The right choice for the ultimate yield!
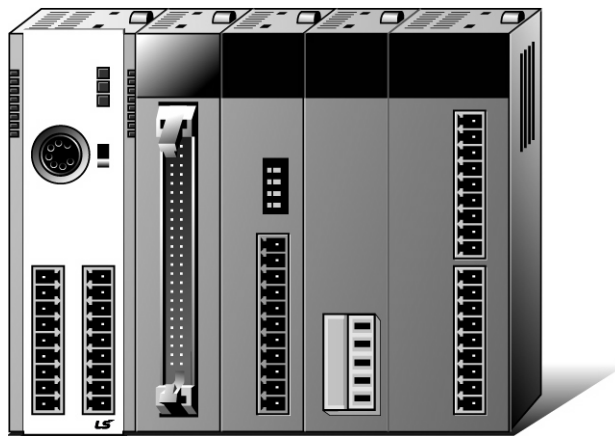
LS ELECTRIC strives to maximize your profits in gratitude for choosing us as your partner.

## Programmable Logic Control

# XGB Main unit(XBM-S, XBC-H Type)

**XGT Series** | **User Manual**

XBM-DR16S
XBM-DN16S
XBM-DN32S
XBC-DR32H
XBC-DN32H
XBC-DR64H
XBC-DN64H
XBC-DR32HL
XBC-DN32H/DC
XBC-DN64H/DC
XBC-DR32H/DC
XBC-DR64H/DC

## ⚠ Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.

- Keep this manual within easy reach for quick reference.

**LS** ELECTRIC

# Before using the product …

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

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

► Instructions are 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

<div style="border:1px solid">

## ⚠ 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.

</div>

# 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 | Remark | Page |
|---------|------|--------|------|
| V 1.0 | 2006.6 | 1. First Edition | - |
| V 1.1 | 2007.7 | 1. Position and Special function contents separated<br>  (1) Position function contents separated<br>    (position part published)<br>  (2) PID control and Ch. 12 Analog IO module contents<br>    separated | -<br><br>- |
|  |  | 2. Contents added<br>  (1) Naming standard added<br>  (2) Caution when selecting IO module added<br>  (3) IO wiring method by using Smart Link board added<br>  (4) Installation and wiring contents added | 2-3 ~ 2-6<br>7-1 ~ 7-6<br>7-27 ~ 7-28<br>10-1 ~ 10-18 |
|  |  | 3. Content modified<br>  (1) Safety instruction modified<br>  (2) System Configuration modified<br>  (3) High speed counter function modified<br>  (4) External dimension modified | 1 ~ 6<br>2-7 ~ 2-10<br>8-6 ~ 8-8<br>App. 2-1 ~ 2-4 |
| V 1.2 | 2008.3 | 1. XGB compact type 'H' type added | - |
|  |  | 2. Built-in communication content separated<br>  (1) Ch.9 built-in communication function separated<br>    (Cnet I/F user manual) | Ch. 9 |
| V1.3 | 2009.3 | 1. Specification of output for positioning added | 7-13,14,17,18 |
| V1.6 | 2010.3 | 1. "UL warranty voltage" word added | 4-6 |
|  |  | 2. RTC example program modified | 6-22 |
|  |  | 3. XBC input resistor modified and digital I/O mixed module added | Chapter 7 |
|  |  | 4. Installation of module added | 9-10 |
|  |  | 5. DC power unit added | Front cover |
|  |  | 6. DC power unit and expansion module added | 2-1 ~ 2-4 |
|  |  | 7. DC power unit and expansion module added | 4-6 ~ 4-7 |
|  |  | 8. DC power unit and expansion module added | Chapter 7 |
|  |  | 9. DC power unit and expansion module added | Appendix 2 |
|  |  | 10. Error in high speed counter channel fixed | 8-3 |
|  |  | 11. Specification of TR output for positioning modified | 7-13, 14, 17, 18 |
|  |  | 12. Error in figure fixed | 4-4 |
|  |  | 13. External memory module added | Ch6.13 |
|  |  | 14. XGB compact type model added | Front cover |

| Version | Date | Remark | Page |
|---|---|---|---|
| | | 15. 'S', 'H' type max. I/O point modified | 2-1 ~ 2-4 |
| | | 16. 'S', 'H' type max. I/O point modified | 4-1 ~ 4-2 |
| V1.7 | 2014.3 | 1. Data Back-up method added | 4-11 |
| | | 2. Module added | |
| | |   (1) XBE-DC16B/RY08B | 7-20,7-23 |
| | |   (2) XBF-AD04C/DV04C/DC04C | 2-2~ 2-8 |
| | |   (3) XBL-EIMT/EIMF/EIMH/EIPT/CMEA/CSEA/PMEC | 2-2~ 2-8 |
| | | 3. Domain of Homepage Changed | Front/Back Cover |
| | | 4. External Memory Module Modified | 6-23~6-30 |
| | |   (XBO-M1024B→XBO-M2MB) | |
| V1.8 | 2015.2 | 1. Data Back-up Time Modified | 4-11 |
| | | 2. Address & phone number Changed | Back Cover |
| | 2015.7 | 3. Add new module | Ch2.1, Ch2.2 Ch2.3.3,Ch2.3.4 |
| | | 4. Vibration Specification modified | Ch3.1 |
| V1.9 | 2016.11 | 1. Module added | |
| | |   (1) XBE-DN32A | Ch7 |
| V 2.0 | 2020.06 | LSIS to change its corporate name to LS ELECTRIC | Entire |
| V2.1 | 2022.08 | XBC-H Type Renewal content added | Entire |
| V2.2 | 2023.06 | 1. Module added | Ch7 |
| | | (1)XBE-AC08A | |
| | | 2. Ferrule specification contents added | |

# About User's Manual

Congratulations on purchasing PLC of LS ELECTRIC Co.,Ltd.

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

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

Relevant User's Manual

| Title | Description | No. of User Manual |
|---|---|---|
| XG5000 User's Manual | It describes how to use XG5000 software especially about online functions such as programming, printing, monitoring and debugging by using XGT series products. | 10310000512 |
| XGK/XGB Series Instruction & Programming | It describes how to use the instructions for programming using XGK/XGB series. | 10310000510 |
| XGB Main unit (XBM-S, XBC-H) User's Manual | It describes how to use the specification of power/input /output/expansion modules, system configuration and built-in High-speed counter for XGB basic unit. | 10310000926 |
| XGB Analog User's Manual | It describes how to use the specification of analog input/analog output/temperature input module, system configuration and built-in PID control for XGB basic unit. | 10310000920 |
| XGB Cnet I/F User's Manual | It describes how to use built-in communication function for XGB basic unit and external Cnet I/F module. | 10310000816 |
| XGB Fast Ethernet I/F User's Manual | It describes how to use XGB FEnet I/F module. | 10310000873 |
| CANopen Commnunication Module | It describes how to use XGB CANopen Commnunication Module | 10310001245 |
| EtherNet/IP Commnunication Module | It describes how to use XGB EtherNet/IP Communication module | 10310001159 |
| XGB Profibus-DP I/F (Master) User's Manaual | It describes how to use XGB Profibus-DP I/F (Master)  Commnunication Module | 10310001310 |
| XGB Profibus-DP I/F (Slave) User's Manaual | It describes how to use XGB Profibus-DP I/F (Slave)  Commnunication Module | 10310001410 |

| XGB DeviceNet I/F (Slave) User's Manaual | It describes how to use XGB DeviceNet I/F (Slave) Commnunication Module | 10310001414 |
|---|---|---|
| XGB High speed counter module User's Manual | It describes how to use High speed counter(XBF-HO02A, XBF-HD02A) | 10310001240 |

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## Chapter 8 Built-in High-speed Counter Function ...................................8-1~54

# Chapter 1 Introduction

## 1.1 Guide to Use This Manual

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

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

## 1.2 Features

The features of XGB system are as follows.

(1) The system secures the following high performances.

(a) High Processing Speed

(b) Max. 384 I/O control supporting small & mid-sized system implementation

| Item | Type | | | Reference |
|---|---|---|---|---|
| | XBM-DxxxS | XBC-DxxxH (O/S Ver: Less than V5.00) | XBC-DxxxH (O/S Ver: V5.00 or later) | |
| Operation processing speed | 160ns / Step | 83ns / Step | 60ns / Step | - |
| Max IO contact point | 256 points | 384 points | 384 points | |
| Program capacity | 10Kstep | 15Kstep | 15Kstep | - |
| Max. no. of expanded base | 7 | 10 | 10 | - |

(c) Enough program capacity

(d) Expanded applications with the support of floating point.

(e) XBM-DxxxS is expressed "S" type and XBC-DxxxH is expressed "H" type.

(2) Compact : the smallest size comparing to the same class model of competitors.

(a) Compact panel realized through the smallest size.

| Item | Type | Size (W * H * D) | Reference |
|---|---|---|---|
| Basic unit | XBC-Dx32H | 114 * 90 * 64 | "H" type |
| | XBC-Dx64H | 180 * 90 * 64 | |
| | XBM-DxxxS | 30 * 90 * 64 | "S" type |
| Extension module | XBE-,XBF-,XBL- | 20 * 90 * 60 | Basis of minimum size |

(3) Easy attachable/extensible system for improved user convenience.

(a) Easy attachable to European terminal board and convenient-to-use MIL connector method improving convenient wiring. ("S" type basic unit and expanded module)

(b) By adopting a removable terminal block connector (M3 X 6 screw), convenience of wiring may be increased.

(c) By adopting connector coupling method, modules may be easily connected and separated.

(4) Improved maintenance ability with kinds of register, built-in RTC ("H" type), comment backup and etc

(a) Convenient programming environment by providing analogue register and index register.

(b) Improved maintenance ability by operating plural programs and task program through module program.

(c) Built-in Flash ROM enabling permanent backup of program without any separate battery.

(d) Improved maintenance ability by types of comment backup.

(e) Built-in RTC function enabling convenient history and schedule management

(5) Optimized communication environment.

 (a) With max. 2 channels of built-in COM (excl. loader), up to 2 channel communication is available without any expanded of module.

 (b) Supporting various protocols to improve the convenience (dedicated, Modbus, user-defined communication)

 (c) Communication module may be additionally increased by adding modules (up to 2 stages such as Cnet, Enet and etc).

 (d) Convenient network-diagnostic function through network & communication frame monitoring.

 (e) Convenient networking to upper systems through Enet or Cnet.

 (f) High speed program upload and download by USB Port

(6) Applications expanded with a variety of I/O modules.

 (a) 8, 16, 32 points modules provided (if relay output, 8/16 points module).

 (b) Single input, single output and combined I/O modules supported.

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

 (a) All analogue modules can be attachable on extension base. (H type: up to 10 stages available)

 (b) With analog dedicated register(U) and monitoring dedicated function, convenient use for I/O is maximized (can designate operations using easy programming of U area and monitoring function)

(8) Through XG5000, it provides an integrated programming environment such as enhanced program convenience and various monitoring, diagnosis, and editing functions.

(9) Built-in high speed counter function

 (a) Providing High-speed counter 1phase, 2phase and more additional functions.

 (b) Providing parameter setting, diverse monitoring and diagnosis function using XG5000.

 (c) Monitoring function in XG5000 can inspect without program, inspecting external wiring, data setting and others.

(10) Built-in position control function

 (a) Supporting max 100Kpps 2 axes.

 (b) Providing parameter setting, operation data collection, diverse monitoring and diagnosis by using XG5000.

 (c) Commissioning by monitoring of XG5000, without program, inspecting external wiring and operation data setting.
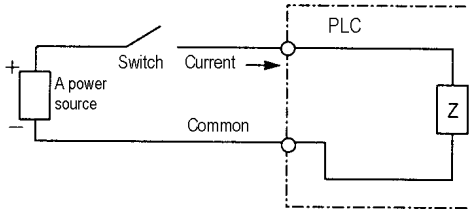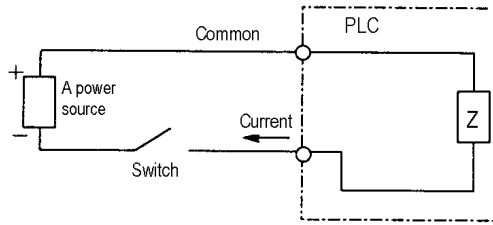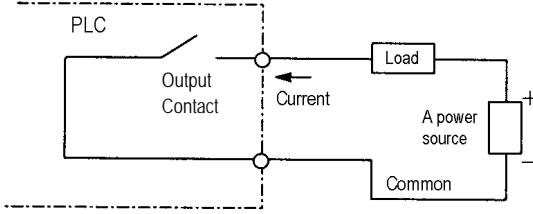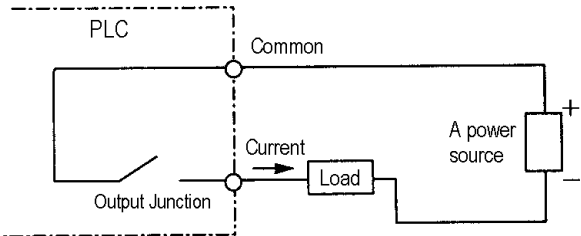
(11) Built-in PID

    (a) Supporting max. 16 loops.

    (b) Setting parameters by using XG5000 and supporting loop status monitoring conveniently with trend monitor.

    (c) Control constant setting through the improved Auto-tuning function.

    (d) With many other additional functions including PWM output, ∆MV, ∆PV and  SV Ramp, improving the control preciseness.

    (e) Supporting types of control modes such as forward/backward mixed operation, 2-stage SV PID control, cascade control and etc.

    (f) A variety of warning functions such as PV MAX and PV variation warning securing the safety.

## 1.3 Terminology

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

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

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

# Chapter 2 System Configuration

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

This chapter describes the configuration and features of each system.

## 2.1. XGB System Configuration

XGB series System Configuration is as follows. Expanded I/O module and special module are available to connect maximum 7 stages for "S" type and 10 stages for "H" type. Expanded communication module is available to connect maximum 2 stages.
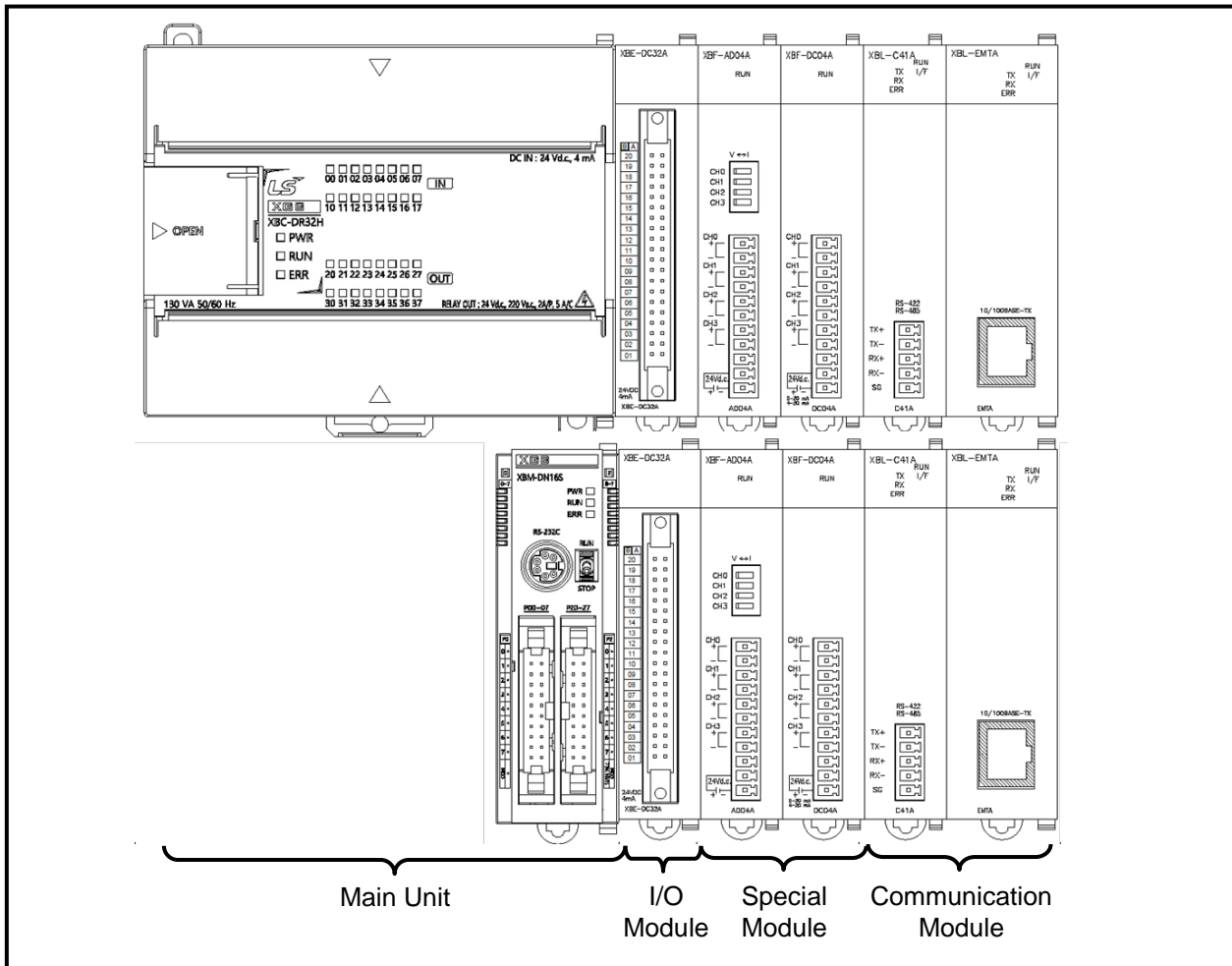
| Item | | | Description |
|---|---|---|---|
| Total I/O points | | | • XBC-DxxxH ("H" type): 32~384 points |
| | | | • XBM-DxxxS ("S" type): 16~256 points |
| Maximum number of expansion modules | | Digital I/O module | • "S" type: Max. 7 / "H" type: Max. 10 |
| | | Special module | • "S" type: Max. 7 / "H" type: Max. 10 |
| | | Communication I/F module | • Maximum 2 |
| Items | Main unit | "H" type | • refer to 2.2 Product List |
| | | "S" type | |
| | Expansion module | Digital I/O module | |
| | | A/D·D/A module | |
| | | Communication I/F module | |

## 2.2. Product List

XGB series' product list is as follows.

| Types | Model | Description | Remark |
|---|---|---|---|
| Main Unit | XBC-DR32H | AC100-240V power supply, DC24V input 16 point, Relay output 16 point | "H" type |
| | XBC-DN32H | AC100-240V power supply, DC24V input 16 point, Transistor output 16 point | |
| | XBC-DR64H | AC100-240V power supply, DC24V input 32 point, Relay output 32 point | |
| | XBC-DN64H | AC100-240V power supply, DC24V input 32 point, Transistor output 32 point | |
| | XBC-DR32HL | AC100-240V power supply, DC24V input 16 point, relay output 16 point | |
| | XBC-DR32H/DC | DC 24V power supply, DC24V input 16 point, relay output 16 point | |
| | XBC-DN32H/DC | DC 24V power supply, DC24V input 16 point, TR output 16 point | |
| | XBC-DR64H/DC | DC 24V power supply, DC24V input 32 point, relay output 32 point | |
| | XBC-DN64H/DC | DC 24V power supply, DC24V input 32 point, TR output 32 point | |
| | XBM-DN16S | DC24V Power supply, DC24V Input 8 point, Transistor output 8 point | "S" type |
| | XBM-DN32S | DC24V Power supply, DC24V Input 16 point, Transistor output 16 point | |
| | XBM-DR16S | DC24V Power supply, DC24V Input 8 point, Relay output 8 point | |
| Expansion Unit | XBE-DC08A | DC24V Input 8 point | Input |
| | XBE-DC16A/B | DC24V Input 16 point | |
| | XBE-DC32A | DC24V Input 32 point | |
| | XBE-AC08A | AC110V Input 8 point | |
| | XBE-RY08A | Relay output 8 point | Output |
| | XBE-RY08B | Relay output 8 point(isolated ouput) | |
| | XBE-RY16A | Relay output 16 point | |
| | XBE-TN08A | Transistor output 8 point (sink type) | |
| | XBE-TN16A | Transistor output 16 point (sink type) | |
| | XBE-TN32A | Transistor output 32 point (sink type) | |
| | XBE-TP08A | Transistor output 8 point (source type) | |
| | XBE-TP16A | Transistor output 16 point (source type) | |
| | XBE-TP32A | Transistor output 32 point (source type) | |
| | XBE-DR16A | DC24V Input 8 point, Relay output 8 point | In/Output |
| | XBE-DN32A | DC24V Input 16 point, Transistor output 16 point (sink type) | |
| Special Module | XBF-AD04A | Current/Voltage input 4 channel | Analog In/Out |
| | XBF-AD04C | Current/Voltage input 4 channel, High resolution | |
| | XBF-AD08A | Current/Voltage input 8 channel | |
| | XBF-DC04A | Current output 4 channel | |
| | XBF-DC04C | Current output 4 channel, High resolution | |
| | XBF-DV04A | Voltage output 4 channel | |
| | XBF-DV04C | Voltage output 4 channel, High resolution | |
| | XBF-AH04A | Current/Voltage input 2 channel, Current/Voltage output 2 channel, | |

| Types | Model | Description | Remark |
|---|---|---|---|
| Special Module | XBF-RD04A | RTD (Resistance Temperature Detector) input 4 channel | Temperature |
| | XBF-RD01A | RTD (Resistance Temperature Detector) input 1 channel | |
| | XBF-TC04S | TC (Thermocouple) input 4 channel | |
| | XBF-PD02A | Position 2Axis, Line Drive type | Position |
| | XBF-HD02A | High Speed Counter 2 channel, Line Drive Type | Counter |
| | XBF-HO02A | High Speed Counter 2 channel, Open Collector Type | |
| | XBF-TC04RT | Temperature controller module (RTD input, 4 roof) | Temperature |
| | XBF-TC04TT | Temperature controller module (TC input, 4 roof) | |
| | XBF-LD02S | Isolated-type Loadcell Input 2 channels | |
| Communication Module | XBL-C21A | Cnet (RS-232C/Modem) I/F | - |
| | XBL-C41A | Cnet (RS-422/485) I/F | - |
| | XBL-EMTA | Enet I/F | - |
| | XBL-EIMT | RAPIEnet I/F 2 UTP cable | - |
| | XBL-EIPT | EtherNet I/P Module | - |
| | XBL-CMEA | CANopen MasterI/F | - |
| | XBL-CSEA | CANopen Slave I/F | - |
| | XBL-PMEC | Pnet I/F | - |
| | XBL-RMEA | Rnet Master | |
| Option module | XBO-M1024A | Memory module | - |
| Down load cable | PMC-310S | Connection cable (PC to PLC), 9pin(PC)-6pin(PLC) | - |
| | USB-301A | Connection cable (PC to PLC), USB | -- |

> **Note**
>
> Download Cable (PMC-310S) Diagram
>
>
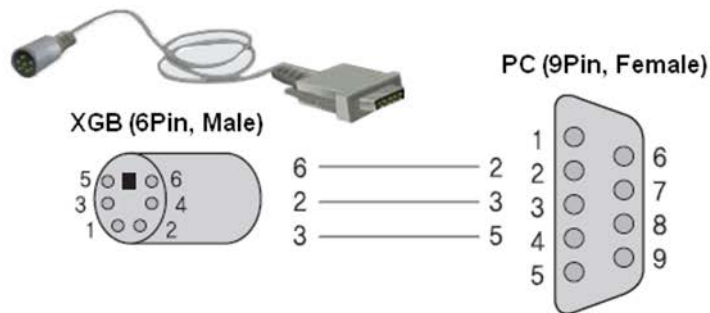
## 2.3. Classification and Type of Product Name

### 2.3.1 Classification and type of basic unit

Name of basic unit is classified as follows.
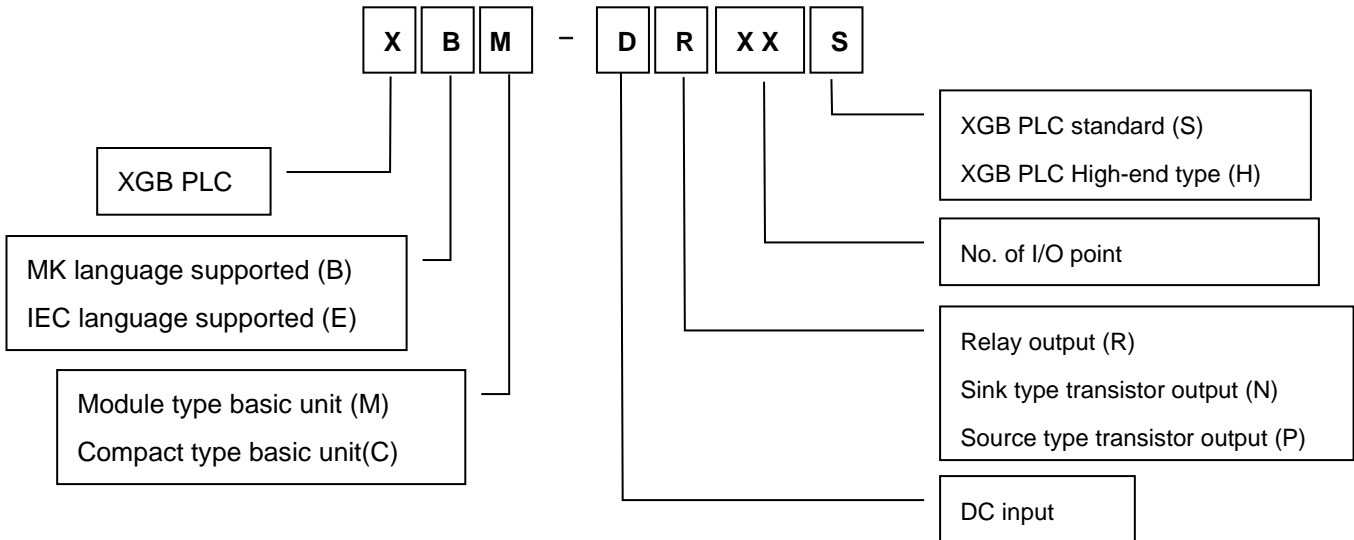


| Classification | Name | DC input | Relay output | Transistor output | Power |
|---|---|---|---|---|---|
| Module type basic unit | XBM-DR16S | 8 point | 8 point | None | DC24V |
| | XBM-DN16S | 8 point | None | 8 point | |
| | XBM-DN32S | 16 point | None | 16 point | |
| Compact type basic unit | XBC-DR32H | 16 point | 16 point | None | AC110V-220V |
| | XBC-DN32H | 16 point | None | 16 point | |
| | XBC-DR64H | 32 point | 32 point | None | |
| | XBC-DN64H | 32 point | None | 32 point | |
| | XBC-DR32HL | 16 point | 16 point | None | |
| | XBC-DR32H/DC | 16 point | 16 point | None | DC24V |
| | XBC-DN32H/DC | 16 point | None | 16 point | |
| | XBC-DR64H/DC | 32 point | 32 point | None | |
| | XBC-DN64H/DC | 32 point | None | 32 point | |

## 2.3.2 Classification and type of expansion module

Name of expansion module is classified as follows.

```
X   B   E   -   DC   X X   A
```

XGB series

I/O expansion module

No. of I/O point

Relay output(RY)

Transistor output (TN/TP)

Digital input (DC)

Digital input+ sink type transistor output (DN)

Digital input+ source type transistor output (DP)

Digital input + Relay output (DR)
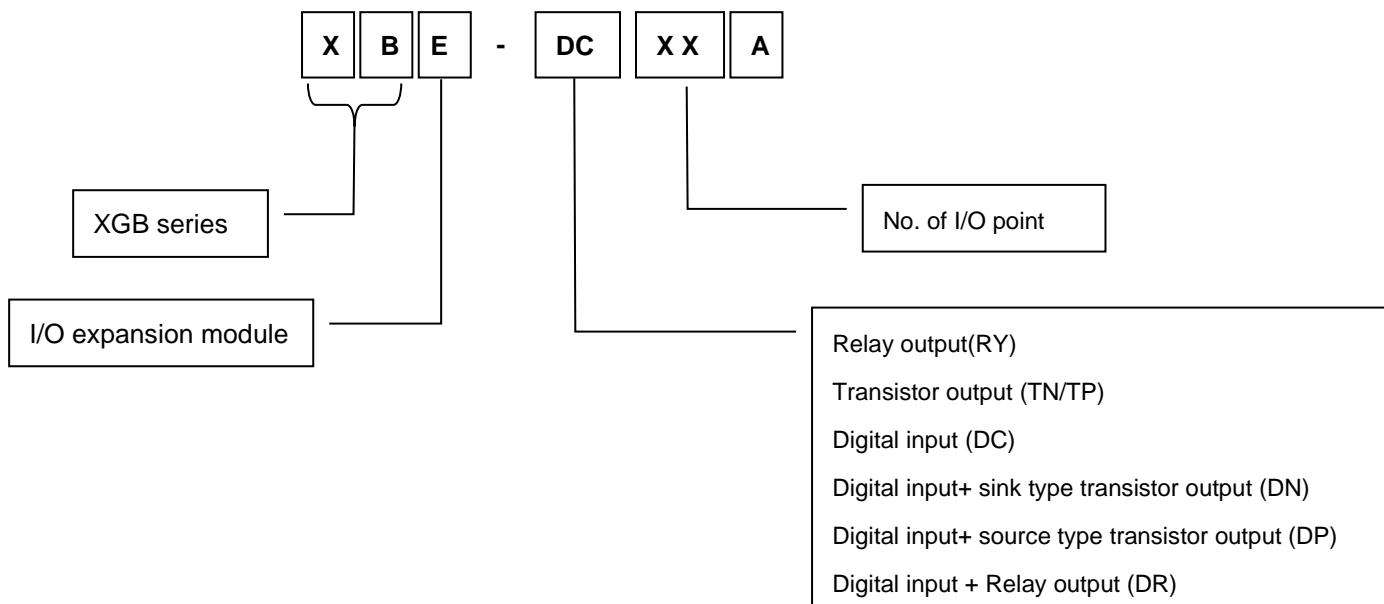
| Name | DC input | Relay output | Transistor output | Reference |
|---|---|---|---|---|
| XBE-DC08A | 8 point | None | None | Input |
| XBE-DC16A/B | 16 point | None | None | |
| XBE-DC32A | 32 point | None | None | |
| XBE-AC08A | 8 point (AC) | None | None | |
| XBE-RY08A/B | None | 8 point | None | Relay Output |
| XBE-RY16A | None | 16 point | None | |
| XBE-TN08A | None | None | 8 point (sink type) | Sink type Output |
| XBE-TN16A | None | None | 16 point (sink type) | |
| XBE-TN32A | None | None | 32 point (sink type) | |
| XBE-TP08A | None | None | 8 point (source type) | Source type Output |
| XBE-TP16A | None | None | 16 point (source type) | |
| XBE-TP32A | None | None | 32 point (source type) | |
| XBE-DR16A | 8 point | 8 point | None | In/Output |
| XBE-DN32A | 16 point | None | 16 point (sink type) | |

### 2.3.3 Classification and type of special module

Special module is classified as follows.
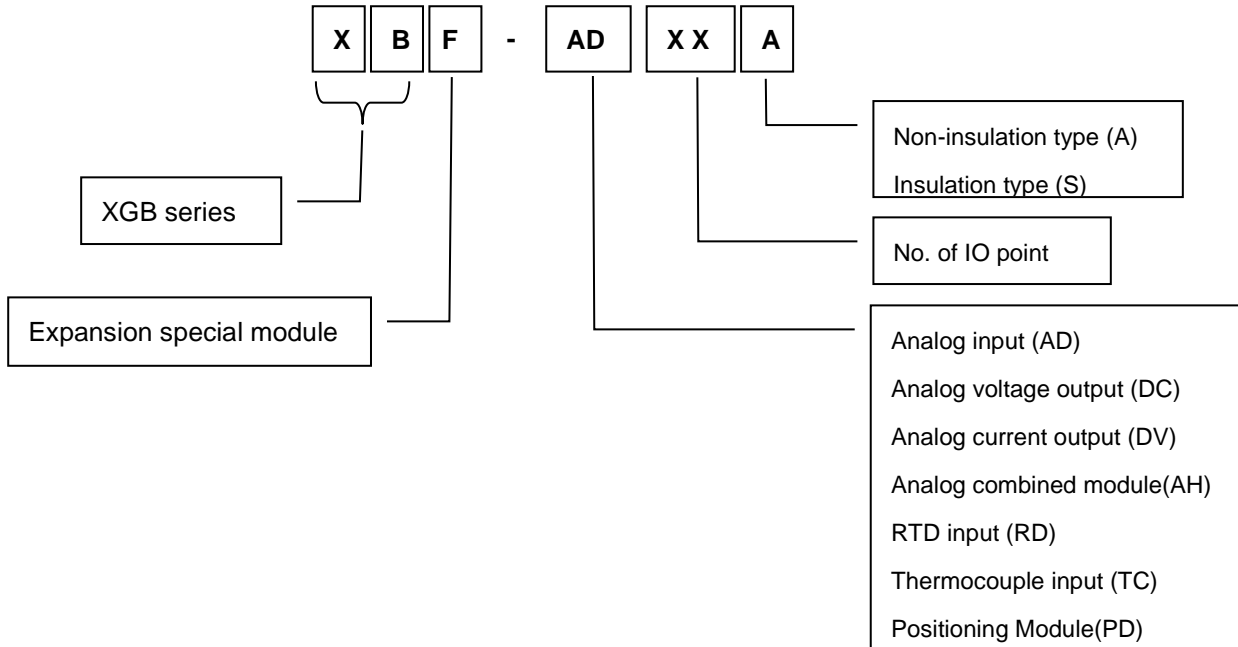


| Classification | Name | No. of input ch. | Input type | No. of output ch. | Output type |
|---|---|---|---|---|---|
| Analog input | XBF-AD04A/C | 4 | Voltage/Current | None | - |
| | XBF-AD08A | 8 | Voltage/Current | None | |
| Analog output | XBF-DC04A/C | None | - | 4 | Current |
| | XBF-DV04A/C | None | - | 4 | Voltage |
| | XBF-DV04A | None | - | 4 | Voltage |
| | XBF-AH04A | 2 | Voltage/Current | 2 | Voltage/Current |
| RTD input | XBF-RD04A | 4 | PT100/JPT100 | None | - |
| | XBF-RD01A | 1 | PT100/JPT100 | None | - |
| TC input | XBF-TC04S | 4 | K, J, T, R | None | - |
| | XBF-TC04RT | 4 | PT100/JPT100 | 4 | Transister |
| | XBF-TC04TT | 4 | K, J, T, R | 4 | Transister |
| Positioning | XBF-PD02A | - | Line Driver | 2 | Voltage |
| High Speed Counter | XBF-HD02A | 2 | Line Driver | | - |
| | XBF-HO02A | 2 | Open Collector | | - |
| Loadcell | XBF-LD02A | 2 | Volatage | - | - |

## 2.3.4 Classification and type of communication module

Name of communication module is classified as follows.



| C21A : Cnet 1 channel (RS-232C) |
| C41A: Cnet 1 channel (RS-422/485) |
| EMTA : Fast Ethernet 1chanel |
| EIMT/F/H: RAPIEnet 2 Port (elec. Optic and mixed) |
| CMEA: CANopen Master |
| CSEA: CANopen Slave |
| PMEC: Profibus DP Master |
| PSEA: Profibus DP Slave |
| DSEA: DeviceNet Slave |

XGB series

Expansion communication module
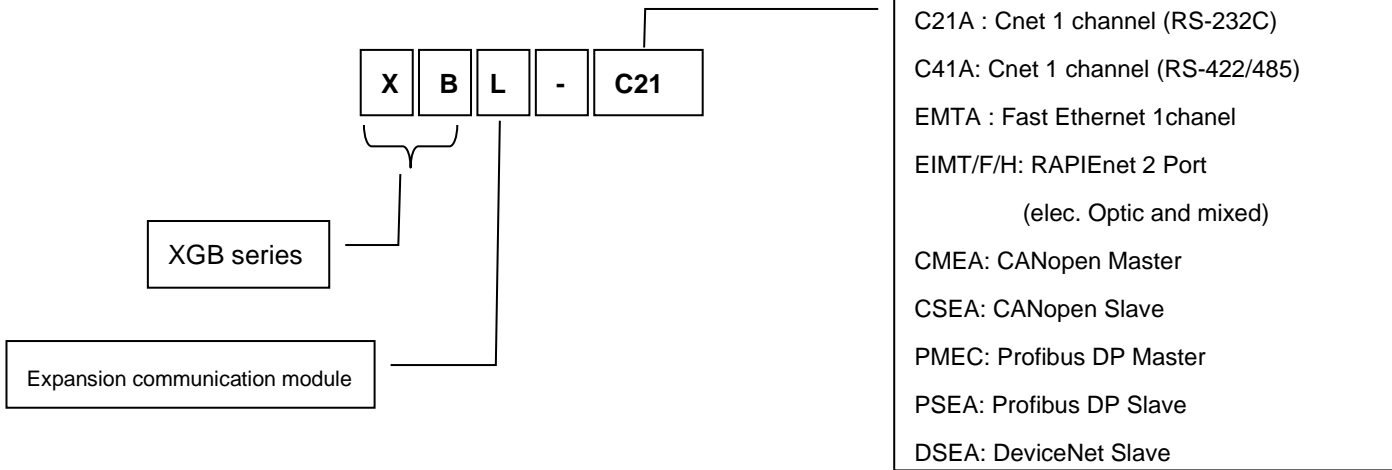
| Classification | Name | Type |
|---|---|---|
| Cnet Comm. Module | XBL-C21A | RS-232C, 1 channel |
| | XBL-C41A | RS-422/485, 1 channel |
| FEnet Comm. Module | XBL-EMTA | Electricity, open type Ethernet |
| RAPIEnet Comm. Module | XBL-EIMT/EIMF/EIMH | Comm. Module between PLCs, electric media, 100 Mbps industrial Ethernet supported |
| EtherNet Comm. Module | XBL-EIPT | Open EtherNet I/P |
| CANopen Comm. Module | XBL-CMEA | CANopen Master |
| | XBL-CSEA | CANopen Slave |
| Pnet Comm. Module | XBL-PMEC | Profibus-DP Master |
| | XBL-PSEA | Profibus-DP Slave |
| DeviceNet Comm. Module | XBL-DSEA | DeviceNet Slave |
| Rnet Comm. Module | XBL-RMEA | RemoteNet Master |

## 2.3.5 Classification and Type of Option Module

Name of option module is classified as follows.
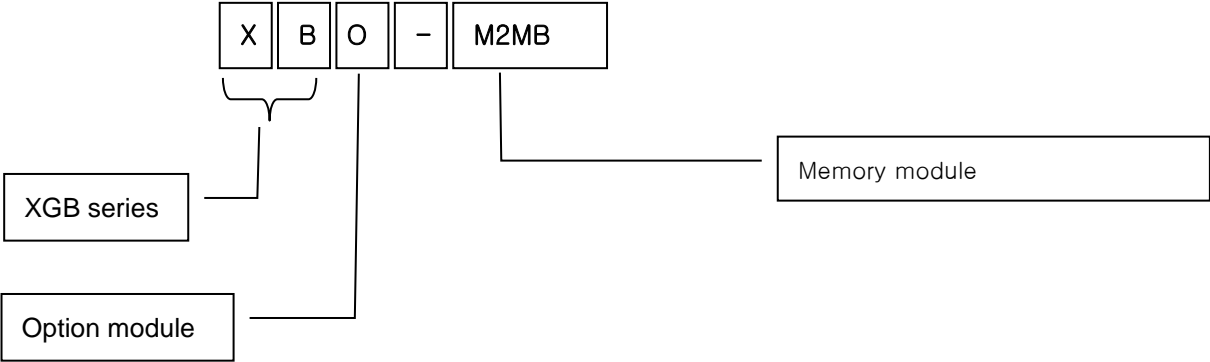


| Classification | Name | Type |
|---|---|---|
| Memory module | XBO-M1024A | Memory module |

## 2.4. System Configuration

### 2.4.1 Cnet I/F system

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

1) 1:1 communication system

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

XBC-DR32H
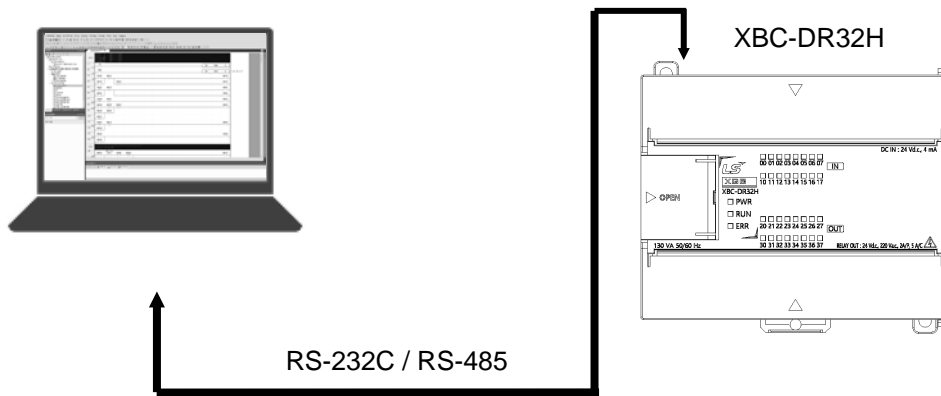
RS-232C / RS-485

(2) 1:1 communication with main unit using a built-in RS-485 port
(In case of built-in RS-232C,it is for connecting to HMI device.)

Built-in RS-485 Connection

XBC-DR32H                                            XBM-DN32S

PADT
connection

iXP2-0800

Built-in RS-232C Connection
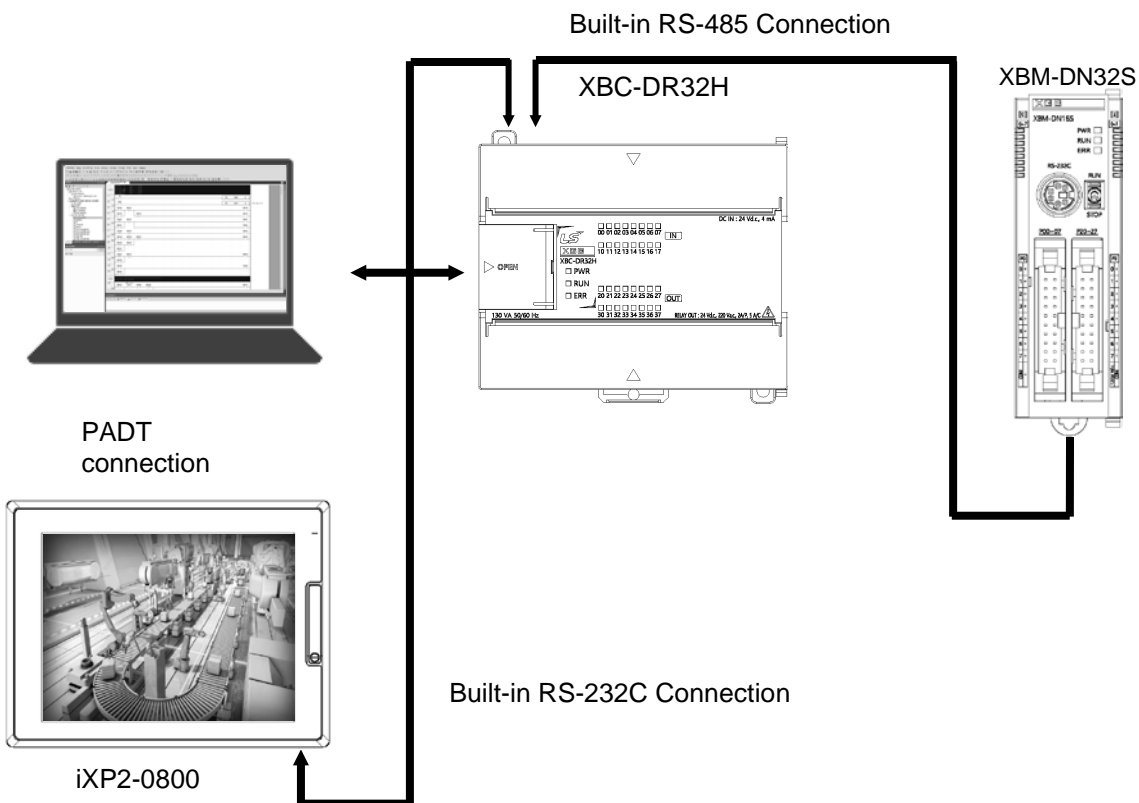
(3) 1:1 RS-232C Communication with remote device via modem by Cnet I/F modules

XBM-DN32S  XBL-C21A                    XBM-DN32S  XBL-C21A



Modem

Modem

XBC-DR32H          XBL-C21A



Modem

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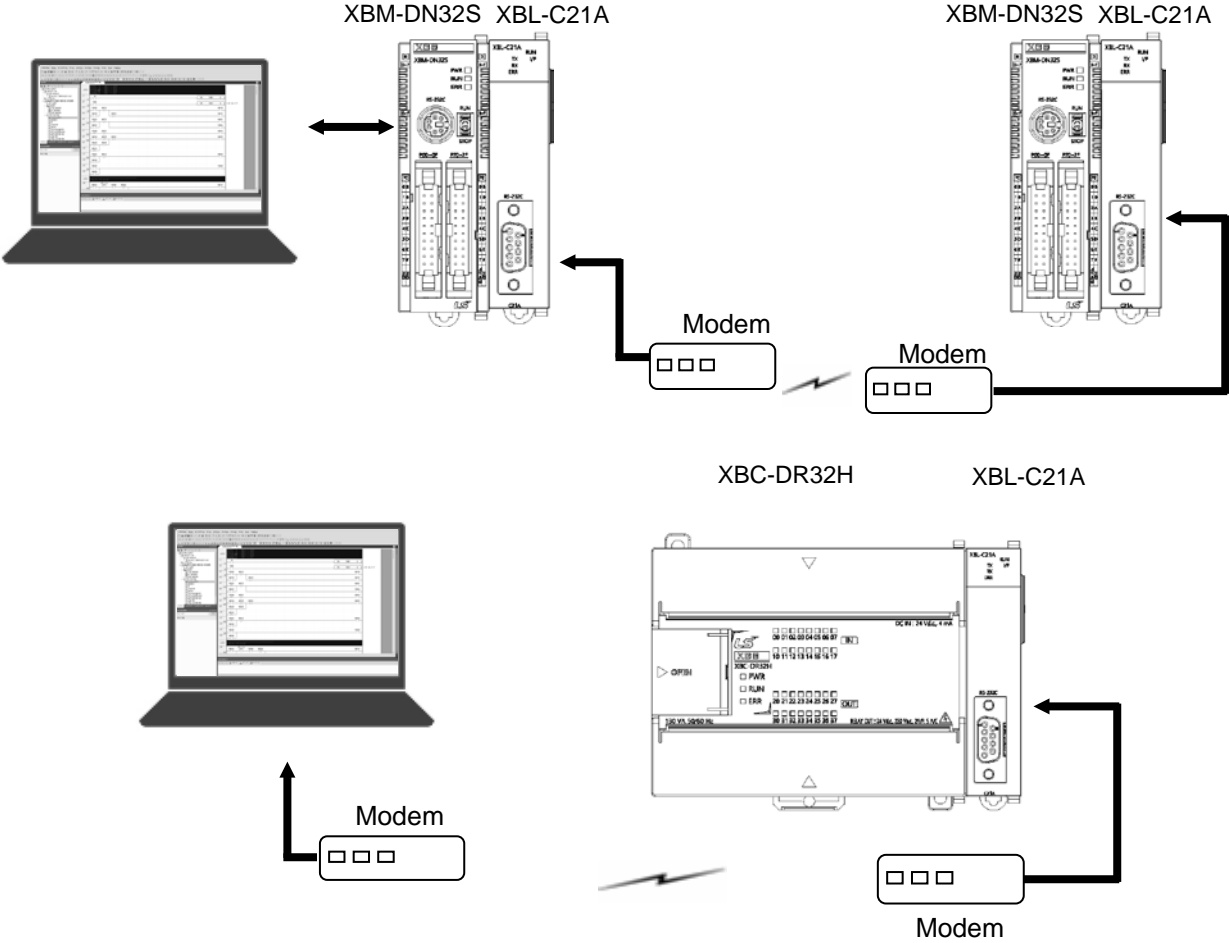
(4) 1:1 communication of an external device (monitoring unit) with main unit using a built-in RS-232C/485 port.



iXP2-0800
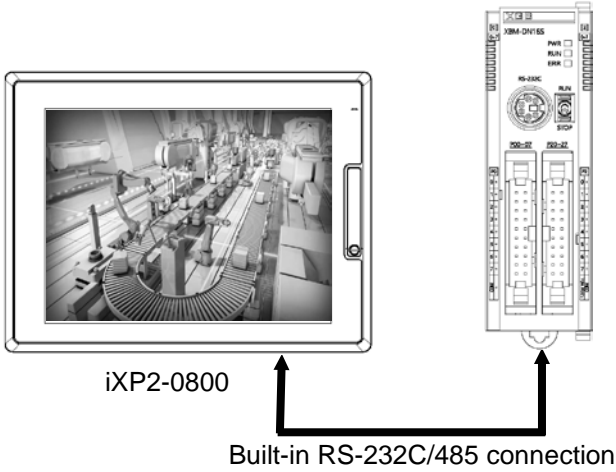
Built-in RS-232C/485 connection

2) 1:n Communication system

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

XBM-DN32S    XBM-DR16S    XBM-DN32S

XBC-DN32H

PADT connection

Can be connected
Max. 32 stations

Built-in    RS-232C
Connection
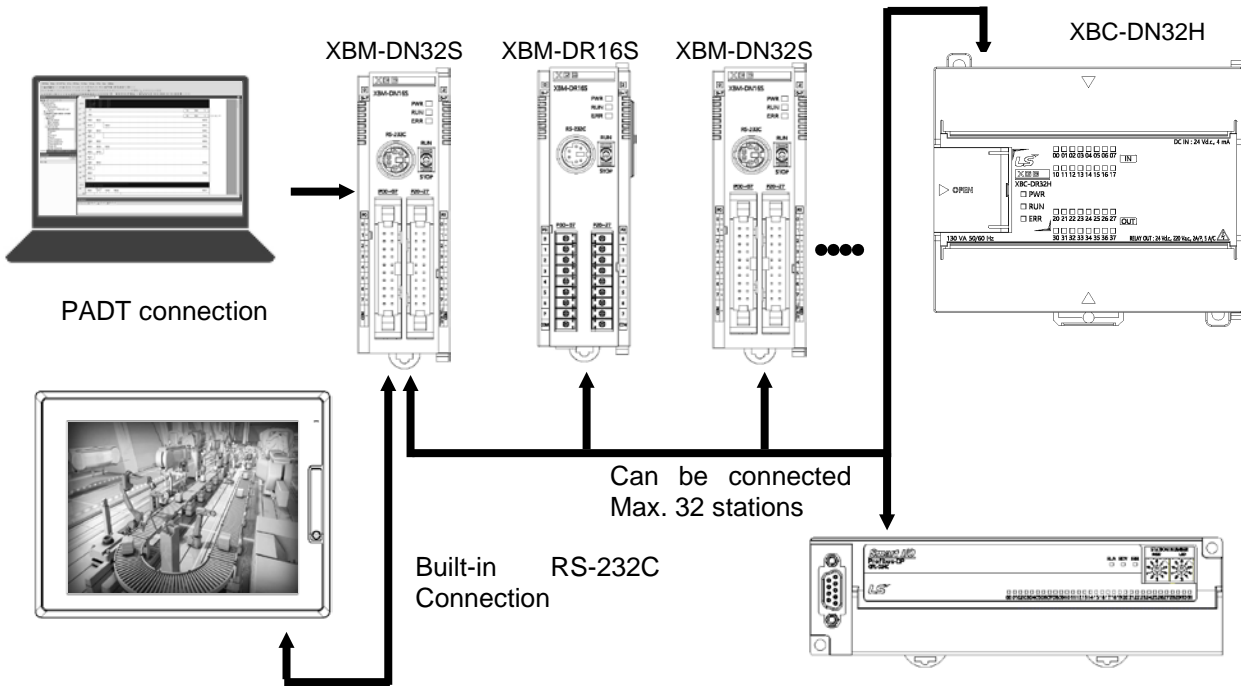
(2) Using RS-485 built-in function/expansion Cnet I/F module can be connect for up to 32 stations.

XBL-C41A
XBM-DN32S

XBL-C41A
XBM-DN16S

XBC-DN32H        XBL-C41A

PADT Connection

Can be connected
Max. 32 stations

Can be connected
Max. 32 stations

Built-in RS-232C connection
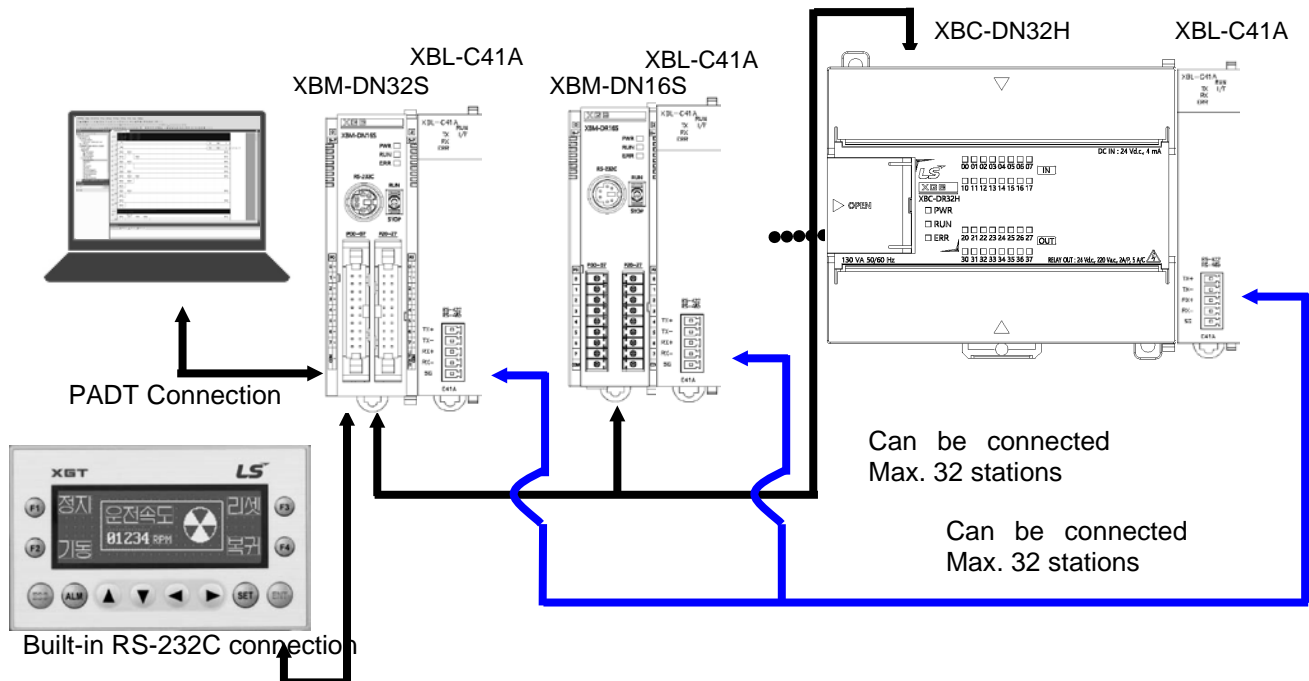
Note

1) Refer to 'XGB Cnet I/F user manual' for details

## 2.4.2 Ethernet system

Ethernet made by cooperation of Xerox, Intel, DEC is standard LAN connection method (IEEE802.3), which is network connection system using 1.5KB packet with 100Mbps transmission ability. Since Ethernet can combine a variety of computer by network, it is called as standard specification of LAN and diverse products. By adopting CSMA/CD method, it is easy to configure the network and collect large capacity data.
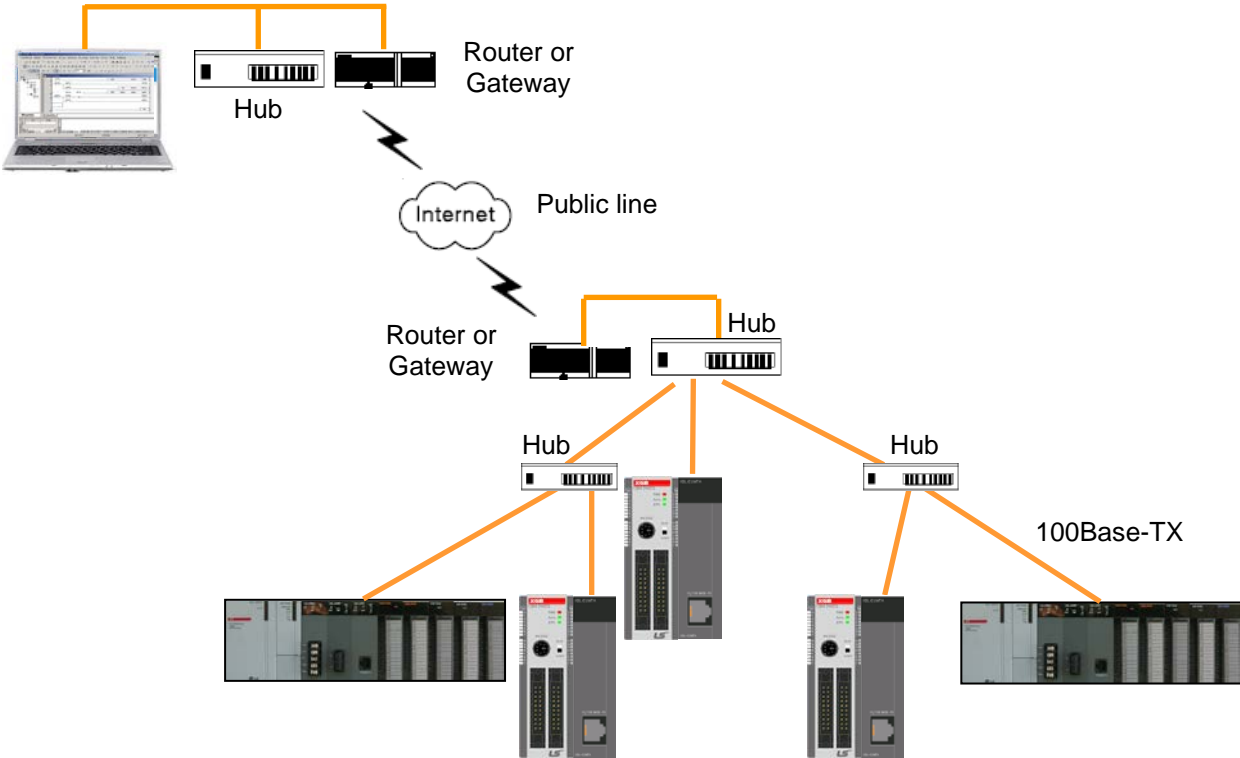


| Note |
| --- |
| 1） Refer to 'XGB FEnet I/F user manual' for details |

# Chapter 3 General Specifications

## 3.1 General Specifications

The General specification of XGB series is as below.

| No. | Items | Specification | | | | Reference |
|-----|-------|---------------|---|---|---|-----------|
| 1 | Ambient Temp. | 0 ~ 55 °C | | | | - |
| 2 | Storage Temp. | −25 ~ +70 °C | | | | |
| 3 | Ambient humidity | 5 ~ 95%RH (Non-condensing) | | | | |
| 4 | Storage humidity | 5 ~ 95%RH (Non-condensing) | | | | |
| 5 | Vibration | Occasional vibration | | | - | IEC61131-2 |
| | | Frequency | Acceleration | Pulse width | Times | |
| | | 5 ≤ f < 8.4Hz | – | 3.5mm | 10 times each direction (X,Y and Z) | |
| | | 8.4 ≤ f ≤ 150Hz | 9.8m/s$^2$(1G) | – | | |
| | | Continuous vibration | | | | |
| | | Frequency | Acceleration | Pulse width | | |
| | | 5 ≤ f < 8.4Hz | – | 1.75mm | | |
| | | 8.4 ≤ f ≤ 150Hz | 4.9m/s$^2$(0.5G) | – | | |
| 6 | Shocks | • Peak acceleration : 147 m/s$^2$(15G)<br>• Duration : 11ms<br>• Pulse wave type : Half-sine (3 times each direction per each axis) | | | | |
| 7 | Impulse noise | Square wave impulse noise | AC: ±1,500 V<br>DC: ±900 V | | | LS ELECTRIC standard |
| | | Electrostatic discharge | Voltage: 4kV (Contact discharge) | | | IEC61131-2<br>IEC61000-4-2 |
| | | Radiated electromagnetic field noise | 80 ~ 1,000 MHz, 10V/m | | | IEC61131-2,<br>IEC61000-4-3 |
| | | Fast transient /Burst noise | Classifi-cation | Power supply | Digital/Analog Input/Output, Communication Interface | IEC61131-2<br>IEC61000-4-4 |
| | | | Voltage | 2kV | 1kV | |
| 8 | Operation ambience | Free from corrosive gases and excessive dust | | | | |
| 9 | Altitude | Less than 2,000m | | | | - |
| 10 | Pollution degree | Less than 2 | | | | |
| 11 | Cooling method | Air-cooling | | | | |

---

**Notes**

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

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

# Chapter 4 CPU Specifications

## 4.1 Performance Specifications

The following table shows the general specifications of the XGB module type CPU.

| Items | | Specifications ("S" type) | | | Remark |
|---|---|---|---|---|---|
| | | XBM-DR16S | XBM-DN16S | XBM-DN32S | |
| Program control method | | Cyclic execution of stored program, Time-driven interrupt, Process-driven interrupt | | | - |
| I/O control method | | Batch processing by simultaneous scan (Refresh method), Directed by program instruction | | | |
| Program language | | Ladder Diagram, Instruction List | | | |
| Number of instructions | Basic | About 30 | | | |
| | Application | About 540 | | | |
| Processing speed (Basic instruction) | | 0.16 $\mu$s/Step | | | |
| Program capacity | | 10 ksteps | | | |
| Max. I/O points | | 240 point (Main + Expansion 7 stages) | | 256 point | |
| Data area | P | P0000 ~ P127F (2,048 point) | | | |
| | M | M0000 ~ M255F (4,096 point) | | | |
| | K | K00000 ~ K2559F (Special area: K2600~2559F) (40,960 point) | | | |
| | L | L00000 ~ L1279F (20,480 point) | | | |
| | F | F000 ~ F255F (4,096 point) | | | |
| | T | 100ms, 10ms, 1ms : T000 ~ T255 (Adjustable by parameter setting) | | | |
| | C | C000 ~ C255 | | | |
| | S | S00.00 ~ S127.99 | | | |
| | D | D0000 ~ D5119 (5120 word) | | | Word |
| | U | U00.00 ~ U07.31 (Analog data refresh area: 256 word) | | | |
| | Z | Z000~Z127 (128 Word) | | | |
| | N | N0000~N3935 (3936 Word) | | | |
| Total program | | 128 | | | - |
| Initial task | | 1 (_INT) | | | |
| Cyclic task | | Max. 8 | | | |
| I/O task | | Max. 8 | | | |
| Internal device task | | Max. 8 | | | |
| Operation mode | | RUN, STOP, DEBUG | | | |
| Self-diagnosis function | | Detects errors of scan time, memory, I/O and power supply | | | |
| Program port | | RS-232C (Loader) | | | |
| Back-up method | | Latch area setting in basic parameter | | | |
| Internal consumption current | | 400 mA | 250 mA | 280 mA | |
| Weight | | 140 g | 100 g | 110 g | |

The following table shows the general specifications of the XGB compact type CPU (XBC-DR32/64H, XBC-DN32/DN64).

| Items | | Specifications ("H" type) | | | | Remark |
|---|---|---|---|---|---|---|
| | | XBC-DN32H (/DC) | XBC-DR32H (/DC) | XBC-DN64H (/DC) | XBC-DR64H (/DC) | |
| Program control method | | Cyclic execution of stored program, Time-driven interrupt, Process-driven interrupt | | | | |
| I/O control method | | Batch processing by simultaneous scan (Refresh method), Directed by program instruction | | | | |
| Program language | | Ladder Diagram, Instruction List | | | | |
| Number of instructions | Basic | About 30 | | | | |
| | Application | About 540 | | | | |
| Processing speed (Basic instruction) | | O/S Version V5.00 or later: 60ns/Step<br>O/S Version Less than V5.00: 83ns/Step | | | | |
| Program capacity | | 15 Kstep | | | | |
| Max. I/O points | | 352 point (Main + Expansion 10 stages) | | 384 point (Main + Expansion 10 stages) | | - |
| Data area | P | P0000 ~ P1023F (16,384 point) | | | | |
| | M | M0000 ~ M1023F (16,384 point) | | | | |
| | K | K0000 ~ K4095F (65,536 point) | | | | |
| | L | L0000 ~ L2047F (32,768 point) | | | | |
| | F | F0000 ~ F1023F (16,384 point) | | | | |
| | T | 100ms, 10ms, 1ms : T0000 ~ T1023 (1,024 point) (Adjustable by parameter setting) | | | | |
| | C | C0000 ~ C1023 (1,024) | | | | |
| | S | S00.00 ~ S127.99 | | | | |
| | D | D0000 ~ D10239 (10,240 word) | | | | Word |
| | U | U00.00 ~ U0A.31 (Analog data refresh area: 352 word) | | | | |
| | Z | Z000~Z127 (128 Word) | | | | |
| | N | N0000~N5119 (5,120 Word) | | | | |
| | R | R0000~R10239 (10,240 Word) | | | | |
| Total program | | 128 | | | | - |
| Initial task | | 1 (_INT) | | | | |
| Cyclic task | | Max. 8 | | | | |
| I/O task | | Max. 8 | | | | |
| Internal device task | | Max. 8 | | | | |

| Operation mode | RUN, STOP, DEBUG | | | | |
|---|---|---|---|---|---|
| Self-diagnosis function | Detects errors of scan time, memory, I/O and power supply | | | | |
| Program port | RS-232C 1 channel, USB 1 channel (USB 1.1 supported) | | | | |
| Back-up method | Latch area setting in basic parameter | | | | |
| Internal consumption current | 260 mA | 660 mA | 330 mA | 1,040 mA | |
| Weight | 500 g | 600 g | 800 g | 900 g | |

| Items | | Specifications | | Remark |
|---|---|---|---|---|
| | | "S" type | "H" type | |
| Built-in function | PID control function | Controlled by instructions, Auto-tuning, PWM output, Manual output, Adjustable operation scan time, Anti Windup, Delta MV function, SV-Ramp function | | |
| | Cnet I/F function | Dedicated protocol support / MODBUS protocol support / User defined protocol support ⎰ RS-232C 1 port / RS-485 1 port | | |
| | High-speed counter — Capacity | 1 phase: 20 kHz 4 channel 2 phase: 10 kHz 2 channel | 1 phase: 100 kHz 4 channel, 20kHz 4 channel 2 phase: 50 kHz 2 channel, 10kHz 2 channel | - |
| | High-speed counter — Counter mode | 4 different counter modes according to input pulse and addition/subtraction method • 1 phase pulse input: addition/subtraction counter • 1 phase pulse input: addition/subtraction counter by B phase • 2 phase pulse input: addition/subtraction counter • 2 phase pulse input: addition/subtraction by phase differences | | |
| | High-speed counter — Additional function | • Internal/External preset function • Latch counter function • Comparison output function • Revolution number per unit time function | | |
| | Positioning function — Basic function | No. of control axis: 2 axes Control method: position/speed control Control unit: pulse Positioning data: 30 data/axis (operation step No. 1~30) Operation mode: End/Keep/ Continuous Operation method: Single, Repeated operation | No. of control axis: 2 axes Control method: position/speed control Control unit: pulse Positioning data: 80 data/axis (operation step No. 1~80) Operation mode: End/Keep/Continuous Operation method: Single, Repeated operation | TR output type support |
| | Positioning function — Positioning function | Positioning method: Absolute / Incremental Address range: -2,147,483,648 ~ 2,147,483,647 Speed: Max. 100Kpps(setting range 1 ~ 100,000pps) Acceleration / Deceleration method : trapezoidal method | | |
| | Positioning function — Return to Origin | Origin detection when approximate origin turns off Origin detection when approximate origin turns on Origin detection by approximate origin. | | |
| | Positioning function — JOG operation | Setting range: 1~100,000 ( High / Low speed) | | |
| | Positioning function — Additional function | Inching operation, Speed synchronizing operation, Position synchronizing operation, linear interpolation operation etc. | | |
| | Pulse catch | 50 $\mu$s 8 point (P0000 ~ P0007) | 10 $\mu$s 4 point (P0000 ~ P0003) 50 $\mu$s 4 point (P0004 ~ P0007) | - |
| | External interrupt | 8 point: 50 $\mu$s (P0000 ~ P0007) | 10 $\mu$s 4 point (P0000 ~ P0003) 50 $\mu$s 4 point (P0004 ~ P0007) | |
| | Input filter | Select among 1,3,5,10,20,70,100 ms (Adjustable) | | |

## 4.2 Names of Part and Function

| "S" Type |
|---|
|  |

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

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

## "H" Type



| No. | Name | | Description |
|---|---|---|---|
| ① | Input indicator LED | | ▪ Input indicator LED |
| ② | PADT connecting connector | | ▪ PADT connecting USB (USB 1.1 supported) 1 channel, RS-232C 1 channel connector |
| ③ | Input connector and terminal block | | ▪ Input connector and terminal block |
| ④ | Output connector and terminal block | | ▪ Output connector and terminal block |
| ⑤ | Key switch | | ▪ RUN / STOP Key switch In case of STOP mode, Remote mode changeable. |
| ⑥ | Output indicator LED | | ▪ Output indicator LED |
| ⑦ | Status indicator LED | | It indicates CPU module's status. ▪ PWR(Red): Power status ▪ RUN(Green): RUN status STOP mode: Off/ RUN mode : On ▪ Error(Red): In case of error, it is flickering. |
| ⑧ | 8-1 | Built-in RS-232C / RS-485 Connecting connector | • Built-in RS-485 connecting connector "+" , "-" terminal connecting connector in RS-485 communication ▪Built-in RS-232C connecting connector "TxD" , "RxD" , "GND" connecting connector in RS-232C |
| | 8-2 | Power supply connector | ▪ AC100~240V power supply connector |

## 4.3 Power Supply Specifications

It describes the power supply specification of main unit.

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

| Items | | | Specification ( "H" type) | | | |
|---|---|---|---|---|---|---|
| | | | XBC-DR32H, XBC-DN32H | XBC-DR64H, XBC-DN64H | XBC-DR32H/DC, XBC-DN32H/DC | XBC-DR64H/DC, XBC-DN64H/DC |
| Input | Rated voltage (UL warranty voltage) | | AC 100 ~ 240 V | | DC 24V | |
| | Input voltage range | | AC85~264V(-15%, +10%) | | DC19.2~28.8V(-20%, +20%) | |
| | Inrush current | | 50A$_{Peak}$ or less | | | |
| | Input current | | AC 220V : 0.5A or less, AC 110V : 1A or less | | 0.7A or less | 1A or less |
| | Efficiency | | 65% or more | | | |
| | Permitted momentary power failure | | Less than 10 $_{ms}$ | | | |
| Output | Rated output | DC5V | 2A | 3A | 2A | 3A |
| | | DC24V | 0.4A | 0.6A | - | - |
| | Output voltage ripple | | DC5V ($\pm$2%) | | | |
| Power supply status indication | | | LED On when power supply is normal | | | |
| Cable specification | | | 0.75 ~ 2 mm$^2$ | | | |

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

1) Consumption current (DC 5V)

| Item | Model | Current consumption |
|---|---|---|
| Main unit | XBM-DR16S | 400 |
| | XBM-DN16S | 250 |
| | XBM-DN32S | 280 |
| | XBC-DR32H | 510 |
| | XBC-DR64H | 970 |
| | XBC-DN32H | 180 |
| | XBC-DN64H | 240 |
| | XBC-DR32H/DC | 510 |
| | XBC-DR64H/DC | 970 |
| | XBC-DN32H/DC | 180 |
| | XBC-DN64H/DC | 240 |
| Expansion I/O module | XBE-DC32A | 50 |
| | XBE-DC16A | 40 |
| | XBE-DC08A | 30 |
| | XBE-AC08A | 30 |
| | XBE-RY16A | 420 |
| | XBE-RY08A | 230 |
| | XBE-TN32A | 120 |
| | XBE-TN16A | 60 |
| | XBE-TN08A | 40 |
| | XBE-TP32A | 120 |
| | XBE-TP16A | 60 |
| | XBE-TP08A | 40 |
| | XBE-DR16A | 280 |
| | XBE-DN32A | 60 |
| Expansion special module | XBF-AD04A | 120 |
| | XBF-DV04A | 110 |
| | XBF-DC04A | 110 |
| | XBF-RD04A | 100 |
| | XBF-RD01A | 100 |
| | XBF-TC04S | 100 |
| | XBF-PD02A | 500 |
| | XBF-HO02A | 270 |
| | XBF-HD02A | 330 |
| | XBF-AD04C | 105 |

|  |  |  |
|---|---|---|
|  | XBF-DC04C | 70 |
|  | XBF-DV04C | 70 |
|  | XBF-TC04RT | 120 |
|  | XBF-TC04TT | 120 |
|  | XBF-LD02S | 110 |
| Expansion communication module | XBL-C21A | 110 |
|  | XBL-C41A | 110 |
|  | XBL-EMTA | 190 |
|  | XBL-EIMT/F/H | 280/670/480 |
|  | XBL-EIPT | 400 |
|  | XBL-CMEA | 150 |
|  | XBL-CSEA | 150 |
|  | XBL-PMEC | 300 |
|  | XBL-PSEA | 230 |
|  | XBL-DSEA | 100 |
|  | XBL-RMEA | 250 |

## 4.4 Calculation Example of Consumption Current/Voltage

Calculate the consumption current and configure the system not to exceed the output current capacity of basic unit.

(1) XGB PLC configuration example 1
Consumption of current/voltage is calculated as follows.

| Type | Model | Unit No. | Internal 5V consumption current (Unit : mA) | Remark |
|------|-------|----------|---------------------------------------------|--------|
| Main unit | XBM-DN16S | 1 | 250 | In case contact points are On. (Maximum consumption current) |
| Expansion module | XBE-DC32A | 2 | 50 | |
| | XBE-TN32A | 2 | 120 | |
| | XBF-AD04A | 1 | 120 | All channel is used. (Maximum consumption current) |
| | XBF-DC04A | 1 | 110 | |
| | XBL-C21A | 1 | 110 | |
| Consumption current | 930 mA | | | - |
| Consumption voltage | 4.65 W | | | 0.93 * 5V = 4.65W |

In case system is configured as above, since 5V consumption current is total 930mA and 5V output of XGB standard type main unit is maximum 1.5A, normal system configuration is available.

(2) XGB PLC configuration example 2

| Type | Model | Unit No. | Internal 5V consumption current (Unit : mA) | Remark |
|------|-------|----------|---------------------------------------------|--------|
| Main unit | XBM-DR16S | 1 | 400 | In case all contact points are On. (Maximum consumption current) |
| Expansion module | XBE-DR16A | 3 | 280 | |
| | XBE-TN32A | 2 | 120 | |
| | XBF-AD04A | 1 | 120 | All channel is used. (Maximum consumption current) |
| | XBL-C21A | 1 | 110 | |
| Consumption current | 1,710 mA | | | - |
| Consumption voltage | 8.55W | | | 1.710 * 5V = 8.55W |

If system is configured as above, total 5V current consumption is exceeded 1,710 mA and it exceeds the 5V output of XGB standard type main unit. Normal system configuration is not available. Although we assume the above example that all contact points are on, please use high-end type main unit which 5V output capacity is higher than standard type main unit.

(3) XGB PLC configuration example 3

| Type | Model | Unit No. | Internal 5V consumption current (Unit : ㎃) | Remark |
|---|---|---|---|---|
| Main unit | XBC-DR32H | 1 | 510 | In case of all contact points are On. (Maximum consumption current) |
| Expansion module | XBE-DR16A | 3 | 280 | |
| | XBE-TN32A | 2 | 80 | |
| | XBF-AD04A | 1 | 120 | All channel is used. (Maximum consumption current) |
| | XBL-C21A | 1 | 110 | |
| Consumption current | 1,740 ㎃ | | | - |
| Consumption voltage | 8.7W | | | 1.74 * 5V = 8.7W |

The above system is an example using XBC-DR32H about system example (2). Unlike (2) example, 5V output capacity of XBC-DR32H is maximum 2A, normal configuration is available.

**Remark**

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

# 4.5 Battery

This contents is only applied to "H" type.

## 4.5.1 Battery specification

| Items | Specifications |
|---|---|
| Nominal voltage / current | DC 3.0V / 6.5 mAh |
| Warranty term | 3 years(at room temperature) |
| Purpose | RTC operation during the blackout |
| Charging time |  |
| Backup time | About 6 months(25℃) |

| surrounding temperature | Back-up time |
|---|---|
| 70℃ | about 195 days |
| 25℃ | about 183 days |
| -25℃ | about 133 days |

## 4.5.2 Instruction for Use

The built-in battery of the XBC high-end type can be replaced through a service center.

## 4.5.3 Battery Life

Battery's life may be different depending on the conditions of blackout time, service temperature, etc. Battery can be charged when power is on, and be used for RTC function.
If the battery voltage is discharged below 2V due to not using the PLC for a long time, the battery may not be charged. Recharge within 6 months (when stored at 25℃) after fully charged. If the battery is not charged, replace the battery through a service center. In this case, the PLC clock must be set again, but the program and backed up data are maintained and preserved regardless of whether the battery is discharged or not.

## 4.6 Data Back-up Time

Super capacitor-based data backup is applied to XBM series.

| Model | Backup time | Note |
|---|---|---|
| XBM-DR16S<br>XBM-DN16S<br>XBM-DN32S | 10 days | Standard ambient temperature (25℃) |

**Remark**

(1) It takes about 30minutes to charge XBM super capacitor
(2) In case of data backup failure within backup time, please contact LS ELECTRIC distributors.
(3) The backup time depends on the ambient temperature. The higher the temperature is, the shorter the backup time will be.
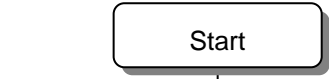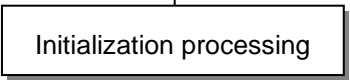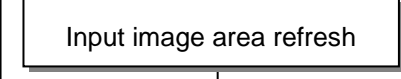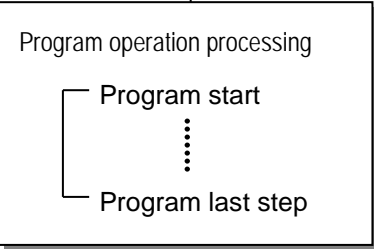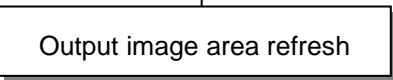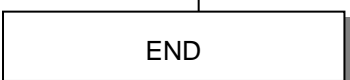
# Chapter 5 Program Configuration and Operation Method

## 5.1 Program Instruction

### 5.1.1 Program execution methods

1) Cyclic operation method (Scan)

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

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

2) Interrupt operation (Cycle time, Internal device)
   This is the method that stops the program operation in proceeding temporarily and carries out the operation processing which corresponds to interrupt program immediately in case that there occurs the status to process emergently during PLC program execution.
   The signal to inform this kind of urgent status to CPU module is called 'interrupt signal'. There is a Cycle time signal that operates program every appointed time and external interrupt signal that operates program by external contact (I/O; P000~P007). Besides, there is an internal device start program that starts according to the state change of device assigned inside.

3) Constant Scan (Fixed Period)
   This is the operation method that performs the scan program every appointed time. This stands by for a while after performing all the scan program, and starts again the program scan when it reaches to the appointed time. The difference from constant program is the update of input/output and the thing to perform with synchronization.
   At constant operation, the scan time indicates the net program processing time where the standby time is deducted. In case that scan time is bigger than 'constant', [F0005C] '_CONSTANT_ER' flag shall be 'ON'.

## 5.1.2 Operation processing during momentary power failure

CPU module detects the momentary power failure when input power voltage supplied to power module is lower than the standard. If CPU module detects the momentary power failure , it carries out the operation processing as follows.
If momentary power failure within 10 ms is occurred, main unit (CPU) keeps the operation. But, if momentary power failure above 10 ㎳, the operation is stop and the output is Off. Restart processing like at power input shall be performed.

1) Momentary power failure within 10 ms

Input power

Within 10 ms momentary
power failure
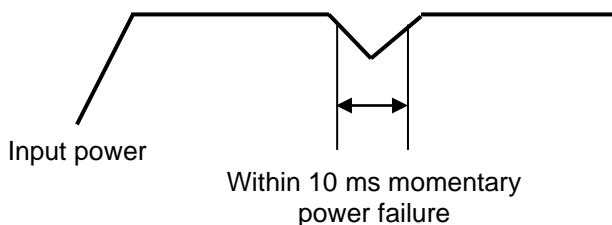
• CPU keeps the operation.

2) Momentary power failure exceeding 10 ms

Input power

Momentary power failure exceeding 20ms
momentary power failure exceed
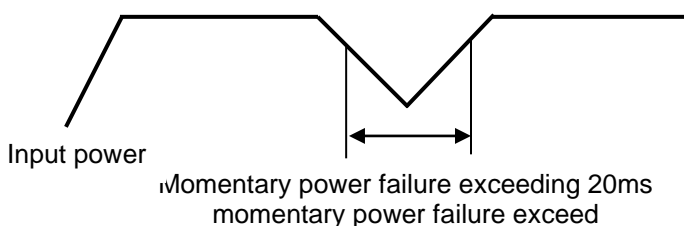
• Restart processing like at power input shall
  be performed.

**Remark**

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

### 5.1.3 Scan time

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

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

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

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

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

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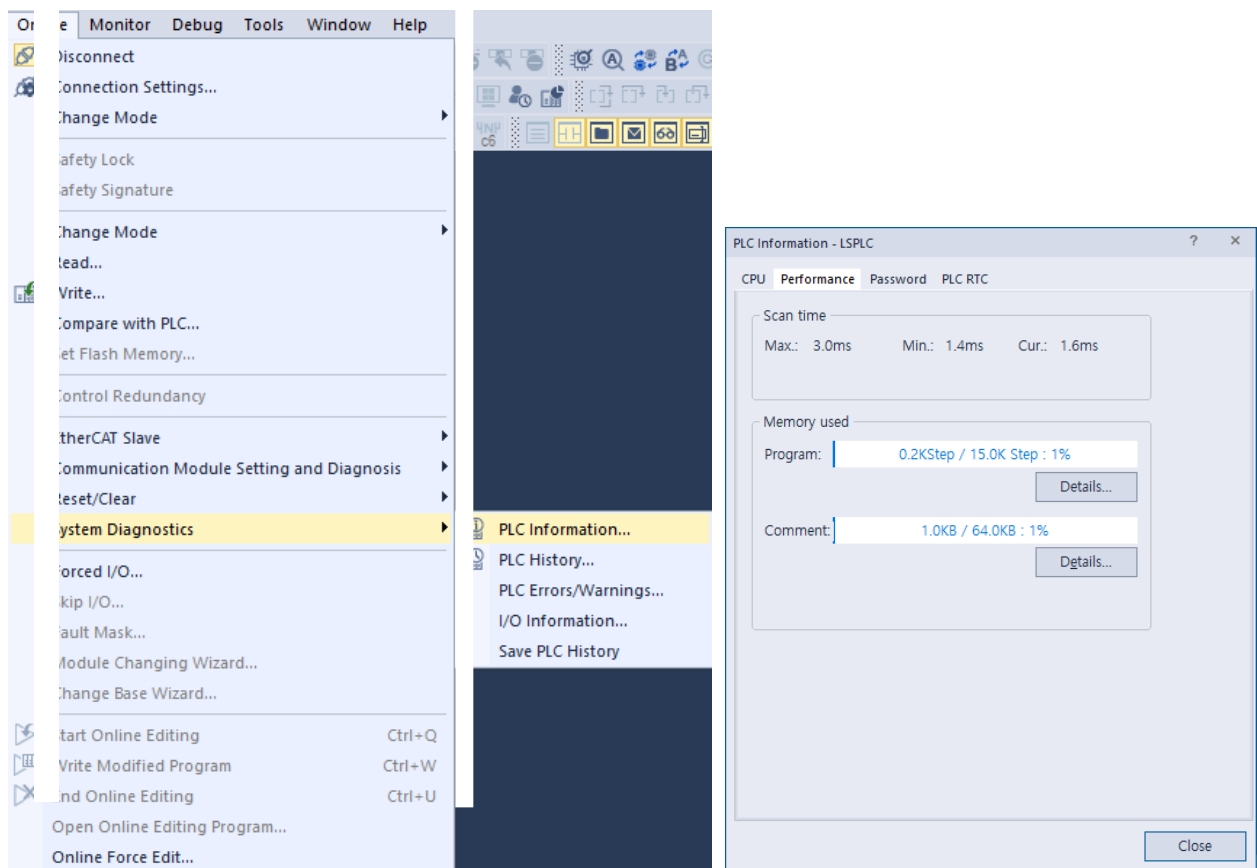


    (2) Scan time is save in special relay (F) area as follows.
      • F0050: max. value of scan time (unit: 0.1 ms)
      • F0051: min. value of scan time (unit: 0.1 ms)
      • F0052: current value of scan time (unit: 0.1 ms)

## 5.1.4 Scan Watchdog timer

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

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

2) If WDT detects the excess of detection setting time while watching the elapsed time of scan during operation, it stops the operation of PLC immediately and keeps or clears the output according to parameter setting

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

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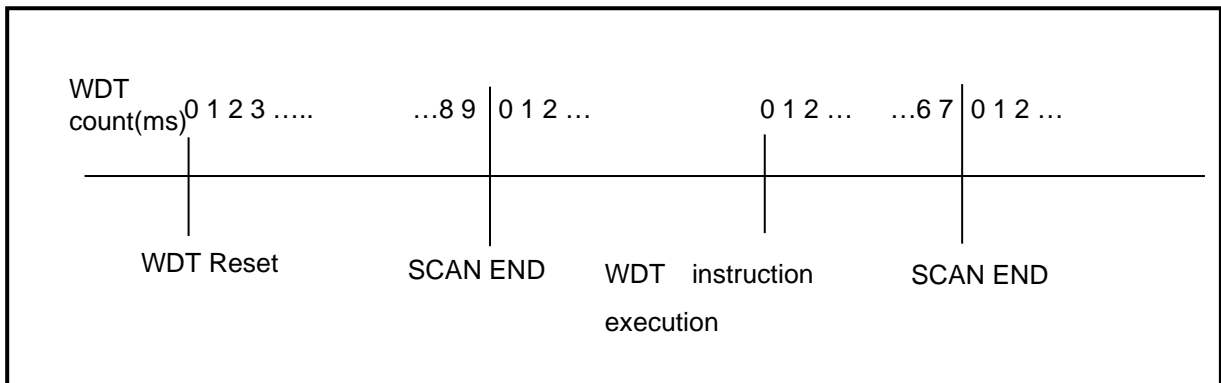


| Remark |
| --- |
| 1) The setting range of Watchdog Timer is 10 ~ 1000ms (Unit: 1ms). |

## 5.1.5 Timer processing

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

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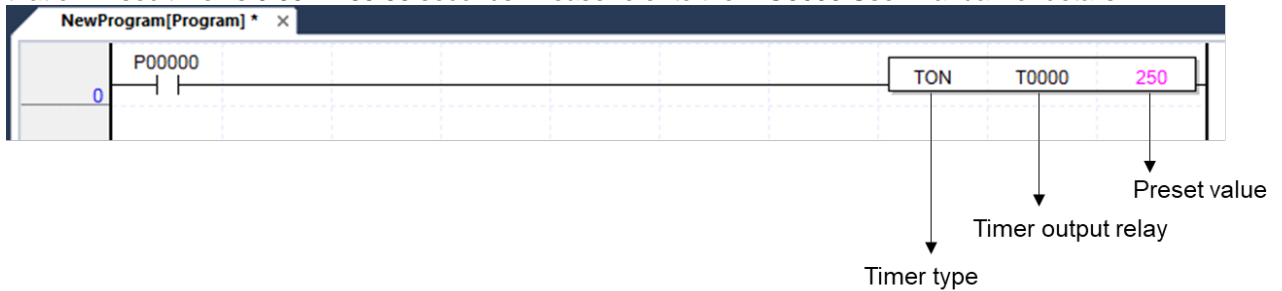


### 1) On delay timer

The current value of timer starts to increase from 0 when the input condition of TON instruction turns on. When the current value reaches the preset value (Current value=Preset value), the timer output relay (Txxxx) turns on. When the timer input condition is turned off, the current value becomes 0 and the timer output relay is turned off.
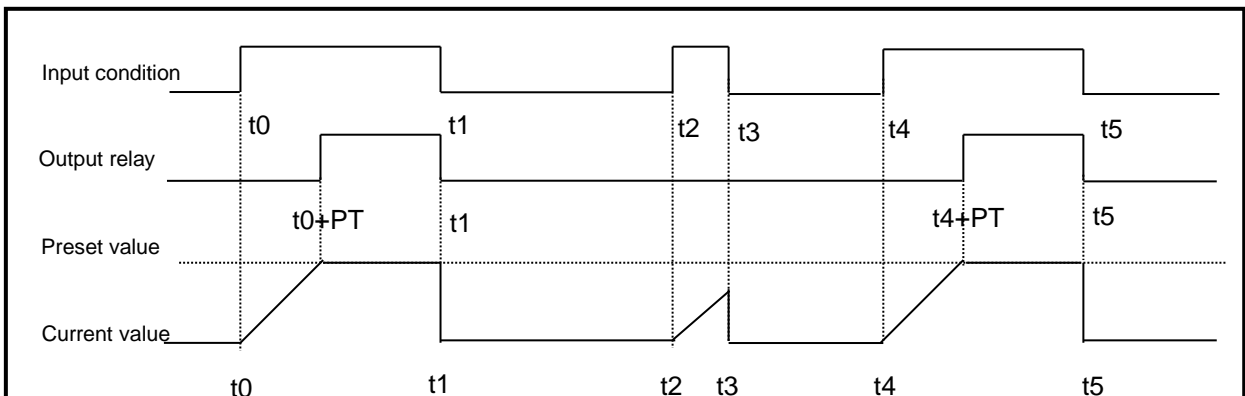


### 2) Off delay timer

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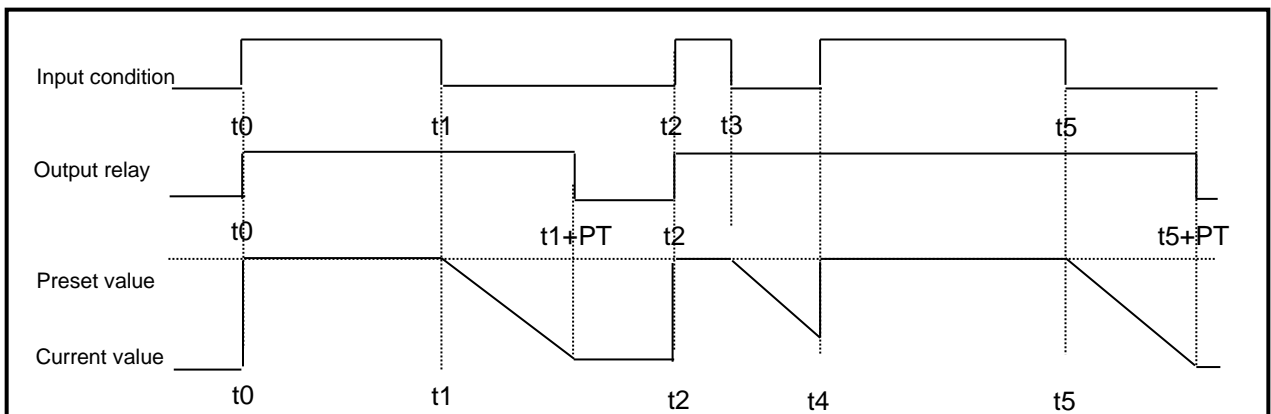
### 3) Integral timer

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

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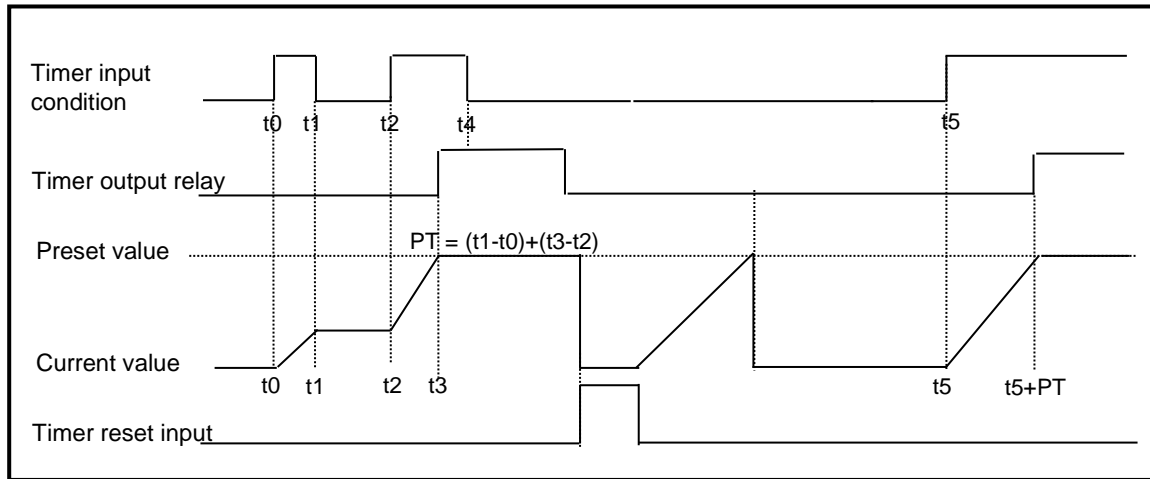


### 4) Monostable timer

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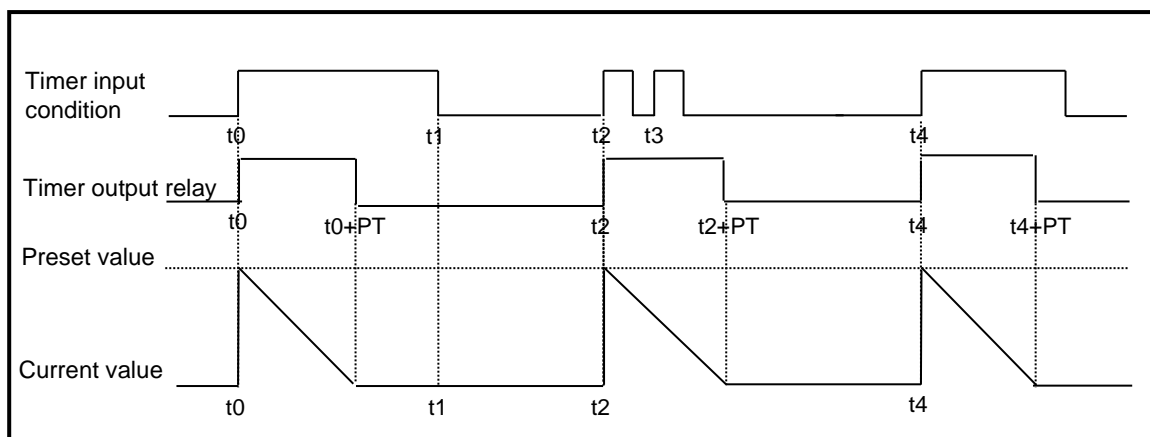
### 5) Retriggerable timer

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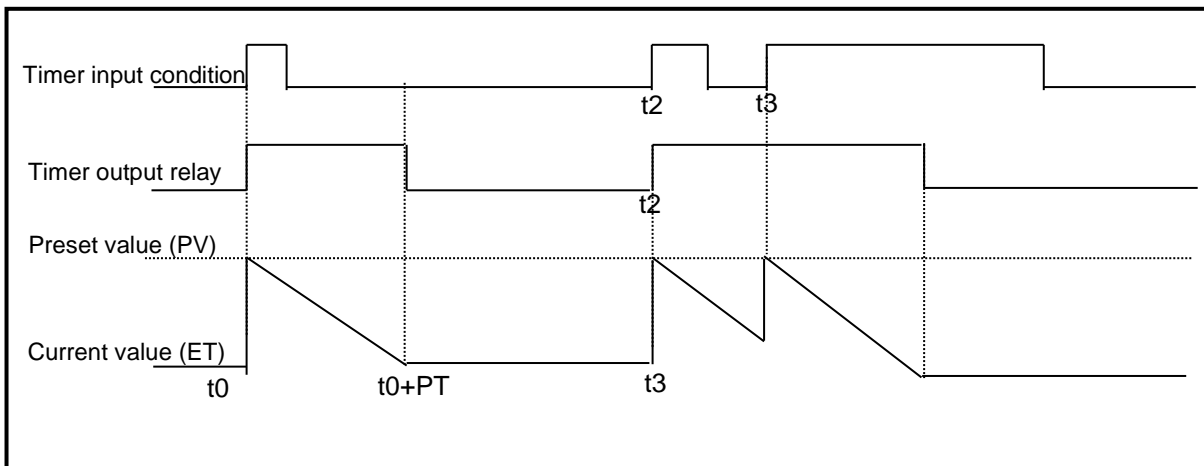


### Remark

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

## 5.1.6 Counter processing

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

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

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

(1) Up counter
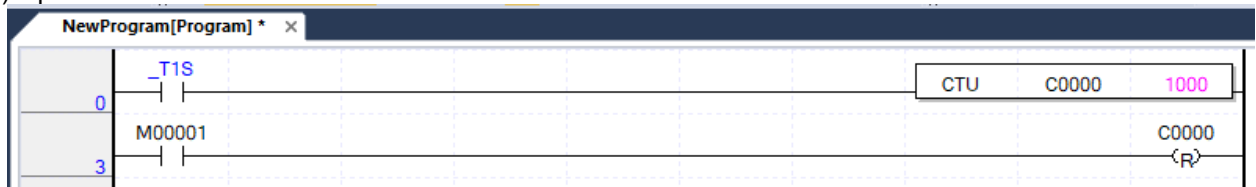


- Up counter increases the current value at the rising edges of input.
- The counter output contact (Cxxx) is turned On when the current value reaches the preset value.
  When the reset input is turned On, the counter output contact (Cxxx) is turned Off.

(2) Down counter
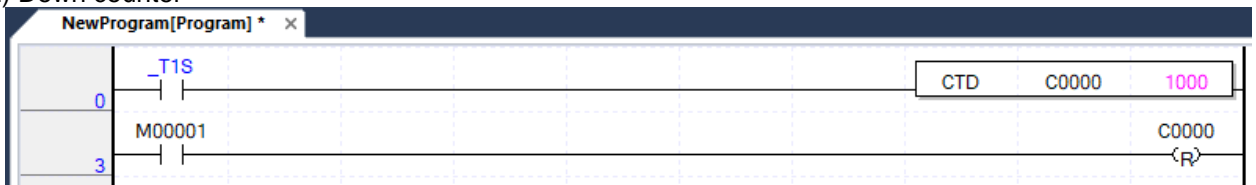


- Down counter decreases the current value at the rising edges of input.
- The counter output contact (Cxxx) is turned On when the current value reaches the preset value.
  When the reset input is turned On, the counter output contact (Cxxx) is turned Off.

(3) Up/Down counter
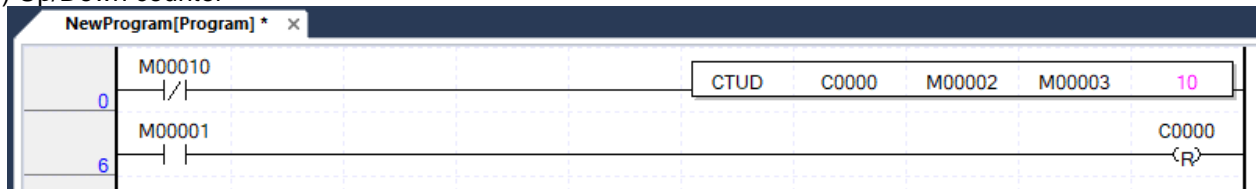


- The current value is increased with the rising edge of up-count input signal, and decreased with the rising edge of down-count input signal. The counter output contact (Cxxx) is turned On when the current value is same as or more than current value. The counter output contact (Cxxx) is turned Off when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

(4) Ring counter
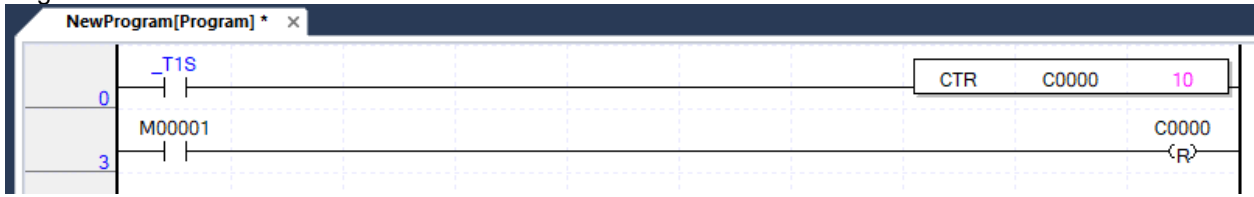


- The current value is increased with the rising edge of the counter input signal, and the counter output contact (Cxxx) is turned on when the current value reaches the preset value. Then the current value and counter output contact (Cxxx) is cleared as 0 when the next rising edge of the counter input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

2) Maximum counting speed

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

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

n : duty (%)
$t_S$ : scan time [s]

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



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

If T1 > T2,  n = $\dfrac{}{}$ x 100 [%]
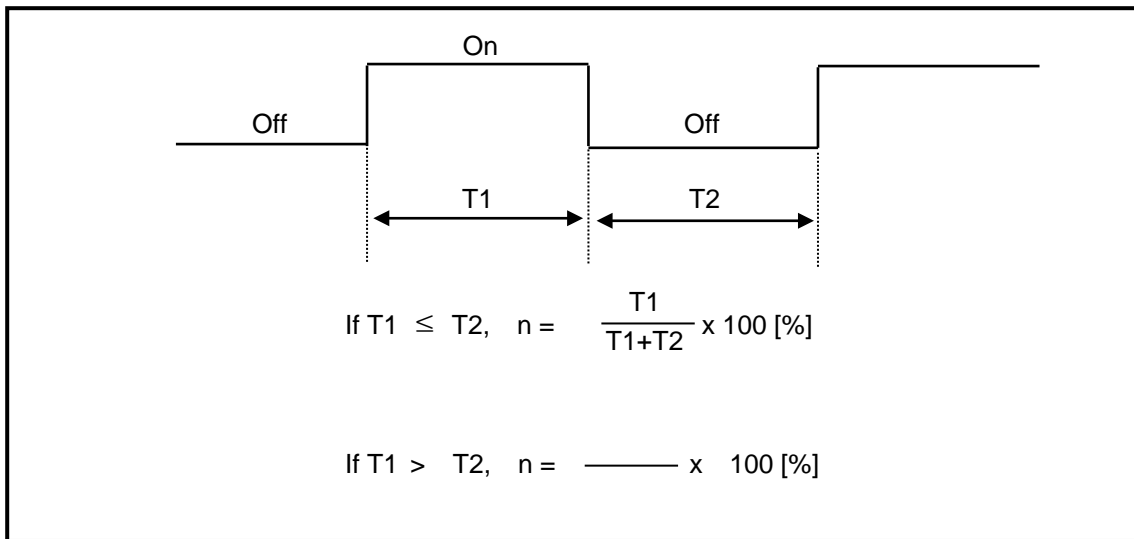
| Remark |
| --- |

1) Use of High Speed Counter

  In order to counter pulse that is faster than maximum counting speed of normal counter, use built-in High Speed counter function.

# 5.2 Program Execution

## 5.2.1 Configuration of program

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

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

## 5.2.2 Program execution methods

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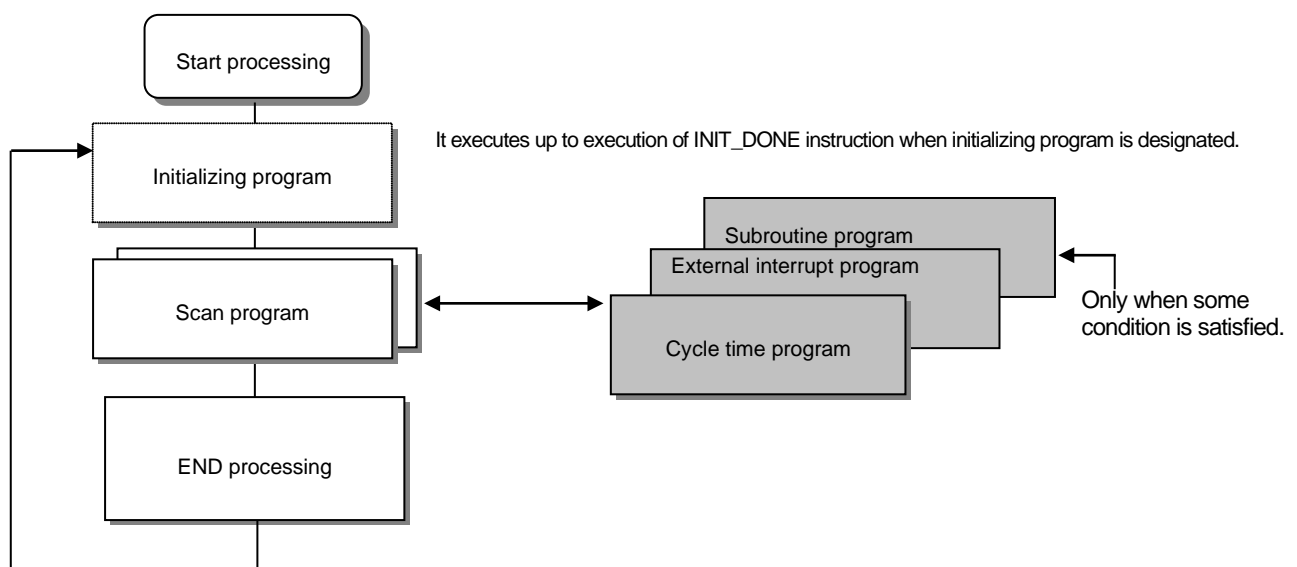
1) Scan program

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

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

2) Interrupt program

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

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

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

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

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

---

**Remark**

(1) Write the interrupt program as shortly as possible. In case same interrupt occurs repeatedly before completion of interrupt, program is not executed and O/S watch dog error may occur.

(2) Though interrupt which has lower priority occurs many times during execution of interrupt which has higher priority, interrupt which has lower priority occurs only one time.

---

## 5.2.3 Interrupt

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

- Interrupt setting

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

**Scan program**
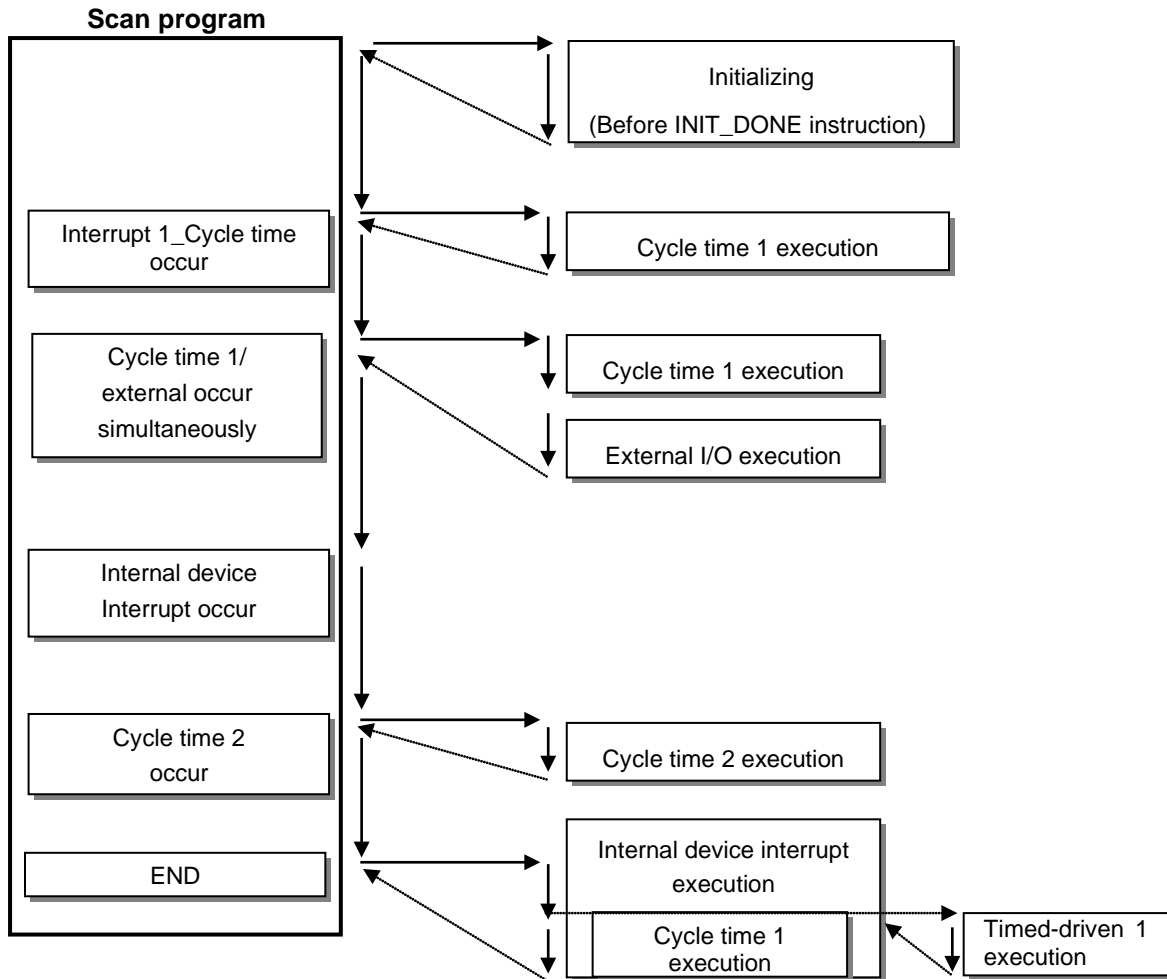


### Remark

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

1) How to prepare interrupt program

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

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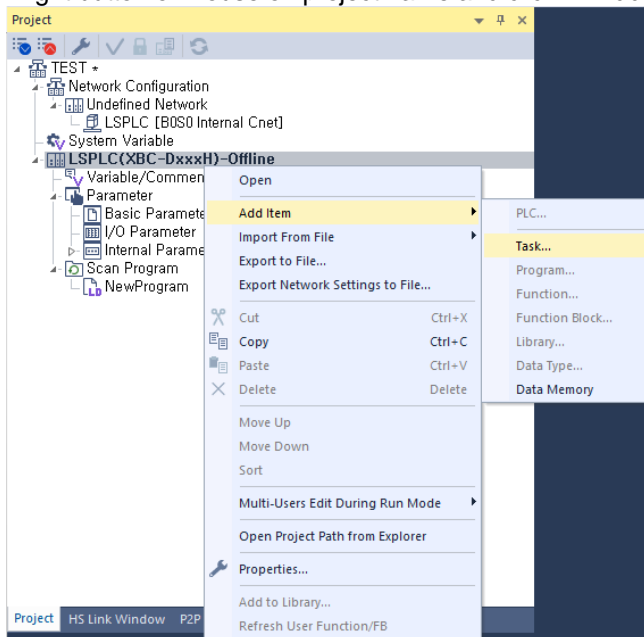


• The screen of Task setting is shown. Click 『Initialization』 in Execution condition and make a Task name.
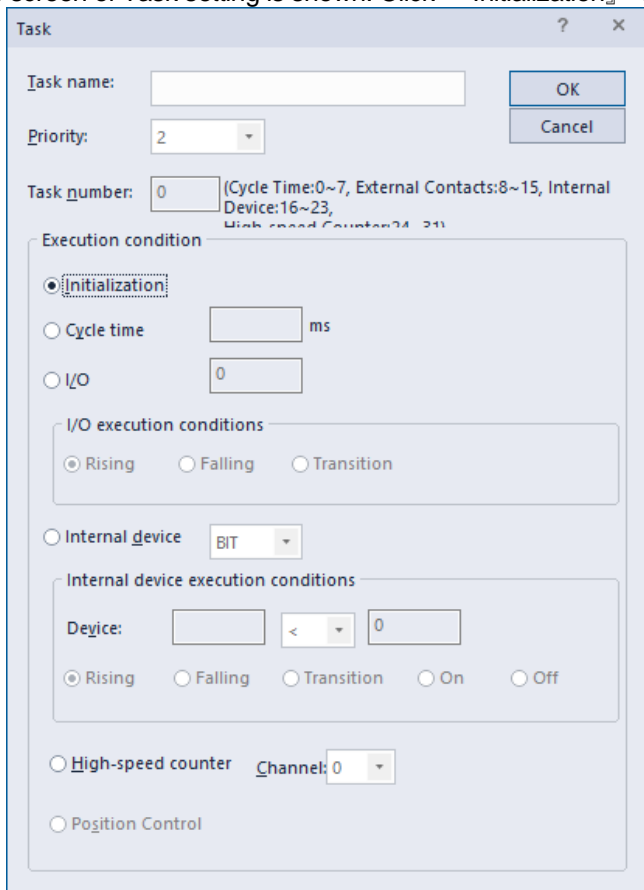
- Click right button of mouse at registered task and select 『Add Item』 - 『Program』.
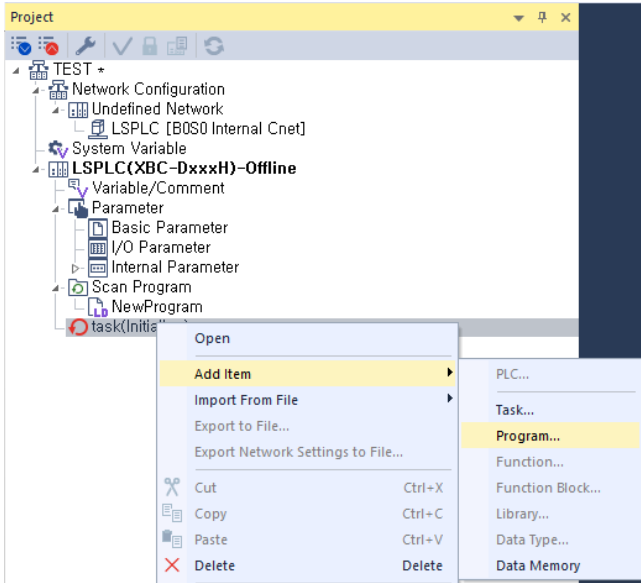


- Make initializing program. In initializing program, INIT_DONE instruction must be made. If not, Scan program is not executed.
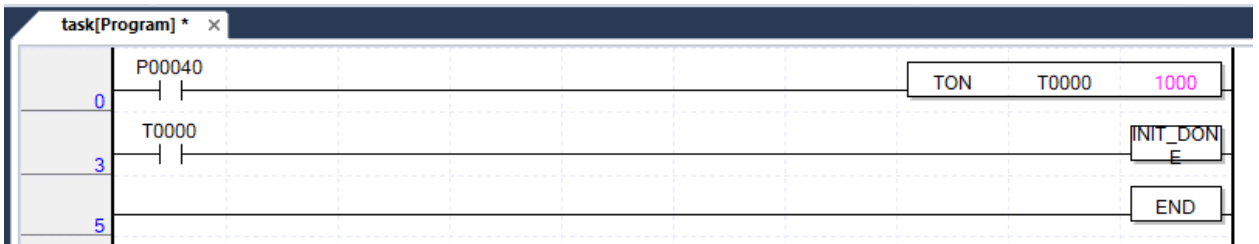
2) How to prepare Cycle interrupt program

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

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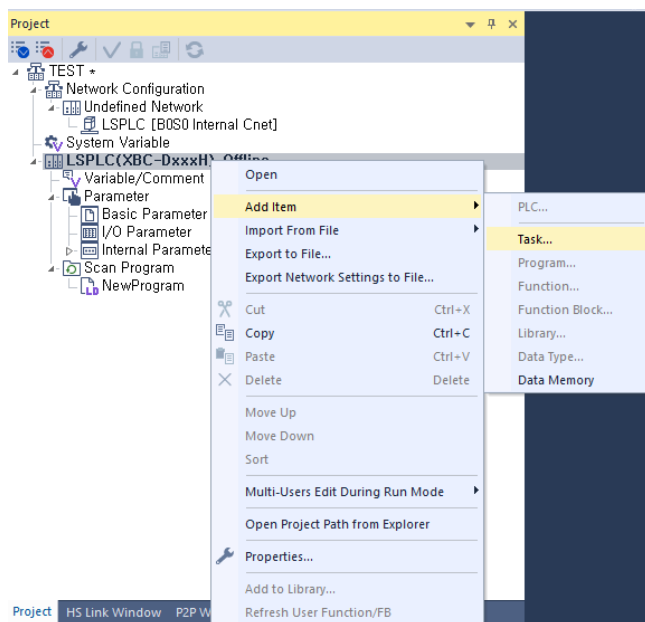


• It shows setting screen of Task.
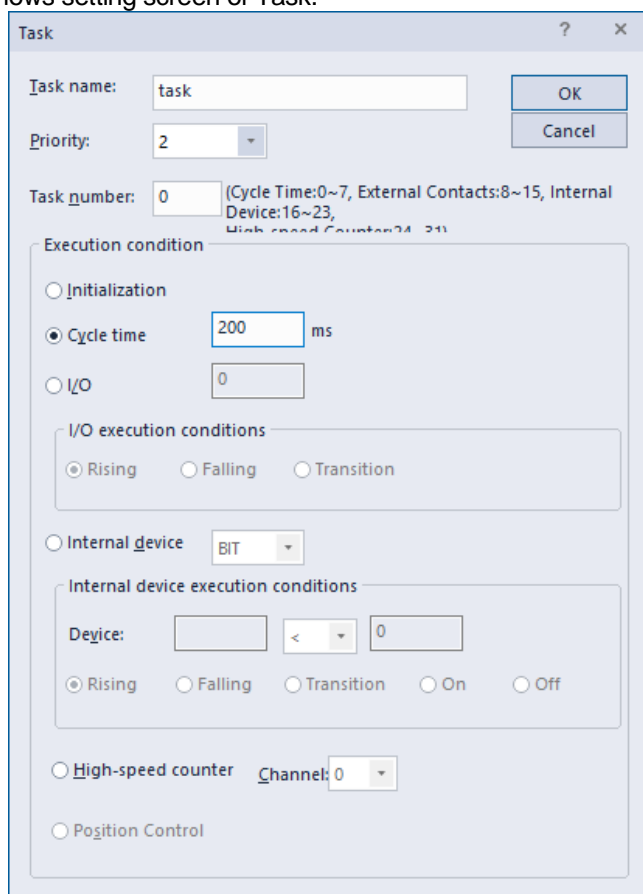
• Task type

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

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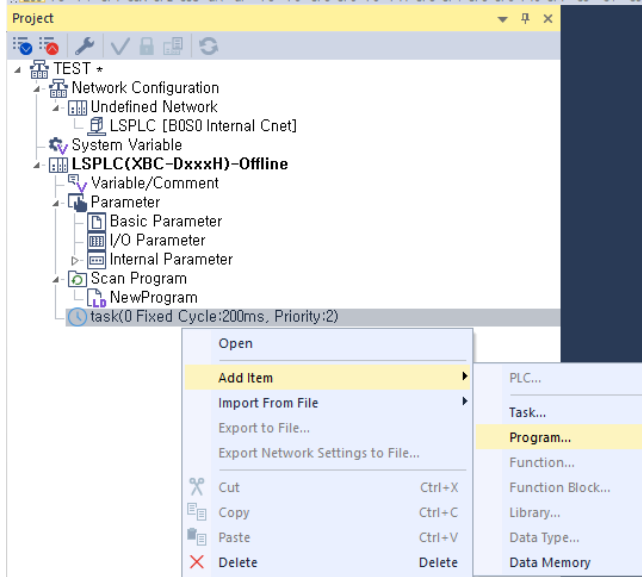


- Register the Program name and Program description.
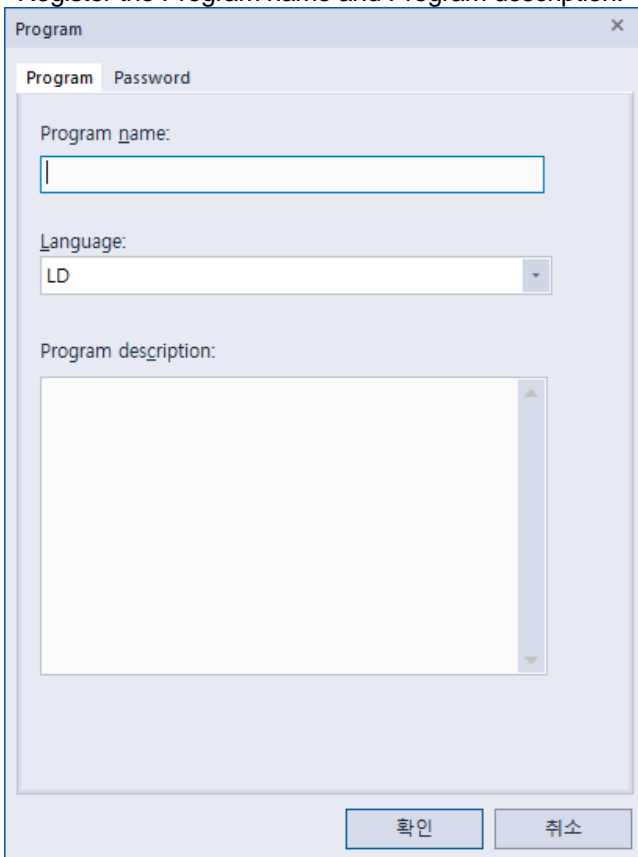
• It is displayed the program window to write task program.
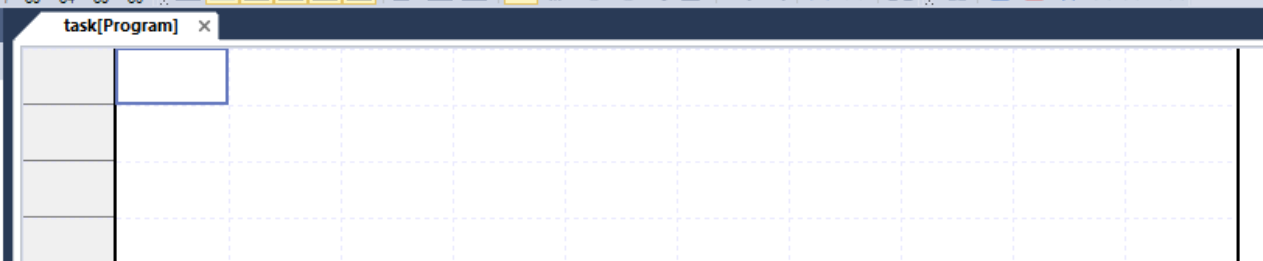


• It is displayed the setting in project window.
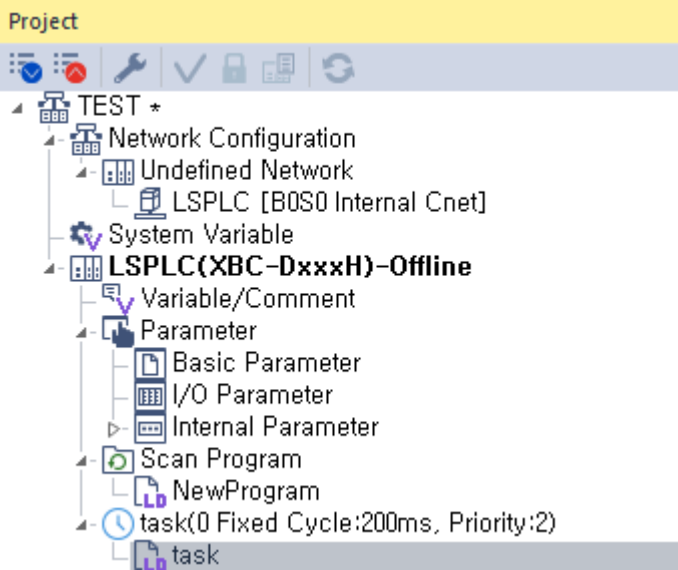
3) Task type

Task type and function is as follows.

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

4) Processing methods of task program

Here describes common processing method and notices for Task program.

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

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

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

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

(5) Protection of Program in execution from Task Program
  • In case that the continuity of program execution is interrupted by high priority Task Program during program execution, it is available to prohibit the execution of Task Program partially for the part in problem. In this case, it is available to perform the program protection by ' DI (Task Program Start Disabled) and 'EI (Task Program Start Enabled)' application instruction.
 • Insert 'DI' application instruction in the start position of the part requiring the protection and insert 'EI' application instruction in the position to release. Initialization Task is not influenced by 'DI', 'EI' application instruction.
 • If interrupt is occurred while 'CALLP' instruction executing, interrupt program is executed after 'CALLP' instruction execution.
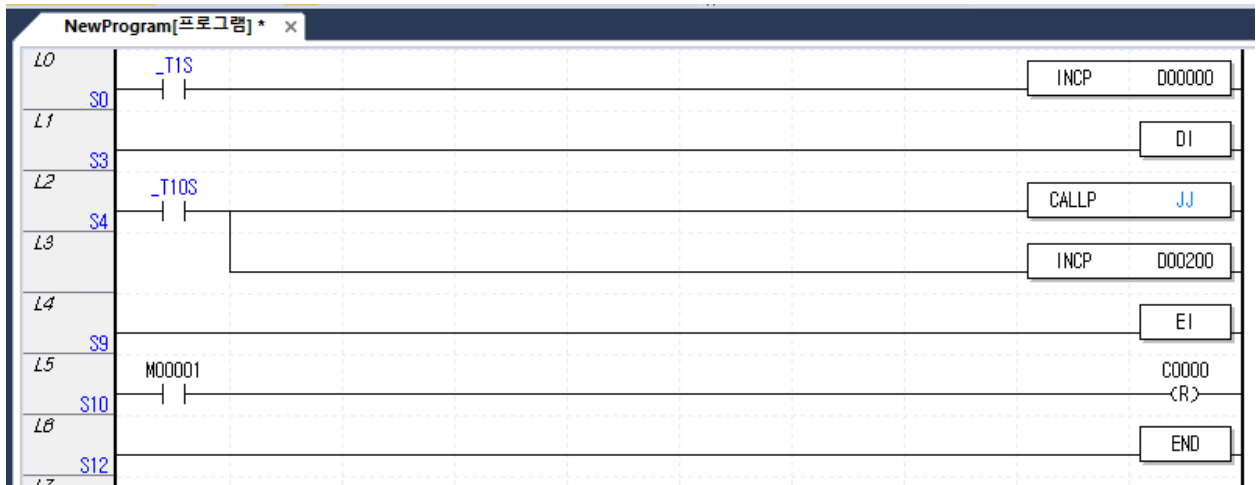
5) Cyclic task program processing method
   Here describes the processing method in case that task (start condition) of Task program is set as Cycle time.

   (1) Items to be set in Task
   • Set the execution cycle and priority which are the start condition o f Task program to execution. Check the task no. to manage the task.
   (2) Cyclic task processing
   • Performance the corresponding cyclic task program per setting time interval (execution cycle).
   (3) Notice in using cyclic task program
   • When cyclic task program is in execution currently or waiting for execution, if the demand to execute the same task program occurs, the new occurred task shall be disregarded.
   • Timer that makes a demand to execute cyclic task program only while operation mode is Run mode, shall be added. The shutdown time shall be all disregarded.
   • When setting the execution cycle of cyclic task program, consider the possibility that the demand to execute several cyclic task program at the same time occurs.
   If 4 cyclic task programs that the cycle is 2sec, 4sec, 10sec and 20sec are used, 4 demands of execution per 20 seconds shall be occurred at the same time and scan time may extend   instantaneously.

6) I/O task program processing

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

(1) Items to be set in Task
  • Set the execution condition and priority to the task being executed. Check the task no. to manage the task.
(2) I/O task processing
  • If interrupt signal from external signal (I/O) is occurred on main unit (P000 ~ P007), task program is executed by external (I/O) signal.
(3) Precaution in using I/O task program
  • If task program which is executed by interrupt signal is on execution or standby status, new task program which is requested by identical I/O is ignored.
  • Only operation mode is Run mode, execution request of task program is recognized. Namely, execution request of task program is ignored when operation mode is Stop mode.

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

| Task | | ? ✕ |
|---|---|---|
| Task name: | Cycle | OK |
| Priority: | 2 ▾ | Cancel |
| Task number: | 16 | (Cycle Time:0~7, External Contacts:8~15, Internal Device:16~23, High-speed Counter:24~31) |

Execution condition
  ○ Initialization
  ○ Cycle time    20    ms
  ○ I/O    0

  I/O execution conditions
  ● Rising    ○ Falling    ○ Transition

  ● Internal device    BIT ▾

  Internal device execution conditions
  Device:    M000    < ▾    0
  ● Rising  ) Falling  ι Transition  ) On  ) Off

  ○ High-speed counter    Channel: 0 ▾

  ○ Position Control

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

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

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


8) Verification of task program

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

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

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

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

9) Program configuration and processing example

If task and program are registered as below.

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

• Scan program name: " Scan Program"
• Execution time respective program: Scan program = 17 ㎳, Program 1 = 2 ㎳, Program 2= 7 ㎳, Program 3 = 2 ㎳



| Process per time | |
|---|---|
| Time (㎳) | Process |
| 0 | Scan started and scan program started to execute. |
| 0~6 | Scan program is executed. |
| 6~8 | Scan program is stop because execution external I/O (P000) is requested. And program 3 is executed. Request of execution at 7[ms] is ignored because program 3 has been executing. |
| 8~10 | Program 3 is finished and Scan program is continued. |
| 10~12 | Scan program is stop by request of '10 ㎳_Cycle time' interrupt signal and execute program 1. |
| 12~20 | Program 1 is finished and Scan program is continued. |
| 20 | Request of 'Cycle time' interrupt signal and 'External I/O (P000)' signal is occurred concurrently but priority of 'External I/O' signal is higher than 'Cycle time' interrupt signal so program 3 is executed and program 1 is standby. |
| 20~22 | Program 3 is finished and Scan program is continued. |
| 22~24 | After program 3 is completed, program 1 (the program of '10ms_Cycle time' is executed. |
| 24~25 | P1 execution completed and the stopped scan program execution finished |

| 25 | At the finished point of scan program, check the request of Internal device 'M000' execution and execute program 2. |
|---|---|
| 25~30 | Program P2 is executed. |
| 30~32 | When '10 ㎳_Cycle time' interrupt signal is occurred, the priority of that is higher than Internal device 'M000' though program 2 is stopped and program 1 is executed. |
| 32~34 | P1 executed completed and the stopped P2 execution finished |
| 34 | New scan starts (Start scan program execution) |

# 5.3 Operation Mode

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

## 5.3.1 RUN mode

This is the mode to executed program operation normally.

```
┌─────────────────────────────┐
│   RUN mode first scan start  │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│      Initialize data area    │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────────────┐
│ Examine Program effectiveness and    │
│ judge the possibility of execution   │
└─────────────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│      Execute input refresh   │
└─────────────────────────────┘
              │
              ▼
┌──────────────────────────────────────┐
│ Program execute, Interrupt Program    │
│ execute                                │
└──────────────────────────────────────┘
              │
              ▼
┌──────────────────────────────────────┐
│ Examine the normal operation or       │
│ missing of built-in module            │
└──────────────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     Execute output refresh   │
└─────────────────────────────┘
              │
              ▼
┌──────────────────────────────────────┐
│ Communication service and internal    │
│ processing                             │
└──────────────────────────────────────┘
              │
RUN mode keep ▼
         ◇ Operation mode change ◇
              │ Change to other mode
              ▼
┌─────────────────────────────┐
│ Operation by changed         │
│ operation mode               │
└─────────────────────────────┘
```

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

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

## 5.3.2 STOP mode

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

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

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

## 5.3.3 DEBUG mode

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

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

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

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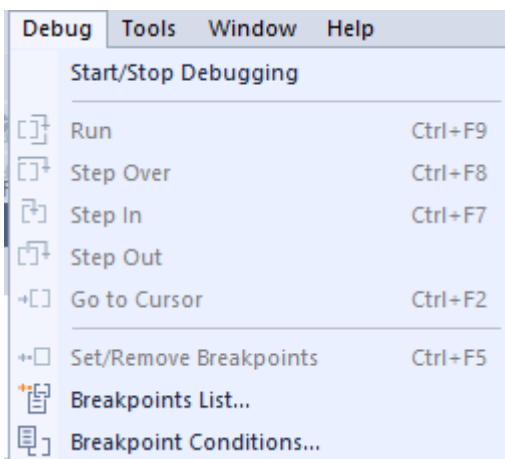
| Item | Description | Remark |
|---|---|---|
| Start/Stop Debugging | Change the debug ↔ stop mode | |
| Go | It starts debug operation. | |
| Step Over | It operates by 1 step. | |
| Step Into | It starts the subroutine program. | Other operation is identical to Step Over. |
| Step Out | It finished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

(1) Set/Remove Breakpoints
▪ Sets breakpoint at current cursor position. After breakpoint setting, ● (breakpoint setting indicator) is displayed.
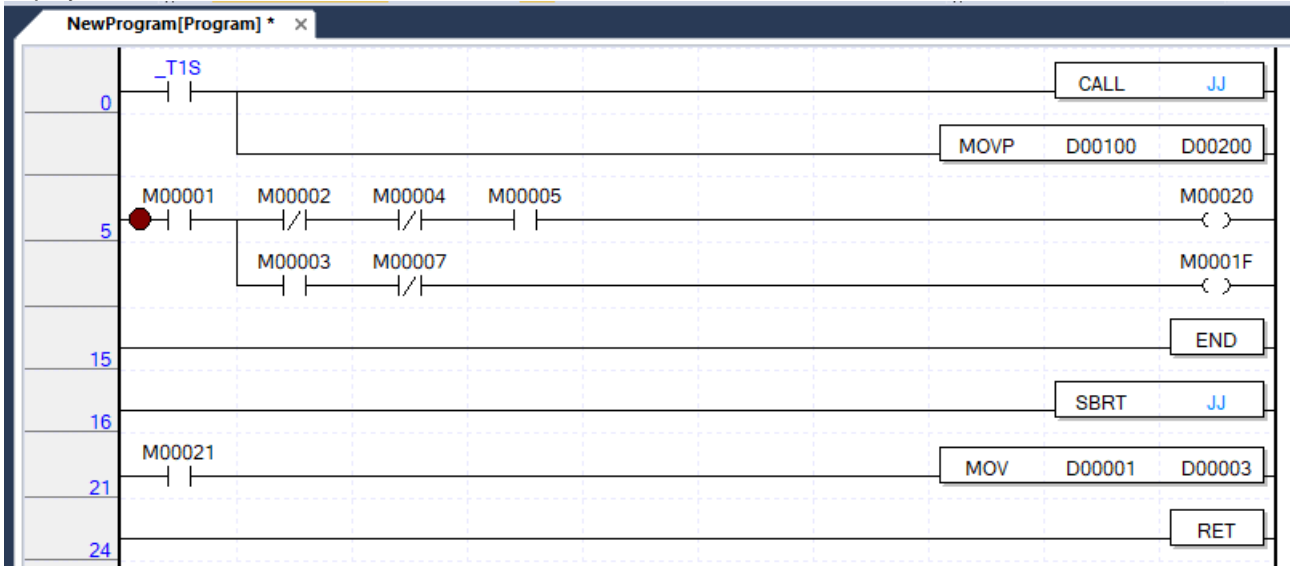


(2) Go
▪ Run the program to breakpoint. At break-pointer ◌ (stop indicator) is displayed.
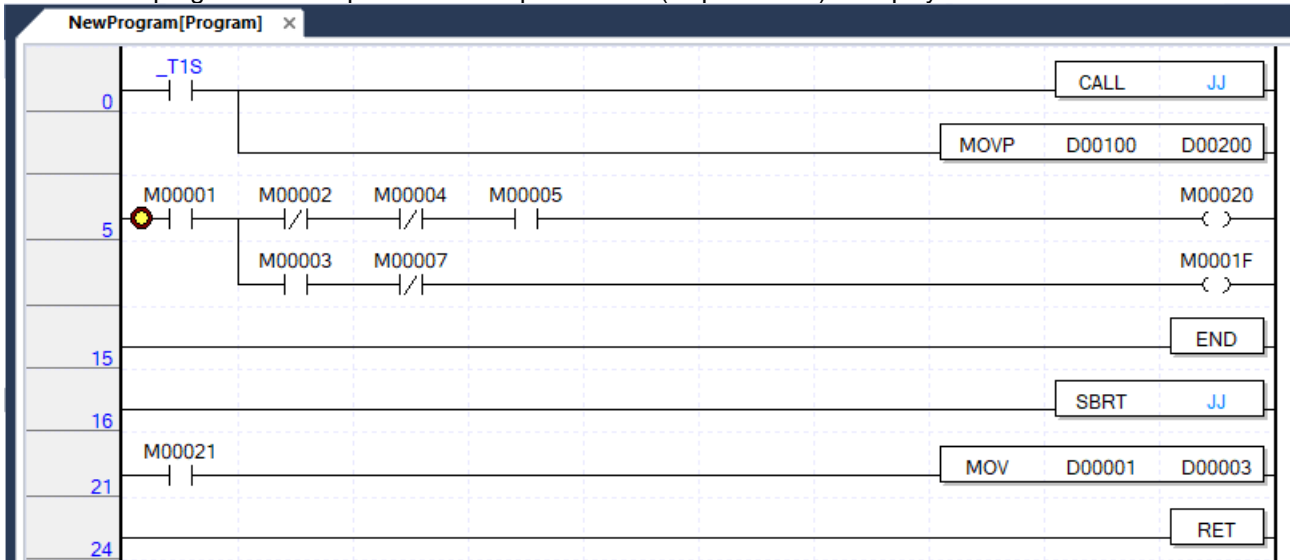
(3) Step Over
▪ Run the program to next step. At break point, Step over indicator ⊙ is displayed.
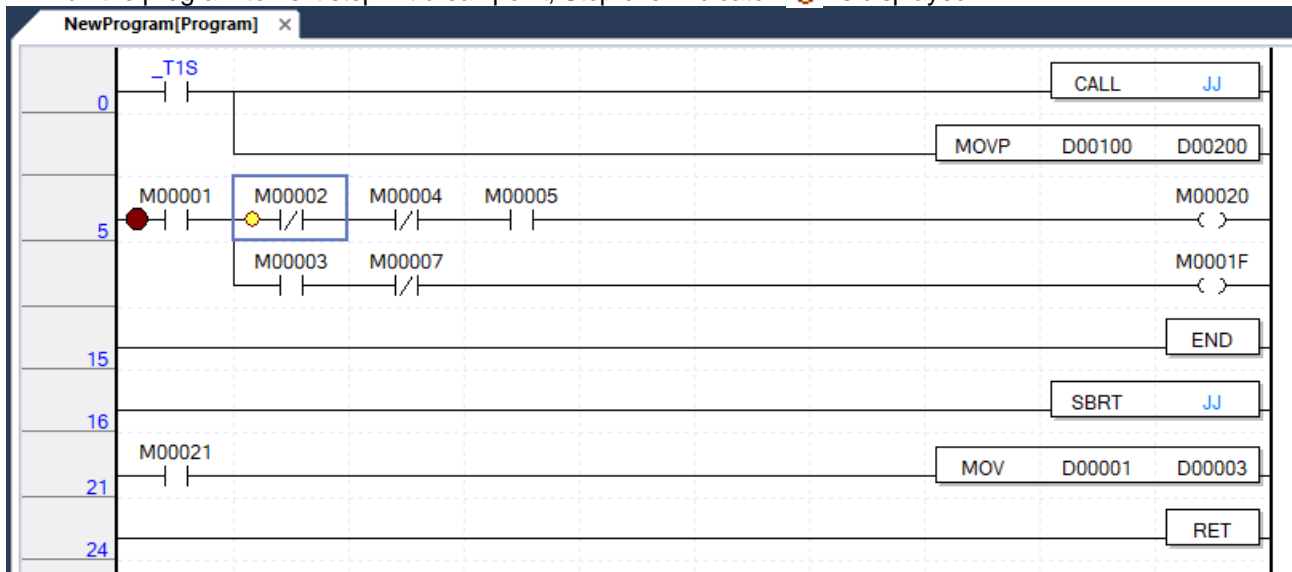


(4) Breakpoint List
▪ It displays current Breakpoint List. It supports Select All, Reset All, Goto, Remove, Remove All.
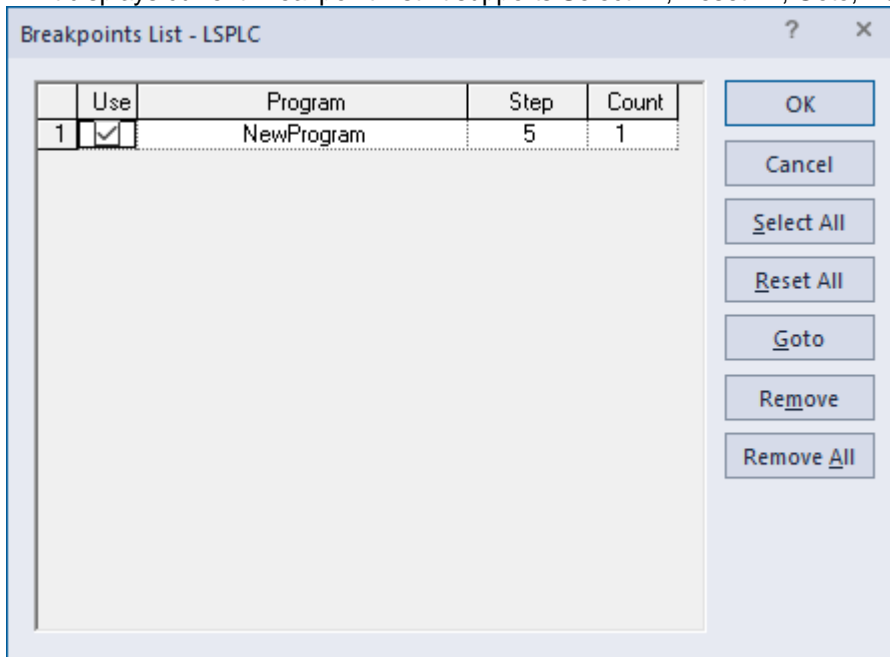


(5) Break condition
▪ It sets Device Break and Scan Break.

Break condition - LSPLC                                    ?    ×

**Variable Breakpoint**    Scan Breakpoint

☑ Use the device as a variable breakpoint.

Device:          D000                    Select Variable...

Type:            WORD          ▼

Variable:        Empty

Comment:         Empty

☑ Value Condition

Value:           H1234

확인          취소

---

Break condition - LSPLC                                    ?    ×

Variable Breakpoint    **Scan Breakpoint**

☑ Use Scan Breakpoint

Debugger stops after scanning following counts.

Scan Count:      60000  ▲▼      times

확인          취소

---

| **Remark** |
|---|
| ▪ Refer to XG5000 Users Manual 'Chapter 12 Debugging' for detailed information. |

## 5.3.4 Change operation mode

1) Operation Mode Change Method

The method to change operation mode are as follows.

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

2) Type of operation mode

The operation mode setting is as follows.

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

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

---

⚠ **Warning**

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

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

---

## 5.4 Memory

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

### 5.4.1 Data memory

1) Bit device area

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

| Area per device | | Device features | Description |
|---|---|---|---|
| "S" type | "H" type | | |
| P0000 ~ P127f | P0000~ P1023f | I/O device "P" | Image area to save the state of I/O device. After reading the input module state, saves it in the corresponding P area and sends P area Data saving the operation result to output module. |
| M0000 ~ M255f | M0000~ M1023f | Internal device "M" | Internal Memory provided to save Bit Data in Program |
| L0000 ~ L1279f | L0000~ L2047f | Communication device "L" | Device to indicate high speed link/P2P service state information of communication module. |
| K00000 ~ K2559f | K00000~ K4095f | Preservation device "K" | Device area to preserve the data during power shutdown, which is used without setting power shutdown preservation parameter separately. (Pay attention to write in special area (K2600 ~ 2559F)). |
| F0000 ~ F255f | F0000~ F1023f | Special device "F" | System flag area that manages the flag necessary for system operation in PLC. |
| T0000 ~ T255 | T0000~ T1023 | Timer device "T" | Area to save the state of contact/current value/set value of timer device |
| C0000 ~ C255 | C0000~ C1023 | Counter device "C" | Area to save the state of contact/current value/set value of counter device |
| S00.00 ~ S127.99 | S00.00~ S127.99 | Step controller "S" 128 x 100 step | Relay for step control |

2) Word device area

| Area per device | | Device features | Description |
|---|---|---|---|
| "S" type | "H" type | | |
| D00000 ~ D5119 | D0000~ D10239 | Data register "D" | Area to preserve the internal data.<br>Bit expression possible. (D0000.0) |
| U00.00 ~ U07.31 | U00.00~ U0A.31 | Analog data register "U" | Register used to read data from special module installed in the slot. Bit expression possible |
| N0000 ~ N3935 | N0000~ N5119 | Communication data register "N" | P2P Service Save area of communication module.<br>Bit expression impossible |
| Z000 ~ Z127 | Z000~ Z127 | Index register "Z" | Dedicated device to use Index function<br>Bit expression impossible |
| T0000 ~ T255 | T0000~ T1023 | Timer current value register "T" | Area to indicate the current value of timer |
| C0000 ~ C255 | C0000~ C1023 | Counter current value register "C" | Area to indicate the current value of counter |
| - | R0000~ R10239 | File register "R" | Register for saving the file |

# 5.5 Configuration Diagram of Data Memory

## 5.5.1 "S" type



| Bit data area | Word data area | User Program area |
| --- | --- | --- |

**Bit data area**

0 ~ F

P000
I/O Relay (2048 points) "P"
P127

M000
Auxiliary Relay (4096 points) "M"
M255

K000
Keep Relay (40960 points) "K"
K2559

F000
Special Relay (4096 points) "F"
F255

L0000
Auxiliary Relay (20480 points) "L"
L1279

T000
Timer (256 points) "T"
T255

C000
Counter (256 points) "C"
C255

S000
Step controller (128 x 100 step) S00.00~S127.99 "S"
S127

**Word data area**

0000 ~ FFFF

D0000
Data Register (5120 words) "D"
D5119

N0000
Comm. Data Register (3936 words) "N"
N3935

U00.00
Analog Data Register (256 words) "U"
U07.31

Z000
Index Register (128 words) "Z"
Z127

T000
Timer setting value (256 words)
T255

T000
Timer current value (256 words)
T255

C000
Counter setting value (256 words)
C255

C000
Counter current value (256 words)
C255

**User Program area**

Parameter area

User Program area (10 K step)

## 5.5.2 "H" type

<u>Bit data area</u>

|  | 0 ~ F |
|---|---|
| P0000 | I/O Relay (2048 points) "P" |
| P1023 M0000 | Auxiliary Relay (4096 points) "M" |
| M1023 K0000 | Keep Relay (40960 points) "K" |
| K4095 F0000 | Special Relay (4096 points) "F" |
| F1023 | |

| | |
|---|---|
| L0000 | Auxiliary Relay (20480 points) "L" |
| L2047 | |

| | |
|---|---|
| T0000 | Timer (256 points) "T" |
| T1023 C0000 | Counter (256 points) "C" |
| C1023 | |

| | |
|---|---|
| S000 | Step controller (128 x 100 step) S00.00~S127.99 "S" |
| S127 | |

<u>Word data area</u>

| | 0000 ~ FFFF |
|---|---|
| D0000 | Data Register (10240 words) "D" |
| D10239 N0000 | Comm. Data Register (5120 words) "N" |
| N5119 | |

| | |
|---|---|
| U00.00 | Analog Data Register (1024 words) "U" |
| U0A.31 | |

| | |
|---|---|
| Z000 | Index Register (128 words) "Z" |
| Z127 | |

| | |
|---|---|
| R000 | File Register (10240 words) "R" |
| R10239 | |

| | |
|---|---|
| T0000 | Timer setting value (1024 words) |
| T1023 T0000 | Timer current value (1024 words) |
| T1023 C0000 | Counter setting value (1024 words) |
| C1023 C0000 | Counter current value (1024 words) |
| C1023 | |

<u>User Program area</u>

| |
|---|
| Parameter area |
| User Program area (15 K step) |

## 5.5.3 Data latch area setting

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

The below shows the features for latch device.

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

**Remark**

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

1) Latch area setting
   ▪ Click Device Area Setup of Basic parameter settings.
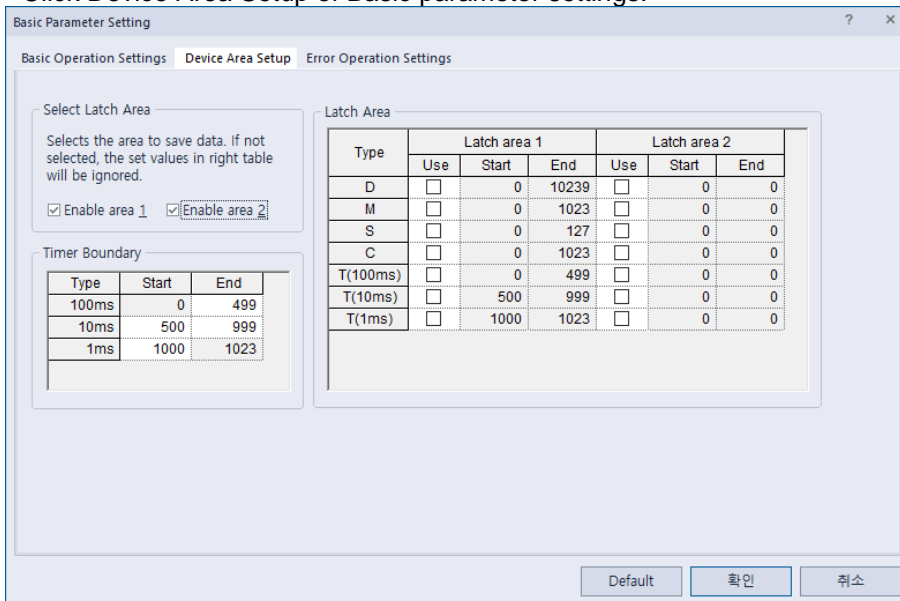
2) Data latch area operation
   The method to delete the latched data is as below.
      - latch 1, latch 2 clear operation by XG5000
      - write by Program (initialization program recommended)
      - write '0' FILL from XG5000 monitor mode.

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

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

▪ Latch 1 area is cleared by 『Online』 - 『Reset PLC』 - "Overall reset".
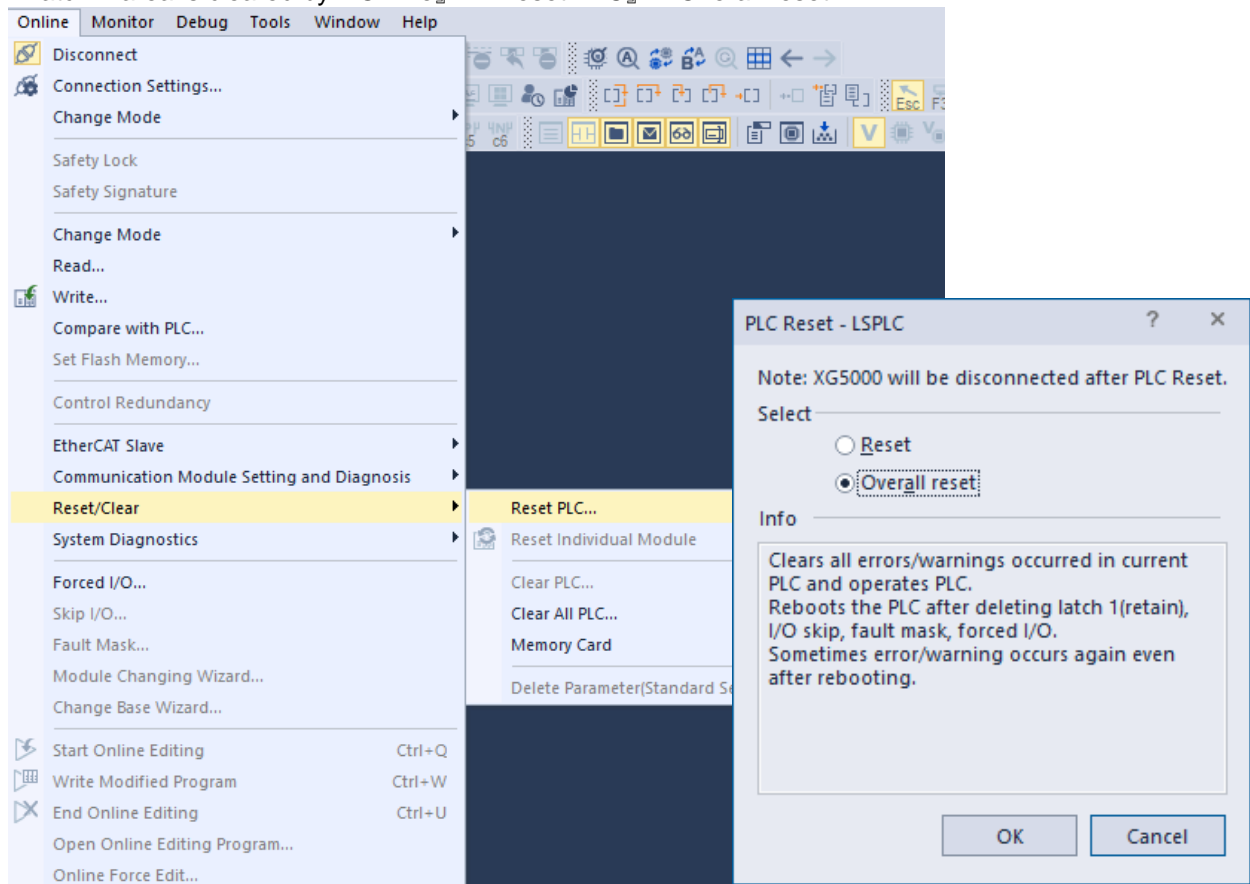
▪ Latch 1, 2 area is cleared by 『Online』 - 『Clear PLC』 .
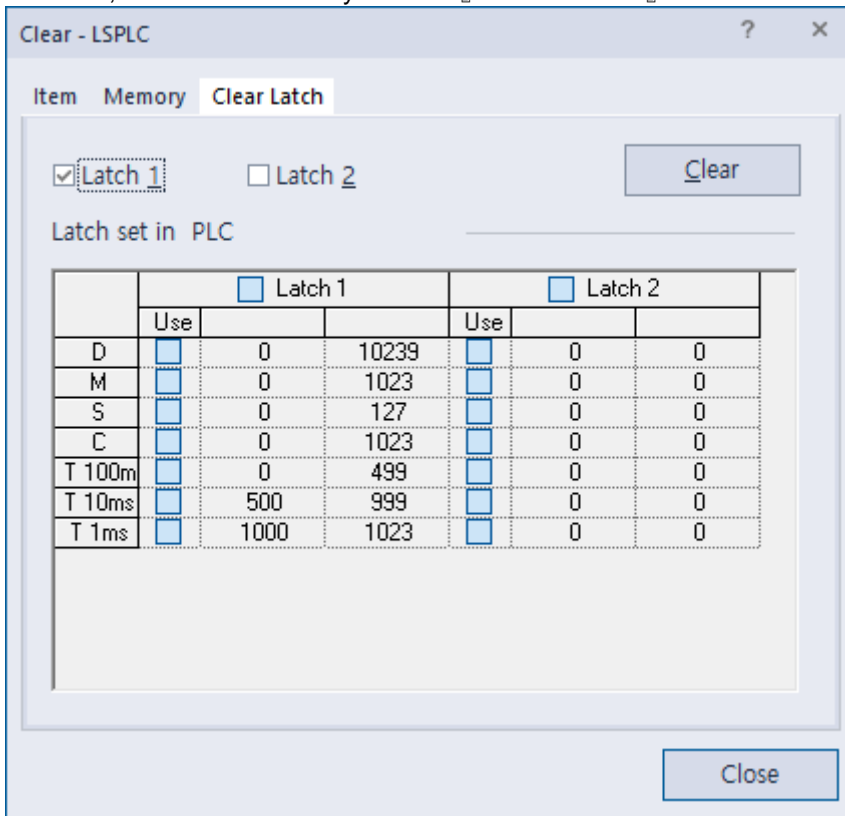


3) Data initialization

In case of Memory Delete state, the memory of all device shall be cleared as '0'. In case of giving the data value at the beginning according to system, please use the initialization task.
Device area is cleared by click 'Clear' in   『Online』 - 『Clear   PLC』 - 『Clear Memory』 .
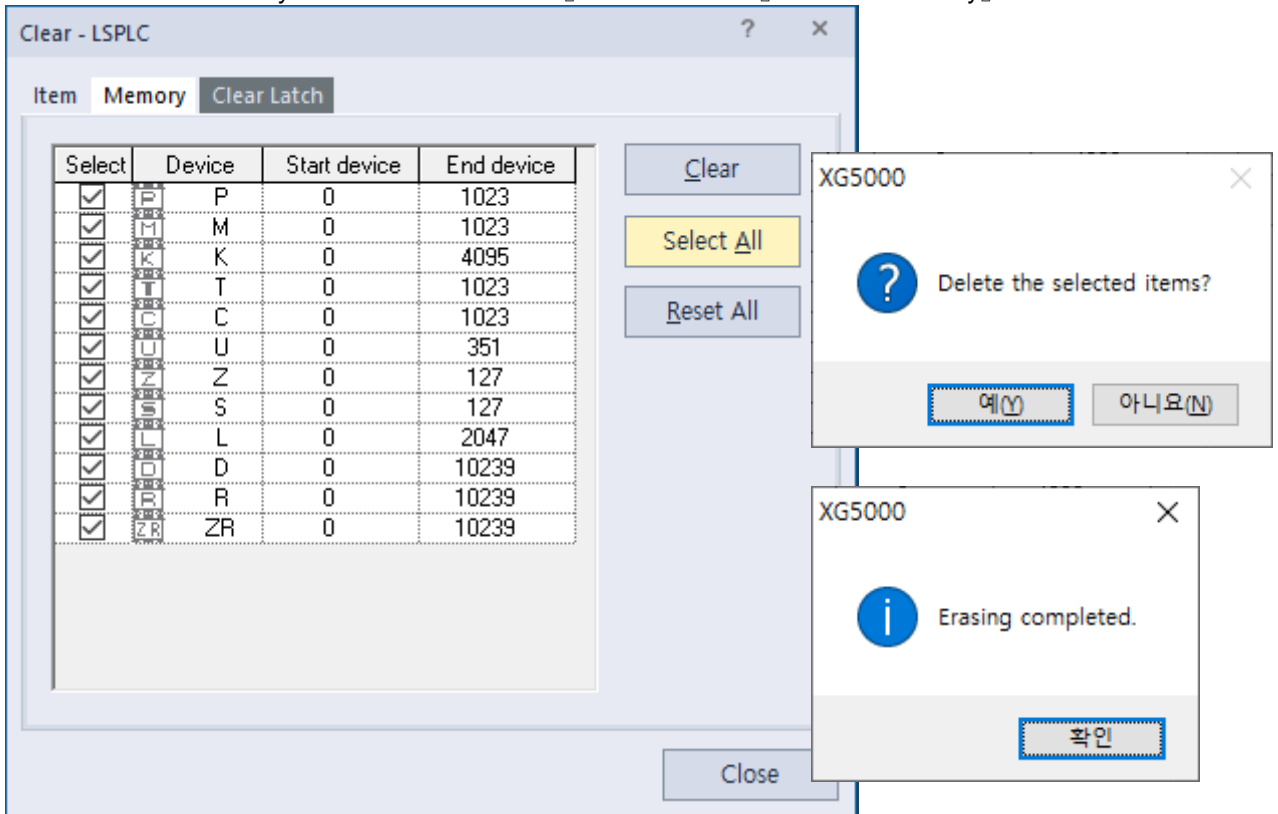
# Chapter 6 CPU Functions

## 6.1 Type Setting
It describes setting of XGB PLC type.



| PLC Series | CPU type | Description | Reference |
|---|---|---|---|
| XGB | XGB-XBMS | "S" type : XBM-DN16/32S , XBM-DR16S | Module type |
| | XGB-XBCH | "H" type : XBC-DR32/64H , XBC-DN32/64H | Compact type |

| Remark |
|---|
| ▪ In case type is different, connection is not available. |

## 6.2 Parameter Setting

This paragraph describes how to set parameters.

### 6.2.1 Basic parameter setting

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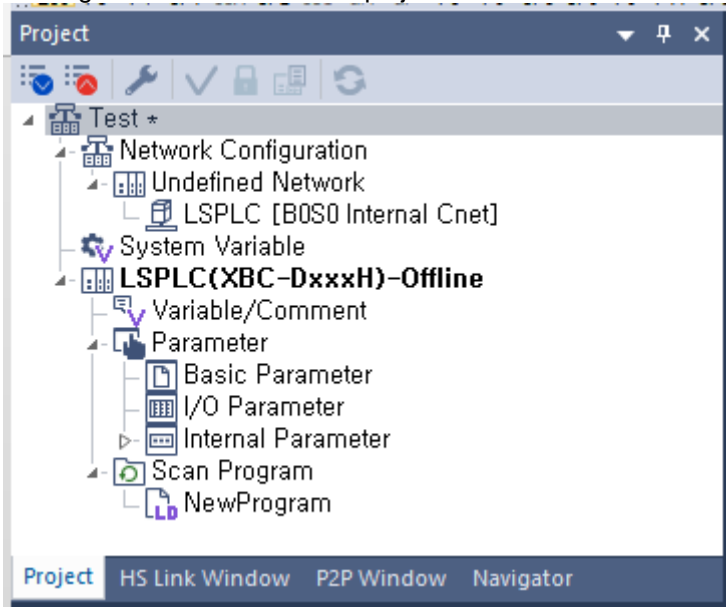


There are three main options ; "Basic Operation Setup" , "Device Area Setup" and "Error Operation Setup".
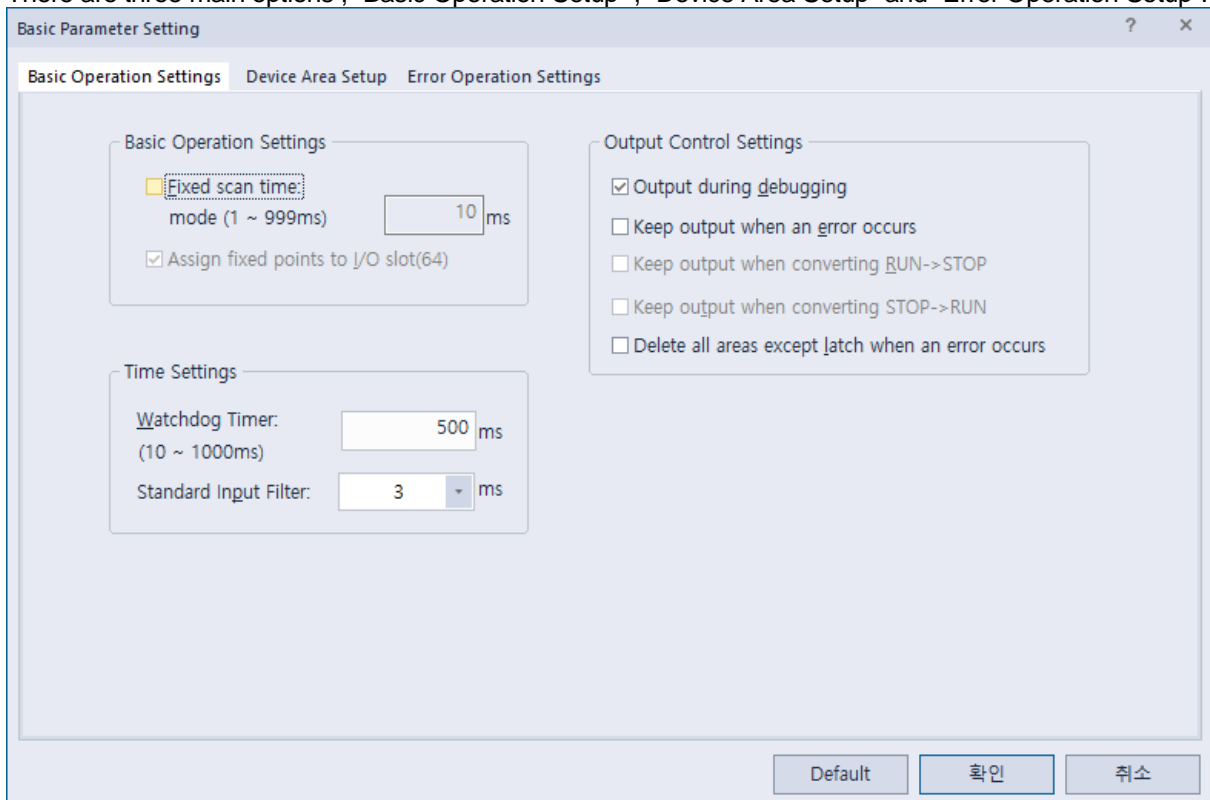
| Category | Item | Description | Note |
|---|---|---|---|
| Basic operations | Fixed period operation | Set the time of fixed period operation. | 1~999 ㎳ |
| | Watchdog timer | Set the time of scan watchdog. | 10~1000 ㎳ |
| | Standard input filter | Set the time of standard input filter. | 1,3,5,10,20,70,100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

## 6.2.2 I/O parameter setting

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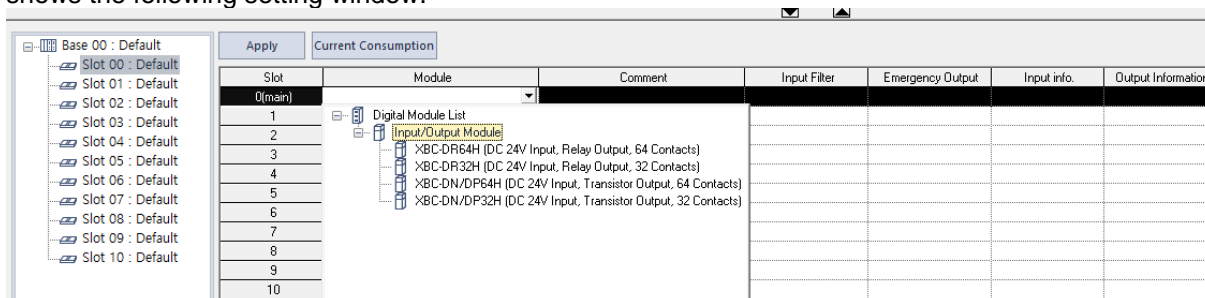


Clicking 『Module』 in 『Slot Position』 indicates a list of modules, in which you may set I/O corresponding to the actual system. Then, the following window is displayed.
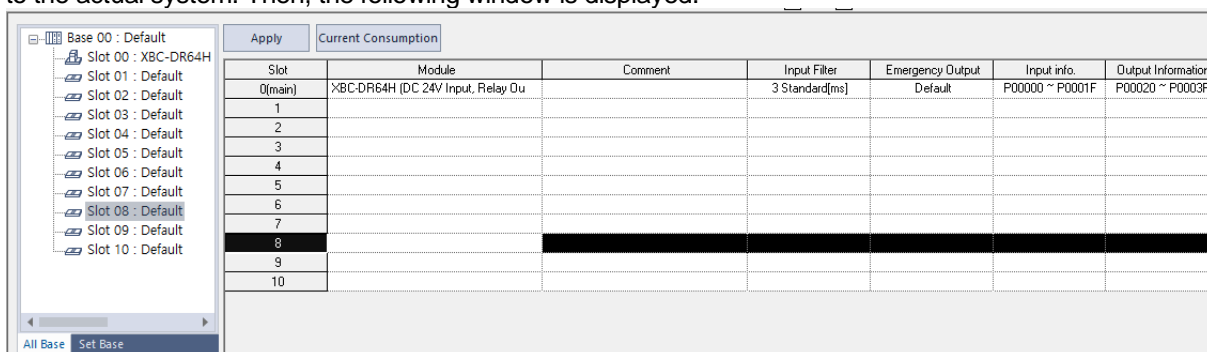
Clicking 『Details』 in 『Slot Position』 shows the following window to set filter and emergency output.



---
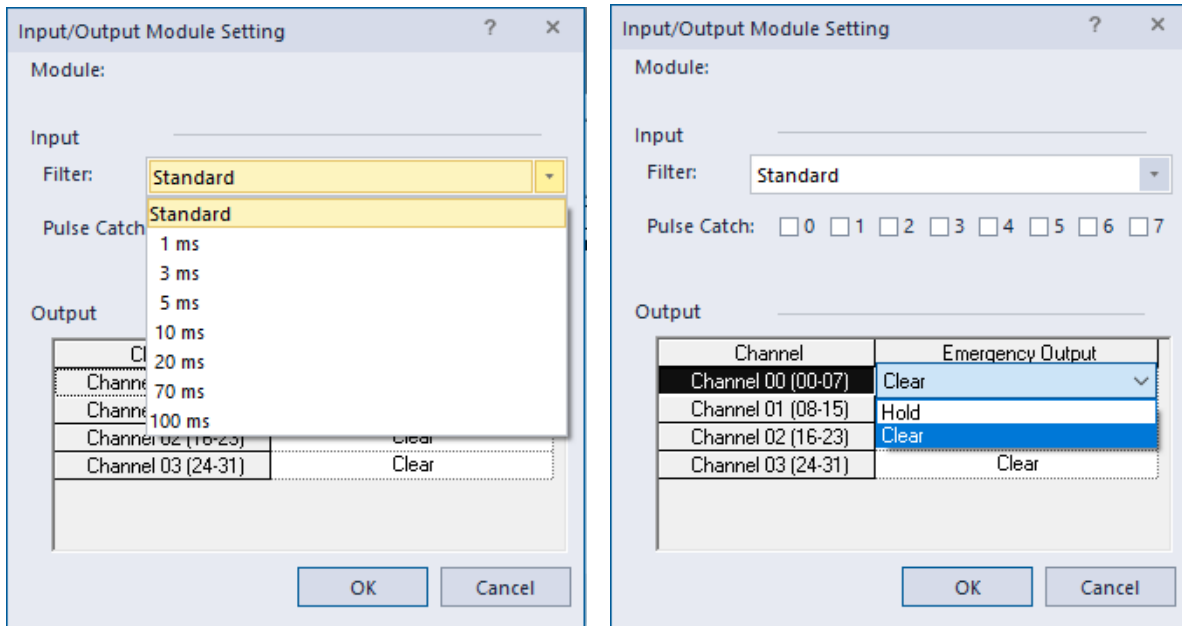
**Remark**

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

# 6.3 Self-diagnosis Function

## 6.3.1 Saving of error log

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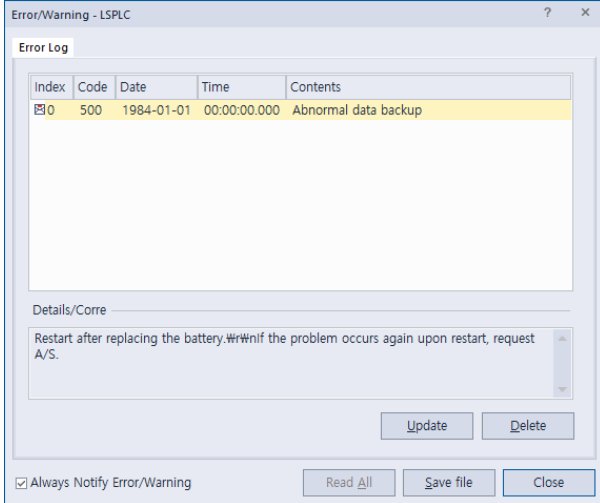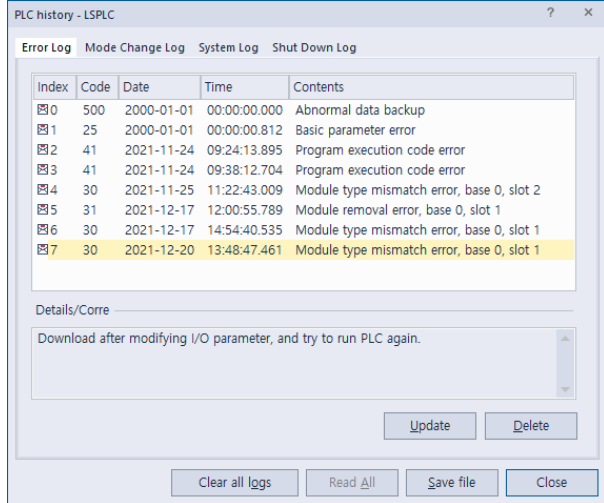


["S" type]     ["H" type]

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

**Remark**

1) Saved data are not deleted until selecting a menu of XG5000 and clicking "Delete".
2) "H" type displays Data and Time.

## 6.3.2 Troubleshooting

### (1) Trouble types

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

The causes troubling PLC system are as follows.

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

### (2) Operation mode if trouble occurs

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

A) PLC hardware trouble

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

B) Operation error while operating user program

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

C) Error detected owing to external device in trouble

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

---

**Remark**

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

---

## 6.4 Remote Functions

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

### (1) Remote operations are as follows.
- Operable by accessing to XG5000 through RS-232C port mounted on CPU module.
- Can operate other PLC connected to PLC network with CPU module connected to XG5000.

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

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

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

---

**Remark**

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

---

## 6.5 Forced Input/Output On and Off Function

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

### 6.5.1 Force I/O setup

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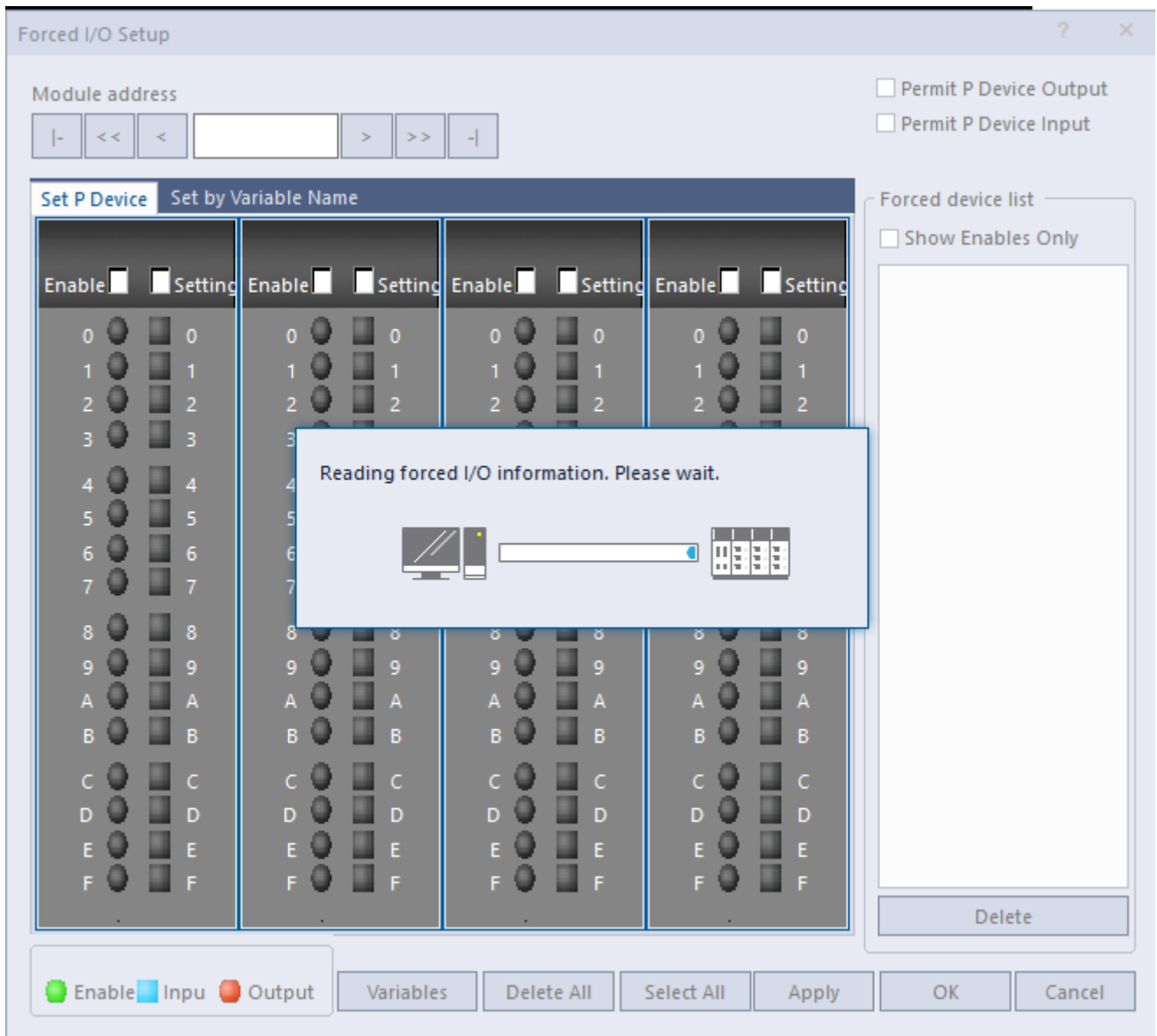
| Item | | | Description |
|---|---|---|---|
| Move address | I- | -I | Move to the beginning and end of I/O area (P000↔P127) |
| | << | >> | Move to ±8 of I/O area displayed at the very left. |
| | < | > | Move to ±1 of I/O area. |
| Application | | | Set whether to allow or not Force I/O |
| Single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

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

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

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

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

## 6.6 Direct Input/Output Operation

Refreshing I/O operates after completion of scan program. If data of I/O is changed while program is scanned, it does not refreshed at the changed moment. Refreshed I/O data is applied after 'END' instruction on program.

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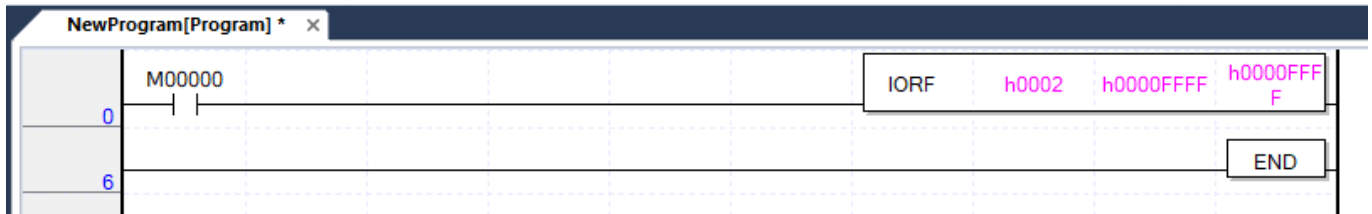


'IORF' command is operated when M00000 is ON. First operand designates slot number. Second operand designates the upper 32 bit data as mask data. Third operand designates the lower 32 bit data as mask data. The bit to refresh set as 1 (hFF) and others set as 0 (h00) (not refreshed).

---

**Remark**

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

---

## 6.7 Diagnosis of External Device

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

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

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

   ❏ Example
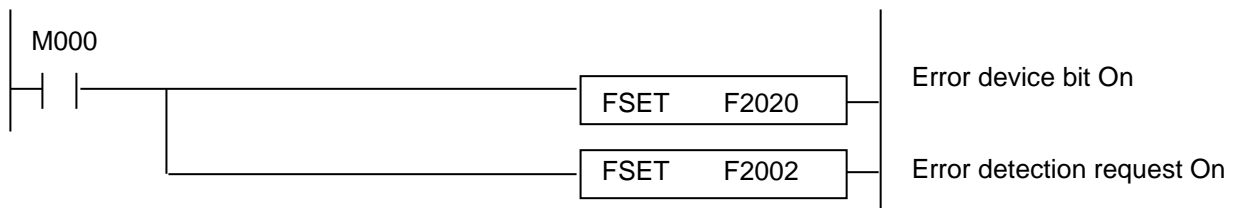


   ▪If any trouble occurs, CPU is in error status and operation halts. At this moment, F2020 and F2002 flags are off (error LED switches on and off every second.)

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

   ❏ Example
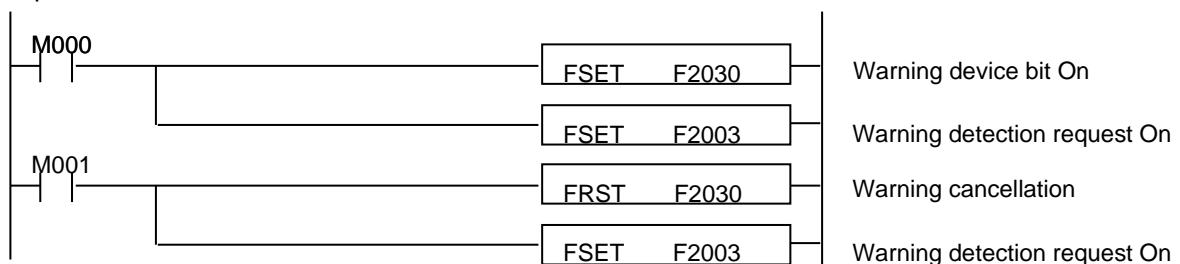
## 6.8 Allocation of Input/Output Number

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

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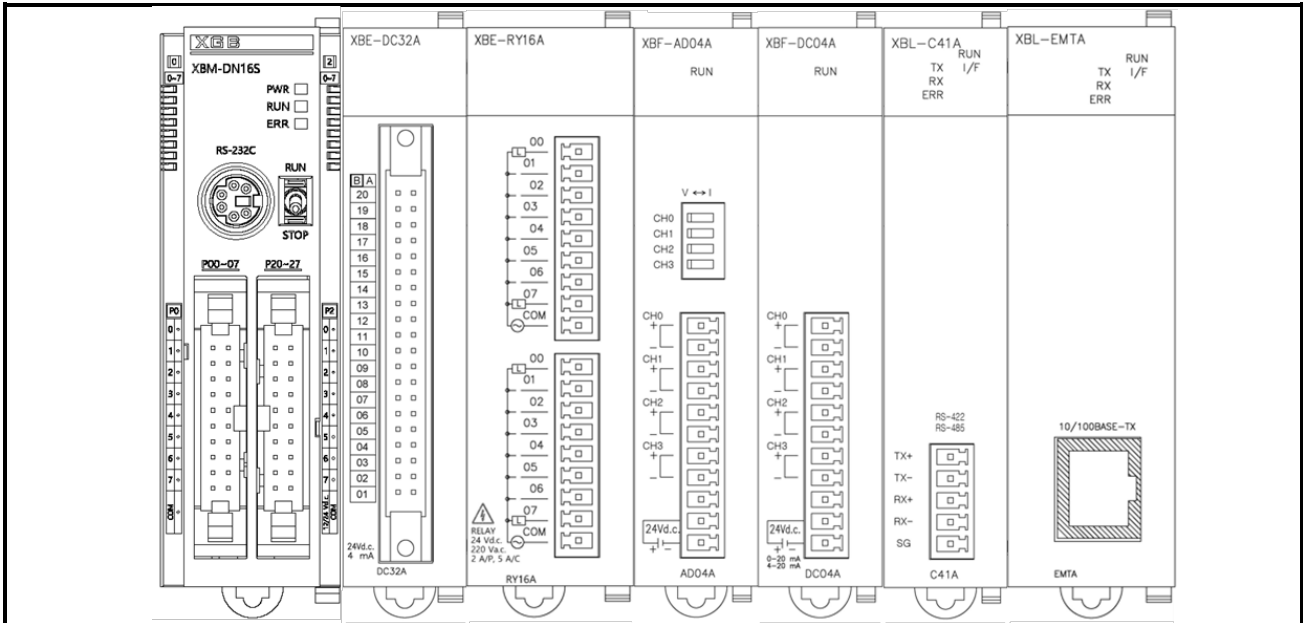


| Number of Connection stage | Type | I/O allocation | Remarks |
|---|---|---|---|
| 0 | XBM-DN32S | Input: P0000 ~ P001F<br>Output: P0020 ~ P003F | Basic unit fixed |
| 1 | XBE-DC32A | Input: P0040~P007F | Actual input: P0040 ~ P004F |
| 2 | XBE-RY16A | Output: P0080~P011F | Actual Output: P0080 ~ P009F |
| 3 | XBE-AD04A | Input: P0120~P015F | Actual input: P0120 ~ P013F |
| 4 | XBF-DC04A | P0160 ~ P019F | - |
| 5 | XBL-C41A | P0200 ~ P027F | - |
| 6 | XBL-EMTA | P0240 ~ P027F | - |

Empty I/O point is available for internal relay.

(2) In case of allocating IO of IO parameter, allocation information is displayed.

| System Configuration |
|---|
|  |

| Number of Connection stage | Type | I/O allocation | Remarks |
|---|---|---|---|
| 0 | XBC-DN32H | Input: P0000 ~ P001F<br>Output: P0020 ~ P003F | Basic unit fixed |
| 1 | XBE-DC32A | Input: P0040~P007F | Actual input: P0040 ~ P004F |
| 2 | XBE-RY16A | Output: P0080~P011F | Actual Output: P0080 ~ P009F |
| 3 | XBE-AD04A | Input: P0120~P015F | Actual input: P0120 ~ P013F |
| 4 | XBF-DC04A | P0160 ~ P019F | - |
| 5 | XBL-C41A | P0200 ~ P027F | - |
| 6 | XBL-EMTA | P0240 ~ P027F | - |

In case of using monitor function of XG5000, I/O allocation information is displayed.



I/O module allocation information

Description of each module

## 6.9 Online Editing

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

Items to be modified during operation are as follows.
- Program
- Communication parameter

(1) It displays programs that are currently running.
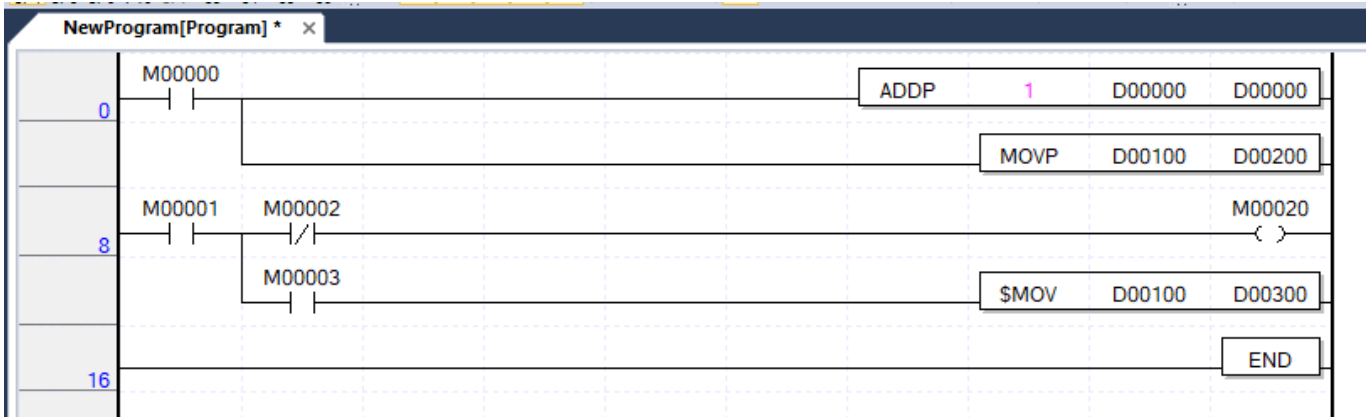


(2) Click 『Online』 - 『Start Online Editing』.
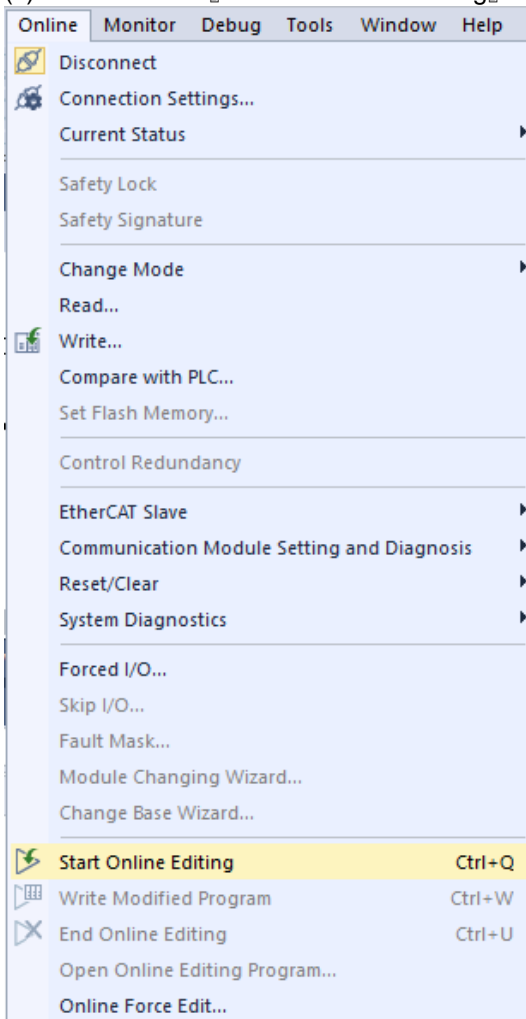
(3) It turns to program modification mode during run when the program background is changed.
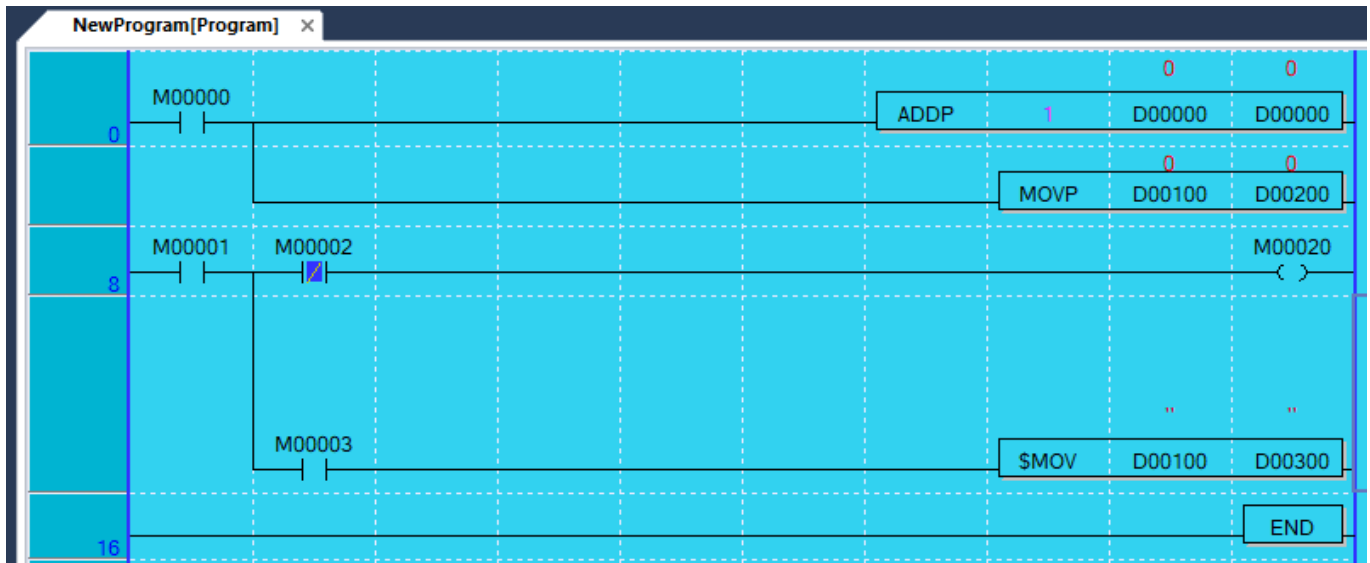


(4) Modifying a program.
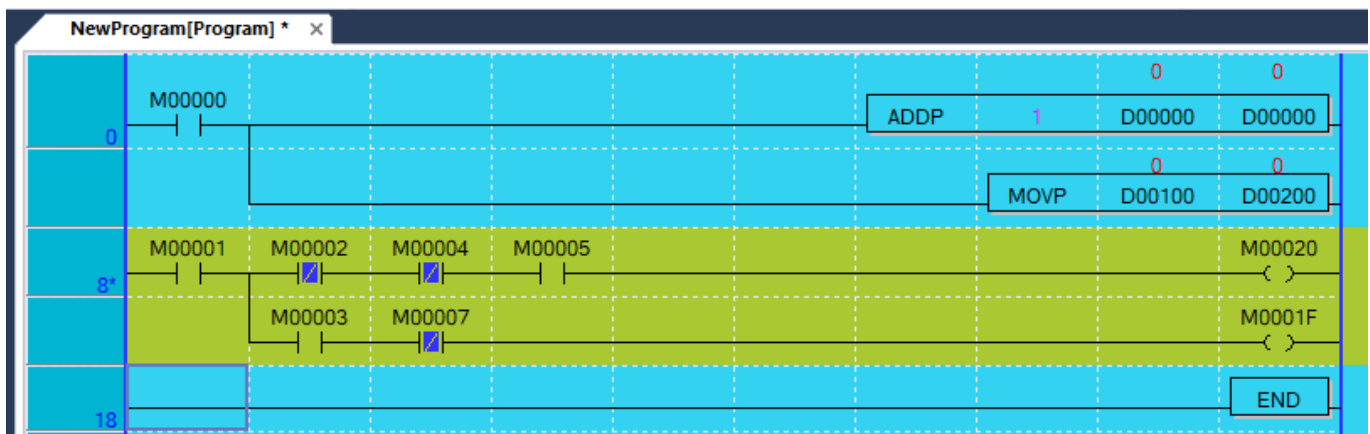
(5) Upon the modification of program, click 『Online』- 『Write Modified Program』.

| Online | Monitor | Debug | Tools | Window | Help |
|---|---|---|---|---|---|

Disconnect

Connection Settings...

Current Status ▶

Safety Lock

Safety Signature

Change Mode ▶

Read...

Write...

Compare with PLC...

Set Flash Memory...

Control Redundancy

EtherCAT Slave ▶

Communication Module Setting and Diagnosis ▶

Reset/Clear ▶

System Diagnostics ▶

Forced I/O...

Skip I/O...

Fault Mask...

Module Changing Wizard...

Change Base Wizard...

Start Online Editing     Ctrl+Q

Write Modified Program     Ctrl+W

End Online Editing     Ctrl+U

Open Online Editing Program...

Online Force Edit...

---

XG5000 ✕

ⓘ Modified program successfully written to PLC.

확인

---

Write to PLC - LSPLC    ?   ✕

Writing PLC Information...      Elapsed time:

0.1KB / 0.1KB

Current:    100 %

Total:    62 %

Cancel

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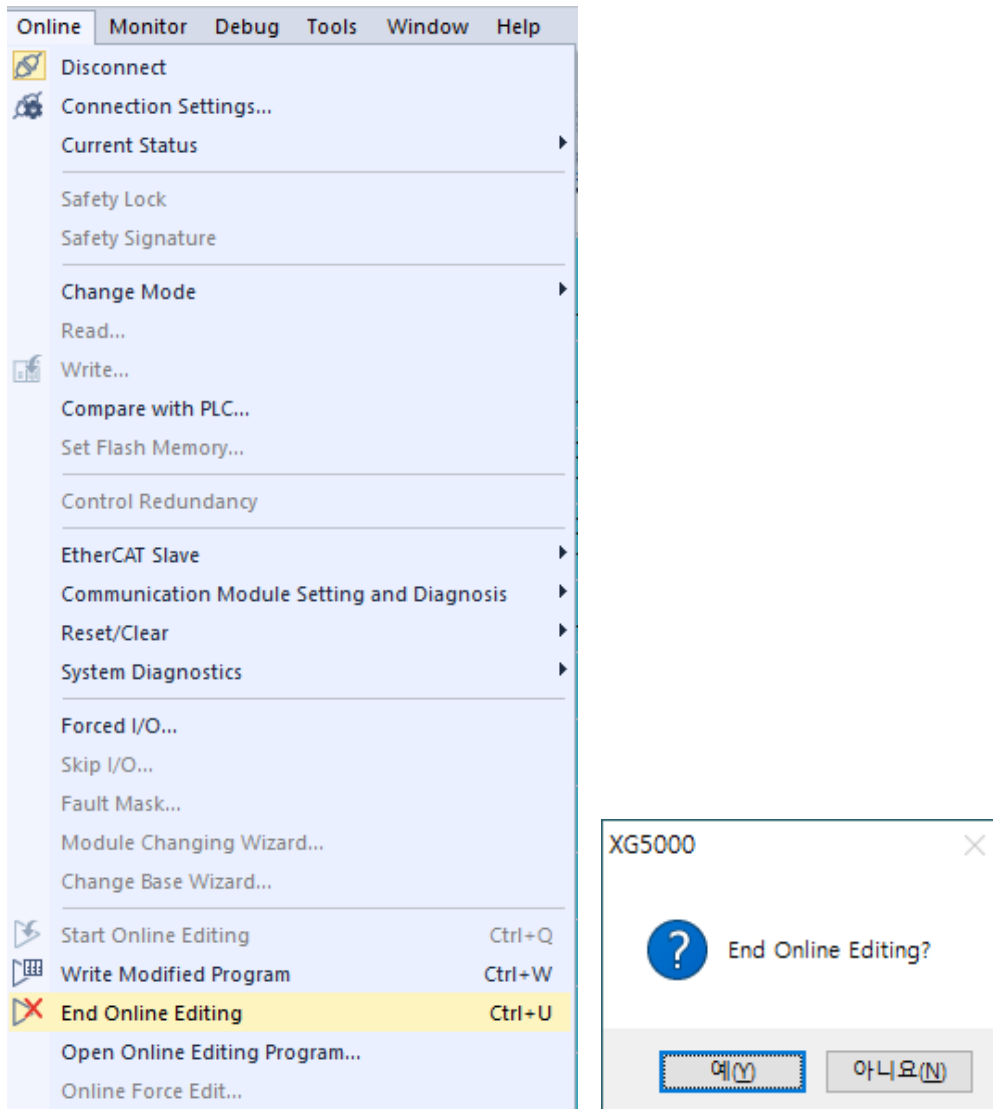


(7) The program background returns and the program modification during run is completed.



---
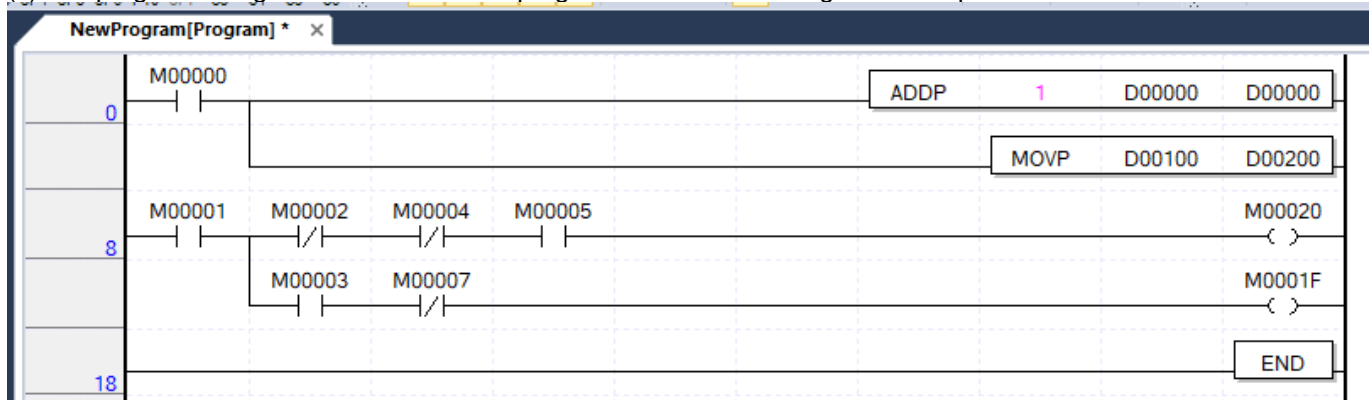
**Remark**

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

---

## 6.10 Reading Input/Output Information

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

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

| I/O information | ? × |
|---|---|

**Base module information**    **Slot I/O information**

┄┄┄ Base 00

| Slot | Module |
|---|---|
| 0 | XBC-DR64H (DC 24V Input, Relay Output, 64 Contacts) |
| 1 | XBE-DC16A/B (DC 24V Input, 16 Contacts / DC12/24V Input, 16 Conta |
| 2 | XBF-DC04A (D/A Current Output Type(4 Channels)) |
| 3 | XBE-TN/TP16A (Transistor Output, 16 Contacts (0.2A, Sink Output/Sour |
| 4 | XBE-TN/TP16A (Transistor Output, 16 Contacts (0.2A, Sink Output/Sour |
| 5 | XBF-DV04C (D/A Voltage Output Type, 4 Channels, 14bit) |
| 6 | XBL-C41A |
| 7 | |
| 8 | |
| 9 | |
| 10 | |

☐ Show Existing Base Only

[ Write Parameter ]   [ Details ]   [ OK ]   [ Cancel ]

(2) If clicking Details after selecting a module, it displays detail information of a selected module.

**Module Info. - XBE-TN/TP16A (Transistor Output, 16 Contacts (0.2A,...**    ? ×

| Details | Contents |
|---|---|
| Module Name | XBE-TN/TP16A (Transistor Output, 16 Contacts (0.2A, Sink Out |
| Error Status | Normal |
| OS ver | Ver. 1.40 |
| OS Date | 2018-08-21 |

[ Close ]
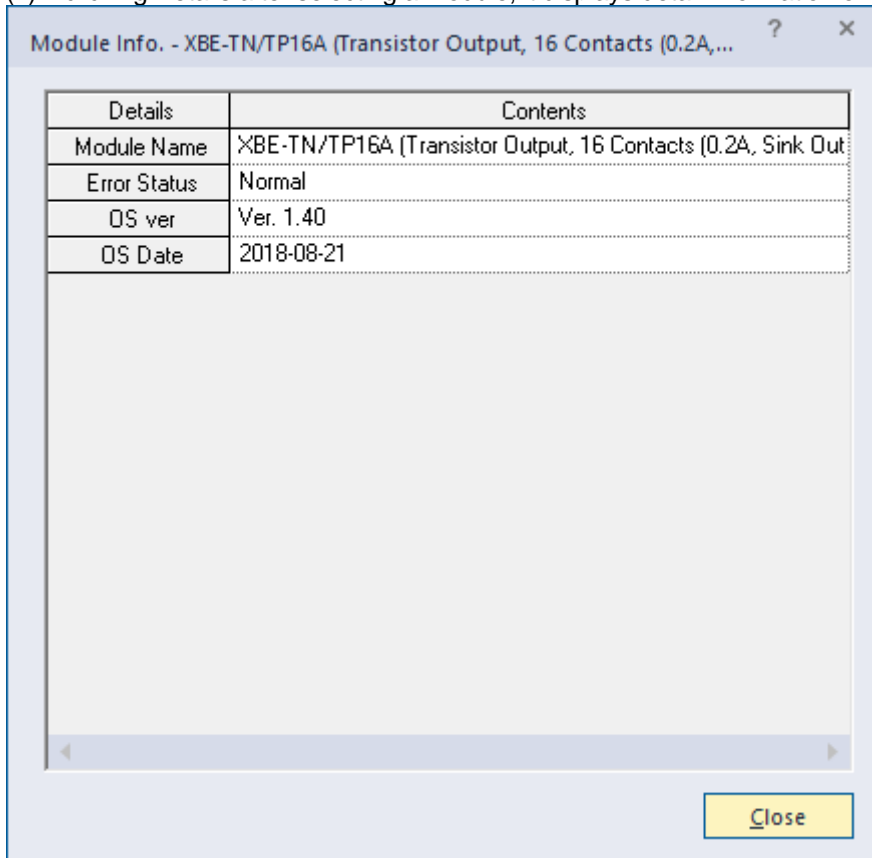
## 6.11 Monitoring

It monitors system information of XGB series system.

(1) Clicking 『Monitor』 displays the following sub-menus.

| Monitor | Debug | Tools | Window | He |

- Start Monitoring
- Pause
- Resume
- Pausing Conditions...
- Change Current Value...
- Add to Variable Monitor ▶
- Add to Current Variable Monitor
- System Monitoring
- Device Monitoring
- Special Module Monitoring
- Trend Monitoring
- PID Monitoring
- SOE Monitoring
- Custom Events
- Data Traces
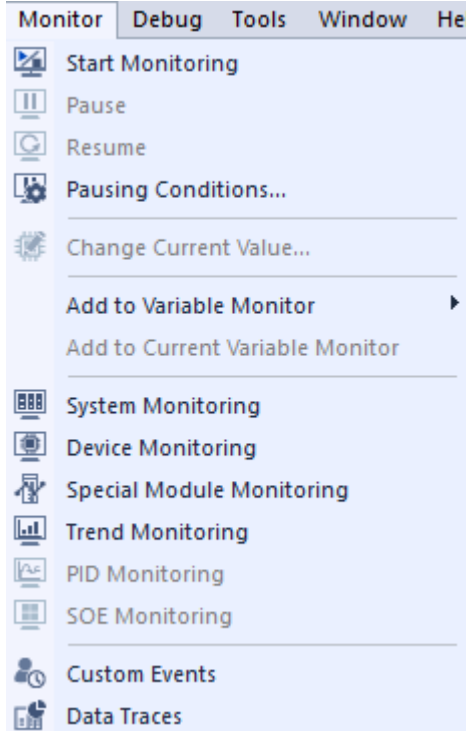
(2) Items and descriptions

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

(a) Change current value
▪It changes the current value of each device selected in the current program window.
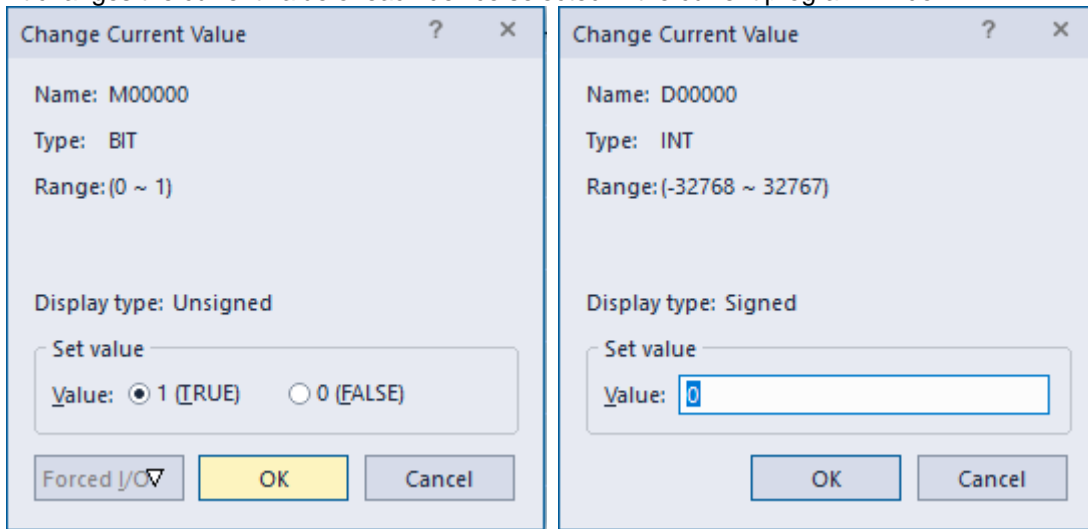


(b) Device monitoring
▪It monitors by device (type).
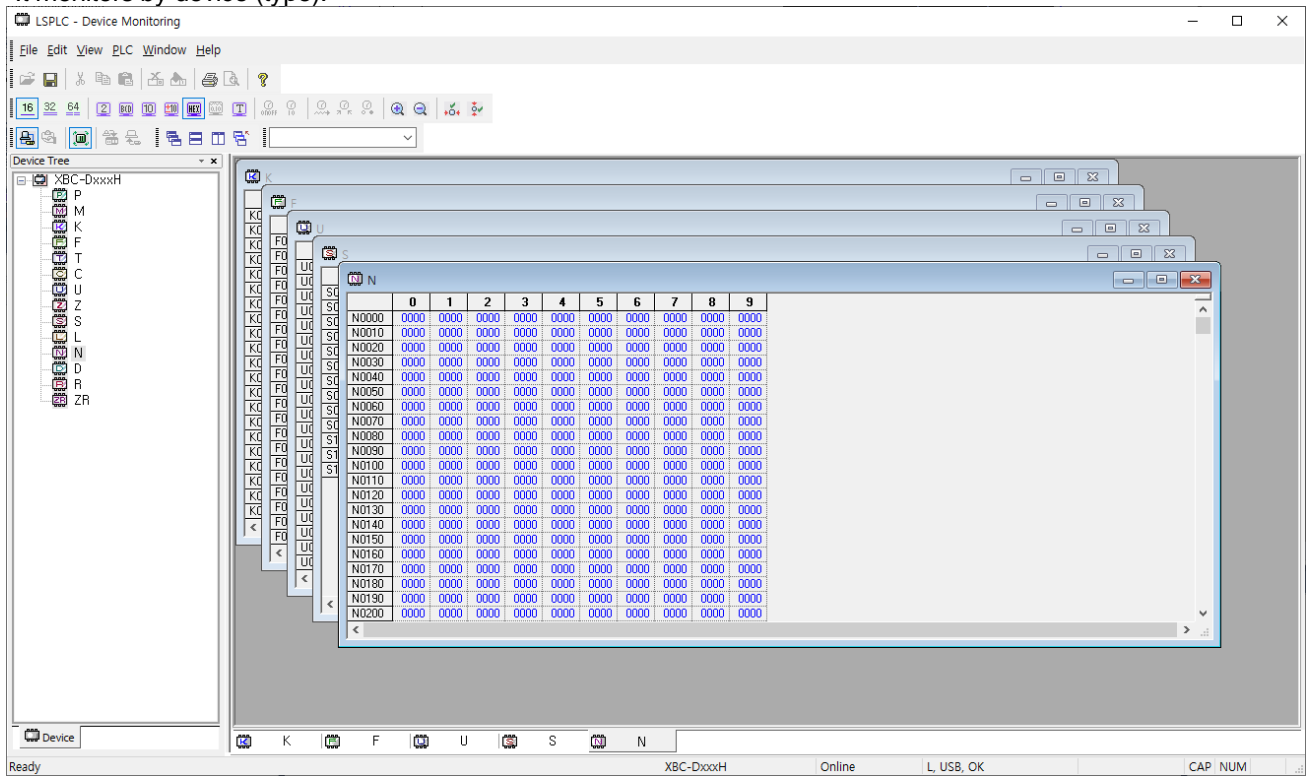
(c) Pausing conditions
   ▪It stops monitoring in case a device value set in the program corresponds.



(d) Trend monitoring

   ▪It displays device values graphically.
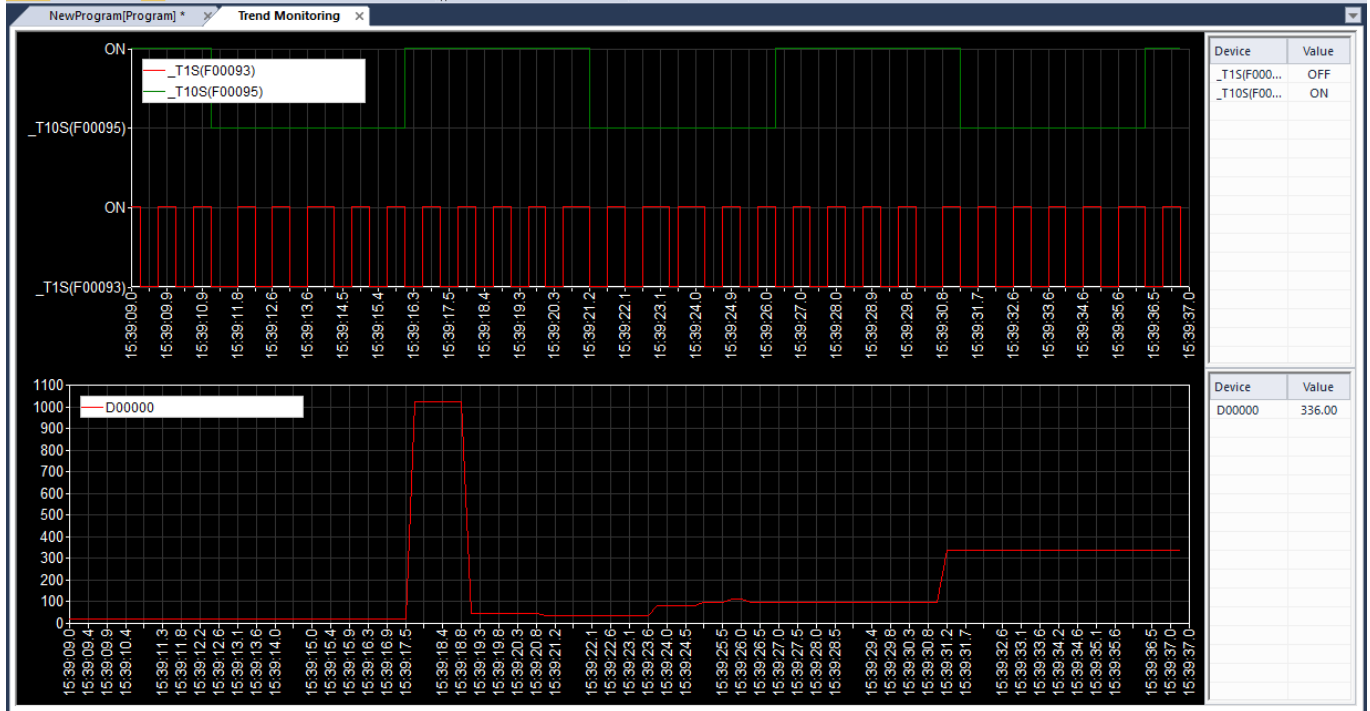
(e) Custom events

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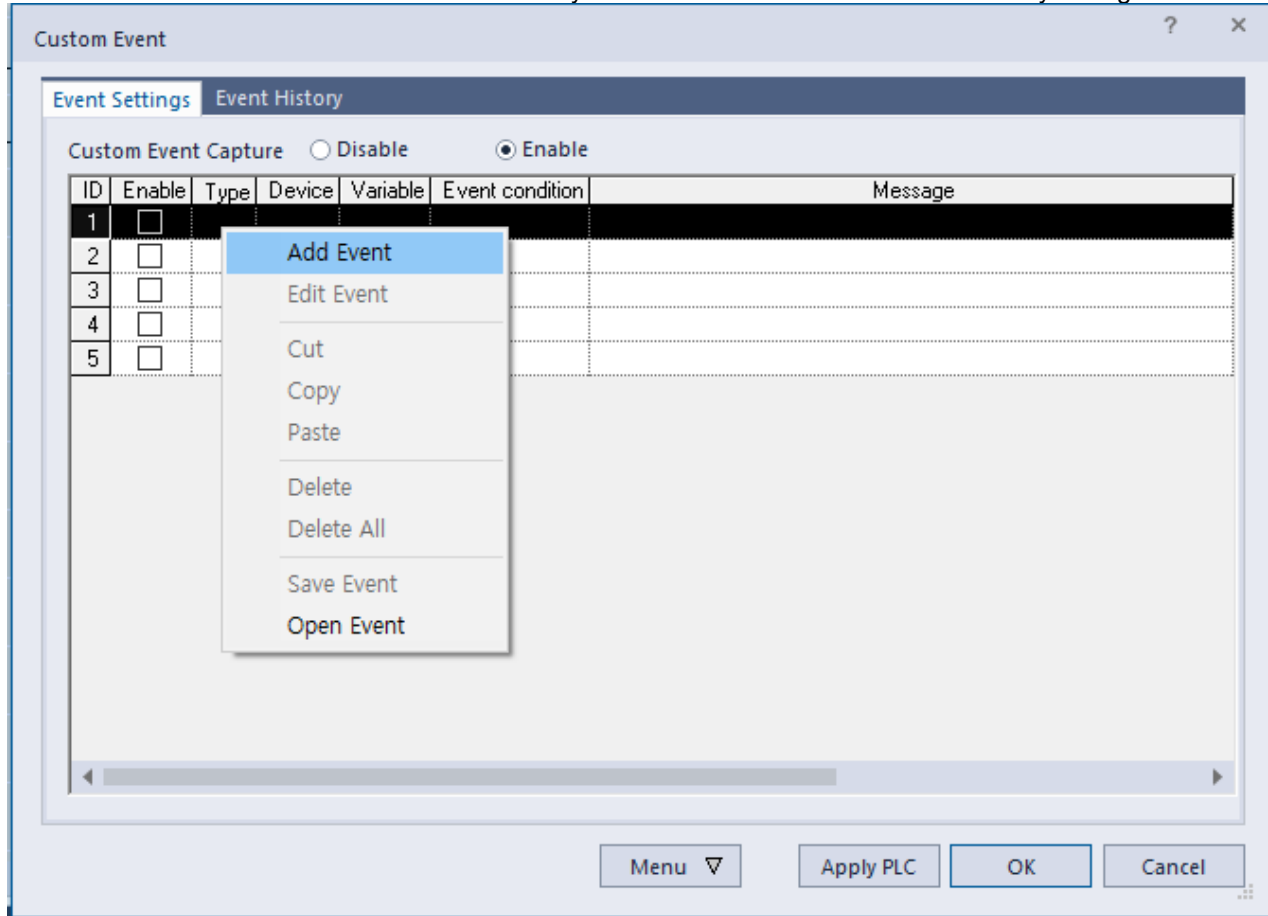


▪It sets basic setting and relative device.
  If rising edge of M0000 device occurs, it records the message of an alarm, "Out of order Water Tank 1"   and the device values of D0000,L0000,D0100,N1000 are recorded.
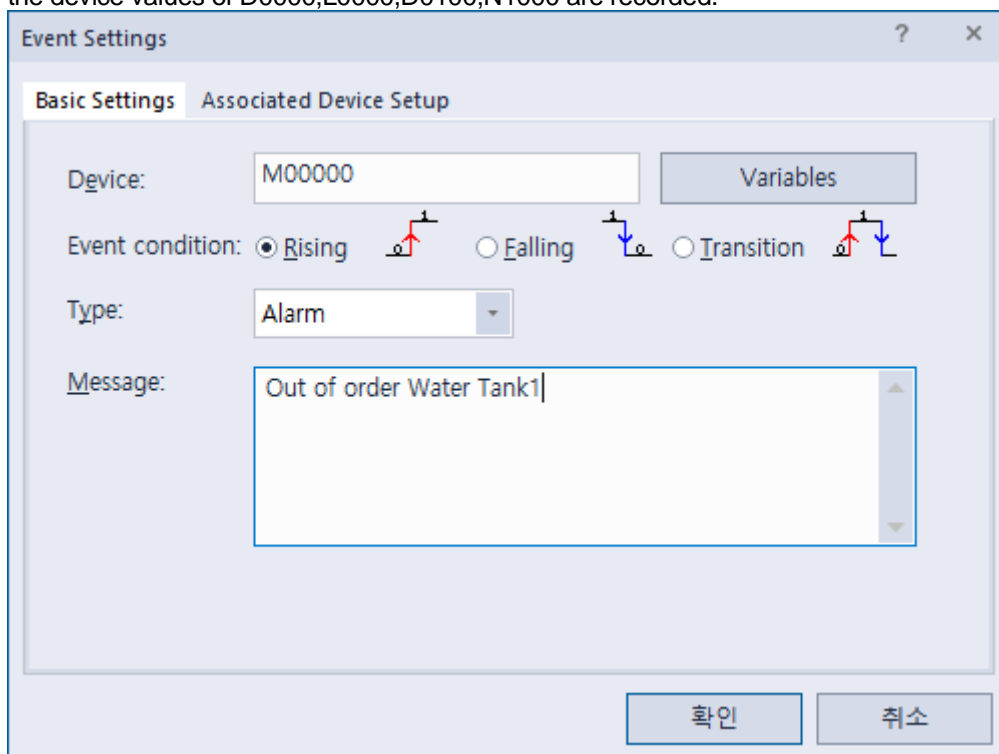
▪ Set the relative device(s).

**Event Settings**    ?    ×

Basic Settings | **Associated Device Setup**

Available Space(Bytes):    07 (Current)  /  16 (Maximum)

| ID | Device | Variable | Type |
|----|--------|----------|------|
| 1 | D00000 | | WORD |
| 2 | L00000 | _HS1_RLINK | BIT |
| 3 | D00010 | | WORD |
| 4 | N0010 | | WORD ⌄ |

확인    취소
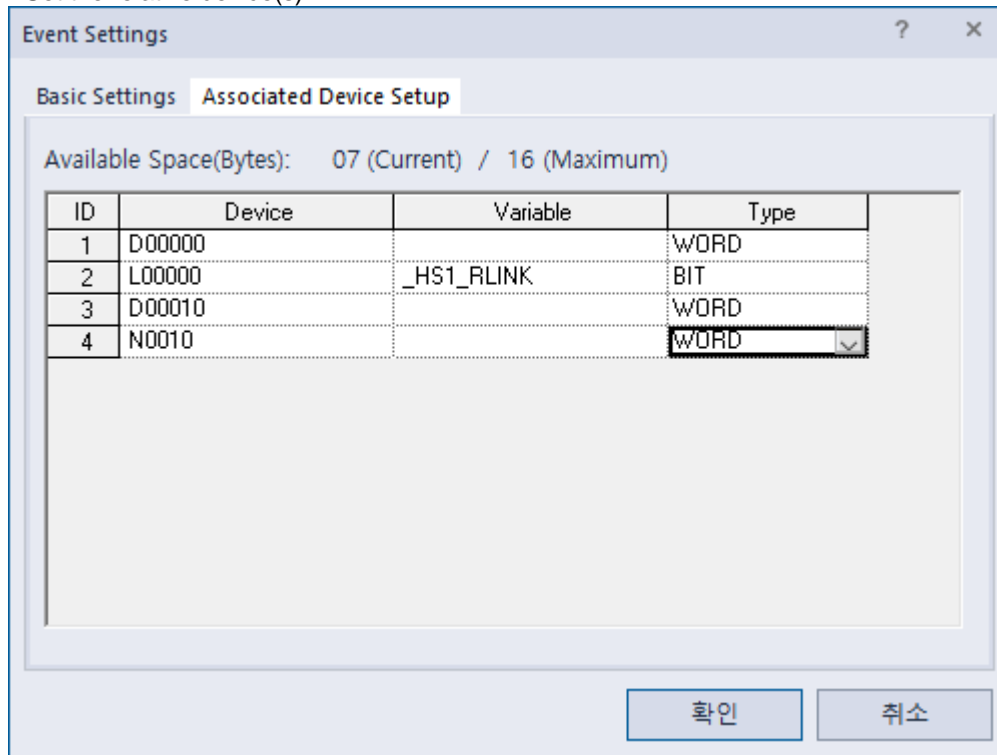
▪ Monitor event history of custom event.

**Custom Event**    ?    ×

Event Settings | **Event History**

| Number | Type | ID | Date | Time | Device | Contents |
|--------|------|----|------|------|--------|----------|
| 1 | ⊗ Alarm | 1 | 2022-08-17 | 15:45:31:113 | M00000 | Out of order Water Tank1 |
| 2 | ⊗ Alarm | 1 | 2022-08-17 | 15:45:33:112 | M00000 | Out of order Water Tank1 |
| 3 | ⊗ Alarm | 1 | 2022-08-17 | 15:45:35:341 | M00000 | Out of order Water Tank1 |
| 4 | ⊗ Alarm | 1 | 2022-08-17 | 15:45:37:557 | M00000 | Out of order Water Tank1 |

Menu ▽    Apply PLC    OK    Cancel
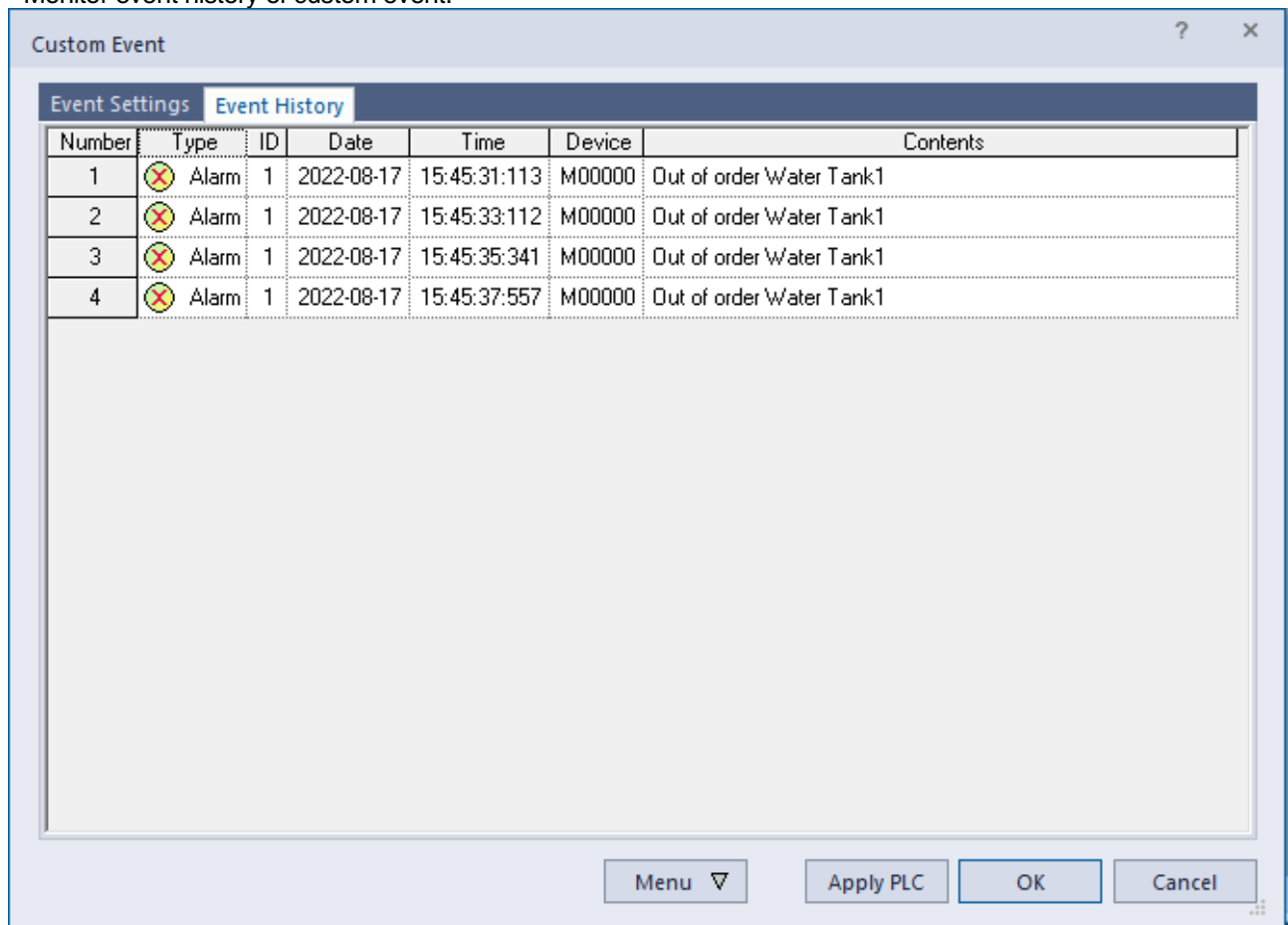
▪ Double-clicking a number produced monitors the relative values of device and the detail message as follows.

**Event History** ? ✕

**Event History**

Date:  2022-08-17        Time:   15:45:35:341        [Back]

Event ID:   1              Type:    Alarm           [Next]

Condition:  Rising       Device:   M00000          [Copy]

Message:

Out of order Water Tank1

Related Device List:

| Num | Device | Variable | Type | Value |
|---|---|---|---|---|
| 1 | D00000 | | WORD | 339 |
| 2 | L00000 | _HS1_RLINK | BIT | 0 |
| 3 | D00010 | | WORD | 0 |
| 4 | N0010 | | WORD | 0 |

[Close]
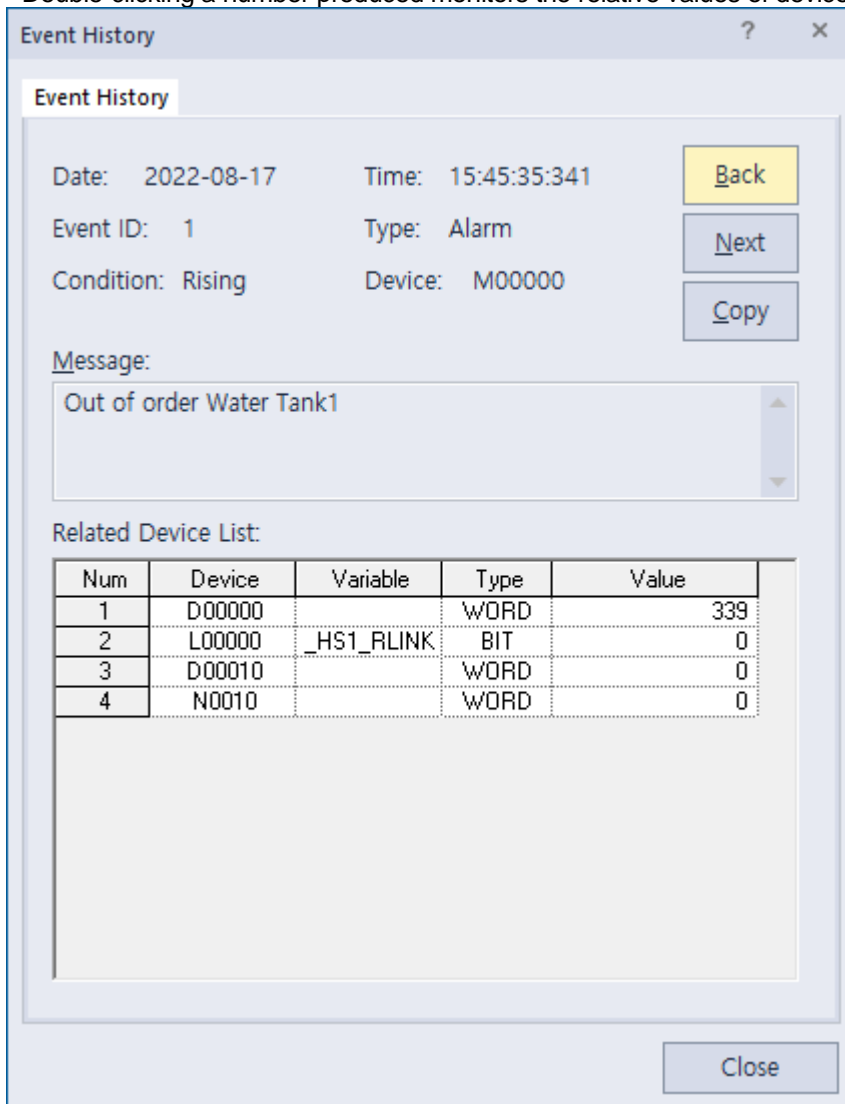
**Remark**

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

## 6.12 RTC function

"H" type (XBC-DxxxH) supports the RTC (clock) function and user can use this function for time management of system or error log. RTC function is executed steadily when power is off or instantaneous power cut status. Current time of RTC is renewed every scan by system operation status information flag.

### 6.12.1 How to use

(1) Reading/setting clock data
  (a) Reading or setting from XG5000
     1) Click 『Online』 의 『PLC Information』.
     2) Click PLC RTC tap of PLC Information』.
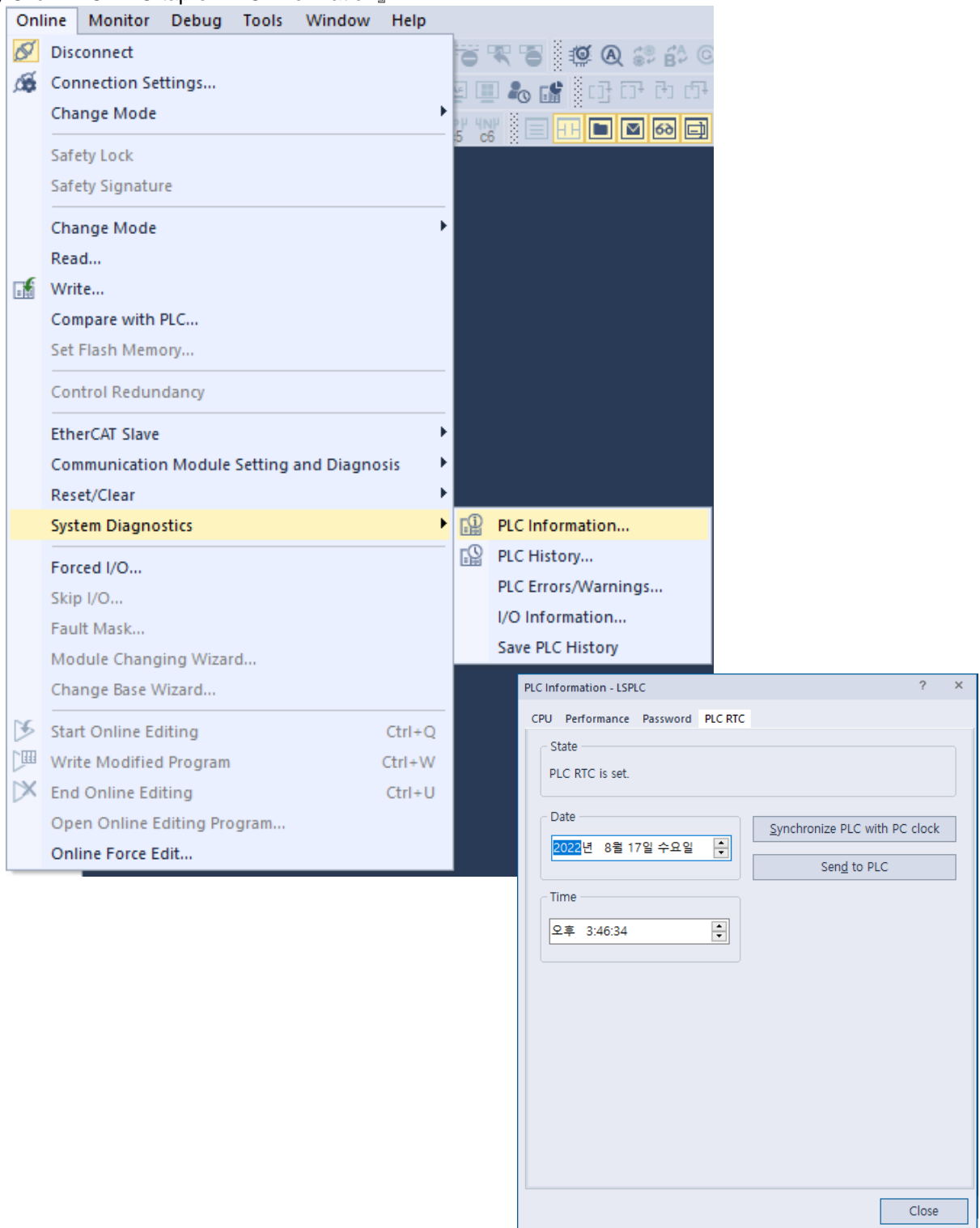
3) In case the user wants to send the clock of PC to PLC, press 'Synchronize PLC with PC clock'.
4) In case the user wants to send the clock the user wants, change the setting value of Time box and press 'Send to PLC'.

(b) Reading by special relay
The user can monitor as follows by special relay.

| Special relay area | Data | Contents |
|---|---|---|
| F053 | H0709 | 07year 9month |
| F054 | H1214 | 12date 14hour |
| F055 | H2040 | 20minute 40second |
| F056 | H2003 | 20XXyear, Wednesday |

(c) Modification of clock data by program
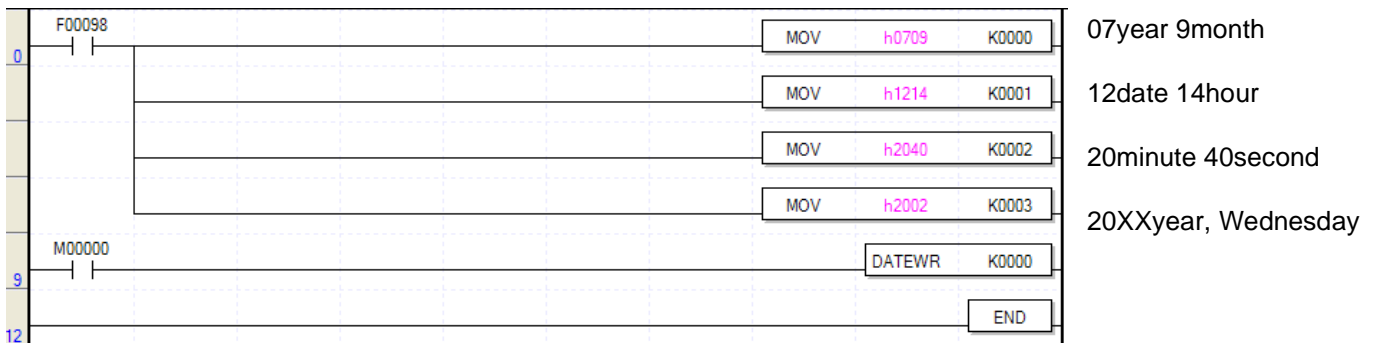


| area | Content |
|---|---|
| K0000 | Year, month |
| K0001 | Date, hour |
| K0002 | Minute, second |
| K0003 | Centaury, day |

Write clock data to temporary device (P, M, K, L, Z, U, D, R) and turn on/off input contact point M0000.
( If date and day data is not matched, Write is not available.)
Monitor and check the above special area (F053~F056)

(d) How to express the day

| Number | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Day | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |

(2) Deviation of clock data
±2.2s / 1 d

> **Remark**
>
> 1) Initially, RTC may not have any clock data.
> 2) When using the CPU module, first make sure to set the accurate clock data.
> 3) If any data out of the clock data range is written into RTC, it does not work properly.
>    i.e.) 14M 32D 25H
> 4) RTC may stop or have an error due to abnormal battery and other causes. The error is released if a new clock data is written.

## 6.13 External Memory Module

You can save the user program safely and download the program into the system when program is damaged without special manipulation by using external memory module.

### 6.13.1 Memory module specification

| Item | XBO-M2MB | Ref. |
|------|----------|------|
| Memory capacity | 2MByte | |
| Memory type | Flash Memory | |
| Specification | USB supported, Program Read/Write | |
| Indicator | LED | 1. RUN<br>2. WRITE<br>3. READ |
| Operating mode setup | Mode setup by rotary switch | |
| Operating power supply | RS-232C communication connecter,<br>USB connector | 5V |
| Purpose | For moving | |
| Version | CPU O/S V5.00 or higher: use memory module V1.60 or higher.<br>CPU O/S less than V5.00: No restriction. | |

### 6.13.2 Memory module structure



RS-232C connector

USB connector

RUN LED
WRITE LED
READ LED

1 : READ mode
3 : WRITE mode
5 : PADT I/F mode
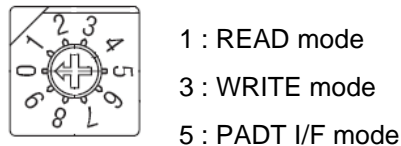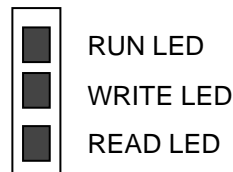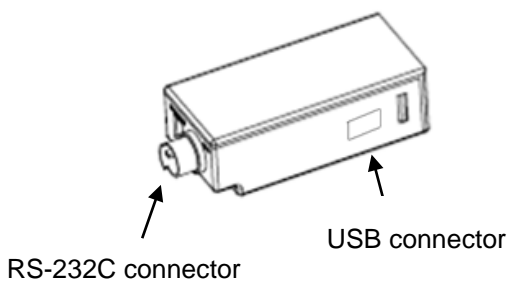
**Note**

-.Memory module can be used for XGB (not supported for XGK/I/R)
-.Memory module is not supported at the version below
    (XBMS: V2.5 or less, XBCH: V1.8 or less, XECH: V1.2 or less)

### 6.13.3 How to use memory module

(1) Save program, parameter, communication parameter at external memory module
      (a) Set the switch of memory module as 1
      (b) Install memory module at the RS-232C port of main unit
         - After installation, program and parameter (including communication) is saved into memory module and READ LED is on
         - If Saving program and parameter is complete, READ LED is off
      (c) Separate memory module from main unit

(2) Save user program of external memory module at main unit
      (a) Set the operating mode of main unit as STOP
         - In RUN mode, you can't save program
      (b) Set the switch of memory module as 3
      (c) Install the memory module
         - Install it at the RS-232C port of the main unit.
         - PLC program and parameter (including communication) is written and WRITE LED is on
         - If saving program and parameter is complete, WRITE LED is off.
      (d) If you change operation mode of PLC into RUN, PLC operates with program and parameter saved in memory module.

      With the above handling, you can run PLC with program saved in memory module

(3) Save program of XG5000at the memory module
      (a) Set the mode switch of XBO-M2MB as "5" and connect XBO-M2MB to USB port of PC
      (b) Select Project → Write to Memory on XG5000 menu.

| Project | Edit | Find/Replace | View | Online |
|---|---|---|---|---|
| New Project... | | | | Ctrl+N |
| Open Project... | | | | Ctrl+O |
| Open From PLC... | | | | |
| Open KGLWIN File... | | | | |
| Open GMWIN File... | | | | |
| Save Project | | | | Ctrl+S |
| Save As... | | | | |
| Save as Earlier Version... | | | | |
| Save as PLC Project... | | | | |
| Close Project | | | | |
| Save As Binary... | | | | |
| Write Binary to PLC... | | | | |
| Open from Memory | | | | |
| Write to Memory... | | | | |
| Edit Memory Card | | | | ▶ |
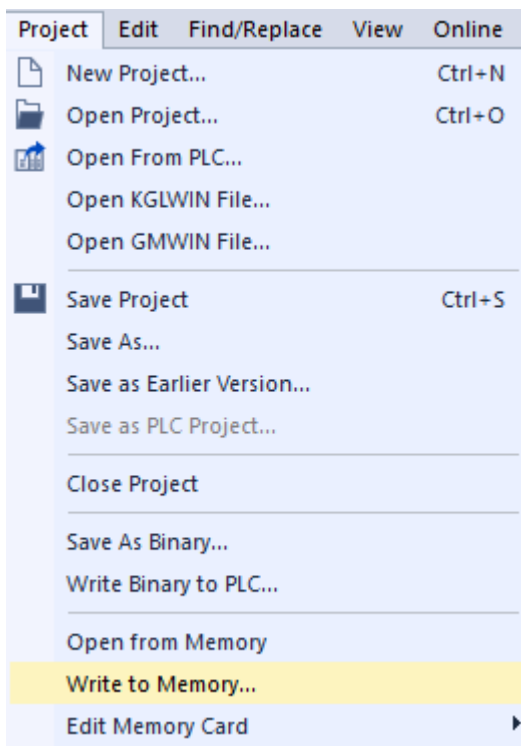
(c) 'Write' window is created as follows.
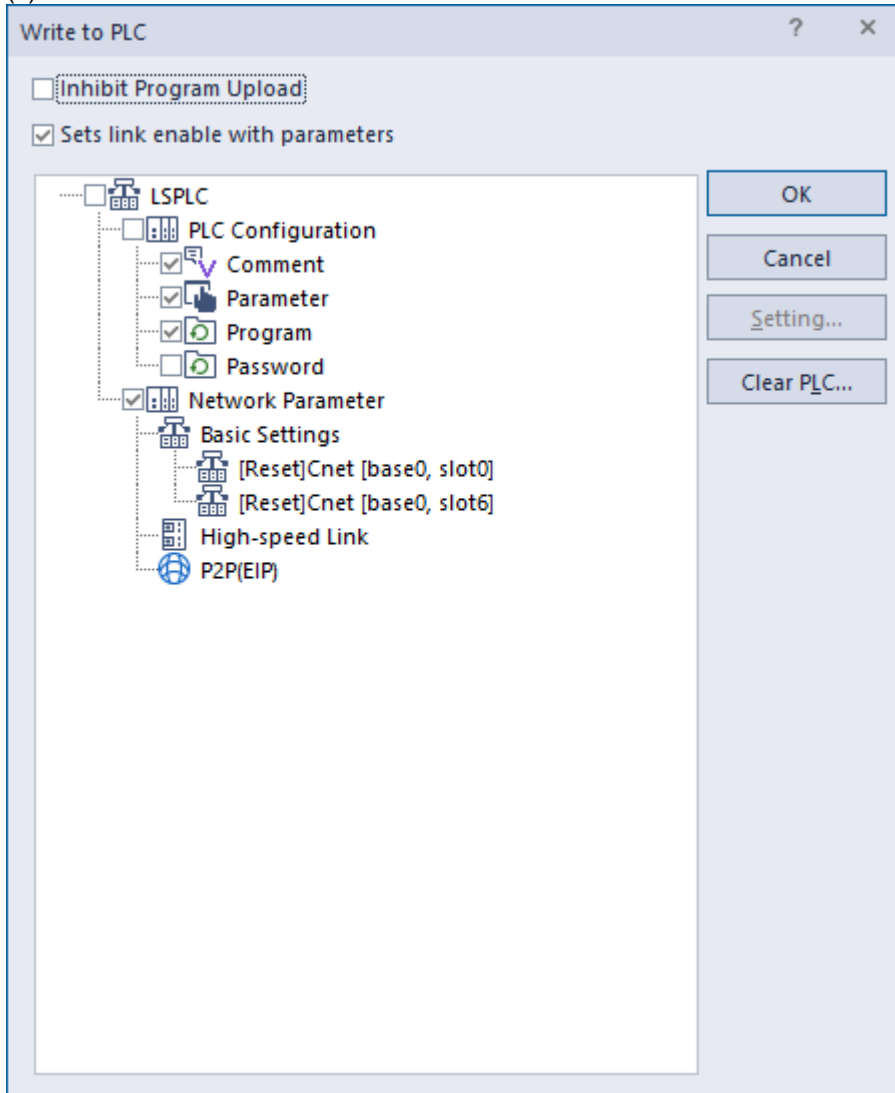


(d) "Writing completed" window appears.
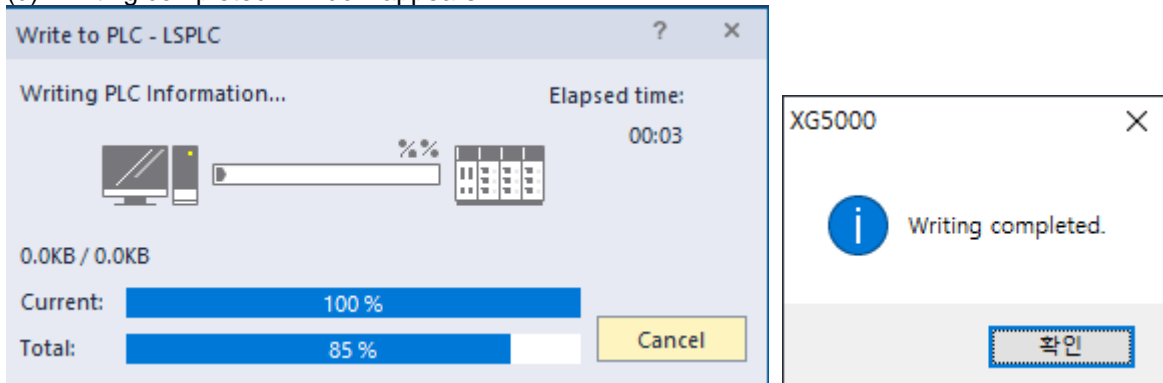


(e) With above method, through PADT, you can save program, parameter, communication parameter at XBO-M2MB

(4) Open from memory module
    (a) Set the mode switch of XBO-M2MB as "5" and connect XBO-M2MB to USB port of PC
    (b) Select "Project → Open from Memory" on XG5000 menu

| Project | Edit | Find/Replace | View | Online |
|---|---|---|---|---|

- New Project...      Ctrl+N
- Open Project...      Ctrl+O
- Open From PLC...
- Open KGLWIN File...
- Open GMWIN File...
- Save Project      Ctrl+S
- Save As...
- Save as Earlier Version...
- Save as PLC Project...
- Close Project
- Save As Binary...
- Write Binary to PLC...
- **Open from Memory**
- Write to Memory...
- Edit Memory Card      ▶

    (c) "Read" window is created as follows.

Read From PLC    ?    ×

☐ Inhibit Program Upload
☑ Sets link enable with parameters

- ☐ NewPLC
  - ☐ PLC Configuration
    - ☑ Comment
    - ☑ Parameter
    - ☑ Program
    - ☐ Data memory
  - ☑ Network Parameter
    - Basic Settings
      - Cnet [base0, slot0]
      - Cnet [base0, slot6]
    - High-speed Link
      - High-speed Link 01
      - High-speed Link 02
    - P2P(EIP)
      - P2P(EIP) 01
      - P2P(EIP) 02
      - P2P(EIP) 03

[ OK ]
[ Cancel ]
[ Setting... ]

(d) "Reading is completed" window appears.
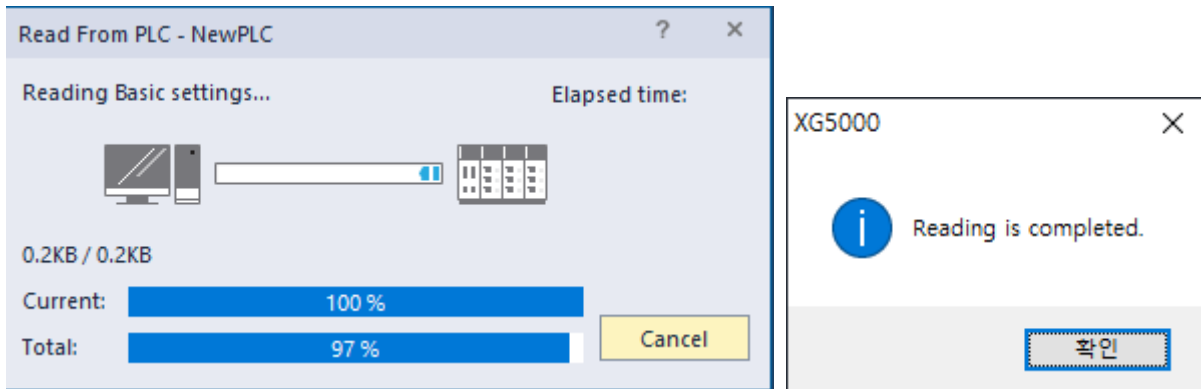


(e) With above method, through PADT, you can save program, parameter, communication parameter from XBO-M2MB

### 6.13.4 How to use when password is set

(1) When connecting PADT with memory module
   (a) When setting password at program and writing program to memory module, it is saved according to rotary switch operating mode without functions cancelling the password
   1)  When writing program, check whether to use password at 'Write' window.
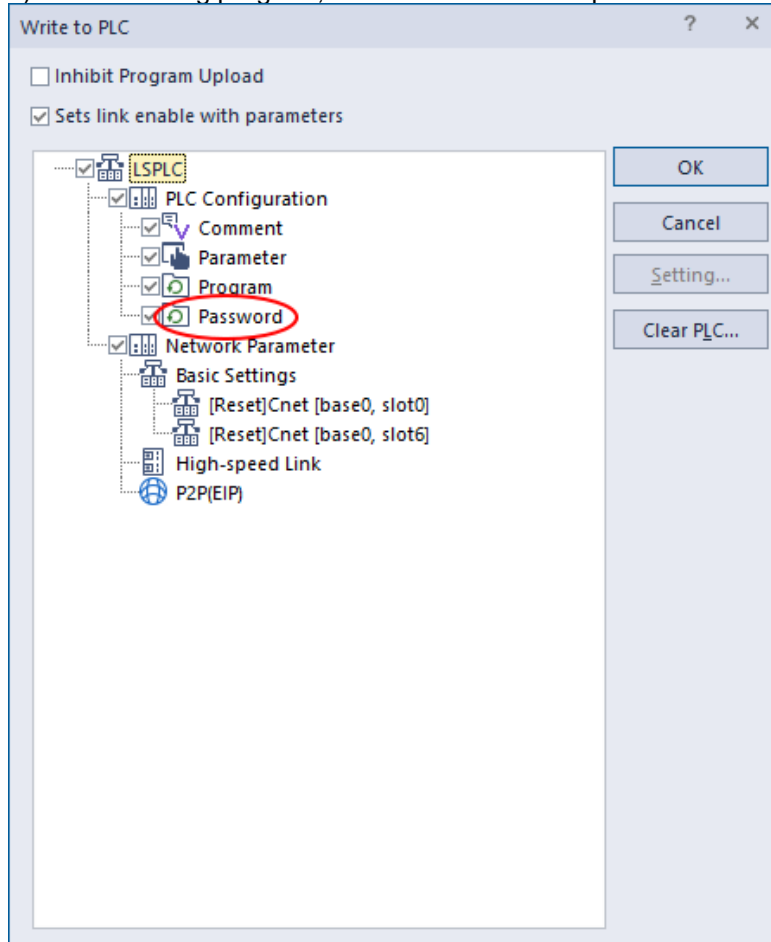


   2)  If you press 'OK' after setting password, program is saved at memory module with that password.
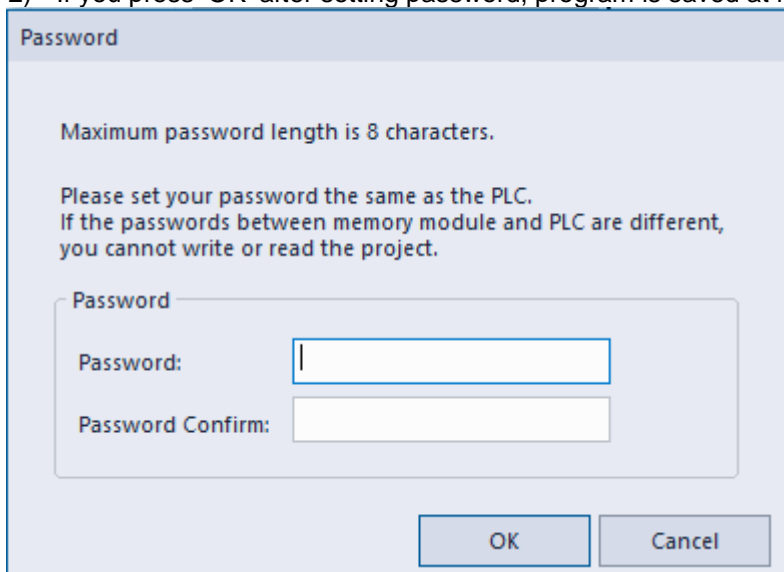
(b) When reading password-set program to PADT, screen appears, which is same as when password is set in PLC.

1) "Password" window is created.
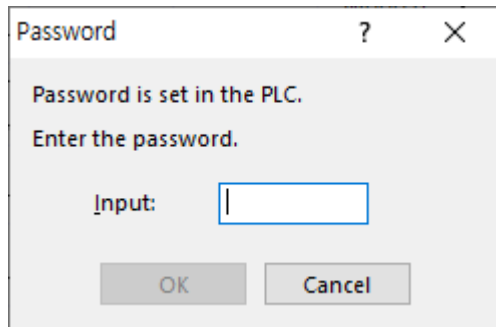


2) If you input password same as that in memory module, it reads program.
3) When password is incorrect, error message appears as follows.
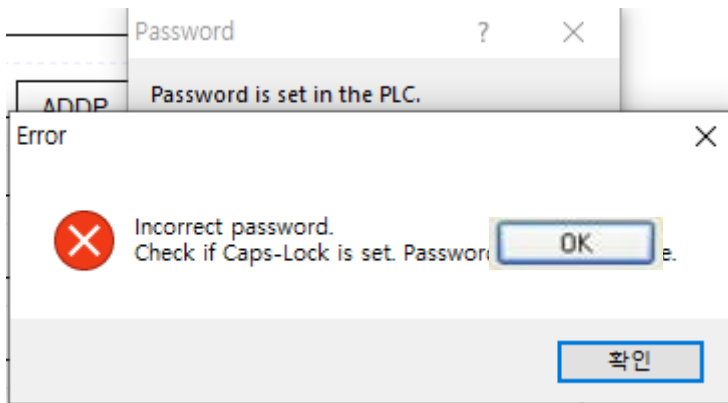


(2) Write to PLC by memory module

(a) When password of program in memory module is not set
   1) When no password is set in PLC
      - Saves program of the memory module in PLC
   2) When password is set in PLC
      - Writing is not executed
(b) When password of program in memory module is set
   1) When no password is set in PLC
      - Writing to PLC is executed
        But, password of the memory module is not written to PLC.
   2) When password is set in PLC
      - When PLC password is same as that of the memory module, writing is executed.
      - When PLC password is not same as that of the memory module, writing is not executed.
        (WRITE LED flickers)

(3) Reading program in PLC to memory module

    (a) When password of program in PLC is not set
        1) When no password is set in the memory module
          - Reads program from PLC
        2) When password is set in the memory module
          - After reading, it clears password of the memory module
    (b) When password of program in PLC is set
        1) When no password is set in the memory module
          - Writing is not executed
        2) When password is set in the memory module
          - When PLC password is same as that of the memory module, writing is executed.
          - When PLC password is not same as that of the memory module, writing is not executed.

(4) When LED flickers

| | Condition | LED |
|---|---|---|
| 1 | PLC type is not XGB | RUN LED flickers |
| 2 | Operating mode changes while being connected to PADT or PLC | RUN LED flickers |
| 3 | Connected to PADT while mode switch is "1" | READ LED flickers |
| 4 | PLC program upload is prohibited | READ LED flickers |
| 5 | You execute reading when password is set in PLC (when password is not same as that of memory module) | READ LED flickers |
| 6 | Connected to PADT while mode switch is "3" | WRITE LED flickers |
| 7 | You execute writing the memory module when PLC mode is RUN | WRITE LED flickers |
| 8 | Connected to the different type of PLC with the type set in the memory module | WRITE LED flickers |
| 9 | You executes writing when PLC password is not same as that of memory module | WRITE LED flickers |

> **Note**
>
> -. Memory module can cancel PLC password and read/write but can't set, delete and change the password.
> -. Do not run PLC while external memory module is connected to.
> -. Do not remove memory module while READ/WRITE LED is on.

## 6.14 Program Upload Prohibit

Program Upload Prohibit function prohibits from uploading comment, parameter, program saved on PLC. If Program Upload Prohibit function is set, you can't open from PLC, read PLC and compare PLC.

(1) How to set
   (a) Click 『Online』 - 『Write』
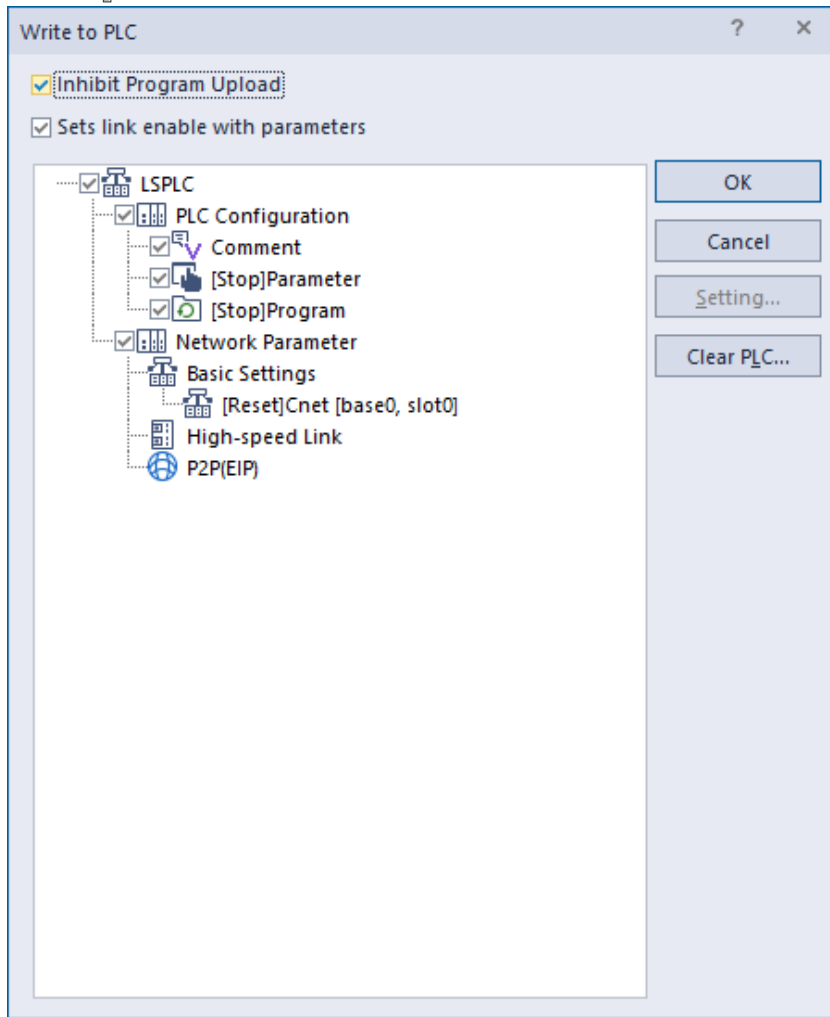


   (b) Select "Program" to activate "Program Upload Prohibit"
   (c) Select "Program Upload Prohibit" and click OK.

(2) When reading PLC is prohibited, if you try to read PLC, the following dialog box appears. After releasing Program Upload Prohibit, execute reading.
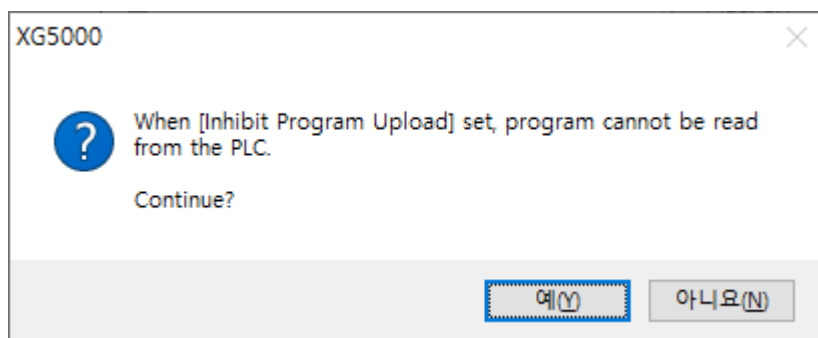
(3) How to release Program Upload Prohibit
   (a) Click 『Online』 - 『Write』 .
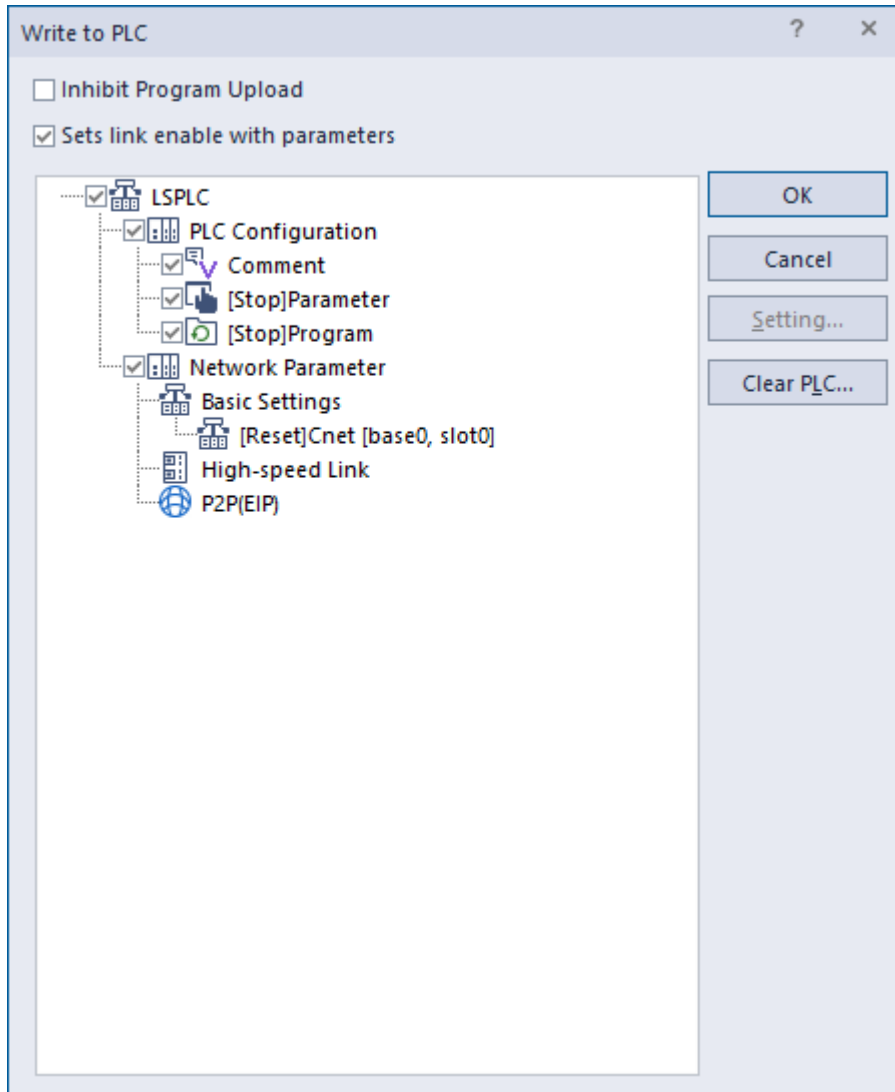


   (b) Release Program Upload Prohibit and click OK.

## 6.15 Clear All PLC

Clear All PLC function clears parameter, program, data, password saved on PLC

(1) How to clear all PLC
    (a) Click 『Online』 - 『Clear All PLC』 .
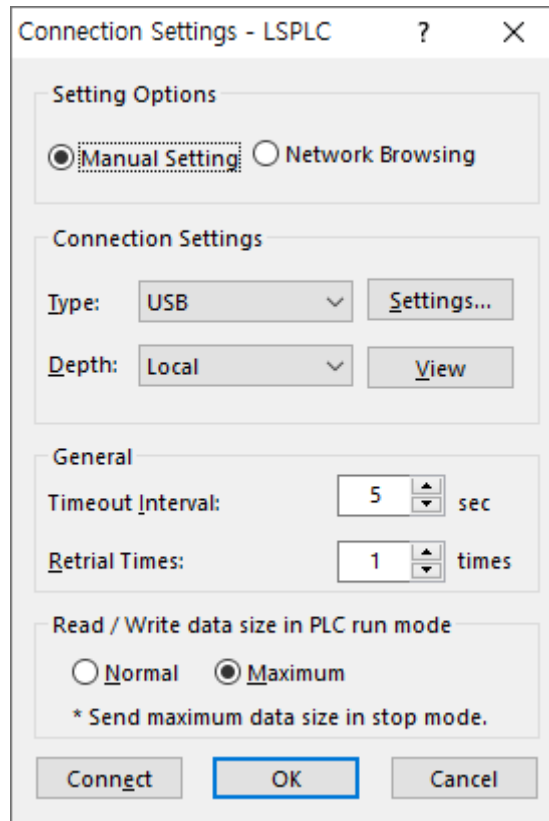


    (b) After selection connection method, click 『Connect』 or 『OK』 .
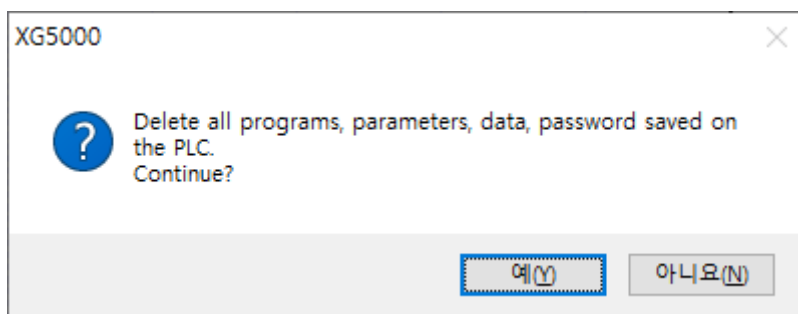


    (c) If you select 『Yes』 on the dialog box, PLC program, parameter, data, password will be deleted.

| Note |
| --- |
| •Clear All PLC function can be executed though not connected.<br>•If you use Clear All PLC function, password will be deleted. So be careful.<br>•In case you lose password, use this function to clear password. |

## 6.16 Password Setting per Program Block

Password Setting per Program Block function sets password for each program block. You should input password to open program.

(1) How to set program block password
    (a) Click 『Properties』 after selecting program in project window.
    (b) Click password tap.
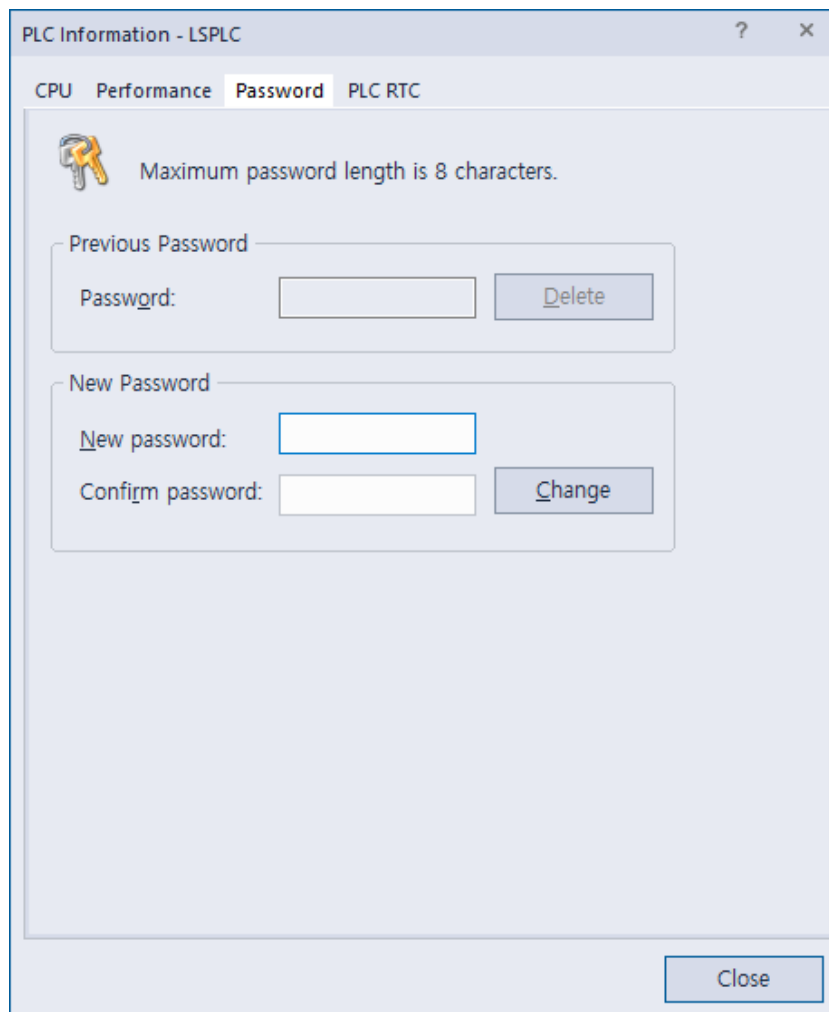


(c) Click 『OK』 after inputting new password.

(2) Opening password-set program
    (a) When you open password-set program, the following window appears.
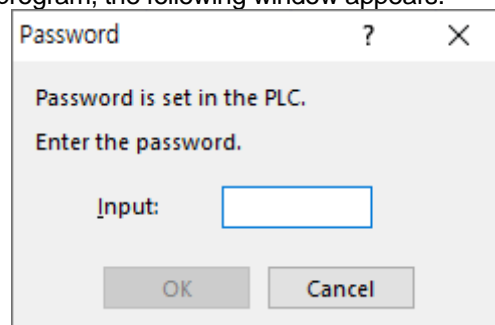


(b) After inputting correct password, click 『OK』 to open program.

(3) How to delete program block password
    (a) After program in project window, click 『Properties』.
    (b) Click password tap.

PLC Information - LSPLC      ?    ✕

CPU   Performance   **Password**   PLC RTC

Maximum password length is 8 characters.

Previous Password

Password:    [       ]     Delete

New Password

New password:    [     ]

Confirm password:    [     ]    Change

Close
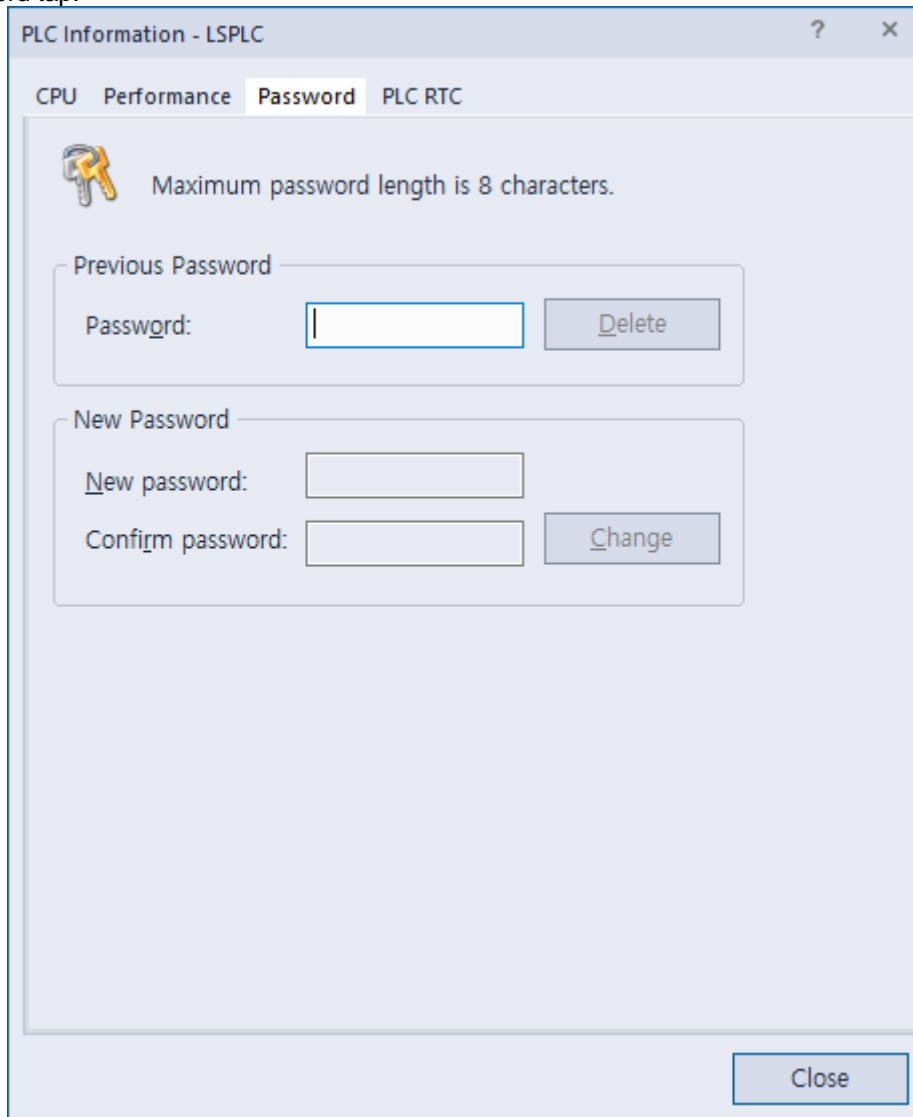
    (c) After inputting previous password, click 『Delete』.
    (d) Click 『OK』.

# Chapter 7 Input/Output Specifications

## 7.1  Introduction

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

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

2) The number of max. Simultaneous input contact point is different according to module type. It depends on the input voltage, ambient temperature. Use input module after checking the specification.

3) When response to high speed input is necessary, use interrupt input contact point. Up to 8 interrupt points are supported.

4) 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.

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

6) 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.
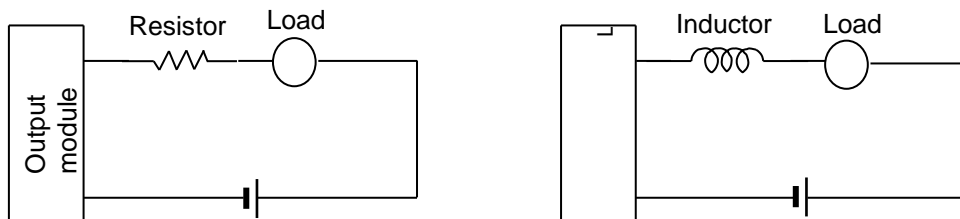
7) Relay life of Relay output module is shown as below.
Max. life of Relay used in Relay output module is shown as below.
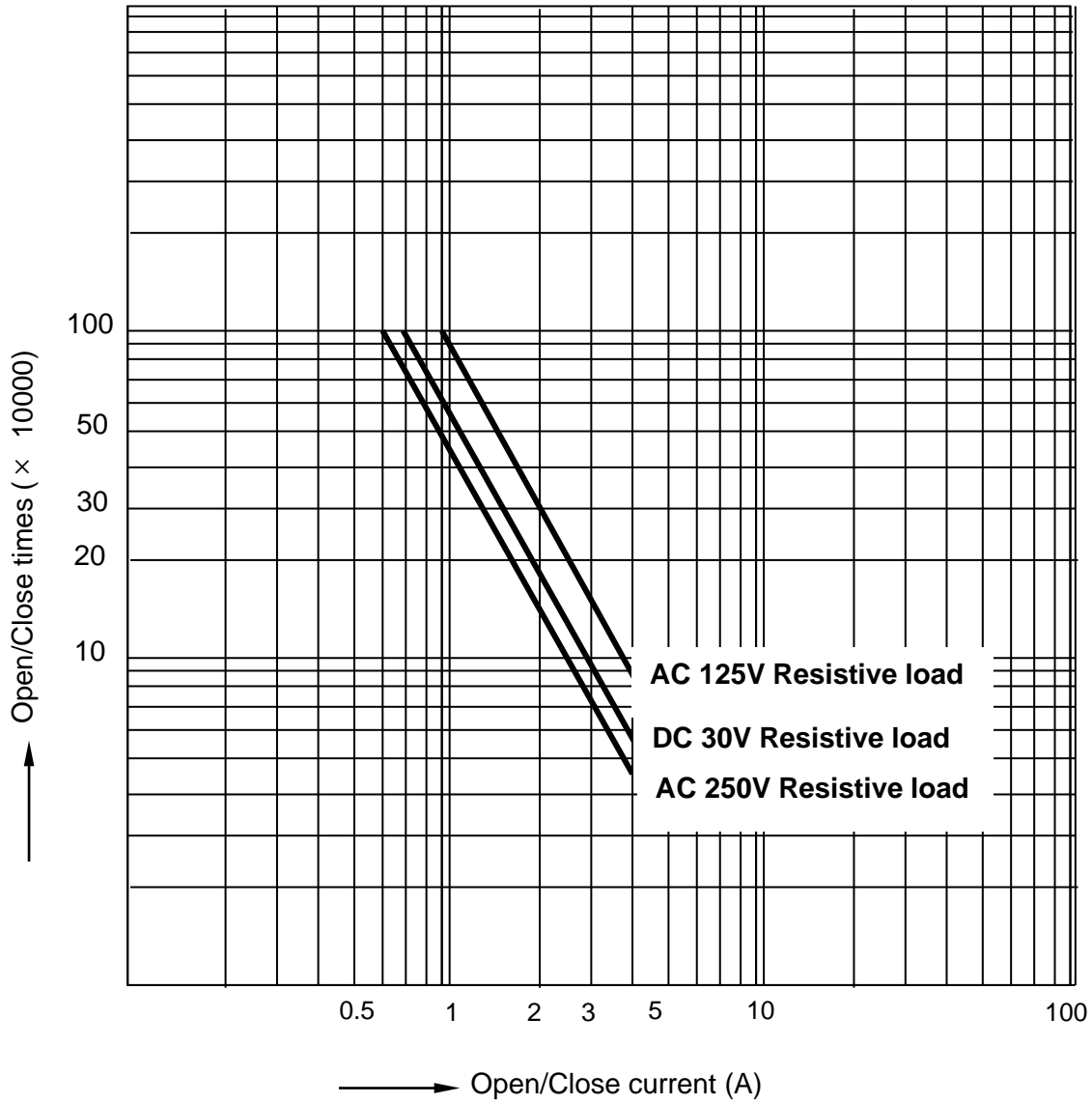
(8) Terminal blocks are of barrier type and pluggable type, and pluggable terminal blocks have screw type and push-in type depending on the connection method.

1) Barrier terminal block
As a terminal block mainly applied to the XGB compact type basic unit, crimp terminals with insulation sleeves cannot be used. Crimp terminals suitable for connection to terminal blocks are as follows.

6.0mm or less        6.0mm or less
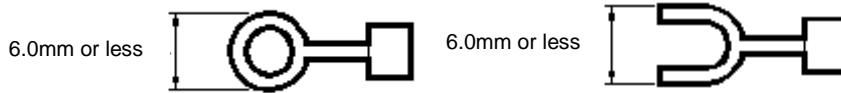
For the size of the wire connected to the terminal block, use a stranded wire of 0.3 to 0.75 ㎟ and a thickness of 2.8 mm or less. Please note that the allowable current may differ depending on the insulation thickness of the wire.

The tightening torques of the module fixing screws and terminal block screws must be within the following ranges.

| Coupling position | Coupling torque range |
|---|---|
| IO module terminal strip screw (M3 screw) | 42 ~ 58 N·cm |
| IO module terminal strip fixation screw (M3 screw) | 66 ~ 89 N·cm |
| IO module external connector(M2 screw) | 18   22 N·cm |

2) Screw connection type plug (PCB plug, Screw connection):XBE-xx08A, XBE-xx16A
As a terminal block mainly applied to the XGB compact type basic unit, crimp terminals with insulation

① Wire size

| Number of wires per contact | single wire | stranded wire | When using ferrules with plastic sleeves | When using ferrules without plastic sleeves |
|---|---|---|---|---|
| 1 | 0.2 ~ 1.5 ㎟ | 0.2 ~ 1.5 ㎟ | 0.25 ~ 0.5 ㎟ | 0.25 ~ 1.5 ㎟ |
| 2 | 0.75 ㎟ | 0.75 ㎟ | 0.5 ㎟ (Twin Ferrules) | 0.25 ~ 0.34 ㎟ |

② Ferrule size

| Stripping Dimensions of Wires | penhole |
|---|---|

6~7 mm

1mm or less
8mm
Crimp area
14mm
Sleeve
2.6mm or less
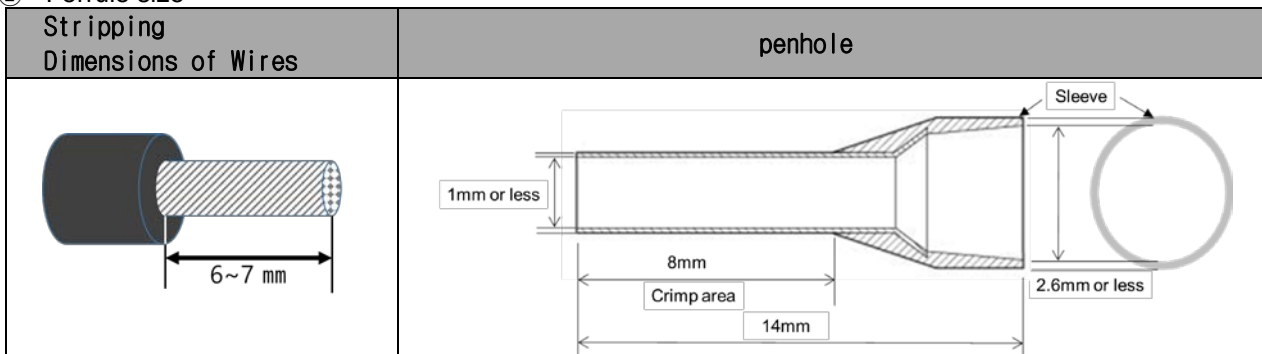
③ Recommended ferrule

| Manufacturer | model name | line size | crimping tool |
|---|---|---|---|
| GLW GmbH | DN00508D | 0.5 ㎟ | CO225 Or CAP4 |
| | DN00308D | 0.34 ㎟ | |
| | DN00208D | 0.25 ㎟ | |

Peel off about 6-7 mm of the sheath from the end of the wire and connect it to the ferrule. Excessive stripping of the sheath can result in poor contact with the crimp area of the ferrule. Tighten the terminal block

screws as follows.

| Screw thread | M2 |
|---|---|
| Flat screwdriver size | 0.4 x 2.5 |
| Tightening torque | 0.2 N · m |

9) Relay life graph is not written based on real use. (This is not a guaranteed value). So consider margin. Relay life is specified under following condition.

(a) Rated voltage, load: 3 million times: 100 million times
(b) 200V AC 1.5A, 240V AC 1A (COS¢ =0.7): 1 million times
(c) 200V AC 0.4A, 240V AC 0.3A (COS¢ =0.7): 3 million times
(d) 200V AC 1A, 240V AC 0.5A (COS¢ =0.35): 1 million times
(e) 200V AC 0.3A, 240V AC 0.15A (COS¢ =0.35): 3 million times
        (f) 24V DC 1A, 100V DC 0.1A (L/R=7ms): 1million times
        (g) 24V DC 0.3A, 100V DC 0.03A (L/R=7ms): 3million times

10) Noise can be inserted into input module. To prevent this noise, the user can set filter for input delay in parameter. Consider the environment and set the input filter time.

| Input filter time (ms) | Noise signal pulse size (ms) | Reference |
|---|---|---|
| 1 | 0.3 | |
| 3 | 1.8 | Initial value |
| 5 | 3 | |
| 10 | 6 | |
| 20 | 12 | |
| 70 | 45 | |
| 100 | 60 | |

(a) Setting input filter
1) Click I/O Parameter』 in the project window of XG5000
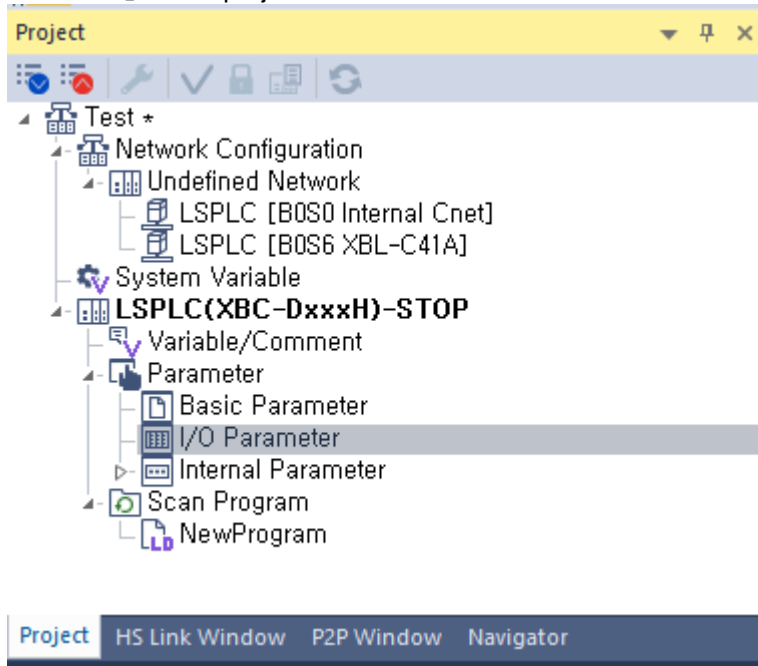


2) Click 『Module』 at the slot location.
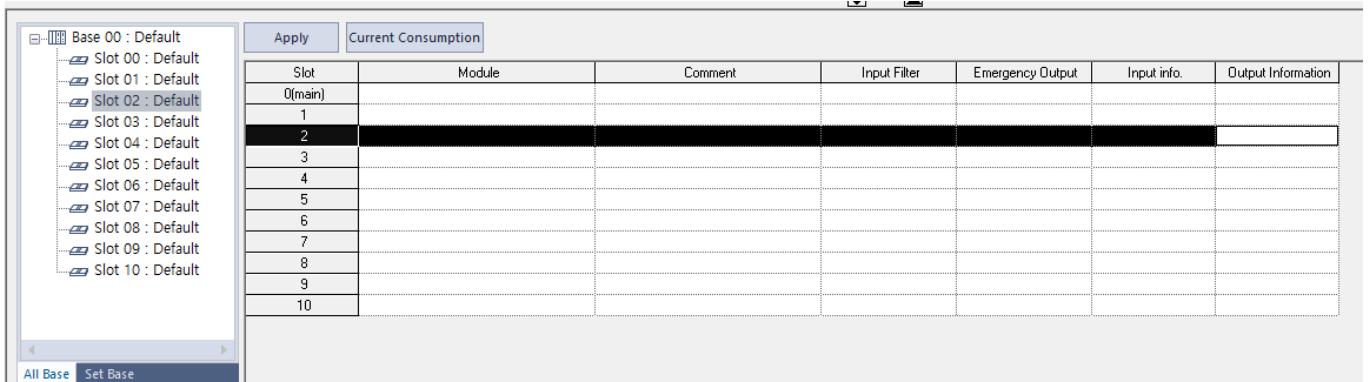


3) Set I/O module really equipped.
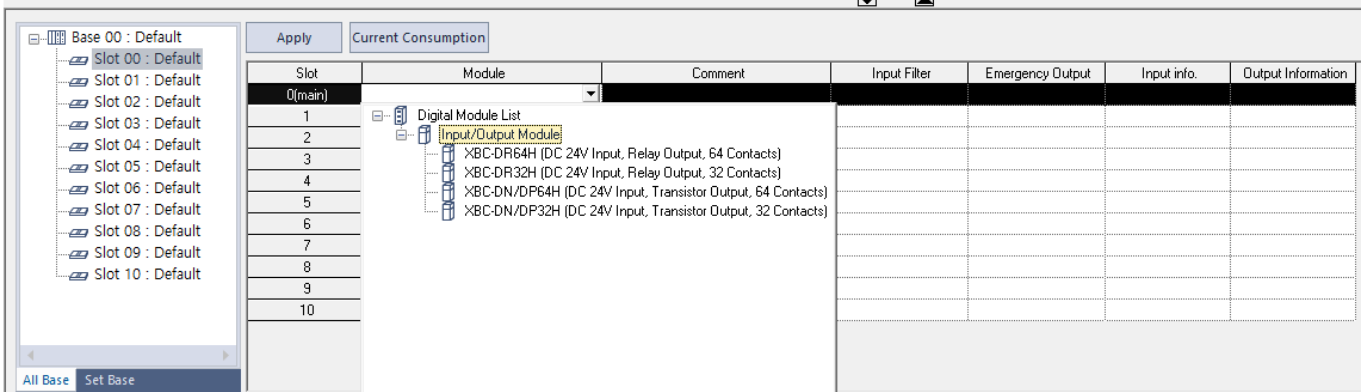
4) After setting I/O module, click Input Filter.
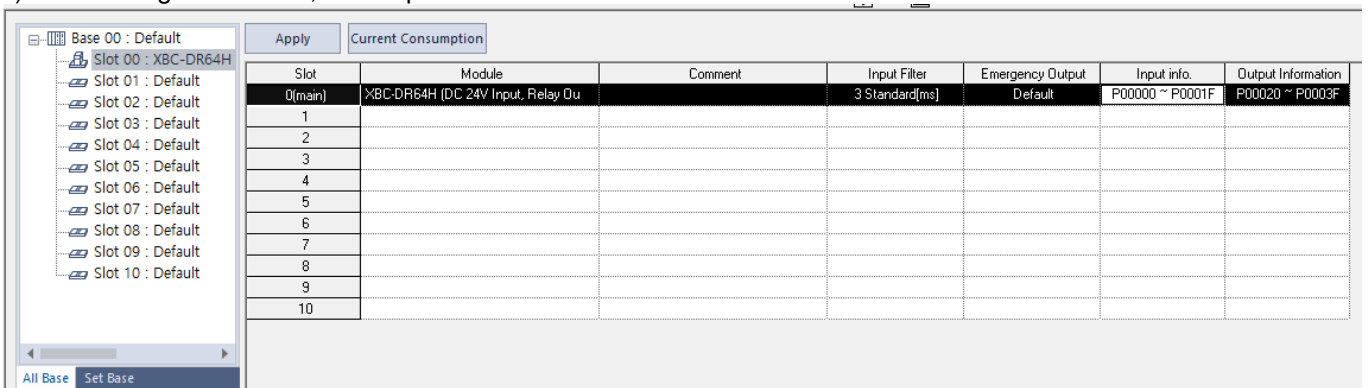


5) Set filter value.
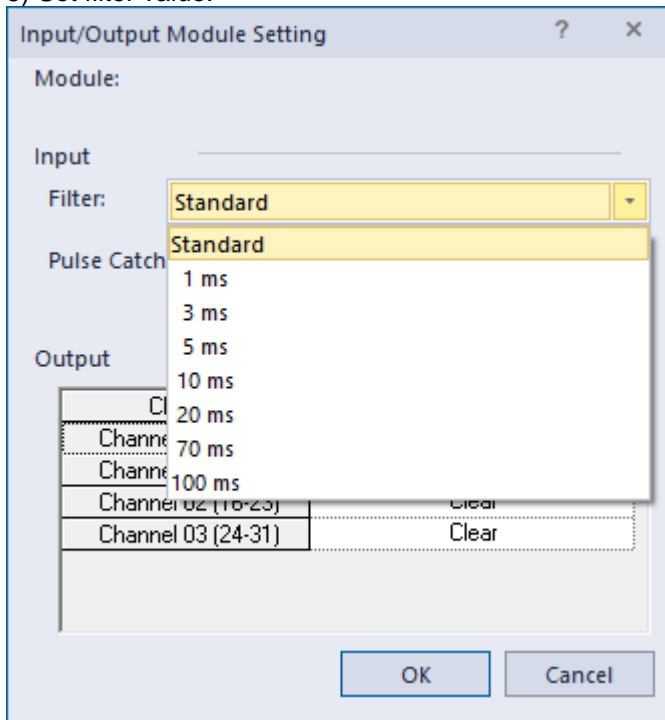
(b) Setting output status in case of error

1) Click Emergency Out in the I/O parameter setting window.
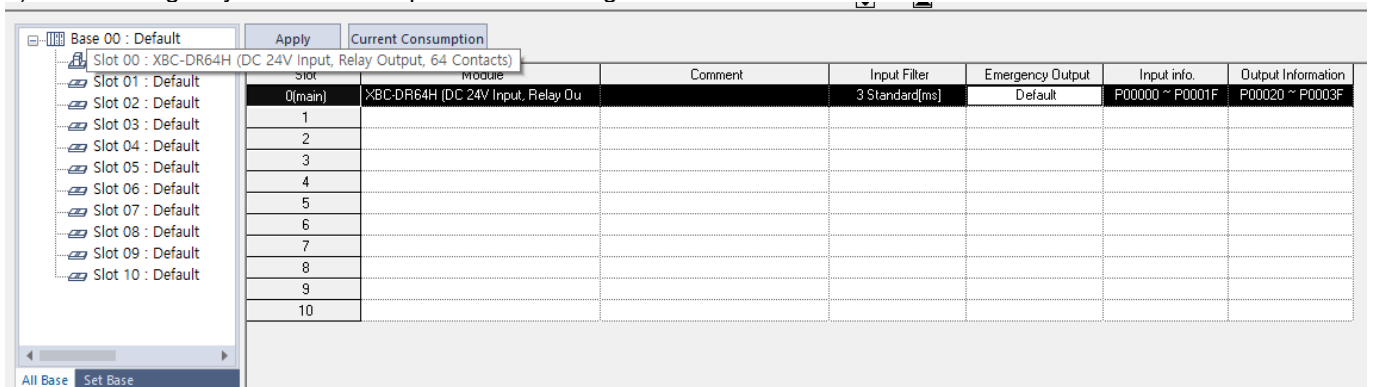


2) Click Emergency Output.
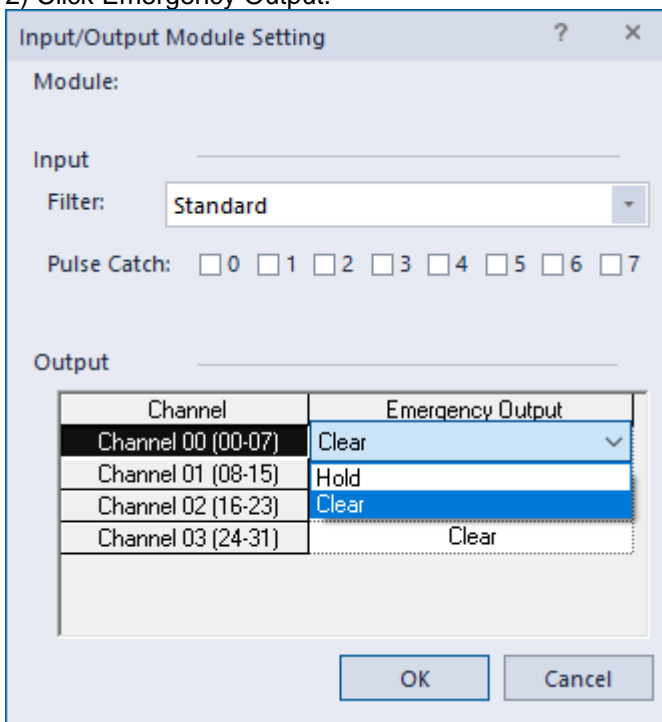


If it is selected as Clear, the output will be Off and if Hold is selected, the output will be kept.

## 7.2  Basic Digital Input Unit Specifications
### 7.2.1 XBM-DR16S input unit (Source/Sink type)

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

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

### 7.2.2 XBM-DN16S input unit (Source/Sink type)

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

Note: Response time — 1/3/5/10/20/70/100 ms (set by I/O parameter) Default: 3 ms

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

Circuit diagram labels: 0, B10, R, Photo coupler, R, Internal circuit, 7, B03, B02, COM, DC24V, Connector no.

Connector pin layout: B10/A10, B09/A09, B08/A08, B07/A07, B06/A06, B05/A05, B04/A04, B03/A03, B02/A02, B01/A01

## 7.2.3 XBM-DN32S input unit (Source/Sink type)

| Model | Basic unit |
|---|---|
| Specification | XBM-DN32S |
| Input point | 16 point |
| Insulation method | Photo coupler insulation |
| Rated input voltage | DC24V |
| Rated input current | About 4 ㎃ (Contact point 0~3: About 7 ㎃) |
| Operation voltage range | DC20.4~28.8V (ripple rate < 5%) |
| On Voltage/Current | DC19V or higher / 3 ㎃ or higher |
| Off Voltage/Current | DC6V or less / 1 ㎃ or less |
| Input resistance | About 5.6 ㏀ (P00~P03: About 3.3 ㏀) |

<table>
<tr><td rowspan="2">Response time</td><td>Off → On</td><td rowspan="2">1/3/5/10/20/70/100 ㎳ (set by I/O parameter) Default: 3 ㎳</td></tr>
<tr><td>On → Off</td></tr>
</table>

| | |
|---|---|
| Insulation pressure | AC560Vrms / 3Cycle (altitude 2000m) |
| Insulation resistance | 10 ㏁ or more by Megohmmeter |
| Common method | 16 point / COM |
| Proper cable size | 0.3 ㎟ |
| Current consumption | 200 ㎃ (when all point On) |
| Operation indicator | Input On, LED On |
| External connection method | 20 pin connector |
| Weight | 110g |

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

### 7.2.4 XBC-DR32H / XBC-DN32H input unit (Source/Sink type)

| Model<br>Specification | Basic unit | |
|---|---|---|
| | XBC-DR32H(/DC) | XBC-DN32H(/DC) |
| Input point | 16 point | |
| Insulation method | Photo coupler insulation | |
| Rated input voltage | DC24V | |
| Rated input current | About 4 ㎃ (Contact point 0~3: About 7 ㎃) | |
| Operation voltage range | DC20.4~28.8V (ripple rate < 5%) | |
| On Voltage/Current | DC19V or higher / 3 ㎃ or higher | |
| Off Voltage/Current | DC6V or less / 1 ㎃ or less | |
| Input resistance | About 5.6 ㏀ (P00~P03: About 3.3 ㏀) | |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳ (set by I/O parameter) Default: 3 ㎳ |
| | On → Off | |
| Insulation pressure | AC560Vrms / 3Cycle (altitude 2000m) | |
| Insulation resistance | 10 ㏁ or more by Megohmmeter | |
| Common method | 16 point / COM | |
| Proper cable size | 0.3 ㎟ | |
| Current consumption | 200 ㎃ (when all point On) | |
| Operation indicator | Input On, LED On | |
| External connection method | 24 points connecting connector (M3 X 6 screw) | |
| Weight | 600g | 500g |

| Circuit configuration | No. | Contact | No. | Contact | Type |
|---|---|---|---|---|---|
| | | | TB1 | RX | |
| | TB2 | 485+ | TB3 | TX | |
| | TB4 | 485- | TB5 | SG | |
| | TB6 | 00 | TB7 | 01 | |
| | TB8 | 02 | TB9 | 03 | |
| | TB10 | 04 | TB11 | 05 | |
| | TB12 | 06 | TB13 | 07 | |
| | TB14 | 08 | TB15 | 09 | |
| | TB16 | 0A | TB17 | 0B | |
| | TB18 | 0C | TB19 | 0D | |
| | TB20 | 0E | TB21 | 0F | |
| | TB22 | **COM** | TB23 | 24G | |
| | TB24 | 24V | | | |

## 7.2.5 XBC-DR64H / XBC-DN64H input unit (Source/Sink Type)

| Model / Specification | Basic unit | |
|---|---|---|
| | XBC-DR64H(/DC) | XBC-DN64H(/DC) |
| Input point | 32 point | |
| Insulation method | Photo coupler insulation | |
| Rated input voltage | DC24V | |
| Rated input current | About 4 ㎃ (Contact point 0~3: About 7 ㎃) | |
| Operation voltage range | DC20.4~28.8V (ripple rate < 5%) | |
| On Voltage/Current | DC19V or higher / 3 ㎃ or higher | |
| Off Voltage/Current | DC6V or less / 1 ㎃ or less | |
| Input resistance | About 5.6 ㏀ (P00~P03: About 3.3 ㏀) | |
| Response time — Off → On / On → Off | 1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳ | |
| Insulation pressure | AC560Vrms / 3Cycle (altitude 2000m) | |
| Insulation resistance | 10 ㏁ or more by Megohmmeter | |
| Common method | 16 point / COM | |
| Proper cable size | 0.3 ㎟ | |
| Current consumption | 200 ㎃ (when all point On) | |
| Operation indicator | Input On, LED On | |
| External connection method | 42 point connecting connector (M3 X 6 screw) | |
| Weight | 900g | 800g |

| Circuit configuration | No. | contact | No. | contact | type |
|---|---|---|---|---|---|



Circuit configuration diagram with terminal block numbers (TB6, TB21, TB22, COM0, DC24V, TB24, TB39, TB40, COM1, DC24V), Photo coupler, R resistors, and Internal circuit.

| No. | contact | No. | contact |
|---|---|---|---|
| | | TB1 | RX |
| TB2 | 485+ | TB3 | TX |
| TB4 | 485- | TB5 | SG |
| TB6 | 00 | TB7 | 01 |
| TB8 | 02 | TB9 | 03 |
| TB10 | 04 | TB11 | 05 |
| TB12 | 06 | TB13 | 07 |
| TB14 | 08 | TB15 | 09 |
| TB16 | 0A | TB17 | 0B |
| TB18 | 0C | TB19 | 0D |
| TB20 | 0E | TB21 | 0F |
| **TB22** | **COM0** | TB23 | NC |
| TB24 | 10 | TB25 | 11 |
| TB26 | 12 | TB27 | 13 |
| TB28 | 14 | TB29 | 15 |
| TB30 | 16 | TB31 | 17 |
| TB32 | 18 | TB33 | 19 |
| TB34 | 1A | TB35 | 1B |
| TB36 | 1C | TB37 | 1D |
| TB38 | 1E | TB39 | 1F |
| **TB40** | **COM1** | TB41 | 24G |
| TB42 | 24V | | |

## 7.3 Basic Digital Output Unit Specification

### 7.3.1 XBM-DR16S relay output unit

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

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

## 7.3.2 XBM-DN16S transistor output unit (Sink type)

| Model / Specification | | Basic unit |
|---|---|---|
| | | XBM-DN16S |
| Output point | | 8 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | General output: 0.2A/ 1point, Output for positioning (P20, P21): 0.1A/ 1 point, 2A/1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | Zener Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 8 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 180 ㎃ (when all point On) |
| External power supply | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | Current | 10 ㎃ or less (DC24V connection) |
| Operation indicator | | Output On, LED On |
| External connection method | | 20 pin connector |
| Weight | | 100g |

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

### 7.3.3 XBM-DN32S transistor output unit (Sink type)

| Model Specification | | Basic unit |
|---|---|---|
| | | XBM-DN32S |
| Output point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | General output: 0.2A/ 1point, Output for positioning (P20, P21): 0.1A/ 1 point, 2A/1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | Zener Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 16 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 200 ㎃ (when all point On) |
| External power supply | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | Current | 10 ㎃ or less (DC24V connection) |
| Operation indicator | | Output On, LED On |
| External connection method | | 20 pin connector |
| Weight | | 110g |

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

### 7.3.4 XBC-DR32H output unit

| Model / Specification | Basic unit |
| --- | --- |
| | XBC-DR32H(/DC) |
| Output point | 16 point |
| Insulation method | Relay insulation |
| Rated load voltage/current | DC24V 2A (Resistive load) / AC220V 2A (COSΦ = 1), 5A/COM |
| Min. load voltage/current | DC5V / 1 ㎃ |
| Max. load voltage | AC250V, DC125V |
| Off leakage current | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. on/off frequency | 3,600 times / hour |
| Surge killer | None |

| Life | Mechanical | 20 million or above |
| --- | --- | --- |
| | Electrical | Rated load voltage / current one hundred thousand or above |
| | | AC200V / 1.5A, AC240V / 1A (COSΦ = 0.7) one hundred thousand or above |
| | | AC200V / 1A, AC240V / 0.5A (COSΦ = 0.35) one hundred thousand or above |
| | | DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) one hundred thousand or above |

| Response time | Off → On | 10 ㎳ or less |
| --- | --- | --- |
| | On → Off | 12 ㎳ or less |

| Common method | 4 point / COM |
| --- | --- |
| Proper cable size | Strand wire 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Internal consumption current | 360 ㎃ (When all output are on) |
| Operation indicator | Output On, LED On |
| External connection method | 24 point terminal block connector (M3 X 6 screw) |
| Weight | 600g |

| Circuit configuration | | No. | contact | No. | Contact | Type |
|---|---|---|---|---|---|---|
|  | | | | TB1 | AC100 ~ 240V |  |
| | | TB2 | PE | TB3 | | |
| | | TB4 | NC | TB5 | 20 | |
| | | TB6 | 21 | TB7 | 22 | |
| | | TB8 | 23 | TB9 | COM0 | |
| | | TB10 | 24 | TB11 | 25 | |
| | | TB12 | 26 | TB13 | 27 | |
| | | TB14 | COM1 | TB15 | 28 | |
| | | TB16 | 29 | TB17 | 2A | |
| | | TB18 | 2B | TB19 | COM2 | |
| | | TB20 | 2C | TB21 | 2D | |
| | | TB22 | 2E | TB23 | 2F | |
| | | TB24 | COM3 | | | |

Terminal block no.

## 7.3.5 XBC-DR64H output unit

| Model<br>Specification | | Basic unit<br>XBC-DR64H(/DC) |
|---|---|---|
| Output point | | 32 point |
| Insulation method | | Relay insulation |
| Rated load voltage/current | | DC24V 2A (resistive load) / AC220V 2A (COSΦ = 1), 5A/COM |
| Min. load voltage/current | | DC5V / 1 ㎃ |
| Max. load voltage | | AC250V, DC125V |
| Off leakage current | | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. on/off frequency | | 3,600 times / hour |
| Surge killer | | None |
| Life | Mechanical | 20 million or above |
| | Electrical | Rated load voltage / current one hundred thousand or above |
| | | AC200V / 1.5A, AC240V / 1A (COSΦ = 0.7) one hundred thousand or above |
| | | AC200V / 1A, AC240V / 0.5A (COSΦ = 0.35) one hundred thousand or above |
| | | DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) one hundred thousand or above |
| Response time | Off → On | 10 ㎳ or less |
| | On → Off | 12 ㎳ or less |
| Common method | | 4 point / COM (COM0~COM3), 8 point / COM (COM4~COM5) |
| Proper cable size | | Strand wire 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Internal consumption current | | 720 ㎃ (When all output are on) |
| Operation indicator | | Output On, LED On |
| External connection method | | 42 point terminal block connector (M3 X 6 screw) |
| Weight | | 900g |

| Circuit configuration | No. | Contact | No. | Contact | type |
|---|---|---|---|---|---|
| | | | TB1 | AC100 ~240V | |
| | TB2 | PE | TB3 | | |
| | TB4 | NC | | | |
| | TB6 | 21 | TB5 | 20 | |
| | | | TB7 | 22 | |
| | TB8 | 23 | | | |
| | | | TB9 | COM0 | |
| | TB10 | 24 | TB11 | 25 | |
| | TB12 | 26 | | | |
| | | | TB13 | 27 | |
| | TB14 | COM1 | TB15 | 28 | |
| | TB16 | 29 | | | |
| | | | TB17 | 2A | |
| | TB18 | 2B | TB19 | COM2 | |
| | TB20 | 2C | | | |
| | | | TB21 | 2D | |
| | TB22 | 2E | TB23 | 2F | |
| | TB24 | COM3 | | | |
| | | | TB25 | 30 | |
| | TB26 | 31 | TB27 | 32 | |
| | TB28 | 33 | | | |
| | | | TB29 | 34 | |
| | TB30 | 35 | TB31 | 36 | |
| | TB32 | 37 | | | |
| | | | TB33 | COM4 | |
| | TB34 | 38 | TB35 | 39 | |
| | TB36 | 3A | | | |
| | | | TB37 | 3B | |
| | TB38 | 3C | TB39 | 3D | |
| | TB40 | 3E | | | |
| | | | TB41 | 3F | |
| | TB42 | COM5 | | | |

Terminal block no.

### 7.3.6 XBC-DN32H output unit (Sink type)

| Model<br>Specification | | Basic unit |
|---|---|---|
| | | XBC-DN32H(/DC) |
| Output point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage/current | | DC 12 / 24V |
| Min. load voltage/current | | DC 10.2 ~ 26.4V |
| Max. load voltage | | General output: 0.5A/ 1point, 2A/1COM<br>Output for positioning (P20, P21, P22, P23): 0.1A/ 1 point, 0.4A/1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. on/off frequency | | 4A / 10 ㎳ or less |
| Surge killer | | DC 0.4V or less |
| Output point | | Zener diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 4 point / COM |
| Proper cable size | | Strand wire 0.3~0.75 ㎟ (external diameter 2.8 ㎜ or less) |
| Internal consumption current | | 400 ㎃ (When all output are on) |
| External power supply | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | Current | 25 ㎃ or less (When connecting DC24V) |
| Operation indicator | | Output On, LED On |
| External connection method | | 24 point terminal block connector (M3 X 6 screw) |
| Weight | | 500g |

| Circuit configuration | No. | Contact | No. | Contact | Type |
|---|---|---|---|---|---|
| | | | TB1 | AC100 ~240V | |
| | TB2 | PE | TB3 | | |
| | TB4 | P | TB5 | 20 | |
| | TB6 | 21 | TB7 | 22 | |
| | TB8 | 23 | TB9 | COM0 | |
| | TB10 | 24 | TB11 | 25 | |
| | TB12 | 26 | TB13 | 27 | |
| | TB14 | COM1 | TB15 | 28 | |
| | TB16 | 29 | TB17 | 2A | |
| | TB18 | 2B | TB19 | COM2 | |
| | TB20 | 2C | TB21 | 2D | |
| | TB22 | 2E | TB23 | 2F | |
| | TB24 | COM3 | | | |

Circuit configuration labels:
DC5V
INTERNAL CIRCUIT
TB05
TB08
TB09
DC12/24V
TB10
TB13
TB14
DC12/24V
TB15
TB18
TB19
DC12/24V
TB20
TB23
TB24
DC12/24V
TB04
Terminal block no.

Type column labels:
TB2 PE AC100~240V TB1
TB4 P TB3
TB6 P21 P20 TB5
TB8 P23 P22 TB7
TB10 P24 COM0 TB9
TB12 P26 P25 TB11
TB14 COM1 P27 TB13
TB16 P29 P28 TB15
TB18 P2B P2A TB17
TB20 P2C COM2 TB19
TB22 P2E P2D TB21
TB24 COM3 P2F TB23
TB26

### 7.3.7 XBC-DN64H output unit (Sink type)

| Model<br>Specification | | Basic unit<br>XBC-DN64H(/DC) |
|---|---|---|
| Output point | | 32 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load current | | General output: 0.5A/ 1point, 2A/1COM<br>Output for positioning (P20, P21, P22, P23): 0.1A/ 1 point, 0.4A/1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| On max. voltage drop | | DC 0.4V or less |
| Surge killer | | Zener diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, Resistive load) |
| Common method | | 4 point / COM (COM0~COM3), 8 point / COM (COM4~COM5) |
| Proper cable size | | Strand wire 0.3~0.75 ㎟ (external diameter 2.8 ㎜ or less) |
| Internal consumption current | | 500 ㎃ (When all output are on) |
| External power supply | Voltage | DC12/24V ± 10% (Ripple voltage 4 Vp-p or less) |
| | Current | 25 ㎃ or less (when connecting DC24V) |
| Operation indicator | | Output On, LED On |
| External connection method | | 42 point terminal block connector (M3 X 6 screw) |
| Weight | | 800g |

| Circuit configuration | No. | contact | No. | contact | Type |
|---|---|---|---|---|---|
| | | | TB1 | AC100 ~240V | |
| | TB2 | PE | TB3 | | |
| | TB4 | P | TB5 | 20 | |
| | TB6 | 21 | TB7 | 22 | |
| | TB8 | 23 | TB9 | COM0 | |
| | TB10 | 24 | TB11 | 25 | |
| | TB12 | 26 | TB13 | 27 | |
| | TB14 | COM1 | TB15 | 28 | |
| | TB16 | 29 | TB17 | 2A | |
| | TB18 | 2B | TB19 | COM2 | |
| | TB20 | 2C | TB21 | 2D | |
| | TB22 | 2E | TB23 | 2F | |
| | TB24 | COM3 | TB25 | 30 | |
| | TB26 | 31 | TB27 | 32 | |
| | TB28 | 33 | TB29 | 34 | |
| | TB30 | 35 | TB31 | 36 | |
| | TB32 | 37 | TB33 | COM4 | |
| | TB34 | 38 | TB35 | 39 | |
| | TB36 | 3A | TB37 | 3B | |
| | TB38 | 3C | TB39 | 3D | |
| | TB40 | 3E | TB41 | 3F | |
| | TB42 | COM5 | | | |

Terminal block no.

## 7.4  Digital Input Module Specification
### 7.4.1  8 point DC24V input module (Source/Sink type)

| Model<br>Specification | DC input module |
|---|---|
| | XBE-DC08A |
| Input point | 8 point |
| Insulation method | Photo coupler insulation |
| Rated input voltage | DC24V |
| Rated input current | About 4 ㎃ |
| Operation voltage range | DC20.4~28.8V (ripple rate < 5%) |
| On Voltage/Current | DC19V or higher / 3 ㎃ or higher |
| Off Voltage/Current | DC6V or less / 1 ㎃ or less |
| Input resistance | About 5.6 ㏀ |
| Response time   Off → On <br> On → Off | 1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳ |
| Insulation pressure | AC560Vrms / 3Cycle (altitude 2000m) |
| Insulation resistance | 10 ㏁ or more by Megohmmeter |
| Common method | 8 point / COM |
| Proper cable size | Stranded pair 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | 30 ㎃ (when all point On) |
| Operation indicator | Input On, LED On |
| External connection method | 10 point terminal block connector |
| Weight | 52 g |

| Circuit configuration | No. | Contact | Type |
|---|---|---|---|
| | TB2 | 0 | |
| | TB2 | 1 | TB1 |
| | TB3 | 2 | TB2 |
| | TB4 | 3 | TB3<br>TB4 |
| | TB5 | 4 | TB5 |
| | TB6 | 5 | TB6 |
| | TB7 | 6 | TB7 |
| | TB8 | 7 | TB8 |
| | TB9 | COM | TB9 |
| | TB10 | COM | TB10 |

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

| Model | DC input module | |
|---|---|---|
| Specification | XBE-DC16A | XBE-DC16B |
| Input point | 16 point | |
| Insulation method | Photo coupler insulation | |
| Rated input voltage | DC24V | DC12/24V |
| Rated input current | About 4 ㎃ | About 4/8 ㎃ |
| Operation voltage range | DC20.4~28.8V (ripple rate < 5%) | |
| On Voltage/Current | DC19V or higher / 3 ㎃ or higher | DC9V or higher / 3 ㎃ or higher |
| Off Voltage/Current | DC6V or less / 1 ㎃ or less | DC5V or less / 1 ㎃ or less |
| Input resistance | About 5.6 ㏀ | About 2.7 ㏀ |
| Response time — Off → On | 1/3/5/10/20/70/100 ㎳ (set by CPU parameter) Default: 3 ㎳ | |
| Response time — On → Off | | |
| Insulation pressure | AC560Vrms / 3Cycle (altitude 2000m) | |
| Insulation resistance | 10 ㏁ or more by Megohmmeter | |
| Common method | 16 point / COM | |
| Proper cable size | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) | |
| Current consumption | 40 ㎃ (when all point On) | |
| Operation indicator | Input On, LED On | |
| External connection method | 8 pin terminal block connector + 10 pin terminal block connector | |
| Weight | 53 g | |

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

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

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

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



Input Derating diagram

### 7.4.4  8point AC110V input module

| Model<br>Specification | AC input module<br>XBE-AC08A | | | |
|---|---|---|---|---|
| Input point | 8 point | | | |
| Insulation method | Photo coupler insulation | | | |
| Rated input voltage | AC100-120V(+10/-15%) 50/60 ㎐(±3 ㎐) (distortion rate < 5%) | | | |
| Rated input current | About 8 ㎃(AC100,60 ㎐), About 7mA(AC100, 50 ㎐) | | | |
| Inrush current | Max. 200 ㎃ 1 ㎳ (AC132V) | | | |
| Input Derating | Refer to the below Derating diagram. | | | |
| On Voltage/Current | AC80V or higher / 5 mA or higher (50 ㎐, 60 ㎐) | | | |
| Off Voltage/Current | AC30V or lower / 1 mA or lower (50 ㎐, 60 ㎐) | | | |
| Input resistance | About 12 kΩ(60 ㎐), About 15 kΩ(50 ㎐) | | | |
| Response time | Off → On | 20 ms or less (AC100V 50 ㎐, 60 ㎐) | | |
| | On → Off | 25 ms or less (AC100V 50 ㎐, 60 ㎐) | | |
| Insulation pressure | AC3000Vrms / 3Cycle (altitude 2000m) | | | |
| Insulation resistance | 10 ㏁ or more by Megohmmeter | | | |
| Common method | 4 point / COM | | | |
| Proper cable size | Twisted pair 0.3~0.75 ㎟ (external diameter 2.8mm or less) | | | |
| Current consumption | 30 ㎃ (when all point On) | | | |
| Operation indicator | Input On, LED On | | | |
| External connection method | 10 point terminal block connector | | | |
| Weight | 70 g | | | |
| Circuit configuration | | No. | Contact | Type |
|  | | TB1 | 0 | |
| | | TB2 | 1 |  |
| | | TB3 | 2 | |
| | | TB4 | 3 | |
| | | TB5 | COM0 | |
| | | TB6 | 4 | |
| | | TB7 | 5 | |
| | | TB8 | 6 | |
| | | TB9 | 7 | |
| | | TB10 | COM1 | |
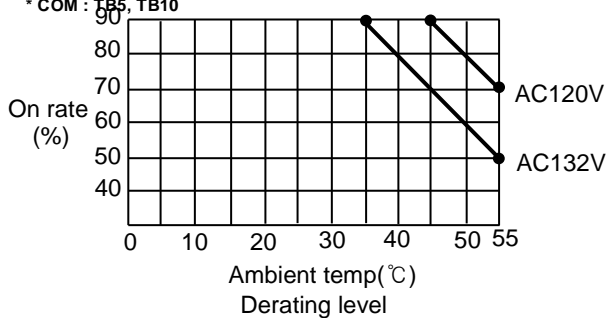
## 7.5  Digital Output Module Specification

### 7.5.1  8 point relay output module

| Model / Specification | Relay output module |
|---|---|
| | XBE-RY08A |
| Output point | 8 point |
| Insulation method | Relay insulation |
| Rated load voltage / Current | DC24V 2A (Resistive load) / AC220V 2A (COSΨ = 1), 5A/COM |
| Min. load voltage/Current | DC5V / 1 mA |
| Max. load voltage/Current | AC250V, DC125V |
| Off leakage current | 0.1 mA  (AC220V, 60 Hz) |
| Max. On/Off frequency | 3,600 times/hr |
| Surge absorber | None |
| Service life — Mechanical | 20 millions times or more |
| Service life — Electrical | Rated load voltage / current 100,000 times or more |
| | AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or more |
| | AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or more |
| | DC24V / 1A, DC100V / 0.1A (L / R = 7 ms) 100,000 times or more |
| Response time — Off → On | 10 ms  or less |
| Response time — On → Off | 12 ms  or less |
| Common method | 8 point / COM |
| Proper cable size | Stranded cable 0.3~0.75 mm² (External diameter 2.8 mm  or less) |
| Current consumption | 230 mA  (when all point On) |
| Operation indicator | Output On, LED On |
| External connection method | 9 pin terminal block connector |
| Weight | 80g |

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

## 7.5.2  8 point relay output module(Relay insulation)

| Model | Relay output module |
|---|---|
| Specification | XBE-RY08B |
| Output point | 8 point |
| Insulation method | Relay insulation |
| Rated load voltage / Current | DC24V 2A (Resistive load) / AC220V 2A (COS$\Psi$ = 1), 5A/COM |
| Min. load voltage/Current | DC5V / 1 mA |
| Max. load voltage/Current | AC250V, DC125V |
| Off leakage current | 0.1 mA (AC220V, 60 Hz) |
| Max. On/Off frequency | 3,600 times/hr |
| Surge absorber | None |

| Service life | Mechanical | 20 millions times or more |
|---|---|---|
| | Electrical | Rated load voltage / current 100,000 times or more |
| | | AC200V / 1.5A, AC240V / 1A (COS$\Psi$ = 0.7) 100,000 times or more |
| | | AC200V / 1A, AC240V / 0.5A (COS$\Psi$ = 0.35) 100,000 times or more |
| | | DC24V / 1A, DC100V / 0.1A (L / R = 7 ms) 100,000 times or more |
| Response time | Off → On | 10 ms or less |
| | On → Off | 12 ms or less |

| Common method | 8 point / COM |
|---|---|
| Proper cable size | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 mm or less) |
| Current consumption | 230 mA (when all point On) |
| Operation indicator | Output On, LED On |
| External connection method | 9 pin terminal block connector |
| Weight | 81g |

| Circuit configuration | No. | Contact | Type |
|---|---|---|---|
| | TB1 | 0 | |
| | TB2 | COM0 | |
| | TB3 | 1 | |
| | TB4 | COM1 | |
| | TB5 | 2 | |
| | TB6 | COM2 | |
| | TB7 | 3 | |
| | TB8 | COM3 | |
| | TB9 | NC | |
| | TB1 | 4 | |
| | TB2 | COM4 | |
| | TB3 | 5 | |
| | TB4 | COM5 | |
| | TB5 | 6 | |
| | TB6 | COM6 | |
| | TB7 | 7 | |
| | TB8 | COM7 | |
| | TB9 | NC | |

Internal circuit

DC5V

Terminal block no.

## 7.5.3 16 point relay output module

| Model / Specification | Relay output module |
|---|---|
| | XBE-RY16A |
| Output point | 16 point |
| Insulation method | Relay insulation |
| Rated load voltage/ current | DC24V 2A (Resistive load) / AC220V 2A (COSΨ = 1), 5A/COM |
| Min. load voltage/current | DC5V / 1 ㎃ |
| Max. load voltage/current | AC250V, DC125V |
| Off leakage current | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. On/Off frequency | 3,600 times/hr |
| Surge absorber | None |

| Service life | Mechanical | 20 millions times or more |
|---|---|---|
| | Electrical | Rated load voltage / current 100,000 times or more |
| | | AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or more |
| | | AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or more |
| | | DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) 100,000 times or more |
| Response time | Off → On | 10 ㎳ or less |
| | On → Off | 12 ㎳ or less |
| Common method | | 8 point / COM |
| Proper cable size | | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | | 420 ㎃ (when all point On) |
| Operation indicator | | Output On, LED On |
| External connection method | | 9 pin terminal block connector x 2 ea |
| Weight | | 130g |

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

## 7.5.4  8 point transistor output module (Sink type)

| Model / Specification | | Transistor output module |
|---|---|---|
| | | XBE-TN08A |
| Output point | | 8 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.5A / 1 point |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | Zener Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 8 point / COM |
| Proper cable size | | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | | 40 ㎃ (when all point On) |
| External power supply | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | Current | 10 ㎃ or less (DC24V connection) |
| Operation indicator | | Output On, LED On |
| External connection method | | 10 pin terminal block connector |
| Weight | | 52g |

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

## 7.5.5  16 point transistor output module (Sink type)

| Model<br>Specification | Transistor output module |
|---|---|
| | XBE-TN16A |
| Output point | 16 point |
| Insulation method | Photo coupler insulation |
| Rated load voltage | DC 12 / 24V |
| Load voltage range | DC 10.2 ~ 26.4V |
| Max. load voltage | 0.5A / 1 point, 2A / 1COM |
| Off leakage current | 0.1 ㎃ or less |
| Max. inrush current | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | DC 0.4V or less |
| Surge absorber | Zener Diode |
| Response time — Off → On | 1 ㎳ or less |
| Response time — On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | 16 point / COM |
| Proper cable size | Stranded cable 0.3~0.75 ㎟ (External diameter 2.8 ㎜ or less) |
| Current consumption | 60 ㎃ (when all point On) |
| External power supply — Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| External power supply — Current | 10 ㎃ or less (DC24V connection) |
| Operation indicator | Output On, LED On |
| External connection method | 8 pin terminal block connector + 10 pin terminal block connector |
| Weight | 54 g |

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

### 7.5.6  32 point transistor output module (Sink type)

| Model / Specification | Transistor output module |
|---|---|
| | XBE-TN32A |
| Output point | 32 point |
| Insulation method | Photo coupler insulation |
| Rated load voltage | DC 12 / 24V |
| Load voltage range | DC 10.2 ~ 26.4V |
| Max. load voltage | 0.2A / 1 point, 2A / 1COM |
| Off leakage current | 0.1 ㎃ or less |
| Max. inrush current | 0.7A / 10 ㎳ or less |
| Max. voltage drop (On) | DC 0.4V or less |
| Surge absorber | Zener Diode |
| Response time — Off → On | 1 ㎳ or less |
| Response time — On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | 32 point / COM |
| Proper cable size | 0.3 ㎟ |
| Current consumption | 120 ㎃ (when all point On) |
| External power supply — Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| External power supply — Current | 20 ㎃ or less (DC24V connection) |
| Operation indicator | Output On, LED On |
| External connection method | 40 pin connector |
| Weight | 60g |

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

Internal circuit

DC5V

B20

A05

B01,B02

A01,A02

DC12/24V

Connector no.

## 7.5.7  8 point transistor output module (Source type)

| Model / Specification | Transistor output module |
| --- | --- |
| | XBE-TP08A |
| Output point | 8 point |
| Insulation method | Photo coupler insulation |
| Rated load voltage | DC 12 / 24V |
| Load voltage range | DC 10.2 ~ 26.4V |
| Max. load voltage | 0.5A / 1 point |
| Off leakage current | 0.1 ㎃ or less |
| Max. inrush current | 4A / 10 ㎳ or less |
| Max. voltage drop (On) | DC 0.4V or less |
| Surge absorber | Zener Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | 8 point / COM |
| Proper cable size | Stranded cable 0.3~0.75 ㎟ (external diameter 2.8 ㎜ or less) |
| Current consumption | 40 ㎃ (when all outputs are on) |
| External power | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | Current | 10 ㎃ or less (when connecting DC24V) |
| Operation indicator | LED on when output on |
| External connection method | 10 pin terminal block connector |
| Weight | 30g |

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

## 7.5.8 16 point transistor output module (Source type)

| Model / Specification | | Transistor output module |
|---|---|---|
| | | XBE-TP16A |
| Output point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.5A / 1 point, 2A / 1COM |
| Off leakage current | | 0.1 mA or less |
| Max. inrush current | | 4A / 10 ms or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | Zener Diode |
| Response time | Off → On | 1 ms or less |
| | On → Off | 1 ms or less (Rated load, resistive load) |
| Common method | | 16 point / COM |
| Proper cable size | | Stranded cable 0.3~0.75 mm² (external diameter 2.8 mm or less) |
| Current consumption | | 60 mA (When all outputs are on) |
| External power | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | Current | 10 mA or less (connecting DC24V) |
| Operation indicator | | LED On when output On |
| External connection method | | 8 pin terminal block connector + 10 pin terminal block connector |
| Weight | | 40g |

| Circuit configuration | No. | Contact | Type |
|---|---|---|---|
| | TB01 | 0 | |
| | TB02 | 1 | |
| | TB03 | 2 | |
| | TB04 | 3 | |
| | TB05 | 4 | |
| | TB06 | 5 | |
| | TB07 | 6 | |
| | TB08 | 7 | |
| | TB01 | 8 | |
| | TB02 | 9 | |
| | TB03 | A | |
| | TB04 | B | |
| | TB05 | C | |
| | TB06 | D | |
| | TB07 | E | |
| | TB08 | F | |
| | TB09 | COM | |
| | TB10 | 0V | |

## 7.5.9  32 point transistor output module (Source type)

| Model / Specification | Transistor output module |
|---|---|
| | XBE-TP32A |
| Output point | 32 point |
| Insulation method | Photo coupler insulation |
| Rated load voltage | DC 12 / 24V |
| Load voltage range | DC 10.2 ~ 26.4V |
| Max. load voltage | 0.2A / 1 point, 2A / 1COM |
| Off leakage current | 0.1 ㎃  or less |
| Max. inrush current | 4A / 10 ㎳  or less |
| Max. voltage drop (On) | DC 0.4V or less |
| Surge absorber | Zener Diode |
| Response time · Off → On | 1 ㎳  or less |
| Response time · On → Off | 1 ㎳  or less (Rated load, resistive load) |
| Common method | 32 point / COM |
| Proper cable size | 0.3 ㎟ |
| Current consumption | 120 ㎃  (When all outputs are on) |
| External power · Voltage | DC12/24V $\pm$ 10% (ripple voltage 4 Vp-p or less) |
| External power · Current | 20 ㎃  or less (connecting DC24V) |
| Operation indicator | LED On when output On |
| External connection method | 40 pin connector |
| Weight | 60g |

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



DC5V
LED
Internal circuit
B02,B01
DC12/24V
A02,A01
A05
B20
Connector No.

## 7.6 Digital I/O Mixed module Input Specification
### 7.6.1 8 point DC24V input (Source/Sink type)

| Model<br>Specification | DC input module |
|---|---|
| | XBE-DR16A |
| Input point | 8 point |
| Insulation method | Photo coupler insulation |
| Rated input voltage | DC24V |
| Rated input current | About 4 mA |
| Operation voltage range | DC20.4~28.8V (within ripple rate 5%) |
| On Voltage/Current | DC19V or higher / 3 mA or higher |
| Off Voltage/Current | DC6V or less / 1 mA or less |
| Input resistance | About 5.6 kΩ |
| Response time | Off → On / On → Off: 1/3/5/10/20/70/100 ms (set by CPU parameter) Default: 3 ms |
| Insulation pressure | AC560Vrms / 3Cycle (altitude 2000m) |
| Insulation resistance | 10 MΩ or more by Megohmmeter |
| Common method | 8 point / COM |
| Proper cable size | Stranded cable 0.3~0.75 mm² (External diameter 2.8 mm or less) |
| Current consumption | 280 mA (When all inputs and outputs are on) |
| Operation indicator | LED on when input on |
| External connection method | 9 pin terminal block connector |
| Weight | 81g |

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

## 7.6.2 16 point DC24V input (Source/Sink type)

| Model / Specification | | DC input module |
|---|---|---|
| | | XBE-DN32A |
| Input point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated input voltage | | DC24V |
| Rated input current | | About 4 mA |
| Operation voltage range | | DC20.4~28.8V    (ripple rate < 5%) |
| Input Derating | | Refer to Derating diagram |
| On Voltage/Current | | DC 19V or higher / 3 mA  or higher |
| Off Voltage/Current | | DC 6V or less / 1 mA  or less |
| Input resistance | | About 5.6 kΩ |
| Response time | Off → On | 1/3/5/10/20/70/100 ㎳    (set by CPU parameter) Default:3 ㎳ |
| | On → Off | |
| Insulation pressure | | AC 560Vrms / 3 Cycle    (altitude 2000m) |
| Insulation resistance | | 10 ㏁  or more by Megohmmeter |
| Common method | | 16 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 60 ㎃    (When all inputs and outputs are on) |
| Operation indicator | | Input On, LED On |
| External connection method | | 40 pin connector |
| Weight | | 60g |

| Circuit configuration | No. | Contact | No. | Contact | Type |
|---|---|---|---|---|---|
| | B20 | 00 | A20 | 20 | |
| | B19 | 01 | A19 | 21 | |
| | B18 | 02 | A18 | 22 | |
| | B17 | 03 | A17 | 23 | |
| | B16 | 04 | A16 | 24 | |
| | B15 | 05 | A15 | 25 | |
| | B14 | 06 | A14 | 26 | |
| | B13 | 07 | A13 | 27 | |
| | B12 | 08 | A12 | 28 | |
| | B11 | 09 | A11 | 29 | |
| | B10 | 0A | A10 | 2A | |
| | B09 | 0B | A09 | 2B | |
| | B08 | 0C | A08 | 2C | |
| | B07 | 0D | A07 | 2D | |
| | B06 | 0E | A06 | 2E | |
| | B05 | 0F | A05 | 2F | |
| | B04 | NC | A04 | P | |
| | B03 | NC | A03 | P | |
| | B02 | IN_COM | A02 | OUT_COM | |
| | B01 | IN_COM | A01 | OUT_COM | |



Input Derating diagram

## 7.7  Digital I/O Mixed module Output Specification
### 7.7.1  8 point relay output

| Model / Specification | Relay output module |
|---|---|
| | XBE-DR16A |
| Output point | 8 point |
| Insulation method | Relay insulation |
| Rated load voltage / Current | DC24V 2A(Resistive load) / AC220V 2A(COSΨ = 1), 5A/COM |
| Min. load voltage/Current | DC5V / 1 ㎃ |
| Max. load voltage | AC250V, DC125V |
| Off leakage current | 0.1 ㎃ (AC220V, 60 ㎐) |
| Max. On/Off frequency | 3,600 times/hr |
| Surge absorber | None |

| Service life | Mechanical | 20 millions times or more |
|---|---|---|
| | Electrical | Rated load voltage / current 100,000 times or more |
| | | AC200V / 1.5A, AC240V / 1A (COSΨ = 0.7) 100,000 times or more |
| | | AC200V / 1A, AC240V / 0.5A (COSΨ = 0.35) 100,000 times or more |
| | | DC24V / 1A, DC100V / 0.1A (L / R = 7 ㎳) 100,000 times or more |

| Response time | Off → On | 10 ㎳ or less |
|---|---|---|
| | On → Off | 12 ㎳ or less |

| Common method | 8 point / COM |
|---|---|
| Proper cable size | Stranded cable 0.3~0.75 ㎟ (external diameter 2.8 ㎜ or less) |
| Current consumption | 280 ㎃ (When all inputs and outputs are on) |
| Operation indicator | LED on when output on |
| External connection method | 9 pin terminal block connector |
| Weight | 81g |

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

## 7.7.2  16 point transistor output (Sink type)

| Model / Specification | | Transistor output module |
|---|---|---|
| | | XBE-DN32A |
| Output point | | 16 point |
| Insulation method | | Photo coupler insulation |
| Rated load voltage | | DC 12 / 24V |
| Load voltage range | | DC 10.2 ~ 26.4V |
| Max. load voltage | | 0.2A / 1 point, 2A / 1COM |
| Off leakage current | | 0.1 ㎃ or less |
| Max. inrush current | | 0.7A / 10 ㎳ or less |
| Max. voltage drop (On) | | DC 0.4V or less |
| Surge absorber | | TVS Diode |
| Response time | Off → On | 1 ㎳ or less |
| | On → Off | 1 ㎳ or less (Rated load, resistive load) |
| Common method | | 16 point / COM |
| Proper cable size | | 0.3 ㎟ |
| Current consumption | | 60 ㎃ (When all inputs and outputs are on) |
| External power supply | Voltage | DC12/24V ± 10% (ripple voltage 4 Vp-p or less) |
| | Current | 20 ㎃ or less (DC24V connection) |
| Operation indicator | | Output On, LED On |
| External connection method | | 40 pin connector |
| Weight | | 60g |

| Circuit configuration | No. | Contact | No. | Contact | Type |
|---|---|---|---|---|---|
| | B20 | 00 | A20 | 20 | |
| | B19 | 01 | A19 | 21 | |
| | B18 | 02 | A18 | 22 | |
| | B17 | 03 | A17 | 23 | |
| | B16 | 04 | A16 | 24 | |
| | B15 | 05 | A15 | 25 | |
| | B14 | 06 | A14 | 26 | |
| | B13 | 07 | A13 | 27 | |
| | B12 | 08 | A12 | 28 | |
| | B11 | 09 | A11 | 29 | |
| | B10 | 0A | A10 | 2A | |
| | B09 | 0B | A09 | 2B | |
| | B08 | 0C | A08 | 2C | |
| | B07 | 0D | A07 | 2D | |
| | B06 | 0E | A06 | 2E | |
| | B05 | 0F | A05 | 2F | |
| | B04 | NC | A04 | P | |
| | B03 | NC | A03 | P | |
| | B02 | IN_COM | A02 | OUT_COM | |
| | B01 | IN_COM | A01 | OUT_COM | |



Circuit configuration: DC5V, Internal circuit, R, A20, A05, A03.A04, A01,A02, DC12/24V Terminal block no.

## 7.8 IO Wiring by Using Smart Link Board
### 7.8.1 Smart link board

Easy wiring is available by connecting the IO connector with smart link board.
The available smart link and IO cable are as follows.

| XGB | | Smart link | | Connection cable | | |
|---|---|---|---|---|---|---|
| Item | Model | Model | No. of Pin | Model | Length | Contents |
| Main unit | XBM-DN32S | XTB-40H | 40 | R40H/20HH-05S-XBM3 R40H/20HH-10S-XBM3 | 0.5m~ 1m | For main unit connection (20Pin + 20Pin) |
| | XBM-DN16S | | | | | |
| Expansion module | XBE-DC32A | XTB-40H | 40 | C40HH-05SB-XBE C40HH-10SB-XBE C40HH-15SB-XBE C40HH-20SB-XBE C40HH-30SB-XBE | 0.5m~ 3m | For expansion module connection (40Pin) |
| | XBE-TN32A | XTB-40H | 40 | | | |
| | | R32C-NS5A-40P | 40 | | | For expansion module connection (40Pin) Exclusive for relay built-in SLP type |

It describes wring of XGB, XTB-40H and R40H/20HH-10S-XBM3.
For wring of other smart link boards or XGB extension module, refer to XGB user manual for hardware.

1) XTB-40H terminal array

Terminal array of XTB-40H is as follows.
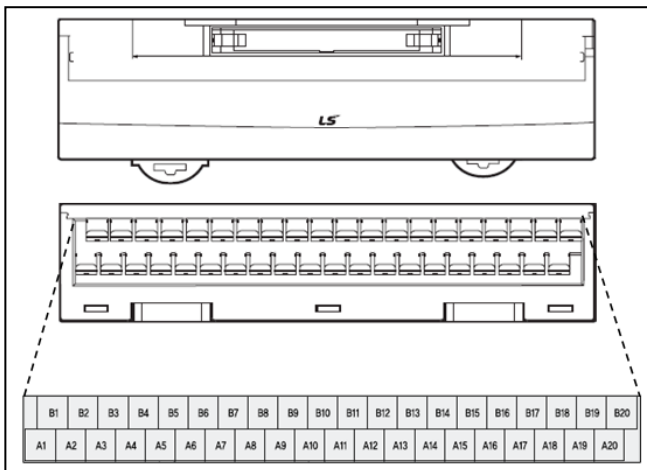


| Item | | Specification |
|---|---|---|
| Rated voltage | | AC125 / DC 24[V] |
| Rated current | | Max. 1[A] |
| Withstanding voltage | | 500V 1min |
| Insulation resistor | | 100 ㏁ (DC500V) |
| Cable specification | | AWG22-16 (1.5mm$^2$ / MAX) |
| Terminal/screw | | M3 X 8L |
| Torque | | 1.2N·m (12kgf·cm) |
| material | Terminal | Modifide PP0 |
| | Cover | Polycarbonate |
| | PCB | Epoxy 1.6t |

2) Wiring of XTB-40H and XGB main unit
   Wiring of XGB main unit through XTB-40H and R40H/20HH-10S-XBM3 is as follows.



| XBM-DN16S | R40H/20HH-10S-XBM3 | XTB-40H |

At this time, relationship of XGB IO signal and Smart link board terminal number is as follows.
The following figure describes signal allocation when R40H/20HH-05S-XBM3   is used as connection cable. When the user makes the cable, make sure that wring is done as figure below.
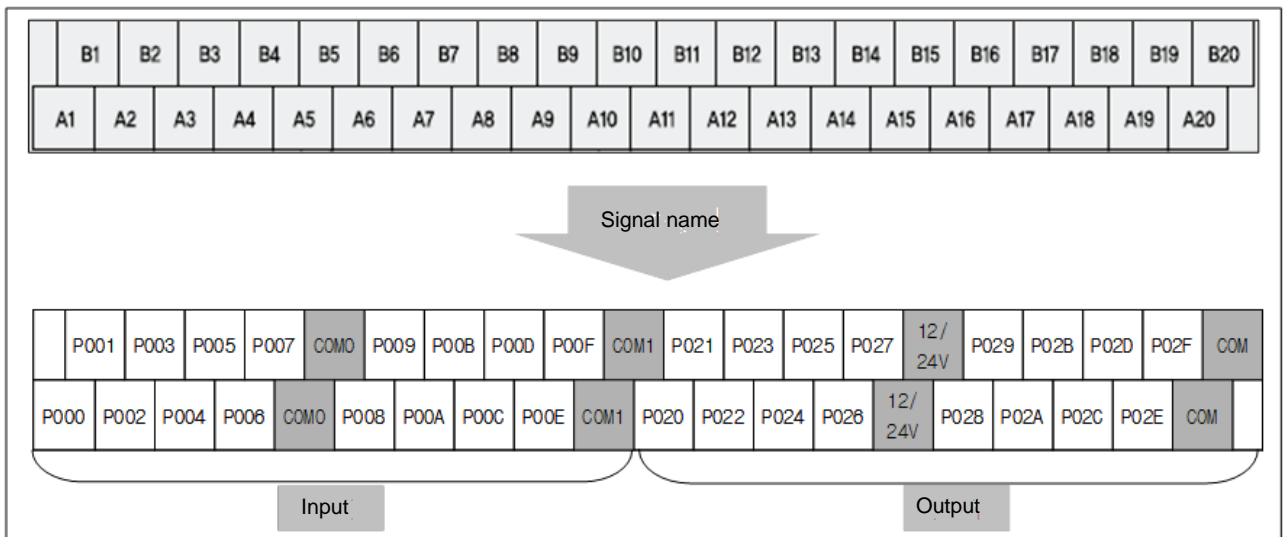
3) Wiring of XTB-40H and XGB extension modulet
Wiring of XGB extension module through XTB-40H and C40HH-10SB-XBE SLT-CT101-XBE is as follows.
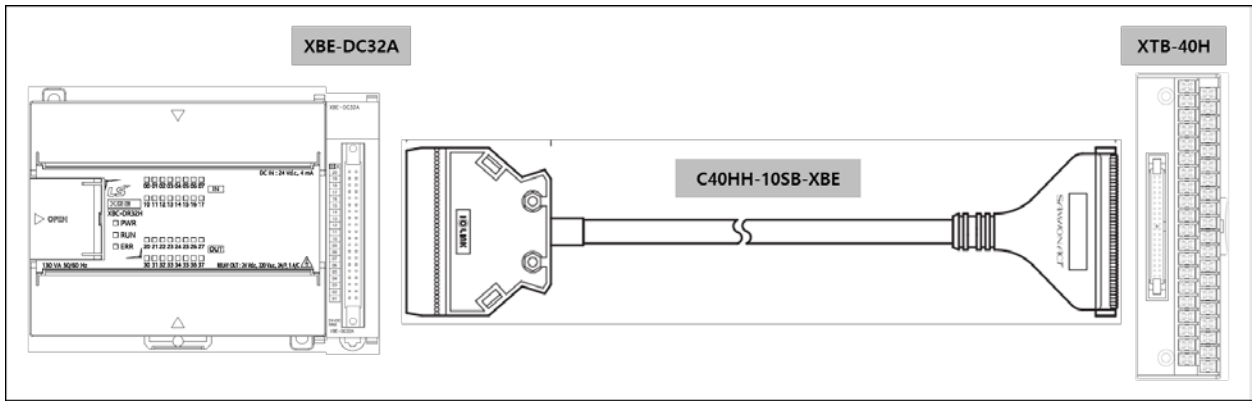


At this time, relationship of XGB IO signal and Smart link board terminal number is as follows.
The following figure describes signal allocation when C40HH-10SB -XBE is used as connection cable.
When the user makes the cable, make sure that wring is done as figure below.
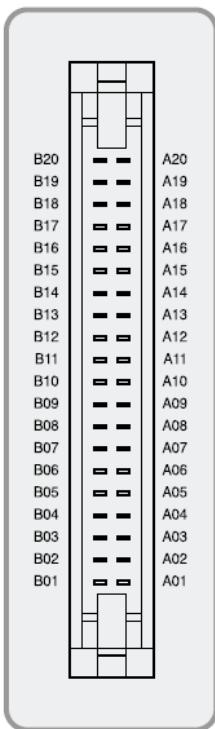


| Pin No. | | PLC | | | | | | Terminal block Name | |
|---|---|---|---|---|---|---|---|---|---|
| | | XBE-DC32A | | XBE-TN32A | | XBE-TP32A | | Terminal block board (SLP-T40P) | |
| B20 | A20 | 00 | 10 | 00 | 10 | 00 | 10 | A1 | A11 |
| B19 | A19 | 01 | 11 | 01 | 11 | 01 | 11 | B1 | B11 |
| B18 | A18 | 02 | 12 | 02 | 12 | 02 | 12 | A2 | A12 |
| B17 | A17 | 03 | 13 | 03 | 13 | 03 | 13 | B2 | B12 |
| B16 | A16 | 04 | 14 | 04 | 14 | 04 | 14 | A3 | A13 |
| B15 | A15 | 05 | 15 | 05 | 15 | 05 | 15 | B3 | B13 |
| B14 | A14 | 06 | 16 | 06 | 16 | 06 | 16 | A4 | A14 |
| B13 | A13 | 07 | 17 | 07 | 17 | 07 | 17 | B4 | B14 |
| B12 | A12 | 08 | 18 | 08 | 18 | 08 | 18 | A5 | A15 |
| B11 | A11 | 09 | 19 | 09 | 19 | 09 | 19 | B5 | B15 |
| B10 | A10 | 0A | 1A | 0A | 1A | 0A | 1A | A6 | A16 |
| B09 | A09 | 0B | 1B | 0B | 1B | 0B | 1B | B6 | B16 |
| B09 | A08 | 0C | 1C | 0C | 1C | 0C | 1C | A7 | A17 |
| B07 | A07 | 0D | 1D | 0D | 1D | 0D | 1D | B7 | B17 |
| B06 | A06 | 0E | 1E | 0E | 1E | 0E | 1E | A8 | A18 |
| B05 | A05 | 0F | 1F | 0F | 1F | 0F | 1F | B8 | B18 |
| B04 | A04 | NC | NC | NC | NC | NC | NC | A9 | A19 |
| B03 | A03 | NC | NC | NC | NC | NC | NC | B9 | B19 |
| B02 | A02 | COM | COM | DC12/24V | COM | COM | DC0V | A10 | A20 |
| B01 | A01 | | | | | | | B10 | B20 |

4) I/O wiring
- XBE-DC32A (XTB-40H)



DC 24V

- XBE-TN32A (XTB-40H)



DC 12/24V

- XBE-TP32A (XTB-40H)



DC 12/24V
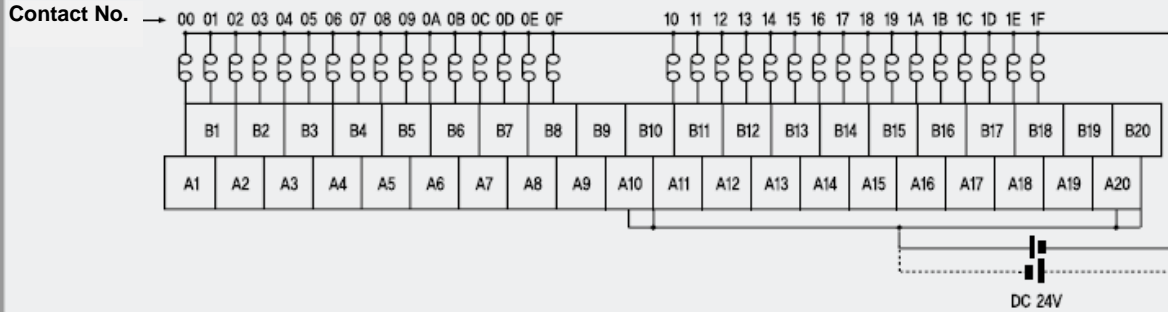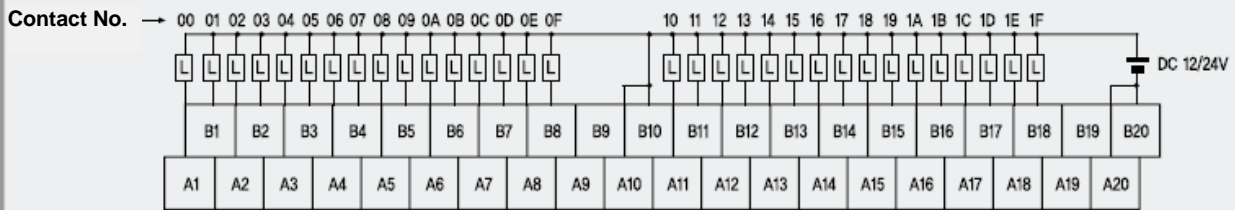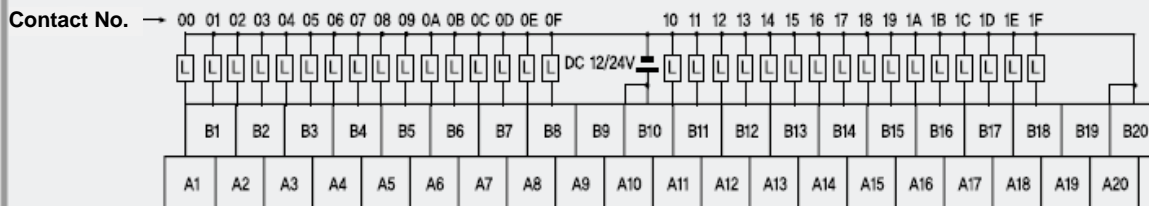
- XBE-TN32A (R32C-NS5A-40P)
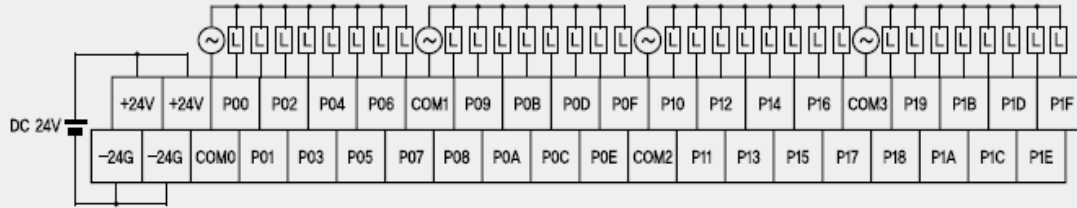
# Chapter 8 Built-in High-speed Counter Function

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

## 8.1  High-speed Counter Specifications

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

### 8.1.1 Performance specifications

(1)  Performance specification

| Classification | | Description | |
|---|---|---|---|
| | | "S" type | "H" type |
| Count input signal | Signal | A-phase, B-phase | |
| | Input type | Voltage input (Open collector) | |
| | Signal level | 24V | |
| Max. coefficient speed | | 20 kpps | 100 kpps |
| Number of channels | 1 phase | 4 (20kpps 4 channels) | 8 (10kpps 4 channels/20kpps 4 channels) |
| | 2 phase | 2 — In case of 2 multiplication: 10kpps / In case of 4 multiplication: 8kpps | 4 — (50kpps 2 channels/ 10kpps 2 channels) / (50kpps 2 channels/ 8kpps 2 channels) |
| Coefficient range | | Signed 32 Bit (-2,147,483,648 ~ 2,147,483,647) | |
| Count mode (Program setting) | | Linear count (if 32-bit range exceeded, Carry/Borrow occurs) Counter max. and min. value is indicated | |
| | | Ring count (repeated count within setting range) | |
| Input mode (Program setting) | | 1-phase input | |
| | | 2-phase input | |
| | | CW/CCW input | |
| Signal type | | Voltage | |
| Up/Down setting | 1 phase input | Increasing/decreasing operation setting by B-phase input | |
| | | Increasing/decreasing operation setting by program | |
| | 2 phase input | Automatic setting by difference in phase | |
| | CW/CCW | A-phase input: increasing operation | |
| | | B-phase input: decreasing operation | |
| Multiplication function | 1 phase input | 1 multiplication | |
| | 2 phase input | 4 multiplication | |
| | CW/CCW | 1 multiplication | |
| Control input | Signal | Preset instruction input | |
| | Signal level | DC 24V input type | |
| | Signal type | Voltage | |
| External output | Output points | 1 point/channel (for each channel) :output contact point of basic unit available | 2 point/channel (for each channel) :output contact point of basic unit available |
| | Type | Select single-compared (>, >=, =, =<, <) or section compared output (included or excluded) (program setting) | |

| Classification | | Description | |
|---|---|---|---|
| | | "S" type | "H" type |
| | Output type | Relay, Open-collector output (Sink) | |
| Count Enable | | To be set through program (count available only in enable status) | |
| Preset function | | To be set through terminal (contact) or program | |
| Auxiliary mode | | Count Latch | |

(2) Counter/Preset input specification

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

## 8.1.2 Designation of parts

(1) Designation of parts

| Name | "S"type | | "H" type |
|---|---|---|---|
| | XBM-DN16/32S | XBM-DR16S | XBC-DN32/64H,XBC-DR32.64H |
| Structure |  |  |  |

(a) "S" type

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

(b) "H" type

| Terminal No. | Names | | Usage | |
|---|---|---|---|---|
| | 1-phase | 2-phase | 1-phase | 2-phase |
| P000 | Ch0 counter input | Ch0 A-phase input | Counter input terminal | A-phase input |
| P001 | Ch1 counter input | Ch0 B-phase input | Counter input terminal | B-phase input |
| P002 | Ch2 counter input | Ch2 A-phase input | Counter input terminal | A-phase input |
| P003 | Ch3 counter input | Ch2 B-phase input | Counter input terminal | B-phase input |
| P004 | Ch4 counter input | Ch4 A-phase input | Counter input terminal | A-phase input |
| P005 | Ch5 counter input | Ch4 B-phase input | Counter input terminal | B-phase input |
| P006 | Ch6 counter input | Ch6 A-phase input | Counter input terminal | A-phase input |
| P007 | Ch7 counter input | Ch6 B-phase input | Counter input terminal | B-phase input |

| | | | | |
|---|---|---|---|---|
| P008 | Ch0 preset 24V | Ch0 preset 24V | Preset input terminal | Preset input terminal |
| P009 | Ch1 preset 24V | - | Preset input terminal | No use |
| P00A | Ch2 preset 24V | Ch2 preset 24V | Preset input terminal | Preset input terminal |
| P00B | Ch4 preset 24V | - | Preset input terminal | No use |
| P00C | Ch5 preset 24V | Ch4 preset 24V | Preset input terminal | Preset input terminal |
| P00D | Ch6 preset 24V | - | Preset input terminal | No use |
| P00E | Ch7 preset 24V | Ch6 preset 24V | Preset input terminal | Preset input terminal |
| P00F | Ch8 preset 24V | - | Preset input terminal | No use |
| COM0 | Input common | Input common | Input common | Input common |

(3)   Interface with external devices

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

(a) "S" type

| I/O | Internal circuit | Terminal No. | Signal | | Operation | On/Off guaranteed voltage |
|---|---|---|---|---|---|---|
| | | | 1-phase | 2-phase | | |
| Input | 3.3 kΩ | P00 | Ch 0 Pulse input | Ch 0 A-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 3.3 kΩ | P01 | Ch 1 Pulse input | Ch 0 B-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 3.3 kΩ | P02 | Ch 2 Pulse input | Ch 2 A-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 3.3 kΩ | P03 | Ch 3 Pulse input | Ch 2 B-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P04 | Ch 0 Preset input | Ch 0 Preset input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P05 | Ch 1 Preset input | - | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P06 | Ch 2 Preset input | Ch 2 Preset input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P07 | Ch 2 Preset input | - | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | | COM0 | COM (input common) | | | |

| I/O | Internal circuit | Terminal No. | Signal | | Operation | On/Off guaranteed voltage |
|---|---|---|---|---|---|---|
| | | | 1-phase | 2-phase | | |
| Input | 2.7 kΩ | P0000 | Ch 0 Pulse input | Ch 0 A-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 2.7 kΩ | P0001 | Ch 1 Pulse input | Ch 0 B-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 2.7 kΩ | P0002 | Ch 2 Pulse input | Ch 2 A-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 2.7 kΩ | P0003 | Ch 3 Pulse input | Ch 2 B-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 2.7 kΩ | P0004 | Ch 4 Pulse input | Ch 4 A-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 2.7 kΩ | P0005 | Ch 5 Pulse input | Ch 4 B-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 2.7 kΩ | P0006 | Ch 6 Pulse input | Ch 6 A-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 2.7 kΩ | P0007 | Ch 7 Pulse input | Ch 6 B-phase input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P0008 | Ch 0 Preset input | Ch 0 Preset input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P0009 | Ch 1 Preset input | - | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P000A | Ch 2 Preset input | Ch 2 Preset input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P000B | Ch 3 Preset input | - | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P000C | Ch 4 Preset input | Ch 4 Preset input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P000D | Ch 5 Preset input | - | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P000E | Ch 6 Preset input | Ch 6 Preset input | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | 5.6 kΩ | P000F | Ch 7 Preset input | - | On | 20.4~28.8V |
| | | | | | Off | 6V or less |
| | | COM0 | COM (input common) | | | |

## 8.1.3 "S" type Functions

(1) Counter mode

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

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

C) Count increasing/decreasing methods are as follows;

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

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

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

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

D) Auxiliary modes are as follows;

① Count Latch

②Periodic Pulse Count

E) Pulse input mode

(1) Increasing/decreasing count operation by program setting

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

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

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

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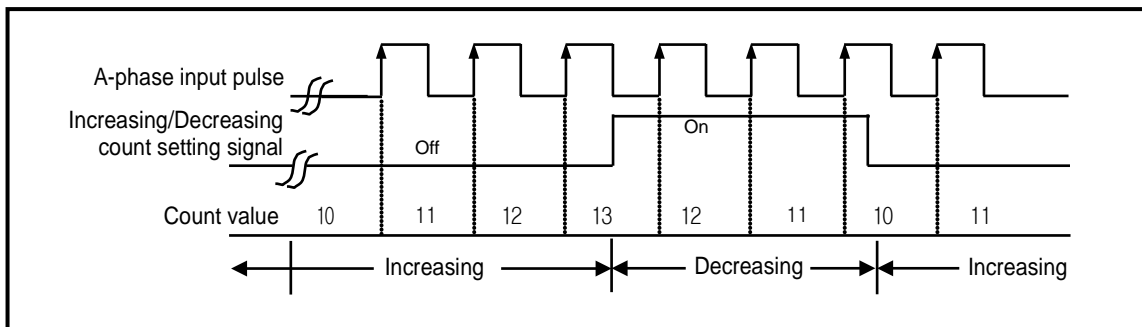
(2) Increasing/decreasing count operation by B-phase input signal

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

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

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

● Operation example



2) 2-phase count mode

a) 2-phase 4-multiplication operation mode

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

▪ Operation example

3) CW(Clockwise)/CCW(Counter Clockwise) operation mode

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

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

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

▪ Operation example



(4) Counter type

2 types of count (Linear counter, Ring counter) can be selected for the applicable use based on functions.
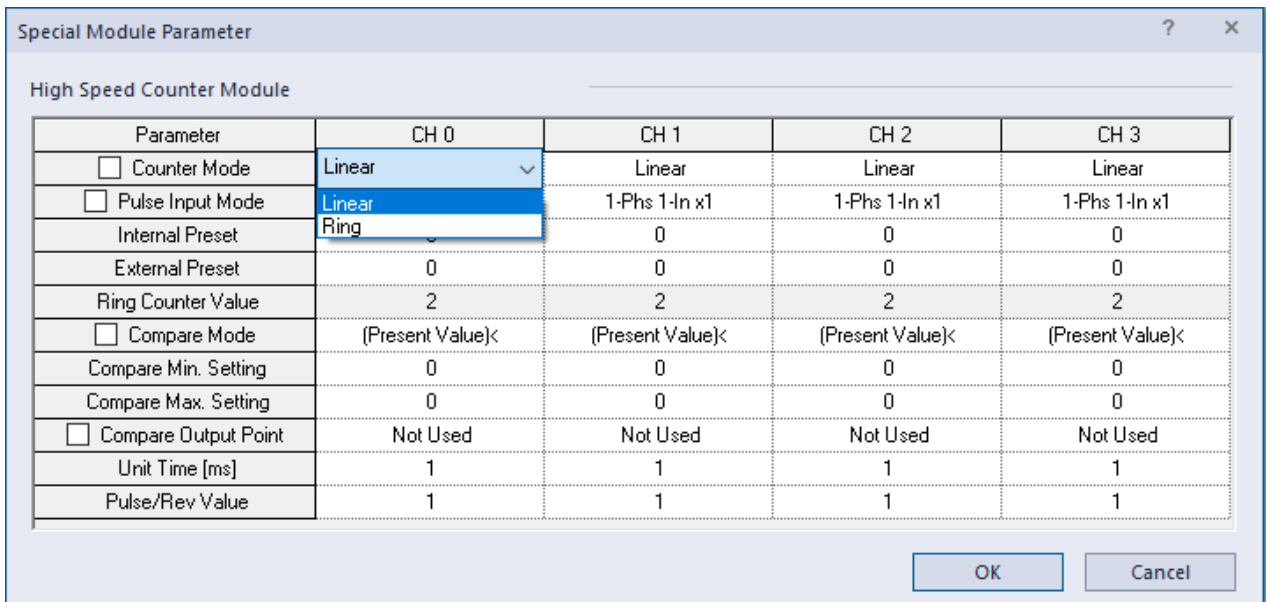


▪ Counter mode is saved at the following special K area.

| Mode | Area per each channel (word) | | | | Reference[1] |
|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | |
| Counter mode | K300 | K330 | K360 | K390 | 0 : linear 1 : ring |

*1) If counter mode is set as value other than 0, 1, error code '20' will occur.

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

A) Linear counter

■ Linear Count range: -2,147,483,648 ~ 2,147,483,647

■ If count value reaches the maximum value while increased, Carry will occur, and if count value reaches the minimum value while decreased, Borrow will occur.

■ If Carry occurs, count stops and increasing is not available but decreasing is available.

■ If Borrow occurs, count stops and decreasing is not available but increasing is available.
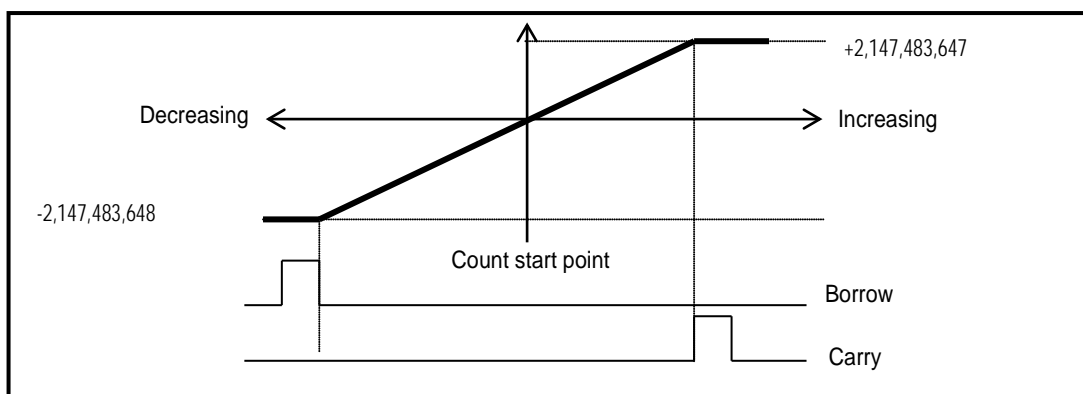


B) Ring count

■ Ring Count range: user-defined minimum value ~ user-defined maximum value

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



• Ring counter value is saved at the following special K area.

| type | Area per each channel (Double word) | | | | Reference |
|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | |
| Ring counter value | K310 | K340 | K270 | K400 | |

1) During increasing count

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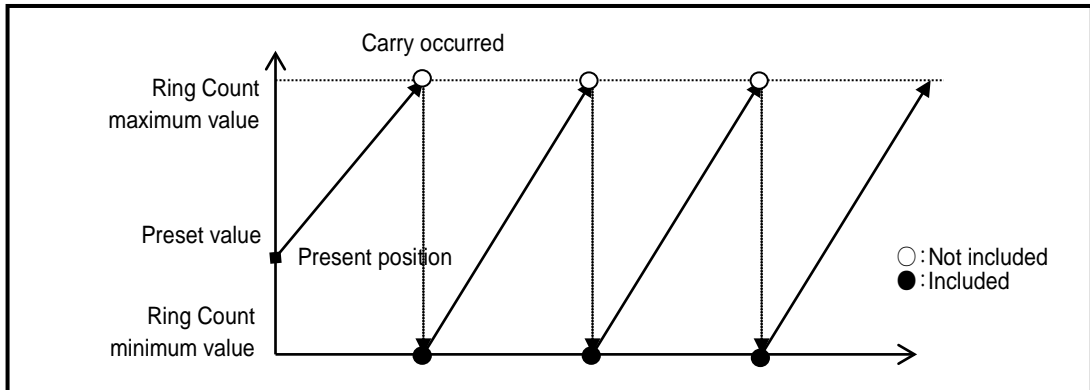


2) During decreasing count

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



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

■ When setting the ring count, the current count value is below the minimum value of the ring counter.

- Opens an error (Code No. 27), operates as a linear counter, and operates as a ring count when the current count value falls within the range of the ring count (error codes are not cleared).

■ When setting the ring count, the current count value is above the maximum value of the ring counter.

- Displays an error (Code No. 27), operates as a linear counter, and stops counting when the current count value reaches the maximum count value (error code is not cleared).

■ When setting the ring count, the current count value is within the user setting range

- It starts to increase from the current count value, increases to the maximum value set by the user, then becomes the minimum value set by the user and continues to count after carrying a carry.

- As shown in the figure below, the maximum value is not displayed and the count continues after displaying the minimum value.

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

■ When setting the ring count, the current count value is below the minimum value of the ring counter.

- When an error (Code No. 27) is displayed, it operates as a linear counter, and if the current count value falls within the range of the ring count, it operates as a ring count. (The error code is not cleared)

■ When setting the ring count, the current count value is above the maximum value of the link counter.

- An error (Code No. 27) is displayed, and it operates as a linear counter, but stops counting when the current count value reaches the count minimum value. (The error code is not cleared)

■ When setting the ring count, the current count value is within the user setting range

- It starts to decrease from the current count value, decreases to the minimum value set by the user, and becomes the maximum value set by the user, and then continues counting after Borrow occurs.

**Remark**

(1) When using a ring count, be sure to place the count value within the range using a preset or the like.

(4) Compared output

    (a) High Speed counter module has a compared output function used to compare present count value with compared value in size to output as compared.

    (b) Available compared outputs are 2 for 1 channel, which can be used separately.

    (c) Compared output conditions are 7 associated with >, =, < .

    (d) Parameter setting

■ Compared output mode setting
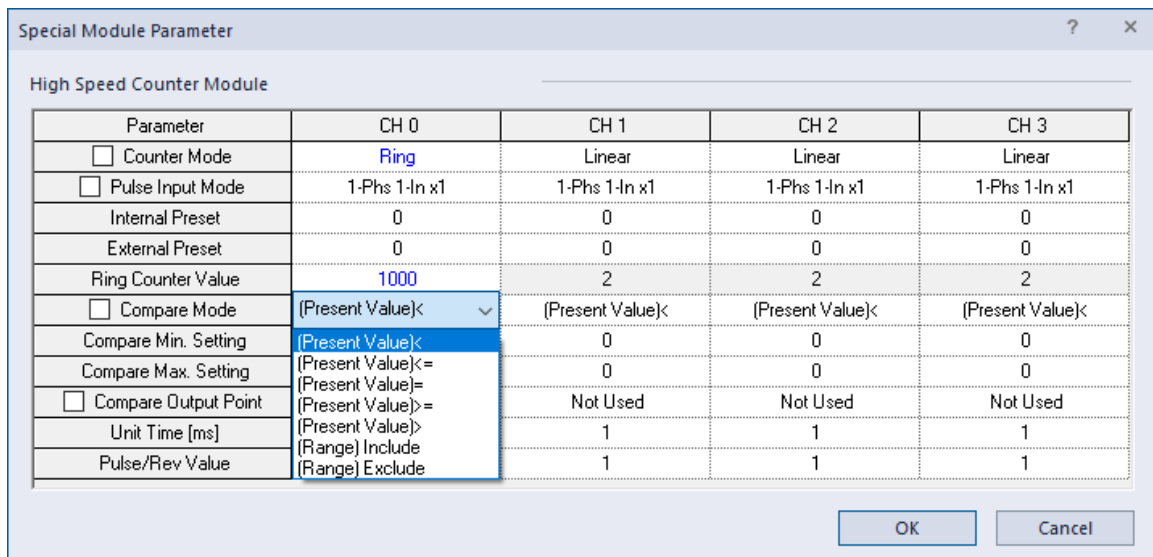


■ Upper setting value is saved in special K area.

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

    *2) If compared output value not set to 0~6 using counter, error code '23' will be occurred.

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

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

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

| Classification | Area per channel | | | | Operation |
|---|---|---|---|---|---|
| | Ch. 0 | Ch. 1 | Ch. 2 | Ch. 3 | |
| Compared equivalent output signal | K2612 | K2712 | K2812 | K2912 | 0: Compared output not equivalent<br>1: Compared output equivalent |

• Comp output point (P20 ~ P27) setting
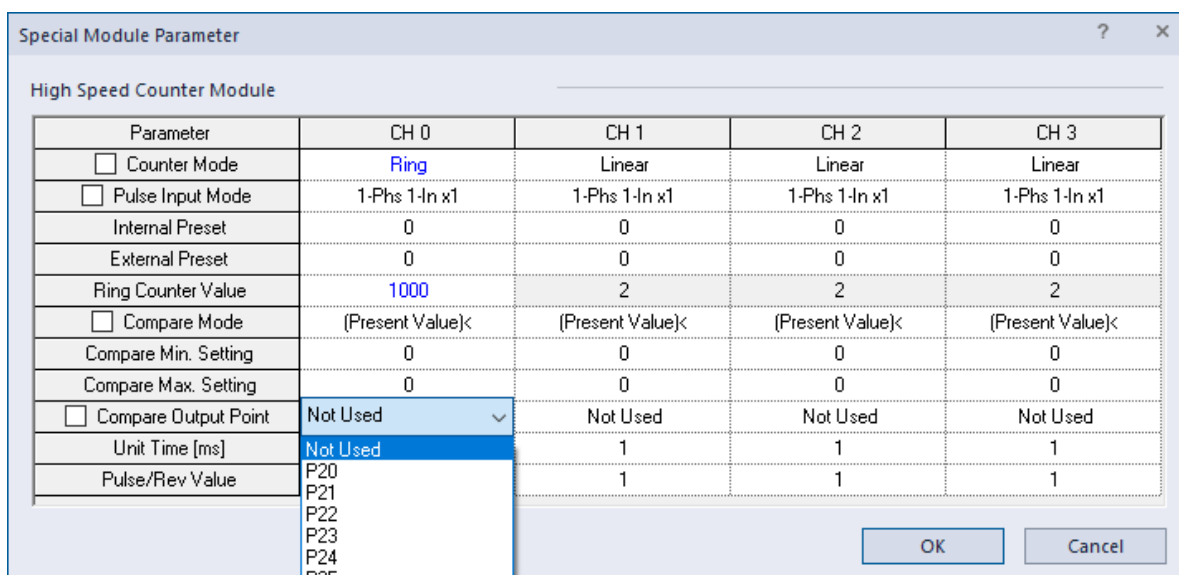
(e) Detailed description for compared output

A) Mode 0 (Present value < Compared value)

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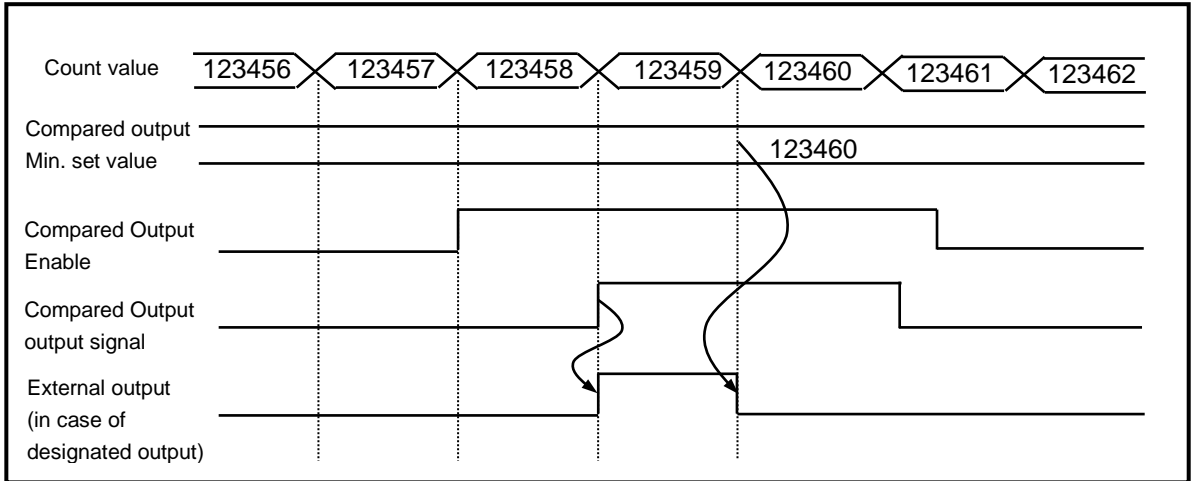


B) Mode1 (Count value ≤ Compared value)

■ If present count value is less than or equal to compared value, output is sent out, and if count
value increases to be greater than compared value, output is not sent out.
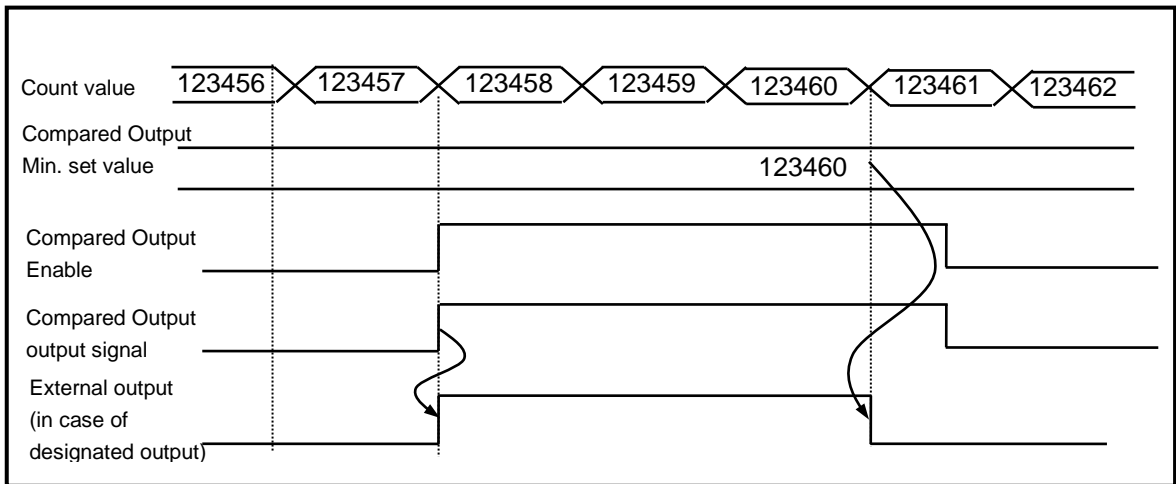
C) Mode 2 (Count value = Compared value)

■ If present count value is equal to compared value, output is sent out. In order to turn the output Off,

Compared output Enable and Compared output signal is to be On.
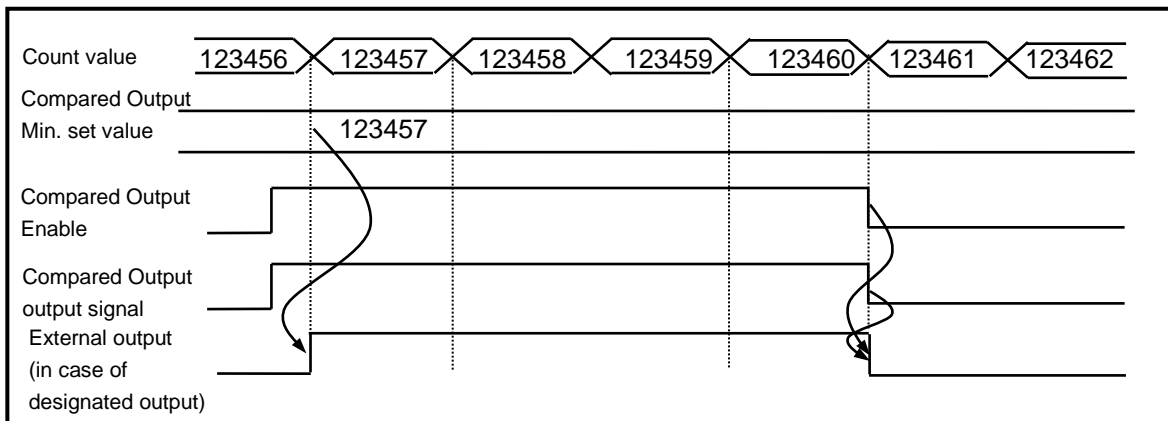


D) Mode 3 (Count value ≥ Compared value)

■ If present count value is greater than or equal to compared value, output is sent out, and if count

value decreases to be less than compared value, output is not sent out.
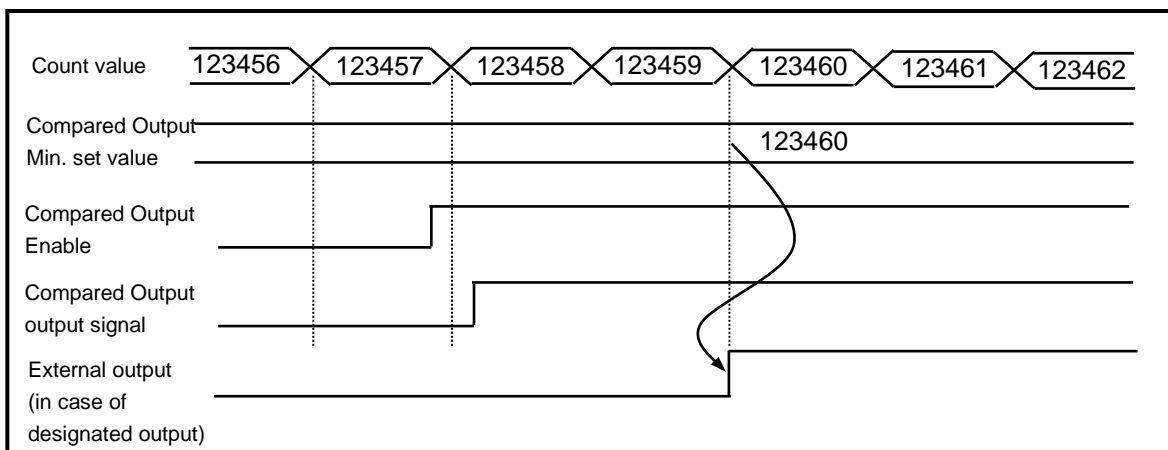
E) Mode 4 (Count value > Compared value)

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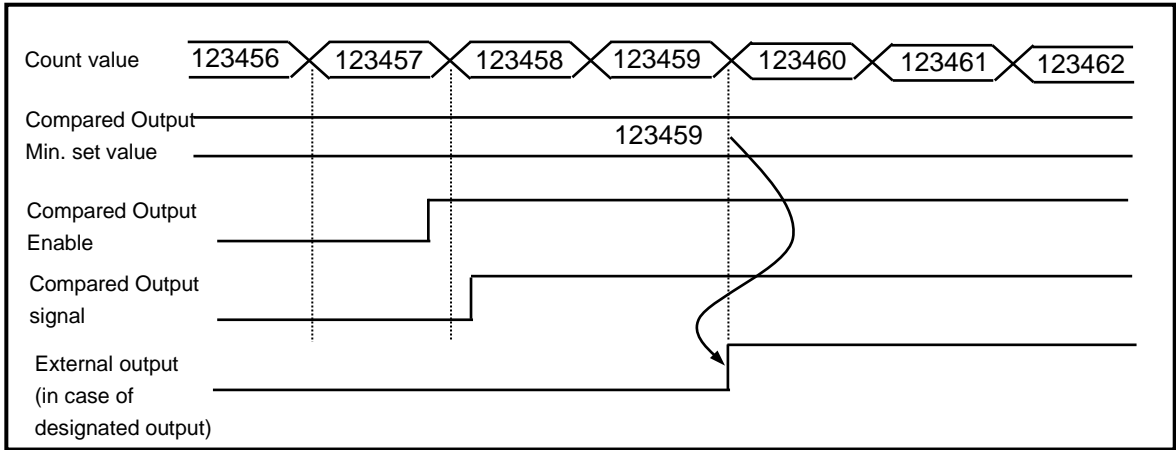


F) Mode 5

(Compared output Min. set value ≤ Count value ≤ Compared output Max. set value)

■ If present count value is greater than or equal to compared output Min. value and less than or equal to compared output Max. set value, output is sent out, and if count value increases/decreases to exceed compared value's range, output is not sent out.
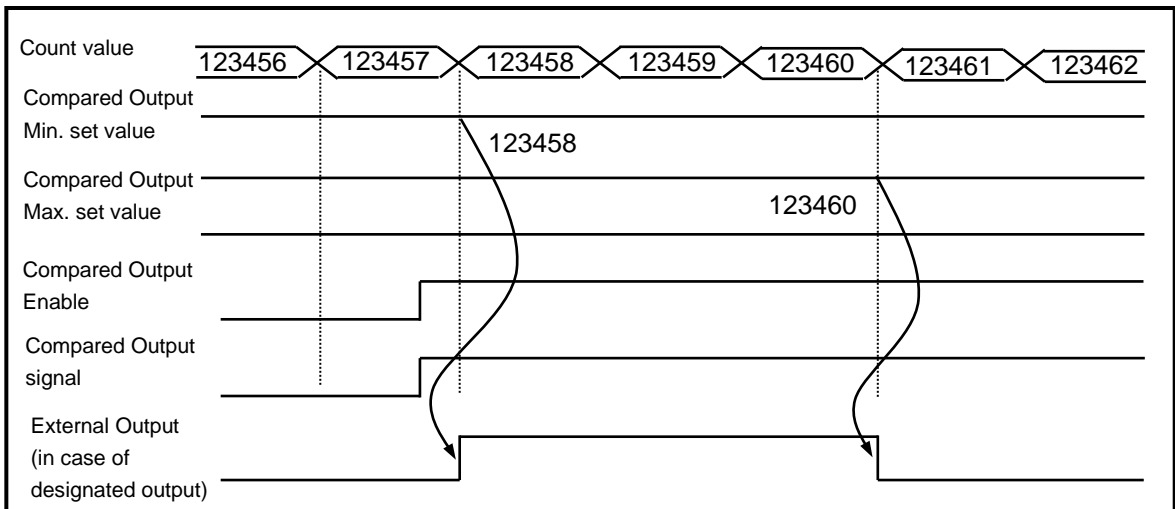
G) Mode 6 (Count value ≤ Compared output Min. value, Count value ≥ Compared output Max. value)

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

| Count value | 123456 | 123457 | 123458 | 123459 | 123460 | 123461 | 123462 |
|---|---|---|---|---|---|---|---|

Compared Output Min. set value 123457

Compared Output Max. set value 123461

Compared Output Enable

Compared Output output signal

External output (in case of designated output)

(5) Carry signal

A) Carry signal occurs

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

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

B) Count when Carry Signal occurs

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

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

C) Carry reset

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

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

(6) Borrow signal

A) Borrow signal occurs

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

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

B) Count when Borrow signal occurs

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

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

C) Borrow reset

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

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

(7) Revolution/Unit time

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

A) Setting

(1) Unit time setting

1) Input unit time and pulse number per 1 revolution
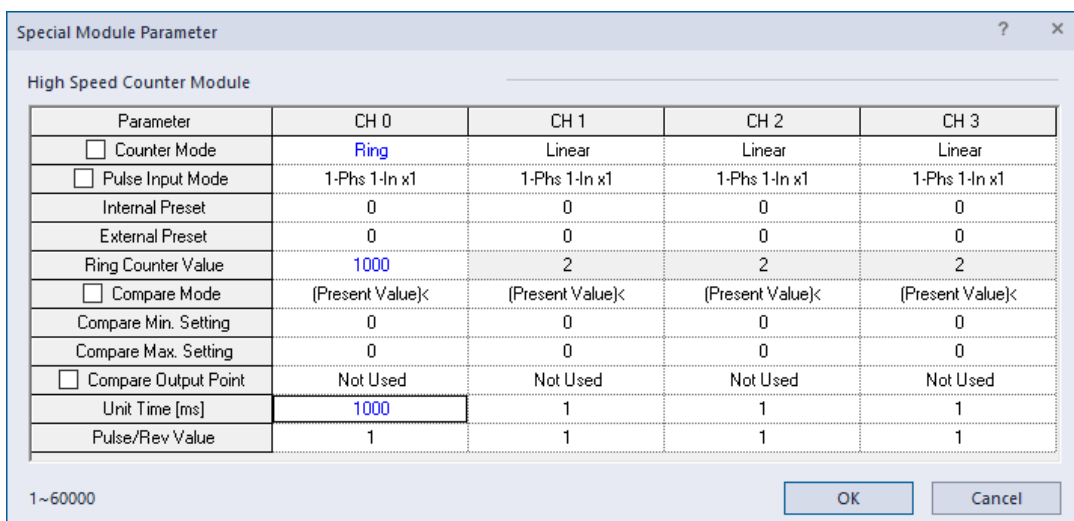


Setting value is saved at the following special K are and user can designate it directly.

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

[*3] If revolution per unit time is enabled and unit time value is other than 1~60000ms, error code '34' occurs.

2) Input pulse number per 1 revolution

| Classification | Device area per channel | | | |
|---|---|---|---|---|
| | Channel 0 | Channel 1 | Channel 2 | Channel 3 |
| Pulse number /revolution (1~60000)[*4] | K323 | K353 | K383 | K413 |

[*4] If revolution per unit time is enabled and pulse number/revolution is other than 1~60000, error code '35' occurs.

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

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

B) Count function of Revolution per Unit time is used to count the number of pulses for a specified time while Enable signal is On.

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

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

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



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

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



(8)  Count latch

(a) When Count latch signal is On, present count value is latched.

(b) Setting

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

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

▪ Count latch function is operated when Count latch signal is On. Namely, counter value is not cleared when power supply Off =>On and mode change, it is counted from previous value.

▪ In latch counter function, internal or external preset function has to use for clearing present value.

(9) Preset function

It changes the current value into preset value.

There are two types of preset function, internal preset and external preset. External preset is fixed as input contact point.
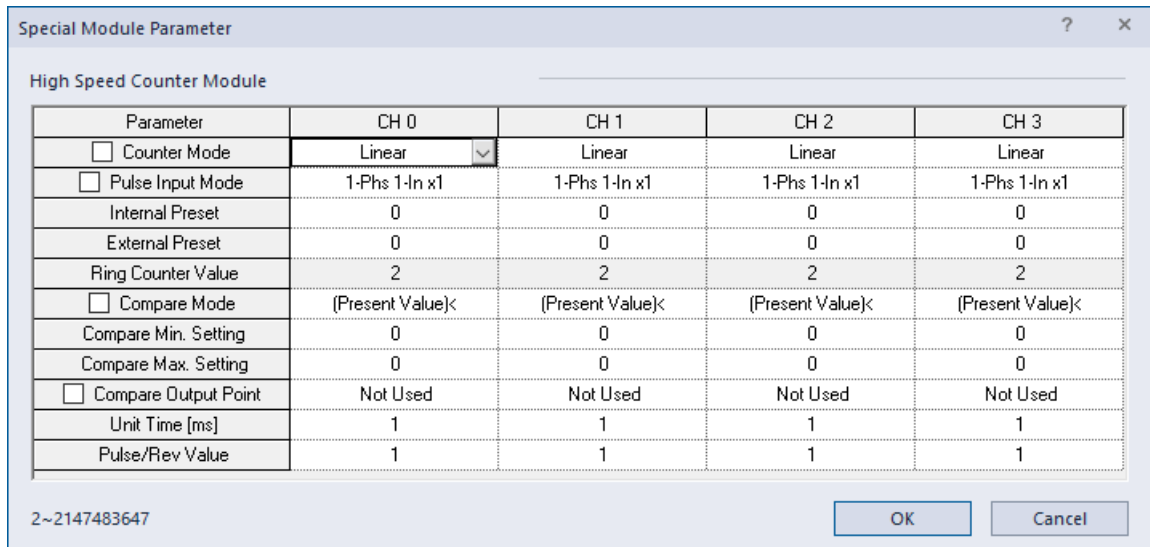


• Preset setting value is saved at the following special K area.

| Type | Area per each channel (Double word) | | | | Ref. |
|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | |
| Internal preset | K304 | K334 | K364 | K394 | - |
| External preset | K306 | K336 | K366 | K396 | - |

• Preset command is specified through the following special K area, external preset is used by executing the designated input contact point after allowance bit is on.

| Type | Area per each channel (Bit) | | | | Ref. |
|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | |
| Internal preset command | K2601 | K2701 | K2801 | K2901 | - |
| External preset allowance | K2602 | K2702 | K2802 | K2902 | - |
| External preset command | P008 | P009 | P00A | P00B | - |

## 8.1.4 "H" type Functions

(1) Counter mode

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

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

C) Count increasing/decreasing methods are as follows;

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

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

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

D) Auxiliary modes are as follows;

① Count Latch

② Count function about the number of revolution per unit time

E) Pulse input mode

1) 1 phase count mode

A) Increasing/decreasing count operation by program setting

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

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

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

● Operation example
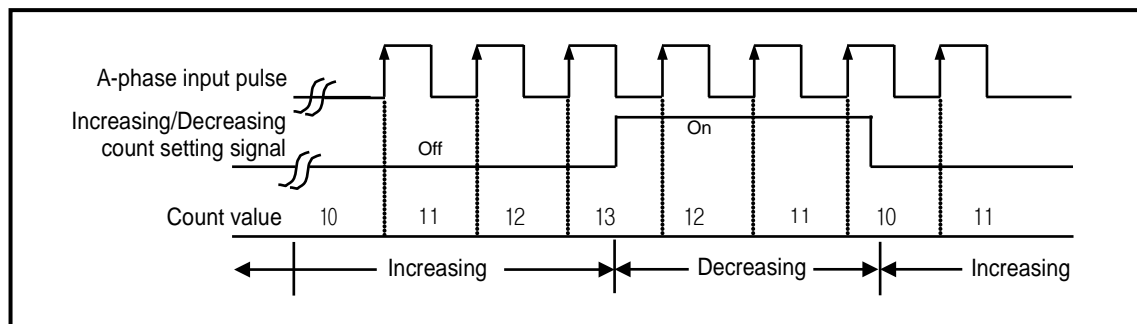
B) Increasing/decreasing count operation by B-phase input signal

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

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

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

● Operation example



2) 2-phase count mode

  a) 2-phase 4-multiplication operation mode

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

▪ Operation example

3) CW(Clockwise)/CCW(Counter Clockwise) operation mode

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

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

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

▪ Operation example



(2) Counter type

2 types of count (Linear counter, Ring counter) can be selected for the applicable use based on functions.
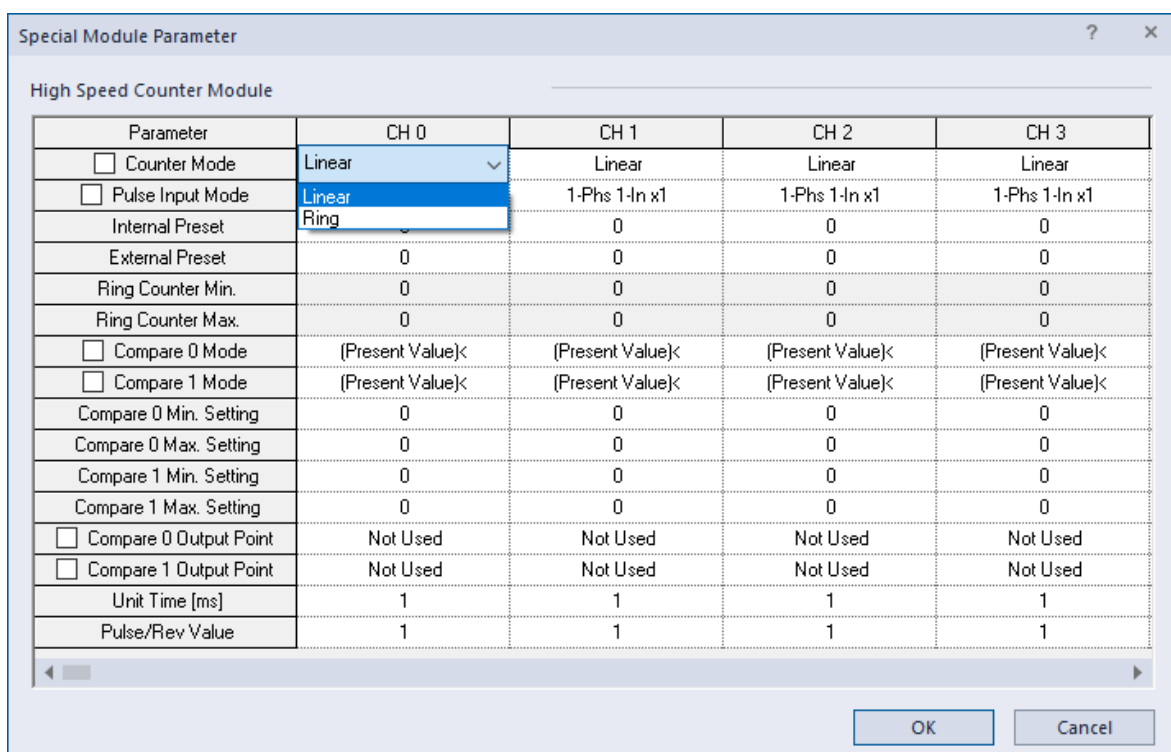


▪ Counter mode is saved at the following special K area.

| Mode | Area per each channel (word) | | | | | | | | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Counter mode | K300 | K330 | K360 | K390 | K2220 | K2250 | K2280 | K2310 | 0 : linear 1 : ring |

A) Linear counter

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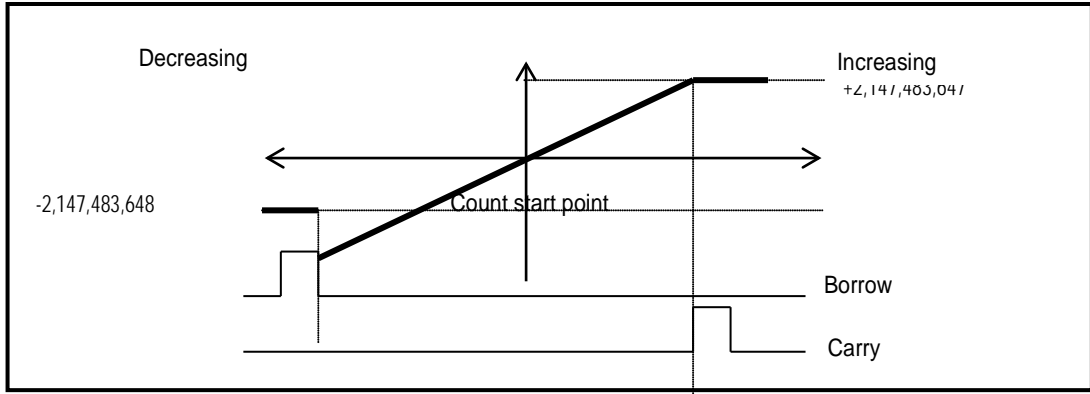


B) Ring count

Set Ring Counter Min. Value and Max. value. Preset value and compared set value should be in range of ring counter min. value and max. value.



- • Ring counter max. and min value is saved at the following special K area.

| type | Area per each channel (Double word) | | | | | | | | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Ring counter min. value | K308 | K338 | K368 | K398 | K2228 | K2258 | K2288 | K2318 | - |
| Ring counter max. value | K310 | K340 | K270 | K400 | K2230 | K2260 | K2290 | K2320 | - |

▪ Range of Ring counter: user defined min. value ~ user defined max. value

▪ Counter display: in case of using ring counter, user defined max. value is not displayed.

   a. During increasing count

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

Carry occurred

Ring Count maximum value

Preset value   Present position

Ring Count minimum value

○：Not included
●：Included

  b. During decreasing count

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

Ring Count maximum value

Present position

Preset value

○：Not included
●：Included

Ring Count Minimum value (0)

Borrow occurred

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

  ■ When setting the ring count, the current count value is below the minimum value of the ring counter.

   - Opens an error (Code No. 27), operates as a linear counter, and operates as a ring count when the current count value falls within the range of the ring count (error codes are not cleared).

  ■ When setting the ring count, the current count value is above the maximum value of the ring counter.

 - Displays an error (Code No. 27), operates as a linear counter, and stops counting when the current count value reaches the maximum count value (error code is not cleared).

  ■ When setting the ring count, the current count value is within the user setting range

 - It starts to increase from the current count value, increases to the maximum value set by the user, then becomes the minimum value set by the user and continues to count after carrying a carry.

  - As shown in the figure below, the maximum value is not displayed and the count continues after displaying the minimum value.

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

■ When setting the ring count, the current count value is below the minimum value of the ring counter.

- When an error (Code No. 27) is displayed, it operates as a linear counter, and if the current count value
  falls within the range of the ring count, it operates as a ring count. (The error code is not cleared)

■ When setting the ring count, the current count value is above the maximum value of the link counter.

- An error (Code No. 27) is displayed, and it operates as a linear counter, but stops counting when the
  current count value reaches the count minimum value. (The error code is not cleared)

■ When setting the ring count, the current count value is within the user setting range

- It starts to decrease from the current count value, decreases to the minimum value set by the user, and
  becomes the maximum value set by the user, and then continues counting after Borrow occurs.



### Remark

(1) When using a ring count, be sure to place the count value within the range using a preset or the like.

(3) Compared output

   (a) High Speed counter module has a compared output function used to compare present count value with compared value in size to output as compared.

   (b) Available compared outputs are 2 for 1 channel, which can be used separately.

   (c) Compared output conditions are 7 associated with >, =, < .

   (d) Parameter setting

   ■ Comp. output mode setting
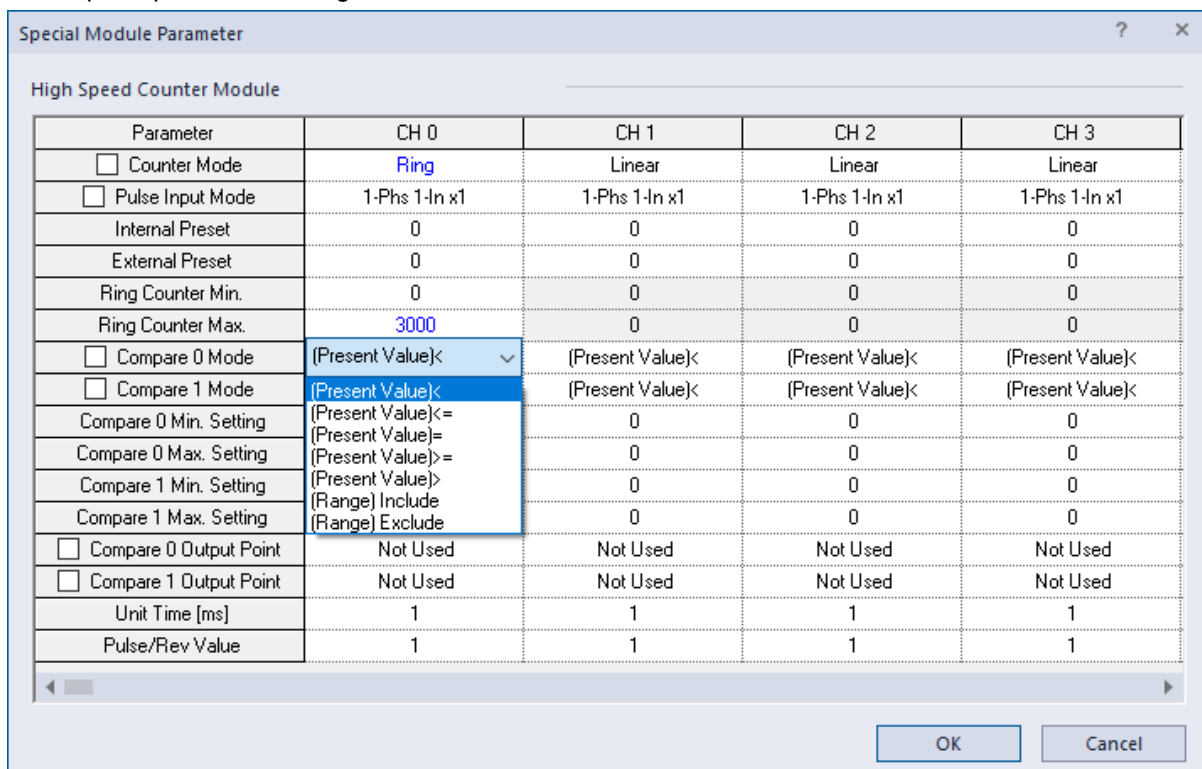


   ■ Upper setting value is saved in special K area.

| Compared output condition | Memory address (word) | | Value[2] |
|---|---|---|---|
| | Comp output 0 | Comp output 1 | |
| Present Value < Compared Value | Ch.0 K302<br>Ch.1 K332<br>Ch.2 K362<br>Ch.3 K392<br>Ch.4 K2222<br>Ch.5 K2252<br>Ch.6 K2282<br>Ch.7 K2312 | Ch.0 K303<br>Ch.1 K333<br>Ch.2 K363<br>Ch.3 K393<br>Ch.4 K2223<br>Ch.5 K2253<br>Ch.6 K2283<br>Ch.7 K2313 | Set to "0" |
| Present Value ≤ Compared Value | | | Set to "1" |
| Present Value = Compared Value | | | Set to "2" |
| Present Value ≥ Compared Value | | | Set to "3" |
| Present Value > Compared Value | | | Set to "4" |
| Compared value 1 ≤ Count value ≤ Compared value 2 | | | Set to "5" |
| Count value ≤ Compared value 1,<br>Count value ≥ Compared value 2 | | | Set to "6" |

[2] If compared output mode set value is other than 0~6 at using counter, error code '23' occurs.

■ In order to output the compared output signal, compared output enable flag set to '1' after compared output condition set.

| Classification | Area per channel | | | | | | | | Operation |
|---|---|---|---|---|---|---|---|---|---|
| | Ch. 0 | Ch. 1 | Ch. 2 | Ch. 3 | Ch. 4 | Ch. 5 | Ch. 6 | Ch. 7 | |
| Count enable signal | K2600 | K2700 | K2800 | K2900 | K21800 | K21900 | K22000 | K22100 | 0:disable, 1: enable |
| Compared 0 enable signal | K2604 | K2704 | K2804 | K2904 | K21804 | K21904 | K22004 | K22104 | 0: disable, 1: enable |
| Compared 1 enable signal | K2607 | K2707 | K2807 | K2907 | K21807 | K21907 | K22007 | K22107 | 0: disable, 1: enable |

▪ In order to make external output, the compared coincidence output signal (P20~P2F) must be set. If Compared output contact is 'Off' at Special Module Parameter Setting of XG5000, Compared coincidence output signal (internal device) is only output.

| Classification | Area per channel | | | | | | | Operation |
|---|---|---|---|---|---|---|---|---|
| | Ch. 0 | Ch. 1 | Ch. 2 | Ch.4 | Ch.5 | Ch. 6 | Ch.7 | |
| Compared coincidence output signal 0 | K2612 | K2712 | K2812 | K2912 | K21812 | K22012 | K22112 | 0: Compared output Off<br>1: Compared output On |
| Compared coincidence output signal 1 | K2613 | K2713 | K2813 | K2913 | K21813 | K22013 | K22113 | 0: Compared output Off<br>1: Compared output On |

• Comp. output point (P20 ~ P2F) setting

| Parameter | CH 0 | CH 1 | CH 2 | CH 3 |
|---|---|---|---|---|
| ☐ Counter Mode | Ring | Linear | Linear | Linear |
| ☐ Pulse Input Mode | 1-Phs 1-In x1 | 1-Phs 1-In x1 | 1-Phs 1-In x1 | 1-Phs 1-In x1 |
| Internal Preset | 0 | 0 | 0 | 0 |
| External Preset | 0 | 0 | 0 | 0 |
| Ring Counter Min. | 0 | 0 | 0 | 0 |
| Ring Counter Max. | 3000 | 0 | 0 | 0 |
| ☐ Compare 0 Mode | (Present Value)< | (Present Value)< | (Present Value)< | (Present Value)< |
| ☐ Compare 1 Mode | (Present Value)< | (Present Value)< | (Present Value)< | (Present Value)< |
| Compare 0 Min. Setting | 0 | 0 | 0 | 0 |
| Compare 0 Max. Setting | 0 | 0 | 0 | 0 |
| Compare 1 Min. Setting | 0 | 0 | 0 | 0 |
| Compare 1 Max. Setting | 0 | 0 | 0 | 0 |
| ☐ Compare 0 Output Point | Not Used | Not Used | Not Used | Not Used |
| ☐ Compare 1 Output Point | Not Used | Not Used | Not Used | Not Used |
| Unit Time [ms] | | 1 | 1 | 1 |
| Pulse/Rev Value | | 1 | 1 | 1 |

(e) Detail of comparator output

It describes detail of comparator output (based on comparator output 0)

1) Mode 0 (Present value < Compared value)

■ If counted present value is less than the minimum value of compared output 0, output is sent out, and if present value increases to be equal to or greater than the minimum value of compared output 0, output is not sent out.
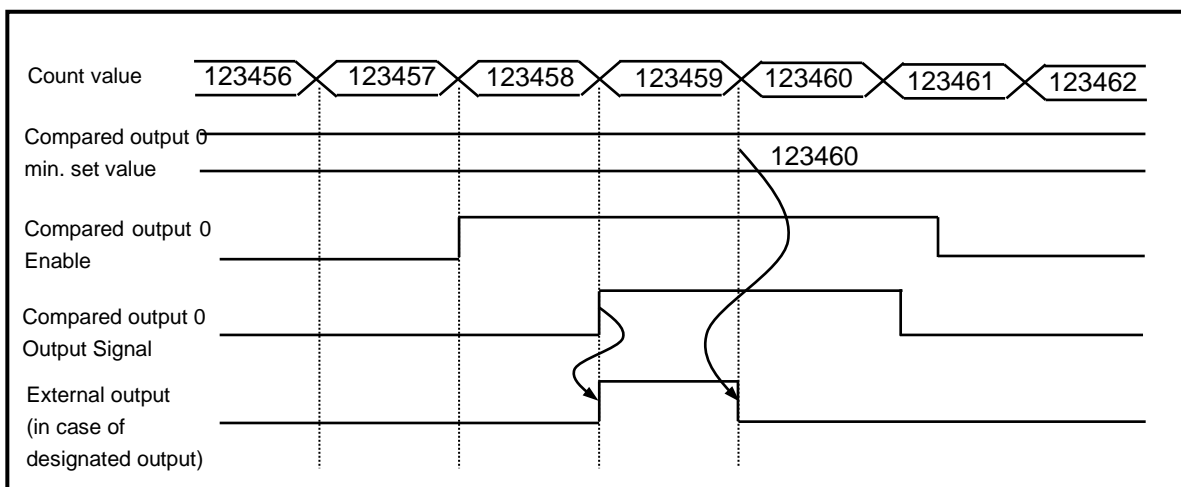


2) Mode1 (Count value ≤ Compared value)

■ If present count value is less than or equal to the minimum set value of compared output 0, output is sent out, and if count value increases to be greater than the minimum set value of

compared output 0, output is not sent out.
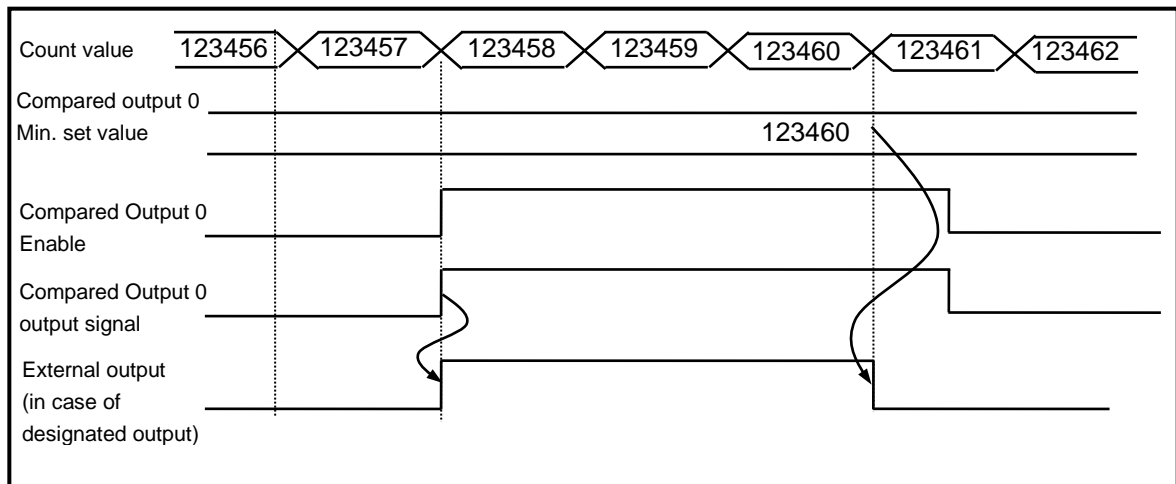
3) Mode 2 (Count value = Compared value)

■ If present count value is equal to the minimum set value of compared output 0, output is sent out. In order to turn the output Off, Compared output Enable signal 0 or Compared Coincidence Output Enable signal 0 is to be Off.
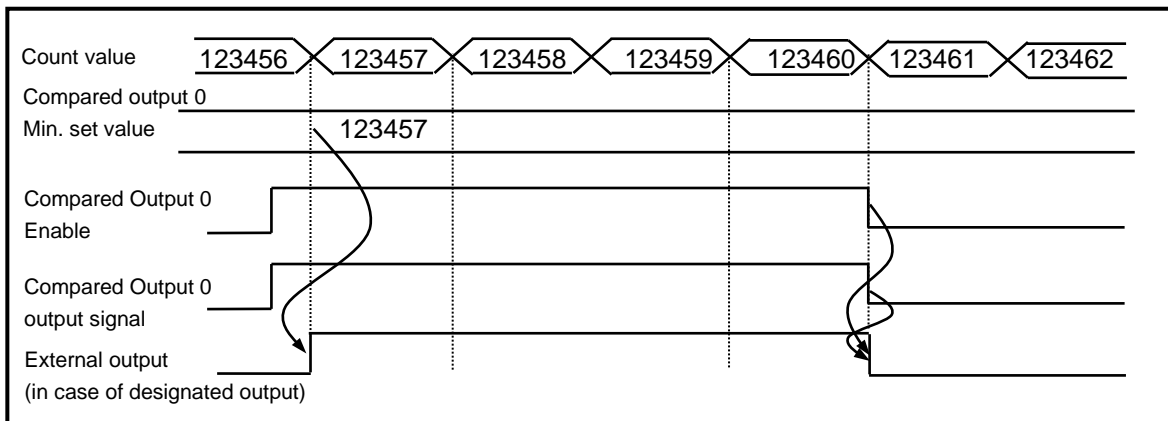


D) Mode 3 (Count value ≥ Compared value)

■ If present count value is greater than or equal to the minimum set value of compared output 0, output is sent out, and if count value decreases to be less than the minimum set value of compared output 0, output is not sent out.
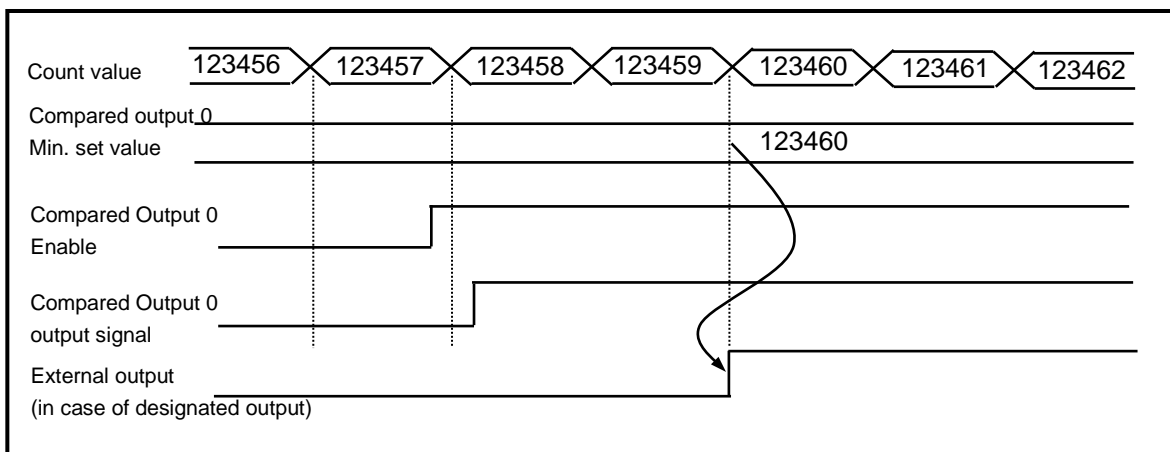
E) Mode 4 (Count value > Compared Output value)

■ If present count value is greater than the minimum set value of compared output 0, output is sent out, and if count value decreases to be less than or equal to the minimum set value of compared output 0, output is not sent out.
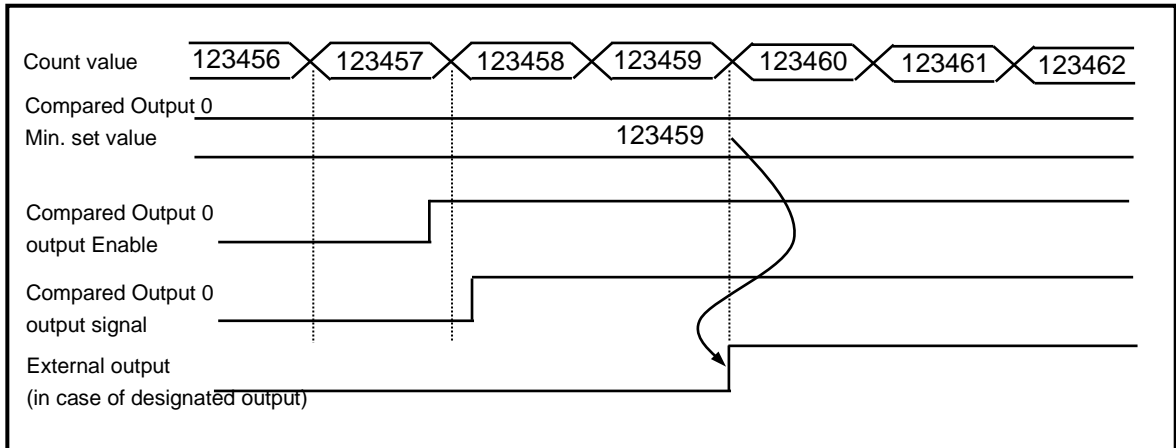


F) Mode 5

(Section comparison: Min. set value of Compared Output 0 ≤ Count value ≤ Max. set value of Compared Output 0)

■ If present count value is greater than or equal to the minimum set value of compared output 0 and less than or equal to the maximum set value of compared output 0, output is sent out, and if count value increases/decreases to exceed compared value's range, output is not sent out.
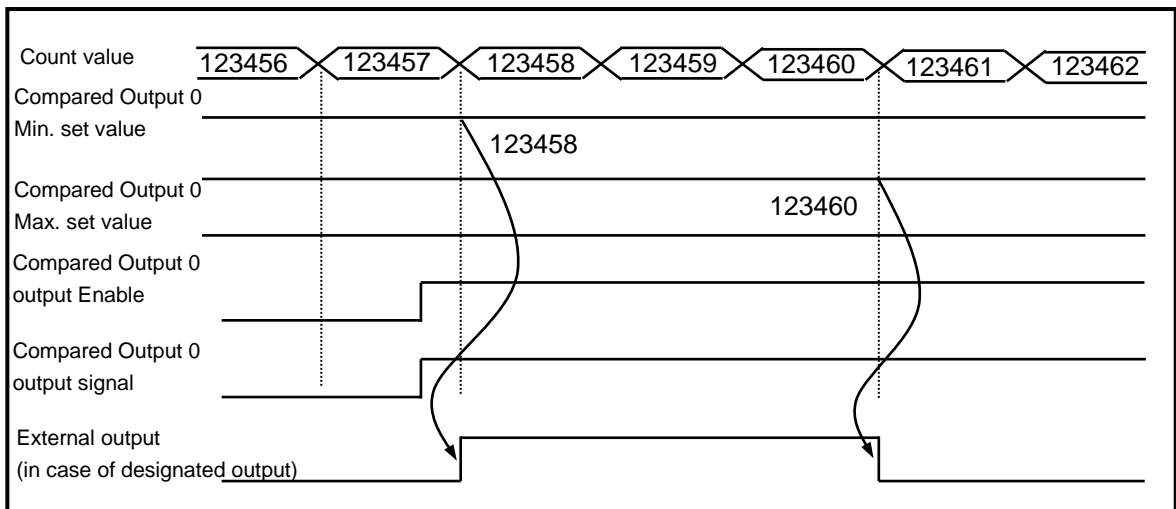
G) Mode 6 (Count value ≤ Min. set value of Compared Output 0 or Count value ≥ Max. set value of Compared Output 0)

■ If present count value is less than or equal to the minimum set value of compared 0 and greater than or equal to the maximum set value of compared 0, output is sent out, and if count value increases/decreases to exceed compared value's range, output is not sent out.

(4) Carry signal

    A) Carry signal occurs

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

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

    B) Count when Carry Signal occurs

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

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

    C) Carry reset

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

| Classification | Device area per channel | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 |
| Carry signal | K2610 | K2710 | K2810 | K2910 | K21810 | K21910 | K22010 | K22110 |

(5) Borrow signal

    A) Borrow signal occurs

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

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

    B) Count when Borrow signal occurs

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

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

    C) Borrow reset

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

| Classification | Device area per channel | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 |
| Borrow signal | K2611 | K2711 | K2811 | K2911 | K21811 | K21911 | K22011 | K22111 |

(6) Revolution/Unit time

While the Flag about the number of revolution per unit time is On, it counts the number of input pulses for a specified time.

A) Setting

(1) Unit time setting

1) Set the unit time and the number of pulse per 1 revolution.
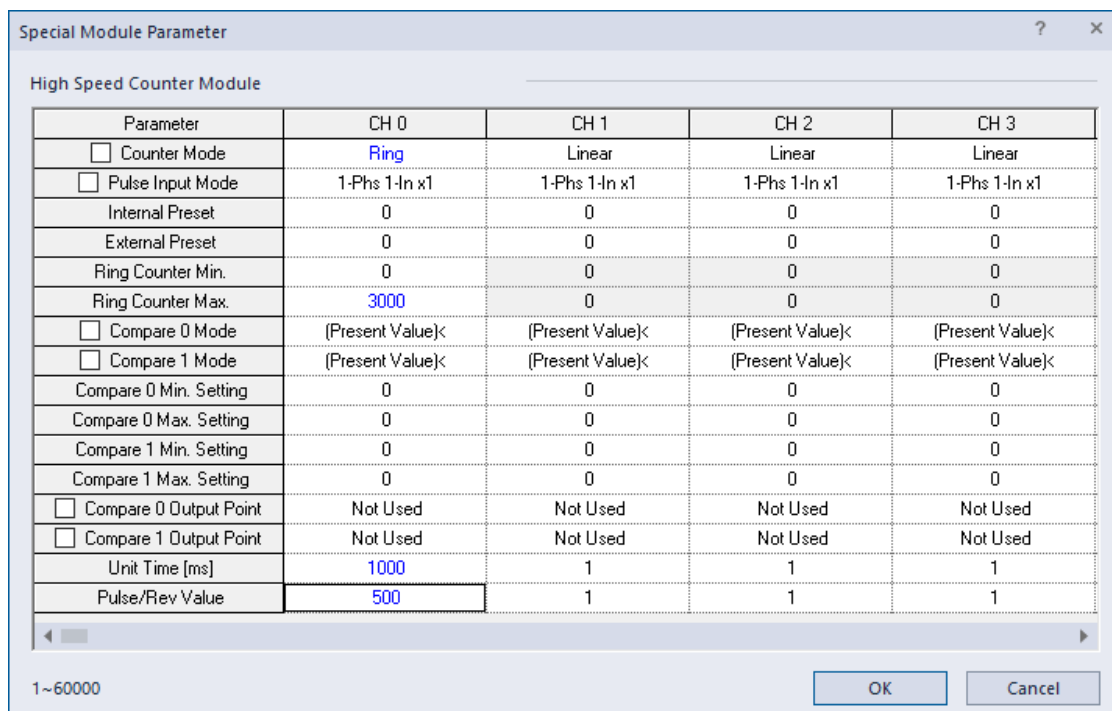


Setting value is saved at the following special K area and user can designate directly.

| Class | Device per each channel (Word) | | | | | | | | Setting range |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Unit time | K322 | K352 | K382 | K412 | K2242 | K2272 | K2302 | K2332 | 1~60000ms |
| Pulse/Rev value | K323 | K353 | K383 | K413 | K2243 | K2273 | K2303 | K2333 | 1~60000 |

2) In case of using Rev/unit time function, enable the following special K area

| Class | Device per each channel (Word) | | | | | | | | Operation |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Rev/unit time command | K2605 | K2705 | K2805 | K2905 | K21805 | K21905 | K22005 | K22105 | 0: disable 1: enable |

3) Rev/unit time value is saved at the following special K area.

| Class | Device per each channel (Word) | | | | | | | | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Rev/unit time | K264 | K274 | K284 | K294 | K2184 | K2194 | K2204 | K2214 | - |

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

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

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

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



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

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



(7) Count latch

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

▪ Setting

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

| Class | Device area per channel | | | | | | | | Operation |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Count latch command | K2606 | K2706 | K2806 | K2906 | K21806 | K21906 | K22006 | K22106 | 0: disable 1: enable |

▪ Count latch function is operated when Count latch signal is On. Namely, counter value is not cleared when power supply Off =>On and mode change, it is counted from previous value.

▪ In latch counter function, internal or external preset function has to use for clearing present value.

(8) Preset function

It changes the current value into preset value.

There are two types of preset function, internal preset and external preset. External preset is fixed as input contact point.
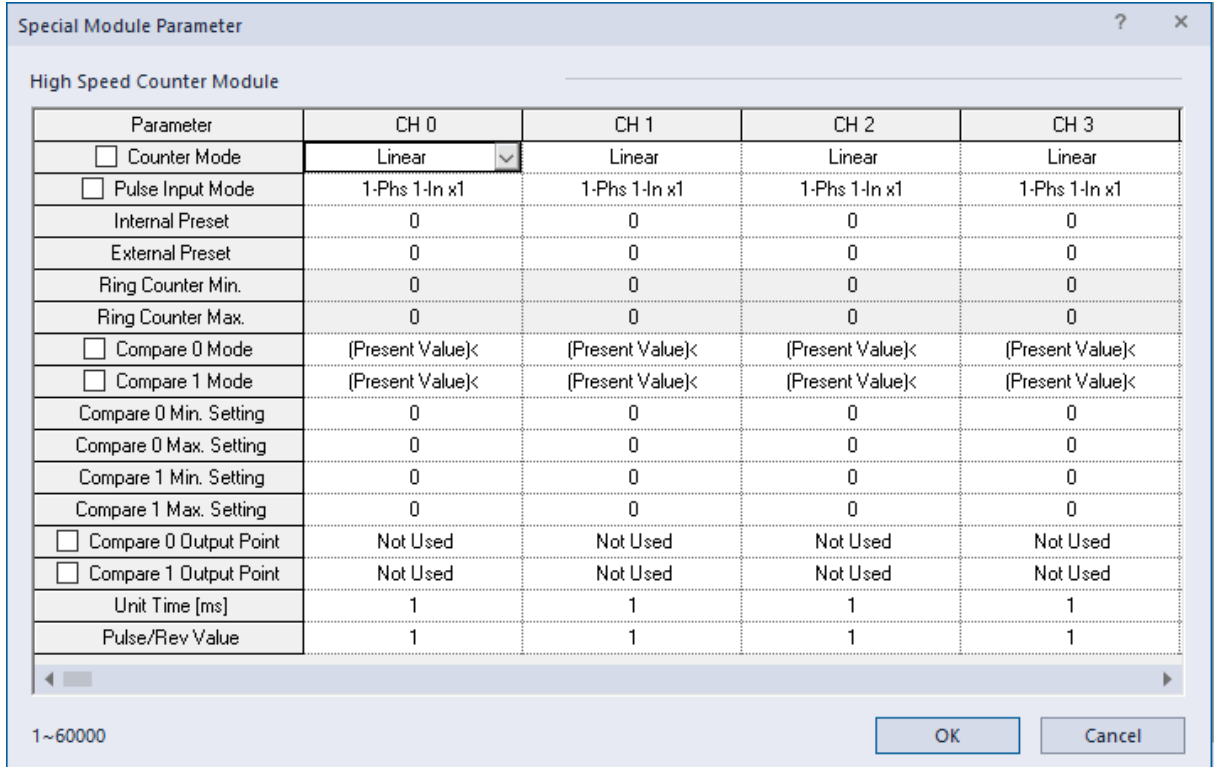


• Preset setting value is saved at the following special K area.

| Type | Area per each channel (Double word) | | | | | | | | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Internal preset value | K304 | K334 | K364 | K394 | K2224 | K2254 | K2284 | K2314 | − |
| External preset value | K306 | K336 | K366 | K396 | K2226 | K2256 | K2286 | K2316 | − |

• Preset command is specified through the following special K area, external preset is used by executing the designated input contact point after allowance bit is on.

| Type | Area per each channel (Bit) | | | | | | | | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| | Ch.0 | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | |
| Internal preset command | K2601 | K2701 | K2801 | K2901 | K21801 | K21901 | K22001 | K22101 | − |
| External preset allowance | K2602 | K2702 | K2802 | K2902 | K21802 | K21902 | K22002 | K22102 | − |
| External preset command | P008 | P009 | P00A | P00B | P00C | P00D | P00E | P00F | − |

## 8.2  Installation and Wiring

### 8.2.1 Precaution for wiring

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

1) Surely use twisted pair shielded cable, grounded with 3 class applied.

2) Keep away from power cable or I/O line which may cause noise.

3) Stabilized power should be used for filter.

▶ Connect A-phase only for 1-phase input.

▶ Connect A-phase and B-phase for 2-phase input.

### 8.2.2 Example of wiring

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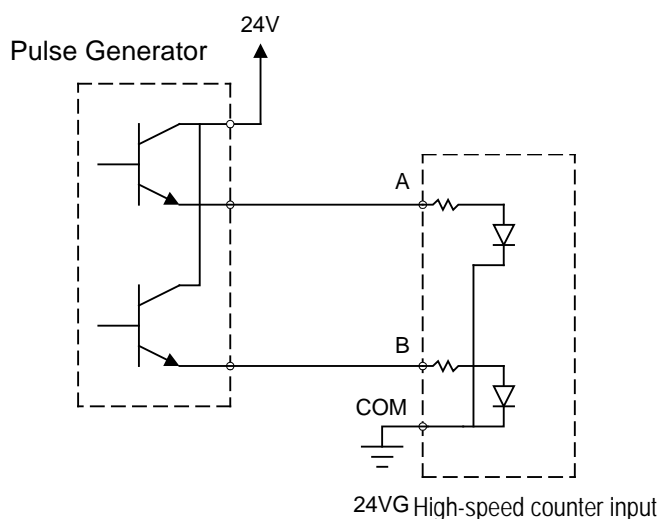


(2) In case of pulse generator is open collector type
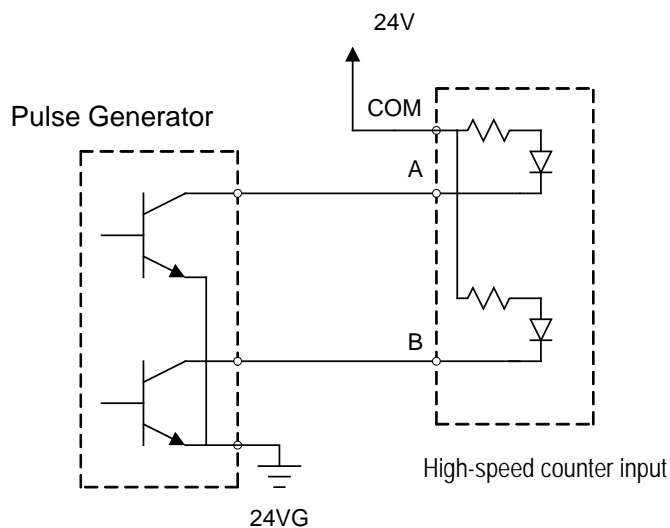
## 8.3　Internal Memory

### 8.3.1 Special area for High-speed counter

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

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

▪ The following example shows that the internal preset values of CH1 set in parameter are changed by program and saved in flash.

  - Receiving an order command (M000), it moves (MOV) the new internal preset value (5000) to the CH1 present area (K332).

  - To save the changed settings into flash, it uses WRT command. At the moment, slot information is set to '0' in case of built-in function.



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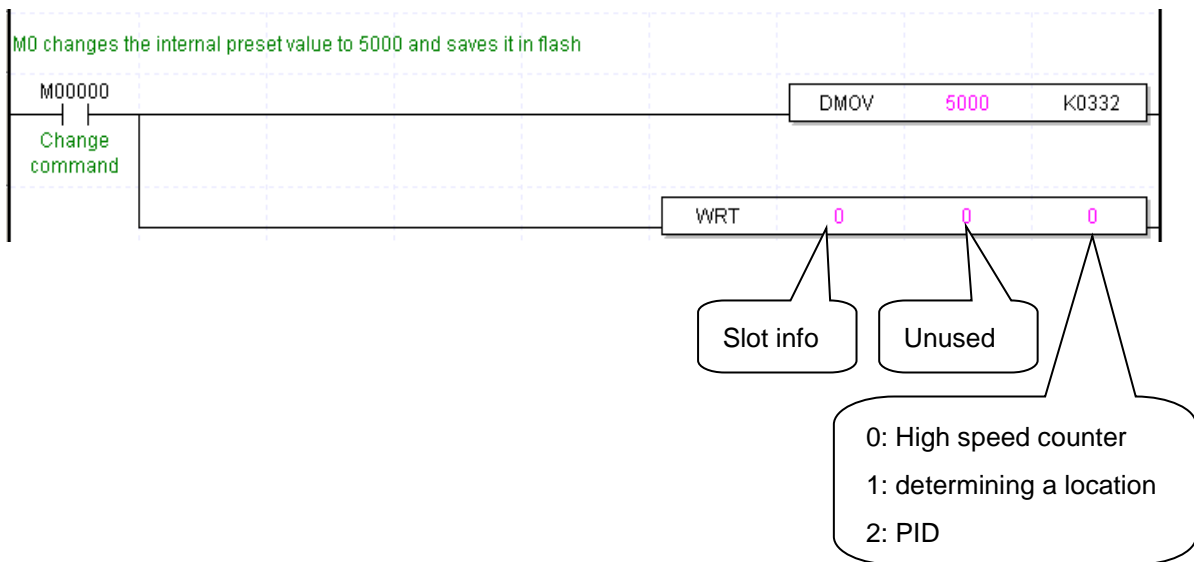
| **Remark** | | |
|---|---|---|
| (1) In case of saving in flash memory using WRT instruction, processing time of about 200~300ms is required. | | |
| (2) Turning off the PLC power while writing to the flash memory or repetitively using the WRT command may damage the flash memory, so be careful when using it. | | |

(1) "S" type

  (a) Parameter setting

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

| Parameter | Description | | Device area per channel | | | | Remark |
|---|---|---|---|---|---|---|---|
| | Value | Setting | Ch 0 | Ch 1 | Ch 2 | Ch 3 | |
| Ring counter Max. value setting | -2,147,483,648 ~ 2,147,483,647 | | K310 | K340 | K370 | K400 | DWord |
| Comp. Output Min. value setting | -2,147,483,648 ~ 2,147,483,647 | | K312 | K342 | K372 | K402 | DWord |
| Comp. output Max. value setting | -2,147,483,648 ~ 2,147,483,647 | | K314 | K344 | K374 | K404 | DWord |
| Comp. output point designation | HFFFF | No use | K320 | K350 | K380 | K410 | Word |
| | h0000 | P0020 | | | | | |
| | h0001 | P0021 | | | | | |
| | h0002 | P0022 | | | | | |
| | h0003 | P0023 | | | | | |
| | h0004 | P0024 | | | | | |
| | h0005 | P0025 | | | | | |
| | h0006 | P0026 | | | | | |
| | h0007 | P0027 | | | | | |
| Unit time [ms] | 1 ~ 60,000 | | K322 | K352 | K382 | K412 | DWord |
| Pulse/Rev.value | 1 ~ 60,000 | | K323 | K353 | K383 | K413 | DWord |

(b) Operation command

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

(c) Area of monitoring

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

(2) "H" type

(a) Parameter setting

| Parameter | Description | | Device area per channel | | | | Remark |
|---|---|---|---|---|---|---|---|
| | Value | Setting | Ch 0 | Ch 1 | Ch 2 | Ch 3 | |
| | | | Ch 4 | Ch 5 | Ch 6 | Ch 7 | |
| Counter mode | h0000 | Linear count | K300 | K330 | K360 | K390 | Word |
| | h0001 | Ring count | K2220 | K2250 | K2280 | K2310 | |
| Pulse input mode setting | h0000 | 1 phase 1 input 1 multiplication | K301 | K331 | K361 | K391 | Word |
| | h0001 | 1 phase 2 input 1 multiplication | | | | | |
| | h0002 | CW / CCW | K2221 | K2251 | K2281 | K2311 | Word |
| | h0003 | 2 phase 4 multiplication | | | | | |
| Comp. Output 0 mode setting | h0000 | (Magnitude) < | K302 | K332 | K362 | K392 | Word |
| | h0001 | (Magnitude) ≤ | | | | | |
| | h0002 | (Magnitude) = | | | | | |
| | h0003 | (Magnitude) ≥ | | | | | |
| | h0004 | (Magnitude) > | K2222 | K2252 | K2282 | K2312 | |
| | h0005 | (Range) Include | | | | | |
| | h0006 | (Range) Exclude | | | | | |
| Comp. Output 1 mode setting | h0000 | (Magnitude) < | K303 | K333 | K363 | K393 | Word |
| | h0001 | (Magnitude) ≤ | | | | | |
| | h0002 | (Magnitude) = | | | | | |
| | h0003 | (Magnitude) ≥ | | | | | |
| | h0004 | (Magnitude) > | K2223 | K2253 | K2283 | K2313 | |
| | h0005 | (Range) Include | | | | | |
| | h0006 | (Range) Exclude | | | | | |
| Internal preset value setting | -2,147,483,648 ~ 2,147,483,647 | | K304 | K334 | K364 | K394 | DWord |
| | | | K2224 | K2254 | K2284 | K2314 | |
| External preset value setting | -2,147,483,648 ~ 2,147,483,647 | | K306 | K336 | K366 | K396 | DWord |
| | | | K2226 | K2256 | K2286 | K2316 | |

| Parameter | Description | | Device area per channel | | | | Remark |
|---|---|---|---|---|---|---|---|
| | Value | Setting | Ch 0 | Ch 1 | Ch 2 | Ch 3 | |
| | | | Ch 4 | Ch 5 | Ch 6 | Ch 7 | |
| Ring counter min. value setting | -2,147,483,648 ~ 2,147,483,645 | | K308 | K338 | K368 | K398 | DWord |
| | | | K2228 | K2258 | K2288 | K2318 | |
| Ring counter max. value setting | -2,147,483,646 2,147,483,647 | | K310 | K340 | K370 | K400 | DWord |
| | | | K2230 | K2260 | K2290 | K2320 | |
| Comp. output min. value setting | -2,147,483,648 ~ 2,147,483,647 | | K312 | K342 | K372 | K402 | DWord |
| | | | K2232 | K2262 | K2292 | K2322 | |
| Comp. output max. value setting | -2,147,483,648 ~ 2,147,483,647 | | K314 | K344 | K374 | K404 | DWord |
| | | | K2234 | K2264 | K2294 | K2324 | |
| Comp. output 0 point designation | HFFFF | No use | K320 | K350 | K380 | K410 | Word |
| | h0000 | P0020 | | | | | |
| | h0001 | P0021 | | | | | |
| | h0002 | P0022 | | | | | |
| | h0003 | P0023 | | | | | |
| | h0004 | P0024 | | | | | |
| | h0005 | P0025 | | | | | |
| | h0006 | P0026 | | | | | |
| | h0007 | P0027 | | | | | |
| | h0008 | P0028 | K2240 | K2270 | K2300 | K2330 | |
| | h0009 | P0029 | | | | | |
| | h000A | P002A | | | | | |
| | h000B | P002B | | | | | |
| | h000C | P002C | | | | | |
| | h000D | P002D | | | | | |
| | h000E | P002E | | | | | |
| | h000F | P002F | | | | | |

| Parameter | Description | | Device area per channel | | | | Remark |
|---|---|---|---|---|---|---|---|
| | Value | Setting | Ch 0 | Ch 1 | Ch 2 | Ch 3 | Remark |
| | | | Ch 4 | Ch 5 | Ch 6 | Ch 7 | |
| Comp. output 1 point designation | HFFFF | No use | K321 | K351 | K381 | K411 | Word |
| | h0000 | P0020 | | | | | |
| | h0001 | P0021 | | | | | |
| | h0002 | P0022 | | | | | |
| | h0003 | P0023 | | | | | |
| | h0004 | P0024 | | | | | |
| | h0005 | P0025 | | | | | |
| | h0006 | P0026 | | | | | |
| | h0007 | P0027 | | | | | |
| | h0008 | P0028 | K2241 | K2271 | K2301 | K2331 | |
| | h0009 | P0029 | | | | | |
| | h000A | P002A | | | | | |
| | h000B | P002B | | | | | |
| | h000C | P002C | | | | | |
| | h000D | P002D | | | | | |
| | h000E | P002E | | | | | |
| | h000F | P002F | | | | | |
| Unit time [ms] | 1 ~ 60,000 ms | | K322 | K352 | K382 | K412 | Word |
| | | | K2242 | K2272 | K2302 | K2332 | |
| Pulse/Rev.value | 1 ~ 60,000 | | K323 | K353 | K383 | K413 | Word |
| | | | K2243 | K2273 | K2303 | K2333 | |

(b) Operation command

| Parameter | Device area per channel | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ch 0 | Ch 1 | Ch 2 | Ch 3 | Ch 4 | Ch 5 | Ch 6 | Ch 7 |
| Counter enabling | K2600 | K2700 | K2800 | K2900 | K21800 | K21900 | K22000 | K22100 |
| Internal preset designation of counter | K2601 | K2701 | K2801 | K2901 | K21801 | K21901 | K22001 | K22101 |
| External preset enabling of counter | K2602 | K2702 | K2802 | K2902 | K21802 | K21902 | K22002 | K22102 |
| Designation of decremental counter | K2603 | K2703 | K2803 | K2903 | K21803 | K21903 | K22003 | K22103 |
| Comp. output 0 enabling | K2604 | K2704 | K2804 | K2904 | K21804 | K21904 | K22004 | K22104 |
| Comp. output 1 enabling | K2607 | K2707 | K2807 | K2907 | K21807 | K21907 | K22007 | K22107 |
| Enabling of revolution time per unit time | K2605 | K2705 | K2805 | K2905 | K21805 | K21905 | K22005 | K22105 |
| Designation of latch counter | K2606 | K2706 | K2806 | K2906 | K21806 | K21906 | K22006 | K22100 |
| Carry signal (Bit) | K2610 | K2710 | K2810 | K29100 | K21810 | K21910 | K22010 | K22110 |
| Borrow signal | K2611 | K2711 | K2811 | K29101 | K21811 | K21911 | K22011 | K22111 |
| Comp. output 0 signal | K2612 | K2712 | K2812 | K29102 | K21812 | K21912 | K22012 | K22112 |
| Comp. output 1 signal | K2613 | K2713 | K2813 | K29103 | K21813 | K21913 | K22013 | K22113 |

(c) Area of monitoring

| Parameter | Device area per channel | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ch 0 | Ch 1 | Ch 2 | Ch 3 | Ch 4 | Ch 5 | Ch 6 | Ch 7 |
| Current counter value | K262 | K272 | K282 | K292 | K2182 | K2192 | K2202 | K2212 |
| Revolution per unit time | K264 | K274 | K284 | K294 | K2184 | K2194 | K2204 | K2214 |

## 8.3.2 Error code

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

▪ Error occurred is saved in the following area.

| Category | Device area per channel | | | | | | | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | Ch0 | Ch1 | Ch2 | Ch3 | Ch4 | Ch5 | Ch6 | Ch7 | |
| Error code | K266 | K276 | K286 | K296 | K2186 | K2196 | K2206 | K2216 | Word |

▪ Error codes and descriptions

| Error code (Decimal) | Description | Remark |
|---|---|---|
| 20 | Counter type is set out of range | |
| 21 | Pulse input type is set out of range | |
| 22 | Requesting #1(3,5,7)channel Run during the 2-phase operation of #0(2,4,6) <br> * During #0(2,4,6) channel 2-phase operation, using #1(3,5,7)channel is not possible. | |
| 23 | Compared output type setting is set out of range. | |
| 25 | Internal preset value is set out of counter range | |
| 26 | External present value is set out of counter range | |
| 27 | Ring counter setting is set out of range <br> * Note ring counter setting should be 2 and more. | |
| 28 | Compared output min. value is set out of permissible max. input range | |
| 29 | Compared output max. value is set out of permissible max. input range | |
| 30 | Error of Compared output min. value>Compared output max. value | |
| 31 | Output point designation value of Compared output is set out of range | |
| 34 | Set value of Unit time is out of the range | |
| 35 | Pulse value per 1 revolution is set out of range | |
| 36 | Compared output min. value is set out of permissible max. input range (Compared output 1) | "H" type |
| 37 | Compared output max. value is set out of permissible max. input range (Compared output 1) | "H" type |
| 38 | Error of Compared output min. value>Compared output max. value (Compared output 1) | "H" type |
| 39 | Output point designation value of Compared output is set out of range (Compared output 1) | "H" type |

> **Remark**
>
> ▪ If two and more errors occur, the module saves the latter error code and removes the former one.

## 8.4  Examples: Using High-speed Counter

It describes examples of using high-speed counter.

1)  Setting high-speed counter parameter

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

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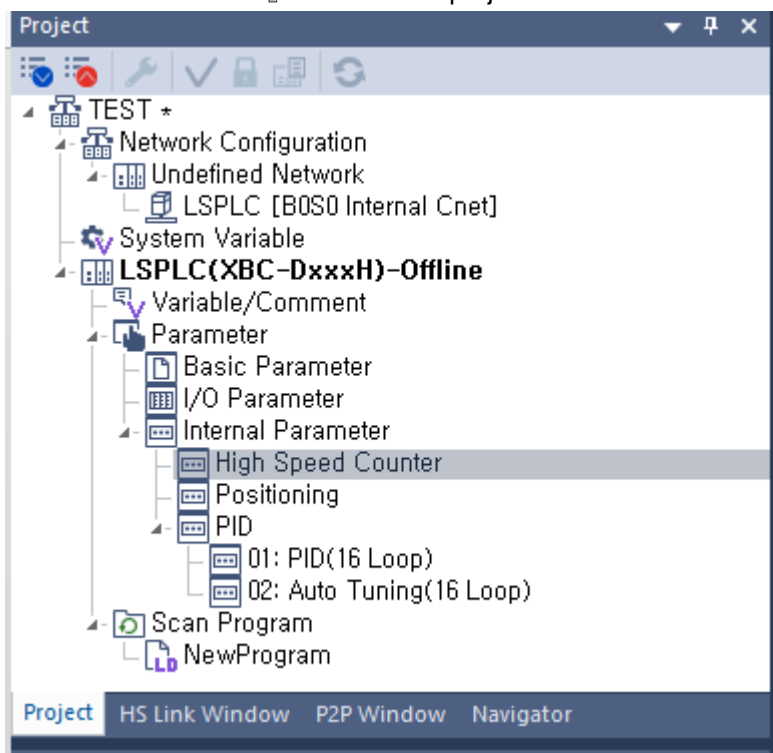


B) Selecting high-speed counter opens a window to set high-speed counter parameters as follows.
For details regarding each parameter setting, refer to 8.1~8.3.
(Every parameter settings are saved in the special K device area.)

| Parameter | CH 0 | CH 1 | CH 2 | CH 3 |
|---|---|---|---|---|
| ☐ Counter Mode | Linear | Linear | Linear | Linear |
| ☐ Pulse Input Mode | 1-Phs 1-In x1 | 1-Phs 1-In x1 | 1-Phs 1-In x1 | 1-Phs 1-In x1 |
| Internal Preset | 0 | 0 | 0 | 0 |
| External Preset | 0 | 0 | 0 | 0 |
| Ring Counter Min. | 0 | 0 | 0 | 0 |
| Ring Counter Max. | 0 | 0 | 0 | 0 |
| ☐ Compare 0 Mode | (Present Value)< | (Present Value)< | (Present Value)< | (Present Value)< |
| ☐ Compare 1 Mode | (Present Value)< | (Present Value)< | (Present Value)< | (Present Value)< |
| Compare 0 Min. Setting | 0 | 0 | 0 | 0 |
| Compare 0 Max. Setting | 0 | 0 | 0 | 0 |
| Compare 1 Min. Setting | 0 | 0 | 0 | 0 |
| Compare 1 Max. Setting | 0 | 0 | 0 | 0 |
| ☐ Compare 0 Output Point | Not Used | Not Used | Not Used | Not Used |
| ☐ Compare 1 Output Point | Not Used | Not Used | Not Used | Not Used |
| Unit Time [ms] | 1 | 1 | 1 | 1 |
| Pulse/Rev Value | 1 | 1 | 1 | 1 |

1~60000

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

```
High-speed counter Enable signal (Ch.0: K2600) is On.
   F00099                                                              K02600
    ─┤ ├──────────────────────────────────────────────────────────────( )──
```
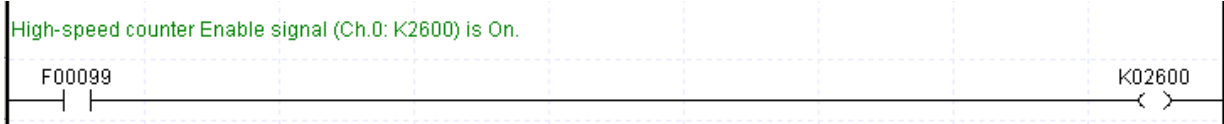
D) To use additional functions of the high-speed counter, you needs to turn on the flag allowing an operation command.

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

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

```
High-speed counter Enable signal (Ch.0: K2600) and number of revolution per unit time  function is
On.
   F00099                                                              K02600
    ─┤ ├────────────┬─────────────────────────────────────────────────( )──
                    │                                                   K02605
                    └─────────────────────────────────────────────────( )──
```
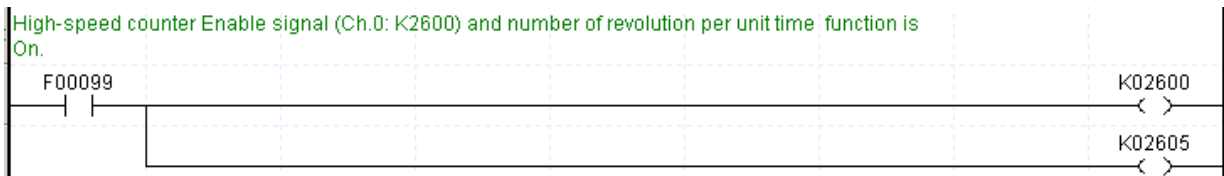
E) Upon the setting, download program and parameter to PLC.

```
Write to PLC                                              ?    ×

 ☐ Inhibit Program Upload
 ☑ Sets link enable with parameters

   ☑ 🖧 LSPLC                                         ┌──────────────┐
     ☑ ▦ PLC Configuration                           │      OK      │
       ☑ 🗸 Comment                                   └──────────────┘
       ☑ 🖑 [Stop]Parameter                           ┌──────────────┐
       ☑ 🔃 [Stop]Program                             │    Cancel    │
     ☑ ▦ Network Parameter                           └──────────────┘
         🖧 Basic Settings                            ┌──────────────┐
           🖧 [Reset]Cnet [base0, slot0]             │   Setting... │
         ▦ High-speed Link                           └──────────────┘
         🌐 P2P(EIP)                                  ┌──────────────┐
                                                      │  Clear PLC...│
                                                      └──────────────┘
```
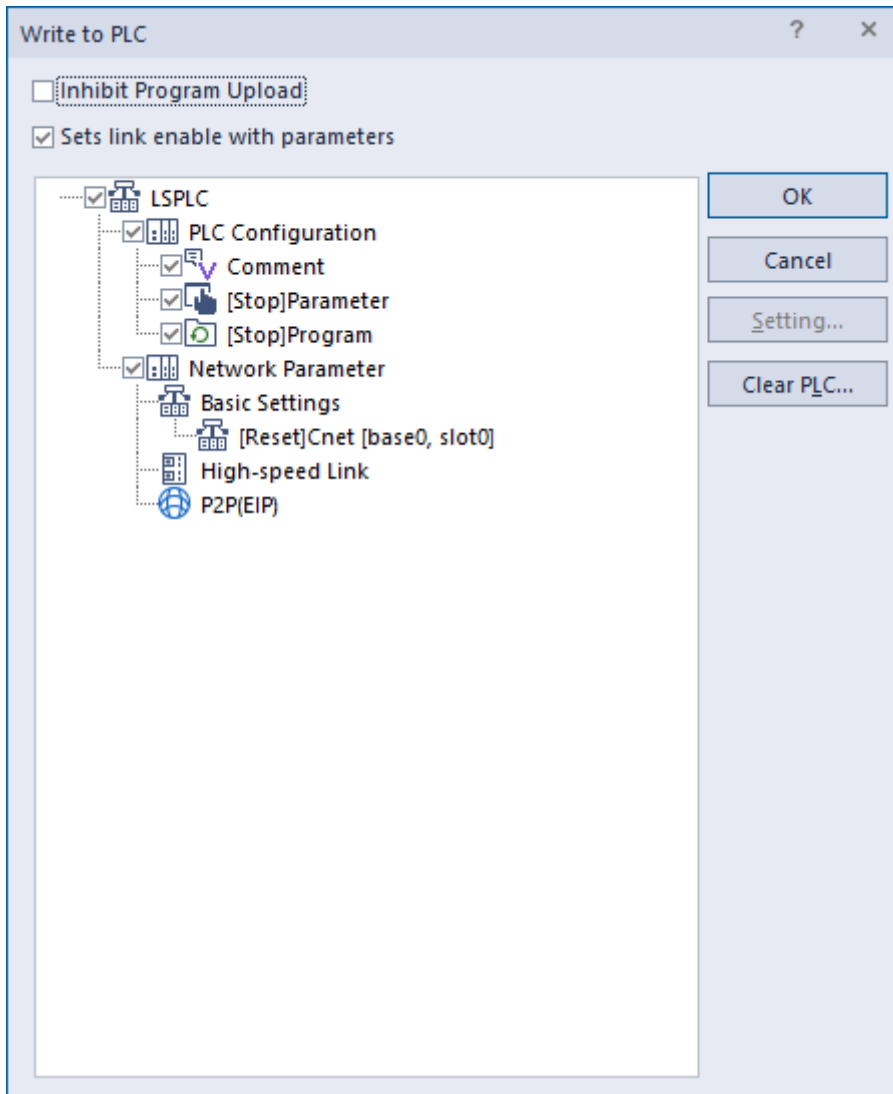
2) Monitoring and setting command

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

A) If starting a monitor and clicking a Special Module Monitor, the following window is opened.
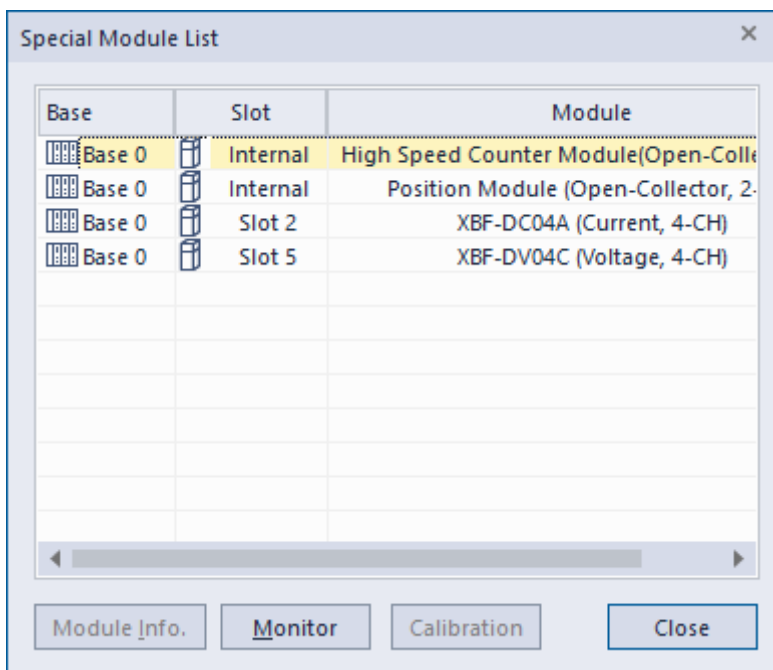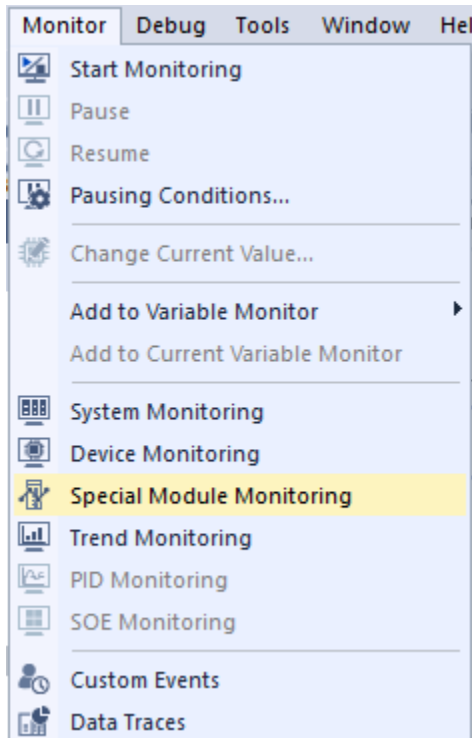
B) Clicking 『Monitor』 shows monitor and test window of high-speed counter.
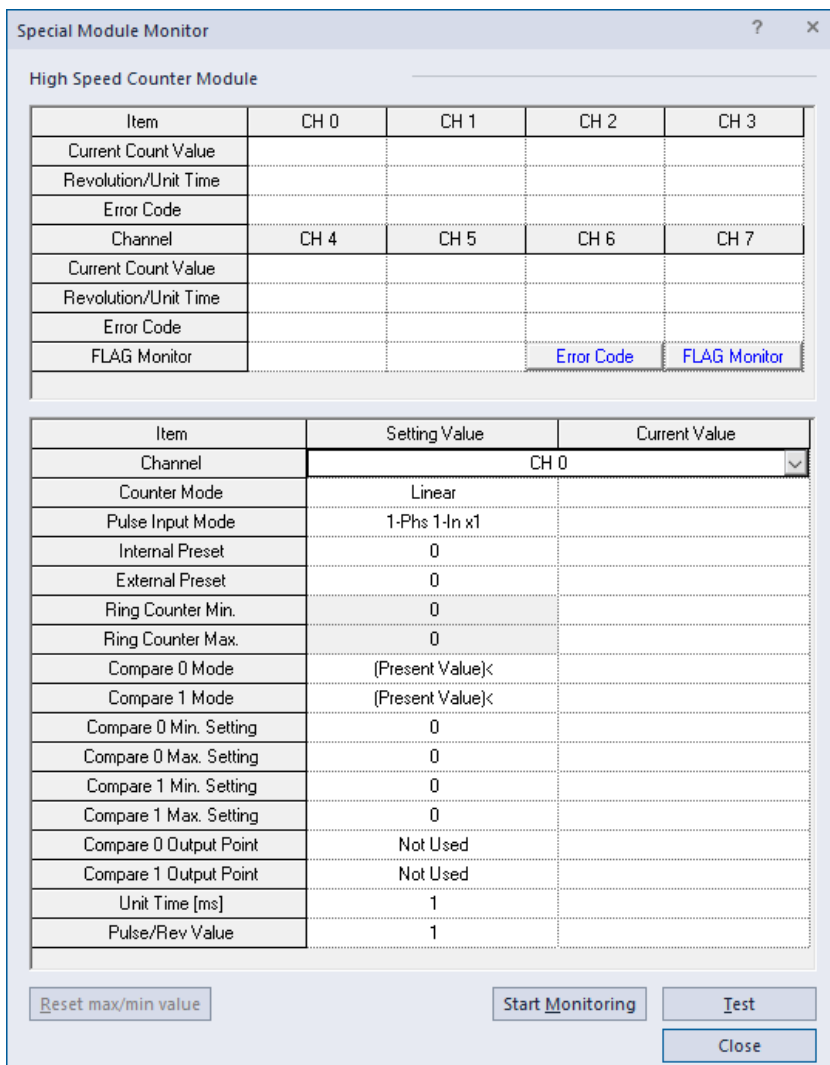


| Item | Description |
|---|---|
| FLAG Monitor | Show flag monitoring and command window of high-speed counter |
| Start Monitoring | Start monitoring each item (special K device area monitor). |
| Test | Write each item setting to PLC.<br>(Write the setting to special K device) |
| Close | Close monitor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

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

**Special Module Monitor**

**High Speed Counter Module**

| Item | CH 0 | CH 1 | CH 2 | CH 3 |
|---|---|---|---|---|
| Current Count Value | 0 | 0 | 0 | 0 |
| Revolution/Unit Time | 0 | 0 | 0 | 0 |
| Error Code | 0 | 0 | 0 | 0 |
| Channel | CH 4 | CH 5 | CH 6 | CH 7 |
| Current Count Value | 0 | 0 | 0 | 0 |
| Revolution/Unit Time | 0 | 0 | 0 | 0 |
| Error Code | 0 | 0 | 0 | 0 |
| FLAG Monitor | | | Error Code | FLAG Monitor |

| Item | Setting Value | Current Value |
|---|---|---|
| Channel | CH 0 | |
| Counter Mode | Linear | Linear |
| Pulse Input Mode | 1-Phs 1-In x1 | 1-Phs 1-In x1 |
| Internal Preset | 1-Phs 1-In x1 | 0 |
| External Preset | 1-Phs 2-In x1 | 0 |
| Ring Counter Min. | CW/CCW | 0 |
| Ring Counter Max. | 2-Phs x4 | 0 |
| | 0 | 0 |
| Compare 0 Mode | (Present Value)< | (Present Value)< |
| Compare 1 Mode | (Present Value)< | (Present Value)< |
| Compare 0 Min. Setting | 0 | 0 |
| Compare 0 Max. Setting | 0 | 0 |
| Compare 1 Min. Setting | 0 | 0 |
| Compare 1 Max. Setting | 0 | 0 |
| Compare 0 Output Point | Not Used | Not Used |
| Compare 1 Output Point | Not Used | Not Used |
| Unit Time [ms] | 1 | 1 |
| Pulse/Rev Value | 1 | 1 |

Reset max/min value     Stop Monitoring     Test     Close

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

**HSC Module Command**

**High Speed Counter Module**

| Item | CH 0 | CH 1 | CH 2 | CH 3 |
|---|---|---|---|---|
| CARRY Flag | OFF | OFF | OFF | OFF |
| BORROW Flag | OFF | OFF | OFF | OFF |
| Compare 0 Output Status | OFF | OFF | OFF | OFF |
| Compare 1 Output Status | OFF | OFF | OFF | OFF |

| Command | CH 0 | CH 1 | CH 2 | CH 3 |
|---|---|---|---|---|
| Enable Counter | OFF | OFF | OFF | OFF |
| Count Internal Preset | OFF | OFF | OFF | OFF |
| Count External Preset | OFF | OFF | OFF | OFF |
| Decrement Counter | OFF | OFF | OFF | OFF |
| Enable Compare 0 | OFF | OFF | OFF | OFF |
| Enable Compare 1 | OFF | OFF | OFF | OFF |
| Revolution/Unit Time | OFF | OFF | OFF | OFF |
| Latch Counter | OFF | OFF | OFF | OFF |

Close

# Chapter 9 Installation and Wiring
## 9.1 Safety Instruction

> ⚠ **Danger**
>
> ‣ Please design protection circuit at the external of PLC for entire system to operate safely because an abnormal output or an malfunction may cause accident when any error of external power or malfunction of PLC module.
>
>   (1) It should be installed at the external side of PLC to emergency stop circuit, protection circuit, interlock circuit of opposition action such as forward /reverse operation and interlock circuit for protecting machine damage such as upper/lower limit of positioning.
>
>   (2) If PLC detects the following error, all operation stops and all output is off.
>
>      (Available to hold output according to parameter setting)
>
>      (a) When over current protection equipment or over voltage protection operates
>
>      (b) When self diagnosis function error such as WDT error in PLC CPU occurs
>
> ‣ In case of error about IO control part that is not detected by PLC CPU, all output is off.
>   Design Fail Safe circuit at the external of PLC for machine to operate safely. Refer to 9.1.1 Fail Safe circuit.
>
>   (1) Because of error of output device, Relay, TR, etc., output may not be normal. About output signal that may cause the heavy accident, design supervisory circuit to external.
>
> ‣ In case load current more than rating or over current by load short flows continuously, danger of heat, fire may occur so design safety circuit to external such as fuse.
>
> ‣ Design for external power supply to be done first after PLC power supply is done. If external power supply is done first, it may cause accident by misoutput, misoperation.
>
> ‣ In case communication error occurs, for operation status of each station, refer to each communication manual.
>
> ‣ In case of controlling the PLC while peripheral is connected to CPU module, configure the interlock circuit for system to operate safely. During operation, in case of executing program change, operation status change, familiarize the manual and check the safety status. Especially, in case of controlling long distance PLC, user may not response to error of PLC promptly because of communication error or etc.
>   Limit how to take action in case of data communication error between PLC CPU and external device adding installing interlock circuit at the PLC program.

⚠ Danger

▸ Don't close the control line or communication cable to main circuit or power line. Distance should be more than 100mm. It may cause malfunction by noise.

▸ In case of controlling lamp load, heater, solenoid valve, etc. in case of Off -> On, large current (10 times of normal current) may flows, so consider changing the module to module that has margin at rated current.

▸ Process output may not work properly according to difference of delay of PLC main power and external power for process (especially DC in case of PLC power On-Off and of start time.
   For example, in case of turning on PLC main power after supplying external power for process, DC output module may malfunction when PLC is on, so configure the circuit to turn on the PLC main power first
   Or in case of external power error or PLC error, it may cause the malfunction.

▸ Not to lead above error to entire system, part causing breakdown of machine or accident should be configured at the external of PLC

### 9.1.1 Fail safe circuit

(1) example of system design (In case of not using ERR contact point of power module)

In case of AC

In case of AC . DC



Check direct current Signal input

PLC RUN output Start available as RA1

Output for warning (Lamp or buzzer)

RUN by F009C

Power off to output device

Emergency stop, Stop by limit

Configure part that lead opposite operation or breakdown such as interlock circuit forward, reverse revolution by external interlock circuit

Timer setting which DC input signal is configured.

Voltage relay equipped

Output for warning (Lamp or buzzer)

Run by F009C

Power Off to output device（Emergency stop, stop by limit switch)

Start sequence of power
In case of AC
- (1) Turn on power
- (2) Run CPU.
- (3) Turn on start switch
- (4) Output device runs by program through magnetic contactor (MC) [On]
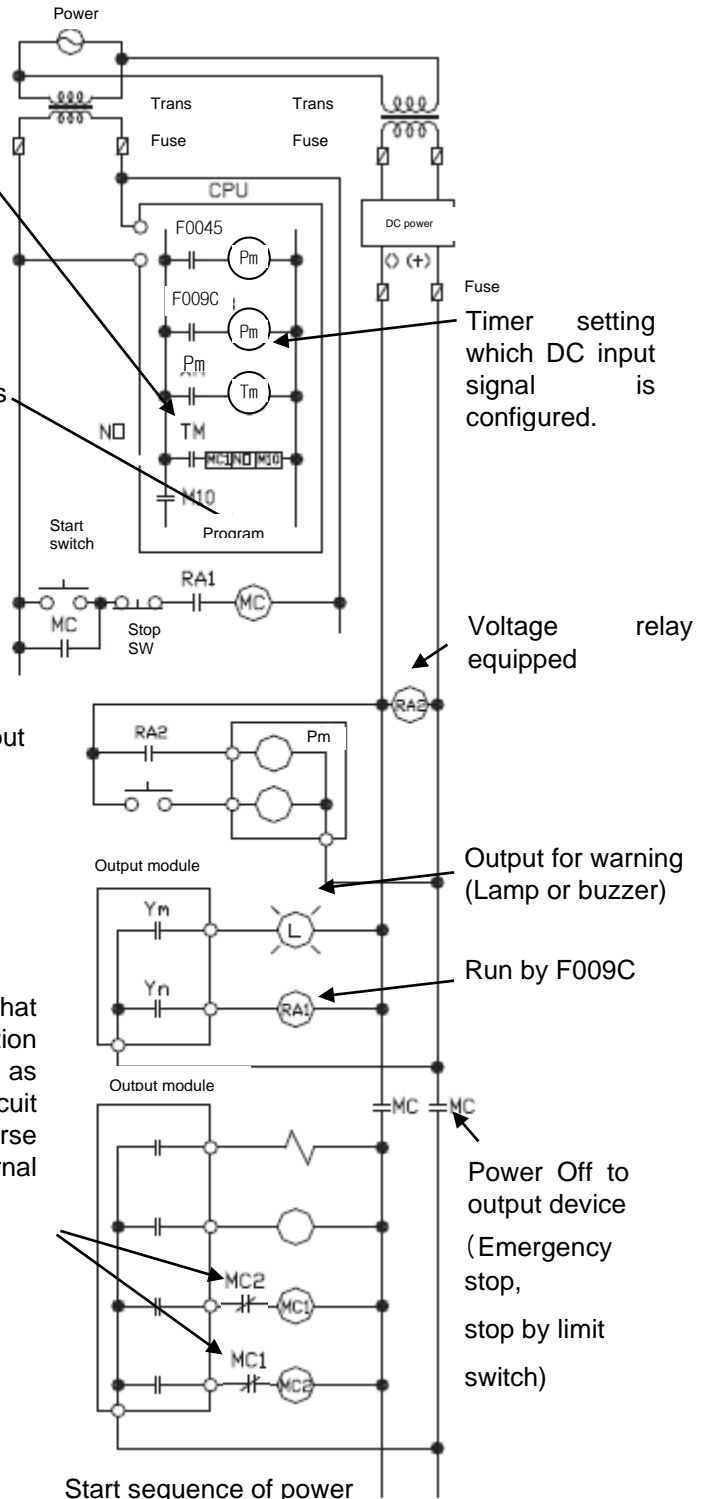
Start sequence of power
In case of AC DC
Run CPU after power is on
- (1) Turn on RA2 as DC power on
- (2) Turn on timer after DC power is stable.
- (3) Turn on start switch
- (4) Output device runs by program through magnetic contactor (MC) [On]

(2) System design circuit example (In case of using ERR contact point of power module)

Checking DC current Signal input

Start stop circuit

PLC RUN output Available to start as RA1

전원

Trans Fuse

Trans Fuse

CPU

F0045

Pm

F009C

Pm

Pm

Tm

DC power

() (+)

Fuse

Timer setting which DC input signal is configured.

NO

Tm

MC1 NO M10

M10

Program

Start SW

RA1

MC

Stop SW

RA2

Voltage relay equipped

RA2

Pm

Pm

Output module

Output for warning (Lamp or buzzer)

Pm

L

Pn,

RA1

ERR

RA3

Stop by ERR
Error Off

Output module

MC

MC

Configure part that lead opposite operation or breakdown such as interlock circuit forward, reverse revolution by external interlock circuit

MC2

MC1

MC1

MC2

ERR contact point off to output device power off

（Emergency stop,

stop by limit）

Start sequence of power
In case of AC DC
(1) Run CPU after turning on power.
(2) Turn on RA2 with DC power supplied
(3) Turn on timer after DC power is stable
(4) Turn on start switch Output device runs by program through magnetic contactor (MC) [On]

(3) Fail safe countermeasure in case of PLC error

Error of PLC CPU and memory is detected by self diagnosis but in case error occurs in IO control part, etc., CPU can detect the error. At this case, though it is different according to status of error, all contact point is on or off, so safety may not be guaranteed. Though we do out best to our quality as producer, configure safety circuit preparing that error occurs in PLC and it lead to breakdown or accident.

System example

| Main unit | Input 16 point | Input 16 point | Input 16 point | Input 16 point | Output 16 point | Output 16 point |
|-----------|---------|---------|---------|---------|---------|---------|
|           |         |         |         |         |         |         |

Output module for fail safe

Equip output module for fail safe to last slot of system.

[Fail safe circuit example]



Since P80 turn on/off every 0.5s, use TR output.
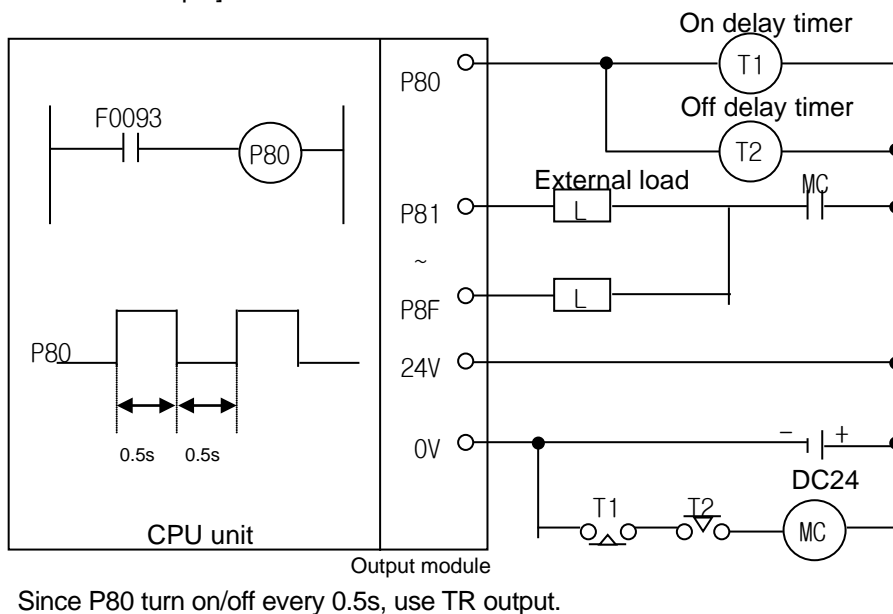
### 9.1.2 PLC heat calculation

(1) Power consumption of each part

(a) Power consumption of 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)

$I_{5V}$ : power 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.

(b) 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)

(c) 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)

(d) 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 $\times$ simultaneous On rate (W)

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

$V_{drop}$: voltage drop of each output module (V)
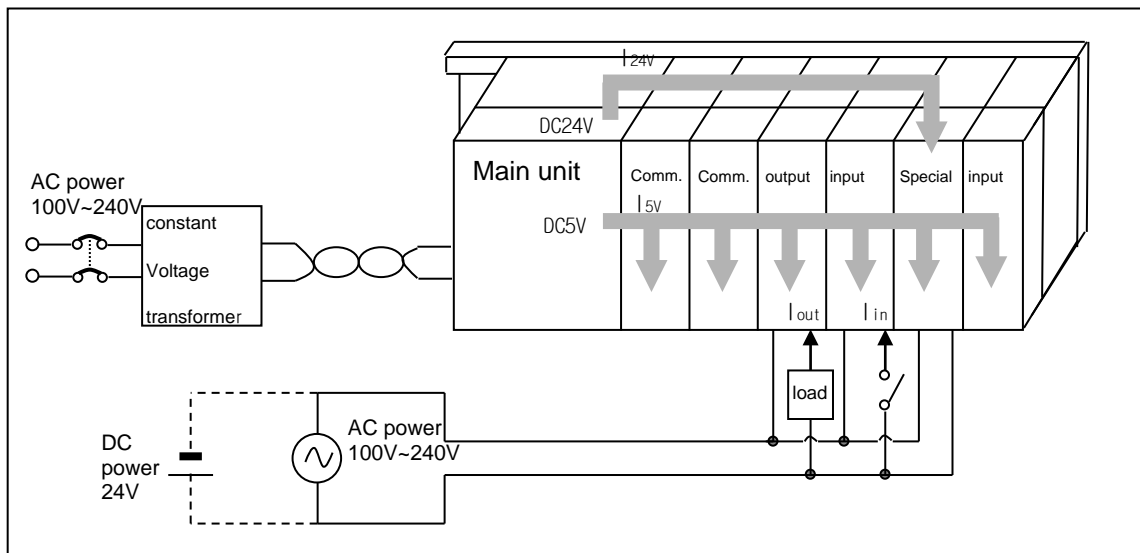
(e) Input average power consumption of input module
(power consumption of simultaneous On point)
- $W_{in} = I_{in} \times E \times$ input point $\times$ simultaneous On rate (W)
  $I_{in}$: input current (root mean square value in case of AC) (A)
  $E$ : input voltage (actually used voltage) (V)

(f) Power consumption of special module power assembly
- $W_S = I_{5V} \times 5 + I_{24V} \times 24 + I_{100V} \times 100$ (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]
$W$ : power consumption of the entire PLC system (the above calculated value)
$A$ : surface area of control panel [m²]
$U$ : if equalizing the temperature of the control panel by using a fan and others - - - 6
If the air inside the panel is not ventilated - - - - - - - - - - 4

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.

## 9.2  Attachment/Detachment of Modules

### 9.2.1 Attachment/Detachment of modules

Caution in handling
Use PLC in the range of general specification specified by manual.
In case of using out of range, it may cause electric shock, fire, malfunction, damage of product.

---

⚠ **Warning**

---

‣ Module must be mounted to hook for fixation properly before its fixation. The module may be damaged from over-applied force. If module is not mounted properly, it may cause malfunction.

‣ Do not drop or impact the module case, terminal block connector.

‣ Do not separate the PCB from case.

---

(1) Equipment of module

- Eliminate the extension cover at the upper of module.
- Push the module and connect it in agreement with hook for fixation of four edges and hook for connection at the bottom.
- After connection, get down the hook for fixation at the upper part and lower part and fix it completely.
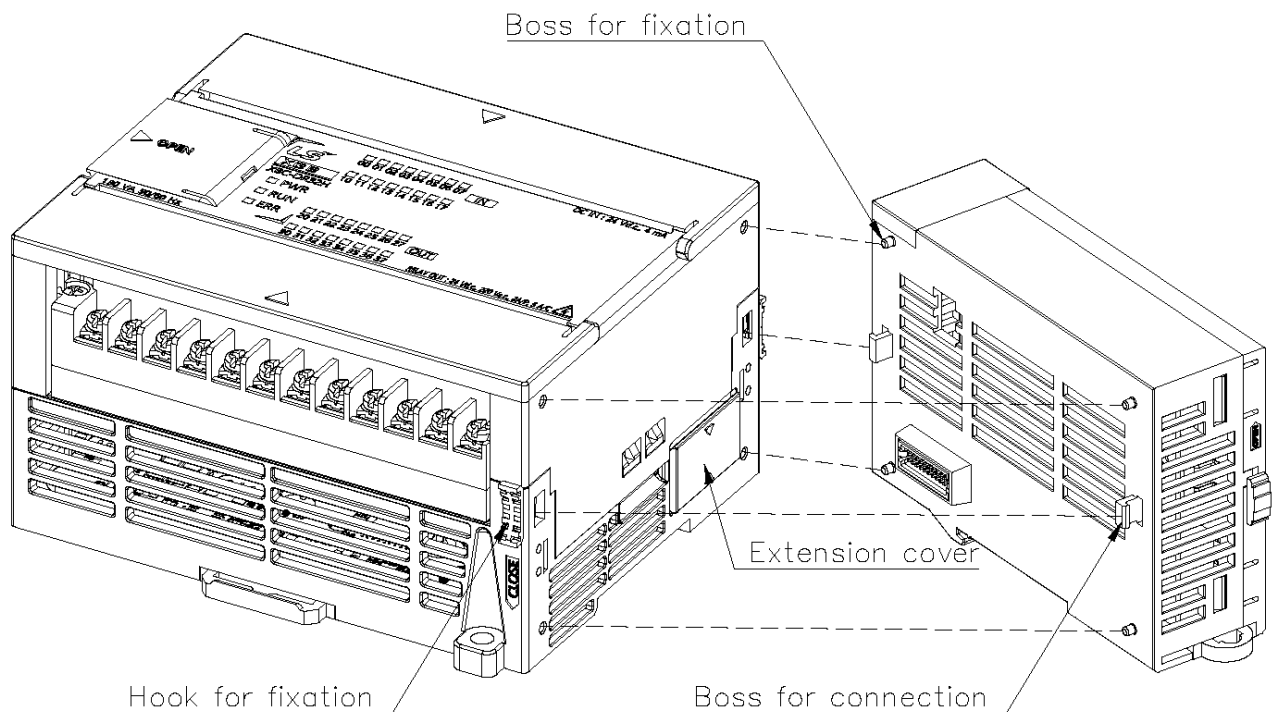
(2) Detachment of module

• Get up the hook for fixation of upper part and lower part and disconnect it.

• Detach the module with two hands. (Don't force over-applied force.)
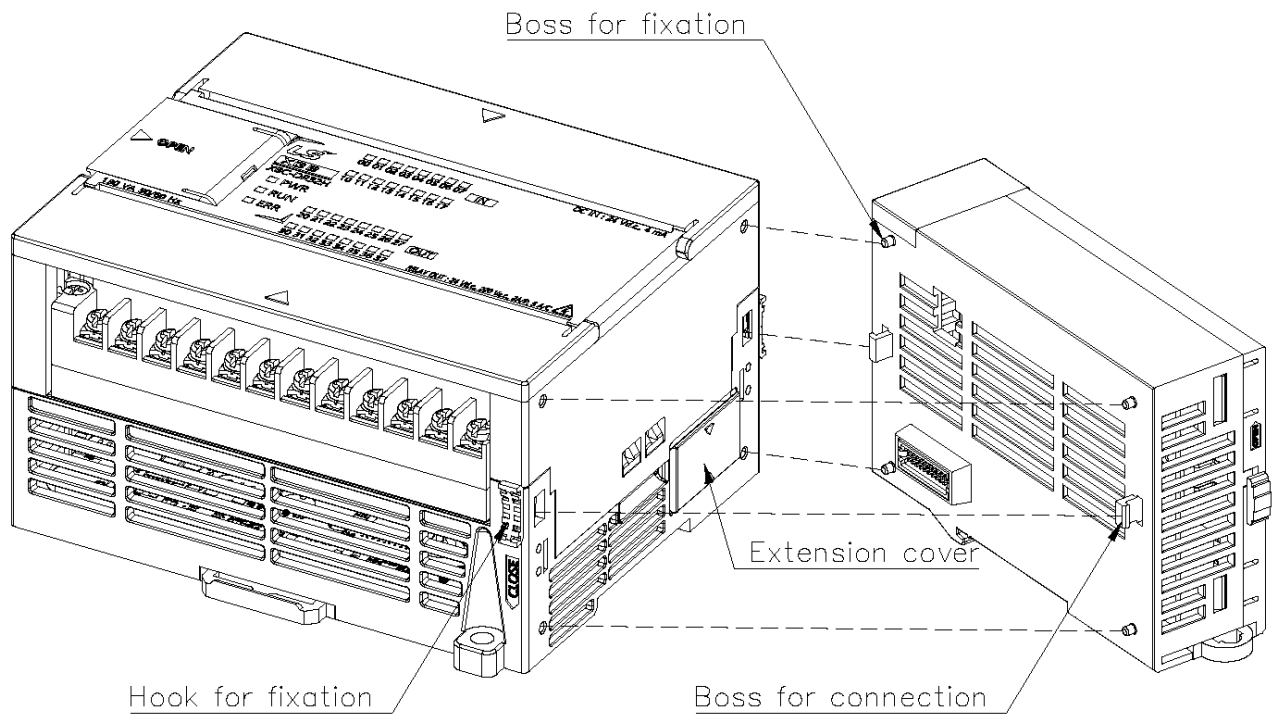


⚠ **Caution**

‣ When separating module, don't force over-applied power. If so, hook may be damaged.

(3) Installation of module
    XGB PLC main unit and expansion unit are having the hook for DIN rail (rail width 35mm).
    So they can be installed at DIN rail.

  (a) In case of installing at DIN rail
        • Pull out the hook for DIN rail in the bottom of module and install the module at DIN rail.
        • After installing the module at DIN rail, push the hook and fix the module at DIN rail.
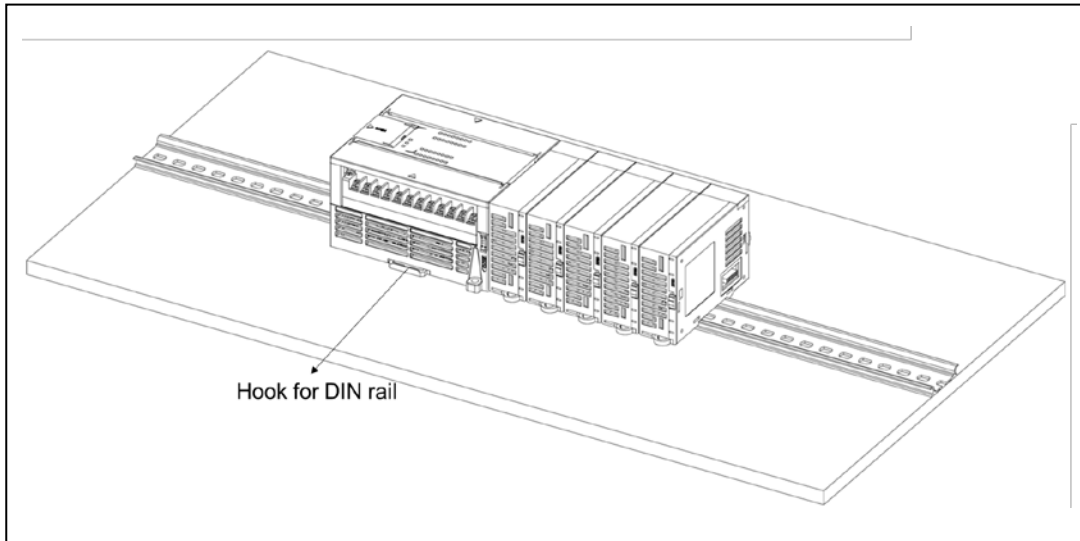


  (b) In case of installing at the panel
        • You can install the XGB compact type main unit at the panel directly by using screw hole.
        • When installing the product at the panel directly, use M4 type screw
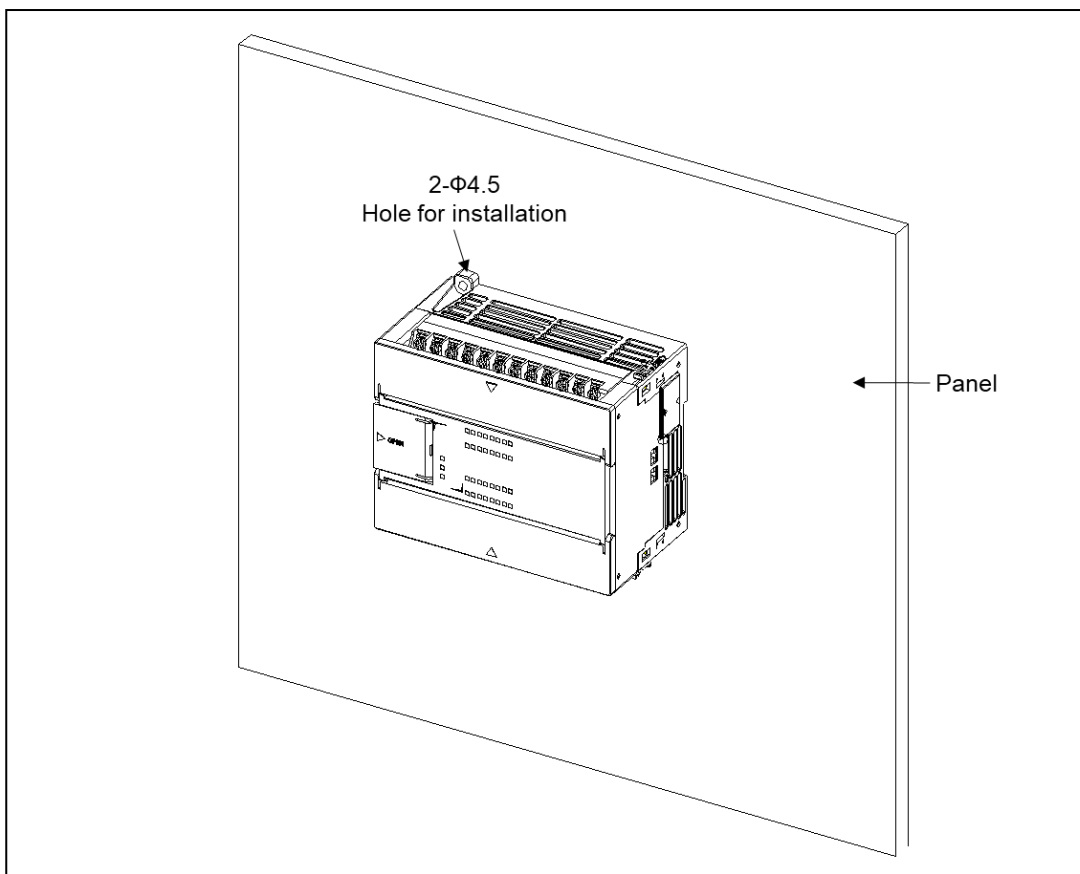
(4) Module equipment location
   Keep the following distance between module and structure or part for well ventilation and easy detachment and attachment.



30 ㎜ or above [*1]

30 ㎜ or above[*1]

5 ㎜ or above[*1]

5 ㎜ or above

PLC

Panel
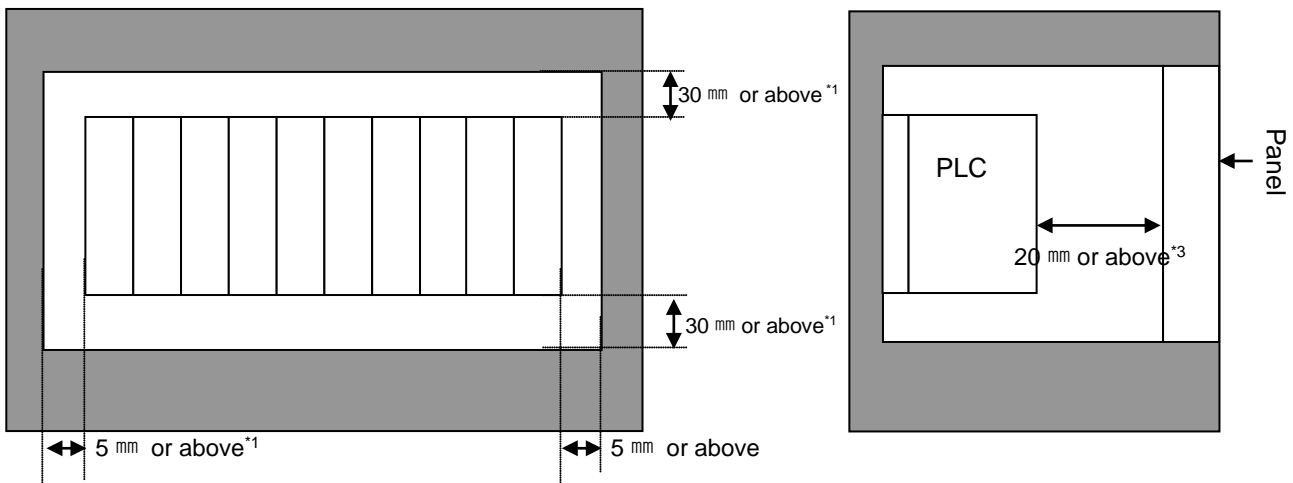
20 ㎜ or above[*3]

   *1 : In case height of wiring duct is less than 50 mm (except this 40mm or above)
   *2 : In case of equipping cable without removing near module, 20mm or above
   *3 : In case of connector type, 80mm or above

(5) Module equipment direction
   (a) For easy ventilation, install like the following figure.
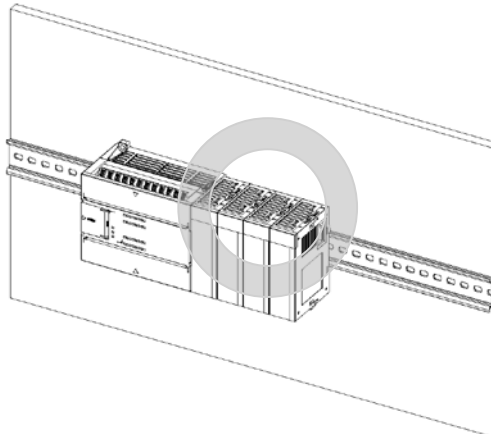


   (b) Don't install like the following figure
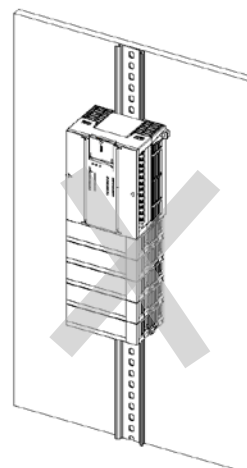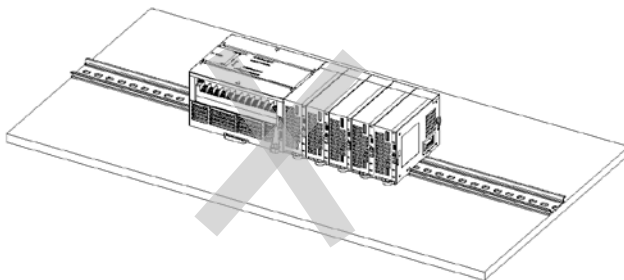
(6) Distance with other device

To avoid radiation noise or heat, keep the distance between PLC and device (connector and relay) as far as the following figure.

Device installed in front of PLC: 100 ㎜ or above

Device installed beside PLC: 50 ㎜ or above
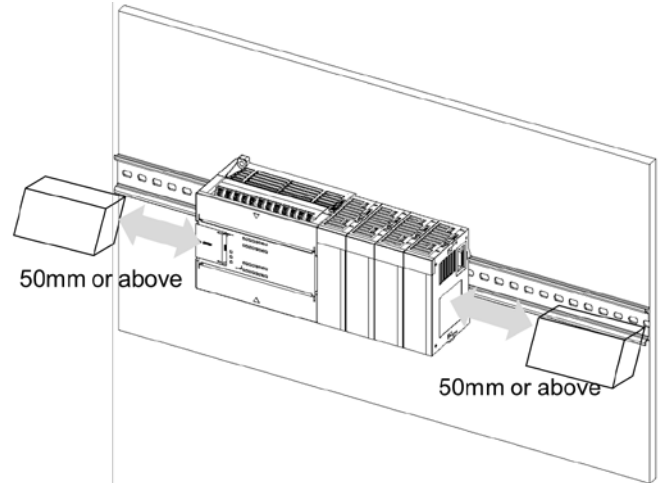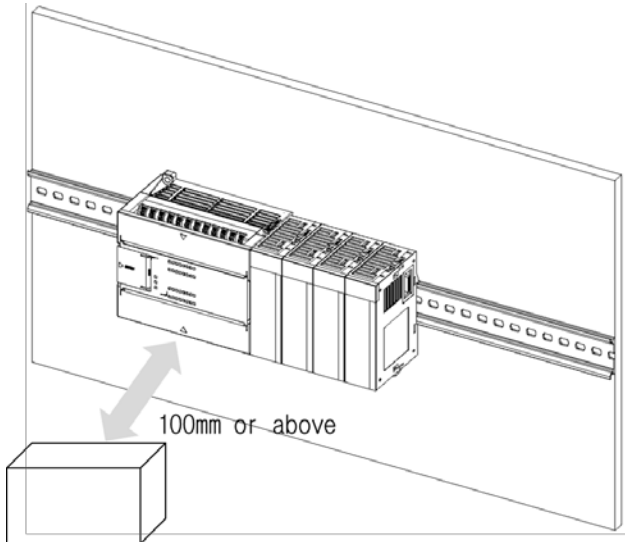
### 9.2.2 Caution in handling

Here describes caution from open to install
- Don't drop or impact product.
- Don't disassemble the PCB from case. It may cause the error.
- In case of wiring, make sure foreign substance not to enter upper part of module. If it enters, eliminate it.

(1) Caution in handling IO module
It describes caution in handling IO module.

(a) Recheck of IO module specification
For input module, be cautious about input voltage, for output module, if voltage that exceeds the max. open/close voltage is induced, it may cause the malfunction, breakdown or fire.

(b) Used wire
When selecting wire, consider ambient temp, allowed current and minimum size of wire is AWG22(0.3mm$^2$) or above.

(c) Environment
In case of wiring IO module, if device or material that induce high heat is too close or oil contacts wire too long time, it may cause short, malfunction or error.

(d) Polarity
Before supplying power of module which has terminal block, check the polarity.

(e) Wiring
- In case of wiring IO with high voltage line or power line, induced obstacle may cause error.
- Let no cable pass the IO operation indication part (LED).
  (You can't discriminate the IO indication.)
- In case induced load is connected with output module, connect the surge killer or diode load to load in parallel. Connect cathode of diode to + side of power.
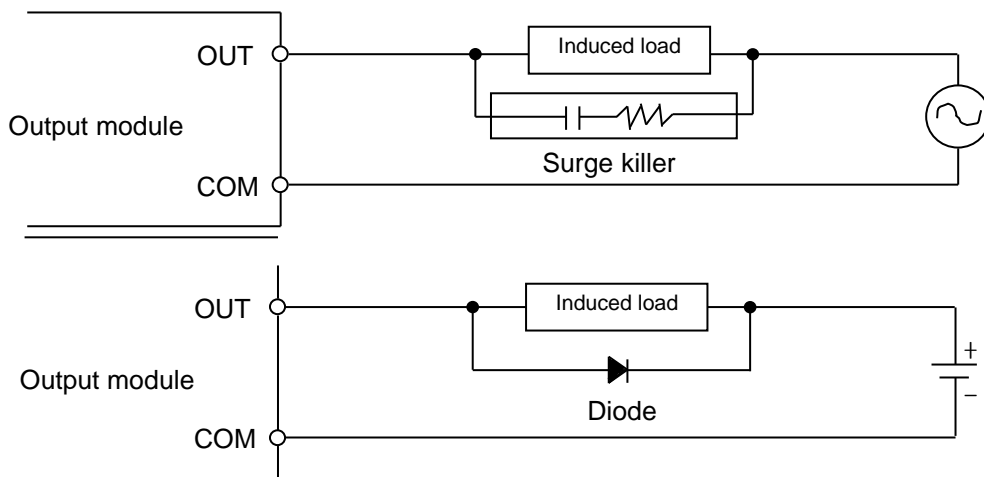


(f) Terminal block
Check close adhesion status. Let no foreign material of wire enter into PLC when wring terminal block or processing screw hole. At this case, it may cause malfunction.

(g) Don't impact to IO module or don't disassemble the PCB from case.

# 9.3  Wire

In case using system, it describes caution about wiring.

---

## ⚠ **Danger**

---

▸ When wiring, cut off the external power.
▸ If all power is cut, it may cause electric shock or damage of product.
▸ In case of flowing electric or testing after wiring, equip terminal cover included in product. It not, it may cause electric shock.

---

## ⚠ **Caution**

---

▸ Do D type ground (type 3 ground) or above dedicated for PLC for FG and LG terminal. It may cause electric shock or malfunction.
▸ When wiring module, check the rated voltage and terminal array and do properly.
   If rating is different, it may cause fire, malfunction.
▸ For external connecting connector, use designated device and solder.
  If connecting is not safe, it may cause short, fire, malfunction.
▸ For screwing, use designated torque range. If it is not fit, it may cause short, fire, malfunction.
▸ Let no foreign material enter such as garbage or disconnection part into module. It may cause fire, malfunction, error.

### 9.3.1 Power wiring

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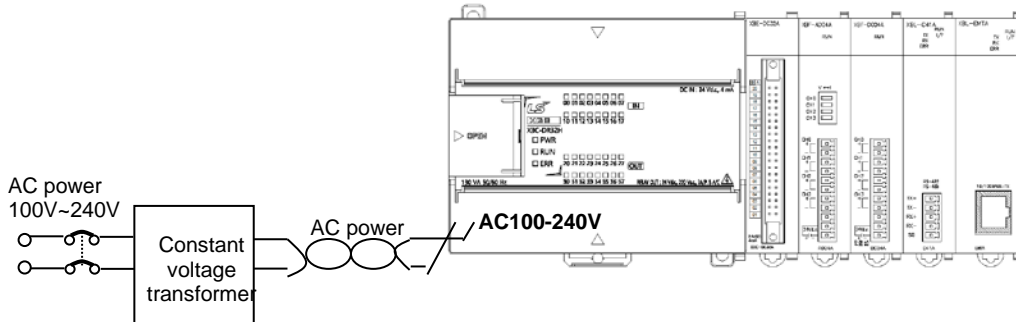


(2) Connect noise that include small noise between line and earth.
(When there are many noise, connect insulated transformer.)

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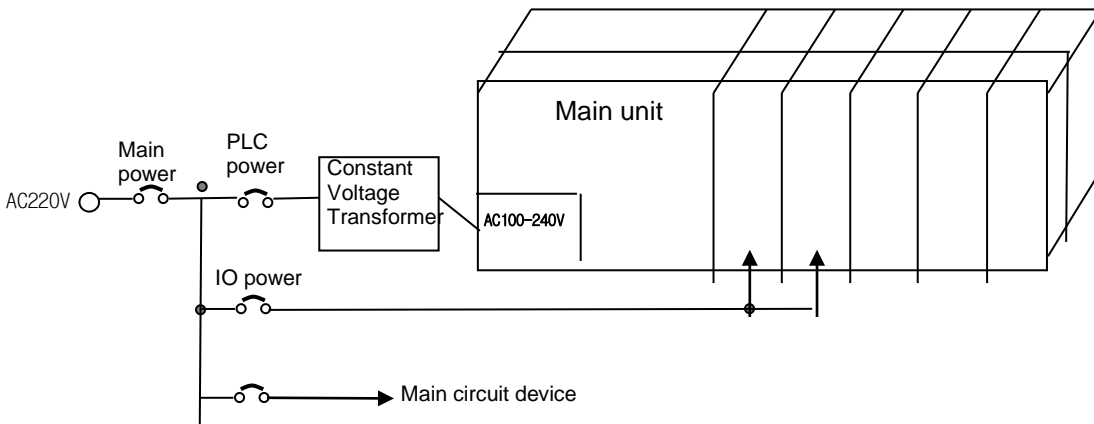


(4) If using DC24V of the power module

    (a) Do not connect DC24V of several power modules in parallel. It may cause the destruction of a module.
    (b) If a power module can not meet the DC24V output capacity, supply DC24V externally as presented below.
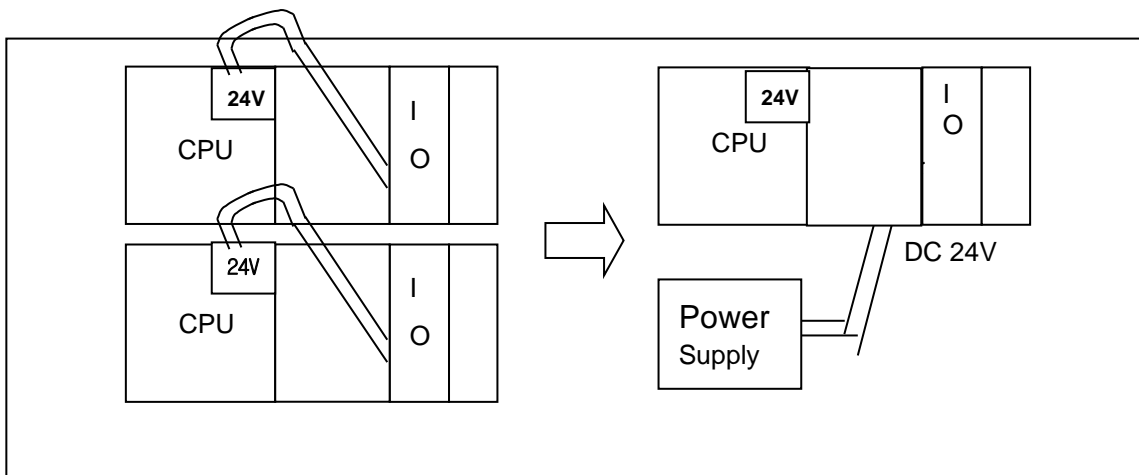


(5) AC110V/AC220V/DC24V cables should be compactly twisted and connected in the shortest distance.

(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

**Note**

(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.
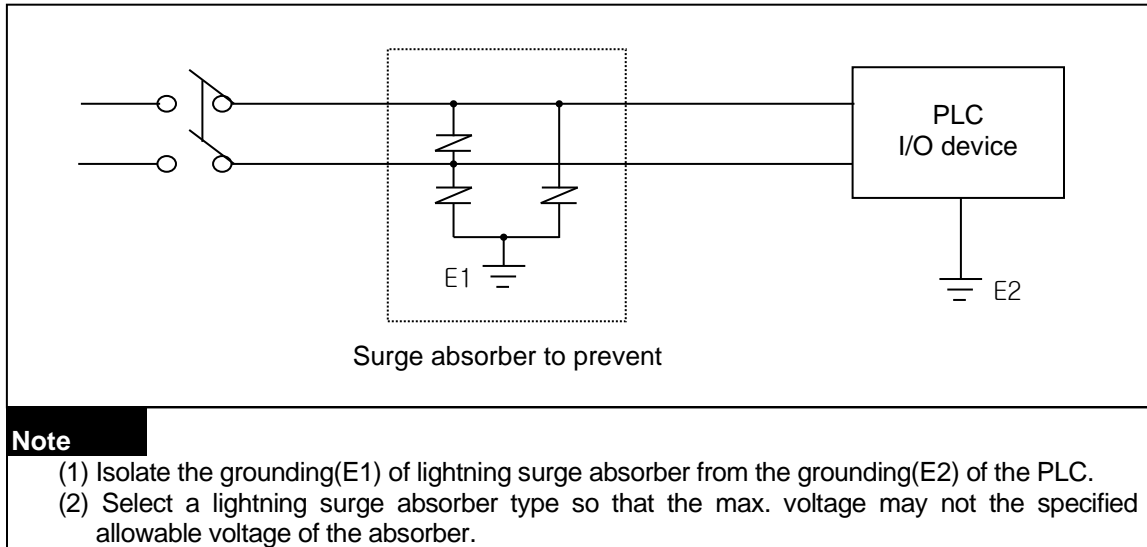
(9) When noise may be intruded inside it, use an insulated shielding transformer or noise filter.

(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) All field-wiring connections to this unit shall be from Limited Voltage / Limited Current, below 24Vdc isolated secondary source with an output fused with a 4A fuse max. or class 2 secondary circuits as defined in UL 508, 17th Edition.

### 9.3.2 I/O Device 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.
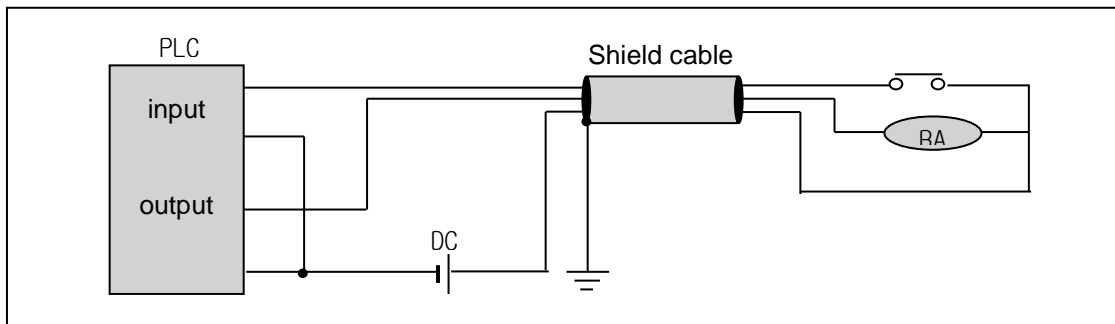


(5) When applying pipe-wiring, make sure to firmly ground the piping.

### 9.3.3 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.
For grounding construction, apply type 3 grounding(grounding resistance lower than 100 $\Omega$)

(3) If the exclusive grounding is not possible, use the common grounding as presented in B) of the figure below.
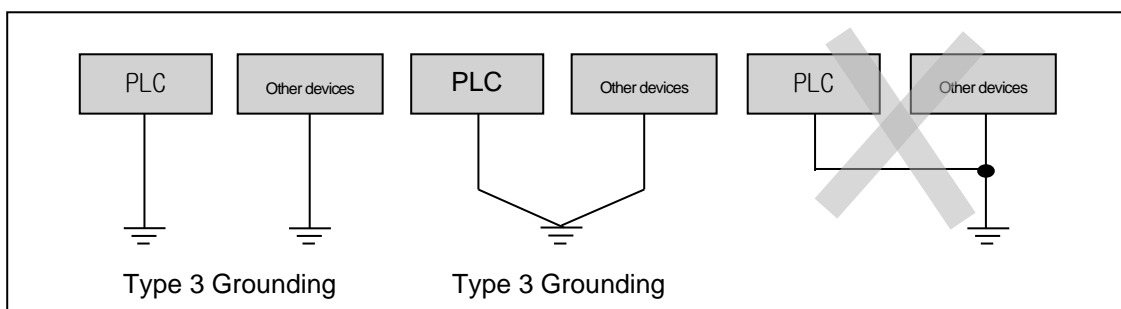


A) Exclusive grounding : best      B) common grounding : good      C) common grounding: defective

(4) 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.

(5) If any malfunction from grounding is detected, separate the FG of the base from the grounding.

### 9.3.4 Specifications of wiring cable

The specifications of cable used for wiring are as follows.

| Types of external connection | Cable specification (mm²) | | Wire Type | Temperature rating |
|---|---|---|---|---|
| | Lower limit | Upper limit | | |
| Digital input | 0.18 (AWG24) | 1.5 (AWG16) | Cu | 60℃/75℃ |
| Digital output | 0.18 (AWG24) | 2.0 (AWG14) | | |
| Analogue I/O | 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 10 Maintenance

Be sure to perform daily and periodic maintenance and inspection in order to maintain the PLC in the best conditions.

## 10.1 Maintenance and Inspection

The I/O module mainly consist of semiconductor devices and its service life is semi-permanent. However, periodic inspection is requested for ambient environment may cause damage to the devices. When inspecting one or two times per six months, check the following items.

| Check Items | | Judgment | Corrective Actions |
|---|---|---|---|
| Change rate of input voltage | | Within change rate of input voltage (Less than −15%  to +20% ) | Hold it with the allowable range. |
| Power supply for input/output | | Input/Output specification of each module | Hold it with the allowable range of each module. |
| Ambient environment | Temperature | 0 ~ + 55℃ | Adjust the operating temperature and humidity with the defined range. |
| | Humidity | 5 ~ 95%RH | |
| | Vibration | No vibration | Use vibration resisting rubber or the vibration prevention method. |
| Play of modules | | No play allowed | Securely enrage the hook. |
| Connecting conditions of terminal screws | | No loose allowed | Retighten terminal screws. |
| Spare parts | | Check the number of Spare parts and their Store conditions | Cover the shortage and improve the conditions. |

## 10.2 Daily Inspection

The following table shows the inspection and items which are to be checked daily.

| Check Items | | Check Points | Judgment | Corrective Actions |
|---|---|---|---|---|
| Connection conditions of base | | Check the screws. | Screws should not be loose. | Retighten Screws. |
| Connection conditions of Input/Output module | | Check the connecting screws Check module cover. | Screws should not be loose. | Retighten Screws. |
| Connecting conditions of terminal block or extension cable | | Check for loose mounting screws. | Screws should not be loose. | Retighten Screws. |
| | | Check the distance between solderless terminals. | Proper clearance should be provided. | Correct. |
| | | Connecting of expansion cable. | Connector should not be loose. | Correct. |
| LED indicator | PWR LED | Check that the LED is On. | On(Off indicates an error) | See chapter 5. |
| | Run LED | Check that the LED is On during Run. | On (flickering indicates an error) | See chapter 5. |
| | ERR LED | Check that the LED is Off during Run. | Off(On indicates an error) | See chapter 5. |
| | Input LED | Check that the LED turns On and Off. | On when input is On, Off when input is off. | See chapter 5. |
| | Output LED | Check that the LED turns On and Off | On when output is On, Off when output is off | See chapter 5. |

## 10.3 Periodic Inspection

Check the following items once or twice every six months, and perform the needed corrective actions.

| Check Items | | Checking Methods | Judgment | Corrective Actions |
|---|---|---|---|---|
| Ambient environment | Ambient temperature | -. Measure with thermometer and hygrometer<br>-. measure corrosive gas | 0 ~ 55 °C | Adjust to general standard (Internal environmental standard of control section) |
| | Ambient Humidity | | 5 ~ 95%RH | |
| | Ambient pollution level | | There should be no corrosive gases | |
| PLC Conditions | Looseness, Ingress | The module should be move the unit | The module should be mounted securely. | Retighten screws |
| | dust or foreign material | Visual check | No dust or foreign material | |
| Connecting conditions | Loose terminal screws | Re-tighten screws | Screws should not be loose | Retighten |
| | Distance between terminals | Visual check | Proper clearance | Correct |
| | Loose connectors | Visual check | Connectors should not be loose. | Retighten connector mounting screws |
| Line voltage check | | Measure voltage between input terminals | DC24V: DC20.4 ~ 28.8V | Change supply power |

# Chapter 11 Troubleshooting

The following explains contents, diagnosis and corrective actions for various errors that can occur during system operation.

## 11.1 Basic Procedure of Troubleshooting

System reliability not only depends on reliable equipment but also on short downtimes in the event of fault. The short discovery and corrective action is needed for speedy operation of system. The following shows the basic instructions for troubleshooting.

   1) Visual checks

     Check the following points.
- Machine operating condition (in stop and operation status)
- Power On/Off
- Status of I/O devices
- Condition of wiring (I/O wires, extension and communications cables)
- Display states of various indicators (such as POWER LED, RUN LED, ERR LED and I/O LED)

     After checking them, connect peripheral devices and check the operation status of the PLC and the program contents.

  2) Trouble Check

     Observe any change in the error conditions during the following.
- Switch to the STOP position, and then turn the power on and off.

  3) Narrow down the possible causes of the trouble where the fault lies, i.e.:
- Inside or outside of the PLC ?
- I/O module or another module?
- PLC program?

## 11.2 Troubleshooting

This section explains the procedure for determining the cause of troubles as well as the errors and corrective actions.

| Symptoms | |
|---|---|
| Is the power LED turned Off ? | Flowchart used when the POWER LED is turned Off. |
| Is the ERR LED flickering ? | Flowchart used when the ERR LED is flickering. |
| Are the RUN LED turned Off ? | Flowchart used when the RUN turned Off. |
| I/O module doesn't operate properly. | Flowchart used when the output load of the output module doesn't turn on. |
| Program cannot be written. | Flowchart used when a program can't be written to the PLC. |

## 11.2.1 Troubleshooting flowchart used when the PWR (Power) LED turns Off.

The following flowchart explains corrective action procedure used when the power is supplied or the power LED turns Off during operation.

```
                    ┌──────────────────────────┐
                    │  Power LED is turned Off.  │
                    └──────────────────────────┘
                                 │
                    ◇ Is the power supply ───No──→ ┌──────────────────┐
                      operating?                    │  Supply the power. │
                                 │                  └──────────────────┘
                                Yes                          │
                                 │         No      ◇ Does the power LED ──Yes──┐
                                 │◀────────────────── turns On?                │
                                 │                                             │
                    ◇ Is the voltage within the ──No──→ ┌──────────────────┐   │
                      rated power?                       │  Supply the power │   │
                                 │                       │  properly.        │   │
                                Yes                      └──────────────────┘   │
                                 │              Yes              │              │
                                 │◀──────── ◇ Does the power LED ──Yes──────────┤
                                 │            turns On?                         │
                                 │                                             │
                    ◇ Over current protection ─────────────┐                   │
                      device activated?                     │                   │
                                 │                          ▼                   │
                                 │          ┌───────────────────────────────┐  │
                                 │          │ 1) Eliminate the excess current│  │
                                 │          │ 2) Switch the input power Off   │  │
                                 │          │    then On.                     │  │
                                 │          └───────────────────────────────┘  │
                                 No                        │                    │
                                 │          No   ◇ Does the power LED ──Yes──────┤
                                 │◀────────────── turns On?                      │
                                 ▼                                               ▼
                    ┌──────────────────────────┐                      ┌──────────────┐
                    │ Write down the troubleshooting│                   │  Complete    │
                    │ Questionnaire and contact     │                   └──────────────┘
                    │ the nearest service center.   │
                    └──────────────────────────────┘
```

## 11.2.2 Troubleshooting flowchart used with when the ERR (Error) LED is flickering

The following flowchart explains corrective action procedure use when the power is supplied starts or the ERR LED is flickering during operation.



<div align="center">

| STOP LED goes flickering |

↓

| Check the error code, with connected XG5000. |

↓

Warning error? ──No──→ | See Appendix 1 Flag list and remove the cause of the error. |

Yes ↓

Is ERR LED still flicking ?

No ──→ Complete

Yes ↓

| Write down the Troubleshooting Questionnaires and contact the nearest service center. |

</div>

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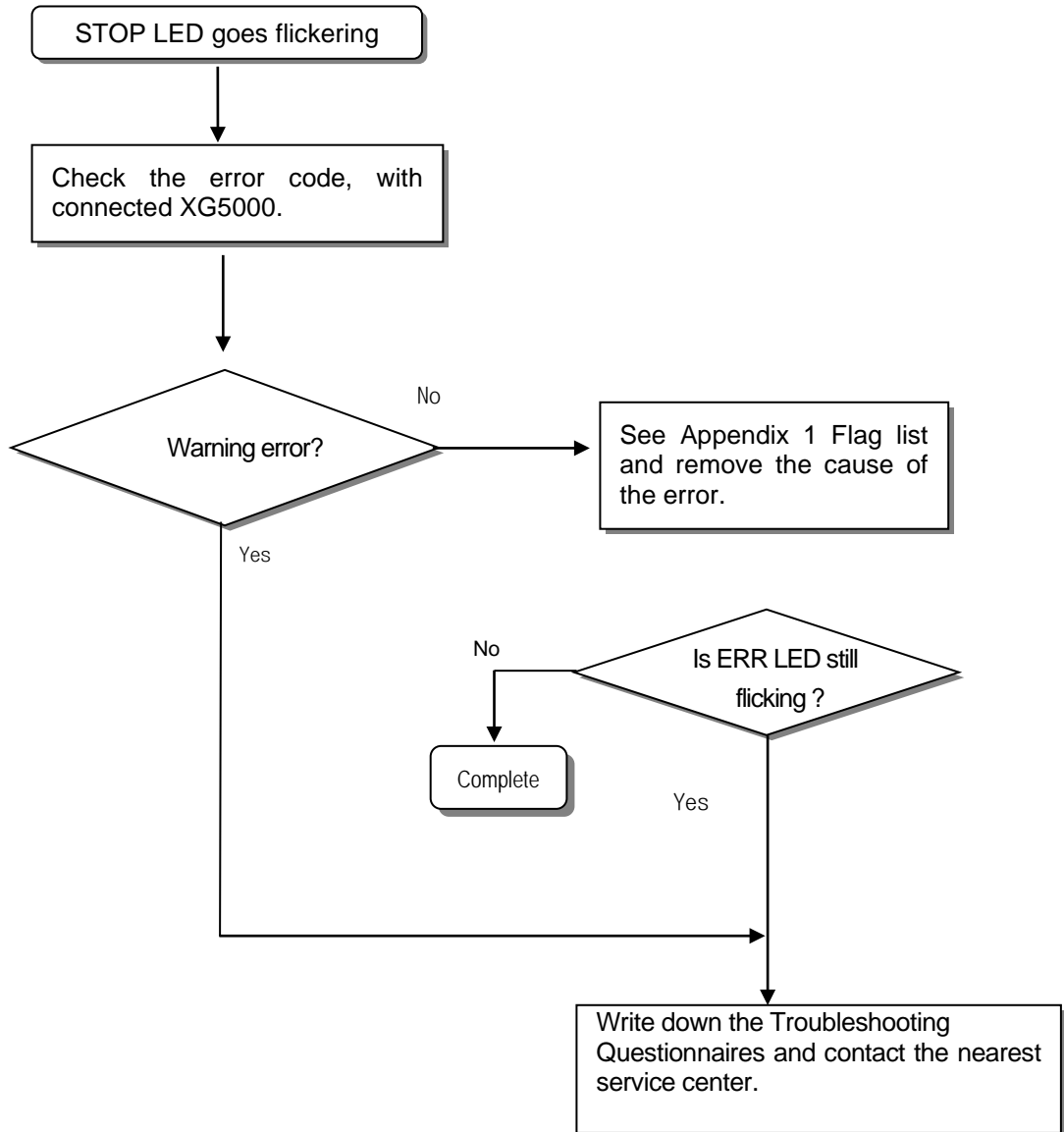
## ⚠ **Warning**

Though warning error appears, PLC system doesn't stop but corrective action is needed promptly. If not, it may cause the system failure.

## 11.2.3 Troubleshooting flowchart used with when the RUN , STOP LED turns Off.

The following flowchart explains corrective action procedure to treat the lights-out of RUN LED when the power is supplied, operation starts or operation is in the process.

```
            ┌──────────────────────────┐
            │   RUN, STOP LED is Off.   │
            └──────────────────────────┘
                         │
                         ▼
            ┌──────────────────────────┐
            │ Turn the power unit Off and On. │
            └──────────────────────────┘
                         │
                         ▼
                      ◇ Is RUN/ STOP LED Off? ◇ ──No──┐
                         │                             │
                        Yes                            │
                         │                             │
                         ▼                             ▼
   ┌──────────────────────────┐          ┌──────────────────┐
   │ Write down the Troubleshooting │     │    Complete       │
   │ Questionnaires and contact the nearest │ └──────────────────┘
   │ service center.          │
   └──────────────────────────┘
```
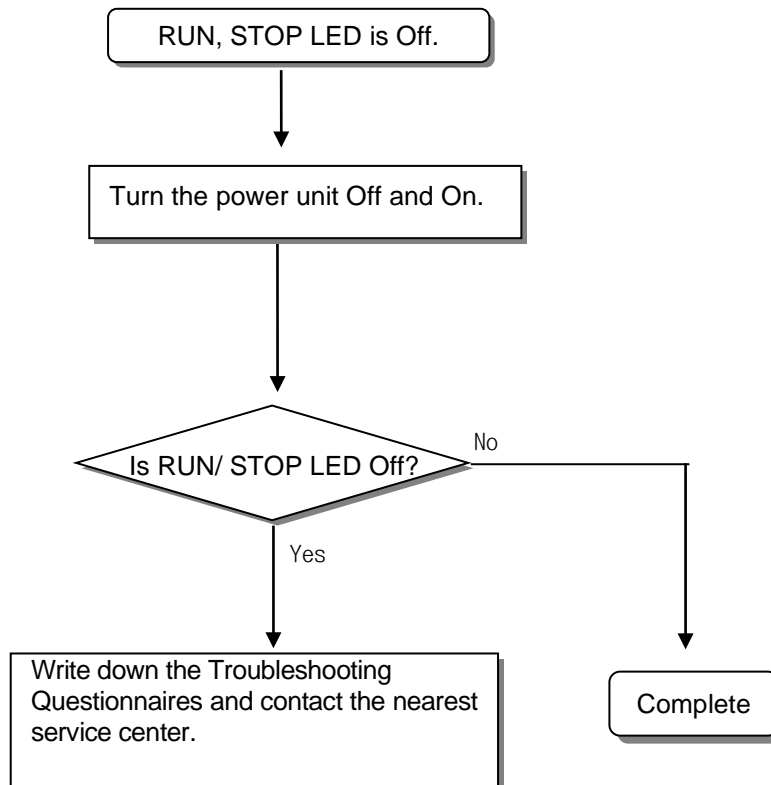
## 11.2.4 Troubleshooting flowchart used when the I/O part doesn't operate normally.

The following flowchart explains corrective action procedure used when the I/O module doesn't operate normally.

```
                              ( Continue )
                                   │
                                   ▼
                    ◇ Are the indicator LED of the ◇ ──No──┐
                      switch 1 and 2 on?                    │
                                   │ Yes                    │
                                   ▼                        ▼
            ┌──────────────────────────┐      ┌──────────────────────────┐
            │ Check voltage of switch 1,2│     │ Check voltage of switch 1,2│
            │ by tester                 │      │ by tester                 │
            └──────────────────────────┘      └──────────────────────────┘
                                   │                        │
                                   ▼                        ▼                              ◇ Is the
                    ◇ Is the measured value ◇       ◇ Is the measured value ◇ ──Yes──    terminal screw tighten ◇
                      normal?                          normal?                              securely?
                          │ Yes   │ No                    │ No                          No │         │ Yes
                                                                                            ▼         ▼
                                                                                                  ◇ Is the condition
                         Yes ──── ◇ Is input wiring correct? ◇              of the terminal board connector ◇
                                              │ No                                       appropriate?
            ┌──────────────────────────┐                                                    │ No
            │ Separate the external     │
            │ wiring witch then check   │
            │ the status by forced input│
            └──────────────────────────┘
                          │
                          ▼
            ◇ Is the measured value ◇
              normal?
         No │           │ Yes
```

| Input unit replacement is Needed. | Check the status of the switch 1 and 2. | Correct wiring | Retighten the terminal screw. | Replace the terminal board connector. | Check from the beginning. | Input unit replacement is Needed. |

## 11.3 Troubleshooting Questionnaire

When problems have been met during operation of the XGC series, please write down this Questionnaires and contact the service center via telephone or facsimile.
• For errors relating to special or communication modules, use the questionnaire included in the User's manual of the unit.

1. Telephone & FAX No
    Tell)                                    FAX)
2. Using equipment model:

3. Details of using equipment
    CPU model: (            )     OS version No.:(          )     Serial No.(                    )
    XG5000 (for program compile) version No.: (          )

4. General description of the device or system used as the control object:


5. The kind of the base unit:
− Operation by the mode setting switch (                ),
− Operation by the XG5000 or communications (          ),
− External memory module operation (              ),

6. Is the ERR. LED of the CPU module turned On ? Yes(      ), No(      )

7. XG5000 error message:

8. History of corrective actions for the error message in the article 7:

9. Other tried corrective actions:

10. Characteristics of the error
• Repetitive(      ): Periodic(      ), Related to a particular sequence(      ), Related to environment(      )
• Sometimes(      ): General error interval:

11. Detailed Description of error contents:


12. Configuration diagram for the applied system:

## 11.4 Troubleshooting Examples
Possible troubles with various circuits and their corrective actions are explained.
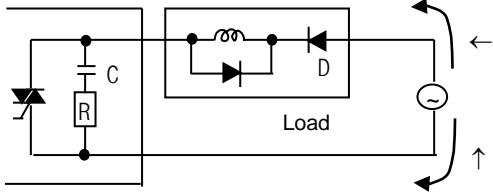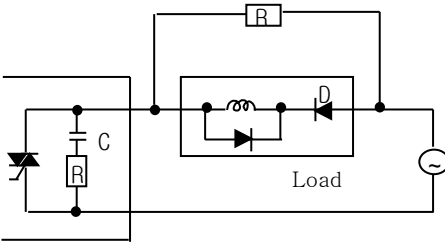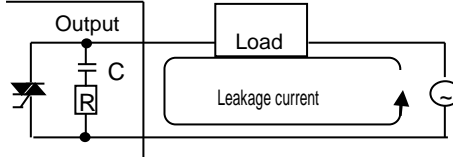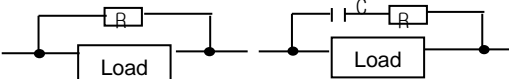
### 11.4.1 Input circuit troubles and corrective actions

The followings describe possible troubles with input circuits, as well as corrective actions.
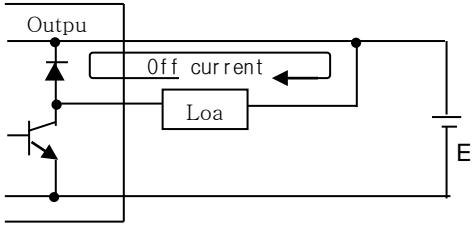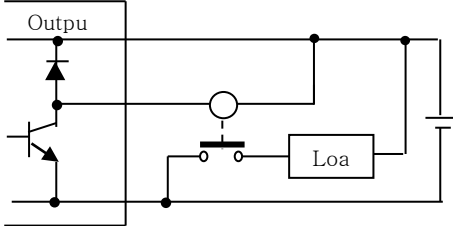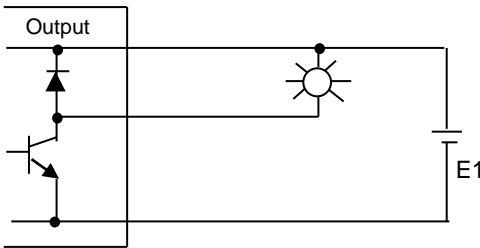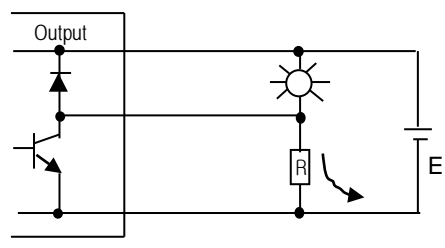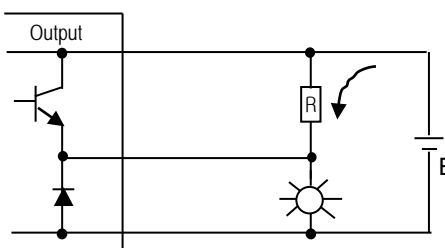
| Condition | Cause | Corrective Actions |
|---|---|---|
| Input signal doesn't turn off. | Leakage current of external device (Such as a drive by non-contact switch)<br> | • Connect an appropriate register and capacity, which will make the voltage lower across the terminals of the input module.<br> |
| Input signal doesn't turn off. (Neon lamp may be still on) | Leakage current of external device (Drive by a limit switch with neon lamp)<br> | • CR values are determined by the leakage current value.<br>− Recommended value C : 0.1 ~ 0.47 $\mu$F<br>  R: 47 ~ 120 Ω (1/2W)<br>Or make up another independent display circuit. |
| Input signal doesn't turn off. | Leakage current due to line capacity of wiring cable.<br> | • Locate the power supply on the external device side as shown below.<br> |
| Input signal doesn't turn off. | Leakage current of external device (Drive by switch with LED indicator)<br> | • Connect an appropriate register, which will make the voltage higher than the OFF voltage across the input module terminal and common terminal.<br> |
| Input signal doesn't turn off. | • Sneak current due to the use of two different power supplies.<br><br>• E1 > E2, sneaked. | • Use only one power supply.<br> • Connect a sneak current prevention diode.<br> |

## 11.4.2 Output circuit and corrective actions

The following describes possible troubles with output circuits, as well as their corrective actions.

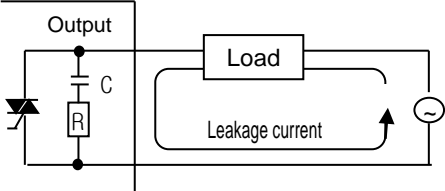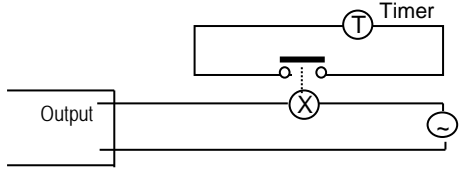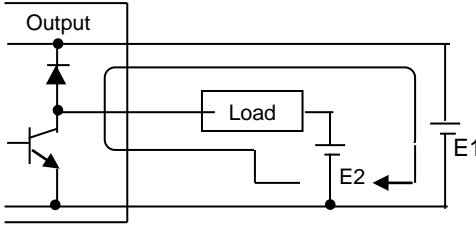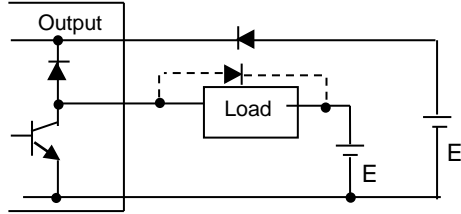| Condition | Cause | Corrective Action |
|---|---|---|
| When the output is off, excessive voltage is applied to the load. | •Load is half-wave rectified inside (in some cases, it is true of a solenoid)<br>•When the polarity of the power supply is as shown in ①, C is charged. When the polarity is as shown in ②, the voltage charged in C plus the line voltage are applied across D. Max. voltage is approx. 2√2.<br><br>*) If a resistor is used in this way, it does not pose a problem to the output element. But it may make the performance of the diode (D), which is built in the load, drop to cause problems. | • Connect registers of tens to hundreds KΩ across the load in parallel.<br> |
| The load doesn't turn off. | • Leakage current by surge absorbing circuit, which is connected to output element in parallel.<br> | • 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.<br> |
| When the load is C-R type timer, time constant fluctuates. | • Leakage current by surge absorbing circuit, which is connected to output element in parallel.<br> | • Drive the relay using a contact and drive the C-R type timer using the since contact.<br>• Use other timer than the C−R contact some timers have half-ware rectified internal circuits therefore, be cautious.<br> |
| The load does not turn off. | • Sneak current due to the use of two different power supplies.<br><br>E1<E2, sneaks. E1 is off (E2 is on), sneaks. | • Use only one power supply.<br>• Connect a sneak current prevention diode.<br><br>If the load is the relay, etc, connect a counter-electromotive voltage absorbing code as shown by the dot line. |

Output circuit troubles and corrective actions (continued).

| Condition | Cause | Corrective actions |
|---|---|---|
| The load off response time is long. | • Over current at off state [The large solenoid current fluidic load (L/R is large) such as is directly driven with the transistor output.<br><br><br><br>• 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.<br><br> |
| Output transistor is destroyed. | Surge current of the white lamp<br><br><br><br>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.<br><br><br><br>Sink type transistor output<br><br><br><br>Source type transistor output |

# 11.5 Error Code List

| Error code | Error cause | Action (restart mode after taking an action) | Operation status | LED status | Diagnosis point |
|---|---|---|---|---|---|
| 23 | Program to execute is abnormal | Start after reloading the program | Warning | 0.5 second Flicker | RUN mode |
| 24 | I/O parameter error | Start after reloading I/O parameter, Battery change if battery has a problem. Check the preservation status after I/O parameter reloading and if error occurs, change the unit. | Warning | 0.5 second Flicker | Reset RUN mode switching |
| 25 | Basic parameter error | Start after reloading Basic parameter, Change battery if it has a problem. Check the preservation status after Basic parameter reloading and if error occurs, change the unit. | Warning | 0.5 second Flicker | Reset RUN mode switching |
| 30 | Module set in parameter and the installed module does not match | modify the module or parameter and then restart. | Warning | 0.5 second Flicker | RUN mode switching |
| 31 | Module falling during operation or additional setup | After checking the position of attachment/detachment of expansion module during Run mode | Warning | 0.1 second Flicker | Every scan |
| 33 | Data of I/O module does not access normally during operation. | After checking the position of slot where the access error occurs by XG5000, change the module and restart (acc.to parameter.) | Heavy error | 0.1 second Flicker | Scan end |
| 34 | Normal access of special/link module data during operation not available | After checking the position of slot that access error occurred by XG5000, change the module and restart (acc.to parameter). | Heavy error | 0.1 second Flicker | Scan end |
| 39 | Abnormal stop of CPU or malfunction | Abnormal system end by noise or hard ware error. 1) If it occurs repeatedly when power reinput, request service center 2) Noise measures | Heavy error | 0.1 second Flicker | Ordinary time |
| 40 | Scan time of program during operation exceeds the scan watchdog time designated by parameter. | After checking the scan watchdog time designated by parameter, modify the parameter or the program and then restart. | Warning | 0.5 second Flicker | While running the program |
| 41 | Operation error occurs while running the user program. | Remove operation error → reload the program and restart. | Warning | 0.5 second Flicker | While running the program |
| 44 | Timer index user error | After reloading a timer index program modification, start | Warning | 0.5 second Flicker | Scan end |
| 50 | Heavy error of external device | Refer to Heavy error detection flag and modifies the device and restart. (Acc. Parameter) | Heavy error | 1 second Flicker | Scan end |
| 60 | E_STOP function executed | After removing error causes which starts E_STOP function in program, power reinput | Heavy error | 1 second Flicker | While running the program |

| Error code | Error cause | Action (restart mode after taking an action) | Operation status | LED status | Diagnosis point |
|---|---|---|---|---|---|
| 500 | Data memory backup not possible | If not error in battery, power reinput Remote mode is switched to STOP mode. | Warning | 1 second Flicker | Reset |
| 501 | Abnormal clock data | Setting the time by XG5000 if there is no error | Warning | 0.1 second Flicker | Ordinary time |
| 502 | Battery voltage falling | Battery change at power On status | Warning | 0.1 second Flicker | Ordinary time |

# Appendix 1 Flag List

## Appendix 1.1 Special Relay (F) List

| Word | Bit | Variables | Function | Description |
|------|-----|-----------|----------|-------------|
| F000~1 | - | _SYS_STATE | Mode and state | Indicates PLC mode and operation State. |
| | F0000 | _RUN | Run | Run state. |
| | F0001 | _STOP | Stop | Stop state. |
| | F0002 | _ERROR | Error | Error state. |
| | F0003 | _DEBUG | Debug | Debug state. |
| | F0004 | _LOCAL_CON | Local control | Local control mode. |
| | F0006 | _REMOTE_CON | Remote mode | Remote control mode. |
| | F0008 | _RUN_EDIT_ST | Editing during RUN | Editing program download during RUN. |
| | F0009 | _RUN_EDIT_CHK | Editing during RUN | Internal edit processing during RUN. |
| | F000A | _RUN_EDIT_DONE | Edit done during RUN | Edit is done during RUN. |
| | F000B | _RUN_EDIT_END | Edit end during RUN | Edit is ended during RUN. |
| | F000C | _CMOD_KEY | Operation mode | Operation mode changed by key. |
| | F000D | _CMOD_LPADT | Operation mode | Operation mode changed by local PADT. |
| | F000E | _CMOD_RPADT | Operation mode | Operation mode changed by Remote PADT. |
| | F000F | _CMOD_RLINK | Operation mode | Operation mode changed by Remote communication module. |
| | F0010 | _FORCE_IN | Forced input | Forced input state. |
| | F0011 | _FORCE_OUT | Forced output | Forced output state. |
| | F0014 | _MON_On | Monitor | Monitor on execution. |
| | F0015 | _USTOP_On | Stop | Stop by Stop function. |
| | F0016 | _ESTOP_On | EStop | Stop by EStop function. |
| | F0017 | _CONPILE_MODE | Compile | Compile on execution. |
| | F0018 | _INIT_RUN | Initialize | Initialization task on execution. |
| | F001C | _PB1 | Program Code 1 | Program Code 1 selected. |
| | F001D | _PB2 | Program Code 2 | Program Code 2 selected. |
| | F001E | _CB1 | Compile Code 1 | Compile Code 1 selected. |
| | F001F | _CB2 | Compile Code2 | Compile Code 2 selected. |
| F002~3 | - | _CNF_ER | System error | Reports heavy error state of system. |
| | F0021 | _IO_TYER | Module Type error | Module Type does not match. |
| | F0022 | _IO_DEER | Module detachment error | Module is detached. |
| | F0024 | _IO_RWER | Module I/O error | Module I/O error. |
| | F0025 | _IP_IFER | Module interface error | Special/communication module interface error. |
| | F0026 | _ANNUM_ER | External device error | Detected heavy error in external Device. |

| Word | Bit | Variable | Function | Description |
|------|-----|----------|----------|-------------|
| F002~3 | F0028 | _BPRM_ER | Basic parameter | Basic parameter error. |
| | F0029 | _IOPRM_ER | IO parameter | I/O configuration parameter error. |
| | F002A | _SPPRM_ER | Special module parameter | Special module parameter is Abnormal. |
| | F002B | _CPPRM_ER | Communication module parameter | Communication module parameter is abnormal. |
| | F002C | _PGM_ER | Program error | Program error. |
| | F002D | _CODE_ER | Code error | Program Code error. |
| | F002E | _SWDT_ER | System watchdog | System watchdog operated. |
| | F0030 | _WDT_ER | Scan watchdog | Scan watchdog operated. |
| F004 | - | _CNF_WAR | System warning | Reports light error state of system. |
| | F0041 | _DBCK_ER | Backup error | Data backup error. |
| | F0043 | _ABSD_ER | Operation shutdown error | Stop by abnormal operation. |
| | F0046 | _ANNUM_WAR | External device error | Detected light error of external device. |
| | F0048 | _HS_WAR1 | High speed link 1 | High speed link – parameter 1 error. |
| | F0049 | _HS_WAR2 | High speed link 2 | High speed link – parameter 2 error. |
| | F0054 | _P2P_WAR1 | P2P parameter 1 | P2P – parameter 1 error. |
| | F0055 | _P2P_WAR2 | P2P parameter 2 | P2P – parameter 2 error. |
| | F0056 | _P2P_WAR3 | P2P parameter 3 | P2P – parameter 3 error. |
| | F005C | _CONSTANT_ER | Constant error | Constant error. |
| F009 | - | _USER_F | User contact | Timer used by user. |
| | F0090 | _T20MS | 20ms | 20ms cycle Clock. |
| | F0091 | _T100MS | 100ms | 100ms cycle Clock. |
| | F0092 | _T200MS | 200ms | 200ms cycle Clock. |
| | F0093 | _T1S | 1s Clock | 1s cycle Clock. |
| | F0094 | _T2S | 2 s Clock | 2s cycle Clock. |
| | F0095 | _T10S | 10 s Clock | 10s cycle Clock. |
| | F0096 | _T20S | 20 s Clock | 20s cycle Clock. |
| | F0097 | _T60S | 60 s Clock | 60s cycle Clock. |
| | F0099 | _On | Ordinary time On | Always On state Bit. |
| | F009A | _Off | Ordinary time Off | Always Off state Bit. |
| | F009B | _1On | 1scan On | First scan On Bit. |
| | F009C | _1Off | 1scan Off | First scan OFF bit. |
| | F009D | _STOG | Reversal | Reversal every scan. |

| Word | Bit | Variable | Function | Description |
|------|-----|----------|----------|-------------|
| F010 | - | _USER_CLK | User Clock | Clock available for user setting. |
| | F0100 | _USR_CLK0 | Setting scan repeat | On/Off as much as set scan Clock 0. |
| | F0101 | _USR_CLK1 | Setting scan repeat | On/Off as much as set scan Clock 1. |
| | F0102 | _USR_CLK2 | Setting scan repeat | On/Off as much as set scan Clock 2. |
| | F0103 | _USR_CLK3 | Setting scan repeat | On/Off as much as set scan Clock 3. |
| | F0104 | _USR_CLK4 | Setting scan repeat | On/Off as much as set scan Clock 4. |
| | F0105 | _USR_CLK5 | Setting scan repeat | On/Off as much as set scan Clock 5. |
| | F0106 | _USR_CLK6 | Setting scan repeat | On/Off as much as set scan Clock 6. |
| | F0107 | _USR_CLK7 | Setting scan repeat | On/Off as much as set scan Clock 7. |
| F011 | - | _LOGIC_RESULT | Logic result | Indicates logic results. |
| | F0110 | _LER | operation error | On during 1 scan in case of operation error. |
| | F0111 | _ZERO | Zero flag | On when operation result is 0. |
| | F0112 | _CARRY | Carry flag | On when carry occurs during operation. |
| | F0113 | _ALL_Off | All output OFF | On in case that all output is Off. |
| | F0115 | _LER_LATCH | Operation error Latch | Keeps On during operation error. |
| F012 | - | _CMP_RESULT | Comparison result | Indicates the comparison result. |
| | F0120 | _LT | LT flag | On in case of "less than". |
| | F0121 | _LTE | LTE flag | On in case of "equal or less than". |
| | F0122 | _EQU | EQU flag | On in case of "equal". |
| | F0123 | _GT | GT flag | On in case of "greater than". |
| | F0124 | _GTE | GTE flag | On in case of "equal or greater than". |
| | F0125 | _NEQ | NEQ flag | On in case of "not equal". |
| F014 | - | _FALS_NUM | FALS no. | Indicates FALS no. |
| F015 | - | _PUTGET_ERR0 | PUT/GET error 0 | Main base Put / Get error. |
| F023 | - | _PUTGET_NDR0 | PUT/GET end 0 | Main base Put/Get end. |
| F044 | - | _CPU_TYPE | CPU Type | Indicates information for CPU Type. |
| F045 | - | _CPU_VER | CPU version | Indicates CPU version. |
| F046 | - | _OS_VER | OS version | Indicates OS version. |
| F048 | - | _OS_DATE | OS date | Indicates OS distribution date. |
| F050 | - | _SCAN_MAX | Max. scan time | Indicates max. scan time. |
| F051 | - | _SCAN_MIN | Min. scan time | Indicates min. scan time. |
| F052 | - | _SCAN_CUR | Current scan time | Current scan time. |
| F0053 | - | _MON_YEAR | Month/year | Clock data (month/year) |
| F0054 | - | _TIME_DAY | Hour/date | Clock data (hour/date) |
| F0055 | - | _SEC_MIN | Second/minute | Clock data (Second/minute) |
| F0056 | - | _HUND_WK | Hundred year/week | Clock data (Hundred year/week) |

| Word | Bit | Variable | Function | Description |
|---|---|---|---|---|
| F057 | - | _FPU_INFO | N/A | - |
| | F0570 | _FPU_LFLAG_I | N/A | - |
| | F0571 | _FPU_LFLAG_U | N/A | - |
| | F0572 | _FPU_LFLAG_O | N/A | - |
| | F0573 | _FPU_LFLAG_Z | N/A | - |
| | F0574 | _FPU_LFLAG_V | N/A | - |
| | F057A | _FPU_FLAG_I | N/A | - |
| | F057B | _FPU_FLAG_U | N/A | - |
| | F057C | _FPU_FLAG_O | N/A | - |
| | F057D | _FPU_FLAG_Z | N/A | - |
| | F057E | _FPU_FLAG_V | N/A | - |
| | F057F | _FPU_FLAG_E | Irregular input | Reports in case of irregular input. |
| F058 | - | _ERR_STEP | Error step | Saves error step. |
| F060 | - | _REF_COUNT | Refresh | Increase when module Refresh. |
| F062 | - | _REF_OK_CNT | Refresh OK | Increase when module Refresh is normal. |
| F064 | - | _REF_NG_CNT | Refresh NG | Increase when module Refresh is Abnormal. |
| F066 | - | _REF_LIM_CNT | Refresh Limit | Increase when module Refresh is abnormal (Time Out). |
| F068 | - | _REF_ERR_CNT | Refresh Error | Increase when module Refresh is Abnormal. |
| F070 | - | _MOD_RD_ERR_CNT | - | - |
| F072 | - | _MOD_WR_ERR_CNT | - | - |
| F074 | - | _CA_CNT | - | - |
| F076 | - | _CA_LIM_CNT | - | - |
| F078 | - | _CA_ERR_CNT | - | - |
| F080 | - | _BUF_FULL_CNT | Buffer Full | Increase when CPU internal buffer is full. |
| F082 | - | _PUT_CNT | Put count | Increase when Put count. |
| F084 | - | _GET_CNT | Get count | Increase when Get count. |
| F086 | - | _KEY | Current key | indicates the current state of local key. |
| F088 | - | _KEY_PREV | Previous key | indicates the previous state of local key |
| F090 | - | _IO_TYER_N | Mismatch slot | Module Type mismatched slot no. |
| F091 | - | _IO_DEER_N | Detach slot | Module detached slot no. |
| F093 | - | _IO_RWER_N | RW error slot | Module read/write error slot no. |
| F094 | - | _IP_IFER_N | IF error slot | Module interface error slot no. |
| F096 | - | _IO_TYER0 | Module Type 0 error | Main base module Type error. |

| Word | Bit | Variable | Function | Description |
|------|-----|----------|----------|-------------|
| F104 | - | _IO_DEER0 | Module Detach 0 error | Main base module Detach error. |
| F120 | - | _IO_RWER0 | Module RW 0 error | Main base module read/write error. |
| F128 | - | _IO_IFER_0 | Module IF 0 error | Main base module interface error. |
| F140 | - | _AC_FAIL_CNT | Power shutdown times | Saves the times of power shutdown. |
| F142 | - | _ERR_HIS_CNT | Error occur times | Saves the times of error occur. |
| F144 | - | _MOD_HIS_CNT | Mode conversion times | Saves the times of mode conversion. |
| F146 | - | _SYS_HIS_CNT | History occur times | Saves the times of system history. |
| F148 | - | _LOG_ROTATE | Log Rotate | Saves log rotate information. |
| F150 | - | _BASE_INFO0 | Slot information 0 | Main base slot information. |
| F200 | - | _USER_WRITE_F | Available contact point | Contact point available in program. |
|  | F2000 | _RTC_WR | RTC RW | Data write and read in RTC. |
|  | F2001 | _SCAN_WR | Scan WR | Initializing the value of scan. |
|  | F2002 | _CHK_ANC_ERR | Request detection of external serious error | Request detection of external error. |
|  | F2003 | _CHK_ANC_WAR | Request detection of external slight error (warning) | Request detection of external slight error (warning). |
| F201 | - | _USER_STAUS_F | User contact point | User contact point. |
|  | F2010 | _INIT_DONE | Initialization completed | Initialization complete displayed. |
| F202 | - | _ANC_ERR | Display information of external serious error | Display information of external serious error |
| F203 | - | _ANC_WAR | Display information of external slight error (warning) | Display information of external slight error (warning) |
| F210 | - | _MON_YEAR_DT | Month/year | Clock data (month/year) |
| F211 | - | _TIME_DAY_DT | Hour/date | Clock data (hour/date) |
| F212 | - | _SEC_MIN_DT | Second/minute | Clock data (Second/minute) |
| F213 | - | _HUND_WK_DT | Hundred year/week | Clock data (Hundred year/week) |

## Appendix 1.2 Communication Relay (L) List

Here describes data link communication relay(L).

### 1. High-speed Link 1

| Device | Keyword | Type | Description |
|---|---|---|---|
| L000 | _HS1_RLINK | Bit | High speed link parameter 1 normal operation of all station |
| | | | Indicates normal operation of all station according to parameter set in High speed link, and On under the condition as below.<br>1. In case that all station set in parameter is RUN mode and no error,<br>2. All data block set in parameter is communicated normally, and<br>3. The parameter set in each station itself is communicated normally.<br>Once RUN_LINK is On, it keeps On unless stopped by LINK_DISABLE. |
| L001 | _HS1_LTRBL | Bit | Abnormal state after _HS1RLINK On |
| | | | In the state of _HSmRLINK flag On, if communication state of the station set in the parameter and data block is as follows, this flag shall be On.<br>1. In case that the station set in the parameter is not RUN mode, or<br>2. There is an error in the station set in the parameter, or<br>3. The communication state of data block set in the parameter is not good.<br>LINK TROUBLE shall be On if the above 1, 2 & 3 conditions occur, and if the condition return to the normal state, it shall be OFF again. |
| L0020 ~ L005F | _HS1_STATE[k] (k = 00~63) | Bit Array | High speed link   parameter 1, K block general state |
| | | | Indicates the general state of communication information for each data block of setting parameter.<br>_HS1_STATE[k] = HS1MOD[k]&_HS1TRX[k]&(~_HS1_ERR[k]) |
| L0060 ~ L009F | _HS1_MOD[k] (k = 00~63) | Bit Array | High speed link   parameter 1, k block station RUN operation mode |
| | | | Indicates operation mode of station set in K data block of parameter. |
| L0100 ~ L013F | _HS1_TRX[k] (k = 00~63) | Bit Array | Normal communication with High speed link   parameter 1, k block station |
| | | | Indicates if communication state of Kdata of parameter is communicated smoothly according to the setting. |
| L0140 ~ L017F | _HS1_ERR[k] (k = 00~63) | Bit Array | High speed link parameter 1, K block station operation error mode |
| | | | Indicates if the error occurs in the communication state of k data block of parameter. |
| L0180 ~ L021F | _HS1_SETBLOCK[k] | Bit Array | High speed link parameter 1, K block setting |
| | | | Indicates whether or not to set k data block of parameter. |

## 2. High-speed Link2

| Device | Keyword | Type | Description |
|---|---|---|---|
| L0260 | _HS2_RLINK | Bit | High-speed link parameter 2 normal operation of all station. |
| | | | Indicates normal operation of all station according to parameter set in High-speed link and On under the condition as below.<br>1. In case that all station set in parameter is Run mode and no error<br>2. All data block set in parameter is communicated and<br>3.The parameter set in each station itself is communicated normally.<br>Once RUN_LINK is On, it keeps On unless stopped by LINK_DISABLE. |
| L0261 | _HS2_LTRBL | Bit | Abnormal state after _HS2RLINK On. |
| | | | In the state of _HSmRLINK flag On, if communication state of the station set in the parameter and data block is as follows, this flag shall be On.<br>1. In case that the station set in the parameter is not RUN mode, or<br>2. There is an error in the station set in the parameter, or<br>3. The communication state of data block set in the parameter is not good.<br>LINK TROUBLE shall be On if the above 1, 2 & 3 conditions occur, and if the condition return to the normal state, it shall be OFF again. |
| L0280 ~ L031F | _HS2_STATE[k] (k = 00~63) | Bit Array | High speed link   parameter 1, k   block general state. |
| | | | Indicates the general state of communication information for each data block of setting parameter.<br>_HS2_STATE[k]=HS2MOD[k]&_HS2TRX[k]&(~_HS2_ERR[k]) |
| L0320 ~ L035F | _HS2_MOD[k] (k = 00~63) | Bit Array | High speed link   parameter 1, k block station RUN operation mode. |
| | | | Indicates operation mode of station set in k data block of parameter. |
| L0360 ~ L039F | _HS2_TRX[k] (k = 00~63) | Bit Array | Normal communication with High speed link   parameter 1, K block station. |
| | | | Indicates if communication state of K data of parameter is communicated smoothly according to the setting. |
| L0400 ~ L043F | _HS2_ERR[k] (k = 00~63) | Bit Array | High speed link parameter 1, K block station operation error mode. |
| | | | Indicates if the error occurs in the communication state of k data block of parameter. |
| L0440 ~ L047F | _HS2_SETBLOCK[k] | Bit Array | High speed link parameter 1, K block setting. |
| | | | Indicates whether or not to set k data block of parameter. |

### 3. Common area

Communication flag list according to P2P service setting.
 P2P parameter: 1~3, P2P block: 0~31

| Device | Keyword | Type | Description |
|---|---|---|---|
| L5120 | _P2P1_NDR00 | Bit | Indicates P2P parameter 1, 0 Block service normal end. |
| L5121 | _P2P1_ERR00 | Bit | Indicates P2P parameter 1, 0 Block service abnormal end. |
| L513 | _P2P1_STATUS00 | Word | Indicates error code in case of   P2P parameter 1, 0 Block service abnormal end. |
| L514 | _P2P1_SVCCNT00 | DWord | Indicates P2P parameter 1, 0 Block service normal count. |
| L516 | _P2P1_ERRCNT00 | DWord | Indicates P2P parameter 1, 0 Block service abnormal count. |
| L5180 | _P2P1_NDR01 | Bit | P2P parameter 1, 1 Block service normal end. |
| L5181 | _P2P1_ERR01 | Bit | P2P parameter 1, 1 Block service abnormal end. |
| L519 | _P2P1_STATUS01 | Word | Indicates error code in case of P2P parameter 1, 1 Block service abnormal end. |
| L520 | _P2P1_SVCCNT01 | DWord | Indicates P2P parameter 1, 1 Block service normal count. |
| L522 | _P2P1_ERRCNT01 | DWord | Indicates P2P parameter 1, 1 Block service abnormal count. |
| L524~L529 | - | Word | P2P parameter 1,2 Block service total. |
| L530~L535 | - | Word | P2P parameter 1,3 Block service total. |
| L536~L697 | - | Word | P2P parameter 1,4~30 Block service total. |
| L698~L703 | - | Word | P2P parameter 1,31 Block service total. |

## Appendix 1.3 Network Register (N) List

Here describes Network Register for communication (N). P2P parameter: 1~3, P2P block: 0~31

| Device | Keyword | Type | Description |
|---|---|---|---|
| N000 | _P1B00SN | Word | Saves another station no. of P2P parameter 1, 00 block. |
| N0000~0004 | _P1B00RD1 | Word | Saves area device 1 to read P2P parameter 1, 01 block. |
| N005 | _P1B00RS1 | Word | Saves area size 1 to read P2P parameter 1, 01 block. |
| N0006~0009 | _P1B00RD2 | Word | Saves area device 2 to read P2P parameter 1, 01 block. |
| N010 | _P1B00RS2 | Word | Saves area size 2 to read P2P parameter 1, 01 block. |
| N0011~0014 | _P1B00RD3 | Word | Saves area device 3 to read P2P parameter 1, 01 block. |
| N015 | _P1B00RS3 | Word | Saves area size 3 to read P2P parameter 1, 01 block. |
| N0016~0019 | _P1B00RD4 | Word | Saves area device 4 to read P2P parameter 1, 01 block. |
| N020 | _P1B00RS4 | Word | Saves area size 4 to read P2P parameter 1, 01 block. |
| N0021~0024 | _P1B00WD1 | Word | Saves area device 1 to save P2P parameter 1, 01 block. |
| N025 | _P1B00WS1 | Word | Saves area size 1 to save P2P parameter 1, 01 block. |
| N0026~0029 | _P1B00WD2 | Word | Saves area device 2 to save P2P parameter 1, 01 block. |
| N030 | _P1B00WS2 | Word | Saves area size 2 to save P2P parameter 1, 01 block. |
| N0031~0034 | _P1B00WD3 | Word | Saves area device 3 to save P2P parameter 1, 01 block. |
| N035 | _P1B00WS3 | Word | Saves area size 3 to save P2P parameter 1, 01 block. |
| N0036~0039 | _P1B00WD4 | Word | Saves area device 4 to save P2P parameter 1, 01 block. |
| N040 | _P1B00WS4 | Word | Saves area size 4 to save P2P parameter 1, 01 block. |
| N0041~0081 | - | Word | Saving area of   P2P parameter 1, 01 block. |
| N0082~0122 | - | Word | Saving area of   P2P parameter 1, 02 block. P2P |
| N0123~1311 | - | Word | Saving area of   P2P parameter 1, 03~31 block. |
| N1312~2623 | - | Word | Saving area of   P2P parameter 2. |
| N2624~3935 | - | Word | Saving area of   P2P parameter 3. |

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**Remark**

❑ In XGB series, Network register is available only monitoring. (Read Only)

# Appendix 2 Dimension (Unit: mm)

(1) standard type main unit ("S" type)

-. XBM-DN16S/32S



-. XBM-DR16S

(2) Compact type main unit ("H" type)
-. XBC-DN32H(/DC)



-. XBC-DR32H (/DC)
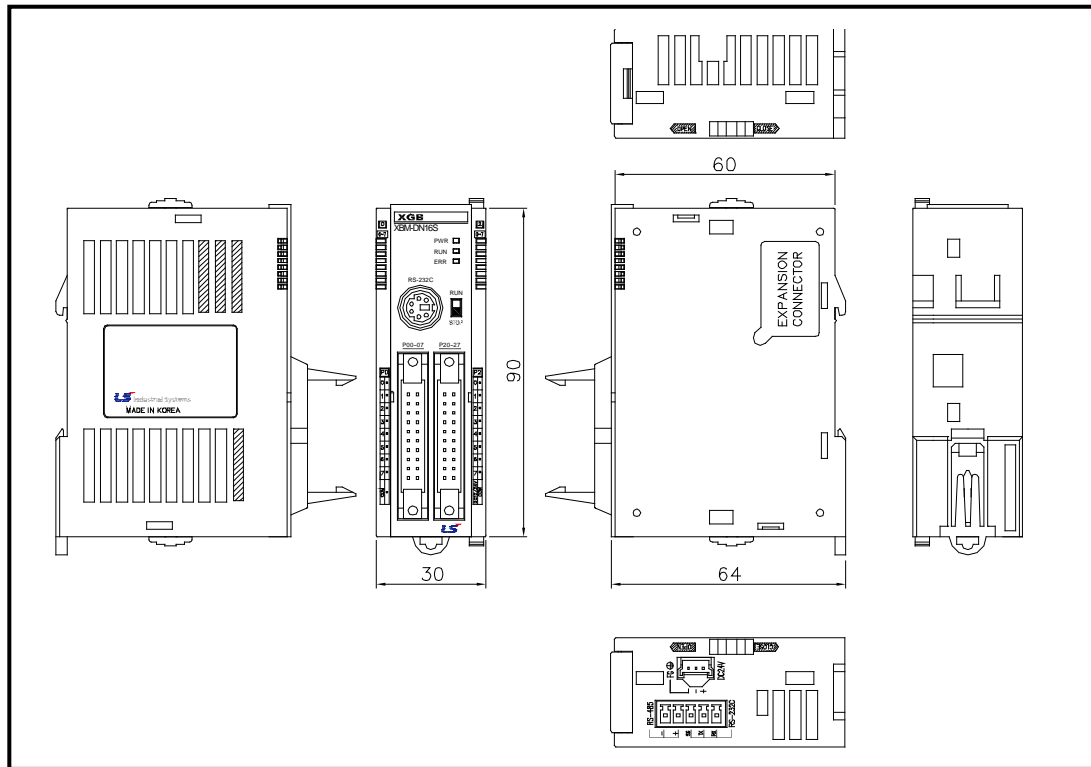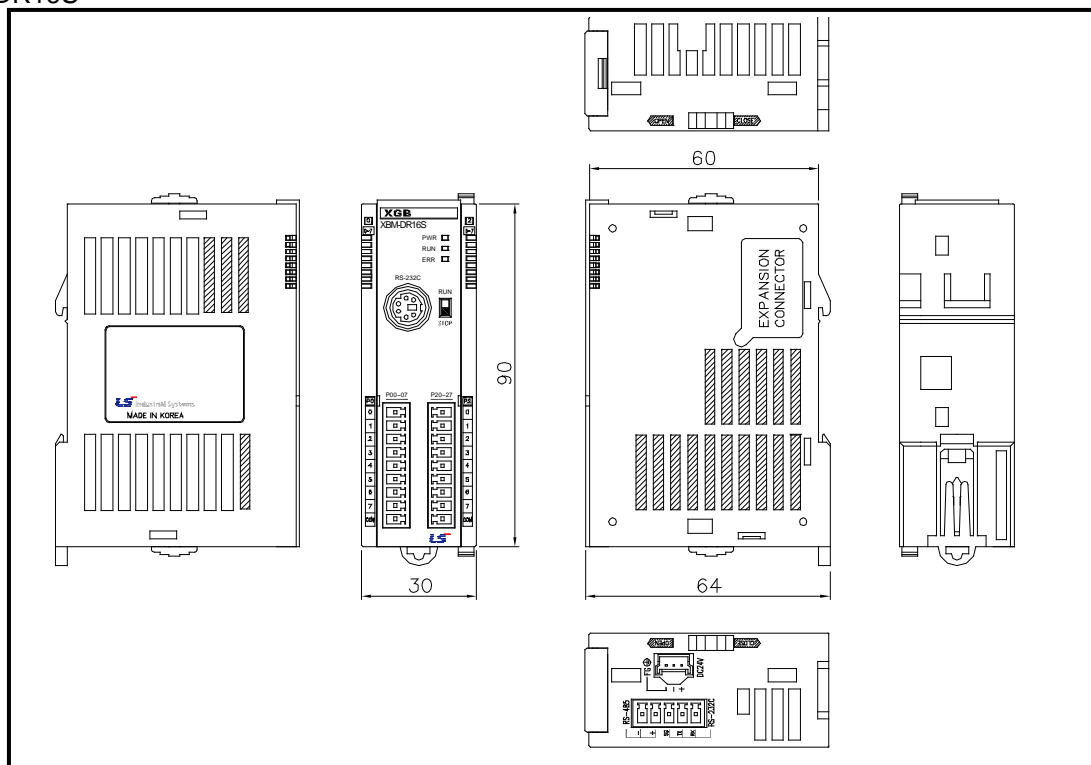
-. XBC-DN64H (/DC)
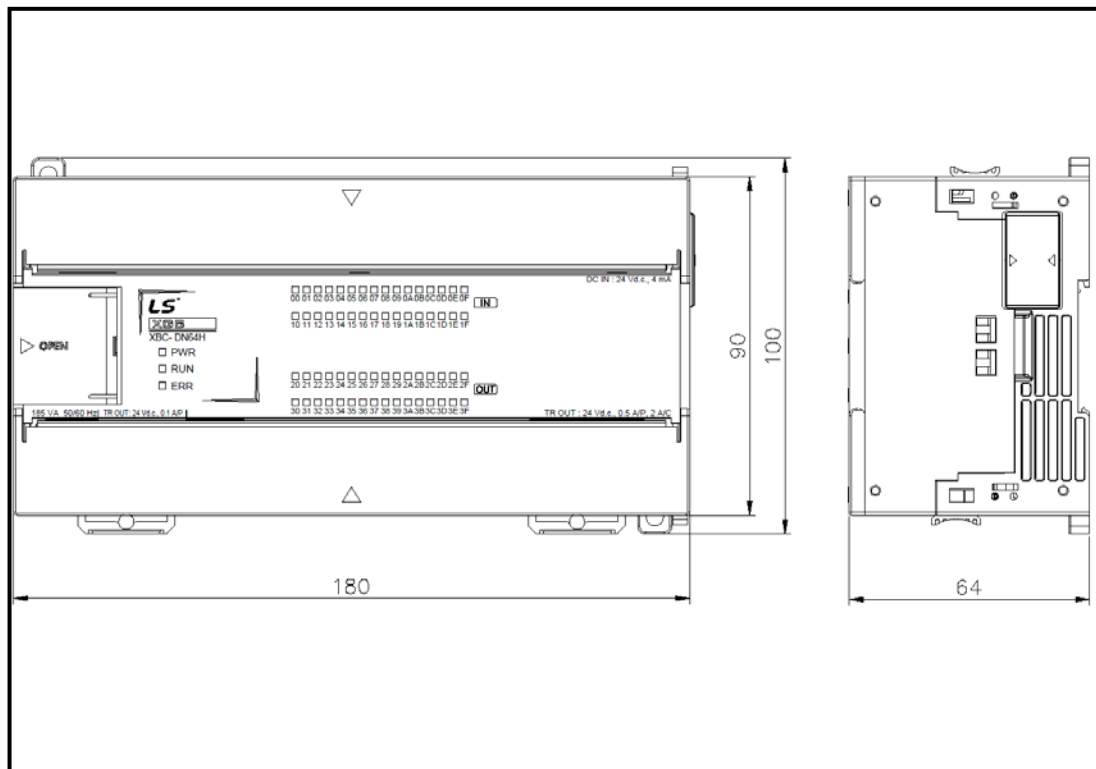


-. XBC-DR64H (/DC)

(3) Extension I/O module

-. XBE-DC32A, XBE-TN32A, XBE-TP32A, XBE-DN32A



-. XBE-RY16A
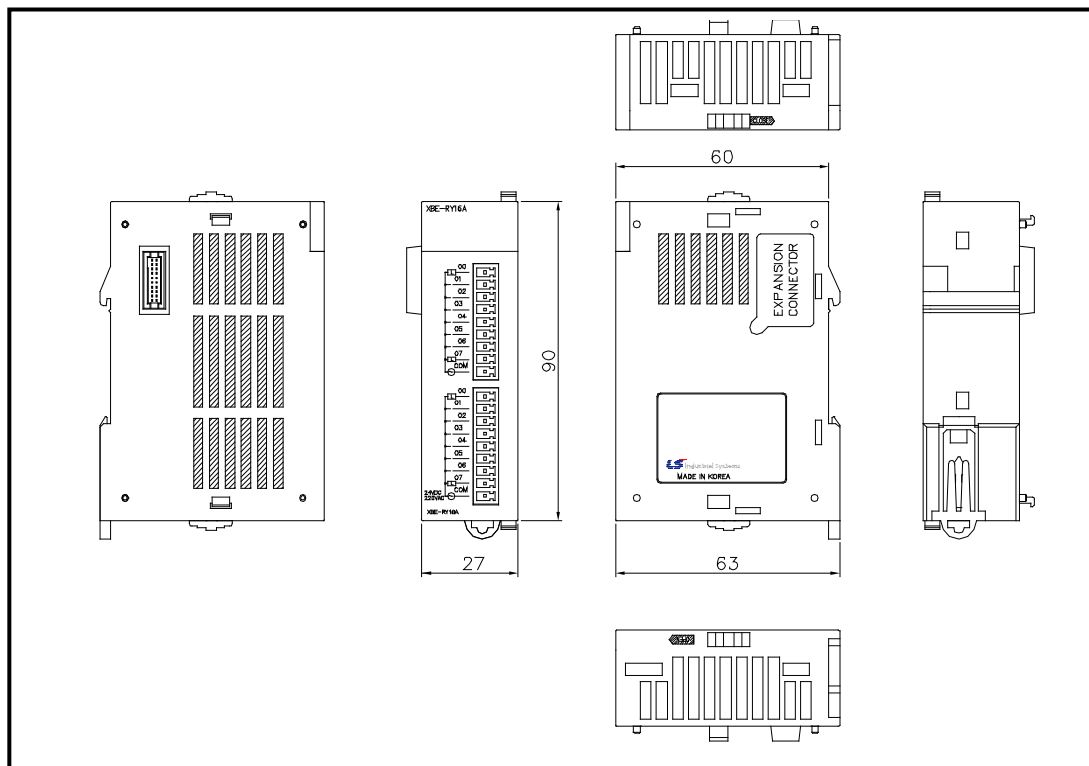
-. XBE-DC08A, XBE-DC16A, XBE-TN08A, XBE-TP08A, XBE-TN16A, XBE-TP16A, XBE-AC08A
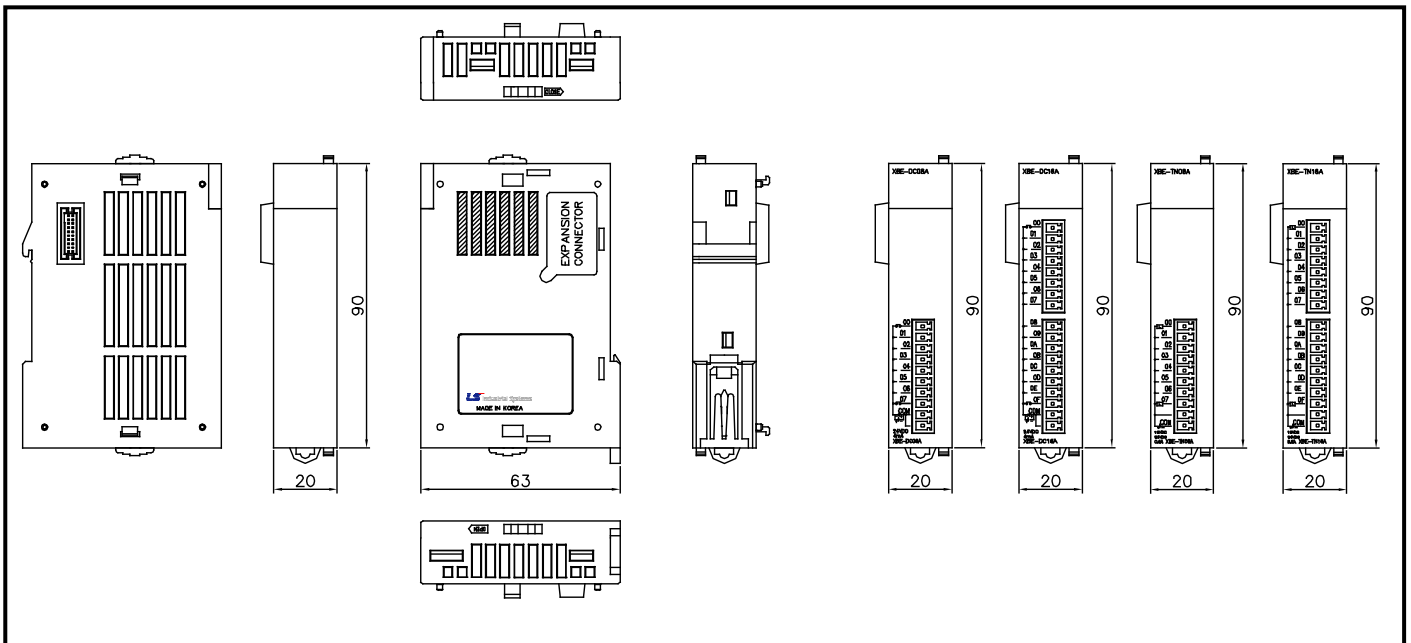


-. XBE-DR16A, XBE-RY08A
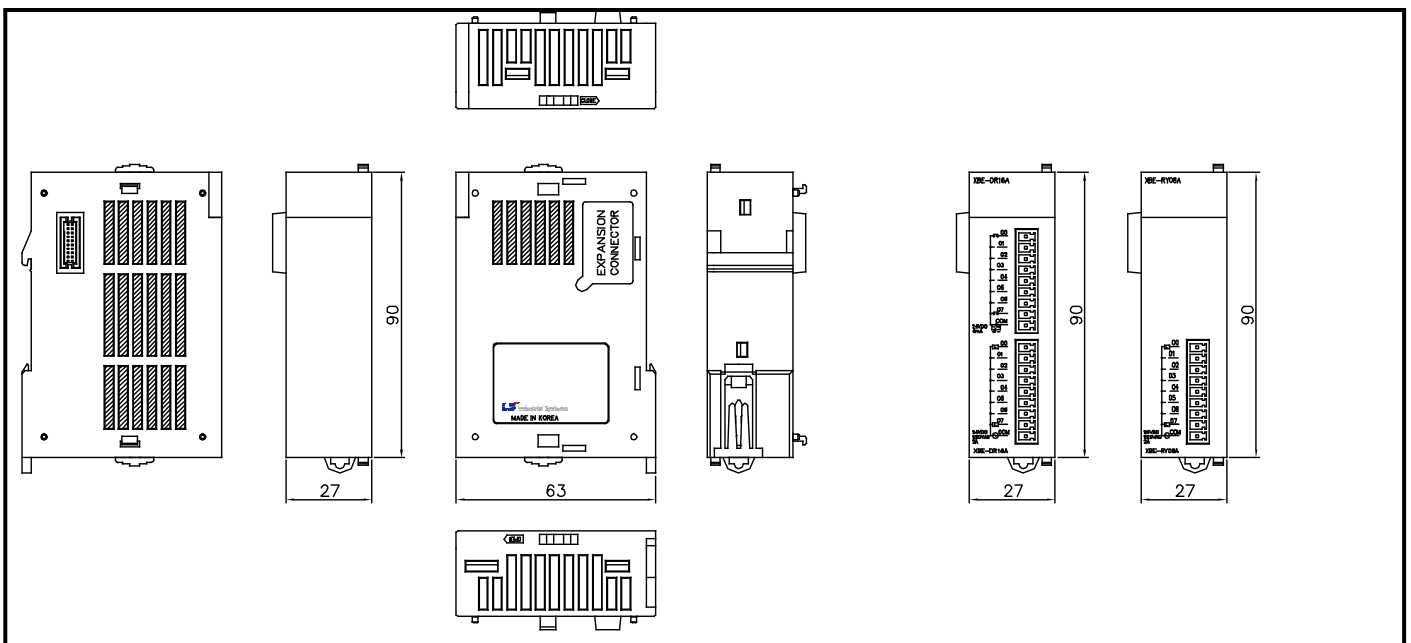
## Appendix 3 Compatibility with MASTER-K (Special Relay)

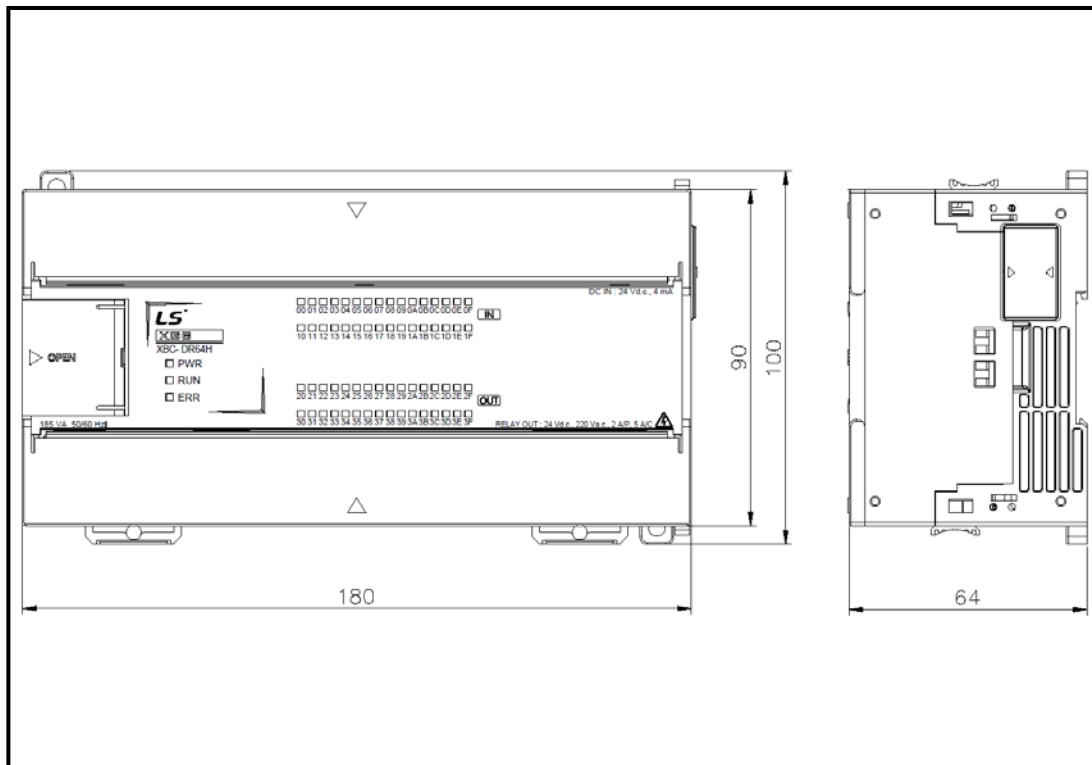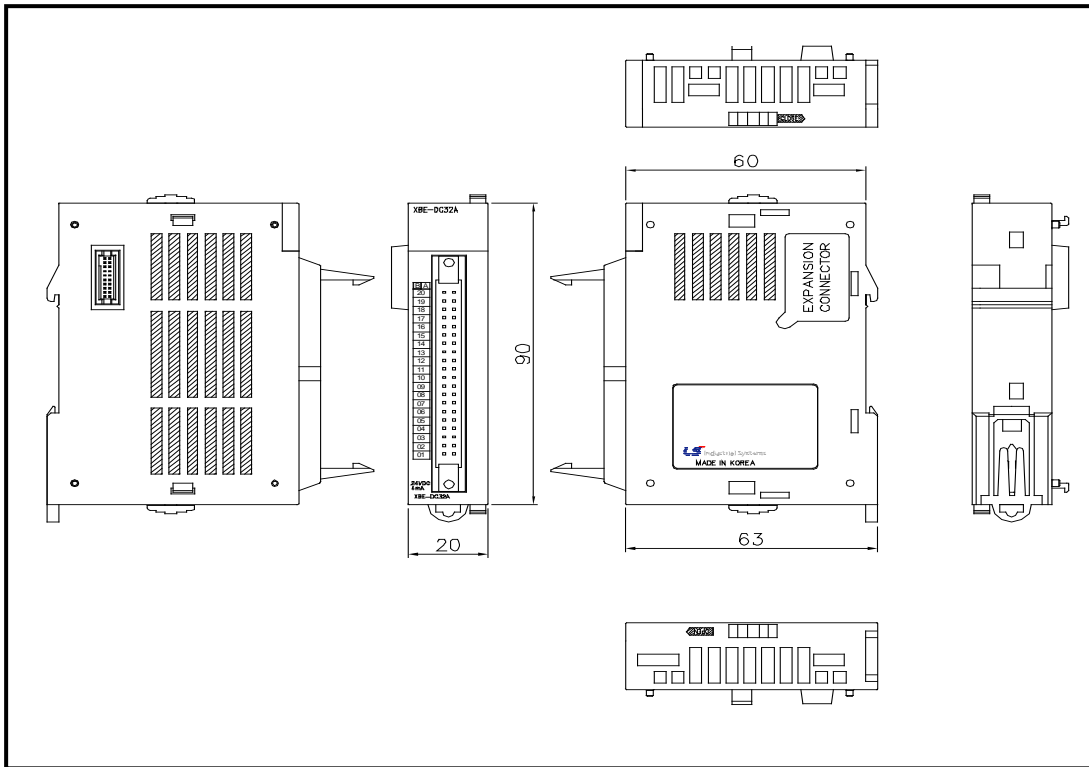| MASTER-K | | XGB | | |
|---|---|---|---|---|
| Device | Function | Symbol | Device | Function |
| F0000 | RUN mode | _RUN | F0000 | RUN Edit mode |
| F0001 | Program mode | _STOP | F0001 | Program mode |
| F0002 | Pause mode | _ERROR | F0002 | Error mode |
| F0003 | Debug mode | _DEBUG | F0003 | Debug mode |
| F0004 | N/A | _LOCAL_CON | F0006 | Remote mode |
| F0005 | N/A | _MODBUS_CON | F0006 | Remote mode |
| F0006 | Remote mode | _REMOTE_CON | F0006 | Remote mode |
| F0007 | User memory setup | - | F0007 | N/A |
| F0008 | N/A | _RUN_EDIT_ST | F0008 | Editing during RUN |
| F0009 | N/A | _RUN_EDIT_CHK | F0009 | Editing during RUN |
| F000A | User memory operation | _RUN_EDIT_DONE | F000A | Edit done during RUN |
| F000B | N/A | _RUN_EDIT_END | F000B | Edit end during RUN |
| F000C | N/A | _CMOD_KEY | F000C | Operation mode change by KEY |
| F000D | N/A | _CMOD_LPADT | F000D | Operation mode change by PADT |
| F000E | N/A | _CMOD_RPADT | F000E | Operation mode change by Remote PADT |
| F000F | STOP command execution | _CMOD_RLINK | F000F | Operation mode change cause by remote communication module |
| F0010 | Ordinary time On | _FORCE_IN | F0010 | Forced input |
| F0011 | Ordinary time Off | _FORCE_OUT | F0011 | Forced output |
| F0012 | 1 Scan On | _SKIP_ON | F0012 | I/O Skip execution |
| F0013 | 1 Scan Off | _EMASK_ON | F0013 | Error mask execution |
| F0014 | Reversal every Scan | _MON_ON | F0014 | Monitor execution |
| F0015 ~ F001C | N/A | _USTOP_ON | F0015 | Stop by Stop Function |
| | | _ESTOP_ON | F0016 | Stop by ESTOP Function |
| | | _CONPILE_MODE | F0017 | Compile |
| | | _INIT_RUN | F0018 | Initialize |
| | | - | F0019 ~ F001F | N/A |
| | | _PB1 | F001C | Program Code 1 |
| F001D | N/A | _PB2 | F001D | Program Code 2 |
| F001E | N/A | _CB1 | F001E | Compile code 1 |
| F001F | N/A | _CB2 | F001F | Compile code 2 |

| MASTER-K | | XGB | | |
|---|---|---|---|---|
| Device | Function | Symbol | Device | Function |
| F0020 | 1 Step RUN | _CPU_ER | F0020 | CPU configuration error |
| F0021 | Break Point RUN | _IO_TYER | F0021 | Module type mismatch error |
| F0022 | Scan RUN | _IO_DEER | F0022 | Module detach error |
| F0023 | Contact value match RUN | _FUSE_ER | F0023 | Fuse cutoff error |
| F0024 | Word value match RUN | _IO_RWER | F0024 | I/O module read/write error |
| F0025 ~ F002F | N/A | _IP_IFER | F0025 | Special/communication module interface error |
| | | _ANNUM_ER | F0026 | Heavy error detection of external equipment error |
| | | - | F0027 | N/A |
| | | _BPRM_ER | F0028 | Basic parameter error |
| | | _IOPRM_ER | F0029 | I/O configuration parameter error |
| | | _SPPRM_ER | F002A | Special module parameter error |
| | | _CPPRM_ER | F002B | Communication module parameter error |
| | | _PGM_ER | F002C | Program error |
| | | _CODE_ER | F002D | Program Code error |
| | | _SWDT_ER | F002E | System watchdog error |
| | | _BASE_POWER_ER | F002F | Base power error |
| F0030 | Heavy error | _WDT_ER | F0030 | Scan watchdog |
| F0031 | Light error | - | F0031 | - |
| F0032 | WDT error | - | F0032 | - |
| F0033 | I/O combination error | - | F0033 | - |
| F0034 | Battery voltage error | - | F0034 | - |
| F0035 | Fuse error | - | F0035 | - |
| F0036 ~ F0038 | N/A | - | F0036 ~ F0038 | - |
| F0039 | Backup normal | - | F0039 | - |
| F003A | Clock data error | - | F003A | - |
| F003B | Program change | - | F003B | - |
| F003C | Program change error | - | F003C | - |
| F003D ~ F003F | N/A | - | F003D ~ F003F | N/A |

| MASTER-K | | XGB | | |
|---|---|---|---|---|
| Device | Function | Symbol | Device | Function |
| F0040~ F005F | N/A | _RTC_ER | F0040 | RTC data error |
| | | _DBCK_ER | F0041 | Data backup error |
| | | _HBCK_ER | F0042 | Hot restart disabled error |
| | | _ABSD_ER | F0043 | Abnormal operation stop |
| | | _TASK_ER | F0044 | Task collision |
| | | _BAT_ER | F0045 | Battery error |
| | | _ANNUM_ER | F0046 | Light error detection of external equipment |
| F0040 ~ F005F | N/A | _LOG_FULL | F0047 | Log memory full warning |
| | | _HS_WAR1 | F0048 | High speed link parameter 1 error |
| | | _HS_WAR2 | F0049 | High speed link parameter 2 error |
| | | - | F004A ~ F0053 | N/A |
| | | _P2P_WAR1 | F0054 | P2P parameter 1 error |
| | | _P2P_WAR2 | F0055 | P2P parameter 2 error |
| | | _P2P_WAR3 | F0056 | P2P parameter 3 error |
| | | - | F0057 ~ F005B | N/A |
| | | _Constant_ER | F005C | Constant error |
| | | - | F005D ~ F005F | N/A |
| F0060 ~ F006F | Error Code save | - | F0060 ~ F006F | N/A |
| F0070 ~ F008F | Fuse cutoff save | - | F0070 ~ F008F | N/A |
| F0090 | 20ms cycle Clock | _T20MS | F0090 | 20ms cycle Clock |
| F0091 | 100ms cycle Clock | _T100MS | F0091 | 100ms cycle Clock |
| F0092 | 200ms cycle Clock | _T200MS | F0092 | 200ms cycle Clock |
| F0093 | 1s cycle Clock | _T1S | F0093 | 1s cycle Clock |
| F0094 | 2s cycle Clock | _T2S | F0094 | 2s cycle Clock |
| F0095 | 10s cycle Clock | _T10S | F0095 | 10s cycle Clock |
| F0096 | 20s cycle Clock | _T20S | F0096 | 20s cycle Clock |
| F0097 | 60s cycle Clock | _T60S | F0097 | 60s cycle Clock |
| F0098 ~F009F | N/A | - | F0098 | N/A |
| | | _ON | F0099 | Ordinary time On |
| | | _OFF | F009A | Ordinary time Off |
| | | _1ON | F009B | 1 Scan On |
| | | _1OFF | F009C | 1 Scan Off |
| | | _STOG | F009D | Reversal every Scan |
| | | - | F009B ~ F009F | N/A |

| MASTER-K | | XGB | | |
|---|---|---|---|---|
| Device | Function | Symbol | Device | Function |
| F0100 | User Clock 0 | - | F0100 | User Clock 0 |
| F0101 | User Clock 1 | - | F0101 | User Clock 1 |
| F0102 | User Clock 2 | - | F0102 | User Clock 2 |
| F0103 | User Clock 3 | - | F0103 | User Clock 3 |
| F0104 | User Clock 4 | - | F0104 | User Clock 4 |
| F0105 | User Clock 5 | - | F0105 | User Clock 5 |
| F0106 | User Clock 6 | - | F0106 | User Clock 6 |
| F0107 | User Clock 7 | - | F0107 | User Clock 7 |
| F0108 ~ F010F | | - | F0108 ~ F010F | N/A |
| F0110 | Operation error flag | _Ler | F0110 | Operation error flag |
| F0111 | Zero flag | _Zero | F0111 | Zero flag |
| F0112 | Carry flag | _Carry | F0112 | Carry flag |
| F0113 | Full output Off | _All_Off | F0113 | Full output Off |
| F0114 | Common RAM R/W error | - | F0114 | N/A |
| F0115 | Operation error flag (latch) | _Ler_Latch | F0115 | Operation error flag(latch) |
| F0116 ~ F011F | | - | F0116 ~ F011F | N/A |
| F0120 | LT flag | _LT | F0120 | LT flag |
| F0121 | LTE flag | _LTE | F0121 | LTE flag |
| F0122 | EQU flag | _EQU | F0122 | EQU flag |
| F0123 | GT flag | _GT | F0123 | GT flag |
| F0124 | GTE flag | _GTE | F0124 | GTE flag |
| F0125 | NEQ flag | _NEQ | F0125 | NEQ flag |
| F0126 ~ F012F | N/A | - | F0126 ~ F012F | N/A |
| F0130~ F013F | AC Down Count | _AC_F_CNT | F0130~ F013F | AC Down Count |
| F0140~ F014F | FALS no. | _FALS_NUM | F0140~ F014F | FALS no. |
| F0150~ F015F | PUT/GET error flag | _PUTGET_ERR | F0150~ F030F | PUT/GET error   flag |
| | | CPU TYPE | F0440 ~ F044F | CPU TYPE |
| | | CPU VERSION | F0450 ~ F045F | CPU VERSION |
| | | OS version no. | F0460 ~ F047F | System OS version no. |
| F0160~ F049F | N/A | OS date | F0480 ~ F049F | System OS DATE |

| MASTER-K | | XGB | | |
|---|---|---|---|---|
| Device | Function | Symbol | Device | Function |
| F0500~ F050F | Max. Scan time | _SCAN_MAX | F0500~ F050F | Max. Scan time |
| F0510~ F051F | Min. Scan time | _SCAN_MIN | F0510~ F051F | Min. Scan time |
| F0520~ F052F | Current Scan time | _SCAN_CUR | F0520~ F052F | Current Scan time |
| F0530~ F053F | Clock data (year/month) | _YEAR_MON | F0530~ F053F | Clock data (year/month) |
| F0540~ F054F | Clock data (day/hr) | _DAY_TIME | F0540~ F054F | Clock data(day/hr) |
| F0550~ F055F | Clock data (min/sec) | _MIN_SEC | F0550~ F055F | Clock data(min/sec) |
| F0560~ F056F | Clock data (100year/weekday) | _HUND_WK | F0560~ F056F | Clock data(100year/weekday) |
| F0570~ F058F | N/A | _FPU_LFlag_I | F0570 | - |
| | | _FPU_LFlag_U | F0571 | - |
| | | _FPU_LFlag_O | F0572 | - |
| | | _FPU_LFlag_Z | F0573 | - |
| | | _FPU_LFlag_V | F0574 | - |
| | | - | F0575 ~ F0579 | N/A |
| | | _FPU_Flag_I | F057A | - |
| | | _FPU_Flag_U | F057B | - |
| | | _FPU_Flag_O | F057C | - |
| | | _FPU_Flag_Z | F057D | - |
| | | _FPU_Flag_V | F057E | - |
| | | _FPU_Flag_E | F057F | - |
| | | Error Step | F0580~ F058F | Error step save |
| F0590~ F059F | Error step save | - | F0590~ F059F | N/A |
| F0600~ F060F | FMM detailed error information | _REF_COUNT | F060~F061 | Refresh Count |
| F0610~ F063F | N/A | _REF_OK_CNT | F062~F063 | Refresh OK Count |
| | | _REF_NG_CNT | F064~F065 | Refresh NG Count |
| | | _REF_LIM_CNT | F066~F067 | Refresh Limit Count |
| | | _REF_ERR_CNT | F068~F069 | Refresh Error Count |
| | | _MOD_RD_ERR_CNT | F070~F071 | MODULE Read Error Count |
| | | _MOD_WR_ERR_CNT | F072~F073 | MODULE Write Error Count |
| | | _CA_CNT | F074~F075 | Cmd Access Count |
| | | _CA_LIM_CNT | F076~F077 | Cmd Access Limit Count |
| | | _CA_ERR_CNT | F078~F079 | Cmd Access Error Count |
| | | _BUF_FULL_CNT | F080~F081 | Buffer Full Count |

# Appendix 4 Instruction List

## Appendix 4.1 Classification of Instructions

| Classification | Instructions | Details | Remarks |
|---|---|---|---|
| Basic Instructions | Contact Point Instruction | LOAD, AND, OR related Instructions | |
| | Unite Instruction | AND LOAD, OR LOAD, MPUSH, MLOAD, MPOP | |
| | Reverse Instruction | NOT | |
| | Master Control Instruction | MCS, MCSCLR | |
| | Output Instruction | OUT, SET, RST, 1 Scan Output Instruction, Output Reverse Instruction (FF) | |
| | Sequence/Last-input Preferred Instruction | Step Control Instruction ( SET Sxx.xx, OUT Sxx.xx ) | |
| | End Instruction | END | |
| | Non-Process Instruction | NOP | |
| | Timer Instruction | TON, TOFF, TMR, TMON, TRTG | |
| | Counter Instruction | CTD, CTU, CTUD, CTR | |
| Application Instructions | Data Transfer Instruction | Transfers specified Data, Group, String | 4/8/64 Bits available |
| | Conversion Instruction | Converts BIN/BCD of specified Data & Group | 4/8 Bits available |
| | Data Type Conversion Instruction | Converts Integer/Real Number | |
| | Output Terminal Compare Instruction | Saves compared results in special relay | Compare to Unsigned |
| | Input Terminal Compare Instruction | Saves compared results in BR. Compares Real Number, String & Group. Compares 3 Operands | Compare to Signed |
| | Increase/Decrease Instruction | Increases or decreases specified data 1 by 1 | 4/8 Bits available |
| | Rotate Instruction | Rotates specified data to the left and right, including Carry | 4/8 Bits available |
| | Move Instruction | Moves specified data to the left and right, word by word, bit by bit | 4/8 Bits available |
| | Exchange Instruction | Exchanges between devices, higher & lower byte, group data | |
| | BIN Operation Instruction | Addition, Subtraction, Multiplication & Division for Integer/ Real Number, Addition for String, Addition & Subtraction for Group | |
| | BCD Operation Instruction | Addition, Subtraction, Multiplication, Division. | |
| | Logic Operation Instruction | Logic Multiplication, Logic Addition, Exclusive OR, Exclusive NOR, Group Operation | |
| | System Instruction | Error Display, WDT Initialize, Output Control, Operation Stop, etc. | |
| | Data Process Instruction | Encode, Decode, Data Disconnect/Connect, Search, Align, Max., Min., Total, Average, etc. | |
| | Data Table Process Instruction | Data Input/Output of Data Table | |
| | String Process Instruction | String related Convert, Comment Read, String Extract, ASCII Convert, HEX Convert, String Search, etc. | |
| | Special Function Instruction | Trigonometric Function, Exponential/Log Function, Angle/ Radian Convert, etc. | |
| | Data Control Instruction | Max/Min Limit Control, Dead-zone Control, Zone Control | |
| | Time related Instruction | Date Time Data Read/Write, Time Data Adjust & Convert | |
| | Diverge Instruction | JMP, CALL | |
| | Loop Instruction | FOR/NEXT/BREAK | |
| | Flag related Instruction | Carry Flag Set/Reset, Error Flag Clear | |
| | Special/Communication related Instruction | Data Read/Write by BUSCON Direct Access | |
| | Interrupt related Instruction | Interrupt Enable/Disable | |
| | Signal Reverse Instruction | Reverse Integer/Real Signals, Absolute Value Operation | |

## Appendix 4.2 Basic Instructions

### 1) Contact point instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Contact Point | LOAD | ⊢⊣ ⊢ | A Contact Point Operation Start | ○ | ○ |
| | LOAD NOT | ⊢⟋⊢ | B Contact Point Operation Start | ○ | ○ |
| | AND | ⊣ ⊢ | A Contact Point Series-Connected | ○ | ○ |
| | AND NOT | ⟋⊢ | B Contact Point Series-Connected | ○ | ○ |
| | OR | ⊢⊣ ⊢ | A Contact Point Parallel-Connected | ○ | ○ |
| | OR NOT | ⟋⊢ | B Contact Point Parallel-Connected | ○ | ○ |
| | LOADP | ⊢P⊢ | Positive Convert Detected Contact Point | ○ | ○ |
| | LOADN | ⊢N⊢ | Negative Convert Detected Contact Point | ○ | ○ |
| | ANDP | ⊣P⊢ | Positive Convert Detected Contact Point Series- | ○ | ○ |
| | ANDN | ⊣N⊢ | Negative Convert Detected Contact Point Series- | ○ | ○ |
| | ORP | ⊢P⊣ | Positive Convert Detected Contact Point Parallel- | ○ | ○ |
| | ORN | ⊢N⊣ | Negative Convert Detected Contact Point Parallel- | ○ | ○ |

### 2) Union instruction
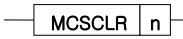
| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Unite | AND LOAD | A B | A,B Block Series-Connected | ○ | ○ |
| | OR LOAD | A / B | A,B Block Parallel-Connected | ○ | ○ |
| | MPUSH | MPUSH ⊣⊢( ) | Operation Result Push up to present | ○ | ○ |
| | MLOAD | MLOAD ⊣⊢( ) | Operation Result Load Previous to Diverge Point | ○ | ○ |
| | MPOP | MPOP ⊣⊢( ) | Operation Result Pop Previous to Diverge Point | ○ | ○ |
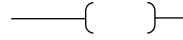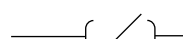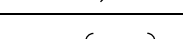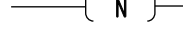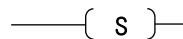
### 3) Reverse instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Reverse | NOT | ─────✕───── | Previous Operation results Reverse | ○ | ○ |
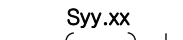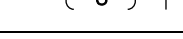
### 4) Master Control instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Master Control | MCS | ─┤ MCS │ n ├─ | Master Control Setting (n:0~7) | ○ | ○ |
| | MCSCLR | ─┤ MCSCLR │ n ├─ | Master Control Cancel (n:0~7) | ○ | ○ |

### 5) Output instruction

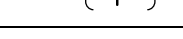| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Output | OUT | ───( )─┤ | Operation Results Output | ○ | ○ |
| | OUT NOT | ───( / )─┤ | Operation Results Reverse Output | ○ | ○ |
| | OUTP | ───( P )─┤ | 1 Scan Output if Input Condition rises | ○ | ○ |
| | OUTN | ───( N )─┤ | 1 Scan Output if Input Condition falls | ○ | ○ |
| | SET | ───( S )─┤ | Contact Point Output ON kept | ○ | ○ |
| | RST | ───( R )─┤ | Contact Point Output OFF kept | ○ | ○ |
| | FF | ─┤ FF │ D ├ | Output Reverse if Input Condition rises | ○ | ○ |

### 6) Sequence/Last-input preferred instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Step Control | SET S | Syy.xx ───( S )─┤ | Sequence Control | ○ | ○ |
| | OUT S | Syy.xx ───( )─┤ | Last-input Preferred | ○ | ○ |

### 7) End instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| End | END | ─┤ END ├─ | Program End | ○ | ○ |

### 8) Non-process instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Non-Process | NOP | Ladder not displayed | Non-Process Instruction, used in Nimonic | ○ | ○ |

## 9) Timer instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Timer | TON | TON    T  t |  | ○ | ○ |
| | TOFF | TOFF    T  t |  | ○ | ○ |
| | TMR | TMR    T  t |  | ○ | ○ |
| | TMON | TMON    T  t |  | ○ | ○ |
| | TRTG | TRTG    T  t |  | ○ | ○ |

## 10) Counter instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Counter | CTD | CTD    C  c |  | ○ | ○ |
| | CTU | CTU    C  c |  | ○ | ○ |
| | CTUD | CTUD    C  U  D  c |  | ○ | ○ |
| | CTR | CTR    C  c |  | ○ | ○ |

## Appendix 4.3 Application Instruction

### 1) Data transfer instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 16 bits Transfer | MOV | MOV S D | (S) ———→ (D) | ○ | ○ |
| | MOVP | MOVP S D | | | |
| 32 bits Transfer | DMOV | DMOV S D | (S+1,S) ———→ (D+1,D ) | ○ | ○ |
| | DMOVP | DMOVP S D | | | |
| Short Real Number Transfer | RMOV | RMOV S D | (S+1,S) ———→ (D+1,D ) | ○ | ○ |
| | RMOVP | RMOVP S D | | | |
| Long Real Number Transfer | LMOV | LMOV S D | (S+3,S+2,S+1,S) ———→ (D+3,D+2,D+1,D) | ○ | ○ |
| | LMOVP | LMOVP S D | | | |
| 4 bits Transfer | MOV4 | MOV4 Sb Db |  | ○ | ○ |
| | MOV4P | MOV4P Sb Db | | | |
| 8 bits Transfer | MOV8 | MOV8 Sb Db |  | ○ | ○ |
| | MOV8P | MOV8P Sb Db | | | |
| 1's complement Transfer | CMOV | CMOV S D | 1's complement (S) ———→ (D) | ○ | ○ |
| | CMOVP | CMOVP S D | | | |
| | DCMOV | DCMOV S D | 1's complement (S+1,S) ———→ (D+1,D ) | ○ | ○ |
| | DCMOVP | DCMOVP S D | | | |
| 16 bits Group Transfer | GMOV | GMOV S D N |  | ○ | ○ |
| | GMOVP | GMOVP S D N | | | |
| Multiple Transfer | FMOV | FMOV S D N |  | ○ | ○ |
| | FMOVP | FMOVP S D N | | | |
| Specified Bits Transfer | BMOV | BMOV S D N |  ＊Z: Control Word | ○ | ○ |
| | BMOVP | BMOVP S D N | | | |
| Specified Bits Group Transfer | GBMOV | GBMOV S D Z N |  ＊Z: Control Word | ○ | ○ |
| | GBMOVP | GBMOVP S D Z N | | ○ | ○ |

## 1) Data Transfer Instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| String Transfer | $MOV | $MOV  S  D | String started from (S) → String started from (D) | ○ | ○ |
| | $MOVP | $MOVP  S  D | | ○ | ○ |

## 2) BCD/BIN conversion instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| BCD Conversion | BCD | BCD  S  D | (S) —To BCD→ (D) ⤶ BIN( 0~9999 ) | ○ | ○ |
| | BCDP | BCDP  S  D | | | |
| | DBCD | DBCD  S  D | (S+1,S) —To BCD→ (D+1,D ) ⤶ BIN( 0~99999999 ) | ○ | ○ |
| | DBCDP | DBCDP  S  D | | | |
| 4/8 Bits BCD Conversion | BCD4 | BCD4  Sb  Db | (Sb):Bit, BIN(0~9) To 4bit BCD (Db): Bit | ○ | ○ |
| | BCD4P | BCD4P  Sb  Db | | | |
| | BCD8 | BCD8  Sb  Db | (Sb):Bit, BIN(0~99) To 8bit BCD (Db):Bit | ○ | ○ |
| | BCD8P | BCD8P  Sb  Db | | | |
| BIN Conversion | BIN | BIN  S  D | (S) —To BIN→ (D) ⤶ BCD( 0~9999 ) | ○ | ○ |
| | BINP | BINP  S  D | | | |
| | DBIN | DBIN  S  D | (S+1,S) —To BIN→ (D+1,D ) ⤶ BCD( 0~99999999 ) | ○ | ○ |
| | DBINP | DBINP  S  D | | | |
| 4/8 Bits BIN Conversion | BIN4 | BIN4  Sb  Db | (Sb):Bit, BCD(0~9) To 4bit BIN (Db):Bit | ○ | ○ |
| | BIN4P | BIN4P  Sb  Db | | | |
| | BIN8 | BIN8  Sb  Db | (Sb):Bit, BCD(0~99) To bit BIN (Db):Bit | ○ | ○ |
| | BIN8P | BIN8P  Sb  Db | | | |
| Group BCD,BIN Conversion | GBCD | GBCD  S  D  N | Data (S) to N converted to BCD, and (D) to N saved | ○ | ○ |
| | GBCDP | GBCDP  S  D  N | | | |
| | GBIN | GBIN  S  D  N | Data (S) to N converted to BIN, and (D) to N saved | ○ | ○ |
| | GBINP | GBINP  S  D  N | | | |

## 3) Data type conversion instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 16 Bits Integer/Real Conversion | I2R | ─ I2R S D ─ | (S) ─To Real→ (D+1,D)  └─ Int( −32768~32767 ) | ○ | ○ |
| | I2RP | ─ I2RP S D ─ | | | |
| | I2L | ─ I2L S D ─ | (S) ─To Long→ (D+3,D+2,D+1,D)  └─ Int( −32768~32767 ) | ○ | ○ |
| | I2LP | ─ I2LP S D ─ | | | |
| 32 Bits Integer/Real Conversion | D2R | ─ D2R S D ─ | (S+1,S) ─To Real→ (D+1,D)  └─Dint(−2147483648~2147483647) | ○ | ○ |
| | D2RP | ─ D2RP S D ─ | | | |
| | D2L | ─ D2L S D ─ | (S+1,S) ─To Long→ (D+3,D+2,D+1,D)  └─Dint(−2147483648~2147483647) | ○ | ○ |
| | D2LP | ─ D2LP S D ─ | | | |
| Short Real/Integer Conversion | R2I | ─ R2I S D ─ | (S+1,S) ─To INT→ (D)  └─ Whole Sing Real Range | ○ | ○ |
| | R2IP | ─ R2IP S D ─ | | | |
| | R2D | ─ R2D S D ─ | (S+1,S) ─To DINT→ (D+1,D)  └─ Whole Sing Real Range | ○ | ○ |
| | R2DP | ─ R2DP S D ─ | | | |
| Long Real/Integer Conversion | L2I | ─ L2I S D ─ | (S+3,S+2,S+1,S) ─To INT→ (D)  └─ Whole Double Real Range | ○ | ○ |
| | L2IP | ─ L2IP S D ─ | | | |
| | L2D | ─ L2D S D ─ | (S+3,S+2,S+1,S) ─To DINT→ (D+1,D)  └─ Whole Double Real Range | ○ | ○ |
| | L2DP | ─ L2DP S D ─ | | | |

| Remark |
|---|

1) Integer value and Real value will be saved respectively in quite different format. For such reason, Real Number Data should be converted as applicable before used for Integer Operation.

## 4) Comparison instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Unsigned Compare with Special Relay used | CMP | —[ CMP   S1 S2 ] | CMP(S1,S2) and applicable Flag SET (S1, S2 is Word) | ○ | ○ |
| | CMPP | —[ CMPP   S1 S2 ] | | | |
| | DCMP | —[ DCMP   S1 S2 ]— | CMP(S1,S2) and applicable Flag SET (S1, S2 is Double Word) | ○ | ○ |
| | DCMPP | —[ DCMPP   S1 S2 ]— | | | |
| 4/8 Bits Compare | CMP4 | —[ CMP4   S1 S2 ]— | CMP(S1,S2) and applicable Flag SET (S1, S2 is Nibble) | ○ | ○ |
| | CMP4P | —[ CMP4P   S1 S2 ]— | | | |
| | CMP8 | —[ CMP8   S1 S2 ]— | CMP(S1,S2) and applicable Flag SET (S1, S2 is Byte) | ○ | ○ |
| | CMP8P | —[ CMP8P   S1 S2 ]— | | | |
| Table Compare | TCMP | —[ TCMP   S1 S2 D ] | CMP(S1,S2)) ⋮ CMP(S1+15,S2+15) Result:(D) ~ (D+15), 1 if identical | ○ | ○ |
| | TCMPP | —[ TCMPP   S1 S2 D ]— | | | |
| | DTCMP | —[ DTCMP   S1 S2 D ]— | CMP((S1+1,S1),(S2+1,S2)) ⋮ CMP((S1+31,S1+30),(S2+31,S2+30)) Result:(D) ~ (D+15) | ○ | ○ |
| | DTCMPP | —[ DTCMPP   S1 S2 D ]— | | | |
| Group Compare (16 Bits) | GEQ | —[ GEQ   S1 S2 D N ]— | Compares S1 data to S2 data word by word, and saves its result in Device (D) bit by bit from the lower bit ( N ≤ 16 ) | ○ | ○ |
| | GEQP | —[ GEQP   S1 S2 D N ]— | | | |
| | GGT | —[ GGT   S1 S2 D N ]— | | | |
| | GGTP | —[ GGTP   S1 S2 D N ]— | | | |
| | GLT | —[ GLT   S1 S2 D N ]— | | | |
| | GLTP | —[ GLTP   S1 S2 D N ]— | | | |
| | GGE | —[ GGE   S1 S2 D N ]— | | | |
| | GGEP | —[ GGEP   S1 S2 D N ]— | | | |
| | GLE | —[ GLE   S1 S2 D N ]— | | | |
| | GLEP | —[ GLEP   S1 S2 D N ]— | | | |
| | GNE | —[ GNE   S1 S2 D N ]— | | | |
| | GNEP | —[ GNEP   S1 S2 D N ]— | | | |

**Remark**

1) CMP(P), DCMP(P), CMP4(P), CMP8(P), TCMP(P) & DTCMP(P) Instructions all process the results of Unsigned Compare. All the other Compare Instructions will perform Signed Compare.

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Group Compare (32 Bits) | GDEQ | GDEQ S1 S2 D N | Compares S1 data to S2 data 2 by 2 words, and saves its result in Device (D) bit by bit from the lower bit ( N ≤ 16 ) | ○ | ○ |
| | GDEQP | GDEQP S1 S2 D N | | ○ | ○ |
| | GDGT | GDGT S1 S2 D N | | ○ | ○ |
| | GDGTP | GDGTP S1 S2 D N | | ○ | ○ |
| | GDLT | GDLT S1 S2 D N | | ○ | ○ |
| | GDLTP | GDLTP S1 S2 D N | | ○ | ○ |
| | GDGE | GDGE S1 S2 D N | | ○ | ○ |
| | GDGEP | GDGEP S1 S2 D N | | ○ | ○ |
| | GDLE | GDLE S1 S2 D N | | ○ | ○ |
| | GDLEP | GDLEP S1 S2 D N | | ○ | ○ |
| | GDNE | GDNE S1 S2 D N | | ○ | ○ |
| | GDNEP | GDNEP S1 S2 D N | | ○ | ○ |

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 16 Bits Data Compare (LOAD) | LOAD= | ⊢⊣= S1 S2 ⊢ | Compares (S1) to (S2), and saves its result in Bit Result(BR) (Signed Operation) | ○ | ○ |
| | LOAD> | ⊢⊣> S1 S2 ⊢ | | | |
| | LOAD< | ⊢⊣< S1 S2 ⊢ | | | |
| | LOAD>= | ⊢⊣>= S1 S2 ⊢ | | | |
| | LOAD<= | ⊢⊣<= S1 S2 ⊢ | | | |
| | LOAD<> | ⊢⊣<> S1 S2 ⊢ | | | |
| 16 Bits Data Compare (AND) | AND= | ⊢⊢= S1 S2 ⊢ | Performs AND operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | AND> | ⊢⊢> S1 S2 ⊢ | | | |
| | AND< | ⊢⊢< S1 S2 ⊢ | | | |
| | AND>= | ⊢⊢>= S1 S2 ⊢ | | | |
| | AND<= | ⊢⊢<= S1 S2 ⊢ | | | |
| | AND<> | ⊢⊢<> S1 S2 ⊢ | | | |
| 16 Bits Data Compare (OR) | OR= | = S1 S2 | Performs OR operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation) | ○ ○ | ○ ○ |
| | OR<= | <= S1 S2 | | | |
| | OR<> | <> S1 S2 | | | |
| 32 Bits Data Compare (LOAD) | LOADD= | ⊢D= S1 S2 ⊢ | Compares (S1) to (S2), and saves its result in Bit Result(BR) (Signed Operation) | | |
| | LOADD> | ⊢D> S1 S2 ⊢ | | | |
| | LOADD< | ⊢D< S1 S2 ⊢ | | | |
| | LOADD>= | ⊢D>= S1 S2 ⊢ | | | |
| | LOADD<= | ⊢D<= S1 S2 ⊢ | | | |
| | LOADD<> | ⊢D<> S1 S2 ⊢ | | | |

**Remark**

Comparison instruction for input process the result of Signed comparison instruction generally. To process Unsigned comparison, Use comparison instruction for input.

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 32 Bits Data Compare (AND) | ANDD= | ⊣⊢⊣ D= S1 S2 ├ | Performs AND operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | ANDD> | ⊣⊢⊣ D> S1 S2 ├ | | | |
| | ANDD< | ⊣⊢⊣ D< S1 S2 ├ | | | |
| | ANDD>= | ⊣⊢⊣ D>= S1 S2 ├ | | | |
| | ANDD<= | ⊣⊢⊣ D<= S1 S2 ├ | | | |
| | ANDD<> | ⊣⊢⊣ D<> S1 S2 ├ | | | |
| 32bt Data Compare (OR) | ORD= | D= S1 S2 | Performs OR operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | ORD> | D> S1 S2 | | | |
| | ORD< | D< S1 S2 | | | |
| | ORD>= | D>= S1 S2 | | | |
| | ORD<= | D<= S1 S2 | | | |
| | ORD<> | D<> S1 S2 | | | |
| Short Real Number Compare (LOAD) | LOADR= | ⊢ R= S1 S2 ├ | Performs OR operation of (S1) & (S2) Compare Result and Bit Result (BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | LOADR> | ⊢ R> S1 S2 ├ | | | |
| | LOADR< | ⊢ R< S1 S2 ├ | | | |
| | LOADR>= | ⊢ R>= S1 S2 ├ | | | |
| | LOADR<= | ⊢ R<= S1 S2 ├ | | | |
| | LOADR<> | ⊢ R<> S1 S2 ├ | | | |
| Short Real Number Compare (AND) | ANDR= | ⊣⊢⊣ R= S1 S2 ├ | Compares (S1+1,S) to (S2+1,S2) and saves its result in Bit Result (BR) (Signed Operation) | ○ | ○ |
| | ANDR> | ⊣⊢⊣ R> S1 S2 ├ | | | |
| | ANDR< | ⊣⊢⊣ R< S1 S2 ├ | | | |
| | ANDR>= | ⊣⊢⊣ R>= S1 S2 ├ | | | |
| | ANDR<= | ⊣⊢⊣ R<= S1 S2 ├ | | | |
| | ANDR<> | ⊣⊢⊣ R<> S1 S2 ├ | | | |

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Real Number Compare (OR) | ORR= | R= S1 S2 | Compares (S1+1,S1) to (S2+1,S2) and saves its result in Bit Result (BR) (Signed Operation) | ○ | ○ |
| | ORR> | R> S1 S2 | | | |
| | ORR< | R< S1 S2 | | | |
| | ORR>= | R>= S1 S2 | | | |
| | ORR<= | R<= S1 S2 | | | |
| | ORR<> | R<> S1 S2 | | | |
| Long Real Number Compare (LOAD) | LOADL= | L= S1 S2 | Compares (S1+3,S1+2,S1+1,S) to (S2+3,S2+2, S2+1,S2) and saves its result in Bit Result(BR) (Signed Operation) | ○ | ○ |
| | LOADL> | L> S1 S2 | | | |
| | LOADL< | L< S1 S2 | | | |
| | LOADL>= | L>= S1 S2 | | | |
| | LOADL<= | L<= S1 S2 | | | |
| | LOADL<> | L<> S1 S2 | | | |
| Long Real Number Compare (AND) | ANDL= | L= S1 S2 | Performs AND operation of (S1+1,S1) & (S2+1,S2) Compare Result and Bit Result(BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | ANDL> | L> S1 S2 | | | |
| | ANDL< | L< S1 S2 | | | |
| | ANDL>= | L>= S1 S2 | | | |
| | ANDL<= | L<= S1 S2 | | | |
| | ANDL<> | L<> S1 S2 | | | |

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Double Real Number Compare (OR) | ORL= | L= S1 S2 | Performs OR operation of (S1 +1,S1) & (S2+1,S2) Compare Result and Bit Result(BR), and then saves its result in BR (Signed Operation) | ○ | ○ |
| | ORL> | L> S1 S2 | | | |
| | ORL< | L< S1 S2 | | | |
| | ORL>= | L>= S1 S2 | | | |
| | ORL<= | L<= S1 S2 | | | |
| | ORL<> | L<> S1 S2 | | | |
| String Compare (LOAD) | LOAD$= | $= S1 S2 | Compares (S1) to (S2) Starting String and saves its result in Bit Result(BR) | ○ | ○ |
| | LOAD$> | $> S1 S2 | | | |
| | LOAD$< | $< S1 S2 | | | |
| | LOAD$>= | $>= S1 S2 | | | |
| | LOAD$<= | $<= S1 S2 | | | |
| | LOAD$<> | $<> S1 S2 | | | |
| String Compare (AND) | AND$= | $= S1 S2 | Performs AND operation of (S 1) & (S2) Starting String Compare Result and Bit Result(BR), and then saves its result in BR | ○ | ○ |
| | AND$> | $> S1 S2 | | | |
| | AND$< | $< S1 S2 | | | |
| | AND$>= | $>= S1 S2 | | | |
| | AND$<= | $<= S1 S2 | | | |
| | AND$<> | $<> S1 S2 | | | |

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| String Compare (OR) | OR$= | ⊢⊢ $= S1 S2 | Performs OR operation of (S1) & (S2) Starting String Compare Result and Bit Result(BR), and then saves its result in BR | ○ | ○ |
| | OR$> | ⊢⊢ $> S1 S2 | | | |
| | OR$< | ⊢⊢ $< S1 S2 | | | |
| | OR$>= | ⊢⊢ $>= S1 S2 | | | |
| | OR$<= | ⊢⊢ $<= S1 S2 | | | |
| | OR$<> | ⊢⊢ $<> S1 S2 | | | |
| 16 Bits Data Group Compare (LOAD) | LOADG= | G= S1 S2 N | Compares (S1), (S1+1), ···, (S1+N) to (S2), (S2+1), ··· , (S2+N) 1 to 1, and then saves 1 in Bit Result(BR) if each value compared meets given condition | ○ | ○ |
| | LOADG> | G> S1 S2 N | | | |
| | LOADG< | G< S1 S2 N | | | |
| | LOADG>= | G>= S1 S2 N | | | |
| | LOADG<= | G<= S1 S2 N | | | |
| | LOADG<> | G<> S1 S2 N | | | |
| 16 Bits Data Group Compare (AND) | ANDG= | ⊢⊢ G= S1 S1 N | Performs AND operation of (S1), (S1+1), ···, (S1+N) & (S2), (S2+1), ··· , (S2+N) 1 to 1 Compare Result and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | ANDG> | ⊢⊢ G> S1 S1 N | | | |
| | ANDG< | ⊢⊢ G< S1 S1 N | | | |
| | ANDG>= | ⊢⊢ G>= S1 S1 N | | | |
| | ANDG<= | ⊢⊢ G<= S1 S1 N | | | |
| | ANDG<> | ⊢⊢ G<> S1 S1 N | | | |
| 16 Bits Data Group Compare (OR) | ORG= | ⊢⊢ G= S1 S2 N | Performs OR operation of (S1), (S1+1), ···, (S1+N) & (S2), (S2+1), ··· , (S2+N) 1 to 1 Compare Result and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | ORG> | ⊢⊢ G> S1 S2 N | | | |
| | ORG< | ⊢⊢ G< S1 S2 N | | | |
| | ORG>= | ⊢⊢ G>= S1 S2 N | | | |
| | ORG<= | ⊢⊢ G<= S1 S2 N | | | |
| | ORG<> | ⊢⊢ G<> S1 S2 N | | | |

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGX | XGB |
| 32 Bits Data Group Compare (LOAD) | LOADDG= | DG= S1 S2 N | Compares (S1), (S1+1), …, (S1+N) to (S2), (S2+1), … , (S2+N) 1 to 1, and then saves 1 in Bit Result(BR) if each value compared meets given condition | ○ | ○ |
| | LOADDG> | DG> S1 S2 N | | | |
| | LOADDG< | DG< S1 S2 N | | | |
| | LOADDG>= | DG>= S1 S2 N | | | |
| | LOADDG<= | DG<= S1 S2 N | | | |
| | LOADDG<> | DG<> S1 S2 N | | | |
| 32 Bits Data Group Compare (AND) | ANDDG= | DG= S1 S1 N | Performs AND operation of (S1), (S1+1), …, (S1+N) & (S2), (S2+1), … , (S2+N) 1 to 1 Compare Result and Bit Result(BR), and then saves its result in BR | ○ | ○ |
| | ANDDG> | DG> S1 S1 N | | | |
| | ANDDG< | DG< S1 S1 N | | | |
| | ANDDG>= | DG>= S1 S1 N | | | |
| | ANDDG<= | DG<= S1 S1 N | | | |
| | ANDDG<> | DG<> S1 S1 N | | | |
| 32 Bits Data Group Compare (OR) | ORDG= | DG= S1 S2 N | Performs OR operation of (S1), (S1+1), …, (S1+N) & (S2), (S2+1), … , (S2+N) 1 to 1 Compare Result and Bit Result(BR), and then saves its result in BR | ○ | ○ |
| | ORDG> | DG> S1 S2 N | | | |
| | ORDG< | DG< S1 S2 N | | | |
| | ORDG>= | DG>= S1 S2 N | | | |
| | ORDG<= | DG<= S1 S2 N | | | |
| | ORDG<> | DG<> S1 S2 N | | | |

## 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Three 16-Bit Data Compare (LOAD) | LOAD3= | ⊢— 3= S1 S2 S3 —| Saves 1 in Bit Result(BR) if each value of (S1), (S2), (S3) meets given condition | ○ | ○ |
| | LOAD3> | ⊢— 3> S1 S2 S3 —| | | |
| | LOAD3< | ⊢— 3< S1 S2 S3 —| | | |
| | LOAD3>= | ⊢— 3>= S1 S2 S3 —| | | |
| | LOAD3<= | ⊢— 3<= S1 S2 S3 —| | | |
| | LOAD3<> | ⊢— 3<> S1 S2 S3 —| | | |
| Three 16-Bit Data Compare (AND) | AND3= | ⊣⊢ 3= S1 S2 S3 —| Performs AND operation of (S1), (S2), (S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | AND3> | ⊣⊢ 3> S1 S2 S3 —| | | |
| | AND3< | ⊣⊢ 3< S1 S2 S3 —| | | |
| | AND3>= | ⊣⊢ 3>= S1 S2 S3 —| | | |
| | AND3<= | ⊣⊢ 3<= S1 S2 S3 —| | | |
| | AND3<> | ⊣⊢ 3<> S1 S2 S3 —| | | |
| Three 32-Bit Data Compare (OR) | OR3= | ⊣⊢ 3= S1 S2 S3 | Performs OR operation of (S1), (S2), (S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | OR3> | ⊣⊢ 3> S1 S2 S3 | | | |
| | OR3< | ⊣⊢ <3 S1 S2 S3 | | | |
| | OR3>= | ⊣⊢ >=3 S1 S2 S3 | | | |
| | OR3<= | ⊣⊢ 3<= S1 S2 S3 | | | |
| | OR3<> | ⊣⊢ 3<> S1 S2 S3 | | | |
| Three 16-Bit Data Compare (LOAD) | LOADD3= | ⊢— D3= S1 S2 S3 —| Saves 1 in Bit Result(BR) if each value of (S1+1,S1), (S2+ 1,S2), (S3+1,S3) meets given condition | ○ | ○ |
| | LOADD3> | ⊢— D3> S1 S2 S3 —| | | |
| | LOADD3< | ⊢— D3< S1 S2 S3 —| | | |
| | LOADD3>= | ⊢— D3>= S1 S2 S3 —| | | |
| | LOADD3<= | ⊢— D3<= S1 S2 S3 —| | | |
| | LOADD3<> | ⊢— D3<> S1 S2 S3 —| | | |

### 4) Comparison instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Three 32-Bit Data Compare (AND) | ANDD3= | ⊢⊢ D3= S1 S2 S3 | Performs AND operation of (S1+1,S1), (S2+1,S2), (S3+1,S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | ANDD3> | ⊢⊢ D3> S1 S2 S3 | | | |
| | ANDD3< | ⊢⊢ D3< S1 S2 S3 | | | |
| | ANDD3>= | ⊢⊢ D3>= S1 S2 S3 | | | |
| | ANDD3<= | ⊢⊢ D3<= S1 S2 S3 | | | |
| | ANDD<> | ⊢⊢ D3<> S1 S2 S3 | | | |
| Three 32-Bit Data Compare (OR) | ORD3= | D3= S1 S2 S3 | Performs OR operation of (S1+1, S1), (S2+1,S2), (S3+1,S3) Compare Result by given condition and Bit Result (BR), and then saves its result in BR | ○ | ○ |
| | ORD3> | D3> S1 S2 S3 | | | |
| | ORD3< | D3< S1 S2 S3 | | | |
| | ORD3>= | D3>= S1 S2 S3 | | | |
| | ORD3<= | D3<= S1 S2 S3 | | | |
| | ORD3<> | D3<> S1 S2 S3 | | | |

## 5) Increase/Decrease instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| BIN Data Increase / Decrease (Signed) | INC | ─┤ INC   D ├─ | (D)+1 ────────▶ (D) | 2 | 4-94 |
| | INCP | ─┤ INCP   D ├─ | | | |
| | DINC | ─┤ DINC   D ├─ | (D+1,D)+1 ────────▶ (D+1,D) | 2 | |
| | DINCP | ─┤ DINCP   D ├─ | | | |
| | DEC | ─┤ DEC   D ├─ | (D)−1 ────────▶ (D) | 2 | 4-96 |
| | DECP | ─┤ DECP   D ├─ | | | |
| | DDEC | ─┤ DDEC   D ├─ | (D+1,D)−1 ────────▶ (D+1,D) | 2 | |
| | DDECP | ─┤ DDECP   D ├─ | | | |
| 4/8 Bits Data Increase / Decrease (Signed) | INC4 | ─┤ INC4   Db ├─ | (D:x bit ~ D:x bit+4) + 1 ────────▶ (D:x bit ~ D:x bit+4) | 2 | 4-95 |
| | INC4P | ─┤ INC4P   Db ├─ | | 3 | |
| | INC8 | ─┤ INC8   Db ├─ | (D:x bit ~ D:x bit+8) + 1 ────────▶ (D:x bit ~ D:x bit+8) | 2 | |
| | INC8P | ─┤ INC8P   Db ├─ | | 3 | |
| | DEC4 | ─┤ DEC4   Db ├─ | (D:x bit ~ D:x bit+4) − 1 ────────▶ (D:x bit ~ D:x bit+4) | 2 | 4-97 |
| | DEC4P | ─┤ DEC4P   Db ├─ | | 3 | |
| | DEC8 | ─┤ DEC8   Db ├─ | (D:x bit ~ D:x bit+8) − 1 ────────▶ (D:x bit ~ D:x bit+8) | 2 | |
| | DEC8P | ─┤ DEC8P   Db ├─ | | 3 | |
| BIN Data Increase / Decrease (Unsigned) | INCU | ─┤ INCU   D ├─ | (D)+1 ────────▶ (D) | 2 | 4-98 |
| | INCUP | ─┤ INCUP   D ├─ | | | |
| | DINCU | ─┤ DINCU   D ├─ | (D+1,D)+1 ────────▶ (D+1,D) | 2 | |
| | DINCUP | ─┤ DINCUP   D ├─ | | | |
| | DECU | ─┤ DECU   D ├─ | (D)−1 ────────▶ (D) | 2 | 4-99 |
| | DECUP | ─┤ DECUP   D ├─ | | | |
| | DDECU | ─┤ DDECU   D ├─ | (D+1,D)−1 ────────▶ (D+1,D) | 2 | |
| | DDECUP | ─┤ DDECUP   D ├─ | | | |

## 6) Rotation instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Rotate to Left | ROL | ROL D n |  | ○ | ○ |
| | ROLP | ROLP D n | | | |
| | DROL | DROL D n |  | | |
| | DROLP | DROLP D n | | | |
| 4/8 Bits Rotate to Left | ROL4 | ROL4 Db n |  | ○ | ○ |
| | ROL4P | ROL4P Db n | | | |
| | ROL8 | ROL8 Db n |  | | |
| | ROL8P | ROL8P Db n | | | |
| Rotate to Right | ROR | ROR D n |  | ○ | ○ |
| | RORP | RORP D n | | | |
| | DROR | DROR D n |  | | |
| | DRORP | DRORP D n | | | |
| 4/8 Bits Rotate to Right | ROR4 | ROR4 Db n |  | ○ | ○ |
| | ROR4P | ROR4P Db n | | | |
| | ROR8 | ROR8 Db n |  | | |
| | ROR8P | ROR8P Db n | | | |
| Rotate to Left (including Carry) | RCL | RCL D n |  | ○ | ○ |
| | RCLP | RCLP D n | | | |
| | DRCL | DRCL D n |  | | |
| | DRCLP | DRCLP D n | | | |
| 4/8 Bits Rotate to Left (including Carry) | RCL4 | RCL4 Db n |  | ○ | ○ |
| | RCL4P | RCL4P Db n | | | |
| | RCL8 | RCL8 Db n |  | | |
| | RCL8P | RCL8P Db n | | | |
| Rotate to Right (including Carry) | RCR | RCR D n |  | ○ | ○ |
| | RCRP | RCRP D n | | | |
| | DRCR | DRCR D n |  | | |
| | DRCRP | DRCRP D n | | | |
| 4/8 Bits Rotate to Right (including Carry) | RCR4 | RCR4 Db n |  | ○ | ○ |
| | RCR4P | RCR4P Db n | | | |
| | RCR8 | RCR8 Db n |  | | |
| | RCR8P | RCR8P Db n | | | |

## 7) Move instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Bits Move | BSFT | BSFT St Ed |  | ○ | ○ |
| | BSFTP | BSFTP St Ed | | | |
| Move to Higher Bit | BSFL | BSFL D n |  | ○ | ○ |
| | BSFLP | BSFLP D n | | | |
| | DBSFL | DBSFL D n | | | |
| | DBSFLP | DBSFLP D n | | | |
| Move to Higher Bit within 4/8 Bits range | BSFL4 | BSFL4 Db n |  | ○ | ○ |
| | BSFL4P | BSFL4P Db n | | | |
| | BSFL8 | BSFL8 Db n | | | |
| | BSFL8P | BSFL8P Db n | | | |
| Move to Lower Bit | BSFR | BSFR D n |  | ○ | ○ |
| | BSFRP | BSFRP D n | | | |
| | DBSFR | DBSFR D n | | | |
| | DBSFRP | DBSFRP D n | | | |
| Move to Lower Bit within 4/8 Bits range | BSFR4 | BSFR4 Db n |  | ○ | ○ |
| | BSFR4P | BSFR4P Db n | | | |
| | BSFR8 | BSFR8 Db n | | | |
| | BSFR8P | BSFR8P Db n | | | |
| Word Move | WSFT | WSFT Et Ed |  | ○ | ○ |
| | WSFTP | WSFTP Et Ed | | | |
| Word Data Move to Left/Right | WSFL | WSFL D1 D2 N |  | ○ | ○ |
| | WSFLP | WSFLP D1 D2 N | | | |
| | WSFR | WSFR D1 D2 N | | | |
| | WSFRP | WSFRP D1 D2 N | | | |
| Bit Move | SR | SR Db I D N | Moves N bits starting from Db bit along Input direction (I) and Move direction (D) | ○ | ○ |

## 8) Exchange instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Data Exchange | XCHG | XCHG D1 D2 | (D1) ←——→ (D2) | ○ | ○ |
| | XCHGP | XCHGP D1 D2 | | | |
| | DXCHG | DXCHG D1 D2 | (D1+1, D1) ←——→ (D2+1, D2) | | |
| | DXCHGP | DXCHGP D1 D2 | | | |
| Group Data Exchange | GXCHG | GXCHG D1 D2 N | (D1) (D2) : ←——→ : N | ○ | ○ |
| | GXCHGP | GXCHGP D1 D2 N | | | |
| Higher/Lower Byte Exchange | SWAP | SWAP D | b15 b0 (D) Upper Byte Lower Byte (D) Lower Byte Upper Byte | ○ | ○ |
| | SWAPP | SWAPP D | | | |
| Group Byte Exchange | GSWAP | GSWAP D N | Exchanges Higher/Lower Byte of Words N starting from D | ○ | ○ |
| | GSWAPP | GSWAPP D N | | | |

## 9) BIN operation instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Integer Addition (Signed) | ADD | ADD S1 S2 D | (S1)+(S2) ⟶ (D) | ○ | ○ |
| | ADDP | ADDP S1 S2 D | | | |
| | DADD | DADD S1 S2 D | (S1+1,S1)+(S2+1,S2) ⟶ (D+1,D) | | |
| | DADDP | DADDP S1 S2 D | | | |
| Integer Subtraction (Signed) | SUB | SUB S1 S2 D | (S1)−(S2) ⟶ (D) | ○ | ○ |
| | SUBP | SUBP S1 S2 D | | | |
| | DSUB | DSUB S1 S2 D | (S1+1,S1)−(S2+1,S2) ⟶ (D+1,D) | | |
| | DSUBP | DSUBP S1 S2 D | | | |
| Integer Multiplication (Signed) | MUL | MUL S1 S2 D | (S1)×(S2) ⟶ (D+1,D) | ○ | ○ |
| | MULP | MULP S1 S2 D | | | |
| | DMUL | DMUL S1 S2 D | (S1+1,S1)×(S2+1,S2) ⟶ (D+3,D+2,D+1,D) | | |
| | DMULP | DMULP S1 S2 D | | | |
| Integer Division (Signed) | DIV | DIV S1 S2 D | (S1)÷(S2) ⟶ (D) Quotient / (D+1) Remainder | ○ | ○ |
| | DIVP | DIVP S1 S2 D | | | |
| | DDIV | DDIV S1 S2 D | (S1+1,S1)÷(S2+1,S2) ⟶ (D+1,D) Quotient / (D+3,D+2) Remainder | | |
| | DDIVP | DDIVP S1 S2 D | | | |
| Integer Addition (Unsigned) | ADDU | ADDU S1 S2 D | (S1)+(S2) ⟶ (D) | ○ | ○ |
| | ADDUP | ADDUP S1 S2 D | | | |
| | DADDU | DADDU S1 S2 D | (S1+1,S1)+(S2+1,S2) ⟶ (D+1,D) | | |
| | DADDUP | DADDUP S1 S2 D | | | |
| Integer Subtraction (Unsigned) | SUBU | SUBU S1 S2 D | (S1)−(S2) ⟶ (D) | ○ | ○ |
| | SUBUP | SUBUP S1 S2 D | | | |
| | DSUBU | DSUBU S1 S2 D | (S1+1,S1)−(S2+1,S2) ⟶ (D+1,D) | | |
| | DSUBUP | DSUBUP S1 S2 D | | | |
| Integer Multiplication (Unsigned) | MULU | MULU S1 S2 D | (S1)×(S2) ⟶ (D+1,D) | ○ | ○ |
| | MULUP | MULUP S1 S2 D | | | |
| | DMULU | DMULU S1 S2 D | (S1+1,S1)×(S2+1,S2) ⟶ (D+3,D+2,D+1,D) | | |
| | DMULUP | DMULUP S1 S2 D | | | |

## 9) BIN operation instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Integer Division (Unsigned) | DIVU | —[ DIVU  S1 S2 D ]— | (S1)÷(S2) → (D) Quotient / (D+1) Remainder | ○ | ○ |
| | DIVUP | —[ DIVUP  S1 S2 D ]— | | | |
| | DDIVU | —[ DDIVU  S1 S2 D ]— | (S1+1,S1)÷(S2+1,S2) → (D+1,D) Quotient / (D+3,D+2) Remainder | | |
| | DDIVUP | —[ DDIVUP  S1 S2 D ]— | | | |
| Real Number Addition | RADD | —[ RADD  S1 S2 D ]— | (S1+1,S1)+(S2+1,S2) → (D+1,D) | ○ | ○ |
| | RADDP | —[ RADDP  S1 S2 D ]— | | | |
| | LADD | —[ LADD  S1 S2 D ]— | (S1+3,S1+2,S1+1,S1) +(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D) | | |
| | LADDP | —[ LADDP  S1 S2 D ]— | | | |
| Real Number Subtraction | RSUB | —[ RSUB  S1 S2 D ]— | (S1+1,S1)−(S2+1,S2) → (D+1,D) | ○ | ○ |
| | RSUBP | —[ RSUBP  S1 S2 D ]— | | | |
| | LSUB | —[ LSUB  S1 S2 D ]— | (S1+3,S1+2,S1+1,S1) −(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D) | | |
| | LSUBP | —[ LSUBP  S1 S2 D ]— | | | |
| Real Number Multiplication | RMUL | —[ RMUL  S1 S2 D ]— | (S1+1,S1)×(S2+1,S2) → (D+1,D) | ○ | ○ |
| | RMULP | —[ RMULP  S1 S2 D ]— | | | |
| | LMUL | —[ LMUL  S1 S2 D ]— | (S1+3,S1+2,S1+1,S1) ×(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D) | | |
| | LMULP | —[ LMULP  S1 S2 D ]— | | | |
| Real Number Division | RDIV | —[ RDIV  S1 S2 D ]— | (S1+1,S1)÷(S2+1,S2) → (D+1,D) | ○ | ○ |
| | RDIVP | —[ RDIVP  S1 S2 D ]— | | | |
| | LDIV | —[ LDIV  S1 S2 D ]— | (S1+3,S1+2,S1+1,S1) ÷(S2+3,S2+2,S2+1,S2) → (D+3,D+2,D+1,D) | | |
| | LDIVP | —[ LDIVP  S1 S2 D ]— | | | |
| String Addition | $ADD | —[ $ADD  S1 S2 D ]— | Connects S1 String with S2 String to save in D | ○ | ○ |
| | $ADDP | —[ $ADDP  S1 S2 D ]— | | | |
| Group Addition | GADD | —[ GADD  S1 S2 D N ]— | (S1) + (S2) = (D) , N | ○ | ○ |
| | GADDP | —[ GADDP  S1 S2 D N ]— | | | |
| Group Subtraction | GSUB | —[ GSUB  S1 S2 D N ]— | (S1) − (S2) = (D) , N | ○ | ○ |
| | GSUBP | —[ GSUBP  S1 S2 D N ]— | | | |

## 10) BCD operation instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| BCD Addition | ADDB | — ADDB  S1 S2 D — | (S1)+(S2) ⟶ (D) | ○ | ○ |
| | ADDBP | — ADDBP  S1 S2 D — | | | |
| | DADDB | — DADDB  S1 S2 D — | (S1+1,S1)+(S2+1,S2) ⟶ (D+1,D) | | |
| | DADDBP | — DADDBP  S1 S2 D — | | | |
| BCD Subtraction | SUBB | — SUBB  S1 S2 D — | (S1)−(S2) ⟶ (D) | ○ | ○ |
| | SUBBP | — SUBBP  S1 S2 D — | | | |
| | DSUBB | — DSUBB  S1 S2 D — | (S1+1,S1)−(S2+1,S2) ⟶ (D+1,D) | | |
| | DSUBBP | — DSUBBP  S1 S2 D — | | | |
| BCD Multiplication | MULB | — MULB  S1 S2 D — | (S1)×(S2) ⟶ (D+1,D) | ○ | ○ |
| | MULBP | — MULBP  S1 S2 D — | | | |
| | DMULB | — DMULB  S1 S2 D — | (S1+1,S1)×(S2+1,S2) ⟶ (D+3,D+2,D+1,D) | | |
| | DMULBP | — DMULBP  S1 S2 D — | | | |
| BCD Division | DIVB | — DIVB  S1 S2 D — | (S1)÷(S2) ⟶ (D) Quotient (D+1) Remainder | ○ | ○ |
| | DIVBP | — DIVBP  S1 S2 D — | | | |
| | DDIVB | — DDIVB  S1 S2 D — | (S1+1,S1)÷(S2+1,S2) ⟶ (D+1,D) Quotient (D+3,D+2) Remainder | | |
| | DDIVBP | — DDIVBP  S1 S2 D — | | | |

## 11) Logic operation instruction

| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| Logic Multiplication | WAND | —[ WAND  S1 S2 D ]— | Word AND (S1) ∧ (S2) ──► (D) | ○ | ○ |
| | WANDP | —[ WANDP  S1 S2 D ]— | | | |
| | DWAND | —[ DWAND  S1 S2 D ]— | DWord AND (S1+1,S1)∧(S2+1,S2) ──► (D+1,D) | | |
| | DWANDP | —[ DWANDP  S1 S2 D ]— | | | |
| Logic Addition | WOR | —[ WOR  S1 S2 D ]— | Word OR (S1) ∨ (S2) ──► (D) | ○ | ○ |
| | WORP | —[ WORP  S1 S2 D ]— | | | |
| | DWOR | —[ DWOR  S1 S2 D ]— | DWord OR (S1+1,S1)∨(S2+1,S2) ──► (D+1,D) | | |
| | DWORP | —[ DWORP  S1 S2 D ]— | | | |
| Exclusive OR | WXOR | —[ WXOR  S1 S2 D ]— | Word Exclusive OR (S1) ⊻ (S2) ──► (D) | ○ | ○ |
| | WXORP | —[ WXORP  S1 S2 D ]— | | | |
| | DWXOR | —[ DWXOR  S1 S2 D ]— | DWord Exclusive OR (S1+1,S1)⊻(S2+1,S2) ──► (D+1,D) | | |
| | DWXORP | —[ DWXORP  S1 S2 D ]— | | | |
| Exclusive NOR | WXNR | —[ WXNR  S1 S2 D ]— | Word Exclusive NOR (S1) ⊻ (S2) ──► (D) | ○ | ○ |
| | WXNRP | —[ WXNRP  S1 S2 D ]— | | | |
| | DWXNR | —[ DWXNR  S1 S2 D ]— | DWord Exclusive NOR (S1+1,S1)⊻(S2+1,S2) ──► (D+1,D) | | |
| | DWXNRP | —[ DWXNRP  S1 S2 D ]— | | | |
| Group Logic Operation | GWAND | —[ GWAND  S1 S2 D N ]— | (S1) ∧ (S2) = (D)  N | ○ | ○ |
| | GWANDP | —[ GWANDP  S1 S2 D N ]— | | | |
| | GWOR | —[ GWOR  S1 S2 D N ]— | (S1) ∨ (S2) = (D)  N | ○ | ○ |
| | GWORP | —[ GWORP  S1 S2 D N ]— | | | |
| | GWXOR | —[ GWXOR  S1 S2 D N ]— | (S1) ⊻ (S2) = (D)  N | ○ | ○ |
| | GWXORP | —[ GWXORP  S1 S2 D N ]— | | | |
| | GWXNR | —[ GWXNR  S1 S2 D N ]— | (S1) ⊻ (S2) = (D)  N | ○ | ○ |
| | GWXNRP | —[ GWXNRP  S1 S2 D N ]— | | | |

## 12) Data process instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Bit Check | BSUM | —[ BSUM \| S \| D ]— |  | ○ | ○ |
| | BSUMP | —[ BSUMP \| S \| D ]— | | | |
| | DBSUM | —[ DBSUM \| S \| D ]— | | | |
| | DBSUMP | —[ DBSUM \| S \| D ]— | | | |
| Bit Reset | BRST | —[ BRST \| D \| N ]— | Resets N Bits (starting from D) to 0 | ○ | ○ |
| | BRSTP | —[ BRSTP \| D \| N ]— | | | |
| Encode | ENCO | —[ ENCO \| S \| D \| n ]— |  | ○ | ○ |
| | ENCOP | —[ ENCOP \| S \| D \| n ]— | | | |
| Decode | DECO | —[ DECO \| S \| D \| n ]— |  | ○ | ○ |
| | DECOP | —[ DECOP \| S \| D \| n ]— | | | |
| Data Disconnect & Connect | DIS | —[ DIS \| S \| D \| n ]— |  | ○ | ○ |
| | DISP | —[ DISP \| S \| D \| n ]— | | | |
| | UNI | —[ UNI \| S \| D \| n ]— | | | |
| | UNIP | —[ UNIP \| S \| D \| n ]— | | | |
| Word/ Byte Conversion | WTOB | —[ WTOB \| S \| D \| n ]— |  | ○ | ○ |
| | WTOBP | —[ WTOBP \| S \| D \| n ]— | | | |
| | BTOW | —[ BTOW \| S \| D \| n ]— |  | | |
| | BTOWP | —[ BTOWP \| S \| D \| n ]— | | | |
| I/O Refresh | IORF | —[ IORF \| S1 \| S2 \| S3 ]— | Right after masking I/O data (located on S1) with S2 and S3 data, perform process | ○ | ○ |
| | IORFP | —[ IORFP \| S1 \| S2 \| S3 ]— | | | |
| Data Search | SCH | —[ SCH \| S1 \| S2 \| D \| N ]— | Finds S1 value within S2 ~ N range and saves the first identical valued position in D and S1's identical valued total number in D+1 | ○ | ○ |
| | SCHP | —[ SCHP \| S1 \| S2 \| D \| N ]— | | | |
| | DSCH | —[ DSCH \| S1 \| S2 \| D \| N ]— | | | |
| | DSCHP | —[ DSCHP \| S1 \| S2 \| D \| N ]— | | | |
| Max. Value Search | MAX | —[ MAX \| S \| D \| n ]— | Saves the max value in D among N words starting from S | ○ | ○ |
| | MAXP | —[ MAXP \| S \| D \| n ]— | | | |
| | DMAX | —[ DMAX \| S \| D \| n ]— | Saves the max value in D among N double words starting from S | | |
| | DMAXP | —[ DMAXP \| S \| D \| n ]— | | | |

## 12) Data process instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Min. Value Search | MIN | MIN S D n | Saves the min value in D among N words starting from S | ○ | ○ |
| | MINP | MINP S D n | | | |
| | DMIN | DMIN S D n | Saves the min value in D among N double words starting from S | | |
| | DMINP | DMINP S D n | | | |
| Sum | SUM | SUM S D n | Adds up N words starting from S to save in D | ○ | ○ |
| | SUMP | SUMP S D n | | | |
| | DSUM | DSUM S D n | Adds up N double words starting from S to save in D | | |
| | DSUMP | DSUMP S D n | | | |
| Average | AVE | AVE S D n | Averages N words starting from S to save in D | ○ | ○ |
| | AVEP | AVEP S D n | | | |
| | DAVE | DAVE S D n | Averages N double words starting from S to save in D | | |
| | DAVEP | DAVEP S D n | | | |
| MUX | MUX | MUX S1 S2 D N | | ○ | ○ |
| | MUXP | MUXP S1 S2 D N | | | |
| | DMUX | DMUX S1 S2 D N | | | |
| | DMUXP | DMUXP S1 S2 D N | | | |
| Data Detect | DETECT | DETECT S1 S2 D N | Detects N data from S1, to save the first value larger than S2 in D, and the extra number in D+1 | ○ | ○ |
| | DETECTP | DETECTP S1 S2 D N | | | |
| Ramp Signal Output | RAMP | RAMP n1 n2 D1 n3 D2 | Saves linear-changed value in D1 during n3 scanning of initial value n1 to final n2 and present scanning number in D1+1, and changes D2 value to ON after completed | ○ | ○ |
| Data Align | SORT | SORT S n1 n2 D1 D2 | S : Head Address of Sort Data<br>n1 : Number of Words to sort<br>n1+1 : Sorting Method<br>n2: Operation number per Scan<br>D1 : ON if complete<br>D2 : Auxiliary Area | ○ | ○ |
| | SORTP | SORTP S n1 n2 D1 D2 | | | |

## 13) Data table process instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Data Write | FIWR | ─┤ FIWR S D ├─ | Adds S to the last of Data Table D ~ D+N, and increases Data Table Length(N) saved in D by 1 | ○ | ○ |
| | FIWRP | ─┤ FIWRP S D ├─ | | | |
| First-input Data Read | FIFRD | ─┤ FIFRD S D ├─ | Moves first data, S+1 of Data Table S ~ S+N to D (pull 1 place after origin deleted) and decreases Data Table Length(N) saved in D by 1 S | ○ | ○ |
| | FIFRDP | ─┤ FIFRDP S D ├─ | | | |
| Last-Input Data Read | FILRD | ─┤ FILRD S D ├─ | Moves last data, S+N of Data Table S ~ S+N to D (origin deleted) and decreases Data Table Length(N) saved in D by 1 S | ○ | ○ |
| | FILRDP | ─┤ FILRDP S D ├─ | | | |
| Data Insert | FIINS | ─┤ FINS S D n ├─ | Adds S to 'N'th place of Data Table D ~ D+N (origin data pulled by 1), and increases Data Table Length(N) saved in D by 1 | ○ | ○ |
| | FIINSP | ─┤ FINSP S D n ├─ | | | |
| Data Pull | FIDEL | ─┤ FDEL S D n ├─ | Deletes 'N'th data of Data Table S ~ S+N (pull 1 place) and decreases Data Table Length(N) saved in D by 1 | ○ | ○ |
| | FIDELP | ─┤ FDELP S D n ├─ | | | |

## 14) Display instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 7 Segment Display | SEG | ─┤ SEG S D Z ├─ | Converts S Data to 7-Segment as adjusted in Z Format so to save in D | ○ | ○ |
| | SEGP | ─┤ SEGP S D Z ├─ | | | |

## 15) String Process instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Convert to Decimal ASCII Cord | BINDA | BINDA S D | Converts S of 1-word BIN value to Decimal ASCII Cord to save in starting D | ○ | ○ |
| | BINDAP | BINDAP S D | | | |
| | DBINDA | DBINDA S D | Converts S of 2-word BIN value to Decimal ASCII Cord to save in starting D | | |
| | DBINDAP | DBINDAP S D | | | |
| Convert to Hexadecimal ASCII Cord | BINHA | BINHA S D | Converts S of 1-word BIN value to Hexadecimal ASCII Cord to save in starting D | ○ | ○ |
| | BINHAP | BINHAP S D | | | |
| | DBINHA | DBINHA S D | Converts S of 2-word BIN value to Hexadecimal ASCII Cord to save in starting D | | |
| | DBINHAP | DBINHAP S D | | | |
| Convert BCD to Decimal ASCII Cord | BCDDA | BCDDA S D | Converts S of 1-word BCD to ASCII Cord to save in starting D | ○ | ○ |
| | BCDDAP | BCDDAP S D | | | |
| | DBCDDA | DBCDDA S D | Converts S of 2-word BCD to ASCII Cord to save in starting D | | |
| | DBCDDAP | DBCDDAP S D | | | |
| Convert Decimal ASCII to BIN | DABIN | DABIN S D | Converts S S+2,S+1,S's Decimal ASCII Cord to BIN to save in D | ○ | ○ |
| | DABINP | DABINP S D | | | |
| | DDABIN | DDABIN S D | Converts S+5~S's Decimal ASCII Cord to BIN value to save in D+1 & D | | |
| | DDABINP | DDABINP S D | | | |
| Convert Hexadecimal ASCII to BIN | HABIN | HABIN S D | Converts S+1,S's Hexadecimal ASCII Cord to BIN value to save in D | ○ | ○ |
| | HABINP | HABINP S D | | | |
| | DHABIN | DHABIN S D | Converts S+3~S's Hexadecimal ASCII Cord to BIN to save in D | | |
| | DHABINP | DHABINP S D | | | |
| Convert Decimal ASCII to BCD | DABCD | DABCD S D | Converts S+1,S's Decimal ASCII Cord to BCD to save in D | ○ | ○ |
| | DABCDP | DABCDP S D | | | |
| | DDABCD | DDABCD S D | Converts S+3~S's Decimal ASCII Cord to BCD to save in D | | |
| | DDABCDP | DDABCDP S D | | | |
| String Length Detect | LEN | LEN S D | Saves String Length with S starting in D | ○ | ○ |
| | LENP | LENP S D | | | |

## 15) String process instruction (continued)

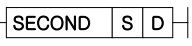| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Convert BIN16/32 to String | STR | ⊢ STR | S1 S2 D ⊣ | Adjusts S2 saved word data to S1 saved place number to convert to String and save in D | ○ | ○ |
| | STRP | ⊢ STRP | S1 S2 D ⊣ | | | |
| | DSTR | ⊢ DSTR | S1 S2 D ⊣ | Adjusts S2 saved double word data to S1 saved place number to convert to String and save in D | | |
| | DSTRP | ⊢ DSTRP | S1 S2 D ⊣ | | | |
| Convert String to BIN16/32 | VAL | ⊢ VAL | S D1 D2 ⊣ | Adjusts S saved string to number to save in word D1 and saves the place number in D2 | ○ | ○ |
| | VALP | ⊢ VALP | S D1 D2 ⊣ | | | |
| | DVAL | ⊢ DVAL | S D1 D2 ⊣ | Adjusts S saved string to number to save in double word D1 and saves the place number in D2 | | |
| | DVALP | ⊢ DVALP | S D1 D2 ⊣ | | | |
| Convert Real Number to String | RSTR | ⊢ RSTR | S1 S2 D ⊣ | Adjusts Floating decimal point point Real Number Data (S1: number, S2: places) to String format to save in D | ○ | X |
| | RSTRP | ⊢ RSTRP | S1 S2 D ⊣ | | | |
| | LSTR | ⊢ LSTR | S1 S2 D ⊣ | Adjusts Floating decimal point point Double Real Number Data (S1:number, S2:places) to String format to save in D | | |
| | LSTRP | ⊢ LSTRP | S1 S2 D ⊣ | | | |
| Convert String to Real Number | STRR | ⊢ STRR | S D ⊣ | Converts String S to Floating decimal point point Real Number Data to save in D | ○ | X |
| | STRRP | ⊢ STRRP | S D ⊣ | | | |
| | STRL | ⊢ STRL | S D ⊣ | Converts String S to Floating decimal point point Double Real Number Data to save in D | | |
| | STRLP | ⊢ STRLP | S D ⊣ | | | |
| ASCII Conversion | ASC | ⊢ ASC | S D cw ⊣ | Converts BIN Data to ASCII in Nibble unit, based on cw's format from S to save in D | ○ | ○ |
| | ASCP | ⊢ ASCP | S D cw ⊣ | | | |
| HEX Conversion | HEX | ⊢ HEX | S D N ⊣ | Converts 2N ASCII saved in N words from S in byte unit to Nibble unit of Hexadecimal BIN so to save in D | ○ | ○ |
| | HEXP | ⊢ HEXP | S D N ⊣ | | | |
| String Extract from Right | RIGHT | ⊢ RIGHT | S D N ⊣ | Extracts n string from S string's final letter to save in starting D | ○ | ○ |
| | RIGHTP | ⊢ RIGHTP | S D N ⊣ | | | |
| String Extract from Left | LEFT | ⊢ LEFT | S D N ⊣ | Extracts n string from S string's first letter to save in starting D | ○ | ○ |
| | LEFTP | ⊢ LEFTP | S D N ⊣ | | | |
| String Random Extract | MID | ⊢ MID | S1 S2 D ⊣ | Extracts string which conforms to S2 condition among S1 string to save in starting D | ○ | ○ |
| | MIDP | ⊢ MIDP | S1 S2 D ⊣ | | | |

### 15) String process instruction (continued)

| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| String Random Replace | REPLACE | REPLACE S1 D S2 | Processes S1 String as applicable to S2 Condition to save in D String | ○ | ○ |
| | REPLACEP | REPLACEP S1 D S2 | | | |
| String Find | FIND | FIND S1 S2 D N | Finds identical String to S2 in S1 ~ N data to save the absolute position in D | ○ | ○ |
| | FINDP | FINDP S1 S2 D N | | | |
| Parse Real Number to BCD | RBCD | RBCD S1 S2 D | Adjusts Floating decimal point point Real Number Data S1 to S2 place to convert to BCD, and then to save in D | ○ | X |
| | RBCDP | RBCDP S1 S2 D | | | |
| | LBCD | LBCD S1 S2 D | Adjusts Floating decimal point point Double Real Number Data S1 to S2 place to convert to BCD, and then to save in D | | |
| | LBCDP | LBCDP S1 S2 D | | | |
| Convert BCD Data to Real Number | BCDR | BCDR S1 S2 D | Adjusts BCD Data S1 to S2 place to convert to Floating decimal point point Real Number, and then to save in D | ○ | X |
| | BCDRP | BCDRP S1 S2 D | | | |
| | BCDL | BCDR S1 S2 D | Adjusts BCD Data S1 to S2 place to convert to Floating decimal point point Double Real Number, and then to save in D | | |
| | BCDLP | BCDLP S1 S2 D | | | |

## 16) Special function instruction
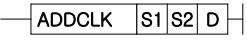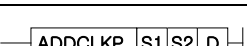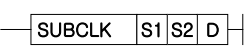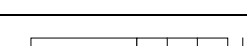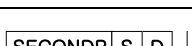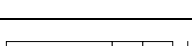
| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| SIN Operation | SIN | ─| SIN | S | D |─ | SIN(S+1,S) ─────→ (D+1,D) | ○ | ○ |
| | SINP | ─| SINP | S | D |─ | | | |
| COS Operation | COS | ─| COS | S | D |─ | COS(S+1,S) ─────→ (D+1,D) | ○ | ○ |
| | COSP | ─| COSP | S | D |─ | | | |
| TAN Operation | TAN | ─| TAN | S | D |─ | TAN(S+1,S) ─────→ (D+1,D) | ○ | ○ |
| | TANP | ─| TANP | S | D |─ | | | |
| RAD Conversion | RAD | ─| RAD | S | D |─ | (S+1,S) ─────→ (D+1,D)<br>Converts angle to radian | ○ | ○ |
| | RADP | ─| RADP | S | D |─ | | | |
| Angle Conversion | DEG | ─| DEG | S | D |─ | (S+1,S) ─────→ (D+1,D)<br>Converts radian to angle | ○ | ○ |
| | DEGP | ─| DEGP | S | D |─ | | | |
| Square Root Operation | SQRT | ─| SQRT | S | D |─ | $\sqrt{(S+1,S)}$ ─────→ (D+1,D) | ○ | ○ |
| | SQRTP | ─| SQRTP | S | D |─ | | | |
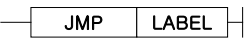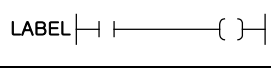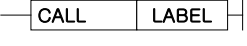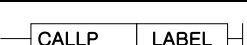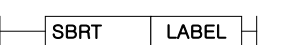
## 17) Data control instruction

| Classification | Designations | Symbol | Description | Basic Steps | Page |
|---|---|---|---|---|---|
| Limit Control | LIMIT | ─ LIMIT S1 S2 S3 D ─ | If S1 < S2, then<br>D = S2<br>If S2 < S1 < S3, then<br>D = S1<br>If S3 < S1, then<br>D = S3 | ○ | ○ |
| | LIMITP | ─ LIMITP S1 S2 S3 D ─ | | | |
| | DLIMIT | ─ DLIMIT S1 S2 S3 D ─ | | | |
| | DLIMITP | ─ DLIMITP S1 S2 S3 D ─ | | | |
| Dead-zone Control | DZONE | ─ DZONE S1 S2 S3 D ─ | If S1 < -S2, then<br>D = S1+S2-S2(S3/100)<br>If –S2 < S1 < S2, then<br>D = (S3/100)S1<br>If S1 < S2, then<br>D = S1-S2+S2(S3/100) | ○ | ○ |
| | DZONEP | ─ DZONEP S1 S2 S3 D ─ | | | |
| | DDZONE | ─ DDZONE S1 S2 S3 D ─ | | | |
| | DDZONEP | ─ DDZONEP S1 S2 S3 D ─ | | | |
| Vertical-zone Control | VZONE | ─ VZONE S1 S2 S3 D ─ | If S1 < -S2(S3/100), then<br>D = S1-S2+S2(S3/100)<br>If –S2(S3/100) <S1< S2(S3/100), then<br>D = (100/S3)S1<br>If S1 < S2(S3/100), then<br>D = S1+S2-S2(S3/100) | ○ | ○ |
| | VZONEP | ─ VZONEP S1 S2 S3 D ─ | | | |
| | DVZONE | ─ DVZONE S1 S2 S3 D ─ | | | |
| | DVZONEP | ─ DVZONEP S1 S2 S3 D ─ | | | |
| Built-in PID Control Instruction | PIDRUN | ─ PIDRUN N ─ | Operates PID Loop N | ○ | ○ |
| | PIDPAUSE | ─ PIDPAUSE N ─ | Stops PID Loop N momentarily | ○ | X |
| | PIDPRMT | ─ PIDPRMT S N ─ | Changes PID Loop N's Parameter.<br>( SV(word) / Ts(word) / Kp(real) / Ti(real) / Td(real) ) | ○ | X |
| | PIDAT | ─ PIDRUN N ─ | Start of PID loop Auto-tuning | X | ○ |
| | PIDCAS | ─ PIDPRMT S N ─ | Start of PID loop cascade operation | X | ○ |
| | PIDHBD | ─ PIDPRMT S N ─ | Start of PID loop combination operation | X | ○ |

## 18) Time related instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Date/Time Data Read | DATERD | DATERD D | Reads PLC Time to save in D ~ D+6 (Yr/Mn/Dt/Hr/Mn/Sd/Day) | ○ | X |
| | DATERDP | DATERDP D | | | |
| Date/Time Data Write | DATEWR | DATEWR S | Input S ~ S+6's Time Data in PLC (Yr/Mn/Dt/Hr/Mn/Sd/Day) | ○ | X |
| | DATEWRP | DATEWRP S | | | |
| Time Data Increase | ADDCLK | ADDCLK S1 S2 D | Adds S1 ~ S1+2 & S2 ~ S2+2 Time Data to save in D ~ D+2 in Time Data format (Hr/Mn/Sd) | ○ | X |
| | ADDCLKP | ADDCLKP S1 S2 D | | | |
| Time Data Decrease | SUBCLK | SUBCLK S1 S2 D | Extracts S2 ~ S2+2's Time Data from S1 ~ S1+2 to save in D ~ D+2 in Time Data format (Hr/Mn/Sd) | ○ | X |
| | SUBCLKP | SUBCLKP S1 S2 D | | | |
| Time Data Format Conversion | SECOND | SECOND S D | Converts Time Data S ~ S+2 to seconds to save in double word D | ○ | X |
| | SECONDP | SECONDP S D | | | |
| | HOUR | HOUR S D | Converts the seconds saved in double word S to Hr/Mn/Sd to save in D ~ D+2 | ○ | X |
| | HOURP | HOURP S D | | | |

## 19) Divergence instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Divergence Instruction | JMP | JMP LABEL | Jumps to LABEL location | ○ | ○ |
| | LABEL | LABEL ⊢ ⊢ ( ) ⊢ | Jumps and designates the location to move to | | |
| Subroutine Call Functional | CALL | CALL LABEL | Calls Function applicable to LABEL | ○ | ○ |
| | CALLP | CALLP LABEL | | | |
| | SBRT | SBRT LABEL | Designates Function to be called by CALL | | |
| | RET | RET | RETURN | | |

## 20) Loop instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Loop Instruction | FOR | ⊢――――⎡ FOR    N ⎤⊣ | Operates FOR~NEXT section n times | ○ | ○ |
| | NEXT | ⊢――――⎡ NEXT ⎤⊣ | | | |
| | BREAK | ―⎡ BREAK ⎤⊣ | Escapes from FOR~NEXT section | ○ | ○ |

## 21) Flag instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Carry Flag Set, Reset | STC | ―⎡ STC ⎤⊣ | Carry Flag ( F0112 ) SET | ○ | ○ |
| | CLC | ―⎡ CLC ⎤⊣ | Carry Flag ( F0112 ) RESET | | |
| Error Flag Clear | CLE | ―⎡ CLE ⎤⊣ | Error Latch Flag (F0115) RESET | ○ | ○ |

## 22) System instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Error Display | FALS | ―⎡ FALS    n ⎤⊣ | Self Diagnosis (Error Display ) | ○ | ○ |
| Scan Cluck | DUTY | ―⎡ DUTY    D n1 n2 ⎤⊣ | On during n1 Scan, Off during n2 Scan | ○ | ○ |
| Time Cluck | TFLK | ―⎡ TFLK    D1 S1 S2 D2 ⎤⊣ | On during S1 set time, Off during S2 set time | ○ | ○ |
| WDT Initialize | WDT | ―⎡ WDT ⎤⊣ | Watch Dog Timer Clear | ○ | ○ |
| | WDTP | ―⎡ WDTP ⎤⊣ | | | |
| Output Control | OUTOFF | ―⎡ OUTOFF ⎤⊣ | All Output Off | ○ | ○ |
| Operation Stop | STOP | ―⎡ STOP ⎤⊣ | Finishes applicable scan to end PLC Operation | ○ | ○ |
| Emergent Operation Stop | ESTOP | ―⎡ ESTOP ⎤⊣ | Ends PLC operation right after Instruction executed | ○ | ○ |

## 23) Interrupt related instruction

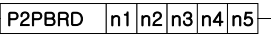| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| All Channels Interrupt Setting | EI | ―⎡ EI ⎤⊣ | All Channels Interrupt allowed | ○ | ○ |
| | DI | ―⎡ DI ⎤⊣ | All Channel Interrupt prohibited | | |
| Individual Channel Interrupt Setting | EIN | ―⎡ EIN    N ⎤⊣ | Individual Channel Interrupt allowed | ○ | ○ |
| | DIN | ―⎡ DIN    N ⎤⊣ | Individual Channel Interrupt prohibited | | |

## 24) Sign reversion instruction
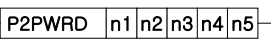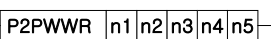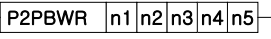
| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| 2's complement | NEG | — NEG D — | Saves D value again in D with 2's complement taken | ○ | ○ |
| | NEGP | — NEGP D — | | | |
| | DNEG | — DNEG D — | Saves (D+1,D) value again in (D+1,D) with 2's complement taken | | |
| | DNEGP | — DNEGP D — | | | |
| Real Number Data Sign Reverse | RNEG | — RNEG D — | Reverses D Real Number Sign then to save again | ○ | ○ |
| | RNEGP | — RNEGP D — | | | |
| | LNEGR | — LNEG D — | Reverses D Double Real Number Sign then to save again | | |
| | LNEGP | — LNEGP D — | | | |
| Absolute Value Operation | ABS | — ABS D — | Converts D highest Bit to 0 | ○ | ○ |
| | ABSP | — ABSP D — | | | |
| | DABS | — DABS D — | Converts (D+1,D) highest Bit to 0 | | |
| | DABSP | — DABSP D — | | | |

## 25) File related instruction
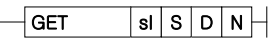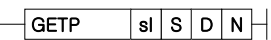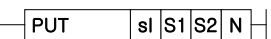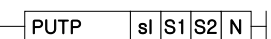
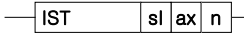| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Block Conversion | RSET | — RSET S — | Changes Block Number of file register to S Number | ○ | X |
| | RSETP | — RSETP S — | | | |
| Flash Word Data Transfer | EMOV | — EMOV S1 S2 D — | Transfers S2 word data in S1 Block to D | o | X |
| | EMOVP | — EMOVP S1 S2 D — | | | |
| Flash Double Word Data Transfer | EDMOV | — EDMOV S1 S2 D — | Transfers S2+1, S2 double word data in S1 Block to D+1, D | | |
| | EDMOVP | — EDMOVP S1 S2 D — | | | |
| Block Read | EBREAD | — EBREAD S1 S2 — | Reads Flash Memory Block | ○ | X |
| Block Write | EBWRITE | — EBWRITE S1 S2 — | Writes Flash Memory Block | ○ | X |
| Block Compare | EBCMP | — EBCMP S1 S2 D1 D2 — | Compares R Area's Bank with Flash Area's Block | ○ | X |

## Appendix 4.4 Special/Communication Instruction
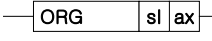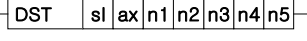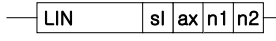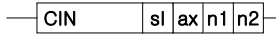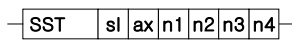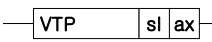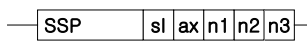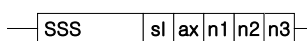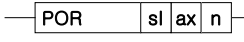
### 1) Communication module related instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Station No. Set | P2PSN | P2PSN  n1 n2 n3 | Sets opposite station No. for P2P Communication. n1:P2P No., n2:Block, n3:Station No. | ○ | X |
| Read Area Set (WORD) | P2PWRD | P2PWRD  n1 n2 n3 n4 n5 | Sets word data Read Area n1:P2P No., n2:Block, n3:Variable sequence, n4:Variable Size, n5:Device | ○ | X |
| Write Area Set (WORD) | P2PWWR | P2PWWR  n1 n2 n3 n4 n5 | Sets word data Write Area n1:P2P No., n2:Block, n3:Variable sequence, n4:Variable Size, n5:Device | ○ | X |
| Read Area Set (BIT) | P2PBRD | P2PBRD  n1 n2 n3 n4 n5 | Sets bit data Read Area n1:P2P No., n2:Block, n3:Variable sequence, n4: Variable Size, n5:Device | ○ | X |
| Write Area Set (BIT) | P2PBWR | P2PBWR  n1 n2 n3 n4 n5 | Sets bit data Write Area n1:P2P No., n2:Block, n3:Variable sequence,n4:Variable Size, n5:Device | ○ | X |

### 2) Special module common instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Special Module Read/Write | GET | GET  sl S D N | Reads data of special module memory is installed on | ○ | ○ |
| | GETP | GETP  sl S D N | | | |
| | PUT | PUT  sl S1 S2 N | Writes data on special module memory is installed on | ○ | ○ |
| | PUTP | PUTP  sl S1 S2 N | | | |

## 3) Exclusive positioning instruction

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Return to Origin Point | ORG | ─┤ ORG \| sl \| ax ├─ | Instructions Positioning Module's ax axis installed on sl slot to return to Origin Point | ○ | ○ |
| Floating Origin Point | FLT | ─┤ FLT \| sl \| ax ├─ | Instructions Positioning Module's ax axis installed on sl slot to set Floating Origin Point | ○ | ○ |
| Direct Start | DST | ─┤ DST \| sl \| ax \| n1 \| n2 \| n3 \| n4 \| n5 ├─ | Instructions Positioning Module's ax axis installed on sl slot to start directly with Target Position(n1), Target Speed(n2), Dwell Time(n3), M Code(n4) & Control Word(n5) | ○ | ○ |
| Indirect Start | IST | ─┤ IST \| sl \| ax \| n ├─ | Instructions Positioning Module's ax axis installed on sl slot to start n step indirectly | ○ | ○ |
| Linear Interpolation | LIN | ─┤ LIN \| sl \| ax \| n1 \| n2 ├─ | Instructions Positioning Module's ax axis installed on sl slot to let n2 axes operate n1 step by Linear Interpolation | ○ | ○ |
| Circular Interpolation | CIN | ─┤ CIN \| sl \| ax \| n1 \| n2 ├─ | Instructions Positioning Module's ax axis installed on sl slot to let n2 axes operate n1 step by Circular Interpolation | ○ | X |
| Simultaneous Start | SST | ─┤ SST \| sl \| ax \| n1 \| n2 \| n3 \| n4 ├─ | Instructions Positioning Module's ax axis installed on sl slot to let n4 axes operate n1(X), n2(Y), n3(Z) steps by Simultaneous Start | ○ | ○ |
| Speed/Position Control Switch | VTP | ─┤ VTP \| sl \| ax ├─ | Instructions Positioning Module's ax axis installed on sl slot to switch Speed to Position Control | ○ | ○ |
| Position/Speed Control Switch | PTV | ─┤ PTV \| sl \| ax ├─ | Instructions Positioning Module's ax axis installed on sl slot to switch Position to Speed Control | ○ | ○ |
| Decelerated Stop | STP | ─┤ STP \| sl \| ax ├─ | Instructions Positioning Module's ax axis installed on sl slot to stop as decelerated. | ○ | ○ |
| Skip | SKP | ─┤ SKP \| sl \| ax ├─ | Instructions Positioning Module's ax axis installed on sl slot to skip | ○ | X |
| Position Synchronization | SSP | ─┤ SSP \| sl \| ax \| n1 \| n2 \| n3 ├─ | Instructions Positioning Module's ax axis installed on sl slot to do Position Sync with main axis of n3, n1 sync-positioned and n2 step operated | ○ | ○ |
| Speed Synchronization | SSS | ─┤ SSS \| sl \| ax \| n1 \| n2 \| n3 ├─ | Instructions Positioning Module's ax axis installed on sl slot to do Speed Sync with main axis of n3, n1 master and n2 slave | ○ | ○ |
| Position Override | POR | ─┤ POR \| sl \| ax \| n ├─ | Instructions Positioning Module's ax axis installed on sl slot to override Position to change the target position to n | ○ | ○ |

## 4) Exclusive position control instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Speed Override | SOR | SOR sl ax n | Instructions Positioning Module's ax axis installed on sl slot to override Speed to change the target speed to n | ○ | ○ |
| Position specified Speed Override | PSO | PSO sl ax n | Instructions Positioning Module's ax axis installed on sl slot to override position specified speed to change the target speed to n2 from n1 position | ○ | ○ |
| Continuous Operation | NMV | NMV sl ax | Instructions Positioning Module's ax axis installed on sl slot to operate continuously to n step | ○ | X |
| Inching | INCH | INCH sl ax n | Instructions Positioning Module's ax axis installed on sl slot to inch to n position | ○ | ○ |
| Return to Position Previous to Manual Operation | RTP | RTP sl ax | Instructions Positioning Module's ax axis installed on sl slot to return to position previous to manual operation | ○ | X |
| Operation Step Change | SNS | SNS sl ax n | Instructions Positioning Module's ax axis installed on sl slot to change operation step to n | ○ | ○ |
| Repeated Operation Step Change | SRS | SRS sl ax n | Instructions Positioning Module's ax axis installed on sl slot to change repeated operation step to n | ○ | X |
| M Code Off | MOF | MOF sl ax | Instructions Positioning Module's ax axis installed on sl slot to make M code off | ○ | ○ |
| Present Position Change | PRS | PRS sl ax n | Instructions Positioning Module's ax axis to change present position to n | ○ | ○ |
| Zone Allowed | ZOE | ZOE sl ax | Allows zone output of Positioning Module installed on sl slot | ○ | X |
| Zone Prohibited | ZOD | ZOD sl ax | Prohibits zone output of Positioning Module installed on sl slot | ○ | X |
| Encoder Value change | EPRS | EPRS sl ax n | Changes Encoder Value of Positioning Module installed on sl slot to n | ○ | X |
| Teaching | TEA | TEA sl ax n1 n2 n3 n4 | Changes n1 step's target position or speed of Positioning Module's ax axis installed on sl slot | ○ | X |
| Teaching Array | TEAA | TEAA sl ax n1 n2 n3 n4 | Changes multiple target positions or speed of Positioning Module's ax axis installed on sl slot | ○ | X |
| Emergent Stop | EMG | EMG sl ax | Instructions Positioning Module installed on sl slot to perform Emergent Stop | ○ | ○ |

## 5) Exclusive position control instruction (continued)

| Classification | Designations | Symbol | Description | Support | |
|---|---|---|---|---|---|
| | | | | XGK | XGB |
| Error Reset | CLR | CLR sl ax n | Resets Error originated from Positioning Module's ax axis installed on sl slot | ○ | ○ |
| Error History Reset | ECLR | ECLR sl ax | Deletes Error History originated from Positioning Module's ax axis installed on sl slot | ○ | X |
| Point Operation | PST | PST sl ax n | Performs Point Operation of Positioning Module's ax axis installed on sl slot | ○ | X |
| Basic Parameter Teaching | TBP | TBP sl ax n1 n2 | Changes n2 to n1 among basic parameters of Positioning Module's ax axis installed on sl slot | ○ | X |
| Extended Parameter Teaching | TEP | TEP sl ax n1 n2 | Changes n2 to n1 among extended parameters of Positioning Module's ax axis installed on sl slot | ○ | X |
| Return to Origin Point Parameter Teaching | THP | THP sl ax n1 n2 | Changes n2 to n1 among returned parameters to origin point of Positioning Module's ax axis installed on sl slot | ○ | X |
| Manual Operation Parameter Teaching | TMP | TMP sl ax n1 n2 | Changes n2 to n1 among manual operation parameters of Positioning Module's ax axis installed on sl slot | ○ | X |
| Input Signal Parameter Teaching | TSP | TSP sl ax n | Changes input signal parameter of Positioning Module's ax axis installed on sl slot to the value set in n1 | ○ | X |
| Common Parameter Teaching | TCP | TCP sl ax n1 n2 | Changes n2 to n1 among common parameters of Positioning Module installed on sl slot | ○ | X |
| Parameter Save | WRT | WRT sl ax n | Instructions Positioning Module's ax axis installed on sl slot to save present parameter of n axis in flash ROM. | ○ | ○ |
| Present State Read | SRD | SRD sl ax D | Reads and saves present state of Positioning Module's ax axis installed on sl slot in D area of CPU | ○ | X |
| Point Operation Step Write | PWR | PWR sl ax S n1 | Writes value of S area of CPU on point operation step area of Positioning Module's ax axis installed on sl slot in | ○ | X |
| Plural Teaching Data Write | TWR | TWR sl ax S n1 | Writes n value of S area of CPU on plural teaching dada area of Positioning Module's ax axis installed on sl slot in | ○ | X |

## Warranty

1. Warranty Period
   The product you purchased will be guaranteed for 18 months from the date of manufacturing.
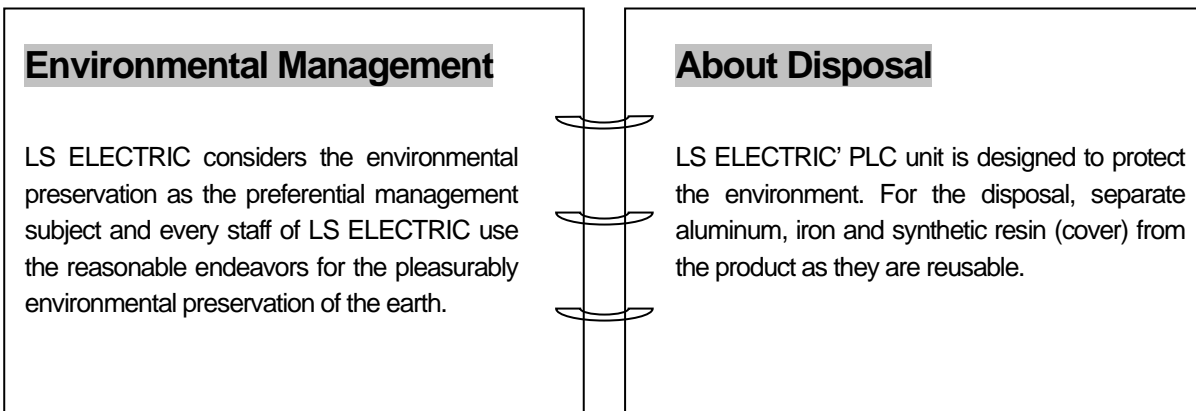
2. Scope of Warranty
   Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

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

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

## Environmental Policy

LS 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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