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Programmable Logic Control

XGK CPU Module

XGT Series **User Manual**

XGK-CPUUN
XGK-CPUHN
XGK-CPUSN
XGK-CPUU
XGK-CPUH
XGK-CPUA
XGK-CPUS
XGK-CPUE



Safety Instructions

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

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Before using the product …

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

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

- Instructions are 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 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 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 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	Contents	Chapter
V 1.0	2006. 2	First Edition	-
V1.1	2009.10	1. XGK-CPUU added	Ch1.1, Ch2.3.1, Ch2.4.1, Ch4.1
		2. Fnet -> Rnet modified	Ch1.3
		3. Scan Time modified	Ch5.1.3
		4. Interrupt module removed	Ch7.1
		5. Clock data F device modified	Ch6.2
		6. Heavy error/light error modified	Ch6.7
		7. Fault mask -> “Release by program” removed	Ch6.8
		8. Skip function -> “Release by program” removed	Ch6.9
		9. Product list modified	Ch2.2
		10. Program language SFC, ST added	Ch4.1
		11. XGQ-SOEA added	Ch7.5
		12. Flag list modified	Appendix 1
V1.6	2010.3	1. Product list modified	Ch2.2, Ch2.4.2
		2. Supported functions according to OS version	Ch4.1
		3. Description on Reset/D.Clear switch added	Ch4.2
		4. Wiring diagram of Smart Link added	Ch7.6.3
		5. Flag added (indicated version to decimal places _OS_VER_PATCH)	App1.1
		6. Typos fixed	Ch1.1, Ch1.2, Ch1.3, Ch3.1, Ch4.1, Ch5.2.3, Ch5.5, Ch8.1, Ch10.3, Ch10.7, CH12.2, 12.3
V1.7	2013.1	1. Product list modified	Ch2.2
		2. Size of data refresh area added	Ch2.3.5
		3. Supported functions according to CPU OS version added	Ch4.1
		4. Fixed cycle task’s flag information added	Ch5.2.3
		5. Digital I/O module added	Ch7.2.10
		XGI-A21C, XGQ-TR1C	Ch7.3.11
		6. Flag added	App1.1

Version	Date	Contents	Chapter
V 1.8	2015. 2	1.CPU Module Added (XGK-CPUUN, XGK-CPUHN, XGK-CPUSN)	1.2, 2.2, 2.3, 2.4, 4.1, 4.2, 5.1.3, 5.4.1, 5.4.2 5.5, 6.13, 8.1, Appendix1.1
V 1.9	2015. 9	1. Circuit configuration modified 2. Smart Link Model name modified 3. Rated input voltage modified 4. Terminology modified (FG → PE) 5. CPU Processing Speed Unit changed (us → ns) 6. List of Configuration Products updated	7.2, 7.3, 7.4, 7.5 7.6 8.2 8.3, 9.1, 9.2, 11.2, 13.1 1.2, 4.1 2.2
V 2.0	2016. 3	1. Smart Link manual supplemented	7.6
V 2.1	2020.5	LSIS to change its corporate name to LS ELECTRIC	Entire
V2.2	2023.6	Domain modification (www.lselectric.co.kr -> www.ls-electric.com)	
V2.3	2024.5	1. Chapter 4 document location and error correction. 2. Chapter 8 Power module model addition and content modification. 3. Chapter 14 Troubleshooting error correction. 4. Appendix 1 Flag List error correction. 5. Appendix 2 Dimensions error correction. 6. Appendix 3 Compatibility with MASTER-K error correction.	4.1,4.2 8.2 Chapter 14 Appendix 1 Appendix 2 Appendix 3
V2.4	2024.6	Warranty period changed	BackCover

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

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

Relevant User's Manuals

Title	Description
XG5000 User's Manual (for XGK, XGB)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGK, XGB CPU
XG5000 User's Manual (for XGI, XGR)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGI, XGR CPU
XGK/XGB Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGK, XGB CPU.
XGI/XGR/XEC Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGI, XGR CPU.
XGK CPU User's Manual (XGK-CPUA/CPUE/CPUH/CPUS/CPUU /CPUUN/CPUHN/CPUSN)	User manual describing about XGK CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGI CPU User's Manual (XGI-CPUU/CPUH/CPUS/CPUE/CPUU/D CPUUN)	User manual describing about XGI CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGI CPUZ User's Manual (XGI-CPUZ3/ CPUZ5/ CPUZ7)	XGI-CPUZ3/ CPUZ5/ CPUZ7 user manual describing about XGI CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard.
XGR redundant series User's Manual	User manual describing about XGR CPU module, power module, extension drive, base, IO module, specification of extension cable and system configuration, EMC standard

Current user manual is written based on the following version.

Related OS version list

Product name	OS version
XGI-CPUUN	V1.0
XGI-CPUU, CPUH, CPUS, CPUE, CPUU/D	V3.3
XGK-CPUU, CPUH, CPUA, CPUS, CPUE	V3.5
XGR-CPUH/F, CPUH/T	V1.8
XG5000	V4.0

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Warranty

Chapter 1.Overview

1.1 How to use

This User's Manual provides the information for the specification·performance and operation method of each product required to use a PLC system configured by XGK series CPU modules.

The configuration of User's Manual is as follows.

Chapter	Item	Content
Chapter 1	Overview	This chapter describes the configuration of this manual, product features, and terminology.
Chapter 2	System configuration	Describes the product type and system configuration method to be used for XGK series.
Chapter 3	General specifications	Shows the common specification of each module used for XGK series.
Chapter 4	Specifications of the CPU module	Describes the performance · specification and operation method of XGK-CPU.
Chapter 5	Program Configuration and Operation Method	
Chapter 6	Function of CPU module	
Chapter 7	I/O Module	Describes the specification and the method to use I/O module and power module except CPU module.
Chapter 8	Power supply module	
Chapter 9	Base ·and Extended Cable	
Chapter 10	Built-in PID function	Describes on the built-in PID function and how to use it.
Chapter 11	Installation and Wiring.	Describes the installation, wiring method and notices to secure the reliability of PLC system.
Chapter 12	Maintenance	Describes the checking items and methods to run the PLC system normally for a long time.
Chapter 13	EMC Standard	Describes system configuration following EMC specification.
Chapter 14	Troubleshooting	Describes various errors and action methods occurred while using a system.
Appendix 1.	List of flags	Describes various type of each flag and its description.
Appendix 2.	External dimension	Shows the outer dimension of CPU, I/O module and Base.
Appendix 3.	Compatibility with MASTER-K	Explain using compatibility of flag with Master-K PLC.

Notes

1) This user's manual does not describe the special/communication module and program writing method.
For the corresponding function, please refer to the related user's manual.
2) XGK CPU is one of the XGT PLC system and CPU types of XGT PLC system are as follows.
① XGK series: XGT PLC system that consists of CPU using Master-K Language.
② XGI series: XGT PLC system that consists of CPU using IEC Language.
③ XGR series: XGT PLC system that consists of dual CPU using IEC Language.

1.2 Characteristics

XGK system have the following features.

1) Compact size

The function is extended to large sized but the size is reduced informatively to make the installation in the small space for any purpose easily.

2) High speed processing

(1) XGK-CPUUN

- Sequence instruction: 8.5 ns
- MOV instruction: 25.5 ns
- Floating point arithmetic operation (the operation speed for the single real number and double real number is profoundly improved)

Classification	+	−	×	÷
Short Real number	183 ns	183 ns	336 ns	345 ns
Long Real number	327 ns	327 ns	727 ns	808 ns

(2) XGK-CPUU

- Sequence instruction: 28 ns
- MOV instruction : 84 ns
- Real operation

Classification	+	−	×	÷
Short Real number	602 ns	602 ns	1,106 ns	1,134 ns
Long Real number	1,078 ns	1,078 ns	2,394 ns	2,660 ns

(3) Improvement of data transfer speed between modules through base.

- 16 point I/O module data process: 200 ns ~ 800 ns
- Analogue 1 Ch data process: 200 ns ~ 800 ns
- 1 KB communication module data process: 12,800 ns
- Parallel process by I/O data auto refresh during programming

3) Convenience to use Analog Data

Analog module enforced the precision and stability and provides the convenience as below.

- Program simplification by providing analog data dedicated 'U ' device
- Setting without memory map of special module is available by providing parameter setting method.

4) System configuration

Various convenient functions are provided to meet the demands of users.

- Filter value adjustment of input module
- Output hold at emergency time
- Varistor built-in relay output module with strong durability
- Total extension length of expanded base shall be 15m.
- Provides system RUN contact to power module
- Cost efficiency of setup, startup and maintenance/repair by enforced self-diagnosis function

5) Various communication system

Provides various network function to satisfy both the user convenience and compatibility.

- Network opening available without writing a ladder program
- Network setting and operation status monitoring by dedicated tool(XG-PD)
- Supports Open network of various international specification
- Dedicated network to provide the ease in use and optimal performance
- Network compatibility with the existing products (MASTER-K, GLOFA-GM)

6) Enforcement of program and online function

Minimized the program writing time by providing the convenience of programming and available to complete the control system of equipment without stopping the system by enforcement of online function.

- Available of ladder and text (Mnemonic) method
- Enforcement of symbolic program
- Automatic conversion of GLOFA program
- Available to modify the program during operation and secure the stability
- Available to install and change the network during operation
- Enforcement of trend monitoring function
- User event function
- Data trace function

7) User's convenience

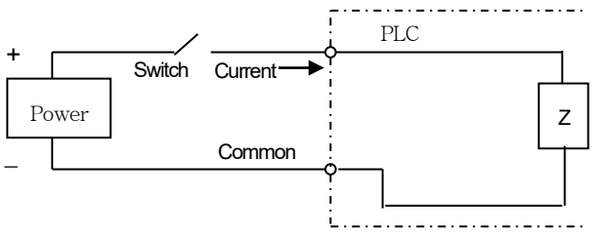
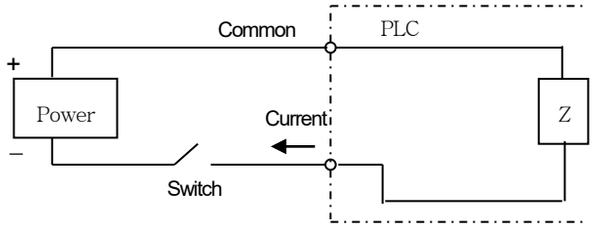
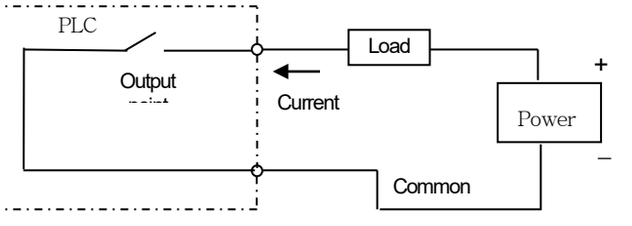
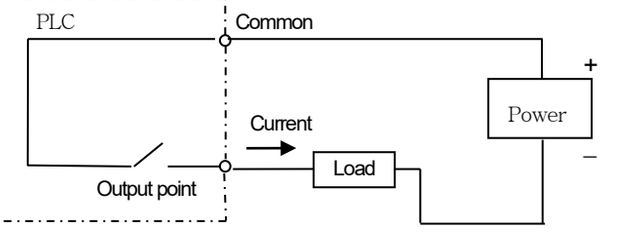
Various functions are provided for user's convenience.

- Module Changing Wizard function (User's tool is unnecessary.)
- System Diagnosis function
- Skip I/O function
- Fault Mask function
- Various Operation History

1.3 Terminology

Describes the terms used in the user's manual

Terminology	Definition	Remarks
Module	A device like I/O board assembled to insert in a motherboard or base as a standardized factor having the regular function to configure the system.	Ex) CPU Module, Power module, Input/output Module
Unit	A single module or group of modules that perform an independent operation as a part of a PLC system.	Ex) 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 XGT series. It executes program creation, edit, compile and debugging.	
I/O image area	Internal memory area of the CPU module which used to hold I/O status.	
Rnet	Remote Network	
Fnet	Field bus Network	
RAPIEnet	Real-time Automation Protocols for Industrial Ethernet	
Cnet	Computer Network	
FEnet	Fast Ethernet Network	
Pnet	Profibus-DP Network	
Dnet	DeviceNet Network	
RTC	Abbreviation of "Real Time Clock" RTC available only through use of XBO-RTCA option board	
Watchdog timer	It is a function to set the predetermined execution time of the program and to generate an alarm when the processing is not completed within the specified time, indicating that there is an error in the PLC operation.	
Task	There are three type of tasks. (cycle time task, internal device task, external device task by external interrupt module's input signal)	

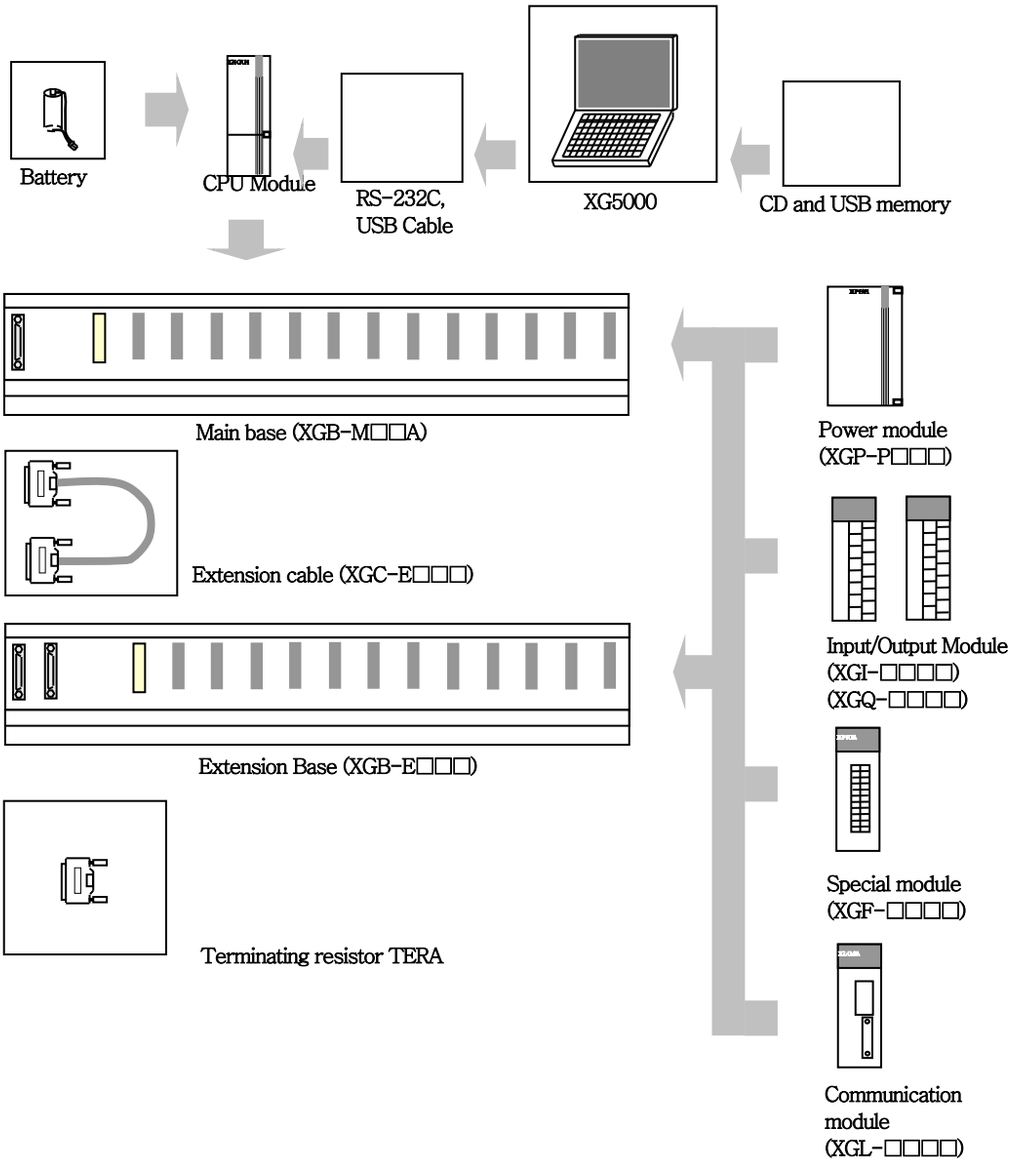
Terminology	Definition	Remarks
Sink Input	Current flows from the switch to the PLC input terminal if an input signal turns on. 	Z : Input resistance
Source Input	Current flows from the PLC input terminal to the switch after a input signal turns on. 	
Sink Output	Current flows from the load to the output 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

XGT series are equipped with various products proper for basic system, computer link and network system configuration. Here describes the configuration method of each system and its features.

2.1 XGK Series System Configuration

XGK series System Configuration is as follows.



Recommendations of selecting USB Cable (To avoid disconnection with XG5000)

1. Recommend that the company's USB Cable(USB-301A) which is shielded and shorter than 3m.
2. Recommend using USB Hub when connecting up to the PC poor at Noise.

2.2 Product List

The product configuration of XGK series is as below.

Product	Type	Content	Remarks
CPU Module	XGK-CPUE	• Standard type CPU module (Max I/O point: 1,536 points)	16kstep
	XGK-CPUS	• Standard type CPU module (Max I/O point: 3,072 points)	32kstep
	XGK-CPUA	• High speed type CPU module (Max I/O point: 3,072 points)	32kstep
	XGK-CPUH	• High speed type CPU module (Max I/O point: 6,144 points)	64kstep
	XGK-CPUU	• High speed type CPU module (Max I/O point: 6,144 points)	128kstep
	XGK-CPUSN	• High speed type CPU module (Max I/O point: 3,072 points)	64kstep
	XGK-CPUHN	• High speed type CPU module (Max I/O point: 6,144 points)	128kstep
	XGK-CPUUN	• High speed type CPU module (Max I/O point: 6,144 points)	256kstep
Digital input module	XGI-D21A	• DC 24V Input, 8 point (Current source / sink input)	-
	XGI-D21D	• DC 24V Diagnosis Input, 8 point (Current source / sink input)	-
	XGI-D22A	• DC 24V Input, 16 point (Current source / sink input)	-
	XGI-D24A	• DC 24V Input, 32 point (Current source / sink input)	-
	XGI-D28A	• DC 24V Input, 64 point (Current source / sink input)	-
	XGI-D22B	• DC 24V Input, 16 point (Current source input)	-
	XGI-D24B	• DC 24V Input, 32 point (Current source input)	-
	XGI-D28B	• DC 24V Input, 64 point (Current source input)	-
	XGI-A12A	• AC 110V Input, 16 point	-
	XGI-A21A	• AC 220V Input, 8 point	-
	XGI-A21C	• 220V isolated input, 8 point	-
Digital output module	XGQ-RY1A	• Relay output, 8 point (for 2A, single COM.)	-
	XGQ-RY1D	• Diagnostic Relay output, 8 point (for 2A)	-
	XGQ-RY2A	• Relay output, 16 point (for 2A)	-
	XGQ-RY2B	• Relay output, 16 point (for 2A),	-
	XGQ-TR2A	• Transistor output, 16 point (for 0.5A, sink output)	-
	XGQ-TR4A	• Transistor output, 32 point (for 0.1A, sink output)	-
	XGQ-TR8A	• Transistor output, 64 point (for 0.1A, sink output)	-
	XGQ-TR2B	• Transistor output, 16 point (for 0.5A, sink output)	-
	XGQ-TR4B	• Transistor output, 32 point (for 0.1A, source output)	-
	XGQ-TR8B	• Transistor output, 64 point (for 0.1A, source output)	-
	XGQ-SS2A	• Triac output 16 point (for 0.6A)	-
	XGQ-TR1C	• Isolated transistor output, 8 point (for 2A, sink output)	-
Digital Input/output module	XGH-DT4A	• DC 24V input, 16 point(source/sink) • Transistor output, 16 point (for 0.1A,sink output)	-

Product	Type	Content		Remarks
Main base unit	XGB-M04A	• for 4 module installation		-
	XGB-M06A	• for 6 module installation		-
	XGB-M08A	• for 8 module installation		-
	XGB-M12A	• for 12 module installation		-
Maximum extension base	XGB-E04A	• for 4 module installation		-
	XGB-E06A	• for 6 module installation		-
	XGB-E08A	• for 8 module installation		-
	XGB-E12A	• for 12 module installation		-
Power supply module	XGP-ACF1	AC100V / 240V Input	• DC5V: 3A, • DC24V: 0.6A	-
	XGP-ACF2	AC100V / 240V Input	• DC5V: 6A	-
	XGP-AC23	AC200V / 240V Input	• DC5V: 8.5A	-
	XGK-DC42	DC24V / 0V Input	• DC5V: 6A	-
Extension cable	XGC-E041	• length : 0.4 m		Total extension distance should not exceed 15m
	XGC-E061	• length : 0.6 m		
	XGC-E121	• length : 1.2 m		
	XGC-E301	• length : 3.0 m		
	XGC-E501	• length : 5.0 m		
	XGC-E102	• length : 10 m		
	XGC-E152	• length : 15 m		
Terminating resistor	XGT-TERA	• Must use terminating resistor when connecting extension base		-
Dust proof module	XGT-DMMA	• Dust protection module for unused slot		-
Battery	XGT-BAT	• Battery for XGT(DC 3.0V/1,800 mAh)		-

Product		Type	Content	Remarks
Special module	Analog input module	XGF-AV8A	• Power Input: 8 channel(DC1~5V/0~5V/0~10V/–10 ~ +10)	-
		XGF-AC8A	• Current input: 8 channel(DC 4 ~ 20mA / 0 ~ 20mA)	-
		XGF-AD8A	• Voltage/current input: 8 channel	-
		XGF-AD4S	• Voltage/current input: 4 channel, isolation between channels	-
		XGF-AD16A	• Voltage/current input: 16 channel	-
		XGF-AW4S	• 2-wire voltage/current input: 4 channel, isolation between channels • 2-Wire transmitter driver power supported	-
	Analog output module	XGF-DV4A	• voltage output: 4 channel • DC 1 ~ 5V / 0 ~ 5V / 0 ~ 10V / –10 ~ +10V	-
		XGF-DC4A	• Current output: 4 channel (DC 4 ~ 20mA / 0 ~ 20mA)	-
		XGF-DV4S	• Voltage output: 4 channel, isolation between channels	-
		XGF-DC4S	• Current output: 4 channel, isolation between channels	-
		XGF-DV8A	• Voltage output: 8 채널 (DC 1~5V/0~5V/0~10V/–10~+10)	-
		XGF-DC8A	• Current output: 8 channel (DC 4 ~ 20mA / 0 ~ 20mA)	-
	Analog input/output mixed module	XGF-AH6A	• Voltage/current input 4 channel • Voltage/current output 2 channel	-
	HART I/F analog input module	XGF-AC4H	• Current input 4 channel, HART I/F, DC 4 ~ 20mA	-
	HART I/F analog output module	XGF-DC4H	• Current output 4 channel, HART I/F, DC 4 ~ 20mA	-
	Thermo couple input module	XGF-TC4S	• Thermocouple input, 4 channel, isolation between channels	-
	RTD Input module	XGF-RD4A	• RTD input 4 channel	-
		XGF-RD4S	• RTD input, 4 channel, isolation between channels	-
		XGF-RD8A	• RTD input 8 channel	-
	Temperature control module	XGF-TC4UD	• Control loop : 4 loop • Input(4 channel, TC/RTD/Voltage/Current), Output(8 channel, TR/current)	-
		XGF-TC4RT	• Control loop : 4 loop • Input(4 channel, RTD), output(4 channel, TR)	-
	High speed counter module	XGF-HO2A	• Voltage input type(Open Collector), • 200KHz, 2 channel	-
		XGF-HD2A	• Differential input type(Line Driver), • 500KHz, 2 channel	-
		XGF-HO8A	• Voltage input type(Open Collector), • 200KHz, 8 channel	-

Product		Type	Content	Remarks
Special module	Positioning module	XGF-PO3A	• Pulse output(Open Collector), 3 axes	-
		XGF-PO2A	• Pulse output(Open Collector), 2 axes	-
		XGF-PO1A	• Pulse output(Open Collector), 1 axes	-
		XGF-PD3A	• Pulse output(Line Driver), 3 axes	-
		XGF-PD2A	• Pulse output(Line Driver), 2 axes	-
		XGF-PD1A	• Pulse output(Line Driver), 1 axes	-
		XGF-PO4H	• Pulse output(Open Collector), 4 axes	-
		XGF-PO3H	• Pulse output(Open Collector), 3 axes	-
		XGF-PO2H	• Pulse output(Open Collector), 2 axes	-
		XGF-PO1H	• Pulse output(Open Collector), 1 axes	-
		XGF-PD4H	• Pulse output(Line Driver), 4 axes	-
		XGF-PD3H	• Pulse output(Line Driver), 3 axes	-
		XGF-PD2H	• Pulse output(Line Driver), 2 axes	-
		XGF-PD1H	• Pulse output(Line Driver), 1 axes	-
		XGF-PN8A	• Network type(EtherCAT), 8 axes, LS dedicated	-
		XGF-PN8B	• Network type(EtherCAT), 8 axes, standard	-
	Motion control module	XGF-M16M	• Motion dedicated network(M-II), 16 axes	-
		XGF-M32E	• Motion dedicated network(EtherCAT), 32 axes ,standard	-
	Temperature input module	XGF-SOEA	• DC 24V input, 32 point, Sequence of Event module	-
	Data log module	XGF-DL16A	• USB 2.0, CF2001, Max 16GB • 32 point(input: 22 point, output 10 point)	-

Product		Type	Content	Remarks
Communication module	FEnet I/F Module (Optical/electric)	XGL-EFMF	• Fast Ethernet(optical), Master • 100/10 Mbps supported	-
		XGL-EFMT	• Fast Ethernet(electric), Master • 100/10 Mbps supported	-
		XGL-ESHF	• Fast Ethernet Switch module(optical)	-
		XGL-EH5T	• Fast Ethernet Switch module(electric)	-
	RAPIEnet I/F module	XGL-EIMT	• Communication module between PLCs ,electrical 100 Mbps Industrial Ethernet supported	-
		XGL-EIMF	• Communication module between PLCs 100 Mbps Industrial Ethernet supported	-
		XGL-EIMH	• Communication module between PLCs, electrical / optical mixed media, 100 Mbps Industrial Ethernet supported	-
		XGL-ES4T	• Communication module between PLCs , electrical 100 Mbps Industrial Ethernet supported • RAPIEnet switch	-
	Cnet I/F Module	XGL-C22A	• Serial communication • RS-232C, 2 channel	-
		XGL-C42A	• Serial communication • RS-422(485), 2 channel	
		XGL-CH2A	• Serial communication • RS-232C 1 channel / RS-422(485) 1 channel	
	FDEnet I/F module(Master)	XGL-EDMF	• Dedicated Ethernet(optical), Master • Deterministic communication supported • 100/10 Mbps supported	-
		XGL-EDMT	• Dedicated Ethernet(electric), Master • Deterministic communication supported • 100/10 Mbps supported	-
	Rnet I/F module	XGL-RMEA	• Rnet master module	-
	Profibus-DP I/F module	XGL-PMEA XGL-PMEC	• Profibus-DP master module	-
	Pnet Slave I/F module	XGL-PSEA	• Profibus-DP slave module	-
	DeviceNet I/F module	XGL-DMEA	• DeviceNet master module	-
	Ethernet/IP I/F module	XGL-EIPT	• EtherNet/IP(electric) • 100/10 Mbps supported	-
	BACnet/IP I/F module	XGL-BIPT	• BACnet/IP (electric) • 100/10 Mbps supported	-
	Fnet I/F module	XGL-FMEA	• Field Bus master module	-
Etc	40 points connector	1473381,1	• 40 point connector (for input/output and special module)	-

Notes

For the further information about active coupler, optical converter, repeater and block type remote module, which are network devices, refer to the user's manual of network.

O/S version of communication module applicable to XGK system is as follows.

Classification	Module							
	FEnet	FDEnet	Cnet	Rnet	Pnet	Dnet	RAPIEnet	IFOS module Switch
Product name	XGL-EFMT XGL-EFMF	XGL-EDMT XGL-EDMF	XGL-C22A XGL-CH2A XGL-C42A	XGL-RMEA	XGL-PMEA	XGL-DMEA	XGL-EIMF XGL-EIMT XGL-EIMH	XGL-ESHF
Apply Possible Version	V2.0 or higher	V2.0 or higher	V2.1 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher

2.3 Basic System

2.3.1 Configuration method of Basic System

The features of Basic system consisted by connecting the main base and expanded base by a cable are as follows. The number of stages of expanded base is limited according to the CPU type and the allocation method of I/O No. is available to select the fixed type and variable type according to the setting of basic parameter.

Classification	XGK-CPUE	XGK-CPUS XGK-CPUSN	XGK-CPUA	XGK-CPUH XGK-CPUHN	XGK-CPUU XGK-CPUUN
Maximum number of extension stages	1 stages	3 stages	3 stages	7 stages	7 stages
Maximum number of I/O module installation	24 module	48 module	48 module	96 module	96 module
Maximum I/O score	1,536 points	3,072 points	3,072 points	6,144 points	6,144 points
Maximum extension distance	15m				
Assignment of I/O number (fixed value)	• Each slot of base is allocated by 64 points regardless module installation and type. • For one base, I/O no. of 16 slots is allocated. That is, the start no. of No.1 base becomes P00640. (Refer to 2.3.2). •The example of I/O no. of 12 Slot base is as below.				
Assignment of I/O number (Variable type)	•The point is allocated according to the assignment of installation module per slot. - Specified points will be assigned if installed module specified by I/O parameter. - To the slot not specified by I/O parameter, points will be automatically assigned according to actually installed module. **(Caution: 16 points will be assigned to 8-point module)** **- 16 points will be assigned to empty slot which is not specified by I/O parameter.** • Available to assign the point only by I/O parameter without module assignment • The slot installed by special module or communication module is allocated by 16 point. •The example of I/O no. of 12 Slot base is as below.				

Slot no. 0 1 2 3 4 5 6 7 8 9 10 11

PWR	CPU	Input 16	Input 16	Input 32	Input 64	Output 16	Output 32	Output 32	Output 64	Output 32	Output 16	Output 32	Output 32

P0	P40	P80	P120	P160	P200	P240	P280	P320	P360	P400	P440
~	~	~	~	~	~	~	~	~	~	~	~
P3F	P7F	P11F	P15F	P19F	P23F	P27F	P31F	P35F	P39F	P43F	P47F

Slot no. 0 1 2 3 4 5 6 7 8 9 10 11

PWR	CPU	Input 16	Input 16	Input 32	Input 64	Output 16	Output 32	Output 32	Output 64	Input 32	Output 16	Output 32	Output 32

P00	P10	P20	P40	P80	P90	P110	P130	P170	P190	P200	P220
~	~	~	~	~	~	~	~	~	~	~	~
P0F	P1F	P3F	P7F	P8F	P10F	P12F	P16F	P18F	P19F	P21F	P23F

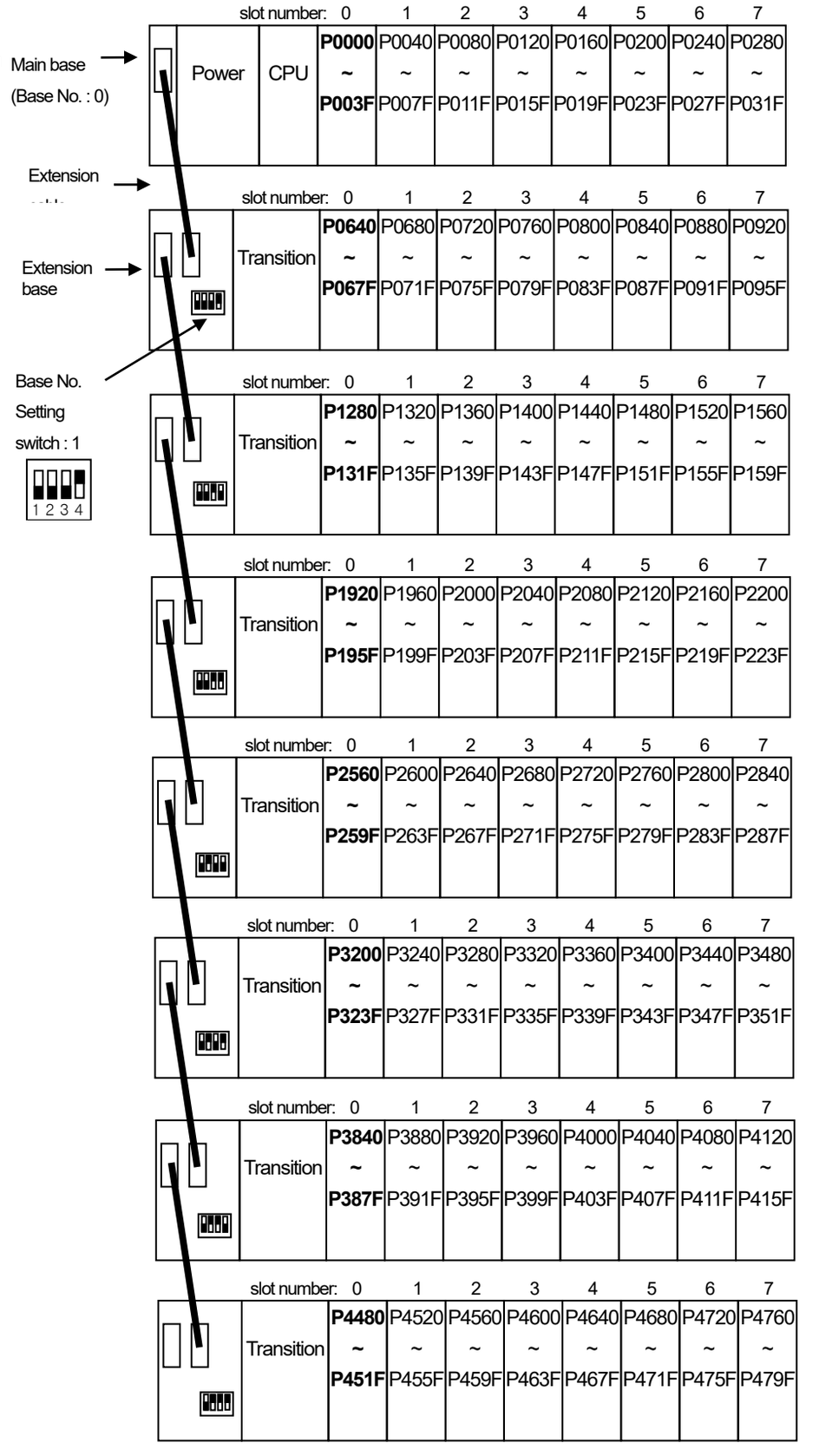
Notes

1) The allocation method of I/O no. shall be set in basic parameter.
2) For Main base, the base no. is fixed as "0" and the extension base has a switch to set the base no.
3) In case of setting module type by I/O parameter, it starts the operation when the type of actually installed module is matched.

2.3.2 Max. Configuration of Basic System (Point Fixed)

System configuration example 1

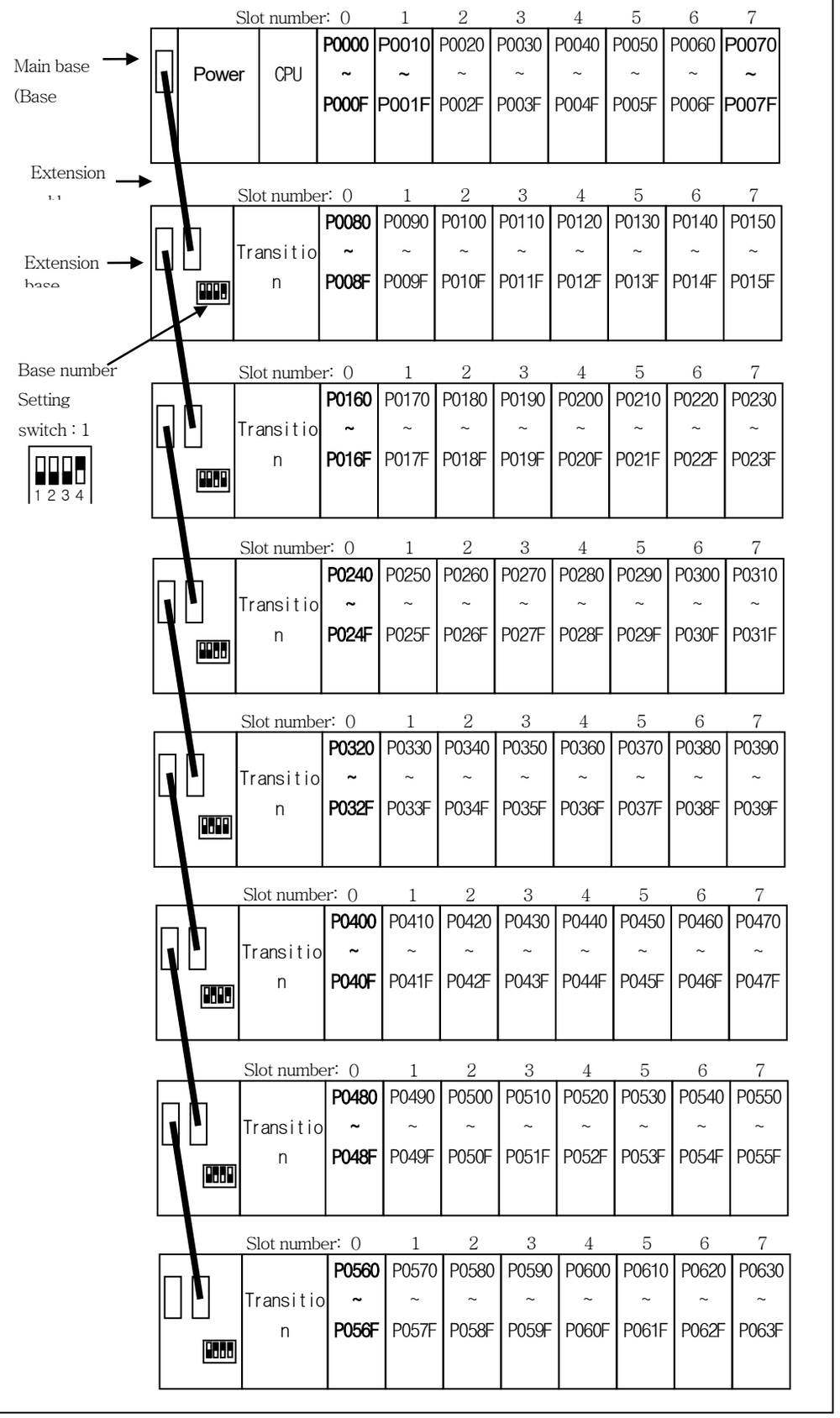
- I/O point fixed
- XGK-CPUH
- 8 slot base



2.3.3 Max. Configuration of Basic System (Point Variable)

System configuration example 2

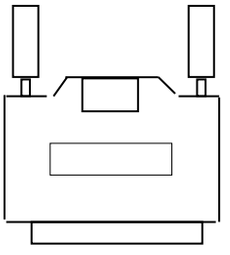
- I/O point Variable
- XGK-CPUH
- 8 slot base
- When installing 16 point module



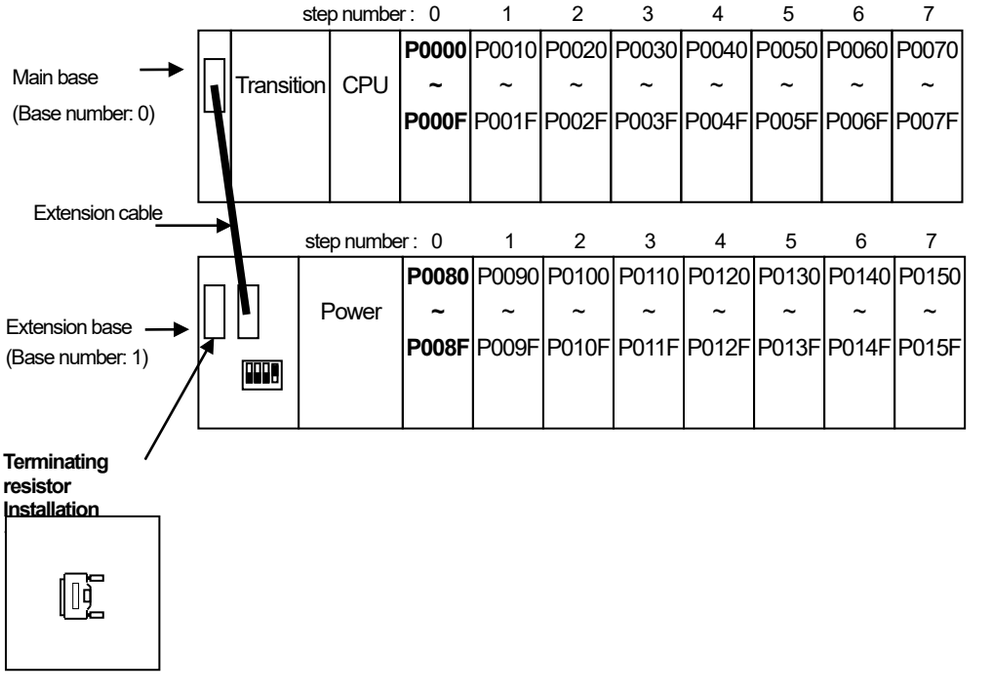
2.3.4 Terminating resistor connection

When an extension base is connected, a terminating resistor must installed for the system reliability on the extension connector (OUT) of the last extension base.

(1) Structure



(2) Installation position



2.3.5 Module selection when configuring basic system

When configuring basic system, you must consider about size of each module's Data Refresh area Data Refresh area is used for data transmission between CPU and modules in XGK/XGI CPU system. Data Refresh area is allocated to CPU memory, irrespective of module's operation. You must consider about maximum size of Data Refresh area.

If it exceeds 1,024 words, system doesn't operate properly.

(1) Size of each module's Data Reflesh area

(Unit : WORD)

Product	Type	Refresh size	Product	Type	Refresh Size
Digital input module	XGI-A12A	1	Digital output module	XGQ-RY1A	1
	XGI-A21A	1		XGQ-RY2A	1
	XGI-A21C	1		XGQ-RY2B	1
	XGI-D21A	1		XGQ-SS2A	1
	XGI-D22A B+	1		XGQ-TR1C	1
	XGI-D24A B+	2		XGQ-TR2A B+	2
	XGI-D28A B+	4		XGQ-TR4A B+	4
Digital Input/output module	XGH-DT4A	2		XGQ-TR8A B+	8
Analog input module	XGF-AC8A	22	Temperature input module	XGF-RD4A	30
	XGF-AV8A	22		XGF-RD4S	30
	XGF-AD8A	22		XGF-TC4S	30
	XGF-AD16A	21		XGF-RD8A	23
	XGF-AD4S	12	Temperature control module	XGF-TC4RT	31
	XGF-AW4S	12		XGF-TC4UD	31
	XGF-AC4H	11	High speed counter module	XGF-HO2A	25
Analog output module	XGF-DC8A	11		XGF-HD2A	25
	XGF-DV8A	11		XGF-HO8A	25
	XGF-DC4A	11	SOE module	XGF-SOEA	2
	XGF-DV4A	11	Data log module	XGF-DL16A	32
	XGF-DC4S	11	Communication module	XGL-EFMT	16
	XGF-DV4S	11		XGL-EFMF	16
	XGF-DC4H	7		XGL-ESHF	16
Analog Input/ output module	XGF-AH6A	11		XGL-DMEA	16
Position control module	XGF-PO1A	2		XGL-PSEA	16
	XGF-PO2A	2		XGL-PMEA	16
	XGF-PO3A	2		XGL-PMEC	16
	XGF-PD1A	2		XGL-EDMT	16
	XGF-PD2A	2		XGL-EDMF	16
	XGF-PD3A	2		XGL-EDST	16
	XGF-PO1H	2		XGL-EDSF	16
	XGF-PO2H	2		XGL-RMEA	16

(Unit : WORD)

Product	Type	Refresh Size	Product	Type	Refresh Size
Position control module	XGF-PO3H	2	Communication module	XGL-FMEA	16
	XGF-PO4H	2		XGL-C22A	16
	XGF-PD1H	2		XGL-C42A	16
	XGF-PD2H	2		XGL-CH2A	16
	XGF-PD3H	2		XGL-EIMT	16
	XGF-PD4H	2		XGL-EIMH	16
	XGF-PN8A	3		XGL-EIMF	16
	XGF-PN8B	3		XGL-ES4T	16
	XGF-M16M	1		XGL-BBM	16
	XGF-M32E	4		XGL-EIPT	16

(2) Size of each module's Data Refresh area

1) Limit of Data Refresh area's size

Sum of Data Refresh area's size installed in system ≤ 1,024 words

2) Example

In a system, XGI-D28A(20 EA), XGQ-D24A(10EA), XGF-AC8A(20EA) and XGF-RD4A(10EA) modules are installed.

→ (4 * 20) + (2 * 10) + (22 * 20) + (30 * 10) = 840 WORD ≤ 1,024 WORD

Notes

1) Sum of Data Refresh area's size must not exceed 1,024 words.

2) If size of Data Refresh area exceeds 1,024 words, XGK/I system doesn't operate properly.

2.4 Network system

XGK series provides various network system for easy system configuration.
This provides Ethernet (FEnet, FDEnet) and Cnet for communication between PLC and upper system or between PLCs and provides a Profibus-DP, DeviceNet, Rnet etc. as lower control network system.

2.4.1 Network system

(1) Local network

It is available to install max. 24 communication module without any constraint of Main base and Extension base. It is recommended to install the module with lots of communication capacity in Main base considering system operation and performance. The constraints by function are shown on the table as below.

Classification by purpose	XGK-CPUE	XGK-CPUS XGK-CPUSN	XGK-CPUA	XGK-CPUH XGK-CPUHN	XGK-CPUU XGK-CPUUN
Module No. to set max. high speed link	12				
Module No. to set max.P2P service	8				
Module No. to set max. Dedicated service	24				

*Note 1) P2P service : 1 : 1 communication

(2) Computer Link (Cnet I/F) System

Cnet I/F system is the system to carry out the data communication between computer or various external equipment and CPU module by using RS-232C, RS-422 (or RS-485) port of Cnet module.
For further information of Cnet module, please refer to Cnet I/F Module user's manual.
As mentioned on the above "Local Network", Cnet module is available to install max. 24 bases (including other communication module) regardless Main base and Extension base. Cnet does not provide high speed link but supports P2P service up to 8.

2.4.2 OS version of communication module

(1) O/S version of communication module applicable to XGK system

O/S version of communication module applicable to XGK system is as follows.

Classification	Module							
	FEnet	FDEnet	Cnet	Rnet	Pnet	Dnet	RAPIEnet	IFOS module Switch
Product name	XGL-EFMT XGL-EFMF	XGL-EDMT XGL-EDMF	XGL-C22A XGL-CH2A XGL-C42A	XGL-RMEA	XGL-PMEA	XGL-DMEA	XGL-EIMF XGL-EIMT XGL-EIMH	XGL-ESHF
* Available OS version	V2.0 or higher	V2.0 or higher	V2.1 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher

2.4.3 Remote I/O System

This is the network system to control I/O module installed at far distance. Network system such as Profibus-DP, DeviceNet, Rnet, Cnet Smart i/O module series are applied.

(1) I/O System Application by Network Type

Smart I/O modules are classified as follows.

Network type (master)	Smart IO	
	Block type	Extension type
Profibus-DP Network	O	O
DeviceNet	O	O
Rnet	O	O
Modbus(Cnet)	O	-
FEnet	-	O
Ethernet/IP	-	O
RAPIEnet	-	-

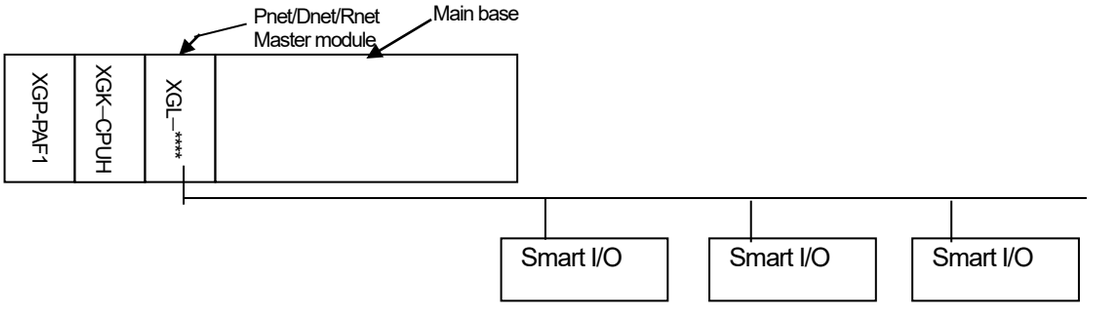
The above description is subject to change for function improvement. For more information, please refer to each network system manual.

(2) Block type Remote I/O System

1) System configuration

This system is configured by Profibus-DP, DeviceNet and Rnet and it is available to use block type Remote I/O regardless of the series.

Profibus-DP and DeviceNet were developed based on International Standard which enables to connect with Smart-I/O of our company as well as the product of other manufacturer.



Master module is available to install up to max. 12 and also available in the extension base.

2) I/O allocation method and I/O no. assignment

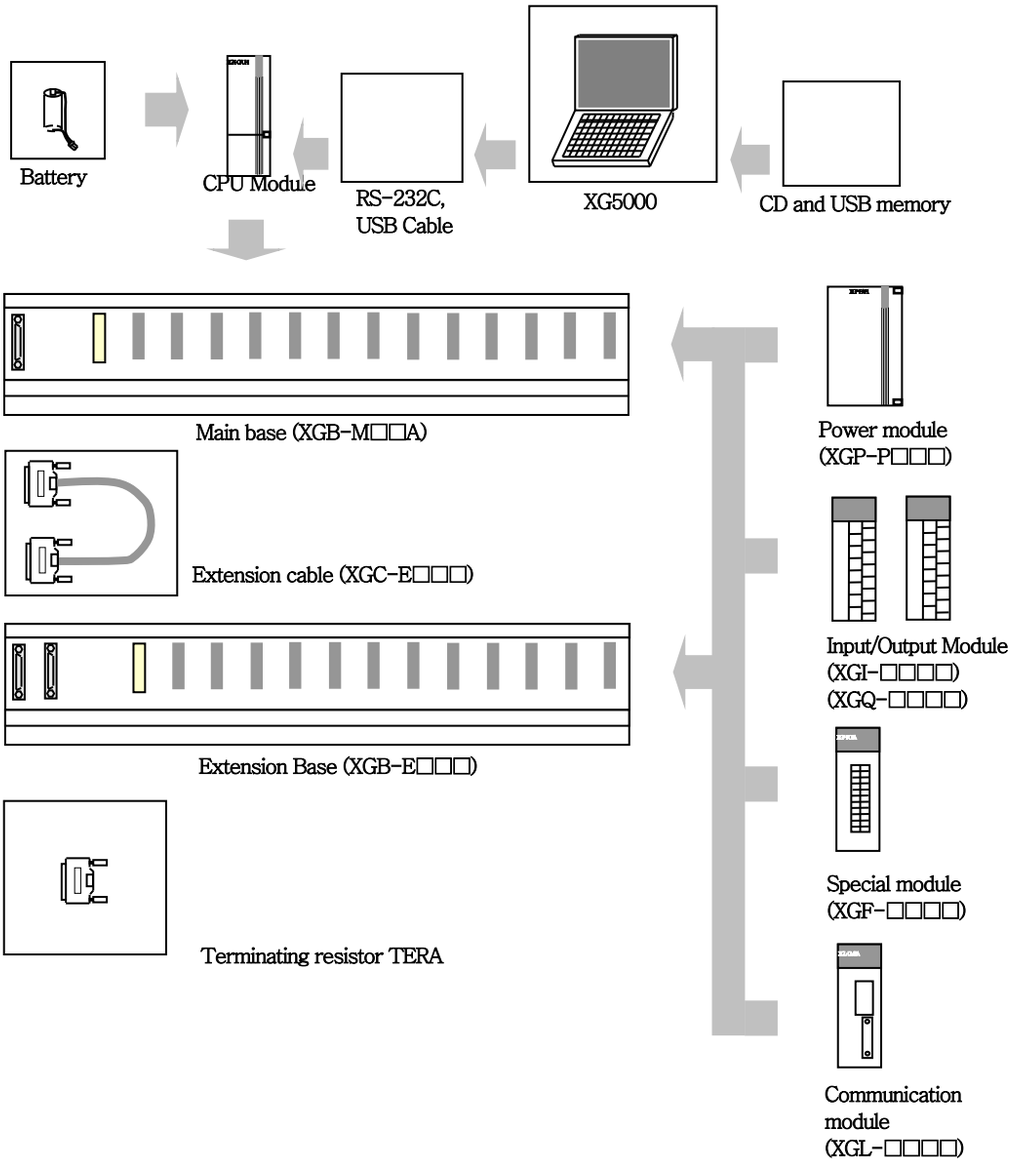
- It is available to allocate 'P', 'M', 'K' and 'D' device to Remote I/O by high speed link parameter. P' area is recommended to use the forced ON/OFF function and initial reset function.
- Max. available point of I/O device (P area) is 32,768 point(P00000 ~P2047F).
- For the setting method of high speed link parameter per module, please refer to XG-PD manual.

Chapter 2 System Configuration

XGT series are equipped with various products proper for basic system, computer link and network system configuration. Here describes the configuration method of each system and its features.

2.1 XGK Series System Configuration

XGK series System Configuration is as follows.



Recommendations of selecting USB Cable (To avoid disconnection with XG5000)

1. Recommend that the company's USB Cable(USB-301A) which is shielded and shorter than 3m.
2. Recommend using USB Hub when connecting up to the PC poor at Noise.

2.2 Product List

The product configuration of XGK series is as below.

Product	Type	Content	Remarks
CPU Module	XGK-CPUE	• Standard type CPU module (Max I/O point: 1,536 points)	16kstep
	XGK-CPUS	• Standard type CPU module (Max I/O point: 3,072 points)	32kstep
	XGK-CPUA	• High speed type CPU module (Max I/O point: 3,072 points)	32kstep
	XGK-CPUH	• High speed type CPU module (Max I/O point: 6,144 points)	64kstep
	XGK-CPUU	• High speed type CPU module (Max I/O point: 6,144 points)	128kstep
	XGK-CPUSN	• High speed type CPU module (Max I/O point: 3,072 points)	64kstep
	XGK-CPUHN	• High speed type CPU module (Max I/O point: 6,144 points)	128kstep
	XGK-CPUUN	• High speed type CPU module (Max I/O point: 6,144 points)	256kstep
Digital input module	XGI-D21A	• DC 24V Input, 8 point (Current source / sink input)	-
	XGI-D21D	• DC 24V Diagnosis Input, 8 point (Current source / sink input)	-
	XGI-D22A	• DC 24V Input, 16 point (Current source / sink input)	-
	XGI-D24A	• DC 24V Input, 32 point (Current source / sink input)	-
	XGI-D28A	• DC 24V Input, 64 point (Current source / sink input)	-
	XGI-D22B	• DC 24V Input, 16 point (Current source input)	-
	XGI-D24B	• DC 24V Input, 32 point (Current source input)	-
	XGI-D28B	• DC 24V Input, 64 point (Current source input)	-
	XGI-A12A	• AC 110V Input, 16 point	-
	XGI-A21A	• AC 220V Input, 8 point	-
	XGI-A21C	• 220V isolated input, 8 point	-
Digital output module	XGQ-RY1A	• Relay output, 8 point (for 2A, single COM.)	-
	XGQ-RY1D	• Diagnostic Relay output, 8 point (for 2A)	-
	XGQ-RY2A	• Relay output, 16 point (for 2A)	-
	XGQ-RY2B	• Relay output, 16 point (for 2A),	-
	XGQ-TR2A	• Transistor output, 16 point (for 0.5A, sink output)	-
	XGQ-TR4A	• Transistor output, 32 point (for 0.1A, sink output)	-
	XGQ-TR8A	• Transistor output, 64 point (for 0.1A, sink output)	-
	XGQ-TR2B	• Transistor output, 16 point (for 0.5A, sink output)	-
	XGQ-TR4B	• Transistor output, 32 point (for 0.1A, source output)	-
	XGQ-TR8B	• Transistor output, 64 point (for 0.1A, source output)	-
	XGQ-SS2A	• Triac output 16 point (for 0.6A)	-
	XGQ-TR1C	• Isolated transistor output, 8 point (for 2A, sink output)	-
Digital Input/output module	XGH-DT4A	• DC 24V input, 16 point(source/sink) • Transistor output, 16 point (for 0.1A,sink output)	-

Product	Type	Content		Remarks
Main base unit	XGB-M04A	• for 4 module installation		-
	XGB-M06A	• for 6 module installation		-
	XGB-M08A	• for 8 module installation		-
	XGB-M12A	• for 12 module installation		-
Maximum extension base	XGB-E04A	• for 4 module installation		-
	XGB-E06A	• for 6 module installation		-
	XGB-E08A	• for 8 module installation		-
	XGB-E12A	• for 12 module installation		-
Power supply module	XGP-ACF1	AC100V / 240V Input	• DC5V: 3A, • DC24V: 0.6A	-
	XGP-ACF2	AC100V / 240V Input	• DC5V: 6A	-
	XGP-AC23	AC200V / 240V Input	• DC5V: 8.5A	-
	XGK-DC42	DC24V / 0V Input	• DC5V: 6A	-
Extension cable	XGC-E041	• length : 0.4 m		Total extension distance should not exceed 15m
	XGC-E061	• length : 0.6 m		
	XGC-E121	• length : 1.2 m		
	XGC-E301	• length : 3.0 m		
	XGC-E501	• length : 5.0 m		
	XGC-E102	• length : 10 m		
	XGC-E152	• length : 15 m		
Terminating resistor	XGT-TERA	• Must use terminating resistor when connecting extension base		-
Dust proof module	XGT-DMMA	• Dust protection module for unused slot		-
Battery	XGT-BAT	• Battery for XGT(DC 3.0V/1,800 mAh)		-

Product		Type	Content	Remarks
Special module	Analog input module	XGF-AV8A	• Power Input: 8 channel(DC1~5V/0~5V/0~10V/–10 ~ +10)	-
		XGF-AC8A	• Current input: 8 channel(DC 4 ~ 20mA / 0 ~ 20mA)	-
		XGF-AD8A	• Voltage/current input: 8 channel	-
		XGF-AD4S	• Voltage/current input: 4 channel, isolation between channels	-
		XGF-AD16A	• Voltage/current input: 16 channel	-
		XGF-AW4S	• 2-wire voltage/current input: 4 channel, isolation between channels • 2-Wire transmitter driver power supported	-
	Analog output module	XGF-DV4A	• voltage output: 4 channel • DC 1 ~ 5V / 0 ~ 5V / 0 ~ 10V / –10 ~ +10V	-
		XGF-DC4A	• Current output: 4 channel (DC 4 ~ 20mA / 0 ~ 20mA)	-
		XGF-DV4S	• Voltage output: 4 channel, isolation between channels	-
		XGF-DC4S	• Current output: 4 channel, isolation between channels	-
		XGF-DV8A	• Voltage output: 8 채널 (DC 1~5V/0~5V/0~10V/–10~+10)	-
		XGF-DC8A	• Current output: 8 channel (DC 4 ~ 20mA / 0 ~ 20mA)	-
	Analog input/output mixed module	XGF-AH6A	• Voltage/current input 4 channel • Voltage/current output 2 channel	-
	HART I/F analog input module	XGF-AC4H	• Current input 4 channel, HART I/F, DC 4 ~ 20mA	-
	HART I/F analog output module	XGF-DC4H	• Current output 4 channel, HART I/F, DC 4 ~ 20mA	-
	Thermocouple input module	XGF-TC4S	• Thermocouple input, 4 channel, isolation between channels	-
	RTD Input module	XGF-RD4A	• RTD input 4 channel	-
		XGF-RD4S	• RTD input, 4 channel, isolation between channels	-
		XGF-RD8A	• RTD input 8 channel	-
	Temperature control module	XGF-TC4UD	• Control loop : 4 loop • Input(4 channel, TC/RTD/Voltage/Current), Output(8 channel, TR/current)	-
		XGF-TC4RT	• Control loop : 4 loop • Input(4 channel, RTD), output(4 channel, TR)	-
	High speed counter module	XGF-HO2A	• Voltage input type(Open Collector), • 200KHz, 2 channel	-
		XGF-HD2A	• Differential input type(Line Driver), • 500KHz, 2 channel	-
		XGF-HO8A	• Voltage input type(Open Collector), • 200KHz, 8 channel	-

Product		Type	Content	Remarks
Special module	Positioning module	XGF-PO3A	• Pulse output(Open Collector), 3 axes	-
		XGF-PO2A	• Pulse output(Open Collector), 2 axes	-
		XGF-PO1A	• Pulse output(Open Collector), 1 axes	-
		XGF-PD3A	• Pulse output(Line Driver), 3 axes	-
		XGF-PD2A	• Pulse output(Line Driver), 2 axes	-
		XGF-PD1A	• Pulse output(Line Driver), 1 axes	-
		XGF-PO4H	• Pulse output(Open Collector), 4 axes	-
		XGF-PO3H	• Pulse output(Open Collector), 3 axes	-
		XGF-PO2H	• Pulse output(Open Collector), 2 axes	-
		XGF-PO1H	• Pulse output(Open Collector), 1 axes	-
		XGF-PD4H	• Pulse output(Line Driver), 4 axes	-
		XGF-PD3H	• Pulse output(Line Driver), 3 axes	-
		XGF-PD2H	• Pulse output(Line Driver), 2 axes	-
		XGF-PD1H	• Pulse output(Line Driver), 1 axes	-
		XGF-PN8A	• Network type(EtherCAT), 8 axes, LS dedicated	-
		XGF-PN8B	• Network type(EtherCAT), 8 axes, standard	-
	Motion control module	XGF-M16M	• Motion dedicated network(M-II), 16 axes	-
		XGF-M32E	• Motion dedicated network(EtherCAT), 32 axes ,standard	-
	Temperature input module	XGF-SOEA	• DC 24V input, 32 point, Sequence of Event module	-
	Data log module	XGF-DL16A	• USB 2.0, CF2001, Max 16GB • 32 point(input: 22 point, output 10 point)	-

Product		Type	Content	Remarks
Communication module	FEnet I/F Module (Optical/electric)	XGL-EFMF	• Fast Ethernet(optical), Master • 100/10 Mbps supported	-
		XGL-EFMT	• Fast Ethernet(electric), Master • 100/10 Mbps supported	-
		XGL-ESHF	• Fast Ethernet Switch module(optical)	-
		XGL-EH5T	• Fast Ethernet Switch module(electric)	-
	RAPIEnet I/F module	XGL-EIMT	• Communication module between PLCs ,electrical 100 Mbps Industrial Ethernet supported	-
		XGL-EIMF	• Communication module between PLCs 100 Mbps Industrial Ethernet supported	-
		XGL-EIMH	• Communication module between PLCs, electrical / optical mixed media, 100 Mbps Industrial Ethernet supported	-
		XGL-ES4T	• Communication module between PLCs , electrical 100 Mbps Industrial Ethernet supported • RAPIEnet switch	-
	Cnet I/F Module	XGL-C22A	• Serial communication • RS-232C, 2 channel	-
		XGL-C42A	• Serial communication • RS-422(485), 2 channel	
		XGL-CH2A	• Serial communication • RS-232C 1 channel / RS-422(485) 1 channel	
	FDEnet I/F module(Master)	XGL-EDMF	• Dedicated Ethernet(optical), Master • Deterministic communication supported • 100/10 Mbps supported	-
		XGL-EDMT	• Dedicated Ethernet(electric), Master • Deterministic communication supported • 100/10 Mbps supported	-
	Rnet I/F module	XGL-RMEA	• Rnet master module	-
	Profibus-DP I/F module	XGL-PMEA XGL-PMEC	• Profibus-DP master module	-
	Pnet Slave I/F module	XGL-PSEA	• Profibus-DP slave module	-
	DeviceNet I/F module	XGL-DMEA	• DeviceNet master module	-
	Ethernet/IP I/F module	XGL-EIPT	• EtherNet/IP(electric) • 100/10 Mbps supported	-
	BACnet/IP I/F module	XGL-BIPT	• BACnet/IP (electric) • 100/10 Mbps supported	-
	Fnet I/F module	XGL-FMEA	• Field Bus master module	-
Etc	40 points connector	1473381,1	• 40 point connector (for input/output and special module)	-

Notes

For the further information about active coupler, optical converter, repeater and block type remote module, which are network devices, refer to the user's manual of network.

O/S version of communication module applicable to XGK system is as follows.

Classification	Module							
	FEnet	FDEnet	Cnet	Rnet	Pnet	Dnet	RAPIEnet	IFOS module Switch
Product name	XGL-EFMT XGL-EFMF	XGL-EDMT XGL-EDMF	XGL-C22A XGL-CH2A XGL-C42A	XGL-RMEA	XGL-PMEA	XGL-DMEA	XGL-EIMF XGL-EIMT XGL-EIMH	XGL-ESHF
Apply Possible Version	V2.0 or higher	V2.0 or higher	V2.1 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher	V1.0 or highe	V1.0 or higher

2.3 Basic System

2.3.1 Configuration method of Basic System

The features of Basic system consisted by connecting the main base and expanded base by a cable are as follows. The number of stages of expanded base is limited according to the CPU type and the allocation method of I/O No. is available to select the fixed type and variable type according to the setting of basic parameter.

Classification	XGK-CPUE	XGK-CPUS XGK-CPUSN	XGK-CPUA	XGK-CPUH XGK-CPUHN	XGK-CPUU XGK-CPUUN
Maximum number of extension stages	1 stages	3 stages	3 stages	7 stages	7 stages
Maximum number of I/O module installation	24 module	48 module	48 module	96 module	96 module
Maximum I/O score	1,536 points	3,072 points	3,072 points	6,144 points	6,144 points
Maximum extension distance	15m				
Assignment of I/O number (fixed value)	• Each slot of base is allocated by 64 points regardless module installation and type. • For one base, I/O no. of 16 slots is allocated. That is, the start no. of No.1 base becomes P00640. (Refer to 2.3.2). •The example of I/O no. of 12 Slot base is as below.				
Assignment of I/O number (Variable type)	•The point is allocated according to the assignment of installation module per slot. - Specified points will be assigned if installed module specified by I/O parameter. - To the slot not specified by I/O parameter, points will be automatically assigned according to actually installed module. **(Caution: 16 points will be assigned to 8-point module)** **- 16 points will be assigned to empty slot which is not specified by I/O parameter.** • Available to assign the point only by I/O parameter without module assignment • The slot installed by special module or communication module is allocated by 16 point. •The example of I/O no. of 12 Slot base is as below.				

Slot no. 0 1 2 3 4 5 6 7 8 9 10 11

PWR	CPU	Input 16	Input 16	Input 32	Input 64	Output 16	Output 32	Output 32	Output 64	Output 32	Output 16	Output 32	Output 32

P0	P40	P80	P120	P160	P200	P240	P280	P320	P360	P400	P440
~	~	~	~	~	~	~	~	~	~	~	~
P3F	P7F	P11F	P15F	P19F	P23F	P27F	P31F	P35F	P39F	P43F	P47F

Slot no. 0 1 2 3 4 5 6 7 8 9 10 11

PWR	CPU	Input 16	Input 16	Input 32	Input 64	Output 16	Output 32	Output 32	Output 64	Input 32	Output 16	Output 32	Output 32

P00	P10	P20	P40	P80	P90	P110	P130	P170	P190	P200	P220
~	~	~	~	~	~	~	~	~	~	~	~
P0F	P1F	P3F	P7F	P8F	P10F	P12F	P16F	P18F	P19F	P21F	P23F

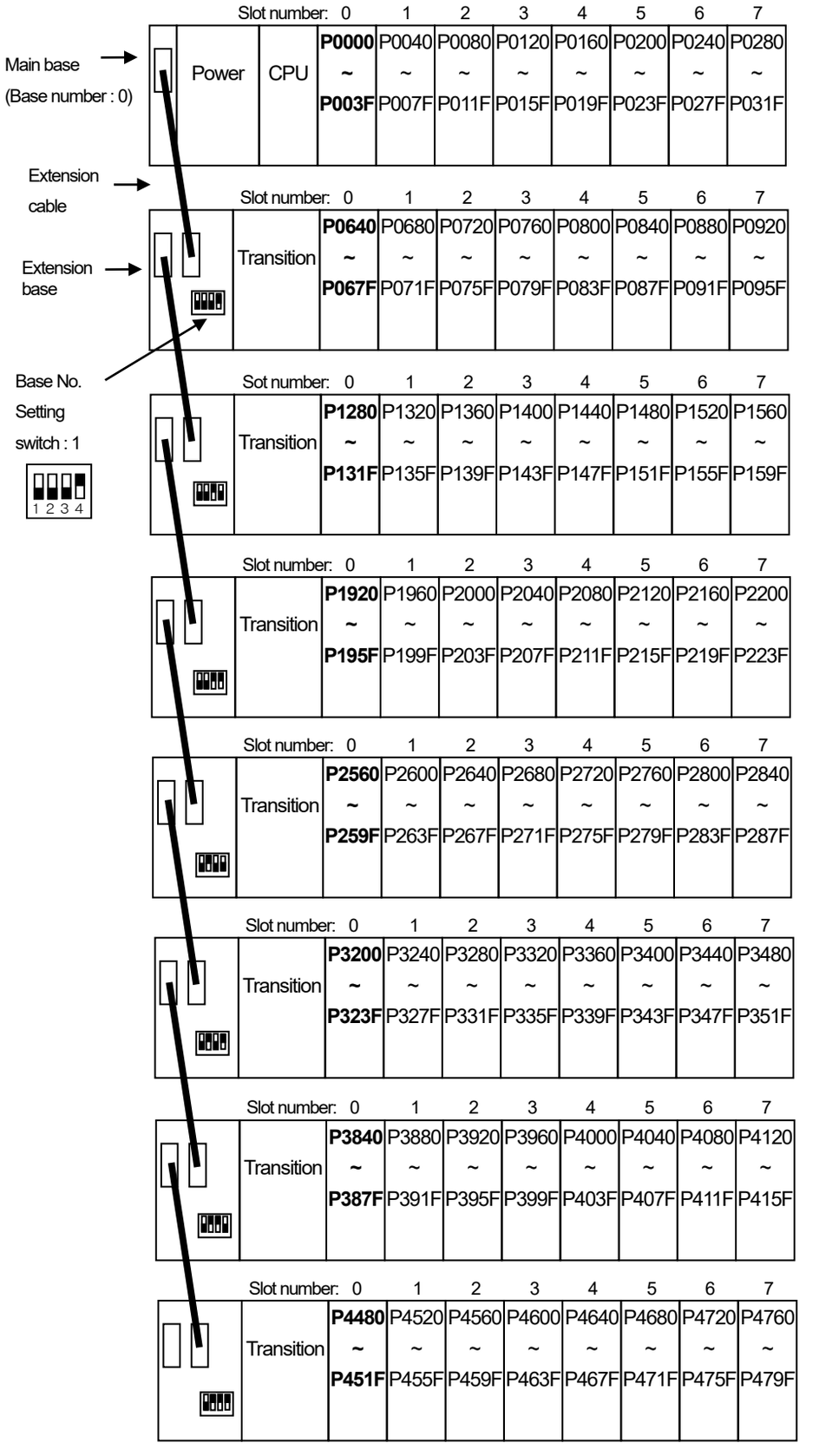
Notes

1) The allocation method of I/O no. shall be set in basic parameter.
2) For Main base, the base no. is fixed as "0" and the extension base has a switch to set the base no.
3) In case of setting module type by I/O parameter, it starts the operation when the type of actually installed module is matched.

2.3.2 Max. Configuration of Basic System (Point Fixed)

System configuration example 1

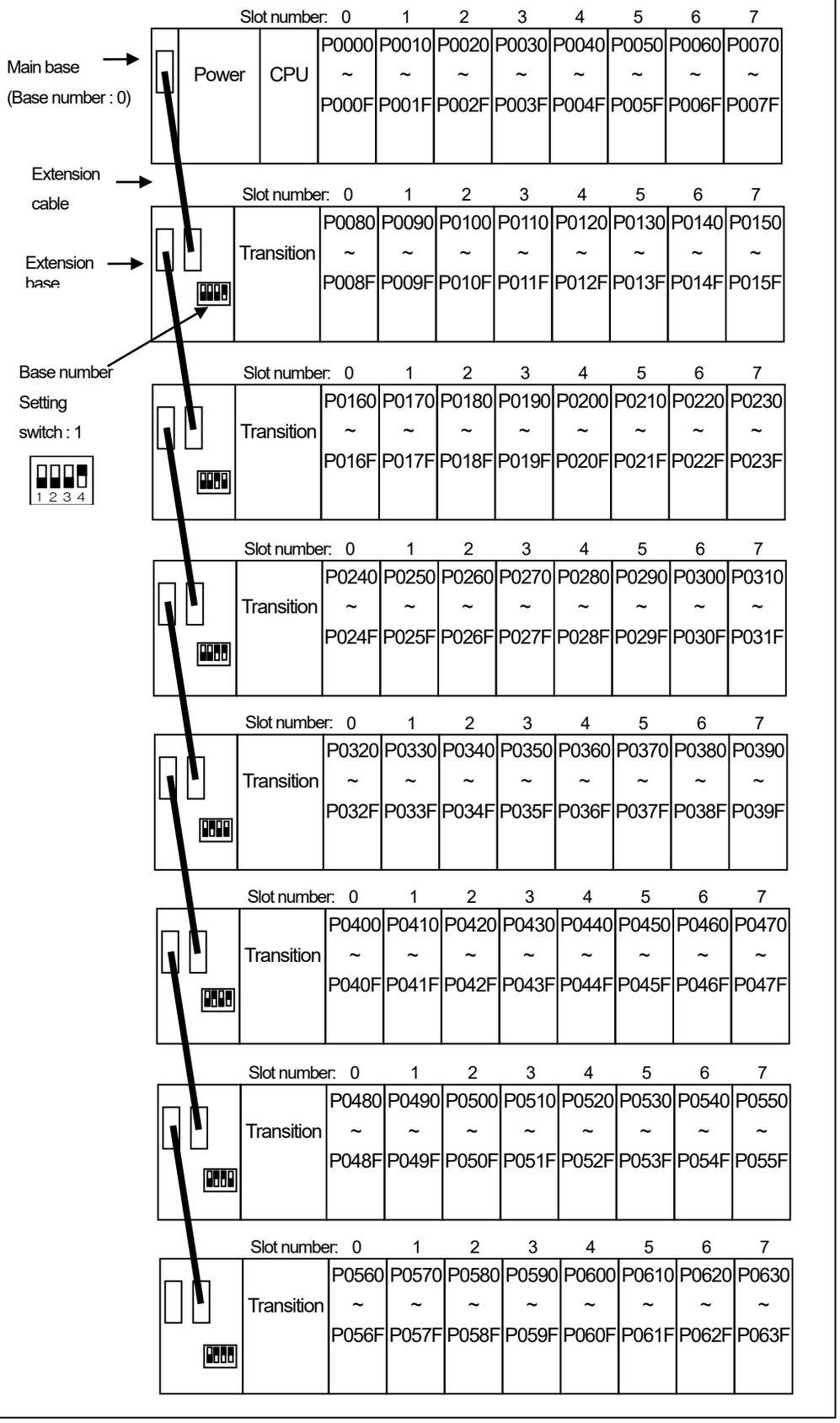
- I/O point fixed
- XGK-CPUH
- 8 slot base



2.3.3 Max. Configuration of Basic System (Point Variable)

System configuration example 2

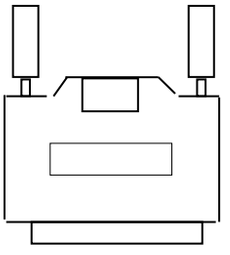
- I/O point Variable
- XGK-CPUH
- 8 slot base
- When installing 16 point module



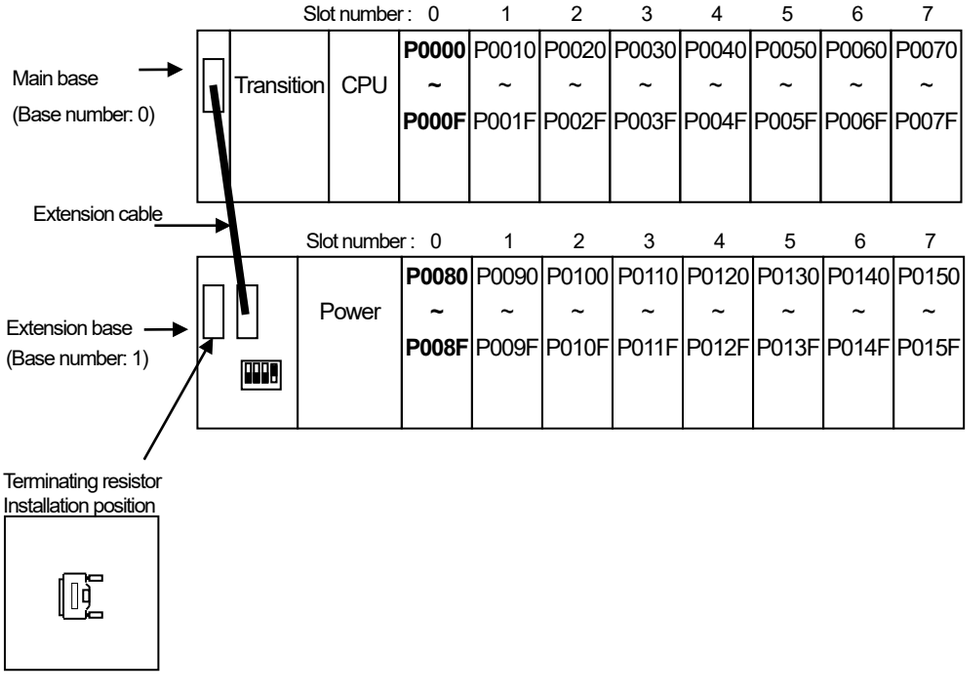
2.3.4 Terminating resistor connection

When an extension base is connected, a terminating resistor must installed for the system reliability on the extension connector (OUT) of the last extension base.

(1) Structure



(2) Installation position



2.3.5 Module selection when configuring basic system

When configuring basic system, you must consider about size of each module's Data Refresh area Data Refresh area is used for data transmission between CPU and modules in XGK/XGI CPU system. Data Refresh area is allocated to CPU memory, irrespective of module's operation. You must consider about maximum size of Data Refresh area.

If it exceeds 1,024 words, system doesn't operate properly.

(1) Size of each module's Data Refresh area

(Unit : WORD)

Product	Type	Refresh size	Product	Type	Refresh Size
Digital input module	XGI-A12A	1	Digital output module	XGQ-RY1A	1
	XGI-A21A	1		XGQ-RY2A	1
	XGI-A21C	1		XGQ-RY2B	1
	XGI-D21A	1		XGQ-SS2A	1
	XGI-D22A B+	1		XGQ-TR1C	1
	XGI-D24A B+	2		XGQ-TR2A B+	2
	XGI-D28A B+	4		XGQ-TR4A B+	4
Digital Input/output module	XGH-DT4A	2		XGQ-TR8A B+	8
Analog input module	XGF-AC8A	22	Temperature input module	XGF-RD4A	30
	XGF-AV8A	22		XGF-RD4S	30
	XGF-AD8A	22		XGF-TC4S	30
	XGF-AD16A	21		XGF-RD8A	23
	XGF-AD4S	12	Temperature control module	XGF-TC4RT	31
	XGF-AW4S	12		XGF-TC4UD	31
	XGF-AC4H	11	High speed counter module	XGF-HO2A	25
Analog output module	XGF-DC8A	11		XGF-HD2A	25
	XGF-DV8A	11		XGF-HO8A	25
	XGF-DC4A	11	SOE module	XGF-SOEA	2
	XGF-DV4A	11	Data log module	XGF-DL16A	32
	XGF-DC4S	11	Communication module	XGL-EFMT	16
	XGF-DV4S	11		XGL-EFMF	16
	XGF-DC4H	7		XGL-ESHF	16
Analog Input/ output module	XGF-AH6A	11		XGL-DMEA	16
Position control module	XGF-PO1A	2		XGL-PSEA	16
	XGF-PO2A	2		XGL-PMEA	16
	XGF-PO3A	2		XGL-PMEC	16
	XGF-PD1A	2		XGL-EDMT	16
	XGF-PD2A	2		XGL-EDMF	16
	XGF-PD3A	2		XGL-EDST	16
	XGF-PO1H	2		XGL-EDSF	16
	XGF-PO2H	2		XGL-RMEA	16

(Unit : WORD)

Product	Type	Refresh Size	Product	Type	Refresh Size
Position control module	XGF-PO3H	2	Communication module	XGL-FMEA	16
	XGF-PO4H	2		XGL-C22A	16
	XGF-PD1H	2		XGL-C42A	16
	XGF-PD2H	2		XGL-CH2A	16
	XGF-PD3H	2		XGL-EIMT	16
	XGF-PD4H	2		XGL-EIMH	16
	XGF-PN8A	3		XGL-EIMF	16
	XGF-PN8B	3		XGL-ES4T	16
	XGF-M16M	1		XGL-BBM	16
	XGF-M32E	4		XGL-EIPT	16

(2) Size of each module's Data Refresh area

1) Limit of Data Refresh area's size

Sum of Data Refresh area's size installed in system ≤ 1,024 words

2) Example

In a system, XGI-D28A(20 EA), XGQ-D24A(10EA), XGF-AC8A(20EA) and XGF-RD4A(10EA) modules are installed.

→ (4 * 20) + (2 * 10) + (22 * 20) + (30 * 10) = 840 WORD ≤ 1,024 WORD

Notes

1) Sum of Data Refresh area's size must not exceed 1,024 words.

2) If size of Data Refresh area exceeds 1,024 words, XGK/I system doesn't operate properly.

2.4 Network system

XGK series provides various network system for easy system configuration.
This provides Ethernet (FEnet, FDEnet) and Cnet for communication between PLC and upper system or between PLCs and provides a Profibus-DP, DeviceNet, Rnet etc. as lower control network system.

2.4.1 Network system

(1) Local network

It is available to install max. 24 communication module without any constraint of Main base and Extension base. It is recommended to install the module with lots of communication capacity in Main base considering system operation and performance. The constraints by function are shown on the table as below.

Classification by purpose	XGK-CPUE	XGK-CPUS XGK-CPUSN	XGK-CPUA	XGK-CPUH XGK-CPUHN	XGK-CPUU XGK-CPUUN
Module No. to set max. high speed link	12				
Module No. to set max.P2P service	8				
Module No. to set max. Dedicated service	24				

*Note 1) P2P service : 1 : 1 communication

(2) Computer Link (Cnet I/F) System

Cnet I/F system is the system to carry out the data communication between computer or various external equipment and CPU module by using RS-232C, RS-422 (or RS-485) port of Cnet module.
For further information of Cnet module, please refer to Cnet I/F Module user's manual.
As mentioned on the above "Local Network", Cnet module is available to install max. 24 bases (including other communication module) regardless Main base and Extension base. Cnet does not provide high speed link but supports P2P service up to 8.

2.4.2 OS version of communication module

(1) O/S version of communication module applicable to XGK system

O/S version of communication module applicable to XGK system is as follows.

Classification	Module							
	FEnet	FDEnet	Cnet	Rnet	Pnet	Dnet	RAPIEnet	IFOS module Switch
Product name	XGL-EFMT XGL-EFMF	XGL-EDMT XGL-EDMF	XGL-C22A XGL-CH2A XGL-C42A	XGL-RMEA	XGL-PMEA	XGL-DMEA	XGL-EIMF XGL-EIMT XGL-EIMH	XGL-ESHF
* Available OS version	V2.0 or higher	V2.0 or higher	V2.1 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher	V1.0 or higher

2.4.3 Remote I/O System

This is the network system to control I/O module installed at far distance. Network system such as Profibus-DP, DeviceNet, Rnet, Cnet Smart I/O module series are applied.

(1) I/O System Application by Network Type

Smart I/O modules are classified as follows.

Network type (master)	Smart IO	
	Block type	Extension type
Profibus-DP Network	O	O
DeviceNet	O	O
Rnet	O	O
Modbus(Cnet)	O	-
FEnet	-	O
Ethernet/IP	-	O
RAPIEnet	-	-

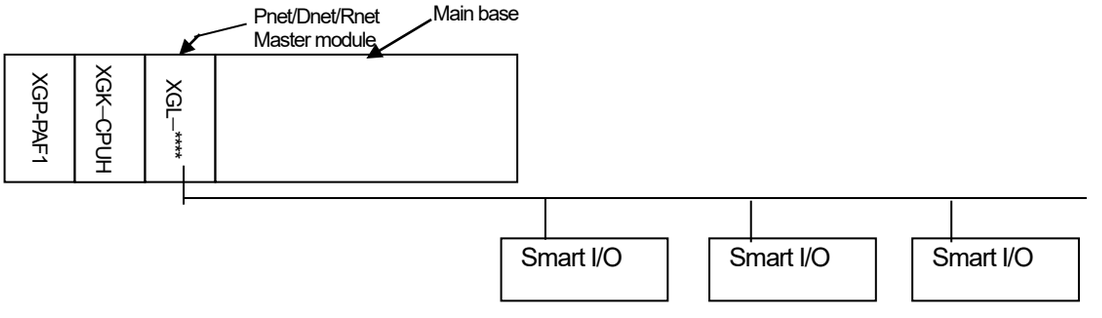
The above description is subject to change for function improvement. For more information, please refer to each network system manual.

(2) Block type Remote I/O System

1) System configuration

This system is configured by Profibus-DP, DeviceNet and Rnet and it is available to use block type Remote I/O regardless of the series.

Profibus-DP and DeviceNet were developed based on International Standard which enables to connect with Smart-I/O of our company as well as the product of other manufacturer.



Master module is available to install up to max. 12 and also available in the extension base.

2) I/O allocation method and I/O no. assignment

- It is available to allocate 'P', 'M', 'K' and 'D' device to Remote I/O by high speed link parameter. P' area is recommended to use the forced ON/OFF function and initial reset function.
- Max. available point of I/O device (P area) is 32,768 point(P00000 ~P2047F).
- For the setting method of high speed link parameter per module, please refer to XG-PD manual.

Chapter 3 General specifications

3.1 General specifications

The general specifications of the XGT series are as follows.

<table>
<tr><th>No</th><th>Item</th><th colspan="6">Specification</th><th>Related specification</th></tr>
<tr><td>1</td><td>Operating ambient temperature</td><td colspan="6">0 ~ 55 °C</td><td></td></tr>
<tr><td>2</td><td>Storage temperature</td><td colspan="6">–25 ~ +70 °C</td><td></td></tr>
<tr><td>3</td><td>Ambient humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td></td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td></td></tr>
<tr><td rowspan="11">5</td><td rowspan="11">Vibration resistance</td><td colspan="4">In case of occasional vibration</td><td>-</td><td></td></tr>
<tr><td colspan="2">Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Times</td><td rowspan="10">IEC61131-2</td></tr>
<tr><td colspan="2">5 ≤ f < 8.4 Hz</td><td>–</td><td>3.5mm</td><td rowspan="8">X, Y, Z
Each direction
10 times</td></tr>
<tr><td colspan="2">8.4 ≤ f ≤ 150 Hz</td><td>9.8m/s^2(1G)</td><td>–</td></tr>
<tr><td colspan="4">In case of continuous vibration</td></tr>
<tr><td colspan="2">Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td colspan="2">5 ≤ f < 8.4 Hz</td><td>–</td><td>1.75mm</td></tr>
<tr><td colspan="2">8.4 ≤ f ≤ 150 Hz</td><td>4.9m/s^2(0.5G)</td><td>–</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>Shock resistance</td><td colspan="6">• Maximum shock acceleration: 147㎨ (15G)
• Duration : 11ms
• Pulse waveform: Half-sine (3 times for each direction of X, Y and Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="4">7</td><td rowspan="4">Noise resistance</td><td>Square wave impulse noise</td><td colspan="4">±1,500 V</td><td>Test standard of LS ELECTRIC</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">Voltage : 4kV</td><td>IEC61131-2
IEC61000-4-2</td></tr>
<tr><td>Radiated electromagnetic field noise</td><td colspan="4">80 ~ 1,000 ㎒, 10 V/m</td><td>IEC61131-2,
IEC61000-4-3</td></tr>
<tr><td rowspan="2">Fast transient/bust noise</td><td>Classification</td><td>Power module</td><td colspan="2">Digital/analog I/O, communication interface</td><td rowspan="2">IEC61131-2
IEC61000-4-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td colspan="2">1kV</td></tr>
<tr><td>8</td><td>Operating atmosphere</td><td colspan="6">Free from corrosive gases and excessive dust</td><td></td></tr>
<tr><td>9</td><td>Operating altitude</td><td colspan="6">Up to 2,000m</td><td></td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="6">Less than equal to 2</td><td></td></tr>
<tr><td>11</td><td>Cooling method</td><td colspan="6">Natural air cooling</td><td></td></tr>
</table>

Notes

1) IEC (International Electrotechnical Commission):
An international nongovernmental organization which promotes internationally cooperated standardization in electric/electronic field, publishes international standards and manages applicable estimation system related with.

2) Pollution degree:
An index indicating pollution degree of the operating environment which decides insulation performance of the devices. For instance, Pollution degree 2 indicates the state generally that only non-conductive pollution occurs. However, temporary conduction occurs in this state due to dew formation.

Chapter 4 CPU Module

4.1 Performance Specifications

There are 2 types of CPU module ; standard type CPU module (XGK-CPUS/E) and high performance type CPU module (XGK-CPUA/H/U),and their specification are as follows.

Item		Specifications					Remarks
		XGK-CPUE	XGK-CPUS	XGK-CPUA	XGK-CPUH	XGK-CPUU	
Operation Method		Cyclic operation, Constant Scan, Fixed scan					-
I/O control method		Scan synchronous batch processing method (Refresh method), Directed by program instruction					-
Program language		Ladder Diagram, Instruction List,, SFC (Sequential Function Chart), ST (Structured Text)					-
Number of instructions	Basic instructions	About 40					-
	Application instructions	About 700					-
Operation processing speed(Basic instruction)	LD	84 ns/Step		28 ns/Step			-
	MOV	252 ns/Step		84 ns/Step			-
	Real operation	±: 1,442 ns(S), 2,870 ns(D) x : 1,948 ns(S), 4,186 ns(D) ÷ : 1,974 ns(S), 4,200 ns(D)		±: 602 ns(S), 1,078 ns(D) x : 1,106 ns(S), 2,394 ns(D) ÷ : 1,134 ns(S), 2,660 ns(D)			S:Short Real number D: Long Real number
Program memory capacity (Automatic device assignment)		16kstep (64KB)	32kstep (128KB)	32kstep (128KB)	64kstep (256KB)	128kstep (512KB)	-
I/O Point(Installation available)		1,536 points	3,072 points	3,072 points	6,144 points		-
Data Area	P	P00000 ~ P2047F(32,768 point)					-
	M	M00000 ~ M2047F(32,768 point)					-
	K	K00000 ~ K2047F(32,768 point)					-
	L	L00000 ~ L11263F(180,224 point)					-
	F	F00000 ~ F2047F(32,768 point)					-
	T	100ms: T0000 - T0999, 10ms. T1000 ~ T1499 1ms: T1500 - T1999, 0.1ms. T2000 ~ T2047					Area changeable according to parameter setting
	C	C0000 ~ C2047					-
	S	S00.00 ~ S127.99					-
	D	D0000 ~ D19999		D0000 ~ D32767			-
	U	U0.0 ~ U1F.31	U0.0 ~ U3F.31	U0.0 ~ U3F.31	U0.0 ~ U7F.31		Special Module data refresh area
	Z	128 points					Index
	N	N00000 ~ N21503					-
	R	1 blocks		2 blocks			32K words per block (R0 ~ R32767)
FLASH area		2 MB, 32 blocks (32K words per block)					Controllable using R device

Item		Specification					Remarks
		XGK- CPUE	XGK-CPUS	XGK-CPUA	XGK-CPUH	XGK-CPUU	
Configuration of program	Total number of program	256					-
	Initial task	1					-
	Cycle task	32					-
	Internal device task	32					-
Operation mode		RUN, STOP, DEBUG					-
Self-diagnosis function		Detection of operation delay, memory error, I/O error, battery error, power error, etc					-
Program port		RS-232C(1CH), USB(1CH)					RS-232C port supports Modbus slave
Back-up method		Latch area setting in basic parameter					-
Maximum extension base number		1 stages	3 stages	3 stages	7 stages		Total length 15m
Internal consumption current		940mA		960mA			-
Weight		0.12kg					-

Notes

- Supported functions according to CPU OS version: the following OS version and XG5000 version is needed for each function.

CPU OS version	XG5000 version	Function	Note
V3.0	V3.0	SFC, ST language support Automatic assignment variable support	-
V3.1	V3.1	Event input module (XGF-SOEA)	-
V3.2	V3.2	Effective conversion value, alarm function of analog input module	-
V3.4	V3.3	User defined function/function block for XGK Positioning commands (APM/XPM): VRD, VWR, XVRD, XVWR	-
V3.50	V3.4	Enhanced password function (in order to connect XG5000 V3.4 or higher is needed.) Disable setting of the Reset/D.Clear switch. Version information is indicated to two decimal places (_OS_VER_PATCH flag added)	-
V3.60	V3.5	Command: TRAMP, RTRAMP, VTPP, XVTPP	-
V3.70	V3.61	Scan time flag of fixed cycle task P2P, HS enable-disable flag SOE flag	-

- Please refer to the XG5000 release notes for details.

The performance of XGK-CPUUN/CPUHN/CPUSN is as follows.

Item		Specification			Remarks
		XGK-CPUSN	XGK-CPUHN	XGK-CPUUN	
Operation Method		Cyclic operation, Constant Scan, Fixed scan			-
I/O control method		Scan synchronous batch processing method (Refresh method), Directed by program instruction			-
Program language		Ladder Diagram Instruction List SFC (Sequential Function Chart) ST (Structured Text)			-
Number of instructions	Basic instructions	About 40			-
	Application instructions	About 700			-
Operation processing speed(Basic instruction)	LD	8.5 ns/Step			-
	MOV	25.5 ns/Step			-
	Real operation	±: 182.8 ns(S), 327.3 ns(D) x : 336 ns(S), 727 ns(D) ÷ : 345 ns(S), 808 ns(D)			S: Short Real number D: Long Real number
Program memory capacity (Automatic device assignment)		64kstep (512KB)	128kstep (1,024KB)	256kstep (2,048KB)	-
I/O Point(Installation available)		3,072 points	6,144 points		-
Data Area	P	P00000 ~ P4095F(65,536 point)			-
	M	M00000 ~ M4095F(65,536 point)			-
	K	K00000 ~ K4095F(65,536 point)			-
	L	L00000 ~ L11263F(180,224 point)			-
	F	F00000 ~ F4095F(65,536 point)			-
	T	100ms: T0000 ~ T2999 10ms: T3000 ~ T5999 1ms: T6000 ~ T7999 0.1ms: T8000 ~ T8191			Area changeable according to parameter setting
	C	C0000 ~ C4095			-
	S	S00.00 ~ S255.99			-
	D	D0000 ~ D262143	D0000 ~ D524287		-
	U	U0.0 ~ U3F.31	U0.0 ~ U7F.31		Special Module data refresh area
	Z	256 points			Index
	N~~	N00000 ~ N21503			-
	R	2 blocks	8 blocks	16 blocks	32K words per block (R0 ~ R32767)
FLASH area		2 MB, 32 blocks (32K words per block)			Controllable using R device

Item		Specification			Remarks
		XGK-CPUSN	XGK-CPUHN	XGK-CPUUN	
Configuration of program	Total number of program	256			-
	Initial task	1			-
	Cycle task	32			-
	Internal device Interrupt	32			-
Operation mode		RUN, STOP, DEBUG			-
Self-diagnosis function		Detection of operation delay, memory error, I/O error, battery error, power error, etc			-
Program port		USB(1CH), Ethernet(1CH)			-
Back-up method		Latch area setting in basic parameter			-
Maximum extension base number		3 stages	7 stages		Total length 15m
Internal consumption current		960mA			-
Weight		0.12kg			-

XGK-CPUUN/CPUHN/CPUSN has built-in Ethernet communication The Performance specifications of the XGT series are as follows.

Item		Products	Remarks
		XGK-CPUSN/CPUHN/CPUUN	
Ethernet	Characteristics	1 Port	-
		10/100BASE-TX	-
		Auto negotiation (Full-duplex and half duplex)	-
		Auto MDIX Crossover	-
		Max. 4 Channel supported	Supports 8KByte each send/receive per channel
		Up to 100M distance between nodes	-
		Maximum 1500Byte protocol size	IP Fragmentation is not supported
	Cable	Use UTP, STP, FTP cable	STP and FTP are recommended in noisy environments.
	Service	CPU communication parameter setting in XG5000	-
		The loader service (XG5000) is supported	Support remote 1 connection function
		Own protocol support (XGT) - Dedicated communication	Server function support(client function not supported) TCP supported UDP not supported
		Third-party protocol support(MODBUS TCP/IP)	

Notes

- Supported functions according to CPU OS version: the following OS version and XG5000 version is needed for each function.

A function by OS version of XGK-CPUS, XGK-CPUE, XGK-CPUA, XGK-CPUH and XGK-CPUU is as follows.

CPU OS version	XG5000 version	Function	Note
V3.0	V3.0	SFC, ST language support Automatic assignment variable support	-
V3.1	V3.1	Event input module (XGF-SOEA)	-
V3.2	V3.2	Effective conversion value, alarm function of analog input module	-
V3.4	V3.3	User defined function/function block for XGK Positioning commands (APM/XPM): VRD, VWR, XVRD, XVWR	-
V3.50	V3.4	Enhanced password function (in order to connect XG5000 V3.4 or higher is needed.) Disable setting of the Reset/D.Clear switch. Version information is indicated to two decimal places (_OS_VER_PATCH flag added)	-
V3.60	V3.5	Command: TRAMP, RTRAMP, VTPP, XVTPP	-
V3.70	V3.61	Scan time flag of fixed cycle task P2P,HS enable-disable flag SOE flag	-

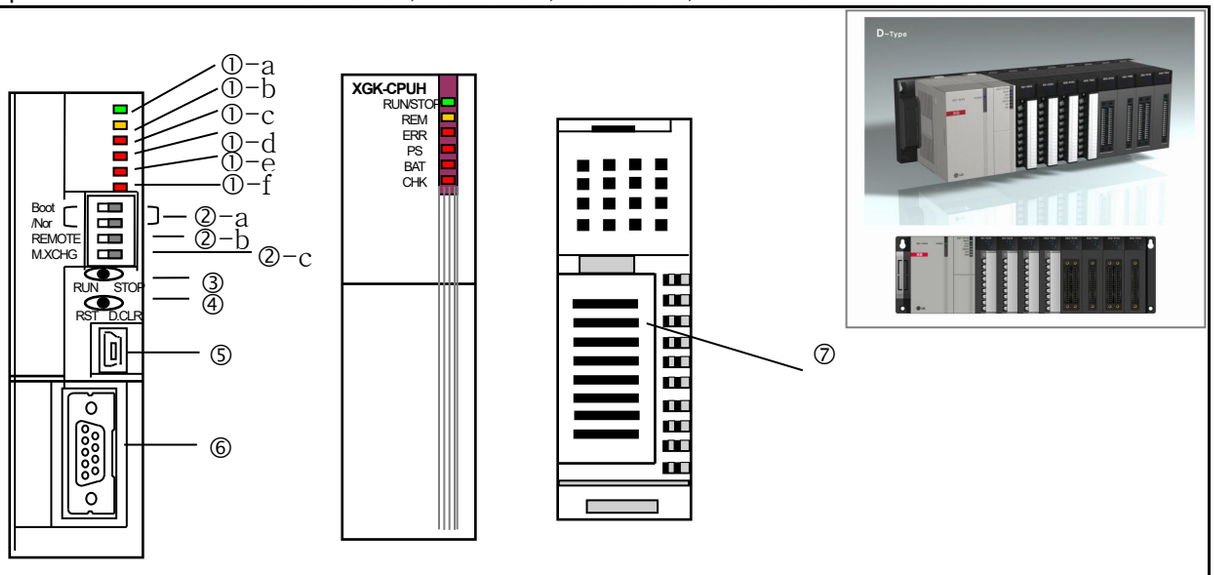
A function by OS version of XGK- CPUSN, XGK- CPUHN and XGK -CPUUN is as follows.

CPU OS version	XG5000 version	Function	Note
V1.0	V4.03	XGK-CPUUN/CPUHN/CPUSN types are added	-

- Please refer to the XG5000 release notes for details.

4.2 Name of each part and function

Each part's function and name of XGK- CPUS, XGK- CPUE, XGK- CPUA, XGK- CPUH and XGK-CPUU is as follows.



No.	Name	Usage
①-a	RUN/STOP LED	Indicates the operating status of the CPU module • Green ON: indicates 'in operation' by 'RUN' mode state. ▶ 'RUN' operation by RUN/STOP mode switch ▶ 'RUN' operation by Remote RUN/STOP mode switch • Red ON: indicates 'in operation' by 'STOP' mode state ▶ 'STOP' operation by RUN/STOP mode switch ▶ 'STOP' operation by Remote STOP/STOP mode switch ▶ If detect an error to stop Run
①-b	REM LED	• ON (Yellow): indicates 'remote enabled' ▶ In case that 'REMOTE' switch is 'On' • OFF: indicates 'remote disabled' ▶ In case that 'REMOTE' switch is 'Off'

No.	Name	Usage
①-c	ERR LED	• ON (Red): indicates when occurred error that CPU is impossible to operate. • OFF: Indicates 'no error'
①-d	PS LED (Programmable Status)	• ON (Red): ▶ In case that 'user assigned flag' is 'On' ▶ 'In case of operating in the error state by setting the 'operation proceeding in the error' ▶ 'In case that the module is detached or other module is installed in the state that 'M.XCHG' switch is 'On' • OFF: ▶ Indicates 'no error'
①-e	BAT LED	• ON (Red): in case that battery voltage is lowered • OFF: No battery error
①-f	CHK LED	•ON (Red): indicates the setting is different from standard setting (Available to add/delete[clear] by parameter) ▶ In case that 'Module change' switch is set as 'Module change'. ▶ 'In case of operating in 'DEBUG mode ▶ 'Forced ON' setting state ▶ In case that 'fault mask', 'I/O SKIP' is set ▶ In case that Warning occurs during operation. ▶ Extended base power error • Flicker: In case error occurred when 'Continue running when an arithmetic error occurs' is set at Error Operation Setup in XG5000 Basic Parameter Settings. • OFF: indicates during operation by standard setting
②-a	Boot/Nor switch	It is used to download O/S before shipping. • On (right): executes control action in normal operation mode. • Off (left): used for manufacturing, user's operation prohibited (Download mode of O/S) • **Note: Boot/Nor switches should be both set in On (right) side. If set in Off (left) side, it may cause abnormal operation**.
②-b	REMOTE enabled Switch	Limits the operation of PLC by remote connection. • On (right): all function enabled (REMOTE mode) • Off (left): PLC function limited ▶ D/L of program, Operation mode operation limited ▶ Monitor, data change operation enabled
②-c	M.XCHG (Module change switch)	Used in case of performing the module change during operation. • On (right): executes the module change ▶ Available to change the module only by key switch operation • Off (left): completes the module change

<table>
<tr><th>No.</th><th>Name</th><th>Usage</th></tr>
<tr><td>③</td><td>RUN/STOP mode Switch</td><td>Sets the operation mode of CPU module
•STOP → RUN: execute operation of program
•RUN → STOP: stop operation of program

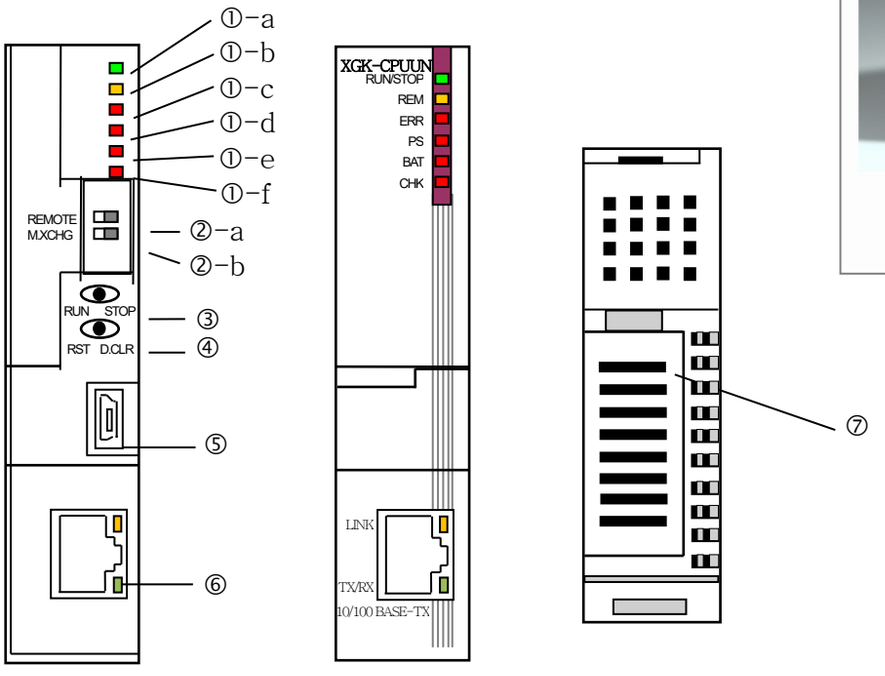
Operates prior to REMOTE switch.</td></tr>
<tr><td>④</td><td>Reset/ D.Clear Switch</td><td>You can enable/disable Reset/D.Clear switch in “XG5000→Basic Parameter→Basic Operation Setup”

• When is not set “Disable Reset switch“ in XG5000→ Basic parameter setting.
<table><tr><th>Operation</th><th>Result</th></tr><tr><td>Move to left → return to center</td><td>Reset</td></tr><tr><td>Move to left →hold for more than 3 seconds →return to center</td><td>Overall reset</td></tr></table>
• When is not set”Disable D.Clear reset switch” in XG5000→ Basic parameter setting.
<table><tr><th>Operation</th><th>Result</th></tr><tr><td>Move to right → return to center</td><td>Clear Latch1 area data and general data area</td></tr><tr><td>Move to right →hold for more than 3 seconds →return to center</td><td>Clear Latch2 area data and general data area</td></tr></table>
• Caution: DATA CLEAR acts only in “STOP” operation mode</td></tr>
<tr><td>⑤</td><td>USB connector</td><td>A connector to connect with peripherals (XG5000 etc.) (USB 1.1 support)</td></tr>
<tr><td>⑥</td><td>RS–232C connector</td><td>A connector to connect with peripherals
• XG5000 connection: support
• Modbus device connection: Modbus protocol support(Only as Server)
TX: no.7 Pin, RX: no.8 Pin, GND: no.5 Pin</td></tr>
<tr><td>⑦</td><td>Battery built-in cover</td><td>Backup Battery built-in cover</td></tr>
</table>

Notes

When using the communication service using the RS-232C connector, abnormal CPU operation may occur due to the inflow of external noise, so be careful of the external environment when using.

Each part's function and name of XGK- CPUSN, XGK- CPUHN and XGK-CPUU is as follows.





No.	Name	Usage
①-a	RUN/STOP LED	Indicates the operating status of the CPU module •Green On: indicates 'in operation' by 'RUN' mode state ▶ 'RUN' operation by RUN/STOP mode switch ▶ 'RUN' operation by Remote RUN/STOP mode switch • Red On: indicates 'in operation' by 'STOP' mode state ▶ 'STOP' operation by RUN/STOP mode switch ▶ 'STOP' operation by Remote STOP/STOP mode switch ▶ If detect an error to stop Run
①-b	REM LED	• ON (Yellow): indicates 'remote enabled' ▶ In case that 'REMOTE' switch is 'On' • Off: Indicates 'remote disabled' ▶ In case that 'REMOTE' switch is 'Off'

No.	Name	Usage
①-c	ERR LED	• On(Red): indicates the case of an error that cannot be operated • Off: Indicates 'no error'
①-d	PS LED (Programmable Status)	• On(Red): ▶ If 'User Defined Flag' is 'On' ▶ 'In case of operating in the error state by setting the 'operation proceeding in the error' ▶ 'In case that the module is detached or other module is installed in the state that 'M.XCHG' switch is 'On' • Off: ▶ Indicates 'no error'
①-e	BAT LED	• ON (Red): in case that battery voltage is lowered • Off: No battery error
①-f	CHK LED	•ON (Red): indicates the setting is different from standard setting (Available to add/delete[clear] by parameter) ▶ In case that 'Module change' switch is set as 'Module change'. ▶ 'In case of operating in 'DEBUG mode ▶ In 'Compulsory ON' setting status ▶ If 'Error mask' or 'SKIP' flag is set. ▶ In case that Warning occurs during operation. ▶ Extended base power error • Flicker: In case error occurred when 'Continue running when an arithmetic error occurs' is set at Error Operation Setup in XG5000 Basic Parameter Settings. • Off: Displayed if operating in standard setting
②-a	REMOTE Switch	Limit PLC operation PLC operation by remote connection. • On (right): all function enabled (REMOTE mode) • Off (left): Remote function limited ▶ D/L L is, Operation mode operation limited ▶ Monitor, data change operation enabled
②-b	M.XCHG (Module change switch)	Used in case of performing the module change during operation. • On (right): executes the module change ▸ Available to change the module only by key switch operation • Off (left): completes the module change

<table>
<tr><th>No.</th><th>Name</th><th>Usage</th></tr>
<tr><td>③</td><td>RUN/STOP mode Switch</td><td>Sets the operation mode of CPU module
•STOP → RUN: execute operation of program
•RUN → STOP: stop operation of program

Operates prior to REMOTE switch.</td></tr>
<tr><td>④</td><td>Reset/ D.Clear Switch</td><td>You can enable/disable Reset/D.Clear switch in “XG5000→Basic Parameter →Basic Operation Setup”

• When is not set ”Disable reset switch”
<table><tr><th>Operation</th><th>Result</th></tr><tr><td>Move to left → return to center</td><td>PLC Reset</td></tr><tr><td>Move to left →hold for more than 3 seconds →return to center</td><td>Overall reset</td></tr></table>• When is not set ”Disable D.Clear reset switch”
<table><tr><th>Operation</th><th>Result</th></tr><tr><td>Move to right → return to center</td><td>General data area and retain setting area (M, Automatic variable) will be cleared.</td></tr><tr><td>Move to right →hold for more than 3 seconds →return to center</td><td>General data area, retain setting area (M, Automatic variable) and R area will be cleared.</td></tr></table>• Caution: DATA CLEAR acts only in “STOP” operation mode</td></tr>
<tr><td>⑤</td><td>USB connector</td><td>A connector to connect with peripherals (XG5000 etc.) (USB 1.1 support)</td></tr>
<tr><td>⑥</td><td>Ethernet connector</td><td>A connector to connect with peripherals
• XG5000 connection: support
• TCP/IP server connection</td></tr>
<tr><td>⑦</td><td>Battery built-in cover</td><td>Backup Battery built-in cover</td></tr>
</table>

4.3 Battery

4.3.1 Battery specifications

Item	Specification
Nominal voltage/current	DC 3.0 V / 1,800 mAh
Warranty	5 years (ambient temperature)
Usage	Program and data backup, RTC operation in case of power off
Specification	Manganese Dioxide lithium battery
Dimensions (mm)	ϕ 17.0 X 33.5 mm

4.3.2 Cautions for using

(1) Do not charge, dismantle, heat up, short, or solder the battery.
(2) Improper handling of the battery may result in injury or fire due to heat generation, blowout or ignition.

4.3.3 Battery life

(1) A battery's life may be different depending on the conditions of blackout time, service temperature, etc. (Ambient temperature use: At least 5 years of use)
(2) If battery is getting low, CPU Module will trigger, 'battery voltage low warning'. It is available to check it through CPU module LED and flag or error message of XG5000.
(3) When the battery voltage drop warning occurs, replace the battery immediately.

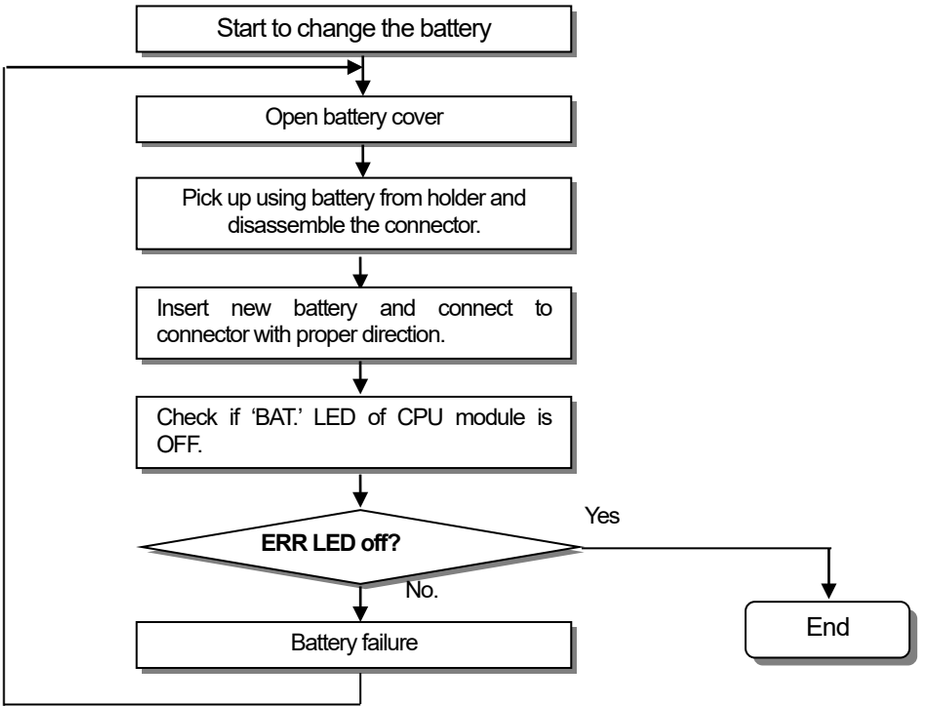
Notes

In general, the battery warning occurs 5 years after purchasing but it may occur earlier due to a poor battery or excessive current discharge caused by leakage current etc. If the warning occurs again within the short time after battery change, you need to request A/S service for CPU module.

4.3.4 Battery replacement

The battery used for program backup or data backup at power out needs the regular change. Even if the battery is removed, program and power-out keeping data shall be kept for 30 minutes by super capacity but it is required to change the battery as fast as possible.

The procedures to replace the battery are as below.



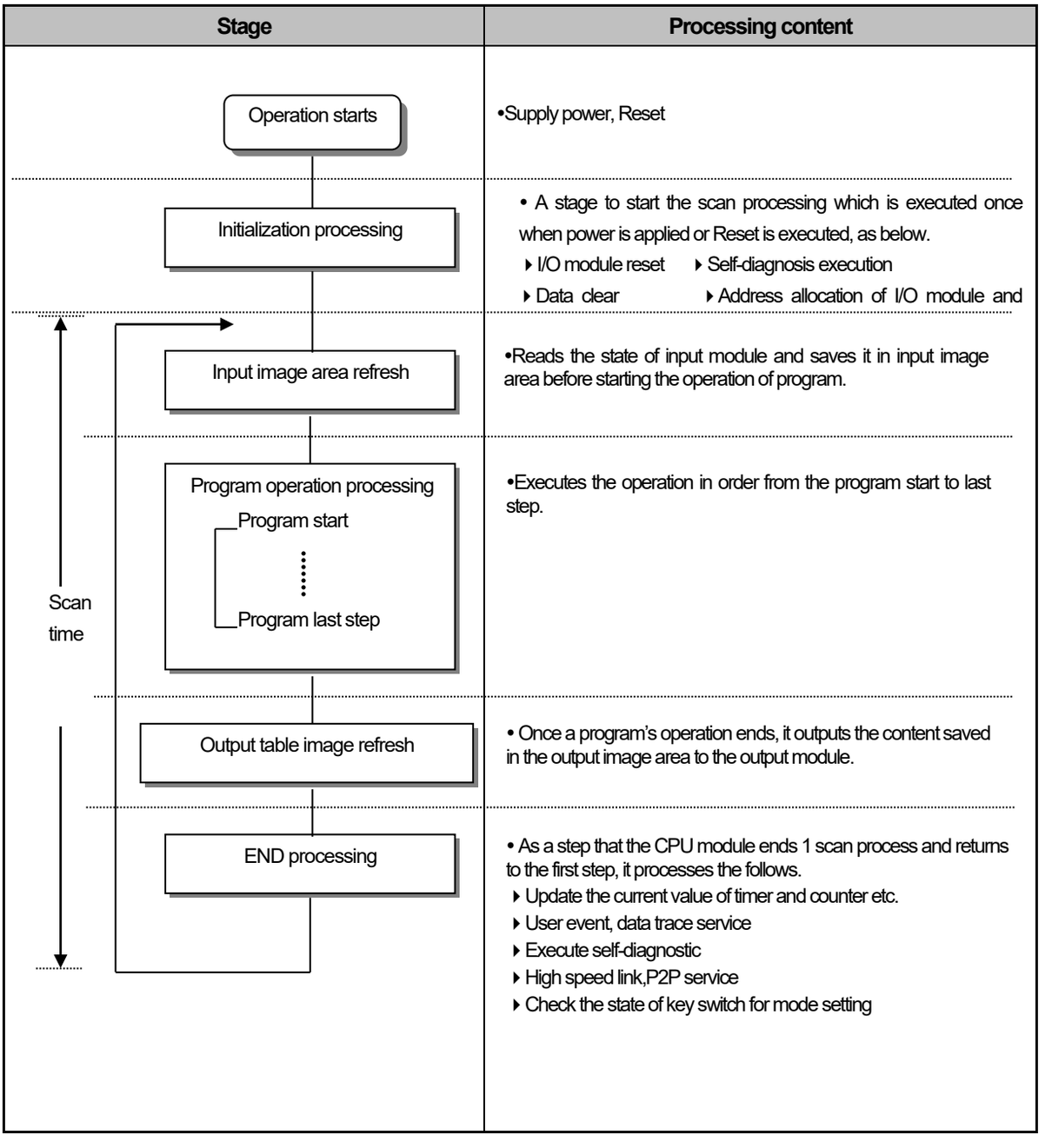
Chapter 5 Program Configuration and Operation

5.1 Program Command

5.1.1 Program operation methods

1) Cyclic operation (Scan)

It executes a program created by the basic program operation method of the PLC from the first to the last step cyclically and the procedure is called 'Program Scan.' And the series of process is called cyclic operation.
The processing is divided per stages as below.



2) Interrupt operation (fixed period, internal device operation)

It temporarily stops a currently executing program operation and immediately processes an operation corresponding to the interrupt program in case an urgent event occurs during the operation of PLC program.
The signal notifying the CPU module about the emergency is called 'Interrupt signal' and there are fixed period operations that are executed at every fixed time.
In addition, there is also internal device operation program that works depending on the change in the status of an internally designated device.

3) Fixed period scan (Constant Scan)

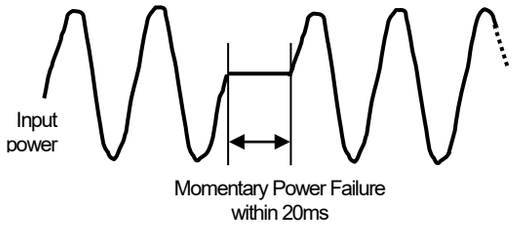
The operation executes a scan program at a fixed time. It executes every scan programs, waits for a moment and resumes program scan at a pre-defined time. Unlike fixed period program, it is executed synchronously as I/O is updated.

The scan time of fixed period operation is displayed as a pure program processing time subtracting waiting time.
If the scan time is longer than the pre-defined 'fixed period', '_CONSTANT_ER' flag is 'On'.

5.1.2 Operation Processing during Momentary Power Failure

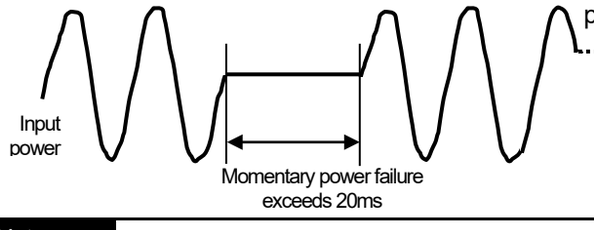
The CPU module detects Momentary Power Failure when the voltage of input power supplied to the power module is lower than the nominal value.
If the CPU module detects Momentary Power Failure, it processes operation as follows.

1) In case of Momentary Power Failure within 20ms occurs



(1) It stops an operation and maintains the output when the moment of Momentary Power Failure is maintained.
(2) It continues the operation once the interruption is removed
(3) The output voltage of power module is maintained within the specified value.
(4) Even though an operation stops due to Momentary Power Failure, timer measurement and interrupt timer measurements still work normally.

2) In case of Momentary Power Failure over 20ms occurs;



It executes resumption process such as when it is power on ....

Notes

1) Momentary power failure ?
It means the status that the power supply voltage specified in the PLC is out of the allowable variance range and falls, and especially, a short term interruption(several ms ~ dozens of ms) is called Momentary power failure.

5.1.3 Scan time

The time required to complete it from the first step 0 to the next step 0 of a program, that is, a time taken for a control operation is called 'scan time.' It is directly related to the control performance of the system.

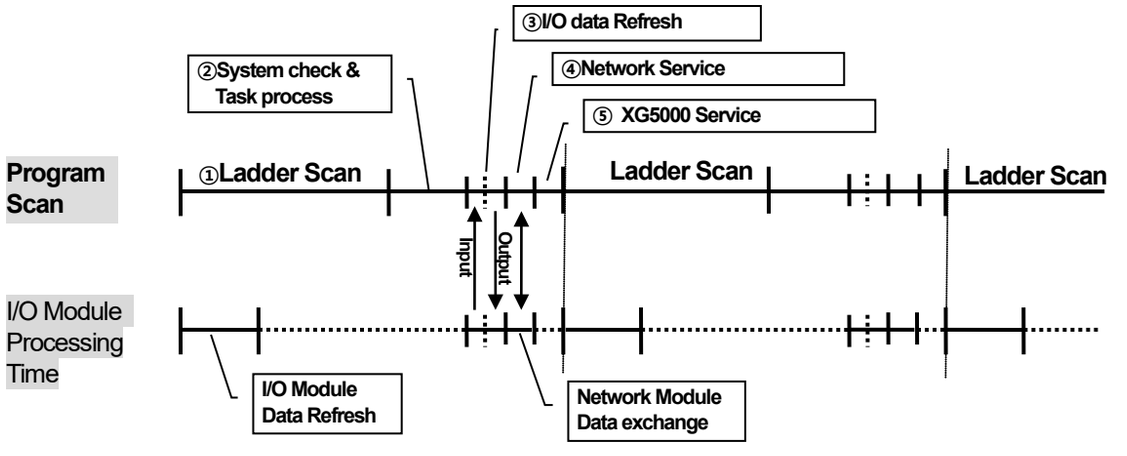
(1) Operation and performance of XGK

Program execution time, I/O data process time and communication service time are important factors affecting the 'scan time.' The XGK CPU impressively reduces scan time by means of the improved data reception performance through ladder program execution and backplane, ladder program execution by MPU and parallel execution of I/O data scan etc.

Type	Program processing time		Module processing time		
	Ladder execution (32kstep)	System Task	I/O module 32 Type 1	Analog I/O module (8 channel,1)	Communication module(Main/Extension) (200 byte, 1 block)
CPUSN/HN/UN	0.272 ㎳	0.2 ㎳	20 ㎲	75 ㎲	170 + 44(200byte 1 block) ㎲
CPUA,H,U	0.896 ㎳	0.6 ㎳			
CPUE,S	2.688 ㎳	0.8 ㎳			

(2) Calculation of scan time

The CPU module executes controls along the following steps. A user can estimate the control performance of a system that the user is to structure from the following calculation.



1) Scan time = ① Scan program process + ② System check & Task process + ③I/O data Refresh
+ ④ Network Service + ⑤ XG5000 Service + ⑥ User Task Program process

① Scan program process = no. of program steps created x 0.028 (㎲)
(CPUE/S are 0.084 applied, CPUSN/HN/UN are 0.0085 applied)

② System check & Task process: 600 ㎲ ~ 1.0 ms [varies depending on the usage of auxiliary functions]

③ I/O data Refresh [Including special module]: minimum 0.06ms~0.2ms

④ Network Service = Service of communication module in main base+ Service of communication module in extension base
= (No. of service x 3 ㎲) + (Total amount of send/receive data (byte)/4 x 0.056 [CPUS:0.112] ㎲)
+ (Comm. module's total amount of send/receive data of main base (byte))/4 x 0.084 ㎲
+ (Comm. module's total amount of send/receive data of extension base (byte)/4 x 0.280 ㎲

* The number of service and send/receive data occurred within one scan are standard of calculation.

⑤ XG5000 Service process time: 100 ㎲ at the max data monitor (However, if monitor screen is changed, scan time increases temporarily. If connecting by "Max. USB Writing", it is 6ms; if connecting by "Normal USB Writing", it is 1.6ms.)

⑥ Task Program process time: Sum of task processing time that occurs within a scan; the time calculation by task programs are as same as that of scan program.

2) Example

The scan time of a system consisting of CPUH (program 16kstep) + 32 points, 6 I/O modules + 6 analogue modules + 4 communication modules (200 bytes 8 blocks per module) is as follows.

Scan time(㎲) = ladder execution time + system processing time + digital module I/O processing time + analogue I/O processing time + communication module processing time + XG5000 Service processing time
= (16000 x 0.028) + (600) + (20 x 6) + (75 x 6) + (44 x 8 x 4) + (100)
= 3806 ㎲
= 3.806 ㎳

(3) Scan time monitor

(1) Scan time is save in special relay (F) area as follows.
1) F0050 : Max. value of scan time(0.1ms unit)
2) F0051 : Min. value of scan time(0.1ms unit)
3) F0052 : Current value of scan time (0.1ms unit)

When monitoring scan time, monitor the special relay (F) as INT type.

5.2 Program Execution

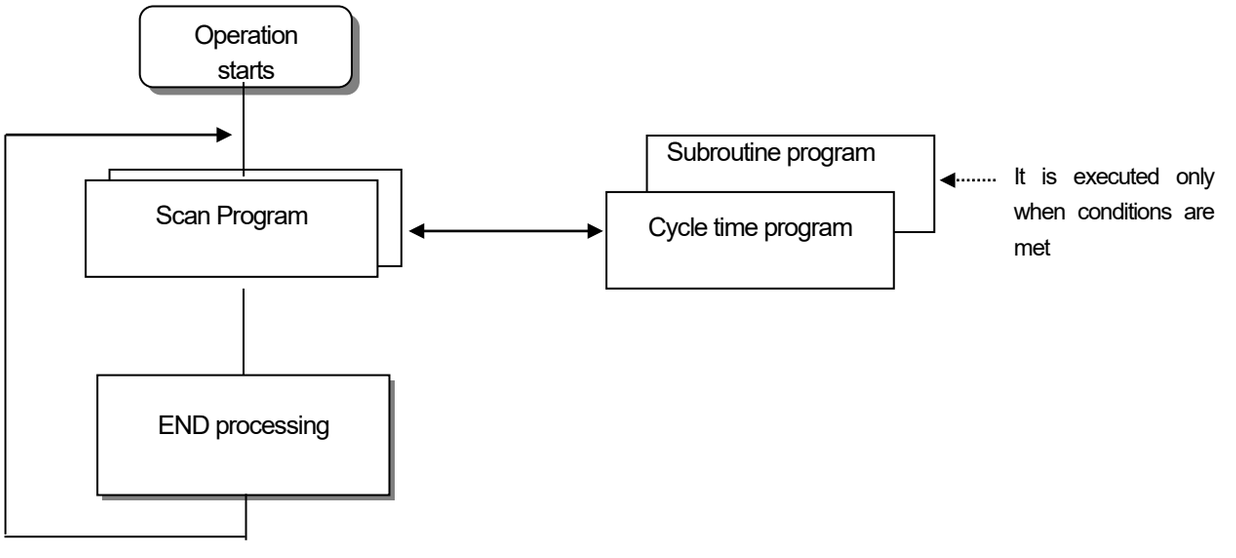
5.2.1 Program Configuration

Program consists of every functional element necessary for executing a specific control and is saved into the internal RAM or a flash memory of the CPU module.
The functional elements can be categorized as follows.

Function	Operation processing content
Scan Program	• Processing of signal that repeats regularly every 1 scan.
Cycle time interrupt Program	• If time conditional process is required as follows, it executes the program at the fixed time interval. ▸ If requiring faster process than the average processing time of a scan ▸ If requiring longer time interval than the average processing time of a scan ▸ If a process is to be executed at a fixed time interval.
Subroutine program	• Executed only when a specific condition is met (if the input condition of CALL command is On)

5.2.2 Program Execution Method

It describes the program execution in case the power is turn on or the key switch of the CPU module is RUN.
The program processes an operation according to the following configuration.



(1) Scan Program

1) Function

• It cyclically executes an operation from the first step 0 to the last step according to the sequences that the program is created in order to process a signal that repeats uniformly per scan.

• If the execution conditions of cycle time interrupt or interrupt by input module are met during the operation of scan program, it suspends the currently running program and executes the interrupt program.

(2) Interrupt Program

1) Function

To process internal/external signals that occur irregularly/regularly, it suspends the operation of scan program and processes the function preferentially.

2) Types

• Cycle task program: A program is executed at the fixed time interval. (Max. 32 program available)

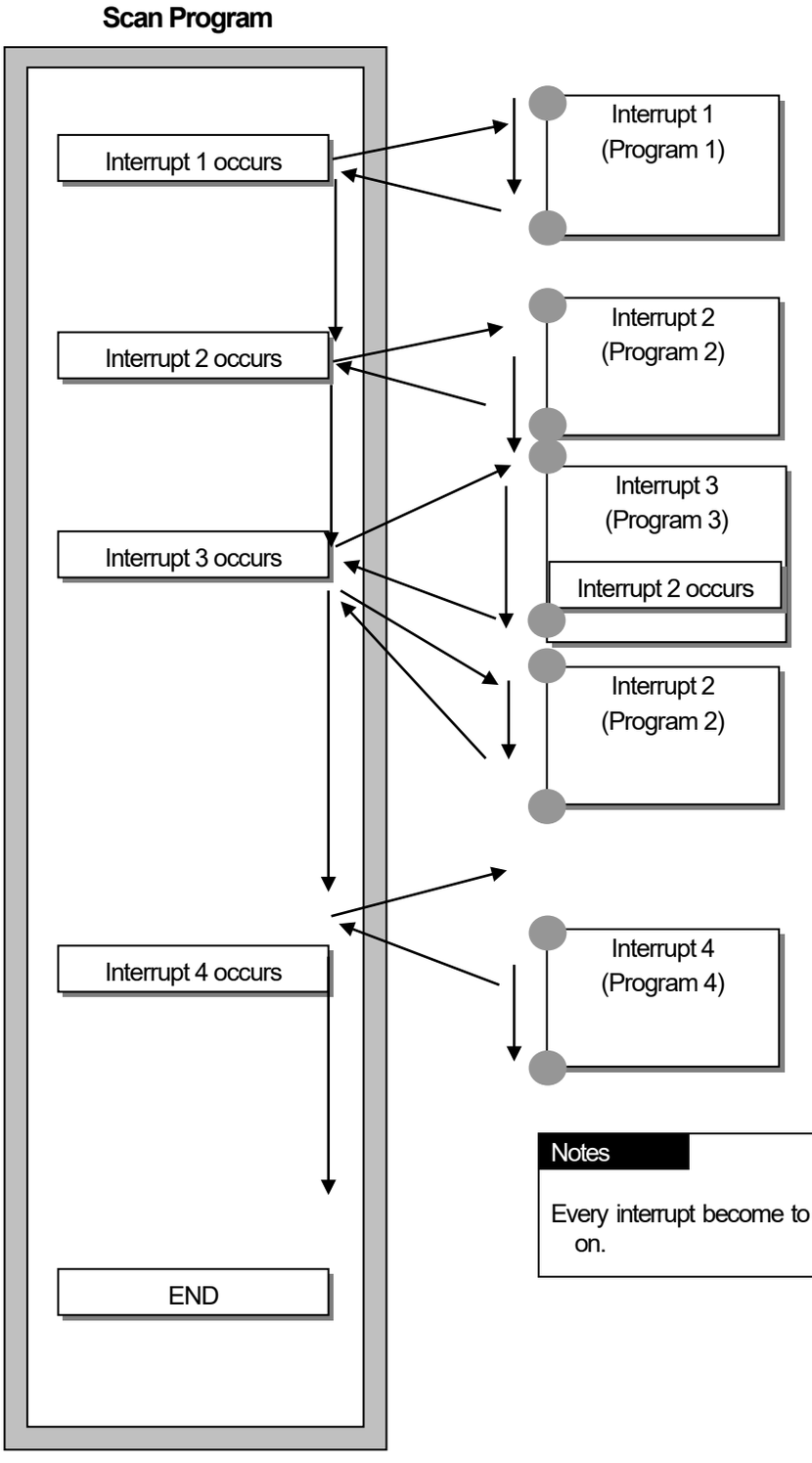
• Internal device task program : If any operation condition of an internal device occurs, it executes the program Detection of device's start condition is executed after scan program (Max. 32 program available)

Notes

1) For further information about interrupt program, please refer to 5.2.3 Interrupt.

5.2 3 Interrupt

How to set XG5000 of XGT programming S/W will be described below simply to help understand interrupt function. (Refer to XG5000 manual for details on XG5000.)

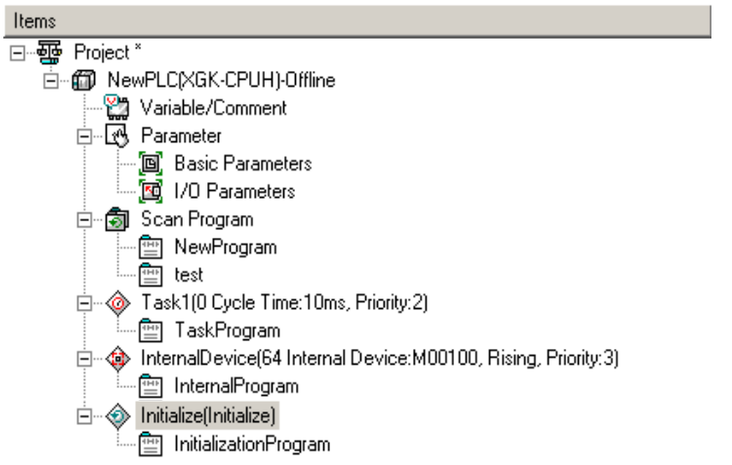


Notes

Every interrupt become to disabled status when the power is turned on.

(1) How to prepare Interrupt Program

Create a task in the project window of XG5000 as follows and add programs to be executed by each task. Refer to XG5000 manual for more details.



(2) Task Types

Types and functions of tasks are as specified below.

Type / Specifications	Cycle task (Interval task)	Internal contact (Single task)
Quantity	32	32
Start condition	Cycle time((up to 4,294, 967. 295 second available in 1ms unit)	Internal device's designated conditions
Detection and execution	Executed periodically per setting time	Executed by searching for condition after scan program completed.
Detection delay time	Max. 0.2 ms delayed	Delayed as much as max. scan time
Execution priority	Setting 2 ~ 7 levels (level 2 is the highest priority)	As specified in the left
Task no.	With 0~31 range without user duplication	Assigning it between 64~95 so that it is not duplicated

(3) Processing methods of task program

Common processing method and precautions for task program will be described.

1) Features of task program

a) Task program does not repeat every scan differently from scan program but perform execution only when its conditions are met. Task program shall be considered of this point.

b) For example, if timer and counter are used for cycle time task program with a cycle of 10 seconds, tolerance of the timer can be maximum 10 seconds. And since the counter checks its input status every 10 seconds, any input changed within 10 seconds will not be counted.

2) Execution priority

In the event several tasks to be executed are waiting, execute from the highest Task Program in priority. When the same priority tasks are waiting, execute consecutively.
Priority of tasks can be assigned only in each task.
The task program priority should be set considering the program requirements, importance, and the emergency when the execution is requested.

3) Process delay time

The delay of task program processing occurs due to the following factors. Make sure to consider them when setting a task or creating a program.
1) Task's detection delay (refer to details of each task)
2) Program execution delay due to execution of precedent task program.

4) Relationship between initialization, scan program and task program

User frame definition task dose not start when initialization task program is executed.
Since scan program's priority is the lowest, task program will be preferably processed with the scan program stopped if task occurs.
Therefore, if tasks frequently occur during 1'st 1 scan or intensively and intermittently occur, a scan time may increase unreasonably.
A special attention should be paid when setting the conditions of task.

5) Protection of currently running program from task program

If continuity of program execution might be lost while performed, by a task program with higher priority, the task program can be partially prevented from execution. At this time, DI (task program operation disallowed) or 'EI (task program operation allowed)' application instruction can be used to protect program.
Insert 'DI' application instruction in the start position to protect or 'EI' application instruction in the position to cancel the protection.
Initialization Task is not influenced by 'DI' or 'EI' application instruction.

Notes

1) If task program priority is duplicate set, a program works according to the creation order.

(4) Processing method of cycle task program

When task program's task (operation condition) is set to cycle task, its processing is as described below.

(1) Task settings

Specify execution cycle and priority of the task which will be operation condition of the task program to execute. Check the task number for task management.

(2) Cycle task processing

Execute cycle task program applicable at specified time intervals (execution cycle).

(3) Cautions for using a cycle task program

a) If the same task program is requested to operate with cycle task program presently executed or standing by, the newly generated task will be ignored.

b) Only in Run mode, timer that requests execution of cycle task program will be added. The shutdown time power failure time shall be all ignored

c) When setting cycle task program's execution cycle, consider that execution request of several cycle task programs may occur at a

time. If 4 cycle task programs are used with a cycle of 2, 4, 10 and 20 seconds, execution request of 4 cycle task programs will occur at a time every 20 seconds, causing a problem to increase the scan time in a moment.

d) Maximum, minimum, and current scan time of cycle task can be checked with flag of cycle task.
_CYCLE_TASK_SCANx_MAX : Maximum scan time of 'x'th cycle task(x=0~31)
_CYCLE_TASK_SCANx_MIN : Minimum scan time of 'x'th cycle task(x=0~31)
_CYCLE_TASK_SCANx_CUR : Current scan time of 'x'th cycle task(x=0~31)

e) Initial value of minimum scan time flag is 16#ffff. It can verify cycle task is not used, or never executed.

Caution
1) Note that if the total time length during which cycle task programs are executed simultaneously is longer than the specified time length when several cycle task occur simultaneously, a short cycle task may not be successfully executed. 2) The only cycle task of which cycle is longer than scan cycle can be guaranteed for the cycle task.

(5) Processing method of internal device task program

When execution range of task program's task (operation condition) is extended from the contact to device, the extended internal device task program will be processed as described below.

1) Task settings

Set the conditions and priority of a device which is the operation condition of a task program to execute. Check the task number for task management.

2) Internal device task processing

If devices' conditions which will be operation condition of internal device task program are identical according to priority after scan program is executed completely in CPU module, it will start to execute.

3) Cautions for using internal device task program

a) Internal device task program starts to execute when the moment of scan program is completed. Therefore, although a scan program or task program (cycle task, external contact) generates the execution conditions of internal device task program, it is not immediately executed and instead, it is executed at the moment when a scan program is executed completely.

b) Execution request of internal device task program inspects the execution conditions when the moment scan of program is completed. Therefore, if the execution conditions of internal device task occur and disappear by a scan program or task program(cycle time, external contact) during '1 scan', a task is not executed because it is not detected at the moment when the execution conditions are surveyed.

(6) Task processing in momentary power failure

1) When resuming operation due to a long momentary power failure, ignore any waiting task and tasks that occur during the interruption and process the only tasks from the moment of starting operation.

2) If an interruption is within 20ms, a task that was waiting is executed once the interruption is removed. Any cycle task, interrupt task that is duplicated during the interruption is ignored.

(7) Verification of task program

After creating a task program, verify it in accordance with the followings.

1) Is the task set properly?

If task occurs more than needed or several tasks occur in one scan, scan time may lengthen or be irregular. When unable to change the task setting, verify maximum scan time.

2) Is the task priority well arranged?

A low priority task program may not be processed in a specified time due to a delay from a higher priority task program. The case may be, since the next task occurs with a preceding task delayed, it may cause task collision. The priority should be set in consideration of urgency of task, execution time and etc.

3) Is the task program created as short as possible?

A longer execution time of task program may cause a longer scan time or irregularity. In addition, it may cause task program collision. Make sure to set the execution time as short as possible. The scan time of the cyclic task program should be made shorter than the cyclic setting time of the corresponding task, and it should be made as small as possible (recommended within 5ms).

4) Doesn't the program for the highest priority task need to be protected during the execution of program?

If a different task breaks into a task program execution, it completes a current task and then, operates from a task with the highest priority among waiting tasks. In case it is prohibited that a different task breaks into a scan program, it can be protected by using 'DI'/'EI' application functional commands. It may cause a trouble while processing a global parameter process commonly used with other program or a special or communication module.

(8) Program configuration and example of processing

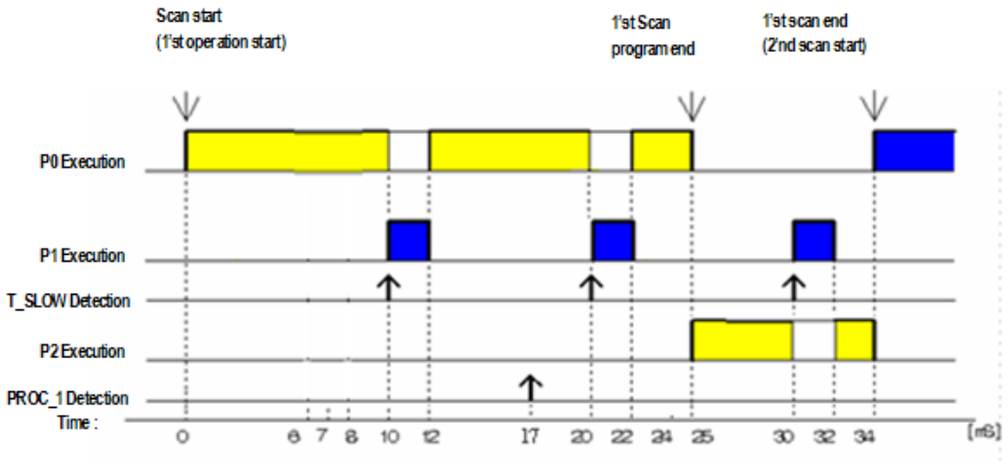
First of all, register task and program as follows.

1) Register task :
T_SLOW (fixed cycle : = 10ms, Priority := 3)
PROC_1 (internal device : = M0, Priority := 5)

2) Register Program :
Program –> P0 (scan program)
Program –> P1 (operating by task T_SLOW)
Program –> P2 (operating by task PROC_1)

Then, if the program execution time and the occurrence time of external interrupt signal are same,

Execution time of each program: P0 = 17ms, P1 = 2ms and P2 = 7ms, respectively
PROC_1 occurs During a scan program, the program is executed as follows.



• Processing by time period

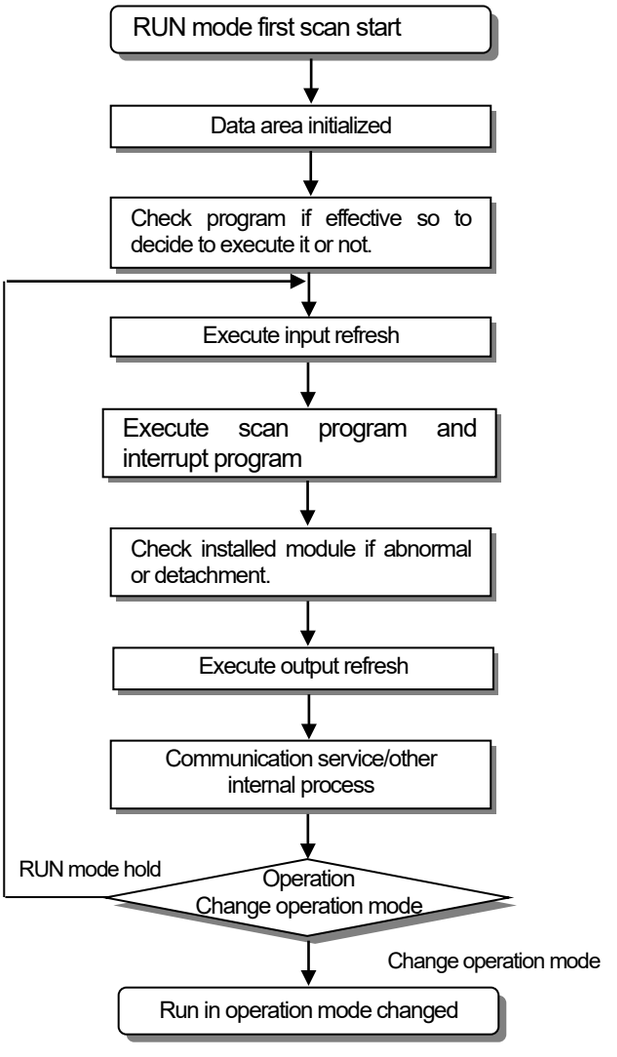
Time (ms)	Detail
0	Scan starts and the scan program P0 starts operation
0~10	Program P0 is executed
10~12	P0 stops due to the execution request for P1 and P1 is executed
17	Execution request for P2
12~20	P1 execution is complete and the suspended P0 resumes
20~22	P0 stops due to the execution request for P1 and P1 is executed
22~25	As P1 execution is complete, the suspended P0 is completely executed.
25	Check the execution request for P2 at the moment when scan program (P0) is complete and execute P2.
25~30	Execute program P2
30~32	P2 stops due to the execution request for P1 and P1 is executed
32~34	As P1 execution is complete, the suspended P2 is completely executed.
34	New scan starts (P0 starts to execute)

5.3 Operation Mode

CPU module's operation status is classified into Run mode, Stop mode and Debug mode.
This describes the operation processing of each operation mode.

5.3.1 RUN mode

Executes program operation normally.



(1) Processing when a mode is changed
At the beginning, the data area is initialized and it determines whether to execute it by verifying the effectiveness of program.

(2) The contents of operation processing
Execute I/O refresh and program operation.
1) Execute the interrupt program by detecting the operation conditions of interrupt program.
2) Inspect the operation and detachment of modules installed.
3) Process communication service and other internal operation.

5.3 2 Stop Mode

It is the mode in Stop status without program operation. Program transfer is available only in remote STOP mode via XG5000.

(1) Processing when changing the mode
1) Remove the output image area and execute output refresh.

(2) The contents of operation processing
1) Execute I/O refresh.
2) Inspect the operation and detachment of modules installed.
3) Process communication service and other internal operation.

5.3 3 Debug Mode

As a mode to find any error from a program or trace an operation procedure, the mode can be changed only from STOP mode. In the mode, a user can verify a program while checking the program execution and data.

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

(2) The contents of operation processing
1) Execute I/O refresh.
2) Debugging operation depending on the settings.
3) After completing debugging operation to the end of the program, it executes output refresh.
4) Check the normal operation and detachment of modules' installation.
5) Process communication service and other internal operations.

(3) Conditions of debug operation
There are 4 conditions for Debug operation and in case that it reaches break point, it is available to set other type of break point.

Operation condition	Operation description
Execute by one operation unit (step over)	With operation instruction, it executes one operation unit and then stops.
Execute according to Break Point	If break point is assigned in Program, it stops at the assigned break point.
Execute according to the state of contact point	If the contact area desired to watch and the state (Read, Write, Value) desired to stop are assigned, it stops when the assigned operation occurs at the assigned contact point.
Execute according to scan times	If scan times to operate are assigned, it operates as much as the assigned scan times and stops.

(4) Operation method
1) After setting Debug operation condition at XG5000, execute the operation.
2) Interrupt Program is available to set whether or not to operate (Enable/Disable) by each Interrupt unit.
(For further information, please refer to Chapter 9 Debugging, XG5000 user's manual.)

5.3.4 Changing 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' command during program execution.

(2) Types of operation mode

The operation mode setting is as follows.

Operation mode Switch	Remote allowable switch	XG5000 command	Operation mode
RUN	X	X	Run
STOP	ON	RUN	Remote RUN
		STOP	Remote stop
		Debug	Debug Run
	OFF	Executing mode change	Previous Operation mode
RUN -> STOP	X	-	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.(Operating STOP) → RUN → STOP)

Notes

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

2) 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 Program memory

The configuration of user program memory is as below

Item	Memory capacity(KB)							
	CPUUN	CPUHN	CPUSN	CPUU	CPUH	CPUA	CPUS	CPUE
Parameter setting area: • Basic parameter area • I/O parameter area • Special module parameter error • Communication module parameter area • User event parameter area • Data trace parameter area	320	320	320	320			320	
Program saving area • Scan program area 1 • Scan program area 2 • Variable/comment area	2,320	1,288	772	704			352	
System area • User event data area • Data trace data area • System log area • Device backup area	2,552	2,040	1,656	896			896	
Execution program area • Executing program area 1 • Executing program area 2 • System program area	4,096	2.048	1,024	2,048	1,024	512	512	256

5.4.2 Data memory

(1) Bit device area

Various Bit Devices 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 for the last digit.

Area per Device	Device feature	Usage
P00000 ~ P4095F***1	I/O device "P" 65,536 points	Image area saving the I/O contacts state 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.
M00000 ~ M4095F***2	I/O device "M" 65,536 points	Internal Memory provided to save Bit Data in Program.
L00000 ~ L11263F	I/O device "L" 180,224 points	Device to indicate high speed link/P2P service state information of communication module. (Refer to appendix 1.2)
K00000 ~ K4095F***3	I/O device "K" 65,536 points	Device area to preserve the data during power shutdown, which is used without setting power shutdown preservation parameter separately. Using the PID Parameter area(Refer to 10.5 Flag Configuration)
F00000 ~ F4095F***4	I/O device "F" 65,536 points	System flag area that manages the flags necessary for system operation in PLC.
T0000 ~ T8191***5	I/O device "T" 8,192 points	Area to save the state of timer device
C0000 ~ C4095***6	I/O device "C" 4,096 points	Area to save the state of counter device
S00.00 ~ S255.99***7	Step controller "S" 256 x 100 steps	Relay for step control

Notes

The following devices are limited to the area according to CPU type.

Classification	P***1	M***2	K***3	F***4	T***5	C***6	S***7
XGK-CPUE	P2047F	M2047F	K2047F	F2047F	T2047	C2047	S127.99
XGK-CPUS							
XGK-CPUA							
XGK-CPUH							
XGK-CPUU							
XGK-CPUSN	P4095F	M4095F	K4095F	F4095F	T8191	C4095	S255.99
XGK-CPUHN							
XGK-CPUUN							

(2) Word device area

Area per Device	Device feature	Usage
D00000 ~ D524287 ***1	Data register “D”524,288 word	Area to preserve the internal data. Bit expression possible.
R00000 ~ R32767	File Register “R”32,768 word	Dedicated device to access Flash Memory. Consisted of 1,2,8,16 banks depending on the CPU Types Bit expression possible
U00.00 ~ U7F.31 ***2	Analog Data Register “U” 4,096 word	Register used to read data from special module installed in the slot. Bit expression possible
N00000 ~ N21503	Communication Data Register “N”21,504 word	P2P Service Save area of communication module. Bit expression Impossible
Z000 ~ Z255 ***3	Index Register “Z”256 word	Dedicated device to use Index function Bit expression Impossible
T0000 ~ T8191 ***4	Timer Current Value Register “T”8192 word	Area to indicate the current value of timer
C0000 ~ C4095 ***5	Counter Current Value Register “C” 4096 word	Area to indicate the current value of counter

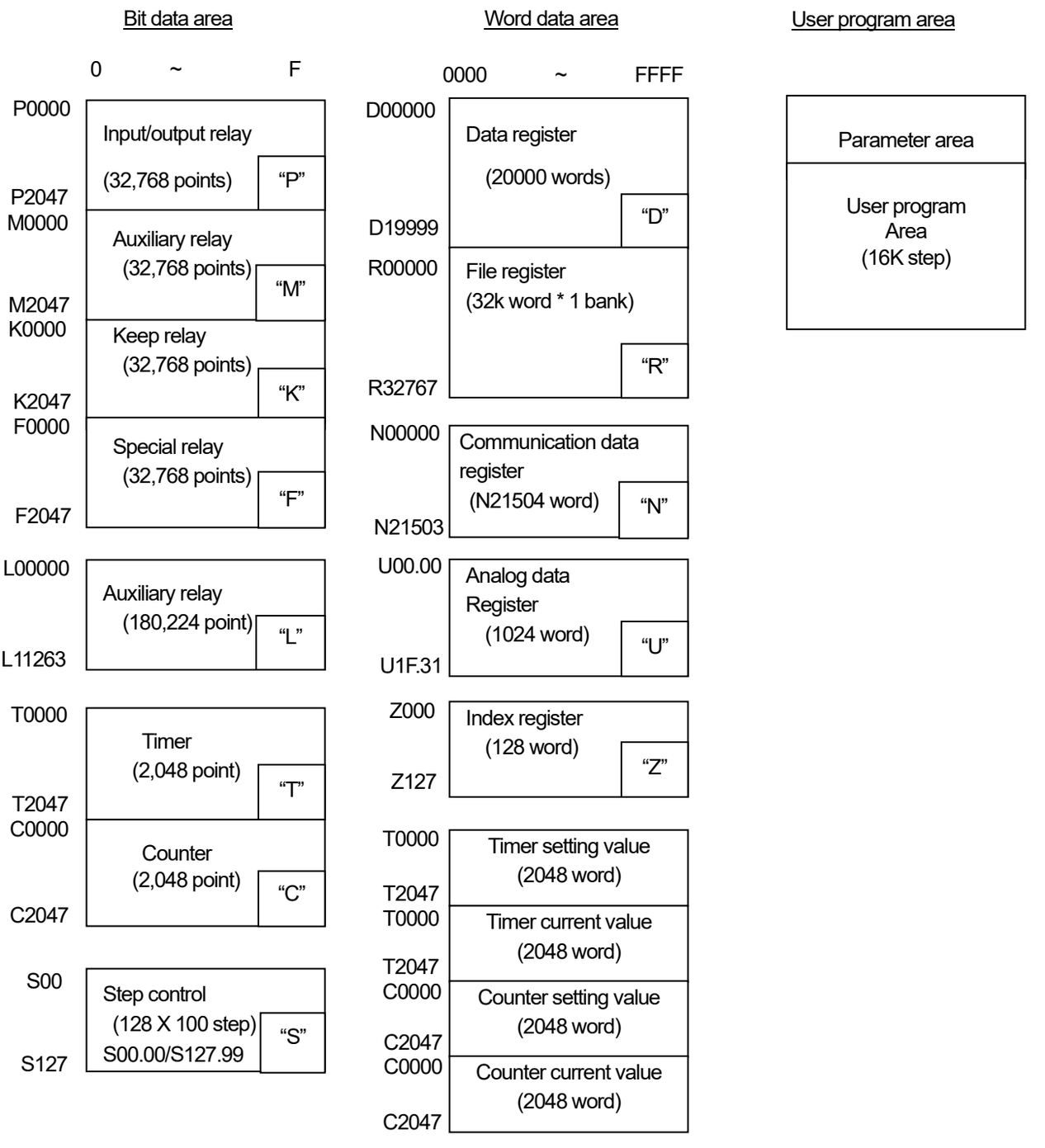
Notes

The following devices are limited to the area according to CPU type.

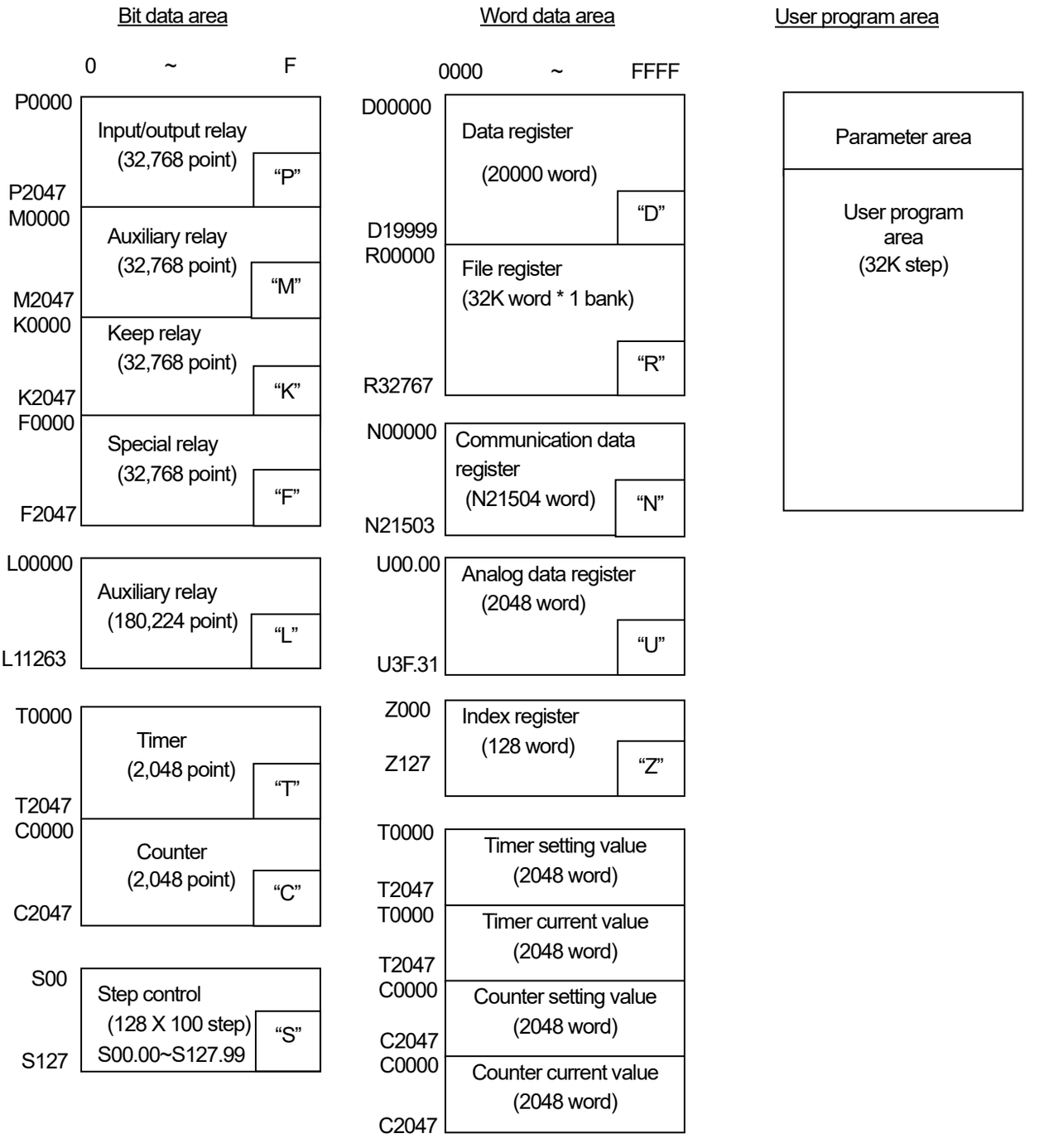
Classification	D***1	U***2	Z***3	T***4	C***5
XGK-CPUE	D19999	U1F.31	Z127	T2047	C2047
XGK-CPUS		U3F.31			
XGK-CPUA	D32767	U3F.31			
XGK-CPUH		U7F.31			
XGK-CPUU					
XGK-CPUSN	D262143	U3F.31	Z255	T8191	C4095
XGK-CPUHN	D524287	U7F.31			
XGK-CPUUN					

5.5 Configuration Diagram of Data Memory

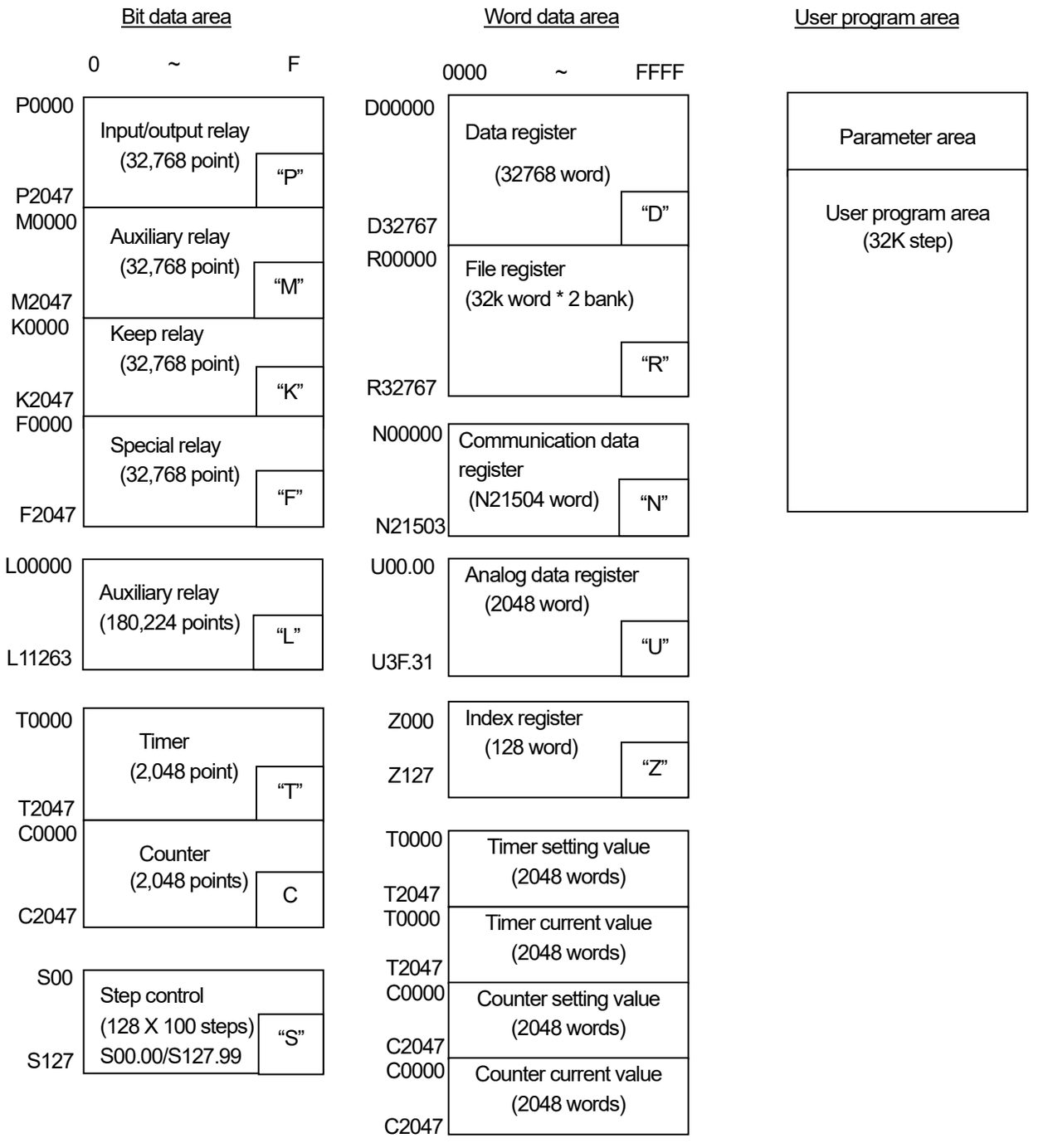
5.5.1 XGK-CPUE



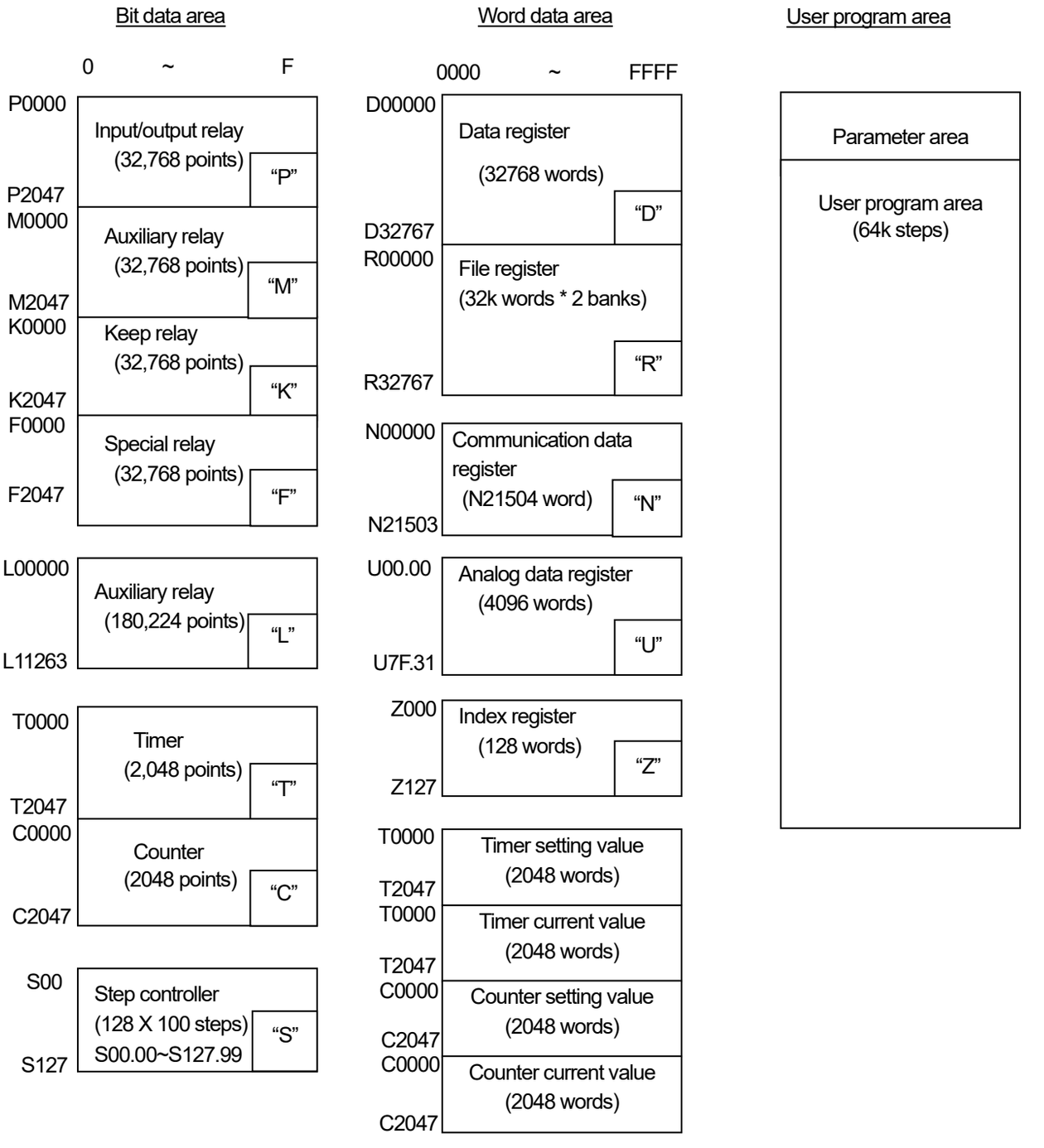
5.5.2 XGK-CPUS


Bit data area
0 ~ F
P0000
Input/output relay
(32,768 point)
"P"
P2047
M0000
Auxiliary relay
(32,768 point)
"M"
M2047
K0000
Keep relay
(32,768 point)
"K"
K2047
F0000
Special relay
(32,768 point)
"F"
F2047
L00000
Auxiliary relay
(180,224 point)
"L"
L11263
T0000
Timer
(2,048 point)
"T"
T2047
C0000
Counter
(2,048 point)
"C"
C2047
S00
Step control
(128 X 100 step)
S00.00~S127.99
"S"
S127
Word data area
0000 ~ FFFF
D00000
Data register
(20000 word)
"D"
D19999
R00000
File register
(32K word * 1 bank)
"R"
R32767
N00000
Communication data register
(N21504 word)
"N"
N21503
U00.00
Analog data register
(2048 word)
"U"
U3F.31
Z000
Index register
(128 word)
"Z"
Z127
T0000
Timer setting value
(2048 word)
T2047
T0000
Timer current value
(2048 word)
T2047
C0000
Counter setting value
(2048 word)
C2047
C0000
Counter current value
(2048 word)
C2047
User program area
Parameter area
User program area
(32K step)

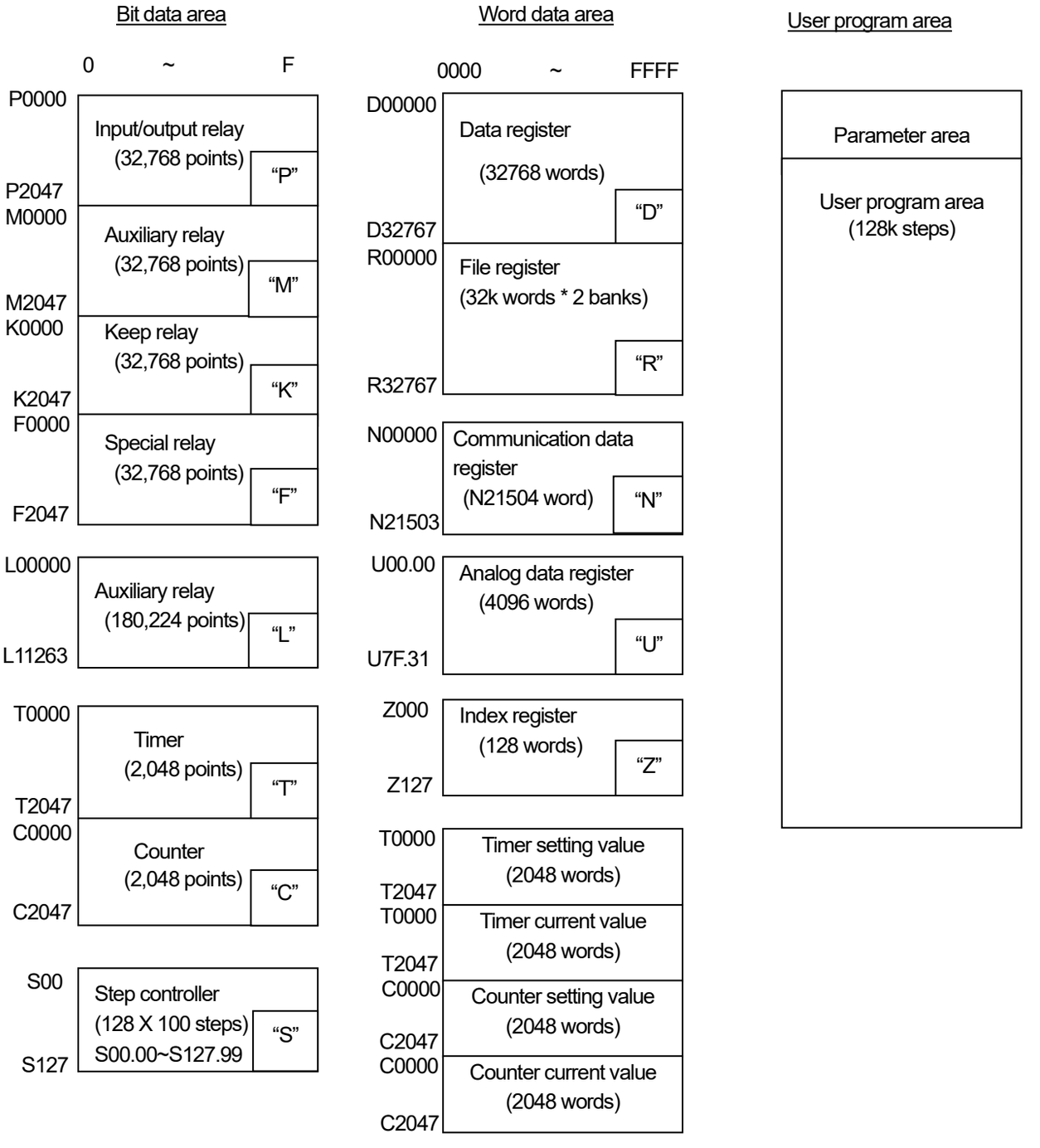
5.5.3 XGK-CPUA


Bit data area
0 ~ F
P0000
Input/output relay
(32,768 point)
"P"
P2047
M0000
Auxiliary relay
(32,768 point)
"M"
M2047
K0000
Keep relay
(32,768 point)
"K"
K2047
F0000
Special relay
(32,768 point)
"F"
F2047
L00000
Auxiliary relay
(180,224 points)
"L"
L11263
T0000
Timer
(2,048 point)
"T"
T2047
C0000
Counter
(2,048 points)
C
C2047
S00
Step control
(128 X 100 steps)
S00.00/S127.99
"S"
S127
Word data area
0000 ~ FFFF
D00000
Data register
(32768 word)
"D"
D32767
R00000
File register
(32k word * 2 bank)
"R"
R32767
N00000
Communication data register
(N21504 word)
"N"
N21503
U00.00
Analog data register
(2048 word)
"U"
U3F.31
Z000
Index register
(128 word)
"Z"
Z127
T0000
Timer setting value
(2048 words)
T2047
T0000
Timer current value
(2048 words)
T2047
C0000
Counter setting value
(2048 words)
C2047
C0000
Counter current value
(2048 words)
C2047
User program area
Parameter area
User program area
(32K step)

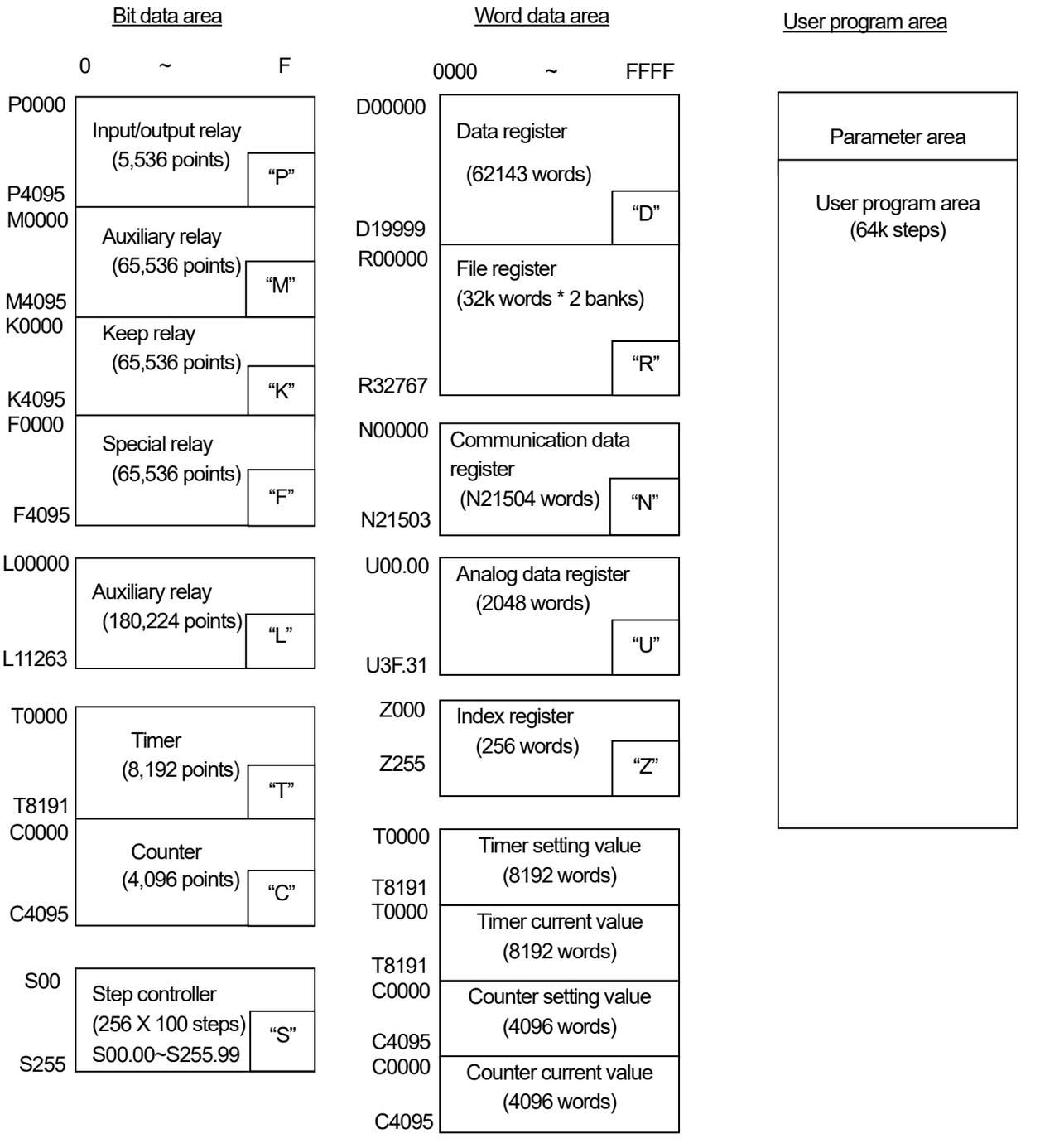
5.5.4 XGK-CPUH


Bit data area
0 ~ F
P0000
Input/output relay
(32,768 points)
"P"
P2047
M0000
Auxiliary relay
(32,768 points)
"M"
M2047
K0000
Keep relay
(32,768 points)
"K"
K2047
F0000
Special relay
(32,768 points)
"F"
F2047
L00000
Auxiliary relay
(180,224 points)
"L"
L11263
T0000
Timer
(2,048 points)
"T"
T2047
C0000
Counter
(2048 points)
"C"
C2047
S00
Step controller
(128 X 100 steps)
S00.00~S127.99
"S"
S127
Word data area
0000 ~ FFFF
D00000
Data register
(32768 words)
"D"
D32767
R00000
File register
(32k words * 2 banks)
"R"
R32767
N00000
Communication data register
(N21504 word)
"N"
N21503
U00.00
Analog data register
(4096 words)
"U"
U7F.31
Z000
Index register
(128 words)
"Z"
Z127
T0000
Timer setting value
(2048 words)
T2047
T0000
Timer current value
(2048 words)
T2047
C0000
Counter setting value
(2048 words)
C2047
C0000
Counter current value
(2048 words)
C2047
User program area
Parameter area
User program area
(64k steps)

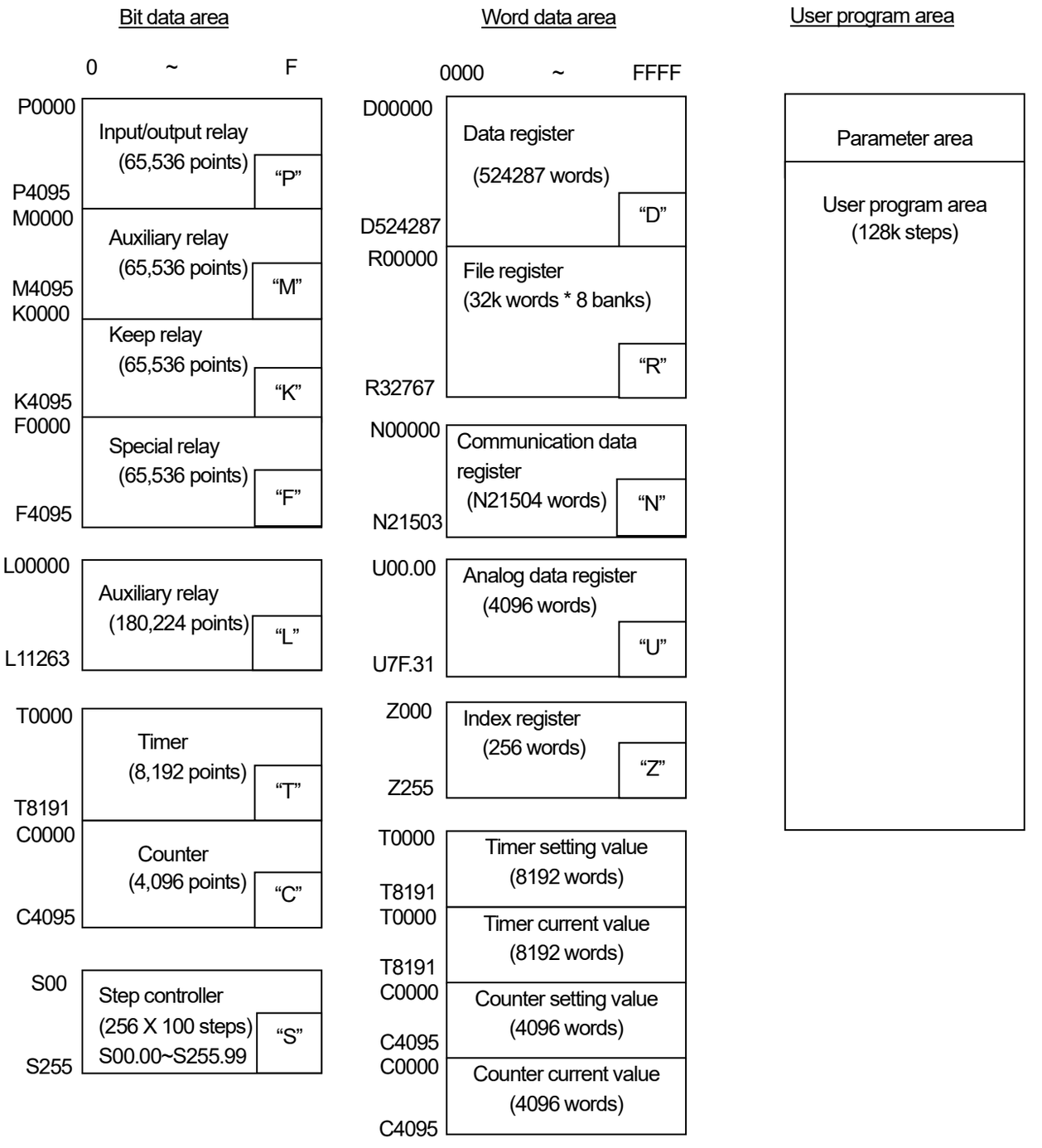
5.5.5 XGK-CPUU


Bit data area
0 ~ F
P0000
Input/output relay
(32,768 points)
"P"
P2047
M0000
Auxiliary relay
(32,768 points)
"M"
M2047
K0000
Keep relay
(32,768 points)
"K"
K2047
F0000
Special relay
(32,768 points)
"F"
F2047
L00000
Auxiliary relay
(180,224 points)
"L"
L11263
T0000
Timer
(2,048 points)
"T"
T2047
C0000
Counter
(2,048 points)
"C"
C2047
S00
Step controller
(128 X 100 steps)
S00.00~S127.99
"S"
S127
Word data area
0000 ~ FFFF
D00000
Data register
(32768 words)
"D"
D32767
R00000
File register
(32k words * 2 banks)
"R"
R32767
N00000
Communication data register
(N21504 word)
"N"
N21503
U00.00
Analog data register
(4096 words)
"U"
U7F.31
Z000
Index register
(128 words)
"Z"
Z127
T0000
Timer setting value
(2048 words)
T2047
T0000
Timer current value
(2048 words)
T2047
C0000
Counter setting value
(2048 words)
C2047
C0000
Counter current value
(2048 words)
C2047
User program area
Parameter area
User program area
(128k steps)

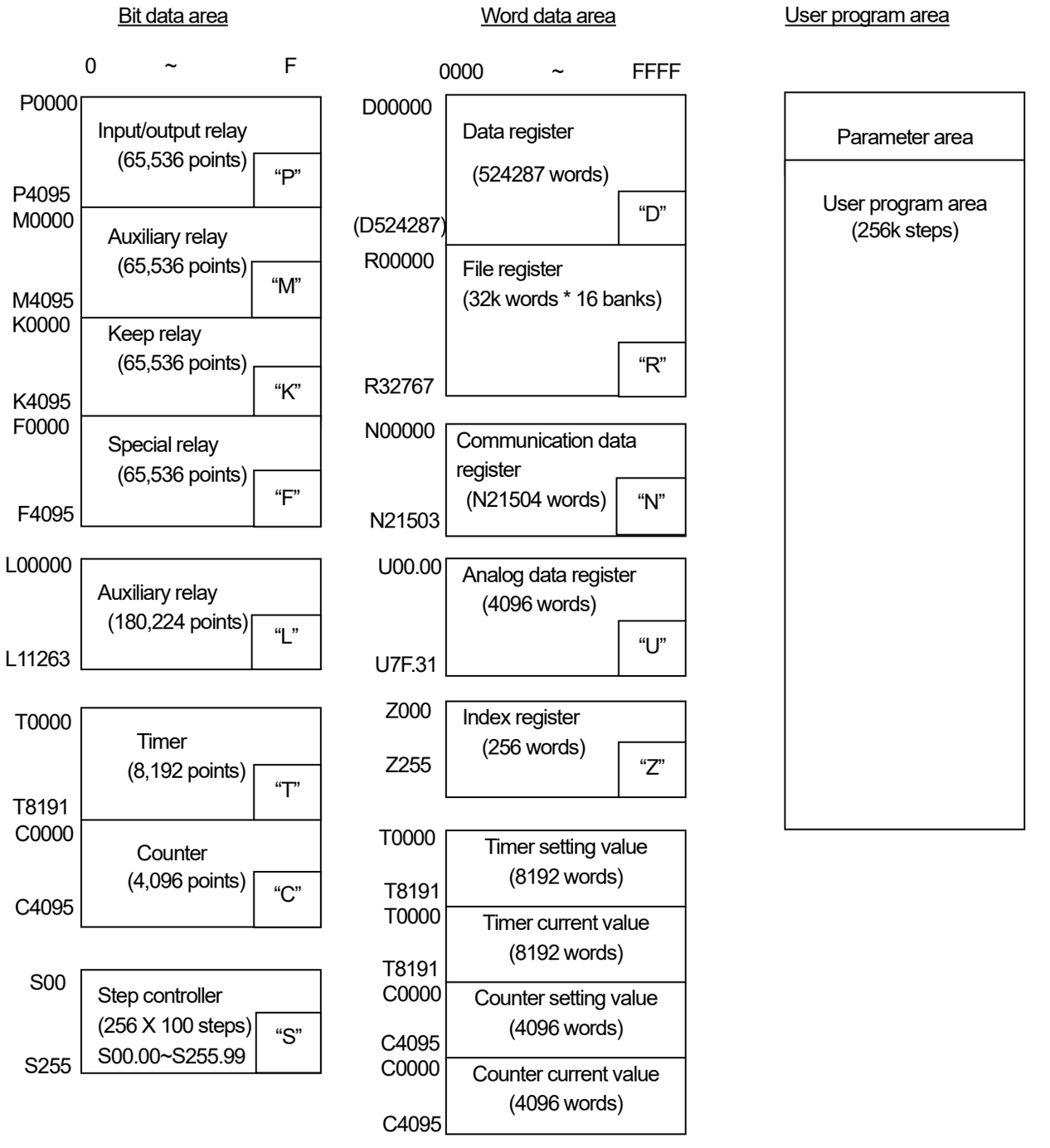
5.5.6 XGK-CPUSN



5.5.7 XGK-CPUHN



5.5.8 XGK-CPUUN



5.5.9 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	Feature
P	X	X	Image area saving the I/O contacts state
M	O	O	Internal contact 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	Area saving general word data
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)
R	X	X	Flash memory dedicated area (latch enabled)

Notes

1) K, L, N, R devices are basically latched
2) K, L, R devices operate like the 1st Latch that clears data by using Overall Reset or the CPU module D.CLR switch. That is, it is erased by overall reset or CPU module D.CLR switch operation.
3) For more information, refer to the Online section of the XG 5000 user's manual.

4) Operation in the data latch area

The method to delete the latched data is as below.

- D.CLR switch of the CPU module
- Latch 1/latch 2 clear operation by XG5000
- Write by Program (initialization program recommended)
- Writing '0' FILL from XG5000 monitor mode

D.CLR clear does not work at RUN mode. To do it, after make sure to change to STOP mode. Also when clearing by D.CLR switch, bear in mind that general area shall be initialized.

When operating D.CLR momentarily, latch 1 area only shall be removed. If keeping D.CLR for 3 seconds, 6 LEDs shall be blinked and at this time, if returning the switch, even latch 2 area shall be cleared.

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	Note
1	Power change	Off/On	Keep	Keep	
2	Reset switch	Reset	Keep	Keep	
		Overall reset	Reset	Keep	
3	D.CLR switch	Latch 1 clear	PLC Reset	Keep	
		Latch 2 clear	PLC Reset	PLC Reset	
4	Program write (online)	-	Keep	keep	
5	Data broken	SRAM broken by battery error	PLC Reset	PLC Reset	
		Data broken by other reason	PLC Reset	PLC Reset	
6	XG5000 Online	Latch 1 clear	Reset	Keep	
		Latch 2 clear	Reset	Reset	

5) Data Initialize

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.

Chapter 6 Functions of CPU Module

6.1 Self-diagnosis

(1)Self-diagnosis function means the function that CPU module diagnoses the error of PLC system itself.
(2) If the power of PLC system is applied or the error occurs during operation, it detects the error and prevents the abnormal operation.

6.1.1 Scan watchdog timer

(1) WDT(Watchdog Timer)

WDT (Watchdog Timer) is the function to detect error of hardware or the sequence program of PLC CPU module.

1) Setting and Reset of WDT

a. WDT Setting

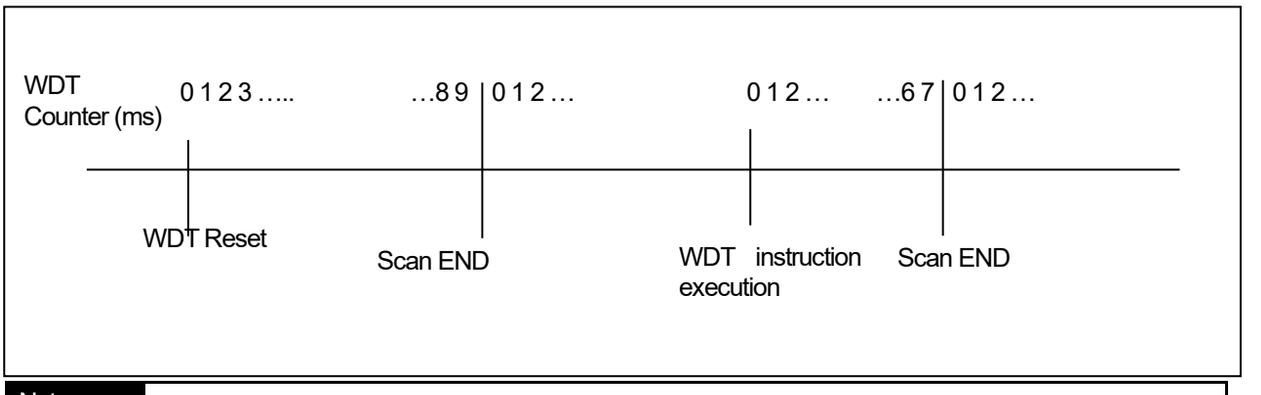
The detection time of WDT is set in Basic parameter of XG5000.
The range of WDT is between 10 ~ 1000ms(unit of 1ms)

2) WDT Reset

CPU module resets WDT in scan END processing.
If it is expected that programming a specific part (using FOR ~ NEXT command, CALL command and etc) may have an overtime delay of scan watchdog timer while executing a user program, you can clear the timer by using 'WDT' command.
If WDT detects the excess of detection setting time while watching the elapsed time of scan during operation (for the details of WDT command, please refer to the chapter about commands in the manual).

(2) WDT Occurs

1) It stops the operation of PLC immediately and makes the output all off.
2) The front Error LED turn on.
3) To release a watchdog error, Power on again, operate manual reset switch or change the mode to STOP mode.



Notes

The range of WDT is between 10 ~ 1000ms(unit of 1ms)
(Default time : XG5000 V3.67 or higher = 500ms, V3.66 or lower = 50ms)

6.1.2 I/O Module check

This function is to check the error state of I/O module at the time of start or during operation.

(1) In case that the module different from parameter setting is built-in at the time of start or it occurs the error.
(2) In case I/O module is removed or occurs the error during operation

The error state is detected and warning lamp (ERR) in front of CPU module and then CPU stops to operate.

6.1.3 Battery Voltage check

If battery voltage falls less than memory backup voltage CPU module detects it and informs of it The warning lamp(BAT) in front of CPU module shall be ON.
For further information, please refer to “4.3.3 Battery Durability ”.

6.1.4 Error History Save Function

CPU module has the function that records the error history and analyzes the cause of the error to take a proper action if the error occurs. (Refer to 6.6.1 Error History)

This is the function to save each error code in special relay F0002.

Notes

All results of self-diagnosis shall be recorded in ‘F’ device area.
For further information of self-diagnosis comments and error actions, please refer to Chapter 14.5 Error Code List.

6.1.5 Troubleshooting

(1) Classification of Error

The error occurs by PLC itself error, error in system configuration or error detection from operation results.
The error is classified by critical error mode that stops the operation for the system safety and minor error mode that informs of the error occurrence warning to the user and continues the operation.

The failures of the PLC system are mainly caused by the below.

1) PLC hardware error
2) Error in system configuration
3) Operation error during user program proceeding
4) Error detection by external device failure

(2) Action Mode in case that Error Occurs

If error occurs, PLC system records the error comments in flag and stops to operate or continues the operation according to error mode.

1) PLC hardware error

In case of critical error that the normal operation of PLC such as CPU module, power module is disabled, the system ‘stop’s and in case of minor error such as battery error, it continues to operate.

2) Error in system configuration

This error occurs when hardware configuration of PLC is different from the configuration identified in software, and the system stops.

3) Operation Error during User Program Proceeding

This is the error occurred during user program proceeding and in case of numeric operation error, it is indicated in the error flag and the system continues to operate. While performing the operation, if the operation time exceeds the scan watchdog time or the built-in I/O module can not be controlled normally, the system stops.

Notes

1) The operation process is determined by selecting 'Basic Parameters → Error Operation Setup → Continue running when an arithmetic error occurs'.
2) The default is set to 'Continue running when an arithmetic error occurs'.

4) Error detection by external device error

This is to detect the error of external control device by PLC user program. In case of critical error, the system stops but in case of minor error, the system indicates the error state only and continues to operate.

Notes

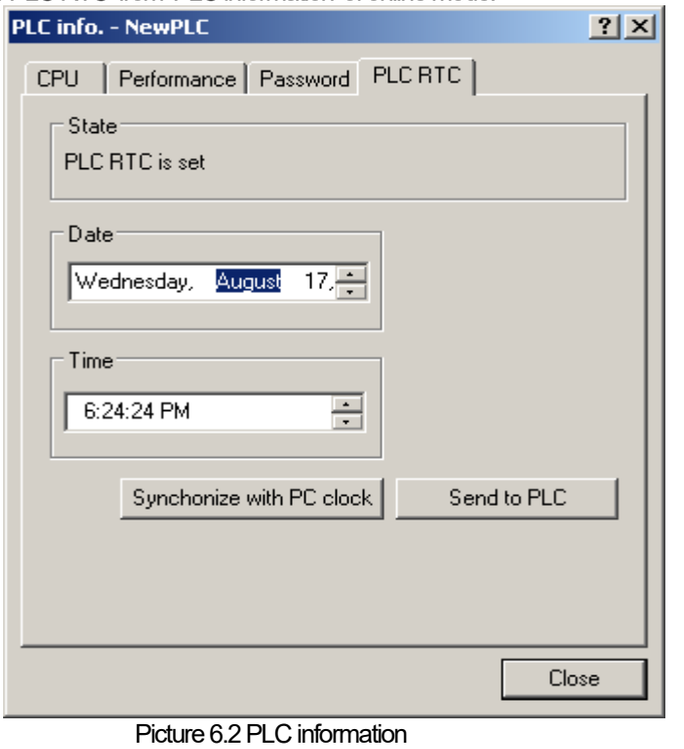
1) If the error occurs, the error codes are saved in special relay F1026.
2) The error code is saved in F1027 when a minor error is detected.
3) For further information on the Flag, please refer to Appendix 1 Flag List.

6.2 Clock

CPU module has a built-in clock device (RTC). RTC continues the clock action by battery backup even in case of power off or Momentary Power Failure.
It is available to perform the time management such as operation history or failure history of system by using a clock data of RTC. The current time of RTC can be updated in F device related to the clock every scan.

(1) Read and Setting from XG5000

Click 'PLC RTC' from 'PLC information' of online mode.



Picture 6.2 PLC information

The time of PLC RTC is displayed. If the time of PLC RTC is wrong, you can adjust the time correct by setting the time directly to transmit to PLC or selecting 'Synchronize with PC clock' that transmits the time of PC connected to PLC.

(2) RTC Read by Device

1) Read by special device (Time data of _TIME_DAY is displayed in 24-hour clock).

RTC Read F device	Data example	Description
_MON_YEAR (F0053)	h0599	May xx99
_TIME_DAY (F0054)	h1512	12(day), 15 (time)
_SEC_MIN (F0055)	h4142	42min 41sec
_HUND_WK (F0056)	h2001	Monday 20xx

Table 6.1

2) Read by command

Time data can be read using DATERD and DATERDP commands.
For details, refer to the XGK/B instruction manual.

3) RTC Data Modification by Program

It is available for the user to set the RTC value by program. This function is used when setting the time manually through external Digit switch or making the system that corrects the time periodically through network.

a) DATEWR(P) command is a long word type.
In the DATEWR command, the clock value is applied at scan END when the 'write request' input condition is 'On'.

DATEWR(P)	Content	Content	Setting range
M0300	0313	Month / Year	1984 ~ 2163 Year, Jan.~ Dec
M0301	1625	Time / Day	1~31 Days, 0~23 Hour
M0302	2020	Second / Minute	0~59 minute, 0~59 second
M0303	2001	Hundred years / Weekday	19~21, 0 ~ 6 (Default : 6)

b) Write RTC data in XG5000
F device input for clock writing to device monitor

F device for clock writing	Content	Setting range
_MON_YEAR_DT (F1034)	Month / Year	1984 ~ 2163 Year, Jan.~ Dec.
_TIME_DAY_DT (F1035)	Time / Day	1~31 Days, 0~23 Hour
_SEC_MIN_DT (F1036)	Second / Minute	0~59 minute, 0~59 second
_HUND_WK_DT (F1037)	Hundred years / Weekday	19 ~ 21, 0 ~ 6 (Default : 6)

c) It is available to write the data to RTC without using a instruction, by writing the RTC data to the above area and making '_RTC_WR (F10240)' to be 'On'.
d) In case that time data does not match with the form, the value is not allowed to write.
(But if the week does not match, it shall be set as it is without error detection.)
e) Monitor the RTC read device after writing RTC data, and check if it is modified correctly.

4) Weekday Expression Method

Numbers	0	1	2	3	4	5	6
Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

5) Time error

The RTC's error may be different depending on usual temperature. Time tolerance according to temperature per day was indicated on the table as below.

Operation temperature	Max error (second/day)	Normal case (second/day)
0 °C	-4.67 ~ 1.38	-1.46
25 °C	-1.64 ~ 2.42	0.43
55 °C	-5.79 ~ 0.78	-2.29

Notes

1) RTC may not have the clock data written at first.
2) When using a CPU module, you must set the clock data correctly at first.
3) In case that the data out of range of clock data is written in RTC, it may not work normally.
Ex) 14Month 32Day 25Hour
4) RTC may stop or occur error because of battery error.
If new clock data is written in RTC, the error shall be cleared.
5) For more information about the time date modification by program, refer to the XGK Instructions user's manual.

6.3 Remote Functions

CPU module may change operation by communication as well as by key switches mounted on the module. If you want to operate it by Remote, you should set 'REM enable' switch (4-pin deep) of CPU module as 'ON' position and 'RUN/STOP' switch as 'STOP' position.

(1) Type of remote operation

1) Operated by connecting XG5000 through USB or RS-232 port mounted in CPU module.
2) Available to operate other PLC connected to the network of PLC in the state that XG5000 is connected to CPU module.
3) Controls the operation state of PLC by MMI software through dedicated communication.

(2) Remote RUN/STOP

1) Remote RUN/STOP
Remote RUN/STOP performs RUN/STOP when the deep switch of the CPU module is in the REMOTE position and the RUN/STOP switch is in the STOP position.

2) Usage of remote RUN/STOP
a. When CPU module is located at a position hard to control.
b. When CPU module within control panel is to control RUN/STOP function remotely.

(3) Remote DEBUG

1) Remote DEBUG is the function to perform DEBUG operation in the state that deep switch of CPU module is in REMOTE position and the RUN/STOP switch is in the STOP position. DEBUG operation means the function performed according to the operation condition assigned for program operation.

2) Convenient function in case of checking the execution state of program or the contents of each data from Debugging work.

(4) Remote Reset

1) Remote Reset is the function to reset a CPU module by remote operation in case that the error occurs in the place not possible to operate a CPU module.

2) This supports 'Reset' and "Overall Reset' as like an operation by switch.

Notes

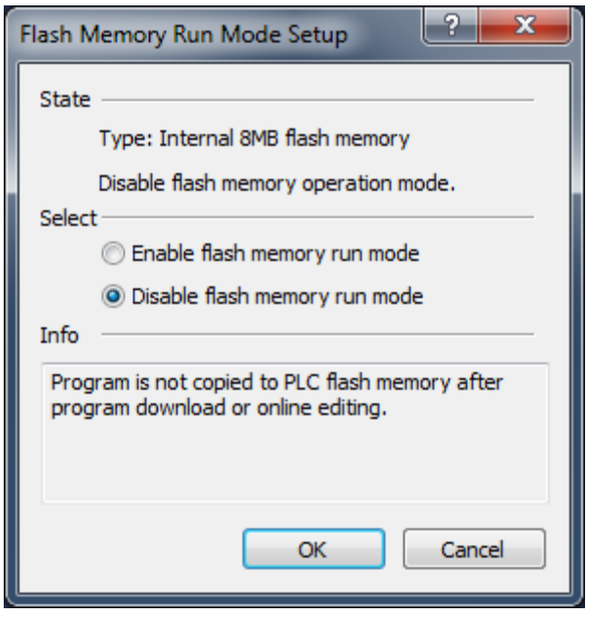
1) For operation method of Remote Function, please refer to 'Online' part from XG5000 user's manual.

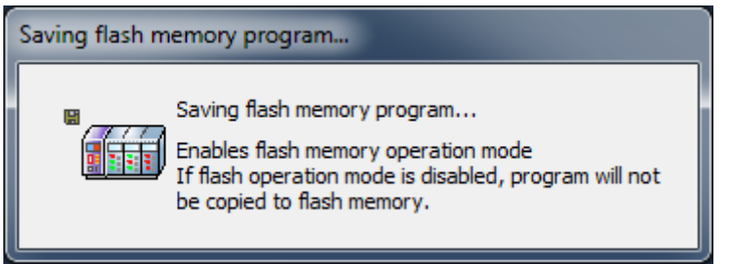
(5) Flash memory operation mode

(1) What is the flash operation mode? When the data in the program RAM (RAM) is damaged, it means operating with the program back-up in the flash. If "Flash memory operation mode setting" is selected, operation starts after being transferred to the program memory of the CPU module when the operation mode changes to RUN in restart or other modes.

(2) Flash Memory Operation Mode Setting

Online → Set Flash Memory → Check the 'Enable flash memory operation mode' → Click OK.
When you click OK, "Saving flash memory program… "Window appears and the program is copied from the user program area to flash.





Notes

1) Initial mode is Disable flash memory run mode.

2) Set Enable flash memory run mode at once, it keeps the mode On until change to Off on the XG5000.

3) Change of the flash memory operation mode is available regardless of RUN/STOP Mode.

4) Flash memory operation mode setting is On in the XG5000 online menu in case of flash memory operation mode setting after program debugging is completed with the flash memory operation mode setting Off.

5) In the case of online modification in the state of "Flash memory operation mode", the changed program is applied upon restart only when the program is normally written to the flash memory. If the PLC is restarted before the program is saved in the flash memory, it operates with the previous flash memory program.

6) If the flash memory operation mode is changed from off to on, the flash memory operation mode is applied only when the flash memory write is completed. If the PLC restarts before the program write is complete, the "flash memory operation mode" is canceled.

(3) Flash memory operation method

If you want to change the restart or operation mode the PLC system to RUN, depending on the setting of the flash operation mode, it works as follows.

Flash Memory Operation Mode Setting	Operation contents
ON	If contents of the flash memory and program memory is different or if the contents of program memory is damaged due to decreasing in the battery voltage, then operation after downloading the program stored in the flash memory to program memory.
OFF	The CPU recognizes that there is no program in the flash memory and operates with the program stored in the internal RAM.

(4) The saving data in flash memory mode

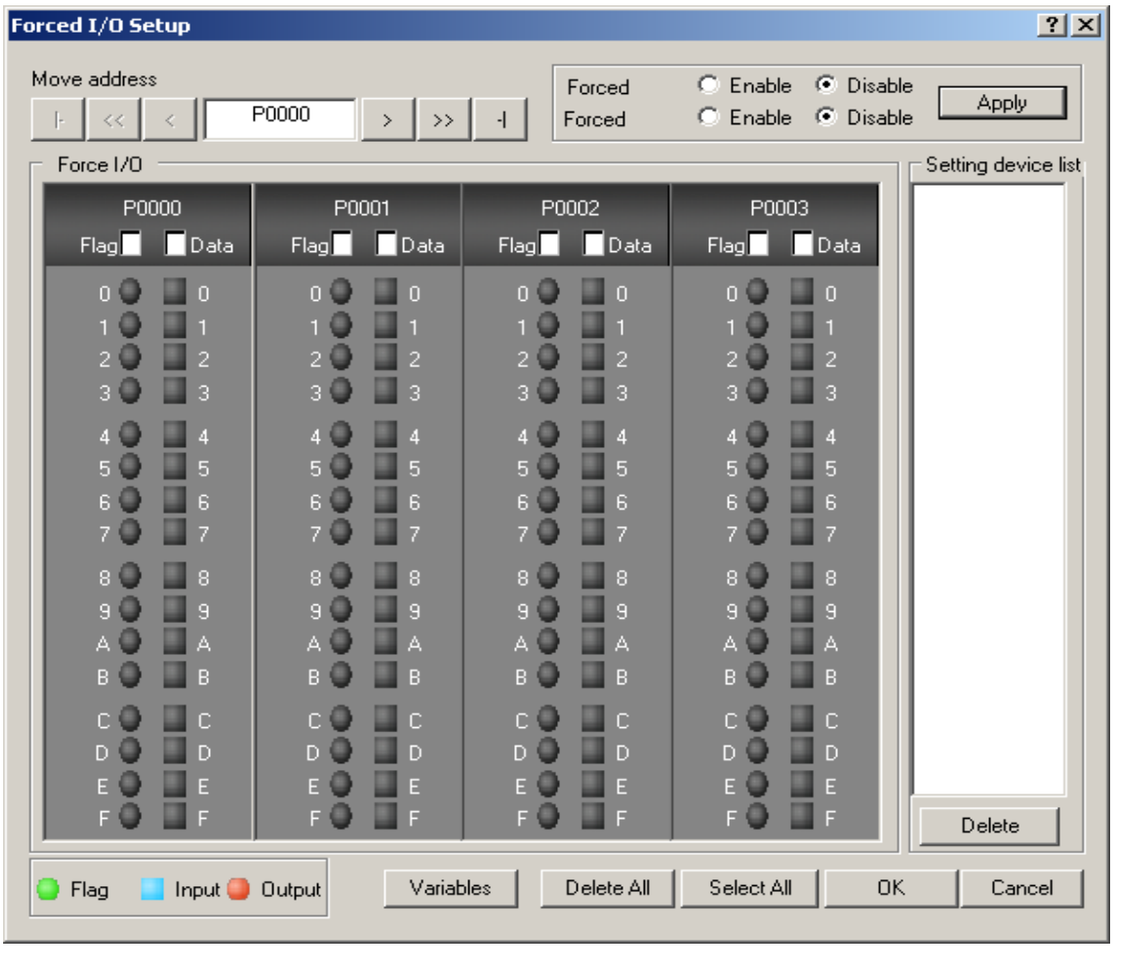
CPU Mode	Saving data
Run	Local Ethernet Parameter
	Communication parameter
Stop	Program changing
	Basic parameter
	Local Ethernet parameter
	Communication parameter
	Special module parameter
	Automatic variable
	Comment
Modification during run	Program changing
	Automatic variable
	Comment

6.4 Forced I/O On/Off Function

The forced I/O function is used to turn On/Off I/O areas by force regardless of the results of program execution.

6.4.1 Force I/O setup Method

Click 'Forced I/O setup' in online mode.



To set Forced I/O, select the proper flag and data check box of P device.
To set the value "1", select correspond bit data and flag.
To set the value "0", select the flag only not bit data.
The setting is applied when forced input or output is enabled.
For further information of setting method, please refer to the XG5000 user's manual

Notes

1) The Forced I/O setting is only available for the local I/O module.
2) It is not available for the remote I/O module (Smart I/O module).
3) The "CHK LED" is turned On if Forced I/O is selected.
4) The set forced I/O is kept even if a new program is downloaded.

6.4.2 Forced On/Off Execution Point and Execution Method

(1) Forced input

Input replaces the data of contact point set as forced On/Off from the data read in input module at the time of input refresh with the forced setting data and updates the input image area. Therefore, the user program operates with actual input data and with forced setting data.

(2) Forced output

Output replaces the data of contact point set as forced On/Off from the data of output image area having the operation result, at the time of output refresh after completion of user program operation execution, with the forced setting data and makes prints in output module. In case of output other than input, the data of output image area does not change by forced On/Off setting.

(3) Notices in using forced I/O function

1) It operates from the point setting 'enable' of each input/output, after setting the forced data.

2) It is available to set the forced input even if actual I/O module is not built-in.

3) Even if there are power Off -> On, change of operation mode or operation by reset key, On/Off setting data set in before is kept in CPU module. Forced I/O data shall be cleared when operating Overall reset.

4) Forced I•O data shall not be cleared even in Stop mode

5) If you want to set the new data from the beginning, clear all settings by using 'Delete all' before using.

6.5 Direct I/O Operations

I/O of the CPU module is processed in a refresh method.
By making Refresh for I/O contact point with using 'IORF' instruction, it enables to read the state of input contact point directly during program execution and use it for operation, and also this is used when printing out the result of operation directly in output contact point.

Describes the input/output processing method and response delay of the CPU module.

(1) Refresh method

This is a method in which access to the I/O module is executed collectively before the operation of the scan program starts.

(2) Direct method

This is a method in which access to the I/O module is executed collectively when the commands of the scan program starts.
When accessing the I/O module by direct method, use direct access input or output with a scan program.

(3) The difference between the refresh method and the direct method

The direct method accesses the I/O module directly when executing instructions, so input collection is faster than the refresh method.
However, compared to the refresh method, the instruction processing time is longer.

Notes

1) For further information of IORF instructions, please refer to XGK Instruction manual.
2) If IORF instruction is used, the value is applied immediately, and it is used prior to Forced I/O.
3) Applicable Product : Digital Input/output module

6.6 Saving Operation History

There are 4 types of operation history; error history, mode conversion history, power down history and system history.
The occurrence time, frequency, operating details of each event are saved in the memory and you can conveniently monitor the data through XG5000.
Operation history is kept saving in PLC unless it is deleted by XG5000 etc

6.6.1 Error History

It saves the error history occurred during operation.
(1) Sav3 the error code, date, time, error details.
(2) Saves up to max. 2048
(3) Automatic release in case that memory backup is broken by battery voltage falling etc.

6.6.2 Mode Conversion History

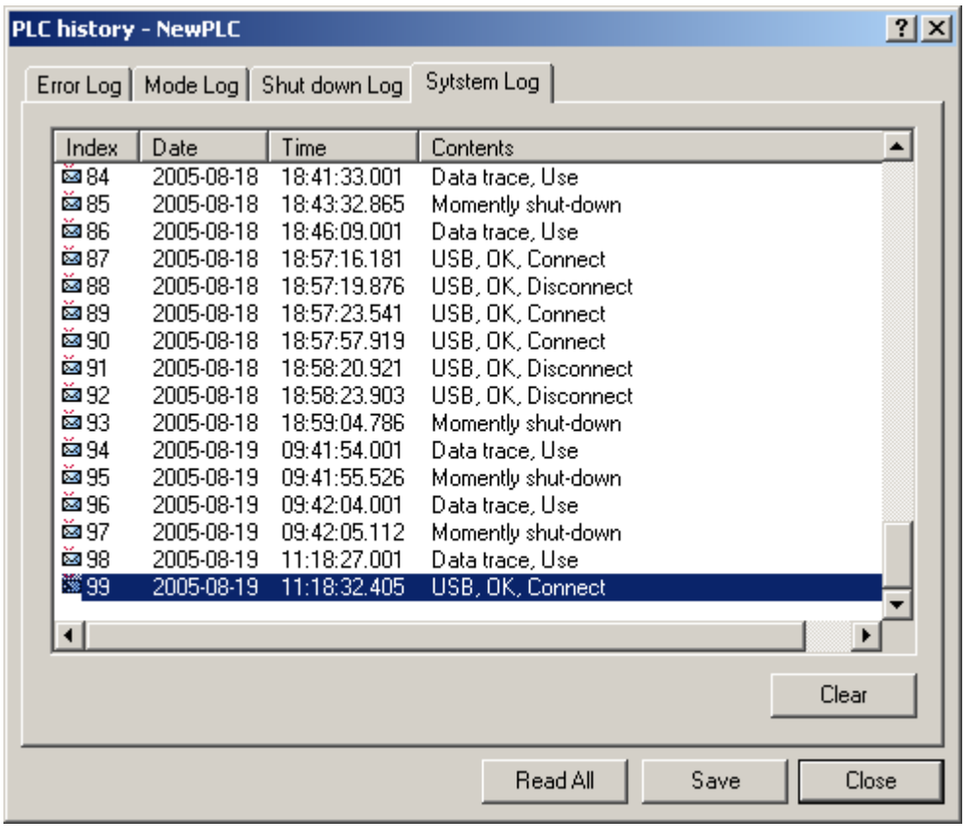
It saves the information on the changed mode and time when changing the operation mode.
(1) Saves the date, time, mode conversion contents
(2) Saves up to max. 1024

6.3.3 Power Shutdown History

It saves the time that the power is ON or OFF with ON/OFF information.
(1) Saves ON/OFF information, date, time
(2) Saves up to max. 1024

6.6.4 System History

It saves the operation history of the system occurred during operation.
(1) Saves the date, time and operation change contents
(2) XG5000 operation information, key switch change information
(3) Saves up to max. 2048



Notes

1) The saved information will not be deleted before selecting the menu from XG5000 to delete.
2) If the index number saved is over 100, select Read All to check previous history.

6.7 External Device Error Diagnosis

This is the flag provided so that the user can detect the error of external device and realize the stop and warning of system easily. By using this flag, it enables to indicate the error of external device without preparing the complicated program and monitor the error position without special device (XG5000) or source program.

(1) Detection and classification of external device error

1) The error of external device is detected by the user program and classified by critical error that needs to stop the PLC operation and minor error (warning) that continues the PLC operation and only indicates the error state, according to the contents of detected error.

2) For critical error, '_ANC_ERR flag' is used and for minor error, '_ANC_WAR flag' is used.

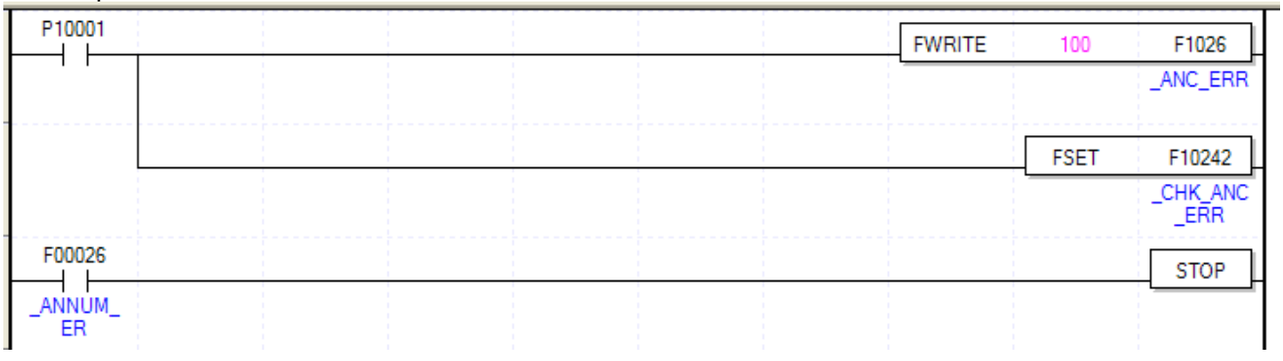
(2) Treatment of critical error of external device

1) In case that critical error of external device is detected in the user program, classify the type of error defined by the user and write the value except '0' in the system flag '_ANC_ERR', and set system flag '_CHK_ANC_ERR'. System representative error flag '_ANNUN_ER' of '_CNF_ER' is set, PLC shall shut off all output module and becomes the error state same as PLC own error detection.

2) If the error occurs, the user can find the cause of error by using a XG5000 or by monitoring '_ANC_ERR flag'.

3) It is available to write the error code assigned temporarily by the user at _ANC_ERR and the available numbers are from 1 to 65,535.

Example



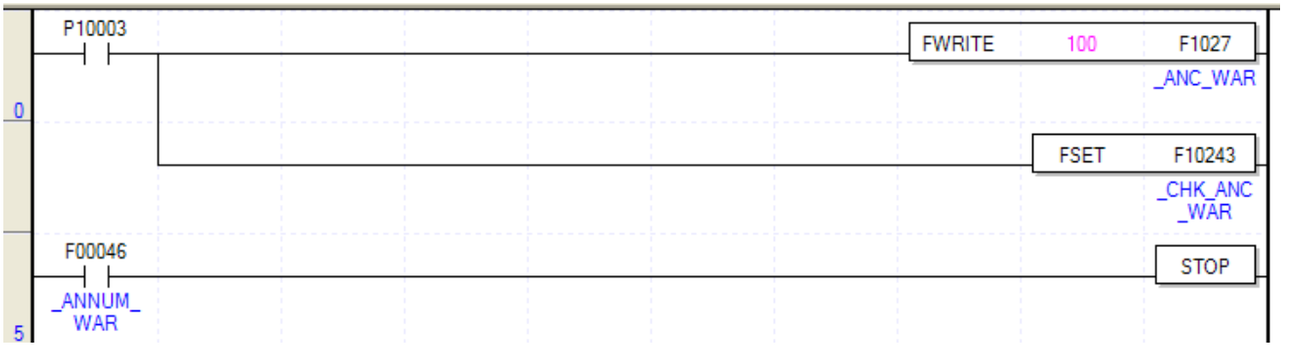
(3) Treatment of minor error of external device

1) In case that minor error is detected in the user program, classify the type of error defined by the user and write the value except '0' in the system flag '_ANC_WAR', and set system flag '_CHK_ANC_WAR'. Then, system representative error flag '_ANNUN_WAR' of '_CNF_WAR' is set and minor error code of external device is saved at _ANC_WAR.

2) If the error occurs, the user can find the cause of error by monitoring '_ANC_WAR' flag directly.

3) If the minor error of external device is released, '_ANC_WAR' will be released after user program is executed and system flag '_ANNUN_WAR" of '_CNF_WAR' will be reset.

Example)



This is a program that stops the PLC operation by setting the '_ANNUM_WAR' flag by setting the '_CHK_ANC_WAR' system flag by putting '100' in '_ANC_WAR' when 'Warning error detection' is on.

6.8 Fault Mask

(1) Purpose and Operation Overview

1) Fault Mask is the function to continue the program execution even if the module error occurs during operation. The module assigned as Fault Mask shall be operated normally before error occurs.

2) If the error occurs in the module where the Fault Mask is set, the corresponding module stops the operation but the whole system continues the operation.

3) If the module error occurs during operation, CPU module will set the error flag and the front "PS LED" shall be "ON". If connecting XG5000, you can see the error state.

(2) Fault Mask Setting Method

1) Set the base or slot failure mask in the online →failure mask setting window of XG5000.

2) Check Fault Mask setting: read only
a) Slot Fault Mask Flag (_SLOT_EMASK_INFO_n): Displays the slot number for which fault mask is set.
- n : base No.

b) Fault mask main flag (_EMASK_ON).
- Displays whether the fault mask is executed.

(3) Release of Fault Mask

The Fault Mask is released only by the same method as the setting.
a) Setting release from online menu of XG5000.
b) Automatic release in case that memory backup is broken by battery voltage falling.
c) When executing PLC Overall Reset

2) The Fault Mask shall not be released in the following cases. Cares should be taken.
a) Power Off → On
b) Change of operation mode
c) Program download
d) Operation of reset key (However, if it is longer than 3 seconds, release it)
e) Data clear

Notes

If releasing the Fault Mask in the state that error flag of CPU module is not deleted even if the cause of error occurrence is removed, the system stops. Before releasing the Fault Mask flag, check the state of error flag.

6.9 I/O Module Skip

(1) Purpose and Operation Overview

I/O skip function is a function to exclude a designated module from operation during operation. For the assigned module, it is disabled to update I/O data or diagnose the error from the assigned moment. It is allowed to use only in case of temporary operation excluding the error part.

(2) Setting Method and I/O Data Processing

1) It is available to set by I/O module unit.
(For further information, please refer to XG5000 user's manual.)

2) As Input(I) image area stops input refresh, it keeps the value before skip setting. But, at this time. it is effective to operate the image by forced On/Off.

3) Actual output of output module shall be OFF in case of skip setting but output(Q) image area is changed according to the user program operation regardless of skip setting. It is not allowed to operate output value of output module by forced On/Off after skip setting.

4) The execution of skip function is same when using direct I/O function.

(3) Release of Skip Function

1) The skip of I/O module shall be released only by the same method as setting.
a) Setting release from online menu of XG5000.
b) Automatic release in case that memory backup is broken by battery voltage falling.
c) When executing PLC Overall Reset

d) Cares should be taken.
a) Power Off → On
b) Change of operation mode
c) Program download
d) Operation of reset key (However, if it is longer than 3 seconds, release it)
E) Data clear

Notes

1) When releasing a skip, if the error occurs in the corresponding module, the system may stop. Release the skip while the fault mask is set to confirm the normal operation of the module, and then release the skip.

2) Do not release base skip and module skip at the same time. (system abnormal operation)

6.10 Changing Module during Operation

XGK system enables to change the module during operation. But, as the change of module during operation may occur the abnormal operation of whole system, special attention should be taken. Just follow the procedure assigned in this user's manual.

(1) Notices in Using

Not allowed to change the base and power module.

- Some part of communication module (XGL-PMEA, XGL-DMEA) needs the network setting (Sycon used) for communication.
- In case of module change, match the joint part of the lower part of base and module correctly before inserting. If not, it may cause the system shutdown.

(2) Module Change Method

There are 2 kinds of module change method.

1) By using XG5000 "Module Change Wizard" function.
For further information, please refer to XG5000 user's manual.

2) Module replacement can be performed using the switch of the CPU module.

a) Set "Module change switch (M.XCHG)" in front of CPU module as right(ON).
b) Remove the module. (PS LED is ON)
c) Install the new module. (in case of normal module setup, PS LED is OFF)
d) Check if module operates normally.
e) Set "Module change switch (M.XCHG)" as left (OFF).

3) Module replacement can be performed manually using XG5000.
a) Set the fault mask in the slot to perform module replacement with XG5000.
b) Set the skip to the slot to perform module replacement with XG5000.
c) Changing the module.
d) Release the skip setting with XG5000.
e) Check normal operation (check with error detail flag, refer to Appendix 1').
If there is a problem with the replacement module and you want to replace it with another module again, you must follow the procedure from (1) again.
f) The fault mask is released to restore normal operation.

Notes

1) When replacing the module, take safety into consideration and cut off the load power before implementing it.
2) When replacing the input module, consider the designation of the input image status using forced On/Off, etc.
3) During this process, the I/O module operating on the same base may momentarily generate erroneous data.
4) Other modules on the same base may be faulty due to an abnormality in the replaced module. It is safe to set a fault mask on the entire device.

Warning

When installing the module, it may cause an abnormal operation if the lower connection is not mounted on the base completely.

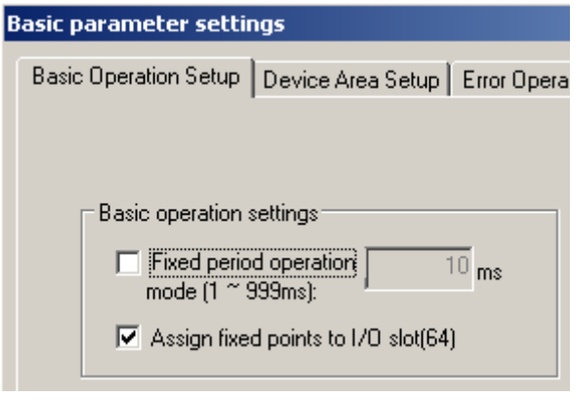
6.11 I/O No. Allocation Method

The allocation of I/O No. is to give the address to the I/O terminal of each module in order to read the data from input module and print the data to output module when performing the operation.

For I/O No. allocation, base no., slot position, module type for setup and parameter setting etc. are related. XGK provides 2 types such as fixed and variable.

(1) Fixed I/O No. Allocation

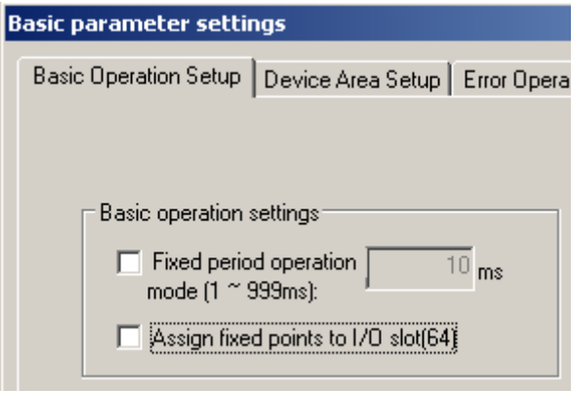
By selecting "Assign fixed points to I/O slot" from basic parameter, 64 points shall be allocated to each slot regardless of setup module. In this case, I/O parameter shall be applied only to judge whether the module type installed in the system corresponds, but not applied to point allocation.



For example of point allocation, please refer to "2.3 Basic System".

(2) Variable I/O No. Allocation

By releasing "Assign fixed points to I/O slot" from basic parameter, the variable type that the point allocation is changed per slot shall be set.

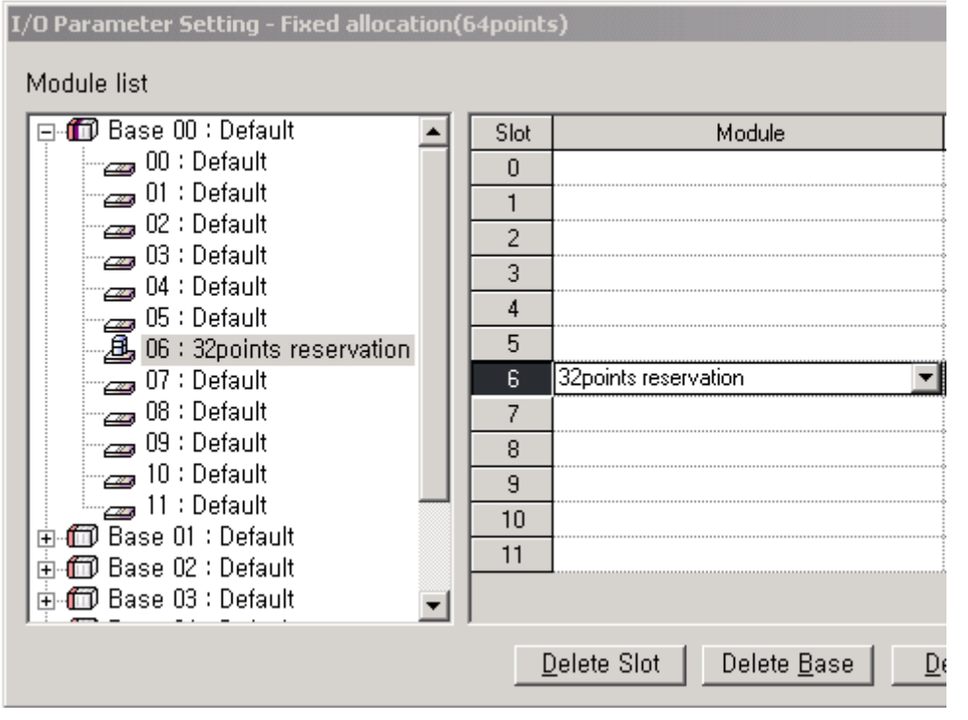


If setting I/O parameter, the point related to the setting module shall be given to the assigned slot. For the next slot, the number following I/O no. occupied by the previous slot shall be allocated.

For example of point allocation, please refer to "2.3 Basic System".

(3) Module Reservation Function

This function is used for the variable I/O number allocation method to reserve modules to be mounted.
If this function is used, the program modification is not necessary to change the I/O number. It can be set in the I/O Parameters window of XG5000.



Notes

1) If a module greater than 16-point is mounted on without reservation, the I/O number will become different and an abnormal operation will occur.
2) Only reserved points are available although larger point modules are mounted. The remainder are ignored.
3) Program modification is not necessary because all slots are assigned as 64points in Fixed Allocation.

6.12 Program Modification during Operation

It is available to modify program or some parameter without stopping the control operation during PLC operation.
For further information, please refer to XG5000 user's manual.

The items available to modify during operation are as below.

- Modify program
- Modify communication parameter

Notes

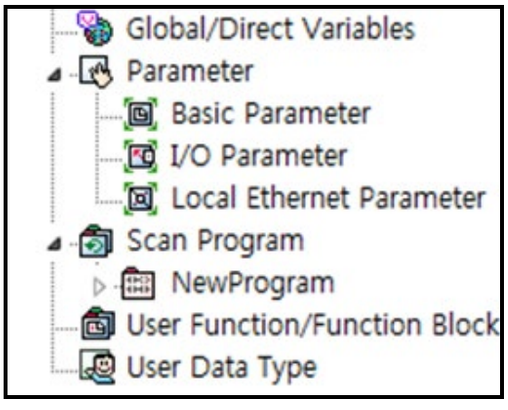
Basic parameters and IO parameters cannot be modified during operation. If parameter modification is necessary, modify it after stopping the operation.

6.13 Local Ethernet function (XGK-CPUSN, CPUHN, CPUUN)

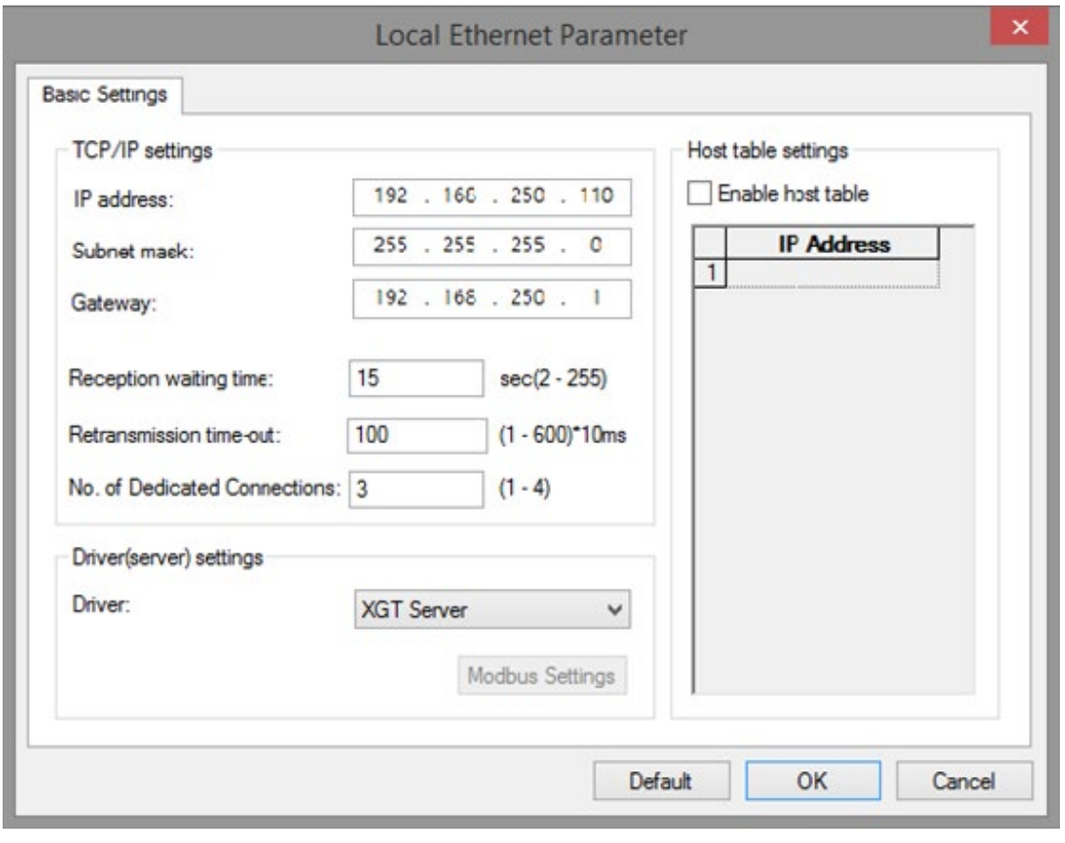
XGK-CPUUN/CPUHN/CPUSN can carry out the functions of Ethernet server using internal local Ethernet function without extra Enet I/F module.

6.13.1 Local Ethernet Parameter Settings

Make a new project. Then user can see Local Ethernet Parameters as shown below figure.



If user selects Local Ethernet Parameter item, Local Ethernet Parameter setting window will be displayed.



To use the Local Ethernet function, user should set the parameters.

(1) TCP/IP setting

Classification	Content
IP address	Set the IP address to be assigned to the CPU module as a server * Note : There can be a communications disruption if you set more than 2 servers as a same IP
Subnet mask	Value necessary to check if destination station is on the same network of the applicable station.
Gateway	Set the gateway module address (router address) for sending and receiving data through a station or a public network that uses a different network from your own station.
Reception waiting time (second)	If there is no request during the specified time from the host PC or MMI (Human Machine Interface) connected for dedicated communication, it will end the dedicated service connection regardless of normal ending procedures supposing that the higher level system is with error. This time is used in the dedicated service for resetting the channel when an abnormality occurs in the destination station or the cable is disconnected. (available range is 2s to 255s)
Retransmission time-out (10ms)	It is the time it takes CPU to send a data to the destination station if the destination station does not answer the data sent by applicable station during setting time. (available range is 10㎳ ~ 6000㎳ in units of 10ms) *Precautions: Retransmission time-out should be set depending on the network situation. If the setting time is too long, it takes a long time to resend a data in case of data missing. This will deteriorate the network performance. But if the setting time is too short, there is a chance to make a frequent disconnection or increase the load to the network.
No. of Dedicated Connections	Number of TCP dedicated services accessible at a time.

(2) Driver (Server) setting

Classification	Content
XGT server	Set when operated as dedicated communication server (slave)
Modbus TCP/IP server	Set when operated as Modbus server driver (slave)

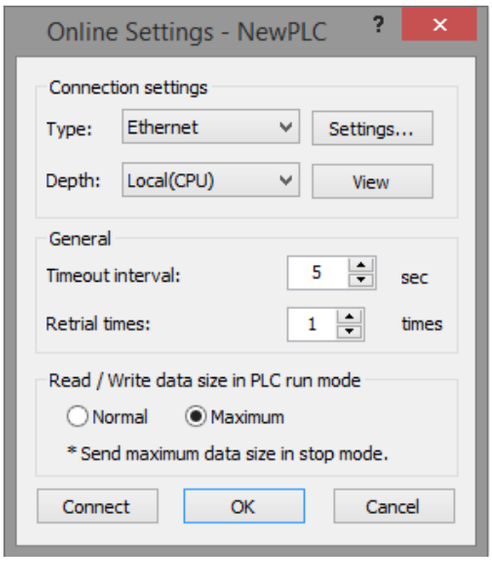
(3) Host table setting

Classification	Content
Enable host table	Access allowed to applicable module of IP address registered in host table. (Unregistered client (IP address) is prohibited from connection when enabled.)

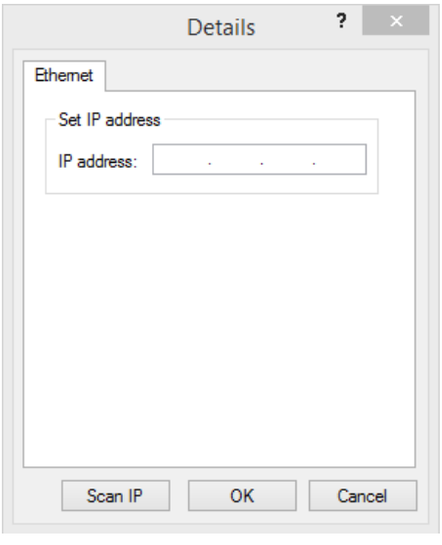
6.13.2 Local Ethernet Connection with XG5000

After finishing Local Ethernet Parameter settings, download the settings to the CPU, then user can connect to XG5000.
Select Online Settings and set the options as shown below figure.
(Notice: CPU module's Ethernet port does not support the relay function about remote connection. In other words, remote 1st and 2nd level connections are not provided)

Select XG5000 connection setting and select the following options for connection option setting.

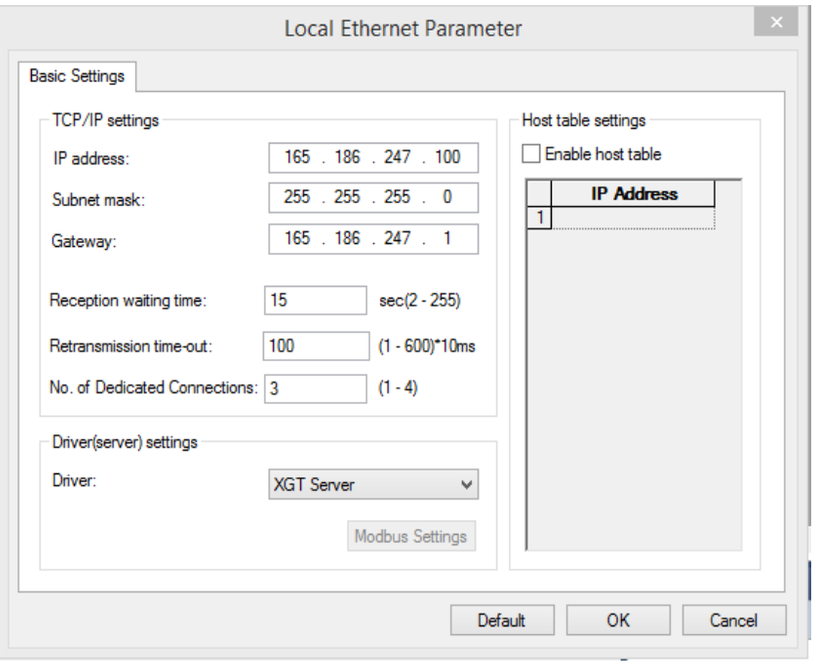


After that, press the Set button to display the detailed setting screen as shown below. Enter the IP address of the local Ethernet parameter previously set and click OK. Also, if you click the Find IP button, you can see the IP information currently available for access.



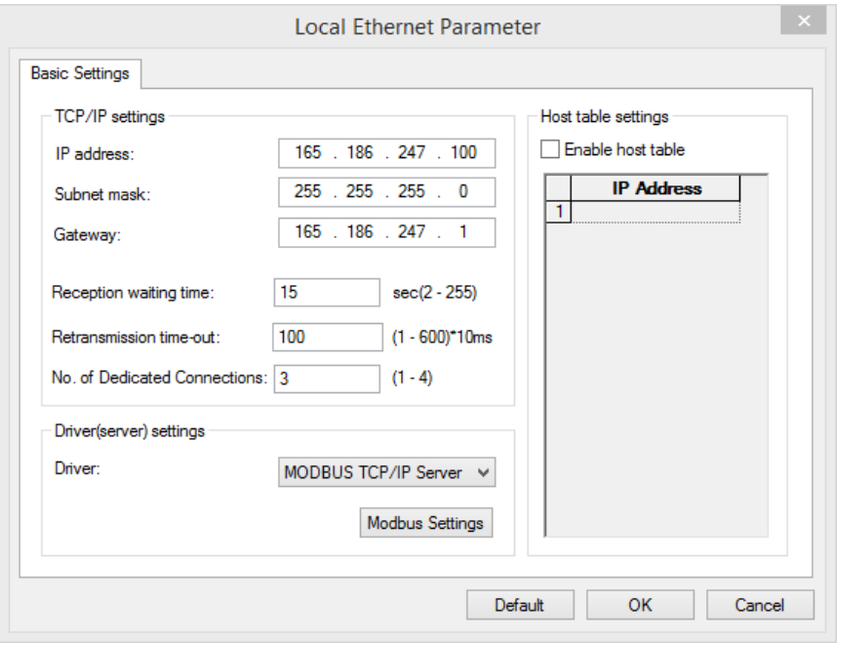
6.13.3 Local Ethernet Connection with XGT Server

Set the Local Ethernet Parameters as shown below figure. User can use it as a XGT Server (LS ELECTRIC dedicated Protocol Communication).

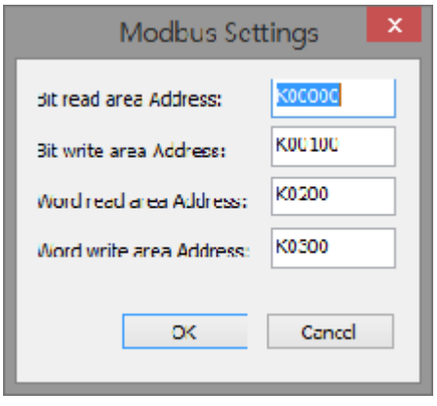


6.13.4 Local Ethernet Connection with TCP / IP Server

If the driver (server) setting is set to Modbus TCP/IP server as below in the local Ethernet parameter, it operates as a Modbus server at the request of the client using Modbus protocol.



Below figure is about Modbus settings.



Notes

1) Modbus TCP/IP server connection function allows RST packet transmission depending on the network condition.(TCP/IP protocol) So the user devices connecting to CPU module should have RST packet process.
2) Connection to user devices can be disconnected for retransmission time-out. Retransmission time-out = retransmission time-out value(set in the Local Ethernet Parameter window) x 30ms
3) Too much Network loads can affect a scan time. So user should consider appropriate network loads for CPU scan time.

Chapter 7 I/O Module

7.1 Precaution on mounting

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

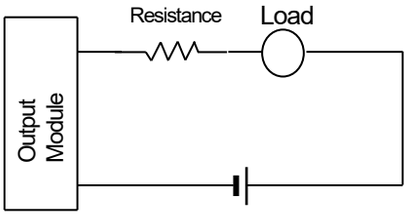
(1) For the type of digital input, there are two types such as current sink input and current source input.
For DC input module, as the wiring method of external input power varies according to such input type, consider the specification of input connecting device when selecting.

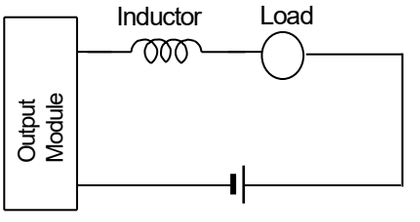
(2) Max. Simultaneous input point depends on the module type. It is subject to input voltage, ambient temperature.
Be sure to check specifications of input module before use.

(3) 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.

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

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.

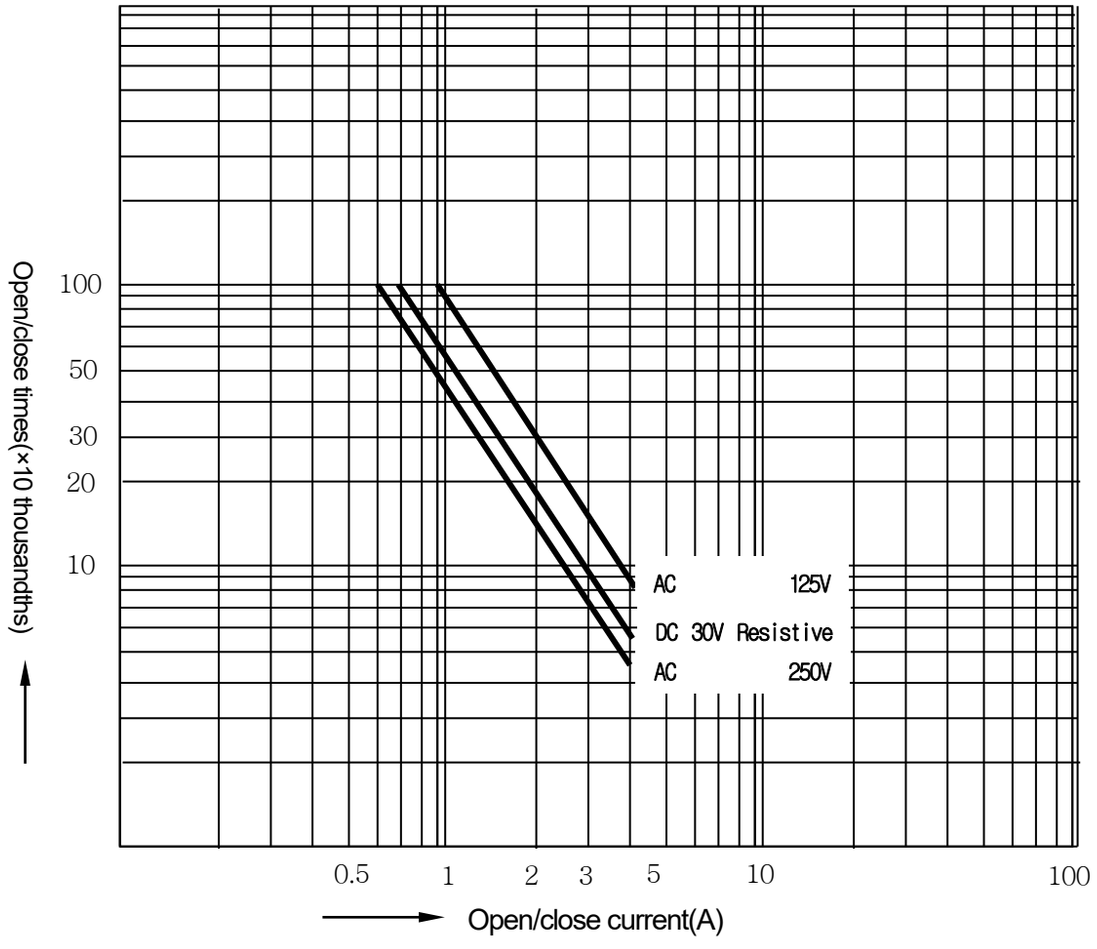




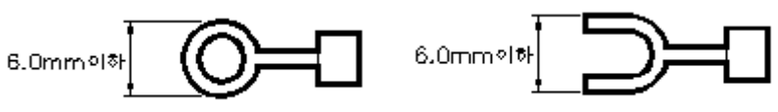
(6) For output module, fuse is not possible to change. This is to prevent of burnout of external wiring in case of short circuit of module output. This may not protect output module. In case that output module is destroyed in error mode except short circuit, fuse may not work.

(7) Relay life of Relay output module is shown as below.

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



(8) XGK terminal block is not allowed to use solderless terminal attached with sleeve. The proper solder less terminal to connect to terminal blocks is as below. (JOR 1.25-3: DAEDONG Electronic Ltd.)



(9) 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.

(10) The attachment torque of fixed screw of module and the screw of terminal block should be within the range as below.

Attachment part	Attachment Torque range
I/O module terminal block screw (M3 screw)	42 ~ 58 N·㎝
I/O module terminal block fixed screw (M3 screw)	66 ~ 89 N·㎝

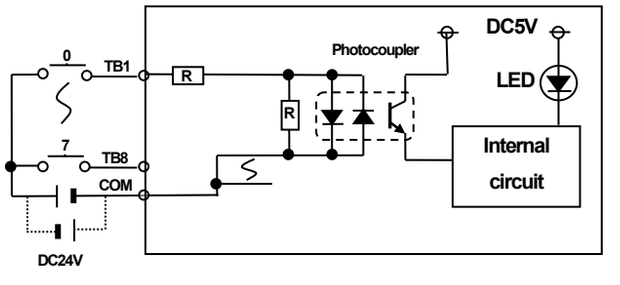
(11) Transistor output module (XGQ-TR4A, XGQ-TR8A) has Thermal Protector Function.
Thermal Protector Function is the protection function for overload and overheats.

7.2 Digital Input Module Specifications

7.2.1 8 point DC24V Input Module(Source/Sink type)

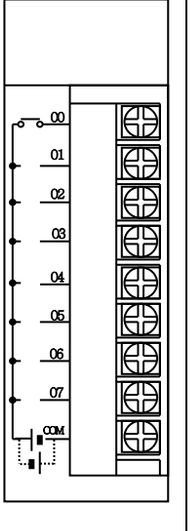
Specification \ Type		DC input module
		XGI-D21A
Input point		8 points
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (within ripple rate 5%)
Input Derating		None
On voltage / On current		DC19V or higher / 3 mA or higher
Off voltage / Off current		DC11V or less / 1.7 mA or less
Input resistance		About 5.6 kΩ
Response time	Off → On	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
Dielectric withstanding voltage		AC560V/3 Cycle (Altitude 2,000m)
Insulation resistor		10 ㏁ or higher by insulation resistor
Common method		16 point/COM
Proper cable size		Twisted pair 0.3~0.75 ㎟ (external diameter 2.8mm or less)
Applicable solderless terminal		R1.25-3 (not allowed to use a sleeve attached compressed terminal.)
Current consumption (㎃)		20mA
Operating indicator		Input On LED On
External connection method		9 point terminal block connector (M3 X 6 screw)
Weight		0.1 kg

Circuit configuration



* COM : TB9

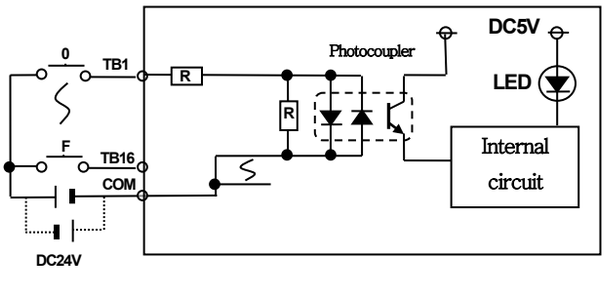
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	COM



7.2.2 16 point DC24V Input Module(Source/Sink type)

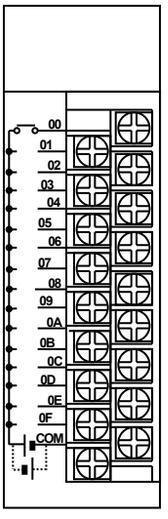
Specification \ Type		DC input module XGI-D22A
Input point		16 points
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (within ripple rate 5%)
Input Derating		None
On voltage / On current		DC15V or higher / 3 mA or higher
Off voltage / Off current		DC12V or less / 1.7 mA or less
Input resistance		About 5.6 kΩ
Response time	Off→On	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
Dielectric withstanding voltage		AC560Vrms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 ㏁ or higher by insulation resistor
Common method		16 point/COM
Proper cable size		Twisted pair 0.3~0.75 ㎟ (external diameter 2.8mm or less)
Applicable solderless terminal		R1.25-3 (not allowed to use a sleeve attached compressed terminal.)
Current consumption (㎃)		30mA
Operating indicator		Input On LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.12 kg

Circuit configuration



* COM : TB17

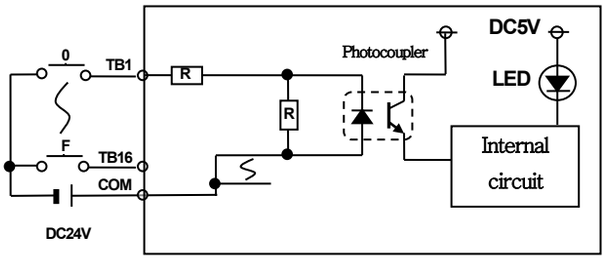
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	COM
TB18	NC



7.2.3 16 point DC24V Input Module(Source type)

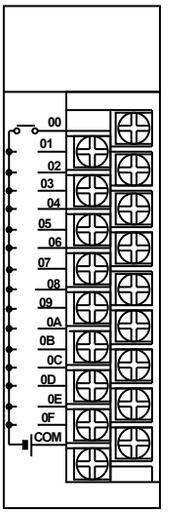
Specification \ Type		DC input module XGI-D22B
Input point		16 points
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (within ripple rate 5%)
Input Derating		None
On voltage / On current		DC19V or higher / 3 mA or higher
Off voltage / Off current		DC11V or less / 1.7 mA or less
Input resistance		About 5.6 kΩ
Response time	Off→On	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
Dielectric withstanding voltage		AC560Vrms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 ㏁ or higher by insulation resistor
Common method		16 point/COM
Proper cable size		Twisted pair 0.3~0.75 ㎟ (external diameter 2.8mm or less)
Applicable solderless terminal		R1.25-3 (not allowed to use a sleeve attached compressed terminal.)
Current consumption (㎃)		30mA
Operating indicator		Input On LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.12 kg

Circuit configuration



* COM : TB17

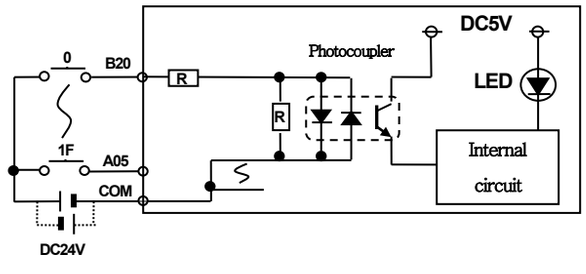
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	COM
TB18	NC



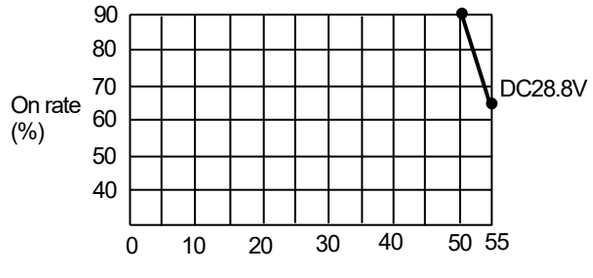
7.2.4 32 point DC24V Input Module(Source/Sink type)

Specification \ Type		DC input module
		XGI-D24A
Input point		32 points
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (within ripple rate 5%)
Input Derating		Refer to the below Derating diagram.
On voltage / On current		DC19V or higher / 3 mA or higher
Off voltage / Off current		DC11V or less / 1.7 mA or less
Input resistance		About 5.6 kΩ
Response time	Off→On	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
Dielectric withstanding voltage		AC560Vrms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 ㏁ or higher by insulation resistor
Common method		32 point/COM
Proper cable size		0.3 ㎟
Current consumption (㎃)		50mA
Operating indicator		Input On LED On
External connection method		40 point connector
Weight		0.1 kg

Circuit configuration

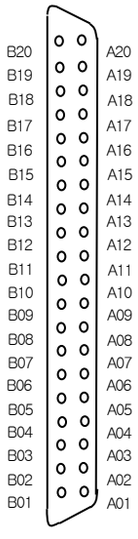


* COM : B02, B01, A02, A01



Derating diagram

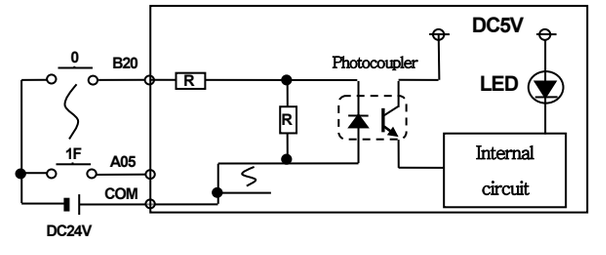
No	Contact Point	No	Contact Point
B20	P00	A20	P10
B19	P01	A19	P11
B18	P02	A18	P12
B17	P03	A17	P13
B16	P04	A16	P14
B15	P05	A15	P15
B14	P06	A14	P16
B13	P07	A13	P17
B12	P08	A12	P18
B11	P09	A11	P19
B10	P0A	A10	P1A
B09	P0B	A09	P1B
B08	P0C	A08	P1C
B07	P0D	A07	P1D
B06	P0E	A06	P1E
B05	P0F	A05	P1F
B04	NC	A04	NC
B03	NC	A03	NC
B02	COM	A02	COM
B01	COM	A01	COM



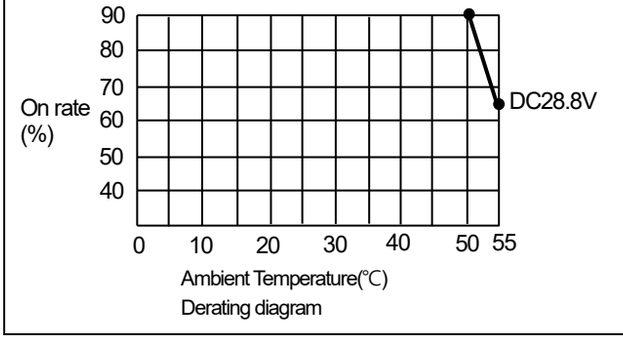
7.2.5 32 point DC24V Input Module(Source type)

Specification \ Type		DC input module
		XGI-D24B
Input point		32 points
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (within ripple rate 5%)
Input Derating		Refer to the below Derating diagram.
On voltage / On current		DC19V or higher / 3 mA or higher
Off voltage / Off current		DC11V or less / 1.7 mA or less
Input resistance		About 5.6 kΩ
Response time	Off→On	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
Dielectric withstanding voltage		AC560V rms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 ㏁ or higher by insulation resistor
Common method		32 point/COM
Proper cable size		0.3 ㎟
Current consumption (㎃)		50mA
Operating indicator		Input On LED On
External connection method		40 point connector
Weight		0.1 kg

Circuit configuration

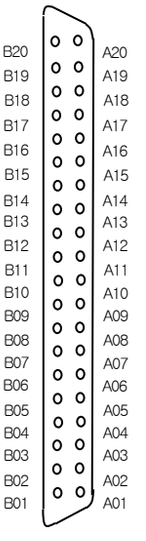


* COM : B02, B01, A02, A01



Derating diagram

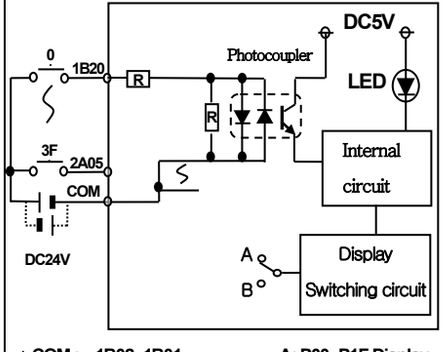
No	Contact Point	No	Contact Point
B20	P00	A20	P10
B19	P01	A19	P11
B18	P02	A18	P12
B17	P03	A17	P13
B16	P04	A16	P14
B15	P05	A15	P15
B14	P06	A14	P16
B13	P07	A13	P17
B12	P08	A12	P18
B11	P09	A11	P19
B10	P0A	A10	P1A
B09	P0B	A09	P1B
B08	P0C	A08	P1C
B07	P0D	A07	P1D
B06	P0E	A06	P1E
B05	P0F	A05	P1F
B04	NC	A04	NC
B03	NC	A03	NC
B02	COM	A02	COM
B01	COM	A01	COM



7.2.6 64 point DC24V Input Module(Source/Sink type)

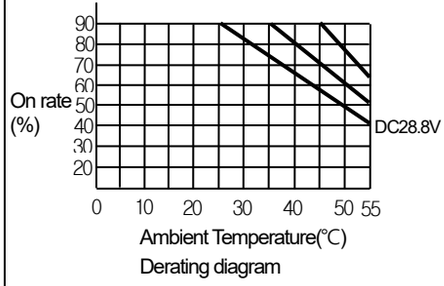
Specification \ Type		DC input module
		XGI-D28A
Input point		64 points
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (within ripple rate 5%)
Input Derating		Refer to the below Derating diagram.
On voltage / On current		DC19V or higher / 3 mA or higher
Off voltage / Off current		DC11V or less / 1.7 mA or less
Input resistance		About 5.6 kΩ
Response time	Off→On	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
Dielectric withstanding voltage		AC560V rms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 ㏁ or higher by insulation resistor
Common method		32 point/COM
Proper cable size		0.3 ㎟
Current consumption (㎃)		60mA
Operating indicator		Input On, LED On (32 point LED On by switch operation)
External connection method		40 point connector×2ea
Weight		0.15 kg

Circuit configuration



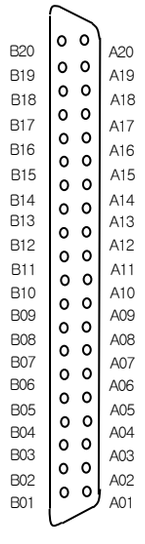
* COM : 1B02, 1B01, 2B02, 2B01

A: P00~P1F Display
B: P20~P3F Display



Derating diagram

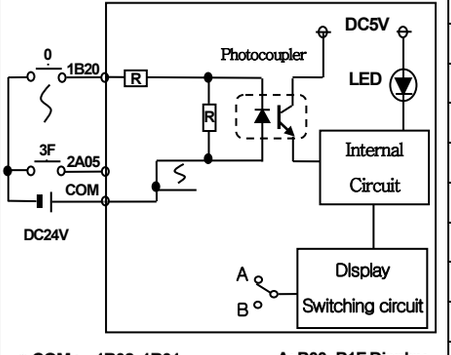
No	Contact Point	No	Contact Point	No	Contact Point	No	Contact Point
1B20	P00	1A20	P10	2B20	P20	2A20	P30
1B19	P01	1A19	P11	2B19	P21	2A19	P31
1B18	P02	1A18	P12	2B18	P22	2A18	P32
1B17	P03	1A17	P13	2B17	P23	2A17	P33
1B16	P04	1A16	P14	2B16	P24	2A16	P34
1B15	P05	1A15	P15	2B15	P25	2A15	P35
1B14	P06	1A14	P16	2B14	P26	2A14	P36
1B13	P07	1A13	P17	2B13	P27	2A13	P37
1B12	P08	1A12	P18	2B12	P28	2A12	P38
1B11	P09	1A11	P19	2B11	P29	2A11	P39
1B10	P0A	1A10	P1A	2B10	P2A	2A10	P3A
1B09	P0B	1A09	P1B	2B09	P2B	2A09	P3B
1B08	P0C	1A08	P1C	2B08	P2C	2A08	P3C
1B07	P0D	1A07	P1D	2B07	P2D	2A07	P3D
1B06	P0E	1A06	P1E	2B06	P2E	2A06	P3E
1B05	P0F	1A05	P1F	2B05	P2F	2A05	P3F
1B04	NC	1A04	NC	2B04	NC	2A04	NC
1B03	NC	1A03	NC	2B03	NC	2A03	NC
1B02	COM	1A02	NC	2B02	COM	2A02	NC
1B01	COM	1A01	NC	2B01	COM	2A01	NC



7.2.7 64 point DC24V Input Module(Source type)

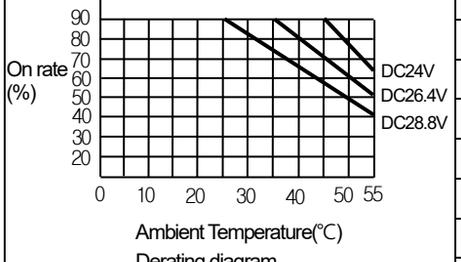
Specification \ Type		DC input module
		XGI-D28B
Input point		64 points
Insulation method		Photo coupler insulation
Rated input voltage		DC24V
Rated input current		About 4 ㎃
Operation voltage range		DC20.4~28.8V (within ripple rate 5%)
Input Derating		Refer to the below Derating diagram.
On voltage / On current		DC19V or higher / 3 mA or higher
Off voltage / Off current		DC11V or less / 1.7 mA or less
Input resistance		About 5.6 kΩ
Response time	Off→On	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms(set by CPU parameter) default: 3ms
Dielectric withstanding voltage		AC560V rms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 ㏁ or higher by insulation resistor
Common method		32 point/COM
Proper cable size		0.3 ㎟
Current consumption (㎃)		60mA
Operating indicator		Input On, LED On (32 point LED On by switch operation)
External connection method		40 point connector×2ea
Weight		0.15 kg

Circuit configuration



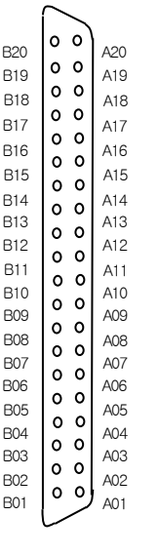
* COM : 1B02, 1B01, 2B02, 2B01

A: P00~P1F Display
B: P20~P3F Display



Derating diagram

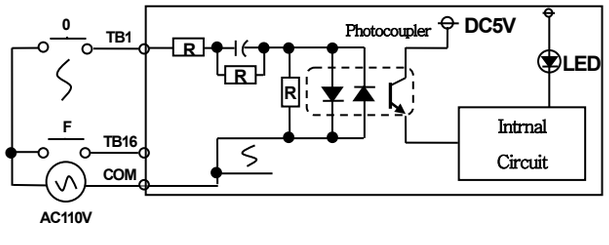
No	Contact Point	No	Contact Point	No	Contact Point	No	Contact Point
1B20	P00	1A20	P10	2B20	P20	2A20	P30
1B19	P01	1A19	P11	2B19	P21	2A19	P31
1B18	P02	1A18	P12	2B18	P22	2A18	P32
1B17	P03	1A17	P13	2B17	P23	2A17	P33
1B16	P04	1A16	P14	2B16	P24	2A16	P34
1B15	P05	1A15	P15	2B15	P25	2A15	P35
1B14	P06	1A14	P16	2B14	P26	2A14	P36
1B13	P07	1A13	P17	2B13	P27	2A13	P37
1B12	P08	1A12	P18	2B12	P28	2A12	P38
1B11	P09	1A11	P19	2B11	P29	2A11	P39
1B10	P0A	1A10	P1A	2B10	P2A	2A10	P3A
1B09	P0B	1A09	P1B	2B09	P2B	2A09	P3B
1B08	P0C	1A08	P1C	2B08	P2C	2A08	P3C
1B07	P0D	1A07	P1D	2B07	P2D	2A07	P3D
1B06	P0E	1A06	P1E	2B06	P2E	2A06	P3E
1B05	P0F	1A05	P1F	2B05	P2F	2A05	P3F
1B04	NC	1A04	NC	2B04	NC	2A04	NC
1B03	NC	1A03	NC	2B03	NC	2A03	NC
1B02	COM	1A02	NC	2B02	COM	2A02	NC
1B01	COM	1A01	NC	2B01	COM	2A01	NC



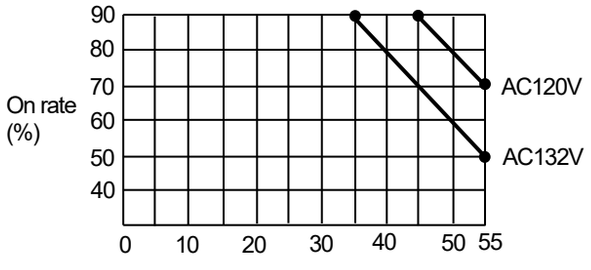
7.2.8 16 point AC110V Input Module

Specification \ Type		AC Input module XGI-A12A
Input point		16 points
Insulation method		Photo coupler insulation
Rated input voltage		AC100-120V(+10/-15%) 50/60 Hz(±3 Hz) (distortion rate < 5%)
Rated input current		About 8 mA (AC100,60 Hz) , About 7 mA (AC100,50 Hz)
Inrush current		Max. 200 mA 1 ms (AC132V)
Input Derating		Refer to the below Derating diagram.
On voltage / On current		AC80V or higher / 5 mA or higher (50 Hz, 60 Hz)
Off voltage / Off current		AC30V or lower / 1 mA or lower (50 Hz, 60 Hz)
Input resistance		About 12 kΩ(60 Hz), About 15 kΩ(50 Hz)
Response time	Off→On	15 ms or less(AC100V 50 Hz,60 Hz)
	On→Off	25 ms or less(AC100V 50 Hz,60 Hz)
Dielectric withstanding voltage		AC1780V rms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 MΩ or higher by insulation resistor
Common method		16 point/COM
Proper cable size		Twisted pair 0.3~0.75 ㎟ (external diameter 2.8mm or less)
Applicable solderless terminal		R1.25-3 (not allowed to use a sleeve attached compressed terminal.)
Current consumption (mA)		30mA
Operating indicator		Input On LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.13 kg

Circuit configuration

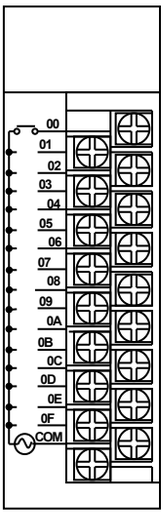


* COM : TB17



Derating diagram

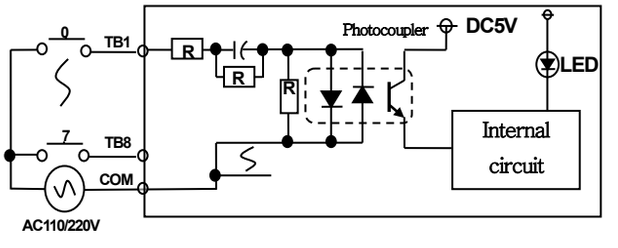
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	COM
TB18	NC



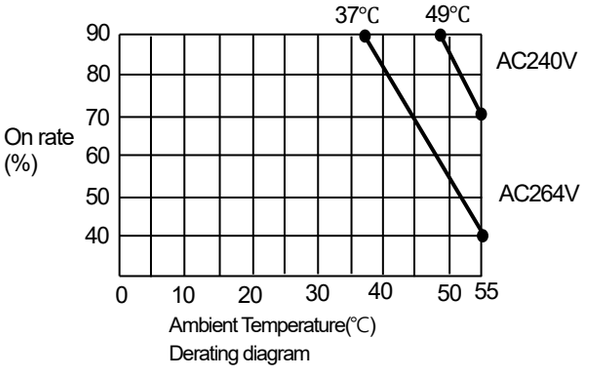
7.2.9 8 point AC220V Input Module

Specification \ Model		AC Input Module XGI-A21A
Input point		8 points
Insulation method		Photo coupler insulation
Rated input voltage		AC100-240V(+10/-15%) 50/60 Hz(±3 Hz) (distortion rate < 5%)
Rated input current		About 17 mA (AC200,60 Hz) , About 14 mA (AC200,50 Hz)
Inrush current		Max. 500 mA 1 ms (AC264V)
Input Derating		Refer to the below Derating diagram.
On voltage / On current		AC80V or higher / 5 mA or higher (50 Hz, 60 Hz)
Off voltage / Off current		AC30V or lower / 1 mA or lower (50 Hz, 60 Hz)
Input resistance		About 12 kΩ(60 Hz), About 15 kΩ(50 Hz)
Response time	Off→On	15 ms or less(AC200V 50 Hz,60 Hz)
	On→Off	25 ms or less(AC200V 50Hz,60Hz)
Dielectric withstanding voltage		AC2830V rms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 MΩ or higher by insulation resistor
Common method		8 point/COM
Proper cable size		Twisted pair 0.3~0.75 ㎟ (external diameter 2.8mm or less)
Applicable solderless terminal		R1.25-3 (not allowed to use a sleeve attached compressed terminal.)
Current consumption (mA)		20mA
Operating indicator		Input On LED On
External connection method		9 point terminal block connector (M3 X 6 screw)
Weight		0.13 kg

Circuit configuration

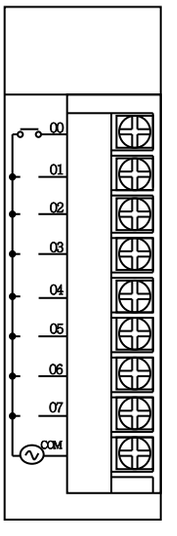


* COM : TB9



Derating diagram

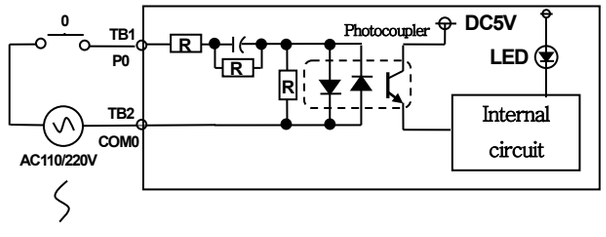
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	COM

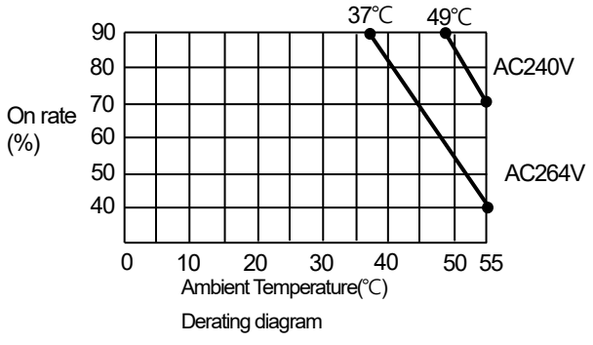


7.2.10 8 point AC220V Input Module(Isolated contact point)

Specification \ Model		AC Input Module XGI-A21C
Input point		8 points
Insulation method		Photo coupler insulation
Rated input voltage		AC100-240V(+10/-15%) 50/60 Hz(±3 Hz) (distortion rate < 5%)
Rated input current		About 17 mA (AC200,60 Hz) , About 14 mA (AC200,50 Hz)
Inrush current		Max. 500 mA 1 ms (AC264V)
Input Derating		Refer to the below Derating diagram.
On voltage / On current		AC80V or higher / 5 mA or higher (50 Hz, 60 Hz)
Off voltage / Off current		AC30V or lower / 1 mA or lower (50 Hz, 60 Hz)
Input resistance		About 12 kΩ(60 Hz), About 15 kΩ(50 Hz)
Response time	Off→On	15 ms or less(AC200V 50 Hz,60 Hz)
	On→Off	25 ms or less(AC200V 50Hz,60Hz)
Dielectric withstanding voltage		AC2830V rms/3 Cycle (Altitude 2,000m)
Insulation resistor		10 MΩ or higher by insulation resistor
Common method		1 point/COM
Proper cable size		Twisted pair 0.3~0.75 ㎟ (external diameter 2.8mm or less)
Applicable solderless terminal		R1.25-3 (not allowed to use a sleeve attached compressed terminal.)
Current consumption (mA)		20mA
Operating indicator		Input On LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.13 kg

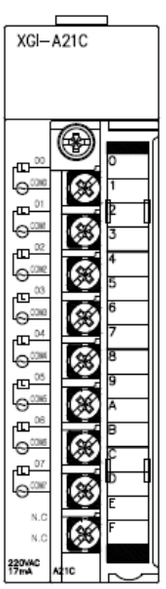
Circuit configuration





Derating diagram

Terminal block	Contact point name
TB1	P0
TB2	COM0
TB3	P1
TB4	COM1
TB5	P2
TB6	COM2
TB7	P3
TB8	COM3
TB9	P4
TB10	COM4
TB11	P5
TB12	COM5
TB13	P6
TB14	COM6
TB15	P7
TB16	COM7
TB17	NC
TB18	NC

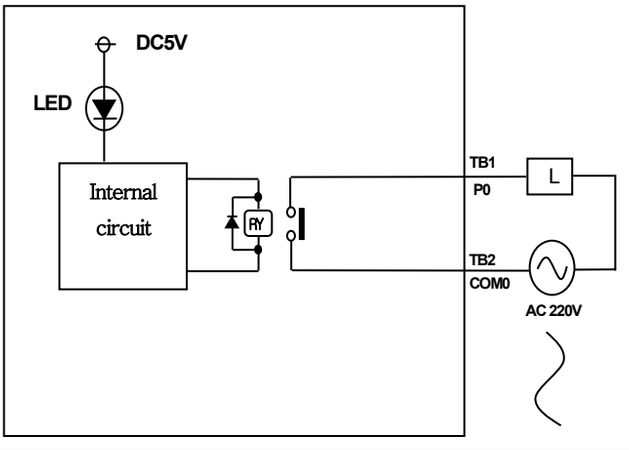


7.3 Digital output module specifications

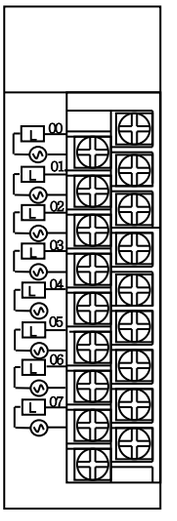
7.3.1 8 point relay output module

Specification \ Type		Relay output module
		XGQ-RY1A
Output point		8 points
Insulation method		Relay insulation
Rated load voltage/current		DC24V 2A(resistive load) / AC220V 2A(COSΨ = 1)
Min.load voltage/current		DC5V, 1mA
Max. load voltage/current		AC250V 2A, DC125V 2A
Off leakage current		0.1mA (AC220V, 60Hz)
Max. On/Off frequency		3,600 times/hr
Surge absorber		None
life span	Mechanical	20 millions times or higher
	Electrical	Rated load voltage / Current 100,000 times or more
		AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or higher
		AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or higher
		DC24V / 1A, DC100V / 0.1A (L, R = 7ms) 100,000 times or higher
Response time	Off→On	10 ms or less
	On→Off	12 ms or less
Common method		1 point / 1COM (isolated contact point)
Current consumption		260mA (when all point On)
Operating indicator		Output On, LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.13kg

Circuit configuration



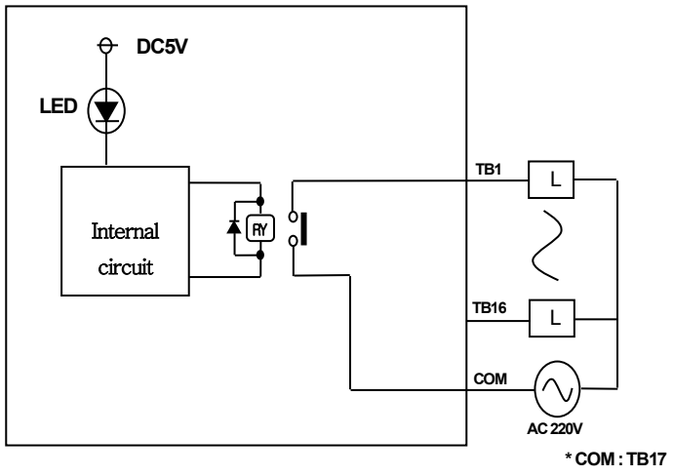
Terminal block	Contact point name
TB1	P0
TB2	COM0
TB3	P1
TB4	COM1
TB5	P2
TB6	COM2
TB7	P3
TB8	COM3
TB9	P4
TB10	COM4
TB11	P5
TB12	COM5
TB13	P6
TB14	COM6
TB15	P7
TB16	COM7
TB17	NC
TB18	NC



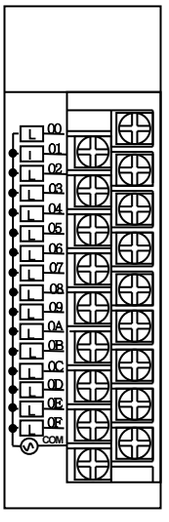
7.3.2 16 point relay output module

Specification \ Type		Relay output module
		XGQ-RY2A
Output point		16 points
Insulation method		Relay insulation
Rated load voltage/current		DC24V 2A(resistive load) / AC220V 2A(COSΨ = 1)
Min.load voltage/current		DC5V 1mA
Max. load voltage/current		AC250V 2A, DC125V 2A
Off leakage current		0.1mA (AC220V, 60Hz)
Max. On/Off frequency		3,600 times/hr
Surge absorber		None
life span	Mechanical	20 millions times or higher
	Electrical	Rated load voltage / Current 100,000 times or more
		AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or higher
		AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or higher
		DC24V / 1A, DC100V / 0.1A (L, R = 7ms) 100,000 times or higher
Response time	Off→On	10 ms or less
	On→Off	12 ms or less
Common method		16 point / 1COM
Current consumption		500mA (when all point On)
Operating indicator		Output On, LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.17kg

Circuit configuration



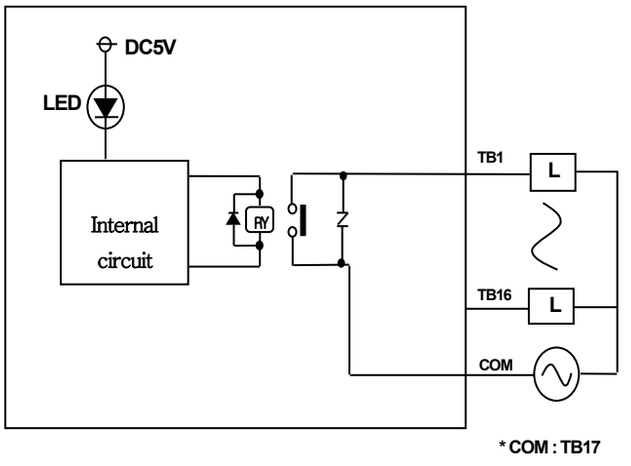
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	COM
TB18	NC



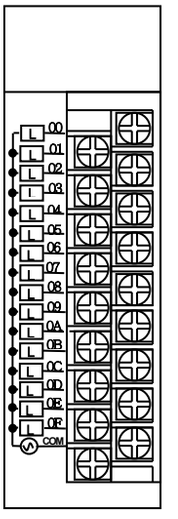
7.3.3 16 point Relay Output Module (Surge Absorber Type)

Specification \ Type		Relay output module
		XGQ-RY2B
Output point		16 points
Insulation method		Relay insulation
Rated load voltage/current		DC24V 2A(resistive load) / AC220V 2A(COSΨ = 1)
Min.load voltage/current		DC5V 1mA
Max. load voltage/current		AC250V 2A, DC125V 2A
Off leakage current		0.1mA (AC220V, 60Hz)
Max. On/Off frequency		3,600 times/hr
Surge absorber		Varistor (387 ~ 473V), C.R Absorber
life span	Mechanical	20 millions times or higher
	Electrical	Rated load voltage / Current 100,000 times or more
		AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or higher
		AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or higher
		DC24V / 1A, DC100V / 0.1A (L, R = 7ms) 100,000 times or higher
Response time	Off→On	10 ms or less
	On→Off	12 ms or less
Common method		16 point / 1COM
Current consumption		500mA (when all point On)
Operating indicator		Output On, LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.19kg

Circuit configuration



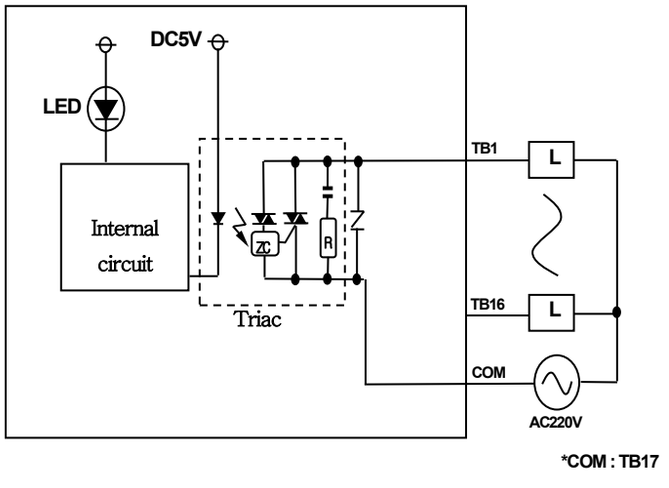
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	COM
TB18	NC



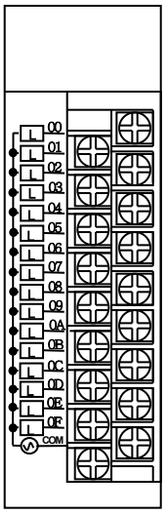
7.3.4 16 point triac output module

Specification \ Type		Triac output module
		XGQ-SS2A
Output point		16 points
Insulation method		Photo coupler insulation
Rated load voltage		AC 100-240V (50 / 60 Hz)
Max. load voltage		AC 264V
Max. load current		0.6A / 1 point 4A / 1COM
Min. load current		20 mA
Off leakage current		2.5 mA (AC 220V 60 Hz)
Max. Inrush current		20A / cycle or less
Max. voltage drop (On)		AC 1.5V or less (2A)
Surge absorber		Varistor (387 ~ 473V), C.R Absorber
Response time	Off→On	1 ms or less
	On→Off	0.5 Cycle + 1 ms or less
Common method		16 point / 1 COM
Current consumption		300 mA (when all point On)
Operating indicator		Output On, LED On
External connection method		18 point terminal block connector (M3 X 6 screw)
Weight		0.2 kg

Circuit configuration



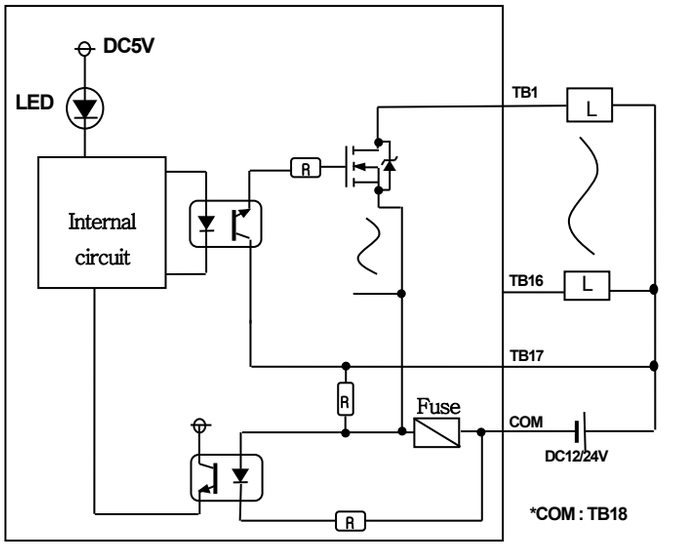
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	COM
TB18	NC



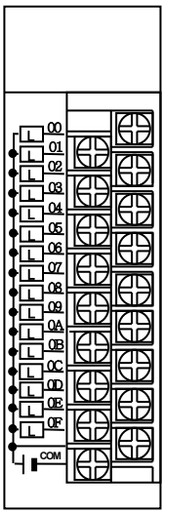
7.3.5 16 point transistor output module(Sink type)

Specification \ Type		TR output module
		XGQ-TR2A
Output point		16 points
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.5A / 1 point, 4A / 1COM
Off leakage current		0.1mA or less
Max. Inrush current		4A/ 10 ms or less
Max. voltage drop (On)		DC 0.3V or less
Surge absorber		Zener diode
Fuse		4A×2ea(no change) (fuse shutdown capacity:50A)
Fuse cutoff indication		Yes (fuse cutoff, LED On, transmit the signal to CPU) External power supply Off, not detected Fuse cutoff
Response time	Off→On	1 ms or less
	On→Off	1ms or less (rated load, resistive load)
Common method		16 point / 1COM
Current consumption		70mA (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10mA or less (DC24V connection)
Operating indicator		Output On, LED On
External connection method		18 point terminal block connector
Weight		0.11kg

Circuit configuration



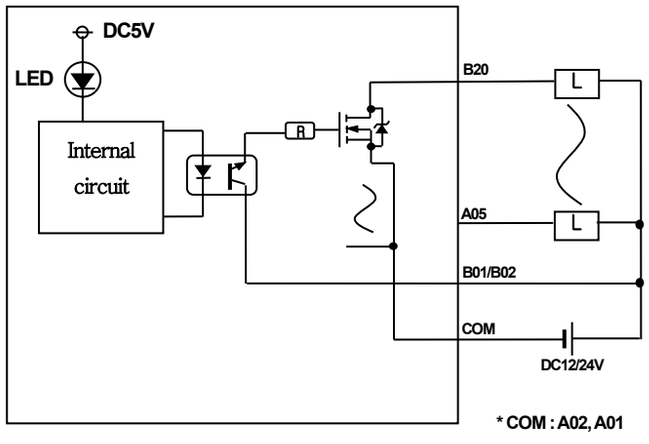
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	DC24V
TB18	COM



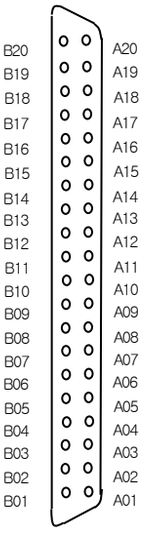
7.3.6 32 point transistor output module(Sink type)

Specification \ Type		TR output module
		XGQ-TR4A
Output point		32 points
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.1A / 1 point, 2A / 1COM
Off leakage current		0.1mA or less
Max. Inrush current		0.7A/ 10 ms or less
Max. voltage drop (On)		DC 0.2V or less
Surge absorber		Zener diode
Response time	Off→On	1 ms or less
	On→Off	1ms or less (rated load, resistive load)
Common method		32 point / 1COM
Current consumption		130mA (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10mA or less (DC24V connection)
Operating indicator		Input On LED On
External connection method		40 Pin Connector
Cable size		0.3 ㎟
Weight		0.1 kg

Circuit configuration



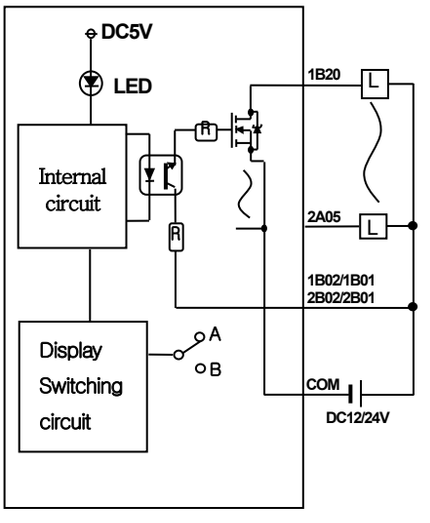
No	Contact Point	No	Contact Point
B20	P00	A20	P10
B19	P01	A19	P11
B18	P02	A18	P12
B17	P03	A17	P13
B16	P04	A16	P14
B15	P05	A15	P15
B14	P06	A14	P16
B13	P07	A13	P17
B12	P08	A12	P18
B11	P09	A11	P19
B10	P0A	A10	P1A
B09	P0B	A09	P1B
B08	P0C	A08	P1C
B07	P0D	A07	P1D
B06	P0E	A06	P1E
B05	P0F	A05	P1F
B04	NC	A04	NC
B03	NC	A03	NC
B02	DC12/ 24V	A02	COM
B01		A01	COM



7.3.7 64 point transistor output module(Sink type)

Specification \ Type		TR output module
		XGQ-TR8A
Output point		64 points
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.1A / 1 point, 2A / 1COM
Off leakage current		0.1mA or less
Max. Inrush current		0.7A/ 10 ms or less
Max. voltage drop (On)		DC 0.2V or less
Surge absorber		Zener diode
Response time	Off→On	1 ms or less
	On→Off	1ms or less (rated load, resistive load)
Common method		16 point / 1COM
Current consumption		230mA (when all point On)
Common method		32 point/COM
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10mA or less (DC24V connection)
Operating indicator		Input On, LED On (32 point LED On by switch operation)
External connection method		40 point connector×2ea
Cable size		0.3 ㎟
Weight		0.15 kg

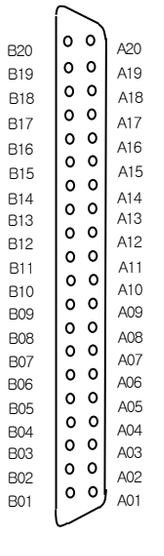
Circuit configuration



A: P00~P1F Display
B: P20~P3F Display

*COM : 1A02, 1A01
2A02, 2A01

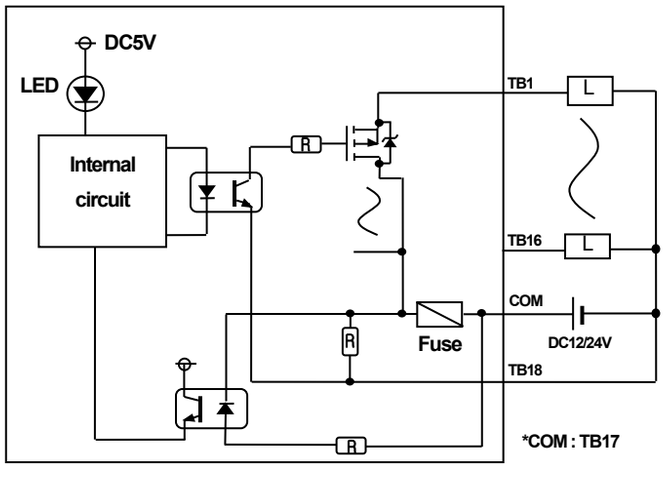
No	Contact Point	No	Contact Point	No	Contact Point	No	Contact Point
1B20	P00	1A20	P10	2B20	P20	2A20	P30
1B19	P01	1A19	P11	2B19	P21	2A19	P31
1B18	P02	1A18	P12	2B18	P22	2A18	P32
1B17	P03	1A17	P13	2B17	P23	2A17	P33
1B16	P04	1A16	P14	2B16	P24	2A16	P34
1B15	P05	1A15	P15	2B15	P25	2A15	P35
1B14	P06	1A14	P16	2B14	P26	2A14	P36
1B13	P07	1A13	P17	2B13	P27	2A13	P37
1B12	P08	1A12	P18	2B12	P28	2A12	P38
1B11	P09	1A11	P19	2B11	P29	2A11	P39
1B10	P0A	1A10	P1A	2B10	P2A	2A10	P3A
1B09	P0B	1A09	P1B	2B09	P2B	2A09	P3B
1B08	P0C	1A08	P1C	2B08	P2C	2A08	P3C
1B07	P0D	1A07	P1D	2B07	P2D	2A07	P3D
1B06	P0E	1A06	P1E	2B06	P2E	2A06	P3E
1B05	P0F	1A05	P1F	2B05	P2F	2A05	P3F
1B04	NC	1A04	NC	2B04	NC	2A04	NC
1B03	NC	1A03	NC	2B03	NC	2A03	NC
1B02	12/24V	1A02	COM1	2B02	12/24V DC	2A02	COM2
1B01	DC	1A01		2B01		2A01	



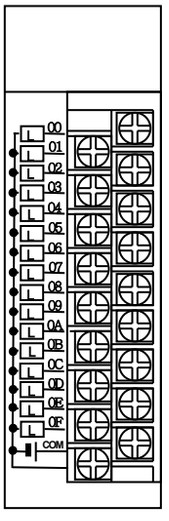
7.3.8 16 point TR output module(Source type)

Specification \ Type		TR output module
		XGQ-TR2B
Output point		16 points
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.5A / 1 point, 4A / 1COM
Off leakage current		0.1mA or less
Max. Inrush current		4A/ 10 ms or less
Max. voltage drop (On)		DC 0.3V or less
Surge absorber		Zener diode
Fuse		4A×2ea(no change) (fuse shutdown capacity:50A)
Fuse cutoff indication		Yes (fuse cutoff, LED On, transmit the signal to CPU)
Response time	Off→On	1 ms or less
	On→Off	1ms or less (rated load, resistive load)
Common method		16 point / 1COM
Current consumption		70mA (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10mA or less (DC24V connection)
Operating indicator		Output On, LED On
External connection method		18 point terminal block connector
Weight		0.12kg

Circuit configuration



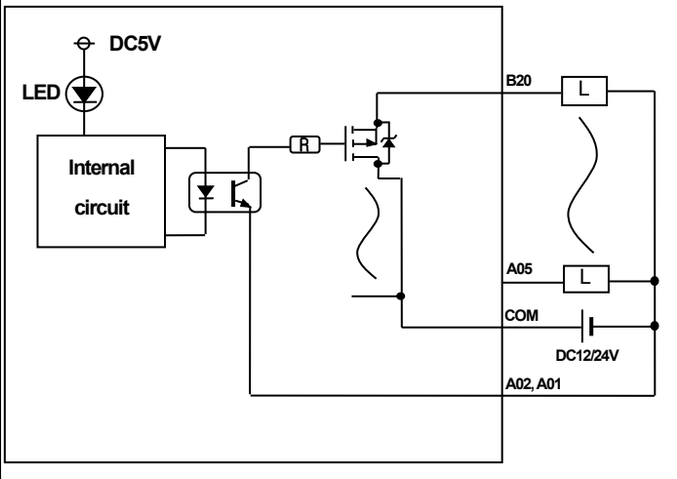
Terminal block	Contact point name
TB1	P0
TB2	P1
TB3	P2
TB4	P3
TB5	P4
TB6	P5
TB7	P6
TB8	P7
TB9	P8
TB10	P9
TB11	PA
TB12	PB
TB13	PC
TB14	PD
TB15	PE
TB16	PF
TB17	COM
TB18	0V



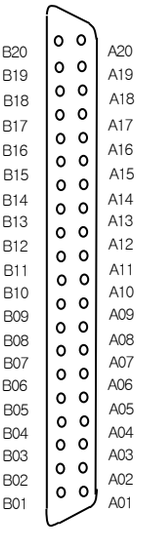
7.3.9 32 point TR output module(Source type)

Specification \ Type		TR output module
		XGQ-TR4B
Output point		32 points
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.1A / 1 point, 2A / 1COM
Off leakage current		0.1mA or less
Max. Inrush current		4A/ 10 ms or less
Max. voltage drop (On)		DC 0.3V or less
Surge absorber		Zener diode
Response time	Off→On	1 ms or less
	On→Off	1ms or less (rated load, resistive load)
Common method		32 point / 1COM
Current consumption		130mA (when all point On)
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10mA or less (DC24V connection)
Operating indicator		Input On LED On
External connection method		40 Pin Connector
Cable size		0.3 ㎟
Weight		0.1 kg

Circuit configuration



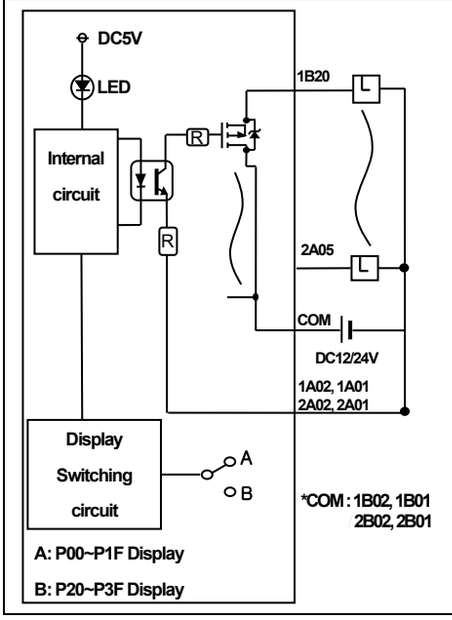
No	Contact Point	No	Contact Point
B20	P00	A20	P10
B19	P01	A19	P11
B18	P02	A18	P12
B17	P03	A17	P13
B16	P04	A16	P14
B15	P05	A15	P15
B14	P06	A14	P16
B13	P07	A13	P17
B12	P08	A12	P18
B11	P09	A11	P19
B10	P0A	A10	P1A
B09	P0B	A09	P1B
B08	P0C	A08	P1C
B07	P0D	A07	P1D
B06	P0E	A06	P1E
B05	P0F	A05	P1F
B04	NC	A04	NC
B03	NC	A03	NC
B02	COM	A02	0V
B01		A01	



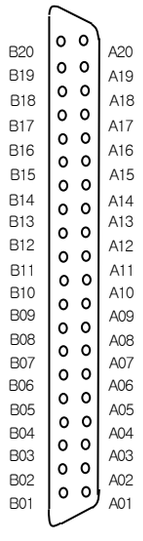
7.3.10 64 point TR output module(Source type)

Specification \ Type		TR output module
		XGQ-TR8B
Output point		64 points
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		0.1A / 1 point, 2A / 1COM
Off leakage current		0.1mA or less
Max. Inrush current		4A/ 10 ms or less
Max. voltage drop (On)		DC 0.3V or less
Surge absorber		Zener diode
Response time	Off→On	1 ms or less
	On→Off	1ms or less (rated load, resistive load)
Common method		32 point / 1COM
Current consumption		230mA (when all point On)
Common method		32 point/COM
External power supply	Voltage	DC12/24V ± 10% (ripple voltage 4 Vp-p or less)
	Current	10mA or less (DC24V connection)
Operating indicator		Input On, LED On (32 point LED On by switch operation)
External connection method		40 point connector×2ea
Cable size		0.3 ㎟
Weight		0.15 kg

Circuit configuration



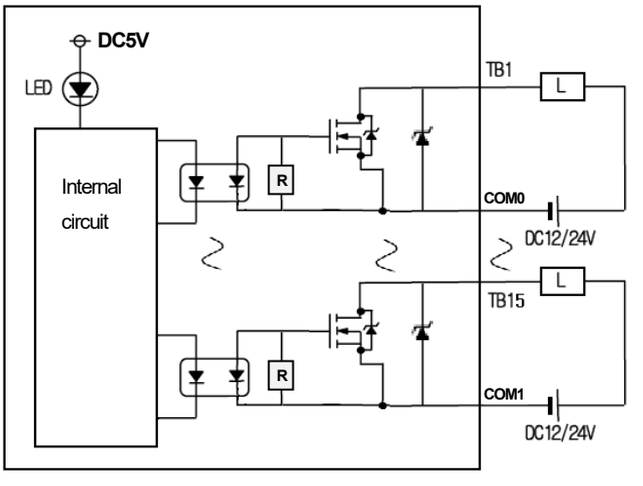
No	Contact Point	No	Contact Point	No	Contact Point	No	Contact Point
1B20	P00	1A20	P10	2B20	P20	2A20	P30
1B19	P01	1A19	P11	2B19	P21	2A19	P31
1B18	P02	1A18	P12	2B18	P22	2A18	P32
1B17	P03	1A17	P13	2B17	P23	2A17	P33
1B16	P04	1A16	P14	2B16	P24	2A16	P34
1B15	P05	1A15	P15	2B15	P25	2A15	P35
1B14	P06	1A14	P16	2B14	P26	2A14	P36
1B13	P07	1A13	P17	2B13	P27	2A13	P37
1B12	P08	1A12	P18	2B12	P28	2A12	P38
1B11	P09	1A11	P19	2B11	P29	2A11	P39
1B10	P0A	1A10	P1A	2B10	P2A	2A10	P3A
1B09	P0B	1A09	P1B	2B09	P2B	2A09	P3B
1B08	P0C	1A08	P1C	2B08	P2C	2A08	P3C
1B07	P0D	1A07	P1D	2B07	P2D	2A07	P3D
1B06	P0E	1A06	P1E	2B06	P2E	2A06	P3E
1B05	P0F	1A05	P1F	2B05	P2F	2A05	P3F
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	



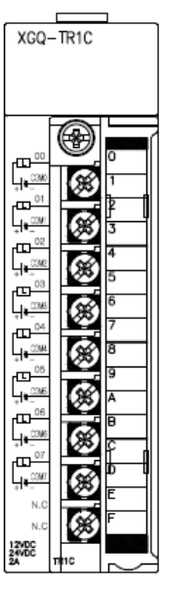
7.3.11 8 point TR output module(isolated contact point)

Specification \ Type		TR output module
		XGQ-TR1C
Output point		8 points
Insulation method		Photo coupler insulation
Rated load voltage		DC 12 / 24V
Load voltage range		DC 10.2 ~ 26.4V
Max. load current		2A / 1 point
Off leakage current		0.1mA or less
Max. Inrush current		8A/ 10 ms or less
Max. voltage drop (On)		DC 0.3V or less
Surge absorber		Zener diode
Response time	Off→On	3 ms or less
	On→Off	10ms or less (rated load, resistive load)
Common method		1 point / 1COM
Current consumption		100mA (when all point On)
Operating indicator		Output On, LED On
External connection method		18 point terminal block connector
Weight		0.11kg

Circuit configuration



Terminal block	Contact point name
TB1	P0
TB2	COM0
TB3	P1
TB4	COM1
TB5	P2
TB6	COM2
TB7	P3
TB8	COM3
TB9	P4
TB10	COM4
TB11	P5
TB12	COM5
TB13	P6
TB14	COM6
TB15	P7
TB16	COM7
TB17	NC
TB18	NC



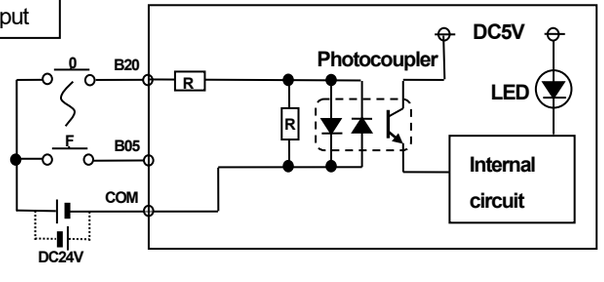
7.4 Digital I/O hybrid module specifications

7.4.1 32 point (DC Input · Transistor Output) I/O hybrid module

XGH-DT4A					
Input			**Output**		
Input point		16 points	Output point		16 points
Insulation method		Photocoupler isolation	Insulation method		Photocoupler isolation
Rated input voltage		DC 24V	Rated load voltage		DC 12 / 24V
Rated input current		About 4 ㎃	Load voltage range		DC 10.2 ~ 26.4V
Operation voltage range		DC20.4~28.8V (ripple rate < 5%)	Max. load current		0.1A / 1 point, 1.6A / 1COM
Dielectric withstanding voltage		AC560Vrms/3Cycle(altitude: 2000m)	Off leakage current		0.1mA or less
On voltage/On current		DC19V or higher / 3 mA or higher	Max. Inrush current		0.7A/ 10 ms or less
Off voltage/Off current		DC11V or less / 1.7 mA or less	Surge absorber		Zener diode
Input resistance		About 5.6 kΩ	Max. voltage drop (On)		DC 0.2V or less
Response time	Off→On	1ms/3ms/5ms/10ms/20ms/70ms/ 100ms (set by CPU parameter) Default:3ms	Response time	Off→On	1 ms or less
	On→Off	1ms/3ms/5ms/10ms/20ms/70ms/ 100ms (set by CPU parameter) Default:3ms		On→Off	1 ms or less (rated load, resistive load)
Common method		16 point/COM	Common method		16 point / 1COM
Operating indicator		LED ON when input is ON	Operating indicator		LED ON when output is ON
Current consumption (㎃)		110mA (when all points On)			
External connection method		40 point connector×1ea			
Weight		0.1 kg			

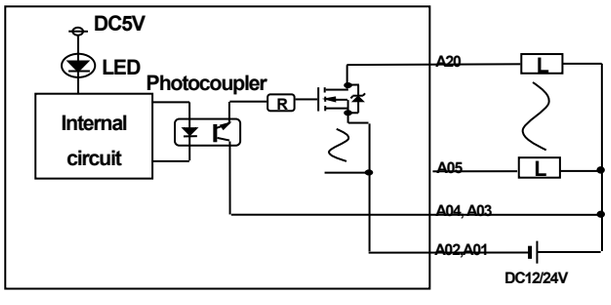
Circuit configuration

Input



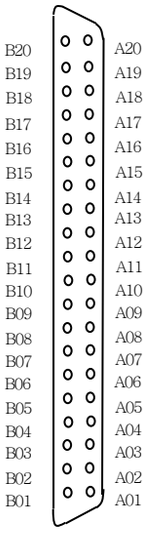
* COM : B02, B01

Output



External connection

No	Contact Point	No	Contact Point
B20	P00	A20	P10
B19	P01	A19	P11
B18	P02	A18	P12
B17	P03	A17	P13
B16	P04	A16	P14
B15	P05	A15	P15
B14	P06	A14	P16
B13	P07	A13	P17
B12	P08	A12	P18
B11	P09	A11	P19
B10	P0A	A10	P1A
B09	P0B	A09	P1B
B08	P0C	A08	P1C
B07	P0D	A07	P1D
B06	P0E	A06	P1E
B05	P0F	A05	P1F
B04	NC	A04	DC12/ 24V
B03	NC	A03	
B02	COM	A02	0V
B01		A01	

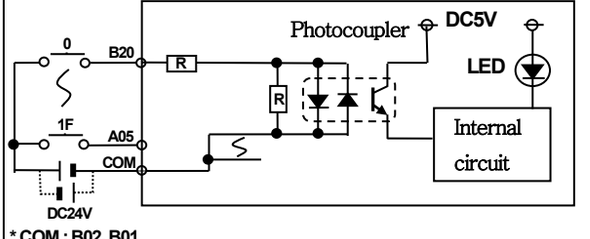


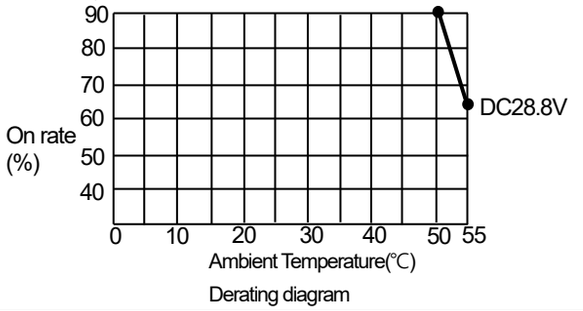
7.5 Event Input Module Specification

7.5.1 Event Input Module (Source/Sink type)

Item		XGF-SOEA
Input point		32 point/COM
Insulation method		Photo coupler insulation
Memory size		1Mbit. Records 1Mbit event information (300 event information per XGF-SOEA module)
Event time		Internal time : PLC time External time : External time server time
Resolution(Precision)		Internal time :1ms (precision : ±2ms) External time :1ms (precision : ±0.5ms)
Rated input voltage		DC24V (DC 20.4 ~ 28.8V)
Rated input current		About 4mA
On voltage / On current		DC19V or more / 3 mA or more
Off voltage / Off current		DC11V or less / 1.7 mA or less
Input filter	Time	1 ~ 100ms
	Mode	Steady State , Integrating
Input chattering		Counter : 2~127, Timer : 0.000~10.000 sec
Response time	Off→On	H/W delay(10㎲: Normal) + Input filter time + Module processing time(100㎲)
	On→Off	H/W delay(84㎲: Normal) + Input filter time + Module processing time(100㎲)
Insulation resistor		Insulation resistance 10 MΩ or above (DC500V)
Internal current consumption(A)		0.7(MAX)
Operation display		LED is on when input is on
External connection method		40 point connector
Size		27x98x90
Weight		0.2 kg

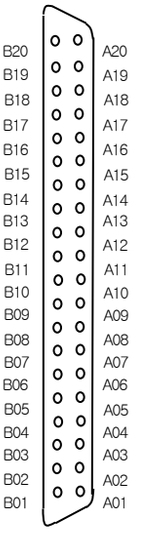
Circuit configuration





Derating diagram

No	Contact Point	No	Contact Point
B20	0	A20	16
B19	1	A19	17
B18	2	A18	18
B17	3	A17	19
B16	4	A16	20
B15	5	A15	21
B14	6	A14	22
B13	7	A13	23
B12	8	A12	24
B11	9	A11	25
B10	10	A10	26
B09	11	A09	27
B08	12	A08	28
B07	13	A07	29
B06	14	A06	30
B05	15	A05	31
B04	RX+	A04	SG
B03	RX-	A03	SG
B02	COM	A02	COM
B01	COM	A01	COM



7.6 Smart Link

7.6.1 Module accessible to Smart Link

From digital I/O modules used for XGT Series, the modules accessible to Smart Link are as follows.
32 point modules need a connector(40 Pin x 1), 64 point modules need 2 connectors(40 Pin x 2)

Product name	Specification	No. of pins
XGI-D24A/B	DC input 32 point module	40 pin connector×1ea
XGI-D28A/B	DC input 64 point module	40 pin connector×2ea
XGQ-TR4A	TR output 32 point module(sink type)	40 pin connector×1ea
XGQ-TR8A	TR output 64 point module(sink type)	40 pin connector×2ea
XGQ-TR4B	TR output 32 point module(source type)	40 pin connector×1ea
XGQ-TR8B	TR output 64 point module(source type)	40 pin connector×2ea
XGF-SOEA	Evnet input module	40 pin connector×1ea

7.6.2 Smart Link Components

The company prepares smart link products for the convenience of using our Connector type I/O modules.
For further information, please refer to the data sheet contained in a smart link product.
(Refer to 7.6.6 1to confirm the differences between TG7-1H40CA 1and 1TG7-1H40S)

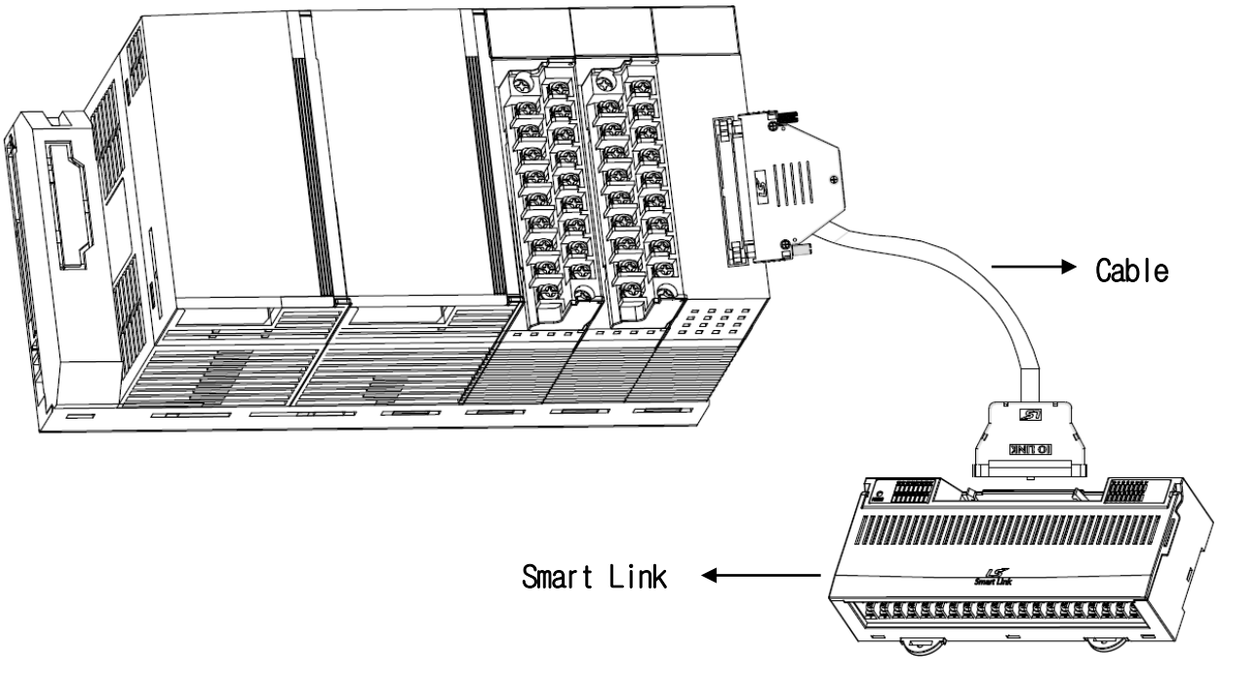
	Product name	Cable	Length of Cable
Terminal board	**TG7-1H40S**	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
	TG7-1H40CA (20Pin Common assembled)	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
Relay board	**R32C-NS5A-40P (Sink type)**	C40HF-05PB-1	0.5m
		C40HF-10PB-1	1m
		C40HF-15PB-1	1.5m
		C40HF-20PB-1	2m
		C40HF-30PB-1	3m
	R32C-PS5A-40P (Source type)	C40HF-05PB-XGP1	0.5m
		C40HF-10PB-XGP1	1m
		C40HF-20PB-XGP1	2m

7.6.3 Smart Link Mapping Table

❶ : Module using 1ea Cable , ❷ : Module using 2ea Cable

LS Smart Link Mapping Table				XGT PLC (Digital I/O Module)									
			Length (m)	XGQ-TR4A	XGQ-TR4B	XGQ-TR8A	XGQ-TR8B	XGI-D24A	XGI-D24B	XGI-D28A	XGI-D28B	XGH-DT4A	XGF-SOEA
	Cable	Description	Sets	1	1	2	2	1	1	2	2	1	1
TG7-1H40S /TG7-1H40CA	C40HF-05PB-1B	PLC,CABLE ASS'Y,40p-40p,0.5m	0.5	❶	❶			❶	❶			❶	❶
	C40HF-10PB-1B	PLC,CABLE ASS'Y,40p-40p,1m	1.0	❶	❶			❶	❶			❶	❶
	C40HF-15PB-1B	PLC,CABLE ASS'Y,40p-40p,1.5m	1.5	❶	❶			❶	❶			❶	❶
	C40HF-20PB-1B	PLC,CABLE ASS'Y,40p-40p,2m	2.0	❶	❶			❶	❶			❶	❶
	C40HF-30PB-1B	PLC,CABLE ASS'Y,40p-40p,3m	3.0	❶	❶			❶	❶			❶	❶
R32C-NS5A-40P (SINK)	C40HF-05PB-1	PLC,CABLE ASS'Y,40p-40p,0.5m	0.5	❶									
	C40HF-10PB-1	PLC,CABLE ASS'Y,40p-40p,1m	1.0	❶									
	C40HF-15PB-1	PLC,CABLE ASS'Y,40p-40p,1.5m	1.5	❶									
	C40HF-20PB-1	PLC,CABLE ASS'Y,40p-40p,2m	2.0	❶									
	C40HF-30PB-1	PLC,CABLE ASS'Y,40p-40p,3m	3.0	❶									
R32C-PS5A-40P (Source)	C40HF-05PB-XGP1	PLC,CABLE ASS'Y,40p-40p,0.5m	0.5		❶								
	C40HF-10PB-XGP1	PLC,CABLE ASS'Y,40p-40p,1m	1.0		❶								
	C40HF-15PB-XGP1	PLC,CABLE ASS'Y,40p-40p,1.5m	1.5										
	C40HF-20PB-XGP1	PLC,CABLE ASS'Y,40p-40p,2m	2.0		❶								
	C40HF-30PB-XGP1	PLC,CABLE ASS'Y,40p-40p,3m	3.0										

7.6.4 Smart Link Connection



7.6.5 Smart Link Connection Diagram

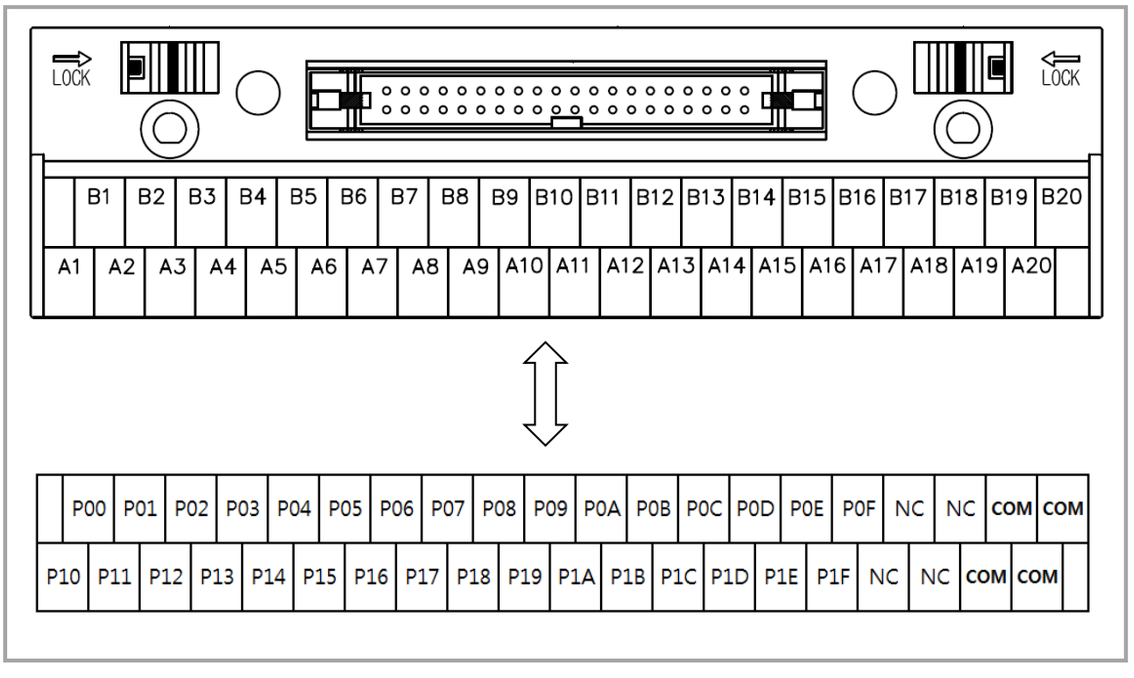
(1) XGI-D24A/B

1) Applicable Smart Link

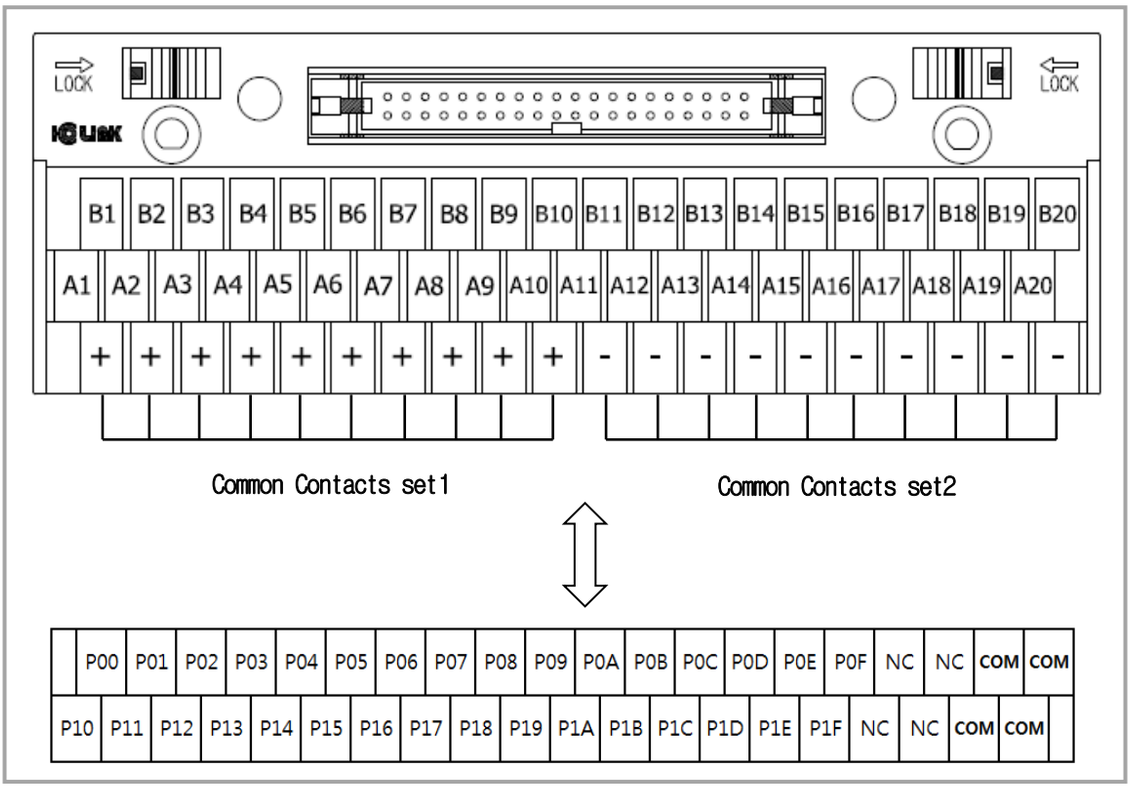
	Product name	Cable	Length of Cable
Terminal board	TG7-1H40S	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
	TG7-1H40CA (20Pin Common assembled)	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m

2) Connection diagram (XGI-D24A/B)

(a) **TG7-1H40S**



(b) **TG7-1H40CA**


LOCK
LOCK
B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20
+ + + + + + + + + + - - - - - - - - - -
Common Contacts set1
Common Contacts set2
P00 P01 P02 P03 P04 P05 P06 P07 P08 P09 P0A P0B P0C P0D P0E P0F NC NC COM COM
P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P1A P1B P1C P1D P1E P1F NC NC COM COM

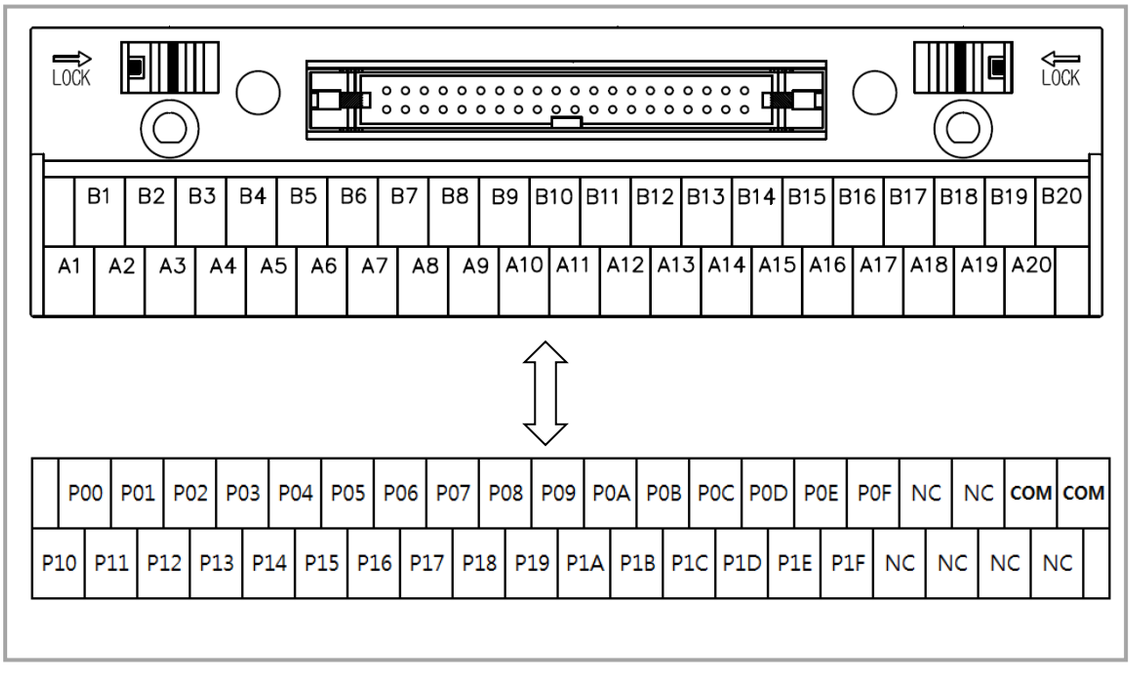
(2) XGI-D28A/B

1) Applicable Smart Link

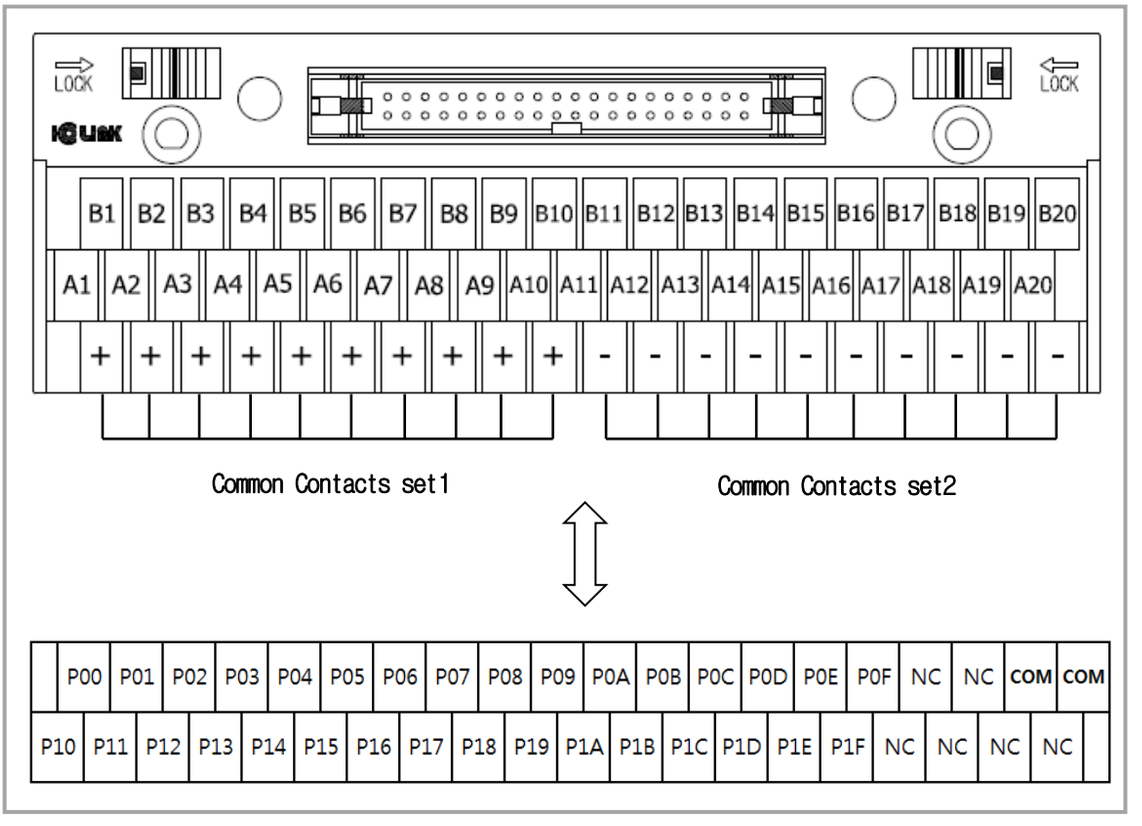
	Product name	Cable	Length of Cable
Terminal board	TG7-1H40S	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
	TG7-1H40CA (20Pin Common assembled)	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m

2) Connection diagram (XGI-D28A/B)

(a) **TG7-1H40S**



(b) **TG7-1H40CA**


LOCK
LOCK
B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20
+ + + + + + + + + + - - - - - - - - - -
Common Contacts set1
Common Contacts set2
P00 P01 P02 P03 P04 P05 P06 P07 P08 P09 P0A P0B P0C P0D P0E P0F NC NC COM COM
P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P1A P1B P1C P1D P1E P1F NC NC NC NC

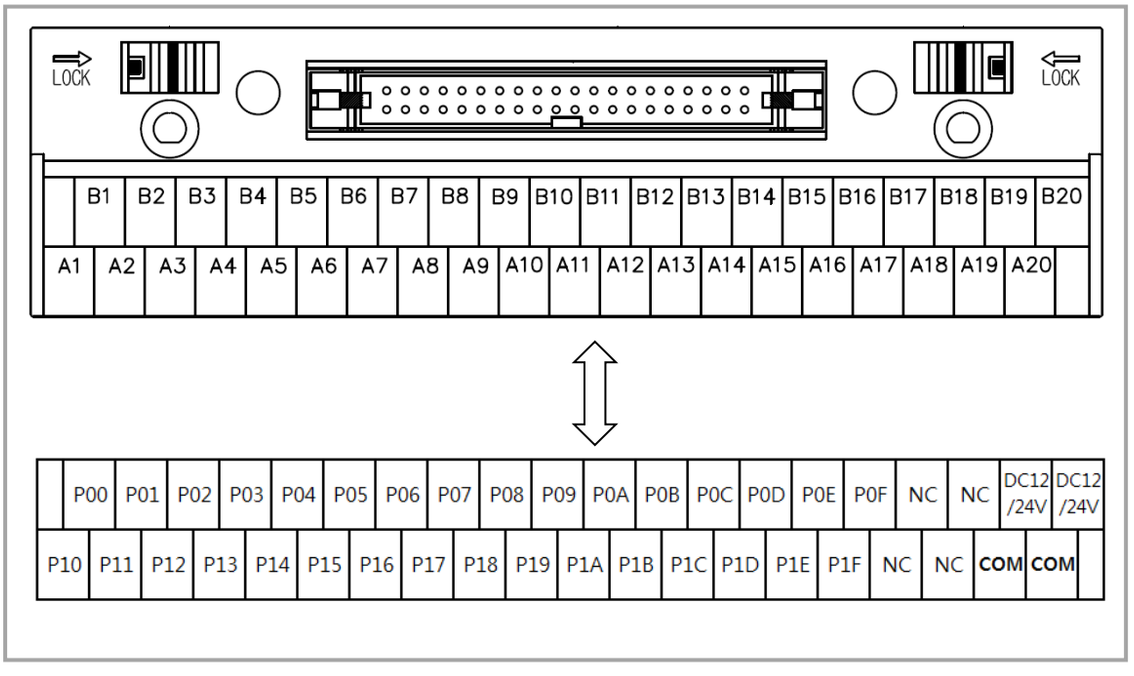
(3) XGQ-TR4A/8A

1) Applicable Smart Link

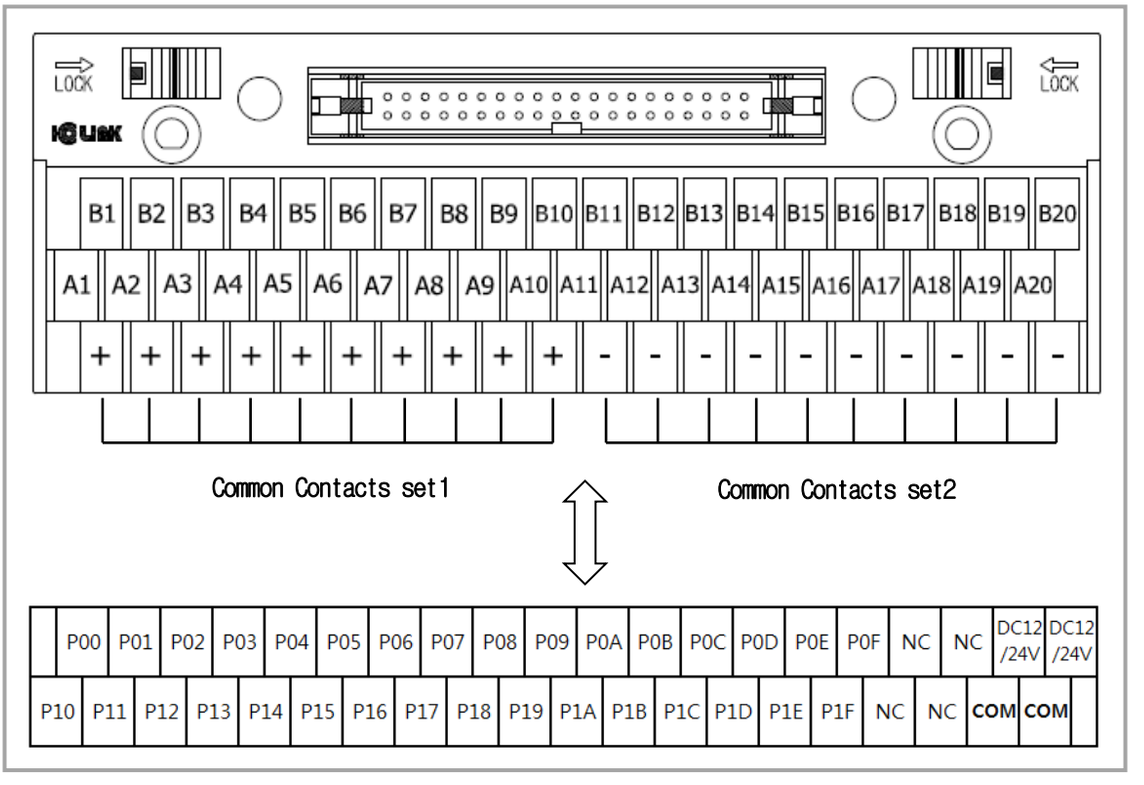
	Product name	Cable	Length of Cable
Terminal board	TG7-1H40S	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
	TG7-1H40CA (20Pin Common assembled)	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
Relay board	R32C-NS5A-40P (sink type)	C40HF-05PB-1	0.5m
		C40HF-10PB-1	1m
		C40HF-15PB-1	1.5m
		C40HF-20PB-1	2m
		C40HF-30PB-1	3m

2) Connection diagram (XGQ-TR4A/ 8A)

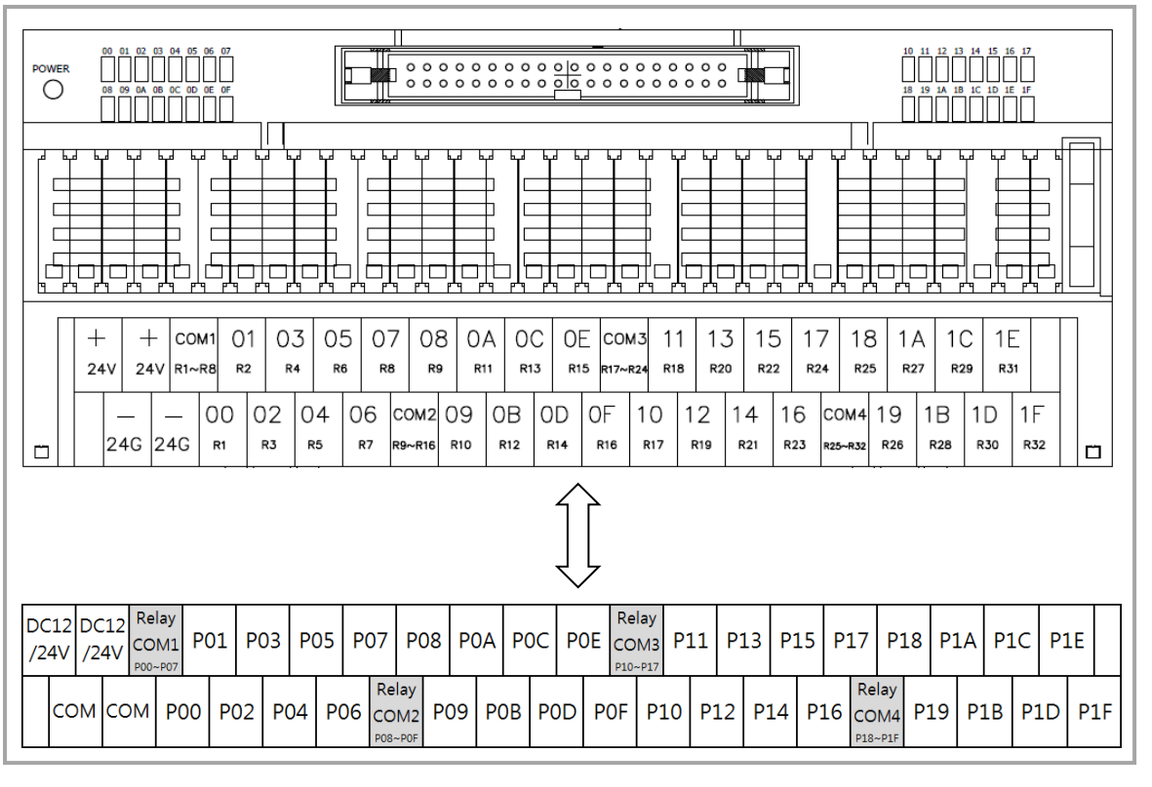
(a) **TG7-1H40S**



(b) **TG7-1H40CA**



(c) **R32C-NS5A-40P**



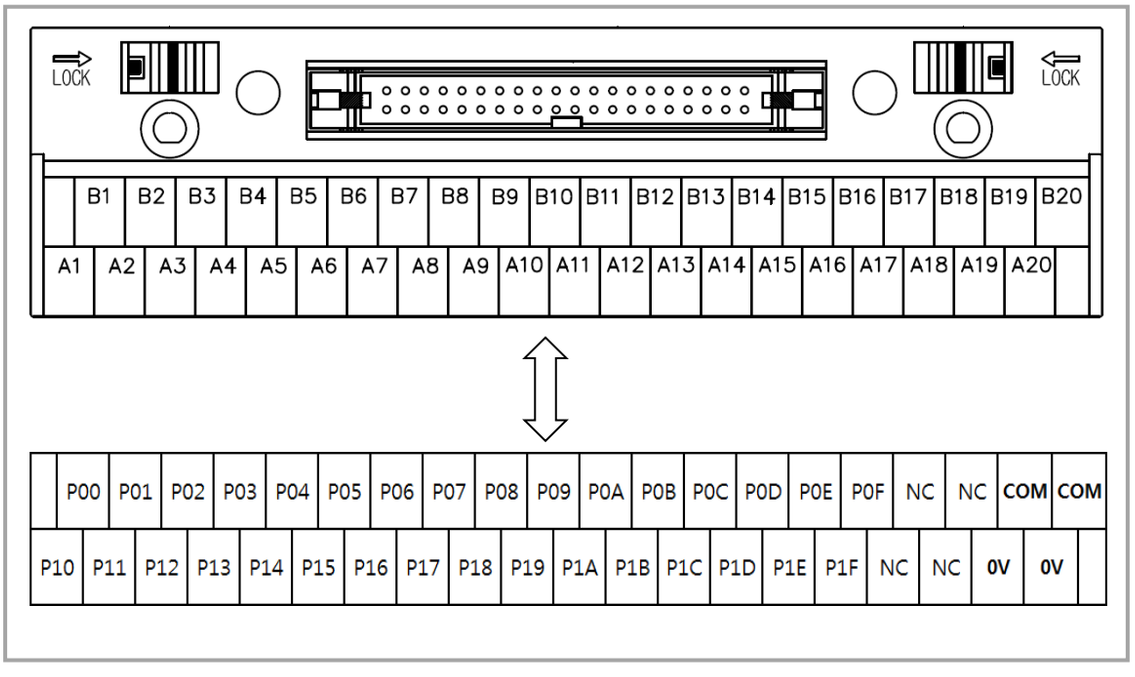
(4) XGQ-TR4B/8B

1) Applicable Smart Link

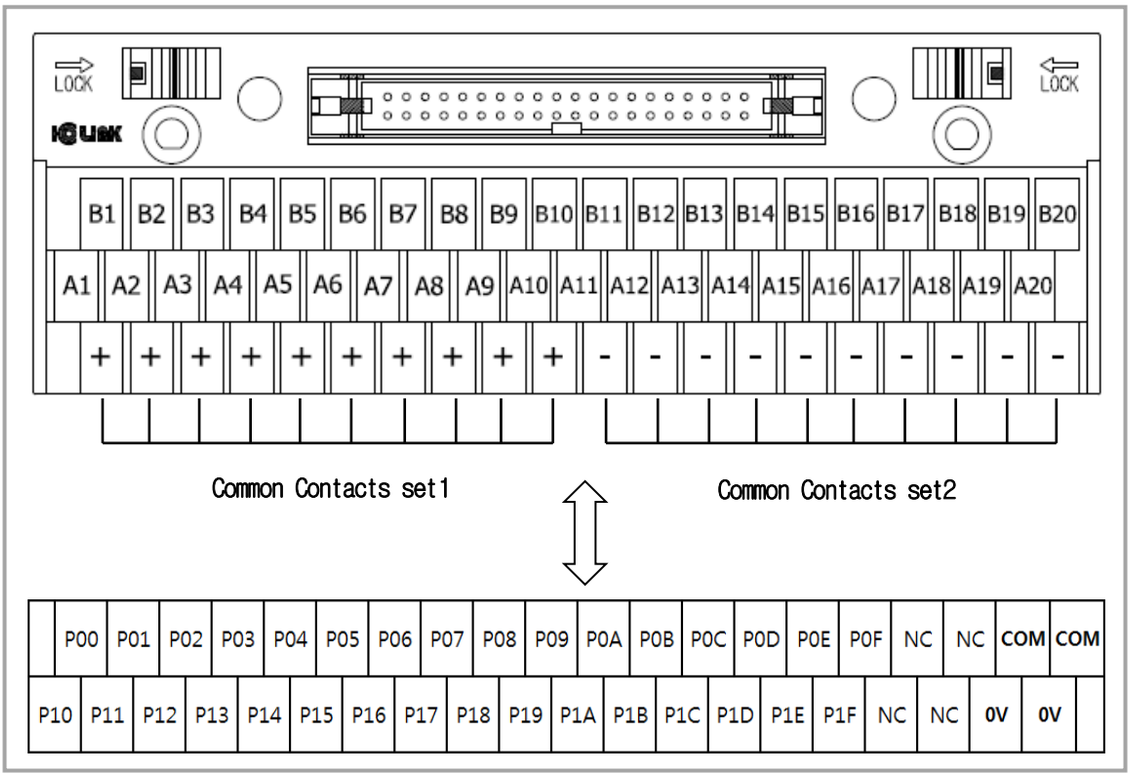
	Product name	Cable	Length of Cable
Terminal board	TG7-1H40S	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
	TG7-1H40CA (20Pin Common assembled)	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
Relay board	R32C-PS5A-40P (Source type)	C40HF-05PB-XGP1	0.5m
		C40HF-10PB-XGP1	1m
		C40HF-20PB-XGP1	2m
		-	-
		-	-

2) Connection diagram (XGQ-TR4B/ 8B)

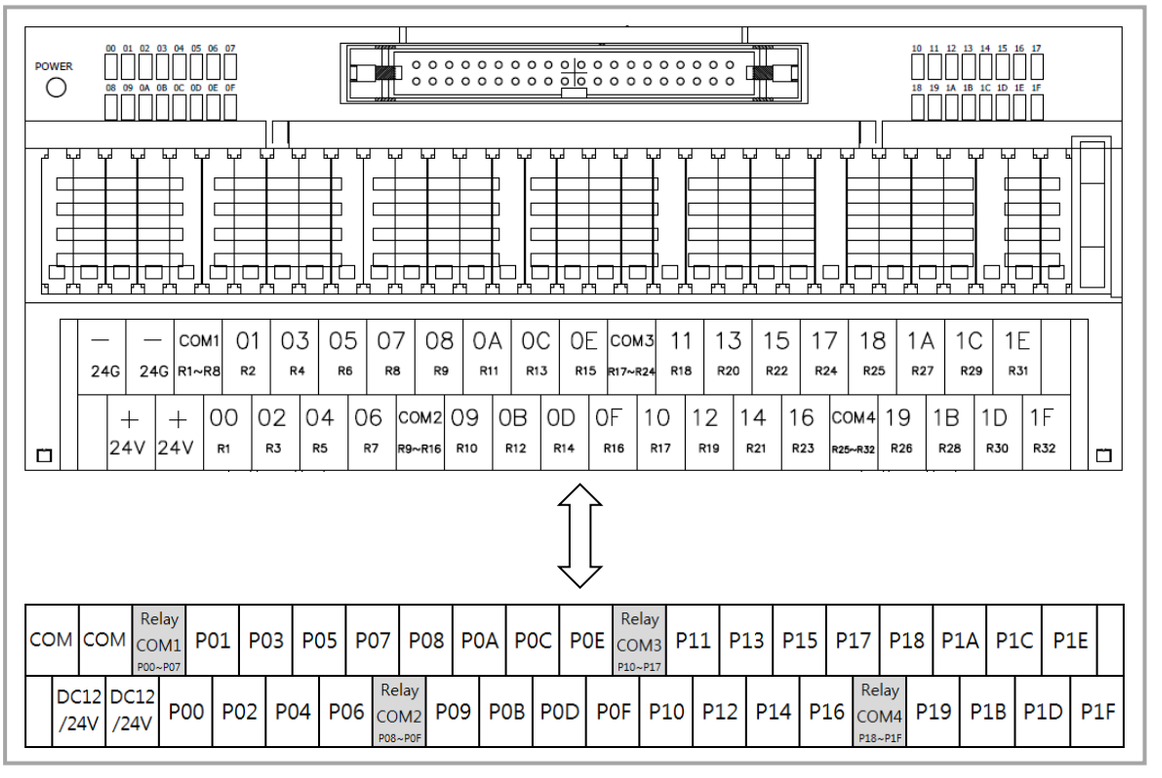
(a) **TG7-1H40S**



(b) **TG7-1H40CA**



(c) **R32C-PS5A-40P**



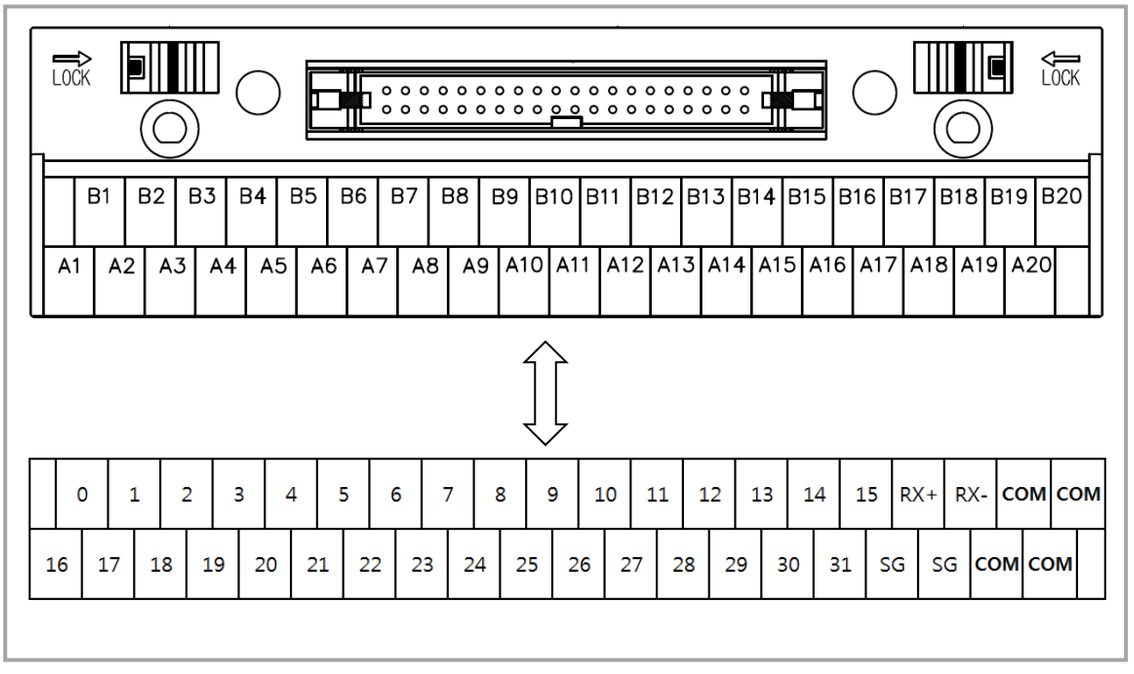
(5) XGF-SOEA

1) Applicable Smart Link

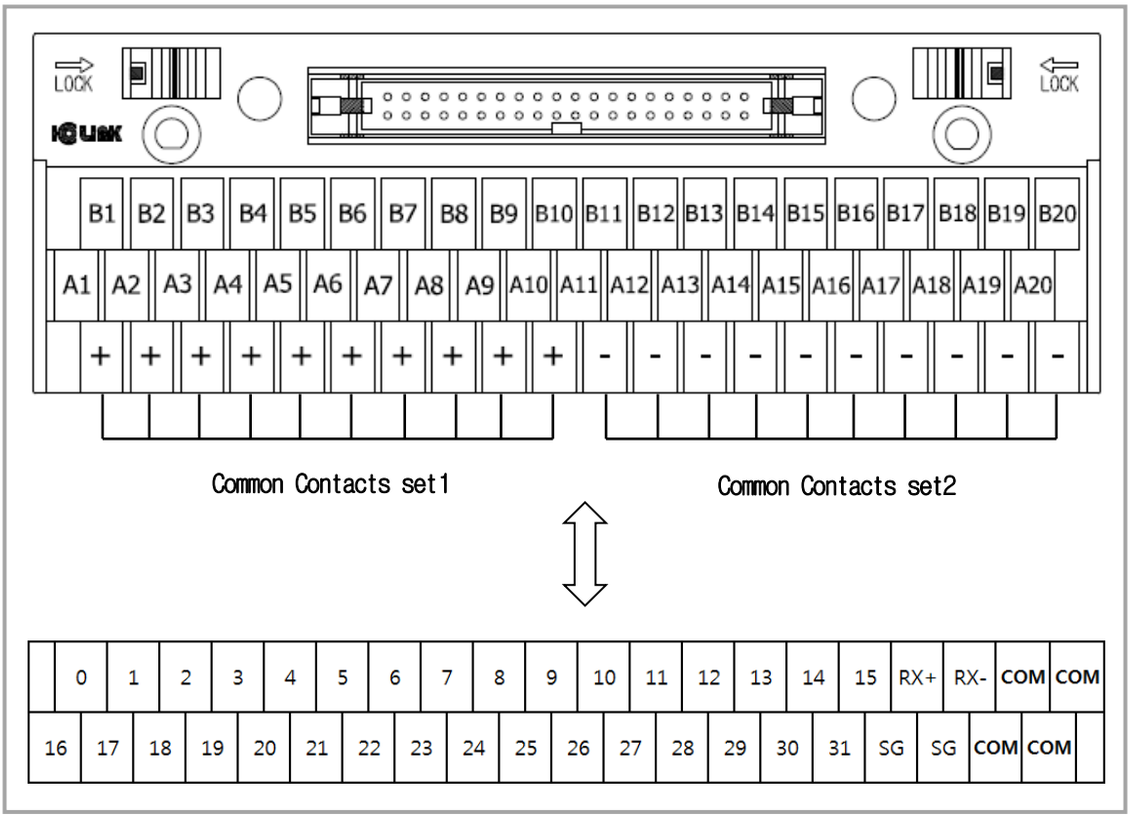
	Product name	Cable	Length of Cable
Terminal board	TG7-1H40S	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m
	TG7-1H40CA (20Pin Common assembled)	C40HF-05PB-1B	0.5m
		C40HF-10PB-1B	1m
		C40HF-15PB-1B	1.5m
		C40HF-20PB-1B	2m
		C40HF-30PB-1B	3m

2) Connection diagram (XGF-SOEA)

(a) **TG7-1H40S**



(b) **TG7-1H40CA**


LOCK
LOCK
B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20
+ + + + + + + + + + - - - - - - - - - -
Common Contacts set1
Common Contacts set2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 RX+ RX- COM COM
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 SG SG COM COM

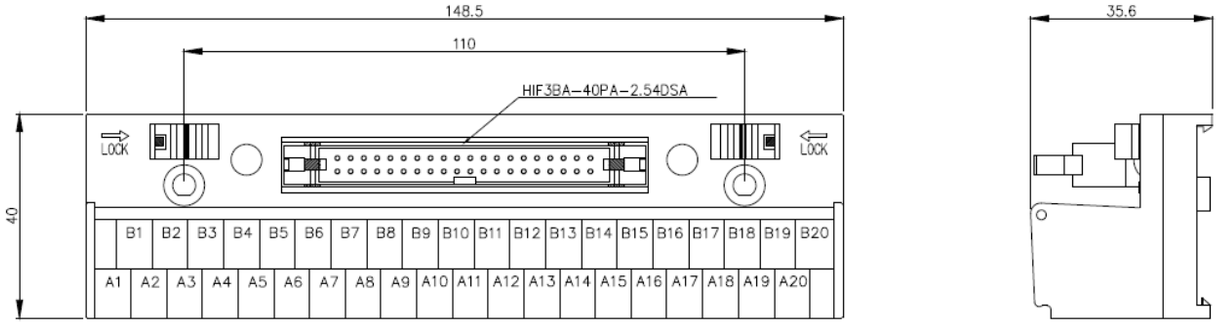
7.6.6 Smart Link Specifications and Dimensions

(1) TG7-1H40S

1) Specification

Rated voltage	AC, DC 125V
Rated current	1A
Withstand voltage	600V 1 min
Insulation resistor	100MΩ (DC 500V)
Cable	1.25 ㎟ /MAX
T/B Screw	M3 X 10L
Screw torque	1.2N • m(12Kgf • cm)
Material	Modified PPO(Noryl)(UL 94V-0)

2) Dimension (mm)

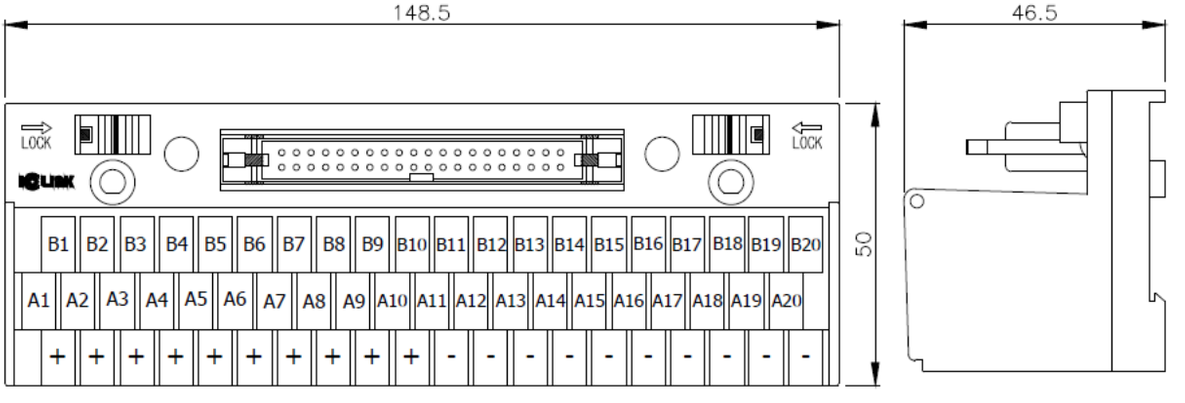


(2) TG7-1H40CA

1) Specification

Rated voltage		125V AC / 24V DC
Rated current	**IO**	1A
	Common	10A (Total)
Insulation resistor		100MΩ (DC 500V)
Withstand voltage		AC500V 1min
Wire		AWG22-16 (MAX / 1.5 ㎟)
Terminal Screw		M3 X 10L
Screw torque		1.2N • m(12Kgf • cm)
Ambient temperature		-10℃ ~ +50℃ (Non-condensing)
Terminal Block & Cover		Modified PPO
Protective Cover		Polycarbonate
PCB		Epoxy 1.6t

2) Dimension (mm)



(3) R32C-N(P)S5A-40P

1) Specification

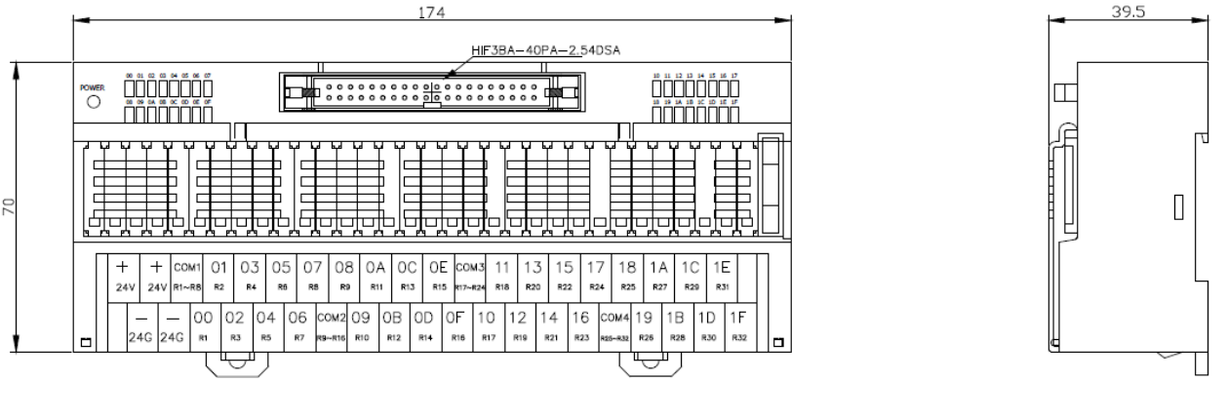
(A) Relay board

Case	Modified PPO
Protective Cover	Polycarbonate
PCB	Epoxy 1.6t / 2oz
Wire	AWG22-16 (MAX / 1.5 ㎟)
Terminal Screw	M3 X 8L
Screw torque	1.2N • m(12Kgf • cm)
Ambient temperature	-10℃ ~ +50℃ (Non-condensing)

(B) Relay

Item		PA1a-24V
Contact Point	**Contact configuration**	1a
	Rated voltage	5A 250V AC / 5A 30V DC
	Max. Inrush current	5A
	Max. switching voltage	250V AC / 110V DC
Coil	**Rated voltage**	24V DC
	Operation voltage	16.8V
	Release Voltage	1.2V DC
	Coil resistance	3,200Ω
	Rating power consumption	180mW
Lightning surge voltage		4,000V
Withstand voltage		2,000V rms

2) Dimension (mm)



Chapter 11 Power Module

Here describes the selection method, type and specification of power module.

11.1 Selection Method

Power Module selection of power module is determined by the current that input Power Module voltage and power module should supply to the system, that is, the sum of current consumption of digital I/O module, special module and communication module that Current Consumption installed on a same base with the power module. If it exceeds the rated output capacity of Power Module module, the system does not properly work. In case of system configuration, consider the current consumption current into of each module before selecting the power module module.

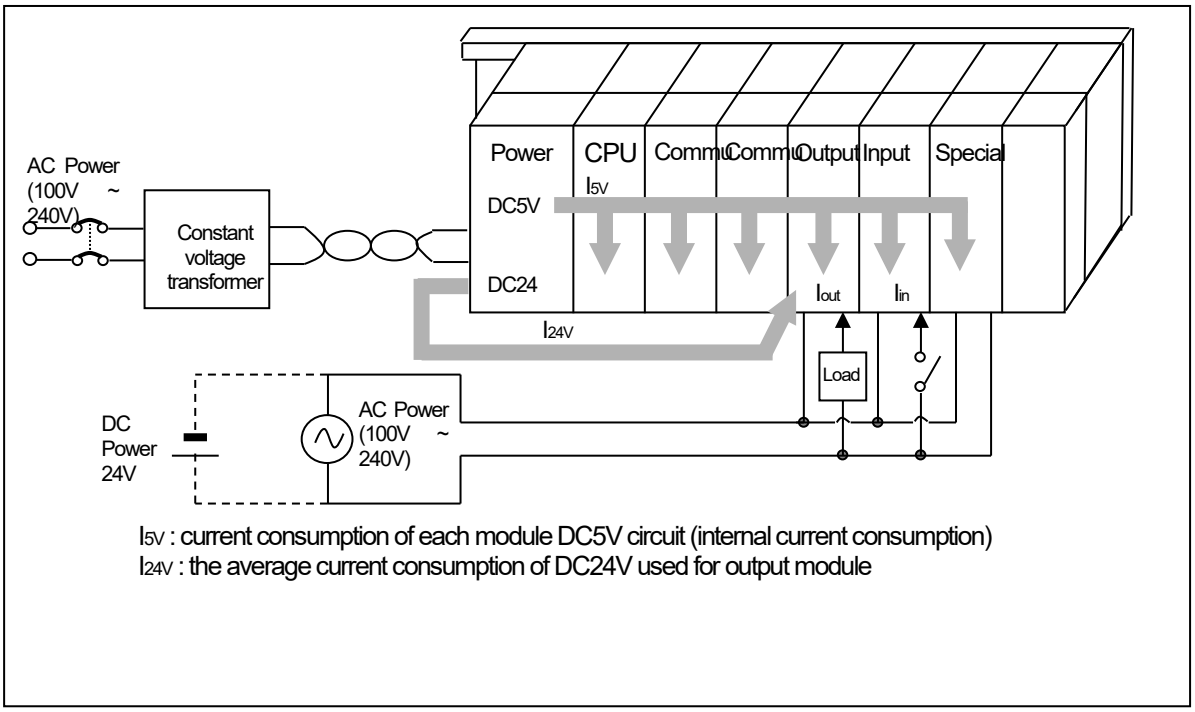
- For consumption current of each module, refer to user manual or data sheet of each module.

(1) Current consumption by modules (DC 5V) (Unit: mA)

Product	Type	Current consumption	Product	Type	Current consumption
CPU Module	XGI-CPUZ7	1400	Analog input	XGF-AV8A	420
	XGC-CPUX7	1400		XGF-AC8A	420
	XGI-CPUZ5	1400			
	XGI-CPUZ3	1400		XGF-AD4S	610
	XGI-CPUUN	960		XGF-AD8A	420
	XGI-CPUH,/UN	960		XGF-AD16A	420
	XGI-CPUS/E	940	2-wire analog input	XGF-AW4S	180(480)
DC24V Input	XGI-D21A	20	Analog output	XGF-DV4A	190 (140)
	XGI-D22A/B	30		XGF-DC4A	190 (210)
	XGI-D24A/B	50		XGF-DV8A	190 (180)
	XGI-D28A/B	60		XGF-DC8A	190 (300)
AC110V Input	XGI-A12A	30		XGF-DV4S	200 (150)
AC220V Input	XGI-A21A/C	20		XGF-DC4S	200 (220)
Relay output	XGQ-RY1A	260	Analog input/output mixed	XGF-AH6A	770
	XGQ-RY2A/B	500	HART analog input	XGF-AC4H	340
Transistor output	XGQ-TR1C	100	HART analog output	XGF-DC4H	200(220)
	XGQ-TR2A/B	70	High speed counter input	XGF-HO2A	270
	XGQ-TR4A/B	130		XGF-HD2A	330
	XGQ-TR8A/B	230	Multi-channel High speed counter input	XGF-HO8A	600
Triac output	XGQ-SS2A	300	Positioning	XGF-PO1H	400
Input/output mixed	XGH-DT4A	110		XGF-PO2H	410
Built-in Diagnosis function Input	XGI-D21D	60		XGF-PO3H	420
Built-in Diagnosis function output	XGQ-RY1D	400		XGF-PO4H	430
Cnet I/F	XGL-C22B	420		XGF-PD1H	520
	XGL-C42B	520		XGF-PD2H	600
	XGL-CH2B	480		XGF-PD3H	850
FEnet I/F	XGL-EFMTB	560/900		XGF-PD4H	890
	XGL-EFMFB	750/740	Positioning(Network)	XGF-PN4B	500
	XGL-EFMHB	670/670		XGF-PN8A/B	500

Product	Type	Current consumption	Product	Type	Current consumption
Ethernet electric switch	XGL-EH5T	700		XGF-PN16B	900
Pnet I/F	XGL-PMEB	500	Motion control	XGF-M32E	900
	XGL-PSEA	410	Thermo couple input	XGF-TC4S	610
	XGL-PSRA	600	RTD input	XGF-RD4/8A	450
Dnet I/F	XGL-DSEB	350		XGF-RD4S	783
	XGL-DMEB	350	Main base	XGB-M12A	230
Rnet I/F	XGL-RMEB	410		XGB-M10A	220
Fnet	XGL-FMEA	410		XGB-M08A	220
BACnet/IP	XGL-BIPT	400		XGB-M06A	200
EtherNet/IP	XGL-EIPT	400		XGB-M04A	200
Temperature controller module	XGF-TC4UD	900(300)	Extension base	XGB-M12E	190
	XGF-TC4RT	310(28)		XGB-M08E	180
Evnet input save	XGF-SOEA	700		XGB-M06E	180
Data log	XGF-DL16A	530		XGB-M04E	180

( ) means the current consumption for external DC24V.



I_{5V} : current consumption of each module DC5V circuit (internal current consumption)
I_{24V} : the average current consumption of DC24V used for output module

11.2 Specifications

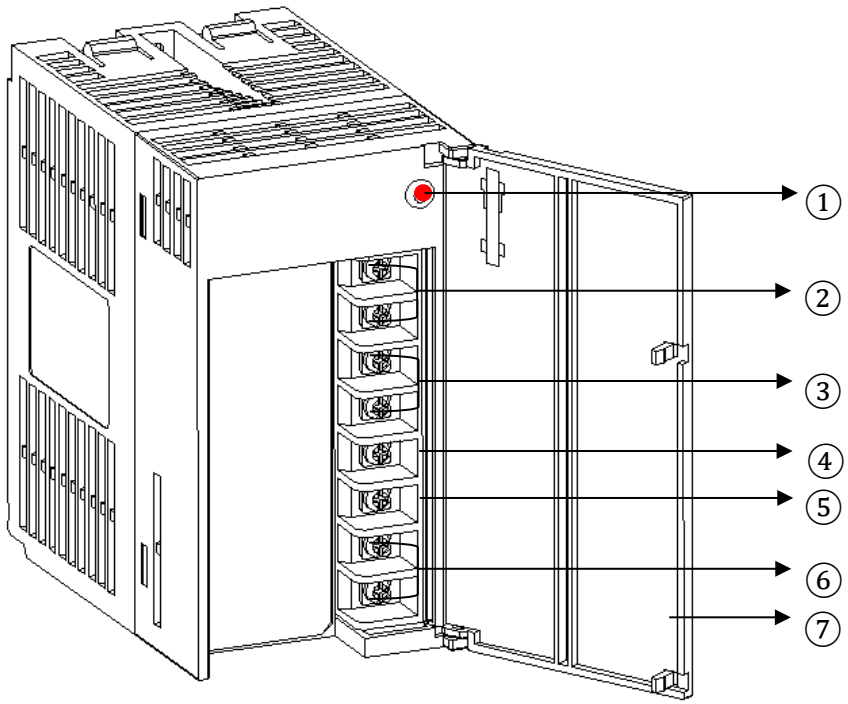
Item		XGP-ACF1	XGP-ACF2	XGP-AC23	XGP-AC24	XGP-SAC24 (SELV)	XGP-AC14	XGP-DC42	XGP-DC44
Input	Rated input voltage	AC110/220V		AC220V			AC110V	DC24V	
	Input voltage range	AC85V ~ AC264V		AC170V ~AC264V			AC85V~ AC132V	DC19.2V ~ 28.8V	
	Input frequency	50 / 60 Hz (47 ~ 63 Hz)						-	
	Power Consumption	185VA		330VA	140VA	180VA	180VA	39VA	57VA
	Inrush current	80APeak or less			20APeak or less			120APeak or less	
	Efficiency (or more)	65%			80%			60%	75%
	Input fuse	Built in (not replaceable by a user), UL standard product (Slow Blow Type)							
	Permitted momentary power failure	10 ms or less							
Output 1	Output voltage	DC5V (±2%)							
	Output current	3 A	6 A	8.5 A	10A			6A	9A
	Over current protection	3.2A or higher	6.6 A or higher	9A or higher	11.2 or higher			6.6 A or higher	9.5 A or higher
	Over voltage protection	5.5V ~ 6.5V							
Output 2	Output voltage	DC24V(±10%)	-					-	
	Output current	0.6 A							
	Over current protection	0.7 A or higher							
	Over voltage protection	None							
Relay Output	Usage	RUN contact(refer to chapter 8.3)							
	Rated switching Voltage/current	DC24V, 0.5A							
	Min. switching load	DC5V, 1 ㎃							
	Response time	Off→On/ On→Off: 10 ㎳ or less/12 ㎳ or less							
	Life span	Mechanical life:20 million and more times, electrical life: Rated switching voltage/current load 100,000 times or more							
Voltage status display		LED On when output voltage is normal							
Available cable size		0.75 ~ 2 mm^2							
Available clamped terminal		RAV1.25-3.5,RAV2-3.5							
Weight(kg)		0.32		0.36	0.4		0.36	0.32	0.36

Notes

1) The DC24V output voltage of the XGP-ACF1 product is guaranteed above the minimum load current (0.15A). In the case of no load, over rated voltage may be output.
2) Allowable Momentary Power Failure Time
   The time that input voltage keeps normal output voltage (normal operation) in the state that AC110/220V voltage is below rated value (AC85 / 170V).
3) Over current protection
   (1) If the current over the standard flows in DC5V, DC24V circuit, the over current protection device shutdowns the circuit to stop the system.
   (2) In case of over current, remove the causes such as lack of current capacity or short circuits etc. and then restart the system.
4) Over voltage protection
   If the voltage over the standard is applied in DC5V circuit, the over voltage protection device shutdowns the circuit to stop the system.
5) If an input higher than the rated input is applied to the power module, the system may be damaged, so Use it within the rated input range.
6) The condition of XGP-AC14/AC24 inrush current is when the On/Off cycle is more than 10 seconds with Cold Start at AC264V maximum load. If the On/Off cycle is less than 10 seconds, the inrush current may exceed 20A.
7) The XGP-SAC24 product is SELV power

11.3 Part names

Here describes the names of each part and its purpose of Power module.



NO.	Name	Usage
1	Power LED	DC5V power display LED
2	DC24V, 24G terminal	Power supply to the module required for DC24V in output module ▶ Only XGP-ACF1 does provide DC24V.
3	RUN terminal	Displaying RUN state of a system ▶ Off when the stop error of CPU occurs. ▶ It is Off when the mode of CPU is changed to STOP mode.
4	PE terminal	Grounding terminal to prevent electric shock.
5	LG terminal	Grounding terminal of power filter
6	Power input terminal	Power input terminal ▶ XGP-ACF1, XGP-ACF2: AC100 ~ 240V connection ▶ XGP-AC23, XGP-(S)AC24: AC200 ~ 240V connection ▶ XGP-AC14: AC85 ~ 132V connection ▶ XGP-DC42, XGP-DC44: DC24V connection
7	Terminal cover	Terminal block protection cover

11.4 Example of Current Consumption/Power Calculations

It describes which power module should be used for the XGT system with the following module.

Type	Model name	Number of installation	Voltage system	
			5V	24V
CPU Module	XGI-CPUH	1	0.96A	-
Main base 12 slot	XGB-B12M	1	0.23A	-
Input module	XGI-D24A	4	0.2A	-
Output module	XGQ-RY2A	4	2.0A	-
FEnet module	XGL-EFMTB	2	1.12A	-
Profibus-DP	XGL-PMEB	2	1.0A	-
Current consumption	Calculation (Current consumption of each modules x Number of installation)		0.96+0.23+0.2+2+1.12+1.0	-
	Result		5.51A	-
Power consumption	Calculation		5.51×5V	-
	Result		27.55W	-

Since the current consumption calculation for 5V displays 5.58V, XGP-ACF2 (for 5V:6A) or XGP-AC23 (for 5V:8.5A) should be used. If used XGP-ACF1(5V:3A), the system does not operate.

Chapter 9. Base and Extension Cable

9.1 Specifications

9.1.1 Main base

The Main base installs Power module, CPU module, I/O module, Special module and Communication module.

Item \ Type	XGB-M12A	XGB-M10A	XGB-M08A	XGB-M06A	XGB-M04A
No. of I/O modules installation	12 module	10 module	8 module	6 module	4 module
Dimensions (mm)	426 X 98 X 19	375 X 98 X 19	318 X 98 X 19	264 X 98 X 19	210 X 98 X 19
Hole distance to attach panel	406 X 75	355 X 75	298 X 75	244 X 75	190 X 75
Hole size to attach panel	ϕ 4.5 (using M4 screw)				
Screw size for PE connection	(+)PHM 3 X 6 washer(ϕ 5)				
Current consumption(A)	0.23	0.22	0.22	0.2	0.2
Weight (kg)	0.54	0.48	0.42	0.34	0.28

9.1.2 Extension base

The extension base installs Power module, I/O module, Special module and Communication module.

Item \ Type	XGB-E12A	XGB-E08A	XGB-E06A	XGB-E04A
No. of I/O modules installation	12 module	8 module	6 module	4 module
Dimensions (mm)	426 X 98 X 19	318 X 98 X 19	264 X 98 X 19	210 X 98 X 19
Hole distance to attach panel	406 X 75	298 X 75	244 X 75	190 X 75
Hole size to attach panel	ϕ 4.5 (using M4 screw)			
Screw size for PE connection	(+)PHM 3 X 6 washer(ϕ 5)			
Current consumption (A)	0.19	0.18	0.18	0.18
Weight (kg)	0.59	0.47	0.39	0.33

9.1.3 Extension cable

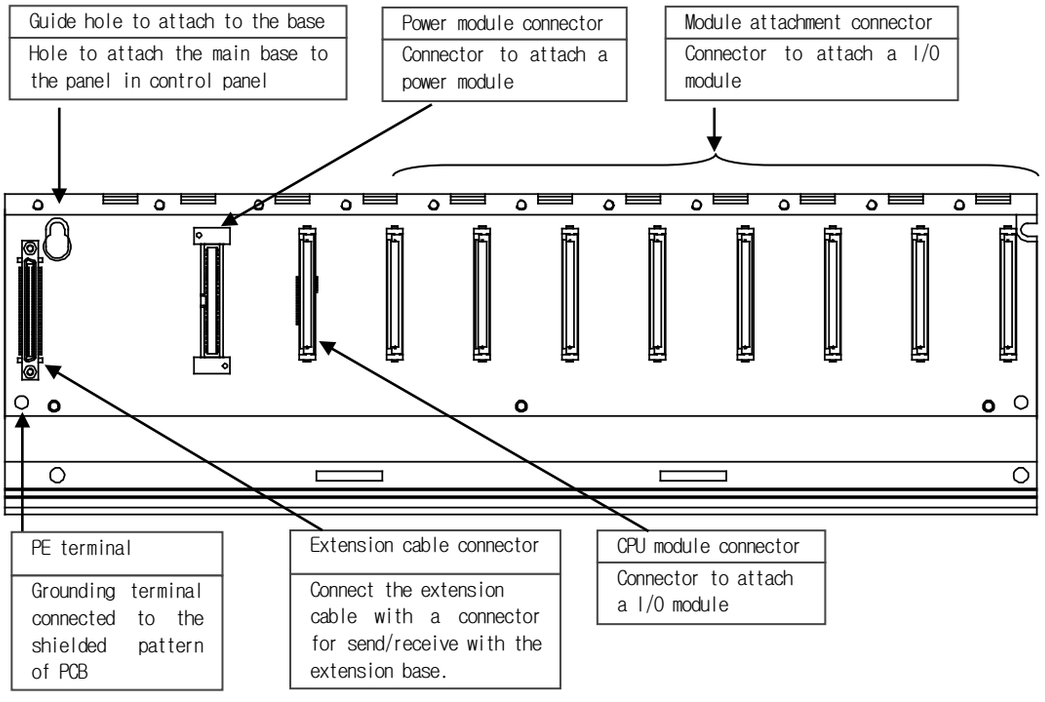
Item \ Type	XGC-E041	XGC-E061	XGC-E121	XGC-E301	XGC-E501	XGC-E102	XGC-E152
Length (m)	0.4	0.6	1.2	3	5	10	15
Weight (kg)	0.15	0.16	0.22	0.39	0.62	1.2	1.8

Notes

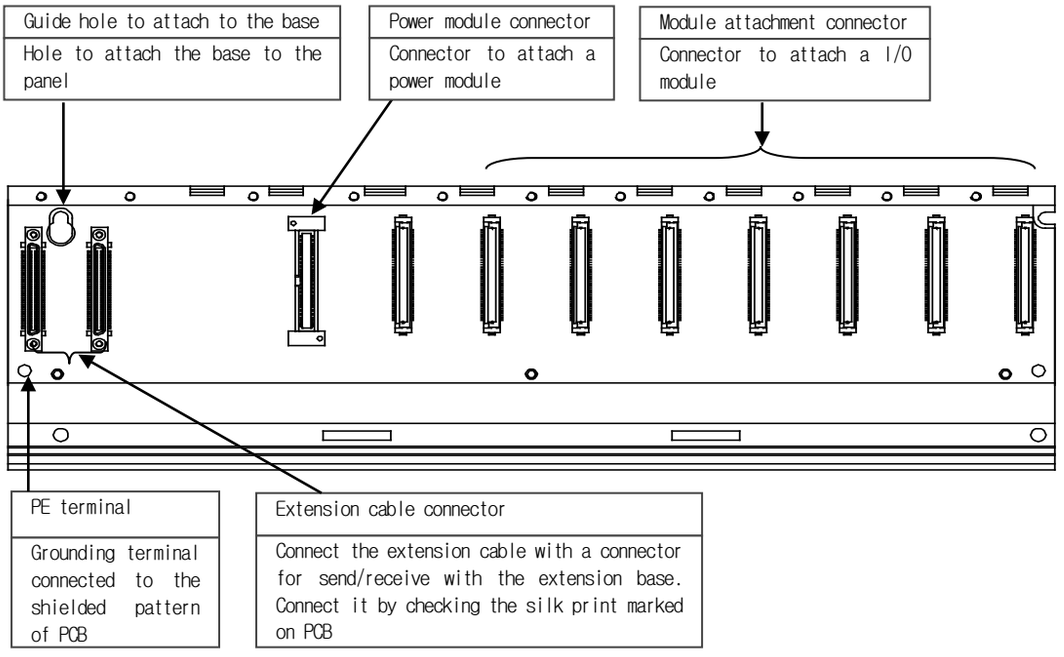
If using a combination with extension cable, it should not be longer than 15m.

9.2 Part Names

9.2.1 Main base



9.2.2 Extension base



Chapter 10 Built-in PID Functions

This chapter describes the XGK Series CPU built-in PID function.
Sections 10.2 and 10.3 cover the principles and structure of PID control; the subsequent sections are dedicated to the PID function built into XGK Series.

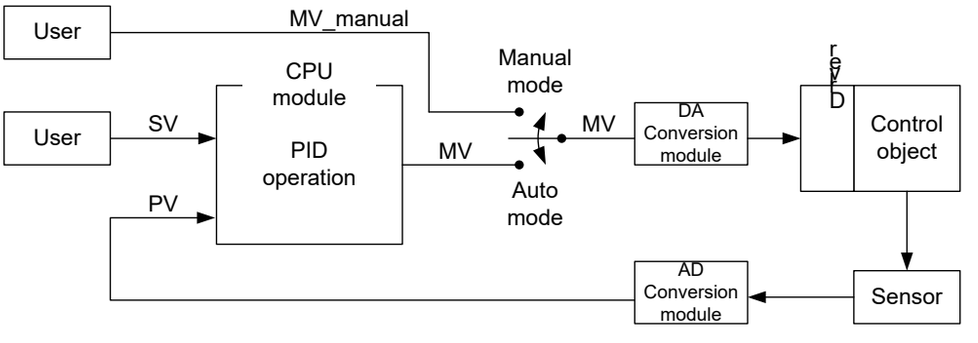
10.1 Characteristics

The features of the PID function built into XGK Series (XGK-CPUH, XGK-CPUA, XGK-CPUS, XGK-CPUE, XGK-CPUU) are as follows.

(1) Enables high-precision control operation.
(2) Supports a high-speed operation cycle of 0.6 ms
(3) XGK-CPUE, A, H, U, SN, HN, UN can each use 32 loops to calculate PID loops.
(4) Provides a symbol function for easy setting and monitoring.
(5) Supports the forward and reverse processes.
(6) Effectively prevents over/undershoot by means of powerful dual anti-windup.
(7) Allows operation by external equipment(HMI).
(8) Protects the system by limiting the maximum variation of PV
(9) Protects the driver by limiting the maximum variation, maximum value and minimum value of MV.
(10) Enables PID control by the Auto-tuning function.
(11) Enables the cascade PID control

10.2 PID control

PID control is a control method to keep the state of the control object at the Set Value. In case there exists an error between the preset Set Value and the value measured by the detector (current value), the controller operates to adjust the output (control signal) so that the current value can reach the Set Value.



As illustrated in the figure above, the PLC functions as a controller for the whole control system. The sensor and driver are used respectively for the current value detection and driving of the control object.
The sensor detects the current value of the control object and transmits them to the controller, the PLC transfers the proper output to the driver, the driver drives the control object according to the controller output, then again the sensor detects the changed current value and transmits them to the PLC (Closed Loop Control). The process of going around the control loop once is repeated at intervals ranging from a few seconds to hundreds of microseconds. The time taken is called the control cycle.

10.3 PID Control Operation

10.3.1 Terms

Below are the terms used to describe the PID control operation.

SV: The target value which the control object value should reach
T_s (Ts) : Sampling time (Control cycle)
K_p (Kp) : Proportional coefficient
T_i (Ti) : Integral time constant
T_d (Td) : Differential time constant
PV: Current value of the control object, which is detected by the sensor
ERR : Current error of the control object, which is represented by (SV – PV)
MV : Control input or controller output
MV_p (MVp) : Proportional component of MV
MV_i (MVi) : Integral component of MV
MV_d (MVd) : Derivative component of MV

10.3.2 PID expressions

PID expressions are as follows.

$$E = SV - PV \qquad (10.3.1)$$

$$MV_p = K_p E \qquad (10.3.2)$$

$$MV_i = \frac{K_p}{T_i} \int E\,dt \qquad (10.3.3)$$

$$MV_d = K_p T_d \frac{dE}{dt} \qquad (10.3.4)$$

$$MV = MV_p + MV_i + MV_d \qquad (10.3.5)$$

An error is a mathematical expression that tells about how far the current system is from the state desired by the user.
Here is an example; a user wants the water in a electric pot to be kept at 50 ℃ and the current water temperature is 35 ℃.

Then, SV is 50 ℃, PV is 35 ℃. The error (E) is 15 ℃, the difference between SV and PV. Upon detection of the error, the controller performs PID operation.
Note that, as shown in (10.3.5), MV is the sum of the P, I and D components (MV_p, MV_i, and Mv_d). Therefore, if the D component is excluded from the PID control expression, then the PI control results and, if the I and D components are excluded, then P control results.

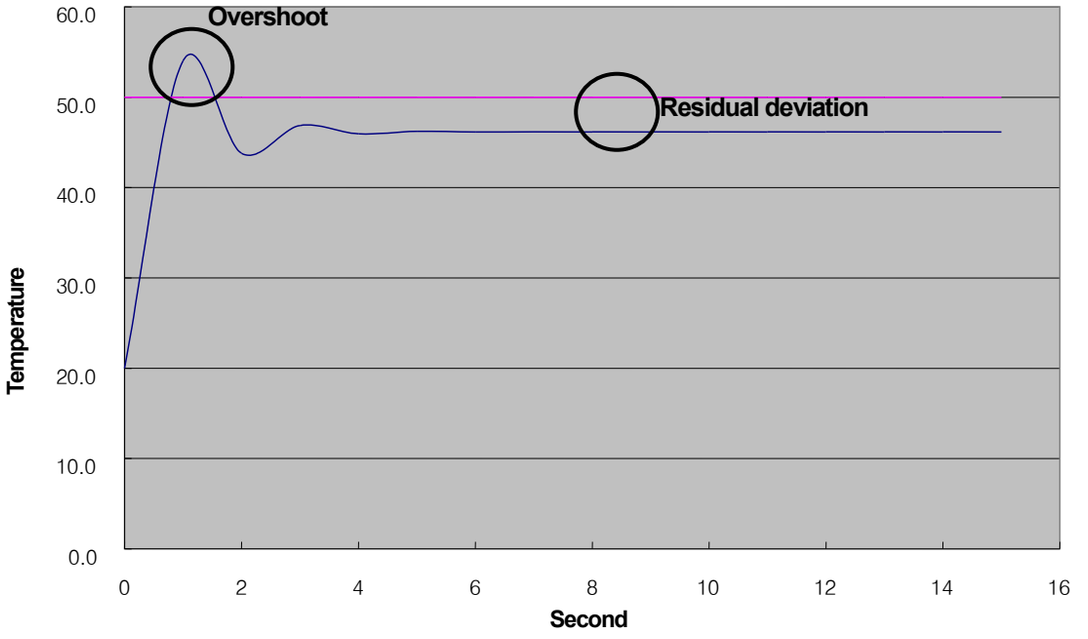
10.3.3 P control

As shown in the following expression (10.3.7), MV in P control is composed of the proportional term operation MV_p only. The proportional term operates in the form of the multiplication of the error by the proportional coefficient. The user must set the proportional coefficient properly according to the system. The greater the proportional coefficient is set, the more sensitive the system becomes to the error.

$$MV_p = K_p E \qquad (10.3.6)$$

$$MV = MV_p \qquad (10.3.7)$$

The development of P control of any virtual system has the following characteristics.
The virtual system below is designed for better understanding by the user, but may be different from an actual temperature system.



In the simulation above, SV is 50.0. the K_p value is properly adjusted to obtain the PV development above. Four seconds after the operation starts at the initial temperature of 20 ℃, the system settles into the stable state and thereafter remains constant at 46.2 ℃. The offset is 3.8 ℃ (around 7.6%). The reason there exists a permanent offset in P control is that, as PV approaches SV, the E gets smaller and also MV gets smaller and comes into equilibrium at the equilibrium point with K_p at the equilibrium point (46.2℃ above). The offset (residual deviation)in the P controller can be compensated by using PI control.

Proportional gain	Result
Decrease	The time to reach the Target value (SV) becomes longer.
Increase	The time to reach the Target value (SV) becomes shorter. (However, if the value increases too much depending on the system, there is a risk of overshoot.)

10.3.4 PI control

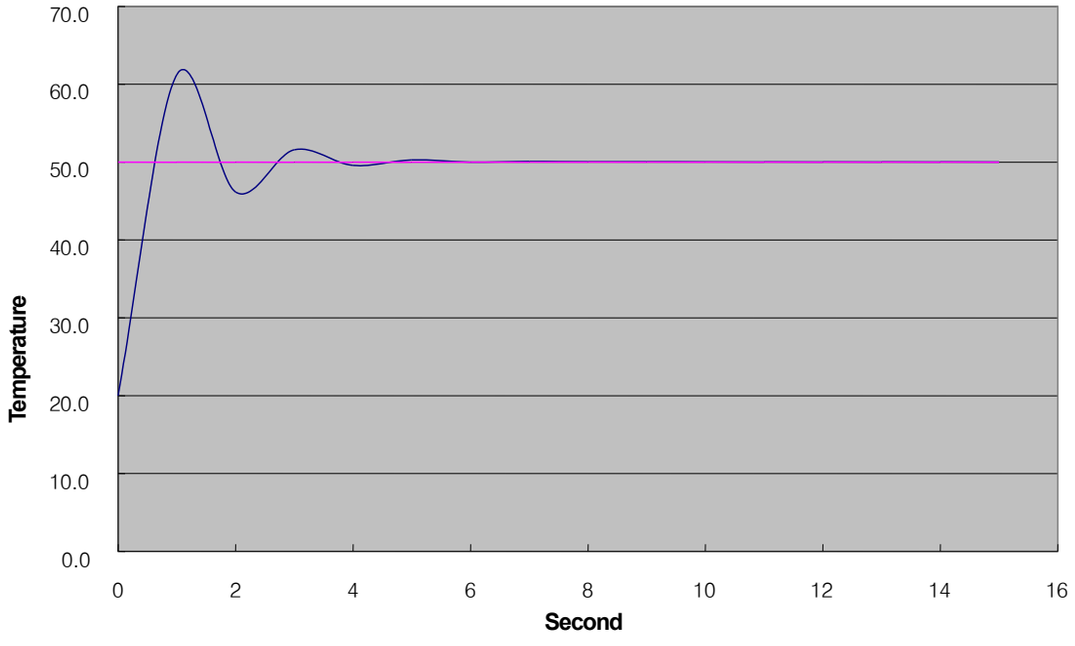
As shown in the following expression (10.3.10), PI (Proportional-Integral) control is calculated as the sum of the proportional and integral terms. To reduce the offset, the shortcoming of the proportional term, PI control uses the integrated error.

$$MV_p = K_p E \qquad (10.3.8)$$

$$MV_i = \frac{K_p}{T_i} \int E\, dt \qquad (10.3.9)$$

$$MV = MV_p + MV_i \qquad (10.3.10)$$

If the error, though constant, is integrated until it is reduced to zero, the integral amount is accumulated over time. Therefore the PI controller can be used to compensate for the offset characteristic of P control. It should be noted that the integral time constant (Ti) is the denominator of the integral term, therefore, the smaller the Ti value, the larger the integral effect. The following graph shows the result of PI control of the previously described P controlled system.

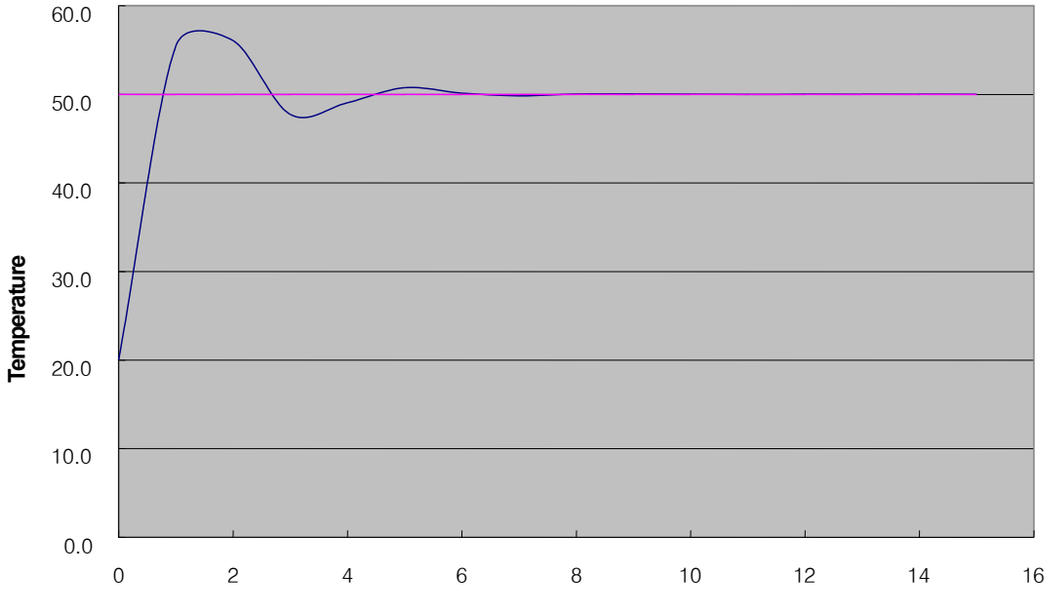


As a result of adding the integral effect, the offset disappears and the system converges exactly to 50 ℃. At the initial control, however, there occurs an overshoot in which the temperature rises to 61.2 ℃ and then falls. An excessive overshoot imposes a burden on the system or, in some cases, unstabilizes the system, therefore, it should be reduced through proper coefficient tuning or can be improved through PID control using the integral effect.

Integral time(Ti)	Result
Decrease	Removing residual deviation (However, if the value decreases too much depending on the system, there is a risk of overshoot.)
Increase	The effect of removing residual deviation is decrease.

10.3.5 PID control

As shown by (10.3.1) ~ (10.3.5), PID control reduces vibration during PI control by adding the derivative effect to PI control. The derivative effect operates only when the system state changes, regardless of the system error value. When the PV measurement signal at the system sensor is not clean or mixed with noise, however, an undesired derivative effect is created and causes an unstable operation of the heater or pump. To be sure that the derivative effect is not caused by such trivial changes as noise in the system, it is required to install a filter at the sensor input and set the derivative coefficient to a low value. in case of an actual system, it is common to set the derivative coefficient between 0.001 ~ 0.1.



Derivative time(Td)	Result
Decrease	Decrease vibration damping effect
Increase	Increase vibration damping effect (However, if the value increases too much depending on the system, the system is unstable)

10.4 PID Commands

10.4.1 PID loop States

A PID loop has 5 states: PIDSTOP, AT (Auto-tuning), PIDRUN, PIDCAS, and PIDPAUSE.

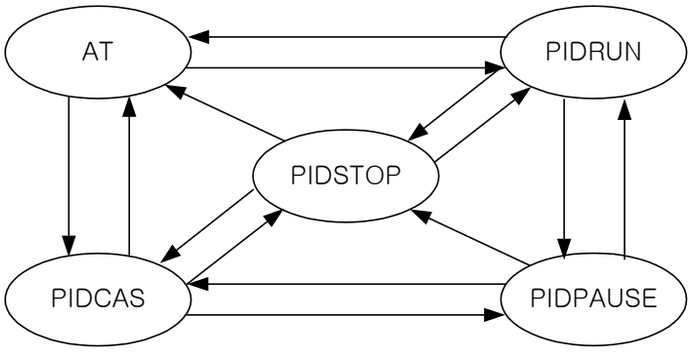
(1) PIDSTOP is a state in which the output (MV) is represented by MV_min, the internal states are initialized, and user settings are maintained. Under this condition, it is impossible to enter into PIDPAUSE.

(2) AT can be entered into by, in PIDSTOP only, setting the PIDxx_AT_EN bit to On and then executing the PIDRUN instruction. Once the AT operation is completed, the system automatically enters into PIDRUN. Tasks in AT include monitoring the system's response to a series of inputs and determining the PID coefficients (K_p, T_i, T_d) and operation cycle (T_s). Upon completion of AT, those values are updated and the previous coefficients are lost.

(3) PIDRUN is a state in which the PID loop executes a normal control operation. MV by PID operation is output and the changed settings are all applied since each scan operation is executed independently. If the contact in front of the PIDRUN command is set to On or if the PIDRUN command exists on the ladder program and PIDxx_REM_RUN is set to On, then it enter into PIDRUN.

(4) PIDCAS is a state in which two loops (master and slave loops) execute a control operation. Setting the two loops in the same way as with PIDRUN and then using the PIDCAS command enables to enter into PIDCAS, and the internal connection necessary for the inter working between the two loops is automatically generated allowing data exchange between the loops. Loops operated in cascade are displayed in the state flag PIDxx_STATE, under which state the remote operation PIDxx_REM_RUM bit does not operate.

(5) PIDPAUSE is a state in which output, internal states and user settings are all maintained and the control operation is paused. Setting PIDxx_PAUSE bit to On or using the PIDPAUSE command enables to enter into PIDPAUSE. But, this is only possible when the previous state is PIDRUN.

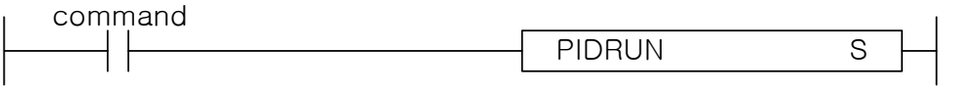


10.4.2 PID command group

The PID command group includes 5 instructions: PIDRUN, PIDCAS, PIDINIT, PIDPRMT, and PIDPAUSE.
All operations of the PID function are performed by the PIDRUN or PIDCAS command. The three other additional command (PIDINIT, PIDPRMT, PIDPAUSE) operate normally when the PIDRUN or PIDCAS instruction also exists on the ladder program. They are for the convenience in using the PIDRUN or PIDCAS command.

(1) PIDRUN

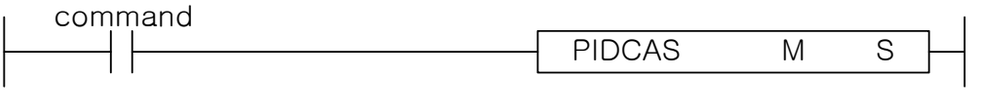
PIDRUN is the most basic PID control command that executes single PID loop control.



Operand S has the range 0 ~ 31 (constants) and means the loop number.

(2) PIDCAS

PIDCAS is a command to implement a cascade control using two loops.



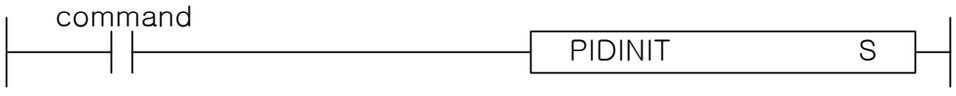
Operand M is the master loop with the range 0 ~ 31 (constants) and means the loop number.
Operand S is the slave loop with the range 0 ~ 31 (constants) and means the loop number.

Notes

Operands M and S in PIDCAS cannot be the same.
Operand M means the number of the master loop during cascade PID operation, while operand S means the number of the slave loop.
Basically, the master loop inputs its MV into SV of the slave loop during operation, while the slave loop executes its operation using the SV value input through the master loop.
In addition, the two loops observe each other's operation information (wind-up, manual mode, auto mode change, etc).

(3) PIDINIT

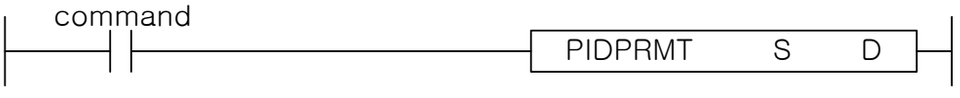
It initializes setting and status of applicable PID loop. All the setting values of the corresponding loop are initialized as 0 (Off in case of bit).



Operand S has the range 0 ~ 31 (constants) and means the loop number.

(4) PIDPRMT

PIDPRMT facilitates parameter changes in the loop memory configuration.
As soon as the contact is On, the main setting values of the PIDRUN command (SV, T_s, K_p, T_i, T_d) are simultaneously changed to the values set by the user. Make sure that each of the 5 setting values holds its respective data type as shown the table below.

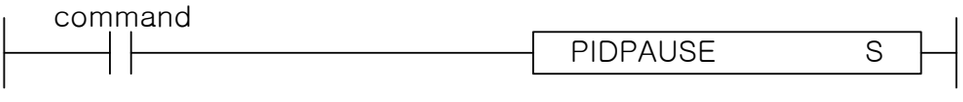


Device	Parameter	Data type	Setting example	Unit
S+0	SV	[WORD]	5000	
S+1	Ts	[WORD]	1000	0.1 msec
S+2	Kp	[REAL]	3.32	sec
S+4	Ti	[REAL]	9.3	sec
S+6	Td	[REAL]	0.001	sec

Operand S represents the first word address of the place the parameter to be changed is stored.
Operand D has the range 0 ~ 31 (constants) and means the loop number.

(5) PIDPAUSE

PIDPAUSE is used to switch the corresponding loop from the PIDRUN state to the PIDPAUSE state.



Operand S has the range 0 ~ 31 (constants) and means the loop number.

10.5 PID Flag Configuration.

The table below shows the PID flag configuration for use of the built-in PID function. (For details, refer to the description of common bits and individual data areas)

K device value	Symbol	Data type	Contents	Note
K10000+m	_PIDn_MAN	Bit	PID Output Select (0:Auto, 1:Manual)	PID monitor
K10020+m	_PIDn_PAUSE	Bit	PID Pause (0: STOP/RUN 1:PAUSE)	PID monitor
K10040+m	_PIDn_REV	Bit	PID Operation select (0:Forward, 1:Reverse)	PID monitor
K10060+m	_PIDn_AW2D	Bit	PID Anti Wind-up2 (0:Enable, 1:Disable)	
K10080+m	_PIDn_REM_RUN	Bit	PID Remote RUN bit for HMI (,0:STOP 1:RUN)	
K10100+m	_PIDn_P_on_PV	Bit	PID proportional calculation source select (0: ERR, 1: PV)	PID monitor
K10120+m	_PIDn_D_on_ERR	Bit	PID derivative calculation source select(0:PV, 1:ERR)	PID monitor
K10140+m	_PIDn_AT_EN	Bit	PID auto-tuning command setting (0:Disable, 1:Enable)	PID monitor
K10160+m	_PIDn_MV_BMPL	Bit	MV Non-impact Conversion for PID Mode Conversion (A/M) (0:Disable, 1:Enable)	PID monitor
K1024+32n	_PIDn_SV	INT	PID Set Value (SV)	PID monitor
K1025+32n	_PIDn_T_s	WORD	PID control cycle(T_s)[0.1ms]	PID monitor
K1026+32n	_PIDn_K_p	REAL	PID P - Constant (K_p)	PID monitor
K1028+32n	_PIDn_T_i	REAL	PID I - Constant (T_i)[sec]	PID monitor
K1030+32n	_PIDn_T_d	REAL	PID D – constant(T_d)[sec]	PID monitor
K1032+32n	_PIDn_d_PV_max	WORD	PID Max. delta_PV Limit	PID monitor
K1033+32n	_PIDn_d_MV_max	WORD	PID Max. delta_MV Limit	PID monitor
K1034+32n	_PIDn_MV_max	INT	PID MV maximum value limit/MV upper limit	PID monitor
K1035+32n	_PIDn_MV_min	INT	PID MV minimum value limit/MV lower limit	PID monitor
K1036+32n	_PIDn_MV_man	INT	PID Manual MV (MV_man)	PID monitor
K1037+32n	_PIDn_STATE	WORD	PID State	
K10370+320n	_PIDn_ALARM0	Bit	PID Alarm 0 (1:T_s setting is small)	
K10371+320n	_PIDn_ALARM1	Bit	PID Alarm 1 (1:K_p is 0)	
K10372+320n	_PIDn_ALARM2	Bit	PID Alarm 2 (1:delta PV is limited)	
K10373+320n	_PIDn_ALARM3	Bit	PID Alarm 3 (1:delta MV is limited)	
K10374+320n	_PIDn_ALARM4	Bit	PID Alarm 4 (1:MV max. value is limited)	
K10375+320n	_PIDn_ALARM5	Bit	PID Alarm 5 (1:MV min. value is limited)	
K10376+320n	_PIDn_ALARM6	Bit	PID Alarm 6 (1:AT abnormal cancel state)	
K10377+320n	_PIDn_ALARM7	Bit	PID Alarm 7	
K10378+320n	_PIDn_STATE0	Bit	PID State 0 (0:PID_STOP, 1:PID_RUN)	
K10379+320n	_PIDn_STATE1	Bit	PID State 1 (0:AT_STOP, 1:AT_RUN)	
K1037A+320n	_PIDn_STATE2	Bit	PID State 2 (0:AT_UNDONE, 1:DONE)	
K1037B+320n	_PIDn_STATE3	Bit	PID State 3 (0:REM_STOP, 1:REM_RUN)	
K1037C+320n	_PIDn_STATE4	Bit	PID State 4 (0:AUTO_OUT, 1:MAN_OUT)	
K1037D+320n	_PIDn_STATE5	Bit	PID State 5 (0:CAS_STOP, CAS_RUN)	
K1037E+320n	_PIDn_STATE6	Bit	PID State 6 (0:SLV/SINGLE, 1:CAS_MST)	
K1037F+320n	_PIDn_STATE7	Bit	PID State 7 (0:AW_STOP, 1:AW_ACT)	
K1038+32n	_PIDn_PV	INT	PID Current Value (PV)	PID monitor
K1039+32n	_PIDn_PV_old	INT	PID previous PV (PV_old)	
K1040+32n	_PIDn_MV	INT	PID Manipulated Value (MV)	
K1041+32n	_PIDn_MV_BMPL_val	WORD	PID no impulse operation memory	
K1042+32n	_PIDn_ERR	DINT	PID Control Error Value	
K1044+32n	_PIDn_MV_p	REAL	PID P component of the MV	
K1046+32n	_PIDn_MV_i	REAL	PID I component of the MV	
K1048+32n	_PIDn_MV_d	REAL	PID D component of the MV	
K1050+32n	_PIDn_DB_W	WORD	PID deadband setting (operate after stabilization)/Dead-zone	PID monitor
K1051+32n	_PIDn_Td_lag	WORD	PID Derivative function Lag Filter /derivative filter value	PID monitor
K1052+32n	_PIDn_AT_HYS_val	WORD	PID auto-tuning hysteresis setting / Auto tuning HYS	PID monitor
K1053+32n	_PIDn_AT_SV	INT	PID auto-tuning SV setting	PID monitor
K1054+32n	_PIDn_AT_step	WORD	PID auto-tuning state display (User setting disable)	
K1055+32n	_PIDn_INT_MEM	WORD	PID internal memory (User setting disable)	

* : User setting disable area

n : PID's loop number, decimal expression

m : PID's loop number, hexadecimal expression

* PID monitor: Flag that can be operated in the PID monitor window without registering it in the variable monitor window (refer to XG5000 manual for how to use PID monitor)

The PID command uses part of the K device to perform operation. When the PID function is not used, the K device can be used as a general Keep Relay.

The area of K0000 ~ K0999 is not used by the PID function. So as to guarantee compatibility with previous PLC models and secure the user's area.

K10000 ~ K1023F is the common bit area for all PID loops. The bit states and settings of the loops are collectively arranged in the front part of the PID area. The maximum number of 32 loops that can be used by the PID function - bits comprise a double word and the states and settings of each loop are stored in each bit order. But the loop number is represented in hexadecimal form.

K1024 ~ K1055 is the individual data area for PID Loop 0, where the settings and states of Loop 0 are stored. In this area are stored the settings for PID Loop 0 (SV, dPV_max, MV_man, T_s, Kp, Ti, Td, MV_max, MV_min, dMV_max) and, while the PID function is performed, the states for PID Loop 0 is stored(PV, ETC, MV, MV_rvs, ERR, MVp, Mvi, MVd, PV). By writing data into the set memory area, the user can change the PID setting at any time even during operation and obtain the corresponding results in the next cycle.

K1056 ~ K2047 is the memory part of Loops 1 ~ 31 that are in the same form as Loop 0. Each loop operates independently. If the user wants a dependent operation such as application of cascade, it need some work to connect the states and settings of the loop.
In addition, please refer to the K device memory configuration in the latter part of this manual for an understanding of the accurate memory location of PID.

For performance improvement of the product, the location and order of the memory area is subject to change without prior notice.

Notes

1) PID Memory statement 's format
_PIDn_MAN n : Loop no.
Ex) _PID10_MAN : Means MAN of Loop 10.

2) Common bit area
Ex) K10040+ (25) = K10040+ (19h) = K10059 : PID25_REV bit of Loop 25

3) Individual Data Area
Ex) K1024+ (32*1) = K1056 : SV of Loop 1

10.5.1 Common bit area

The common bit area is the part that contain all bit data for the 32 loops. All information 32 loops have for a signal item is combined to take the form of 32 bit double word and the nth bit provides information on the nth loop. m is the hexadecimal value of loop number n.

(1) _PIDn_MAN (PID Manual operation enable) - Setting Area

K device area : K10000+m
Unit : Bit
This allows you to determine whether the PID function of the nth loop will operate in AUTO or in Manual.
In AUTO, the result of performing a normal PID operation is output and In MANUAL, a random Set Value desired by the user (_PIDn_MV_man) is output without performing the PID operation.
If the corresponding bit is Off, then it is set to [Default] AUTO.

(2) _PIDn_PAUSE (PID PAUSE mode) - Setting Area

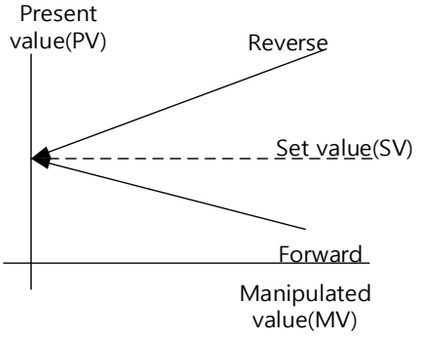
K device area : K10020+m
Unit : Bit
This allows the nth PID Loop to enter into PAUSE.
Even when switching from PAUSE to RUN again, the control continues to operate. If the system state is changed in PAUSE, the control system may produce an unexpected result. So, be very careful when using the the PAUSE function.

If the corresponding bit is Off, [Default] PAUSE is cleared.

(3) _PIDn_REVN (PID Reverse operation) - Setting Area

K device area : K10040+m
Unit : Bit
This allows you to set the control system as Forward system or Reverse system.
1) Forward: This is an operation to control the current value as the target value while the current value is smaller than the target value. (Heating)
2) Reverse: This is an operation to control the current value as the target value while the current value is greater than the target value. (Cooling)

Default : Off (Forward control)



Notes

_PIDn_PAUSE

(1) Putting the PID loop into PAUSE by using PIDn_PAUSE and PIDPAUSE brings all operations to a stop and outputs the last calculation values before PAUSE. If the system state is changed but proper control is not exercised, the control system may produce an unexpected result. So, be very careful when using the PAUSE function.
(2) In the first PLC scan, PIDRUN performs initialization to turn the PAUSE bit to Off. If PLC is turned on in PAUSE, it quits the PAUSE mode and enters into the STOP or Run mode.

(4) _PIDn_AW2D (PID Anti Wind-up 2 Disable) **- Setting area**

K device area : K10060+m
Unit : Bit
If this bit is turned OFF , The Anti Wind-up2 function is inactivated.
The Anti Wind-up function is described in detail in 10.6.
If the corresponding bit is Off, [Default] Anti Wind-up2 is enabled.

(5) _PIDn_REM_RUN (PID REMote RUN) **- Setting area**

K device area : K10080+m
Unit : Bit
This is the external operation command of the PIDRUN instruction
This is the external operation command of PIDRUN and has the same effect as when the contact of PIDRUN is turned On/Off. PIDRUN performs an OR operation of the "PIDRUN input condition" contact and the corresponding bit in order to decide whether to perform the operation. Using this function enables you to assign the operation contact of PIDRUN to a fixed address, facilitating easier use of external input/output devices such as HMI.
If the corresponding bit is Off, [Default](the contact is Off) PIDRUN comes to STOP.

(6) _PIDn_P_ov_PV (PID P on PV) **- Setting area**

K device value: K10100+m
Unit : Bit
This sets the P operation source of the corresponding PID loop to PV. P operation is performed on ERR or PV. P operation moves relatively slowly to a stable state when using PV than when using ERR under the unstable instantaneous control due to initial response or disturbance. This implies that the change in output is slow and a heavy load is not imposed on the driver. But, with the change in the range of the internal operation value, the Anti Wind-up function does not operate.
If the corresponding bit is Off, PID performs P operation on the ERR value and, if it is On, P operation is performed on the PV value.

(7) _PIDn_D_on_ERR (PID D on ERRor) **- Setting area**

K device area : K10120+m
Unit : Bit
This sets the D operation source of the corresponding PID loop to ERR. D operation is performed on ERR or PV. In case of D operation using ERR, D response shows a dramatic change at the moment SV is changed by the user and an excessive input may be applied to the driver. To prevent this, the method of using PV for D operation is used and the [Default] value is also set to support D operation using PV. Using ERR without this algorithm turns the corresponding bit On.
If the corresponding bit is Off, PID performs D operation on the PV value and, if it is On, D operation is performed on the ERR value.

Notes

_PIDn_REM_RUN

This bit is stored in the K device even though the PLC stops. If the PLC is stopped and restarted with this bit On (eg. power failure), the system is initialized at the first scan and then PIDRUN operates.

(8) _PIDn_AT_EN (PID Auto-Tuning ENable) **- Setting area**

K device area : K10140+m
Unit : Bit
This performs AT (Auto-tuning) of the corresponding PID loop. The approximate T_s (operation cycle) and PID coefficients (K_p, T_i, T_d) of the system are determined through AT. Do not forget to set the PIDn_HYS_val item before starting AT. The AT function is described in detail in 10.6.
If the corresponding bit is Off, the [Default] AT function is Disabled and AT is performed in the rising edge.

(9) _PIDn_MV_BMPL (PID MV BuMPLess changeover) **- Setting area**

K device area : K10160+m
Unit : Bit
This allows to not only determine an appropriate MV value through operation so that MV can continue smoothly when the corresponding PID loop changes from manual to auto output mode, but also reflect the MV value to the internal state so as to stabilize MV. This function shows an algorithm difference between single operation and cascade operation, but both operations are performed by this bit.
If the corresponding bit (in cascade operation, the corresponding bit of the master loop) is On, Bumpless changeover is performed. If it is Off, The [Default] Bumpless changeover function is Disabled.

Notes

_PIDn_AT_EN

This bit is initialized as Off when the PLC changes to Run mode. If the PLC is stopped and restarted with this bit On (eg. power failure), the system is initialized at the first scan but does not enter into AT mode again. Since there is no change in the PID settings, the system operates in the state before the PLC stops.

_PIDn_MV_BMPL

Assuming that the manual output value is 1000 and the auto output of 2000 is required, the driver receives the value of 1000 for system operation and instantly receives 2000 at the time of mode conversion If the corresponding bit is On, the corresponding PID loop outputs 1000 at the time of mode conversion and performs an operation in order that the output gradually increases to 2000.

10.5. 2 Individual data area

The individual data area is in the range of K1024 ~ K2047 and a 32 word length is assigned for each of 32 loops. So, the individual data area of the nth loop is K (1024+32n) ~ K (1055+32n).

(1) _PIDn_SV (PID Set-point Value) **- Setting area**

K device area : K1024+ 32n
Unit : INT [-32768 ~ 32767]
This is the SV setting part of the corresponding loop.
As described in the previous section, this is used to set the system state as desired by the user. The system state is displayed in numeral and must be input after converted to PV according to the system gain.
In case of a system in which PV is sensed as 5000 at the temperature of 50℃, if the temperature is controlled at 50℃, SV is set to 5000.

(2) _PIDn_T_s (PID Sampling Time) **- Setting area**

K device area : K1025+ 32n
Unit : WORD [0 ~ 65535]
This sets the sampling time of the corresponding loop.
The sampling time is a time cycle in which a control operation is performed. This can be set in the range of 0.1msec to 6553.5 msec in the unit of 0.1msec; an integer value of 1 is assigned for each 0.1ms. If 100ms of sampling time is required, 1000 is input to _PIDn_T_s.
If the user sets the sampling time to 0, the scan cycle control mode is also set. In this case, as a control operation occurs in each scan, a full speed control operation is performed in the current environment.
When the current scan speed is exceeded due to the too short sampling time, The ALARM bit of _PIDn_STATE is displayed.

(3) _PIDn_K_p (PID Proportional Gain) **- Setting area**

K device area : K1026+ 32n
unit : REAL [-3.40282347e+38 ~ -1.17549435e-38 , 0 , 1.17549435e-38 ~ 3.40282347e+38]
This sets the proportional constant(K_p) for the corresponding loop. As K_p is multiplied into the P, I, D (Proportional, Integral, Derivative) terms, As K_p increases, the proportional and differential effects increase, and the integral effect decreases.
If _PIDn_K_p is set to 0, P control is not performed. For more details, refer to 10.6
K_p can be set in the short/long real number (REAL) range.

Notes

_PIDn_SV

PID changes the output (MV) through several times of operations until SV equals PV. So, when SV is 0, PIDRUN may be seen as inoperable.
If SV of a simple heater with the current temperature of 20℃ and PV of 2000 (20℃) is set to 0, PID will output 0 as MV and will not output until PV goes below 0 (0℃).

(4) _PIDn_T_i (PID integral Time gain) **- Setting area**

K device area : K1028+ 32n
Unit : REAL [-3.40282347e+38 ~ -1.17549435e-38 , 0 , 1.17549435e-38 ~ 3.40282347e+38]
This sets the integral time constant (T_i) of the corresponding loop. As T_i divides the I (integral) term, As the T_i increase the integral effect is decrease.
If _PIDn_T_i is set to 0, I control is not performed. For more details, refer to 10.6.
K_p can be set in the short/long real number (REAL) range.

(5) _PIDn_T_d (PID derivative Time gain) **- Setting area**

K device area : K1030+ 32n
Unit : REAL [-3.40282347e+38 ~ -1.17549435e-38 , 0 , 1.17549435e-38 ~ 3.40282347e+38]
This sets the derivative time constant (T_d) of the corresponding loop. As T_d is multiplied into the D (derivative) term, the T_d increase, the derivative effect increase.
If _PIDn_T_d is set to 0, D control is not performed. For more details, refer to 10.6.
K_d can be set in the short/long real number (REAL) range.

(6) _PIDn_dPV_max (PID delta PV MAXimum limit) **- Setting area**

K device area : K1032+ 32n
Unit : WORD [0 ~ 65535]
This limits the PV variation of the corresponding loop.
PV does not always reflect the exact system state. Unwanted signals caused by sensor malfunction, noise or disturbance can be mixed and reflected in PV. Like this, PV often undergoes a sudden change and causes a large change in PID output. It is a priority to prevent a PV change greater than the value set in _PIDn_dPV_max. Meanwhile, if _PIDn_dPV_max is set too small, the system change is slowly reflected and the convergence time takes longer. Therefore, setting should be made according to the system features.
If this is set to 0, the function does not operate.

(7) _PIDn_dMV_max (PID delta MV MAXimum limit) **- Setting area**

K device area : K1033+ 32n
Unit : WORD [0 ~ 65535]
This limits the MV variation of the corresponding loop.
A sudden change in the output of the control system may cause a system instability or impose a heavy load on the driver resulting in failure or unstable operation. To prevent this, this item limits the controller output variation. If this is set to 0, the function does not operate.

(8) _PIDn_MV_max (PID MV MAXimum limit) **- Setting area**

K device area : K1034+ 32n
Unit : INT [-32768 ~ 32767]
This limits the maximum MV value of the corresponding loop.
This prevents overload and system errors by limiting the maximum value of the controller output transferred to the output equipment. This also prevents the transfer of an unwanted value by overflow.
If PIDn_MV_max and PIDn_MV_min are both set to 0, this function does not operate.

(9) _PIDn_MV_min (PID MV MINimum limit) **- Setting area**

K device area : K1035+ 32n
Unit : INT [-32768 ~ 32767]
This limits the minimum MV value of the corresponding loop.
This prevents system errors by limiting the minimum value of the controller output transferred to the output equipment.
This also prevents the transfer of an unwanted value by overflow.

(10) _PIDn_MV_man (PID Manual MV variable) **- Setting area**

K device area : K1036+ 32n
Unit : INT [-32768 ~ 32767]
When the corresponding loop is set to manual operation, this designates MV.
If _PIDn_MAN in the common bit area is ON, the PIDn_MV_man value is output as the MV value of the corresponding loop.

(11) _PIDn_STATE (PID STATE) **- Setting Prohibited**

K device area : K1037+32n or K10370+320n ~ K1037F+320n
Unit : WORD [h00 ~ hff] or bit
This displays the state or abnormalities of the corresponding loop.
This is located at the address K1037+32n and each of the 16 bits has its own meaning. Only some of the 16 bits are currently in use.
STATE turns On when the corresponding operation occurs and returns Off when it is cleared.
The upper 8 bits of STATE (_PIDn_ALARM 0~_PIDn_ALARM 7) display abnormalities of the loop. The lower 8 bits of STATE (_PIDn_STATE 0~_PIDn_STATE 7) displays the control state of the loop.
Each bit is assigned as follows.
_PIDn_ALARM 0 (K10370+32n): Indicates the operation is skipped because T_s setting is set too small.
_PIDn_ALARM 1 (K10371+32n): Indicates the K_p value is 0.
_PIDn_ALARM 2 (K10372+32n): Indicates the PV variation is limited.
_PIDn_ALARM 3 (K10373+32n): Indicates the MV variation is limited.
_PIDn_ALARM 4 (K10374+32n): Indicates the MV Maximum value is limited.
_PIDn_ALARM 5 (K10375+32n): Indicates the MV Minimum value is limited.
_PIDn_ALARM 6 (K10376+32n): Indicates AT has been canceled abnormally.

_PIDn_STATE 0 (K10378+32n): Indicates PID operation is performed. (valid in case of PLC Run)
_PIDn_STATE 1 (K10379+32n): Indicates PID AT is being performed.
_PIDn_STATE 2 (K1037A+32n): Indicates PID AT has been completed.
_PIDn_STATE 3 (K1037B+32n): Indicates PID is in remote operation by _PIDn_REM_RUM bit.
_PIDn_STATE 4 (K1037C+32n): Indicates PID is in manual output mode.
_PIDn_STATE 5 (K1037D+32n): Indicates the PID loop belongs to cascade.
_PIDn_STATE 6 (K1037E+32n): Indicates the PID loop is the cascade master loop.
_PIDn_STATE 7 (K1037F+32n): Indicates Aniti Wind-up is in operation during PID operation.

(12) _PIDn_PV (PID Process Variable) **- Input/Output area**

K device area : K1038+ 32n
Unit : INT [-32768 ~ 32767]
This displays the PV of the corresponding loop
PV is an indicator of the current state of the system. In general, the input from the sensor is stored on the U device of the CPU via an input device such as A/D conversion module: At each scan, this value should be transferred to _PIDn_PV using a command such as MOV. Please refer to the program examples in the latter part of this manual.

(13) _PIDn_PV_old (PID previous PV) **- Setting Prohibited**

K device area : K1039+ 32n
Unit : INT [-32768 ~ 32767]
This is used internally for derivative and integral operations at a step prior to the PV state of the corresponding loop. This can be referred to when necessary. Input of a random value will lead to a malfunction.

(14) _PIDn_MV (PID Manipulated output Variable) **- Input/Output area**

K device area : K1040+ 32n
Unit : INT [-32768 ~ 32767]
This displays the MV of the corresponding loop.
MV is a signal source for system driver. Contrary to the description of _PID_PV in (12), this values is transferred at each scan to the U device using a command such as MOV and then used as a system startup input via an output device such as D/A conversion module. Please refer to the program examples in the latter part of this manual.

(15) _PIDn_MV_BMPL (PID MV BuMPLess changeover actual value) **- Setting Prohibited**

K device area : K1041+ 32n
Unit : WORD [0 ~ 65535]
This stores the information necessary for the Bumpless changeover operation of the corresponding loop. The corresponding memory is automatically set and input by PID-internal operation and this value should not be set by the user.

Notes

Bumpless Change Over

When the PID controller is converted to manual output mode and back again to auto output mode, the output is increased again from 0 as in a freshly started control system. This causes a mode changing impact to the system. In other words, when a certain output is applied to the system in manual mode, and when it is switched to automatic mode, the output rises from 0 again. To avoid this, the MV_BMPL function is used; when the current system is converted to auto mode with the corresponding bit authorized, this senses the system's last state in manual mode and lets the control output continue smoothly from that point. Furthermore, with the master loop MV_BMPL in cascade control authorized, the master loop senses the state of the slave loop and generates a smoothly continuing control output.

(16) _PIDn_ERR (PID ERRor value) - Setting Prohibited

K device area : K1042+ 32n
Unit : DINT [-2747483648 ~ 2747483647]
This is the current error value of the corresponding loop.
An error value in PID is defined as SV – PV. This is used as an indicator of how far the current state is from the desired state. If the error is 0, it means the control system reaches its desired state. The control system can be considered ideal if, when a control starts, the error rapidly decreases in the transient state and, when it reaches the normal state, vibration is minimized and the offset(the error in the stable state) is kept at 0.

(17) _PIDn_MV_p (PID MV Proportional component) - Setting Prohibited

K device area : K1044+ 32n
Unit : REAL [-3.40282347e+38 ~ -1.17549435e-38 , 0 , 1.17549435e-38 ~ 3.40282347e+38]
This displays the proportional control value of the corresponding loop.
If the error of the current system is known, its integral and derivative control output values can also be calculated independently. Comparing the 3 output values enables to determine the exact operational state of the control system and PID control. MV is the sum of MV_p, MV_i, and MV_d.

(18) _PIDn_MV_i (PID MV Integral component) - Setting Prohibited

K device area : K1046+32n ~ K1047+32n
Unit : REAL [-3.40282347e+38 ~ -1.17549435e-38 , 0 , 1.17549435e-38 ~ 3.40282347e+38]
This displays the integral control value of the corresponding loop.

(19) _PIDn_MV_d (PID MV Derivative component) - Setting Prohibited

K device area : K1048+32n ~ K1049+32n
Unit : REAL [-3.40282347e+38 ~ -1.17549435e-38 , 0 , 1.17549435e-38 ~ 3.40282347e+38]
This displays the derivative control value of the corresponding loop.

(20) _PIDn_DB_W (PID DeadBand Width) - Setting area

K device area : K1050+32n
Unit : WORD, setting range : [0 ~ 5000]
This sets the deadband of the corresponding loop. It is set only as a positive value, and operates in the area as much as the set value above and below SV. In other words, when PV enters [SV – DB_W] ~ [SV + DB_W], SV is substituted for PV value (cannot be checked from outside). If this value is set to 0, the corresponding function does not operate.

Notes

Deadband
This is used to let PV fully approach SV during system control so as to eliminate fine output variations due to fine state changes. In PID control, if a value is entered into DB_W, a dead band as much as that value is formed above and below SV. If PV follows SV into the deadband during control, ERR is forcibly calculated as 0 and, as far as PV remains in this area, the MV variation stops. This has the same effect as stopping the controller for a while in the stabilization area and helps avoiding a heavy load on the driver during stabilization operation. It is recommended to fully stabilize the system before use in the area to be set as the deadband. Otherwise, when entering the deadband, the controller experiences a temporary output excess.

(21) _PIDn_Td_lag (PID Td lag filter) **- Setting area**

K device area : K1051+ 32n
Unit : WORD [0 ~ 65535]
This sets the primary delay filter for the corresponding loop so as to allow the derivative effect acting as an instantaneous impact to act more slowly and continuously. If the corresponding value is set high, the derivative effect becomes smoother and, if it set to 0, the corresponding function does not operate. The derivative value leads the system output to low vibration and helps avoid a heavy load on the driver.

(22) _PIDn_AT_HYS_val (PID Auto-Tuning HYSteresis value) **- Setting area**

K device area : K1052+ 32n
Unit : INT [-32768 ~ 32767]
This sets a directional deadband appropriate for AT. The _PIDn_AT_HYS_val value operates differently as a upper deadband when PV increases and as a lower deadband when PV decreases. Proper setting of this value is critical for successful AT. Setting _PIDn_AT_HYS_val is described in 10.7.4.

(23) _PIDn_AT_SV (PID Auto-Tuning SV) **- Setting area**

K device area : K1053+ 32n
Unit : INT [-32768 ~ 32767]
This separately sets AT_SV to be used as SV for AT of the corresponding loop. AT enables PV to vibrate 3 times up and down around AT_SV.

(24) _PIDn_AT_step (PID Auto-Tuning step) **- Setting Prohibited**

K device area : K1054+ 32n
Unit : INT [-32768 ~ 32767]
This displays the AT operation state of the corresponding loop. _PIDn_AT_step has values from 0 to 7; 0 indicates “before AT operation” and 7 indicates “AT operation completed”. 1, 3 and 5 indicate the PV-increasing areas and 2, 4 and 6 indicate the PV-decreasing area.

Caution
1) **Setting Prohibited** : The items marked with – Setting Prohibited are prohibited from being set by the user. The corresponding area not only provides the user with operational information but also stores information necessary for operations. A random setting of the corresponding area causes the malfunction of the control system. 2) **Input/Output Area** :_PIDn_PV and _PIDn_MV belong to **- Input/Output Area,** so use them in a way they are connected to external equipment (AD, DA device).

Notes

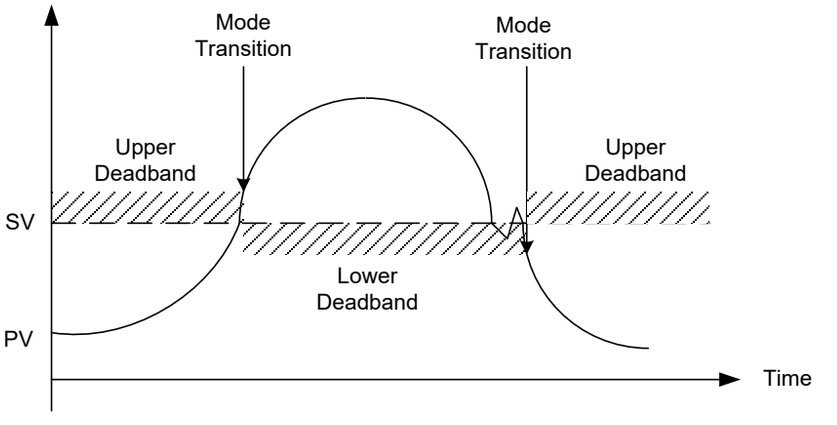
Transient and Steady States

1) Transient State : A state during which the control system starts its control operation and reaches the desired control state. There often occurs an instantaneous output variation and, while the integral value approaches stability, there may occur a vibration or overshoot.

2) Steady States :A state during which the control system reaches the desired state after passing through the transient state vibration is eliminated, there may occur an offset and there is little change in the output value.

Upper / Lower Deadbands

When the analog output of the sensor is converted into a digital signal by means of an AD device, much of the signal is mixed with noise. The PID control command executes Auto-tuning using this converted value; it enables PV to increase and decrease 3 times up and down at SV. In the course of this process, if noise is input at the time when SV equals PV, a single up and down conversion is incorrectly perceived as multiple conversions. This is the same effect as the chattering of the digital switch. To overcome this, the PID controller uses a unidirectional deadband (Hysteresis); when the PV value of the system increases toward SV, the set deadband value operates in the upper part of SV and when the PV value passes SV and decreases, the set deadband value operates only in the lower part of SV



10.6 Convenient Additional Functions of PID Command

This section describes additional functions that can be conveniently used in combination with the PID command.

10.6.1 Various PID-based control methods

Commonly used among PID controls are P control, PI control, PD control and PID control. When a certain feature (mostly stabilization) is required, ID control, I control or D control is often used though they are somehow more complicated. To implement these various controls, PIDRUN includes functions that enable or disable controls by P, I, and D, respectively. In case of P control, the P controller can be configured by setting _PIDn_Ti and _PIDn_Td to 0. Similary, the ID controller can be obtained by setting _PIDn_Kp to 0 and assigning ID control coefficients to _PIDn_Ti and _PIDn_T.
One special thing about the PIDRUN command is that, in case of ID control, setting _PIDn_Kp to 0 theoretically results in the controller 's 0 output. (Refer to Expressions 10.3.2 ~ 10.3.5) Actually, however, PIDRUN, if 0 is input to _PIDn_Kp, internally calculates as MVp = 0 and K_p = 1, thus enabling ID, I control and D control.
For example, when PI control is required, only _PIDn_Kp and _PIDn_Ti are set and 0 is input to _PIDn_Td. When ID control is required, _PIDn_Kp is set to 0 and only _PIDn_Ti and _PIDn_Td are set.

10.6.2 Operation and function of anti wind – up

PIDRUN provides 2 Wind-up prevention functions: Anti Wind-up 1 and Anti Wind-up 2. The more basic of the two, Anti Wind-up 1 operates for all I-related controls¬ - I control, PI control, ID control and PID control - and cannot be cleared. This operates by limiting Mvi (the integral term results) using _PIDn_MV_max, _PIDn_MV_min.
Aniti Wind-up 2 is organically connected to MVp (the proportional term results) In case MV reaches ± (_PIDn_MV_max) on MVp only, regardless of the MVi and MVd values, due to a large system error, Mvi does not perform a calculation but keeps the previous value. In case the error is large, PV is brought near SV (operating point) by MVp, not by Mvi or MVd, and then I control is resumed to prevent and excessive value from being entered into Mvi. The operation of Anti Wind-up 2 can be cleared by the user by setting the _PIDn_AW2D bit on the common bit area to On. This operates only during PI control or during a control combining P control and I control, e.g. PID control.

10.6.3 Operation and function of Auto-tuning

PIDRUN has an AT function that enables to test operate the system though several basic settings and calculate _PIDn_T_s, _PIDn_K_p, _PIDn_T_i and _PIDn_T_d appropriate for the system. The values of _PIDn_MV_min, _PIDn_MV_max, _PIDn_AT_HYS_val, and _PIDn_AT_SV should be set before AT. Based on these values, the AT function sets and operates MV over 3 different times in order, examines the repeated system state (PV) reaction, measures the time taken for the system state (PV) to reach the AT Set Value ((AT_SV) and the vibration level, and accordingly calculates _PIDn_T_s, _PIDn_K_p, _PIDn_T_i and _PIDn_T_d. To calculate the exact tuning value, please refer to “AT Setting” in 10.7.4 for proper AT operation.

Notes

Deletion of Previous Data upon Completion of Auto-tuning (AT)

When the AT operation described in 10.6.3 is completed, the new values of _PIDn_T_s, _PIDn_K_p, _PIDn_T_i and _PIDn_T_d are automatically substituted for the existing values.
Therefore, that the previous value of _PIDn_T_s, _PIDn_K_p, _PIDn_T_i and _PIDn_T_d are deleted.

10.6.4 Operation and function of cascade

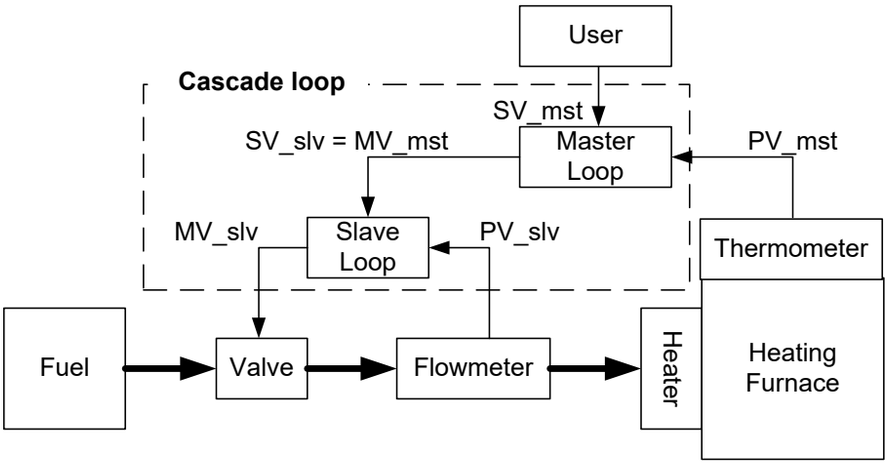
PDCAS performs cascade PID control through sequential operation of two PID loops.
Generally, cascade PID control is used for temperature control through chemical process or fuel control; The two loops used here are called master loop and slave loop. As an example of temperature control through fuel flow, in case of a single loop PID control, the fuel valve is opened and closed to control the fuel flow and consequently control the temperature of the heating furnace.

In this case, equipping the system with a fuel flow meter enables cascade PID control that consists of flow control and temperature control. The slave loop controls the flow using the valve and the master loop controls temperature using the flow. The master loop transfers the desired flow to the slave loop, while the slave loop monitors the flow meter and adjusts the flow using the valve.so that fuel corresponding to the flow desired by the master loop is injected. The slave loop operates on the flow Set Value set by the master loop, regardless of temperature.

In terms of the internal cascade operation, the master loop measures the temperature (PV_mst) in a more delayed manner than the slave loop and transfers the flow value (MV_mst) computed for the user's desired temperature (MV_mst) to the slave loop.
The slave loop sets the flow value (MV_mst) transferred from the master loop as the Set Value (SV_slv) and measures the fuel injection amount (PV_slv) in a more frequent manner than the master loop in order to control the valve opening and closing (MV_slv). Therefore, cascade functions to transfer MV (MV_mst) of the master loop to SV (SV _slv) of the slave loop when two loops are in operation.

If the slave loop is converted to manual output mode, the master output is not used and the master loop is also converted to manual output mode. The manual mode _PIDn_MAN bit is not turned ON in the master loop.
If the slave loop is converted to auto output mode again, the master loop is also turned to auto output mode. If _PIDn_MV_BMPL is set to On, state data is exchanged between the two loops to ensure a smooth conversion.

If the slave loop is in Anti Wind-up mode, the master loop operates in PIDPAUSE mode. When there is a need to increase or decrease the slave Set Value (SV_mst) despite the occurrence of anti wind-up, this function prevents the occurrence of 2nd wind-up for the whole cascade loop. This function always operates according to the corresponding conditions and the _PIDn_PAUSE bit is not turned On.



Notes

Auto-tuning (AT) of Cascade System

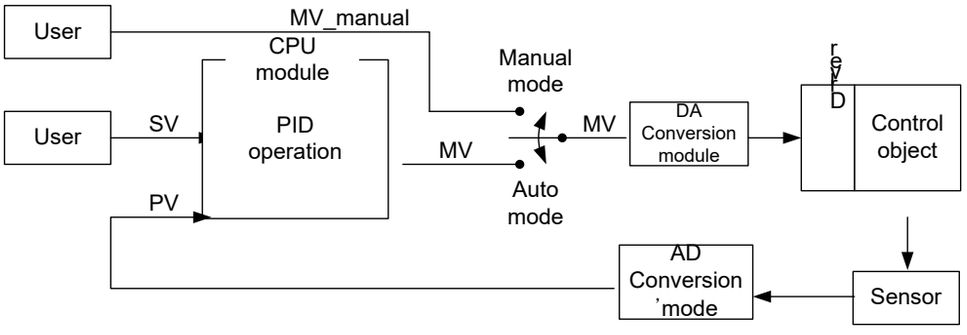
In case of AT of a cascade system, AT of the slave loop precedes AT of the master loop. For AT of the slave loop, it is required to predict how much SV the slave loop receives from the master loop and setting AT_SV to this value enables the slave loop to operate as an independent loop. AT performance may differ according to the predicted value.

10.7 How to Use PID Command

This section describes how to use PID instructions.
For detailed description of the functions of the CPU, specific modules and XG5000, refer to the corresponding manuals

10.7.1 Hardware Configuration

The example system has a configuration as shown below.

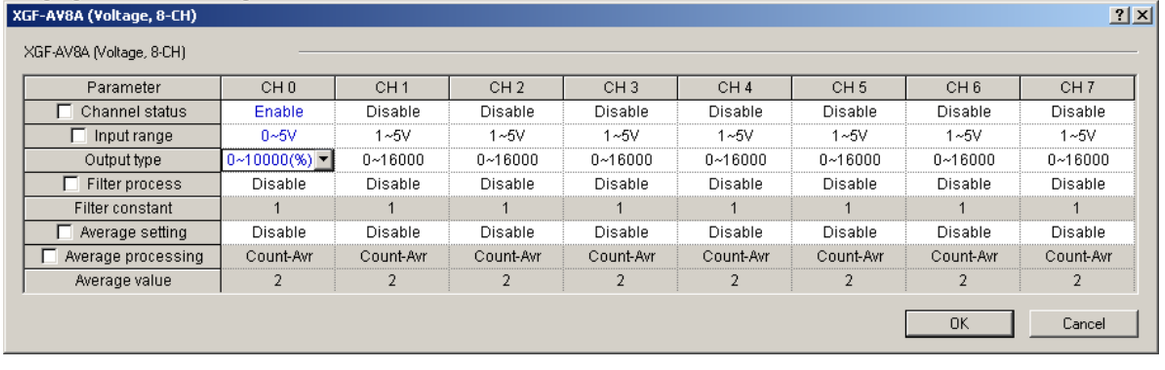


(1) CPU (XGK-CPUH)

The CPU is where PID operation occurs and so can be called “PID controller”. The controller receives data sensed from the input module, calculates a proper output through operation, and then transfers it to the output module. What the user should do is to connect input and output and design the interior of the PID controller (tuning).
Generally, analog input module and analog output modules are used for input and output, respectively.

(2) Analog Input Module(XGF-AV8A)

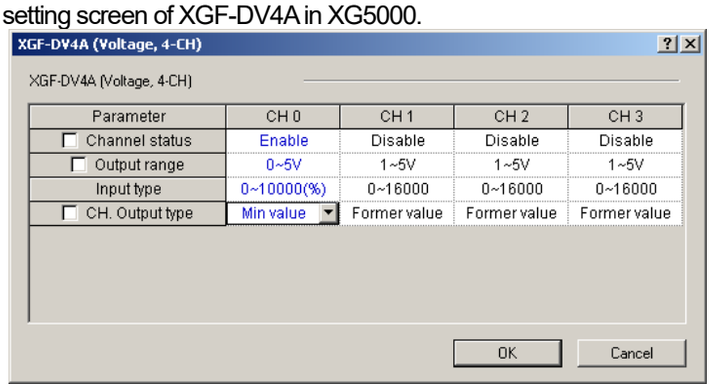
This functions to receive the state of the control object from the sensor and transfer it to the CPU module. The analog input module channel 0 enables to receive a voltage of 0 V ~ 5 V as input and transfer its digital value to the PLC as output. There are 8 channels (CH 0 ~ CH 7) in XGF-AV8A The setting for XGXGF-AV8A can be changed through the I/O parameter setting window that appears when selecting I/O Parameter from the parameter items in the project window. Channel 0 is changed to “Enable” mode and the input range is set to 0 ~ 5 V (according to the sensor). The output data type is the PV value of the PID controller. For PID control, the range of its value is set to 0 ~ 10000.
The 0 ~ 5 V signal detected from the sensor during analog input module operation is converted 2,000 times to a digital value of 0 ~ 10000 and then transferred to the PLC.
The following figure is the setting screen of XGF-AV8A in XG5000.



(3) Analog output Module(XGF-DV4A)

The analog output module converts a controller output digital value generated through control operation in the PLC to 4mA ~ 20mA and transfers it to the driver of the control object. The XGF-DV4A model has 4 channels and its setting can be changed through the I/O parameter setting window, as in XGXGF-AV8A. Channel 0 is changed to “Enable” mode and the output range is set to 0 ~ 5V (according to the driver).
The 0 ~ 10000 MV digital output generated through PID control operation is reduced to 1/2000 and then transferred to

the signal of the driver.
The following figure is the setting screen of XGF-DV4A in XG5000.

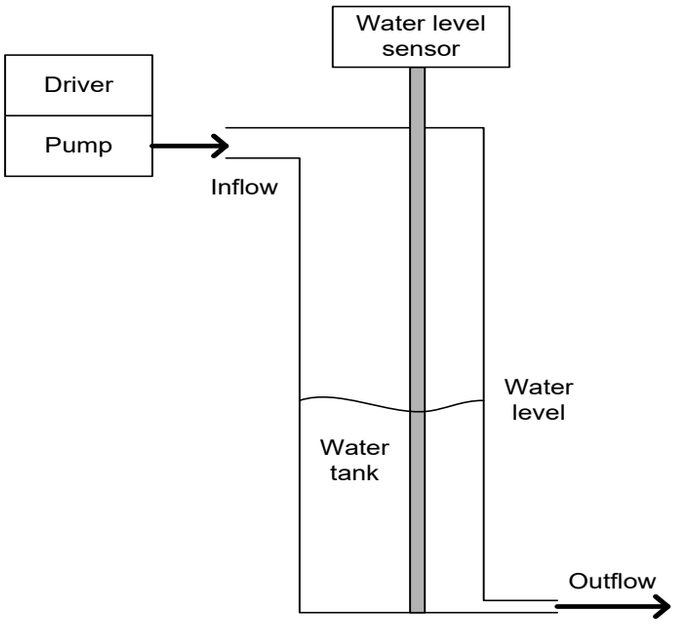


(4) Sensor and Driver

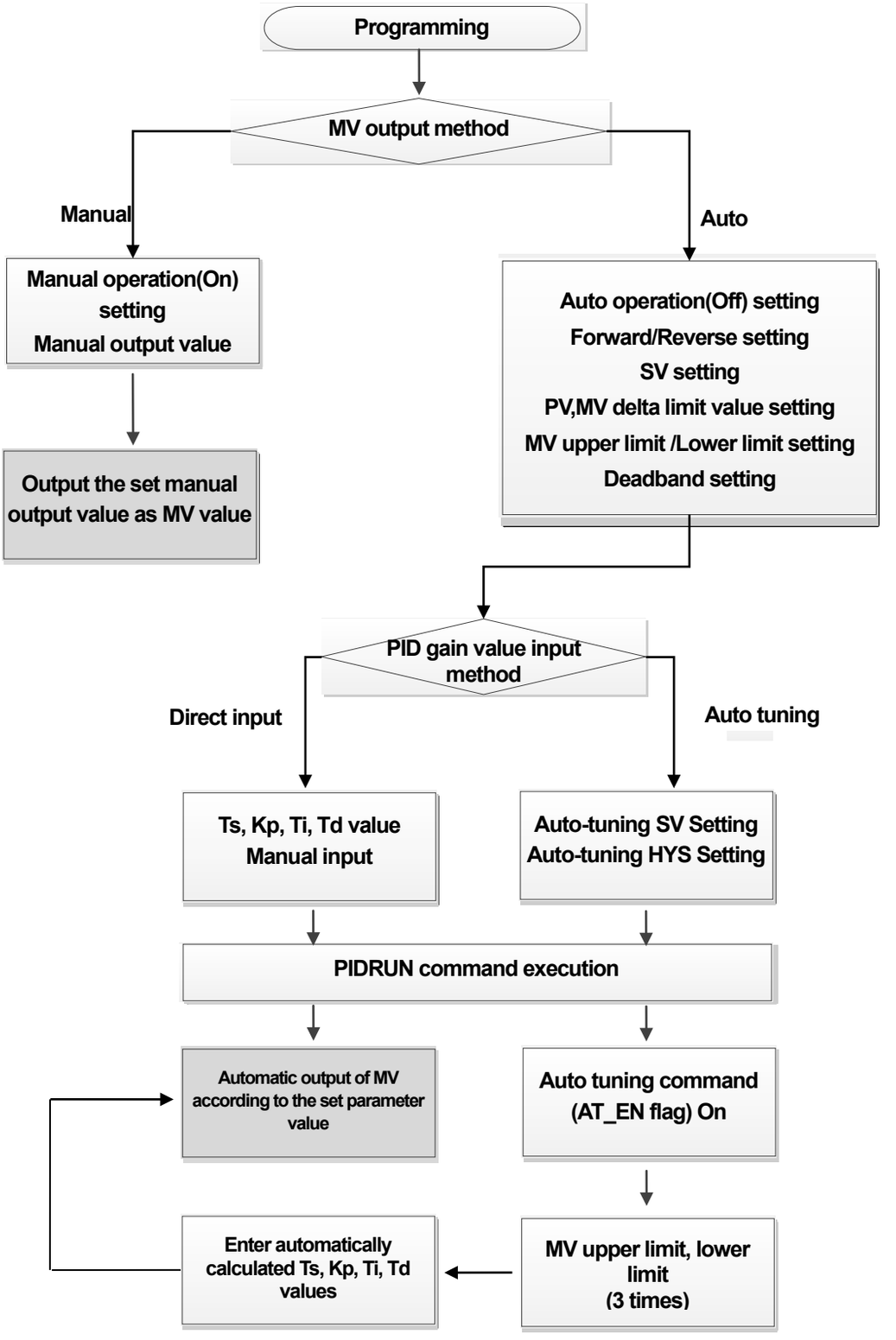
Along with the analog output module and analog input module, the sensor and driver respectively function as the media to transfer the state of the control object to the controller and transfer the controller output to the control object. The output generated from the sensor connect to input of the analog input module and the output generated from the analog output module should be connect to input of the driver. For an easy example, if the sensor's current mode is 4mA ~ 20mA, the analog input module's current mode should be 4mA ~ 20mA and if the driver's voltage mode is 0V ~ 5V, the analog output module's voltage mode should be 0V ~ 5V.
The output of the analog output module used as the driving signal of the driver. Using it as the power of the driver may cause malfunction of the PLC due to power loss.

(5) Control Object

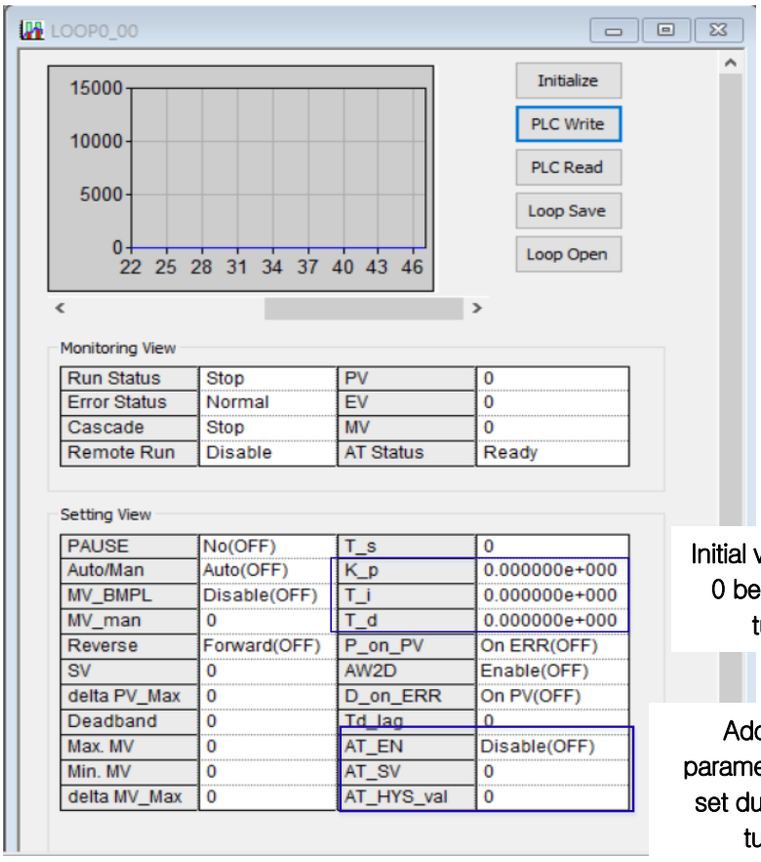
The current system uses a water level control system as the control object. A water level control system is a system to maintain a desired water level by pumping water into a water tank whose lower part has a small opening for outflow of water. The water in the tank flows out at a constant rate. The decision to increase or decrease the water level is based on the water inflow. The structure of a water level control system is shown below.



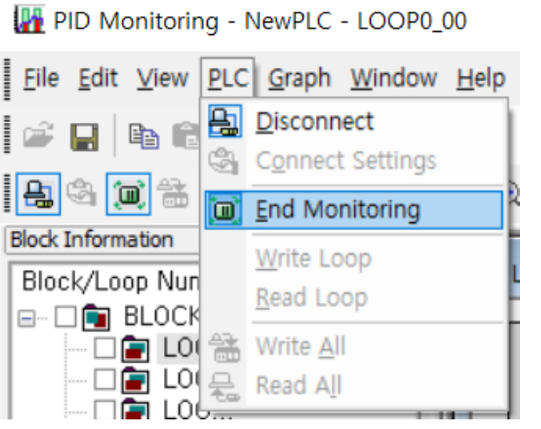
10.7.2 PID Control Function Flow



10.7.3 How to set parameters through PID monitor



(Caution :To write the set parameter values to PLC, the monitor must be in the disabled state.)

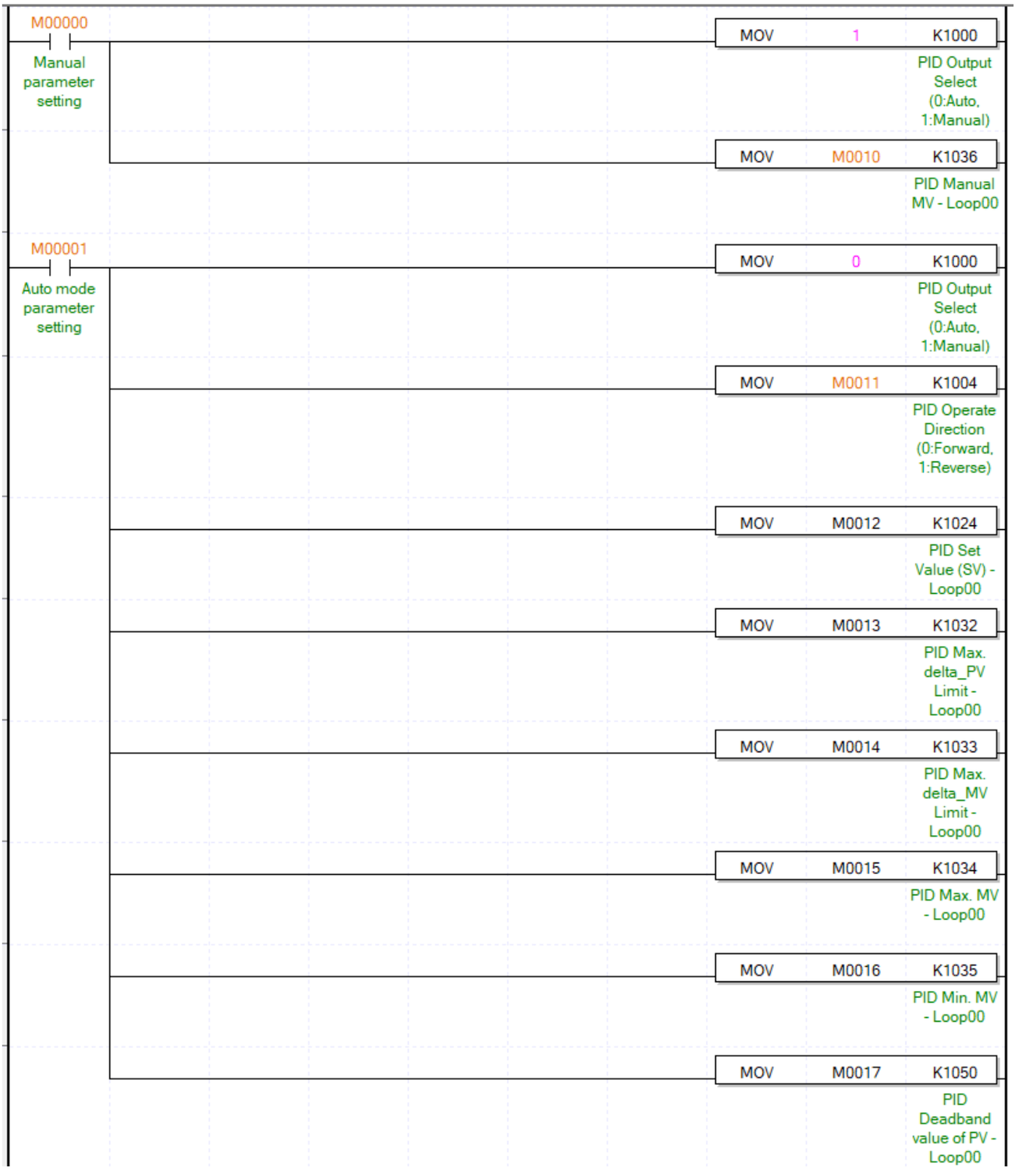


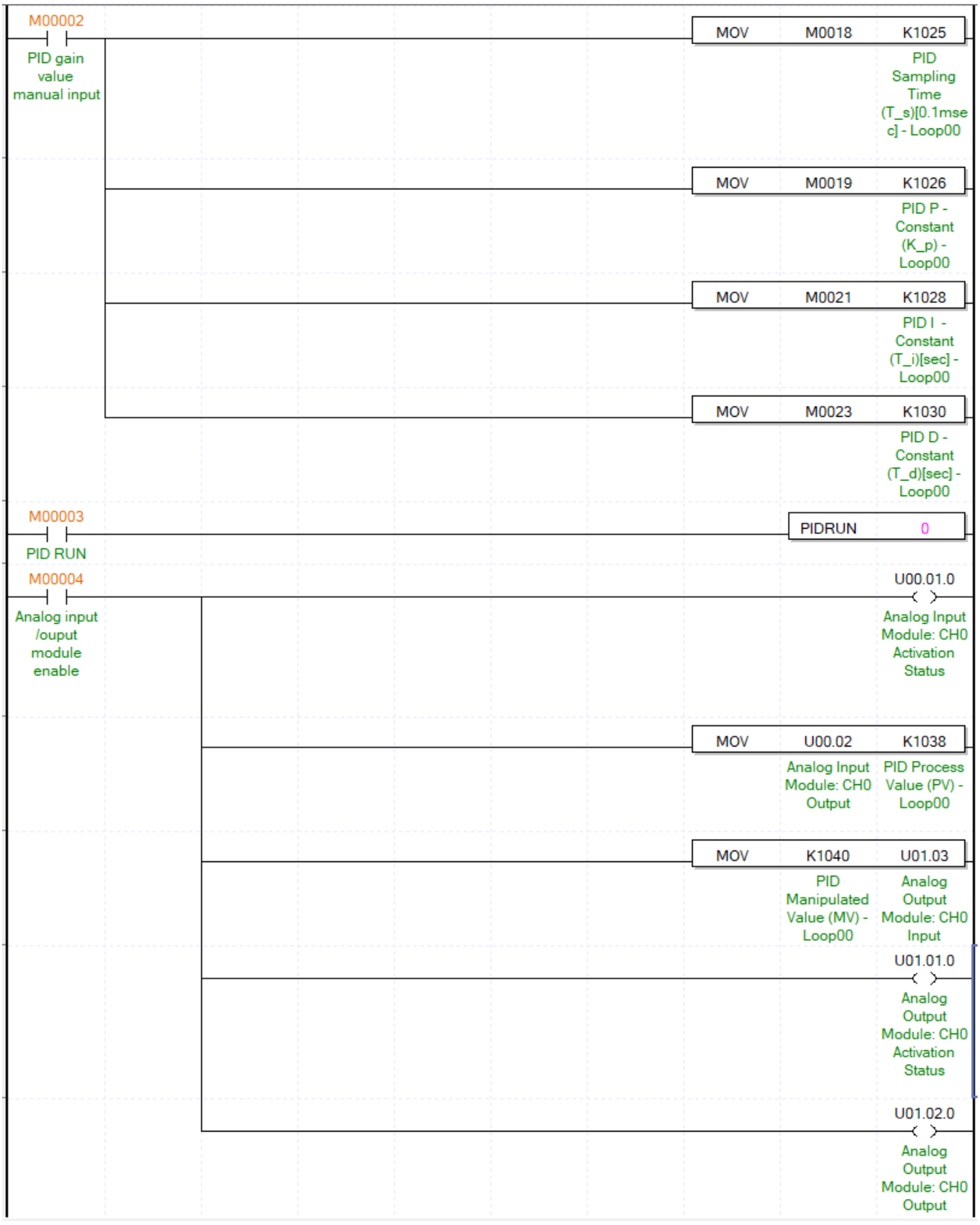
*** Other parameter setting methods.**

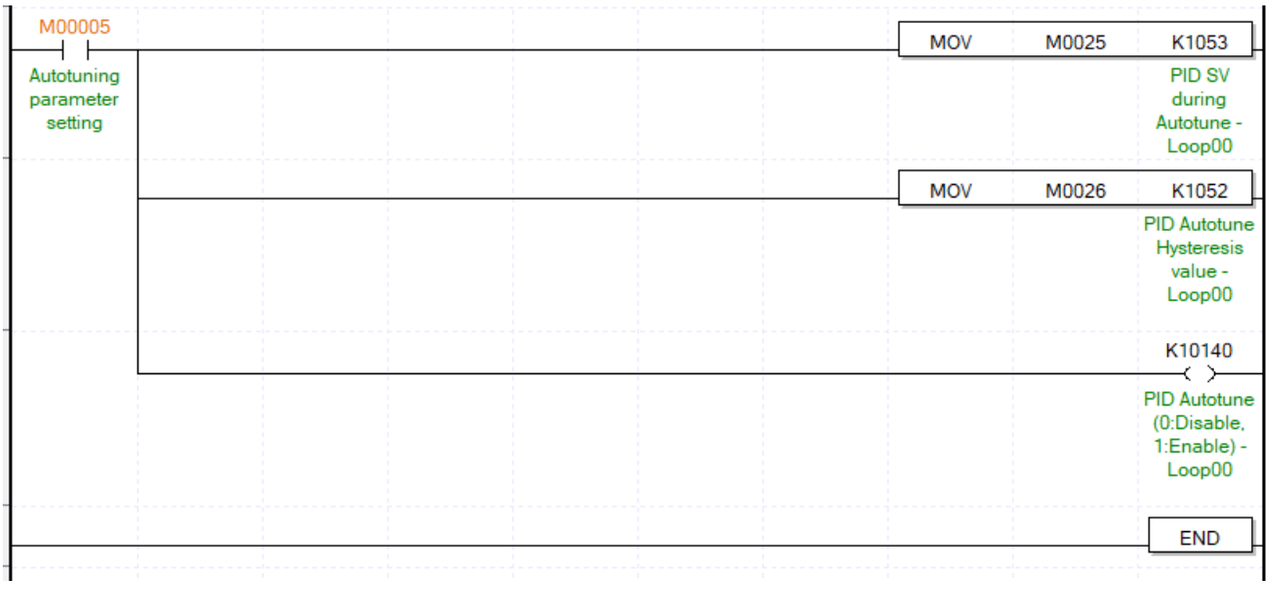
1) Using the variable monitor (register the desired parameters in the variable monitor and enter the value)
2) Using command (PID PRMT) (Only Block, Loop, SV, Ts, Kp, Ti, Td can be set)

10.7.4 Program Example 1

(1) LD Program




M00002
PID gain value manual input
MOV M0018 K1025
PID Sampling Time (T_s)[0.1msec] - Loop00
MOV M0019 K1026
PID P - Constant (K_p) - Loop00
MOV M0021 K1028
PID I - Constant (T_i)[sec] - Loop00
MOV M0023 K1030
PID D - Constant (T_d)[sec] - Loop00
M00003
PID RUN
PIDRUN 0
M00004
Analog input /ouput module enable
U00.01.0
Analog Input Module: CH0 Activation Status
MOV U00.02 K1038
Analog Input Module: CH0 Output
PID Process Value (PV) - Loop00
MOV K1040 U01.03
PID Manipulated Value (MV) - Loop00
Analog Output Module: CH0 Input
U01.01.0
Analog Output Module: CH0 Activation Status
U01.02.0
Analog Output Module: CH0 Output


M00005
Autotuning parameter setting
MOV M0025 K1053
PID SV during Autotune - Loop00
MOV M0026 K1052
PID Autotune Hysteresis value - Loop00
K10140
PID Autotune (0:Disable, 1:Enable) - Loop00
END

10.7.5 PID control (Variable monitor and Trend monitor)

(1) Register parameter in variable monitor

Control settings is performed by registering PID variables in the “Variable Monitor” window.
Clicking the right button of the mouse and then selecting “Register in Variable/Command” in the Variable Monitor window allows you to see the “Variable/Device Select” window. Selecting PID in the “List” box and unlocking “All” and then entering 0 (loop number) in “Parameter Number” allows you to see the variables to store all the settings and states for Loop 0. Selecting all variables and then clicking “Confirm” enables you to monitor the variables or change their values even when the program is in “RUN” mode.

Flag type: PID

Select List: ☑ All Loop Number 0

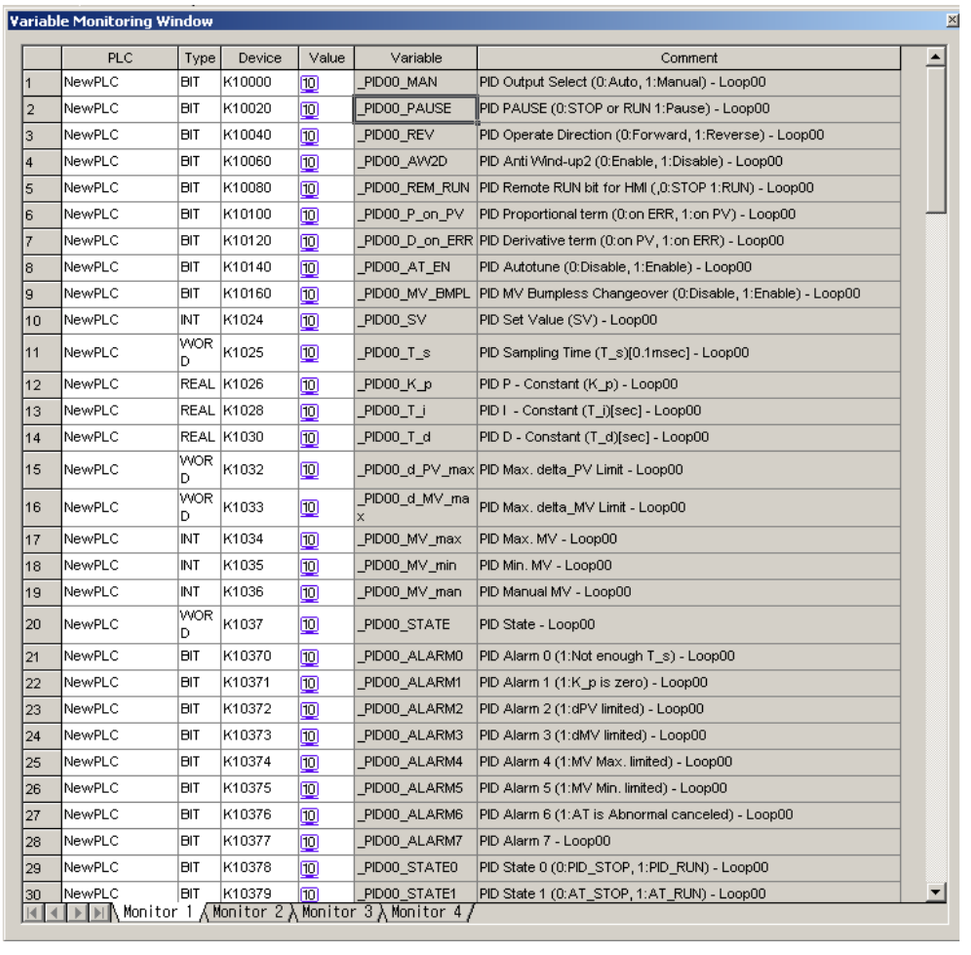
	Variable	Type	Device	EIP/OPC UA	HMI	Comment
1	_PID_MAN	DWORD	K1000	☐	☐	PID Output Select (0:Auto, 1:Manual)
2	_PID00_MAN	BIT	K10000	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop00
3	_PID01_MAN	BIT	K10001	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop01
4	_PID02_MAN	BIT	K10002	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop02
5	_PID03_MAN	BIT	K10003	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop03
6	_PID04_MAN	BIT	K10004	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop04
7	_PID05_MAN	BIT	K10005	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop05
8	_PID06_MAN	BIT	K10006	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop06
9	_PID07_MAN	BIT	K10007	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop07
10	_PID08_MAN	BIT	K10008	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop08
11	_PID09_MAN	BIT	K10009	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop09
12	_PID10_MAN	BIT	K1000A	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop10
13	_PID11_MAN	BIT	K1000B	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop11
14	_PID12_MAN	BIT	K1000C	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop12
15	_PID13_MAN	BIT	K1000D	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop13
16	_PID14_MAN	BIT	K1000E	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop14
17	_PID15_MAN	BIT	K1000F	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop15
18	_PID16_MAN	BIT	K10010	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop16
19	_PID17_MAN	BIT	K10011	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop17
20	_PID18_MAN	BIT	K10012	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop18
21	_PID19_MAN	BIT	K10013	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop19
22	_PID20_MAN	BIT	K10014	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop20
23	_PID21_MAN	BIT	K10015	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop21
24	_PID22_MAN	BIT	K10016	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop22
25	_PID23_MAN	BIT	K10017	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop23
26	_PID24_MAN	BIT	K10018	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop24
27	_PID25_MAN	BIT	K10019	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop25
28	_PID26_MAN	BIT	K1001A	☐	☐	PID Output Select (0:Auto, 1:Manual) - Loop26

(2) SV Calculation

In order to set SV, the PV value of the system desired by the user should be determined. To put it easily, in order to maintain the water level at 250mm, the PV value for 250mm should be determined. This value can be determined through numerical analysis of the system but it will be more exactly determined by experimenting with the reaction of the control object. Analysis with the current system suggests that, with the water level of 250mm, PV outputs the value of 8333, but an actual operation showed that, with the water level of 250mm, the sensor output value was 3250. The reasons for such an error are the inaccuracy of the sensor, the error of the measuring base point, etc. So, the actually measured value of 8250 should be used as the state value when the water level is 250mm. This value will be used as the SV value for control of 250mm.

(3) Control setting

After the previously developed program is downloaded to the PLC, then monitoring begins. The next step is to set the variables registered in the Variable Monitor window. The following figure shows the screen of settings in the Variable Monitor window of the example program.



Variable Monitoring Window

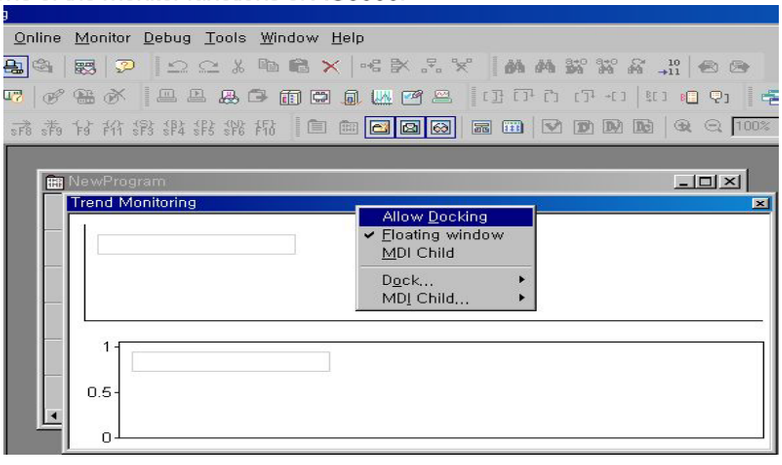
	PLC	Type	Device	Value	Variable	Comment
1	NewPLC	BIT	K10000	10	_PID00_MAN	PID Output Select (0:Auto, 1:Manual) - Loop00
2	NewPLC	BIT	K10020	10	_PID00_PAUSE	PID PAUSE (0:STOP or RUN 1:Pause) - Loop00
3	NewPLC	BIT	K10040	10	_PID00_REV	PID Operate Direction (0:Forward, 1:Reverse) - Loop00
4	NewPLC	BIT	K10060	10	_PID00_AW2D	PID Anti Wind-up2 (0:Enable, 1:Disable) - Loop00
5	NewPLC	BIT	K10080	10	_PID00_REM_RUN	PID Remote RUN bit for HMI (,0:STOP 1:RUN) - Loop00
6	NewPLC	BIT	K10100	10	_PID00_P_on_PV	PID Proportional term (0:on ERR, 1:on PV) - Loop00
7	NewPLC	BIT	K10120	10	_PID00_D_on_ERR	PID Derivative term (0:on PV, 1:on ERR) - Loop00
8	NewPLC	BIT	K10140	10	_PID00_AT_EN	PID Autotune (0:Disable, 1:Enable) - Loop00
9	NewPLC	BIT	K10160	10	_PID00_MV_BMPL	PID MV Bumpless Changeover (0:Disable, 1:Enable) - Loop00
10	NewPLC	INT	K1024	10	_PID00_SV	PID Set Value (SV) - Loop00
11	NewPLC	WORD	K1025	10	_PID00_T_s	PID Sampling Time (T_s)[0.1msec] - Loop00
12	NewPLC	REAL	K1026	10	_PID00_K_p	PID P - Constant (K_p) - Loop00
13	NewPLC	REAL	K1028	10	_PID00_T_i	PID I - Constant (T_i)[sec] - Loop00
14	NewPLC	REAL	K1030	10	_PID00_T_d	PID D - Constant (T_d)[sec] - Loop00
15	NewPLC	WORD	K1032	10	_PID00_d_PV_max	PID Max. delta_PV Limit - Loop00
16	NewPLC	WORD	K1033	10	_PID00_d_MV_max	PID Max. delta_MV Limit - Loop00
17	NewPLC	INT	K1034	10	_PID00_MV_max	PID Max. MV - Loop00
18	NewPLC	INT	K1035	10	_PID00_MV_min	PID Min. MV - Loop00
19	NewPLC	INT	K1036	10	_PID00_MV_man	PID Manual MV - Loop00
20	NewPLC	WORD	K1037	10	_PID00_STATE	PID State - Loop00
21	NewPLC	BIT	K10370	10	_PID00_ALARM0	PID Alarm 0 (1:Not enough T_s) - Loop00
22	NewPLC	BIT	K10371	10	_PID00_ALARM1	PID Alarm 1 (1:K_p is zero) - Loop00
23	NewPLC	BIT	K10372	10	_PID00_ALARM2	PID Alarm 2 (1:dPV limited) - Loop00
24	NewPLC	BIT	K10373	10	_PID00_ALARM3	PID Alarm 3 (1:dMV limited) - Loop00
25	NewPLC	BIT	K10374	10	_PID00_ALARM4	PID Alarm 4 (1:MV Max. limited) - Loop00
26	NewPLC	BIT	K10375	10	_PID00_ALARM5	PID Alarm 5 (1:MV Min. limited) - Loop00
27	NewPLC	BIT	K10376	10	_PID00_ALARM6	PID Alarm 6 (1:AT is Abnormal canceled) - Loop00
28	NewPLC	BIT	K10377	10	_PID00_ALARM7	PID Alarm 7 - Loop00
29	NewPLC	BIT	K10378	10	_PID00_STATE0	PID State 0 (0:PID_STOP, 1:PID_RUN) - Loop00
30	NewPLC	BIT	K10379	10	_PID00_STATE1	PID State 1 (0:AT_STOP, 1:AT_RUN) - Loop00

Monitor 1 | Monitor 2 | Monitor 3 | Monitor 4

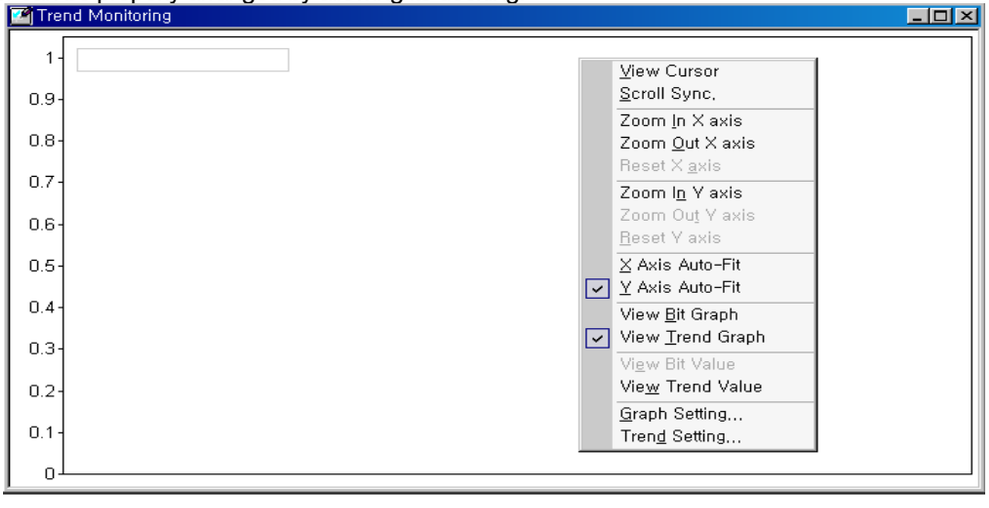
Settings contents are SV, K_p, and Mv_max.
The actually measured value of 8250 was set for SV and 5 was randomly selected for Kp
MV_max, an item to limit the maximum value of MV, was set to 10000 according to the analog module.

(4) Observation of Control States Using the Trend Monitor

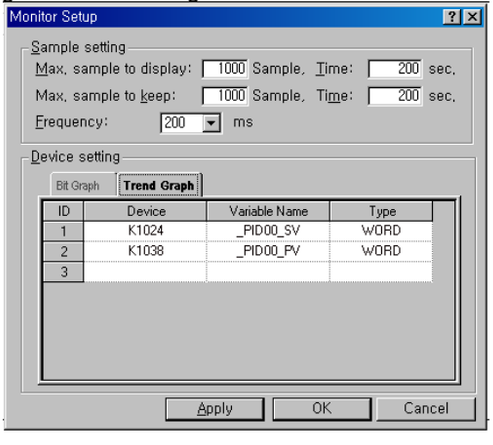
Enable the trend monitor, one of the monitor functions of XG5000.



The trend monitor can be properly arranged by allowing its docking.



Data to be observed are registered through the trend setting.

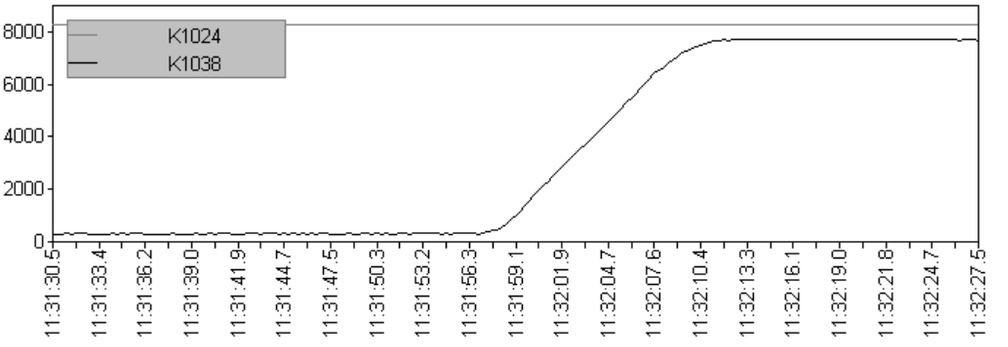


The monitoring cycle is set to 200m and, after the trend graph tap in the lower part is selected, SV and PV of Loop 0 are registered as INT.

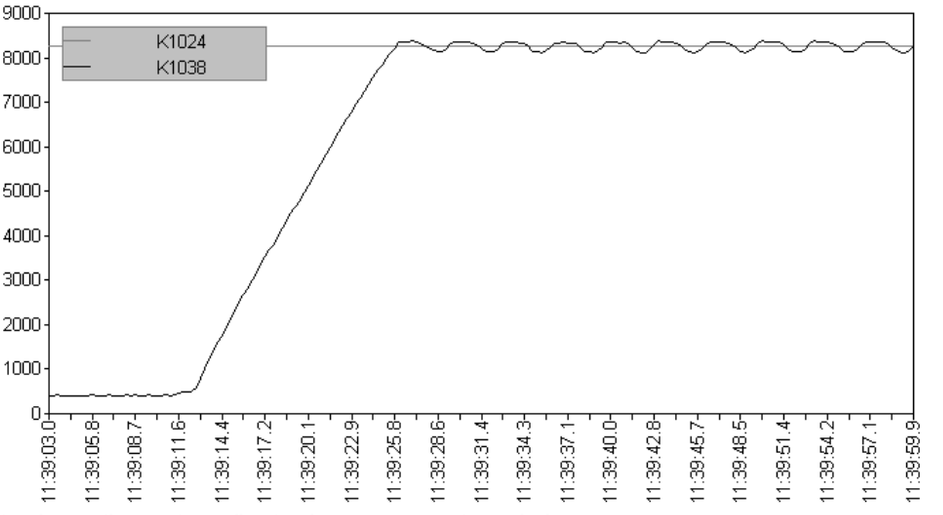
(5) Program Execution

(Here an example is given to show how to find a parameter manually. For auto tuning, refer to the method below.)

When the contact (M00000) is turned On, the system starts up.

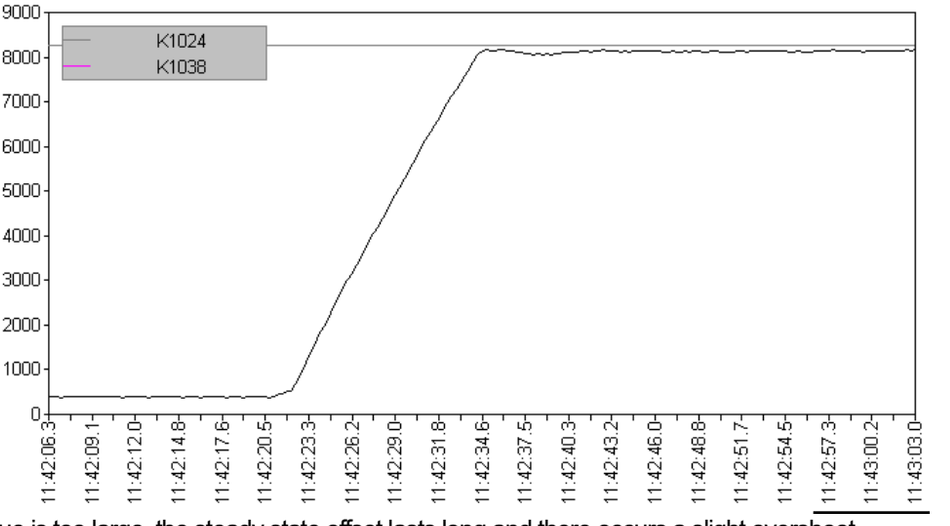


After increasing K_p to 100, the system is started again.



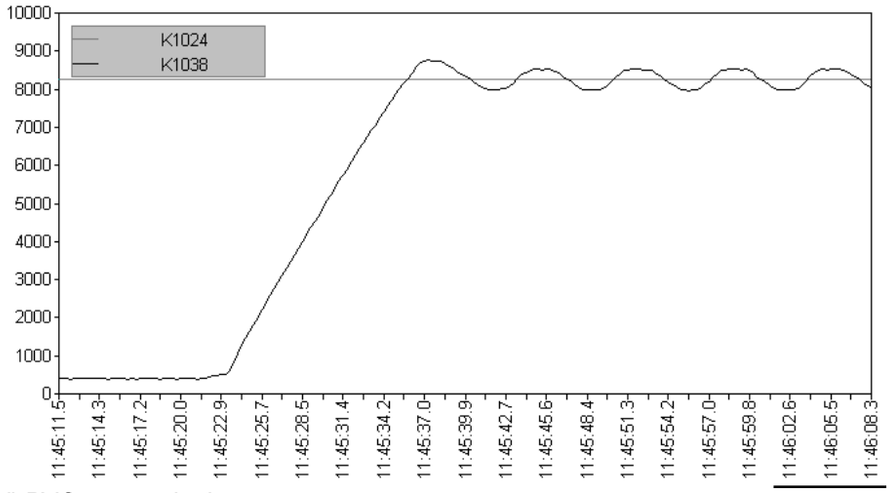
Because K_p is set too large, the system vibrates in a permanent regularly.

Set as follows: K_p = 20, T_i = 100



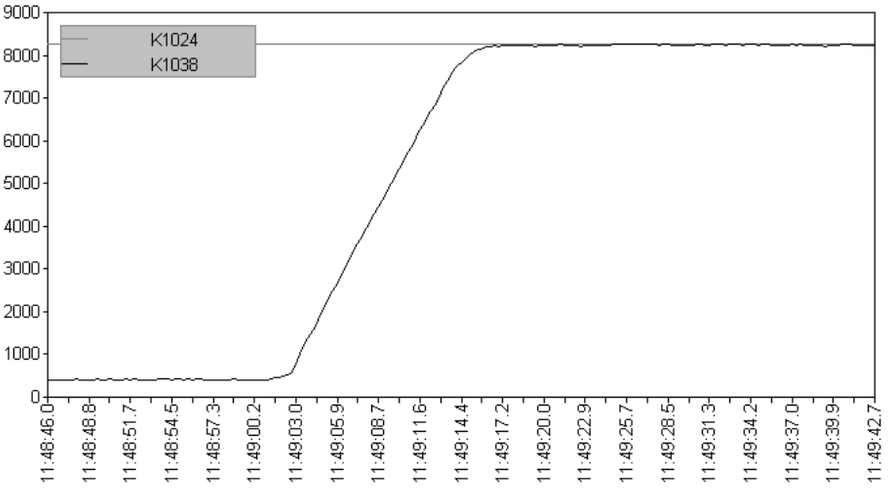
Because the T_i value is too large, the steady state offset lasts long and there occurs a slight overshoot.

Set as follows: K_p = 10, T_i = 1.

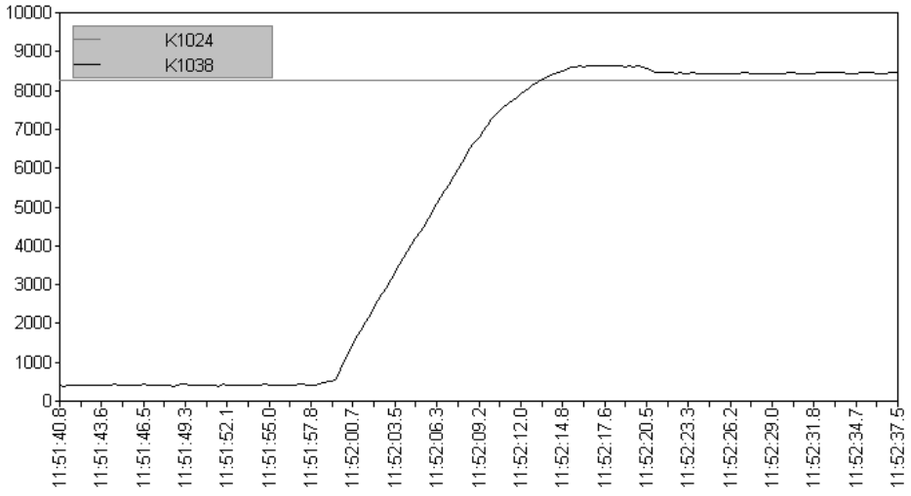


Because T_i is too small, PV fluctuates slowly.

Set as follows: K_p = 10, T_i = 5



This is a satisfactory result.
After changing T_d to 0.1, the system is started again.



The system rocks and the error increases. Since the current system is a slow system that can be fully controlled by PI, only PI control is required.
Therefore, the tuning results are as follows: K_p = 10, T_i = 5, T_d = 0.
For PID control (additional D control), refer to Appendix 12.8.

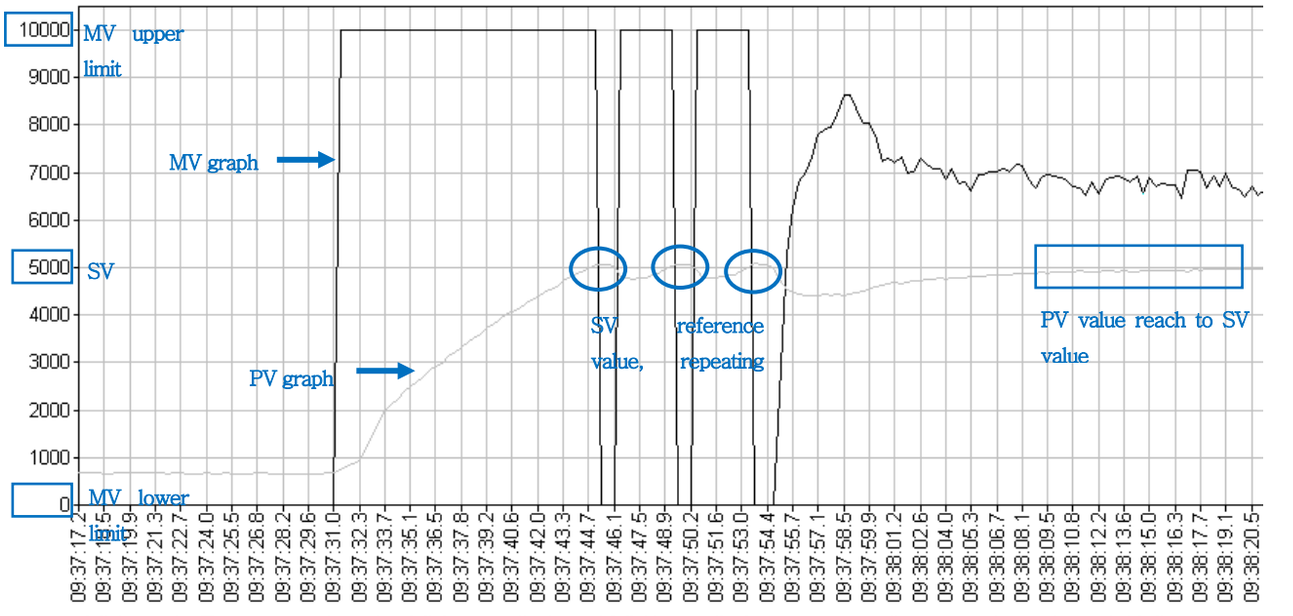
10.7.6 How to start up using AT (Auto-tuning)

Basically, it operates normally when the PV of the system before auto-tuning is smaller than the AT_SV value in reverse control.
In the case of Forward control, on the contrary, it operates normally when the PV value of the system before auto-tuning is greater than the AT_SV value..
Total step consists of 7 steps (AT step is 0 in PIDSTOP status) The current step of the loop can be known by looking at _PID[B]_[L]AT_step.. In other words, in the PIDSTOP state, AT starts at 0 in the AT step, and increases in sequence (automatically) from 1, and AT is terminated in step 7. Therefore, malfunction may occur if the user operates the step arbitrarily.

In order to avoid overlapping content, proceed with the contents of 10.7.5 (5) above and then proceed with the following.
Set AT_SV. In general case, set AT_SV same as SV. However, during auto tuning, the system vibrates so that the PV exceeds the AT_SV value, so if this process is not suitable for the system, set the appropriate AT_SV value.

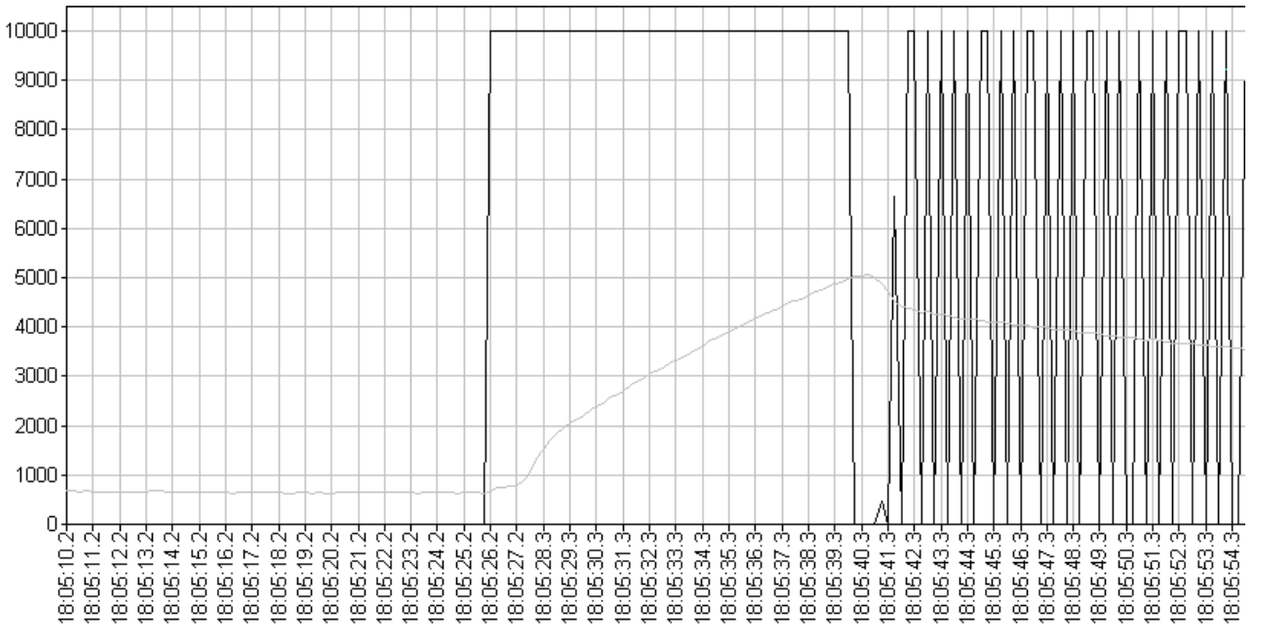
Next, set _PID[B]_[L]MV_min and _PID[B]_[L]MV_max. Each value is considered the minimum/maximum output of the system. During auto tuning, these two values are output alternately in 3 cycles. For example, if _PID[B]_[L]MV_min = 0, _PID[B]_[L]MV_max = 10000, the MV value delivered to the motor or heater repeats 0 →10000 → 0 output 3 times. If there is a risk that such a sudden change puts a burden on the system, set _PID[B]_[L]dMV.

Now set the _PID[B]_[L]HYS_val value. This value is used only during auto tuning. It is a dead band that occurs when PV reaches a value near SV, and occurs above the reference when rising and below the reference when falling. In other words, if SV is 5000 and _PID[B]_[L]HYS_val is 100, increase PV by maintaining MV as _PID[B]_[L]MV_max up to 5100 (SV + _PID[B]_[L]HYS_val) After that, the MV is kept at _PID[B]_[L]MV_min up to 4900 (SV-_PID[B]_[L]HYS_val) and tuning is performed while decreasing PV.



- MV graph: For auto-tuning, the MV upper limit and MV lower limit are repeatedly output three times initially.
- PV graph: Repeats the ascending and descending operation 3 times based on the SV value by the change of the MV value.

The above graph is the water level waveform obtained by setting the appropriate _PIDn_HYS_val setting value (50 in the figure), and the square waveform should appear 3 times in MV as above.

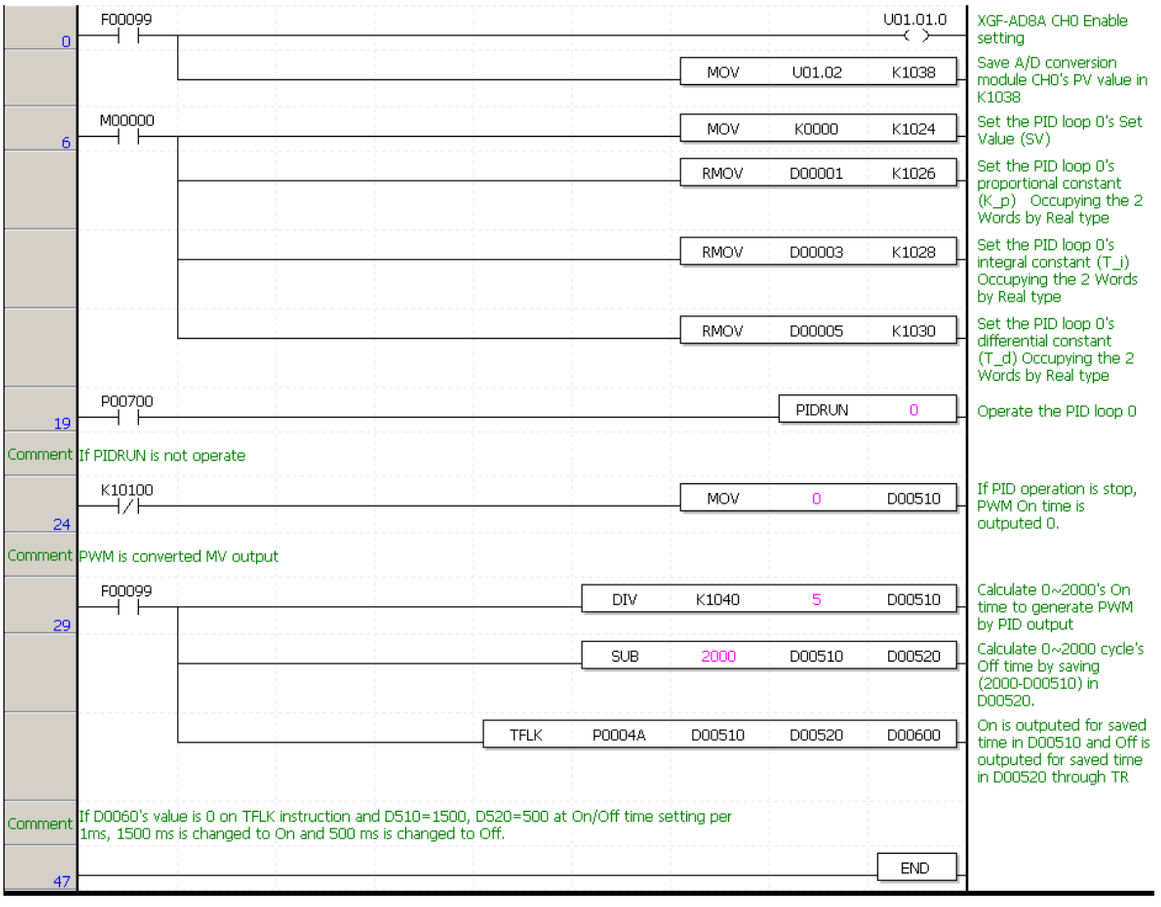


The above graph is the water level waveform obtained because the _PIDn_HYS_val setting is too small (10 in the figure). If the 3 square wave does not appear clearly on the MV as above, correct AT operation cannot be guaranteed. In addition, if an excessively large _PIDn_HYS_val value is added, the side effect of slowing down the system may occur.

10,7.7 Driver using PWM

Input is done using the A/D conversion module as shown in the simulation above and the output signal is converted to PWM to control the system using a relay module or TR module.

The following figure is an example of a program that performs PID control using A/D conversion module and D/A conversion module.



Step 1: Use the always On contact to enable A/D conversion module channel 0 and transfer the input data of the A/D conversion module to loop 0 PV of the PIDRUN instruction.

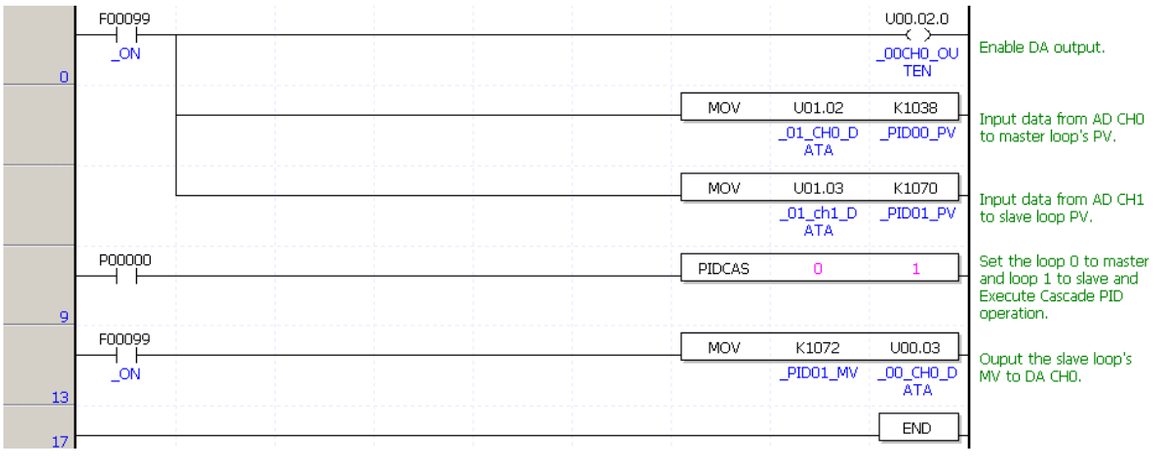
Step 7: When the user turns on P00700 bit, PIDRUN loop 0 control operation is performed.

Step 12: Look at the status of PIDRUN loop 0 and if it is stopped, set the PWM On time to 0 and turn the output off.

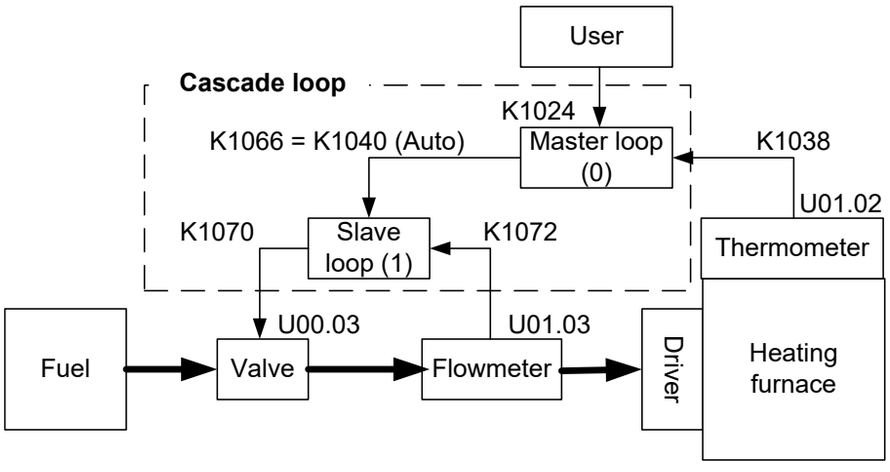
Step 17: Using the always-on contact, divide the MV output (0 ~ 10000) of loop 0 of the PIDRUN command by 5 and change it to (0 ~ 2000). Used as PWM Off time.
Using D00510 and D00520, you can obtain a PWM signal with a cycle of 2000 (2 seconds).
The corresponding output device is driven by controlling the P0004A bit by using the generated PWM.

Step 34: The scan ends.

10.7.8 Cascade control



The ladder program above is a program that performs cascade drive based on the block diagram below.



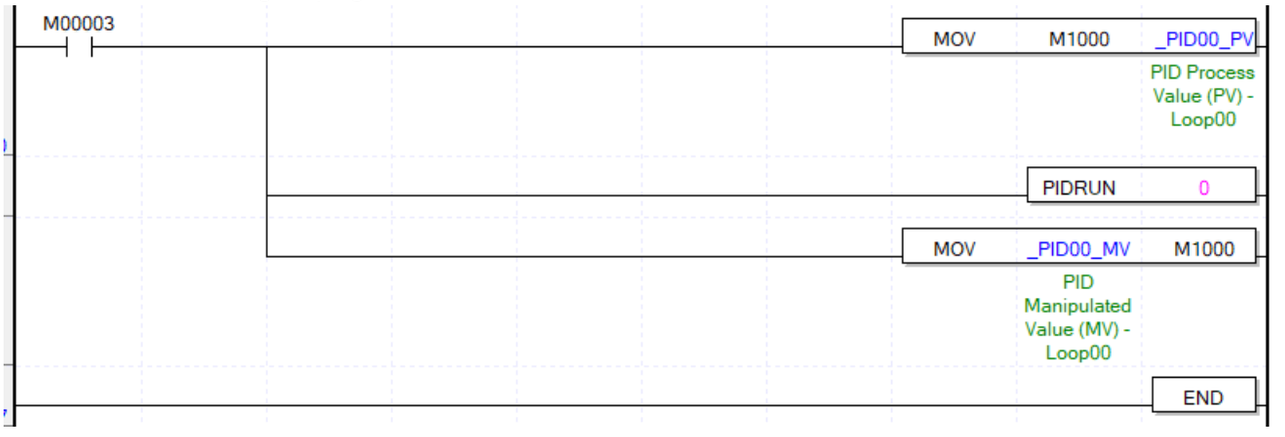
The block diagram above is a heating system that measures the temperature of the furnace and maintains the desired temperature by properly supplying fuel to the heater when viewed only by considering the master loop. Here, if a flow meter is installed to control the signal transmitted to the fuel valve to form a slave loop, when the master loop gives a fuel command with an arbitrary value, a constant flow of fuel is supplied by the operation of the slave loop.

10.8 Appendix

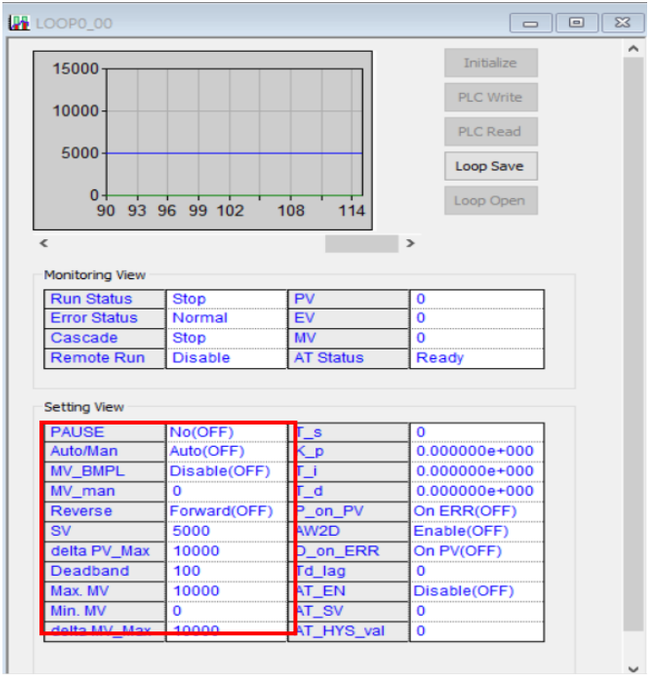
In order to check the function of PID, the system must be configured. However, by using the simulator function of XG5000, you can check the functions of various PID parameters without configuring the system. You can improve your understanding of PID control. (However, in the program below, PV and MV are output with the same value.)

10.8.1 PID control example program (simulation)

Start the simulator after writing the program as shown below.

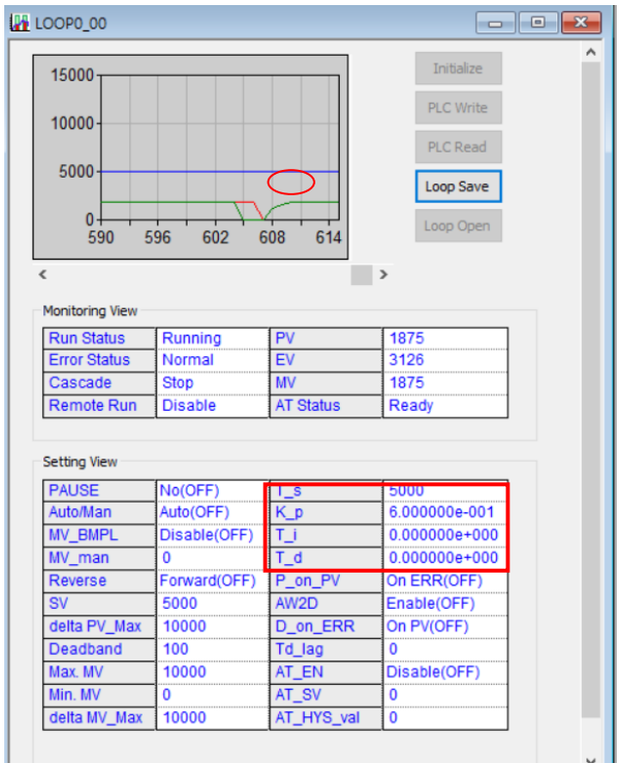


Open the PID monitor window, set the basic setting parameters as follows, and then write to PLC.

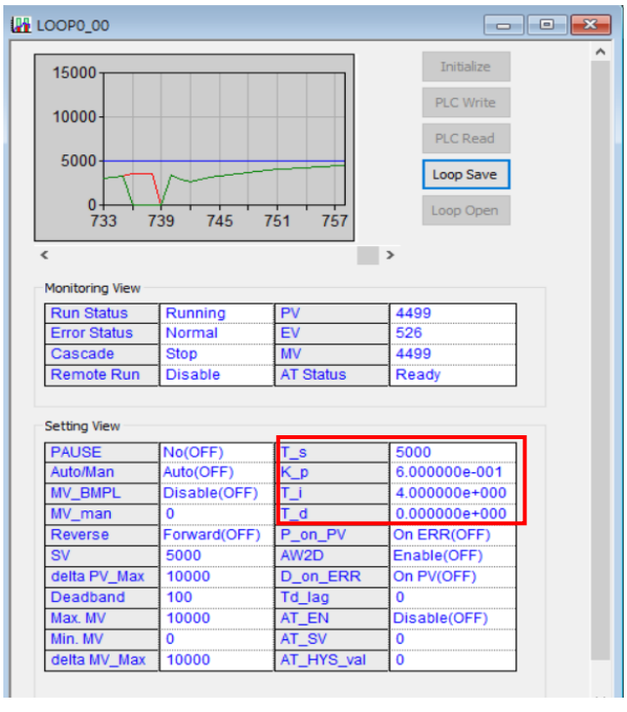


Set the control period to 500ms(5000). Next, set the Kp (proportional coefficient) value to 0.6 and then operate PIDRUN.

You can see that the system (PV) did not reach the target value (SV) and a certain residual deviation occurred.

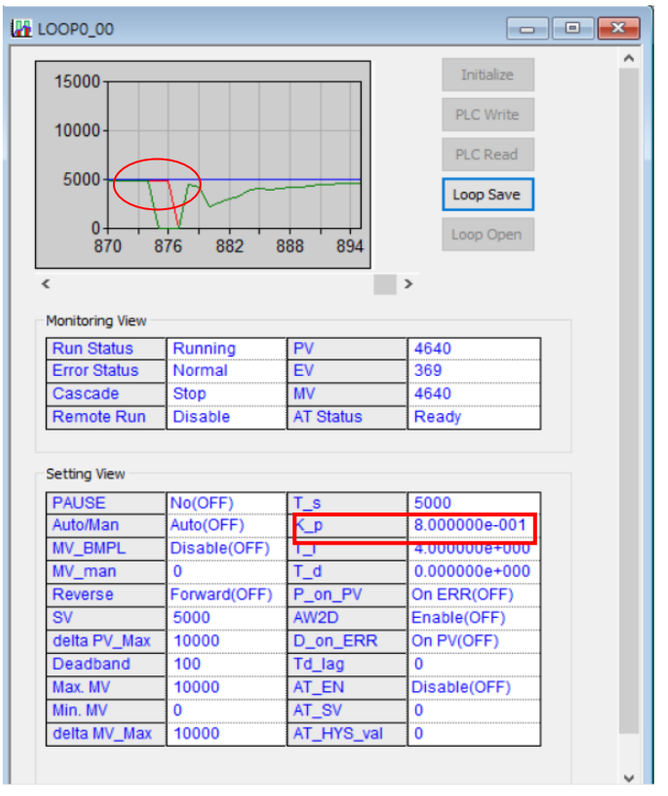


Set the Ti (Integral Coefficient) value to 4 to remove residual deviation. See that the system is getting closer to the target value.



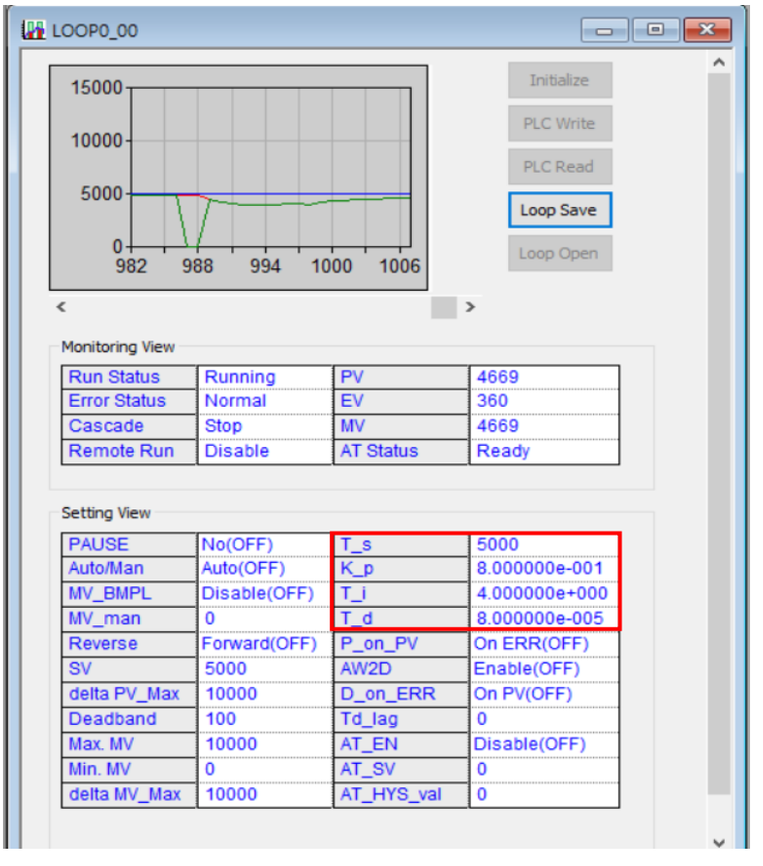
This time, let's change the Kp value to 0.6 → 0.8 so the system can reach the target value more quickly.

Although the arrival time was faster than before, the system was initially unstable



In order to stabilize the initial unstable system, the Td (differential coefficient) value was set to 0.00008.

As a result, the initial system stabilized.



Chapter 11. Installation and Wiring

11.1 Installation

11.1.1 Installation Environment

This equipment has a high reliability regardless the installation environment. However, to guarantee the reliability and stability, make sure to keep the following cautions.

(1) Environment Condition

1) Install in a control panel resisting to moisture and vibration.
2) Free of any continuous impact or vibration.
3) Do not expose directly to the sun.
4) No condensation from sudden temperature fluctuation.
5) Ambient temperature range between 0 ~ 55°C.
6) Relative humidity between 5 ~ 95%.
7) Free of any corrosive gas or flammable gas.

(2) Installation construction

1) When boring a screw hole or executing wiring construction, any wiring impurities should not be inserted to the PLC.
2) The system should be installed in a place easily accessible.
3) Do not install the system on a same panel of a high voltage device.
4) It should be 50mm and more away from wiring duct or proximate modules.
5) Grounding on a position where noise is lower than the specified level.

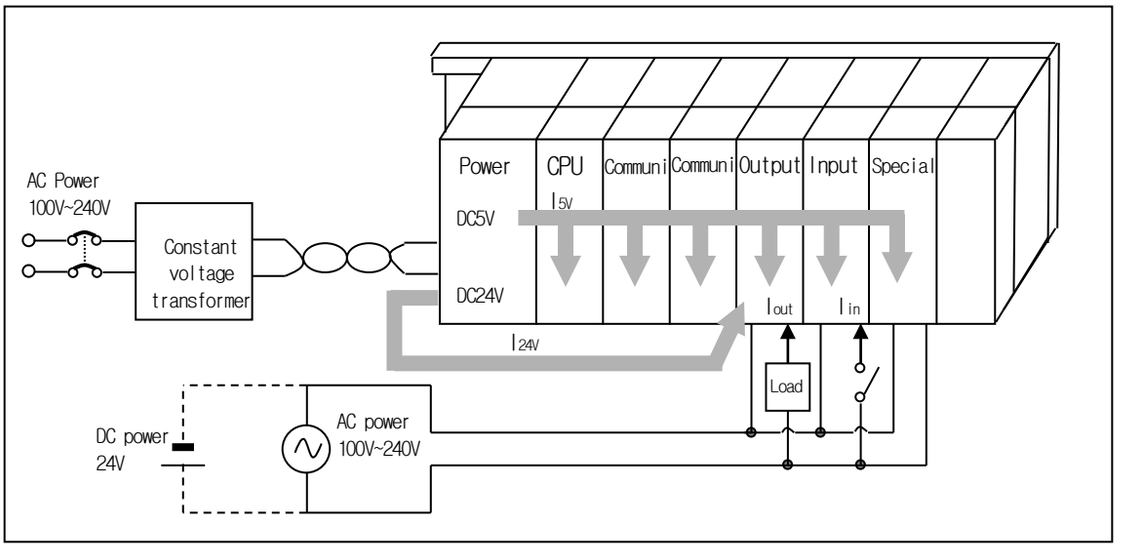
(3) Heat protective design of control panel

1) If installing the PLC in an air-tight control panel, it needs heat-protective (control) design considering the heat from the PLC as well as other devices. If ventilating by vent or fan, inflow of dust or gas may affect the performance of the PLC system.

2) Install a filter or use a closed heat exchanger.

The following shows the calculation of PLC system's power consumption requiring heat protective design.

4) Power Consumption block diagram of the PLC system



(5) Power consumption of each part

1) Power consumption of power module

The power conversion efficiency of power module is about 70% and the other 30% is gone with heat; 3/7 of the output power is the pure power consumption. Therefore, the calculation is as follows.

- $W_{pw} = 3/7 \{(I_{5V} \times 5) + (I_{24V} \times 24)\}$ (W)

I_{5V} : current consumption of each module DC5V circuit (internal current consumption)

I_{24V}: The average current consumption of DC24V used for output module

(Current consumption of simultaneous On point)

If DC24V is externally supplied or a power module without DC24V is used, it is not applicable.

2) Sum of DC5V circuit current consumption

The DC5V output circuit power of the power module is the sum of power consumption used by each module.

- $W_{5V} = I_{5V} \times 5$ (W)

3) DC24V average power consumption (power consumption of simultaneous On point)

The DC24V output circuit's average power of the power module is the sum of power consumption used by each module.

- $W_{24V} = I_{24V} \times 24$ (W)

4) Average power consumption by output voltage drop of the output module (power consumption of simultaneous On point)

- $W_{out} = I_{out} \times V_{drop} \times$ output point X simultaneous On rate (W)

I_{out} : output current(actually used current) (A)

V_{drop}: Vdrop : voltage drop of each output module (V)

5) Input average power consumption of input module (power consumption of simultaneous On point)

- $W_{in} = I_{in} \times E \times$ input point X simultaneous On rate (W)

I_{in}: Iin: input current (root mean square value in case of AC) (A)
E : input voltage (actually used voltage) (V)

6) Current consumption of Special module power

- $W_S = I_{5V} \times 5 + I_{24V} \times 24 + I_{100V} \times 100$ (W)

The sum of power consumption calculated by each block is the power consumption of the entire PLC system.

- $W = W_{PW} + W_{5V} + W_{24V} + W_{out} + W_{in} + W_s$ (W)

Calculate the heats according to the entire power consumption (W) and review the temperature increase within the control panel.

The calculation of temperature rise within the control panel is displayed as follows.

T = W / UA [°C]
W : Total current consumption of PLC system(the value obtained on the above)
A : surface area of control panel [m^2]
U : if equalizing the temperature of the control panel by using a fan and others - - - 6

11.1.2 Handling Precautions

It describes the cautions for handling from unpacking to installation.

- Please do not drop it or apply excessive force on it.
- Please do not separate PCB from the case. Doing so may cause failure of the module and/or printed-circuit board.
- During wiring, a special attention should be paid so that impurities such as wiring remainder should not be inserted into the top of a module.

If impurities are found, immediately remove them.

(1) Cautions for handling I/O module

It describes the cautions for installing or handling I/O module.

1) Recheck the I/O module specifications.
The input module may be affected by input voltage while the output module may be subject to breakage, destruction or a fire if the voltage over the max. switching capacity is allowed.

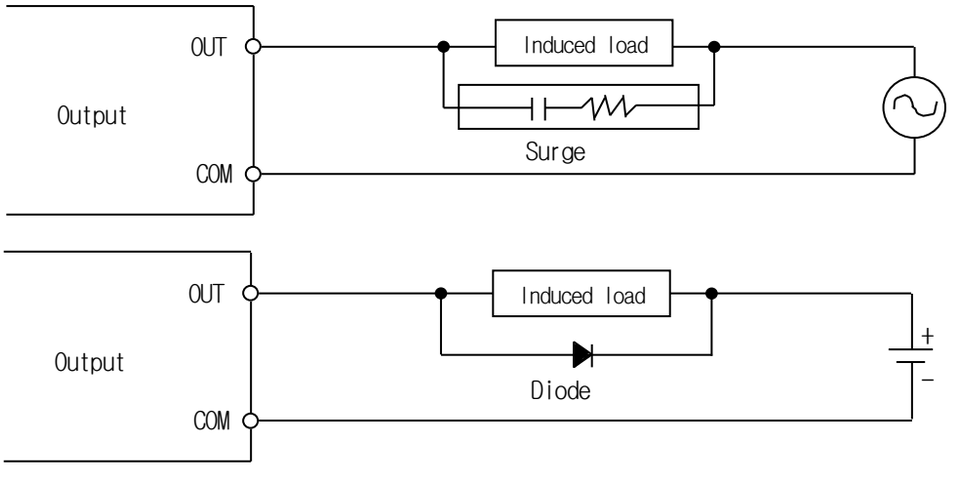
2) Available cable type
Cable should be selected in consideration of ambient temperature and allowable current; the min. size of cable should be AWG22(0.3mm^2) and higher.

3) Environment
If I/O module wiring is close to heating sources or materials or the wiring is directly contacted with oils for a long time during wiring, it may cause short-circuit, destruction or malfunction.

4) Polarities
Please make sure to check the polarities of modules of which terminal block is polarized before allowing the power.

5) Wiring
- When I/O wiring is executed with high voltage or power cable, it may cause inductive fault, probably leading to malfunction or trouble.
- Do not allow the cables to pass in front of I/O operation indicator (LED).

(It is not possible to distinguish I/O indicator correctly.)
- If an output module is connected to inductive load, please make sure to connect a surge killer or diode to load in parallel. Please connect the cathode side of a diode to (+) of the power.



6) Terminal block
Please check the tightness of terminal strip and prevent any wiring impurities (remainder) from being inserted into the PLC when processing terminal strip wiring or screw hole making. It may cause malfunction or trouble.

7) Besides the above, it is prohibited to apply excessive impact on I/O module or separating PCB board from the case.

(2) Cautions for installing the base

It describes the cautions when installing the PLC on the control panel and others.

1) A proper distance between the top of a module and structure/parts should be secured to facilitate ventilation and module replacement.

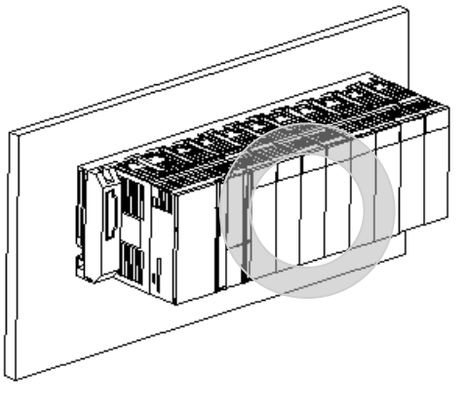
2) Please do not install it vertically or horizontally for the ventilation purpose.

3) Please use a different panel or secure a proper distance if there is vibration source from a large electronic contact or no-fuse breaker

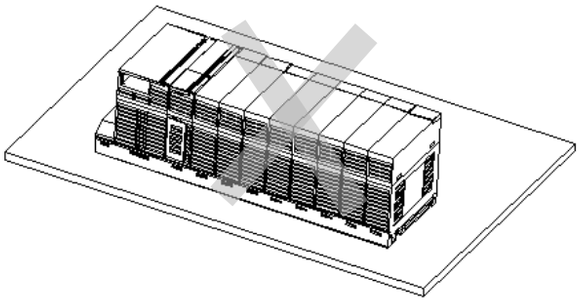
4) If necessary, please install a wiring duct. But cares should be taken for the following notices in case the dimension of the upper or lower part of PLC is smaller than that of Figure 10.1.

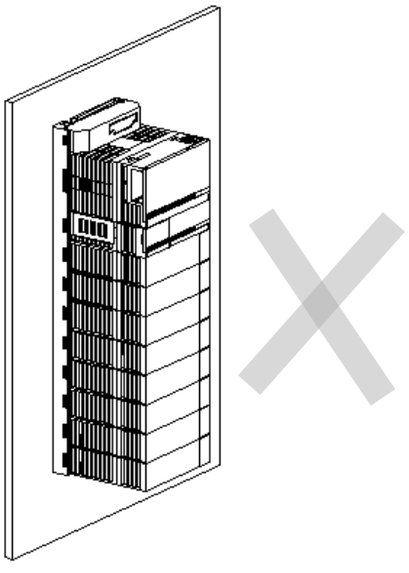
a) If installing on the top of PLC, maintain the height of a wiring duct 50mm more than for better ventilation.
In addition, maintain the distance from the top of PLC so that the hook on the top of the base can be pressed.
b) If installing on the bottom of it, let optical or coaxial cable be connected and consider the minimum radius of the cable.

5) Please install the PLC along the well-ventilated direction as presented below for the heat prevention purpose.

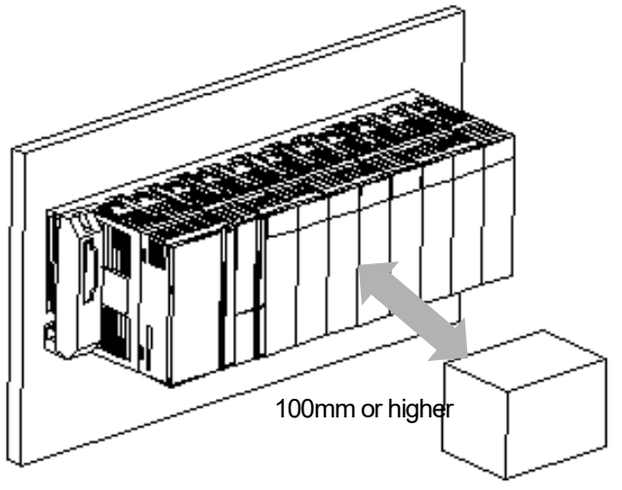


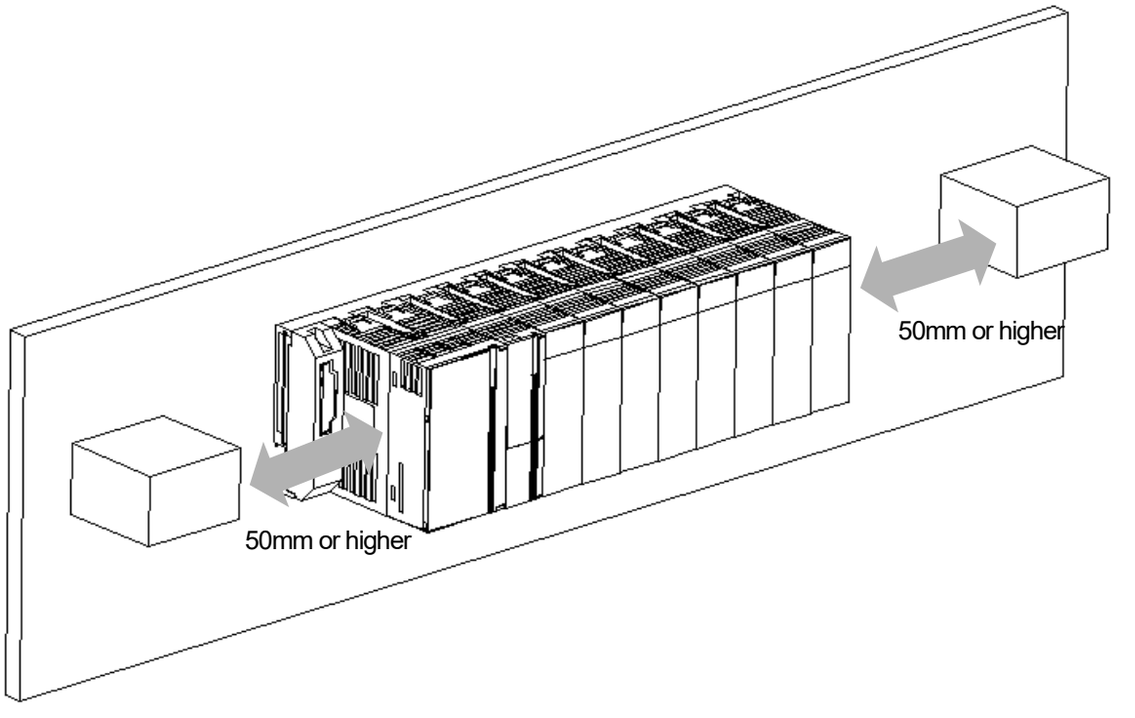
6) Please do not install it to the direction as presented below.





7) To avoid any influence of radiating noise or heat, please install the PLC and other devices (relay, electronic contact) with a spacing secured as presented below.



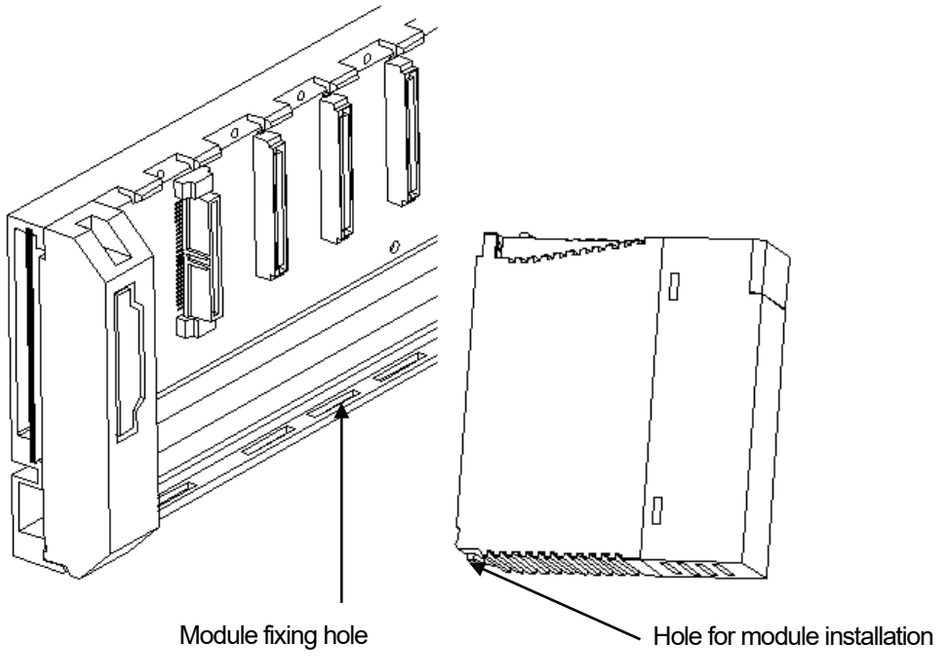


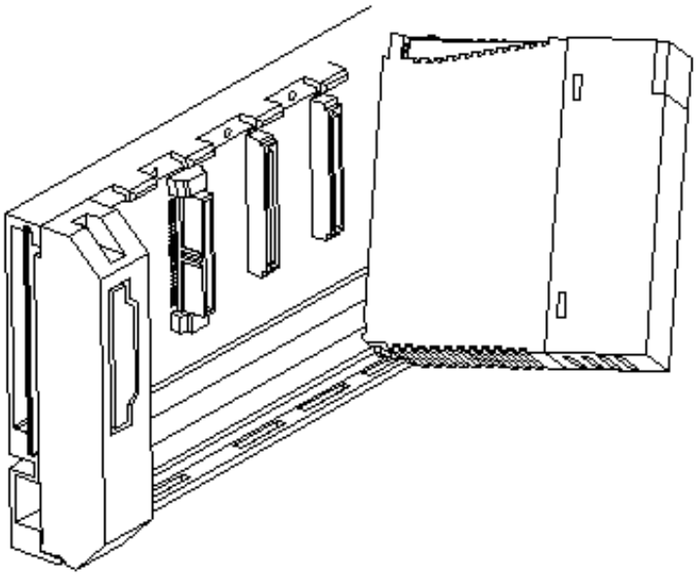
11.1.3 Attachment/Detachment of Module

It describes how to attach or detach a module on the base.

(1) Module mounting

1) Insert a fixed projection of the lower part of PLC into the module fixed hole of the base.
2) Slide the upper part of module to fix to the base, and then fit it to the base by using the module fixed screw.
3) Pull the upper part of module to check if it is installed to the base completely.



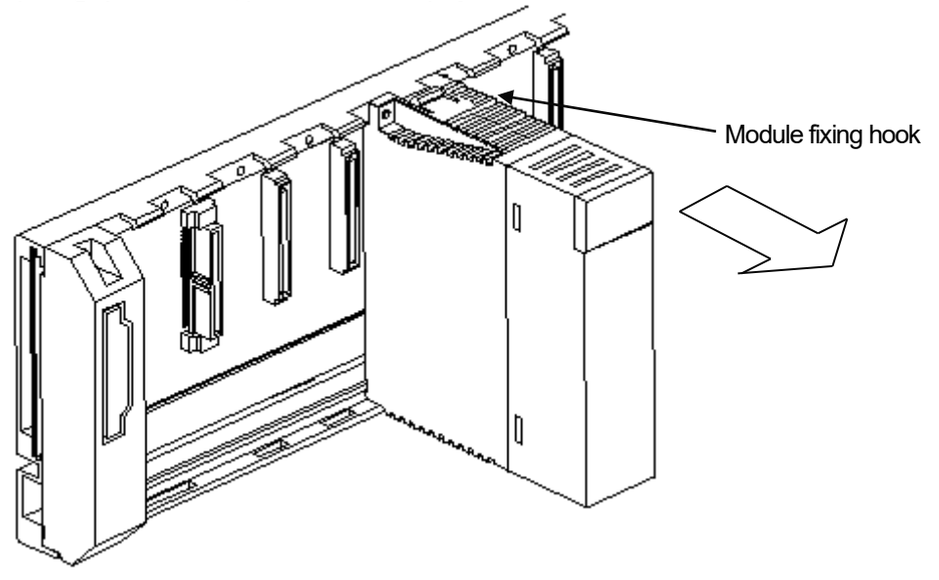


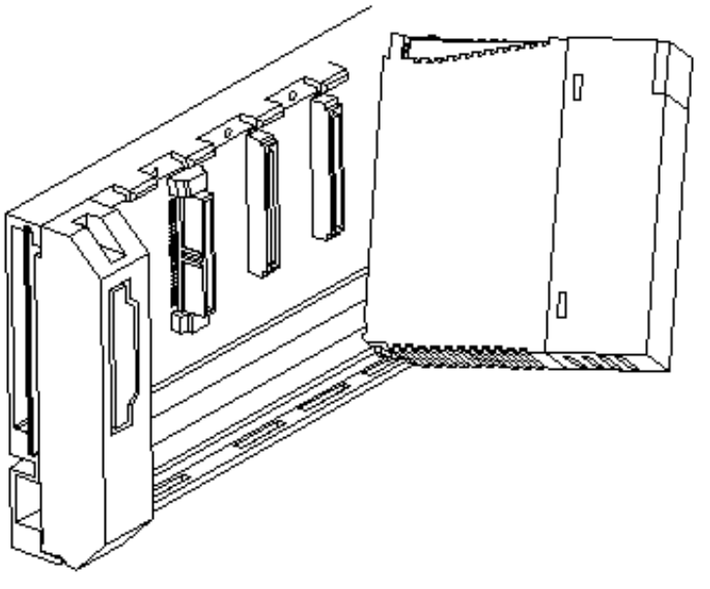
Notes

1) A module should be installed by inserting the projection for module installation to the hole for module installation.
If applying an excessive force, a module may be broken.

(2) Detachment of module

1) Please unscrew the fixation screw on the top of a module.
2) Please press the hook for module installation with a module held by both hands.
3) Please pull the bottom of a module toward the top while pressing the hook.
4) Lifting up the module, please detach the projection for module installation from the hole for module installation.





Notes

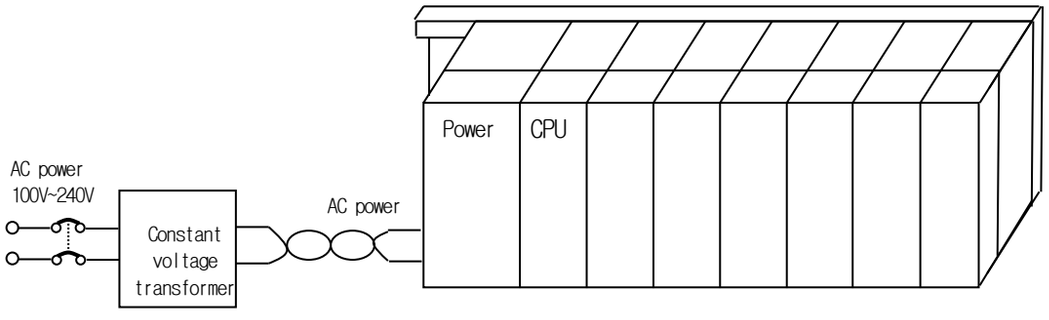
1) When detaching a module, please press the hook to detach it from the base and then, isolate the projection for module installation from the hole for module installation. At the moment, if trying to detach it forcibly, the hook or projection may be damaged.

11.2 Wiring

It describes the important information about wiring when using the system.

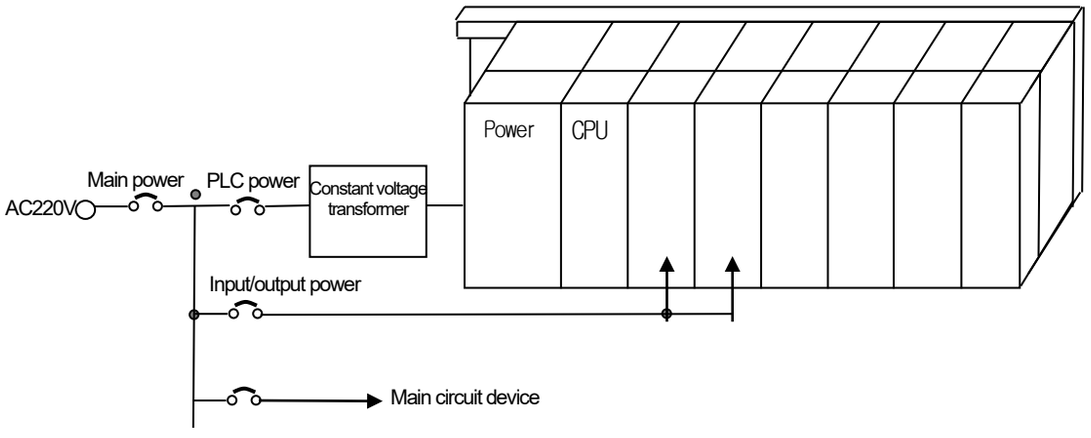
11.2.1 Power Wiring

(1) In case voltage regulation is larger than specified, connect constant voltage transformer.



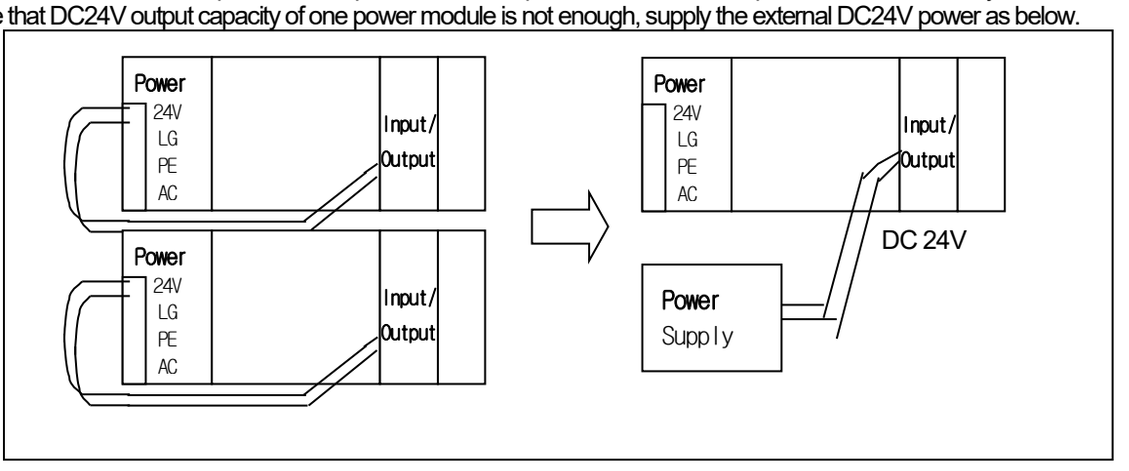
(2) Connect the power source of which inter-cable or cable-ground noise is small.
(When there is much noise, connect insulated transformer.)

(3) Isolate the PLC power, I/O devices and power devices as follows.



(4) In case of using a DC24V output of Power Module

1) Do not connect a DC24V output of several power module in parallel. If connected in parallel, the module may be broken.
2) In case that DC24V output capacity of one power module is not enough, supply the external DC24V power as below.

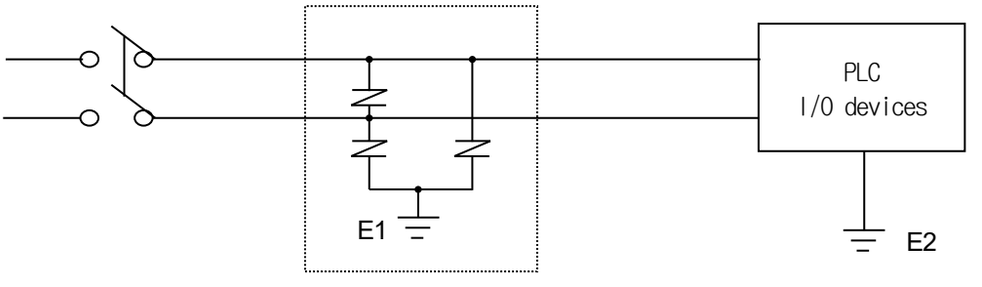


(5) AC110V/AC220V/DC24V cables should be compactly twisted and connected in the shortest distance.

(6) AC110V/AC220V cable should be as thick as possible (2mm^2) to reduce voltage drop.

(7) AC110V/ DC24V cables should not be installed close to main circuit cable (high voltage/high current) and I/O signal cable. They should be 100mm away from such cables.

(8) To prevent surge from lightning, use the lightning surge absorber as presented below.



Surge absorber to prevent lighting

Notes

1) Isolate the grounding (E1) of lightning surge absorber from the grounding (E2) of the PLC.
2) Select a lightning surge absorber type so that the max. Voltage may not the specified allowable voltage of the absorber.

(9) Use the shielded insulation trans or noise filter when a noise invasion is expected.

(10) Wiring of each input power should be twisted as short as possible and the wiring of shielding transformer or noise filter should not be arranged via a duct.

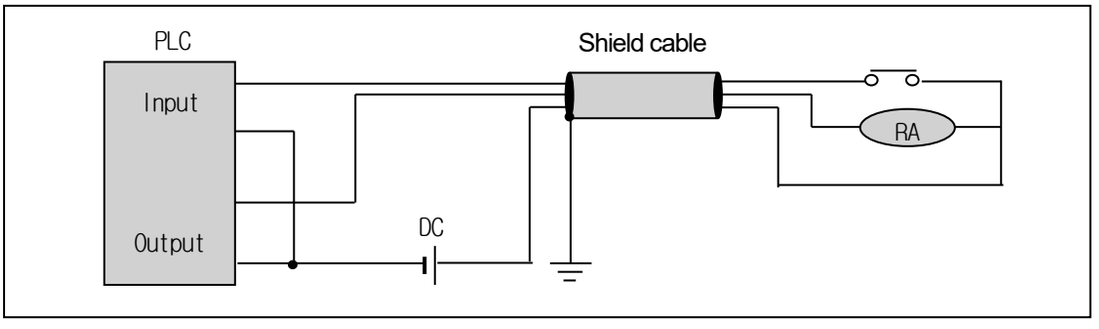
11.2.2 I/O Module wiring

(1) The size of I/O device cable is limited to 0.3~2 mm^2 but it is recommended to select a size (0.3 mm^2) to use conveniently.

(2) Please isolate input signal line from output signal line.

(3) I/O signal lines should be wired 100mm and more away from high voltage•high current main circuit cable.

(4) Batch shield cable should be used and the PLC side should be grounded unless the main circuit cable and power cable can not be isolated.



(5) When applying pipe-wiring, make sure to firmly ground the piping.

(6) The output line of DC24V should be isolated from AC110V cable or AC220V cable.

For a long distance wiring over 200m, please refer to 14.4 Cases in Chapter 14 because it is expected that accident may occur due to leakage current due to inter-cable capacity.

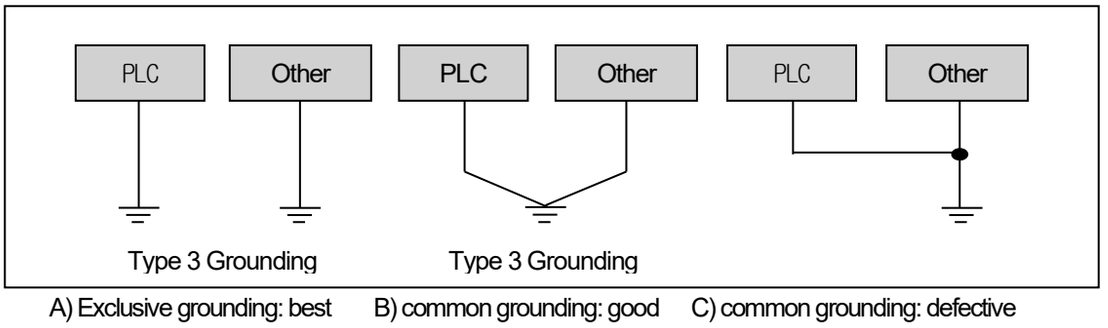
11.2.3 Grounding wiring

(1) The PLC contains a proper noise measure, so it can be used without any separate grounding if there is a large noise. However, if grounding is required, please refer to the followings.

(2) For grounding, please make sure to use the exclusive grounding.

(3) For grounding construction, apply type 3 grounding (grounding resistance lower than 100 Ω)

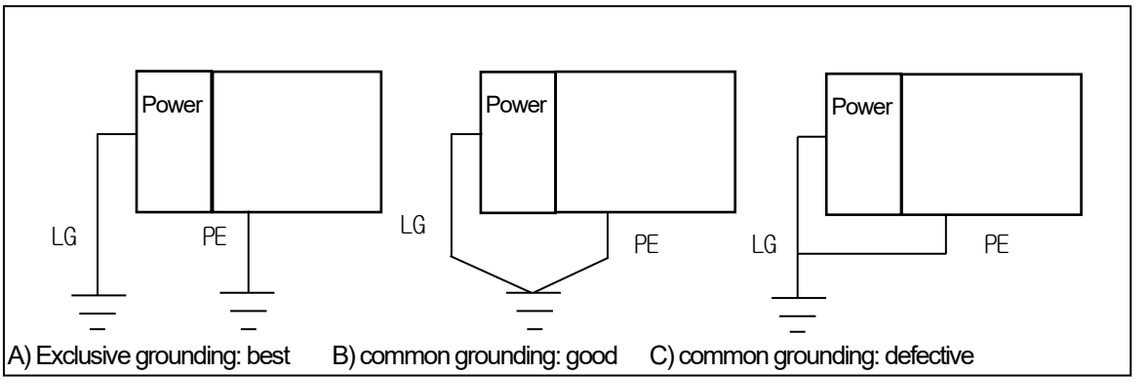
(4) If the exclusive grounding is not possible, use the common grounding as presented in B) of the figure below.



A) Exclusive grounding: best B) common grounding: good C) common grounding: defective

(5) Use the grounding cable more than 2 mm^2. To shorten the length of the grounding cable, place the grounding point as close to the PLC as possible.

(6) Separately ground the LG of the power module and the PE of the base board.



(7) If any malfunction from grounding is detected, separate the PE of the base from the grounding.

11.2.4 Cable Specification for Wiring

The specifications of cable used for wiring are as follows.

Types of external connection	Cable specification (mm^2)	
	lower limit	Upper limit
Digital input	0.18 (AWG24)	1.5 (AWG16)
Digital output	0.18 (AWG24)	2.0 (AWG14)
Analog input/output	0.18 (AWG24)	1.5 (AWG16)
Communication	0.18 (AWG24)	1.5 (AWG16)
Main power	1.5 (AWG16)	2.5 (AWG12)
Protective grounding	1.5 (AWG16)	2.5 (AWG12)

Chapter 12 Maintenance and Repair

Be sure to perform daily and periodic maintenance and inspection in order to maintain the PLC best conditions.

12.1 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	Action
Power supply		Within change rate of input voltage (Within –15% / +10%)	Change the power so that it should be within the allowable voltage range.
Power supply for input/output		Input/Output specification of each module	Hold it with the allowable range of each module.
Operating atmosphere	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.
Check the connecting screws		Screws should not be loose.	Retighten terminal screws.
Spare parts		Check the number of Spare parts and their Store conditions	Cover the shortage and improve the conditions.

12.2 Daily inspection

The following table shows the inspection and items which are to be checked daily.

Check Items		Check Points	Judgment	Action
Base attachment state		Check the screws.	Screws should not be loose.	Retighten Screws.
I/O module attachment state		• Check if the attached screw of module is tightened completely •Check if the upper cover of module is detachment.	Complete tightening	Check screw
Connection state of terminal block and extension cable		Check the connecting screws	Screws should not be loose.	Retighten Screws.
		Check the distance between solderless terminals.	Proper clearance should be provided.	Check terminals
		Extension cable connector	Connector should not be loose.	Check screw
Display LED	Power LED	Check LED ON	On(Off indicates an error)	Refer to chapter 16
	Run LED	Check that the LED is On during Run.	On (flickering or Off indicates an error)	Refer to chapter 16
	STOP LED	Check that the LED is Off during Run.	Flickering indicates an error	Refer to chapter 16
	Input LED	Check that the LED turns On and Off	On when input is On, Off when input is off.	Refer to chapter 16
	Output LED	Check that the LED turns On and Off	On when output is On, Off when output is off	Refer to chapter 16

12.3 Periodic Inspection

Check the following items once or twice every six months, and perform corrective actions as needed.

Check Items		Checking Methods	Judgment	Action
Operating atmosphere	Ambient temperature	Measured with a thermometer/hygrometer measure corrosive gas	0 ~ 55 °C	Adjust to meet general specification (environment standard in control panel)
	Ambient humidity		5 ~ 95%RH	
	Pollution degree		There should be no corrosive gases	
PLC condition	Looseness, Ingress	Try moving each module.	The module should be mounted securely.	Retighten Screws.
	Dust or foreign material	Visual checks	No dust or foreign material	-
Connecting conditions	Loose terminal screws	Re-tighten screws	Screws should not be loose.	Tighten
	Distance between terminals	Visual checks	Proper clearance	Check screw
	Loose connectors	Visual checks	Screws should not be loose.	Retighten connector mounting screws
Line voltage check		Measure voltage between input terminals	AC100~240V:AC85~ 264V DC24V:DC19.2 ~ 28.8V	Change supply power
Battery		Check the battery change period and voltage drop indication	• Check total shutdown time and warranty • No indication of battery voltage drop	Change the battery if exceeding the warranty without battery capacity indication
Fuse		Visual checks	• Not to be melted	Even if it is not melted, the element is deteriorated by inrush current, so replace it regularly.

Chapter 13 EMC standard

13.1 Requirements for Conformance to EMC Directive

The EMC Directive specifies the products must 'be so constructed that they do not cause excessive electromagnetic interference (emissions) 'and 'are not unduly affected by electromagnetic interference (immunity)'. The applicable products are requested to meet these requirements This section summarizes the precautions on conformance to the EMC Directive of the machinery assembled using XGT PLC series. The details of these precautions are based on the requirements and the applicable standards control. However, LSIS will not guarantee that the overall machinery manufactured according to the these details conforms to the below-described directives. The method of conformance to the EMC directive and the judgment on whether or not the machinery conforms to the EMC Directive must be determined finally by the manufacturer of the machinery

13.1.1 EMC Standard

The standards applicable to the EMC Directive are listed below.

Table 13-1

Specifications	Test item	Test details	Standard value
EN50081-2	EN55011 Radiated noise ＊2	Electromagnetic emissions from the product are measured	30~230 ㎒ QP : 50 ㏈㎶/m ＊1 230~1000 ㎒ QP : 57 ㏈㎶/m
	EN55011 Conducted EM noise	Electromagnetic emissions from the product to the power line is measured.	150~500 ㎑ QP :79 ㏈ Mean : 66 ㏈ 500~230 ㎒ QP : 73 ㏈ Mean : 60 ㏈
EN61131-2	EN61000-4-2 Electrostatic immunity	Immunity test in which static electricity is applied to the case of the equipment	Voltage : 4kV (contact discharging)
	EN61000-4-4 Fast transient burst noise	Immunity test in which burst noise is applied to the power line and signal lines	Power line: 2 ㎸ Digital /O : 1 ㎸ Analog I/O, signal lines: 1 ㎸
	EN61000-4-3 Radiated field AM modulation	Immunity test in which field is irradiated to the product	10Vm,26~1000 ㎒ 80%AM modulation@ 1 ㎑
	EN61000-4-12 Damped oscillatory wave immunity	Immunity test in which a damped oscillatory wave is superimposed on the power line	Power line: 1 ㎸ Digital I/O (24V or higher): 1 ㎸

＊1 : QP: Quasi-peak value, Mean: Average value

*2 :The PLC is an open type device (device installed to another device) and must be installed in a control panel.
The test was conducted while installed in the panel.

13.1.2 Control Panel

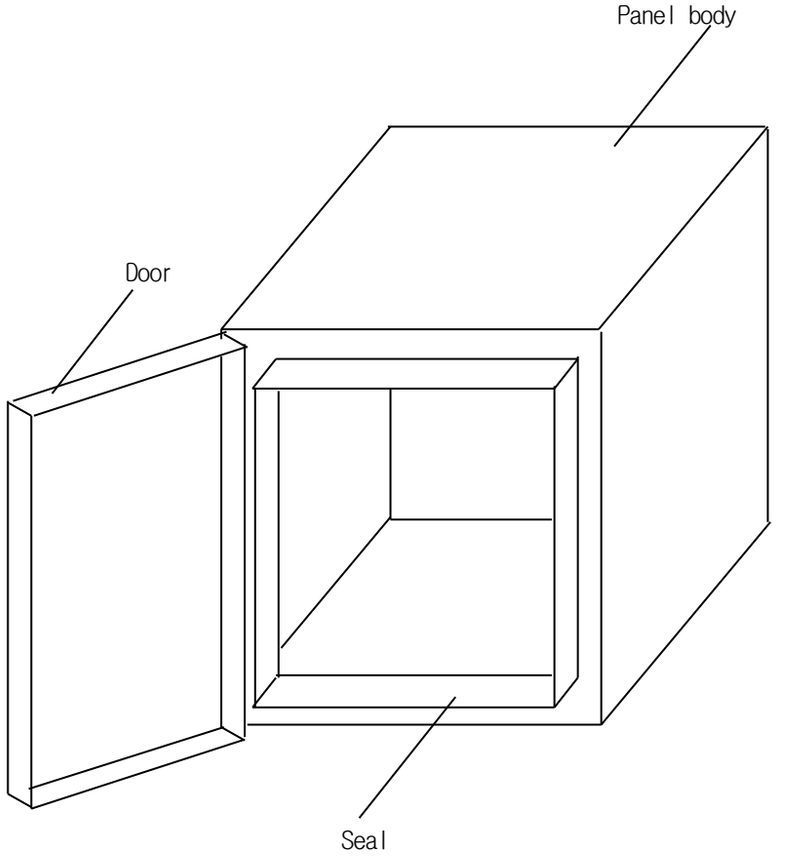
The PLC is an open type device (device installed to another device) and must be installed in a control panel. This is because an accident such as electric shock does not occur when a person comes into contact with the product (XGT PLC), and the noise generated in the PLC has the effect of attenuating the control panel.
In the case of XGT PLC, it is necessary to install on a metal control panel in order to suppress electromagnetic waves (EMI) emitted from the product. The specifications for the control panel are as follows

(1) Control panel

The PLC control panel must have the following features.

1) Use SPCC (Cold Rolled Mild Steel) for the control panel.
2) The steel plate should be thicker than 1.6mm.
3) Use isolating transformers to protect the power supply from external surge voltage.
4) The control panel must have a structure which the radio waves does not leak out.

For example, make the door as a box-structure so that the panel body and the door are overlapped each other.
This structure reduces the surge voltage generate by PLC.



5) To ensure good electrical contact with the control panel or base plate, mask painting and weld so that good surface contact can be made between the panel and plate.

(2) Connection of power and earth wires

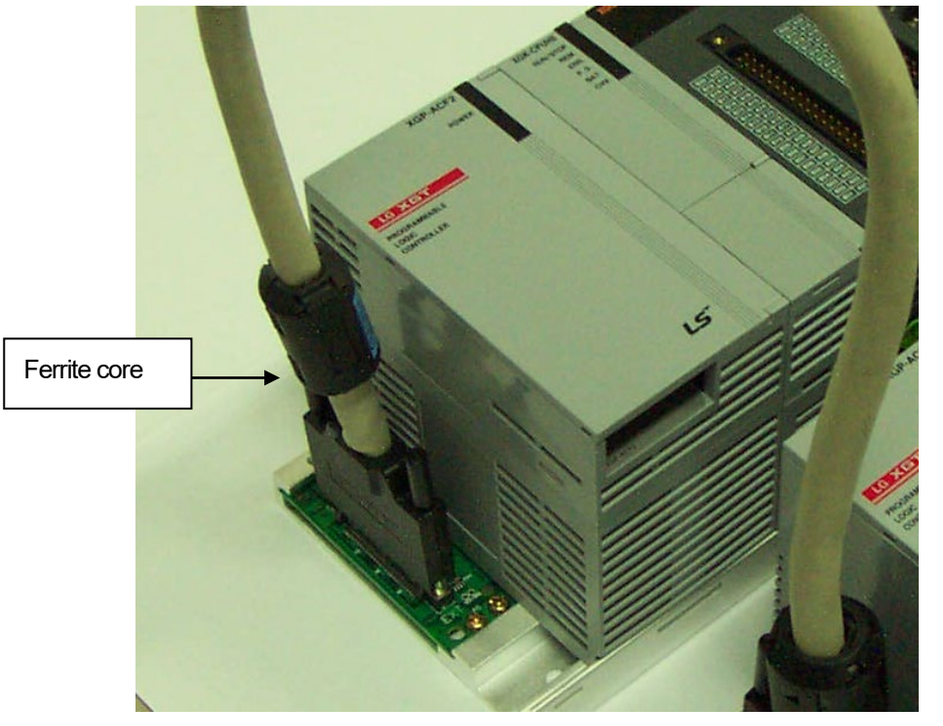
Earthing and power supply wires for the PLC system must be connected as described below.

1) Earth the control panel with a thick wire so that a low impedance connection to ground can be ensured even at high frequencies.
2) The function of LG (Line Ground) and FG (Frame Ground) terminals is to pass the noise generated in the PLC system to the ground, so an impedance that is as low as possible must be ensured.
3) The earthing wire itself can generate the noise, so wire as short and thick to prevent from acting as an antenna.
4) Attach ferrite core under the power cable to satisfy CE specification.

13.1.3 Cable

(1) Extension cable processing

High-speed electrical signals flow through the extension cables of the XGT series. Therefore, high frequency noise waves are radiated from this extension cable. To ensure CE conformity, attach ferrite cores as shown below to the extension cable.



Type	Vendor	Note
CU1330D	E tech	-
ZCAT3035-1330	TDK	-

(2) How to fix the cable in the panel

When fixing the extension cable of the XGT series to the metal control panel, keep the extension cable at least 1 cm so that the extension cable does not directly contact the metal plate. The metal plate of the control panel has a shielding effect that blocks noise from radio waves, but it can also be a good antenna if a cable that is a source of noise is connected nearby. The transmission cable for high speed signals, not limited to the extension cable, needs to be kept as far as possible from the metal plate of the control panel

13.2 Requirement to Conform to the Low-Voltage Directive

The low-voltage directive requires each device that operates with the power supply ranging from 50V to 1000VAC and 75V to 1500VDC to satisfy the safety requirements. Cautions and installation and wiring of the series PLC XGT series to conform to the low-voltage directive are described in this section. However, LSIS will not guarantee that the overall machinery manufactured according to the details conforms to the below-described directives. The method of conformance to the EMC directive and compliance to the EMC Directive must be determined by the manufacturer of the machinery.

13.2.1 Standards applicable to XGT series

The XGT PLC complies with EN6100-1 (safety of equipment used in measurement and control laboratories.)
XGT series PLCs have been developed in accordance with the above standards for modules operating at rated voltage of AC50V / DC75V or higher.

13.2.2 Selection of XGT Series PLC

(1) Power module
There are dangerous voltages (higher than 42.4V peak) inside the power supply modules of the Rated input voltage AC110/ 220Vtes. Therefore, the CE mark-compliant models feature enhanced insulation strong primary and secondary windings.

(2) I/O module
There are dangerous voltages (voltages higher than 42.4V peak) inside the I/O modules of the AC110/220V rated I/O voltages. Therefore, the CE mark-compliant models are enhanced in insulation internally between the primary and secondary. The I/O modules of DC24V or less rating are out of the low-voltage directive application range.

(3) CPU module, Base module
The above modules are using DC5V and 3.3V circuits inside, so they are out of the low-voltage directive application range.

(4) Special, Communication module
Special and communication modules are DC24V or less in rated voltage, therefore they are out of the low-voltage directive application range.

Chapter 14 Troubleshooting

The following explains contents, diagnosis and corrective actions for various errors that can occur during system operation.

14.1 Basic Procedure of Troubleshooting

System reliability not only depends on reliable equipment but also on short downtimes in the event of fault.
To start the system promptly, it is more important to find the trouble occurring cause promptly and take the necessary action. The basic items to comply when taking this trouble shooting are as follows.

(1) Visual check

Check the following points.

1) Machine operation state (STOP, RUN)
2) Power supply state
3) I/O device state
4) Wiring state (I/O cable, extension and communication cable)
5) After checking the indication state of each indicator (Power LED, Run LED, Stop LED, I/O LED etc.), connect the peripheral device and check PLC operation state and program contents.

(2) Trouble Check

Observe any change in the error conditions during the following.

1) Switch to the STOP position, and then turn the power on and off.

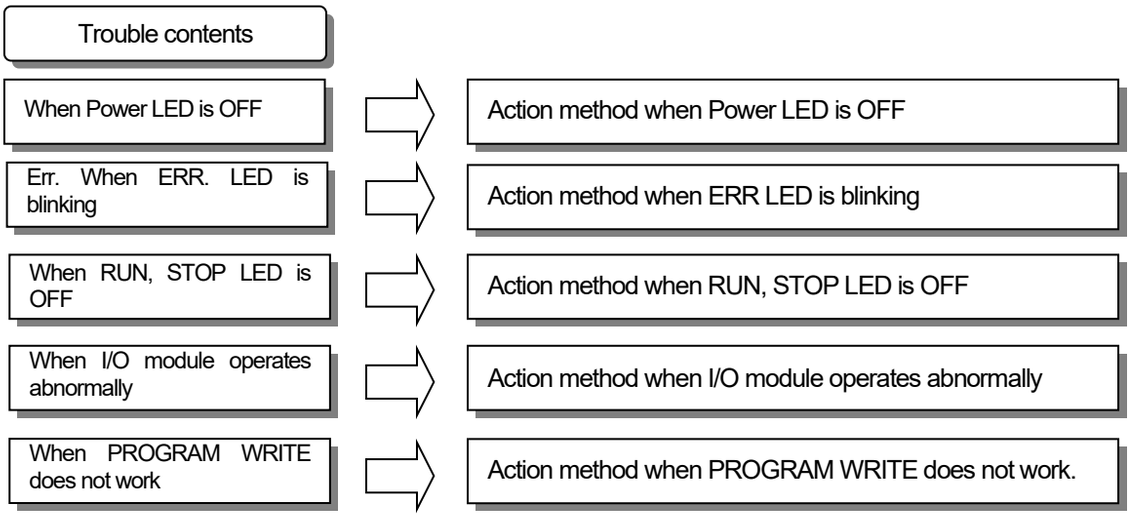
(3) Range limit

Estimate what is the trouble cause using the above method.

1) Is it from PLC itself or external cause?
2) Is it from I/O module or other cause?
3) Is it from PLC program?

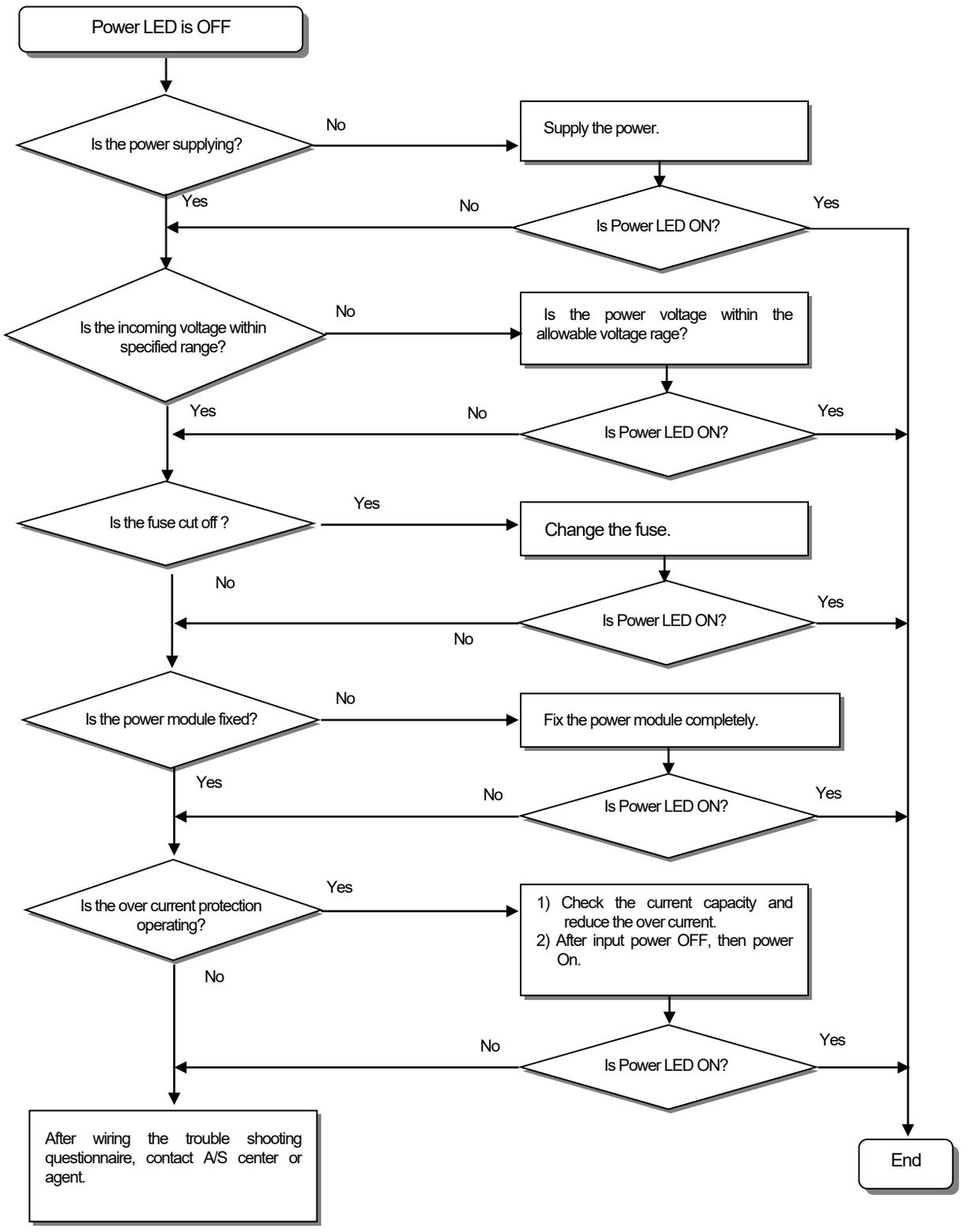
14.2 Troubleshooting

This section explains the procedure for determining the cause of troubles as well as the errors and corrective actions.



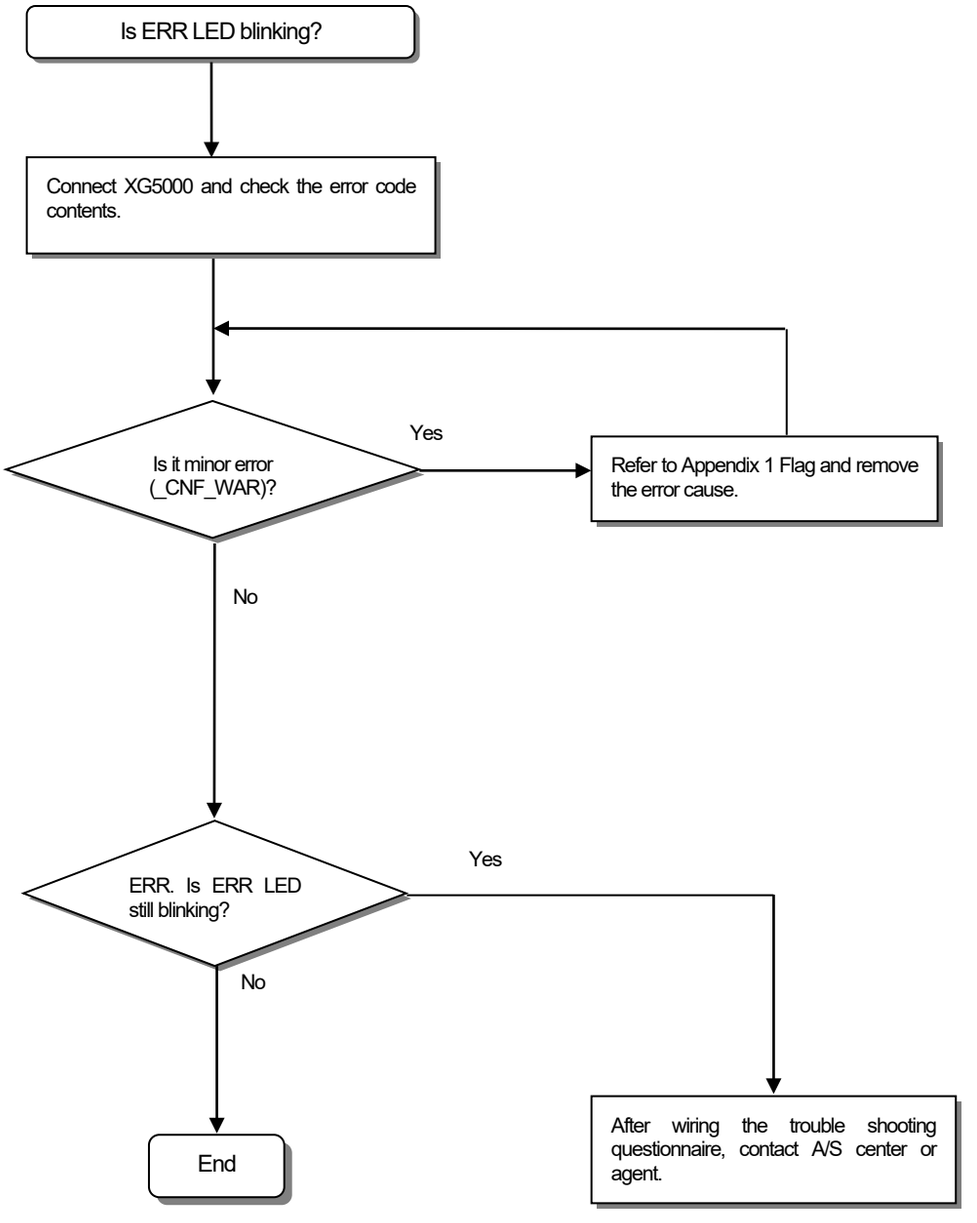
14.2.1 Action when Power LED is OFF

Here describes the action procedure when Power LED is OFF while supplying the power or during operation.



14.2. 2 Action when ERR LED is blinking

Here describes the action procedure when ERROR LED is blinking in case of power supply, or when operation starts, or during operation.

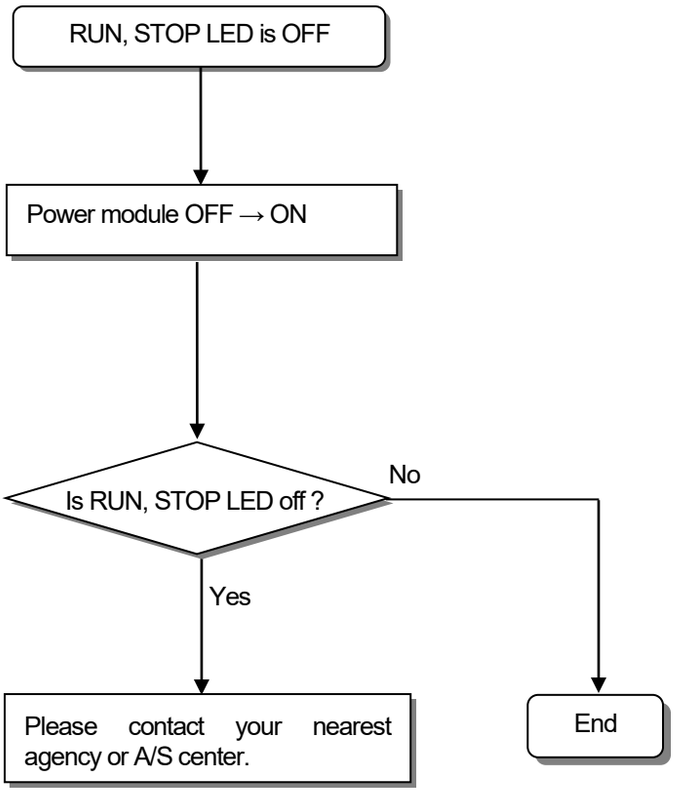


Notes

In case of minor error, PLC system does not stop but you should check the error contents promptly and take an action.
If not, it may cause the critical error.

14.2.3 Action when Run, Stop LED is OFF

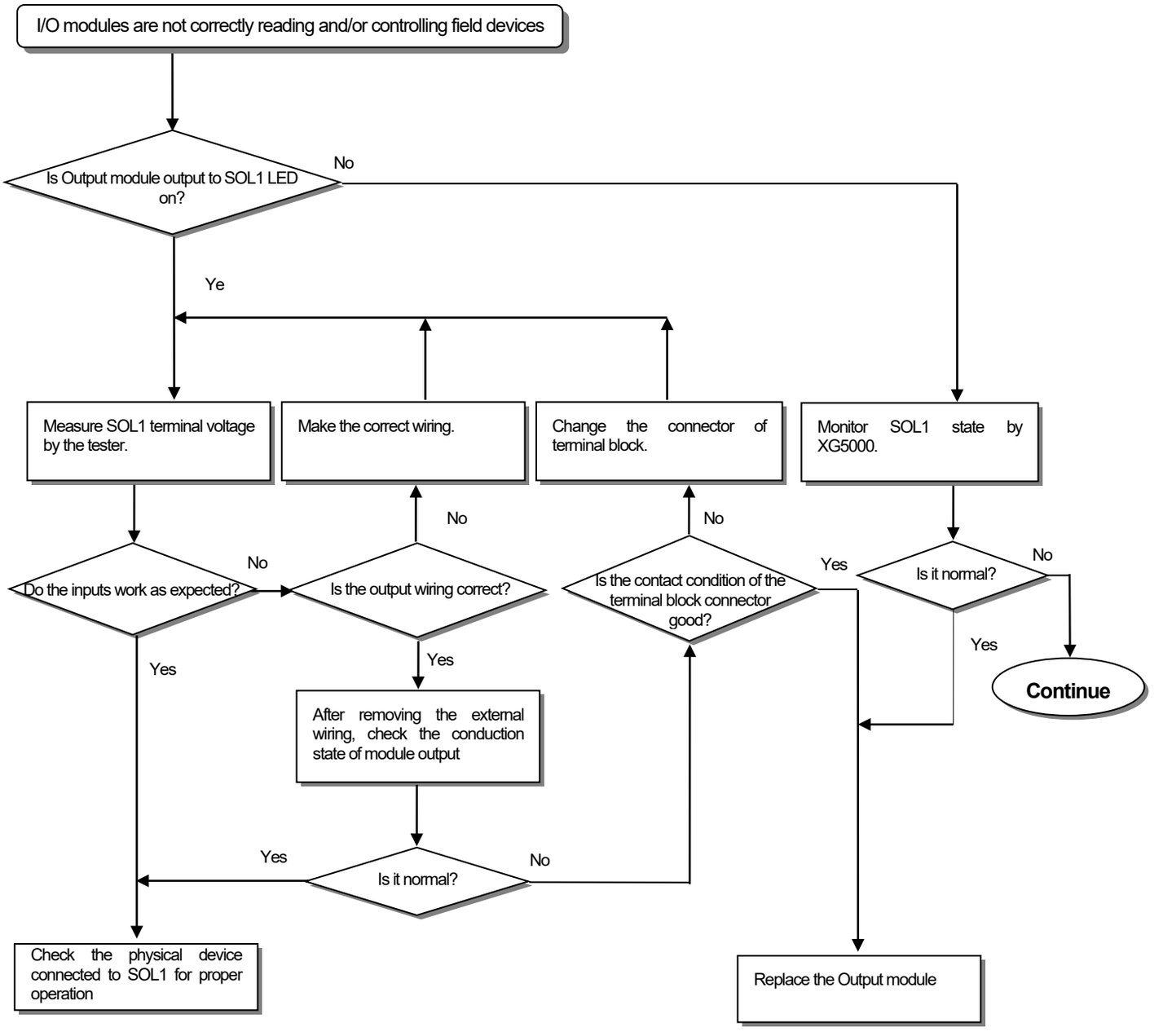
Here describes the action procedure when RUN, STOP LED is OFF in case of power supply, when operation starts or during operation.

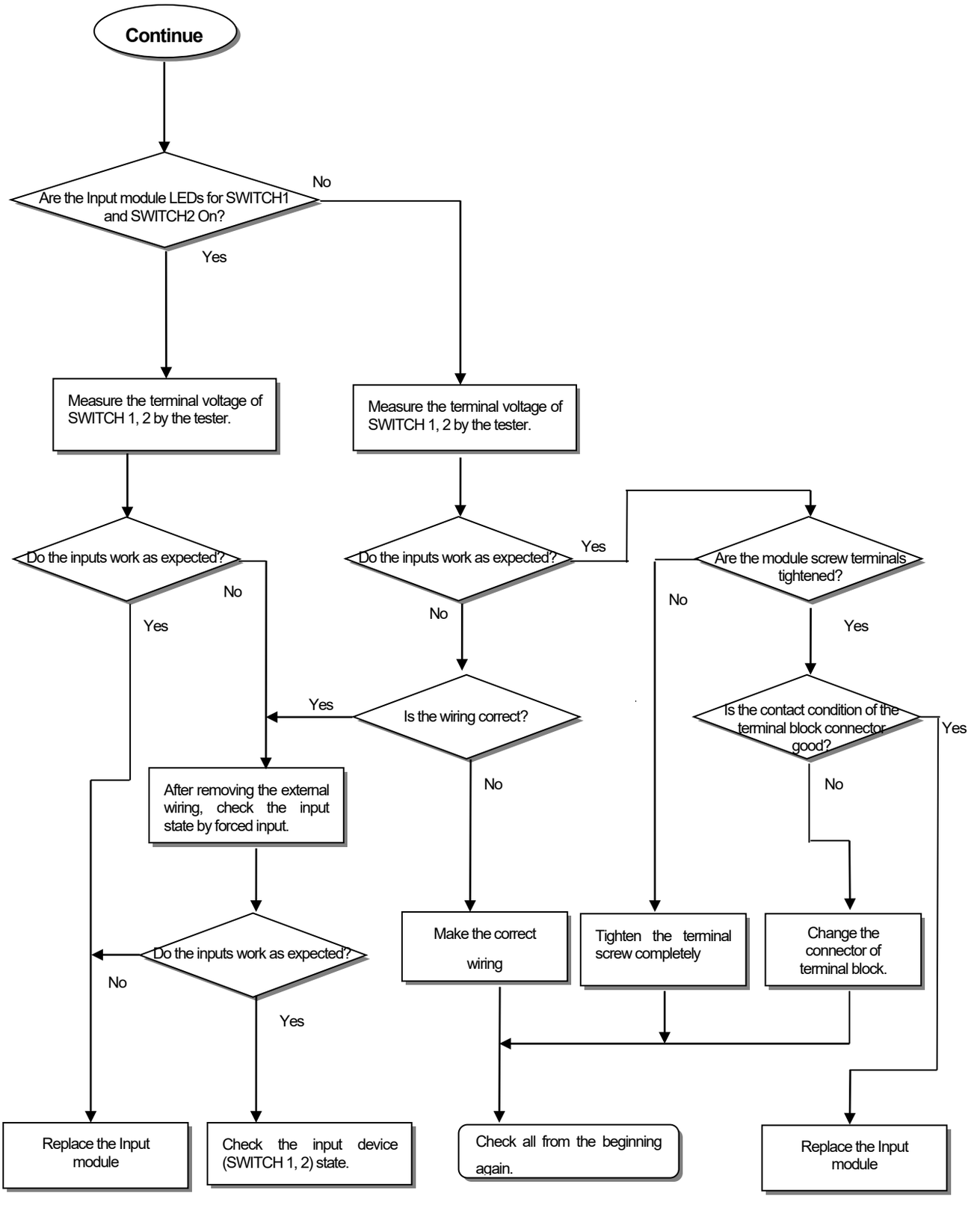


14.2.4 Action when I/O Module does not work normally

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

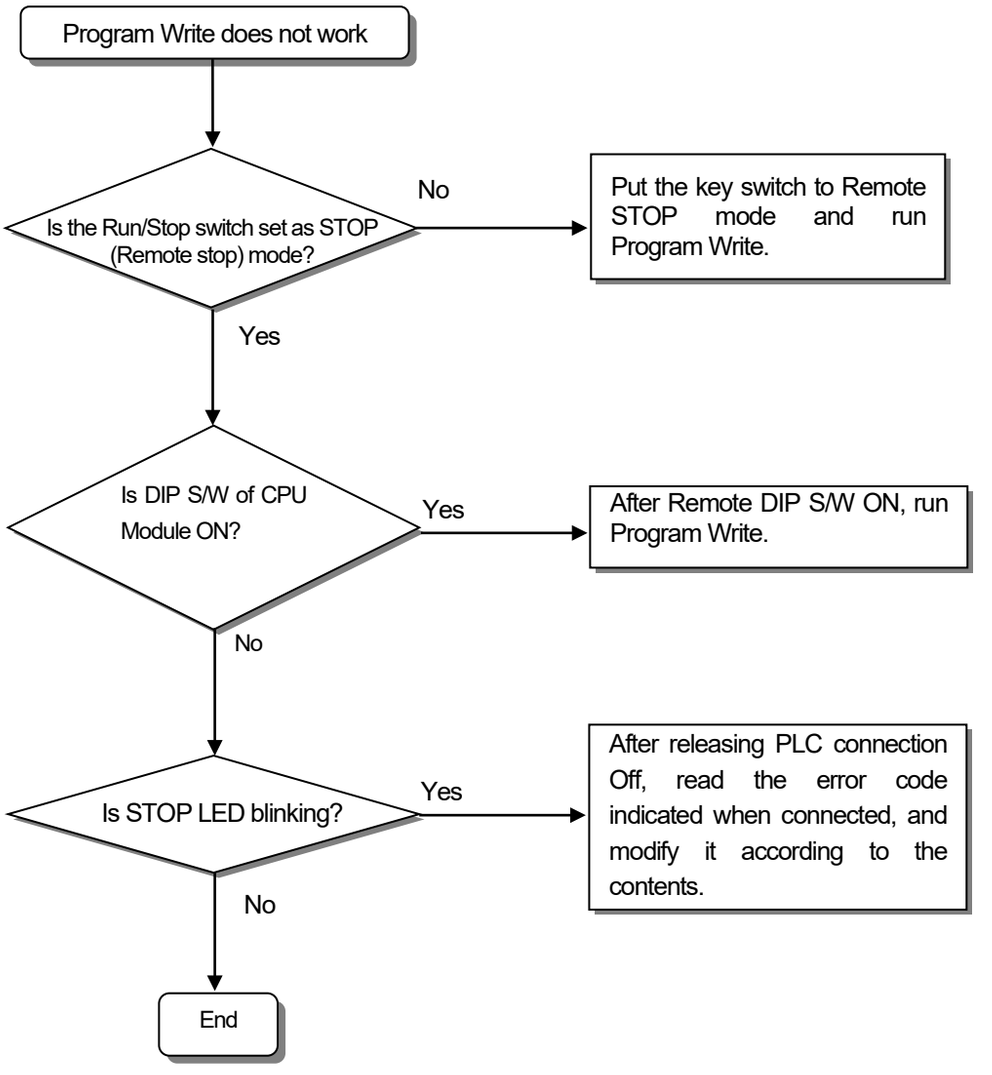





Continue
Are the Input module LEDs for SWITCH1 and SWITCH2 On?
No
Yes
Measure the terminal voltage of SWITCH 1, 2 by the tester.
Measure the terminal voltage of SWITCH 1, 2 by the tester.
Do the inputs work as expected?
No
Yes
Do the inputs work as expected?
Yes
No
Are the module screw terminals tightened?
No
Yes
Is the wiring correct?
Yes
No
Is the contact condition of the terminal block connector good?
Yes
No
After removing the external wiring, check the input state by forced input.
Do the inputs work as expected?
No
Yes
Make the correct wiring
Tighten the terminal screw completely
Change the connector of terminal block.
Replace the Input module
Check the input device (SWITCH 1, 2) state.
Check all from the beginning again.
Replace the Input module

14.2.5 Action when Program Write does not work

Here describes the action procedure when PROGRAM WRITE does not work in CPU Module.



14.3 Questionnaire for Troubleshooting

If the trouble occurs when using XGK series, fill in the following questionnaire and then contact customer's service center by phone or FAX.
• For errors relating to special or communication modules, use the questionnaire included in the User's manual of the module.

1. User Contact point: TEL) _____
FAX) _____
2. Model: ( )

3. Applied Module details
– CPU module details : – OS version ( ), – Serial no. of product ( )
– XG5000 version no. used in program compile : ( )

4. Brief description of control object device and system:

5. Using module of CPU module :
– Operation by key switch ( ), – XG5000 or operation by communication ( )
– Memory module operation ( )
6. STOP LED of CPU module ON? Yes( ), No( )
7. Error message content by XG5000:
8. History of corrective actions for the error message in the article 7:
9. Trouble shooting method for other error action:
10. Characteristics of the error
• Repetitive ( ) : Periodic ( ), Related to a particular sequence ( ), Related to environment ( )

• Intermittent ( ) : General error interval:
11. Detailed description for the error phenomena:

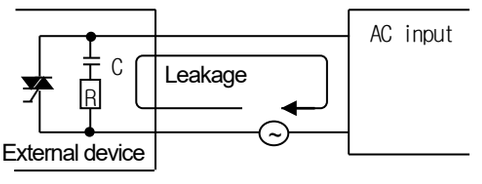
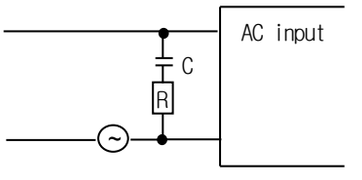
12. Configuration diagram of applied system:

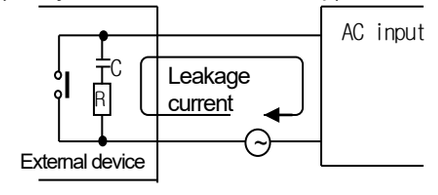
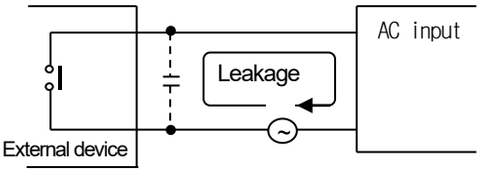
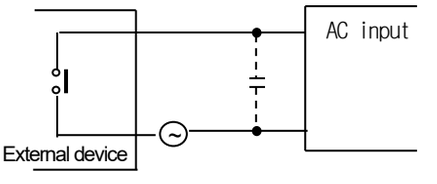
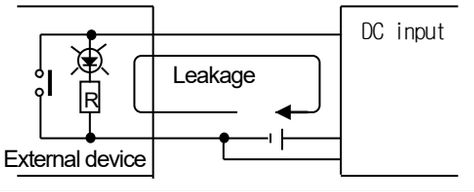
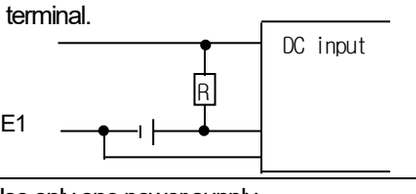
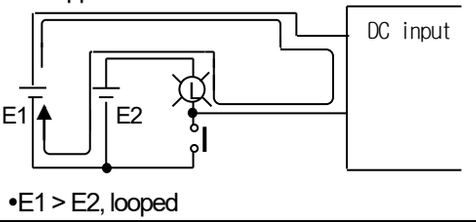
14.4 Cases

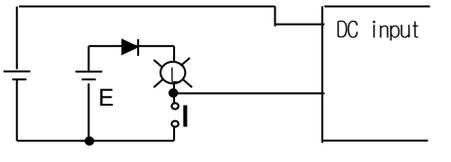
Here describes the trouble type and measures for each circuit.

14.4.1 Input Circuit Error Type and Corrective Actions

Here describes the trouble examples of input circuit and its measures.

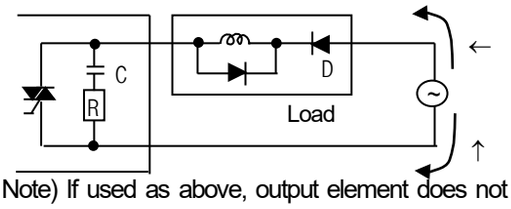
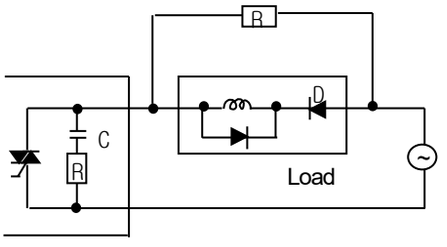
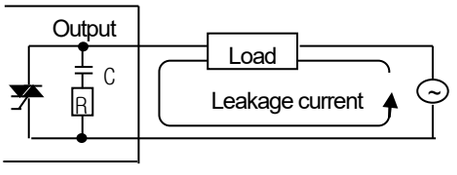
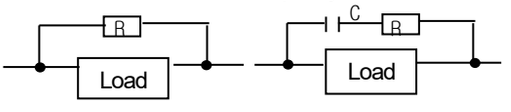
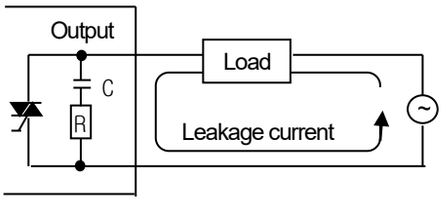
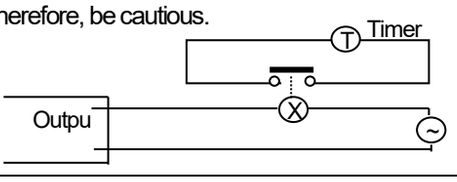
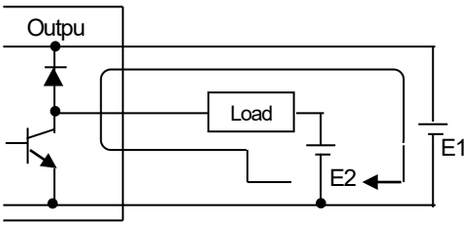
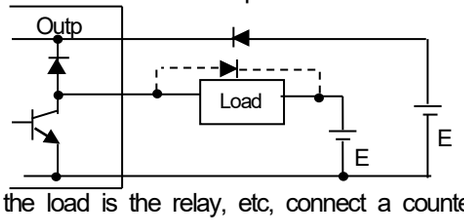
<table>
<tr><th>Phenomena</th><th>Causes</th><th>Measures</th></tr>
<tr><td>Input signal doesn't turn off.</td><td>Leakage current of external device
(Such as a drive by proximity switch)

</td><td rowspan="2">• Connect the proper resistance and capacity so that the voltage between terminals of input module is below return voltage.


•CR values are determined by the leakage current value.
– Recommended value C : 0.1 ~ 0.47 μF
R : 47 ~ 120 Ω (1/2W)
or make up another independent display circuit.</td></tr>
<tr><td>Input signal doesn't turn off (Neon lamp may be still on)</td><td>Leakage current of external device
(run by limit switch with neon lamp)

</td></tr>
<tr><td>Input signal not OFF</td><td>Leakage current due to line capacity of wiring cable.

</td><td>•Install the power on the external device as below.

</td></tr>
<tr><td>Input signal not OFF</td><td>Leakage current of external device
(Drive by switch with LED indicator)

</td><td>•Connect an appropriate register, which will make the voltage higher than the OFF voltage across the input module terminal and common terminal.

</td></tr>
<tr><td>Input signal not OFF</td><td>• loop current due to the use of two different power supplies.


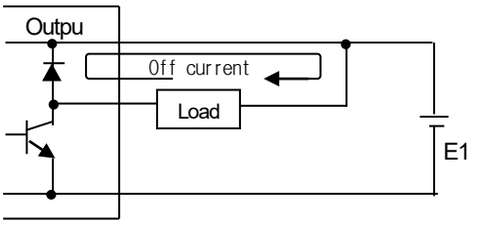
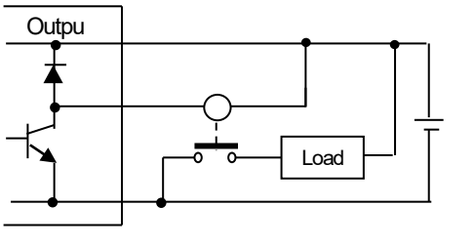
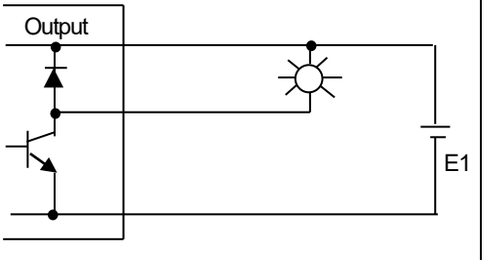
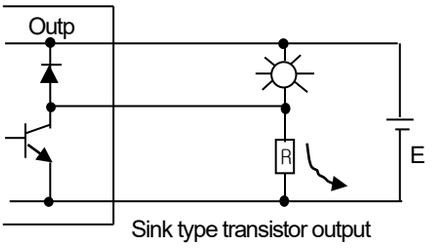
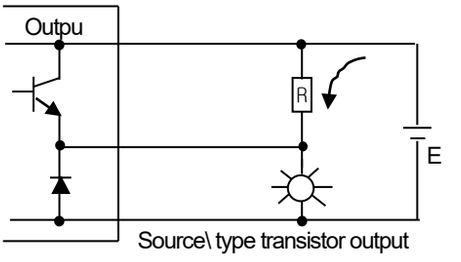
•E1 > E2, looped</td><td>• Use only one power supply.
•Connect a loop current prevention diode.

</td></tr>
</table>

14.4.2 Output Circuit Error Type and Corrective Actions

Here describes the trouble examples of output circuit and its measures.

Phenomena	Causes	Measures
Over voltage applied to the load if case of output contact OFF	•Load is half-wave rectified inside (in some cases, it is true of a solenoid) • If power polarity is ←, C is charged, if polarity is ↑, voltage charged to C +power voltage is applied to both sides of diode(D). Max. voltage is about $2\sqrt{2}$.  Note) If used as above, output element does not make trouble but the function of diode(D) built-in the load becomes low which causes the trouble.	• Connect registers of tens to hundreds KΩ across the load in parallel. 
The load doesn't turn off.	•Leakage through a surge suppressor connected in parallel to the load. 	•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 through a surge suppressor connected in parallel to the load. 	• Drive the relay using a contact and drive the C–R type timer using the since. • Use other timer than the C–R contact some timers. Note) Have half-ware rectified internal circuits therefore, be cautious. 
The load does not turn off. (for DC)	• Sneak current due to the use of two different power supplies.  • E1< E2, looped • E1 is off (E2 is on), looped.	• 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).

Phenomena	Causes	Measures
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 on.  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

14.5 Error Code List

14.5.1 Error Codes List during CPU Operation.

Code	Cause of error	Action (Restart Mode After Action)	Operation Status	LED status	Diagnostics point
13	Base information error	A / S request if repeated on power up	STOP	ERR : ON	Power on RUN mode change
23	Program execution error	Start after reloading the program Change battery if it has a problem. Check the preservation status after program reloading and if error occurs, change the CPU module.	STOP	ERR : ON	Reset Convert to RUN mode
24	I/O parameter error	Battery change if battery has a problem. Check the preservation status after I/O parameter reloading and if error occurs, change the CPU module.	STOP	ERR : ON	Reset Convert to RUN mode
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 CPU module.	STOP	ERR : ON	Reset Convert to RUN mode
26	Exceed execution range error	Start after reloading program. If it occurs repeatedly, request service center	STOP	ERR : ON	Reset Convert to RUN mode
27	Compile error	Start after reloading program. If it occurs repeatedly, request service center.	STOP	ERR : ON	Reset Convert to RUN mode
29	Special parameter error	Start after reloading the special parmeter Change battery if it has a problem. Check the preservation status after program reloading and if error occurs, change the CPU module.	STOP	ERR : ON	Reset Convert to RUN mode
30	Module set in parameter and the installed module does not match.	After checking the wrong position of slot by XG5000, modify the module or parameter and then restart. Reference flag: module type mismatch error flag	STOP (RUN)	ERR : ON (P.S. : ON)	RUN mode switching
31	Module falling during operation or additional setup	After checking the position of falling/adding slot by XG5000, modify the installation status of module and then restart (according to parameter). Reference flag: Module detach error flag	STOP (RUN)	ERR : ON (P.S. : ON)	Scan end
32	Fuse cutoff of fuse built-in module during operation	After checking the position of slot where the fuse cutoff occurs by XG5000, change the fuse and then restart (according to parameter). Reference flag: Fuse break error flag	STOP (RUN)	ERR : ON (P.S. : ON)	Scan end
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 (according to the parameter). Reference flag: I / O module read / write error flag	STOP (RUN)	ERR : ON (P.S. : ON)	Scan end

Code	Cause of error	Action (Restart Mode After Action)	Run status	LED status	Diagnostics point
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). Reference flag : special/link module interface error	STOP (RUN)	ERR : ON (P.S. : ON)	Scan end
39	Abnormal stop of CPU or malfunction	Abnormal system shutdown due to noise or hardware failure 1) If it occurs repeatedly when power reinput, request service center 2) Noise measures	STOP	RUN: ON ERR : ON	Always
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.	STOP	RUN: ON ERR : ON	In operation
41	Operation error occurs while running the user program.	Remove operation error → reload the program and restart	STOP	RUN: ON ERR : ON	While running the program
42	The stack exceeds the normal range while running the program	Restart	STOP	RUN: ON ERR : ON	While running the program
44	Timer index user error	After reloading a timer index program modification, start	STOP (RUN)	RUN: ON ERR : ON	Scan end
50	Detecting critical error of external device by user program during operation	Repair and restart the wrong device by referring to the fault detection flag of the external device (according to the parameter).	STOP (RUN)	ERR : ON (P.S. : ON)	Scan end
60	E_STOP function executed	Remove the error factor that triggered the E_STOP function in the program and turn the power on again	STOP	RUN: ON ERR : ON	While running the program
500	Data memory backup not possible	If the battery is OK, turn the power back on. Switch to STOP mode in remote mode	Stop	ERR : ON	PLC Reset
501	Clock data abnormal	If there is no problem with the battery, resetting the time with a device such as XG5000.	-	CHK: ON	Always
502	Low battery voltage	Battery change in the state of power input.	-	BAT: ON	Always

Notes

1) When error code 39 occurs, the values in the other retain areas except for the R and ZR areas are restored to previously backed up data.

It will be restored. Data at the time of abnormal termination is not backed up.

24.5.2 Error Code of Program Operation

Code	Error	CPU condition	Cause	Action
16	Indirect setting/index error	Run/Stop based on parameter setting	If operand with indirect setting or index used exceeds applicable device's range	Modify applicable step's indirect setting/index area
17	Group instruction range check error	Run/Stop based on parameter setting	If N value to set group range in group instructions exceeds device's range	Modify N value
18	0-division error	Run/Stop based on parameter setting	If divisor is 0, when Divide instructions (except RDIV, LDIV) executed.	Change the value of divisor to other than 0.
19	BCD convert error	Run/Stop based on parameter setting	If BCD related instruction's operand value exceeds BCD format.	Modify data to be within BCD displayed range.
20	File bank setting error	Run/Stop based on parameter setting	If bank setting value in file related instructions exceeds the max. Bank range.	Modify bank setting value.
21	Floating point operation error	Run/Stop based on parameter setting	If an error occurs when real operation command is used.	Modify data
22	Data type conversion error	Run/Stop based on parameter setting	If available data size to display is different when converting data format (Real<->Integer).	Modify data
23	BMOV error	Run/Stop based on parameter setting	If BMOV instruction's setting value exceeds 16.	Modify setting value
24	DECO/ENCO Error	Run/Stop based on parameter setting	With DECO, ENCO instruction used if range setting value exceeds 8.	Modify setting value
25	DIS/UNI error	Run/Stop based on parameter setting	With DIS/UNI instruction used if N value exceeds 4.	Modify N value
26	Data type related error	Run/Stop based on parameter setting	If data control related command's range is exceeded.	Correct the range
27	Time Data Error	Run/Stop based on parameter setting	Time related instruction error	Modify time data
28	MUX error	Run/Stop based on parameter setting	MUX/DMUX instruction setting value error.	Modify setting value
29	Data table instruction error	Run/Stop based on parameter setting	FIINS, FIDEL instruction setting value error.	Modify setting value
30	SEG error	Run/Stop based on parameter setting	If the number to be converted among formats specified exceeds 4.	Modify setting value
31	ASCII value error	Run/Stop based on parameter setting	ASCII data related instruction error	Modify data
32	Position module setting axis error	Run/Stop based on parameter setting	If 3 or more axes are set with position module instruction used. (check only for 3 or more unconditionally)	Modify axis setting value.
33	String Process error	Run/Stop based on parameter setting	String process related command error refer to commands List.	Modify based on instructions.
34	SORT error	Run/Stop based on parameter setting	SORT/DSORT instruction setting error.	Modify setting value
35	FOR nesting error	Run/Stop based on parameter setting	If the number of FOR instruction's nesting exceeds 16.	Modify program
36	Task number error	Run/Stop based on parameter setting	If the task number is 96 or higher.	Modify task number

37	Device range check error	Run/Stop based on parameter setting	If the device area settings exceeds instruction specification.	Modify device area
38	P2P data error	Run/Stop based on parameter setting	Settings of P2P are out of range	Modify data
39	Module Configuration error	Run/Stop based on parameter setting	The module can't be set properly	Install the module properly
41	Command error	Run/Stop based on parameter setting	GETIP,SEIP command operation error	Check GETIP,SETIP command setting and operation

Notes

1) If the basic parameter is set to "Continue running when error occurs," the program operation error code can be checked using XG5000 system history.

2) If "Continue running when error occurs" is removed, it can be checked with XG5000 error history.

Appendix 1 Flag List

App.1.1 Special Relay (F) List

Device1	Device2	Type	Variables	Function	Description
F0000		DWORD	_SYS_STATE	Mode and state	Indicates PLC mode and operation state
	F00000	BIT	_RUN	Run	Run state
	F00001	BIT	_STOP	Stop	Stop state
	F00002	BIT	_ERROR	Error	Error state
	F00003	BIT	_DEBUG	Debug	Debug state
	F00004	BIT	_LOCAL_CON	Local control	Local control mode
	F00005	BIT	_MODBUS_CON	Mode bus mode	Mode bus control mode
	F00006	BIT	_REMOTE_CON	Remote mode	Remote control mode
	F00008	BIT	_RUN_EDIT_ST	Editing during RUN	Editing program download during RUN
	F00009	BIT	_RUN_EDIT_CHK	Editing during RUN	Internal edit processing during RUN
	F0000A	BIT	_RUN_EDIT_DONE	Edit done during RUN	Edit is done during RUN
	F0000B	BIT	_RUN_EDIT_END	Edit end during RUN	Edit is ended during RUN
	F0000C	BIT	_CMOD_KEY	Operation mode	Operation mode changed by key
	F0000D	BIT	_CMOD_LPADT	Operation mode	Operation mode changed by local PADT
	F0000E	BIT	_CMOD_RPADT	Operation mode	Operation mode changed by Remote PADT
	F0000F	BIT	_CMOD_RLINK	Operation mode	Operation mode changed by Remote communication module
	F00010	BIT	_FORCE_IN	Forced input	Forced input state
	F00011	BIT	_FORCE_OUT	Forced output	Forced output state
	F00012	BIT	_SKIP_ON	I/O SKIP	I/O SKIP on execution
	F00013	BIT	_EMASK_ON	Error mask	Error mask on execution
	F00014	BIT	_MON_ON	monitor	Monitor on execution
	F00015	BIT	_USTOP_ON	Stop	Stop by Stop function
	F00016	BIT	_ESTOP_ON	EStop	Stop by EStop function
	F00017	BIT	_CONPILE_MODE	Compile	Compile on execution
	F00018	BIT	_INIT_RUN	Initialize	Initialization task on execution
	F0001C	BIT	_PB1	Program Code 1	Program Code 1 selected
	F0001D	BIT	_PB2	Program Code 2	Program Code 2 selected
	F0001E	BIT	_CB1	Compile Code 1	Compile Code 1 selected
	F0001F	BIT	_CB2	Compile Code2	Compile Code 2 selected
F0002		DWORD	_CNF_ER	System error	Reports heavy error state of system
	F00020	BIT	_CPU_ER	CPU error	CPU configuration error
	F00021	BIT	_IO_TYER	Module Type error	Module Type does not match

Device1	Device2	Type	Variables	Function	Description
	F00022	BIT	_IO_DEER	Module detachment error	Module is detached.
	F00023	BIT	_FUSE_ER	Fuse error	Fuse is cutoff
	F00024	BIT	_IO_RWER	Module I/O error	Module I/O error
	F00025	BIT	_IP_IFER	Module interface error	Special/communication module interface error
	F00026	BIT	_ANNUM_ER	External device error	Detected heavy error in external device
	F00027	BIT	_CDOVER_ER	Basic parameter	Execution code area exceeded error
	F00028	BIT	_BPRM_ER	Basic parameter	Basic parameter error
	F00029	BIT	_IOPRM_ER	IO parameter	I/O configuration parameter error
	F0002A	BIT	_SPPRM_ER	Special module parameter	Special module parameter is abnormal
	F0002B	BIT	_CPPRM_ER	Communication module parameter	Communication module parameter is abnormal
	F0002C	BIT	_PGM_ER	Program error	Program error
	F0002D	BIT	_CODE_ER	Code error	Program Code error
	F0002E	BIT	_SWDT_ER	System watchdog	System watchdog operated
	F0002F	BIT	_BASE_POWER_ER	Power error	Base power error
	F00030	BIT	_WDT_ER	Scan watchdog	Scan watchdog operated
F0004		DWORD	_CNF_WAR	System warning	Reports light error state of system
	F00031	BIT	_BASE_INFO_ER	Base information error	There is a problem with the base information.
	F00032	BIT	_TMRIDX_ER	Timer index use error	An error occurred in the timer index.
	F00033	BIT	_COMPILE_ER	compile error	A compilation error occurred.
	F00034	BIT	_INST_ER	operation error	An operation error occurred.
	F00041	BIT	_DBCK_ER	Backup error	Data backup error
	F00042	BIT	_HBCK_ER	Restart error	Hot restart not possible
	F00042	BIT	_HBCK_ER	Restart error	Hot restart not possible
	F00043	BIT	_ABSD_ER	Operation shutdown error	Stop by abnormal operation
	F00044	BIT	_TASK_ER	Task collision	Task collision
	F00045	BIT	_BAT_ER	Battery error	Battery error
	F00046	BIT	_ANNUM_WAR	External device error	Detected light error of external device
	F00047	BIT	_LOG_FULL	Memory full	Log memory is full.
	F00048	BIT	_HS_WAR1	High speed link 1	High speed link – parameter 1 error
	F00049	BIT	_HS_WAR2	High speed link 2	High speed link – parameter 2 error
	F0004A	BIT	_HS_WAR3	High speed link 3	High speed link – parameter 3 error
	F0004B	BIT	_HS_WAR4	High speed link 4	High speed link – parameter 4 error
	F0004C	BIT	_HS_WAR5	High speed link 5	High speed link – parameter 5 error
	F0004D	BIT	_HS_WAR6	High speed link 6	High speed link – parameter 6 error

Device1	Device2	Type	Variables	Function	Description
	F0004E	BIT	_HS_WAR7	High speed link 7	High speed link – parameter 7 error
	F0004F	BIT	_HS_WAR8	High speed link 8	High speed link – parameter 8 error
	F00050	BIT	_HS_WAR9	High speed link 9	High speed link – parameter 9 error
	F00051	BIT	_HS_WAR10	High speed link 10	High speed link – parameter 10 error
	F00052	BIT	_HS_WAR11	High speed link 11	High speed link - parameter 11 error
	F00053	BIT	_HS_WAR12	High speed link 12	High speed link - parameter 12 error
	F00054	BIT	_P2P_WAR1	P2P parameter 1	P2P – parameter 1 error
	F00055	BIT	_P2P_WAR2	P2P parameter 2	P2P – parameter 2 error
	F00056	BIT	_P2P_WAR3	P2P parameter 3	P2P – parameter 3 error
	F00057	BIT	_P2P_WAR4	P2P parameter 4	P2P – parameter 4 error
	F00058	BIT	_P2P_WAR5	P2P parameter 5	P2P – parameter 5 error
	F00059	BIT	_P2P_WAR6	P2P parameter 6	P2P – parameter 6 error
	F0005A	BIT	_P2P_WAR7	P2P parameter 7	P2P – parameter 7 error
	F0005B	BIT	_P2P_WAR8	P2P parameter 8	P2P – parameter 8 error
	F0005C	BIT	_CONSTANT_ER	Constant error	Constant error
	F0005F	BIT	_EIP_TAG_WAR	EtherNet/IP TAG information error	EtherNet/IP TAG information error
F0009		WORD	_USER_F	User contact	Timer used by user
	F00090	BIT	_T20MS	20ms	20ms cycle Clock
	F00091	BIT	_T100MS	100ms	100ms cycle Clock
	F00092	BIT	_T200MS	200ms	200ms cycle Clock
	F00093	BIT	_T1S	1s	1s cycle Clock
	F00094	BIT	_T2S	2s	2s cycle Clock
	F00095	BIT	_T10S	10s	10s cycle Clock
	F00096	BIT	_T20S	20s	20s cycle Clock
	F00097	BIT	_T60S	60s	60s cycle Clock
	F00099	BIT	_ON	Ordinary time On	Always On state Bit
	F0009A	BIT	_OFF	Ordinary time Off	Always Off state Bit
	F0009B	BIT	_1ON	1scan On	First scan ON Bit
	F0009C	BIT	_1OFF	1scan Off	First scan OFF bit
	F0009D	BIT	_STOG	Reversal	Reversal every scan
F0010		WORD	_USER_CLK	User Clock	Clock available for user setting
	F00100	BIT	_USR_CLK0	Setting scan repeat	On/Off as much as set scan Clock 0
	F00101	BIT	_USR_CLK1	Setting scan repeat	On/Off as much as set scan Clock 1
	F00102	BIT	_USR_CLK2	Setting scan repeat	On/Off as much as set scan Clock 2
	F00103	BIT	_USR_CLK3	Setting scan repeat	On/Off as much as set scan Clock 3
	F00104	BIT	_USR_CLK4	Setting scan repeat	On/Off as much as set scan Clock 4
	F00105	BIT	_USR_CLK5	Setting scan repeat	On/Off as much as set scan Clock 5
	F00106	BIT	_USR_CLK6	Setting scan repeat	On/Off as much as set scan Clock 6

Device1	Device2	Type	Variables	Function	Description
	F00107	BIT	_USR_CLK7	Setting scan repeat	On/Off as much as set scan Clock 7
F0011		WORD	_LOGIC_RESULT	Logic result	Indicates logic results
	F00110	BIT	_LER	operation error	ON during 1 scan in case of operation error
	F00111	BIT	_ZERO	Zero flag	ON when operation result is 0
	F00112	BIT	_CARRY	Carry flag	ON when carry occurs during operation
	F00113	BIT	_ALL_OFF	All output OFF	ON in case that all output is Off
	F00115	BIT	_LER_LATCH	Operation error Latch	Keeps ON during operation error
F0012		WORD	_CMP_RESULT	Comparison result	Indicates the comparison result.
	F00120	BIT	_LT	LT flag	ON in case of “less than”
	F00121	BIT	_LTE	LTE flag	ON in case of “equal or less than”
	F00122	BIT	_EQU	EQU flag	On in case of “equal”
	F00123	BIT	_GT	GT flag	ON in case of “greater than”
	F00124	BIT	_GTE	GTE flag	ON in case of “equal or greater than”
	F00125	BIT	_NEQ	NEQ flag	ON in case of “not equal”
F0013		WORD	_AC_F_CNT	Moment shutdown	Indicates moment shutdown times
F0014		WORD	_FALS_NUM	FALS no.	Indicates FALS no.
F0015		WORD	_PUTGET_ERR0	PUT/GET error 0	Main base Put / Get error
F0016		WORD	_PUTGET_ERR1	PUT/GET error 1	Extended base 1 step Put/Get error
F0017		WORD	_PUTGET_ERR2	PUT/GET error 2	Extended base 2 step Put/Get error
F0018		WORD	_PUTGET_ERR3	PUT/GET error 3	Extended base 3 step Put/Get error
F0019		WORD	_PUTGET_ERR4	PUT/GET error 4	Extended base 4 step Put/Get error
F0020		WORD	_PUTGET_ERR5	PUT/GET error 5	Extended base 5 step Put/Get error
F0021		WORD	_PUTGET_ERR6	PUT/GET error 6	Extended base 6 step Put/Get error
F0022		WORD	_PUTGET_ERR7	PUT/GET error 7	Extended base 7 step Put/Get error
F0023		WORD	_PUTGET_NDR0	PUT/GET end 0	Main base Put/Get end
F0024		WORD	_PUTGET_NDR1	PUT/GET end 1	Extended base 1 step Put/Get end
F0025		WORD	_PUTGET_NDR2	PUT/GET end 2	Extended base 2 step Put/Get end
F0026		WORD	_PUTGET_NDR3	PUT/GET end 3	Extended base 3 step Put/Get end
F0027		WORD	_PUTGET_NDR4	PUT/GET end 4	Extended base 4 step Put/Get end
F0028		WORD	_PUTGET_NDR5	PUT/GET end 5	Extended base 5 step Put/Get end
F0029		WORD	_PUTGET_NDR6	PUT/GET end 6	Extended base 6 step Put/Get end
F0030		WORD	_PUTGET_NDR7	PUT/GET end 7	Extended base 7 step Put/Get end
F0044		WORD	_CPU_TYPE	CPU Type	Indicates information for CPU Type.
F0045		WORD	_CPU_VER	CPU version	Indicates CPU version
F0046		DWORD	_OS_VER	OS version	Indicates OS version
F0048		DWORD	_OS_DATE	OS date	Indicates OS distribution date.
F0050		WORD	_SCAN_MAX	Max. scan time	Indicates max. scan time.

Device1	Device2	Type	Variables	Function	Description
F0051		WORD	_SCAN_MIN	Min. scan time	Indicates min. scan time.
F0052		WORD	_SCAN_CUR	Current scan time	Current scan time
F0053		WORD	_MON_YEAR	Month/Year	PLC month, year data
F0054		WORD	_TIME_DAY	Time/Day	PLC time, day data
F0055		WORD	_SEC_MIN	Sec/Min	PLC second, minute data
F0056		WORD	_HUND_WK	Hundred year/Weekday	PLC hundred year, weekday data
F0057		WORD	_FPU_INFO	FPU operation result	Fixed decimal operation result
	F00570	BIT	_FPU_LFLAG_I	Incorrect error latch	Latch in case of incorrect error
	F00571	BIT	_FPU_LFLAG_U	Underflow latch	Latch in case of underflow
	F00572	BIT	_FPU_LFLAG_O	Overflow latch	Latch in case of overflow
	F00573	BIT	_FPU_LFLAG_Z	Zero(0) divide latch	Latch in case of zero(0) divide
	F00574	BIT	_FPU_LFLAG_V	Invalid operation latch	Latch in case of invalid operation
	F0057A	BIT	_FPU_FLAG_I	Incorrect error	Reports incorrect error
	F0057B	BIT	_FPU_FLAG_U	Underflow	Reports underflow
	F0057C	BIT	_FPU_FLAG_O	Overflow	Reports overflow
	F0057D	BIT	_FPU_FLAG_Z	Zero divide	Reports in case of zero divide
	F0057E	BIT	_FPU_FLAG_V	Invalid operation	Reports in case of invalid operation
	F0057F	BIT	_FPU_FLAG_E	Irregular input	Reports in case of irregular input
F0058		DWORD	_ERR_STEP	Error step	Saves error step
F0060		DWORD	_REF_COUNT	Refresh	Increase when module Refresh
F0062		DWORD	_REF_OK_CNT	Refresh OK	Increase when module Refresh is normal
F0064		DWORD	_REF_NG_CNT	Refresh NG	Increase when module Refresh is abnormal
F0066		DWORD	_REF_LIM_CNT	Refresh Limit	Increase when module Refresh is abnormal (Time Out)
F0068		DWORD	_REF_ERR_CNT	Refresh Error	Increase when module Refresh is abnormal
F0070		DWORD	_MOD_RD_ERR_CNT	Module Read Error	Increase when reading module 1 word abnormally
F0072		DWORD	_MOD_WR_ERR_CNT	Module Write Error	Increase when module 1 word abnormally
F0074		DWORD	_CA_CNT	Block service	Increase when module block data service
F0076		DWORD	_CA_LIM_CNT	Block service Limit	Increase when block data service is limited
F0078		DWORD	_CA_ERR_CNT	Block service Error	Increase in case of block data service error
F0080		DWORD	_BUF_FULL_CNT	Buffer Full	Increase when CPU internal buffer is full.
F0082		DWORD	_PUT_CNT	Put count	Increase when Put count
F0084		DWORD	_GET_CNT	Get count	Increase when Get count
F0086		DWORD	_KEY	Current key	indicates the current state of local key.
F0088		DWORD	_KEY_PREV	Previous key	indicates the previous state of local

Device1	Device2	Type	Variables	Function	Description
					key
F0090		WORD	_IO_TYER_N	Mismatch slot	Module Type mismatched slot no.
F0091		WORD	_IO_DEER_N	Detach slot	Module detached slot no.
F0092		WORD	_FUSE_ER_N	Fuse cutoff slot	Fuse cutoff slot no.
F0093		WORD	_IO_RWER_N	RW error slot	Module read/write error slot no.
F0094		WORD	_IP_IFER_N	IF error slot	Module interface error slot no.
F0096		WORD	_IO_TYER0	Module Type 0 error	Main base module Type error
F0097		WORD	_IO_TYER1	Module Type 1 error	Extended base 1 step module Type error
F0098		WORD	_IO_TYER2	Module Type 2 error	Extended base 2 step module Type error
F0099		WORD	_IO_TYER3	Module Type 3 error	Extended base 3 step module Type error
F0100		WORD	_IO_TYER4	Module Type 4 error	Extended base 4 step module Type error
F0101		WORD	_IO_TYER5	Module Type 5 error	Extended base 5 step module Type error
F0102		WORD	_IO_TYER6	Module Type 6 error	Extended base 6 step module Type error
F0103		WORD	_IO_TYER7	Module Type 7 error	Extended base 7 step module Type error
F0104		WORD	_IO_DEER0	Module detach 0 error	Main base module detach error
F0105		WORD	_IO_DEER1	Module detach 1 error	Extended base 1 step module detach error
F0106		WORD	_IO_DEER2	Module detach 2 error	Extended base 2 step module detach error
F0107		WORD	_IO_DEER3	Module detach 3 error	Extended base 3 step module detach error
F0108		WORD	_IO_DEER4	Module detach 4 error	Extended base 4 step module detach error
F0109		WORD	_IO_DEER5	Module detach 5 error	Extended base 5 step module detach error
F0110		WORD	_IO_DEER6	Module detach 6 error	Extended base 6 step module detach error
F0111		WORD	_IO_DEER7	Module detach 7 error	Extended base 7 step module detach error
F0112		WORD	_FUSE_ER0	Fuse cutoff 0 error	Main base fuse cutoff error
F0113		WORD	_FUSE_ER1	Fuse cutoff 1 error	Extended base 1 step fuse cutoff error
F0114		WORD	_FUSE_ER2	Fuse cutoff 2 error	Extended base 2 step fuse cutoff error
F0115		WORD	_FUSE_ER3	Fuse cutoff 3 error	Extended base 3 step fuse cutoff error
F0116		WORD	_FUSE_ER4	Fuse cutoff 4 error	Extended base 4 step fuse cutoff error
F0117		WORD	_FUSE_ER5	Fuse cutoff 5 error	Extended base 5 step fuse cutoff error
F0118		WORD	_FUSE_ER6	Fuse cutoff 6 error	Extended base 6 step fuse cutoff error
F0119		WORD	_FUSE_ER7	Fuse cutoff 7 error	Extended base 7 step fuse cutoff error
F0120		WORD	_IO_RWER0	Module RW 0 error	Main base module read/write error
F0121		WORD	_IO_RWER1	Module RW 1 error	Extended base1 step module read/ write error

Device1	Device2	Type	Variables	Function	Description
F0122		WORD	_IO_RWER2	Module RW 2 error	Extended base 2 step module read/ write error
F0123		WORD	_IO_RWER3	Module RW 3 error	Extended base 3 step module read/ write error
F0124		WORD	_IO_RWER4	Module RW 4 error	Extended base 4 step module read/ write error
F0125		WORD	_IO_RWER5	Module RW 5 error	Extended base 5 step module read/ write error
F0126		WORD	_IO_RWER6	Module RW 6 error	Extended base 6 step module read/ write error
F0127		WORD	_IO_RWER7	Module RW 7 error	Extended base 7 step module read/ write error
F0128		WORD	_IO_IFER_0	Module IF 0 error	Main base module interface error
F0129		WORD	_IO_IFER_1	Module IF 1 error	Extended base 1step module interface error
F0130		WORD	_IO_IFER_2	Module IF 2 error	Extended base 2step module interface error
F0131		WORD	_IO_IFER_3	Module IF 3 error	Extended base 3step module interface error
F0132		WORD	_IO_IFER_4	Module IF 4 error	Extended base 4step module interface error
F0133		WORD	_IO_IFER_5	Module IF 5 error	Extended base 5step module interface error
F0134		WORD	_IO_IFER_6	Module IF 6 error	Extended base 6step module interface error
F0135		WORD	_IO_IFER_7	Module IF 7 error	Extended base 7step module interface error
F0136		WORD	_RTC_DATE	RTC date	RTC current date
F0137		WORD	_RTC_WEEK	RTC weekday	RTC current weekday
F0138		DWORD	_RTC_TOD	RTC time	RTC current time (ms unit)
F0140		DWORD	_AC_FAIL_CNT	Power shutdown times	Saves the times of power shutdown
F0142		DWORD	_ERR_HIS_CNT	Error occur times	Saves the times of error occur
F0144		DWORD	_MOD_HIS_CNT	Mode conversion times	Saves the times of mode conversion
F0146		DWORD	_SYS_HIS_CNT	History occur times	Saves the times of system history
F0148		DWORD	_LOG_ROTATE	Log Rotate	Saves log rotate information
F0150		WORD	_BASE_INFO0	Slot information 0	Main base slot information
F0151		WORD	_BASE_INFO1	Slot information 1	Extended base 1step slot information
F0152		WORD	_BASE_INFO2	Slot information 2	Extended base 2step slot information
F0153		WORD	_BASE_INFO3	Slot information 3	Extended base 3step slot information
F0154		WORD	_BASE_INFO4	Slot information 4	Extended base 4step slot information
F0155		WORD	_BASE_INFO5	Slot information 5	Extended base 5step slot information
F0156		WORD	_BASE_INFO6	Slot information 6	Extended base 6step slot information
F0157		WORD	_BASE_INFO7	Slot information 7	Extended base 7step slot information
F0158		WORD	_RBANK_NUM	Use block no.	Current using block no.
F0159		WORD	_RBLOCK_STATE	Flash state	Flash block state
F0164		DWORD	_RBLOCK_ER_FLAG	Flash error	Error during flash NBlock service
F0160		DWORD	_RBLOCK_RD_FLAG	Flash read	ON when reading flash Nblock data

Device1	Device2	Type	Variables	Function	Description
F0162		DWORD	_RBLOCK_WR_FLAG	Flash write	ON when writing flash Nblock data
F0178		DWORD	_OS_VER_PATCH	OS patch version	Indicates OS version to second decimal places.
F09320		BIT	_FUSE_ER_PMT	Setting in case of fuse error	Ignores fuse error
F09321		BIT	_IO_ER_PMT	Setting in case of I/O error	Ignores I/O module error
F09322		BIT	_SP_ER_PMT	Setting in case of special module error	Ignores special module error
F09323		BIT	_CP_ER_PMT	Setting in case of communication error	Ignores communication module error
F0934		DWORD	_BASE_EMASK_INFO	Base fault mask	Base fault mask information
F0936		DWORD	_BASE_SKIP_INFO	Base Skip	Base skip information
F0938		WORD	_SLOT_EMASK_INFO_0	Slot fault mask	Slot fault mask information (BASE 0)
F0939		WORD	_SLOT_EMASK_INFO_1	Slot fault mask	Slot fault mask information (BASE 1)
F0940		WORD	_SLOT_EMASK_INFO_2	Slot fault mask	Slot fault mask information (BASE 2)
F0941		WORD	_SLOT_EMASK_INFO_3	Slot fault mask	Slot fault mask information (BASE 3)
F0942		WORD	_SLOT_EMASK_INFO_4	Slot fault mask	Slot fault mask information (BASE 4)
F0943		WORD	_SLOT_EMASK_INFO_5	Slot fault mask	Slot fault mask information (BASE 5)
F0944		WORD	_SLOT_EMASK_INFO_6	Slot fault mask	Slot fault mask information (BASE 6)
F0945		WORD	_SLOT_EMASK_INFO_7	Slot fault mask	Slot fault mask information (BASE 7)
F0946		WORD	_SLOT_SKIP_INFO_0	Slot skip	Slot skip information (BASE 0)
F0947		WORD	_SLOT_SKIP_INFO_1	Slot skip	Slot skip information (BASE 1)
F0948		WORD	_SLOT_SKIP_INFO_2	Slot skip	Slot skip information (BASE 2)
F0949		WORD	_SLOT_SKIP_INFO_3	Slot skip	Slot skip information (BASE 3)
F0950		WORD	_SLOT_SKIP_INFO_4	Slot skip	Slot skip information (BASE 4)
F0951		WORD	_SLOT_SKIP_INFO_5	Slot skip	Slot skip information (BASE 5)
F0952		WORD	_SLOT_SKIP_INFO_6	Slot skip	Slot skip information (BASE 6)
F0953		WORD	_SLOT_SKIP_INFO_7	Slot skip	Slot skip information (BASE 7)
F1024		WORD	_USER_WRITE_F	User contact	User contact from Program
	F10240	BIT	_RTC_WR	RTC RW	Write and Read the data to RTC
	F10241	BIT	_SCAN_WR	Scan WR	Scan value initialize
	F10242	BIT	_CHK_ANC_ERR	External heavy error request	Requests heavy error detection from external device
	F10243	BIT	_CHK_ANC_WAR	External light error request	Requests light error detection from external device
F1025		WORD	_USER_STAUS_F	User contact	User contact
	F10250	BIT	_INIT_DONE	Initialize end	Initialization task is done
F1026		WORD	_ANC_ERR	External heavy error information	Indicates heavy error information of external device.
F1027		WORD	_ANC_WAR	External light error warning	Indicates light error information of external device
F1034		WORD	_MON_YEAR_DT	Month/year	Clock information data (month/year)
F1035		WORD	_TIME_DAY_DT	Time/day	Clock information data (time/day)

Appendix 1. Flag List

Device1	Device2	Type	Variables	Function	Description
F1036		WORD	_SEC_MIN_DT	Sec/min	Clock information data (sec/min)
F1037		WORD	_HUND_WK_DT	Hundred year / weekday	Clock information data (hundred year / weekday)
F0176		WORD	_SOE_READ_LOG_CNT	Event count	SOE event count read by user
F0177		WORD	_SOE_READ_LOG_ROTATE	Rotate information	Rotate information of SOE event count read by user
F0954		WORD	_SOE_LOG_CNT	Event count occurred	SOE event count occurred
F0955		WORD	_SOE_LOG_ROTATE	Rotate information	SOE event rotate information
F09600		BIT	_HS1_ENABLE_STATE	High speed link state	High speed link 1 enable/disable current state
~		BIT	_HSx_ENABLE_STATE	High speed link state	High speed link x enable/disable current state
F0960B		BIT	_HS12_ENABLE_STATE	High speed link state	High speed link 12 enable/disable current state
F10300		BIT	_HS1_REQ	High speed link request	High speed link 1 enable/disable request
~		BIT	_HSx_REQ	High speed link request	High speed link x enable/disable request
F1030B		BIT	_HS12_REQ	High speed link request	High speed link 12 enable/disable request
F10310		BIT	_HS1_REQ_NUM	High speed link setting	High speed link 1 enable/disable setting
~		BIT	_HSx_REQ_NUM	High speed link setting	High speed link x enable/disable setting
F1031B		BIT	_HS12_REQ_NUM	High speed link setting	High speed link 12 enable/disable setting
F09620		BIT	_P2P1_ENABLE_STATE	P2P state	P2P 1 enable/disable current state
~		BIT	_P2Px_ENABLE_STATE	P2P state	P2P x enable/disable current state
F09627		BIT	_P2P8_ENABLE_STATE	P2P state	P2P 8 enable/disable current state
F10320		BIT	_P2P1_REQ	P2P request	P2P 1 enable/disable request
~		BIT	_P2Px_REQ	P2P request	P2P x enable/disable request
F10327		BIT	_P2P8_REQ	P2P request	P2P 8 enable/disable request
F10330		BIT	_P2P1_REQ_NUM	P2P setting	P2P 1 enable/disable setting
~		BIT	_P2Px_REQ_NUM	P2P setting	P2P x enable/disable setting
F10337		BIT	_P2P8_REQ_NUM	P2P setting	P2P 8 enable/disable setting
F0190		WORD	_CYCLE_TASK_SCAN0_MAX	Maximum scan time	Fixed cycle task 0 maximum scan time
F0191		WORD	_CYCLE_TASK_SCAN0_MIN	Minimum scan time	Fixed cycle task 0 minimum scan time
F0192		WORD	_CYCLE_TASK_SCAN0_CUR	Current scan time	Fixed cycle task 0 current scan time
~		WORD	_CYCLE_TASK_SCANx_MAX	Maximum scan time	Fixed cycle task x maximum scan time
~		WORD	_CYCLE_TASK_SCANx_MIN	Minimum scan time	Fixed cycle task x minimum scan time
~		WORD	_CYCLE_TASK_SCANx_CUR	Current scan time	Fixed cycle task x current scan time
F0283		WORD	_CYCLE_TASK_SCAN31_MAX	Maximum scan time	Fixed cycle task 31 maximum scan time
F0284		WORD	_CYCLE_TASK_SCAN31_MIN	Minimum scan time	Fixed cycle task 31 minimum scan time
F0285		WORD	_CYCLE_TASK_SCAN31_CUR	Current scan time	Fixed cycle task 31 current scan time
F10248		BIT	_CYCLE_TASK_SCAN_WR	Scan time initialization	Initialize fixed cycle task's scan time
F0964		WORD	_SOCKET0_CLOSE_COUNTER	close number each socket	Close number (Socket 0)
F0965		WORD	_SOCKET1_CLOSE_COUNTER	close number each socket	Close number (Socket 1)

Device1	Device2	Type	Variables	Function	Description
F0966		WORD	_SOCKET2_CLOSE_COUNTER	close number each socket	Close number (Socket 2)
F0967		WORD	_SOCKET3_CLOSE_COUNTER	close number each socket	Close number (Socket 3)
F0966		DWORD	_PLC_OPERATING_TIME	PLC Operation Time	PLC Operation Time(Sec) / Normal Type CPU
F0992		DWORD	_PLC_OPERATING_TIME	PLC Operation Time	PLC Operation Time(Sec)/N-Type CPU
F0998		DWORD	_SOCKET1_ERR_CNT	Error Frame Counter1	Local Ethernet Socket1 Error Counter
F1000		DWORD	_SOCKET2_ERR_CNT	Error Frame Counter2	Local Ethernet Socket2 Error Counter
F1002		DWORD	_SOCKET3_ERR_CNT	Error Frame Counter3	Local Ethernet Socket3 Error Counter
F1004		DWORD	_SOCKET4_ERR_CNT	Error Frame Counter4	Local Ethernet Socket4 Error Counter

Appendix 1.2 Communication Relay (L) List

Here describes data link communication relay(L).

[Table 1] Communication Flag List according to High speed link no.(High speed link no. 1 ~ 12)

No.	Keyword	Type	Contents	Description
L000000	_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.
L000001	_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.
L000020 ~ L00009F	_HS1_STATE[k] (k=000~127)	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. HS1STATE[k]=HS1MOD[k]&_HS1TRX[k]&(~_HSmERR[k])
L000100 ~ L00017F	_HS1_MOD[k] (k=000~127)	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.
L000180 ~ L00025F	_HS1_TRX[k] (k=000~127)	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.
L000260 ~ L00033F	_HS1_ERR[k] (k=000~127)	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.
L000340 ~ L00041F	_HS1_SETBLOCK[k]	Bit Array	High speed link parameter 1, k block setting	Indicates whether or not to set k data block of parameter.

Notes

High speed link no.	L area address	Remarks
2	L000500~L00099F	Comparing with High speed link 1 from [Table 1], the flag address of different high speed link station no. is as follows by a simple calculation formula. ∗ Calculation formula :L area address = L000000 + 500 x (High speed link no. – 1) In case of using high speed line flag for Program and monitoring, you can use the flag map registered in XG5000 conveniently.
3	L001000~L00149F	
4	L001500~L00199F	
5	L002000~L00249F	
6	L002500~L00299F	
7	L003000~L00349F	
8	L003500~L00399F	
9	L004000~L00449F	
10	L004500~L00499F	
11	L005000~L00549F	

k means block no. and appears 8 words by 16 per 1 word for 128 blocks from 000~127.
For example, mode information (_HS1MOD) appears from block 0 to block 15 for L00010, and block 16~31, 32~47, 48~63, 64~79, 80~95, 96~111, 112~127 information for L00011, L00012, L00013, L00014, L00015, L00016, L00017. Thus, mode information of block no. 55 appears in L000137.

[Table 2] Communication Flag List according to P2P Service Setting

P2P parameter: 1~8, P2P block : 0~63

No.	Keyword	Type	Contents	Description
L006250	_P2P1_NDR00	Bit	P2P parameter 1, 00 Block service normal end	Indicates P2P parameter 1, 0 Block service normal end
L006251	_P2P1_ERR00	Bit	P2P parameter 1, 00 Block service abnormal end	Indicates P2P parameter 1, 0 Block service abnormal end
L00626	_P2P1_STATUS00	Word	P2P parameter 1, 00 Block service abnormal end error Code	Indicates error code in case of P2P parameter 1, 0 Block service abnormal end
L00627	_P2P1_SVCCNT00	Double word	P2P parameter 1, 00 Block service normal count	Indicates P2P parameter 1, 0 Block service normal count
L00629	_P2P1_ERRCNT00	Double word	P2P parameter 1, 00 Block service abnormal count	Indicates P2P parameter 1, 0 Block service abnormal count
L006310	_P2P1_NDR01	Bit	P2P parameter 1, 01 Block service normal end	P2P parameter 1, 1 Block service normal end
L006311	_P2P1_ERR01	Bit	P2P parameter 1, 01 Block service abnormal end	P2P parameter 1, 1 Block service abnormal end
L00632	_P2P1_STATUS01	Word	P2P parameter 1, 01 Block service abnormal end error Code	Indicates error code in case of P2P parameter 1, 1 Block service abnormal end
L00633	_P2P1_SVCCNT01	Double word	P2P parameter 1, 01 Block service normal count	Indicates P2P parameter 1, 1 Block service normal count
L00635	_P2P1_ERRCNT01	Double word	P2P parameter 1, 01 Block service abnormal count	Indicates P2P parameter 1, 1 Block service abnormal count

Appendix 1.3 Link Register (N) List

[Table 1] Link Register List according to P2P no. P2P no. : 1~8, P2P block : 0~63

No.	Keyword	Type	Contents	Description
N00000	_P1B00SN	Word	P2P parameter 1, 00 block another station no.	Saves another station no. of P2P parameter 1, 00 block. In case of using another station no. at XG-PD, it is possible to edit during RUN by using P2PSN command.
N00001 ~ N00004	_P1B00RD1	Device structure	Area device 1 to read P2P parameter 1, 00 block	Saves area device 1 to read P2P parameter 1, 00 block.
N00005	_P1B00RS1	word	Area size 1 to read P2P parameter 1, 00 block	Saves area size 1 to read P2P parameter 1, 00 block.
N00006 ~ N00009	_P1B00RD2	Device structure	Area device 2 to read P2P parameter 1, 00 block	Saves area device 2 to read P2P parameter 1, 00 block.
N00010	_P1B00RS2	word	Area size 2 to read P2P parameter 1, 00 block	Saves area size 2 to read P2P parameter 1, 00 block.
N00011 ~ N00014	_P1B00RD3	Device structure	Area device 3 to read P2P parameter 1, 00 block	Saves area device 3 to read P2P parameter 1, 00 block.
N00015	_P1B00RS3	word	Area size 3 to read P2P parameter 1, 00 block	Saves area size 3 to read P2P parameter 1, 00 block.
N00016 ~ N00019	_P1B00RD4	Device structure	Area device 4 to read P2P parameter 1, 00 block	Saves area device 4 to read P2P parameter 1, 00 block.
N00020	_P1B00RS4	Word	Area size 4 to read P2P parameter 1, 00 block	Saves area size 4 to read P2P parameter 1, 00 block.
N00021 ~ N00024	_P1B00WD1	Device structure	Area device 1 to save P2P parameter 1, 00 block	Saves area device 1 to save P2P parameter 1, 00 block.
N00025	_P1B00WS1	Word	Area size 1 to save P2P parameter 1, 00 block	Saves area size 1 to save P2P parameter 1, 00 block.
N00026 ~ N00029	_P1B00WD2	Device structure	Area device 2 to save P2P parameter 1, 00 block	Saves area device 2 to save P2P parameter 1, 00 block.
N00030	_P1B00WS2	Word	Area size 2 to save P2P parameter 1, 00 block	Saves area size 2 to save P2P parameter 1, 00 block.
N00031 ~ N00034	_P1B00WD3	Device structure	Area device 3 to save P2P parameter 1, 00 block	Saves area device 3 to save P2P parameter 1, 00 block.
N00035	_P1B00WS3	Word	Area size 3 to save P2P parameter 1, 00 block	Saves area size 3 to save P2P parameter 1, 00 block.
N00036 ~ N00039	_P1B00WD4	Device structure	Area device 4 to save P2P parameter 1, 00 block	Saves area device 4 to save P2P parameter 1, 00 block.
N00040	_P1B00WS4	Word	Area size 4 to save P2P parameter 1, 00 block	Saves area size 4 to save P2P parameter 1, 00 block.

No.	Keyword	Type	Contents	Description
N00041	_P1B01SN	Word	P2P parameter 1, 01 block another station no.	Saves another station no. of P2P parameter 1, 01 block. In case of using another station no. at XG-PD, it is possible to edit during RUN by using P2PSN command.
N00042 ~ N00045	_P1B01RD1	Device structure	Area device 1 to read P2P parameter 1, 01 block	Saves area device 1 to read P2P parameter 1, 01 block.
N00046	_P1B01RS1	Word	Area size 1 to read P2P parameter 1, 01 block	Saves area size 1 to read P2P parameter 1, 01 block.
N00047 ~ N00050	_P1B01RD2	Device structure	Area device 2 to read P2P parameter 1, 01 block	Saves area device 2 to read P2P parameter 1, 01 block.
N00051	_P1B01RS2	Word	Area size 2 to read P2P parameter 1, 01 block	Saves area size 2 to read P2P parameter 1, 01 block.
N00052 ~ N00055	_P1B01RD3	Device structure	Area device 3 to read P2P parameter 1, 01 block	Saves area device 3 to read P2P parameter 1, 01 block.
N00056	_P1B01RS3	Word	Area size 3 to read P2P parameter 1, 01 block	Saves area size 3 to read P2P parameter 1, 01 block.
N00057 ~ N00060	_P1B01RD4	Device structure	Area device 4 to read P2P parameter 1, 01 block	Saves area device 4 to read P2P parameter 1, 01 block.
N00061	_P1B01RS4	Word	Area size 4 to read P2P parameter 1, 01 block	Saves area size 4 to read P2P parameter 1, 01 block.
N00062 ~ N00065	_P1B01WD1	Device structure	Area device 1 to save P2P parameter 1, 01 block	Saves area device 1 to save P2P parameter 1, 01 block.
N00066	_P1B01WS1	Word	Area size 1 to save P2P parameter 1, 01 block	Saves area size 1 to save P2P parameter 1, 01 block.
N00067 ~ N00070	_P1B01WD2	Device structure	Area device 2 to save P2P parameter 1, 01 block	Saves area device 2 to save P2P parameter 1, 01 block.
N00071	_P1B01WS2	Word	Area size 2 to save P2P parameter 1, 01 block	Saves area size 2 to save P2P parameter 1, 01 block.
N00072 ~ N00075	_P1B01WD3	Device structure	Area device 3 to save P2P parameter 1, 01 block	Saves area device 3 to save P2P parameter 1, 01 block.
N00076	_P1B01WS3	Word	Area size 3 to save P2P parameter 1, 01 block	Saves area size 3 to save P2P parameter 1, 01 block.
N00077 ~ N00080	_P1B01WD4	Device structure	Area device 4 to save P2P parameter 1, 01 block	Saves area device 4 to save P2P parameter 1, 01 block.
N00081	_P1B01WS4	Word	Area size 4 to save P2P parameter 1, 01 block	Saves area size 4 to save P2P parameter 1, 01 block.

Notes

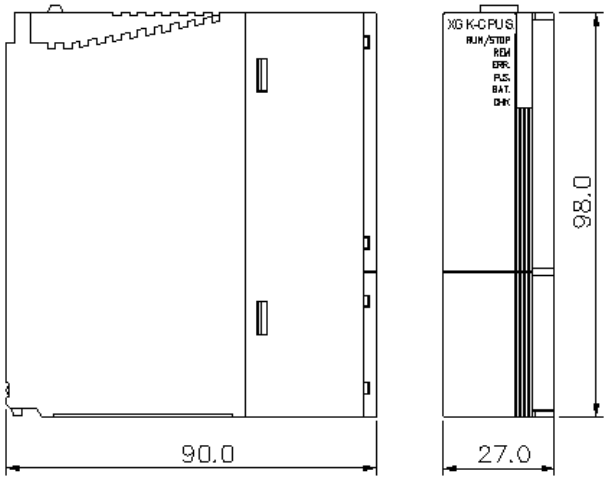
N area shall be set automatically when setting P2P parameter by using XG-PD and available to modify during RUN by using P2P dedicated command.

N area has a different address classified according to P2P parameter setting no., block index. The area not used by P2P service as address is divided, can be used by internal device.

Appendix 2 Dimensions (Unit: mm)

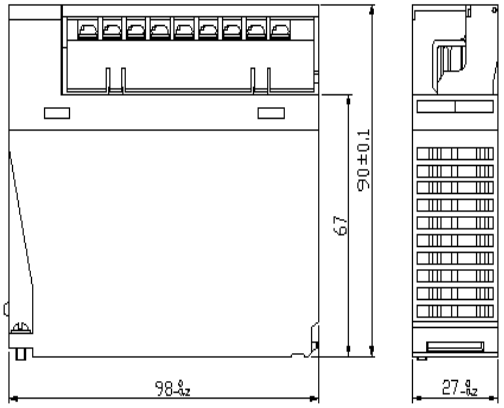
1) CPU Module

XGK-CPUE/CPUS/CPUA/CPUH/CPUU/CPUSN/CPUHN/CPUUN

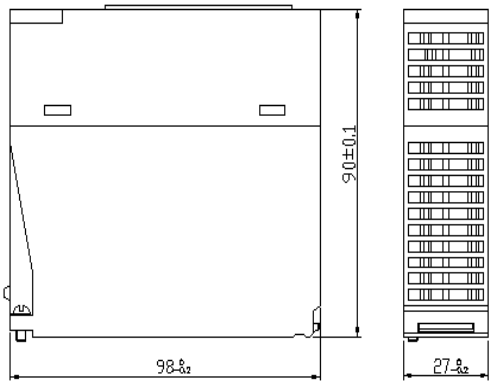


2) I/O Module

I/O Module (Terminal Block type)

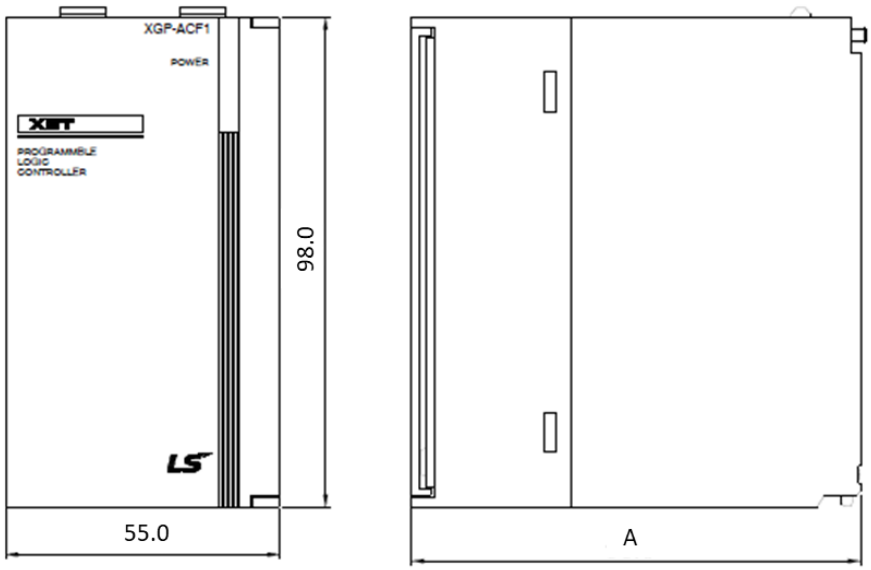


I/O Module (Connector type)



3) Power Module

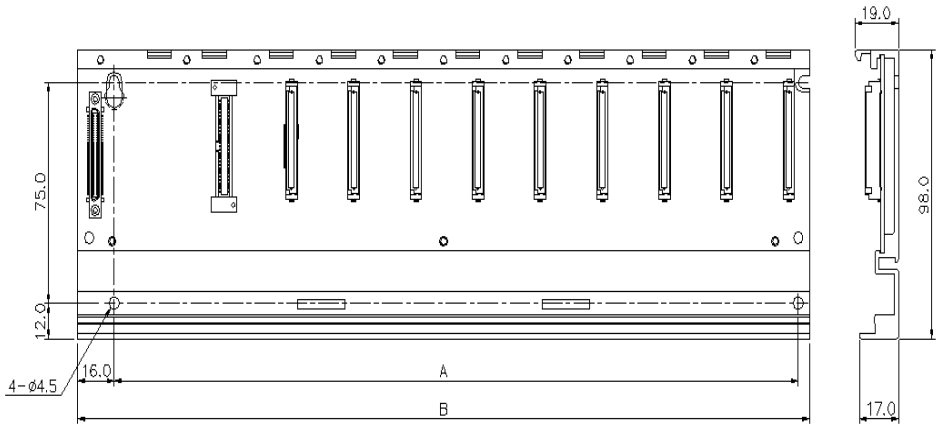
Power Module



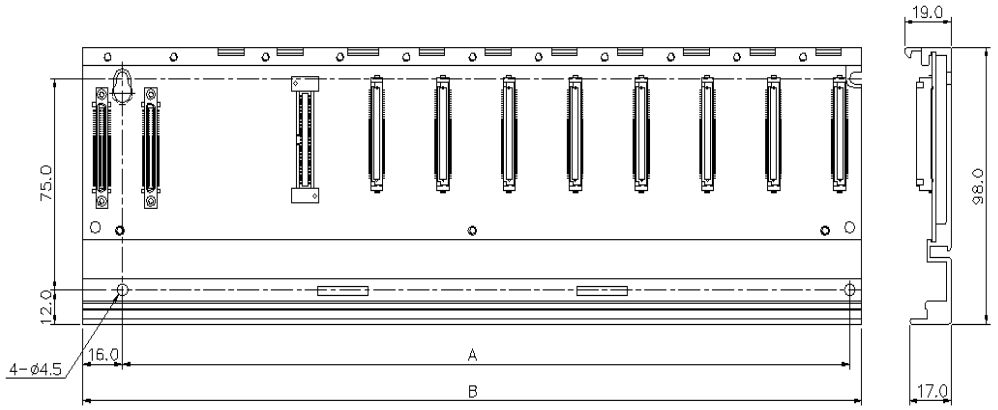
Classification	A(MM)
XGP-ACF1/ACF2/DC42	90.0
XGP-AC23/ AC24/14	110
XGP-SAC24/DC44	130

4) Main/Expansion Base

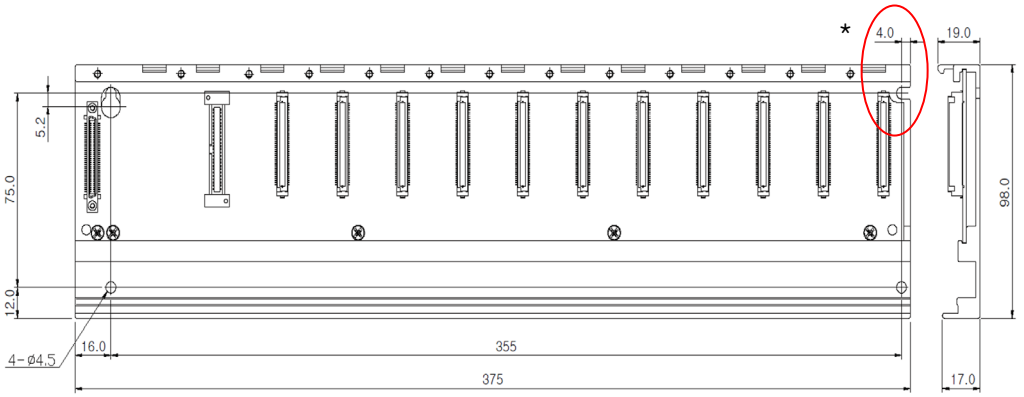
Main Base



Expansion Base



Main Base



*: 3 mm -> 4 mm

Classification	A	B
XGB-M04A/XGB-E04A	190	210
XGB-M06A/XGB-E06A	244	264
XGB-M08A/XGB-E08A	298	318
XGB-M10A	355	375
XGB-M12A/XGB-E12A	406	426

Appendix 3 Compatibility with MASTER-K

App. 3.1 Special Flag Compatibility

1) F Area Relay

MASTER-K		XGK		
Device	Function	Symbol	Device	Function
F00000	RUN mode	_RUN	F00000	RUN Edit mode
F00001	Program mode	_STOP	F00001	Program mode
F00002	Pause mode	_ERROR	F00002	Error mode
F00003	Debug mode	_DEBUG	F00003	Debug mode
F00004	N/A	_LOCAL_CON	F00004	Remote mode
F00005	N/A	_MODBUS_CON	F00005	Remote mode
F00006	Remote mode	_REMOTE_CON	F00006	Remote mode
F00007	User memory setup	-	F00007	N/A
F00008	N/A	_RUN_EDIT_ST	F00008	Editing during RUN
F00009	N/A	_RUN_EDIT_CHK	F00009	Editing during RUN
F0000A	User memory operation	_RUN_EDIT_DONE	F0000A	Edit done during RUN
F0000B	N/A	_RUN_EDIT_END	F0000B	Edit end during RUN
F0000C	N/A	_CMOD_KEY	F0000C	Operation mode change by KEY
F0000D	N/A	_CMOD_LPADT	F0000D	Operation mode change by PADT
F0000E	N/A	_CMOD_RPADT	F0000E	Operation mode change by Remote PADT
F0000F	STOP command execution	_CMOD_RLINK	F0000F	Operation mode change cause by remote communication module
F00010	Ordinary time On	_FORCE_IN	F00010	Forced input
F00011	Ordinary time Off	_FORCE_OUT	F00011	Forced output
F00012	1 Scan On	_SKIP_ON	F00012	I/O Skip execution
F00013	1 Scan Off	_EMASK_ON	F00013	Error mask execution
F00014	Reversal every Scan	_MON_ON	F00014	Monitor execution
		_USTOP_ON	F00015	Stop by Stop Function
		_ESTOP_ON	F00016	Stop by ESTOP Function
		_CONPILE_MODE	F00017	Compile
		_INIT_RUN	F00018	Initialize
F00019 ~ F0001F	N/A	-	F00019 ~ F0001F	N/A
F0001C	N/A	_PB1	F0001C	Program Code 1
F0001D	N/A	_PB2	F0001D	Program Code 2
F0001E	N/A	_CB1	F0001E	Compile code 1
F0001F	N/A	_CB2	F0001F	Compile code 2

MASTER-K		XGK		
Device	Function	Symbol	Device	Function
F00020	1 Step RUN	_CPU_ER	F00020	CPU configuration error
F00021	Break Point RUN	_IO_TYER	F00021	Module type mismatch error
F00022	Scan RUN	_IO_DEER	F00022	Module detach error
F00023	Contact value match RUN	_FUSE_ER	F00023	Fuse cutoff error
F00024	Word value match RUN	_IO_RWER	F00024	I/O module read/write error
		_IP_IFER	F00025	Special/communication module interface error
		_ANNUM_ER	F00026	Heavy error detection of external equipment error
		-	F00027	N/A
		_BPRM_ER	F00028	Basic parameter error
		_IOPRM_ER	F00029	I/O configuration parameter error
		_SPPRM_ER	F0002A	Special module parameter error
		_CPPRM_ER	F0002B	Communication module parameter error
		_PGM_ER	F0002C	Program error
		_CODE_ER	F0002D	Program Code error
		_SWDT_ER	F0002E	System watchdog error
F0002F	N/A	_BASE_POWER_ER	F0002F	Base power error
F00030	Heavy error	_WDT_ER	F00030	Scan watchdog
F00031	Light error		F00031	
F00032	WDT error		F00032	
F00033	I/O combination error		F00033	
F00034	Battery voltage error		F00034	
F00035	Fuse error		F00035	
F00036 ~ F00038	N/A		F00036 ~ F00038	
F00039	Backup normal		F00039	
F0003A	Clock data error		F0003A	
F0003B	Program change		F0003B	
F0003C	Program change error		F0003C	
F0003D ~ F0003F	N/A	-	F0003D ~ F0003F	N/A
		_RTC_ER	F00040	RTC data error
		_DBCK_ER	F00041	Data backup error
		_HBCK_ER	F00042	Hot restart disabled error
		_ABSD_ER	F00043	Abnormal operation stop
		_TASK_ER	F00044	Task collision
		_BAT_ER	F00045	Battery error
		_ANNUM_ER	F00046	Light error detection of external equipment

MASTER-K		XGK		
Device	Function	Symbol	Device	Function
		_LOG_FULL	F00047	Log memory full warning
		_HS_WAR1	F00048	High speed link parameter 1 error
		_HS_WAR2	F00049	High speed link parameter 2 error
		_HS_WAR3	F0004A	High speed link parameter 3 error
		_HS_WAR4	F0004B	High speed link parameter 4 error
		_HS_WAR5	F00004C	High speed link parameter 5 error
		_HS_WAR6	F004D	High speed link parameter 6 error
		_HS_WAR7	F0004E	High speed link parameter 7 error
		_HS_WAR8	F0004F	High speed link parameter 8 error
		_HS_WAR9	F00050	High speed link parameter 9 error
		_HS_WAR10	F00051	High speed link parameter 10 error
		_HS_WAR11	F00052	High speed link parameter 11 error
		_HS_WAR12	F00053	High speed link parameter 12 error
		_P2P_WAR1	F00054	P2P parameter 1 error
		_P2P_WAR2	F00055	P2P parameter 2 error
		_P2P_WAR3	F00056	P2P parameter 3 error
		_P2P_WAR4	F00057	P2P parameter 4 error
		_P2P_WAR5	F00058	P2P parameter 5 error
F00059	N/A	_P2P_WAR6	F00059	P2P parameter 6 error
F0005A	N/A	_P2P_WAR7	F0005A	P2P parameter 7 error
F0005B	N/A	_P2P_WAR8	F0005B	P2P parameter 8 error
F0005C	N/A	_Constant_ER	F0005C	Constant error
F0005D~ F0005F	N/A	-	F0005D ~ F0005F	N/A
F00060 ~ F0006F	Error Code save	-	F00060 ~ F0006F	N/A
F00070 ~ F0008F	Fuse cutoff save	-	F00070 ~ F0008F	N/A
F00090	20ms cycle Clock	_T20MS	F00090	20ms cycle Clock
F00091	100ms cycle Clock	_T100MS	F00091	100ms cycle Clock
F00092	200ms cycle Clock	_T200MS	F00092	200ms cycle Clock
F00093	1s cycle Clock	_T1S	F00093	1s cycle Clock
F00094	2s cycle Clock	_T2S	F00094	2s cycle Clock
F00095	10s cycle Clock	_T10S	F00095	10s cycle Clock
F00096	20s cycle Clock	_T20S	F00096	20s cycle Clock
F00097	60s cycle Clock	_T60S	F00097	60s cycle Clock
		-	F00098	N/A
		_ON	F00099	Ordinary time On
		_OFF	F0009A	Ordinary time Off

MASTER-K		XGK		
Device	Function	Symbol	Device	Function
		_1ON	F0009B	1 Scan On
		_1OFF	F0009C	1 Scan Off
		_STOG	F0009D	Reversal every Scan
F0009B ~ F0009F		-	F0009B ~ F0009F	N/A
F00100	User Clock 0		F00100	User Clock 0
F00101	User Clock 1		F00101	User Clock 1
F00102	User Clock 2		F00102	User Clock 2
F00103	User Clock 3		F00103	User Clock 3
F00104	User Clock 4		F00104	User Clock 4
F00105	User Clock 5		F00105	User Clock 5
F00106	User Clock 6		F00106	User Clock 6
F00107	User Clock 7		F00107	User Clock 7
F00108 ~ F0010F		-	F00108 ~ F0010F	N/A
F00110	Operation error flag	_Ler	F00110	Operation error flag
F00111	Zero flag	_Zero	F00111	Zero flag
F00112	Carry flag	_Carry	F00112	Carry flag
F00113	Full output Off	_All_Off	F00113	Full output Off
F00114	Common RAM R/W error	-	F00114	N/A
F00115	Operation error flag (latch)	_Ler_Latch	F00115	Operation error flag(latch)
F00116 ~ F0011F		-	F00116 ~ F0011F	N/A
F00120	LT flag	_LT	F00120	LT flag
F00121	LTE flag	_LTE	F00121	LTE flag
F00122	EQU flag	_EQU	F00122	EQU flag
F00123	GT flag	_GT	F00123	GT flag
F00124	GTE flag	_GTE	F00124	GTE flag
F00125	NEQ flag	_NEQ	F00125	NEQ flag
F00126 ~ F0012F	N/A	-	F00126 ~ F0012F	N/A
F00130~ F0013F	AC Down Count	_AC_F_CNT	F00130~ F0013F	AC Down Count
F00140~ F0014F	FALS no.	_FALS_NUM	F00140~ F0014F	FALS no.
F00150~ F0030F	PUT/GET error flag	_PUTGET_ERR	F00150~ F0030F	PUT/GET error flag
		CPU TYPE	F00440 ~ F0044F	CPU TYPE
		CPU VERSION	F00450 ~ F0045F	CPU VERSION
		O/S version no.	F00460 ~ F0047F	System O/S version no.
F00480 ~ F0049F	N/A	O/S date	F00480 ~ F0049F	System O/S DATE

MASTER-K		XGK		
Device	Function	Symbol	Device	Function
F00500~ F0050F	Max. Scan time	_SCAN_MAX	F00500~ F0050F	Max. Scan time
F00510~ F0051F	Min. Scan time	_SCAN_MIN	F00510~ F0051F	Min. Scan time
F00520~ F0052F	Current Scan time	_SCAN_CUR	F00520~ F0052F	Current Scan time
F00530~ F0053F	Clock data (year/month)	_YEAR_MON	F00530~ F0053F	Clock data (year/month)
F00540~ F0054F	Clock data (day/hr)	_DAY_TIME	F00540~ F0054F	Clock data(day/hr)
F00550~ F0055F	Clock data (min/sec)	_MIN_SEC	F00550~ F0055F	Clock data(min/sec)
F00560~ F0056F	Clock data (100year/weekday)	_HUND_WK	F00560~ F0056F	Clock data(100year/weekday)
		_FPU_LFlag_I	F00570	Incorrect error latch flag
		_FPU_LFlag_U	F00571	Underflow error latch flag
		_FPU_LFlag_O	F00572	Overflow error latch flag
		_FPU_LFlag_Z	F00573	Zero divide error latch flag
		_FPU_LFlag_V	F00574	Invalid operation error latch flag
		-	F00575~ 00579	N/A
		_FPU_Flag_I	F0057A	Incorrect error flag
		_FPU_Flag_U	F0057B	Underflow error flag
		_FPU_Flag_O	F0057C	Overflow error flag
		_FPU_Flag_Z	F0057D	Zero divide error flag
		_FPU_Flag_V	F0057E	Invalid operation error flag
		_FPU_Flag_E	F0057F	Irregular value Input error flag
F0570~ F058F	N/A	_ERR_STEP	F00580~ F0058F	Error step save
F0590~ F059F	Error step save	-	F00590~ F0059F	N/A
F0600~ F060F	FMM detailed error information	_REF_COUNT	F0060~F0061	Refresh Count
F0610~ F063F	N/A	_REF_OK_CNT	F0062~F0063	Refresh OK Count
		_REF_NG_CNT	F0064~F0065	Refresh NG Count
		_REF_LIM_CNT	F0066~F0067	Refresh Limit Count
		_REF_ERR_CNT	F0068~F0069	Refresh Error Count
		_MOD_RD_ERR_CNT	F0070~F0071	MODULE Read Error Count
		_MOD_WR_ERR_CNT	F0072~F0073	MODULE Write Error Count
		_CA_CNT	F0074~F0075	Cmd Access Count
		_CA_LIM_CNT	F0076~F0077	Cmd Access Limit Count
		_CA_ERR_CNT	F0078~F0079	Cmd Access Error Count
		_BUF_FULL_CNT	F0080~F0081	Buffer Full Count

Notes

For flag over F0820 added at XGK, refer to Appendix 1.

Warranty

1. Warranty Period

The product you purchased will be guaranteed for 36 months from the date of manufacturing.

2. Scope of Warranty

(1) The initial diagnosis of faults is basically conducted by your company. However, upon your request, our company or our service network can undertake this task for a fee. If the cause of the fault lies with our company, this service will be provided free of charge.

(2) This warranty only applies if the product is used under normal conditions according to the specifications and precautions described in the handling instructions, user manuals, catalogs, and caution labels.

(3) Even within the free warranty period, the following cases will be subject to paid repairs:

1) Replacement of consumable and life-limited parts (e.g., relays, fuses, electrolytic capacitors, fans, LCDs, batteries, etc.)

2) Failures or damages caused by improper storage, handling, negligence, or accidents by the customer

3) Failures resulting from the customer's hardware or software design

4) Failures due to modifications without our consent
(Repairs will be refused, even for a fee, if recognized as modified or repaired outside our company)

5) Failures that could have been avoided if the customer's equipment, in which our product is incorporated, had safety devices required by legal regulations or common industry standards

6) Failures that could have been prevented if maintenance and replacement of consumable parts were performed normally according to the handling instructions or user manuals

7) Failures and damages to the product caused by using connected equipment or inappropriate consumables

8) Failures caused by external factors such as fire, abnormal voltage, force majeure, and natural disasters such as earthquakes, lightning, salt damage, wind, and flood damage

9) Failures due to reasons that could not be predicted with the scientific and technical standards at the time of our shipment

10) Other failures, damages, or defects recognized as the responsibility of your company

Environmental Policy

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

Environmental Management

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

About Disposal

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



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