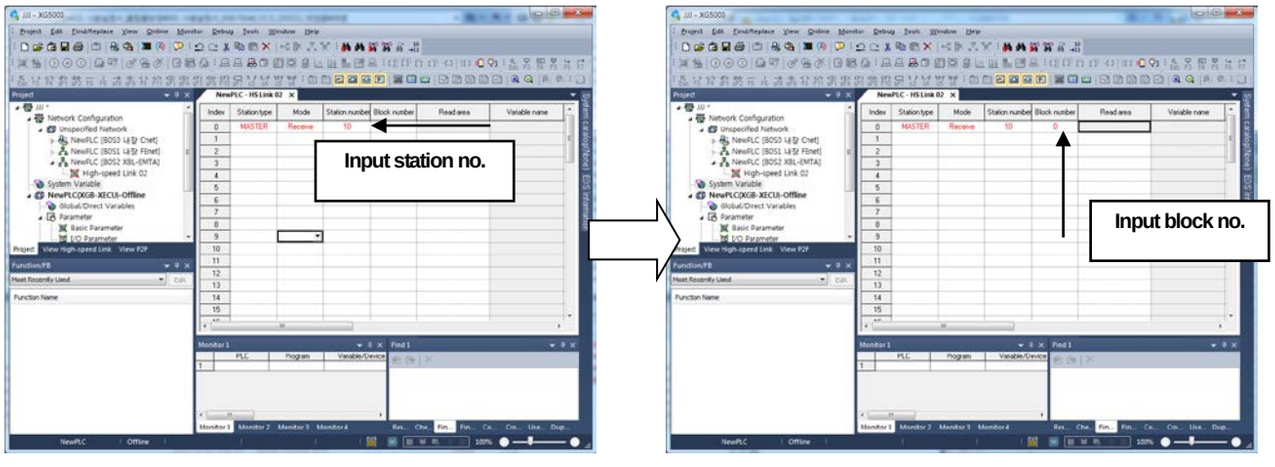
(e) Input READ area as the left screen of [Fig. 8-6]. READ area is each area of XGB CPU module.
(f) Inputting word size of READ area as the right screen of [Fig. 8-6] finishes setting sending block

(3) Setting HS link receiving block



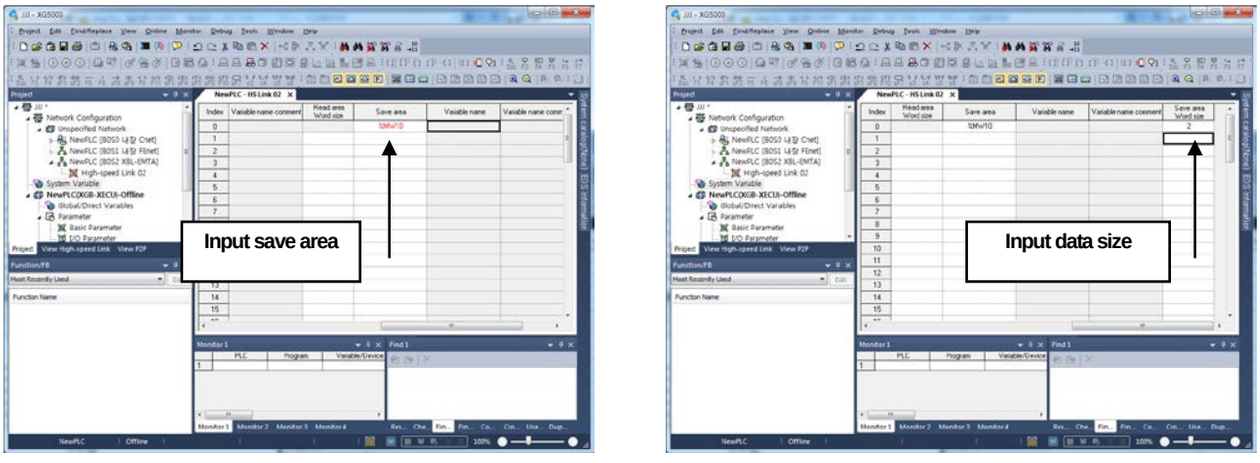
[Fig. 8-7] Setting HS link receiving block station type and mode

(a) Set station type 'MASTER' as the left screen of [Fig. 8-7]
(b) Select mode 'Receive' as the right screen of [Fig. 8-7]



[Fig. 8-8] Setting HS link receiving block station no. and mode

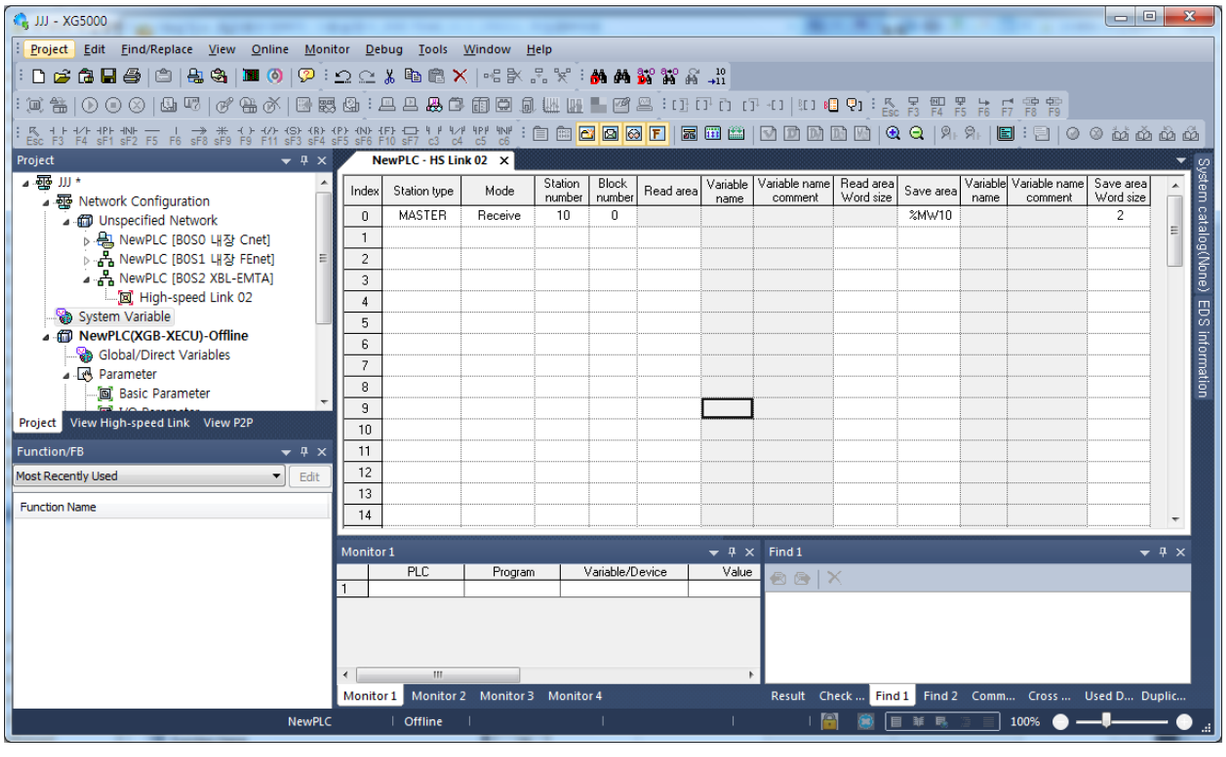
(c) Input station no. as the left screen of [Fig. 8-8]. This station no. is the number of destination device sending the block.
(d) Input block no. as the right screen of [Fig. 8-8]. It receives when the received frame is same as the block no.



[Fig. 8-9] Setting HS link receiving block station no. and mode

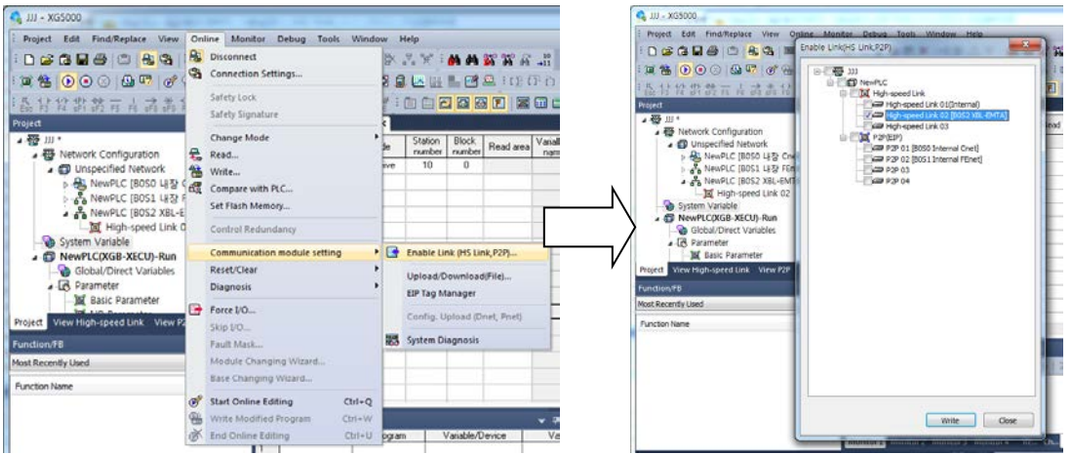
(e) Input save area as the left screen of [Fig 8-9]. Save area is the data saving area when each area of XGB CPU module receives the frame of block no.

(f) Inputting word size of Read area as the right screen of [Fig. 8-9] finishes setting receiving block.



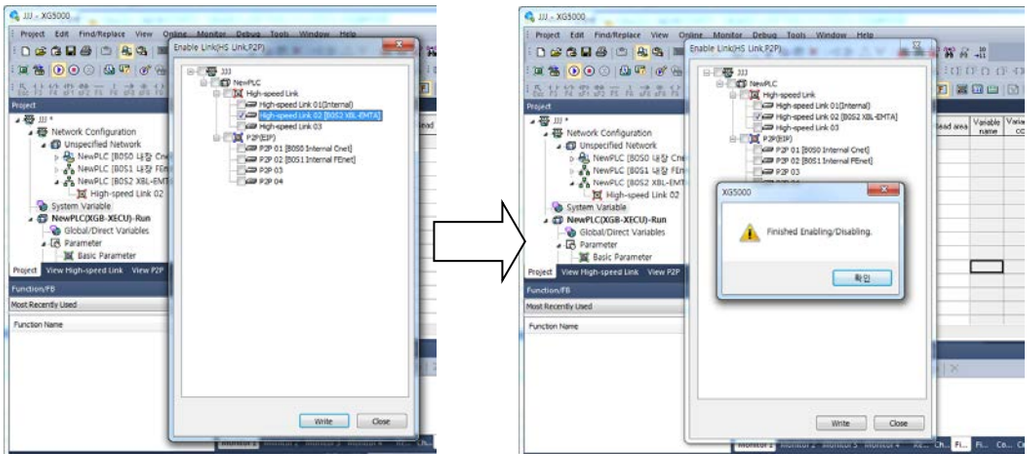
[Fig. 8-10] Finishing HS link receiving block data size setting

(4) Enabling HS link



[Fig. 8-11] HS link enable

(a) Connecting it through XG5000, click link enable on On-line menu.
(b) Select HS link 01 or HS link 02.



[Fig. 8-12] Finishing HS link enable

(c) Click check box, then click write button.
(d) When the message appears, clicking enter key starts HS link communication.

8.3 HS Link Flag

HS link service exchanges between over 2 stations of communication modules. To verify the reliability of the data from destination station through HS link, HS link service provides HS link information to user.
Communication module provides HS link information synthesizing the receiving data every some general interval And it verifies if the HS link operates in good condition followed by the user's assigned parameter.

HS link service consists of Run- Link (_HSxRLINK); It shows communication network overall information, Overall information of Link-Trouble (_HSxLTRBL) and _HSxSTATE, _HSxTRX, _HSxMOD, _HSxERR; Individual information. It shows each communication status by 64 registered item in parameter
User can use upper information in Key word type for programming. And by using HS information monitor function, user can monitor the status of HS link. Operating many PLCs by using HS link, user should do the operation after verifying the reliability of TRX data with understanding the High speed link information such as Run-Link, Link-Trouble, etc. [Table 8-13] shows HS link information function and definition.

8.3.1 HS link flag classification

Classification	Run-Link	Link-Trouble	Send/Receive status	Operation Mode	Error	HS link status
Information type	Overall	Overall	Individual	Individual	Individual	Individual
Keyword name (x=HS Link No.)	_HSxRLINK	_HSxLTRBL	_HSxTRX[n] (n=0..64)	_HSxMOD[n] (n=0..64)	_HSxERR[n] (n=0..64)	_HSxSTATE[n] (n=0..64)
Data type	Bit	Bit	Bit-Array	Bit-Array	Bit-Array	Bit-Array
Monitor availability	Yes	Yes	Yes	Yes	Yes	Yes
Program usability	Yes	Yes	Yes	Yes	Yes	Yes

[Fig. 8-13] HS link flag

8.3.2 HS link flag introduction

(1) Run-Link Flag
Overall information, it shows if HS link operates in good condition by the user's assigned parameter.
It keeps 'On' by the time of permitting 'Off' when it is 'On' once, and it is 'On' under following conditions.
1) The permitting link is 'On'.
2) All parameter registration item setting is normal.
3) Every data which is included in parameter registration item Send/Receive as the setting period.
4) Status of every setting destination station in parameter is RUN and at the moment there's no error.

(2) Trouble-Link Flag
It shows if HS link operates in good condition by the user's assigned parameter.
In the status of 'On' of Run-Link, if Run-Link is out of 'On' condition, it becomes 'On' and it does 'Off' when it recovers.

(3) Synthesized status indication Flag of Block
It's individual information showing operation status by HS link parameter registration item.
It indicates Max. 64 of HS link status by registration item and Max. registration numbers.
It shows the synthesized information of registration item by synthesizing individual information.
When the status of Send/Receive of the list is normal and operation mode is Run, no-error, it becomes 'On' and when it's out of upper condition, it does 'Off'.

(4) Run Operation Mode Flag of Block Station
It's individual information showing operation status by HS link parameter registration item.
It indicates Max. 64 of operation mode information by registration item and Max. registration numbers.
When the setting station in registration item is Run mode, the Bit becomes 'On'. When it's 'Stop/Pause/Debug' mode, it does 'Off'.

(5) Normal communication indication Flag between block station
It's individual information showing operation status by HS link parameter registration item.
It indicates Max. 64 of Send/Receive information by registration item.
When Send/Receive operates in good condition as the setting period, the Bit becomes 'On', if not it does 'Off'.

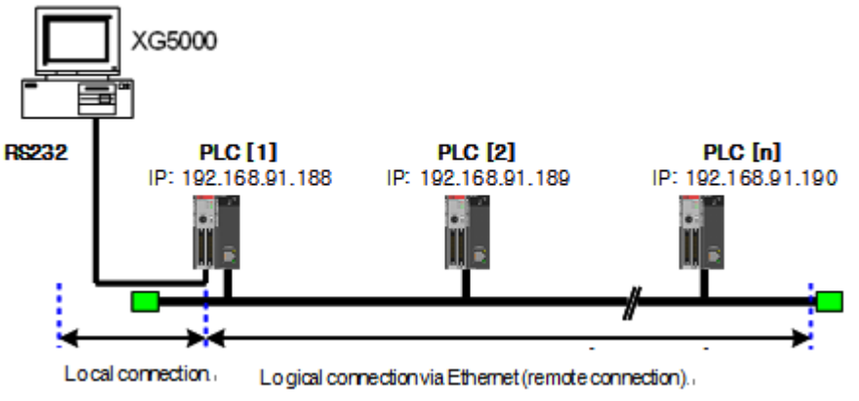
(6) Operation Error mode Flag of block station
It's individual information showing operation status by HS link parameter registration item.
It indicates Max. 64 of error information by registration item and Max. registration numbers.
Error defines that PLC does not execute user program normally. It means the operation of destination station is normal
When it's 'Off', it does the operation of destination station is abnormal.

Chapter 9 Remote Communication Control

9.1 General

The remote communication function is a feature to program, download, debug and monitor at a distance on Ethernet-based network system without a physical connection to XG5000 software.

It is convenient for easy access to each device from a place without repositioning when network-connected devices are separated far. Communication service function creates the following logical path to attain its purpose.



[Fig. 9-1] General of remote communication

A network is supposed where RS-232C cable is connected to PLC #1, and PLC #1, PLC #2, PLC #N are connected with each other via Ethernet.
In order to access the contents of PLC #1 in [Fig.9-1], do local connection on XG5000 online menu, then access the contents of PLC #1. After finishing access, to access the contents of PLC #N, disconnect the access with PLC #1.
Then, select PLC # N (Station No: N, FEnet slot of PLC #1: 2), accessing it connects logical connection between RS-232C and Ethernet.
This status as processed identically to connection with RS-232C as moved to PLC #N station is available to execute all functions of programming, downloading, debugging and monitoring as in PLC #1.

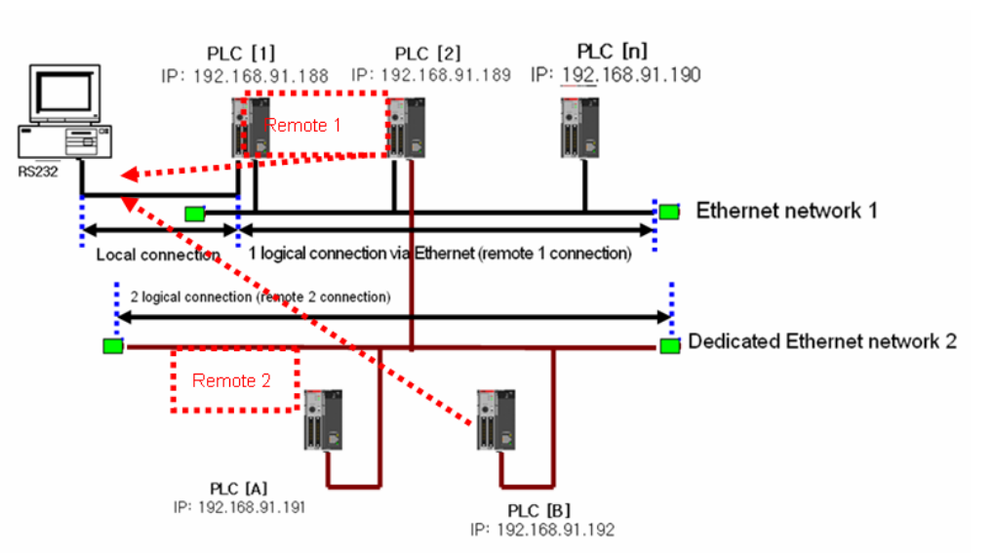
Furthermore, when a PC with operating XG5000 is installed with Enet module is installed, and it's connected to same network with the PLC, it can directly do remote 1 connection with PLC without local connection through RS-232C,

With this remote communication service, easy access to PLC position in the distance is available without moving thereto, which is useful for maintenance of PLC system.

9.2 XG5000 Setting and Connection

All PLCs connected with XGT network are available to connect each PLCs by XG5000 communication service. XG5000 remote connection is composed of remote 1 connection (Hereafter, referred to as **remote 1**) and remote 2 Connection (Hereafter, referred to as **remote 2**)

Following shows remote1 and remote 2

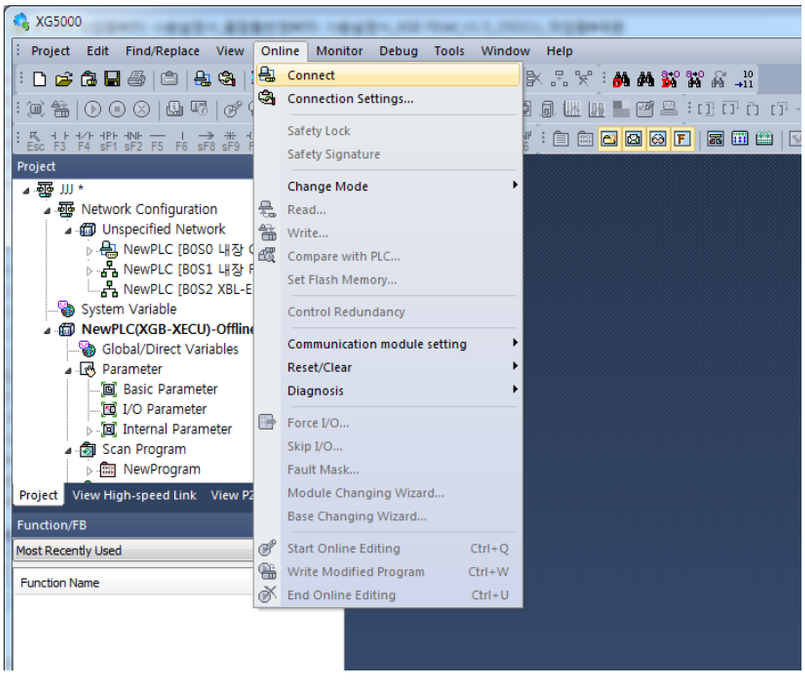


[Fig. 9-2] XG5000 remote connection

[Fig. 9-2] shows examples of remote1 (PLC B) and remote 2 (PLC E) in a system which composed of 2 networks.

9.2.1 Remote 1 (RS-232C Cable)

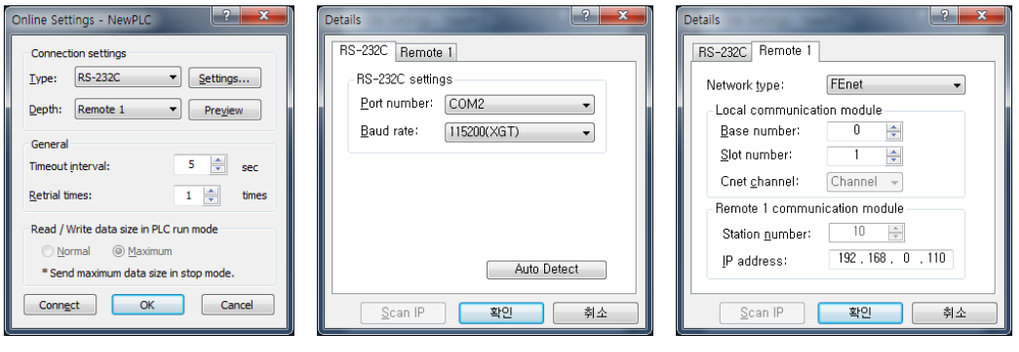
For remote 1, XG5000 shall be in off-line status. In this status, select 'Option' from the project menu. It shows option dialogue box. Then, select 'Option' tap.



[Fig. 9-3] XG5000 remote connection option selecting

(1) Connection type
Select local connection type. [Fig. 9-3] shows a local connection by using RS-232C
Select the communication port from user PC port.
Following section explains the case of Enet user. Refer to the user manual of each communication module.

(2) Connection depth
It decides local or remote 1 or remote 2 for connecting PLC.
Select remote 1.



[Fig. 9-4] XG5000 remote 1

(3) Connecting
Select Rnet, Fdnet, Cnet, FEnet, FDEnet by the remote 1 network type. [Fig. 9-4] shows remote 1 through FEnet.
Select FEnet.

(4) Base No.
Assign Base No. that is installed with FEnet I/F module for remote connection.

(5) IP address
FEnet I/F module IP that installed in destination station PLC for remote 1 in network 1

Assign address.

(6) Slot
It shows the position of communication module which is connected to network 1 from local PLC by RS-232C.

In [Fig. 9-4], FEnet I/F module is installed in PLC A. Select the slot no.0.

Select enter on (b), then select connection online menu.

The status of finishing remote 1 is same as the logical connection status with local connection by moving RS-232C cable.

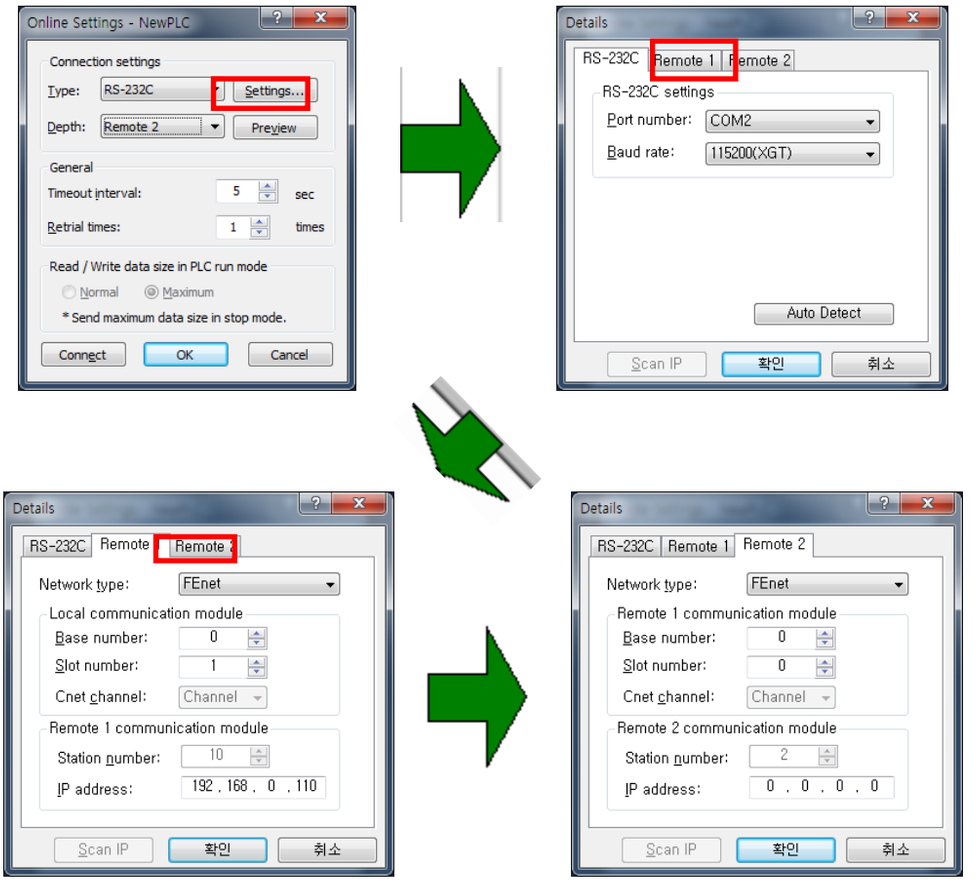
User can use all function of online menu. (But user can't do when the type of PLC and present open project CPU are not matched)

Remark

1) Caution for remote connection
   (1) Do remote connection after programming which is for the destination CPU type. If the CPU type is not a right match, it only do limited functions, it can not do program upload, download and monitoring.
   (2) If you want to write revised parameter on XG5000 by using remote connection, you have to disconnect remote. After then revised parameter will be applied.

9.2.2 Remote 2 (RS-232C Cable)

Remote 2 sets connection stage/remote2 from project/option/connection option.
[Fig.9-5] shows remote 2, it's an example of connection to Fnet I/F module of PLC through FEnet I/F module of PLC B.
To do remote 2, at the connection stage of project/option/connection option, select remote 2, then it shows the following box.



[Fig. 9-5] XG5000 remote 2

Other parts are same as the step of remote 1. Only the step of remote 2 explains.

(1) Network type setting
Select XGT FEnet by network remote 2.

Network type of remote 1 and remote 2 have no relevance.

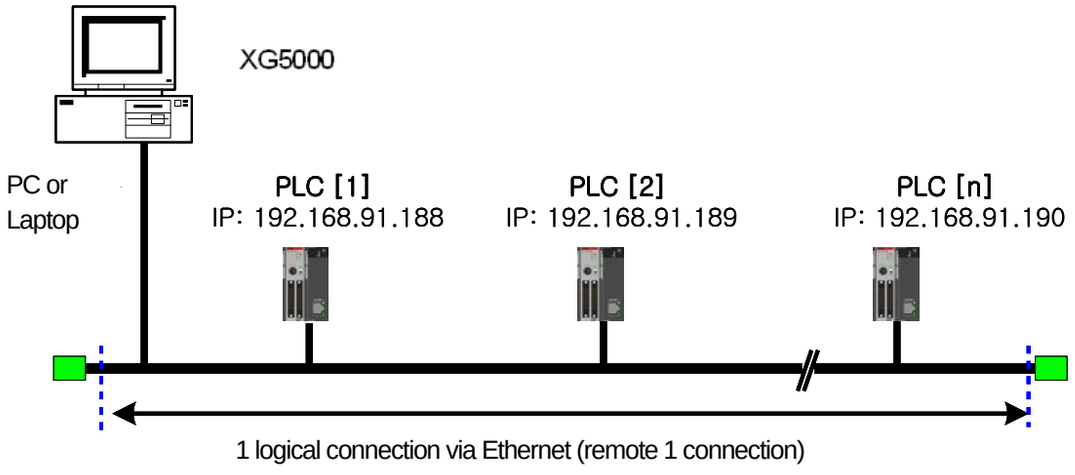
(2) Slot No. setting
In Network 2 , the position of module which installed in remote 2 station PLC (PLC B).

The position shall be inputted as Slot No.

(3) The status of finishing remote 1 is same as the logical connection status with local connection by moving RS-232C. User can use all function of online menu.

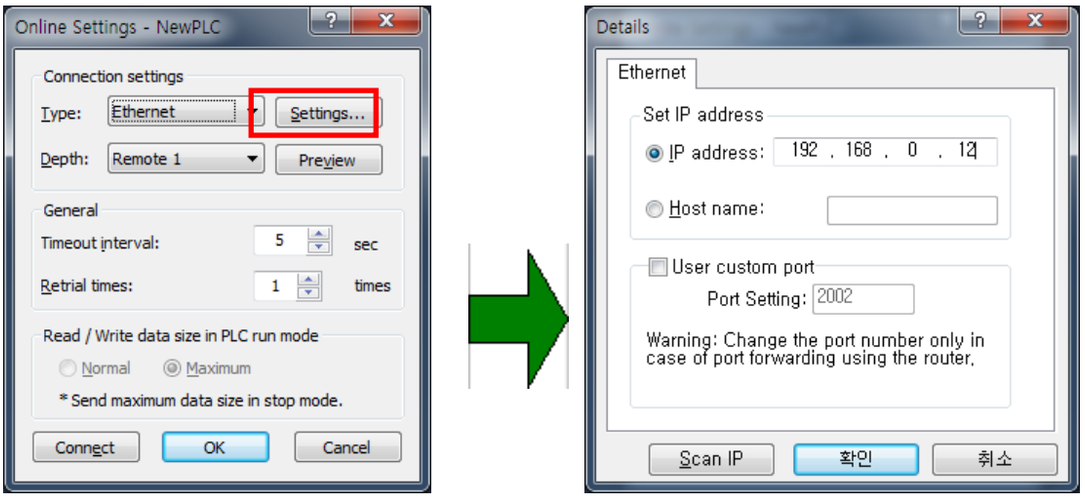
9.2.3 Direct remote 1 Connection on Ethernet connecting PC

When a PC with operating XG5000 connects to PLC on network, remote 1 by Ethernet is available without connecting RS-232C to PLC CPU.



[Fig. 9-6] Remote 1 system through PC

[Fig. 9-6] shows the status that PC and PLC are connected by Ethernet. In this case, XG5000 can connect all PCs on network without using RS-232C. Local connection is not needed, remote 1 can be executed for all PLCs.
To execute direct remote 1 through Ethernet, select connection option and change the settings as following boxes.

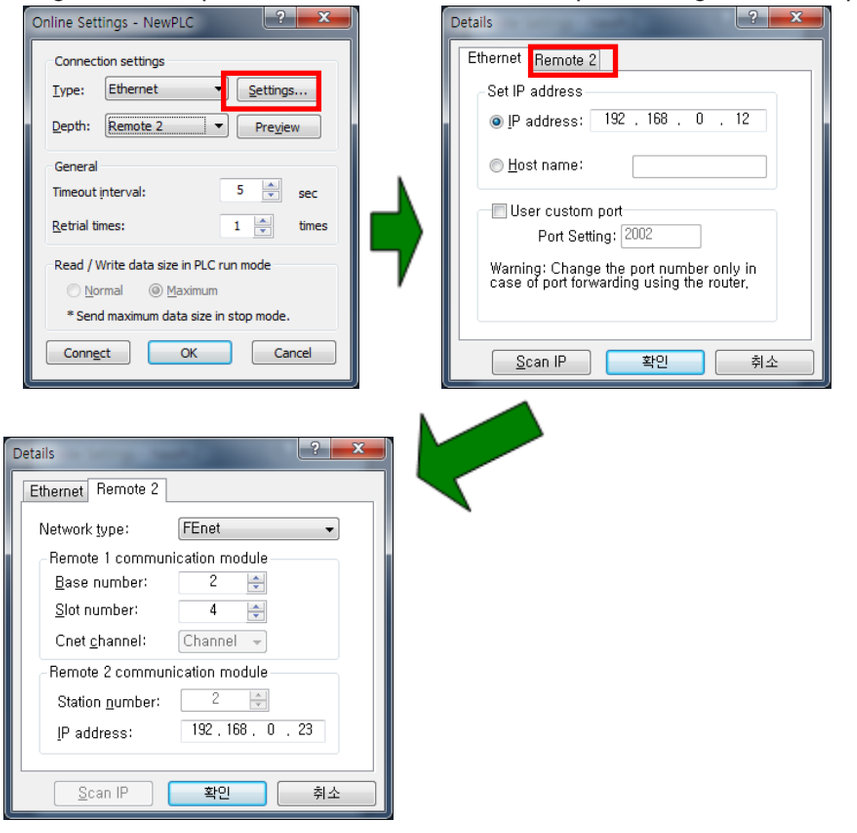


[Fig. 9-7] Direct remote 1 on PC

(1) Connecting type
Select connecting type. [Fig. 9-7] shows the Ethernet connection without using RS-232C. Select Ethernet.
(2) Connection depth
Decide remote 1 or remote 2 for the connection with PLC. In this case, select remote 1.
(3) IP address
Record IP address of FEnet I/F module for connection.
(4) After(3), all steps are same as the steps of the case using RS-232C. Select enter at this status, select connection on online menu.

9.2.4 Direct remote 2 connection on Ethernet connecting PC

Remote 2 is available by using Enet, the step is same as that of remote 1. Example of setting connection option is as following.



[Fig. 9-8] Direct remote 2 from on PC

Remark

1) Cautions for Remote 1 connection and Remote 2 connection
   (1) Following menu item can't be available when XG5000 present open project and remote 1 and 2 connected CPU type are not well matched.
      a) Program and Write each parameter
      b) Program and Read each parameter
      c) Monitor
      d) Enable Link setting
      e) I/O information
      f) Force I/O
   (2) In case of programming by connecting XG5000 as remote 1 and 2, open the right project of connecting station and then execute connection.
   (3) Remote connection provides only by remote 2. Over remote 2 is not available.
2) In case of remote connection by XGR redundant system
   (1) In case of remote connection by redundant system that performs the same service. But, in case of connect to master or stanby, connection path is same as master CPU and data transmission is established.

Chapter 10 Troubleshooting

This chapter describes defects and errors that may occur in system operation, their causes and actions to take against.
If any error occurs on XGB Fast Enet I/F module, its related details can be checked through the procedures below.
Any discretionary or disassembly is not allowed.

Error Details	Actions
RUN LED 'Off' after module powered on	1. Check if CPU unit's correctly connected with FEnet module. 2. Check the upper and lower fixing lever position. Position close after connecting module. ☞ Connecting with CPU unit is not correct, the power can be supplied and module can't operate.
	3. Check voltage (DC 24V) and capacity of power. ☞ When the consumption current of expansion module on CPU unit is over the rated capacity, module can't operate.
	4. Check if communication module is correctly recognized through XG5000. ☞ Check it by using system diagnosis.
I/F LED 'No-Flicker' or 'Off' after module powered on	1. Check if CPU unit's correctly connected with FEnet module. ☞ Connecting with CPU unit is not correct, data can't be exchanged normally.
	2. Check if communication module is correctly recognized through XG5000. ☞ Check it by using system diagnosis.
TX/RX LED 'No-Flicker' or 'Off' after network connection	1. Check communication cable and network status 2. Check if RJ45 connector connected correctly 3. Check if LINK LED flicker ☞ Connection of communication cable and RJ45 connector are not correct, Send/Receive is not available.
All LEDs 'On' after module powered on	Module malfunction, Repairs should be followed
Data Read/Write unavailable during dedicated service	1. Check communication speed (Auto/10/100M-TX). Communication speed should be same as that of destination device. ☞ When the setting communication speed is as same or Auto on network, communication is available.
	2. Check IP address setting. Valid IP address on network should be set. ☞ When IP address overlapped on network or invalid IP, communication is unavailable.
	3. Check driver (Dedicated, Modbus TCP/IP) setting ☞ Same protocol with destination device should be used.
	4. Check if IP of destination device is registered on host table. ☞ When host table is enable, IP address of destination is not registered, communication is not available.

Error Details	Actions
Send/Receive unavailable during HS link service	1. Check communication speed (Auto/10/100M-TX). Communication speed should be same as that of destination device. ☞ When the setting communication speed is as same or Auto on network, communication is available.
	2. Check IP address setting. Valid IP address on network should be set. ☞ When IP address overlapped on network or invalid IP, communication is unavailable.
	3. Check HS link parameter setting ☞ When parameter's not set, station no. is overlapped, wrong block setting, wrong block no., communication is not available.
	4. Check link enable setting ☞ With link enable setting, frame can be sent.
Send/Receive unavailable during P2P service	1. Check communication speed (Auto/10/100M-TX) ☞ When the setting communication speed is as same or Auto on network, communication is available.
	2. Check IP address setting ☞ When IP address overlapped on network or invalid IP, communication is unavailable.
	3. Check if P2P parameter setting ☞ Setting P2P parameter channel, block makes communication available.
	4. Check destination IP address in P2P channel setting ☞ When IP address of destination device is invalid, communication is not available.
	5. Check driver setting ☞ When communication protocol is same as destination device on the right channel, communication is available.
	6. Check link enable setting ☞ With link enable setting, frame can be sent.
	7. Check if operation of operation condition ☞ Setting operation condition should be 'On'.
	8. Check operation mode of CPU ☞ Operation condition of CPU should be 'RUN'.

Chapter 11 Appendix

A.1 XGB CPU Memory Device List

For up-to-date device list of each CPU, refer to relevant CPU user manual. The following contents are based on when this user manual is written.

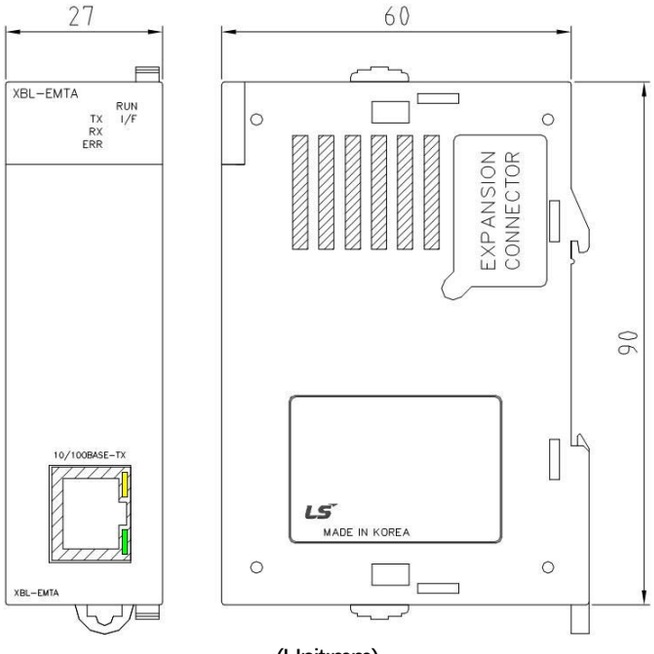
A.1.1 XBM-DXXXS and XBC-DXXXH

Area	"S" type		"H" type		Read(R)/ Write(W)/ Monitor(M)	Reference
	Range	Size (Word)	Range	Size (Word)		
P	P0~P127	128	P0~P1023	1024	R/W/M available	I/O
M	M0~M255	256	M0~M1023	1024	R/W/M available	
K	K0~K2559	2560	K0~K4095	4096	R/W/M available	PID, positioning
F	F0~F255	256	F0~F1023	1024	R/M available	System flag
T	T0~T255	256	T0~T1023	1024	R/W/M available	Timer
C	C0~C255	256	C0~C1023	1024	R/W/M available	Counter
L	L0~L1279	1280	L0~L2047	2048	R/W/M available	HS link flag, P2P flag
N	N0~N3935	3936	N0~N5119	5120	R/M available	P2P parameter (XG5000 setting)
D	D0~D5119	5120	D0~D10239	10240	R/W/M available	
U	U00.00~U07.31	256	U00.00~ U0A.31	352	R/W/M available	Analog data refresh area
Z	Z0~Z127	128	Z0~Z127	128	R/W/M available	
R	-	-	R0 – R10239	10240	R/W/M available	

A.1.2 XEC-DXXXH

Local device type			Size	Range	Read(R)/ Write(W)/ Monitor(M)	Reference
Memory	Input variable(I)		2KB	%IW0.0.0~%IW15.15.3	R/W/M available	
	Output variable(Q)		2KB	%QW0.0.0~%QW15.15.3	R/W/M available	
	Direct variable	M	16KB	%MW0~%MW8191	R/W/M available	
		R	10KB	%RW0~%RW10239	R/W/M available	
		W	10KB	%WW0~%WW10239	R/W/M available	Same area as R
	Flag variable	F	2KB	%FW0~%FW1023	R/M available	System flag
		K	8KB	%KW0~%KW4095	R/W/M available	PID, Positioning
		L	4KB	%LW0~%LW2047	R/W/M available	HS link flag, P2P flag
		N	10KB	%NW0~%NW5119	R/M available	P2P parameter (XG5000 setting)
		U	1KB	%UW0.0.0~%UW0.15.31	R/W/M available	Analog data refresh area (16 slot, 32 word)

A.2 Dimension



(Unit:mm)

A.3 Terminology

This chapter describes about the general terminology of FEnet I/F module. For more detail, refer to professional book on the Ethernet

1. IEEE 802.3

IEEE 802.3 specifies standards for CSMA/CD based Ethernet. Exactly it is a LAN based on CSMA/CD (Carrier Sense Multiple Access with Collision Detection) Ethernet designed by IEEE 802.3 group, which is classified into detailed projects as specified below;

A) IEEE P802.3 - 10G Base T study Group
B) IEEE P802.3ah - Ethernet in the First Mile Task Force
C) IEEE P802.3ak - 10G Base-CX4 Task Force

※ Ethernet and IEEE 802.3 are standardized at RFC894 and RFC1042 so each should process another frame.

2. ARP (Address Resolution Protocol)

Protocol to search for MAC address by means of correspondent IP address on the Ethernet LAN

3. Bridge

A device used to connect two networks so to be operated as one network. Bridge is used not only to connect two different types of networks but also to divide one big network into two small networks in order to increase the performance

4. Client

A user of the network service, or a computer or program (mainly the one requesting services) using other computer's resource.

5. CSMA/CD(Carrier Sense Multiple Access with Collision Detection)

Each client checks if there is any sign prior to transmission of data to the network (Carrier Sense) and then sends its data when the network is empty. At this time, all the clients have the equal right to send (Multiple Access). If two or more clients send data, collision may occur. The client who detects the collision tries to send again in a specific time.

6. DNS (Domain Name System)

A method used to convert alphabetic Domain Name on the Internet to its identical Internet number (namely, IP address)

7. Dot Address

Shows IP address of '100.100.100.100', where each figure is displayed in decimal with 1 byte occupied respectively for 4 bytes in total.

8. E-mail Address

The address of the user with login account for the specific machine connected via the Internet. Usually user's ID @ domain name (machine name) is assigned. In other words, it will be like hjjee@microsoft.com, where @ is called as 'at' displayed with shift+2 pressed on the keyboard. The letters at the back of @ are for the domain name of specific company (school, institute,..) connected with the Internet, and the letters in front of @ are for the user ID registered in the machine. The last letters of the domain name are for the highest level. USA generally uses the following abbreviation as specified below, and Korea uses .kr to stand for Korea. .com : usually for companies) / .edu : usually for educational organizations such as universities. / .ac(academy) is mostly used in Korea / .gov : for governmental organizations. For example, nasa.gov is for NASA (government) / .mil : military related sites. For example, af.mil is for USA air force (military)/ .org : private organizations / .au : Australia / .uk : the United Kingdom / .ca : Canada / .kr : Korea / .jp : Japan / .fr : France / .tw : Taiwan, etc.

9. Ethernet

A representative LAN connection system (IEEE 802.3) developed by Xerox, Intel and DEC of America which can send about 10Mbps and use the packet of 1.5kB. Since Ethernet can allow various types of computers to be connected as one via the network, it has been called a pronoun of LAN as a universal standard with various products available, not limited to some specific companies.

10. FTP (File Transfer Protocol)

An application program used to transfer files between computers among application programs providing TCP/IP protocol. If an account is allowed to the computer to log in, fast log in the computer is available wherever the computer is so to copy files.

11. Gateway

Software/Hardware used to translate for two different protocols to work together, which is equivalent to the gateway necessary to exchange information with the different system.

12. Header

Part of the packet including self station number, correspondent station number and error checking area.

13. HTML

Hypertext Markup Language, standard language of WWW. In other words, it is a language system to prepare Hypertext documents. The document made of HTML can be viewed through the web browser

14. HTTP

Hypertext Transfer Protocol, standard protocol of WWW. It is a protocol supporting the hypermedia system.

15. ICMP (Internet Control Message Protocol)

An extended protocol of IP address used to create error messages and test packets to control the Internet.

16. IP (Internet Protocol)

Protocol of network layers for the Internet

17. IP Address

Address of respective computers on the Internet made of figures binary of 32 bits (4 bytes) to distinguish the applicable machine on the Internet. Classified into 2 sections, network distinguishing address and host distinguishing address. The network address and the host address is respectively divided into class A, B and C based on the bits allotted. IP address since it shall be unique all over the world, shall be decided not optionally but as assigned by NIC(Network Information Center) of the applicable district when joining the Internet. In Korea, KRNIC(Korea Network Information Center) is in charge of this work. Ex.) 165.244.149.190

18. ISO (International Organization for Standardization)

A subsidiary organization of UN establishing and managing the international standards

19. LAN (Local Area Network)

Called also as local area communication network or district information communication network, which allows lots of computers to exchange data with each other as connected though communication cable within a limited area such as in an office or a building

20. MAC (Medium Access Control)

A method used to decide which device should use the network during given time on the broadcast network

21. Node

Each computer connected with the network is called Node

22. Packet

A package of data which is the basic unit used to send through the network. Usually the package is made of several tens or hundreds of bytes with the header attached in front to which its destination and other necessary information are added

23. PORT number

Used to classify the applications on TCP/UDP.
Ex.) 21/tcp : Telet

24. PPP (Point-to-Point Protocol)

Phone communication protocol which allows packet transmission in connecting with the Internet. In other words, normal phone cable and modem can be used for the computer to connect through TCP/IP with this most general Internet protocol.
Similar to SLIP, however with modern communication protocol factors such as error detection and data compression, it demonstrates more excellent performance than SLIP.

25. Protocol

Contains regulations related with mutual information transmission method between computers connected with each other through the network. The protocol may specify detailed interface between machines in Low level (for example, which bit/byte should go out through the line) or high level of message exchange regulations as files are transferred through the Internet.

26. Router

A device used to transfer the data packet between the networks. It sends the data packet to its final destination, waits if the network is congested, or decides which LAN is good to connect to at the LAN junction. Namely, it is a special computer/software used to control the two or more networks connected.

27. Server

The side which passively responds to the client's request and shares its resources.

28. TCP (Transmission Control Protocol)

A transport layer protocol for the Internet
- Data Tx/Rx through connection
- Multiplexing
- Transmission reliable
- Emergent data transmission supported

29. TCP/IP (Transmission Control Protocol/Internet Protocol)

Transmission protocol used for communication among different kinds of computers, which makes the communication available between general PC and medium host, IBM PC and MAC, and medium or large-sized different types of computer. It is also used as a general term for information transmission protocol between computer networks including FTP, Telnet, SMTP, etc. TCP divides data into packets to send through IP and the packets sent will be united back together through TCP.

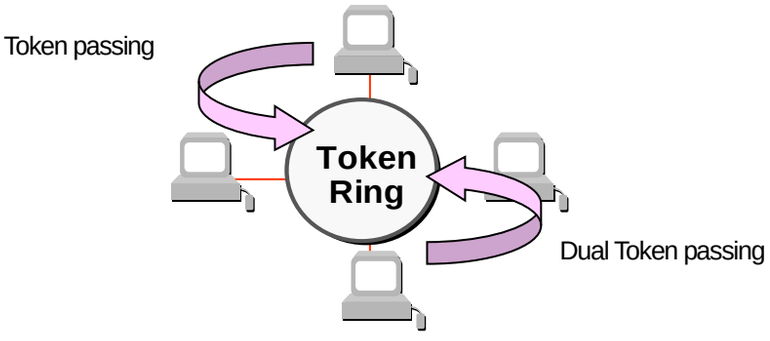
30) Telnet

It means remote login via Internet. To login to remote host via TELNET, account of that host is necessary. But for some hosts providing public service, you can connect without account

31) Token Ring

As short-distance network using Token to connect to network having physical ring structure, one of the Node connection methods at network. If node sending data gets Token, then node gets right to send message packet. Realistically structured examples are IEEE 802.5, ProNet-1080 and FDDI. Terms called Token is used as IEEE 802.5

.



32) UDP(User Datagram Protocol)

A transport layer protocol for the Internet

- High speed communication because of communication without connection
- Multiplexing
- Lower reliability than TCP in transmission (Tough data doesn't arrive, it doesn't send data again)

33) Auto-Negotiation

This is process making the Ethernet devices exchange the information on the performance such as operating speed and duplex mode

1. Detects reason why connection is refused
2. Determines the performance of network device
3. Changes the connection speed

34) FDDI(Fiber Distributed Data Interface)

Based on optical cable, provides 100Mbps, Shared Media Network as Dual Ring method, Token Passing is done in two-way.

Max 200Km distance for entire network, Max 2Km between Nodes, Max 500 nodes. Generally, this used as Backbone Network.

35) Reset

This is function used when you want to initialize the communication module to clear the error

Select [Online] → [Reset/clear] → [PLC reset] in the XG5000

If you execute this function, PLC will restart.

A.4 Flag List

(1) Communication relay(L)

HS link number 1~2

Device	IEC type	Keyword	Type	Detail	Description
L00000	%LX000	_HS1_RLINK	Bit	HS link parameter No.1's all stations normally operates	Displays all stations normally operated as specified in HS link parameter, which will be On if 1.There is no error with all stations specified in parameter in RUN mode 2. All data block is in normal communication as specified in parameter. 3. The parameter specified in each station itself is in normal communication. Run_link will be kept On if once On until stopped by disabling link.
L00001	%LX001	_HS1_LTRBL	Bit	After _HS1RLINK is ON, displays abnormal status	This flag will be On if the station specified in parameter and the data block's communication status are as described below with _HSmRLINK flag On,. 1. when the station specified in parameter is not in RUN mode, 2. when the station specified in parameter is in error, 3. when data block's communication status specified in parameter is unstable, The link trouble will be On if one of those conditions 1,2 and 3 above occurs. And if such a condition is back to normal, it will be Off.
L00020 ~ L0005F	%LX032 ~ %LX095	_HS1_STATE[k]	Bit Array	Displays HS link parameter No.1, Block No.k's general status	Displays the general status of the communication information for the specified parameter's respective data blocks. HS1STATE[k]=HS1MOD[k]&_HS1TRX[k]&(~_HSmERR[k])
L00060 ~ L0009F	%LX096 ~ %LX159	_HS1_MOD[k]	Bit Array	HS link parameter No.1, Block No.k station's Run operation mode	Displays the operation mode of the station specified in parameter's data block k.
L00100 ~ L0013F	%LX160 ~ %LX223	_HS1_TRX[k]	Bit Array	Displays normal communication with HS link parameter No.1, Block No.k station	Displays the communication status of parameter's data block k to check if normal as specified.
L00140 ~ L0017F	%LX224 ~ %LX287	_HS1_ERR[k]	Bit Array	HS link parameter No.1, Block No.k station's Run error mode	Displays the communication status of parameter's data block k to check for any error.
L00180 ~ L0021F	%LX288 ~ %LX767	_HS1_SETBLOCK[K]	Bit Array	Displays HS link parameter No.1, Block No.k setting	Displays the setting status of parameter's data block k.

[Table A.1] List of communication flags based on HS link number

HS link No.	L area address	IEC type	Remarks
2	L0260~ L047F	%LX416~ %LX767	In order to use HS link flag for program and monitoring, use the flag map registered in XG5000 for convenient application.

K as a block number, information on the 64 blocks (00~63) will be displayed through 4 words, 16 per each word.

For example, mode information (_HS1MOD) of block 0~15, 16~31, 32~47, 48~63 will be displayed in the L0006, L0007, L0008, L0009. So the mode information of the block 55 is displayed in the L00097.

P2P parameter : 1~3, P2P block : 0~31

Device	IEC type	Keyword	Type	Detail	Description
L5120	%LX8192	_P2P1_NDR00	Bit	P2P parameter No.1, block No.00 service is completed normally	P2P parameter No.1, block No.0 service is completed normally
L5121	%LX8193	_P2P1_ERR00	Bit	P2P parameter No.1, block No.00 service is completed abnormally	P2P parameter No.1, block No.0 service is completed abnormally
L513	%LW513	_P2P1_STATUS00	Word	Error code if P2P parameter No.1, block No.00 service is completed abnormally	Displays Error code if P2P parameter No.1, block No.0 service is completed abnormally
L514	%LD257	_P2P1_SVCCNT00	DWord	P2P parameter No.1, block No.00 service normal execution times	Displays P2P parameter No.1, block No.0 service normal execution times
L516	%LD258	_P2P1_ERRCNT00	DWord	P2P parameter No.1, block No.00 service abnormal execution times	Displays P2P parameter No.1, block No.0 service abnormal execution times
L5180	%LX8288	_P2P1_NDR01	Bit	P2P parameter No.1, block No.01 service is completed normally	P2P parameter No.1, block No.1 service is completed normally
L5181	%LX8289	_P2P1_ERR01	Bit	P2P parameter No.1, block No.01 service is completed abnormally	P2P parameter No.1, block No.1 service is completed abnormally
L519	%LW519	_P2P1_STATUS01	Word	Error code if P2P parameter No.1, block No.01 service is completed abnormally	Displays error code if P2P parameter No.1, block No.1 service is completed abnormally
L520	%LD260	_P2P1_SVCCNT01	DWord	P2P parameter No.1, block No.01 service normal execution times	Displays P2P parameter No.1, block No.1 service normal execution times
L522	%LD264	_P2P1_ERRCNT01	DWord	P2P parameter No.1, block No.01 service abnormal execution times	Displays P2P parameter No.1, block No.1 service abnormal execution times

[Table 2] List of communication flags based on P2P service setting

(2) Network device (N) list

P2P parameter: 1~3, P2P block: 0~31

Device	IEC type	Keyword	Type	Detail	Description
N0000	%NW00	_P1B00SN	Word	P2P parameter No.1, block No.00 destination station No.	Saves P2P parameter No.1, block No.00 destination station number
N0001~ N0004	%NW01~ %NW05	_P1B00RD 1	Device structure	P2P parameter No.1, block No.00 Read area device 1	Saves P2P parameter No.1, block No.00 Read area device 1
N0005	%NW06	_P1B00RS1	Word	P2P parameter No.1, block No.00 Read area size 1	Saves P2P parameter No.1, block No.00 Read area size 1
N0006~ N0009	%NW07~ %NW11	_P1B00RD 2	Device structure	P2P parameter No.1, block No.00 Read area device 2	Saves P2P parameter No.1, block No.00 Read area device 2
N0010	%NW12	_P1B00RS2	Word	P2P parameter No.1, block No.00 Read area size 2	Saves P2P parameter No.1, block No.00 Read area size 2
N0011~ N0014	%NW13~ %NW17	_P1B00RD 3	Device structure	P2P parameter No.1, block No.00 Read area device 3	Saves P2P parameter No.1, block No.00 Read area device 3
N0015	%NW18	_P1B00RS3	Word	P2P parameter No.1, block No.00 Read area size 3	Saves P2P parameter No.1, block No.00 Read area size 3
N0016~ N0019	%NW19~ %NW23	_P1B00RD 4	Device structure	P2P parameter No.1, block No.00 Read area device 4	Saves P2P parameter No.1, block No.00 Read area device
N0020	%NW24	_P1B00RS4	Word	P2P parameter No.1, block No.00 Read area size 4	Saves P2P parameter No.1, block No.00 area size 4 to read saved
N0021~ N0024	%NW25~ %NW29	_P1B00WD 1	Device structure	P2P parameter No.1, block No.00 Save area device 1	Saves P2P parameter No.1, block No.00 Save area device 1
N0025	%NW30	_P1B00WS 1	Word	P2P parameter No.1, block No.00 Save area size 1	Saves P2P parameter No.1, block No.00 Save area size 1
N0026~ N0029	%NW31~ %NW35	_P1B00WD 2	Device structure	P2P parameter No.1, block No.00 Save area device 2	Saves P2P parameter No.1, block No.00 Save area device 2
N0030	%NW36	_P1B00WS 2	Word	P2P parameter No.1, block No.00 Save area size 2	Saves P2P parameter No.1, block No.00 Save area size 2
N0031~ N0034	%NW37~ %NW41	_P1B00WD 3	Device structure	P2P parameter No.1, block No.00 Save area device 3	Saves P2P parameter No.1, block No.00 Save area device 3
N0035	%NW42	_P1B00WS 3	Word	P2P parameter No.1, block No.00 Save area size 3	Saves P2P parameter No.1, block No.00 Save area size 3
N0036~ N0039	%NW43~ %NW47	_P1B00WD 4	Device structure	P2P parameter No.1, block No.00 Save area device 4	Saves P2P parameter No.1, block No.00 Save area device 4
N0040	%NW48	_P1B00WS 4	Word	P2P parameter No.1, block No.00 Save area size 4	Saves P2P parameter No.1, block No.00 Save area size 4

Device	IEC type	Keyword	Type	Detail	Description
N00041	%NW49	_P1B01SN	Word	P2P parameter No.1, block No.01 destination station No.	Saves P2P parameter No.1, block No.01 destination station number
N00042 ~ N00045	%NW50~ %NW54	_P1B01RD 1	Device structure	P2P parameter No.1, block No.01 Read area device 1	Saves P2P parameter No.1, block No.01 Read area device 1
N00046	%NW55	_P1B01RS 1	Word	P2P parameter No.1, block No.01 Read area size 1	Saves P2P parameter No.1, block No.01 Read area size 1
N00047 ~ N00050	%NW56~ %NW60	_P1B01RD 2	Device structure	P2P parameter No.1, block No.01 Read area device 2	Saves P2P parameter No.1, block No.01 Read area device 1
N00051	%NW61	_P1B01RS 2	Word	P2P parameter No.1, block No.01 Read area size 2	Saves P2P parameter No.1, block No.01 Read area size 2
N00052 ~ N00055	%NW62~ %NW66	_P1B01RD 3	Device structure	P2P parameter No.1, block No.01 Read area device 3	Saves P2P parameter No.1, block No.01 Read area device 3
N00056	%NW67	_P1B01RS 3	Word	P2P parameter No.1, block No.01 Read area size 3	Saves P2P parameter No.1, block No.01 Read area size 3
N00057 ~ N00060	%NW68~ %NW72	_P1B01RD 4	Device structure	P2P parameter No.1, block No.01 Read area device 4	Saves P2P parameter No.1, block No.01 Read area device 4
N00061	%NW73	_P1B01RS 4	Word	P2P parameter No.1, block No.01 Read area size 4	Saves P2P parameter No.1, block No.01 Read area size 4
N00062 ~ N00065	%NW74~ %NW78	_P1B01WD 1	Device structure	P2P parameter No.1, block No.01 Save area device 1	Saves P2P parameter No.1, block No.01 Save area device 1
N00066	%NW79	_P1B01WS 1	Word	P2P parameter No.1, block No.01 Save area size 1	Saves P2P parameter No.1, block No.01 Save area size 1 saved
N00067 ~ N00070	%NW80~ %NW84	_P1B01WD 2	Device structure	P2P parameter No.1, block No.01 Save area device 2	Saves P2P parameter No.1, block No.01 Save area device 2 saved
N00071	%NW85	_P1B01WS 2	Word	P2P parameter No.1, block No.01 Save area size 2	Saves P2P parameter No.1, block No.01 Save area size 2 saved
N00072 ~ N00075	%NW86~ %NW90	_P1B01WD 3	Device structure	P2P parameter No.1, block No.01 Save area device 3	Saves P2P parameter No.1, block No.01 Save area device 3
N00076	%NW91	_P1B01WS 3	Word	P2P parameter No.1, block No.01 Save area size 3	Saves P2P parameter No.1, block No.01 Save area size 3
N00077 ~ N00080	%NW92~ %NW96	_P1B01WD 4	Device structure	P2P parameter No.1, block No.01 Save area device 4	Saves P2P parameter No.1, block No.01 Save area device 4
N00081	%NW97	_P1B01WS 4	Word	P2P parameter No.1, block No.01 Save area size 4	Saves P2P parameter No.1, block No.01 Save area size 4 saved

[Table A.4.3] Communication device list based on the P2P number

Note

1) N area is set automatically if you set the P2P parameter by XG5000
2) N area is flash area and you can use it as the internal device.

A.5 ASCII code table

American National Standard Code for Information Interchange

ASCII code		Value	ASCII code		Value	ASCII code		Value	ASCII code		Value
Hex	Dec		Hex	Dec		Hex	Dec		Hex	Dec	
00	000	NULL	40	064	@	20	032	(space)	60	096	`
01	001	SOH	41	065	A	21	033	!	61	097	a
02	002	STX	42	066	B	22	034	"	62	098	b
03	003	ETX	43	067	C	23	035	#	63	099	c
04	004	EQT	44	068	D	24	036	$	64	100	d
05	005	ENQ	45	069	E	25	037	%	65	101	e
06	006	ACK	46	070	F	26	038	&	66	102	f
07	007	BEL	47	071	G	27	039	'	67	103	g
08	008	BS	48	072	H	28	040	(	68	104	h
09	009	HT	49	073	I	29	041	)	69	105	i
0A	010	LF	4A	074	J	2A	042	*	6A	106	j
0B	011	VT	4B	075	K	2B	043	+	6B	107	k
0C	012	FF	4C	076	L	2C	044	`	6C	108	l
0D	013	CR	4D	077	M	2D	045	-	6D	109	m
0E	014	SO	4E	078	N	2E	046	.	6E	110	n
0F	015	SI	4F	079	O	2F	047	/	6F	111	o
10	016	DLE	50	080	P	30	048	0	70	112	p
11	017	DC1	51	081	Q	31	049	1	71	113	q
12	018	DC2	52	082	R	32	050	2	72	114	r
13	019	DC3	53	083	S	33	051	3	73	115	s
14	020	DC4	54	084	T	34	052	4	74	116	t
15	021	NAK	55	085	U	35	053	5	75	117	u
16	022	SYN	56	086	V	36	054	6	76	118	v
17	023	ETB	57	087	W	37	055	7	77	119	w
18	024	CAN	58	088	X	38	056	8	78	120	x
19	025	EM	59	089	Y	39	057	9	79	121	y
1A	026	SUB	5A	090	Z	3A	058	:	7A	122	z
1B	027	ESC	5B	091	[	3B	059	;	7B	123	{
1C	028	FS	5C	092	\	3C	060	<	7C	124	|
1D	029	GS	5D	093	]	3D	061	=	7D	125	}
1E	030	RS	5E	094	^	3E	062	>	7E	126	~
1F	031	US	5F	095	_	3F	063	?	7F	127	□

A.6 Comparison Table of Ethernet Technology

Technology		Speed (Mbps)	Transmission Media	Max. Distance
Token Ring		4,16	UTP	100m
Ethernet	10BASE-T	10	UTP	100m
	10BASE-F(Multi Mode)	10	Optical Cable	Max. 2km
	10BASE-F(Single Mode)	10	Optical Cable	Max.2.5km
	10BASE-5	10	Coaxial Cable	500m
	10BASE-2	10	Coaxial Cable	185m
Fast Ethernet	100BASE-T4	100	UTP	100m
	100BASE-TX	100	UTP	100m
	100BASE-FX(Multi Mode)	100	Optical Cable	412m(Half Duplex) 2km(Full Duplex)
	100BASE-FX(Single Mode)	100	Optical Cable	20km
Gigabit Ethernet	1000BASE-T	1000	UTP	100m
	100BASE-FX(Single Mode)	1000	Optical Cable	3km
	100BASE-FX(Multi Mode)	1000	Optical Cable	500m
	100BASE-T	1000	Coaxial Cable	25m
100VG-AnyLAN		100	UTP	-
ATM		155-622	UTP, Optical Cable	-
FDDI(Single Mode)		100	Optical Cable	40-60km
FDDI(Multi-Mode)		100	Optical Cable	2km

Warranty

1. Warranty Period

The product you purchased will be guaranteed for 18 months from the date of manufacturing.

2. Scope of Warranty

Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

(1) Any trouble attributable to unreasonable condition, environment or handling otherwise specified in the manual,
(2) Any trouble attributable to others' products,
(3) If the product is modified or repaired in any other place not designated by the company,
(4) Due to unintended purposes
(5) Owing to the reasons unexpected at the level of the contemporary science and technology when delivered.
(6) Not attributable to the company; for instance, natural disasters or fire

3. Since the above warranty is limited to PLC unit only, make sure to use the product considering the safety for system configuration or applications.

Environmental Policy

LS ELECTRIC Co., Ltd supports and observes the environmental policy as below.

Environmental Management

LS ELECTRIC considers the environmental preservation as the preferential management subject and every staff of LS ELECTRIC use the reasonable endeavors for the pleasurably environmental preservation of the earth.

About Disposal

LS ELECTRIC PLC unit is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin (cover) from the product as they are reusable.



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