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Programmable Logic Control

Fnet I/F Module

XGT Series

User Manual

XGL-FMEA



Safety Instructions


- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.


LS ELECTRIC

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 may cause 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 or operation.

- ▶ **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 instruction may cause malfunctions from noise

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 | Details | Page |
|---------|---------|---|----------|
| V 1.0 | '10. 5 | First Edition | - |
| V 1.1 | '11. 5 | How to enable link through flag added | CH 5.2 |
| V1.2 | '13. 03 | Modify cable joint method | CH 2.4.2 |
| V 1.3 | '15. 01 | XG5000 V4.0 UI Updated | - |
| V1.4 | '20.05 | Format and contents modification according to the change of company name(LSIS -> LS ELECTRIC) | |
| V1.5 | '23.05 | Modify cable joint method | CH 2.4.2 |

Thank you for 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.lselectric.co.kr/>) and download the information as a PDF file.

Relevant User's Manuals

| Title | Description | Manual number |
|--|--|---------------|
| XG5000 User's Manual (for XGK, XGB) | 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 |
| XGK CPU User's Manual (XGK-CPUA/CPUE/CPUH/CPUS/CPUU) | XGK-CPUA/CPUE/CPUH/CPUS/CPUU user manual describing about XGK CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard | 10310000508 |
| XGI CPU User's Manual (XGI-CPUU) | XGI-CPUU user manual describing about XGK CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard | 10310000832 |
| XGR redundant series User's Manual | XGR-CPUU user manual describing about XGR CPU module, power module, extension drive, base, IO module, specification of extension cable and system configuration, EMC standard | 10310000694 |

This manual is written based on the following version.

OS version of related product

| Product name | OS version |
|----------------------------------|------------|
| XGK-CPUH, CPUS, CPUA, CPUE, CPUU | V2.2 |
| XGI-CPUU, CPUH | V2.1 |
| XGR-CPUH/F, CPUH/T | V1.8 |
| XG5000 | V4.01 |

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Chapter 1 Overview

1.1 Overview

This User's Manual describes the Fnet Module (hereinafter, shall be referred to "XGT Fnet I/F") which is a fieldbus network of XGT series exclusively for LS ELECTRIC. While the XGT Fnet I/F module operates in the same principle as the Fnet system of the conventional GM/MK series, only a portion of the functions are supported. The Fnet system enables efficient data exchange between our PLCs, therefore, can conveniently connect existing GM/MK system and XGT system with high speed link communication. The Fnet I/F module, exclusive LS ELECTRIC network, supports maximum 64 stations including master, and it enables parameter setting using XG5000 for data communication, providing the users with convenience. The Fnet system normally uses electric cables, however, electrical/optic repeaters are provided for long distance systems and high reliability. This enables the users to construct system of diversified configuration.

In the programming work, please refer to following documents in addition.

- XG5000 User's Manual
- XGK Instruction List
- XGK User's Manual
- XGK/XGR Instruction List
- XGI User's Manual
- XGR User's Manual

Following basic specifications apply to the configuration of a XGT Fnet I/F module system.

- XGT PLC XG5000 Programming Tool: V3.7 or newer
- XGT Fnet I/F Module O/S : V1.0 or newer

1.2 Characteristics of XGT Fnet I/F Module and difference from GM/MK Fnet

1.2.1 Characteristics of XGT Fnet I/F Module

The XGT Fnet I/F module has following features.

- ▶ Exclusive network
- ▶ Convenience due to high speed link parameter setting
- ▶ Electrical/optic repeater option provided
- ▶ Reduced wiring/installation work
- ▶ Up to 12 units on one base
- ▶ Network compatibility with GM/MK series

1.2.2 Difference from GM/MK Fnet

The XGT Fnet I/F module has following differences in its functions from those of the conventional GM/MK Fnet I/F module.

| Function | XGT Fnet I/F | GM/MK Fnet | Remark |
|---------------------------------|---------------|-----------------|---|
| High speed link | Supported | Supported | Refer to XGT Fnet Detail Specifications : 2.2 |
| Function block service | Not supported | Supported | |
| Remote access service | Not supported | Supported | |
| Available communication station | Local | Local/Remote | |
| Communication setting method | XG5000 | GMWIN / KGL-WIN | |

1.3 Product Information

1.3.1 Models

| Classification | Connection Cable | Model | Description | Remark |
|---------------------------------|------------------------------|--|--|--------------------------------------|
| Master Module | Twist pair (Electric) | XGL-FMEA | Fnet Master Module for XGT | Mountable on base for XGT |
| | Twist pair (Electric)/ Optic | G3L-FUEA | GM3/K1000S Fnet (Electric) | Mountable on the base for GM3/K1000S |
| | | G3L-FUOA | GM3/K1000S Fnet (Optic) | |
| | | G4L-FUEA | GM4/K300S Fnet (Electric) | Mountable on the base for GM4/K300S |
| | | G4L-FUOA | GM4/K300S Fnet (Optic) | |
| | | G6L-FUEA | GM6/K200S Fnet (Electric) | Mountable on the base for GM6/K200S |
| | G7L-FUEA | GM7 Fnet (Electric)) | Connect with GM7 using extension cable | |
| Repeater | GOL-FREB | Cable extension (750m) module | Can be used independently | |
| Signal Converter | GOL-FOEA | Optic↔Electric signal converter module | Can be used independently | |
| Optic Splitter (Active Coupler) | GOL-FABA | Base module | - | |
| | GOL-FAPA | Power module | - | |
| | GOL-FACA | Optic I/F Module | - | |
| | GOL-FADA | Dummy module | - | |

1.3.2 Maximum Number of Mounting per CPU

Maximum 12 Fnet I/F Modules can be mounted regardless of main or expansion base. To implement the best performance of communication module, it is recommended to mount on the main base. The table below presents the services available based on CPU type. Apply the specification in system configuration considering the number of the communication modules.

| Classification | XGK | | | | | XGI | | | XGR | |
|-------------------------------------|------------|------|------|------|------|------------|------|------|------------|--------|
| | CPUH | CPUU | CPUA | CPUS | CPUE | CPUU | CPUH | CPUS | CPUH/T | CPUH/F |
| High speed Link Modules Used (Max.) | 12 modules | | | | | 12 modules | | | 12 modules | |

Note

- (1) Optic splitters are also called active couplers.
- (2) Since 8 GOL-FACA units can be installed to an optic splitter, 3 GOL-FADAs (dummy module) are required to install 5 GOL-FACA units.
- (3) Mounting position of Fnet I/F module according to the CPU type
 - For the XGK/XGI CPU series, the Fnet I/F module can be mounted on both main and extension base.
 - For the XGR CPU series, the Fnet I/F module can be mounted on an extension base only.

Chapter 2 Product Specification

2.1 General Specifications

Table 2.1 presents the general specifications of the XGT series.

| No. | Items | Specifications | Related standards | | | |
|-----------------|----------------------------|--|---------------------------|---------------------|---|----------------------------|
| 1 | Ambient temperature | 0 ~ 55 °C | | | | |
| 2 | Storage temperature | -25 ~ +70 °C | | | | |
| 3 | Ambient humidity | 5 ~ 95%RH (Non-condensing) | | | | |
| 4 | Storage humidity | 5 ~ 95%RH (Non-condensing) | | | | |
| 5 | Vibration resistance | Occasional vibration | | | 10 times each directions (X, Y and Z) | IEC61131-2 |
| | | Frequency | Acceleration | Amplitude | | |
| | | 5 ≤ f < 8.4Hz | – | 3.5mm | | |
| | | 8.4 ≤ f ≤ 150Hz | 9.8m/s ² (1G) | – | | |
| | | Continuous vibration | | | | |
| | | Frequency | Acceleration | Amplitude | | |
| | | 5 ≤ f < 8.4Hz | – | 1.75mm | | |
| 8.4 ≤ f ≤ 150Hz | 4.9m/s ² (0.5G) | – | | | | |
| 6 | Shock resistance | <ul style="list-style-type: none"> • Peak acceleration: 147 m/s²(15G) • Duration: 11ms • Half-sine, 3 times each direction per each axis | IEC61131-2 | | | |
| 7 | Noise resistance | Square wave impulse noise | AC: ±1,500V DC: ±900V | | LS ELECTRIC standard | |
| | | Electrostatic discharge | 4.0kV (Contact discharge) | | IEC61131-2 IEC61000-4-2 | |
| | | Radiated electromagnetic field noise | 80 ~ 1,000 MHz, 10V/m | | IEC61131-2, IEC61000-4-3 | |
| | | Fast transient/bust noise | Segment | Power supply module | Digital/analog input/output communication interface | IEC61131-2 IEC61000-4-4 |
| Voltage | 2kV | | 1kV | | | |
| 8 | Environment | Free from corrosive gasses and excessive dust | | | | |
| 9 | Altitude | Up to 2,000 ms | | | | |
| 10 | Pollution degree | 2 or less | | | | |
| 11 | Cooling | Air-cooling | | | | |

[Table 2.1.1] General Specifications

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 Performance Specifications

The specifications for the Fnet I/F Module system configuration are as follows.
Please refer to Table 2.2.1 below for system configuration.

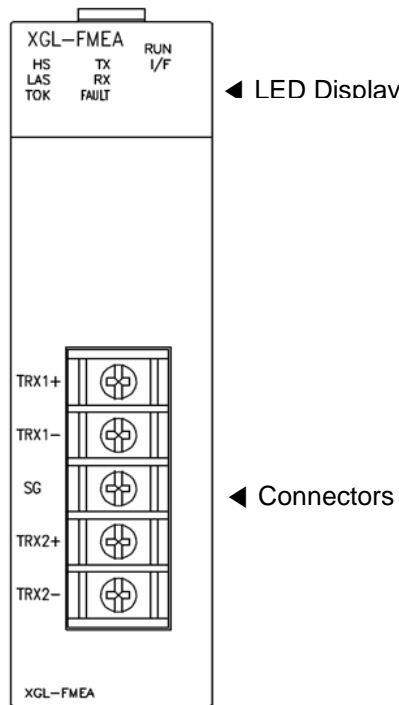
[Table 2.2.1] Performance Specifications

| Classification | | Specification |
|-------------------------------------|---------------------------------|--|
| Baudrate | | 1Mbps |
| Max. Transmission Distance | Segment | Max. 750m |
| | Network | Max. 750m + 6 repeaters (750m*6)= 5.25km - Repeater expansion length: 750m |
| Cable | | Twist pair shield cables. - LIREV-AMESB 1Px22AWG (7/0.254): LS Cable |
| Max. No. Stations | Network | 64 stations |
| | Segment | 32 stations - Use repeaters for 32 or more stations |
| Diagnostics Function | | XG5000: high speed monitoring |
| Terminating Resistance (Ω) | | 110(5%, 1/2W) |
| Master/Slave Function | | Available for master only |
| XG5000 (High Speed Link) | Data Process Unit | Byte |
| | Communication Intervals | Select one of:20ms, 50ms, 100ms, 200ms, 500ms, 1s, 5s, 10s - Default setting is 200ms |
| | Max. Communication Points | 3780 words |
| | Max. No. of Blocks | 64 (Transmission: 32, Reception: 64) |
| | Max. Point per Block | 120 bytes (60 words) |
| | Max. No. of Transmission Blocks | 32 blocks |
| | No. of high speed link usage | Max. 12 |
| Station Numbering | | Set up in the basic setting window of XG5000 |
| Basic Specifications | Max. No. of Modules | 12 units (mountable on basic and expansion base) |
| | Module Position | XGK/XGI: mountable at any position. XGR: available for expansion bases only. |
| | Internal Power Consumption (mA) | 410 |
| | Weight (g) | 115 |

Note

1) XGR System is available for expansion base only, not for basic base.

2.3 Structure and Features



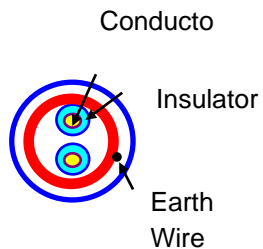
[Table 2.3.1] LED Display Specification

| LED Display | LED Status | Description |
|-------------|------------|--|
| RUN | On | Normal |
| | Off | A/S inspection required |
| I/F | Blink | Normal |
| | On/Off | A/S inspection required |
| HS | On | High speed link communication in service |
| | Blink | Link trouble error, or any one of the set-up communication block fails to perform normal service |
| | Off | High speed link communication service has stopped |
| LAS | On | The Link is acting as an Active Scheduler (master) - normal |
| | Off | Normal |
| TX | On | Transmitting data |
| RX | On | Receiving data |
| TOK | On | Token in possession |
| FAULT | On | Data collision during communication |

2.4 Cable Specification

2.4.1 Electric Cable (LS Cable)

[Table 2.4.1] Electric Cable Specifications

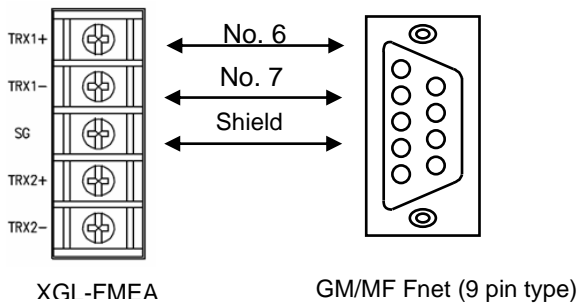
| Classification | LIREV-AMESB 2 *0.64mm 22AWG | Structure |
|---------------------------|---------------------------------|--|
| Manufacturer | LS Cable |  <p>Conducto</p> <p>Insulator</p> <p>Earth Wire</p> |
| Cable Type | Twisted pair, shielded | |
| Conductor Resistance | 59Ω/km (room temperature) | |
| Withstand Voltage (DC) | 500 V/Min (room temperature) | |
| Insulation Resistance | 1,000MΩ/km min. | |
| Capacitance | 45 pF/m max. (1kHz) | |
| Characteristics Impedance | 120±12Ω (10MHz) | |
| No. of Conductor Cores | 2 Cores | |

2.4.2 Cable Joint Method

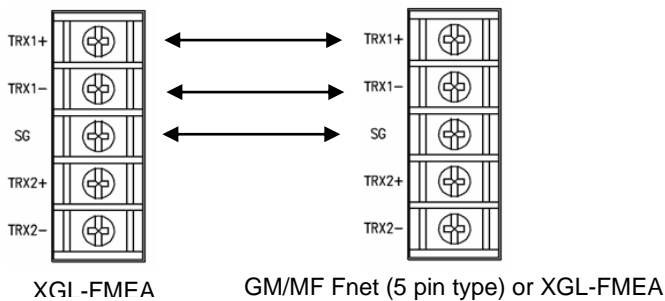
1) Connection between XGL-FMEA and GM/MK Fnet I/F nodule (take care of polarity and pin No.)

| XGL-FMEA | GM/MK Fnet I/F (9 pin type) | GM/MK Fnet I/F (5 pin type) |
|-------------|-----------------------------|-----------------------------|
| TRX1+/TRX2+ | No. 6 | TRX1+/TRX2+ |
| TRX1-/TRX2- | No. 7 | TRX1-/TRX2- |
| SG | 9Pin Shield | SG |

2) Cable connection (XGT Fnet ↔ GM/MF Fnet (9 pin type))

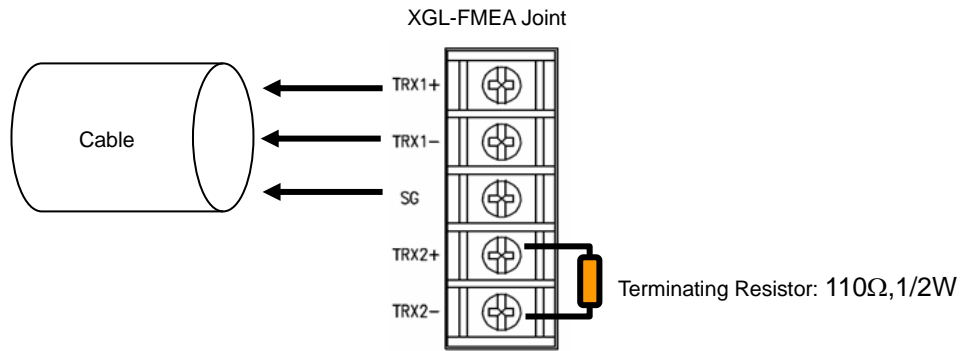


3) Cable connection (XGT Fnet ↔ GM/MF Fnet (5 pin type) or XGT Fnet ↔ XGT Fnet)



2.4.3 Terminating Resistor

Install terminating resistor at both ends of line. Install terminating resistors to TRX2+ and TRX2-.



Chapter 3 Product Installation and Test-Run

3.1 Cautions for Handling

3.1.1 Cautions for Handling

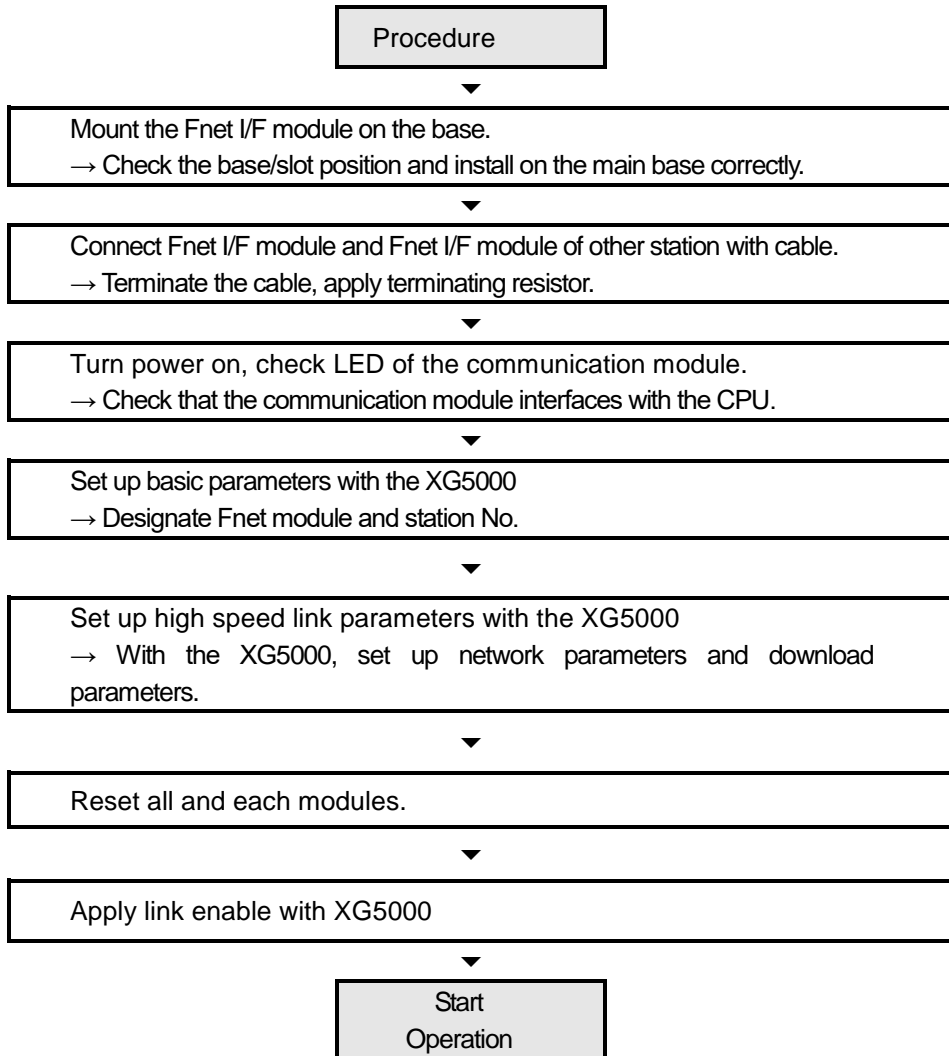
Following basic specifications apply to the construction of Fnet I/F module systems.

- 1) Check the system requirements and select appropriate communication module.
- 2) Select the cable for the communication module (make sure to use standard cable).
- 3) Before mounting, check that the base connector is clean without foreign material and the module connector pins are not damaged.

- 4) Before connecting the communication cable, match the protrusion on the bottom of the module to the groove on the base, and push in until the top is fully engaged with the lock device of the base. If the lock device is not engaged, interface with CPU may fail.

3.2 Product Setting for Operation

This section describes the installation and operation of the product. When the product has been installed, configure and set the system with the following procedures.




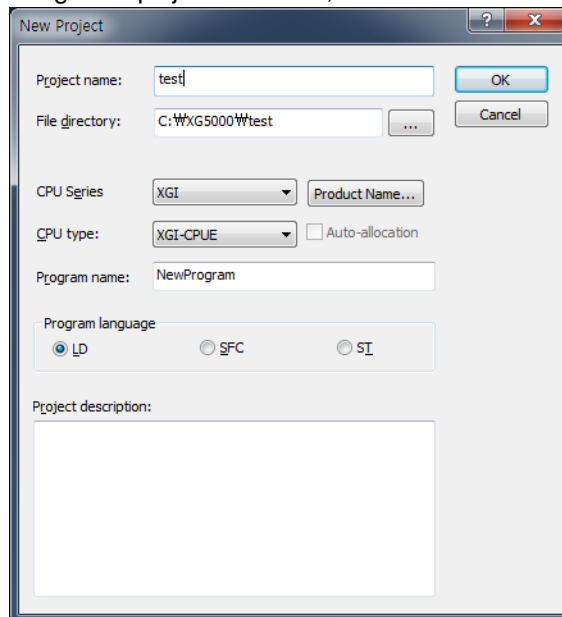
3.3 Registration of Communication Module

To use an XGT Fnet I/F module, set up communication parameters with XG5000, and register the module on the XG5000 for system setting-up of the XGT Fnet I/F module. The registration procedures of the XGT Fnet I/F XGnet I/F modules are as follows, according to the online or off-line status.

3.3.1 Off-line Registration

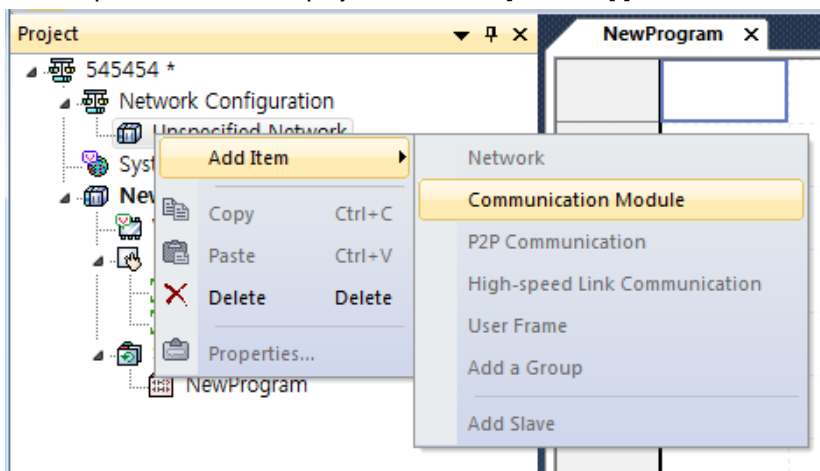
This method is applied for communication module setting and preparing communication related parameters while not in connection with PLC.

- 1) Run XG5000, select Project → New Project, or click () icon.
- 2) Enter the project name for saving in the project name field, and select the CPU series and CPU type.

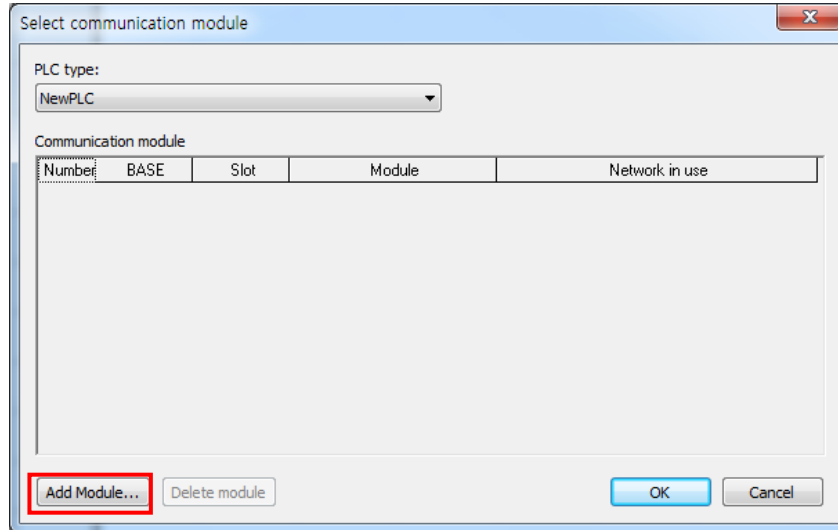


- 3) Adding communication module without connect to XGT, Use “Select Communication module” window. In case of adding Fnet at Base0-Slot3, please follow as below

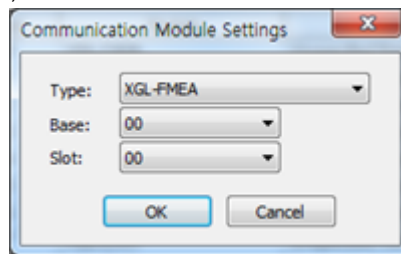
- a) Right click on the ‘Unspecified Network’ in project tree, select [Add Item]-[Communication module]



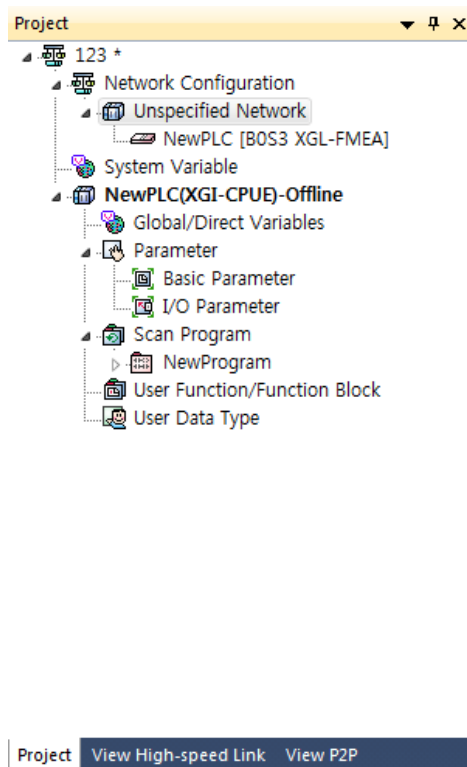
b) Click “Add Module”.



c) Select communication type, base, slot. Then click “OK”.




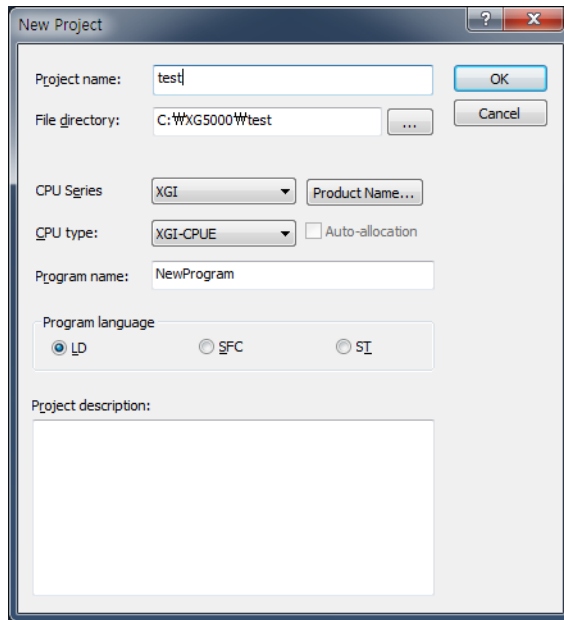
Screen of add Fnet I/F in base0-slot3 is below




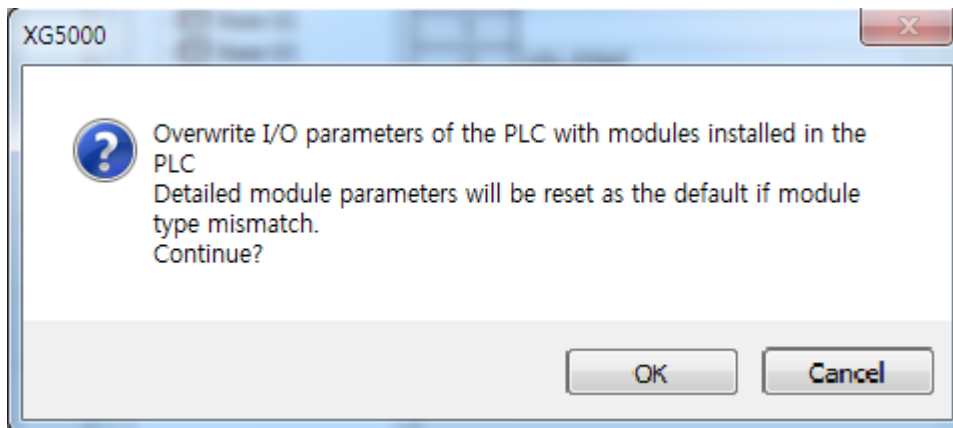
3.3.2 Online Registration

To register communication module using XG5000 in online status, conduct the steps No. 1 and 2 of the off-line registration for XGT Fnet/F module, and conduct following steps.

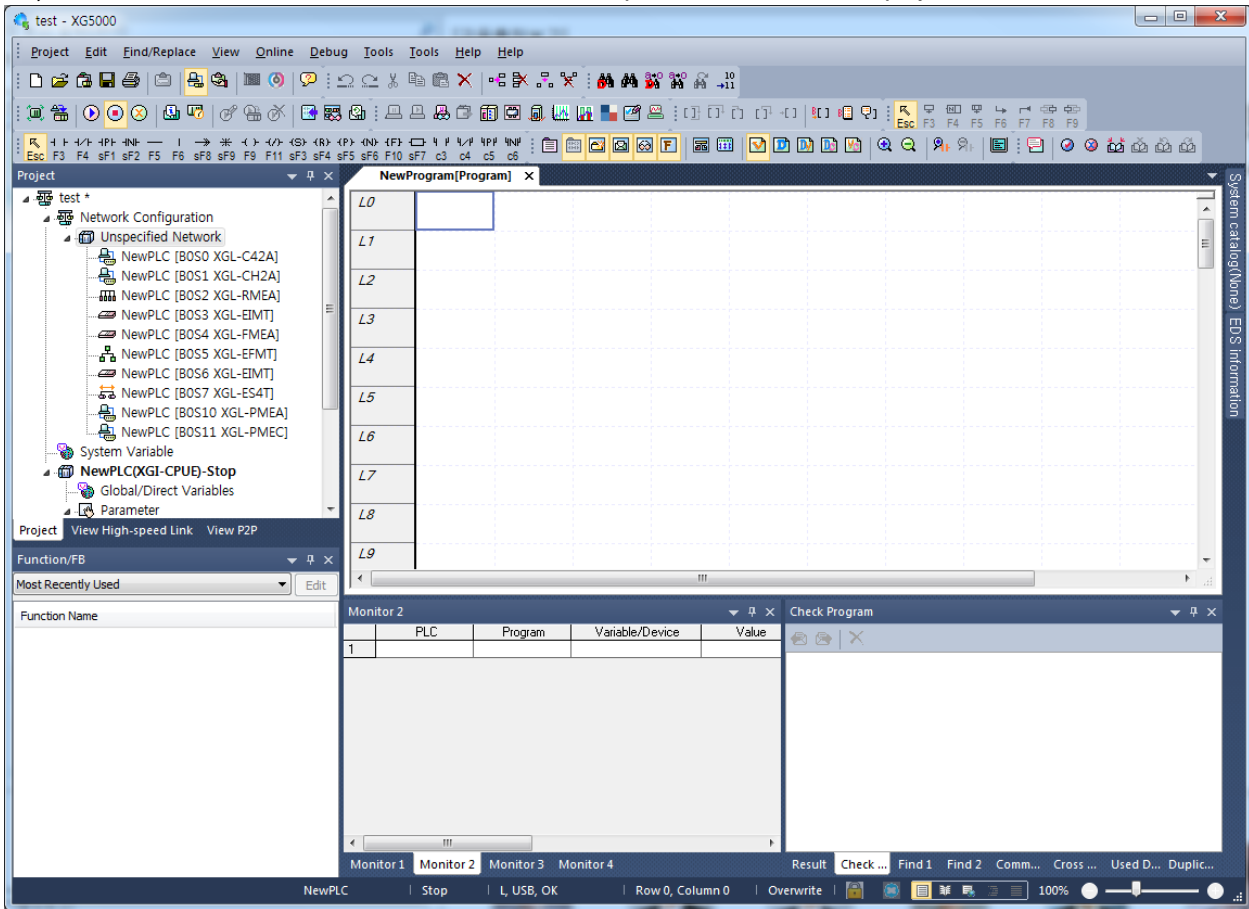
- 1) Enter project name in the project name field, select PLC series and CPU type
- 2) If unable to connect, check the connectivity with the PLC, select Online → Connect Settings or click () icon to select connection method. Available connection methods are RS-232C cable, USB cable, Ethernet module and EtherNet/IP module. For the connection step, select Local for direct access to the PLC. Remote access will be described in section 7.3 Remote Access



- 3) When normally connected, the submenus of the online menus are enabled.
- 4) To check the module currently installed in the base, select Online → Diagnosis → I/O Information → click “I/O Sync”, or click the () icon. All the communication modules on the main and expansion bases are searched and their information is displayed on the project window. If a module registered in off-line status has different information than the currently connected PLC information or different from the type of the communication module worked in the previous project, the change will be checked after giving the message below.



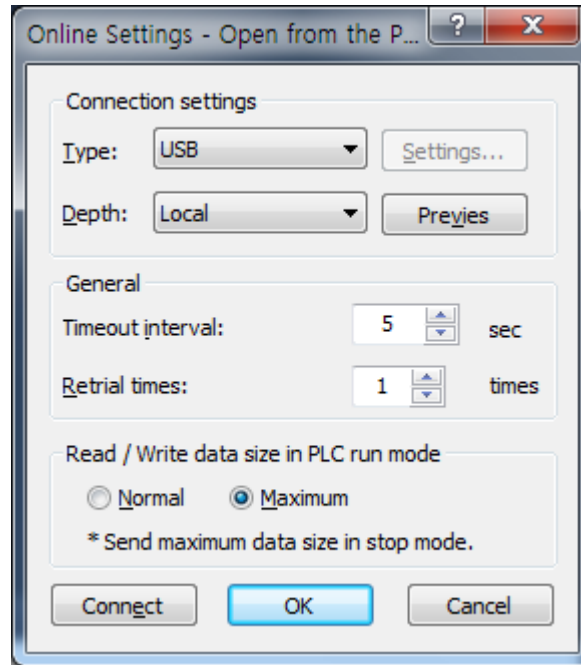
5) The list of the communication modules installed in the product is created in the project window.



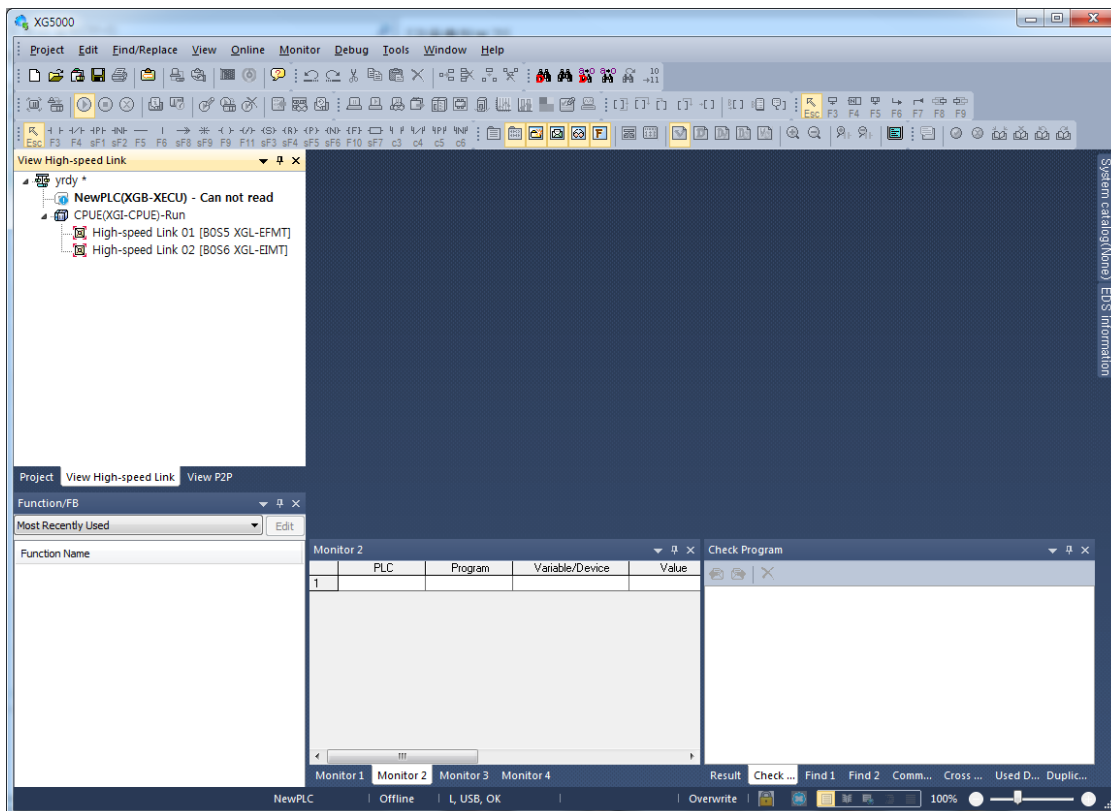
3.3.3 Reading Parameters from PLC

The default setting values and high speed link setting values saved in PLC can be loaded with following procedures.

- 1) From file menu, select Open from PLC.



- 2) You can view the default setting and high speed link setting values stored in the PLC.



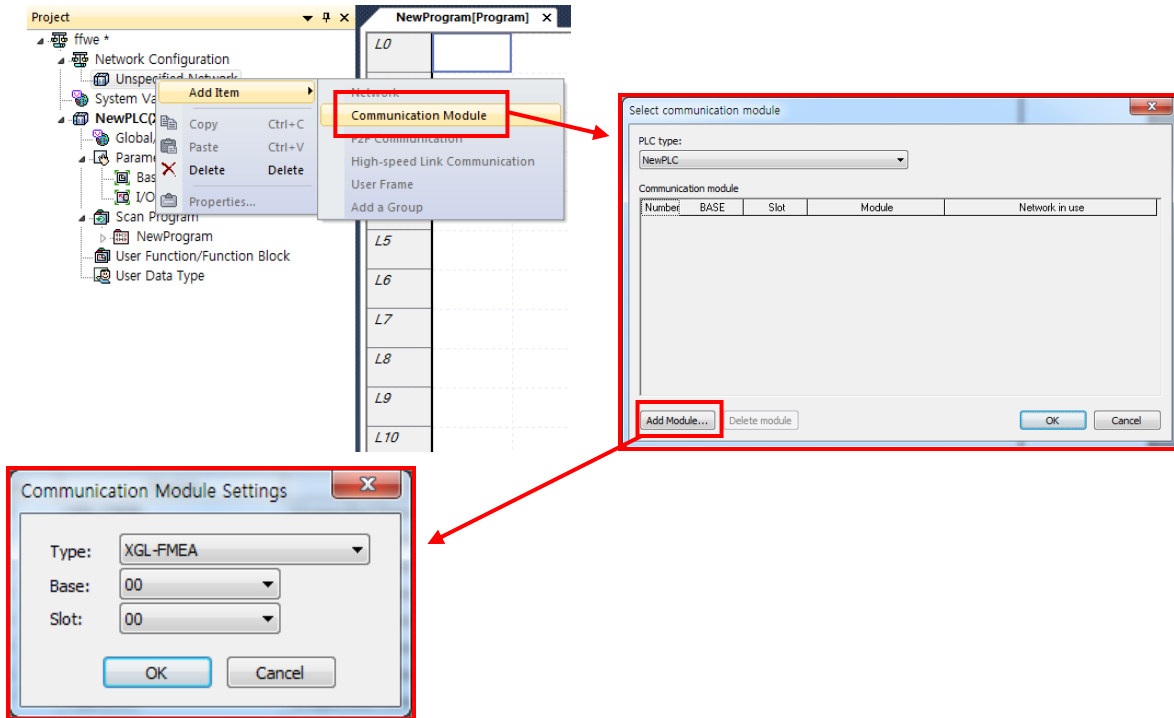
3.3.4 Module Setting Procedure

Set up the XGT Fnet I/F module as follows for operation.

1) Procedure

(1) Direct input in project window


Select Online → Project Window → right click on the “Unspecified Network” → Add Item → Communication Module → Click “Add Module” → set up the type and position of the XGT Fnet I/F module.



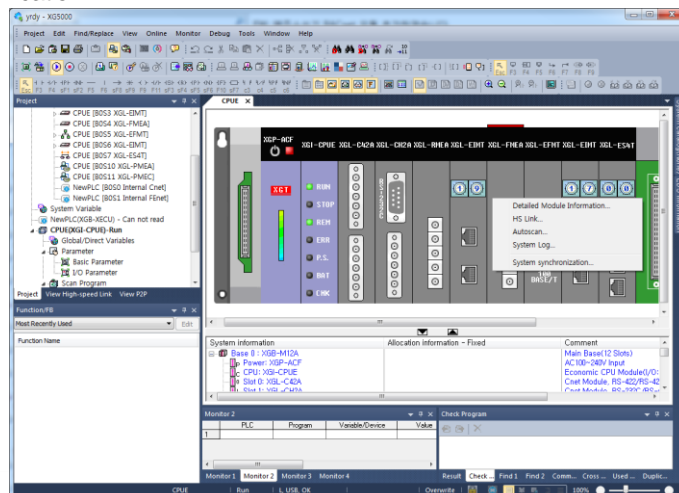
(2) Read I/O Information

Select Online → Connect and Online → Diagnosis → I/O Information and Click “I/O Sync” to read the information of the modules installed in the current base.

2) Operation Check

(1) Select Online → Communication module setting → System Diagnosis, or click () icon.

(2) Click mouse right button on the pertinent module of the system diagnosis window, then click the detailed items to check normal communication.



Chapter 4 System Configuration

4.1 Network System Configuration

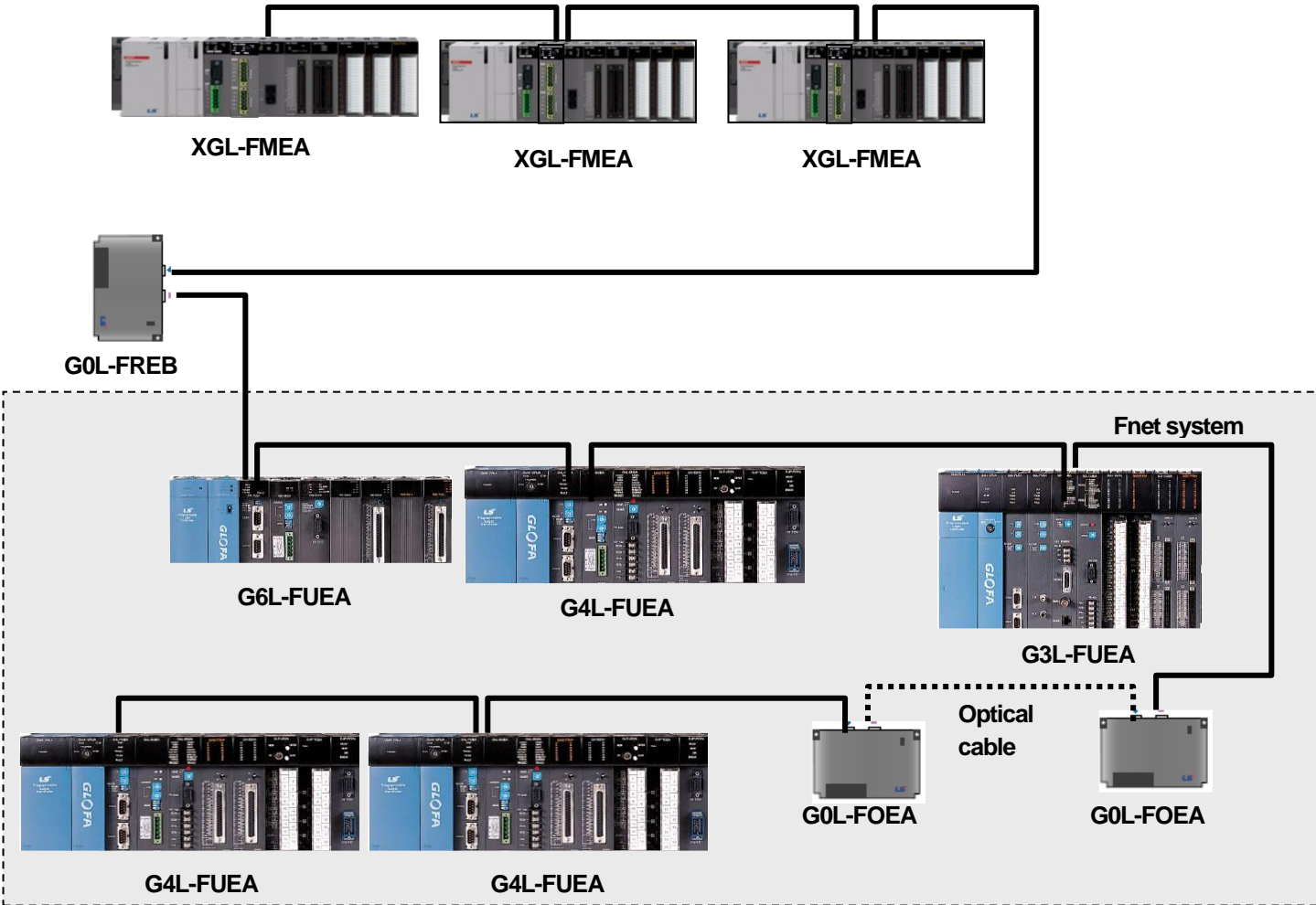
Systems using Fnet I/F module can be configured with the XGT Fnet I/F modules only or with XGT Fnet I/F module and GM/MK Fnet I/F module. Therefore, additional configuration can be implemented to the existing systems consisted with GM/MK Fnet I/F modules. In this case, if the total number of stations is more than 32 or total line length is longer than 750m, repeater is required for normal performance.



[Fig. 4.1.1] System comprised of XGT Fnet only



[Fig. 4.1.2] System comprised of XGT Fnet + GM/MK Fnet



[Fig. 4.1.3] System with existing GM/MK Fnet added with XGT Fnet

Chapter 5 High Speed Link Service

5.1 Outline of High Speed Link

High speed link is a communication method between XGT PLC communication modules, which can communicate data periodically by high speed link parameter setting. It is a data communication service where the user can set up the communication parameters for the data size, intervals, area and storage area of communication using XG5000. The detail information of the high speed link setting is presented in the Table 5.2.1 below.

[Table 5.2.1] High speed link setting

| Classification | | High Speed Link | | | |
|-------------------------------|---|--|---|---|--|
| Communication Module Setting | Communication Module Setting | Module Type | Select Fnet | | |
| | | Base No. | Max.: 0 ~ 7 setting range according to CPU module | | |
| | | Slot No. | Max.: 0 ~ 11 setting range according to the base type | | |
| | Communication Interval Setting (cycle type) | Select one of 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 5s, 10s - Default setting is 200ms | | | |
| | Emergency Output Data Setting | CPU Error | Latch | Maintain the previous output status | |
| | | | Clear | Clear all output | |
| CPU Stop | | Latch | Maintain the previous output status | | |
| | | Clear | Clear all output | | |
| High Speed Link Block Setting | Station Type | Local | | | |
| | Block Type | Send: data sent from master to slave module Receive: data sent from slave module to master module | | | |
| | Station No. | Slave station No. (range: 0 ~ 63) | | | |
| | Block No. | No. of the blocks available for communication (0 ~ 63) | | | |
| | Read Area | Address | XGK | Head address of the device to transmit. Available device: P, M, K, T, C, L, U, N, D, R, ZR | |
| | | | XGI/XGR | Head address of the device to transmit. Available device: M, I, Q, R, W | |
| | | Size (word) | Word expression of the data size to be transmitted | | |
| | Save Area | Address | XGK | Head address of the device to receive. Available device: P, M, K, T, C, L, U, N, D, R, ZR | |
| | | | XGI/XGR | Head address of the device to transmit. Available device: M, I, Q, R, W | |
| | | | Size (word) | Word expression of the data size to be received | |
| PLC Connection | | RS-232C or USB Port of CPU module | | | |
| Control Condition | | Controllable regardless of the position of the operation mode (Run, Stop) switch of the CPU module | | | |
| Max. Communication Points | | 61440 points (64 block * 120 byte) | | | |
| Max. Block No. | | 64 (Setting range: 0~63) | | | |
| Max. Points per Block | | 120 byte (960 points) | | | |

Note

- 1) If high speed link setting is to be changed, download the parameters again.
- 2) Only one high speed link can be set-up and used per each communication module.

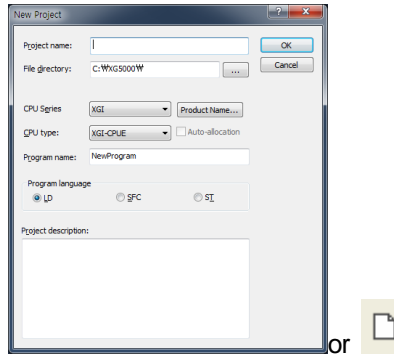
5.2 Using XG5000

For using the Fnet I/F module, the XG5000 has to be set up in following procedures.

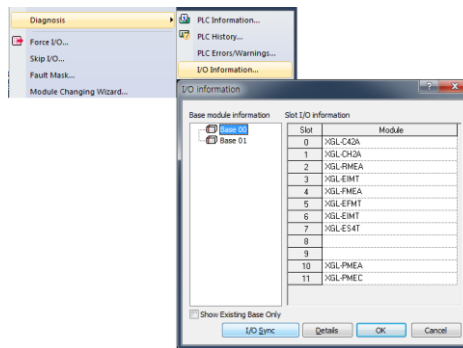
Run XG5000

- 1) Project -> New Project
 - (1) Project Name
 - A) Enter Project name
 - (2) Select PLC Series
 - (3) Select CPU Type

Create a new XG5000 file for the Fnet I/F module

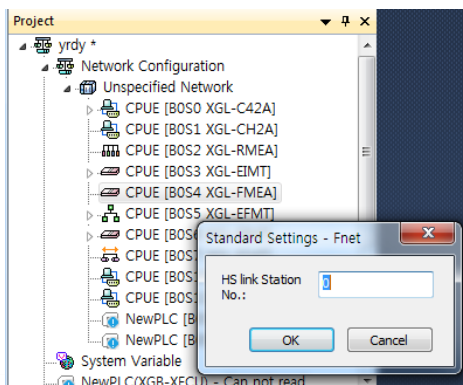


2) Read I/O Information

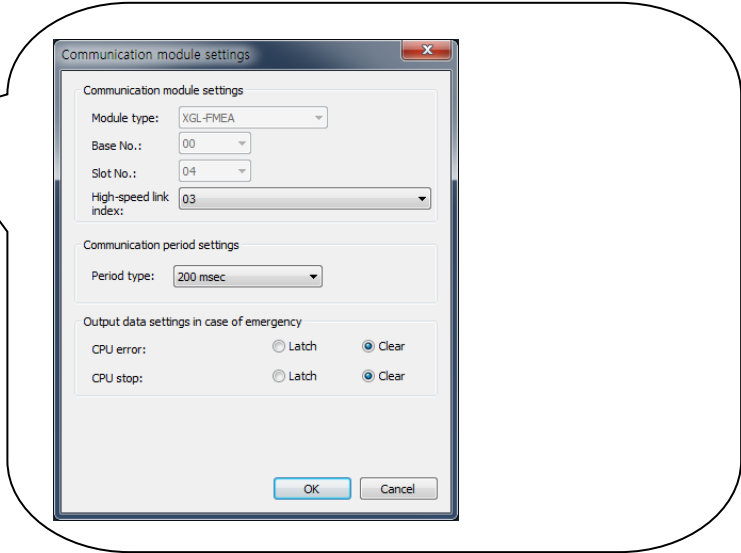


3) Set up station No.

Set up station No. of the communication module



4) Set up HS link communication module in the project window
 A) Set up communication module: Fnet
 - Module type, base, slot
 B) Set up communication intervals
 C) Set up emergency output data - CPU module error, CPU module stop



5) Set up HSL Block in Project Window
 A) Set up Read/Save Area Address



| Index | Station type | Mode | Station number | Block number | Read area | Read area Word size | Save area | Save area Word size |
|-------|--------------|------|----------------|--------------|-----------|---------------------|-----------|---------------------|
| 0 | | | | | | | | |
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | | | | | | | | |

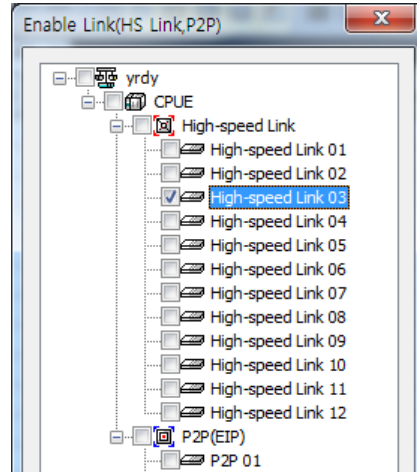
6) Write Parameter



Select "Online – Write," select the standard settings and the module related information of the HS Link, and click OK

7) Enable Link

Allow communication for the installed Fnet I/F module
Select "Online - Communication module - Enable Link" and
the pertinent HS Link, and click OK.



* Enable Link through flag

It describes "Enable Link" method through flag. The following XG5000 version, CPU OS version is needed.

| Item | Version |
|---------|----------------|
| XG5000 | V3.61 or above |
| XGR CPU | V1.91 or above |
| XGI CPU | V3.4 or above |
| XGK CPU | V3.7 or above |

Flag list related with "Enable Link"

-XGR

| Flag | Data type | Device | Description |
|-------------------|----------------------|----------|--------------------------------------|
| _HS_ENABLE_STATE | ARRAY[0..11] OF BOOL | %FX19040 | HS link enable/disable current state |
| _HS_REQ | ARRAY[0..11] OF BOOL | %FX31520 | HS link enable/disable request |
| _HS_REQ_NUM | ARRAY[0..11] OF BOOL | %FX31536 | HS link enable/disable setting |
| _P2P_ENABLE_STATE | ARRAY[0..7] OF BOOL | %FX19072 | P2P enable/disable current state |
| _P2P_REQ | ARRAY[0..7] OF BOOL | %FX31552 | P2P enable/disable request |
| _P2P_REQ_NUM | ARRAY[0..7] OF BOOL | %FX31568 | P2P enable/disable setting |

-XGI

| Flag | Data type | Device | Description |
|-------------------|----------------------|----------|--------------------------------------|
| _HS_ENABLE_STATE | ARRAY[0..11] OF BOOL | %FX15840 | HS link enable/disable current state |
| _HS_REQ | ARRAY[0..11] OF BOOL | %FX16480 | HS link enable/disable request |
| _HS_REQ_NUM | ARRAY[0..11] OF BOOL | %FX16496 | HS link enable/disable setting |
| _P2P_ENABLE_STATE | ARRAY[0..7] OF BOOL | %FX15872 | P2P enable/disable current state |
| _P2P_REQ | ARRAY[0..7] OF BOOL | %FX16512 | P2P enable/disable request |
| _P2P_REQ_NUM | ARRAY[0..7] OF BOOL | %FX16528 | P2P enable/disable setting |

-XGK

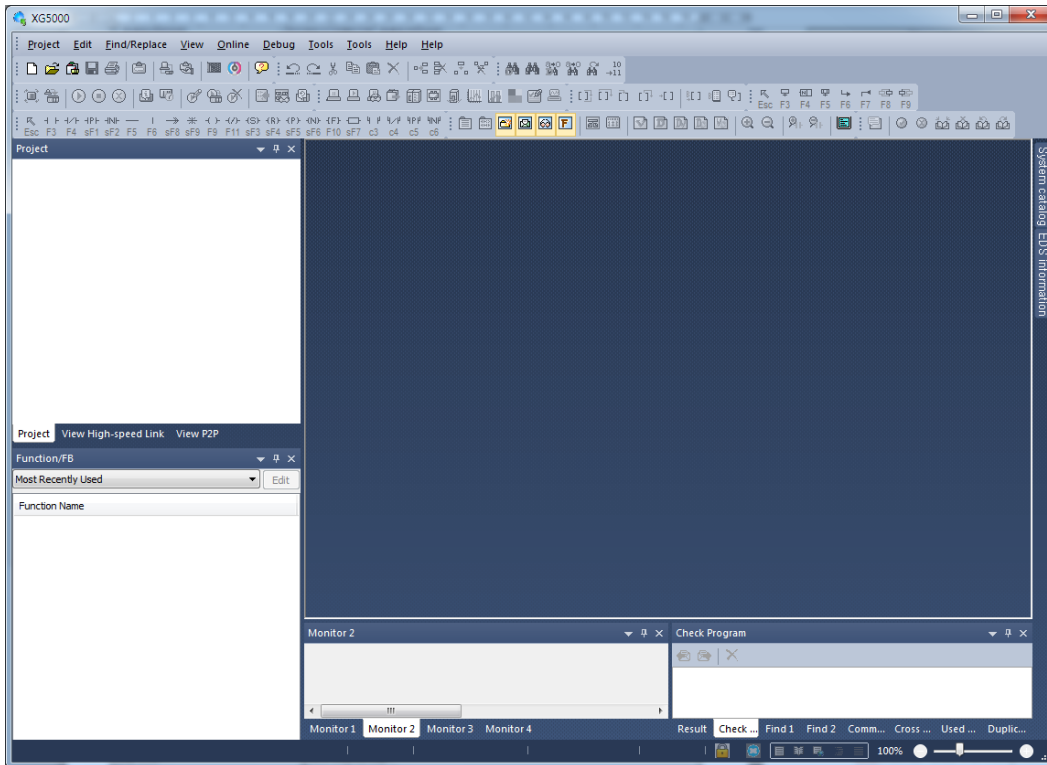
| Flag | Data type | Device | Description |
|--------------------|-----------|--------|---|
| _HS1_ENABLE_STATE | BIT | F09600 | HS link 1 enable/disable current state |
| _HS2_ENABLE_STATE | BIT | F09601 | HS link 2 enable/disable current state |
| _HS3_ENABLE_STATE | BIT | F09602 | HS link 3 enable/disable current state |
| _HS4_ENABLE_STATE | BIT | F09603 | HS link 4 enable/disable current state |
| _HS5_ENABLE_STATE | BIT | F09604 | HS link 5 enable/disable current state |
| _HS6_ENABLE_STATE | BIT | F09605 | HS link 6 enable/disable current state |
| _HS7_ENABLE_STATE | BIT | F09606 | HS link 7 enable/disable current state |
| _HS8_ENABLE_STATE | BIT | F09607 | HS link 8 enable/disable current state |
| _HS9_ENABLE_STATE | BIT | F09608 | HS link 9 enable/disable current state |
| _HS10_ENABLE_STATE | BIT | F09609 | HS link 10 enable/disable current state |
| _HS11_ENABLE_STATE | BIT | F0960A | HS link 11 enable/disable current state |
| _HS12_ENABLE_STATE | BIT | F0960B | HS link 12 enable/disable current state |
| _HS1_REQ | BIT | F10300 | HS link 1 enable/disable request |
| _HS2_REQ | BIT | F10301 | HS link 2 enable/disable request |
| _HS3_REQ | BIT | F10302 | HS link 3 enable/disable request |
| _HS4_REQ | BIT | F10303 | HS link 4 enable/disable request |
| _HS5_REQ | BIT | F10304 | HS link 5 enable/disable request |
| _HS6_REQ | BIT | F10305 | HS link 6 enable/disable request |
| _HS7_REQ | BIT | F10306 | HS link 7 enable/disable request |
| _HS8_REQ | BIT | F10307 | HS link 8 enable/disable request |
| _HS9_REQ | BIT | F10308 | HS link 9 enable/disable request |

| Flag | Data type | Device | Description |
|--------------------|-----------|--------|-----------------------------------|
| _HS10_REQ | BIT | F10309 | HS link 10 enable/disable request |
| _HS11_REQ | BIT | F1030A | HS link 11 enable/disable request |
| _HS12_REQ | BIT | F1030B | HS link 12 enable/disable request |
| _HS1_REQ_NUM | BIT | F10310 | HS link 1 enable/disable setting |
| _HS2_REQ_NUM | BIT | F10311 | HS link 2 enable/disable setting |
| _HS3_REQ_NUM | BIT | F10312 | HS link 3 enable/disable setting |
| _HS4_REQ_NUM | BIT | F10313 | HS link 4 enable/disable setting |
| _HS5_REQ_NUM | BIT | F10314 | HS link 5 enable/disable setting |
| _HS6_REQ_NUM | BIT | F10315 | HS link 6 enable/disable setting |
| _HS7_REQ_NUM | BIT | F10316 | HS link 7 enable/disable setting |
| _HS8_REQ_NUM | BIT | F10317 | HS link 8 enable/disable setting |
| _HS9_REQ_NUM | BIT | F10318 | HS link 9 enable/disable setting |
| _HS10_REQ_NUM | BIT | F10319 | HS link 10 enable/disable setting |
| _HS11_REQ_NUM | BIT | F1031A | HS link 11 enable/disable setting |
| _HS12_REQ_NUM | BIT | F1031B | HS link 12 enable/disable setting |
| _P2P1_ENABLE_STATE | BIT | F09620 | P2P1 enable/disable current state |
| _P2P2_ENABLE_STATE | BIT | F09621 | P2P2 enable/disable current state |
| _P2P3_ENABLE_STATE | BIT | F09622 | P2P3 enable/disable current state |
| _P2P4_ENABLE_STATE | BIT | F09623 | P2P4 enable/disable current state |
| _P2P5_ENABLE_STATE | BIT | F09624 | P2P5 enable/disable current state |
| _P2P6_ENABLE_STATE | BIT | F09625 | P2P6 enable/disable current state |
| _P2P7_ENABLE_STATE | BIT | F09626 | P2P7 enable/disable current state |
| _P2P8_ENABLE_STATE | BIT | F09627 | P2P8 enable/disable current state |
| _P2P1_REQ | BIT | F10320 | P2P1 enable/disable request |
| _P2P2_REQ | BIT | F10321 | P2P2 enable/disable request |
| _P2P3_REQ | BIT | F10322 | P2P3 enable/disable request |
| _P2P4_REQ | BIT | F10323 | P2P4 enable/disable request |
| _P2P5_REQ | BIT | F10324 | P2P5 enable/disable request |
| _P2P6_REQ | BIT | F10325 | P2P6 enable/disable request |
| _P2P7_REQ | BIT | F10326 | P2P7 enable/disable request |
| _P2P8_REQ | BIT | F10327 | P2P8 enable/disable request |
| _P2P1_REQ_NUM | BIT | F10330 | P2P1 enable/disable setting |
| _P2P2_REQ_NUM | BIT | F10331 | P2P2 enable/disable setting |
| _P2P3_REQ_NUM | BIT | F10332 | P2P3 enable/disable setting |
| _P2P4_REQ_NUM | BIT | F10333 | P2P4 enable/disable setting |
| _P2P5_REQ_NUM | BIT | F10334 | P2P5 enable/disable setting |
| _P2P6_REQ_NUM | BIT | F10335 | P2P6 enable/disable setting |
| _P2P7_REQ_NUM | BIT | F10336 | P2P7 enable/disable setting |
| _P2P8_REQ_NUM | BIT | F10337 | P2P8 enable/disable setting |

- ▶ How to enable link
 - HS link/P2P enable/disable setting flag ON → HS link/P2P enable/disable request flag ON
- ▶ How to disable link
 - HS link/P2P enable/disable setting flag OFF → HS link/P2P enable/disable request flag ON
- ▶ You can monitor the Enable/Disable state of the each link through “enable/disable current states” flag.

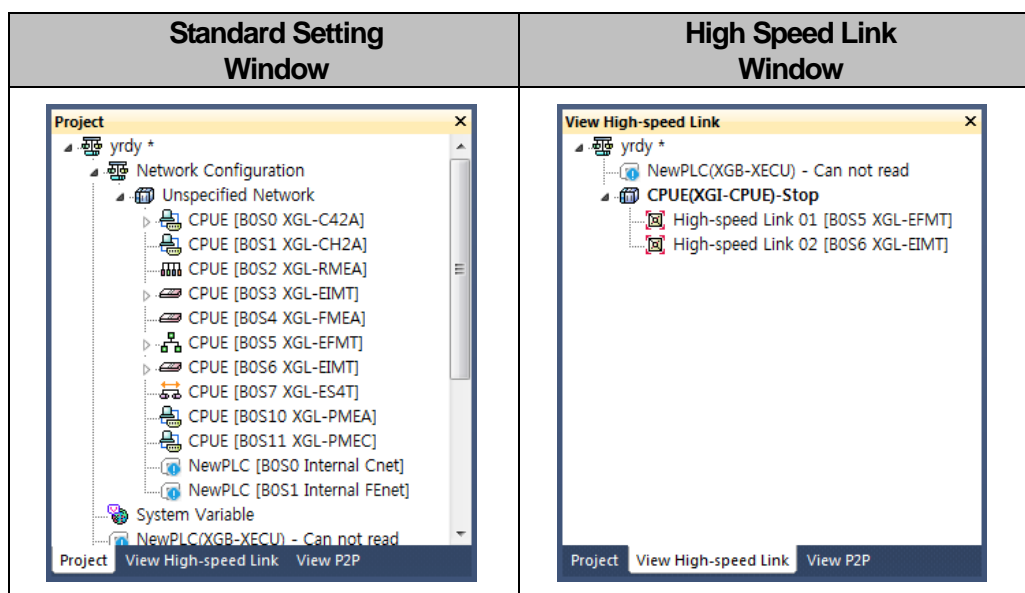
5.3 Setting High Speed Link

When the XG5000 is loaded, the screen below will appear.



[Initial Window]

The parameters which can be set up in XG5000 are as follows.



The window used by Fnet I/F module is high speed link window.

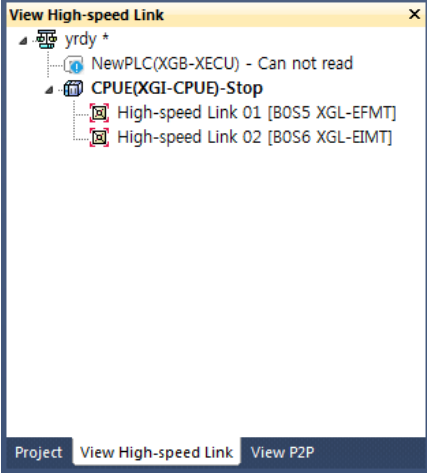
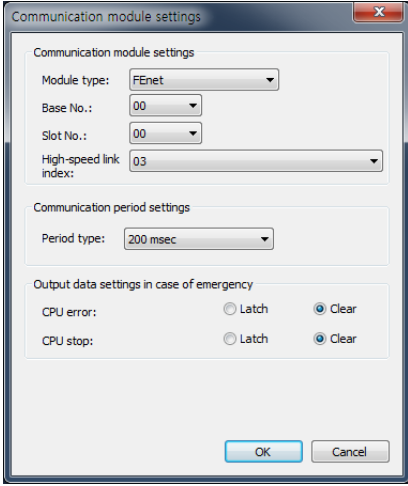
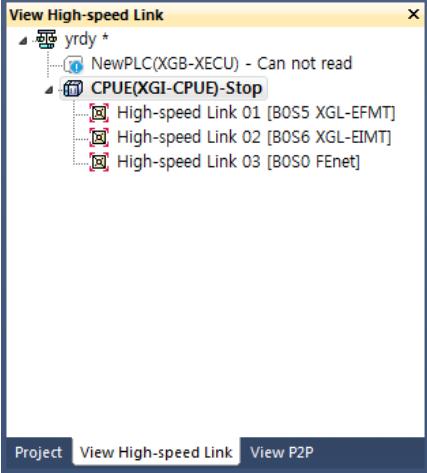
Up to 12 high speed links can be used.

Each Fnet I/F module can make use of one high speed link.

1) Using high speed link window

Select the high speed link window where the user can set up following parameters.

Two windows are available: communication module setting and high speed link block setting windows.

| High Speed Link Window | Parameter Setting Window | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---------|----------------|--------------|----------------|---------------|-----------|---------------|---|-------|------|---|---|--------|--|---|-------|------|---|---|--------|--|---|-------|---------|---|---|--|--|---|-------|---------|---|---|--|--|---|--|--|--|--|--|--|---|--|--|--|--|--|--|---|--|--|--|--|--|--|---|--|--|--|--|--|--|---|--|--|--|--|--|--|---|--|--|--|--|--|--|----|--|--|--|--|--|--|----|--|--|--|--|--|--|----|--|--|--|--|--|--|
|  | <p>To set up communication module, right click the CPU → Add Item → High-speed Link Communication</p>  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | <p>After setting up communication module, double click the High-speed link to set up parameters.</p> <table border="1" data-bbox="650 1396 1414 1780"> <thead> <tr> <th>Index</th> <th>Station type</th> <th>Mode</th> <th>Station number</th> <th>Block number</th> <th>Read area</th> <th>variable name</th> </tr> </thead> <tbody> <tr><td>0</td><td>Local</td><td>Send</td><td>0</td><td>1</td><td>D00000</td><td></td></tr> <tr><td>1</td><td>Local</td><td>Send</td><td>0</td><td>2</td><td>D00100</td><td></td></tr> <tr><td>2</td><td>Local</td><td>Receive</td><td>3</td><td>3</td><td></td><td></td></tr> <tr><td>3</td><td>Local</td><td>Receive</td><td>4</td><td>4</td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table> | Index | Station type | Mode | Station number | Block number | Read area | variable name | 0 | Local | Send | 0 | 1 | D00000 | | 1 | Local | Send | 0 | 2 | D00100 | | 2 | Local | Receive | 3 | 3 | | | 3 | Local | Receive | 4 | 4 | | | 4 | | | | | | | 5 | | | | | | | 6 | | | | | | | 7 | | | | | | | 8 | | | | | | | 9 | | | | | | | 10 | | | | | | | 11 | | | | | | | 12 | | | | | | |
| Index | Station type | Mode | Station number | Block number | Read area | variable name | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | Local | Send | 0 | 1 | D00000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Local | Send | 0 | 2 | D00100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Local | Receive | 3 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Local | Receive | 4 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Note High speed link 1 [B0S1 Fnet] has following meanings;

- 1) High speed link 1: serial No. of high speed link.
- 2) B0: base No. (E.g., expansion base stack 2: B2, expansion base stack 5: B5)
- 3) S0: slot No. (E.g., slot No. 5: S5, slot No. 11: S11)

- 2) Communication module setting parameter
 Communication module parameters can be set up as follows.

| Parameter Window | Item | | Description | |
|------------------|---|-------------|--|---------------------------------|
| | Comm. Module Setting | Module Type | Select Fnet | |
| | | Base No. | Setting range: 0 ~ 7 Range may vary by CPU module | |
| | | Slot No. | Setting range: 0 ~ 11 Range may vary by base type | |
| | Communication period settings (Period Type) | | Select one from: 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 5s, 10s - Default setting is 200ms. - Applicable to transmission data only. - Receiving data is processed at the end of scan program. | |
| | Output data settings in case of emergency | CPU Error | Latch | Maintain previous output status |
| | | | Clear | Clear all outputs |
| | | CPU Stop | Latch | Maintain previous output status |
| Clear | | | Clear all outputs | |

Note

1. Cautions for communication interval setting
 - 1) The communication intervals setting value is pertinent to the transmission data (CPU module data -> Fnet I/F module). If the interval is longer than the rapidly changing data time in the scan program, the data sent to other local module may be different at a moment.
 - 2) High speed link communication interval must be set up taking into consideration of the No. of the transmission blocks and the No. of the Fnet I/F modules participating in the communication. For further information, refer to Section 7.1, Communication Interval Setting.

3) High speed link block setting parameter

Following parameters can be set up in high speed link block.

| Item | Description | | |
|--------------|--|--|--|
| Station Type | Local | | |
| Mode | Transmission: outbound data flow reception: inbound data flow | | |
| Station No. | Internal/External station No. (range: 0 ~ 63): automatically set to internal station no. at transmission | | |
| Block No. | No. of the block which can be set up in communication (0 ~ 63) | | |
| Read Area | Address | XGK | Head address of the device to transmit. Available device: P, M, K, T, C, L, N, D, R, ZR |
| | | XGI/XGR | Head address of the device to transmit. Available device: M, I, Q, R, W |
| | Size (word) | Word expression of the data size to be transmitted | |
| Save Area | Address | XGK | Head address of the device to receive. Available device: P, M, K, T, C, L, N, D, R, ZR |
| | | XGI/XGR | Head address of the device to transmit. Available device: M, I, Q, R, W |
| | Size (word) | Word expression of the data size to be received | |

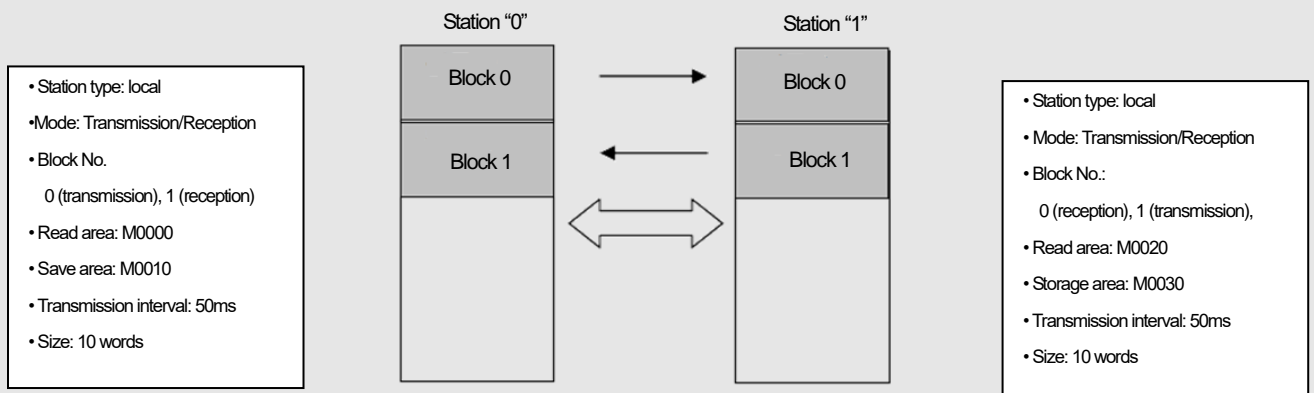
Note

1. How to use high speed link: an exemplary setting for communication between the Fnet I/F modules of “0” and “1” stations

- 1) “0” sends 10 words of M0000 data to “No. 0” block, and save the data received from “1” in M0010.
- 2) “1” receives 10 words of M0000 data from “0” to save it in M0030 and sends 10 words of M0020 data to “No. 1” block.

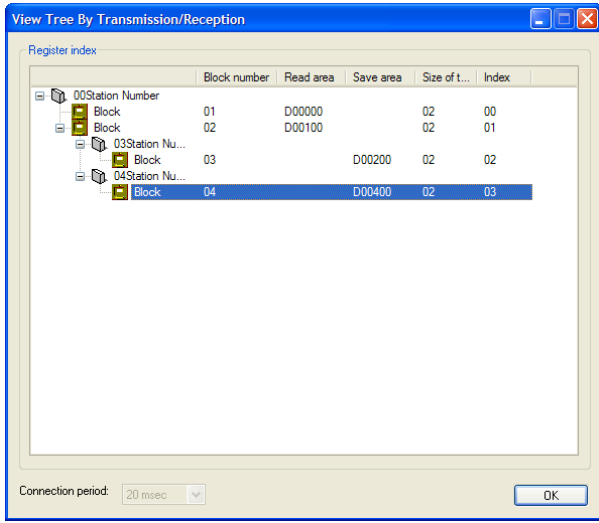
High speed link parameter has 64 blocks for data communication, of which up to 32 are available for transmission and 64 available for reception. (Block No. can be set up between 0~63)

- The transmitter side needs only to decide to read what data and sent it to which block, no need to designate the station No. of the receiver.



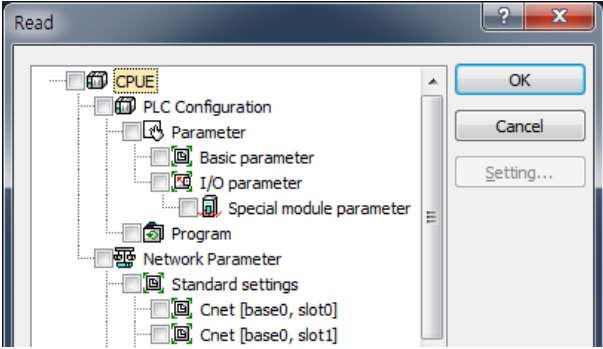
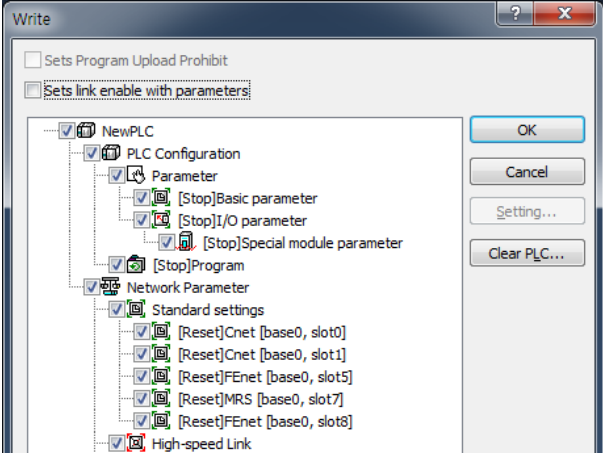
4) Edit tools for high speed link block

The edit tools and their use are presented in the table below.

| Item | | Description | | | | | | | | | | |
|---|--------------|--|---|--------------|-----------|---------------|-----------------------|---------------------|-----------|---------------|----|--|
| Index | Station type | Mode | Station number | Block number | Read area | variable name | variable name comment | Read area Word size | Save area | variable name | va | |
| 0 | Local | Send | 0 | 1 | D00000 | | | 2 | | | | |
| 1 | Local | Send | 0 | 2 | D00100 | | | 2 | | | | |
| 2 | Local | Receive | 3 | 3 | | | | | D00200 | | | |
| 3 | Local | Receive | 4 | 4 | | | | | D00400 | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| <div style="border: 1px solid black; padding: 5px;"> Import variable name Undo Ctrl+Z Redo Ctrl+R Cut Ctrl+X Copy Ctrl+C Paste Ctrl+V Delete Delete View tree by Transmission/Reception </div> | | Undo | Cancel input during parameter edit | | | | | | | | | |
| | | Redo | Do the previous input again | | | | | | | | | |
| | | Cut | Cut off an object | | | | | | | | | |
| | | Copy | Copy and object | | | | | | | | | |
| | | Paste | Add copied index | | | | | | | | | |
| | | Delete | Delete edited index | | | | | | | | | |
| | | View trees by Transmission / Reception | To express high speed link in a tree structure  | | | | | | | | | |
| | | Place the mouse cursor on the index set up with high speed link block, click the right button. | | | | | | | | | | |

5.4 Read and Write High Speed Link

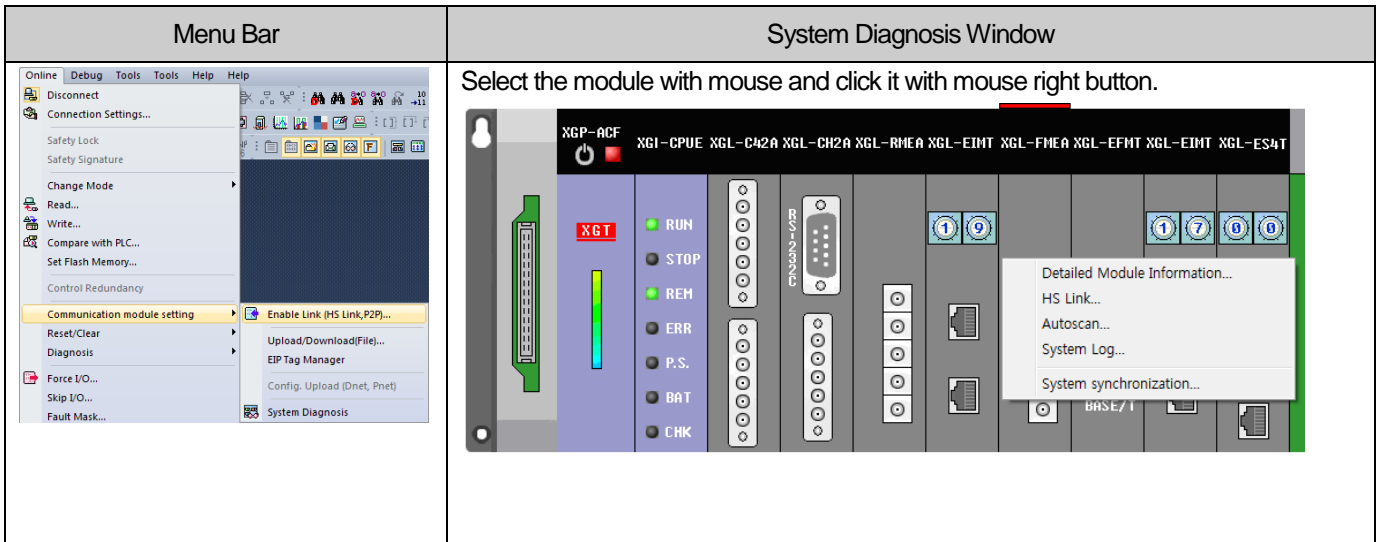
“Online -> Connect -> Online -> Read/Write” is used to read or write high speed link parameters. The window is described below.

| Window Configuration | Description |
|--|---|
|  <p>The 'Read' window shows a tree view of PLC configuration parameters. The 'High-speed Link' parameter is highlighted. The tree structure includes: CPU, PLC Configuration, Parameter (Basic parameter, I/O parameter, Special module parameter), Program, Network Parameter (Standard settings, Cnet [base0, slot0], Cnet [base0, slot1]).</p> | <ol style="list-style-type: none"> 1) For Fnet I/F module, up to 12 high speed links can be set up. <ul style="list-style-type: none"> - Max, 12 are available including other communication module using high speed link. 2) Each high speed link parameter can be read or written. <ul style="list-style-type: none"> - Click the check box left of the high speed link to set up. 3) Read/write high speed link parameter is not influenced by the operation mode of the CPU. |
|  <p>The 'Write' window shows a tree view of PLC configuration parameters. The 'High-speed Link' parameter is checked. The tree structure includes: New PLC, PLC Configuration, Parameter ([Stop]Basic parameter, [Stop]I/O parameter, [Stop]Special module parameter), Program ([Stop]Program), Network Parameter (Standard settings, [Reset]Cnet [base0, slot0], [Reset]Cnet [base0, slot1], [Reset]Fnet [base0, slot5], [Reset]MRS [base0, slot7], [Reset]Fnet [base0, slot8], High-speed Link).</p> | |

If high speed link parameter is written with the CPU module, the data is backed-up by the CPU module. Therefore, when replacing a CPU module, read the high speed link parameters from the CPU module and back-it-up, and then write it in the new CPU module.

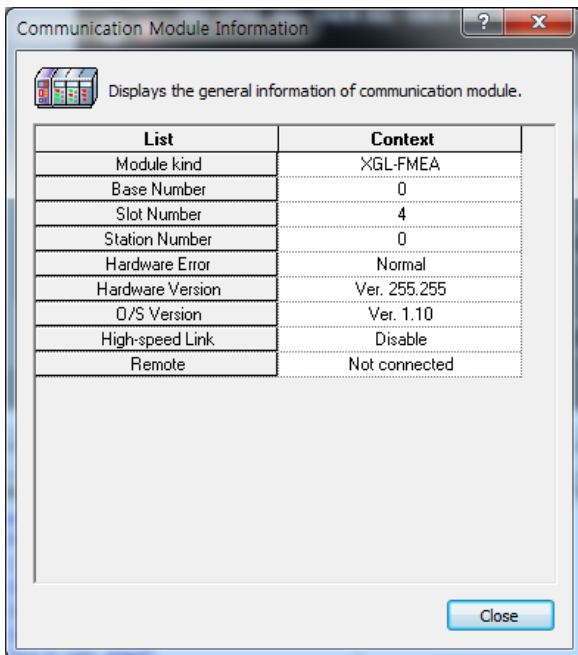
5.5 System Diagnosis

System diagnosis provides the comprehensive information on the system consists of Fnet I/F module. The system diagnosis window and its content are presented below.



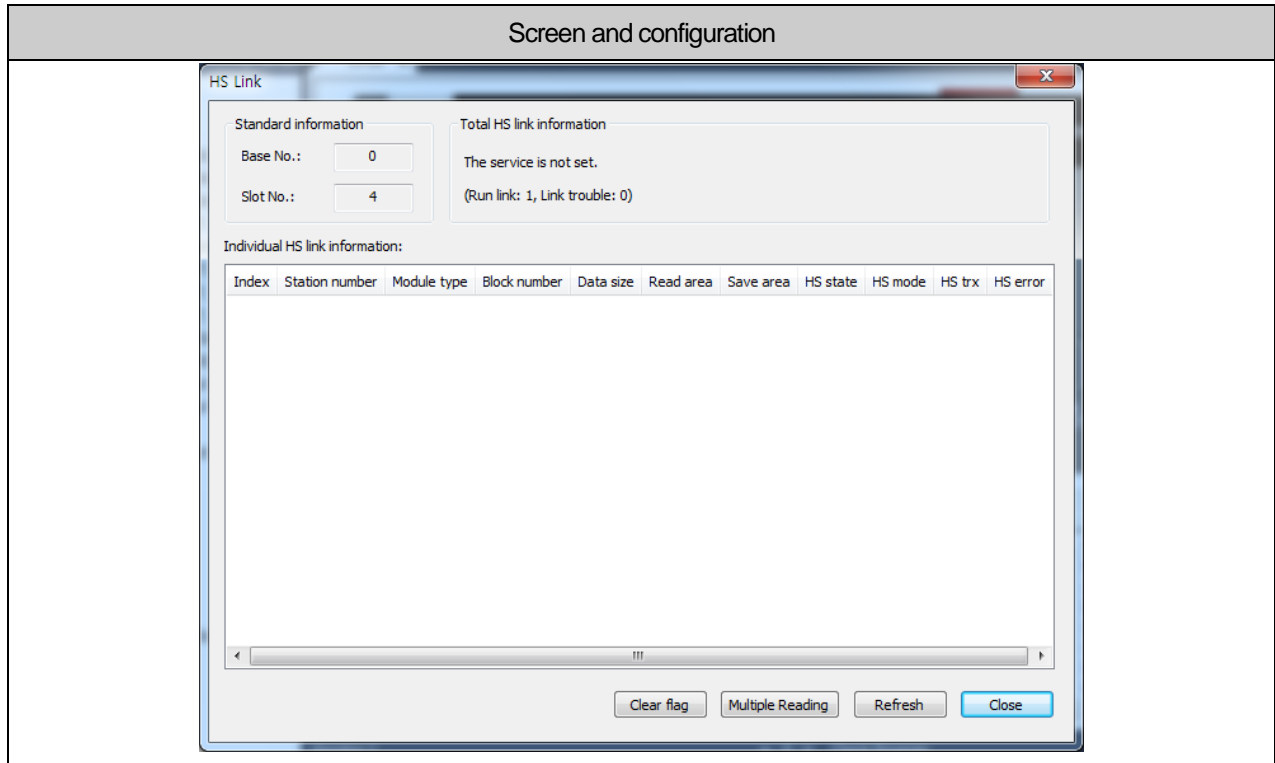
The menu for system diagnosis is as follows.

1) Communication Module Information



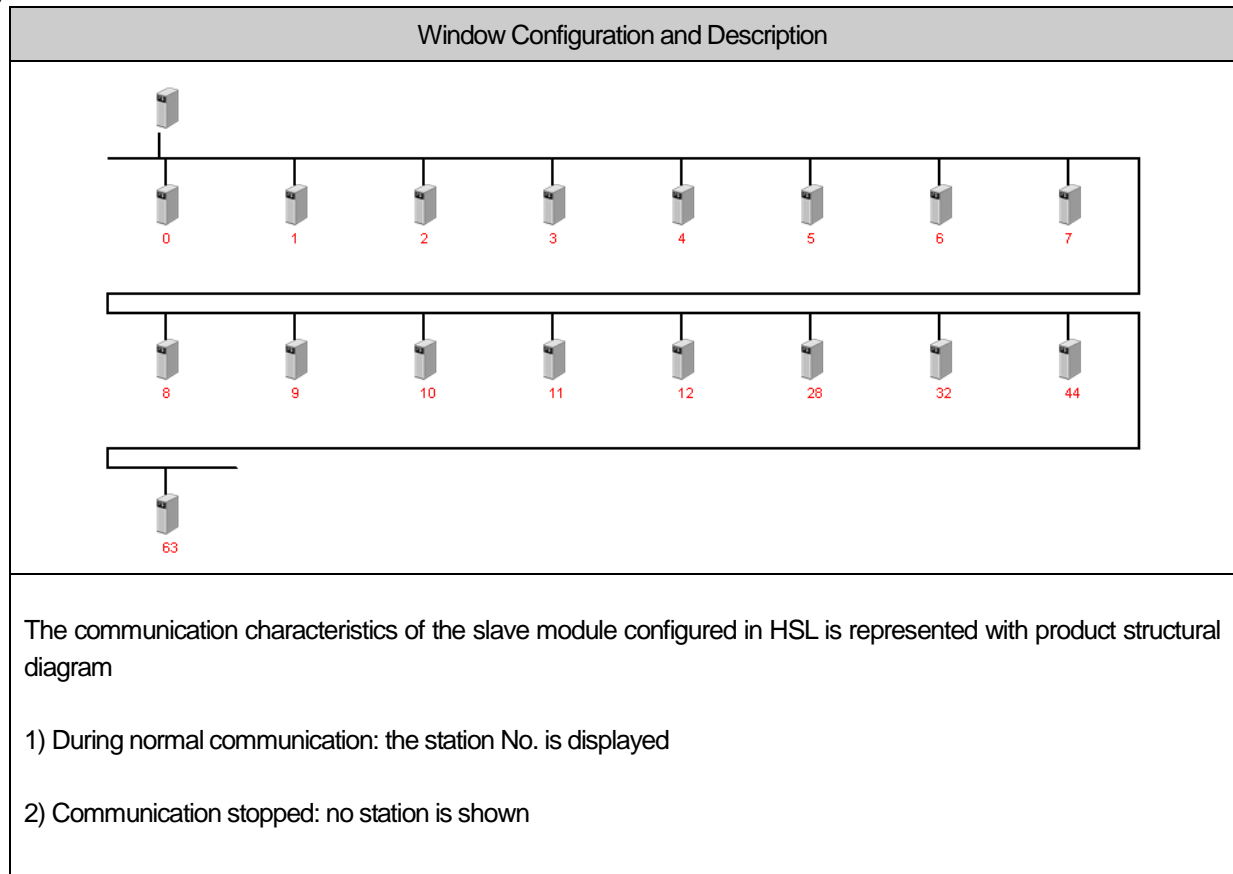
| Window Configuration and Content | |
|----------------------------------|----------------------------|
| Module kind | Communication module model |
| Base Number | Base position of module |
| Slot Number | Slot position of module |
| Station Number | Station No. of module |
| Hardware error | Hardware state of module |
| Hardware version | Hardware version of module |
| OS version | OS version of module |
| High-speed Link | Enabled status of module |
| Remote | Not supported |

2) High speed link (HSL)



| | | |
|---------------------|--------------------------------------|--|
| Standard Info. | Base No. | No. of the base mounted with the product connected with HSL |
| | Slot No. | No. of the slot mounted with the product connected with HSL |
| Total HS link Info. | Run Link | 1: after power On, HSL parameter operates normally at initial phase 0: after power On, HSL parameter fails to operate normally |
| | Link Trouble | 1: after RUN link became normal, error occurred in external station 0: after RUN link became normal, no error occur in external station |
| Individual Info. | Index | Serial No. |
| | Station No. | No. of the local station on the network |
| | Module Type | Type of the module used by being set up with HSL parameter |
| | Block number | Block number of HS link index |
| | Data Size | Size (word) of the data communicated with external station |
| | Read Area | A device about to transmit data to other station |
| | Save Area | A device to save the data received from other station |
| | Hs State | Show general status of HSL |
| | Hs Mode | RUN: when the pertinent station is in RUN mode STOP: when the pertinent station is in STOP/PAUSE mode |
| | Hs Trx | Indicate transmission or reception of the station |
| Hs Error | Indicate error or not of the station | |

3) Auto Scan



5.6 High-Speed Link Information

High-Speed Link communicates data between stations. The information of its normal operation-or-not is provided by flag on station basis or for all the stations.

This information can be used to check the reliability of communication data or cause of error of the system. The types and application of the flags are as follows.

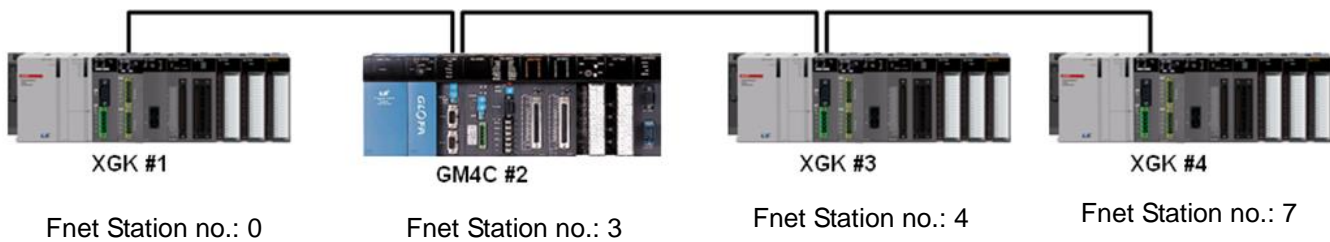
[Table 5.6.1] High-Speed Link Information Function

| Classification | Run-Link | Link-Trouble | Comm. Status | Operation Mode | Error | High-Speed Link State |
|--------------------------|-----------|--------------|-------------------------|-------------------------|------------------------|--------------------------|
| Information Type | Whole | | Individual | | | |
| Flag Name (x=HSL No.) | _HSxRLINK | _HSxLTRBL | _HSxTRX[n] (n=0..63) | _HSxMOD[n] (n=0..63) | HSxERR[n] (n=0..63) | HSxSTATE[n] (n=0..63) |
| Data Type | Bit | Bit | Bit Array | Bit Array | Bit Array | Bit Array |
| Monitoring/ or not | Available | Available | Available | Available | Available | Available |
| Program Applicability | Available | Available | Available | Available | Available | Available |

Chapter 6 Sample Program

6.1 Application Sample in XGK-CPU

In this section, high speed link parameter setting method is provided with sample programs for an XGT Fnet system as shown below. Here, the high speed link parameter settings are in accordance with the XGK #1.



| Mode | Read Area | Send Size (word) | Save Area (XGK#1) | Receive Size (Word) | Remark |
|--------------|-----------|------------------|-------------------|---------------------|---------------------------|
| Transmission | D00100 | 6 | - | - | Data sent to GM4 #2 |
| Reception | - | - | M200 | 6 | Data received from GM4 #2 |
| Transmission | D00106 | 4 | - | - | Data sent to XGT #3 |
| Reception | - | - | M300 | 10 | Data received from XGT #4 |

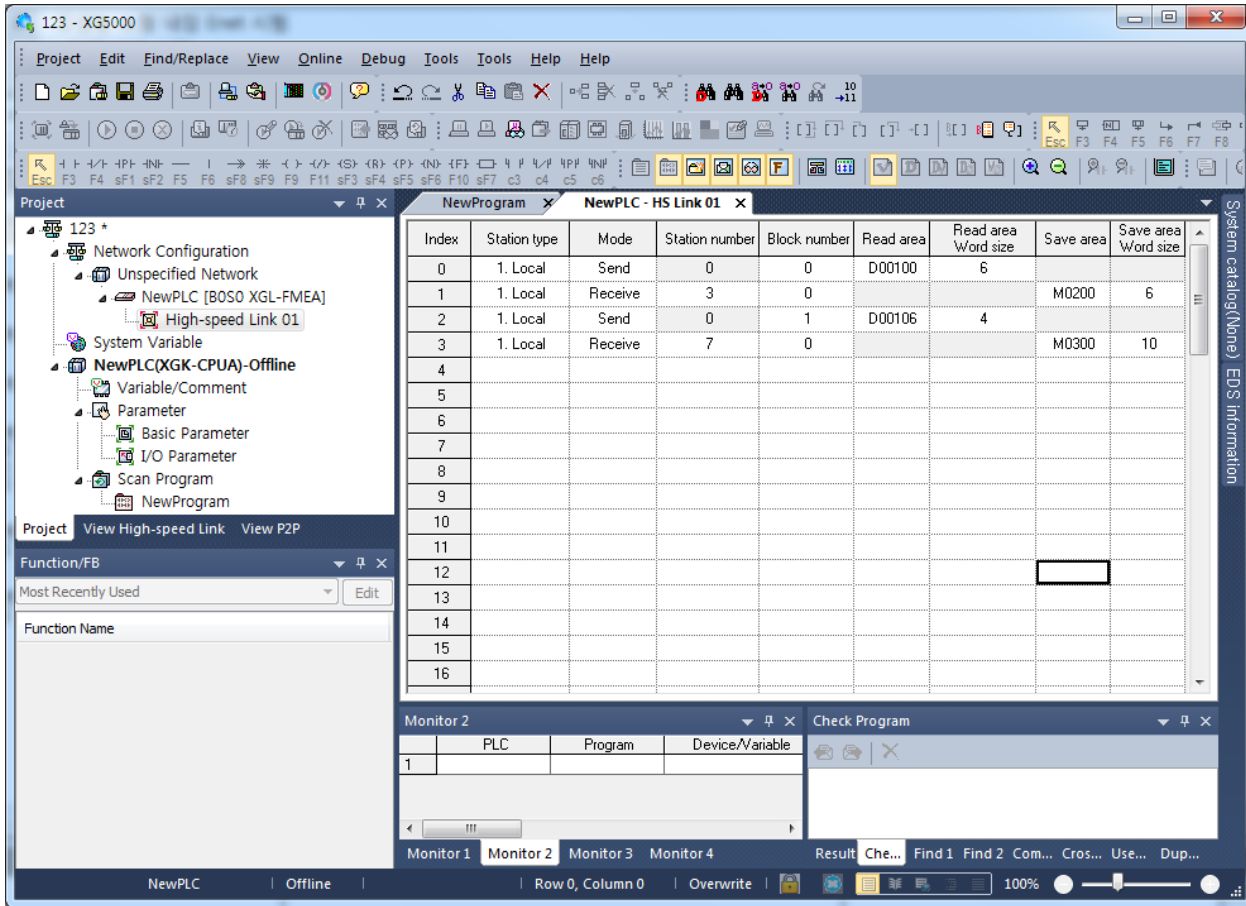
1) HSL Parameter Setting

For system data communication, it is convenient to prepare a data communication map.

Prepare HSL parameter related with data communication and download it to the PLC. Run HSL in the following procedure.

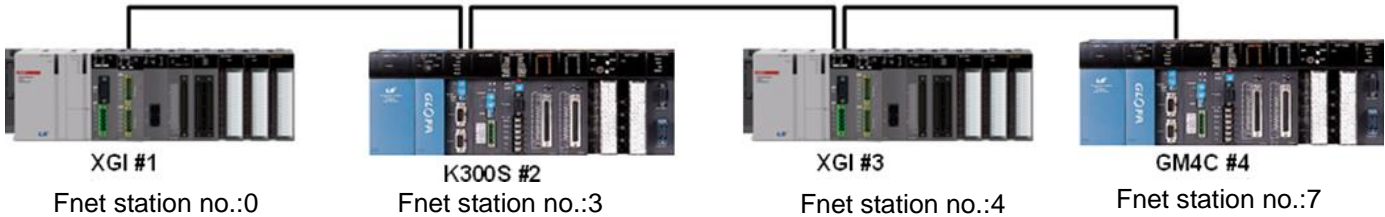
- (1) Prepare data communication map
- (2) Connect XG5000 to XGT CPU locally
- (3) Set up parameter in the HSL parameter setting items of the XG5000
- (4) Conduct Write Parameter in online menu
- (5) From online menu, select Enable Link and enable link suitable for the setting No.
- (6) Check HSL status using diagnosis service
- (7) In the event of an error occurs in above step (6), repeat from step (1) again

In the exemplary system, the high speed link parameter can be set as follows.



6.2 Application Sample in XGI-CPU

In this section, high speed link parameter setting method is provided with sample programs for an XGT Fnet system as shown below. Here, the high speed link parameter settings are in accordance with the XGI #1. With the Fnet system below, high speed link parameter setting method is described as below.



| Mode | Read Area | Send Size (word) | Save Area (XGI#1) | Receive Size (Word) | Remark |
|--------------|-----------|------------------|-------------------|---------------------|-----------------------------|
| Transmission | MW0 | 6 | - | - | Data sent to K300S #2 |
| Reception | - | - | Mw10 | 6 | Data received from K300S #2 |
| Transmission | Mw100 | 4 | - | - | Data sent to XGI #3 |
| Reception | - | - | MW200 | 10 | Data received from GM4C #4 |

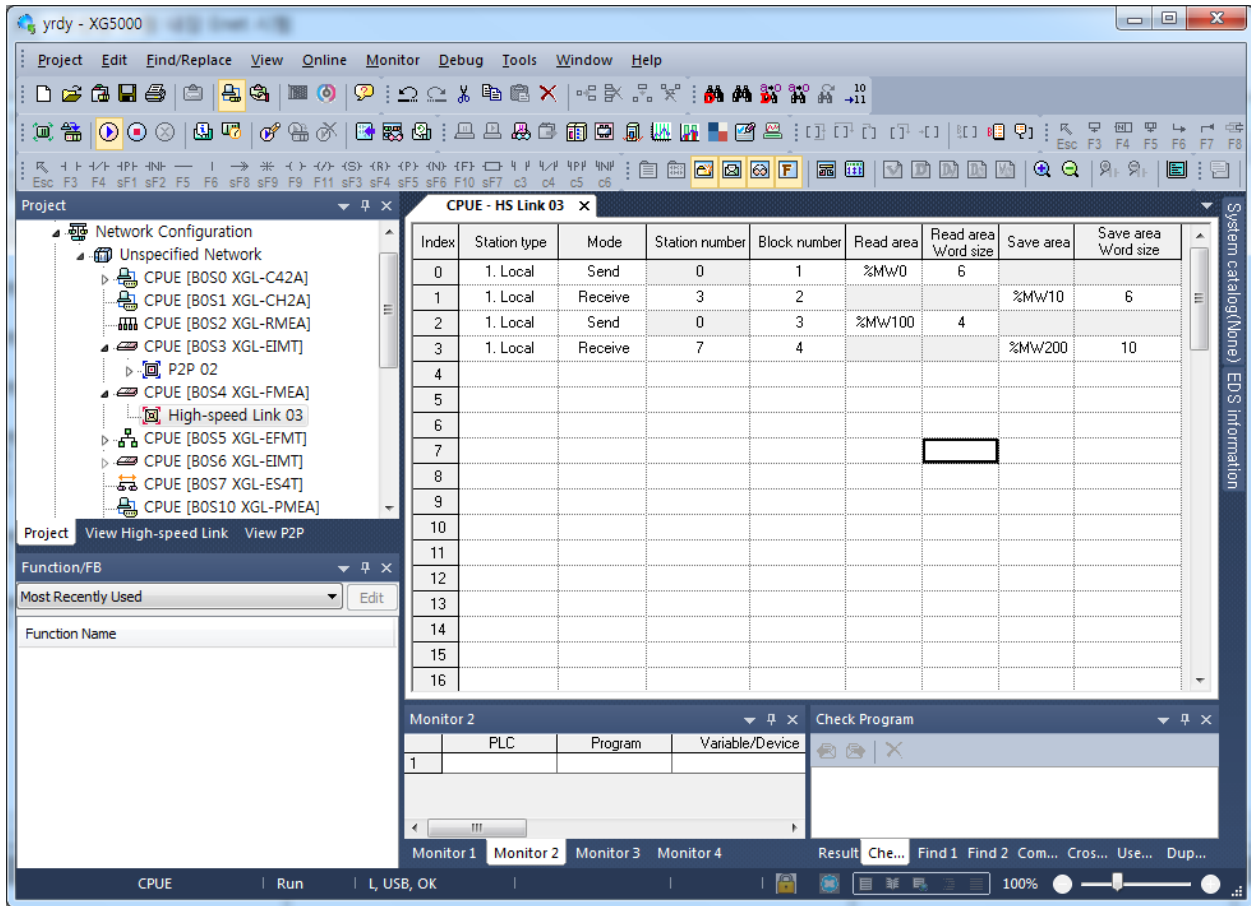
1) HSL Parameter Setting

For system data communication, it is convenient to prepare a data communication map.

Prepare HSL parameter related with data communication and download it to the PLC. Run HSL in the following procedure.

- (1) Prepare data communication map
- (2) Connect XG5000 to XGT CPU locally
- (3) Set up parameter in the HSL parameter setting items of the XG5000
- (4) Conduct Write Parameter in online menu
- (5) From online menu, select Enable Link setting and enable link suitable for the setting No.
- (6) Check HSL status using diagnosis service
- (7) In the event of an error occurs in above step (6), repeat from step (1) again

The result of parameter setting in the XG5000 is as follows.



Chapter 7 Max. Guarantee Time for Data Communication

7.1 Maximum guarantee time for communication between stations

The maximum guarantee time for data communication between stations is the maximum time which may be required for a sender station to transmit data to a receiver station. Therefore, the data which change by shorter cycle than this time cannot be guaranteed for reliability. The maximum guarantee time for data communication between stations depends upon the No. of stations in the communication network, No. of transmission parameters of the stations, and the program scan time of the communication PLC.

- 1) Transmission PLC Delay Time (sender station)
(2 times the max. scan time) + 20msec (time for data move from CPU to FNET module)
- 2) Reception PLC Delay Time (receiver station)
(2 times the max. scan time) + 20msec (time for data move from CPU to FNET module)
- 3) Transmission time (max. token guarantee time * No. of tokens required for the sender)
The max. token guarantee time is the total time of the token holding time of the station, calculated by $1.6 + 1.5 * Nm^{(note1)}$ per station. The No. of the tokens required for transmission is calculated by dividing the No. (N) of transmission blocks of the sender station with No. of the process blocks^(note2) per token plus one if there is remainder (add 2 instead of 1 as safety factor).
E.g.) In an XGT series with 20 transmission blocks, the 3 tokens are required for data transmission.
- 4) Max. Guarantee Time for Inter-Station Data Communication
Transmission PLC delay time + reception PLC delay time + transmission time

If the No. of transmission blocks of the stations is not available, assume the token holding time of the station to be the maximum value, which is $1.6 + 1.5 * 7 = 12.1(\text{msec})$ for XGT and $1.6 + 1.5 * 10 = 16.6(\text{msec})^{(note3)}$ for GM/MK. However, of all the stations, the No. of the transmission blocks of the sender station must be known.

Notes

- [1] Nm is the No. of the transmission blocks set up for each station. The maximum of XGT and GM/MK shall be 7 and 10, respectively.
- [2] No. of processed blocks per token
-XGT: 7
-GM/MK: 10
- [3] Constant for calculating token holding time
- 1.6 msec: time required for processing token
- 1.5 msec: time required for sending a 60 word frame

7.2 Calculation of the Max. Guarantee Time for Data Communication between Stations

The case below is based on; an XGT series having the station numbers and transmission blocks as presented below; program scan of each station is 10msec, and; the time required for the station 4 transmitting data to the station 1.

| Station No. | No. of Blocks |
|-------------|---------------|
| 1 | 3 |
| 2 | 5 |
| 3 | 10 |
| 4 | 20 |
| 5 | 32 |

- 1) For max. token guarantee time, calculate the token holding time of the stations as shown below, and add up.

| Station No. | No. of Blocks | Token holding time (sec) |
|-------------|---------------|-----------------------------|
| 1 | 3 | $1.6 + 1.5 \times 3 = 6.1$ |
| 2 | 5 | $1.6 + 1.5 \times 5 = 9.1$ |
| 3 | 10 | $1.6 + 1.5 \times 7 = 12.1$ |
| 4 | 20 | $1.6 + 1.5 \times 7 = 12.1$ |
| 5 | 32 | $1.6 + 1.5 \times 7 = 12.1$ |

- 2) Since the max. token guarantee time is the sum of the token holding time of the stations;
 $6.1 + 9.1 + 12.1 + 12.1 + 12.1 = 51.4$ (msec)
 3) The time required for the station 4 to send data to the station 1

| Station No. | No. of Blocks | No. of tokens required for station 4 | Transmission Time (msec) |
|-------------|---------------|--------------------------------------|--|
| 4 | 20 | $20/7=28.5=3$ | $3 \times 51.4=154.2$ When add 1 to the No. of tokens for safety, the result is 205.6 |

- 4) Delay time of the sender (station 4): $2 \times 10\text{msec} + 20 \text{ msec} = 40 \text{ msec}$
 5) Delay time of the receiver (station 1): $2 \times 10\text{msec} + 20 \text{ msec} = 40 \text{ msec}$
 6) Max. guaranteed data communication time between stations = (Sender PLC delay time) + (receiver PLC delay time) + (transmission time), therefore,
 $40 + 40 + 154.2(205.6) = 234.2$ or 285.6 (msec)

Therefore, the signals changing at the cycle longer than 234.2 or 285.6 msec can guarantee reliable communication. In particular, correct data communication can be guaranteed when the communication cycle is set to be longer than the maximum guarantee time for inter-station data communication.

7.3 Master Switching Time

Any station in the FNET can be a master station through competition for master. The station then acts as the LAS station and other stations act as slave stations. If the master is disabled for any reason, other stations compete for the mastership. This takes a little time which can be calculated as follows.

- ① (Station No. + 0x10) * 2 * 128 (usec)
- ② (Station No. + 0x10) * 128 (usec)
- ③ (0 ~ 63) * 128 (usec)
- ④ 1msec (RT frame transmission time)

The master switching time is determined by the sum of the above four factors. Due to the factor ③, the switching time becomes uncertain. The max./min. switching time for the stations are as follows.

| Station No. | Min. Time (μs) | Max. Time (μs) | Station No. | Min. Time (μs) | Max. Time (μs) |
|-------------|----------------|----------------|-------------|----------------|----------------|
| 0 | 7144 | 15208 | 32 | 19432 | 27496 |
| 1 | 7528 | 15592 | 33 | 19816 | 27880 |
| 2 | 7912 | 15976 | 34 | 20200 | 28264 |
| 3 | 8296 | 16360 | 35 | 20584 | 28648 |
| 4 | 8680 | 16744 | 36 | 20968 | 29032 |
| 5 | 9064 | 17128 | 37 | 21352 | 29416 |
| 6 | 9448 | 17512 | 38 | 21736 | 29800 |
| 7 | 9832 | 17896 | 39 | 22120 | 30184 |
| 8 | 10216 | 18280 | 40 | 22504 | 30568 |
| 9 | 10600 | 18664 | 41 | 22888 | 30952 |
| 10 | 10984 | 19048 | 42 | 23272 | 31336 |
| 11 | 11368 | 19432 | 43 | 23656 | 31720 |
| 12 | 11752 | 19816 | 44 | 24040 | 32104 |
| 13 | 12136 | 20200 | 45 | 24424 | 32488 |
| 14 | 12520 | 20584 | 46 | 24808 | 32872 |
| 15 | 12904 | 20968 | 47 | 25192 | 33256 |
| 16 | 13288 | 21352 | 48 | 25576 | 33640 |
| 17 | 13672 | 21736 | 49 | 25960 | 34024 |
| 18 | 14056 | 22120 | 50 | 26344 | 34408 |
| 19 | 14440 | 22504 | 51 | 26728 | 34792 |
| 20 | 14824 | 22888 | 52 | 27112 | 35176 |
| 21 | 15208 | 23272 | 53 | 27496 | 35560 |
| 22 | 15592 | 23656 | 54 | 27880 | 35944 |
| 23 | 15976 | 24040 | 55 | 28264 | 36328 |
| 24 | 16360 | 24424 | 56 | 28648 | 36712 |
| 25 | 16744 | 24808 | 57 | 29032 | 37096 |
| 26 | 17128 | 25192 | 58 | 29416 | 37480 |
| 27 | 17512 | 25576 | 59 | 29800 | 37864 |
| 28 | 17896 | 25960 | 60 | 30184 | 38248 |
| 29 | 18280 | 26344 | 61 | 30568 | 38632 |
| 30 | 18664 | 26728 | 62 | 30952 | 39016 |
| 31 | 19048 | 27112 | 63 | 31336 | 39400 |

APPENDIX

A.1 Terms and Definitions

1) Self station

The Fnet I/F modules currently connected with XG5000. Usually, of the Fnet I/F modules installed in the current PLC, those which are connected to XG5000 and monitored and diagnosed.

2) Destination station

Other F-net I/F modules connected with the self station via Fnet. Usually refers to the Fnet I/F modules installed in other PLCs, the Fnet I/F modules installed in other slots of the current PLC may in this category.

3) Local Station

The module type which can act as a master (LAS) in the Fnet. The XGL-FMEA I/F module acts as a master only.
- GMMK series has remote stations in addition.

4) Remote Station

The opposite concept of the local station. As a partner station for communication with local station, a remote stations cannot conduct the role of LAS which controls token.

5) Fnet

Fieldbus is a middle/lower tier network which connects controllers and measuring instruments, or between controller. The specification adopts 3 tiers of the tiers of OSI. The 3 tiers are; the physical layer including H2 (1Mbps Electric), H1 (31.23Kbbs Electric), optic, wireless, etc.; data link layer adopting Scheduled and Circulated Token bus, and; the application layer which processes applications, and further, added with a user layer. Difference from R-net, Peer to Peer communication is supported.

6) Token

The authority of transmitting data by controlling the access to physical medium.

7) Repeater

Used to extend cables in communication networks by regeneration and amplification of electric signals.

8) Manchester Biphase-L

A data modulation method used in Rnet. Data are encoded using Manchester-I Code and transmitted. The data received by encoded with Manchester is decoded.

9) Individual Module Reset

A function used for system initialization in the event of an error in communication module.

In the XG5000, select [Online] → [Reset/Clear] → [Reset individual Module] to conduct reset.

When this function is executed, the communication module restarts.

10) Active Coupler

A module connecting the optic modules in a network. An optic splitter which can regenerate and amplify optic signals.

11) E.O.C (Electric/Optic Converter)

A module converting optic signals into electric signals and vice versa, in addition to signal regeneration and amplification

12) CRC (Cyclic Redundancy Check)

A method of error detection widely used in synchronous communication.

13) Terminating Resistor

The resistor used for impedance matching between the transmitter and receiver on a physical layer. The terminating resistor of Fnet is 110Ω, 1/2 W

14) HS (High Speed) Link

A communication method applicable for Fnet communication modules only. Used for high speed data communication by HIGH SPEED LINK link parameter setting of XG5000 and GMWIN/KGL-WIN.

15) Segment

A local network where all the stations are connected using the same token, not using any connection device such as gateway, EOC or repeater.

16) Network

A communication system comprising one or more segments and using the same token.

17) LAS Creation and Transfer Method

LAS is created in FMM communication modules in following cases.

- (1) Of all the stations connected to the network, the FMM communication module whose power is turned on earlier than all others acquires the LAS
- (2) If two or more stations are powered on at the same time, the station of the lower station number gets the LAS.
- (3) If the LAS station fails during normal communication, the LAS is transferred to the FMM station having the lowest station number.
- (4) Only one LAS exists in a network

A.2 List of Flags

[Table A.2.1] Communication flag according to HSL No. (HSL No. 1 ~ 12)

| No. | Key word | Type | Description | Detail Explanation |
|-------------------|------------------------------|-----------|--|--|
| L000000 | _HS1_RLINK | Bit | All the stations of HSL parameter #1 are operating normally | All the stations are working normally according to the parameters set up in the HSL. This flag is ON under following conditions. - all the stations set up in the parameter are in RUN mode without error, - all the data blocks conduct normal communication, and - when the parameters set up in the stations themselves are normally communicated, the RUN_link, if once turned on, keeps on unless interrupted by link disable. |
| L000001 | _HS1_LTRBL | Bit | After _HS1_RLINK ON, abnormal state is indicated | This flag is on when the _HSm_RLINK flag is on and the communication between the stations set up in the parameters and data block are as follows; - the station set up in the parameter is not in RUN mode, - the station has an error, or -if the data block's communication is not smooth, the link trouble will turn on if the above conditions 1, 2, or 3 occurs, and turns off when the above conditions are corrected. |
| L000020 ~ L00009F | _HS1_STATE[k] (k=000~127) | Bit Array | Show comprehensive condition of the HSL parameter #1&k blocks | Indicates the general status of the communication information of the data block set up in the parameter. _HS1_STATE[k]=_HS1_MOD[k]&_HS1_TRX[k]&(~_HSm_ERR[k]) |
| L000100 ~ L00017F | _HS1_MOD[k] (k=000~127) | Bit Array | RUN operation mode of the HSL parameter #1&k block stations | Indicates the operation mode of the station set up in the K-data block of the parameter |
| L000180 ~ L00025F | _HS1_TRX[k] (k=000~127) | Bit Array | Normal communication with the HSL parameter #1&k block stations | Indicates whether the communication of the K-data block of the parameter is normal. |
| L000260 ~ L00033F | _HS1_ERR[k] (k=000~127) | Bit Array | Operation error mode of the of the HSL parameter #1&k block stations | Indicates if there is error in the communication of the K-data block of the parameter |
| L000340 ~ L00041F | _HS1_SETBLOC K[k] | Bit Array | Block setting of the HSL parameter #1&k blocks | Indicates whether the K-data block is set up in the parameter |

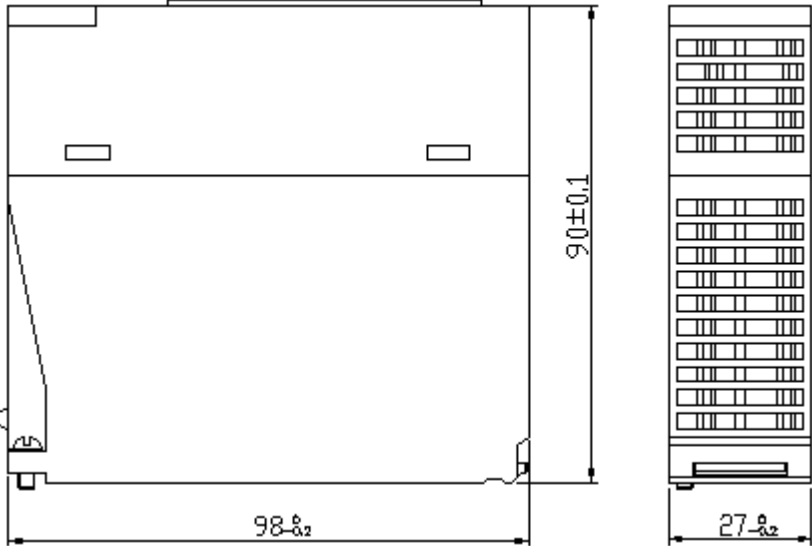
Note

| HSL No. | L Area Address | Remark |
|---------|-----------------|---|
| 2 | L000500~L00099F | Comparing to the HSL #1 of the [Table 1], the flag address No. of other HSL station No. can be calculated with the formula below. |
| 3 | L001000~L00149F | |
| 4 | L001500~L00199F | * L Area Address No. = L000000 + 500 x (HSL No. – 1) |
| 5 | L002000~L00249F | |
| 6 | L002500~L00299F | |
| 7 | L003000~L00349F | |
| 8 | L003500~L00399F | |
| 9 | L004000~L00449F | To use HSL flag for programming and monitoring, it is convenient to use the flag map registered in the XG5000. |
| 10 | L004500~L00499F | |
| 11 | L005000~L00549F | |

Ex) k is the block number, which shows the information of the 128 (1~127) blocks with 8 words (16 blocks per word). For example, the mode information (_HS1_MOD) shows from block 0 to block 15, blocks 16~31, 32~47, 48~63, 64~79, 80~95, 96~111, and 112~127 in the L00010, L00011, L00012, L00013, L00014, L00015, L00016, and L00017, respectively. For example, the mode information of the block #55 is in the L000137.

A.3 Dimensions

Unit: mm



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 pleasurable 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.



www.ls-electric.com

LS ELECTRIC Co., Ltd.

■ Headquarter

LS-ro 127(Hogye-dong) Dongan-gu, Anyang-si, Gyeonggi-Do, 14119, Korea

■ Seoul Office

LS Yongsan Tower, 92, Hangang-daero, Yongsan-gu, Seoul, 04386, Korea

Tel: 82-2-2034-4033, 4888, 4703 Fax: 82-2-2034-4588

E-mail: automation@ls-electric.com

■ Overseas Subsidiaries

• LS ELECTRIC Japan Co., Ltd. (Tokyo, Japan)

Tel: 81-3-6268-8241 E-Mail: japan@ls-electric.com

• LS ELECTRIC (Dalian) Co., Ltd. (Dalian, China)

Tel: 86-411-8730-6495 E-Mail: china.dalian@lselectric.com.cn

• LS ELECTRIC (Wuxi) Co., Ltd. (Wuxi, China)

Tel: 86-510-6851-6666 E-Mail: china.wuxi@lselectric.com.cn

• LS ELECTRIC Middle East FZE (Dubai, U.A.E.)

Tel: 971-4-886-5360 E-Mail: middleeast@ls-electric.com

• LS ELECTRIC Europe B.V. (Hoofddorp, Netherlands)

Tel: 31-20-654-1424 E-Mail: europartner@ls-electric.com

• LS ELECTRIC America Inc. (Chicago, USA)

Tel: 1-800-891-2941 E-Mail: sales.us@lselectricamerica.com

• LS ELECTRIC Turkey Co., Ltd.

Tel: 90-212-806-1225 E-Mail: turkey@ls-electric.com

■ Overseas Branches

• LS ELECTRIC Tokyo Office (Japan)

Tel: 81-3-6268-8241 E-Mail: tokyo@ls-electric.com

• LS ELECTRIC Beijing Office (China)

Tel: 86-10-5095-1631 E-Mail: china.auto@lselectric.com.cn

• LS ELECTRIC Shanghai Office (China)

Tel: 86-21-5237-9977 E-Mail: china.auto@lselectric.com.cn

• LS ELECTRIC Guangzhou Office (China)

Tel: 86-20-3818-2883 E-Mail: china.auto@lselectric.com.cn

• LS ELECTRIC Chengdu Office (China)

Tel: 86-28-8670-3201 E-Mail: china.auto@lselectric.com.cn

• LS ELECTRIC Qingdao Office (China)

Tel: 86-532-8501-2065 E-Mail: china.auto@lselectric.com.cn

• LS ELECTRIC Nanjing Office (China)

Tel: 86-25-8467-0005 E-Mail: china.auto@lselectric.com.cn

• LS ELECTRIC Bangkok Office (Thailand)

Tel: 66-90-950-9683 E-Mail: thailand@ls-electric.com

• LS ELECTRIC Jakarta Office (Indonesia)

Tel: 62-21-2933-7614 E-Mail: indonesia@ls-electric.com

• LS ELECTRIC Moscow Office (Russia)

Tel: 7-499-682-6130 E-Mail: info@lselectric-ru.com

• LS ELECTRIC America Western Office (Irvine, USA)

Tel: 1-949-333-3140 E-Mail: america@ls-electric.com

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