Programmable Logic Controller

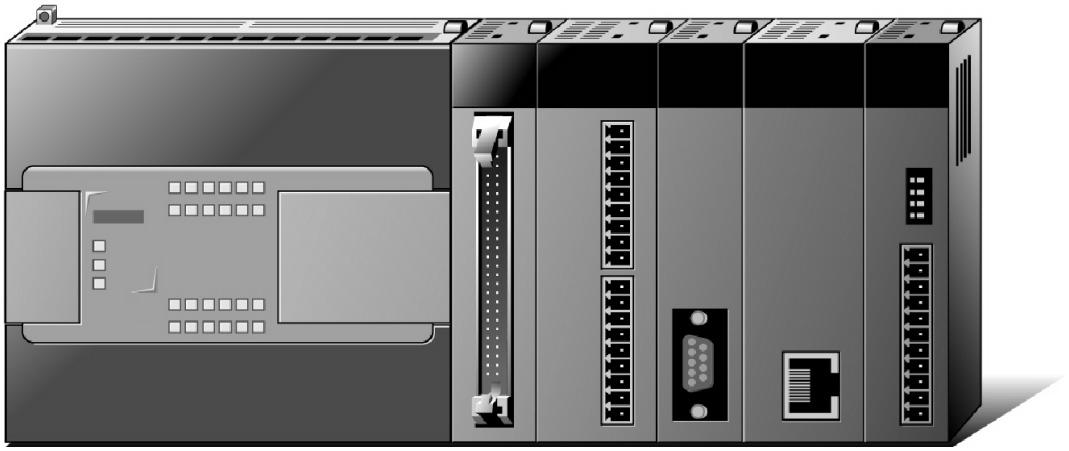
XGB Series

Smart I/O Module

User's Manual

Modbus

Ethernet



Safety Instructions

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

http://www.imopc.com

INDEX

Chapter 1 Overview

1.1 How to use the User's Manual ---------- 1-1
1.2 Characteristics of Smart I/O ---------- 1-3
1.3 Product Configuration of Smart I/O ---------- 1-4
1.3.1 Type name indication ---------- 1-4
1.3.2 Removable Type Terminal Block---------- 1-4
1.3.3 Module Specifications---------- 1-5
1.3.4 Compatibility list according to Smart I/O Module version---------- 1-7
1.4 Notice in using ---------- 1-8

Chapter 2 Product Specification

2.1 General Specification---------- 2-1
2.2 Power Specification---------- 2-2
2.2.1 Performance Specification---------- 2-2
2.3 Digital Input Module Specification---------- 2-3
2.3.1 DC16 point stand-alone type input module (Source/Sink) ---------- 2-3
2.3.2 DC32 point stand-alone type input module (Source/Sink) ---------- 2-4
2.3.3 DC 8 point modular type input module (Source/Sink) ---------- 2-5
2.3.4 DC 16 point modular type input module (Sink/Source) ---------- 2-6
2.3.5 DC 32 point modular type input module (Source/Sink) ---------- 2-7
2.4 Digital Output Module Specification----------2-8
2.4.1 16 point relay output stand-alone type module ---------- 2-8
2.4.2 16 point transistor stand-alone type output module (0.1 Sink) ---------- 2-9
2.4.3 16 point transistor stand-alone type output module (0.5A Sink) ---------- 2-10
2.4.4 16 point transistor stand-alone type output module (0.5A Source) ---------- 2-11
2.4.5 32 point Transistor stand-alone type output module (0.1A Sink) ---------- 2-12
2.4.6 32 point transistor stand-alone type output module (0.5A Source) ---------- 2-13
2.4.7 32 Transistor stand-alone type Output Module (0.5A Sink) ---------- 2-14
2.4.8 8 point relay modular type output module ---------- 2-15
2.4.9 16 point relay modular type output module ---------- 2-16
2.4.10 8 point Transistor Modular type Output Module (0.5 A Sink) ---------- 2-17
2.4.11 16 point Transistor Modular type Output Module (0.5 A Sink) ---------- 2-18
2.4.12 32 point Transistor Modular type Output Module (0.2 A Sink) ---------- 2-19
2.5 Digital I/O combined Module Specification----------2-20
2.5.1 32point I/O combined module (DC16/TR16 point) ---------- 2-20
2.5.2 32point I/O combined module (DC16/TR16 point) ---------- 2-21
2.5.3 32point I/O combined module (DC16/TR16 point) ---------- 2-22
2.6 Modular type analogue module specification ---------- 2-23
2.6.1 Modular type analogue current output module (XBF-DV04A/ XBF-DC04A) -------- 2-23
2.6.2 Modular type analogue input module (XBF-AD04A) ---------- 2-24
2.6.3 Modular type RTD sensor module (XBF-RD04A) ---------- 2-25

2.7 Communication Module Specification ---------- 2-26
2.7.1 Snet (GSL) Module Specification ---------- 2-26
2.7.2 Enet Master Module Specification ---------- 2-27

2.8 Communication Cable Specification ---------- 2-28
2.8.1 Snet (GSL) Cable specification ---------- 2-28
2.8.2 Enet Cable Specification ---------- 2-29
2.9 Terminating---------- 2-31
2.9.1 Snet terminating---------- 2-31

Chapter 3 System Configuration

3.1 Notices in selecting module---------- 3-1
3.2 Names of Each Part---------- 3-2
3.2.1 Basic system configuration---------- 3-2
3.2.2 Names of each part of Smart I/O series---------- 3-4
3.3 I/O Wiring Diagram of Communication Module---------- 3-8
3.3.1 External connection diagram of Smart I/O module---------- 3-8
3.4 Examples of System Configuration---------- 3-11
3.4.1 Snet system---------- 3-11

Chapter 4 Communication Programming

4.1 Overview---------- 4-1
4.2 Function Block---------- 4-3
4.2.1 Overview---------- 4-3
4.2.2 Start of GMWIN Function Block---------- 4-3
4.3 Execution of KGLWIN Instruction ---------- 4-5

Chapter 5 Modbus Communication

5.1 Overview---------- 5-1
5.2 Communication Specification---------- 5-1
5.3 Communication Parameter Setting---------- 5-6
5.3.1 G-GM series ---------- 5-6
5.3.2 K series ---------- 5-9
5.3.3 XGB series ---------- 5-11
5.4 Function Block---------- 5-17
5.4.1 G-GM series ---------- 5-17
5.4.2 K series ---------- 5-34
5.5 Program Examples---------- 5-38
5.5.1 G-GM series ---------- 5-38
5.5.2 K series ---------- 5-48
5.5.3 XGB series ----------5-50

Chapter 6 Ethernet Communication

6.1 Introduction ---------- 6-1
6.2 Communication Dimension ----------6-2
6.3 Module Parameter Setting ----------6-3
6.3.1 BootpServer ----------6-3
6.3.2 Parameter setting ----------6-4

6.4 Modbus/TCP communication ----------6-3
6.4.1 I/O data assignment ----------6-5
6.4.2 Communication Setting ----------6-6
6.4.3 XGB Series communication ----------6-7
6.5 EtherNet/IP communication ----------6-16
6.5.1 I/O data assignment ----------6-16
6.5.2 Communication Setting ----------6-18
6.5.3 XGB Series communication ----------6-19

Chapter 7 Installation & Wiring

7.1 Installation---------- 7-1
7.1.1 Installation Environment----------7-1
7.1.2 Notices in installing Modbus module----------7-2
7.1.3 Notices in Handling----------7-3
7.2 Wiring----------7-7
7.2.1 Power wiring----------7-7
7.2.2 I/O Machine Wiring----------7-9
7.2.3 Grounding wiring----------7-17
7.2.4 Cable specification for wiring----------7-18

Chapter 8 Maintenance and Repair

8.1 Repair and Check---------- 8-1
8.2 Daily Check---------- 8-2
8.3 Regular Check---------- 8-3

Chapter 9 Trouble Shooting

9.1 Basic Procedure of Trouble Shooting---------- 9-1
9.2 Trouble Shooting---------- 9-2
9.2.1 Action method when POWER LED is OFF ---------- 9-3
9.2.2 Action method when ERR LED is blinking---------- 9-4
9.2.3 Action method when RUN LED is OFF ---------- 9-5
9.2.4 Action method when I/O part does not work normally---------- 9-6
9.2.5 Action method when Program Write does not work ---------- 9-8
9.2.6 XG-PD connection error ---------- 9-10
9.3 Trouble Shooting Questionnaire---------- 9-11

Appendix

A.1 Communication Terminology---------- A-1
A1.1 Modbus ---------- A-1
A1.2 Ethernet ---------- A-3
A.2 External Dimension---------- A-8
A.3 Expansion Analogue Module Parameter Setting Method (XEL-BSSA) ---------- A-9

Chapter 1 Overview

1.1 How to use the User's Manual

This User's Manual provides the information such as product specification, performance and operation method needed to use PLC System composed of Smart I/O module.

The User's Manual is composed of as follows.

CHAP.1 Overview
Describes the configuration of the user's manual, product characteristics and terminology.
CHAP.2 Product Specification
Describes common specification of each product used for Smart I/O series.
CHAP.3 System Configuration
Describes the kinds of product available for Smart I/O series and system configuration method.
CHAP.4 Communication Programming
Describes common communication program operating method to act Smart I/O module.
CHAP.8 Modbus Communication
Describes basic communication method of Modbus (Snet) communication module.
CHAP.9 Analogue I/O Module
Describes performance specification, each parts' names and program examples of analogue I/O module.
CHAP.10 Ethernet communication
Describes basic communication method of Ethernet (Enet) communication module.
CHAP.11 Installation and Wiring
Describes installation and wiring method, and notices to make sure of the reliability of PLC system.
CHAP.12 Maintenance and Repair
Describes check list and method to run PLC system normally for a long term.
CHAP.13 Trouble Shooting
Describes various errors to be occurred while using the system and the action to solve the problem.
Appendix
Here describes the product terminology and external dimension for system installation.

If you want to write programs, refer to the following documents.

- XG5000 user manual
- XGB Instruction manual
- XGB CPU manual
- XGB Snet I/F module user manual
- XGB Enet I/F module user manual

- i3 Remote I/O tutorial

When you make system using the i3 Controller and Smart I/O module, consider the followings. The following is CPU or software version for operating the module.

- i3 Configurator

Remark

1) This manual is written for XG5000 V3.0 and i3 Configurator V9.1 (or later)

1.2 Characteristics of Smart I/O

The characteristics of Smart I/O series is as follows.

(1) Product design based on International Electrotechnical Commission (IEC 61131)
- Easy support to programming device
- Standard language (IEC 61131-3) provided (IL / LD / SFC)

(2) Open network by selecting international standard communication protocol.

(3) Available to communicate with remote master module independently without power module/CPU module.

(4) Available to set maximum 32
- Maximum 32 stations (Snet)

(5) Enables to save the cost for installation and maintenance.

(6) Various system configuration and simple maintenance and repair.

(7) Easy to change the system.

(8) Compatible with other maker's product.
- Available to connect Smart I/O to other maker's master.

(9) Easy to set the system as the station address setting by hardware is available.

(10) Simple communication programming.
- Using i3 Configurator protocol config wizard, or Ethernet I/O configuration

(11) Supports various I/O.
- DC input 16/32 points, TR output 16/32 points, Relay output 16 points
- Combined 32 point (DC input 16 point/ TR output 16 point)
- When using XG-Rail type Smart I/O, it is available to use 4 channels, AD (analog input)/DA (analog voltage output)/DC (analog output)/ RTD.

(12) Supports various OPEN type communication method. Modbus (Snet)

(13) Easy to configure system and use
- integrating PLC: Packaged by one unit including CPU, I/O and communication function.
- extension PLC: it is available to configure communication or I/O diversely.

(14) Provides the online network status detection function.
- Available to know the remote module status through high speed link monitor.

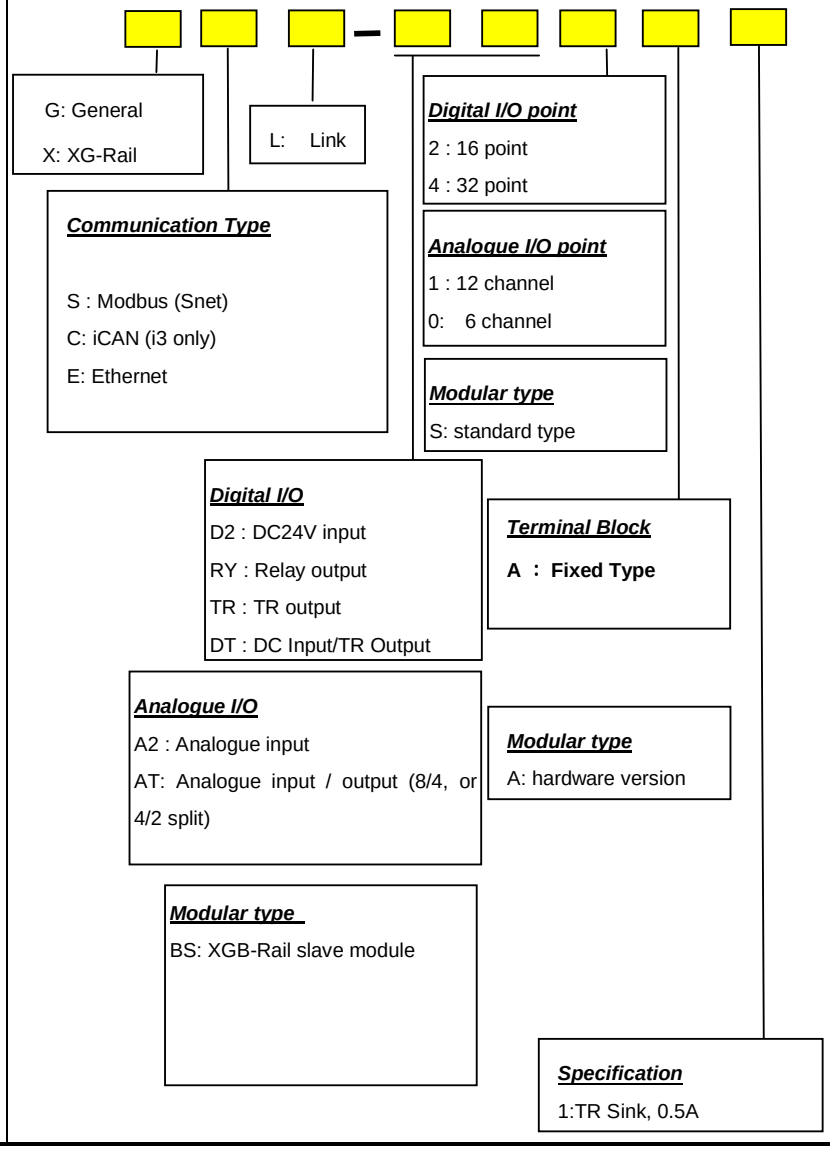
(15) Supports high speed communication.

(16) Flexible communication relation is available as the speed shall be set automatically according to the speed of master.

1.3 Product Configuration of Smart I/O

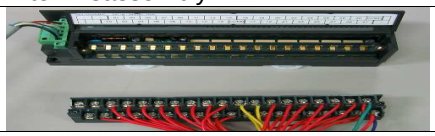
1.3.1 Type Name Indication

Type Name indication



iCAN
Snet
Enet

1.3.2 Removable Type Terminal Block

Before Disassembly	After Disassembly
	

1.3.3 Module Specifications

1) Snet

(1) Stand-alone type

Classification	Type name		Specification
TR output	Fixed	GSL-TR2A	DC24V, TR output 16 (Sink 0.1A)
		GSL-TR4A	DC24V, TR output 32 (Sink 0.1A)
Combo	Fixed	GSL-DT4A	DC24V, DC input 16/TR output 16 (Sink 0.1A)
Relay output	Fixed	GSL-RY2A	DC24V(Rating), Relay output 16
DC input	Fixed	GSL-D22A	DC24V(Rating), DC input 16
		GSL-D24A	DC24V(Rating), DC input 32

1) iCAN

(1) Stand-alone type

Classification	Type name		Specification
TR output	Fixed	GCL-TR2A	DC24V, TR output 16 (Sink 0.1A)
		GCL-TR4A	DC24V, TR output 32 (Sink 0.1A)
Combo	Fixed	GCL-DT4A	DC24V, DC input 16/TR output 16 (Sink 0.1A)
Relay output	Fixed	GCL-RY2A	DC24V(Rating), Relay output 16
DC input	Fixed	GCL-D22A	DC24V(Rating), DC input 16
		GCL-D24A	DC24V(Rating), DC input 32
Analogue	Fixed	GCL-A21A	12 mA / V Inputs
		GCL-AT0A	4 mA / V Inputs, 2 mA / V Outputs
		GCL-AT1A	8 mA / V Inputs, 4 mA / V Outputs

2) Enet / CAN

(1) Modular type

Classification	Type name	Specification
Communication adapter	XEL-BSSA	Enet I/F adapter (MODBUS/TCP)
	XCL-BSSA	CAN I/F adapter (iCAN protocol)
Modular I/O	XBE-DC32A	DC24V input 32 points
	XBE-DC16A	16 points DC24V input (Sink/Source)
	XBE-DC64A	64 points DC24V input (Source/Sink)
	XBE-RY16A	16 points relay output
	XBE-DR16A	8 points DC24V in / 8 relay output
	XBE-TN16A	16 points TR output (Sink)
	XBE-TN32A	32 points TR output (Sink)
	XBE-TN64A	64 points TR output (Sink)
Modular Special	XBF-AD04A	Current/Voltage input 4 channels
	XBF-DV04A	Voltage output 4 channels
	XBF-DC04A	Current output 4 channels
	XBF-RD04A	Resistance Temperature Detector input 4 channels
	XBF-TC04S	Thermocouple 4 channels

1.4 Notice in Using

When installing this device, notice the followings for the reliability and safety.

Category	Classification	Contents
Temperature	Condition	• When installing this device, maintain the temperature between 0~55 °C • Do not exposure it to direct light.
	Measure	• When temperature is too high, install pan, air-conditioner and when temperature is too low, install suitable device.
Condensing	Condition	• No condensing allowed. • Install something in the control panel for protection from the water and dust.
	Measure	• Due to the frequent On/Off, condensing may occur. In this case, turn on the device at the night
Shock	Condition	• Install it in the place where impact and vibration don't occur..
	Measure	• When impact and vibration is severe, install anti-vibration rubber so that vibration and impact doesn't affect the device.
Gas	Condition	• Install in the place where there is not corrosive gas.
	Measure	• When corrosive gas enters, plan air-purification measure in the control panel.
EMC Environment	Condition	• Install in the place where electro-magnetic wave is not severe.
	Measure	• In case of wiring, set the precise route. • Check the shield of control panel For light, use glow lamp and avoid fluorescent lamp • When installing power module, ground the device at standard electric potential

Chapter 2 Product Specification

2.1 General Specification

The General Specification of Smart I/O series is as follows.

No	Items	Specification					References
1	Operating temperature	0 ~ 55 °C					-
2	Storage temperature	–25 ~ +70 °C					-
3	Operating humidity	5 ~ 95%RH, no dew					-
4	Storage humidity	5 ~ 95%RH, no dew					-
5	Vibration	In case of Intermittent vibration				-	-
		Frequency	Acceleration	Amplitude		Times	IEC6 1131-2
		10 ≤ f < 57Hz	–	0.075mm		X, Y, Z 10 times each direction	
		57 ≤ f ≤ 150Hz	9.8m/s^2{1G}	–			
		In case of Continuous vibration					
		Frequency	Acceleration	Amplitude			
		10 ≤ f < 57Hz	–	0.035mm			
		57 ≤ f ≤ 150Hz	4.9m/s^2{0.5G}	–			
6	shocks	• max. impact acceleration : 147 m/s^2{15G} • Application time : 11ms • pulse wave type : semi-sine wave pulse (3 times each direction X, Y, Z)					IEC 61131-2
7	Noise	Square wave impulse noise	± 1,500 V,				IMO Standard
		Electrostatic discharging	Voltage : 4kV (contact discharging)				IEC 61131-2, IEC 61000-4-2
		Radiant electromagnetic field noise	27 ~ 500 MHz, 10 V/m				IEC 61131-2, IEC 61000-4-2
		Fast Transient / Bust Noise	Classification	Power module	Digital I/O (more than 24V)	Digital I/O (below 24V) Analog I/O Communication Interface	IEC 61131-2 IEC 61000-4-4
			Voltage	2kV	1kV	0.25kV	
8	Ambient conditions	No corrosive gas, no dust					-
9	operating altitude	Less than 2,000m					-
10	Pollution degree	Less than 2					-
11	Cooling method	Natural air-conditioning					-

Remark

1) IEC (International Electro-technical Commission)
: International civil community that promotes international cooperation for standardization of electric/ electro technology, publishes international standard and operates suitability assessment system related to the above.

2) Pollution Degree
: An index that indicates the pollution degree of used environment that determines the insulation performance of the device. For example, pollution degree 2 means the state to occur the pollution of non-electric conductivity generally, but the state to occur temporary electric conduction according to the formation of dew.

2.2 Power Specification

.

2.2.1 Performance specification

Here describes the Power Specification of Smart I/O

1) Stand-alone type module

Category	Specification
	Modbus, CAN (stand-alone type)
Input voltage	DC 24V (Tolerance range: DC 20.4V ~ 28.8V)
Input current	0.4A (+24 VDC)
Inrush current	40A lower: (24 VDC Input)
Power indication	When Power is on, LED ON
Cable specification	1.5 ~ 2.5mm^2 (AWG 16 ~ 22)
Fastening torque	12kg · cm

2) Modular type module

Category	Specification
	Enet, CAN (modular type)
Input voltage/current	DC24V/0.55A (allowed range:DC19.2V ~ 28.8V)
Output voltage/current	5V (± 20%) / less than 1.5A
Inrush current	Max 10A
Power indication	When power is On, LED ON

* In order to protect power supplier, use the max. 4A fuse-equipped power supplier.

Consumption current of I/O module available to equip is as follows.

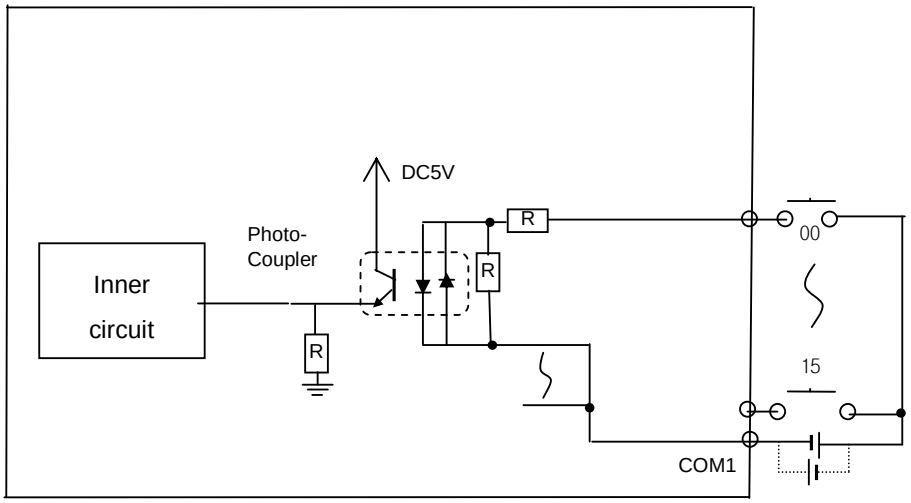
Expansion module		Type name	Consumption current (mA)
I/O module	Input module	XBE-DC16A	40
		XBE-DC32A	50
		XBE-DC64A	70
	Output module	XBE-DR16A	400
		XBE-RY16A	420
		XBE-TN16A	60
		XBE-TN32A	120
		XBE-TN64A	240
Special module		XBF-AD04A	50
		XBF-DC04A	50
		XBF-DV04A	50
		XBF-RD04A	100

2.3 Digital Input Module Specification

2.3.1 DC16 points stand-alone type input module (Source/Sink)

Specification \ Type name		DC Input Module
Input point		16 points
Insulation method		Photo-coupler insulation
Rated input voltage		DC24V
Rated input current		7 mA
Voltage range		DC20.4 ~ 28.8V (ripple rate : within 5%)
Max. simultaneous input point		100% (16 points/1COM) simultaneously ON
ON voltage / ON current		More than DC19V / more than 3.5 mA
OFF voltage / OFF current		Less than DC6V / less than 1.5 mA
Input resistance		Approx. 3.3 kΩ
Response time	Off → On	Less than 3 ms
	On → Off	Less than 3 ms
Common method		16 points / COM (Sink/Source Type)
Internal consumption current		Less than 70mA
Operation indication		LED ON when input ON
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 160g

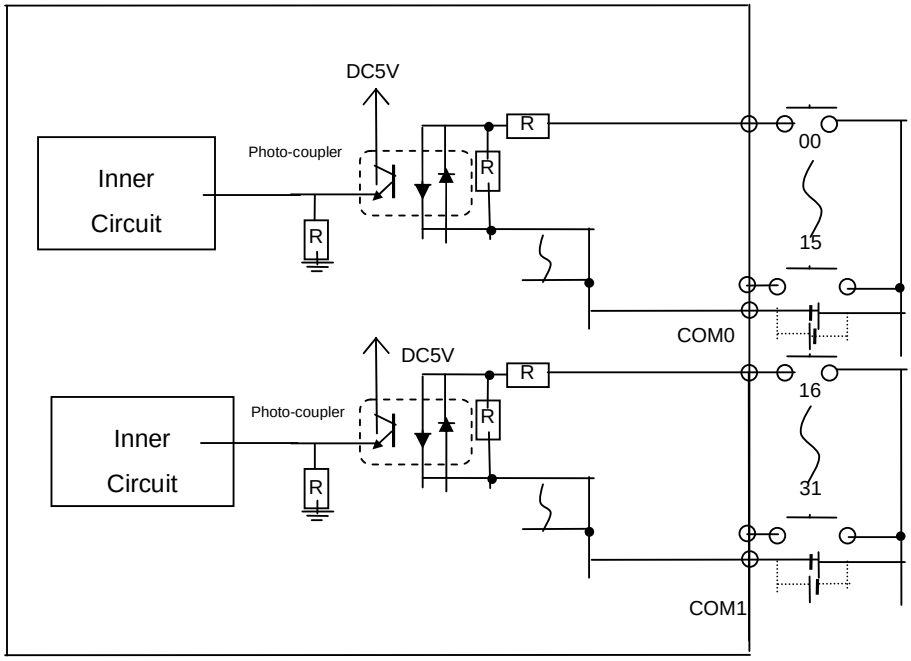
Circuit Configuration



2.3.2 DC32 point stand-alone type input module (Source/Sink)

Specification \ Type name		DC Input Module
Input point		32 points
Insulation method		Photo-coupler insulation
Rated input voltage		DC24V
Rated input voltage		7 mA
Use voltage range		DC20.4 ~ 28.8V (ripple rate : within 5%)
Max. simultaneous input point		100% (16 points/1COM) simultaneously ON
ON voltage / ON current		More than DC19V / more than 3.5 mA
OFF voltage / OFF current		Less than DC6V / less than 1.5 mA
Input resistance		Approx. 3.3 kΩ
Response time	Off -> On	Less than 3 ms
	On - > Off	Less than 3 ms
Common method		16 points / COM (Source/Sink type)
Internal consumption current		Less than 130 mA
Operation indication		LED ON when input ON
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 240g

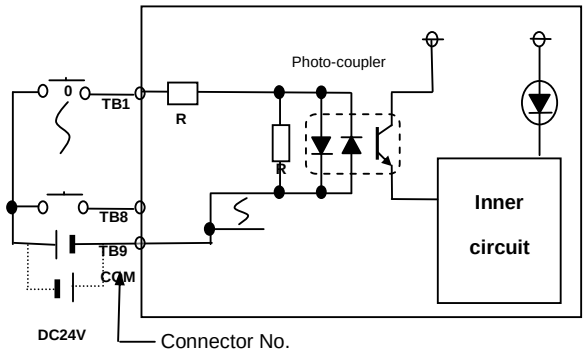
Circuit configuration



2.3.4 DC 16 point modular type input module (Sink/Source)

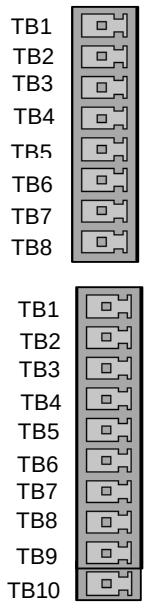
Specification \ Type name		DC input module
		XBE-DC16A
Input point		16point
Insulation method		Photo-coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Usage voltage range		DC20.4~28.8V (ripple rate less than 5%)
On voltage / On current		More than DC19V / more than 3 ㎃
Off voltage / Off current		Less than DC6V / less than 1 ㎃
Input resistance		About 5.6 ㎏Ω
Response time	Off → On	1/3/5/10/20/70/100 ㎳(setting with CPU parameter) initial value:3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistor		With insulation resistor meter more than 10 ㎆Ω
Common method		16 point / COM
Suitable wire size		Stranded wire 0.3~0.75 ㎟ (external less than 2.8 ㎜)
Inner consumption current		40 ㎃ (When input point is On)
Operating indication		LED is On when input is On
External connection method		8 pin terminal unit connector + 10 pin terminal unit connector
Weight		40g

Circuit configuration



No.	Point
TB1	0
TB2	1
TB3	2
TB4	3
TB5	4
TB6	5
TB7	6
TB8	7
TB1	8
TB2	9
TB3	A
TB4	B
TB5	C
TB6	D
TB7	E
TB8	F
TB9	COM
TB10	COM

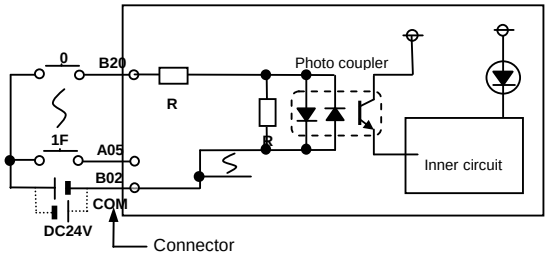
type



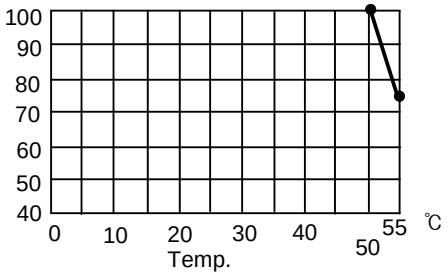
2.3.5 DC 32 point modular type input module (Source/Sink)

Specification \ Type name		DC Input Module XBE-DC32A
Input point		32point
Insulation method		Photo0coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Usage voltage range		DC20.4~28.8V (ripple rate less than 5%)
Input derating		Refer to the following derating diagram
On voltage / On current		More than DC19V / more than 3 ㎃
Off voltage / Off current		Less than DC6V / Less than 1 ㎃
Input resistance		About 5.6 ㎏Ω
Response time	Off → On	1/3/5/10/20/70/100 ㎳(setting with CPU parameter) initial value:3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistor		With resistor meter more than 10 ㎫Ω
Common method		32 point / COM
Suitable wire size		0.3 ㎟
Inner consumption current		50 ㎃ (When input point is On)
Operation indication		LED flicker when input is On
External connection method		40 pin connector
weight		60g

Circuit configuration

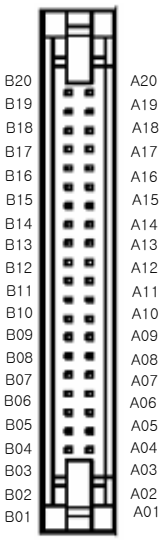


Input derating diagram



No.	Point	No.	Point
B20	00	A20	10
B19	01	A19	11
B18	02	A18	12
B17	03	A17	13
B16	04	A16	14
B15	05	A15	15
B14	06	A14	16
B13	07	A13	17
B12	08	A12	18
B11	09	A11	19
B10	0A	A10	1A
B09	0B	A09	1B
B08	0C	A08	1C
B07	0D	A07	1D
B06	0E	A06	1E
B05	0F	A05	1F
B04	NC	A04	NC
B03	NC	A03	NC
B02	COM	A02	COM
B01	COM	A01	COM

type

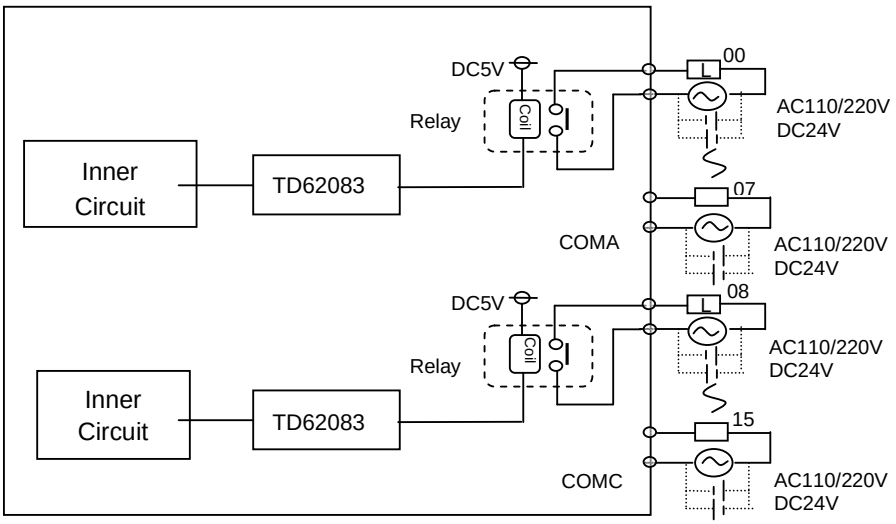


2.4 Digital Output Module Specification

2.4.1 16 point relay output stand-alone type module

Specification \ Type name		Relay Output Module
Output point		16 points
Insulation method		Relay insulation
Rating (Resistive Load)	Max. rated load	3A 250VAC, 3A 30VDC
	Max. rated power	750VA, 90W
	Max. rated load voltage	250VAC, 110VDC
	Max. rated load current	5A
Max. open/close frequency		1,200 times / hr
Surge killer		None
Life	Mechanical	$2X10^7$
	Electrical (20cpm base)	10^5
Response time	Off → On	Less than 10 ms
	On → Off	Less than 12 ms
Common method		8 points / COM
Internal consumption current		Less than 550 mA (when all points ON)
Operation indication		LED ON when output ON
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 300g/330g (RY2A: fixed type/RY2C:removable type)

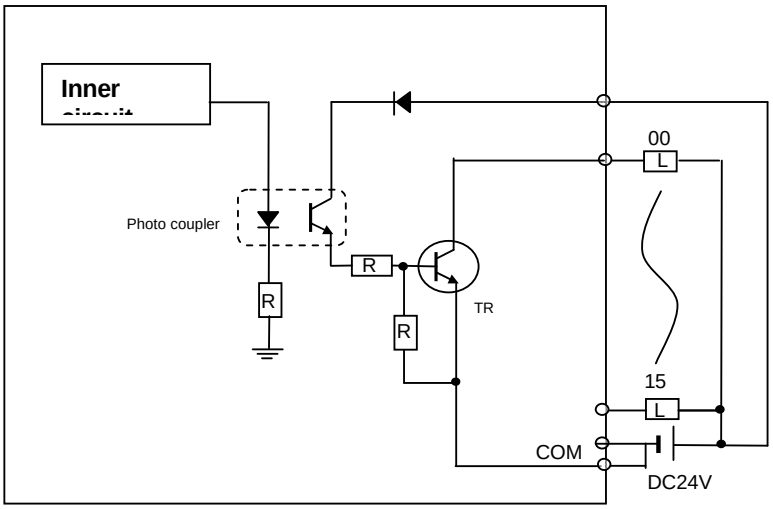
Circuit Configuration



2.4.2 16 point transistor stand-alone type output module (0.1 Sink)

Specification \ Type name		Transistor Output Module
Output point		16 points
Insulation method		Photo-coupler insulation
Rated load voltage		DC 24V
Load voltage range		DC 20.4 ~ 26.4V
Max. load current		0.1A / 1point, 2A / 1COM
Leakage current when OFF		Less than 0.1mA
Max. inrush current		Less than 4A / 10 ms
Max. voltage falling when ON		DC 1.5V
Surge killer		Clamp diode
Response time	Off → On	Less than 2 ms
	On → Off	Less than 2 ms
Common method		16 points / 1COM
Internal consumption current		Less than 280 mA (when all points ON)
External power Supply	Voltage	DC24V ± 10% (ripple voltage : less than 4 Vp-p)
	current	Less than 50 mA (DC24V per 1COM)
Operation indication		LED ON when output ON
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 160g (fixed type)

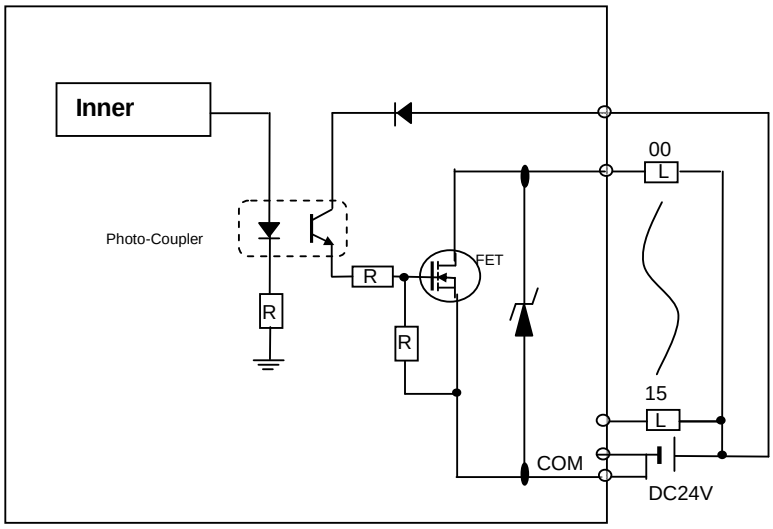
Circuit Configuration



2.4.3 16 point transistor stand-alone type output module (0.5A Sink)

Specification \ Type name		Transistor Output Module
Output point		16 point
Insulation method		Photo-coupler insulation
Rated load voltage		DC 24V
Load voltage range		DC 20.4 ~ 26.4V
Max. load current		0.5A / 1 point, 3A / 1COM
Leakage current when Off		Less than 0.1mA
Max. inrush current		Less than 1A / 10 ms
Max. voltage falling when ON		DC 1.5V
Response time	Off → On	Less than 2 ms
	On → Off	Less than 2 ms
Common method		16 point / 1COM (sink type)
Internal consumption current		Less than 90 mA (when all points ON)
External power Supply	Voltage	DC24V ± 10% (ripple voltage : less than 4 Vp-p)
	Current	Less than 50 mA (DC24V per 1COM)
Operation indication		LED ON when output ON
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 160g/190g (TR2A1:Fixed type/TR2C1:Removable type)

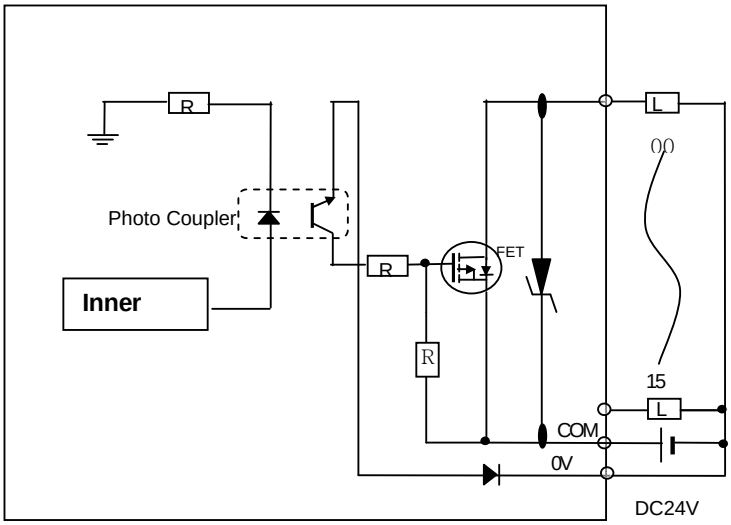
Circuit Configuration



2.4.4 16 point transistor stand-alone type output module (0.5A Source)

Specification \ Type name		Transistor Output Module
Output point		16 point
Insulation method		Photo-coupler insulation
Rated load voltage		DC 24V
Load voltage range		DC 20.4 ~ 26.4V
Max. load current		0.5A / 1 point, 3A / 1COM
Leakage current when Off		Less than 0.1mA
Max. inrush current		Less than 1A / 10 ms
Max. voltage falling when ON		DC 1.5V
Response time	Off → On	Less than 2 ms
	On → Off	Less than 2 ms
Common method		16point / 1COM (sink type)
Internal consumption current		Less than 90 mA (when all points ON)
External power Supply	Voltage	DC24V ± 10% (ripple voltage : less than 4 Vp-p)
	Current	Less than 50 mA (DC24V per 1COM)
Operation indication		LED ON when output ON
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 161g/191g (TR2A1:Fixed type/TR2C1:Removable type)

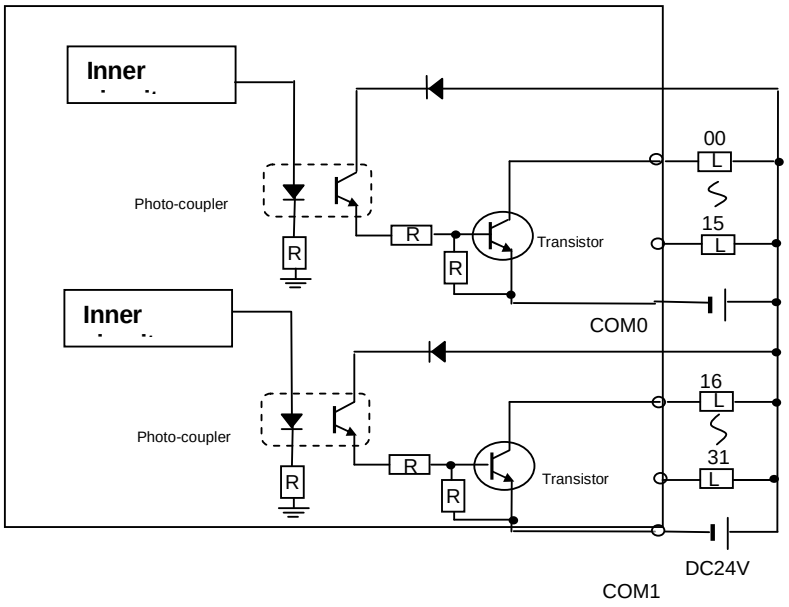
Circuit Configuration



2.4.5 32 point Transistor stand-alone type output module (0.1A Sink)

Specification \ Type Name		Transistor Output Module
Output point		32 point
Insulation method		Photo-coupler insulation
Rated load voltage		DC 24V
Load voltage range		DC 20.4 ~ 26.4V
Max. load current		0.1A / 1 point, 2A / 1COM
Leakage current when Off		Less than 0.1 mA
Max. inrush current		Less than 0.4 A / 10 ms
Max. voltage falling when ON		DC 1.0 V
Response time	Off → On	Less than 2 ms
	On → Off	Less than 2 ms
Common method		16 point / 1 COM(Sink Type)
Internal consumption current		Less than 110 mA (when all points ON)
External power Supply	Voltage	DC24V ± 10% (ripple voltage : less than 4 Vp-p)
	Current	Less than 40 mA (DC24V per 1COM)
Operation indication		LED ON when output ON (16 point indication conversion by using select switch)
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 240g (Fixed type)

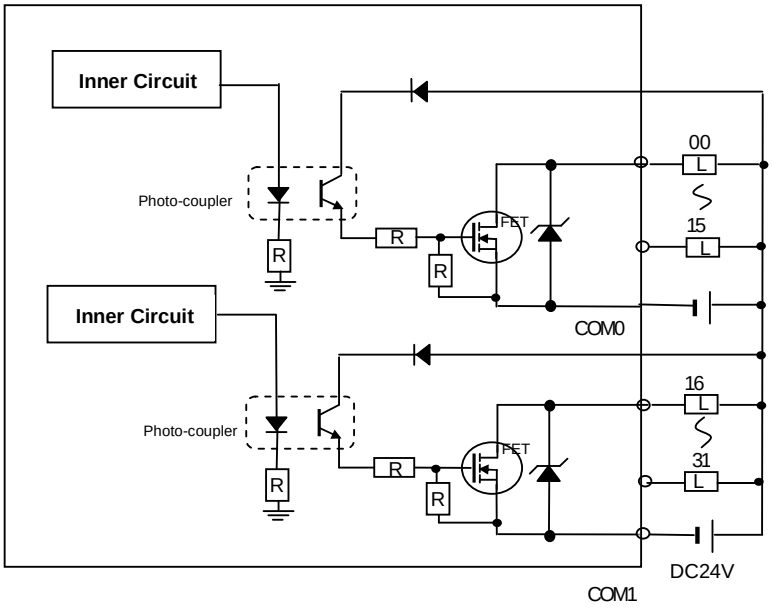
Circuit configuration



2.4.6 32 Transistor stand-alone type Output Module (0.5A Sink)

Specification \ Type Name		Transistor Output Module
Output point		32 point
Insulation method		Photo-coupler insulation
Rated load voltage		DC 24V
Range of load voltage		DC 20.4 ~ 26.4V
Max. load current		0.5A / 1point, 3A / 1COM
Leakage current when Off		Less than 0.1 mA
Max. inrush current		Less than 1A / 10 ms
Max. voltage falling when ON		DC 1.0 V
Response time	Off → On	Less than 2 ms
	On → Off	Less than 2 ms
Common method		16 point / 1 COM (Sink Type)
Internal consumption current		Less than 120 mA (when all points ON)
External power Supply	Voltage	DC24V ± 10% (ripple voltage : less than 4 Vp-p)
	Current	Less than 40 mA (DC24V per 1COM)
Operation indication		LED ON when output ON (16 point indication conversion by using select switch)
External connection method		Terminal unit connector (M3 X 6 screws)
Weight		Less than 240g/290g (TR2A1:Fixed type/TR2C1:Removable type)

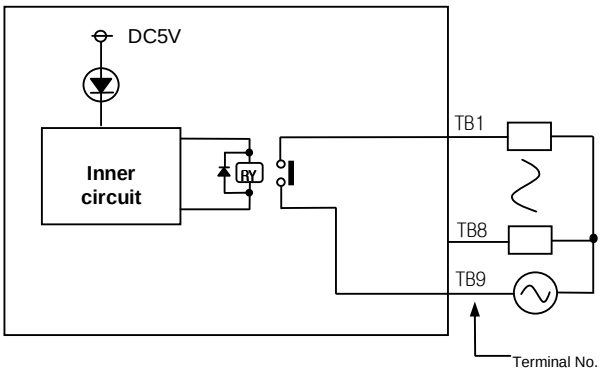
Circuit Configuration



2.4.7 16 point relay modular type output module

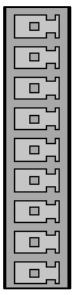
Specification \ Type name		Relay Output Module
		XBE-RY16A
Output point		Output point
Insulation method		Insulation method
Rated load voltage / current		Rated load voltage / current
Min. load voltage / current		Min. load voltage / current
Max. load voltage		Max. load voltage
Leakage current when OFF		Leakage current when OFF
Max. open/close frequency		Max. open/close frequency
Surge killer		Surge killer
Life	Mechanical	More than 2,000 times / hr
	Electrical	Rated load voltage / current more than $1X10^5$
		AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) more than $1X10^5$
		AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) more than $1X10^5$
		DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) more than $1X10^5$
Response time	Off → On	Less than 10 ㎳
	On → Off	Less than12 ㎳
Common method		Common method
Suitable wire size		Suitable wire size
Internal consumption current		Internal consumption current
Operation indication		Operation indication
External connection method		External connection method
Weight		Weight

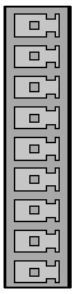
Circuit configuration



No.	Point
TB1	0
TB2	1
TB3	2
TB4	3
TB5	4
TB6	5
TB7	6
TB8	7
TB9	COM
TB1	8
TB2	9
TB3	A
TB4	B
TB5	C
TB6	D
TB7	E
TB8	F
TB9	COM

Shape

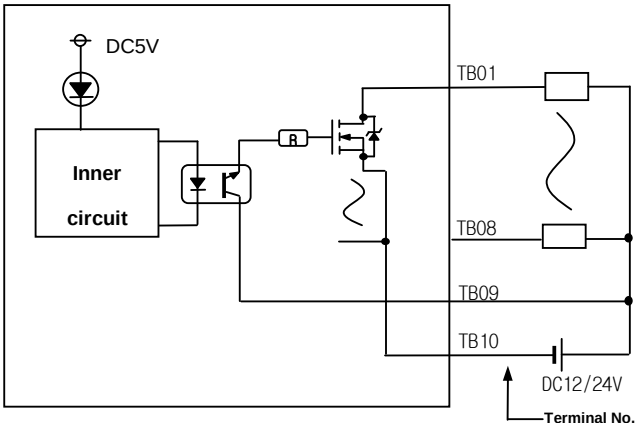




2.4.8 16 point Transistor Modular type Output Module (0.5 A Sink)

Type name / Specification		Transistor output module
		XBE-TN16A
Output point		16 point
Insulation method		Photo-coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.5A / 1 point, 2A / 1COM
Leakage current when Off		Less than 0.1 ㎃
Max. inrush current		Less than 4A / 10 ㎳
Max. voltage drop when On		Less than DC 0.4V
Surge killer		Zenner diode
Response time	Off → On	Less than 1 ㎳
	On → Off	Less than 1 ㎳ (rated load, resistor load)
Common method		Common method
Suitable wire size		Suitable wire size
Internal consumption current		Internal consumption current
External supply power	Voltage	DC12/24V ± 10% (Ripple voltage less than 4 Vp-p)
	Current	Less than 10 ㎃ (when connecting DC24V)
Operation indication		LED On when output is On
External connection method		8 pin terminal connector + 10 pin terminal connector
Weight		50g

Circuit configuration



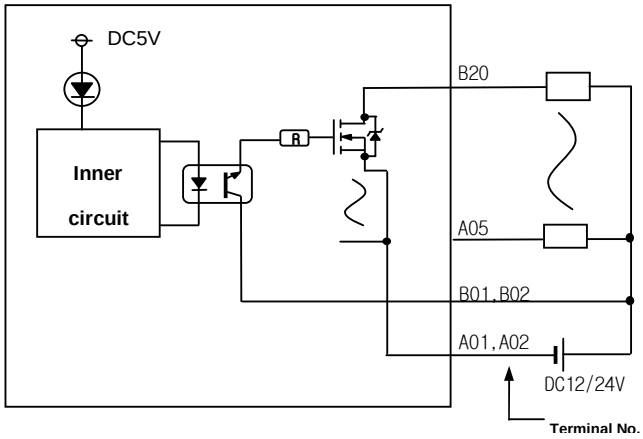
No.	Point
TB01	0
TB02	1
TB03	2
TB04	3
TB05	4
TB06	5
TB07	6
TB08	7
TB01	8
TB02	9
TB03	A
TB04	B
TB05	C
TB06	D
TB07	E
TB08	F
TB09	DC12 /24V
TB10	COM

Shape

2.4.9 32 point Transistor Modular type Output Module (0.2 A Sink)

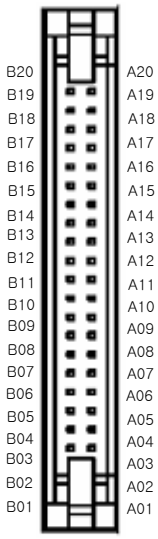
Type name / Specification		Transistor output module
		XBE-TN32A
Output point		32 point
Insulation method		Photo-coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.2A / 1point, 2A / 1COM
Leakage current when Off		Less than 0.1 ㎃
Max. inrush current		Less than 0.7A / 10 ㎳
Max. voltage drop when On		Less than DC 0.4V
Surge killer		Zenner diode
Response time	Off → On	Less than 1 ㎳
	On → Off	Less than 1 ㎳(Rated load, resistor load)
Common method		32 point / COM
Suitable wire size		0.3 ㎟
Internal consumption current		120 ㎃ (When output point is On)
External supply power	Voltage	DC12/24V ± 10% (Ripple voltage less than 4 Vp-p)
	Current	Less than 20 ㎃ (When connecting DC24V)
Operation indication		LED On when output is On
External connection method		40 pin connector
Weight		60g

Circuit configuration



No.	point	No.	point
B20	00	A20	10
B19	01	A19	11
B18	02	A18	12
B17	03	A17	13
B16	04	A16	14
B15	05	A15	15
B14	06	A14	16
B13	07	A13	17
B12	08	A12	18
B11	09	A11	19
B10	0A	A10	1A
B09	0B	A09	1B
B08	0C	A08	1C
B07	0D	A07	1D
B06	0E	A06	1E
B05	0F	A05	1F
B04	NC	A04	NC
B03	NC	A03	NC
B02	DC12 /24V	A02	COM
B01		A01	

Shape

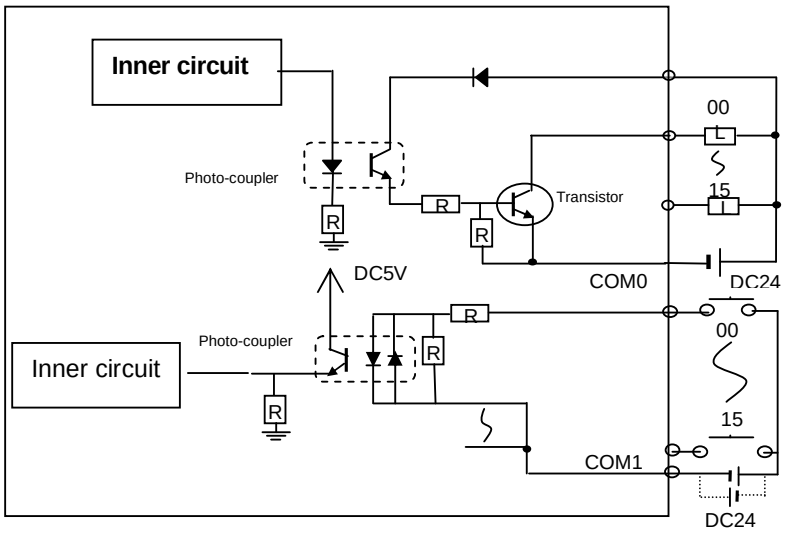


2.5 Digital I/O Combo Module Specification

2.5.1 32 point I/O combo module (DC 16/TR16 point)

I/O combo module					
Input			Output (TR 0.1A Sink)		
Input point		16 points	Output point		16 points
Insulation method		Photo-coupler insulation	Insulation method		Photo-coupler insulation
Rated input voltage		DC 24V	Rated load voltage		DC24V
Rated input current		7 mA	Rated load current		0.1A/1 point, 2A/1COM
Range of load voltage		DC 20.4~26.4V (ripple rate: less than 5%)	Range of load voltage		DC 20.4~26.4V
Max. synchronous input point		100% On synchronously	Leakage current when Off		Less than 0.1mA
On voltage/On current		More than DC19V / 3.0mA	Max. inrush current		Less than 0.4A/10ms
Off voltage/Off current		Less than DC6V / 1.5mA	Surge killer		None
Input resistance		About 3.3 kΩ	Response time	Off → On	Less than 2 ms
Response time	Off→ On	Less than 3 ms		On → Off	Less than 2 ms
	On → Off	Less than 3 ms	Max. voltage falling when ON		DC 1.0 V
Common method		16 point/COM (Source/Sink type)	Common method		16 point / 1COM (sink type)
Operation indication		LED ON when input ON	Operation indication		LED ON when output on
External supply consumption current		Terminal unit connector (M3 X 6 screws)			
External connection method		Less than 100mA			
Weight		Less than 240g (Fixed type)			

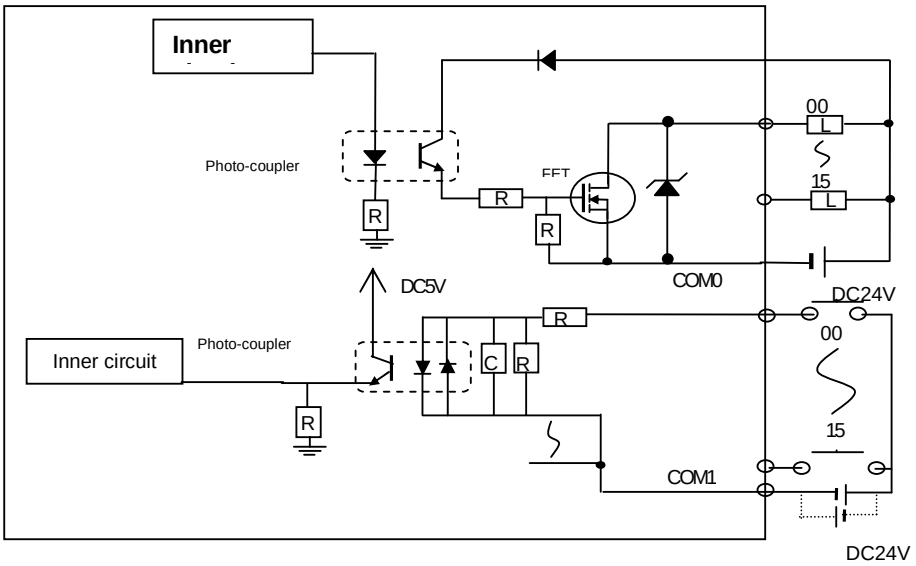
Circuit configuration



2.5.3 32 point I/O combo module (DC16/TR16 point)

I/O combined module			
Input		Output (TR 0.5A Sink)	
Input point	16 point	Output point	16 point
Insulation method	Photo-coupler insulation	Insulation method	Photo-coupler insulation
Rated input voltage	DC 24V	Rated load voltage	DC24V
Rated input current	5mA	Max. load current	0.5A/1 point, 3A/1COM
Range of load voltage	DC20.4~26.4V (ripple rate: less than 5%)	Range of load voltage	DC 20.4~26.4V
Max. synchronous input point	100% On synchronously	Leakage current when Off	Less than 0.1mA
On voltage/On current	More than DC19V/ 3.0mA	Max. inrush current	Less than 1A/10ms
Off voltage/Off current	Less than DC6V/ 1.5mA	Surge killer	None
Input resistance	About4.7 kΩ	Response time: Off → On	Less than 2 ms
Response time: Off→ On	Less than 3 ms	Response time: On → Off	Less than 2 ms
Response time: On → Off	Less than 3 ms	Max. falling voltage when On	DC 1.0 V
Common method	16 point /COM (Sink/Source type)	Common type	16 Point / 1COM (Sink type)
Operation indication	LED On when input on	Operation indication	LED On when output On
External connection method	Terminal unit connector (M3 X 6 screws)		
External supply consumption current	Less than 100mA		
Weight	Less than 240g/290g (DT4A1:Fixed type/DT4C1: Removable type)		

Circuit configuration



2.6 Modular type analogue module specification

2.6.1 Modular type analogue current output module (XBF-DV04A/ XBF-DC04A)

Category			Specification	
			XBF-DV04A	XBF-DC04A
Analogue output	Type		Voltage	Current
	Range		DC 0 ~ 10V (Load resistor: more than 2 kΩ)	DC 4 ~ 20mA DC 0 ~ 20mA (Load resistor: less than 510 Ω)
	Range	Unsigned value	0 ~ 4000	0 ~ 4000
		Signed value	-2000 ~ 2000	-2000 ~ 2000
		Precise value	0 ~ 1000	400 ~ 2000/0 ~ 2000
		Percentile value	0 ~ 1000	0 ~ 1000
Max. resolution			2.5 ㎷ (1/4000)	5 ㎂ (1/4000)
Precision			More than ± 0.5%	
Max conversion speed			1 ㎳/channel	
Absolute Max. output			DC ±15V	DC +25 ㎃
Output channel No.			4 channel	
Insulation method			Photo-coupler insulation between output terminal and PLC power (non-insulation between channels)	
Connection terminal			11point terminal	
I/O occupation point			Fixed type: 64 point	
Max. mount No.			4	
Consum-ption current	Inner (DC 5V)		110 mA	110 mA
	External (DC 21.6 ~26.4V)		70 mA	120 mA
Weight			64 g	70 g

Remark

1) Default value of the modular type Smart I/O Dnet adapter module parameter is 0x0000000F
   (1)XBF-DV04A : all channel (Enable), output (DC 0~10 V), analogue output range (0 ~ 4000)
   (2)XBF-DC04A : all channel (Enable), output (0 ~ 20 mA), analogue output range (0 ~ 4000)

2.6.2 Modular type analogue input module (XBF-AD04A)

Category	Specification XBF-AD04A
Analogue input	DC 0 ~ 10 V (Input resistance: 1 MΩ min.) DC 4 ~ 20 mA , DC 0 ~ 20 mA (Input resistance 250 Ω)
Analogue input range selection	▶ Analogue input range selection is done at the SyCon software after setting external switch. ▶Each input range can be set according to the channel.
Digital output	

Analogue input / Digital output	0~10 V	4 ~ 20 mA	0 ~ 20 m
Unsigned value	0 ~ 4000		
Signed value	-2000 ~ 2000		
Precise value	0 ~ 1000	400 ~ 2000	0 ~ 2000
Percentile value	0 ~ 1000		

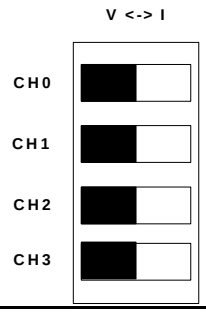
Max. resolution	Analogue input range	Resolution (1/4000)
	0 ~ 10 V	2.5 mV
	4 ~ 20 mA	5 μA
	0 ~ 20 mA	

Precision	Less than ±0.5%	
Max. conversion speed	1.5 ㎳/channel	
Absolute max input	voltage : ±15 V, current : ±30 mA	
Analogue input point	4channel/1module	
Insulation method	Photo-coupler insulation between output terminal and PLC power (non-insulation between channels	
Connection terminal	11point terminal	
Max. mount No.	4	
I/O occupation point	Fixed type: 64 point	
External power supply	Power input range	DC21.6V ~ DC26.4V
	Consumption current	62 ㎃
Weight	67g	

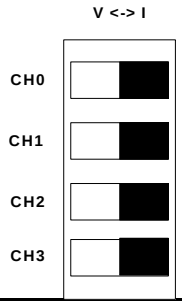
Voltage/current selection switch

▶switch for selecting the voltage/current of analogue input

(1) Off: voltage input



(2) On: current input



Remark

1) In the A/D conversion module, offset/gain value about each analogue input range is set in the factory. It is not available to change it by user

2) Modular type Smart I/O Dnet adapter module

The default value of parameter is 0x0000000 (This value is effective when off status. In the voltage mode you should change parameter.)

→ All channel (Enable), input (DC 0~10 V), analogue input range (0 ~ 4000)

2.6.3 Modular type RTD sensor module (XBF-RD04A)

Category		Specification
		XBF-RD04A
Input channel No.		4 channels
Input sensor type	PT100	JIS C1604-1997
	JPT100	JIS C1604-1981 , KS C1603-1991
Input Tem. range	PT100	-200 ~ 600℃
	JPT100	-200 ~ 600℃
Digital output	PT100	-2000 ~ 6000
	JPT100	-2000 ~ 6000
Precision	Room temp. (25℃)	Less than ±0.3%
	All range (0~55℃)	Less than ±0.5%
Conversion speed		40ms / channel
Insulation method	Between channel	Non-insulation
	Terminal – PLC power	Insulation (Photo-Coupler)
Terminal unit		15point terminal
I/O occupation point		Fixed type: 64point
Sensor wire method		3 line
Max. mount No.		4
Consumption current	Inner DC5V	100mA
	external DC24V	900mA
weight		63g

2.6.4 Stand-alone Analogue output module (GCL)

Category			Specification	
			XBF-DV04A	XBF-DC04A
Analogue output	Type		Voltage	Current
	Range		DC 0 ~ 10V (Load resistor: more than 2 kΩ)	DC 4 ~ 20mA DC 0 ~ 20mA (Load resistor: less than 510 Ω)
	Range	Unsigned value	0 ~ 4000	0 ~ 4000
		Signed value	-2000 ~ 2000	-2000 ~ 2000
		Precise value	0 ~ 1000	400 ~ 2000/0 ~ 2000
		Percentile value	0 ~ 1000	0 ~ 1000
Max. resolution			2.5 ㎷ (1/4000)	5 ㎂ (1/4000)
Precision			More than ± 0.5%	
Max conversion speed			1 ㎳/channel	
Absolute Max. output			DC ±15V	DC +25 ㎃
Output channel No.			4 channel	
Insulation method			Photo-coupler insulation between output terminal and PLC power (non-insulation between channels)	
Connection terminal			11point terminal	
I/O occupation point			Fixed type: 64 point	
Max. mount No.			4	
Consum-ption current	Inner (DC 5V)		110 mA	110 mA
	External (DC 21.6 ~26.4V)		70 mA	120 mA
Weight			64 g	70 g

2.7 Communication Module Specification

2.7.0 Snet Module Specification

Classification	Snet
Module type	Remote slave
Protocol	Modbus-RTU
Max. protocol size	8 Byte
Topology	BUS
Cable	Twisted air shielded cable
Communication speed	2400 ~ 38,400 BPS
Communication distance	1 km
Medium access	POLL
Max. node	32 stations
Communication point	32 points

2.7.1 iCAN Module Specification (i3 Controller only)

Classification	iCAN
Module type	Remote slave
Protocol	iCAN
Max. protocol size	64 Byte
Topology	BUS
Cable	Twisted air shielded cable
Communication speed	125,000 BPS
Communication distance	1.5 km
Medium access	POLL
Max. node	253 stations
Communication point	32 points

2.7.2 Enet Module Specification

Classification		Specification
Communication	Communication speed	10/100Mbps
	Transmission path method	Base Band
	Standard Functions	IEEE 802.3
	Flow Control	HALF/FULL
	Modulation type	NRZI
	Max. distance between nodes	100m
	Max. protocol size	Data 1500byte
	Communication zone access method	CSMA/CD
	Check method for frame error	CRC32
	Connector connection	RJ-45(2Port)
	IP Setting	S/W Setting
	Topology	Bus, Star
	Protocol	MODBUS/TCP, EtherNet/IP
	Max. digital I/O point	256
	Max. digital I/O connection number	8
	Max. analog I/O connection number	8
	Expansion analog module occupation number	8byte
Power	Rated input voltage/current	DC 24V/0.7A
	Power range	DC 19.2V ~ 28.8V
	Output voltage/current	5V(±20%)/1.5A
	Insulation	Non-insulation
-	Weight(g)	100

2.8 Communication Cable Specification

2.8.1 Snet Cable Specification

In case of Snet communication using RS-422 channel, it is required to use Twist pair cable for RS-422 considering communication distance and communication speed. The table below shows the specification of recommended cable. In case of using other cables, it is required to use the cable suitable for the following characteristics.

- ❑ Product name : Low Capacitance Lan Interface Cable
- ❑ Type name : LIREV-AMESB
- ❑ Specification : 2P X 22AWG(D/0.254 TA)
- ❑ Maker : LS Cable

Twist Pair Cable Specification

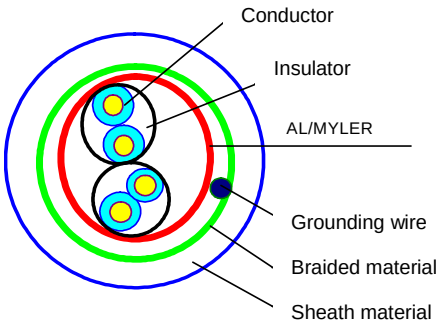
1) Electric Characteristic

Test Items	Unit	Characteristics	Test Condition
Conductor resistance	Ω/km	Less than 59	Normal temp.
Voltage-resistance(DC)	V/1min	500V 1 min resist	In air
Insulation resistance	MΩ-km	More than 1,000	Normal temp.
Capacitance	Pf/M	Less than 45	1kHz
Characteristics impedance	Ω	120 ± 12	10MHz

2) Appearance Characteristic

Items			Single Wire
Conductor	No. of core wire	Pair	2
	Spec.	AWG	22
	Composition	NO./mm	1/0.643
	Outside diameter	Mm	0.643
Insulator	Thickness	Mm	0.59
	Outside diameter	Mm	1.94

* Structure Diagram



2.8.5 Enet Cable Specification

1) UTP cable

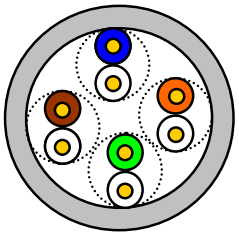
UTP cable is classified into 2 types based on the following criteria.

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

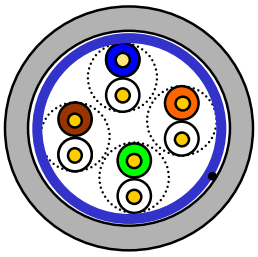
② Frequency band used: classified into 7 (Cat.1~7)

2) Type of cables (shield)

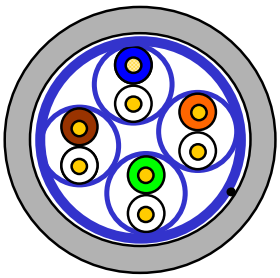
Classification	Details	Purpose
UTP (or U.UTP)	Unshielded cable. High speed data transmission.	Max. 200MHz Phonetic+Data+Low grade of video signal
FTP (or S.UTP)	Shielded cable core only.	Max.100MHz Electronic impediment (EMI) and electric stability considered Phonetic+Data+Low grade of video signal
STP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



UTP



FTP



STP

Notes

1) UTP : Unshielded Twisted Paired Copper Cable

FTP : (Overall) Foiled Twisted Paired Copper Cable

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

2) Patch Cable(or Patch Cord)

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

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

3) Classification based on frequency used

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

Notes

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

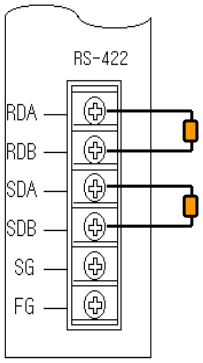
4) Example (CTP-LAN5) of Category 5 twisted-pair cable (UTP)

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

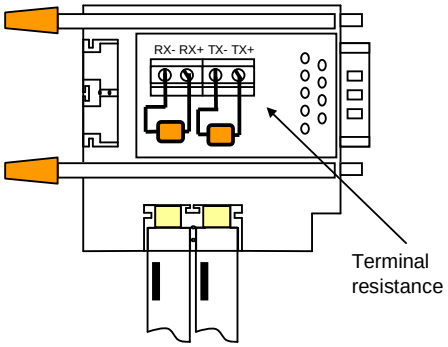
2.9 Terminating

2.9.1 Snet Terminating

In case of communicating through RS-422 channel, it should be required to connect the terminal resistance from outside. In case of long distance communication, terminal resistance plays the role to prevent the signal distortion caused by reflection wave of cable and is required to connect the resistance (1/2W) same as characteristic impedance value to the end of network. In case of using the recommended cable, please connect 120Ω terminal resistance to both end of cable. In case of using other cables except the recommended cable, it is required to connect the 1/2W resistance same as the characteristic impedance value of using cable to both sides of cable.



Master connection



Smart I/O connection

Chapter 3 System Configuration

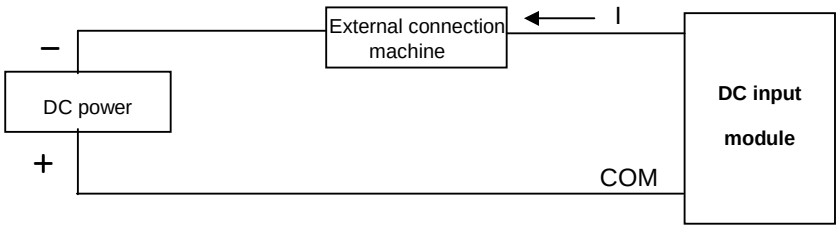
Smart I/O series are equipped with various product suitable for system configuration as various communication models and I/O module. This chapter describes the method of system configuration and characteristics.

3.1 Notices in Selecting Module

Here describes the notices in selecting digital I/O module which is used for Remote I/O.

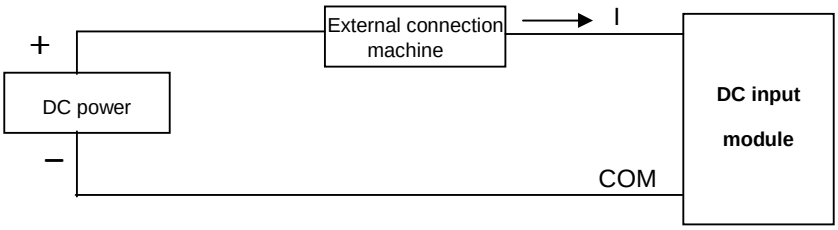
1) Digital input types contain the current sink input and current source input. In case of DC input module, as the wiring method of external input power is different according to such input types, make sure of selecting the input module considering the spec. of input connection machine. Remote I/O is available for source/sink in common. The wiring method per type is as follows.

(1) How to connect the sink type external connection machine to the source type DC input module.



- External connection machine is located between DC power and (-) terminal of DC input module terminal.
- Thus, when inputting ON, the current flows from DC input module terminal to external connection machine.

(2) How to connect the source type external connection machine to the sink type DC input module.



- External connection machine is located between DC power and (+) terminal of DC input module terminal.
- Thus, when inputting ON, the current flows from external connection machine to DC input module terminal.

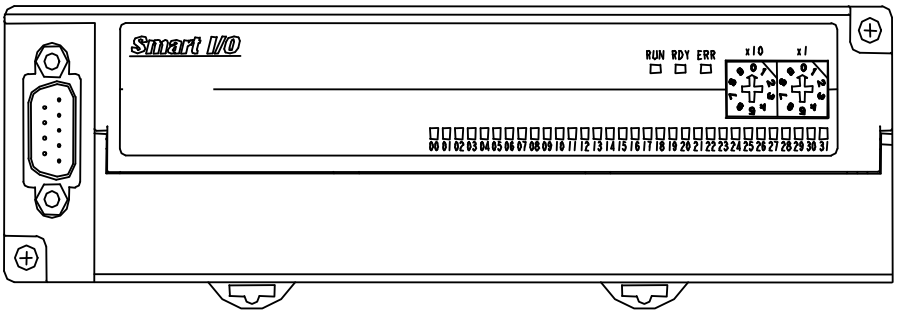
2) In case that the open/close frequency is high or it is used to open/close the conductive load, please use transistor output module as Relay output module may reduce the life.

3.2 Names of Each Part

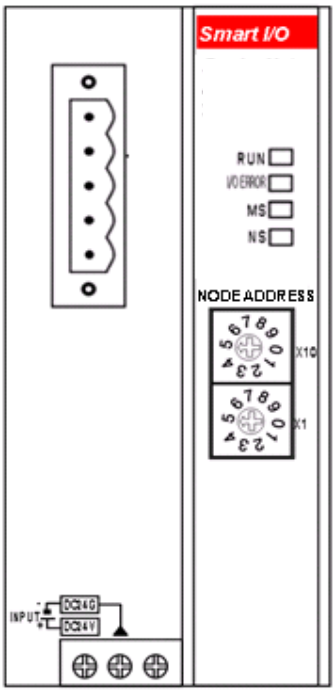
3.2.1 Basic System Configuration

Smart I/O series contain all 4 kinds of module configuration. According to network configuration that the user wants, it is available to install the system simple and effectively by the combination of the following models. The best advantage of Smart I/O series is the simple system configuration and the easy connection with other maker's machine as this is oriented to the open type network.

**Example of Smart I/O Series (stand-alone type)*



Example of Smart I/O Series (modular type)



Available modules for network of Smart I/O series (I/O module)

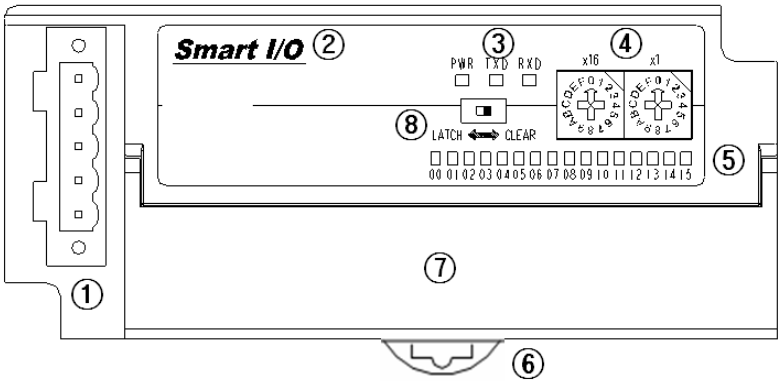
I/O configuration available point		16 points or 32 points
Product type	Snet Communication module	• GSL-TR2A/TR4A • GSL-RY2A • GSL-D22A/D24A • GSL-DT4A
	Enet communication module	• XEL-BSSA/BSSB

3.2.2 Names of Each Part of Smart I/O series

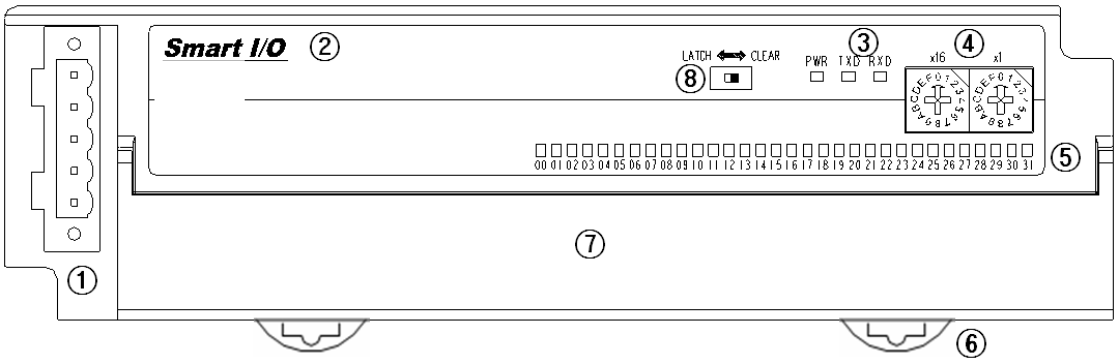
1) Snet series

Modbus communication module have all the same forms, and their characteristics are as follows.

In case of I/O 16 points*



In case of I/O 32 points,*



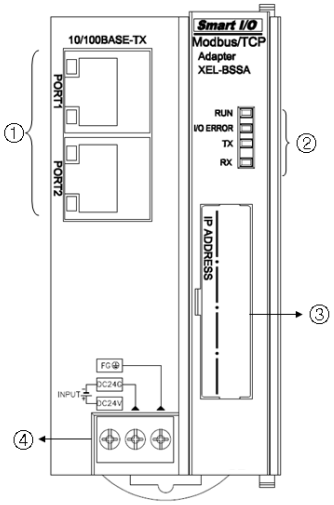
(1) Snet module

No.	Item		Description
□	Connection connector		Connector for communication connection with master/remote unit • 9 pin connector / 5 pin connector for iCAN type
□	Smart I/O type name indication		• Describes Modbus module type name. GSL-D22A: DC input 16 GSL-D24A/ : DC input 32 GSL-TR4A: TR output 32 GSL-RY2A: Relay output 16 GSL-DT4A: DC input 16 / TR output 16 combo
□	Communi-cation status indication LED	PWR LED	It describes the status of power to be supplied to the system. • On : in case of normal power supply • Off : in case of abnormal power supply
		TX LED	It describes the transmission status of communication module. • Blink : when communication module is transmitting (except for GRL-TR4A) • OFF : LED is OFF in the cases as follows ; □ in case that the voltage is not supplied normally to the basic unit. □ in case that the error to stop the operation is detected.
		RX LED	It describes the receiving status of communication module. • Blink : when communication module is receiving. • Off : when communication module has no receiving or the error is detected.
□	self station no setting switch		The switch to set the node station no. of its own station. Available to set from 0~31. • X16 : 16 digits indicated • X1 : 1 digit indicated
□	I/O LED		It describes the contact status of I/O terminal.
□	Hook for DIN rail attachment		• Hook for DIN rail attachment
□	Terminal block		• Terminal block layout for I/O wiring * Refer to Art. 3.3.

2) Modular type Smart I/O adapter module (Enet)

(1) Form of Enet module (Modular type) and name of each part

(a) XEL-BSSA

Name of each part	No.	Name		purpose		
	①	Connection connector		RJ-45 2Port		
	②	Communication status LED	Name	Color	Status	Contents
			RUN	Yellow Green	Indicates operating status of adapter module	
					On	Power on and CPU normal
					Off	Power off and CPU abnormal
			I/O ERROR	RED	Interface status between IO module and adapter	
					On	When IO module is removed When error occurs in IO module
					Off	IO module normal
			TX	Yellow Green	Indicates transmitting data to master module	
					Flicker	Transmitting the data
					Off	There is no transmission
			RX	Yellow Green	Indicates receiving data from master module	
					Flicker	Receiving data
					Off	There is no reception
	③	IP address plate		Writes down IP address of module		
	④	Power terminal block		• Input terminal for external power supply 24V: DC 24V(+) power input terminal 24G: DC 24V GND terminal		

3.3 I/O Wiring Diagram of Communication Module

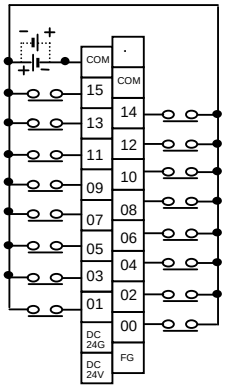
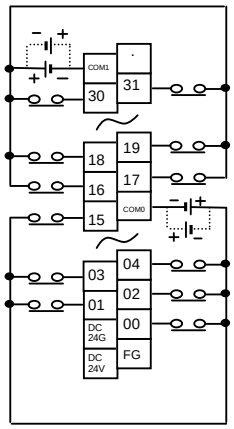
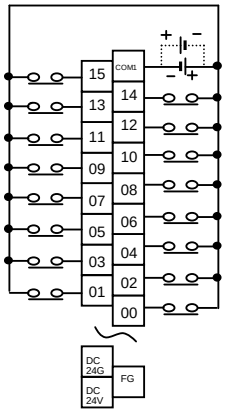
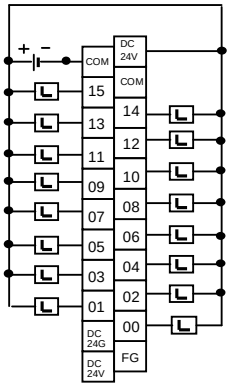
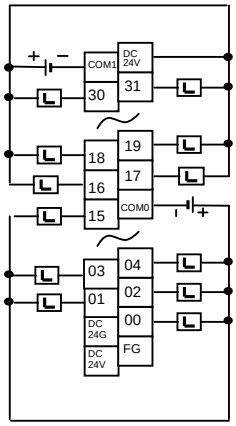
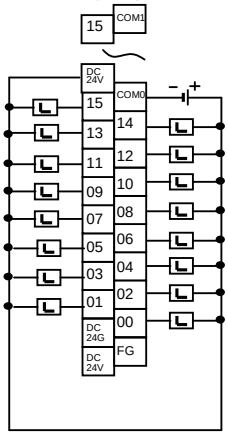
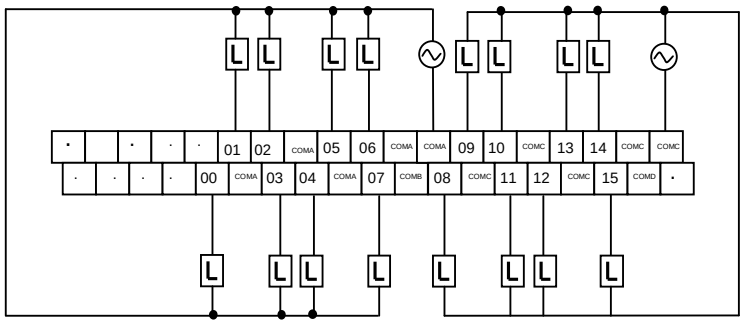
3.3.1 External connection diagram of Smart I/O module

1) Snet module

(1) Terminal block configuration

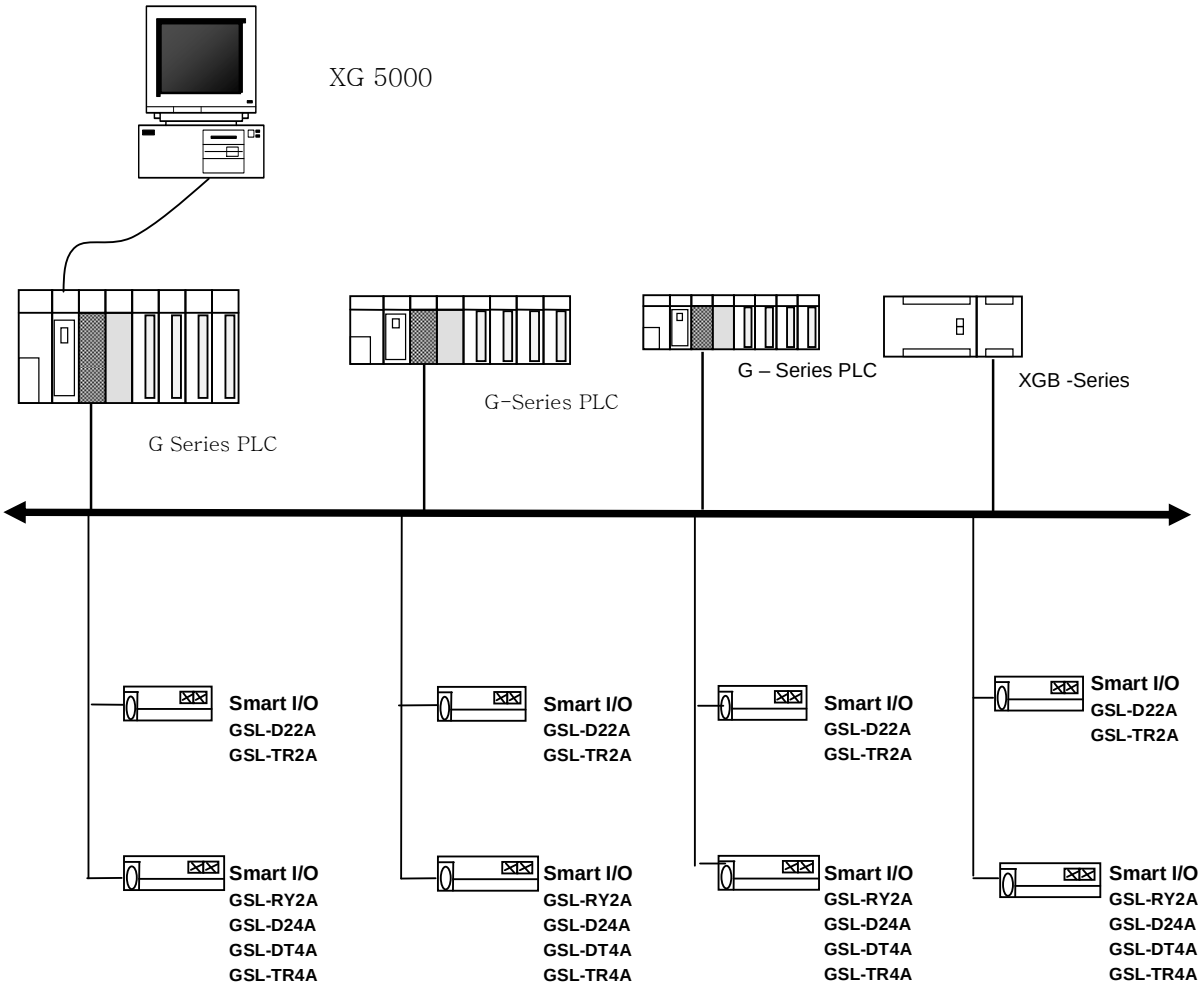
Terminal block		Contact and Power Input
GSL-D22A/D24A	0 ~ 15	Input contact terminal(GSL-D22A)
	0 ~ 31	Input contact terminal(GSL-D24A)
	COM	Common input(16 points COM)(GSL-D22A)
	COM0/COM1	Common input(16 points COM)(GSL-D24A)
	FG	FG terminal
	DC 24V	DC 24V(+) power input terminal
	DC 24G	DC 24V(-) power input terminal
GSL-DT4A	0 ~ 15/0 ~ 15	I/O contact terminal
	COM0/COM1	Common terminal(16 points COM)
	FG	FG terminal
	DC 24V	DC 24V(+) power input terminal
	DC 24G	DC 24V(-) power input terminal
GSL-TR2A/TR4A	0 ~ 15	Output contact terminal(GSL-TR2A)
	0 ~ 31	Output contact terminal(GSL-TR4A)
	COM	Common terminal(16 points COM)(GSL-TR2A)
	COM0/COM1	Common terminal(16 points COM)(GSL-TR4A)
	FG	FG terminal
	24V	DC 24V(+) power input terminal
	24G	DC 24V(-) power input terminal
GSL-RY2A	0 ~ 15	Output contact terminal
	COMA~COMD	Common terminal(8 points COM)
	FG	FG terminal
	DC 24V	DC 24V(+) power input terminal
	DC 24G	DC 24V(-) power input terminal

(2) Wiring diagram

Item	Wiring diagram
DC input module	[GSL-D22A]  [GSL-D24A]  [GSL-DT4A(input section)] 
TR output module	[GSL-TR2A]  [GSL-TR4A]  [GSL-DT4A(output section)] 
RELAY output module	[GSL-RY2A]  * COMA and COMB are connected internally respectively.

3.4 Examples of System Configuration

3.4.1 Snet System



Chapter 4 Communication Programming

4.1 Overview

There are two kinds of Programming methods in using the Smart I/O series.
For further information, please refer to the user's manual related to "Master module".

4.1.1 *Function Block* (G-Series) / Instruction (K-Series)

Function Block/Instruction communication is the service to communicate when the specific event to communicate with other station occurs. In case that the error occurs in other station which results in sending this content to other other station or when specific contact is entered to communicate, it is available to use *Function Block*/Instruction.

The program method is written by designating Enable condition, communication module installed module position, station no., data area of its own station and the area of other station using *Function Block* per type made by GMWIN program mode for G series (by KGLWIN program mode for K series) in advance and Instruction.

Data size to communicate in G Function Block, it is available to communicate with each other station per data type such as Bit, Byte, and Word etc. and in K, also by Word unit.

The operation by Function Block/Instruction

Contents	Function Block/Instruction
Basic unit of TX/RX data	G : available per data type (Bit, Byte, Word etc.) K : supports only Word type.
Communica-tion period	Performs whenever Enable condition of communication program starts.
Operation method	G : Compile→ Download to PLC→Run K : Download to PLC→Run
Control by CPU operation mode key	Performs the operation following to the key condition of CPU module.

Remark

1) Function Block service is used for Modbus communication programming and for further information. Refer to the user's manual.

4.2 Function Block

4.2.1 Overview

Function Block is the function to write or read the specific data of the self station or the specific variable data in the specific area or specific variable area of other station when the regular event occurs, and it can be used diversely according to the purpose.

Program of Smart I/O series using the Function Block is limited all in Modbus Snet.
For further information, please refer to ‘Chapter 8 Modbus Communication’.

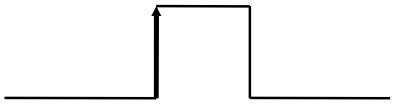
4.2.2 Start of GMWIN Function Block

When programming by using Function Block, please refer to the following. Function Block carries out the variable setting by input section and output section. For the setting method, please refer to the corresponding Function Block.

It describes based on G G7 Function Block.

Input

REQ



This is used as the start condition of mode bus Function Block and it starts at the rising edge from ‘0’ to ‘1’. Once started, Function Block is not influenced until receiving the response from other station. After setting NDR or ERR bit, it shall be reset in next scan.

SLV_ADDR:

This sets the remote station number to communicate by performing this *Function Block*. .

FUNC:

This enters modbus function code. For further information, please refer to ‘Chapter 8 Modbus Communiction’.

ADDRH:

This designates the starting address and middle/high address from the starting address to read in remote station.

ADDRL:

This designates the low address from the starting address to read in remote station.

NUMH:

This designates the high address of data size to read from starting address in remote station.

NUML:

This designates the low address of data size to read from starting address in remote station.

Output

NDR:

After *Function Block* starting, if data receiving is OK, it shall be 'ON'. When the corresponding scan ends, it shall be 'OFF'. If using this bit as other *Function Block* input condition, it is available for carrying out the reliable communication.

ERR:

After *Function Block* starting, if on error occurs, it shall be 'ON' and maintains 'ON' until the next *Function Block* starts again and then 'OFF'. If on error occurs, it is not available to receive data.

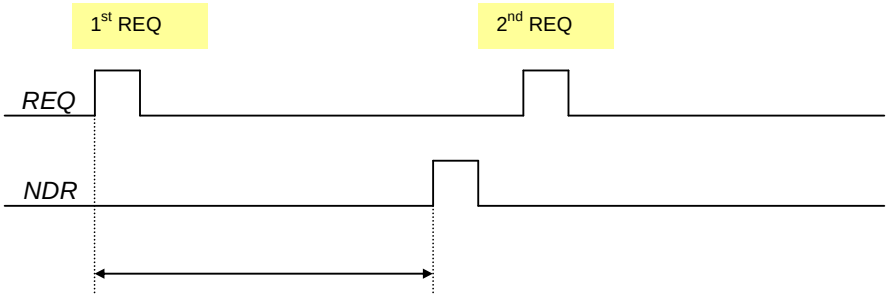
STATUS:

It describes the detailed code value for the error when on error occurs after starting *Function Block* and maintains the value until the next *Function Block* starts again and then 'OFF'.

Remark

Requirements of Function Block

1) Function Block requirements (REQ) start shall be executed after the previous execution is completed normally (after 'NDR' ON).



In communication = internal processing time + response wait time
(internal processing time : approx. 50 ~ 60ms)

4.4 Execution of KGLWIN Instruction

K Instruction executes the programming by using KGLWIN Modbus Instruction.
Please refer to the Instruction execution method and available address area.
(Refer to Chapter 8.4.2 K series (Modbus communication))

5. Modbus Communication

5.1 Overview

Smart I/O module communication supports modbus through G3/4/6/7 master module.
(G6L-CUEC / G7L-CUEC)
This supports ASCII mode that communicates using ASCII (American Standard Code for Information Interchange) data and RTU (Remote Terminal Unit) mode that uses HEX data and the function code used in the modbus is supported by the *Function Block* and only function code 01, 02, 03, 04, 05, 06, 15, 16 are supported.

5.2 Communication Specification

5.2.1 ASCII Mode

(1) This communicates using ASCII data.
(2) Each frame uses ':(Colon) : H3A)' for the header, CRLF (Carriage Return-Line Feed) : HOD HOA) for the tale.
(3) Max. 1second interval between Characters is allowed.
(4) It uses LRC to check the error.
(5) Frame structure (ASCII data)

Classification	Header	Station no.	Function code	Data	LRC	Tale (CR LF)
Size	1 byte	2 byte	2 byte	n byte	2 byte	2 byte

5.2.2 RTU Mode

(1) It uses HEX data to communicate.
(2) There is no header and tale, and it starts from station no. (Address) and ends the frame with CRC.
(3) It has min. 3.5 Character Time Interval between frames.
(4) When exceeding more than 1.5 Character Time between Characters, please disregard the corresponding frame.
(5) It uses 16 bit CRC to check the error.
(6) Frame structure (HEX data)

Classification	Station no.	Function code	Data	CRC
Size	1 byte	1 byte	n byte	2 byte

Remark

1) The size to compose one letter (character) is called '1 character', that is, 1 character is 8 bits = 1byte.
2) 1 character time means the time to take when sending 1 character.
   Ex.1) 1 character time calculation in communication speed 2,400 bps
   2,400 bps is the speed that takes 1 second to send 2,400 bits. When sending 1 bit, 1 (sec) ÷ 2,400 (bit) = 0.41 (ms).

   Thus, 1 character time is 0.41 (ms) × 8 (bit) = 3.28 (ms).

5.2.3 Station no. (Address) Area

(1) Smart I/O series supports 0 ~ 31.

(2) Station 0 uses Broadcast address. Bro adcast address is the station no. the slave device except self station no. recognizes and responds, and it does not support in Smart I/O series.

5.2.4 Function Code Area

(1) In Smart I/O series, it supports Modicon function code 01, 02, 03, 04, 05, 06, 15, 16 only.

(2) When the response format is Confirm+ (ACK response), the same function code is used.

(3) When the response format is Confirm- (NCK response), set the 8th bit of function code as '1' and return.

Ex) when function code is 03,
- specify only the function code part as there is a difference in the function code only.

[Request] 0000 0011 (H03)

[ACK response] 0000 0011 (H03)

[NAK response] **1**000 0011 (H83)

Set the 8th bit of frame function code as '1' and return.

8.2.5 Data Area

(1) It transmits the data using ASCII (ASCII mode) data or HEX (RTU mode).

(2) The data structure is changed according to each function code.

(3) Response frame uses the data area as response data or error code.

5.2.6 Error Check (LRC Check/CRC Check) Area

(1) LRC (Longitudinal Redundancy Check): this is used in ASCII mode and takes the 2's complement from the sum of frame except the header/the tale and carries out the ASCII conversion.

(2) CRC (Cyclical Redundancy Check): this is used in RTU mode and uses 2 bytes of CRC check regulation s.

Remark

All numeric data uses by mixing the hexadecimal, decimal, binary number. Each number is specified as following example.

The example that decimal number 7, 10 is marked as each number.
- Hexadecimal : H07, H0A or 16#07, 16#0A
- Decimal : 7, 10
- Binary : 2#0111, 2#1010

5.2.7 Function Code Type and Memory Mapping

Code	Function code name	Modicon PLC Data address	Smart I/O Mapping	Remarks
01	Read output contact status (Read Coil Status)	0XXXX (bit-output)	%QX0~%QX31	Bit read
02	Read input contact status (Read Input Status)	1XXXX (bit-input)	%IX0~%IX31	Bit read
03	Read output registers (Read Holding Registers)	4XXXX (word-output)	%QW0~%QW3	Bit read
04	Read input register (Read Input Registers)	3XXXX (word-input)	%IW0~%IW3	Word read
05	Write output contact 1 bit (Force Single Coil)	0XXXX (bit-output)	%QX0~%QX31	Bit write
06	Write output register 1 word (Preset Single Register)	4XXXX (word-output)	%QW0~%QW3	Word write
15	Write output contact continuously (Force Multiple Coils)	0XXXX (bit-output)	%QX0~%QX31	Bit write
16	Write output register continuously (Preset Multiple Register)	4XXXX (word-output)	%QW0~%QW3	Word write

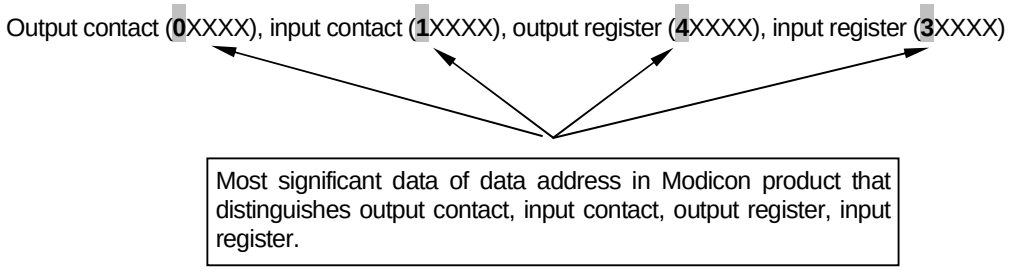
K mapping

Bit area		Word area	
Address	Data area	Address	Data area
H0000	P area	h0000	P area
H1000	M area	H1000	M area
H2000	L area	H2000	L area
H3000	K area	H3000	K area
H4000	F area	H4000	F area
H5000	T area (contact)	H5000	T area (current value)
H6000	C area (contact)	H6000	C area (current value)
H8000, H9000	D area	H7000	S area

5.2.3 Modbus Addressing Regulation

(1) G series

In Smart I/O series, the address in the frame begins from '0' and maps with Modicon data address 1, and 'n'th address of Smart I/O series becomes Modicon address n+1. And in Smart I/O series, it uses only the continuous M area without being distinguished by output contact (0XXXX), input contact (1XXXX), output register (4XXXX), input register (3XXXX). That is, the output contact 1(00001) of Modicon product is indicated as the address '0' of communication frame and the input contact 1(10001) of Modicon product is indicated as the address '0' of communication frame.



(2) K series

XXXX area of Modicon PLC data address is allocated by the mapping of K series. For example, when you try to read M0002 bit of K in Modicon PLC, use the function code 01 or 02 and set the data address as H1002. When you try to read D0010 word area, use the function code 03 or 04 and set the address as H800A.

(3) XGB series

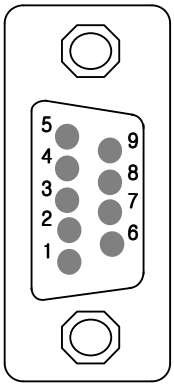
XXXX area of data address of Modbus is mapped with that of XGB as 1:1. Write frame at P2P block by using Modbus RTU/ASCII client of XG-PD.

For more detail, refer to CH 8.3 Communication parameter setting.

5.2.9 Data Size

Smart I/O series supports the data size of 128bytes for ASCII mode and 256bytes for RTU mode.

5.2.10 Wiring diagram



Male Type

PIN spec.	Smart I/O (9-PIN)
1	(1) No.1 : reserved (OS Upgrade) (2) No.2 : reserved (OS Upgrade) (3) No.3 : RX- (4) No.4 : RX+ (5) No.5 : GND (6) No.6/7: reserved (7) No.8 : TX- (8) No.9 : TX+
2	
3	
4	
5	
6	
7	
8	
9	

5.3 Communication Parameter Setting

5.3.1 G Series

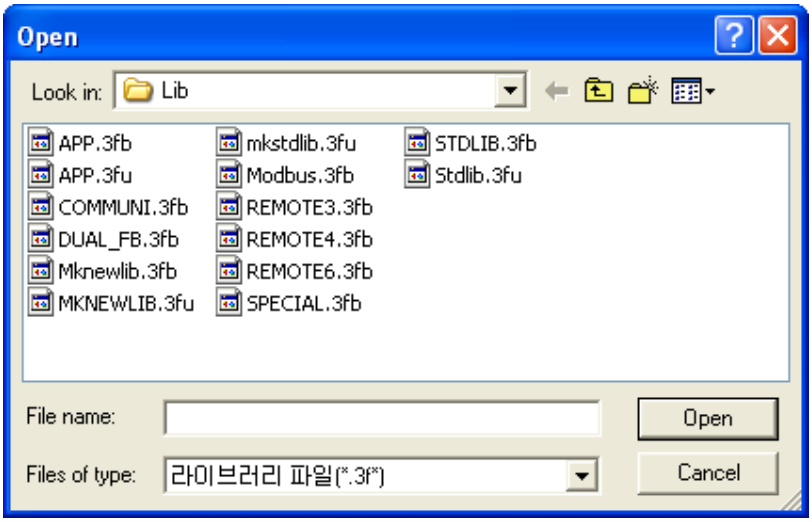
(1) In case of GM4/6/7 is the master,

(a) Insert communication *Function Block*

When communicating modbus communication with Smart I/O using G3/4/6 as the master, it is required to insert the following *Function Block* library into GMWIN Lib folder.

Classification		Corresponding *Function Block* library	Remarks
G3	G3L-CUEA	Modbus.3FB	GMWIN Library adding
G4	G4L-CUEA	Modbus.4FB	
G6	G6L-CUEA	Modbus.6FB	

1) Select GMWIN menu [Project] → [Add Item] → [Library] and insert the corresponding library per model.



2) Insert the *Function Block* into GMWIN scan program and set the *Function Block* I/O variable. For the *Function Block* type and the method to use, please refer to Chapter 8.4. *Function Block*.

- RTU_WR
- RTU_RD

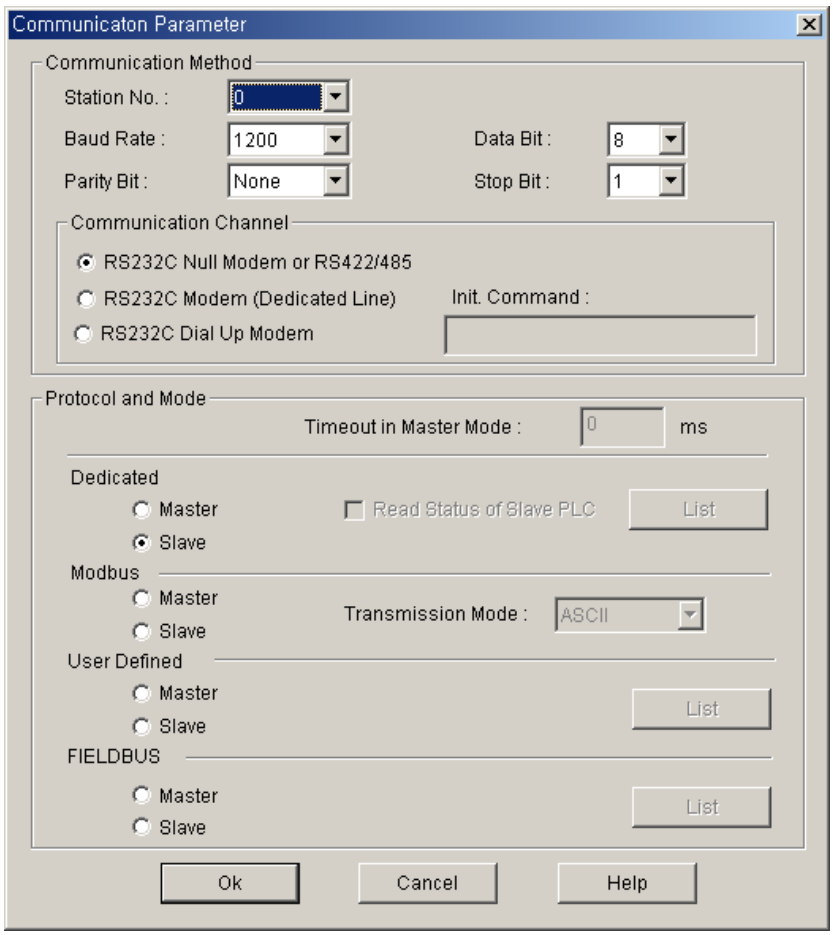
(2) In case of G7 is the master,

(a) Communication parameter setting

1) Open the new project file in GMWIN.

a) Select 'G7' as PLC type.
b) Create new project file for the master and the slave, respectively.

2) Select communication parameter from GMWIN parameter and double-click and the following figure will appear.



3) Set the contents as follows.

Items		Setting Description
Communication type	Self station no.	Available to set 1~31 stations. (do not set station 0 as broadcast station no. It may cause the failure.)
	Communication speed	Available to set 2400, 4800, 9600, 19200, 38400 bps.
	Data bit	Available to set as 7 or 8 bits. ASCII mode: set as 7 bits. RTU mode: set as 8 bits.
	Parity bit	Available to set as None, Even, Odd.
	Stop bit	Available to set as 1 or 2 bits. In case that the parity bit is set: set as 1 bit. In case that the parity bit is not set: set as 2 bits.
	Communication channel	• RS-232C null modem or RS422/485 : when communicating using G7 basic unit and Cnet I/F module (G7L-CUEC). • RS-232C dedicated modem : when communicating by the dedicated modem using Cnet I/F module (G7L-CUEB). • RS-232C dialup modem : when communicating by the general modem connecting with other station by the phone using Cnet I/F module (G7L-CUEB). Note) RS-232C exclusive modem and RS-232C dialup modem communication is done only by Cnet I/F module (G7L-CUEB) that supports RS-232C but not by Cnet I/F module (G7L-CUEC) that supports RS-422/485.
Protocol and Transmission mode	Time out when setting the master	• This is the time to wait the response frame after sending the request frame from GM7 basic unit set as the master. • Default value is 500ms. • When setting, max. sending/receiving period of master PLC should be considered. • If the value smaller than max. sending/receiving period is set, it may cause the communication error.
	Modbus master / slave	If setting as the master, it shall be the subject in the communication system and if setting as the slave, it will reply only according to the request frame of the master.
	Transmission mode	Available to select one from ASCII mode or RTU mode.

5.3.2 K series

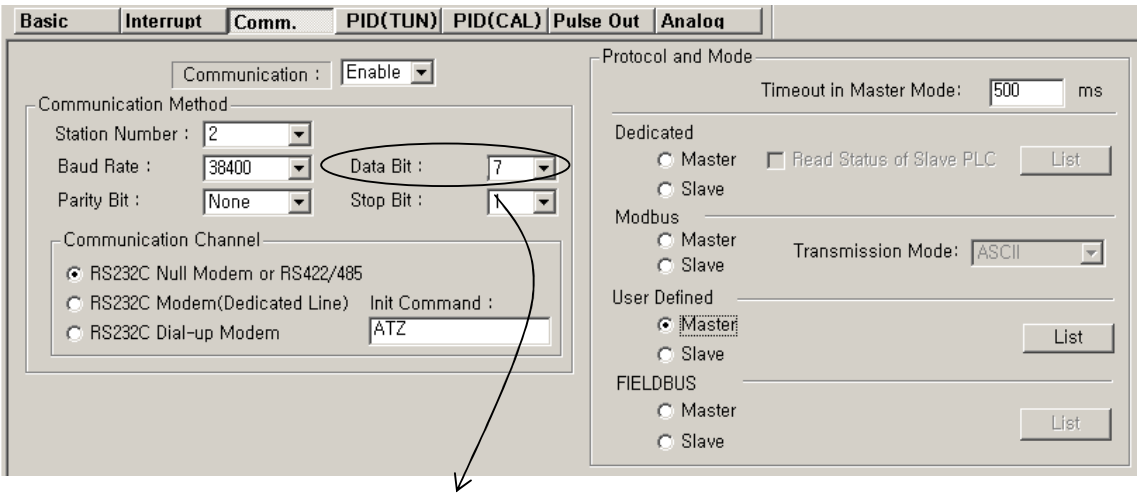
(1) K80S modbus communication

(a) Communication parameter setting

1) Open new project file in KGLWIN.

a) Select MK80S as PLC type.
b) Create new project file for the master and the slave respectively.

2) Select communication parameter from KGWIN parameter and doubleclick, and the following figure will appear.



When transmission mode is ASCII mode, set as 7 bits.

3) Set the contents as follows.

Items		Setting Description
Communication type	Self station no.	Available to set 1~31 stations. (do not set station 0 as broadcast station no. It may cause the failure.)
	Communication speed	Available to set 2400, 4800, 9600, 19200, 38400 bps.
	Data bit	Available to set as 7 or 8 bits. ASCII mode : set as 7 bits. RTU mode : set as 8 bits.
	Parity bit	Available to set as None, Even, Odd.
	Stop bit	Available to set as 1 or 2 bits. When the parity bit is set : set as 1 bit. When the parity bit is not set : set as 2 bits.
	Communication channel	• RS-232C null modem or RS-422/485 : when communicating using MK80S basic unit and Cnet I/F module (G7L-CUEC). • RS-232C dedicated modem : when communicating by the dedicated modem using Cnet I/F module (G7L-CUEB). • RS-232C dialup modem : when communicating by the general dialup modem using Cnet I/F module (G7L-CUEB). Note) RS-232C dedicated modem and RS232C dialup modem communication is done by Cnet I/F module (G7L-CUEB) only that supports RS-232C and not by Cnet I/F module (G7L-CUEC) that

Items		Setting Description
		supports RS-422/485.
Protocol and Transmission mode	Timeout when setting the master	• This is the time to wait the response frame after sending the request frame from MK80S basic unit set as the master. • Default value is 500ms. • When setting, max. sending/receiving period of master PLC should be considered. • If the value smaller than max. sending/receiving period is set, it may cause the communication error.
	Modbus master /Slave	If setting as the master, it shall be the subject in the communication system and if setting as the slave, it will reply only according to the request frame of the master.
	Transmission mode	Available to select one from ASCII mode or RTU mode.

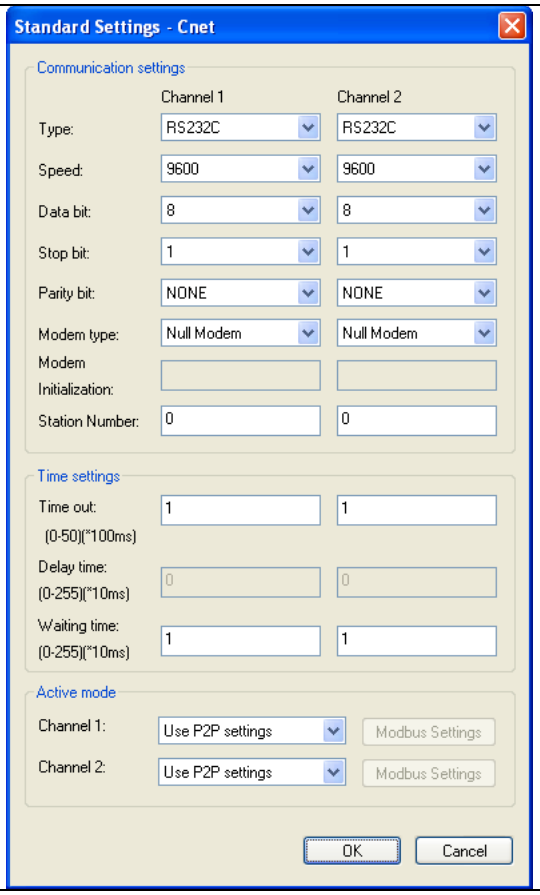
Remark

1) Modbus master communication of K series operates only at the K80S and K120s
K1000S/300/200S don't support Modbus master communication.

5.3.3 XGB series

When using XGB Snet I/F module as client and executing Modbus communication, set each parameter through XG-PD.

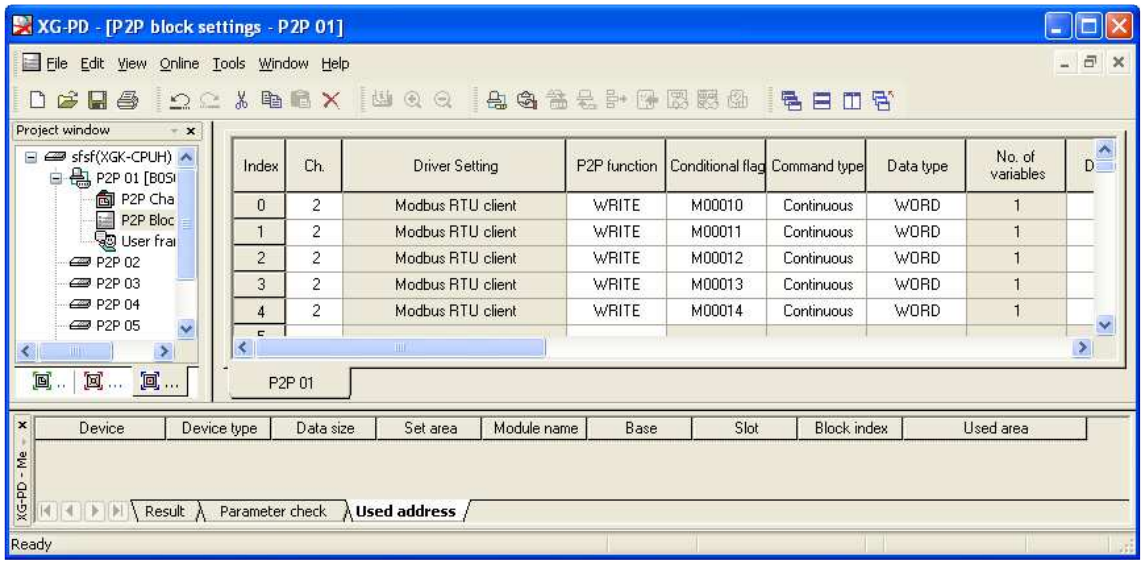
(1) Basic parameter setting method in the XG-PD

Sequence	Setting process	Setting method
1	I/O information reading	1. After online connecting, select Online->Read IO Information and read information of module which is equipped at the current base.
2	Basic setting	
		1. Connect by double-clicking the module you want to use. (1) Modbus RTU protocol: set data bit as 8. (2) Modbus ASCII protocol: set data bit as 7. 2. select “Use p2p settings” in Active mode.

(2) P2P parameter setting method in the XG-PD

(a) P2P service

P2P service is used when communication module operates as client and P2P function (command) is different according to protocol. P2P function is set as WRITE/READ when it operates as modbus RTU/ASCII. When P2P function is set as WRITE, it write data in the Smart I/O module which operate as a server and when READ, it read data from the Smart I/O module which operates as a server. P2P service can be set up to Max. 8 and each service consists of Max. 64. The following figure is parameter setting example.

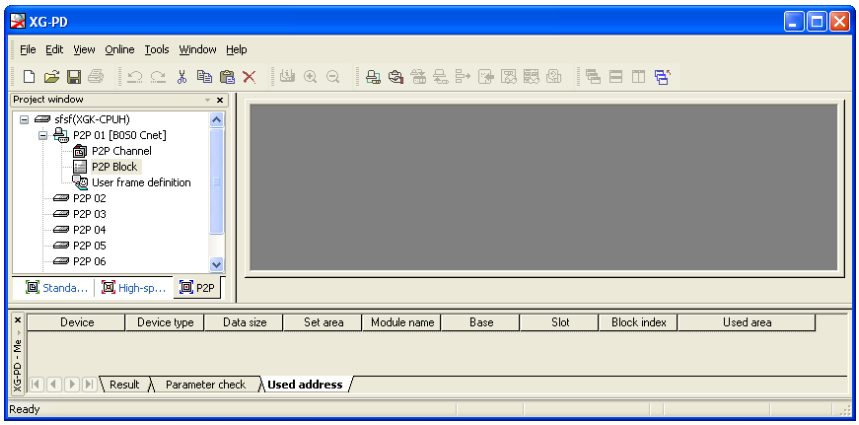


1) P2P parameter setting window
   a) Max. 8 P2P parameter can be set.
   b) It is available to set many P2P parameter per one Cnet I/F module.
      But only one enable among P2P parameter is available about Cnet I/F module.
   c) Each P2P parameter consist of P2P channel, P2P block, user frame definition.

2) P2P edit window
   a) Max. up to 64 P2P block can be registered and edited.

In order to use P2P service, the user set for the wanted action in the P2P parameter window.

P2P parameter consists of 3 category.



1) P2P channel

a) Set the P2P channel which defines P2P service's communication protocol.

b) Support protocol: XGB/Modbus client, user frame definition

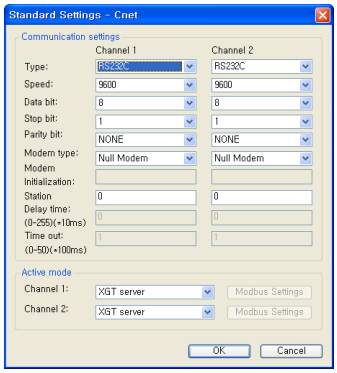
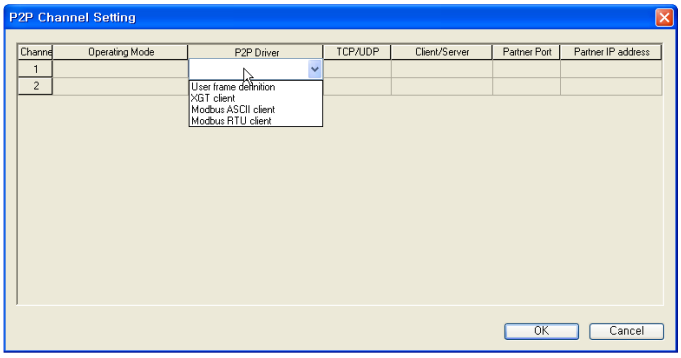
c) Set it per channel. It is applied when basic setting's run mode is "Use P2P settings"

2) P2P block: set 64 P2P blocks which operate independently.

3) User frame definition: register user definition frame

(2) P2P channel setting

Cnet I/F module provide two communication channels (channel 1, 2) which operate independently. About each channel, you can set driver type for P2P service. But when P2P channel is client, you should set run mode as "Use P2P settings". P2P channel setting according to operating mode is as follows.

Operating mode	P2P channel setting
	

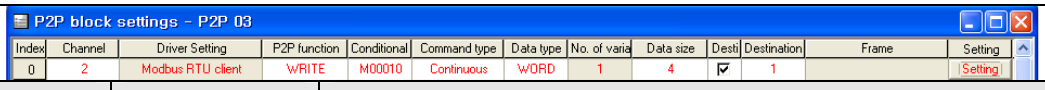
When setting as “Use P2P settings” in operating mode, the available driver in the XGT Cnet and meaning is as follows.

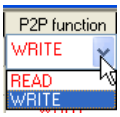
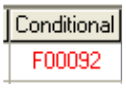
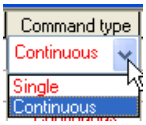
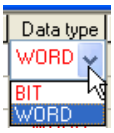
Driver	Meaning
User frame definition	It is used when transmitting and receiving desirable user definition frame.
XGB client	Select when you read and write by using XGB dedicated protocol.
Modbus ASCII client	Select when it operated as modbus client and ASCII mode.
Modbus RTU client	Select when it operated as modbus client and RTU mode.

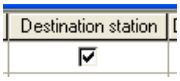
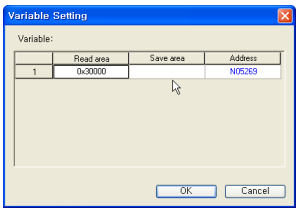
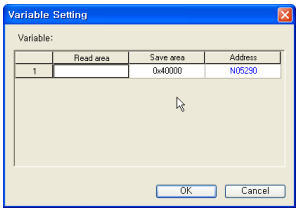
[Table 7.2.1] driver table

(3) P2P setting for using Smart I/O Snet

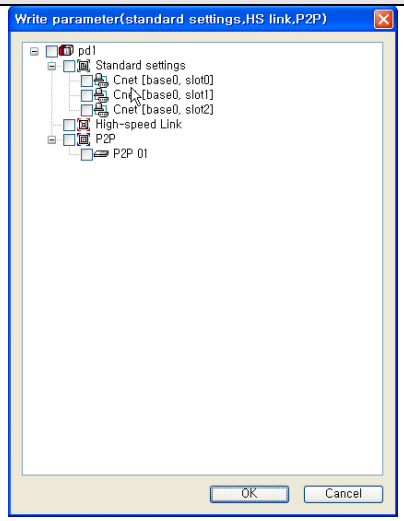
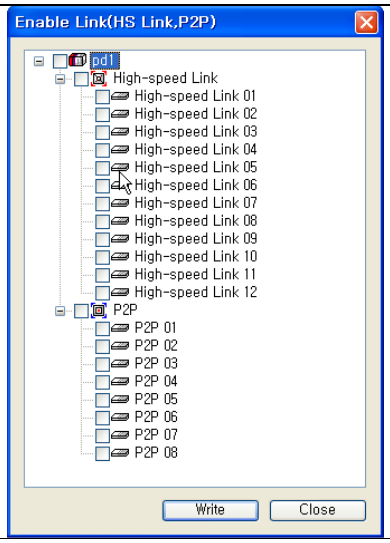
Modbus RTU/ASCII client’s action is divided into Read and Write. Modbus RTU’s setting method is same with ASCII client’s setting method.



No.	Type	Block type	Description
1	Channel		Setting driver name is changed according to the driver which is set in the P2P driver.
2	P2P function		1. Read : reads data from other station. 2. Write : writes data at the other station.
3	Conditional flag		1. select when to transmit or receive the data by using special flag or bit point. 2. In case of XGK type: F90 (operate every 20ms), M01 3. In case of XGI type: _T20MS (operate every 20ms), %MX01
4	Command type		1. Single: is used when reading or writing data of max. 4 memory area. (example: M01, M10, M20, M30) 2. Continuous: is used when reading or writing data continuously. (example: M01~M10)
5	Data type		Data type can be selected as Bit or Word.

No.	Type	Block type	Description
6	Data size		▶It define data size and it is activated when continuous method. 1. when P2P function is Read (1) modbus RTU client (a) bit type: 1~2000 (b) word type: 1~125 (2) modbus ASCII client (a) bit type: 1~976 (b) word type: 1~61 2. when P2P function is Write (1) modbus RTU client (a) bit type: 1~1968 (b) word type: 1~123 (2) modbus ASCII client (b) bit type: 1~944 (a) word type: 1~125
7	Destination station		It is checked automatically and if you don't want to use this function, click the box and cancel the check.
8	Destination station number		It means other station's address and the range is 0~31 total 32 station.
9	Setting		▶When P2P function is Read 1.Read area: start address of other station's data area (1) bit: bit input (0x00000), bit output (0x10000) (2) word: word input (0x30000), word output (0x40000) 2.Save area: data writing area at the self station (client)
			▶When P2P function is Write 1. Read area: data area of self station 2. Save area: start address of other station's data area (1) bit: bit input (0x00000), bit output (0x10000) (2) word: word input (0x30000), word output (0x40000)

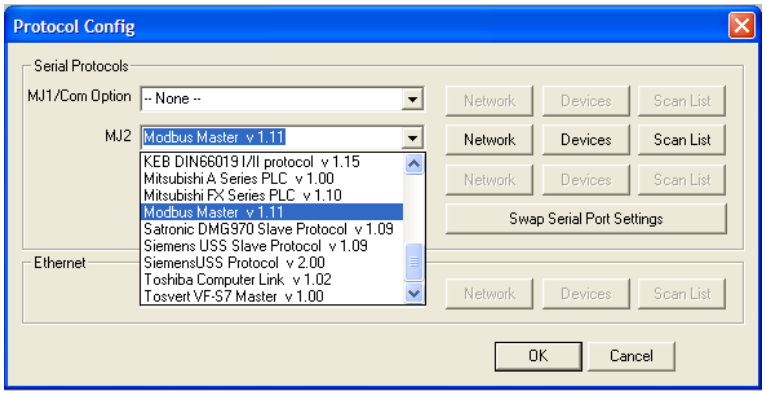
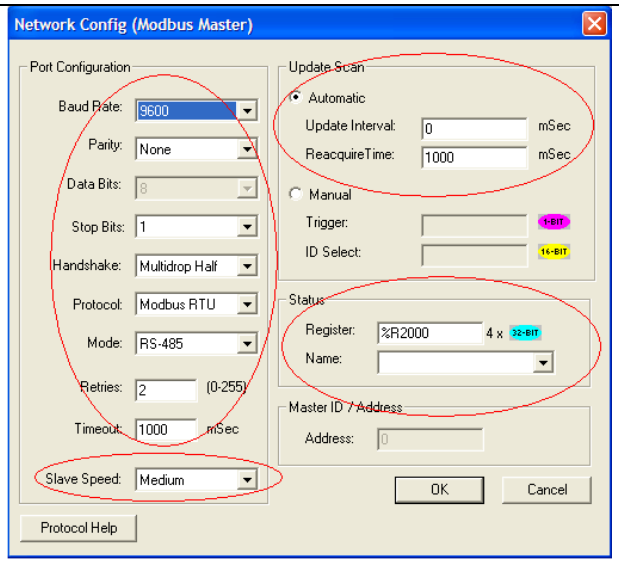
(4) Basic setting and P2P parameter writing

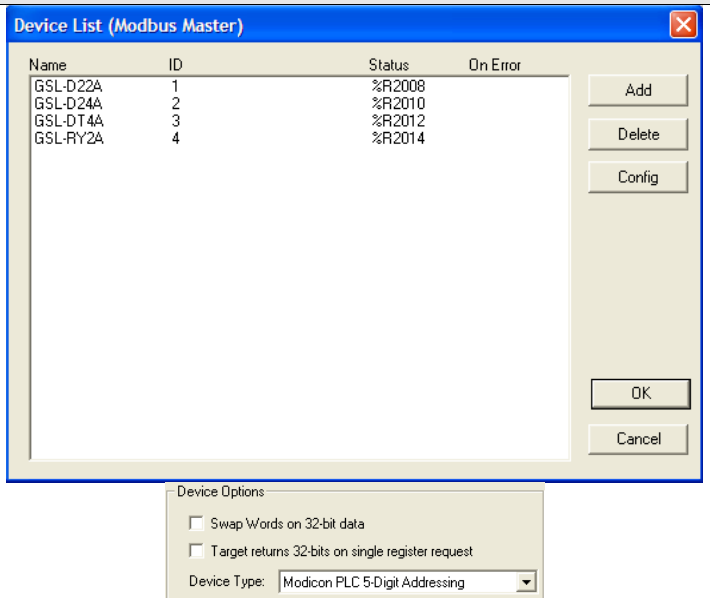
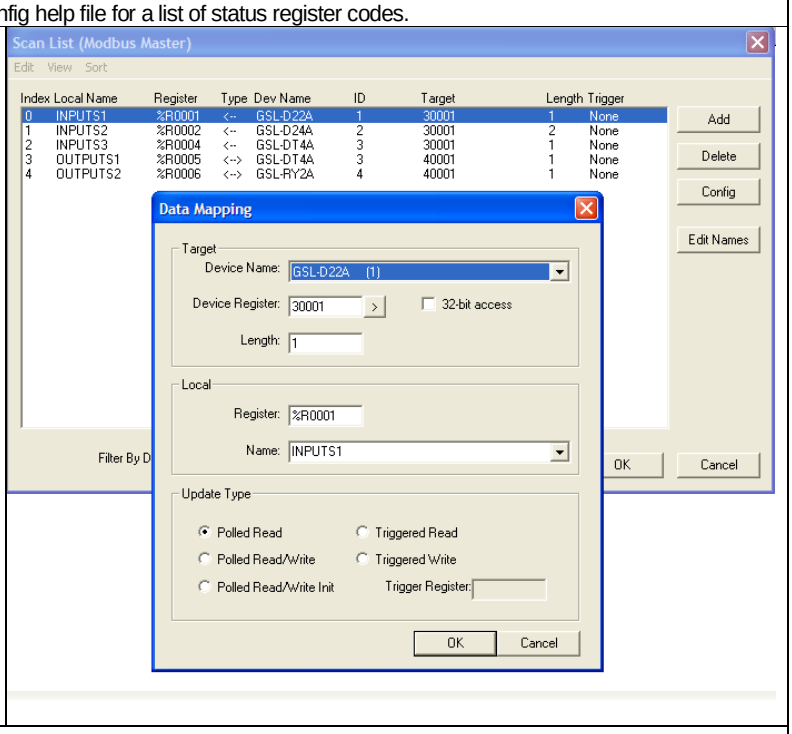
Sequence	Setting process	Setting method
1	Write Parameter	
1. Click parameter writing in online menu. 2. Check the module where basic is set and P2P parameter and click OK. 3. Communication module is reset automatically.		
2	Enable Link	
1. Click link enable in online menu. 2. Check P2P parameter and click Write.		

5.3.4 i3 Controller series

When setting up the connection of a GSL module it is important to firstly decide if the network will be Full-duplex(4 wire) or Half-duplex(2 wire). If other devices are on the bus that only support Half-duplex – i.e. iOS, iSmart, VXR, iDrive then this option should be taken, otherwise Full-duplex should be chosen.

(1) Basic parameter setting method in the i3 Config

Sequence	Setting process	Setting method
1	Open menu	1. Select Program -> Protocol Config.
2	Config	
	1. Select Modbus Protocol in the dropdown for the desired port then click on 'Network' button.	
3	Network	
	1. Set up the port configuration, taking care to select Half or Full duplex in the Handshake dropdown in accordance to the optioned wiring scheme. 2. When there is more than one device on the network, Smart I/O require a little Delay Time. This is configured by selecting Medium in the Slave Speed. 3. Set Reacquire time – time the i3 will stop comms to the device after a No Response. 4. Specify 4x 32 bit status register. (Interval(ms), No Response count, Corrupt Response count, Valid Response count).	

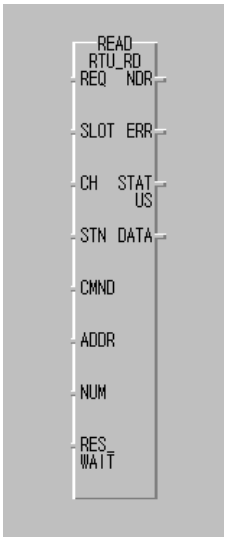
Sequence	Setting process	Setting method
4	Devices	
		1. Click Add and set up the devices on the network. 2. Give the device a name and unique ID, select Modicon 5-digit addressing. 3. Enable status register and specify an unused register. If this register is zero, then the communication to the device is OK, any other value specifies a problem. Please see the i3 Config help file for a list of status register codes.
4	Scan List	
		1. Set up devices in the Scan List. Device Register 30001 with Polled Read for inputs and 40001 with Polled Write for Outputs.

5.4 Function Block

5.4.1 G Series

(1) For G6

(a) RTU_RD



Item	IN / OUT	Type	Description
	REQ	BOOL	*Function Block* execution condition (Rising edge action) - When changing from 0 to 1, one time executed.
	SLOT	USINT	Cnet module slot no. (0 ~ 7)
	CH	USINT	Channel setting (0 : RS-232C, 1 : RS-422/485)
	STN	USINT	Other station no. setting (0 ~ 32)
	CMND	USINT	Modbus Command (1 ~4) 1 : Read coil status (Bit) 2 : Read input status (Bit) 3 : Read holding register (Word) 4 : Read input register (Word)
	ADDR	INT	Leading address of other station to Read (1 ~ 9999)
	NUM	USINT	Data number to Read (1 ~ 64)
	RES_WAIT	TIME	Response wait time (after the setting wait time, receive the response data from Cnet module of CPU.)
	NDR	BOOL	After completing the normal communication, 1 Scan 'ON'.
	ERR	BOOL	When communication error occurs, 1 Scan 'ON'.
	STATUS	USINT	Communication status code (Error code) 0 : normal, if not 0, : Error code
	DATA	USINT ARRY (256)	Receiving data storage area Array [0] : High Byte of first word Array [1] : Low Byte of first word Array [2] : High Byte of second word Array [3] : Low Byte of second word ... Array [3] : Low Byte of 256 word

1) Function

This is the *Function Block* that is executed by selecting function code 01, 02, 03, 04 from modbus protocol communication and used for Bit/Word Read. Function code 01 executes output contact status (Coil Status) Data Read and function code 02 executes input contact status (Input Status) Data Read. Function code 03 executes output register (Holding Registers) Data Read and function code 04 executes input register (Input Registers) Data Read.

2) Error

Output the error code from output STATUS. For further information, please refer to error code.

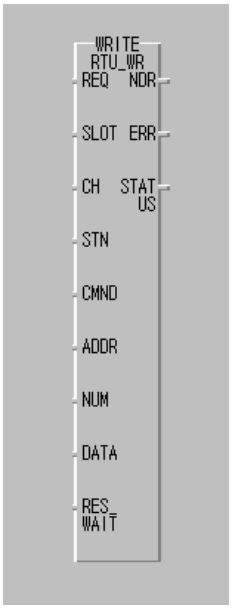
Remark

Response Wait Time setting

1) After the setting wait time, receive the response data from Cnet module of CPU.
2) If the response does not reach from other station within the setting time, error (code 74 or code 10) occurs. This *Function Block* acts in Cnet function '**User Definition Mode'**.
3) Response Wait Time shall be set considering Read/Write data number, transmission speed (Baudrate), the response speed of other station etc.
4) When setting, please refer to the table below and if error occurs, extend the setting time.

Classification	1 ~ 16 word	17 ~ 32 word	33 ~ 48 word	49 ~ 64 word
4800 bps	150ms	250ms	330ms	400ms
9600 bps	100ms	180ms	230ms	280ms
19200 bps	80ms	150ms	180ms	230ms

(b) RTU_WR

Item	IN / OUT	Type	Description
	REQ	BOOL	*Function Block* execution condition (Rising edge action) - When changing from 0 to 1, one time executed.
	SLOT	USINT	Cnet module slot no. (0 ~ 7)
	CH	USINT	Channel setting (0 : RS-232C, 1 : RS-422/485)
	STN	USINT	Other station no. setting (0 ~ 32)
	CMND	USINT	Modbus function code (15 ~ 16) 15 : Force Multiple coils(Bit) 16 : Preset Multiple register (Word)
	ADDR	INT	Leading address to Write (1 ~ 9999)
	NUM	USINT	Data number to Write (1 ~ 64)
	RES_WAIT	TIME	Response wait time (after the setting wait time, receive the response data from Cnet module of CPU.)
	NDR	BOOL	After completion of the normal communication, 1 Scan 'ON'.
	ERR	BOOL	When communication error occurs, 1 Scan 'ON'.
	STATUS	USINT	Communication status code (Error code) 0 : normal, if not 0: Error code
	DATA	USINT ARRY (256)	Self station data storage area to Write Array [0] : High Byte of first word Array [1] : Low Byte of first word Array [2] : High Byte of second word Array [3] : Low Byte of second word ...

1) Function

This is the *Function Block* to execute by selecting function code 15 and 16 from modbus protocol communication and used for Continuous 1 bit Write (function code 15), Continuous 1 word Write (function code 16). Function code 15 performs 1 bit Data Write to output contact (Coil) continuously and function code 16 performs 1 word Data Write to output register (Holding Registers) continuously.

2) Error

Output the error code to output STATUS. For further information, please refer to the error code.

Remark

1) This *Function Block* acts in Cnet function '**User Definition Mode'.**
2) Basic parameter (Baudrate, Data bit, Stop bit, Parity check, Station No. etc.) shall be set in Cnet editor and the frame editing is not needed.
3) This supports Modbus RTU Protocol. (scheduled to support ASCII Protocol later)
4) Cnet module requirements to use this *Function Block* are as follows.
   - Cnet module version : more than v2.0 (available to verify in GMWIN)
   - Cnet module Flash Rom OS version : more than v1.01 (available to verify in Cnet Editor)
   - Modbus.Nfb (Modbus *Function Block* file, N=3,4,6) needed.

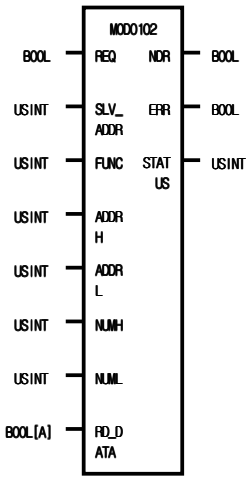
Error code table

Status code (Dec)	Description	Solution	Remarks
0	Normal	No error	
1	Illegal function code (When the master requires the command that the Slave does not support.)	After confirming the command available to support by the Slave, modify the command on FB.	The error returned from the Slave
2	Illegal address (When the Master requires the address that the Slave does not support.)	After confirming the address available to support by the Slave, modify the address on FB.	
3	Illegal data value (When the Master requires the data of the range that the Slave does not support.)	After confirming the data range available to support by the Slave, modify the data on FB.	
4	Slave device failure (The unrecoverable error occurs while performing the Master requirements in the Slave.)	Check the Slave station status.	
6	Slave device busy	After waiting for the regular time, Master	
10	Receiving Frame CRC error	1. After confirming the receiving frame status, extend the Response Wait Time. 2. Check the Cable and Noise status.	Function Block setting error
16	Cnet module I/F error (No Cnet module in the designated slot.)	Check the slot no. designated on FB.	
64	Channel (RS-232C/422) stop	RUN the Cnet module. (power reinput)	

Status code (Dec)	Description	Solution	Remarks
74	Time out error	1. Check the basic parameter (station no./speed etc.) 2. Check the Slave station status (power etc.) 3. Check the Cable status and disconnection	
115	Communication mode error	Check if Cnet user definition	

(2) For G7

(a) MOD0102 (reading bit)

Function Block	Description
	**Input** REQ : When 1 (rising edge), *Function Block* execution SLV_ADDR : Input of Slave station number FUNC : Function code input It supports function code 01 and 02. ADDRH : High address of starting address to read in the Slave station. ADDRL : Low address of starting address to read in the Slave station. NUMH : High address of data size to read from the starting address to read in the Slave station. NUML : Low address of data size to read from the starting address to read in the Slave station. **Output** RD_DATA : Variable name to save the Read data. (Array number should be declared as equal to or greater than the data size.) NDR : If executing without error, output 1 and maintain 1 until calling next *Function Block*. ERR : When error occurs, output 1 and maintain 1 until calling next *Function Block*. STATUS : When error occurs, output the error code.

1) Function

This is the *Function Block* to execute by selecting function code 01 and 02 from modbus protocol communication and used for Bit Read. Function code 01 performs output contact status (Coil status) data Read and function code 02 performs input contact status (Input Status) data Read.

2) Error

Output the error code to the Output STATUS. For further information, please refer to the error code.

a) Program Example

This is the example when G7 basic unit is the Master and when reading output contact data of Modicon product that is station no.17.

- Execute the Status Read of output contact (Coil) 00000 ~ 00010 of the Slave station (Station no.17). The output contact of the Slave station is assumed as follows and the read data is saved in the BOOL type random array variable RD_DB0 whose size is 16.

Output contact	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Contact status	1	1	1	1	0	0	0	1	1	1	1	0	0	1	1	0
Hex	F				1				E				6			

<Data status of Smart I/O 16 point output module 'contact (00000~00009)>

- The data shall be transmitted from low bit by byte unit. The insufficient bit part of the byte shall be filled with '0'. The transmission of the above data is shown on Ex.1).
  Ex.1) E6 F1

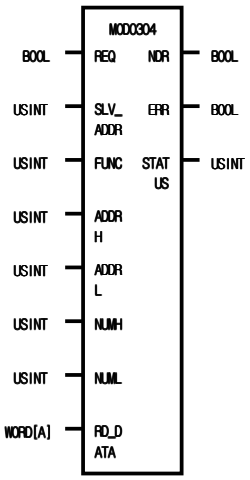
Function Block	Input value	
REQ	Enter the input condition to run.	
SLV_ADDR	16#11 or 17	Slave station no.
FUNC	16#01 or 1	Enter '1' when reading output contact status.
ADDRH	16#00 or 0	High byte among the address starting to read from the Slave station.
ADDRL	16#FF or 255	Low byte among the address starting to read from the Slave station. - In order to read from output contact 00000, it is required to read **from no. 255** according to the 8) modbus addressing regulation. And most significant data in its address shall be processed automatically by the input value of 'FUNC' without a separate input.
NUMH	16#00 or 0	High byte when expressing total size of data to read by Hexadecimal.
NUML	16#0A or 10	Low byte when expressing total size of data to read by Hexadecimal. − From the example, it is required to read 00000 ~ 00010 and total size of data shall be 10. If expressing 10 by Hexadecimal, it shall be H000A and it is required to enter H00 for NUMH and H0A for NUML .

- Results

Variable name	Storage value	Variable name	Storage value	Variable name	Storage value	Variable name	Storage value
RD_DB0[0]	0	RD_DB0[4]	0	RD_DB0[8]	1	RD_DB0[12]	X
RD_DB0[1]	1	RD_DB0[5]	1	RD_DB0[9]	0	RD_DB0[13]	X
RD_DB0[2]	1	RD_DB0[6]	1	RD_DB0[10]	X	RD_DB0[14]	X
RD_DB0[3]	0	RD_DB0[7]	1	RD_DB0[11]	X	RD_DB0[15]	X

- The variable to save the read data should be array type variable and the size of array type variable should be equal to or greater than that of the data to read. If it is smaller, error code shall be indicated on the STATUS.
- The read data shall be saved from array variable RD_DB0[0].
- The remaining part after filling the array variable by the read data shall be redundancy.

(b) MOD0304 (reading word)

Function Block	Description
	**Input** REQ : When 1 (rising edge), *Function Block* execution SLV_ADDR : Slave station no. input FUNC : Function code input It supports function code 03 and 04. ADDRH : High address of starting address to read in the Slave station. ADDRL : Low address of starting address to read in the Slave station. NUMH : High address of data size to read from the starting address to read in the Slave station. NUML : Low address of data size to read from the starting address to read in the Slave station. **Output** RD_DATA : Variable name to save the Read data. (Array number should be declared as equal to or greater than the data size.) NDR : If executing without error, output 1 and maintain 1 until calling next *Function Block*. ERR : When error occurs, output 1 and maintain 1 until calling next *Function Block*. STATUS : When error occurs, output the error code.

1) Function

This is the *Function Block* to execute by selecting function code 03 and 04 from modbus protocol communication and used for Word Read. Function code 03 performs output register (Holding Registers) data Read and function code 04 performs input register (Input Registers) data Read.

2) Error

Hold the error code to the Output STATUS. For further information, please refer to the error code.

a) Program Example

This is the example when G7 basic unit is the Master and when reading output register data of Smart I/O 32 point output module that is station no.17.

- Execute the Read of output register (Holding Registers) 40000 ~ 40001 of the Slave station (Station no.17). The output register of the Slave station is assumed as follows and the read data is saved in the WORD type random array variable RD_DW0 whose size is 4.

Output Register	40000	40001
Register Status	H0064	H1234

- The data shall be transmitted from high byte of low word per byte unit. The transmission of the above data is shown on Ex.1).

  Ex.1) 12 34 00 64

Function Block input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#03 or 3 : Enter '3' when reading output register.
ADDRH	16#00 or 0 : High byte among the address starting to read from the Slave station.
ADDRL	16#FF or 255 : Low byte among the address starting to read from the Slave station. - In order to read from output register 40000, it is required to read **from no.255** according to the 8) modbus addressing regulation. And the most significant data in its address shall be processed automatically by the input value of 'FUNC' without a separate input.
NUMH	16#00 or 0 : High byte when expressing total size of data to read by Hexadecimal.
NUML	16#02 or 2 : Low byte when expressing total size of data to read by Hexadecimal. - From the example, it is required to read 40000 ~ 40001 and total sizes of data shall be 2. When expressing 2 by Hexadecimal, it shall be H0002 and it is required to enter H00 for NUMH and H02 for NUML.

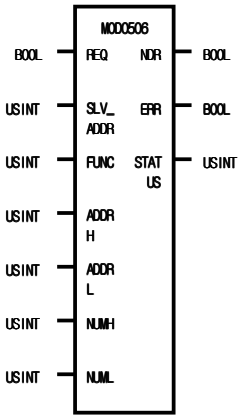
- Results

Variable name	Storage value
RD_DW0[0]	H1234 or 4660
RD_DW0[1]	H0064 or 100
RD_DW0[2]	X
RD_DW0[3]	X

- The variable to save the read data should be array type variable and the size of array type variable should be equal to or greater than that of the data to read. If it is smaller, error code shall be indicated on the STATUS.

- The read data shall be saved from array variable RD_DW0[0].
- The remaining part after filling the array variable by the read data shall be redundancy.

(c) MOD0506 (writing 1bit/1word)

Function Block	Description
	**Input** REQ : When 1 (rising edge), *Function Block* execution SLV_ADDR : Slave station address input FUNC : Function code input It supports function code 05 and 06. ADDRH : High address among start address to write in the Slave station. ADDRL : Low address among start address to write in the Slave station. NUMH : High address among data to write in the Slave station. NUML : Low address among data to write in the Slave station. **Output** NDR : If executing without error, output 1 and maintain 1 until calling next *Function Block*. ERR : When error occurs, output 1 and maintain 1 until calling next *Function Block*. STATUS : When error occurs, output the error code.

1) Function

This is the *Function Block* to execute by selecting function code 05 and 06 from modbus protocol communication and used for 1 Bit Write (function code 05) and 1 Word Write (function code 06). Function code 05 performs 1Bit data Write for output contact (Coil) and if setting 255 (or HFF) for input NUMH of *Function Block* or 0 (or H00) for input NUML, write ‘1’ for output contact and if setting 0 (or H00) for input NUMH or 0 (or H00) for NUML, write ‘0’ for output contact. Function code 06 performs 1 word data write in output register.

2) Error

Output the error code to the output STATUS. For further information, please refer to Error code.

a) Program Example

- This is the example when G7 basic unit is the Master and when writing 1 bit data to the 16 point output contact of smart I/O that is station no.17.

  - Write '1' to the output contact (Coil) 00000 of the Slave station (station no.17)

Function Block input	Input value	
REQ	Enter the input condition to run.	
SLV_ADDR	16#11 or 17	: Slave station no.
FUNC	16#05 or 5	: Enter '5' when writing 1 Bit to output contact.
ADDRH	16#00 or 0	: High byte among the address starting to write in the Slave station.
ADDRL	16#FF or 255	: Low byte among the address starting to write in the Slave station. - In order to write to output contact 00000, it is required to write **from No.255** according to the 8) modbus addressing regulation. And most significant data of data address shall be processed automatically by the input value of FUNC without a separate input.
NUMH	16#00 or 0	: Data to write in the Slave station
NUML	16#00 or 0	: Data to write in the Slave station - From the example, it is required to write '1'. Thus, enter H00 for NUMH and H01 for NUML.

- Results: Output contact 00000 shall be ON. (In case of GM7 basic unit, '1' shall be saved in the corresponding M area.)

Output contact	00000
Contact status	1

- This is the example when G7 basic unit is the Master and when writing 2 Word Data to the 32 point output contact of smart I/O that is station no.17.

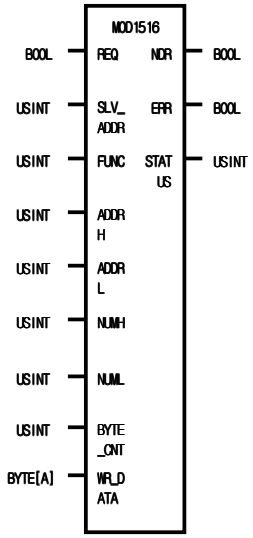
  - This is the example to write '3' to the output register (Holidng Registers) 40000 of the Slave station (Station no.17).

Function Block input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#06 or 6 : Enter '6' when writing 1 Word to output register.
ADDRH	16#00 or 0 : High byte among the address starting to write in the Slave station.
ADDRL	16#FF or 255 : Low byte among the address starting to write in the Slave station. − In order to write to output contact 40000, it is required to write **from No.255** according to the 8) modbus addressing regulation. And most significant data of its address shall be processed automatically by the input value of 'FUNC' without a separate input.
NUMH	16#00 or 0 : High byte when expressing the data to write in the Slave station by Hexadecimal.
NUML	16#03 or 3 : Low byte when expressing the data to write in the Slave station by Hexadecimal. − From the example, it is required to write '3' and if expressing the data by Hexadecimal, it shall be H0003 and it is required to enter H00 for NUMH and H03 for NUML.

  - Results: H0003 shall be saved in output register 40000. (In case of GM7 basic unit, H0003 shall be saved in the corresponding M area.)

Output register	40000
Register status	H0003

(d) MOD1516 (writing 1 bit/1 word continuously)

Function Block	Description
	**Input** REQ : When 1 (rising edge), *Function Block* execution SLV_ADDR : Slave station address input FUNC : Function code input It supports function code 15 and 16. ADDRH : High address among starting address to write in the Slave station. ADDRL : Low address among starting address to write in the Slave station. NUMH : High address of data size to write in the Slave station. NUML : Low address of data size to write in the Slave station. BYTE_CNT : Byte size of data to write in the Slave station. WR_DATA : Variable name to save the data to write. (It should be declared as equal to or greater than the data size.) **Output** NDR : If executing without error, output 1 and maintain 1 until calling next *Function Block*. ERR : When error occurs, output 1 and maintain 1 until calling next *Function Block*. STATUS : When error occurs, output the error code.

1) Function

This is the *Function Block* to execute by selecting function code 15 and 16 from modbus protocol communication and used for Continuous 1Bit Write (function code 15) and Continuous 1Word Write (function code 16). Function code 15 performs 1Bit Data Write for output contact (Coil) by 1 byte continuously and Function code 16 performs 1 Word Data Write for output register (Holding Registers) continuously.

2) Error

Output the error code to the output STATUS. For further information, please refer to Error Code.

a) Program Example

- This is the example when G7 basic unit is the Master and when writing Bit Data continuously to 16 point output contact of Smart I/O that is station no.17.
- It writes the continued 10bit 1010101010101010 to output contact (Coil) 00000 in the Slave station (Station no.17) by 1bit. The data to write is saved in BYTE type random array variable WR_DB0 whose size is 2.

Variable name	Storage value
WR_DB0[0]	2#01010101 or 16#55
WR_DB0[1]	2#01010101 or 16#55

- The data shall be transmitted by byte unit from low bit. The transmission of the above data is shown on Ex.1).

Ex.1) 55 55

Function Block input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#0F or 15 : Enter '15' when writing Bit to output contact continuously.
ADDRH	16#00 or 0 : High byte among starting address to write in the Slave station.
ADDRL	16#FF or 255 : Low byte among starting address to write in the Slave station. − In order to write from output contact 00020, it is required to write **from No.255** according to the 8) modbus addressing regulation. And the most significant data of data address shall be processed automatically by the input value of 'FUNC' without separate input.
NUMH	16#00 or 0 : High byte when expressing total size of data to write in the Slave station by Hexadecimal.
NUML	16#0F or 16 : Low byte when expressing total size of data to write in the Slave station by Hexadecimal. − From the example, it is the 16 bit data continued from 00000 and total size shall be 16. If expressing 16 by Hexadecimal, it shall be H000A and it is required to enter H00 for NUMH and H0A for NUML.
BYTE_CNT	16#02 or 2 : This is the size when converting total size of data to write in the Slave station by byte unit. − From the example, it is the continued 16 bit data and if converted by byte unit, it shall be 2 bytes. Thus, it is required to enter H02 for BYTE_CNT.

- Results

Output contact	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Contact status	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

▸ This is the example when G7 basic unit is the Master and when writing Bit Data continuously to 32 contact output module of Smart I/O that is station no.17.

- It writes 000A and 0102 to output register (Holding Registers) 40000 in the Slave station (station no.17). The data to write is saved in BYTE type array variable WR_DB1 whose size is 4.

Variable name	Storage value
WR_DB1[0]	2#00001010 or 16#0A
WR_DB1[1]	2#00000000 or 16#00
WR_DB1[2]	2#00000010 or 16#02
WR_DB1[3]	2#00000001 or 16#01

- The size of BYTE_CNT is the size when converting the data to write by byte unit. As the above data is 2 words, it is required to use 4 bytes. Thus, the size of BYTE_CNT is 4.
- The data is transmitted from low word by byte unit. The transmission of the above data is shown on Ex.1).

Ex.1) 00 0A 01 02

Function Block input	Input value
REQ	Enter the input condition to run.
SLV_ADDR	16#11 or 17 : Slave station no.
FUNC	16#0F or 16 : Enter '16' when writing Word to output register continuously.
ADDRH	16#00 or 0 : High byte among starting address to write in the Slave station.
ADDRL	16#FF or 255 : Low byte among starting address to write in the Slave station. – In order to write from output register 40000, it is required to write **from No.255** according to the 8) modbus addressing regulation. And most significant data of data address shall be processed automatically by the input value of 'FUNC' without separate input.
NUMH	16#00 or 0 : High byte when expressing total size of data to write in the Slave station by Hexadecimal.

Function Block input	Input value	
NUML	16#02 or 2	: Low byte when expressing total size of data to write in the Slave station by Hexadecimal. – From the example, it is the 2 word data continued from 40000 and total size shall be 2. If expressing 2 by Hexadecimal, it shall be H0002 and it is required to enter H00 for NUMH and H02 for NUML.
BYTE_CNT	16#04 or 4	: This is the size when converting total size of data to write in Slave station by byte unit. – From the example, it is the continued 2 word data and if converted by byte unit, it shall be 4 byte. Thus, it is required to enter H04 for BYTE_CNT.

- Results

Output register	40001	40000
Register status	H0102	H000A

e) Error code

CODE	Error type	Meaning
01	Illegal Function	Function code input error to the *Function Block*
02	Illegal Address	The area to read/write in the slave exceeds the allowed range.
03	Illegal Data Value	The data value to read/write in the Slave is not allowed.
04	Slave Device Failure	Slave error status
05	Waiting for Acknowledge	This is a kind of response code that the Slave sends to the master to prevent the time of the master when it takes a time for the processing of demand command. In the master, it indicates the error code and wait for the regular time without demanding again.
06	Slave Device Busy	The error caused by long processing time of the slave. Master must demand again.
07	Time Out Error	The error occurred when exceeding the setting time of the communication parameter while communication.
08	Data Size Error	The error occurred when data is ‘0’ or more than 256byte, when data size is greater than array size, and when number and BYTE_CNT is different.
09	Parameter Error	Parameter setting error (mode, master/slave)
10	Station Error	The error occurred when the station no. set in self station and input parameter of function is the same.

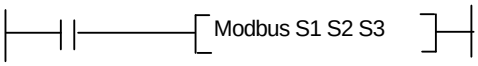
5.4.2 K Series

(1) Command Modbus

MODBUS command is available only in the K80S, K120S.

But in case of using the K120S, it is available to use communication port by only RS-232C.

Command		Available area to use												Step no.	Flag		
		M	P	K		L	F	T	C	S	D	#D	Integral number		Error (F110)	Zero (F111)	Carry (F112)
Modbus	S1	0	0	0	0	0	0	0	0	-	0	0	-	7	0	-	-
	S2	0	0	0	0	0	-	0	0	-	0	0	-				
	S3	0	0	0	0	0	-	0	0	-	0	0	-				



Flag	
F110	When exceeding #D area, it shall be ON.
Area setting	
S1	Device address to register sending/receiving parameter. (3 words)
S2	Device address to save sending/receiving data. (1 word)
S3	Device address to indicate sending/receiving status. (1 word)

(a) Function

1) Here sets data saved in device designated in S1 to fit Modbus protocol type.

It consist of 3 words and must be set by Hexdecimal code.

a) first word : slave station address (high byte) + function code (low byte)

b) second word : means Smart I/O's IO address (h0000).

c) third word

▶When Smart I/O is output module: device address where data for tansmission is saved.

▶When Smart I/O is input module: data number for reading

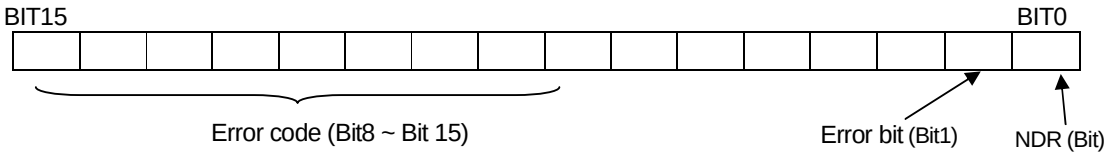
d) This designates the leading address of the device where the received data is saved to S2.

➔ According to function of S1, it designates the leading address of the device that the received data is saved in when receiving and the leading address of the data to sending when sending.

e) The communication action status is saved in S3.

(b) error code

1) S3 (sending/receiving status)'s format is as follows.



2) NDR : when completing the normal communiction, 1 Scan ON.

3) Error bit : when communication error occurs, 1 Scan ON and in this case, error code is indicated Bit8 ~ Bit15.

4) Error code : when error occurs, it shows the information for the error.
(refer to the error code table as below.)

Error code table

Code	Name	Description
01	Illegal Function	Function code error
02	Illegal Address	Address allowed range exceeded
03	Illegal Data Value	The error that data value is not allowed.
04	Slave Device Failure	Slave error status
05	Waiting for Acknowledge	When it takes a time for the processing of demand command, the slave sends to prevent Time Out Error of the master.
06	Slave Device Busy	The slave takes a time for the processing. The master must demand again.
07	Time Out Error	When no response during Time out of communication parameter.
08	Data Size Error	When data size is '0' or exceeds 256Byte. In case of data size is larger than Array size or Number and BYTE_CNT is different.
09	Parameter Error	When the items set in the parameter (such as transmission mode etc.) are wrong.
10	Station Error	When self station no. and input parameter of Modbus command are the same.

(2) Command MODCOM

It is available to use MODCOM command only in the K120S.

Command		Available area to use												Step no	Flag		
		M	P	K		L	F	T	C	S	D	#D	Integral number		Error (F110)	Zero (F111)	carry (F112)
Modbus	CH	-	-	-	-	-	-	-	-	-	-	-	○	7	0	-	-
	S1	0	0	0	0	0	0	0	0	-	0	0	-				
	S2	0	0	0	0	0	-	0	0	-	0	0	-				
	S3	0	0	0	0	0	-	0	0	-	0	0	-				

Flag	
F110	When exceeding #D area, it shall be ON.
Area setting	
CH	Communication channel
S1	Device address to register sending/receiving parameter.
S2	Device address to save sending/receiving data.
S3	Device address to indicate sending/receiving status.

(a) Function

1) CH means commucication channel and is set as integral number.

a) 0 : set when using built-in RS-232C communication or extension communication module (G7L-CUEC)

b) 1 : set when using built-in RS-485 communication.

2) Here sets data saved in device designated in S1 to fit Modbus protocol type.

It consist of 3 word and must be set by Hexdecimal code.

a) first word : slave station address (high byte) + function code (low byte)

b) second word : means Smart I/O's IO address (h0000).

c) third word

▶When Smart I/O is output module: device address where data for tansmission is saved.

▶When Smart I/O is input module: data No. for reading

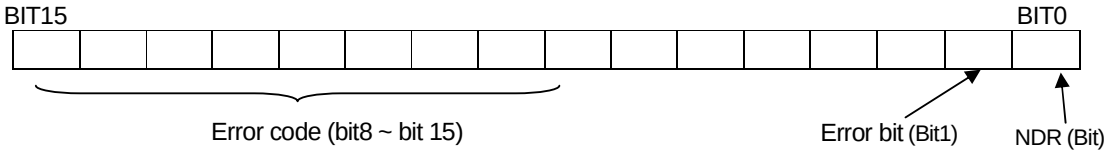
3) This designates the leading address of the device where the received data is saved to S2.

➔ According to function of S1, it designates the leading address of the device that the received data is saved in when receiving and the leading address of the data to sending when sending.

4) The communication action status is saved in S3.

(b) error code

1) S3 (sending/receiving status)'s format is as follows



2) NDR : when completing the normal communiction, 1Scan ON.

3) Error bit : when communication error occurs, 1Scan ON and in this case, error code is indicated Bit8 ~ Bit15.

4) Error code : when error occurs, it shows the information for the error.
(refer to the error code table as below.)

Error code table

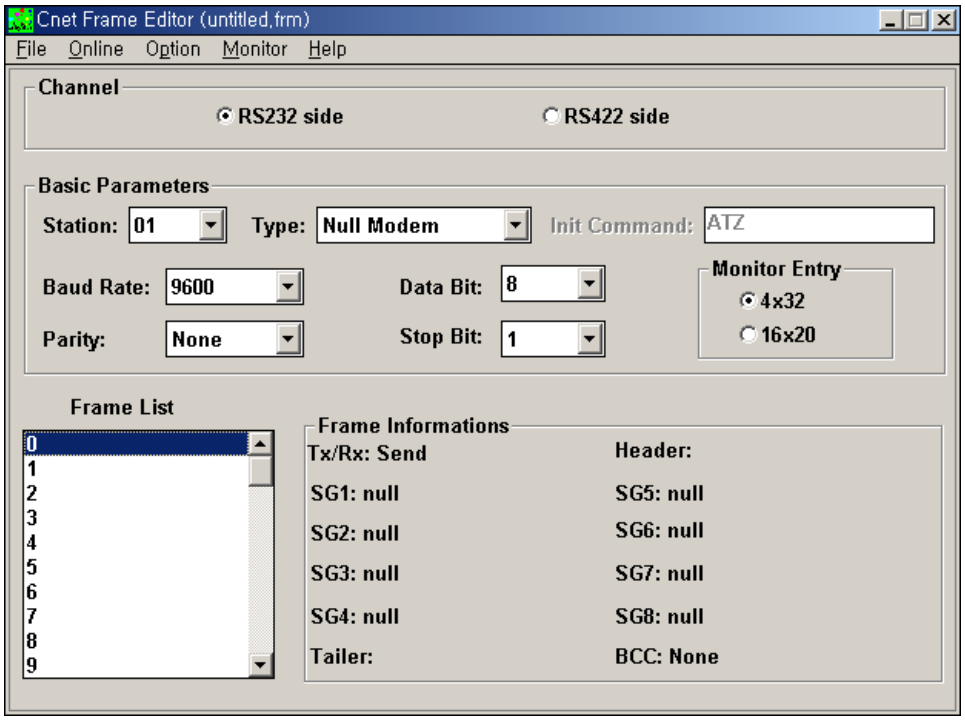
Code	Name	Description
01	Illegal Function	Function code error
02	Illegal Address	Address allowed range exceeded
03	Illegal Data Value	The error that data value is not allowed.
04	Slave Device Failure	Slave error status
05	Acknowledge	When it takes a time for the processing of demand command, the slave sends to prevent time out of the master.
06	Slave Device Busy	The slave takes a time for the processing. The master must demand again.
07	Time Out Error	When no response during Time out of communication parameter.
08	Data Size Error	When data size is '0' or exceeds 256Byte. In case of data size is larger than Array size or Number and BYTE_CNT is different.
09	Parameter Error	When the items set in the parameter (such as transmission mode etc.) are wrong.
10	Station Error	When self station no. and input parameter of Modbus command are the same.

5.5 Program Example

5.5.1 G Series

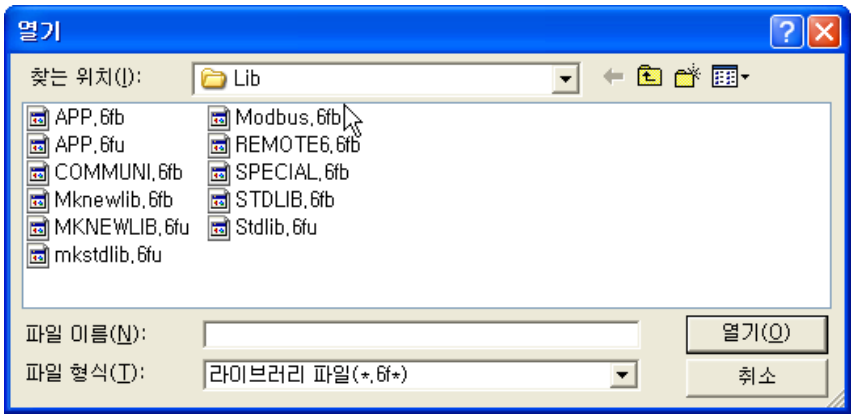
(1) When the Master is G4

(a) Set the basic frame in Cnet module of Master PLC.

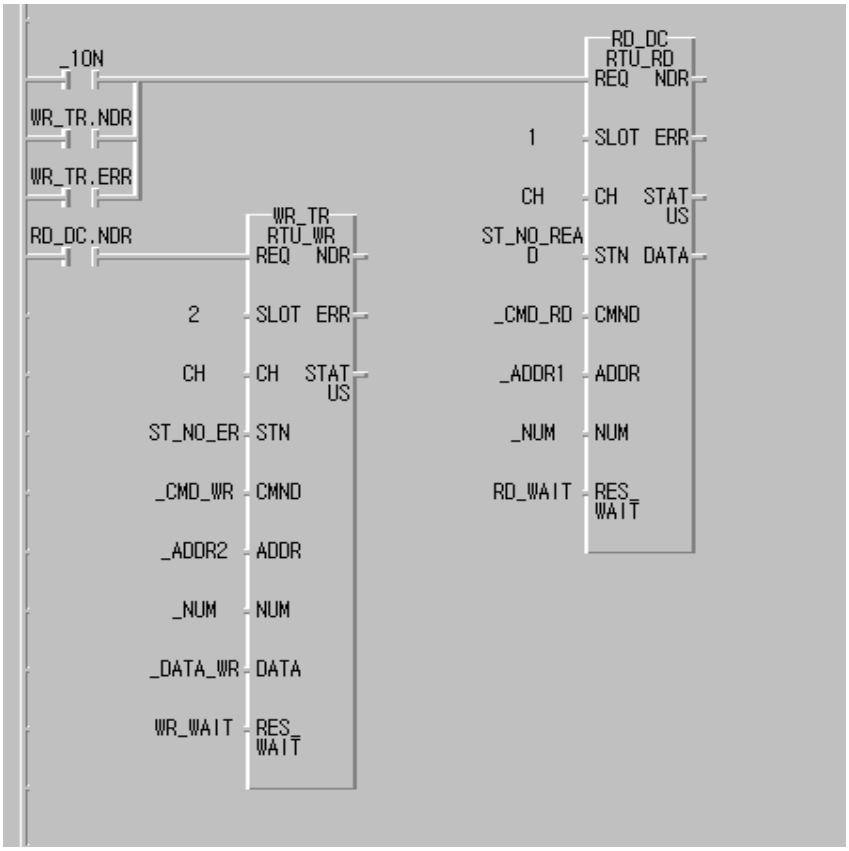


1) Basic parameter (Baudrate, Parity, Data bit, Stop bit) is required to correspond with the setting content of other station.
2) It is not necessary to write the frame list.

(b) Library -> Add item -> Library *



(c) Load the *Function Block* from Scan program of GMWIN program and program it.



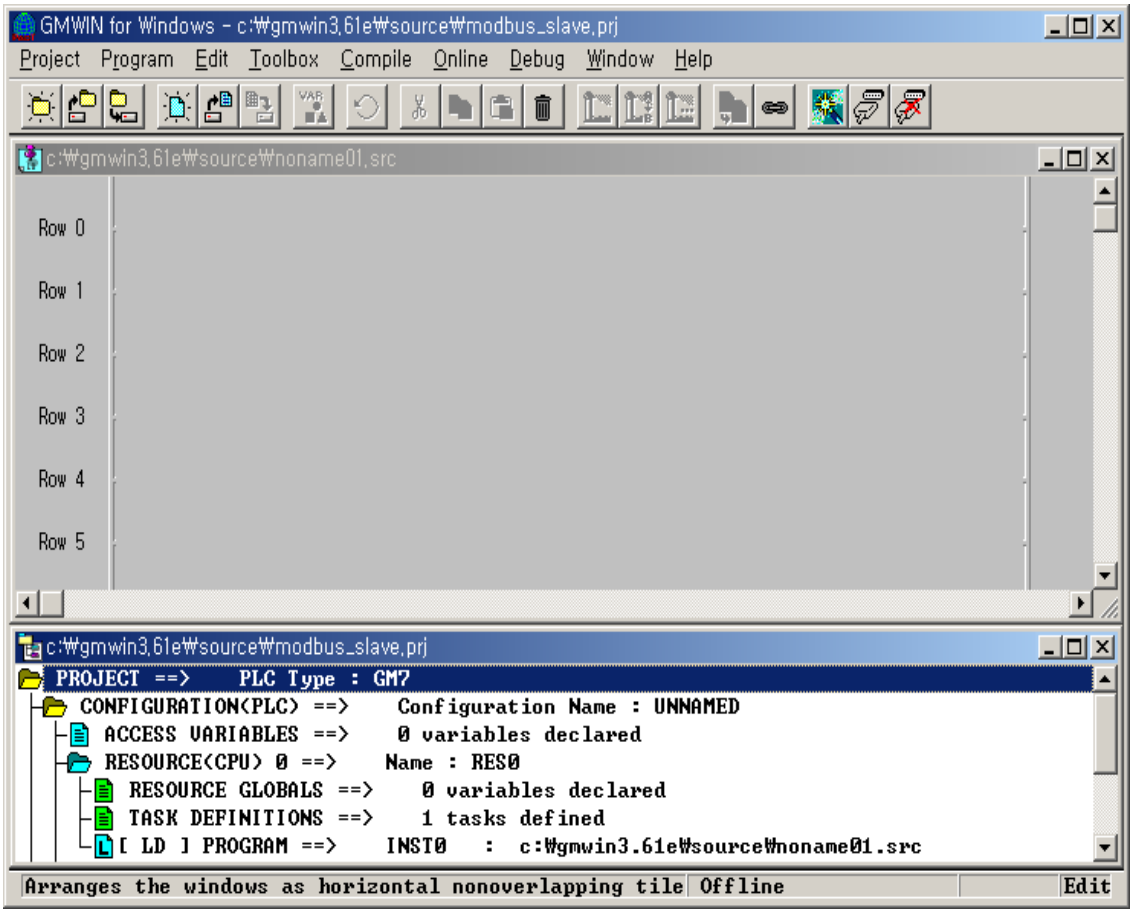
(2) When the Master is G7

(a) Slave station program: output the receiving data saved in M area to the output contact (Coil).

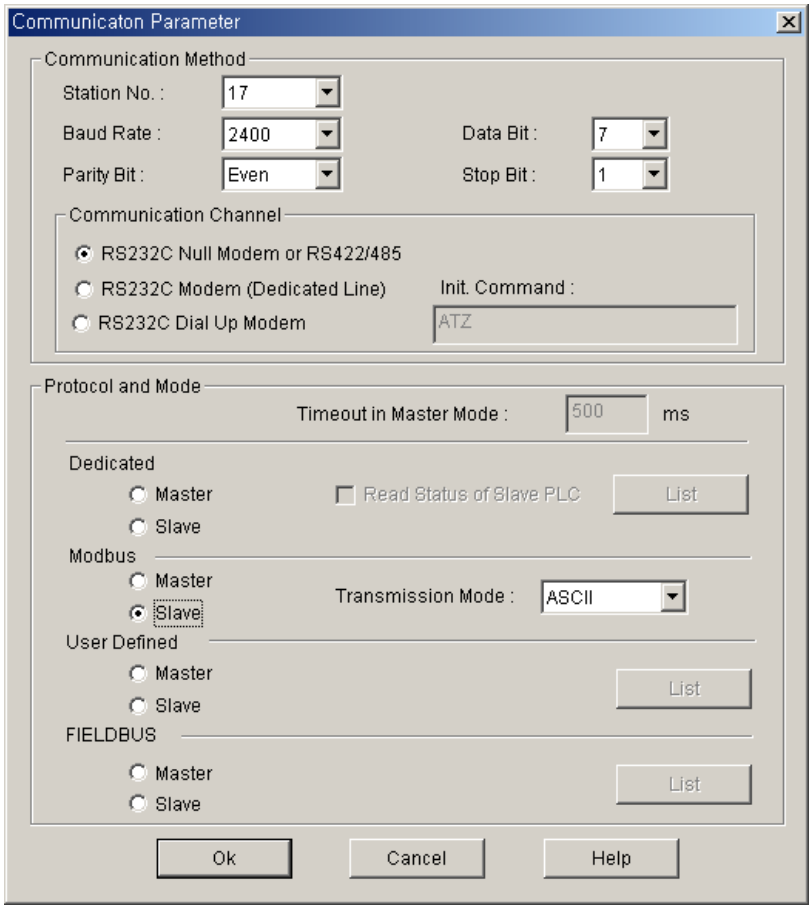
(b) Master station program: After saving 16#FF (OR 255) to %MW0 (this corresponds with %MX0 ~ %MX15 or %MB0 ~ %MB1.) in the *Function Block* MOD0506 (function code 06), read %MX0 using the *Function Block* MOD0102 (function code 01) and save '0' to %MX0 ~ %MX9 using the *Function Block* MOD1516 (function code 15) again and then read %MW0 using the *Function Block* MOD0304 (function code 03).

1) Slave station setting and Program

Create new project file and new program for the Slave station.



a) If you select 'Communication Parameter' from GMWIN parameter and double-click, the communication parameter menu window will open.

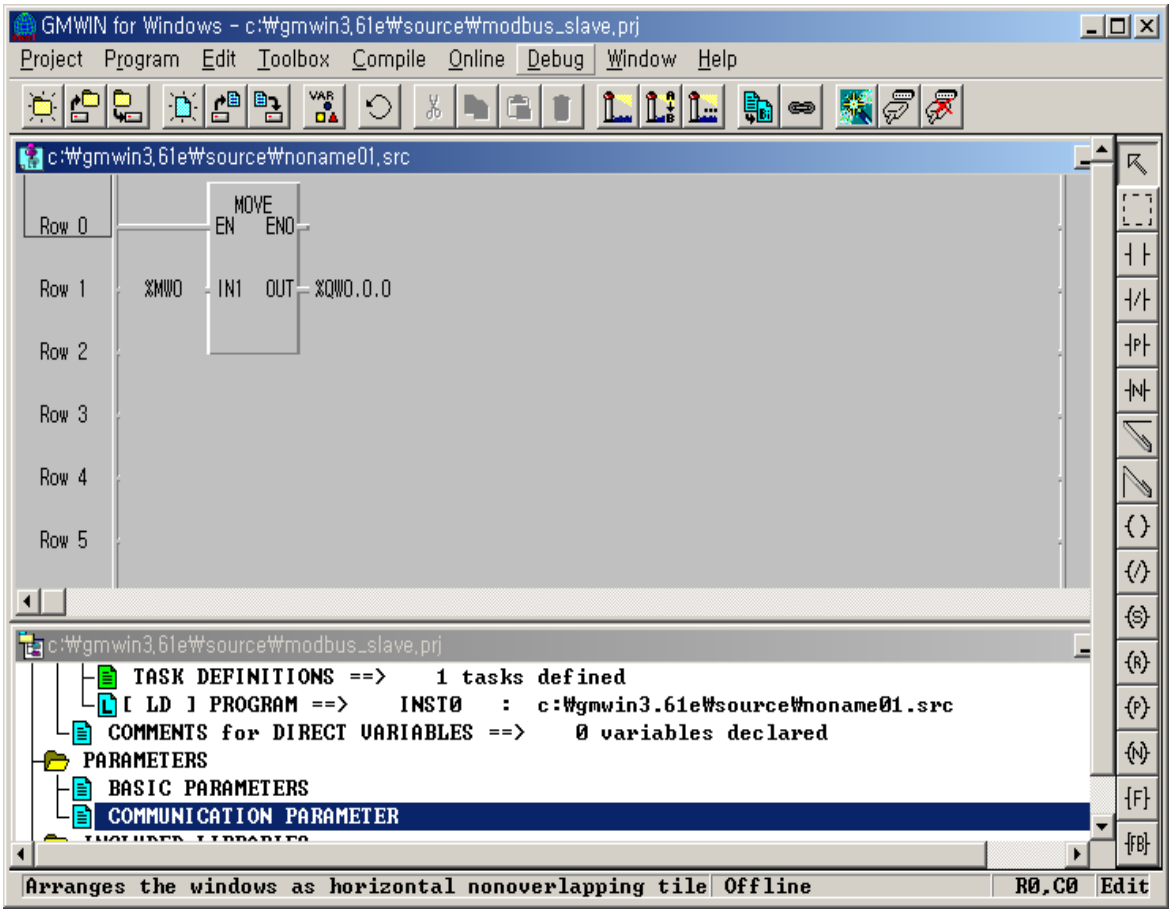


- Please set the parameter as below.

Communication method						Protocol and transmission mode	
Self station no.	Commu-nication speed	Data bit	Parity bit	Mainte-nance bit	Communication channel	Modbus	Exclusive mode
17	2400	7	EVEN	1	RS232C null modem or RS422/485	Slave	ASCII

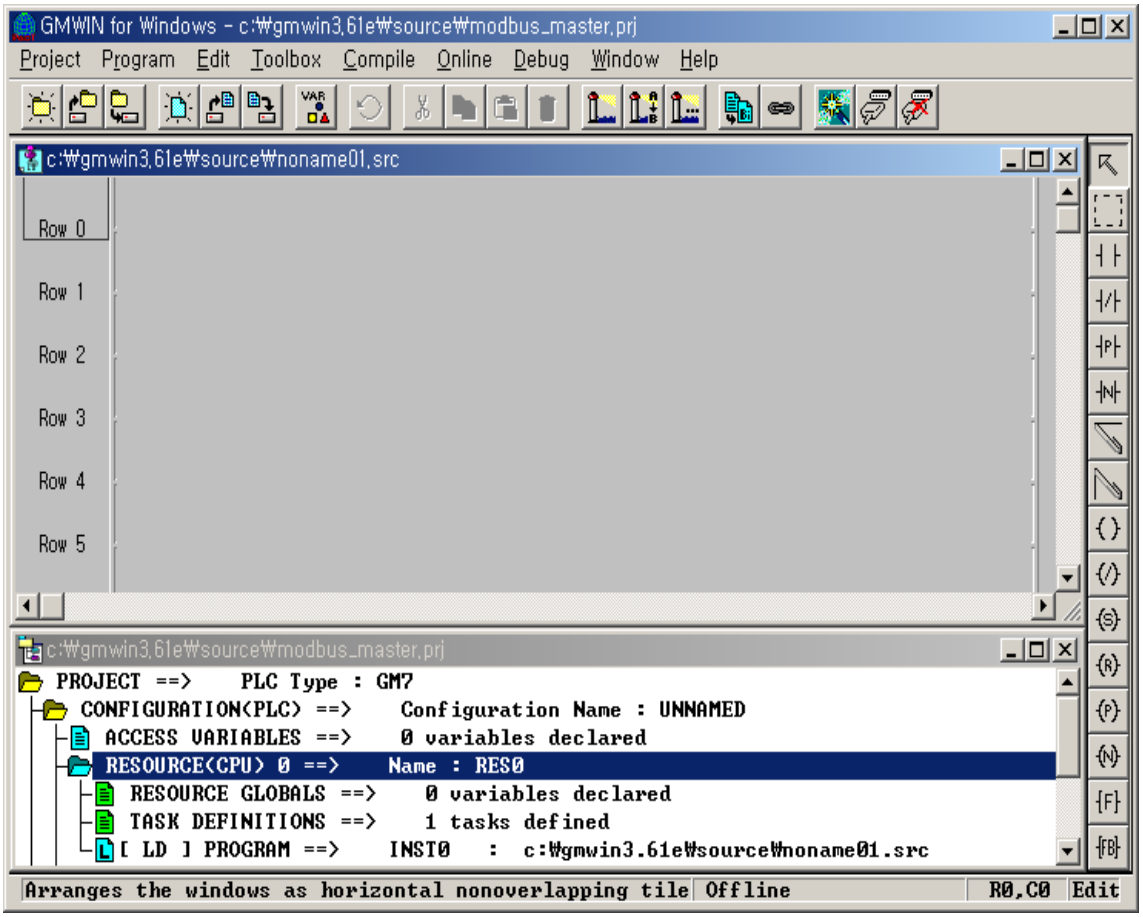
b) After creating the program as below, download it in the G7 basic unit of the Slave station. For further program creation and download method, please refer to GMWIN user's manual.

- The slave program is the program to output the data of M area to the output contact.

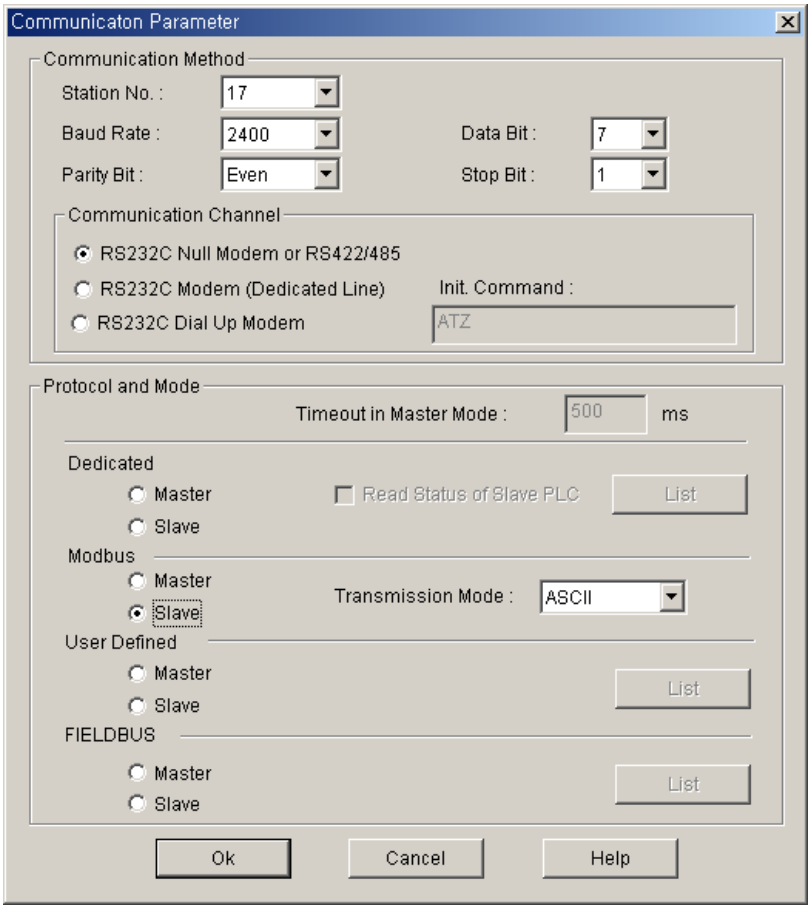


2) Master Station setting and Program

Create new project file and new program for the Master Station.



a) If you select 'Communication Parameter' from GMWIN parameter and double-click, the communication parameter menu window will be open.

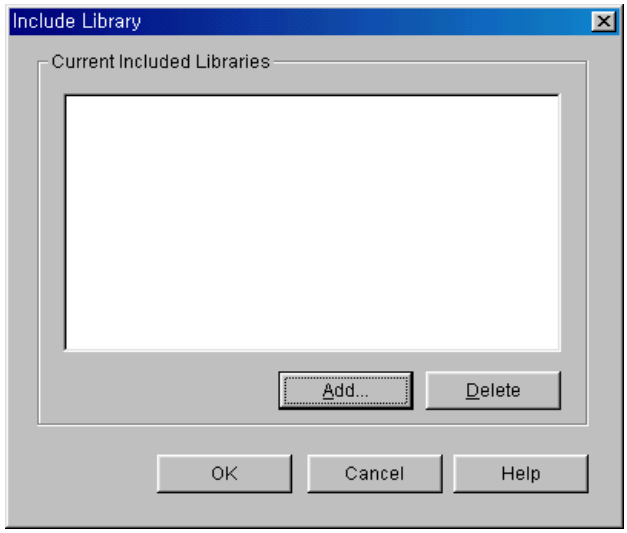


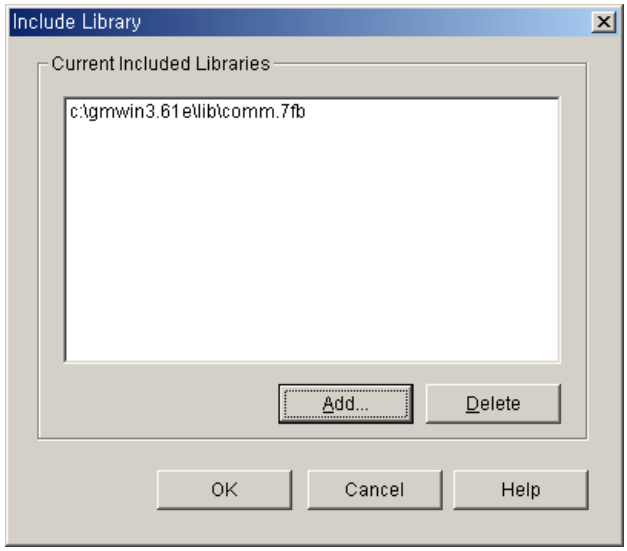
- Please set the parameter as below.

Communication method						Protocol & transmission mode	
Self station no.	Commu nication speed	Data bit	Parity bit	Mainte-nance bit	Communication channel	Modbus	Exclusive mode
1	2400	7	EVEN	1	RS232C null modem or RS422/485	Master	ASCII

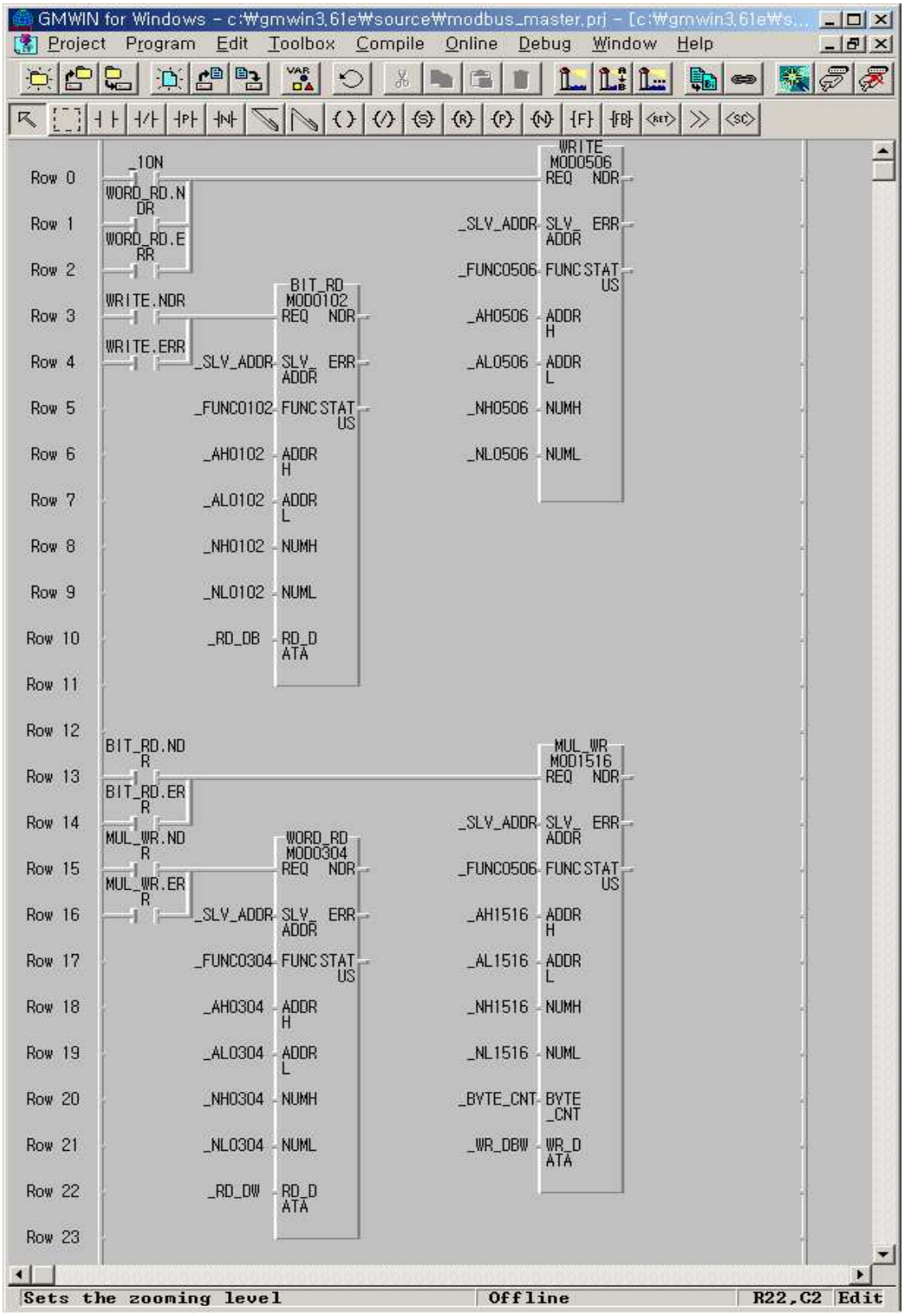
b) After creating the program as below, download it to the GM7 basic unit of the Master station. For further program creation and download method, please refer to GMWIN user's manual.

- In the program, the *Function Block* is used. If you double-click GMWIN 'inserted library files' items before using the *Function Block*, the library insert window will be open as below. Press 'Add (A)…' button and add COMM.7FB library and then press 'verify' button.





- Program Example



- After saving 16#FF (or 255) to %MW0 (this corresponds with %MX0 ~ %MX15 or %MB0 ~ %MB1.) in the *Function Block* MOD0506 (function code 06), read %MX0 using the *Function Block* MOD0102 (function code 01) and save '0' to %MX0 ~ %MX9 using the *Function Block* MOD1516 (function code 15) again and then read %MW0 using the *Function Block* MOD0304 (function code 03).
- You can see that 8 LED of output contact continues to repeat ON/OFF.
- The above figure is the screen that monitors the program execution. Thus, the value to be indicated on Array variable _RD_DB, _RD_DW is the result value after executing 'Read' not the initial value.
- The variable such as instance name.NDR, instance name.ERR, instance name.STATUS is generated automatically if declaring the instance variable of the *Function Block*.
- _1ON flag is the flag that will be ON only for 1Scan.
- Each *Function Block* input REQ is each *Function Block* output.
- The size of _BYTE_CNT must be same when converting the data by byte unit.
- If the size of Array variable is smaller than that of the data to read or write, error occurs.

- Variable table

Variable name	Variable type	Initial value	Variable name	Variable type	Initial value
_SLV_ADDR	USINT	17(H11)	_NH0102	USINT	0(H00)
_FUNC0102	USINT	1(H01)	_NH0304	USINT	0(H00)
_FUNC0304	USINT	3(H03)	_NH0506	USINT	0(H00)
_FUNC0506	USINT	6(H06)	_NH1516	USINT	0(H00)
_FUNC1516	USINT	15(H0F)	_NL0102	USINT	1(H01)
_AH0102	USINT	0(H00)	_NL0304	USINT	255(HFF)
_AH0304	USINT	0(H00)	_NL0506	USINT	1(H01)
_AH0506	USINT	0(H00)	_NL1516	USINT	10(H0A)
_AH1516	USINT	0(H00)	_RD_DB	BOOL type ARRAY[40]	{0,0,…,0}
_AL0102	USINT	0(H00)	_RD_DW	WORD type ARRAY[4]	{0,0,0,0}
_AL0304	USINT	0(H00)	_WR_DBW	BYTE type ARRAY[4]	{0,0,0,0}
_AL0506	USINT	0(H00)	_BYTE_CNT	USINT	2(H02)
_AL1516	USINT	0(H00)			

5.5.2 K Series

(1) Program example 1) when using MODBUS

(a) This example is system configuration of RS-485 communication between GSL-DT4A and G7L-CUEC(K80S)

(b) program of GSL-DT4A output part

1) D0000 : set GSL-DT4A's station address (no.1) and fuction code (06 writing 1 word)

2) D0001 : set GSL-DT4A's address

3) D0002 : data storage area sended to the GSL-DT4A

4) When every 200msec rising edge, it send data saved at the M100 to Smart I/O and error history is saved at the M000

(c) program of GSL-DT4A output part

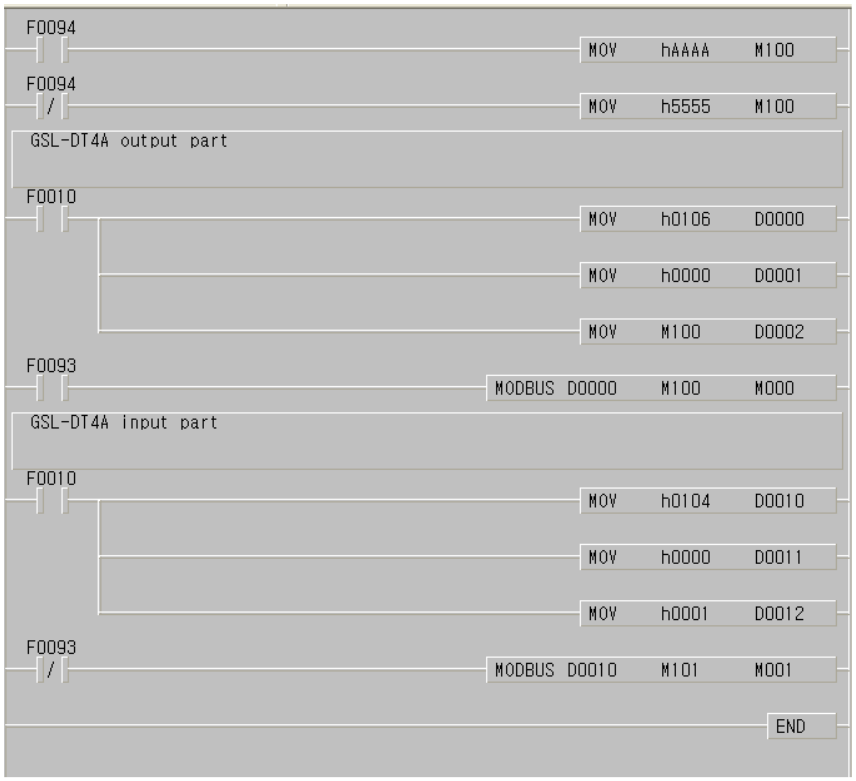
1) D0010 : set GSL-DT4A's station address (no.1) and fuction code (04 reading 1 word)

2) D0011 : set GSL-DT4A's address

3) D0012 : data no. to read from Smart I/O

(Because function code is 04, it reads 1 word)

4) Every 200msec when falling edge, it save data received from the input area of GSL-DT4A at the M110 and save it at the M001.



(2) program example 2) when using command MODCOM

(a) This example is system configuration of RS-485 communication between GSL-DT4A and G7L-CUEC(K120S)

(b) program of GSL-DT4A output part

1) D0000 : set GSL-DT4A's station address (no.1) and fuction code (06 writing 1 word)

2) D0001 : set GSL-DT4A's address

3) D0002 : data storage area sended to the GSL-DT4A

When every 1 sec rising edge, at the 1 channel, it send data saved at the M100 to Smart I/O and error history is saved at the M000

(C) program of GSL-DT4A output part

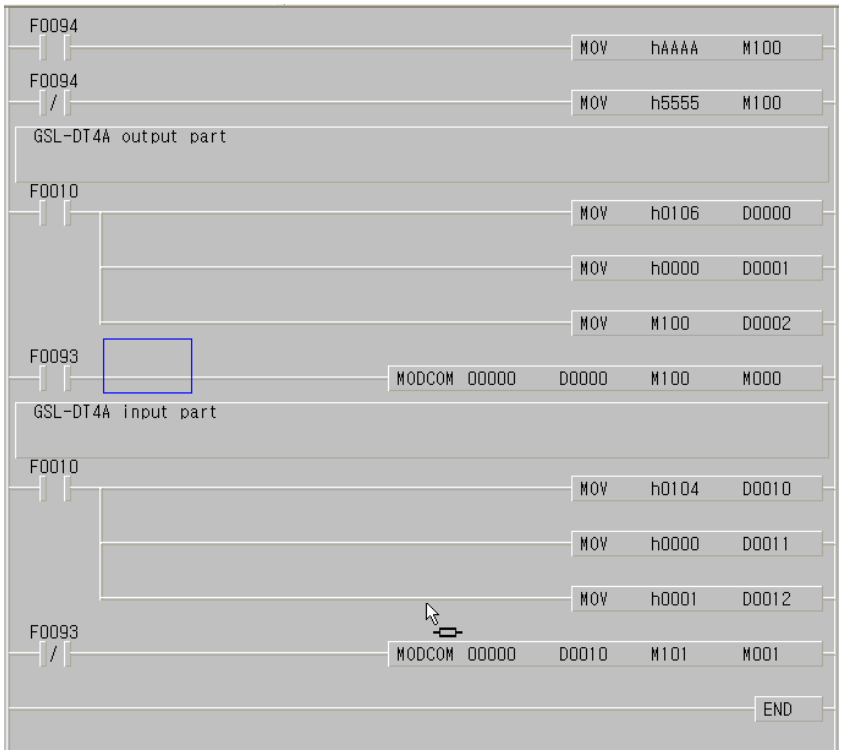
1) D0010 : set GSL-DT4A's station address (no.1) and fuction code (04 reading 1 word)

2) D0011 : set GSL-DT4A's address

3) D0012 : data no. to read from Smart I/O

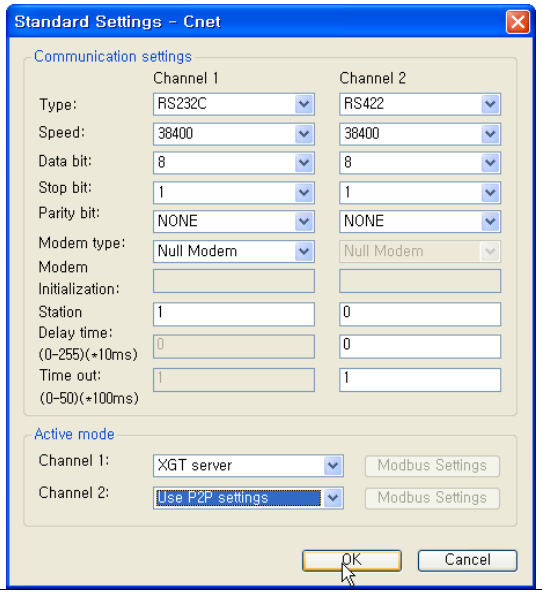
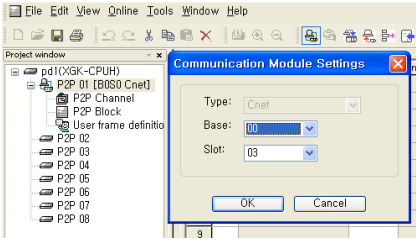
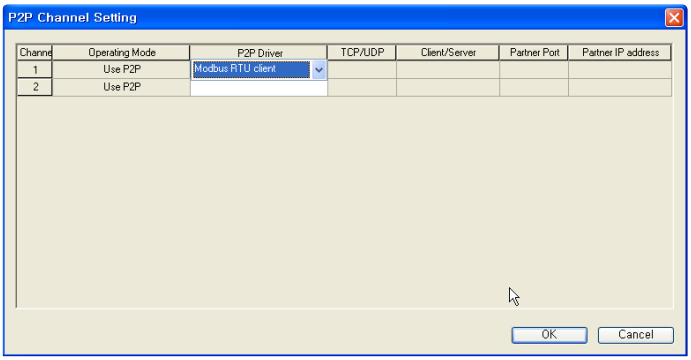
(Because functio code is 04, it reads 1 word)

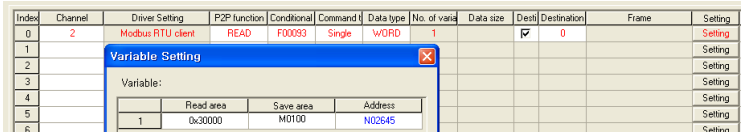
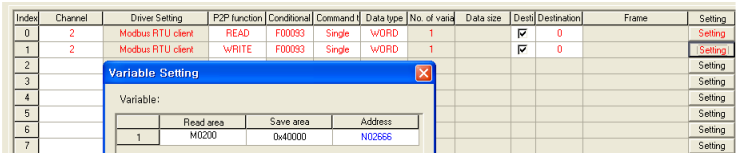
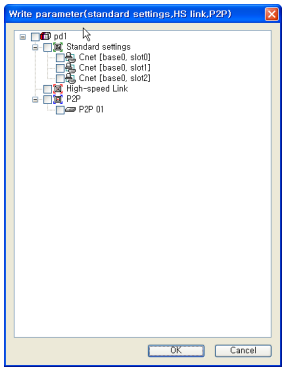
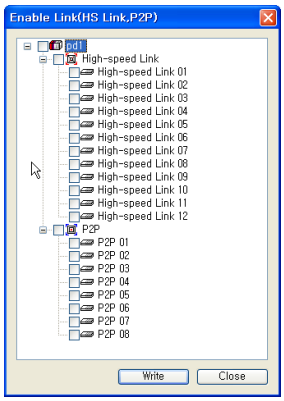
4) When every 1sec falling edge, at the 1 channel, it save data received from the input area of GSL-DT4A at the M110 and save it at the M001.



5.5.3 XGB Series

The following program read input 16 point of Smart I/O GSL-DT4A and save it at XGB M100, write M200's data at the Smart I/O's output (16 point) with setting XGB *Cnet I/F module as client.

Sequence	Setting process	Setting method
1	Basic setting	
1. Setting channel 2. 2. Setting run mode of channel as "use P2P".		
2	P2P setting	
1. Double-click the P2P in the project window and select module location.		
3	P2P Channel Setting	
1. Setting P2P driver as modbus RTU client.		

Sequence	Setting process	Setting method
4	P2P Block setting	 
1. In case of GSL-DT4A, it consists of input 16 point and output 16 point. Therefore set READ and WRITE in the same station. 2. In the above setting, input area which is word type in the READ part is set to be in the M100 of PLC. 3. Smart I/O output area is set to send data in the M200 of PLC.		
5	Write Parameter	
6	Enable Link	

Chapter6 Ethernet Communication

6.1 Introduction

Ethernet is a ‘technical standard’ issued by IEEE, a world-wide entity.
Using CSMA/CD method, it can collect a large capacity of data in a high speed as well as build a network easily by controlling communication.

Smart I/O Enet module has the following characteristics;

- Support IEEE 802.3 Standard
- Support 10/100BASE-TX media
- Accessible to the system thorough public network
- Support Ethernet Electricity 2 Ports (RJ-45)
- Available to run separately from each other because 2-channel Ethernet MAC is mounted
- Support Auto-Negotiation / Auto-Crossover function
- Support topology: Bus, Star
- Support communication protocol: Modbus/TCP, EtherNet/IP

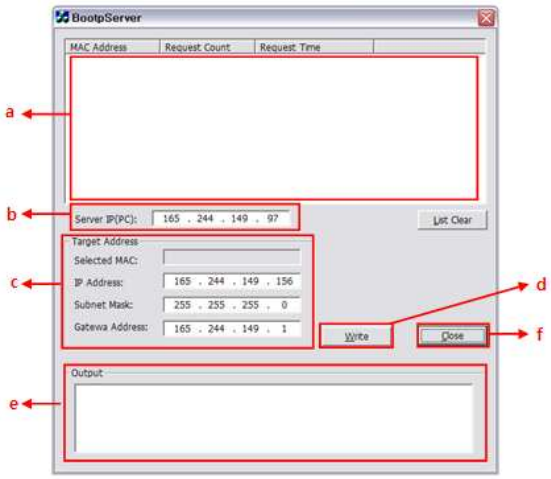
6.2 Communication Dimension

Item		Performance Dimension
Communication	Data Transmission Speed	10/100Mbps
	Transmission System	Base Band
	Standard	IEEE 802.3
	Flow Control	Full-duplex/half-duplex
	Modulation	NRZI
	Max length between nods	100m
	Max protocol size	1500byte
	Access to communication zone	CSMA/CD
	Check method for frame error	CRC32
	Connector	RJ-45 (2-port)
	IP Setting	S/W Setting
	Topology	Bus, Star
	communication protocol	Modbus/TCP, EtherNet/IP
	Max digital in/output score	256 scores
	Max number of extension digital modules to be connected to	8set
	Max number of extension analog modules to be connected to	8set
	Occupation Score of extension analog modules	8byte

6.3 Module Parameter Setting

6.3.1 BootpServer

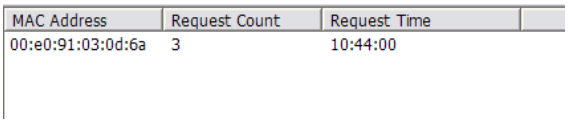
Smart I/O Enet module, as a slave module, needs to set up IP Address, Subnet Mask, and Gateway Address to communication with the master module. .
To set up parameters of Smart I/O Enet module, BootpServer program shall be used.



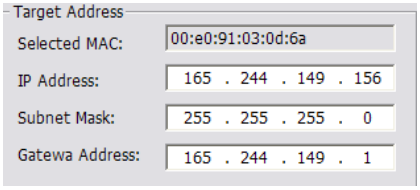
[Description of BootpServer Screen]
a: Bootp Module List Window – A list of Bootp service support devices connected to PC is displayed.
b: PC IP Address Window - IP Address of the user's PC is displayed.
c: Parameter Setting Window - Communication parameters of a target device are set up.
d: Write Button – Parameter Writing is executed.
e: Output Window – The results of parameter settings are displayed.
f: Close Button – The program is ended.

6.3.2 Parameter setting

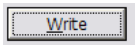
Confirm the power of Smart I/O Enet module and connect to the user's PC with Enet cable.



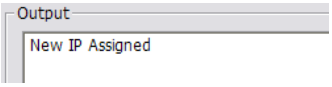
Check and select MAC Address of Smart I/O Enet module to be set up from the Bootp module list window.



Enter IP Address, Subnet Mask and Gateway Address setting values on the parameter setting window.



Press Write button to download parameter to Smart I/O Enet module.

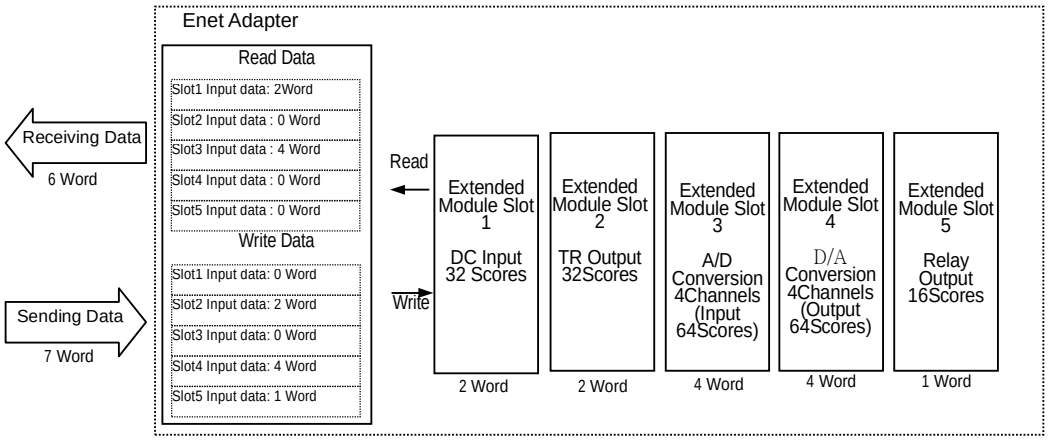


Check "New IP Assigned" message on the output window.

6.4 Modbus/TCP communication

6.4.1 I/O data assignment

(1) Input data and output data are separated.
(2) I/O Addresses are assigned automatically in order of being mounting to the adapter from Address 0 to 1, 2, 3 and etc.
(3) Example of data assignment

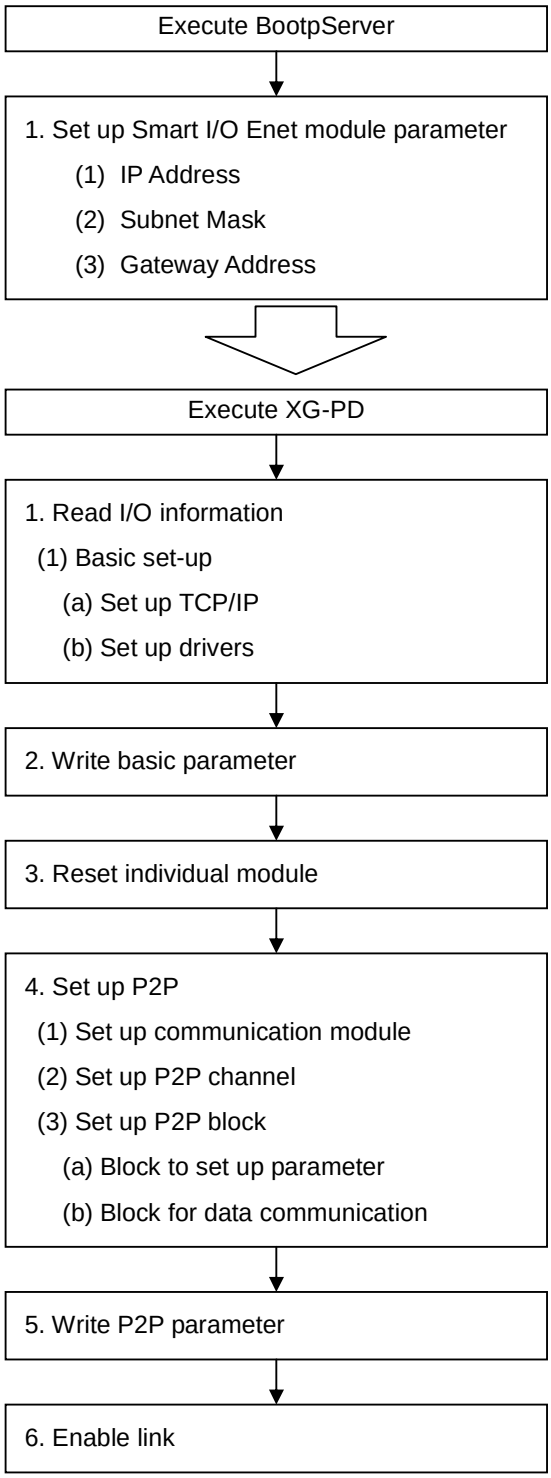


Receiving Data (Slave -> Master)					Sending Data (Master -> Slave)				
Address	Data Size		Extension Input Module		Address	data Size		Extension Output Module	
0	6Word	2Word	DC Input 32 scores		0	7Word	2Word	TR Output 32 scores	
1					1				
2		4Word	A/D Conversion 4CH	CH0	2		4Word	D/A Conversion 4CH	CH 0
3				CH 1	3				CH 1
4				CH 2	4				CH 2
5				CH 3	5				CH 3
					6		1Word	Relay Output 16 scores	

(4) How to set up extension module parameter
(a) The extension modules mounted on Smart I/O Enet module are assigned with Word Address of 2-Word parameter setting area, which starting from 0x100 without distinguishing input modules from output modules.
(When 8 modules are mounted, 0x100~0x10F is assigned)
(b) Parameter setting is available with Read/Write commands-Modbus Words.
(c) Set up parameter read/writ block on XG-PD
1) Read/Write Block setting is equal to data communication setting.
2) Only words are selectable for data type (Since parameters of a module shall be set up at the same time, parameter Read/Write consists of multiple numbers of data at least more than 2 words).
3) It impossible to Read or Write both data and parameter on the same block.
4) For parameter setting values of extension modules, refer to Appendix A.6.1.

10.4.2 Communication Setting

To communication with Smart I/O Enet module, first, download basic parameter of Smart I/O Enet module, then set up the Master module's communication parameter and P2P parameter.

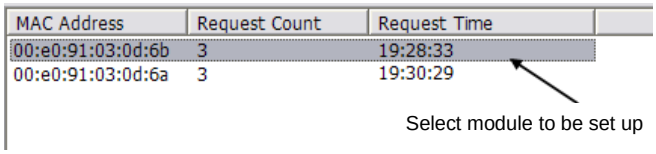
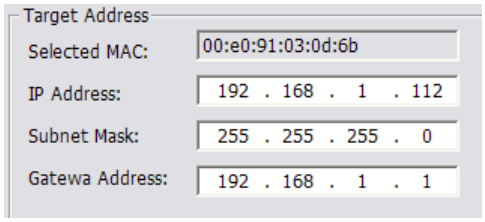
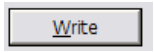
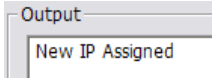


10.4.3 XGB Series communication

Ex) It has the following basic configuration and setting values:

Setting Item			Description		Setting program
Master	Master setting		XGL-EFMT		XG-PD
	Base Number		0		XG-PD
	Slot Number		0		XG-PD
	TCP/IP setting		IP Address	192.168.1.100	XG-PD
			Subnet Mask	255.255.255.0	
			Gateway Address	192.168.1.1	
	P2P Channel setting		Mode Bus TCP Client		XG-PD
	P2P Trigger		20ms clock		XG-PD
	P2P Way		Continual		XG-PD
	Data Type		Word		XG-PD
Slave	Block 1	module parameter setting	IP Address	192.168.1.111	BootpServer
			Subnet Mask	255.255.255.0	
			Gateway Address	192.168.1.1	
		Reading Block	Device	D00000	XG-PD
			Size	18	
		Saving Block	Device	D00100	XG-PD
			Size	10	
		Parameter Setting Block	Device	D00500	XG-PD
			Size	16	
	Block 2	Module Parameter Setting	IP Address	192.168.1.112	BootpServer
			Subnet Mask	255.255.255.0	
			Gateway Address	192.168.1.1	
		Reading Block	Device	D00200	XG-PD
			Size	8	
		Saving Block	Device	D00300	XG-PD
			Size	8	
		Parameter Setting Block	Device	D00600	XG-PD
			Size	16	

[BootpServer – Step1] Smart I/O Enet module parameter setting

Step	Item	Screen Configuration and Setting
1-1	Run BootpServer	Check Bootp module list 
1-2	Input parameter setting value	
1-3	Download parameter	 Select Write button
1-4	Confirm completion of parameter setting	 Check output window
1-5	Set up extension block 2 module	Repeat 1-1 ~ 1-4

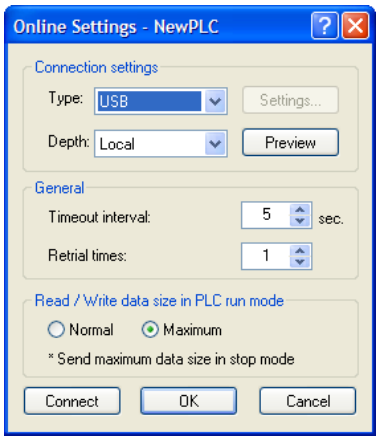
[XG-PD - Step1] Program Creation

Menu Selection: File – New File

Step	Item	Screen Configuration and Setting
1-1	Set up program name	Project name: adapter
1-2	Specify file location	File directory: C:\XG5000\source\adapter
1-3	Select PLC Series	PLC Series XGK XGB XGI XGR Select XGK
1-4	Select CPU Kind	CPU type: XGK-CPUH Select XGK-CPUH
1-5	Complete program creation	OK Select OK button

[XG-PD - Step2] Communication Method Setting

Menu Selection: Online – Connection Setting

Step	Item	Screen Configuration and Setting
2-1	Set up communication method	 Connection Method: USB Connection Step: Local

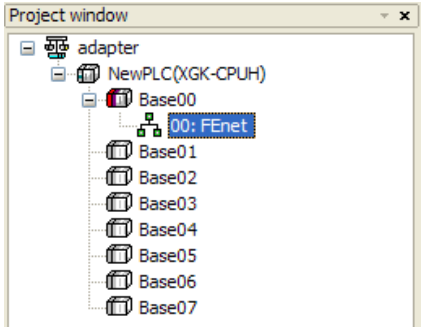
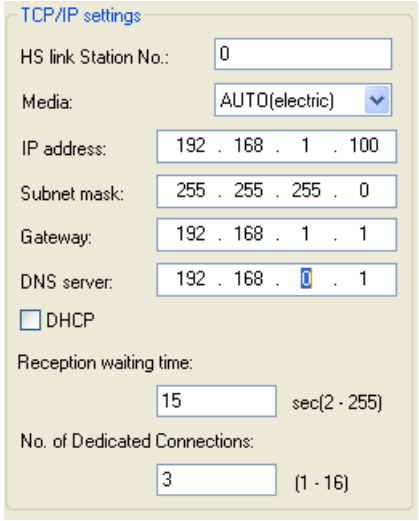
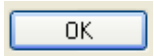
[XG-PD - Step 3] Connection

Menu Selection: Online – Connection

[XG-PD - Step 4] I/O Information Reading

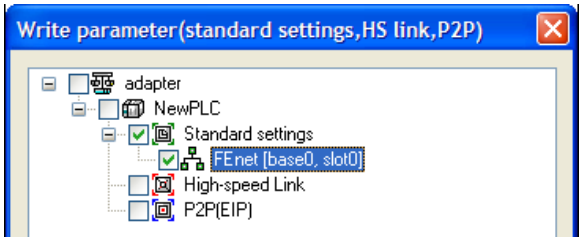
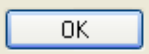
Menu Selection: Online – I/O Information Reading

[XG-PD - Step 5] Master module TCP/IP setting

Step	Item	Screen Configuration and Setting
5-1	Set up Master module	 Select Master module from basic setting tap and double click.
5-2	Set up TCP/IP	 IP Address: 192.168.1.100 Subnet Mask: 255.255.255.0 Gateway: 192.168.1.1 DNS Server, Waiting Time, Exclusive Connection Count: Setting suitable for user's environment
5-3	Set up	 Select OK button

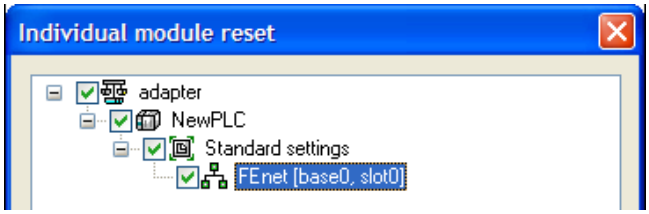
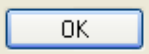
[XG-PD - Step 6] Basic setting parameter writing

Menu Selection: Online – Parameter Writing

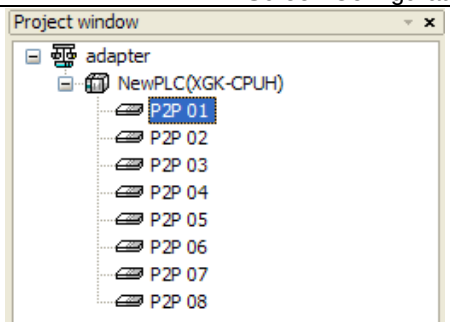
Step	Item	Screen Configuration and Setting
6-1	Select parameter writing	 Select Master module
6-2	Download parameter	 Select OK button

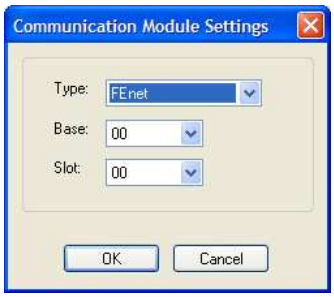
[XG-PD - 7] Individual module reset

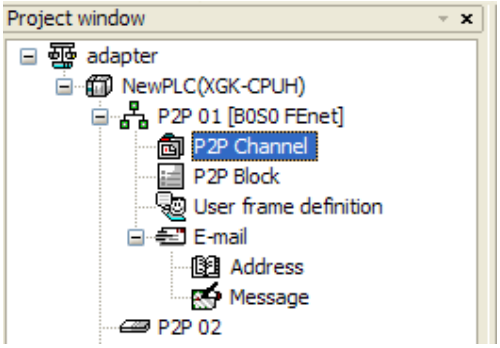
Menu Selection: Online – Reset –Individual Module Reset

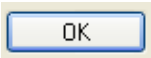
Step	Item	Screen Configuration and Setting
7-1	Select module	 Select Master module
7-2	Reset module	 Select OK button

[XG-PD - Step 8] P2P communication setting

<table>
<tr><th>Step</th><th>Item</th><th>Screen Configuration and Setting</th></tr>
<tr><td>8-1</td><td>Register P2P</td><td> 

After selecting P2P NO.1 on P2P tap, double click it</td></tr>
<tr><td>8-2</td><td>Set up P2P communication module</td><td> 

Kind: FEnet
Base: 0
Slot: 0</td></tr>
<tr><td rowspan="3">8-3</td><td rowspan="3">Register P2P Channel</td><td> 

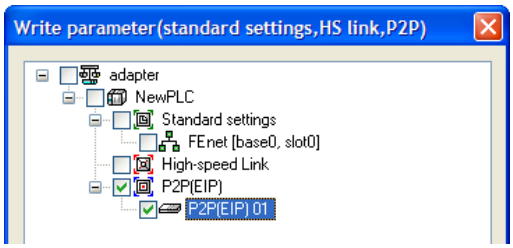
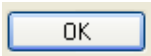
After selecting P2P Channel, double click it</td></tr>
<tr><td>
<table>
<tr><th>Channe</th><th>Operating Mode</th><th>P2P Driver</th><th>TCP/UDP</th><th>Client/Server</th><th>Partner Port</th><th>Partner IP address</th></tr>
<tr><td>0</td><td>XGT server</td><td>Modbus TCP client</td><td>TCP</td><td>Client</td><td>502</td><td>192.168.1.111</td></tr>
<tr><td>1</td><td>XGT server</td><td>Modbus TCP client</td><td>TCP</td><td>Client</td><td>502</td><td>192.168.1.112</td></tr>
</table>
Register P2P Channel
Channel0: Mode Bus TCP Client, Partner’s National IP (Extension stage1)
Channel0: Mode Bus TCP Client, Partner’s National IP (Extension stage2)</td></tr>
<tr><td> 

Select OK button</td></tr>
</table>

<table>
<tr><th>Step</th><th>Item</th><th>Screen Configuration and Setting</th></tr>
<tr><td>8-4</td><td>Set up P2P Block (Extension Module Parameter Setting Block)</td><td>
Parameter Setting Block
<table>
<tr><th>Index</th><th>E-mail</th><th>Ch.</th><th>Driver Setting</th><th>P2P function</th><th>Conditional flag</th><th>Command type</th><th>Data type</th><th>No. of variables</th><th>Data size</th></tr>
<tr><td>0</td><td>☐</td><td>0</td><td>Modbus TCP client</td><td>WRITE</td><td>M00000</td><td>Continuous</td><td>WORD</td><td>1</td><td>16</td></tr>
<tr><td>1</td><td>☐</td><td>1</td><td>Modbus TCP client</td><td>WRITE</td><td>M00001</td><td>Continuous</td><td>WORD</td><td>1</td><td>16</td></tr>
</table>
Extension stage 1 parameter
- Writing Trigger: M00000
- data Size: 16Word
- Set up Writing Block
<table>
<tr><th>Read area</th><th>Save area</th><th>Address</th></tr>
<tr><td>D00500</td><td>0x40000</td><td>N00001</td></tr>
</table>
Extension stage 2 parameter writing trigger M00001
- Writing Trigger : M00001
- Data Size: 16Word
- Set up Writing Block
<table>
<tr><th>Read area</th><th>Save area</th><th>Address</th></tr>
<tr><td>D00600</td><td>0x40000</td><td>N00042</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">8-5</td><td rowspan="2">Set up P2P Block (Data Communication Block)</td><td>
Extension stage 1 communication setting
<table>
<tr><td>0</td><td>Modbus TCP client</td><td>WRITE</td><td>F00090</td><td>Continuous</td><td>WORD</td><td>1</td><td>10</td></tr>
<tr><td>0</td><td>Modbus TCP client</td><td>READ</td><td>F00090</td><td>Continuous</td><td>WORD</td><td>1</td><td>18</td></tr>
</table>
Set up Writing Block
<table>
<tr><th>Read area</th><th>Save area</th><th>Address</th></tr>
<tr><td>D00000</td><td>0x40000</td><td>N00083</td></tr>
</table>
Set up Reading Block
<table>
<tr><th>Read area</th><th>Save area</th><th>Address</th></tr>
<tr><td>0x30000</td><td>D00100</td><td>N00144</td></tr>
</table>
</td></tr>
<tr><td>
Extension stage 1 communication setting
<table>
<tr><td>0</td><td>Modbus TCP client</td><td>WRITE</td><td>F00090</td><td>Continuous</td><td>WORD</td><td>1</td><td>8</td></tr>
<tr><td>0</td><td>Modbus TCP client</td><td>READ</td><td>F00090</td><td>Continuous</td><td>WORD</td><td>1</td><td>8</td></tr>
</table>
Set up Writing Block
<table>
<tr><th></th><th>Read area</th><th>Save area</th><th>Address</th></tr>
<tr><td>1</td><td>D00200</td><td>0x40000</td><td>N00083</td></tr>
</table>
Set up Reading Block
<table>
<tr><th></th><th>Read area</th><th>Save area</th><th>Address</th></tr>
<tr><td>1</td><td>0x30000</td><td>D00300</td><td>N00144</td></tr>
</table>
</td></tr>
</table>

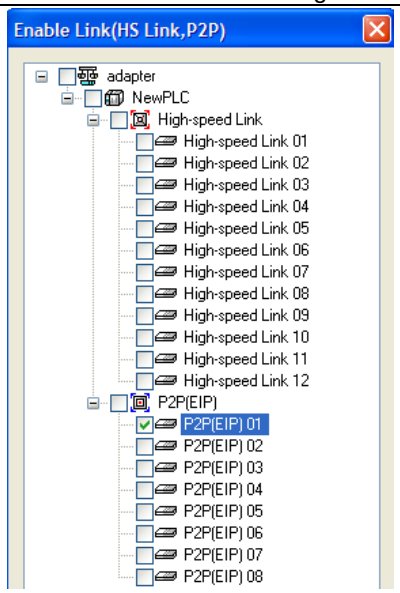
[XG-PD - 9Step] P2P setting writing

Menu Selection: Online – Parameter Writing

Step	Item	Screen Configuration and Setting
9-1	Select parameter writing	 SELECT P2P NO.1
9-2	Download P2P setting	 Select OK button

[XG-PD - Step 10] Link Enable

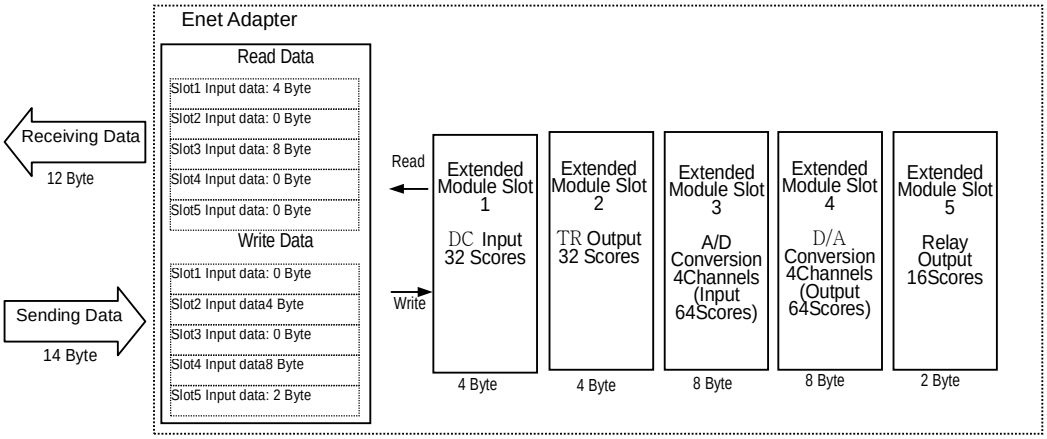
Menu Selection: Online – Link Enable

Step	Item	Screen Configuration and Setting
10-1	Set up Link Enable	 SELECT P2P NO.1
10-2	Set up Link Enable	Select Write button

6.5 EtherNet/IP communication

6.5.1 I/O data assignment

(1) Input data and output data are separated.
(2) I/O Addresses are assigned automatically in order of being mounting to the adapter.
(3) Example of data assignment



(4) How to set up I/O module

(a) In case there are Input and Output module,

Item	Description	Vale
Transport Type	Originator → Target	Point To Point
	Target → Originator	Multicast
Connection Point (Assembly Instance)	Originator → Target	170(Decimal)
	Target → Originator	160(Decimal)
data Size(Byte)	Originator → Target	Adapter Output Size(Byte)
	Target → Originator	Adapter Input Size(Byte)

(b) In case there is input module only,

Item	Description	Vale
Transport Type	Originator → Target	Point To Point
	Target → Originator	Multicast
Connection Point (Assembly Instance)	Originator → Target	128(Decimal)
	Target → Originator	160(Decimal)
data Size(Byte)	Originator → Target	-
	Target → Originator	Adapter Input Size(Byte)

(c) In case there is output module only,

Item	Description	Vale
Transport Type	Originator → Target	Point To Point
	Target → Originator	Multicast
Connection Point (Assembly Instance)	Originator → Target	170(Decimal)
	Target → Originator	160(Decimal)
data Size(Byte)	Originator → Target	Adapter Output Size(Byte)
	Target → Originator	1Byte

(5) How to set up extension module parameter

(a) Extension module parameters of XEL-BSSB module are set up with Assembly Object through UCMM Message.

(b) Parameter setting Assembly Object of XEL-BSSB module has Instance ID 180 (0xB4).

(c) Parameter size of extension modules is 4 bytes per module.

(d) Data size of parameter setting Assembly Object Instance is equal to the sum of parameter setting blocks of the extension module mounted on XEL-BSSB module.

(e) New parameter can be applied only to XEL-BSSB module whose parameter values are changed when setting up parameter writing with UCMM Message.

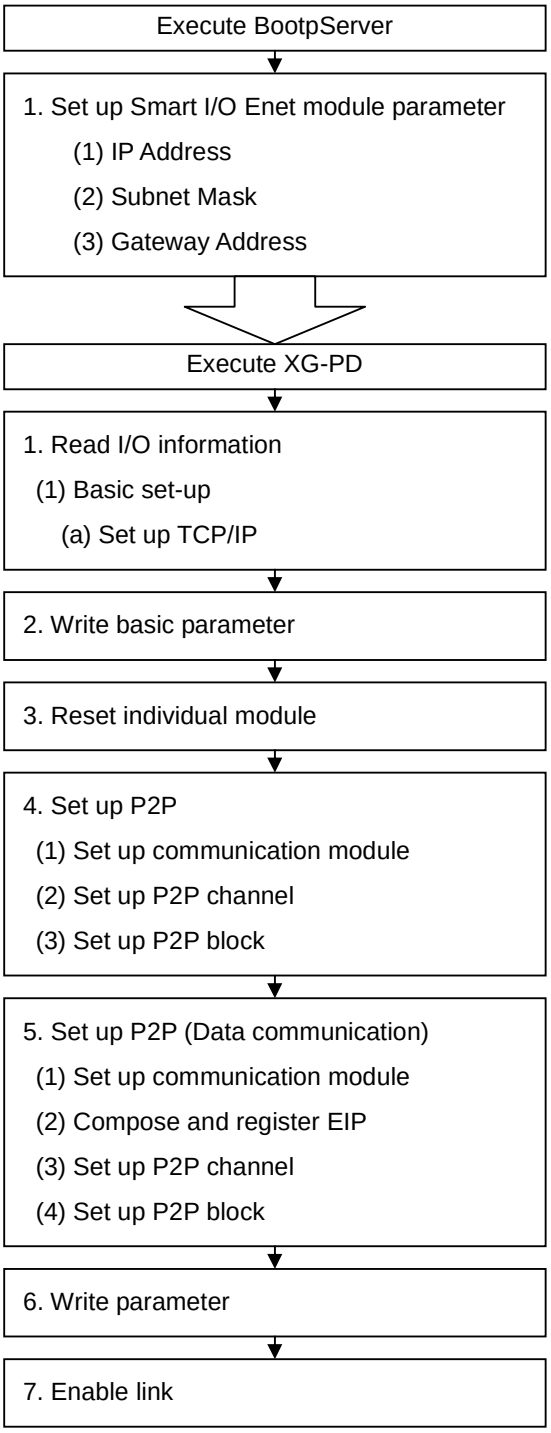
(f) For parameter setting values of extension modules, refer to Appendix A.7.1.

※ Example of UCMM Message

Service Code : 16 (0x10 : Set)
Class : 04 (0x04 : Assembly Class)
Instance : 180 (0xB4 : parameter setting Assembly Object)
Attribute : 03 (0x03 : Data)
Data : XX XX XX XX XX XX XX XX XX XX XX XX (parameter setting value)

6.5.2 Communication Setting

To communication with Smart I/O Enet module, first, download basic parameter of Smart I/O Enet module, then set up Master module의 communication parameter and P2P parameter of the master module.



6.5.3 XGB Series Communication

Ex) It has the following basic configuration and setting values:

Setting Item			Description		setting program
Master	Master setting		XGL-EIMT		XG-PD
	Base Number		0		XG-PD
	Slot Number		0		XG-PD
	Set up TCP/IP		IP Address	192.168.1.100	XG-PD
			Subnet Mask	255.255.255.0	
			Gateway Address	192.168.1.1	
	Non-periodic communication (Extension module parameter setting)		Device	D00200	XG-PD
			Size	32	
	Periodic communication	EDS Channel setting	Generic EtherNet/IP Module		XG-PD
		I/O Type	Exclusive Owner (8bit instance)		XG-PD
		Connection Type	Multicast		XG-PD
		Parameter	T2O Data Size	36	XG-PD
			O2T Data Size	20	
			Config Instance	2	
			Output Connection Point(8bit)	170	
			Input Connection Point(8bit)	160	
		Transmission Cycle	20ms		
		Time Out	RPI ╳ 16		
Slave	Set up module parameter		IP Address	192.168.1.101	BootpServer
			Subnet Mask	255.255.255.0	
			Gateway Address	192.168.1.1	
	Receiving data (Slave -> Master)		Device	D00100	XG-PD
			Size	36	
	Sending data (Master -> Slave)		Device	D00000	XG-PD
			Size	20	

[BootpServer – Step1] Smart I/O Enet module parameter setting

Step	Item	Screen Configuration and Setting
1-1	Execute BootpServer	Check Bootp module list MAC Address | Request Count | Request Time 00:e0:91:03:4c:02 | 5 | 10:28:29 Select module to be set up
1-2	Input parameter setting value.	Target Address Selected MAC: 00:e0:91:03:4c:02 IP Address: 192 . 168 . 1 . 101 Subnet Mask: 255 . 255 . 255 . 0 Gatewa Address: 192 . 168 . 1 . 1
1-3	Down load parameter	Write Select Write button
1-4	Confirm completion of parameter setting	Output New IP Assigned Check output window

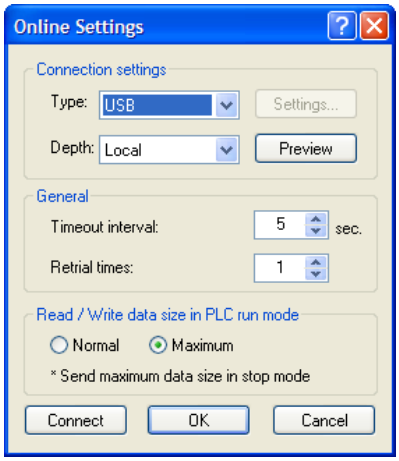
[XG-PD - Step1] Program Creation

Menu Selection: File – New File

Step	Item	Screen Configuration and Setting
1-1	Set up program name	Project name: Enet Adapter
1-2	Specify file location	File location: C:\XG5000\Enet Adapter
1-3	Select PLC Series	PLC Series XGK XGB XGI XGR Select XGK
1-4	Select CPU Kind	CPU kind: XGK-CPUH Select XGK-CPUH
1-5	Complete program creation	OK Select OK button

[XG-PD - Step2]] Communication Method Setting

Menu Selection: Online – Connection Setting

Step	Item	Screen Configuration and Setting
2-1	Set up communication method	 Connection Method: USB Connection Step: Local

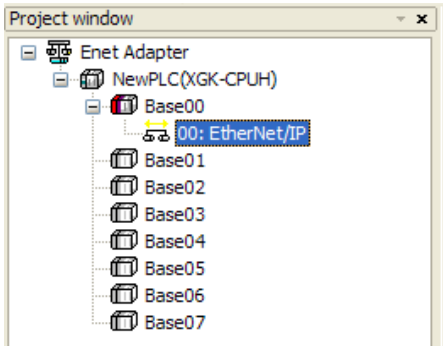
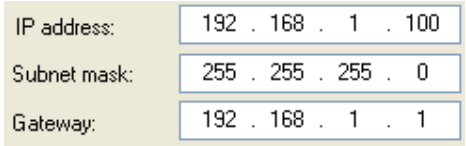
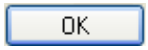
[XG-PD - Step 3] Connection

Menu Selection: Online – Connection

[XG-PD - Step 4] I/O Information Reading

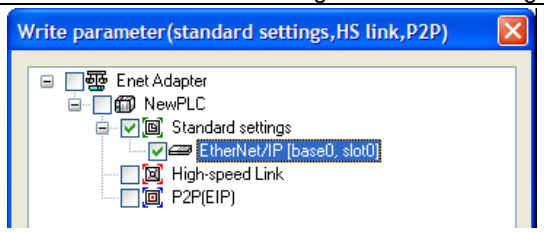
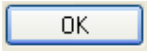
Menu Selection: Online – I/O Information Reading

[XG-PD - Step 5] Master module TCP/IP setting

Step	Item	Screen Configuration and Setting
5-1	Set up Master module	 Select Master module from basic setting tap and double click.
5-2	Set up TCP/IP	 IP Address: 192.168.1.100 Subnet Mask: 255.255.255.0 Gateway: 192.168.1.1 DNS Server: Setting suitable for user's environment
5-3	Set up	 Select OK button

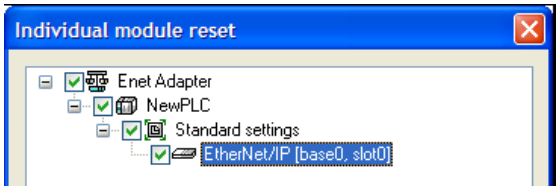
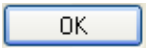
[XG-PD - Step 6] Basic setting parameter writing

Menu Selection: Online – Parameter Writing

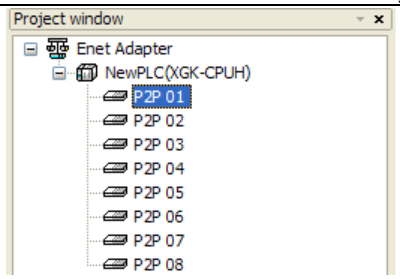
Step	Item	Screen Configuration and Setting
6-1	Select parameter writing	 Select Master module
6-2	Download parameter	 Select OK button

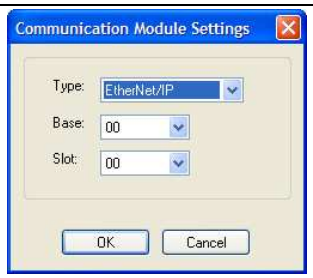
[XG-PD - Step 7] Individual module reset

Menu Selection: Online – Reset –Individual Module Reset

Step	Item	Screen Configuration and Setting
7-1	Select module	 Select Master module
7-2	Reset module	 Select OK button

[XG-PD - Step 8] P2P communication setting (Explicit communication)

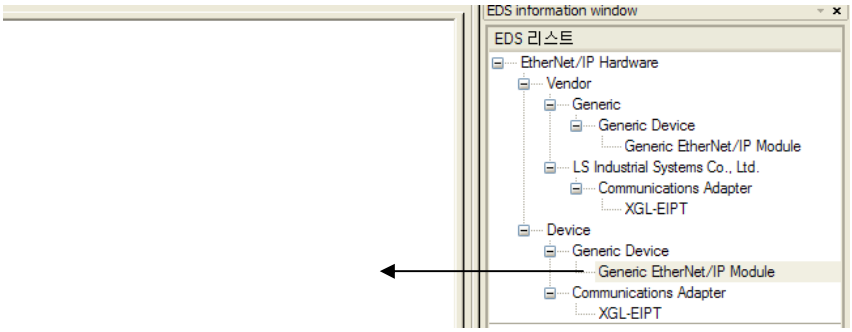
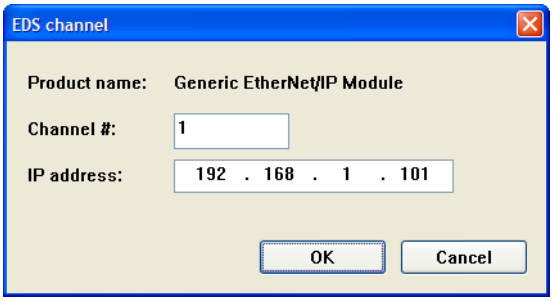
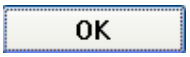
<table>
<tr><th>Step</th><th>Item</th><th>Screen Configuration and Setting</th></tr>
<tr><td>8-1</td><td>Register P2P</td><td> 

After selecting P2P NO.1 on P2P tap, double click it</td></tr>
<tr><td>8-2</td><td>Set up P2P communication module</td><td> 

Kind: EtherNet/IP
Base: 0
Slot: 0</td></tr>
<tr><td rowspan="3">8-3</td><td rowspan="3">Set up EIP Channel</td><td>
<table>
<tr><th>Channel</th><th>Operating Mode</th><th>Partner Port</th><th>Partner IP address</th></tr>
<tr><td>0</td><td>Explicit Client</td><td>44818</td><td>192.168.1.101</td></tr>
</table>
Register Explicit communication channel
Partner’s National IP: Register adapter module’s IP address</td></tr>
<tr><td>
<table>
<tr><th>Ch.</th><th>Operating Mode</th><th>I/O type</th><th>Connection type</th><th>Function</th></tr>
<tr><td>0</td><td>Explicit Client</td><td></td><td></td><td>Generic WRITE</td></tr>
</table>
Function: Generic WRITE</td></tr>
<tr><td>
<table>
<tr><th>Parameter items</th><th>Contents</th></tr>
<tr><td>Service Code(Hex)</td><td>10</td></tr>
<tr><td>Class(Hex)</td><td>4</td></tr>
<tr><td>Instance</td><td>180</td></tr>
<tr><td>Attribute(Hex)</td><td>3</td></tr>
</table>
Parameter setting (UCMM setting)</td></tr>
</table>

<table>
<tr><th>Step</th><th>Item</th><th>Screen Configuration and Setting</th></tr>
<tr><td rowspan="2">8-3</td><td rowspan="2">Set up EIP Channel</td><td>
<table>
<tr><th>Conditional flag</th></tr>
<tr><td>M00000</td></tr>
</table>
Trigger for writing parameter: M00000
</td></tr>
<tr><td>
<table>
<tr><th rowspan="2">Data type</th><th colspan="3">tag settings</th></tr>
<tr><th>Local tag</th><th>Remote tag</th><th>Size</th></tr>
<tr><td>1 BYTE</td><td>D00200</td><td></td><td>32</td></tr>
</table>
Data Type: 1BYTE
Local Tag: D00200
Size: 32 (byte)
</td></tr>
</table>

[XG-PD - Step 9] P2P communication setting (Implicit communication)

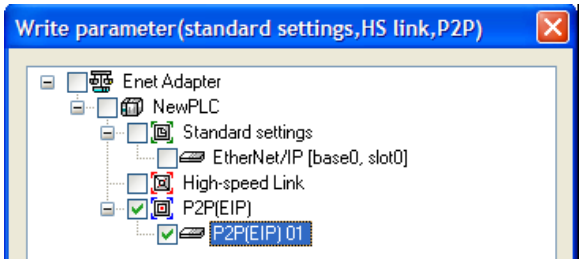
Step	Item	Screen Configuration and Setting
9-1	Register P2P	Refer to 8-1
9-2	Set up P2P communication module	Refer to 8-2
9-3	Set up EIP configuration	 Drag Generic EtherNet/IP Module EDS to EIP configuration window
		 Register channel number and adapter module's IP address
		 Select OK button
9-4	Set up P2P Channel	 Ensure that the channel number and partner nation's IP address are properly registered on EIP configuration window.

Channel	Operating Mode	Partner Port	Partner IP address
1	Implicit Client	2222	192.168.1.101

<table>
<tr><th>Step</th><th>Item</th><th>Screen Configuration and Setting</th></tr>
<tr><td rowspan="4">9-5</td><td rowspan="4">Set up P2P Block</td><td>
<table>
<tr><th>Ch.</th><th>Operating Mode</th><th>I/O type</th><th>Connection type</th></tr>
<tr><td>1</td><td>Implicit Client</td><td>2.Exclusive Owner(8bit instance)</td><td>Multicast</td></tr>
<tr><td></td><td>Implicit Client</td><td></td><td></td></tr>
</table>
After selecting communication channel, set up I/O type and connection type.
</td></tr>
<tr><td>
<table>
<tr><th>Parameter items</th><th>Contents</th></tr>
<tr><td>T2O Data Size</td><td>36</td></tr>
<tr><td>O2T Data Size</td><td>20</td></tr>
<tr><td>Config Instance</td><td>0</td></tr>
<tr><td>Output Assembly Instance(8bit)</td><td>170</td></tr>
<tr><td>Input Assembly Instance(8bit)</td><td>160</td></tr>
</table>
Set up I/O data size and connection points on the parameter setting window.
</td></tr>
<tr><td>
<table>
<tr><th>Transmission period(ms)</th><th>Time out</th></tr>
<tr><td>20</td><td>2. RPI x16</td></tr>
<tr><td>20</td><td></td></tr>
</table>
Set up data transmission cycle and time out.
</td></tr>
<tr><td>
<table>
<tr><th colspan="3">tag settings</th></tr>
<tr><th>Local tag</th><th>Remote tag</th><th>Size</th></tr>
<tr><td>D00100</td><td></td><td>36</td></tr>
<tr><td>D00000</td><td></td><td>20</td></tr>
</table>
Set up In/Output data local tag.
</td></tr>
</table>

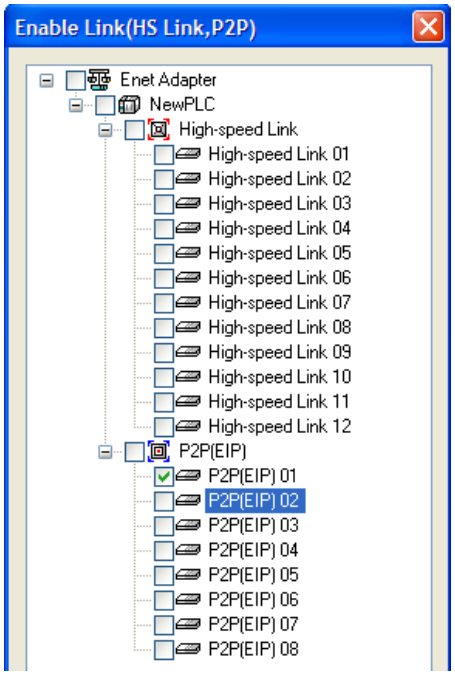
[XG-PD - Step 10]P2P setting writing

Menu Selection: Online – Parameter Writing

Step	Item	Screen Configuration and Setting
10-1	Select parameter writing	 SELECT P2P NO.1
10-2	Download P2P setting	OK Select OK button

[XG-PD - 1Step1] Link Enable

Menu Selection: Online – Link Enable

Step	Item	Screen Configuration and Setting
11-1	Set up Link Enable	 Select P2P No.1
11-2	Set up Link Enable	Write Select Write button

Installation and Wiring

7.1 Installation

7.1.1 Installation Environment

This machine has a high reliability regardless of the environment to install. But cares should be taken to secure the reliability and the safety as follows.

1) Environment Condition

(1) Install it to a water-proof and dust-proof control panel.
(2) Do not apply continuous impact or vibration.
(3) Do not expose it directly to direct rays.
(4) No dew by sudden change of temperature.
(5) Do not exceed surrounding temperature 0~55°C.
(6) Do not exceed relative humidity 5 ~ 95% .
(7) No corrosive gas or combustible gas.

2) Installation Construction

(1) When working the screw hole and the wiring, it is not allowed to put the wire remnants into the PLC.
(2) The installation location should be the place to operate.
(3) Do not install it on the same panel as the high voltage machine.
(4) The distance between wiring duct and the surrounding module should be at least 50mm apart.
(5) The grounding should be done on a good place free from noise.

3) Radiation Design of Control Panel

(1) When installing the PLC in the sealed control panel, the radiation design should be done considering the radiation of other machine as well as the radiation of PLC itself. When circulating the air using the vent or the general fan, it may effect the PLC system due to the inflow of gas or dust.
(2) It is recommended to install the filter or use the sealed type thermal exchanger.

11.1.2 Notices in installing Modbus module

Modbus Smart I/O can set max. 32 stations.

(1) The user must select the action mode for Cnet I/F module correctly and set the action mode accordingly. If setting the action mode wrong, it may cause communication error.
(2) For the channel using the exclusive communication mode, it is required to set the station no. In case of the system using the exclusive communication mode and communicating by RS-422/485, it is not allowed to have Modbus module of the same station no. in the same network. In case of RS-422 communication, if there is double station no., it may cause communication error.
(3) For communication cable, the designated standard cable should be used. If not, it may cause significant communication obstacle.
(4) Check if the communication cable is cut off or short-circuited before installation.
(5) Tighten the communication cable connector completely and fix the cable connection tightly. If cable connection is not complete, it may cause significant communication obstacle.
(6) RS-422/485 cable should connect the TX/RX correctly. When several stations are connected, the first 2 stations should be connected by TX and RX and other stations should be connected by TX to TX and RX to RX themselves. (RS-422 communication)
(7) In case of RS-485 communication, TX and RX of Cnet I/F module should be connected to each other.
(8) If the communication cable is twisted or the cable is not connected properly, it may cause communication error.
(9) In case of connecting the long distance communication cable, the wiring should be separated far from the power line or inductive noise and if necessary, it should be covered.
(10) If LED action is abnormal, check the trouble causes referring to this manual “Chapter 11. Trouble Shooting”. If the problem repeats after taking the action, contact Customer service center.

7.1.3 Notices in Handling

Here it describes notices in handling from the opening of each unit and module to the installation.

- Do not drop or apply the strong impact.
- Do not remove the PCB from the case. It may cause failure.
- Cares should be taken not to make foreign materials such as the wire remnants etc. enter the unit when wiring. If entered, remove them before applying power.

1) Notices in handling the product

Here it describes the notices in handling and installing the basic unit and the extended module.

(1) Recheck the I/O standard specification

Input part should pay attention to the input voltage and in case of output part, if applying the voltage exceeding max. capacity to Open/Close, it may cause failure, breakage and fire.

(2) Use Wire

The wire should be selected considering the ambient temperature, allowable current and the min. spec. of the wire should be more than AWG24(0.18mm^2).

(3) Environment

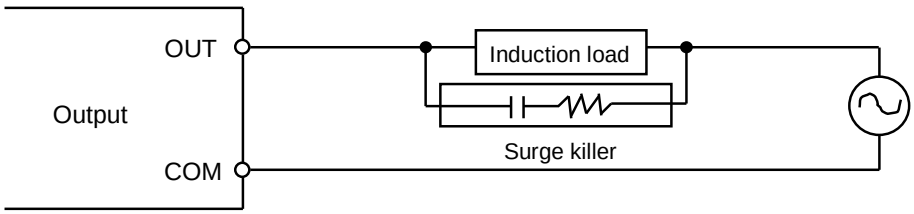
When I/O wiring, if it is close to heat generating machine or material or if the wiring is contacted directly to oil for long time, it may cause short-circuit, breakage and failure.

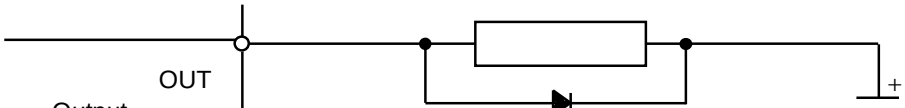
(4) Polarity

Check the polarity before applying power to the terminal block that has the polarity. Special cares should be taken not to wire AC input power to DC24V external power supply terminal on the edge of basic unit input part. In case of DeviceNet, 24V power enters into the communication cable together and it is not necessary to wire separately.

(5) Wiring

- When wiring the I/O line with high voltage cable and the power cable together, induction obstacle occurs which may cause the failure and malfunction.
- It is not allowed to pass the cable in front of I/O action indication part (LED). (because it prevents from distinguishing the I/O indication.)
- In case the inductive load is connected to the output part, please connect the surge killer or diode to the load in parallel. Connect the cathode of diode to the '+' side of the power.





Induction load

(6) Terminal block
When wiring terminal block or making screw hole, cares should be taken not to make the wire remnants enter the PLC. It may cause malfunction and failure.

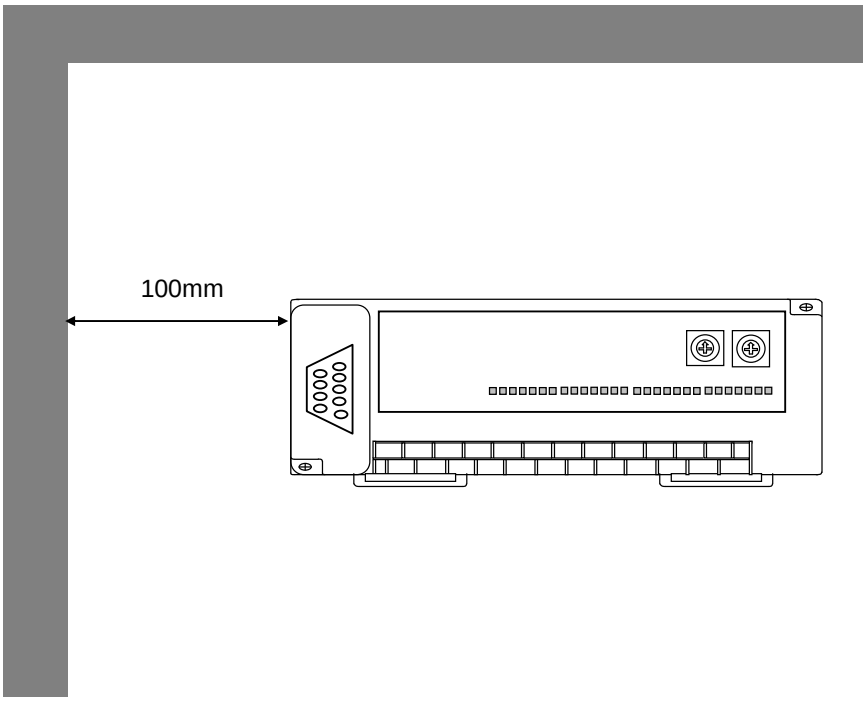
(7) Except for the mentioned above, do not apply strong impact to the basic or extended unit or remove the PCB from the case.

2) Notices in installation

Here it describes the notices in attaching the PLC to the control panel.

(1) Sufficient distance is required to have well-ventilated room and facilitate the exchange of the basic unit and the extended module. Especially, for the periodical exchange of battery (3 years), please separate the left side of the basic unit and the control panel for at least 100mm.

(2) For the max. radiation effect, it is required to install it as shown on the figure below.



(3) Use different panel for large sized electronic contactor or vibration source such as no-fuse breaker etc. and install separately.

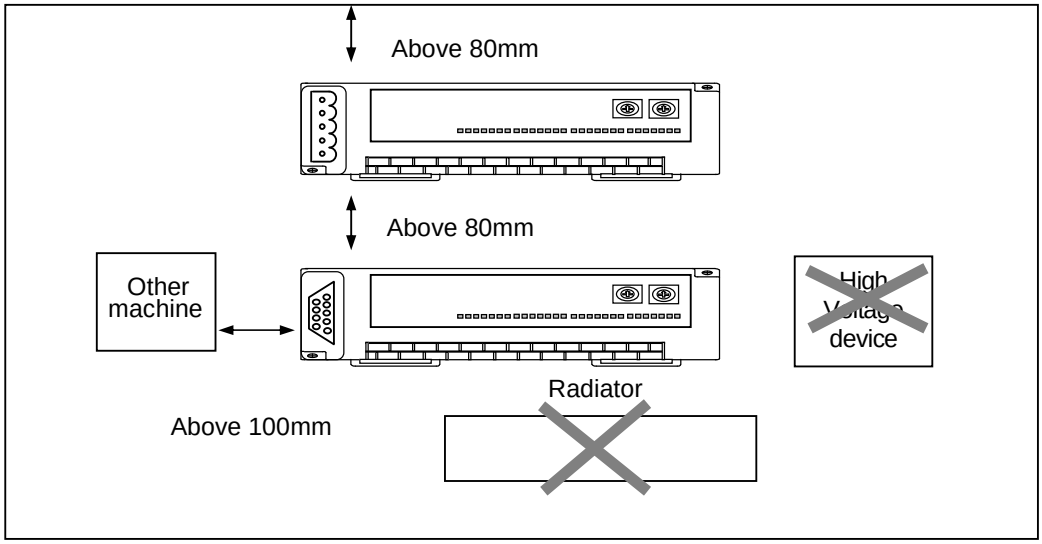
(4) Install the duct for wiring if necessary.

But, if the dimension of upper part or lower part of PLC is smaller than the figure below, please pay attention to the following.

- In case of installing on the upper PLC, the height of wiring duct should be less than 50mm for good ventilation.
- In case of installing on the lower PLC, please consider minimum radius of the cable.

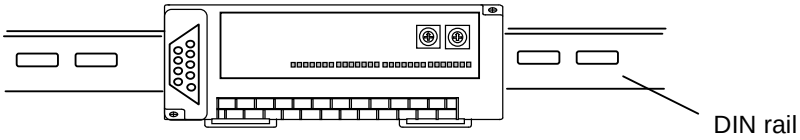
(5) In case the equipment is installed in front of the PLC (inside the door) to avoid the effect of radiant noise or the heat, it is required to separate it more than 100mm and be install.

And the left/right direction of the unit and the equipment should be separated more than 100mm and installed.



PLC Attaching

(6) As Smart I/O is installed with Hook for DIN rail (rail width 35mm), it is available to attach the DIN rail.

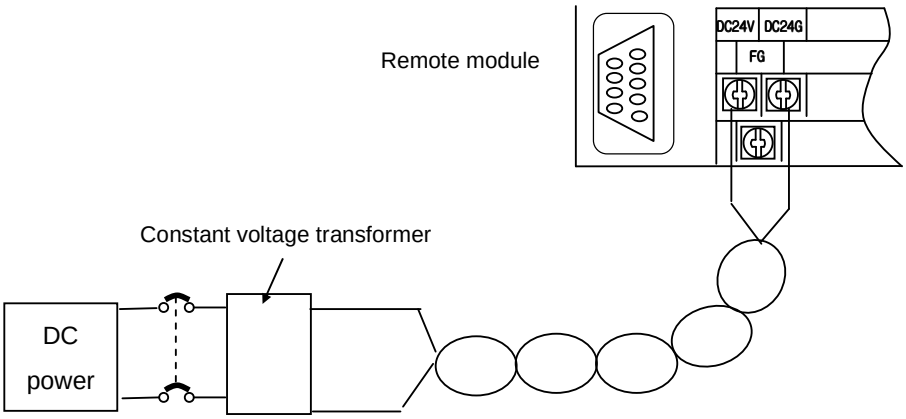


7.2 Wiring

Here it describes the notices related to the wiring in case of using the system..

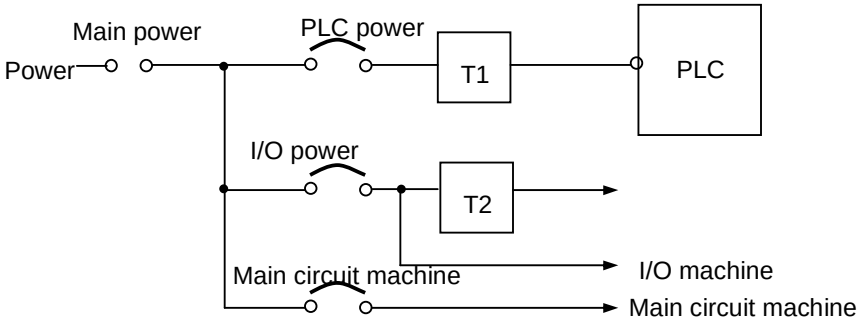
11.2.1 Power Wiring

1) For power, please use DC 24V power supply.
2) If the power variation is larger than the regular range, please connect a constant voltage transformer.
3) In order to prevent the noise from the power cable, it is required to twist the power cable densely if possible, and connect within the shortest distance.



4) Connect power of which the noise between lines or between grounds is small.
(if there is much noise, please connect the insulation transformer.)

5) For PLC power, I/O machine and power machine, it is required to divide the system as follows.

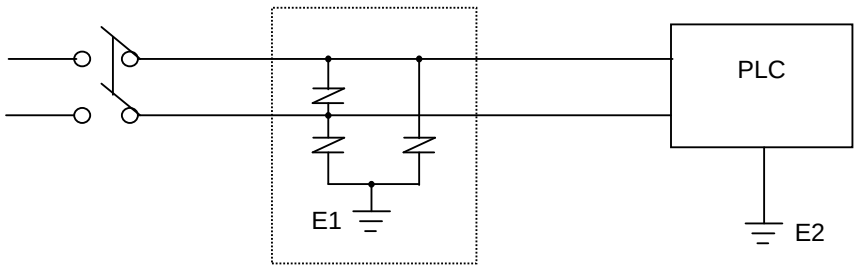


※ T1,T2: Constant voltage transformer

6) For the power cable, it is required to use a thick one ($2mm^2$) to make the small falling down of the voltage.

7) The power DC24V cable is not allowed to approach closely to the main circuit (high voltage, convection current) cable, I/O signal cable and needs to separate more than 80mm apart.

8) Please use the surge absorber to prevent the lightning as shown on the below.



Surge absorber for lightning

Remark

1) Separate the earth (E1) of the surge absorber for lightning and the earth (E2) of PLC.
2) Select the surge absorber for lightning so that it does not exceed max. allowable voltage of the absorber even when the power voltage is rising maximum.

9) When you are afraid of the invasion of the noise, please use the insulation sealed transformer or the noise filter.

10) In case of the wiring of each input resource, the wiring of the sealed transformer or the wiring of the noise filter is not allowed to pass the duct.

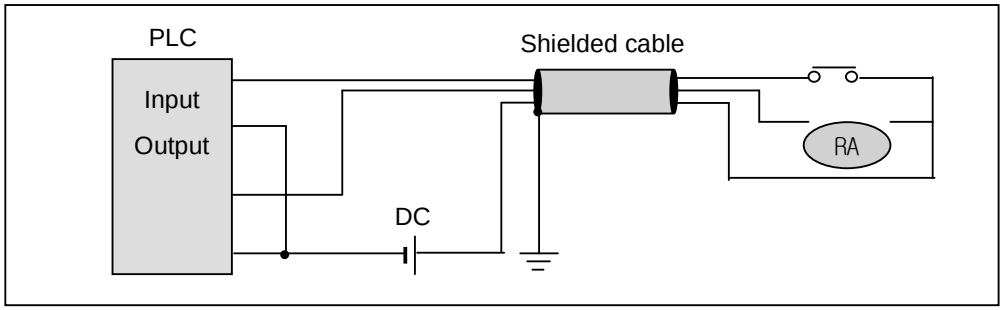
7.2.2 I/O Device Wiring

1) The spec. of I/O wiring cable is 0.18~2 mm^2 and it is recommended to use the cable spec. (0.5mm^2) conveniently.

2) Input cable and output cable should be separated for wiring.

3) I/O signal cable should be separated at least 80mm from main circuit cable of high voltage, high current when wiring.

4) In case it is not available to separate the main circuit cable and the power cable, please use the shielded cable and earth the PLC.



5) In case of pipe wiring, make sure of the pipe and then ground it.

6) DC24V output cable should be separated from AC110V cable and AC220V cable.

7) In case of wiring the long distance more than 200m, the error occurs according to the leakage current caused by the interline capacity.

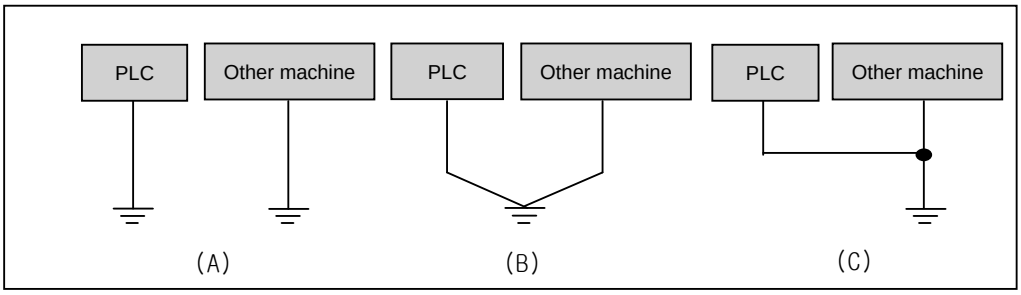
7.2.3 Grounding Wiring

1) As this PLC carries out sufficient noise policy, it is available to use without grounding except the case where there is much noise. But, when grounding, please refer to the following notices.

2) When grounding, please use the exclusive grounding if possible.

For he grounding construction, please use the 3rd class grounding (grounding resistance less than 80 Ω).

3) If not available to use the exclusive grounding, please use the common grounding as shown on the figure (B).



(A) exclusive grounding: Excellent (B) common grounding: Good

(C) common grounding : Bad

4) Please use the electric wire for grounding more than 2 mm^2. Place the grounding point near this PLC if possible and shorten the length of the grounding cable.

- When connecting the extended base, please connect the extended connector accurately.
- Do not remove the PCB from the module case and modify the module.
- When attaching/removing the module, the power should be OFF.
- Use the cellular phone or radio phone apart more than 30mm from the product.
- I/O signal cable and communication cable should be at least 10cm apart from the high voltage cable or the power cable to avoid the effect caused by the noise or the change of magnetic filed.

11.2.4 Cable Specification for Wiring

The Cable specification to be used for the wiring is as follows.

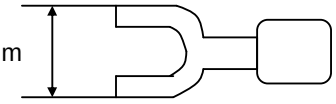
External connection type	Cable spec.(mm^2)	
	Low limit	High limit
Digital input	0.18 (AWG24)	1.5 (AWG16)
Digital output	0.18 (AWG24)	2.0 (AWG14)
Analog I/O	0.18 (AWG24)	1.5 (AWG16)
Communication	0.18 (AWG24)	1.5 (AWG16)
Main power resource	1.5 (AWG16)	2.5 (AWG12)
Protection grounding	1.5 (AWG16)	2.5 (AWG12)

For the power and I/O wiring for Smart I/O, it is required to use the compressed terminal.

- Use ‘M3’ type screw for the terminal.
- Tighten the terminal screw with 6 ~ 9 kg · cm torque.
- Use the fork type screw for the compressed terminal.

Example of the proper compressed terminal (fork type)

Less than 6.2mm



Chapter 8 Maintenance and Repair

To maintain the PLC in optimal status, please carry out daily check and regular check.

8.1 Repair and Check

I/O module is usually composed of semiconductor microelectronic device and the life is semi-permanent. As the microelectronic device may occur the error caused by the ambient environment, it is required to check it periodically. The following are items to be checked 1~2 times every 6 months.

Check items		Judgment basis	Action
Ambient environ-ment	Temperature	0 ~ +55°C	Control the use temperature and the use humidity.
	Humidity	5 ~ 95%RH	
	Vibration	No vibration	Use the dust-proof rubber or take the vibration protection policy.
Shaking of each unit and module		No shake	Make all unit and module not to be shaker
Terminal screw loosened.		No loosening	Tighten the loosened screw.
Input voltage change rate		Within –15%/+10%	Maintain the change rate within the allowable range.
Spare parts		Check if the quantity of spare part and the preservation status is good.	Make up insufficient and improve the preservation status.

8.2 Daily Check

Daily checking point for Smart I/O module is as follows.

1) Daily check for Modbus module

Checking items		Description	Judgment basis	Action
Cable connection status		Cable loosening	No loosening	Tighten the cable
Module connection status		Screw loosening	No loosening	Tighten the module screw.
Indication LED	PWR LED	Light 'ON' check	Steady-state of power	Refer to Chapter 3.
	TX LED	Light 'ON' check	Steady-state of communication module interface (if error occurs, check the H/W or the cable)	Refer to Chapter 3.
	RX LED	Light 'ON' check	Steady-state of communication network (if error occurs, check Smart I/O hardware.)	Refer to Chapter 3.

8.3 Regular Check

Check the following items 1~2 times every 6 months and take the necessary actions.

Checking items		Checking method	Judgment basis	Action
Ambient environment	Temperature	Measure by thermometer/hygrometer.	0 ~ 55℃	Adjust suitable for general standard (in case of using in the area, apply the environment basis in the area)
	Humidity		5 ~ 95%RH	
	Pollution	Measure the corrosive gas.	No corrosive gas	
Module status	Loosening, shaking	Shake the communication module.	Tightening status	Tighten the screw.
	Dust, foreign material adding	Macrography	No adding	
Connection status	Terminal screw loosened	Tightening by the driver	No loosening	Tightening
	Pressed terminal approach	Macrography	Proper interval	Correction
	Connector loosened.	Macrography	No loosening	Connector correction Screw tightening
Power voltage check		Voltage measure between terminals	DC 20.4 ~ 28.8V	Power supply change

Chapter 9 Trouble Shooting

Here it describes the contents of each error to be occurred while operating the system, the method to find the cause and the action.

9.1 Basic Procedure of Trouble Shooting

It is important to use high reliable machine to increase the system reliability but it is important to take prompt action when trouble occurs as well.

To start the system promptly, it is more important to find the trouble occurring cause promptly and take the necessary action. The basic items to comply when taking this trouble shooting are as follows.

1) Check with the naked eye

Check the following items with the naked eye.

- Machine action status (stop, action)
- Power appliance status
- I/O machine status
- Wiring status (I/O cable, extended or communication cable)
- Check the indication status of each indicator (POWER LED, RUN LED, ERR LED, TX LED,RX LED, MS LED,NS LED, I/O LED etc.) and connect the peripheral device and then check the PLC action status or the program contents.

2) Check the trouble

Examine how the trouble is changed by the following action.

- Place the key switch on STOP position and apply power ON/OFF.

3) Limit range

Estimate the cause of trouble using the above method.

- Is it the cause from PLC itself? Or external cause?
- Is it the cause from I/O part? Or other cause?
- Is it the cause from PLC program?

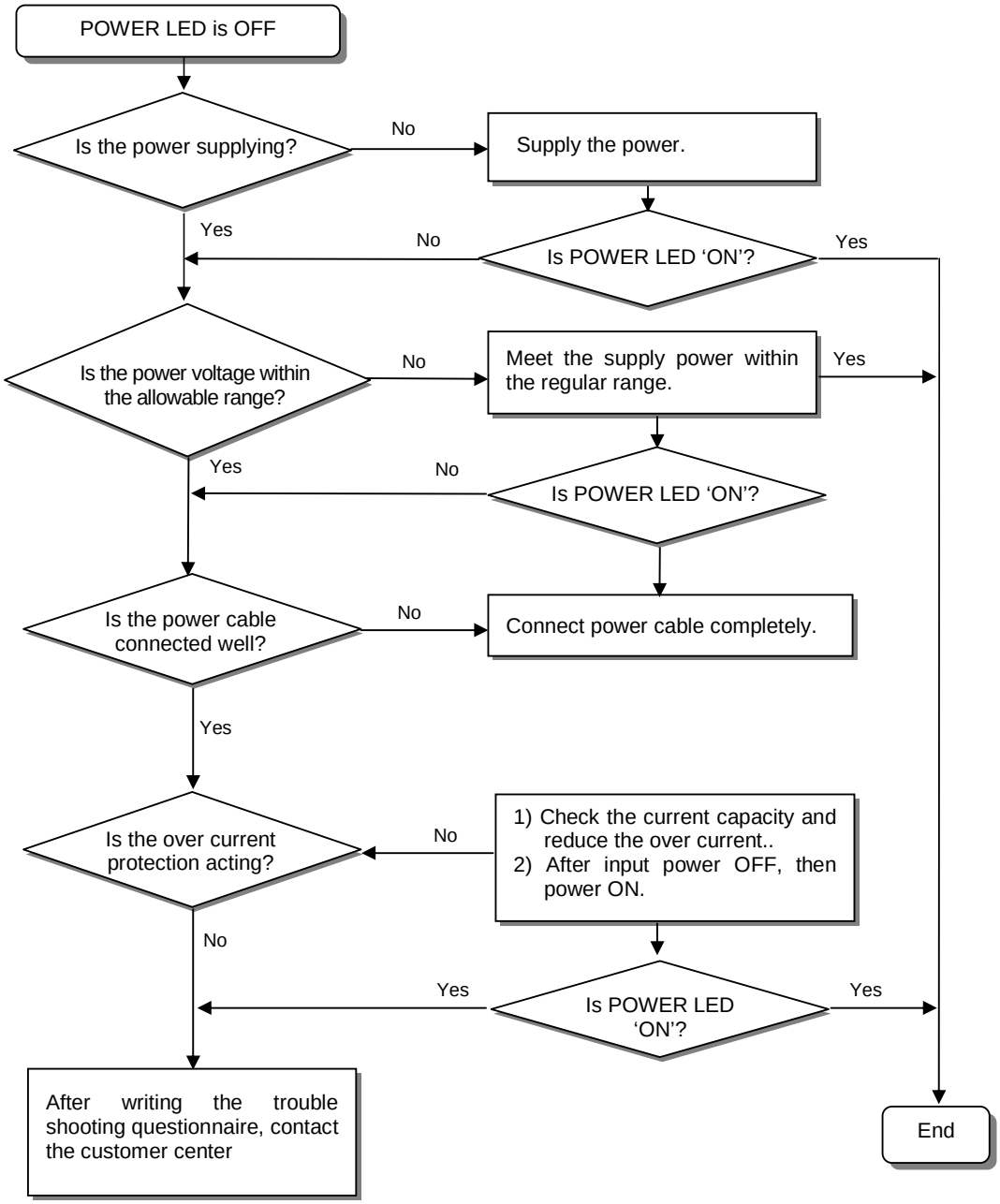
13.2 Trouble Shooting

Here it describes the trouble finding method, the error code and the actions on the above by dividing them per phenomenon.

Description of Trouble		
When POWER LED is OFF	⇨	Action method when POWER LED is OFF.
When ERR LED is blinking	⇨	Action method when ERR LED is blinking.
When RUN LED is OFF.	⇨	Action method when RUN LED is OFF.
In case of abnormal operation I/O part	⇨	Action method in case of abnormal operation of I/O part
When program write does not work	⇨	Action method when program write does not work.

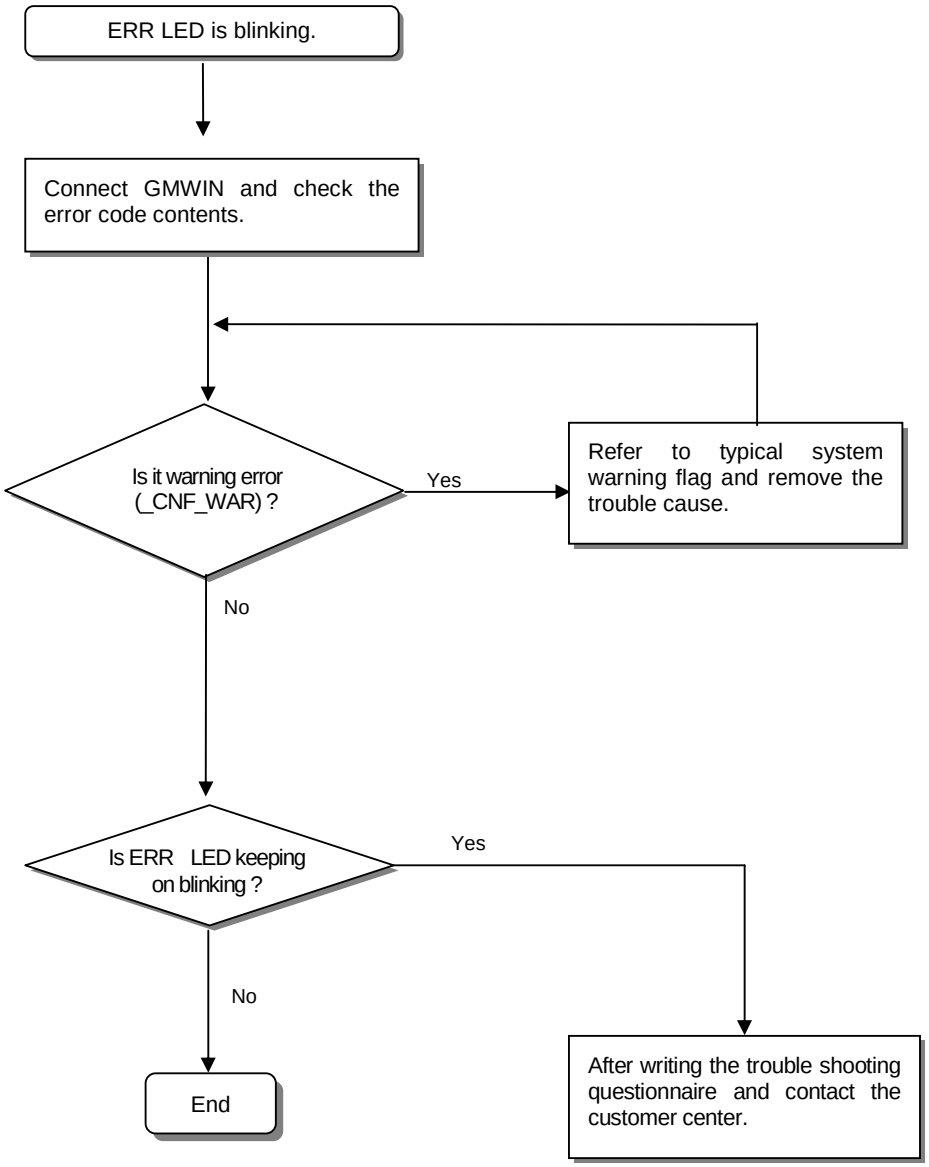
9.2.1 Action method when POWER LED is OFF.

Here it describes the action order when POWER LED is OFF while applying the power or during the operation.



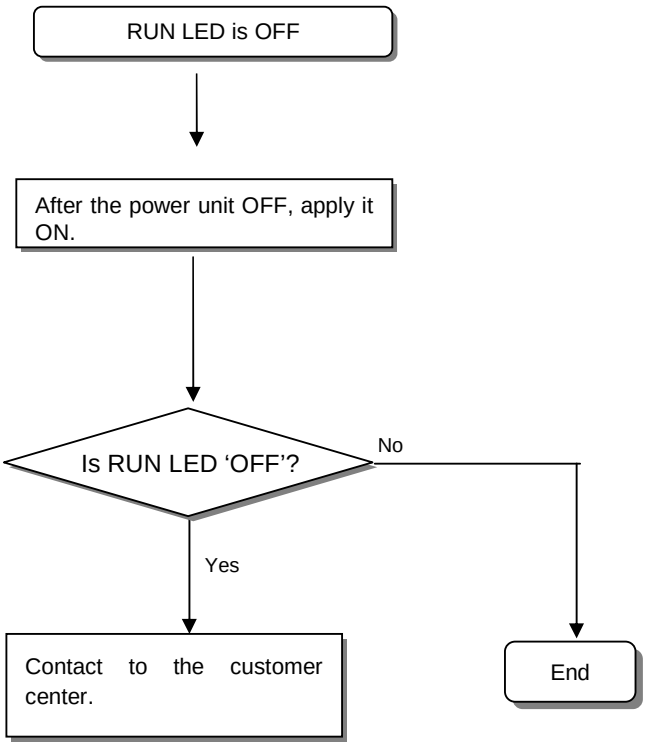
9.2.2 Action method when ERR LED is blinking.

Here it describes the action order when ERR LED is blinking in case of power input, or when operation start, or during operation.



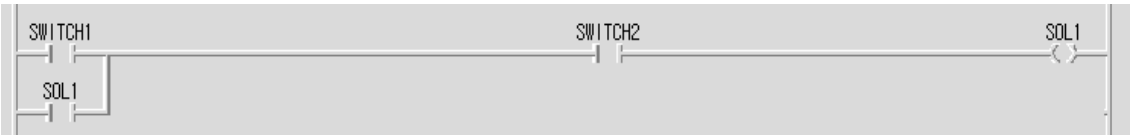
9.2.3 Action method when RUN LED is OFF

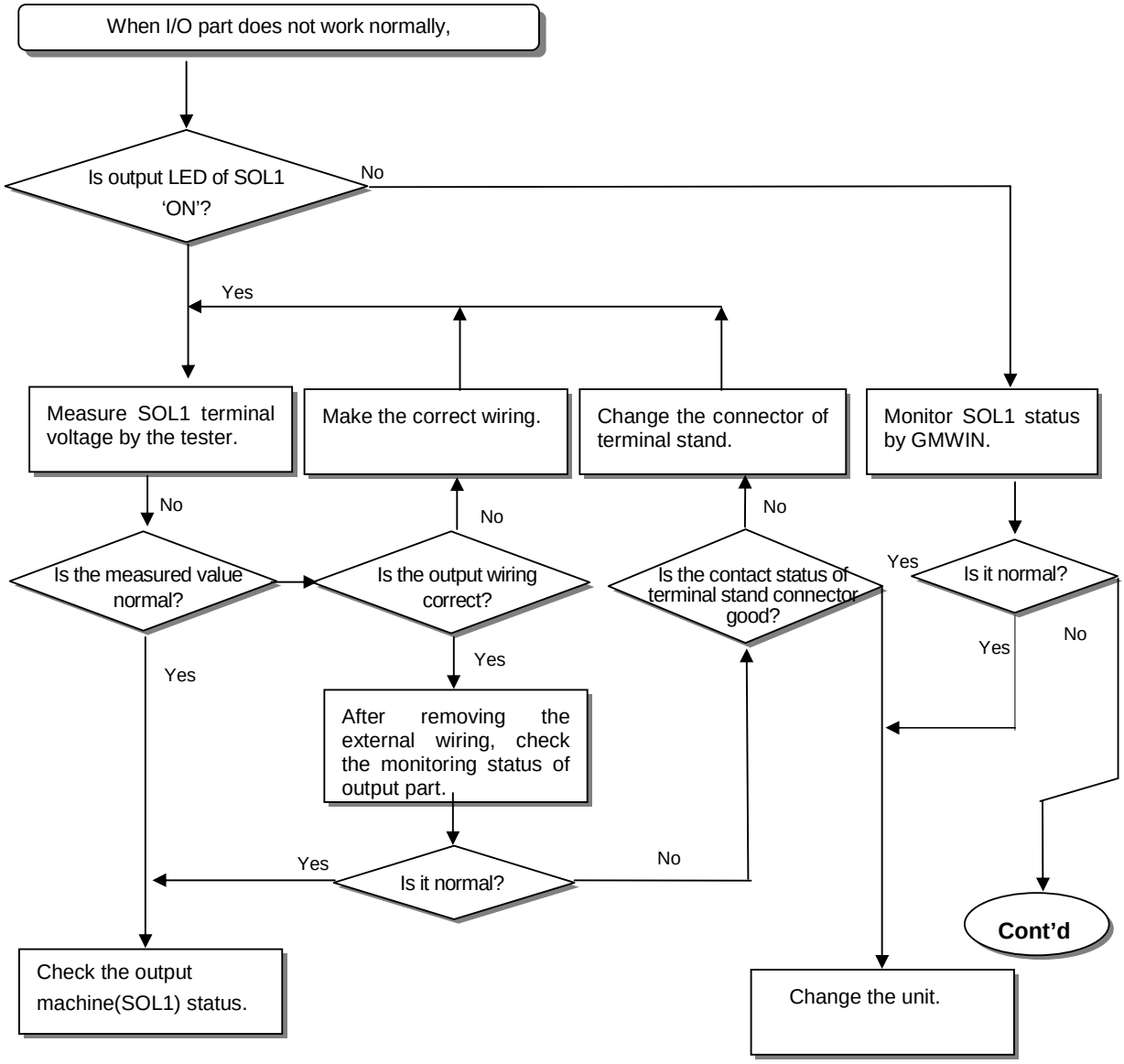
Here it describes the action order when RUN LED is blinking in case of the power input, or when operation start, or during operation.

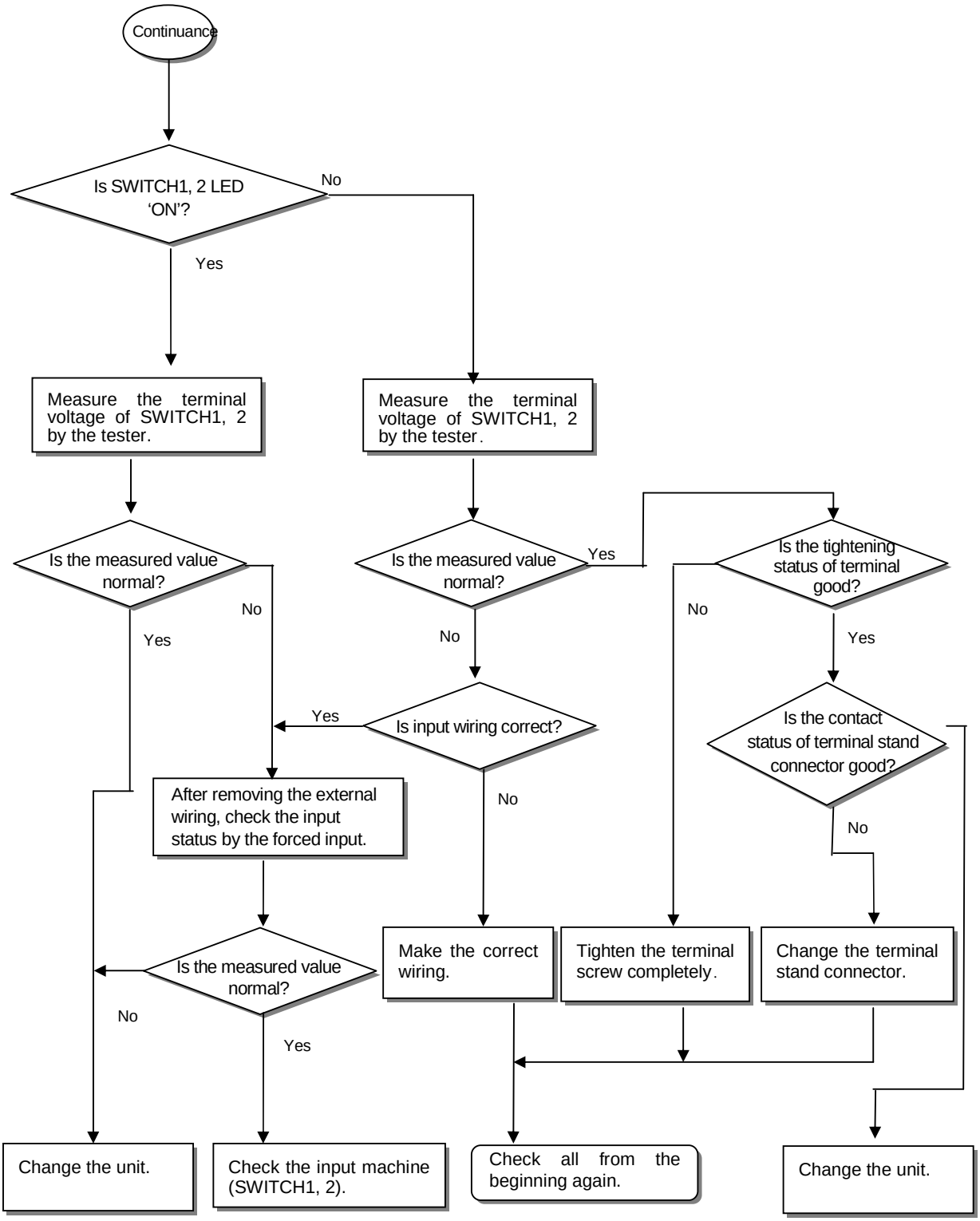


9.2.4 Action method when I/O part does not work normally.

Here it describes the action order when I/O part does not work normally during operation, as shown on the program example below.

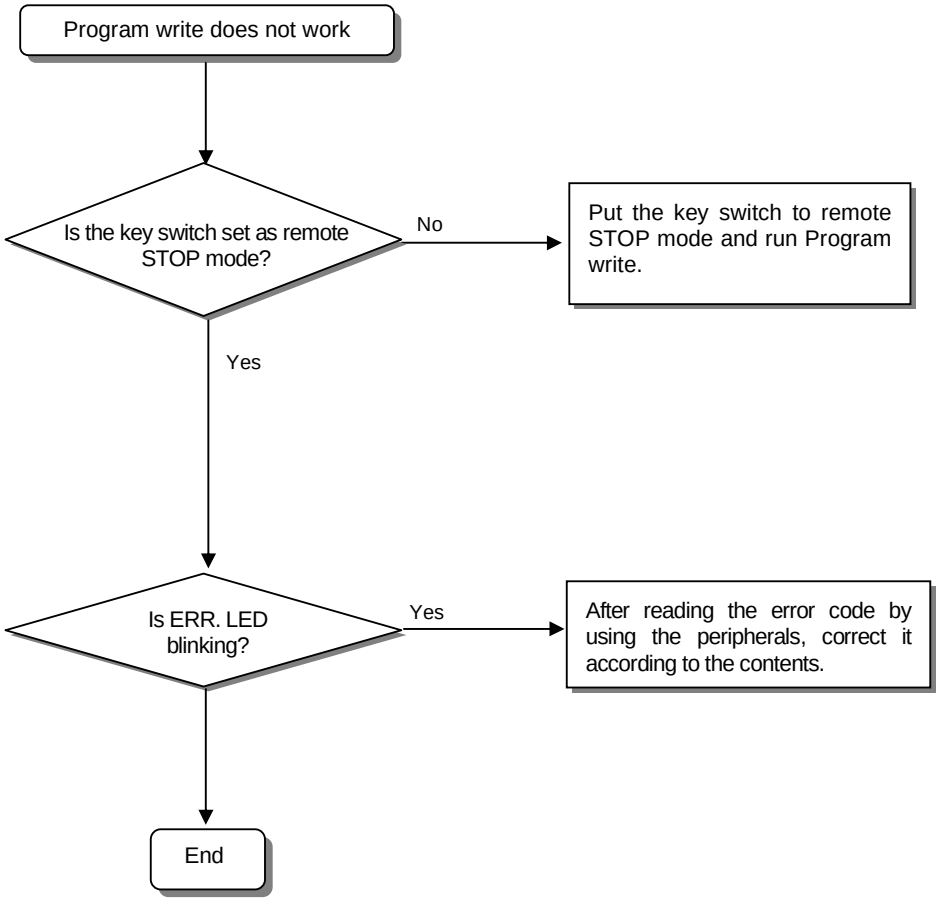




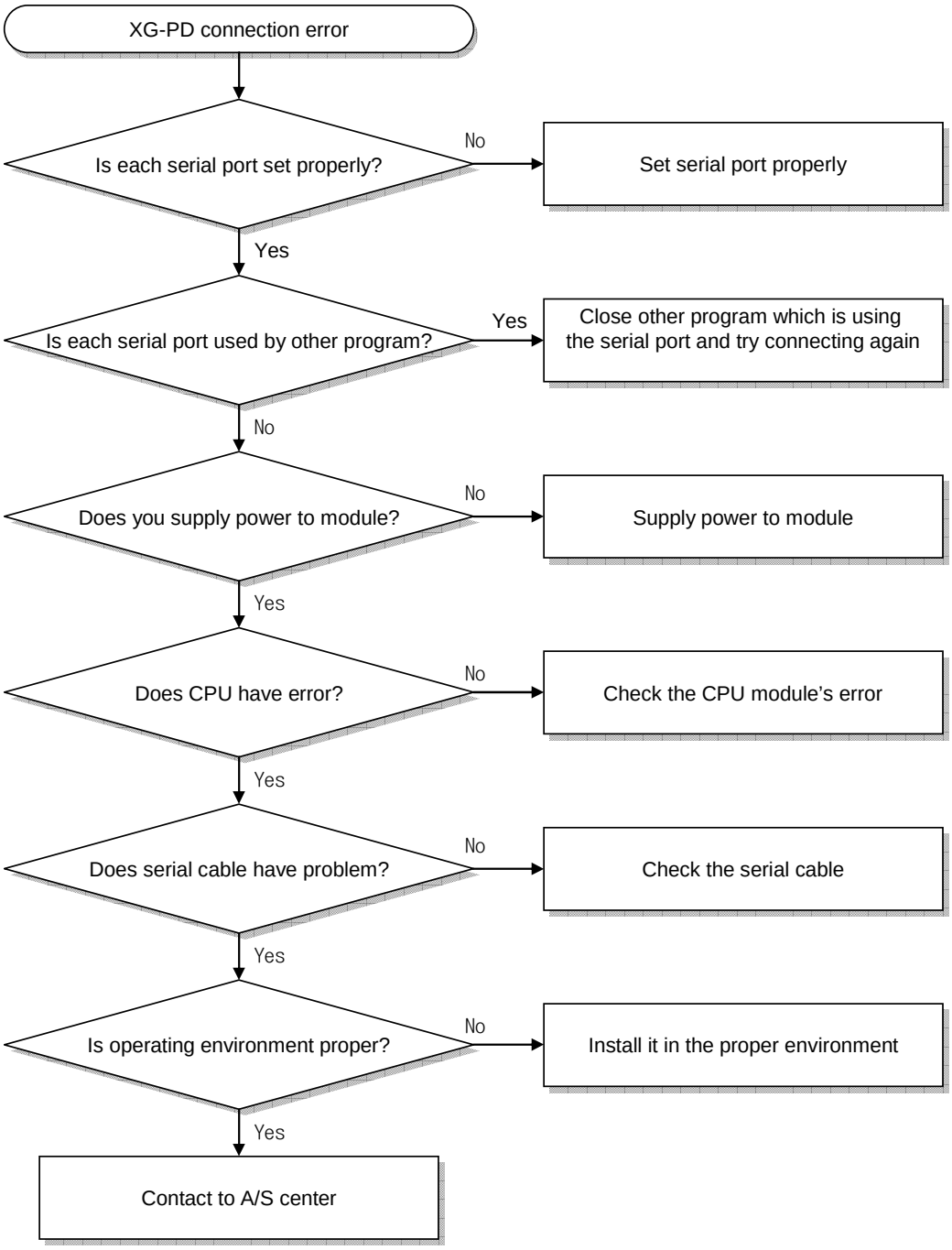

Continuance
Is SWITCH1, 2 LED 'ON'?
No
Yes
Measure the terminal voltage of SWITCH1, 2 by the tester.
Measure the terminal voltage of SWITCH1, 2 by the tester.
Is the measured value normal?
Yes
No
Is the measured value normal?
Yes
No
Is the tightening status of terminal good?
No
Yes
Is input wiring correct?
Yes
No
Is the contact status of terminal stand connector good?
No
After removing the external wiring, check the input status by the forced input.
Is the measured value normal?
No
Yes
Make the correct wiring.
Tighten the terminal screw completely.
Change the terminal stand connector.
Change the unit.
Check the input machine (SWITCH1, 2).
Check all from the beginning again.
Change the unit.

9.2.5 Action method when *Program Write* does not work

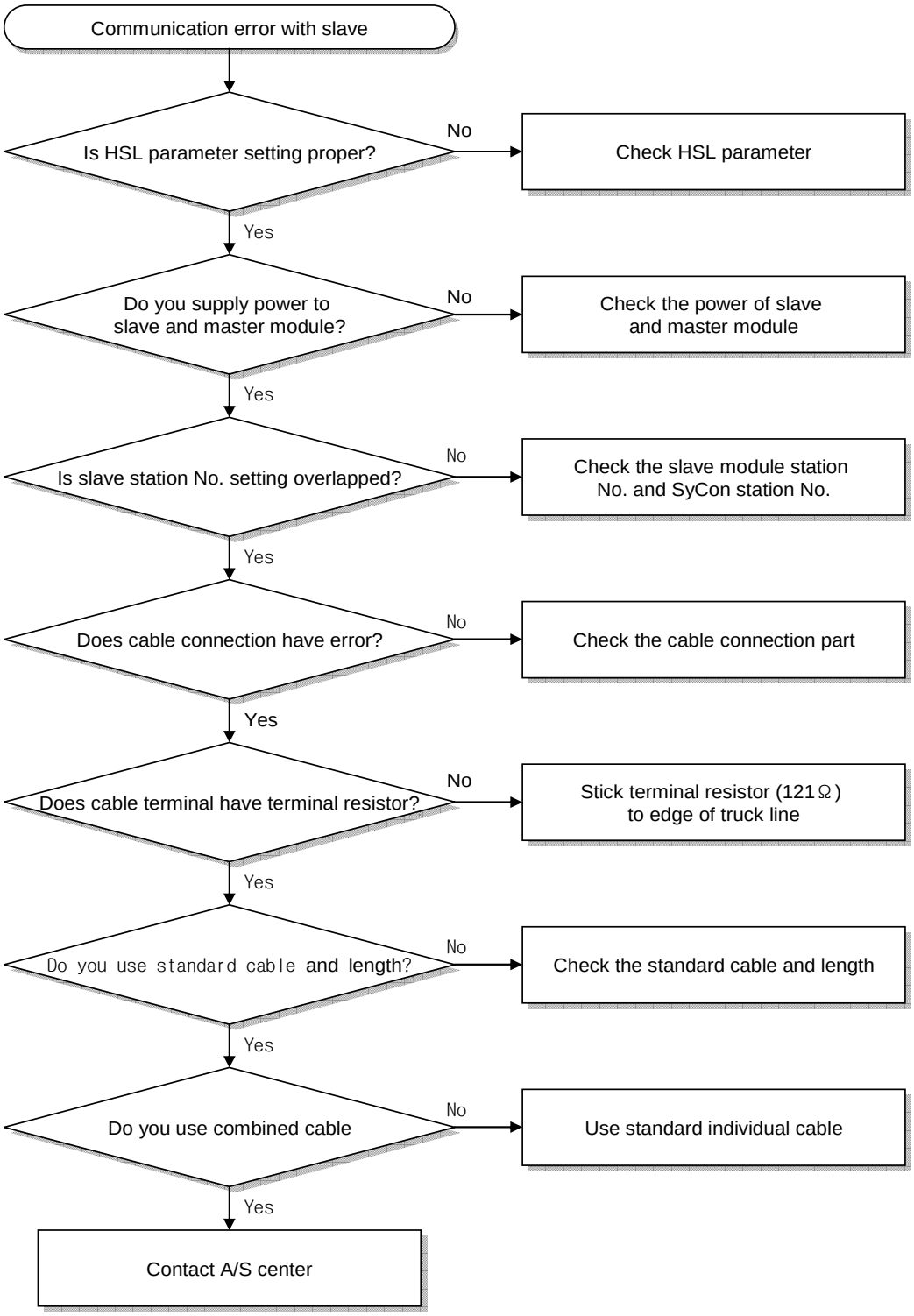
Here it describes the action order when Program write does not work in the Master CPU.



9.2.6 XG-PD connection error



13.2.8 Communication error with slave



13.3 Trouble Shooting Questionnaire

If the trouble occurs when using SMART I/O series, fill in the following questionnaire and contact to the customer center by phone or by fax.

- In case of error related to specific and communication module, use the questionnaire added to the user's manual of the corresponding product.

1. User contact point : TEL.) _____
   FAX) _____
2. Model : ( )
3. Applied machine details
   – Network status : – OS version ( ), – Serial no. of product ( )
   – GMWIN version no. used in program compile : ( )
4. brief description of control object machine and system :

5. Network model using :
6. ERR LED 'OFF' of network unit? Yes( ), No( )
7. Error message content by GMWIN :
8. Action trial status for the error code. :
9. Trouble shooting method for other error action :
10. Error features
    - Repeat( ) : periodical( ) , specific sequence level related( )
      environment related( )
    - Intermittent( ) : error interval :
12. Detail description for the error phenomena :

13. Configuration diagram of applied system:

APPENDIX

A.1 Communication Terminology

A1.1 Modbus

Protocol

This is the communication regulation pre-defined on the sending/receiving side of information to send/receive the efficient and reliable information without error between more than 2 computer and terminals. Generally, it defines the establishment of calling, connection, structure of message exchange form, retransmission of error message, line inversion procedure, character synchronization between terminal etc.

BPS (Bits Per Second) and CPS(Characters Per Second)

BPS is the transmission rate unit how many bit is transmitted per second when transmitting the data and CPS is the number of character to be transmitted per second. Usually 1 character is 1Byte(8Bit) and thus, CPS is the byte number available to transmit per second.

Node

This means the connecting joint of data in network tree structure and generally the network is composed of lots of node. This is expressed also as Station no.

Packet

This is the term used in packet exchange method that divides the information into packet unit and transmits and also is the compound term of Package and Buket. Packet is the thing attached the header indicating the address of other station by dividing the transmitting data into the designated length.

Port

This is a part of data processing device to send/receive the data from remote terminal in the data communication and in case of Cnet serial communication.

RS-232C

This is the serial communication standard designated by EIA according to the recommendation of CCITT as the interface to connect the modem and terminal or model and computer. This is used for modem connection as well as direct connection to the null modem. The demerits are that the transmission distance is short and only 1:1 communication is available. The specification that overcome this demerits is RS-422, RS-485.

RS-422/RS-485

This is one of serial transmission specification and the transmission distance is long and 1:N connection is available comparing with RS-232C. The difference between 2 specification is that RS-422 uses 4 signal cable such as TX(+), TX(-), RX(+), RX(-) while RS-485 has (+), (-) 2 signal

cable and performs the sending/receiving through the same signal cable. So, RS-422 performs full duplex mode communication and RS-485 performs semi duplex mode communication.

A1.2 Ethernet

IEEE 802.3

IEEE 802.3 specifies standards regarding to CSMA/CD-based Ethernet. More specific, it is a Local Area Network (LAN) based on CSMA/CD (Carrier Sense Multiple Access with Collision Detection) Ethernet designed by IEEE 802.3 Group and it is divided into three sub projects as below:

(1) IEEE P802.3 - 10G Base T Study Group

(2) IEEE P802.3ah - Ethernet in the First Mile Task Force

(3) IEEE P802.3ak - 10G Base-CX4 Task Force

 Ethernet and IEEE 802.3are standardized by RFC894 and RFC1042, and they shall conduct frame treatment mutually.

ARP (Address Resolution Protocol)

A protocol to find MAC addresses by using partner's IP address on the Ethernet LAN.

Bridge

A device used to connect two networks together to ensure they act as if they are one network. Even though Bridge is used to connect two different types of networks, it is also used to divide one large network into two small networks to improve its performance.

(1) Related standard : IEEE 802.1D

(2) Bridge (Layer 2 Switch) is a device to link to Layer2 and it extends the limit of distribution of Ethernet, performing filtering and forwarding.

Client

A network service user or, a computer or a program using other computer's resource (Mainly the party who requests the service.)

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

Before sending data to the network, each terminal (Client) checks if there is any signal on the network (Carrier Sense) and sends data when the network is empty. At this time, all terminals have the equal authority to send data (Multiple Access) and, if more than two terminals send data and any collision takes place, the terminal that detects this resends data after a few minutes later (Collision Detect).

DNS (Domain Name System)

A method used to convert a domain name in Alphabet on the Internet to its corresponding Internet number (IP Address)

Dot Address

It is expressed in '100.100.100.100', representing IP Address. Each number is expressed in decimal and dominates each one byte of total four bytes.

E-mail Address

The address of the user who has a login account on a specific device connected to the Internet. Typically, it forms like the user's ID@ domain name (device name). It looks like this example, hjjee@microsoft.com, where, @ is called 'at' and it appears on the screen if shift key and number 2 are pressed simultaneously on the keyboard. The letters after @ represent the domain name of a specific organization (school, research center, company…) connected to the Internet and the letters before @ show the user's ID. The last few letters are for the top level. For example, if it is the US, most cases show the following abbreviation words, and if it is Korea, 'kr' is used. .com : companies / .edu : mainly universities or other educational organization (education). / In Korea, .ac(academy) is widely used., / .gov : government agencies, For example, nasa.gov is used for NASA(government) / .mil : military related sites. For example, af.mil is used for the US Air Force (military)/ .org : private entities. Each nation is identified as follows:/ .au : Australia / .uk : the United Kingdom / .ca : Canada / .kr : Korea / .jp : Japan / .fr : France / .tw : Taiwan etc.

Ethernet

A representative LAN link system (IEEE 802.3) jointly developed by the US Xerox, Intel and DEC. As a network link system with 10Mbps transmission capability using 1500-byte packets, Ethernet is called a major term of LAN because it can bind various kinds of computer with a network. Various goods are available because it is not a standard only for a certain company but a universal standard,

FTP (File Transfer Protocol)

As one of the application programs provided by TCP/IP protocol, it can be used to transfer files between computers. Only if only the user has an account on the computer he wants to log in, it is possible to log in to the computer fast and copy data on it to bring in wherever the computer is in the world.

Gateway

Software/hardware to translate two different protocols into those that can work well each other. A device that serves as a gate where information exchange takes place among different systems

Header

Part of a packet containing national address or partner nation's address and part for error inspection

HTML (Hypertext Markup Language, Standard Language of WWW)

A language system to create a hypertext document, Any document made in HTML can be viewed through web browser.

HTTP (Hypertext Transfer Protocol, Standard Protocol of WWW)

A protocol used for the purpose of sending and receiving various files and data on the World Wide Web (WWW)

ICMP (Internet Control Message Protocol)

An extension protocol of IP Address for the purpose of creating error messages and test packets and reporting and controlling errors to ensure the Internet is properly managed.

IP (Internet Protocol)

This is a protocol of the network layer for the Internet. It is non-connection datagram type protocol, and data such as TCP, UDP, ICMP, IGMP is transmitted and received by using IP(32 bits).

IP Address

This refers to the address of each computer in the internet. It is binary number with 32 bits (4 bytes) to identify each device in the internet. IP address is composed of two parts. One is network address to identify network and the other is host address to identify host. It is divided into class A/ B/ C according to how many bits are allocated to network address and host address respectively. Since each IP address is unique in the world, it is not decided discretionally. When subscribing internet, the Network Information Center (NIC) allocates the address. For Korea, KRNIC is in charge of this role. e.g.) 165.244.149.190

ISO (International Organization for Standardization)

This organization is a subsidiary organization of UN, and it establishes and manages international standard specification.

LAN (Local Area Network)

This is also called as information network in the local area. This refers to the network where multiple computers are connected by communication lines to exchange data in a limited range like one office or building.

MAC (Medium Access Control)

A method to decide which device will be used for a given time on the Broadcast network.

Node

Each computer connected to the network is called a nod.

Packet

This is a packet of data, the basic unit for transmitting data via the network. Usually the size of one packet is between tens and hundreds bytes, and header is attached to the front of the packet to include information about the destination that where this packet should go and other necessary information.

PORT number

This is an identifier to identify application on TCP/UDP. TCP determines that data is sent to which application after identify this port number. The programs used in general operating system have each port.

Ex.) 21/tcp : Telnet

PPP (Point-to-Point Protocol)

This is telephone communication protocol to allow packet transmission in connecting internet. This is the most common internet protocol when computer is connected to TCP/IP by using normal telephone line and modem.

This is similar to SLIP, but it shows more excellent performance than SLIP since PPP has modern communication protocol elements such as error detection and data compression, etc.

Protocol

This refers to the rules about how computers connected to network can send and receive information mutually. Protocol also means low level description (e.g. which bit/byte should be out through the line) for interface between devices, or high level message exchange rules like transmitting files through internet.

Router

A device used to transmit data packet between networks. It sends data packets to the destination and holds them if the network is crowed and also judges which LAN is better to connect to at a junction of multiple LANs. That is, it refers to special computer software that manages connection of more than two networks.

Server

A party to passively respond to the client's request and share its own resource.

TCP (Transmission Control Protocol)

(1) Transport Layer Protocol for the Internet

- Support sending/receiving data by using connection.
- Support multiplexing function
- Perform a reliable connection-oriented transmission of data
- Support emergency data transmission

TCP/IP (Transmission Control Protocol/Internet Protocol)

This refers to the transmission protocol for communications between different type of computers. It plays a role to enable communications between general computers and mid-sized host, IBM PC and MAC, and different companies' mid-sized computers. This is used as general name of protocol for transmitting information between computer networks, and it includes FTP, Telnet and SMTP. TCP divides data into packet and it is transmitted by IP. The transmitted packet is reorganized by TCP.

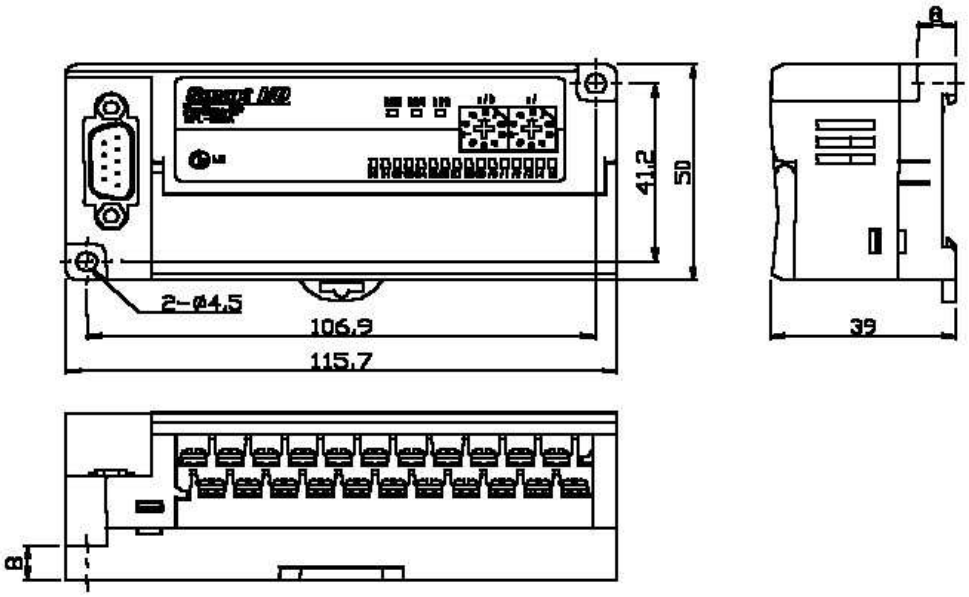
Near-end crosstalk

Crosstalk is a sort of disturbance incurred from electricity or magnetic field of communication signal, which affects another signal of near line. In telephone line, crosstalk may cause to hear some of the talks of another line. The phenomenon caused by crosstalk is also called as electromagnetic interference (EMI). This also happens in small circuit inside of computer or audio equipment as well as network line. This term may be applied to optical signals which interfere with each other. For example, like insulated conductor of telephone cable, there may be electrostatic coupling or electromagnetic coupling between any insulated conductor and another insulated conductor. And call current of one insulated conductor may be exposed to another conductor, and cause the crosstalk phenomenon. When crosstalk occurs at the transmission side, it is called as near-end crosstalk, and when crosstalk occurs at the receiving side, it is called as far-end crosstalk.

A.2 External Dimension

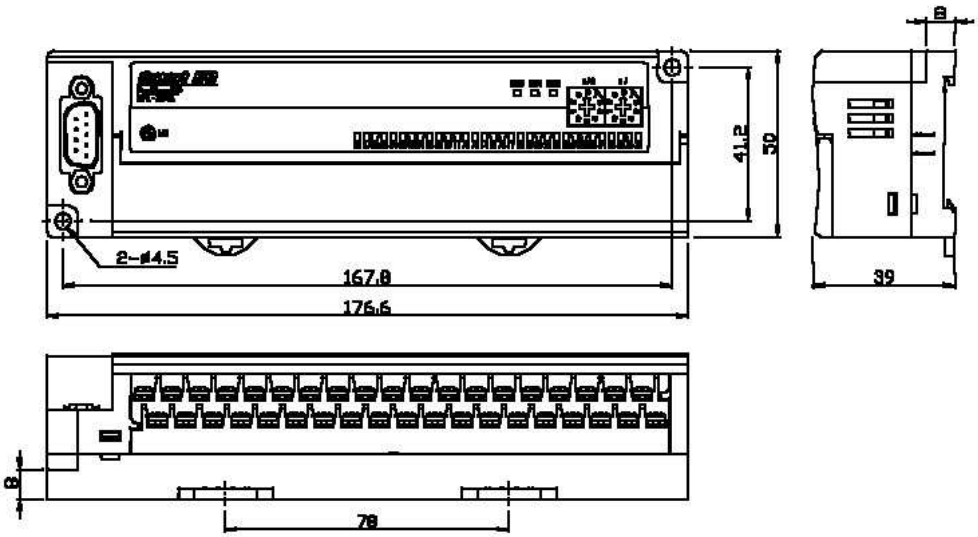
1) External dimension of 16 point unit
   The external dimensions of Snet etc are all same.

Unit: mm

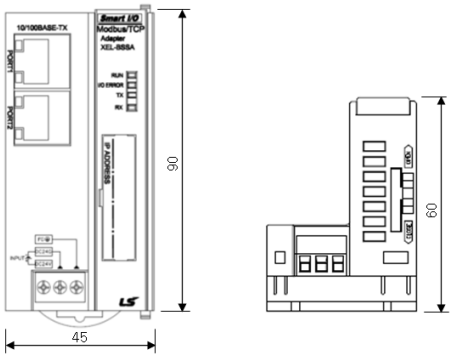


2) External dimension of 32 point unit
   The external dimensions of Snet etc are all same.

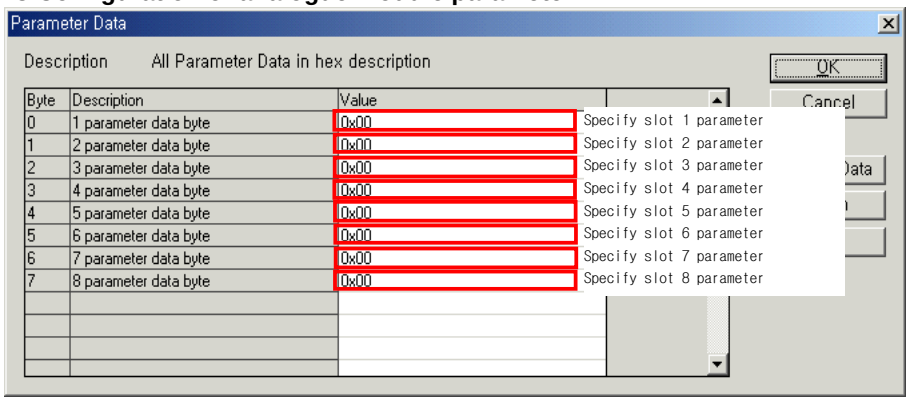
Unit: mm



(1) Enet


10/100BASE-TX
Smart I/O
Modbus/TCP
Adapter
XEL-SSSA
PORT1
PORT2
RUN
I/O ERROR
TX
RX
90
45
60

A.4.3 Configuration of analogue module parameter



-Parameter item and setting value of are as follows.

Classification		Setting range	Description	
Byte		0	Install expansion IO module slot 1	
		1	Install expansion IO module slot 2	
		2	Install expansion IO module slot 3	
		3	Install expansion IO module slot 4	
		4	Install expansion IO module slot 5	
		5	Install expansion IO module slot 6	
		6	Install expansion IO module slot 7	
		7	Install expansion IO module slot 8	
Name		**Value**	**Analogue IO value**	**Digital IO value**
	XBF -AD4A	0	0~10V	0~4,000
		1	0~20mA	0~4,000
		2	4~20mA	0~4,000
		3	0~10V	-2,000~2,000
		4	0~20mA	-2,000~2,000
		5	4~20mA	-2,000~2,000
		6	0~10V	0~1,000
		7	0~20mA	0~1,000
		8	4~20mA	0~1,000
	XBF -DV4A	0	0~10V	0~4,000
		1	0~10V	0~1,000
	XBF-DC04A	0	4~20 ㎃	0 ~ 4,000
		1	0~20 ㎃	0 ~ 4,000
		2	4~20 ㎃	0 ~ 1,000
		3	0~20 ㎃	0 ~ 1,000
	XBF-RD04A	0	pt100	Celsius
		1	jpt100	Celsius
		2	pt100	Fahrenheit
		3	jpt100	Fahrenheit

- Setting range is 0~8.
- Setting value should be specified for each module
- If parameter is not specified, initial value is applied.
- The specified parameter is transmitted from master to slave.
  → While slave is connected to cable, it holds former setting value regardless of power on/off
  → If you restart the power while slave is not connected to cable, initial value is applied.

A.4.4 Analogue output module

(1) Performance specification

Item		Specification	
		XBF-DV04A	XBF-DC04A
Analogue output	Type	Voltage	Current
	Range	DC 0 ~ 10V (load resistance: over 2 kΩ)	DC 4 ~ 20mA DC 0 ~ 20mA (load resistance: over 510Ω)
Digital input	Type	1) 12bit binary data 2) type of digital input is specified for each channel according to program or parameter	
	Unsigned value	0 ~ 4000	0 ~ 4000
	Signed value	-2000 ~ 2000	-2000 ~ 2000
	Precise value	0 ~ 1000	400 ~ 2000/0 ~ 2000
	Percentile value	0 ~ 1000	0 ~ 1000
Max. resolution		2.5 �V(1/4000)	5 ㎂(1/4000)
Precision		±0.5% or less	
Max. conversion speed		1 ㎳/channel	
Absolute max. output		DC ±15V	DC +25 ㎃
No of output channel		4 channels	
Insulation method		Photo-coupler insulation between output terminal and PLC power (non-insulation between channels)	
Connection terminal		11 points terminal block	
IO occupancy points		Fixed type: 64 points	
Consumption current	Internal(DC 5V)	110mA	110mA
	External(DC 24V)	70mA	120mA
Weight		64g	70g

A.4.5 Analogue input module

(1) Performance specification

Item	Specification XBF-AD04A
Analogue input	DC 0 □ 10 V (input resistance: 1 MΩ min.) DC 4 □ 20 mA ,DC 0 ~ 20 mA (input resistance 250 Ω)
Select analogue input range	► Specifies at user program or software package after setting external switch ► Input range can be specified for each channel
Digital output	

Analogue input / Digital output	0 ~ 10 V	4 ~ 20 mA	0 ~ 20 mA
Unsigned Value	0 ~ 4000		
Signed Value	-2000 ~ 2000		
Precise Value	0 ~ 1000	400 ~ 2000	0 ~ 2000
Percentile Value	0 ~ 1000		

Max. resolution	Analogue input range	Resolution (1/4000)
	0 ~ 10 V	2.5 mV
	4 ~ 20 mA	5 μA
	0 ~ 20 mA	

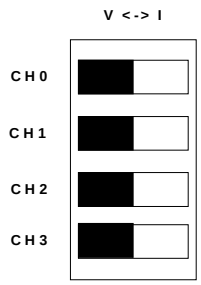
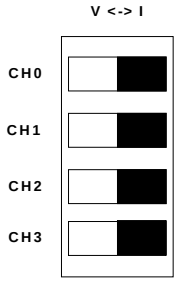
Precision	±0.5% or less	
Max. conversion speed	1.5 ㎳/channel	
Max. absolute input	voltage: ±15 V, current: ±30 mA	
Analogue input channel	4 channels/1 module	
Insulation method	Photo-coupler insulation between input terminal and PLC power (non-insulation between channels)	
Connection terminal	11 points terminal block	
Max. installation no.	4	
IO occupancy points	Fixed type: 64	
External supply power	Power input range	DC21.6V ~ DC26.4V
	Consumption current	62 ㎃
Weight	67g	

Remark

□ Offset/gain value for each analogue input range is specified at factory manufacturing process. That can't be changed by the user

(2) Voltage/Current selector switch

□ Switch for selecting voltage/current input of analogue input

(a)OFF : voltage input	(b)ON : current input
	

A.4.6 RTD module

(1) Performance specification

Item	XBF-RD04A		
No. of input CH	4 channels		
Input sensor type	PT100	JIS C1604-1997	
	JPT100	JIS C1604-1981 , KS C1603-1991	
Input temp. range	PT100	-200 ~ 600	
	JPT100	-200 ~ 600	
Digital output	Temp. unit:0.1□	PT100	-2000 ~ 6000
		JPT100	-2000 ~ 6000
Precision	25□	Within ±0.3%	
	0~55□	Within ±0.5%	
Conversion speed	40ms / channel		
Insulation method	Between channels	Non-insulation	
	Between terminal and PLC power	Insulation (Photo-Coupler)	
Terminal block	15 points terminal block		
RTD wiring method	3 lines type		
Function	Filter	Digital filter	
	Alarm	Disconnection detecion	

A.6 Expansion Analogue Module Parameter Setting Method (XEL-BSSA)

A.6.1 Analogue Expansion Module Parameter Setting Criteria

(1) Analogue Input Parameter Setting (XBF-AD04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
	Designation of input voltage/current range	Ch3		Ch2		Ch1		Ch0		00: 0~10V (4~20mA) 01: 0~20mA 10: 4~20mA
1	Designation of output data range	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
		-	-	-	-	-	-	-	-	

(2) Analogue Output Parameter Setting (XBF-DV04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: 0~10V
1	Designation of input data range	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
	Configuration of output status by channels	Ch3		Ch2		Ch1		Ch0		00: former value 01: minimum value 10: medium value 11: maximum value

(3) Analogue Output Parameter Setting (XBF-DC04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: 4~20mA 01: 0~20mA
1	Designation of input data range	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
	Configuration of output status by channels	Ch3		Ch2		Ch1		Ch0		00: former value 01: minimum value 10: medium value 11: maximum value

(4) Thermocouple Input Parameter Setting (XBF-TC04S)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: K 01: J 10: T 11: R
1	Designation of input data range	Ch3		Ch2		Ch1		Ch0		Bit Off(0): Centigrade Bit On(1): Fahrenheit

(5) Resistance temperature detector Input Parameter Setting (XBF-RD04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: PT100 01: JPT100
1	Designation of input data range	Ch3		Ch2		Ch1		Ch0		Bit Off(0): Centigrade Bit On(1): Fahrenheit

(6) Digital I/O Parameter Setting

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Input filter	-	-	-	-	Input filter				0000: 3ms 0001: 1ms 0010: 5ms 0011: 10ms 0100: 20ms 0101: 70ms 0110: 100ms
	Maintaining output is allowed	Configuration of maintaining output								01: Allow Others: Prohibit
1	Configuration of maintaining output by channels	56~63	48~55	40~47	32~39	24~31	16~23	8~15	0~7	

(7) Analogue I/O Combined Module (XBF-AH04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Output Ch3	Output Ch2	Input Ch1	Input Ch0	Bit off (0): stop Bit on (1): operation
	Designation of input voltage/current range	Output Ch1		Output Ch0		Input Ch1		Input Ch0		00: 4~20mA 01: 0~20mA 10: 0~5V 11: 0~10V
1	Designation of output data range	Output Ch3		Output Ch2		Input Ch1		Input Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
	Configuration of output status by channels	Output Ch1				Output Ch0				00: former value 01: minimum value 10: medium value 11: maximum value

A.7 Expansion Analogue Module Parameter Setting Method (XEL-BSSB)

A.7.1 Analogue Expansion Module Parameter Setting Criteria

(1) Analogue Input Parameter Setting (XBF-AD04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
1	Designation of input voltage/current range	Ch3		Ch2		Ch1		Ch0		00: 0~10V (4~20mA) 01: 0~20mA 10: 4~20mA
2	Designation of output data range	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000(400~2000/0~2000) 11: 0~1000
3		-	-	-	-	-	-	-	-	

(2) Analogue Output Parameter Setting (XBF-DV04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
1	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: 0~10V
2	Designation of input data range	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000 (400~2000/0~2000) 11: 0~1000
3	Configuration of output status by channels	Ch3		Ch2		Ch1		Ch0		00: former value 01: minimum value 10: medium value 11: maximum value

(3) Analogue Output Parameter Setting (XBF-DC04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
1	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: 4~20mA 01: 0~20mA
2	Designation of input data range	Ch3		Ch2		Ch1		Ch0		00: 0~4000 01: -2000~2000 10: 0~1000 (400~2000/0~2000) 11: 0~1000
3	Configuration of output status by channels	Ch3		Ch2		Ch1		Ch0		00: former value 01: minimum value 10: medium value 11: maximum value

(4) Thermocouple Input Parameter Setting (XBF-TC04S)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
1	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: K 01: J 10: T 11: R
2	Designation of input data range	Ch3		Ch2		Ch1		Ch0		Bit Off(0): Centigrade Bit On(1): Fahrenheit
3		-		-		-		-		

(5) Resistance temperature detector Input Parameter Setting (XBF-RD04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Ch3	Ch2	Ch1	Ch0	Bit off (0): stop Bit on (1): operation
1	Configuration of output type	Ch3		Ch2		Ch1		Ch0		00: PT100 01: JPT100
2	Designation of input data range	Ch3		Ch2		Ch1		Ch0		Bit Off(0): Centigrade Bit On(1): Fahrenheit
3		-		-		-		-		

(6) Digital I/O Parameter Setting

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Input filter	-	-	-	-	Input filter				0000: 3ms 0001: 1ms 0010: 5ms 0011: 10ms 0100: 20ms 0101: 70ms 0110: 100ms
1	Maintaining output is allowed	Configuration of maintaining output								01: Allow Others: Prohibit
2	Configuration of maintaining output by channels	56~63	48~55	40~47	32~39	24~31	16~23	8~15	0~7	
3										

(7) Analogue I/O Hybrid Module (XBF-AH04A)

Memory address	Description	Bit								Configuration
		15	14	13	12	11	10	9	9	
		7	6	5	4	3	2	1	0	
0	Configuration of channels to be used	-	-	-	-	Output Ch1	Output Ch0	Input Ch1	Input Ch0	Bit off (0): stop Bit on (1): operation
1	Configuration of output type	Output Ch1		Output Ch0		Input Ch1		Input Ch0		00: 4~20mA 01: 0~20mA 10: 0~5V 11: 0~10V
2	Designation of output data range	Output Ch1		Output Ch0		Input Ch1		Input Ch0		00: 0~4000 01: -2000~2000 10: 0~1000 (400~2000/0~2000) 11: 0~1000
3	Configuration of output status by channels	Ch1				Ch0				0000: former value 0001: minimum value 0010: medium value 0011: maximum value

IMO
The World's Finest

IMO Precision Controls Limited
1000 North Circular Road
Staples Corner
London NW2 7JP
United Kingdom

Tel: +44 (0)20 8452 6444
Fax: +44 (0)20 8450 2274
Email: imo@imopc.com
Web: www.imopc.com

IMO Automazione
Viale A. Volta 127/a
50131 Firenze
Italia

Tel: +39 800 783281
Fax: +39 800 783282
Email: info@imopc.it
Web: www.imopc.it

IMO Jeambrun Automation SAS
Centre D'Affaires Rocroy
30, Rue de Rocroy
94100 Saint-Maur-Des-Fosses
France

Tel: +8000 452 6444
Fax: +8000 452 6445
Email: info@imopc.fr
Web: www.imopc.fr

IMO Canada
Unit 10, 1 Whitmore Road
Woodbridge
Ontario L4L 8G4
Canada

Tel: +1 905 265 9844
Fax: +1 905 265 1749
Email: imocanada@imopc.com
Web: www.imopc.com