Right choice for ultimate yield

LSIS strives to maximize customers' profit in gratitude of choosing us for your partner.

Slim & Compact Solution

Programmable Logic Controller

XGB Series

User Manual

⚠ Safety Instructions

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

LS Industrial Systems

Safety Instruction

Before using the product …

For your safety and effective operation, please read the safety instructions thoroughly before using the product.

- Safety Instructions should always be observed in order to prevent accident or risk with the safe and proper use the product.

- Instructions are separated into “Warning” and “Caution”, and the meaning of the terms is as follows;

⚠ **Warning**	This symbol indicates the possibility of serious injury or death if some applicable instruction is violated
⚠ **Caution**	This symbol indicates the possibility of slight injury or damage to products if some applicable instruction is violated

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

  ⚠ Be careful! Danger may be expected.

  ⚡ Be careful! Electric shock may occur.

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

Safety Instruction

Safety Instructions when designing

⚠Warning

- **Please, install protection circuit on the exterior of PLC to protect the whole control system from any error in external power or PLC module.** Any abnormal output or operation may cause serious problem in safety of the whole system.
  - Install applicable protection unit on the exterior of PLC to protect the system from physical damage such as emergent stop switch, protection circuit, the upper/lowest limit switch, forward/reverse operation interlock circuit, etc.
  - If any system error (watch-dog timer error, module installation error, etc.) is detected during CPU operation in PLC, the whole output is designed to be turned off and stopped for system safety. However, in case CPU error if caused on output device itself such as relay or TR can not be detected, the output may be kept on, which may cause serious problems. Thus, you are recommended to install an addition circuit to monitor the output status.

- **Never connect the overload than rated to the output module nor allow the output circuit to have a short circuit**, which may cause a fire.

- **Never let the external power of the output circuit be designed to be On earlier than PLC power**, which may cause abnormal output or operation.

- **In case of data exchange between computer or other external equipment and PLC through communication or any operation of PLC (e.g. operation mode change), please install interlock in the sequence program to protect the system from any error**. If not, it may cause abnormal output or operation.

Safety Instruction

Safety Instructions when designing

⚠ Caution

- **I/O signal or communication line shall be wired at least 100mm away from a high-voltage cable or power line.** If not, it may cause abnormal output or operation.

Safety Instructions when designing

⚠ Caution

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

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

- **Be sure that each module of PLC is correctly secured.** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused.

- **Be sure that I/O or extension connecter is correctly secured.** If not, electric shock, fire or abnormal operation may be caused.

- **If lots of vibration is expected in the installation environment, don't let PLC directly vibrated.** Electric shock, fire or abnormal operation may be caused.

- **Don't let any metallic foreign materials inside the product**, which may cause electric shock, fire or abnormal operation..

Safety Instructions when wiring

⚠ Warning

- **Prior to wiring, be sure that power of PLC and external power is turned off.** If not, electric shock or damage on the product may be caused.

- **Before PLC system is powered on, be sure that all the covers of the terminal are securely closed.** If not, electric shock may be caused

⚠ Caution

- **Let the wiring installed correctly after checking the voltage rated of each product and the arrangement of terminals.** If not, fire, electric shock or abnormal operation may be caused.

- **Secure the screws of terminals tightly with specified torque when wiring.** If the screws of terminals get loose, short circuit, fire or abnormal operation may be caused.

*

- **Surely use the ground wire of Class 3 for FG terminals, which is exclusively used for PLC**. If the terminals not grounded correctly, abnormal operation may be caused.

- **Don’t let any foreign materials such as wiring waste inside the module while wiring,** which may cause fire, damage on the product or abnormal operation.

Safety Instruction

Safety Instructions for test-operation or repair

⚠ Warning

- **Don’t touch the terminal when powered**. Electric shock or abnormal operation may occur.

- **Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.

- **Don’t let the battery recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

⚠ Caution

- **Don’t remove PCB from the module case nor remodel the module.** Fire, electric shock or abnormal operation may occur.

- **Prior to installing or disassembling the module, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.

- **Keep any wireless installations or cell phone at least 30cm away from PLC**. If not, abnormal operation may be caused.

Safety Instructions for waste disposal

⚠ Caution

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

Revision History

Version	Date	Remark	Page
V 1.0	’06.5	First Edition	-
V 1.1	’06.12	Adds contents of XBF-DV04A	12-34

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

About User's Manual

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

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

Relevant User's Manuals

Title	Description
XGK-CPUA/CPUE/CPUH/CPUS	It describes specifications, system structure and EMC spec. correspondence of CPU module, power module, base, I/O module and increase cable
XG5000 User's Manual	It describes how to use XG5000 software especially about online functions such as programming, printing, monitoring and debugging by using XGT series products.
XGK Series Instructions & Programming	It is the user's manual for programming to explain how to use commands that are used PLC system with XGK CPU.

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Chapter 8 Built-in High-speed Counter Function .... 8-1~8-27

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Chapter 10 Built-in Communication Function .... 10-1 ~ 10-93

Chapter 11 Built-in PID Control Function .... 11-1 ~ 11-39

Chapter 12 Analog Input/Output Function .... 12-1~12-57

Chapter 13 Installation and Wiring .... 13-1~13-8

Chapter 14 Maintenance .... 14-1~14-2

Chapter 15 Troubleshooting .... 15-1~15-11

Chapter 1 Introduction

1.1 Guide to Use This Manual

This manual includes specifications, functions and handling instructions for the XGB series PLC.
This manual is divided up into chapters as follows:

No.	Title	Contents
Chapter 1	Introduction	Describes configuration of this manual, unit's features and terminology.
Chapter 2	System Configurations	Describes available units and system configuration in the XGB series.
Chapter 3	General Specifications	Describes general specifications of units used in the XGB series.
Chapter 4	CPU Specifications	Describes performances, specifications and operations.
Chapter 5	Program Configuration and Operation Method	
Chapter 6	CPU Module Functions	
Chapter 7	Input/Output Specifications	Describes operation of basic and input/output.
Chapter 8	Built-in High-speed Counter Function	Describes built-in high-speed counter functions.
Chapter 9	Built-in Positioning Function	Describes built-in positioning functions.
Chapter 10	Built-in Communication Function	Describes built-in communication functions.
Chapter 11	PID Control Function	Describes built-in PID control functions.
Chapter 12	Analog Input/Output Module	Describes expanded analog input/output module.
Chapter 13	Installation and Wiring	Describes installation, wiring and handling instructions for reliability of the PLC system.
Chapter 14	Maintenance	Describes the check items and method for long-term normal operation of the PLC system.
Chapter 15	Troubleshooting	Describes various operation errors and corrective actions.
Appendix 1	Flag List	Describes the types and contents of various flags.
Appendix 2	Dimension	Shows dimensions of the main units and expansion modules.
Appendix 3	Compatibility with MASTER-K	Describes the compatibility with MASTER-K.
Appendix 4	Instruction List	Describes the special relay and instruction list.

1.2 Features

The features of XGB system are as follows.

1) The system secures the following high performances.
- CPU Processing Speed(bit) : 160ns / Step
- Max. 480 I/O control supporting small & mid-sized system implementation(64 I/O shortly released)
- Max. 10kSteps of large program capacity secured.
- Expanded applications with the support of floating point.

2) Compact : the smallest size comparing to the same class model of competitors.
- Compact panel realized through the smallest size (only 170mm width if extended to 7 racks)
  - Main unit : W30 * H90 * D60mm
  - Expansion module : W20 * H90 * D60mm

3) Easy attachable/extensible system for improved user convenience.
- Easy attachable European terminal board and convenient-to-use MIL connector method improving convenient wiring.
- By adopting connector coupling method, modules may be easily connected and separated.

4) Improved maintenance ability with kinds of register, batter removed, comment backup and etc
- Convenient programming environment by providing analogue register and index register.
- Improved maintenance ability by operating plural programs and task program through module program.
- Built-in Flash ROM enabling permanent backup of program without any separate battery.
- Improved maintenance ability by types of comment backup.

5) Optimized communication environment.
- With max. 3 channels of internal COM (incl. loader), up to 3 channel communication is available without any increase of module.
- Supporting various protocols to improve the convenience (dedicated, mode-bus, user-defined communication)
- Communication module may be additionally increased by adding modules (up to 2 stages such as Cnet, Enet and etc).
- Convenient network-diagnostic function through network & communication frame monitoring.
- Convenient networking to upper systems through Enet or Cnet.

6) Applications expanded with a variety of I/O modules
- 8, 16, 32, 64 modules provided (if relay output, 8/16 module).
- Single input, single output and mixed I/O modules supported.

7) Applications expanded through analog-dedicated register design and full slottable mechanism.

- Prior to increase, slot analogue modules attachable (up to 7 stages available)
- With analog dedicated register(U) and monitoring dedicated function, convenient use of I/O is maximized(can designate operations using easy program of U area and monitoring function)

8) Integrated programming environment

- XG 5000 : intensified program convenience, diverse monitoring, diagnosis and editing function
- XG - PD : COM/network parameters setting, frame monitoring, protocol analysis function

9) Built-in high speed counter function

- Providing High-speed counter 1phase 4CH (max. : 20kpps), 2phase 2CH (max : 10kpps) and more additional functions.
- Providing parameter setting, diverse monitoring and diagnosis function using XG5000.
- Commissioning by monitoring of XG5000, without program, inspecting external wiring, data setting and others.

10) Built-in position control function

- Supporting max 100kpps 2 axes.
- Providing parameter setting, operation data collection, diverse monitoring and diagnosis by using XG5000.
- Commissioning by monitoring of XG5000, without program, inspecting external wiring and operation data setting.

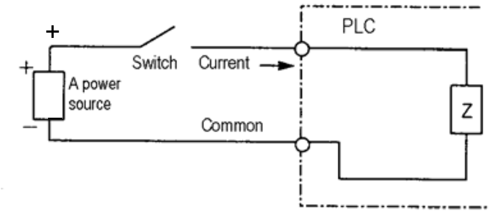
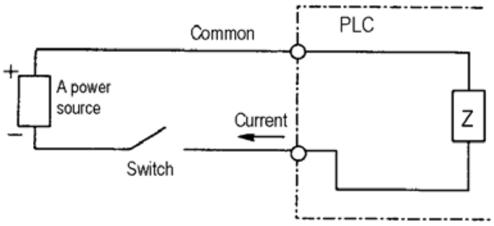
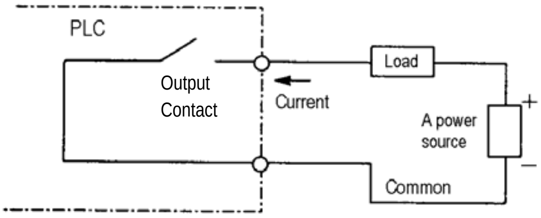
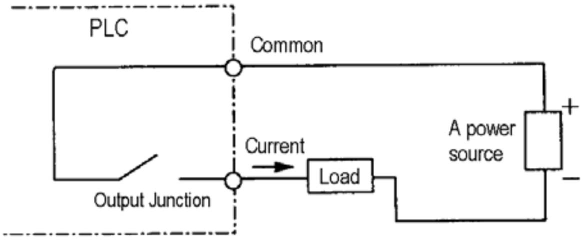
11) Built-in PID

- Supporting max. 16 loops.
- Setting parameters by using XG5000 and supporting loop status monitoring conveniently with trend monitor.
- Control constant setting through the improved Auto-tuning function.
- With many other additional functions including PWM output, ∆MV, ∆PV and SV Ramp, improving the control preciseness.
- Supporting types of control modes such as forward/backward mixed operation, 2-stage SV PID control, cascade control and etc.
- A variety of warning functions such as PV MAX and PV variation warning securing the safety.

1.3 Terminology

The following table gives definition of terms used in this manual.

Terms	Definition	Remark
Module	A standard element that has a specified function which configures the system. Devices such as I/O board, which inserted onto the mother board or bas unit.	Example) Expansion module, Special module, Communication module
Unit	A single module or group of modules that perform an independent operation as a part of PLC systems.	Example) Main unit, Expansion unit
PLC System	A system which consists of the PLC and peripheral devices. A user program can control the system.	
XG5000	A program and debugging tool for the MASTER-K series. It executes program creation, edit, compile and debugging. (PADT : Programming Added Debugging Tool)	
I/O image area	Internal memory area of the CPU module which used to hold I/O status.	
Cnet	Computer Network	
FEnet	Fast Ethernet Network	
Pnet	Profibus-DP Network	
Dnet	DeviceNet Network	
RTC	Abbreviation of 'Real Time Clock'. It is used to call general IC that contains clock function.	
Watchdog Timer	Supervisors the pre-set execution times of programs and warns if a program is not competed within the pre-set time.	

Terms	Definition	Remark
Sink Input	Current flows from the switch to the PLC input terminal if a input signal turns on.  	Z: Input impedance
Source Input	Current flows from the PLC input terminal to the switch after a input signal turns on.  	
Sink Output	Current flows from the load to the output terminal and the PLC output turn on.  	
Source Output	Current flows from the output terminal to the load and the PLC output turn on.  	

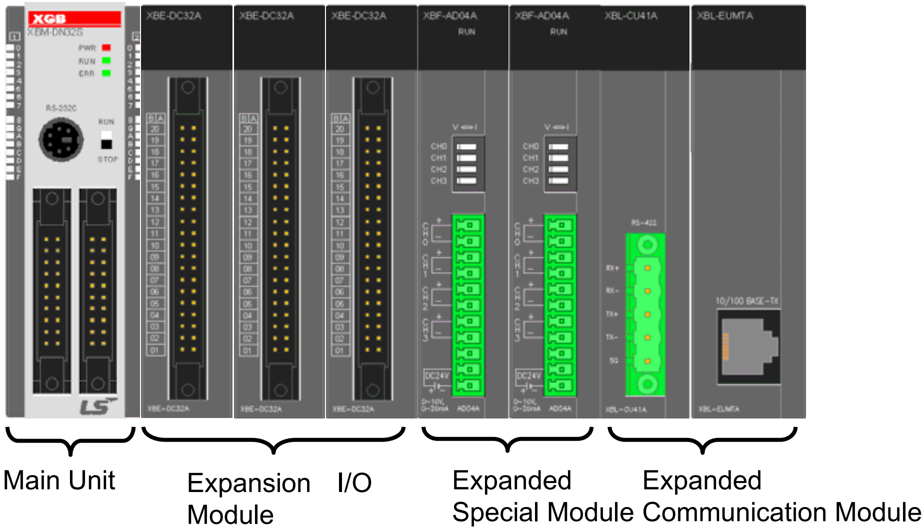
Chapter 2 System Configuration

The XGB series has suitable to configuration of the basic, computer link and network systems.

This chapter describes the configuration and features of each system.

2.1 XGB System Configuration

XGB series System Configuration is as follows. Expanded special module is available to connect maximum 7 stages and expanded communication module is available to connect maximum 2 stages.



Item			Description
Total I/O points			• 16 ~ 480 points
Maximum number of expansion modules	Digital I/O module		• Maximum 7
	A/D·D/A module		• Maximum 7
	Communication I/F module		• Maximum 2
Items	Main unit		• XBM-DR16S • XBM-DN16/32S
	Expansion module	Digital I/O module	• XBE-DC32A • XBE-TN32A • XBE-RY16A
		A/D·D/A module	• XBF-AD04A • XBF-DV04A
		Communication I/F module	• XBL-C41A • XBL-EFMT

2.2 Product List

XGB series' product list is as follows.

Types	Model	Description	Remark
Main Unit	XBM-DR16S	DC24V Power supply, DC24V Input 8 point, Relay output 8 point	
	XBM-DN16S	DC24V Power supply, DC24V Input 8 point, Transistor output 8 point	
	XBM-DN32S	DC24V Power supply, DC24V Input 16 point, Transistor output 16 point	
Expansion Unit	XBE-DC08A	DC24V Input 8 point	Scheduled
	XBE-DC16A	DC24V Input 16 point	
	XBE-DC32A	DC24V Input 32 point	
	XBE-RY08A	Relay output 8 point	Scheduled
	XBE-RY16A	Relay output 16 point	
	XBE-TN08A	Transistor output 8 point	Scheduled
	XBE-TN16A	Transistor output 16 point	
	XBE-TN32A	Transistor output 32 point	
	XBE-DN16A	DC24V Input 8 point, Transistor output 8 point	Scheduled
	XBE-DR16A	DC24V Input 8 point, Relay output 8 point	
	XBE-DN32A	DC24V Input 16 point, Transistor output 16 point	
	XBE-DN64A	DC24V Input 32 point, Transistor output 32 point	
Special Module	XBF-AD04A	Current/Voltage input 4 channel	
	XBF-DC04A	Current output 4 channel	Scheduled
	XBF-DV04A	Voltage output 4 channel	
	XBF-RD04A	RTD input 4 channel	Scheduled
	XBF-TC04A	TC input 4 channel	
Communication Module	XBL-C21A	Cnet (RS-232C/Modem)	Scheduled
	XBL-C41A	Cnet (RS-422/485)	
	XBL-EFMT	Enet module	
	XBL-EDMT	Ethernet Interface dedicated LS industrial systems	Scheduled

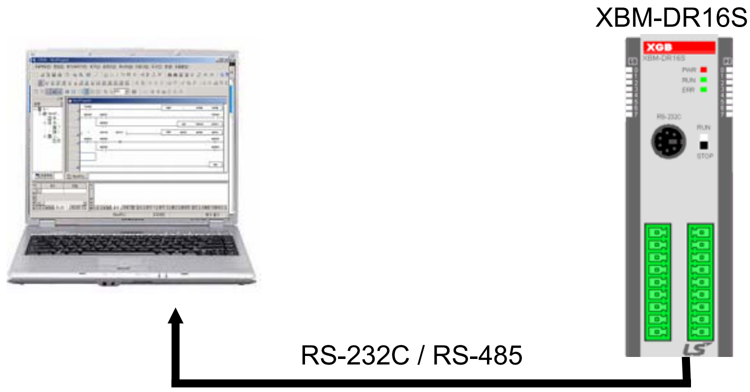
2.3 System Configuration

2.3.1 Cnet system

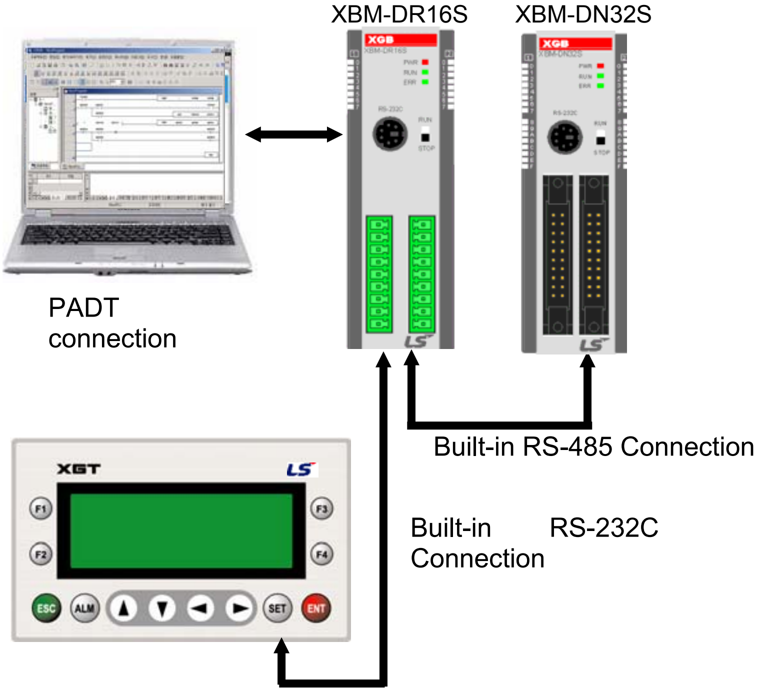
Cnet I/F System is used for communication between the main unit and external devices using RS-232C/RS-422 (485) Interface. The XGB series has a built-in RS-232C port, RS-485 port and has also XBL-C21A for RS-232C, XBL-C41A for RS-422/485. It is possible to construct communication systems on demand.

1) 1:1 communication system

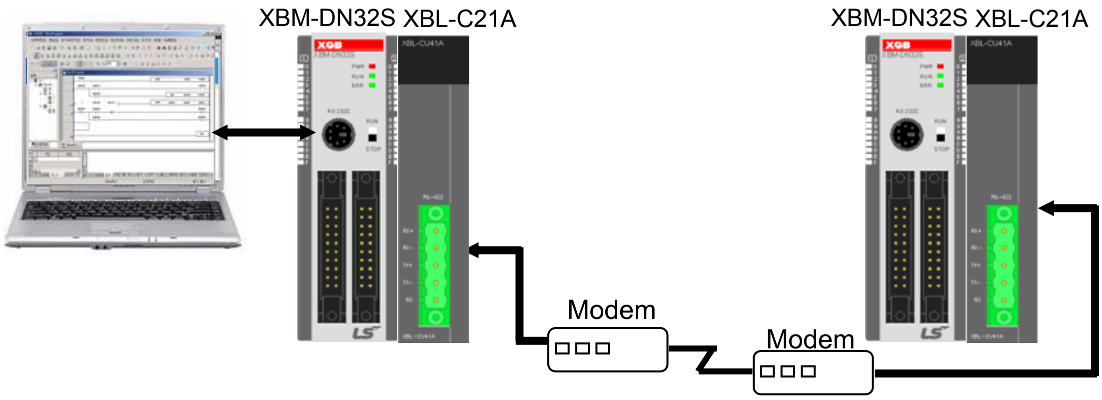
(1) 1:1 ratio of an external device (computer) to main unit using a built-in port (RS-232C/RS-485)

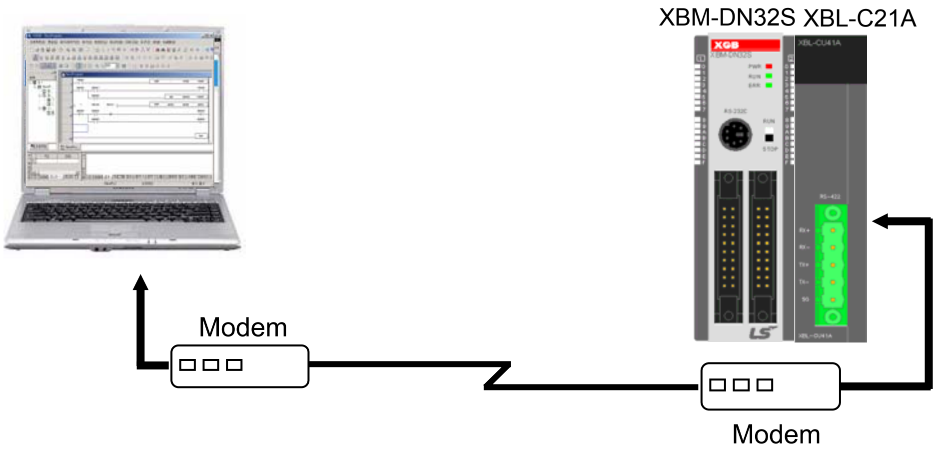


(2) 1:1 ratio to main unit using a built-in RS-485 port
(In case of built-in RS-232C, connect to HMI device.)

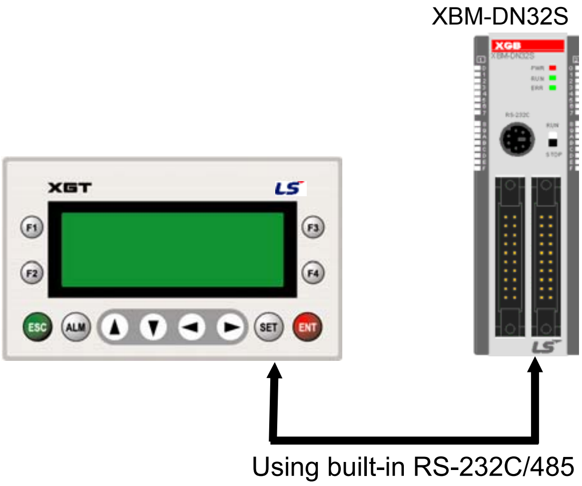


(3) RS-232C Communication over long distance via modem by Cnet I/F modules



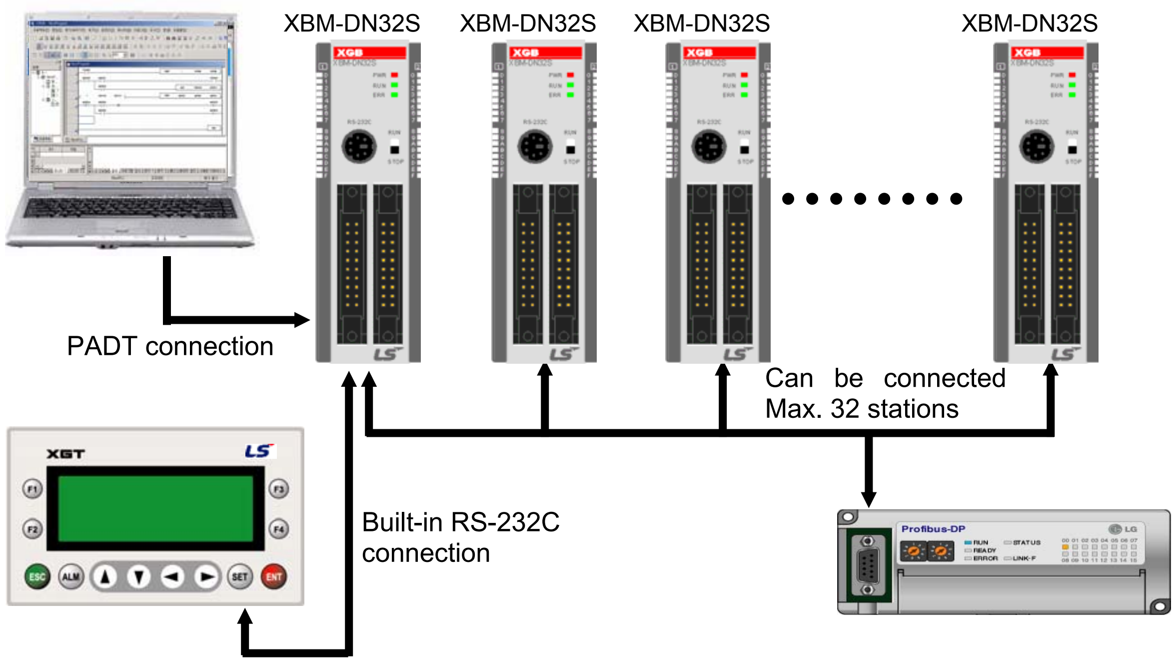


(4) 1:1 ratio of an external device (monitoring unit) to main unit using a built-in RS-232C/485 port.

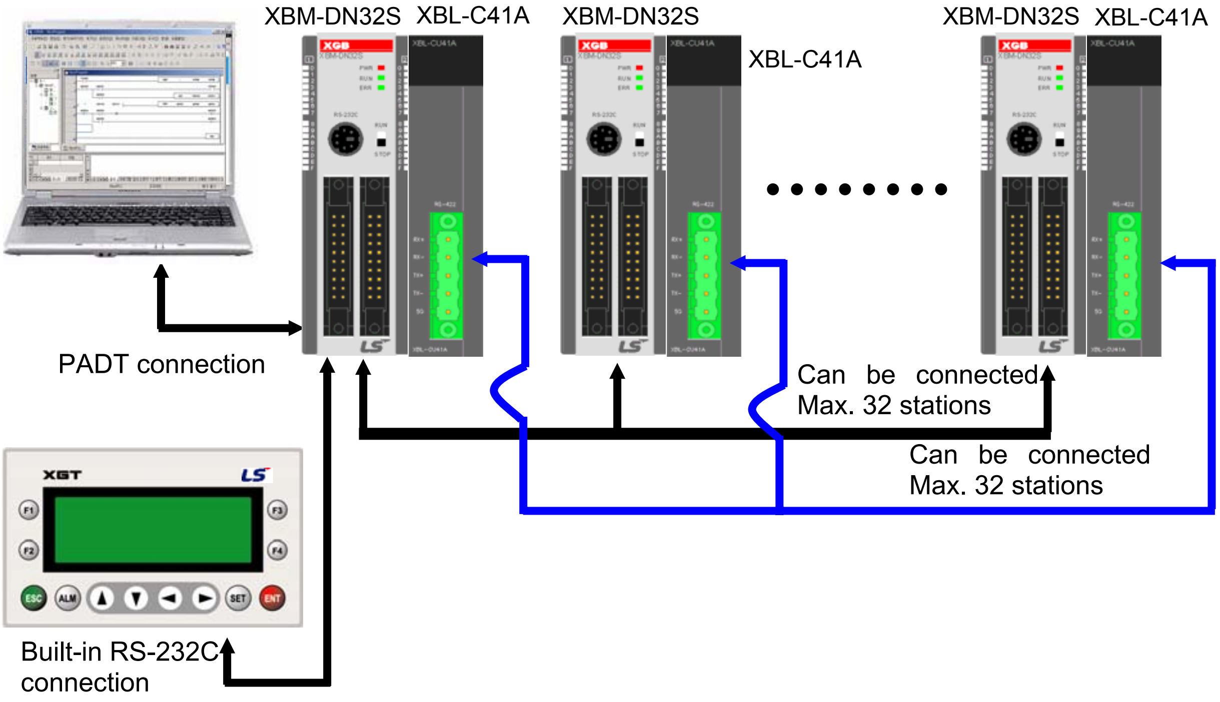


2) 1:n Communication system

(1) Using RS-485 built-in function can connect between one computer and multiple main units for up to 32 stations.



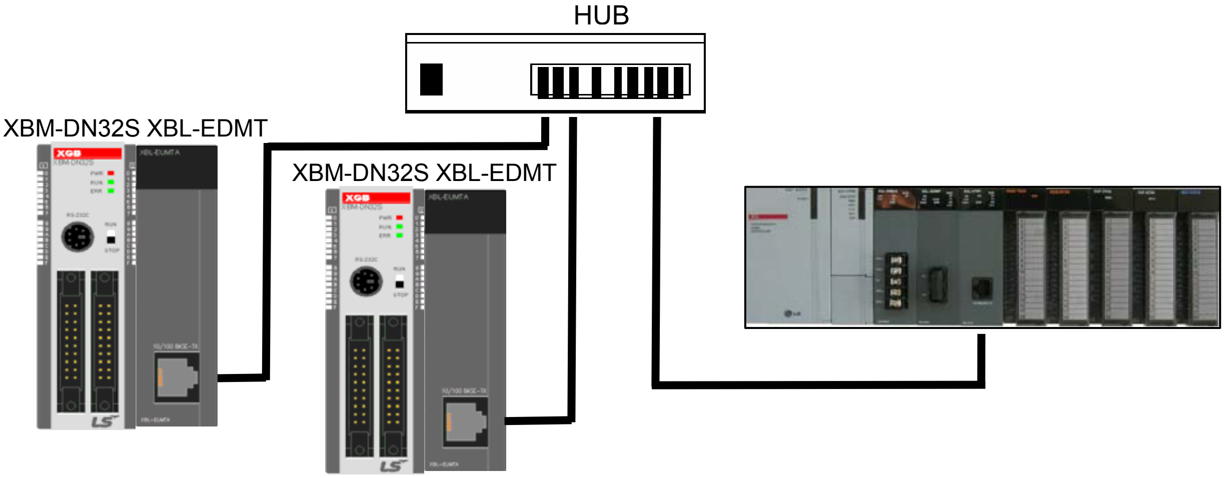
(2) Using RS-485 built-in function/expansion Cnet I/F module can be connect for up to 32 stations.



* Refer to ‘Chapter 10 Built-in Communication Function’ for details.

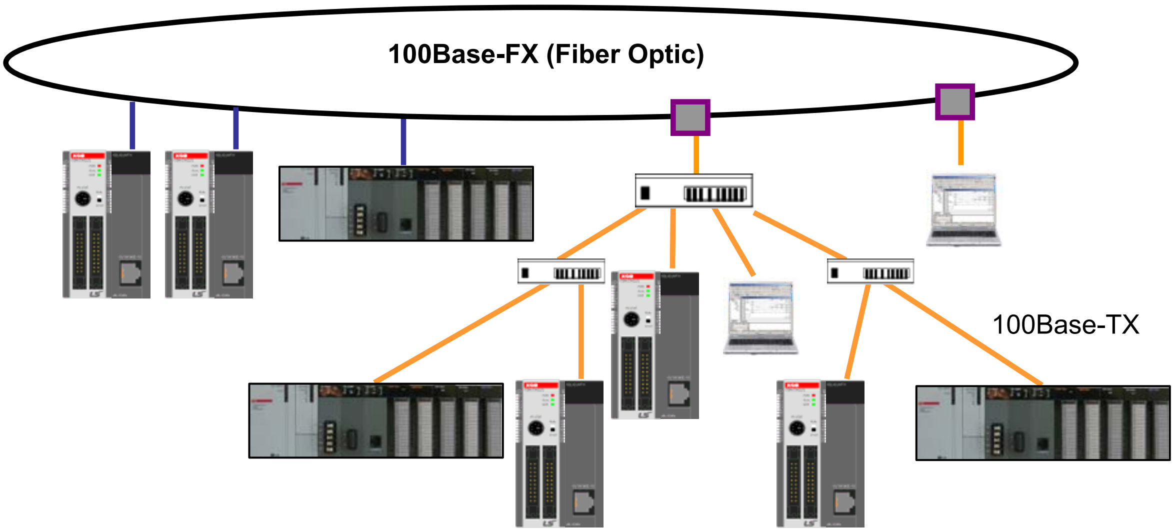
2.3.2 Dedicated network system

Dedicated network system is consist of LS PLC.(**F**ast **D**edicated **E**ther**net** I/F module)



2.3.3 Ethernet system

Ethernet is a network standard of communication. Ethernet uses the CSMA/CD access method to handle simultaneous demands. It is one of the most widely implemented LAN standards.



Refer to XGB Expansion network system for more details.

Chapter 3 General Specifications

3.1 General Specifications

The General Specification of XGB series is as below.

<table>
<tr><th>No.</th><th>Items</th><th colspan="4">Specification</th><th>Reference</th></tr>
<tr><td>1</td><td>Ambient Temp.</td><td colspan="4">0 ~ 55 °C</td><td rowspan="5">-</td></tr>
<tr><td>2</td><td>Storage Temp.</td><td colspan="4">−25 ~ +70 °C</td></tr>
<tr><td>3</td><td>Ambient humidity</td><td colspan="4">5 ~ 95%RH (Non-condensing)</td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="4">5 ~ 95%RH (Non-condensing)</td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Vibration</td><td colspan="3">Occasional vibration</td><td>-</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Pulse width</td><td>Times</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10 ≤ f < 57Hz</td><td>−</td><td>0.075mm</td><td rowspan="6">10 times
each
direction
(X,Y and Z)</td></tr>
<tr><td>57 ≤ f ≤ 150Hz</td><td>9.8m/s² (1G)</td><td>−</td></tr>
<tr><td colspan="3">Continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Pulse width</td></tr>
<tr><td>10 ≤ f < 57Hz</td><td>−</td><td>0.035mm</td></tr>
<tr><td>57 ≤ f ≤ 150Hz</td><td>4.9m/s² (0.5G)</td><td>−</td></tr>
<tr><td>6</td><td>Shocks</td><td colspan="4">• Peak acceleration : 147 m/s² (15G)
• Duration : 11ms
• Pulse wave type : Half-sine (3 times each direction per each axis)</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Impulse noise</td><td>Square wave impulse noise</td><td colspan="3">±1,500 V</td><td>LSIS standard</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="3">Voltage: 4kV (Contact discharge)</td><td>IEC61131-2
IEC61000-4-2</td></tr>
<tr><td>Radiated electromagnetic field noise</td><td colspan="3">27 ~ 500 MHz, 10V/m</td><td>IEC61131-2,
IEC61000-4-3</td></tr>
<tr><td rowspan="2">Fast transient /Burst noise</td><td>Classification</td><td>Power supply</td><td>Digital/Analog Input/Output, Communication Interface</td><td rowspan="2">IEC61131-2
IEC61000-4-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td>1kV</td></tr>
<tr><td>8</td><td>Operation ambience</td><td colspan="4">Free from corrosive gases and excessive dust</td><td rowspan="4">-</td></tr>
<tr><td>9</td><td>Altitude</td><td colspan="4">Less than 2,000m</td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="4">Less than 2</td></tr>
<tr><td>11</td><td>Cooling method</td><td colspan="4">Air-cooling</td></tr>
</table>

Notes

1) IEC(International Electrotechnical Commission)

: An 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 to indicate 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.

Chapter 4 CPU Specifications

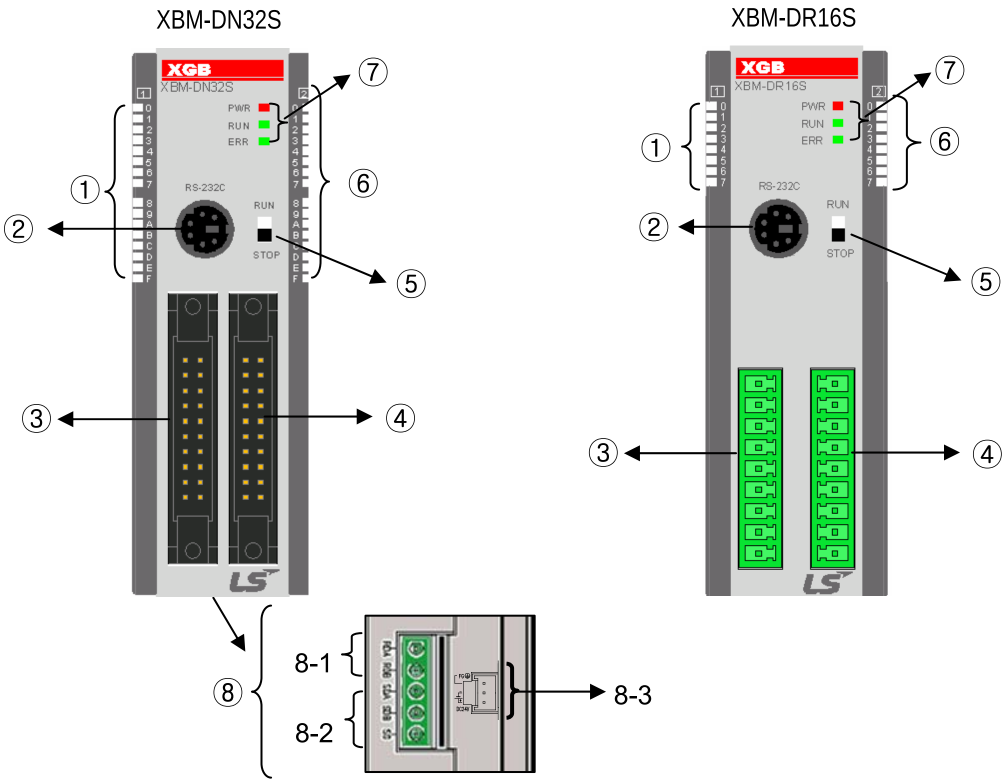
4.1 Performance Specifications

The following table shows the general specifications of the XGB CPU module (XBM-DR16S,XBM-DN16S,XBM-DN32S).

Items		Specifications			Remark
		XBM-DR16S/XBM-DN16S/XBM-DN32S			
Program control method		Cyclic execution of stored program, Time-driven interrupt, Process-driven interrupt			-
I/O control method		Batch processing by simultaneous scan (Refresh method), Directed by program instruction			
Program language		Ladder Diagram, Instruction List			
Number of instructions	Basic	28			
	Application	677			
Processing speed (Basic instruction)		0.16 ㎲/Step			
Program capacity		10ksteps			
Max. I/O points		480 point (Main + Expansion 7 stages)			
Data area	P	P0000 ~ P127F (2,048 point)			
	M	M0000 ~ M255F (4,096 point)			
	K	K00000 ~ K2559F(Special area: K2600~2559F) (40,960 point)			
	L	L00000 ~ L1279F (20,480 point)			
	F	F000 ~ F255F (4,096 point)			
	T	100ms, 10ms, 1ms : T000 ~ T255 (Adjustable by parameter setting)			
	C	C000 ~ C255			
	S	S00.00 ~ S127.99			
	D	D0000 ~ D5119(5120 word)			Word
	U	U00.00 ~ U07.31(Analog data refresh area: 256 word)			
	Z	Z000~Z127(128 Word)			
	N	N0000~N3935(3936 Word)			
Total program		128			-
Initial task		1 (_INT)			
Cyclic task		Max. 8			
I/O task		Max. 8			
Internal device task		Max. 8			
Operation mode		RUN, STOP, DEBUG			
Self-diagnosis function		Detects errors of scan time, memory, I/O and power supply			
Program port		RS-232C(Loader), RS-232C , RS-485			
Back-up method		Latch area setting in basic parameter			
Internal consumption current		400 mA	240 mA	300 mA	
Weight		140 g	100 g	110 g	

Items			Specifications	Remark
			XBM-DxxxS	
Built-in function	PID control function		Controlled by instructions, Auto-tuning, PWM output, Manual output, Adjustable operation scan time, Anti Windup, Delta MV function, SV-Ramp function	-
	Cnet I/F function		Dedicated protocol support MODBUS protocol support User defined protocol support RS-232C 1 port RS-485 1 port	
	High-speed counter	Capacity	1 phase: 20 kHz 4 channel 2 phase: 10 kHz 2 channel	
		Counter function	4 different counter modes according to input pulse and addition/subtraction method • 1 phase pulse input: addition/subtraction counter • 1 phase pulse input: addition/subtraction counter by B phase • 2 phase pulse input: addition/subtraction counter • 2 phase pulse input: addition/subtraction by phase differences	
		Additional function	• Internal/External preset function • Latch counter function • Comparison output function • Revolution number per unit time function	
	Positioning function	Operation specification	No. of control axis: 2 axis Control method: position/speed control Control unit: pulse Positioning data: 30 data/axis (operation step No. 1~20) Operation mode: End/Keep/Continuous Operation method: Single, Repeated operation	TR output type support
		Positioning function	Positioning method : Absolute / Incremental Address range : -2,147,483,648 ~ 2,147,483,647 Speed : Max. 100kpps(setting range 1 ~ 100,000) Acceleration / Deceleration method : trapezoidal method	
		Return to Origin	Origin detection when approximate origin turns off Origin detection when approximate origin turns on. Origin detection by approximate origin.	
		JOG operation	Setting range : 1~100,000 (High / Low speed)	
		Additional function	Inching operation, Speed synchronizing operation, Position synchronizing operation, linear interpolation operation etc.	
	Pulse catch		Pulse width: 50 ㎲ 8 point (P0000 ~ P0007)	-
	External interrupt		8 point: 50 ㎲ 8point (P0000 ~ P0007)	
	Input filter		Select among 1,3,5,10,20,70,100 ㎳(Adjustable)	

4.2 Names of Part and Function



No.	Name	Description
①	Input indicator LED	▪ Input indicator LED
②	PADT connecting connector	▪ PADT connecting connector
③	Input connector and terminal block	▪ Input connector and terminal block
④	Output connector and terminal block	▪ Output connector and terminal block
⑤	Key switch	▪ RUN / STOP Key switch In case of STOP mode, Remote mode changeable.
⑥	Output indicator LED	▪ Output indicator LED
⑦	Status indicator LED	It indicates CPU module's status. ▪ PWR(Red) : Power status ▪ RUN(Green) : RUN status STOP mode : Off/ RUN mode : On ▪ Error(Red): In case of error, it is flickering.

No.	Name		Description
⑧	8-1	Built-in RS-485 connecting connector	• Built-in RS-485 connecting connector - "+" , "-" terminal connecting connector in RS-485 communication
	8-2	Built-inRS-232C connecting connector	• Built-in RS-232C connecting connector - "TxD" , "RxD" , "GND" terminal connecting connector in RS-232C communication
	8-3	Power supply connector	• Power supply connector (24V)

4.3 Power Supply Specifications

It describes the power supply specification of main unit.

Items		Specification
Input	Rated voltage	DC24V
	Input voltage range	DC20.4~28.8V(-15%, +20%)
	Inrush current	70APeak or less
	Input current	1A (Typ.550 ㎃)
	Efficiency	60% or more
	Permitted momentary power failure	Less than 10 ㎳
Output	Output voltage	DC5V (±2%)
	Output current	1.5 A
Power supply status indication		LED On when power supply is normal
Cable specification		0.75 ~ 2 mm^2

* Use the power supply which has 4 A or more fuse for protecting power supply.

1) Consumption current (DC 5V)

Type	Model	Consumption current (Unit : ㎃)
Main unit	XBM-DR16S	400
	XBM-DN16S	240
	XBM-DN32S	300
Expansion I/O module	XBE-DC32A	50
	XBE-RY16A	420
	XBE-TN32A	120
Expansion special module	XBF-AD04A	50
	XBF-DV04A	50
Expansion communication module	XBL-C21A	150
	XBL-EFMT	200

4.4 Calculation Example of Consumption Current/Voltage

Consumption of current/voltage is calculated as follows.

Type	Model	Unit No.	Internal 5V consumption current (Unit : ㎃)	Remark
Main unit	XBM-DN16S	1	240	In case of all LED is On. (Maximum consumption current)
Expansion module	XBE-DC32A	2	100	
	XBE-TN32A	2	160	
	XBF-AD04A	1	50	All channel is used. (Maximum consumption current)
	XBF-DC04A	1	50	
	XBL-C21A	1	150	
Consumption current	830 ㎃			-
Consumption voltage	4.15 W			-

Remark

Calculating of consumption current is based on maximum consumption current. In application system, the consumption current is consumed less than above calculation.

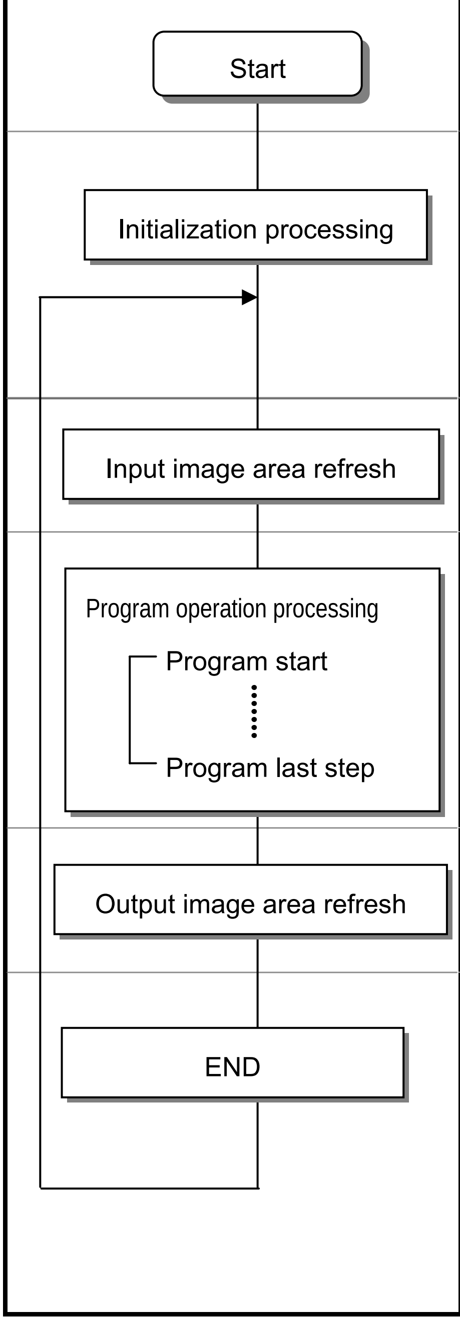
Chapter 5 Program Configuration and Operation Method

5.1 Program Instruction

5.1.1 Program execution methods

1) Cyclic operation method (Scan)

This is a basic program proceeding method of PLC that performs the operation repeatedly for the prepared program from the beginning to the last step, which is called 'program scan'. The series of processing like this is called 'cyclic operation method'. The processing is divided per stage as below.



Stage	Processing description
Start	-
Initialization processing	• A stage to start the scan processing which is executed once when power is applied or Reset is executed, as below. ▸ Self-diagnosis execution ▸ Data clear ▸ Address allocation of I/O module and type register • If initializing task is designated, Initializing program is executed.
Input image area refresh	• Reads the state of input module and saves it in input image area before starting the operation of program.
Program operation processing Program start Program last step	• Performs the operation in order from the program start to last step.
Output image area refresh	• Performs the operation in order from the program start to last step.
END	• A processing stage to return to the first step after CPU module completes 1 scan processing and the processing performed is as below. ▸ Update the current value of timer and counter etc. ▸ User event, data trace service ▸ Self-diagnosis ▸ High speed link, P2P e-Service ▸ Check the state of key switch for mode setting

2) Interrupt operation (Cycle time, Internal device)

This is the method that stops the program operation in proceeding temporarily and carries out the operation processing which corresponds to interrupt program immediately in case that there occurs the status to process emergently during PLC program execution.

The signal to inform this kind of urgent status to CPU module is called ‘interrupt signal’. There is a Cycle time signal that operates program every appointed time and external interrupt signal that operates program by external contact (I/O; P000~P007). Besides, there is an internal device start program that starts according to the state change of device assigned inside.

3) **Constant Scan (Fixed Period)**

This is the operation method that performs the scan program every appointed time. This stands by for a while after performing all the scan program, and starts again the program scan when it reaches to the appointed time. The difference from constant program is the update of input/output and the thing to perform with synchronization.

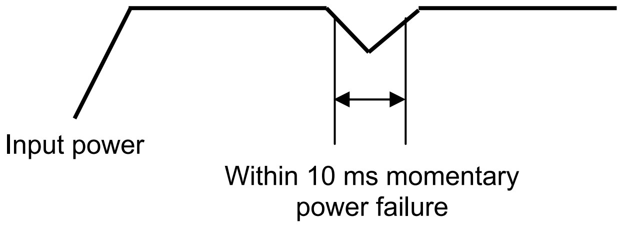
At constant operation, the scan time indicates the net program processing time where the standby time is deducted. In case that scan time is bigger than ‘constant’, [F0005C] ‘_CONSTANT_ER’ flag shall be ‘ON’.

5.1.2 Operation processing during momentary power failure

CPU module detects the momentary power failure when input power voltage supplied to power module is lower than the standard. If CPU module detects the momentary power failure , it carries out the operation processing as follows.

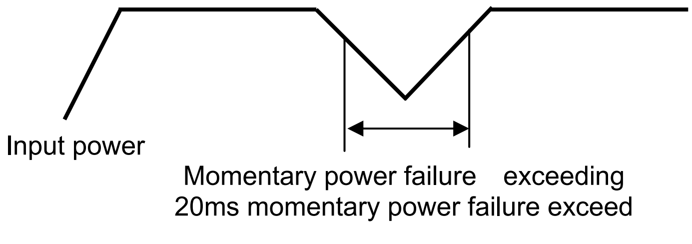
If momentary power failure within 10 ms is occurred, main unit (CPU) keeps the operation. But, if momentary power failure above 10 ㎳, the operation is stop and the output is Off. Restart processing like at power input shall be performed.

1) Momentary power failure within 10 ms



- CPU keeps the operation.

2) Momentary power failure exceeding 10 ms



- Restart processing like at power input shall be performed.

Remark

1) Momentary power failure?

This means the state that the voltage of supply power at power condition designated by PLC is lowered as it exceeds the allowable variable range and the short time (some ms ~ some dozens ms) interruption is called ‘momentary power failure).

5.1.3 Scan time

The processing time from program step 0 to the next step 0 is called ‘Scan Time’.

Scan time is the sum of the processing time of scan program and interrupt program prepared by the user and PLC internal time, and is distinguished by the following formula.

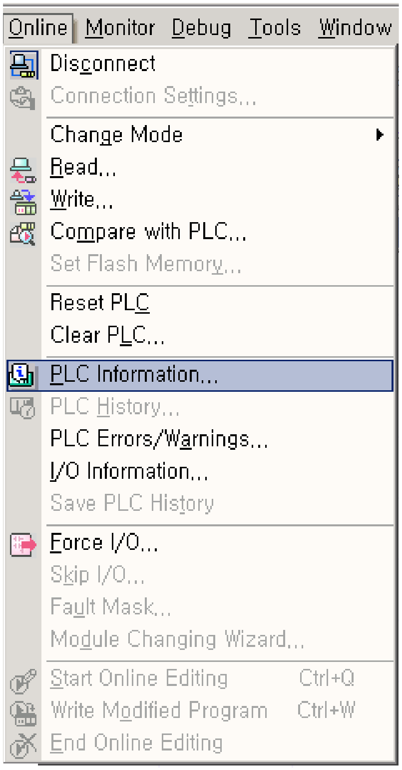
(1) Scan time = Scan program processing time ＋ Interrupt program processing time ＋ PLC internal processing time

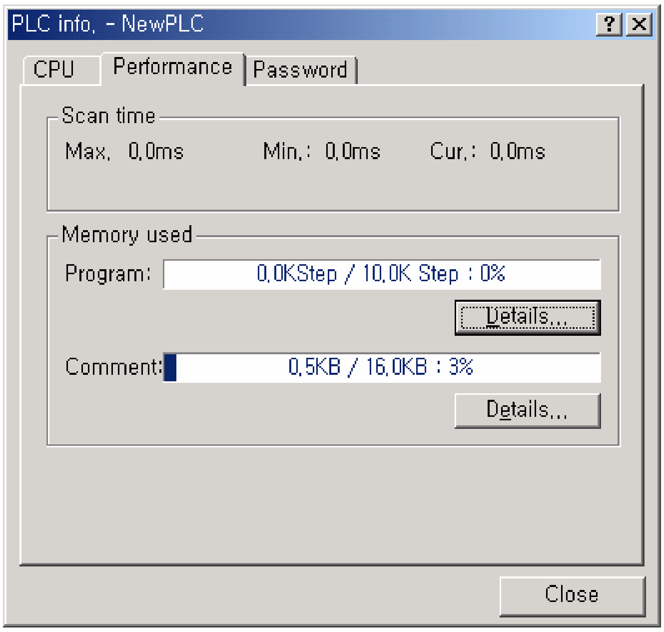
- Scan program processing time = processing time of user program not saved as interrupt program
- Interrupt program processing time = Sum of interrupt program proceeding time processed during 1 scan
- PLC internal processing time = Self-diagnosis time ＋ I/O refresh time ＋ Internal data processing time ＋ Communication service processing time

(2) Scan time depends on whether to execute interrupt program and communication processing.

2) Scan time monitor

(1) Scan time can be monitored 『Online』 - 『PLC Information』 - 『Performance』.





Max. 0.0ms Min.: 0.0ms Cur.: 0.0ms

Program: 0.0KStep / 10.0K Step : 0%

Comment: 0.5KB / 16.0KB : 3%

(2) Scan time is save in special relay (F) area as follows.

- F0050 : max. value of scan time (unit: 0.1 ms)
- F0051 : min. value of scan time (unit: 0.1 ms)
- F0052 : current value of scan time (unit: 0.1 ms)

5.1.4 Scan Watchdog timer

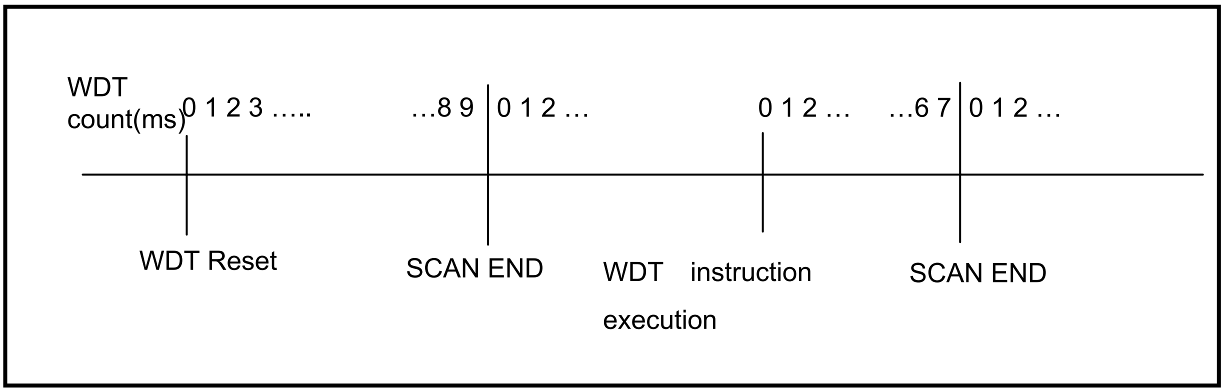
WDT (Watchdog Timer) is the function to detect the program congestion by the error of hardware and software of PLC CPU module.

1) WDT is the timer used to detect the operation delay by user program error. The detection time of WDT is set in Basic parameter of XG5000.

2) If WDT detects the excess of detection setting time while watching the elapsed time of scan during operation, it stops the operation of PLC immediately and makes the output all off.

3) If the excess of Scan Watchdog Time is expected in the program processing of specific part while performing the user program (FOR ~ NEXT instruction, CALL instruction), clear the timer by using 'WDT' instruction.
'WDT' instruction initializes the elapsed time of Scan Watchdog Timer and starts the time measurement from 0 again.
(For further information of WDT instruction, please refer to Instruction.)

4) To clear the error state of watchdog, we can use the following method : power re-supply, manipulation of manual reset switch, mode conversion to STOP mode.



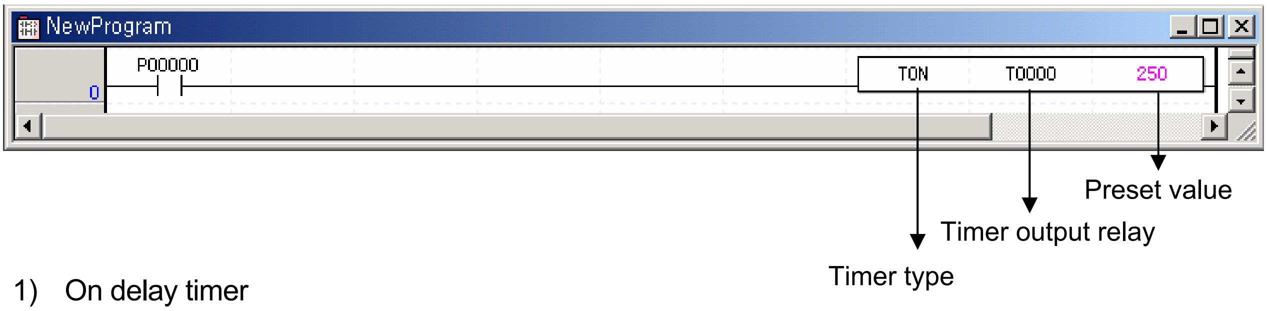
Remark

1) The setting range of Watchdog Timer is 10 ~ 1000ms (Unit: 1ms).

5.1.5 Timer processing

The XGB series use up count timer. There are 5 timer instructions such as on-delay (TON), off-delay (TOFF), integral (TMR), monostable (TMON), and re-triggerable (TRTG) timer.

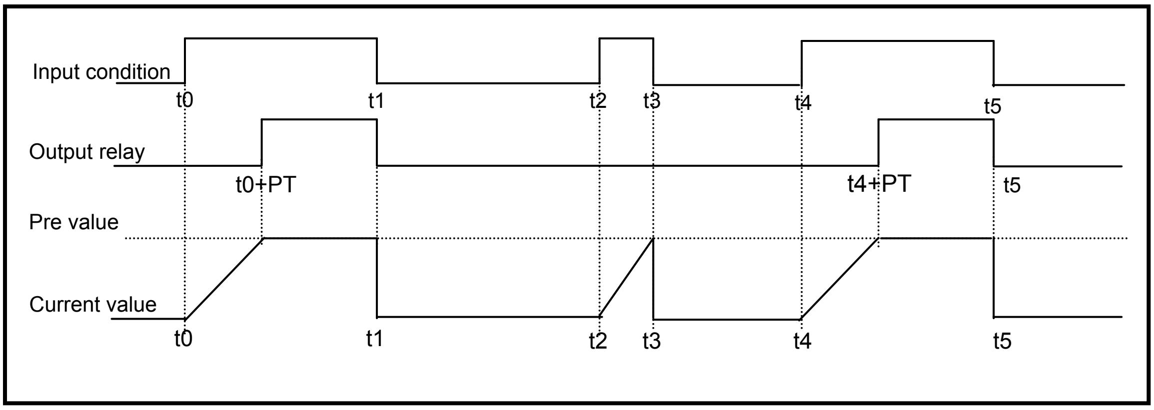
The measuring range of 100msec timer is 0.1 ~ 6553.5 seconds, 10msec timer is 0.01 ~ 655.35 seconds, and that of 1msec timer is 0.001 ~ 65.53 seconds. Please refer to the ‘XG5000 User manual’ for details.



1) On delay timer

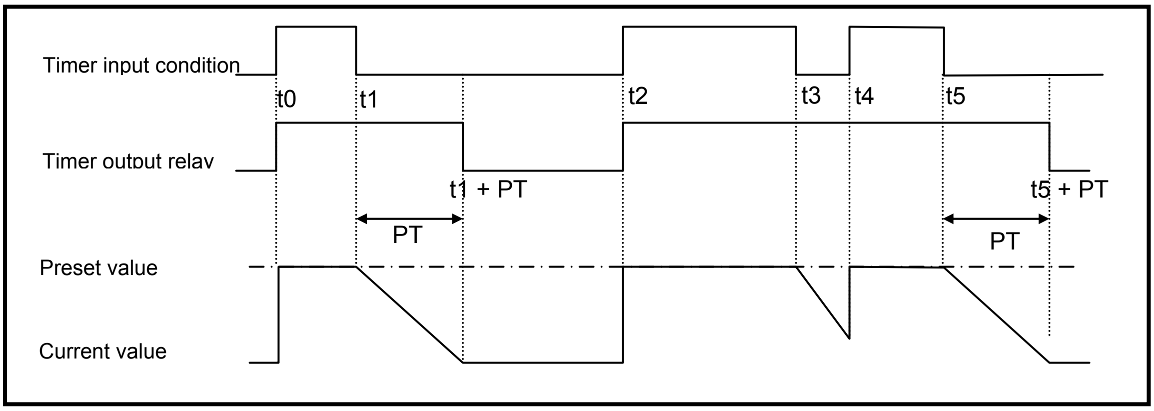
The current value of timer starts to increase from 0 when the input condition of TON instruction turns on. When the current value reaches the preset value, the timer output relay turns on.

When the timer input condition is turned off, the current value becomes 0 and the timer output relay is turned off.



2) Off delay timer

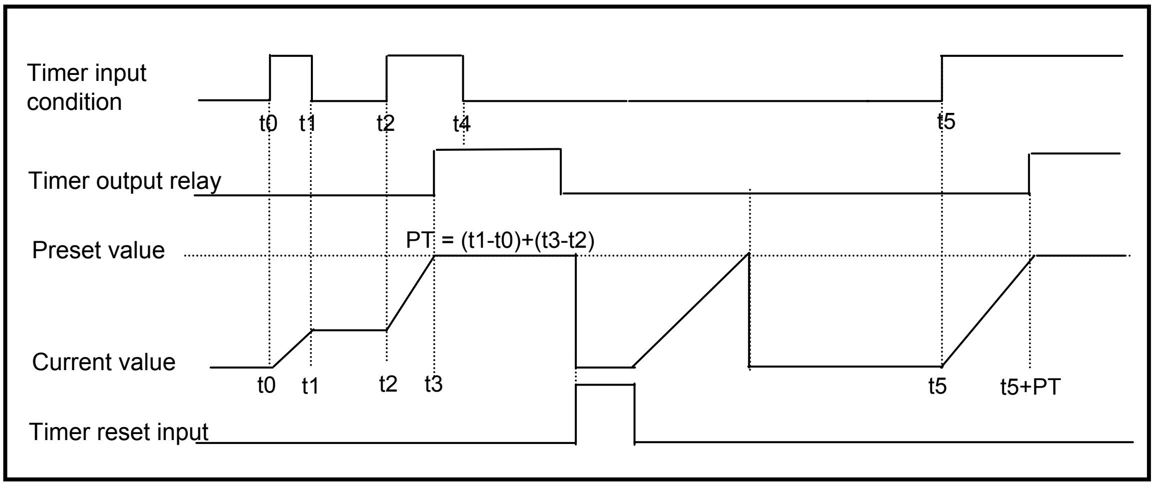
The current value of timer set as preset value and the timer output relay is turned on when the input condition of TOFF instruction turns on. When the input condition is turned off, the current value starts to decrease. The timer output relay is turned off when the current value reaches 0.



3) Integral timer

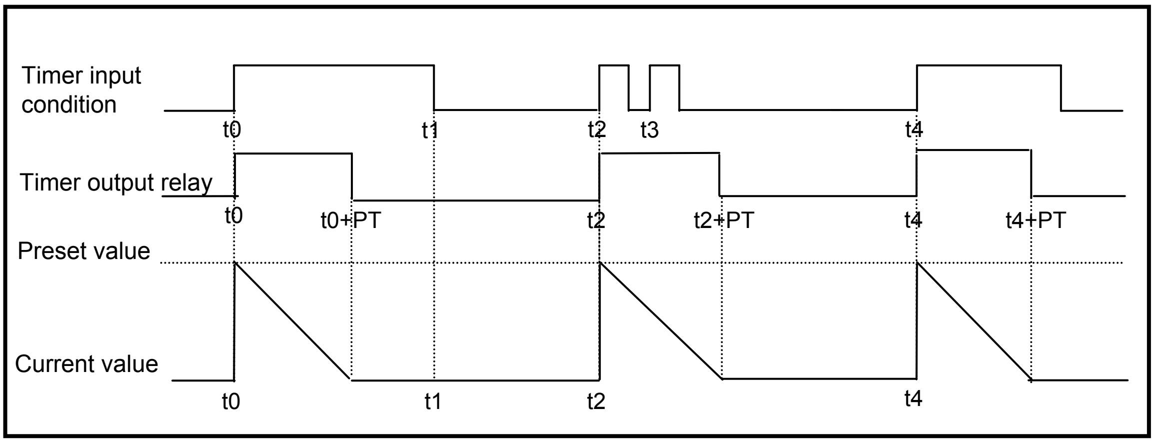
In general, its operation is same as on-delay timer. Only the difference is the current value will not be clear when the input condition of TMR instruction is turned off. It keeps the elapsed value and restart to increase when the input condition is turned on again. When the current value reaches preset value, the timer output relay is turned on.

The current value can be cleared by the RST instruction only.



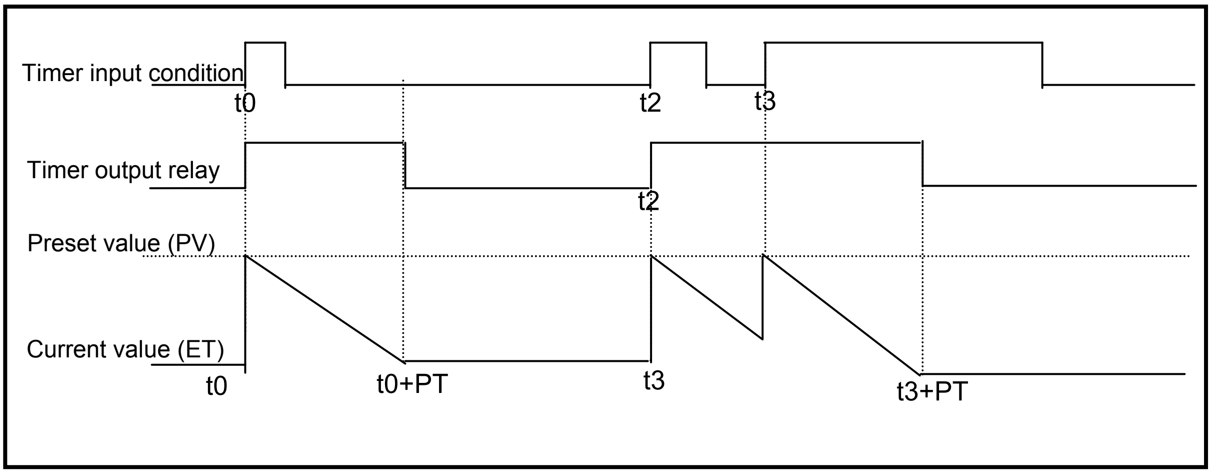
4) Monostable timer

In general, its operation is same as off-delay timer. However, the change of input condition is ignored while the timer is operating (decreasing). When current value reaches preset value the timer output relay is turned off and current value is cleared.



5) Retriggerable timer

The operation of retriggerable timer is same as that of monostable timer. Only difference is that the retriggerable timer is not ignore the input condition of TRTG instruction while the timer is operating (decreasing). The current value of retriggerable timer will be set as preset value whenever the input condition of TRTG instruction is turned on.



Remark

The Maximum timing error of timers of XGB series is '1 scan time + the time from 0 step to timer instruction'

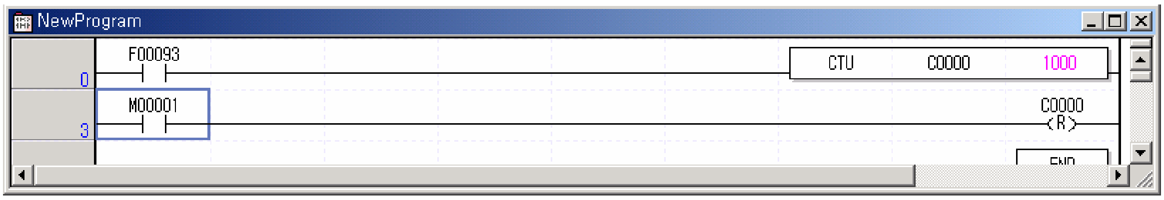
5.1.6 Counter processing

The counter counts the rising edges of pulses driving its input signal and counts once only when the input signal is switched from off to on. XGB series have 4 counter instructions such as CTU, CTD, CTUD, and CTR. The followings shows brief information for counter operation. Refer to the ‘XGB Instruction Manual’ for details.

- Up counter increases the current value.
- Down counter decreases the current value.
- Up/Down counter compares the input value from both counters input.
- Ring counter increase the current value and the current value is cleared as 0 when the current value reaches the preset value.

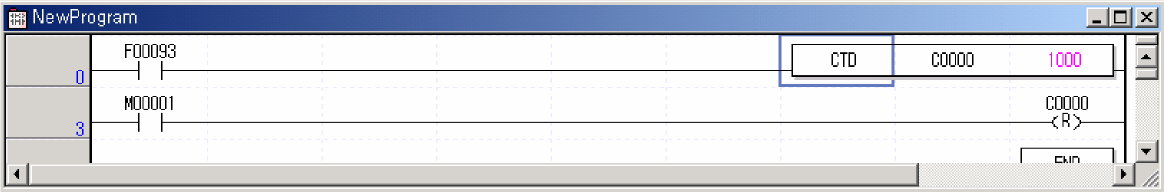
1) Renewal of counter’s current value and contact On/Off

(1) Up counter



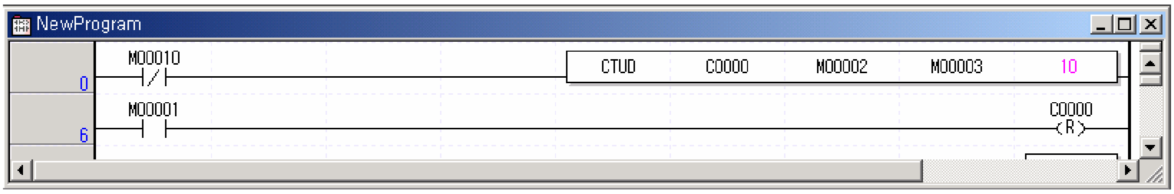
- Up counter increases the current value at the rising edges of input.
- The counter output contact (Cxxx) is turned On when the current value reaches the preset value. When the reset input is turned On, the counter output contact (Cxxx) is turned Off.

(2) Down counter



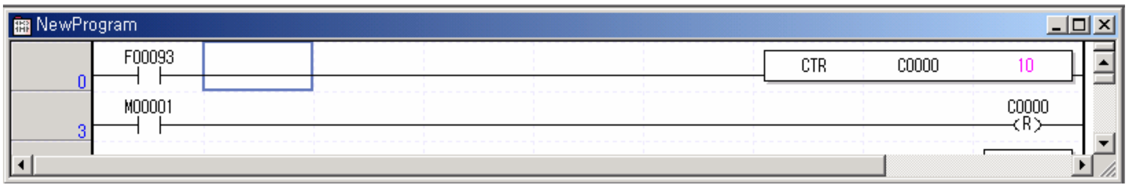
- Down counter decreases the current value at the rising edges of input.
- The counter output contact (Cxxx) is turned On when the current value reaches the preset value. When the reset input is turned On, the counter output contact (Cxxx) is turned Off.

(3) Up/Down counter



- The current value is increased with the rising edge of up-count input signal, and decreased with the rising edge of down-count input signal. The counter output contact (Cxxx) is turned On when the current value is same as or more than current value. The counter output contact (Cxxx) is turned Off when the current value is same as or less than current value.
- When the reset input is turned On, the current value is cleared as 0.

(4) Ring counter



- The current value is increased with the rising edge of the counter input signal, and the counter output contact (Cxxx) is turned on when the current value reaches the preset value. Then the current value and counter output contact (Cxxx) is cleared as 0 when the next rising edge of the counter input signal is applied.
- When the reset input is turned On, the counter output contact is cleared as 0.

2) Maximum counting speed

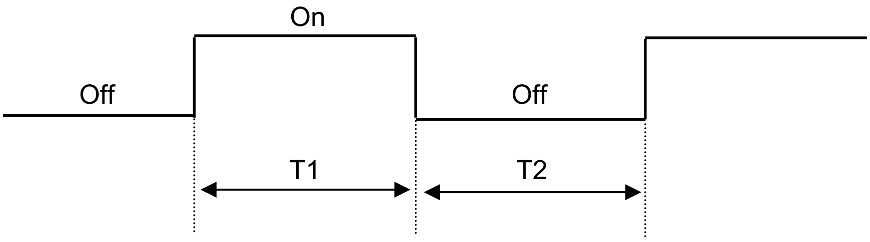
The maximum counting speed of determined by the length of scan time. Counting is possible only when the on/off switching time of the counter input signal is longer than scan time.

Maximum counting speed $C_{max} = \frac{n}{100} \times (\frac{1}{t_S})$

n : duty (%)

t_S : scan time [s]

- Duty is the ratio of the input signal's on time to off time as a percentage.



If T1 $\leq$ T2, n = $\frac{T1}{T1+T2}$ x 100 [%]

If T1 > T2, n = t2———— x 100 [%]

5.2 Program Execution

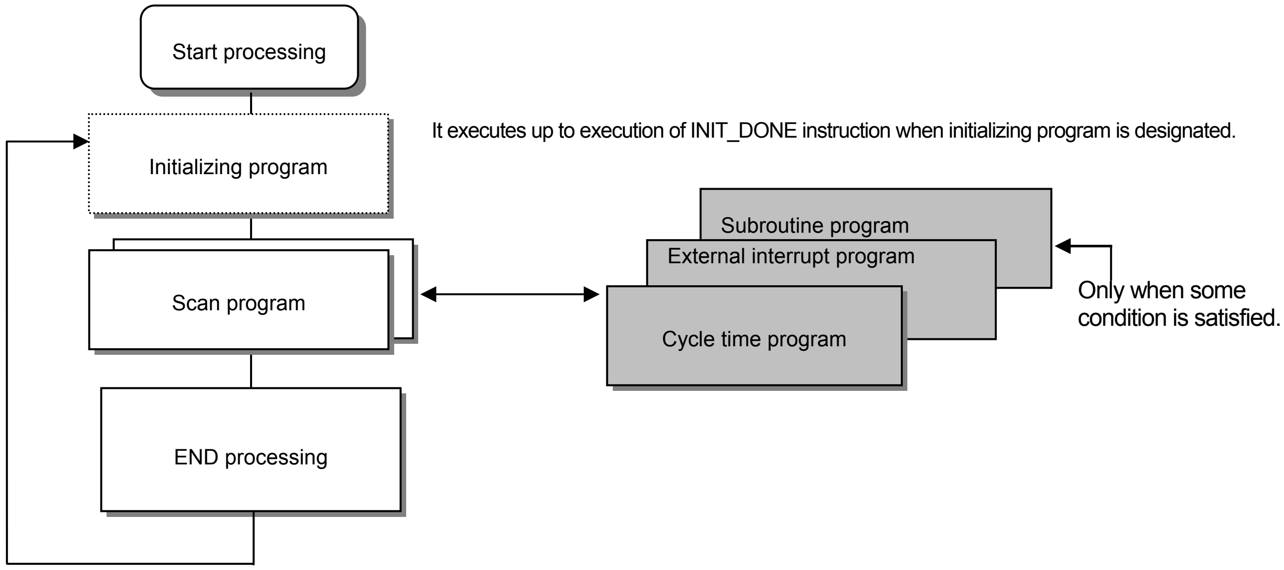
5.2.1 Configuration of program

All functional elements need to execute a certain control process are called as a ‘program’. Program is stored in the built-in RAM mounted on a CPU module or flash memory of a external memory module. The following table shows the classification of the program.

Program type	Description
Initializing program	• It will be executed till the specific Flag ‘INIT_DONE’ is On. And while the initialization task is executed, several of initializing program is programmed. (If INIT_DONE instruction is executed, scan program is executed.)
Scan program	• The scan program is executed regularly in every scan.
Cycle time interrupt program	• The program is performed according to the fixed time interval in case that the required processing time condition is as below. ▸ In case that the faster processing than 1 scan average processing time is required ▸ In case that the longer time interval than 1 scan average processing time is required ▸ In case that program is processed with the appointed time interval
External interrupt program	• The external interrupt program is performed process on external interrupt signal.
Subroutine program	• Only when some condition is satisfied.(in case that input condition of CALL instruction is On)

5.2.2 Program execution methods

Here describes the program proceeding method that is executed when the power is applied or key switch is ‘RUN’. The program performs the operation processing according to the configuration as below.



1) Scan program

(1) Function

- This program performs the operation repeatedly from 0 step to last step in order prepared by the program to process the signal that is repeatedly regularly every scan.

- In case that the execution condition of interrupt by task interrupt or interrupt module while executing program is established, stop the current program in execution and perform the related interrupt program.

2) Interrupt program

(1) Function

- This program stops the operation of scan program and then processes the related function in prior to process the internal/external signal occurred periodically/non-periodically.

(2) Type

- Task program is divided as below.
  - ▶ Cycle time task program: available to use up to 8.
  - ▶ Internal device task program: available to use up to 8.
  - ▶ I/O (External contact task program): available to use up to 8. (P000 ~ P007)

- Cycle time task program
  - ▶ Performs the program according to the fixed time internal.

- Internal device task program
  - ▶ Performs the corresponding program when the start condition of internal device occurs.
  - ▶ The start condition detection of device shall be performed after processing of scan program.

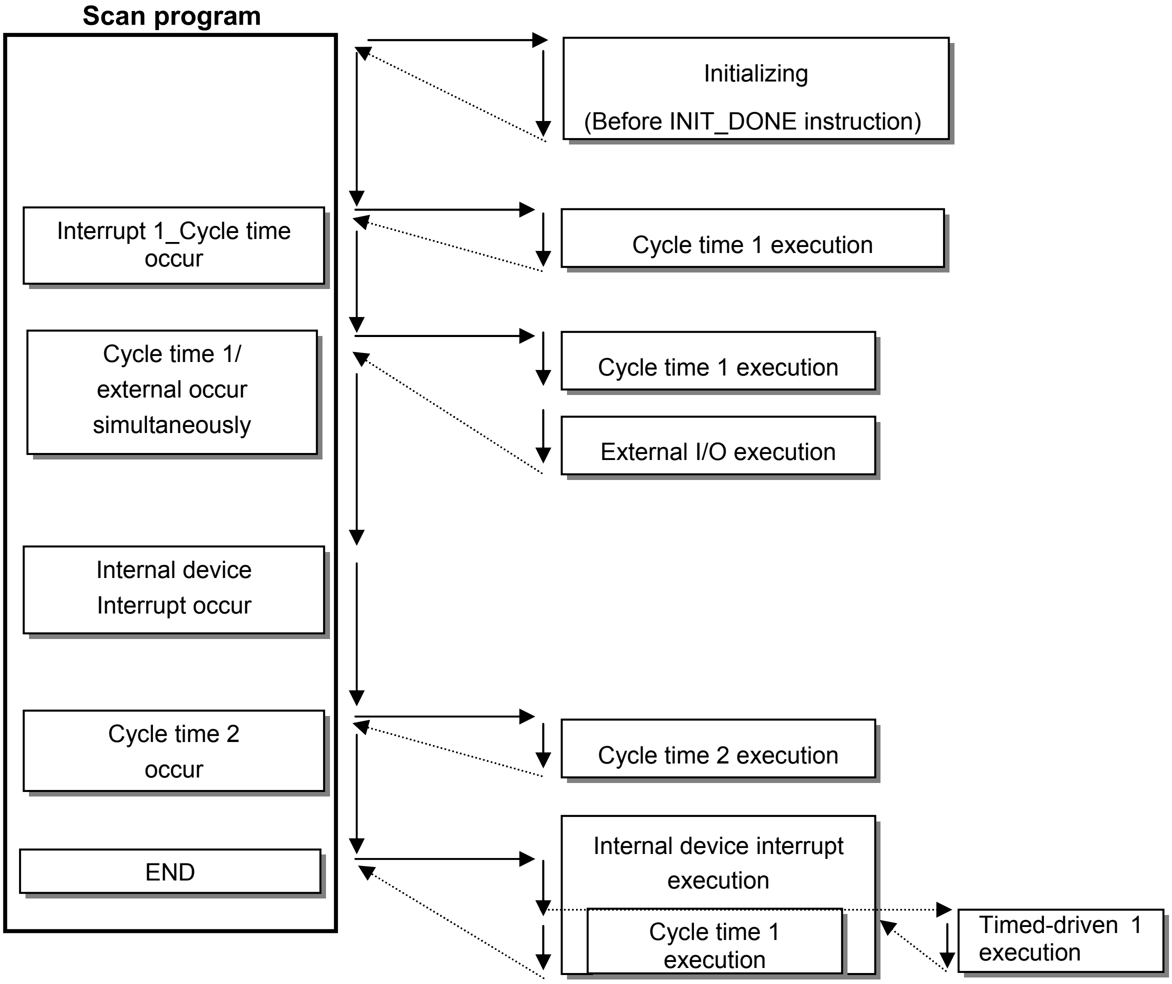
- I/O (External contact task program)
  - ▶ Performs the program according to the input external signal (P000~P007).

5.2.3 Interrupt

For your understanding of Interrupt function, here describes program setting method of XG5000 which is an XGB programming S/W. Example of interrupt setting is as shown bellows.

- Interrupt setting

Interrupt source	Interrupt name	priority	Task No.	Program
Initializing	Interrupt 0_	-	-	-
Cycle time 1	Interrupt 1_cycle time	2	0	Cycle time 1
External	Interrupt 2_external	2	8	External
Internal device	Interrupt 3_internal	3	14	Internal
Cycle time 2	Interrupt 4_cycle time	3	1	Cycle time 2



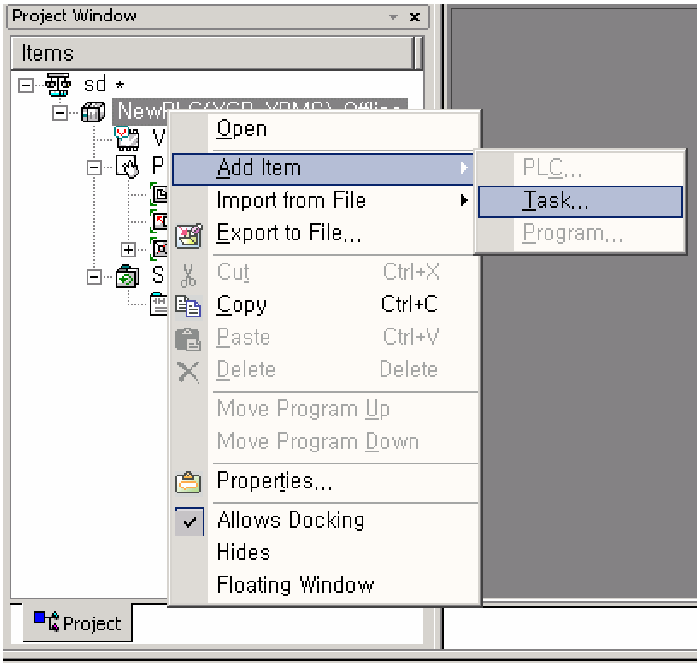
Remark

- In case that several tasks to be executed are waiting, execute from the highest Task Program in priority. When the same priority tasks are waiting, execute from the order occurred.
- While interrupt executing, if the highest interrupt is occurred, the highest interrupt is executed earliest of all.
- When power On, All interrupts are in the state 'Disable'
- Internal device interrupt is executed after END instruction.

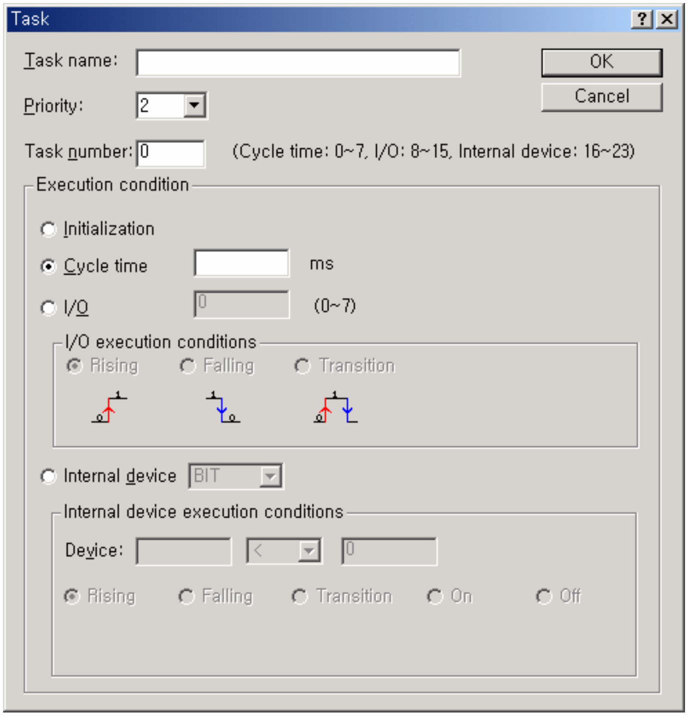
1) How to prepare interrupt program

Generate the task in the project window of XG5000 as below and add the program to be performed by each task. For further information, please refer to XG5000 user's manual.
(It can be additional when XG5000 is not connected with PLC.)

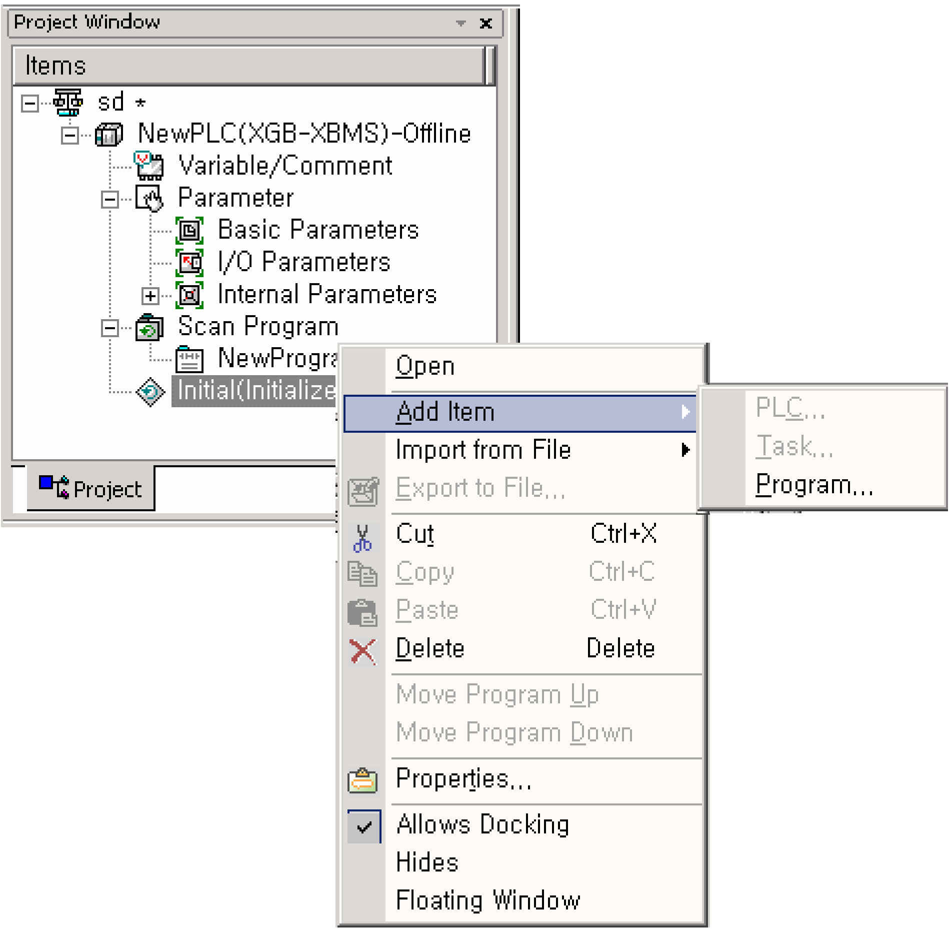
- Click right button of mouse on project name and click 『Add item』 - 『Task』.



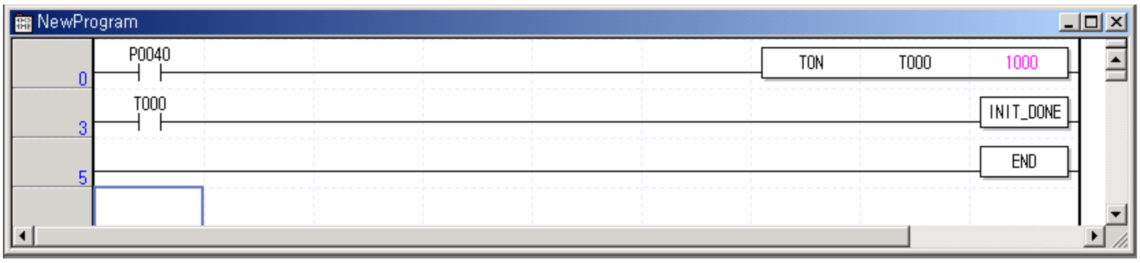
- The screen of Task setting is shown. Click 『Initialization』 in Execution condition and make a Task name.


Task name:
Priority: 2
Task number: 0 (Cycle time: 0~7, I/O: 8~15, Internal device: 16~23)
Execution condition
○ Initialization
● Cycle time ms
○ I/O 0 (0~7)
I/O execution conditions
● Rising ○ Falling ○ Transition
○ Internal device BIT
Internal device execution conditions
Device: < 0
● Rising ○ Falling ○ Transition ○ On ○ Off

- Click right button of mouse at registered task and select『Add Item』-『Program』.



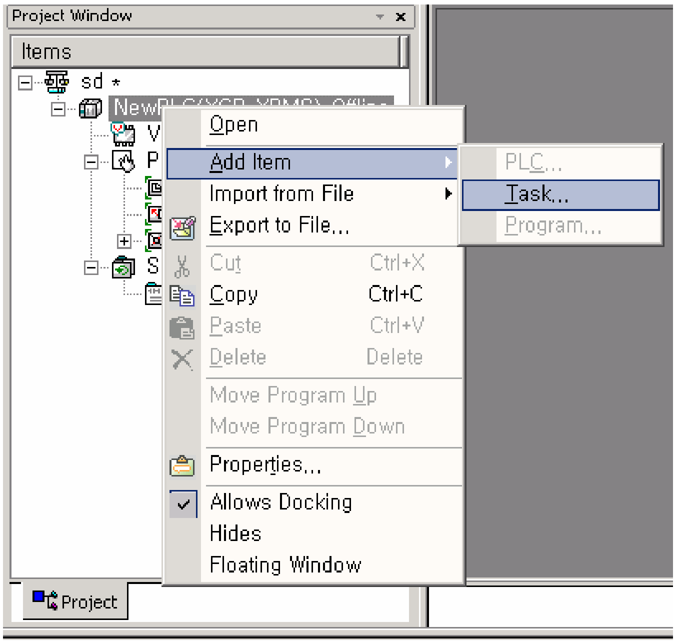
- Make initializing program. In initializing program, INIT_DONE instruction must be made. If not, Scan program is not executed.



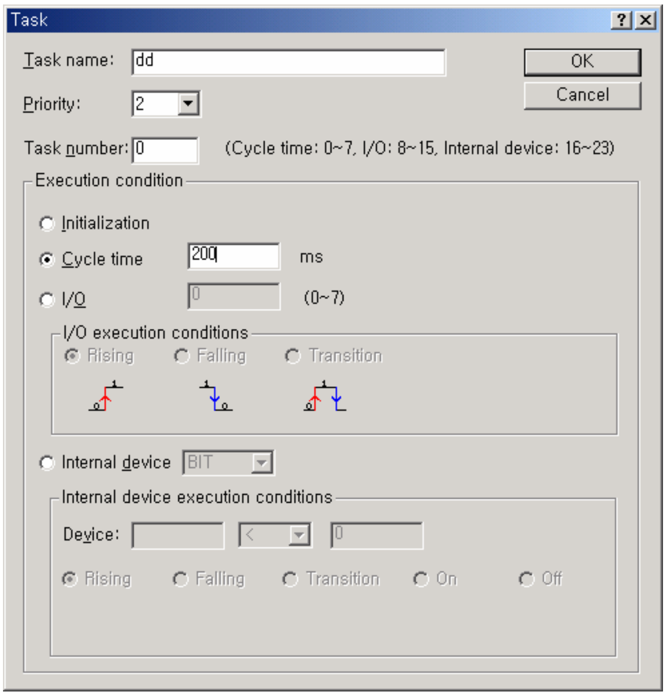
2) How to prepare Cycle interrupt program

Generate the task in the project window of XG5000 as below and add the program to be performed by each task. For further information, please refer to XG5000 user’s manual.
(It can be additional when XG5000 is not connected with PLC)

- Click right button of mouse at registered task and select『Add Item』-『Program』.



- It shows setting screen of Task.



Task name: dd

Priority: 2

Task number: 0 (Cycle time: 0~7, I/O: 8~15, Internal device: 16~23)

Execution condition

○ Initialization

● Cycle time 200 ms

○ I/O 0 (0~7)

I/O execution conditions

● Rising ○ Falling ○ Transition

○ Internal device BIT

Internal device execution conditions

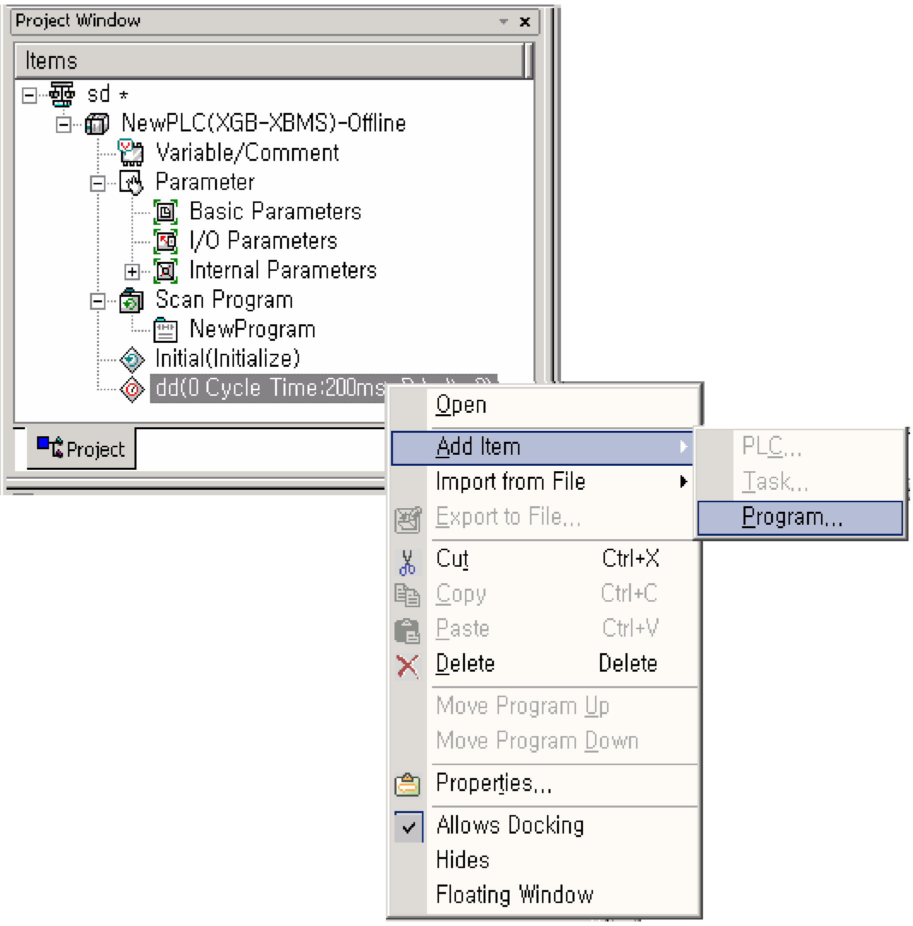
Device: < 0

● Rising ○ Falling ○ Transition ○ On ○ Off

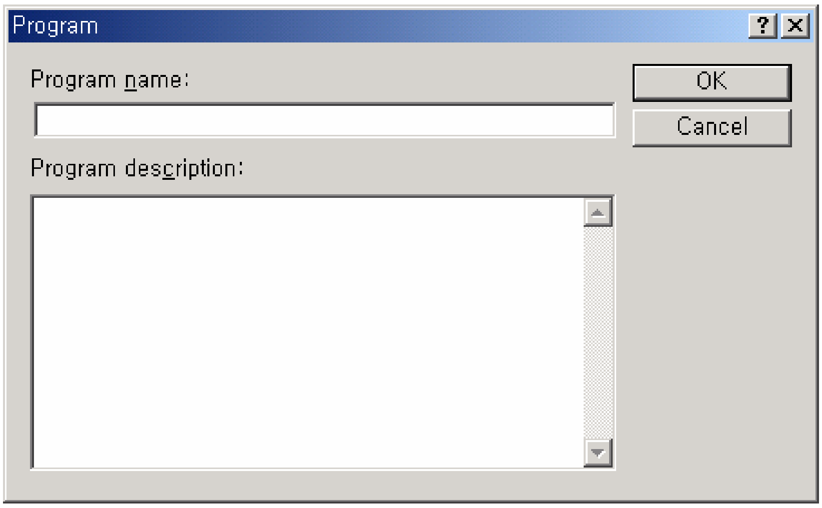
- Task type

Classification		Description	Remark
Task name		Make Task name.	Character, number available
Priority		Set the priority of task. (2~7)	"2" is the highest priority number.
Task number		Set the Task number. • Cycle time task (0 ~ 7) : 8 • External I/O task (8 ~ 15) : 8 • Internal device task (16 ~ 23) : 8	-
Execution condition	Initialization	Set the initial program when running the project.	Till the execution of INIT_DONE instruction
	Cycle time	Set the cyclic interrupt.	0~4294967295 ㎳ available
	I/O	Set the external I/O.	P000 ~ P007 available
	Internal device	Set the internal device to interrupt execution. • Bit: Among Rising, Falling, Transition, On, Off • Word: Among >,>=,<,<=	-

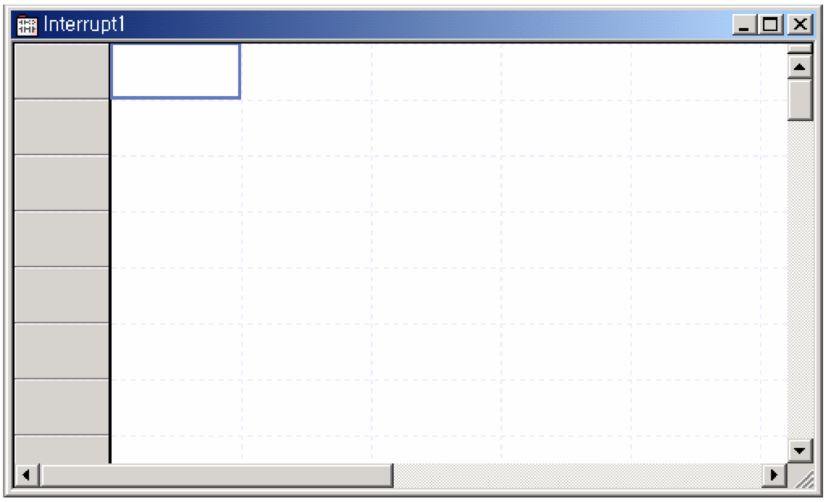
- Click right button of mouse at registered task and select 『Add Item』 - 『Program』.



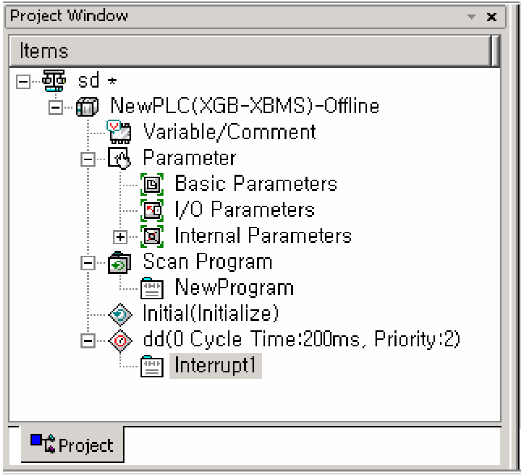
- Register the Program name and Program description.



- It is displayed the program window to write task program.



- It is displayed the setting in project window.



3) Task type

Task type and function is as follows.

Type / Spec.	Cycle time task (Interval task)	I/O task (Interrupt task)	Internal device task (Single task)
Max. Task number	8	8	8
Start condition	Cyclic (setting up to max. 4,294,967.295 sec. by 1ms unit)	Rising or falling edge of main unit's contact P000 ~P007	Internal device execution condition
Detection and execution	Cyclic execution per setting time	Immediate execution at the edge of main unit's contact	Retrieve the condition and execute after completing Scan Program
Detection delay time	Max. 1 ms delay	Max. 0.05 ms delay	Delay as much as max. scan time
Execution priority	2~7 level setting (2 level is highest in priority)	2~7 level setting (2 level is highest in priority)	2~7 level setting (2 level is highest in priority)
Task no.	Within 0~7 range without user duplication	With 8~15 range without user duplication	Within 16~23 range without user duplication

4) Processing methods of task program

Here describes common processing method and notices for Task program.

(1) Feature of task program
- Task Program is executed only when execution condition occurs without every scan repeat processing. When preparing Task Program, please consider this point.
- For example, if a timer and counter were used in cyclic task program of 10 second cycle, this timer occurs the tolerance of max. 10 seconds and the counter and the timer and as the counter checks the input status of counter per 10 seconds, the input changed within 10 seconds is not counted up.

(2) Execution priority
- In case that several tasks to be executed are waiting, execute from the highest Task Program in priority. When the same priority tasks are waiting, execute from the order occurred.
- In case Cycle time task and external I/O task is occurred concurrently, execute from the highest task program. (In sequence of XG5000 setting)
- The task program priority should be set considering the program features, importance and the emergency when the execution requested.

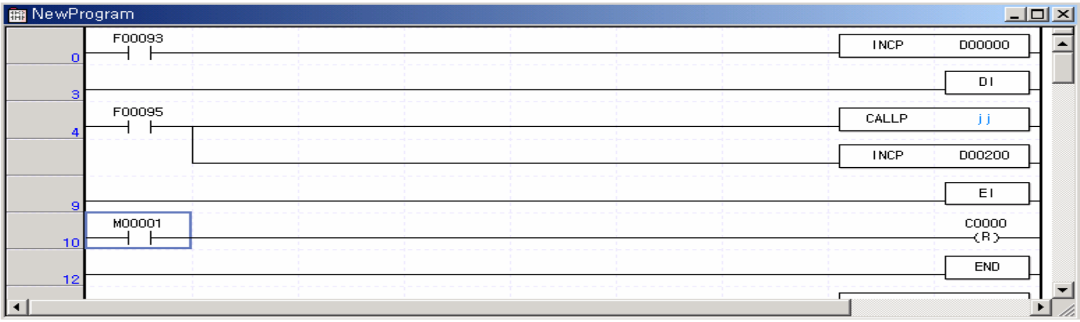
(3) Processing delay time

There are some causes for Task Program processing delay as below. Please consider this when task setting or program preparation.
- Task detection delay (Refer to detailed description of each task.)
- Program proceeding delay caused by Priority Task Program proceeding

(4) Relationship of initialize, Scan Program and Task Program
- ser identification task does not start while performing Initialization Task Program.
- As Scan Program is set as lowest priority, if task occurs, stop Scan Program and process Task Program in advance. Accordingly, if task occurs frequently during 1 scan or concentrates intermittently, scan time may extend abnormally. Cares should be taken in case of task condition setting.

(5) Protection of Program in execution from Task Program

- In case that the continuity of program execution is interrupted by high priority Task Program during program execution, it is available to prohibit the execution of Task Program partially for the part in problem. In this case, it is available to perform the program protection by ' DI (Task Program Start Disabled) and 'EI (Task Program Start Enabled)' application instruction.
- Insert 'DI' application instruction in the start position of the part requiring the protection and insert 'EI' application instruction in the position to release. Initialization Task is not influenced by 'DI', 'EI' application instruction.
- If interrupt is occurred while 'CALLP' instruction executing, interrupt program is executed after 'CALLP' instruction execution.



5) Cyclic task program processing method

Here describes the processing method in case that task (start condition) of Task program is set as Cycle time.

(1) Items to be set in Task

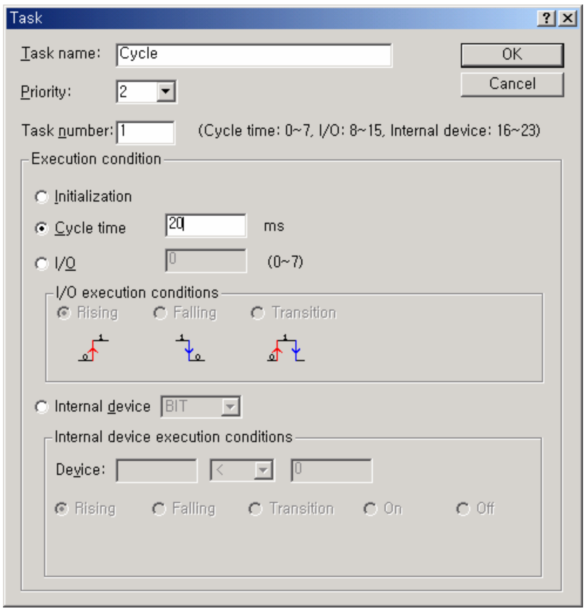
- Set the execution cycle and priority which are the start condition o f Task program to execution. Check the task no. to manage the task.

(2) Cyclic task processing

- Performance the corresponding cyclic task program per setting time interval (execution cycle).

(3) Notice in using cyclic task program

- When cyclic task program is in execution currently or waiting for execution, if the demand to execute the same task program occurs, the new occurred task shall be disregarded.
- Timer that makes a demand to execute cyclic task program only while operation mode is Run mode, shall be added. The shutdown time shall be all disregarded.
- When setting the execution cycle of cyclic task program, consider the possibility that the demand to execute several cyclic task program at the same time occurs.
  If 4 cyclic task programs that the cycle is 2sec, 4sec, 10sec and 20sec are used, 4 demands of execution per 20 seconds shall be occurred at the same time and scan time may extend instantaneously.



Task name: Cycle

Priority: 2

Task number: 1 (Cycle time: 0~7, I/O: 8~15, Internal device: 16~23)

Execution condition

○ Initialization
● Cycle time 20 ms
○ I/O 0 (0~7)

I/O execution conditions

● Rising ○ Falling ○ Transition

○ Internal device BIT

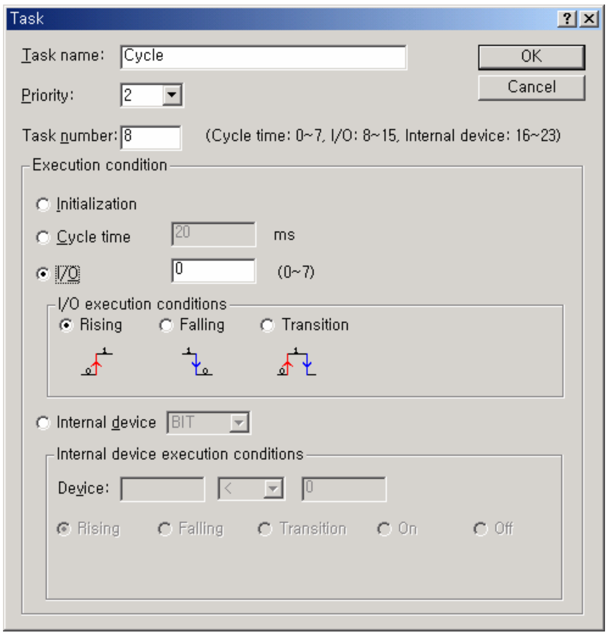
Internal device execution conditions

Device: < 0

● Rising ○ Falling ○ Transition ○ On ○ Off

6) I/O task program processing

It described the I/O task program processing. (P000 ~ P007)



Task name: Cycle

Priority: 2

Task number: 8 (Cycle time: 0~7, I/O: 8~15, Internal device: 16~23)

Execution condition

- ○ Initialization
- ○ Cycle time 20 ms
- ● I/O 0 (0~7)

I/O execution conditions

● Rising ○ Falling ○ Transition

- ○ Internal device BIT

Internal device execution conditions

Device: < 0

● Rising ○ Falling ○ Transition ○ On ○ Off

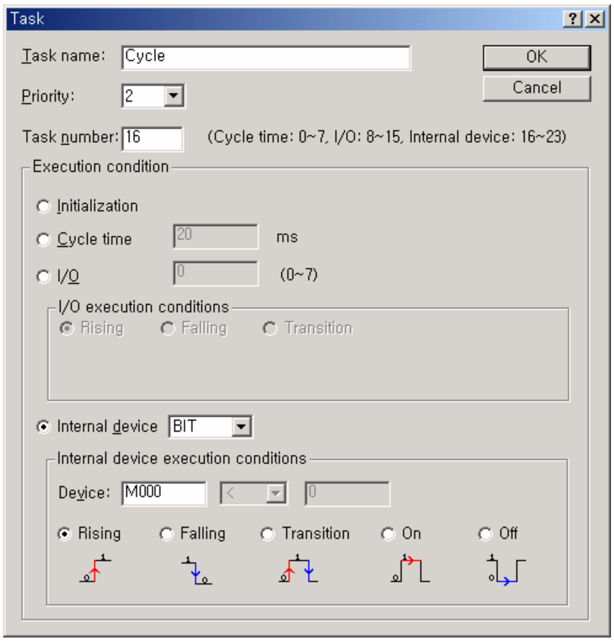
(1) Items to be set in Task
- Set the execution condition and priority to the task being executed. Check the task no. to manage the task.

(2) I/O task processing
- If interrupt signal from external signal (I/O) is occurred on main unit (P000 ~ P007), task program is executed by external (I/O) signal.

(3) Precaution in using I/O task program
- If task program which is executed by interrupt signal is on execution or standby status, new task program which is requested by identical I/O is ignored.
- Only operation mode is Run mode, execution request of task program is recognized. Namely, execution request of task program is ignored when operation mode is Stop mode.

7) Internal device task program processing

Here describes the processing method of international device task program which extended the task (start condition) of task program from contact point to device as execution range.



Task name: Cycle

Priority: 2

Task number: 16 (Cycle time: 0~7, I/O: 8~15, Internal device: 16~23)

Execution condition

○ Initialization

○ Cycle time 20 ms

○ I/O 0 (0~7)

I/O execution conditions

● Rising ○ Falling ○ Transition

● Internal device BIT

Internal device execution conditions

Device: M000 < 0

● Rising ○ Falling ○ Transition ○ On ○ Off

(1) Items to be set in Task

- Set the execution condition and priority to the task being executed. Check the task no. for task management.

(2) Internal device task processing

- After completing the scan program execution in CPU module, if the condition that becomes the start condition of internal device task program is met, according to the priority, it shall be executed.

(3) Precautions in using internal device task program

- Accordingly, even if the execution condition of internal device task program occurs in Scan Program or Task Program (Cycle time, I/O), it shall not be executed immediately but executed at the time of completion of Scan Program.
- If the demand to execute Internal Device Task Program occurs, the execution condition shall be examined at the time of completion of Scan Program. Accordingly, if the execution condition of Internal Device Task occurs by Scan Program or Task Program (Cycle time) during ‘1 scan’ and disappears, the task shall not be executed as it is not possible to detect the execution at the time of examination of execution condition.

8) Verification of task program

(1) Is the task setting proper?
If task occurs frequently more than needed or several tasks occur in one scan at the same time, scan time may lengthen or be irregular. In case not possible to change the task setting, verify max. scan time.

(2) Is the priority of task arranged well?
The low priority task program shall be delayed by the high priority task program, which results in disabling the processing within the correct time and even task collision may occur as next task occurs in the state that the execution of previous task is delayed. Consider the emergency of task and execution time etc when setting the priority.

(3) Is the Task Program written in shortest?
If the execution time of Task Program is longer, scan time may lengthen or be irregular. Even it may cause the collision of task program. Write the execution time as short as possible. (Especially, when writing the cyclic task program, write the execution time so that the task program can be executed within 10% cycle of the shortest task among several tasks.)

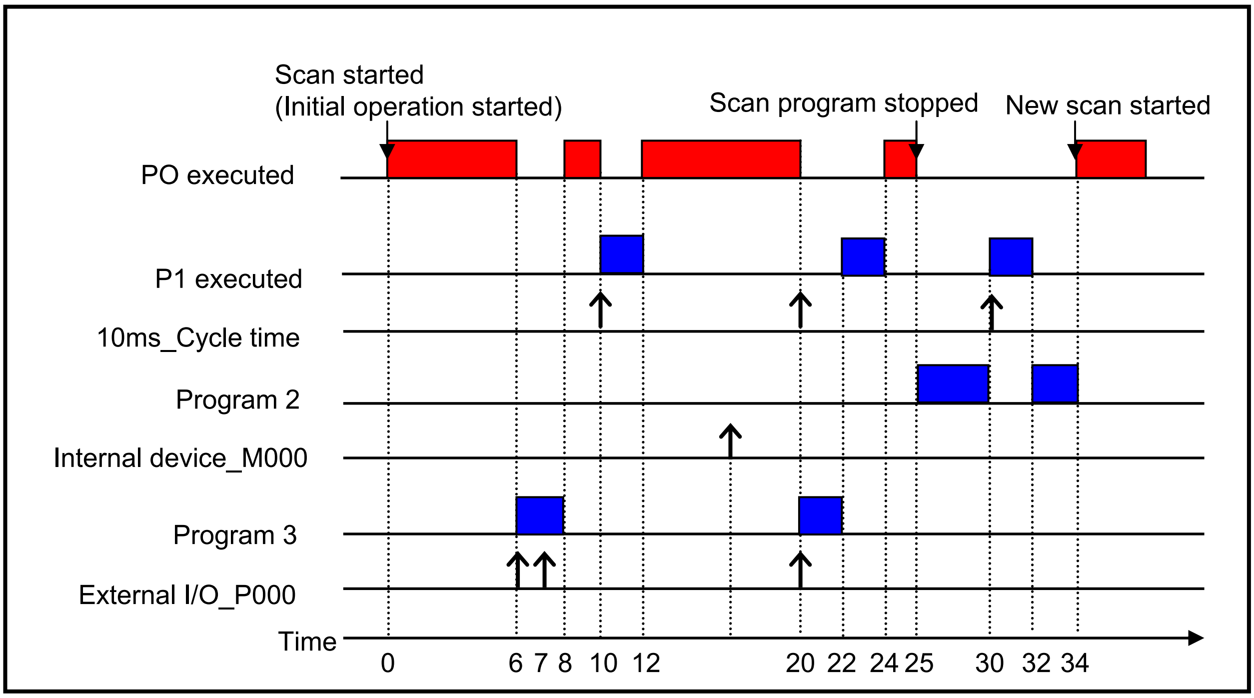
(4) Is program protection for the high priority task needed during program execution?
If other task is inserted during task program execution, complete the task in execution and operate the standby tasks in the order of high priority. In case that it is not allowed to insert other task in Scan Program, prevent the insert partially by using ‘DI’ and ‘EI’ application instruction. The problem may occur while processing the global variables used commonly with other program or special or communication module.

9) Program configuration and processing example

If task and program are registered as below.

Interrupt type	Interrupt name	Priority	Task No.	Program
Cycle time	10 ㎳_cycle time	3	0	Program 1
Internal device	Internal device_M00	5	16	Program 2
I/O	I/O_P00	2	8	Program 3

- Scan program name: “ Scan Program”
- Execution time respective program: Scan program = 17 ㎳, Program 1 = 2 ㎳, Program 2= 7 ㎳, Program 3 = 2 ㎳



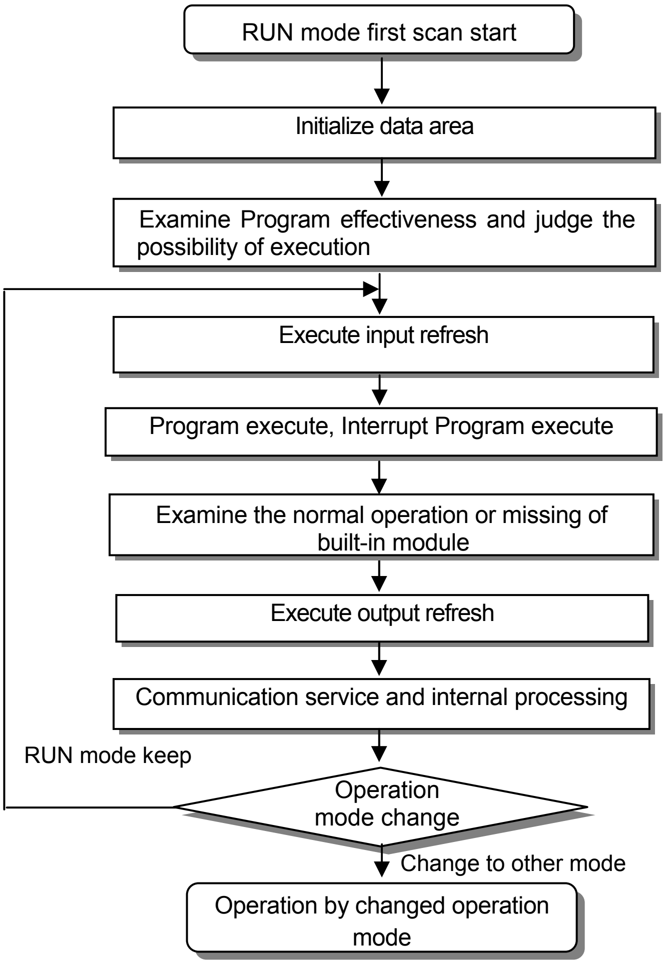
Process per time	
Time (㎳)	Process
0	Scan started and scan program started to execute.
0~6	Scan program is executed.
6~8	Scan program is stop because execution external I/O (P000) is requested. And program 3 is executed. Request of execution at 7[ms] is ignored because program 3 has been executing.
8~10	Program 3 is finished and Scan program is continued.
10~12	Scan program is stop by request of '10 ㎳_Cycle time' interrupt signal and execute program 1.
12~20	Program 1 is finished and Scan program is continued.
20	Request of 'Cycle time' interrupt signal and 'External I/O (P000)' signal is occurred concurrently but priority of 'External I/O' signal is higher than 'Cycle time' interrupt signal so program 3 is executed and program 1 is standby.
20~22	Program 3 is finished and Scan program is continued.
22~24	After program 3 is completed, program 1 (the program of '10ms_Cycle time' is executed.
24~25	P1 execution completed and the stopped scan program execution finished
25	At the finished point of scan program, check the request of Internal device 'M000' execution and execute program 2.
25~30	Program P2 is executed.
30~32	When '10 ㎳_Cycle time' interrupt signal is occurred, the priority of that is higher than Internal device 'M000' though program 2 is stopped and program 1 is executed.
32~34	P1 executed completed and the stopped P2 execution finished
34	New scan starts (Start scan program execution)

5.3 Operation Mode

For operation mode of CPU module, there are 3 types such as RUN mode, STOP mode and DEBUG mode.. Here describes the operation processing of each operation mode.

5.3.1 RUN mode

This is the mode to executed program operation normally.



1) Processing at mode change
At the beginning, execute initialization of data area and examine the effectiveness of program and judge the possibility of execution.

2) Operation processing contents
Execute I/O refresh and program operation.
(1) Detects the start condition of Interrupt Program and executes Interrupt Program.
(2) Examines the normal operation or missing of built-in module.
(3) Communication service and other internal processing.

5.3.2 STOP mode

This is the mode in stop state without Program operation. It is available to transmit the program through XG5000 only in Remote STOP mode.

1) Processing at Mode Change
   Clear the output image area and execute output refresh.

2) Operation Processing Contents
   (1) Executes I/O refresh.
   (2) Examines the normal operation or missing of built-in module.
   (3) Communication service or other internal processing.

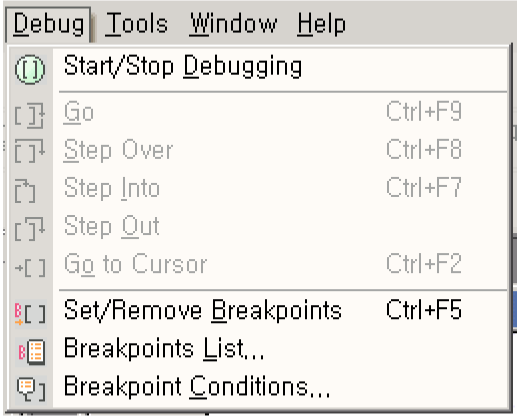
5.3.3 DEBUG mode

This is the mode to detect Program error or trace the operation process and the conversion to this mode is available only in STOP mode. This is the mode to check the program execution state and the contents of each data and verify the program.

1) Processing at mode change
   (1) Initializes the data area at the beginning of mode change.
   (2) Clears the output image area and execute input refresh.

2) Operation processing contents
   (1) Executes I/O refresh.
   (2) Debug operation according to setting state.
   (3) After finishing Debug operation by the end of Program, execute output refresh.
   (4) Examine the normal operation or missing of built-in module.
   (5) Executes communication service or other service.

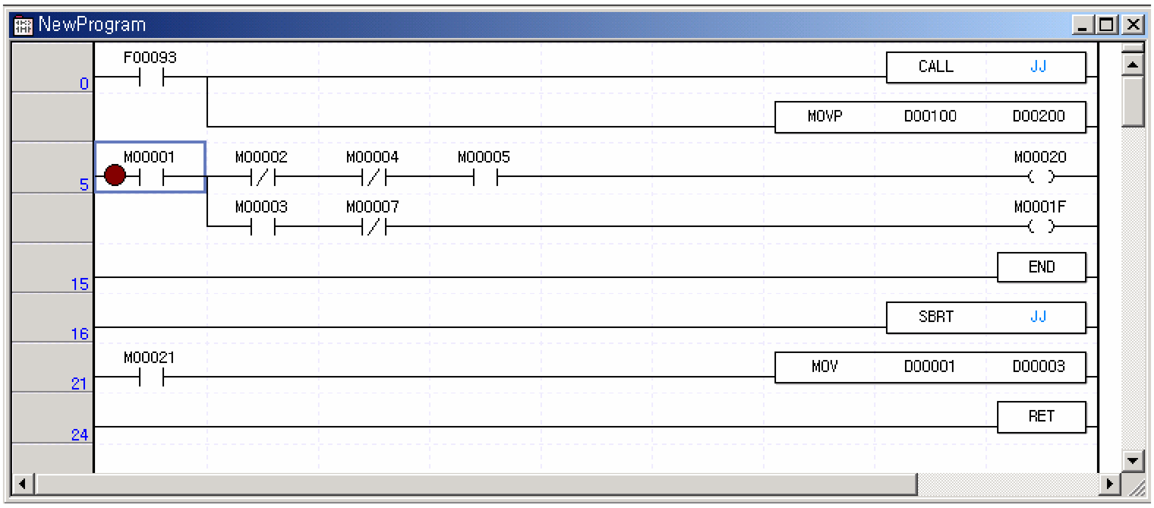
3) Debug operation
   ❑ It describes debug mode.



Item	Description	Remark
Start/Stop Debugging	Change the debug ↔ stop mode	
Go	It starts debug operation.	
Step Over	It operates by 1 step.	
Step Into	It starts the subroutine program.	Other operation is identical to Step Over.
Step Out	It finished the subroutine program.	
Go to Cursor	It operates to current cursor position.	
Set/Remove Breakpoints	Set/Removes current cursor position to break points.	
Breakpoints List	It displays list of breakpoints.	
Breakpoint Conditions	It specifies device value and number of scan.	

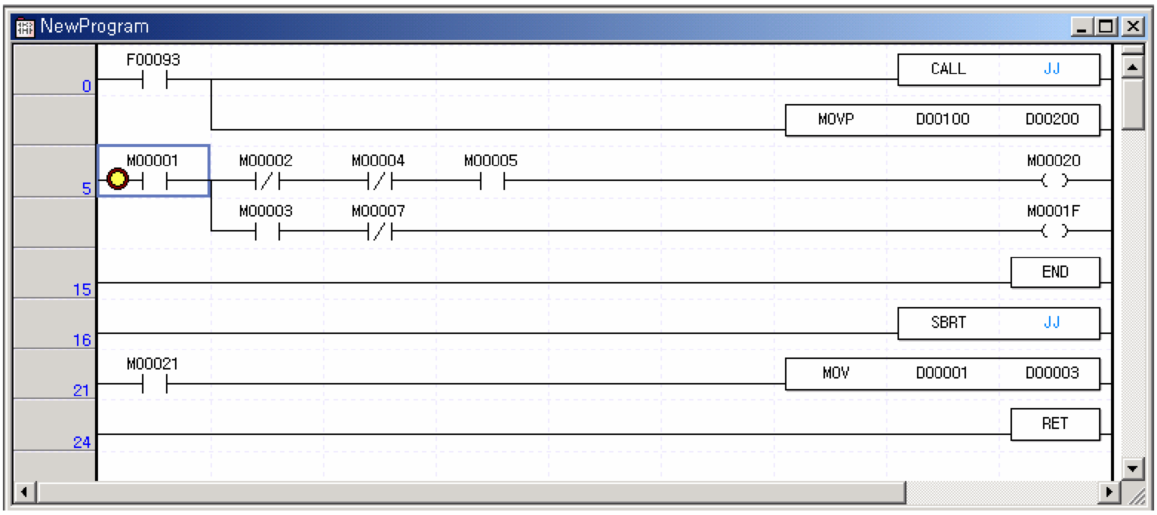
(1) Set/Remove Breakpoints

▪ Sets breakpoint at current cursor position. After breakpoint setting, ● (breakpoint setting indicator) is displayed.



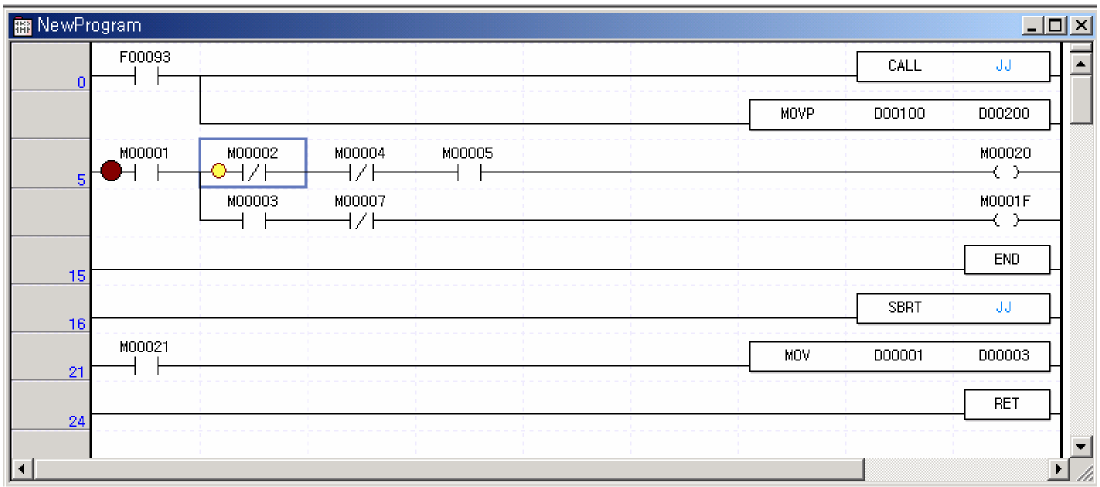
(2) Go

▪ Run the program to breakpoint. At break-pointer ○ (stop indicator) is displayed.



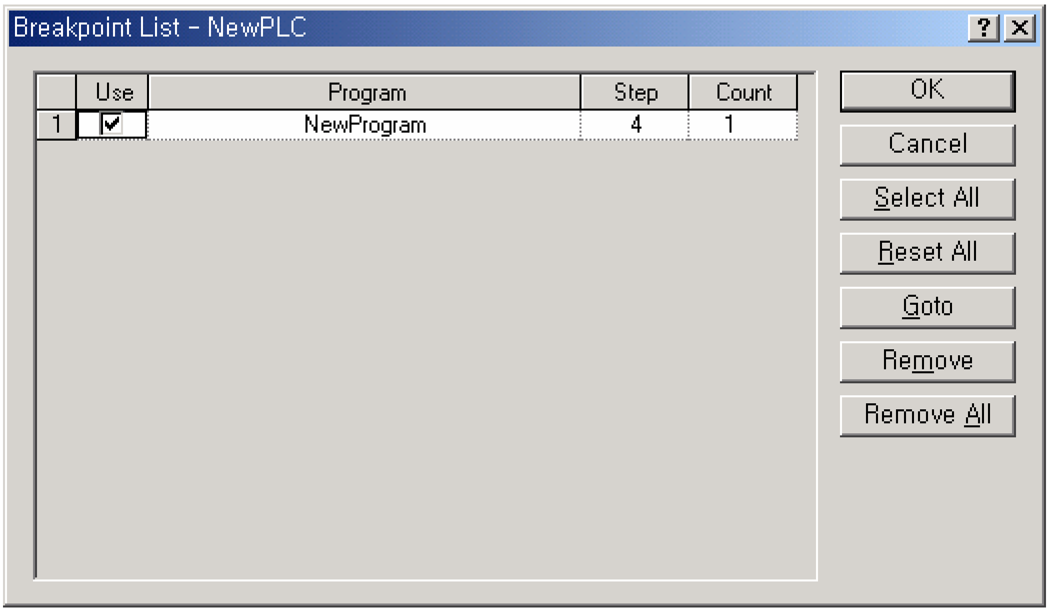
(3) Step Over

- Run the program to next step. At break point, Step over indicator ○ is displayed.



(4) Breakpoint List

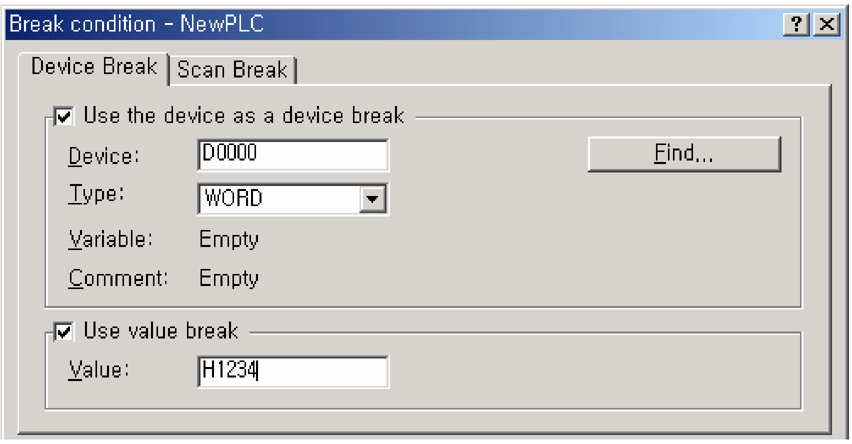
- It displays current Breakpoint List. It supports Select All, Reset All, Goto, Remove, Remove All.


Breakpoint List - NewPLC

	Use	Program	Step	Count
1	☑	NewProgram	4	1

(5) Break condition

- It sets Device Break and Scan Break.


Break condition - NewPLC

☑ Use the device as a device break

Device: D0000

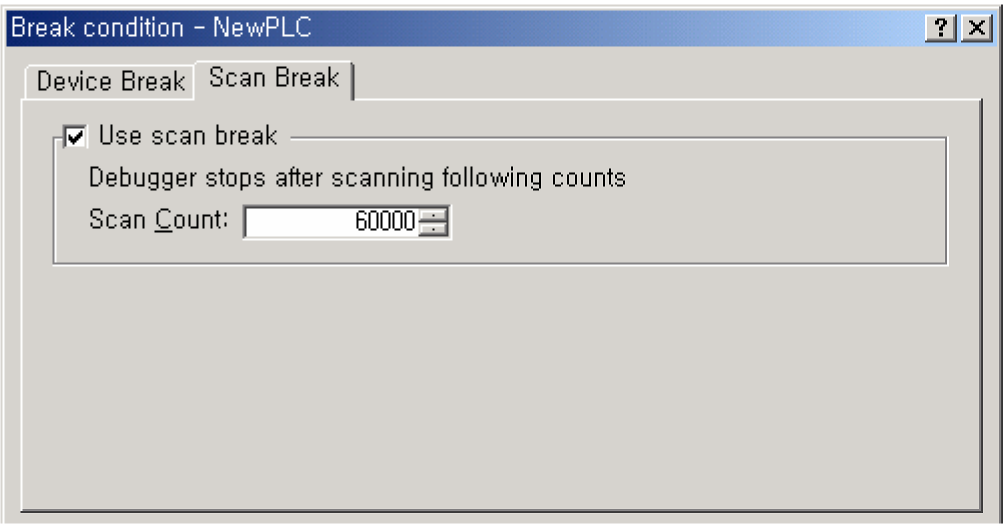
Type: WORD

Variable: Empty

Comment: Empty

☑ Use value break

Value: H1234



☑ Use scan break

Debugger stops after scanning following counts

Scan Count: 60000

Remark

- Refer to XG5000 Users Manual ‘Chapter 12 Debugging’ for detailed information.

5.3.4 Change operation mode

1) Operation Mode Change Method

The method to change operation mode are as follows.

(1) By mode key of CPU module
(2) By connecting the programming tool (XG5000) to communication port of CPU
(3) By changing the operation mode of other CPU module connected to network by XG5000 connected to communication port of CPU.
(4) By using XG5000, HMI, computer link module connected to network
(5) By 'STOP' instruction during program execution

2) Type of operation mode

The operation mode setting is as follows.

Operation mode switch	XG5000 command	Operation mode
RUN	X	Run
STOP	RUN	Remote Run
	STOP	Remote Stop
	Debug	Debug Run
	Mode change	Previous operation mode
RUN -> STOP	-	Stop

(1) Remote mode conversion is available only in the state of **'Remote Enabled: On'**, **'Mode switch: Stop'**.
(2) In case of changing the Remote 'RUN' mode to 'STOP' by switch, operate the switch as follows.
(STOP) → RUN → STOP .

⚠ Warning

In case of changing Remote RUN mode to RUN mode by switch, PLC operation continues the operation without interruption.

It is available to modify during RUN in RUN mode by switch but the mode change operation by XG5000 is limited. This should be set only in case that remote mode change is not allowed.

5.4 Memory

There are two types of memory in CPU module that the user can use. One is Program Memory that saves the user program written by the user to build the system, and the other is Data Memory that provides the device area to save the data during operation.

5.4.1 Data memory

1) Bit device area

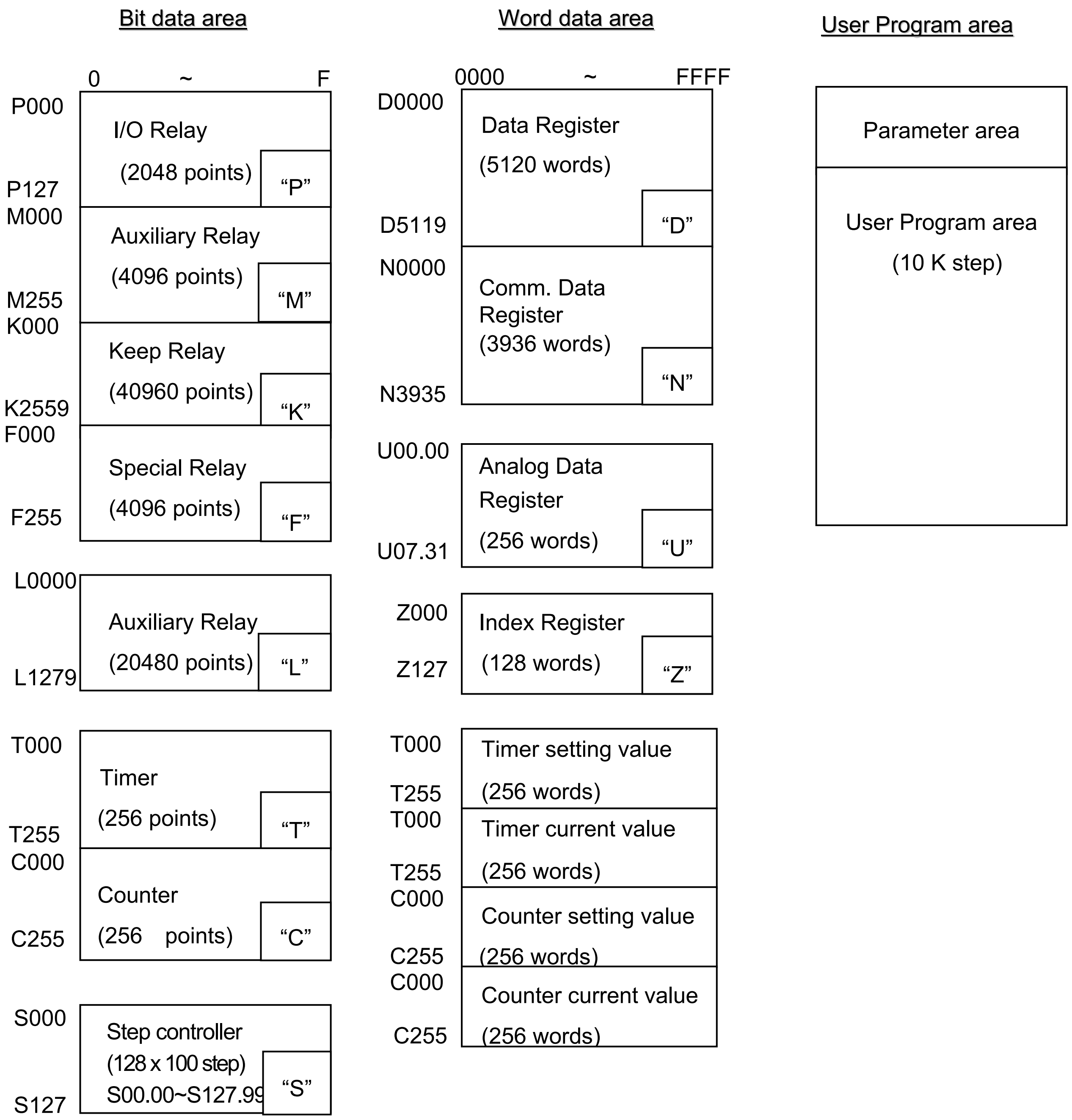
Various Bit Device are provided per function. The indication method is indicated by device type for first digit, word position by decimal for middle digit and bit position by hexadecimal for the last digit.

Area per device	Device features	Description
P0000 ~ P127f	I/O device "P" 2,048 points	Image area to save the state of I/O device. After reading the input module state, saves it in the corresponding P area and sends P area Data saving the operation result to output module.
M0000 ~ M255f	Internal device "M" 4,096 points	Internal Memory provided to save Bit Data in Program
L0000 ~ L1279f	Communication device "L" 20,480 points	Device to indicate high speed link/P2P service state information of communication module.
K00000 ~ K2559F	Preservation device "K" 40,960 points	Device area to preserve the data during power shutdown, which is used without setting power shutdown preservation parameter separately. (Pay attention to write in special area (K2600 ~ 2559F)).
F0000 ~ F255f	Special device "F" 4,096 points	System flag area that manages the flag necessary for system operation in PLC.
T0000 ~ T255	Timer device "T" 256 points	Area to save the state of contact/current value/set value of timer device
C0000 ~ C255	Counter device "C" 256 points	Area to save the state of contact/current value/set value of counter device
S00.00 ~ S127.99	Step controller "S" 128 x 100 step	Relay for step control

2) Word device area

Area per device	Device features	Description
D00000 ~ D5119	Data register "D" 5120 words	Area to preserve the internal data. Bit expression possible.(D0000.0)
U00.00 ~ U07.31	Analog data register "U" 256 words	Register used to read data from special module installed in the slot. Bit expression possible
N0000 ~ N3935	Communication data register "N" 3,936 words	P2P Service Save area of communication module. Bit expression impossible
Z000 ~ Z127	Index register "Z" 128 words	Dedicated device to use Index function Bit expression impossible
T0000 ~ T255	Timer current value register "T" 256 words	Area to indicate the current value of timer
C0000 ~ C255	Counter current value register "C" 256 words	Area to indicate the current value of counter

5.5 Configuration Diagram of Data Memory



5.5.1 Data latch area setting

When PLC stops and restarts the data required for operation or the data occurred during operation, if you want to keep and use those data, data latch can be used and it is available to use a certain area of some data device as latch area by parameter setting.

The below shows the features for latch device.

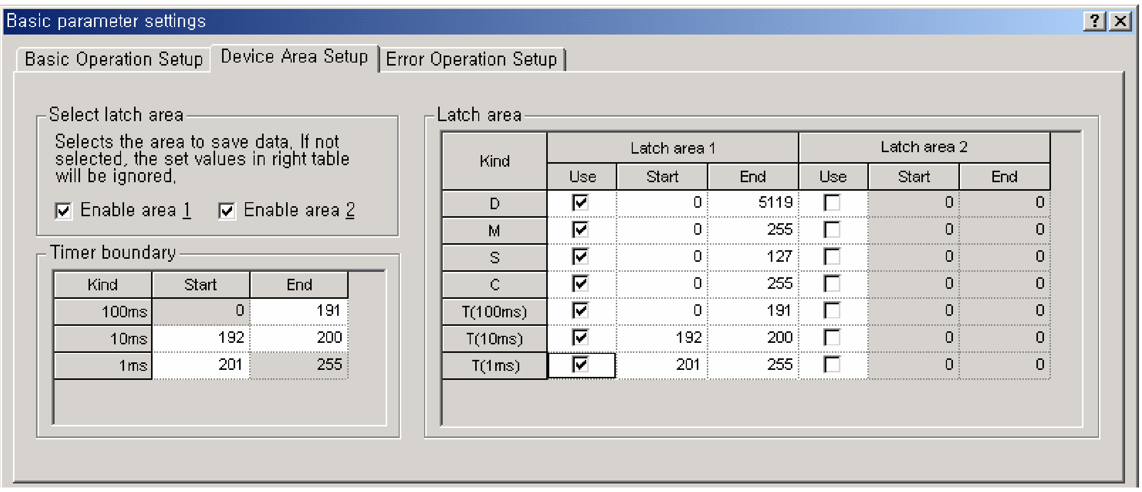
Device	1st latch	2nd latch	Features
P	X	X	Image area to save the state of I/O device
M	O	O	Internal device area
K	X	X	Device keeping the device state during power shutdown
F	X	X	System flag area
T	O	O	Timer related area (Bit/words both)
C	O	O	Counter related area (Bit/words both)
S	O	O	Relay for step control
D	O	O	General words data save area
U	X	X	Analog Data Register (latch disabled)
L	X	X	High speed link/P2P Service state device of communication module (latch enabled)
N	X	X	P2P Service address area of communication module (latch enabled)
Z	X	X	Index dedicated Register (latch disabled)

Remark

- K, L, N, R devices are basically latched.

1) Latch area setting

- Click Device Area Setup of Basic parameter settings.



Select latch area

Selects the area to save data, If not selected, the set values in right table will be ignored.

☑ Enable area 1 ☑ Enable area 2

Timer boundary

Kind	Start	End
100ms	0	191
10ms	192	200
1ms	201	255

Latch area

Kind	Latch area 1			Latch area 2		
	Use	Start	End	Use	Start	End
D	☑	0	5119	☐	0	0
M	☑	0	255	☐	0	0
S	☑	0	127	☐	0	0
C	☑	0	255	☐	0	0
T(100ms)	☑	0	191	☐	0	0
T(10ms)	☑	192	200	☐	0	0
T(1ms)	☑	201	255	☐	0	0

2) Data latch area operation

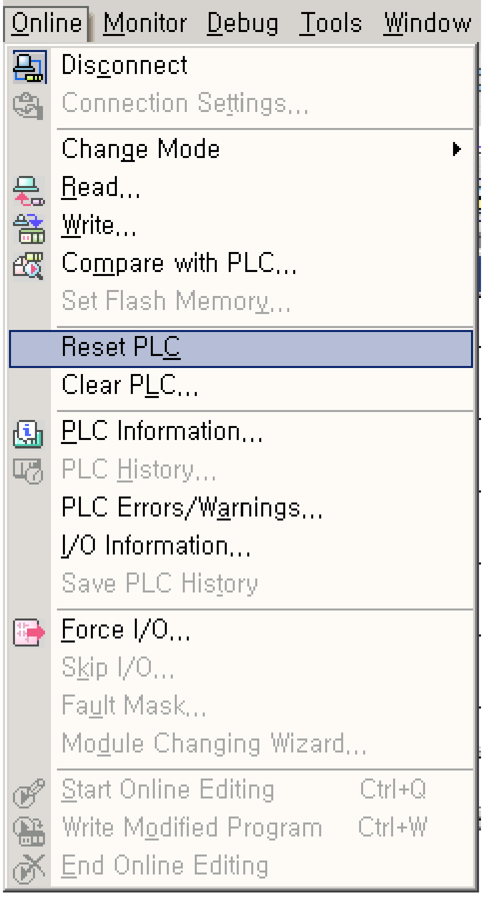
The method to delete the latched data is as below.

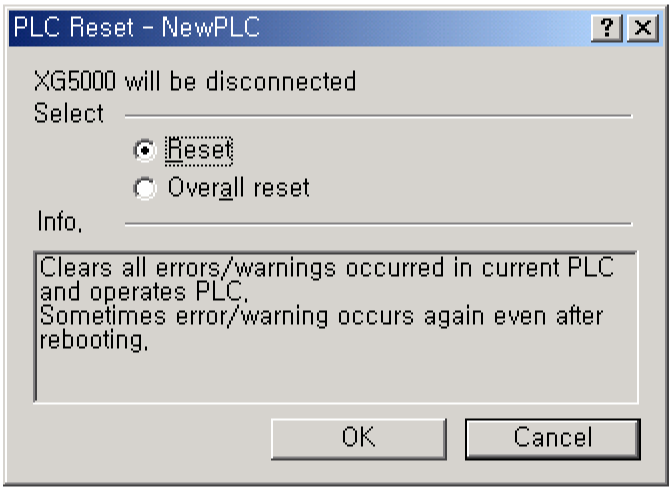
- latch 1, latch 2 clear operation by XG5000
- write by Program (initialization program recommended)
- write ‘0’ FILL from XG5000 monitor mode.

For keep or reset (clear) operation of latch area data according to PLC operation, please refer to the below table.

No.	Classification	Detailed operation	Latch 1	Latch 2
1	Power change	Off/On	Keep	Keep
2	Reset by XG5000	Overall reset	Reset	Keep
3	Program write (online)	-	Keep	Keep
4	Data broken	SRAM broken by battery error	Reset	Reset
		Data broken by other reason	Reset	Reset
5	XG5000 online	Clear Latch 1	Reset	Keep
		Clear Latch 2	Reset	Reset

▪ Latch 1 area is cleared by『Online』-『Reset PLC』- “Overall reset”.





XG5000 will be disconnected

Select

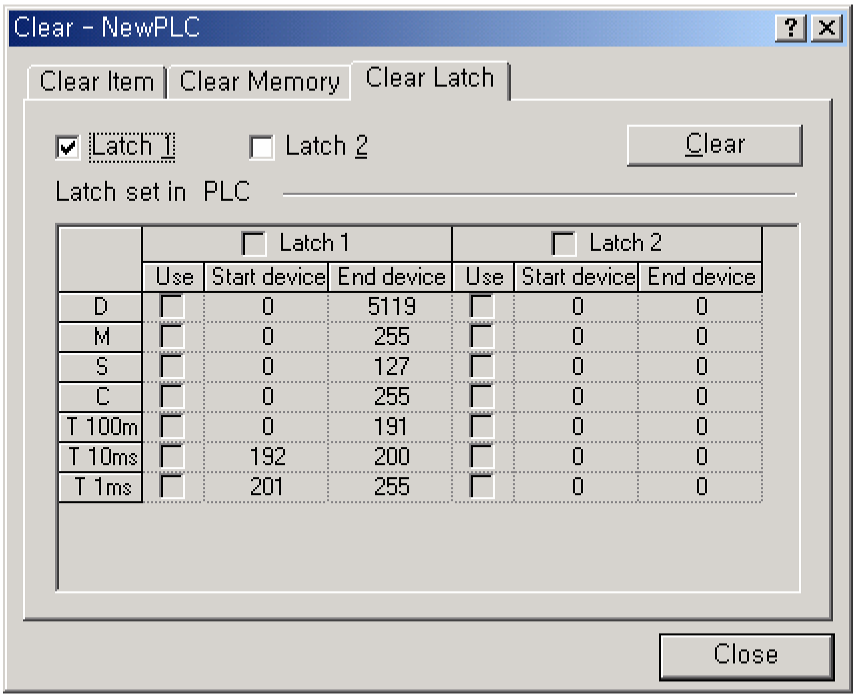
● Reset

○ Overall reset

Info.

Clears all errors/warnings occurred in current PLC and operates PLC.
Sometimes error/warning occurs again even after rebooting.

- Latch 1, 2 area is cleared by『Online』-『Clear PLC』.



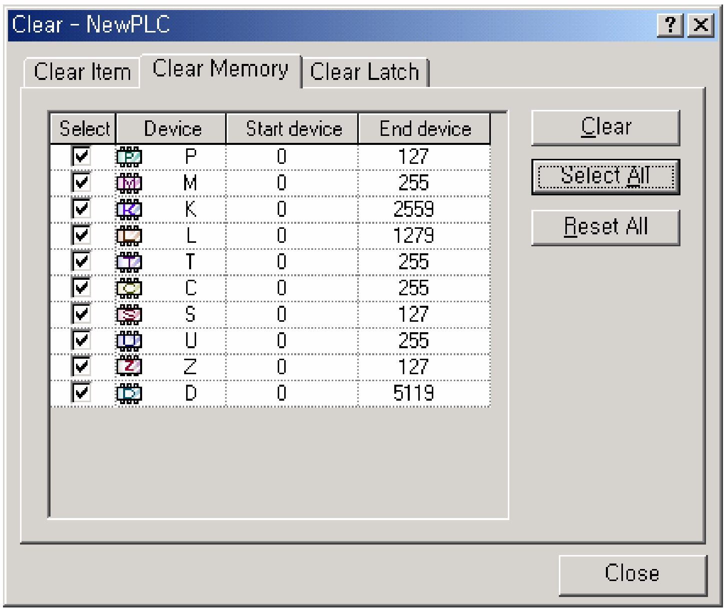
Latch set in PLC

	☐ Latch 1			☐ Latch 2		
	Use	Start device	End device	Use	Start device	End device
D	☐	0	5119	☐	0	0
M	☐	0	255	☐	0	0
S	☐	0	127	☐	0	0
C	☐	0	255	☐	0	0
T 100m	☐	0	191	☐	0	0
T 10ms	☐	192	200	☐	0	0
T 1ms	☐	201	255	☐	0	0

3) Data initialization

In case of Memory Delete state, the memory of all device shall be cleared as ‘0’. In case of giving the data value at the beginning according to system, please use the initialization task.

- Device area is cleared by click ‘Clear’ in 『Online』-『Clear PLC』-『Clear Memory』.



Select	Device	Start device	End device
☑	P	0	127
☑	M	0	255
☑	K	0	2559
☑	L	0	1279
☑	T	0	255
☑	C	0	255
☑	S	0	127
☑	U	0	255
☑	Z	0	127
☑	D	0	5119

Delete the selected items?

Erasing completed

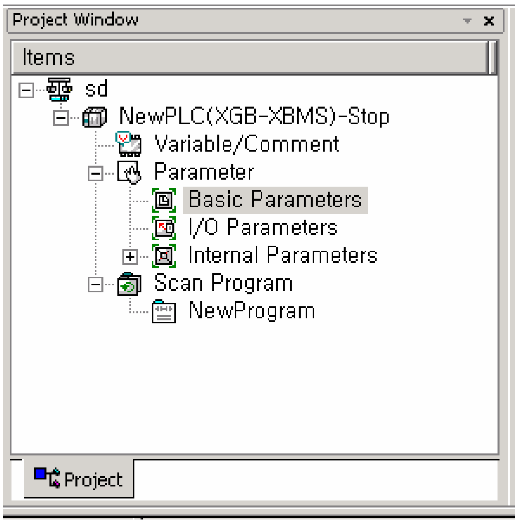
Chapter 6 CPU Functions

6.1 Parameter Setting

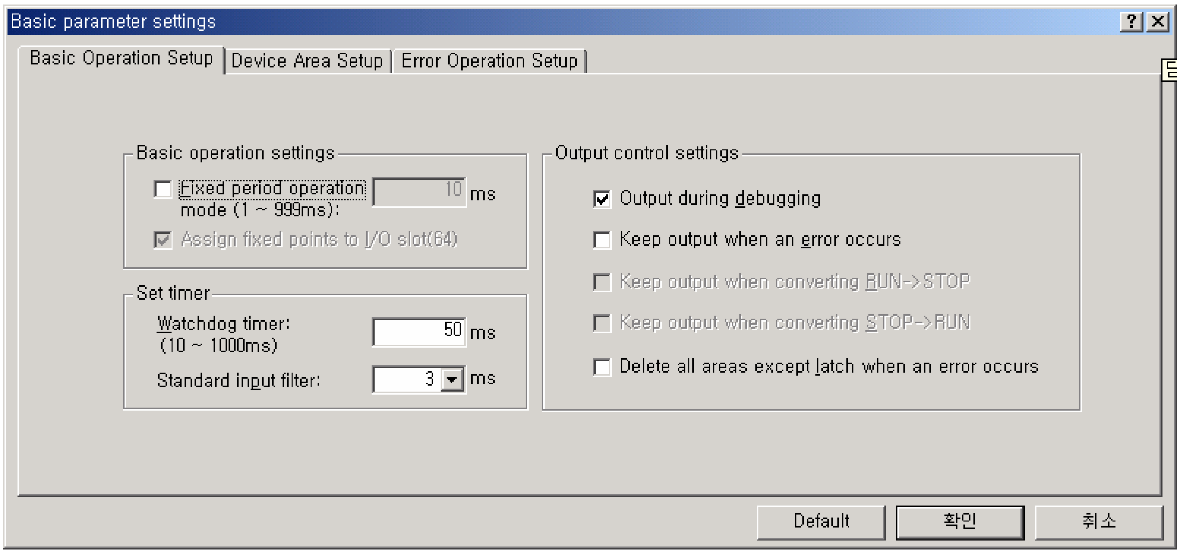
This paragraph describes how to set parameters.

6.1.1 Basic parameter setting

Clicking Basic Parameter in the project window shows the following window.



There are three main options ; "Basic Operation Setup" , "Device Area Setting" and "Error Operation Setup".



Basic operation settings

☐ Fixed period operation mode (1 ~ 999ms): 10 ms

☑ Assign fixed points to I/O slot(64)

Set timer

Watchdog timer: (10 ~ 1000ms) 50 ms

Standard input filter: 3 ms

Output control settings

☑ Output during debugging

☐ Keep output when an error occurs

☐ Keep output when converting RUN->STOP

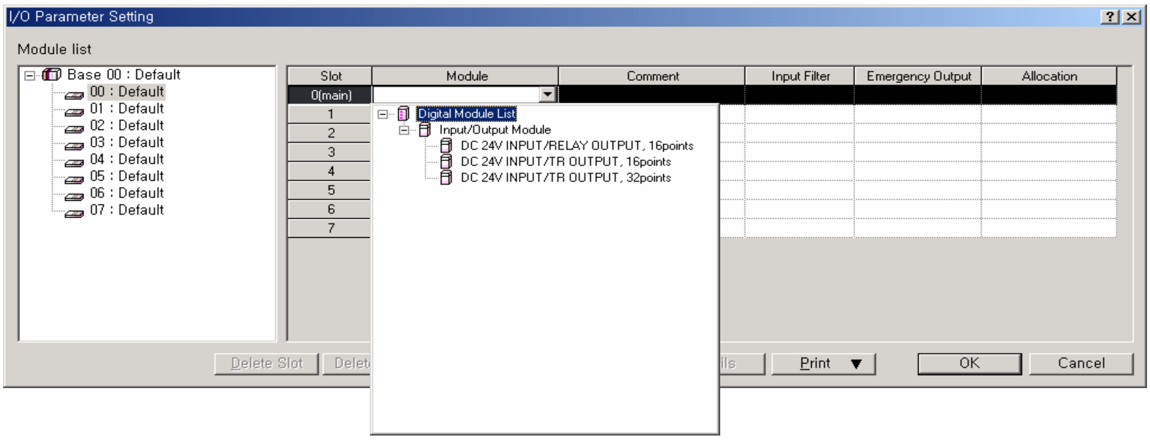
☐ Keep output when converting STOP->RUN

☐ Delete all areas except latch when an error occurs

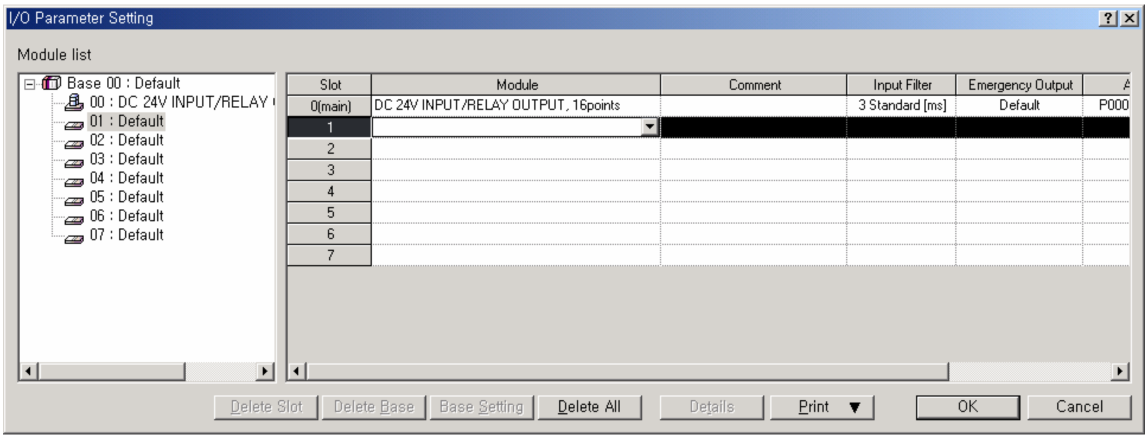
Category	Item	Description	Note
Basic operations	Fixed period operation	Set the time of fixed period operation.	1~999 ㎳
	Watchdog timer	Set the time of scan watchdog.	10~1000 ㎳
	Standard input filter	Set the time of standard input filter.	1,3,5,10,20,70,100 ㎳
	Output during debugging	Set whether to allow output actually during debugging operation.	Allowance/Prohibition
	Keep output when an error occurs	Set whether to preserve output holding function set in I/O parameter in case of error.	Allowance/Prohibition
	Delete all areas except latch when an error occurs	Set whether to clear each device that is not designated as a latch area in case of error	-
Device area	Select latch area	Set the latch area of each device.	-
Error operation	Operation resumes in case of operation error	Set whether to pause or resume operation in case of operation error.	Pause/Resume

6.1.2 I/O parameter setting

This setting is to set and reserve each I/O information. Clicking 『I/O Parameter』 in the project window shows the following setting window.

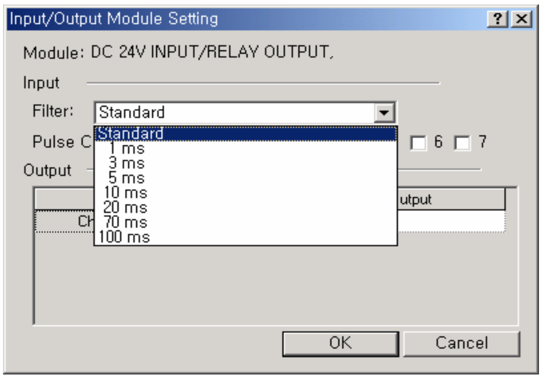


Clicking 『Module』 in 『Slot Position』 indicates a list of modules, in which you may set I/O corresponding to the actual system. Then, the following window is displayed.



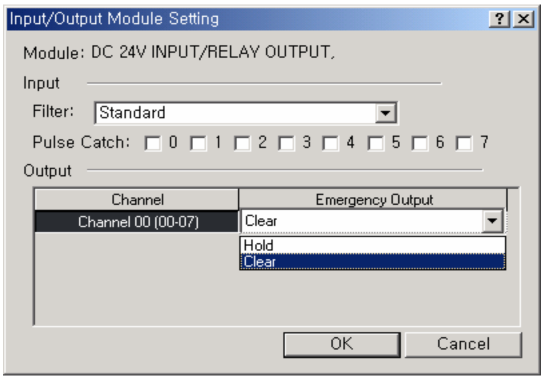
Slot	Module	Comment	Input Filter	Emergency Output	A
0(main)	DC 24V INPUT/RELAY OUTPUT, 16points		3 Standard [ms]	Default	P000
1					
2					
3					
4					
5					
6					
7					

Clicking 『Details』 in 『Slot Position』 shows the following window to set filter and emergency output.



Module: DC 24V INPUT/RELAY OUTPUT.

Filter: Standard



Module: DC 24V INPUT/RELAY OUTPUT.

Filter: Standard

Channel	Emergency Output
Channel 00 (00-07)	Clear

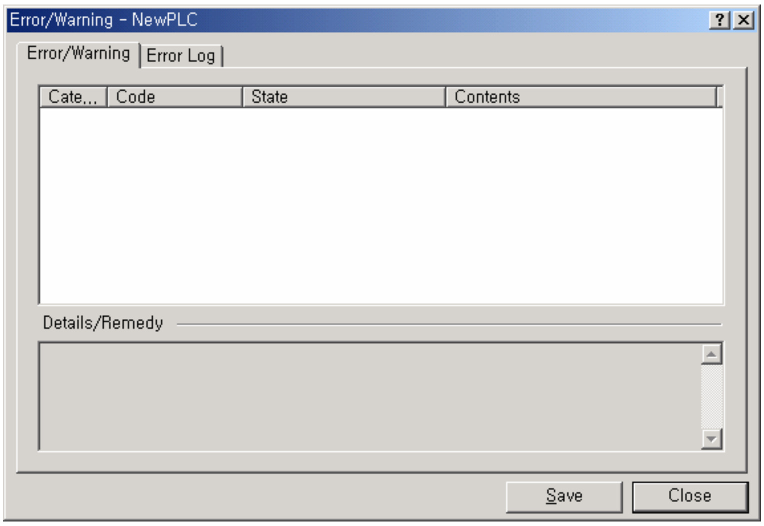
Remark

- If settings are different with I/O module actually accessed, “Inconsistent module type error” occurs, displaying error.
- Without settings, CPU reads each I/O module information and operates.

6.2 Self-diagnosis Function

6.2.1 Saving of error log

CPU module logs errors occurred so that the causes will be identified and fixed easily. Clicking 『Error/Warning』 of 『Online』 shows the current error and previous error log.



Item	Description	Remarks
Error/Warning	Display the current error/warning.	-
Error Log	Display a log of error/warning occurred.	Saving up to 100

Remark

Saved data are not deleted until selecting a menu of XG5000 and clicking “Delete”.

6.2.2 Troubleshooting

1) Trouble types

Trouble occurs due to PLC itself, system configuration error or abnormal operation result detected. Trouble is divided into trouble mode stopping operation for the safety and warning mode generating alert to user with a mode in trouble.

The causes troubling PLC system are as follows.

- PLC hardware trouble
- System configuration error
- Operation error while operating user program
- Error detected owing to external device in trouble

2) Operation mode if trouble occurs

PLC system logs any trouble occurred in flag and determines whether to stop or resume operation depending on trouble mode.

A) PLC hardware trouble

In case an error occurs so that PLC such as CPU module and power module may not work normally, the system is halted, but any warning may not interfere with the operation.

B) Operation error while operating user program

Representing an error occurred during operation of user program, in case of numeric operation error, it displays the error in error flag but the system resumes operating. However, if the operation time exceeds by the operation monitoring time limit and I/O module does not control it normally, the system is halted.

C) Error detected owing to external device in trouble

Representing the detection of external device to be controlled by users program of PLC, if an error is detected, the system is halted, but any warning may not interfere with the operation.

Remark

1) If any trouble occurs, the unique trouble number is saved in a special relay F****.
2) For details of flag, refer to the appendix 1 Flag List.

6.3 Remote Functions

CPU module may change operation by communication as well as by key switches mounted on the module. To operate it remotely, it is necessary to set 'RUN/STOP' switch to 'STOP'.

1) Remote operations are as follows.
   - Operable by accessing to XG5000 through RS-232C port mounted on CPU module.
   - Can operate other PLC connected to PLC network with CPU module connected to XG5000.
   - Can control the operation of PLC by HMI software and other applications through the leased communication.

2) Remote RUN/STOP
   - Remote RUN/STOP is the externally controlled RUN/STOP function.
   - It is convenient when CPU module is located at a position hard to control or when CPU module within control panel is to control RUN/STOP function remotely.

3) Remote DEBUG
   - It manages debugging remotely when remote mode is STOP. Namely, DEBUG operation is to execute program operation depending on designated operation conditions.
   - Remote DEBUG is a convenient function when confirming program operation status or data during system debugging.

4) Remote Reset
   - Remote reset is to reset CPU module remotely if an error occurs at a place hard to directly control CPU module.
   - Like operation by switches, it supports 'Reset' and 'Overall Reset'.

Remark

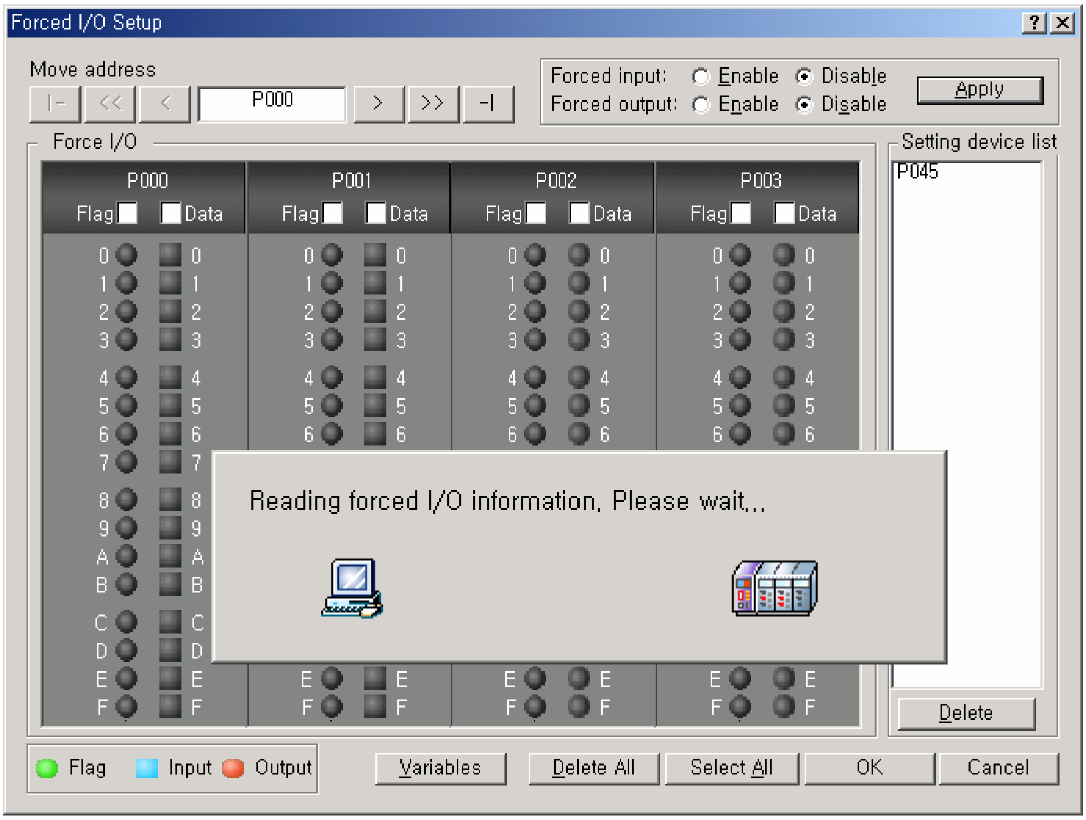
1) For details regarding remote functions, refer to 'Online' of XG5000 Users Manual.

6.4 Forced Input/Output On and Off Function

Force I/O function is used to force to turn I/O areas on or off, regardless of program results.

6.4.1 Force I/O setup

Click 『 Online 』 - 『 Force I/O 』 .



Move address: P000

Forced input: ○ Enable ● Disable

Forced output: ○ Enable ● Disable

Setting device list: P045

Reading forced I/O information. Please wait...

Item		Description
Move address	|- -|	Move to the beginning and end of I/O area(P000↔P127)
	<< >>	Move to ±8 of I/O area displayed at the very left.
	< >	Move to ±1 of I/O area.
Application		Set whether to allow or not Force I/O
Single	Flag	Set whether to allow or not Force I/O by bits.
	Data	Set Force I/O data on or off by bits.
Select All		Set to allow Force I/O with all I/O area on
Delete All		Delete to allow Force I/O with all I/O area off.
Setting device		Display I/O area set as a bit.

6.4.2 Processing time and processing method of Force Input/Output On and Off

1) Force Input

Regarding input, at the time of input refresh it replaces the data of contact set as Force On/Off among data read from input module with the data as Force and updates input image area. Therefore, user program executes operations with actual input data while Force input area is operated with data set as Force.

2) Force Output

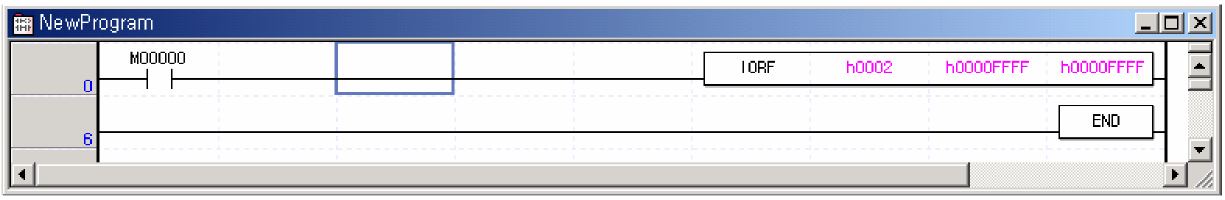
Regarding output, at the time of output refresh upon the execution user program operation, it replaces the data of contact set as Force On/Off among data of output image area containing operation results with data set as Force and outputs the data in output module. Unlike (Force) input, the output image area is not changed by Force On/Off setting.

3) Cautions when using Force I/O function

- It operates from the time when I/O is individually set as 'Allow' after setting Force data.
- It is possible to set Force input although I/O module is not actually mounted.
- Despite of the power changed Off -> On, operation mode changes or any operation by pressing reset key, the data of which On/Off is set before is kept in CPU module.
- Even in STOP mode, Force I/O data is not removed.
- To set new data from the beginning, it is necessary to deselect all settings of I/O by using 'Delete All' option.

6.5 Direct Input/Output Operation

This function may be useful when directly reading the status of input contact during program operation by refreshing I/O by means of 'IORF' command or outputting operation results to output contact.



```
0  M00000  IORF  h0002  h0000FFFF  h0000FFFF
6  END
```

- Can designate bit by bit as mask data is designated.

Remark

For details regarding IORF instruction, refer to XGB Instructions List.

6.6 Diagnosis of External Device

This flag is provided for a user to diagnose any fault of external device and, in turn, execute halt or warning of the system. Use of this flag displays faults of external device without any complicated program prepared and monitors fault location without any specific device(XG5000 and etc) or source program.

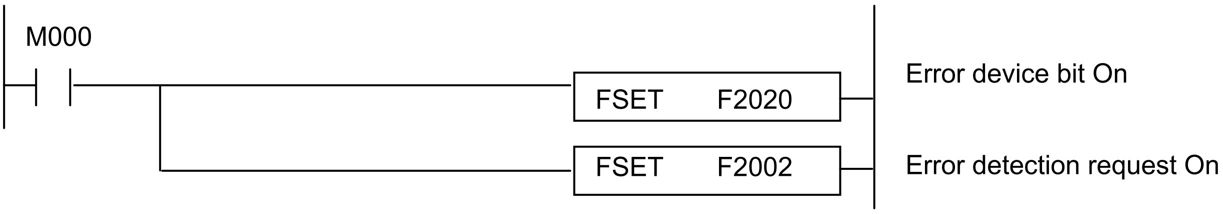
1) Detection and classification of faults in external device

- The trouble(fault) of external device may be detected by user program and largely divided, depending on the type, into error and warning; the former requires halt of PLC operation and the latter simply displays the status while PLC keeps working.
- 'Error' uses 'F202(_ANC_ERR)' and 'Warning' uses 'F203(_ANC_WB) flag'.
- As the detection request flag, 'Error' uses 'F2002(_CHK_ANC_ERR) flag' while 'Warning' uses 'F2003(_CHK_ANC_WB) flag'.

2) Troubleshooting external device

- When detecting any trouble of external device in user program, it writes a value except '0' by classifying the type, which is defined by a user in 'F202(_ANC_ERR)' while the detection request flag checks it at the time when the program ends with 'F2002(_CHK_ANC_ERR) On, and PLC turns off all output, making it as the same error status as detected by PLC itself.
- If any trouble occurs, a user may identify the cause by using XG5000 and alternatively by monitoring 'F202(_ANC_ERR) flag'.

☐ Example

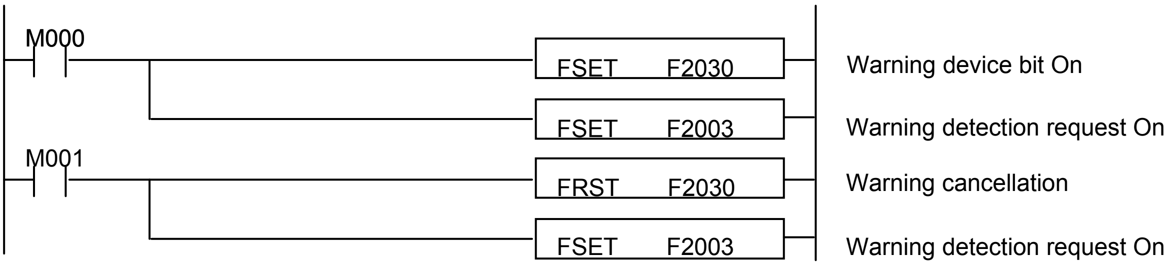


- If any trouble occurs, CPU is in error status and operation halts. At this moment, F2020 and F2002 flags are off (error LED switches on and off every second.)

3) Processing warning of external device

- When detecting any warning of external device in user program, it turns on a flag in the warning position of system flag 'F203 (_ANC_WB) and if turning on the detection request flag, 'F2003(_CHK_ANC_WB)' , it displays warning at the time when scan program ends. If a warning occurs, the detection request flag, 'F2003(_CHK_ANC_WB)' is automatically off(F203 is not deleted).
- If a warning occurs, the LED switches on and off every other second.
- If turning off a bit in question of F203 and turning on F2003 bit after processing warning, warning is cancelled and the LED turns off.

☐ Example



6.7 Allocation of Input/Output number

Allocation of I/O number is to allocate an address to every I/O of each module to read data from input module and output data to output module when it executes operations.
XGB series adopts 64 points occupation to every module.

☐ Allocation of I/O number
64 points are allocated to every module(incl. special, communication).

System Configuration

Number of Connection stage	Type	I/O allocation	Remarks
0	XBM-DN32S	Input : P0000 ~ P001F Output : P0020 ~ P003F	Basic unit fixed
1	XBE-DC32A	Input : P0040~P007F	Actual input : P0040 ~ P004F
2	XBE-TN32A	Output : P0080 ~ P011F	Actual output : P0080 ~ P009F
3	XBL-C41A	P0120 ~ P015F	-
4	XBF-AD04A	P0160 ~ P019F	-
5	XBE-DV04A	P0200~P027F	-
6	XBE-DC32A	Input : P0240~P027F	Actual input : P0240 ~ P024F
7	XBE-TN32A	Output : P0280 ~ P031F	Actual output : P0280 ~ P028F

Empty I/O point is available for internal relay.

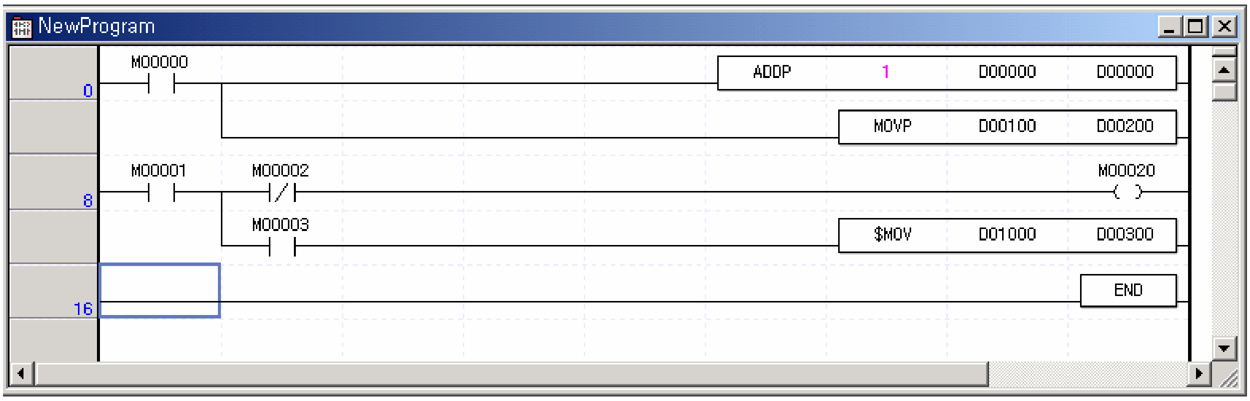
6.8 Online Editing

It is possible to modify program and communication parameter during operation of PLC without control operation stopped. The following describes basic modification. For details of modifying program, refer to XG5000 Users Manual.

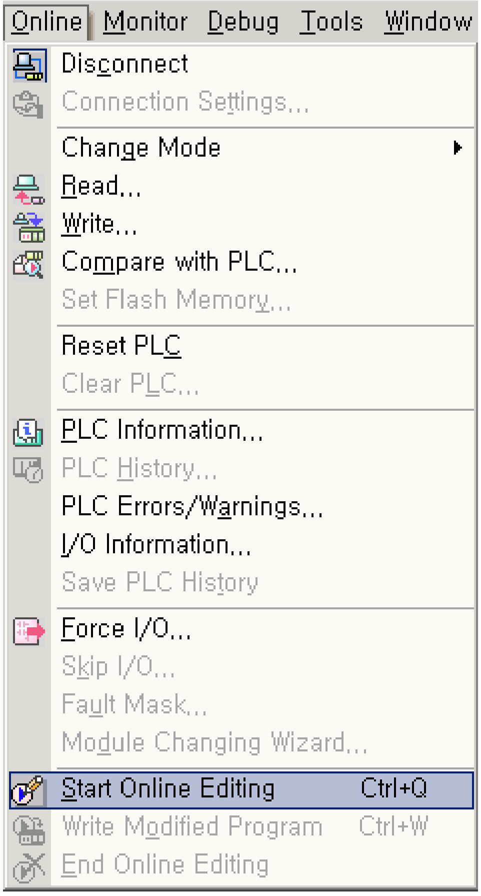
Items to be modified during operation are as follows.

- Program
- Communication parameter

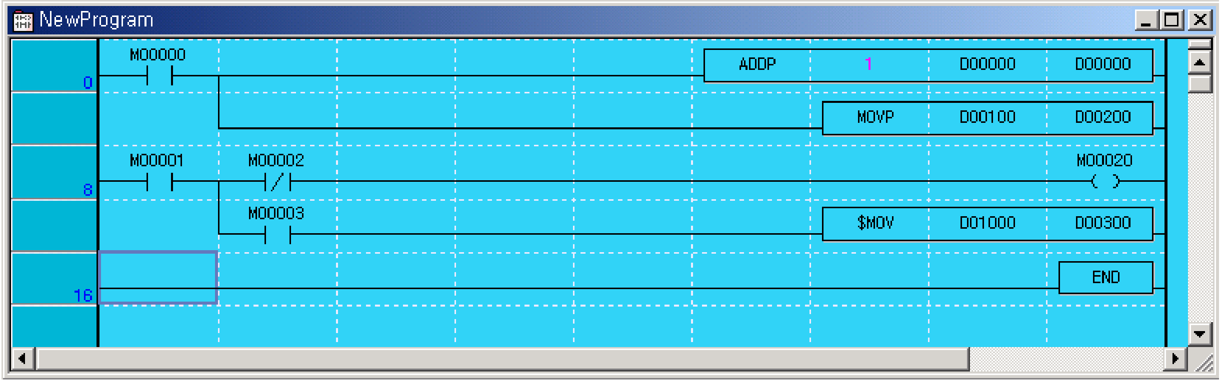
1) It displays programs that are currently running.



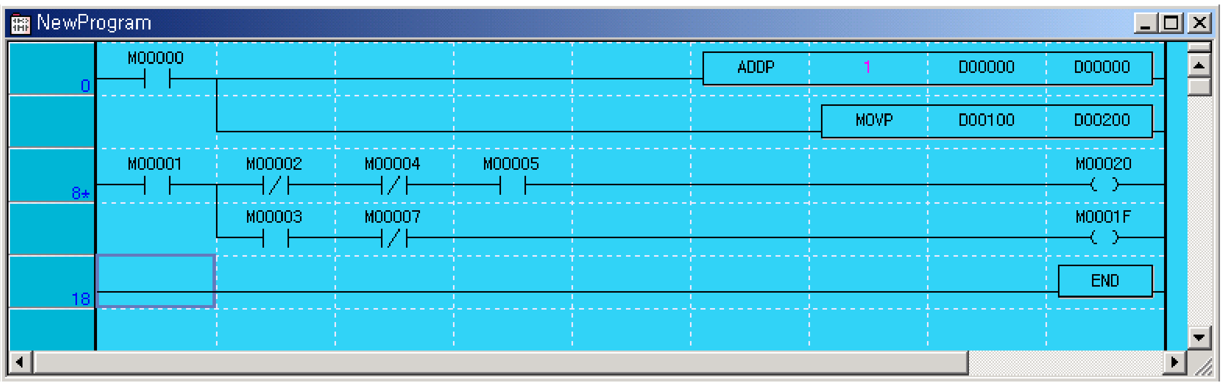
2) Click 『Online』 - 『Start Online Editing』 .



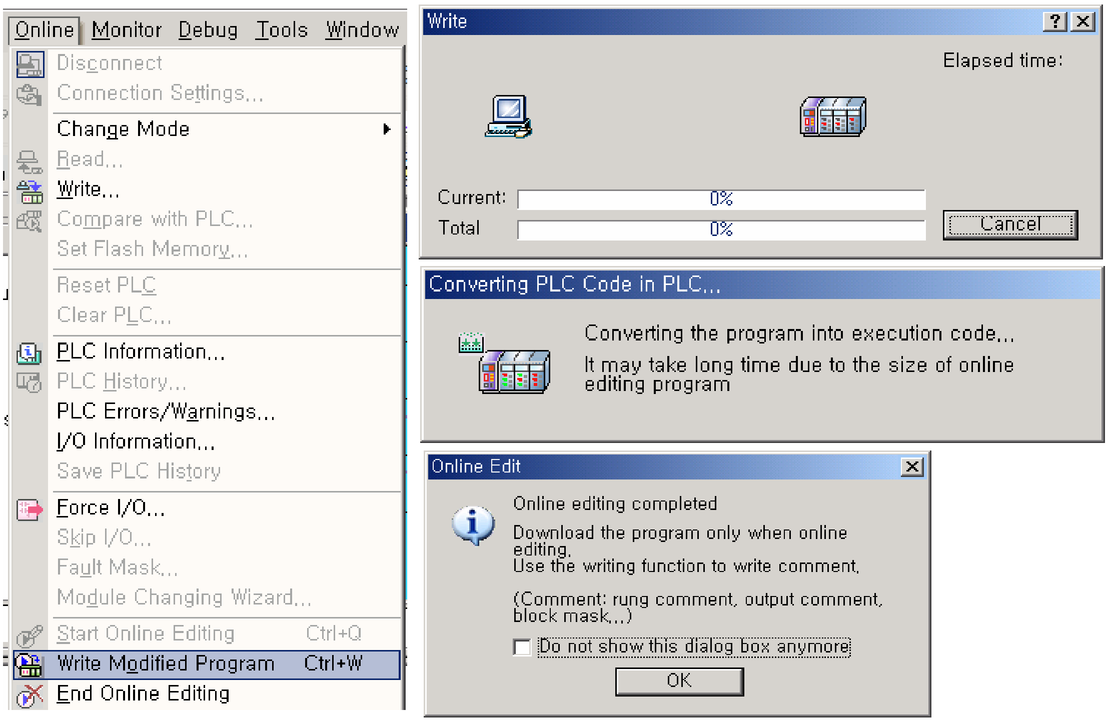
3) It turns to program modification mode during run when the program background is changed.



4) Modifying a program.



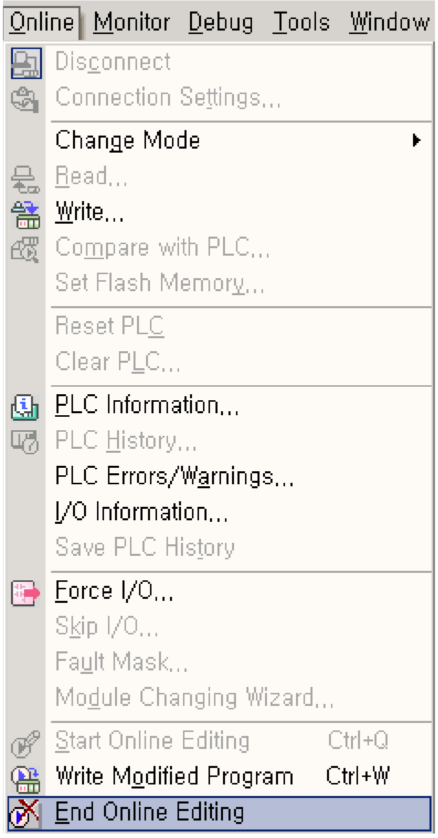
5) Upon the modification of program, click 『Online』 - 『Write Modified Program』.

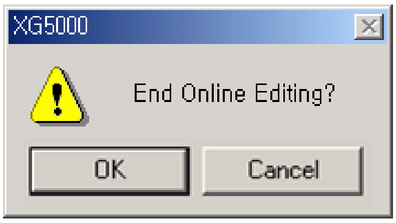


Converting the program into execution code...
It may take long time due to the size of online editing program

Online editing completed
Download the program only when online editing.
Use the writing function to write comment.
(Comment: rung comment, output comment, block mask...)

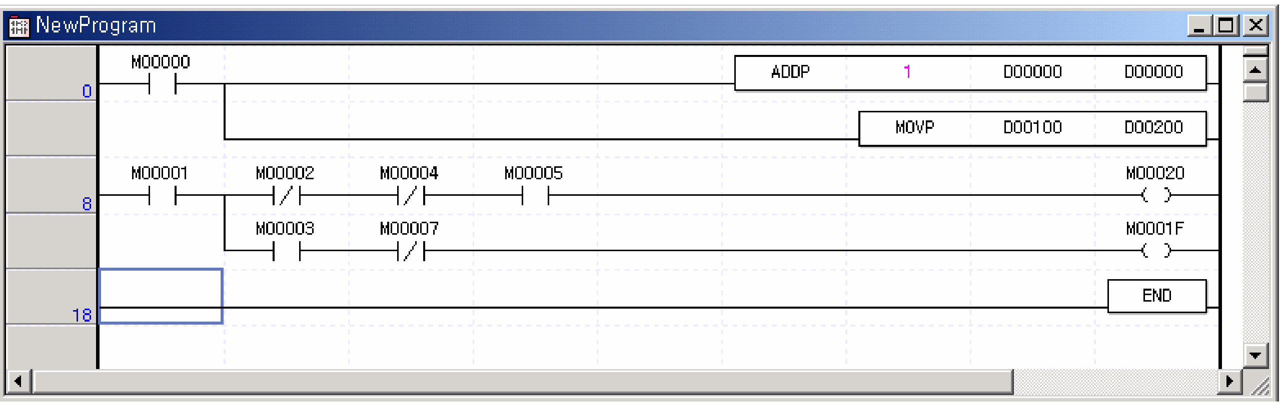
6) Upon the writing of program, click 『Online』 - 『End Online Editing』.





End Online Editing?

7) The program background returns and the program modification during run is completed.



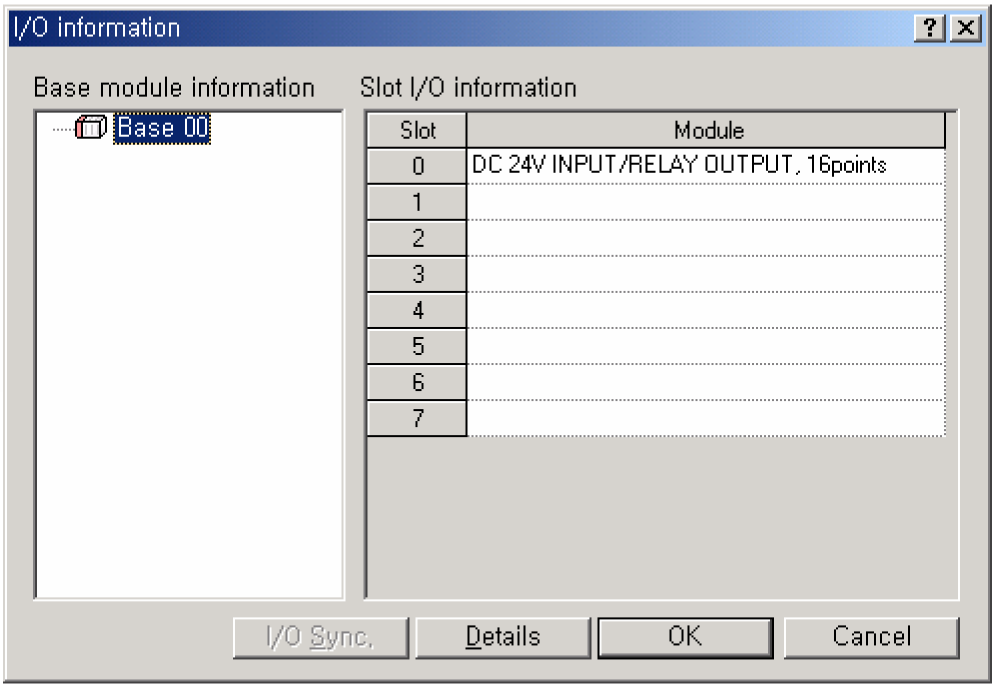
Remark

- For parameter modification during run, change each parameter on XG-PD and click 『Online』 - 『Write Modified Program 』.

6.9 Writing Input/Output Information

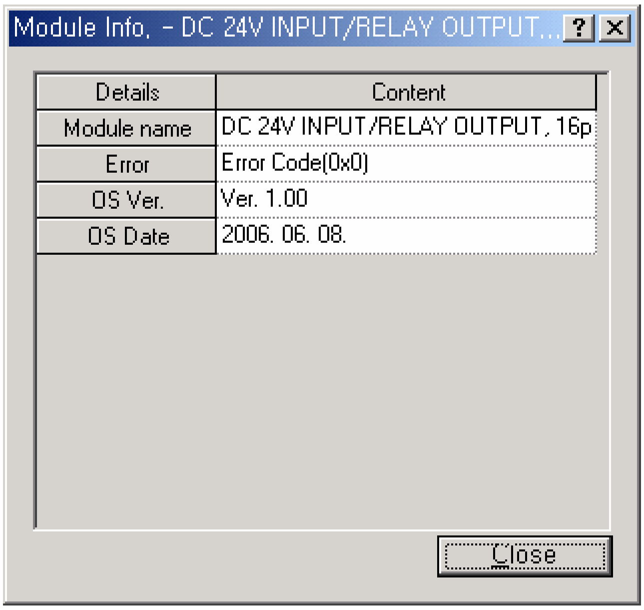
It monitors information of individual modules consisted of XGB series system.

❑ Click『Online』-『I/O Info』. Then, information of each module connected to the system is monitored.



Slot	Module
0	DC 24V INPUT/RELAY OUTPUT, 16points
1	
2	
3	
4	
5	
6	
7	

❑ If clicking Details after selecting a module, it displays detail information of a selected module.

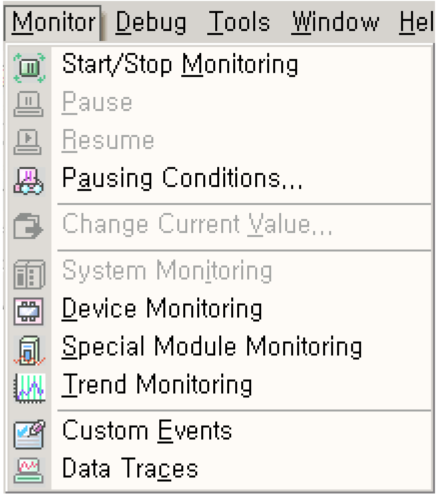


Details	Content
Module name	DC 24V INPUT/RELAY OUTPUT, 16p
Error	Error Code(0x0)
OS Ver.	Ver. 1.00
OS Date	2006. 06. 08.

6.10 Monitoring

It monitors system information of XGB series system.

❑ Clicking『Monitor』 displays the following sub-menus.

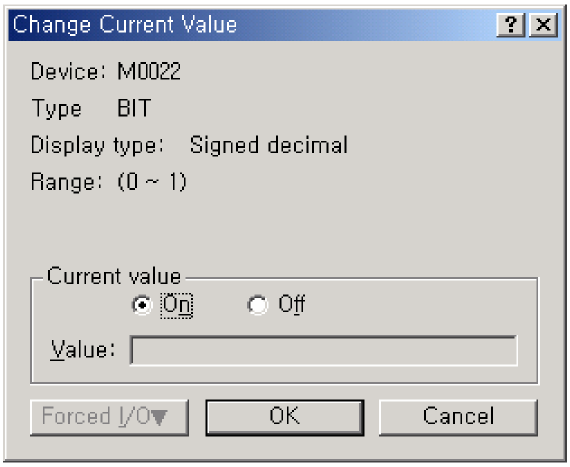


▪ Items and descriptions

Item	Description	Remarks
Start/Stop Monitoring	Designate the start and stop of monitor.	Click for reverse turn.
Pause	Pause monitoring.	-
Resume	Resume paused monitor.	-
Pausing Conditions	Pause monitoring if a preset value of device corresponds to condition.	Monitor resumes; clicking for resume.
Change Current Value	Change the present value of currently selected device.	-
System Monitoring	Monitor general system information.	-
Device Monitoring	Monitor by device (type).	-
Trend Monitoring	Monitor trend of device set in the system.	For details, refer to XG5000 Users Manual.
Custom Events	Monitor the value of device set when an event set by a user occurs.	
Data Traces	Trace the value of device.	

1) Change current value

▪It changes the current value of each device selected in the current program window.



Device: M0022

Type BIT

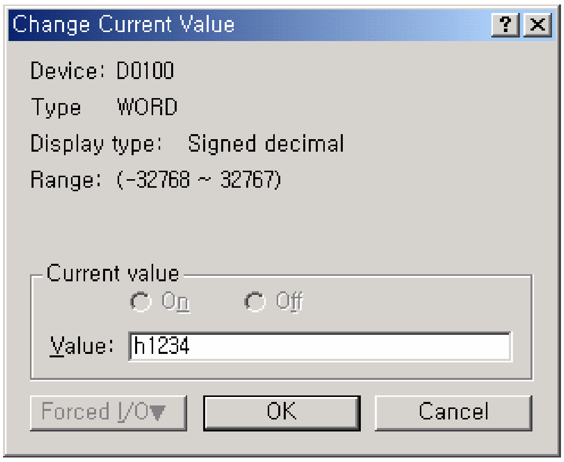
Display type: Signed decimal

Range: (0 ~ 1)

Current value

● On ○ Off

Value:



Device: D0100

Type WORD

Display type: Signed decimal

Range: (-32768 ~ 32767)

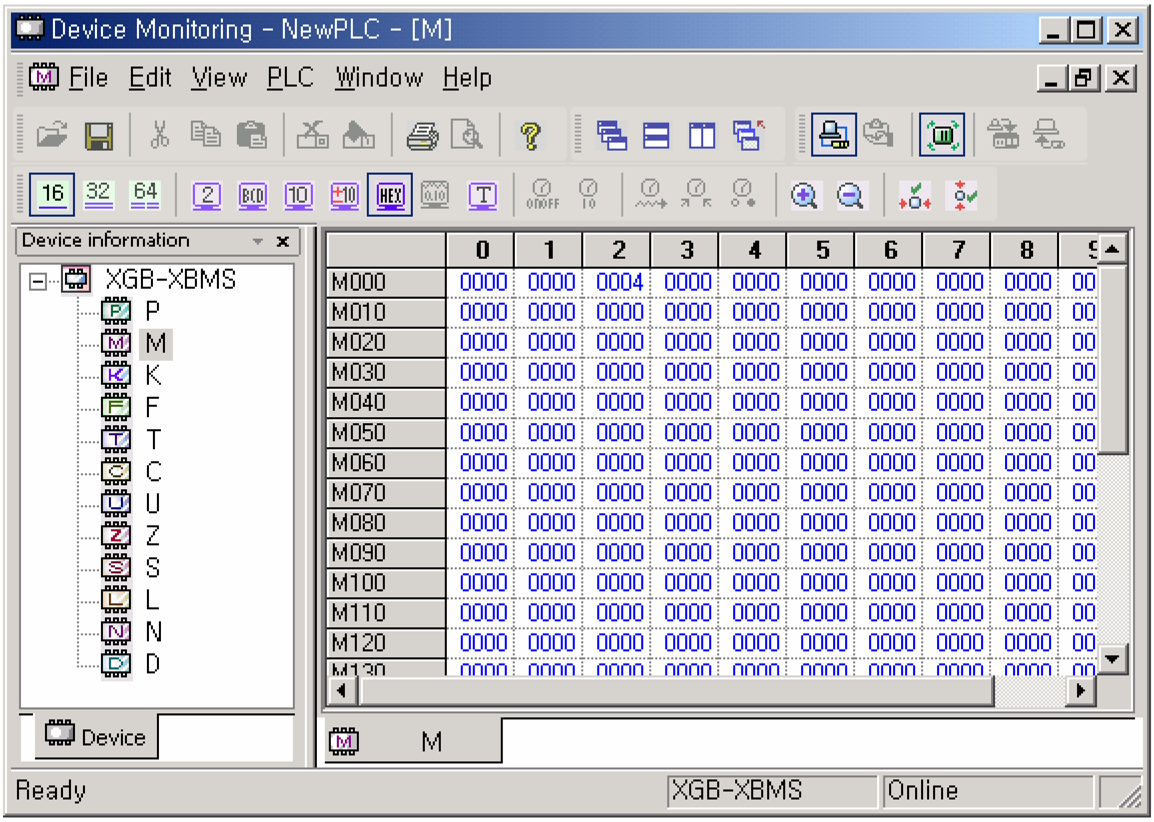
Current value

○ On ○ Off

Value: h1234

2) Device monitoring

▪It monitors by device (type).

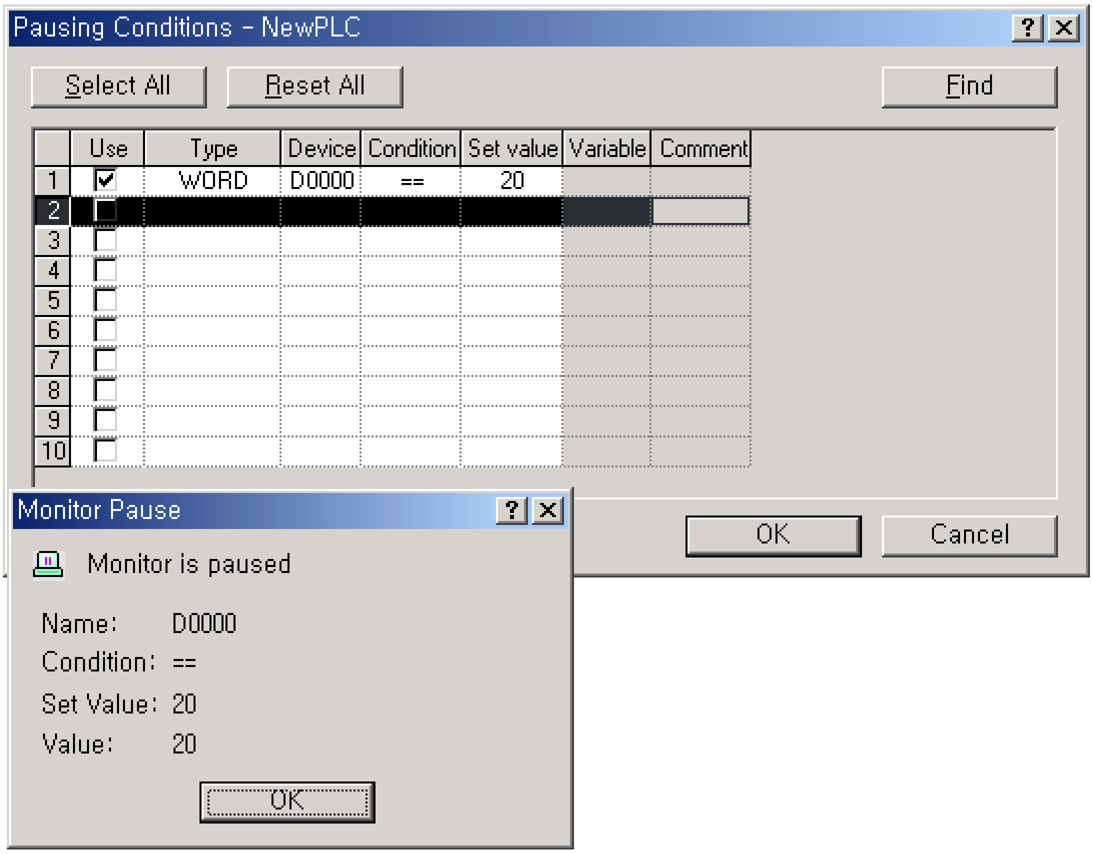


	0	1	2	3	4	5	6	7	8	9
M000	0000	0000	0004	0000	0000	0000	0000	0000	0000	00
M010	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M020	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M030	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M040	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M050	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M060	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M070	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M080	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M090	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M100	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M110	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M120	0000	0000	0000	0000	0000	0000	0000	0000	0000	00
M130	0000	0000	0000	0000	0000	0000	0000	0000	0000	00

Ready XGB-XBMS Online

3) Pausing conditions

▪It stops monitoring in case a device value set in the program corresponds.



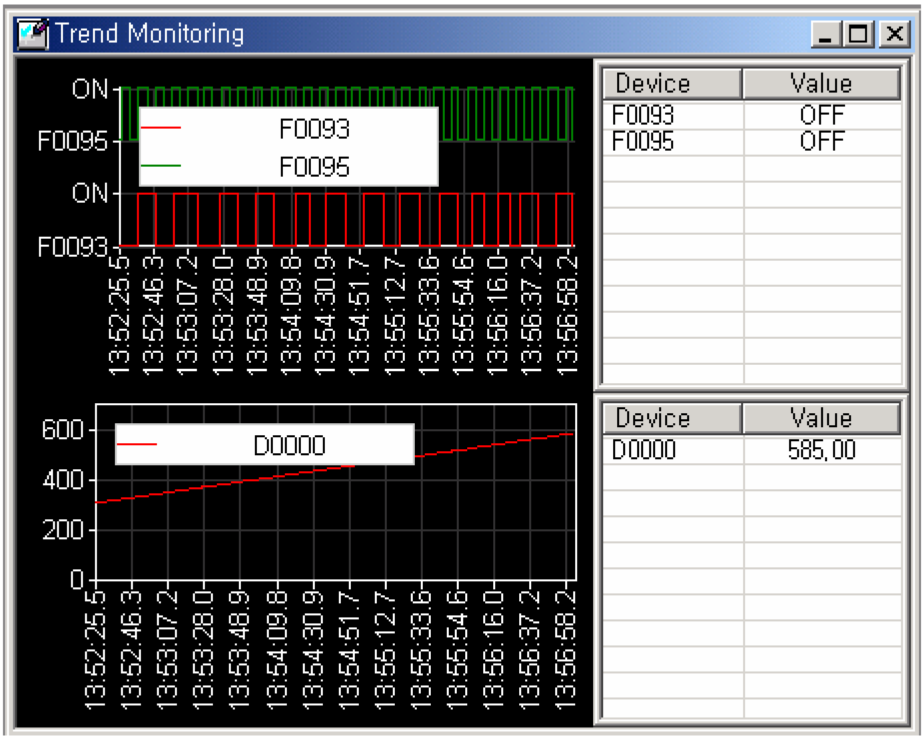
	Use	Type	Device	Condition	Set value	Variable	Comment
1	☑	WORD	D0000	==	20		
2	☐						
3	☐						
4	☐						
5	☐						
6	☐						
7	☐						
8	☐						
9	☐						
10	☐						

Monitor is paused

Name: D0000
Condition: ==
Set Value: 20
Value: 20

4) Trend monitoring

▪It displays device values graphically.

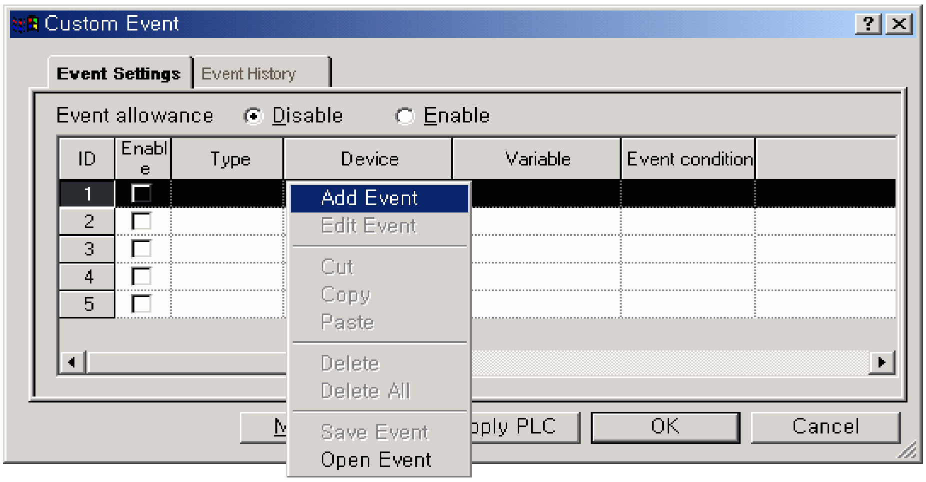


Device	Value
F0093	OFF
F0095	OFF

Device	Value
D0000	585.00

5) Custom events

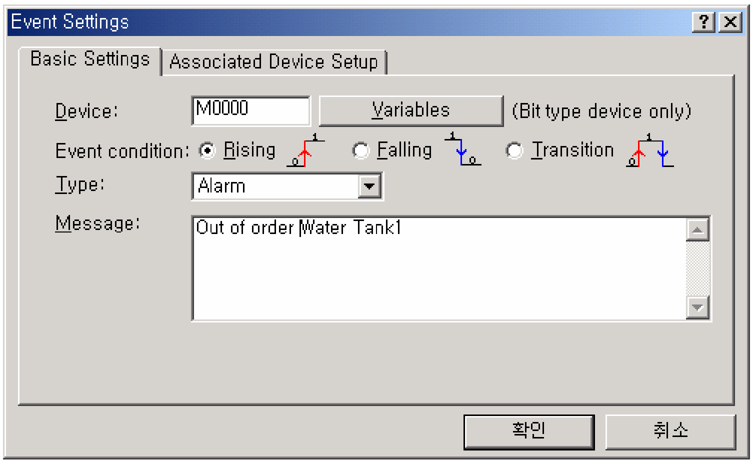
▪It monitors detail information when an event set by a user occurs. Additional user event may be registered.



Event allowance ● Disable ○ Enable

ID	Enable	Type	Device	Variable	Event condition
1	☐				
2	☐				
3	☐				
4	☐				
5	☐				

▪It sets basic setting and relative device.
If rising edge of M0000 device occurs, it records the message of an alarm, “Out of order Water Tank 1” and the device values of D0000,L0000,D0100,N1000 are recorded.



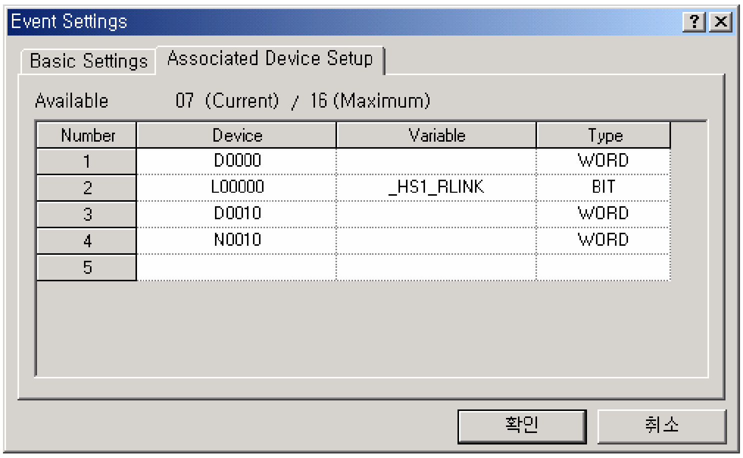
Device: M0000 (Bit type device only)

Event condition: ● Rising ○ Falling ○ Transition

Type: Alarm

Message: Out of order Water Tank1

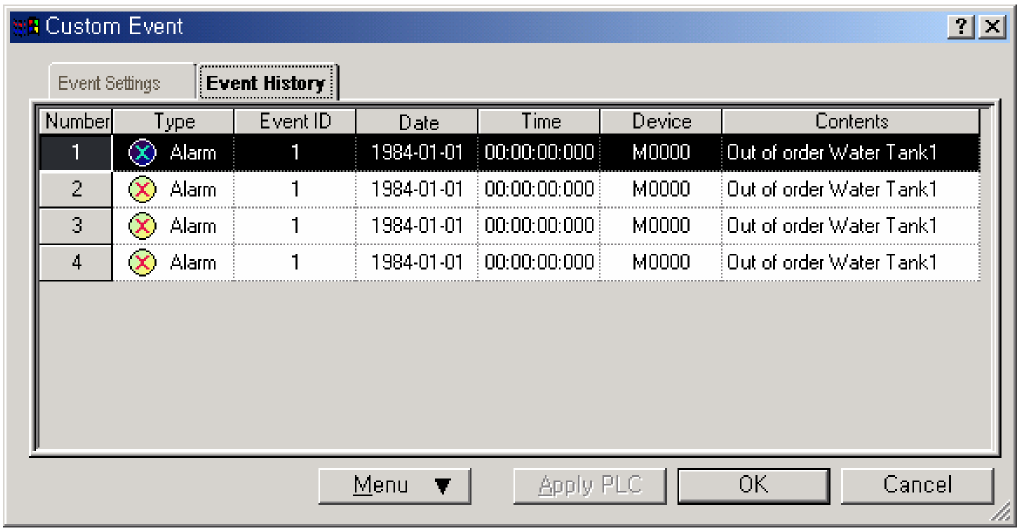
▪ Set the relative device(s).



Available 07 (Current) / 16 (Maximum)

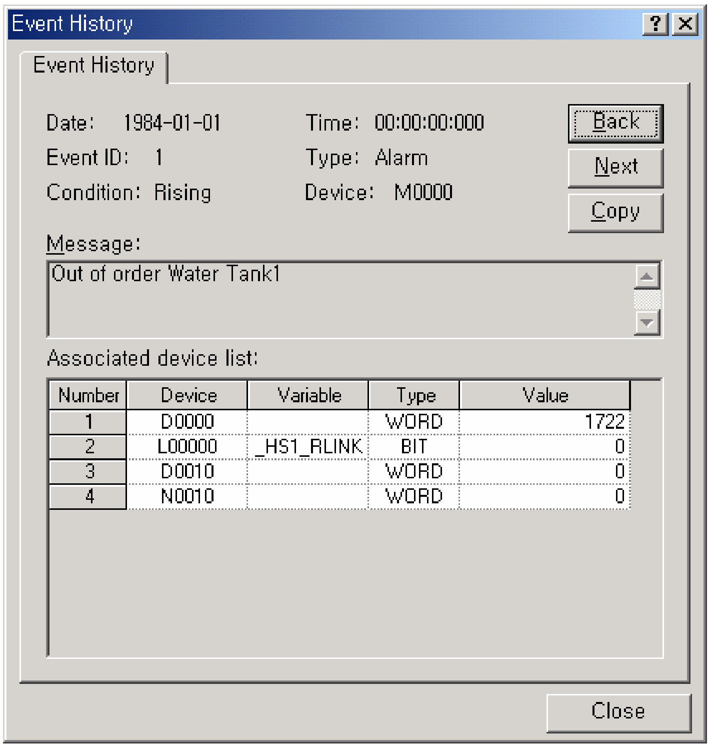
Number	Device	Variable	Type
1	D0000		WORD
2	L00000	_HS1_RLINK	BIT
3	D0010		WORD
4	N0010		WORD
5			

- Monitor event history of custom event.



Number	Type	Event ID	Date	Time	Device	Contents
1	Alarm	1	1984-01-01	00:00:00:000	M0000	Out of order Water Tank1
2	Alarm	1	1984-01-01	00:00:00:000	M0000	Out of order Water Tank1
3	Alarm	1	1984-01-01	00:00:00:000	M0000	Out of order Water Tank1
4	Alarm	1	1984-01-01	00:00:00:000	M0000	Out of order Water Tank1

- Double-clicking a number produced monitors the relative values of device and the detail message as follows.



Date: 1984-01-01
Time: 00:00:00:000
Event ID: 1
Type: Alarm
Condition: Rising
Device: M0000

Message:
Out of order Water Tank1

Associated device list:

Number	Device	Variable	Type	Value
1	D0000		WORD	1722
2	L00000	_HS1_RLINK	BIT	0
3	D0010		WORD	0
4	N0010		WORD	0

Remark

- For details of monitor, refer to XG5000 Users Manual.

Chapter 7 Input/Output Specifications

7.1 Introduction

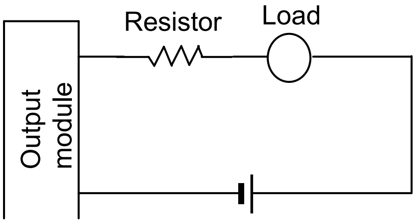
Here describes the notices when selecting digital I/O module used for XGB series.

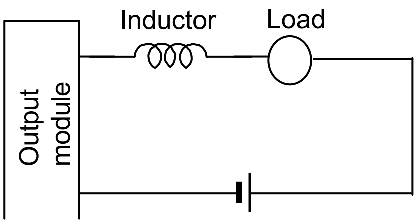
1) For the type of digital input, there are two types such as current sink input and current source input.

2) In case that open/close frequency is high or it is used for conductive load open/close, use Transistor output module or triac output module as the durability of Relay Output Module shall be reduced.

3) For output module to run the conductive (L) load, max. open/close frequency should be used by 1second On, 1 second Off.

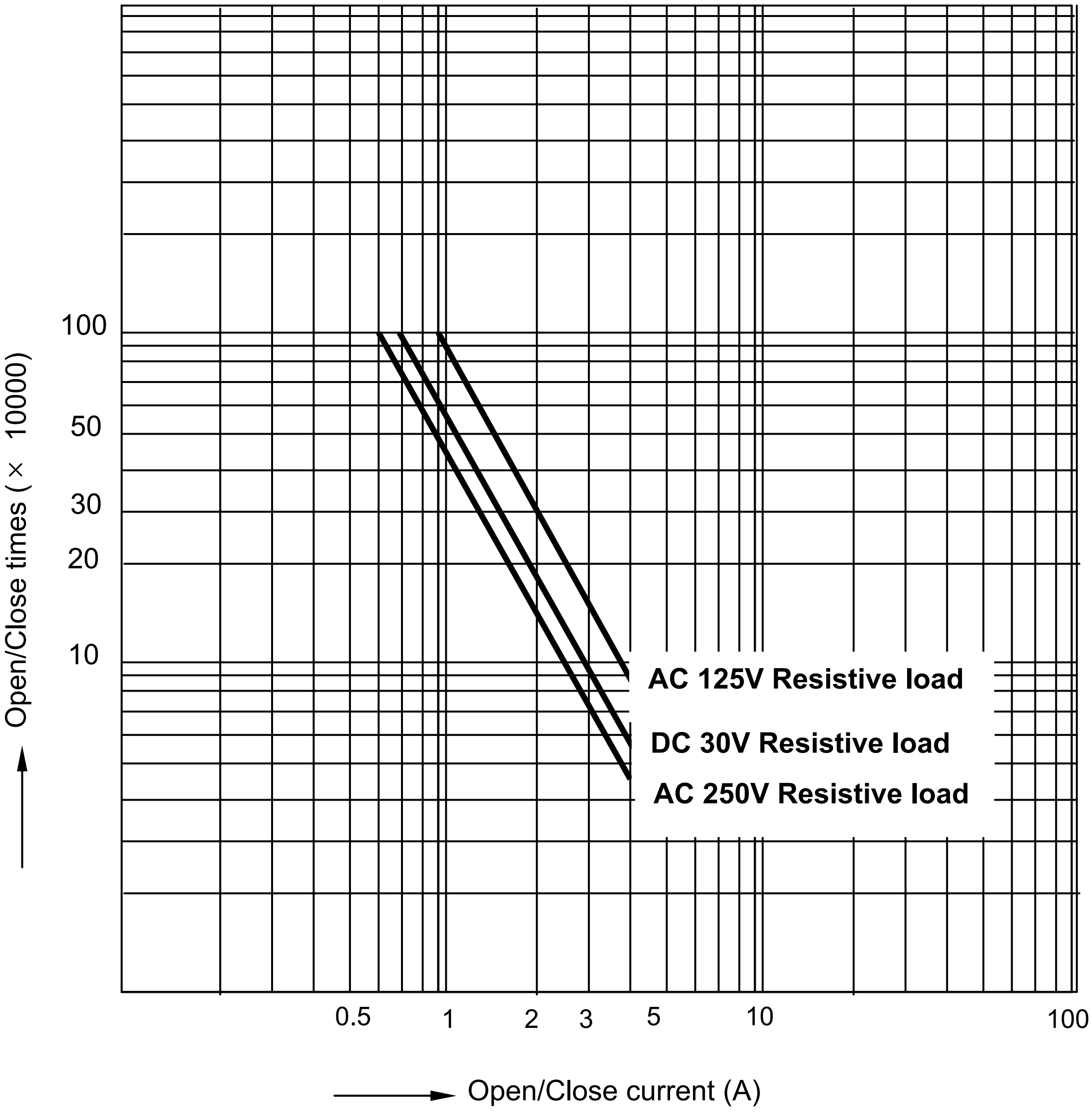
4) For output module, in case that counter timer using DC/DC Converter as a load was used, Inrush current may flow in a certain cycle when it is ON or during operation. In this case, if average current is selected, it may cause the failure. Accordingly, if the previous load was used, it is recommended to connect resistor or inductor to the load in serial in order to reduce the impact of Inrush current or use the large module having a max. load current value.





5) The cable size connected to terminal block should be twisted pair 0.3~0.75 ㎟, thickness less than 2.8 ㎜. As cable varies the allowable current by insulation thickness, cares should be taken.

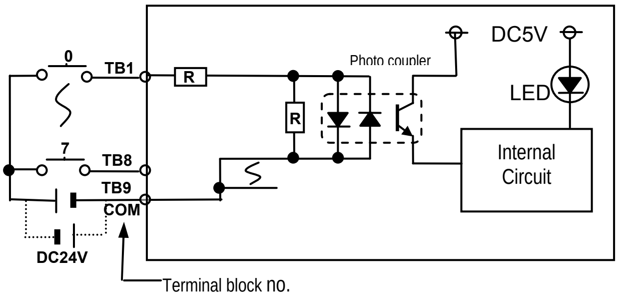
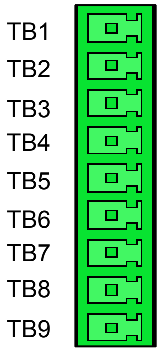
6) Relay life of Relay output module is shown as below.
Max. life of Relay used in Relay output module is shown as below.



7.2Basic Digital Input Unit Specifications

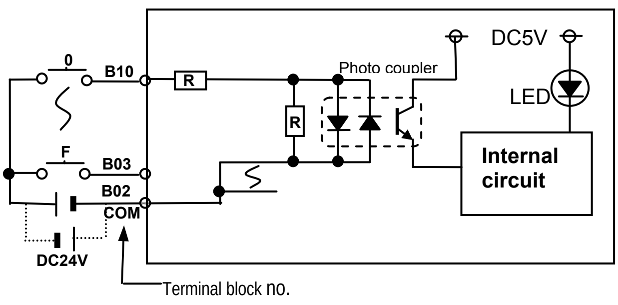
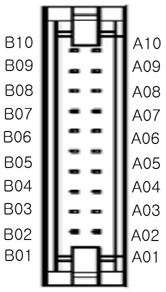
7.2.1 XBM-DR16S 8 point DC24V input unit (Source/Sink type)

Model / Specification		Basic unit
		XBM-DR16S
Input point		8 point
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃ (00~03: About 7 ㎃)
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)
On Voltage/Current		DC19V or higher/ 3 ㎃ or higher
Off Voltage/Current		DC6V or lower/ 1 ㎃ or lower
Input resistance		About 5.6 ㏀ (P00~P03: about 3.3 ㏀)
Response time	Off → On	1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistance		10 ㏁ or more by megger
Common Method		8 point / COM
Proper cable size		Twisted pair 0.3~0.75 ㎟ (external diameter 2.8 ㎜ or less)
Current consumption (㎃)		180 ㎃ (When Input On LED On)
Operation indicator		Input On, LED On
External connection method		9 pin terminal block connector
Weight		140g

Circuit configuration	No.	Contact	Type
	TB1	00	
	TB2	01	
	TB3	02	
	TB4	03	
	TB5	04	
	TB6	05	
	TB7	06	
	TB8	07	
	TB9	COM	

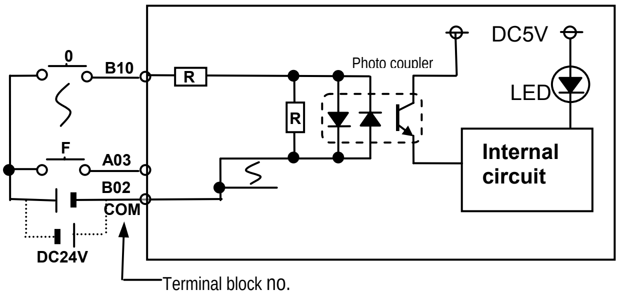
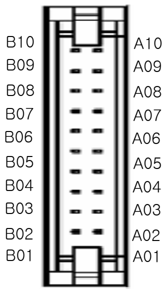
7.2.2 XBM-DN16S 8 point DC24V input unit (Source/Sink type)

Model / Specification		Basic unit
		XBM-DN16S
Input point		8 point
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃ (Contact point 0~3: About 7 ㎃)
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)
On Voltage/Current		DC19V or higher / 3 ㎃ or higher
Off Voltage/Current		DC6V or less / 1 ㎃ or less
Input resistance		About 5.6 ㏀ (P00~P03: About 3.3 ㏀)
Response time	Off → On	1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistance		10 ㏁ or more by megger
Common method		8 point / COM
Proper cable size		0.3 ㎟
Current consumption		180 ㎃ (when all point On)
Operation indicator		Input On, LED On
External connection method		20 pin connector
Weight		100g

Circuit configuration	No.	Contact	No.	Contact	Type
	B10	00	A10	NC	
	B09	01	A09	NC	
	B08	02	A08	NC	
	B07	03	A07	NC	
	B06	04	A06	NC	
	B05	05	A05	NC	
	B04	06	A04	NC	
	B03	07	A03	NC	
	B02	COM	A02	NC	
	B01	COM	A01	NC	

7.2.3 XBM-DN32S 16 point DC24V input unit (Source/Sink type)

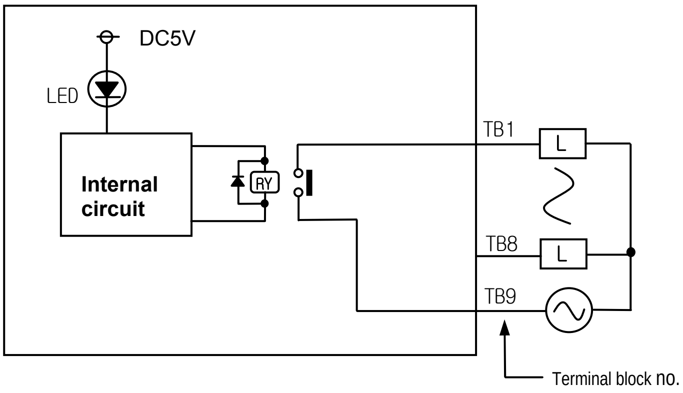
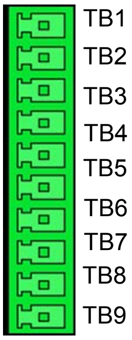
Model / Specification		Basic unit
		XBM-DN32S
Input point		16 point
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃ (Contact point 0~3: About 7 ㎃)
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)
On Voltage/Current		DC19V or higher / 3 ㎃ or higher
Off Voltage/Current		DC6V or less / 1 ㎃ or less
Input resistance		About 5.6 ㏀ (P00~P03: About 3.3 ㏀)
Response time	Off → On	1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistance		10 ㏁ or more by megger
Common method		16 point / COM
Proper cable size		0.3 ㎟
Current consumption		200 ㎃ (when all point On)
Operation indicator		Input On, LED On
External connection method		20 pin connector
Weight		110g

Circuit configuration	No.	Contact	No.	Contact	Type
	B10	00	A10	08	
	B09	01	A09	09	
	B08	02	A08	0A	
	B07	03	A07	0B	
	B06	04	A06	0C	
	B05	05	A05	0D	
	B04	06	A04	0E	
	B03	07	A03	0F	
	B02	COM	A02	COM	
	B01	COM	A01	COM	

7.3 Basic Digital Output Unit Specification

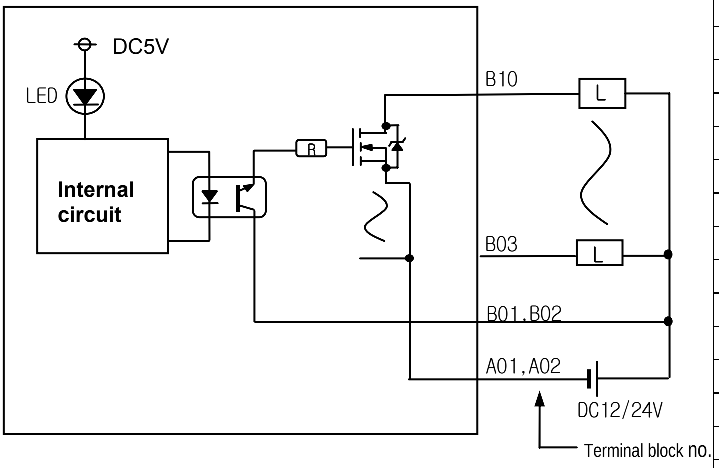
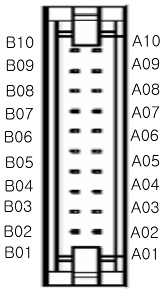
7.3.1 XBM-DR16S 8 point relay output unit

Model Specification		Basic unit
		XBM-DR16S
Output point		8 point
Insulation method		Relay insulation
Rated load voltage / current		DC24V 2A(Resistive load) / AC220V 2A(COSΨ = 1), 5A/COM
Min. load voltage/current		DC5V / 1 ㎃
Max. load voltage/current		AC250V, DC125V
Off leakage current		0.1 ㎃ (AC220V, 60 ㎐)
Max. On/Off frequency		3,600 times/hr
Surge absorber		None
Service life	Mechanical	20 millions times or more
	Electrical	Rated load voltage / current 100,000 times or more
		AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or more
		AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or more
		DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) 100,000 times or more
Response time	Off → On	10 ㎳ or less
	On → Off	12 ㎳ or less
Common method		8 point / COM
Proper cable size		Twisted pair0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		360 ㎃ (when all point On)
Operation indicator		Output On, LED On
External connection method		9 point terminal block connector
Weight		140g

Circuit configuration	No.	Contact	Type
	TB1	20	
	TB2	21	
	TB3	22	
	TB4	23	
	TB5	24	
	TB6	25	
	TB7	26	
	TB8	27	
	TB9	COM	

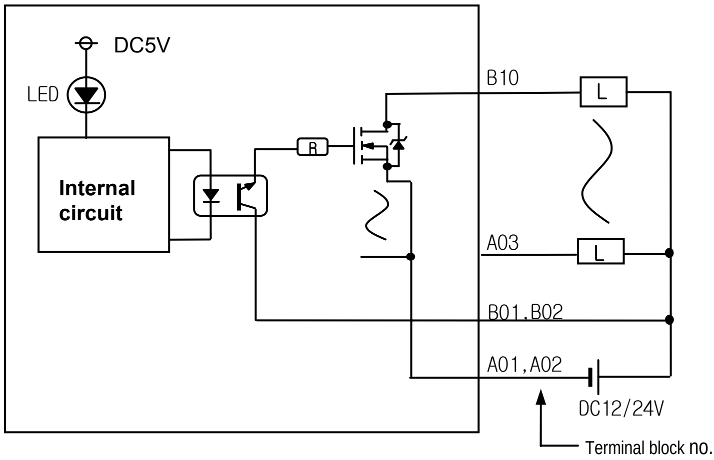
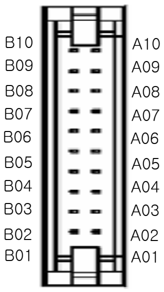
7.3.2 XBM-DN16S 8 point transistor output unit (Sink type)

Specification \ Model		Basic unit
		XBM-DN16S
Output point		8 point
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load voltage		0.5A / 1 point
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		8 point / COM
Proper cable size		0.3 ㎟
Current consumption		180 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		20 pin connector
Weight		100g

Circuit configuration	No.	Contact	Type
	B10	20	
	B09	21	
	B08	22	
	B07	23	
	B06	24	
	B05	25	
	B04	26	
	B03	27	
	B02	DC12 /24V	
	B01		
	A10	NC	
	A09	NC	
	A08	NC	
	A07	NC	
	A06	NC	
	A05	NC	
	A04	NC	
	A03	NC	
	A02	COM	
	A01		

7.3.3 XBM-DN32S 16 point transistor output unit (Sink type)

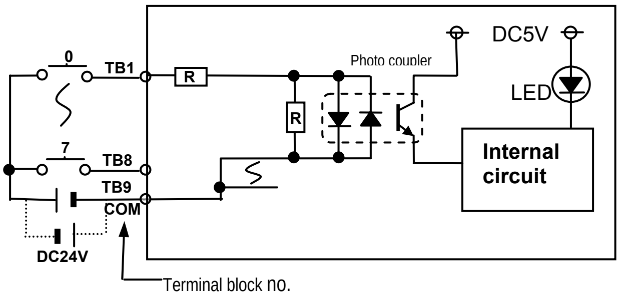
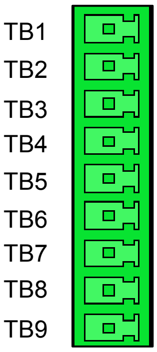
Model Specification		Basic unit
		XBM-DN32S
Output point		16 point
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load voltage		0.2A / 1 point, 2A / 1COM
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		16 point / COM
Proper cable size		0.3 ㎟
Current consumption		200 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		20 pin connector
Weight		110g

Circuit configuration	No.	Contact	Type
	B10	20	
	B09	21	
	B08	22	
	B07	23	
	B06	24	
	B05	25	
	B04	26	
	B03	27	
	B02	DC12 /24V	
	B01		
	A10	28	
	A09	29	
	A08	2A	
	A07	2B	
	A06	2C	
	A05	2D	
	A04	2E	
	A03	2F	
	A02	COM	
	A01		

7.4 Digital Input Module Specification

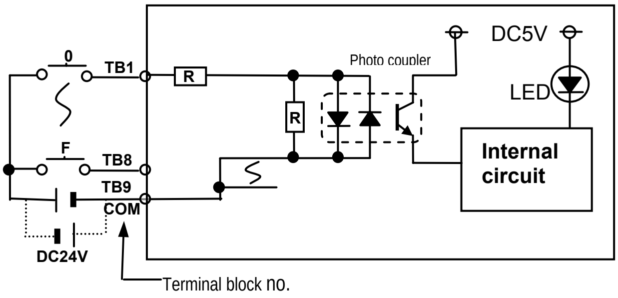
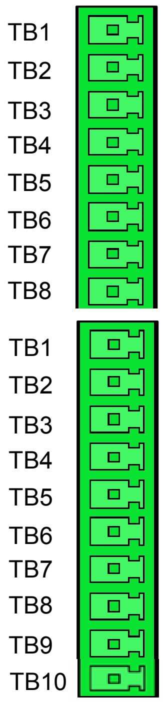
7.4.1 8 point DC24V input module (Source/Sink type)

Model		DC input module
Specification		XBE-DC08A
Input point		8 point
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)
On Voltage/Current		DC19V or higher / 3 ㎃ or higher
Off Voltage/Current		DC6V or less / 1 ㎃ or less
Input resistance		About 5.6 ㏀
Response time	Off → On	1/3/5/10/20/70/100 ㎳(set by CPU parameter) Default: 3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistance		10 ㏁ or more by megger
Common method		8 point / COM
Proper cable size		Stranded pair 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		30 ㎃ (when all point On)
Operation indicator		Input On, LED On
External connection method		9 point terminal block connector
Weight		

Circuit configuration	No.	Contact	Type
	TB1	0	
	TB2	1	
	TB3	2	
	TB4	3	
	TB5	4	
	TB6	5	
	TB7	6	
	TB8	7	
	TB9	COM	

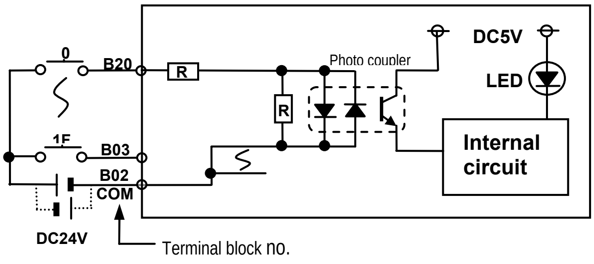
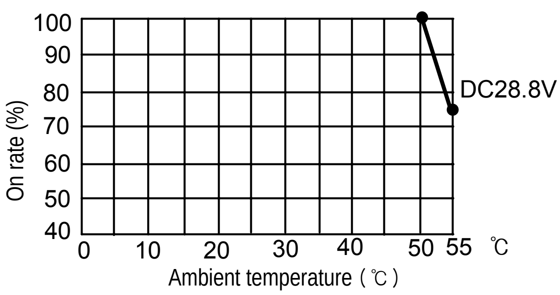
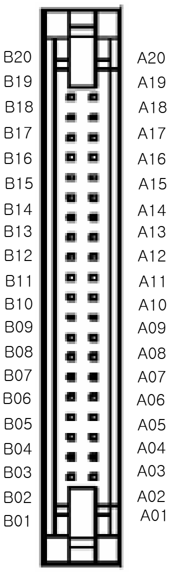
7.4.2 16 point DC24V input module (Sink/Source type)

Model / Specification		DC input module
		XBE-DC16A
Input point		16 point
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)
On Voltage/Current		DC19V or higher / 3 ㎃ or higher
Off Voltage/Current		DC6V or less / 1 ㎃ or less
Input resistance		About 5.6 ㏀
Response time	Off → On	1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistance		10 ㏁ or more by megger
Common method		16 point / COM
Proper cable size		Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		40 ㎃ (when all point On)
Operation indicator		Input On, LED On
External connection method		8 pin terminal block connector + 10 pin terminal block connector
Weight		40g

Circuit configuration	No.	Contact	Type
	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	

7.4.3 32 point DC24V input module (Source/Sink type)

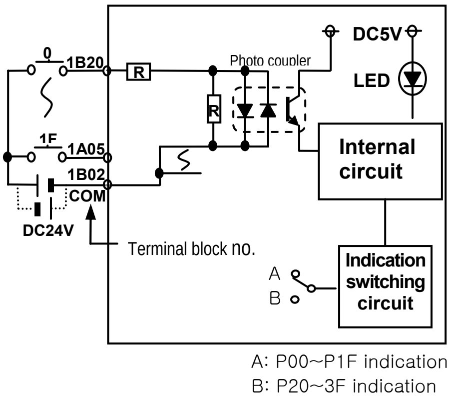
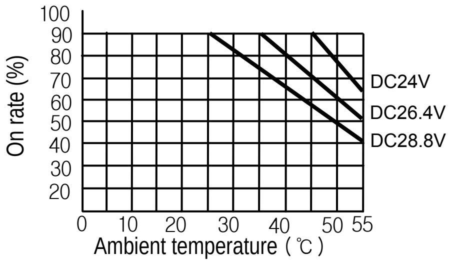
Model / Specification		DC input module
		XBE-DC32A
Input point		32 point
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)
Input Derating		Refer to Derating diagram
On Voltage/Current		DC 19V or higher / 3 ㎃ or higher
Off Voltage/Current		DC 6V or less / 1 ㎃ or less
Input resistance		About 5.6 ㏀
Response time	Off → On	1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default:3 ㎳
	On → Off	
Insulation pressure		AC 560Vrms / 3 Cycle (altitude 2000m)
Insulation resistance		10 ㏁ or more by megger
Common method		32 point / COM
Proper cable size		0.3 ㎟
Current consumption		50 ㎃ (when all point On)
Operation indicator		Input On, LED On
External connection method		40 pin connector
Weight		60g

Circuit configuration	No.	Contact	No.	Contact	Type
 	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	

Input Derating diagram

7.4.4 64 point DC24V input module (Source/Sink type)

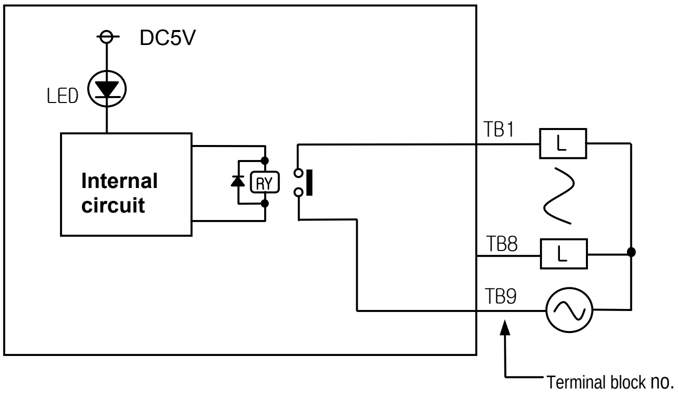
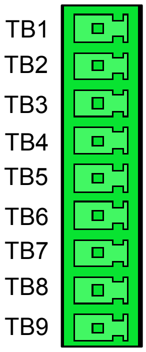
Model Specification		DC input module XBE-DC64A
Input point		64 point
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)
Input Derating		Refer to Derating diagram
On Voltage/Current		DC19V or higher / 3 ㎃ or higher
Off Voltage/Current		DC6V or less / 1 ㎃ or less
Input resistance		About 5.6 ㏀
Response time	Off → On	1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳
	On → Off	
Insulation pressure		AC560Vrms / 3Cycle (altitude 2000m)
Insulation resistance		10 ㏁ or more by megger
Common method		32 point / COM
Proper cable size		0.3 ㎟
Current consumption		90 ㎃ (when all point On)
Operation indicator		Input On, LED On (32 point LED On by switch operation)
External connection method		40 pin connector × 2 ea
Weight		

Circuit configuration	No.	Contact	No.	Contact	No.	Contact	No.	Contact	Type
 Input Derating diagram 	1B20	00	1A20	10	2B20	20	2A20	30	
	1B19	01	1A19	11	2B19	21	2A19	31	
	1B18	02	1A18	12	2B18	22	2A18	32	
	1B17	03	1A17	13	2B17	23	2A17	33	
	1B16	04	1A16	14	2B16	24	2A16	34	
	1B15	05	1A15	15	2B15	25	2A15	35	
	1B14	06	1A14	16	2B14	26	2A14	36	
	1B13	07	1A13	17	2B13	27	2A13	37	
	1B12	08	1A12	18	2B12	28	2A12	38	
	1B11	09	1A11	19	2B11	29	2A11	39	
	1B10	0A	1A10	1A	2B10	2A	2A10	3A	
	1B09	0B	1A09	1B	2B09	2B	2A09	3B	
	1B08	0C	1A08	1C	2B08	2C	2A08	3C	
	1B07	0D	1A07	1D	2B07	2D	2A07	3D	
	1B06	0E	1A06	1E	2B06	2E	2A06	3E	
	1B05	0F	1A05	1F	2B05	2F	2A05	3F	
	1B04	NC	1A04	NC	2B04	NC	2A04	NC	
	1B03	NC	1A03	NC	2B03	NC	2A03	NC	
	1B02	COM	1A02	COM	2B02	COM	2A02	COM	
	1B01	COM	1A01	COM	2B01	COM	2A01	COM	

7.5 Digital output module specification

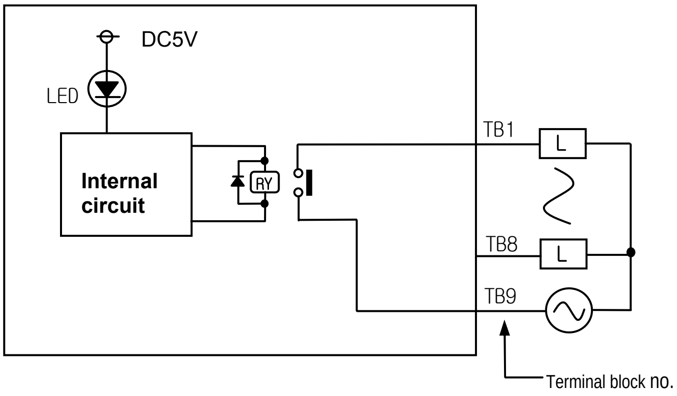
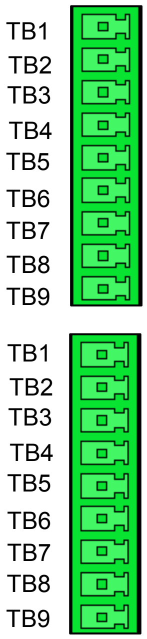
7.5.1 8 point relay output module

Model Specification		Relay output module
		XBE-RY08A
Output point		8 point
Insulation method		Relay insulation
Rated load voltage / Current		DC24V 2A(Resistive load) / AC220V 2A(COSΨ = 1), 5A/COM
Min. load voltage/Current		DC5V / 1 ㎃
Max. load voltage/Current		AC250V, DC125V
Off leakage current		0.1 ㎃ (AC220V, 60 ㎐)
Max. On/Off frequency		3,600 times/hr
Surge absorber		None
Service life	Mechanical	20 millions times or more
	Electrical	Rated load voltage / current 100,000 times or more
		AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or more
		AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or more
		DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) 100,000 times or more
Response time	Off → On	10 ㎳ or less
	On → Off	12 ㎳ or less
Common method		8 point / COM
Proper cable size		Twisted pair0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		230 ㎃ (when all point On)
Operation indicator		Output On, LED On
External connection method		9 point terminal block connector
Weight		80g

Circuit configuration	No.	Contact	Type
	TB1	0	
	TB2	1	
	TB3	2	
	TB4	3	
	TB5	4	
	TB6	5	
	TB7	6	
	TB8	7	
	TB9	COM	

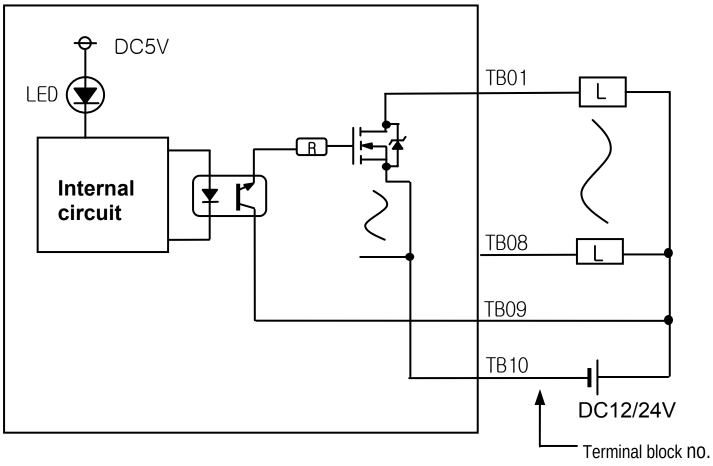
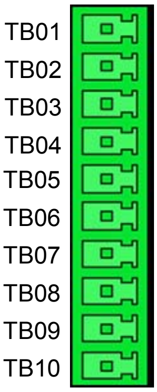
7.5.2 16 point relay output module

Model Specification		Relay output module
		XBE-RY16A
Output point		16 point
Insulation method		Relay insulation
Rated load voltage/ current		DC24V 2A(Resistive load) / AC220V 2A(COSΨ = 1), 5A/COM
Min. load voltage/current		DC5V / 1 ㎃
Max. load voltage/current		AC250V, DC125V
Off leakage current		0.1 ㎃ (AC220V, 60 ㎐)
Max. On/Off frequency		3,600 times/hr
Surge absorber		None
Service life	Mechanical	20 millions times or more
	Electrical	Rated load voltage / current 100,000 times or more
		AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or more
		AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or more
		DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) 100,000 times or more
Response time	Off → On	10 ㎳ or less
	On → Off	12 ㎳ or less
Common method		8 point / COM
Proper cable size		Twisted pair0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		420 ㎃ (when all point On)
Operation indicator		Output On, LED On
External connection method		9 point terminal block connector x 2 ea
Weight		130g

Circuit configuration	No.	Contact	Type
	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	

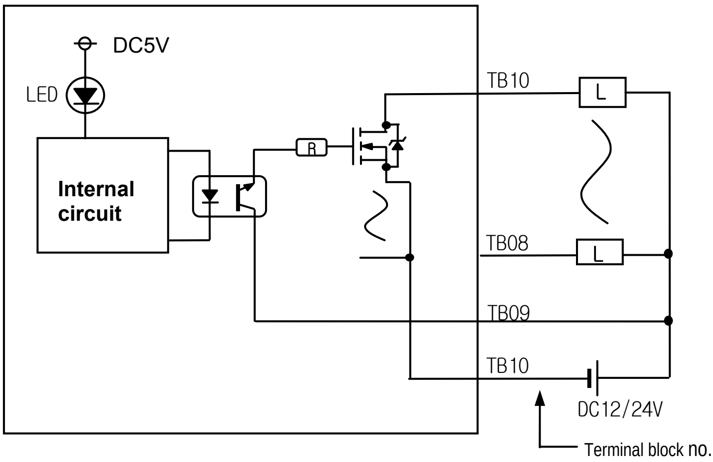
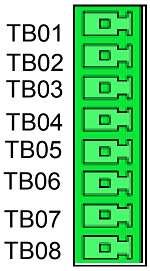
7.5.3 8 point transistor output module (Sink type)

Model / Specification		Transistor output module
		XBE-TN08A
Output point		8 point
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load voltage		0.5A / 1 point
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		8 point / COM
Proper cable size		Stranded pair 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		40 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		10 point terminal block connector
Weight		

Circuit configuration	No.	Contact	Type
	TB01	0	
	TB02	1	
	TB03	2	
	TB04	3	
	TB05	4	
	TB06	5	
	TB07	6	
	TB08	7	
	TB09	DC12 /24V	
	TB10	COM	

7.5.4 16 point transistor output module (Sink type)

Model 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 voltage		0.2A / 1 point, 2A / 1COM
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		16 point / COM
Proper cable size		Stranded pair 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		60 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		8 pin terminal block connector + 10 pin terminal block connector
Weight		40g

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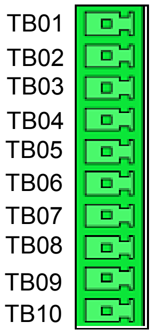
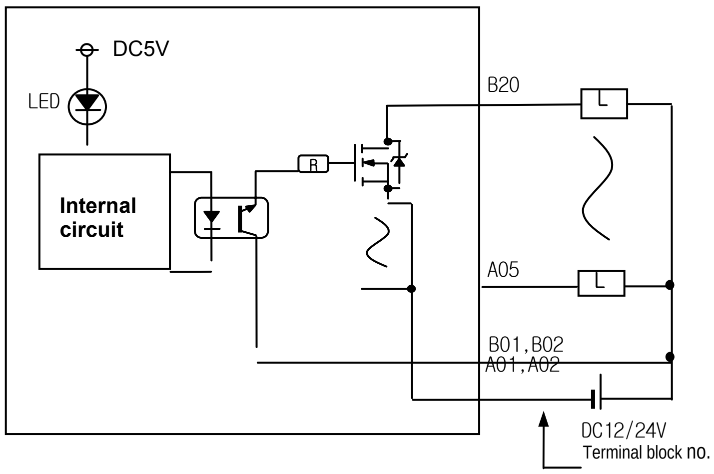
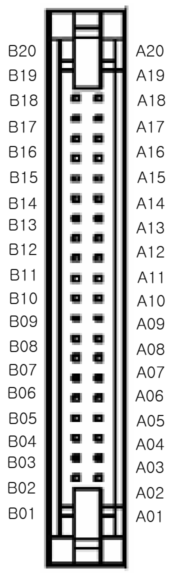
	TB04	3	
	TB05	4	
	TB06	5	
	TB07	6	
	TB08	7	
	TB01	8	
	TB02	9	
	TB03	A	
	TB04	B	
	TB05	C	
	TB06	D	
	TB07	E	
	TB08	F	
	TB09	DC12 /24V	
	TB10	COM	

7.5.5 32 point transistor output module (Sink type)

Specification / Model		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 voltage		0.2A / 1 point, 2A / 1COM
Off leakage current		0.1 ㎃ or less
Max. inrush current		0.7A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		32 point / COM
Proper cable size		0.3 ㎟
Current consumption		120 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	20 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		40 pin connector
Weight		60g

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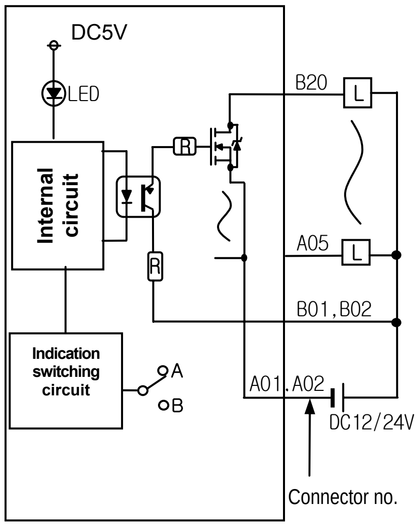
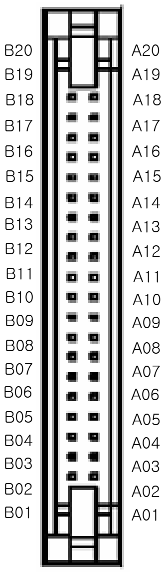
	B18	02	A18	12	
	B17	03	A17	13	
	B16	04	A16	14	
	B15	05	A15	15	
	B14	06	A14	16	
	B13	07	A13	17	
	B12	08	A12	18	
	B11	09	A11	19	
	B10	0A	A10	1A	
	B09	0B	A09	1B	
	B08	0C	A08	1C	
	B07	0D	A07	1D	
	B06	0E	A06	1E	
	B05	0F	A05	1F	
	B04	NC	A04	NC	
	B03	NC	A03	NC	
	B02	DC12/24V	A02	COM	
	B01		A01		

7.5.6 64 point transistor output module (Sink type)

Specification \ Model		Transistor output module
		XBE-TN64A
Output point		64 point
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load voltage		0.2A / 1 point, 2A / 1COM
Off leakage current		0.1 ㎃ or less
Max. inrush current		0.7A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		32 point / COM
Proper cable size		0.3 ㎟
Current consumption		200 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	40 ㎃ or less (DC24V connection)
Operation indicator		Input On, LED On (32 point LED On by switch operation)
External connection method		40 pin connector ×2 ea
Weight		80g

Circuit configuration	No.	Contact	No.	Contact	No.	Contact	No.	Contact	Type
 A: P00~P1F indication B: P20~3F indication	1B20	00	1A20	10	2B20	20	2A20	30	
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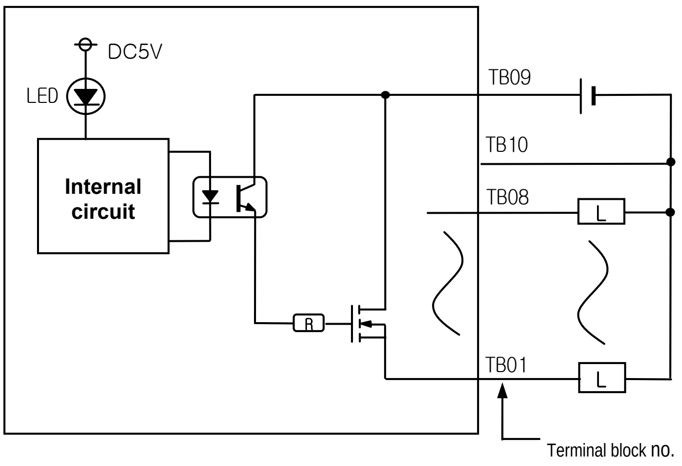
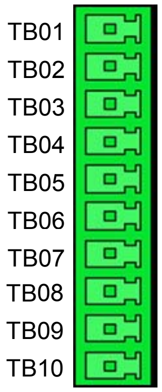
	1B17	03	1A17	13	2B17	23	2A17	33	
	1B16	04	1A16	14	2B16	24	2A16	34	
	1B15	05	1A15	15	2B15	25	2A15	35	
	1B14	06	1A14	16	2B14	26	2A14	36	
	1B13	07	1A13	17	2B13	27	2A13	37	
	1B12	08	1A12	18	2B12	28	2A12	38	
	1B11	09	1A11	19	2B11	29	2A11	39	
	1B10	0A	1A10	1A	2B10	2A	2A10	3A	
	1B09	0B	1A09	1B	2B09	2B	2A09	3B	
	1B08	0C	1A08	1C	2B08	2C	2A08	3C	
	1B07	0D	1A07	1D	2B07	2D	2A07	3D	
	1B06	0E	1A06	1E	2B06	2E	2A06	3E	
	1B05	0F	1A05	1F	2B05	2F	2A05	3F	
	1B04	NC	1A04	NC	2B04	NC	2A04	NC	
	1B03	NC	1A03	NC	2B03	NC	2A03	NC	
	1B02	12/24V DC	1A02	COM	2B02	12/24V DC	2A02	COM	
	1B01		1A01		2B01		2A01		

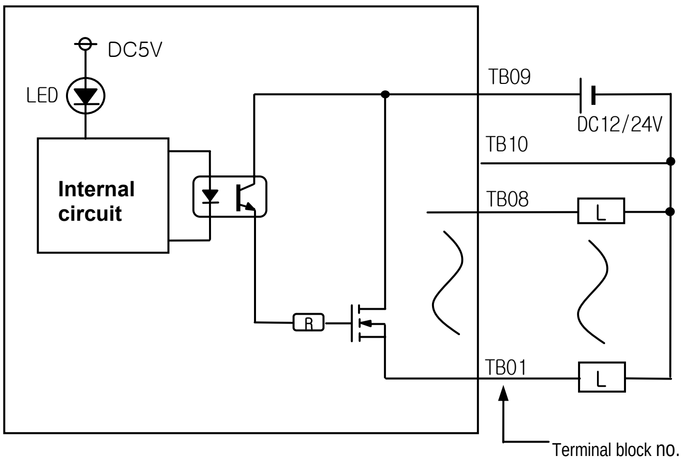
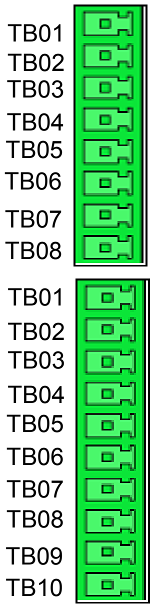
7.5.7 8 point transistor output module (Source type)

Model Specification		Transistor output module
		XBE-TP08A
Output point		8 point
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load voltage		0.5A / 1 point
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		8 point / COM
Proper cable size		Twisted pair0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		40 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		10 pin terminal block connector
Weight		30g

Circuit configuration	No.	Contact	Type
	TB01	0	
	TB02	1	
	TB03	2	
	TB04	3	
	TB05	4	
	TB06	5	
	TB07	6	
	TB08	7	
	TB09	COM	
	TB10	0V	

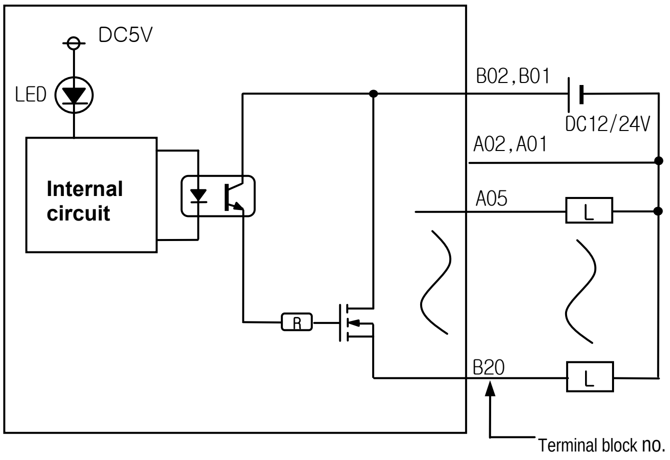
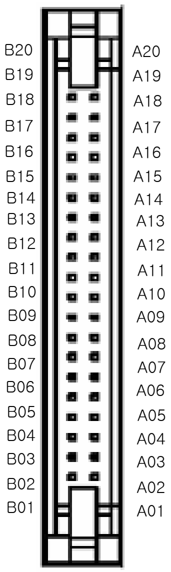
7.5.8 16 point transistor output module (Source type)

Model Specification		Transistor output module
		XBE-TP16A
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 voltage		0.2A / 1 point, 2A / 1COM
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		16 point / COM
Proper cable size		Stranded pair 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less)
Current consumption		60 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		8 pin terminal block connector + 10 pin terminal block connector
Weight		40g

Circuit configuration	No.	Contact	Type
	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	COM	
	TB10	COM	

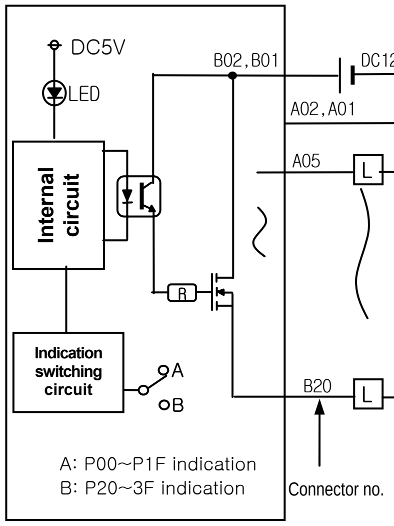
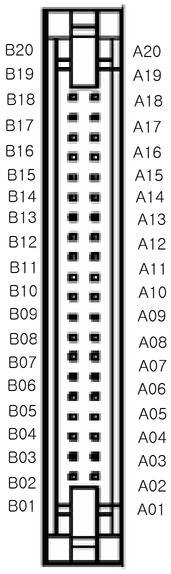
7.5.9 32 point transistor output module (Source type)

Model Specification		Transistor output module
		XBE-TP32A
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 voltage		0.2A / 1 point, 2A / 1COM
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		32 point / COM
Proper cable size		0.3 ㎟
Current consumption		120 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	20 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On
External connection method		40 pin connector
Weight		60g

Circuit configuration	No.	Contact	No.	Contact	Type
	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	0V	
	B01		A01		

7.5.10 64 point transistor output module (Source type)

Model / Specification		Transistor output module XBE-TP64A
Output point		64 point
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load voltage		0.2A / 1 point, 2A / 1COM
Off leakage current		0.1 ㎃ or less
Max. inrush current		4A / 10 ㎳ or less
Max. voltage drop (On)		DC 0.4V or less
Surge absorber		Zener Diode
Response time	Off → On	1 ㎳ or less
	On → Off	1 ㎳ or less (Rated load, resistive load)
Common method		32 point / COM
Proper cable size		0.3 ㎟
Current consumption		200 ㎃ (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	40 ㎃ or less (DC24V connection)
Operation indicator		Output On, LED On (32 point LED On by switch operation)
External connection method		40 pin connector × 2 ea
Weight		80g

Circuit configuration	No.	Contact	No.	Contact	No.	Contact	No.	Contact	Type
	1B20	00	1A20	10	2B20	20	2A20	30	
	1B19	01	1A19	11	2B19	21	2A19	31	
	1B18	02	1A18	12	2B18	22	2A18	32	
	1B17	03	1A17	13	2B17	23	2A17	33	
	1B16	04	1A16	14	2B16	24	2A16	34	
	1B15	05	1A15	15	2B15	25	2A15	35	
	1B14	06	1A14	16	2B14	26	2A14	36	
	1B13	07	1A13	17	2B13	27	2A13	37	
	1B12	08	1A12	18	2B12	28	2A12	38	
	1B11	09	1A11	19	2B11	29	2A11	39	
	1B10	0A	1A10	1A	2B10	2A	2A10	3A	
	1B09	0B	1A09	1B	2B09	2B	2A09	3B	
	1B08	0C	1A08	1C	2B08	2C	2A08	3C	
	1B07	0D	1A07	1D	2B07	2D	2A07	3D	
	1B06	0E	1A06	1E	2B06	2E	2A06	3E	
	1B05	0F	1A05	1F	2B05	2F	2A05	3F	
	1B04	NC	1A04	NC	2B04	NC	2A04	NC	
	1B03	NC	1A03	NC	2B03	NC	2A03	NC	
	1B02	COM	1A02	0V	2B02	COM	2A02	0V	
	1B01		1A01		2B01		2A01		

Chapter 8 Built-in High-speed Counter Function

XGB series have 4 channels built-in function of High-speed counter in basic unit. This chapter describes specifications and usage of High-speed counter's function.

8.1 High-speed Counter Specifications

❑ It describes specifications, setting and usage of function, programming and wiring with external device of built-in basic unit.

8.1.1 Performance specifications

1) Performance specification

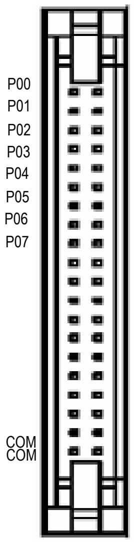
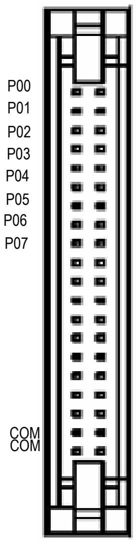
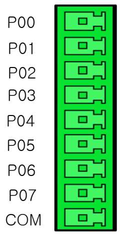
Classification		Description
Count input signal	Signal	A-phase, B-phase
	Input type	Voltage input (Open collector)
	Signal level	24V
Max. coefficient speed		20kpps (In case of 2-phase input 10Kpps)
Number of channels		4 channels (In case of 2-phase, 2 channels available)
Coefficient range		Signed 32 Bit (-2,147,483,648 ~ 2,147,483,647)
Count mode (Program setting)		Linear count (if 32-bit range exceeded, Carry/Borrow occurs)
		Ring count (repeated count within setting range)
Input mode (Program setting)		1-phase input
		2-phase input
		CW/CCW input
Signal type		Voltage
Up/Down setting	1 phase input	Increasing/decreasing operation setting by B-phase input
		Increasing/decreasing operation setting by program
	2 phase input	Automatic setting by difference in phase
	CW/CCW	A-phase input: increasing operation
		B-phase input: decreasing operation
Multiplication function	1 phase input	1 multiplication
	2 phase input	4 multiplication
	CW/CCW	1 multiplication
Control input	Signal	Preset instruction input
	Signal level	DC 24V input type
	Signal type	Voltage
External output	Output points	1 point/channel (for each channel): terminal output available
	Type	Select single-compared (>, >=, =, =<, <) or section compared output (included or excluded) (program setting)
	Output type	Relay, Open-collector output (Sink)
Count Enable		To be set through program (count available only in enable status)
Preset function		To be set through terminal(contact) or program
Auxiliary mode		Count Latch

2) Counter/Preset input specification

Classification	Spcification
Input voltage	24V DC (20.4V ~ 28.8V)
Input current	4㎃
On guranteed voltage (min.)	20.4V
Off guranteed voltage (max.)	6V

8.1.2 Designation of parts

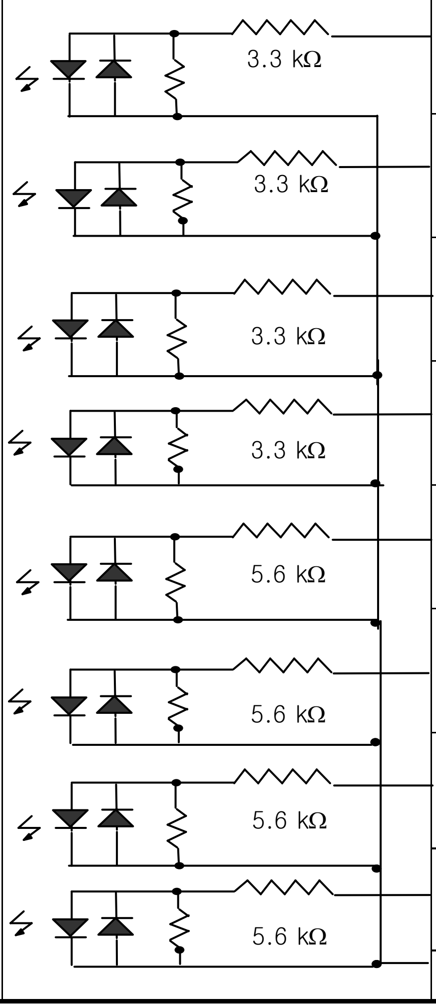
1) Designation of parts

Model	XBM-DN16S	XBM-DN32A	XBM-DR16S
Structure			

Terminal No.	Names		Usage	
	1-phase	2-phase	1-phase	2-phase
P000	Ch0 counter input	Ch0 A-phase input	Counter input terminal	A-phase input
P001	Ch1 counter input	Ch0 B-phase input	Counter input terminal	B-phase input
P002	Ch2 counter input	Ch2 A-phase input	Counter input terminal	A-phase input
P003	Ch3 counter input	Ch2 B-phase input	Counter input terminal	B-phase input
P004	Ch0 preset 24V	Ch0 preset 24V	Preset input terminal	Preset input terminal
P005	Ch1 preset 24V	-	Preset input terminal	No use
P006	Ch2 preset 24V	Ch2 preset 24V	Preset input terminal	Preset input terminal
P007	Ch4 preset 24V	-	Preset input terminal	No use
COM0	Input common	Input common	Common terminal	Common terminal

2) Interface with external devices

The internal circuit of High-speed counter is as shown below.

I/O	Internal circuit	Terminal No.	Signal		Operation	On/Off guaranteed voltage
			1-phase	2-phase		
Input		P00	Ch 0 Pulse input	Ch 0 A-phase input	On	20.4~28.8V
					Off	6V or less
		P01	Ch 1 Pulse input	Ch 0 B-phase input	On	20.4~28.8V
					Off	6V or less
		P02	Ch 2 Pulse input	Ch 2 A-phase input	On	20.4~28.8V
					Off	6V or less
		P03	Ch 3 Pulse input	Ch 2 B-phase input	On	20.4~28.8V
					Off	6V or less
		P04	Ch 0 Preset input	Ch 0 Preset input	On	20.4~28.8V
					Off	6V or less
		P05	Ch 1 Preset input	-	On	20.4~28.8V
					Off	6V or less
		P06	Ch 2 Preset input	Ch 2 Preset input	On	20.4~28.8V
					Off	6V or less
		P07	Ch 2 Preset input	-	On	20.4~28.8V
					Off	6V or less
		COM0	COM (input common)			

<External interface list>

8.1.3 Functions

1) Counter mode

A) High Speed counter module can count High Speed pulses which can not be processed by CPU module's counter instructions (CTU, CTD, CTUD, etc.), up to binary value of 32 bits (-2,147,483,648 ~ 2,147,483,647).

B) Available input is 1-phase input, 2-phase input and CW/ CCW input.

C) Count increasing/decreasing methods are as follows;

(1) For 1-phase input: (1) Increasing/decreasing count operation by program setting
(2) Increasing/decreasing count operation by B-phase input signal

(2) For 2-phase input: setting by difference in phase between A-phase and B-phase

(3) For CW/CCW input: Increasing operation if B-phase is LOW with A-phase input, and Decreasing operation if A-phase is LOW with B-phase input.

D) Auxiliary modes are as follows;

① Count Latch
②Periodic Pulse Count

E) Pulse input mode

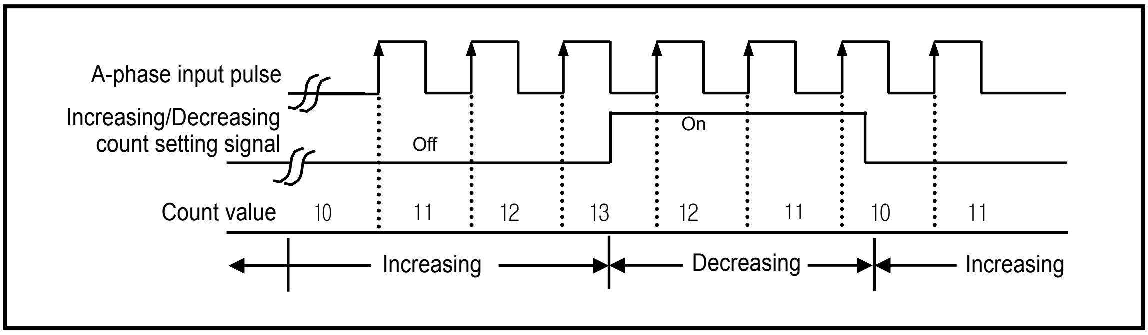
(1) Increasing/decreasing count operation by program setting

a) 1-phase 1-input 1-multiplication operation mode

A-phase input pulse counts at rising and increasing/decreasing will be decided by the applicable program.

Increasing/Decreasing classification	A-phase input pulse rising	A-phase input pulse falling
Increasing/decreasing count setting signal Off	Increasing count	-
Increasing/decreasing count setting signal On	Decreasing count	-

- Operation example



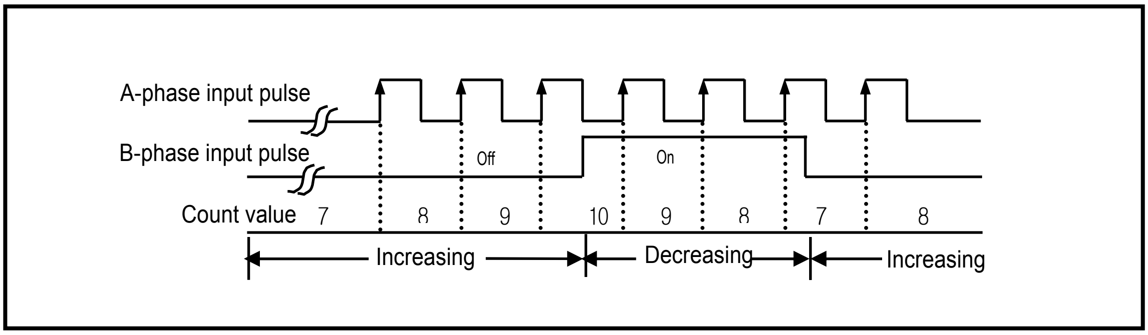
(2) Increasing/decreasing count operation by B-phase input signal

a) 1-phase 2-input 1-multiplication operation mode

A-phase input pulse counts at rising and increasing/decreasing will be decided by B-phase.

Increasing/Decreasing classification	A-phase input pulse rising	A-phase input pulse falling
B-phase input pulse Off	Increasing count	-
B-phase input pulse On	Decreasing count	-

● Operation example

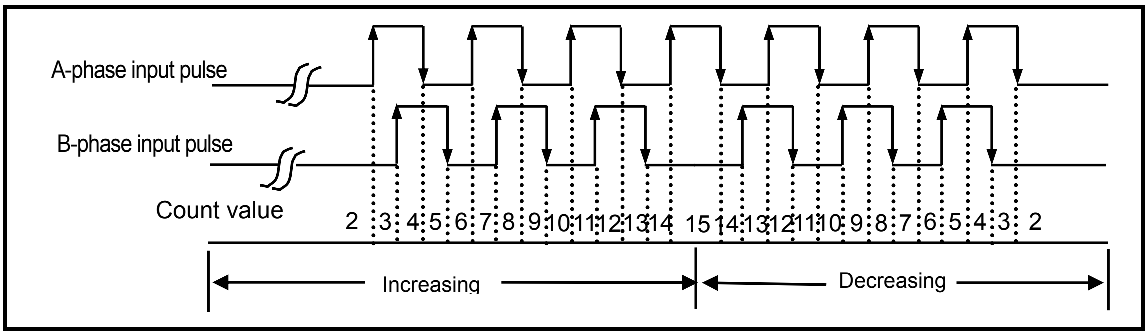


(3) 2-phase count mode

a) 2-phase 4-multiplication operation mode

A-phase input pulse and B-phase input pulse count at rising/falling respectively. If A-phase input is antecedent to B-phase input, increasing operation starts, and if B-phase input is antecedent to A-phase input, decreasing operation starts.

▪ Operation example



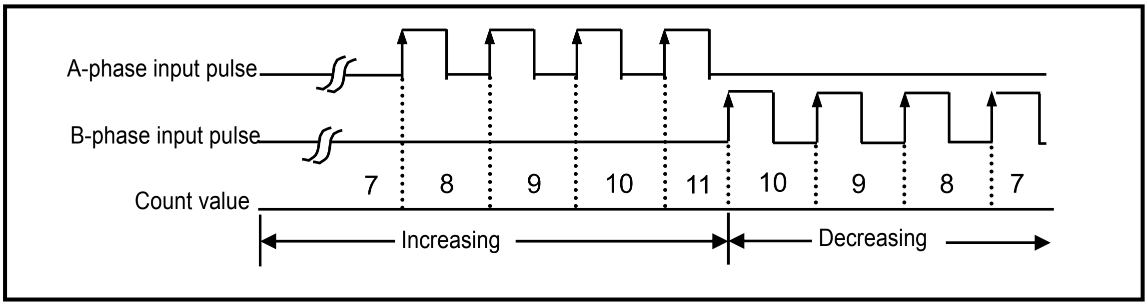
(4) CW(Clockwise)/CCW(Counter Clockw`ise) operation mode

A-phase input pulse counts at rising , or B-phase input pulse counts at rising.

Increasing operation executed when B-phase input pulse is Low with A-phase input pulse at rising, and Decreasing operation executed when A-phase input pulse is Low with B-phase input pulse at rising.

Increasing/Decreasing classification	A-phase input pulse High	A-phase input pulse Low
B-phase input pulse High	-	decreasing count
B-phase input pulse Low	Increasing count	-

▪ Operation example

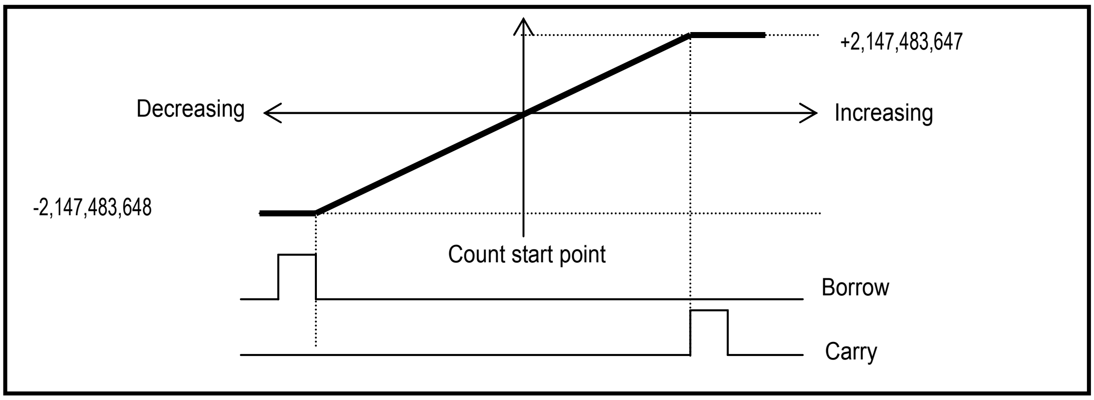


2) Counter mode

2 types of count can be selected for the applicable use based on functions.

A) Linear counter

- Linear Count range: -2,147,483,648 ~ 2,147,483,647
- If count value reaches the maximum value while increased, Carry will occur, and if count value reaches the minimum value while decreased, Borrow will occur.
- If Carry occurs, count stops and increasing is not available but decreasing is available.
- If Borrow occurs, count stops and decreasing is not available but increasing is available.

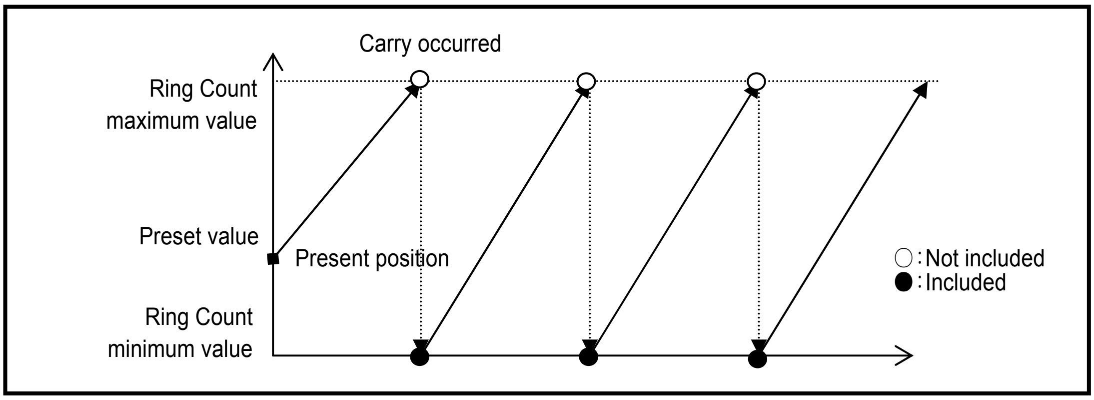


B) Ring count

- ■ Ring Count range: user-defined minimum value ~ user-defined maximum value
- ■ Count display: If Ring Counted, user-defined minimum value of Ring Count is counted and displayed, but the value is not displayed.

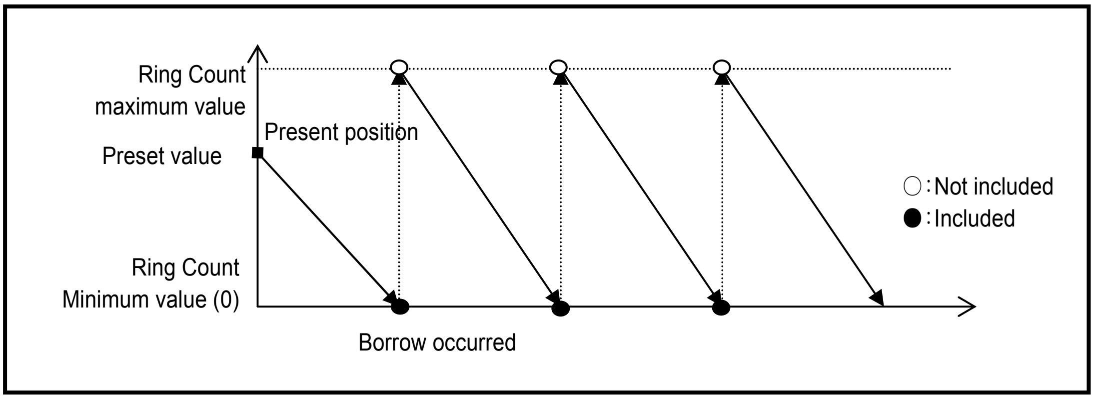
(1) During increasing count

- ■ Even if count value exceeds user-defined maximum value during increasing count, Carry only occurs and count does not stop differently to Linear Count.



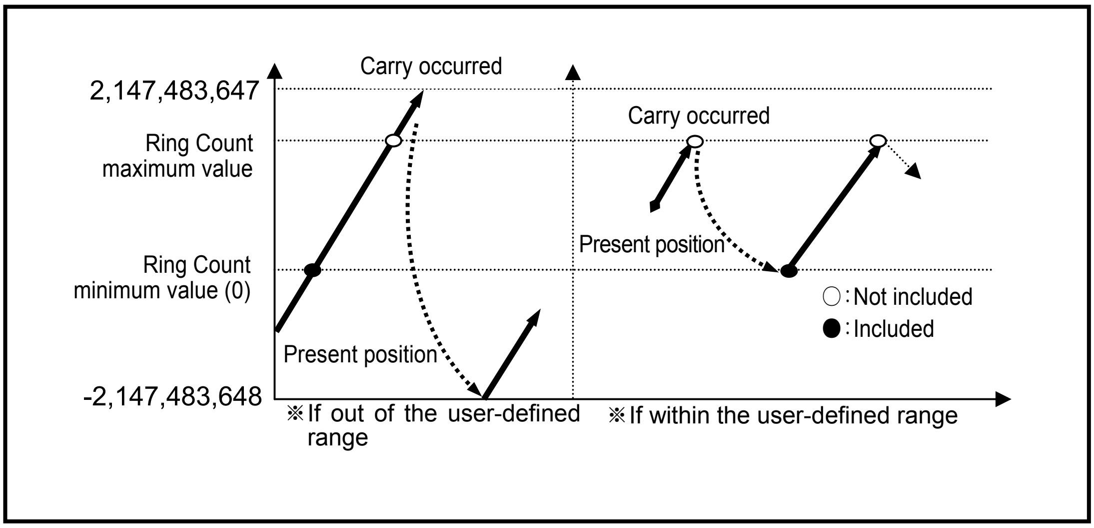
(2) During decreasing count

- ■ Even if count value exceeds user-defined minimum value during decreasing count, Borrow only occurs and count does not stop differently to Linear Count.



(3) Operation when setting Ring Count based on present count value (during increasing count)

- ■ If present count value exceeds user-defined range when setting Ring Count
  - Error (code no. 27) is occurred and it operates linear counter.
- ■ If present count value is within user-defined range when setting Ring Count
  - Present count value starts to increase up to the user-defined maximum value and down to the user-defined minimum value and keeps counting after Carry occurs.
  - Not the maximum but the minimum value only is displayed with count kept on as shown below.



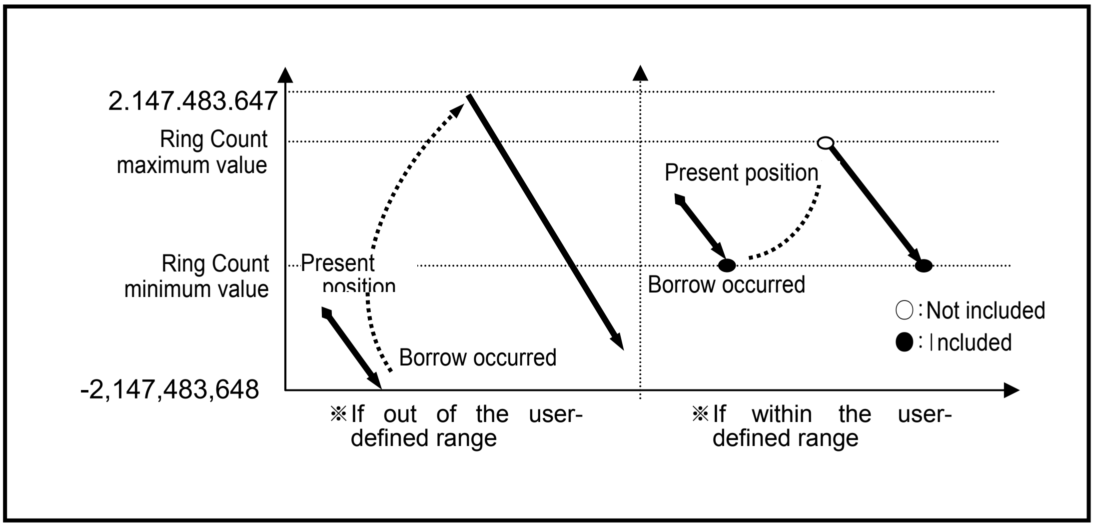
(4) Operation when setting Ring Count based on present count value (during decreasing count)

■ If present count value exceeds user-defined range when setting Ring Count

- Error (code no. 27) is occurred and it operates linear counter.

■ If present count value is within user-defined range when setting Ring Count

- Present count value starts to decrease down to the user-defined minimum value and up to the user-defined maximum value and keeps counting after Borrow occurs.



Remark

1. Based on count value within or out of user-defined range, count will be decided to be within or out of the range when setting Ring Count.

2. Ring Count setting when count value is out of the range is regarded as user’s mistake. The count is not available within the Ring Count range.
3. Use preset function or the like when using Ring Count so to surely position the count value within the range.

3) Compared output

- ■ High Speed counter module has a compared output function used to compare present count value with compared value in size to output as compared.
- ■ Available compared outputs are 2 for 1 channel, which can be used separately.
- ■ Compared output conditions are 7 associated with >, =, < .
- ■ Upper setting value is saved in special K area.

Compared output condition	Memory address (word)	Value
Present Value < Compared Value	Channel 0 : K302 Channel 1 : K330 Channel 2 : K358 Channel 3 : K386	Set to "0"
Present Value ≤ Compared Value		Set to "1"
Present Value = Compared Value		Set to "2"
Present Value ≥ Compared Value		Set to "3"
Present Value > Compared Value		Set to "4"
Compared value 1 ≤ Count value ≤ Compared value 2		Set to "5"
Count value ≤ Compared value 1, Count value ≥ Compared value 2		Set to "6"

- ■ In order to make actual comparison enabled after compared output condition set, the compared enable signal is to be On.

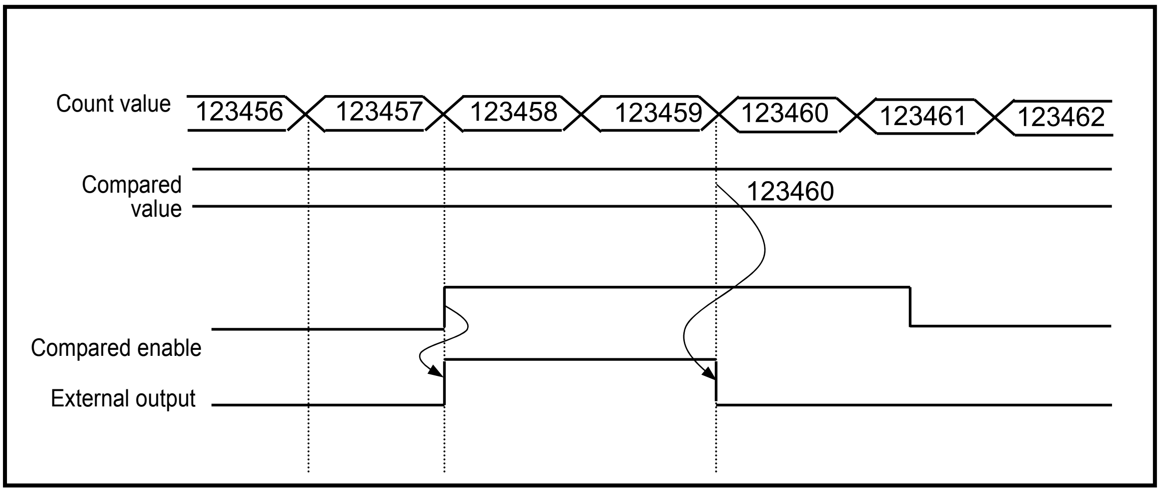
Classification	Area per channel				Operation
	Ch. 0	Ch. 1	Ch. 2	Ch. 3	
Count enable signal	K2600	K2700	K2800	K2900	0: forbidden, 1: enable
Compared enable signal	K2604	K2704	K2804	K2904	0: forbidden, 1: enable

- ▪ In order to make external output, the compared coincidence output signal (P20~P27) must be set. If Compared output contact is Off, Compared coincidence output signal (internal device) is only output.

Classification	Area per channel				Operation
	Ch. 0	Ch. 1	Ch. 2	Ch. 3	
Compared coincidence output signal	K2612	K2712	K2812	K2912	0: Compared output Off 1: Compared output On

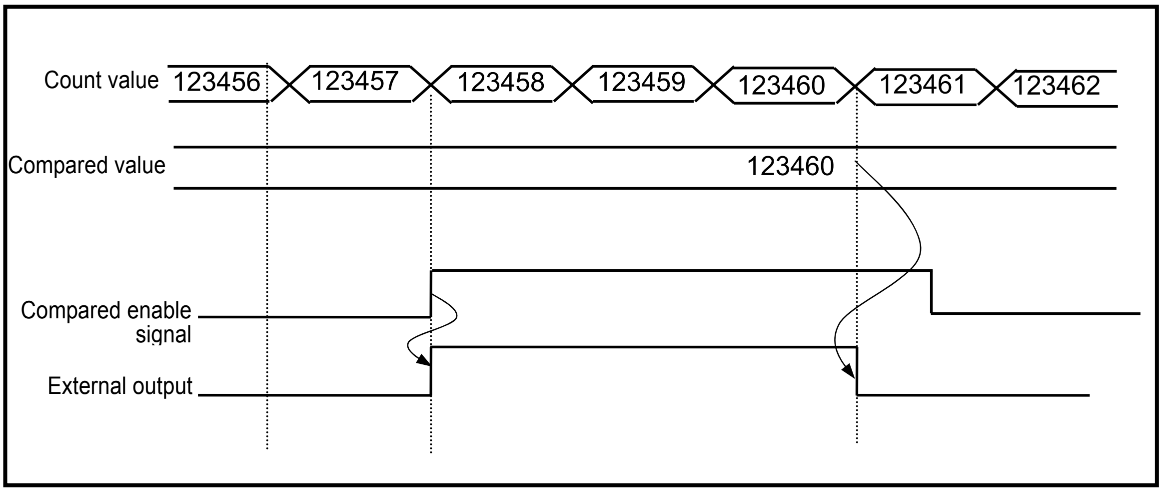
A) Mode 0 (Present value < Compared value)

- ■ If counted present value is less than compared value, output is sent out, and if present value increases to be equal to or greater than compared value, output is not sent out.



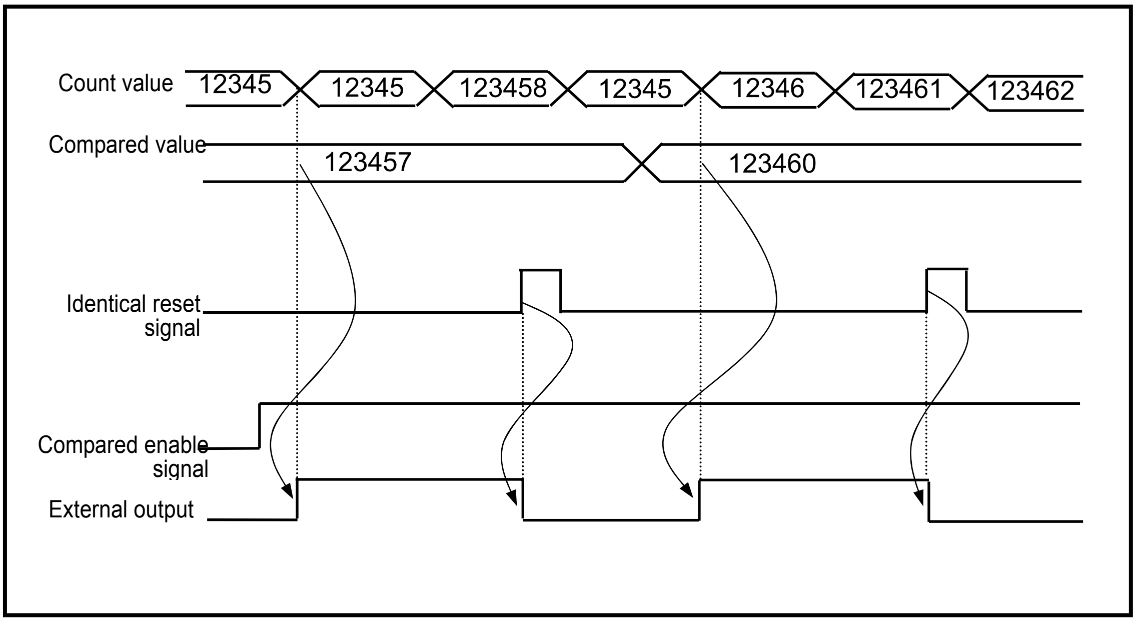
B) Mode1 (Count value ≤ Compared value)

- ■ If present count value is less than or equal to compared value, output is sent out, and if count value increases to be greater than compared value, output is not sent out.



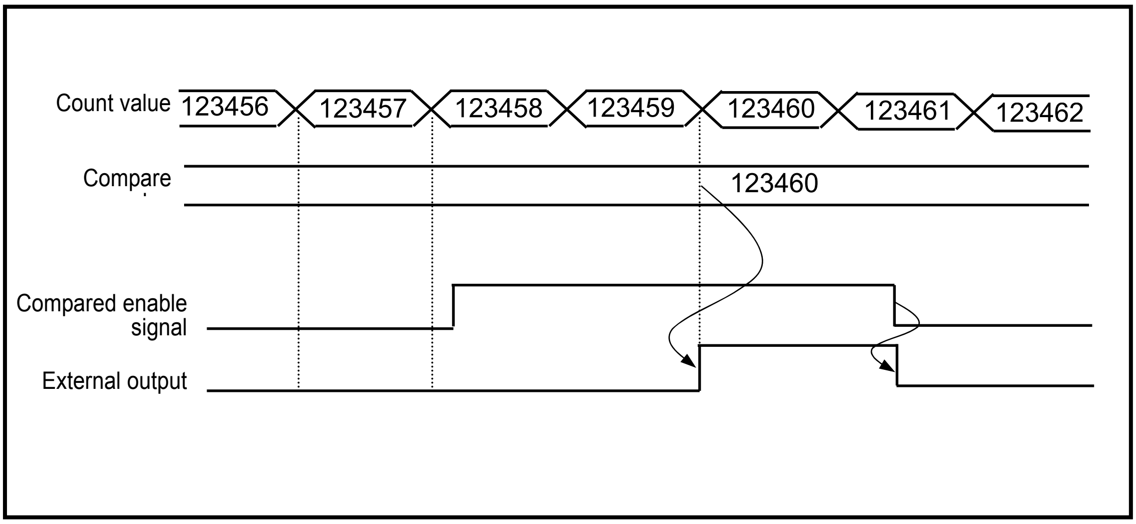
C) Mode 2 (Count value = Compared value)

- ■ If present count value is equal to compared value, output is sent out, and even if count value increases to be greater or less than compared value, output is kept On.
- ■ In order to turn the output Off, identical reset signal is to be On.



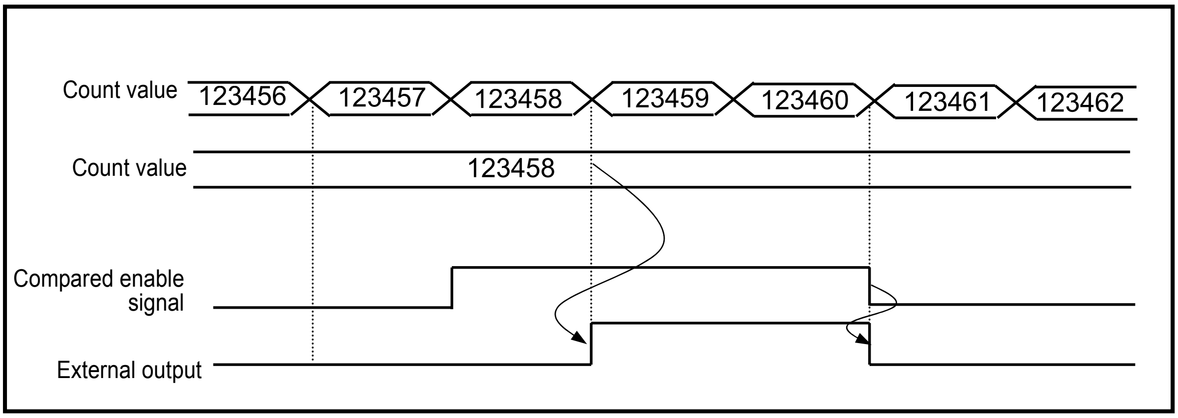
D) Mode 3 (Count value ≥ Compared value)

- ■ If present count value is greater than or equal to compared value, output is sent out, and if count value decreases to be less than compared value, output is not sent out.



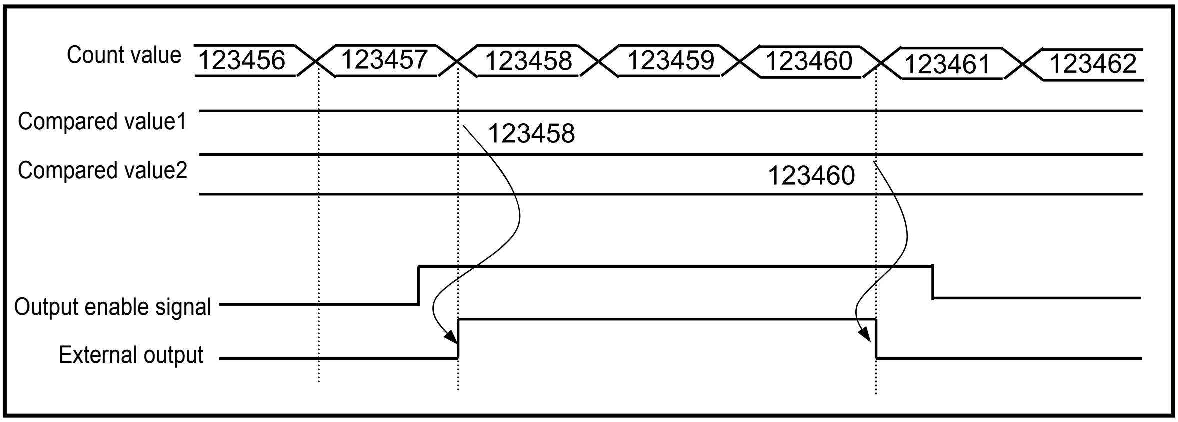
E) Mode 4 (Count value > Compared value)

- ■ If present count value is greater than compared value, output is sent out, and if count value decreases to be less than or equal to compared value, output is not sent out.



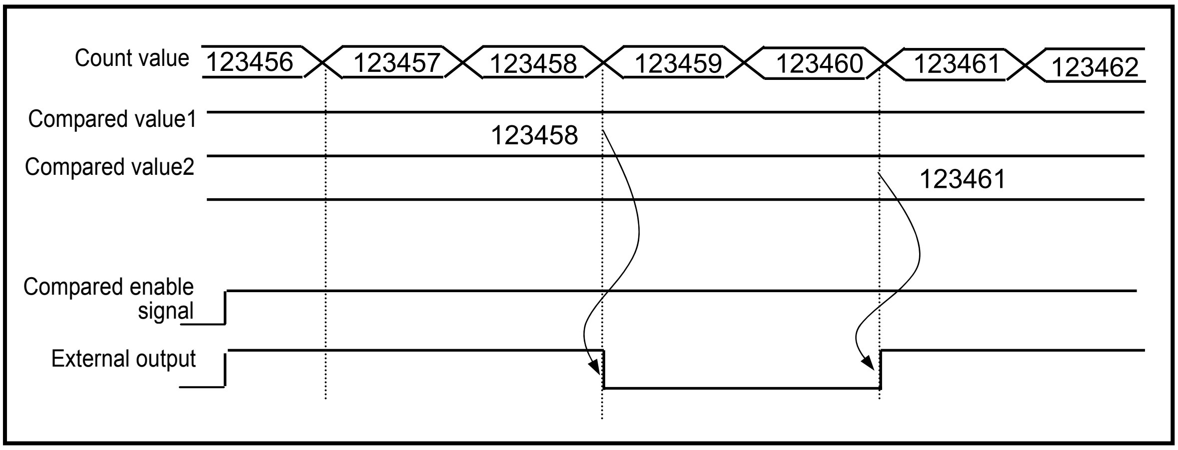
F) Mode 5 (Compared value1 ≤ Count value ≤ Compared value2)

- ■ If present count value is greater than or equal to compared value 1 and less than or equal to compared value 2, output is sent out, and if count value increases/decreases to exceed compared value's range, output is not sent out.



G) Mode 6 (Count value ≤ Compared value1, Count value ≥ Compared value2)

■ If present count value is less than or equal to compared value 1 and greater than or equal to compared value 2, output is sent out, and if count value increases/decreases to exceed compared value's range, output is not sent out.



4) Carry signal

A) Carry signal occurs

(1) When count range maximum value of 2,147,483,647 is reached during Linear Count.

(2) When user-defined maximum value of Ring Count changed to the minimum value during Ring Count.

B) Count when Carry Signal occurs

(1) Count stops if Carry occurs during Linear Count.

(2) Count does not stop even if Carry occurs during Ring Count.

C) Carry reset

(1) The Carry generated can be cancelled by Carry/Borrow reset signal On.

Classification	Device area per channel			
	Channel 0	Channel 1	Channel 2	Channel 3
Carry signal	K2610	K2710	K2810	K2910

5) Borrow signal

A) Borrow signal occurs

(1) When count range minimum value of -2,147,483,648 is reached during Linear Count.

(2) When user-defined minimum value of Ring Count changed to the maximum value during Ring Count.

B) Count when Borrow signal occurs

(1) Count stops if Borrow occurs during Linear Count.

(2) Count does not stop even if Borrow occurs during Ring Count.

C) Borrow reset

(1) The Borrow generated can be cancelled by Carry/Borrow reset signal On..

Classification	Device area per channel			
	Channel 0	Channel 1	Channel 2	Channel 3
Borrow signal	K2611	K2711	K2811	K2911

6) Revolution/Unit time

While auxiliary mode enable signal is On, it counts the number of input pulses for a specified time.

A) Setting

(1) Unit time setting

Classification	Device area per channel			
	Channel 0	Channel 1	Channel 2	Channel 3
Unit time (1~60000㎳)	K322	K352	K382	K412

(2) Input pulse number per 1 revolution

Classification	Device area per channel			
	Channel 0	Channel 1	Channel 2	Channel 3
Pulse number /revolution (1~60000)	K323	K353	K383	K413

(3) If Count function of revolution/unit time is used, enable signal set by On.

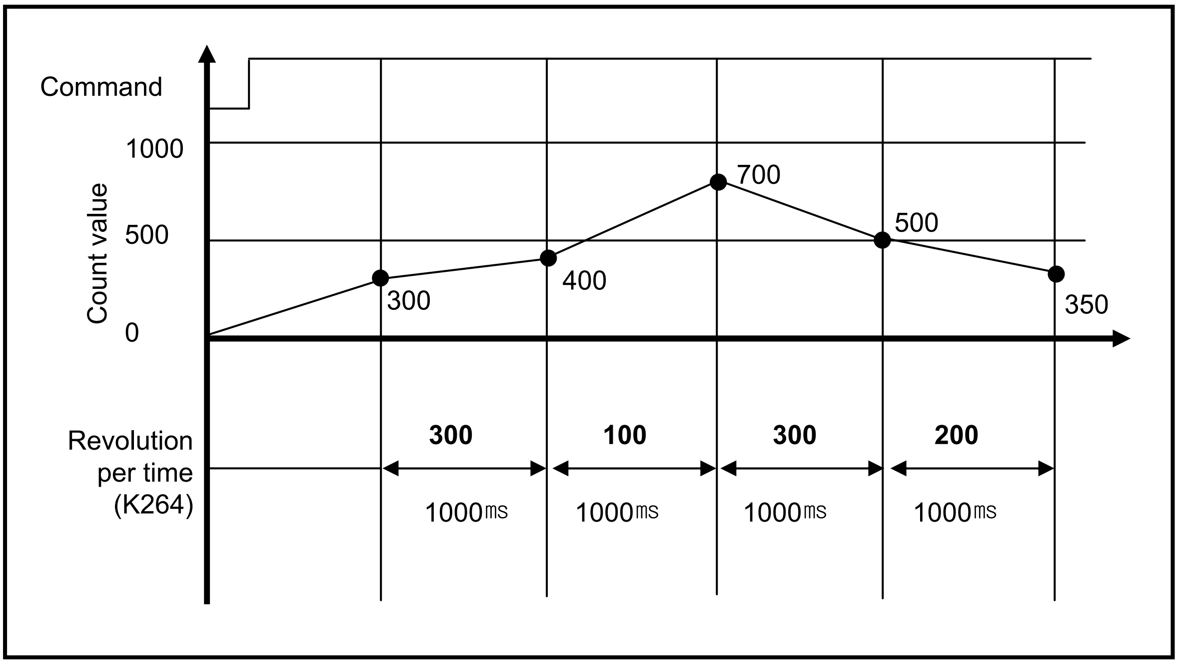
Classification	Device area per channel			
	Channel 0	Channel 1	Channel 2	Channel 3
Revolution/unit time command	K2605	K2705	K2805	K2905

B) Count function of Revolution/Unit time is used to count the number of pulses for a specified time while auxiliary mode enable signal is On.

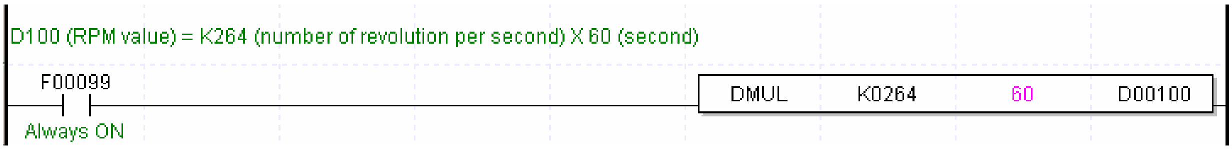
C) With the displayed number of pulses updated for a specified time and the number of pulses per revolution input, Revolution/Unit time can be counted.

D) Number of Revolution per 1 second is indicated after number of pulse per 1 revolution is set and time is set to 1 second (1000ms). In order to indicate by Revolutions per minute (RPM), the operation is executed in program.

E) The example that number of pulse per 1 revolution set to ‘1’ and time is set to 1000 ms is as shown below. (Ch0)



F) In order to indicate revolution per minute (RPM), the program is as shown below. In case of DMUL operation, RPM value is saved 64 bit in D100~D103. If operated RPM value is used, it can use to Word or Dword type according to system (case of RPM value is small number).



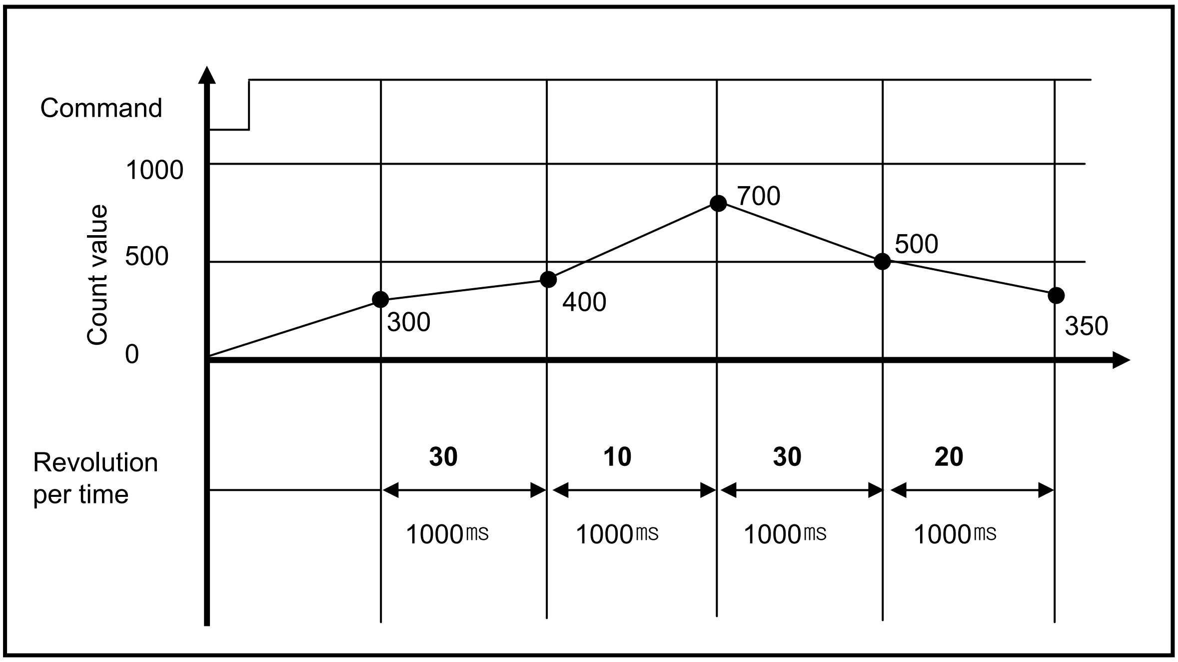
D100 (RPM value) = K264 (number of revolution per second) X 60 (second)

F00099

Always ON

DMUL K0264 60 D00100

G) The example that number of pulse per 1 revolution set to '10' and time is set to 60,000 ms is as shown below.



7) Count latch

- When Count latch signal is On, present count value is latched.
- Setting

  If present counter value is to latch, Count Latch function is set 'Use'.

Classification	Device area per channel			
	Channel 0	Channel 1	Channel 2	Channel 3
Count latch command	K2606	K2706	K2806	K2906

- Count latch function is operated when Count latch signal is On. Namely, counter value is not cleared when power supply Off =>On and mode change, it is counted from previous value.
- In latch counter function, internal or external preset function has to use for clearing present value.

8.2 Installation and Wiring

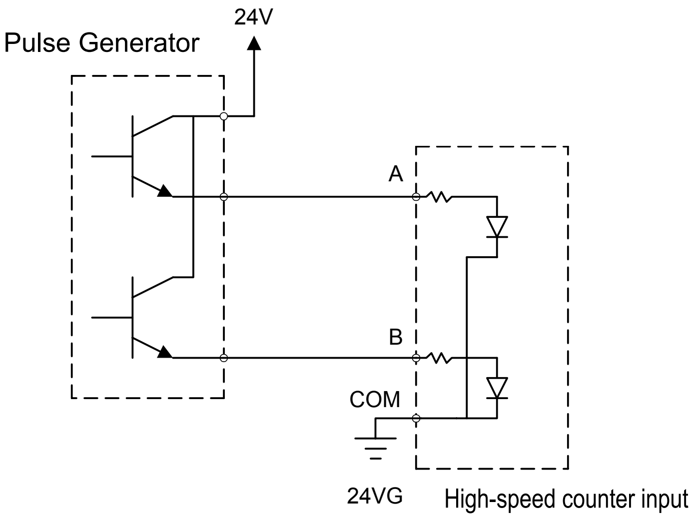
8.2.1 Precaution for wiring

Pay attention to the counteractions against wiring noise especially for High-speed pulse input.

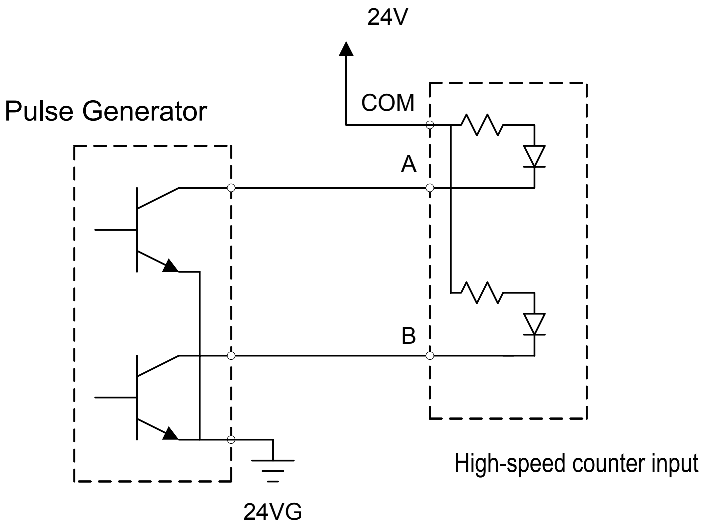
1) Surely use twisted pair shielded cable, grounded with 3 class applied.
2) Keep away from power cable or I/O line which may cause noise.
3) Stabilized power should be used for filter.
   - ▶ Connect A-phase only for 1-phase input.
   - ▶ Connect A-phase and B-phase for 2-phase input.

8.2.2 Example of wiring

1) In case of pulse generator (encoder) is voltage output type



2) In case of pulse generator is open collector type



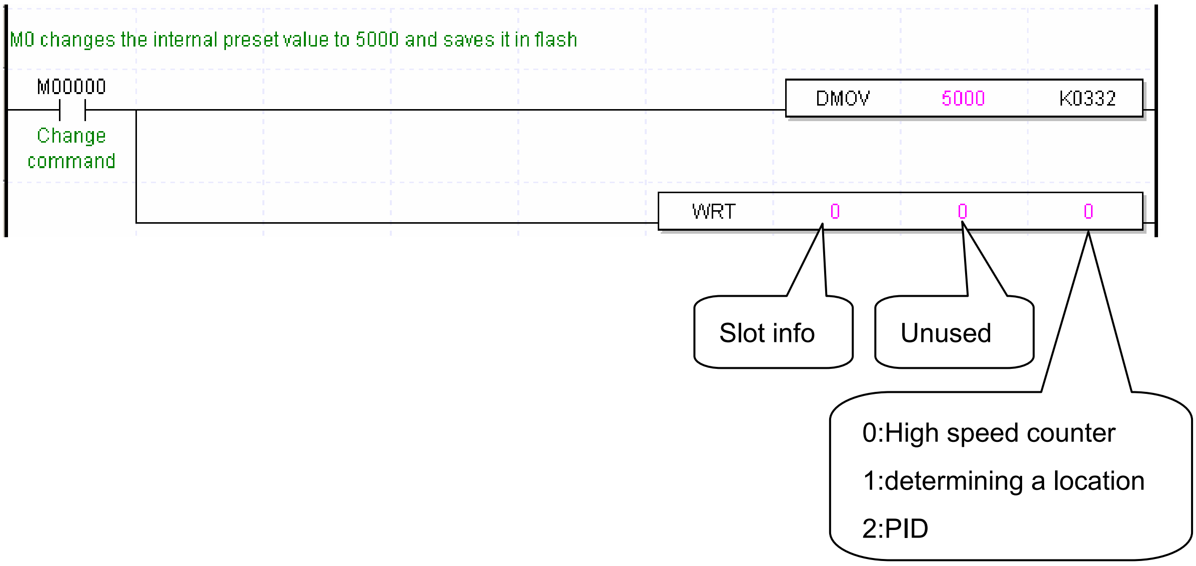
8.3 Internal Memory

8.3.1 Special area for High-speed counter

Parameter and operation command area of built-in high-speed counter use a special K device.

If values set in parameter are changed, it works with the changed values. At the moment, makes sure to use WRT command to save the changed vale to flash. If not saved in flash, the changed values with the power off => on and mode changed may not be maintained.

- The following example shows that the internal preset values of CH1 set in parameter are changed by program and saved in flash.
  - Receiving an order command(M0), it moves(MOV) the new internal preset value(5000) to the CH1 present area(K332).
  - To save the changed settings into flash, it uses WRT command. At the moment, slot information is set to '0' in case of built-in function.



1) Parameter setting

Parameter	Description		Device area per channel				Remark
	Value	Setting	Ch 0	Ch 1	Ch 2	Ch 3	
Counter mode	h0000	Linear count	K300	K330	K360	K390	Word
	h0001	Ring count					
Pulse input mode	h0000	1 phase 1 input 1 multiplication	K301	K331	K361	K391	Word
	h0001	1 phase 2 input 1 multiplication					
	h0002	CW / CCW					
	h0003	2 phase 4 multiplication					
Comp. Output mode	h0000	(Magnitude) <	K302	K332	K362	K392	Word
	h0001	(Magnitude) ≤					
	h0002	(Magnitude) =					
	h0003	(Magnitude) ≥					
	h0004	(Magnitude) >					
	h0005	(Range) Include					
	h0006	(Range) Exclude					
Internal preset	-2,147,483,648 ~ 2,147,483,647		K304	K334	K364	K394	DWord
External preset	-2,147,483,648 ~ 2,147,483,647		K306	K336	K366	K396	DWord

Parameter	Description		Device area per channel				Remark
	Value	Setting	Ch 0	Ch 1	Ch 2	Ch 3	
Ring counter value	-2,147,483,648 ~ 2,147,483,647		K310	K340	K370	K400	DWord
Comp. output min.	-2,147,483,648 ~ 2,147,483,647		K312	K342	K372	K402	DWord
Comp. output max.	-2,147,483,648 ~ 2,147,483,647		K314	K344	K374	K404	DWord
Comp. output point	HFFFF	No use	K320	K350	K380	K410	Word
	h0000	P0020					
	h0001	P0021					
	h0002	P0022					
	h0003	P0023					
	h0004	P0024					
	h0005	P0025					
	h0006	P0026					
	h0007	P0027					
Unit time [ms]	1 ~ 60000		K322	K352	K382	K412	DWord
Pulse/Rev.value	1 ~ 60000		K323	K353	K383	K413	DWord

2) Operation command

Parameter	Device area per channel			
	Ch 0	Ch 1	Ch 2	Ch 3
Counter enabling	K2600	K2700	K2800	K2900
Internal preset designation of counter	K2601	K2701	K2801	K2901
External preset enabling of counter	K2602	K2702	K2802	K2902
Designation of decremental counter	K2603	K2703	K2803	K2903
Comp. output enabling	K2604	K2704	K2804	K2904
Enabling of revolution time per unit time	K2605	K2705	K2805	K2905
Designation of latch counter	K2606	K2706	K2806	K2906
Carry signal (Bit)	K2610	K2710	K2810	K2910
Borrow signal	K2611	K2711	K2811	K2911
Comp. output signal	K2612	K2712	K2812	K2912

3) Area of monitoring

Parameter	Device area per channel				Remark
	Ch 0	Ch 1	Ch 2	Ch 3	
Current counter value	K262	K272	K282	K292	DWord
Revolution time per unit time	K264	K274	K284	K294	DWord

8.3.2 Error code

It describes errors of the built-in high-speed counter.

- Error occurred is saved in the following area.

Category	Device area by channels				Remarks
	CH0	CH1	CH2	CH3	
Error code	K266	K276	K286	K296	Word

- Error codes and descriptions.

Error code (Decimal)	Description
20	Counter type is set out of range
21	Pulse input type is set out of range
22	Requesting #1(3)CH run during the operation of #0(2) CH2 phase * Using #1(3)CH during #0(2) CH2 phase is not possible.
23	Comparative output type is set out of range
25	Internal preset value is set out of counter range
26	External present value is set out of counter range
27	Ring counter setting is set out of range * Note ring counter setting should be 2 and more.
28	Comparative output min. value is set out of permissible min. input range
29	Comparative output max. value is set out of permissible max. input range
30	Error of comparative output min. value>comparative output max. value
31	Comparative output is set out of the default output value
34	Unit time is set out of the range
35	Pulse value per 1 cycle is set out of range

Remark

- If two and more errors occur, the module saves the latter error code and removes the former one.

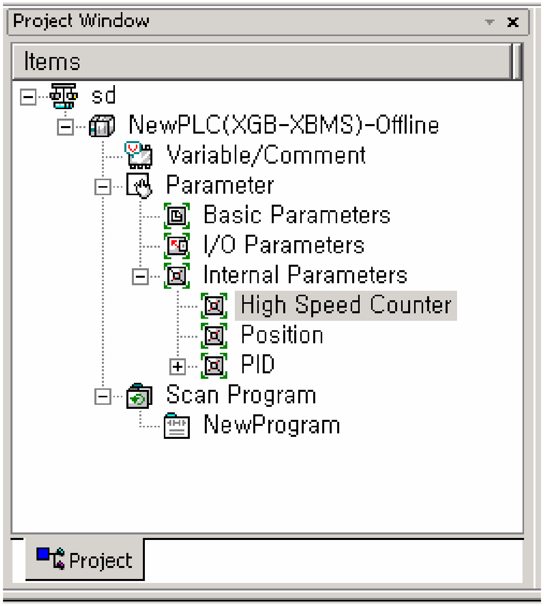
8.4 Examples: Using High-speed Counter

It describes examples of using high-speed counter.

1) Setting high-speed counter parameter

How to set types of parameters to operate a high-speed counter is described as follows.

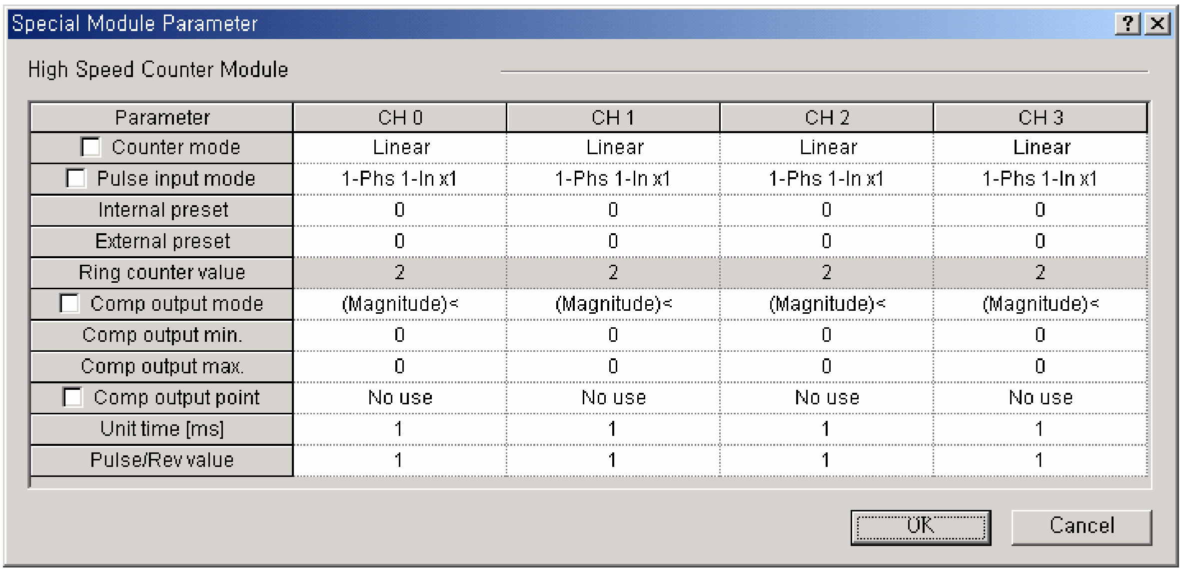
A) Set 『Internal Parameters』 in the basic project window.



B) Selecting high-speed counter opens a window to set high-speed counter parameters as follows.

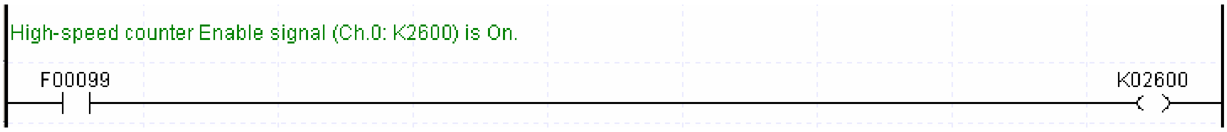
For details regarding each parameter setting, refer to 8.1~8.3.

(Every parameter settings are saved in the special K device area.)



Parameter	CH 0	CH 1	CH 2	CH 3
☐ Counter mode	Linear	Linear	Linear	Linear
☐ Pulse input mode	1-Phs 1-In x1	1-Phs 1-In x1	1-Phs 1-In x1	1-Phs 1-In x1
Internal preset	0	0	0	0
External preset	0	0	0	0
Ring counter value	2	2	2	2
☐ Comp output mode	(Magnitude)<	(Magnitude)<	(Magnitude)<	(Magnitude)<
Comp output min.	0	0	0	0
Comp output max.	0	0	0	0
☐ Comp output point	No use	No use	No use	No use
Unit time [ms]	1	1	1	1
Pulse/Rev value	1	1	1	1

C) Turn ‘ON’ the high-speed counter Enable signal(CH0:K2600) in the program.

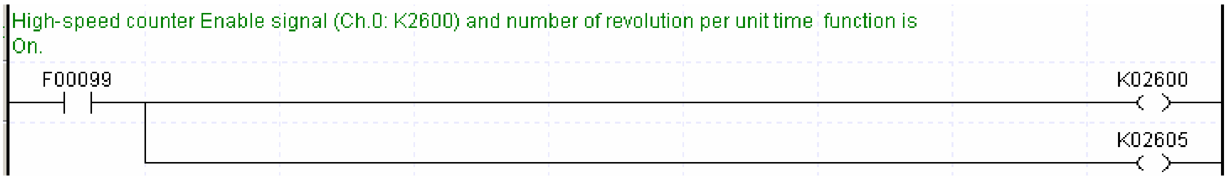


High-speed counter Enable signal (Ch.0: K2600) is On.

D) To use additional functions of the high-speed counter, you needs to turn on the flag allowing an operation command.

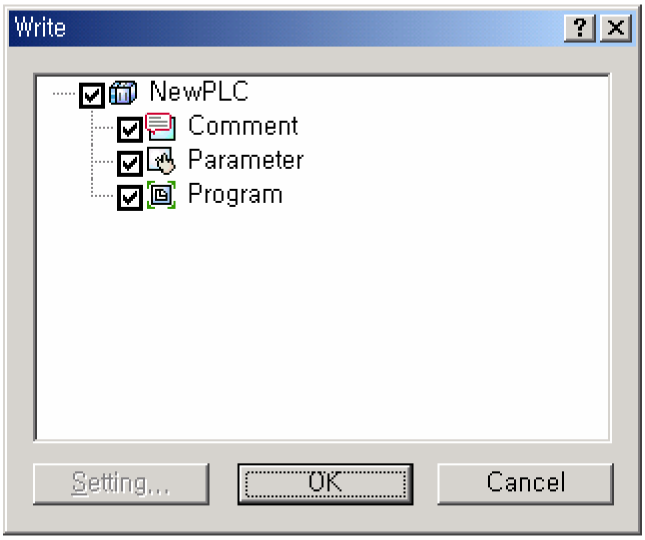
* Refer to 2. Operation Command, <8.3.1 Special K Area for High-speed Counter>

For instance, turn on 2605 bit if among additional functions, rotation number function is used.



High-speed counter Enable signal (Ch.0: K2600) and number of revolution per unit time function is On.

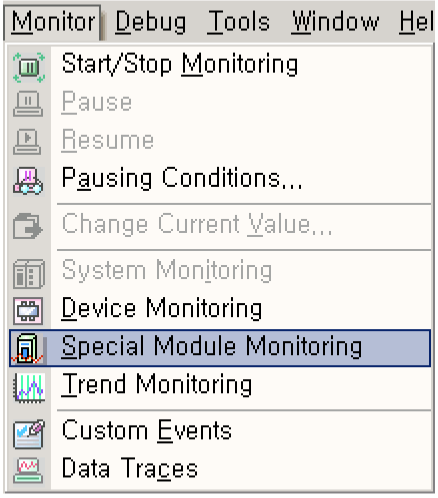
E) Upon the setting, download program and parameter to PLC.

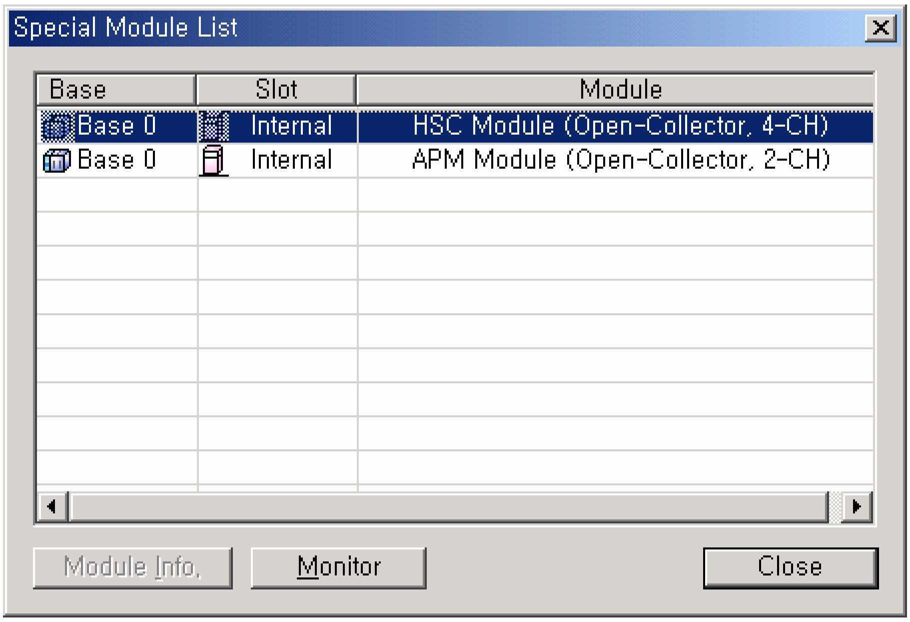


2) Monitoring and setting command

Monitoring and command setting of high-speed counter are described as follows.

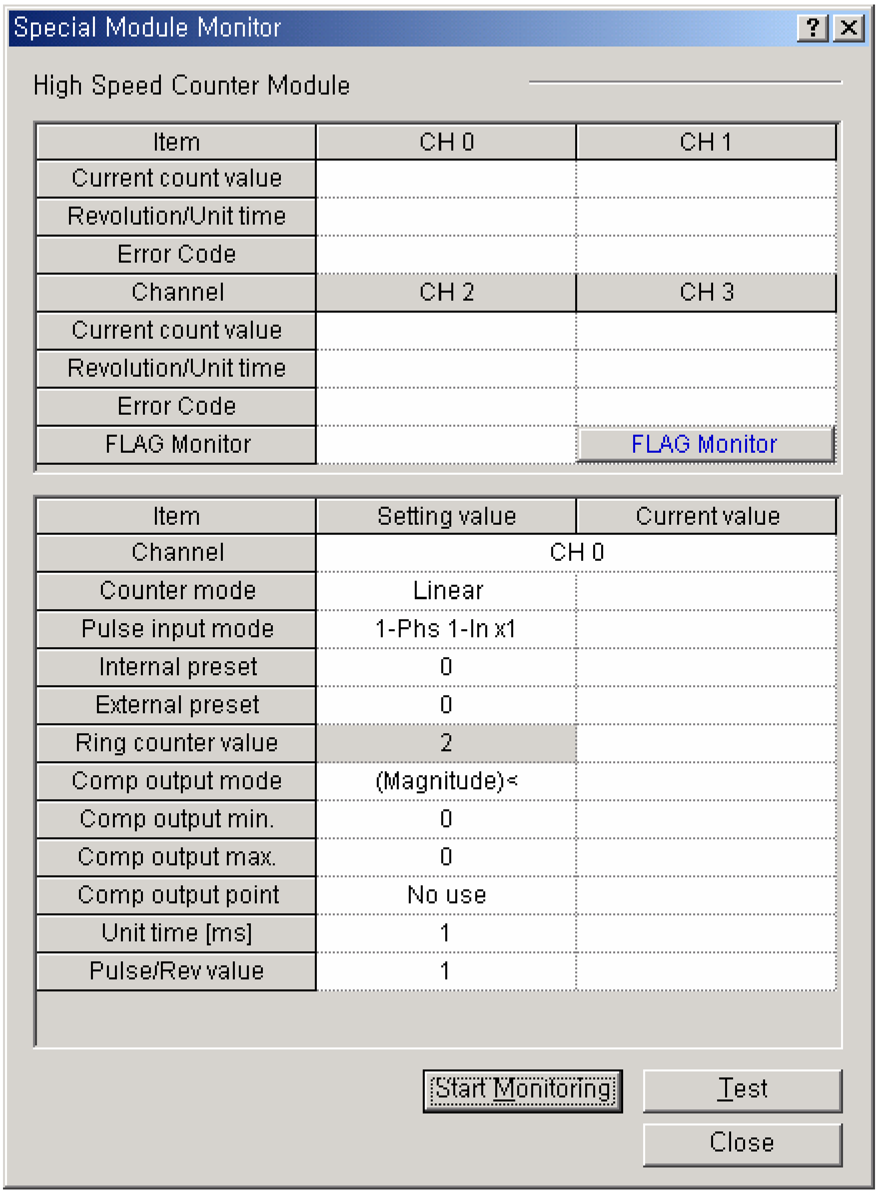
A) If starting a monitor and clicking a special module monitor, the following window is opened.




Special Module List

Base	Slot	Module
Base 0	Internal	HSC Module (Open-Collector, 4-CH)
Base 0	Internal	APM Module (Open-Collector, 2-CH)

B) Clicking 『Monitor』 shows monitor and test window of high-speed counter.

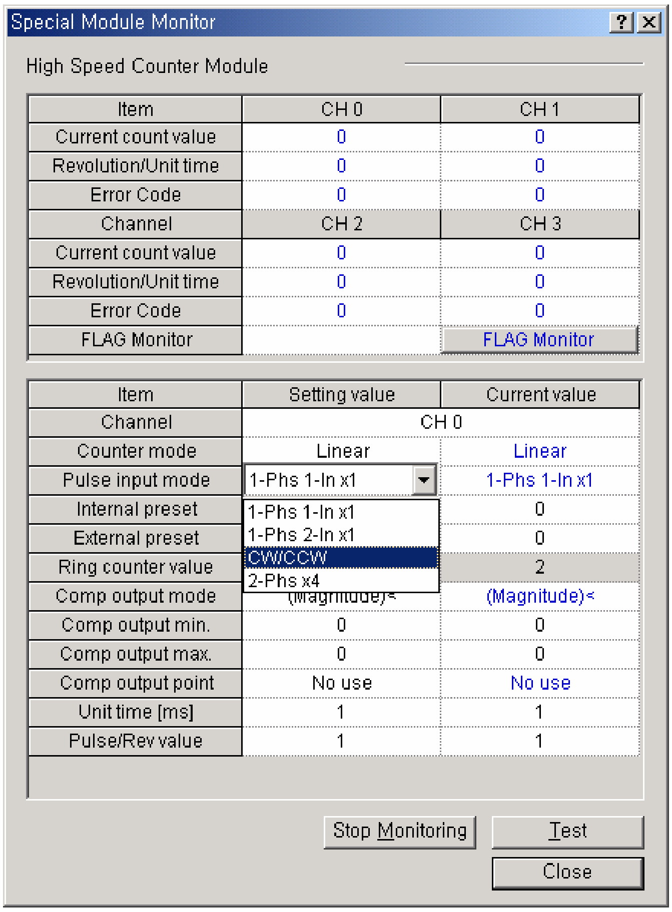


Item	CH 0	CH 1
Current count value		
Revolution/Unit time		
Error Code		
Channel	CH 2	CH 3
Current count value		
Revolution/Unit time		
Error Code		
FLAG Monitor		FLAG Monitor

Item	Setting value	Current value
Channel	CH 0	
Counter mode	Linear	
Pulse input mode	1-Phs 1-In x1	
Internal preset	0	
External preset	0	
Ring counter value	2	
Comp output mode	(Magnitude)<	
Comp output min.	0	
Comp output max.	0	
Comp output point	No use	
Unit time [ms]	1	
Pulse/Rev value	1	

Item	Description
FLAG Monitor	Show flag monitoring and command window of high-speed counter
Start Monitoring	Start monitoring each item(special K device area monitor).
Test	Write each item setting to PLC. (Write the setting to special K device)
Close	Close monitor

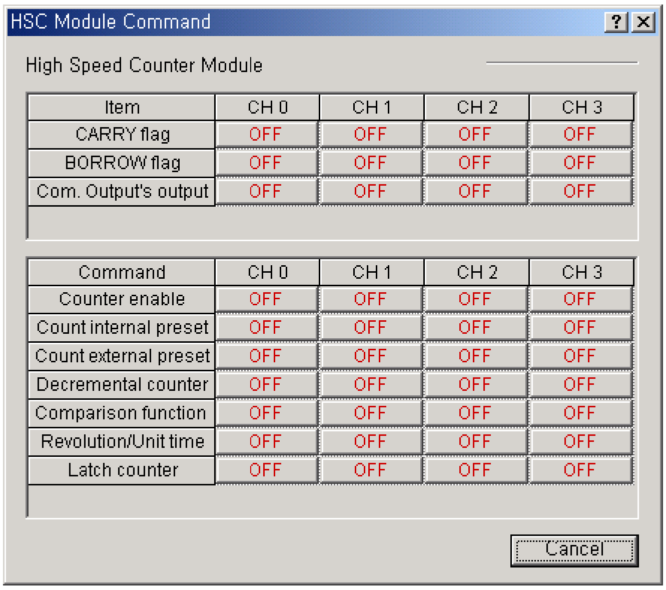
C) Clicking 『Start Monitoring』 shows the high-speed counter monitor display, in which you may set each parameter. At this moment, if any, changed values are not saved if power off=> on or mode is changed.



Item	CH 0	CH 1
Current count value	0	0
Revolution/Unit time	0	0
Error Code	0	0
Channel	CH 2	CH 3
Current count value	0	0
Revolution/Unit time	0	0
Error Code	0	0
FLAG Monitor		FLAG Monitor

Item	Setting value	Current value
Channel	CH 0	
Counter mode	Linear	Linear
Pulse input mode	1-Phs 1-In x1 1-Phs 1-In x1 1-Phs 2-In x1 CW/CCW 2-Phs x4	1-Phs 1-In x1
Internal preset		0
External preset		0
Ring counter value		2
Comp output mode	(Magnitude)<	(Magnitude)<
Comp output min.	0	0
Comp output max.	0	0
Comp output point	No use	No use
Unit time [ms]	1	1
Pulse/Rev value	1	1

D) Clicking 『FLAG Monitor』 shows the monitor of each flag in high-speed counter, in which you may direct operation commands by flags(clicking commands reverse turn).



Item	CH 0	CH 1	CH 2	CH 3
CARRY flag	OFF	OFF	OFF	OFF
BORROW flag	OFF	OFF	OFF	OFF
Com. Output's output	OFF	OFF	OFF	OFF

Command	CH 0	CH 1	CH 2	CH 3
Counter enable	OFF	OFF	OFF	OFF
Count internal preset	OFF	OFF	OFF	OFF
Count external preset	OFF	OFF	OFF	OFF
Decremental counter	OFF	OFF	OFF	OFF
Comparison function	OFF	OFF	OFF	OFF
Revolution/Unit time	OFF	OFF	OFF	OFF
Latch counter	OFF	OFF	OFF	OFF

Chapter 9. Built-in Positioning Function

XGB series transistor output type contains 2 positioning axes. This chapter describes the specifications and usage of position.

9.1 Positioning Specifications

❑ It describes specifications, installation and using functions of XGB built in XGB basic module, programming
and wiring with auxiliary devices

9.1.1 Features

❑ Positioning function features the followings

1) Diversity of positioning function

It contains various functions necessary for position system such as position control at any temporary position or constant speed operation.

A) Operation data containing position address, operation method and operation pattern may set up to
30 steps per axis. It executes position function by using this operation data.

B) Position control per axis may be controlled linearly. The control may also perform singular position
control by one operation data and continual position control by several operation data.

C) It may control linear interpolation.

D) Depending on operation data and control types designated by parameters, there are position control, speed control, position/speed control, switching control and position/speed switching control.

E) It also provides various homing control functions.

(1) Homing control may be chosen among the following three.

- Origin detection after proximal origin Off
- Origin detection after deceleration if proximal origin On
- Origin detection by proximal origin

(2) It is achieved position control from any temporary position to machine's origin (floating origin setting).

2) Easy maintenance

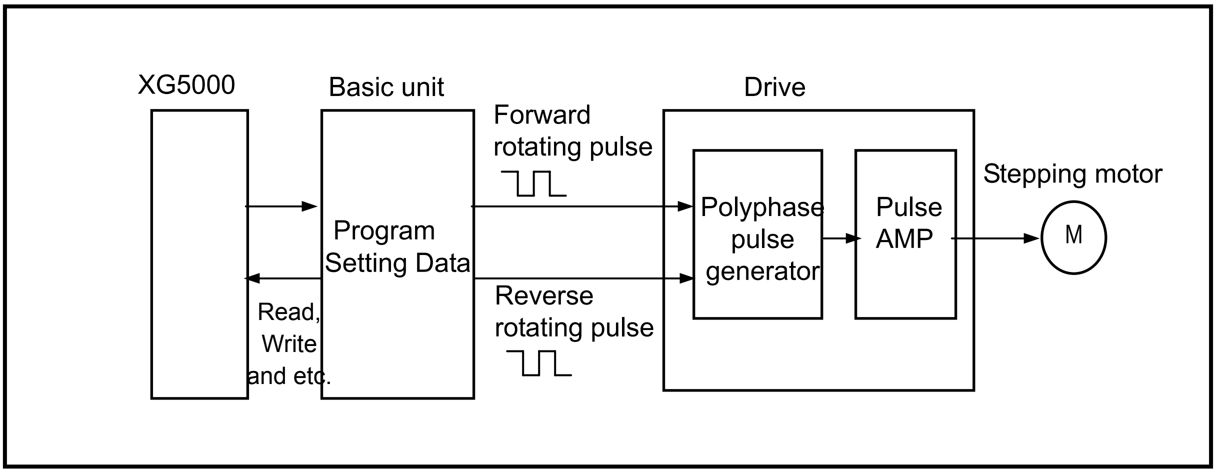
It saves types of data such as position data and parameter into flash memory of main unit.

3) XG5000 may perform health check, monitor and test.

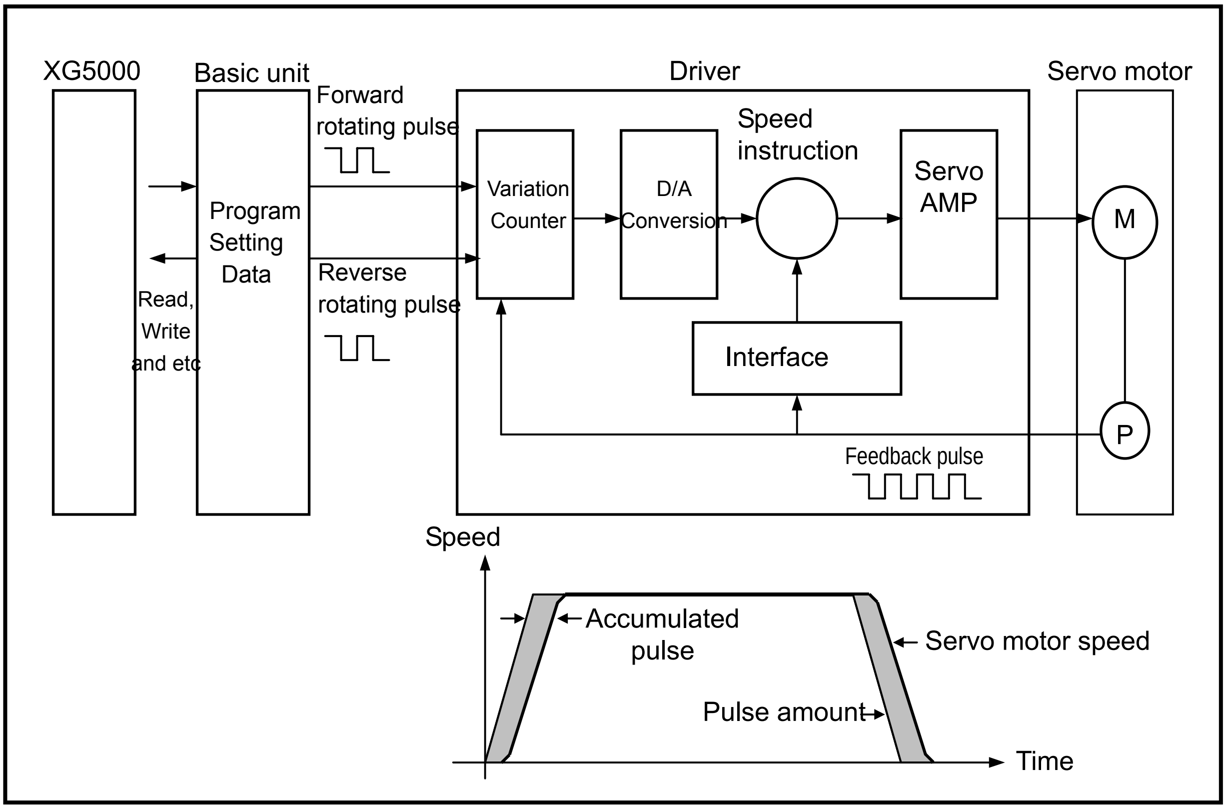
- Diagnosing of I/O signal line
- Monitoring
- Providing detail information of errors and troubleshooting

9.1.2 Purpose of position function

❑ The purpose of position function is to exactly move an object(processed materials, tools and etc) from the current position to a designated position and this function executes highly precise position control by position pulse string signal as being connected to types of servo drive or stepping motor control drive. For applications, it may be widely used; for instance, machine tools, semiconductor assembling machine, grinder, small machine center, lifter and etc.



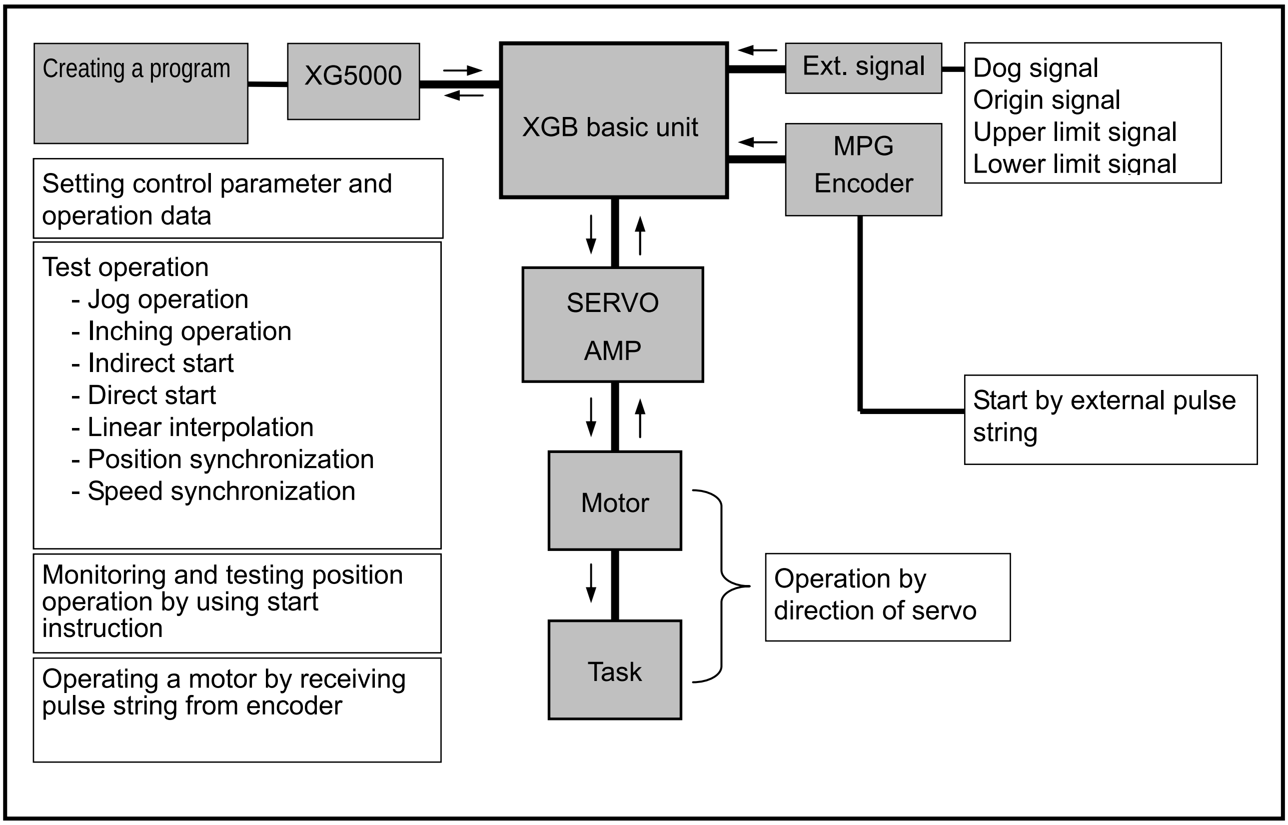
< Position control of stepping motor >



< Position control for servo motor >

9.1.3 Flow of position signal

❑ The flow of PLC system for position function is as follows.



9.1.4 Performance specifications

☐ The performance specifications of position are as follows.

Type / Item		XGB Basic Unit(TR output)
No. of control axis		2 axes
Interpolation		2 axes linear interpolation
Control type		Position control, speed control, speed/position switching, position/speed switching
Control unit		Pulse
Position data		30 data areas per axis(operation step no. 1 ~ 30) Position parameter setting / special module monitoring / setting to special K area available
Position monitor		Monitoring special module in XG5000
Back-up		Saving parameter and operation data in flash/RAM(super capacity backup) Saving into flash memory by instruction
Position	Position method	Absolute method / Incremental method
	Position address range	-2147483648 ~ 2147483647
	Speed range	1 ~ 100,000pps
	Acceleration/deceleration processing	Trapezoid-shaped
	Acceleration/deceleration time	1 ~ 10,000 ㎳ (selectable from 4 types of acceleration/deceleration patterns)
Max. output pulse		100 Kpps
Max. connection distance		2 m

< Performance specifications >

9.1.5 External interface I/O specifications

❑ It describes external interface I/O.

1) Input specifications

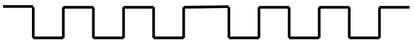
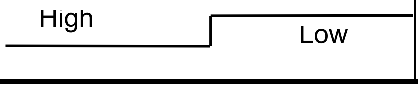
Signal	Rated input voltage/current	Operating voltage range	On voltage/current	Off voltage/current	Input resistance	Response time
Ext. upper limit	DC 24V/7㎃	DC 20.4～28.8V	DC 19V/5.7㎃ or more	DC 6V/1.8㎃ or less	Approx. 3.3㏀	0.5㎳ or less
Ext. lower limit						
DOG	DC 24V/4㎃		DC 19V/3.4㎃ or more	DC 6V/1.1㎃ or less	Approx. 5.6㏀	
Home						

2) Output specifications

- Pulse output specifications

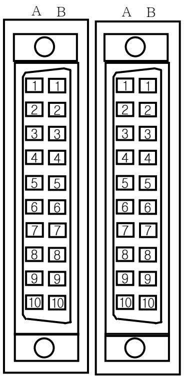
Rated load voltage	Operating load voltage range	Max. load current/inrush current	Max. voltage drop (On)	Leakage current (Off)	Response time
DC 5～24V	DC 4.75～26.4V	100㎃(1 point) 1A / 10㎳ or less	DC 0.3V or less	0.1㎃ or less	100㎲ or less

- Output pulse is outputted in pulse/sign type as below.

Pulse output mode	Selecting output signal level			
	Forward rotating direction		Reverse rotating direction	
	Forward	Reverse	Forward	Reverse
Pulse				
Direction				

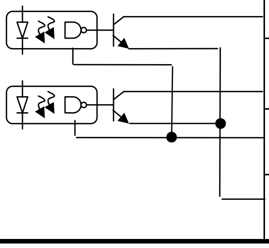
3) External devices and interface specifications

A) Connector's Pin Assignment

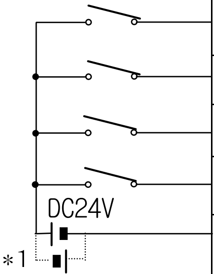
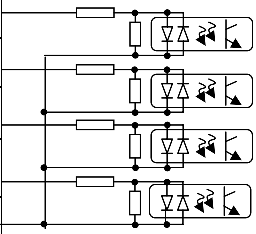
Pin assignment	Type	Pin No.		Signal name		Signal direction Position - external	Operation condition
		X-axis	Y-axis				
 Input output	Output	A1	A2	Pulse	Pulse output (open collector)	→	-
		A3	A4	Direction	Pulse output (open collector)	→	-
		A9/A10		24V	External 24V power	→	-
		B9/B10		Output COM	External 24V GND	→	-
	Input	A1	A3	LimitL	Lower limit	←	Edge
		A2	A4	LimitH	Upper limit	←	Edge
		A5	A7	STOP	DOG	←	Edge
		A6	A8	DOG	Home signal(+24V)	←	Edge
		A9 / A10 B9 / B10		Input COM	Common	←	-

B) Connector's internal circuit

(1)Pulse output stage

Internal circuit	Pin No.		Signal	
	X-axis	Y-axis		
Open collector output 	A1	A2	Pulse	Pulse output
	A3	A4	Direction	Direction output
	A9 A10	A9 A10	24V	External 24V power
	B9 B10	B9 B10	COM	External 24V GND

(2) Input signal

Type	Pin No.		Internal circuit	Signal	
	X-axis	Y-axis			
	Selectable	Selectable		LimitL	Lower limit
	Selectable	Selectable		LimitH	Upper limit
	Selectable	Selectable		STOP	DOG
	Selectable	Selectable		DOG	Home signal(+24V)
	Selectable	Selectable		COM	Common

*1: Is normally works with -24V. That is, NPN or PNP types of sensors are available.

9.2 Positioning Control

❑ Regarding position control, there are contain position control, interpolation control, speed control, speed/position switching and position/speed switching.

9.2.1 Position Control

Position control is to control a designate axis from start address(present position) up to target address(movement).

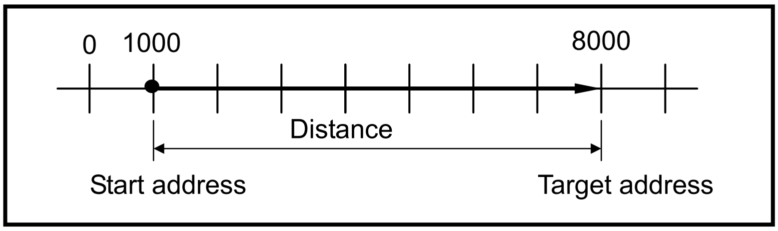
1) Absolute method control (Absolute coordinate)

- Position control from start address to target address(address designated in position data).
- Position control is performed, based on the address designated in Home Return(home address).
- Direction is determined by start address and target address.
  - Start address < target address : forward positioning
  - Start address > target address : reverse positioning

[example]

▷Start address : 1000, ▷ Target address : 8000 → moving forward

That is, the movement distance is 7000(7000 = 8000 - 1000).



▷Parameter setting(position data item setting)

StepNo.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [pulse]	M code	Acce./ dece. No.	Operation speed [pls/s]	Dwell time [ms]
1	Absolute	Position	End	Single	0	8000	0	0	100	0

Remark

- Every position/speed control is available as long as the origin is determined preliminarily.
- Once it starts without the origin, it generates an error and then, does not operate.

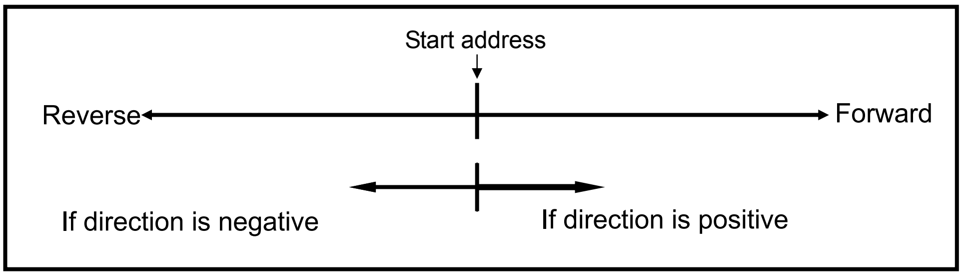
2) Incremental method control (Incremental coordinate)

▪Position control from start address as long as the target distance.

▪Direction is determined by +/-.

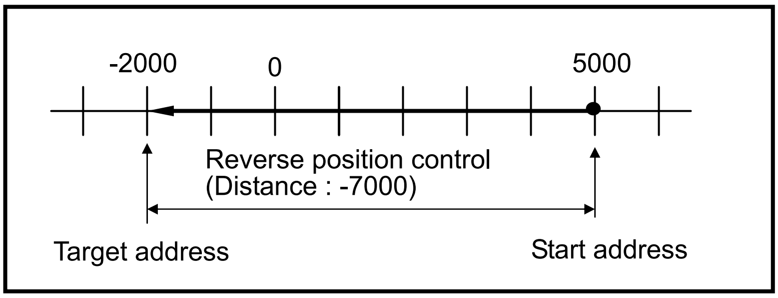
▷If direction is positive(+ or without mark): forward positioning(address is increasing).

▷If direction is negative(-) : reverse positioning(address is decreasing).



[example]

▷Start address : 5000, ▷Target address : -7000: it moves reversely as much as -2000.



▷Parameter setting(position data item setting)

StepNo.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [pulse]	M code	Acce./ dece. No.	Operation speed [pls/s]	Dwell time [ms]
1	Incre-mental	Position	End	Single	0	-7000	0	0	100	0

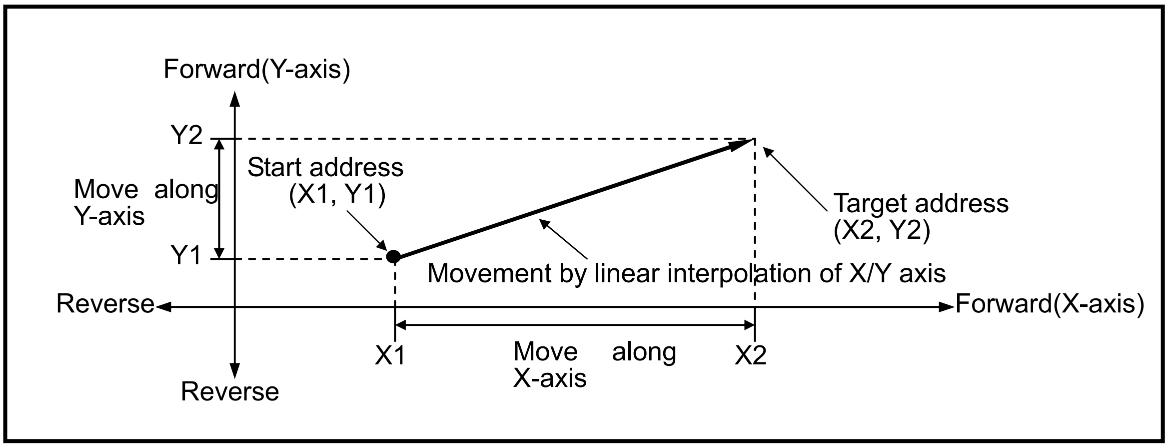
9.2.2 Interpolation control

❑ 2 axes linear interpolation control

Linear interpolation from start address(present position) by using 2 designated axes.

1) Absolute coordinate(Absolute) method control

- Execute 2-axes linear interpolation from start address to target address(address determined in position data).
- Position control is based on the address designated in Home Return.
- Direction is determined by the start/target address of each axis.
  - ▷Start address < target address : forward movement
  - ▷Start address > target address : reverse movement

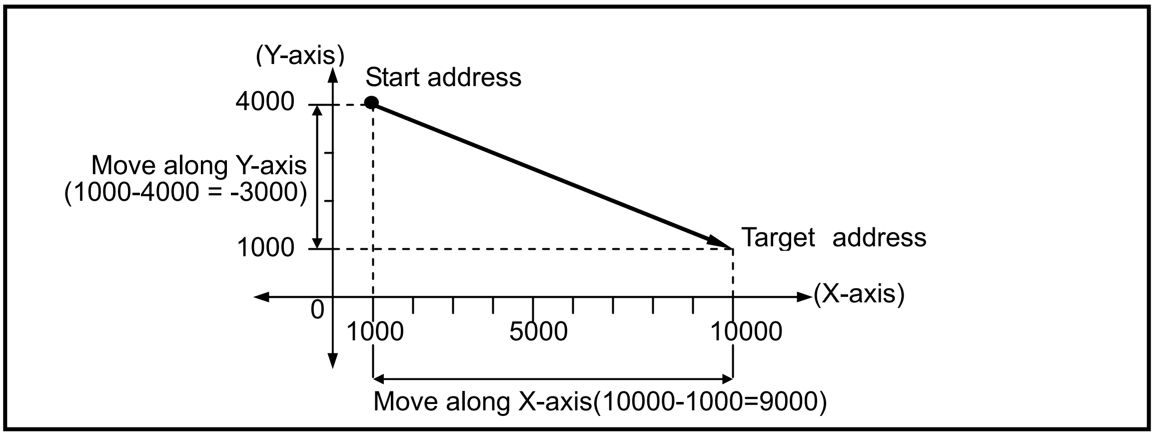


[example]

It moves as follows when

▷Start address is (1000, 4000), and

▷Target address is (10000, 1000).



▷Parameter setting(position data item setting)

	Step No.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [ms]
X axis	1	Absolute	Position control	End	Single	0	10000	0	0	100	0
Y axis	2	Absolute	Position control	End	Single	0	1000	0	0	100	0

Remark

❑ A special attention should be paid that linear interpolation start operates on 2 axes simultaneously.

- Available operation patterns are end or continue while operation methods are single or repeat. If it is set to 'continue', it keeps operating.
- Available backup operation options are as follows.
  Speed override, stop and emergency stop
- The following functions are not available in the linear interpolation.
  Position/speed switching, speed override, position override, continuous operation, position/speed override.
- Auxiliary data relating to operation working on the main axis in case of linear interpolation operation are as follows.
  ; operation method, operation pattern, speed limit, dwell time,
- Main/subordinate axes are determined by comparing the amount of operation step position address.

(1) Main axis: an axis of which position address amount of operation step number is higher between X-axis and Y-axis

(2) Subordinate axis: an axis of which position address amount of operation step number is lower between X-axis and Y-axis.
At the moment, the speed of subordinate axis, acceleration time, deceleration time and bias speed are recalculated.

- Parameters operated depending on axial values are backlash compensation amount, software upper limit and software lower limit.

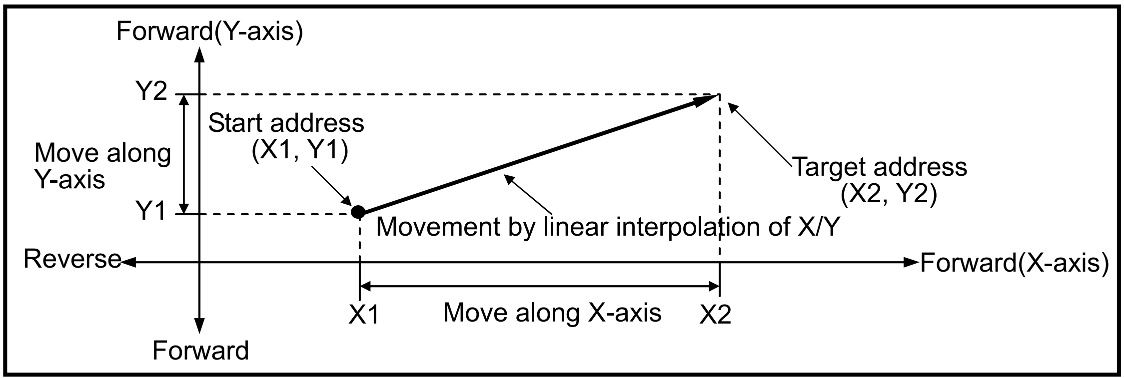
2) Incremental coordinate(Absolute) method control

▪ Position control to a position including direction and distance which are defined as the target per axis at the start address.

▪ Direction of each axis is determined by +/- marks of each axis

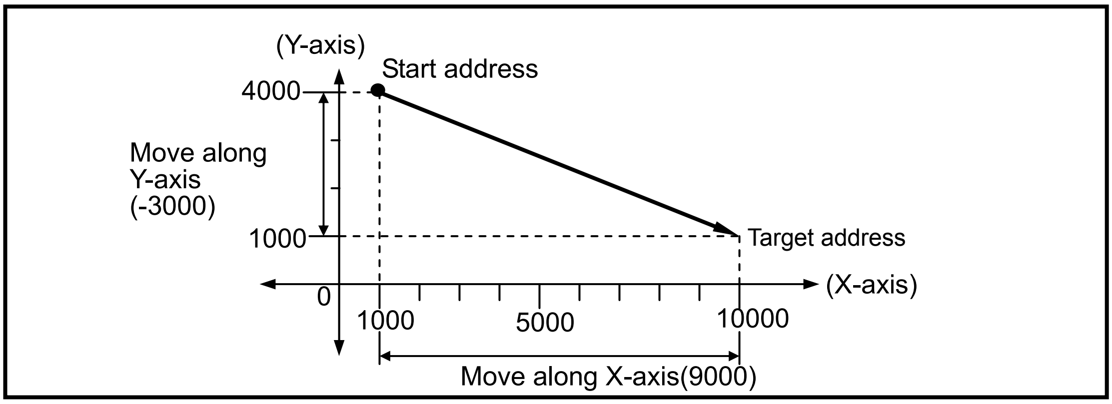
▷ Positive(+) distance(or without any +/- mark): forward movement(increasing address)

▷ Negative(-) distance: reverse movement(decreasing address)



[example]

▷It moves as follows if the start address is (1000, 4000) and the target address is (9000, -3000).



▷Parameter setting(position data item setting)

	Step No.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [㎳]
X axis	1	Absolute	Position control	End	Single	0	9000	0	0	100	0
Y axis	2	Absolute	Position control	End	Single	0	-3000	0	0	100	0

9.2.3 Speed control

❑ The system executes by position start and controls at a defined speed until deceleration stop instruction is entered.

(In case operation stops by a deceleration stop instruction, absolute coordinate type position control mode is not available until there is Home Return or floating origin setting.)

❑ Speed control works on forward or reverse direction.

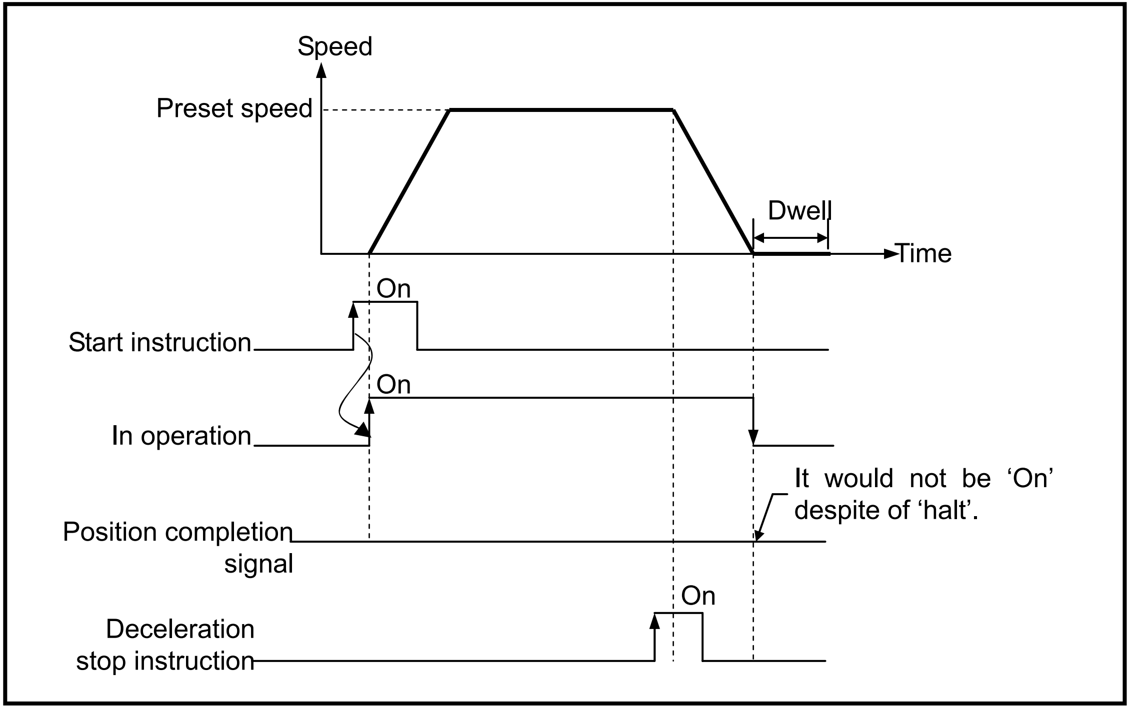
- Forward direction : when position address is positive(incl. “0”)
- Reverse direction : when position address is negative

❑ In case it is used for speed control, the followings among position data items are not affected.

Step No.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [㎳]

Items that does not affect.

❑Operation timing



[example]

▷Parameter setting(position data item setting)

Step No.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [㎳]
1	Absolute	Speed control	End	Single	0	-100	1	0	1000	0

9.2.4 Speed / Position switching

❑ If an axis which was set by position start is given with speed/position switching signal as a position module inside or outside while controlling speed, speed control is switched into position control and determines a position as much as a distance set as a target.

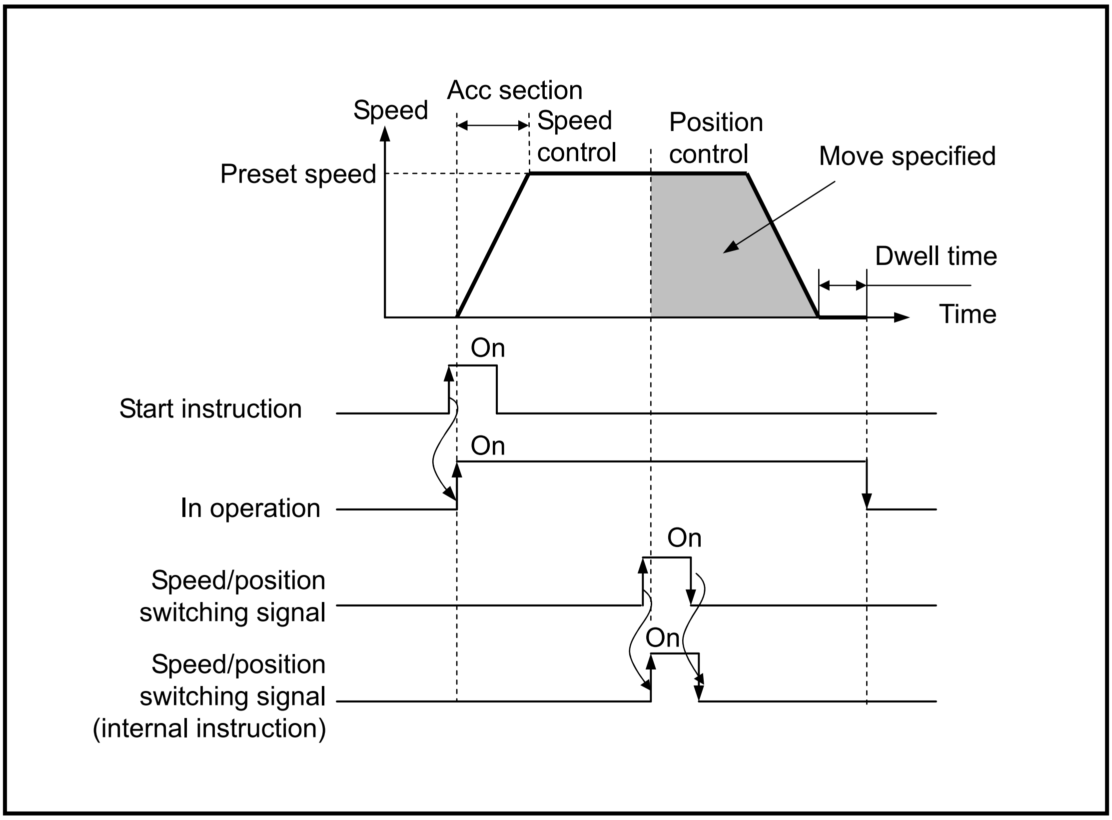
❑ If being used for speed/position switching, forward or reverse operation is available.

	Step No.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [㎳]
Normal	1	Incre-mental	Speed	Keep	Single	0	1000	1	1	1000	100
Reverse	2	Incre-mental	Speed	End	Repeat	0	-1000	2	1	2000	100

↑
The items that does not affect.

- In speed/position switching control, forward or reverse direction is determined by +/- mark front of position address.
  (At the moment, it processes absolute method regardless of absolute or Incremental method)
  *1 (forward) : when position address is positive
  *2 (reverse) : when position address is negative

❑ Operation timing



9.2.5 Position/Speed switching control

☐ If an axis which was set by position start is given with position/speed signal while controlling position, position control is switched into speed control and it stops by deceleration and halt or resumes the subsequent operation.

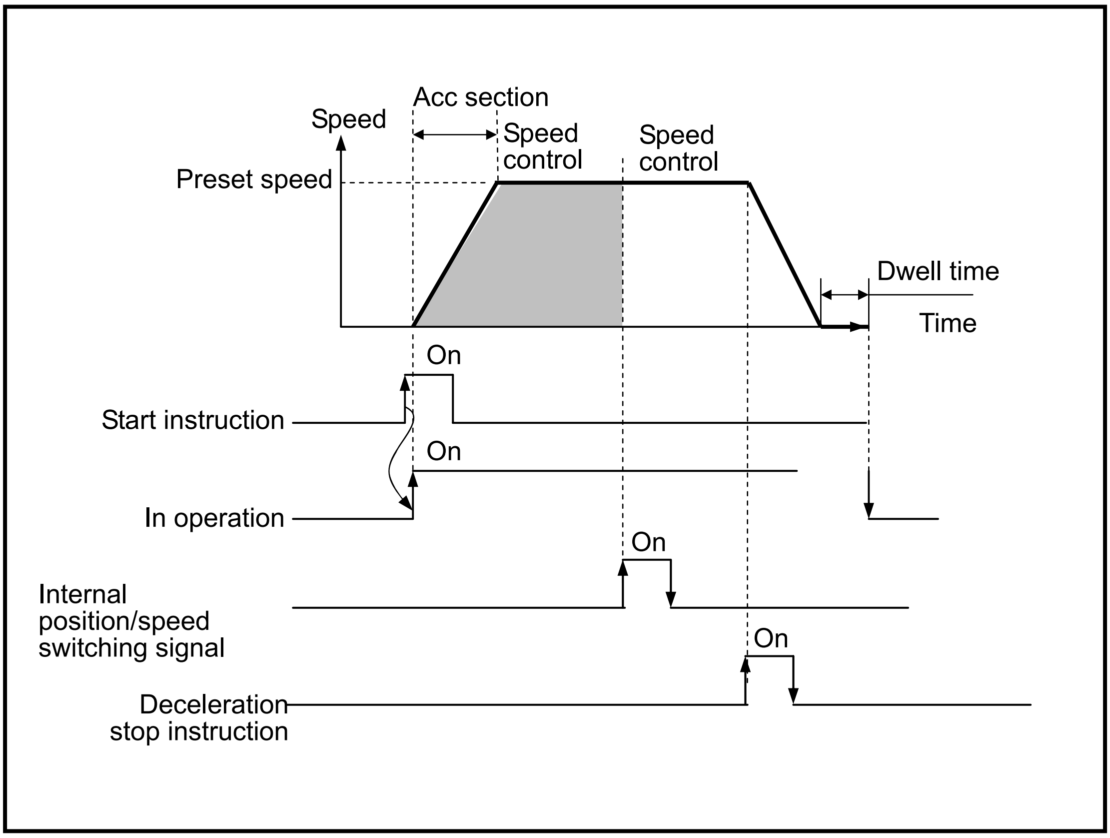
☐ Position/speed switching control may operate in forward or reverse direction.

	Step No.	Coordi-nate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [ms]
Normal	1	Incre-mental	Speed	Keep	Single	0	0	1	1	500	100
Reverse	2	Incre-mental	Speed	End	Repeat	0	0	2	1	600	100

The items that does not affect.

- In position/speed switching control, forward or reverse direction is determined by +/- mark front of position address.
  *1 (forward) : when position address is positive
  *2 (reverse) : when position address is negative

- Operation timing



9.2.6 Operation mode

❑ Operation mode is intended for various structures regarding how to operate position data using several operation step number and how to do with position data speed.

❑ Operation modes are as follows.

Control method	Operation pattern	Operation method	Remarks
Position control	End	Single	-
	End	Repeat	-
	Continue	Single	-
	Continue	Repeat	-
	Continue	Single	Linear interpolation unavailable
	Continue	Repeat	Linear interpolation unavailable
Speed control	End	Single	Linear interpolation unavailable
	Continue	Single	Unavailable
	Continue	Repeat	Unavailable

❑ Operation mode is set by PLC program or operation data items in software package.

❑ Operation data may be set up to 30 per axis between 1 ~ 30 operation step numbers.

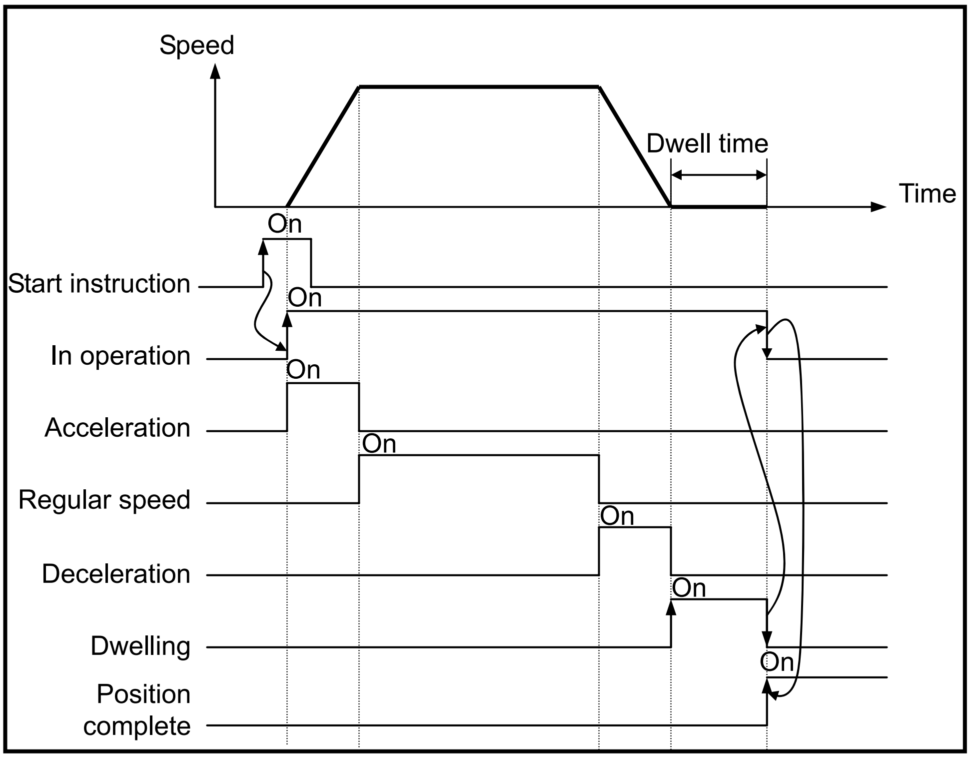
Operation data type	Range/type
Step No.	1~30
Coordinate	Absolute/Incremental
Control method	Position/Speed
Operation pattern	End/Continue/Sequential
Operation method	Single/Repeat
Target position[Pulse]	-2147483648~2147483647
M code	0~65,535
Operation speed[Pulse/s]	0~100,000
Dwell time[㎳]	0~50,000

❑ Position operation method that may be executed by position data one by one operation step if start instruction is ordered or that may be done sequentially by several operation steps is determined by the position data set by a user

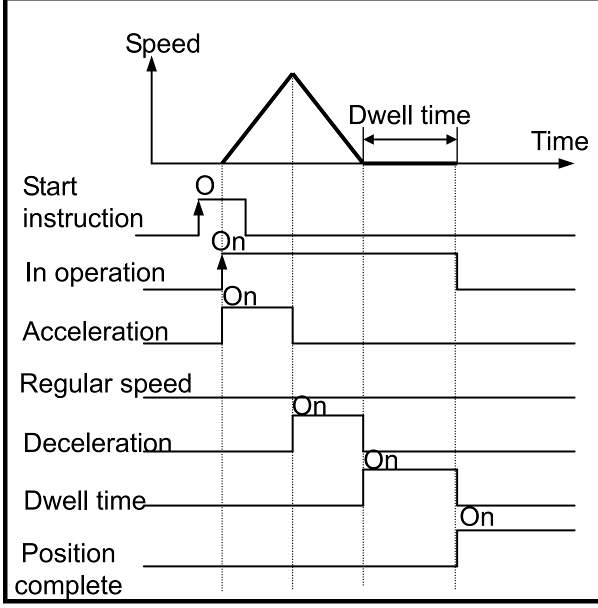
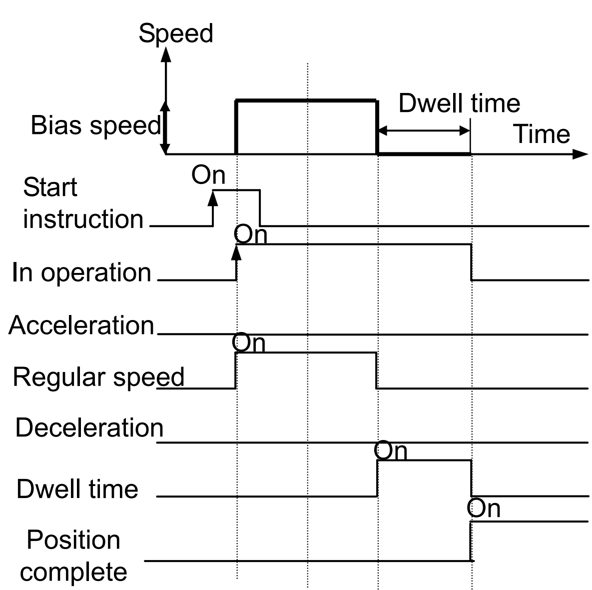
1) End operation(single)

- ☐ It moves up to a target position by only one start instruction and completes position as dwell time elapses.
- ☐ Position completion in the operation mode may be used by the operation mode of the last position data in continuous operation mode or sequential operation mode.
- ☐ Direction is determined by +/- mark front of position address
- ☐ Operation follows trapezoid directions, in which acceleration(Acc.), regular speed and deceleration (Dec.) sections exist, depending on the present speed/position data but it may have the following operation pattern according to preset values.

▪ Regular operation pattern

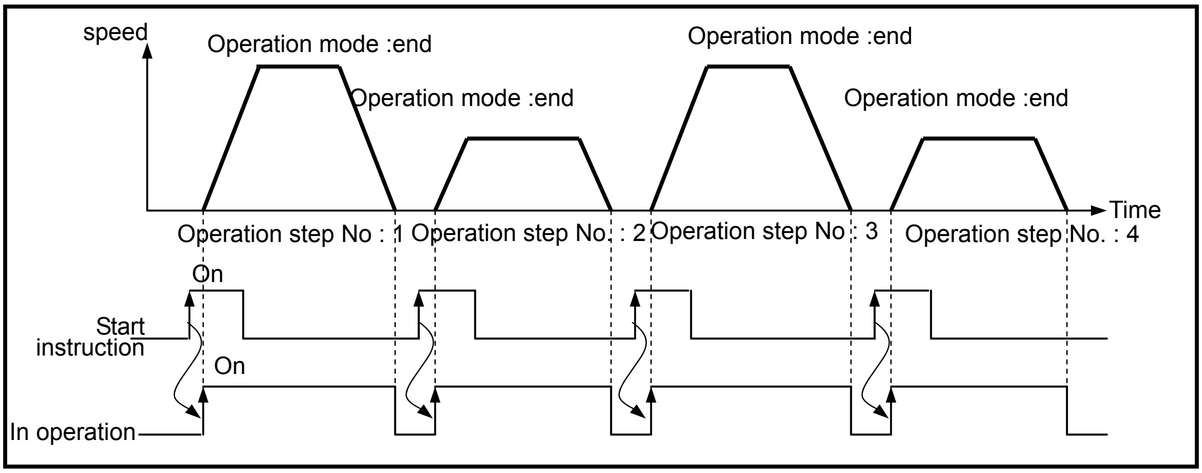


▪ Irregular operation pattern

When setting operation speed excessively than position movement	When setting operation speed as same as bias speed
	

[example]

▷ Operation pattern



▷ Parameter setting

Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [ms]
1	xxxx	Position	End	Single	0	10000	0	0	1000	0
2	Absolute	Position	End	Single	0	20000	0	0	500	0
3	Absolute	Position	End	Single	0	30000	0	1	1000	0
4	Absolute	Position	End	Single	0	40000	0	1	500	0

2) End Operation(repeat)

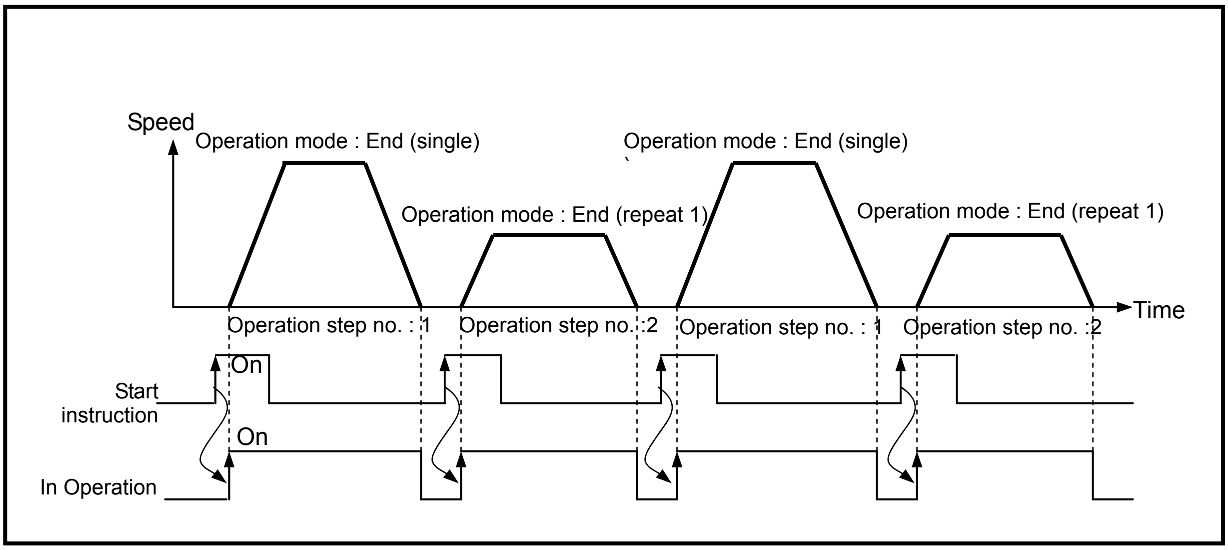
☐ It moves up to a target position by only one start instruction and completes position as dwell time elapses.

☐ Repeat operation mode is similar to single operation but it determines the next operation with a designated repeat step number once position of repeat operation mode is complete unlike single operation.

☐ Direction is determined by +/- mark front of position address

[example1] Operating only by start instruction(if step number is set to “0” by indirect start)

▷ Operation pattern



▷ Parameter setting

Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [㎳]
1	Absolute	Position	End	Single	0	10000	0	0	1000	0
2	Absolute	Position	End	Single	1	20000	0	0	500	0
3	Absolute	Position	End	Single	0	30000	0	1	1000	0
4	Absolute	Position	End	Single	0	40000	0	1	500	0

Operation step 3,4 does not start.

3) Keep operation

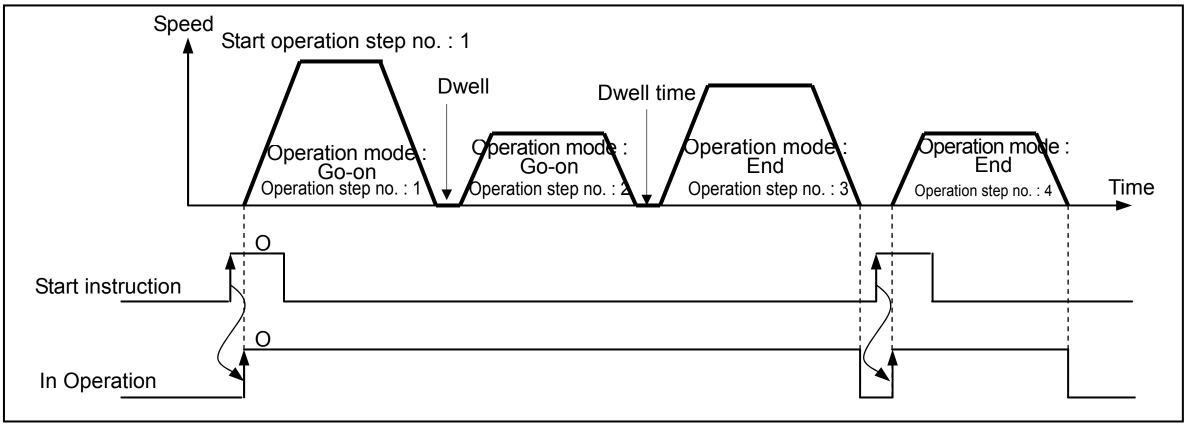
❑ With one time Start instruction, the positioning to the goal position of operation step is executed and the positioning shall be completed at the same time as dwell time proceeds and without additional start instruction, the positioning of operation step for (current operation step no. +1) shall be done.

❑ Keep operation mode is available to execute several operation step in order.

❑ Operation direction shall be determined by position address.

[Example]

- Operation pattern



▷ Parameter setting

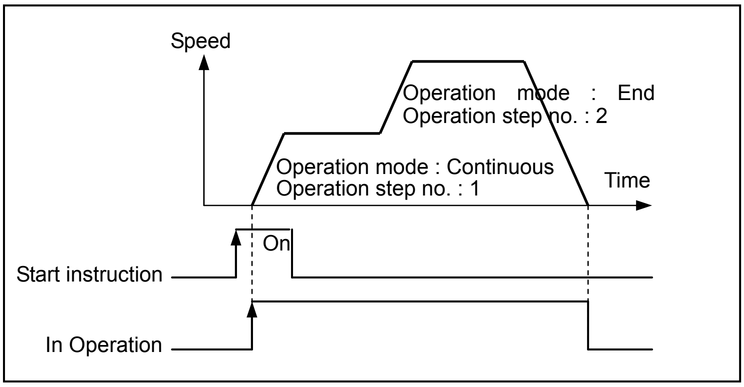
Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [㎳]
1	Absolute	Position	Keep	Single	0	10000	0	0	1000	0
2	Absolute	Position	Keep	Single	0	20000	0	0	500	0
3	Absolute	Position	End	Single	0	30000	0	1	2000	0
4	Absolute	Position	End	Repeat	1	40000	0	1	3000	0

4) Continuous operation

- ❑ With one time Start instruction, the positioning for operation step set by continuous operation mode is executed to the goal position without stop and the positioning shall be completed at the same time as dwell time proceeds.
- ❑ With Next Move continuous operation instruction, the operation in the acceleration, constant speed, deceleration section of Continuous operation is available.
- ❑ Operation direction shall be determined by position address.

[Example]

▷ Operation pattern



▷ Parameter setting

Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeated step	Goal position [Pulse]	M code	Acce/dece. No.	Operation speed [Pls/s]	Dwell time [ms]
1	Absolute	Position	Conti-nuous	Single	0	10000	0	1	1000	0
2	Absolute	Position	End	Repeat	1	20000	0	1	500	0

9.2.7 Positioning start signal

❑ If it stops due to the causal factor during positioning, it may also execute positioning at the stopped position address by re-start.

❑ Types of starts

- General start instruction
- Concurrent start instruction
- Synchronic start instruction
- Linear interpolation start instruction
- Home Return start instruction
- Jog start instruction
- Inching start instruction

❑ When operating start(instruction), the signal during operation should be “Off.”

1) General start

- Program start

XGB series support three starts; indirect start(IST), direct start(DST) and start by designating a special K area.

2) Concurrent start

- Concurrently, start positioning operation data of 2 axes according to axial data and preset step by internal concurrent start instruction.
- If stop instruction is entered during concurrent start operation, it decelerates and stop the axis while it starts positioning operation according to Incremental coordinate or absolute coordinate when internal concurrent start instruction is entered again in case concurrent operation step No. is the current operation step number.
- Concurrently, start positioning operation data of 2 axes according to axial data and present step by external input signal.

3) Synchronic start

A) Position synchronic start

- Position synchronic start is available only when the main axis is in origin setting status.
- Position synchronic instruction starts as a sub axis is synchronized, depending on the current position of a main axis.
- Position synchronization should run position synchronic instruction at a sub axis.
  Therefore, if a instruction axis and a main axis are identically set, Error 347 occurs.
- Once position synchronic instruction is executed, it turns in-operation status and in the actual operation, a sub axis starts operation at a time when the current position of a main axis is in accord with a position set as a position synchronization.
- During position synchronization, the operation step number of a sub axis is determined by the start step number setting of a main axis.
- To cancel it after position synchronization instruction is run at a sub axis, execute stop instruction, canceling the position synchronization instruction.

B) Speed synchronic start

- With speed synchronic start instruction, a sub axis is speed-synchronized according to speed synchronization ratio when a main axis starts.
- Although a sub axis is set in position control mode, start and stop repeat as soon as a main axis operates.
  The rotation direction of a sub axis is identical with that of a main axis.
- Once speed synchronic instruction is executed in a sub axis, it turns in-operation status and it remains speed synchronic operation status until speed synchronic instruction is cancelled by stop instruction.
- Speed synchronization ratio is available from 0.00% to 100.00%, or it may result in Error “356.”
- If executing speed synchronic instruction with M code on, it generates Error 353. Therefore, it should be used after canceling M code.
- A main axis setting may be set as X-axis, Y-axis, HSC CH1, HSC CH1, HSC CH2 and HSC CH3.

4) Linear interpolation start

☐ 2 axes linear interpolation control

- It instructions that it should be linearly moved by 2 axes.
- The use of this instruction needs a caution because 2 axes linear interpolation starts operates two axes simultaneously.
- When 2 axes linear interpolation start instruction is ordered, a main axis and a sub axis are determined by positioning distance sizes of 2 axes.

Speed data of a sub axis is processed with the following operation.

$$\boxed{\text{Sub axis speed} = \frac{\text{Main axis speed} \times \text{sub axis distance}}{\text{Main axis distance}}}$$

▷Terms definition

Main axis : an axis of which operation step number's positioning distance is longer than the other axis Sub axis : an axis of which operation step number's positioning distance is shorten than the other axis At the moment, the speed, acceleration time, deceleration time and bias speed of a sub axis are re-calculated.

- Available operation modes are limited to end operation and continuous operation.
- During 2 axes linear interpolation operation, the operation speed of a sub axis is not displayed.

9.2.8 Positioning stop signal

It describes factors stopping an axis during positioning.

1) Stop instruction and stop factors

❑ Stop instructions and factors are summarized as follows and divided into individual stop and concurrent stop.

- Individual axis stop instructions or the stop factors affect the only axis(axes) of which stop instruction is “On” or stop factor exists. However, interpolation control operation axis stops if an axis is with stop instruction or stop factor during linear/circular interpolation.
- In case of concurrent stop instructions or the stop factors, all the axes of which stop instruction is “On” or stop factor exists would stop.

<table>
<tr><th colspan="2">Stop factor</th><th>Positioning *1</th><th>Home Return *2</th><th>Jog operation</th><th>Stop axis</th><th>Axis operation status after stop instruction *3</th><th>M code ”On” Signal status</th></tr>
<tr><td rowspan="2">Stop by parameter setting *4</td><td>Excess of soft upper limit</td><td>Immediate stop</td><td>Not detected</td><td>Immediate stop</td><td>Individual axis</td><td>Error status (Error 501)</td><td>No change</td></tr>
<tr><td>Excess of soft lower limit</td><td>Immediate stop</td><td>Not detected</td><td>Immediate stop</td><td>Individual axis</td><td>Error status (Error 502)</td><td>No change</td></tr>
<tr><td rowspan="2">Stop by sequence program *5</td><td>Decelerating stop instruction</td><td>Decelerating stop</td><td>Decelerating stop</td><td>Error 322 (keep running)</td><td>Individual axis</td><td>Decelerating</td><td>No change</td></tr>
<tr><td>Emergency stop instruction</td><td colspan="3">Immediate stop</td><td>Individual axis</td><td>Error status (Error 481)
No output</td><td>Individual axis</td></tr>
<tr><td rowspan="2">Stop by external signal</td><td>External upper limit “On”</td><td colspan="2">Immediate stop</td><td>Forward immediate stop</td><td>Individual axis</td><td>Individual axis</td><td>No change</td></tr>
<tr><td>External lower limit “On”</td><td colspan="2">Immediate stop</td><td>Reverse immediate stop</td><td>Individual axis</td><td>Individual axis</td><td>No change</td></tr>
<tr><td>Stop by monitoring</td><td>Decelerating stop instruction</td><td>Decelerating stop</td><td>Decelerating stop</td><td>Error 322 (keep running)</td><td>Individual axis</td><td>Stopping</td><td>No change</td></tr>
</table>

Remark

*1 :Positioning refers to position control, speed control, position/speed switching control and speed/position switching position by positioning data.

*2 : If Home Return is complete, DOG and Home Signal, which are external input signals, do not affect positioning control.

*3 : If axial operation is ‘no output’ after being stopped, run a instruction to cancel ‘No Output’. Then, No output is cancelled and error number is reset.

*4 : Soft upper/lower limits by parameters are unavailable in speed control operation mode.

*5 : Sequence program refers to XGB program method.

*6 : Error 495 may occur depending on a rotation direction.

2) Stop Process and Priority

A) Stop Process

Decelerating stop instruction may vary depending on acceleration section, regular speed section and deceleration section of operation pattern.

(1) In acceleration/regular speed section

Since positioning operation is not complete if it stops due to deceleration stop instruction, After Mode among M code modes is not “On” because it does not generate positioning completion signal.

After then, if indirect start instruction(step number = current step number) is generated,

Absolute method operation operates as much as the remaining distance of the current operation step yet output while Incremental method operation operates as much as the target distance.

(2) In deceleration section

- Although decelerating stop instruction occurs in deceleration section, it generates positioning completion signal and M code signal just like normal stop.
- In case decelerating stop instruction is in a deceleration section of continuous operation mode or sequential operation mode, the decelerating stop instruction is not processed and it executes positioning operation in continuous operation pattern and/or sequential operation pattern set in operation data.

B) Process of emergency stop and external input upper/lower limits

If emergency stop instruction or external input upper/lower limits are input during positioning control, it stops positioning control and turns ‘No output’, generating an error.

C) Stop process priority

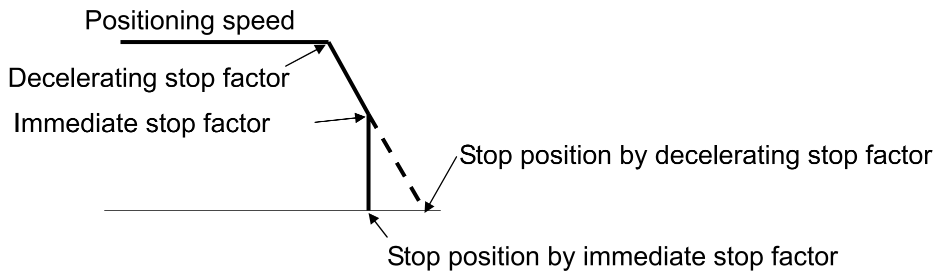
The priority of positioning module stop process is as follows.

Decelerating stop < Immediate stop

- If it meets any immediate stop factor in deceleration section during positioning, it processes immediate stop at the time.

Remark

☐ In case of any immediate stop factor during decelerating stop, it processes as follow.



☐ Immediate stop factors: ①internal emergency stop, ②external input upper/lower limit, ③Soft upper/lower limits

3) Interpolation stop

- ☐ It decelerates and stops if it meets a stop instruction during interpolation operation(2 axes linear interpolation).
- ☐ If indirect start instruction is executed in the current step when re-starting after decelerating stop, it resumes operating the positioning operation data to the target position. At the moment, it operates differently depending on absolute coordinate and Incremental coordinate.
- ☐ During interpolation operation, stop instruction is available for both internal decelerating stop and external decelerating stop.
- ☐ Decelerating stop instruction should be executed on a main axis, which is in interpolation operation.

4) Emergency stop

- ☐ It immediately stops if meeting emergency stop while performing start-related instructions(indirect start, direct start, concurrent start, synchronic start, linear interpolation start, Home Return start, jog start and inching start).
- ☐ Emergency stop is divided into two methods; internal emergency stop and external emergency stop.
- ☐ Internal emergency stop generates Error 481 while external emergency stop generates Error 491.
- ☐ Since it is subject to no output and un-defined origin once emergency stop is executed, it may run positioning operation after executing origin determination(Home Return, floating origin and the current position preset) in case it is operated with absolute coordinate or in determined origin.

9.2.9 Re-start after Positioning

1) Re-start after decelerating stop instruction

A) If meeting decelerating stop instruction in accelerating/regular speed section

- In case of indirect start after decelerating stop, it executes positioning operation with the set operation step.

B) If meeting stop instruction in decelerating section

- If re-starting after decelerating stop, the next operation stop of the previous operation step number operates. However, in continuous operation/sequential operation, it does not process decelerating stop instruction and keeps operating with the operation patter in case of deceleration section.
- If M code mode is used, it may re-start as long as M code is changed from “On” to “Off”.

2) After internal emergency stop/external emergency stop

- If it has internal emergency stop or external emergency stop instruction, positioning module becomes no output and un-defined origin. Therefore, if canceling no output, re-determining origin(Home Return start, floating home setting) and re-starting, it may re-start from the operation step number set.

9.2.10 Home Return

- ☐ Home Return is executed to confirm machine origin when it is powered.
- ☐ For Home Return, every axis should be set for Home Return parameter.
- ☐ Once Home Return is determined by Home Return, it does not recognize origin detection signal during positioning operation.

1) Home Return method

A) DOG Method

There are three Home Return processes using DOG method as follows.

(1) Origin detection after DOG Off
(2) Origin detection after decelerating with DOG On
(3) Origin detection by DOG

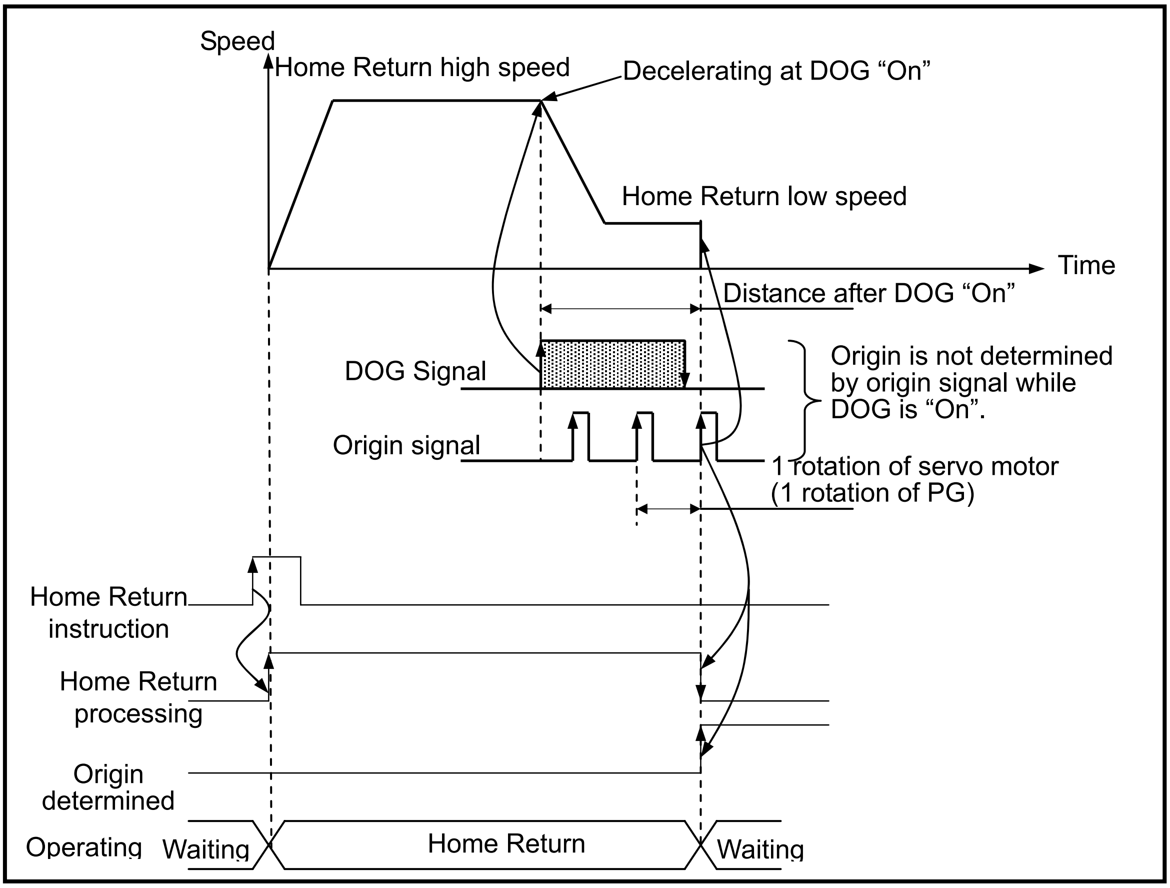
B) In parameters, the items affecting Home Return are as follows.

(1) Home Return methods
(2) Home Return direction
(3) Origin compensation amount
(4) Origin return speed(high speed, low speed)
(5) Origin address
(6) Home Return Dwell time
(7) Home Return accelerating/decelerating time

2) Origin detection after DOG Off

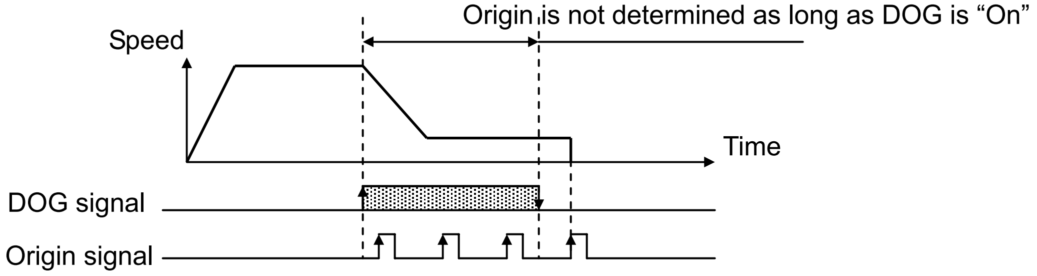
The operations by Home Return instruction using DOG and origin signal are as follows.

- It accelerates toward a preset home return direction and operates by home return high speed.
- At the moment, if an external input, DOG is entered, it decelerates and operates at home return low speed.
- If an external signal, origin signal is entered after DOG signal is changed from “On” to “Off”, it stops.

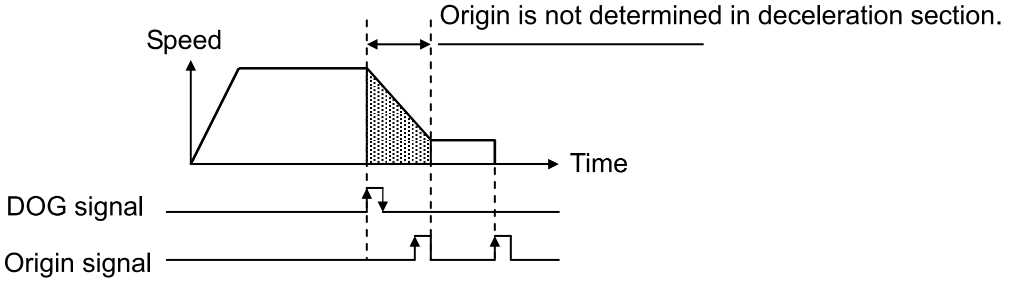


Remark

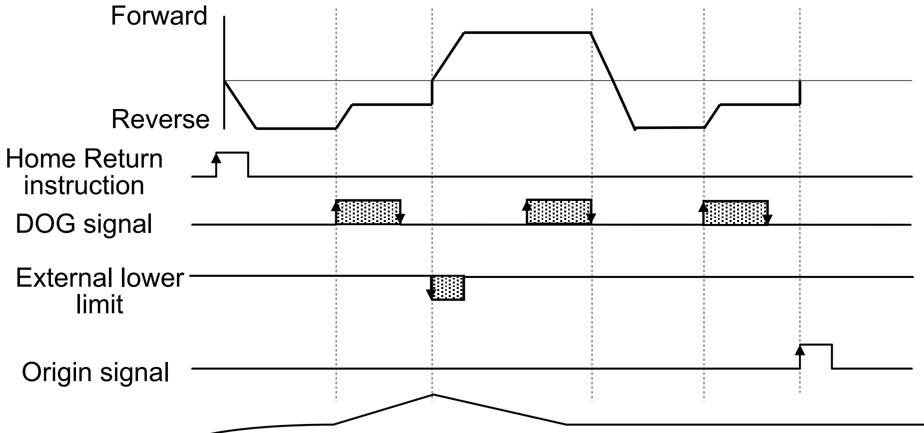
☐While DOG signal is “On”, origin is not determined by origin signal. That is, origin may be determined as soon as DOG signal is changed from “Off” to “On”(acceleration section → home return high speed) or from “On” to “Off”(deceleration section → home return low speed).



☐If Home Return speed is applied from home return high speed to deceleration after DOG signal is changed from/to “Off” and “On”, origin is not determined although it meets origin entry.

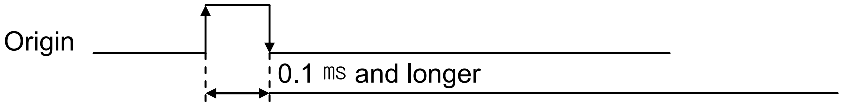


☐It operates as follows if it meets an external lower limit while waiting for origin entry after DOG signal is changed from/to “Off” and “On.”



Since positioning module immediately turns a direction without any decelerating section as soon as it meets external input upper/lower limits during home return operation, it should be noted that using a stepping motor may cause a fault.

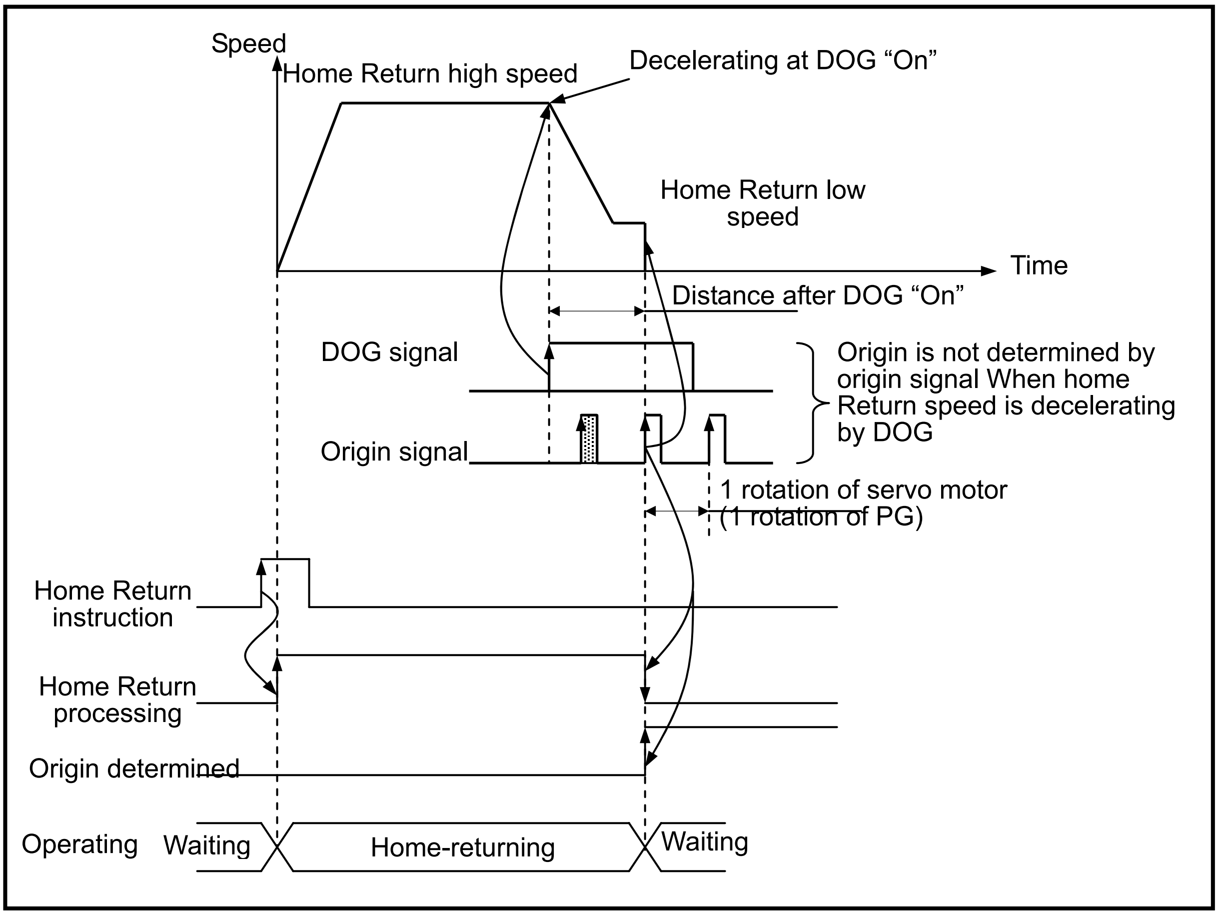
☐If “On” time of origin is short, positioning module may not recognize it.



3) Origin detection after deceleration with DOG set “On”

Operations by home return instruction using DOG and origin signal are as follows.

- It accelerates toward a set home return direction and operates at home return high speed.
- At the moment, if an external entry, DOG signal is entered, it decelerates and operates at home return low speed.
- Origin is determined and it stops if it meets an external entry, origin signal with DOG set “On” while it operates at home return low speed.



Remark

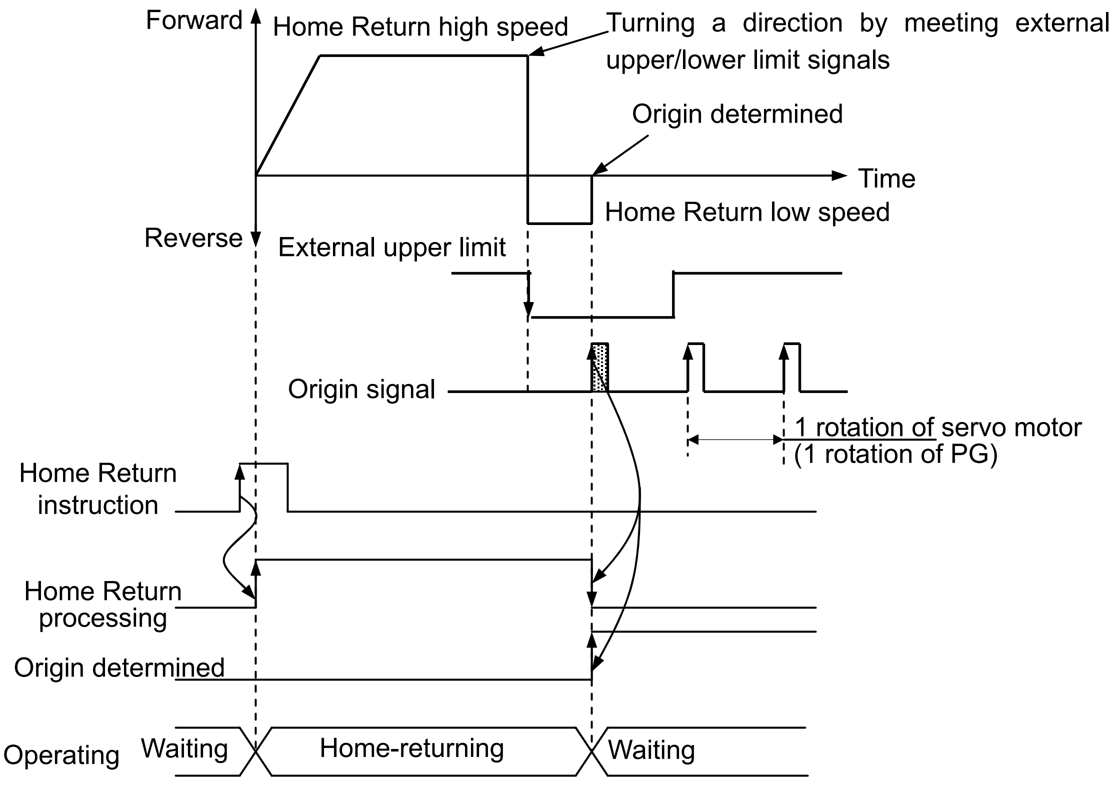
❑ Origin is determined if origin signal is entered with DOG set “On” as long as home return speed is operating at low speed from high speed via decelerating section with DOG signal set “On”. That is, when home return speed is decelerating, origin is not determined by origin signal.

❑ If it meets external upper/lower limit signal prior to origin after DOG signal is changed from “Off” to “On”, it works as same as 3.6.2.

❑ If “On” time of origin is short, positioning module may not recognize it.

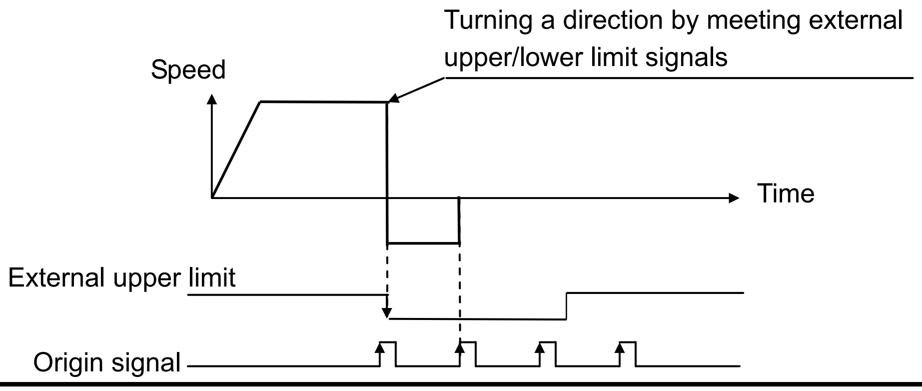
4) Origin detection by origin and upper/lower limits

As a home return method using external upper/lower limit signal and origin signal, it is available in case DOG signal is not used.



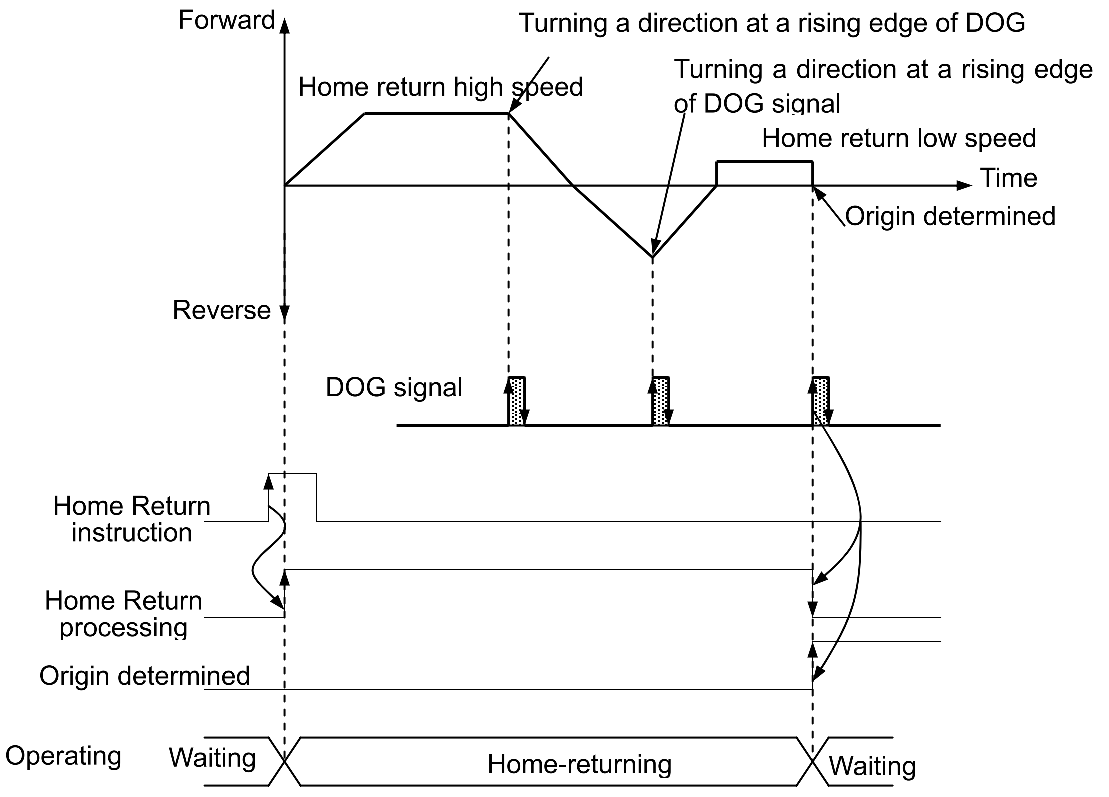
Remark

❑ If origin signal is “On” before external upper/lower limit signals are entered, it turns the rotation direction, keeping home return low speed operation and origin is determined with origin signal set “On” as soon as external upper/lower limit signals are entered regardless of the above.



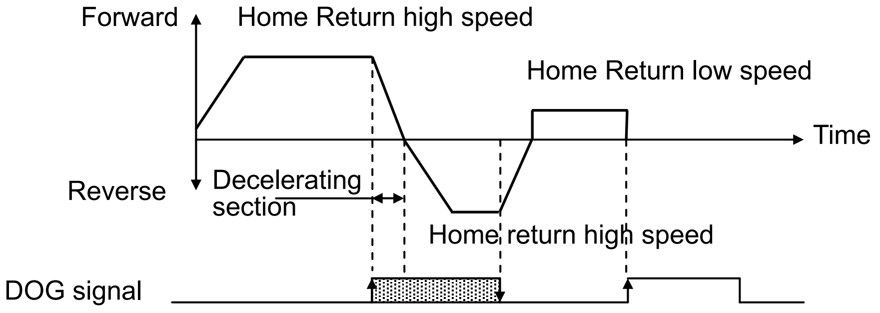
5) Origin detection by DOG

It is used when determining origin by using the only DOG.



Remark

❑ It works as follows if the duration of DOG "On" is longer than that of deceleration.



9.2.11 Manual operation

In general, manual operations refer to jog operation, inching operation and etc.

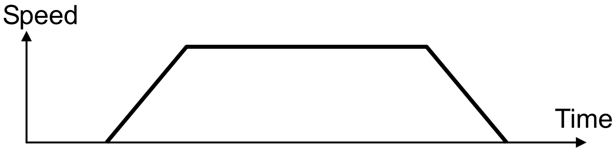
1) Jog operation

A) Jog operation means;

- positioning control by jog instruction.
- It can monitor, if any, position address, which is changed by jog instruction as origin is determined.
- It is one of manual operations executed without origin determination.

B). Acceleration/deceleration process and jog speed

- Acceleration/deceleration process is controlled by the duration set in jog acceleration/deceleration time among parameter settings of this software package.
- Jog high/low speed operation: it operates in accelerating/dec elerating pattern.



C) If jog speed is set out of allowable range, it generates an error and operation is not available.

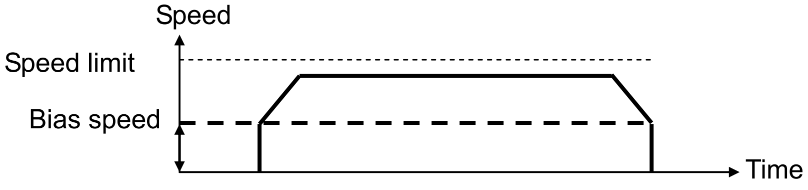
Range	High speed jog operation	1 ～ 100,000	(unit: 1pps)
	Low speed jog operation	1 ～ jog high speed	

Remark

☐Make sure to follow the cautions.

1. Jog high speed needs attention as follows.

Bias speed ≤ Jog high speed ≤ Speed limit



2. Jog low speed operates regardless of bias speed and speed limit.

2) Inching operation

- ☐ As one of manual operations, it outputs as much as pulse set at the speed for origin/manual parameter inching speed.
- ☐ While operation by jog instruction may not exactly move to the start/end points, inching instruction may easily reach to a target point as much as desirable distance. Therefore, it is probable to move close to an operation position by jog instruction and then move to an exact target position by inching operation instruction.
- ☐ The available range is between –2147483648 ～ 2147483647 Pulse.

9.2.12 Speed/Position Change during Positioning Operation

1) Speed Override Instruction

☐ Speed override instruction is available only in acceleration and regular speed sections among operation patterns while the available operation modes are end operation, continuous operation and sequential operation.

☐ The range is between 1 ～100,000pps (unit: 1pps).

Remark

☐ Note that if a sudden difference between the current speed used for operation and a new speed newly changed by speed override is excessive, it may cause a Step-over.

☐ Executing speed override instruction in deceleration section during operation may cause Error 377 but the operation continues.

2) Positioning speed override instruction

☐ Positioning speed override instruction changes its speed and keeps operating once it reaches the set position during positioning operation.

☐ Positioning speed override instruction is available only in acceleration and regular speed sections among operation patterns while the available operation modes are end operation, continuous operation and sequential operation.

☐ Note that positioning speed override instruction is not executed in decelerating section.

☐ The range is between –2147483648 ～ 2147483647 Pulse.

3) Position change by position override

☐ If changing a target position during positioning operation with positioning data, it may be changed by using override instruction.

☐ It should be noted that operation may vary depending on the time of position override instruction during operation.

That is, if passing a position to change during operation, it decelerates, stops and keeps positioning operation by the subsequent operation pattern; if not passing a position, it starts positioning operation as taking a Incremental position as much as override set in the start point of the step of position override instruction.

☐ Position override instruction is available in accelerating, regular speed and decelerating sections among operation patterns while the available operation mode is end operation, continuous operation and sequential operation.

☐ In sequential operation mode, position override operation is allowed once as taking a target position to change the current position of start step of sequential operation as a Incremental position.

☐ The range is between –2147483648 ～ 2147483647 Pulse.

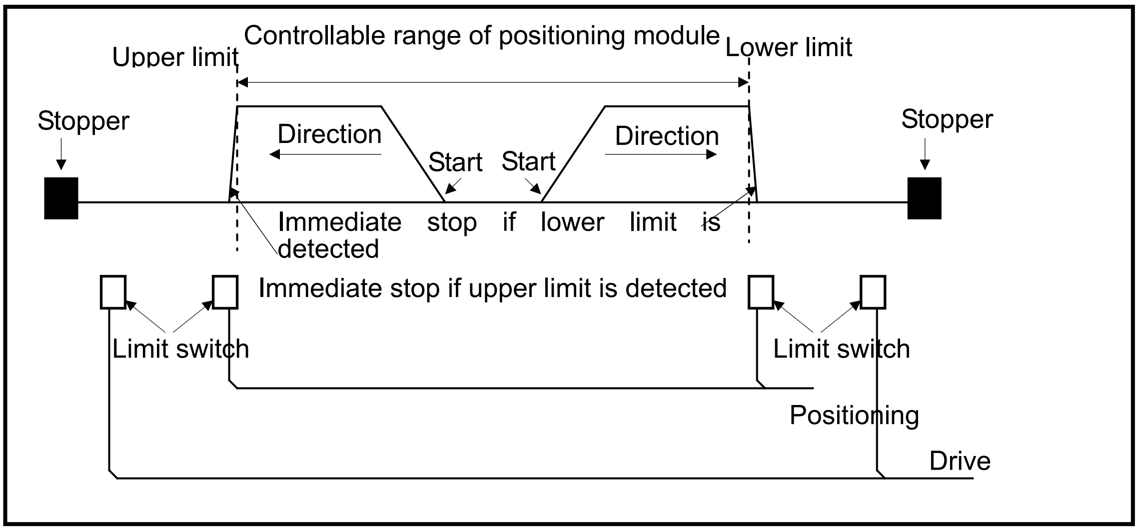
9.2.13 Stroke Upper/Lower Limits

Positioning is subject to external input stroke limit(external input upper limit, external input lower limit) and software stroke limit(software upper limit, software lower limit).

1) External input stroke upper/lower limits

☐ External input stroke limit is an external input connector of positioning; external input upper limit/external input lower limit.

☐ It is used to immediately stop a positioning module before reaching to stroke limit/stroke end by setting up stroke limits of positioning module inside stroke limit/stroke end of drives. At the moment, if exceeding upper limit, it generates Error 492 while if exceeding lower limit, it generates Error 493.



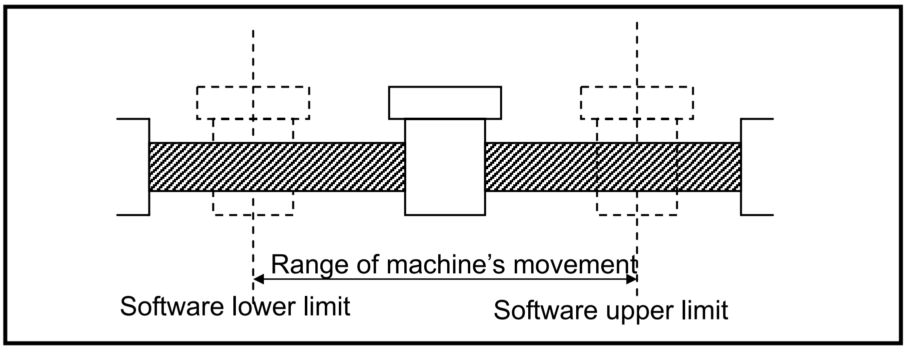
☐ Note that positioning operation is not available if it stops out of positioning range.
If it stops due to external input stroke limit detection, move it into the controllable range of positioning by manual operation(jog operation, inching operation, manual pulse generator operation).

☐ External input stroke upper/lower limit error is detected by edge during positioning, so manual operation is available although it exceeds stroke range.

2) Stroke upper/lower limits

☐ Stroke upper/lower limit function does not execute positioning operation if it is operated out of ranges of stroke upper/lower limits, which are set in positioning parameters.

☐ When it starts operation or is in operation, stroke upper/lower limits are checked.



☐ Positioning is not executed by any operation instruction if it is operated out of ranges

Remark

- ☐ Software stroke upper/lower limits are not detected unless origin is determined.
- ☐ Since positioning operation is unlimitedly available without internal input stroke upper/lower limit detection once S/W upper/lower limits are set to '0', it should be noted when controlling fixed-feed. However, its current position is changed to –2147483648 and it keeps forward rotation if it reaches up to the max. value, 2147483647 during forward operation; during reverse operation, its current position is changed to 2147483647 and keeps the operation once it reaches up to the min value, –2147483648.

9.2.14 Temporary position address setting to origin and current position change

1) Setting a temporary address to origin

- To set a temporary address to origin, you may set it as home return address in this software package parameter.
- Temporary address of a set axis may be confirmed in the current status code info reading function block after executing floating origin setting or home return.
- In addition, it may be checked with current position after executing floating origin setting or home return in this software package monitor.

2) Changing current position

- Current position change is to change the current address to a temporary address.
- If executing a current position change instruction(PRS) without origin set, it is changed to origin determined.
- Once the current position is changed by current position change instruction(PRS), it is necessary to execute home return again because the mechanical origin position is changed by home return.

9.2.15 Floating origin setting

It is used to forcibly set the current position as origin without home return operation of a machine. At the moment, the position is the value set in home return address.

Remark

☐ Since floating origin setting is just to forcibly determine origin from the current position to home return address, it should be noted as follows in a program of which origin is floating origin setting.

- If any error occurs, remove the cause(s), reset the error, cancel 'no output', set floating origin again, change the operation step number to the operation step number designation and start it.

9.2.16 Teaching

- This function is related to positioning data and changes parameter or operation data using MOV instruction without software package.
- Teaching is available only for a step number that is not currently operated.
- This function is convenient when being used by frequently changing its target position and operation speed.

Remark

1) Flash save of changed data(WRT)

If operation data is changed by teaching function, it is necessary to use **WRT** instruction in order to save the changed value to flash memory. It is not possible to maintain the changed values when turning it off or changing a mode unless the values are saved by using **WRT** instruction.

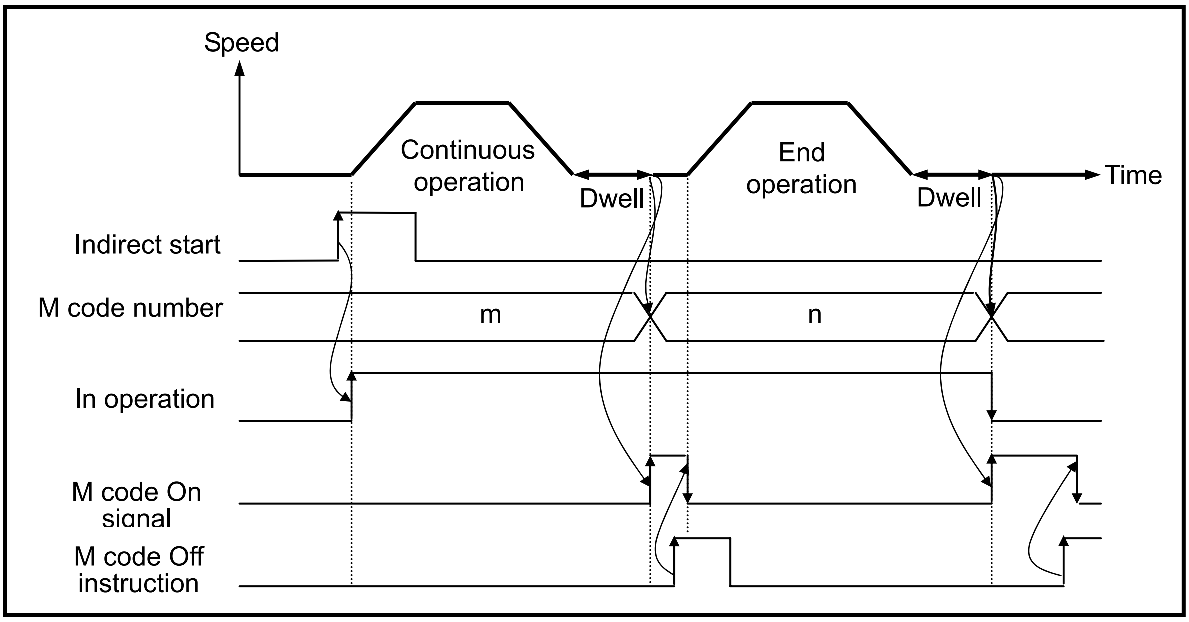
9.2.17 Start step number change

- It is used to change an operation step number to start and available only when it stops.
- If a step number is set to '0' by indirect start instruction(IST), it executes positioning operation with the current operation step number. However, if the current operation step number is 3 without start step number change and operation speed is 0, it generates Error 151.

9.2.18 M code

- By reading M code, it may be used to check the current operation step number and execute any auxiliary task(clamp, drill rotation, tool exchange and etc).
- M code signal generated during operation may be reset by a M code, "Off" instruction.
- M code number may be differently set by each operation step number of positioning data.
- M code number range: 1 ~ 65,535
- M code output is as follows.

M code signal occurred during operation may be reset by M code "Off" instruction. It generates M code On signal while it outputs M code number set in position data after positioning is complete by start instructions(indirect start, direct start, concurrent start and linear interpolation).



Remark

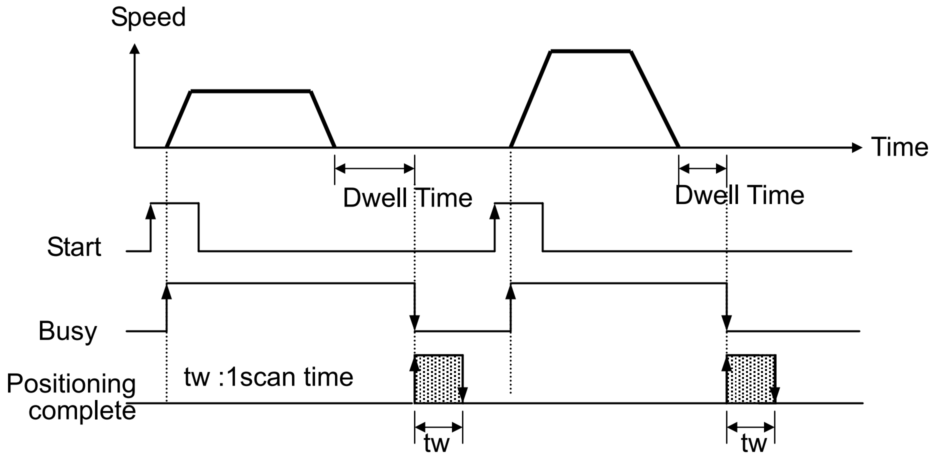
❑ If M code signal is "On" despite of positioning completed, it generates an error(Error number: 233) while the next operation step number is not operated. Therefore, if M code signal is "On", the M code signal should be "Off" by M code "off" instruction in order for positioning operation of the next operation step number.

9.2.19 Error and No output

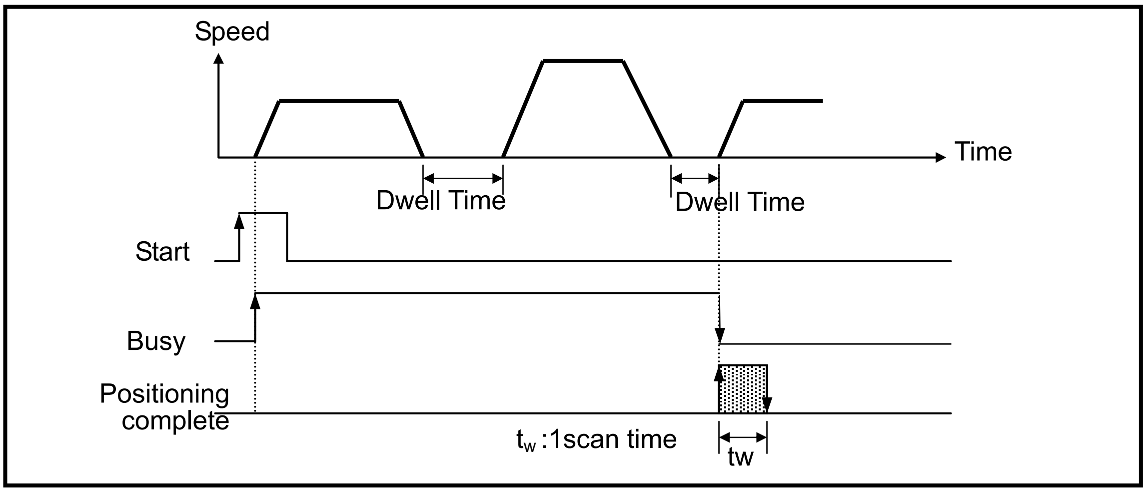
- Error is also divided into 'error' and 'warning'.
- If an error occurs, it keeps positioning operation and generates an error.
- Positioning operation is not executed without an error cleared. In addition, any operation stops if an error occurs during operation.
- Error reset instruction is also subdivided into resetting an error only and canceling 'no pulse output'.
- For details of error, refer to 9.9 Error Code List.

9.2.20 Positioning completion output time

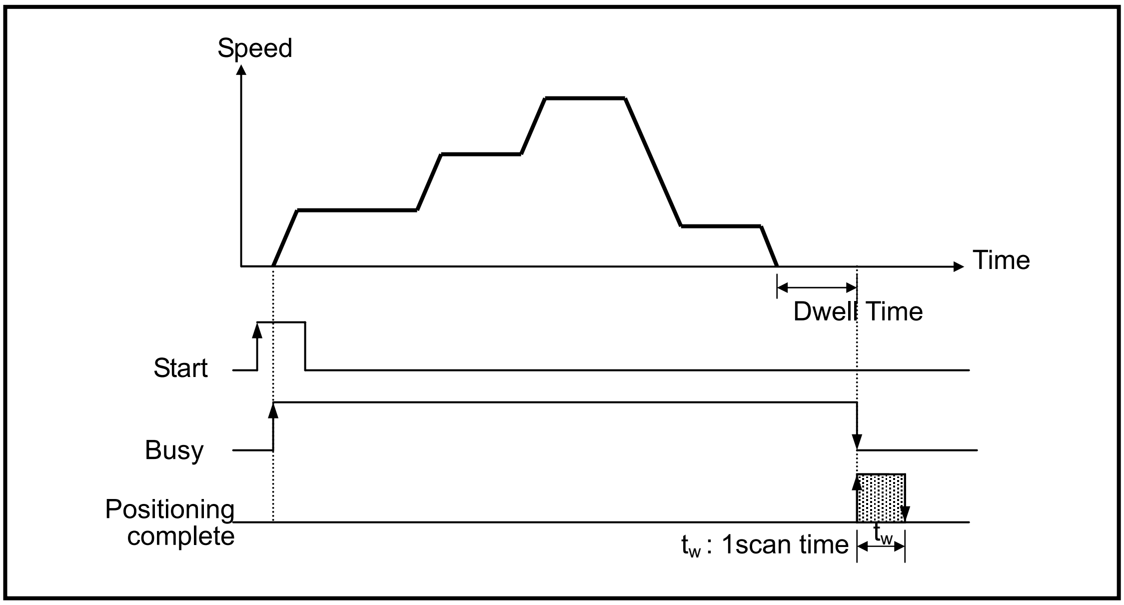
- Regarding positioning completion output time, the completion signal is on and it turns off after 'on' is maintained as much as 1 scan time after positioning is completed during single operation, repeat operation, continuous operation, sequential operation, linear interpolation operation, speed/position switching operation(with position indicated during constant speed operation) and inching operation.
- The operations in single operation mode are as follows.



- The operations in continuous mode are as follows.



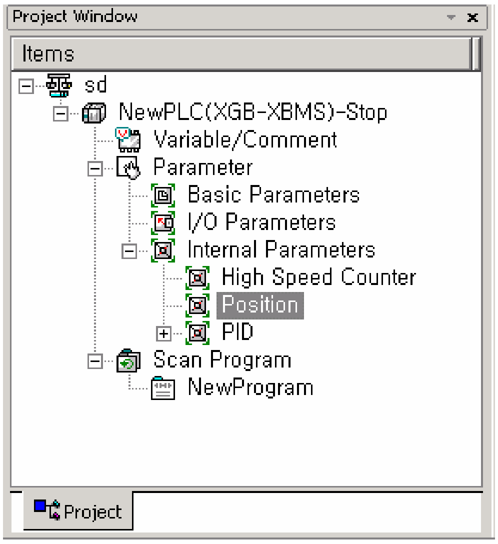
- The operations in sequential operation mode are as follows.



9.3 Positioning Parameters and Operation Data

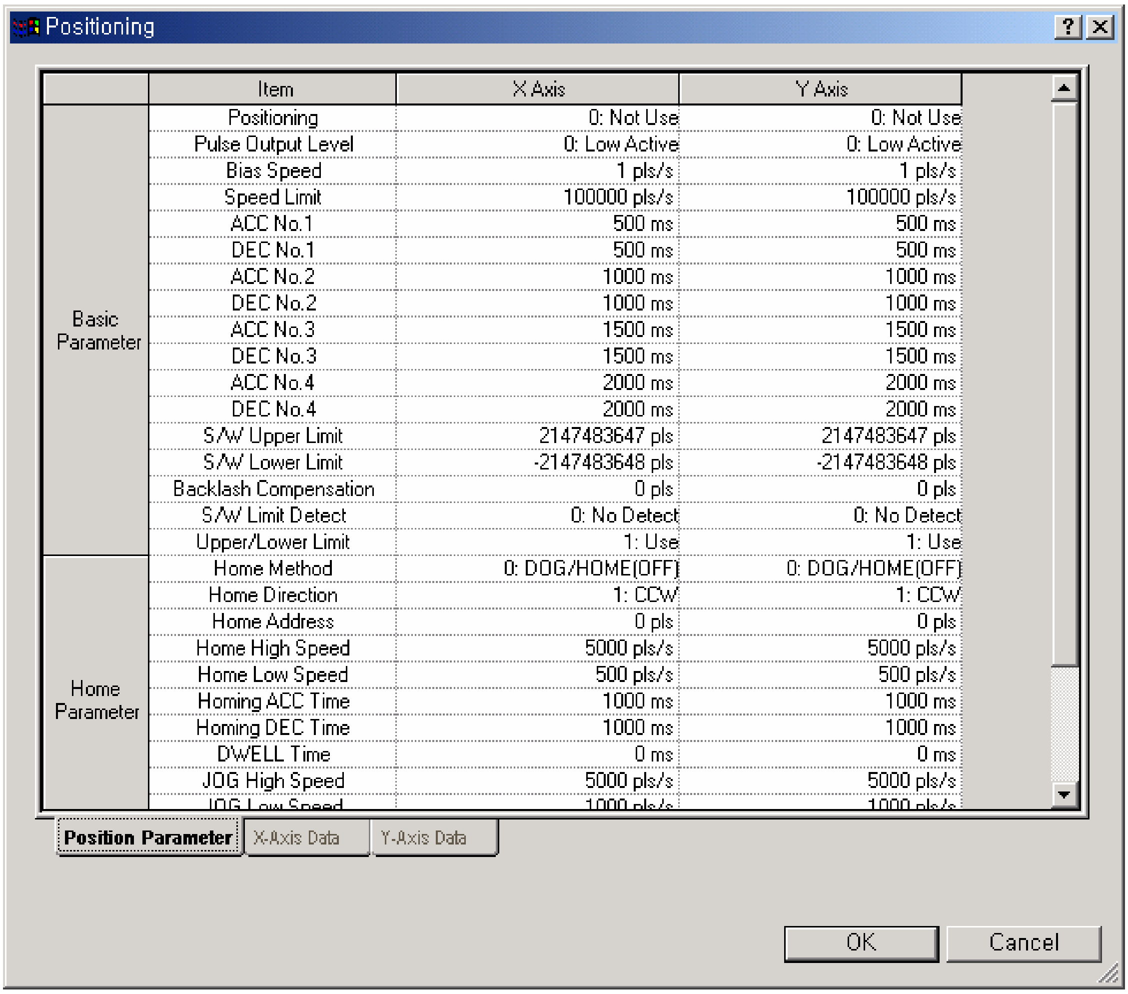
❑ It describes positioning parameter and operation data setting.

- It describes positioning parameters and settings.
- Click 『Positioning』 of 『Built In Parameters』 in Basic Project Window.



- sd
  - NewPLC(XGB-XBMS)-Stop
    - Variable/Comment
    - Parameter
      - Basic Parameters
      - I/O Parameters
      - Internal Parameters
        - High Speed Counter
        - Position
        - PID
    - Scan Program
      - NewProgram

- Once Positioning is selected, the Positioing Parameter Setting window is popped up as follows.



	Item	X Axis	Y Axis
Basic Parameter	Positioning	0: Not Use	0: Not Use
	Pulse Output Level	0: Low Active	0: Low Active
	Bias Speed	1 pls/s	1 pls/s
	Speed Limit	100000 pls/s	100000 pls/s
	ACC No.1	500 ms	500 ms
	DEC No.1	500 ms	500 ms
	ACC No.2	1000 ms	1000 ms
	DEC No.2	1000 ms	1000 ms
	ACC No.3	1500 ms	1500 ms
	DEC No.3	1500 ms	1500 ms
	ACC No.4	2000 ms	2000 ms
	DEC No.4	2000 ms	2000 ms
	S/W Upper Limit	2147483647 pls	2147483647 pls
	S/W Lower Limit	-2147483648 pls	-2147483648 pls
	Backlash Compensation	0 pls	0 pls
	S/W Limit Detect	0: No Detect	0: No Detect
	Upper/Lower Limit	1: Use	1: Use
Home Parameter	Home Method	0: DOG/HOME(OFF)	0: DOG/HOME(OFF)
	Home Direction	1: CCW	1: CCW
	Home Address	0 pls	0 pls
	Home High Speed	5000 pls/s	5000 pls/s
	Home Low Speed	500 pls/s	500 pls/s
	Homing ACC Time	1000 ms	1000 ms
	Homing DEC Time	1000 ms	1000 ms
	DWELL Time	0 ms	0 ms
	JOG High Speed	5000 pls/s	5000 pls/s
	JOG Low Speed	1000 pls/s	1000 pls/s

☐ Basic parameters and details of origin/manual parameters are as follows.

Type	Item	Description
Basic parameters	Positioning	Set whether to use positioning function.
	Pulse output level	Set pulse output mode(Low/High Active).
	Bias speed	Set the initial start speed for early operation.
	Speed limit	Set the max speed settable in positioning operation.
	ACC/DECNo.1	Time setting of ACC/DEC section No.1
	ACC/DEC No.1	Time setting of ACC/DEC section No.2
	ACC/DEC No.3	Time setting of ACC/DEC section No.3
	ACC/DEC No.4	Time setting of ACC/DEC section No.4
	S/W upper limit	Set upper limit within a machine's operation range
	S/W lower limit	Set lower limit within a machine's operation range
	Backlash compensation amount	Set compensation amount of tolerance in which a machine is not operated due to wear when rotation direction is changed.
	S/W upper/lower limits during constant speed operation	Set whether to detect or not S/W upper/lower limits during constant speed operation
	Use upper/lower limits	Use or not
Origin/Manual parameters	Home Return method	Set home return method
	Home Return direction	Set home return direction
	Origin address	Set origin address
	Origin compensation amount	Set origin compensation amount
	Home Return high speed	Set high speed for home return
	Home Return low speed	Set low speed for home return
	Home Return accelerating time	Set accelerating time for home return
	Home Return decelerating time	Set decelerating time for home return
	Dwell time	Set a time required to remove remaining bias counter immediately after positioning ends
	Jog high speed	Set high speed for jog operation
	Jog low speed	Set low speed for jog operation
	Jog accelerating time	Set accelerating time for jog operation
	Jog decelerating time	Set decelerating time for jog operation
	Inching speed	Set speed for inching operation

9.3.1 Setting basic positioning parameters

It describes the range of setting basic parameters and special K area for positioning.

Item	Range	Initial value	Device area		Remarks
			X-axis	Y-axis	
Positioning	0 : No use, 1 : use	0	K4870	K5270	Bit
Pulse output level	0 : Low Active, 1 : High Active	0	K4871	K5271	Bit
Bias speed	1 ～ 100,000[pulse/sec]	1	K450	K490	Double word
Speed limit	1 ～ 100,000[pulse/sec]	10,000	K452	K492	Double word
ACC time 1	0 ~ 10,000[unit: ms]	500	K454	K494	Word
DEC time 1	0 ~ 10,000[unit: ms]	500	K455	K495	Word
ACC time 2	0 ~ 10,000[unit: ms]	1000	K456	K496	Word
DEC time 2	0 ~ 10,000[unit: ms]	1000	K457	K497	Word
ACC time 3	0 ~ 10,000[unit: ms]	1500	K458	K498	Word
DEC time 3	0 ~ 10,000[unit: ms]	1500	K459	K499	Word
ACC time 4	0 ~ 10,000[unit: ms]	2000	K460	K500	Word
DEC time 4	0 ~ 10,000[unit: ms]	2000	K461	K501	Word
Soft upper limit	-2147483648 ～ 2147483647 [pulse]	2147483647	K462	K502	Double word
Soft lower limit	-2147483648 ～ 2147483647 [pulse]	-2147483648	K464	K504	Double word
Backlash compensation amount	0 ～ 65,535[pulse]	0	K466	K506	Word
Soft upper/lower limits during constant speed operation	0 : not detect, 1 : detect	0	K4684	K5084	Bit
Use upper/lower limits	0 : no use, 1 : use	1	K4872	K5272	Bit

1) Positioning

- Determine whether to use positioning.
- If not using positioning function, set it ‘0: no use’ while for use, it should be set to ‘1: use’.

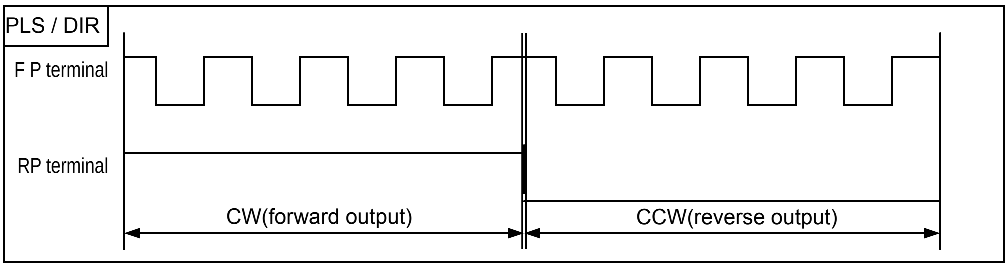
Remark

❑ Make sure to set it ‘1: use’ to use positioning.
❑ If not using positioning and using general output contact, set it ‘0: no use’.

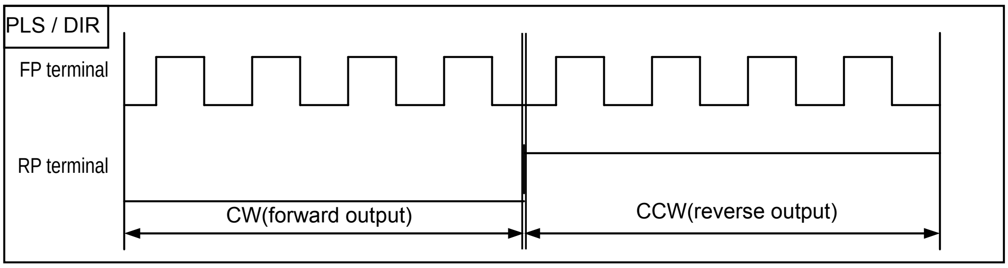
2) Pulse Output Level

▶For pulse output level, select either of ‘Low Active output’ or ‘High Active output’.

▶The following figure shows ‘low active’ pulse output level depending on pulse output mode.

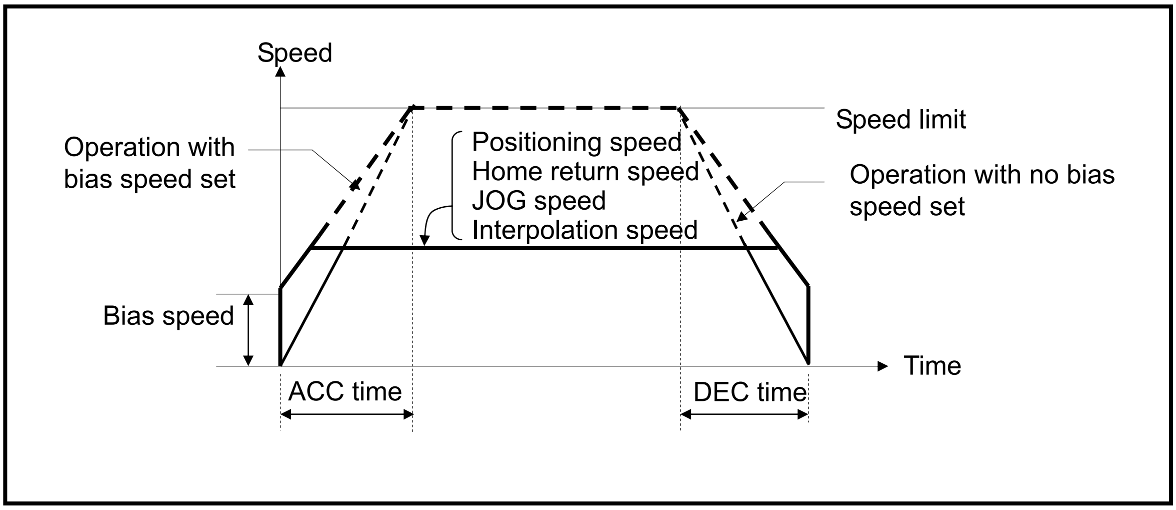


▶The following figure shows ‘high active’ pulse output level depending on pulse output mode.



3) Bias speed

- Considering that torque of stepping motor is unstable when its speed is almost equal to 0, the initial speed is set during early operation in order to facilitate motor’s rotation and is used to save positioning time. The speed set in the case is called ‘bias speed’.
- In Pulse unit, the range is between 0 ～ 1,000,000 (unit: pps).
- Bias speed may be used for
  - ① Positioning operation by start instruction,
  - ② Home Return operation,
  - ③ JOG operation, and
  - ④ Main axis of interpolation operation(not available for sub axis).



Remark

- ☐ The entire operation time may be advantageously reduced if bias speed is highly set, but excessive value may cause impact sound at the start/end time and unreasonable operation on a machine.

- ☐ Bias speed should be set within the following range.
  (If home return speed is set lower than bias speed, it generates Error 133; if operation speed is set lower than bias speed during positioning, it generates Error 153; if JOG high speed is set lower than bias speed, it generates Error 121.)
  1) Bias speed ≤ Positioning speed data
  2) Bias speed ≤ Home Return low speed ≤ Home Return high speed
  3) Bias speed ≤ JOG high speed(Jog low speed is not related to bias speed.)

4) Speed limit

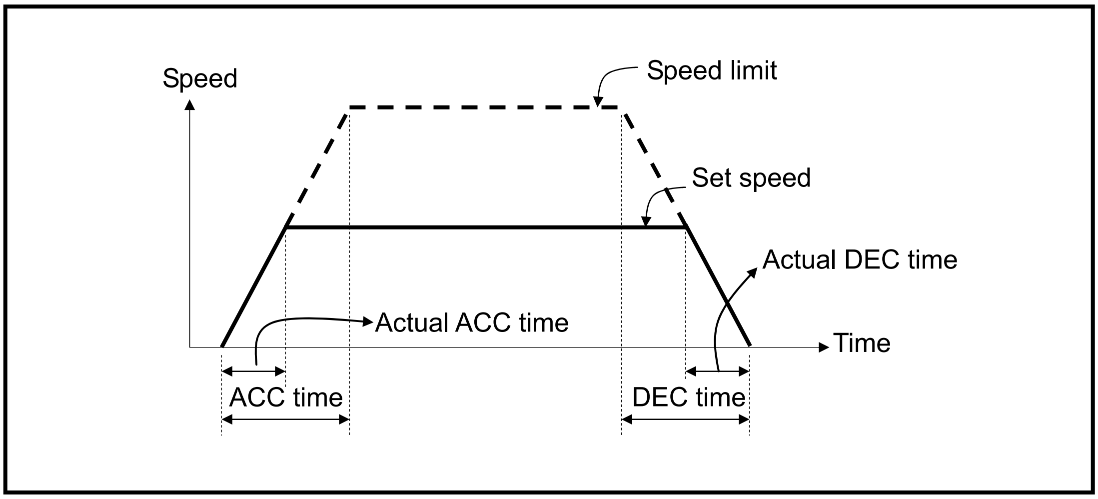
- It refers to the allowable max speed of positioning operation.
- In Pulse unit, the range is between 1 ～ 1,000,000(unit: pps).
- During position operation, operation speed, home return speed and jog operation speed are affected by speed limit, and if they are set higher than speed limit, it detects error.
  ① If home return speed is higher than speed limit : Error 133
  ② If positioning speed is higher than speed limit : Error 152
  ③ If jog operation speed is higher than speed limit : Error 121

5) ACC/DEC time

- It is applied to sequential operation instruction, speed override, positioning speed override during positioning operation as well as start/end time of positioning operation.
- ACC/DEC time is set at units of axis in PLC program(special K area) and position control monitoring.
- The range is between 0 ～ 10,000 (unit: 1㎳) per axis.

A) ACC time : a duration required to reach from “0(stop)” speed to the speed limit set in parameter.
▷Using bias would be a time consumed to reach from bias speed set to the speed limit set in parameter.

B) DEC time: a duration required to reach from the speed limit set in parameter up to “0”(stop) speed.
▷Using bias would be a time consumed to reach from bias speed set to the speed limit set in parameter.



Remark

☐ Terms' definition

Speed limit: the max positioning speed to be set in parameter of software package.

Set speed: Speed of operation data actually operated by position data

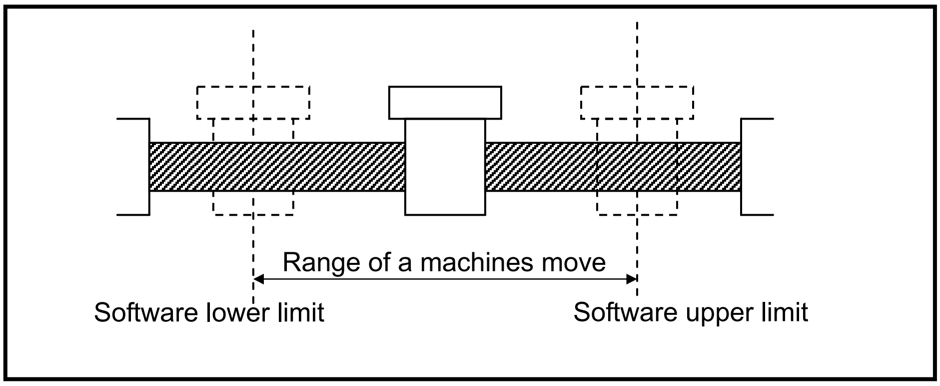
Actual ACC time: a duration reaching from "0"(stop) speed to the speed set by operation data.

Actual DEC time: a duration reaching from the speed set by operation data to "0"speed(stop).

6) S/W Upper/Lower Limits

- A range of a machine's move is called 'stroke limit', and it sets the upper/lower limits of stroke into software upper limit and software lower limit and does not execute positioning if it operates out of ranges set in the above.

  Therefore, it is used to prevent against out-of-range of upper/lower limits resulting from incorrect positioning address or malfunction by program error and it needs installing emergency stop limit switch close to a machine's stroke limit.



- The range of software upper/lower limits may be checked during operation or when operation starts.
- If an error is detected by setting software upper/lower limits(software upper limit error: 501, software lower limit error: 502), pulse output of positioning module is prohibited.

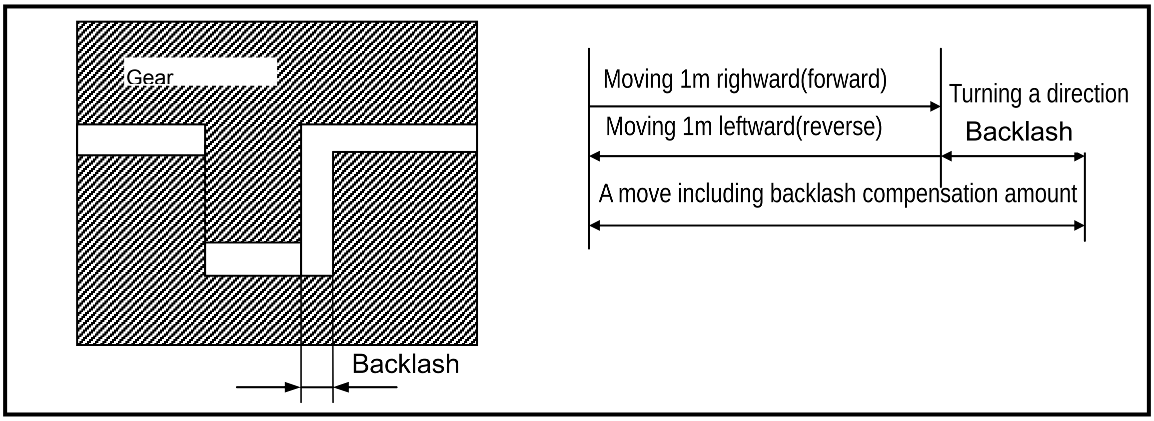
  Therefore, to resume operation after an error is detected, it is prerequisite to cancel 'No output'.
- The range is set per axis as follows;

  Software upper limit address range : -2,147,483,648 ~ 2,147,483,647

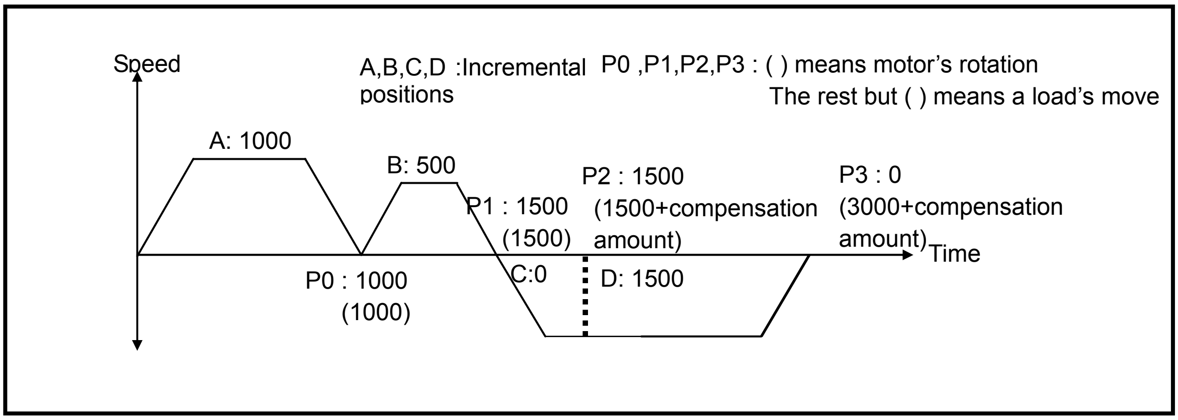
  Software lower limit address range : -2,147,483,648 ~ 2,147,483,647(unit: Pulse).

7) Backlash Compensation Amount

- A tolerance that a machine does not operate due to wear when its rotation direction is changed if it is moving with motor axis combined with gear and screw is called 'backlash'.
  Therefore, when changing a rotation direction, it should output by adding backlash compensation amount to positioning amount.
- It is available for positioning operation, inching operation and jog operation
- The range is between 0 ~ 65,535(unit: Pulse) per axis.
- Once backlash compensation amount is set or changed, home return should be executed.
- Since it may not reach the original position due to backlash if a position is moved 1m rightward and then 1m leftward, backlash compensation amount should be added.



- Backlash compensation outputs backlash compensation amount first and then, address of positioning operation, inching operation and jog operation move to the target positions.



8) S/W upper/lower limits during constant speed operation

- It is used to stop pulse output by S/W upper/lower limit detection during constant speed operation by speed control.
- In the case, S/W upper/lower limit detection is available as long as origin is set and the position mark during constant speed operation is "Mark".

9) Use of Upper/Lower Limits

- To use upper/lower limits during operation, it should be set as "Use".
- If 'No use' is set, it does not detect upper/lower limits and is available with general input contact.

9.3.2 Origin/Manual Parameter Setting for Positioning

It describes origin/manual parameters.

Item	Range	Initial value	Device area		Remarks
			X-axis	Y-axis	
Origin address	-2147483648 ～ 2147483647 [pulse]	0	K469	K509	Double word
Home Return high speed	1 ～ 100,000[pulse/sec]	5,000	K471	K511	Double word
Home Return low speed	1 ～ 100,000[pulse/sec]	500	K473	K513	Double word
Home Return ACC time	0 ~ 65535[unit: ms]	1,000	K475	K515	Word
Home Return DEC time	0 ~ 65535[unit: ms]	1,000	K476	K516	Word
Home Return dwell time	0 ~ 50,000[unit: ms]	0	K477	K517	Word
Home Return method	0 : origin detection after DOG off 1 : origin detection after deceleration when DOG is On 2 : origin detection by DOG	0	K4780 K4781	K5180 K5181	Bit
Home Return direction	0 : forward, 1 : reverse	1	K4782	K5182	Bit
Jog high speed	1 ～ 100,000[pulse/sec]	5,000	K479	K519	Double word
Jog low speed	1 ～ 100,000[pulse/sec]	1,000	K481	K521	Double word
Jog ACC time	0 ~ 10,000[unit: ms]	1,000	K483	K523	Word
Jog DEC time	0 ~ 10,000[unit: ms]	1,000	K484	K524	Word
Inching speed	1 ～ 65,535[pulse/sec]	100	K485	K525	Word

1) Home Return method

- There are three home return methods as follows.

A) Origin detection after DOG off

B) Origin detection after deceleration when DOG is on

C) Origin detection by DOG

  - For details about home return methods, refer to home return items.

2) Home Return direction

- Home Return direction is divided into CW(forward) and CCW(reverse) depending on pulse output direction.

Home Return direction	Pulse output operation of positioning module
Forward	Executing forward home return.
Reverse	Executing reverse home return.

3) Origin address

- It is used to change the current address to a value set in home return address when home return is completed by home return instruction.
- The range of home return address is between -2,147,483,648 ～ 2,147,483,647(unit: Pulse).

4) Home Return high speed

- As a speed when it returns home by home return instruction, it is divided into high speed and low speed.
- When setting home return speed, it should be “speed limit ≥ home return high speed ≥ home return low speed”.
- It refers to a speed operating in regular speed section via accelerating section by home return instruction.
- The range of home return high speed is between 1 ～ 100,000(unit: pps)

5) Home Return low speed

- It refers to a speed operating in regular speed section via decelerating section from home return high speed by home return instruction.
- The range of home return low speed is between 1 ～ 100,000(unit: pps)

Remark

- It is recommended to set home return low speed as low as possible when setting home return speed. Origin signal detection may be inaccurate if low speed is set too fast.

6) ACC/DEC time

- When it returns home by home return instruction, it returns home at the speed of home return high speed and home return low speed by ACC/DEC time.
- The range of home return ACC/DEC time is between 0 ～ 10,000(unit: 1 ㎳).

7) Dwell time

- Dwell time is necessary to maintain precise stop of servo motor when positioning by using a servo motor.
- The actual duration necessary to remove remaining pulse of bias counter after positioning ends is called ‘dwell time’.
- The range of home return dwell time is between 0 ～ 50,000 (unit: 1 ㎳)

8) JOG high speed

▪Jog speed is about jog operation, one of manual operations and is divided into jog low speed operation and jog high speed operation.

▪Jog high speed operation is operated by patterns with accelerating, regular speed and decelerating sections. Therefore, job is controlled by ACC/DEC instruction in accelerating section and decelerating section.

▪The range of jog high speed is between 1 ~ 100,000(unit: 1pps)
(Cautions in setting high speed: bias speed ≤ jog high speed ≤ speed limit)

9) JOG low speed

▪Jog low speed operation is operated with patterns of accelerating, regular speed and decelerating sections.

▪The range of jog low speed is between 1 ~ JOG high speed

10) JOG ACC/DEC time

▪It refers to JOG ACC/DEC time during jog high/low speed operation.

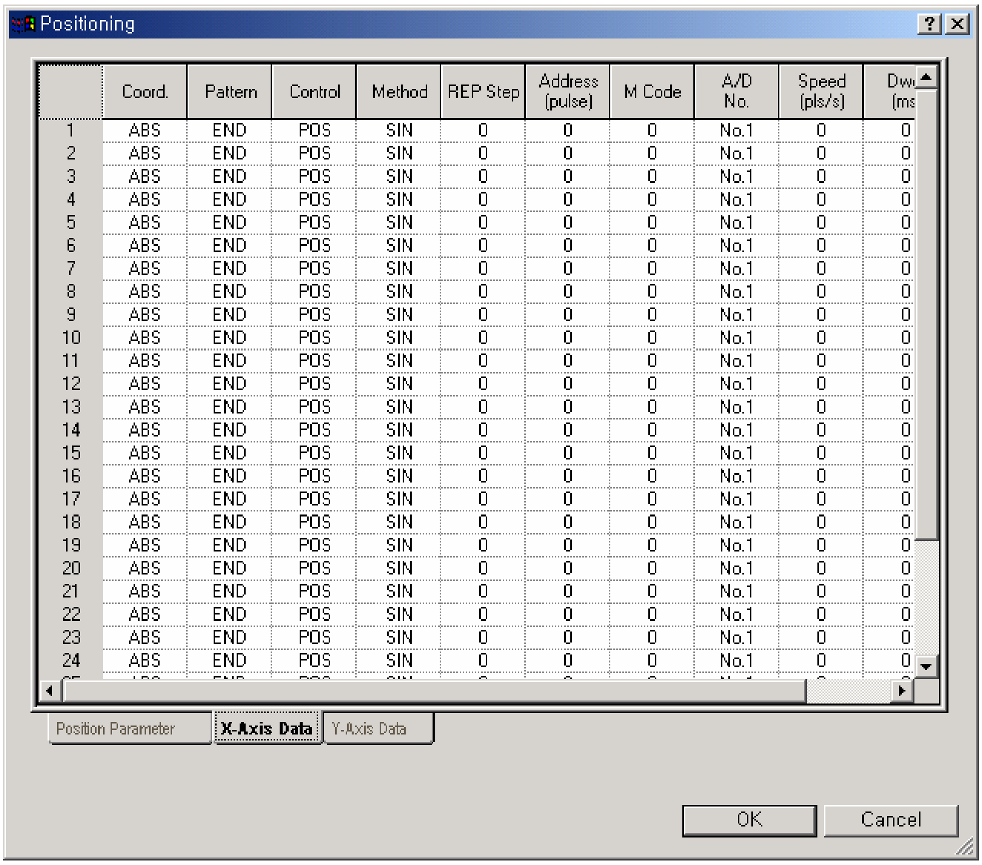
▪The range of JOG ACC/DEC time is between 0 ~ 10,000(unit: 1 ㎳)

11) Inching speed

▪The inching operation speed is set(the range of inching speed is between 1 ~ 65,535(unit: 1pps))

9.3.3 Positioning operation data setting

It describes operation data.



	Coord.	Pattern	Control	Method	REP Step	Address (pulse)	M Code	A/D No.	Speed (pls/s)	Dw (ms
1	ABS	END	POS	SIN	0	0	0	No.1	0	0
2	ABS	END	POS	SIN	0	0	0	No.1	0	0
3	ABS	END	POS	SIN	0	0	0	No.1	0	0
4	ABS	END	POS	SIN	0	0	0	No.1	0	0
5	ABS	END	POS	SIN	0	0	0	No.1	0	0
6	ABS	END	POS	SIN	0	0	0	No.1	0	0
7	ABS	END	POS	SIN	0	0	0	No.1	0	0
8	ABS	END	POS	SIN	0	0	0	No.1	0	0
9	ABS	END	POS	SIN	0	0	0	No.1	0	0
10	ABS	END	POS	SIN	0	0	0	No.1	0	0
11	ABS	END	POS	SIN	0	0	0	No.1	0	0
12	ABS	END	POS	SIN	0	0	0	No.1	0	0
13	ABS	END	POS	SIN	0	0	0	No.1	0	0
14	ABS	END	POS	SIN	0	0	0	No.1	0	0
15	ABS	END	POS	SIN	0	0	0	No.1	0	0
16	ABS	END	POS	SIN	0	0	0	No.1	0	0
17	ABS	END	POS	SIN	0	0	0	No.1	0	0
18	ABS	END	POS	SIN	0	0	0	No.1	0	0
19	ABS	END	POS	SIN	0	0	0	No.1	0	0
20	ABS	END	POS	SIN	0	0	0	No.1	0	0
21	ABS	END	POS	SIN	0	0	0	No.1	0	0
22	ABS	END	POS	SIN	0	0	0	No.1	0	0
23	ABS	END	POS	SIN	0	0	0	No.1	0	0
24	ABS	END	POS	SIN	0	0	0	No.1	0	0

Step	Item	Range	Initial values	Device area		Remarks
				X-axis	Y-axis	
0	Coordinate	0 : ABS, 1 : Incremental	ABS	K5384	K8384	Bit
	Operation pattern	0 : end, 1 : continuous, 2 : sequential	End	K5382~3	K8382~3	Bit
	Control method	0 : position control, 1 : speed control	Position	K5381	K8381	Bit
	Operation method	0: single, 1 : repeat	Single	K5380	K8380	Bit
	Repeat step	0~30	0	K539	K839	Word
	Target position	-2147483648 ~ 2147483647 [pulse]	0	K530	K830	Double word
	M Code number	0 ~ 65,535	0	K537	K837	Word
	ACC/DEC number	0 : No.1, 1 : No.1, 2 : No.3 3 : No.4	0	K5386 K5387	K8386 K8387	Bit
	Operation speed	1 ~ 100,000[pulse/sec]	0	K534	K834	Double word
	Dwell time	0 ~ 50,000[unit: ms]	0	K536	K836	Word
1	Same item with No.0 step			K540~549	K840~849	
2	Same item with No.0 step			K550~559	K850~859	
3~29	Same item with No.0 step			K560~819	K860~K1119	
30	Same item with No.0 step			K820~829	K1120~1129	

1) Step No.

- The range of positioning data serial number is between 0 ~ 30.
- The first step of operation data is from No.1 step.

Remark

If designating step number in indirect start, concurrent start, linear interpolation and position synchronization, it operates in accordance with the operation data set for the current operation step number.

2) Coordinate

- Position data coordinates are absolute coordinate and Incremental coordinate.

A) Absolute coordinate

(1) It controls positioning from the current position to a target position(from positioning data to a designated target position).

(2) Positioning control is executed based on the position designated in home return(origin address).

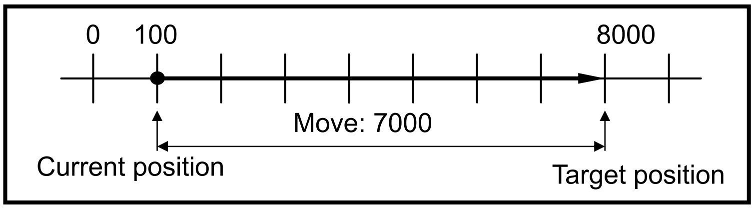
(3) The direction is determined by the current position and target position.

- Start position < target position : forward positioning
- Start position > target position : reverse positioning

[example]

▷If current position: 1000, target position: 8000, the forward move is 7000(8000-1000).

▷Positioning results



Remark

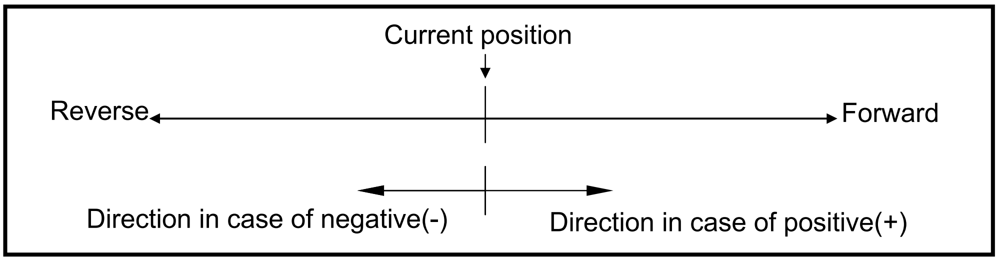
Control by absolute coordinate method may be activated as long as origin is set.
It generates Error 234 if it starts without origin set.

B) Incremental coordinate

(1) It executes positioning control from the current position as much as a target move.

(2) Direction is determined by +/- mark of a move.

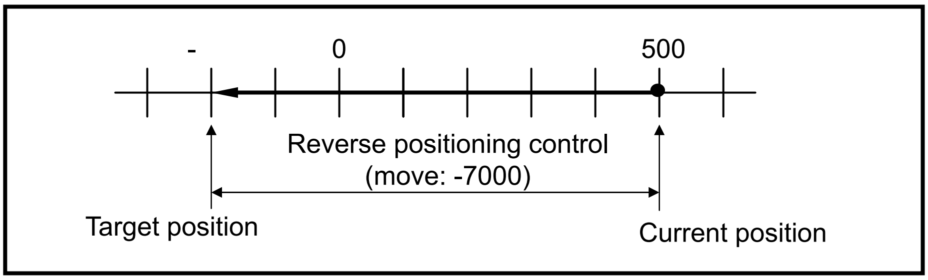
- If direction is positive(+ or none) : forward positioning(position increasing)
- If direction is negative(-) : reverse positioning(position decreasing)



[example]

▷If the current position is 5000 and target position is -7000, it completes positioning at -2000.

▷Positioning results



3) Control method(position/speed)

- Select whether position control or speed control with control method.

4) Operation pattern(end/continuous/sequential)

- For an operation pattern, select one of end, continuous and sequential.

5) Operation method(single/repeat)

- For operation method, select single operation or repeat operation.

6) Target position

- It is an area to set a move of position data as position value
- The range is between –2,147,483,648 ~ 2,147,483,647(unit: Pulse).
- Target position may be changed in a program by using special K area(for position control function).

7) M code

- M code function is applied in a lump by M code mode set in positioning parameter and used in a program by allocating a number per each operation step number within the range.
- The range is between 1 ～ 65,535.

Remark

- How to use M code in a program
  1) M code number may be read by Current Operation Status Code Info Reading.
  2) M code operation may check “On/Off” status by Current Operation Status Bit Info Reading.
- X axis M code No.(Word): K428, Y axis M code No.: K438
- X axis M code No.(Bit): K4203, Y axis M code No.: K4303

8) ACC/DEC number

- As ACC/DEC number, select ACC/DEC number set in basic positioning parameter.
- The range is between No.1 ~ No.4.

9) Operation speed

- Operation speed is set within a range not exceeding speed limit of basic parameter.
- The range of operation speed(unit is pulse) is between 1 ～ 100,000(unit: 1pps).

10) Dwell time

- It refers to a waiting time given before executing the next positioning operation after one positioning operation is complete.
- The range is between 0 ～ 50,000 (unit: 1㎳).
- Especially, Since an actual servo motor may not reach a target position or may be in excessive status while positioning module stops if using a servo motor, the data is used to set a waiting time until it stably stops.
- The operation status of the positioning module axis is maintained “On” while dwell time is operating; if dwell time elapses, operating status is “off” and positioning completion signal is “On.”

9.4 Status Monitoring Flag for Positioning and I/O Signals

9.4.1 Status monitoring flag for positioning

It describes status monitoring flags for positioning.

1) Status information

Address		Status information
X-axis	Y-axis	
K420	K430	Operation status bit information (lower)
K421	K431	Operation status bit information (upper)
K422	K432	Current position (lower)
K423	K433	Current position (upper)
K424	K434	Current speed (lower)
K425	K435	Current speed (upper)
K426	K436	Step number
K427	K437	Error code
K428	K438	M code number
K429	K439	External I/O signal status

▶The status information area of internal memory is ‘read only’ area.

2) Operation status information

Item	Device area						Status information
	X-axis			Y-axis			
	word	bit	address	word	bit	address	
In operation	K420	0	K4200	K430	0	K4300	0:stop, 1:operating
Error status		1	K4201		1	K4301	0:no error, 1:error
Positioning complete		2	K4202		2	K4302	0:incomplete, 1:complete
M code signal		3	K4203		3	K4303	0:M code OFF, 1:M code ON
Home setting status		4	K4204		4	K4304	0:no home setting, 1:home setting
No pulse output		5	K4205		5	K4305	0:pulse output, 1:no pulse output
Stop status		6	K4206		6	K4306	0:no stop status by stop instruction 1:stop status by stop instruction
Upper limit detection		8	K4208		8	K4308	0:no detection, 1:detection
Lower limit detection		9	K4209		9	K4309	0:no detection, 1:detection
Emergency stop		A	K420A		A	K430A	0:normal, 1:emergency stop
Forward/reverse		B	K420B		B	K430B	0:forward, 1:reverse
Operating(ACC)		C	K420C		C	K430C	0:no accelerating, 1:accelerating
Operating(Regular)		D	K420D		D	K430D	0:no regular speed, 1:regular speed
Operating(DEC)		E	K420E		E	K430E	0:no decelerating, 1:decelerating
Operating(Dwell)		F	K420F		F	K430F	0:no dwelling 1:dwelling
Operation control (Position control)	K421	0	K4210	K431	0	K4310	0:no position controlling 1:position controlling
Operation control (Speed control)		1	K4211		1	K4311	0:no speed controlling 1:speed controlling
Operation control (Linear interpolation)		2	K4212		2	K4312	0:no interpolation controlling 1:interpolation controlling
Home Return		5	K4215		5	K4315	0:no home returning 1:home returning
Position synchronization		6	K4216		6	K4316	0:no position synchronizing 1:position synchronizing
Speed synchronization		7	K4217		7	K4317	0:no speed synchronizing 1:speed synchronizing
Jog low speed		8	K4218		8	K4318	0:no jog low speed 1:jog low speed
Jog high speed		9	K4219		9	K4319	0:no jog high speed 1:jog high speed
Inching operation		A	K421A		A	K431A	0:no inching operation 1:inching operation

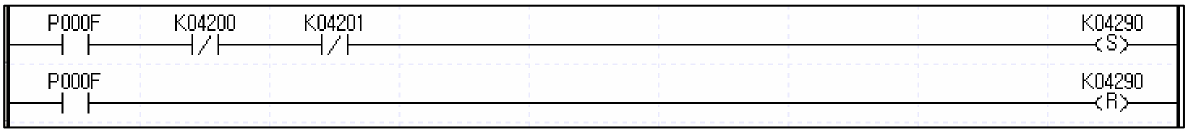
9.4.2 Positioning Input/Output signal

It describes how to use positioning instructions in XGB PLC.

The slot of built-in position control is “ 0 “.

Axis	Output	Description
X	K4290	X-axis start
	K4291	X-axis forward jog
	K4292	X-axis reverse jog
	K4293	X-axis jog low/high speed
Y	K4390	Y-axis start
	K4391	Y-axis forward jog
	K4392	Y-axis reverse jog
	K4393	Y-axis low/high speed

1) Start signal
   - A) Unlike indirect start or direct start by instructions, start signal executes positioning operation in accordance with the current operation step number of positioning module without step number set.
   - B) If changing the current operation step number during operation, it is necessary to use start step number change instruction(SNS).
   - C) Examples of start programs
     - (1) Use push button as external start input switch.
     - (2) If toggle switch is used as external start input switch, it should be noted that operating switch is off once positioning is complete and it restarts.



Device	Description
P000F	X-axis start signal input
K4200	X-axis operating signal
K4201	X-axis error status
K4290	X-axis start

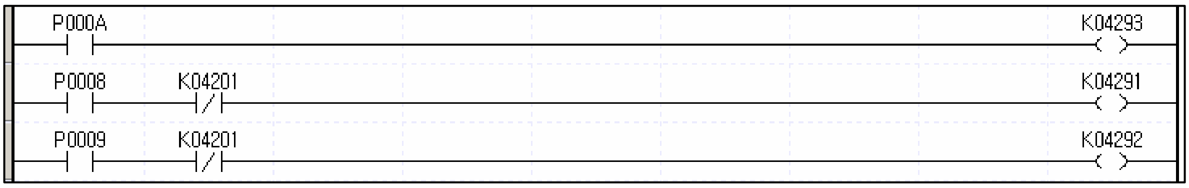
2) Jog operation

A) If K4293 regarding X-axis(Y axis: K4393) is on, it means jog high speed; if OFF, it sets jog low speed.

B) The actual jog operation regarding X-axis is operated forward or reverse depending on ON/Off signal of K4291(Y-axis: K4391) and K4292(Y-axis: K4392) signals.

Jog operation would be On if it operates by On/Off signal level; if Off, jog operation stops.

C) Example of jog operation program



Device	Description
P0008	X-axis forward jog external input
P0009	X-axis reverse jog external input
P000A	X-axis jog low/high speed external input
K4200	X-axis operating signal
K4201	X-axis error
K4291	X-axis forward jog
K4292	X-axis reverse jog
K4293	X-axis jog low/high speed

Remark

▶ Note that if executing jog operation by entering adding operation signals(K4200, K4300) as normal close(B contact) input as jog operation input condition, it may cause malfunction.

9.5 Positioning Instructions

9.5.1 Description of positioning dedicated instructions

It describes positioning instructions used in XGB PLC.

Abbr.	Instruction	Instruction condition
ORG	Home Return start	Slot , instruction axis
FLT	Floating origin setting	Slot , instruction axis
DST	Direct start	Slot , instruction axis, position, sped, dwell time, M code, control word
IST	Indirect start	Slot , instruction axis, step number
LIN	Linear interpolation	Slot , instruction axis, step number, axis info
SST	Concurrent start	Slot , instruction axis, X-axis step number, Y-axis step number, Z-axis step number, axis info
VTP	Speed/position switching	Slot , instruction axis
PTV	Position/speed switching	Slot , instruction axis
STP	Stop	Slot , instruction axis, DEC time
SSP	Position synchronization	Slot , instruction axis, step number, main axis position, main-axis setting
SSS	Speed synchronization	Slot , instruction axis, synchronization ratio, delay time
POR	Position override	Slot , instruction axis, position
SOR	Speed override	Slot , instruction axis, speed
PSO	Positioning speed override	Slot , instruction axis, position, speed
INCH	Inching start	Slot , instruction axis, inching amount
MOF	M code cancel	Slot , instruction axis
PRS	Current position preset	Slot , instruction axis, position
EMG	Emergency stop	Slot , instruction axis
CLR	Error reset, No output cancel	Slot , instruction axis, enable/disable pulse output
WRT	Save parameter/operation data	Slot , instruction axis, select saving area

Remark

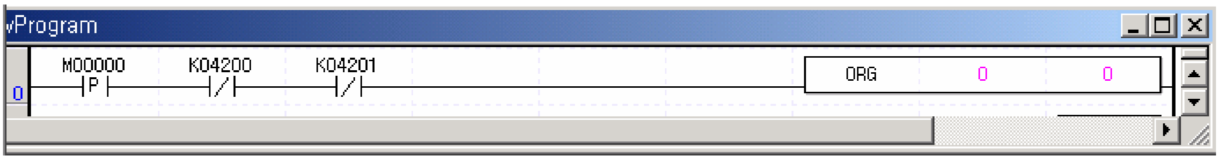
- Dedicated instructions operate at rising edge. That is, it operates once if instruction contact is “On”.

9.5.2 Use of positioning dedicated instruction

Use of dedicated instructions describes how to use program based on X-axis.

1) Home Return start(instruction : ORG)

A) Program



B) Description

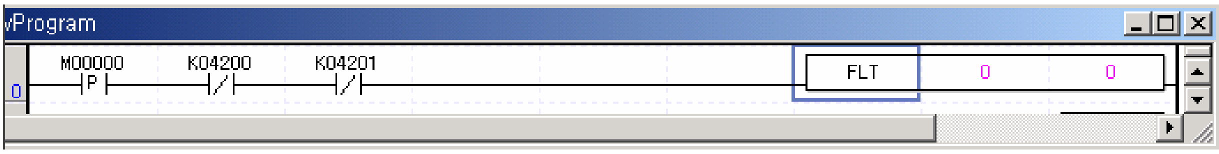
Device	Description
M000	X-axis home return input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	ORG				Home Return
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K, Constant,D,Z,R	Word	Instruction axis(0:X, 1:Y)

▪In case of home return start, it executes home return operation by the set home return parameters; when it operates normally, the origin setting completion signal is On.

2) Floating origin setting(instruction : FLT)

A) Program



B) Description

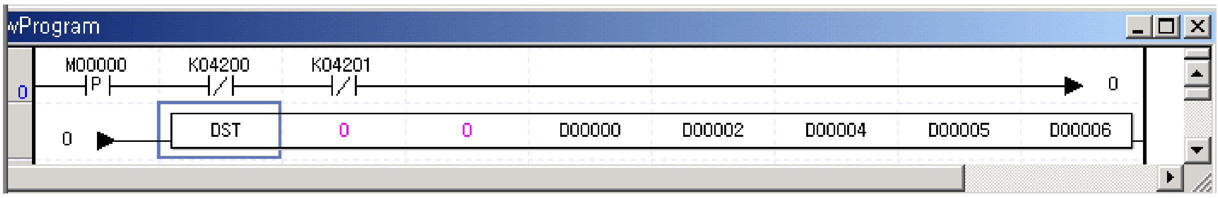
Device	Description
M000	X-axis home return input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	FLT				Floating origin
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K, constant, D,Z,R	Word	Instruction axis(0 :X, 1:Y)

▪Unlike home return, the origin setting completion signal is immediately On without any external signal at the current position.

3) Direction start(Instruction : DST)

A) Program



B) Description

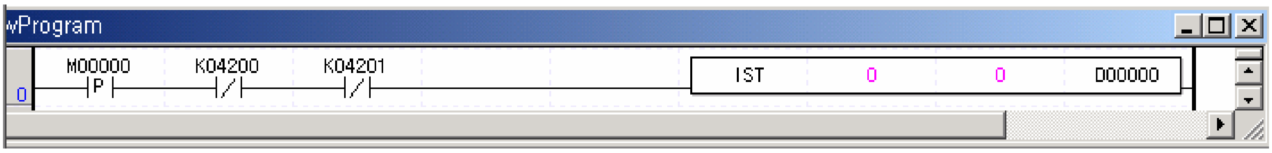
Device	Description
M000	X-axis home return input
K4200	X-axis operating signal
K4201	X-axis error status

Instruc-tion	DST				Direct start
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant, D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Target position	P,M,L,K,constant,D,Z,R	Dint	Target position (-2147483648 ~ 2147483647)
	OP4	Target speed	P,M,L,K,constant,D,Z,R	Double word	Target speed(1~100000)
	OP5	Dwell time	P,M,L,K,constant,D,Z,R	Word	Dwell time(0~50000)
	OP6	M code	P,M,L,K,constant,D,Z,R	Word	M code(0~65535)
	OP7	Control word	P,M,L,K,constant,D,Z,R	word	Bit0(0:position,1:speed), Bit4(0:absolute,1:Incremental), Bit5,6(0:No.1,1:No.2,2:No.3,3:No.4 ACC/DEC time)

- If the control word of instruction info is h0012, it is set by position control, Incremental, ACC/DEC time.
- The 1 ~ 3rd and 7 ~ 15th bits of control words, which are no use area, would not affect the setting.. That is, h0010 and h0012 are set identically.

4) Indirect start(instruction : IST)

A) Program



B) Description

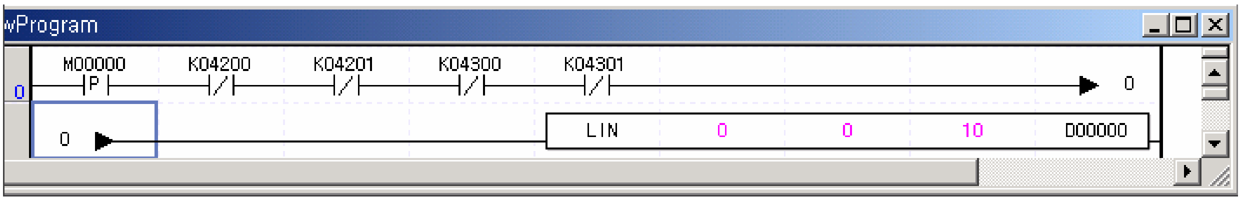
Device	Description
M000	X-axis home return input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	IST				Indirect start
Operand	OP1	Slot	constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0 : X, 1:Y)
	OP3	Operation step	P,M,L,K,constant,D,Z,R	Word	Operating step number(0 ~ 30)

- If step number is set to ‘0’ in indirect start, it operates with the current operation step number.

5) Linear interpolation(instruction : LIN)

A) Program



```
0  M00000   K04200   K04201   K04300   K04301
   ─┤P├────┤/├──────┤/├──────┤/├──────┤/├──────────────────▶ 0
   0 ▶──────────────────────[ LIN   0   0   10   D00000 ]
```

B) Description

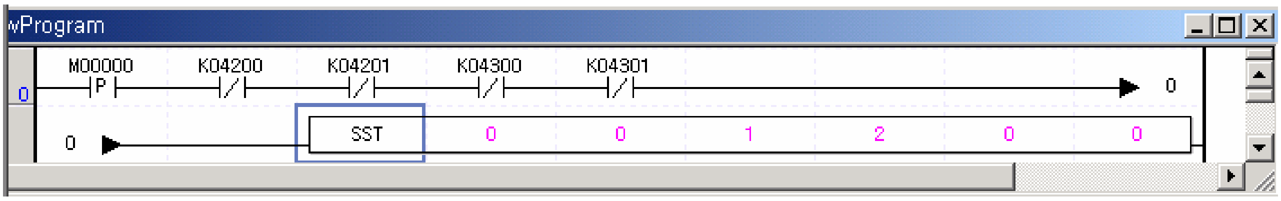
Device	Description
M0000	2 axes linear interpolation input
K4200	X-axis operating signal
K4201	X-axis error status
K4300	Y-axis operating signal
K4301	Y-axis error status

Instruc-tion	LIN				Linear interpolation
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Main axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0 :X, 1 :Y)
	OP3	Operation step	P,M,L,K,constant,D,Z,R	Word	Operating step number(0 ~30)
	OP4	Operation axis	P,M,L,K,constant,D,Z,R	Word	Dummy Operand(*1)

*1 : Dummy Operand value does not affect operation.

6) Concurrent start(instruction : SST)

A) Program



B) Description

Device	Description
M000	Concurrent start input
K4200	X-axis operating signal
K4201	X-axis error status
K4300	Y-axis operating signal
K4301	Y-axis error status

Instruction	SST				Circular interpolation
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 ”
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0 :X, 1 :Y)
	OP3	X-axis operation step	P,M,L,K,constant,D,Z,R	Word	X-axis operating step number(0~30)
	OP4	Y-axis operation step	P,M,L,K,constant,D,Z,R	Word	Y-axis operating step number(0~30)
	OP5	Z-axis operation step	P,M,L,K,constant,D,Z,R	Word	Dummy Operand(*1)
	OP6	Operation axis	P,M,L,K,constantD,Z,R	Word	Dummy Operand(*1)

- It operates concurrently and also called ‘internal concurrent start’ to tell from external concurrent start,

*1 : Dummy Operand value does not affect operation.

7) Speed/position switching(instruction : VTP)

A) Program

B) Description

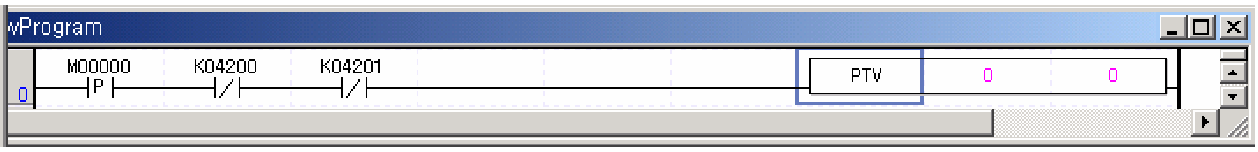
Device	Description
M0000	X-axis speed/position switching
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	VTP				Speed/position switching
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)

- If speed/position switching instruction is executed with X-axis speed-controlled, it is switched to position control, displaying the current position and enabling positioning operation.

8) Position/speed switching(instruction : PTV)

A) Program



B) Description

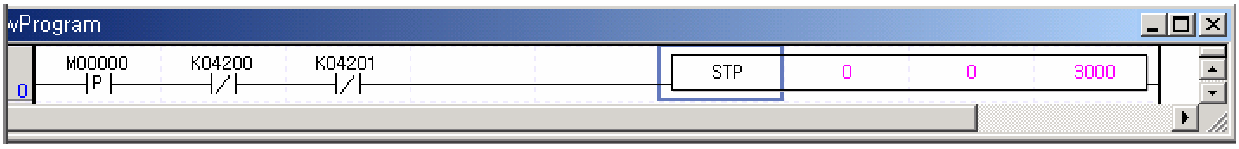
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	PTV				Speed/position switching
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)

- if position/speed switching instruction is executed with X-axis position-controlled, it keeps speed control and it stops by executing decelerating stop instruction for stop.

9) Decelerating stop(instruction : STP)

A) Program



B) Description

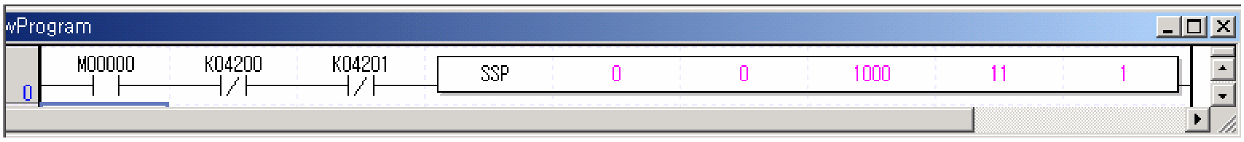
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	STP				Decelerating stop
Operand	OP1	Slot	constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Decelerating time	P,M,L,K,constant,D,Z,R	Word	Decelerating time (0 ~ 65,535ms)

- Decelerating stop instruction is not executed if being decelerating already; instead, it may stop only when accelerating or regular speed operating.
- Decelerating time means a duration until decelerating stop and is available between 0 ~ 65535ms. If it is set to ‘0’, it immediately stop without accelerating/decelerating; if any other value but ‘0’ is set, it stops by ACC/DEC time set by operation data or direct start instruction.

10) Position synchronization(instruction : SSP)

A) Program



```
SSP 0 0 1000 11 1
```

B) Description

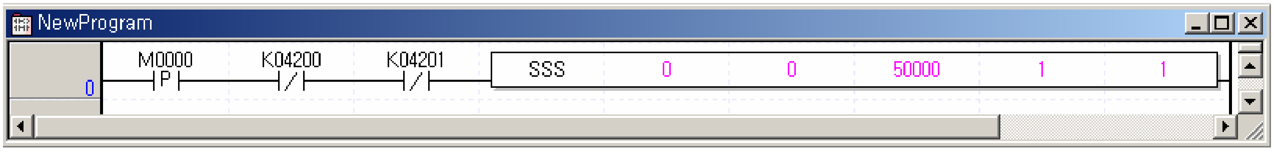
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	SSP				Position synchronization
Operand	OP1	Slot	constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant ,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Main axis synchronization position	P,M,L,K,constant ,D,Z,R	Dint	The synchronization position of main axis operated by instruction axis (-2147483648 ~ 2147483647)
	OP4	Operation step	P,M,L,K,constant ,D,Z,R	Word	Step number operated by instruction axis(0~30)
	OP5	Main axis	P,M,L,K,constant ,D,Z,R	Word	Main axis(0:X, 1:Y)

- If position synchronization instruction is executed first, it turns in operation and the sub-axis, X-axis does not output pulse.
- The main axis, Y-axis starts, No.11 step of X-axis where the current position is 1000 starts, pulse outputs and positioning operation starts by the operation pattern of X-axis.

11) Speed synchronization(instruction : SSS)

A) Program



B) Description

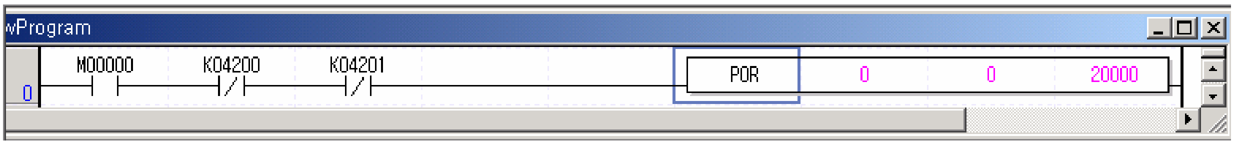
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	SSS				Speed synchronization
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K, constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Main axis ratio	P,M,L,K,constant,D,Z,R	Word	Synchronization ratio(0~10000) / 100%
	OP4	Sub axis ratio	P,M,L,K,costant,D,Z,R	Word	Delay time(1~10)ms
	OP5	Main axis	P,M,L,K,constant,D,Z,R	Word	Main axis(0:X,1:Y, 2:HSC Ch0, 3:HSC Ch1, 4:HSC Ch2, 5:HSC Ch3)

- If speed synchronization instruction is executed, it turns in operation and no pulse is output at X-axis.
- If the synchronization ratio is set to 5,000, the main axis setting, Y-axis starts and if operation speed is 100pps, the sub axis, X-axis operates at 50pps depending on the synchronization ratio 50.50%(5,000/100%).
- If the main axis setting, Y-axis operation speed is changed to 1000pps, the Y-axis operation speed is changed at the speed of 500pps, which is X-axis, the sub axis.
- During speed synchronization operation, the synchronization ratio is available between 1~10000(0.00% ~ 100.00%).
- Delay time is a delayed time of main/sub axes. If delay time is large, delay occurs as long as the delay time set, but output pulse is output stably. In case of any possibility of fault in a motor and etc, the delay time should be set largely. The available range is between 1 ~ 10ms.

12) Position override(instruction : POR)

A) Program



B) Description

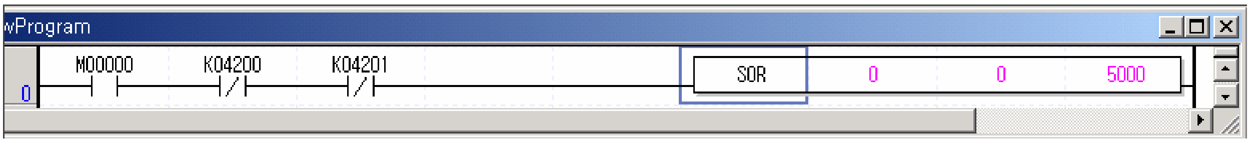
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	POR				Position override
Operand	OP1	Slot	0	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Position	P,M,L,K,constant,D,Z,R	Dint	Target position to change (-2147483648 ~ 2147483647)

- If position override is set before reaching a target position unless the target position is 20000 during X-axis operation, the target position is changed to 20000, starting positioning operation.

13) Speed override(instruction : SOR)

A) Program



B) Description

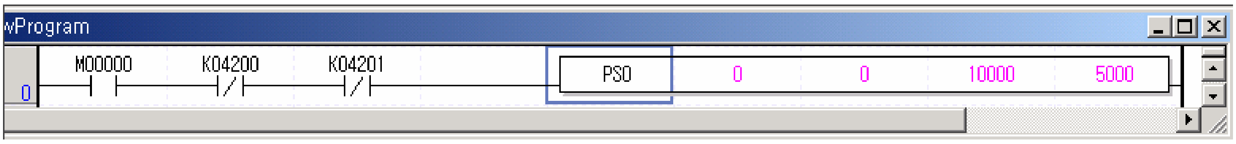
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	SOR				Speed override
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Speed	P,M,L,K,constant,D,Z,R	Double word	Target speed to change(1~100,000)

- If speed override instruction is executed as X-axis operation speed is not 5000, the operation speed is changed to 5000 pps and operation starts.

14) Positioning speed override(instruction : PSO)

A) Program



B) Description

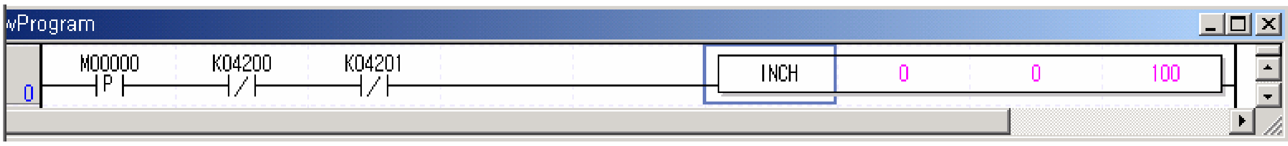
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	PSO				Positioning speed override
Operand	OP1	Slot	0	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K, constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Position	P,M,L,K,constant,D,Z,R	Dint	Position to change speed (-2147483648 ~ 2147483647)
	OP4	Speed	P,M,L,K,constant,D,Z,R	Double word	Target speed to change(1~200000)

- If positioning override instruction is executed when X-axis operation speed is 500pps and the target position is 2,000,000, operation speed is changed to 5000pps and it operates.

15) Inching start(instruction : INCH)

A) Program



B) Description

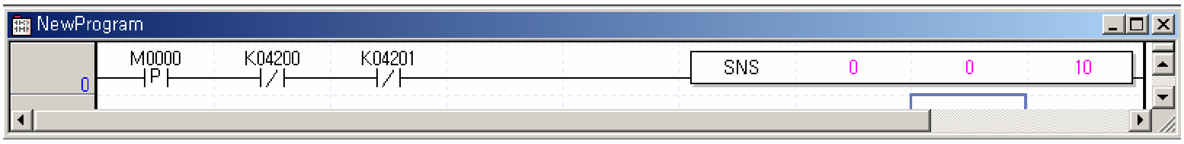
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	INCH				Inching operation
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	Position	P,M,L,K,constant,D,Z,R	Dint	Position to move by inching operation (-2147483648 ~ 2147483647)

- If M000 is on, it operates forward at the inching operation speed set in origin/manual parameters.

16) Start step number change(instruction : SNS)

A) Program



B) Description

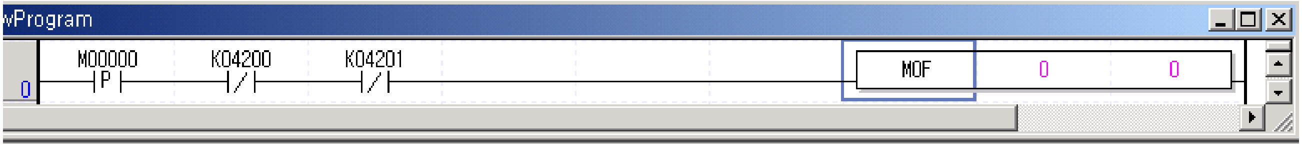
Device	Description
M0000	X-axis start step number change input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	MOF				M code cancel
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,Constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Step number to changed by start step(1~30)

- If M0 is on, X-axis step number is changed to 10.

17) M code cancel(instruction : MOF)

A) Program



B) Description

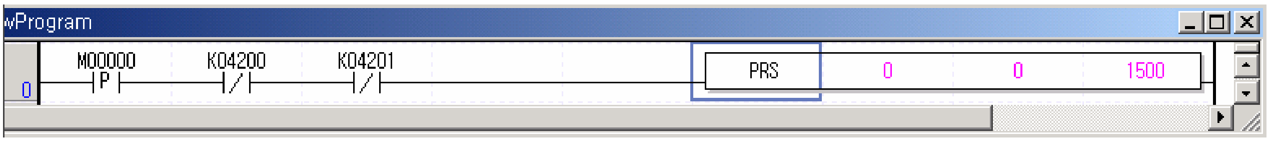
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	MOF				M code cancel
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)

- If on X-axis, M code occurs and M000 is On, M code On signal and M code number are simultaneously cancelled.

18) Present Position Preset(instruction : PRS)

A) Program



B) Description

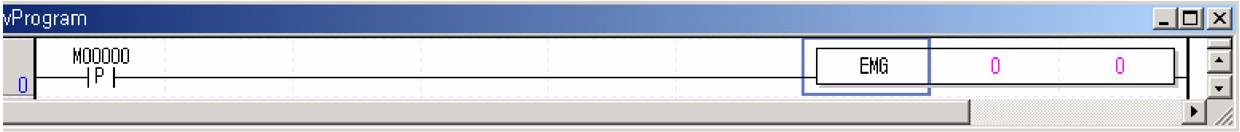
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	PRS				Present position present
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R,ZR	Word	Instruction axis(0:X,1:Y)
	OP3	Position	P,M,L,K,constant,D,Z,R,ZR	Dint	Present position to change (-2147483648 ~ 2147483647)

- If M000 is On, the present position of X-axis is changed to 1500.
- If present position preset instruction is executed without origin set, origin is set and the present position is changed to the preset value.

19) Emergency Stop(instruction : EMG)

A) Program



B) Description

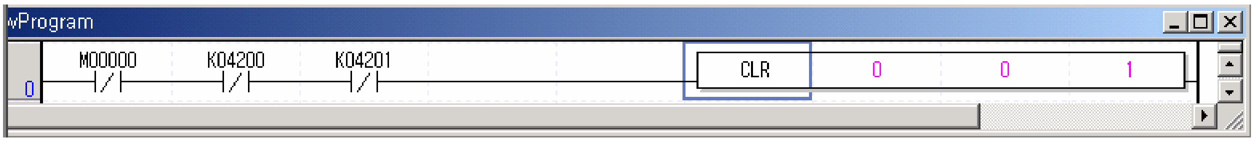
Device	Description
M000	Internal emergency stop input

Instruction	EMG				Emergency stop
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R,ZR	word	Instruction axis(0:X,1:Y)

- If M000 is on, every axis emergently stops and no pulse outputs.

20) Error reset, No output cancel(instruction : CLR)

A) Program



B) Description

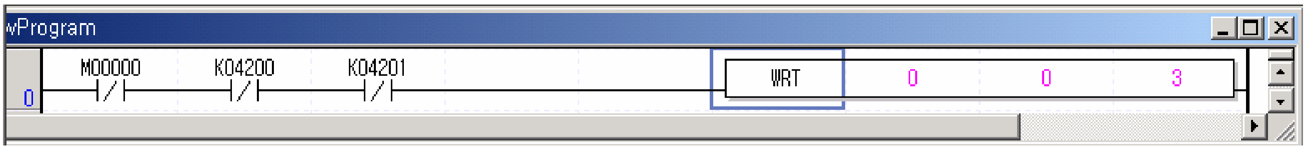
Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	CLR				Error reset, no output cancel
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Instruction axis(0:X,1:Y)
	OP3	No output cancel	P,M,L,K,constant,D,Z,R	Word	0: No cancel of ‘no output’ 1: ‘No output’ cancel

- If M000 is On, an error occurred on X-axis is reset and no pulse status is cancelled.

21) Saving Parameter/Operation Data(instruction : WRT)

A) Program



B) Description

Device	Description
M0000	X-axis speed/position switching input
K4200	X-axis operating signal
K4201	X-axis error status

Instruction	WRT				Saving Parameter/Operation Data
Operand	OP1	Slot	Constant	Word	Basic unit designation : “ 0 “
	OP2	Axis	P,M,L,K,constant,D,Z,R	Word	Dummy Operand
	OP3	Selection of saving area	P,M,L,K,constant,D,Z,R	Word	Positioning : 0 , high speed counter :1 PID : 2

- If M000 is on, it instructions that the parameters and operation data currently operated on a selected axis of X-axis is to be saved.

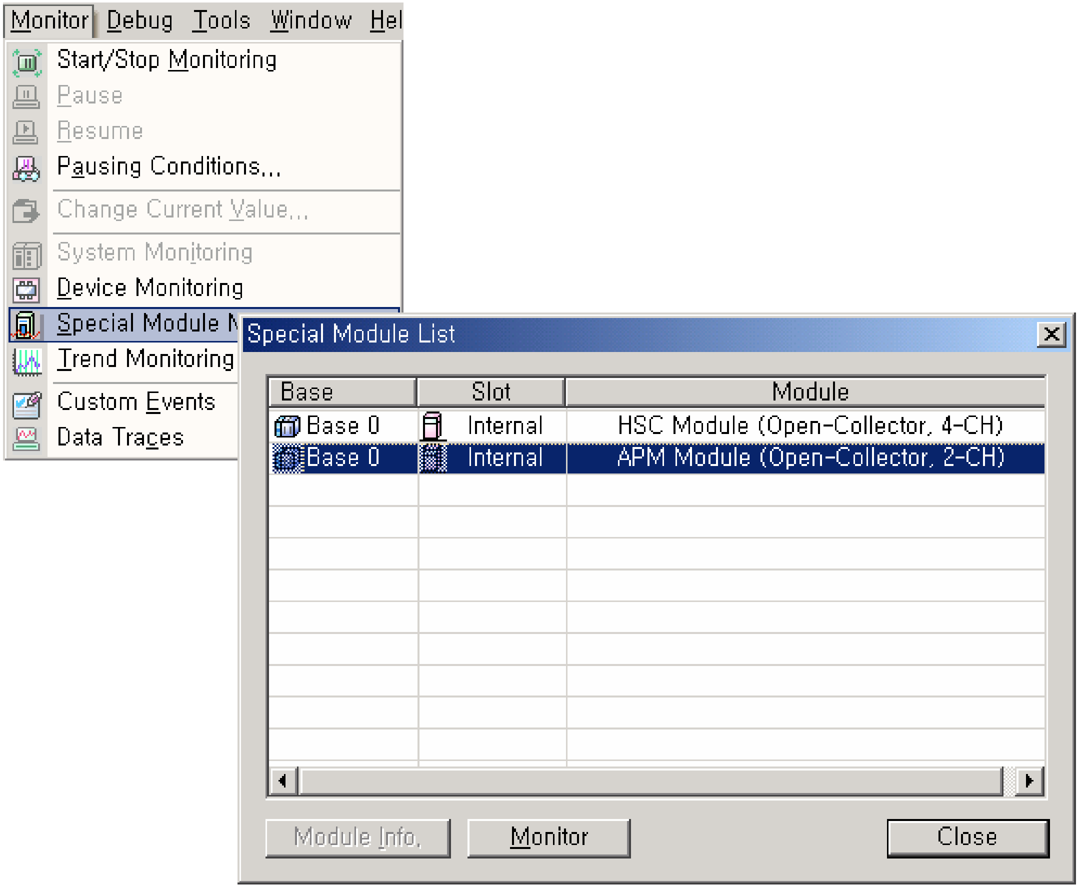
9.6 Positioning Software Package Commissioning

It monitors status of positioning in XGB PLC, changes parameters and operation data and executes instructions on axis.

9.6.1 Instruction and monitoring

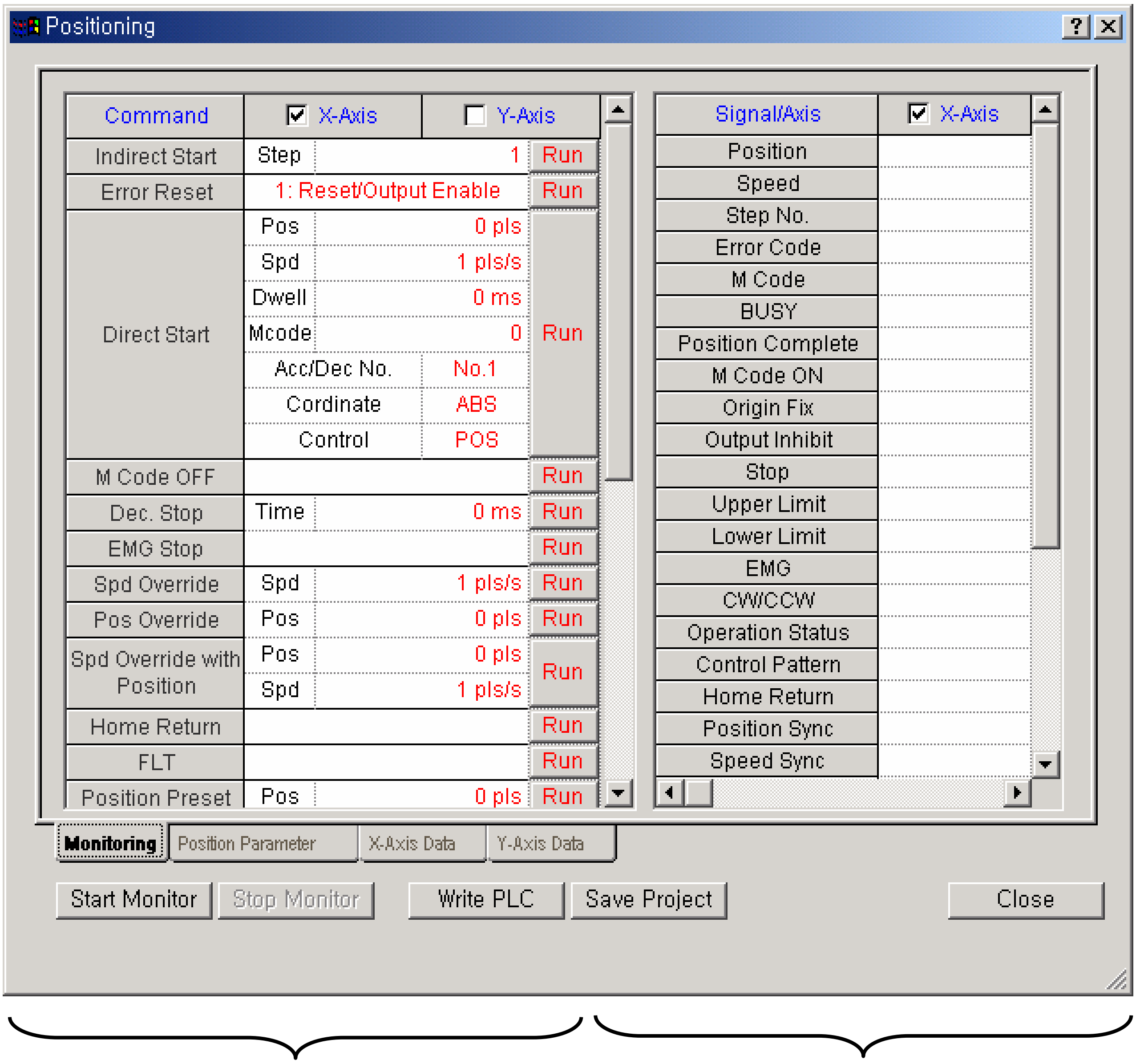
☐ It shows positioning instruction execution and monitoring method.

- Clicking special module monitor after startign monitoring shows the following window.



Base	Slot	Module
Base 0	Internal	HSC Module (Open-Collector, 4-CH)
Base 0	Internal	APM Module (Open-Collector, 2-CH)

❑ It shows positioning instruction and monitoring window.



Command	☑ X-Axis	☐ Y-Axis	
Indirect Start	Step	1	Run
Error Reset	1: Reset/Output Enable		Run
Direct Start	Pos	0 pls	Run
	Spd	1 pls/s	
	Dwell	0 ms	
	Mcode	0	
	Acc/Dec No.	No.1	
	Cordinate	ABS	
	Control	POS	
M Code OFF			Run
Dec. Stop	Time	0 ms	Run
EMG Stop			Run
Spd Override	Spd	1 pls/s	Run
Pos Override	Pos	0 pls	Run
Spd Override with Position	Pos	0 pls	Run
	Spd	1 pls/s	
Home Return			Run
FLT			Run
Position Preset	Pos	0 pls	Run

Signal/Axis	☑ X-Axis
Position	
Speed	
Step No.	
Error Code	
M Code	
BUSY	
Position Complete	
M Code ON	
Origin Fix	
Output Inhibit	
Stop	
Upper Limit	
Lower Limit	
EMG	
CW/CCW	
Operation Status	
Control Pattern	
Home Return	
Position Sync	
Speed Sync	

Instruction window

Monitoring window

Item	Description	Remarks
Monitoring	Monitor positioning values of each axis.	
Position Parameter	Monitor and write parameters of each axis.	
X-Axis Data	Monitor and write each operation pattern parameters of X-axis.	
Y-Axis Data	Monitor and write each operation pattern parameters of Y-axis.	
Start Monitor	Execute positioning monitor.	
Stop Monitor	Stop positioning monitor.	
Write PLC	Write modified parameters into PLC Flash memory	Parameter area
Save Project	Write modified parameters into XG5000 project.	

1) Positioning instruction

Setting each item an clicking 『Run』 or『I I』 execute the designated operation.

Item	Description	Related instruction
Indirect start	Execute indirect start at designated operation step.	IST
Error reset	Cancel any error occurred and 'no output' status.	CLR
Direct start	Execute direct start by designated position, speed, dwell, M code, ACC/DEC time, coordinate and control method.	DST
M-code off	Clear M code On signal	MOF
Decelerating stop	Execute decelerating stop in a designated time.	STP
Emergency stop	Every axis stops and it turns 'no output'	EMG
Speed override	Operation speed is changed into a designated speed.	SOR
Position override	Change a target position to a designated position.	POR
Speed override with position	Change operation speed from a designated position in a designated speed.	PSO
Home Return	Execute a designated home return by parameters.	ORG
FLT	Set the current position as floating origin.	FLT
Position preset	Change the current position to a designated value.	PRS
Start step change	Change start step to a designated step.	SNS
Inching operation	Execute inching operation set in parameters to a designated position(inching amount).	INCH
Jog operation	Execute jog operation designated by parameters(forward/reverse, low/high speed)	-
Speed position switching	Change speed control to position control.	VTP
Position/speed switching	Change position control to speed control.	PTV
Speed synchronization	Execute speed synchronization operation at designated main axis and rate of main/sub axis	SSS
Position synchronization	Execute position synchronization operation in accordance with designated main axis, operation step and position.	SSP
Synchronization start	Execute concurrent starts by operation step of designated axes.	PSS
Linear interpolation	Execute linear interpolation operation by operation step of designated X/Y axes	LIN

2) Positioning Status Monitoring

It monitors positioning results of each axis.

Item	Description	Related flags		Remarks
		X-axis	Y-axis	
Present position	Display the present position of each axis.	K422	K432	Double word
Present speed	Display the present speed of each axis.	K424	K434	Double word
Step number	Display the currently operating step of each axis.	K426	K436	Word
Error code	Display, if any, error code of each axis.	K427	K437	Word
M code	Display the M code of currently operating step.	K428	K438	Word
Busy signal	Display whether each axis is operating.	K4200	K4300	Bit
Positioning complete	Display whether positioning of each axis is complete.	K4202	K4302	Bit
M code On	Display M code on/off of the currently operating step.	K4203	K4302	Bit
Origin setting	Display whether origin is determined(set).	K4204	K4302	Bit
No output	Display whether or not ‘no output’ is set.	K4205	K4305	Bit
Upper limit detection	Display whether upper limit detection or not.	K4208	K4308	Bit
Lower limit detection	Display whether lower limit detection or not.	K4209	K4309	Bit
Emergency stop	Display emergency stop.	K420A	K430A	Bit
Forward/reverse rotation	Display forward/reverse rotation status.	K420B	K430B	Bit
Operation status	Display operation status of each axis(ACC, DEC, regular speed, dwell).	K420C~ K420F	K430C~ K430F	Bit
Operation control status	Display operation control status of each axis(position, speed, interpolation operation)	K4210~ K4212	K4310~ K4312	Bit
Home Return	Display whether home return is being executed.	K4215	K4315	Bit
Position synchronization	Display whether position synchronization operation is being executed.	K4216	K4316	Bit
Speed synchronization	Display whether position synchronization operation or not.	K4217	K4317	Bit
Jog high speed	Display whether jog high speed operation is operating.	K4219	K4319	Bit
Jog low speed	Display whether jog low speed operation is operating.	K4218	K4318	Bit
Inching operation	Display whether inching operation or not	K421A	K431A	Bit

3) Positioning External Input Signal Monitoring

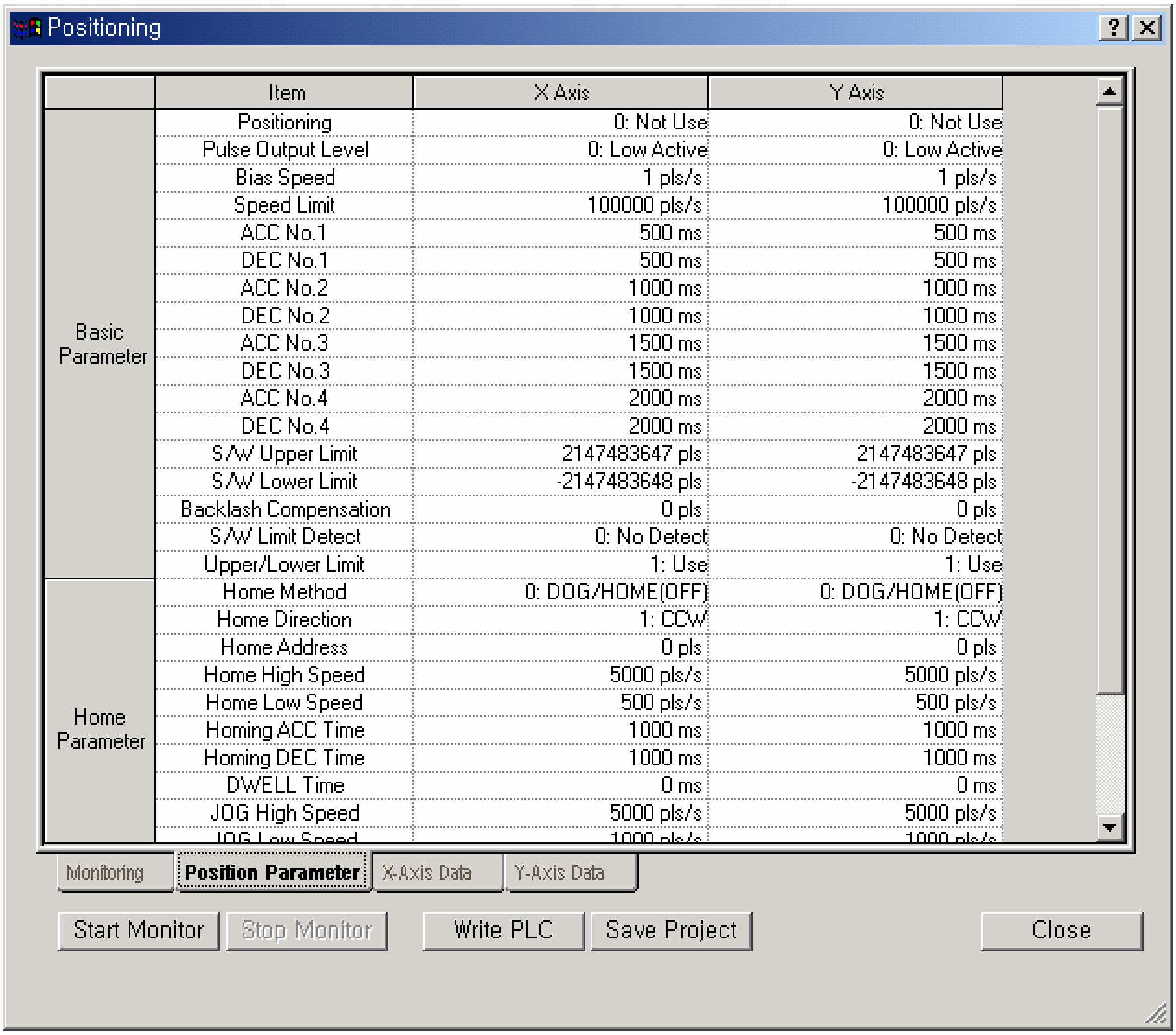
It monitors external input signal of each axis.

Item	Description	Related flags	
		X-axis	Y-axis
Upper limit signal	Display upper limit contact status of each axis.	P1	P3
Lower limit signal	Display lower limit contact status of each axis.	P0	P2
DOG signal	Display DOG contact status of each axis.	P4	P6
Origin signal	Display origin contact status of each axis.	P5	P7

9.6.2 Changing positioning parameters and operation data

1) Parameter Change

- XGB positioning parameters may be changed during operation. However, the changed parameters would be applied after the current operation stops and restarts.
- First of all, modify parameters to change and select PLC Write. At the moment, the saved parameters are changed and the changed data are applied if it restarts.

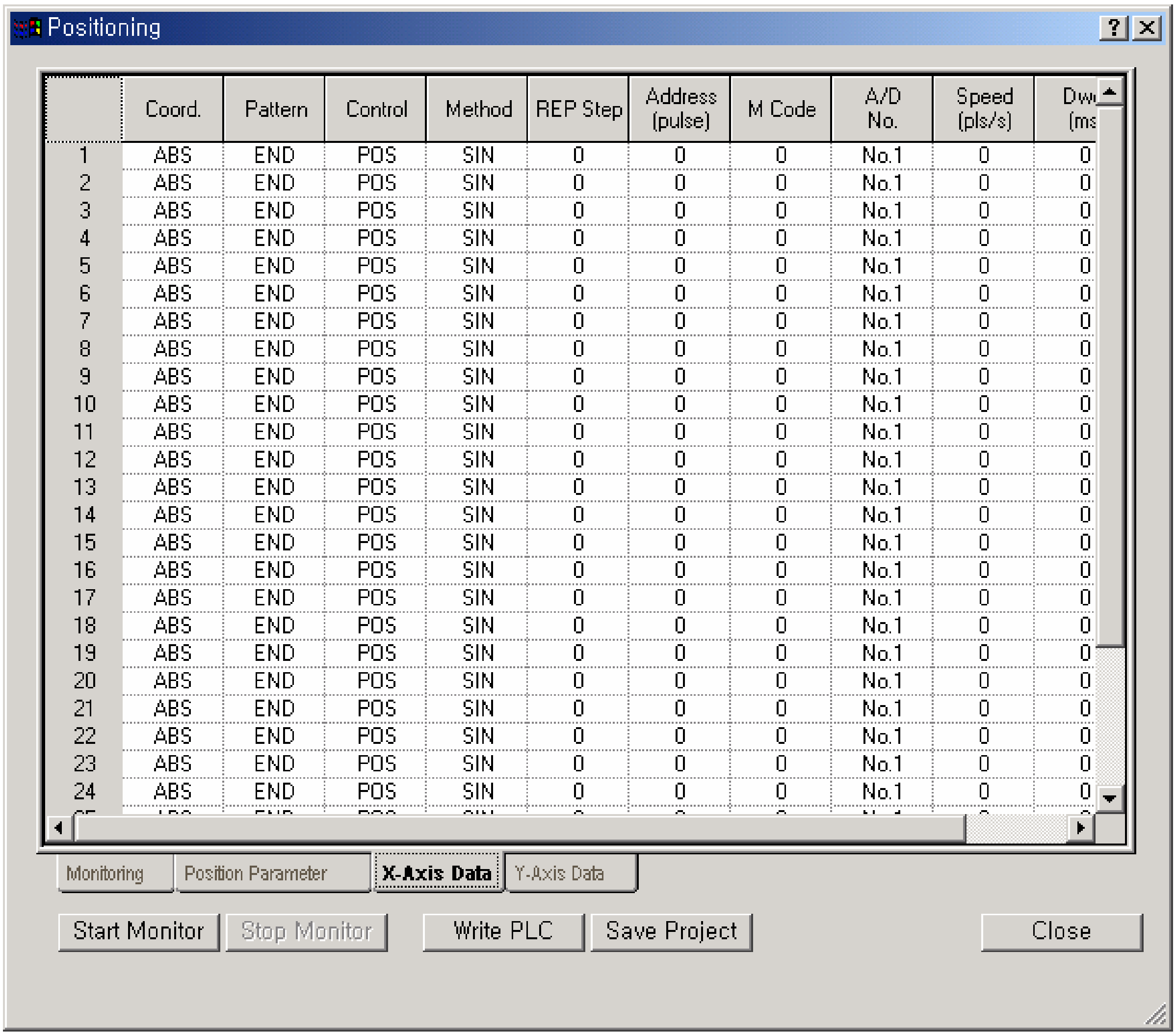


	Item	X Axis	Y Axis
Basic Parameter	Positioning	0: Not Use	0: Not Use
	Pulse Output Level	0: Low Active	0: Low Active
	Bias Speed	1 pls/s	1 pls/s
	Speed Limit	100000 pls/s	100000 pls/s
	ACC No.1	500 ms	500 ms
	DEC No.1	500 ms	500 ms
	ACC No.2	1000 ms	1000 ms
	DEC No.2	1000 ms	1000 ms
	ACC No.3	1500 ms	1500 ms
	DEC No.3	1500 ms	1500 ms
	ACC No.4	2000 ms	2000 ms
	DEC No.4	2000 ms	2000 ms
	S/W Upper Limit	2147483647 pls	2147483647 pls
	S/W Lower Limit	-2147483648 pls	-2147483648 pls
	Backlash Compensation	0 pls	0 pls
	S/W Limit Detect	0: No Detect	0: No Detect
	Upper/Lower Limit	1: Use	1: Use
Home Parameter	Home Method	0: DOG/HOME(OFF)	0: DOG/HOME(OFF)
	Home Direction	1: CCW	1: CCW
	Home Address	0 pls	0 pls
	Home High Speed	5000 pls/s	5000 pls/s
	Home Low Speed	500 pls/s	500 pls/s
	Homing ACC Time	1000 ms	1000 ms
	Homing DEC Time	1000 ms	1000 ms
	DWELL Time	0 ms	0 ms
	JOG High Speed	5000 pls/s	5000 pls/s
	JOG Low Speed	1000 pls/s	1000 pls/s

- If applying the changed data to a project, select Save Project. Make sure that positioning parameters of XG5000 would be changed as long as Save Project is selected. If not selected, the project and parameters of PLC and XG 5000 may be different each other.

2) Operation data change

- XGB positioning operation data may be modified during operation. However, the modified operation data are applied after in-operation step stops and it re-starts.
  To modify the speed of in-operation step and positioning data, use speed override or position override.
- First of all, modify operation data to change and select PLC Write. At the moment, the operation data saved in PLC is changed and the modified operation data is applied when it re-starts.
- When applying the changed data to a project, select a project. Note that the positioning operation data of XG5000 may be changed as long as Project Save is selected. The project and operation data of XG5000 and PLC may be different unless Project Save is not selected.

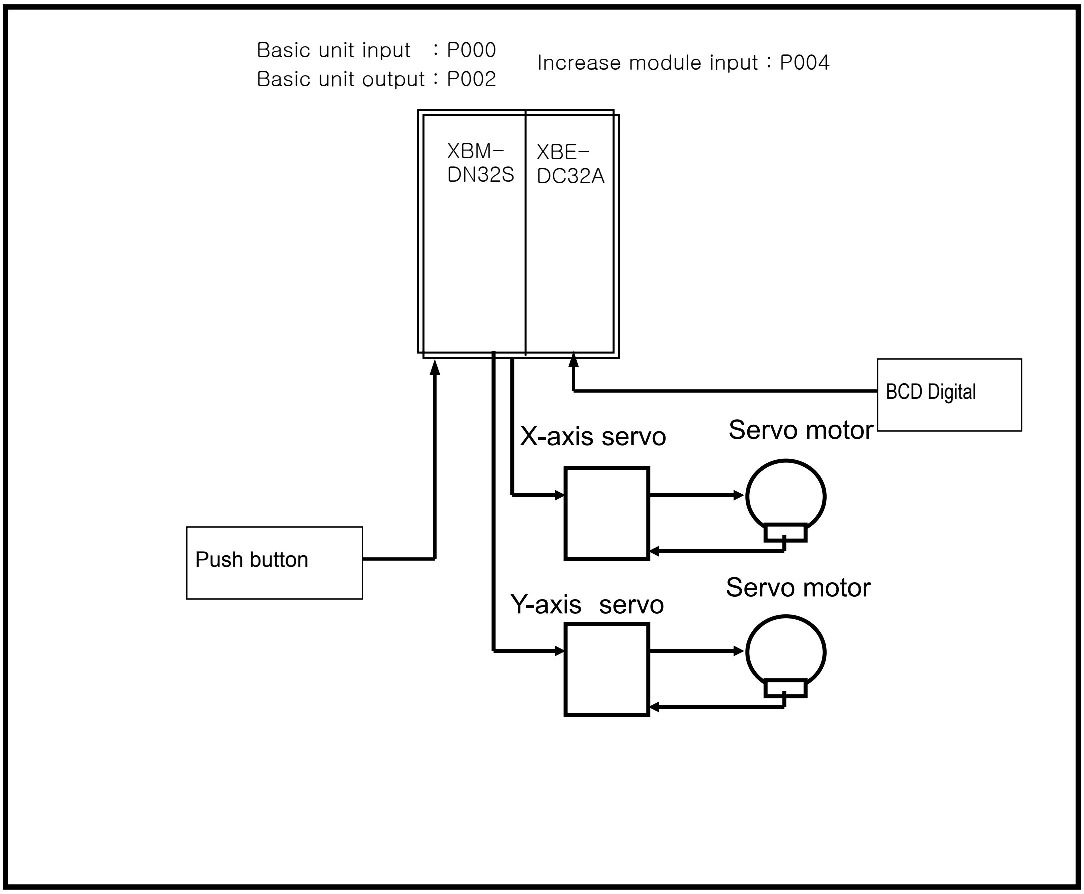


	Coord.	Pattern	Control	Method	REP Step	Address (pulse)	M Code	A/D No.	Speed (pls/s)	Dw (ms
1	ABS	END	POS	SIN	0	0	0	No.1	0	0
2	ABS	END	POS	SIN	0	0	0	No.1	0	0
3	ABS	END	POS	SIN	0	0	0	No.1	0	0
4	ABS	END	POS	SIN	0	0	0	No.1	0	0
5	ABS	END	POS	SIN	0	0	0	No.1	0	0
6	ABS	END	POS	SIN	0	0	0	No.1	0	0
7	ABS	END	POS	SIN	0	0	0	No.1	0	0
8	ABS	END	POS	SIN	0	0	0	No.1	0	0
9	ABS	END	POS	SIN	0	0	0	No.1	0	0
10	ABS	END	POS	SIN	0	0	0	No.1	0	0
11	ABS	END	POS	SIN	0	0	0	No.1	0	0
12	ABS	END	POS	SIN	0	0	0	No.1	0	0
13	ABS	END	POS	SIN	0	0	0	No.1	0	0
14	ABS	END	POS	SIN	0	0	0	No.1	0	0
15	ABS	END	POS	SIN	0	0	0	No.1	0	0
16	ABS	END	POS	SIN	0	0	0	No.1	0	0
17	ABS	END	POS	SIN	0	0	0	No.1	0	0
18	ABS	END	POS	SIN	0	0	0	No.1	0	0
19	ABS	END	POS	SIN	0	0	0	No.1	0	0
20	ABS	END	POS	SIN	0	0	0	No.1	0	0
21	ABS	END	POS	SIN	0	0	0	No.1	0	0
22	ABS	END	POS	SIN	0	0	0	No.1	0	0
23	ABS	END	POS	SIN	0	0	0	No.1	0	0
24	ABS	END	POS	SIN	0	0	0	No.1	0	0

9.7 Examples of Using Program

It describes the positioning programming built in XGB basic module.

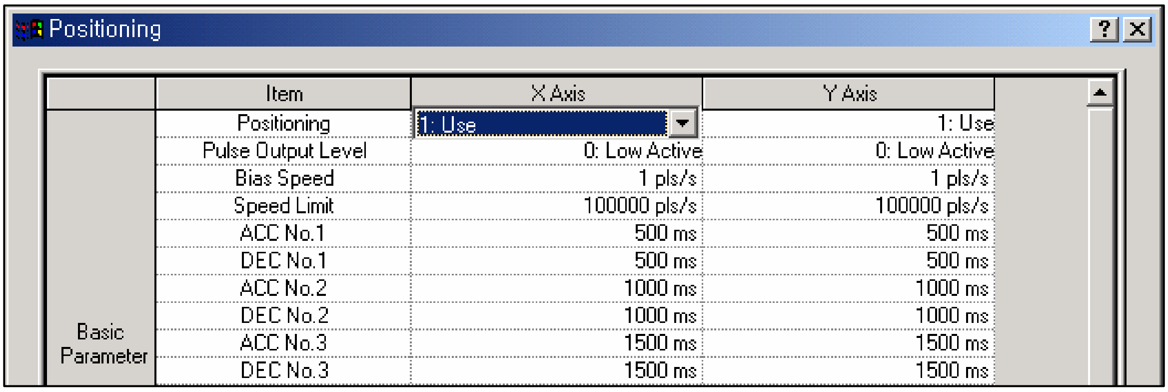
- It also describes examples of applications operated with PLC program in XGB PLC.
- Unless otherwise specified, example programs are prepared by the followign PLC system structure.
- To use positioning function in XGB, select and execute positioning module in ‘Monitor-Special Module Monitor’ of XG5000 or use positioning command with a program.
- Push button switch is used as an external input switch. In case toggle switch is used, a special attention should be paid.



[System structure of example program]

Remark

☐ To use positioning, make sure to set ‘positioning of basic parameter’ as ‘1: use’.



	Item	X Axis	Y Axis
Basic Parameter	Positioning	1: Use	1: Use
	Pulse Output Level	0: Low Active	0: Low Active
	Bias Speed	1 pls/s	1 pls/s
	Speed Limit	100000 pls/s	100000 pls/s
	ACC No.1	500 ms	500 ms
	DEC No.1	500 ms	500 ms
	ACC No.2	1000 ms	1000 ms
	DEC No.2	1000 ms	1000 ms
	ACC No.3	1500 ms	1500 ms
	DEC No.3	1500 ms	1500 ms

9.7.1 Basic program

1) Floating Origin Setting

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis floating origin switch
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning >)

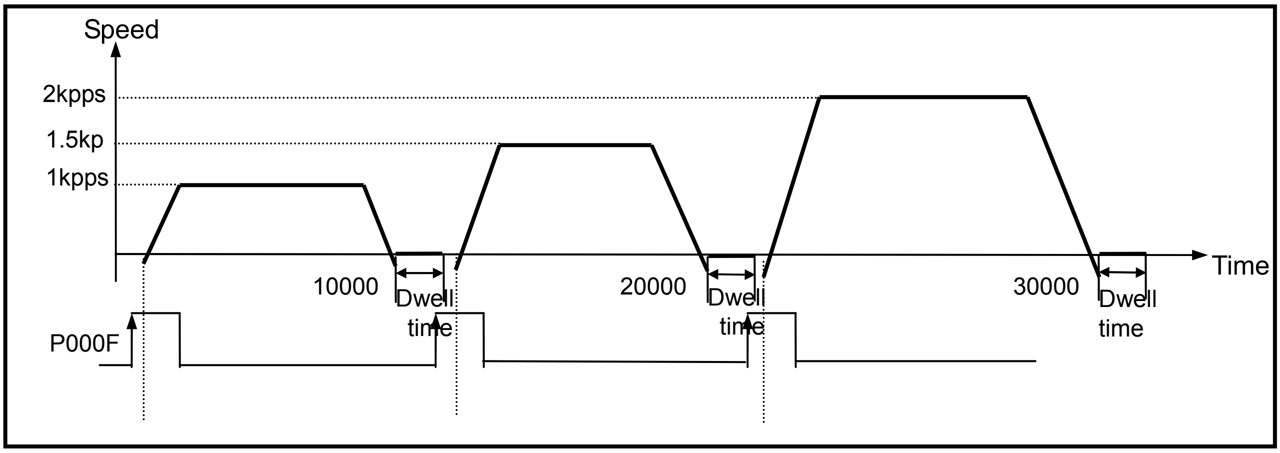
(2) Operation Sequence

P0009(floating origin) switch On => P000F(start) switch On(3 times)

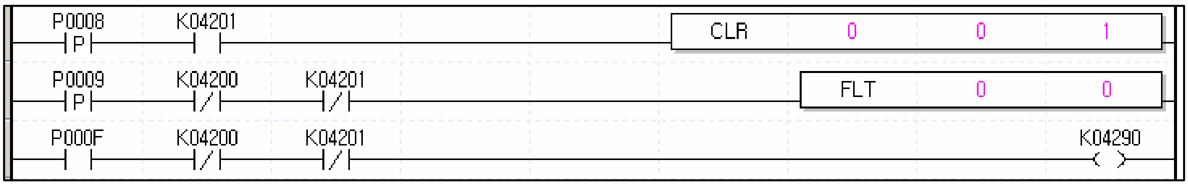
(3) Operation data setting

Position data item	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC no.	Operation speed [pls/s]	Dwell time [ms]
X-axis setting	1	Absolute	Position control	End	Single	0	10000	0	No.1	1000	100
	2	Absolute	Position control	End	Single	0	20000	0	No.1	1500	100
	3	Absolute	Position control	End	Single	0	30000	0	No.1	2000	100

(4) Operation pattern



B) Program



2) Linear Interpolation Start-Floating Origin Setting

A) Description

(1) Device used

Device	Description
P0008	X-axis, Y-axis error reset, no output cancel switch
P0009	X-axis, Y-axis floating origin switch
P000F	X-axis, Y-axis linear interpolation start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4300	Y-axis operating signal
K4301	Y-axis error status signal
K420~K428	X-axis status info(refer to <9.4.1 Positioning Status Monitoring Flag Info>)

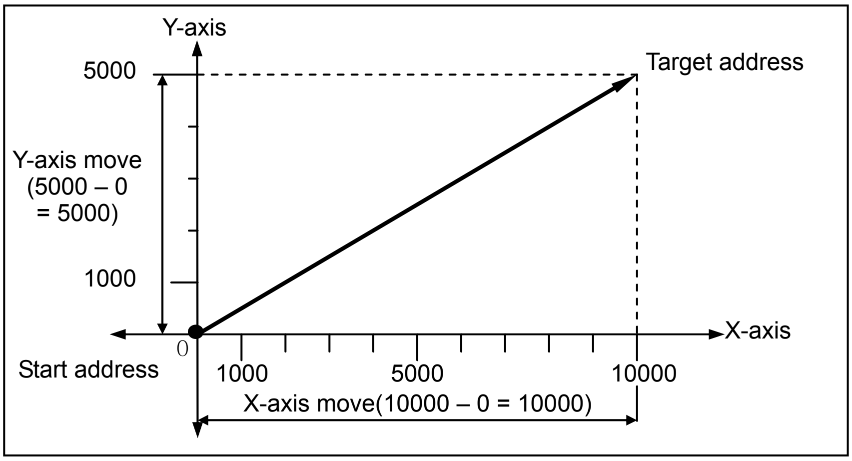
(2) Operation Sequence

P0009(floating origin) switch On => P000F(linear interpolation start) switch on.

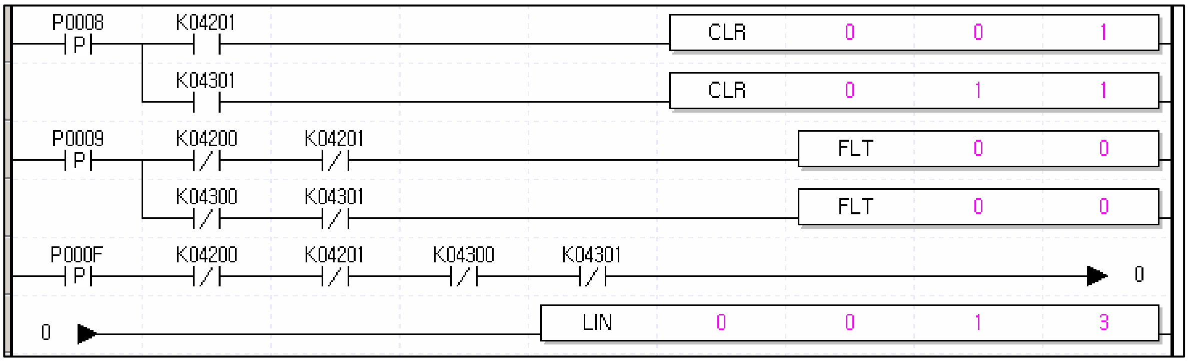
(3) Operation data setting

Position data item	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC no.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	10000	0	No.1	1000	100
Y-axis	2	Absolute	Position control	End	Single	0	5000	0	No.1	1000	100

(4) Operation pattern



B) Program



3) Decelerating Stop(Home return)

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis decelerating stop switch
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning >)

(2) Operation Sequence

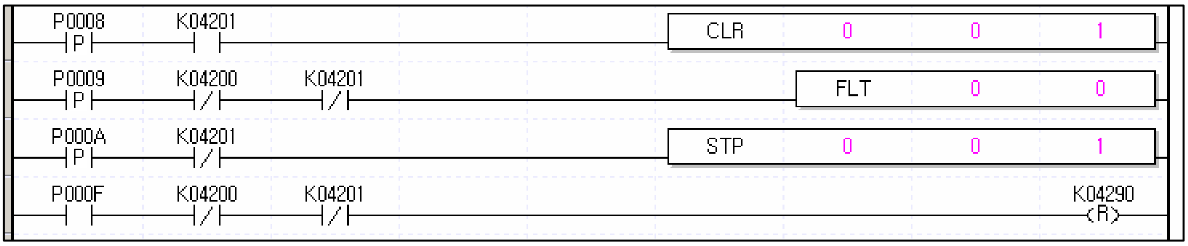
P0001(Home return) switch On => P000F(start) switch On => P0002(decelerating stop) stop On => P000F(start) switch On

- It returns home by the home return method set in home return/manual parameters. (0: DOG/origin(Off)).
- Since DEC time is set as a value but “0” in decelerating stop command, it decelerates by No.1 DEC time.

(3) Operation Data Setting

Position data items	Step no.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	15000	0	1	1000	100

B) Program



4) Single Operation(Operation Step no. designation)

A) Designation

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis floating origin switch
P000A	X-axis step number change switch
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
P0004	BCD Digital switch input
K420~K428	X-axis status info(refer to <9.4.1 Positioning Status Monitoring Flag Info>)

(2) Operation sequence

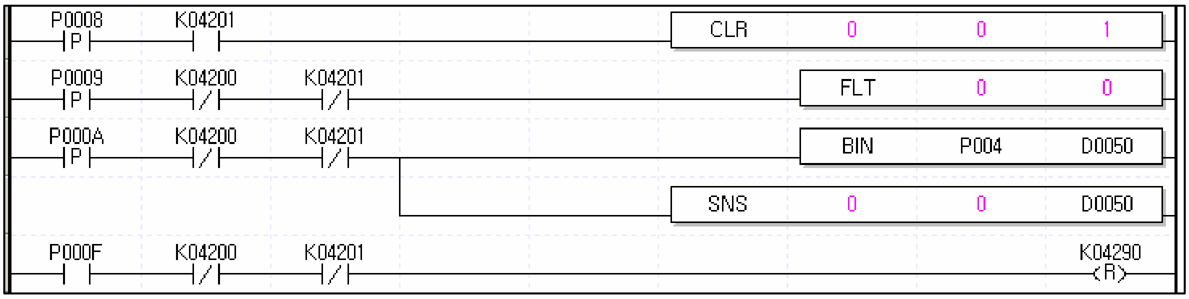
P0009(floating origin) switch On => P000F(start) switch on => P000A(start step change) switch on => P000F(start) switch On

- Set BCD external digital input as 10 and turn on P000A.

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	10000	0	No.11	1000	100
	2	Absolute	Position control	End	Single	0	20000	0	No.1	1500	100
	3	Absolute	Position control	End	Single	0	30000	0	No.1	2000	100
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	10	Absolute	Position control	End	Single	0	50000	0	No.1	1000	100
	11	Absolute	Position control	End	Single	0	60000	0	No.1	1500	100
	12	Absolute	Position control	End	Single	0	70000	0	No.1	2000	100

B) Program



5) Constant Speed Operation(operation step number designation)

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis floating origin switch
P000A	X-axis step number change
P000B	X-axis DEC stop
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
P0004	BCD Digital switch input
K420~K428	X-axis status info (refer to <9.4.1 Positioning Status Monitoring Flag Info>)

(2) Operation sequence

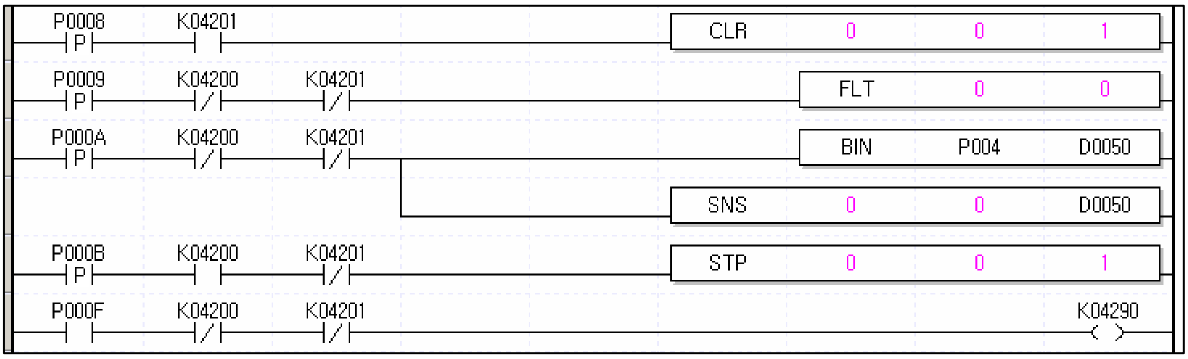
P000F(start) switch On => P000C(DEC stop) switch On => P0009(floating origin) switch On => P000A(start step change) switch On => P000F(start) switch On => P000C(DEC stop)switch On

- Set BCD external digital input as 10 and turn on P000A.
- Since DEC time is set to ‘0” in DEC stop command, execute deceleration by No.1 ACC/DEC time.

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Speed control	End	Single	0	0	0	No.1	1000	100
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	10	Absolute	Speed control	End	Single	0	50000	0	No.1	1000	100

B) Program



6) Concurrent start

A) Description

(1) Devices used

Device	Description
P0008	X-axis, Y-axis error reset, no output cancel switch
P0009	X-axis, Y-axis floating origin switch
P000F	X-axis, Y-axis concurrent start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4300	Y-axis operating switch
K4301	Y-axis error status signal
K420~K428	X-axis status info (refer to < refer to <9.4.1 Positioning Status Monitoring Flag Info>)
K430~K438	Y-axis status info (refer to <9.4.1 Positioning Status Monitoring Flag Info>)

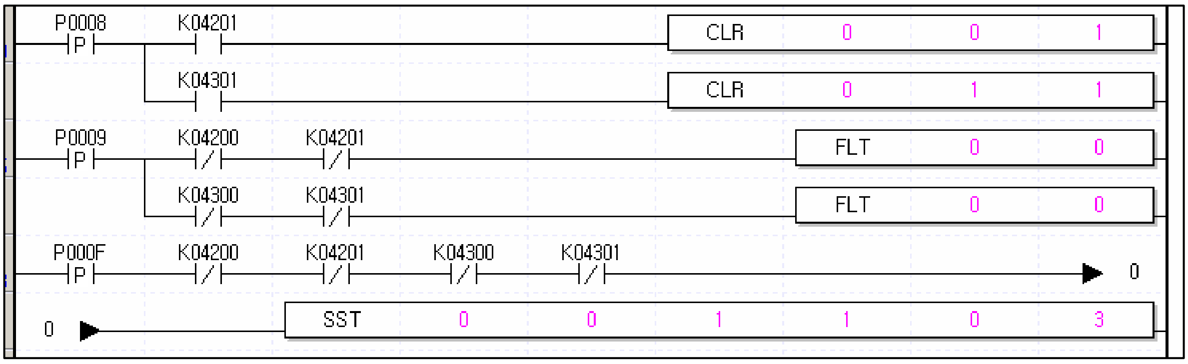
(2) Operation sequence

P0009(floating origin) switch on => P000F(Internal concurrent start) switch on

(3) Operation data setting

Position data item	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Absolute	Position control	End	Single	0	10000	0	No.1	1000	100
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Y-axis	10	Absolute	Position control	End	Single	0	20000	0	No.1	2000	100

B) Program



7) Position Synchronic Start

A) Description

(1) Devices used

Device	Description
P0008	X-axis, Y-axis error reset, no output cancel switch
P0009	X-axis, Y-axis floating origin switch
P000E	X-axis position synchronic switch
P000F	Y-axis indirect start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4300	Y-axis operating signal
K4301	Y-axis error status signal
K420~K428	X-axis status info(refer to <9.4.1 Positioning Status Monitoring Flag Info>)
K430~K438	Y-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

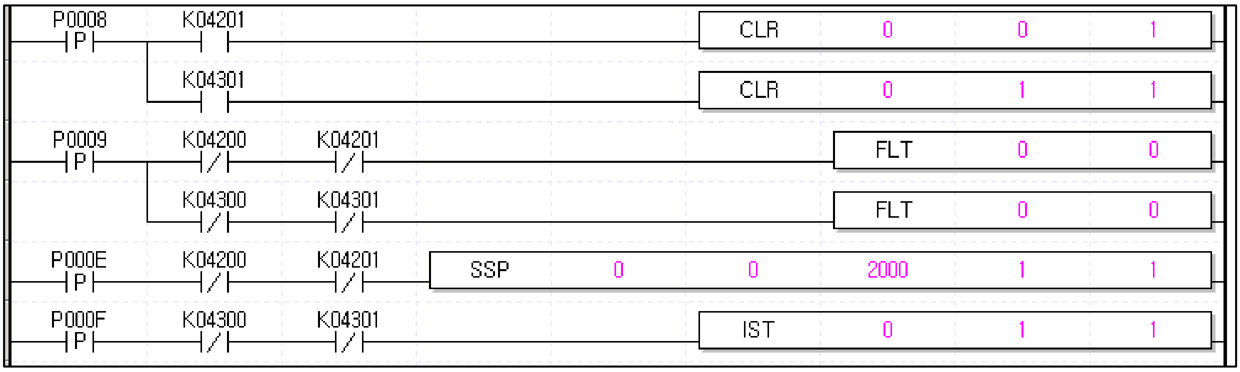
(2) Operation sequence

P0009(floating origin) switch On => P000E(position synchronic) switch On => P000F(indirect start) switch On.

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
Sub-axis X-axis	1	Absolute	Position control	End	Single	0	10000	0	No.1	1000	100
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Main-axis Y-axis	10	absolute	Position control	End	Single	0	15000	0	No.1	1500	100

B) Program



8) Speed synchronic start

1) Description

(1) Devices used

Device	Description
P0008	X-axis, Y-axis error reset, no output cancel switch
P0009	X-axis speed synchronic stop switch(DEC stop command)
P000A	Y-axis start switch
P000E	X-axis synchronic switch
P000F	Y-axis stop switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4300	Y-axis operating signal
K4301	Y-axis error status signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)
K430~K438	Y-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

P000E(X-axis speed synchronic) switch On => P000A(Y-axis start) switch On=> P000F(Y-axis stop) switch On P000A(Y-axis start) switch On => P000F(Y-axis stop) switch On => P0009(X-axis speed synchronic stop) switch On

- If using toggle switch for Y-axis DEC stop, it may generate an error.
- Since DEC time is set to “0” in DEC stop command, it executes DEC by No.1 ACC/DEC time.

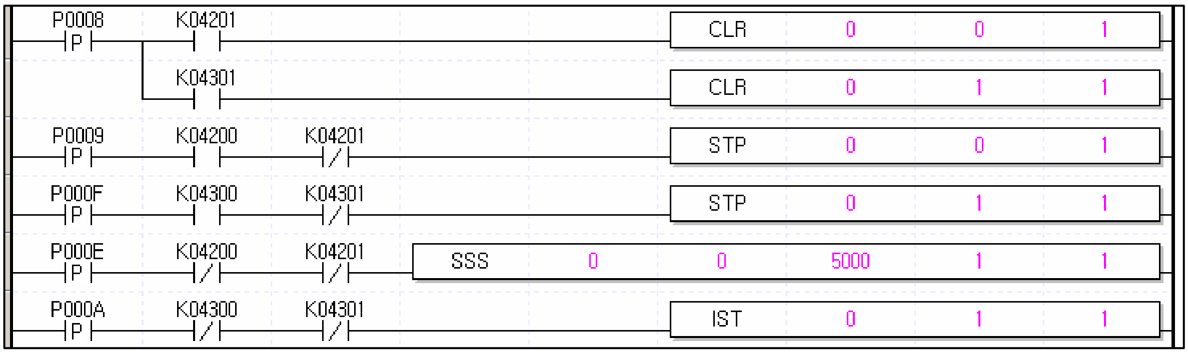
(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
Sub axis, X-axis	1	Absolute	Speed control	End	Single	0	0	0	No.1	1000	100
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Main axis, Y-axis	1	absolute	Speed control	End	Single	0	0	0	No.1	1000	100

(4) Speed synchronization setting

Command1	Main axis	1:Y axis
	Synchronization ratio	5000 : 50.00%
	Delay time	1:1ms

B) Program



9) Emergency stop

A) Description

(1) Devices used

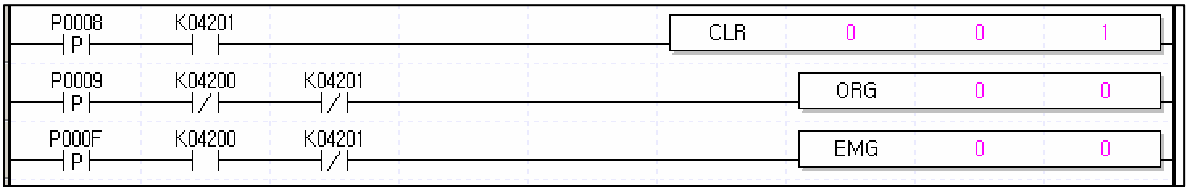
Device	Description
P0008	Error reset in emergency stop, no output cancel switch
P0009	X-axis home return switch
P000F	Emergency stop switch during home return
K4200	X-axis operating signal
K4201	X-axis error status signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

P0009(home return) switch On, Off => P000F(emergency stop) switch On, Off

- 2 axes are emergently stopped in case of emergency stop and both cancel ‘no output’ in case of error reset. To emergently stop axes individually, use emergency stop signal of a servo drive.

B) Program



10) Jog operation

A) Description

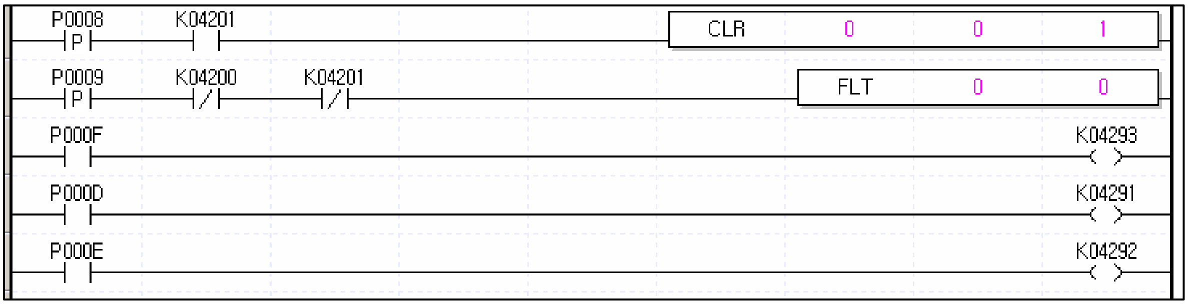
(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis floating origin switch
P000D	X-axis jog forward-rotation
P000E	X-axis jog reverse-rotation
P000F	X-axis jog low/high speed
K4200	X-axis operating signal
K4201	X-axis error status signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

P0009(floating origin) switch On,Off => P000F(jog low/high speed) switch Off => P000E(Jog forward rotation) switch On => P000F(jog low/high speed) switch On => P000E(jog forward rotation) switch Off => P000F(jog reverse rotation) switch On => P000F(jog reverse rotation) switch Off

B) Program



11) Inching Operation

A) Description

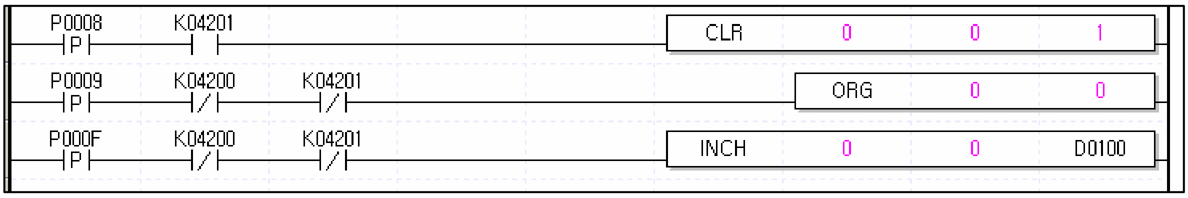
(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000F	X-axis inching operation switch
K4200	X-axis operating signal
K4201	X-axis error status signal
D0100 ~ D0101	Inching move(amount)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

P0009(home return) switch On, Off => P000F(inching operation) switch On, Off

B) Program



12) Speed override

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis floating origin switch
P000A	X-axis indirect start switch
P000F	X-axis speed override switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K420C	X-axis ACC signal
K420D	X-axis constant speed signal
D0100 ~ D0101	Speed override settings(1000pps)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

P0009(floating origin) switch On, Off => P000A(indirect start) switch On,Off => P000F(speed override)switch On,Off

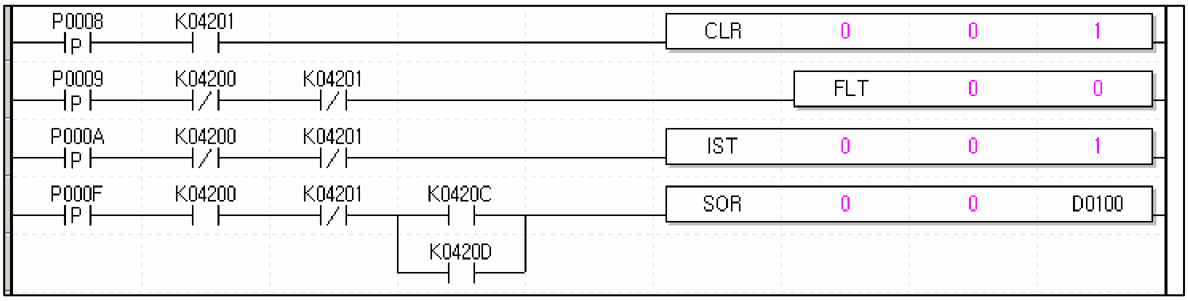
(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	100000	0	No.1	5000	100

↑

Changing operation speed to 1000

B) Program



13) Position override

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis floating origin switch
P000A	X-axis indirect start switch
P000F	X-axis position override switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K420D	X-axis constant speed signal
D0100 ~ D0101	Position override settings(120000 Pulse)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

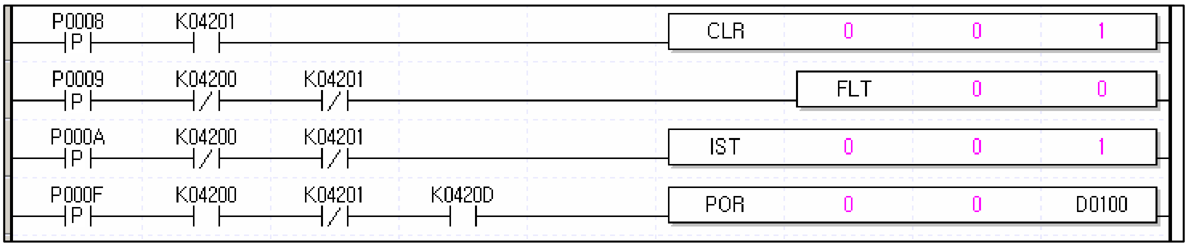
P0009(floating origin) switch On,Off => P000A(indirect start) switch On,Off => P000F(position override) switch On,Off

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	100000	0	No.1	5000	100

Changing a target position to 120000 during operation

B) Program



14) Positioning speed override

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis floating origin switch
P000A	X-axis indirect start switch
P000F	X-axis positioning speed override switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K420D	X-axis constant speed signal
D0100 ~ D0101	Positioning settings(50000pulse)
D0102 ~ D0103	Sped settings(10000pps)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

P0001(floating origin) switch On, Off => P0002(indirect start) switch On, Off => P000F(positioning speed override) switch On, Off

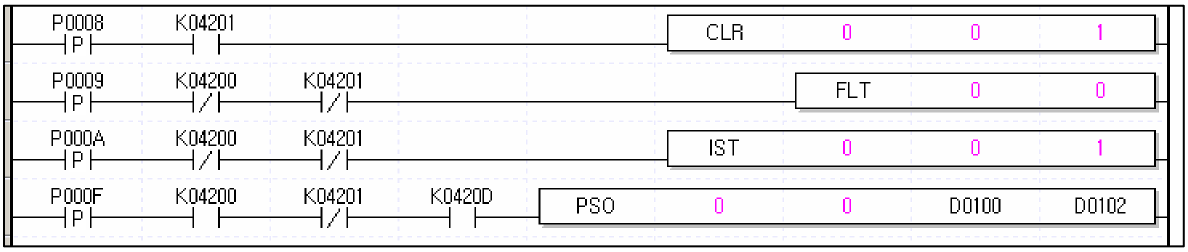
(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	100000	0	No.1	5000	100

Changing operation speed to 10000

Changing target position to 50000 during operation

B) Program



```
CLR 0 0 1
FLT 0 0
IST 0 0 1
PSO 0 0 D0100 D0102
```

15) Operation step change during repeat operation

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

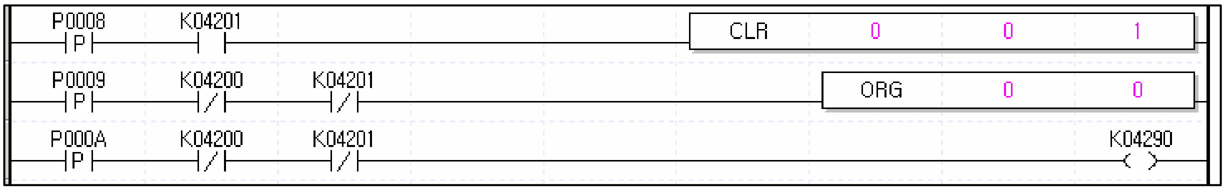
P0009(home return) switch On, Off => P000A(start) switch On, Off => P000A(start) switch On, Off

Depending on start switch On/Off, operation step works in good order of 1=>2=>10=>11=>1=>2….

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	10000	0	No.1	1000	100
	2	Absolute	Position control	End	Single	0	20000	0	No.1	1500	100
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	10	Absolute	Position control	End	Single	0	50000	0	No.1	1000	100
	11	Absolute	Position control	End	Single	0	60000	0	No.1	1500	100

B) Program



16) Present position change

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis start switch
P000F	X-axis present position change switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
D0100 ~ D0101	Present position present settings(3000)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

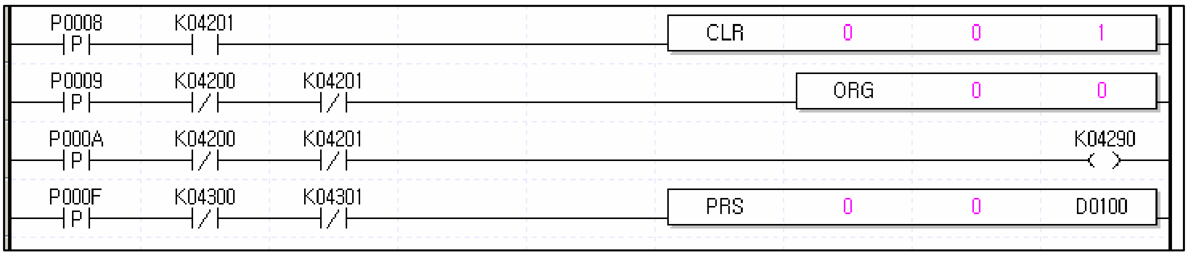
(2) Operation sequence

P0009(home return) switch On, Off => P000F(present position change) switch On, Off => P000A(start) switch On, Off

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	100000	0	No.1	5000	100

B) Program



17) Teaching(speed change)

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis start switch
P000F	X-axis speed change switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
K534 ~ K535	X-axis step 1 operation speed
D0100 ~ D0101	X-axis speed change data(3000)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

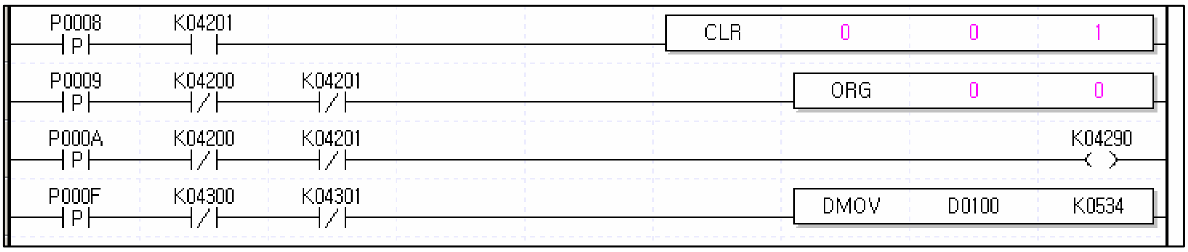
(2) Operation sequence

P0009(home return) switch On, Off => P000F(speed change) switch On,Off => P000A(start) switch On, Off

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Absolute	Position control	End	Single	0	10000	0	No.1	0	100

B) Program



Remark

1) Flash save of changed data(WRT)
If operation data is changed by DMOV command, it is necessary to use **WRT** command in order to save the changed value to flash memory. It is not possible to maintain the changed values when turning it off or changing a mode unless the values are saved by using **WRT** command.

2) Teaching is available for every item of operation data(Coordinate, control method and etc). However, teaching is not available for any operating step. Make sure to execute teaching to not-operating step.

18) Teaching(Position change)

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis start switch
P000F	X-axis position change switch
K4200	X-axis operating switch
K4201	X-axis error status signal
K4290	X-axis start signal
K530 ~ K531	X-axis step 1 target position
D0100 ~ D0101	X-axis position change data(5000)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

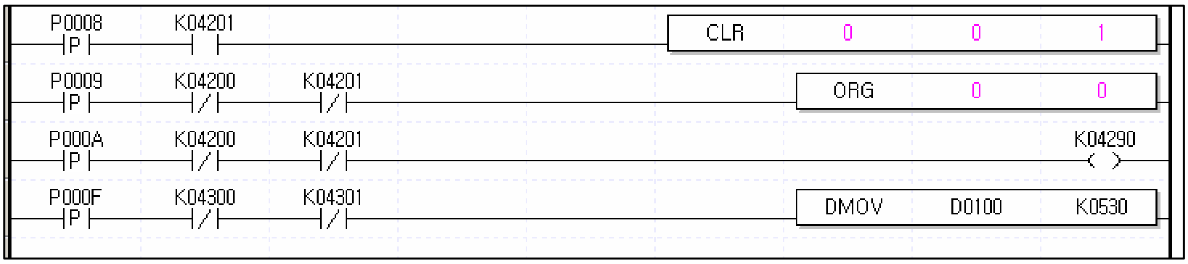
(2) Operation sequence

P0009(home return) switch On, Off => P000F(position change) switch On,Off => P000A(start) switch On, Off

(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Absolute	Position control	End	Single	0	0	0	No.1	500	100

B) Program



Remark

1) Flash save of changed data(WRT)

If operation data is changed by DMOV command, it is necessary to use **WRT** command in order to save the changed value to flash memory. It is not possible to maintain the changed values when turning it off or changing a mode unless the values are saved by using **WRT** command.

19) Teaching(Parameter Change)

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis start switch
P000E	X-axis parameter change switch(speed limit)
P000F	X-axis parameter change switch(ACC/DEC time 1)
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
K420D	X-axis constant speed signal
K426	X-axis present operation step number
K452 ~ K453	X-axis speed limit
K454	X-axis ACC time
K455	X-axis DEC time
D0100 ~ D0101	X-axis speed limit setting data(100000)
D0102	X-axis ACC time1 setting data(100)
D0103	X-axis ACC time1 setting data(100)
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

(2) Operation sequence

P0009(home return) switch On, Off => P000E(speed limit change) switch On, Off => P000F(ACC/DEC time1 change) switch On, Off =>P000A(start) switch On, Off

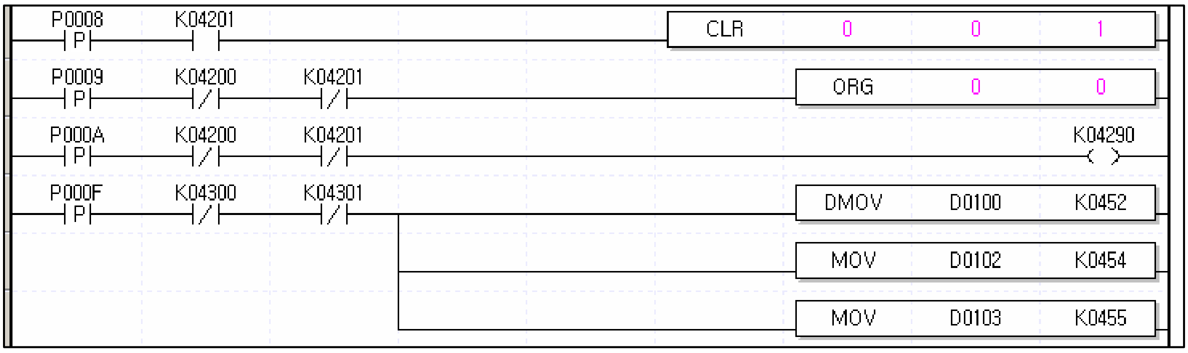
(3) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Absolute	Position control	End	Single	0	10000	0	1번	1000	100

(4) Basic parameter setting of internal memory

Parameter	Settings
Speed limit	100000
ACC time1	100
DEC time1	100

B) Program



Remark

1) Flash save of changed data(WRT)

If operation data is changed by DMOV command, it is necessary to use **WRT** command in order to save the changed value to flash memory. It is not possible to maintain the changed values when turning it off or changing a mode unless the values are saved by using **WRT** command.

20) M Code Cancel

A) Description

(1) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis start switch
P000F	X-axis M code cancel switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
K4203	X-axis M code On signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

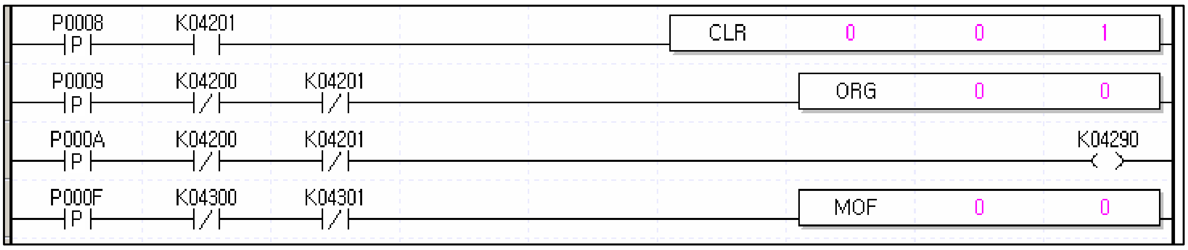
(2) Operation sequence

P0009(home return) switch On, Off => P000A(start) switch On, Off => P000F(M code cancel) switch On, Off => P000F(M code cancel) switch On, Off => P000F(M code cancel) switch On, Off

(3) Operation data and parameter settings

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Absolute	Position control	Continuous	Single	0	10000	1	No.1	1000	100
	2	Absolute	Position control	Continuous	Single	0	20000	2	No.1	1500	100
	3	absolute	Position control	End	Single	0	0	3	No.1	2000	100

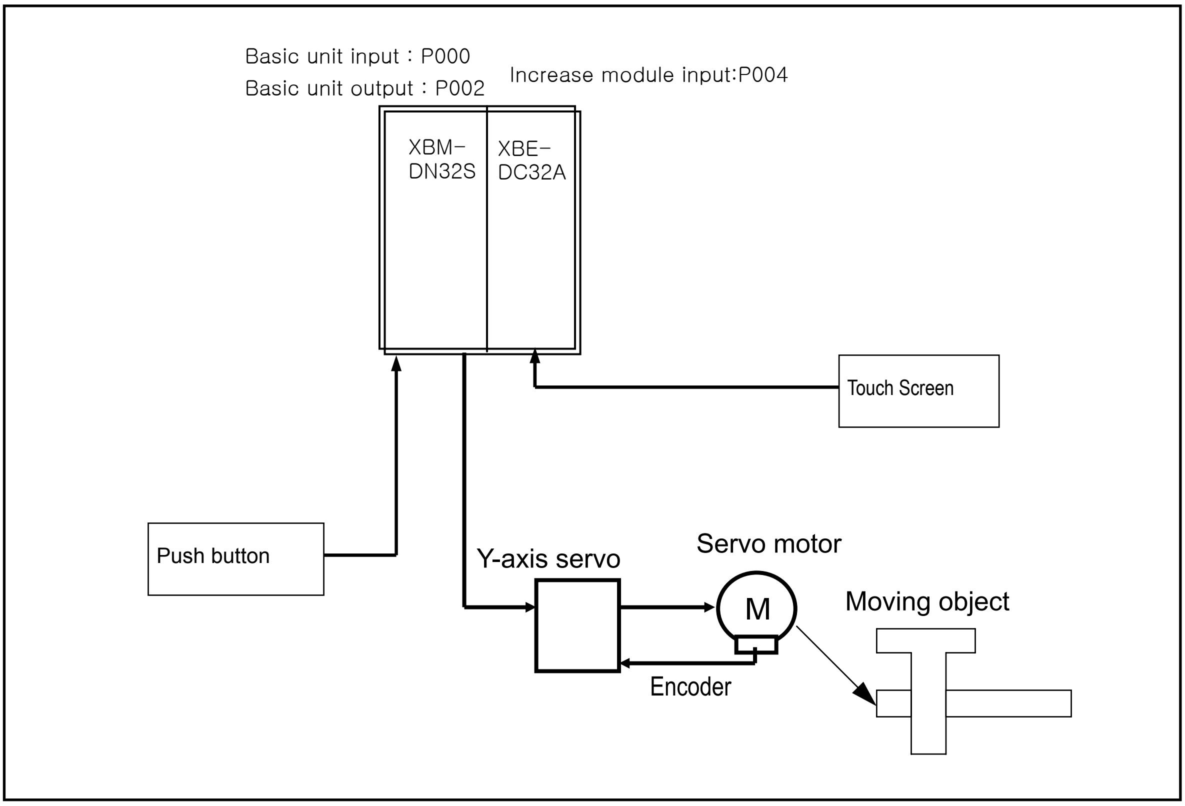
B) Program



9.7.2 Applications

1) Examples of Position change/speed change using HMI.

A) System structure



B) Description

Target position, forward rotation speed and reverse rotation speed are changed in touch screen with MOV command and if starting after home return, a servo motor rotates as much as speed/position move data set in the touch screen. At the moment, to save the changed value into flash memory, make sure to use WRT command. If saving the data into flash memory without WRT command, it does not save the changed values(settings) when it turns off or a mode is changed.

C) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis position change switch
P000B	X-axis forward rotation speed change switch
P000C	X-axis reverse rotation speed change switch
P000D	X-axis operation data flash save switch
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
K530 ~ K531	X-axis 1 step target position
K534 ~ K535	X-axis 1 step operation speed
K544 ~ K545	X-axis 2 step operation speed
D00500 ~ D00501	X-axis position change data
D00540 ~ D00541	X-axis forward rotation speed change data
D00542 ~ D00543	X-axis reverse speed change data
K420~K428	-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

D) Operation sequence

P0009(home return) switch On,Off => P000A(position change) switch On,Off => P000B(forward rotation speed change) switch On,Off => P000F(start) switch On,Off => P000C(reverse rotation speed change) switch On,Off => P000F(start) switch On,Off

Remark

❑ Make sure to turn on/off P000D(flash save) switch after commissioning. If any changed data is not saved in flash memory, the changed data is not saved in case of power off=> on or mode change.

E) Operation data setting

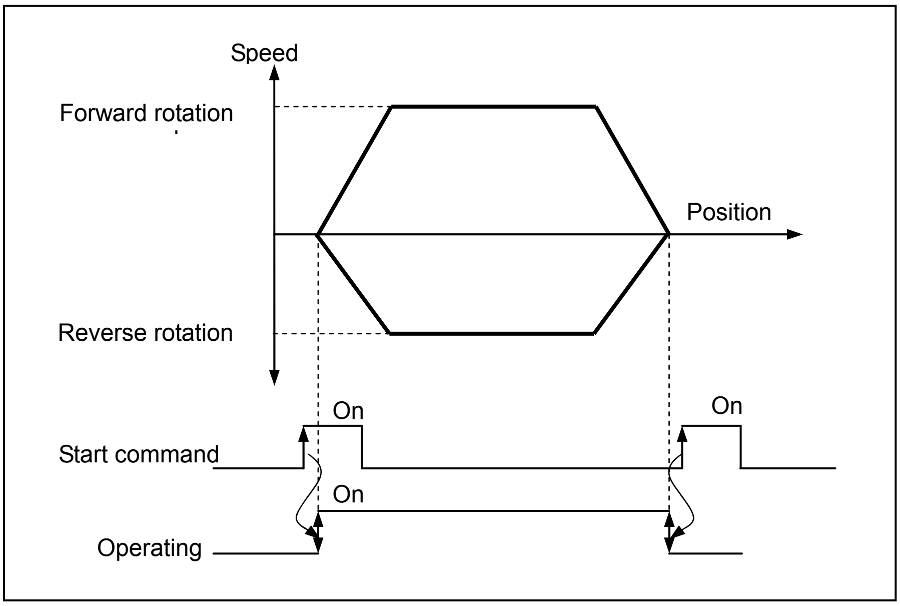
Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [ms]
X-axis	1	Absolute	Position control	End	Single	0	10000	0	No.1	500	20
	2	Absolute	Position control	End	Single	1	0	0	No.1	500	20

F) Internal memory setting

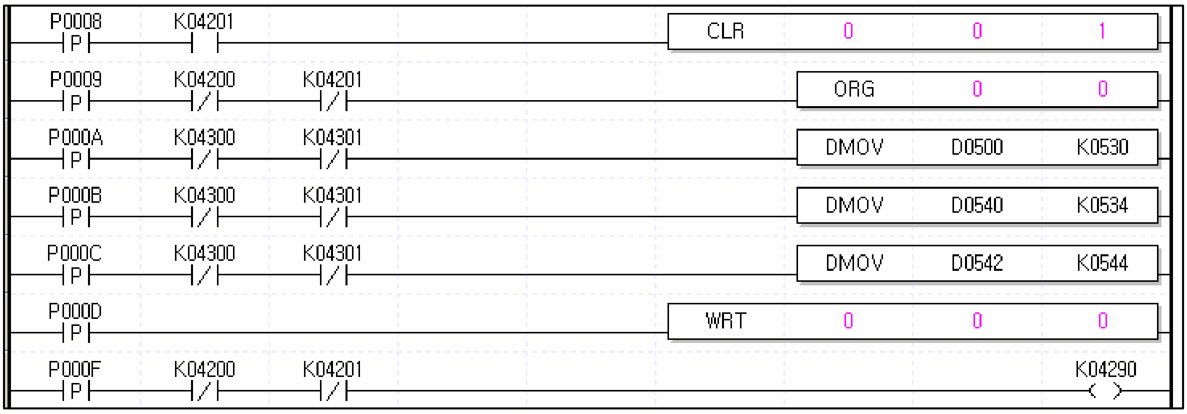
Internal memory content	Change setting (P000A)	Change setting (P000B)	Change setting (P000C)
Change data setting	D0500~D0501	D0540~D0541	D0542~D0543

▪ Changed data is saved as the data set on touch screen.

G) Operation pattern



H) Program



2) Positioning of End operation, continuous operation and sequential operation

A) System structure

System structure is as same as 9.3.1.

Remark

- Origin setting may be executed by three methods; method by home return, method by floating origin and present position preset method.

B) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
K420~K428	X-axis status info (refer to <9.4.1 Status monitoring flag for positioning>)

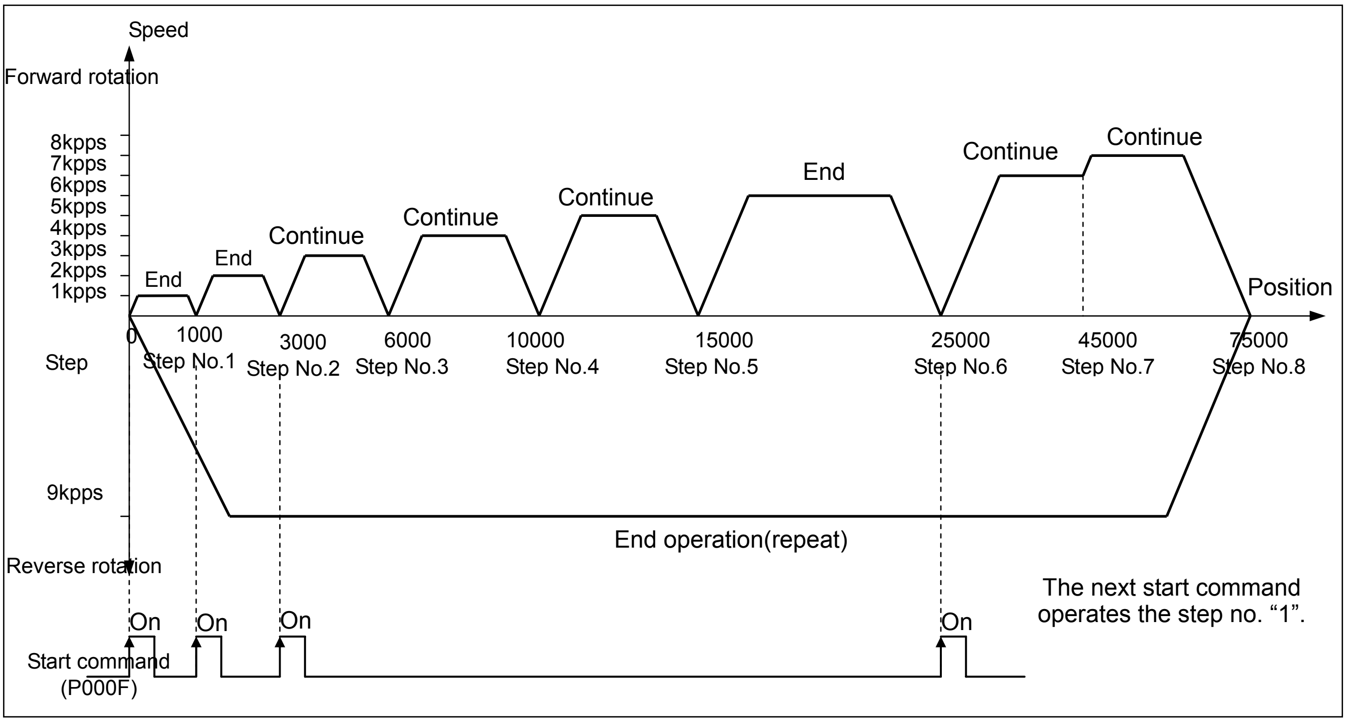
C) Operation sequence

P0009(home return) switch On,Off => P000F(start) switch On,Off 4 times

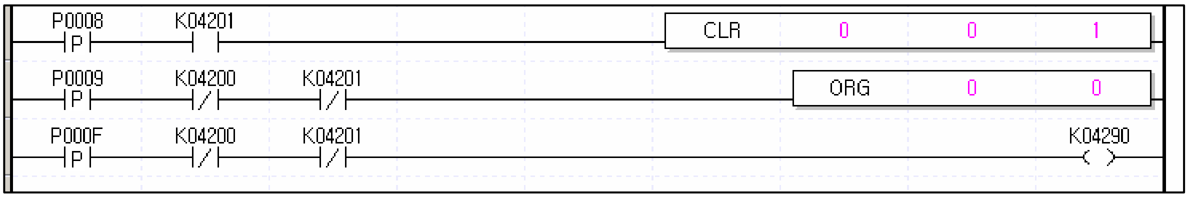
D) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Incremental	Position control	End	Single	0	1000	0	No.1	1000	20
	2	Incremental	Position control	End	Single	0	2000	0	No.1	2000	20
	3	Incremental	Position control	Continuous	Single	0	3000	0	No.1	3000	20
	4	Incremental	Position control	Continuous	Single	0	4000	0	No.1	4000	20
	5	Incremental	Position control	Continuous	Single	0	5000	0	No.1	5000	20
	6	Incremental	Position control	End	Single	0	10000	0	No.1	6000	20
	7	Incremental	Position control	Continuous	Single	0	20000	0	No.1	7000	20
	8	Incremental	Position control	Continuous	Single	0	30000	0	No.1	8000	20

E) Operation pattern



F) Program



3) Positioning using M code

A) System structure

System structure is as same as [position change, speed change using HMI].

B) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis M code cancel switch
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4203	X-axis M code On signal
K4290	X-axis start signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

C) Operation sequence

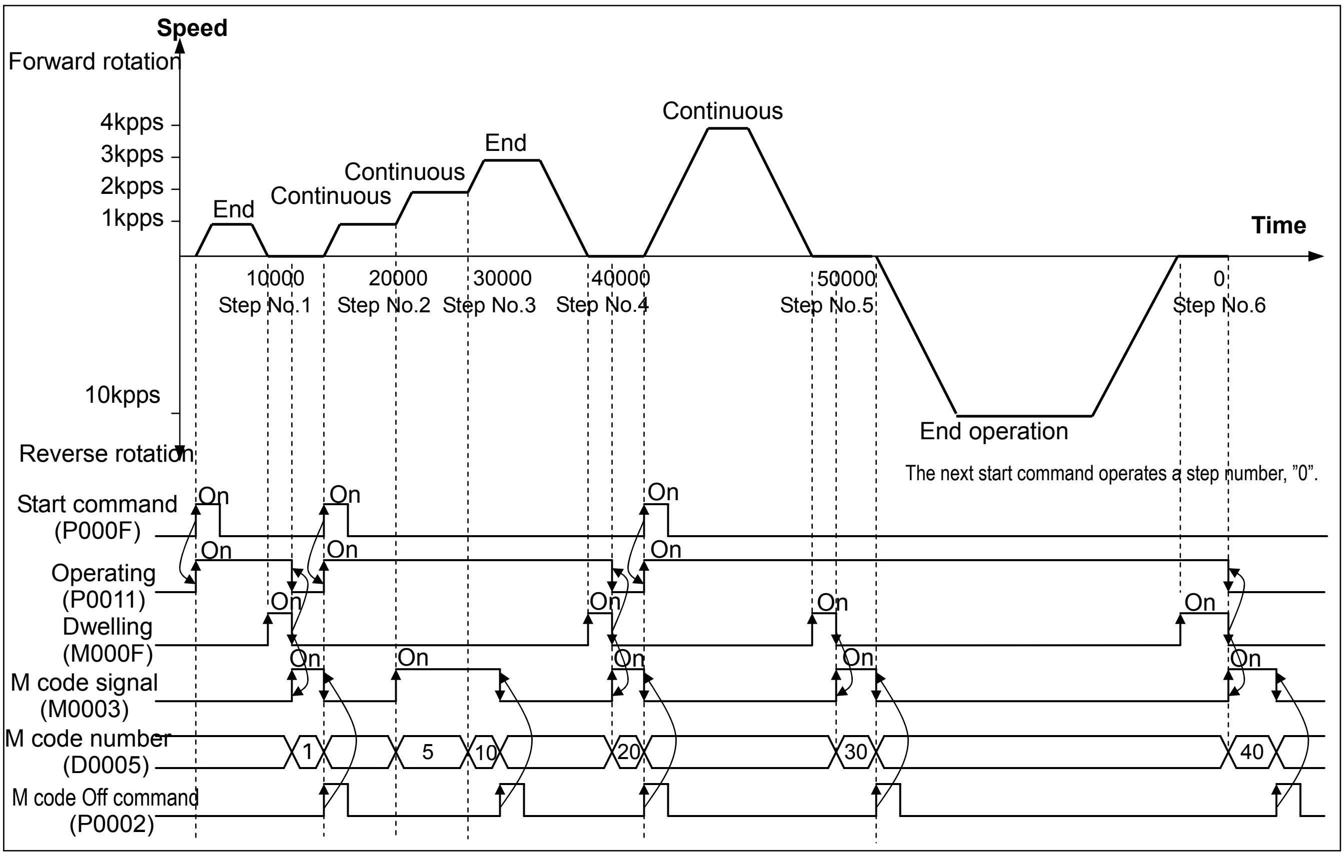
P0009(home return) switch On, Off => P000F(start) switch On, Off => P000A(M code cancel) switch On, Off => P000F(start) switch On, Off => P000A(M code cancel) switch On, Off => P000A(M code cancel) switch On, Off => P000F(start) switch On, Off => P000A(M code cancel) switch On, Off => P000A(M code cancel) switch On, Off

▪ Refer to start commands of operation pattern, M code Off commands.

D) Operation data settings

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Absolute	Position control	End	Single	0	10000	1	No.1	1000	100
	2	Absolute	Position control	Continuous	Single	0	20000	5	No.1	1000	100
	3	Absolute	Position control	Continuous	Single	0	30000	10	No.1	3000	100
	4	Absolute	Position control	End	Single	0	40000	20	No.1	4000	100
	5	Absolute	Position control	Continuous	Single	0	50000	30	No.1	5000	100
	6	Absolute	Position control	End	Single	1	0	40	No.1	6000	100

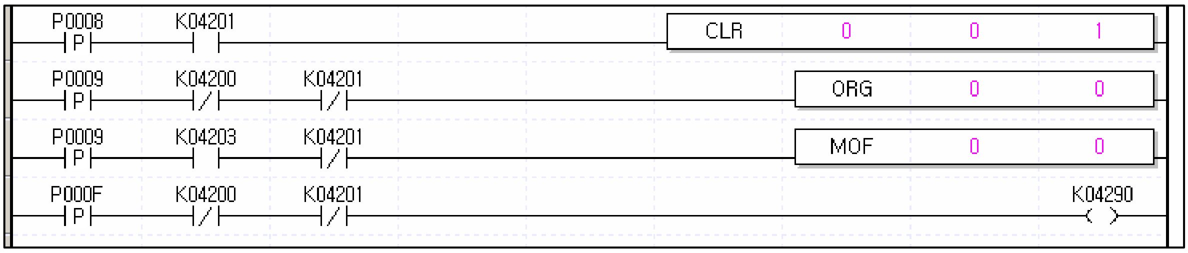
E) Operation pattern



Remark

- In sequential operation mode, M code signal is changed into a M code number without pause every time operation step number is changed and it Continuous operation.
- If M code signal is on in continuous operation mode, the next operation step number may be operated as long as M code "On" is changed to "off" with M code off command.

F) Program



4) 2-axes linear interpolation operation

A) System structure

System is structured to add Y-axis servo drive to X-axis servo drive of [position change, speed change using HMI.

B) Devices used

Device	Description
P0008	X-axis, Y-axis error reset, no output cancel switch
P0009	X-axis, Y-axis home return switch
P000F	2-axes linear interpolation operation switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4300	Y-axis operating signal
K4301	Y-axis error status signal
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)
K430~K438	Y-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

C) Operation sequence

P0009(home return) switch On, Off => P000F(linear interpolation) switch On, Off => P000F(linear interpolation) switch On, Off

D) Operation data setting

Position data items

X-axis

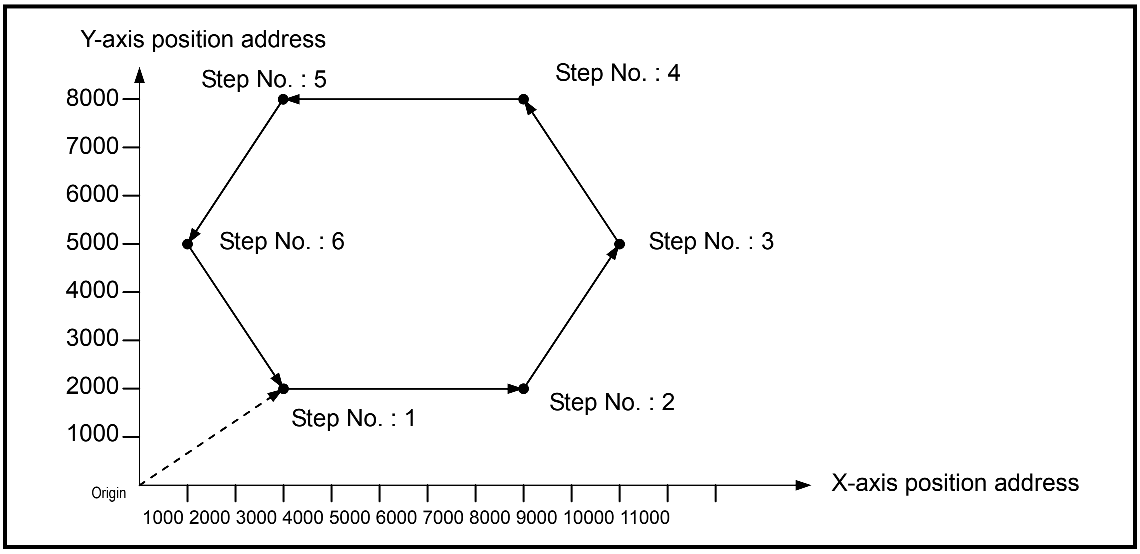
Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
1	Absolute	Position control	End	Single	0	3000	0	No.1	1000	100
2	Absolute	Position control	Continuous	Single	0	8000	0	No.1	1000	100
3	Absolute	Position control	Continuous	Single	0	10000	0	No.1	1000	100
4	Absolute	Position control	Continuous	Single	0	8000	0	No.1	1000	100
5	Absolute	Position control	Continuous	Single	0	3000	0	No.1	1000	100
6	Absolute	Position control	Continuous	Single	1	1000	0	No.1	1000	100

Position data items

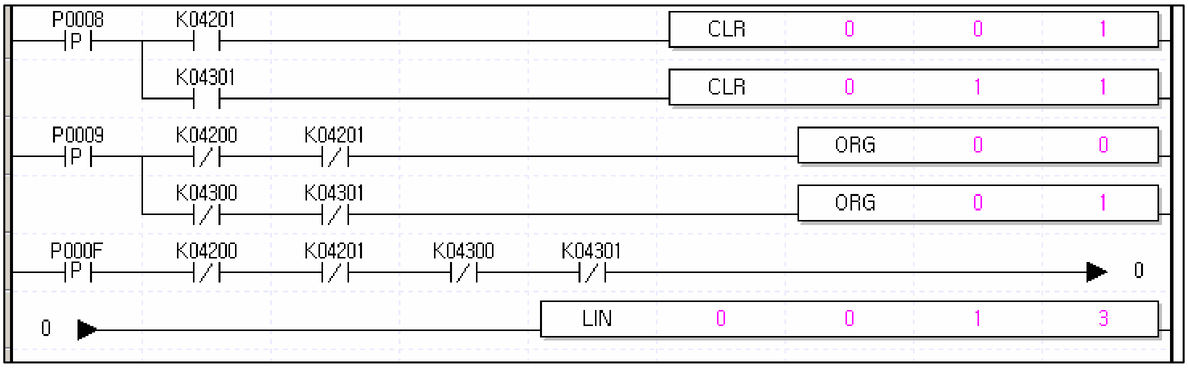
X-axis

Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
1	Absolute	Position control	End	Single	0	2000	0	No.1	1000	100
2	Absolute	Position control	Continuous	Single	0	2000	0	No.1	1000	100
3	Absolute	Position control	Continuous	Single	0	5000	0	No.1	1000	100
4	Absolute	Position control	Continuous	Single	0	8000	0	No.1	1000	100
5	Absolute	Position control	Continuous	Single	0	8000	0	No.1	1000	100
6	Absolute	Position control	Continuous	Single	1	5000	0	No.1	1000	100

E) Operation pattern

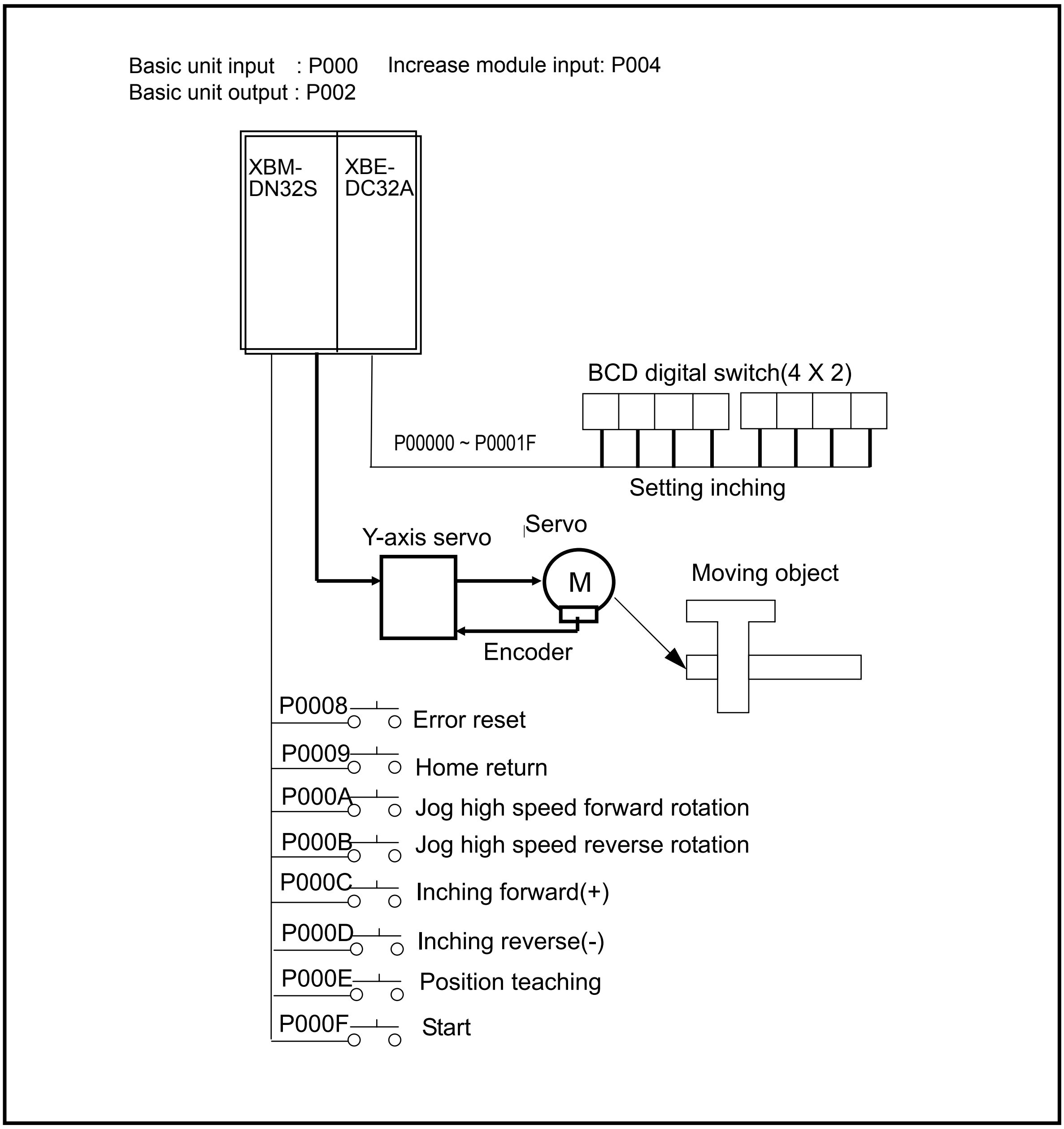


F) Program



5) Position change by Jog operation/inching operation

A) System structure



B) Devices used

Device	Description
P0008	X-axis error reset, no output cancel switch
P0009	X-axis home return switch
P000A	X-axis jog high speed forward rotation switch
P000B	X-axis jog high speed reverse rotation switch
P000C	X-axis inching forward rotation switch
P000D	X-axis inching reverse-rotation switch
P000E	X-axis position change switch
P000F	X-axis start switch
K4200	X-axis operating signal
K4201	X-axis error status signal
K4290	X-axis start signal
K530 ~ K531	X-axis 1 step target position
D00000 ~ D00001	X-axis present position
D0100 ~ D0101	Inching forward rotation settings
D0102 ~ D0103	Inching reverse rotation settings
K420~K428	X-axis status info(refer to <9.4.1 Status monitoring flag for positioning>)

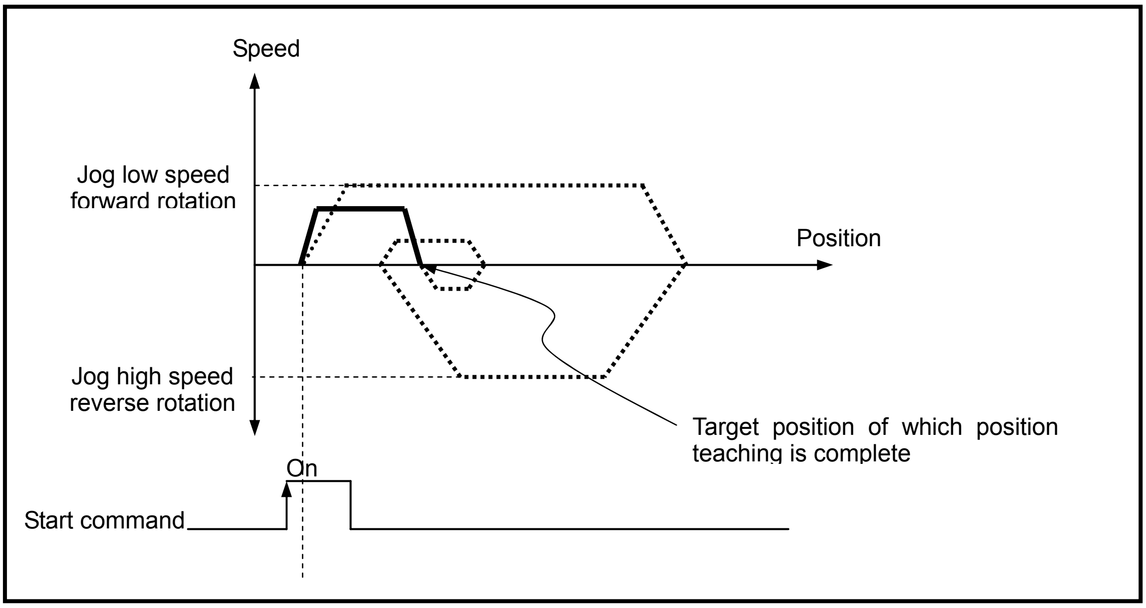
C) Operation sequence

P0009(home return) switch On, Off => P000A(jog high speed forward rotation) switch On, Off => P000B(jog high speed reverse rotation) switch On, Off => Setting inching move(amount) with BCD digital switch => P000C(inching forward rotation) switch On, Off => Setting inching move(amount) with BCD digital switch => P000D(inching reverse-rotation) switch On, Off => P000E(position change) switch On, Off => P0009(home return) switch On,Off => P000F(start) switch On, Off

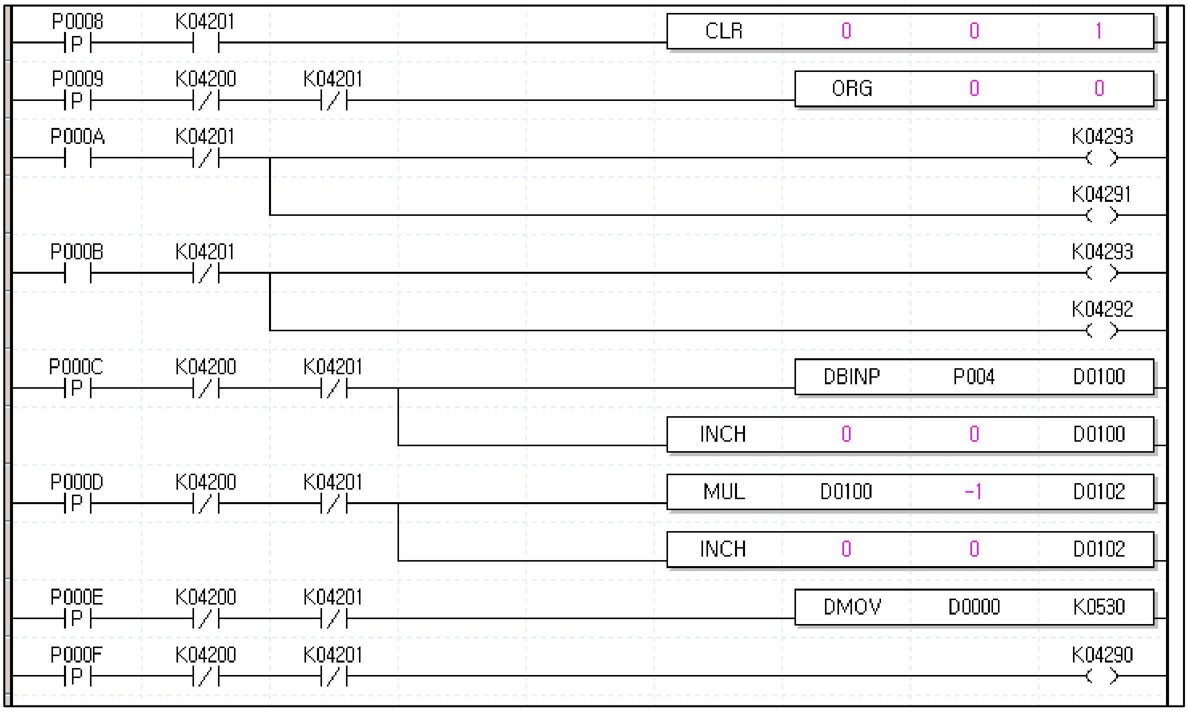
D) Operation data setting

Position data items	Step No.	Coordinate	Control method	Operation pattern	Operation method	Repeat step	Target position [pulse]	M code	ACC/DEC No.	Operation speed [pls/s]	Dwell time [㎳]
X-axis	1	Absolute	Position control	End	Single	0	0	0	No.1	1000	100
	2	Absolute	Position control	End	Single	0	0	0	No.1	0	0

E) Operation pattern



G) Program



Remark

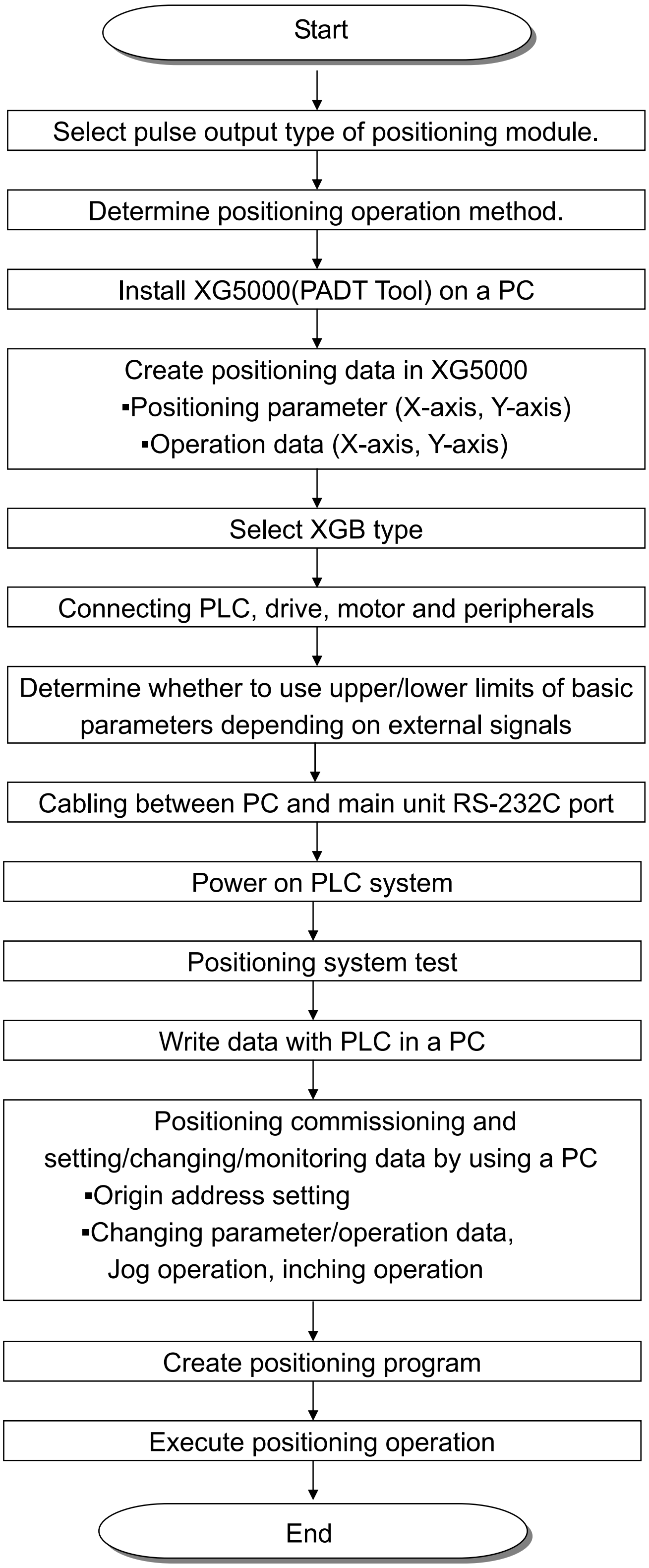
- Flash save of changed data(WRT)

  If operation data is changed by DMOV command, it is necessary to use **WRT** command in order to save the changed value to flash memory. It is not possible to maintain the changed values when turning it off or changing a mode unless the values are saved by using **WRT** command.

9.8 Operation Sequences and Installation

9.8.1 Operation sequences

- It describes the operation sequences when executing positioning operation with positioning module.



Select pulse output level and output type.
XGB series support the only Open Collector method

Determine home return method, coordinate and operation method for positioning operation.

Create software package(XG5000).

Use transistor output type main unit only.
XBM-DN16S, XBM-DN32S and etc

Power on when CPU module stops.

Check wiring by main unit's LED status and software package(XG5000)

Create with software package(XG5000).

Check whether the parameters, position data and speed data settings operation positioning are correct with software package commissioning mode, and change ands save them.

XG5000

9.8.2 Installation

1) Installation Environment

The device is highly reliable regardless of installation environments but the followings should be noted for securing reliability and stability.

A) Environmental conditions

- Install on a water-proof & dust proof control panel
- Place free of continuous impact or vibration
- Place out of direct sunrays.
- Place without dewing by sudden temperature change
- Place where ambient temperature is between 0~55℃

B) Installation construction

- If producing screw holes or wiring, it should be noted that any impurities from wiring work are not to be inserted into PLC.
- Install on an accessible place
- Do not install on high voltage device or same panel.
- Continuous it 50mm and wider out of duct or surrounding modules.
- Ground on a place where little noise is detected

2) Handling cautions

It describes cautions from unpacking positioning module to installing the system

A) Do not drop or apply any excessive impact on it
B) Do not separate PCB from case(shield), which may cause breakage.
C) Make sure that while wiring, any impurities should not be inserted into the upper part of this module If any impurities are found, clear them away.
D) Do not attach or detach the module once power is on.

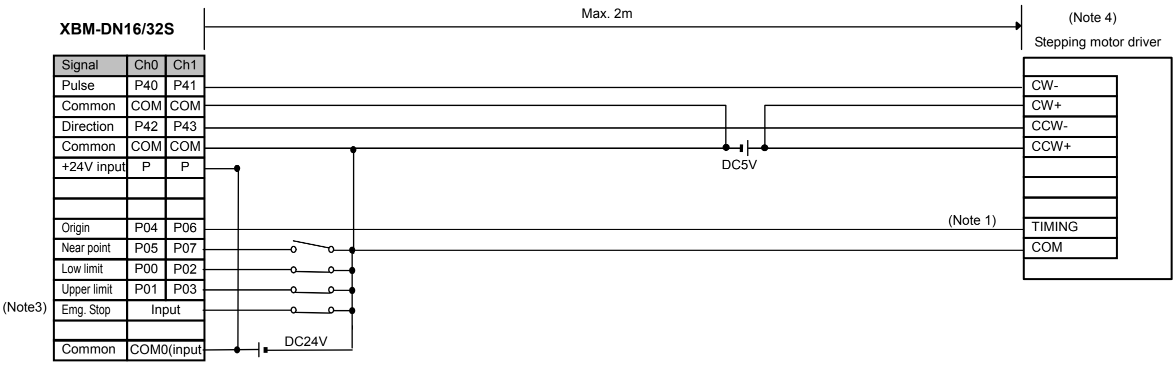
9.8.3 Wiring

1) Wiring cautions

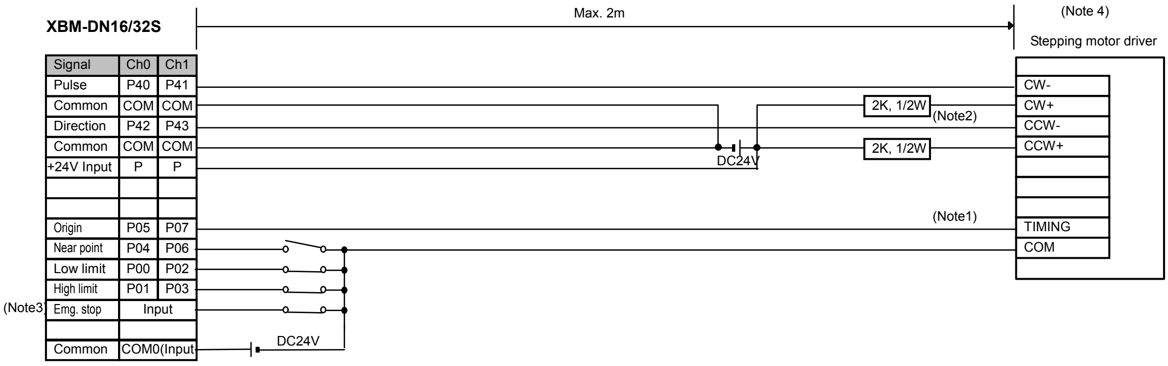
A) The length of cable connecting positioning module and drive should be as short as possible because the lengths are 2m and 10m respectively.
B) By using a separate cable, AC and external I/O signal of positioning module are not subject to any surge or induced noise generated from AC.
C) Cable should be selected considering ambient temperature and allowable current, and it is also recommended that the size should be more than the max size(AWG22(0.3㎟))
D) If wiring is too close to any hot devices or materials or contacts with oils for a long time, it may cause short circuit, malfunction or destruction.
E) Make sure to check the polarities before turn it on.
F) If wiring is linked with high voltage wire or power line, it may cause induction fault, probably resulting in malfunction or troubles
G) If wiring by using pipes, it needs grounding the pipes
H) Use the only stable power supplied from outside(DC 5V, DC 24V)
I) If it is suspicious that there is any noise source of wiring between positioning module and drive, make sure to connect them by using twisted pair wire or shield cable as the wiring of output pulse from positioning module to motor driver.

2) Example of connection between servo and stepping motor drive

A) Connection to a stepping motor driver(DC5V Power)



B) Connection to a stepping motor driver(DC 24V Power)

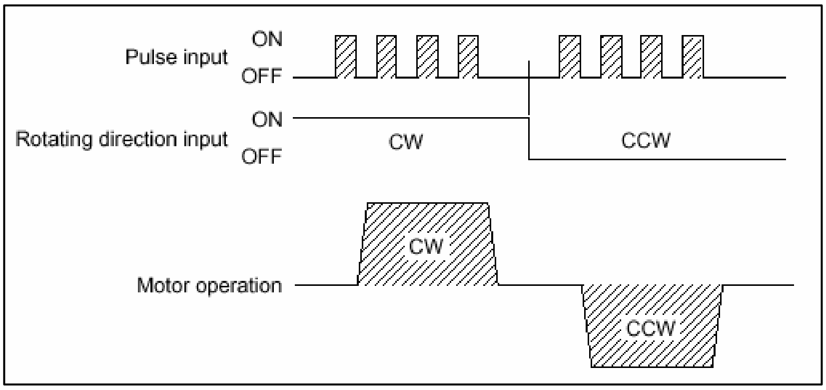


(Note1) In case of VEXTA PKD, timing output is on every time a motor rotates 7.2 degrees. For precise home return, timing output and origin sensor should be structured by AND circuit. Depending on a system's features, it is recommended to use **home return only by DOG signal or origin sensor by origin signal**(XGB origin input rating is DC 24V).

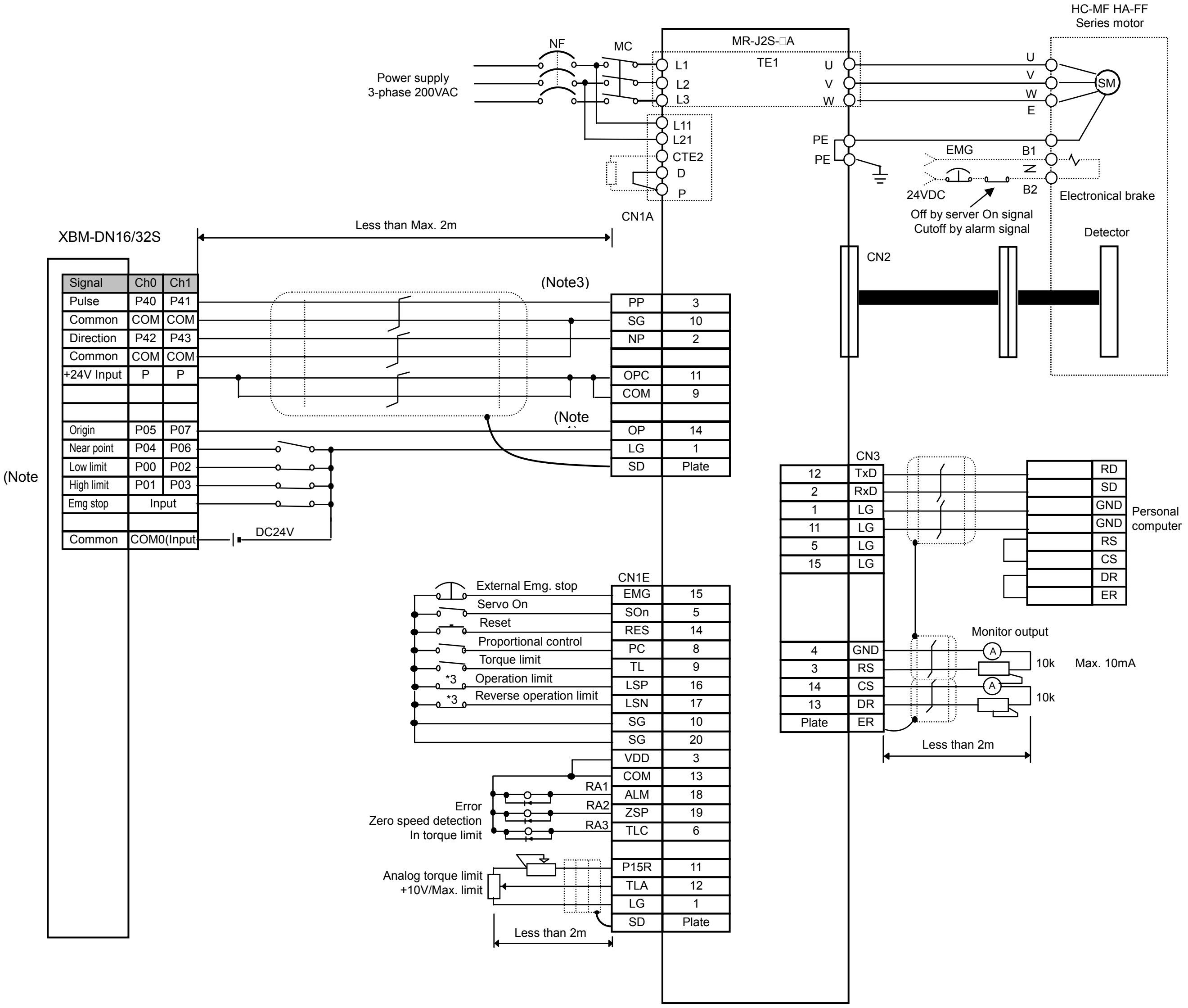
(Note2) Connect resistors suitable for the driver in series if DC24V is used.

(Note3) Although origin, DOC, upper/lower limit signals are with fixed contact, it may be used for general input if they are not used. Emergency stop is available by the command(EMG).

(Note4) Since the positioning pulse of XGB forward/reverse-rotates by the rotation direction as in the below figure, make sure to change the input mode of a stepping motor driver into 1 phase input mode prior to use.



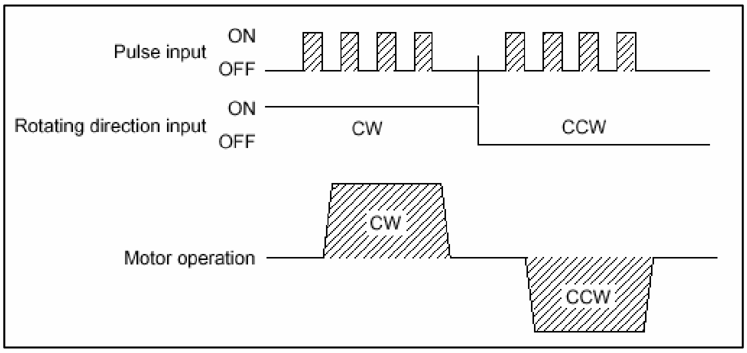
C) Connection to a servo motor driver(MR-J2/J2S-□A)



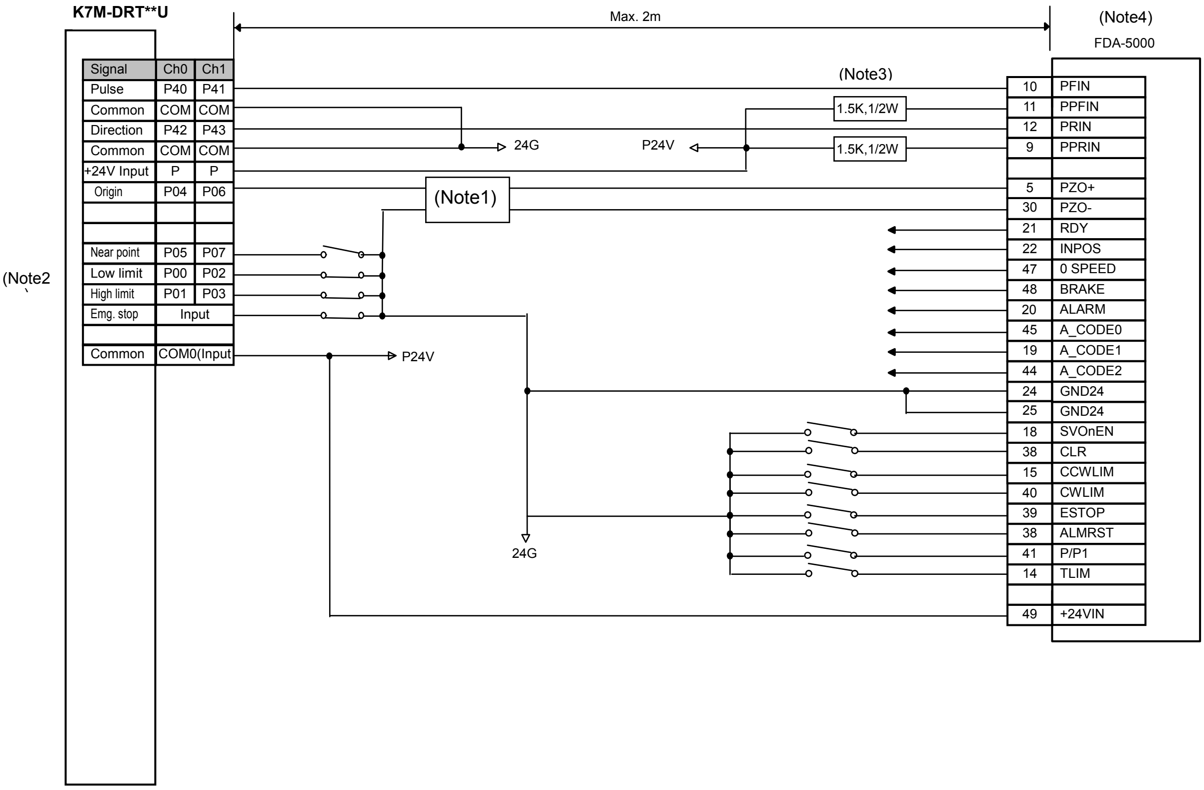
(Note1) The rating of XGB origin input is DC24V. Make sure to connect the open collector output of a driver.

(Note2) Although origin, DOC, upper/lower limit signals are with fixed contact, it may be used for general input if they are not used. Emergency stop is available by the command(EMG).

(Note3) Since the positioning pulse of XGB forward/reverse-rotates by the rotation direction as in the below figure, make sure to change the input mode of a stepping motor driver into 1 phase input mode prior to use.



D) Connection to a servo motor driver(XDA-A AC Servo Driver)

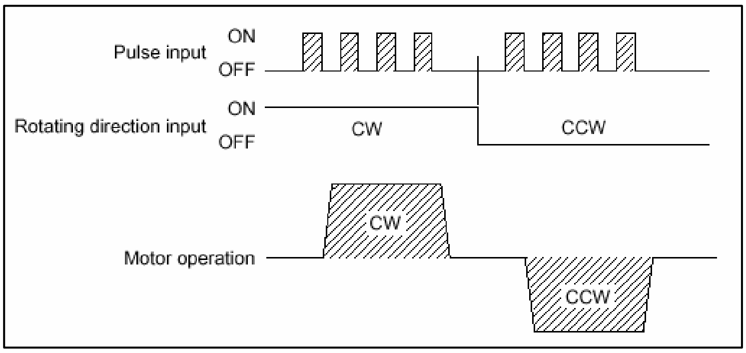


(Note1) The rating of XGB is 24VDC. If it is line driver output, contact is not connected. In the case, use a convert from line driver output to open collector output or use home return only by DOG signal/origin sensor of origin signal.

(Note2) Although origin, DOC, upper/lower limit signals are with fixed contact, it may be used for general input if they are not used. Emergency stop is available by the command(EMG).

(Note3) If using DC24V, make sure to connect resistor suitable for a driver(1.5K,1/2W) in series.

(Note4) Since the positioning pulse of XGB forward/reverse-rotates by the rotation direction as in the below figure, make sure to change the input mode of a stepping motor driver into 1 phase input mode prior to use.



9.9 Error Code List

It describes error codes and the countermeasures.
Regarding error code, monitor positioning monitoring window or X-axis : K427 & Y-axis : K437.

Error code	Description	Operation	Countermeasures
101	Exceeding the max speed range of basic parameter	Stop	Change the max speed value
102	Exceeding the bias speed of basic parameter	Stop	Re-adjust it lower then the max speed of basic parameter.
103	ACC time setting error	Stop	Re-adjust ACC time of basic parameter lower than 10,000
104	DEC time setting error	Stop	Re-adjust DEC time of basic parameter lower than 10,000
111	Expansion parameter soft upper/lower limit error	Stop	Re-adjust S/W upper limit equal to or larger than the lower limit.
121	Manual operation parameter jog high speed range exceeding error	Stop	Re-adjust to be max speed≥jog high speed≥vbias speed
122	Manual operation parameter jog low speed range exceeding error	Stop	Re-adjust to be jog high speed≥jog low speed≥ 1.
123	Manual operation parameter inching speed range exceeding error	Stop	Re-adjust to be max speed ≥ inching speed ≥ bias speed
131	Home return parameter home return mode value range exceeding error	Stop	Re-adjust to be 0 < home return parameter ≤ 3. (1:Dog/origin(On) 2:upper/lower limit/origin 3:DOG)
132	Home return parameter home return address range exceeding error	Stop	Re-adjust to be S/W upper limit ≥ home return address≥ S/W lower limit
133	Home return parameter home return high speed range exceeding error	Stop	Re-adjust to be max speed ≥home return high speed ≥ bias speed
134	Home return parameter home return low speed range exceeding error	Stop	Re-adjust to be home return high speed ≥home return low speed≥ bias speed
135	Home return dwell time out error of home return parameter	Stop	Re-adjust dwell time lower than 50000.
136	Home return ACC time setting error	Stop	Re-adjust home return ACC time lower than 10,000
137	Home return DEC time setting error	Stop	R-adjust home return Dec time lower than 10,000.
151	Operation speed '0' setting error of operation data	Stop	Set operation speed over '0'.
152	Operation speed of operation data exceeding the max speed	Stop	Re-adjust to be max speed ≥ operation speed.
153	Operation speed of operation data set lower than bias speed.	Stop	Re-adjust to be operation speed ≥ bias speed.
154	Exceeding dwell time setting range of operation data	Stop	Set dwell time lower than 50000.
155	Exceeding end/continuous/sequential setting range of operation data	Stop	Re-set operation pattern of operation data as one of 0:end, 1:continuous or 2:sequential
201	Home return command is unavailable during operation	Stop	Check whether command axis was not operating at the time o home return command.
202	Home return command is unavailable in case of 'no output' status.	Stop	Check whether command axis was not in 'no output' status at the time of home return command.
211	Floating origin setting command is unavailable during operation.	Stop	Check whether command axis was not operating at the time o floating origin setting command.
221	Direct start command is unavailable during operation.	Stop	Check whether command axis was not operating at the time of direct start command

Error code	Description	Operation	Countermeasures
222	Direct start command is unavailable in case of 'no output ' status.	Stop	Check whether command axis was not in 'no output' status at the time of direct start command.
223	Direct start command is unavailable in case of M code On	Stop	Check whether M code of command axis was not on at the time of direct start command.
224	Direct start command is unavailable without origin set in absolute coordinate.	Stop	Absolute coordinate operation is not available without origin set. Check whether operation data to operate and the current origin set.
231	Indirect start command is unavailable during operation	Operation	Check whether command axis was not operating at the time of indirect start command.
232	Indirect start command is unavailable in case of 'no output' status.	Stop	Check whether command axis was not in 'no output' status at the time of indirect command.
233	Indirect start command is unavailable in case of M code On.	Stop	Check whether M code signal of command axis was not on at the time of indirect start command.
234	Indirect start command is unavailable without origin set in absolute coordinate.	Stop	Absolute coordinate operation is not available without origin set. Check whether operation data to operate and the current origin set.
236	Continuous operation of indirect start is unavailable in speed control.	Stop	Re-set single or continuous operation if operation data control method is speed
241	Linear interpolation start is unavailable when main axis of linear interpolation s operating.	Operation	Check whether main axis was not operating at the time of linear interpolation command.
242	Linear interpolation start is unavailable when sub axis of linear interpolation is operating.	Operation	Check whether sub axis was not operating at the time of linear interpolation command.
244	Linear interpolation start is unavailable when main axis of linear interpolation is in 'Output disabled' status.	Stop	Check whether main axis was not in 'Output disabled' status at the time of linear interpolation command.
245	Linear interpolation start is unavailable when sub axis of linear interpolation is in 'Output disabled' status.	Stop	Check whether a sub axis was not in 'Output disabled' status at the time of linear interpolation command.
247	Linear interpolation start is unavailable when the M code signal of linear interpolation's main axis is on.	Stop	Check whether M code signal of main axis was not on at the time of linear interpolation command.
248	Linear interpolation start is unavailable when M code signal of linear interpolation's sub axis is on.	Stop	Check whether M code signal of sub axis was not on at the time of linear interpolation.
250	Absolute coordinate positioning operation is unavailable when the origin of linear interpolation sub axis is not set.	Stop	Absolute coordinate operation is not available without origin set. Check whether operation data to operate and the current origin set.
251	Absolute positioning operation is unavailable when the origin of linear interpolation's sub axis is not set.	Stop	Absolute coordinate operation is not available without origin set. Check whether operation data to operate and the current origin set.
253	Main axis and sub axis of linear interpolation are set incorrectly.	Stop	Check whether sub axis was not designated at the time of linear interpolation command.
257	Linear interpolation is not available when the target position of main axis does not have a target position.	Stop	Check whether the target position of operation data of a step for linear interpolation was not the present status in case of absolute coordinate or set to '0' in case of Incremental coordinate.
258	Linear interpolation is unavailable when main axis is controlling speed.	Stop	Check whether the control method of main axis operation data step for linear interpolation operation was not set by speed control.

Error code	Description	Operation	Countermeasures
259	Linear interpolation is unavailable when sub axis is controlling speed.	Stop	Check whether the control method of sub axis operation data step for linear interpolation was not set by speed control.
291	Concurrent start command is unavailable during operation.	Operation	Check whether an axis with error was not contained in concurrent start command and whether there wasn't any operating axis at the time of the command
292	Concurrent start command is unavailable in 'no output' status.	Stop	Check whether an axis with error was not contained in concurrent start command and whether it was not in 'no output' status at the time of the command.
293	Concurrent start command is not available with M code on	Stop	Check whether an axis with error was not contained in concurrent start command and whether M code signal was not on at the time of the command.
294	Concurrent start command is unavailable without origin set	Stop	Concurrent start command with origin set
296	When concurrent start command axis is incorrectly set.	Stop	Check whether only one axis was designated at the time of concurrent start command.
301	Speed/position switching command is unavailable while not operating.	Stop	Check whether an axis did not stop at the time of speed/position switching command.
302	Speed/position switching command is unavailable while not controlling speed.	Stop	Check whether an axis was not in speed control status at the time of speed/position switching command.
304	Speed/position switching command is unavailable without target position.	Stop	Check whether operation had a move(amount) at the time of speed/position switching command.
311	Position/speed switching command is unavailable while not operating.	Stop	Check whether an axis did not stop at the time of position/speed switching command.
312	Position/speed switching command is unavailable on a sub axis of synchronic operation.	Stop	Check whether an axis was operating as a synchronic operation sub axis at the time of position/speed switching command.
314	Position/speed switching command is unavailable during linear operation.	Operation	Check whether an axis was not in linear interpolation operation at the time of position/speed switching command.
321	DEC stop command is unavailable while not operating.	Stop	Check whether it was not operating at the time of DEC stop command.
322	DEC stop command is not available during jog operation.	Operation	Check whether it was not jog-operating at the time of DEC stop command.
341	Position synchronic command is not available during operation	Operation	Check whether an axis was not in operating at the time of position synchronic command
342	Position synchronic command is unavailable in 'no output' status.	Stop	Check whether an axis was not in 'no output' status at the time of position synchronic command.
343	Position synchronic command is unavailable with M code on.	Stop	Check whether M code signal of an axis was not on at the time of position synchronic command.
344	Position synchronic command is unavailable without origin set.	Stop	Absolute coordinate operation is not available without origin set. Check whether operation data to operate and the current origin set.

Error code	Description	Operation	Countermeasures
346	Position synchronic command is unavailable without origin of main axis set.	Stop	Check whether main axis was without origin set at the time o position synchronic command.
347	There is an error of setting main/sub axis of position synchronic command.	Stop	Check whether main axis of position synchronic command was no set equally with command axis.
351	Speed synchronic command is unavailable during operation.	Operation	Check whether an axis was not operating at the time of spee synchronic command.
352	Speed synchronic command is unavailable in 'no output' status.	Stop	Check whether an axis was not in 'no output' status at the time o speed synchronic command.
353	Speed synchronic command is unavailable with M code on	Stop	Check whether M code signal of an axis was not on at the time o speed synchronic command.
355	There is an error of main/sub axis setting of speed synchronic command.	Stop	Check whether the main axis of speed synchronic command wa not set equally with command axis.
356	There is an error of synchronization ratio setting of speed synchronic command	Stop	Check whether the synchronization ratio of speed synchroni command was not set between 0~10,000.
357	Delay time setting error	Stop	Check whether delay time was set between 1 ~ 10ms.
361	Position override command is unavailable in any other status but 'busy'	Stop	Check whether an axis did not stop at the time of position override command.
362	Position override command is unavailable during dwelling	Stop	Check whether an axis was not dwelling at the time of positio override command.
363	Position override command is unavailable in any other status but positioning operation.	Operation	Check whether an axis was not operating by position control at th time of position override command.
364	Position override command is unavailable for an axis of linear interpolation operation.	Operation	Check whether an axis was not in linear-interpolation operation a the time of position override command.
366	Position override command is unavailable for a synchronic operation sub axis.	Operation	Check whether an axis was not operating as a sub axis o synchronic operation at the time of position override command.
371	Speed override command is unavailable in any other status but 'busy'.	Stop	Check whether an axis did not stop at the time of speed override command.
372	Out-of speed override range error	Stop	Re-set the speed of speed override command equal to or lowe than the max speed set in the basic parameter.
373	Speed override command is unavailable to an sub axis of linear interpolation operation.	Operation	Check whether an axis was not operating as a sub axis of linea interpolation at the time of speed override command.
375	Speed override command is unavailable to an sub axis of synchronic operation	Operation	Check whether an axis was not operating as a sub axis o synchronic operation at the time of speed override command.
377	Speed override command is unavailable in a DEC section	Operation	Check whether an axis was not decelerating for stoppage at th time of speed override command.
381	Positioning speed override command is unavailable in any other status but 'operation'.	Stop	Check whether an axis did not stop at the time of positioning spee override command.
382	Positioning speed override command is unavailable in any other operation but 'positioning operation'	Stop	Check whether an axis was not in speed control operation at th time of positioning speed override.
383	Out of speed override range error of positioning sped override command	Stop	Check whether the speed of positioning speed override comman was not equal to or lower than the max speed set in parameter.

Error code	Description	Operation	Countermeasures
384	Positioning speed override command is unavailable to an sub axis of linear interpolation operation.	Operation	Check whether an axis was not operating as a sub axis of linear interpolation at the time of positioning speed override command.
386	Positioning speed override command is unavailable to an sub axis of synchronic operation.	Operation	Check whether an axis was not operating as a sub axis of synchronic operation at the time of positioning speed override command.
401	Inching command is unavailable during operation.	Operation	Check whether an axis was not operating at the time of inching command.
402	Inching command is unavailable in ‘no output’ status.	Stop	Check whether an axis was not in ‘no output’ status at the time of inching command.
411	Jog start command is unavailable during operation.	Operation	Check whether an axis was not operating at the time of jog start command.
412	Jog start command is unavailable in ‘no output’ status.	Stop	Check whether an axis was not in ‘no output’ status at the time of jog start command.
441	Start step number change/repeat operation start step number designation command is unavailable during operation.	Operation	Check whether an axis was not operating at the time of start step number change command.
442	Start step number change/repeat operation start step number command is unavailable during operation.	Stop	Check whether the step number of start step number change command or repeat operation start step number designation command is equal to or higher than 1 and lower and 30 or within the range.
451	Present position preset command is unavailable during operation.	Operation	Check whether an axis was not operating at the time of present position present command.
452	Sub position data may not be set exceeding soft upper/lower limits at the time of present position preset command.	Stop	Check whether the position of present position present command was within the soft upper/lower limits.
481	Internal emergency stop error	Stop	Remove emergency stop causes and clear the error by executing RST command.
491	External emergency stop error	Stop	Remove emergency stop causes and clear the error with RST command.
492	Hard upper limit error	Stop	Escape from external upper signal range by using jog command and clear the error with RST command.
493	Hard lower limit error	Stop	Escape from external upper signal range by using jog command and clear the error with RST command.
494	Upper/lower setting error	Stop	Check whether upper/lower limits were reversely set.
501	Soft upper limit error	Stop	Escape from soft upper limit range by using jog command and clear the error with RST command.
502	Soft lower limit error	Stop	Escape from soft lower limit range by using jog command and clear the error with RST command.
511	Direction turning error during sequential operation	Stop	Check whether the direction are turned during sequential operation.
512	Step number error during indirect start.	Stop	A step over 30 was set in a command. Re-set step number between 1 ~ 30.
513	Address error during indirect start.	Stop	Check whether it repetitively operates a step of which address is ‘0’ during indirection start.

Chapter 10 Built-in Communication Function

10. 1 XGT Dedicated Communication

10.1.1 XGT dedicated protocol

1) Introduction

Dedicated communication is a protocol for communication within XGT series. XGB's main unit has 2 channels built-in communication port and serves all channels dedicated communication. XGB's built-in Cnet communication uses only XGB main unit for a dedicated communication. That is, it doesn't need a separate Cnet I/F module to facilitate the user-intended communication system by utilizing reading or writing of any area in CPU, and monitoring function.

XGB main unit serves as follows;

- Individual/continuous reading of device
- Individual/continuous writing of device
- Reading CPU status
- Monitor devices registration
- Executing monitoring
- 1:1 connection (link between XGB's) system configuration (XGB main unit : RS-232C)

Remark

XGB's built-in communication function supports Cnet communication without any separate Cnet I/F module. It must be used under the following instructions.

1) Channel 0 of XGB's main unit supports 1:1 communication only. For 1:N system having master-slave Format, use RS-485 communication in channel 1 or XGB's main unit with XGL-C41A module connected. XGL-C41A module supports RS-422/485 protocol.
2) RS-232C communication cable for XGB's main unit is different from RS-232C cable for XG5000 (XG-PD) in pin arrangement and from the cable for Cnet I/F module, too. The cable can't be used without any treatment. For the detailed wiring method, refer to configuration of respective communication.
3) It's possible to set baud rate type and station No. in XG5000 (XG-PD).

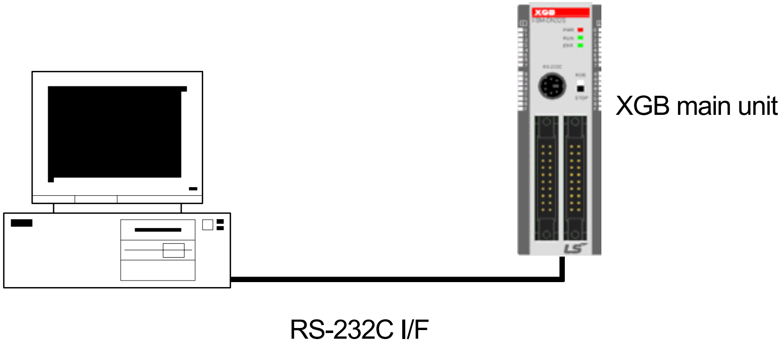
2) System configuration for dedicated communication

According to the method of connection, the system using XGB's built-in communication can be composed.

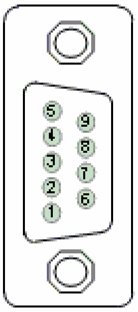
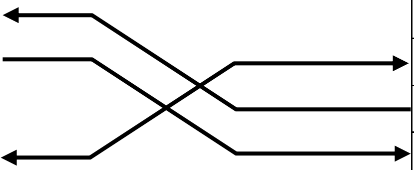
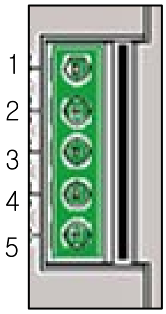
A) Connecting system configuration (Link between XGB's)

(1) 1:1 connection with general PC

- Communication program made by C or BASIC computer language on the user's computer, or utility program like FAM or CIMON can be used.

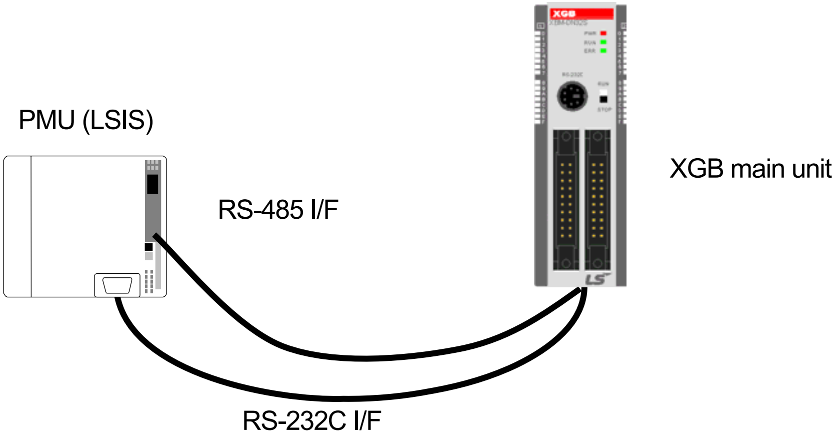


- Wiring

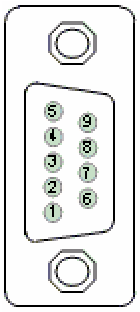
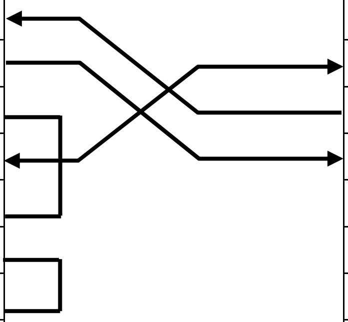
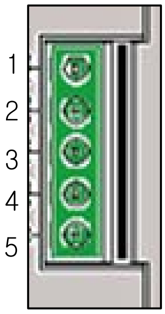
PC	PC	Pin assignment and direction	XGB main unit		XGB
	Pin No.		Pin No.	Signal	
 Female Type	1		1	485+	
	2(RXD)		2	485-	
	3(TXD)		3	GND	
	4		4	TXD	
	5(GND)		5	RXD	
	6				
	7				
	8				
	9				

In case channel 2 is used, it is connected using the 485+ and 485- of 485 terminals.

(2) 1:1 connection with a monitoring device like PMU

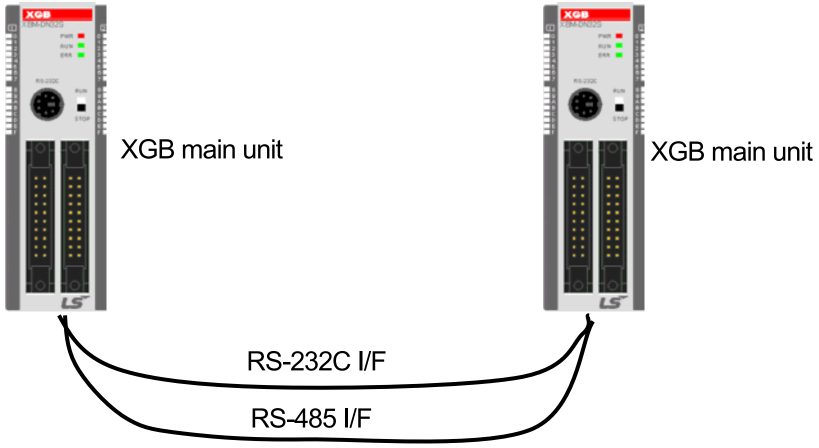


- Wiring

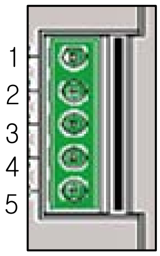
PC	PC	Pin assignment and direction	XGB main unit		PC
	Pin No.		Pin No.	Signal	
 Female Type	1		1	485+	
	2(RXD)		2	485-	
	3(TXD)		3	GND	
	4		4	TXD	
	5(GND)		5	RXD	
	6				
	7				
	8				
	9				

PMU	Pin assignment and direction	XGB main unit
485+	↔	485+
485-	↔	485-

(3) 1:1 connection with other XGB main unit



- Wiring

XGB	XGB main unit	Pin assignment and direction	XGB main unit	
	Pin No.		Pin No.	Signal
	1(485+)	───	1	485+
	2(485-)	───	2	485-
	3(GND)	───	3	GND
	4(TXD)	╳	4	TX
	5(RXD)		5	RX

3) Frame structure

A) Base format

(1) Request frame (external communication device → XGB main unit)(max. 256 bytes)

Header (ENQ)	Station number	Command	Command type	Structurized data area	Tail (EOT)	Frame check (BCC)

(2) ACK response frame (XGB main unit → external communication device, when receiving data normally) (max. 256 bytes)

Header (ACK)	Station number	Command	Command type	Structurized data area or null code	Tail (ETX)	Frame check (BCC)

(3) NAK response frame (Cnet I/F module → external communication device when receiving data abnormally)(max. 256 bytes)

Header (NAK)	Station number	Command	Command type	Error code (ASCII 4 Byte)	Tail (ETX)	Frame check (BCC)

Remark

1) The numerical data of all frames are ASCII codes equal to hexadecimal value, if there's no clear statement.

The terms in hexadecimal are as follows.

- Station No.
- When the main command is R(r) or W (w) and the command type is numerical (means a data type)
- All of the terms indicating size of all data in the Formatted data area.
- Monitoring registration and command registration number of execution commands.
- All contents of data

2) If it is hexadecimal, H is attached in front of the number of frames like H01, H12345, H34, H12, and H89AB.

3) Available frame length is maximum 256 bytes.

4) Used control codes are as follows.

Codes	Hex value	Name	Contents
ENQ	H05	Enquire	Request frame initial code
ACK	H06	Acknowledge	ACK response frame initial code
NAK	H15	Not Acknowledge	NAK response frame initial code
EOT	H04	End of Text	Request frame ending ASCII code
ETX	H03	End Text	Response frame ending ASCII code

5) If the command is small letter (r), BCC value is added in check frame. The other side capital letter (R), BCC value is not added in check frame.

B) Command frame sequence

- Sequence of command request frame

ENQ	Station No.	Command	Formatted data	EOT	BCC

ACK	Station No.	Command	Data or null	ETX	BCC

(PLC ACK response)

NAK	Station No.	Command	Error code	ETX	BCC

(PLC NAK response)

4) List of commands

List of commands used in dedication communication is as shown below.

Classification / Items		Command				Treatment
		Main command		Command type		
		Code	ASCII code	Code	ASCII code	
Reading device	Individual	r(R)	H72 (H52)	SS	5353	Reads data from device of Bit, Byte, Word type.
	Continuous	r(R)	H72 (H52)	SB	5342	Reads device Word in block unit. (Continuous reading Bit is unavailable)
Writing device	Individual	w (W)	H77 (H57)	SS	5353	Writes data to device of Bit, Byte and Word type.
	Continuous	w(W)	H77 (H57)	SB	5342	Writes data to Byte and Word type in block unit. (Continuous reading Bit is unavailable)

Classification / Item	Command			Treatment
	Main command		Register No.	
	Code	ASCII code	Register no.	
Monitoring variable register	x(X)	H78 (H58)	H00~H0F	Register device to monitor.
Execution of monitoring	y(Y)	H79 (H59)	H00~H0F	Execute registered device to monitor.

Remark

- XGB main unit identifies capitals or small letters for main commands, but not for the others.

5) Data type

It's possible to read and write device in built-in communication. When device is used, be aware of data type.

❑ Data type of variable

- Available types of device

Device	Range	Size (Word)	Remark
P	P0 – P127	128	Read/Write/Monitor available
M	M0 – M255	256	Read/Write/Monitor available
K	K0 – K255	256	Read/Write/Monitor available
F	F0 – F255	256	Read/Monitor available
T	T0 – T255	256	Read/Write/Monitor available
C	C0 – C255	256	Read/Write/Monitor available
L	L0 – L127	128	Read/Write/Monitor available
N	N0 – N3935	1024	Read/Monitor available
D	D0 – D5119	5120	Read/Write/Monitor available

- When device is designated, attach '%' (25H) in front of the marking characters. ('%' is stands for starting of device.)

Data type	Marking characters	Examples
Bit	X(58H)	%PX000,%MX000,%LX000,%KX000,%CX000,%TX000,%FX000 etc.
Byte	B(42H)	%PB000,%MB000,%LB000,%KB000,%CB000,%TB000,%FB000 etc.
Word	W(57H)	%PW000,%MW000,%LW000,%KW000,%CW000,%TW000,%FW000, %DW000,%SW000 etc.
Dword	D(44H)	%PD000,%MD000,%LD000,%KD000,%CD000,%TD000, %FD000,%DD000,%SD000 etc.
Lword	L(4CH)	%PL000,%ML000,%LL000,%KL000,%CL000,%TL000, %FL000,%DL000,%SL000 etc.

Remark

1) Timer/Counter used in bit command means contact point values. (word command means current values.)
2) Data register (D) and Step relay (R) can uses only word or byte commands.
3) In byte type commands, address is doubled. For example, D1234 is addressed to '%DW1234' in word type, and is addressed to '%DB2468' in byte type.

6) Execution of commands

A) Individual reading of device (R(r)SS)

(1) Introduction

This is a function that reads PLC device specified in accord with memory data type. Separate device memory can be read up to 16 at a time.

(2) PC request format

Format name	Header	Station No.	Command	Command type	Number of blocks	Device length	Device name	……	Tail	Frame check
Ex. of frame	ENQ	H20	R(r)	SS	H01	H06	%MW100		EOT	BCC
ASCII value	H05	H3230	H52(72)	H5353	H3031	H3036	H254D57313030		H04	-

1 block (setting can be repeated up to max. 16 blocks)

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ENQ to EOT is converted into ASCII and added to BCC. For example, the BCC of the above frame is gotten as below: H05+H32+H30+H72+H53+H53+H30+H31+H30+H36+H25+H4D+H57+H31+H30+H30+H04 = H03A4 Therefore BCC value is A4.
Number of Blocks	This specifies how much of the blocks composed of "[device length][device name]" are in this request format. This can be set up to 16. Therefore, the value of [Number of blocks] must be set between H01(ASCII value:3031)-H10(ASCII value:3030).
Device length (Length of device name)	This indicates the number of name's characters that means device, which is allowable up to 16 characters. This value is one of ASCII converted from hex type, and the range is from H01(ASCII value:3031) to H10(ASCII value:3130). For example, if the device name is %MW0, it has 4 characters to be H04 as its length. If %MW000 characters to be H06.
Device name	Address to be actually read is entered. This must be ASCII value within 16 characters, and in this name, digits, upper/lower case, '%' only is allowable to be entered.

Remark

'H' of example frame represents hex value, and is unnecessary during preparing real frame.

(3) XGB response format (ACK response)

Format name	Header	Station No.	Command	Command type	Number of blocks	Number of data	data	......	Tail	Frame check
Ex. of frame	ACK	H20	R(r)	SS	H01	H02	HA9F3		ETX	BCC
ASCII value	H06	H3230	H52(72)	H5353	H3031	H3032	H41394633		H04	

1 block(max. 16 blocks possible)

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>BCC</td><td>When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ACK to ETX is converted into ASCII and added to BCC, and sent.</td></tr>
<tr><td>Number of data</td><td>Number of data means byte number of hex type, and is converted into ASCII. This number is determined according to data type(X,B,W) included in device name of computer request Format.
• Number of data in accordance with its data type is as follows:
<table>
<tr><th>Data type</th><th>Available variable</th><th>Number of data</th></tr>
<tr><td>Bit(X)</td><td>%(P,M,L,K,F,T,C)X</td><td>1</td></tr>
<tr><td>Byte(B)</td><td>%(P,M,L,K,F,T,C,D,S)B</td><td>1</td></tr>
<tr><td>Word(W)</td><td>%(P,M,L,K,F,T,C,D,S)W</td><td>2</td></tr>
</table>
</td></tr>
<tr><td>Data</td><td>• In data area, there are the values of hex data converted to ASCII code saved.</td></tr>
</table>

Ex.1

The fact that number of data is H04(ASCII code value:H3034) means that there is hex data of 4 bytes in data .

Hex data of 4 bytes is converted into ASCII code in data.

Ex.2

If number of data is H04 and the data is H12345678, ASCII code converted value of this is "31 32 33 34 35 36 37 38," and this contents is entered in data area. Name directly, highest value is entered first, lowest value last.

Remark

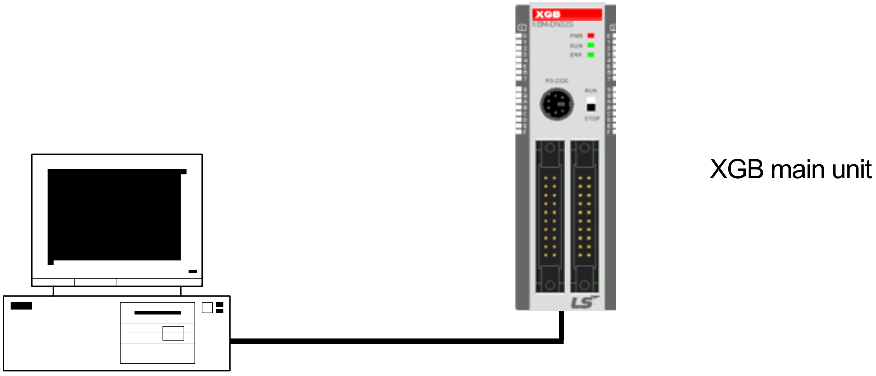
If data type is Bit, data read is indicated by bytes of hex. Namely, if Bit value is 0, it indicated by H00, and if 1, by H01.

(4) XGB response format (NAK response)

Format name	Header	Station No.	Command	Command type	Error code (Hex 2 Byte)	Tail	Frame check
Ex. of frame	NAK	H20	R(r)	SS	H1132	ETX	BCC
ASCII value	H15	H3230	H52(72)	H5353	H31313332	H03	

Item	Explanation
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from NAK to ETX is converted into ASCII and added to BCC.
Error code	Hex and 2 bytes(ASCII code, 4 bytes) indicate error type. Refer to 10.1.4 XGT dedicated communication error codes and countermeasures.

(5) Example



This example supposes when 1 WORD from M20 and 1 WORD from P001 address of station No.1 are read and BCC value is checked. Also it is supposed that H1234 is entered in M20, and data of H5678 is entered in P001.

① PC request format (PC → XGB main unit)

Format name	Header	Station No.	Command	Command type	Number of blocks	Variable length	Format name	Device length	Format name	Tail	Frame check
Ex. of frame	ENQ	H01	r	SS	H02	H05	%MW20	H06	%PW001	EOT	BCC
ASCII value	H05	H3031	H72	H5353	H3032	H3035	H254D57 3230	H3036	H25505730 3031	H04	-

② For ACK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No.	Command	Command type	Number of blocks	Number of data	Data	Number of data	Data	Tail	Frame check
Ex. of frame	ACK	H01	r	SS	H02	H02	H1234	H02	H5678	ETX	BCC
ASCII value	H06	H3031	H52(72)	H5353	H3032	H3032	H31323334	H3032	H35363738	H03	-

③ For NAK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No.	Command	Command type	Error code	Tail	Frame check
Ex. of frame	NAK	H01	r	SS	Error code (2 bytes)	ETX	BCC
ASCII value	H15	H3031	H52(72)	H5353	Error code (4 bytes)	H03	-

B) Continuous reading (R(r)SB) of device

(1) Introduction

This is a function that reads the PLC device memory directly specified in accord with memory data type. With this, data is read from specified address as much as specified continuously.

(2) PC request format

Format name	Header	Station No.	Command	Command type	Device length	Device	Number of data (Max. 128 Bytes)	Tail	Frame check
Ex. of frame	ENQ	H10	R(r)	SB	H06	%MW100	H05	EOT	BCC
ASCII value	H05	H3130	H52(72)	H5342	H3036	H254D573 13030	H3035	H04	-

Remark

1) Number of data specifies the number to read according to the type of data. Namely, if the data type of device is word and number is 5, it means that 5 words should be read.
2) Max. of %MW in number of data can be used up to 120(240bytes).
3) Protocol of RSB doesn't have number of blocks.
4) R(r)SB command of bit devices is not available.

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ENQ to EOT is converted into ASCII and added to BCC.
Device length (Length of device name)	This indicates the number of name's characters that means device, which is allowable up to 16 characters. This value is one of ASCII converted from hex type, and the range is from H01(ASCII value:3031) to H10(ASCII value:3130).
Device name	Address to be actually read is entered. This must be ASCII value within 16 characters, and in this name, digits, upper/lowercase, and '%' only are allowable to be entered.

(3) XGB response format (ACK response)

Format name	Header	Station No.	Command	Command type	Number of blocks	Number of data	data	Tail	Frame check
Ex. of frame	ACK	H10	R(r)	SB	H01	H02	H1122	EOT	BCC
ASCII value	H06	H3130	H52(72)	H5342	H3031	H3134	H31313232	H03	-

Item	Description
Number of data	It means byte number of hex type, and is converted into ASCII.

Data type	Available device	Data size (Byte)
BYTE(B)	%(P,M,L,K,F,T,C,D)B	1
WORD(W)	%(P,M,L,K,F,T,C,D)W	2
DWord(D)	%(P,M,L,K,F,T,C,D)D	4
LWord(L)	%(P,M,L,K,F,T,C,D)L	8

Ex.1

When memory type included in variable name of computer request Format is W(Word), and data number of computer request Format is 03, data number of PLC ACK response after execution of command is indicated by H06(2*03 = 06 bytes)Byte and ASCII code value 3036 is entered in data area.

Ex.2

In just above example, when data contents of 3 words are 1234, 5678, and 9ABC in order, actual ASCII code converted values are 31323334 35363738 39414243, and the contents are entered in data area.

(4) XGB response format (NAK response)

Format name	Header	Station No.	Command	Command type	Number of blocks	Number of data	data
Ex. of frame	NAK	H10	R(r)	SB	H1132	ETX	BCC
ASCII value	H15	H3130	H52(72)	H5342	H31313332	H03	-

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from NAK to ETX is converted into ASCII and added to BCC, and sent.
Error code	Hex and 2 bytes (ASCII code, 4 bytes) indicate error type. For the details, Refer to 10.1.4 XGT dedicated communication error codes and countermeasures.

(5) Example

This example supposes that 2 WORDs from M000 of station No. 10 is read and BCC value is checked. Also it is supposed that data in M000 and in M001 is as follow:

M000 = H1234
M001 = H5678

① PC request format (PC → XGB main unit)

Format name	Header	Station No.	Command	Command type	Device length	Device name	Number of data	Tail	Frame check
Frame (Example)	ENQ	H0A	R(r)	SB	H06	%MW000	H02	EOT	BCC
ASCII value	H05	H3041	H52(72)	H5342	H3036	H254D303030	H3032	H04	-

② For ACK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No.	Command	Command type	Number of data	Data	Tail	Frame check
Frame (Example)	ACK	H0A	R(r)	SB	H04	12345678	ETX	BCC
ASCII value	H06	H3041	H52(72)	H5342	H3034	H3132333435363738	03	-

③ For NAK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No	Command	Command type	Error code	Tail	BCC
Frame (Example)	NAK	H0A	R(r)	SB	Error code (2Byte)	ETX	BCC
ASCII value	H15	H3041	H52(72)	H5342	Error code (4Byte)	H03	-

C) Individual writing of device (W(w)SS)

(1) Introduction

This is a function that writes the PLC device memory directly specified in accord with memory data type.

(2) PC request format

Format name	Header	Station No.	Command	Command type	Number of blocks	Device Length	Device Name	Data	.....	Tail	Frame check
Frame (Example)	ENQ	H20	W(w)	SS	H01	H06	%MW100	H00E2		EOT	BCC
ASCII value	H05	H3230	H57(77)	H5353	H3031	H3036	H254D573130 30	H30304532		H04	-

1 block (setting can be repeated up to max. 16 blocks)

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ENQ to EOT is converted into ASCII and added to BCC.
Number of blocks	This specifies how much of the blocks composed of "[device length][device name]" are in this request Format. This can be set up to 16. Therefore, the value of [Number of blocks] must be set between H01(ASCII value:3031)-H10(ASCII value:3030).
Device Length (Name length of device)	This indicates the number of name's characters that means device, which is allowable up to 16 characters. This value is one of ASCII converted from hex type, and the range is from H01(ASCII value:3031) to H10(ASCII value:3130).
device	Address to be actually read is entered. This must be ASCII value within 16 characters, and in this name, digits, upper/lower case, and '%' only are allowable to be entered.
Data	If the value to be written in %MW100 area is H A, the data Format must be H000A. If the value to be written in %MW100 area is H A, the data Format must be H000A. In data area, the ASCII value converted from hex data is entered.

Ex.1
If type of data to be currently written is WORD, the data is H1234, ASCII code converted value of this is "31323334" and this content must be entered in data area. Namely, most significant value must be sent first, least significant value last.

Remark

1) Device data types of each block must be the same.
2) If data type is Bit, the data to be written is indicated by bytes of hex. Namely, if Bit value is 0, it must be indicated by H00(3030), and if 1, by H01(3031).

(3) Response format (ACK response)

Format name	Header	Station No.	Command	Command type	Tail	Frame check
Frame (Example)	ACK	H20	W(w)	SS	ETX	BCC
ASCII value	H06	H3230	H57(77)	H5353	H03	-

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ACK to ETX is converted into ASCII and added to BCC, and sent.

(4) Response format (NAK response)

Format name	Header	Station No.	Command	Command type	Error code (Hex 2 Byte)	Tail	Frame check
Frame (Example)	NAK	H20	W(w)	SS	H4252	ETX	BCC
ASCII value	H15	H3230	H57(77)	H5353	H34323532	H03	-

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from NAK to ETX is converted into ASCII and added to BCC, and sent.
Error code	Hex and 2 bytes(ASCII code, 4 bytes) indicate error type. For the details, Refer to 10.1.4 XGT dedicated communication error codes and countermeasures.

(5) Example

This example supposes that "HFF" is written in M230 of station No. 1.

① PC request format (PC → XGB main unit)

Format name	Header	Station No.	Command	Command type	Number of blocks	Device Length	Device Name	Data	Tail	Frame check
Frame (Example)	ENQ	H01	W(w)	SS	H01	H06	%MW230	H00FF	EOT	BCC
ASCII value	H05	H3031	H57(77)	H5353	H3031	H3036	H254D573233 30	H30304646	H04	-

② For ACK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No.	Command	Command type	Tail	Frame check
Frame (Example)	ACK	H01	W(w)	SS	ETX	BCC
ASCII value	H06	H3031	H57(77)	H5353	H03	-

③ For NAK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No.	Command	Command type	Tail	Tail	Format name
Frame (Example)	NAK	H01	W(w)	SS	Error code (2 Byte)	ETX	BCC
ASCII value	H15	H3031	H57(77)	H5353	Error code (4 Byte)	H03	-

D) Continuous writing of device (W(w)SB)

(1) Introduction

This is a function that directly specifies PLC device memory and continuously writes data from specified address as much as specified length.

(2) Request format

Format name	Header	Station No.	Command	Command type	Device Length	Device	Number of data (Max.128 Byte)	Data	Tail	Frame check
Frame (Example)	ENQ	H10	W(w)	SB	H06	%MW100	H02	H11112222	EOT	BCC
ASCII value	H05	H3130	H57(77)	H5342	H3036	H254D57313030	H3032	H3131313132323232	H04	

Remark

1) Number of data specifies the number according to the type of device. Namely, if the data type of device is WORD, and number of data is 5, it means that 5 WORDs should be written.
2) Number of data can be used up to 240Bytes(120 Words).

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ENQ to EOT is converted into ASCII and added to BCC.
Device Length (Name length of variable)	This indicates the number of name's characters that means device, which is allowable up to 16 characters. This value is one of ASCII converted from hex type, and the range is from H01(ASCII value:3031) to H10(ASCII value:3130).
device	Address to be actually read. This must be ASCII value within 16 characters, and in this name, digits, upper/lower case, and '%' only are allowable to be entered.

(3) Response format (ACK response)

Format name	Header	Station No.	Command	Command type	Tail	Frame check
Frame (Example)	ACK	H10	W(w)	SB	ETX	BCC
ASCII value	H06	H3130	H57(77)	H5342	H03	

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ACK to ETX is converted into ASCII and added to BCC, and sent.

(4) Response format NAK response)

Format name	Header	Station No.	Command	Command type	Error code (Hex 2 Byte)	Tail	Frame check
Frame (Example)	ENQ	H10	W(w)	SB	H1132	EOT	BCC
ASCII value	H05	H3130	H57(77)	H5342	H31313332	H03	

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from NAK to ETX is converted into ASCII and added to BCC, and sent.
Error code	Hex and 2 bytes(ASCII code, 4 bytes) indicate error type. For the details, Refer to 10.1.4 XGT dedicated communication error codes and countermeasures.

(5) Example

This example supposes that 2 byte H'AA15 is written in D000 of station No. 1.

① PC request format (PC → XGB main unit)

Format name	Header	Station No.	Command	Command type	Device Length	Device	Number of data	Data	Tail	Frame check
Frame (Example)	ENQ	H01	W(w)	SB	H06	%DW000	H01	HAA15	EOT	BCC
ASCII value	H05	H3031	H57(77)	H5342	H3036	H254457303030	H3031	H41413135	H04	

② For ACK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No.	Command	Command type	Tail	Frame check
Frame (Example)	ACK	H01	W(w)	SB	ETX	BCC
ASCII value	H06	H3031	H57(77)	H5342	H03	

③ For NAK response after execution of command (PC ← XGB main unit)

Format name	Header	Station No.	Command	Command type	Tail	Frame check	Format name
Frame (Example)	NAK	01	W(w)	SB	Error code (2)	ETX	BCC
ASCII value	H15	H3031	H57(77)	H5342	Error code (4)	H03	

E) Monitor variable register(X##)

(1) Introduction

Monitor register can separately register up to 10 in combination with actual variable reading command, and carries out the registered one through monitor command after registration.

(2) PC request format

Format name	Header	Station No.	Command	Registration No.	Registration format	Tail	Frame check
Frame (Example)	ENQ	H10	X(x)	H09	Refer to registration format	EOT	BCC
ASCII value	H05	H3130	H58(78)	H3039	Refer to *1	H04	-

Item	Description
BCC	When command is lowercase(x), only one lower byte of the value resulted by adding 1 byte each to ASCII values from ENQ to EOT is converted into ASCII, added to BCC.
Register No.	This can be registered up to 10(0 to 9, H00-H09), and if an already registered No. is registered again, the one currently being executed is registered.
Register Format	This is used to before EOT in command of Formats of separate reading of variable, continuous reading, and named variable reading.

*1: Register Format of request Formats must select and use only one of the followings.

①Individual reading of device

RSS	Number of blocks(2 Byte)	Device length (2 Byte)	Device name (16 Byte)	...

1 block (max. 16 blocks)

②Continuous reading of device

RSB	Device length (2 Byte)	Device name (16 Byte)	Number of data

(3) Response format (ACK response)

Format name	Header	Station No.	Command	Command type	Tail	Frame check
Frame (Example)	ACK	H10	X(x)	H09	ETX	BCC
ASCII value	H06	H3130	H58(78)	H3039	H03	-

Item	Description
BCC	When command is lowercase(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from ACK to ETX is converted into ASCII and added to BCC, and sent.

(4) Response format (NAK response)

Format name	Header	Station No.	Command	Registration No.	Error code (Hex 2Byte)	Tail	Frame check
Frame (Example)	ACK	H10	X(x)	H09	H1132	ETX	BCC
ASCII value	H06	H3130	H58(78)	H3039	H31313332	H03	

Item	Description
BCC	When command is one of lower case(r), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from NAK to ETX is converted into ASCII and added to BCC, and sent.
Error code	Hex and 2 bytes (ASCII code, 4 bytes) indicate error type. For the details, Refer to 10.1.4 XGT dedicated communication error codes and countermeasures.

(5) Example

This example supposes that device M000 of station NO. 1 is monitor registered.

① PC request format (PC → XGB basic unit)

Format name	Header	Station No.	Command	Registration No.	Registration Format				Tail	Frame check
					R##	Number of blocks	Device length	Device name		
Frame (Example)	ENQ	H01	X(x)	H01	RSS	H01	H06	%MW000	EOT	BCC
ASCII value	H05	H3031	H58(78)	H3031	H525353	H3031	H3036	H255457303030	H04	-

② For ACK response after execution of command (PC ← XGB unit)

Format name	Header	Station No.	Command	Registration No.	Tail	Frame check
Frame (Example)	ACK	H01	X(x)	H01	ETX	BCC
ASCII value	H06	H3031	H58(78)	H3031	H03	-

③ For NAK response after execution of command (PC ← XGB unit)

Format name	Format name	Header	Station No.	Command	Registration No.	Tail	Frame check
Frame (Example)	NAK	H01	X(x)	H01	Error code(2)	ETX	BCC
ASCII value	H15	H3031	H58(78)	H3031	Error code(4)	H03	-

E) Monitor execution(Y##)

(1) Introduction

This is a function that carries out the reading of the variable registered by monitor register. This also specifies a registered number and carries out reading of the variable registered by the number.

(2) PC request format

Format name	Header	Station No.	Command	Registration No.	Tail	Frame check
Frame (Example)	ENQ	H10	Y(y)	H09	EOT	BCC
ASCII value	H05	H3130	H59(79)	H3039	H03	

Item	Description
Register No.	Register No. uses the same number registered during monitor register for monitor execution. It is possible to set from 00-09(H00-H09).
BCC	When command is lower case(y), only one lower byte of the value resulted by adding 1 byte each to ASCII values from ENQ to EOT is converted into ASCII, added to BCC.

(3) Response format (ACK response)

① In case that the register Format of register No. is the Individual reading of device

Format name	Header	Station No.	Command	Registration No.	Number of Blocks	Number of data	Data	Tail	Frame check
Frame (Example)	ACK	H10	Y(y)	H09	H01	H02	H9183	ETX	BCC
ASCII value	H06	H3130	H59(79)	H3039	H3031	H3032	H39313833	H03	

② In case that the register Format of register No. is the continuous reading of device

Format name	Header	Station No.	Command	Registration No.	Number of data	Data	Tail	Frame check
Frame (Example)	ACK	H10	Y(y)	H09	H04	H9183AABB	ETX	BCC
ASCII value	H06	H3130	H59(79)	H3039	H3034	H3931383341414242	H03	

(4) Response Format (NAK response)

Format name	Header	Station No.	Command	Registration No.	Error code (Hex 2Byte)	Tail	Frame check
Frame (Example)	NAK	H10	Y(y)	H09	H1132	ETX	BCC
ASCII value	H15	H3130	H59(79)	H3039	H31313332	H03	

Item	Description
BCC	When command is lowercase(y), only one lower byte of the value resulted by adding 1 Byte each to ASCII values from NAK to ETX is converted into ASCII and added to BCC, and sent.
Error code	Hex and 2 bytes (ASCII code, 4 bytes) indicate error type. For the details, Refer to 10.1.4 XGT dedicated communication error codes and countermeasures.

(5) Example

This example supposes that registered device No. 1 of station No. 1 is read. and BCC value is checked. And it is supposed that device M000 is registered and the number of blocks is 1.

① PC request format (PC → XGB unit)

Format name	Header	Station No.	Command	Registration No.	Tail	Frame check
Frame (Example)	ENQ	H01	Y(y)	H01	EOT	BCC
ASCII value	H05	H3031	H59(79)	H3031	H04	

② For ACK response after execution of command (PC → XGB unit)

Format name	Header	Station No.	Command	Registration No.	Number of Blocks	Number of data	Data	Tail	Frame check
Frame (Example)	ACK	H01	Y(y)	H01	H01	H02	H2342	ETX	BCC
ASCII value	H06	H3031	H59(79)	H3031	H3031	H3032	H32333432	H03	

③ For NAK response after execution of command (PC → XGB unit)

Format name	Header	Station No.	Command	Registration No.	Error code	Tail	Frame check
Frame (Example)	NAK	H01	Y(y)	H01	Error code(2)	ETX	BCC
ASCII value	H15	H3031	H59(79)	H3031	Error code(4)	H03	

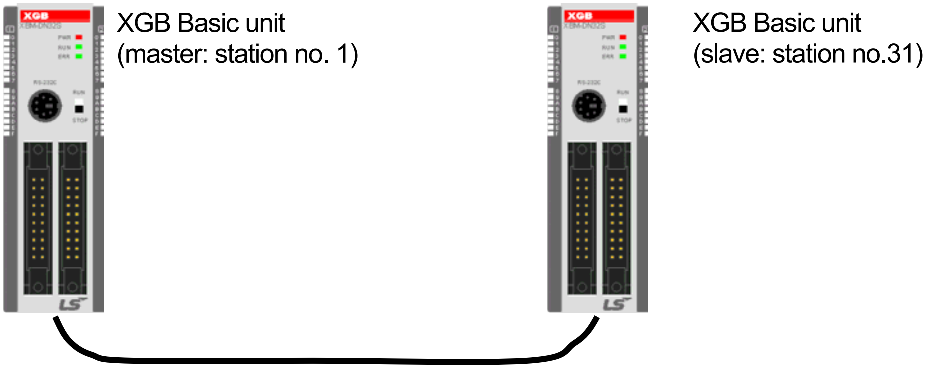
10.1.2 XGT dedicated server communication

XGT series dedicated server communication, as a slave communication, may not demand data from devices and it supplies the required data to the connected master module.

1) Introduction

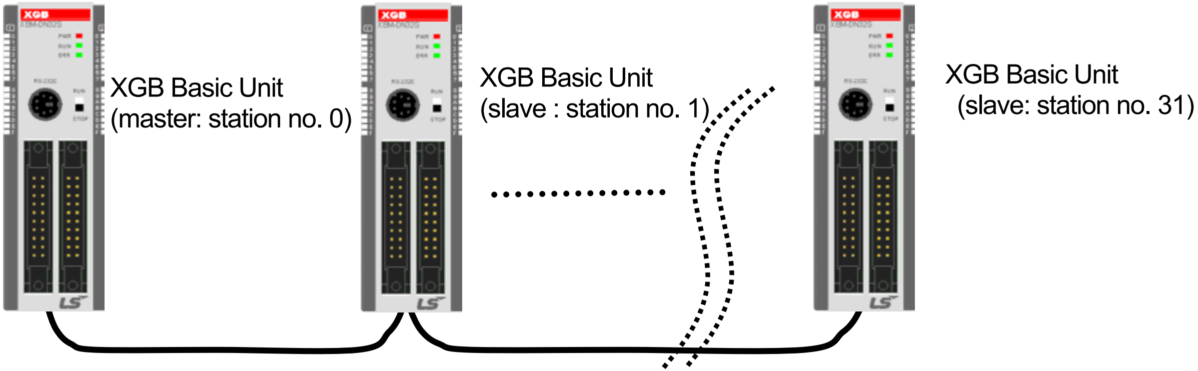
Intra-company 1:1, 1:n dedicated protocol communication is a function to implement a dedicated communication system in a way of 1(master) : 1, n (slave). The system may be easily structured by using basic parameters and communication parameters in XG5000(XG-PD)(note that RS-232C communication is available only for 1:1 communication).

- Device area may be set for totally 64 data access block and communication time-out period of each block in words
- Accessible up to 32 stations (if using built-in RS-485(Ch 1) , XBL-C41A)
- Depending on parameter setting, it updates flags of slave PLC and error code.
- Also, it may updates flags of trans-reception error frequency of parameter and error codes.
- It may monitor communication status per parameter by using the monitoring function of XG5000 (XG-PD).



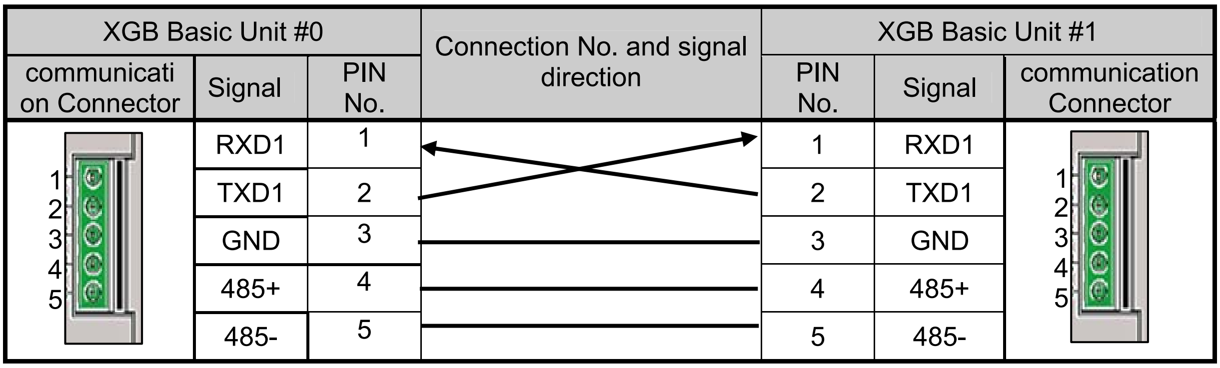
Intra-company 1:1 dedicated protocol communication
(if using built-in RS-232C communication)

The wiring diagram of communication cable used is as same as ‘c) 1:1 Connection with intra-company device, 8.7.1 System Configuration Using Dedicated Communication.



Intra-company 1:N dedicated protocol communication (if using built-in RS-485 communication)

2) Wiring Diagram



XGB Basic Unit #0			Connection No. and signal direction	XGB Basic Unit #1		
communication Connector	Signal	PIN No.		PIN No.	Signal	communication Connector
1 2 3 4 5	RXD1	1		1	RXD1	1 2 3 4 5
	TXD1	2		2	TXD1	
	GND	3		3	GND	
	485+	4		4	485+	
	485-	5		5	485-	

If using CH2, connect it by means of 485+ and 485- of RS-485 Terminal.

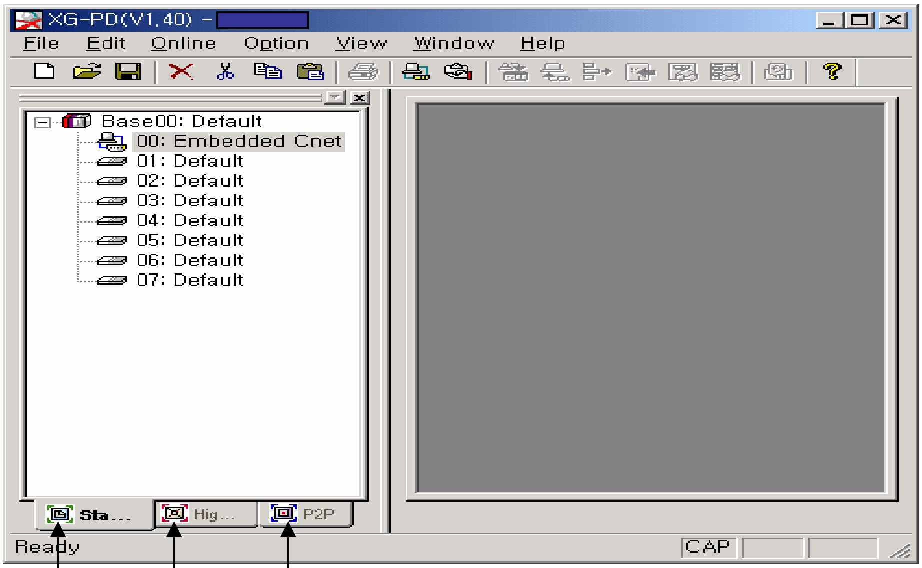
3) Communication Parameter Setting

The followings describe how to set parameters for XGT dedicated server communication.

(1) Open a new project file in XG5000.

- Make sure to select XGP as PLC type.
- Select 『Network Manager』 in 『Tools』 menu of (XG-PD) XG5000.
  Then, 『Network Manager』 is called XG-PD throughout this document.

(2) Selecting XG-PD and setting “XGB-XBMS” in 『Option』 shows the following window.



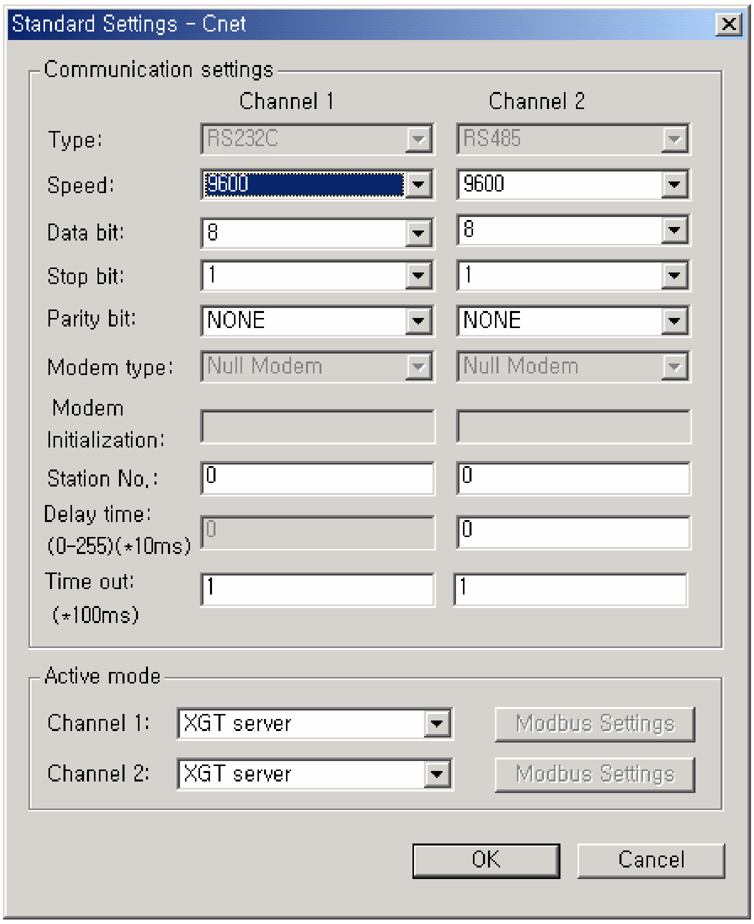
P2P Setting

High speed Link setting

Basic parameter setting

Communication Parameter Setting mode

▪Double-clicking 『Built-in Cnet』 shows the following basic communication window.



	Channel 1	Channel 2
Type:	RS232C	RS485
Speed:	9600	9600
Data bit:	8	8
Stop bit:	1	1
Parity bit:	NONE	NONE
Modem type:	Null Modem	Null Modem
Modem Initialization:		
Station No.:	0	0
Delay time: (0-255)(*10ms)	0	0
Time out: (*100ms)	1	1

Channel 1: XGT server

Channel 2: XGT server

(3) Communication setting

▪Set the following items at user's option for communication.

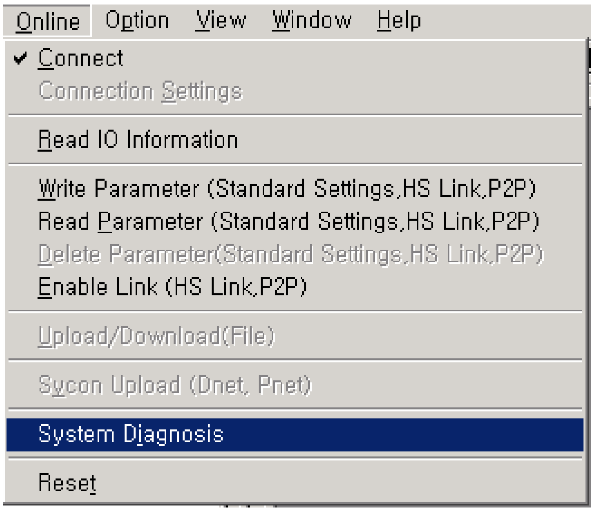
Item	Description
Type	• Basic unit communication type is fixed as follows. (CH 1 : RS-232C , CH 2 : RS-485)
Speed	• Available from/to 1200, 2400, 4800, 9600, 19200, 38400, 57600 bps.
Data bit	• Set to 7 or 8 bits.
Stop bit	• Set to 1 or 2 bit(s). (1 if parity bit is set or 2 if not)
Parity bit	• None, Even or Odd.
Station No.	• Available from 1 to 31 as station number (The broadcast station number, '0' is not available. It may cause malfunction)
Delay time	• Set the time from when this frame is sent to when the next frame is sent. (0 ~ 255 in the unit of 10 ㎳)
Timeout	• Set the time elapsed waiting for response after asking data. (1~ 65535 in the unit of 100 ㎳)

(4) Operation Mode Setting

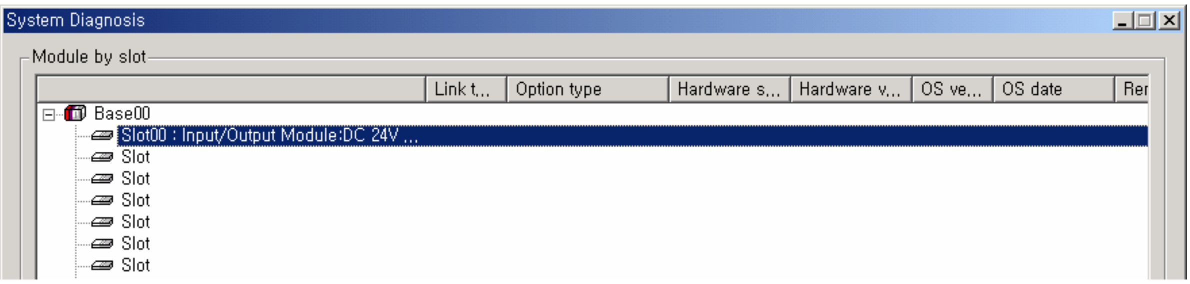
▪ Set XGT server driver.

Driver type	Meaning	Remarks
P2P	The port works as a client and performs communication by P2P parameter setting	Refer to P2P setting
XGT server	It works by XGT server supporting XGT dedicated communication.	Dedicated service
Modbus ASCII server	It operate by modbus ASCII server	Dedicated service
Modbus RTU server	It operates by modbus RTU server	Dedicated service

(5) Upon the settings, save the above parameter and run 『Online 』 『 Write Parameter』 .
For communication monitoring, use 『**Online**』 → 『**System Diagnosis**』 .



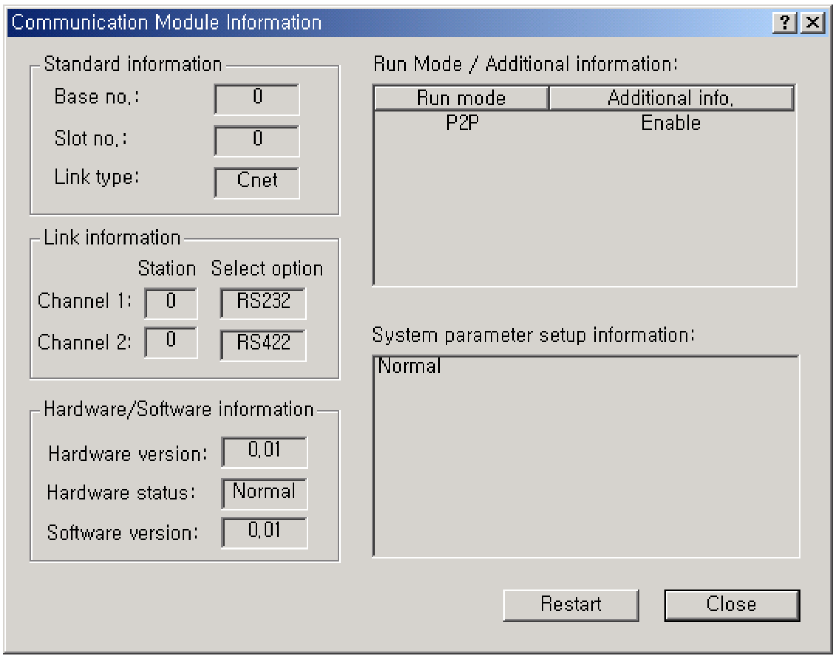
▪Clicking the right mouse button displays the following menu.



Item	Description
communication Module info	Displays communication module information.
Frame monitor	Monitors each frame currently used for communication.
Service status	Displays the current communication service status.

a) Communication Module Infomation

▪It displays communication module information currently connected.



Communication Module Information

Standard information

Base no.: 0

Slot no.: 0

Link type: Cnet

Link information

	Station	Select option
Channel 1:	0	RS232
Channel 2:	0	RS422

Hardware/Software information

Hardware version: 0.01

Hardware status: Normal

Software version: 0.01

Run Mode / Additional information:

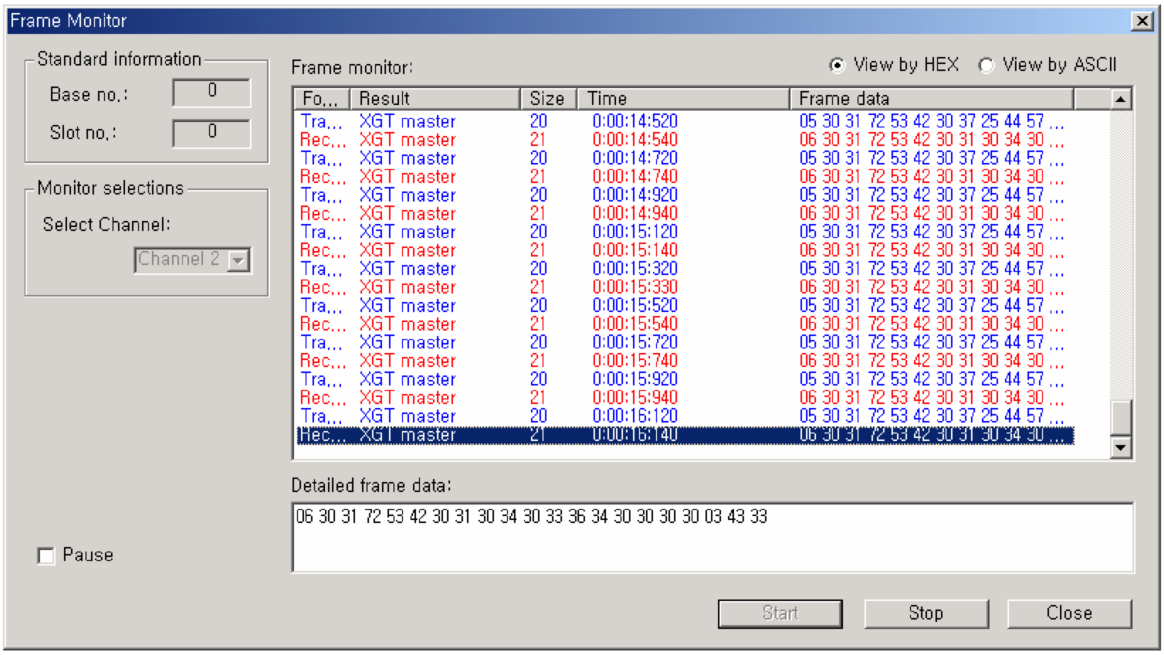
Run mode	Additional info.
P2P	Enable

System parameter setup information:

Normal

b) Frame Monitor

▪It displays each frame currently used for communication.



Frame Monitor

Standard information

Base no.: 0

Slot no.: 0

Monitor selections

Select Channel: Channel 2

☐ Pause

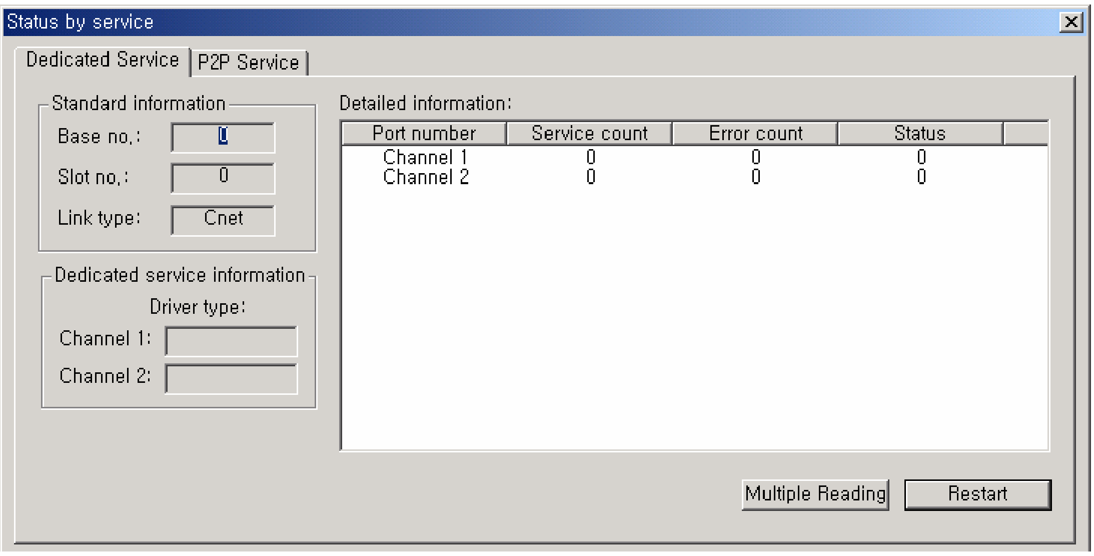
Frame monitor: ● View by HEX ○ View by ASCII

Fo...	Result	Size	Time	Frame data
Tra...	XGT master	20	0:00:14:520	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:14:540	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:14:720	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:14:740	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:14:920	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:14:940	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:15:120	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:15:140	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:15:320	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:15:330	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:15:520	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:15:540	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:15:720	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:15:740	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:15:920	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:15:940	06 30 31 72 53 42 30 31 30 34 30 ...
Tra...	XGT master	20	0:00:16:120	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:16:140	06 30 31 72 53 42 30 31 30 34 30 ...

Detailed frame data:

```
06 30 31 72 53 42 30 31 30 34 30 33 36 34 30 30 30 30 03 43 33
```

c) Service status



Base no.: 0
Slot no.: 0
Link type: Cnet
Channel 1:
Channel 2:

Port number	Service count	Error count	Status
Channel 1	0	0	0
Channel 2	0	0	0

Item		Description	Remarks
Standard information	Base No.	Built-in communication Base is set to “0”.	-
	Slot No.		-
	Link type	Display communication module type.	Cnet / Enet
Dedicated service information	Drive type	Display a preset drive.	-
Detailed information	Port No.	Display communication CH No.	-
	Service count	Display communication frequency	Display the current communication frequency
	Error count	Display the no. of communication error occurred.	Display the current no. of communication error occurred.
	Status	Display communication status	-

10.1.3 XGT dedicated client communication

XGT dedicated client communication is a communication method demand types of data from each slave device connected to master communication at a desirable time.

1) Communication Parameter Setting

It describes how to set types of parameters for XGT dedicated client communication.

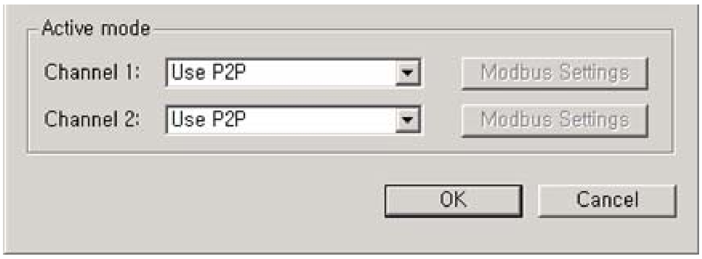
A) Open a new project file in XG5000.

- Make sure to select XGB as PLC type.
- Select 『Network Manager』 in 『Tools』 menu of (XG-PD) XG5000.
  Then, 『Network Manager』 is called XG-PD throughout this document.

B) Selecting XG-PD, set each item for communication(as same as XGT server communication).

C) Operation Mode Setting

▪Set XG-PD operation mode as 『Use P2P』.

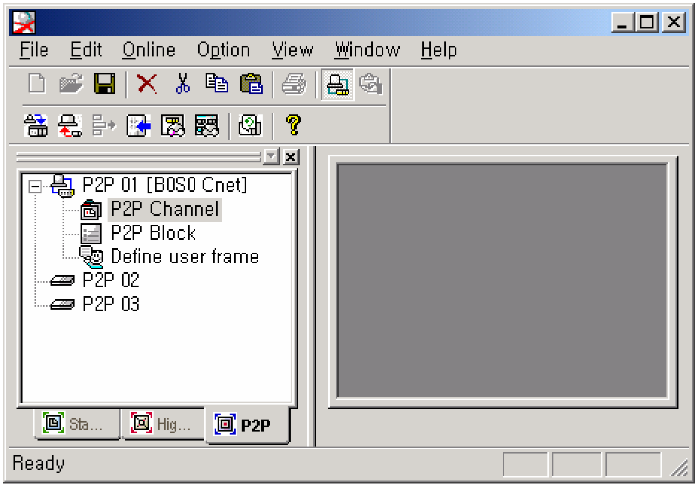


Active mode

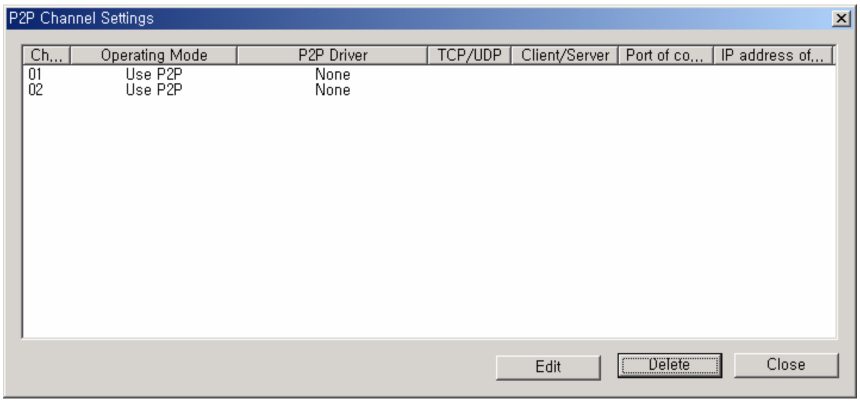
Channel 1: Use P2P

Channel 2: Use P2P

▪Set 『P2P Channel』 in P2P Setting of Parameter Setting Mode.



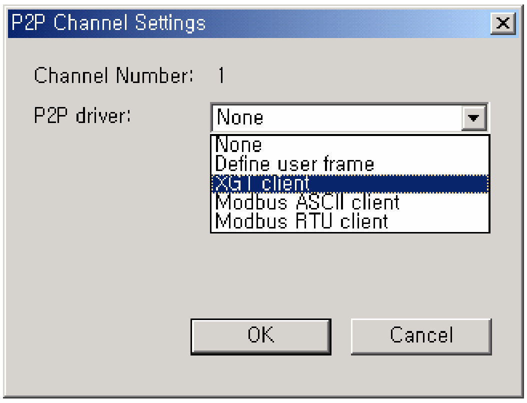
▪Double-clicking 『P2P Channel』 shows the following P2P driver setting window.



P2P Channel Settings

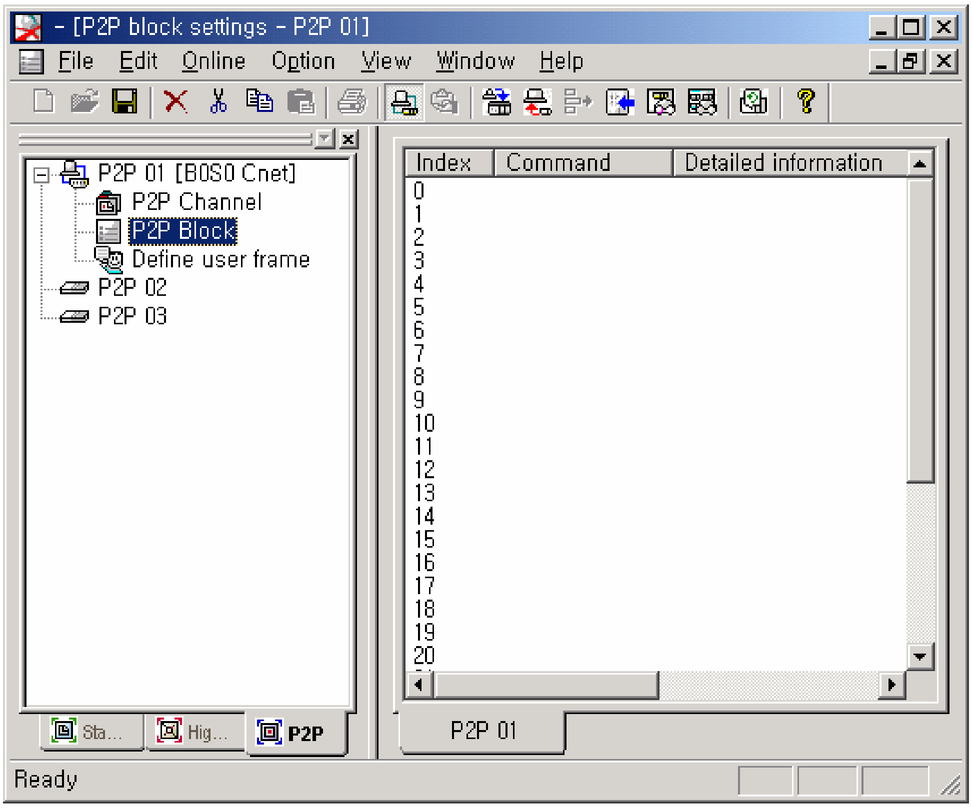
Ch...	Operating Mode	P2P Driver	TCP/UDP	Client/Server	Port of co...	IP address of...
01	Use P2P	None				
02	Use P2P	None				

▪Clicking 『Edit』 shows the P2P Driver Setting window as follows.

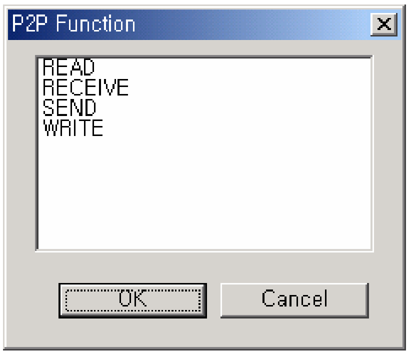


▪ Select 『XGT Client』.

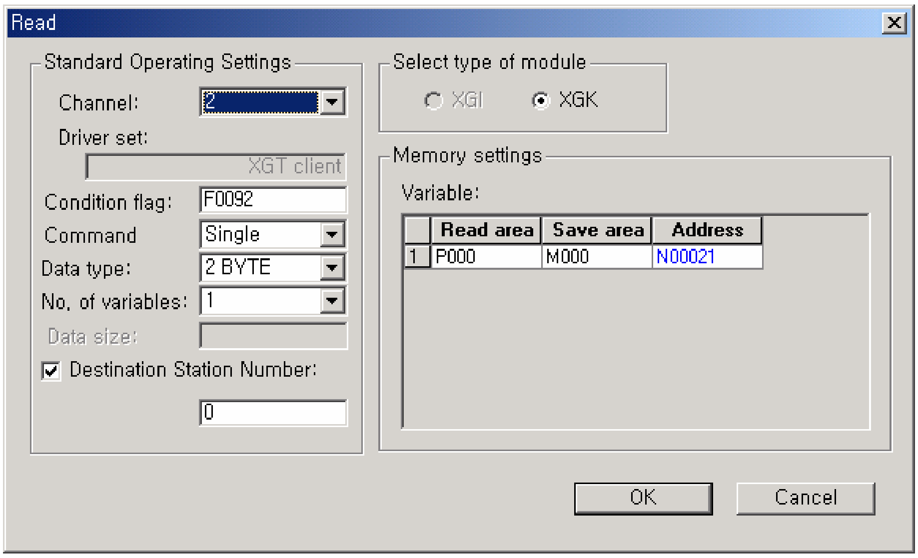
▪By double-clicking 『P2P Block』, edit XGT dedicated client communication frame.



▪ It is allowed to edit up to 32 communication frames. If double-clicking on index, the following communication mode (READ, WRITE) setting window is displayed.



▪XGT dedicated client sets one of two modes; 『READ』 or 『WRITE』.



Read

Standard Operating Settings

Channel: 2

Driver set: XGT client

Condition flag: F0092

Command: Single

Data type: 2 BYTE

No. of variables: 1

Data size:

☑ Destination Station Number: 0

Select type of module: ○ XGI ● XGK

Memory settings

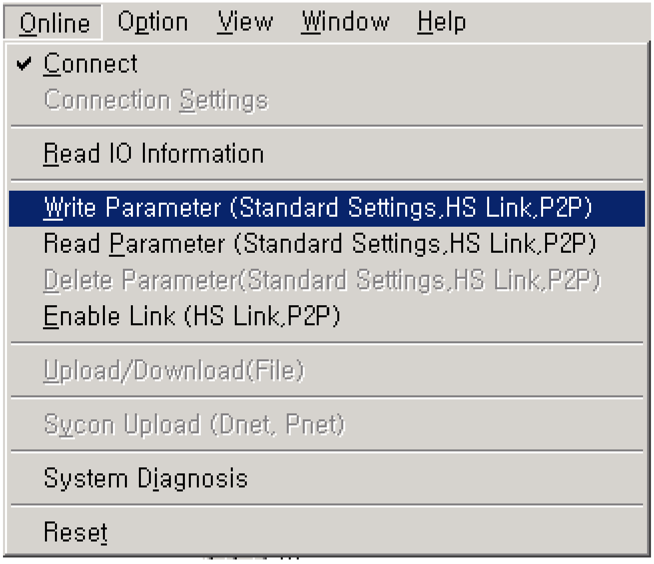
Variable:

	Read area	Save area	Address
1	P000	M000	N00021

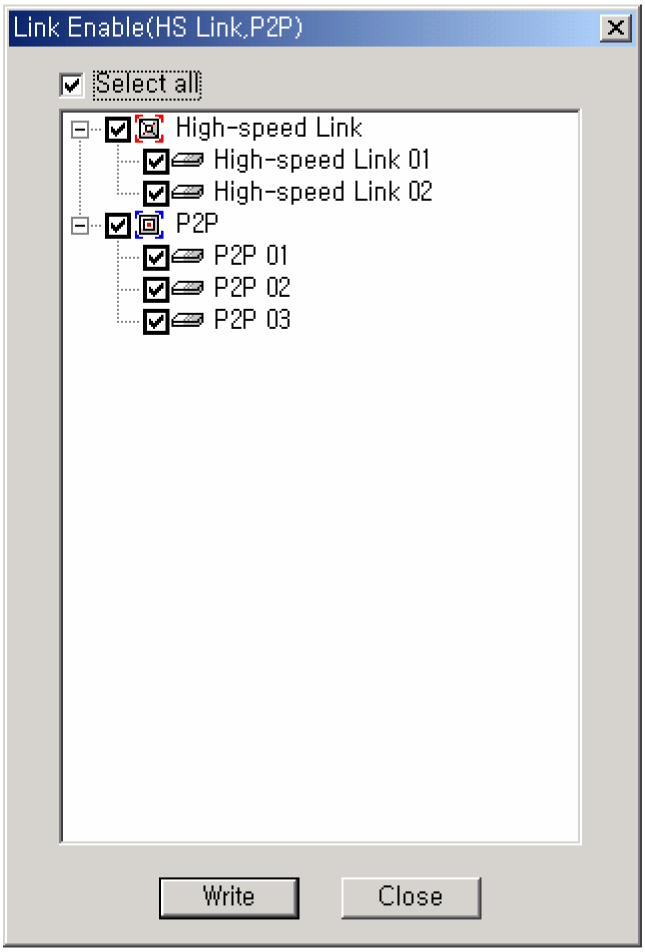
Item		Description	Remarks
Standard Operating Settings			
CH. Setting	1,2	Designate a desirable communication Channel. (CH1 : RS-232C, CH2 : RS-485)	Built in Basic unit
Condition flag		Designate communication command condition flag.	Bit device
Command type	Single	Designate individual communication device.	
	Series	Designate communication device in series.	
Data type	BIT	Set the communication data type as BIT.	
	Byte	Set the communication data type as Byte.	1 : 1Byte
	WORD	Set the communication data type as Word.	2 : 2Byte
	Dword	Set the communication data type as Double Word.	4 : 4Byte
	Lword	Set the communication data type as Long Word.	8 : 8Byte
No. of variables		Not used for Modbus Communication.	
Data size		Valid only when command type is series and designated up to 120 bytes.	Unit: Byte
Destination station number		Set the designation station number for communication.	
Memory Settings			
Read area			
If designating READ	Read area	Designate a READ device of a connected designation station number.	
	Save area	Designate read area to save data read from a designation station number.	
	Address	-	
If designating WRITE	Read area	Designate a device with data to write.	
	Save area	Designate a WRITE device of a connected designation station number.	
	Address	-	

▪Upon the completion of settings for each block, save the above parameter and write parameters. For communication monitoring, use 『**Diagnosis**』 → 『**System Diagnosis**』 function.

▪Upon the completion of settings for each block, the set parameters are written to PLC by running 『**Online** 』 → 『**Write Parameter**』.

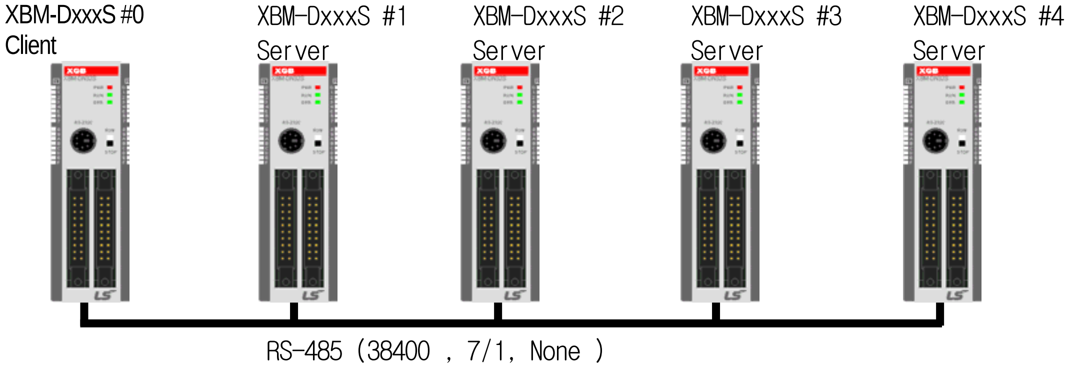


▪After writing parameters(WRITE), setting 『Enable Link』 starts communication.



2) Examples

A) System Structure



▪Communication uses RS-485(using CH2) communication channel built in XGB basic unit.
▪Communication speed: 38400bps
▪Communication mode: XGT dedicated mode
▪Data bit: 8it
▪Stop bit: 1Bit
▪Parity setting: None

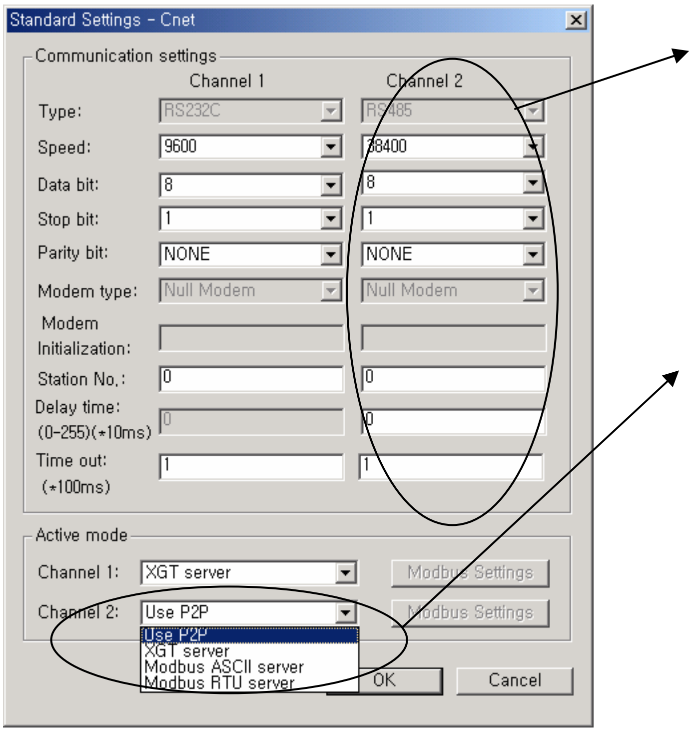
B) Communication Operation

It is assumed that the above-structured system operates as follows.

- Read P000 Input 16 Point value of station no.1 at every 100ms and save it to M010.
- If M0 No.1 Bit is On, it reads P000 Input of No.2 and saves it into M020.
- If M0 No.2 Bit is On, it saves P000 16 point data into No.3 M020.
- If M0 No.3 Bit is On, it reads P000 Input of No.4 and saves it into M030.

C) No.“0” Client Setting

(1) Open a new project file in XG5000.
(2) Selecting XG-PD, set the communication basic parameters as follows.



Standard Settings - Cnet

Communication settings

	Channel 1	Channel 2
Type:	RS232C	RS485
Speed:	9600	38400
Data bit:	8	8
Stop bit:	1	1
Parity bit:	NONE	NONE
Modem type:	Null Modem	Null Modem
Modem Initialization:		
Station No.:	0	0
Delay time: (0-255)(*10ms)	0	0
Time out: (*100ms)	1	1

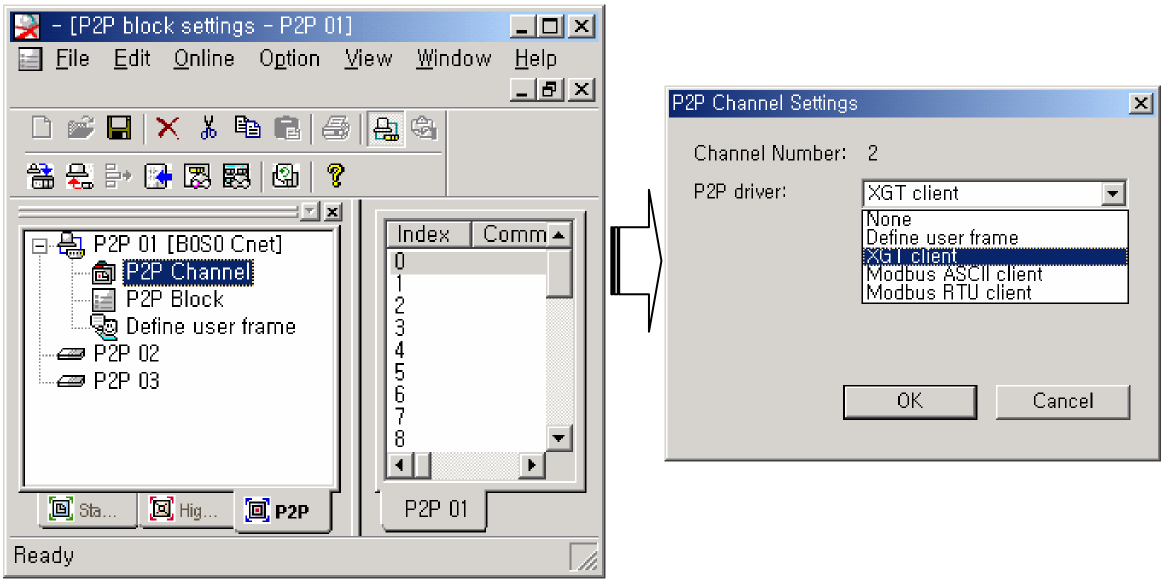
Active mode

Channel 1: XGT server
Channel 2: Use P2P

Basic Parameter Setting

P2P setting for XGT dedicated client setting

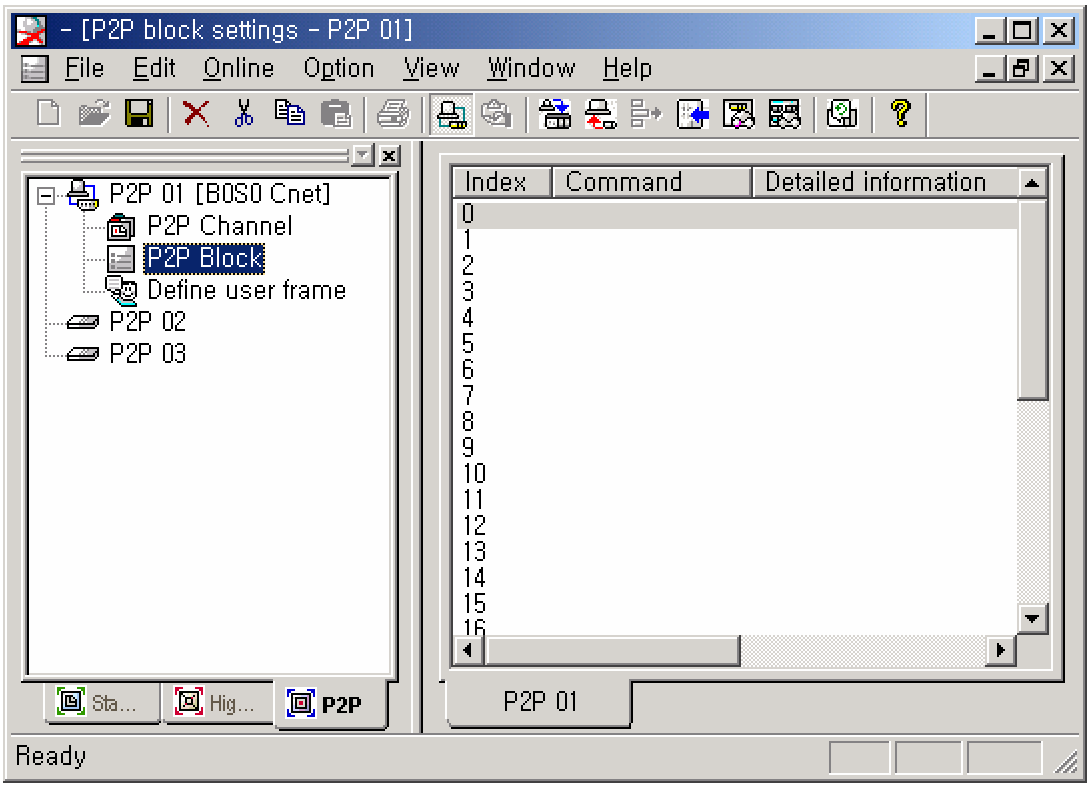
(3) In a parameter setting mode, P2P setting, set CH 2 『P2P driver』 as 『XGT client』.



Channel Number: 2

P2P driver: XGT client

(4) Set the communication parameter with each XGB basic unit(XGT dedicated server) in 『P2P Block』.

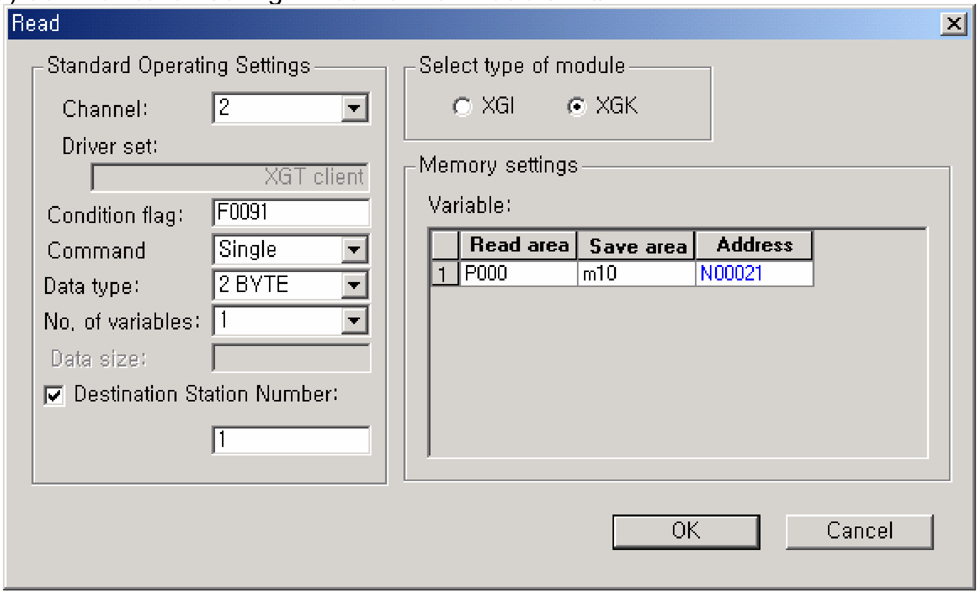


- Communication Parameter Setting of XGB Basic Unit (Client #0)

Set the communication parameter for each station as seen in the following table.

Index	Operation	Channel	Condition flag	Command type	Data type	Data size	Designation station No.	Read area	Save area	Remarks
0	Read	2	F091	Single	2	-	1	P000	M0010	2 Byte
1	Read		M0001	Single	2	-	2	P000	M0020	2 Byte
2	Write		M0002	Single	2	-	3	P000	M0020	2 Byte
3	Read		M0003	Single	2	-	4	P000	M0030	2 Byte

a) Communication Setting Window of XGB Basic Unit #1



Read

Standard Operating Settings

Channel: 2

Driver set: XGT client

Condition flag: F0091

Command: Single

Data type: 2 BYTE

No. of variables: 1

Data size:

☑ Destination Station Number: 1

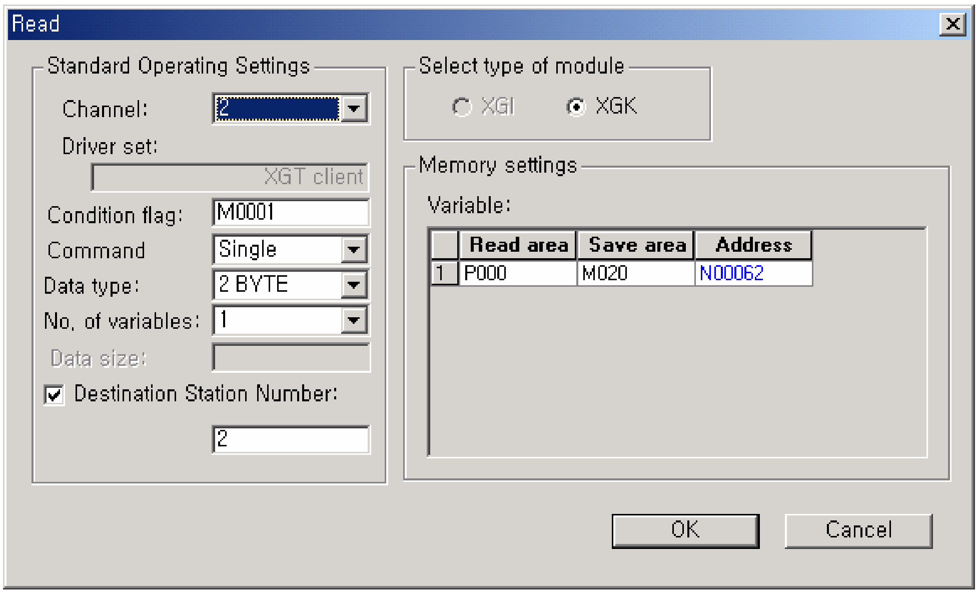
Select type of module: ○ XGI ● XGK

Memory settings

Variable:

	Read area	Save area	Address
1	P000	m10	N00021

b) Communication Setting Window of XGB Basic Unit #2



Read

Standard Operating Settings

Channel: 2

Driver set: XGT client

Condition flag: M0001

Command: Single

Data type: 2 BYTE

No. of variables: 1

Data size:

☑ Destination Station Number: 2

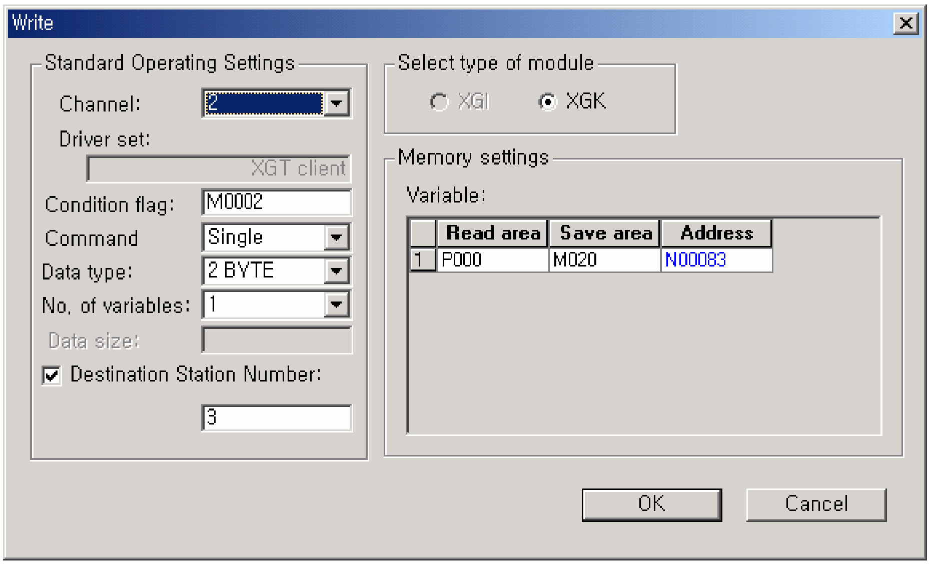
Select type of module: ○ XGI ● XGK

Memory settings

Variable:

	Read area	Save area	Address
1	P000	M020	N00062

c) Communication Setting Window of XGB Basic Unit #3



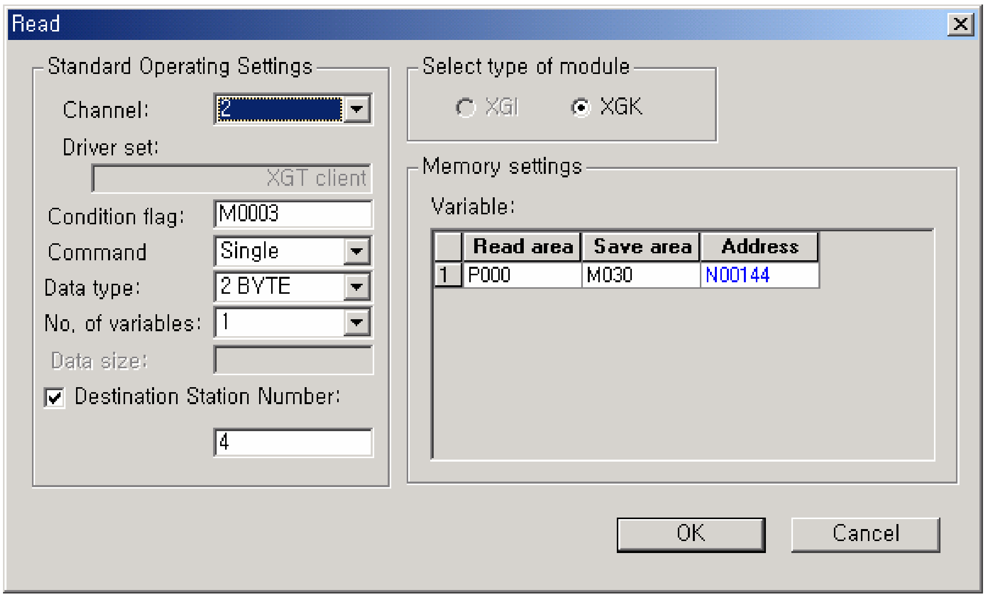
Channel: 2
Driver set: XGT client
Condition flag: M0002
Command: Single
Data type: 2 BYTE
No. of variables: 1
Data size:
☑ Destination Station Number: 3

○ XGI ● XGK

Variable:

	Read area	Save area	Address
1	P000	M020	N00083

d) Communication Setting Window of XGB Basic Unit #4



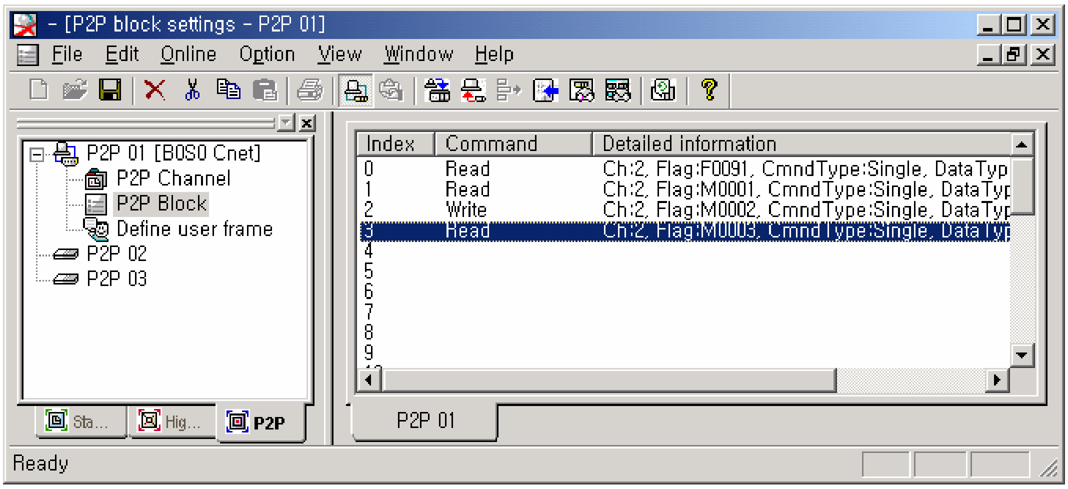
Channel: 2
Driver set: XGT client
Condition flag: M0003
Command: Single
Data type: 2 BYTE
No. of variables: 1
Data size:
☑ Destination Station Number: 4

○ XGI ● XGK

Variable:

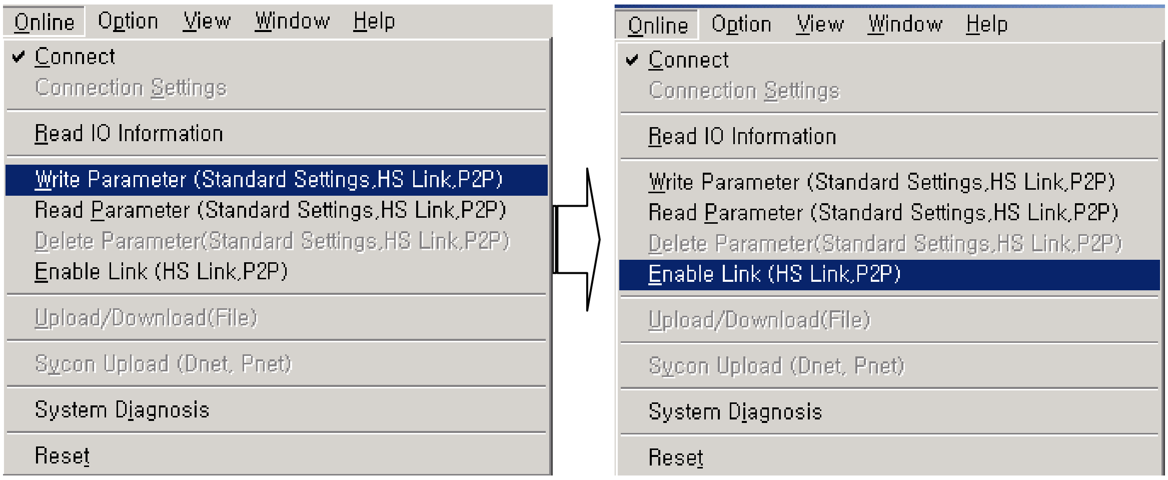
	Read area	Save area	Address
1	P000	M030	N00144

▪Upon P2P block setting, it is displayed as seen in the following window.



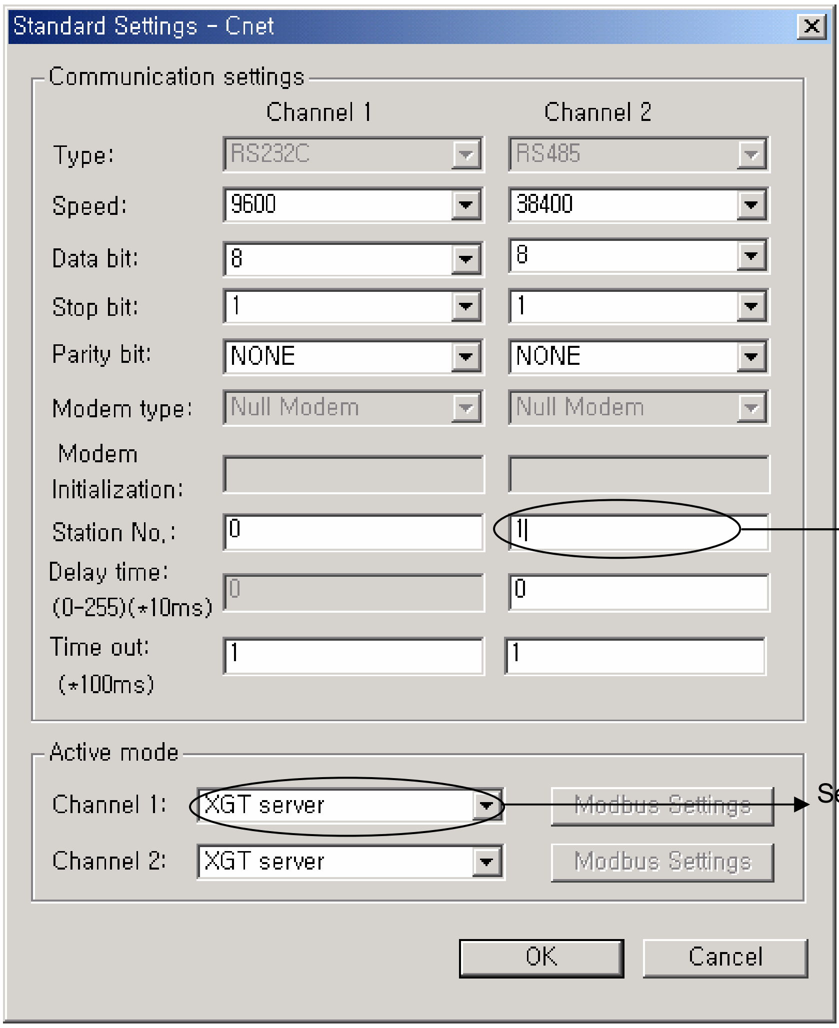
Index	Command	Detailed information
0	Read	Ch:2, Flag:F0091, CmndType:Single, DataTyp
1	Read	Ch:2, Flag:M0001, CmndType:Single, DataTyp
2	Write	Ch:2, Flag:M0002, CmndType:Single, DataTyp
3	Read	Ch:2, Flag:M0003, CmndType:Single, DataTyp
4		
5		
6		
7		
8		
9		

- Once P2P parameter setting is complete, it writes the parameters.
- To execute P2P service, start P2P service by using “Online → Enable Link” menu.



D) Slave Setting

- Regarding Slave Stations, set the basic parameters only, write parameters(WRITE) and allows Enable Link, completing the setting.



Standard Settings - Cnet

Communication settings

	Channel 1	Channel 2
Type:	RS232C	RS485
Speed:	9600	38400
Data bit:	8	8
Stop bit:	1	1
Parity bit:	NONE	NONE
Modem type:	Null Modem	Null Modem
Modem Initialization:		
Station No.:	0	1
Delay time: (0-255)(*10ms)	0	0
Time out: (*100ms)	1	1

Active mode

Channel 1: XGT server

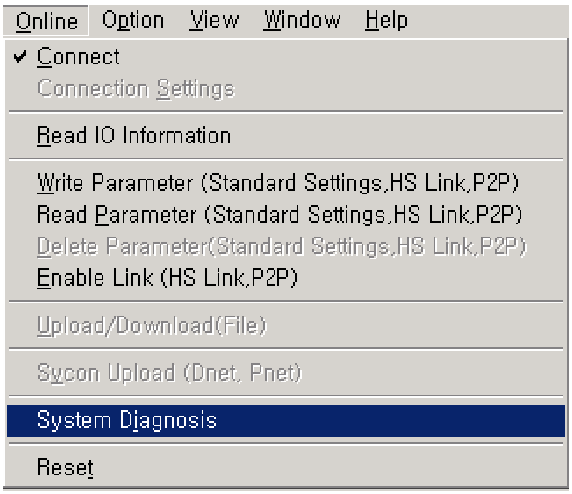
Channel 2: XGT server

Set the station number.

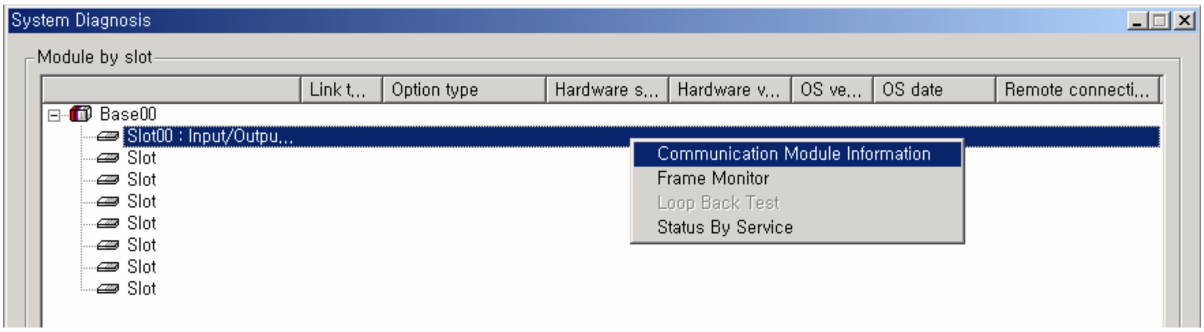
Set the operation mode as XGT server.

E) System Diagnosis

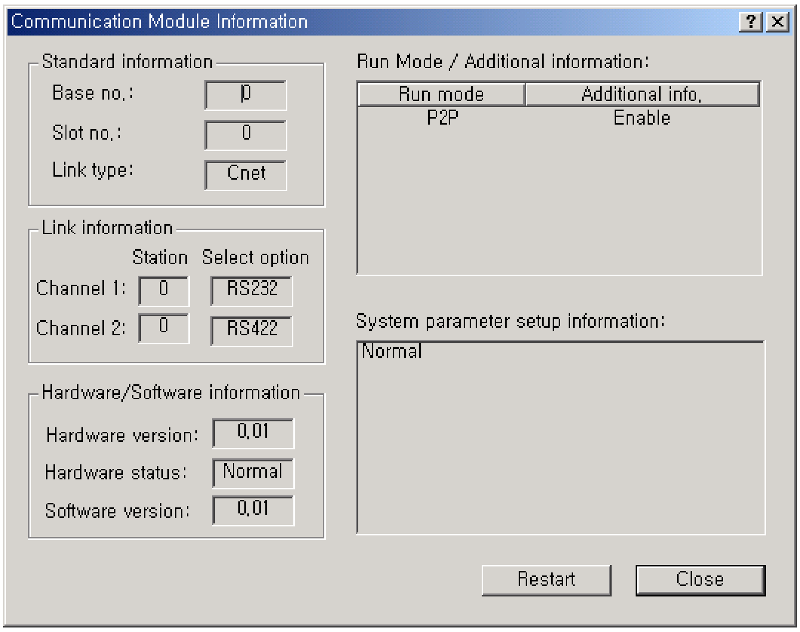
▪Upon Enable Link, it diagnoses communication and monitors by using system diagnosis function. (exemplifying client #0 station)



▪Clicking System Diagnosis shows the following window.



▪It shows communication module information.



Standard information

Base no.: 0

Slot no.: 0

Link type: Cnet

Link information

	Station	Select option
Channel 1:	0	RS232
Channel 2:	0	RS422

Hardware/Software information

Hardware version: 0.01

Hardware status: Normal

Software version: 0.01

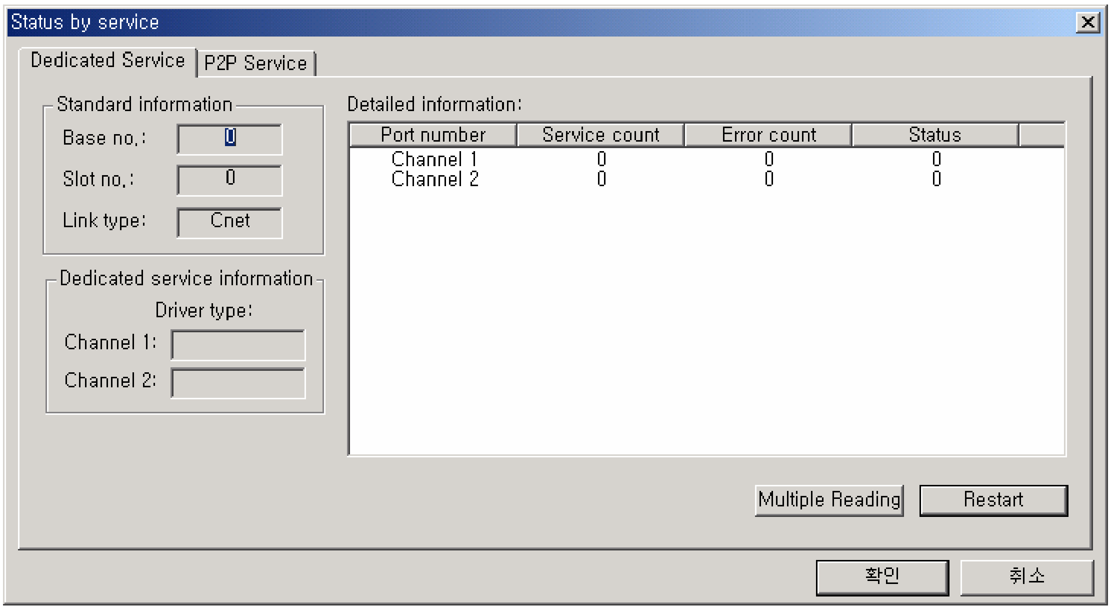
Run Mode / Additional information:

Run mode	Additional info.
P2P	Enable

System parameter setup information:

Normal

▪It shows communication Status by service.



Standard information

Base no.: 0

Slot no.: 0

Link type: Cnet

Dedicated service information

Driver type:

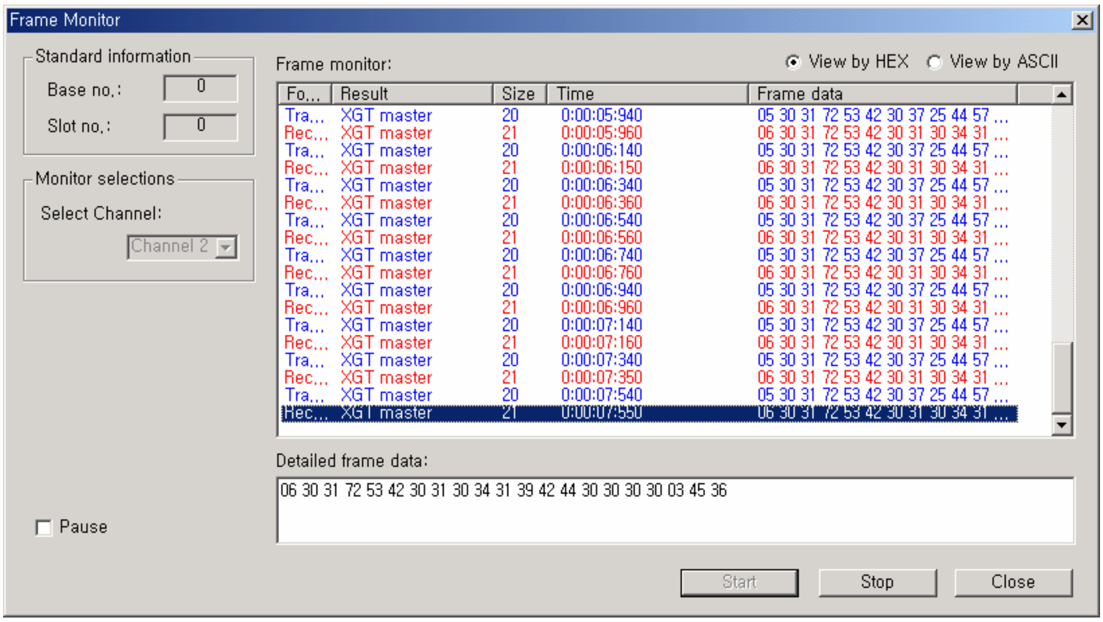
Channel 1:

Channel 2:

Detailed information:

Port number	Service count	Error count	Status
Channel 1	0	0	0
Channel 2	0	0	0

▪Then, it monitors frames currently used for communication.



Standard information

Base no.: 0

Slot no.: 0

Monitor selections

Select Channel: Channel 2

☐ Pause

Frame monitor: ● View by HEX ○ View by ASCII

Fo...	Result	Size	Time	Frame data
Tra...	XGT master	20	0:00:05:940	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:05:960	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:06:140	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:06:150	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:06:340	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:06:360	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:06:540	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:06:560	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:06:740	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:06:760	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:06:940	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:06:960	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:07:140	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:07:160	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:07:340	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:07:350	06 30 31 72 53 42 30 31 30 34 31 ...
Tra...	XGT master	20	0:00:07:540	05 30 31 72 53 42 30 37 25 44 57 ...
Rec...	XGT master	21	0:00:07:550	06 30 31 72 53 42 30 31 30 34 31 ...

Detailed frame data:

```
06 30 31 72 53 42 30 31 30 34 31 39 42 44 30 30 30 30 03 45 36
```

10.1.4 XGT dedicated communication error codes and countermeasures

- It describes the types, causes and measures of error codes.
  Error type is displayed by hexadecimal 2 bytes (4bytes in ASCII code). Errors can be confirmed by Frame Monitor. Followed error frame is shown in ASCII mode.

Error code	Error type	Description & Cause	Measure
0003	Exceeding of block number error	Block number is larger than 16 when Single Read and Write is requested.	01rSS1105%MW10…
0004	Variable size error	Variable size is larger than 16 (Max. size).	01rSS113%MW10000000000…
0007	Data type error	If any other characters but X, B, W, D and L are used in data type.	01rSS1105%MK10
0011	Data error	If area information of data size is incorrect.	01rSB05%MW%4
		If '%' is omitted.	01rSS0105$MW10
		If Value of variable area is incorrect.	01rSS0105%MW^&
		If the value is not appropriate. On Bit mode, it must be written 00 of 01 bit.	01wSS0105$MX1011
0090	Monitor execution error	Out of range of registration number.	-
0190	Monitor execution error	Out of range of registration number.	-
0290	Monitor registration error	Out of range of registration number.	-
1132	Device memory error	Designating incorrect device memory.	-
1232	Data size error	If data is requested more than 60 words (Max.).	01wSB05%MW1040AA5512…
1234	Overplus frame error	If there is unnecessary contents.	01rSS0105%MW10000
1332	Data type discordance error	In case of single read and write, all block have to request for identical data type..	01rSS0205%MW1005%MB10
1432	Data value error	If data value is unable to Hexadecimal conversion.	01wSS0105%MW10AA%5
7132	Requesting of exceeding area of variable	If exceeding area is requested respective device.	01rSS0108%MWFFFFF

10.2 Modbus Communication

10.2.1 Modbus communication

1. Introduction

XGB built-in communication supports Modbus, the Modicon product's communication protocol. It supports ASCII mode, using ASCII data and RTU mode using Hex data. Function code used in Modbus is supported by instruction and especially function code 01, 02, 03, 04, 05, 06, 15 and 16. Refer to "Modicon Modbus Protocol Reference Guide".

2. Basic specification

1) ASCII mode

A) It communicates, using ASCII data.
B) Each frame uses ':' (Colon: H3A), for header, CR/LF (Carriage return-line feed: HoD H0A), for tail.
C) It checks errors, using LRC.
D) Frame structure (ASCII data)

Item	Header	Address	Function code	Data	LRC	Tail(CR/LF)
Size	1 byte	2 bytes	2 bytes	n bytes	2 bytes	2 bytes

2) RTU mode

A) It communicates, using hexadecimal data.
B) There's no header and tail. It starts with address and finishes frame with CRC.
C) It has at least 3.5 character times between two frames.
D) It checks errors, using 16 bit CRC.
E) Frame structure (Hexadecimal data)

Item	Address	Function code	Data	CRC
Size	1 byte	1 bytes	n bytes	2 bytes

3) Address area

(1) Setting range is available from 1 to 247, but XGB supports from 0 to 63.

(2) Address 0 is used for broadcast address. Broadcast address is all slave device recognize and respond to like the self-address, which can't be supported by XGB.

4) Function code area

(1) It divides the command using 0~225. XGB supports only **01, 02, 03, 04, 05, 06, 15, and 16** among function codes.
(2) If the response format is confirm+(ACK), it uses the same function code.
(3) If the response format is confirm-(NAK), it returns as it sets the 8th bit of function code as 1.

Ex.) If function code is 03
- We write here only function code part, because only function codes are different.

[Request]
0000 0011 (H03)
[Confirm+]
0000 0011 (H03)
[Confirm-]
1000 0011 (H83)

It returns as it sets the 8th bit of function code of request frame.

5) Data area

(1) It sends data, using ASCII data(ASCII mode) or hex (RTU mode).

(2) Data is changed according to each function code.

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

6) LRC check/CRC check area

(1) LRC (Longitudinal Redundancy Check) : It works in ASCII mode. It takes 2' complement from sum of frame except header or tail to change into ASCII code,

(2) CRC (Cyclical Redundancy Check): It works in RTU mode. It uses 2-byte CRC check rules.

Remark

1) All numerical data can use hexadecimal, decimal, and binary type. If we convert decimal 7 and 10 into each type:

Hexadecimal : H07, H0A or 16#07, 16#0A

Decimal : 7, 10

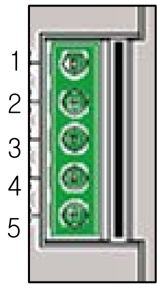
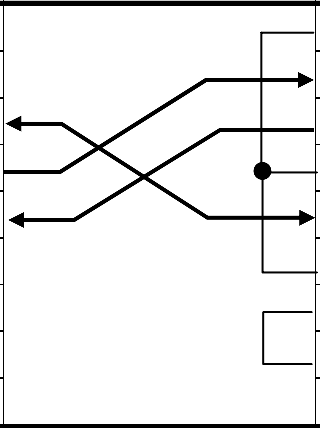
7) Function code type

Code	Function code name	Modicon PLC Data address	Remark
01	Read Coil Status	0XXXX(bit-output)	Read bits
02	Read Input Status	1XXXX(bit-input)	Read bits
03	Read Holding Registers	4XXXX(word-output)	Read words
04	Read Input Registers	3XXXX(word-input)	Read words
05	Force Single Coil (1 bit)	0XXXX(bit-output)	Write bit
06	Preset Single Register (1 word)	4XXXX(word-output)	Write word
15	Force Multiple Coils	0XXXX(bit-output)	Write bits
16	Preset Multiple Registers	4XXXX(word-output)	Write words

8) The size of using data

As for data size, XGB unit supports 240 bytes. The maximum size of the Modicon products is different from each other kind. So refer to "Modicon Modbus Protocol Reference Guide."

9) Wiring

XGB	XGB unit		Connecting no. and direction	Quantum (9 pin)	
	Signal	Pin no.		Pin no.	Signal
	485+	1		1	CD
	485-	2		2	RXD
	GND	3		3	TXD
	TXD	4		4	DTR
	RXD	5		5	GND
				6	DSR
				7	RTS
				8	CTS
				9	

- Use RS-485+ and 485- of RS-485 terminal connector when using channel 2.

PMU	Connecting no. and direction	XGB unit
485+	↔	485+
485-	↔	485-

10.2.2 Modbus server communication

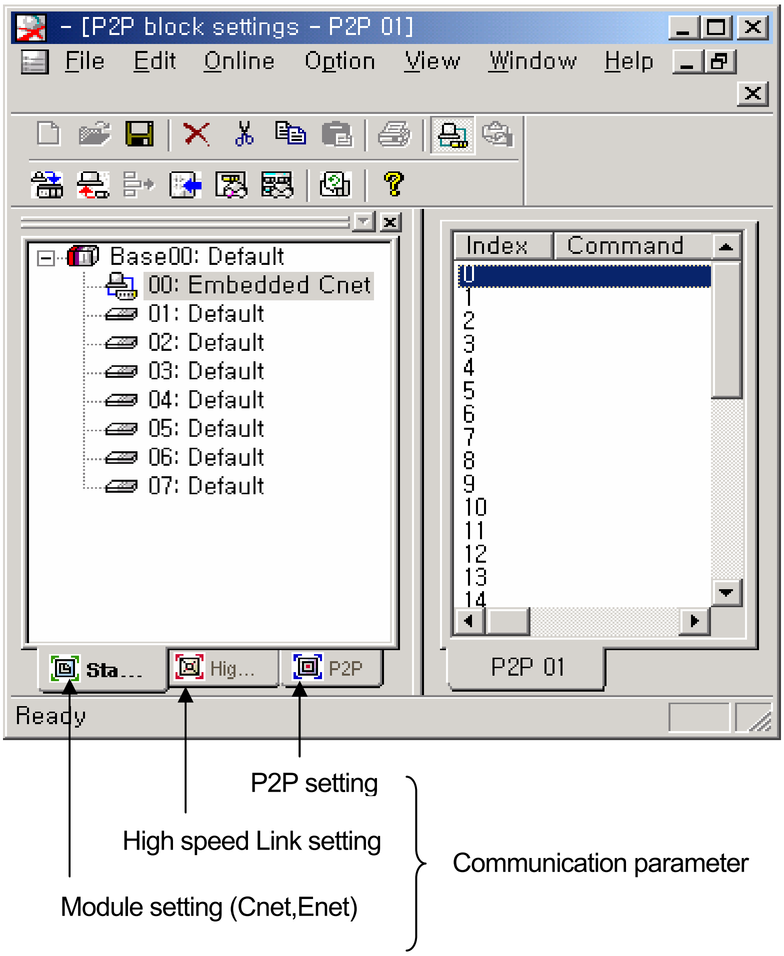
Modbus server communication may not demand data to each device connected as a slave communication but send data requested by the connected master module.

1) Communication parameter setting
The following describes how to set types of parameters for Modbus server communication.

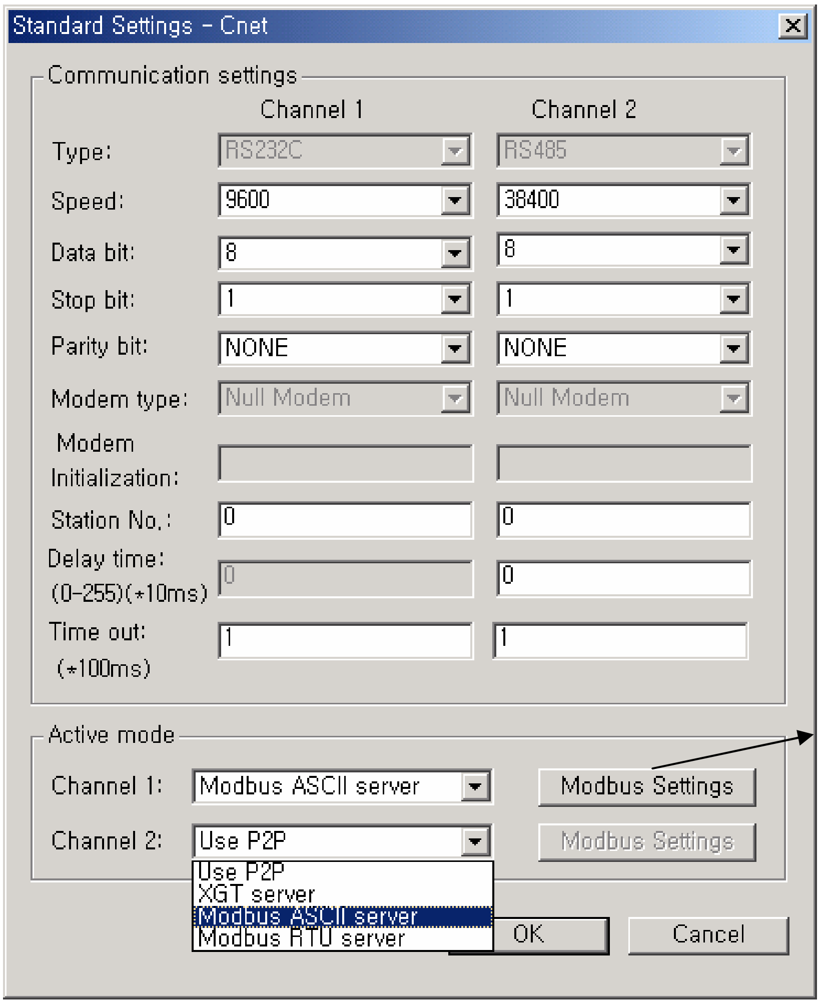
A) Open a new project file in XG5000.

- Make sure to select XGB as PLC type.
- Select 『Network Manager』 in 『Tools』 menu of (XG-PD) XG5000.
  Then, 『Network Manager』 is called XG-PD throughout this document..

B) Selecting “XGB-XBMS” in 『Option』 menu of XG-PD shows the following window..



▪Double-clicking『00 : Built-in Cnet』 shows the following basic communication window.



Standard Settings - Cnet

Communication settings

	Channel 1	Channel 2
Type:	RS232C	RS485
Speed:	9600	38400
Data bit:	8	8
Stop bit:	1	1
Parity bit:	NONE	NONE
Modem type:	Null Modem	Null Modem
Modem Initialization:		
Station No.:	0	0
Delay time: (0-255)(*10ms)	0	0
Time out: (*100ms)	1	1

Active mode

Channel 1: Modbus ASCII server

Channel 2: Use P2P

It is activated if Modbus server is selected.

C) communication setting

▪ Set the following items at a user's option for communication.

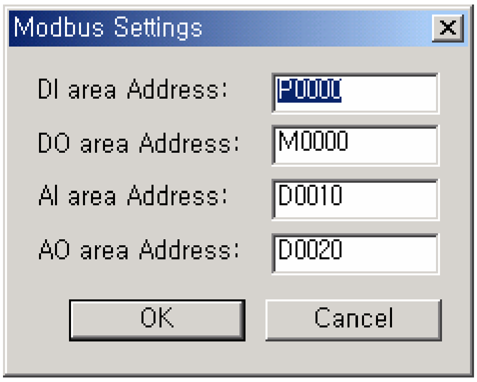
Item	Description
Station No.	• Available from 0 to 63 as station number.
Speed	• Available from/to 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bps.
Data bit	• Set to 7 or 8 bits. (7 bits for ASCII mode or 8 bits for RTU mode.
Parity bit	• None, Even or Odd.
Stop bit	• Set to 1 or 2 bit(s).
Type	• Basic unit built-in communication channel is fixed as follows. (CH 1 : RS-232C , CH 2 : RS-485)

D) Operation mode setting

▪Set a Modbus driver.

Driver type	Meaning	Remarks
P2P	The port operates by client and communicates through P2P parameter setting. (used when Modbus client communication is designated)	Refer to P2P setting
XGT server	Operate with XGT server supporting XGT dedicated communication	Dedicated service
Modbus ASCII server	Operate with Modbus ASCII server	-
Modbus RTU server	Operate with Modbus RTU server	-

E) Address mapping (address designation) when setting Modbus server (ASCII , RTU)
Clicking "Modbus Setting" shows the following address mapping window.

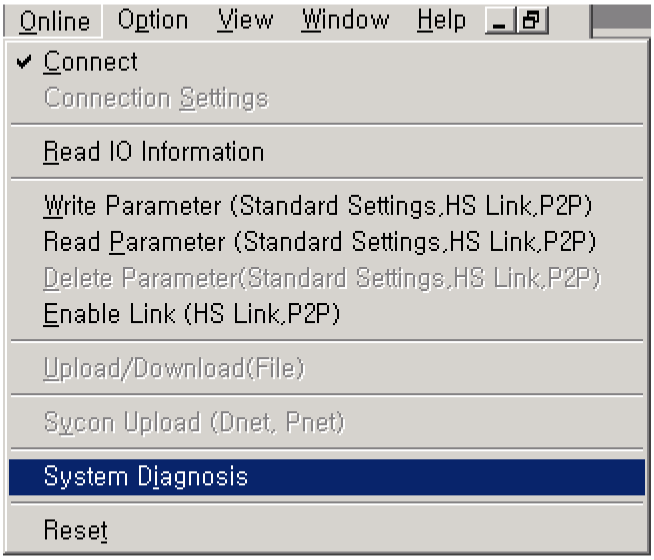


DI area Address: P0000
DO area Address: M0000
AI area Address: D0010
AO area Address: D0020

Modbus setting	Meaning
Start address of DI area	Designate Input contact start address
Start address of DO area	Designate Output contact start address
Start address of AI area	Designate Input register start address
Start address of AO area	Designate Output register start address

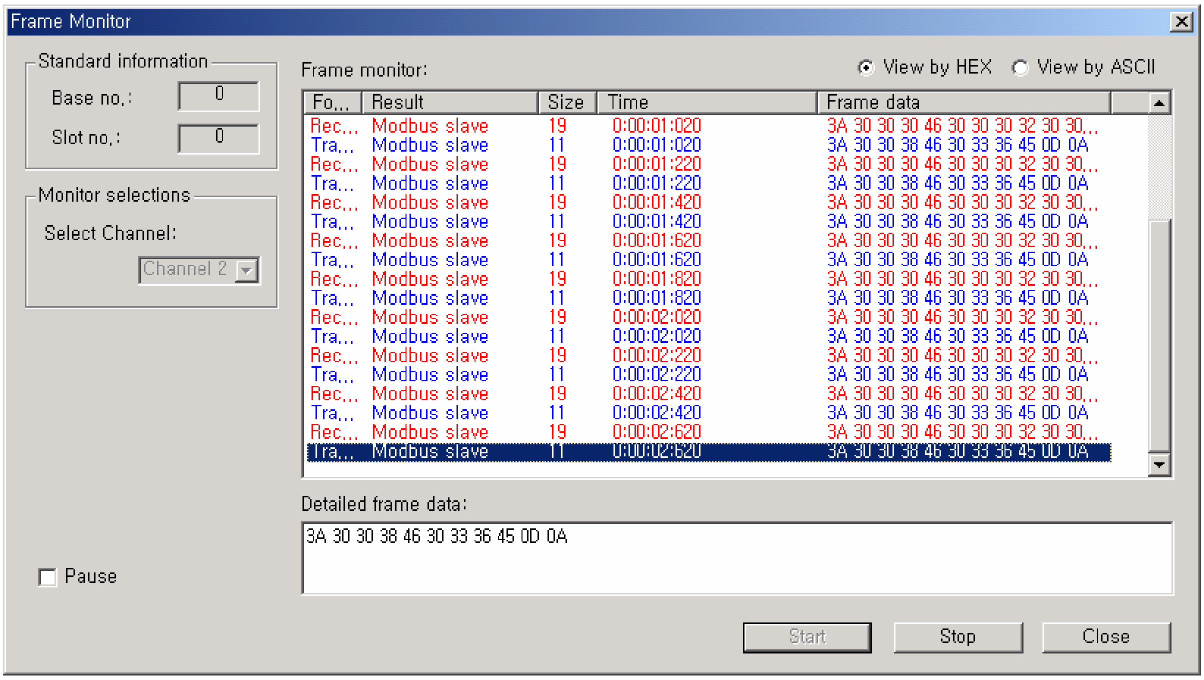
According to the above Modbus bus addressing rules, designate each XGB device (If designating "00000" as a function code "01" in Modbus master, it means that XGB series bit area is designated as M0000; if designating "0000" as a function code, "h10", it means that it designates XGB series word D0020.)

F) Upon the setting, save the above parameters and download them.
Resetting communication module or turning off/on PLC after downloading applies the communication parameters. For the communication monitoring, use 『**Online**』 → 『**System Diagnosis**』.



Frame Monitor

▪It shows frames currently used for communication.



Base no.: 0

Slot no.: 0

Channel 2

● View by HEX ○ View by ASCII

Fo...	Result	Size	Time	Frame data
Rec...	Modbus slave	19	0:00:01:020	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:01:020	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:01:220	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:01:220	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:01:420	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:01:420	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:01:620	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:01:620	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:01:820	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:01:820	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:02:020	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:02:020	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:02:220	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:02:220	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:02:420	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:02:420	3A 30 30 38 46 30 33 36 45 0D 0A
Rec...	Modbus slave	19	0:00:02:620	3A 30 30 30 46 30 30 30 32 30 30...
Tra...	Modbus slave	11	0:00:02:620	3A 30 30 38 46 30 33 36 45 0D 0A

Detailed frame data:

```
3A 30 30 38 46 30 33 36 45 0D 0A
```

☐ Pause

▪communication frame analysis

≫ Client (Master) Demand Frame

Header	Station No.	Function code	Address	No. of Data	No. of Byte	Date	LRC	Tail
:	00	10	077F	0002	04	192B0000	A0	CR/LF

This frame is commanded to write(Function Code h10: continue to write output register) two words data(4 bytes) in 07ff(2047) address of 00 station no. by Modbus ASCII Communication(if 4xxxx area is set as D0020 in the address mapping, the address actually written is D(0020 + 2047) = D2067, from which the data, D2067 = h192B, D2068 = h0000 is written.)

≫ Server (Slave) Normal Response Frame

Header	Station No.	Function code	Address	No. of Data	LRC	Tail
:	00	10	077F	0002	A0	CR/LF

The response is that 2 words data (4 bytes) are written to 07ff (2047) of #00 by Modbus ASCII Communication.

≫ Server(Slave) Abnormal Response Frame

Header	Station No.	Function code	Error code	LRC	Tail
:	00	90 *1	xx *2	xx	CR/LF

In case of an error, set the function code MSB as “1” and respond the error code.

*1 function code : 0001 0000 = h10, if error occurs: 1001 0000 = h90

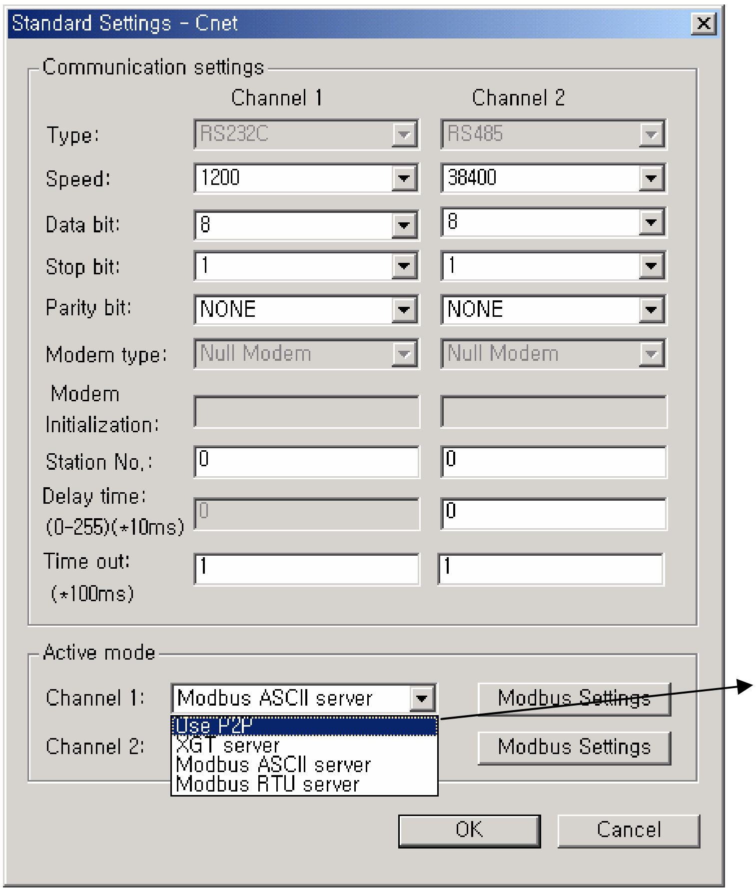
*2 for details of error codes, refer to “Error Code”.

10.2.3 Modbus client communication

Modbus client communication may demand data to each slave device connected to master communication at a desirable time.

1) Communication parameter setting
The following describes how to set types of parameters for Modbus client communication.

A) Set XG-PD basic parameters.

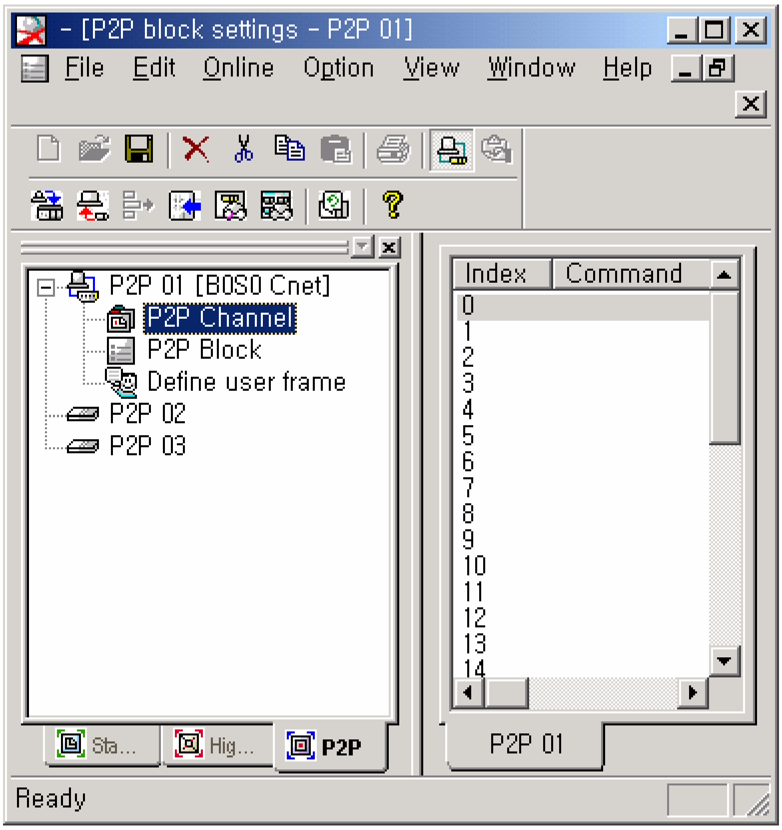


Set by "Use P2P".

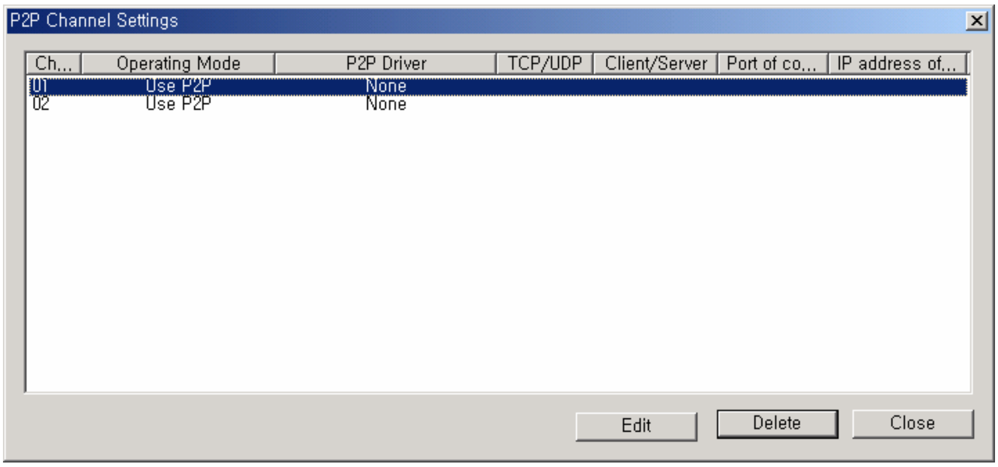
B) communication Setting
▪ Set the following items at a user's option for communication.

Item	Description
Station No.	• Available from 1 to 63.
Speed	• Available from/to 1200, 2400, 4800, 9600, 19200, 38400, 57600 bps.
Data bit	• Set to 7 or 8. (7 bits for ASCII mode or 8 bits for RTU mode.)
Parity bit	• None, Even or Odd.
Stop bit	• Set to 1 or 2 bit(s). (1 with parity bit or 2 without parity bit.)
Type	• Basic unit built-in communication channel is fixed as follows. (CH 1 : RS-232C , CH 2 : RS-485)

- Set 『P2P Channel』 in P2P Setting of Parameter Setting Mode.

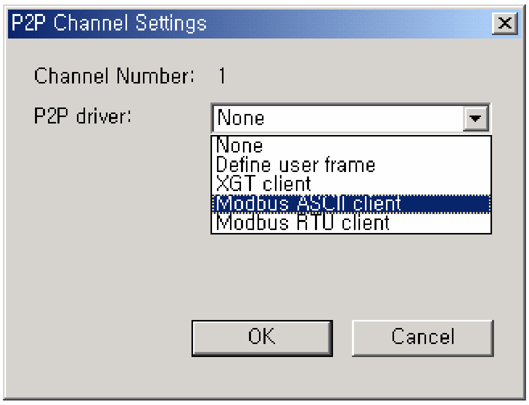


- Double-clicking 『P2P Channel』 shows the following P2P driver setting window.

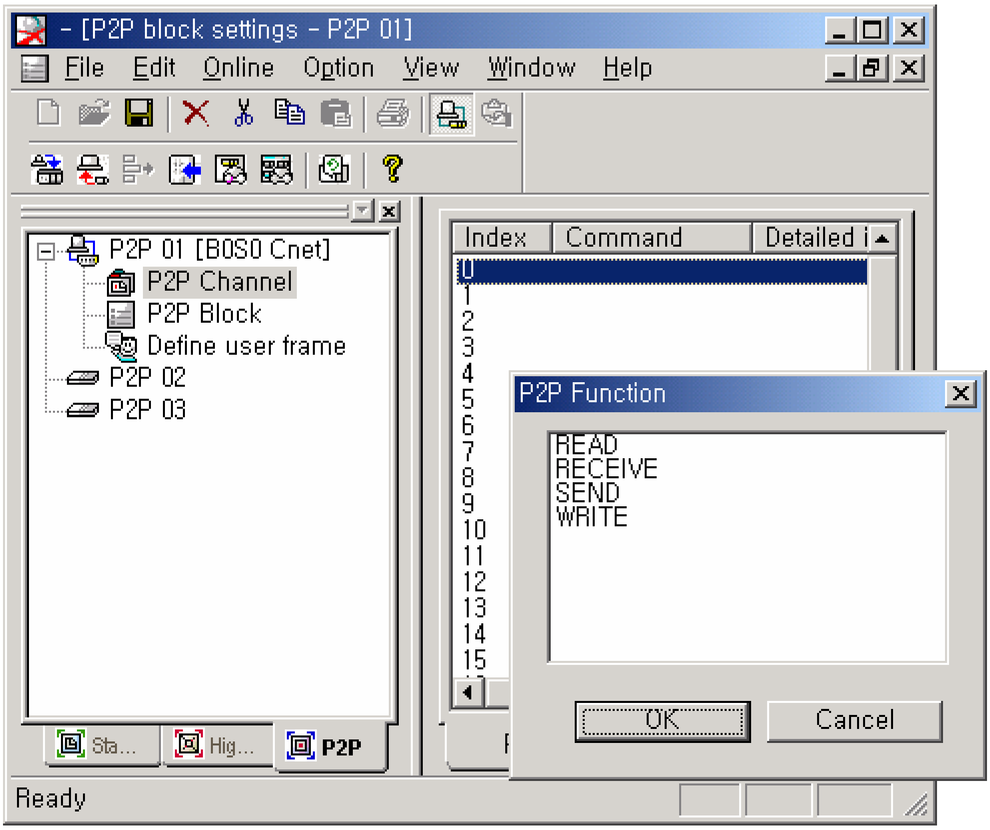


Ch...	Operating Mode	P2P Driver	TCP/UDP	Client/Server	Port of co...	IP address of...
01	Use P2P	None				
02	Use P2P	None				

- Clicking 『Edit』 shows the P2P Driver Setting window as follows.
  Select 『Modbus ASCII client 』 or 『Modbus RTU client』 .

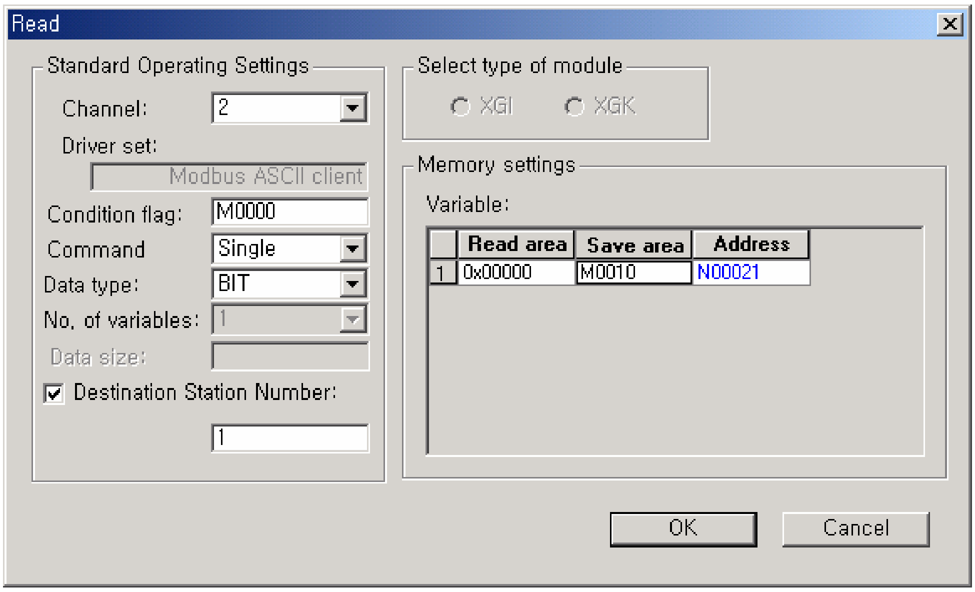


- Double click 『P2P Block』 to edit Modbus Client communication Frame.



- Edit up to 21 communication frames. Double-click it to show communication Mode (Read, Write) Setting window.

- As a Modbus Client, set one of two modes; 『READ』 and 『WRITE』.



Channel: 2

Driver set: Modbus ASCII client

Condition flag: M0000

Command: Single

Data type: BIT

No. of variables: 1

Data size:

☑ Destination Station Number: 1

○ XGI ○ XGK

Variable:

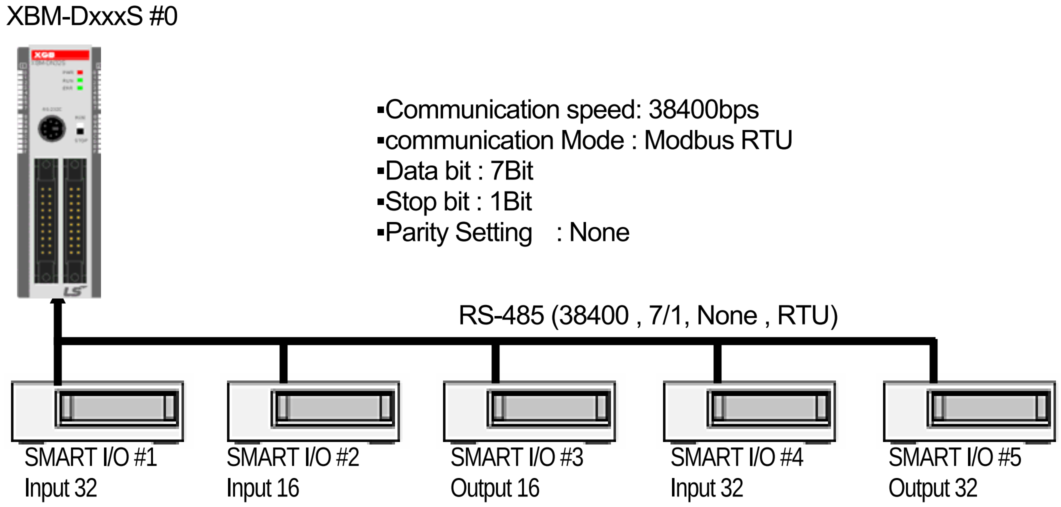
	Read area	Save area	Address
1	0x00000	M0010	N00021

Item		Description	Remarks
Standard Operation Settings			
Channel	1,2	Designate a desirable communication Channel. (CH1 : RS-232C, CH2 : RS-485)	Built in Basic unit
Condition flag		Designate communication command condition flag.	Bit device
Command	Single	Designate individual communication device.	-
	Continuous	Designate communication device in series.	-
Data type	BIT	Set the communication data type as BIT.	-
	WORD	Set the communication data type as Word.	-
No. of variables		Not used for Modbus Communication.	-
Data size		Valid only when a command type is ‘series’; available up to 124 bytes in case of ASCII mode or 250 bytes in case of RTU mode.	Unit: Byte
Destination station number		Set the designation station number for communication.	-
Memory settings			
If designating READ	Read area	Designate a READ device of a connected designation station number.	-
	Save area	Designate read area to save data read from a designation station number.	-
	Address	Address saved in Network Device.	Auto allocation
If designating WRITE	Read area	Designate a device with data to write.	-
	Save area	Designate a WRITE device of a connected designation station number.	-
	Address	Address saved in Network Device.	Auto allocation

- Upon the completion of settings for each block, save the above parameter and write parameters. Once downloading is complete, reset communication module or turn off/on PLC to apply the set communication parameter. For communication monitoring, use 『**Diagnosis**』 → 『**System Diagnosis**』 function. For details of communication monitor function, refer to the examples, 10.1.1 Built-in dedicated communication.

3) Example

A) System Configuration



- Communication speed: 38400bps
- communication Mode : Modbus RTU
- Data bit : 7Bit
- Stop bit : 1Bit
- Parity Setting : None

- Communication uses RS-485 (using CH2) communication Channel built in XGB basic unit.

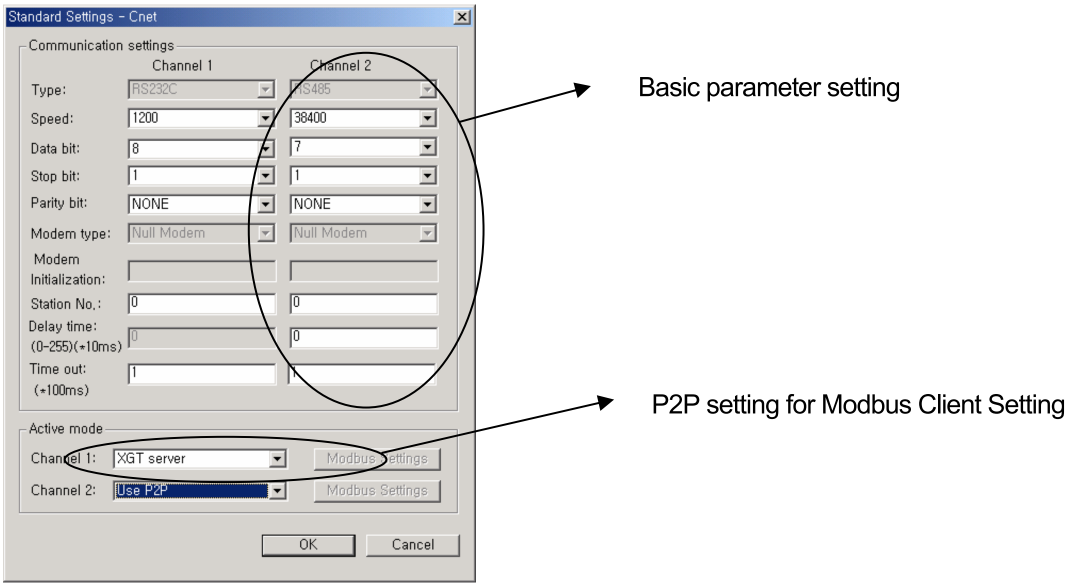
B) Communication Operation

It is assumed that the above-structured system operates as follows.

- Read 32 point input data of Smart I/O #1 at every 200ms and save it to M10.
- If P04 #1 Bit is set, it reads 16 point input of Smart I/O #2 and saves it into M20.
- If M10 #2 Bit is set, it outputs 1word of M11 to Smart I/O #3.
- If P04 #2 Bit is set, it reads 32 input of Smart I/O #4 and saves into MW30.
- If P04 #3 Bit is set, it outputs 2 words of M20 to Smart I/O #5.

C) Parameter Setting

(1) Open a new file in XG5000.
(2) Selecting XG-PD, set the communication basic parameters as follows.



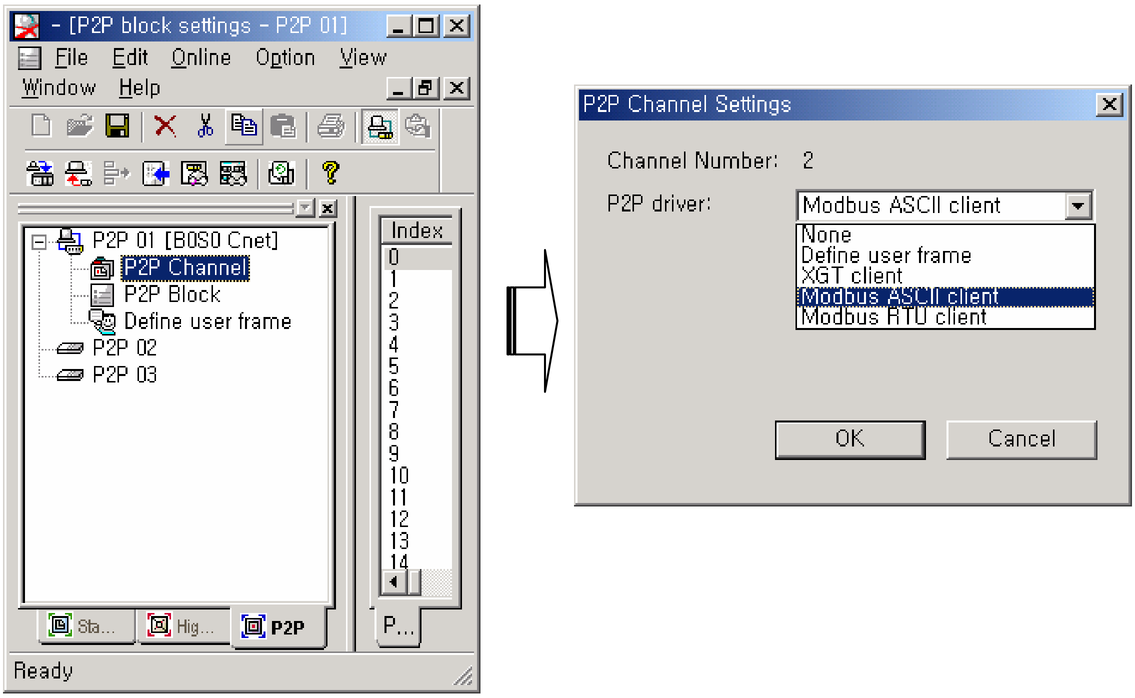
Communication settings

	Channel 1	Channel 2
Type:	RS232C	RS485
Speed:	1200	38400
Data bit:	8	7
Stop bit:	1	1
Parity bit:	NONE	NONE
Modem type:	Null Modem	Null Modem
Modem Initialization:		
Station No.:	0	0
Delay time: (0~255)(*10ms)	0	0
Time out: (*100ms)	1	1

Active mode

Channel 1: XGT server
Channel 2: Use P2P

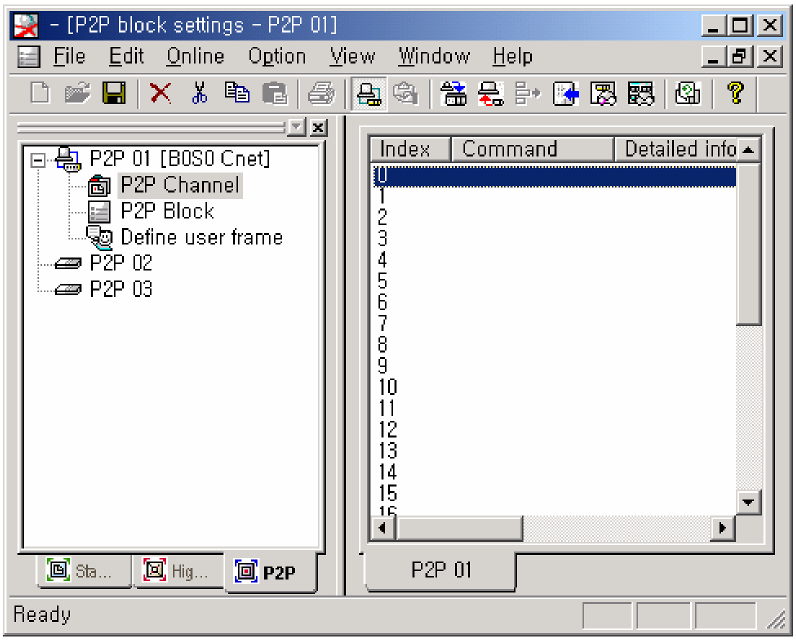
(3) In P2P Setting of Parameter Setting Mode, set CH2 『P2P Driver』 as 『Modbus RTU Client』.



Channel Number: 2

P2P driver: Modbus ASCII client

(4) Set communication parameter with each SMART I/O in『P2P Block』.

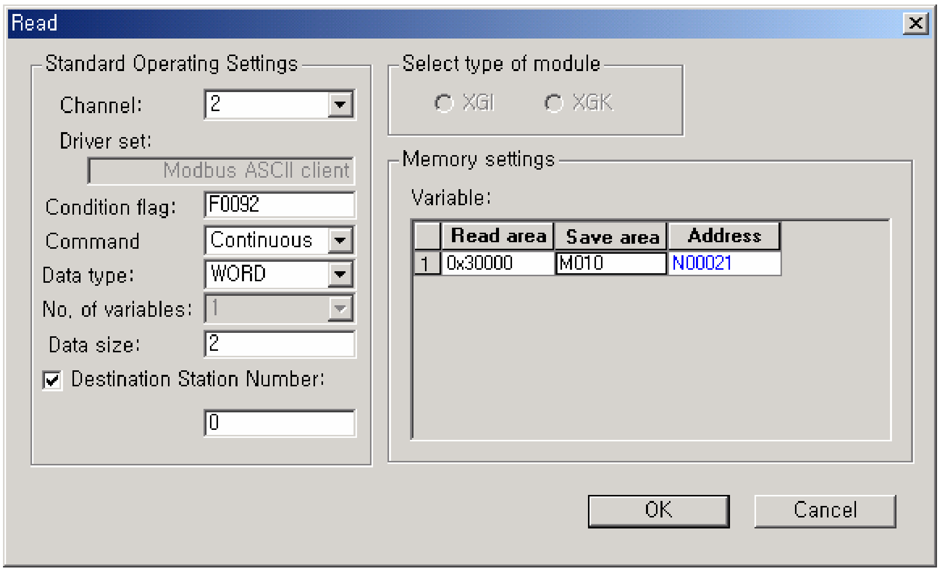


- Communication Parameter Setting for Slave Module (SMART I/O)

Set the communication parameter for each station as seen in the following table.

Index	Operation	Ch.	Condition flag	Command type	Data Type	Data size	Destination station No.	Read area	Save area	Remark
0	Read	2	F092	Series	Word	2	1	0x30000	M0010	SMART I/O #1
1	Read		P0041	Single	Word	-	2	0x30000	M0020	SMART I/O #2
2	Write		M0102	Single	Word	-	3	M0011	0x40000	SMART I/O #3
3	Read		P0042	Series	Word	2	4	0x30000	M0030	SMART I/O #4
4	Write		P0043	Series	Word	2	5	M040	0x40000	SMART I/O #5

a) SMART I/O #1 Setting Window



Read

Standard Operating Settings

Channel: 2

Driver set: Modbus ASCII client

Condition flag: F0092

Command: Continuous

Data type: WORD

No. of variables: 1

Data size: 2

☑ Destination Station Number: 0

Select type of module

○ XGI ○ XGK

Memory settings

Variable:

	Read area	Save area	Address
1	0x30000	M010	N00021

▪Communication Frame Analysis

≫ Client(Master) Demand Frame

Station No.	Function Code	Address	No. of Data	CRC
01	04	0000	0002	71CB

The frame is commanded to read 2words(4 bytes) in 0000 address of #01 by Modbus RTU Communication(Function Code h04: read input register).

≫ Server(Slave) Normal Response Frame

Station No.	Function Code	No. of Bytes	Data	CRC
01	04	04	12345678	xxxx

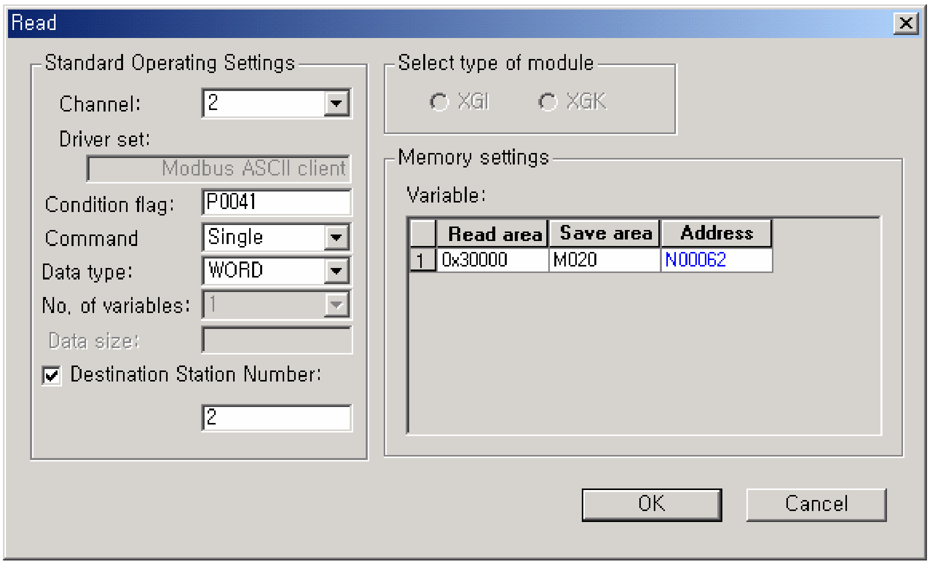
It normally responds 4 bytes data of 0000 address(h12345678) to #01 by Modbus RTU Communication.

≫ Server(Slave) Abnormal Response Frame

Station No.	Function Code	Error Code	LRC
01	84 *1	xx *2	xx

In case of an error, set the function code MSB as “1” and respond the error code.
*1 function code : 0000 0100 = h04, if error occurs : 1000 0100 = h84
*2 for details of error codes, refer to “Error Code”.

b) SMART I/O #2 Setting Window



Channel: 2
Driver set: Modbus ASCII client
Condition flag: P0041
Command: Single
Data type: WORD
No. of variables: 1
Data size:
☑ Destination Station Number: 2

Variable:

	Read area	Save area	Address
1	0x30000	M020	N00062

▪Communication Frame Analysis

≫ Client(Master) Demand Frame

Station No.	Function Code	Address	No. of Data	CRC
02	04	0000	0001	xxxxx

The frame is commanded to read 1 word(4 bytes) in 0000 address of #2 by Modbus RTU communication(Function Code h04: read input register).

≫ Server(Slave) Normal Response Frame

Station No.	Function Code	No. of Bytes	Data	CRC
02	04	02	1234	xxxx

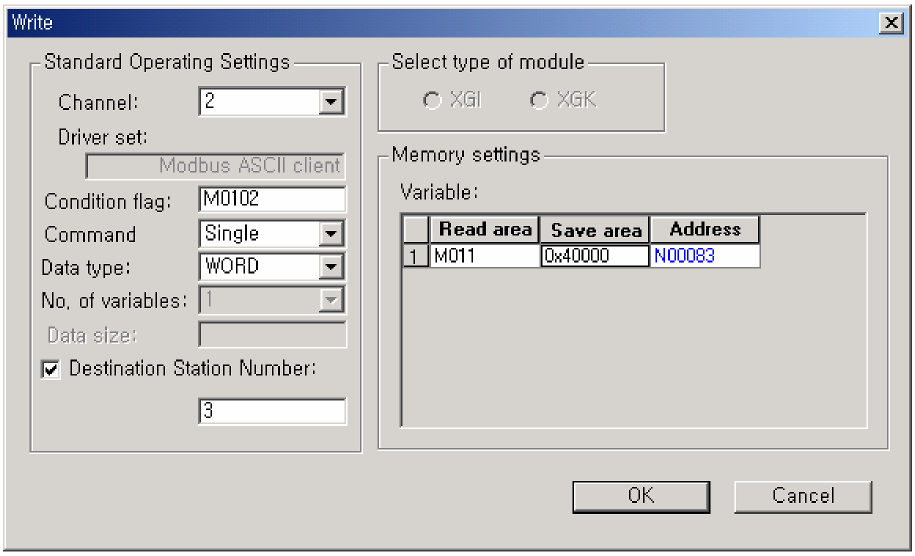
It normally responds 2 bytes data of 0000 address(h1234) by Modbus RTU Communication.

≫ Server(Slave) Abnormal Response Frame

Station No.	Function Code	Error Code	LRC
02	84 *1	xx *2	xx

In case of an error, set the function code MSB as “1” and respond the error code.
*1 function code : 0000 0100 = h04, if error occurs: 1000 0100 = h84
*2 for details of error codes, refer to “Error Code”.

c) SMART I/O #3 Setting Window



Write

Standard Operating Settings

Channel: 2

Driver set: Modbus ASCII client

Condition flag: M0102

Command: Single

Data type: WORD

No. of variables: 1

Data size:

☑ Destination Station Number: 3

Select type of module

○ XGI ○ XGK

Memory settings

Variable:

	Read area	Save area	Address
1	M011	0x40000	N00083

▪Communication Frame Analysis

≫ Client(Master) Demand Frame

Station No.	Function Code	Address	Data	CRC
03	06	0000	1234	xxxx

The frame is commanded to write 1 word(2bytes: h1234) in 0000 address of #3 by Modbus RTU Communication(Function Code h06: write 1 word output register).

≫ Server(Slave) Normal Response Frame

Station No.	Function Code	Address	Data	CRC
03	06	0000	1234	xxxx

The response is that 2 bytes data(h1234) of 0000 address is written to #01 by Modbus RTU Communication.

≫ Server(Slave) Abnormal Response Frame

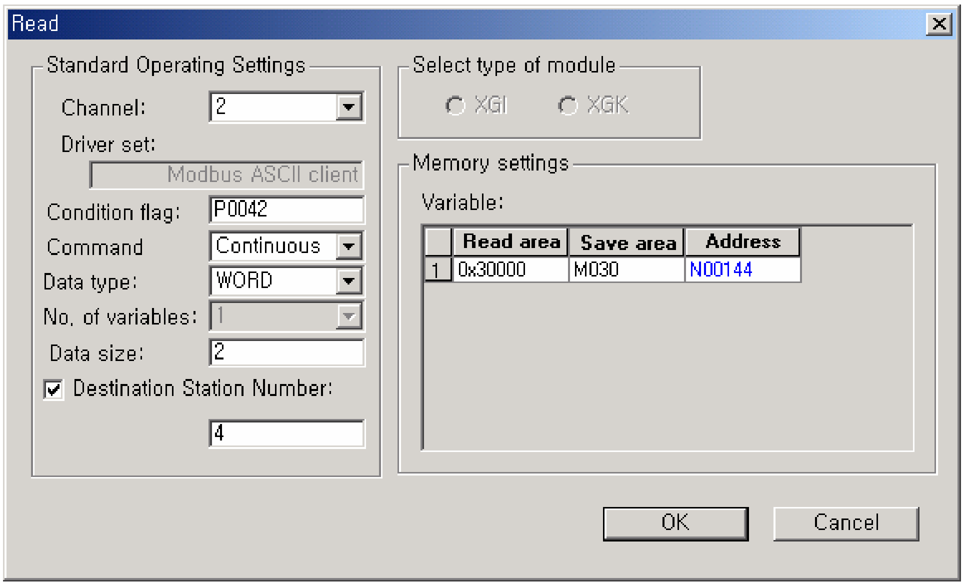
Station No.	Function Code	Error Code	LRC
03	86 *1	xx *2	xx

In case of an error, set the function code MSB as “1” and respond the error code

*1 function code : 0000 0110 = h06, if error occurs : 1000 0110 = h86

*2 for details of error code, refer to “Error Code.”

d) SMART I/O #4 Setting window



Channel: 2

Driver set: Modbus ASCII client

Condition flag: P0042

Command: Continuous

Data type: WORD

No. of variables: 1

Data size: 2

☑ Destination Station Number: 4

Variable:

	Read area	Save area	Address
1	0x30000	M030	N00144

▪Communication Frame Analysis

≫ Client(Master) Demand Frame

Station No.	Function Code	Address	No. of Data	CRC
04	04	0000	0002	xxxx

This frame is commanded to read 1 word(4bytes) in 0000 address of #02 by Modbus RTU Communications(Function Code h04 : read input register).

≫ Server(Slave) Normal Response Frame

Station No.	Function Code	No. of Bytes	Data	CRC
04	04	02	1234	xxxx

The response is that 2 bytes data(h1234) of 0000 address is read to #01 by Modbus RTU Communications.

≫ Server(Slave) Abnormal Response Fram

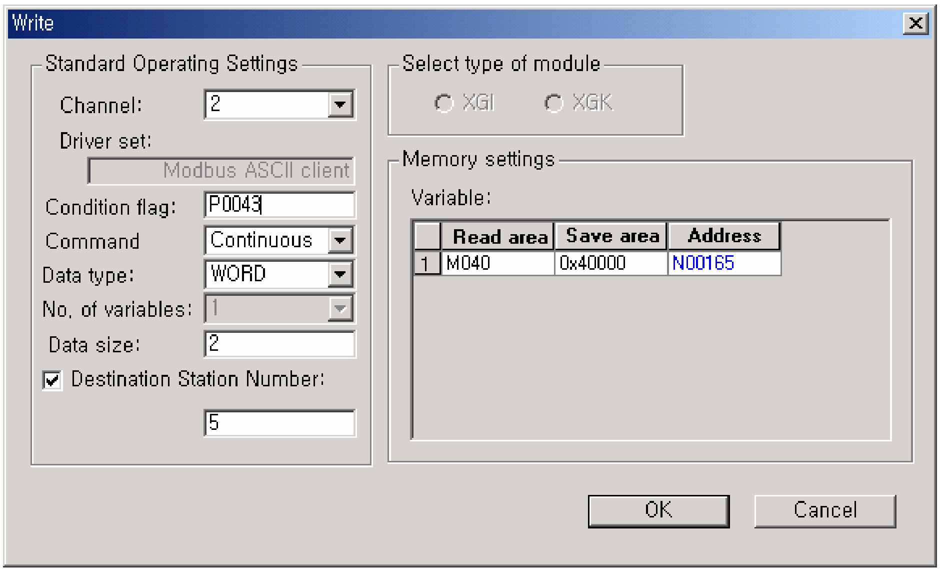
Station No.	Function Code	Error Code	LRC
04	84 *1	xx *2	Xx

In case of an error, set the function code MSB as “1” and respond the error code

*1 function code : 0000 0100 = h04, if error occurs: 1000 0100 = h84

*2 for details of error code, refer to “Error Code.”

e) SMART I/O #4 Setting window



Channel: 2

Driver set: Modbus ASCII client

Condition flag: P0043

Command: Continuous

Data type: WORD

No. of variables: 1

Data size: 2

☑ Destination Station Number: 5

Variable:

	Read area	Save area	Address
1	M040	0x40000	N00165

- Communication Frame Analysis

≫ Client(Master) Demand Frame

Station No.	Function Code	Address	No. of Data	No. of Bytes	Data	CRC
05	10	0000	0002	04	12345678	xxxx

The frame is commanded to write 2 words(4 bytes) data(h12345678) to 0000 address of #05 by Modbus RTU Communication(Function code h10: continue to write output register)

≫ Server(Slave) Normal Response Frame

Station No.	Function Code	Address	No. of Data	CRC
05	10	0000	0002	xxxx

The response is that 2 words data(h12345678) of 0000 address is normally written to #01 by Modbus RTU Communication.

≫ Server(Slave) Abnormal Response Frame

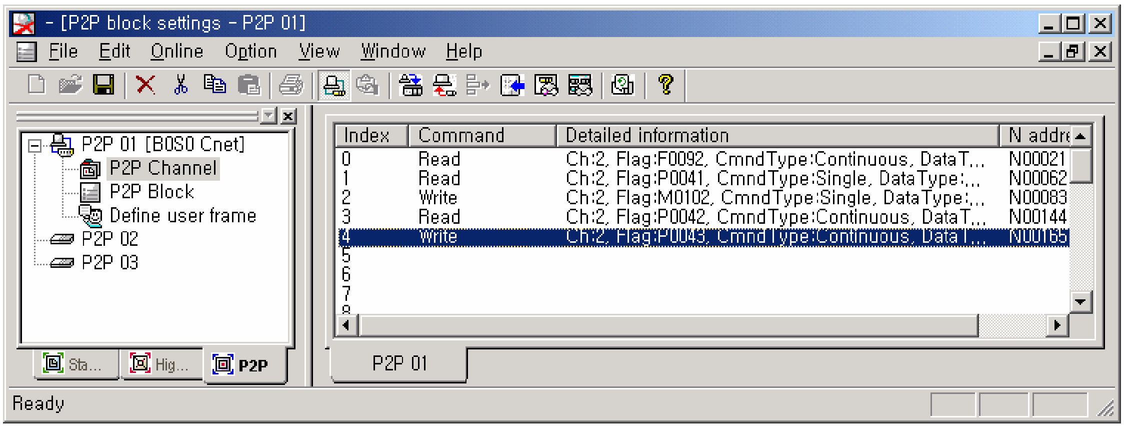
Station No.	Function Code	Error Code	LRC
05	90 *1	xx *2	xx

In case of an error, set the function code MSB as “1” and respond the error code.

*1 function code : 0001 0000 = h10, if error occurs : 1001 0000 = h90

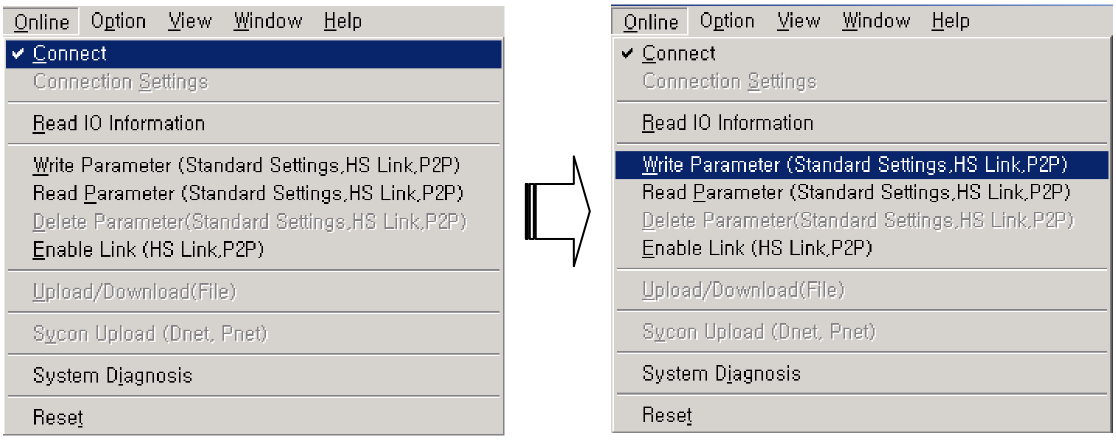
*2 for details of error codes, refer to “Error Code”.

▪Upon P2P Block Setting, the window is displayed as follows.

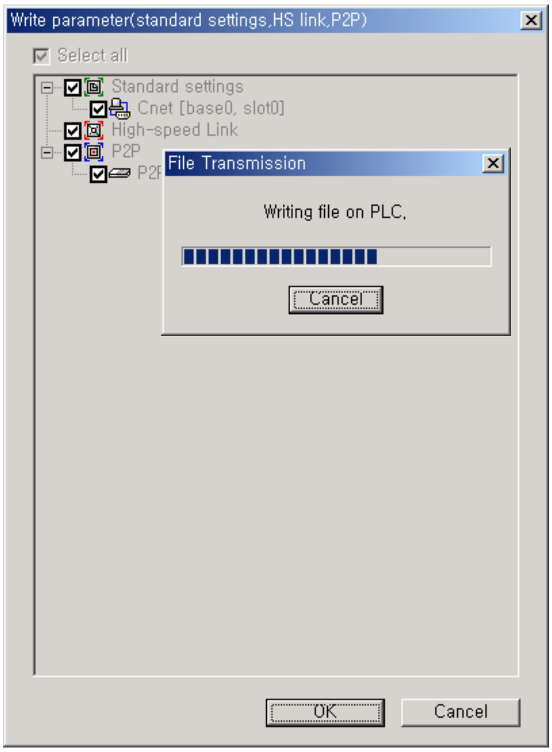


Index	Command	Detailed information	N addre
0	Read	Ch:2, Flag:F0092, CmndType:Continuous, DataT...	N00021
1	Read	Ch:2, Flag:P0041, CmndType:Single, DataType:...	N00062
2	Write	Ch:2, Flag:M0102, CmndType:Single, DataType:...	N00083
3	Read	Ch:2, Flag:P0042, CmndType:Continuous, DataT...	N00144
4	Write	Ch:2, Flag:P0043, CmndType:Continuous, DataT...	N00165
5			
6			
7			
8			

▪Once P2P parameter setting is complete, connect to the system by using XG-PD 『**Online**』 → 『**Connect**』 menu and download the set parameters by using 『Write Parameter』 menu..

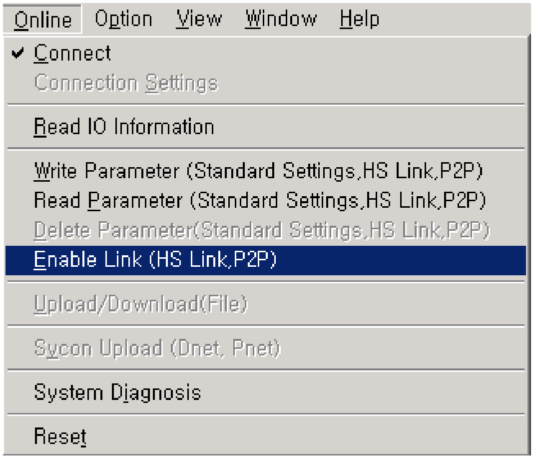


▪Select and download Basic Setting and P2P.

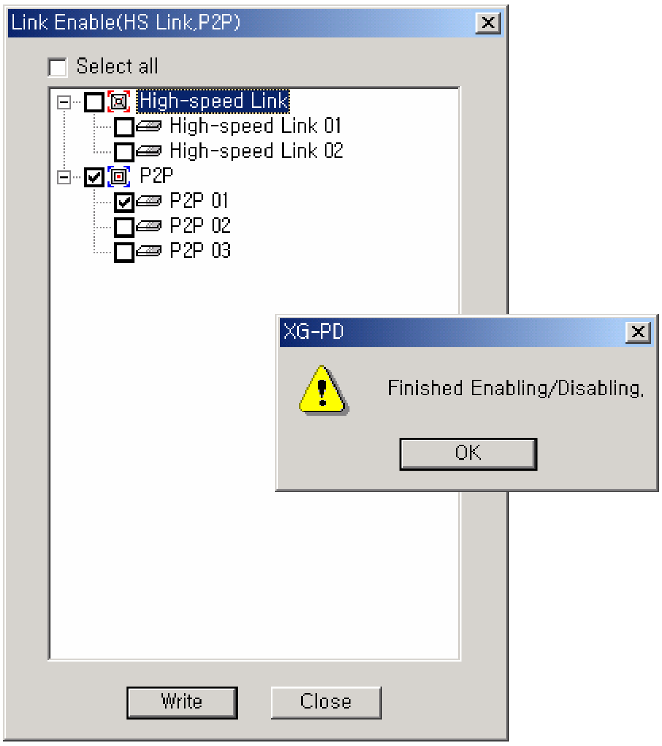


Writing file on PLC.

- Set 『 **Online** 』 → 『 **Enable Link** 』 and start Communication.



- Enable the only set communication.

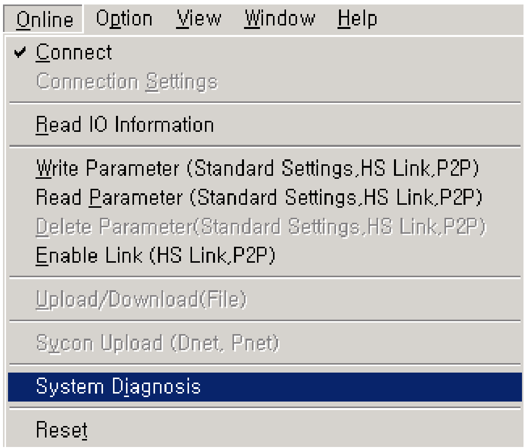


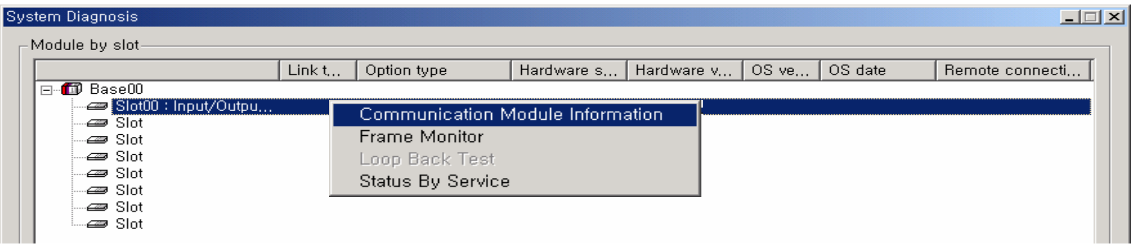
☐ Select all

- ☐ High-speed Link
  - ☐ High-speed Link 01
  - ☐ High-speed Link 02
- ☑ P2P
  - ☑ P2P 01
  - ☐ P2P 02
  - ☐ P2P 03

Finished Enabling/Disabling.

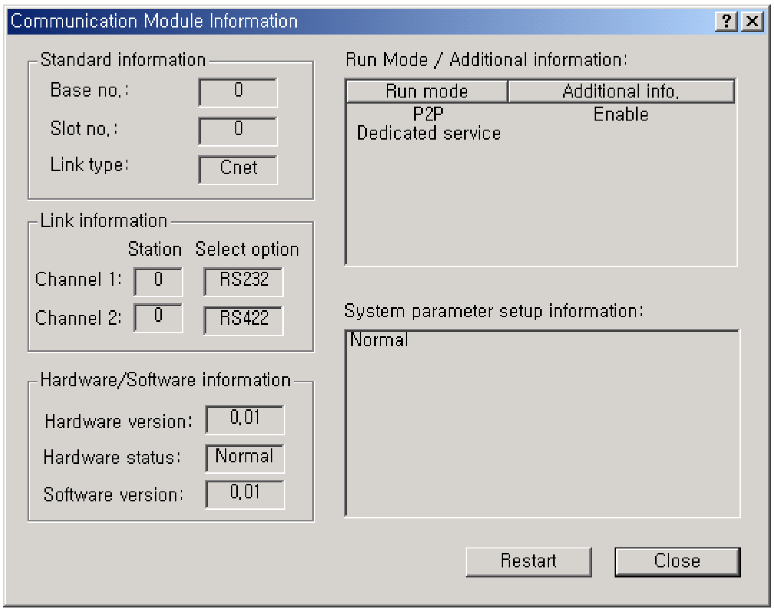
- Monitor communication status by using 『 **Online** 』 → 『 **System Diagnosis**』 menu.





f) Communication Module Info

▪Display the information of communication module connected.



Base no.: 0
Slot no.: 0
Link type: Cnet

	Station	Select option
Channel 1:	0	RS232
Channel 2:	0	RS422

Hardware version: 0.01
Hardware status: Normal
Software version: 0.01

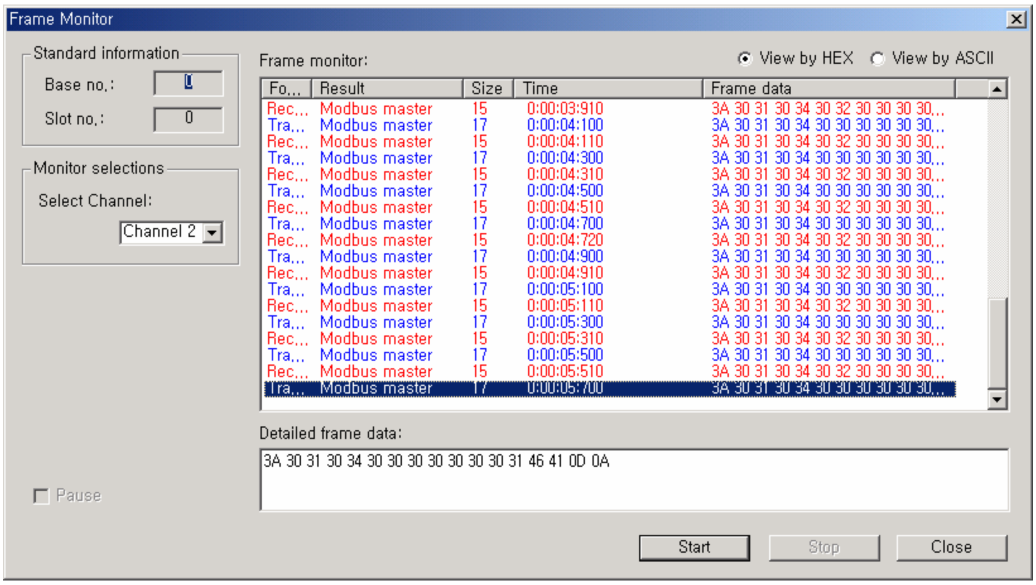
Run mode	Additional info.
P2P	Enable
Dedicated service	

Normal

Item		Description
Standard Information	Base no.	Display base number (XGB has ‘0’ as its base)
	Slot no.	Display a location of communication module slot (built-in communication is ‘0’)
	Link type	Display communication Module type (Cnet / Enet).
Link information		Display the station number and communication type for each channel.
Hardware/Software information		Display communication type and the status and version of H/W.
Run mode / Additional Info.		Display communication type and Enable info.
System parameter setup information		Display system parameter setting info.

g) Frame Monitor

▪Display each frame currently used for communication.



Base no.: 0

Slot no.: 0

Select Channel: Channel 2

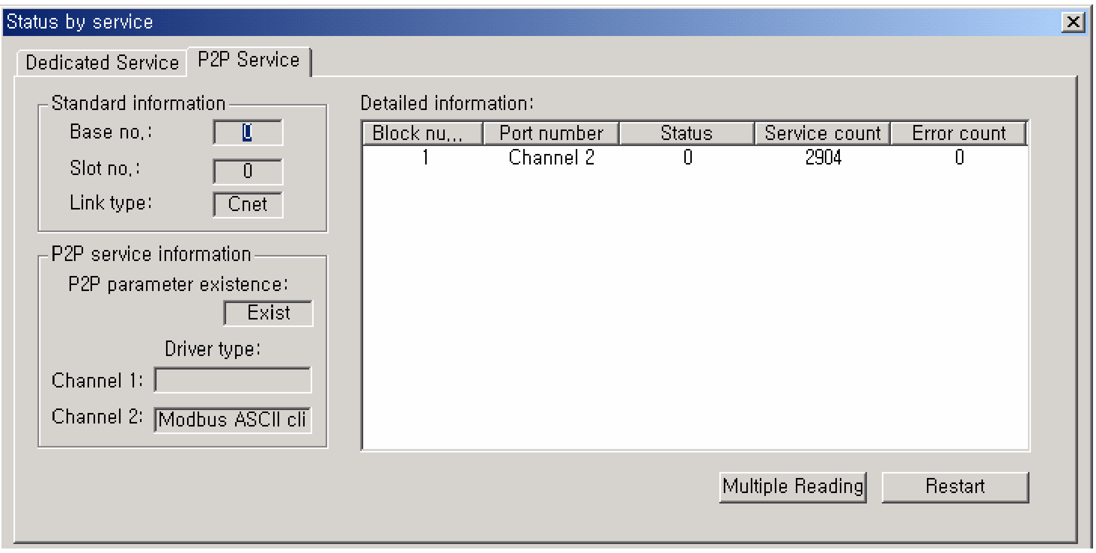
Frame monitor: ● View by HEX ○ View by ASCII

Fo...	Result	Size	Time	Frame data
Rec...	Modbus master	15	0:00:03:910	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:04:100	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:04:110	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:04:300	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:04:310	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:04:500	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:04:510	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:04:700	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:04:720	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:04:900	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:04:910	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:05:100	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:05:110	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:05:300	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:05:310	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:05:500	3A 30 31 30 34 30 30 30 30 30 30...
Rec...	Modbus master	15	0:00:05:510	3A 30 31 30 34 30 32 30 30 30 30...
Tra...	Modbus master	17	0:00:05:700	3A 30 31 30 34 30 30 30 30 30 30...

Detailed frame data:

```
3A 30 31 30 34 30 30 30 30 30 30 30 31 46 41 0D 0A
```

h) Monitor communication service status.



Base no.: 0

Slot no.: 0

Link type: Cnet

P2P parameter existence: Exist

Driver type:

Channel 1:

Channel 2: Modbus ASCII cli

Detailed information:

Block nu...	Port number	Status	Service count	Error count
1	Channel 2	0	2904	0

Item		Description
Standard Information	Base no.	Display Base No (XGB has '0' as its base.)
	Slot no.	Display the location of communication Module slot(built-in communication is '0').
	Link type	Display communication module type(Cnet / Enet)
P2P service Information		Display the existence of P2P communication parameter and driver type by channels.
Detailed information	Block number	Display P2PBlock Setting No.(Parameter setting)
	Port number	Display a user-designated channel.
	Status	Display the current communication status(error code).
	Service count	Display the communication service frequency executed till now.
	Error count	Display the number of communication errors occurred till now.

4) Modbus communication Error Codes and the Countermeasures

Error codes and the description

Code	Name	Description
01	Illegal Function	Function code error
02	Illegal Address	Out of range of allowable address
03	Illegal Data Value	Out of data range

10.3 User Defined Communication

10.3.1 User defined protocol communication

1) Introduction

User Defined Protocol Communication allows users who do communication between XGB unit and other kind of device to define the other company's protocol at XGB PLC. There're a number of kinds of protocols made by many companies, that it's difficult to have all protocols in it. So if a user defines a protocol that can be applied to his/her purpose, XGB unit executes the communication with the other kind of device through the defined protocol.

For this, protocol frame must be defined in XG5000. And exact knowledge about the contents of the protocol defined by the user is vital in making the communication possible. XG5000 can download a user defined protocol frame into XGB unit and it is saved. it is not erased by power's off/on. For using user-defined mode, he/she should program with instruction controlling sending of PLC as well as edit frames. This section explains User Defined Protocol Communication setting & usage.

2) Parameter Setting

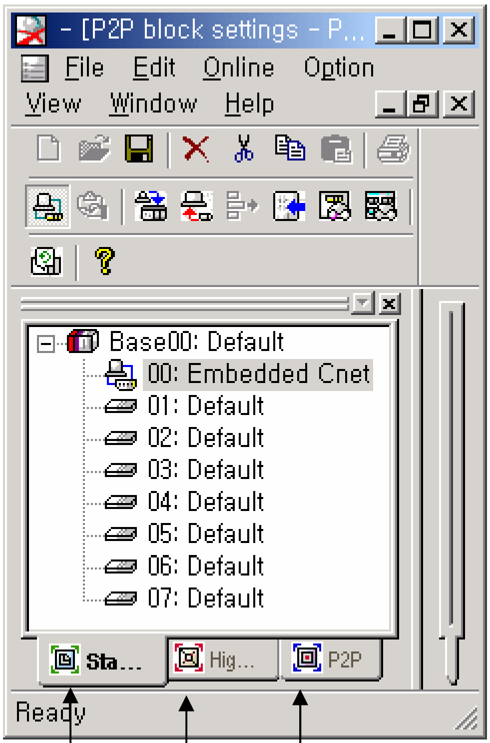
A) Communication parameter setting

It describes how to set types of parameters for Modbus server communication.

(1) Open a new project file in XG5000.

- Make sure to select XGB as PLC type.
- Select 『Network Manager』 in 『Tools』 menu of (XG-PD) XG5000. Then, 『Network Manager』 is called XG-PD throughout this document.

(2) Selecting “XGB-XBMS” in 『Option』 menu of XG-PD shows the following window.



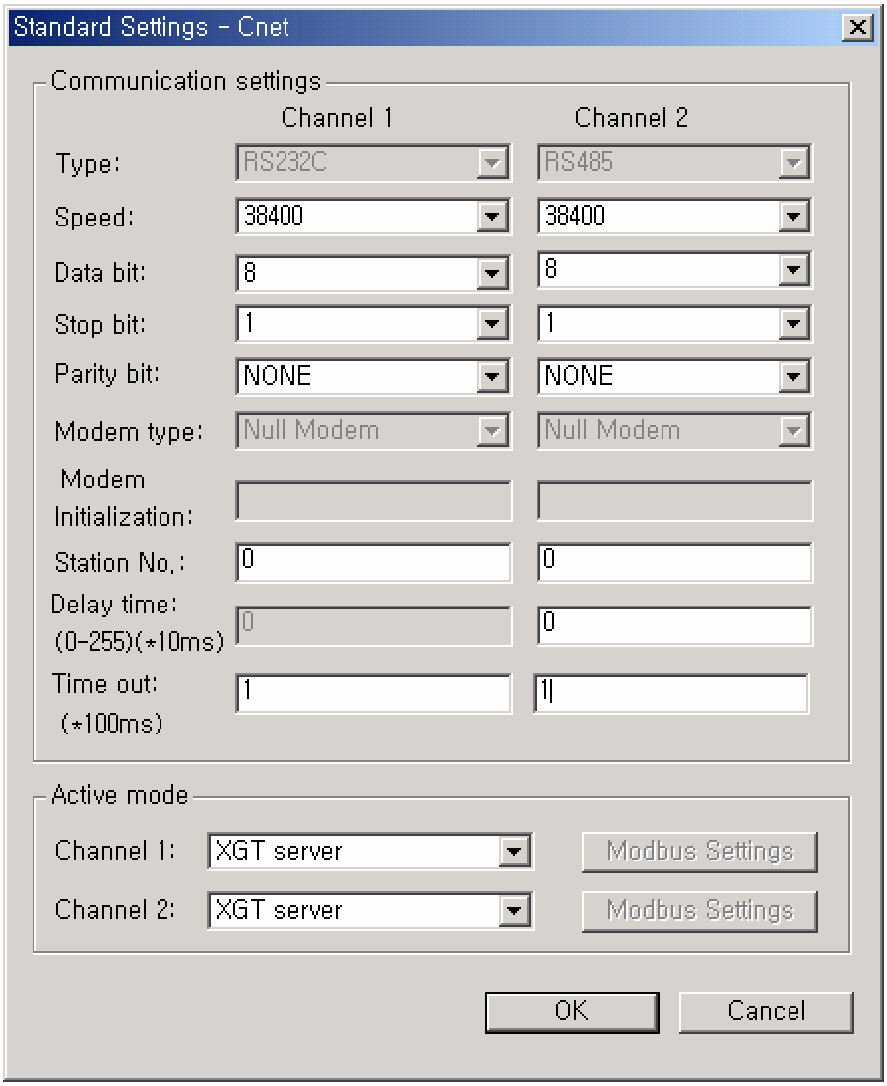
P2P Setting

High speed Link setting

Module setting (Cnet, Enet)

Communication parameter setting mode

▪Double-clicking 『00 : Cnet』 shows the following basic communication window.



	Channel 1	Channel 2
Type:	RS232C	RS485
Speed:	38400	38400
Data bit:	8	8
Stop bit:	1	1
Parity bit:	NONE	NONE
Modem type:	Null Modem	Null Modem
Modem Initialization:		
Station No.:	0	0
Delay time: (0-255)(*10ms)	0	0
Time out: (*100ms)	1	1

Channel 1: XGT server

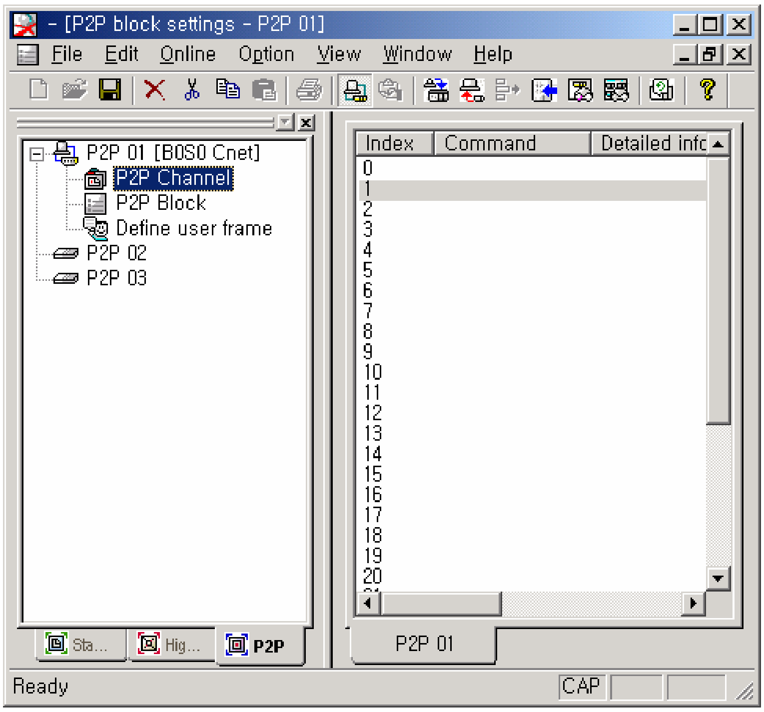
Channel 2: XGT server

(3) Communication setting

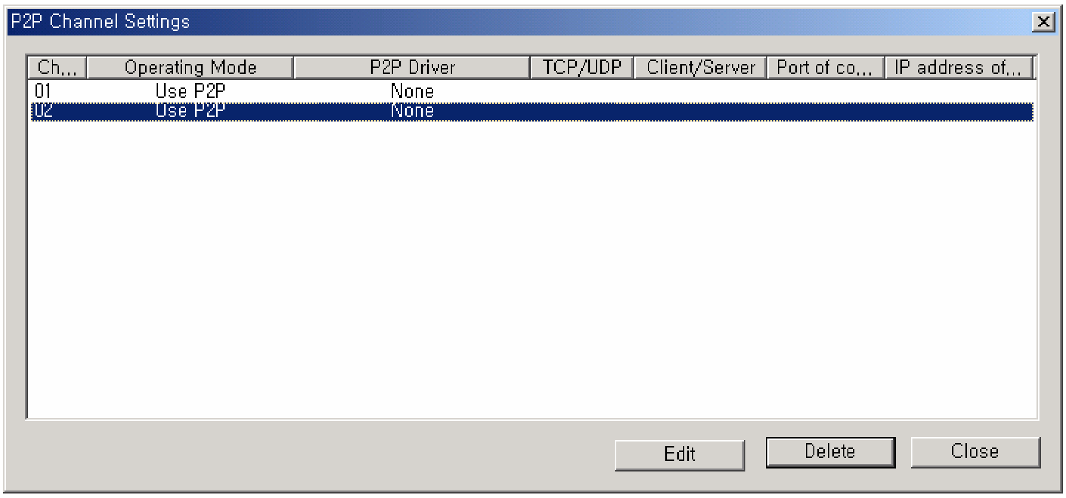
▪Set the following items at a user's option for communication.

Item	Description
Station No.	• Available from 1 to 31 as station number.
Speed	• Available from/to 1200, 2400, 4800, 9600, 19200, 38400, 57600 bps.
Data bit	• Set to 7 or 8 bits. (7 bits for ASCII mode or 8 bits for RTU mode.
Parity bit	• None, Even or Odd.
Stop bit	• Set to 1 or 2 bit(s). (1 with parity bit or 2 without parity bit.)
Type	Basic unit built-in Communication channel is fixed as follows. (CH 1 : RS-232C , CH 2 : RS-485)
Delay time	• Set the interval of communication frame (0 ~ 255 in the unit of 10 ㎳).

- Set to 『P2P Channel』 in P2P setting of parameter setting mode.

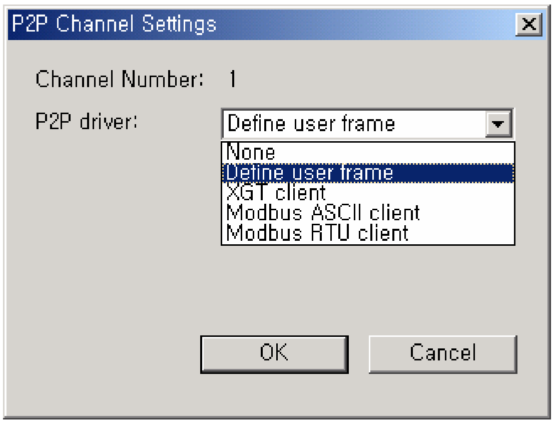


- Double-clicking『P2P Channel』 opens the following P2P Driver Setting Window.



Ch...	Operating Mode	P2P Driver	TCP/UDP	Client/Server	Port of co...	IP address of...
01	Use P2P	None				
02	Use P2P	None				

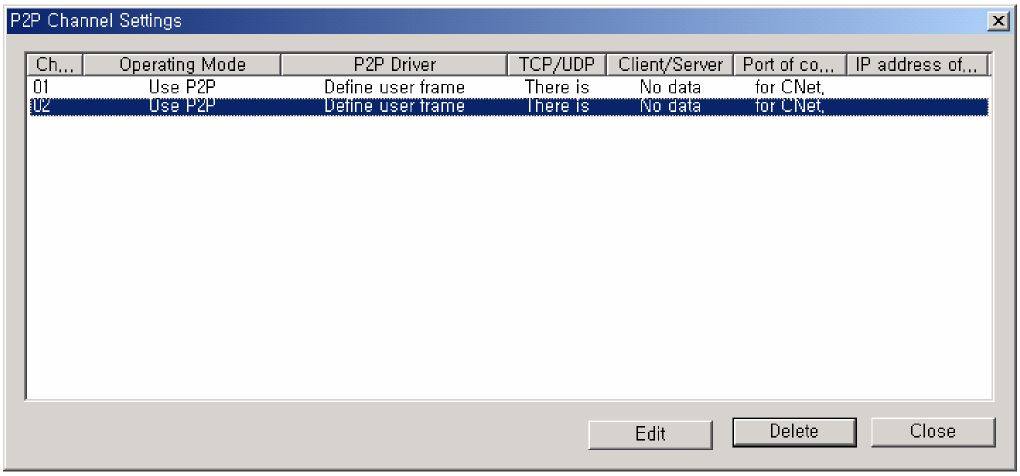
- Clicking『Edit』 shows the following P2P Driver Setting Window.



Channel Number: 1

P2P driver: Define user frame

- Select 『Define user frame』.

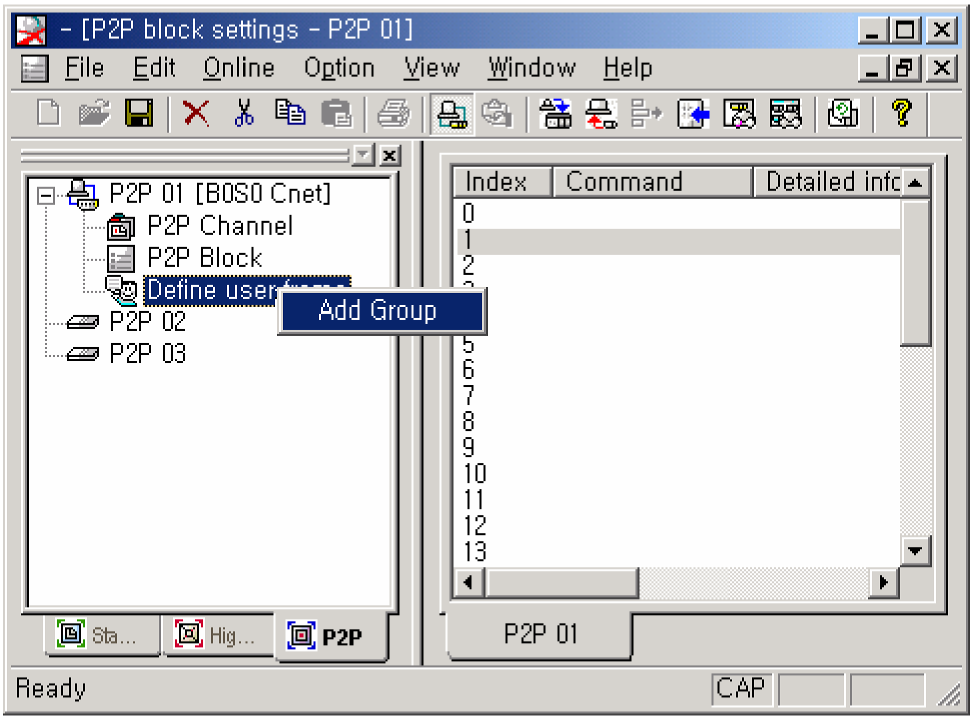


Ch...	Operating Mode	P2P Driver	TCP/UDP	Client/Server	Port of co...	IP address of...
01	Use P2P	Define user frame	There is	No data	for CNet,	
02	Use P2P	Define user frame	There is	No data	for CNet,	

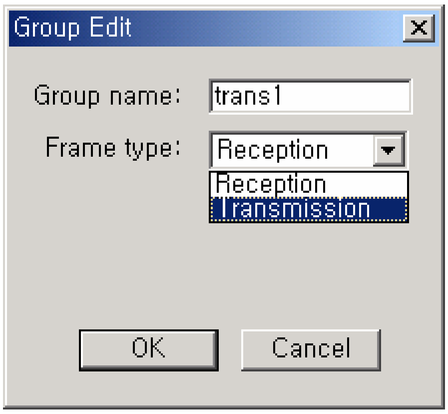
- It describes the procedure and method of how to create a user-defined transmission frame for the communication with the following frame.

Item	Header	Body					Tail	
Frame	h05	00	wSB	06%MW100	04	Variable size variable	h04	BCC
Setting	Numeric constant	String constant	String constant	String constant	String constant	Hex To ASCII conversion	-	Byte Checksum ASCII conversion(Body)
Size	1	2	3	8	2	Transmission condition setting	1	2

- Set 'Add Group' in 『Define user frame』.

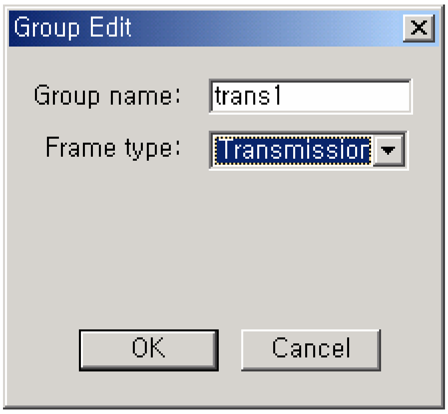


- Designate group name and frame type. First of all, select transmission.



Group name: trans1

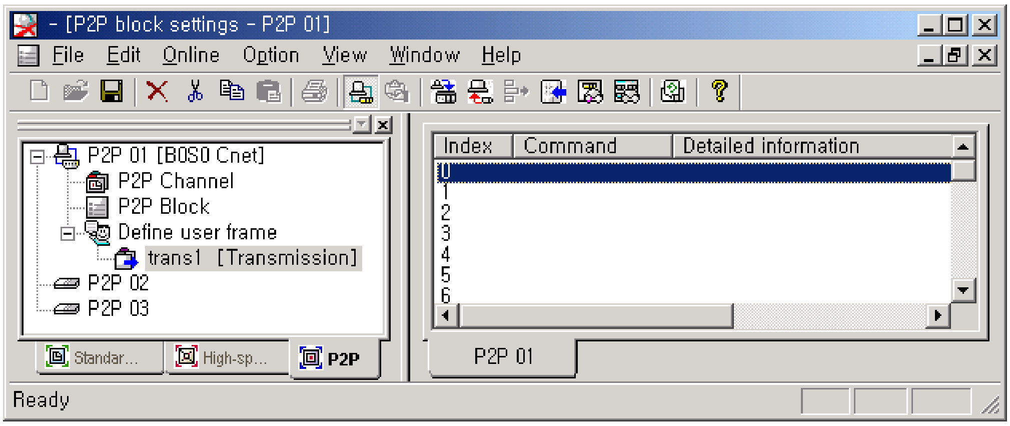
Frame type: Reception



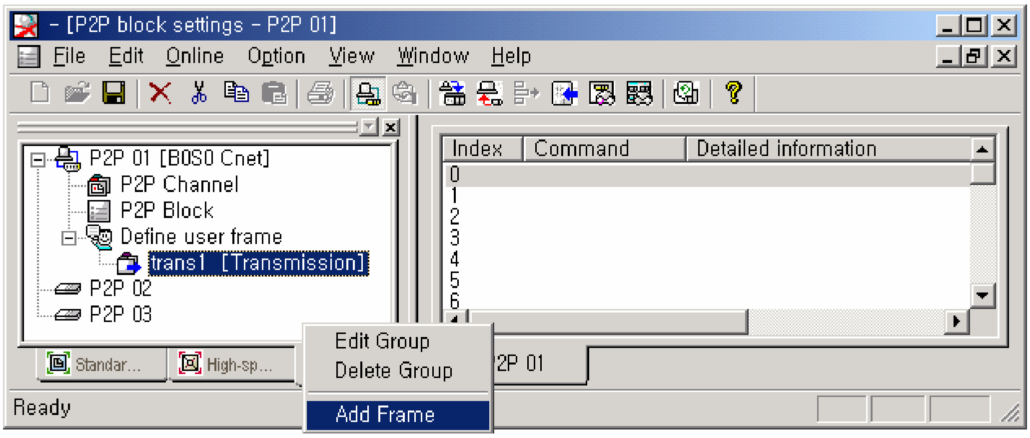
Group name: trans1

Frame type: Transmission

- Upon the designation, the following frame menus are displayed.

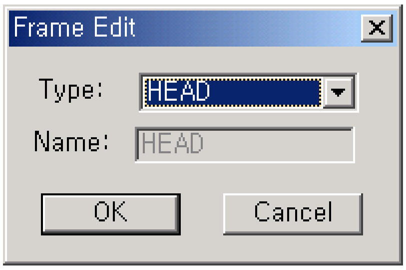


- To show editing menus, click the right mouse button on the frame.



Item	Description
Edit Group	Edit user frame group.
Delete Group	Delete user frame group.
Add Frame	Add user frame.

- Add HEAD frame.

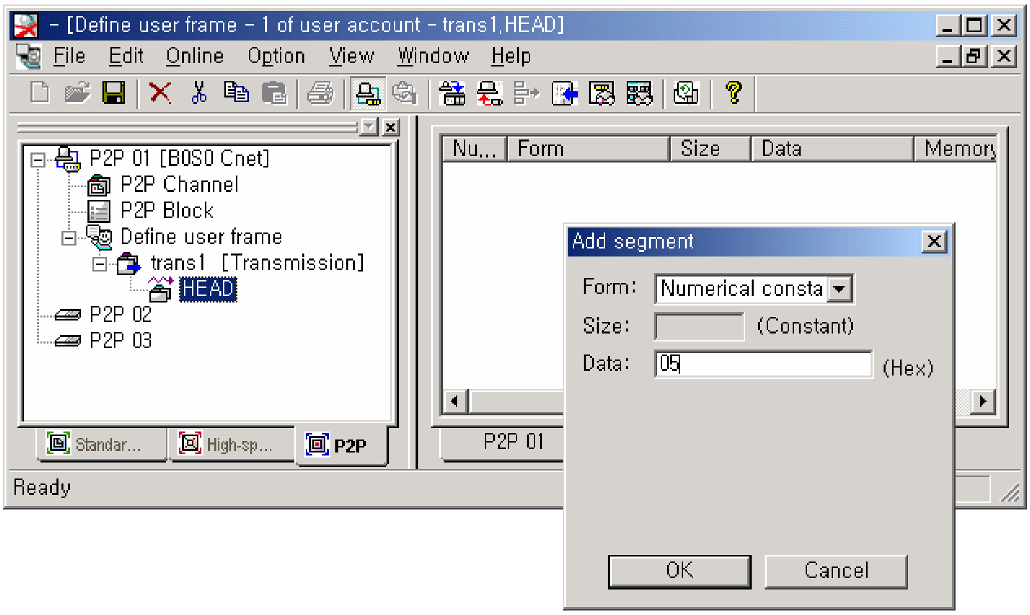


Frame Edit

Type: HEAD

Name: HEAD

- To show HEAD frame registration window, double click it with cursor placed on the right window.



- [Define user frame - 1 of user account - trans1,HEAD]

Add segment

Form: Numerical consta

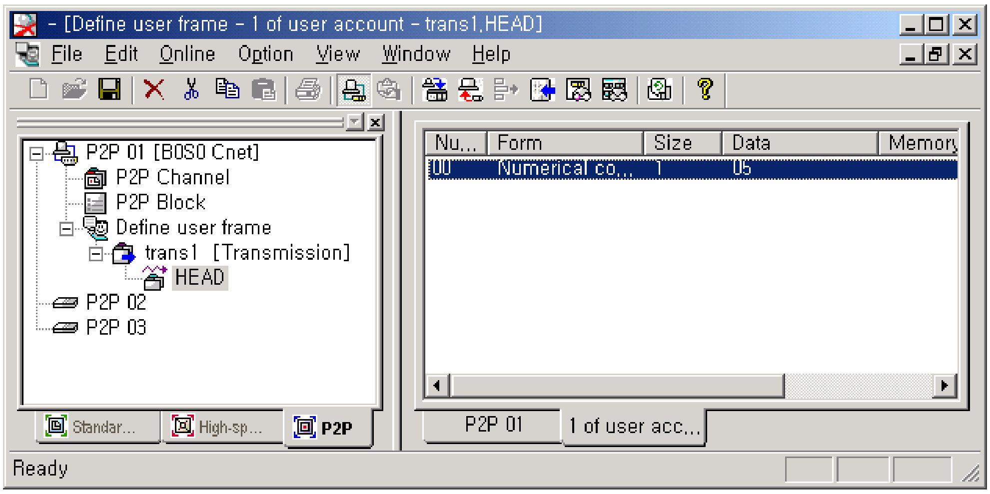
Size: (Constant)

Data: 05 (Hex)

- Set a numeric constant, “05 (ENQ)”.

Item		Description	Remark
Type	Numeric constant	Set numeric constant.	Set data with 20 numbers(10bytes) to the max.
	String constant	Set string constant.	Set data with 10 numbers or characters (10bytes) to the max.
Data		Set data.	-

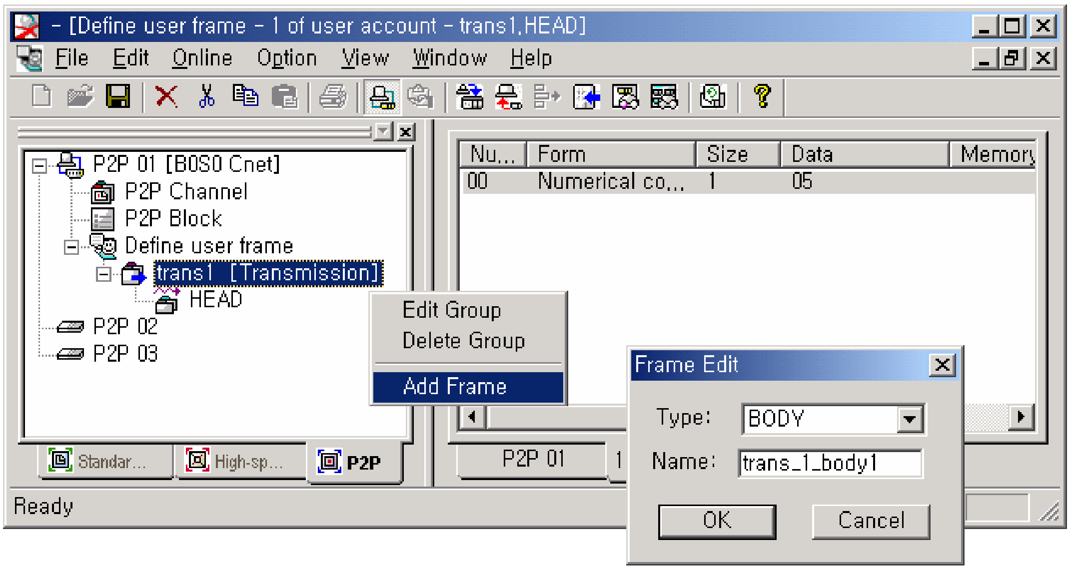
- The following window shows the status that HEAD setting is complete.



- [Define user frame - 1 of user account - trans1,HEAD]

Nu...	Form	Size	Data	Memory
00	Numerical co...	1	05	

- From Add Frame, add BODY frame.



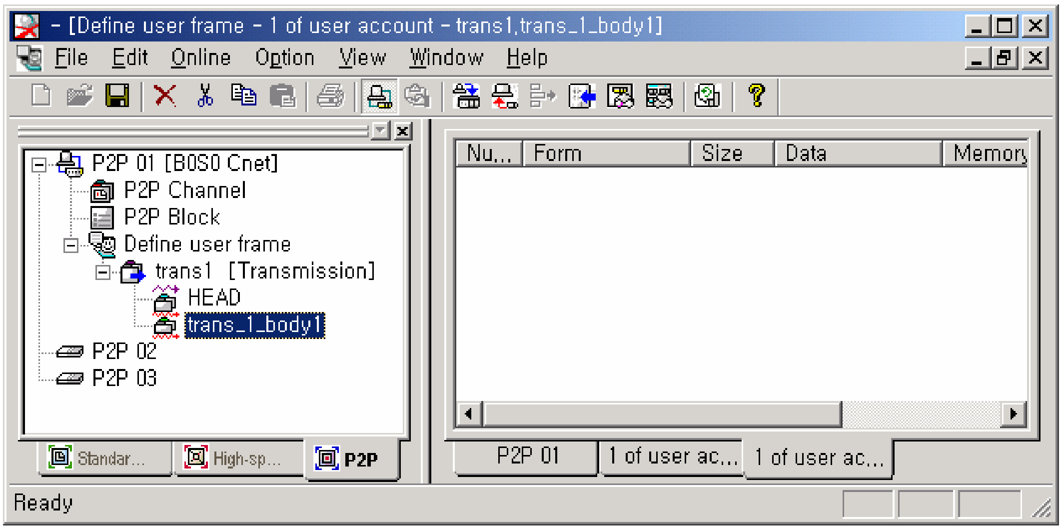
- [Define user frame - 1 of user account - trans1,HEAD]

Nu...	Form	Size	Data	Memory
00	Numerical co...	1	05	

Frame Edit

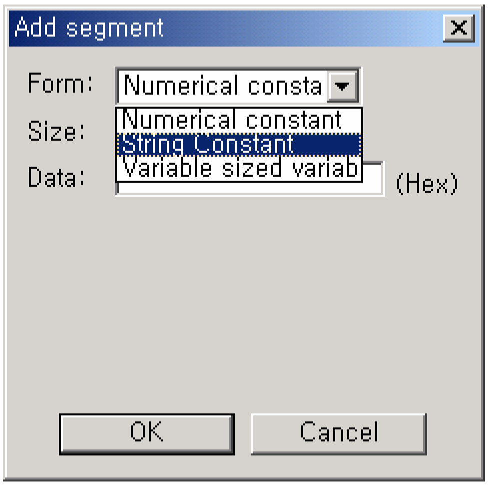
Type: BODY

Name: trans_1_body1



- [Define user frame - 1 of user account - trans1,trans_1_body1]

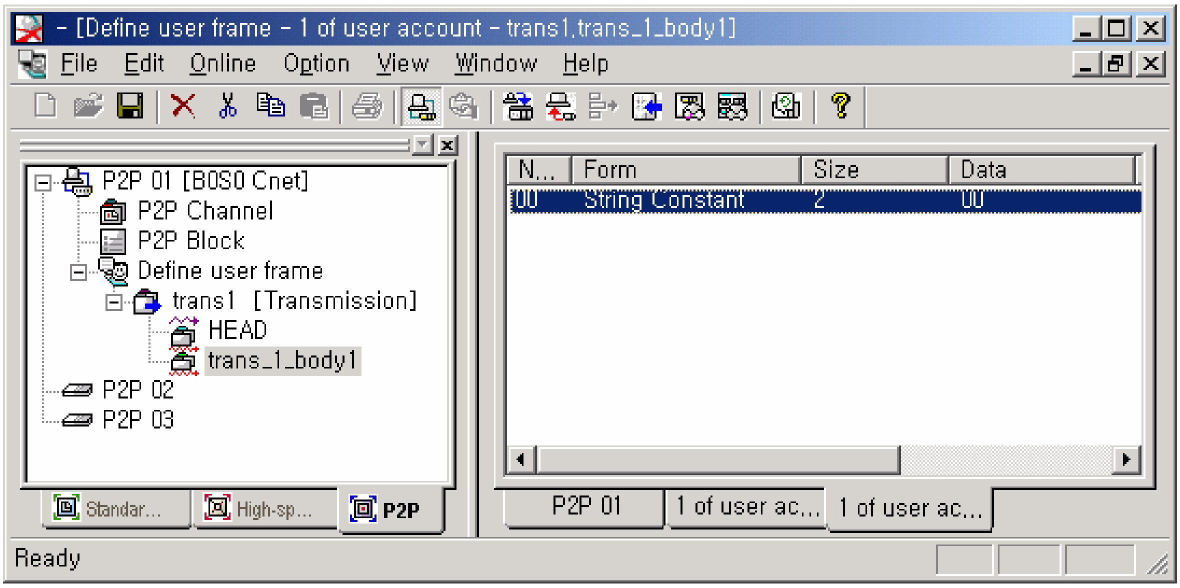
- Double-clicking on the right window opens the below Add Segment window, in which a string constant, “00” is set.



Add segment

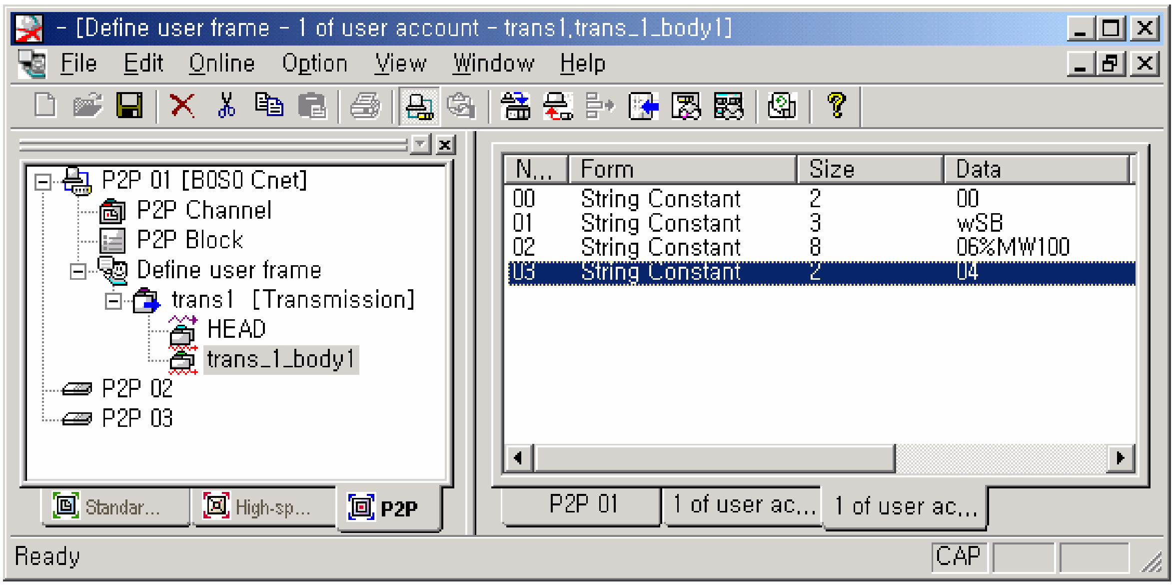
Form: Numerical consta

Item			Description	Remarks
Type	Numeric constant		Set a numeric constant.	Set data with 20 digits (10 bytes) to the max.
	String constant		Set a string constant.	Set data with 10 numbers and characters (10 bytes) to the max.
	Variable size variables	Conversion	Set data conversion	Set whether to convert data as ASCII->HEX and HEX->ASCII or not
		Swap	Set data swap	Set swap in the unit of 2, 4 or 8 bytes.
Data			Set data	Set data when setting numeric or character constant.



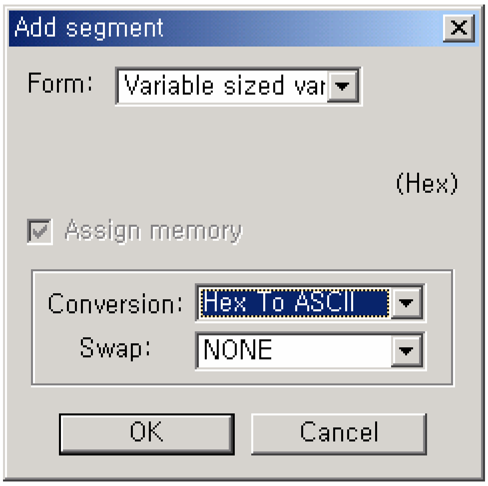
N...	Form	Size	Data
00	String Constant	2	00

- According to the above method, set the string constants, “wSB”, “06%MW100” and “04”.



N...	Form	Size	Data
00	String Constant	2	00
01	String Constant	3	wSB
02	String Constant	8	06%MW100
03	String Constant	2	04

- Set variable size variables.



Add segment

Form: Variable sized var

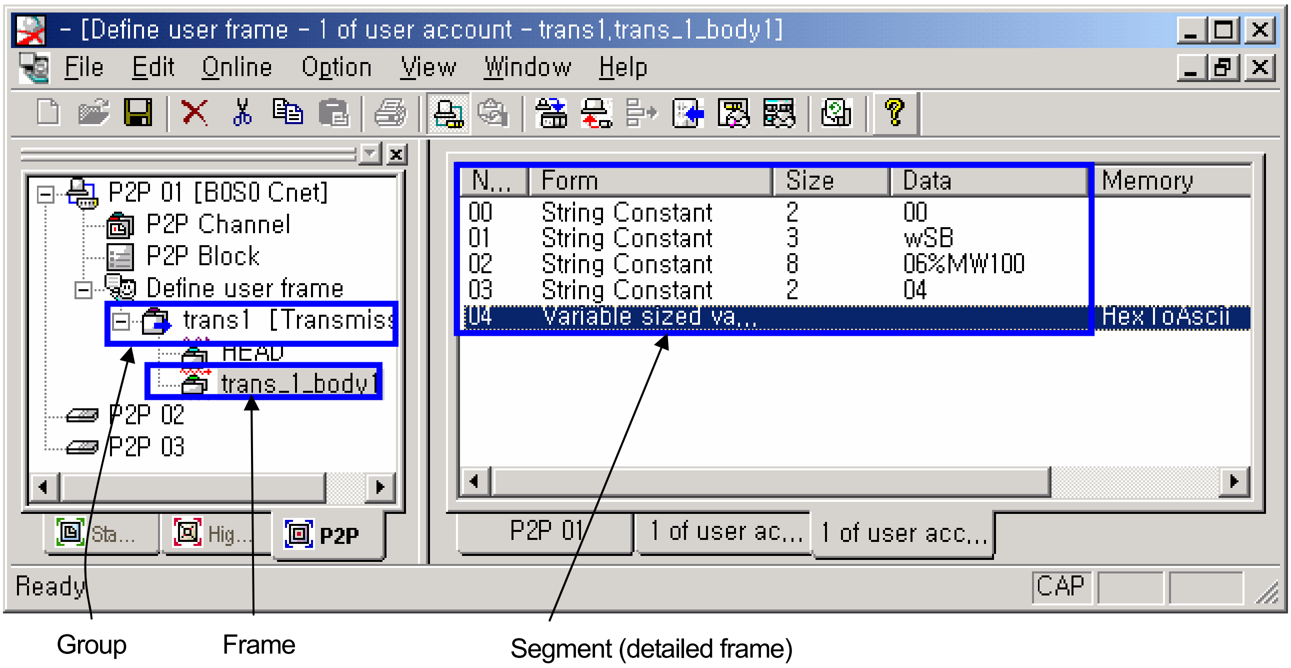
(Hex)

☑ Assign memory

Conversion: Hex To ASCII

Swap: NONE

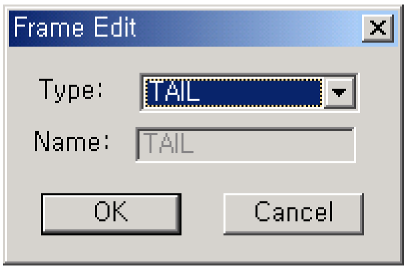
- It shows the window of complete transmission frame body.



- [Define user frame - 1 of user account - trans1,trans_1_body1]

N...	Form	Size	Data	Memory
00	String Constant	2	00	
01	String Constant	3	wSB	
02	String Constant	8	06%MW100	
03	String Constant	2	04	
04	Variable sized va...			HexToAscii

- Add TAIL frame in Add Frame.

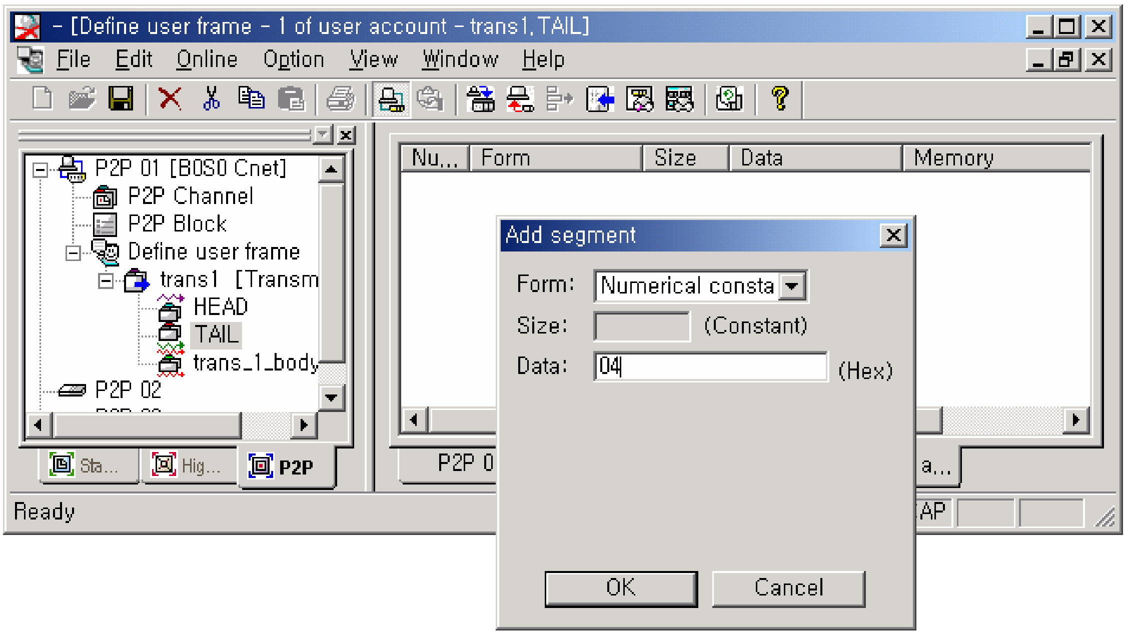


Frame Edit

Type: TAIL

Name: TAIL

- Set a numeric constant, “04 (EOT)”.



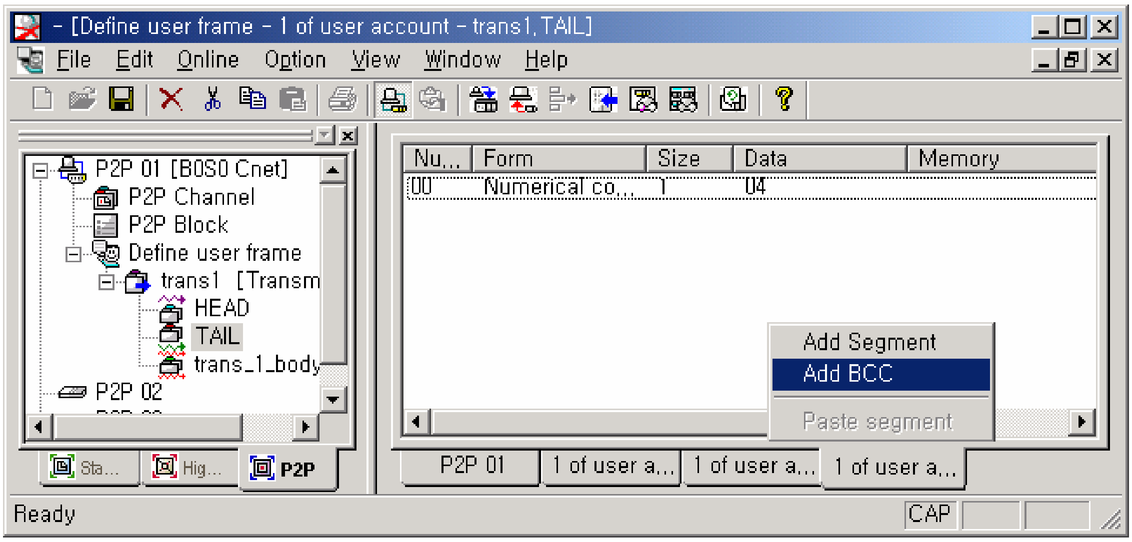
Form: Numerical consta

Size: (Constant)

Data: 04 (Hex)

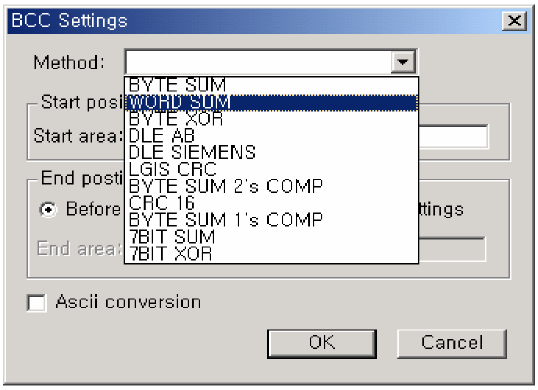
Item		Description	Remarks
Type	Numeric constant	Set a numeric constant.	Set data with 20 numbers (10 bytes) to the max.
	String constant	Set a string constant.	Set data with 10 numbers and characters (10 bytes) to the max.
Data		Set data.	-

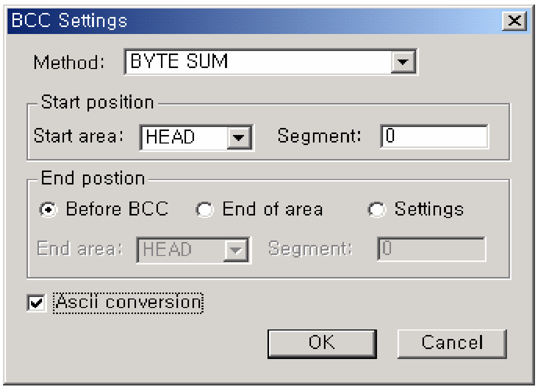
- Set BCC(to show the following window, click the right mouse button in the frame setting window).



Nu...	Form	Size	Data	Memory
00	Numerical co...	1	04	

- To show the following window, click Insert BCC.
  Create a desirable BCC form, referring to the below table.





Method: BYTE SUM

Start position

Start area: HEAD Segment: 0

End postion

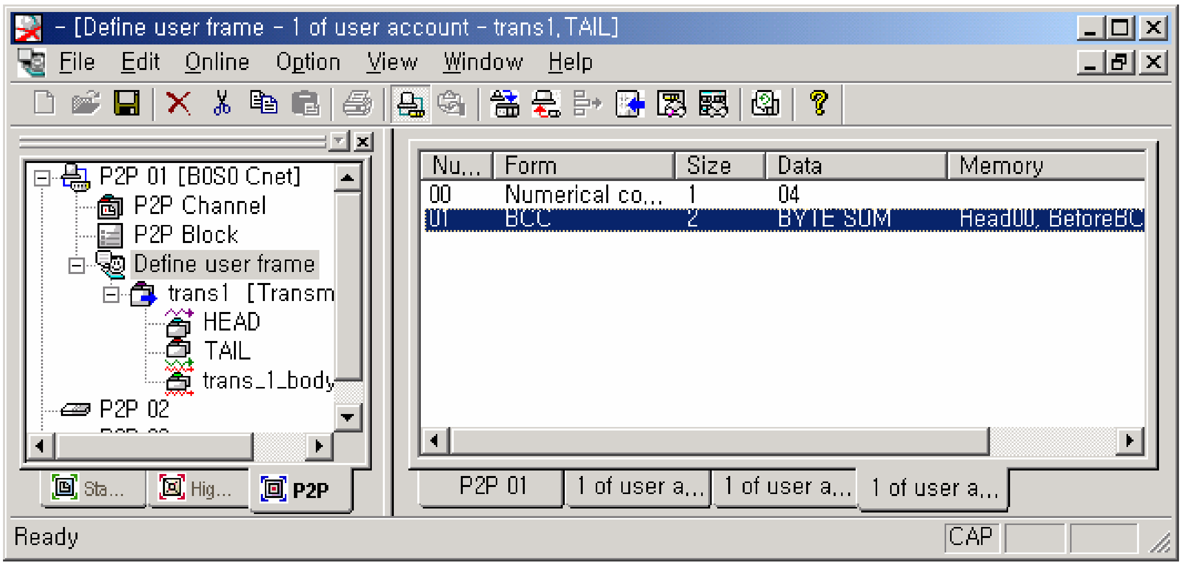
● Before BCC ○ End of area ○ Settings

End area: HEAD Segment: 0

☑ Ascii conversion

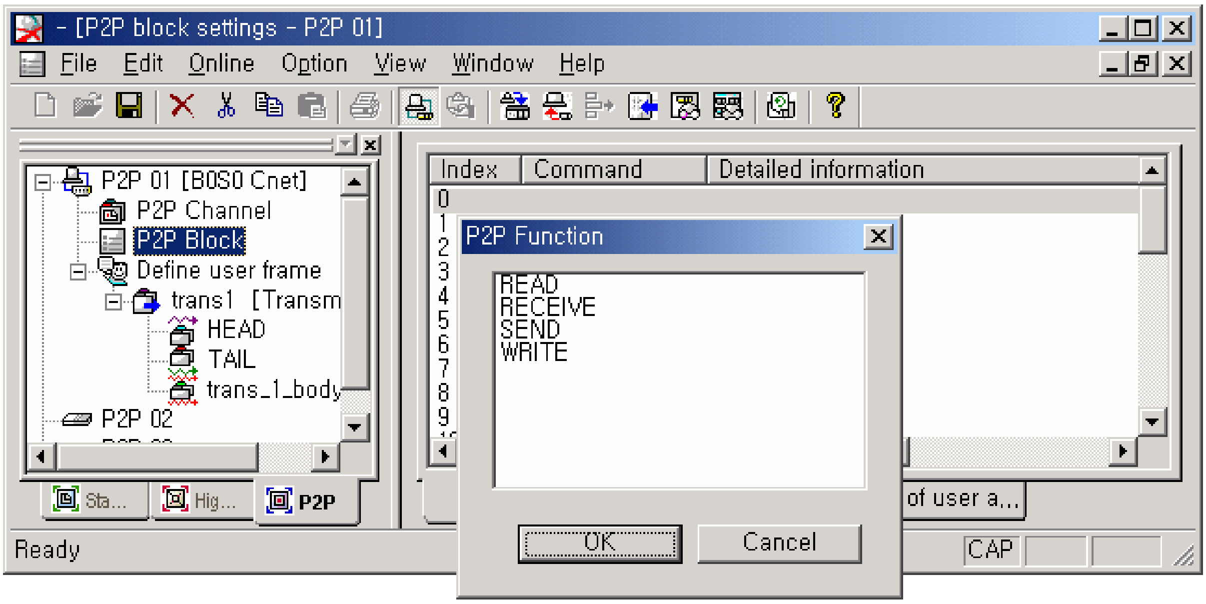
Item		Description
Method	BYTE SUM	Sum up and attach bytes.
	WORD SUM	Sum up and attach words.
	BYTE XOR	Execute Exclusive OR of each byte and attach the results.
	DLE AB	Attach BCC Check Option of AB PLC.
	DLE SIEMENS	Attach BCC Check Option of SIEMENS PLC.
	LSIS CRC	Attach CRC16 Check Option of LSIS.
	BYTE SUM 2'S CMP	Sum up bytes and attach the 2's complement.
	CRC 16	Attach CRC 16 Check Options of Modbus.
	BYTE SUM 1'S CMP	Sum up bytes and attach the 2's complement.
	7BIT SUM	Sum up bytes and attach the value taking the only 7 bits.
	7BIT XOR	Execute Exclusive OR of each byte and attach the value taking the only 7 bits.
Start position	HEAD	Start SUM Check from the designated segment(number) of HEAD frame.
	BODY	Start SUM Check from the designated segment(number) of BODY frame.
	TAIL	Start SUM Check from the designated segment(number) of TAIL frame.
End position	Before BCC	Designate up to just before BCC.
	End of area	Designate up to the last segments of HEAD, BODY and TAIL frames.
	Settings	Designate up to the designated segments of HEAD, BODY, TAIL frames.
ASCII Conversion		Execute ASCII conversion of the calculated SUM Check values.

BCC Check is a method in which, in order to transmit and receive accurate frame, values are calculated in accordance with the defined method, the calculated values, in turn, inserted into a designated place and transmitted while it is checked at the receiver whether to determine if correct and normal data are received in order that the only correct data would be received. It sends data with 2bytes inserted to the designated place of frame (designated BCC segment).

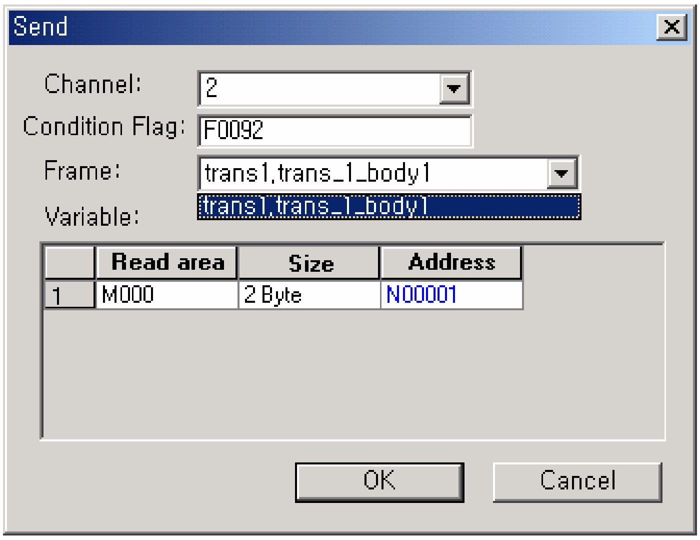


Nu...	Form	Size	Data	Memory
00	Numerical co...	1	04	
01	BCC	2	BYTE SUM	Head00, BeforeBC

▪ Once SEND group is set, SEND Command conditions are to be readily designated in P2P block.



▪ In user defined communication command, send is designated as ‘SEND’; receive as ‘RECEIVE’.



Channel: 2

Condition Flag: F0092

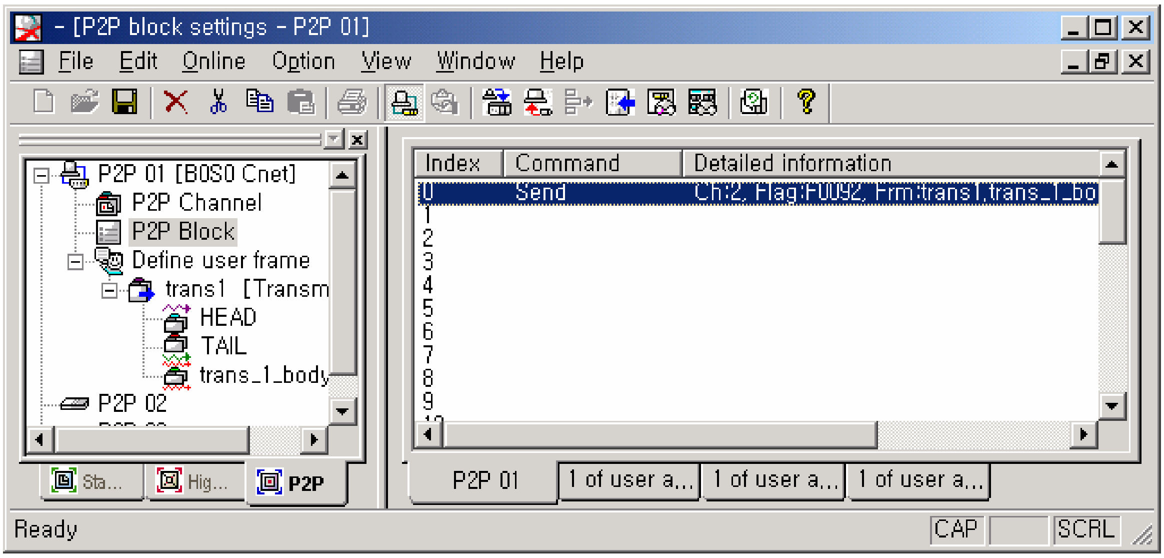
Frame: trans1,trans_1_body1

Variable: trans1,trans_1_body1

	Read area	Size	Address
1	M000	2 Byte	N00001

Item		Description	Remark
Channel		Designate Communication channel.	-
Condition flag		Set SEND condition.	F00092: 200 ㎳ clock
Frame		Designate a SEND group.	Group already registered as SEND Group
Variable	Read area	Designate an internal device to send.	Available only when variable size variables are set in the BODY segment of SEND group.
	Size	Set the size of device to send.	
	Address	Display network device allocation.	

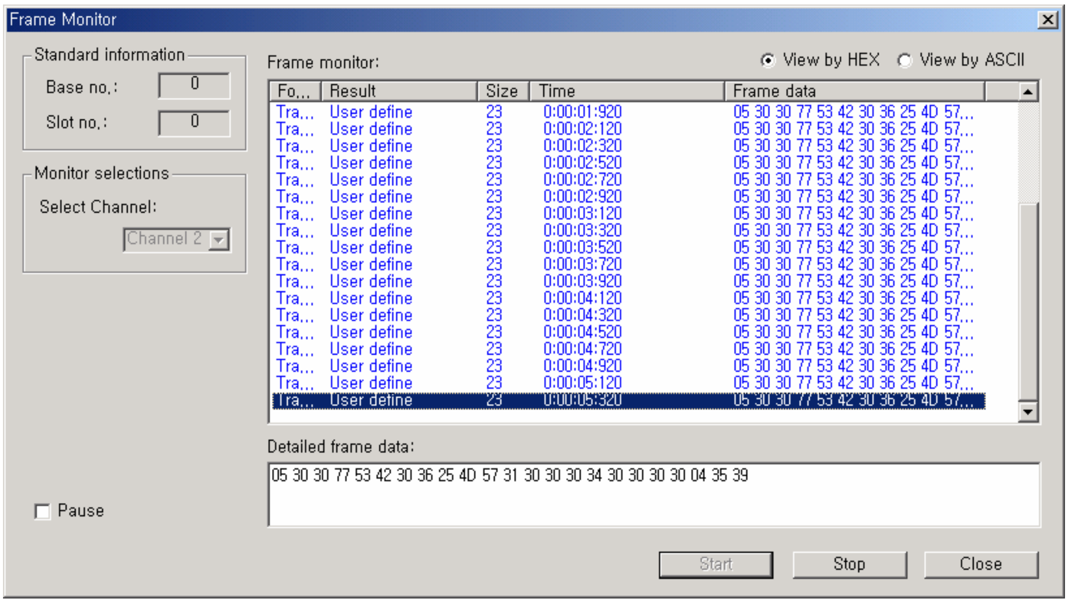
- It shows the window that settings are completed.



Index	Command	Detailed information
0	Send	Ch:2, Flag:F0092, Frm:trans1,trans_1_bo
1		
2		
3		
4		
5		
6		
7		
8		
9		

- Write parameter and allow Enable Link.

Looking at the above settings in the frame monitor, you may confirm that the following communication frame is sent.



Fo...	Result	Size	Time	Frame data
Tra...	User define	23	0:00:01:920	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:02:120	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:02:320	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:02:520	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:02:720	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:02:920	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:03:120	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:03:320	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:03:520	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:03:720	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:03:920	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:04:120	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:04:320	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:04:520	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:04:720	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:04:920	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:05:120	05 30 30 77 53 42 30 36 25 4D 57...
Tra...	User define	23	0:00:05:320	05 30 30 77 53 42 30 36 25 4D 57...

Detailed frame data:

```
05 30 30 77 53 42 30 36 25 4D 57 31 30 30 30 34 30 30 30 30 04 35 39
```

i.e.) If sending the below frame when the above BCC is designated, it shows how to calculate SUM Check.

(excl. variable size variable)

Header	Body					Tail	
h05	00	wSB	06%MW100	04	Variable size variable (h1234)	0x04	BCC
Numeric constant	String constant	String constant	String constant	String constant	Hex To ASCII conversion	Numeric constant	Byte Checksum ASCII conversion

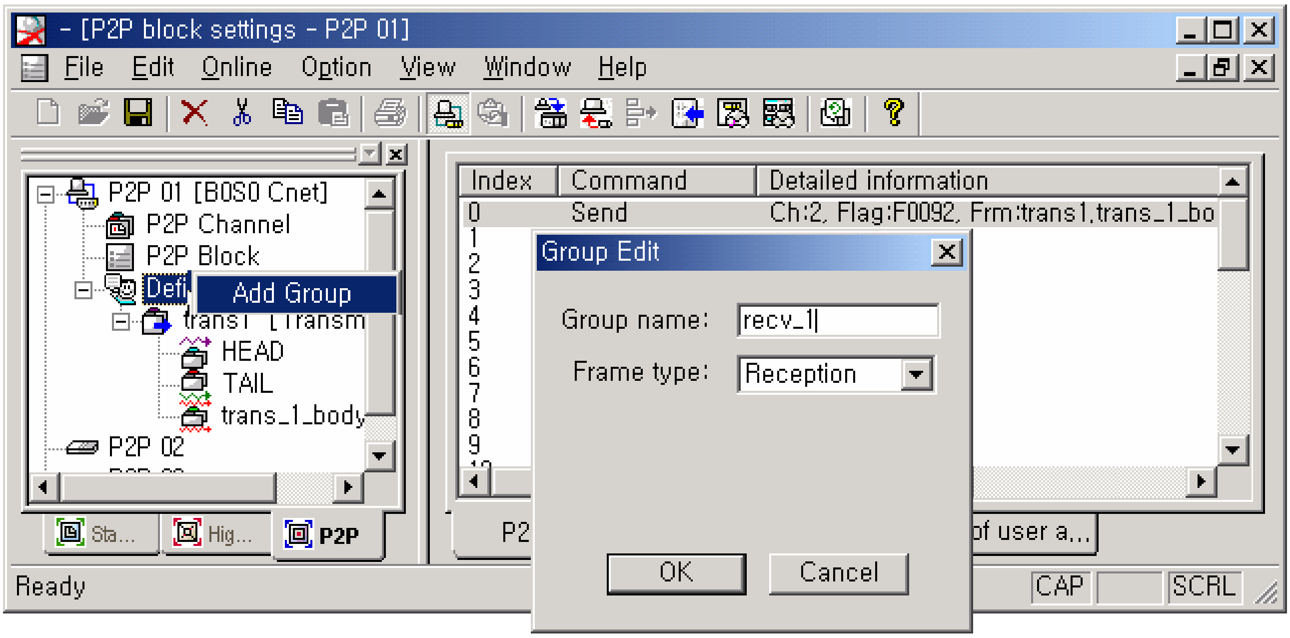
BCC method: byte: SUM , start position : HEAD segment 0 , stop position : just before BCC

05 + 30 + 30 + 77 + 53 + 42 + 30 + 36 + 25 + 4D + 57 + 31 + 30 + 30 + 30 + 34 + 31 + 32 + 33 + 34 + 04 = 463 **(36 33)**

- The following describes the procedure and method of creating user-defined receive frame.

Item	Header				Body		Tail	
Frame	h05	00	wSB	06%MW100	Fixed size variable	Variable size variable	0x04	BCC
Setting	Numeric constant	String constant	String constant	String constant	2	Hex To ASCII conversion	-	Byte Checksum ASCII conversion
Byte	1	2	3	8	2		1	2

- Set Add Group in『Define user frame』.
  Designate group name and frame type and then, designate RECEIVE.

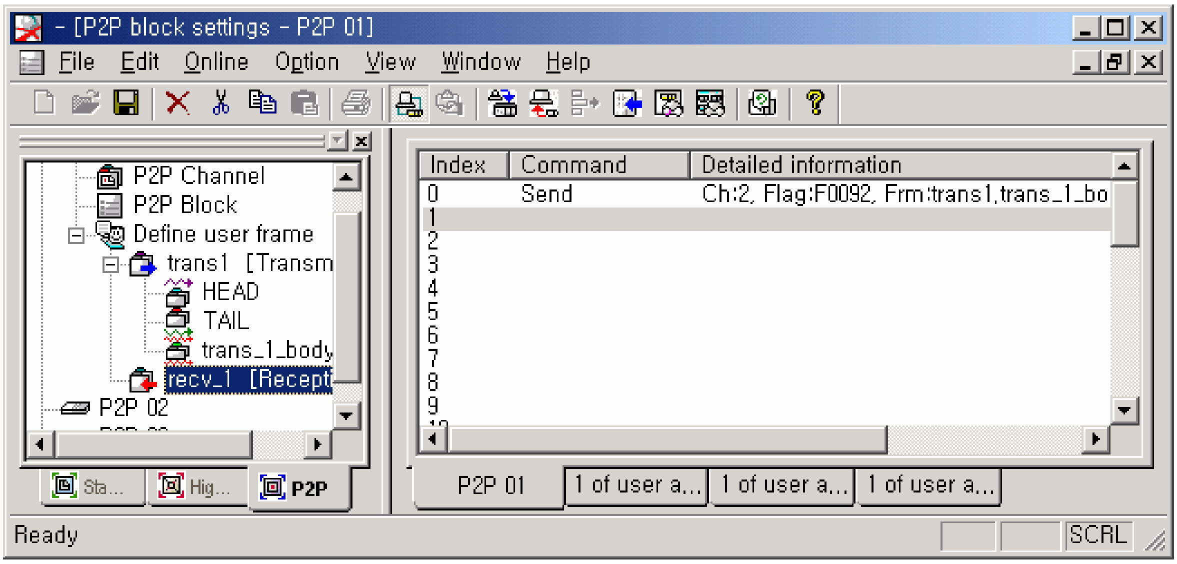


Index	Command	Detailed information
0	Send	Ch:2, Flag:F0092, Frm:trans1,trans_1_bo

Group name: recv_1

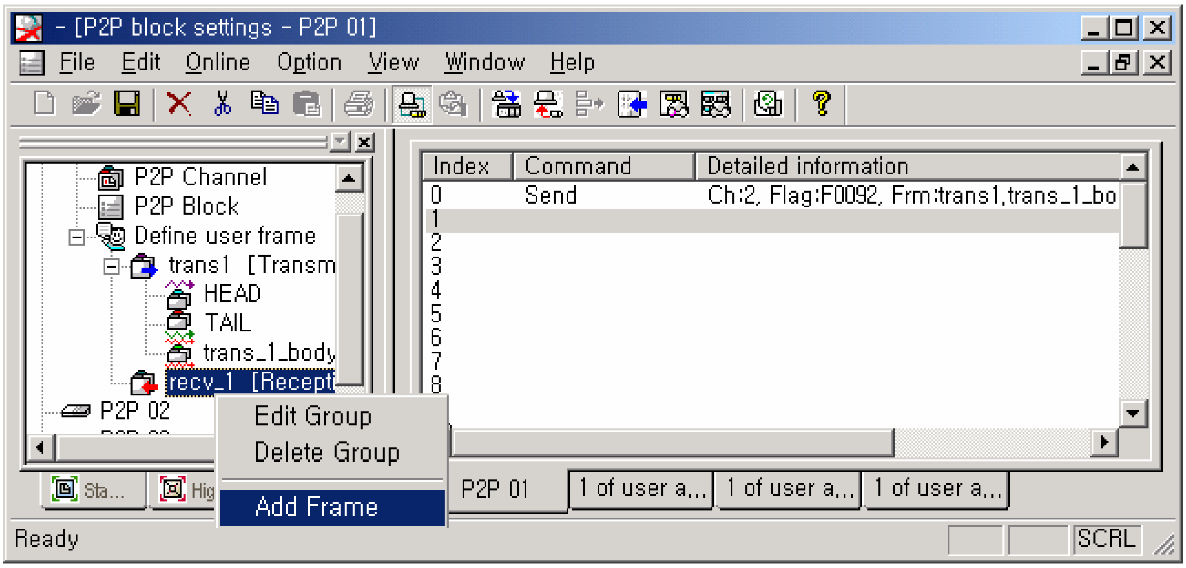
Frame type: Reception

- 『recv_1[recv]』 Group is added as follows.



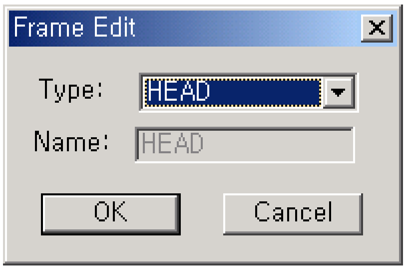
Index	Command	Detailed information
0	Send	Ch:2, Flag:F0092, Frm:trans1,trans_1_bo
1		
2		
3		
4		
5		
6		
7		
8		
9		

- Add each frame.



Index	Command	Detailed information
0	Send	Ch:2, Flag:F0092, Frm:trans1,trans_1_bo
1		
2		
3		
4		
5		
6		
7		
8		

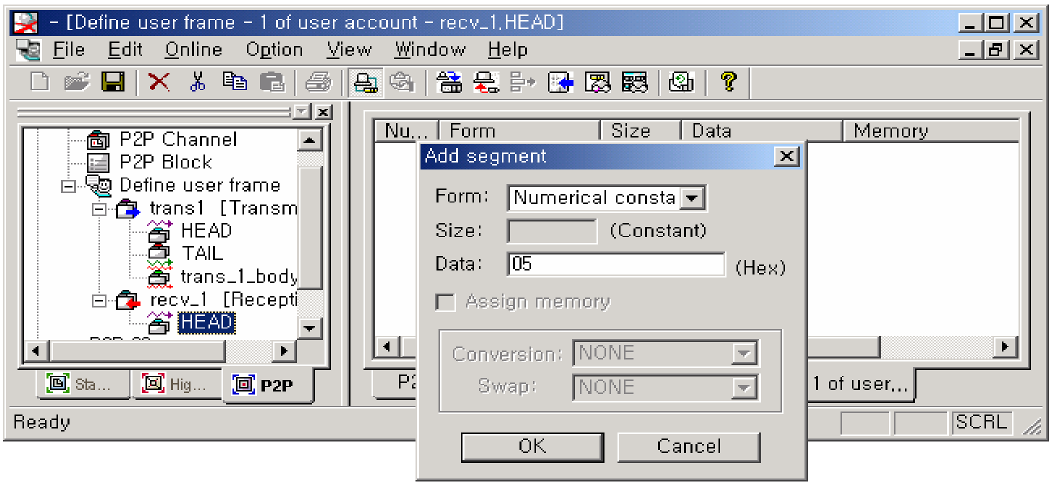
- Add HEAD frame.



Type: HEAD

Name: HEAD

- Set numeric constant, “05 (ENQ)” to a segment, #00.



- [Define user frame - 1 of user account - recv_1.HEAD]

Add segment

Form: Numerical consta

Size: (Constant)

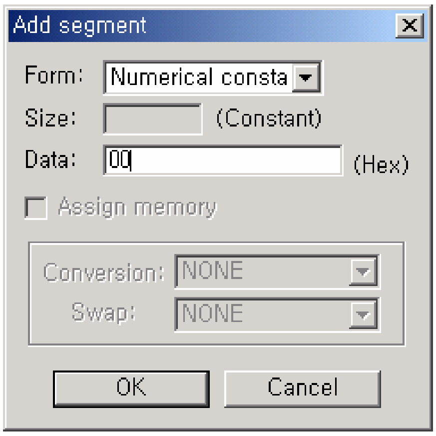
Data: 05 (Hex)

☐ Assign memory

Conversion: NONE

Swap: NONE

- Add the above segment to HEAD frame and edit it.
  Set string constants, “00 ”, “wSB” and “ 06%MW100” in accordance with segment order.



Add segment

Form: Numerical consta

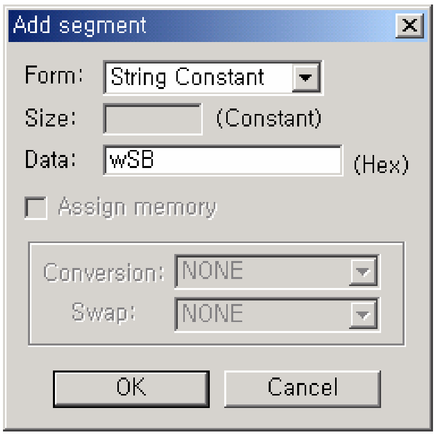
Size: (Constant)

Data: 00 (Hex)

☐ Assign memory

Conversion: NONE

Swap: NONE



Add segment

Form: String Constant

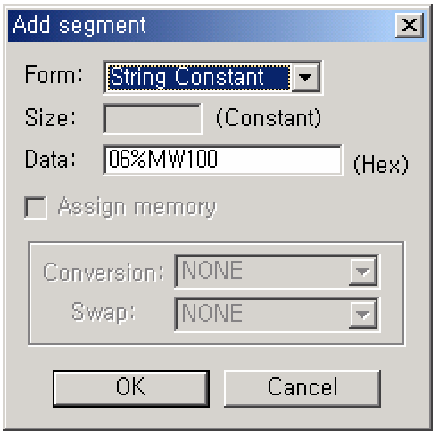
Size: (Constant)

Data: wSB (Hex)

☐ Assign memory

Conversion: NONE

Swap: NONE



Add segment

Form: String Constant

Size: (Constant)

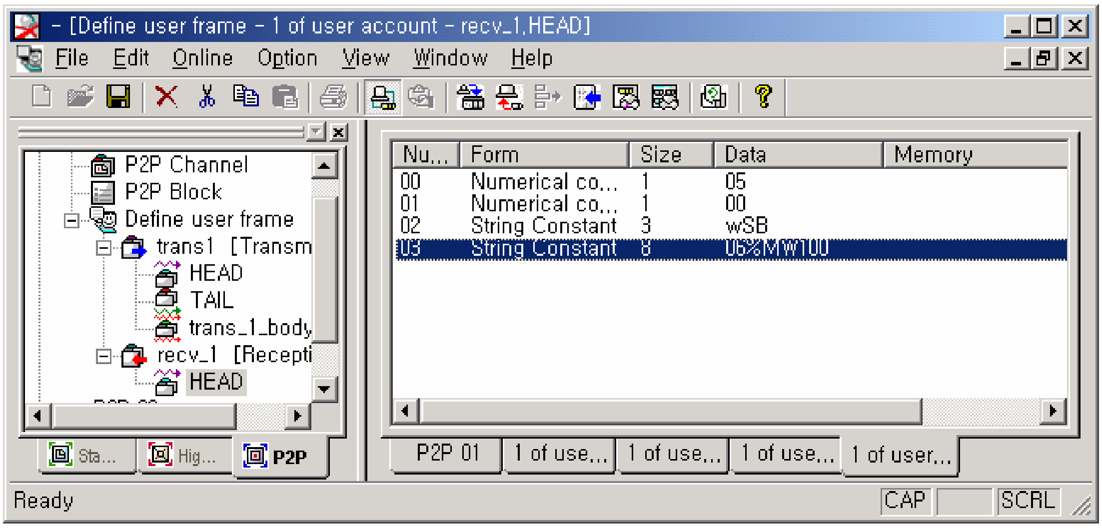
Data: 06%MW100 (Hex)

☐ Assign memory

Conversion: NONE

Swap: NONE

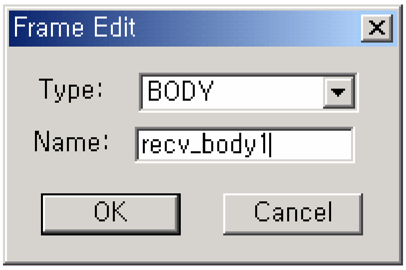
- HEAD frame setting is completed.



- [Define user frame - 1 of user account - recv_1,HEAD]

Nu...	Form	Size	Data	Memory
00	Numerical co...	1	05	
01	Numerical co...	1	00	
02	String Constant	3	wSB	
03	String Constant	8	06%MW100	

- Add BODY frame.

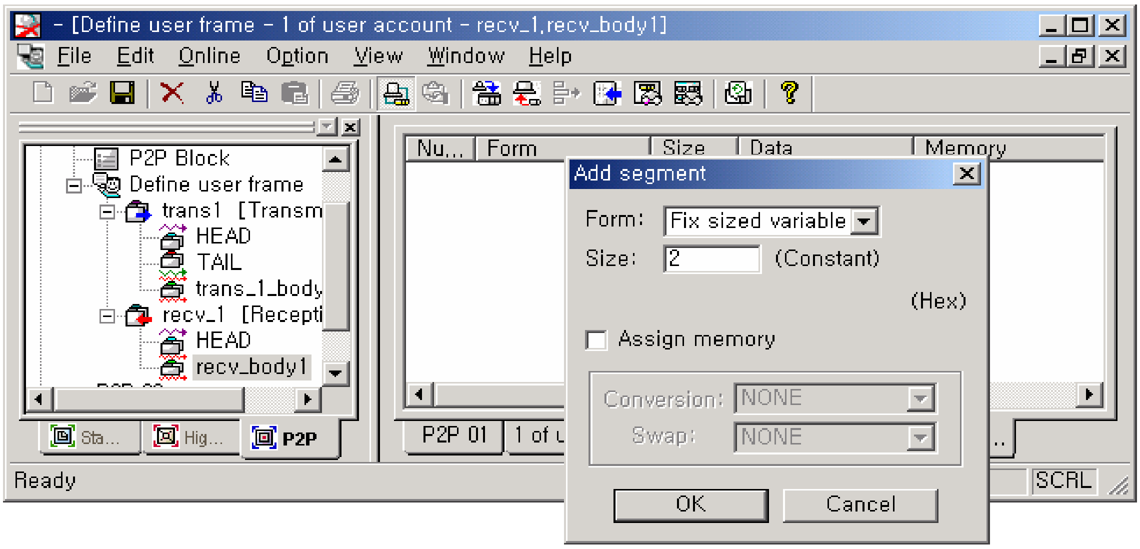


Frame Edit

Type: BODY

Name: recv_body1

- Set a fixed size variable as 2 bytes in segment.



- [Define user frame - 1 of user account - recv_1,recv_body1]

Add segment

Form: Fix sized variable

Size: 2 (Constant)

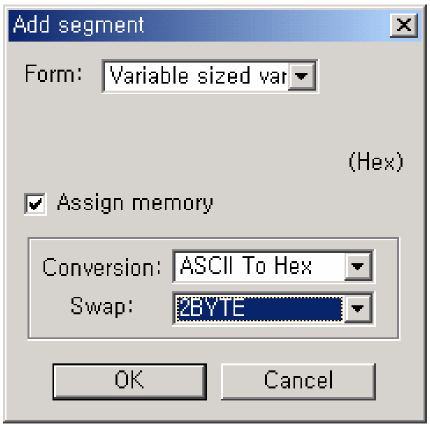
(Hex)

☐ Assign memory

Conversion: NONE

Swap: NONE

- Set a variable size variable as “ASCII To Hex” and “ 2 bytes swap” in segment.



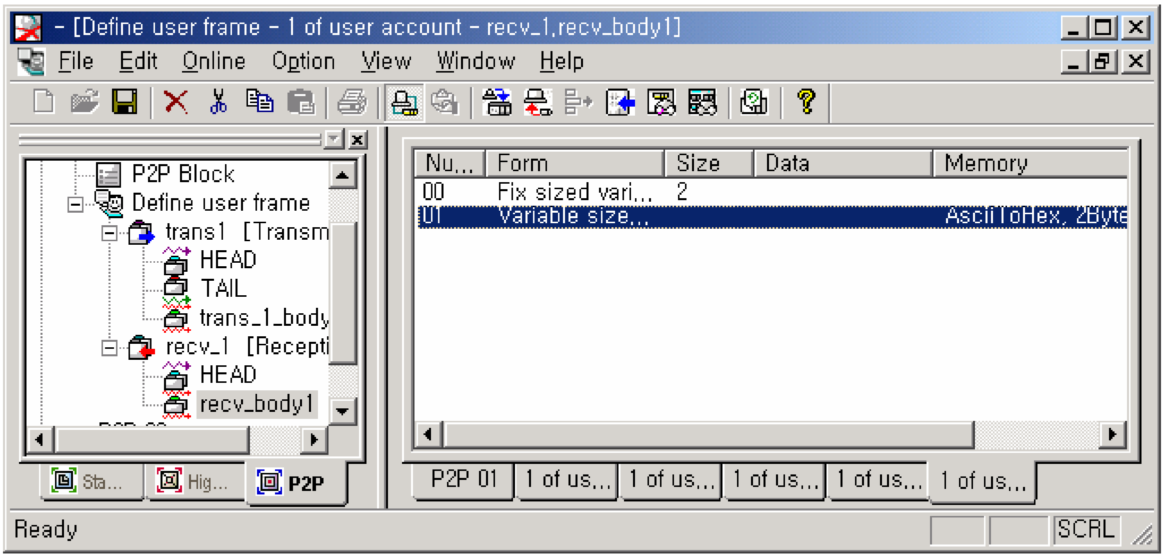
Form: Variable sized var

☑ Assign memory

Conversion: ASCII To Hex

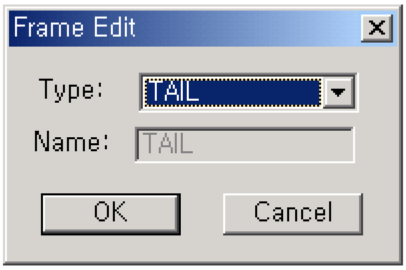
Swap: 2BYTE

- BODY frame setting is completed.



Nu...	Form	Size	Data	Memory
00	Fix sized vari...	2		
01	Variable size...			AsciiToHex, 2Byte

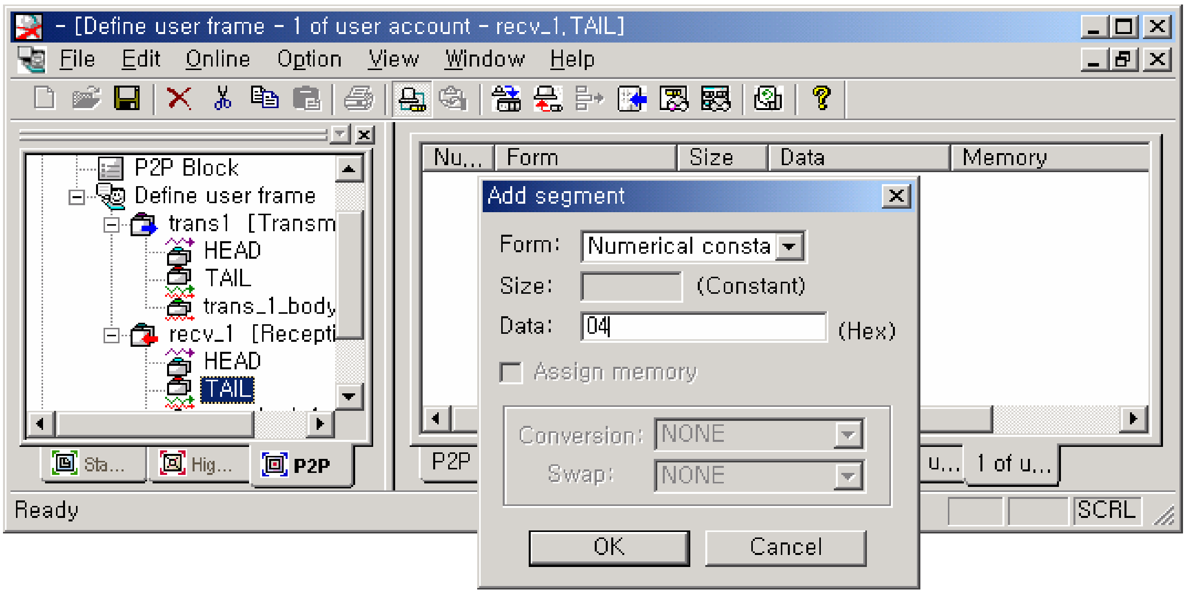
- Add TAIL frame.



Type: TAIL

Name: TAIL

- Set a numeric constant, “04 (EOT)”.



Form: Numerical consta

Size: (Constant)

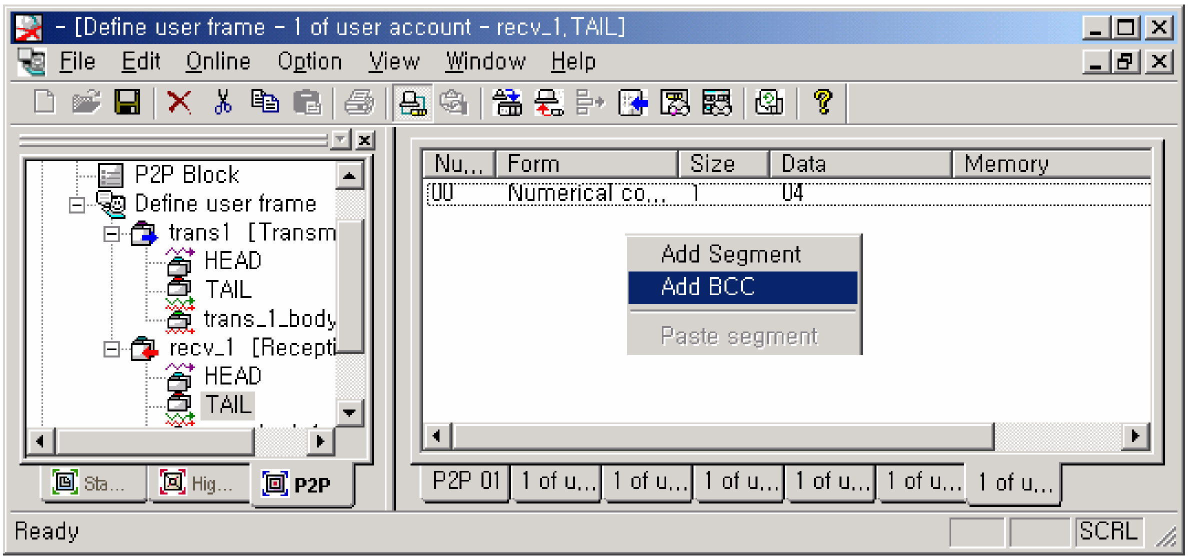
Data: 04 (Hex)

☐ Assign memory

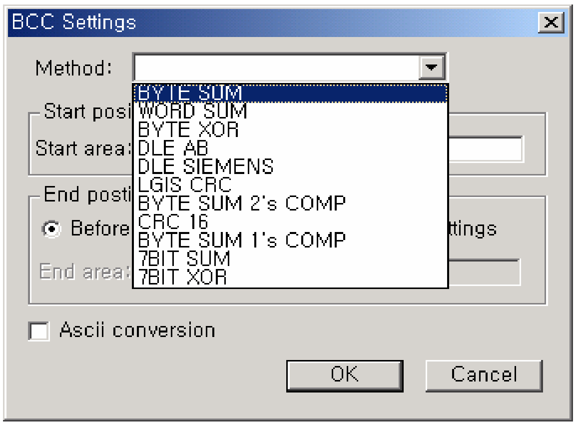
Conversion: NONE

Swap: NONE

- Set BCC segment(clicking the right mouse button in segment setting window shows the following window).

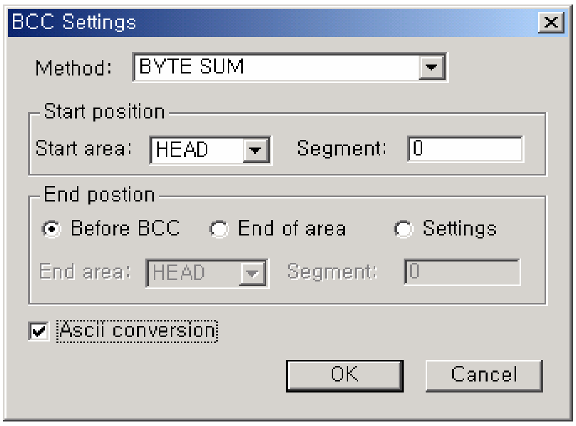


Nu...	Form	Size	Data	Memory
00	Numerical co...	1	04	



BYTE SUM
WORD SUM
BYTE XOR
DLE AB
DLE SIEMENS
LGIS CRC
BYTE SUM 2's COMP
CRC 16
BYTE SUM 1's COMP
7BIT SUM
7BIT XOR

☐ Ascii conversion



Method: BYTE SUM

Start position

Start area: HEAD Segment: 0

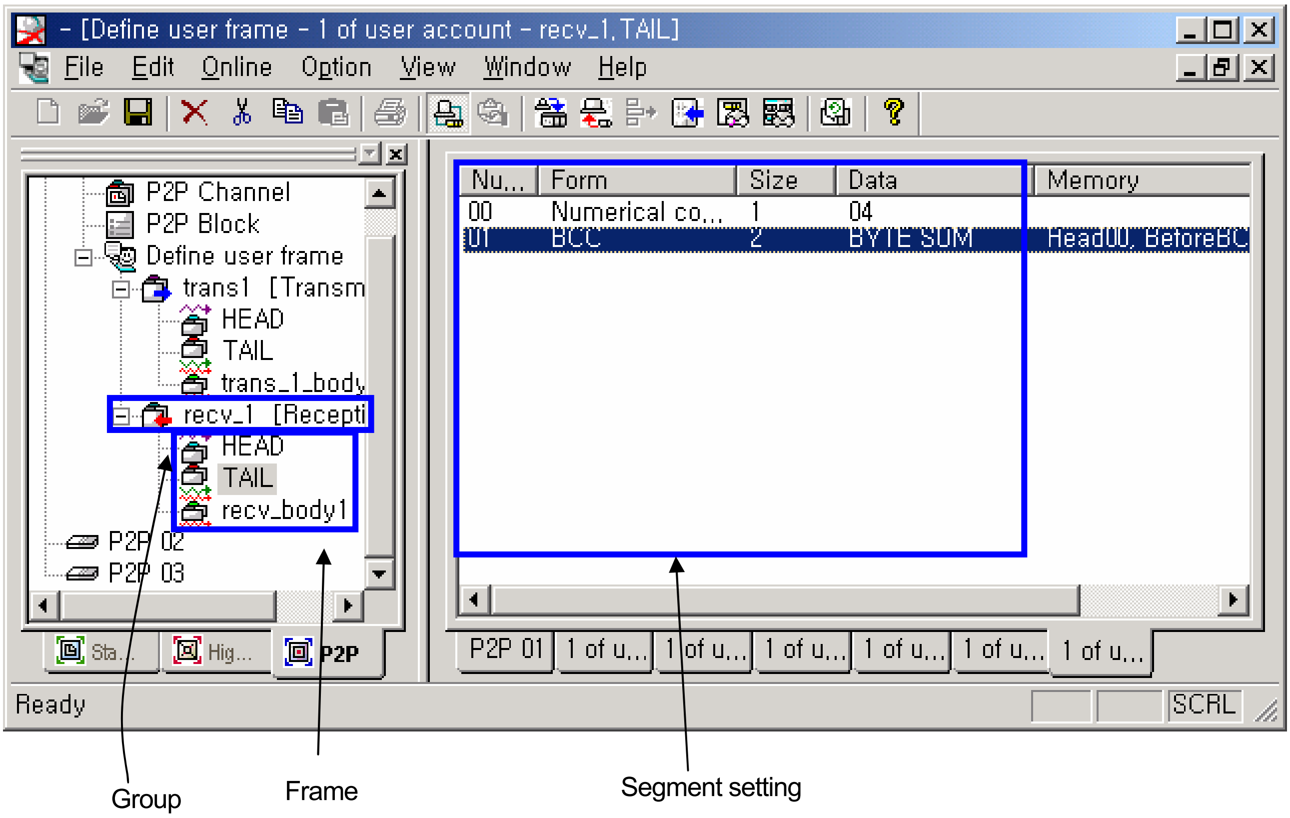
End postion

● Before BCC ○ End of area ○ Settings

End area: HEAD Segment: 0

☑ Ascii conversion

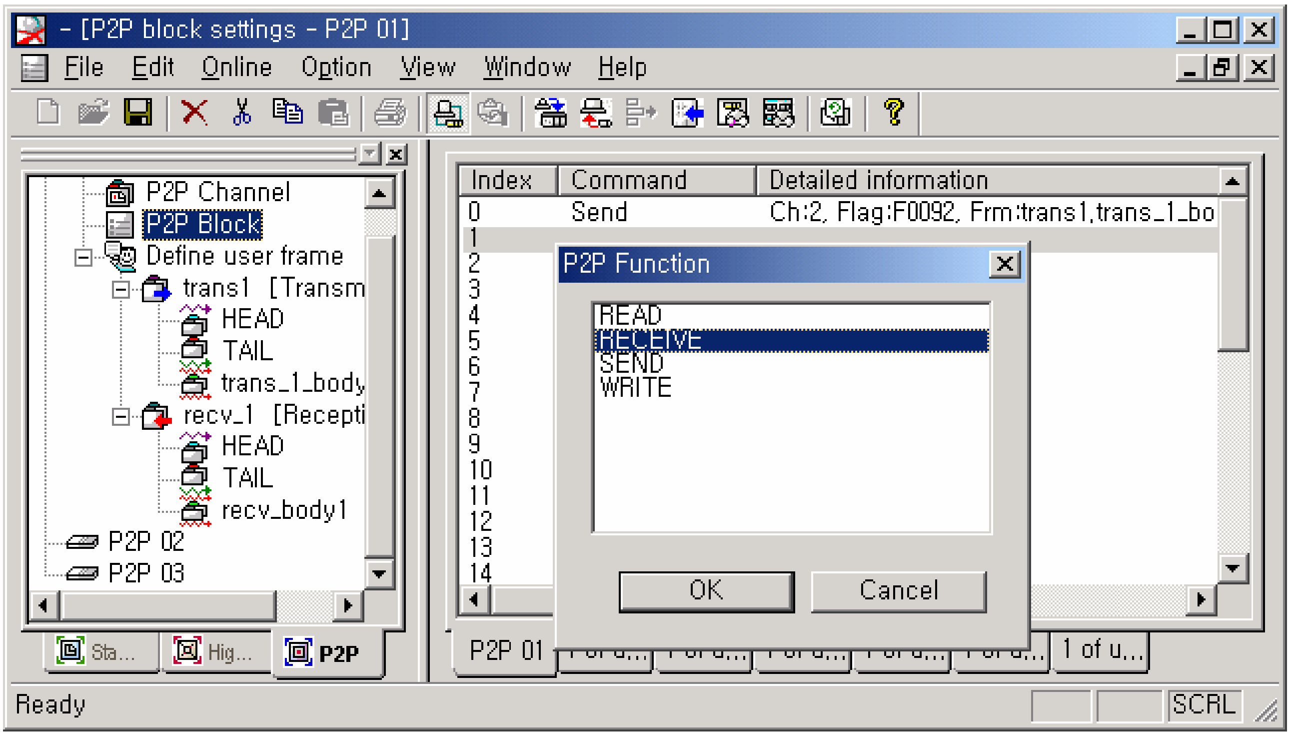
- Setting of “recv_1” RECEIVE Group is completed.



- [Define user frame - 1 of user account - recv_1, TAIL]

Nu...	Form	Size	Data	Memory
00	Numerical co...	1	04	
01	BCC	2	BYTE SUM	Head00, BeforeBC

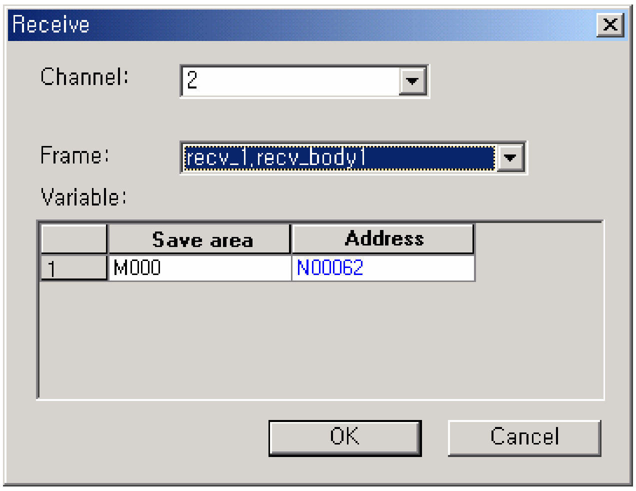
- Once RECEIVE Group setting is completed, it is to designate RECEIVE condition in P2P block.



- [P2P block settings - P2P 01]

Index	Command	Detailed information
0	Send	Ch:2, Flag:F0092, Frm:trans1,trans_1_bo
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

- Then, designate “RECEIVE”.



Channel: 2

Frame: recv_1,recv_body1

Variable:

	Save area	Address
1	M000	N00062

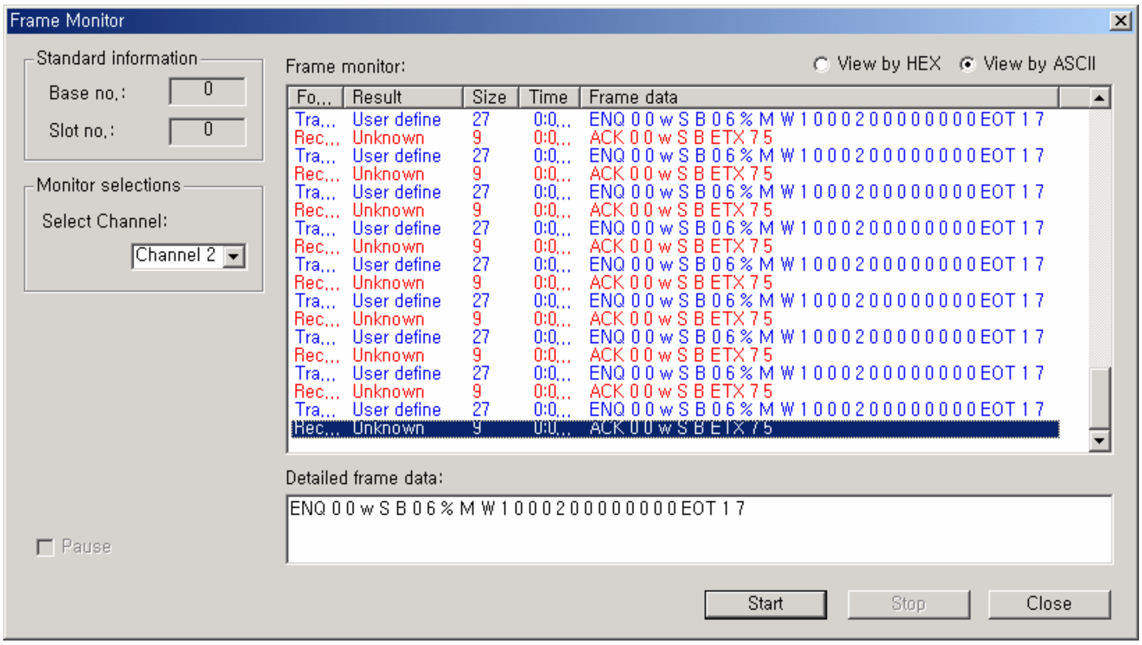
Item		Description	Remarks
Channel		Designate Communication channel.	-
Frame		Designate RECEIVE Group	Group already registered as RECEIVE Group
Variable	Save area	Designate internal device to receive.	Available only when variable size variables are set in the BODY segment of RECEIVE group.
	Address	Display network device allocation.	

In case of RECEIVE, if a frame corresponding to the communication type of a designated group is received, it starts receiving data to variable size variable area.

- Download parameters set before.

Looking at the above settings in the frame monitor, you may confirm that the following communication frame is sent, and data h1234 is written in Word M000 area.

- Each send/receive communication frames may be monitored in System Diagnosis frame monitor.



Standard information

Base no.: 0

Slot no.: 0

Monitor selections

Select Channel: Channel 2

Frame monitor: ○ View by HEX ● View by ASCII

```
Fo...  Result       Size  Time   Frame data
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
Tra... User define  27    0:0... ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
Rec... Unknown      9     0:0... ACK 0 0 w S B ETX 7 5
```

Detailed frame data:

```
ENQ 0 0 w S B 0 6 % M W 1 0 0 0 2 0 0 0 0 0 0 0 0 EOT 1 7
```

☐ Pause

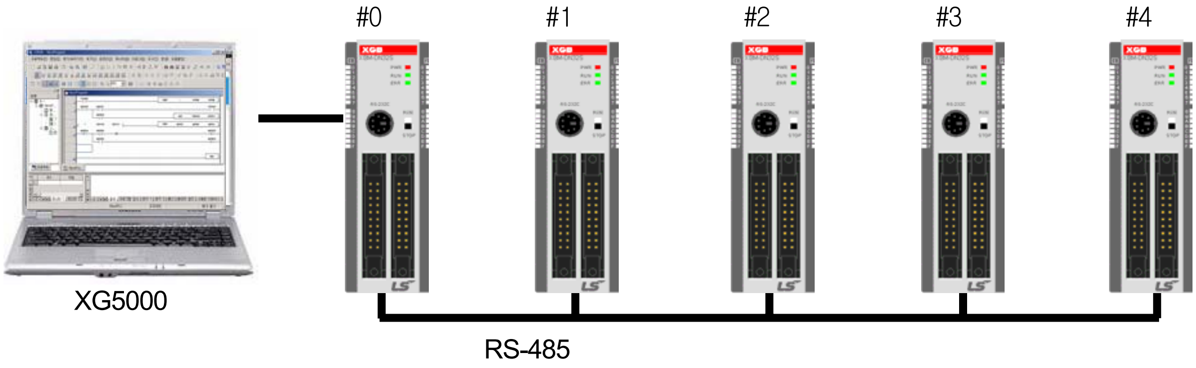
10.4 Remote Access Service

It is possible to control PLC program in a remote place, for instance, PLC program download/upload, program debugging and monitor as long as XGB PLC is connected to Cnet I/F module. Especially, it is so useful and convenient function to support easy access to PLC CPU by means of remote access (XGB-C21A) through aerial lines by using XG5000 remote access function and model access from a computer link in case XG5000 and PLC are remotely placed each other. Remote access is a function to support the built-in Cnet and Enet at XGB PLC communication module and Cnet at I/F module, enabling inter-network access and conveniently controlling PLC program at a remote place through the multiple access. The remote access using Cnet module also makes it possible the remote access directly connected the built-in RS-485, Cnet I/F module (RS-232C, RS-422). This chapter describes the remote access in case it is accessed to the built-in Cnet (RS-485).

10.4.1 Remote 1 communication module access

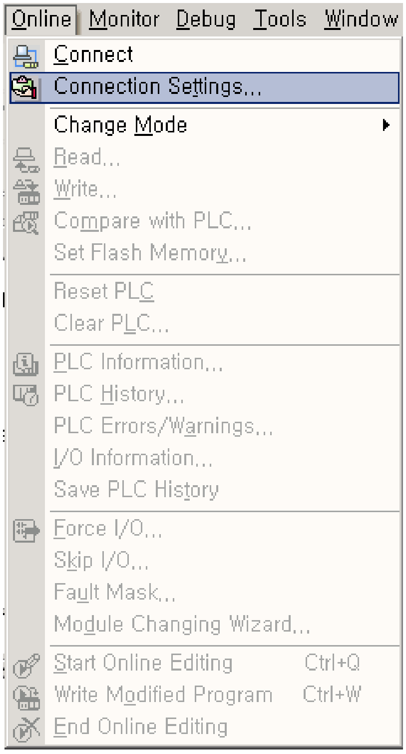
1) System Configuration

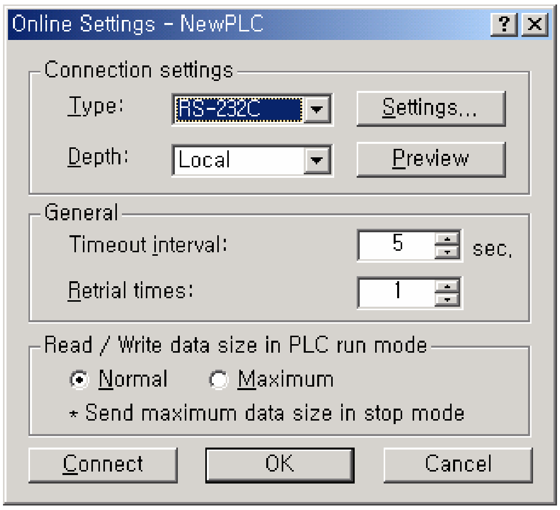
- It is configured to communicate by using RS-485 (use of CH 2) communication channel built in XGB basic unit. (It also assumes that communication is normally operated.)



2) It exemplifies the remote access to #01.

- Execute 『Online』 -> 『Connection Settings』 of XG5000.





Online Settings - NewPLC

Connection settings

Type: RS-232C

Depth: Local

General

Timeout interval: 5 sec.

Retrial times: 1

Read / Write data size in PLC run mode

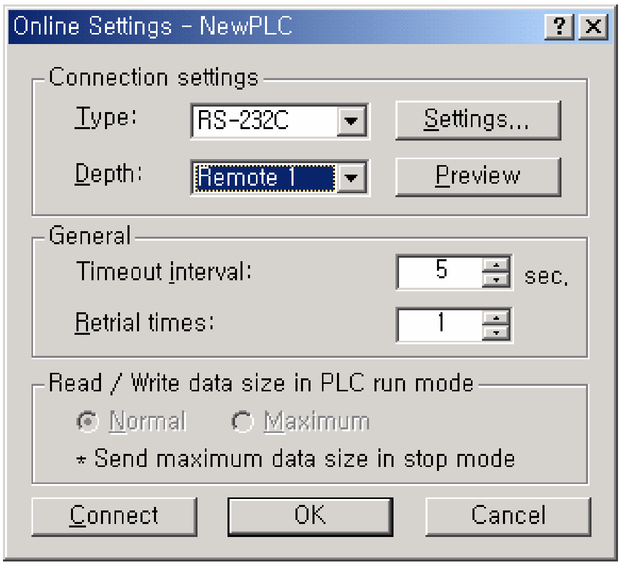
● Normal ○ Maximum

* Send maximum data size in stop mode

- Options in 『Connection Settings』 are as follows.

Item		Description
Connection settings	Type	Select one of RS-232C ,USB ,Ethernet and Modem. (USB is not supported in XGB series)
	Depth	Select one of local, remote 1 communication module and remote 2 communication module.
General	Timeout interval	Set waiting duration of time out when communication fails.
	Retrial times	Set the frequency of retry when communication fails.

- Click 『Settings...』 with Remote 1 as 『Depth』.



Type: RS-232C

Depth: Remote 1

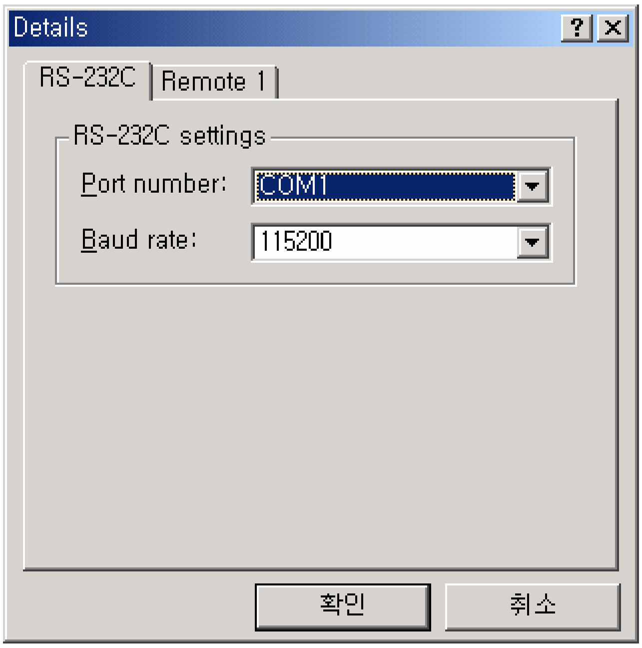
Timeout interval: 5 sec.

Retrial times: 1

● Normal ○ Maximum

* Send maximum data size in stop mode

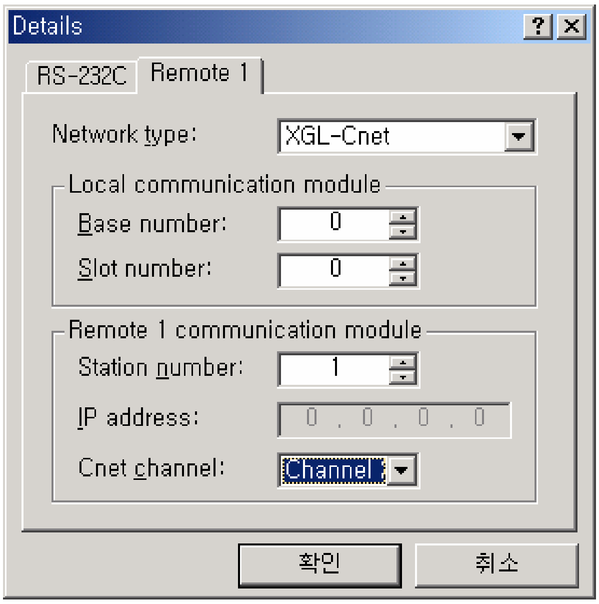
- Setting Port number and Baud rate of the locally connected RS-232C, click 『Remote 1』.



Port number: COM1

Baud rate: 115200

- Set the Connection Settings of 『Remote 1』.



Network type: XGL-Cnet

Local communication module

Base number: 0

Slot number: 0

Remote 1 communication module

Station number: 1

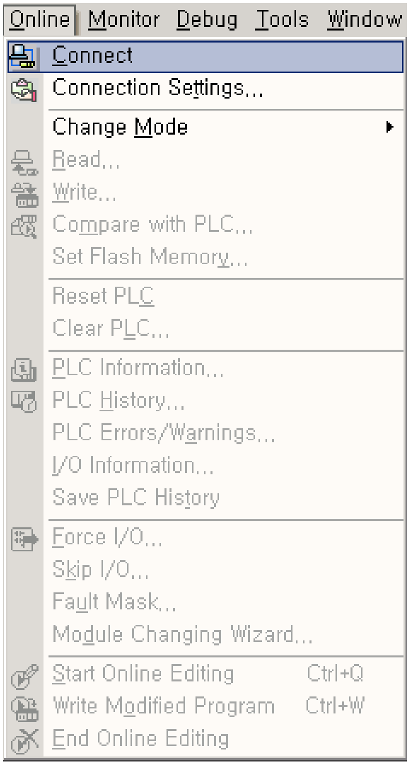
IP address: 0 . 0 . 0 . 0

Cnet channel: Channel

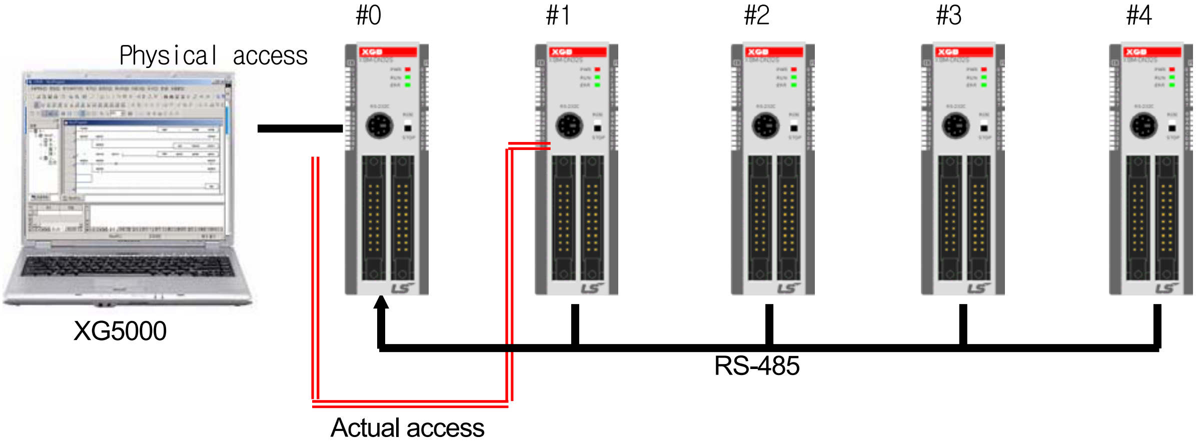
Item		Description
Network type		Set a type of communication network to remotely access. (Rnet , Enet, FDnet, Cnet, FEnet, FDEnet)
Local communication module	Base number	Set a base number to mount communcation module of Local. (XGB series have the default, « 0 ».)
	Slot number	Designate a slot location for communication module of Local. (it should be set to « 0« for built-in communcation.)
Remote 1 communiction module	Station number	Set the prefix of remote communication module.
	IP address	Set IP address in case a network type is Ethernet.
	Cnet channel	Set a communication channel of Cnet to remotely access.

- Upon the setup, click 『OK』.

- Execute 『Online』-> 『Connect 』 of XG5000.



- Upon the Connect, XG5000 operates as if XG5000 is locally connected to #1 although it is physically connected to #0.

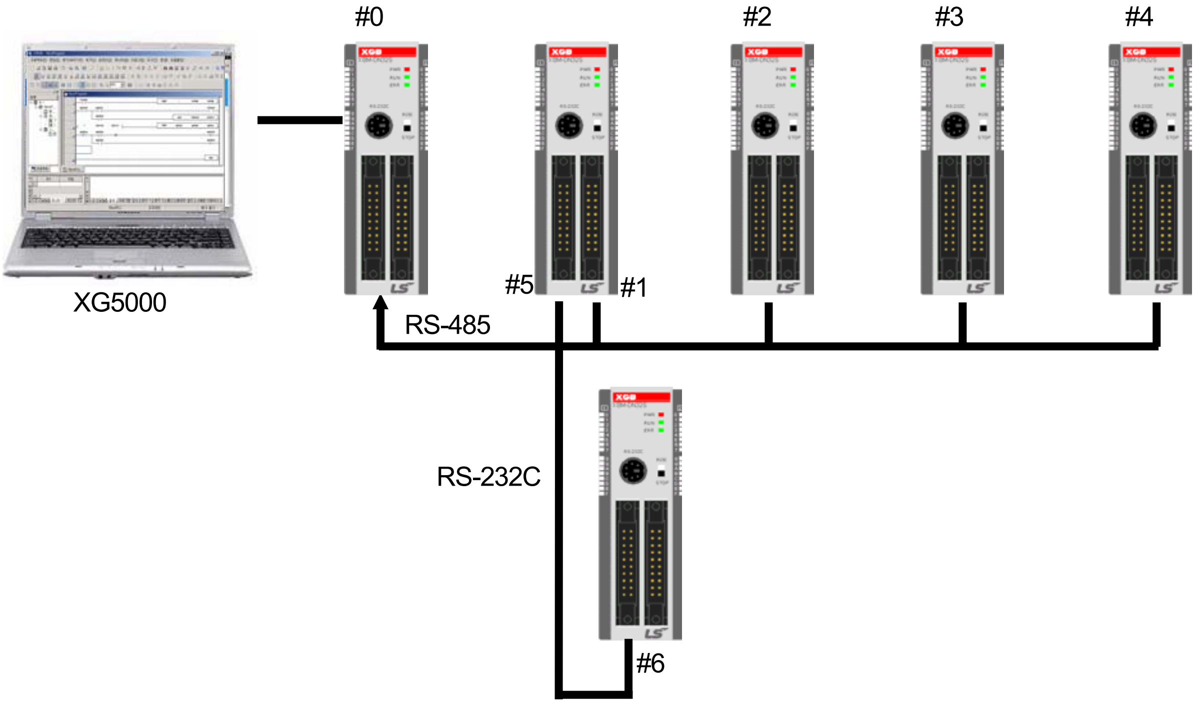


If running 'program read', it starts reading the program of #1.

10.4.2 Remote 2 communication module access

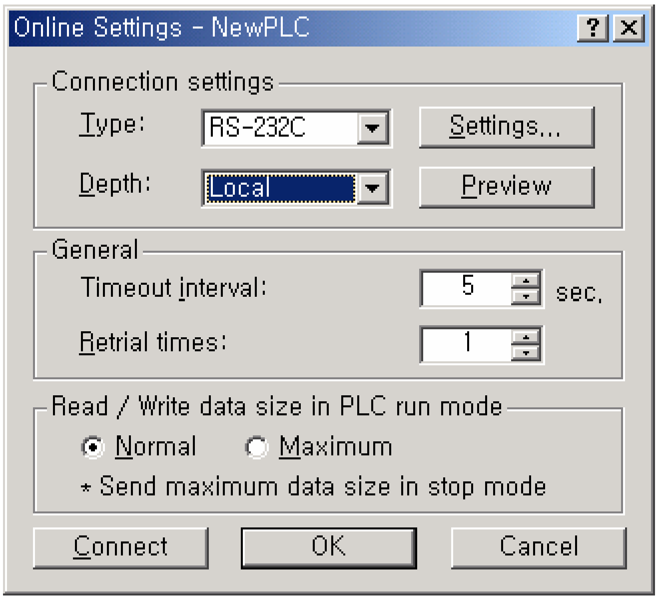
1) System Configuration

▪It is configured to communicate by using RS-485 (use of CH 2) communication channel built in XGB basic unit. (it also assumes that communication is normally operated.)



2) It exemplifies the remote Connect to #01.

▪ Execute 『Online』 -> 『Connection Settings』 of XG5000.



Connection settings

Type: RS-232C

Settings...

Depth: Local

Preview

General

Timeout interval: 5 sec.

Retrial times: 1

Read / Write data size in PLC run mode

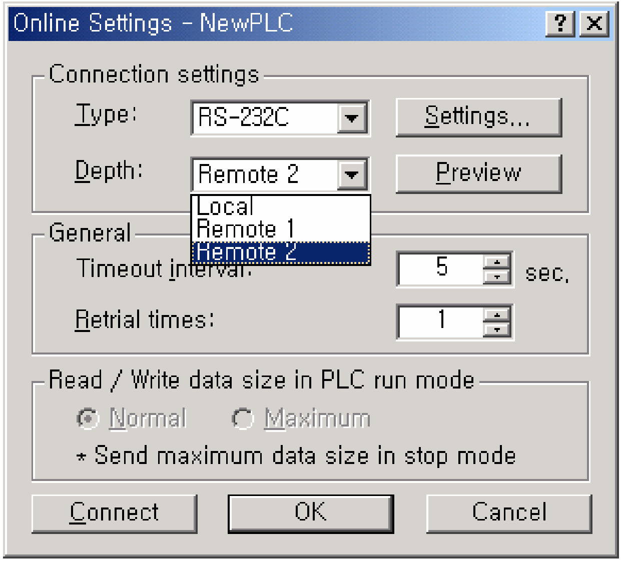
● Normal ○ Maximum

* Send maximum data size in stop mode

- Options in 『Connection Settings』 are as follows.

Item		Description
Connection settings	Type	Select one of RS-232C ,USB ,Ethernet and Modem. (USB is not supported in XGB series)
	Depth	Select one of local, remote 1 communication module and remote 2 communication module.
General	Time out duration	Set waiting duration of time out when communication fails.
	Retrial times	Set the frequency of retry when communication fails.
Read/Write data size in PLC run mode	Normal	(Activates only when Depth is “Local”.)
	Maximum	-

- Click 『Settings...』 with Remote 2 as 『Depth』.



Online Settings - NewPLC

Connection settings

Type: RS-232C

Depth: Remote 2

General

Timeout interval: 5 sec.

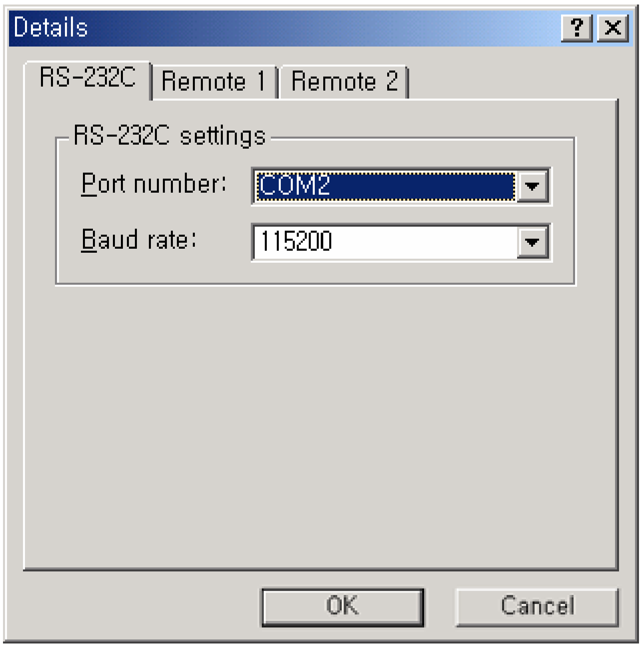
Retrial times: 1

Read / Write data size in PLC run mode

○ Normal ○ Maximum

* Send maximum data size in stop mode

- Setting communication port number and Baud rate of the locally connected RS-232C, click 『Remote 1』.



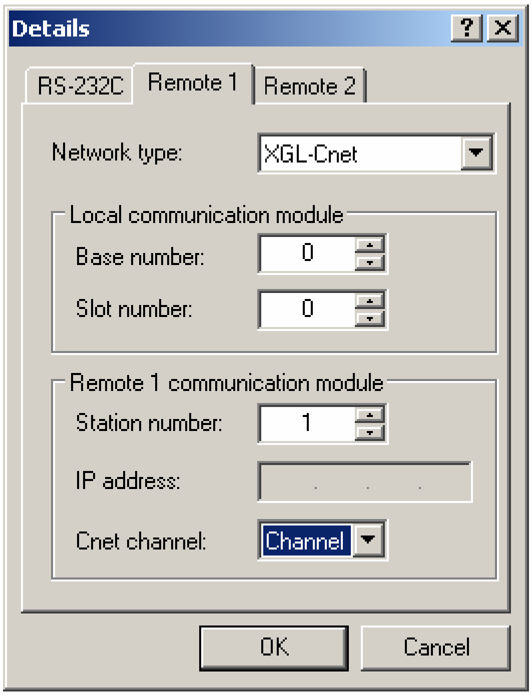
Details

RS-232C settings

Port number: COM2

Baud rate: 115200

- Set the Connection Settings of 『Remote 1』.



Network type: XGL-Cnet

Local communication module

Base number: 0

Slot number: 0

Remote 1 communication module

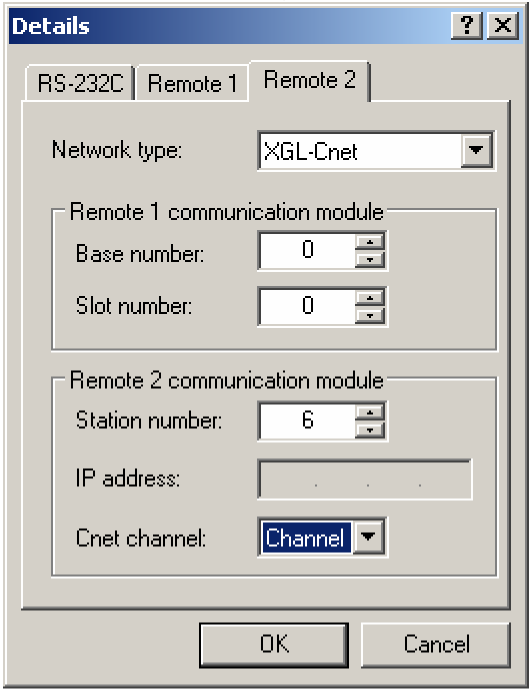
Station number: 1

IP address: . . .

Cnet channel: Channel

Item		Description
Network type		Set a type of communication network to remotely access. (Rnet , Enet, FDnet, Cnet, FEnet, FDEnet)
Local communication module	Base number	Set a base number to mount communcation module of Local. (XGB series have the default, ‘0’.)
	Slot number	Designate a slot location for communication module of Local. (it should be set to ‘0’ for built-in communcation.)
Remote 1 communication module	Station number	Set the station number of remote communication module.
	IP address	Set IP address in case a network type is Ethernet.
	Cnet channel	Set a communication channel of Cnet to remotely access.

- Set the Connection Settings of『Remote 1』.



Network type: XGL-Cnet

Remote 1 communication module

Base number: 0

Slot number: 0

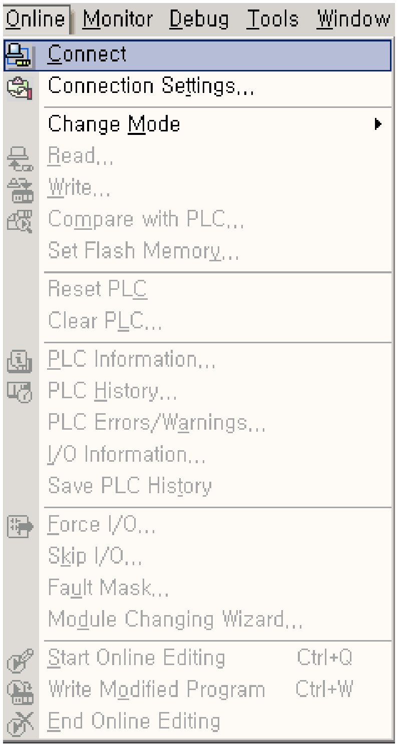
Remote 2 communication module

Station number: 6

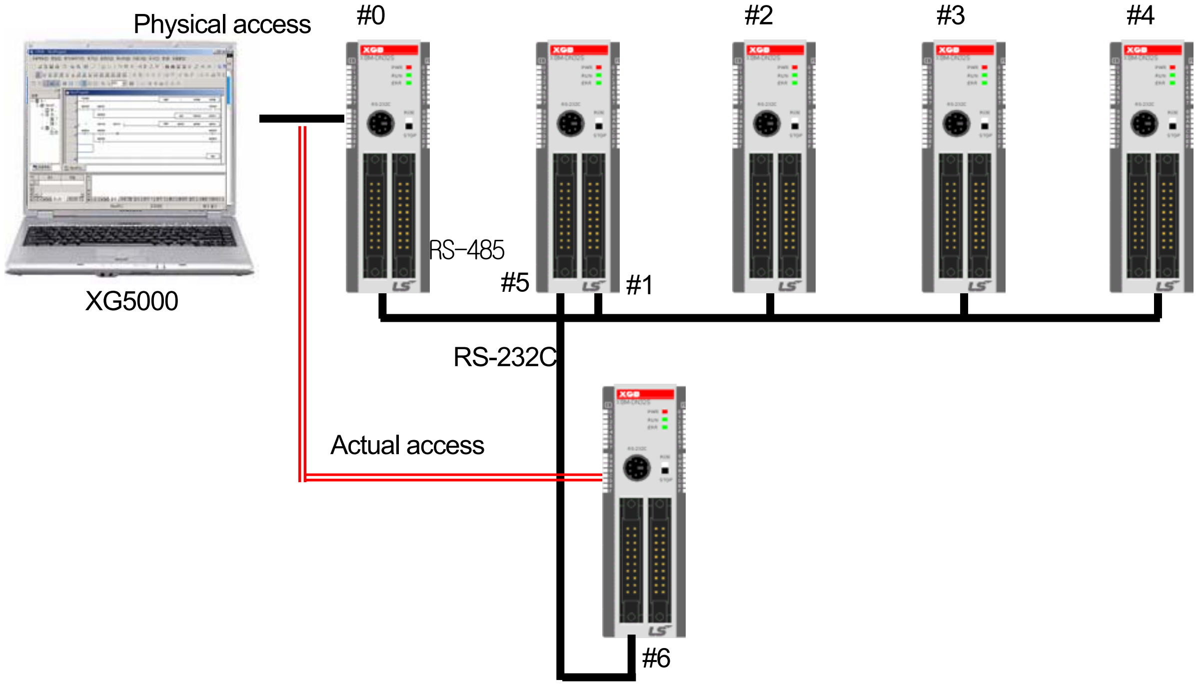
IP address: . . .

Cnet channel: Channel

- Execute 『Online』 -> 『Connect』 of XG5000.



- Upon the connect, XG5000 operates as if XG5000 is locally connected to #6 although it is physically connected to #0.



If running ‘program read’, it starts reading the program of #6.

Chapter 11 PID Control Function

11.1 Features

11.1.1 Introduction

The built-in PID control functions of XGB series feature as follows.

1) Since operations are executed within CPU part, it can be controlled by PID parameters and PLC program without PID module.

2) A variety of controls can be selected
▪That is, a user can easily select P operation, PI operation and PID operation.

3) Precise control operation
▪It can make precise PID control operations possible through floating point operations.

4) PWM(Pulse Width Modulation) output available.
▪It outputs control operation results to the output junction designated by a user through PWM.

4) Improving convenience of control settings and monitoring
▪Through parameter setting method and K area flag, it maximizes control parameter settings during operation and monitoring convenience

5) Freely selectable operation direction
▪Forward, reverse and mixed forward/reverse operations are available

6) Cascade operation realizing quick and precise PID control
▪It can increase quickness of response to disturbance through cascade loop.

7) Various additional functions
▪PID control can be achieved by various methods a user wishes because set value ramp, the present value follow-up, limiting change of values and types of alarm functions are provided.

11.2 PID Control

11.2.1 Functional specifications of PID control

1) Functional Specifications

The performance specifications of the built-in PID control function in XGB series are summarized in the below table.

Item		Specifications
No. of loops		16 Loop
Scope of setting PID constants	Proportional constant(P)	Real number (0 ~ 3.40282347e+38)
	Integral constant(I)	Real number (0 ~ 3.40282347e+38), unit: second
	Differential constant(D)	Real number (0 ~ 3.40282347e+38), unit: second
Scope of set value		INT(-32,768 ~ 32,767)
Scope of present value		INT(-32,768 ~ 32,767)
Scope of maneuver value		INT(-32,768 ~ 32,767)
Scope of manual maneuver value		INT(-32,768 ~ 32,767)
Indication	RUN/STOP	Operation: PID RUN Flag On (by loops) Stop: PID RUN Flag Off (by loops)
	Error	Normal: PID Error Flag Off (by loops) Error: PID Error Flag On, error code occurrence(by loops)
	Warning	Normal: PID Warning Flag Off (by loops) Error: PID Warning Flag On, error code occurrence(by loops)
Control operation		Control of P,PI,PD and PID, control of forward/reverse operation
Control interval		10.0ms ~ 6,553.6ms (0.1msUnit)
Additional functions	PWM output	Available
	Mixed forward/reverse output	Supportable
	Limiting change of present value	INT(-32,768 ~ 32,767)
	Limiting change of maneuver value	INT(-32,768 ~ 32,767)
	Equally dividing set value	0 ~ 65,536(frequency of control cycle time)
	Present value follow-up	0 ~ 65,536(frequency of control cycle time)
	Cascade control	Supportable.
	Min./max. present value	-32,768 ~ 32,767
	Differential filter	0.01 ~ 655.35 (x 100 Scaled Up)
	Dead band setting	0 ~ 65,535
	Prevention of dual integral accumulation	Supportable
	PID operation pause	Supportable

[Performance specifications of built-in PID control]

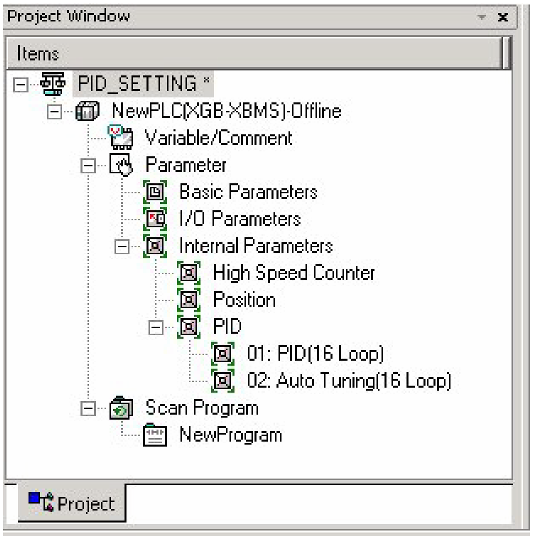
11.2.2 PID control parameter setting

To use the built-in PID control function of XGB series, it is necessary to set PID control parameters by loops in the parameter window and operate it though the commands. Here, it explains parameters to use PID control functions and how to set them.

1) PID parameter settings

Follow the steps to set the PID control function parameters of XGB series.

(1) If selecting the built-in parameters in Parameter of the project window, it shows the built-in parameter setting window as in below figure.



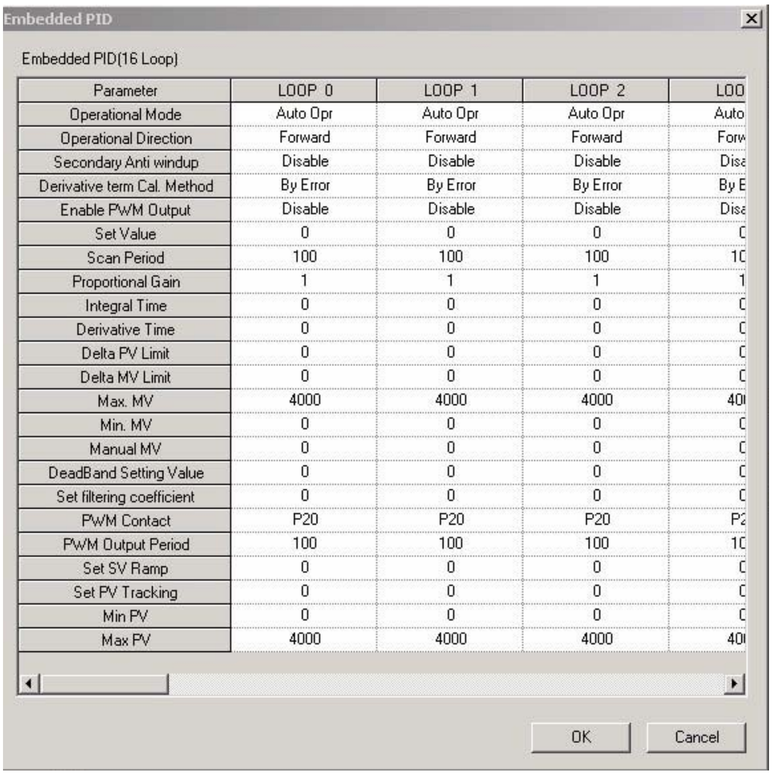
Project Window

Items

- PID_SETTING *
  - NewPLC(XGB-XBMS)-Offline
    - Variable/Comment
    - Parameter
      - Basic Parameters
      - I/O Parameters
      - Internal Parameters
        - High Speed Counter
        - Position
        - PID
          - 01: PID(16 Loop)
          - 02: Auto Tuning(16 Loop)
    - Scan Program
      - NewProgram

< Parameters setting window>

(2) If selecting PID Control, it shows the PID control parameter setting window as in below figure.



Embedded PID(16 Loop)

Parameter	LOOP 0	LOOP 1	LOOP 2	LOO
Operational Mode	Auto Opr	Auto Opr	Auto Opr	Auto
Operational Direction	Forward	Forward	Forward	Forw
Secondary Anti windup	Disable	Disable	Disable	Disa
Derivative term Cal. Method	By Error	By Error	By Error	By E
Enable PWM Output	Disable	Disable	Disable	Disa
Set Value	0	0	0	C
Scan Period	100	100	100	1C
Proportional Gain	1	1	1	1
Integral Time	0	0	0	C
Derivative Time	0	0	0	C
Delta PV Limit	0	0	0	C
Delta MV Limit	0	0	0	C
Max. MV	4000	4000	4000	40
Min. MV	0	0	0	C
Manual MV	0	0	0	C
DeadBand Setting Value	0	0	0	C
Set filtering coefficient	0	0	0	C
PWM Contact	P20	P20	P20	P2
PWM Output Period	100	100	100	1C
Set SV Ramp	0	0	0	C
Set PV Tracking	0	0	0	C
Min PV	0	0	0	C
Max PV	4000	4000	4000	40

[Built-in PID function parameters setting window]

(3) Input items

The items to set in the built-in PID function parameter window and the available scope of them are summarized in below table.

Items	Description	Scope
RUN mode	Set the operation mode of PID control.	Auto/manual operation
RUN direction	Set the operation direction of PID control.	Forward/reverse
Prevention of dual integral accumulation	Set whether to allow dual integral accumulation.	Disabled/enabled
PWM output	Set whether to allow PWM output of maneuver value.	Disabled/enabled
Operation cycle time	Set the operation cycle time of PID control cycle.	100 ~ 65535
Set value	Set target control value.	-32,768 ~ 32,767
Proportional gain	Set proportional gain.	Real number
Integral time	Set integral time.	Real number
Differential time	Set differential time.	Real number
Limiting change of present value	Set the limited change of present value per operation cycle.	-32,768 ~ 32,767
Limiting change of maneuver value	Set the limited change of maneuver value per operation cycle.	-32,768 ~ 32,767
Max. maneuver value	Set the max. maneuver value for control.	-32,768 ~ 32,767
Min. maneuver value	Set the min. maneuver value for control.	-32,768 ~ 32,767
Manual maneuver value	Set the manual maneuver value for control.	-32,768 ~ 32,767
DeadBand setting	Set the deadband width of the set value.	0 ~ 65,535
Differential filter value	Set the filter coefficient of differential operation.	0 ~ 65,535
PWM junction	Set the junction to which PWM output is out.	P20 ~ P3F
PWM output cycle	Set the output cycle of PWM output.	100 ~ 65,535
Set value ramp	Set the frequency of set value ramp.	0 ~ 65,535
Present value follow-up	Set the follow-up frequency of the present value follow-up function.	0 ~ 65,535
Min. present value	Set the min. value of the input present value.	-32,768 ~ 32,767
Max. present value	Set the max. value of input present value.	-32,768 ~ 32,767

< PID function parameter setting items>

2) Description of Setting of PID Parameters

(1) Operation mode

It is the mode to set the operation for PID control of a loop in question.
The available scope is automatic operation or manual operation.
If automatic operation is selected, it outputs the PID control result internally operated by the input PID control parameter as the maneuver value while if manual operation is selected, it outputs the value input to the manual maneuver value parameter without PID operation modified. The default is automatic operation.

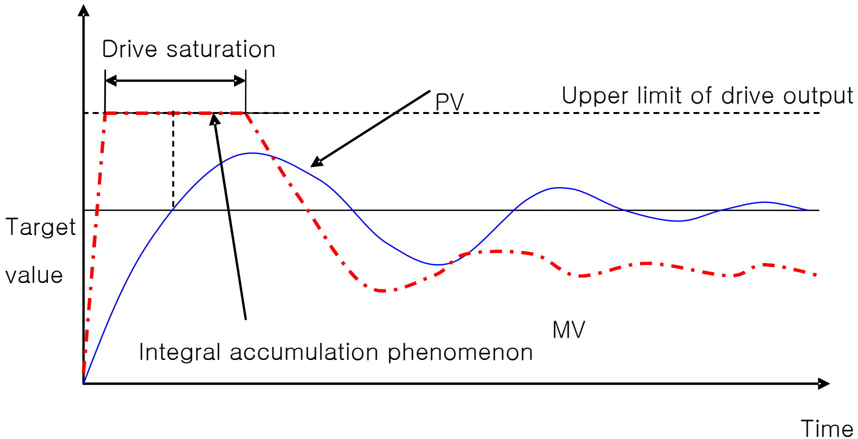
(2) Operation direction

It is designed to set the operation direction for PID control of a loop in question. The available scope is forward or reverse direction. At the moment, forward direction means increase of PV when MV increases; reverse direction means decrease PV when MV increases. For instance, a heater is a kind of forward direction system because PV(temperature) increases when output(heating) increases. A refrigerator is a kind of reverse direction system in which PV(temperature) decreases when output increases.

(3) Prevention of dual integral accumulation

It makes dual integral accumulation function enabled/disabled. To understand integral accumulation prevention function, it is necessary to explain the phenomenon of integral accumulation first of all. Every drive has a limit. That is, a motor is limited to the speed while a value is limited not to be open/close over the complete size. If it happens that MV output from a control is beyond the output limit of a drive, its output is maintained as saturated, which may deteriorate the control performance of a system and shorten the life of a drive. Formula $MV_d = K_P T_d \frac{dE}{dt}$ shows that the integral control among PID control output components accumulates errors as time goes on, from which it may take more time to return the normal status after the actuator is saturated in a system of which response characteristically is slow. It is so called integral accumulation phenomenon as illustrated in Fig. 11.9, which shows that if the initial error is very large, the error is continuously accumulated by integral control. Accordingly, a drive is saturated within its output upper limit while the control signal is getting larger, keeping being saturated for a long while until the drift becomes negative and the integral term turns small enough. Due to the operation, the PV may have a large over-shoot as seen in the figure. Such a wind-up phenomenon may occur if the initial drift is large or by a large disturbance or due to malfunction of a device.

The PID function of XGB series is basically with the integral accumulation prevention function, cutting off any integral accumulation phenomenon. In addition, it can detect a time when SV is suddenly decreased, providing a more strong dual integral accumulation prevention function.



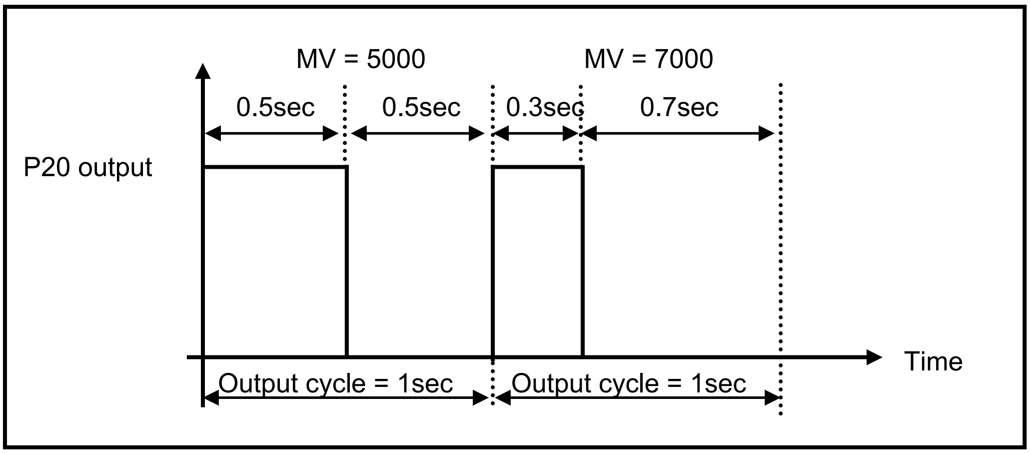
< Integral accumulation phenomenon >

(4) PWM Output Enabled

PWM output means an output method to turn a junction on – off with a duty proportional to control output calculated by a uniform output cycle. If PWM output is enabled, it realizes PWM output in accordance with PWM output cycle set in the parameter of PWM output junction(P20 ~ P3F) designated in the parameter. At the moment, the PWM output cycle follows the PWM output cycle separately set in PID operation cycle. figure shows the relation between PID control output and PWM output.

i.e.) if PWM output cycle: 1 second, PWM output junction: P20, max. output: 10000, min. output: 0

Time	Output	P40 junction operation
0 sec	5000	0.5 sec On, 0.5 sec Off
1 sec	3000	0.3 sec On, 0.7 sec Off



[Relation between PWM output cycle and MV]

(5) Set value

It sets the target of a loop in question, that is, the target status a user wishes to control. In case of the PID control built in XGB, physical values(temperature, flow rate, pressure and etc) of an object to control is not meaningful and instead, it should use the physical amount of an object to control after converting them into numerals. For instance, in order to control a system using a sensor that the output is 0V when its heating device temperature is 0℃ while it is 10V when the temperature is 100℃ as much as 50℃, it is necessary to set SV as 2000(as long as it uses AD input module XBE-AD04A).

(6) Operation cycle

It sets the cycle to yield control output by executing the built-in PID operation. The setting cycle is 0.1ms and available between 10ms ~ 6553.5ms(setting value: 100 ~ 65,535) while it is set at a unit of integer per 0.1ms. For instance, to set PID operation per 100ms, set the operation cycle as 1000.

(7) Proportional gain

It is intended to set the proportional coefficient of a PID loop in question(Kp). As larger Kp, the proportional control operation is getting stronger. The scope is real number.

(8) Integral time

It sets the integral time of PID loop in question(Ti). As larger the integral time, the integral operation is getting weaker. The scope is real number at the unit of second.

(9) Differential time

It sets the differential time of PID loop in question(Td). As larger the differential time, the differential operation is getting stronger. The scope is real number at the unit of second.

(10) Limiting change of present value

It sets the limit of change in present value of PID loop in question. If PV suddenly changes due to signal components such as sensor's malfunction, noise or disturbance during control of PID, it may cause sudden change of PID control output. To prevent the phenomenon, a user can set the max. limit of change in present value that is allowed per PID operation cycle. If the change of present value is limited accordingly, it may calculate the present value as much as the limit although the present value is changed more than the limit once the limit of change in present value is set. If using the PV change limit function, it may prevent against sudden change of control output owing to noise or etc. If it is, however, set too small, it may reduce the response speed to the PV change of an actual system, not to sudden change by noise or etc, so it is necessary to set the value appropriately according to the environment of a system to control in order that the PV toward the set value does not take a longer time. The available scope is between -32,768 ~ 32,767. If setting the PV change limit as 0, the function is not available.

(11) Limiting change of MV(ΔMV function)

It limits the max. size that control output, which is output by PID operation is changed at a time. The output MV in this operation cycle is not changed more than the max. change limit set in the previous operation cycle. The function has an effect to prevent a drive from operating excessively due to sudden change of output by preventing sudden change of output resulting from instantaneous change of set value. If it is, however, set too small, it may cause taking a longer time until PV reaches to its target, so it is necessary to adjust it appropriately. The available scope is between -32,768 ~ 32,767. If setting it as 0, the function does not work.

(12) Max. MV

It sets the max. value of control output that may be output by the result of PID operation. The available scope is between -32,768 ~ 32,767. if it exceeds the max. output designated by PID operation result, it outputs the set max. output and alerts the max. output excess warning. For the types and description of warnings, refer to Error/Warning Codes.

(13) Min. MV

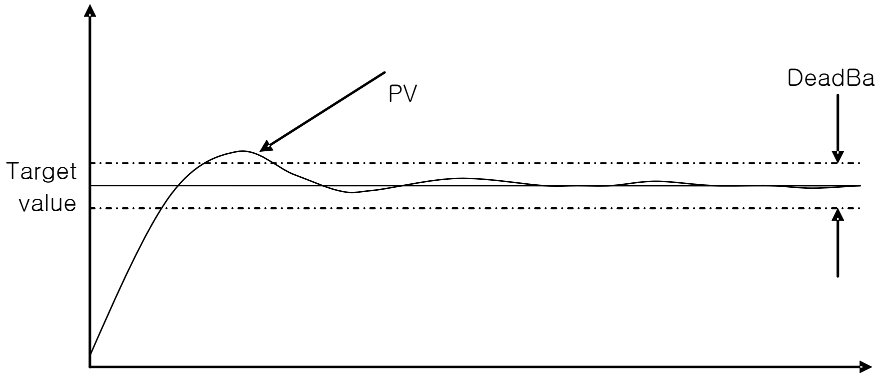
It sets the min. value of control output that may be output by the result of PID operation. The available scope is between -32,768 ~ 32,767. If it is smaller than the min. output value designated by PID operation result, it outputs the set min. MV and alerts the min. output shortage warning. For the types and description of warnings, refer to Error/Warning Codes.

(14) Manual MV

It sets the output when the operation mode is manual. The available scope is between -32,768 ~ 32,767.

(15) DeadBand setting

It sets the deadband between set value and present value. Although it may be important to reduce normal status reply of PV for its set value even when MV fluctuates heavily, depending on control system, it may be more important to reduce the frequent change of MV although the normal status reply is somewhat getting larger. DeadBand may be useful in the case.
Below figure shows an example of DeadBand setting.



[Example of DeadBand setting]

If setting deadband as in the figure, the PID control built in XGB may regard the error between PV and set value as 0 as long as PV is within the available scope of deadband.

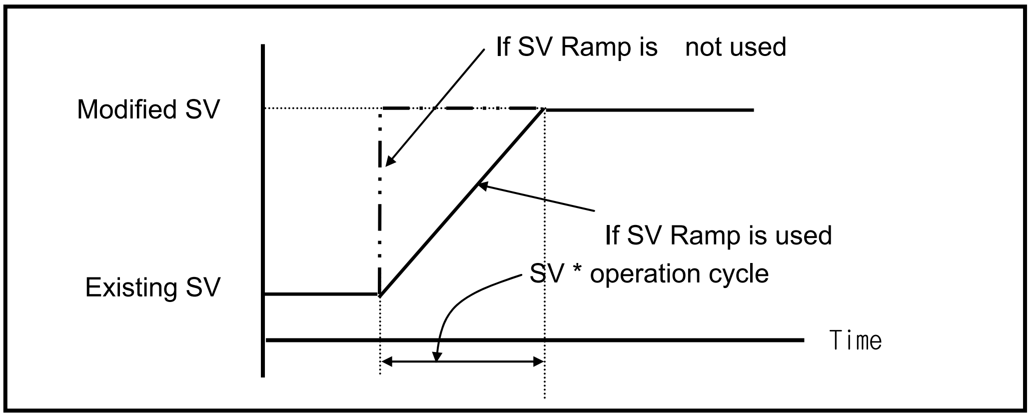
That is, in the case, the change of MV is reduced. The available scope is between 0 ~ 65,535 and if it is set as 0, it does not work.

(16) Differential Filter Value Setting

It sets the coefficient of differential filter. Since differential control outputs in proportion to gradient of error and gradient of PV change, it may suddenly change MV as it generates a large response to instantaneous noise or disturbance. To prevent it, XGB series uses a value to which PV is filtered mathematically for differential control. Differential filter value is the coefficient to determine the filter degree for differential control. As smaller differential value set, as stronger differential operation is. The available scope is between 0 ~ 65,535 and if it is set as 0, the differential filter does not work.

(17) Setting set value ramp

Since the drift is suddenly large if SV is heavily changed during PID control, MV is also changed heavily to correct it. Such an operation may cause excessive operation of a system to control and a drive. To prevent it, SV ramp is used, changing SV gradually step by step when modifying SV during operation. If using the function, SV is gradually changed by SV ramp when SV is changed during PID control. At the moment, SV ramp setting represents the frequency of PID operation cycle taken from when SV starts changing to when it reaches to the final SV. For instance, if SV is to be changed from 1000 to 2000 during operation as PID operation cycle is 10ms and its SV ramp is 500, SV may reach to 2000 after 500X10ms = 5 seconds, that is, as it increases each 2 per operation cycle and after the 500th operation scans. The available scope is between 0 ~65,535 and it is set as 0, it does not work.



[SV Ramp function]

(18) PV Follow-up setting

It is intended to prevent any excessive operation of a drive resulting from sudden change of output at the initial control and changes SV gradually from PV at the time when PID operation starts, not directly to SV in case control just turns from stop to operation mode or it changes from manual to automatic operation. At the moment, SV represents the frequency of PID operation cycles taken from when control starts to when it reaches to the set SV(other operations are same as SV ramp function). The available scope is between 0 ~ 65,535. If SV is changed again while PV follow-up is in operation, the SV would be also changed according to SV ramp.

(19) Min./max. PV

It sets the min./max. value entered as the present value of PID control. The available scope is between -32,768 ~ 32,767.

11.2.3 PID Flag

The parameter set by the XGB series built-in PID control function is saved into the flash memory of the basic unit. Such parameters are moved to K area for the built-in PID function as soon as PLC turns from STOP to RUN mode. PID control operation by PID control command is executed through K area data for PID functions. Therefore, if a user changes the value in the trend monitor window or variable monitor window during operation, PID operation is executed by the changed value. At the moment, if PLC is changed to RUN again after being changed to STOP, it loads the parameters in flash memory to K area, so the data changed in K area is lost. Thus, to keep applying the parameters adjusted in K area, it is necessary to write the parameter set in K area to flash memory by using WRT command.

1) PID Flag Configuration

K area flags for XGB series built-in PID control function are summarized in the below table.

Loop	K area	Symbol	Data type	Default	Description
Common	K12000~F	_PID_MAN	Bit	Auto	PID output designation(0:auto, 1:manual)
	K12010~F	_PID_PAUSE	Bit	RUN	PID pause (0:RUN, 1:pause)
	K12020~F	_PID_REV	Bit	Forward	Control direction(0:forward, 1:reverse) operation control
	K12030~F	_PID_AW2D	Bit	Disabled	Dual integral accumulation prevention(0:enabled, 1:disabled)
	K12040~F	_PID_REM_RUN	Bit	Disabled	PID remote operation(0:disabled, 1:enabled)
	K1205~K1207	Reserved	WORD	-	Reserved
	K12080~F	_PID_PWM_EN	Bit	Disabled	PWM output enable(0:disabled, 1:enabled)
	K12090~F	_PID_STD	Bit	-	PID operation indication(0:stop, 1:run)
	K12100~F	_PID_ALARM	Bit	-	PID warning(0:normal, 1:warning)
	K12110~F	_PID_ERROR	Bit	-	PID error(0:normal, 1:error)
	K1212~K1215	Reserved	WORD	-	Reserved
Loop 0	K1216	_PID00_SV	INT	0	PID SV
	K1217	_PID00_T_s	WORD	100	PID operation cycle[0.1ms]
	K1218	_PID00_K_p	REAL	1	PID proportional constant
	K1220	_PID00_T_i	REAL	0	PID integral time[sec]
	K1222	_PID00_T_d	REAL	0	PID differential time[sec]
	K1224	_PID00_d_PV_max	WORD	0	PID PV change limit
	K1225	_PID00_d_MV_max	WORD	0	PID MV change limit
	K1226	_PID00_MV_max	INT	4000	PID MV max. value limit
	K1227	_PID00_MV_min	INT	0	PID MV min. value limit
	K1228	_PID00_MV_man	INT	0	PID manual output
	K1229	_PID00_PV	INT	-	PID PV

< K area flags for PID control >

Loop	K area	Symbol	Data type	Default	Description
Loop 0	K1230	_PID00_PV_old	INT	-	PID PV of previous cycle
	K1231	_PID00_MV	INT	0	PID MV
	K1232	_PID00_ERR	DINT	-	PID control error
	K1234	_PID00_MV_p	REAL	0	PID MV proportional value component
	K1236	_PID00_Mv_i	REAL	0	PID MV integral control component
	K1238	_PID00_MV_d	REAL	0	PID MV differential control component
	K1240	_PID00_DB_W	WORD	0	PID deadband setting
	K1241	_PID00_Td_lag	WORD	0	PID differential filter coefficient
	K1242	_PID00_PWM	WORD	H'20	PID PWM junction setting
	K1243	_PID00_PWM_Prd	WORD	100	PID PWM output cycle
	K1244	_PID00_SV_RAMP	WORD	0	PID SV Ramp value
	K1245	_PID00_PV_Track	WORD	0	PID PV follow-up setting
	K1246	_PID00_PV_MIN	INT	0	PID PV min. value limit
	K1247	_PID00_PV_MAX	INT	4000	PID PV max. value limit
	K1248	_PID00_ALM_CODE	Word	0	PID warning code
	K1249	_PID00_ERR_CODE	Word	0	PID error code
	K1250	_PID00_CUR_SV	INT	0	PID SV of current cycle
	K1251-1255	Reserved	WORD	-	Reserved
Loop 1	K1256~K1295[1]	-	-	-	PID Loop1 control parameter
~					
Loop16	K1816~K1855	-	-	-	PID Loop16 control parameter

< K area flags for PID control(continued)>

K1200 ~ K1211 areas are the common bit areas of PID loops while each bit represents the status of each PID control loop. Therefore, each 16 bits, the max number of loops of XGB PID control represents loop status and setting respectively. K1216 ~ K1255 areas are K areas for PID control loop 0 and save the loop 0 setting and status. It also contains parameters such as SV, operation cycle, proportional coefficient, integral time and differential time set in the built-in parameter window and the XGB built-in PID function executes PID control by each device value in question. In addition, the output data such as MV calculated and output while PID control is executed is also saved into the K areas. By changing the values in K areas, control setting may be changed any time during PID control.

Remark

1) PID control flag expression : _PID[n]_xxx
  ➔ [n] : loop number
  ➔ xxx : flag function
 i.e.) _PID10_K_p : means K_p of loop 10.

---

[1] Occupies 40 words per loop.

2) PID flag function

Each function of K area flags for XGB series built-in PID control function is summarized as follows.

A) Common bit area

The area is a flag collecting operation setting and information consisting of bits to each 16 loop. Each bit of each word device represents the information of each loop. That is, 'n' th bit represents the information about PID loop n.

(1) _PID_MAN (PID RUN mode setting)

Flag name	address	Unit	Setting
_PID_MAN (PID RUN mode setting)	K1200n	BIT	Available

It determines whether to operate the PID control of n loop automatically or manually. For more information about RUN mode, refer to 11.2.2 PID control parameter setting. If the bit is off, it operates automatically; if on, it runs manually.

(2) _PID_PAUSE (PID Pause setting)

Flag name	Address	Unit	Setting
_PID_PAUSE (PID pause setting)	K1201n	BIT	Available

It changes PID control of n loop to pause status. If PID control is paused, the control MV is fixed as the output at the time of pause. At the moment, PID operation is continued internally with output fixed. If changing pause status to operation status again, it resumes control, so it may take a longer time until the PV is going to SV once system status is largely changed during pause. If the bit is off, it cancels pause; if on, it operates as paused.

(3) _PID_REV (PID RUN direction setting)

Flag name	Address	Unit	Setting
_PID_REV (PID RUN direction setting)	K1202n	BIT	Available

It sets the RUN direction of PID control of n loop. For more information about run direction, refer to 11.2.2 PID control parameter setting. If the bit is off, it operates normally; if on, it operates reversely.

(4) _PID_AW2D (Dual Integral accumulation prevention setting)

Flag name	Address	Unit	Setting
_PID_AW2D (dual integral accumulation prevention setting)	K1203n	BIT	Available

It sets enable/disable of dual integral accumulation prevention of 'n' th loop. For more information about dual integral accumulation prevention, refer to 11.2.2 PID control parameter setting. If the bit is off, it is enabled; if on, it is disabled.

(5) _PID_REM_RUN (PID remote operation setting)

Flag name	Address	Unit	Setting
_PID_REM_RUN (PID remote run setting)	K1204n	BIT	Available

XGB series built-in PID function can be started by both run from command's start junction and remote run bit setting. That is, XGB starts PID control if PIDRUN command's start junction is on or remote run setting bit is on. Namely, if one of them is on, it executed PID control.

(6) _PID_PWM_EN (PWM output enable)

Flag name	Address	Unit	Setting
_PID_PWM_EN (PWM output enable)	K1208n	BIT	Available

It determines whether to output the MV of PID control of n th loop as PWM output. For more information about PWM output, refer to 11.2.2 PID control parameter setting. If the bit is off, it is disabled; if on, it is enabled.

(7) _PID_STD (PID RUN status indication)

Flag name	Address	Unit	Setting
_PID_STD (PID RUN status indication)	K1209n	BIT	Unavailable

It indicates the PID control RUN status of ‘n’ th loop. If a loop is running or paused, it is on while if it stops or has an error during RUN, it is off. In the area as monitoring area, it is changed to the current run status by PLC although a user enters any value temporarily.

(8) _PID_ALARM (PID Warning occurrence)

Flag name	Address	Unit	Setting
_PID_ALARM (PID Warning occurrence)	K1210n	BIT	Unavailable

It indicates warning if any warning occurs during PID control of ‘n’th loop. Once a warning occurs during PID control operation of a loop, it is on while if it is normal, it is off. At the moment, despite of warning, PID control continues without interruption, but it is desirable to check warning information and take a proper measure. Once a warning occurs, the warning code is also indicated in warning code area of a loop. For more information about the types of warning codes and measures, refer to 11.6. In the area as monitoring area, it is changed to the current run status by PLC although a user enters any value temporarily.

(9) _PID_ERROR (PID Error occurrence)

Flag name	Address	Unit	Setting
_PID_ERROR (PID error occurrence)	K1211n	BIT	Unavailable

If an error that discontinues running during PID control of ‘n’ th loop occurs, it indicates the error’s occurrence. If an error generates warning, it is on; if normal, it is off. When an error occurs, PID control stops and MV is output as the min. output set in parameter. Also, if an error occurs, the error code is indicated in the error code area of a loop. For more information about type of error codes and measures, refer to 11.6. In the area as monitoring area, it is changed to the current run status by PLC although a user enters any value temporarily.

B) PID Flag area by loops

PID flag areas by loops are allocated between K1216 ~ K1855 and for totally 16 loops, each 40 words is allocated per loop. Therefore, the individual data areas of ‘n’ th loop are between K(1216+16*n) ~ K(1255+16*n). Every setting of the PID flag areas by loops may be changed during PID control operation. Once the settings are changed, they are applied from the next PID control cycle.

(1) _PIDxx_SV (PID xx Loop SV setting)

Flag name	Address	Unit	Scope
_PIDxx_SV (PID xx Loop SV setting)	K1216+16*xx	INT	-32,768 ~ 32,767

It sets/indicates the SV of PID control of ‘xx’ th loop. For more information about SV, refer to 11.2.2 PID control parameter setting. The available scope is between -32,768 ~ 32,767.

(2) _PIDxx_T_s (PID xx Loop operation cycle)

Flag name	Address	Unit	Scope
_PIDxx_T_s (PID xx Loop operation cycle)	K1217+16*xx	WORD	100 ~ 65,535

It sets/indicates the operation cycle of PID control of ‘x’ th loop. For more information about operation cycle, refer to 11.2.2 PID control parameter setting. The available scope is between 100 ~ 65,535.

(3) _PIDxx_K_p (PID xx Loop proportional constant)

Flag name	Address	Unit	Scope
_PIDxx_K_p (PID xx Loop proportional constant)	K1218+16*xx	REAL	Real number

It sets/indicates the proportional constant of PID control of ‘x’ th loop. For more information about proportional constant, refer to 8.3.3 PID Control Parameter Setting. The available scope is real number(-3.40282347e+38 ~ -1.17549435e-38 , 0 , 1.17549435e-38 ~ 3.40282347e+38). If it is, however, set as 0 and lower, the PID control of a loop generates an error and does not work.

(4) _PIDxx_T_i (PID xx Loop Integral time)

Flag name	Address	Unit	Scope
_PIDxx_T_i (PID xx Loop integral time)	K1220+16*xx	REAL	Real number

It sets/indicates integral time of PID control of ‘xx’ th loop. The available scope is real number. If it is set as 0 and lower, it does not execute integral control.

(5) _PIDxx_T_d (PID xx Loop differential time)

Flag name	Address	Unit	Scope
_PIDxx_T_d (PID xx Loop differential time)	K1222+16*xx	REAL	Real number

It sets/indicates differential time of PID control of ‘x’ th loop. The available scope is real number. If it is set as 0 and lower, it does not execute differential control.

(6) _PIDxx_d_PV_max (PV change limit)

Flag name	Address	Unit	Scope
_PIDxx_d_PV_max (PV change limit)	K1224+16*xx	WORD	0 ~ 65,535

It sets the PV change limit of ‘xx’ th loop.
For more information about PV change limit, refer to 11.2.2 PID control parameter setting. If it is set as 0, the PV change limit function does not work.

(7) _PIDxx_d_MV_max (MV change limit)

Flag name	Address	Unit	Scope
_PIDxx_d_MV_max (MV change limit)	K1225+16*xx	WORD	0 ~ 65,535

It sets the MV change limit of ‘xx’th loop. For more information about MV change limit, refer to 11.2.2 PID control parameter setting. If it is set as 0, the MV change limit function does not work.

(8) _PIDxx_MV_max, _PIDxx_MV_min, _PIDxx_MV_man (max. MV, min. MV, manual MV)

Flag name	Address	Unit	Scope
_PIDxx_MV_max (max. MV)	K1226+16*xx	INT	-32,768 ~ 32,767
_PIDxx_MV_min (min. MV)	K1227+16*xx		
_PIDxx_MV_man (manual MV)	K1228+16*xx		

It sets the max. MV, min. MV and manual MV of 'x' th loop. For more information about max. MV, min. MV and manual MV, refer to 11.2.2 PID control parameter setting. If the max. MV is set lower than the min. MV, the PID control loop generates an error and does not work.

(9) _PIDxx_PV (prevent value)

Flag name	Address	Unit	Scope
_PIDxx_PV (present value)	K1229+16*xx	INT	-32,768 ~ 32,767

It is the area that receives the present value of 'xx' th PID control loop. PV is the present status of the system to control and is normally saved into U device via input devices such as A/D input module if it is entered from a sensor. The value is used to execute PID operation by moving to _PIDxx_PV by means of commands like MOV.

(10) _PIDxx_PV_OLD (PV of previous control cycle)

Flag name	Address	Unit	Scope
_PIDxx_PV_OLD (PV of previous control cycle)	K1230+16*xx	INT	Unavailable

The area indicates the PV just before the xx th PID control loop. The flag, as a dedicated monitoring flag, would be updated by PLC although a user directly enters it.

(11) _PIDxx_MV (Control MV)

Flag name	Address	Unit	Scope
_PIDxx_MV (control MV)	K1231+16*xx	INT	Unavailable

The areas shows the MV of 'xx' th PID control loop. As the area in which XGB built-in PID operation result is output every PID control cycle, it delivers the value in the area to U device every scanning by using commands like MOV in the program and outputs to D/A output module, operating a drive.

(12) _PID00_ERR (Present error)

Flag name	Address	Unit	Scope
_PID00_ERR (present error)	K1232+16*xx	DINT	Unavailable

The areas shows the current error of 'xx' th PID control loop. It is also used as an indicated about how much gap the present status has with a desired status and if an error is 0, it means the control system reaches a desired status exactly. Therefore, if control starts, error is quickly reduced at transient state and it reaches normal state, maintaining remaining drift as 0, it could be an ideal control system. The flag, as a dedicated monitoring, is updated although a user directly enters it.

(13) _PIDxx_MV_p, _PIDxx_MV_i, _PIDxx_MV_d (P/I/D control components of MV)

Flag name	Address	Unit	Scope
_PIDxx_MV_p (MV proportional control component)	K1234+16*xx	REAL	Unavailable
_PIDxx_MV_i (MV integral control component)	K1236+16*xx		
_PIDxx_MV_d (MV differential control component)	K1238+16*xx		

It indicates 'n' th loop MV by classifying proportional control MV, integral control max. MV and differential control MV. The entire MV consists of the sum of these three components. The flag, as a dedicated monitoring, is updated although a user directly enters it.

(14) _PIDxx_DB_W (DeadBand setting)

Flag name	Address	Unit	Scope
_PIDxx_DB_W (DeadBand setting)	K1240+16*xx	WORD	0 ~ 65,535

It sets the deadband of 'xx' th loop. For more information about Deadband function, refer to 11.2.2 PID control parameter setting. If it is set as 0, the function does not work.

(15) _PIDxx_Td_lag (Differential filter coefficient)

Flag name	Address	Unit	Scope
_PIDxx_Td_lag (differential filter coefficient)	K1241+16*xx	WORD	0 ~ 65,535

It sets the differential filter coefficient of 'x' th loop. For more information about differential filter coefficient, refer to 11.2.2 PID control parameter setting. If it is set as 0, the function does not work.

(16) _PIDxx_PWM (PWM output junction setting)

Flag name	Address	Unit	Scope
_PID00_PWM (PWM output junction setting)	K1242+16*xx	WORD	H'20 ~ H'3F

It sets the junction to which PWM output of 'x' th loop is output. PWM output junction is valid only between H'20 ~ H'3F. If any other value is entered, PWM output does not work.

(17) _PIDxx_PWM_Prd (PWM Output cycle setting)

Flag name	Address	Unit	Scope
_PIDxx_PWM_Prd (PWM output cycle setting)	K1243+16*xx	WORD	100 ~ 65,535

It sets the PWM output cycle of 'x' th loop. The available scope is between 100 ~ 65,535 at the unit of 0.1ms.

(18) _PIDxx_SV_RAMP (SV ramp setting)

Flag name	Address	Unit	Scope
_PIDxx_SV_RAMP (SV ramp setting)	K1244+16*xx	WORD	0 ~ 65,535

It sets the SV ramp value of 'xx' th loop. For more information about SV ramp of PV, refer to 11.2.2 PID control parameter setting. If it is set as 0, the function does not work.

(19) _PIDxx_PV_Track(PV follow-up setting)

Flag name	Address	Unit	Scope
_PIDxx_PV_Track(PV follow-up setting)	K1245+16*xx	WORD	0 ~ 65,535

It sets the PV follow-up SV of 'xx' th loop. For more information about PV follow-up, refer to 11.2.2 PID control parameter setting. If it is set as 0, the function does not work.

(20) _PIDxx_PV_MIN, _PIDxx_PV_MAX(Min. PV input, Max. PV input)

Flag name	Address	Unit	Scope
_PIDxx_MV_p (MV proportional control component)	K1246+16*xx	INT	-32,768 ~ 32,767
_PIDxx_MV_i (MV integral control component)	K1247+16*xx		

It sets the min./max. PV of 'n' th loop.

(21) _PIDxx_ALM_CODE(Warning code)

Flag name	Address	Unit	Scope
_PIDxx_ALM_CODE(Warning code)	K1248+16*xx	WORD	Unavailable

It indicates warning code if a warning occurs during 'x' th loop run. The flag, as a dedicated monitoring, is updated although a user directly enters it. For more information about warning code, refer to 11.5.

(22) _PIDxx_ERR_CODE(Error code)

Flag name	Address	Unit	Scope
_PIDxx_ERR_CODE(error code)	K1249+16*xx	WORD	Unavailable

It indicates error code if an error occurs during 'x' th loop run. The flag, as a dedicated monitoring, is updated although a user directly enters it. For more information about warning code, refer to 11.5.

(23) _PIDxx_CUR_SV(SV of the present cycle)

Flag name	Address	Unit	Scope
_PIDxx_CUR_SV (SV of the present cycle)	K1250+16*xx	INT	Unavailable

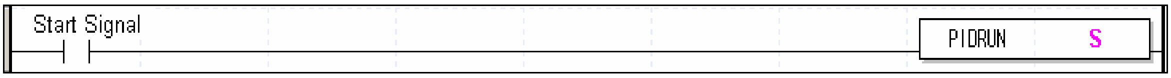
It indicates SV currently running of 'x' th loop. If SV is changing due to SV ramp or PV follow-up function, it shows the currently changing PV. The flag, as a dedicated monitoring, is updated although a user directly enters it.

11.2.4 PID instructions

It describes PID control commands used in XGB series. The command type of PID control used in XGB series built-in PID control is 4.

1) PIDRUN

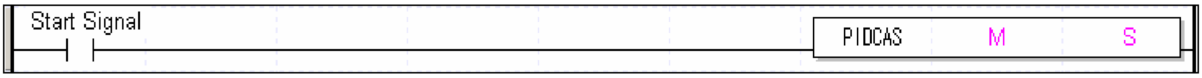
PIDRUN is used to execute PID control by loops.



- Operand S means the loop no. to execute PID control and avaiable only for constant(0~15).
- If start signal is on, the PID control of a loop starts.

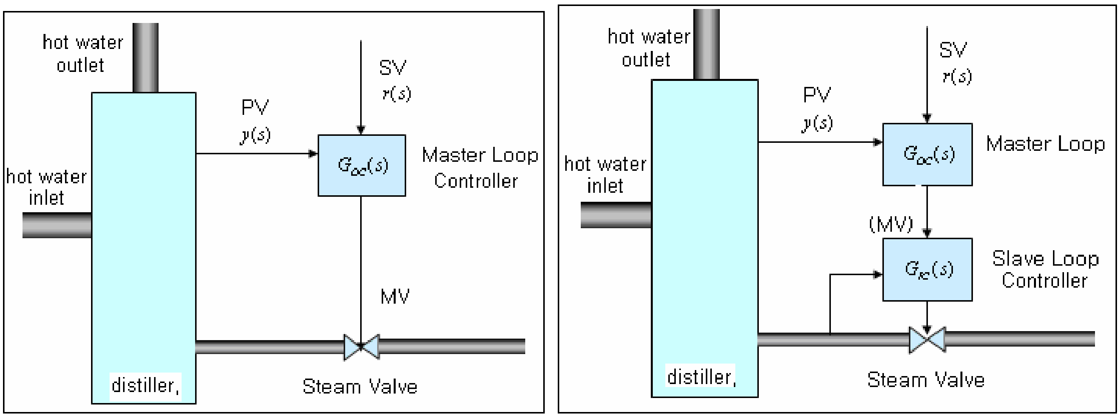
2) PIDCAS

PIDCAS is a command to execute CASCADE control.



- Operand M and S mean master loop and slave loop respecively and available only for constant(0~15).
- If start junction is on, cascade control is executed through master loop and slave loop.

Cascade control is called a control method which is intended to increase control stability through quick removal of disturbance by connecting two PID control loops in series and is structured as follows.



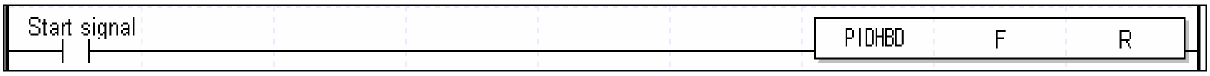
[Comparison of single loop control and cascade control]

Looking at the figure, it is found that cascade control contains slave loop control within external control loop. That is, the control output of external loop PID control is entered as SV of the internal loop control. Therefore, if steam valve suffers from disturbance in the figure, single loop PID control may not be modified until PV, y(s) appears while cascade control is structured to remove any disturbance by the internal PID loop control before any disturbance that occurs in its internal loop affects the PV, y(s), so it can early remove the influence from disturbance.

XGB internal PID control connects two PID control loops each other, making cascade control possible. At the moment, MV of external loop is automatically entered as the SV of internal loop, so it is not necessary to enter it through program.

3) PIDHBD

PIDHBD is a command to execute the mixed forward/reverse E control.



- Operand F and R represent forward operation loop and reverse operation loop and available only for constant(0~15).
- If start junction is on, it starts the mixed forward/reverse operation from the designated forward/reverse loops.

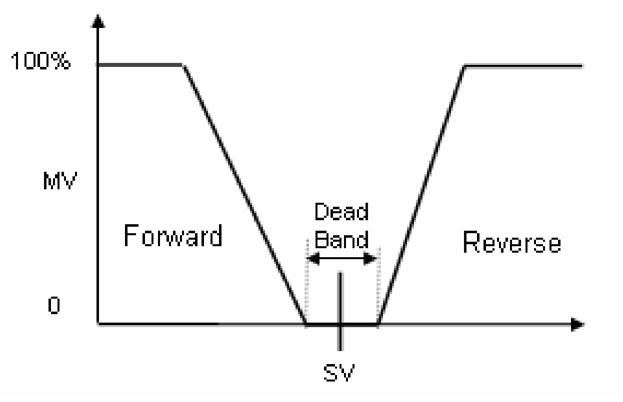
The mixed forward/reverse control is called a control method to control forward operation control output and reverse operation control operation alternatively to a single control process. The XGB built-in PID control enables the mixed forward/reverse control by connecting two PID control loops set as forward/reverse operations. At the moment, it uses PIDHBD command. For more information about the command, refer to 11.3.5. The mixed forward/reverse run is executed as follows in the XGB built-in PID control.

A) Commencement of mixed run

If PIDHBC command starts first, it starts reverse run when PV is higher than SV; it starts forward run if PV is lower than SV.

B) Conversion of RUN direction

The conversion of run direction is executed according to the following principles. In case of forward operation run, it keeps running by converting to reverse operation once PV is over SV + DeadBand value. At the moment, the DeadBand setting value uses the deadband of a loop set for forward operation. If PV is below SV – DeadBand value during reverse operation, it also keeps running by converting to forward operation. In the case, the DeadBand setting uses the deadband of a loop set for reverse loop. It may be illustrated as 11.14.



[Conversion of RUN direction in the mixed forward/reverse control]

C) At the moment, every control parameter uses the parameter of a loop set for forward operation while MV is output to MV output area of a loop of forward operation. Reversely, every control parameter uses the parameter of a loop set for reverse operation during reverse operation run while MV is also output to MV output area of reverse operation loop.

D) WRT

WRT is a command to save K area flags changed during operation to the internal flash memory of PLC.

M0000

WRT 0 0 0

- Once start juction is on, it writes K area values to flash memory.
- Each operand description is summarized as follows.

Operand	Item designated	Available device	Remark
OP1	Slot	Constant	Designating basic uit as 0
OP2	N/A	P,M,L,K,D,Z,R, constant	Not used
OP3	Parameter type	P,M,L,K,D,Z,R,constant	0 : positioning X axis 1 : positioning Y axis 2 : HS counter 3 : PID parameter 4 : PID auto-tuning parameter

11.3 PID Auto-tuning

11.3.1 PID Auto-Tuning function specifications

The specifications of the XGB series built-in PID auto-tuning function are summarized as in Table.

Item		Specifications
Scope of SV		INT(-32,768 ~ 32,767)
Scope of PV		INT(-32,768 ~ 32,767)
Scope of MV		INT(-32,768 ~ 32,767)
	Error indication	Normal: error flag off Error: error flag off, error code occurs
AT direction setting		Forward/reverse
Control cycle		100 ~ 65,536 (0.1msUnit)
Additional function	PWM output	Available
	Hysterisis	Supportable

[Spec. of built-in PID auto-tuning function]

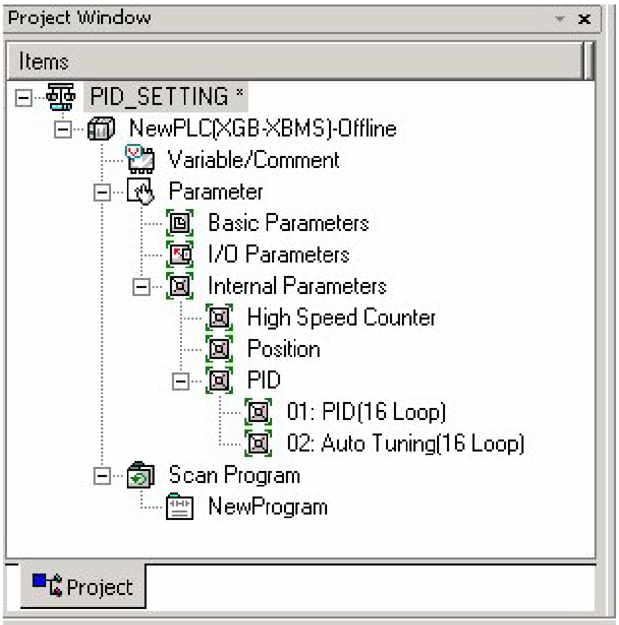
11.3.2 Auto-tuning parameter setting

To use the XGB series auto-tuning function, it is necessary to start it by using a command after setting auto-tuning parameters by loops in the parameter window. It explains the parameters to use auto-tuning function and how to set them.

1) Auto-tuning parameter setting

To set the parameters of XGB series auto-tuning function, follow the steps.

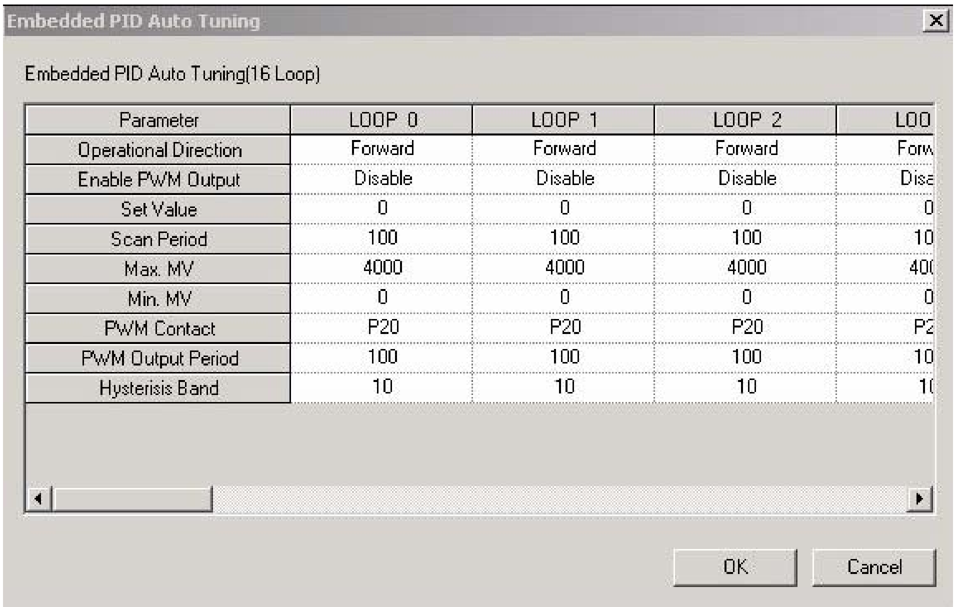
A) If selecting parameter in project window and the built-in parameter, it shows the built-in parameter setting window as seen in below figure.



- PID_SETTING *
  - NewPLC(XGB-XBMS)-Offline
    - Variable/Comment
    - Parameter
      - Basic Parameters
      - I/O Parameters
      - Internal Parameters
        - High Speed Counter
        - Position
        - PID
          - 01: PID(16 Loop)
          - 02: Auto Tuning(16 Loop)
    - Scan Program
      - NewProgram

< Built-in parameter setting window >

B) If selecting auto-tuning, it shows the parameter setting window as seen in figure.



Embedded PID Auto Tuning(16 Loop)

Parameter	LOOP 0	LOOP 1	LOOP 2	LOO
Operational Direction	Forward	Forward	Forward	Forw
Enable PWM Output	Disable	Disable	Disable	Disa
Set Value	0	0	0	0
Scan Period	100	100	100	10
Max. MV	4000	4000	4000	40
Min. MV	0	0	0	0
PWM Contact	P20	P20	P20	P2
PWM Output Period	100	100	100	10
Hysterisis Band	10	10	10	1

< Built-in auto-tuning function parameter setting window>

C) Input items

Table shows the items to set in auto-tuning parameter window and the available scopes.

Items	Description	Scope
RUN direction	Set the run direction of auto-tuning.	Forward/reverse
PWM output enable	Set whether to set PWM output of MV enabled/disabled.	Disable/enable
SV	Set SV.	-32,768 ~ 32,767
Operation time	Set auto-tuning operation time.	100 ~ 65535
Max. MV	Set the max. MV in control.	-32,768 ~ 32,767
Min. mV	Set the min. MV in control.	-32,768 ~ 32,767
PWM junction designation	Designate the junction to which PWM output is output.	P20 ~ P3F
PWM output cycle	Set the output cycle of PWM output.	100 ~ 65,535
Hysterisis setting	Set the hysteris of auto-tuning MV.	0 ~ 65,535

< Auto-tuning function parameter setting items>

2) Description of auto-tuning parameters and how to set them

A) RUN direction

RUN direction is to set the direction of auto-tuning run of a loop. The available option is forward or reverse. The former(forward) means that PV increase when MV increases while the latter(reverse) means PV decreases when MV increases. For instance, a heater is a kind of forward direction system because PV(temperature) increases when output(heating) increases. A refrigerator is a kind of reverse direction system in which PV(temperature) decreases when output increases.

B) PWM output enable

PWM output means an output method to turn a junction on – off with a duty proportional to control output calculated by a uniform output cycle. If PWM output is enabled, it realizes PWM output in accordance with PWM output cycle set in the parameter of PWM output junction(P20 ~ P3F) designated in the parameter. At the moment, the PWM output cycle follows the PWM output cycle separately set in auto-tuning operation cycle.

C) SV

It sets the auto-tuning SV of a loop in question. Similar to PID control, physical values(temperature, flow rate, pressure and etc) of an object to control is not meaningful and instead, it should use the physical amount of an object to control after converting them into numerals. For instance, in order to control a system using a sensor that the output is 0V when its heating device temperature is 0℃ while it is 10V when the temperature is 100℃ as much as 50℃, it is necessary to set SV as 2000(as long as it uses AD input module XBE-AD04A).

D) Operation time

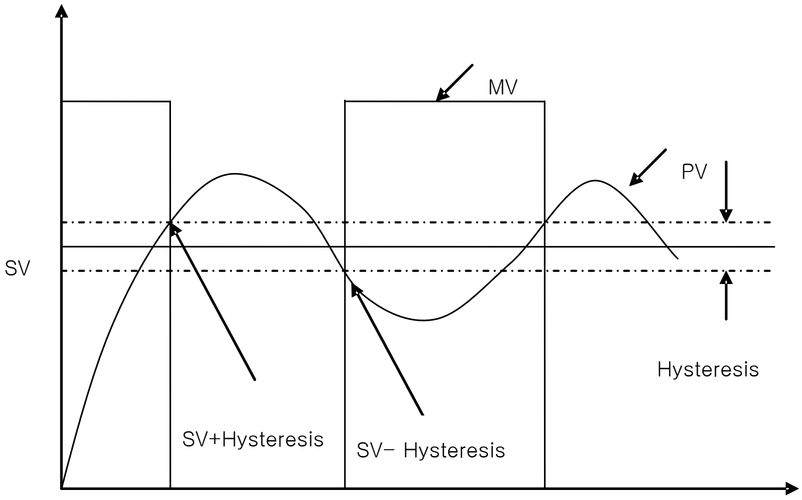
It sets the cycle to execute operation for auto-tuning. The setting cycle is 0.1ms and available between 10ms ~ 6553.5ms(setting value: 100 ~ 65,535) while it is set at a unit of integer per 0.1ms.

E) Max./min. MV

It sets the max./min. value of output for auto-tuning. The available scope is between -32,768 ~ 32,767. If the max. MV is set lower than min. MV, the auto-tuning function of a loop generates an error and does not work.

F) Hysterisis setting

Looking at relay tuning in figure, it shows it outputs the max. MV as auto-tuning starts but it converts to min. output as PV is over SV and then, it converts to the max. output as PV is lower than SV. However, if input PV contains noise components or reply components, auto-tuning ends by a slight vibration of PV around SV, yielding incorrect tuning result. To prevent it, hysterisis may be set. XGB auto-tuning converts output at SV + Hysterisis when PV increases or at SV – Hysterisis when it decreases once hysterisis is set. With it, it may prevent incorrect tuning by a slight vibration around SV.



[Example of Hysterisis setting]

11.3.3 Auto-tuning flag

The parameters set in the XGB series auto-tuning function are saved to the flash memory of basic unit. Such parameters are moved to K area for auto-tuning function as soon as PLC enters to RUN mode from STOP. Auto-tuning operation using auto-tuning command is achieved by data in K area. At the moment, if PLC is changed to RUN again after being changed to STOP, it takes the parameters in flash memory to K area, so the data changed in K area is lost. Therefore, to continuously apply the parameters adjusted in K area, it is necessary to write the parameters set in K area into flash memory by using WRT command.

1) Auto-tuning flag configuration

The K area flags of XGB series auto-tuning function are summarized in Table.

Loops	K area	Symbol	Data type	Default	Description
Common	K18560~F	_AT_REV	Bit	Forward	Auto-tuning direction(0:forward, 1:reverse)
	K18570~F	_AT_PWM_EN	Bit	Disable	PWM output enable(0:disable, 1:enable)
	K18580~F	_AT_ERROR	Bit	-	Auto-tuning error(0:normal,1:error)
	K1859	Reserved	WORD	-	Reserved
Loop0	K1860	_AT00_SV	INT	0	AT SV – loop 00
	K1861	_AT00_T_s	WORD	100	AT operation cycle (T_s)[0.1msec]
	K1862	_AT00_MV_max	INT	4000	AT MV max. value limit
	K1863	_AT00_MV_min	INT	0	AT MV min. value limit
	K1864	_AT00_PWM	WORD	0	AT PWM junction setting
	K1865	_AT00_PWM_Prd	WORD	0	AT PWM output cycle
	K1866	_AT00_HYS_val	WORD	0	AT hysterisis setting
	K1867	_AT00_STATUS	WORD	0	AT auto-tuning status indication
	K1868	_AT00_ERR_CODE	WORD	0	AT error code
	K1869	_AT00_K_p	REAL	0	AT result proportional coefficient
	K1871	_AT00_T_i	REAL	0	AT result integral time
	K1873	_AT00_T_d	REAL	0	AT result differential time
	K1875	_AT00_PV	INT	0	AT PV
	K1876	_AT00_MV	INT	0	AT MV
	K1877~1879	Reserved	Word	0	Reserved

[K area flags for auto-tuning]

K1856 ~ K1859 areas are the common bit areas for auto-tuning and each bit represents auto-tuning loop status respectively. K1860~K1879 areas save the setting and status of loop 0 as the K area for auto-tuning loop 0. In the area, the parameters such as PV, operation cycle and etc set in the built-in parameter window are saved and the XGB built-in auto-tuning function executes auto-tuning by the device values and saves the results into the K areas.

2) Auto-tuning flag function

Each function of K area flags for XGB series auto-tuning is summarized as follows.

A) Common bit area

The area is a flag collecting operation setting and information consisting of bits to each 16 loop. Each bit of each word device represents the information of each loop.

(1) _AT_REV (auto-tuning run direction setting)

Flag name	Address	Unit	Setting
_AT_REV (PID RUN direction setting)	K1856n	BIT	Available

It determines the run direction of auto-tuning of ‘n’ th loop. If the bit is off, it is forward operation; if on, it is reverse operation.

(2) _AT_PWM_EN (PWM output enable)

Flag name	Address	Unit	Setting
_AT_PWM_EN (PWM output enable)	K857n	BIT	Available

It sets whether to output the auto-tuning MV of ‘n’ th loop as PWM output. If the bit is off, it is disabled; if on, it is enabled.

(3) _AT_ERROR (Auto-tuning error occurrence)

Flag name	Address	Unit	Setting
_PID_ERROR (PID error occurrence)	K1858n	BIT	Unavailable

It indicates the error in case an error that discontinues operation during auto-tuning of ‘n’th loop occurs. If an error occurs, it is on; if normal, it is off. Once an error occurs, auto-tuning stops and the MV is output as the min. output set in the parameter. Also, if an error occurs, it indicates the error code in the error code area of a loop. For more information about error code types and measures, refer to 11.6. The area, as a dedicated monitor area, is updated although a user directly enters it.

B) Auto-tuning flag area by loops

The auto-tuning flag areas by loops are K1860 ~ K2179 and each 20 words per loop are allocated to totally 16 loops. Therefore, individual data area of ‘n’ th loop is between K(1860+16*n) ~ K(1879+16*n).

(1) _ATxx_SV (auto-tuning xx Loop SV setting)

Flag name	Address	Unit	Scope
_ATxx_SV (AT xx Loop SV setting)	K1860+16*xx	INT	-32,768 ~ 32,767

It sets/indicates the auto-tuning SV of ‘xx’th loop.
The available scope is between -32,768 ~ 32,767.

(2) _ATxx_T_s (Auto-tuning xx Loop operation cycle)

Flag name	Address	Unit	Scope
_PIDxx_T_s (Auto-tuning xx Loop operation cycle)	K1861+16*xx	WORD	100 ~ 65,535

It sets/indicates the operation cycle of 'x' th loop auto-tuning. The available scope is 100 ~ 65,535.

(3) _ATxx_MV_max, _ATxx_MV_min(max. MV, min. MV)

Flag name	Address	Unit	Scope
_PIDxx_MV_max (Max. MV)	K1862+16*xx	INT	-32,768 ~ 32,767
_PIDxx_MV_min (Min. MV)	K1863+16*xx		

It sets max. MV and min. MV of 'xx' th loop respectively. If the max. MV is set lower than min. MV, the auto-tuning loop generates an error and does not work.

(4) _ATxx_PWM (AT output junction setting)

Flag name	Address	Unit	Scope
_AT00_PWM (AT output junction setting)	K1864+16*xx	WORD	H'20 ~ H'3F

It sets the junction that PWM output of 'x'th loop is output. The PWM output junction is valid only between H'20 ~ H'3F(hex). If any other value is entered, PWM output does not work.

(5) _ATxx_PWM_Prd (PWM output cycle setting)

Flag name	Address	Unit	Scope
_ATxx_PWM_Prd (PWM output cycle setting)	K1865+16*xx	WORD	100 ~ 65,535

It sets the PWM output cycle of 'x' th loop. The available scope is between 100 ~ 65,535 at the unit of 0.1ms.

(6) _ATxx_HYS_val (Hysterisis setting)

Flag name	Address	Unit	Scope
_ATxx_HYS_val (Hysterisis setting)	K1866+16*xx	WORD	0 ~ 65,535

It sets the hysterisis of 'xx' th loop. For more information about hysterisis function, refer to 11.4.3 Auto-Tuning Parameter Setting. If it is set as 0, it does not work.

(7) _ATxx_STATUS (Auto-tuning status)

Flag name	Address	Unit	Scope
_ATxx_STATUS (Auto-tuning status)	K1867+16*xx	WORD	Unavailable

It indicates the auto-tuning status of 'xx' th loop. If auto-tuning is in operation, it is 1; if completed, it is 128. In any other cases, it shows 0.

(8) _ATxx_ERR_CODE(Error code)

Flag name	Address	Unit	Scope
_ATxx_ERR_CODE(Error code)	K1868+16*xx	WORD	Unavailable

It indicates error code in case an error occurs during the auto-tuning of 'x'th loop. The flag, as a dedicated monitor, is updated although a user directly enters it. For more information about error code, refer to Error codes.

(9) _ATxx_K_p, _ATxx_T_i, _ATxx_T_d (AT result proportional coefficient, integral time, differential time)

Flag name	Address	Unit	Scope
_ATxx_K_p (proportional coefficient)	K1869+16*xx	Real	Unavailable
_ATxx_T_i (integral time)	K1871+16*xx		
_ATxx_T_d (differential time)	K1873+16*xx		

The area indicates proportional coefficient, integral time and differential time calculated after the auto-tuning of 'x' th loop is normally completed. The flag, as a dedicated monitoring, updated although a user directly enters it.

(10) _ATxx_PV (PV)

Flag name	Address	Unit	Scope
_ATxx_PV (PV)	K1875+16*xx	INT	-32,768 ~ 32,767

It is the area to receive PV of 'xx' th auto-tuning loop. PV is the present status of a system to control and in case of PID control, the entry from a sensor is saved into U device through input devices such as A/D input module and it moves the value to _ATxx_PV by using commands such as MOV every scanning, executing auto-tuning.

(11) _ATxx_MV (Auto-tuning MV)

Flag name	Address	Unit	Scope
_ATxx_MV (auto-tuning MV)	K1876+16*xx	INT	Unavailable

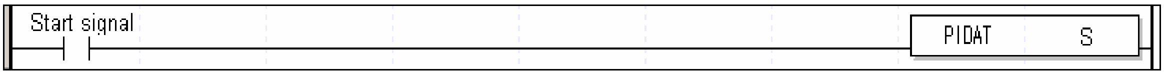
It is the area to output MV of 'xx' th auto-tuning loop. Every auto-tuning cycle, it saves XGB auto-tuning and it delivers the value in the area by using commands like MOV in a program and operates a drive every scanning.

11.3.4 Auto-tuning instructions

The commands used in XGB series auto-tuning are as follows.

1) PIDAT

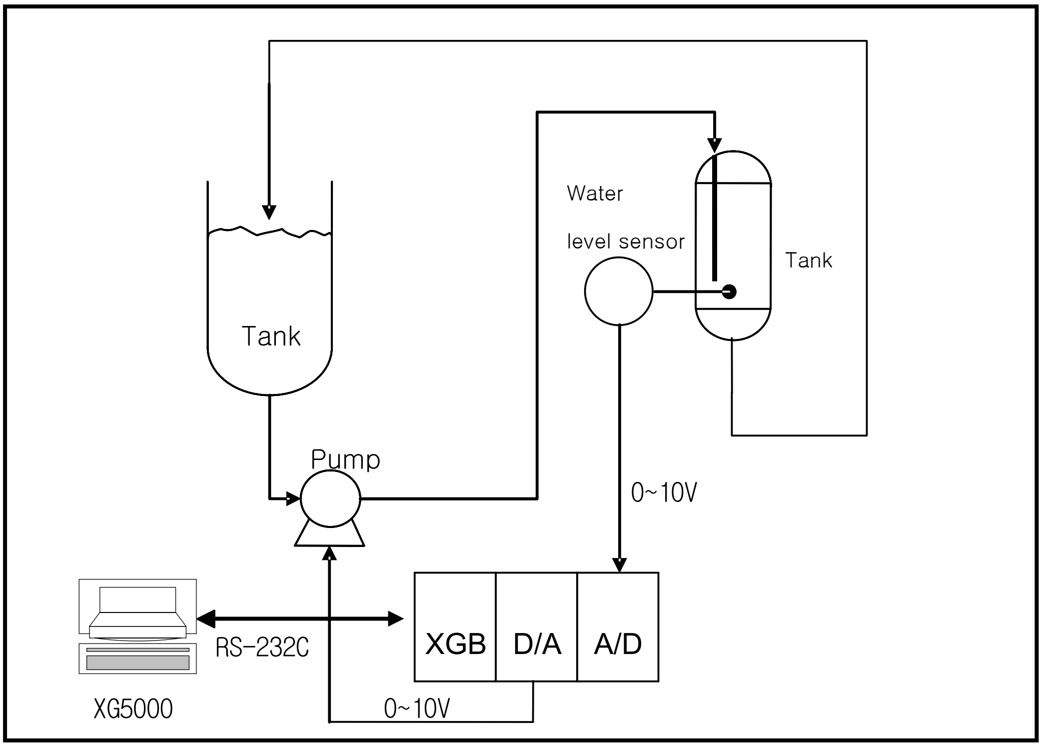
PIDAT is a command to execute auto-tuning by loops.



- Operand S means the loop no. to execute auto-tuning and avaiable only for constant(0~15).
- If start junction is on, the PID control of a loop starts.

11.4 Example Programs

The paragraph explains example programs regarding the directions of XGB built-in PID function. The example programs are explained with water level system as illustrated in 11.17.



[Example of water level control system]

11.4.1 System structure

The example system in figure is an example of a system to control a pail's water level to a desired level. The pail's water level is sensed by a water level sensor and entered to A/D input module while PID control operation result, MV is output to a pump through D/A output module, controlling a pump's rotation velocity, regulating the water amount flowing into a pail and regulating the water level as desired. Each mechanism is explained as follows.

1) XGB basic unit

The XGB basic unit operates by PID control operating PID control operation. It receives PV from A/D input module(XBF-AD04A), executes the built-in PID control operation, output the MV to D/A(XBF-DV04A) and executes PID control.

2) A/D input module(XBF-AD04A)

It functions as receiving PV of an object to control from a water level sensor and delivering it to basic unit. XBF-AD04A is a 4CH analog input module and settings of analog input types and scopes can be changed in the I/O parameter setting window appeared when selecting I/O parameter in the parameter item of project window. For more information, refer to 12. Analog I/O Module.

3) D/A output module(XBF-DV04A)

It functions as delivering control MV from basic unit to a drive(pump). XBF-DV04A is a 4CH analog voltage output module and ranges 0 ~ 10V. For detail setting, refer to 12. Analog I/O Module.

4) Water Level Sensor

A water level sensor plays a role to deliver the PV of an object to control to XGB by measuring the water level of a pail and outputting it within 0 ~ 10V. Since the types and output scope of water level sensors varies, the output scope of a sensor should be identical with that of A/D input module's input scope. The example uses a water level sensor outputting between 0 ~ 10V.

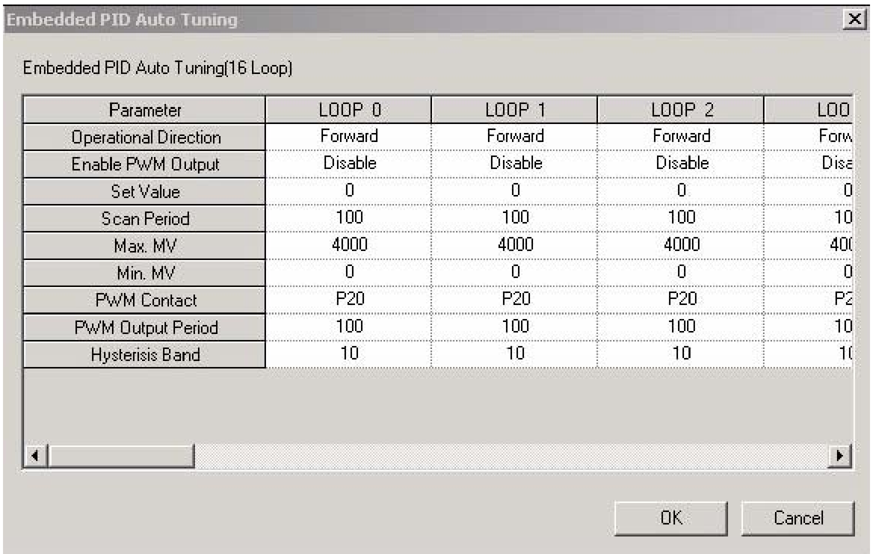
5) Drive(pump)
A drive uses a pump that receives control output of XGF-DV04A and of which rotation velocity is variable. For accurate PID control, the output scope of XBF-DV04A(0~10V) should be same with that of a pump's control input. The example uses a pump that receives its control input between 0 ~ 10V.

11.4.2. Example of PID Auto-tuning

Here, with examples, it explains how to calculate proportional constant, integral time and differential time by using PID auto-tuning function

1) PID auto-tuning parameter setting

A) If double-clicking Parameter – Built-in Parameter – PID – Auto-tuning parameter in the project window, it opens up the auto-tuning parameter setting window as illustrated in figure.



Embedded PID Auto Tuning(16 Loop)

Parameter	LOOP 0	LOOP 1	LOOP 2	LOO
Operational Direction	Forward	Forward	Forward	Forw
Enable PWM Output	Disable	Disable	Disable	Disa
Set Value	0	0	0	0
Scan Period	100	100	100	10
Max. MV	4000	4000	4000	40
Min. MV	0	0	0	0
PWM Contact	P20	P20	P20	P2
PWM Output Period	100	100	100	10
Hysterisis Band	10	10	10	1

[Auto-tuning parameter setting window]

B) Set each parameter and click OK.
In the example, Loop 0 is set as follows.

- RUN direction: forward
  - Since in the system, water level is going up as MV increases and pump's rotation velocity increases, it should be set as forward operation.

- PWM output : disabled
  - In the example, auto-tuning using PWM is not executed. Therefore, PWM output is set as disabled.

- SV : 1000(2.5V)
  - It shows an example in which XBF-AD04A is set as the voltage input of 0~10V.

- Max. MV : 4000
  - Max. MV is set as 4000. If MV is 4000, XBF-DV04A outputs 10V.

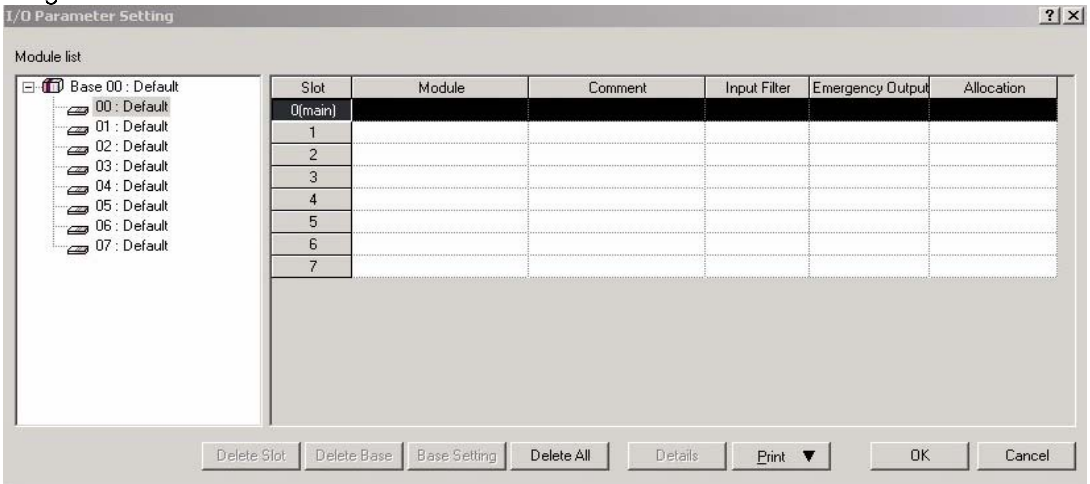
- Min. MV : 0
  - Min. MV is set as 0. If MV is 0, XBF-DV04A outputs 0V.

- PWM junction, PWM output cycle
  - It is not necessary to set it because the example does not use PWM output.

- Hysterisis setting: 10

2) A/D input module parameter setting

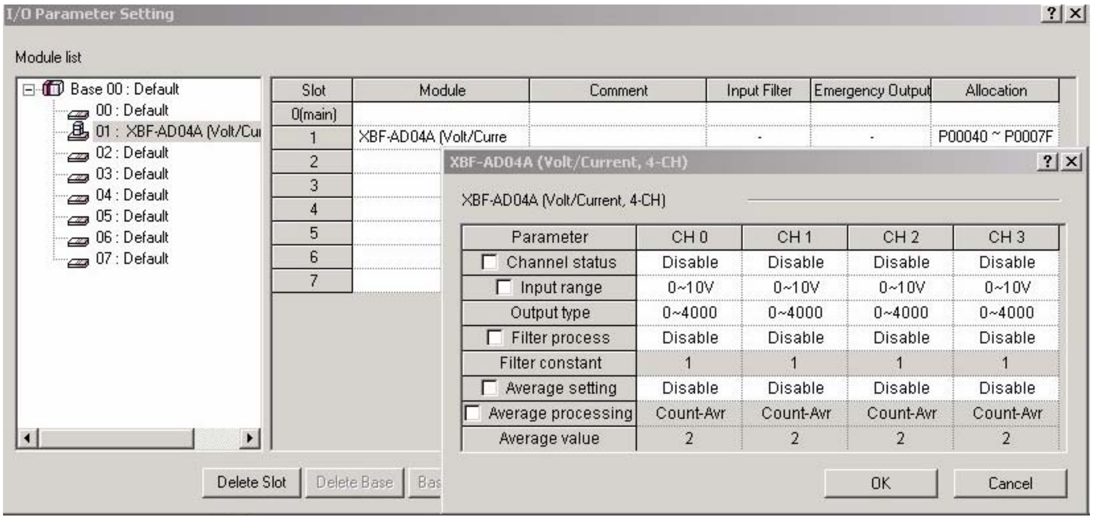
A) If double-clicking Parameter – I/O parameter, it opens up the setting window as illustrated in figure.



Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1					
2					
3					
4					
5					
6					
7					

[I/O parameter setting window]

B) If selecting A/D module for a slot in A/D input module, it opens up the setting window as illustrated in.



Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1	XBF-AD04A (Volt/Curre		-	-	P00040 ~ P0007F
2					
3					
4					
5					
6					
7					

XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Disable	Disable	Disable	Disable
Filter constant	1	1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

[A/D input mode setting window]

C) Check A/D Module operation parameter and click OK. The example is set as follows.

- RUN CH : CH0 RUN
  - The example receives the water level sensor input as CH0.

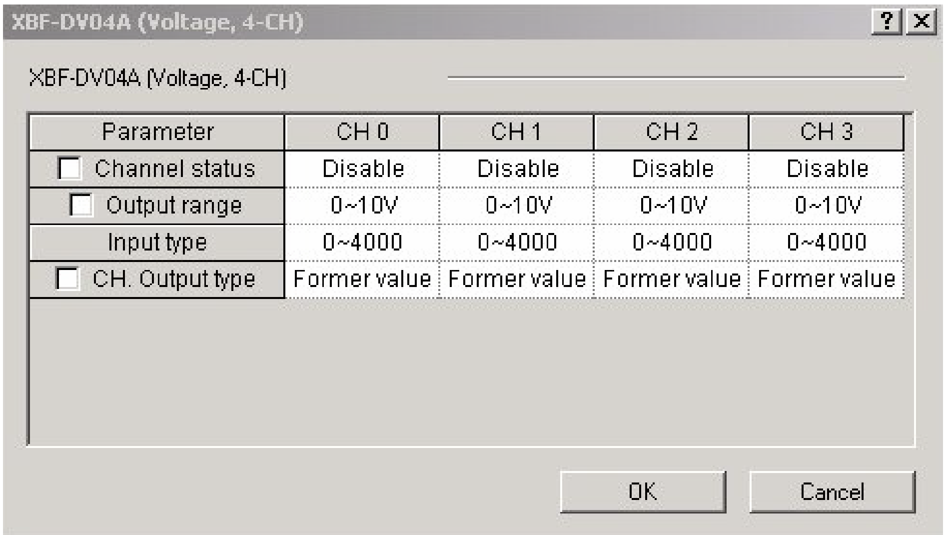
- Input scope : 0 ~ 10V
  - Set XBF-AD04A input scope as 0 ~ 10V so that it should be identical with the output scope of water level sensor.

- Output data type: 0 ~ 4000
  - It converts the input 0 ~ 10V to digital value from 0 ~ 4000 and delivers it to basic unit.
  - In the case, the resolving power of digital value 1 is 10/4000 = 2.5mV

- Filter process, averaging : disabled
  - The example sets the input values in order that filter process and averaging are not available.
  - For more information about each function, refer to 12 Analog I/O Module.

3) D/A Output Module Parameter setting

A) Set the parameter of D/A output module(XBF-DV04A) that output MV to a drive.
How to set them is as same as A/D input module. In the example, it is set as follows.



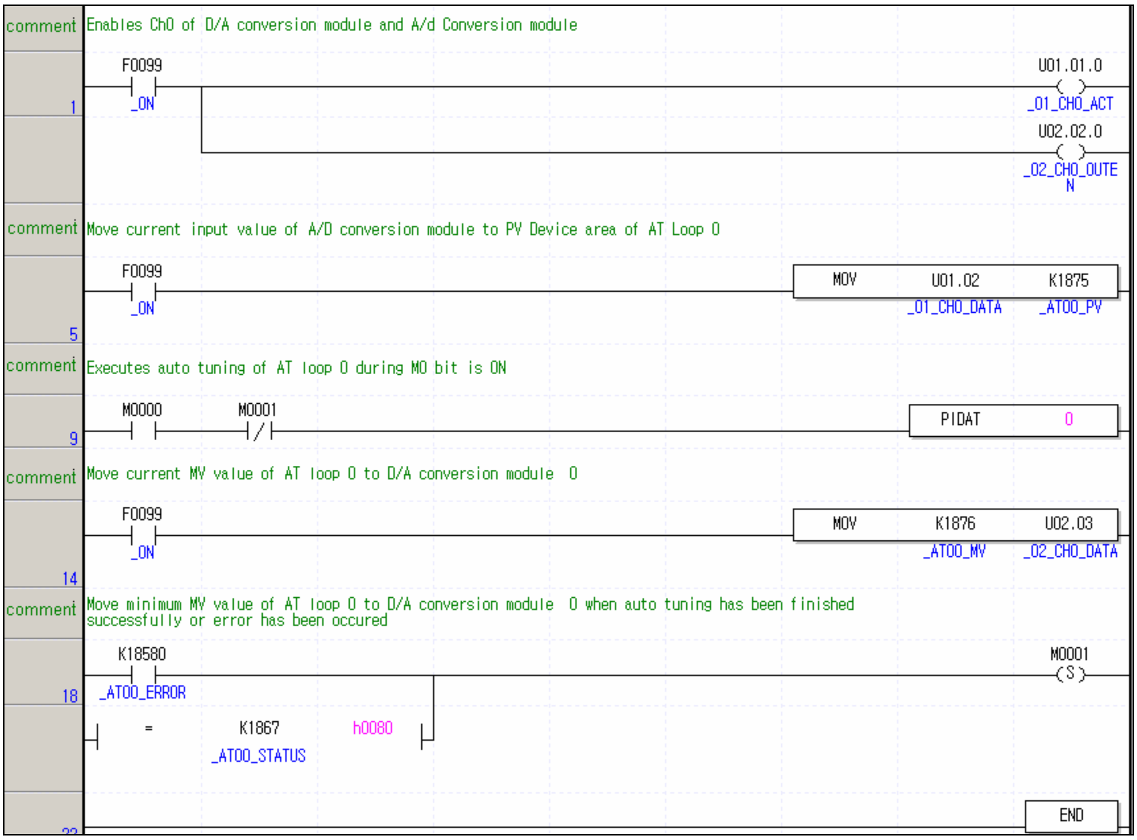
XBF-DV04A (Voltage, 4-CH)

XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Output range	0~10V	0~10V	0~10V	0~10V
Input type	0~4000	0~4000	0~4000	0~4000
☐ CH. Output type	Former value	Former value	Former value	Former value

- RUN CH: CH0 RUN
  - In the example, MV is output as CH0 of D/A output module.
- Output scope : 0 ~ 10V
- Input data type: 0 ~ 4000

4) Example of PID Auto-tuning program
The example of PID auto-tuning program is illustrated as figure.



comment Enables Ch0 of D/A conversion module and A/d Conversion module

comment Move current input value of A/D conversion module to PV Device area of AT Loop 0

comment Executes auto tuning of AT loop 0 during M0 bit is ON

comment Move current MV value of AT loop 0 to D/A conversion module 0

comment Move minimum MV value of AT loop 0 to D/A conversion module 0 when auto tuning has been finished successfully or error has been occured

< Auto-tuning example program>

A) Devices used

Device	Data type	Application
F0099	BIT	It is always on, so it readily operates once PLC is RUN.
U01.01.0	BIT	It starts operation of CH0 of Slot 1 A/D input module.
U02.02.0	BIT	It starts operation of CH0 of Slot 2 D/A output module.
U01.02	INT	PV entered to A/D input module.
U02.03	INT	MV entered to D/A output module.
K1875	INT	Device to which PV is entered for LOOP 0 auto-tuning
K1876	INT	Device to which auto-tuning MV of LOOP 0 is output.
K18677	BIT	Junction that is on once auto-tuning is complete.
K18580	BIT	Junction that is on once auto-tuning has an error.
K1863	INT	Min. MV of auto-tuning designated in parameter.

B) Program explanation

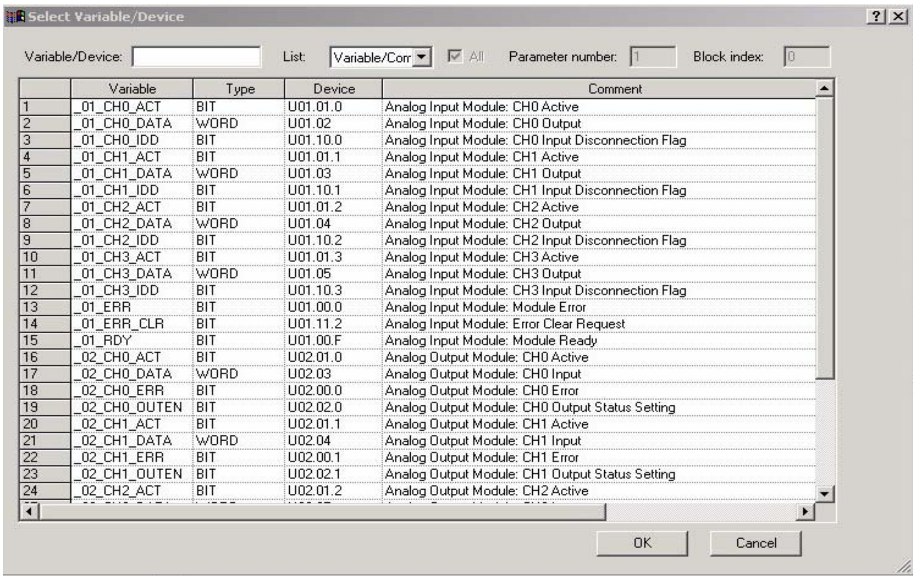
(1) Since F0099(always on) is ON if PLC is converted form STOP to RUN, CH0 of A/D and D/A starts operating.
(2) At the moment, PV entered to CH0 is moved to K1875, the input device of PV and saved accordingly.
(3) Once M0000 junction is on, the auto-tuning of loop 0 starts.
(4) The auto-tuning MV of loop 0 that is output by PIDAT command is output to D/A output module by line 14 MOV command.
(5) If auto-tuning is complete or there is any error during auto-tuning, M0001 junction is set, blocking operation of PIDAT command and it outputs min. MV set in parameter to D/A output module.

C) Monitoring and changing PID control variables using K area

In XGB series built-in auto-tuning, it can monitor and change RUN status of auto-tuning by using K area allocated as fixed area by loops.

▪ Variable registration

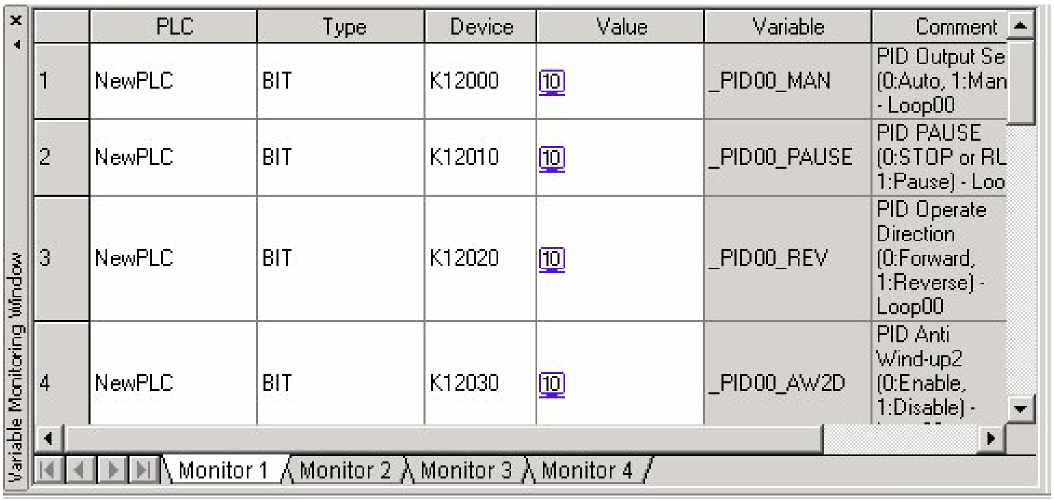
If selecting “Register in Variable/Description” by right clicking in the variable monitor window, “Variable/Device Selection” window appears. Select “Item” as PID, deselect “View All” and enter 0(means loop number) in “Parameter No”, K area device list to save every setting and status of loop 0 appears. Then, if selecting a variable to monitor and clicking “OK”, a selected device is registered to variable monitor window as illustrated in figure. Through the monitor window, a user can monitor auto-tuning run status or change the settings.



Variable/Device:
List: Variable/Com
☑ All
Parameter number: 1
Block index: 0

	Variable	Type	Device	Comment
1	_01_CH0_ACT	BIT	U01.01.0	Analog Input Module: CH0 Active
2	_01_CH0_DATA	WORD	U01.02	Analog Input Module: CH0 Output
3	_01_CH0_IDD	BIT	U01.10.0	Analog Input Module: CH0 Input Disconnection Flag
4	_01_CH1_ACT	BIT	U01.01.1	Analog Input Module: CH1 Active
5	_01_CH1_DATA	WORD	U01.03	Analog Input Module: CH1 Output
6	_01_CH1_IDD	BIT	U01.10.1	Analog Input Module: CH1 Input Disconnection Flag
7	_01_CH2_ACT	BIT	U01.01.2	Analog Input Module: CH2 Active
8	_01_CH2_DATA	WORD	U01.04	Analog Input Module: CH2 Output
9	_01_CH2_IDD	BIT	U01.10.2	Analog Input Module: CH2 Input Disconnection Flag
10	_01_CH3_ACT	BIT	U01.01.3	Analog Input Module: CH3 Active
11	_01_CH3_DATA	WORD	U01.05	Analog Input Module: CH3 Output
12	_01_CH3_IDD	BIT	U01.10.3	Analog Input Module: CH3 Input Disconnection Flag
13	_01_ERR	BIT	U01.00.0	Analog Input Module: Module Error
14	_01_ERR_CLR	BIT	U01.11.2	Analog Input Module: Error Clear Request
15	_01_RDY	BIT	U01.00.F	Analog Input Module: Module Ready
16	_02_CH0_ACT	BIT	U02.01.0	Analog Output Module: CH0 Active
17	_02_CH0_DATA	WORD	U02.03	Analog Output Module: CH0 Input
18	_02_CH0_ERR	BIT	U02.00.0	Analog Output Module: CH0 Error
19	_02_CH0_OUTEN	BIT	U02.02.0	Analog Output Module: CH0 Output Status Setting
20	_02_CH1_ACT	BIT	U02.01.1	Analog Output Module: CH1 Active
21	_02_CH1_DATA	WORD	U02.04	Analog Output Module: CH1 Input
22	_02_CH1_ERR	BIT	U02.00.1	Analog Output Module: CH1 Error
23	_02_CH1_OUTEN	BIT	U02.02.1	Analog Output Module: CH1 Output Status Setting
24	_02_CH2_ACT	BIT	U02.01.2	Analog Output Module: CH2 Active

[Variable registration window]



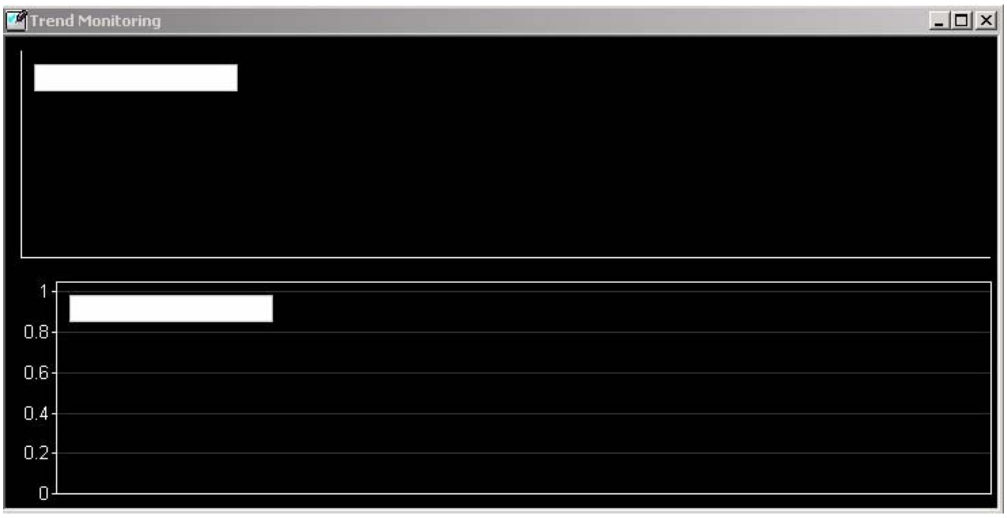
	PLC	Type	Device	Value	Variable	Comment
1	NewPLC	BIT	K12000	10	_PID00_MAN	PID Output Se (0:Auto, 1:Man - Loop00
2	NewPLC	BIT	K12010	10	_PID00_PAUSE	PID PAUSE (0:STOP or RL 1:Pause) - Loo
3	NewPLC	BIT	K12020	10	_PID00_REV	PID Operate Direction (0:Forward, 1:Reverse) - Loop00
4	NewPLC	BIT	K12030	10	_PID00_AW2D	PID Anti Wind-up2 (0:Enable, 1:Disable) -

[Auto-tuning variables registered]

D) Observing RUN status by using trend monitor function

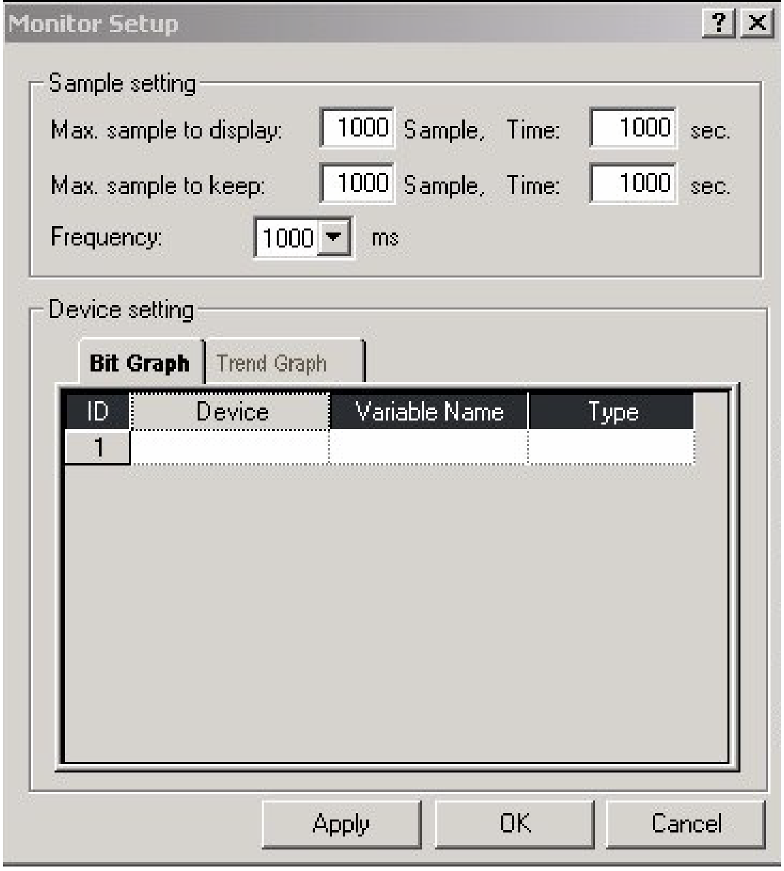
Since it is possible to monitor the operation status of XGB series built-in auto-tuning graphically, it is useful to monitor the operation status of auto-tuning clearly.

(1) If selecting Monitor – Trend monitor menu, it shows the trend monitor widow as illustrated in figure.



[Trend Monitor window]

(2) If right-clicking trend setting, a user can select a variable to monitor as illustrated in figure.



Sample setting

Max. sample to display: 1000 Sample, Time: 1000 sec.

Max. sample to keep: 1000 Sample, Time: 1000 sec.

Frequency: 1000 ms

Device setting

ID	Device	Variable Name	Type
1			

[window to register trend monitor variable]

(3) For more information about trend monitor, refer to “XG5000 Use’s Manual.”

11.4.3. Stand-along operation after PID Auto-Tuning

Here, with example, it explains how to execute PID control followed by PID auto-tuning.

1) PID auto-tuning parameter setting

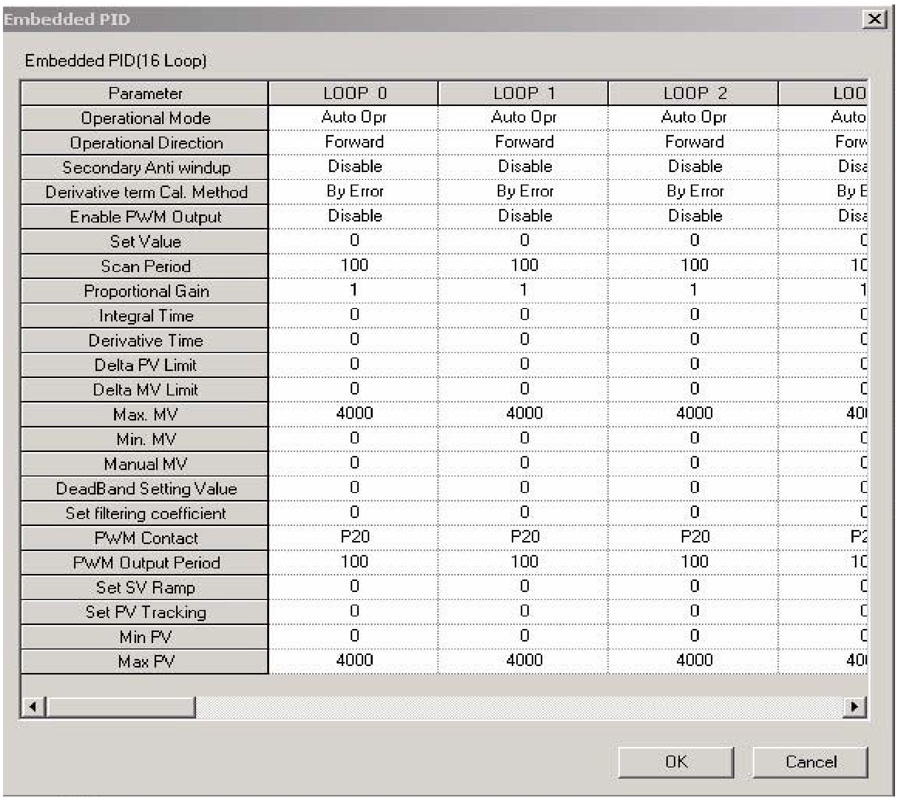
▪ PID auto-tuning parameters are set as same as examples of 11.4.2 Example of PID Auto-tuning.

2) Setting parameters of A/D input module and D/A output module

▪ Set the parameters of A/D input module and D/A output module as same as the example in 11.4.2 Example of PID Auto-tuning.

3) PID parameter setting

A) If double-clicking Parameter – Built-in Parameter – PID – PID Parameter, it shows the built-in PID parameter setting window as seen in figure.



Embedded PID(16 Loop)

Parameter	LOOP 0	LOOP 1	LOOP 2	LOO
Operational Mode	Auto Opr	Auto Opr	Auto Opr	Auto
Operational Direction	Forward	Forward	Forward	Forw
Secondary Anti windup	Disable	Disable	Disable	Disa
Derivative term Cal. Method	By Error	By Error	By Error	By E
Enable PWM Output	Disable	Disable	Disable	Disa
Set Value	0	0	0	0
Scan Period	100	100	100	10
Proportional Gain	1	1	1	1
Integral Time	0	0	0	0
Derivative Time	0	0	0	0
Delta PV Limit	0	0	0	0
Delta MV Limit	0	0	0	0
Max. MV	4000	4000	4000	40
Min. MV	0	0	0	0
Manual MV	0	0	0	0
DeadBand Setting Value	0	0	0	0
Set filtering coefficient	0	0	0	0
PWM Contact	P20	P20	P20	P2
PWM Output Period	100	100	100	10
Set SV Ramp	0	0	0	0
Set PV Tracking	0	0	0	0
Min PV	0	0	0	0
Max PV	4000	4000	4000	40

[Auto-tuning parameter setting window]

B) Set each parameter and click OK.
In the example, Loop 0 is set as follows.

- RUN mode : automatic
  - Set as automatic in order that PID control is executed as the built-in PID operation outputs MV.

- RUN direction : forward
  - Since in the system, water level is going up as MV increases and pump's rotation velocity increases, it should be set as forward operation.

- PWM Output : disabled
  - In the example, auto-tuning using PWM is not executed. Therefore, PWM output is set as disabled.

- SV : 1000(2.5V)
  - It shows an example in which XBF-AD04A is set as the voltage input of 0~10V

- Operation cycle: 1000
  - In the example, it is set that PID control is executed every 100ms.

- Proportional gain, integral time and differential time
  - It should be initially set as 1,0,0 because PID auto-tuning results is used with PID constant.

- Max. MV : 4000
  - Max. MV is set as 4000. If MV is 4000, XBF-DV04A outputs 10V.

- DeadBand : 0
  - It is set as 0 because the example does not use DeadBand function.

- Differential filter setting: 0
  - it is also set as 0 because the example does not use differential filter.

- Min. MV : 0
  - Min. MV is set as 0. If MV is 0, XBF-DV04A outputs 0V.

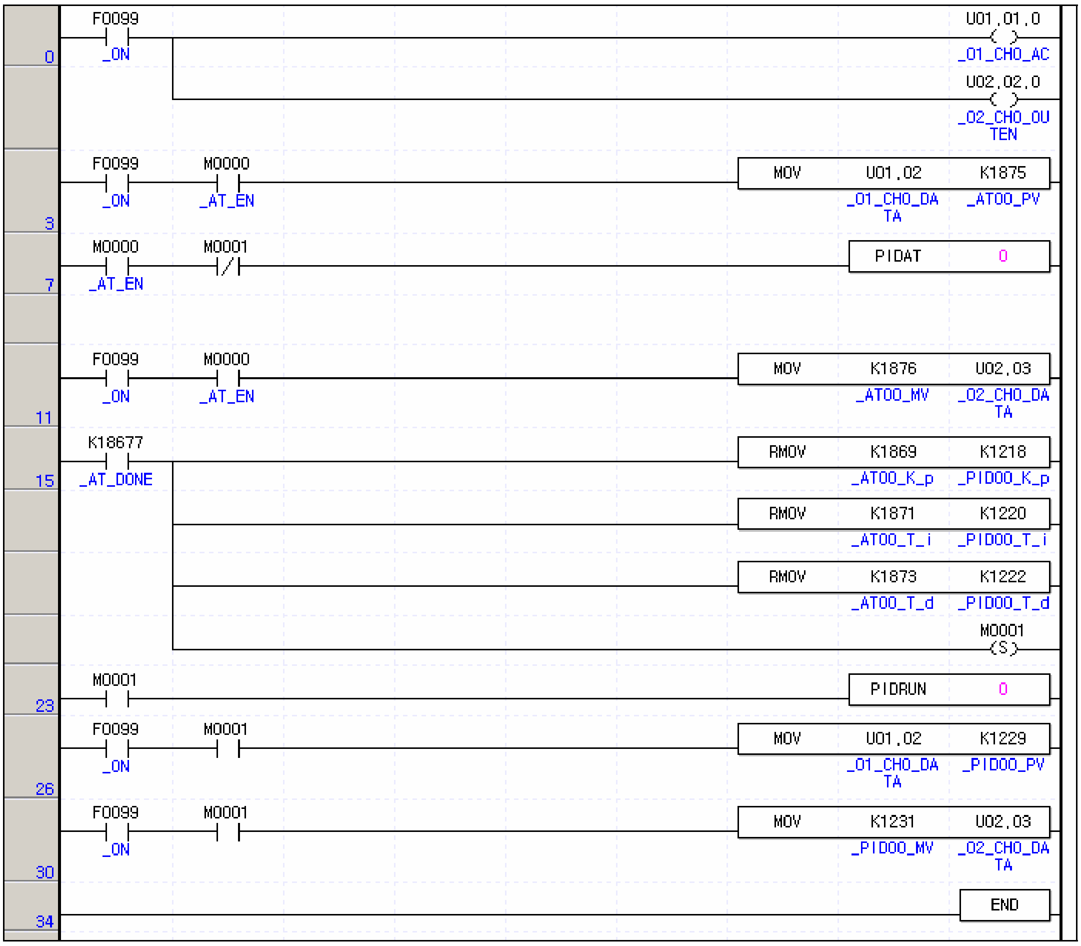
- PWM junction, PWM output cycle
  - It is not necessary to set them because the example does not use PWM output.

- SV ramp, PV follow-up: 0
  - It is not necessary to set SV ramp and PV follow-up because the example does not use them.

- Min. PV, Max. PV : 0
  - Set them as 0 and 4000 respectively so that it could be identical with A/D input module’s input scope.

4) Example of PID control program after PID auto-tuning

The program example for PID auto-tuning is illustrated as figure.



[Example program of PID control after auto-tuning]

A) Devices used

Device	Data type	Application
F0099	BIT	It is always on, so it readily operates once PLC is RUN.
U01.01.0	BIT	It starts operation of CH0 of Slot 1 A/D input module.
U02.02.0	BIT	It starts operation of CH0 of Slot 2 D/A output module.
U01.02	INT	PV entered to A/D input module.
U02.03	INT	MV entered to D/A output module.
K1875	INT	Device to which PV is entered for LOOP 0 auto-tuning
K1876	INT	Device to which auto-tuning MV of LOOP 0 is output.
K18677	BIT	Junction that is on once auto-tuning is complete.
K18580	BIT	Junction that is on once auto-tuning has an error.
K1863	INT	Min. MV of auto-tuning designated in parameter.
K1229	INT	Device to which PV is entered for Loop 0 PID control
K1876	INT	Device to which MV of loop 0 PID control is output.

B) Program explanation

(1) Since F0099(always on) is ON if PLC is converted form STOP to RUN, CH0 of A/D and D/A starts operating.
(2) Once M0000 junction is on, the auto-tuning of loop 0 starts. At the moment, PV entered to CH0 is moved to K1875, the PV input device of loop 0 and saved accordingly.
(3) The auto-tuning MV of Loop 0 output by PIDAT command is output to D/A output module by line 11, MOV command.
(4) Once auto-tuning is complete, it moves P, I, D coefficients generated from auto-tuning to the input devices of P, I and D, K1218,K1220 and K1222, sets M001 and starts the operation of PID loop 0.

11.5 Error/Warning Codes

It describes error codes and warning codes of the XGB built-in PID function. The error codes and warning codes that may occur during use of the XGB built-in PID function are summarized as table. if any error or warning occurs, remove potential causes of the error by referring to the tables.

11.5.1. Error codes

Error codes	Indications	Measures
H’0001	MV_MIN_MAX_ERR	It occurs when max. MV is set lower than min. MV. Make sure to set max. MV larger than min. MV.
H’0002	PV_MIN_MAX_ERR	It occurs when max. PV is set lower min. Pv. Make sure to set max. PV larger than min. PV.
H’0004	SV_RANGE_ERR	It occurs when SV is larger than PV at the start time of auto-tuning if auto-tuning is forward or when SV is larger than PV at the start time of auto-tuning if auto-tuning is reverse.
H’0005	PWM_ADDRESS_ERR	It occurs when the junction designated as PWM output junction is beyond between P20 ~ P3F.
H’0006	P_GAIN_SET_ERR	It occurs when proportional constant is set lower than 0.
H’0007	I_TIME_SET_ERR	It occurs when integral time is set lower than 0.
H’0008	D_TIME_SET_ERR	It occurs when differential time is set lower than 0.
H’0009	CONTROL_MODE_ERR	It occurs when control mode is not P, PI, PD or PID.
H’000A	TUNE_DIR_CHG_ERR	It occurs when operation direction is changed during auto-tuning. Never attempt to change operation direction during auto-tuning.
H000B	PID_PERIOD_ERR	It occurs when period of operation is smaller than 100 (10ms) at Auto-tuning or PID operation. Make sure to set period of operation larger than 100.
H000C	HBD_WRONG_DIR	In mixed operation, It occurs when the direction parameter of forward operation set to reverse operation or the direction parameter of reverse operation set to forward operation. Make sure set to appropriate direction each loop.
H000D	HBD_SV_NOT_MATCH	In mixed operation, it occurs when the Set value of each loop is not concurrent. Make sure set to Set value concurrently.

[PID error codes]

11.5.2. Warning codes

Error codes	Indications	Measures
H’0001	PV_MIN_MAX_ALM	It occurs when the set PV is beyond the min./max. PV.
H’0002	PID_SCANTIME_ALM	It occurs when PID operation cycle is too short. It is desirable to set PID operation cycle longer than PLC scan time.
H’0003	PID_dPV_WARN	It occurs when the PV change of PID cycle exceeds PV change limit.
H’0004	PID_dMV_WARN	It occurs when the PV cycle MV change exceeds MV change limit.
H’0005	PID_MV_MAX_WARN	It occurs when the calculated MV of PID cycle exceeds the max. MV.
H’0006	PID_MV_MIN_WARN	It occurs when the calculated MV of PID cycle is smaller than the min. MV

[PID warning codes]

Chapter 12 Analog Input/Output Module

12.1 Analog Voltage Input Module

12.1.1 Performance specification

Performance specifications of A/D conversion modules are as specified as below table.

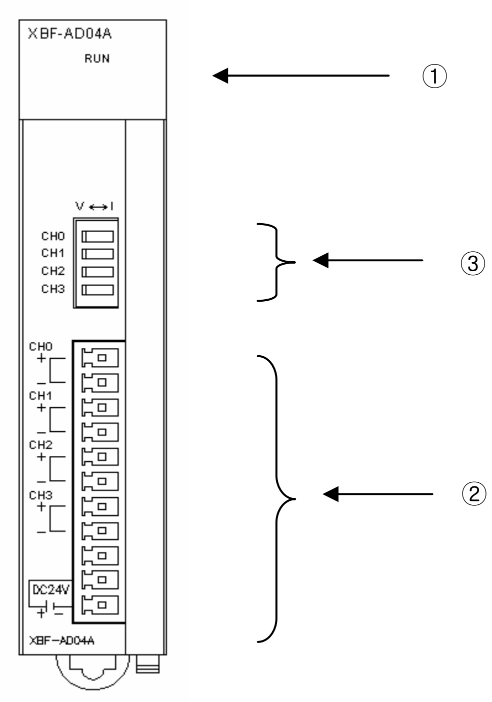
<table>
<tr><th rowspan="2">Classification</th><th colspan="2">Specifications</th></tr>
<tr><th colspan="2">XBF-AD04A</th></tr>
<tr><td>Analog input range</td><td colspan="2">DC 0 ～ 10 V (Input resistance: 1 MΩ min.)
DC 4 ～ 20 mA (Input resistance 250 Ω)
DC 0 ~ 20 mA (Input resistance 250 Ω)</td></tr>
<tr><td>Analog input range setting</td><td colspan="2">► Analog input range can be selected through XG5000 user's (or sequence) program or [I/O parameter].
► Respective input ranges can be set based on channels.</td></tr>
<tr><td>Digital output</td><td colspan="2">
<table>
<tr><th>Analog input
Digital output</th><th>0 ~ 10 V</th><th>4 ~ 20 mA</th><th>0 ~ 20 mA</th></tr>
<tr><td>Unsigned Value</td><td colspan="3">0 ~ 4000</td></tr>
<tr><td>Signed Value</td><td colspan="3">-2000 ~ 2000</td></tr>
<tr><td>Precise Value</td><td>0 ~ 1000</td><td>400 ~ 2000</td><td>0 ~ 2000</td></tr>
<tr><td>Percentile Value</td><td colspan="3">0 ~ 1000</td></tr>
</table>
▪ Format of digital output data can be set through user program or S/W package respectively based on channels.</td></tr>
<tr><td>Max. resolution</td><td colspan="2">
<table>
<tr><th>Analog input range</th><th>Resolution (1/4000)</th><th>Analog input range</th><th>Resolution (1/4000)</th></tr>
<tr><td rowspan="2">0 ~ 10 V</td><td rowspan="2">2.5 mV</td><td>4 ~ 20 mA</td><td rowspan="2">5.0 μA</td></tr>
<tr><td>0 ~ 20 mA</td></tr>
</table>
</td></tr>
<tr><td>Accuracy</td><td colspan="2">±0.5% or less</td></tr>
<tr><td>Max. conversion speed</td><td colspan="2">1.5 ms/channel</td></tr>
<tr><td>Absolute max. input</td><td>±15 V</td><td>±25 mA</td></tr>
<tr><td>Analog input points</td><td colspan="2">4 channels/1 module</td></tr>
<tr><td>Insulation method</td><td colspan="2">Photo-coupler insulation between input terminal and PLC power
(no insulation between channels)</td></tr>
<tr><td>Terminal connected</td><td colspan="2">11 point terminal block</td></tr>
<tr><td>I/O points occupied</td><td colspan="2">Fixed type: 64 points, Changeable: 16 points</td></tr>
<tr><td>Internal-consumed current</td><td colspan="2">DC 24V: 62㎃</td></tr>
<tr><td>Weight</td><td colspan="2">67g</td></tr>
</table>

Remark

1) When A/D conversion module is released from the factory, Offset/Gain value is as adjusted for respective analog input ranges, which is unavailable for user to change.
2) Offset Value: Analog input value where digital output value is 0 when digital output format is set to Unsigned Value.
3) Gain Value: Analog input value where digital output value is 16000 when digital output format is set to Unsigned Value.

12.1.2 Name of part and function

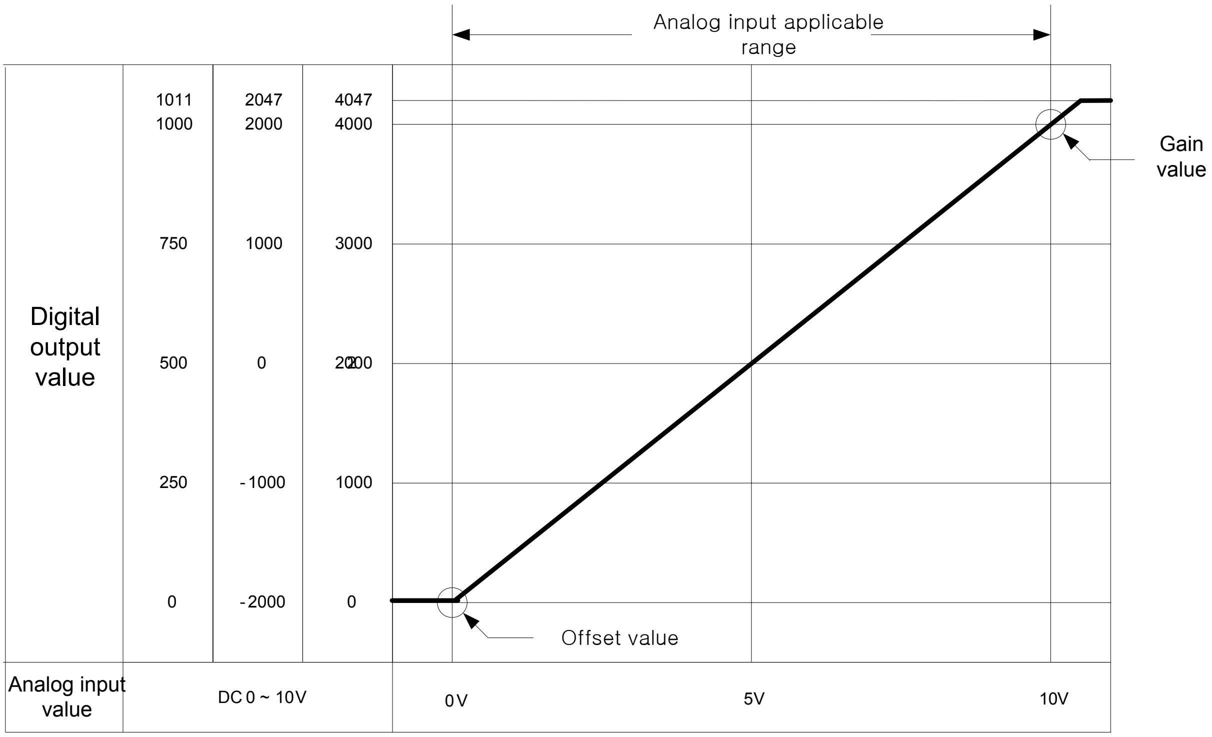
Respective designations of the parts are as described below.



No.	Description
①	RUN LED ▪ Displays the operation status of XBF-AD04A On: Operation normal Flickering: Error occurs (page 12-30) Off: Module error
②	Terminal block ▪ Analog input terminal, whose respective channels can be connected with external devices.
③	Voltage/Current selection switch ▪ Switch for voltage and current selection of analog input

12.1.3 Characteristic of I/O conversion

Characteristics of I/O conversion are the inclination connected in a straight line between Offset and Gain values when converting analog signal (voltage or current input) from PLC’s external device to digital value. I/O conversion characteristics of A/D conversion modules are as described below.

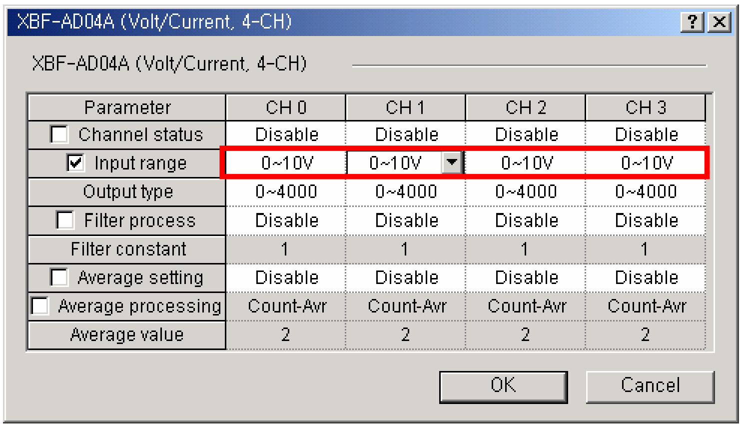


12.1.4 Input/Output characteristics of XBF-AD04A

XGF-AV8A is a module exclusively used for 4-channel analog voltage, where Offset/Gain can not be adjusted by user. Voltage input range can be set through user program or special module package for respective channels. Output formats of digital data are as specified below;

A. Unsigned Value
B. Signed Value
C. Precise Value
D. Percentile Value

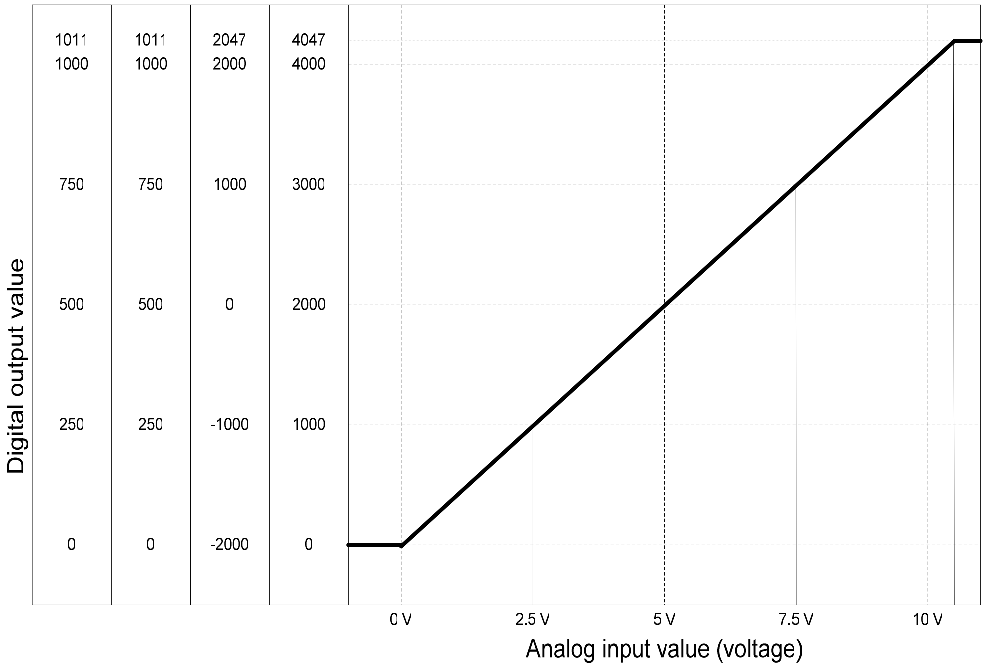
1) If the range is DC 0 ~ 10 V
▪ On the XG5000 menu [I/O Parameters Setting], set [Input Range] to “0~10 V”.



XBF-AD04A (Volt/Current, 4-CH)

XBF-AD04A (Volt/Current, 4-CH)

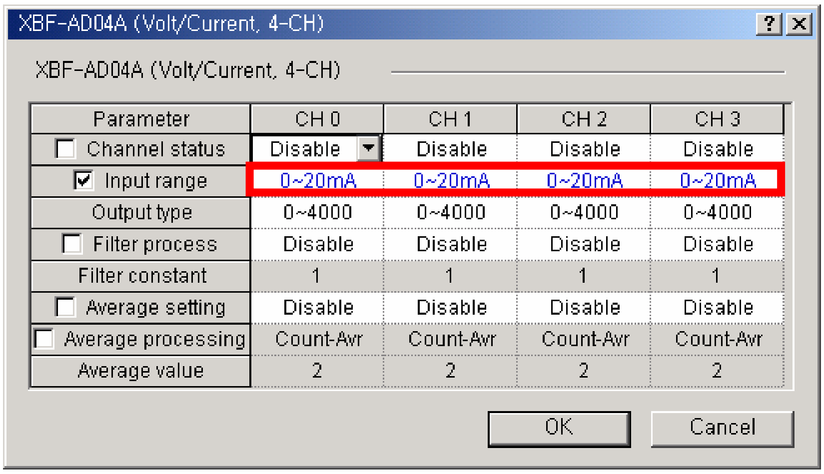
Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☑ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Disable	Disable	Disable	Disable
Filter constant	1	1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2



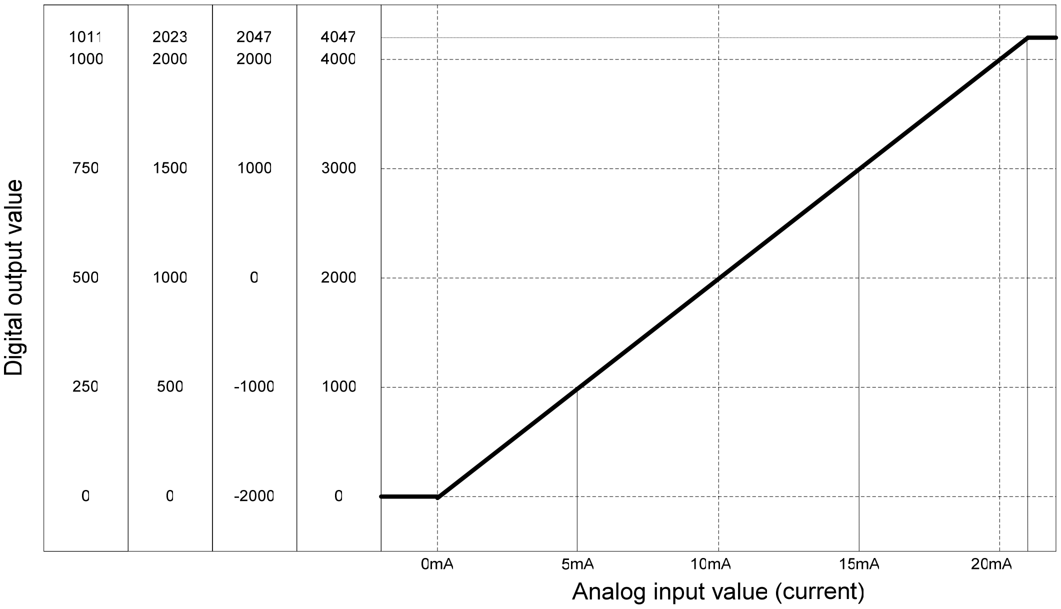
- Digital output value for voltage input characteristic is as specified below.
  (Resolution (based on 1/4000): 2.5 mV)

Digital output range	Analog input voltage (V)					
	0	2.5	5	7.5	10	10.11
Unsigned value (0 ~ 4047)	0	1000	2000	3000	4000	4047
Signed value (-2000 ~ 2047)	-2000	-1000	0	1000	2000	2047
Precise value (0 ~ 1011)	0	250	500	750	1000	1011
Percentile value (0 ~ 1011)	0	250	500	750	1000	1011

2) If the range is DC0 ~ 20mA
- On the XG5000 menu [I/O Parameters Setting], set [Input Range] to “0 ~ 20 ㎃”.
  (Select current mode switch on the upper of the module.)



Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☑ Input range	0~20mA	0~20mA	0~20mA	0~20mA
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Disable	Disable	Disable	Disable
Filter constant	1	1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

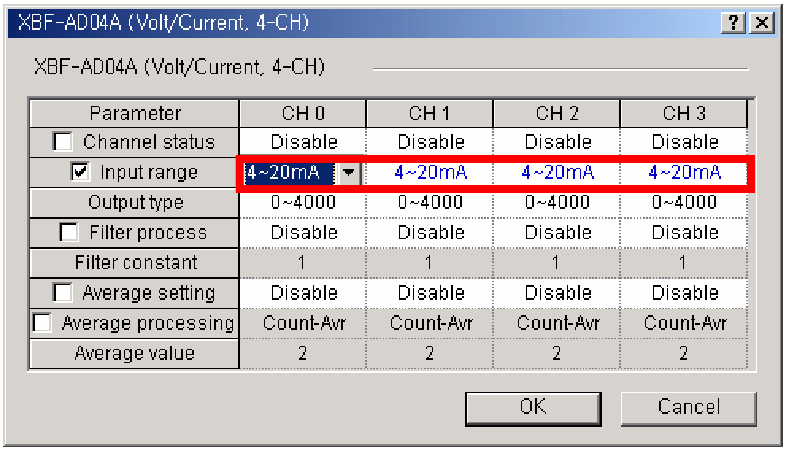


- Digital output value for current input characteristic is as specified below.
  (Resolution (based on 1/4000): 5 ㎂)

Digital output range	Analog input current (㎃)					
	0	5	10	15	20	20.23
Unsigned value (0 ~ 4047)	0	1000	2000	3000	4000	4047
Signed value (-2000 ~ 2047)	-2000	-1000	0	1000	2000	2047
Precise value (0 ~ 2023)	0	500	1000	1500	2000	2023
Percentile value (0 ~ 1011)	0	250	500	750	1000	1011

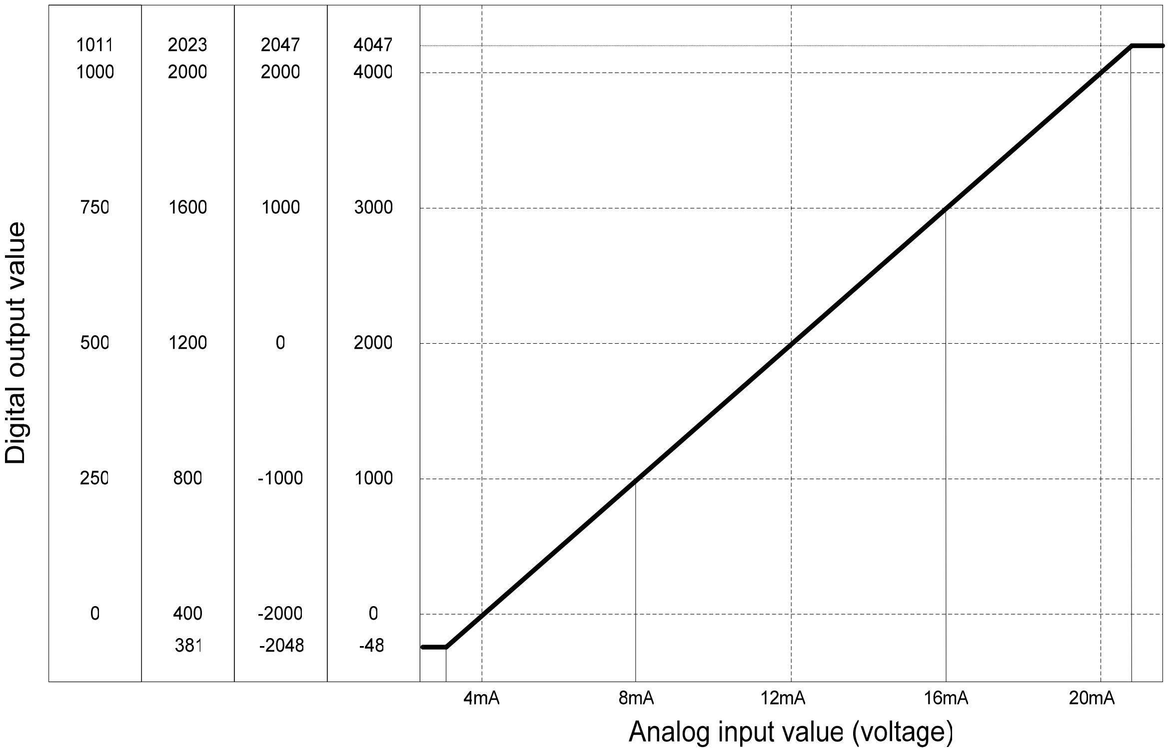
3) If the range is DC4 ~ 20mA

- On the XG5000 menu [I/O Parameters Setting], set [Input Range] to “4~ 20 ㎃”.
  (Select current mode switch on the upper of the module.)



XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☑ Input range	4~20mA	4~20mA	4~20mA	4~20mA
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Disable	Disable	Disable	Disable
Filter constant	1	1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2



▪ Digital output value for current input characteristic is as specified below.
(Resolution (Based on 1/4000): 5 ㎂)

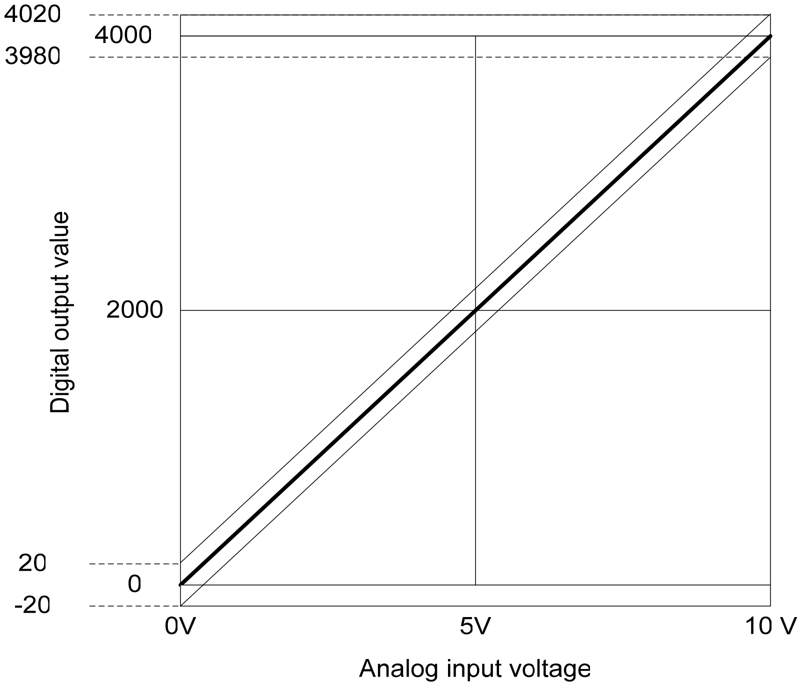
Digital Output range	Analog input current (㎃)						
	0	4	8	12	16	20	20.23
Unsigned value (-48 ~ 4047)	-48	0	1000	2000	3000	4000	4047
Signed value (-2048 ~ 2047)	-2048	-2000	-1000	0	1000	2000	2047
Precise value (381 ~ 2023)	381	400	800	1200	1600	2000	2023
Percentile value (-12 ~ 1011)	-12	0	250	500	750	1000	1011

Remark

1) If analog input value exceeding digital output range is input, the digital output value will be kept to be the max. or the min. value applicable to the output range specified. For example, if the digital output range is set to unsigned value (0 ~ 4047) and the digital output value exceeding 4047 or analog value exceeding –0 is input, the digital output value will be fixed as 0~4047.
2) Voltage and current input shall not exceed ±15 V and ±25 ㎃ respectively. Rising heat may cause defects.
3) Offset/Gain setting for XBF-AD04A module shall not be performed by user.▪

12.1.5 Accuracy of XBF-AD04A

Accuracy of digital output value does not changed even if input range is changed. Figure 2.1 shows the range of the accuracy with analog input range of 0 ~ 10 V and digital output type of unsigned value selected.



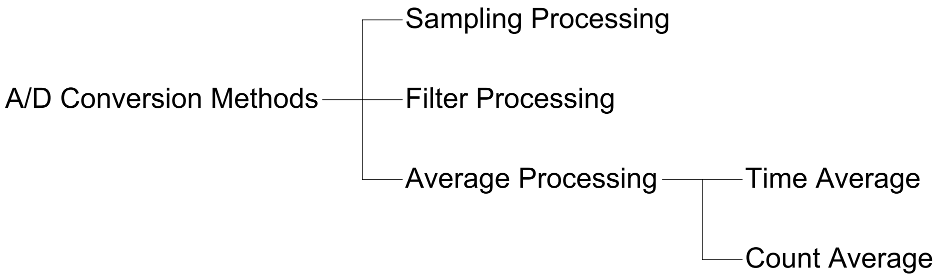
[Accuracy]

12.1.6 Functions of XBF-AD04A

Functions of A/D conversion module are as described below.

Function	Description
Channel Run/Stop setting	(1) Specify Run/Stop of the channel to execute A/D conversion. (2) If the unused channel is set to Stop, whole Run time can be reduced.
Input voltage/Current range setting	(1) Specify analog input range to be used. (2) Select range in parameter setting after select Voltage/Current switch.
Output data format setting	(1) Specify digital output type. (2) 4 output data formats are provided in this module.
A/D conversion methods	(1) Sampling processing Sampling process will be performed if A/D conversion type is not specified. (2) Filter processing Used to delay the sudden change of input value. (3) Average processing Outputs average A/D conversion value based on frequency or time.

There are three A/D conversion methods, sampling processing, filter processing and average processing.



1) Sampling processing

It collects analog input sign through general A/D conversion processing at a specific interval so to convert to digital. The time required for A/D conversion of analog input sign till saved on the memory depends on the number of channels used.

(Processing time) = (Number of channels used) X (Conversion speed)

Ex.) If the number of channels used is 3, its process time will be

3 x 1.5 ㎳ = 4.5 ㎳

Sampling is to calculate the sampling value of continuous analog sign at a specific interval.

2) Filter processing

Filter process function is used to obtain stable digital output value by filtering (delaying) noise or sudden change of input value. Filter constant can be specified for respective channels through user program or I/O parameters setting.

- Setting range: 1 ~ 99 (%)

F[n] = (1 - α) x A[n] + α x F [n - 1]

F[n] : Present filter output value
A[n] : Present A/D converted value
F[n-1] : Previous filter output value
A : Filter constant (0.01 ~ 0.99: previous value added)

❑ If filter setting value is not specified within 1 ~ 99, RUN LED blinks at an interval of 1 second. In order to set RUN LED to On status, reset the filter setting value within 1 ~ 99 and then convert PLC CPU from STOP to RUN. Be sure to use request flag of error clear (UXY.11.0) to clear the error through modification during RUN.

- Analog input range: DC 0 ~ 10 V, Digital output range: 0 ~ 4000
- If analog input value changes 0 V → 10 V (0 → 4000), filter output value based on α value is as specified below.

αvalue	Filter output value				α value
	0 scan	1 scan	2 scan	3 scan	
[*1)] 0.01	0	3600	3960	3997	1% inclined toward previous value
[*2)] 0.66	0	1360	2257	2850	50% inclined toward previous value
[*3)] 0.99	0	40	80	119	99% inclined toward previous value

*1) 4000 output after about 4 scans
*2) 4000 output after about 18 scans
*3) 4000 output after about 950 scans(1.19 s for 1 channel Run)

❑ If filter process function is not used, present A/D converted value will be output as it is. The filter process function takes value-added data between 'Present A/D converted value' and 'Previous A/D converted value'. And the value-added data can be decided with filter constant. If output data shakes too much, set a big filter constant value.

3) Average processing

This process is used to execute A/D conversion of the channel designated for specified frequency or for specified time and save the average of the accumulated sum on memory. Average processing option and time/frequency value can be defined through user program or I/O parameters setting for respective channels.

A) What is the average process used for

This process is used for A/D conversion of abnormal analog input signal such as noise to a value near to normal analog input signal.

B) Average processing type

Average processing type is of time average and count average.

(1) Time average processing
- Setting range: 4 ~ 16000 (ms)
- Average processing count within specified time is decided based on the number of channels used.

$$\text{Average processing count} = \frac{\text{Setting time}}{(\text{Number of Channels used}) \times (\text{Conversion Speed})}$$

Ex.1) Channels used: 1, setting time: 16000 ms

$$\text{Average processing count} = \frac{16000 \ ms}{1 \times 1.5 \ ms} = 10667 \ times$$

Ex.2) Channels used: 8, setting time: 4 ms

$$\text{Average processing count} = \frac{4 \ ms}{4 \times 1.5 \ ms} = 1 \ times$$

If setting value of time average is not specified within 4 ~ 16000, RUN LED blinks at an interval of 1 second. In order to set RUN LED to On status, reset the setting value of time average within 4 ~ 16000 and then convert PLC CPU from STOP to RUN. Be sure to use request flag of error clear (UXY.11.0) to clear the error through modification during RUN.

- Time average is processed after converted to average of the times inside the A/D conversion module. In this case, a remainder may be produced when setting time is divided by (number of channels used X conversion speed), which will be disregarded. Thus, the average processing frequency will be the quotient of [(setting time) ÷ (number of channels used x conversion speed)].

Ex.) If the number of channels used is 5, and setting time is 151 ms

151 ms ÷ (4 X 1.5 ms) = 26 times …… Remainder of 2 → 26 times

(2) Count average process

A) Setting range: 2 ~ 64000 (times)

B) The time required for average value to be saved on memory when frequency average used depends on the number of channels used.

Process time = setting frequency X number of channels used X conversion speed

*1: If setting value of count average is not specified within 2 ~ 64000, RUN LED blinks at an interval of 1 second. In order to set RUN LED to On status, reset the setting value of frequency average within 2 ~ 64000 and then convert PLC CPU from STOP to RUN. Be sure to use request flag of error clear (UXY.11.0) to clear the error through modification during RUN..

*2: If any error occurs in setting value of frequency average, the default value 2 will be saved.

Ex.) If the number of channels used is 4, and average processing frequency is 50

50 X 4 X (1.5 ms) = 300 ms

12.1.7 Wiring

1) Precaution for wiring

A) Don't let AC power line near to A/D conversion module's external input sign line. With an enough distance kept away between, it will be free from surge or inductive noise.

B) Cable shall be selected in due consideration of ambient temperature and allowable current, whose size is not less than the max. cable standard of AWG22 (0.3㎟).

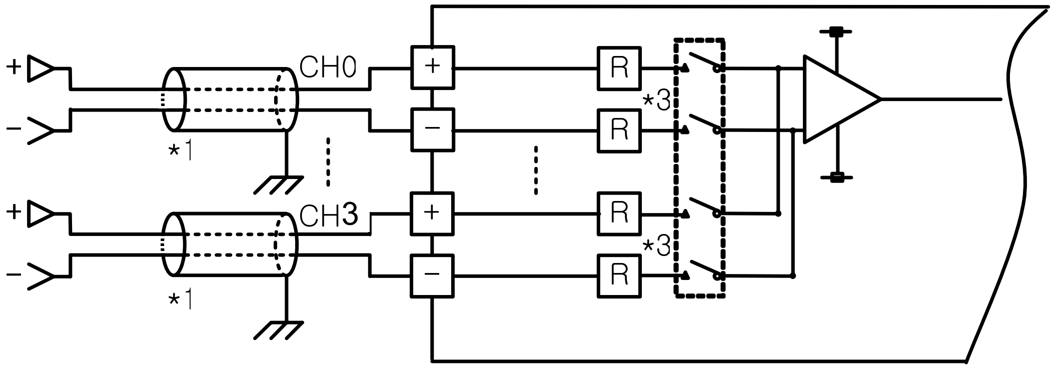
C) Don't let the cable too close to hot device and material or in direct contact with oil for long, which will cause damage or abnormal operation due to short-circuit.

D) Check the polarity when wiring the terminal.

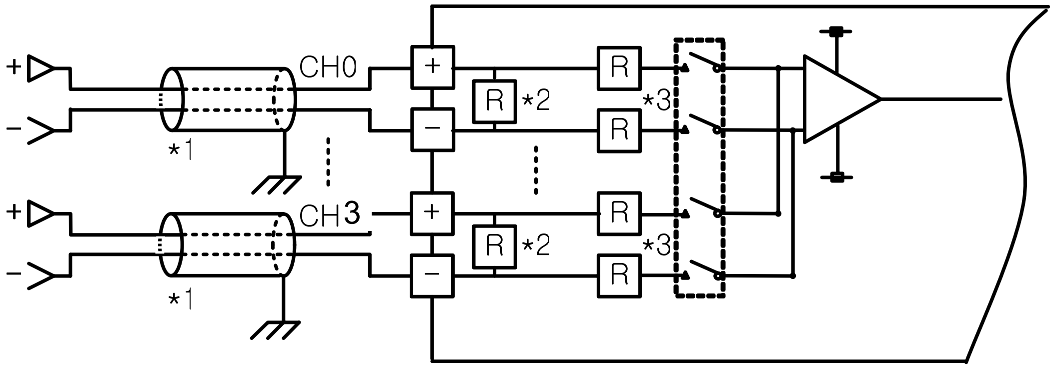
E) Wiring with high-voltage line or power line may produce inductive hindrance causing abnormal operation or defect.

2) Wiring examples

A) Voltage input



B) Current input

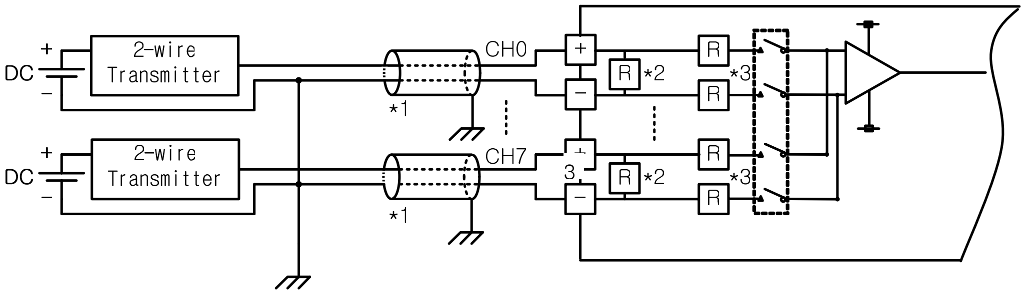


*1) Use a 2-core twisted shielded wire. AWG 22 is recommended for the cable standard.

*2) XGF-AC8A's input resistance is 250 Ω (typ.).

*3) XGF-AV8A's input resistance is 1 MΩ (min.).

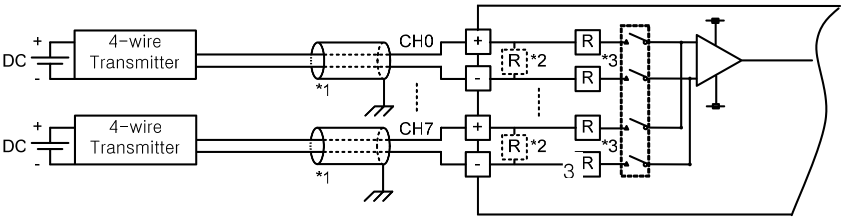
D) Wiring example of 2-wire sensor/transmitter (current input)



-. Run the channel to be used only.

-. Analog input module does not provide power for the input device. Use an external power supplier.

E) Wiring example of 4- wire sensor/transmitter (voltage/current input)



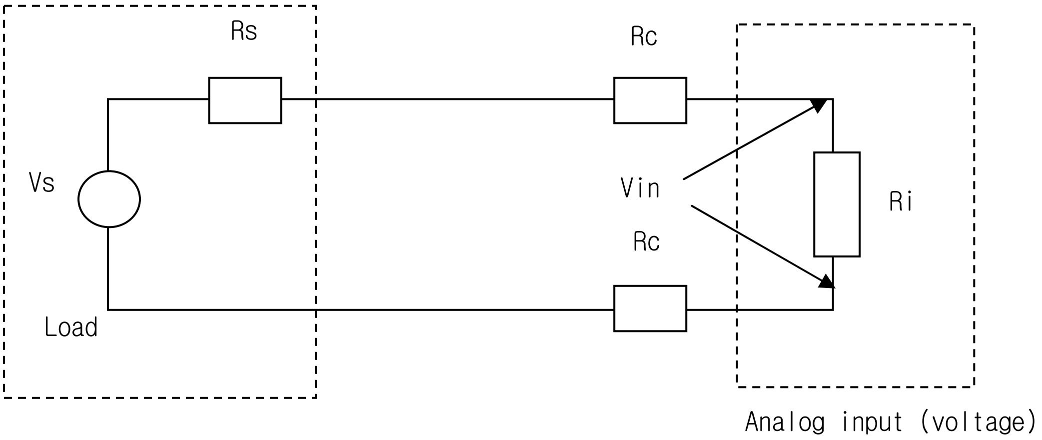
-. Start the channel to be used only.

-. Analog input module does not provide power for the input device. Use an external power supplier.

* 1) Use a 2-core twisted shielded wire. AWG 22 is recommended for the cable standard.
* 2) Current’s input resistance is 250 Ω (typ.).
* 3) Voltage’s input resistance is 1 MΩ (min.).

F) Relationship between voltage input accuracy and wiring length

In voltage input, the wiring (cable) length between transmitter or sensor and module has an effect on digital-converted values of the module as specified below;



Where,

Rc: Resistance value due to line resistance of cable

Rs: Internal resistance value of transmitter or sensor

Ri: Internal resistance value (1㏁) of voltage input module

Vin: Voltage allowed to analog input module

% Vi: Tolerance of converted value (%) due to source and cable length in voltage input

$$Vin = \frac{Ri \times Vs}{\left[Rs + (2 \times Rc) + Ri\right]}$$

$$\%Vi = \left(1 - \frac{Vin}{Vs}\right) \times 100\,\%$$

Remark

In current input, there will be no accuracy tolerance caused by cable length and internal resistance of the source.

12.1.8 Operation parameter setting

A/D conversion module's operation parameters can be specified through XG5000's [I/O parameters].

1) Settings

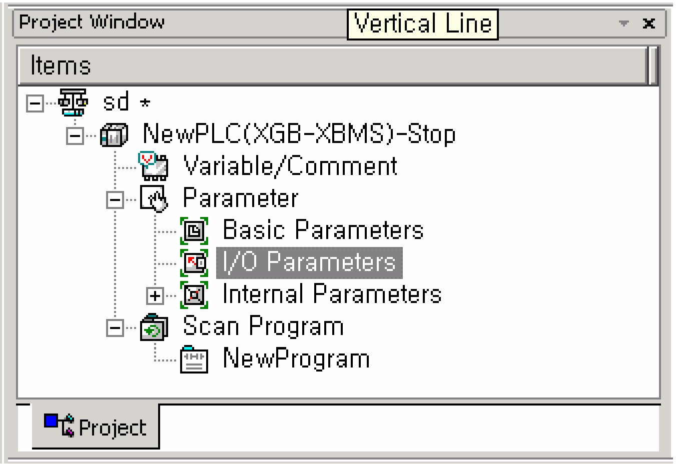
For the user's convenience of A/D conversion module, XG5000 provides GUI (Graphical User Interface) for parameters setting of A/D conversion module. Setting items available through [I/O parameters] on the XG5000 project window are as described below in the table.

Item	Details
[I/O parameter]	(1) Specify the following setting items necessary for the module operation. – Channel Enable/Disable setting – Setting ranges of input voltage/current – Output data format setting – Filter processing Enable/Disable setting – Filter constant setting – Average processing Enable/Disable setting – Average processing method setting – Average value setting (2) The data specified by user through S/W package will be saved on A/D conversion module when [Special Module Parameters] are downloaded. In other words, the point of time when [Special Module Parameters] are saved on A/D conversion module has nothing to do with PLC CPU's status RUN or SPOP.

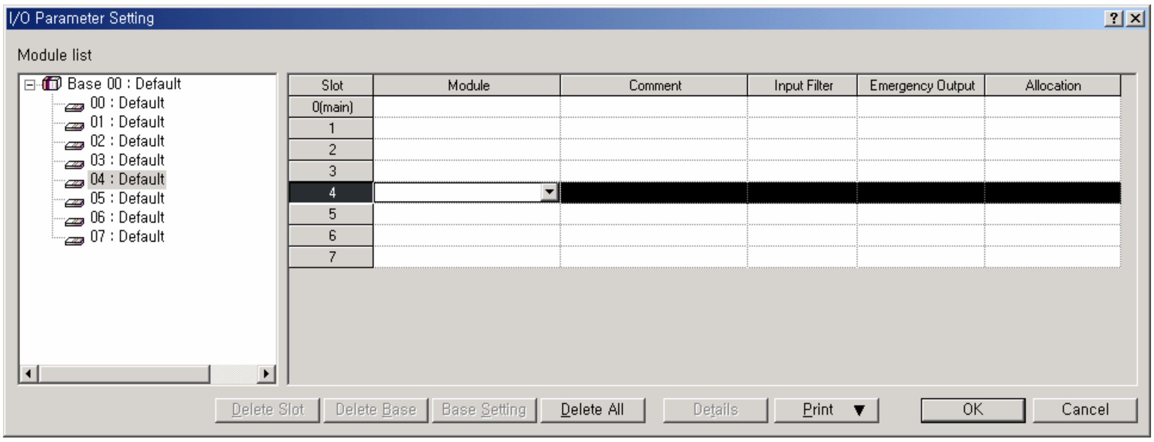
2) I/O Parameter setting

(1) Run XG5000 to create a project.
(Refer to XG5000 program manual for details on how to create the project)

(2) Double-click [I/O parameters] on the project window.



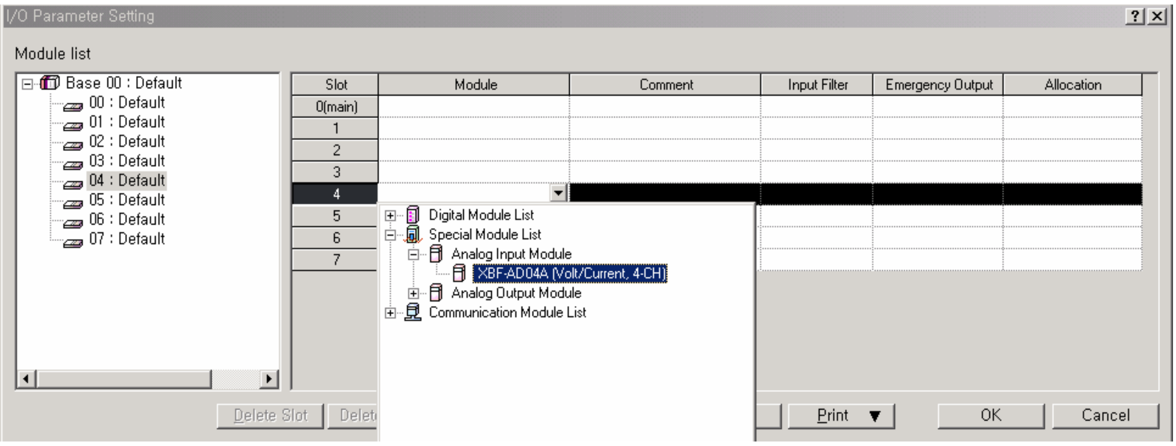
(3) On the 'I/O parameters setting' screen, find and click the slot of the base A/D conversion module is installed on. 8-channel voltage type of A/D conversion module is installed on Base No.0, Slot No.4 in this description.



Base 00 : Default
00 : Default
01 : Default
02 : Default
03 : Default
04 : Default
05 : Default
06 : Default
07 : Default

Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1					
2					
3					
4					
5					
6					
7					

(4) Click the arrow button on the screen above to display the screen where an applicable module can be selected. Search for the applicable module to select.

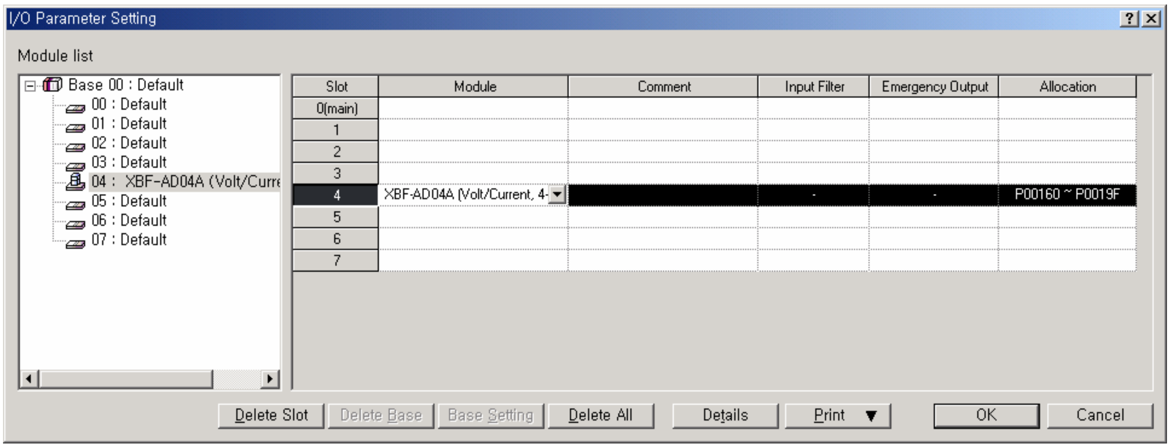


Base 00 : Default
00 : Default
01 : Default
02 : Default
03 : Default
04 : Default
05 : Default
06 : Default
07 : Default

Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1					
2					
3					
4					
5					
6					
7					

Digital Module List
Special Module List
  Analog Input Module
    XBF-AD04A (Volt/Current, 4-CH)
  Analog Output Module
Communication Module List

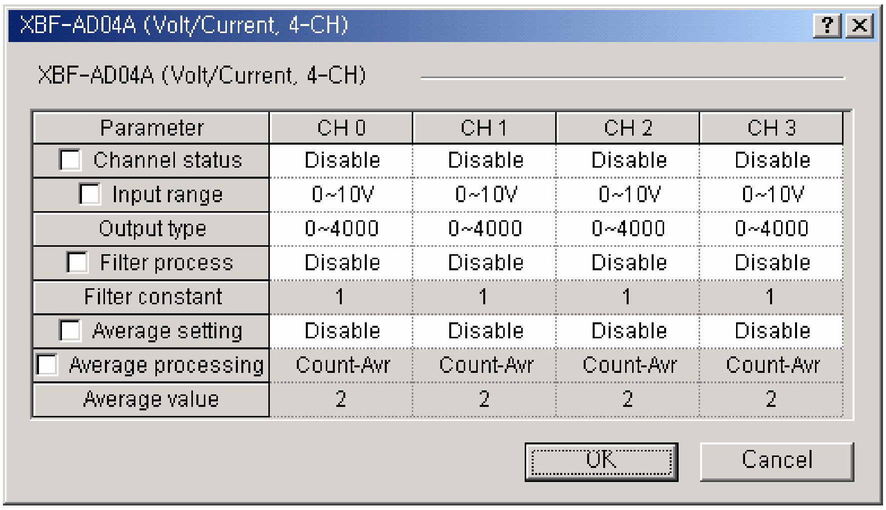
(5) After the module selected, click [Details].



Base 00 : Default
00 : Default
01 : Default
02 : Default
03 : Default
04 : XBF-AD04A (Volt/Curre
05 : Default
06 : Default
07 : Default

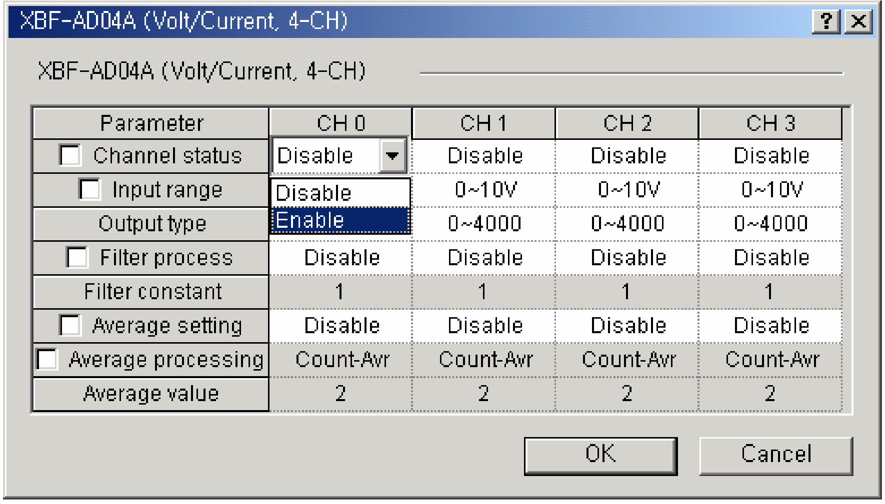
Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1					
2					
3					
4	XBF-AD04A (Volt/Current, 4-		-	-	P00160 ~ P0019F
5					
6					
7					

(6) A screen will be displayed for you to specify parameters for respective channels as shown below. Click a desired item to display parameters to set for respective items.



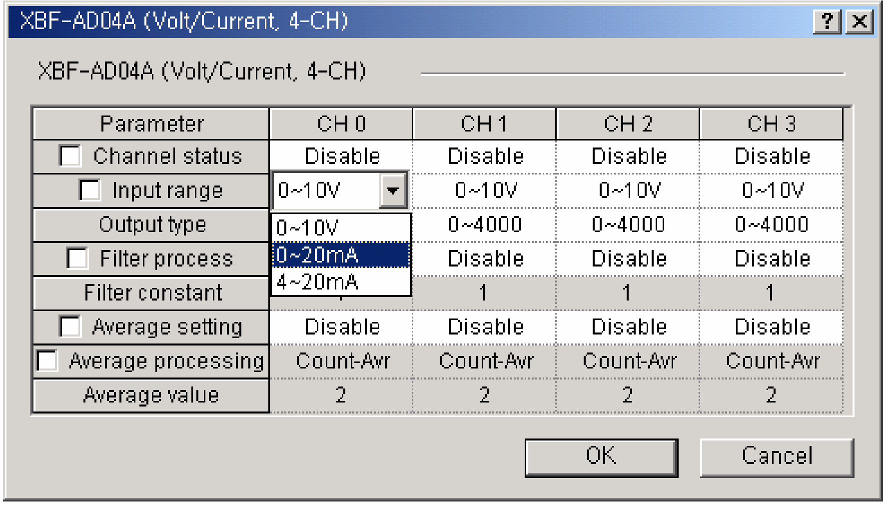
Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Disable	Disable	Disable	Disable
Filter constant	1	1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

(7) Run channel: Select Stop or Run.



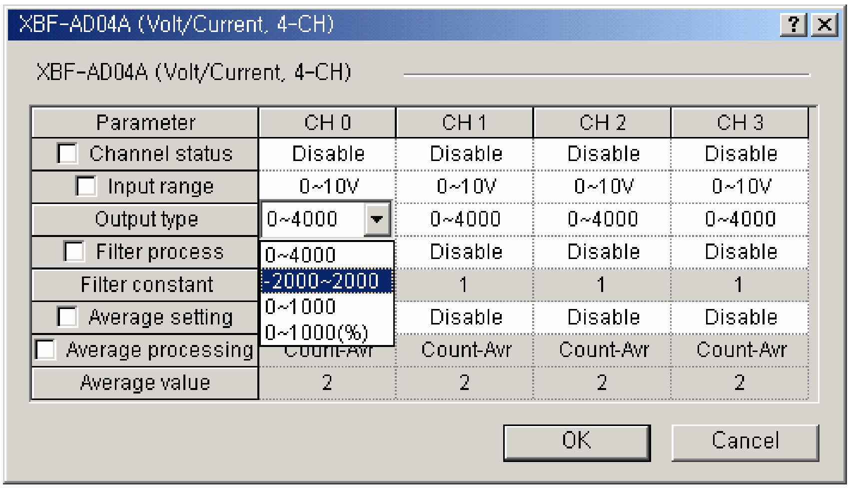
Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range		0~10V	0~10V	0~10V
Output type		0~4000	0~4000	0~4000
☐ Filter process	Disable	Disable	Disable	Disable
Filter constant	1	1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

(8) Input range: Select the range of analog input voltage as desired.



Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type		0~4000	0~4000	0~4000
☐ Filter process		Disable	Disable	Disable
Filter constant		1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

(9) Output data format: Select the format of output data. 4 formats are available in total.

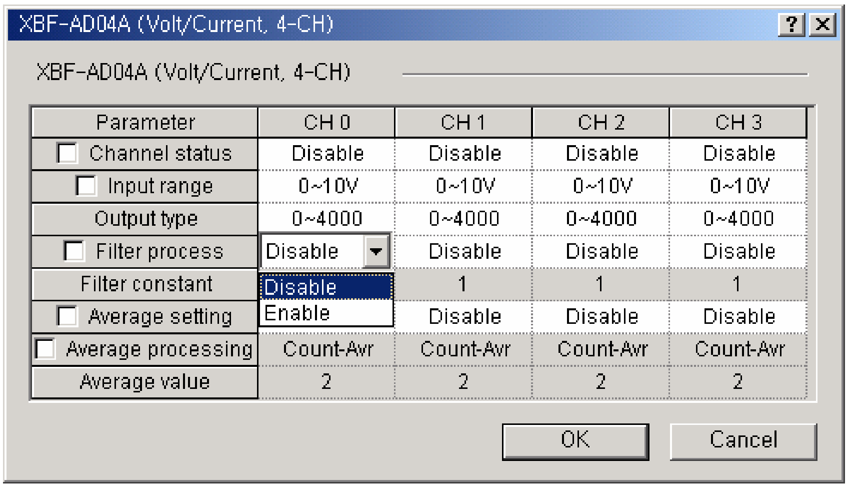


XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process		Disable	Disable	Disable
Filter constant		1	1	1
☐ Average setting		Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

0~4000
-2000~2000
0~1000
0~1000(%)

(10) Filter process: Set the filter process to Enable or Disable.

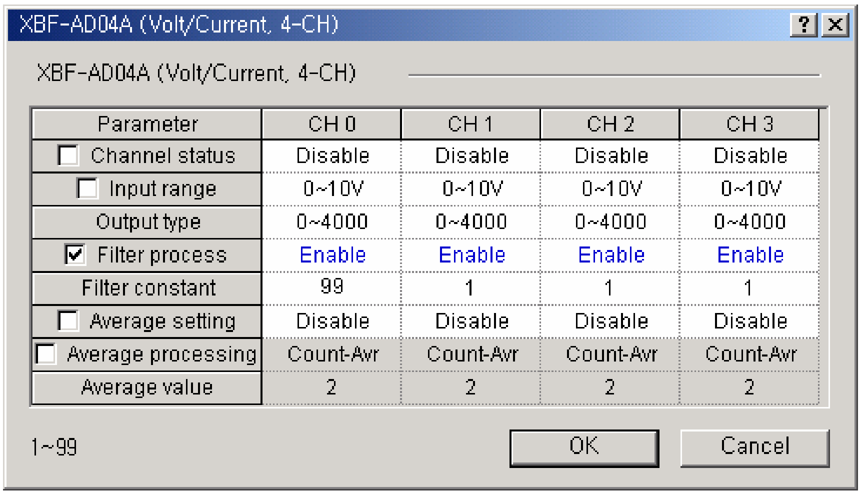


XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Disable	Disable	Disable	Disable
Filter constant		1	1	1
☐ Average setting		Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

Disable
Enable

(11) Filter constant: Set the filter process above surely to [Enable] in order to input the filter constant in this field. With the filter process set to [Enable], double-click the value of the filter constant to input the value. The range of the value available in this field is 1 ~ 99. Any value exceeding this range will not be input.

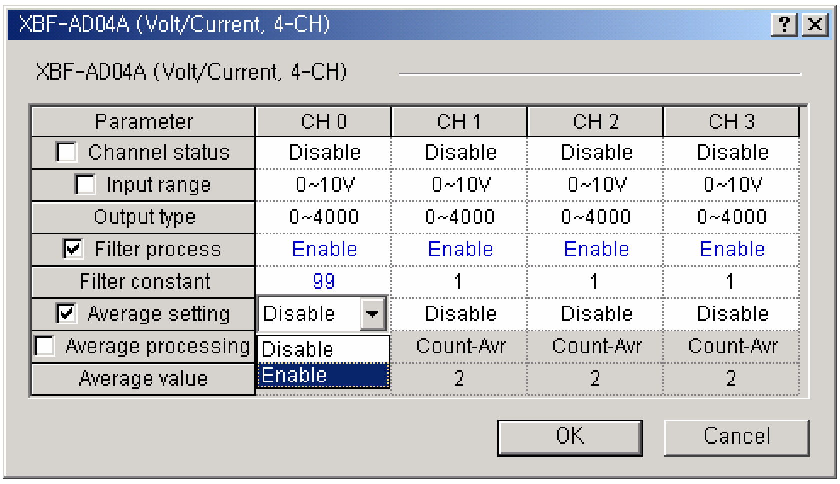


XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☑ Filter process	Enable	Enable	Enable	Enable
Filter constant	99	1	1	1
☐ Average setting	Disable	Disable	Disable	Disable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	2	2	2	2

1~99

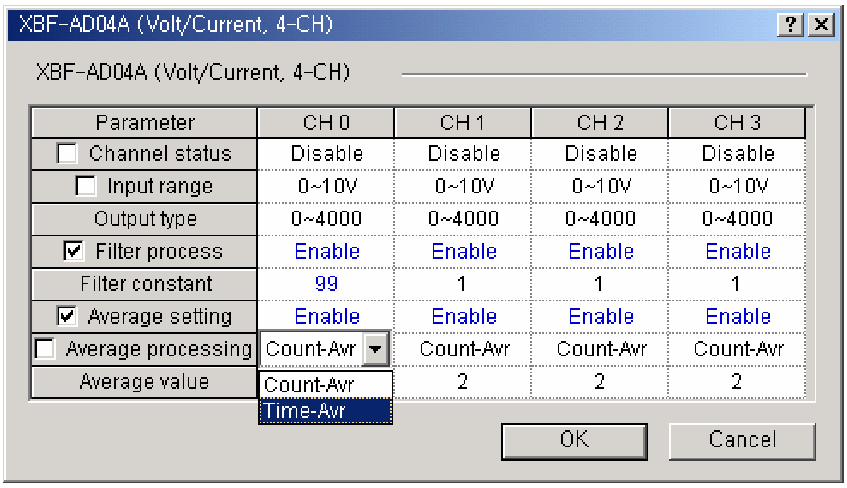
(12) Average process: Set the average process to Enable or Disable.



XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☑ Filter process	Enable	Enable	Enable	Enable
Filter constant	99	1	1	1
☑ Average setting	Disable	Disable	Disable	Disable
☐ Average processing		Count-Avr	Count-Avr	Count-Avr
Average value		2	2	2

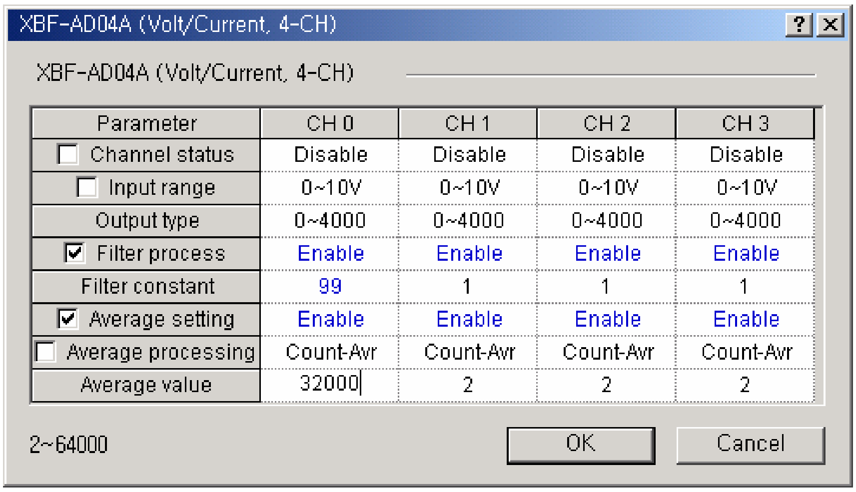
(13) Average method: Set the average process above surely to [Enable] in order to change the value in this field. Average processing can be selected between time average and frequency average.



XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☑ Filter process	Enable	Enable	Enable	Enable
Filter constant	99	1	1	1
☑ Average setting	Enable	Enable	Enable	Enable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value		2	2	2

(14) Average value: Set the average process above surely to [Enable] in order to input the average value in this field. With the average process set to [Enable], double-click the average value to input the value. The range of the value available in this field is 2 ~ 64000 for frequency average, and 4 ~ 16000 for time average. Any value exceeding this range will not be input



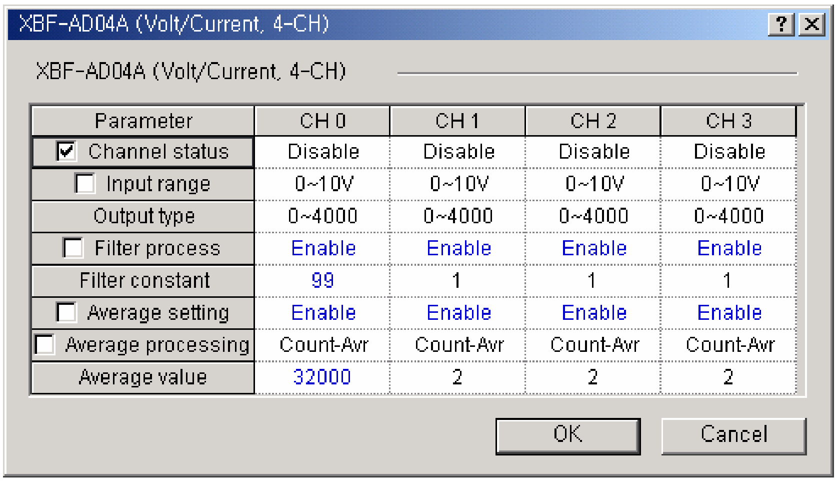
XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☑ Filter process	Enable	Enable	Enable	Enable
Filter constant	99	1	1	1
☑ Average setting	Enable	Enable	Enable	Enable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	32000	2	2	2

2~64000

(15) How to select the whole channels to change parameters

Click and check the radio button in the parameters item in order to change the whole channels to identical setting value. And then change the parameters of an optional channel to change the parameters of the whole channels at a time. Fig. 4.2 shows an example that Run channel is changed to whole channels 'Run' by means of this function.



Parameter	CH 0	CH 1	CH 2	CH 3
☑ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Enable	Enable	Enable	Enable
Filter constant	99	1	1	1
☐ Average setting	Enable	Enable	Enable	Enable
☐ Average processing	Count-Avr	Count-Avr	Count-Avr	Count-Avr
Average value	32000	2	2	2

[Parameters change of the whole channels]

12.1.9 Special module monitoring functions

Functions of Special Module Monitoring are as described below in table.

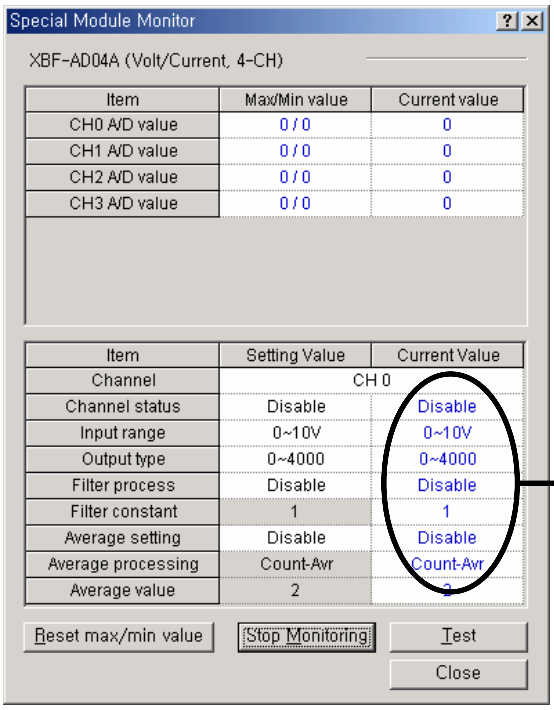
Item	Details
[Special Module Monitoring]	(1) Monitor/Test Through applicable XG5000 menu of [Monitor] -> [Special Module Monitoring], A/D converted value can be monitored and the operation of A/D conversion module can be tested. (2) Monitoring the max./min. value The max./min. value of the channel can be monitored during Run. However, the max./min. value displayed here is based on the present value shown on the screen. Accordingly, when [Monitoring/Test] screen is closed, the max./min. value will not be saved.

Remark

The screen may not be normally displayed due to insufficient system resource. In such a case, close the screen and finish other applications in order to restart XG5000.

- The parameters specified for the test of A/D conversion module on the “Special Module Monitoring” screen of [Special Module Monitoring] will be deleted the moment the “Special Module Monitoring” screen is closed. In other words, the parameters of A/D conversion module specified on the “Special Module Monitoring” screen will not be saved in [I/O parameters] located on the left tap of XG5000.

- Test function of [Special Module Monitoring] is provided for user to check the normal operation of A/D conversion module even without sequence programming. If A/D conversion module is to be used for other purposes than a test, use parameters setting function in [I/O parameters].



XBF-AD04A (Volt/Current, 4-CH)

Item	Max/Min value	Current value
CH0 A/D value	0 / 0	0
CH1 A/D value	0 / 0	0
CH2 A/D value	0 / 0	0
CH3 A/D value	0 / 0	0

Item	Setting Value	Current Value
Channel	CH 0	
Channel status	Disable	Disable
Input range	0~10V	0~10V
Output type	0~4000	0~4000
Filter process	Disable	Disable
Filter constant	1	1
Average setting	Disable	Disable
Average processing	Count-Avr	Count-Avr
Average value	2	2

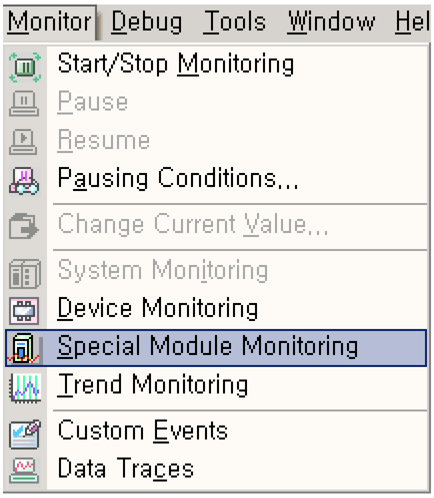
Not saved in [I/O parameters]

12.1.10 Special module monitoring

Monitoring special module will be based on XBF-AD04A.

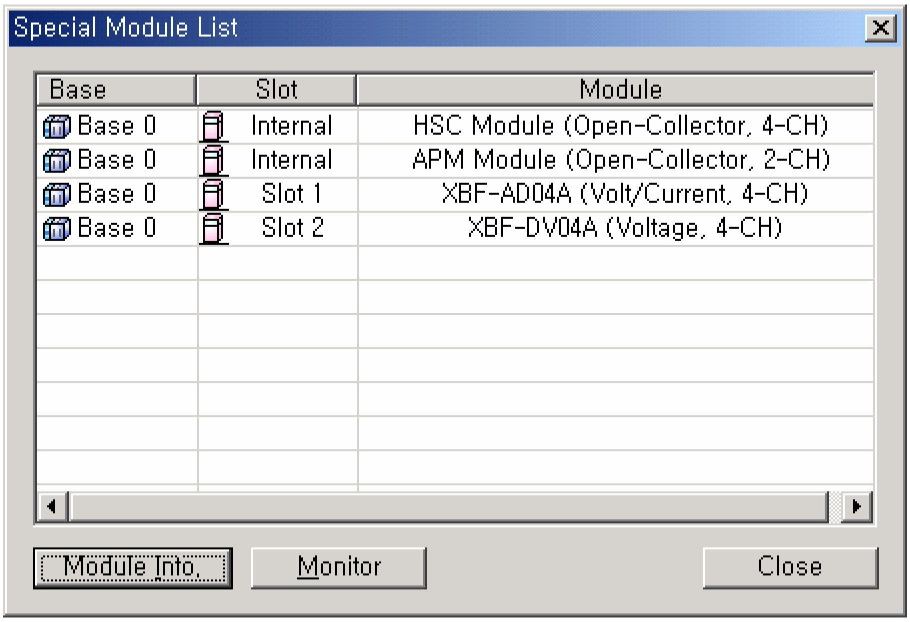
1) Start of [Special Module Monitoring]

Go through [On-Line] -> [Connect] and [Monitor] -> [Special Module Monitoring] to start. If the status is not [On-Line], [Special Module Monitoring] menu will not be active.



2) How to use [Special Module Monitoring]

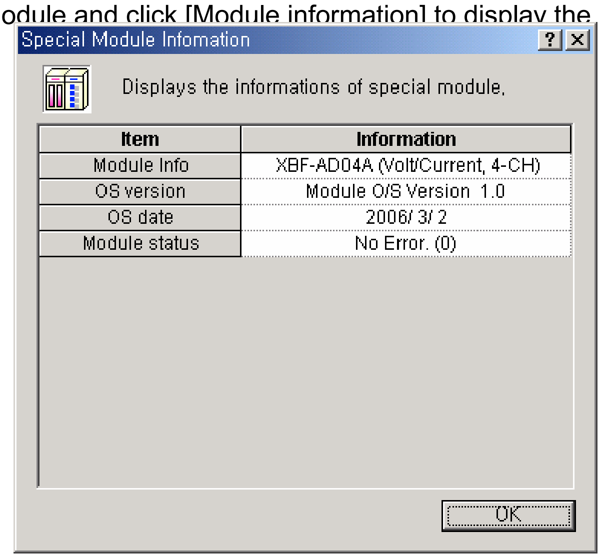
A) With XG5000 connected to PLC CPU (on-line status), click [Monitor] -> [Special Module Monitoring] to display ‘Special Module Select’ screen as in Fig. 5.1 showing base/slot information in addition to special module type. The module installed on the present PLC system will be displayed on the list dialog box.



Base	Slot	Module
Base 0	Internal	HSC Module (Open-Collector, 4-CH)
Base 0	Internal	APM Module (Open-Collector, 2-CH)
Base 0	Slot 1	XBF-AD04A (Volt/Current, 4-CH)
Base 0	Slot 2	XBF-DV04A (Voltage, 4-CH)

Screen of [Special Module Select]

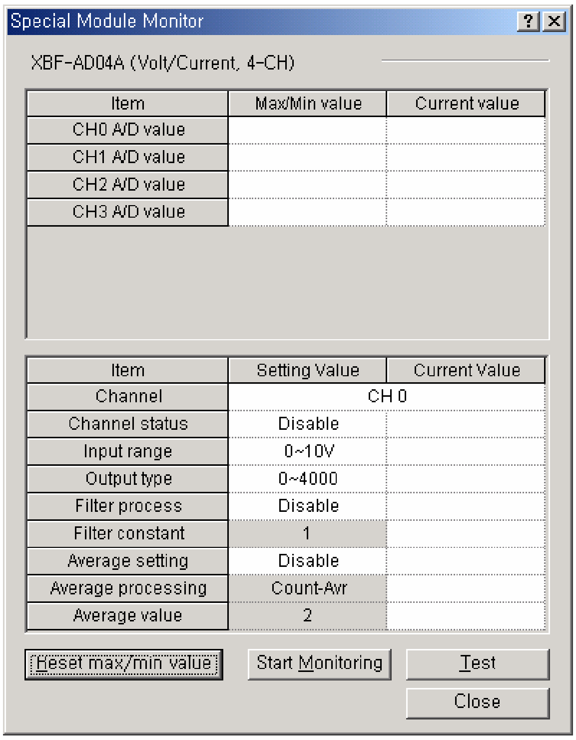
B) Select Special module and click [Module information] to display the information as below.



Displays the informations of special module.

Item	Information
Module Info	XBF-AD04A (Volt/Current, 4-CH)
OS version	Module O/S Version 1.0
OS date	2006/ 3/ 2
Module status	No Error. (0)

C) Click [Monitor] on the “Special Module” screen in [Special Module List] to display [Special Module Monitoring] screen as below, where 4 options are available such as [Reset max./min. value], [Monitor Start], [Test Execute] and [Close]. A/D conversion module’s output value and max./ min. value are displayed on the monitoring screen at the top of the screen, and parameters items of respective modules are displayed for individual setting on the test screen at the bottom of the screen.



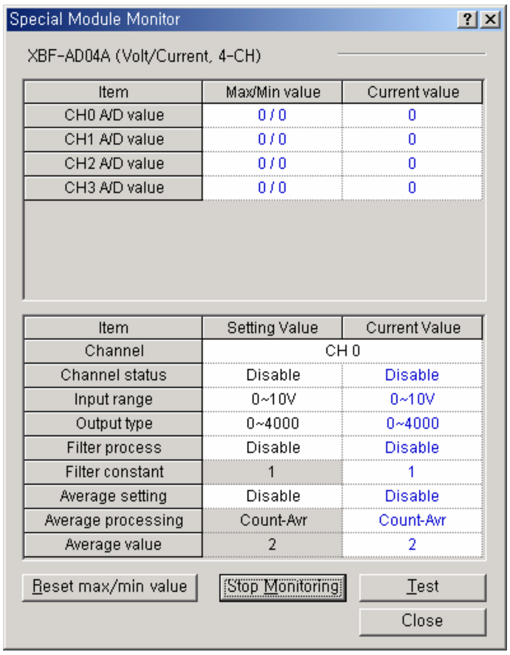
XBF-AD04A (Volt/Current, 4-CH)

Item	Max/Min value	Current value
CH0 A/D value		
CH1 A/D value		
CH2 A/D value		
CH3 A/D value		

Item	Setting Value	Current Value
Channel	CH 0	
Channel status	Disable	
Input range	0~10V	
Output type	0~4000	
Filter process	Disable	
Filter constant	1	
Average setting	Disable	
Average processing	Count-Avr	
Average value	2	

Screen of [Special Module Monitoring]

D) [Start Monitoring]: Click [Start Monitoring] to display A/D converted value of the presently operated channel. Below screen is the monitoring screen displayed when the whole channels are in Stop status. In the present value field at the screen bottom, presently specified parameters of A/D conversion module are displayed.



Special Module Monitor

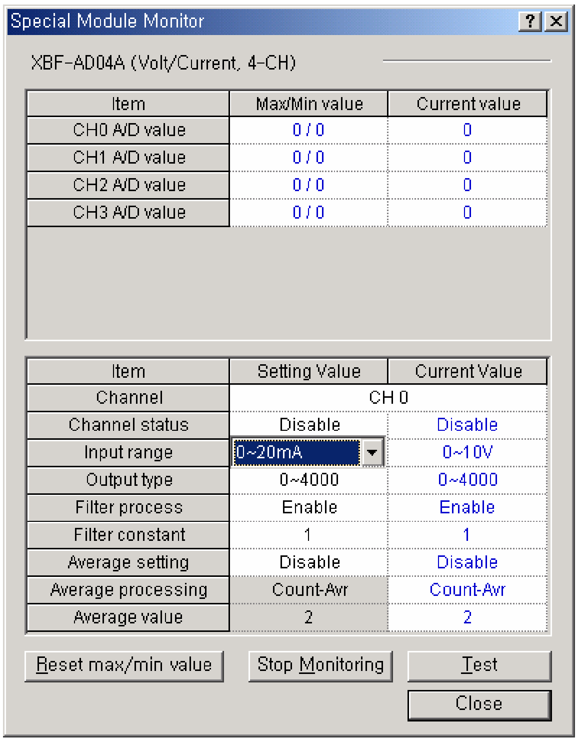
XBF-AD04A (Volt/Current, 4-CH)

Item	Max/Min value	Current value
CH0 A/D value	0 / 0	0
CH1 A/D value	0 / 0	0
CH2 A/D value	0 / 0	0
CH3 A/D value	0 / 0	0

Item	Setting Value	Current Value
Channel	CH 0	
Channel status	Disable	Disable
Input range	0~10V	0~10V
Output type	0~4000	0~4000
Filter process	Disable	Disable
Filter constant	1	1
Average setting	Disable	Disable
Average processing	Count-Avr	Count-Avr
Average value	2	2

Execution screen of [Start Monitoring]

E) [Test]: [Test] is used to change the presently specified parameters of A/D conversion module. Click the setting value at the bottom field of the screen to change parameters. Below screen will be displayed after [Test] is executed with channels 0's input voltage range changed to -0~20 mAin the state of input not wired.



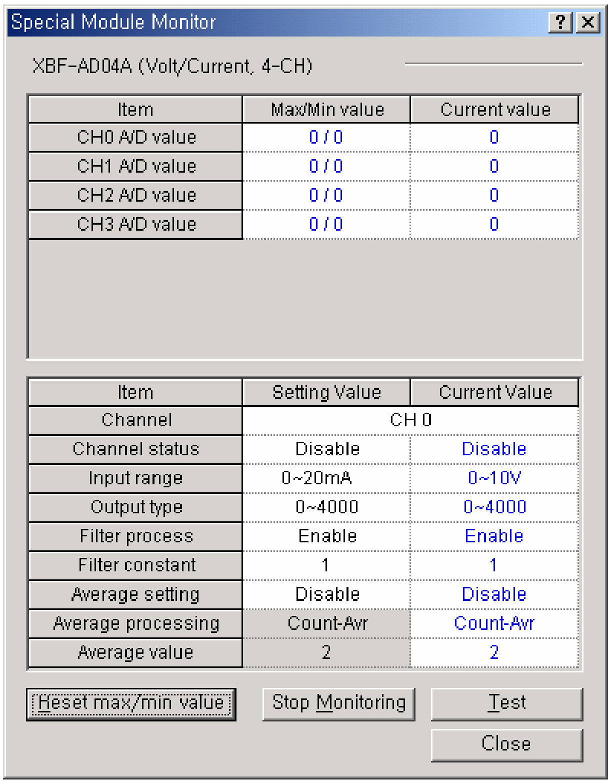
Special Module Monitor

XBF-AD04A (Volt/Current, 4-CH)

Item	Max/Min value	Current value
CH0 A/D value	0 / 0	0
CH1 A/D value	0 / 0	0
CH2 A/D value	0 / 0	0
CH3 A/D value	0 / 0	0

Item	Setting Value	Current Value
Channel	CH 0	
Channel status	Disable	Disable
Input range	0~20mA	0~10V
Output type	0~4000	0~4000
Filter process	Enable	Enable
Filter constant	1	1
Average setting	Disable	Disable
Average processing	Count-Avr	Count-Avr
Average value	2	2

F) [Reset max./min. value]: The max./min. value field at the upper screen shows the max. value and the min. value of A/D converted value. Click [Reset max./min. value] to initialize the max./min. value. Below screen is after [Reset max./min. value] button is clicked in the screen of Special Module Monitor, where channel 0's A/D converted value can be checked as reset.



XBF-AD04A (Volt/Current, 4-CH)

Item	Max/Min value	Current value
CH0 A/D value	0 / 0	0
CH1 A/D value	0 / 0	0
CH2 A/D value	0 / 0	0
CH3 A/D value	0 / 0	0

Item	Setting Value	Current Value
Channel	CH 0	
Channel status	Disable	Disable
Input range	0~20mA	0~10V
Output type	0~4000	0~4000
Filter process	Enable	Enable
Filter constant	1	1
Average setting	Disable	Disable
Average processing	Count-Avr	Count-Avr
Average value	2	2

Execution screen of [Reset max./min. value]

.

G) [Close]: [Close] is used to escape from the monitoring/test screen. When the monitoring/test screen is closed, the max. value, the min. value and the present value will not be saved any more.

12.1.11 Register U devices

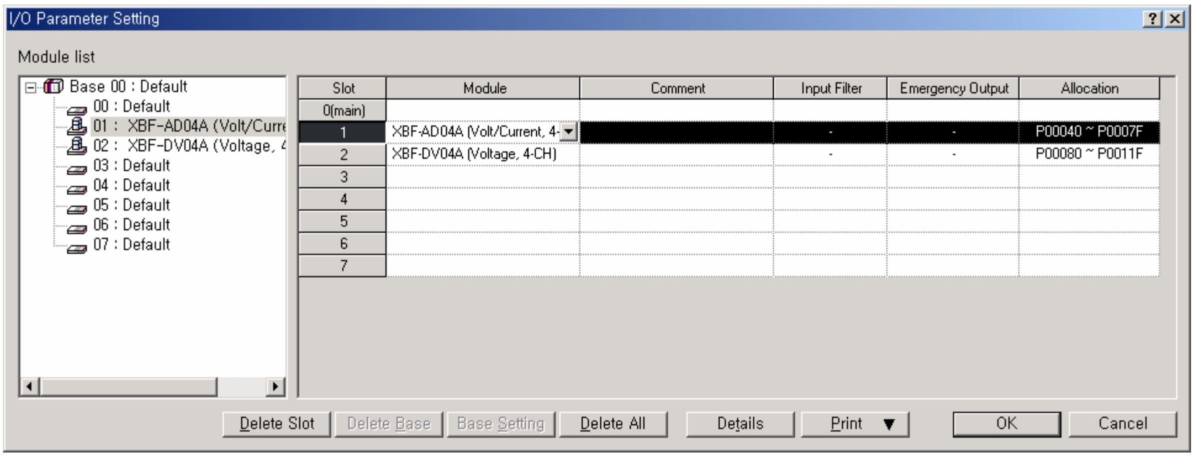
This section describes the automatic registration function of the U device in the XG5000.

1) Register U devices

Register the variables for each module referring to the special module information that is set in the I/O parameter. The user can modify the variables and comments.

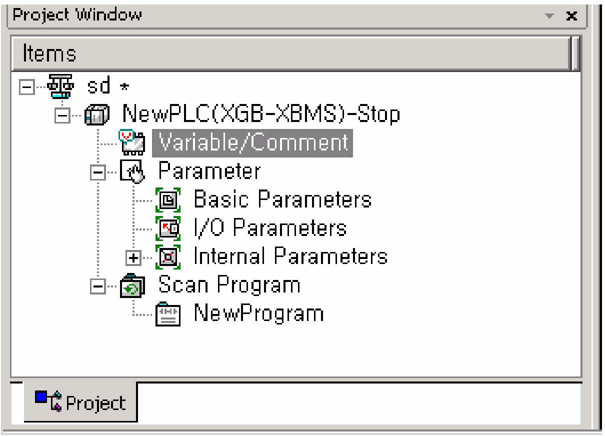
[Procedure]

A) Select the special module type in the [I/O parameter] setting window.

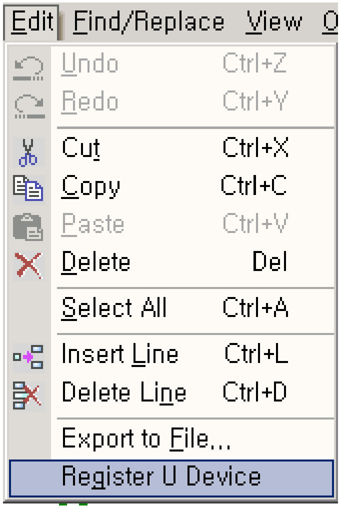


Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1	XBF-AD04A (Volt/Current, 4-		-	-	P00040 ~ P007F
2	XBF-DV04A (Voltage, 4-CH)		-	-	P00080 ~ P011F
3					
4					
5					
6					
7					

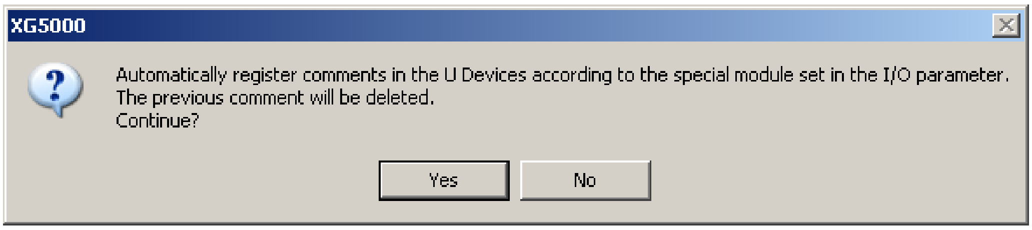
B) Double click ‘Variable/Comment’ from the project window.



C) Select [Edit] – [Register U Device].

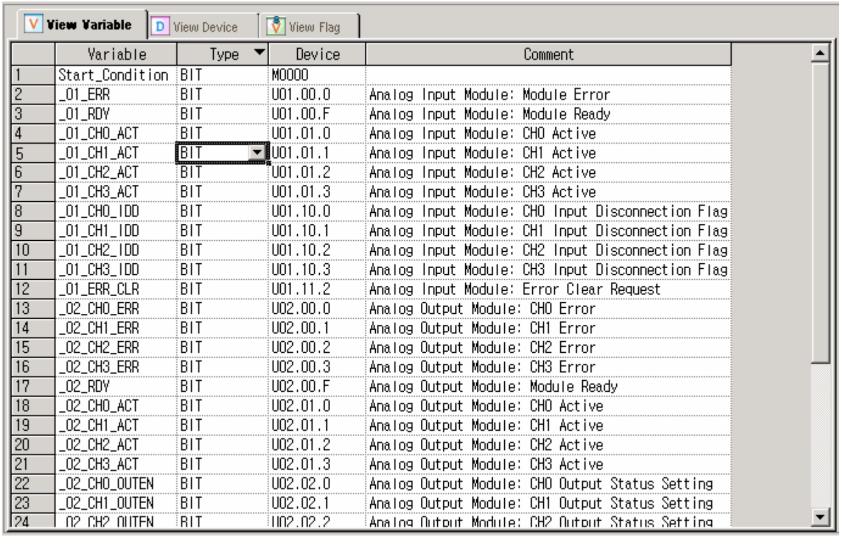


D) Click ‘Yes’.



Automatically register comments in the U Devices according to the special module set in the I/O parameter.
The previous comment will be deleted.
Continue?

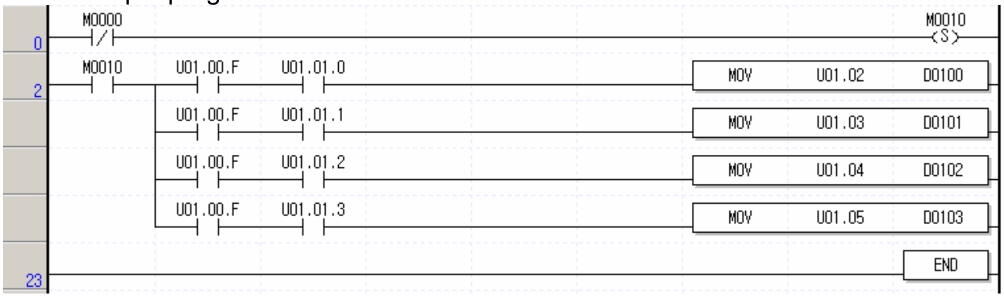
E) As shown below, the variables are registered.



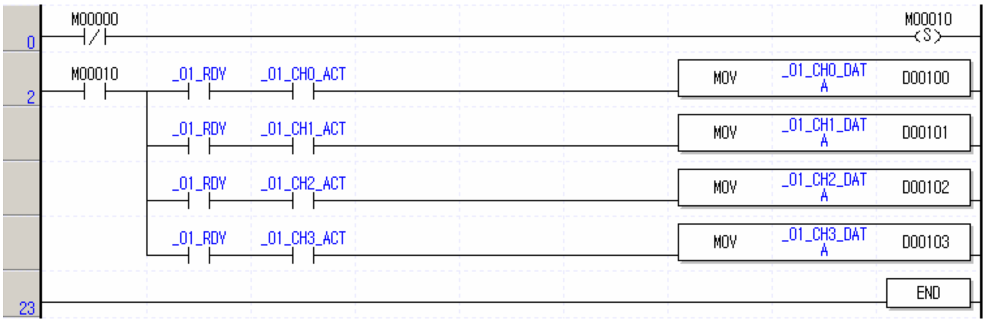
	Variable	Type	Device	Comment
1	Start_Condition	BIT	M0000	
2	_01_ERR	BIT	U01.00.0	Analog Input Module: Module Error
3	_01_RDY	BIT	U01.00.F	Analog Input Module: Module Ready
4	_01_CH0_ACT	BIT	U01.01.0	Analog Input Module: CH0 Active
5	_01_CH1_ACT	BIT	U01.01.1	Analog Input Module: CH1 Active
6	_01_CH2_ACT	BIT	U01.01.2	Analog Input Module: CH2 Active
7	_01_CH3_ACT	BIT	U01.01.3	Analog Input Module: CH3 Active
8	_01_CH0_IDD	BIT	U01.10.0	Analog Input Module: CH0 Input Disconnection Flag
9	_01_CH1_IDD	BIT	U01.10.1	Analog Input Module: CH1 Input Disconnection Flag
10	_01_CH2_IDD	BIT	U01.10.2	Analog Input Module: CH2 Input Disconnection Flag
11	_01_CH3_IDD	BIT	U01.10.3	Analog Input Module: CH3 Input Disconnection Flag
12	_01_ERR_CLR	BIT	U01.11.2	Analog Input Module: Error Clear Request
13	_02_CH0_ERR	BIT	U02.00.0	Analog Output Module: CH0 Error
14	_02_CH1_ERR	BIT	U02.00.1	Analog Output Module: CH1 Error
15	_02_CH2_ERR	BIT	U02.00.2	Analog Output Module: CH2 Error
16	_02_CH3_ERR	BIT	U02.00.3	Analog Output Module: CH3 Error
17	_02_RDY	BIT	U02.00.F	Analog Output Module: Module Ready
18	_02_CH0_ACT	BIT	U02.01.0	Analog Output Module: CH0 Active
19	_02_CH1_ACT	BIT	U02.01.1	Analog Output Module: CH1 Active
20	_02_CH2_ACT	BIT	U02.01.2	Analog Output Module: CH2 Active
21	_02_CH3_ACT	BIT	U02.01.3	Analog Output Module: CH3 Active
22	_02_CH0_OUTEN	BIT	U02.02.0	Analog Output Module: CH0 Output Status Setting
23	_02_CH1_OUTEN	BIT	U02.02.1	Analog Output Module: CH1 Output Status Setting
24	_02_CH2_OUTEN	BIT	U02.02.2	Analog Output Module: CH2 Output Status Setting

2) Save variables
   A) The contents of ‘View Variable’ can be saved as a text file.
   B) Select [Edit] -> [Export to File].
   C) The contents of ‘View variable’ are saved as a text file.

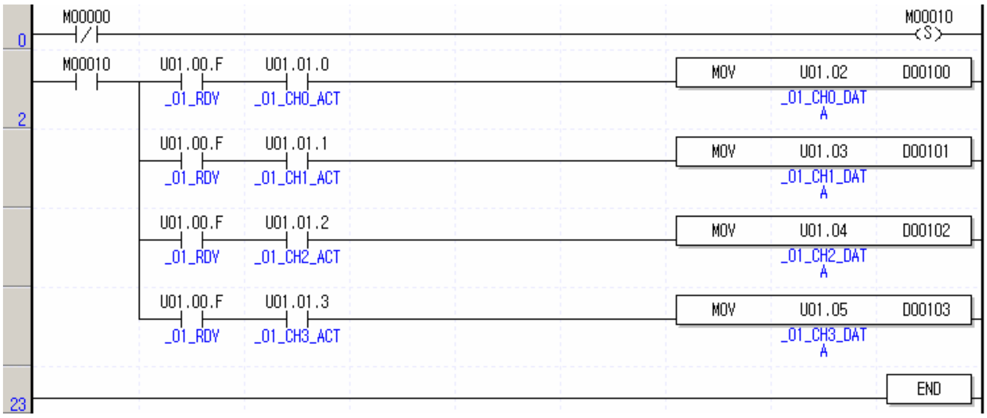
3) View variables
   A) The example program of XG5000 is as shown below.



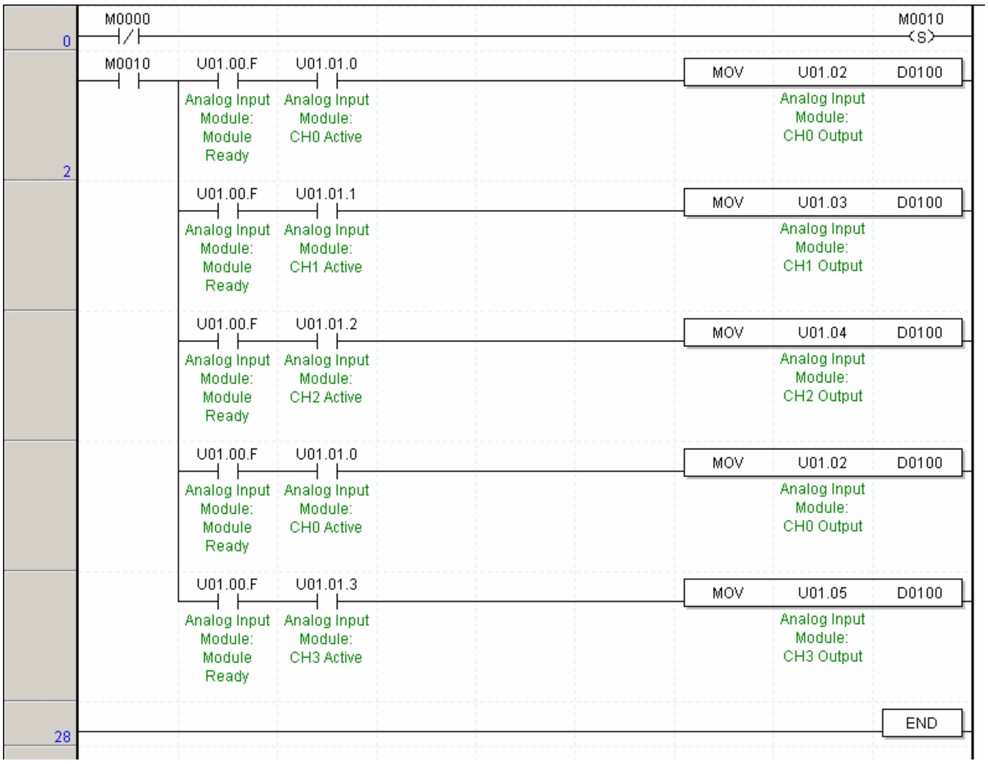
B) Select [View] -> [Variables]. The devices are changed into variables.



C) Select [View] -> [Devices/Variables]. Devices and variables are both displayed.



D) Select [View] -> [Device/Comments]. Devices and comments are both displayed.



12.1.12 Configuration and function of internal memory

A/D conversion module has the internal memory to transmit/receive data to/from PLC CPU.

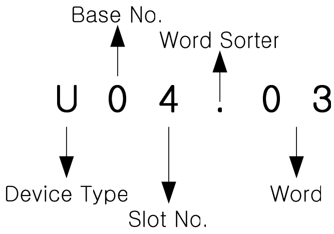
1) I/O area of A/D converted data

I/O area of A/D converted data is as displayed in table.

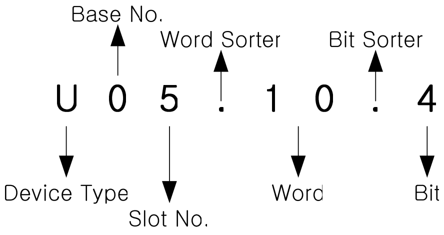
Device assigned	Details	R/W	Sign direction
UXY.00.0 UXY.00.F	Module ERROR flag Module READY flag	R	A/D → CPU
UXY.01.0 UXY.01.1 UXY.01.2 UXY.01.3	CH0 Run flag CH1 Run flag CH2 Run flag CH3 Run flag	R	A/D → CPU
UXY.02	Ch0 digital output value	R	A/D → CPU
UXY.03	Ch1 digital output value	R	
UXY.04	Ch2 digital output value	R	
UXY.05	Ch3 digital output value	R	
UXY.11.0	Flag to request error clear	W	CPU → A/D

A) In the device assigned, X stands for the Base No. and Y for the Slot No. on which module is installed.

B) In order to read 'CH1 digital output value' of A/D conversion module installed on Base No.0, Slot No.4, it shall be displayed as U04.03.



C) In order to read 'Flag to detect CH4 disconnection' of A/D conversion module installed on Base No.0, Slot No.5, it shall be displayed as U05.10.4.



2) Operation parameters setting area

Setting area of A/D conversion module's Run parameters is as described in Table.

Memory address		Details	R/W	Remark
Hex.	Dec.			
0_H	0	Channel enable/disable setting	R/W	PUT
1_H	1	Setting ranges of input voltage/current	R/W	PUT
2_H	2	Output data format setting	R/W	PUT
3_H	3	Filter processing enable/disable setting	R/W	PUT
4_H	4	CH0 filter constant	R/W	PUT
5_H	5	CH1 filter constant		
6_H	6	CH2 filter constant		
7_H	7	CH3 filter constant		
C_H	12	Average processing enable/disable setting	R/W	PUT
D_H	13	Average processing method setting	R/W	
E_H	14	CH0 average value	R/W	
F_H	15	CH1 average value		
10_H	16	CH2 average value		
11_H	17	CH3 average value		
16_H	22	Error code	R/W	GET

※R/W is to denote Read/Write if available from PLC program.

3) Module READY/ERROR flag (UXY.00, X: Base No., Y: Slot No.)

A) UXY.00.F**:** It will be ON when PLC CPU is powered or reset with A/D conversion ready to process A/D conversion.

B) UXY.00.0**:** It is a flag to display the error status of A/D conversion module.

	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
UXY.00	RDY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	ERR

⇩ Module READY
Bit ON (1): READY, Bit Off (0): NOT READY

⇩ Error information
Bit ON (1): Error, Bit Off (0): Normal

4) Run channel flag (UXY.01, X: Base No., Y: Slot No.)
The area where Run information of respective channels is saved. (XGB series base number is 0)

UXY.01

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—	—	—	—	—	CH3	CH2	CH1	CH0

Run channel information
Bit ON (1): During Run, Bit Off (0): Operation Stop

5) Digital output value (UXY.02 ~ UXY.09, X: Base No., Y: Slot No.)

A) A/D converted-digital output value will be output to buffer memory addresses 2 ~ 5 (UXY.02 ~ UXY.05) for respective channels.

B) Digital output value will be saved in 16-bit binary.

UXY.02 ~ UXY.09

<table>
<tr><th>B15</th><th>B14</th><th>B13</th><th>B12</th><th>B11</th><th>B10</th><th>B9</th><th>B8</th><th>B7</th><th>B6</th><th>B5</th><th>B4</th><th>B3</th><th>B2</th><th>B1</th><th>B0</th></tr>
<tr><td colspan="16">Channel # digital output value</td></tr>
</table>

Address	Details
Address No.2	CH0 digital output value
Address No.3	CH1 digital output value
Address No.4	CH2 digital output value
Address No.5	CH3 digital output value

6) Flag to request error clear (UXY.11.0, X: Base No., Y: Slot No.)

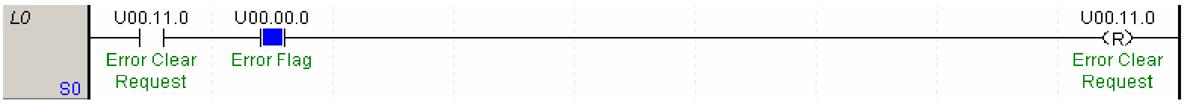
A) If a parameters setting error occurs, address No.22's error code will not be automatically erased even if parameters are changed correctly. At this time, turn the 'error clear request' bit ON to delete address No.22's error code and the error displayed in XG5000's [System Monitor]. In addition, RUN LED which blinks will be back to On status.

B) The 'flag to request error clear' shall be used surely together with UXY.00.0 attached thereon for guaranteed Normal operation.
(XGB series base number is 0)

UXY.11.0

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	ECR

Flag to request error clear (UXY.11.0)
Bit ON (1): Error clear request, Bit Off (0): Error clear standing-by



[How to use the flag to]

7) Error code (22 address)

A) It saves the error code detected from A/D conversion module.
B) Error type and details is as below.

Address“ 22”

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—	Error code							

Error code (Dec.)	Details	Remark
0	Normal operation	RUN LED flickering
50#	Exceeding of filter constant setting range	Flickering RUN LED per 1 second
60#	Exceeding of time average setting range	
70#	Exceeding of Frequency average setting range	
80#	Setting error of analog input range	

※ # of the error codes stands for the channel with error found.

C) If 2 or more errors occur, the module sill not save other error codes than the first error code found.
D) If an error found is corrected, use the ‘flag to request error clear’, or let power OFF → ON in order to stop LED blinking and to delete the error code.

12.1.13 Program to sort A/D converted value in size

1) System configuration

XBM-DR16S	XBF-AD04A	XBE-RY16A

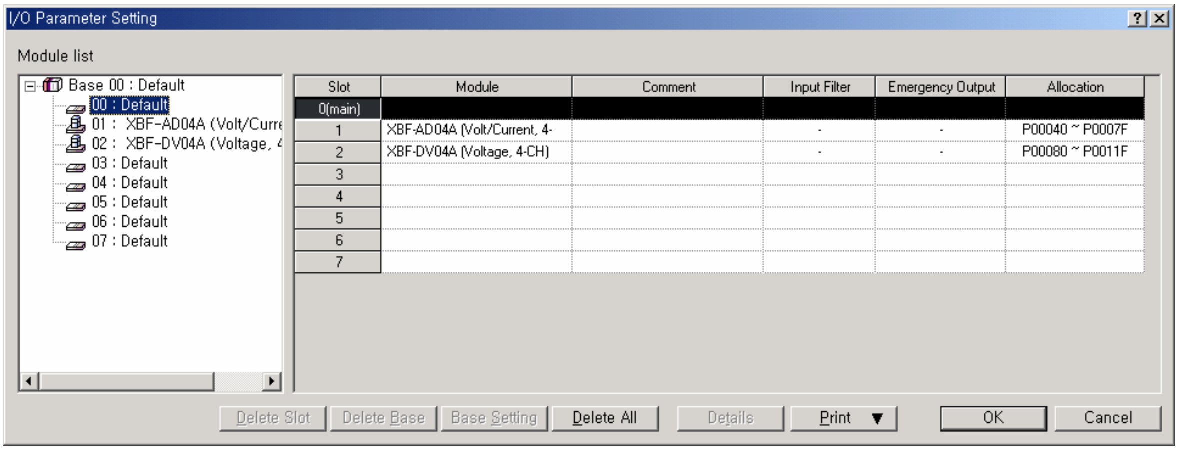
2) Initial setting

No.	Item	Details	Internal memory address	The value to write in internal memory
1	Channel	Ch0, Ch1, Ch2	0	h0007
2	Input voltage range	0 ~ 10 V	1	h0000
3	Output data range	0 ~ 4000	2	h0000
4	Filter process	Ch0	3	h0001
5	Ch0 filter constant	50	4	50
6	Average process	Ch1, Ch2	12	h0006
6	Average process method	Frequency average: Ch1 Time average: Ch2	13	h0100
7	Average value	Frequency average value: 100 (times)	15	100
		Time average value: 200 (ms)	16	200

3) Program
   A) If Ch 0's digital value is less than 3000, Contact No. 0 (P00080) of relay output module installed on Slot No.2 will be On.
   B) If CH 1's digital value is greater than 3200, Contact No.2 (P00082) of relay output module installed on Slot No.2 will be On.
   C) If CH 2's digital value is greater than or equal to 3000 and less than or equal to 3200, Contact No.4 (P00086) of relay output module installed on Slot No.2 will be On.
   D) If CH 2's digital value is equal to 3200, Contact No.5 (P00085) of relay output module installed on Slot No.2 will be On.

4) Program

A) Program example using [I/O Parameters]

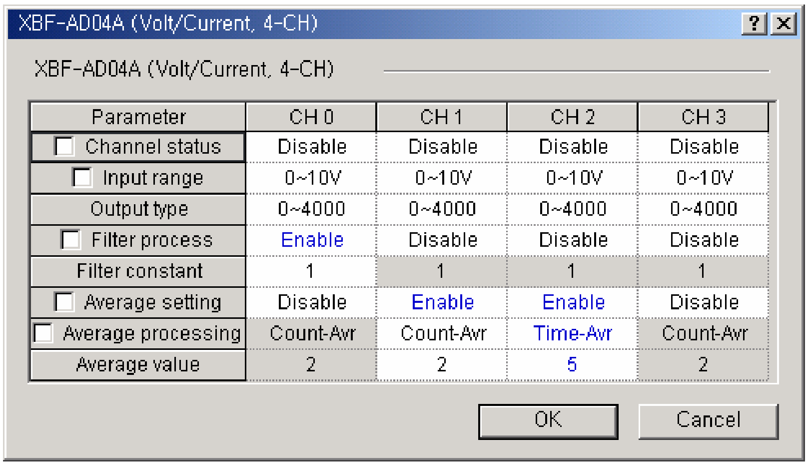


I/O Parameter Setting

Module list

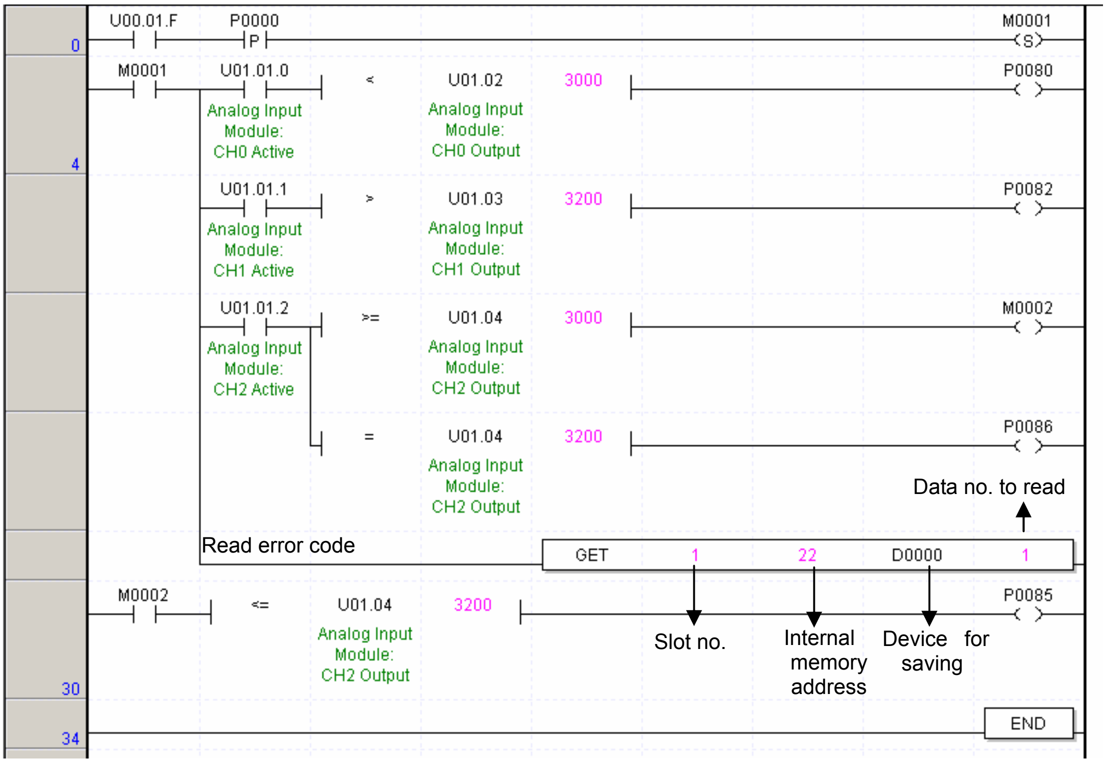
- Base 00 : Default
  - 00 : Default
  - 01 : XBF-AD04A (Volt/Curre
  - 02 : XBF-DV04A (Voltage, 4
  - 03 : Default
  - 04 : Default
  - 05 : Default
  - 06 : Default
  - 07 : Default

Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1	XBF-AD04A (Volt/Current, 4-		-	-	P00040 ~ P007F
2	XBF-DV04A (Voltage, 4-CH)		-	-	P00080 ~ P0011F
3					
4					
5					
6					
7					

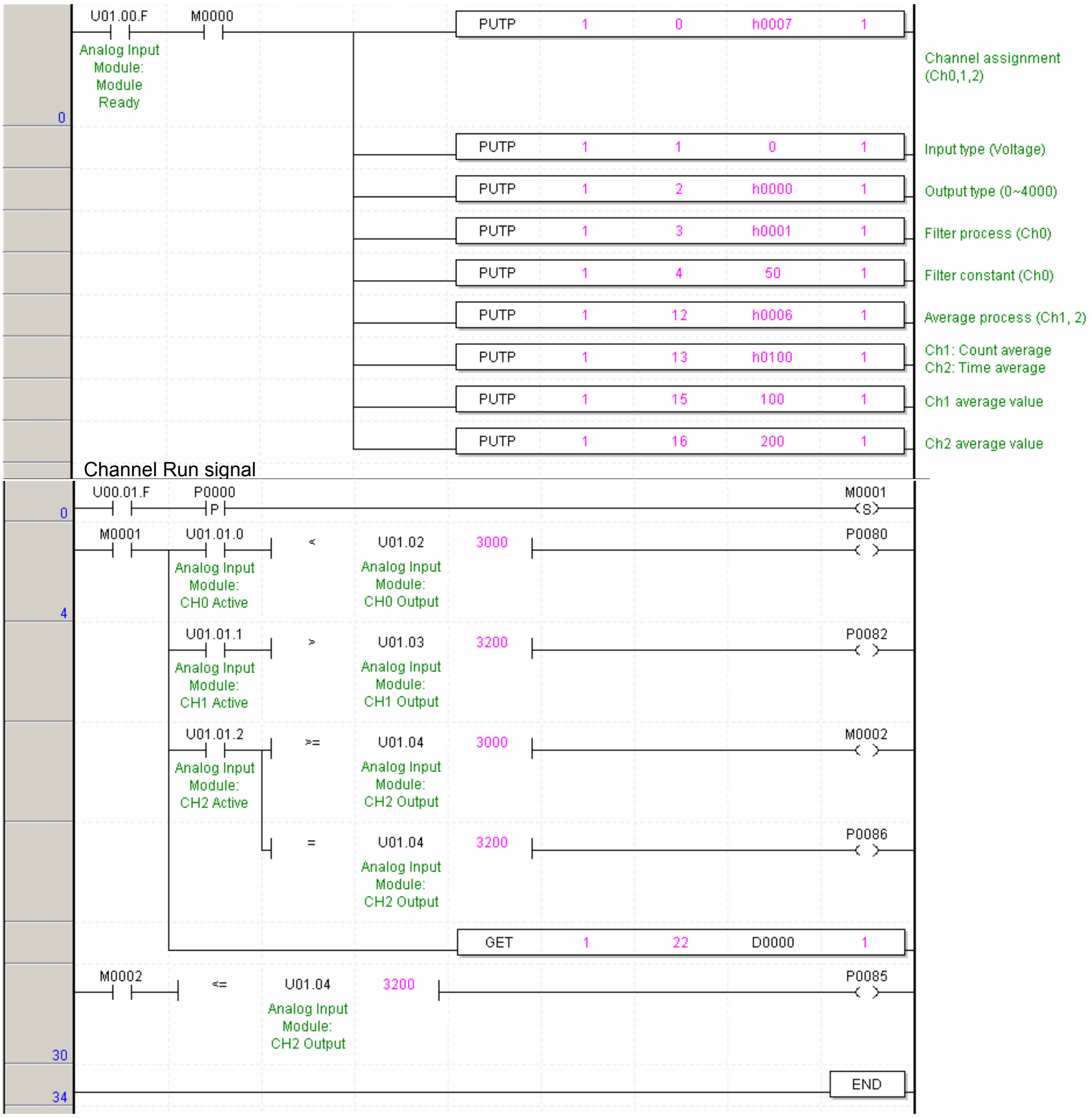


XBF-AD04A (Volt/Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Input range	0~10V	0~10V	0~10V	0~10V
Output type	0~4000	0~4000	0~4000	0~4000
☐ Filter process	Enable	Disable	Disable	Disable
Filter constant	1	1	1	1
☐ Average setting	Disable	Enable	Enable	Disable
☐ Average processing	Count-Avr	Count-Avr	Time-Avr	Count-Avr
Average value	2	2	5	2



B) Program example of PUT/GET instruction used



If A/D conversion value of Ch4 is 3000 or more and 3200 or less, P0085 is changed to On status. ~~204~~

12.2 Analog Output Module

12.2.1 Performance specification

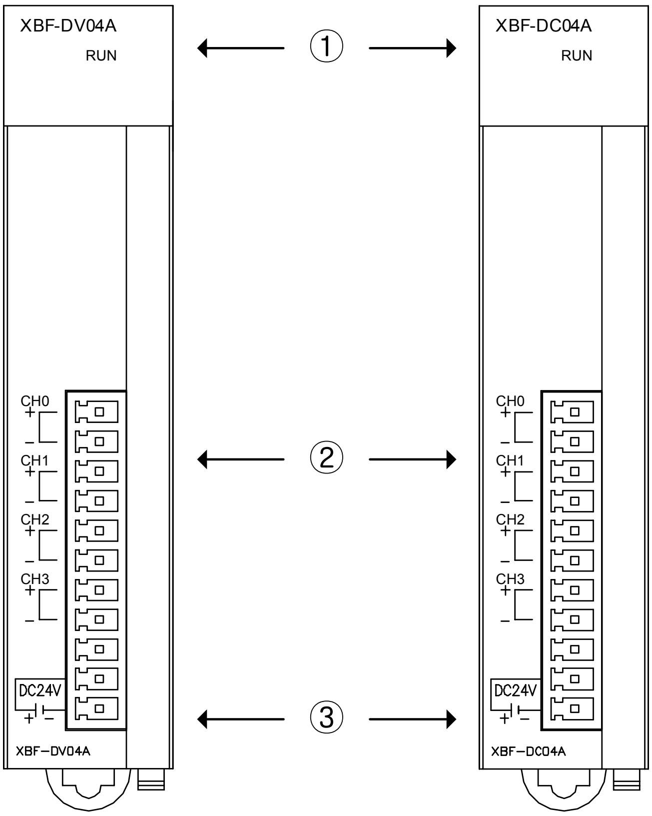
Performance specifications of D/A conversion module(XBF-DV04A and XBF-DC-04A) are as specified in table below.

Item			Specification	
			XBF-DV04A	XBF-DC04A
Analog output	Type		Voltage	Current
	Range		DC 0 ~ 10V (Load resistance: 2kΩ or more)	DC 4 ~ 20mA DC 0 ~ 20mA (Load resistance: 510Ω or less)
Digital input	Type		12-bit binary data	
	Range	Signed value	0 ~ 4000	0 ~ 4000
		Unsigned value	-2000 ~ 2000	-2000 ~ 2000
		Precise value	0 ~ 1000	400 ~ 2000/0 ~ 2000
		Percentile value	0 ~ 1000	0 ~ 1000
Maximum resolution			2.5㎷(1/4000)	5㎂(1/4000)
Accuracy			±0.5% or less	
Maximum conversion speed			1㎳/channel	
Absolute maximum output			DC ±15V	DC +25㎃
Number of maximum channel			4 channels	
Insulation method			Photo-coupler insulation between input terminal and PLC power (no insulation between channels)	
Terminal connected			11-point terminal block	
I/O points occupied			Fixed type: 64 points	
Current consumption	Internal (DC 5V)		110mA	110mA
	External (DC 21.6 ~26.4V)		70mA	120mA
Weight			64g	70g

Remark

1) You may set a range of digital input and an analog output with parameters or a program by channels.
2) When D/A conversion module is released from the factory, Offset/Gain value is as adjusted for respective analog output ranges, which is unavailable for user to change.
3) Offset Value: Digital input value when analog output value reaches 0V (0mA) while analog output type is Unsigned Value type.
4) Gain Value: Digital input value when analog output value reaches 0V (0mA) while analog output type is Unsigned Value type.

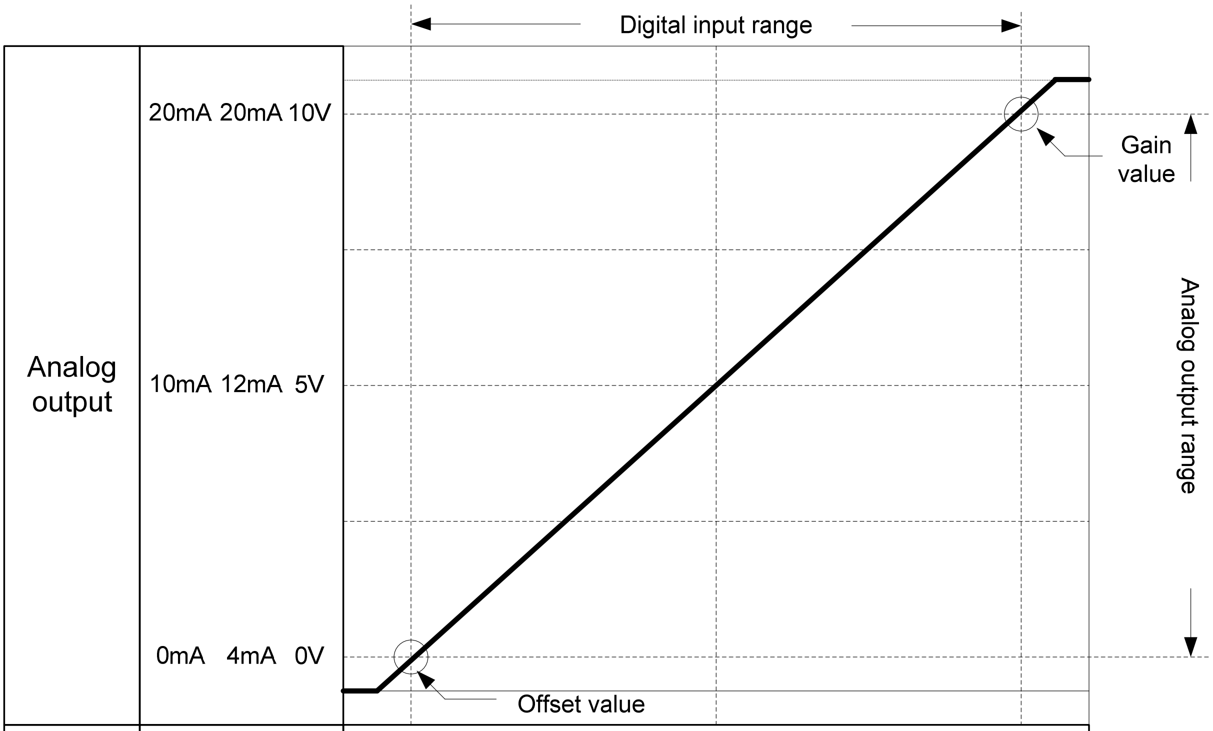
12.2.2 Name of part and function



No.	Description
①	RUN LED It displays the operation status of D/A conversion module - On: Normal operation status - Flickering: Error occurred - Off: Power off or abnormal status of the module
②	Analog output terminal (Voltage, Current) It is an output terminal to connect an analog output (Voltage, Current) of each channel to external machinery and tools.
③	External power input terminal It is an external DC 24V input terminal that supplies power for an analog output (voltage, current).

12.2.3 Characteristic of I/O conversion

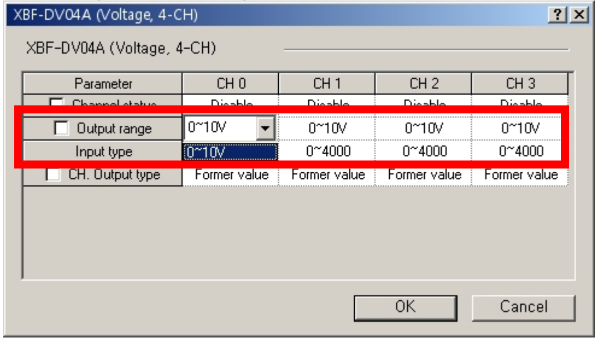
Characteristic of I/O conversion converts a digital input into an analog output (voltage, current) and displays a straight line with the gradient as shown below. The range of digital input is shown with Unsigned Value, Signed Value, Precise Value, and Percentile Value such as the graph below.



Digital input	Unsigned value	-48	0	2000	4000	4047
	Singed value	-2048	-2000	0	2000	2047
	Precise value	-12	0	500	1000	1011
		381	400	1200	2000	2018
		-24	0	1000	2000	2023
	Percentile value	-12	0	500	1000	1011

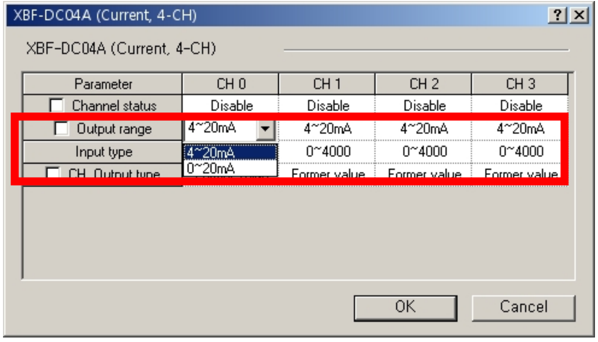
12.2.4 Input/Output characteristic of XBF-DV04A, XBF-DC04A

The range of a voltage output is DC 0 ~ 10V and a current output is DC 4 ~ 20mA / DC 0 ~ 20mA.



XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Output range	0~10V	0~10V	0~10V	0~10V
Input type	0~10V	0~4000	0~4000	0~4000
☐ CH. Output type	Former value	Former value	Former value	Former value



XBF-DC04A (Current, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Output range	4~20mA	4~20mA	4~20mA	4~20mA
Input type	4~20mA 0~20mA	0~4000	0~4000	0~4000
☐ CH. Output type		Former value	Former value	Former value

Digital input value toward analog voltage output is shown below.
Resolution: 2.5mV(1/4000), Accuracy: within ±0.5%

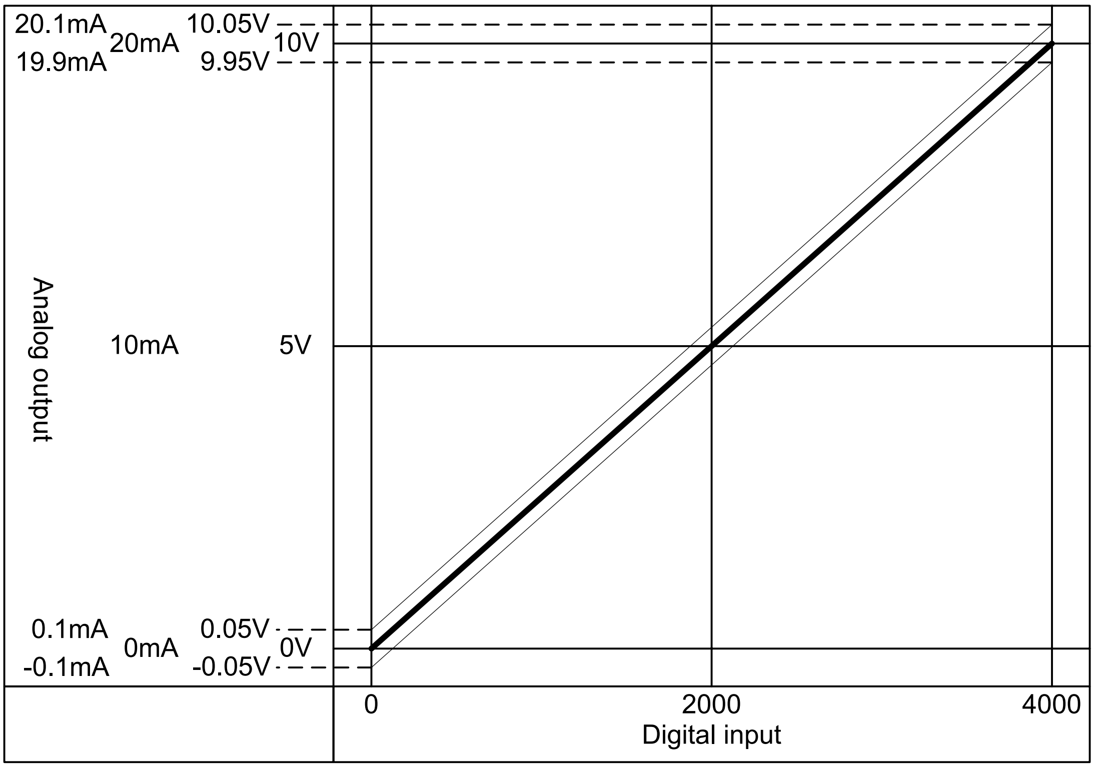
The range of digital input	Analog voltage output						
	under 0V	**0V**	**2.5V**	**5V**	**7.5V**	**10V**	**over 10V**
Unsigned value (-48 ~ 4047)	under 0	0	1000	2000	3000	4000	over 4000
Signed value (-2048 ~ 2047)	under -2000	-2000	-1000	0	1000	2000	over 2000
Precise value (-12 ~ 1011)	under 0	0	250	500	750	1000	over 1000
Percentile value (-12 ~ 1011)	under 0	0	250	500	750	1000	over 1000

Digital input value toward analog current output is shown below.
Resolution: 5μA(1/4000), Accuracy: within ±0.5%

The range of digital input	Analog current output						
	under 4mA	**4mA**	**8mA**	**12mA**	**16mA**	**20mA**	**over 20mA**
	under 0mA	**0mA**	**5mA**	**10mA**	**15mA**	**20mA**	**over 20mA**
Unsigned value (-48 ~ 4047)	under 0	0	1000	2000	3000	4000	over 4000
Signed value (-2048 ~ 2047)	under -2000	-2000	-1000	0	1000	2000	over 2000
Precise value (381 ~ 2018, -24 ~ 2023)	under 400	400	800	1200	1600	2000	over 2000
	under 0	0	500	1000	1500	2000	over 2000
Percentile value (-12 ~ 1011)	under 0	0	250	500	750	1000	over 1000

12.2.5 Accuracy of XBF-DV04A, XBF-DC04A

Though the range of input is changed, the accuracy for the analog output values doesn't change. The range of accuracy is displayed at the ambient temperature of 25 ± 5 ℃ if you select unsigned value as your range of the digital input. The accuracy is satisfied ±0.5%.



12.2.6 Functions of XBF-DV04A, XBF-DC04A

Function	Details
Operation channel	1) It sets up Run/Stop of a channel that will operate an analog output. 2) You can save the time of whole operation by stopping unused channels.
The range of output	1) It sets up the range of an analog output. 2) Analog voltage output module offers one range of output (DC 0 ~ 10V) and analog current output module offers two (DC 4 ~ 20mA, DC 0 ~ 20mA).
The range of input data	1) It sets up the range of a digital input. 2) It offers four ranges of digital input.
The status of channel output	1) It sets up the output status of a channel when it switches Run to Stop. 2) It offers four types of output status.

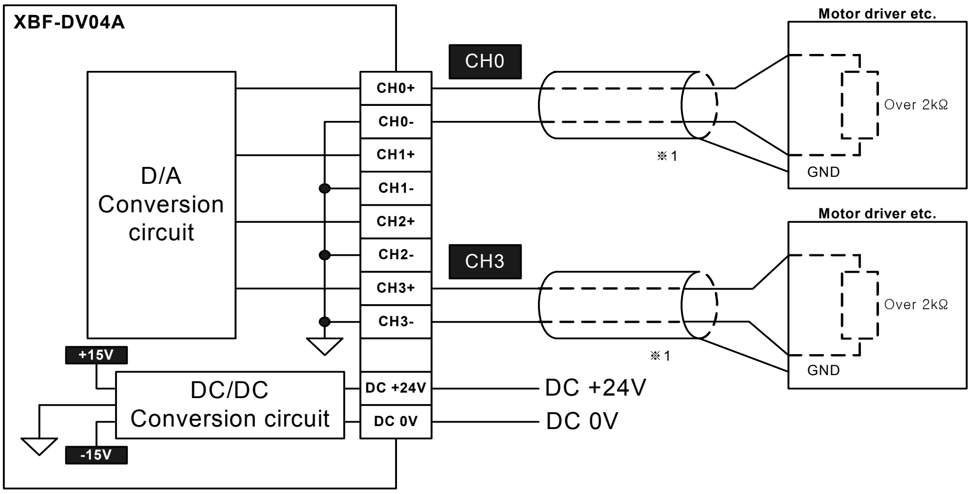
12.2.7 Wiring

Precautions for wiring

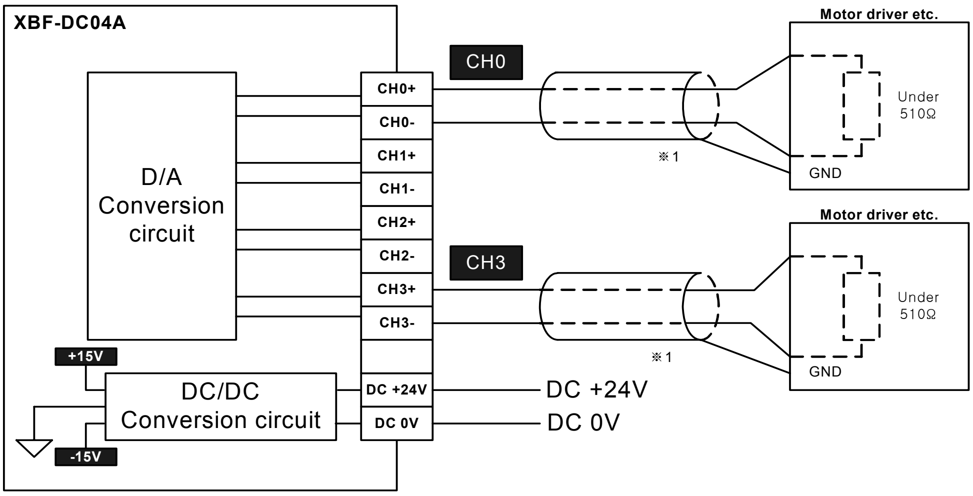
1) Use separate cable of an A.C. power line and an external output signal of an analog output module to prevent a surge or inductive noise from the A.C. side.
2) Select the cable with consideration of an ambient temperature and a permitted current limit. It is recommended over AWG22(0.3㎟).
3) Don't let the cable at close range to hot devices or materials. And don't bring it into contact with oil for a long time. These are the factors of a short circuit occurs unusual operation or damages devices.
4) Check the polarity before external power is supplied to the terminal.
5) It may produce inductive hindrance that is a cause of unusual operations or defects if you wire the cable with a high-voltage line or a power line.

Wiring example

Analog voltage output module



Analog current output module



※1: Use a 2-core twisted shielded wire.

12.2.8 Operation parameter setting

You can specify operation parameters of the analog output module through [I/O parameters] menu in XG5000.

1) Setting items

For the user's convenience, XG5000 provides GUI (Graphical User Interface) for parameters setting of analog voltage/current output module.

Followings are available through [I/O parameters] on the XG5000 project window.

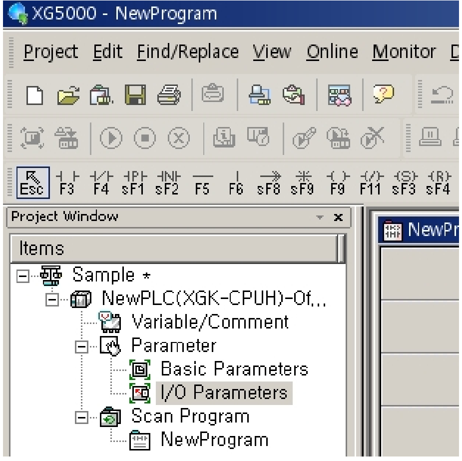
Item	Details
[I/O parameters]	(1) It specifies the following items for the module operation. – Channel Enable/Disable – Analog output range – Input type – Channel output type (2) After the parameters that user specified in XG5000 are downloaded, they will be saved to a flash memory in the CPU unit.

2) How to use [I/O parameters] menu

It is described below how to set I/O parameters based on an analog voltage output module (XBF-DV04A).

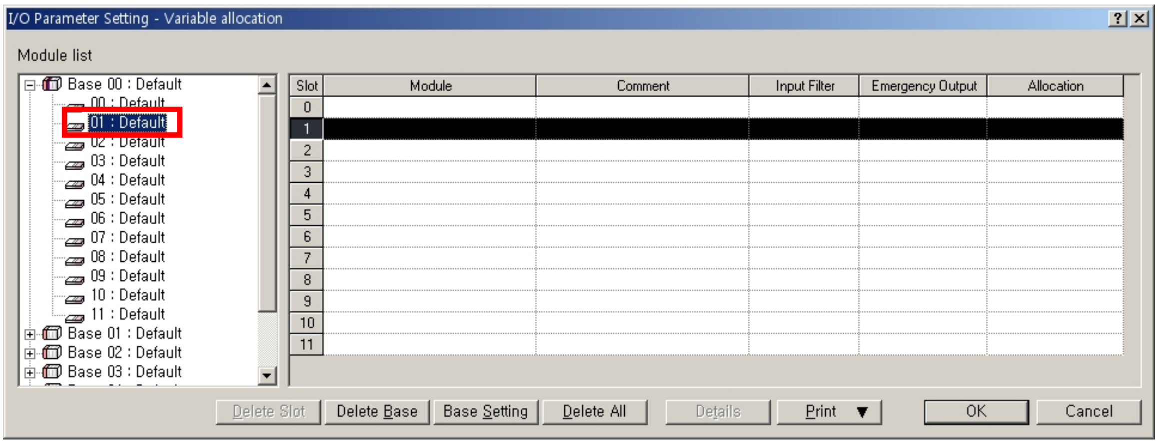
(1) Run XG5000 to create a project. (Refer to XG5000 program manual for details on how to create the project)

(2) Double-click [I/O parameters] on the project window.

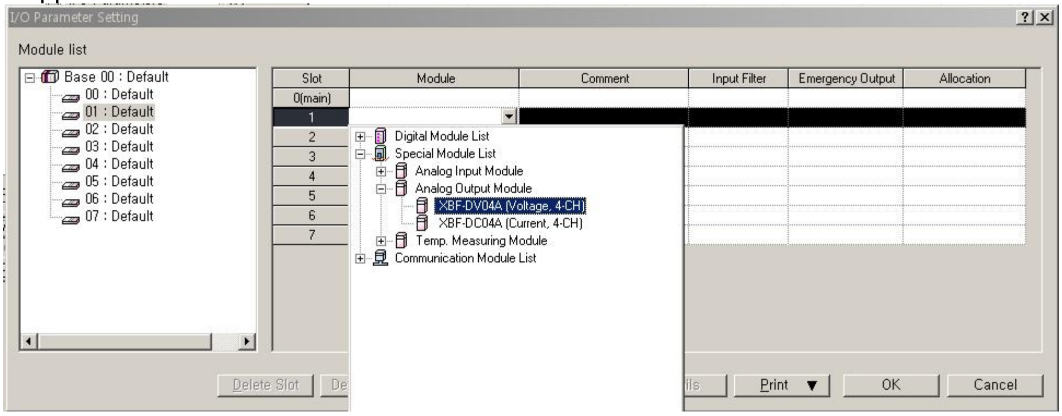


(3) If [I/O parameter setting] window is displayed, click the module area of the applicable slot to select the applicable module.

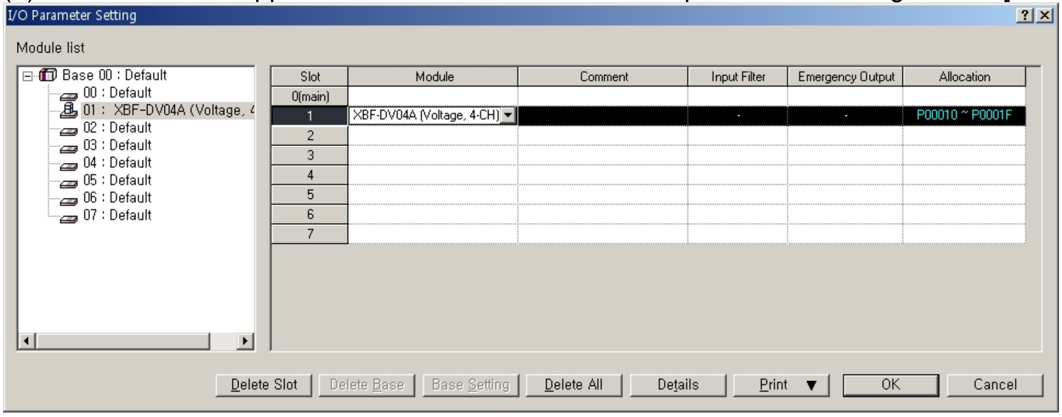
(4) Click the slot of the base that contains analog voltage output module in the [I/O Parameter Setting] window.



(5) Click the arrow button then you can see the menu to choose the applicable module. Select the applicable module.

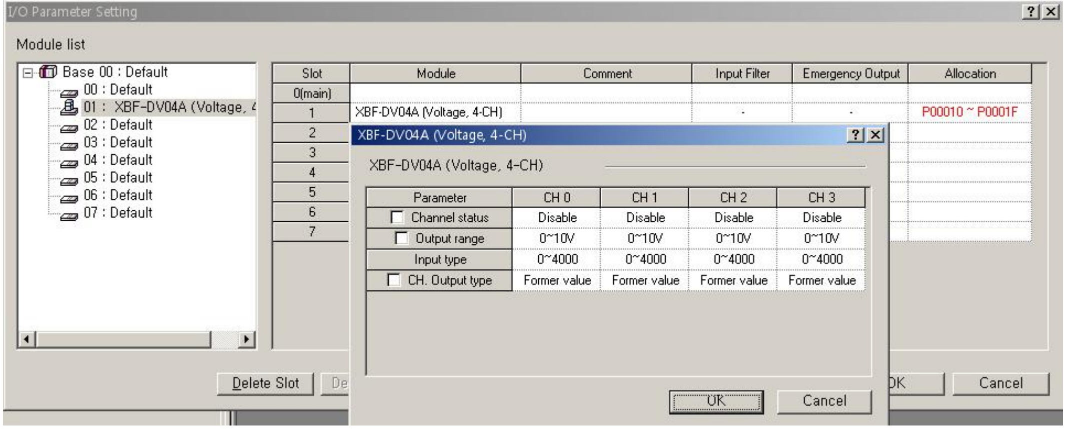


(6) Double-click the applicable slot that is selected for the parameters setting or click [Details].



Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1	XBF-DV04A (Voltage, 4-CH)		-	-	P00010 ~ P0001F
2					
3					
4					
5					
6					
7					

(7) A screen will be displayed for you to specify parameters for respective channels as shown below. Click a desired item to display parameters to set for respective items.

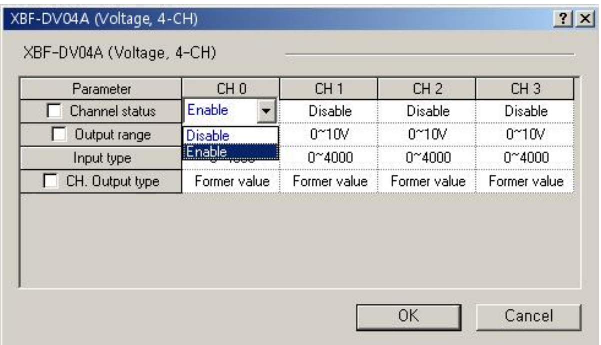


XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Disable	Disable	Disable	Disable
☐ Output range	0~10V	0~10V	0~10V	0~10V
Input type	0~4000	0~4000	0~4000	0~4000
☐ CH. Output type	Former value	Former value	Former value	Former value

※ Default value of each item is shown above.

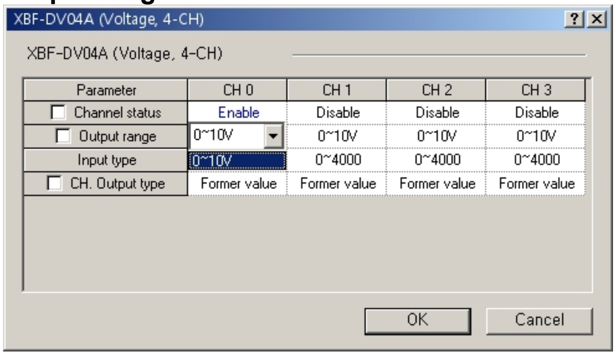
Channels



XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Enable	Disable	Disable	Disable
☐ Output range		0~10V	0~10V	0~10V
Input type		0~4000	0~4000	0~4000
☐ CH. Output type	Former value	Former value	Former value	Former value

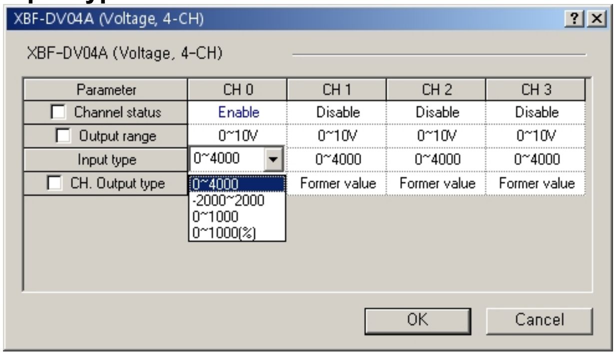
Output range



XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Enable	Disable	Disable	Disable
☐ Output range	0~10V	0~10V	0~10V	0~10V
Input type	0~10V	0~4000	0~4000	0~4000
☐ CH. Output type	Former value	Former value	Former value	Former value

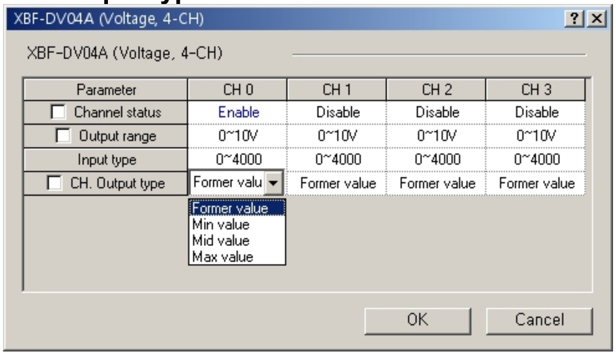
Input type



XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Enable	Disable	Disable	Disable
☐ Output range	0~10V	0~10V	0~10V	0~10V
Input type	0~4000	0~4000	0~4000	0~4000
☐ CH. Output type		Former value	Former value	Former value

CH. Output type

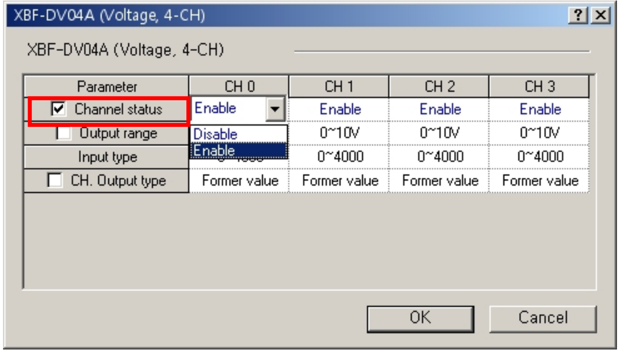


XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☐ Channel status	Enable	Disable	Disable	Disable
☐ Output range	0~10V	0~10V	0~10V	0~10V
Input type	0~4000	0~4000	0~4000	0~4000
☐ CH. Output type	Former valu	Former value	Former value	Former value

8) After finish the setting, click [OK].

9) If you want to replace the value of the whole channel at a time, check the radio button then change the value. All the channel s' values will be changed at the same time. The figure below shows an example.



XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☑ Channel status	Enable	Enable	Enable	Enable
☐ Output range		0~10V	0~10V	0~10V
Input type		0~4000	0~4000	0~4000
☐ CH. Output type	Former value	Former value	Former value	Former value

12.2.9 Special module monitoring/test

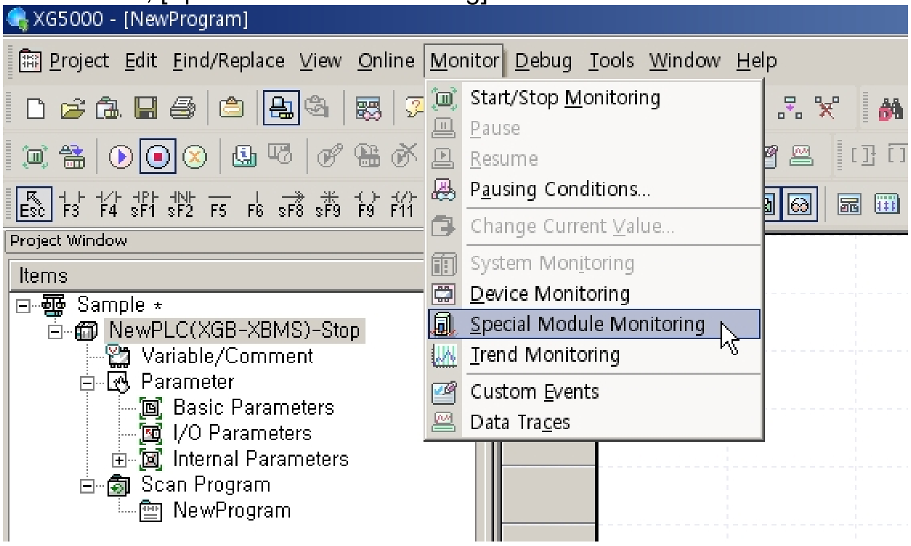
You can start to test the analog output module connecting by [Online] → [Connect] and then click [Monitor] → [Special Module Monitoring] menu in XG5000.

Remark

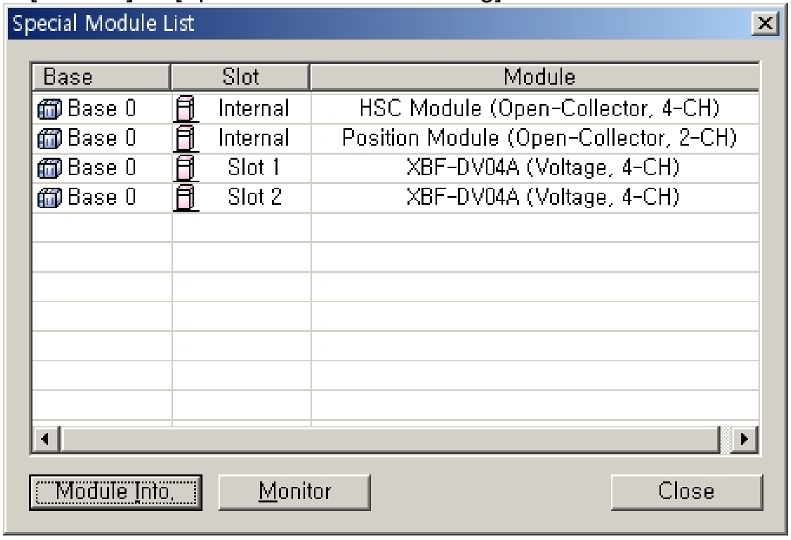
1) If the program is not displayed normally because of insufficient system resource, you may start XG5000 again after close the program and other applications.
2) I/O parameters those are specified in the state of [Special Module Monitoring] menu are temporarily set up for the test. They will be disappeared when the [Special Module Monitoring] is finished.
3) Testing of [Special Module Monitoring] is the way to test the analog output module. It can test the module without a sequence program.

Special module monitoring function is described below based on the analog voltage output module (XGF-DV04A).

1) Go through [Online] → [Connect] and [Monitor] → [Special module Monitoring] to start. If the status is not online, [Special Module Monitoring] menu will not be activated.

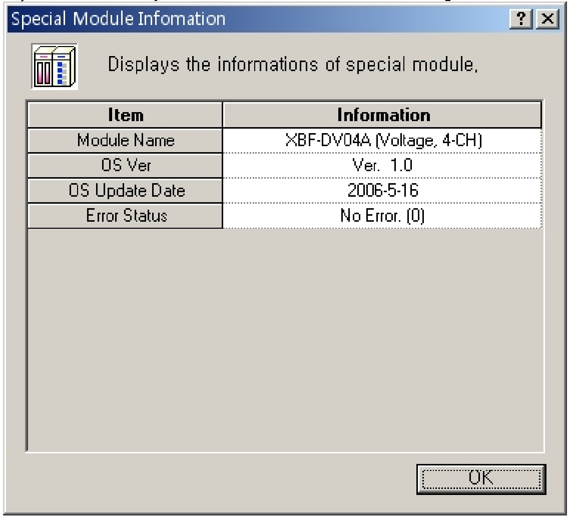


2) [Special Module List] window will show base/slot information and types of special module by click [Monitor] → [Special Module Monitoring].



Base	Slot	Module
Base 0	Internal	HSC Module (Open-Collector, 4-CH)
Base 0	Internal	Position Module (Open-Collector, 2-CH)
Base 0	Slot 1	XBF-DV04A (Voltage, 4-CH)
Base 0	Slot 2	XBF-DV04A (Voltage, 4-CH)

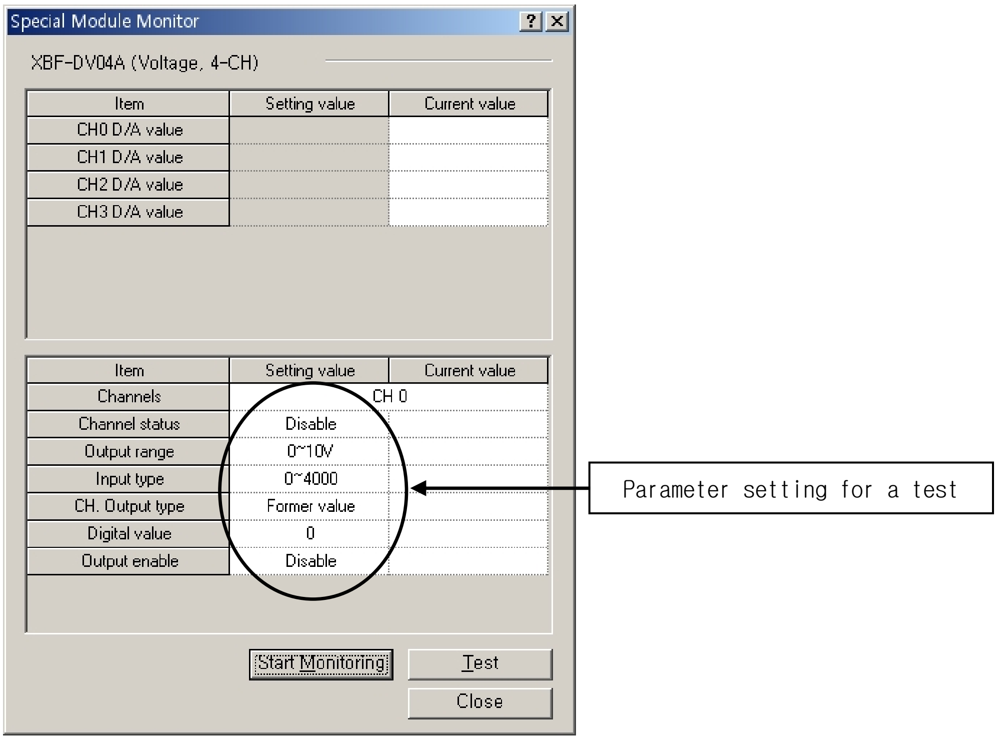
3) Select a special module then click [Module Info.] button to display the information as described below.



Displays the informations of special module.

Item	Information
Module Name	XBF-DV04A (Voltage, 4-CH)
OS Ver	Ver. 1.0
OS Update Date	2006-5-16
Error Status	No Error. (0)

4) Select a special module then click [Start Monitoring] button to display the information as described below.

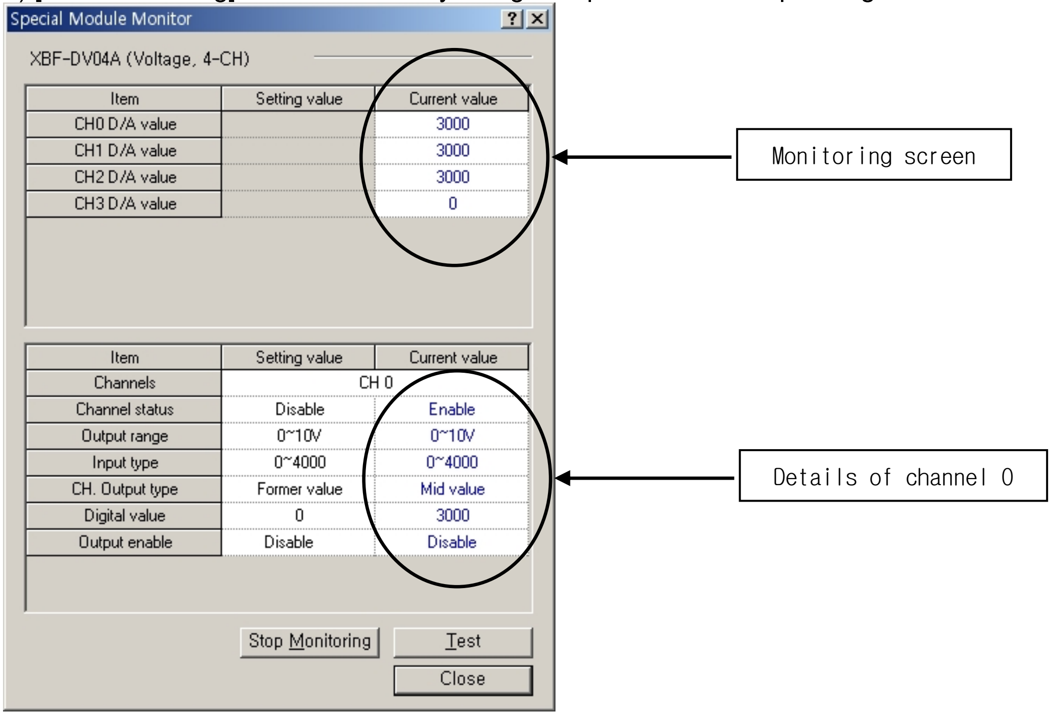


XBF-DV04A (Voltage, 4-CH)

Item	Setting value	Current value
CH0 D/A value		
CH1 D/A value		
CH2 D/A value		
CH3 D/A value		

Item	Setting value	Current value
Channels	CH 0	
Channel status	Disable	
Output range	0~10V	
Input type	0~4000	
CH. Output type	Former value	
Digital value	0	
Output enable	Disable	

5) [Start Monitoring] button will show you digital input data of the operating channel.

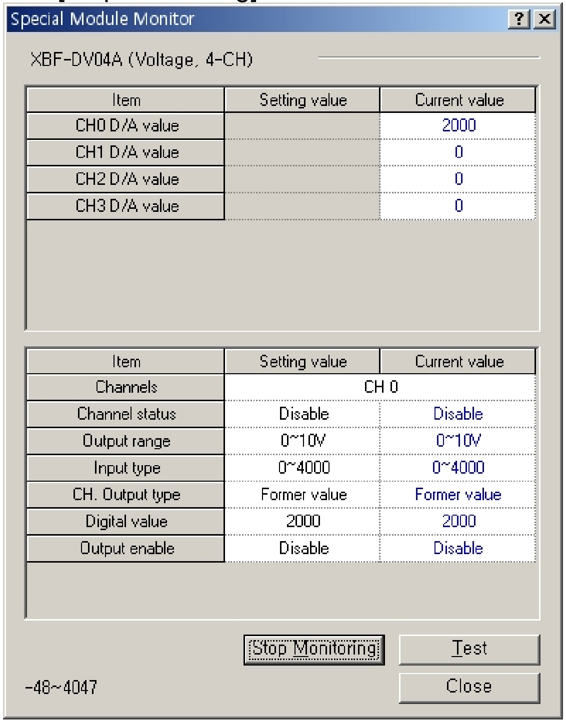


XBF-DV04A (Voltage, 4-CH)

Item	Setting value	Current value
CH0 D/A value		3000
CH1 D/A value		3000
CH2 D/A value		3000
CH3 D/A value		0

Item	Setting value	Current value
Channels	CH 0	
Channel status	Disable	Enable
Output range	0~10V	0~10V
Input type	0~4000	0~4000
CH. Output type	Former value	Mid value
Digital value	0	3000
Output enable	Disable	Disable

6) [Test] is used to change the parameters of the voltage output module. You can change the parameters when you click the values at the bottom of the screen. It is only available when XGB CPU unit’s status is in [Stop Monitoring].



XBF-DV04A (Voltage, 4-CH)

Item	Setting value	Current value
CH0 D/A value		2000
CH1 D/A value		0
CH2 D/A value		0
CH3 D/A value		0

Item	Setting value	Current value
Channels	CH 0	
Channel status	Disable	Disable
Output range	0~10V	0~10V
Input type	0~4000	0~4000
CH. Output type	Former value	Former value
Digital value	2000	2000
Output enable	Disable	Disable

-48~4047

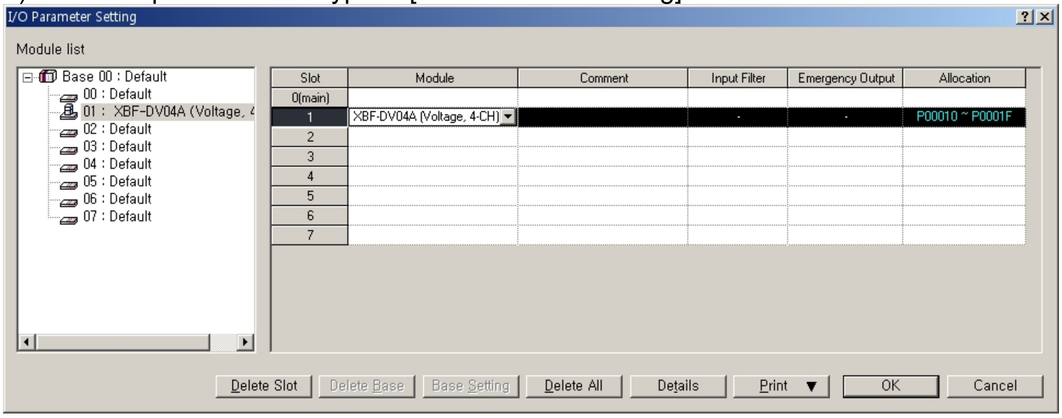
7) [Close] is used to escape from the monitoring/test screen.

12.2.10 Register U devices

Register the variables for each module referring to the special module information that is set in the I/O parameter. The user can modify the variables and comments.

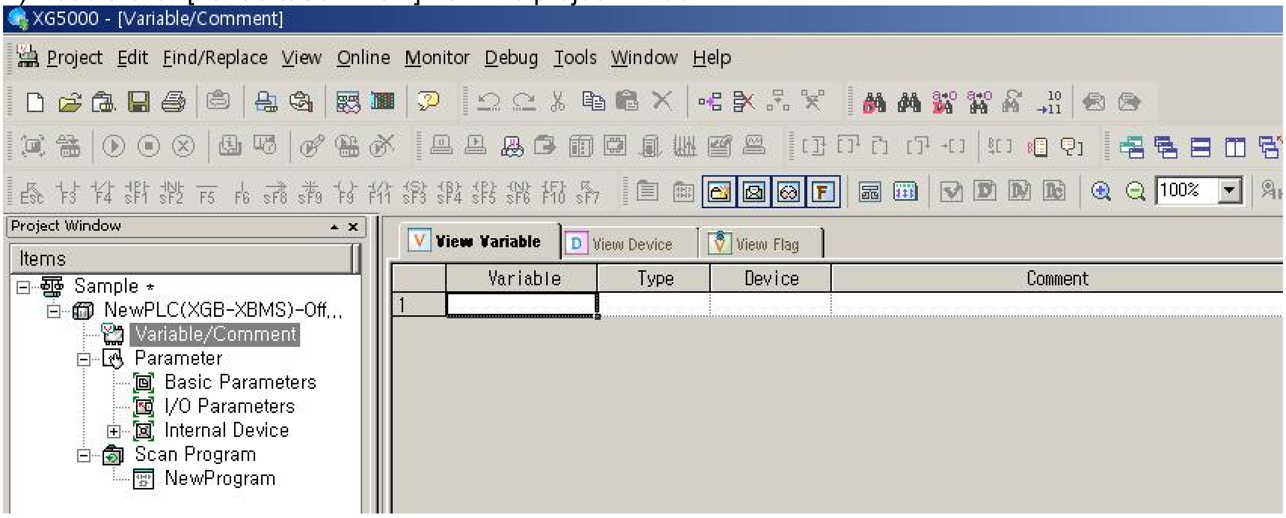
This section describes the automatic registration function of the U device based on analog voltage output module (XBF-DV04A).

1) Select a special module type in [I/O Parameter Setting] window.



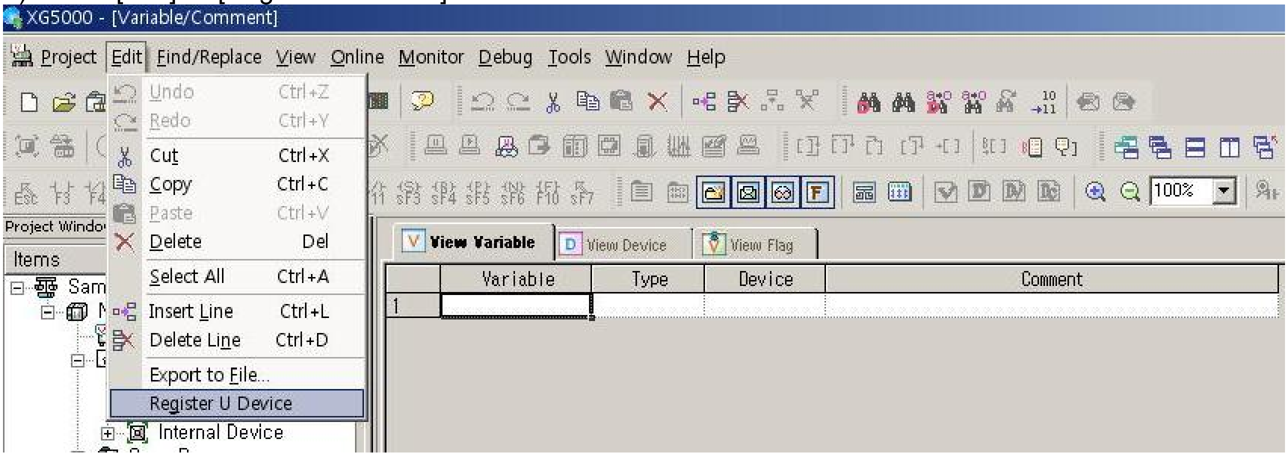
Slot	Module	Comment	Input Filter	Emergency Output	Allocation
0(main)					
1	XBF-DV04A (Voltage, 4-CH)		-	-	P00010 ~ P0001F
2					
3					
4					
5					
6					
7					

2) Double-click [Variable/Comment] from the project window.



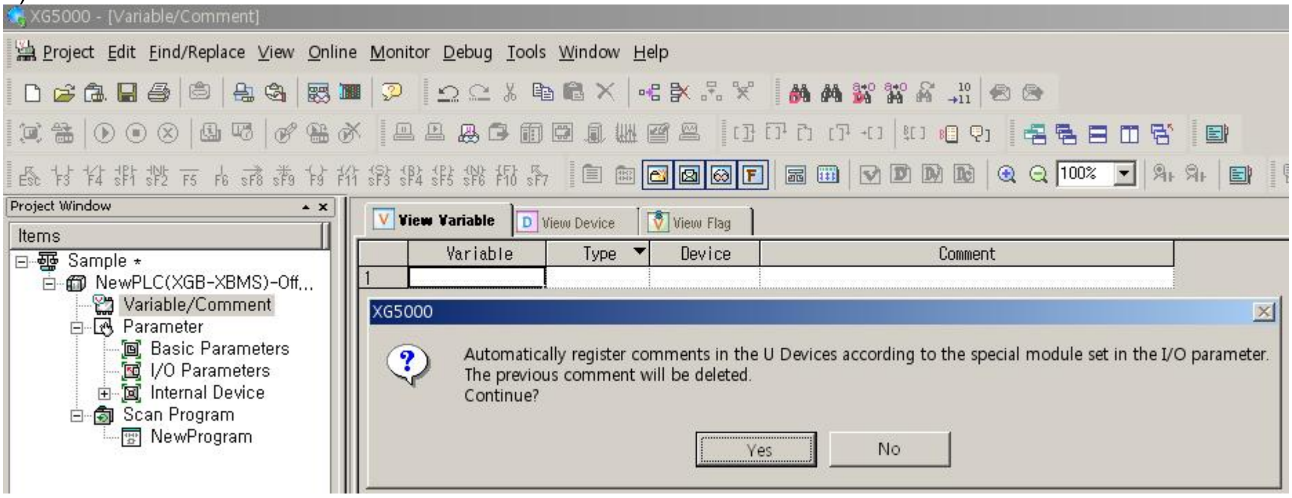
	Variable	Type	Device	Comment
1				

3) Select [Edit] → [Register U Device].



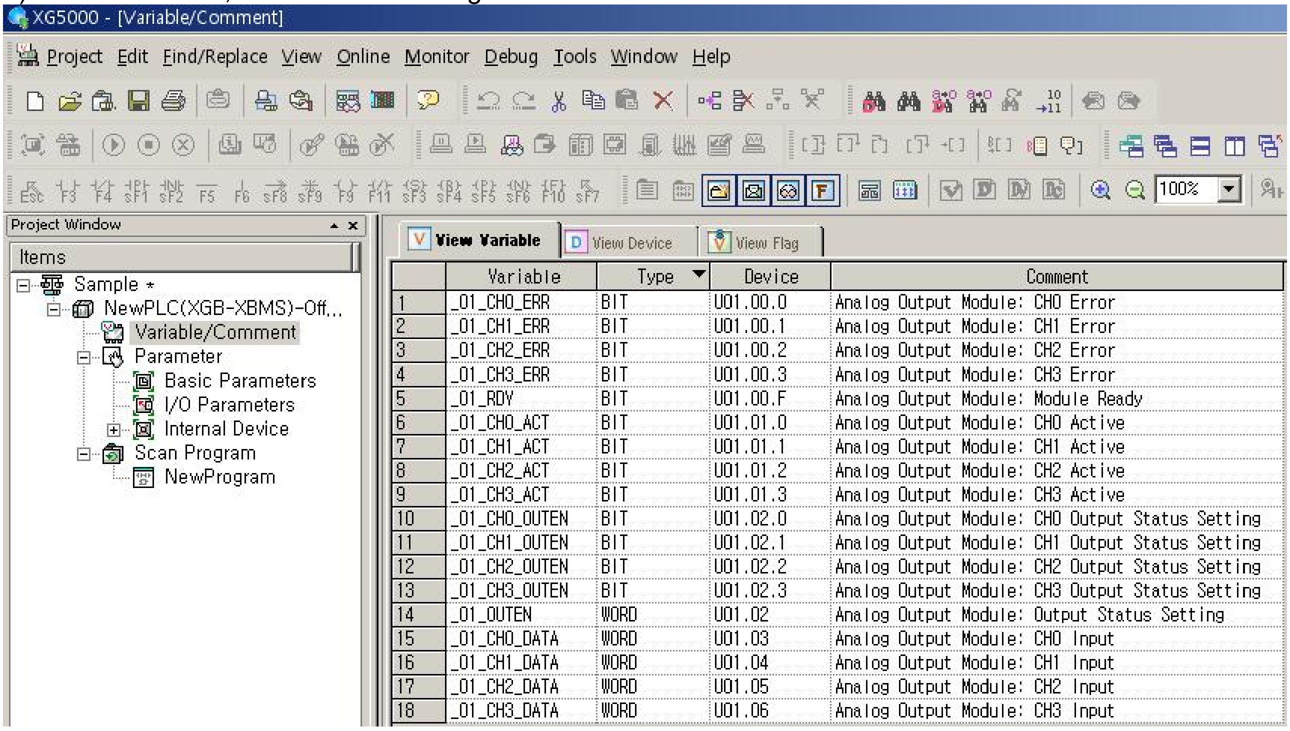
	Variable	Type	Device	Comment
1				

4) Click ‘Yes’.



Automatically register comments in the U Devices according to the special module set in the I/O parameter.
The previous comment will be deleted.
Continue?

5) As shown below, the variables are registered.



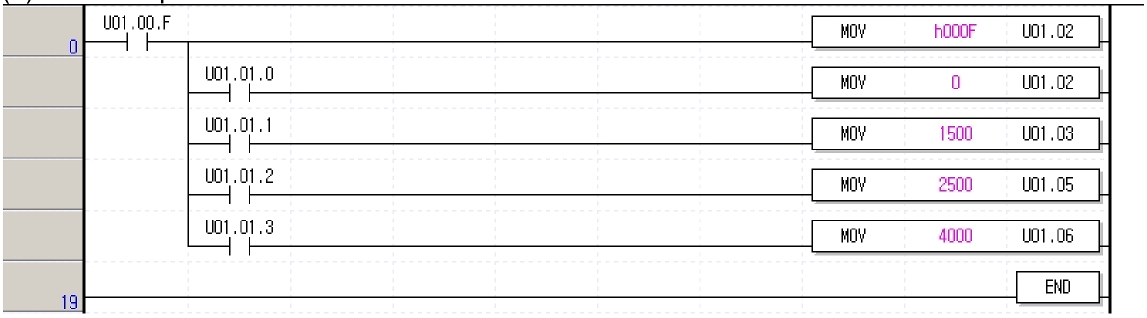
	Variable	Type	Device	Comment
1	_01_CH0_ERR	BIT	U01.00.0	Analog Output Module: CH0 Error
2	_01_CH1_ERR	BIT	U01.00.1	Analog Output Module: CH1 Error
3	_01_CH2_ERR	BIT	U01.00.2	Analog Output Module: CH2 Error
4	_01_CH3_ERR	BIT	U01.00.3	Analog Output Module: CH3 Error
5	_01_RDY	BIT	U01.00.F	Analog Output Module: Module Ready
6	_01_CH0_ACT	BIT	U01.01.0	Analog Output Module: CH0 Active
7	_01_CH1_ACT	BIT	U01.01.1	Analog Output Module: CH1 Active
8	_01_CH2_ACT	BIT	U01.01.2	Analog Output Module: CH2 Active
9	_01_CH3_ACT	BIT	U01.01.3	Analog Output Module: CH3 Active
10	_01_CH0_OUTEN	BIT	U01.02.0	Analog Output Module: CH0 Output Status Setting
11	_01_CH1_OUTEN	BIT	U01.02.1	Analog Output Module: CH1 Output Status Setting
12	_01_CH2_OUTEN	BIT	U01.02.2	Analog Output Module: CH2 Output Status Setting
13	_01_CH3_OUTEN	BIT	U01.02.3	Analog Output Module: CH3 Output Status Setting
14	_01_OUTEN	WORD	U01.02	Analog Output Module: Output Status Setting
15	_01_CH0_DATA	WORD	U01.03	Analog Output Module: CH0 Input
16	_01_CH1_DATA	WORD	U01.04	Analog Output Module: CH1 Input
17	_01_CH2_DATA	WORD	U01.05	Analog Output Module: CH2 Input
18	_01_CH3_DATA	WORD	U01.06	Analog Output Module: CH3 Input

Save variables

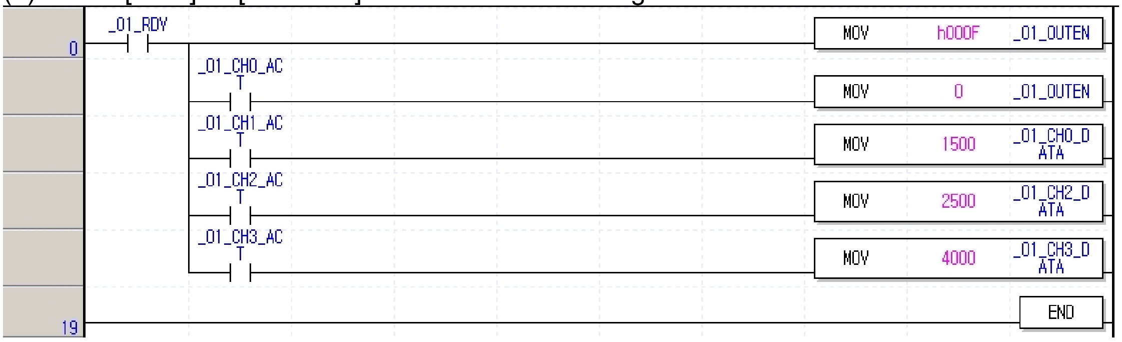
(1) The contents of ‘View Variables’ can be saved as a text file.
(2) Click [Edit] → [Export to File].
(3) The contents of ‘View Variable’ are saved as a text file.

View variables in a program

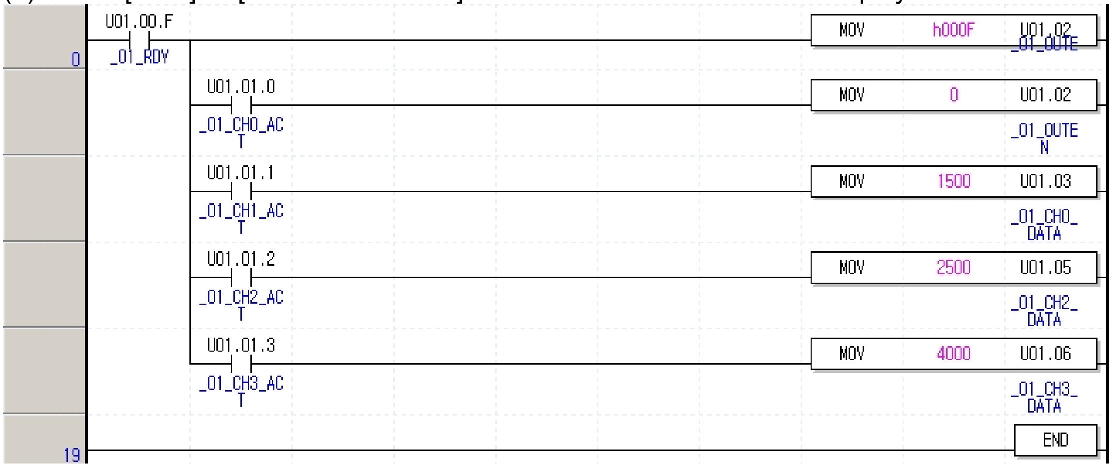
(1) The example of XG5000 is shown below.



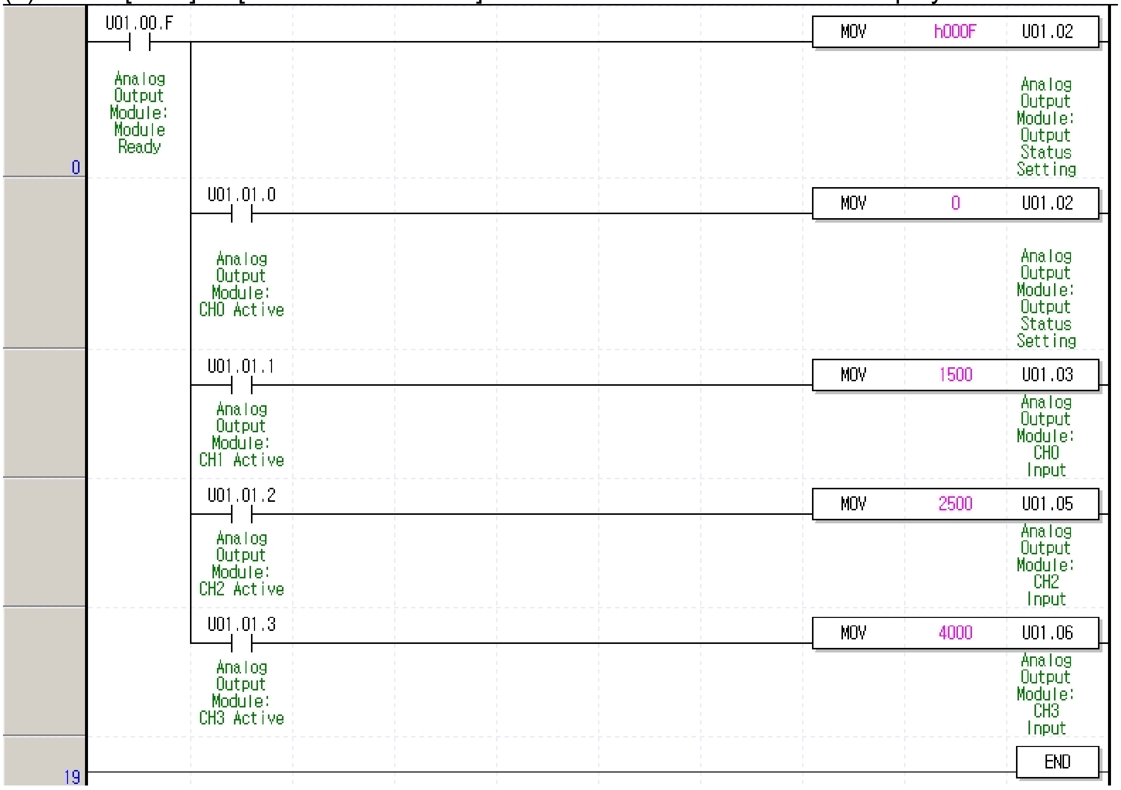
(2) Select [View] → [Variables]. The devices are changed into variables.



(3) Select [View] → [Devices/Variables]. Device and variable both are displayed.



(4) Select [View] → [Devices/Comments]. Device and comment both are displayed.



12.2.11 Internal memory

Configuration of internal memory is described below.

1) I/O area of digital/analog conversion

XBF-DV04A/XBF-DC04A

Address	Description	Details	Remarks
U0x.00	Module Ready / Error	F Bit On(1): Module Ready 0~3 Bit On(1): Channel Error	Read available
U0x.01	CH operation information	Bit On(1): Channel Run Bit Off(0): Channel Stop	
U0x.02	Output setting	Bit On(1): Output Allow Bit Off(0): Output Forbid	Read/Write available
U0x.03	CH0 digital input value	12-bit binary data	
U0x.04	CH1 digital input value		
U0x.05	CH2 digital input value		
U0x.06	CH3 digital input value		

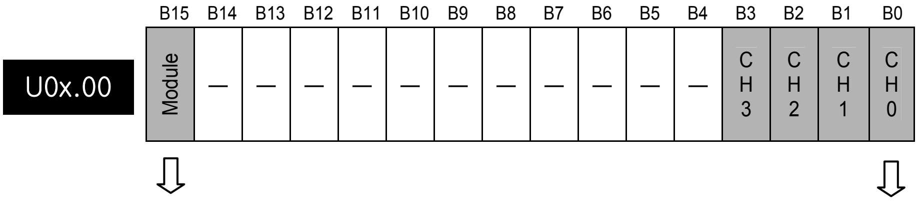
※ In the device assignment, x stands for a slot number that the module is installed.

※ In order to write ‘CH0 digital input value’ of the analog output module installed on Slot No.4, it should be named as U04.03.

(1) Module Ready/Channel Error information

a) U0x.00.F: It will be ON when XGB CPU unit is powered or reset with the condition that an analog output module has prepared to convert.

b) U0x.00.0 ~ U0x.00.3: It is the flags those display error status of each channel in the analog output module.



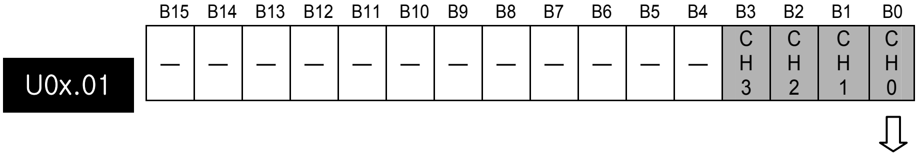
	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
U0x.00	Module	—	—	—	—	—	—	—	—	—	—	—	CH3	CH2	CH1	CH0

Module Ready
→ Bit On (1): Ready
→ Bit Off (0): Not Ready

Error information (bit)
→ Bit On (1): Error
→ Bit Off (0): Normal

(2) Channel operation information

a) This area is used to display the channel being used.



	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
U0x.01	—	—	—	—	—	—	—	—	—	—	—	—	CH3	CH2	CH1	CH0

Run channel information (bit)
→ Bit On (1): During Run
→ Bit Off (0): Operation Stop

(3) Output setting

a) Each channel can be specified enable/disable the analog output.

b) If the output is not specified, output of all the channels will be disabled.

U0x.02

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—	—	—	—	—	CH3	CH2	CH1	CH0

⇩

Output status setting (bit)
→ Bit On (1): Allowed
→ Bit Off (0): Forbidden

(4) Digital input

a) Digital input value can be selected and used within the range of -48~4047, -2048~2047, -12~1011 (381~2018/-24~2023), and -12~1011 based on input type.

b) If the digital input value is not specified, it will be set to 0.

U0x.03 ~ U0x.06

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
-	-	-	-	12-bit digital input data											

⇩

Input digital data (decimal)

Address	Details
U0x.03	Digital input value of CH0
U0x.04	Digital input value of CH1
U0x.05	Digital input value of CH2
U0x.06	Digital input value of CH3

2) Setting area of operation parameters

XBF-DV04A

Address (Dec)	Description	Details	Remarks
0	Set up the run channel	Bit On(1): Run Bit Off(0): Stop	Read/Write available
1	Set up the output voltage range	Bit (00): 0 ~ 10V	
2	Set up the input data type	Bit (00): 0 ~ 4000 Bit (01): -2000 ~ 2000 Bit (10): 0 ~ 1000 Bit (11): 0 ~ 1000	
3	Set up the output type of CH0	0: outputs the previous value 1: outputs the min. value of output range 2: outputs the mid. value of output range 3: outputs the max. value of output range	
4	Set up the output type of CH1		
5	Set up the output type of CH2		
6	Set up the output type of CH3		
11	CH0 setting error	Error code	Read available
12	CH1 setting error		
13	CH2 setting error		
14	CH3 setting error		

XBF-DC04A

Address (Dec)	Description	Details	Remarks
0	Set up the run channel	Bit On(1): Run Bit Off(0): Stop	Read/Write available
1	Set up the output voltage range	Bit (00): 4 ~ 20mA Bit (01): 0 ~ 20mA	
2	Set up the input data type	Bit (00): 0 ~ 4000 Bit (01): -2000 ~ 2000 Bit (10): 400 ~ 2000/0 ~ 2000 Bit (11): 0 ~ 1000	
3	Set up the output type of CH0	0: outputs the previous value 1: outputs the min. value of output range 2: outputs the mid. value of output range 3: outputs the max. value of output range	
4	Set up the output type of CH1		
5	Set up the output type of CH2		
6	Set up the output type of CH3		
11	CH0 setting error	Error code	Read available
12	CH1 setting error		
13	CH2 setting error		
14	CH3 setting error		

(1) Setting up the run channel

If the run channel is not specified, all the channels will be set to Stop.

	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Address “0”	-	—	—	—	—	—	—	—	—	—	—	—	CH3	CH2	CH1	CH0

⇩

Run channel (bit)

→ 1: Run

→ 0: Stop

(2) Setting up the output voltage/current range

The range of analog output voltage is DC 0 ~ 10V and analog output current is DC 4 ~ 20mA, DC 0 ~ 20mA.

	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Address "1"	-	—	—	—	—	—	—	—	CH 3		CH 2		CH 1		CH 0	

⇩

Output range (bit)
→ 00: 0 ~ 10V(4 ~ 20mA)
→ 01: 0 ~ 20mA

(3) Setting up the input data type

a) Input type can be specified for respective channels.

b) If input data type is not specified, all the channels will be set to the range of 0 ~ 4000.

	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Address "2"	-	—	—	—	—	—	—	—	CH 3		CH 2		CH 1		CH 0	

⇩

Input data type (bit)
→ 00: 0 ~ 4000
→ 01: -2000 ~ 2000
→ 10: 0 ~ 1000(400 ~ 2000/0 ~ 2000)
→ 11: 0 ~ 1000

(4) Setting up the output type

a) It defines an analog output status when XGB CPU unit is stopped.

b) The range is 0 ~3 and used devices are regarded as Words.

	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Address "3" ~ Address "6"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Value	

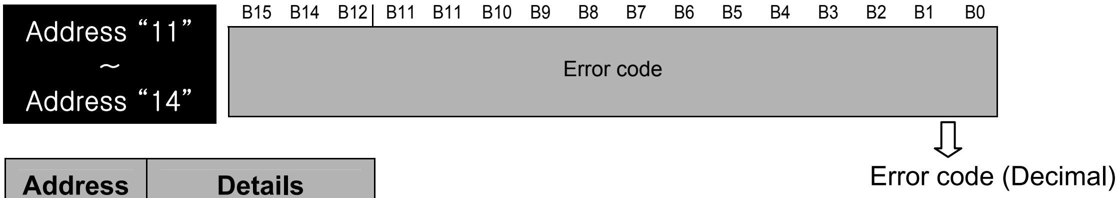
⇩

Input data type (bit)
→ 00: Previous value
→ 01: Min. value
→ 10: Mid. value
→ 11: Max. value

Address	Details
3	Set up the output type of CH0
4	Set up the output type of CH1
5	Set up the output type of CH2
6	Set up the output type of CH3

(5) Error code

It displays error codes of each channel.



Address	Details
11	CH0 error
12	CH1 error
13	CH2 error
14	CH3 error

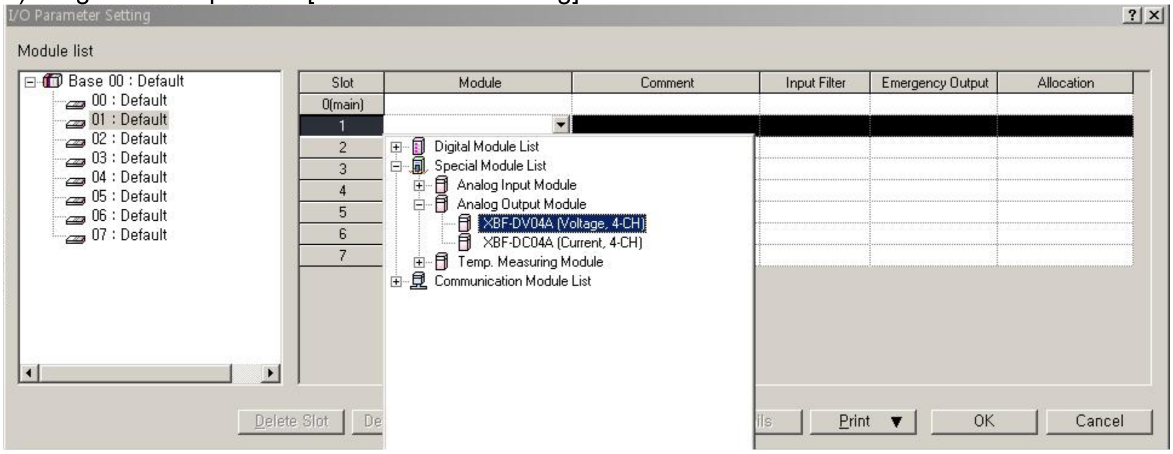
Error code (Dec)	Details	LED status
-	Offset/Gain setting error	Blinks every 2 sec.
31#	Exceed the range of parameter	Blinks every 1sec.
41#	Exceed the range of digital input	

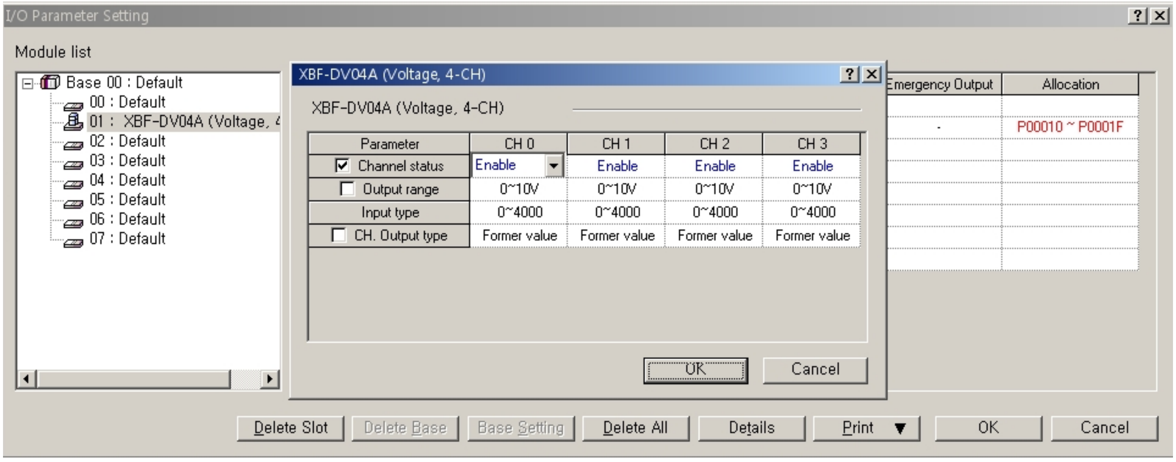
※ # stands for the channel with error found.

12.2.12 Basic program

Analog voltage output module is installed on slot no.1.

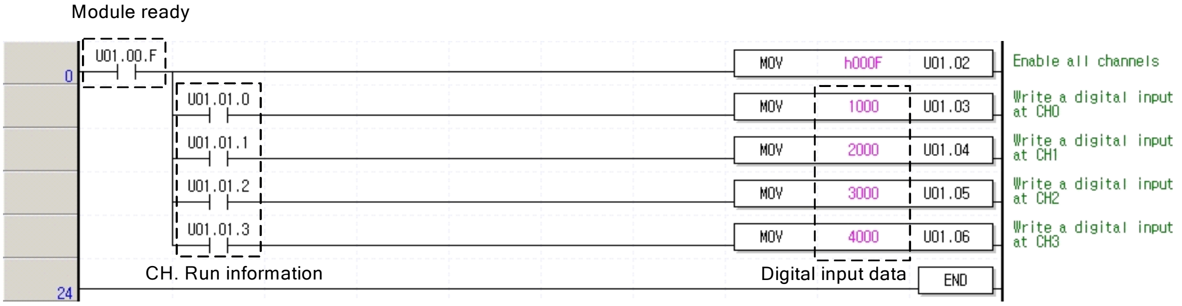
1) Program example with [I/O Parameter Setting].





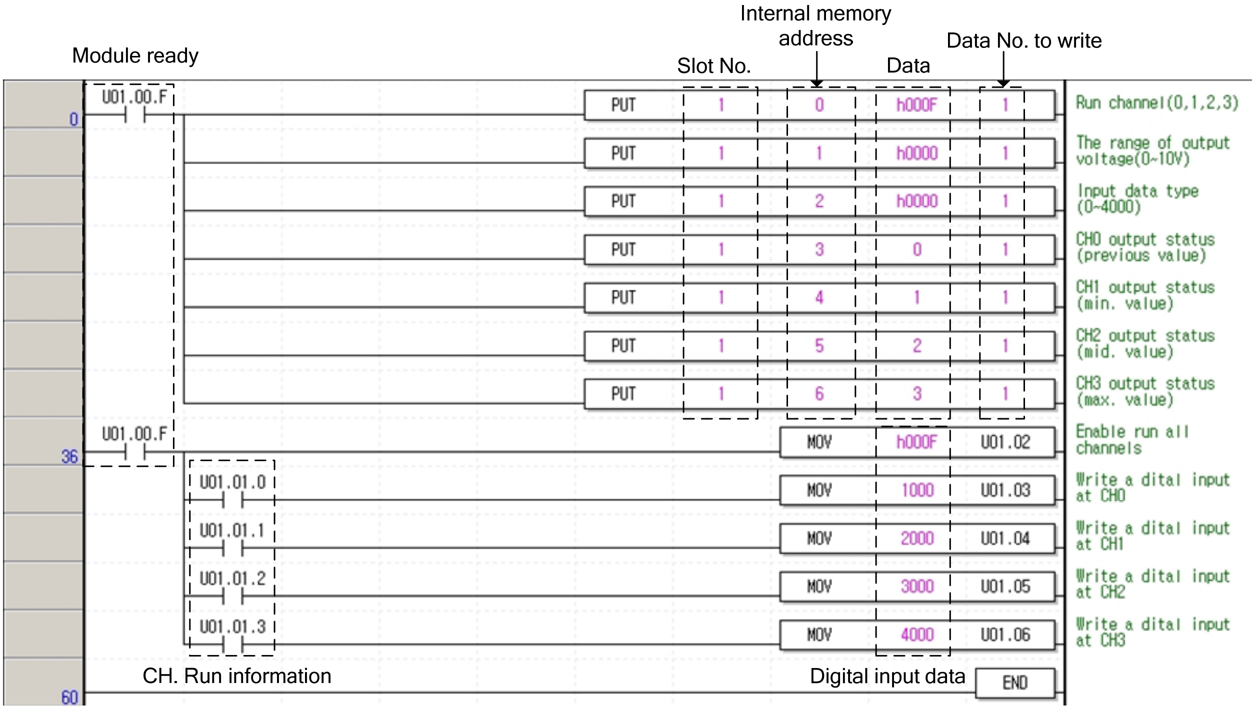
XBF-DV04A (Voltage, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
☑ Channel status	Enable	Enable	Enable	Enable
☐ Output range	0~10V	0~10V	0~10V	0~10V
Input type	0~4000	0~4000	0~4000	0~4000
☐ CH. Output type	Former value	Former value	Former value	Former value



```
0   U01.00.F                       MOV  h000F  U01.02   Enable all channels
              U01.01.0             MOV  1000   U01.03   Write a digital input at CH0
              U01.01.1             MOV  2000   U01.04   Write a digital input at CH1
              U01.01.2             MOV  3000   U01.05   Write a digital input at CH2
              U01.01.3             MOV  4000   U01.06   Write a digital input at CH3
24                                 END
```

2) Program example with PUT/GET instruction.



Chapter 13 Installation and Wiring

13.1 Installation

13.1.1 Installation environment

This unit has high reliability regardless of its installation environment, but be sure to check the following for system reliability.

1) Environment requirements

Avoid installing this unit in locations which are subjected or exposed to:

(1) Water leakage and dust.
(2) Continuous shocks or vibrations.
(3) Direct sunlight.
(4) Dew condensation due to rapid temperature change.
(5) Higher or lower temperatures outside the range of 0 to 55℃
(6) Relative humidity outside the range of 5 to 95℃
(7) Corrosive or flammable gases

2) Precautions during installing

(1) During drilling or wiring, do not allow any wire scraps to enter into the PLC.
(2) Install it on locations that are convenient for operation.
(3) Make sure that it is not located on the same panel that high voltage equipment located.
(4) Make sure that the distance from the walls of duct and external equipment be 50mm or more.
(5) Be sure to be grounded to locations that have good ambient noise immunity.

3) Heat protection design of control box

(1) When installing the PLC in a closed control box, be sure to design heat protection of control box with consideration of the heat generated by the PLC itself and other devices.
(2) It is recommended that filters or closed heat exchangers be used.

13.1.2 Handling Instructions

It describes handling instruction from handling to installation.

- Do not drop it off, and make sure that strong shock should not be applied.
- Do not unload the PCB from its case. It can cause faults.
- During wiring, be sure to check any foreign matter like wire scraps should not enter into the upper side of the PLC. If any foreign matter has entered into it, always eliminate it.

1) Input/Output Module handling instructions

The followings explains instructions for handling or installing the Input/Output Module.

(1) I/O specifications re-check

Re-check the input voltage for the input part. if a voltage over the maximum switching capacity is applied, it can cause faults, destruction or fire.

(2) Used wire

Select the wire with due consideration of ambient temperature and rated current. Its minimum specifications should be AWG22 (0.3 ㎟) or more.

(3) Environment

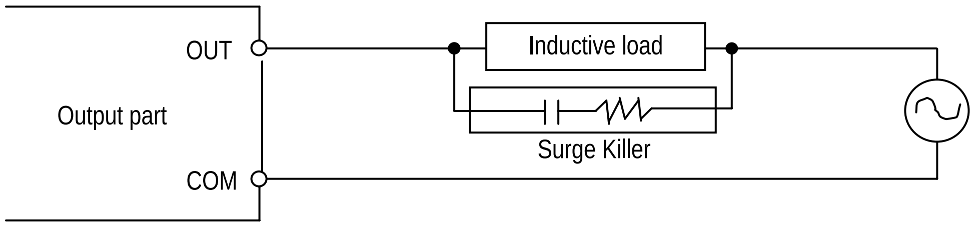
When wiring the I/O part, if it locates near a device generating an cause short circuit, destruction or malfunction.

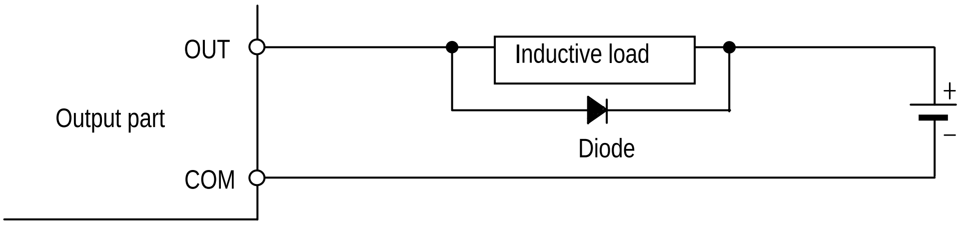
(4) Polarity

Before applying the power to part that has polarities, be sure to check its polarities.

(5) Wiring

- Wiring I/O wires with high voltage cable or power supply line can cause malfunction or disorder.
- Be sure that any wire does not pass across during input LED(I/O status will not be clearly identified).
- If an inductive load has been connected to output part, connect parallel surge killer or diode to a load. Connect the cathode of diode to the '+' part of the power supply.





(6) Terminal block

Check its fixing. During drilling or wiring, do not allow any wire scraps to enter the PLC. It can cause malfunction and fault.

(7) Be cautious that strong shock does not applied to the I/O part. Do not separate the PCB from its case.

2) Mounting instructions

Here describes the notices in case of attaching PLC to the control panel.

(1) Keep the distance enough between the upper part of module and the structures or parts in order to make a ventilation good and change the module easily.

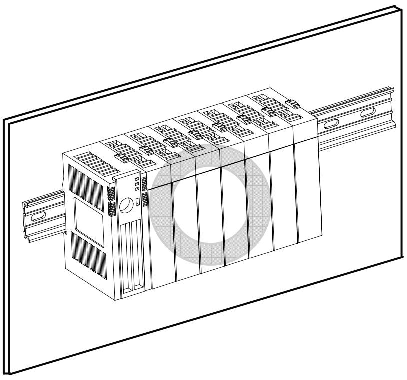
(2) Avoid the longitudinal connection or horizontal attachment considering a ventilation.

(3) Use the panel different from the vibration sources of large sized electronic contactor or no fuse breaker etc., or keep the clearance when installing.

(4) Install the wiring duct if necessary. But cares should be taken for the following notices in case the dimension of the upper or lower part of PLC is smaller than that of Figure 10.1.

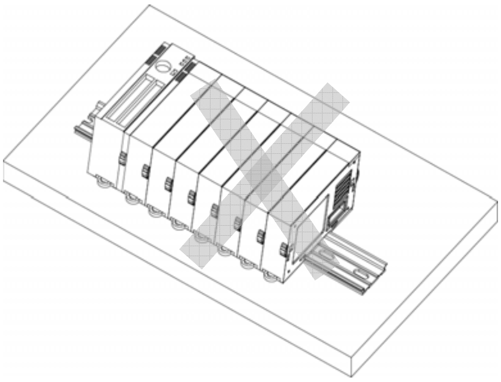
- In case of installing on the upper part of PLC, keep the height of wiring duct less than 50mm for good ventilation. And keep the distance from the upper part of PLC enough to press the hook on the upper part of Base.
- In case of installing on the lower part of PLC, consider the connection of optical cable or coaxial cable and minimum radius of cables.

(5) PLC should be installed to the direction as shown on the following Figure for good ventilation against radiation.

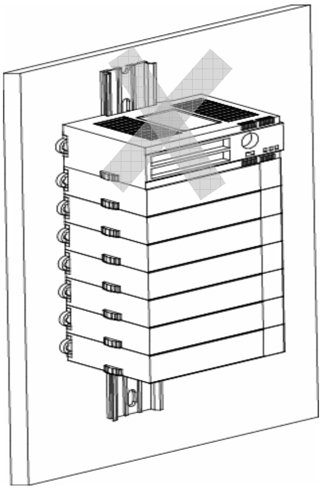


(6) Do not install PLC to the direction as below.

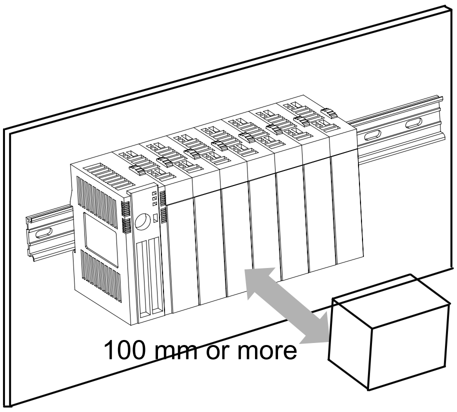
1) Do not lay down the XGB series as shown below.

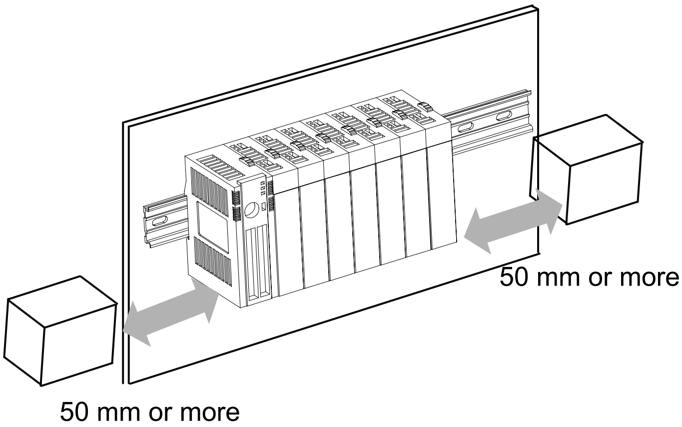


2) Do not install the XGB series to reverse side as shown below.



(7) When installing PLC or other equipment (Relay, electronic contactor), keep the distance to avoid radiant noise or heat.



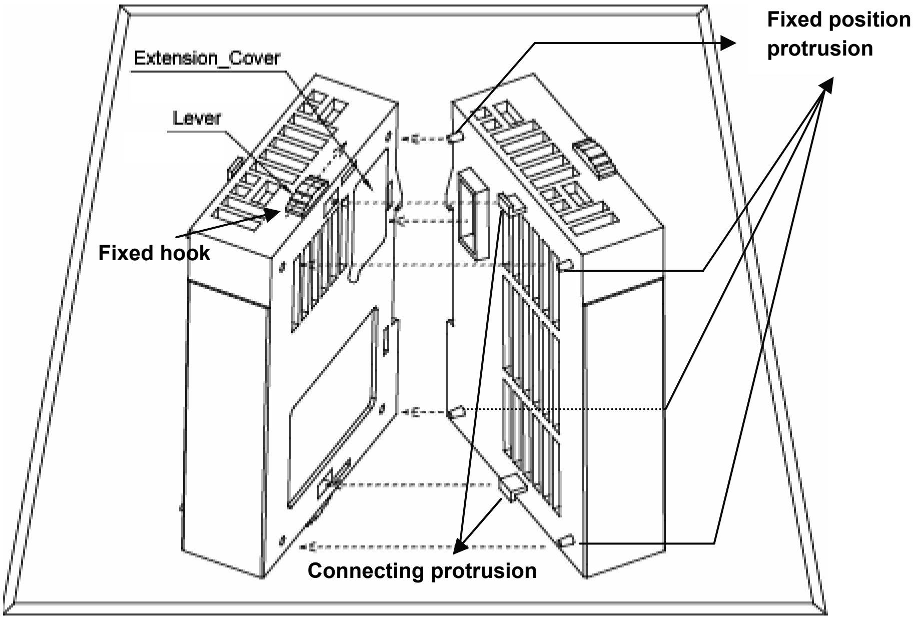


13.1.3 Attachment and detachment of module

It describes attachment and detachment of module.

1) Attachment of module

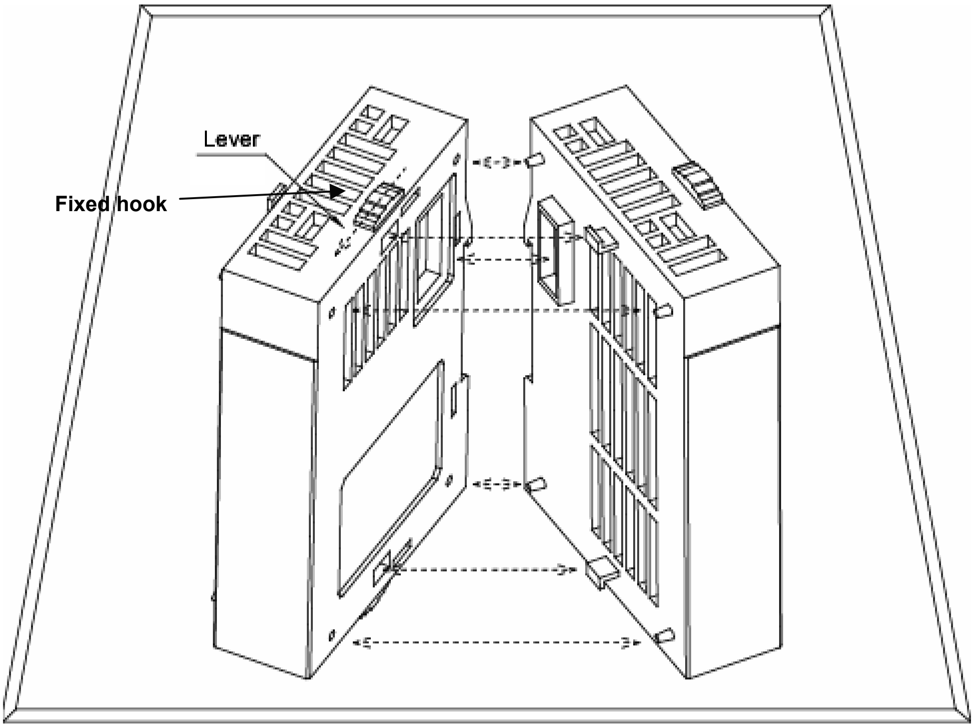
- Remove the extension cover on upper part of module.
- Attach connecting protrusion on module and fixed position protrusion of corner on module.
- After attachment, pull down the fixed hook of module correctly..



⚠ Warning
Module must be attached after fixed the module correctly. Module is broken when attach the module by force.

2) Detachment of module

- Push up the fixed hook.
- Detach the module. (Do not detach by force.)

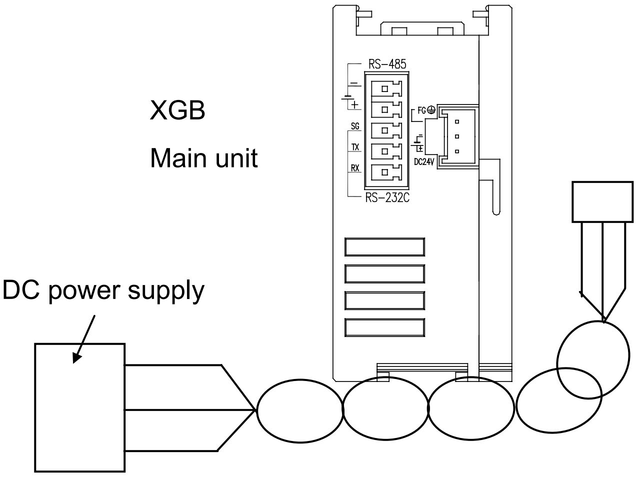


⚠ **Warning**
If detach the module by force, fixed hook or fixed position of module would be broken.

13.2 Wiring

13.2.1 Power wiring

(1) Use a power supply which generates minimal noise across wire and across PLC and ground.



(2) Use a DV power supply capacity more than 1A.

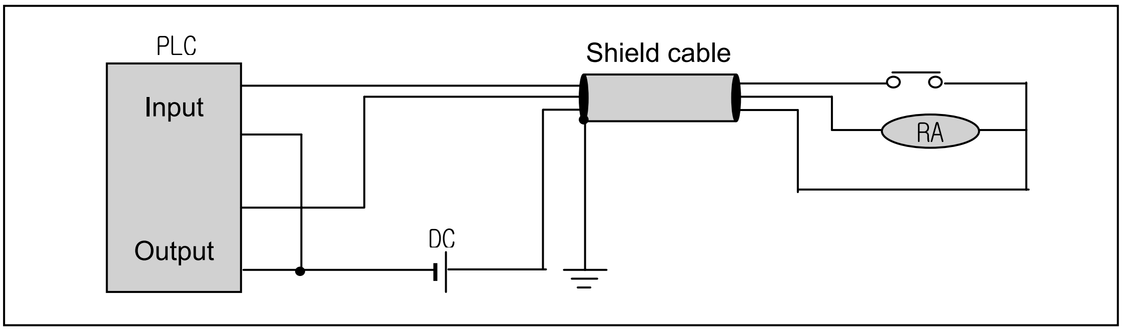
13.2.2 Input/Output device wiring

1) The spec. of cable for I/O wiring shall be 0.3~2 mm^2 but it is recommend to use the convenient cable spec.(0.3 mm$^{2)}$).

2) Separate Input cable and Output cable for wiring.

3) I/O signal cable should be separated more than 100mm from main circuit cable of high voltage/high current.

4) If not possible to separate main circuit cable and power cable, use the shielded cable all and earth a PLC.



5) In case of pipe wiring, check the pipe completely for earth.

6) Separate output cable of DC24V from AC110V cable or AC220V cable.

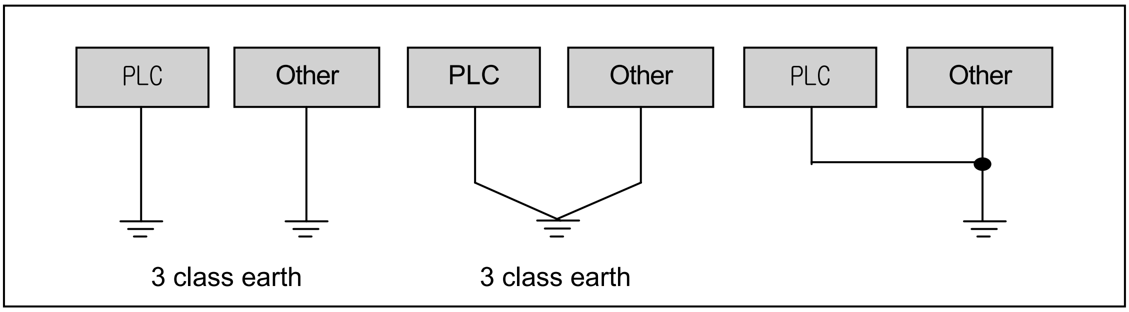
7) For the long distance wiring more than 200m, as it is expected to have problem by leakage current caused by the capacity between cables, please refer to 12.4 Various Cases.

13.2.3 Earth wiring

1) As this PLC has a sufficient measures against noise, it is possible to use it without earth except the case having specially lots of noises.

2) Use the dedicated earth if possible.
In case of Earth works, use 3 class earth (earth resistance 100 Ω or less).

3) If not possible to use dedicated earth, use the common earth as shown on the Figure B] as below.



A) Dedicated earth : Best B) Common earth : Good C) Common earth : Poor

4) Use more than 2 mm^2 cable for earth. Place the earth point near this PLC as possible to have the short length of earth cable.

13.2.4 Cable specifications for wiring

The specification of cable used for wiring is as below.

Type of External Connection	**Cable specification (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	1.5 (AWG16)	2.5 (AWG12)
Protection earth	1.5 (AWG16)	2.5 (AWG12)

Chapter 14 Maintenance

Be sure to perform daily and periodic maintenance and inspection in order to maintain the PLC in the best conditions.

14.1 Maintenance and Inspection

The I/O module mainly consist of semiconductor devices and its service life is semi-permanent. However, periodic inspection is requested for ambient environment may cause damage to the devices. When inspecting one or two times per six months, check the following items.

Check Items		Judgment	Corrective Actions
Change rate of input voltage		Within change rate of input voltage (Less than –15% to +20%)	Hold it with the allowable range.
Power supply for input/output		Input/Output specification of each module	Hold it with the allowable range of each module.
Ambient environment	Temperature	0 ~ + 55℃	Adjust the operating temperature and humidity with the defined range.
	Humidity	5 ~ 95%RH	
	Vibration	No vibration	Use vibration resisting rubber or the vibration prevention method.
Play of modules		No play allowed	Securely enrage the hook.
Connecting conditions of terminal screws		No loose allowed	Retighten terminal screws.
Spare parts		Check the number of Spare parts and their Store conditions	Cover the shortage and improve the conditions.

14.2 Daily Inspection

The following table shows the inspection and items which are to be checked daily.

Check Items		Check Points	Judgment	Corrective Actions
Connection conditions of base		Check the screws.	Screws should not be loose.	Retighten Screws.
Connection conditions of Input/Output module		Check the connecting screws Check module cover.	Screws should not be loose.	Retighten Screws.
Connecting conditions of terminal block or extension cable		Check for loose mounting screws.	Screws should not be loose.	Retighten Screws.
		Check the distance between solderless terminals.	Proper clearance should be provided.	Correct.
		Connecting of expansion cable.	Connector should not be loose.	Correct.
LED indicator	PWR LED	Check that the LED is ON.	ON(OFF indicates an error)	See chapter 15.
	Run LED	Check that the LED is ON during Run.	ON (flickering indicates an error)	See chapter 15.
	ERR LED	Check that the LED is OFF during Run.	OFF(ON indicates an error)	See chapter 15.
	Input LED	Check that the LEO turns ON and OFF.	ON when input is ON, OFF when input is off.	See chapter 15.
	Output LED	Check that the LEO turns ON and OFF	ON when output is ON, OFF when output is off	See chapter 15.

14.3 Periodic Inspection

Check the following items once or twice every six months, and perform the needed corrective actions.

Check Items		Checking Methods	Judgment	Corrective Actions
Ambient environment	Ambient temperature	-. Measure with thermometer and hygrometer -. measure corrosive gas	0 ~ 55 °C	Adjust to general standard (Internal environmental standard of control section)
	Ambient Humidity		5 ~ 95%RH	
	Ambient pollution level		There should be no corrosive gases	
PLC Conditions	Looseness, Ingress	The module should be move the unit	The module should be mounted securely.	Retighten screws
	dust or foreign material	Visual check	No dust or foreign material	
Connecting conditions	Loose terminal screws	Re-tighten screws	Screws should not be loose	Retighten
	Distance between terminals	Visual check	Proper clearance	Correct
	Loose connectors	Visual check	Connectors should not be loose.	Retighten connector mounting screws
Line voltage check		Measure voltage between input terminals	DC24V:DC20.4 ~ 28.8V	Change supply power

Chapter 15 Troubleshooting

The following explains contents, diagnosis and corrective actions for various errors that can occur during system operation.

15.1 Basic Procedure of Troubleshooting

System reliability not only depends on reliable equipment but also on short downtimes in the event of fault. The short discovery and corrective action is needed for speedy operation of system. The following shows the basic instructions for troubleshooting.

1) Visual checks
   Check the following points.
   - Machine operating condition (in stop and operation status)
   - Power On/Off
   - Status of I/O devices
   - Condition of wiring (I/O wires, extension and communications cables)
   - Display states of various indicators (such as POWER LED, RUN LED, ERR LED and I/O LED)

   After checking them, connect peripheral devices and check the operation status of the PLC and the program contents.
2) Trouble Check
   Observe any change in the error conditions during the following.
   - Switch to the STOP position, and then turn the power on and off.
3) Narrow down the possible causes of the trouble where the fault lies, i.e.:
   - Inside or outside of the PLC?
   - I/O module or another module?
   - PLC program?

15.2 Troubleshooting

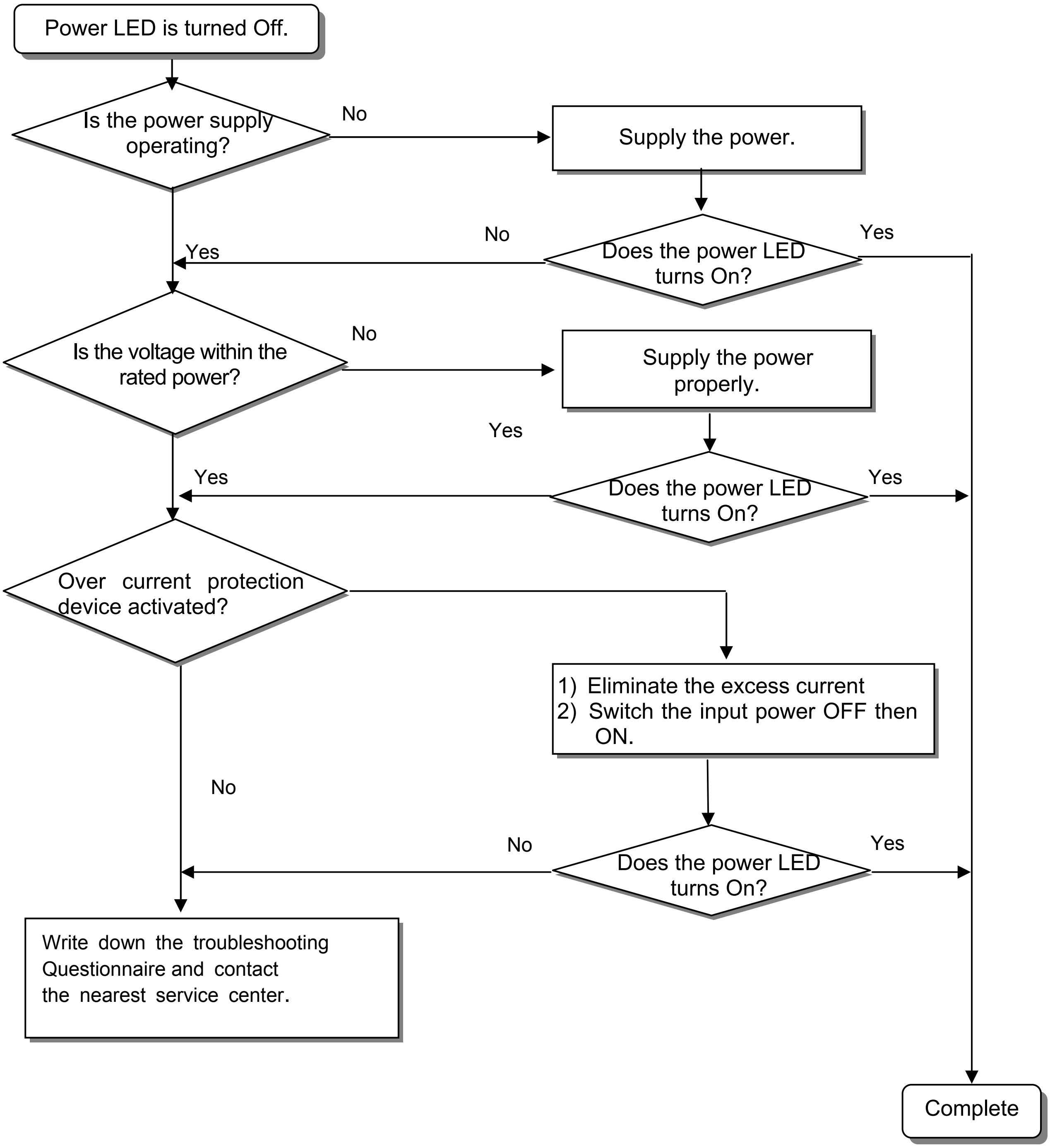
This section explains the procedure for determining the cause of troubles as well as the errors and corrective actions.

Symptoms

Is the power LED turned OFF?	Flowchart used when the POWER LED is turned OFF.
Is the ERR LED flickering?	Flowchart used when the ERR LED is flickering.
Are the RUN LED turned OFF?	Flowchart used when the RUN turned OFF.
I/O module doesn't operate properly.	Flowchart used when the output load of the output module doesn't turn on.
Program cannot be written.	Flowchart used when a program can't be written to the PLC.

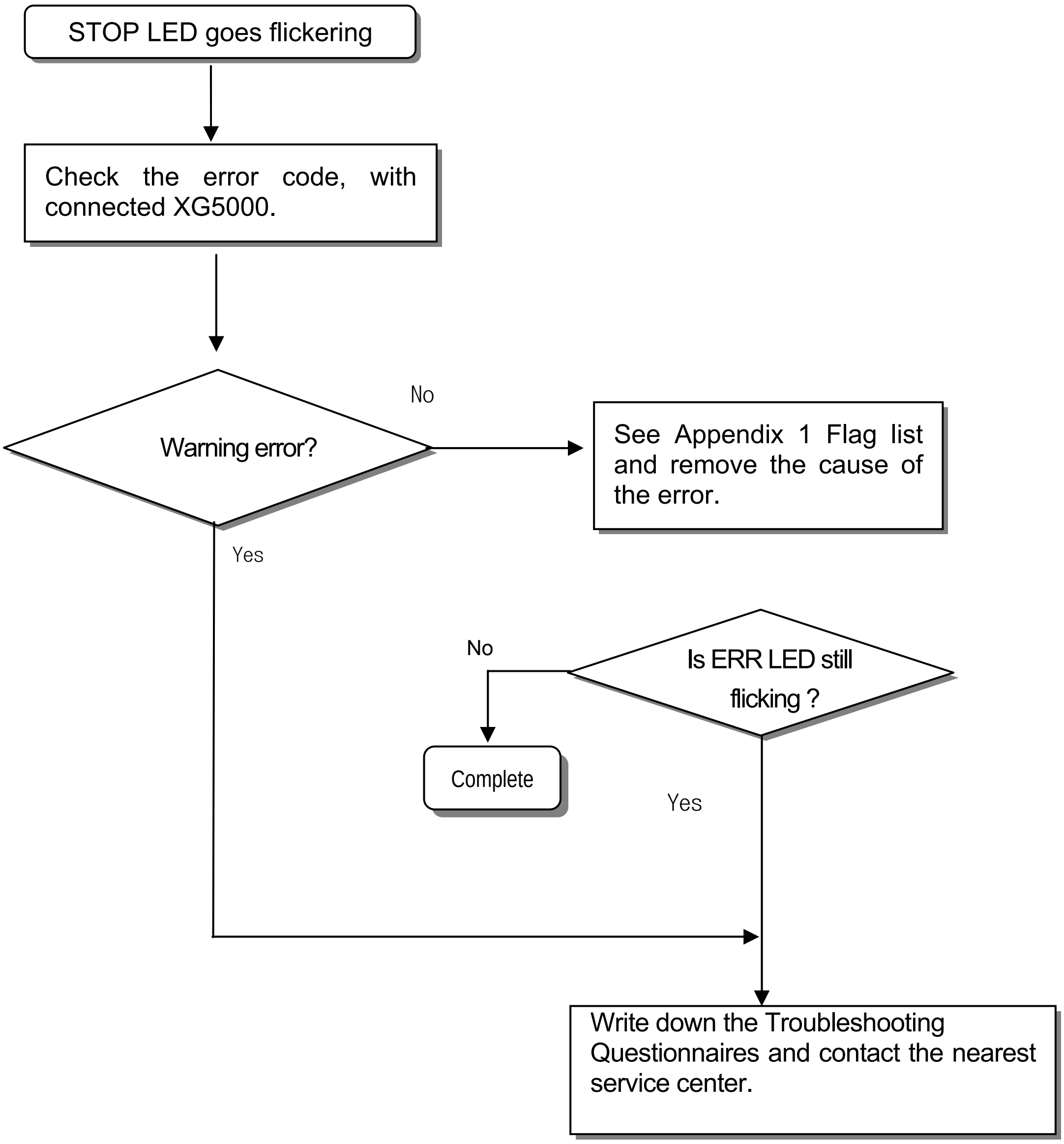
15.2.1 Troubleshooting flowchart used when the PWR(Power) LED turns Off.

The following flowchart explains corrective action procedure used when the power is supplied or the power LED turns Off during operation.



15.2.2 Troubleshooting flowchart used with when the ERR (Error) LED is flickering

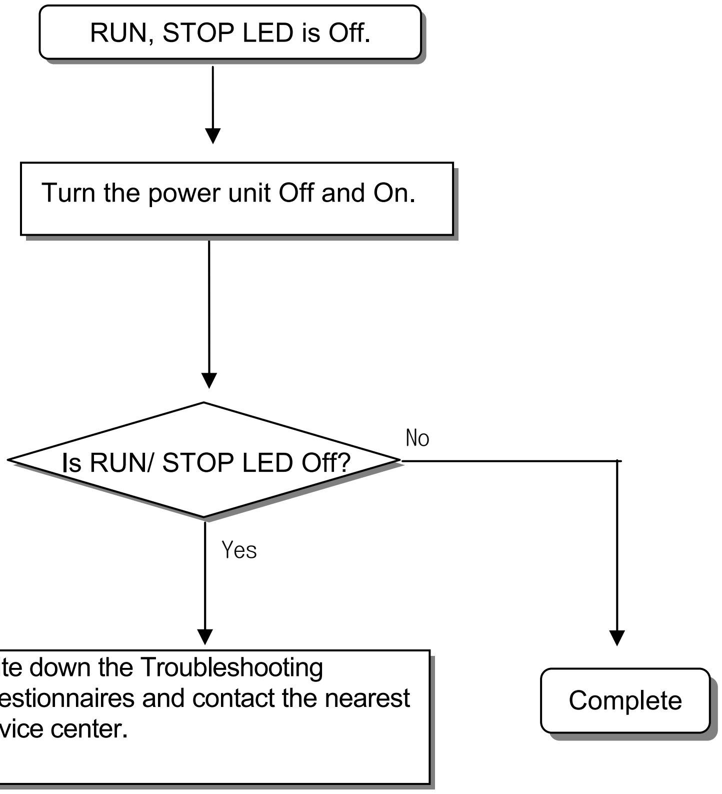
The following flowchart explains corrective action procedure use when the power is supplied starts or the ERR LED is flickering during operation.



⚠ **Warning**
Though warning error appears, PLC system doesn't stop but corrective action is needed promptly. If not, it may cause the system failure.

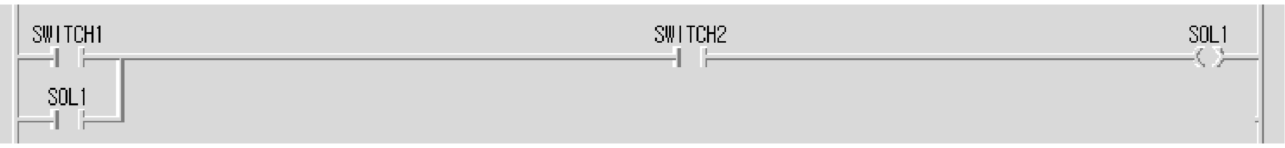
15.2.3 Troubleshooting flowchart used with when the RUN , STOP LED turns Off.

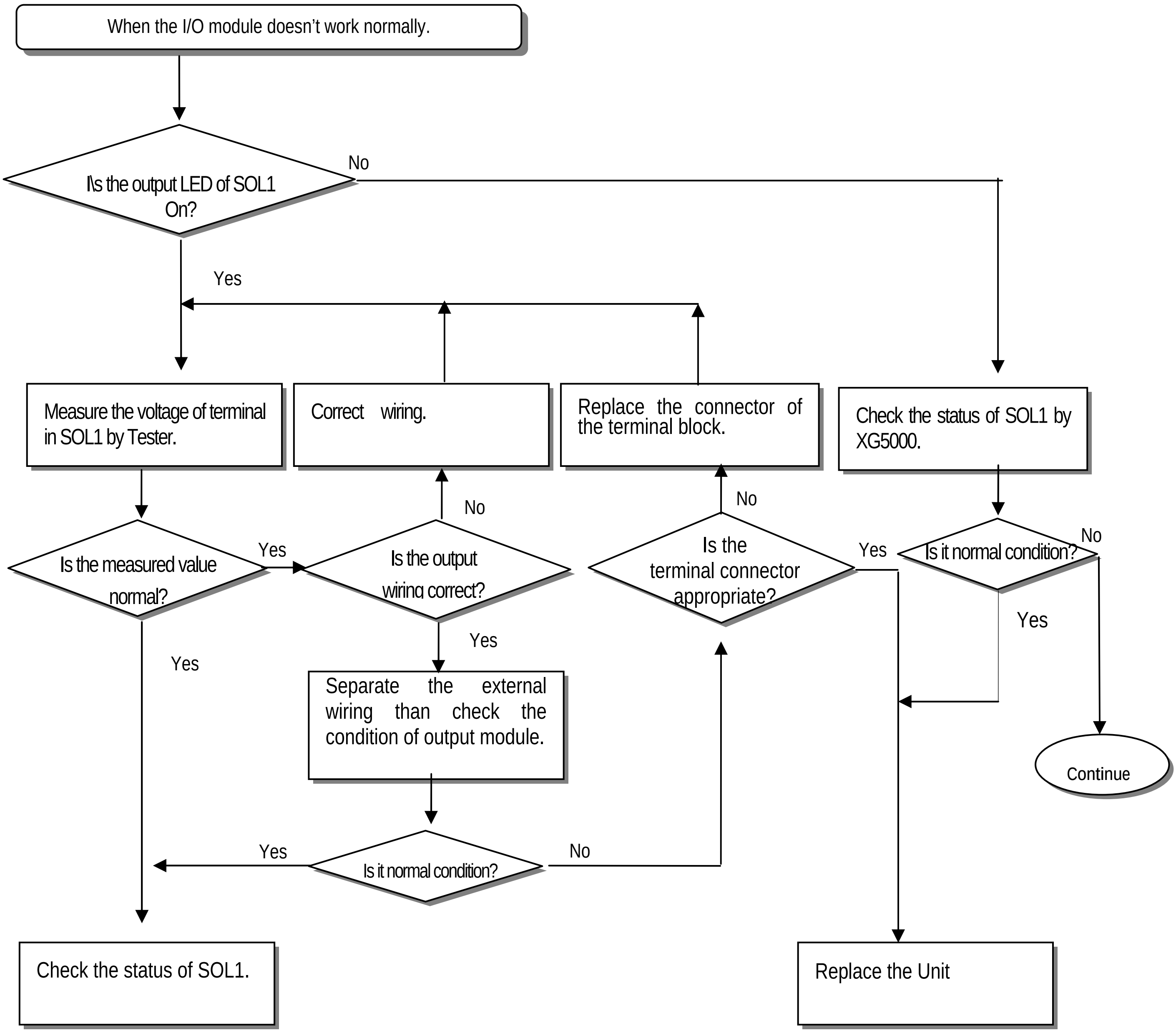
The following flowchart explains corrective action procedure to treat the lights-out of RUN LED when the power is supplied, operation starts or operation is in the process.

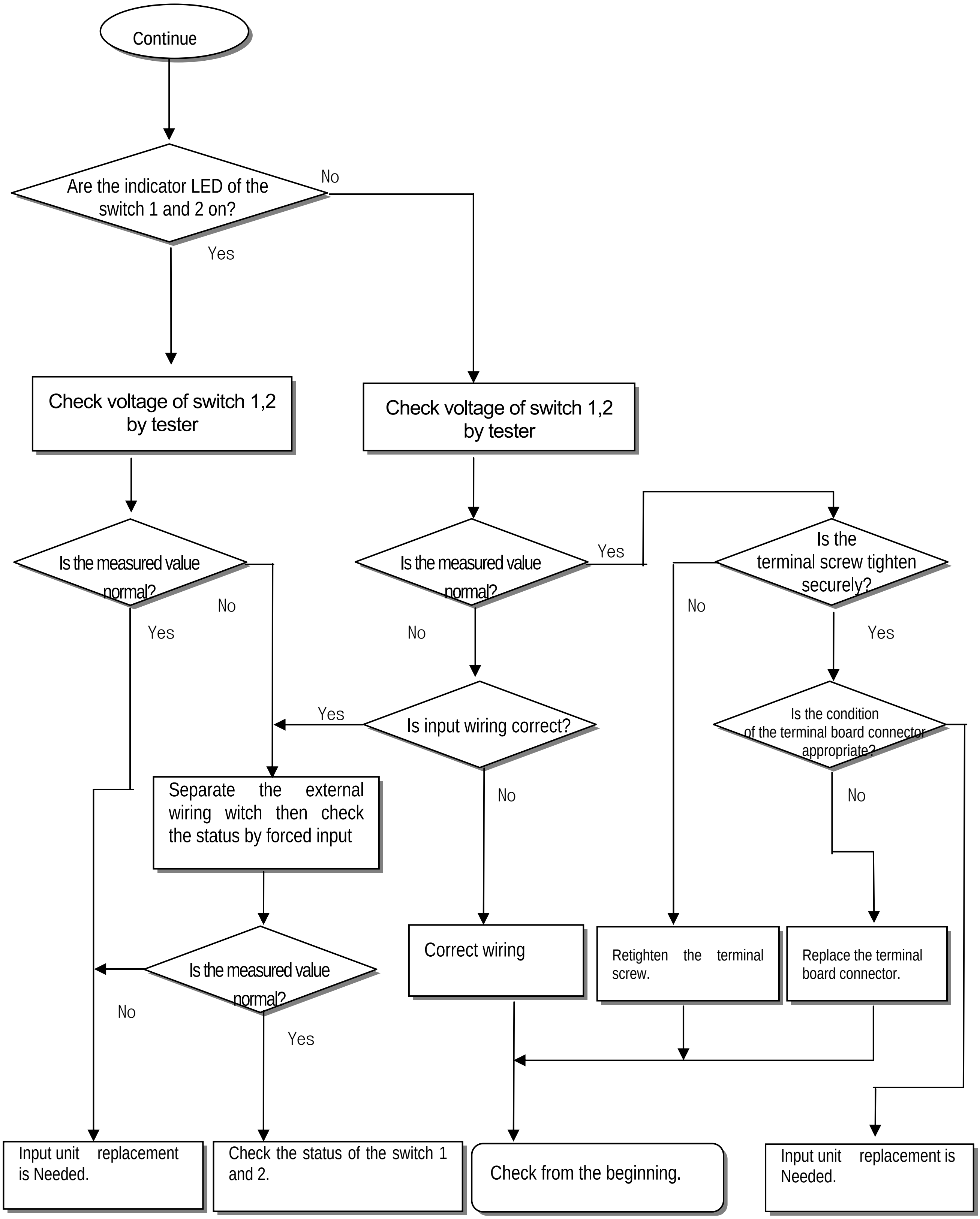


15.2.4 Troubleshooting flowchart used when the I/O part doesn't operate normally.

The following flowchart explains corrective action procedure used when the I/O module doesn't operate normally.






Continue
Are the indicator LED of the switch 1 and 2 on?
No
Yes
Check voltage of switch 1,2 by tester
Check voltage of switch 1,2 by tester
Is the measured value normal?
No
Yes
Is the measured value normal?
Yes
No
Is the terminal screw tighten securely?
No
Yes
Is input wiring correct?
Yes
No
Is the condition of the terminal board connector appropriate?
No
Separate the external wiring witch then check the status by forced input
Is the measured value normal?
No
Yes
Correct wiring
Retighten the terminal screw.
Replace the terminal board connector.
Input unit replacement is Needed.
Check the status of the switch 1 and 2.
Check from the beginning.
Input unit replacement is Needed.

15.3 Troubleshooting Questionnaire

When problems have been met during operation of the XGB series, please write down this Questionnaires and contact the service center via telephone or facsimile.

- For errors relating to special or communication modules, use the questionnaire included in the User's manual of the unit.

1. Telephone & FAX No
Tell) FAX)
2. Using equipment model:

3. Details of using equipment
CPU model: .( ) OS version No.( ) Serial No.( )

4.General description of the device or system used as the control object:

5. The kind of the base unit:
– Operation by the mode setting switch ( ),
– Operation by the KGLWIN or communications ( ),
– External memory module operation ( ),

6. Is the ERR. LED of the CPU module turned ON? Yes( ), No( )

7. XG5000 error message:

8. History of corrective actions for the error message in the article 7:

9. Other tried corrective actions:

10. Characteristics of the error
- Repetitive( ): Periodic( ), Related to a particular sequence( ), Related to environment( )
- Sometimes( ): General error interval:

11. Detailed Description of error contents:

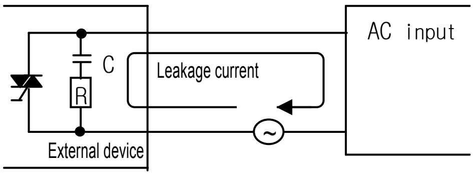
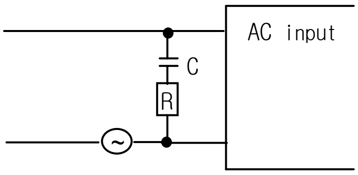
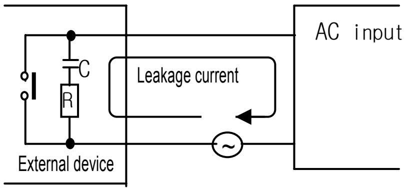
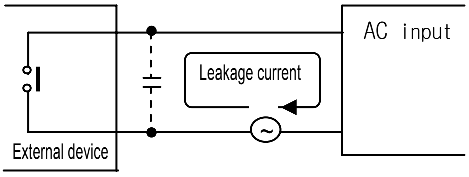
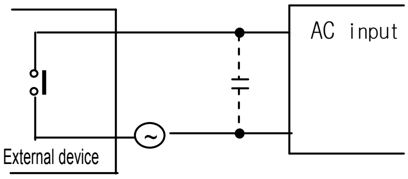
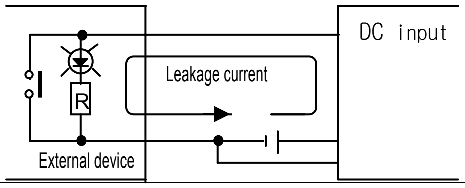
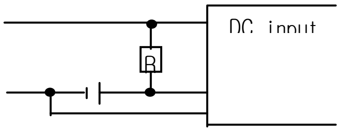
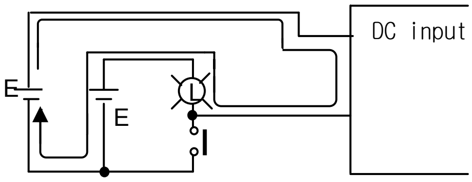
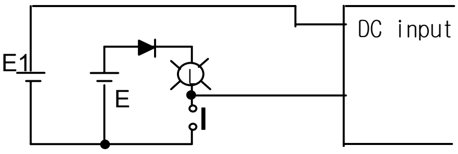
12. Configuration diagram for the applied system:

15.4 Troubleshooting Examples

Possible troubles with various circuits and their corrective actions are explained.

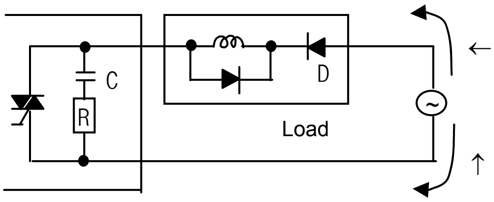
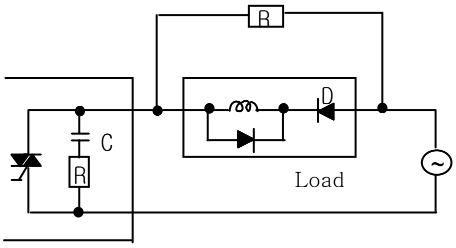
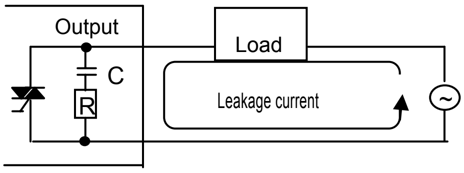
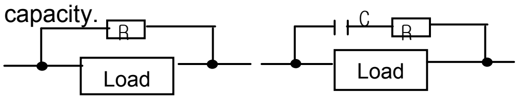
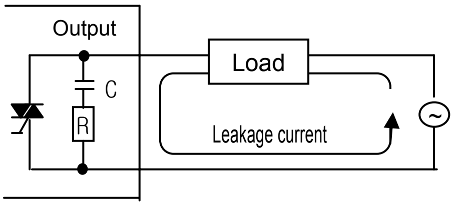
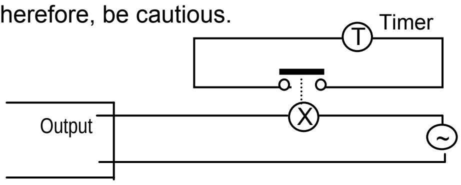
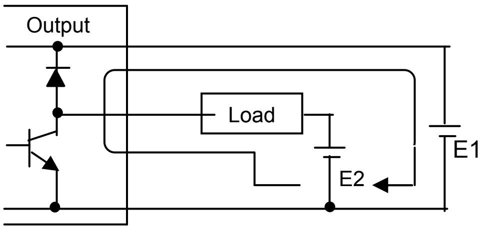
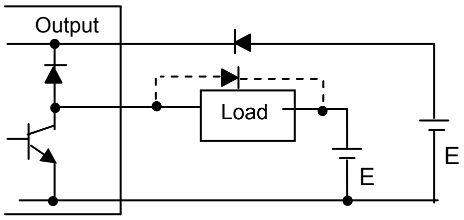
15.4.1 Input circuit troubles and corrective actions

The followings describe possible troubles with input circuits, as well as corrective actions.

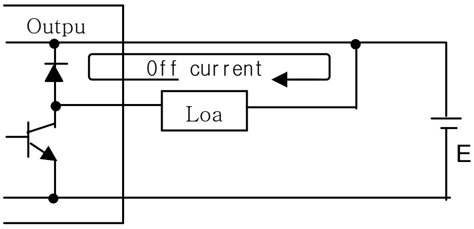
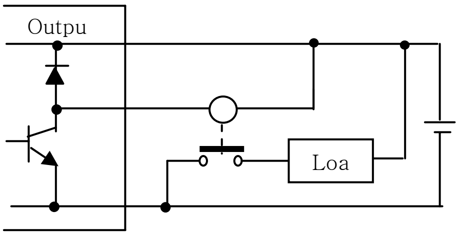
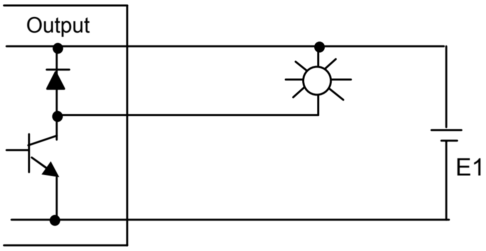
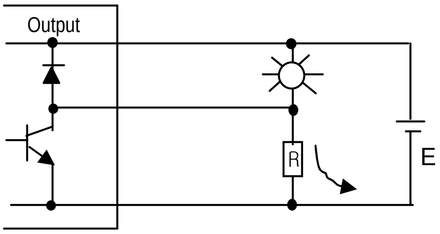
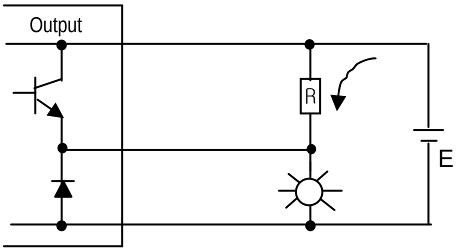
Condition	Cause	Corrective Actions
Input signal doesn't turn off.	Leakage current of external device (Such as a drive by non-contact switch) 	• Connect an appropriate register and capacity, which will make the voltage lower across the terminals of the input module.  • CR values are determined by the leakage current value. – Recommended value C : 0.1 ~ 0.47 ㎌ R: 47 ~ 120 Ω (1/2W) Or make up another independent display circuit.
Input signal doesn't turn off. (Neon lamp may be still on)	Leakage current of external device (Drive by a limit switch with neon lamp) 	
Input signal doesn't turn off.	Leakage current due to line capacity of wiring cable. 	• Locate the power supply on the external device side as shown below. 
Input signal doesn't turn off.	Leakage current of external device (Drive by switch with LED indicator) 	• Connect an appropriate register, which will make the voltage higher than the OFF voltage across the input module terminal and common terminal. 
Input signal doesn't turn off.	• Sneak current due to the use of two different power supplies.  • E1 > E2, sneaked.	• Use only one power supply. • Connect a sneak current prevention diode. 

15.4.2 Output circuit and corrective actions

The following describes possible troubles with output circuits, as well as their corrective actions.

Condition	Cause	Corrective Action
When the output is off, excessive voltage is applied to the load.	•Load is half-wave rectified inside (in some cases, it is true of a solenoid) •When the polarity of the power supply is as shown in ①, C is charged. When the polarity is as shown in ②, the voltage charged in C plus the line voltage are applied across D. Max. voltage is approx. 2√2.  *) If a resistor is used in this way, it does not pose a problem to the output element. But it may make the performance of the diode (D), which is built in the load, drop to cause problems.	• Connect registers of tens to hundreds KΩ across the load in parallel. 
The load doesn't turn off.	• Leakage current by surge absorbing circuit, which is connected to output element in parallel. 	• Connect C and R across the load, which are of registers of tens KΩ. When the wiring distance from the output module to the load is long, there may be a leakage current due to the line capacity. 
When the load is C-R type timer, time constant fluctuates.	• Leakage current by surge absorbing circuit, which is connected to output element in parallel. 	• Drive the relay using a contact and drive the C-R type timer using the since contact. • Use other timer than the C–R contact some timers have half-ware rectified internal circuits therefore, be cautious. 
The load does not turn off.	• Sneak current due to the use of two different power supplies.  E1<E2, sneaks. E1 is off (E2 is on), sneaks.	• Use only one power supply. • Connect a sneak current prevention diode.  If the load is the relay, etc, connect a counter-electromotive voltage absorbing code as shown by the dot line.

Output circuit troubles and corrective actions (continued).

Condition	Cause	Corrective actions
The load off response time is long.	• Over current at off state [The large solenoid current fluidic load (L/R is large) such as is directly driven with the transistor output.  • The off response time can be delayed by one or more second as some loads make the current flow across the diode at the off time of the transistor output.	• Insert a small L/R magnetic contact and drive the load using the same contact. 
Output transistor is destroyed.	Surge current of the white lamp  A surge current of 10 times or more when turned on.	• To suppress the surge current make the dark current of 1/3 to 1/5 rated current flow.  Sink type transistor output  Source type transistor output

15.5 Error Code List

Error code	Error cause	Action (restart mode after taking an action)	Operation status	LED status	Diagnosis point
23	Program to execute is abnormal	Start after reloading the program	Warning	0.5 second Flicker	RUN mode
24	I/O parameter error	Start after reloading I/O parameter, Battery change if battery has a problem. Check the preservation status after I/O parameter reloading and if error occurs, change the unit.	Warning	0.5 second Flicker	Reset RUN mode switching
25	Basic parameter error	Start after reloading Basic parameter, Change battery if it has a problem. Check the preservation status after Basic parameter reloading and if error occurs, change the unit.	Warning	0.5 second Flicker	Reset RUN mode switching
30	Module set in parameter and the installed module does not match	modify the module or parameter and then restart.	Warning	0.5 second Flicker	RUN mode switching
31	Module falling during operation or additional setup	After checking the position of attachment/detachment of expansion module during Run mode	Warning	0.1 second Flicker	Every scan
33	Data of I/O module does not access normally during operation.	After checking the position of slot where the access error occurs by XG5000, change the module and restart (acc.to parameter.)	Heavy error	0.1 second Flicker	Scan end
34	Normal access of special/link module data during operation not available	After checking the position of slot that access error occurred by XG5000, change the module and restart (acc.to parameter).	Heavy error	0.1 second Flicker	Scan end
39	Abnormal stop of CPU or malfunction	Abnormal system end by noise or hard ware error. 1) If it occurs repeatedly when power reinput, request service center 2) Noise measures	Heavy error	0.1 second Flicker	Ordinary time
40	Scan time of program during operation exceeds the scan watchdog time designated by parameter.	After checking the scan watchdog time designated by parameter, modify the parameter or the program and then restart.	Warning	0.5 second Flicker	While running the program
41	Operation error occurs while running the user program.	Remove operation error → reload the program and restart.	Warning	0.5 second Flicker	While running the program
44	Timer index user error	After reloading a timer index program modification, start	Warning	0.5 second Flicker	Scan end
50	Heavy error of external device	Refer to Heavy error detection flag and modifies the device and restart. (Acc. Parameter)	Heavy error	1 second Flicker	Scan end
60	E_STOP function executed	After removing error causes which starts E_STOP function in program, power reinput	Heavy error	1 second Flicker	While running the program
500	Data memory backup not possible	If not error in battery, power reinput Remote mode is switched to STOP mode.	Warning	1 second Flicker	Power On

Appendix 1 Flag List

App. 1.1 Special Relay (F) List

Word	Bit	Variables	Function	Description
F000~1	-	_SYS_STATE	Mode and state	Indicates PLC mode and operation State.
	F0000	_RUN	Run	Run state.
	F0001	_STOP	Stop	Stop state.
	F0002	_ERROR	Error	Error state.
	F0003	_DEBUG	Debug	Debug state.
	F0004	_LOCAL_CON	Local control	Local control mode.
	F0006	_REMOTE_CON	Remote mode	Remote control mode.
	F0008	_RUN_EDIT_ST	Editing during RUN	Editing program download during RUN.
	F0009	_RUN_EDIT_CHK	Editing during RUN	Internal edit processing during RUN.
	F000A	_RUN_EDIT_DONE	Edit done during RUN	Edit is done during RUN.
	F000B	_RUN_EDIT_END	Edit end during RUN	Edit is ended during RUN.
	F000C	_CMOD_KEY	Operation mode	Operation mode changed by key.
	F000D	_CMOD_LPADT	Operation mode	Operation mode changed by local PADT.
	F000E	_CMOD_RPADT	Operation mode	Operation mode changed by Remote PADT.
	F000F	_CMOD_RLINK	Operation mode	Operation mode changed by Remote communication module.
	F0010	_FORCE_IN	Forced input	Forced input state.
	F0011	_FORCE_OUT	Forced output	Forced output state.
	F0014	_MON_On	Monitor	Monitor on execution.
	F0015	_USTOP_On	Stop	Stop by Stop function.
	F0016	_ESTOP_On	EStop	Stop by EStop function.
	F0017	_CONPILE_MODE	Compile	Compile on execution.
	F0018	_INIT_RUN	Initialize	Initialization task on execution.
	F001C	_PB1	Program Code 1	Program Code 1 selected.
	F001D	_PB2	Program Code 2	Program Code 2 selected.
	F001E	_CB1	Compile Code 1	Compile Code 1 selected.
	F001F	_CB2	Compile Code2	Compile Code 2 selected.
F002~3	-	_CNF_ER	System error	Reports heavy error state of system.
	F0021	_IO_TYER	Module Type error	Module Type does not match.
	F0022	_IO_DEER	Module detachment error	Module is detached.
	F0024	_IO_RWER	Module I/O error	Module I/O error.
	F0025	_IP_IFER	Module interface error	Special/communication module interface error.
	F0026	_ANNUM_ER	External device error	Detected heavy error in external Device.

Word	Bit	Variable	Function	Description
F002~3	F0028	_BPRM_ER	Basic parameter	Basic parameter error.
	F0029	_IOPRM_ER	IO parameter	I/O configuration parameter error.
	F002A	_SPPRM_ER	Special module parameter	Special module parameter is Abnormal.
	F002B	_CPPRM_ER	Communication module parameter	Communication module parameter is abnormal.
	F002C	_PGM_ER	Program error	Program error.
	F002D	_CODE_ER	Code error	Program Code error.
	F002E	_SWDT_ER	System watchdog	System watchdog operated.
	F0030	_WDT_ER	Scan watchdog	Scan watchdog operated.
F004	-	_CNF_WAR	System warning	Reports light error state of system.
	F0041	_DBCK_ER	Backup error	Data backup error.
	F0043	_ABSD_ER	Operation shutdown error	Stop by abnormal operation.
	F0046	_ANNUM_WAR	External device error	Detected light error of external device.
	F0048	_HS_WAR1	High speed link 1	High speed link – parameter 1 error.
	F0049	_HS_WAR2	High speed link 2	High speed link – parameter 2 error.
	F0054	_P2P_WAR1	P2P parameter 1	P2P – parameter 1 error.
	F0055	_P2P_WAR2	P2P parameter 2	P2P – parameter 2 error.
	F0056	_P2P_WAR3	P2P parameter 3	P2P – parameter 3 error.
	F005C	_CONSTANT_ER	Constant error	Constant error.
F009	-	_USER_F	User contact	Timer used by user.
	F0090	_T20MS	20ms	20ms cycle Clock.
	F0091	_T100MS	100ms	100ms cycle Clock.
	F0092	_T200MS	200ms	200ms cycle Clock.
	F0093	_T1S	1s Clock	1s cycle Clock.
	F0094	_T2S	2 s Clock	2s cycle Clock.
	F0095	_T10S	10 s Clock	10s cycle Clock.
	F0096	_T20S	20 s Clock	20s cycle Clock.
	F0097	_T60S	60 s Clock	60s cycle Clock.
	F0099	_On	Ordinary time On	Always On state Bit.
	F009A	_Off	Ordinary time Off	Always Off state Bit.
	F009B	_1On	1scan On	First scan On Bit.
	F009C	_1Off	1scan Off	First scan OFF bit.
	F009D	_STOG	Reversal	Reversal every scan.

Word	Bit	Variable	Function	Description
F010	-	_USER_CLK	User Clock	Clock available for user setting.
	F0100	_USR_CLK0	Setting scan repeat	On/Off as much as set scan Clock 0.
	F0101	_USR_CLK1	Setting scan repeat	On/Off as much as set scan Clock 1.
	F0102	_USR_CLK2	Setting scan repeat	On/Off as much as set scan Clock 2.
	F0103	_USR_CLK3	Setting scan repeat	On/Off as much as set scan Clock 3.
	F0104	_USR_CLK4	Setting scan repeat	On/Off as much as set scan Clock 4.
	F0105	_USR_CLK5	Setting scan repeat	On/Off as much as set scan Clock 5.
	F0106	_USR_CLK6	Setting scan repeat	On/Off as much as set scan Clock 6.
	F0107	_USR_CLK7	Setting scan repeat	On/Off as much as set scan Clock 7.
F011	-	_LOGIC_RESULT	Logic result	Indicates logic results.
	F0110	_LER	operation error	On during 1 scan in case of operation error.
	F0111	_ZERO	Zero flag	On when operation result is 0.
	F0112	_CARRY	Carry flag	On when carry occurs during operation.
	F0113	_ALL_Off	All output OFF	On in case that all output is Off.
	F0115	_LER_LATCH	Operation error Latch	Keeps On during operation error.
F012	-	_CMP_RESULT	Comparison result	Indicates the comparison result.
	F0120	_LT	LT flag	On in case of “less than”.
	F0121	_LTE	LTE flag	On in case of “equal or less than”.
	F0122	_EQU	EQU flag	On in case of “equal”.
	F0123	_GT	GT flag	On in case of “greater than”.
	F0124	_GTE	GTE flag	On in case of “equal or greater than”.
	F0125	_NEQ	NEQ flag	On in case of “not equal”.
F014	-	_FALS_NUM	FALS no.	Indicates FALS no.
F015	-	_PUTGET_ERR0	PUT/GET error 0	Main base Put / Get error.
F023	-	_PUTGET_NDR0	PUT/GET end 0	Main base Put/Get end.
F044	-	_CPU_TYPE	CPU Type	Indicates information for CPU Type.
F045	-	_CPU_VER	CPU version	Indicates CPU version.
F046	-	_OS_VER	OS version	Indicates OS version.
F048	-	_OS_DATE	OS date	Indicates OS distribution date.
F050	-	_SCAN_MAX	Max. scan time	Indicates max. scan time.
F051	-	_SCAN_MIN	Min. scan time	Indicates min. scan time.
F052	-	_SCAN_CUR	Current scan time	Current scan time.

Word	Bit	Variable	Function	Description
F057	-	_FPU_INFO	FPU operation result	Fixed decimal operation result.
	F0570	_FPU_LFLAG_I	-	-
	F0571	_FPU_LFLAG_U	-	-
	F0572	_FPU_LFLAG_O	-	-
	F0573	_FPU_LFLAG_Z	Zero(0) divide latch	Latch in case of zero(0) divide.
	F0574	_FPU_LFLAG_V	-	-
	F057A	_FPU_FLAG_I	-	-
	F057B	_FPU_FLAG_U	-	-
	F057C	_FPU_FLAG_O	-	-
	F057D	_FPU_FLAG_Z	Zero divide	Reports in case of zero divide.
	F057E	_FPU_FLAG_V	Invalid operation	Reports in case of invalid operation.
	F057F	_FPU_FLAG_E	Irregular input	Reports in case of irregular input.
F058	-	_ERR_STEP	Error step	Saves error step.
F060	-	_REF_COUNT	Refresh	Increase when module Refresh.
F062	-	_REF_OK_CNT	Refresh OK	Increase when module Refresh is normal.
F064	-	_REF_NG_CNT	Refresh NG	Increase when module Refresh is Abnormal.
F066	-	_REF_LIM_CNT	Refresh Limit	Increase when module Refresh is abnormal (Time Out).
F068	-	_REF_ERR_CNT	Refresh Error	Increase when module Refresh is Abnormal.
F070	-	_MOD_RD_ERR_CNT	Module Read Error	Increase when reading module 1 word abnormally.
F072	-	_MOD_WR_ERR_CNT	Module Write Error	Increase when module 1 word abnormally.
F074	-	_CA_CNT	Block service	Increase when module block data service.
F076	-	_CA_LIM_CNT	Block service Limit	Increase when block data service is limited.
F078	-	_CA_ERR_CNT	Block service Error	Increase in case of block data service error.
F080	-	_BUF_FULL_CNT	Buffer Full	Increase when CPU internal buffer is full.
F082	-	_PUT_CNT	Put count	Increase when Put count.
F084	-	_GET_CNT	Get count	Increase when Get count.
F086	-	_KEY	Current key	indicates the current state of local key.
F088	-	_KEY_PREV	Previous key	indicates the previous state of local key
F090	-	_IO_TYER_N	Mismatch slot	Module Type mismatched slot no.
F091	-	_IO_DEER_N	Detach slot	Module detached slot no.
F093	-	_IO_RWER_N	Fuse cutoff slot	Fuse cutoff slot no.
F094	-	_IP_IFER_N	RW error slot	Module read/write error slot no.
F096	-	_IO_TYER0	IF error slot	Module interface error slot no.

Word	Bit	Variable	Function	Description
F104	-	_IO_DEER0	Module Type 0 error	Main base module Type error.
F120	-	_IO_RWER0	Module RW 0 error	Main base module read/write error.
F128	-	_IO_IFER_0	Module IF 0 error	Main base module interface error.
F140	-	_AC_FAIL_CNT	Power shutdown times	Saves the times of power shutdown.
F142	-	_ERR_HIS_CNT	Error occur times	Saves the times of error occur.
F144	-	_MOD_HIS_CNT	Mode conversion times	Saves the times of mode conversion.
F146	-	_SYS_HIS_CNT	History occur times	Saves the times of system history.
F148	-	_LOG_ROTATE	Log Rotate	Saves log rotate information.
F150	-	_BASE_INFO0	Slot information 0	Main base slot information.
F200	-	_USER_WRITE_F	Available contact point	Contact point available in program.
	F2000	_RTC_WR	RTC RW	Data write and read in RTC.
	F2001	_SCAN_WR	Scan WR	Initializing the value of scan.
	F2002	_CHK_ANC_ERR	Request detection of external serious error	Request detection of external error.
	F2003	_CHK_ANC_WAR	Request detection of external slight error (warning)	Request detection of external slight error (warning).
F201	-	_USER_STAUS_F	User contact point	User contact point.
	F2010	_INIT_DONE	Initialization completed	Initialization complete displayed.
F202	-	_ANC_ERR	Display information of external serious error	Display information of external serious error
F203	-	_ANC_WAR	Display information of external slight error (warning)	Display information of external slight error (warning)

Appendix 1.2 Communication Relay (L) List

Here describes data link communication relay(L).

1. High-speed Link 1

Device	Keyword	Type	Description
L000	_HS1_RLINK	Bit	High speed link parameter 1 normal operation of all station
			Indicates normal operation of all station according to parameter set in High speed link, and On under the condition as below. 1. In case that all station set in parameter is RUN mode and no error, 2. All data block set in parameter is communicated normally, and 3. The parameter set in each station itself is communicated normally. Once RUN_LINK is On, it keeps On unless stopped by LINK_DISABLE.
L001	_HS1_LTRBL	Bit	Abnormal state after _HS1RLINK On
			In the state of _HSmRLINK flag On, if communication state of the station set in the parameter and data block is as follows, this flag shall be On. 1. In case that the station set in the parameter is not RUN mode, or 2. There is an error in the station set in the parameter, or 3. The communication state of data block set in the parameter is not good. LINK TROUBLE shall be On if the above 1, 2 & 3 conditions occur, and if the condition return to the normal state, it shall be OFF again.
L0020 ~ L005F	_HS1_STATE[k] (k = 00~63)	Bit Array	High speed link parameter 1, k block general state
			Indicates the general state of communication information for each data block of setting parameter. _HS1_STATE[k] = HS1MOD[k]&_HS1TRX[k]&(~_HS1_ERR[k])
L0060 ~ L009F	_HS1_MOD[k] (k = 00~63)	Bit Array	High speed link parameter 1, k block station RUN operation mode
			Indicates operation mode of station set in k data block of parameter.
L0100 ~ L013F	_HS1_TRX[k] (k = 00~63)	Bit Array	Normal communication with High speed link parameter 1, k block station
			Indicates if communication state of k data of parameter is communicated smoothly according to the setting.
L0140 ~ L017F	_HS1_ERR[k] (k = 00~63)	Bit Array	High speed link parameter 1, k block station operation error mode
			Indicates if the error occurs in the communication state of k data block of parameter.
L0180 ~ L021F	_HS1_SETBLOCK[k]	Bit Array	High speed link parameter 1, k block setting
			Indicates whether or not to set k data block of parameter.

2. High-speed 2

Device	Keyword	Type	Description
L0260	_HS2_RLINK	Bit	High-speed link parameter 2 normal operation of all station.
			Indicates normal operation of all station according to parameter set in High-speed link and On under the condition as below. 1. In case that all station set in parameter is Run mode and no error 2. All data block set in parameter is communicated and 3.The parameter set in each station itself is communicated normally. Once RUN_LINK is On, it keeps On unless stopped by LINK_DISABLE.
L0261	_HS2_LTRBL	Bit	Abnormal state after _HS2RLINK On.
			In the state of _HSmRLINK flag On, if communication state of the station set in the parameter and data block is as follows, this flag shall be On. 1. In case that the station set in the parameter is not RUN mode, or 2. There is an error in the station set in the parameter, or 3. The communication state of data block set in the parameter is not good. LINK TROUBLE shall be On if the above 1, 2 & 3 conditions occur, and if the condition return to the normal state, it shall be OFF again.
L0280 ~ L031F	_HS2_STATE[k] (k = 00~63)	Bit Array	High speed link parameter 1, k block general state.
			Indicates the general state of communication information for each data block of setting parameter. _HS2_STATE[k]=HS2MOD[k]&_HS2TRX[k]&(~_HS2_ERR[k])
L0320 ~ L035F	_HS2_MOD[k] (k = 00~63)	Bit Array	High speed link parameter 1, k block station RUN operation mode.
			Indicates operation mode of station set in k data block of parameter.
L0360 ~ L039F	_HS2_TRX[k] (k = 00~63)	Bit Array	Normal communication with High speed link parameter 1, k block station.
			Indicates if communication state of k data of parameter is communicated smoothly according to the setting.
L0400 ~ L043F	_HS2_ERR[k] (k = 00~63)	Bit Array	High speed link parameter 1, k block station operation error mode.
			Indicates if the error occurs in the communication state of k data block of parameter.
L0440 ~ L047F	_HS2_SETBLOCK[k]	Bit Array	High speed link parameter 1, k block setting.
			Indicates whether or not to set k data block of parameter.

3. **Common area**

Device	Keyword	Type	Description
L5120	_P2P1_NDR00	Bit	Indicates P2P parameter 1, 0 Block service normal end.
L5121	_P2P1_ERR00	Bit	Indicates P2P parameter 1, 0 Block service abnormal end.
L513	_P2P1_STATUS00	Word	Indicates error code in case of P2P parameter 1, 0 Block service abnormal end.
L514	_P2P1_SVCCNT00	DWord	Indicates P2P parameter 1, 0 Block service normal count.
L516	_P2P1_ERRCNT00	DWord	Indicates P2P parameter 1, 0 Block service abnormal count.
L5180	_P2P1_NDR01	Bit	P2P parameter 1, 1 Block service normal end.
L5181	_P2P1_ERR01	Bit	P2P parameter 1, 1 Block service abnormal end.
L519	_P2P1_STATUS01	Word	Indicates error code in case of P2P parameter 1, 1 Block service abnormal end.
L520	_P2P1_SVCCNT01	DWord	Indicates P2P parameter 1, 1 Block service normal count.
L522	_P2P1_ERRCNT01	DWord	Indicates P2P parameter 1, 1 Block service abnormal count.
L524~L529	-	Word	P2P parameter 1,2 Block service total.
L530~L535	-	Word	P2P parameter 1,3 Block service total.
L536~L697	-	Word	P2P parameter 1,4~30 Block service total.
L698~L703	-	Word	P2P parameter 1,31 Block service total.

[Communication flag list according to P2P service setting] P2P parameter: 1~3, P2P block: 0~31

Appendix 1.3 Network Register (N) List

Here describes Network Register (N).

Device	Keyword	Type	Description
N000	_P1B00SN	Word	Saves another station no. of P2P parameter 1, 00 block.
N0000~0004	_P1B00RD1	Word	Saves area device 1 to read P2P parameter 1, 01 block.
N005	_P1B00RS1	Word	Saves area size 1 to read P2P parameter 1, 01 block.
N0006~0009	_P1B00RD2	Word	Saves area device 2 to read P2P parameter 1, 01 block.
N010	_P1B00RS2	Word	Saves area size 2 to read P2P parameter 1, 01 block.
N0011~0014	_P1B00RD3	Word	Saves area device 3 to read P2P parameter 1, 01 block.
N015	_P1B00RS3	Word	Saves area size 3 to read P2P parameter 1, 01 block.
N0016~0019	_P1B00RD4	Word	Saves area device 4 to read P2P parameter 1, 01 block.
N020	_P1B00RS4	Word	Saves area size 4 to read P2P parameter 1, 01 block.
N0021~0024	_P1B00WD1	Word	Saves area device 1 to save P2P parameter 1, 01 block.
N025	_P1B00WS1	Word	Saves area size 1 to save P2P parameter 1, 01 block.
N0026~0029	_P1B00WD2	Word	Saves area device 2 to save P2P parameter 1, 01 block.
N030	_P1B00WS2	Word	Saves area size 2 to save P2P parameter 1, 01 block.
N0031~0034	_P1B00WD3	Word	Saves area device 3 to save P2P parameter 1, 01 block.
N035	_P1B00WS3	Word	Saves area size 3 to save P2P parameter 1, 01 block.
N0036~0039	_P1B00WD4	Word	Saves area device 4 to save P2P parameter 1, 01 block.
N040	_P1B00WS4	Word	Saves area size 4 to save P2P parameter 1, 01 block.
N0041~0081	-	Word	Saving area of P2P parameter 1, 01 block.
N0082~0122	-	Word	Saving area of P2P parameter 1, 02 block. P2P
N0123~1311	-	Word	Saving area of P2P parameter 1, 03~31 block.
N1312~2623	-	Word	Saving area of P2P parameter 2.
N2624~3935	-	Word	Saving area of P2P parameter 3.

[Network register according to P2P service setting] P2P parameter: 1~3, P2P block: 0~31

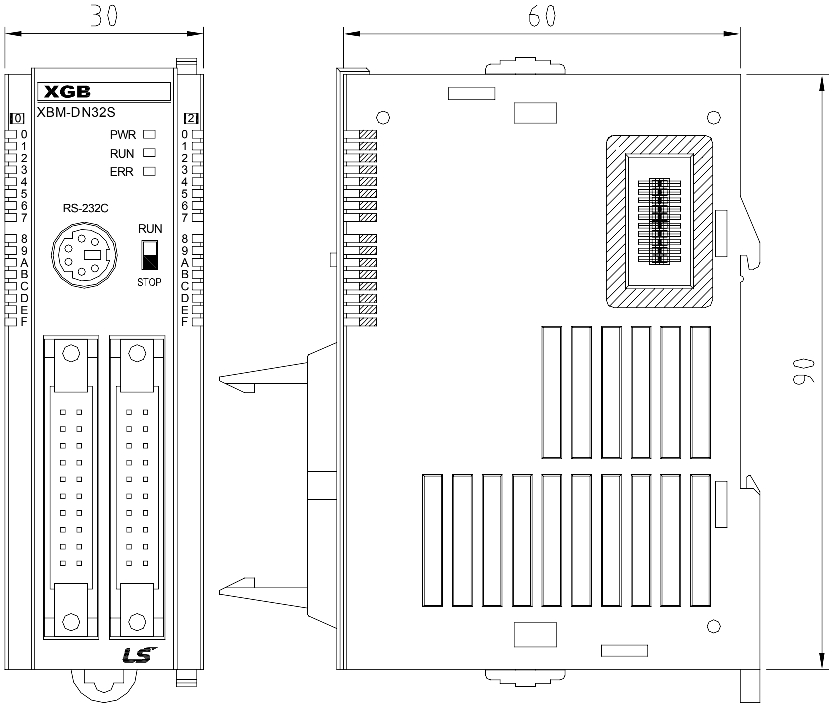
Remark

❑ In XGB S type, Network register is available only monitoring. (Read Only)

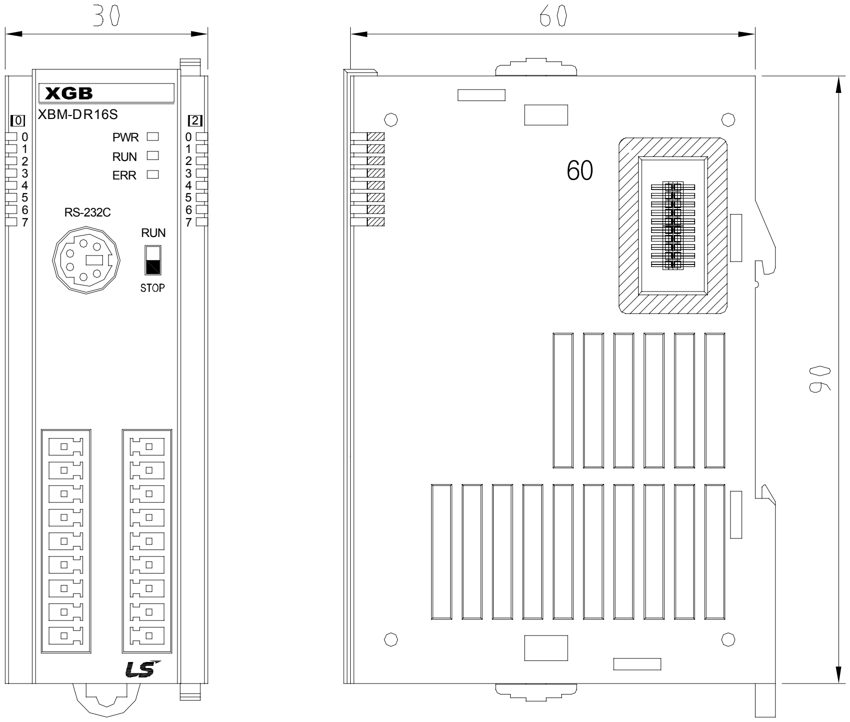
Appendix 2 Dimension (Unit: mm)

1) Basic unit

-. XBM-DN16S/32S

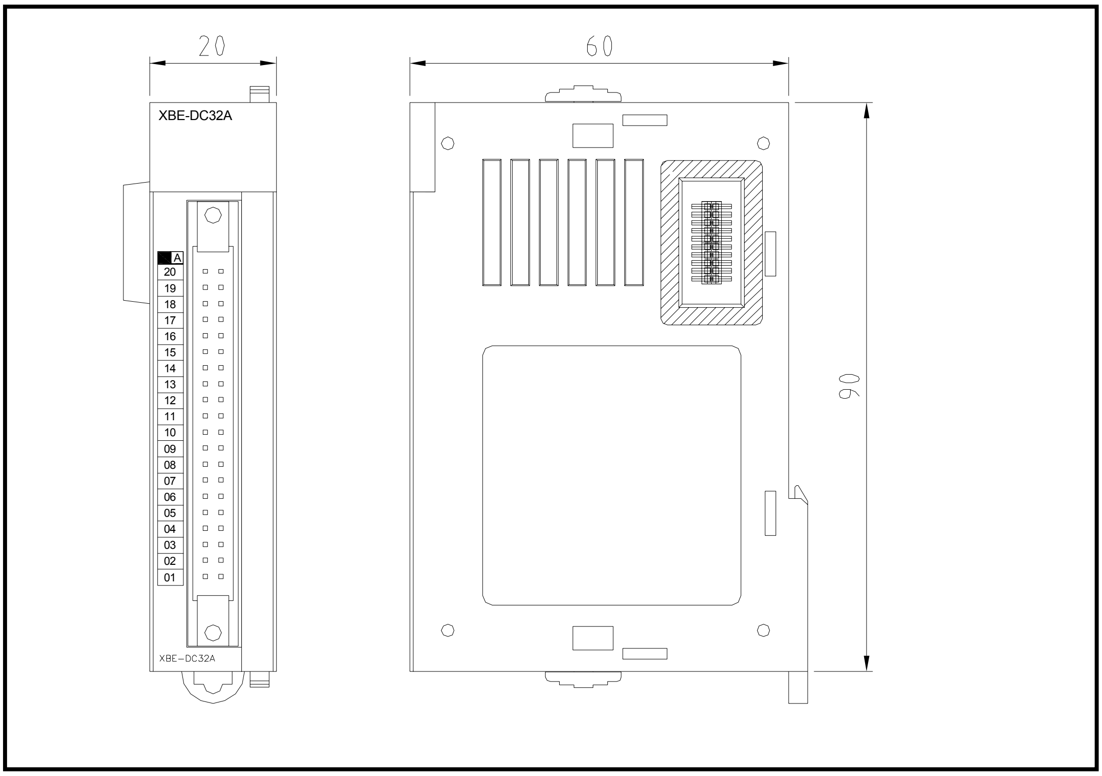


-. XBM-DR16S

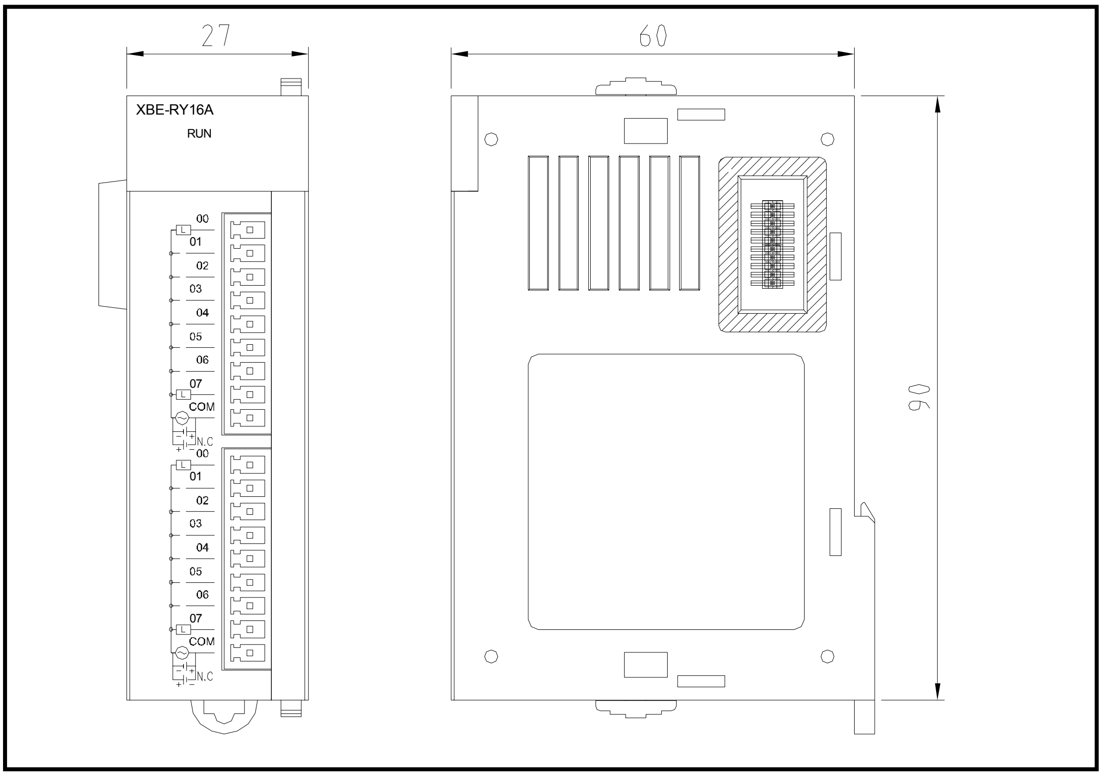


2) Expansion module

-. XBE-DC32A, XBE-TR32A

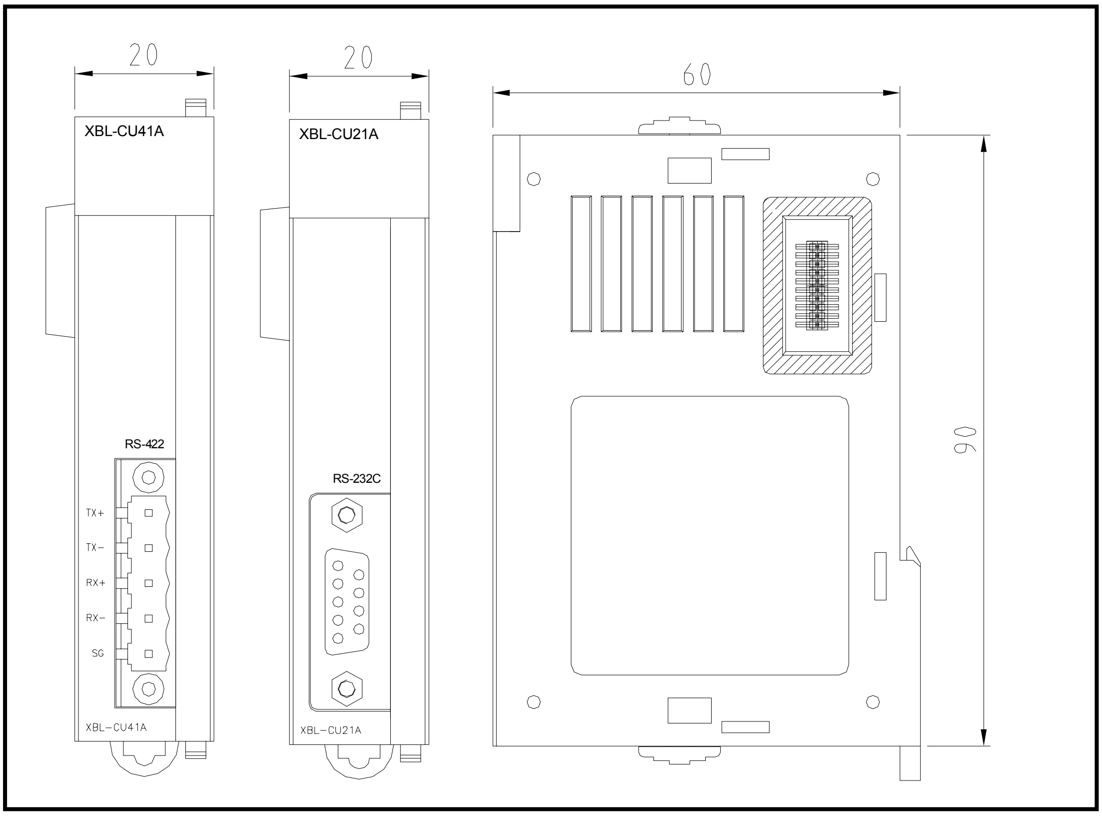


-. XBE-RY16A

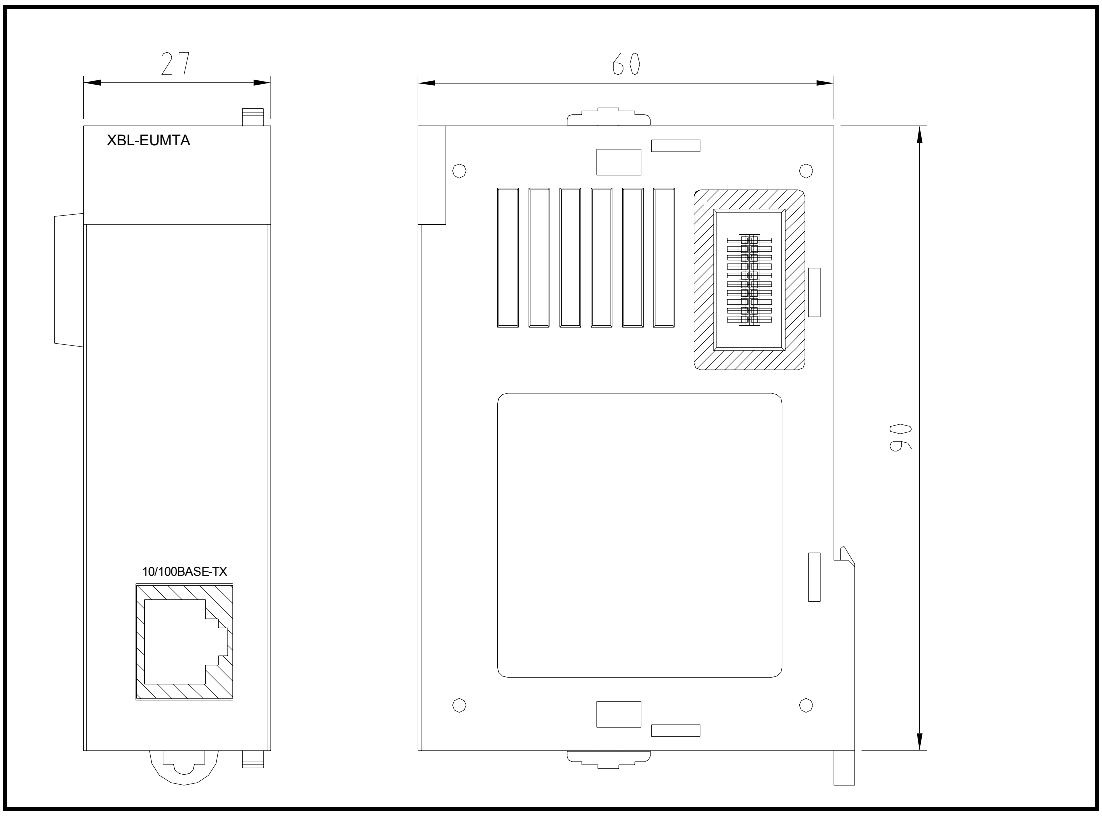


3) Communication module

-. XBL-C41/21A

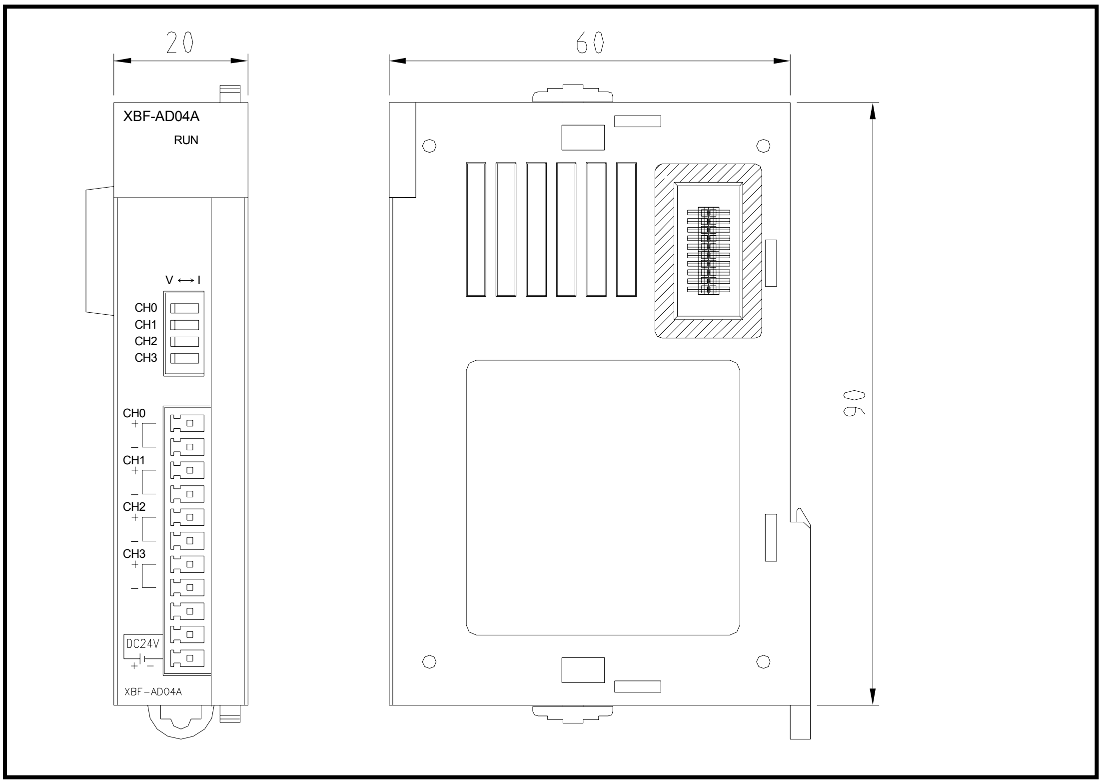


-. XBL-EMTA

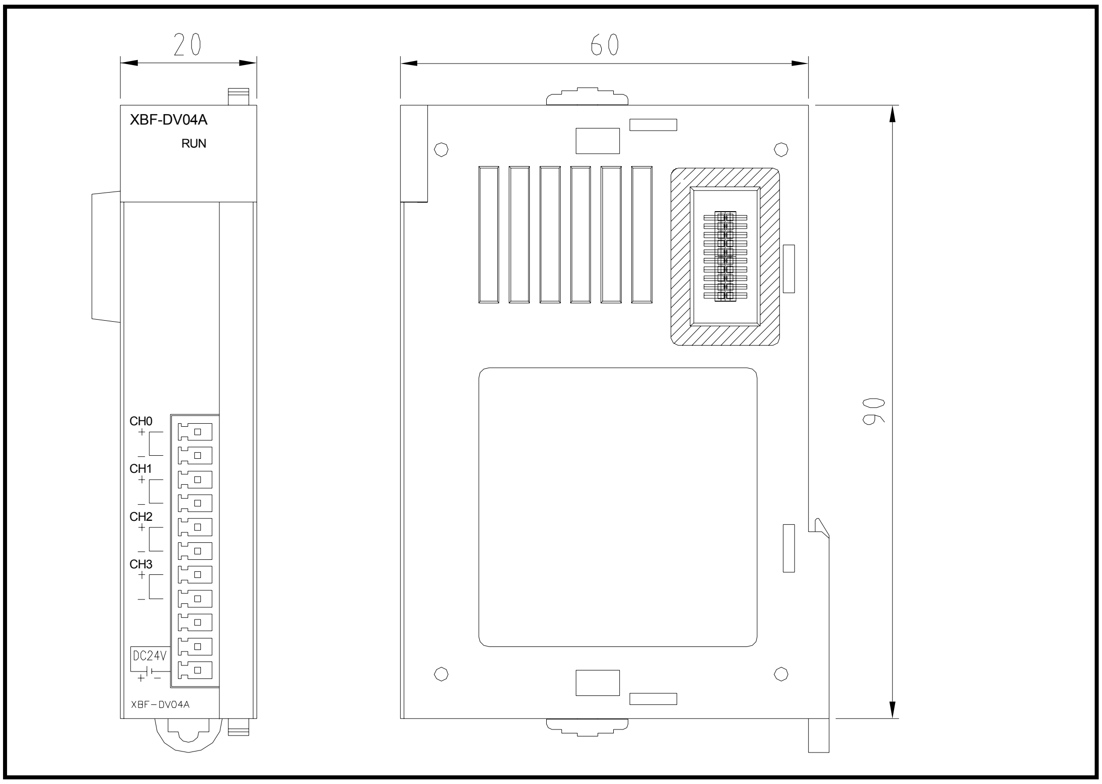


4) Special module

-. XBF-AD04A



-. XBF-DV04A



Appendix 3 Compatibility with MASTER-K

MASTER-K		XGB		
Device	Function	Symbol	Device	Function
F0000	RUN mode	_RUN	F0000	RUN Edit mode
F0001	Program mode	_STOP	F0001	Program mode
F0002	Pause mode	_ERROR	F0002	Error mode
F0003	Debug mode	_DEBUG	F0003	Debug mode
F0004	N/A	_LOCAL_CON	F0006	Remote mode
F0005	N/A	_MODBUS_CON	F0006	Remote mode
F0006	Remote mode	_REMOTE_CON	F0006	Remote mode
F0007	User memory setup	-	F0007	N/A
F0008	N/A	_RUN_EDIT_ST	F0008	Editing during RUN
F0009	N/A	_RUN_EDIT_CHK	F0009	Editing during RUN
F000A	User memory operation	_RUN_EDIT_DONE	F000A	Edit done during RUN
F000B	N/A	_RUN_EDIT_END	F000B	Edit end during RUN
F000C	N/A	_CMOD_KEY	F000C	Operation mode change by KEY
F000D	N/A	_CMOD_LPADT	F000D	Operation mode change by PADT
F000E	N/A	_CMOD_RPADT	F000E	Operation mode change by Remote PADT
F000F	STOP command execution	_CMOD_RLINK	F000F	Operation mode change cause by remote communication module
F0010	Ordinary time On	_FORCE_IN	F0010	Forced input
F0011	Ordinary time Off	_FORCE_OUT	F0011	Forced output
F0012	1 Scan On	_SKIP_ON	F0012	I/O Skip execution
F0013	1 Scan Off	_EMASK_ON	F0013	Error mask execution
F0014	Reversal every Scan	_MON_ON	F0014	Monitor execution
F0015 ~ F001C	N/A	_USTOP_ON	F0015	Stop by Stop Function
		_ESTOP_ON	F0016	Stop by ESTOP Function
		_CONPILE_MODE	F0017	Compile
		_INIT_RUN	F0018	Initialize
		-	F0019 ~ F001F	N/A
		_PB1	F001C	Program Code 1
F001D	N/A	_PB2	F001D	Program Code 2
F001E	N/A	_CB1	F001E	Compile code 1
F001F	N/A	_CB2	F001F	Compile code 2

MASTER-K		XGB		
Device	Function	Symbol	Device	Function
F0020	1 Step RUN	_CPU_ER	F0020	CPU configuration error
F0021	Break Point RUN	_IO_TYER	F0021	Module type mismatch error
F0022	Scan RUN	_IO_DEER	F0022	Module detach error
F0023	Contact value match RUN	_FUSE_ER	F0023	Fuse cutoff error
F0024	Word value match RUN	_IO_RWER	F0024	I/O module read/write error
F0025 ~ F002F	N/A	_IP_IFER	F0025	Special/communication module interface error
		_ANNUM_ER	F0026	Heavy error detection of external equipment error
		-	F0027	N/A
		_BPRM_ER	F0028	Basic parameter error
		_IOPRM_ER	F0029	I/O configuration parameter error
		_SPPRM_ER	F002A	Special module parameter error
		_CPPRM_ER	F002B	Communication module parameter error
		_PGM_ER	F002C	Program error
		_CODE_ER	F002D	Program Code error
		_SWDT_ER	F002E	System watchdog error
		_BASE_POWER_ER	F002F	Base power error
F0030	Heavy error	_WDT_ER	F0030	Scan watchdog
F0031	Light error	-	F0031	-
F0032	WDT error	-	F0032	-
F0033	I/O combination error	-	F0033	-
F0034	Battery voltage error	-	F0034	-
F0035	Fuse error	-	F0035	-
F0036 ~ F0038	N/A	-	F0036 ~ F0038	-
F0039	Backup normal	-	F0039	-
F003A	Clock data error	-	F003A	-
F003B	Program change	-	F003B	-
F003C	Program change error	-	F003C	-
F003D ~ F003F	N/A	-	F003D ~ F003F	N/A
F0040~ F005F	N/A	_RTC_ER	F0040	RTC data error
		_DBCK_ER	F0041	Data backup error
		_HBCK_ER	F0042	Hot restart disabled error
		_ABSD_ER	F0043	Abnormal operation stop
		_TASK_ER	F0044	Task collision
		_BAT_ER	F0045	Battery error
		_ANNUM_ER	F0046	Light error detection of external equipment

MASTER-K		XGB		
Device	Function	Symbol	Device	Function
F0040 ~ F005F	N/A	_LOG_FULL	F0047	Log memory full warning
		_HS_WAR1	F0048	High speed link parameter 1 error
		_HS_WAR2	F0049	High speed link parameter 2 error
		_HS_WAR3	F0049	High speed link parameter 3 error
		_HS_WAR4	F0049	High speed link parameter 4 error
		_HS_WAR5	F0049	High speed link parameter 5 error
		_HS_WAR6	F0049	High speed link parameter 6 error
		_HS_WAR7	F0049	High speed link parameter 7 error
		_HS_WAR8	F0049	High speed link parameter 8 error
		_HS_WAR9	F0050	High speed link parameter 9 error
		_HS_WAR10	F0051	High speed link parameter 10 error
		_HS_WAR11	F0052	High speed link parameter 11 error
		_HS_WAR12	F0053	High speed link parameter 12 error
		_P2P_WAR1	F0054	P2P parameter 1 error
		_P2P_WAR2	F0055	P2P parameter 2 error
		_P2P_WAR3	F0056	P2P parameter 3 error
		_P2P_WAR4	F0057	P2P parameter 4 error
		_P2P_WAR5	F0058	P2P parameter 5 error
		_P2P_WAR6	F0059	P2P parameter 6 error
		_P2P_WAR7	F005A	P2P parameter 7 error
		_P2P_WAR8	F005B	P2P parameter 8 error
		_Constant_ER	F005C	Constant error
		-	F005D ~ F005F	N/A
F0060 ~ F006F	Error Code save	-	F0060 ~ F006F	N/A
F0070 ~ F008F	Fuse cutoff save	-	F0070 ~ F008F	N/A
F0090	20ms cycle Clock	_T20MS	F0090	20ms cycle Clock
F0091	100ms cycle Clock	_T100MS	F0091	100ms cycle Clock
F0092	200ms cycle Clock	_T200MS	F0092	200ms cycle Clock
F0093	1s cycle Clock	_T1S	F0093	1s cycle Clock
F0094	2s cycle Clock	_T2S	F0094	2s cycle Clock
F0095	10s cycle Clock	_T10S	F0095	10s cycle Clock
F0096	20s cycle Clock	_T20S	F0096	20s cycle Clock
F0097	60s cycle Clock	_T60S	F0097	60s cycle Clock
F0098 ~F009F	N/A	-	F0098	N/A
		_ON	F0099	Ordinary time On
		_OFF	F009A	Ordinary time Off

MASTER-K		XGB		
Device	Function	Symbol	Device	Function
F0098~F009F	N/A	_1ON	F009B	1 Scan On
		_1OFF	F009C	1 Scan Off
		_STOG	F009D	Reversal every Scan
		-	F009B ~ F009F	N/A
F0100	User Clock 0	-	F0100	User Clock 0
F0101	User Clock 1	-	F0101	User Clock 1
F0102	User Clock 2	-	F0102	User Clock 2
F0103	User Clock 3	-	F0103	User Clock 3
F0104	User Clock 4	-	F0104	User Clock 4
F0105	User Clock 5	-	F0105	User Clock 5
F0106	User Clock 6	-	F0106	User Clock 6
F0107	User Clock 7	-	F0107	User Clock 7
F0108 ~ F010F		-	F0108 ~ F010F	N/A
F0110	Operation error flag	_Ler	F0110	Operation error flag
F0111	Zero flag	_Zero	F0111	Zero flag
F0112	Carry flag	_Carry	F0112	Carry flag
F0113	Full output Off	_All_Off	F0113	Full output Off
F0114	Common RAM R/W error	-	F0114	N/A
F0115	Operation error flag (latch)	_Ler_Latch	F0115	Operation error flag(latch)
F0116 ~ F011F		-	F0116 ~ F011F	N/A
F0120	LT flag	_LT	F0120	LT flag
F0121	LTE flag	_LTE	F0121	LTE flag
F0122	EQU flag	_EQU	F0122	EQU flag
F0123	GT flag	_GT	F0123	GT flag
F0124	GTE flag	_GTE	F0124	GTE flag
F0125	NEQ flag	_NEQ	F0125	NEQ flag
F0126 ~ F012F	N/A	-	F0126 ~ F012F	N/A
F0130~ F013F	AC Down Count	_AC_F_CNT	F0130~ F013F	AC Down Count
F0140~ F014F	FALS no.	_FALS_NUM	F0140~ F014F	FALS no.
F0150~ F015F	PUT/GET error flag	_PUTGET_ERR	F0150~ F030F	PUT/GET error flag
		CPU TYPE	F0440 ~ F044F	CPU TYPE
		CPU VERSION	F0450 ~ F045F	CPU VERSION
		O/S version no.	F0460 ~ F047F	System O/S version no.
F0160~ F049F	N/A	O/S date	F0480 ~ F049F	System O/S DATE

MASTER-K		XGB		
Device	Function	Symbol	Device	Function
F0500~ F050F	Max. Scan time	_SCAN_MAX	F0500~ F050F	Max. Scan time
F0510~ F051F	Min. Scan time	_SCAN_MIN	F0510~ F051F	Min. Scan time
F0520~ F052F	Current Scan time	_SCAN_CUR	F0520~ F052F	Current Scan time
F0530~ F053F	Clock data (year/month)	_YEAR_MON	F0530~ F053F	Clock data (year/month)
F0540~ F054F	Clock data (day/hr)	_DAY_TIME	F0540~ F054F	Clock data(day/hr)
F0550~ F055F	Clock data (min/sec)	_MIN_SEC	F0550~ F055F	Clock data(min/sec)
F0560~ F056F	Clock data (100year/weekday)	_HUND_WK	F0560~ F056F	Clock data(100year/weekday)
F0570~ F058F	N/A	_FPU_LFlag_I	F0570	-
		_FPU_LFlag_U	F0571	-
		_FPU_LFlag_O	F0572	-
		_FPU_LFlag_Z	F0573	Zero divide error latch flag
		_FPU_LFlag_V	F0574	-
		-	F0575 ~ F0579	N/A
		_FPU_Flag_I	F057A	-
		_FPU_Flag_U	F057B	-
		_FPU_Flag_O	F057C	-
		_FPU_Flag_Z	F057D	Zero divide error flag
		_FPU_Flag_V	F057E	
		_FPU_Flag_E	F057F	Irregular value Input error flag
		Error Step	F0580~ F058F	Error step save
F0590~ F059F	Error step save	-	F0590~ F059F	N/A
F0600~ F060F	FMM detailed error information	_REF_COUNT	F060~F061	Refresh Count
F0610~ F063F	N/A	_REF_OK_CNT	F062~F063	Refresh OK Count
		_REF_NG_CNT	F064~F065	Refresh NG Count
		_REF_LIM_CNT	F066~F067	Refresh Limit Count
		_REF_ERR_CNT	F068~F069	Refresh Error Count
		_MOD_RD_ERR_CNT	F070~F071	MODULE Read Error Count
		_MOD_WR_ERR_CNT	F072~F073	MODULE Write Error Count
		_CA_CNT	F074~F075	Cmd Access Count
		_CA_LIM_CNT	F076~F077	Cmd Access Limit Count
		_CA_ERR_CNT	F078~F079	Cmd Access Error Count
		_BUF_FULL_CNT	F080~F081	Buffer Full Count

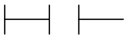
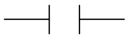
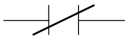
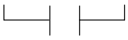
Appendix 4 Instruction List

Appendix 4.1 Classification of Instructions

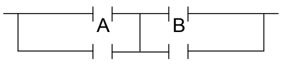
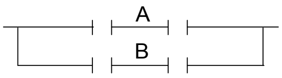
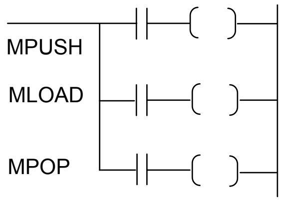
Classification	Instructions	Details	Remarks
Basic Instructions	Contact Point Instruction	LOAD, AND, OR related Instructions	
	Unite Instruction	AND LOAD, OR LOAD, MPUSH, MLOAD, MPOP	
	Reverse Instruction	NOT	
	Master Control Instruction	MCS, MCSCLR	
	Output Instruction	OUT, SET, RST, 1 Scan Output Instruction, Output Reverse Instruction (FF)	
	Sequence/Last-input Preferred Instruction	Step Control Instruction (SET Sxx.xx, OUT Sxx.xx)	
	End Instruction	END	
	Non-Process Instruction	NOP	
	Timer Instruction	TON, TOFF, TMR, TMON, TRTG	
	Counter Instruction	CTD, CTU, CTUD, CTR	
Application Instructions	Data Transfer Instruction	Transfers specified Data, Group, String	4/8/64 Bits available
	Conversion Instruction	Converts BIN/BCD of specified Data & Group	4/8 Bits available
	Data Type Conversion Instruction	Converts Integer/Real Number	
	Output Terminal Compare Instruction	Saves compared results in special relay	Compare to Unsigned
	Input Terminal Compare Instruction	Saves compared results in BR. Compares Real Number, String & Group. Compares 3 Operands	Compare to Signed
	Increase/Decrease Instruction	Increases or decreases specified data 1 by 1	4/8 Bits available
	Rotate Instruction	Rotates specified data to the left and right, including Carry	4/8 Bits available
	Move Instruction	Moves specified data to the left and right, word by word, bit by bit	4/8 Bits available
	Exchange Instruction	Exchanges between devices, higher & lower byte, group data	
	BIN Operation Instruction	Addition, Subtraction, Multiplication & Division for Integer/ Real Number, Addition for String, Addition & Subtraction for Group	
	BCD Operation Instruction	Addition, Subtraction, Multiplication, Division.	
	Logic Operation Instruction	Logic Multiplication, Logic Addition, Exclusive OR, Exclusive NOR, Group Operation	
	System Instruction	Error Display, WDT Initialize, Output Control, Operation Stop, etc.	
	Data Process Instruction	Encode, Decode, Data Disconnect/Connect, Search, Align, Max., Min., Total, Average, etc.	
	Data Table Process Instruction	Data Input/Output of Data Table	
	String Process Instruction	String related Convert, Comment Read, String Extract, ASCII Convert, HEX Convert, String Search, etc.	
	Special Function Instruction	Trigonometric Function, Exponential/Log Function, Angle/ Radian Convert, etc.	
	Data Control Instruction	Max/Min Limit Control, Dead-zone Control, Zone Control	
	Time related Instruction	Date Time Data Read/Write, Time Data Adjust & Convert	
	Diverge Instruction	JMP, CALL	
	Loop Instruction	FOR/NEXT/BREAK	
	Flag related Instruction	Carry Flag Set/Reset, Error Flag Clear	
	Special/Communication related Instruction	Data Read/Write by BUSCON Direct Access	
	Interrupt related Instruction	Interrupt Enable/Disable	
	Signal Reverse Instruction	Reverse Integer/Real Signals, Absolute Value Operation	

Appendix 4.2 Basic Instructions

1) Contact point instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Contact Point	LOAD		A Contact Point Operation Start	○	○
	LOAD NOT		B Contact Point Operation Start	○	○
	AND		A Contact Point Series-Connected	○	○
	AND NOT		B Contact Point Series-Connected	○	○
	OR		A Contact Point Parallel-Connected	○	○
	OR NOT		B Contact Point Parallel-Connected	○	○
	LOADP		Positive Convert Detected Contact Point	○	○
	LOADN		Negative Convert Detected Contact Point	○	○
	ANDP		Positive Convert Detected Contact Point Series-Connected	○	○
	ANDN		Negative Convert Detected Contact Point Series-Connected	○	○
	ORP		Positive Convert Detected Contact Point Parallel-	○	○
	ORN		Negative Convert Detected Contact Point Parallel-	○	○

2) Union instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Unite	AND LOAD		A,B Block Series-Connected	○	○
	OR LOAD		A,B Block Parallel-Connected	○	○
	MPUSH		Operation Result Push up to present	○	○
	MLOAD		Operation Result Load Previous to Diverge Point	○	○
	MPOP		Operation Result Pop Previous to Diverge Point	○	○

Remark

1) The number of Basic Steps means the case that indirect specification, index formula and direct variable input were not used. In other words, it represents the minimum number of the steps of the applicable instruction.
2) The number of steps depends on indirect specification, index formula and pulse application used.

3) Reverse instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Reverse	NOT	─*─	Previous Operation results Reverse	○	○

4) Master Control instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Master Control	MCS	─[MCS │ n]─	Master Control Setting (n:0~7)	○	○
	MCSCLR	─[MCSCLR │ n]─	Master Control Cancel (n:0~7)	○	○

5) Output instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Output	OUT	──( )─	Operation Results Output	○	○
	OUT NOT	──(/)─	Operation Results Reverse Output	○	○
	OUTP	──(P)─	1 Scan Output if Input Condition rises	○	○
	OUTN	──(N)─	1 Scan Output if Input Condition falls	○	○
	SET	──(S)─	Contact Point Output ON kept	○	○
	RST	──(R)─	Contact Point Output OFF kept	○	○
	FF	─[FF │ D]─	Output Reverse if Input Condition rises	○	○

6) Sequence/Last-input preferred instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Step Control	SET S	Syy.xx ──(S)─	Sequence Control	○	○
	OUT S	Syy.xx ──( )─	Last-input Preferred	○	○

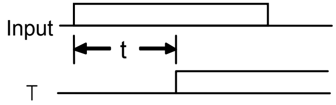
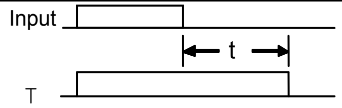
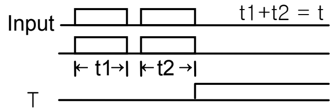
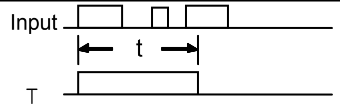
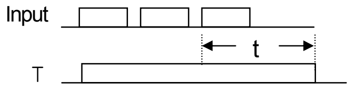
7) End instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
End	END	─[END]─	Program End	○	○

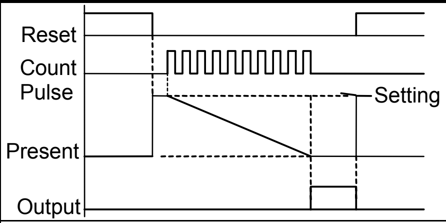
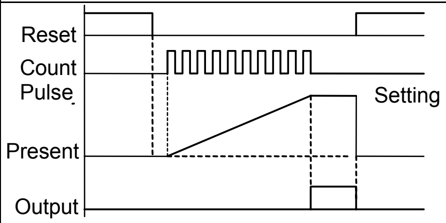
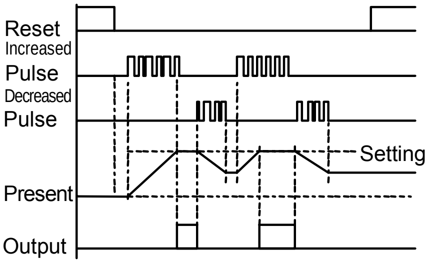
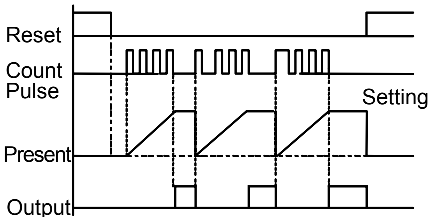
8) Non-process instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Non-Process	NOP	Ladder not displayed	Non-Process Instruction, used in Nimonic	○	○

9) Timer instruction

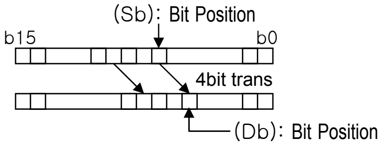
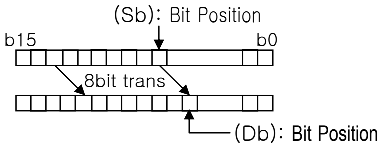
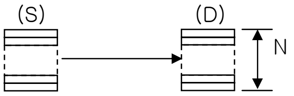
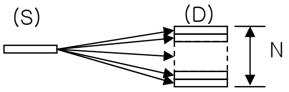
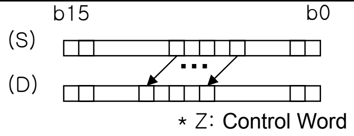
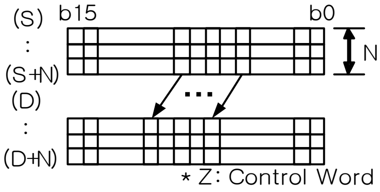
Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Timer	TON	TON T t		○	○
	TOFF	TOFF T t		○	○
	TMR	TMR T t		○	○
	TMON	TMON T t		○	○
	TRTG	TRTG T t		○	○

10) Counter instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Counter	CTD	CTD C c		○	○
	CTU	CTU C c		○	○
	CTUD	CTUD C U D c		○	○
	CTR	CTR C c		○	○

Appendix 4.3 Application Instruction

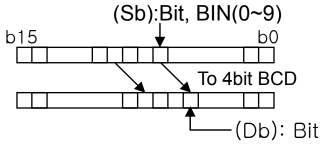
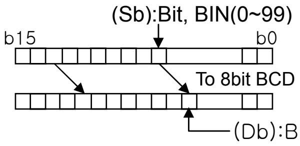
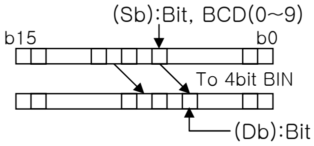
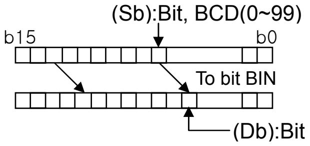
1) Data transfer instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
16 bits Transfer	MOV	MOV S D	(S) → (D)	○	○
	MOVP	MOVP S D			
32 bits Transfer	DMOV	DMOV S D	(S+1,S) → (D+1,D)	○	○
	DMOVP	DMOVP S D			
Short Real Number Transfer	RMOV	RMOV S D	(S+1,S) → (D+1,D)	○	○
	RMOVP	RMOVP S D			
Long Real Number Transfer	LMOV	LMOV S D	(S+3,S+2,S+1,S) → (D+3,D+2,D+1,D)	○	○
	LMOVP	LMOVP S D			
4 bits Transfer	MOV4	MOV4 Sb Db		○	○
	MOV4P	MOV4P Sb Db			
8 bits Transfer	MOV8	MOV8 Sb Db		○	○
	MOV8P	MOV8P Sb Db			
1's complement Transfer	CMOV	CMOV S D	1's complement (S) → (D)	○	○
	CMOVP	CMOVP S D			
	DCMOV	DCMOV S D	1's complement (S+1,S) → (D+1,D)	○	○
	DCMOVP	DCMOVP S D			
16 bits Group Transfer	GMOV	GMOV S D N		○	○
	GMOVP	GMOVP S D N			
Multiple Transfer	FMOV	FMOV S D N		○	○
	FMOVP	FMOVP S D N			
Specified Bits Transfer	BMOV	BMOV S D N		○	○
	BMOVP	BMOVP S D N			
Specified Bits Group Transfer	GBMOV	GBMOV S D Z N		○	○
	GBMOVP	GBMOVP S D Z N		○	○

1) Data Transfer Instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
String Transfer	$MOV	$MOV S D	String started from (S) → String started from (D)	○	○
	$MOVP	$MOVP S D		○	○

2) BCD/BIN conversion instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
BCD Conversion	BCD	BCD S D	To BCD (S) → (D) BIN(0~9999)	○	○
	BCDP	BCDP S D			
	DBCD	DBCD S D	To BCD (S+1,S) → (D+1,D) BIN(0~99999999)	○	○
	DBCDP	DBCDP S D			
4/8 Bits BCD Conversion	BCD4	BCD4 Sb Db		○	○
	BCD4P	BCD4P Sb Db			
	BCD8	BCD8 Sb Db		○	○
	BCD8P	BCD8P Sb Db			
BIN Conversion	BIN	BIN S D	To BIN (S) → (D) BCD(0~9999)	○	○
	BINP	BINP S D			
	DBIN	DBIN S D	To BIN (S+1,S) → (D+1,D) BCD(0~99999999)	○	○
	DBINP	DBINP S D			
4/8 Bits BIN Conversion	BIN4	BIN4 Sb Db		○	○
	BIN4P	BIN4P Sb Db			
	BIN8	BIN8 Sb Db		○	○
	BIN8P	BIN8P Sb Db			
Group BCD,BIN Conversion	GBCD	GBCD S D N	Data (S) to N converted to BCD, and (D) to N saved	○	○
	GBCDP	GBCDP S D N			
	GBIN	GBIN S D N	Data (S) to N converted to BIN, and (D) to N saved	○	○
	GBINP	GBINP S D N			

3) Data type conversion instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
16 Bits Integer/Real Conversion	I2R	I2R S D	(S) $\xrightarrow{\text{To Real}}$ (D+1,D) Int(-32768~32767)	○	○
	I2RP	I2RP S D			
	I2L	I2L S D	(S) $\xrightarrow{\text{To Long}}$ (D+3,D+2,D+1,D) Int(-32768~32767)	○	○
	I2LP	I2LP S D			
32 Bits Integer/Real Conversion	D2R	D2R S D	(S+1,S) $\xrightarrow{\text{To Real}}$ (D+1,D) Dint(-2147483648~2147483647)	○	○
	D2RP	D2RP S D			
	D2L	D2L S D	(S+1,S) $\xrightarrow{\text{To Long}}$ (D+3,D+2,D+1,D) Dint(-2147483648~2147483647)	○	○
	D2LP	D2LP S D			
Short Real/Integer Conversion	R2I	R2I S D	(S+1,S) $\xrightarrow{\text{To INT}}$ (D) Whole Sing Real Range	○	○
	R2IP	R2IP S D			
	R2D	R2D S D	(S+1,S) $\xrightarrow{\text{To DINT}}$ (D+1,D) Whole Sing Real Range	○	○
	R2DP	R2DP S D			
Long Real/Integer Conversion	L2I	L2I S D	(S+3,S+2,S+1,S) $\xrightarrow{\text{To INT}}$ (D) Whole Double Real Range	○	○
	L2IP	L2IP S D			
	L2D	L2D S D	(S+3,S+2,S+1,S) $\xrightarrow{\text{To DINT}}$ (D+1,D) Whole Double Real Range	○	○
	L2DP	L2DP S D			

Remark

1) Integer value and Real value will be saved respectively in quite different format. For such reason, Real Number Data should be converted as applicable before used for Integer Operation.

4) Comparison instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Unsigned Compare with Special Relay used	CMP	CMP S1 S2	CMP(S1,S2) and applicable Flag SET (S1, S2 is Word)	○	○
	CMPP	CMPP S1 S2			
	DCMP	DCMP S1 S2	CMP(S1,S2) and applicable Flag SET (S1, S2 is Double Word)	○	○
	DCMPP	DCMPP S1 S2			
4/8 Bits Compare	CMP4	CMP4 S1 S2	CMP(S1,S2) and applicable Flag SET (S1, S2 is Nibble)	○	○
	CMP4P	CMP4P S1 S2			
	CMP8	CMP8 S1 S2	CMP(S1,S2) and applicable Flag SET (S1, S2 is Byte)	○	○
	CMP8P	CMP8P S1 S2			
Table Compare	TCMP	TCMP S1 S2 D	CMP(S1,S2)) : CMP(S1+15,S2+15) Result:(D) ~ (D+15), 1 if identical	○	○
	TCMPP	TCMPP S1 S2 D			
	DTCMP	DTCMP S1 S2 D	CMP((S1+1,S1),(S2+1,S2)) : CMP((S1+31,S1+30),(S2+31,S2+30)) Result:(D) ~ (D+15)	○	○
	DTCMPP	DTCMPP S1 S2 D			
Group Compare (16 Bits)	GEQ	GEQ S1 S2 D N	Compares S1 data to S2 data word by word, and saves its result in Device (D) bit by bit from the lower bit (N ≤ 16)	○	○
	GEQP	GEQP S1 S2 D N			
	GGT	GGT S1 S2 D N			
	GGTP	GGTP S1 S2 D N			
	GLT	GLT S1 S2 D N			
	GLTP	GLTP S1 S2 D N			
	GGE	GGE S1 S2 D N			
	GGEP	GGEP S1 S2 D N			
	GLE	GLE S1 S2 D N			
	GLEP	GLEP S1 S2 D N			
	GNE	GNE S1 S2 D N			
	GNEP	GNEP S1 S2 D N			

Remark

1) CMP(P), DCMP(P), CMP4(P), CMP8(P), TCMP(P) & DTCMP(P) Instructions all process the results of Unsigned Compare. All the other Compare Instructions will perform Signed Compare.

4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Group Compare (32 Bits)	GDEQ	GDEQ S1 S2 D N	Compares S1 data to S2 data 2 by 2 words, and saves its result in Device (D) bit by bit from the lower bit (N ≤ 16)	○	○
	GDEQP	GDEQP S1 S2 D N		○	○
	GDGT	GDGT S1 S2 D N		○	○
	GDGTP	GDGTP S1 S2 D N		○	○
	GDLT	GDLT S1 S2 D N		○	○
	GDLTP	GDLTP S1 S2 D N		○	○
	GDGE	GDGE S1 S2 D N		○	○
	GDGEP	GDGEP S1 S2 D N		○	○
	GDLE	GDLE S1 S2 D N		○	○
	GDLEP	GDLEP S1 S2 D N		○	○
	GDNE	GDNE S1 S2 D N		○	○
	GDNEP	GDNEP S1 S2 D N		○	○

4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
16 Bits Data Compare (LOAD)	LOAD=	= S1 S2	Compares (S1) to (S2), and saves its result in Bit Result(BR) (Signed Operation)	○	○
	LOAD>	> S1 S2			
	LOAD<	< S1 S2			
	LOAD>=	>= S1 S2			
	LOAD<=	<= S1 S2			
	LOAD<>	<> S1 S2			
16 Bits Data Compare (AND)	AND=	= S1 S2	Performs AND operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation)	○	○
	AND>	> S1 S2			
	AND<	< S1 S2			
	AND>=	>= S1 S2			
	AND<=	<= S1 S2			
	AND<>	<> S1 S2			
16 Bits Data Compare (OR)	OR=	= S1 S2	Performs OR operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation)	○ ○	○ ○
	OR<=	<= S1 S2			
	OR<>	<> S1 S2			
32 Bits Data Compare (LOAD)	LOADD=	D= S1 S2	Compares (S1) to (S2), and saves its result in Bit Result(BR) (Signed Operation)		
	LOADD>	D> S1 S2			
	LOADD<	D< S1 S2			
	LOADD>=	D>= S1 S2			
	LOADD<=	D<= S1 S2			
	LOADD<>	D<> S1 S2			

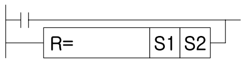
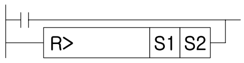
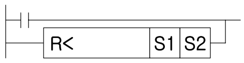
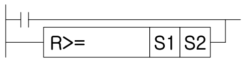
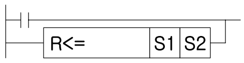
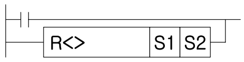
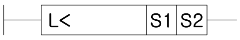
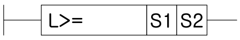
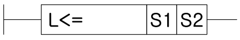
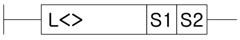
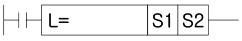
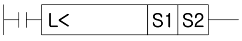
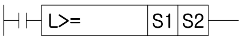
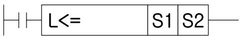
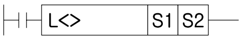
Remark

Comparison instruction process Signed comparison instruction generally. To process Unsigned comparison, Use comparison instruction.

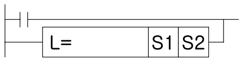
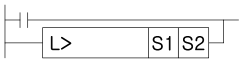
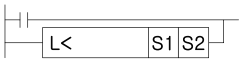
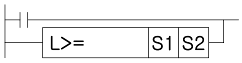
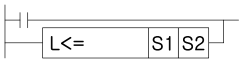
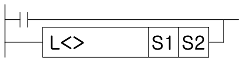
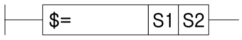
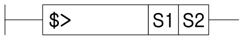
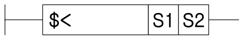
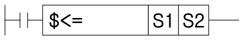
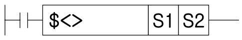
4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
32 Bits Data Compare (AND)	ANDD=	D= S1 S2	Performs AND operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation)	○	○
	ANDD>	D> S1 S2			
	ANDD<	D< S1 S2			
	ANDD>=	D>= S1 S2			
	ANDD<=	D<= S1 S2			
	ANDD<>	D<> S1 S2			
32bt Data Compare (OR)	ORD=	D= S1 S2	Performs OR operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation)	○	○
	ORD>	D> S1 S2			
	ORD<	D< S1 S2			
	ORD>=	D>= S1 S2			
	ORD<=	D<= S1 S2			
	ORD<>	D<> S1 S2			
Short Real Number Compare (LOAD)	LOADR=	R= S1 S2	Performs OR operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation)	○	○
	LOADR>	R> S1 S2			
	LOADR<	R< S1 S2			
	LOADR>=	R>= S1 S2			
	LOADR<=	R<= S1 S2			
	LOADR<>	R<> S1 S2			
Short Real Number Compare (AND)	ANDR=	R= S1 S2	Compares (S1+1,S) to (S2+1,S2) and saves its result in Bit Result (BR) (Signed Operation)	○	○
	ANDR>	R> S1 S2			
	ANDR<	R< S1 S2			
	ANDR>=	R>= S1 S2			
	ANDR<=	R<= S1 S2			
	ANDR<>	R<> S1 S2			

4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Real Number Compare (OR)	ORR=		Compares (S1+1,S1) to (S2+1,S2) and saves its result in Bit Result (BR) (Signed Operation)	○	○
	ORR>				
	ORR<				
	ORR>=				
	ORR<=				
	ORR<>				
Long Real Number Compare (LOAD)	LOADL=		Compares (S1+3,S1+2,S1+1,S) to (S2+3,S2+2, S2+1,S2) and saves its result in Bit Result(BR) (Signed Operation)	○	○
	LOADL>				
	LOADL<				
	LOADL>=				
	LOADL<=				
	LOADL<>				
Long Real Number Compare (AND)	ANDL=		Performs AND operation of (S1+1,S1) & (S2+1,S2) Compare Result and Bit Result(BR), and then saves its result in BR (Signed Operation)	○	○
	ANDL>				
	ANDL<				
	ANDL>=				
	ANDL<=				
	ANDL<>				

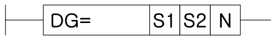
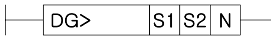
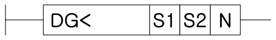
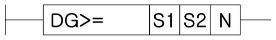
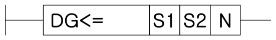
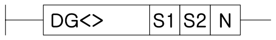
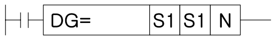
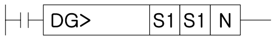
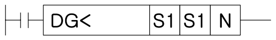
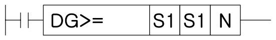
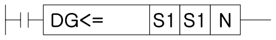
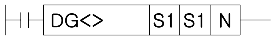
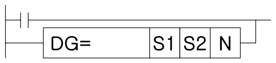
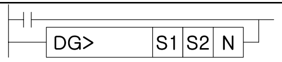
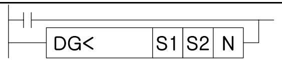
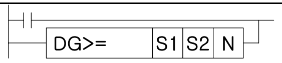
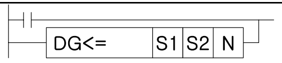
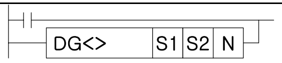
4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Double Real Number Compare (OR)	ORL=		Performs OR operation of (S1 +1,S1) & (S2+1,S2) Compare Result and Bit Result(BR), and then saves its result in BR (Signed Operation)	○	○
	ORL>				
	ORL<				
	ORL>=				
	ORL<=				
	ORL<>				
String Compare (LOAD)	LOAD$=		Compares (S1) to (S2) Starting String and saves its result in Bit Result(BR)	○	○
	LOAD$>				
	LOAD$<				
	LOAD$>=				
	LOAD$<=				
	LOAD$<>				
String Compare (AND)	AND$=		Performs AND operation of (S 1) & (S2) Starting String Compare Result and Bit Result(BR), and then saves its result in BR	○	○
	AND$>				
	AND$<				
	AND$>=				
	AND$<=				
	AND$<>				

4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
String Compare (OR)	OR$=	$= S1 S2	Performs OR operation of (S1) & (S2) Starting String Compare Result and Bit Result(BR), and then saves its result in BR	○	○
	OR$>	$> S1 S2			
	OR$<	$< S1 S2			
	OR$>=	$>= S1 S2			
	OR$<=	$<= S1 S2			
	OR$<>	$<> S1 S2			
16 Bits Data Group Compare (LOAD)	LOADG=	G= S1 S2 N	Compares (S1), (S1+1), ⋯, (S1+N) to (S2), (S2+1), ⋯ , (S2+N) 1 to 1, and then saves 1 in Bit Result(BR) if each value compared meets given condition	○	○
	LOADG>	G> S1 S2 N			
	LOADG<	G< S1 S2 N			
	LOADG>=	G>= S1 S2 N			
	LOADG<=	G<= S1 S2 N			
	LOADG<>	G<> S1 S2 N			
16 Bits Data Group Compare (AND)	ANDG=	G= S1 S1 N	Performs AND operation of (S1), (S1+1), ⋯, (S1+N) & (S2), (S2+1), ⋯ , (S2+N) 1 to 1 Compare Result and Bit Result (BR), and then saves its result in BR	○	○
	ANDG>	G> S1 S1 N			
	ANDG<	G< S1 S1 N			
	ANDG>=	G>= S1 S1 N			
	ANDG<=	G<= S1 S1 N			
	ANDG<>	G<> S1 S1 N			
16 Bits Data Group Compare (OR)	ORG=	G= S1 S2 N	Performs OR operation of (S1), (S1+1), ⋯, (S1+N) & (S2), (S2+1), ⋯ , (S2+N) 1 to 1 Compare Result and Bit Result (BR), and then saves its result in BR	○	○
	ORG>	G> S1 S2 N			
	ORG<	G< S1 S2 N			
	ORG>=	G>= S1 S2 N			
	ORG<=	G<= S1 S2 N			
	ORG<>	G<> S1 S2 N			

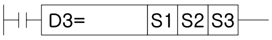
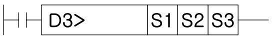
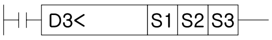
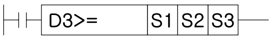
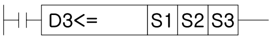
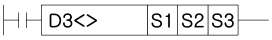
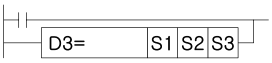
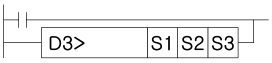
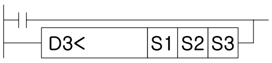
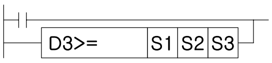
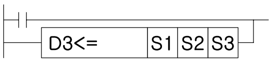
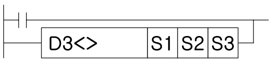
4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGX	XGB
32 Bits Data Group Compare (LOAD)	LOADDG=		Compares (S1), (S1+1), ···, (S1+N) to (S2), (S2+1), ··· , (S2+N) 1 to 1, and then saves 1 in Bit Result(BR) if each value compared meets given condition	○	○
	LOADDG>				
	LOADDG<				
	LOADDG>=				
	LOADDG<=				
	LOADDG<>				
32 Bits Data Group Compare (AND)	ANDDG=		Performs AND operation of (S1), (S1+1), ···, (S1+N) & (S2), (S2+1), ··· , (S2+N) 1 to 1 Compare Result and Bit Result(BR), and then saves its result in BR	○	○
	ANDDG>				
	ANDDG<				
	ANDDG>=				
	ANDDG<=				
	ANDDG<>				
32 Bits Data Group Compare (OR)	ORDG=		Performs OR operation of (S1), (S1+1), ···, (S1+N) & (S2), (S2+1), ··· , (S2+N) 1 to 1 Compare Result and Bit Result(BR), and then saves its result in BR	○	○
	ORDG>				
	ORDG<				
	ORDG>=				
	ORDG<=				
	ORDG<>				

4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Three 16-Bit Data Compare (LOAD)	LOAD3=	3= S1 S2 S3	Saves 1 in Bit Result(BR) if each value of (S1), (S2), (S3) meets given condition	○	○
	LOAD3>	3> S1 S2 S3			
	LOAD3<	3< S1 S2 S3			
	LOAD3>=	3>= S1 S2 S3			
	LOAD3<=	3<= S1 S2 S3			
	LOAD3<>	3<> S1 S2 S3			
Three 16-Bit Data Compare (AND)	AND3=	3= S1 S2 S3	Performs AND operation of (S1), (S2), (S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR	○	○
	AND3>	3> S1 S2 S3			
	AND3<	3< S1 S2 S3			
	AND3>=	3>= S1 S2 S3			
	AND3<=	3<= S1 S2 S3			
	AND3<>	3<> S1 S2 S3			
Three 32-Bit Data Compare (OR)	OR3=	3= S1 S2 S3	Performs OR operation of (S1), (S2), (S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR	○	○
	OR3>	3> S1 S2 S3			
	OR3<	<3 S1 S2 S3			
	OR3>=	>=3 S1 S2 S3			
	OR3<=	3<= S1 S2 S3			
	OR3<>	3<> S1 S2 S3			
Three 16-Bit Data Compare (LOAD)	LOADD3=	D3= S1 S2 S3	Saves 1 in Bit Result(BR) if each value of (S1+1,S1), (S2+ 1,S2), (S3+1,S3) meets given condition	○	○
	LOADD3>	D3> S1 S2 S3			
	LOADD3<	D3< S1 S2 S3			
	LOADD3>=	D3>= S1 S2 S3			
	LOADD3<=	D3<= S1 S2 S3			
	LOADD3<>	D3<> S1 S2 S3			

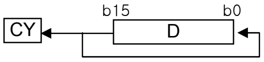
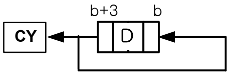
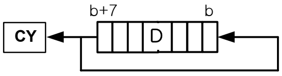
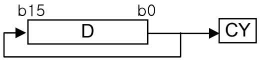
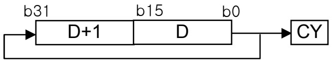
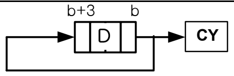
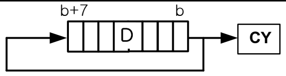
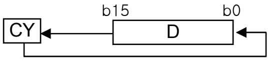
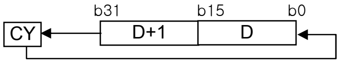
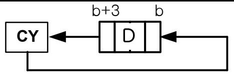
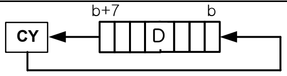
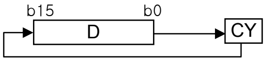
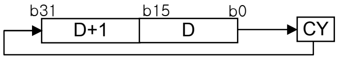
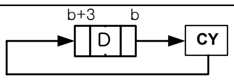
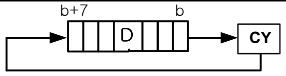
4) Comparison instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Three 32-Bit Data Compare (AND)	ANDD3=		Performs AND operation of (S1+1,S1), (S2+1,S2), (S3+1,S3) Compare Result by given condition and Bit Result(BR), and then saves its result in BR	○	○
	ANDD3>				
	ANDD3<				
	ANDD3>=				
	ANDD3<=				
	ANDD<>				
Three 32-Bit Data Compare (OR)	ORD3=		Performs OR operation of (S1+1, S1), (S2+1,S2), (S3+1,S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR	○	○
	ORD3>				
	ORD3<				
	ORD3>=				
	ORD3<=				
	ORD3<>				

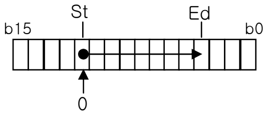
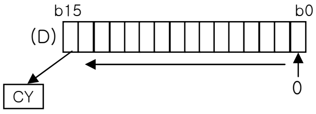
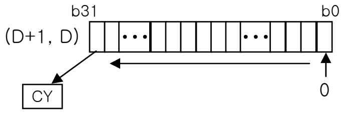
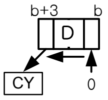
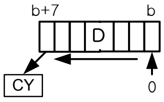
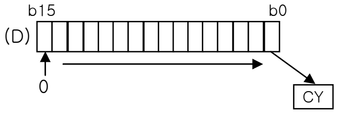
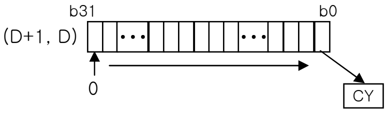
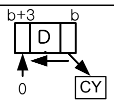
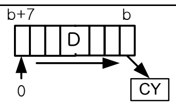
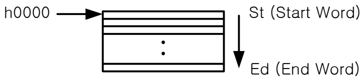
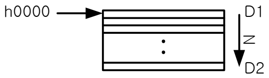
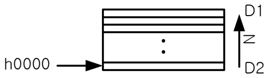
5) Increase/Decrease instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
BIN Data Increase / Decrease (Signed)	INC	INC D	(D)+1 → (D)	2	4-94
	INCP	INCP D			
	DINC	DINC D	(D+1,D)+1 → (D+1,D)	2	
	DINCP	DINCP D			
	DEC	DEC D	(D)−1 → (D)	2	4-96
	DECP	DECP D			
	DDEC	DDEC D	(D+1,D)−1 → (D+1,D)	2	
	DDECP	DDECP D			
4/8 Bits Data Increase / Decrease (Signed)	INC4	INC4 Db	(D:x bit ~ D:x bit+4) + 1 → (D:x bit ~ D:x bit+4)	2	4-95
	INC4P	INC4P Db		3	
	INC8	INC8 Db	(D:x bit ~ D:x bit+8) + 1 → (D:x bit ~ D:x bit+8)	2	
	INC8P	INC8P Db		3	
	DEC4	DEC4 Db	(D:x bit ~ D:x bit+4) − 1 → (D:x bit ~ D:x bit+4)	2	4-97
	DEC4P	DEC4P Db		3	
	DEC8	DEC8 Db	(D:x bit ~ D:x bit+8) − 1 → (D:x bit ~ D:x bit+8)	2	
	DEC8P	DEC8P Db		3	
BIN Data Increase / Decrease (Unsigned)	INCU	INCU D	(D)+1 → (D)	2	4-98
	INCUP	INCUP D			
	DINCU	DINCU D	(D+1,D)+1 → (D+1,D)	2	
	DINCUP	DINCUP D			
	DECU	DECU D	(D)−1 → (D)	2	4-99
	DECUP	DECUP D			
	DDECU	DDECU D	(D+1,D)−1 → (D+1,D)	2	
	DDECUP	DDECUP D			

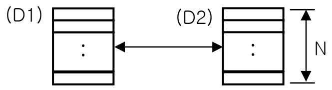
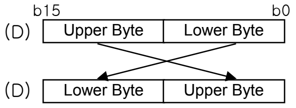
6) Rotation instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Rotate to Left	ROL	ROL D n		○	○
	ROLP	ROLP D n			
	DROL	DROL D n			
	DROLP	DROLP D n			
4/8 Bits Rotate to Left	ROL4	ROL4 Db n		○	○
	ROL4P	ROL4P Db n			
	ROL8	ROL8 Db n			
	ROL8P	ROL8P Db n			
Rotate to Right	ROR	ROR D n		○	○
	RORP	RORP D n			
	DROR	DROR D n			
	DRORP	DRORP D n			
4/8 Bits Rotate to Right	ROR4	ROR4 Db n		○	○
	ROR4P	ROR4P Db n			
	ROR8	ROR8 Db n			
	ROR8P	ROR8P Db n			
Rotate to Left (including Carry)	RCL	RCL D n		○	○
	RCLP	RCLP D n			
	DRCL	DRCL D n			
	DRCLP	DRCLP D n			
4/8 Bits Rotate to Left (including Carry)	RCL4	RCL4 Db n		○	○
	RCL4P	RCL4P Db n			
	RCL8	RCL8 Db n			
	RCL8P	RCL8P Db n			
Rotate to Right (including Carry)	RCR	RCR D n		○	○
	RCRP	RCRP D n			
	DRCR	DRCR D n			
	DRCRP	DRCRP D n			
4/8 Bits Rotate to Right (including Carry)	RCR4	RCR4 Db n		○	○
	RCR4P	RCR4P Db n			
	RCR8	RCR8 Db n			
	RCR8P	RCR8P Db n			

7) Move instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Bits Move	BSFT	BSFT St Ed		○	○
	BSFTP	BSFTP St Ed			
Move to Higher Bit	BSFL	BSFL D n		○	○
	BSFLP	BSFLP D n			
	DBSFL	DBSFL D n			
	DBSFLP	DBSFLP D n			
Move to Higher Bit within 4/8 Bits range	BSFL4	BSFL4 Db n		○	○
	BSFL4P	BSFL4P Db n			
	BSFL8	BSFL8 Db n			
	BSFL8P	BSFL8P Db n			
Move to Lower Bit	BSFR	BSFR D n		○	○
	BSFRP	BSFRP D n			
	DBSFR	DBSFR D n			
	DBSFRP	DBSFRP D n			
Move to Lower Bit within 4/8 Bits range	BSFR4	BSFR4 Db n		○	○
	BSFR4P	BSFR4P Db n			
	BSFR8	BSFR8 Db n			
	BSFR8P	BSFR8P Db n			
Word Move	WSFT	WSFT Et Ed		○	○
	WSFTP	WSFTP Et Ed			
Word Data Move to Left/Right	WSFL	WSFL D1 D2 N		○	○
	WSFLP	WSFLP D1 D2 N			
	WSFR	WSFR D1 D2 N			
	WSFRP	WSFRP D1 D2 N			
Bit Move	SR	SR Db I D N	Moves N bits starting from Db bit along Input direction (I) and Move direction (D)	○	○

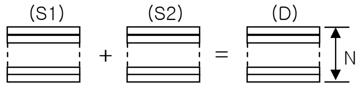
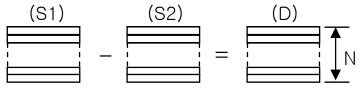
8) Exchange instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Data Exchange	XCHG	XCHG D1 D2	(D1) ←→ (D2)	○	○
	XCHGP	XCHGP D1 D2			
	DXCHG	DXCHG D1 D2	(D1+1, D1) ←→ (D2+1, D2)		
	DXCHGP	DXCHGP D1 D2			
Group Data Exchange	GXCHG	GXCHG D1 D2 N		○	○
	GXCHGP	GXCHGP D1 D2 N			
Higher/Lower Byte Exchange	SWAP	SWAP D		○	○
	SWAPP	SWAPP D			
Group Byte Exchange	GSWAP	GSWAP D N	Exchanges Higher/Lower Byte of Words N starting from D	○	○
	GSWAPP	GSWAPP D N			

9) BIN operation instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Integer Addition (Signed)	ADD	ADD S1 S2 D	(S1)+(S2) → (D)	○	○
	ADDP	ADDP S1 S2 D			
	DADD	DADD S1 S2 D	(S1+1,S1)+(S2+1,S2) → (D+1,D)		
	DADDP	DADDP S1 S2 D			
Integer Subtraction (Signed)	SUB	SUB S1 S2 D	(S1)−(S2) → (D)	○	○
	SUBP	SUBP S1 S2 D			
	DSUB	DSUB S1 S2 D	(S1+1,S1)−(S2+1,S2) → (D+1,D)		
	DSUBP	DSUBP S1 S2 D			
Integer Multiplication (Signed)	MUL	MUL S1 S2 D	(S1)×(S2) → (D+1,D)	○	○
	MULP	MULP S1 S2 D			
	DMUL	DMUL S1 S2 D	(S1+1,S1)×(S2+1,S2) → (D+3,D+2,D+1,D)		
	DMULP	DMULP S1 S2 D			
Integer Division (Signed)	DIV	DIV S1 S2 D	(S1)÷(S2) → (D) Quotient (D+1) Remainder	○	○
	DIVP	DIVP S1 S2 D			
	DDIV	DDIV S1 S2 D	(S1+1,S1)÷(S2+1,S2) → (D+1,D) Quotient (D+3,D+2) Remainder		
	DDIVP	DDIVP S1 S2 D			
Integer Addition (Unsigned)	ADDU	ADDU S1 S2 D	(S1)+(S2) → (D)	○	○
	ADDUP	ADDUP S1 S2 D			
	DADDU	DADDU S1 S2 D	(S1+1,S1)+(S2+1,S2) → (D+1,D)		
	DADDUP	DADDUP S1 S2 D			
Integer Subtraction (Unsigned)	SUBU	SUBU S1 S2 D	(S1)−(S2) → (D)	○	○
	SUBUP	SUBUP S1 S2 D			
	DSUBU	DSUBU S1 S2 D	(S1+1,S1)−(S2+1,S2) → (D+1,D)		
	DSUBUP	DSUBUP S1 S2 D			
Integer Multiplication (Unsigned)	MULU	MULU S1 S2 D	(S1)×(S2) → (D+1,D)	○	○
	MULUP	MULUP S1 S2 D			
	DMULU	DMULU S1 S2 D	(S1+1,S1)×(S2+1,S2) → (D+3,D+2,D+1,D)		
	DMULUP	DMULUP S1 S2 D			

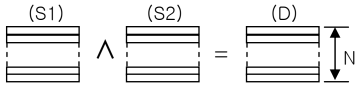
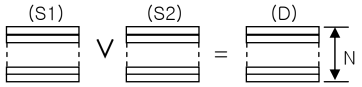
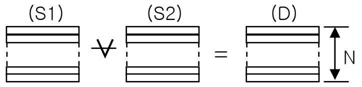
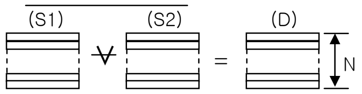
9) BIN operation instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Integer Division (Unsigned)	DIVU	DIVU S1 S2 D	(S1)÷(S2) → (D) Quotient (D+1) Remainder	○	○
	DIVUP	DIVUP S1 S2 D			
	DDIVU	DDIVU S1 S2 D	(S1+1,S1)÷(S2+1,S2) → (D+1,D) Quotient (D+3,D+2) Remainder		
	DDIVUP	DDIVUP S1 S2 D			
Real Number Addition	RADD	RADD S1 S2 D	(S1+1,S1)+(S2+1,S2) → (D+1,D)	○	○
	RADDP	RADDP S1 S2 D			
	LADD	LADD S1 S2 D	(S1+3,S1+2,S1+1,S1) +(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D)		
	LADDP	LADDP S1 S2 D			
Real Number Subtraction	RSUB	RSUB S1 S2 D	(S1+1,S1)−(S2+1,S2) → (D+1,D)	○	○
	RSUBP	RSUBP S1 S2 D			
	LSUB	LSUB S1 S2 D	(S1+3,S1+2,S1+1,S1) −(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D)		
	LSUBP	LSUBP S1 S2 D			
Real Number Multiplication	RMUL	RMUL S1 S2 D	(S1+1,S1)×(S2+1,S2) → (D+1,D)	○	○
	RMULP	RMULP S1 S2 D			
	LMUL	LMUL S1 S2 D	(S1+3,S1+2,S1+1,S1) ×(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D)		
	LMULP	LMULP S1 S2 D			
Real Number Division	RDIV	RDIV S1 S2 D	(S1+1,S1)÷(S2+1,S2) → (D+1,D)	○	○
	RDIVP	RDIVP S1 S2 D			
	LDIV	LDIV S1 S2 D	(S1+3,S1+2,S1+1,S1) ÷(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D)		
	LDIVP	LDIVP S1 S2 D			
String Addition	$ADD	$ADD S1 S2 D	Connects S1 String with S2 String to save in D	○	○
	$ADDP	$ADDP S1 S2 D			
Group Addition	GADD	GADD S1 S2 D N		○	○
	GADDP	GADDP S1 S2 D N			
Group Subtraction	GSUB	GSUB S1 S2 D N		○	○
	GSUBP	GSUBP S1 S2 D N			

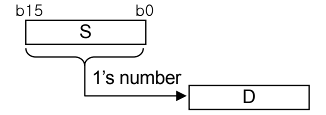
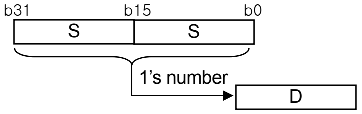
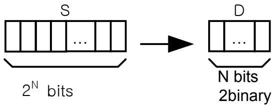
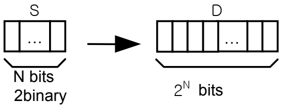
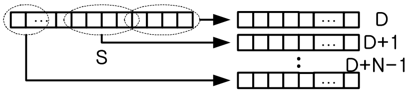
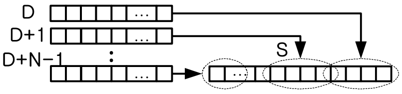
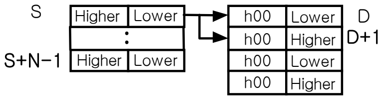
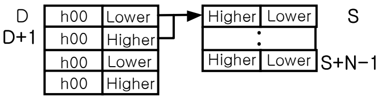
10) BCD operation instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
BCD Addition	ADDB	ADDB S1 S2 D	(S1)+(S2) → (D)	○	○
	ADDBP	ADDBP S1 S2 D			
	DADDB	DADDB S1 S2 D	(S1+1,S1)+(S2+1,S2) → (D+1,D)		
	DADDBP	DADDBP S1 S2 D			
BCD Subtraction	SUBB	SUBB S1 S2 D	(S1)−(S2) → (D)	○	○
	SUBBP	SUBBP S1 S2 D			
	DSUBB	DSUBB S1 S2 D	(S1+1,S1)−(S2+1,S2) → (D+1,D)		
	DSUBBP	DSUBBP S1 S2 D			
BCD Multiplication	MULB	MULB S1 S2 D	(S1)×(S2) → (D+1,D)	○	○
	MULBP	MULBP S1 S2 D			
	DMULB	DMULB S1 S2 D	(S1+1,S1)×(S2+1,S2) → (D+3,D+2,D+1,D)		
	DMULBP	DMULBP S1 S2 D			
BCD Division	DIVB	DIVB S1 S2 D	(S1)÷(S2) → (D) Quotient (D+1) Remainder	○	○
	DIVBP	DIVBP S1 S2 D			
	DDIVB	DDIVB S1 S2 D	(S1+1,S1)÷(S2+1,S2) → (D+1,D) Quotient (D+3,D+2) Remainder		
	DDIVBP	DDIVBP S1 S2 D			

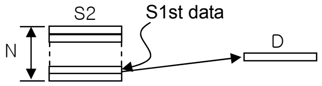
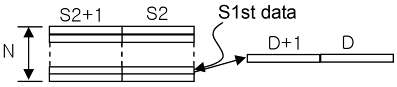
11) Logic operation instruction

Classification	Designations	Symbol	Description	Basic Steps	Page
Logic Multiplication	WAND	WAND S1 S2 D	Word AND $(S1) \wedge (S2) \longrightarrow (D)$	○	○
	WANDP	WANDP S1 S2 D			
	DWAND	DWAND S1 S2 D	DWord AND $(S1+1,S1) \wedge (S2+1,S2) \longrightarrow (D+1,D)$		
	DWANDP	DWANDP S1 S2 D			
Logic Addition	WOR	WOR S1 S2 D	Word OR $(S1) \vee (S2) \longrightarrow (D)$	○	○
	WORP	WORP S1 S2 D			
	DWOR	DWOR S1 S2 D	DWord OR $(S1+1,S1) \vee (S2+1,S2) \longrightarrow (D+1,D)$		
	DWORP	DWORP S1 S2 D			
Exclusive OR	WXOR	WXOR S1 S2 D	Word Exclusive OR $(S1) \veebar (S2) \longrightarrow (D)$	○	○
	WXORP	WXORP S1 S2 D			
	DWXOR	DWXOR S1 S2 D	DWord Exclusive OR $(S1+1,S1) \veebar (S2+1,S2) \longrightarrow (D+1,D)$		
	DWXORP	DWXORP S1 S2 D			
Exclusive NOR	WXNR	WXNR S1 S2 D	Word Exclusive NOR $\overline{(S1) \veebar (S2)} \longrightarrow (D)$	○	○
	WXNRP	WXNRP S1 S2 D			
	DWXNR	DWXNR S1 S2 D	DWord Exclusive NOR $\overline{(S1+1,S1) \veebar (S2+1,S2)} \longrightarrow (D+1,D)$		
	DWXNRP	DWXNRP S1 S2 D			
Group Logic Operation	GWAND	GWAND S1 S2 D N		○	○
	GWANDP	GWANDP S1 S2 D N			
	GWOR	GWOR S1 S2 D N		○	○
	GWORP	GWORP S1 S2 D N			
	GWXOR	GWXOR S1 S2 D N		○	○
	GWXORP	GWXORP S1 S2 D N			
	GWXNR	GWXNR S1 S2 D N		○	○
	GWXNRP	GWXNRP S1 S2 D N			

12) Data process instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Bit Check	BSUM	BSUM S D		○	○
	BSUMP	BSUMP S D			
	DBSUM	DBSUM S D			
	DBSUMP	DBSUMP S D			
Bit Reset	BRST	BRST D N	Resets N Bits (starting from D) to 0	○	○
	BRSTP	BRSTP D N			
Encode	ENCO	ENCO S D n		○	○
	ENCOP	ENCOP S D n			
Decode	DECO	DECO S D n		○	○
	DECOP	DECOP S D n			
Data Disconnect & Connect	DIS	DIS S D n		○	○
	DISP	DISP S D n			
	UNI	UNI S D n			
	UNIP	UNIP S D n			
Word/ Byte Conversion	WTOB	WTOB S D n		○	○
	WTOBP	WTOBP S D n			
	BTOW	BTOW S D n			
	BTOWP	BTOWP S D n			
I/O Refresh	IORF	IORF S1 S2 S3	Right after masking I/O data (located on S1) with S2 and S3 data, perform process	○	○
	IORFP	IORFP S1 S2 S3			
Data Search	SCH	SCH S1 S2 D N	Finds S1 value within S2 ~ N range and saves the first identical valued position in D and S1's identical valued total number in D+1	○	○
	SCHP	SCHP S1 S2 D N			
	DSCH	DSCH S1 S2 D N			
	DSCHP	DSCHP S1 S2 D N			
Max. Value Search	MAX	MAX S D n	Saves the max value in D among N words starting from S	○	○
	MAXP	MAXP S D n			
	DMAX	DMAX S D n	Saves the max value in D among N double words starting from S		
	DMAXP	DMAXP S D n			

12) Data process instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Min. Value Search	MIN	MIN S D n	Saves the min value in D among N words starting from S	○	○
	MINP	MINP S D n			
	DMIN	DMIN S D n	Saves the min value in D among N double words starting from S		
	DMINP	DMINP S D n			
Sum	SUM	SUM S D n	Adds up N words starting from S to save in D	○	○
	SUMP	SUMP S D n			
	DSUM	DSUM S D n	Adds up N double words starting from S to save in D		
	DSUMP	DSUMP S D n			
Average	AVE	AVE S D n	Averages N words starting from S to save in D	○	○
	AVEP	AVEP S D n			
	DAVE	DAVE S D n	Averages N double words starting from S to save in D		
	DAVEP	DAVEP S D n			
MUX	MUX	MUX S1 S2 D N		○	○
	MUXP	MUXP S1 S2 D N			
	DMUX	DMUX S1 S2 D N			
	DMUXP	DMUXP S1 S2 D N			
Data Detect	DETECT	DETECT S1 S2 D N	Detects N data from S1, to save the first value larger than S2 in D, and the extra number in D+1	○	○
	DETECTP	DETECTP S1 S2 D N			
Ramp Signal Output	RAMP	RAMP n1 n2 D1 n3 D2	Saves linear-changed value in D1 during n3 scanning of initial value n1 to final n2 and present scanning number in D1+1, and changes D2 value to ON after completed	○	○
Data Align	SORT	SORT S n1 n2 D1 D2	S : Head Address of Sort Data n1 : Number of Words to sort n1+1 : Sorting Method n2: Operation number per Scan D1 : ON if complete D2 : Auxiliary Area	○	○
	SORTP	SORTP S n1 n2 D1 D2			

13) Data table process instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Data Write	FIWR	FIWR S D	Adds S to the last of Data Table D ~ D+N, and increases Data Table Length(N) saved in D by 1	○	○
	FIWRP	FIWRP S D			
First-input Data Read	FIFRD	FIFRD S D	Moves first data, S+1 of Data Table S ~ S+N to D (pull 1 place after origin deleted) and decreases Data Table Length(N) saved in D by 1 S	○	○
	FIFRDP	FIFRDP S D			
Last-Input Data Read	FILRD	FILRD S D	Moves last data, S+N of Data Table S ~ S+N to D (origin deleted) and decreases Data Table Length(N) saved in D by 1 S	○	○
	FILRDP	FILRDP S D			
Data Insert	FIINS	FINS S D n	Adds S to 'N'th place of Data Table D ~ D+N (origin data pulled by 1), and increases Data Table Length(N) saved in D by 1	○	○
	FIINSP	FINSP S D n			
Data Pull	FIDEL	FDEL S D n	Deletes 'N'th data of Data Table S ~ S+N (pull 1 place) and decreases Data Table Length(N) saved in D by 1	○	○
	FIDELP	FDELP S D n			

14) Display instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
7 Segment Display	SEG	SEG S D Z	Converts S Data to 7-Segment as adjusted in Z Format so to save in D	○	○
	SEGP	SEGP S D Z			

15) String Process instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Convert to Decimal ASCII Cord	BINDA	BINDA S D	Converts S of 1-word BIN value to Decimal ASCII Cord to save in starting D	○	○
	BINDAP	BINDAP S D			
	DBINDA	DBINDA S D	Converts S of 2-word BIN value to Decimal ASCII Cord to save in starting D		
	DBINDAP	DBINDAP S D			
Convert to Hexadecimal ASCII Cord	BINHA	BINHA S D	Converts S of 1-word BIN value to Hexadecimal ASCII Cord to save in starting D	○	○
	BINHAP	BINHAP S D			
	DBINHA	DBINHA S D	Converts S of 2-word BIN value to Hexadecimal ASCII Cord to save in starting D		
	DBINHAP	DBINHAP S D			
Convert BCD to Decimal ASCII Cord	BCDDA	BCDDA S D	Converts S of 1-word BCD to ASCII Cord to save in starting D	○	○
	BCDDAP	BCDDAP S D			
	DBCDDA	DBCDDA S D	Converts S of 2-word BCD to ASCII Cord to save in starting D		
	DBCDDAP	DBCDDAP S D			
Convert Decimal ASCII to BIN	DABIN	DABIN S D	Converts S S+2,S+1,S's Decimal ASCII Cord to BIN to save in D	○	○
	DABINP	DABINP S D			
	DDABIN	DDABIN S D	Converts S+5~S's Decimal ASCII Cord to BIN value to save in D+1 & D		
	DDABINP	DDABINP S D			
Convert Hexadecimal ASCII to BIN	HABIN	HABIN S D	Converts S+1,S's Hexadecimal ASCII Cord to BIN value to save in D	○	○
	HABINP	HABINP S D			
	DHABIN	DHABIN S D	Converts S+3~S's Hexadecimal ASCII Cord to BIN to save in D		
	DHABINP	DHABINP S D			
Convert Decimal ASCII to BCD	DABCD	DABCD S D	Converts S+1,S's Decimal ASCII Cord to BCD to save in D	○	○
	DABCDP	DABCDP S D			
	DDABCD	DDABCD S D	Converts S+3~S's Decimal ASCII Cord to BCD to save in D		
	DDABCDP	DDABCDP S D			
String Length Detect	LEN	LEN S D	Saves String Length with S starting in D	○	○
	LENP	LENP S D			

15) String process instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Convert BIN16/32 to String	STR	STR S1 S2 D	Adjusts S2 saved word data to S1 saved place number to convert to String and save in D	○	○
	STRP	STRP S1 S2 D			
	DSTR	DSTR S1 S2 D	Adjusts S2 saved double word data to S1 saved place number to convert to String and save in D		
	DSTRP	DSTRP S1 S2 D			
Convert String to BIN16/32	VAL	VAL S D1 D2	Adjusts S saved string to number to save in word D1 and saves the place number in D2	○	○
	VALP	VALP S D1 D2			
	DVAL	DVAL S D1 D2	Adjusts S saved string to number to save in double word D1 and saves the place number in D2		
	DVALP	DVALP S D1 D2			
Convert Real Number to String	RSTR	RSTR S1 S2 D	Adjusts Floating decimal point point Real Number Data (S1: number, S2: places) to String format to save in D	○	X
	RSTRP	RSTRP S1 S2 D			
	LSTR	LSTR S1 S2 D	Adjusts Floating decimal point point Double Real Number Data (S1:number, S2:places) to String format to save in D		
	LSTRP	LSTRP S1 S2 D			
Convert String to Real Number	STRR	STRR S D	Converts String S to Floating decimal point point Real Number Data to save in D	○	X
	STRRP	STRRP S D			
	STRL	STRL S D	Converts String S to Floating decimal point point Double Real Number Data to save in D		
	STRLP	STRLP S D			
ASCII Conversion	ASC	ASC S D cw	Converts BIN Data to ASCII in Nibble unit, based on cw's format from S to save in D	○	○
	ASCP	ASCP S D cw			
HEX Conversion	HEX	HEX S D N	Converts 2N ASCII saved in N words from S in byte unit to Nibble unit of Hexadecimal BIN so to save in D	○	○
	HEXP	HEXP S D N			
String Extract from Right	RIGHT	RIGHT S D N	Extracts n string from S string's final letter to save in starting D	○	○
	RIGHTP	RIGHTP S D N			
String Extract from Left	LEFT	LEFT S D N	Extracts n string from S string's first letter to save in starting D	○	○
	LEFTP	LEFTP S D N			
String Random Extract	MID	MID S1 S2 D	Extracts string which conforms to S2 condition among S1 string to save in starting D	○	○
	MIDP	MIDP S1 S2 D			

15) String process instruction (continued)

Classification	Designations	Symbol	Description	Basic Steps	Page
String Random Replace	REPLACE	REPLACE S1 D S2	Processes S1 String as applicable to S2 Condition to save in D String	○	○
	REPLACEP	REPLACEP S1 D S2			
String Find	FIND	FIND S1 S2 D N	Finds identical String to S2 in S1 ~ N data to save the absolute position in D	○	○
	FINDP	FINDP S1 S2 D N			
Parse Real Number to BCD	RBCD	RBCD S1 S2 D	Adjusts Floating decimal point point Real Number Data S1 to S2 place to convert to BCD, and then to save in D	○	X
	RBCDP	RBCDP S1 S2 D			
	LBCD	LBCD S1 S2 D	Adjusts Floating decimal point point Double Real Number Data S1 to S2 place to convert to BCD, and then to save in D		
	LBCDP	LBCDP S1 S2 D			
Convert BCD Data to Real Number	BCDR	BCDR S1 S2 D	Adjusts BCD Data S1 to S2 place to convert to Floating decimal point point Real Number, and then to save in D	○	X
	BCDRP	BCDRP S1 S2 D			
	BCDL	BCDR S1 S2 D	Adjusts BCD Data S1 to S2 place to convert to Floating decimal point point Double Real Number, and then to save in D		
	BCDLP	BCDLP S1 S2 D			

16) Special function instruction

Classification	Designations	Symbol	Description	Basic Steps	Page
SIN Operation	SIN	SIN S D	SIN(S+1,S) → (D+1,D)	○	○
	SINP	SINP S D			
COS Operation	COS	COS S D	COS(S+1,S) → (D+1,D)	○	○
	COSP	COSP S D			
TAN Operation	TAN	TAN S D	TAN(S+1,S) → (D+1,D)	○	○
	TANP	TANP S D			
RAD Conversion	RAD	RAD S D	(S+1,S) → (D+1,D) Converts angle to radian	○	○
	RADP	RADP S D			
Angle Conversion	DEG	DEG S D	(S+1,S) → (D+1,D) Converts radian to angle	○	○
	DEGP	DEGP S D			
Square Root Operation	SQRT	SQRT S D	$\sqrt{(S+1,S)}$ → (D+1,D)	○	○
	SQRTP	SQRTP S D			

17) Data control instruction

Classification	Designations	Symbol	Description	Basic Steps	Page

Limit Control	LIMIT	LIMIT S1 S2 S3 D	If S1 < S2, then
			D = S2
			If S2 < S1 < S3, then
			D = S1
			If S3 < S1, then
			D = S3
				○	○

	LIMITP	LIMITP S1 S2 S3 D			
	DLIMIT	DLIMIT S1 S2 S3 D			
	DLIMITP	DLIMITP S1 S2 S3 D			

Dead-zone Control	DZONE	DZONE S1 S2 S3 D	If S1 < -S2, then
			D = S1+S2-S2(S3/100)
			If –S2 < S1 < S2, then
			D = (S3/100)S1
			If S1 < S2, then
			D = S1-S2+S2(S3/100)
				○	○

	DZONEP	DZONEP S1 S2 S3 D			
	DDZONE	DDZONE S1 S2 S3 D			
	DDZONEP	DDZONEP S1 S2 S3 D			

Vertical-zone Control	VZONE	VZONE S1 S2 S3 D	If S1 < -S2(S3/100), then
			D = S1-S2+S2(S3/100)
			If –S2(S3/100) <S1< S2(S3/100), then
			D = (100/S3)S1
			If S1 < S2(S3/100), then
			D = S1+S2-S2(S3/100)
				○	○

	VZONEP	VZONEP S1 S2 S3 D			
	DVZONE	DVZONE S1 S2 S3 D			
	DVZONEP	DVZONEP S1 S2 S3 D			
Built-in PID Control Instruction	PIDRUN	PIDRUN N	Operates PID Loop N	○	○
	PIDPAUSE	PIDPAUSE N	Stops PID Loop N momentarily	○	X
	PIDPRMT	PIDPRMT S N	Changes PID Loop N's Parameter. (SV(word) / Ts(word) / Kp(real) / Ti(real) / Td(real))	○	X
	PIDAT	PIDRUN N	Start of PID loop Auto-tuning	X	○
	PIDCAS	PIDPRMT S N	Start of PID loop cascade operation	X	○
	PIDHBD	PIDPRMT S N	PID 루프 혼합운전 시작.	X	○

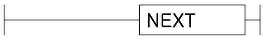
18) Time related instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Date/Time Data Read	DATERD	DATERD D	Reads PLC Time to save in D ~ D+6 (Yr/Mn/Dt/Hr/Mn/Sd/Day)	○	X
	DATERDP	DATERDP D			
Date/Time Data Write	DATEWR	DATEWR S	Input S ~ S+6's Time Data in PLC (Yr/Mn/Dt/Hr/Mn/Sd/Day)	○	X
	DATEWRP	DATEWRP S			
Time Data Increase	ADDCLK	ADDCLK S1 S2 D	Adds S1 ~ S1+2 & S2 ~ S2+2 Time Data to save in D ~ D+2 in Time Data format (Hr/Mn/Sd)	○	X
	ADDCLKP	ADDCLKP S1 S2 D			
Time Data Decrease	SUBCLK	SUBCLK S1 S2 D	Extracts S2 ~ S2+2's Time Data from S1 ~ S1+2 to save in D ~ D+2 in Time Data format (Hr/Mn/Sd)	○	X
	SUBCLKP	SUBCLKP S1 S2 D			
Time Data Format Conversion	SECOND	SECOND S D	Converts Time Data S ~ S+2 to seconds to save in double word D	○	X
	SECONDP	SECONDP S D			
	HOUR	HOUR S D	Converts the seconds saved in double word S to Hr/Mn/Sd to save in D ~ D+2	○	X
	HOURP	HOURP S D			

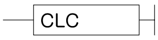
19) Divergence instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Divergence Instruction	JMP	JMP LABEL	Jumps to LABEL location	○	○
	LABEL	LABEL ( )	Jumps and designates the location to move to		
Subroutine Call Functional	CALL	CALL LABEL	Calls Function applicable to LABEL	○	○
	CALLP	CALLP LABEL			
	SBRT	SBRT LABEL	Designates Function to be called by CALL		
	RET	RET	RETURN		

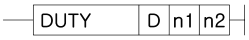
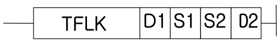
20) Loop instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Loop Instruction	FOR		Operates FOR~NEXT section n times	○	○
	NEXT				
	BREAK		Escapes from FOR~NEXT section	○	○

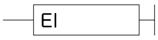
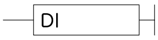
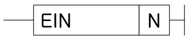
21) Flag instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Carry Flag Set, Reset	STC		Carry Flag(F0112) SET	○	○
	CLC		Carry Flag(F0112) RESET		
Error Flag Clear	CLE		Error Latch Flag(F0115) RESET	○	○

22) System instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Error Display	FALS		Self Diagnosis (Error Display)	○	○
Scan Cluck	DUTY		On during n1 Scan, Off during n2 Scan	○	○
Time Cluck	TFLK		On during S1 set time, Off during S2 set time	○	○
WDT Initialize	WDT		Watch Dog Timer Clear	○	○
	WDTP				
Output Control	OUTOFF		All Output Off	○	○
Operation Stop	STOP		Finishes applicable scan to end PLC Operation	○	○
Emergent Operation Stop	ESTOP		Ends PLC operation right after Instruction executed	○	○

23) Interrupt related instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
All Channels Interrupt Setting	EI		All Channels Interrupt allowed	○	○
	DI		All Channel Interrupt prohibited		
Individual Channel Interrupt Setting	EIN		Individual Channel Interrupt allowed	○	○
	DIN		Individual Channel Interrupt prohibited		

24) Sign reversion instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
2's complement	NEG	NEG D	Saves D value again in D with 2's complement taken	○	○
	NEGP	NEGP D			
	DNEG	DNEG D	Saves (D+1,D) value again in (D+1,D) with 2's complement taken		
	DNEGP	DNEGP D			
Real Number Data Sign Reverse	RNEG	RNEG D	Reverses D Real Number Sign then to save again	○	○
	RNEGP	RNEGP D			
	LNEGR	LNEG D	Reverses D Double Real Number Sign then to save again		
	LNEGP	LNEGP D			
Absolute Value Operation	ABS	ABS D	Converts D highest Bit to 0	○	○
	ABSP	ABSP D			
	DABS	DABS D	Converts (D+1,D) highest Bit to 0		
	DABSP	DABSP D			

25) File related instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Block Conversion	RSET	RSET S	Changes Block Number of file register to S Number	○	X
	RSETP	RSETP S			
Flash Word Data Transfer	EMOV	EMOV S1 S2 D	Transfers S2 word data in S1 Block to D	o	X
	EMOVP	EMOVP S1 S2 D			
Flash Double Word Data Transfer	EDMOV	EDMOV S1 S2 D	Transfers S2+1, S2 double word data in S1 Block to D+1, D		
	EDMOVP	EDMOVP S1 S2 D			
Block Read	EBREAD	EBREAD S1 S2	Reads Flash Memory Block	○	X
Block Write	EBWRITE	EBWRITE S1 S2	Writes Flash Memory Block	○	X
Block Compare	EBCMP	EBCMP S1 S2 D1 D2	Compares R Area's Bank with Flash Area's Block	○	X

Appendix 4.4 Special/Communication Instruction

1) Communication module related instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Station No. Set	P2PSN	P2PSN n1 n2 n3	Sets opposite station No. for P2P Communication. n1:P2P No., n2:Block, n3:Station No.	○	X
Read Area Set (WORD)	P2PWRD	P2PWRD n1 n2 n3 n4 n5	Sets word data Read Area n1:P2P No., n2:Block, n3:Variable sequence, n4:Variable Size, n5:Device	○	X
Write Area Set (WORD)	P2PWWR	P2PWWR n1 n2 n3 n4 n5	Sets word data Write Area n1:P2P No., n2:Block, n3:Variable sequence, n4:Variable Size, n5:Device	○	X
Read Area Set (BIT)	P2PBRD	P2PBRD n1 n2 n3 n4 n5	Sets bit data Read Area n1:P2P No., n2:Block, n3:Variable sequence, n4: Variable Size, n5:Device	○	X
Write Area Set (BIT)	P2PBWR	P2PBWR n1 n2 n3 n4 n5	Sets bit data Write Area n1:P2P No., n2:Block, n3:Variable sequence,n4:Variable Size, n5:Device	○	X

2) Special module common instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Special Module Read/Write	GET	GET sl S D N	Reads data of special module memory is installed on	○	○
	GETP	GETP sl S D N			
	PUT	PUT sl S1 S2 N	Writes data on special module memory is installed on	○	○
	PUTP	PUTP sl S1 S2 N			

3) Exclusive positioning instruction

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Return to Origin Point	ORG	ORG sl ax	Instructions Positioning Module's ax axis installed on sl slot to return to Origin Point	○	○
Floating Origin Point	FLT	FLT sl ax	Instructions Positioning Module's ax axis installed on sl slot to set Floating Origin Point	○	○
Direct Start	DST	DST sl ax n1 n2 n3 n4 n5	Instructions Positioning Module's ax axis installed on sl slot to start directly with Target Position(n1), Target Speed(n2), Dwell Time(n3), M Code(n4) & Control Word(n5)	○	○
Indirect Start	IST	IST sl ax n	Instructions Positioning Module's ax axis installed on sl slot to start n step indirectly	○	○
Linear Interpolation	LIN	LIN sl ax n1 n2	Instructions Positioning Module's ax axis installed on sl slot to let n2 axes operate n1 step by Linear Interpolation	○	○
Circular Interpolation	CIN	CIN sl ax n1 n2	Instructions Positioning Module's ax axis installed on sl slot to let n2 axes operate n1 step by Circular Interpolation	○	X
Simultaneous Start	SST	SST sl ax n1 n2 n3 n4	Instructions Positioning Module's ax axis installed on sl slot to let n4 axes operate n1(X), n2(Y), n3(Z) steps by Simultaneous Start	○	○
Speed/Position Control Switch	VTP	VTP sl ax	Instructions Positioning Module's ax axis installed on sl slot to switch Speed to Position Control	○	○
Position/Speed Control Switch	PTV	PTV sl ax	Instructions Positioning Module's ax axis installed on sl slot to switch Position to Speed Control	○	○
Decelerated Stop	STP	STP sl ax	Instructions Positioning Module's ax axis installed on sl slot to stop as decelerated.	○	○
Skip	SKP	SKP sl ax	Instructions Positioning Module's ax axis installed on sl slot to skip	○	X
Position Synchronization	SSP	SSP sl ax n1 n2 n3	Instructions Positioning Module's ax axis installed on sl slot to do Position Sync with main axis of n3, n1 sync-positioned and n2 step operated	○	○
Speed Synchronization	SSS	SSS sl ax n1 n2 n3	Instructions Positioning Module's ax axis installed on sl slot to do Speed Sync with main axis of n3, n1 master and n2 slave	○	○
Position Override	POR	POR sl ax n	Instructions Positioning Module's ax axis installed on sl slot to override Position to change the target position to n	○	○

4) Exclusive position control instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Speed Override	SOR	SOR sl ax n	Instructions Positioning Module's ax axis installed on sl slot to override Speed to change the target speed to n	○	○
Position specified Speed Override	PSO	PSO sl ax n	Instructions Positioning Module's ax axis installed on sl slot to override position specified speed to change the target speed to n2 from n1 position	○	○
Continuous Operation	NMV	NMV sl ax	Instructions Positioning Module's ax axis installed on sl slot to operate continuously to n step	○	X
Inching	INCH	INCH sl ax n	Instructions Positioning Module's ax axis installed on sl slot to inch to n position	○	○
Return to Position Previous to Manual Operation	RTP	RTP sl ax	Instructions Positioning Module's ax axis installed on sl slot to return to position previous to manual operation	○	X
Operation Step Change	SNS	SNS sl ax n	Instructions Positioning Module's ax axis installed on sl slot to change operation step to n	○	○
Repeated Operation Step Change	SRS	SRS sl ax n	Instructions Positioning Module's ax axis installed on sl slot to change repeated operation step to n	○	X
M Code Off	MOF	MOF sl ax	Instructions Positioning Module's ax axis installed on sl slot to make M code off	○	○
Present Position Change	PRS	PRS sl ax n	Instructions Positioning Module's ax axis to change present position to n	○	○
Zone Allowed	ZOE	ZOE sl ax	Allows zone output of Positioning Module installed on sl slot	○	X
Zone Prohibited	ZOD	ZOD sl ax	Prohibits zone output of Positioning Module installed on sl slot	○	X
Encoder Value change	EPRS	EPRS sl ax n	Changes Encoder Value of Positioning Module installed on sl slot to n	○	X
Teaching	TEA	TEA sl ax n1 n2 n3 n4	Changes n1 step's target position or speed of Positioning Module's ax axis installed on sl slot	○	X
Teaching Array	TEAA	TEAA sl ax n1 n2 n3 n4	Changes multiple target positions or speed of Positioning Module's ax axis installed on sl slot	○	X
Emergent Stop	EMG	EMG sl ax	Instructions Positioning Module installed on sl slot to perform Emergent Stop	○	○

5) Exclusive position control instruction (continued)

Classification	Designations	Symbol	Description	Support	
				XGK	XGB
Error Reset	CLR	CLR sl ax n	Resets Error originated from Positioning Module's ax axis installed on sl slot	○	○
Error History Reset	ECLR	ECLR sl ax	Deletes Error History originated from Positioning Module's ax axis installed on sl slot	○	X
Point Operation	PST	PST sl ax n	Performs Point Operation of Positioning Module's ax axis installed on sl slot	○	X
Basic Parameter Teaching	TBP	TBP sl ax n1 n2	Changes n2 to n1 among basic parameters of Positioning Module's ax axis installed on sl slot	○	X
Extended Parameter Teaching	TEP	TEP sl ax n1 n2	Changes n2 to n1 among extended parameters of Positioning Module's ax axis installed on sl slot	○	X
Return to Origin Point Parameter Teaching	THP	THP sl ax n1 n2	Changes n2 to n1 among returned parameters to origin point of Positioning Module's ax axis installed on sl slot	○	X
Manual Operation Parameter Teaching	TMP	TMP sl ax n1 n2	Changes n2 to n1 among manual operation parameters of Positioning Module's ax axis installed on sl slot	○	X
Input Signal Parameter Teaching	TSP	TSP sl ax n	Changes input signal parameter of Positioning Module's ax axis installed on sl slot to the value set in n1	○	X
Common Parameter Teaching	TCP	TCP sl ax n1 n2	Changes n2 to n1 among common parameters of Positioning Module installed on sl slot	○	X
Parameter Save	WRT	WRT sl ax n	Instructions Positioning Module's ax axis installed on sl slot to save present parameter of n axis in flash ROM.	○	○
Present State Read	SRD	SRD sl ax D	Reads and saves present state of Positioning Module's ax axis installed on sl slot in D area of CPU	○	X
Point Operation Step Write	PWR	PWR sl ax S n1	Writes value of S area of CPU on point operation step area of Positioning Module's ax axis installed on sl slot in	○	X
Plural Teaching Data Write	TWR	TWR sl ax S n1	Writes n value of S area of CPU on plural teaching dada area of Positioning Module's ax axis installed on sl slot in	○	X

Warranty

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

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

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

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

Environmental Policy

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

Environmental Management

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

About Disposal

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